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RESEARCH MEMORANDUM

TESTS OF A TRIANGULAR WING OF ASPECT RATIO 2 IN THE AMES 12-FOOT PRESSURE WIND TUNNEL. II - THE EFFECTIVENESS AND HINGE MOMENTS OF A CONSTANT-CHORD PLAIN FLAP

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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

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TESTS OF A TRIANGULAR WING OF ASPECT RATIO 2 IN THE AMES 12-FOOT PRESSURE WIND TUNNEL. II – THE EFFECTIVENESS AND HINGE MOMENTS OF A CONSTANT-CHORD PLAIN FLAP

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SUMMARY

A semispan triangular wing with a constant-chord trailing-edge flap was tested to evaluate the aerodynamic characteristics of such a wing from landing speeds up to a Mach number of 0.95. Tests were included to ascertain the effects of the addition of a body and of modifications to the airfoil section. Data are presented showing the lift, drag, and pitching-moment characteristics of the model for various flap deflections and the hinge-moment characteristics of the flap.

As the Mach number was increased from 0.18 to 0.95, the lift-curve slope increased by 0.01 per degree, and the aerodynamic center moved aft 5 percent of the mean aerodynamic chord. For the same increase in Mach number, the lift effectiveness of the flap increased 20 percent, and the pitching-moment effectiveness at a constant angle of attack increased 35 percent. At low speeds, the effectiveness of the flap was maintained to large deflections and large angles of attack, and changes in Reynolds number between 5,300,000 and 15,000,000 had no significant effect.

The rate of change of hinge-moment coefficient with angle of attack had a large negative value and became more negative with increasing Mach number. The rate of change of hinge-moment coefficient with control-flap deflection had a low-speed value of –0.013 and a value of –0.022 at a Mach number of 0.95.

Data from the tests have been applied to the calculation of the longitudinal-stability and -control characteristics of an airplane

geometrically similar to the wing-body model. The calculations indicate that effective longitudinal control could be provided by the constant-chord control surface at all speeds, but the hinge-moment characteristics were such as to require a powerful irreversible actuator.

INTRODUCTION

In various investigations of the characteristics of wings designed to operate at moderate supersonic speeds, it has been shown that the low-aspect-ratio triangular wing offers several advantages. The low aspect ratio and high taper result in structural problems less serious than those usually associated with thin wings designed for these speeds. The beneficial effects of sweep at supersonic speeds, low-pressure drag, and low drag due to lift have been shown to be theoretically possible for the triangular wing with the apex forward and the leading edge swept well behind the Mach wave (reference 1). Compared with high-aspect-ratio wings having the same amount of sweep, the triangular wing gives evidence of superior longitudinal-stability characteristics at high lift coefficients.

This report presents results of tests in the Ames 12-foot pressure wind tunnel of a triangular wing equipped with a plain constant-chord trailing-edge flap. Tests of the same model with an undeflected flap were described in reference 2.

SYMBOLS

The following symbols are used in this report:

C_D drag coefficient $\left(\frac{\text{drag}}{qS}\right)$

C_h hinge-moment coefficient $\left(\frac{\text{hinge moment}}{qb_f\bar{c}_f^2}\right)$

C_L lift coefficient $\left(\frac{\text{lift}}{qS}\right)$

C_m pitching-moment coefficient about the quarter-chord point of the wing mean aerodynamic chord $\left(\frac{\text{pitching moment}}{qSc'}\right)$

H hinge moment, foot-pounds

M Mach number $\left(\frac{V}{a}\right)$

R Reynolds number $\left(\frac{\rho V c'}{\mu}\right)$

g acceleration due to gravity, feet per second per second

n normal acceleration, feet per second per second

α angle of attack of the wing chord line, degrees

δ angle of the flap from the wing chord line, degrees

δ_u flap angle uncorrected for distortion, degrees

S area of the semispan wing, square feet

V airspeed, feet per second

a speed of sound, feet per second

b wing semispan, feet

b_f span of the flap, feet

c local chord, feet

c' wing mean aerodynamic chord, M.A.C. $\left(\frac{\int_0^b c^2 dy}{S}\right)$, feet

$\overline{c}_f$ root-mean-square chord of the flap aft of the hinge line, feet

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

y spanwise station, feet

μ coefficient of viscosity of air, slugs per foot-second

ρ mass density of air, slugs per cubic foot

MODEL AND APPARATUS

The tests described in this report were conducted in the Ames 12-foot pressure tunnel, which is a variable-density wind tunnel having a circular test section modified by the addition of four equally spaced flat sections of 4-foot chord. The characteristics and performance of the wind tunnel are discussed in reference 2.

The semispan triangular wing, which was constructed of steel, was mounted on a turntable in the flat section on the tunnel floor. The unmodified wing had 5-percent-thick, uncambered, double-wedge sections with the maximum thickness at 20 percent of the chord. A limited amount of data was obtained with the leading edge sharp and the ridge line (line of maximum thickness) sharp, and with the leading edge sharp and the ridge line rounded to a radius of 32.22 percent of the chord. The major portion of the data was obtained with the ridge line rounded to a radius of 32.22 percent and the leading edge rounded to a radius of 0.25 percent of the chord. Figure 1 shows the dimensions corresponding to the three profiles. Figures 2 and 3 are photographs of the model in the test section illustrating these modifications. Dimensional constants used in defining the coefficients for the model are given in table I.

A wing-body combination was formed by the addition of half of a body of revolution, mounted symmetrically on the wing, as shown in figure 4. The coordinates of the body are also shown in this figure.

A constant-chord flap having an area aft of the hinge line of 1.8 square feet (20 percent of the original unmodified wing area) was supported on three hinges and restrained from rotation at the inboard end by an electric strain-gage unit and an angle-indexing bracket. (See fig. 2.) The flap had a radius nose with no aerodynamic balance and an unsealed nose gap of 0.028 inch (0.37 percent of the flap chord). Flap angles in increments of 2° from 30° to -30° could be set by means of the indexing bracket. In tests of the wing-body combination, the flap extended into the fuselage through a cover plate which was changed for each flap setting. It was necessary to leave clearance in the plates to allow for the deflection of the flap due to the aerodynamic load. These gaps averaged about five-eighths inch in width at the trailing edge and tapered to a small clearance at the hinge line.

The gap between the wing root and test-section floor was between 0.01 and 0.15 inch where the wing root extended beyond the turntable; consequently, some air leakage was possible. The boundary layer on the tunnel floor, the displacement thickness of which was 0.5 inch at the model, was not removed.

CORRECTIONS TO DATA

Corrections have been applied to the data to account for the effects of tunnel-wall interference, constriction of the air stream, tare forces on the model-support plate, and distortion of the flap under load. All corrections except that for the distortion are the same as those used in reference 2 and are summarized as follows:

Tunnel-Wall Corrections (Added)

$$\Delta\alpha = 0.722\ C_L$$

$$\Delta C_D = 0.0107\ C_L^2$$

$$\Delta C_m = 0$$

Constriction Corrections

The following table gives the uncorrected Mach number and the ratio of corrected dynamic pressure to the uncorrected dynamic pressure corresponding to the Mach numbers for which data are presented:

Corrected Mach number	Uncorrected Mach number		$\frac{q,\ \text{corrected}}{q,\ \text{uncorrected}}$	
	Wing alone	Wing and body	Wing alone	Wing and body
0.40	0.400	0.400	1.000	1.000
.50	.500	.500	1.000	1.008
.60	.600	.600	1.000	1.010
.70	.699	.695	1.000	1.012
.80	.797	.790	1.004	1.018
.85	.845	.835	1.006	1.024
.90	.892	.877	1.009	1.034
.93	.918	.899	1.013	1.043
.95	.933	.912	1.017	1.052

Tare Corrections

Tare corrections were applied to account for the turntable drag but not for aerodynamic interference between the model and the turntable. The tare-drag coefficients were found to vary with Reynolds number only. The values are as follows:

Reynolds number	Tare-drag coefficient	
	Wing alone	Wing and body
5.3×10^6	0.0032	0.0022
15×10^6	.0028	.0018

No correction was applied for the effect of air leakage between the turntable and the tunnel, although there was some evidence that this leakage may have affected the drag data slightly.

Flap-Distortion Corrections

Angular deflection of the flap under load was known to be appreciable because of the low rigidity of the restraining bracket and the flap itself. In order to determine the magnitude of the distortion, measurements were made of the angular displacement, at three spanwise stations, of the flap under aerodynamic loading. This was done by measuring, with the model in the air stream, the deflection of beams of light reflected from mirrors on the flap at each station. The distortion of the flap as a whole, which was assumed to be the average of the values at the three stations, was then correlated with the hinge moment. The distortion data were obtained only when the test section was approximately at atmospheric pressure and, therefore, at relatively low Mach number. The effect upon the correction of changes in the load distribution resulting from changes in Mach number was not considered because the mean torsional deformation of the flap was found to be small compared with the angular deflection originating in the restraining bracket. Since the flap was set by means of an indexing head which maintained fixed no-load angles, each series of data was for a small range of flap angles. Data for constant flap angles or constant angles of attack were obtained by interpolating graphically between test points. Care was taken to preserve any irregularities, so that the uniformity of the test points within any one curve is typical of the uncorrected data.

TESTS

Tests were made to ascertain the lift, drag, and pitching-moment characteristics of the model and the hinge-moment characteristics of the flap as they are influenced by changes in Reynolds number and Mach number. The flap could be deflected throughout a range of angles from -30° to $+30^\circ$, but at the higher Mach numbers and higher dynamic pressures the range was limited by the strain-gage capacity and by excessive vibration of the flap. The angle of attack was varied from

-10° to $+30^{\circ}$ for the wing-alone tests, and from -18° to $+18^{\circ}$ for tests with the wing-body combination. These ranges were also reduced at high speed because of the excessive hinge loads, vibration, and limitations of wind-tunnel power.

Data were obtained at constant Mach numbers from 0.18 to 0.95 with the tunnel at the pressures required for a Reynolds number of about 5,300,000, the highest Reynolds number for which high Mach number data could be obtained over a moderate angle-of-attack range. At the lowest Mach number, 0.18, the effect of increasing the Reynolds number to 15,000,000 was determined.

RESULTS AND DISCUSSION

Tests have been made to investigate the characteristics of the wing alone and the wing in combination with the fuselage under the variety of conditions within the capacity of the 12-foot pressure tunnel. Initial tests showed that the effects of some changes were quite small, permitting the elimination of certain portions of the test program. As shown in reference 2, changes in Reynolds number from 3,500,000 to 5,300,000, the maximum extent possible at high Mach number, had practically no effect, and a change from 15,000,000 to 27,500,000 at 0.18 Mach number caused only a small decrease in drag coefficient and little change in other data. Because the pitching moment of the wing at high angles of attack seemed to be affected by Mach number even at low speeds, tests were made at several Mach numbers for which ordinarily no effects of compressibility would be expected.

Results are presented graphically in this report for a representative series of test conditions, and data are tabulated for intermediate conditions. Except for a limited number of curves which show a comparison of the data obtained with the slightly modified airfoil sections, the data are for the wing having the leading edge rounded to a radius of 0.0025c and the ridge line rounded to a radius of 0.3222c.

Wing Alone, Low Mach Number

Angle of attack, drag coefficient, and pitching-moment coefficient as functions of the lift coefficient, and hinge-moment coefficient as a function of angle of attack are presented in figures 5 through 10 for the wing alone and in figures 11 through 16 for the wing with the fuselage. Similar data for intermediate test conditions are presented in tables II through IX.

Figure 5 shows that the effectiveness of the flap in producing lift and pitching moment at low Mach number was maintained throughout the range of flap angles from -24° to $+24^{\circ}$. When the angle of attack was increased to 14°, the pitching-moment curves indicate that there was a sudden forward shift in the center of pressure accompanied by a slight loss in lift. The shift became greater and more abrupt as the flap was deflected to increase the lift. The angle of attack at which the shift occurred was not influenced by a change in Reynolds number from 15,000,000 to 5,300,000. (Compare figs. 5 and 6.) An investigation of the causes of the break in the pitching-moment curves of a similar triangular-wing model is described in reference 3.

As the flap was deflected to angles over 12°, the minimum drag began to increase and the variation of drag with lift became somewhat greater (fig. 6(b)). The lift coefficient for minimum drag changed slightly with flap angle, increasing with positive deflection of the flap. Figure 6(c) shows that the variation of hinge-moment coefficient with angle of attack was negative and large. Within the range of flap angles between $\pm 12^{\circ}$, the curves are smooth except at the angle of attack where the break in the pitching-moment curve occurred.

Wing Alone, High Mach Number

The aerodynamic characteristics of the wing alone at Mach numbers of 0.70, 0.85, 0.93, and 0.95 are presented in figures 7 through 10. Below the angle of attack at which the center of pressure shifted suddenly, there were nearly linear variations of angle of attack and pitching-moment coefficient with lift coefficient over a wide range of flap settings. As the Mach number was increased, the slopes of the lift curves increased gradually, and the slopes of the pitching-moment curves became increasingly negative. The control flap remained effective throughout the whole range of Mach numbers. The shift in the center of pressure occurred at approximately a constant angle of attack regardless of flap angle for any one Mach number. As the Mach number was increased, this discontinuity was delayed to higher angles of attack, but the abruptness and extent of the center-of-pressure shift became greater. A comparison of the drag data at various Mach numbers shows that the drag rise with lift decreased slightly with increasing Mach number. When the flap was deflected more than 6°, there was a considerably greater increase in minimum drag coefficient with Mach number than that for the model with the flap neutral.

The large negative variation of hinge moment with angle of attack became greater as the Mach number increased, particularly for the higher angles of attack. A divergence of the curves for constant flap angle at the higher Mach numbers indicates increased hinge-moment variation with flap deflection.

Effect of the Body

Data obtained with the wing-body combination are presented for a Reynolds number of 15,000,000 at a Mach number of 0.18 (fig. 11), and for a Reynolds number of 5,300,000 at Mach numbers of 0.30, 0.70, 0.85, 0.93, and 0.95 (figs. 12 through 16). Addition of the body caused a slight reduction of the static longitudinal stability and an increase of the minimum drag, but did not change the lift or the shape of the drag curves. The variation of hinge moment with angle of attack was slightly greater than that measured for the wing alone, probably because of the pressure differential over a part of the flap within the fuselage.

Effect of the Flap

Variations of lift coefficient, pitching-moment coefficient, and hinge-moment coefficient with flap deflection at zero angle of attack are shown in figures 17 and 18. Figure 17 shows low Mach number data for the wing alone and the wing-body combination at a Reynolds number of 15,000,000. Data obtained at a Reynolds number of 5,300,000 are presented in figure 18 for a series of Mach numbers from 0.18 to 0.95. The lift and pitching-moment coefficients varied linearly over a large range of flap angles, the effectiveness increasing somewhat with Mach number. The hinge-moment curves decreased (algebraically) in slope fairly rapidly with increases in Mach number, particularly for negative flap angles beyond -4°. The effect of adding the body was to cause a slight reduction in flap effectiveness but to increase slightly the absolute value of the variation of hinge-moment coefficient with flap deflection.

Effect of Mach Number

Figure 19 shows how the lift, pitching moment, and hinge moment varied with Mach number at an angle of attack of 0° for several constant flap angles. For flap angles greater than 4°, the hinge-moment coefficient underwent considerable change with Mach number; whereas the changes in lift and pitching-moment coefficients were relatively small.

The minimum drag coefficients are shown in figure 20 as a function of Mach number for several flap angles. The large increase in minimum drag with flap deflection, when the Mach number exceeded 0.60, suggests an important loss in wing efficiency if large flap angles are required in order to provide balance. A similar loss would result from large positive deflections if the flap were used as a lift-producing device in this speed range.

Figure 21 shows the variation with Mach number of lift-curve slope and aerodynamic center. The lift-curve slope at zero lift and 0.18 Mach number was 0.038, becoming greater with an increase in either lift coefficient or Mach number. The aerodynamic center began to move aft at 0.40 Mach number until at 0.95 Mach number the total displacement was 5 percent of the mean aerodynamic chord. Figure 22 shows the variation with Mach number of the lift effectiveness $\partial C_L/\partial\delta$, the pitching-moment effectiveness $\partial C_m/\partial\delta$, and the location of the aerodynamic center of the load due to the flap, measured at zero angle of attack and within a range of flap angles near zero. As the Mach number increased from 0.50 to 0.95, data for the wing-body combination showed an increase of 20 percent in lift effectiveness, an increase of 35 percent in pitching-moment effectiveness, and an aft movement of the aerodynamic center of the loading due to control-surface deflection amounting to 6 percent of the mean aerodynamic chord.

Slopes of the curves of hinge-moment coefficient against angle of attack $\partial C_h/\partial\alpha$, measured with the flap undeflected, and hinge-moment coefficient against flap angle $\partial C_h/\partial\delta$, measured at zero angle of attack, are plotted in figure 23. There was a decrease of about 20 percent in the algebraic value of $\partial C_h/\partial\alpha$ as the Mach number was increased from 0.18 to 0.90. The value of $\partial C_h/\partial\delta$ decreased algebraically with increasing Mach number, the decrease becoming more pronounced as the Mach number exceeded 0.90. At a Mach number of 0.95, $\partial C_h/\partial\delta$ was 160 percent of the low-speed value.

Lift-Drag Ratio

Figure 24 presents the variation of lift-drag ratio with lift coefficient for the wing-body combination at three Mach numbers: 0.18, 0.30, and 0.93. This variation affords a measure of the efficiency of the configuration when the flap is deflected, either to provide balance or to obtain increases in lift. Since the model was symmetrical about the chord plane, the curves may be used to represent positive flap angles by reversing the signs of the axes. It is evident that the loss in lift-drag ratio accompanying negative flap deflections is important if it becomes necessary to deflect the flap in the direction such as to reduce the lift in order to provide longitudinal balance, and that a substantial gain in lift-drag ratio could be realized if the movable surface were deflected to positive angles and used as a landing flap. In addition to improving the lift-drag ratio, the use of the surface as a landing flap offers a means of avoiding the excessive angles of attack otherwise required in landing (fig. 11(a)). The effect of adding a horizontal surface, which would be necessary to balance the pitching moment due to the flap, must be included in any evaluation of the gain in lift-drag ratio associated with these positive flap deflections. At a Mach number of 0.93, improvement in the lift-drag ratio resulting from the effective camber due to a down-deflection of the flap was offset by the increase in minimum drag with flap deflection. The lift-drag ratios of the triangular wing were low under all conditions, and the maximum values for the wing-body combination, which occurred at a lift coefficient of about 0.2, were never greater than 11.

Wing-Profile Modifications

Figures 25 through 28 indicate the aerodynamic effects of slightly modifying the wing profile. Curves presented in these figures are uncorrected for flap distortion, the effect of which was investigated only for the wing with a rounded leading edge and rounded ridge lines. In the investigation of the effects of the modifications to the airfoil section, the wing was first tested with true double-wedge sections and was subsequently tested with two alterations, rounded ridge lines, and a rounded leading edge with the rounded ridge lines. (See fig. 1.) Effects of the modification are noticeable only at the higher angles of attack and, in particular, above the angle at which the discontinuity in the pitching-moment curve appears (fig. 25). Rounding the leading edge resulted in a slightly reduced lift-curve slope and an increase in the static stability at the higher angles of attack. The center-of-pressure shift occurred at a somewhat lower angle of attack for the rounded profile. Only small changes in hinge-moment characteristics resulted from the modifications (fig. 27), the principal differences appearing at the angles of attack near the center-of-pressure shift. There was no apparent effect of rounding the ridge lines.

APPLICATION OF DATA

Data from the tests have been used in the calculation of the stability, maneuverability, control-flap hinge moments, and sinking speeds of a tailless airplane employing a triangular wing in flight at subsonic speeds. The airplane was chosen to be geometrically similar to the model tested with the fuselage and the wing with rounded leading edge and ridge lines. Dimensions of the airplane were assumed to be as follows:

Wing area . . . . 500 sq ft

Wing span . . . . 31.91 ft

Control-flap area . . . . 90.80 sq ft

Flap hinge moment . . . . 281.8 $C_h q$ ft-lb

Consideration of the requirements for longitudinal control to be provided by the constant-chord flap led to the assumption of an irreversible control actuator. This assumption was a result of the hinge-moment investigation, which indicated that the stick-free neutral point was a considerable distance ahead of the aerodynamic center of the wing. If the center of gravity were located sufficiently far forward to obviate the need for irreversible controls, the large up-elevator angles required for level flight would impose serious limitations on the maneuverability of the airplane and result in high drag due to the large angles of attack. A center of gravity at 32 percent of the mean aerodynamic chord was chosen, based upon the requirement for the maximum maneuverability without allowing the airplane to become unstable (with irreversible controls) at low speed.

Figure 29 shows the lift coefficient, the hinge moment, and the control-flap angle as a function of Mach number for the airplane in level flight at 30,000 feet altitude. Although the flap-angle variation is stable over the range below 0.93 Mach number, the control-force variations indicate marginal stability. If a trim tab were used to trim out the large push force, stick-free instability would result at all Mach numbers. The control-surface angles and control forces required in a constant-speed maneuver which produces a change in the normal acceleration are shown in figure 30 for various Mach numbers from 0.60 to 0.95. It is assumed that the airplane has a wing loading of 60 pounds per square foot and is operating at 30,000 feet altitude. The control-flap angle necessary to increase the normal acceleration becomes greater at the higher accelerations for the Mach numbers above 0.70, indicating the effect of the increase in static stability at high Mach number and high angles of attack. At the lower speeds, increasing push forces are required as the normal acceleration is increased. The nonlinear variation of control-flap angle with normal acceleration factor at the higher Mach numbers, larger angles being required at high lift, results in the reversal of the slopes of the control hinge-moment curves. At the highest Mach numbers, 0.93 and 0.95, a large (negative) change in $\partial C_h/\partial \delta$ causes the floating angle to be reduced to the extent that a pull force is needed for balance in the maneuver. The sharp rise in hinge moment with increase in normal acceleration above 2.8g at a Mach number of 0.95 indicates that structural requirements of the control actuator may be a major problem, if even moderate maneuverability is to be attained at this speed.

The steep power-off gliding angle resulting from a low lift-drag ratio at high angles of attack is one of the objectionable characteristics associated with this type of airplane. Figure 31 shows the sinking speed, hinge moment for balance, control-flap angle, and angle of attack as a function of gliding speed at sea level. The minimum power-off sinking speed for the lightest wing loading considered, 20 pounds per square foot, is 32 feet per second, and occurs at a forward speed of 190 miles per hour. For the 40-pound wing loading, the minimum sinking speed is 45 feet per second at a forward speed of 270 miles per hour. Reference 4 indicates that some reduction in the vertical speed during a landing would result from the large ground effect upon the triangular wing. However, figure 31 shows that even the moderate wing loadings which were assumed result in sinking speeds that are substantially greater than those thought to be safe for piloted airplanes (reference 5). The data indicate that considerable difficulty may be experienced by a pilot of an airplane employing a low-aspect-ratio triangular wing in landing without power.

CONCLUSIONS

The following conclusions have been drawn from the results of tests of a triangular wing model with a constant-chord plain flap:

1. At low speeds, the flap was effective in producing changes in lift and pitching moment to deflections as large as 24°. Changes in Reynolds number between 5,300,000 and 15,000,000 had little effect, except at flap angles over 20°.

2. Increasing the Mach number from 0.18 to 0.95 caused the aerodynamic center to move rearward about 5 percent of the mean aerodynamic chord and the slope of the lift curve to increase by about 0.01 per degree.

3. For the wing-body combination, the lift effectiveness of the flap increased with Mach number by 20 percent of the low-speed value, and the pitching-moment effectiveness at a constant angle of attack increased 35 percent between Mach numbers of 0.18 and 0.95.

4. The variation of hinge-moment coefficient with angle of attack was negative and large under all conditions, and its algebraic value decreased 20 percent between Mach numbers of 0.18 and 0.90.

5. A considerable change with Mach number was found for the variation of hinge-moment coefficient with flap deflection. At a Mach number of 0.95, this variation had increased to 160 percent of the low-speed value.

6. The lift-drag ratios were generally low and were reduced considerably by upward deflections of the flap, such as are required to balance a tailless airplane in flight. At low speeds, an improvement in the lift-drag ratio resulted from small positive deflections, but at the higher Mach numbers the improvement was offset by the rise in minimum drag with flap deflection.

7. For a given Mach number, the sudden shift of the center of pressure of the wing occurred at about the same angle of attack for all flap angles. Increasing the Mach number delayed the shift to higher angles of attack and caused the abruptness and amount of the shift to increase.

8. Calculations were made of the characteristics of a tailless airplane consisting of a triangular wing with a fuselage and using a constant-chord plain flap for longitudinal control. Results of the calculations may be summarized as follows:

(a) The hypothetical airplane had a stable variation of control-flap angle with speed until the Mach number exceeded 0.93.

(b) At Mach numbers below 0.90 with the center of gravity at 32 percent of the mean aerodynamic chord, a large variation of flap hinge moment with angle of attack resulted in stick-free instability and, unless an irreversible type of control actuator were employed, large push forces would be required in a maneuver to increase the normal acceleration. The effect of increasing the Mach number above 0.90 was to cause the push forces to diminish and then become pull forces.

(c) The forward speeds and sinking speeds associated with the low-aspect-ratio triangular wing in a power-off approach were so large as to indicate that some power would have to be applied if a safe landing were to be accomplished.

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TABLE I - MODEL GEOMETRIC DATA

Area of semispan wing, S	
With rounded leading edge	8.84 sq ft
With sharp leading edge.	9 sq ft
Mean aerodynamic chord, c'	
With rounded leading edge	3.93 ft
With sharp leading edge	4 ft
Wing semispan, b	3 ft
Root-mean-square chord of the flap, $\bar{c}_f$	
Wing alone	0.6107 ft
Wing and body	0.6043 ft
Span of the flap, b_f	
Wing alone	3 ft
Wing and body	2.565 ft

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Table II.- Aerodynamic characteristics of a triangular wing with various flap angles. Reynolds number, 5,300,000; Mach number, 0.50.

δ	a	C_L	C_D	C_m	C_h
0	-10	-0.463	0.078	0.071	-0.090
0	-8	-.360	.050	.057	.073
0	-6	-.264	.028	.044	.056
0	-4	-.169	.016	.028	.038
0	-2	-.085	.008	.015	.021
0	0	-.005	.007	003	.003
0	2	.075	.009	-.011	-.016
0	4	.162	.014	-.022	-.032
0	6	.255	.026	-.037	-.049
0	8	.352	.048	-.051	-.064
0	10	.453	.076	-.062	-.083
0	12	.550	.111	-.075	-.098
0	14	.648	.153	-.086	-.114
0	16	.740	.200	-.092	-.123
0	18	.809	.253	-.096	-.156
0	20	.895	.313	-.109	-.184
0	22	.982	.380	-.121	-.199
0	24	1.060	.453	-.132	-.210
0	26	1.138	.530	-.139	-.228
0	28	1.190	.606	-.148	-.248
0	30	1.228	.684	-.159	-.266
2	-10	-.412	.680	.045	.060
2	-8	-.310	.420	.033	.042
2	-6	-.216	.230	.019	.025
2	-4	-.120	.120	.005	009
2	-2	-.035	.007	-.008	-.008
2	0	-.042	.008	-.020	-.026
2	2	.127	.011	-.033	-.045
2	4	.213	.019	-.044	-.061
2	6	.305	.034	-.061	-.079
2	8	.405	.058	-.075	-.096
2	10	.505	.087	-.085	-.113
2	12	.601	.125	-.100	-.128
2	14	.700	.169	-.112	-.144
2	16	.800	.220	-.125	-.158
2	18	.858	.275	-.118	-.184
2	20	.940	.336	-.129	-.212
2	22	1.028	.402	-.142	-.228
2	24	1.102	.474	-.152	-.236
2	26	1.179	.546	-.159	-.251
2	28	1.225	.622	-.167	-.270
2	30	1.242	.697	-.173	-.285
4	-10	-.360	.058	.021	.030
4	-8	-.260	.036	.010	.013
4	-6	-.165	.019	-.004	-.004
4	-4	-.071	.010	-.018	-.020
4	-2	.013	.008	-.051	-.037
4	0	.093	.010	-.044	-.055
4	2	.178	.014	-.056	-.076
4	4	.266	.025	-.072	-.093
4	6	.360	.042	-.085	-.111
4	8	.459	.067	-.099	-.130
4	10	.559	.100	-.114	-.145
4	12	.658	.140	-.127	-.162
4	14	.755	.187	-.140	-.178
4	16	.861	.242	-.151	-.198
4	18	.916	.300	-.145	-.216
4	20	1.008	.362	-.154	-.242
4	22	1.079	.425	-.165	-.260
4	24	1.155	.499	-.172	-.267
4	26	1.229	.574	-.177	-.279
4	28	1.257	.645	-.186	-.300
4	30	1.289	.731	-.191	-.312

δ	a	C_L	C_D	C_m	C_h
8	-10	-0.259	0.045	-0.024	-0.030
8	-8	-.160	.027	-.036	-.046
8	-6	-.065	.014	-.050	-.063
8	-4	.023	.010	-.065	-.082
8	-2	.110	.010	-.077	-.099
8	0	.190	.016	-.090	-.115
8	2	.275	.024	-.104	-.132
8	4	.368	.039	-.121	-.156
8	6	.470	.064	-.137	-.178
8	8	.570	.092	-.151	-.196
8	10	.669	.129	-.164	-.208
8	12	.770	.175	-.175	-.225
8	14	.864	.225	-.186	-.241
8	16	.965	.284	-.197	-.257
8	18	1.065	.350	-.209	-.271
8	20	1.094	.405	-.192	-.301
8	22	1.148	.466	-.192	-.312
8	24	1.221	.540	-.204	-.316
8	26	1.280	.616	-.209	-.327
8	28	1.308	.698	-.213	-.334
8	30	1.338	.774	-.221	-.359
12	-10	-.165	.040	-.066	-.080
12	-8	-.068	.024	-.078	-.096
12	-6	.029	.014	-.093	-.113
12	-4	.120	.014	-.108	-.131
12	-2	.215	.019	-.121	-.151
12	0	.281	.027	-.132	-.165
12	2	.362	.039	-.144	-.181
12	4	.458	.058	-.159	-.206
12	6	.560	.087	-.180	-.232
12	8	.661	.120	-.195	-.250
12	10	.760	.160	-.207	-.266
12	12	.855	.208	-.217	-.280
12	14	.948	.262	-.228	-.296
12	16	1.048	.325	-.239	-.312
12	18	1.137	.389	-.237	-.321
12	20	1.141	.437	-.219	-.341
12	22	1.196	.500	-.214	-.350
12	24	1.262	.592	-.231	-.356
12	26	1.313	.645	-.233	-.363
12	28	1.343	.724	-.235	-.376
12	30	---	---	---	.394
20	-10	0	.038	-.150	-.222
20	-8	.100	.031	-.162	-.242
20	-6	.200	.031	-.178	-.257
20	-4	.290	.039	-.189	-.284
20	-2	.362	.050	-.200	-.302
20	0	.430	.063	-.205	-.311
20	2	.495	.080	-.212	-.321
20	4	.565	.100	-.221	-.330
20	6	.615	.138	-.240	-.386
20	8	.830	.186	-.278	-.421
20	10	.925	.234	-.289	-.437
20	12	1.019	.287	-.299	-.446
20	14	1.107	.347	-.307	-.458
20	16	1.200	.410	-.312	-.464
20	18	1.210	.448	---	-.464
20	20	1.230	.497	---	-.468
20	22	1.290	.602	---	-.478
20	24	1.339	.659	---	-.485
20	26	1.380	.727	---	-.487
20	28	1.399	.801	---	-.499

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δ	α	C_L	C_D	C_m	C_h
-2	-10	-0.512	0.090	0.093	0.120
-2	-8	-.410	.059	.081	.102
-2	-6	-.311	.035	.068	.086
-2	-4	-.217	.020	.051	.067
-2	-2	-.131	.010	.038	.051
-2	0	-.051	.008	.024	.032
-2	2	.028	.008	.011	.014
-2	4	.111	.011	0	-.004
-2	6	.204	.022	-.014	-.020
-2	8	.302	.041	-.028	-.037
-2	10	.401	.066	-.041	-.052
-2	12	.497	.098	-.052	-.068
-2	14	.596	.137	-.063	-.083
-2	16	.680	.182	-.066	-.093
-2	18	.760	.234	-.074	-.129
-2	20	.850	.294	-.089	-.153
-2	22	.939	.260	-.101	-.168
-2	24	1.018	.430	-.111	-.183
-2	26	1.093	.503	-.120	-.203
-2	28	1.151	.582	-.131	-.224
	30	1.209	.660	-.144	-.246
-4	-10	-.560	.101	.115	.146
-4	-8	-.458	.068	.103	.130
-4	-6	-.360	.043	.090	.113
-4	-4	-.265	.025	.073	.094
-4	-2	-.177	.013	.059	.076
-4	0	-.095	.009	.045	.060
-4	2	-.017	.008	.033	.043
-4	4	.066	.009	.021	.024
-4	6	.157	.019	.007	.006
-4	8	.252	.035	-.006	-.010
-4	10	.350	.059	-.020	-.026
-4	12	.450	.088	-.031	-.040
-4	14	.545	.124	-.040	-.055
-4	16	.629	.167	-.045	-.066
-4	18	.711	.218	-.052	-.100
-4	20	.805	.276	-.068	-.122
-4	22	.895	.342	-.080	-.137
-4	24	.975	.410	-.090	-.153
-4	26	1.050	.481	-.102	-.172
-4	28	1.110	.553	-.114	-.196
-4	30	1.155	.630	-.127	-.218
-8	-10	-.658	.126	.160	.201
-8	-8	-.555	.091	.147	.185
-8	-6	-.458	.061	.133	.167
-8	-4	-.361	.038	.117	.147
-8	-2	-.264	.022	.100	.123
-8	0	-.179	.014	.086	.107
-8	2	-.096	.010	.072	.090
-8	4	-.012	.008	.060	.070
-8	6	.076	.015	.047	.054
-8	8	.171	.028	.033	.039
-8	10	.272	.046	.020	.020
-8	12	.368	.074	.008	.004
-8	14	.465	.108	-.005	-.011
-8	16	.553	.147	-.008	-.029
-8	18	.650	.195	-.021	-.060
-8	20	.735	.252	-.036	-.080
-8	22	.827	.314	-.047	-.095
-8	24	.908	.380	-.058	-.113
-8	26	.981	.450	-.070	-.133
-8	28	1.050	.525	-.085	-.155
-8	30	1.109	.602	-.098	-.179

δ	α	C_L	C_D	C_m	C_h
-12	-10	-0.754	0.157	0.206	0.282
-12	-8	-.654	.117	.194	.264
-12	-6	-.556	.083	.179	.246
-12	-4	-.457	.056	.161	.223
-12	-2	-.353	.036	.143	.190
-12	0	-.271	.024	.128	.170
-12	2	-.189	.016	.116	.155
-12	4	-.104	.014	.102	.135
-12	6	-.013	.015	.089	.117
-12	8	.081	.024	.075	.100
-12	10	.181	.038	.062	.081
-12	12	.274	.062	.050	.065
-12	14	.372	.093	.040	.050
-12	16	.461	.127	.030	.029
-12	18	.560	.171	.019	.001
-12	20	.648	.226	.004	-.019
-12	22	.740	.284	-.008	-.037
-12	24	.821	.346	-.021	-.056
-12	26	.900	.414	-.034	-.077
-12	28	.975	.488	-.047	-.098
	30	1.030	.565	-.064	-.122
-16	-10	-.840	.192	.248	.352
-16	-8	-.747	.148	.237	.333
-16	-6	-.646	.110	.223	.314
-16	-4	-.538	.078	.203	.276
-16	-2	-.433	.054	.180	.238
-16	0	-.354	.039	.169	.238
-16	2	-.276	.030	.159	.218
-16	4	-.190	.022	.147	.198
-16	6	-.102	.019	.133	.176
-16	8	-.008	.024	.119	.160
-16	10	.090	.037	.104	.141
-16	12	.182	.056	.093	.121
-16	14	.282	.082	.082	.104
-16	16	.370	.113	.072	.081
-16	18	.470	.154	.056	.058
-16	20	.560	.204	.041	.035
-16	22	.658	.259	.028	.013
-16	24	.743	.319	.013	-.019
-16	26	.825	.385	-.002	-.043
-16	28	.899	.456	-.015	-.061
-16	30	---	---	---	---
-20	-10	-.910	.232	.279	---
-20	-8	-.815	.187	.267	---
-20	-6	-.709	.146	.253	.393
-20	-4	-.595	.105	.226	.320
-20	-2	-.498	.078	.207	.320
-20	0	-.412	.064	.198	.320
-20	2	-.348	.050	.190	.316
-20	4	-.259	.036	.178	.274
-20	6	-.179	.031	.165	.250
-20	8	-.085	.032	.151	.228
-20	10	.015	.041	.139	.206
-20	12	.108	.056	.126	.186
-20	14	.207	.079	.115	.167
-20	16	.300	.108	.103	.139
-20	18	.394	.146	.089	.111
-20	20	.486	.190	.075	.088
-20	22	.580	.242	.061	.064
-20	24	.672	.300	.047	.044
-20	26	.757	.366	.031	.022
-20	28	.835	.435	.015	-.006
-20	30	---	---	---	---

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Table III.- Aerodynamic characteristics of a triangular wing with various flap angles. Reynolds number, 5,300,000; Mach number, 0.60.

δ	α	C_L	C_D	C_m	C_h
0	28	1.189	0.608	-0.157	-0.257
0	26	1.139	.536	-.153	-.240
0	24	1.072	.457	-.141	-.234
0	22	1.005	.387	-.133	-.231
0	20	.960	.328	-.130	-.180
0	18	.869	.267	-.115	-.152
0	16	.769	.211	-.107	-.132
0	14	.665	.157	-.095	-.114
0	12	.564	.112	-.081	-.099
0	10	.463	.078	-.067	-.081
0	8	.361	.050	-.055	-.064
0	6	.262	.028	-.040	-.048
0	4	.156	.015	-.023	-.034
0	2	.077	.010	-.012	-.019
0	0	-.006	.007	.001	.004
0	-2	-.080	.008	.015	.021
0	-4	-.170	.015	.028	.038
0	-6	-.268	.028	.045	.056
0	-8	-.373	.051	.061	.075
0	-10	-.476	.079	.075	.094
2	28	1.223	.618	-.181	-.286
2	26	1.180	.549	-.173	-.268
2	24	1.112	.477	-.160	-.259
2	22	1.050	.406	-.151	-.255
2	20	1.026	.356	-.157	-.210
2	18	.934	.289	-.147	-.194
2	16	.828	.224	-.134	-.175
2	14	.723	.173	-.121	-.157
2	12	.622	.125	-.107	-.138
2	10	.520	.088	-.092	-.120
2	8	.416	.058	-.080	-.101
2	6	.320	.035	-.065	-.084
2	4	.219	.019	-.046	-.066
2	2	.127	.012	-.036	-.050
2	0	.042	.008	-.023	-.031
2	-2	-.035	.007	-.010	-.012
2	-4	-.122	.012	.003	.007
2	-6	-.214	.024	.018	.024
2	-8	-.316	.044	.034	.042
2	-10	-.421	.070	.048	.061
4	28	1.255	.640	-.199	-.317
4	26	1.218	.572	-.190	-.300
4	24	1.148	.496	-.180	-.292
4	22	1.091	.424	-.175	-.274
4	20	1.079	.378	-.182	-.247
4	18	.988	.309	-.173	-.232
4	16	.881	.244	-.161	-.215
4	14	.780	.191	-.147	-.196
4	12	.678	.140	-.132	-.176
4	10	.578	.100	-.121	-.159
4	8	.472	.069	-.107	-.141
4	6	.372	.044	-.090	-.120
4	4	.275	.025	-.070	-.104
4	2	.182	.015	-.060	-.082
4	0	.095	.011	-.046	-.064
4	-2	.008	.010	-.033	-.044
4	-4	-.069	.008	-.020	-.023
4	-6	-.160	.019	-.007	-.005
4	-8	-.262	.038	.009	.008
4	-10	-.364	.062	.021	.027
8	28	1.302	0.682	-0.210	-0.368
8	26	1.274	.614	-.208	-.354
8	24	1.210	.536	-.202	-.343
8	22	1.158	.461	-.193	-.320
8	20	1.111	.416	-.205	-.308
8	18	1.078	.359	-.217	-.290
8	16	.980	.291	-.209	-.271
8	14	.881	.230	-.195	-.254
8	12	.782	.174	-.180	-.240
8	10	.682	.132	-.173	-.224
8	8	.579	.094	-.159	-.208
8	6	.475	.064	-.145	-.189
8	4	.378	.040	-.129	-.167
8	2	.288	.026	-.109	-.141
8	0	.200	.018	-.095	-.120
8	-2	.112	.012	-.081	-.104
8	-4	.030	.010	-.067	-.085
8	-6	-.062	.014	-.054	-.068
8	-8	-.162	.029	-.040	-.052
8	-10	-.249	.049	-.027	-.032
12	28	---	---	---	---
12	26	---	---	---	---
12	24	---	---	---	---
12	22	---	---	---	---
12	20	1.148	.448	-.223	-.360
12	18	1.155	.403	-.256	-.344
12	16	1.069	.333	-.249	-.330
12	14	.969	.270	-.238	-.314
12	12	.870	.213	-.230	-.302
12	10	.771	.166	-.218	-.288
12	8	.670	.124	-.208	-.274
12	6	.565	.088	-.187	-.252
12	4	.461	.059	-.168	-.221
12	2	.375	.041	-.151	-.198
12	0	.300	.030	-.143	-.181
12	-2	.209	.021	-.127	-.164
12	-4	.121	.015	-.112	-.143
12	-6	.027	.016	-.096	-.125
12	-8	-.071	.026	-.082	-.108
12	-10	-.152	.041	-.070	-.089
16	28	1.349	.755	-.265	-.450
16	26	1.319	.688	-.265	-.445
16	24	1.279	.610	-.250	-.441
16	22	1.225	.533	-.227	-.437
16	20	1.225	.478	-.254	-.416
16	18	1.199	.442	-.293	-.408
16	16	1.138	.374	-.286	-.408
16	14	1.044	.309	-.276	-.395
16	12	.946	.252	-.269	-.381
16	10	.853	.202	-.258	-.367
16	8	.751	.157	-.255	-.350
16	6	.642	.116	-.218	-.333
16	4	.528	.081	-.184	-.280
16	2	.439	.061	-.176	-.265
16	0	.368	.047	-.179	-.255
16	-2	.285	.035	-.167	-.242
16	-4	.204	.027	-.153	-.220
16	-6	.111	.023	-.137	-.202
16	-8	.014	.029	-.123	-.178
16	-10	-.078	.039	-.110	-.162

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δ	α	C_L	C_D	C_m	C_h
-2	28	1.151	0.587	-0.141	-0.237
-2	26	1.095	.511	-.131	-.215
-2	24	1.030	.435	-.121	-.197
-2	22	.935	.361	-.069	-.192
-2	20	.840	.288	-.090	-.159
-2	18	.769	.235	-.077	-.120
-2	16	.710	.194	-.078	-.098
-2	14	.608	.143	-.068	-.083
-2	12	.509	.102	-.055	-.070
-2	10	.406	.069	-.044	-.054
-2	8	.304	.042	-.030	-.038
-2	6	.208	.023	-.015	-.020
-2	4	.106	.012	0	-.004
-2	2	.029	.008	.011	.011
-2	0	-.050	.007	.024	.033
-2	-2	-.121	.010	.039	.051
-2	-4	-.223	.020	.051	.066
-2	-6	-.321	.035	.067	.088
-2	-8	-.418	.061	.084	.109
-2	-10	-.545	.095	.098	.132
-4	28	1.118	.566	-.124	-.205
-4	26	1.059	.492	-.112	-.185
-4	24	.978	.413	-.102	-.168
-4	22	.910	.346	-.088	-.159
-4	20	.818	.280	-.070	-.138
-4	18	.726	.221	-.058	-.100
-4	16	.662	.180	-.054	-.071
-4	14	.574	.133	-.049	-.060
-4	12	.472	.093	-.036	-.043
-4	10	.370	.060	-.020	-.027
-4	8	.265	.036	-.006	-.012
-4	6	.167	.020	.010	.005
-4	4	.067	.011	.022	.026
-4	2	-.010	.008	.034	.044
-4	0	-.090	.008	.047	.062
-4	-2	-.172	.013	.062	.081
-4	-4	-.272	.026	.075	.098
-4	-6	-.367	.043	.092	.120
-4	-8	-.480	.071	.107	.137
-4	-10	-.587	.104	.121	.152
-8	28	1.038	.525	-.092	-.161
-8	26	.981	.454	-.079	-.138
-8	24	.910	.385	-.067	-.118
-8	22	.829	.318	-.054	-.106
-8	20	.742	.256	-.037	-.086
-8	18	.652	.201	-.020	-.058
-8	16	.568	.152	-.010	-.024
-8	14	.475	.113	-.005	-.012
-8	12	.377	.077	.007	.005
-8	10	.276	.049	.018	.022
-8	8	.179	.029	.033	.039
-8	6	.079	.016	.048	.062
-8	4	-.010	.010	.061	.077
-8	2	-.092	.010	.074	.092
-8	0	-.177	.015	.088	.110
-8	-2	-.267	.023	.103	.126
-8	-4	-.361	.038	.121	.153
-8	-6	-.462	.062	.137	.176
-8	-8	-.562	.092	.153	.196
-8	-10	-.661	.129	.166	.211
-12	28	0.979	0.492	-0.057	-0.100
-12	26	.904	.424	-.043	-.081
-12	24	.835	.348	-.031	-.064
-12	22	.750	.286	-.016	-.046
-12	20	.659	.223	-.002	-.029
-12	18	.566	.170	.017	-.003
-12	16	.470	.126	.031	.033
-12	14	.379	.091	.039	.051
-12	12	.283	.063	.050	.068
-12	10	.187	.042	.062	.084
-12	8	.088	.025	.075	.102
-12	6	-.020	.016	.091	.122
-12	4	-.100	.013	.107	.138
-12	2	-.188	.018	.120	.161
-12	0	-.282	.026	.134	.179
-12	-2	-.359	.037	.144	.190
-12	-4	-.454	.056	.165	.230
-12	-6	-.563	.086	.186	.254
-12	-8	-.660	.120	.201	.278
-12	-10	-.761	.160	.214	.293
-16	28	.889	.455	-.021	-.047
-16	26	.821	.389	-.008	-.028
-16	24	.744	.324	.005	-.006
-16	22	.662	.265	.021	.016
-16	20	.568	.207	.037	.036
-16	18	.475	.158	.058	.060
-16	16	.381	.117	.071	.094
-16	14	.282	.083	.080	.117
-16	12	.191	.059	.092	.135
-16	10	.092	.041	.104	.154
-16	8	. 0	.027	.116	.177
-16	6	-.101	.022	.132	.199
-16	4	-.188	.023	.146	.215
-16	2	-.269	.031	.160	.245
-16	0	-.362	.042	.172	.259
-16	-2	-.431	.057	.180	.265
-16	-4	-.536	.077	.199	.295
-16	-6	-.641	.111	.223	.338
-16	-8	-.740	.149	.240	.356
-16	-10	-.839	.195	.253	.373

Table IV.-Aerodynamic characteristics of a triangular wing with various flap angles. Reynolds number, 5,300,000; Mach number, 0.80.

δ	α	C_L	C_D	C_m	C_h	δ	α	C_L	C_D	C_m	C_h
0	20	0.962	0.344	-0.130	-0.206	-4	20	0.812	0.302	-0.094	-0.160
0	18	.900	.295	-.149	-.178	-4	18	.759	.243	-.069	-.105
0	16	.825	.233	-.137	-.168	-4	16	.714	.198	-.071	-.086
0	14	.715	.177	-.119	-.149	-4	14	.612	.147	-.052	-.070
0	12	.610	.127	-.104	-.130	-4	12	.502	.105	-.048	-.053
0	10	.502	.088	-.086	-.107	-4	10	.395	.069	-.032	-.035
0	8	.392	.056	-.067	-.084	-4	8	.290	.042	-.010	-.015
0	6	.286	.033	-.048	-.060	-4	6	.175	.023	.004	.004
0	4	.182	.018	-.031	-.042	-4	4	.081	.012	.019	.022
0	2	.088	.010	-.016	-.022	-4	2	0	.009	.032	.042
0	0	.001	.008	0	-.001	-4	0	-.084	.009	.048	.064
0	-2	-.075	.009	.013	.016	-4	-2	-.180	.015	.063	.080
0	-4	-.176	.016	.029	.035	-4	-4	-.274	.026	.081	.105
0	-6	-.281	.031	.047	.058	-4	-6	-.383	.046	.099	.128
0	-8	-.392	.055	.065	.081	-4	-8	-.491	.074	.120	.155
0	-10	-.498	.086	.084	.100	-4	-10	-.600	.110	.157	.179
2	20	1.010	.362	-.153	-.243	-8	20	.761	.272	-.052	-.106
2	18	.960	.314	-.173	-.212	-8	18	.674	.213	-.029	-.065
2	16	.878	.254	-.166	-.203	-8	16	.580	.166	-.016	-.017
2	14	.775	.194	-.149	-.191	-8	14	.511	.130	-.015	0
2	12	.665	.144	-.133	-.172	-8	12	.413	.088	-.002	.012
2	10	.556	.101	-.115	-.146	-8	10	.308	.058	.011	.030
2	8	.450	.066	-.095	-.123	-8	8	.193	.035	.031	.050
2	6	.340	.040	-.075	-.101	-8	6	.086	.019	.049	.073
2	4	.235	.022	-.057	-.079	-8	4	-.012	.012	.067	.090
2	2	.143	.013	-.042	-.056	-8	2	-.098	.014	.080	.114
2	0	.044	.008	-.026	-.035	-8	0	-.186	.018	.098	.134
2	-2	-.033	.009	-.012	-.016	-8	-2	-.276	.027	.115	.159
2	-4	-.120	.013	.003	0	-8	-4	-.382	.044	.138	.186
2	-6	-.223	.026	.019	.022	-8	-6	-.489	.068	.157	.214
2	-8	-.335	.047	.038	.044	-8	-8	-.597	.100	.177	.248
2	-10	-.444	.075	.055	.064	-8	-10	-.691	.142	.195	.274
4	20	1.050	.384	-.177	-.287	-12	20	.675	.250	-.009	-.029
4	18	1.009	.335	-.200	-.251	-12	18	.575	.197	.014	.003
4	16	.928	.275	-.196	-.245	-12	16	.486	.149	.034	.049
4	14	.831	.214	-.181	-.234	-12	14	.403	.111	.042	.085
4	12	.721	.162	-.163	-.214	-12	12	.308	.078	.050	.100
4	10	.614	.116	-.145	-.188	-12	10	.209	.054	.063	.117
4	8	.508	.078	-.125	-.166	-12	8	.101	.034	.083	.139
4	6	.395	.049	-.105	-.143	-12	6	-.003	.024	.100	.164
4	4	.290	.029	-.085	-.119	-12	4	-.092	.020	.113	.185
4	2	.192	.017	-.069	-.092	-12	2	-.190	.025	.126	.217
4	0	.095	.012	-.053	-.071	-12	0	-.271	.029	.143	.241
4	-2	.012	.009	-.037	-.050	-12	-2	-.353	.044	.155	.260
4	-4	-.078	.011	-.023	-.036	-12	-4	-.442	.064	.171	.279
4	-6	-.175	.021	-.007	-.014	-12	-6	-.558	.091	.197	.314
4	-8	-.278	.041	.012	.009	-12	-8	-.669	.128	.218	.360
4	-10	-.388	.068	.029	.030	-12	-10	---	---	---	---
-2	20	.853	.320	-.111	-.179	-16	20	.608	.239	.028	.064
-2	18	.814	.263	-.102	-.128	-16	18	.512	.188	.048	.095
-2	16	.753	.215	-.108	-.124	-16	16	.419	.141	.068	.137
-2	14	.659	.161	-.091	-.108	-16	14	.328	.108	.081	.178
-2	12	.551	.115	-.076	-.089	-16	12	.238	.078	.088	.200
-2	10	.450	.078	-.058	-.069	-16	10	.142	.063	.096	.218
-2	8	.339	.048	-.039	-.049	-16	8	.039	.041	.109	---
-2	6	.232	.027	-.022	-.027	-16	6	-.103	.030	.128	.260
-2	4	.132	.014	-.006	-.010	-16	4	-.143	.031	.144	.285
-2	2	.041	.008	.008	.009	-16	2	-.231	.037	.155	.305
-2	0	-.040	.009	.024	.033	-16	0	-.313	.047	.168	.323
-2	-2	-.129	.011	.037	.048	-16	-2	-.399	.060	.179	.336
-2	-4	-.224	.020	.055	.070	-16	-4	-.482	.082	.192	.347
-2	-6	-.332	.038	.075	.093	-16	-6	---	---	---	---
-2	-8	-.440	.064	.094	.118	-16	-8	---	---	---	---
-2	-10	-.549	.098	.119	.138	-16	-10	---	---	---	---

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Table V.- Aerodynamic characteristics of a triangular wing with various flap angles. Reynolds number, 5,300,000; Mach number, 0.90.

δ	α	C_L	C_D	C_m	C_h
2	12	---	0.160	-0.176	---
2	10	---	.113	-.156	---
2	8	.486	.078	-.116	-0.150
2	6	.372	.047	-.092	-.115
2	4	.269	.027	-.070	-.089
2	2	.153	.016	-.052	-.067
2	0	.063	.011	-.036	-.048
2	-2	-.027	.010	-.020	-.028
2	-4	-.125	.015	-.001	-.010
2	-6	-.235	.030	.018	.014
2	-8	-.348	.051	.051	.040
2	-10	-.466	.083	.068	.069
0	12	.675	.142	.140	-.164
0	10	.540	.098	-.109	-.132
0	8	.420	.062	-.082	-.101
0	6	.307	.036	-.060	-.071
0	4	.202	.019	-.040	-.050
0	2	.099	.012	-.021	-.028
0	0	.008	.009	-.006	-.009
0	-2	-.085	.010	.013	.012
0	-4	-.182	.018	.032	.035
0	-6	-.292	.034	.052	.056
0	-8	-.407	.059	.075	.085
0	-10	-.525	.094	.104	.117
-2	12	.601	.127	-.102	-.120
-2	10	.475	.086	-.073	-.082
-2	8	.357	.052	-.049	-.055
-2	6	.247	.030	-.028	-.030
-2	4	.142	.016	-.009	-.012
-2	2	.044	.010	.010	.009
-2	0	-.047	.095	.025	.032
-2	-2	-.140	.013	.043	.056
-2	-4	-.241	.024	.074	.081
-2	-6	-.348	.040	.084	.103
-2	-8	-.460	.067	.106	.137
-2	-10	-.578	.103	.136	.171
-4	12	.546	.117	-.068	-.073
-4	10	.422	.076	-.043	-.041
-4	8	.306	.047	-.020	-.013
-4	6	.197	.027	.001	.008
-4	4	.086	.015	.020	.025
-4	2	-.006	.011	.039	.047
-4	0	-.097	.012	.054	.077
-4	-2	-.190	.018	.073	.100
-4	-4	-.295	.028	.094	.131
-4	-6	-.400	.049	.115	.160
-4	-8	-.511	.075	.134	.197
-4	-10	-.636	.112	.167	---
-6	12	0.490	0.109	-0.036	-0.021
-6	10	.373	.072	-.014	.005
-6	8	.265	.044	.008	.031
-6	6	.156	.025	.029	.050
-6	4	.037	.015	.047	.073
-6	2	-.053	.013	.066	.103
-6	0	-.145	.016	.082	.129
-6	-2	-.238	.024	.100	.160
-6	-4	-.340	.034	.122	.202
-6	-6	-.450	.060	.142	.236
-8	12	.437	-.007	.103	.039
-8	10	.324	.014	.067	.067
-8	8	.207	.036	.042	.088
-8	6	.101	.056	.026	.114
-8	4	-.005	.072	.018	.147
-8	2	-.096	.090	.018	.175
-8	0	-.191	.107	.023	.201
-8	-2	-.283	.125	.334	.236
-8	-4	-.385	.148	.052	.278
-10	12	.387	.098	.020	.117
-10	10	.274	.060	.040	.140
-10	8	.163	.042	.060	.162
-10	6	.057	.029	.079	.184
-10	4	-.042	.022	.096	.205
-10	2	-.136	.023	.113	.232
-10	0	-.230	.031	.130	.259
-10	-2	-.321	.042	.147	.297
-10	-4	-.421	.063	.169	.342
-12	12	.344	.096	.046	.188
-12	10	.237	.065	.065	.200
-12	8	.131	.045	.082	.217
-12	6	.026	.033	.099	.232
-12	4	-.070	.027	.116	.255
-12	2	-.165	.029	.132	.281
-12	0	-.260	.037	.150	.313
-12	-2	-.350	.050	.166	.355
-12	-4	-.445	.072	.188	.400
-16	12	.272	.102	.088	.299
-16	10	.171	.074	.103	.300
-16	8	.071	.053	.113	.301
-16	6	-.026	.042	.130	.317
-16	4	-.136	---	.148	.350
-16	2	-.230	---	---	---

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Table VI.–Aerodynamic characteristics of a triangular wing and a fuselage for various flap angles. Reynolds number, 5,300,000; Mach number, 0.50.

δ	α	C_L	C_D	C_m	C_h
4	-16	-0.624	0.169	0.046	0.096
4	-14	-.536	.126	.036	.067
4	-12	-.447	.091	.029	.050
4	-10	-.357	.062	.020	.033
4	-8	-.263	.039	.008	.016
4	-6	-.165	.024	-.006	.000
4	-4	-.070	.014	-.019	-.021
4	-2	.003	.012	-.030	-.040
4	0	.082	.014	-.040	-.062
4	2	.166	.019	-.051	-.084
4	4	.255	.029	-.066	-.105
4	6	.360	.045	-.080	-.125
4	8	.445	.070	-.092	-.144
4	10	.543	.101	-.106	-.164
4	12	.638	.137	-.116	-.182
4	14	.743	.183	-.114	-.190
4	16	.835	.225	-.122	-.230
4	18	.850	.288	-.130	-.244
0	-16	-.701	.192	.078	.152
0	-14	-.617	.148	.070	.117
0	-12	-.526	.108	.065	.103
0	-10	-.432	.075	.054	.086
0	-8	-.337	.050	.043	.069
0	-6	-.240	.030	.030	.050
0	-4	-.145	.017	.017	.030
0	-2	-.066	.012	.006	.011
0	0	.015	.011	-.005	-.008
0	2	.092	.013	-.016	-.028
0	4	.178	.019	-.028	-.049
0	6	.267	.033	-.038	-.068
0	8	.362	.054	-.056	-.086
0	10	.456	.081	-.065	-.103
0	12	.550	.113	-.077	-.119
0	14	.626	.150	-.077	-.132
0	16	.715	.198	-.087	-.165
0	18	.801	.251	-.108	-.184
-2	-16	-.742	.206	.099	.182
-2	-14	-.678	.163	.095	.150
-2	-12	-.572	.120	.085	.133
-2	-10	-.477	.084	.075	.116
-2	-8	-.381	.057	.065	.098
-2	-6	-.284	.035	.050	.079
-2	-4	-.192	.021	.036	.060
-2	-2	-.106	.013	.024	.039
-2	0	-.026	.011	.014	.020
-2	2	.052	.012	.004	.000
-2	4	.137	.017	-.008	-.020
-2	6	.226	.029	-.021	-.039
-2	8	.321	.048	-.035	-.057
-2	10	.414	.073	-.047	-.074
-2	12	.508	.103	-.056	-.088
-2	14	.584	.149	-.057	-.101
-2	16	.670	.183	-.068	-.133
-2	18	.766	.236	-.079	-.153
-4	-16	-.782	.221	.122	.213
-4	-14	-.732	.178	.122	.186
-4	-12	-.620	.132	.100	.166
-4	-10	-.524	.095	.099	.148
-4	-8	-.430	.065	.088	.130
-4	-6	-.332	.042	.073	.111
-4	-4	-.237	.025	.060	.092
-4	-2	-.150	.016	.047	.069
-4	0	-.070	.013	.034	.048
-4	2	.008	.012	.025	.028
-4	4	.093	.015	.012	.007
-4	6	.184	.025	-.001	-.013
-4	8	.279	.041	-.013	-.031
-4	10	.373	.065	-.026	-.048
-4	12	.470	.095	-.036	-.063
-4	14	.545	.129	-.040	-.079
-4	16	.633	.170	-.050	-.106
-4	18	.729	.223	-.061	-.126

δ	α	C_L	C_D	C_m	C_h
-8	-16	-0.865	0.255	0.159	0.276
-8	-14	-.821	.221	.166	.254
-8	-12	-.718	.161	.149	.234
-8	-10	-.619	.119	.145	.217
-8	-8	-.524	.085	.134	.200
-8	-6	-.426	.059	.120	.181
-8	-4	-.329	.038	.106	.157
-8	-2	-.238	.025	.089	.130
-8	0	-.158	.018	.075	.108
-8	2	-.075	.014	.064	.087
-8	4	.007	.014	.056	.067
-8	6	.098	.020	.040	.046
-8	8	.193	.032	.028	.027
-8	10	.290	.054	.016	.009
-8	12	.386	.080	.005	-.007
-8	14	.475	.112	-.005	-.029
-8	16	.563	.152	-.018	-.053
-8	18	.658	.202	-.029	-.073
-12	-16	-.942	.287	.195	.339
-12	-14	-.904	.244	.213	.326
-12	-12	-.804	.193	.197	.309
-12	-10	-.715	.149	.188	.292
-12	-8	-.614	.111	.179	.279
-12	-6	-.517	.079	.164	.256
-12	-4	-.417	.054	.146	.219
-12	-2	-.324	.038	.129	.189
-12	0	-.243	.026	.116	.172
-12	2	-.160	.020	.107	.153
-12	4	-.078	.016	.096	.132
-12	6	.013	.020	.082	.107
-12	8	.107	.029	.067	.086
-12	10	.207	.046	.054	.066
-12	12	.297	.069	.041	.047
-12	14	.392	.098	.034	.032
-12	16	.484	.136	.021	-.002
-12	18	.582	.182	.007	-.023
-16	-16	-.977	.317	.221	.395
-16	-14	-.953	.259	.230	.390
-16	-12	-.883	.226	.236	.390
-16	-10	-.792	.181	.230	.377
-16	-8	-.705	.140	.223	.362
-16	-6	-.602	.105	.207	.336
-16	-4	-.496	.073	.182	.278
-16	-2	-.401	.053	.165	.258
-16	0	-.320	.040	.155	.248
-16	2	-.246	.031	.149	.230
-16	4	-.163	.024	.137	.201
-16	6	-.072	.023	.124	.179
-16	8	.020	.029	.111	.156
-16	10	.119	.041	.096	.132
-16	12	.213	.061	.083	.109
-16	14	.310	.087	.069	.075
-16	16	.409	.121	.054	.052
-16	18	.505	.163	.042	.029

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Table VII.- Aerodynamic characteristics of a triangular wing and a fuselage for various flap angles. Reynolds number, 5,300,000; Mach number, 0.60.

δ	α	C_L	C_D	C_m	C_h
4	-16	-0.635	0.172	0.034	0.103
4	-14	-.543	.130	.050	.061
4	-12	-.458	.094	.030	.050
4	-10	-.365	.063	.019	.032
4	-8	-.265	.041	.006	.025
4	-6	-.160	.024	-.007	-.005
4	-4	-.072	.013	-.021	-.026
4	-2	.010	.011	-.032	-.045
4	0	.092	.014	-.043	-.066
4	2	.175	.020	-.054	-.088
4	4	.268	.030	-.068	-.111
4	6	.355	.047	-.083	-.134
4	8	.458	.073	-.099	-.154
4	10	.550	.104	-.112	-.174
4	12	.645	.143	-.122	-.194
4	14	.760	.171	-.135	-.217
4	16	.870	.248	---	-.232
4	18	.912	.301	-.144	-.254
0	-18	-.797	.252	.094	.178
0	-16	-.710	.196	.073	.161
0	-14	-.630	.152	.085	.123
0	-12	-.543	.111	.070	.108
0	-10	-.440	.077	.059	.089
0	-8	-.341	.050	.046	.070
0	-6	-.245	.031	.033	.050
0	-4	-.147	.017	.019	.031
0	-2	-.063	.013	.007	.010
0	0	.017	.011	-.004	-.010
0	2	.095	.014	-.015	-.030
0	4	.180	.020	-.029	-.051
0	6	.270	.024	-.041	-.070
0	8	.370	.054	-.056	-.091
0	10	.465	.082	-.070	-.108
0	12	.560	.116	-.081	-.127
0	14	.660	.157	-.092	-.144
0	16	.740	.206	-.094	-.173
0	18	.804	.258	-.106	-.192
-2	-18	-.836	.267	.115	.211
-2	-16	-.750	.211	.106	.191
-2	-14	-.690	.170	.102	.163
-2	-12	-.590	.123	.092	.139
-2	-10	-.485	.086	.081	.119
-2	-8	-.386	.057	.068	.101
-2	-6	-.290	.036	.053	.080
-2	-4	-.192	.021	.039	.060
-2	-2	-.109	.014	.027	.038
-2	0	-.025	.012	.015	.018
-2	2	.050	.012	.004	-.002
-2	4	.140	.018	-.008	-.022
-2	6	.230	.029	-.021	-.040
-2	8	.326	.048	-.036	-.060
-2	10	.422	.074	-.048	-.077
-2	12	.519	.106	-.060	-.093
-2	14	.601	.145	-.066	-.103
-2	16	.686	.191	-.072	-.144
-2	18	.770	.243	-.085	-.162
-4	-18	-.875	.282	.137	.246
-4	-16	-.788	.225	.131	.223
-4	-14	-.741	.184	.121	.197
-4	-12	-.635	.136	.116	.173
-4	-10	-.531	.097	.104	.153
-4	-8	-.435	.066	.090	.136
-4	-6	-.335	.042	.076	.115
-4	-4	-.238	.026	.060	.090
-4	-2	-.150	.017	.046	.067
-4	0	-.070	.012	.035	.046
-4	2	.001	.012	.024	.027
-4	4	.095	.015	.012	.008
-4	6	.185	.026	.001	-.013
-4	8	.283	.043	-.014	-.032
-4	10	.380	.066	-.027	-.049
-4	12	.475	.098	-.039	-.064
-4	14	.555	.133	-.043	-.074
-4	16	.651	.181	-.053	-.115
-4	18	.750	.232	-.066	-.132
-8	-16	-0.880	0.255	0.176	0.282
-8	-14	-.831	.217	.169	.261
-8	-12	-.730	.165	.164	.242
-8	-10	-.632	.123	.154	.225
-8	-8	-.536	.088	.138	.213
-8	-6	-.432	.060	.125	.190
-8	-4	-.330	.039	.107	.162
-8	-2	-.235	.025	.090	.131
-8	0	-.157	.018	.077	.110
-8	2	-.077	.014	.066	.090
-8	4	.010	.014	.053	.069
-8	6	.100	.021	.041	.047
-8	8	.195	.035	.028	.028
-8	10	.295	.056	.014	.008
-8	12	.393	.083	.003	-.007
-8	14	.485	.114	-0.004	-.025
-8	16	.572	.159	-0.017	-.057
-8	18	.670	.207	-0.030	-.073
-12	-16	-1.022	.291	.218	.351
-12	-14	-.915	.251	---	.338
-12	-12	-.815	.192	.207	.320
-12	-10	-.722	.152	.198	.304
-12	-8	-.629	.115	.189	.292
-12	-6	-.527	.082	.173	.270
-12	-4	-.414	.054	.152	.223
-12	-2	-.320	.035	.136	.203
-12	0	-.243	.025	.123	.184
-12	2	-.162	.020	.109	.160
-12	4	-.078	.016	.097	.135
-12	6	.015	.019	.084	.115
-12	8	.110	.031	.070	.091
-12	10	.205	.048	.057	.067
-12	12	.305	.070	.044	.051
-12	14	.403	.101	.033	.022
-12	16	.490	.138	.017	-.003
-12	18	.592	.184	.005	-.014
-16	-16	-.986	.328	.255	.397
-16	-14	-.990	.294	---	.396
-16	-12	-.896	.233	.244	.394
-16	-10	-.803	.189	.237	.388
-16	-8	-.708	.149	.230	.380
-16	-6	-.600	.108	.214	.357
-16	-4	-.488	.070	.181	.288
-16	-2	-.396	.055	.169	.278
-16	0	-.326	.040	.159	.268
-16	2	-.247	.030	.152	.245
-16	4	-.163	.026	.139	.221
-16	6	-.072	.024	.126	.200
-16	8	.020	.030	.112	.165
-16	10	.120	.044	.100	.138
-16	12	.220	.064	.086	.117
-16	14	.320	.091	.070	.082
-16	16	.420	.127	.054	.055
-16	18	.465	.171	.041	.030

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Table VIII.- Aerodynamic characteristics of a triangular wing and a fuselage for various flap angles. Reynolds number, 5,300,000; Mach number, 0.80.

δ	α	C_L	C_D	C_m	C_h
4	-16	-0.645	0.183	0.051	---
4	-14	-.567	.140	.051	.063
4	-12	-.485	.102	.038	.047
4	-10	-.381	.070	.023	.031
4	-8	-.278	.044	.006	.009
4	-6	-.170	.026	-.008	-.014
4	-4	-.073	.017	-.030	-.037
4	-2	.020	.014	-.042	-.057
4	0	.117	.018	-.054	-.080
4	2	.197	.023	-.067	-.100
4	4	.285	.034	-.081	-.131
4	6	.385	.054	-.101	-.162
4	8	.495	.080	-.120	-.192
4	10	.596	.112	-.138	-.222
4	12	.690	.155	-.161	-.245
4	14	.781	.199	-.178	-.265
4	16	.828	.253	---	-.279
4	18	---	---	---	-.347
-2	-16	-.745	.230	.143	---
-2	-14	-.722	.183	.127	.181
-2	-12	-.630	.136	.115	.163
-2	-10	-.724	.096	.092	.139
-2	-8	-.414	.063	.079	.117
-2	-6	-.307	.038	.059	.090
-2	-4	-.203	.022	.042	.065
-2	-2	-.112	.015	.028	.042
-2	0	-.026	.012	.017	.019
-2	2	.054	.014	.004	-.003
-2	4	.147	.019	-.011	-.024
-2	6	.246	.033	-.027	-.044
-2	8	.350	.053	-.043	-.065
-2	10	.453	.083	-.060	-.087
-2	12	.554	.118	-.073	-.105
-2	14	.641	.159	-.078	-.116
-2	16	.704	.205	-.079	-.149
-2	18	---	.250	---	-.178
-8	-16	-1.000	.280	.231	---
-8	-14	-.878	.235	.214	.285
-8	-12	-.786	.187	.201	.284
-8	-10	-.687	.140	.186	.273
-8	-8	-.582	.101	.167	.255
-8	-6	-.466	.069	.149	.229
-8	-4	-.360	.045	.124	.187
-8	-2	-.265	.030	.106	.162
-8	0	-.165	.022	.086	.137
-8	2	-.081	.018	.075	.114
-8	4	.001	.017	.061	.084
-8	6	.104	.025	.045	.062
-8	8	.210	.038	.029	.040
-8	10	.310	.059	.013	.018
-8	12	.411	.087	.002	.002
-8	14	.498	.128	-.007	-.033
-8	16	.588	.171	-.024	-.075
-8	18	.696	.222	-.054	-.110

δ	α	C_L	C_D	C_m	C_h
0	-14	-0.667	0.165	0.098	0.141
0	-12	-.579	.122	.087	.123
0	-10	-.472	.085	.069	.102
0	-8	-.366	.054	.054	.079
0	-6	-.258	.032	.035	.054
0	-4	-.156	.019	.019	.031
0	-2	-.064	.014	.005	.008
0	0	.020	.012	-.007	-.014
0	2	.100	.015	-.020	-.036
0	4	.190	.022	-.034	-.056
0	6	.293	.038	-.051	-.080
0	8	.398	.062	-.068	-.103
0	10	.501	.092	-.084	-.127
0	12	.602	.130	-.100	-.146
0	14	.688	.172	-.108	-.156
0	16	.741	.220	-.099	-.180
0	18	---	.270	---	-.220
-4	-16	-.820	.248	.151	---
-4	-14	-.780	.202	.158	.225
-4	-12	-.684	.152	.144	.207
-4	-10	-.575	.109	.123	.181
-4	-8	-.463	.073	.107	.157
-4	-6	-.357	.046	.086	.130
-4	-4	-.250	.028	.067	.100
-4	-2	-.160	.018	.052	.075
-4	0	-.071	.014	.037	.053
-4	2	.010	.014	.027	.030
-4	4	.100	.017	.013	.008
-4	6	.200	.029	-.003	-.012
-4	8	.302	.046	-.019	-.032
-4	10	.406	.074	-.036	-.051
-4	12	.507	.106	-.048	-.067
-4	14	.592	.147	-.052	-.079
-4	16	.666	.192	-.060	-.131
-4	18	.771	.235	-.083	-.174
-12	-16	-.940	.316	.213	---
-12	-14	-.930	.259	.239	.360
-12	-12	-.847	.214	.233	.385
-12	-10	-.749	.170	.225	.393
-12	-8	-.651	.127	.209	.375
-12	-6	-.544	.090	.189	.340
-12	-4	-.425	.063	.161	.282
-12	-2	-.338	.046	.146	.265
-12	0	-.250	.034	.132	.240
-12	2	-.165	.026	.121	.209
-12	4	-.077	.024	.106	.180
-12	6	.019	.027	.091	.148
-12	8	.120	.038	.075	.123
-12	10	.222	.056	.060	.095
-12	12	.318	.081	.051	.079
-12	14	.405	.115	.034	.026
-12	16	.514	.156	.015	-.009
-12	18	.618	.208	-.010	-.023
-16	-16	-.958	.328	.237	---
-16	-14	-.955	.280	.251	---
-16	-12	-.872	.232	.246	---
-16	-10	-.762	.186	.236	---
-16	-8	-.670	.143	.223	---
-16	-6	-.567	.108	.206	---
-16	-4	-.470	.081	.186	---
-16	-2	-.382	.063	.171	---
-16	0	-.300	.049	.155	---
-16	2	-.220	.040	.149	---
-16	4	-.130	.025	.136	.297
-16	6	-.036	.025	.120	.269
-16	8	.057	.044	.107	.239
-16	10	.156	.060	.094	.216
-16	12	.243	.082	.084	.189
-16	14	.346	.111	.067	.125
-16	16	.452	.151	.053	.091
-16	18	.540	.197	.026	.067

Table IX.– Aerodynamic characteristics of a triangular wing and a fuselage for various flap angles. Reynolds number, 5,300,000; Mach number, 0.90.

δ	α	C_L	C_D	C_m	C_h
0	-12	0.630	0.138	0.116	0.179
0	-10	-.500	.094	.083	.131
0	- 8	-.376	.062	.041	.090
0	- 6	-.273	.037	.038	.058
0	- 4	-.167	.022	.022	.031
0	- 2	-.071	.015	.005	.008
0	0	.021	.013	-.008	-.013
0	2	.107	.016	-.024	-.036
0	4	.208	.024	-.039	-.060
0	6	.306	.041	-.056	-.088
0	8	.417	.068	-.075	-.127
0	10	.529	.103	-.102	-.173
0	12	.642	.147	-.133	-.218
0	14	.761	.207	---	---
0	16	.882	---	---	---
4	-12	-.524	.117	.059	.067
4	-10	-.404	.078	.034	.033
4	- 8	-.292	.049	.012	.007
4	- 6	-.184	.030	-.006	-.017
4	- 4	-.085	.020	-.023	-.039
4	- 2	.017	.016	-.041	-.061
4	0	.110	.020	-.055	-.084
4	2	.197	.029	-.068	-.118
4	4	.300	.040	-.086	-.155
4	6	.410	.061	-.111	-.194
4	8	.523	.091	-.133	-.238
4	10	.640	.130	-.162	-.283
4	12	.770	.176	-.191	---
4	14	---	.246	---	---
4	16	---	---	---	---
-2	-12	-.678	.151	.149	.213
-2	-10	-.554	.106	.113	.177
-2	- 8	-.437	.071	.090	.138
-2	- 6	-.325	.045	.070	.104
-2	- 4	-.210	.027	.047	.073
-2	- 2	-.120	.017	.030	.046
-2	0	-.030	.014	.017	.022
-2	2	.060	.015	.000	-.001
-2	4	.158	.022	-.015	-.024
-2	6	.258	.037	-.032	-.048
-2	8	.365	.059	-.051	-.074
-2	10	.474	.092	-.075	-.120
-2	12	.584	.134	-.103	-.167
-2	14	.698	.190	---	---
-2	16	.820	---	---	---
-4	-12	-0.723	0.165	—	---
-4	-10	-.608	.121	0.151	0.204
-4	-8	-.494	.083	.130	.173
-4	-6	-.382	.053	.105	.148
-4	-4	-.267	.032	.080	.117
-4	-2	-.172	.021	.059	.088
-4	0	-.082	.015	.043	.060
-4	2	.007	.015	.026	.036
-4	4	.107	.019	.011	.015
-4	6	.208	.032	-.005	-.008
-4	8	.316	.054	-.025	-.032
-4	10	.422	.083	-.046	-.057
-4	12	.528	.123	-.068	-.084
-4	14	.635	.174	-.093	-.122
-4	16	.754	---	—	---
-8	-12	-.796	.196	—	---
-8	-10	-.696	.150	.215	---
-8	-8	-.590	.109	.192	.294
-8	-6	-.476	.077	.166	.282
-8	-4	-.370	.053	.143	.267
-8	-2	-.270	.036	.119	.240
-8	0	-.175	.027	.102	.214
-8	2	-.087	.022	.087	.187
-8	4	.008	.022	.069	.155
-8	6	.115	.032	.052	.126
-8	8	.222	.049	.031	.100
-8	10	.322	.073	.010	.090
-8	12	.421	.105	-.004	.040
-8	14	.525	.147	-.020	-.032
-8	16	.640	---	-.047	---
-12	-12	---	.230	---	---
-12	-10	-.735	.176	.242	.402
-12	-8	-.631	.134	.228	.403
-12	-6	-.533	.100	.204	.402
-12	-4	-.430	.073	.180	.389
-12	-2	-.338	.055	.159	.362
-12	0	-.242	.043	.142	.322
-12	2	-.156	.034	.129	.286
-12	4	-.069	.031	.114	.258
-12	6	.033	.037	.097	.234
-12	8	.137	.050	.080	.211
-12	10	.240	.069	.063	.190
-12	12	.338	.099	.047	.205
-12	14	.440	.135	.032	.160
-12	16	.551	.188	.001	---
-14	-12	---	.247	---	---
-14	-10	-.738	.190	.252	---
-14	-8	-.633	.147	.242	---
-14	-6	-.539	.112	.215	---
-14	-4	-.440	.083	.189	---
-14	-2	-.355	.064	.169	---
-14	0	-.265	.051	.151	---
-14	2	-.177	.039	.138	---
-14	4	-.095	.037	.126	.311
-14	6	.005	.042	.112	.291
-14	8	.100	.054	.096	.278
-14	10	.210	.074	.080	.256
-14	12	.308	.102	.068	.270
-14	14	.419	.141	.049	.219
-14	16	.530	.186	.009	—

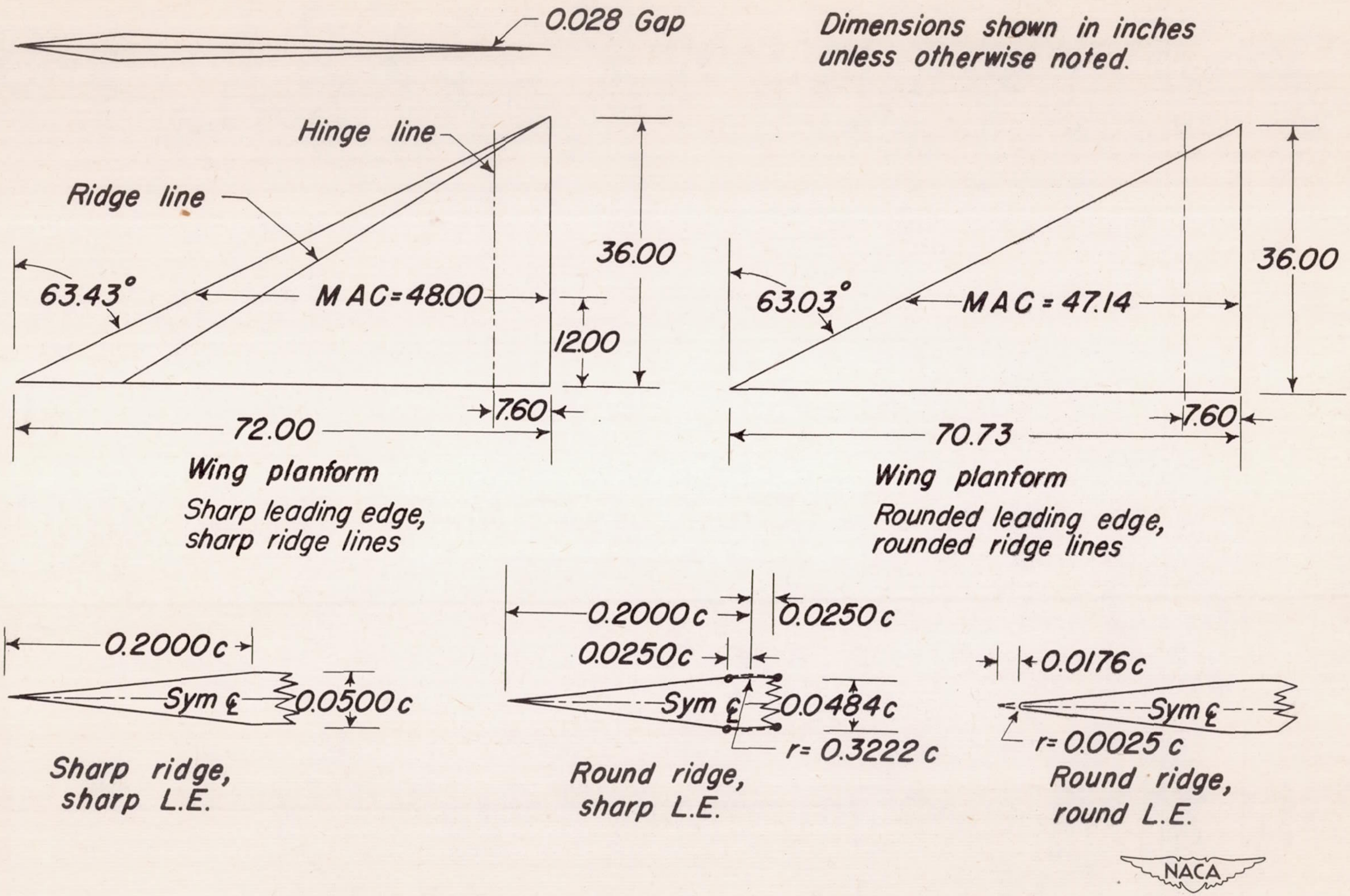


Figure 1.– Semispan model of a triangular wing of aspect ratio 2 tested in the Ames 12-foot pressure wind tunnel.

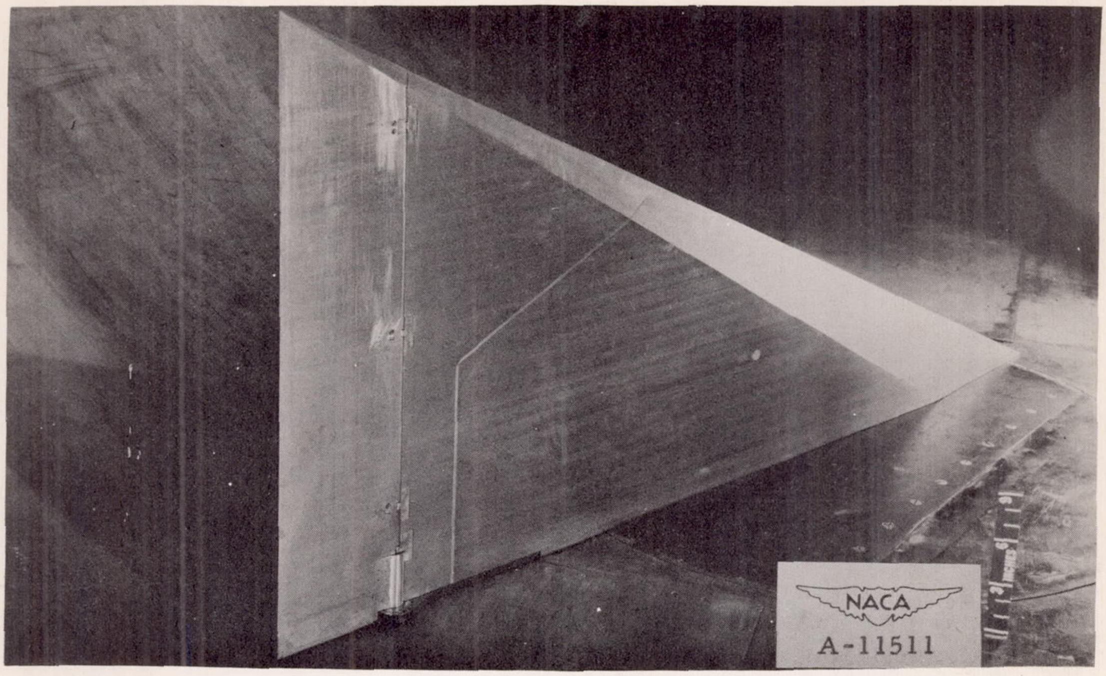


Figure 2.- The semispan triangular wing with sharp ridge lines and sharp leading edge mounted in the Ames 12-foot pressure wind tunnel.

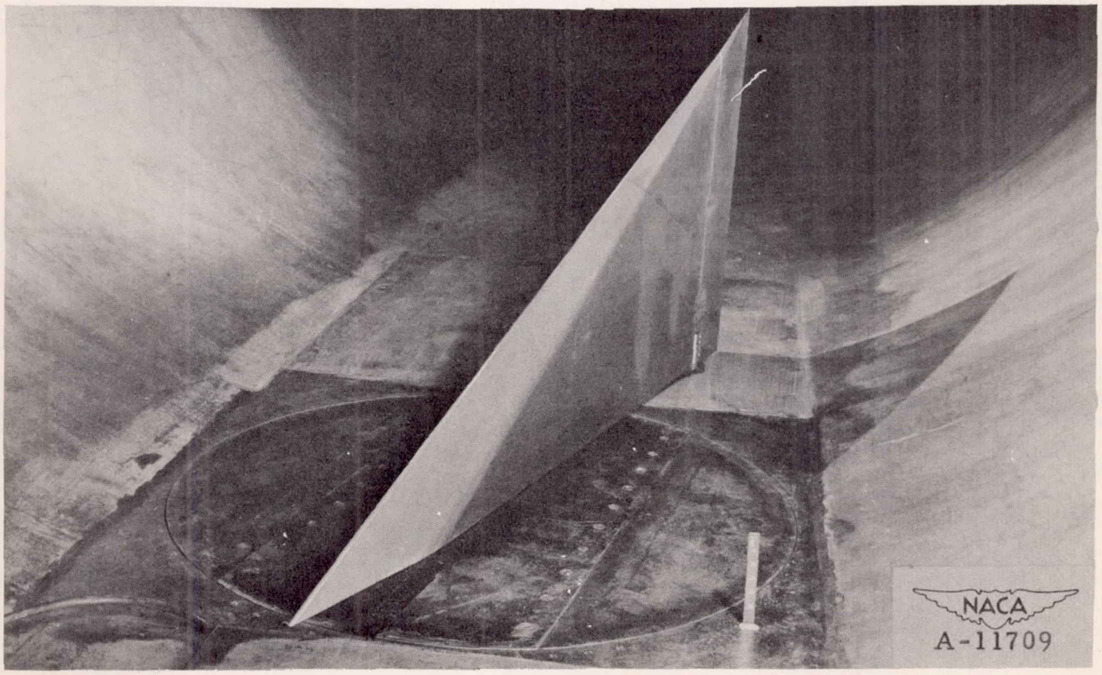
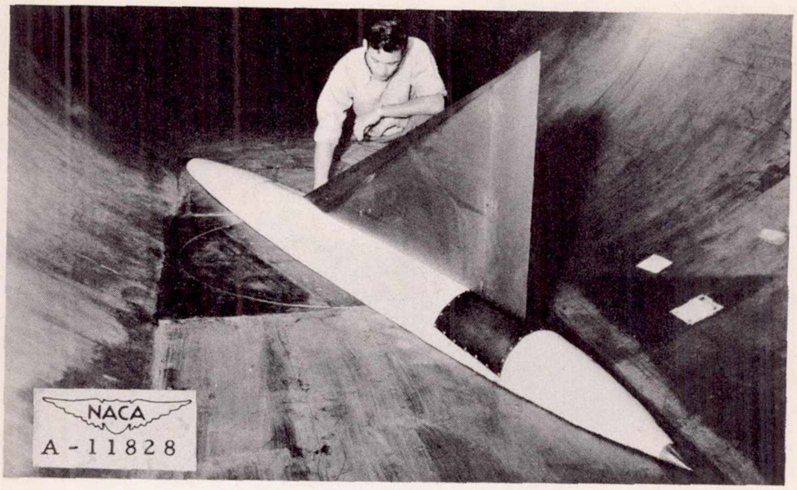
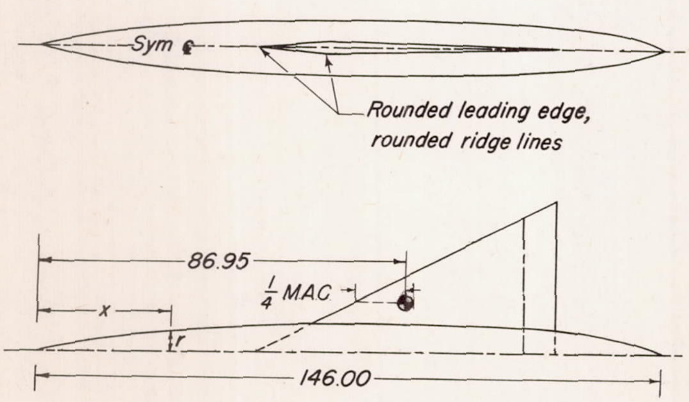


Figure 3.- The triangular wing with rounded ridge lines and a rounded leading edge.

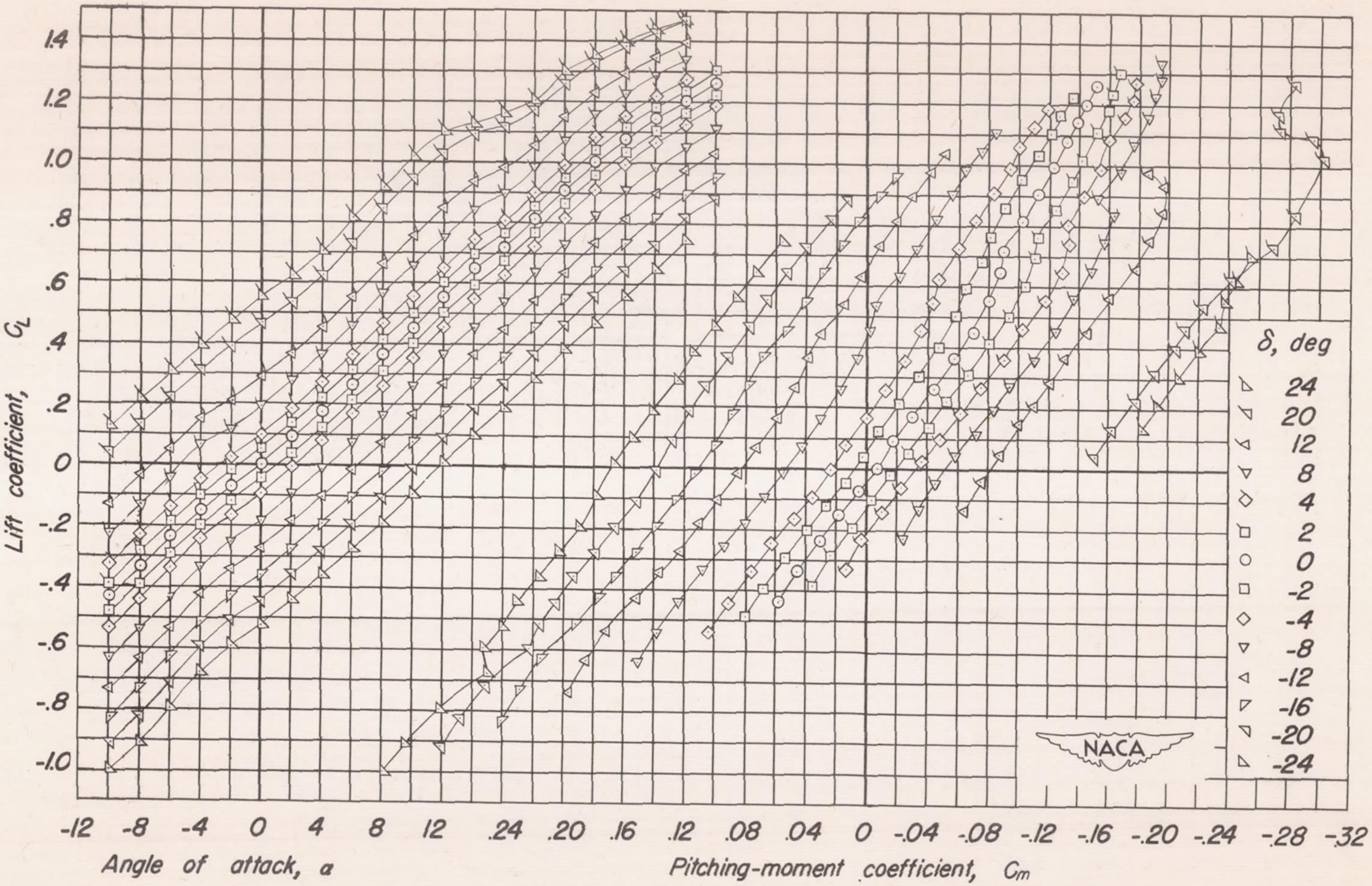


Note: Dimensions shown in inches



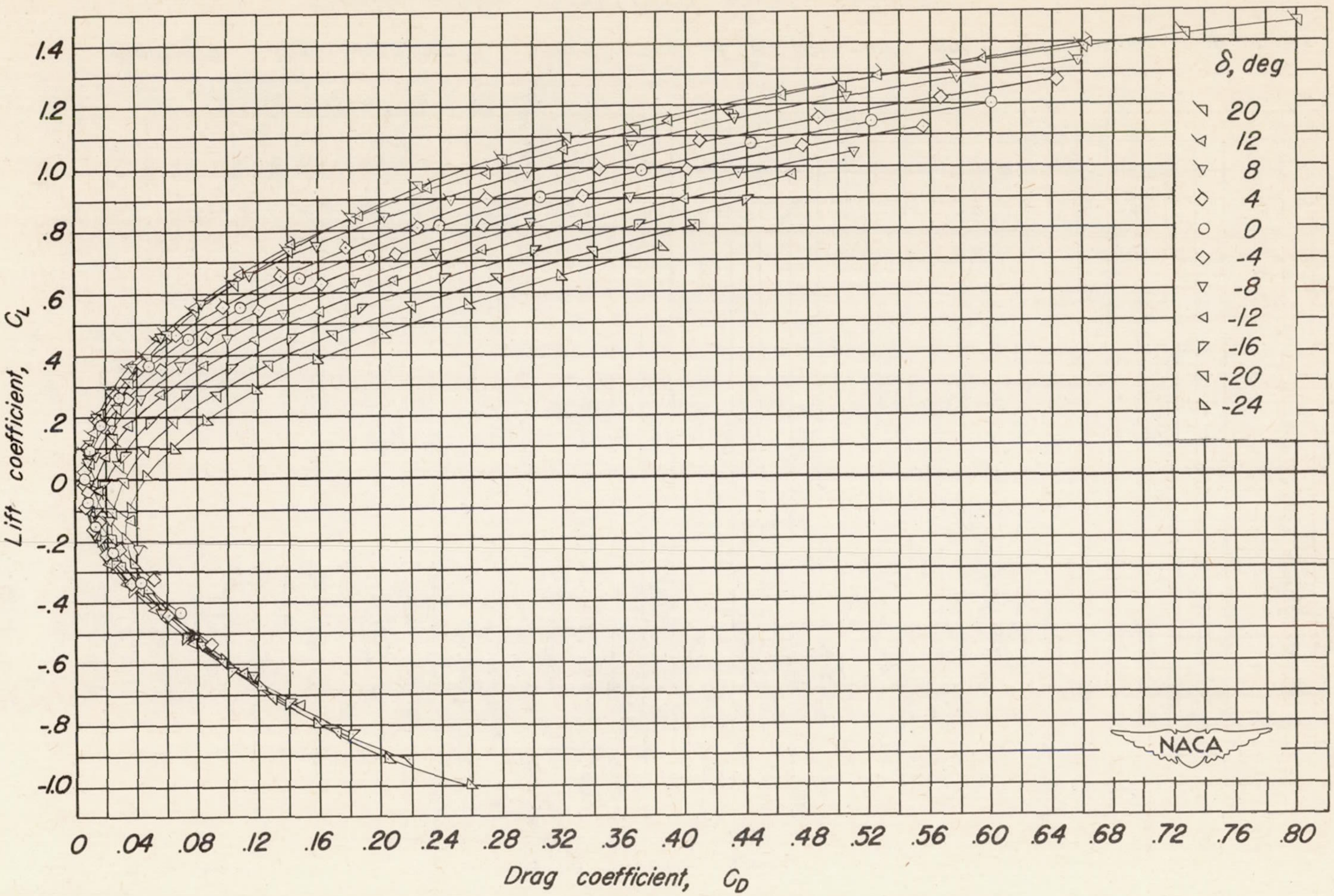
Body coordinates Percent length			
x	r	x	r
0	0	61.60	4.398
3.42	0.904	68.50	4.252
6.85	1.480	75.30	3.992
10.27	1.958	83.20	3.575
13.70	2.370	84.95	3.445
20.55	3.034	86.30	3.310
27.40	3.553	89.00	2.938
34.23	3.939	91.80	2.460
41.10	4.211	94.50	1.835
47.92	4.375	97.30	1.034
54.80	4.430	99.30	0.293
55.50	4.439	100.00	0

Figure 4.-The wing-body combination tested in the Ames 12-foot pressure wind tunnel.



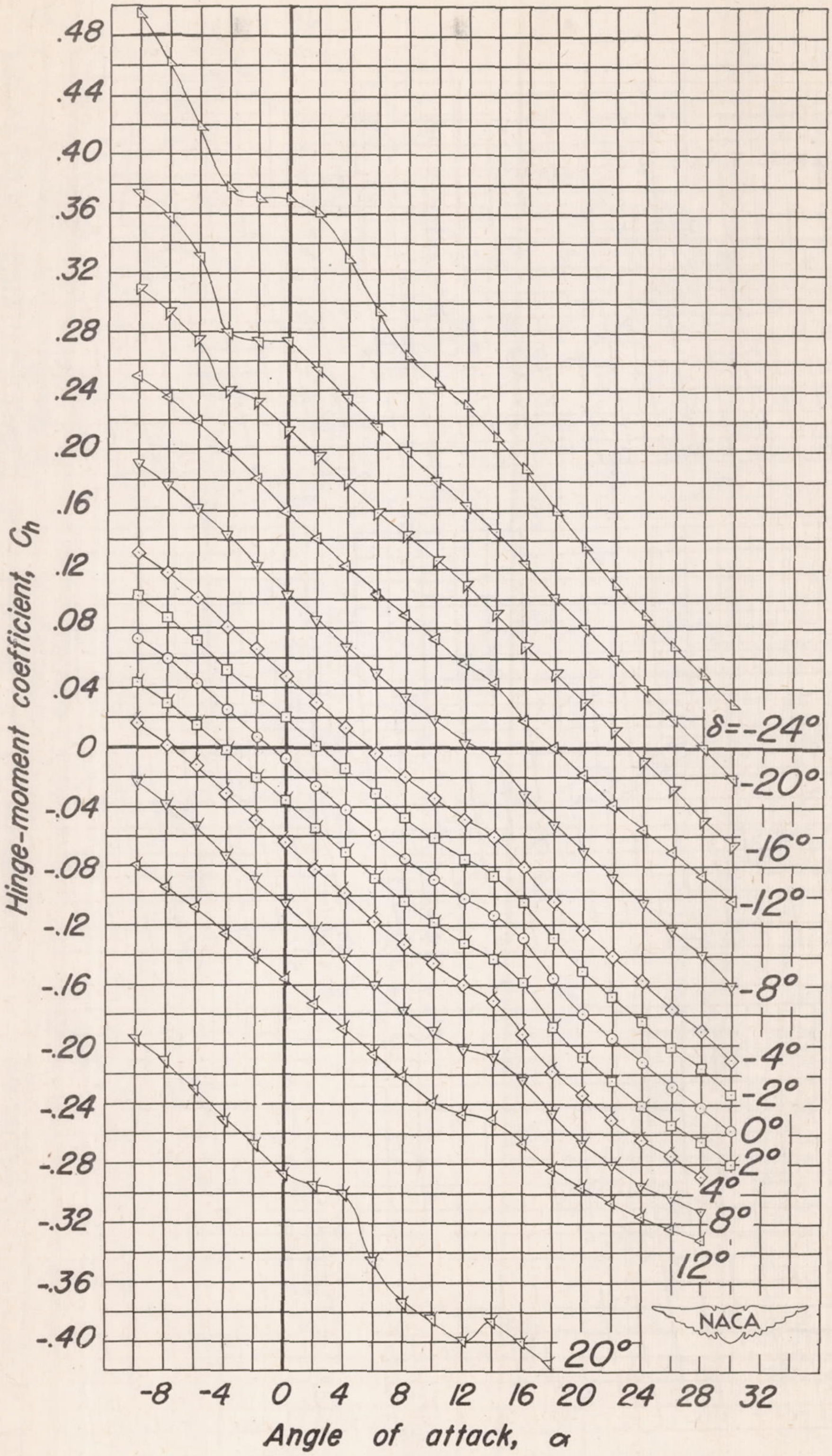
(a) C_L vs α, C_L vs C_m

Figure 5.- The aerodynamic characteristics of a triangular wing with various flap angles. Reynolds number, 15,000,000; Mach number, 0.18.

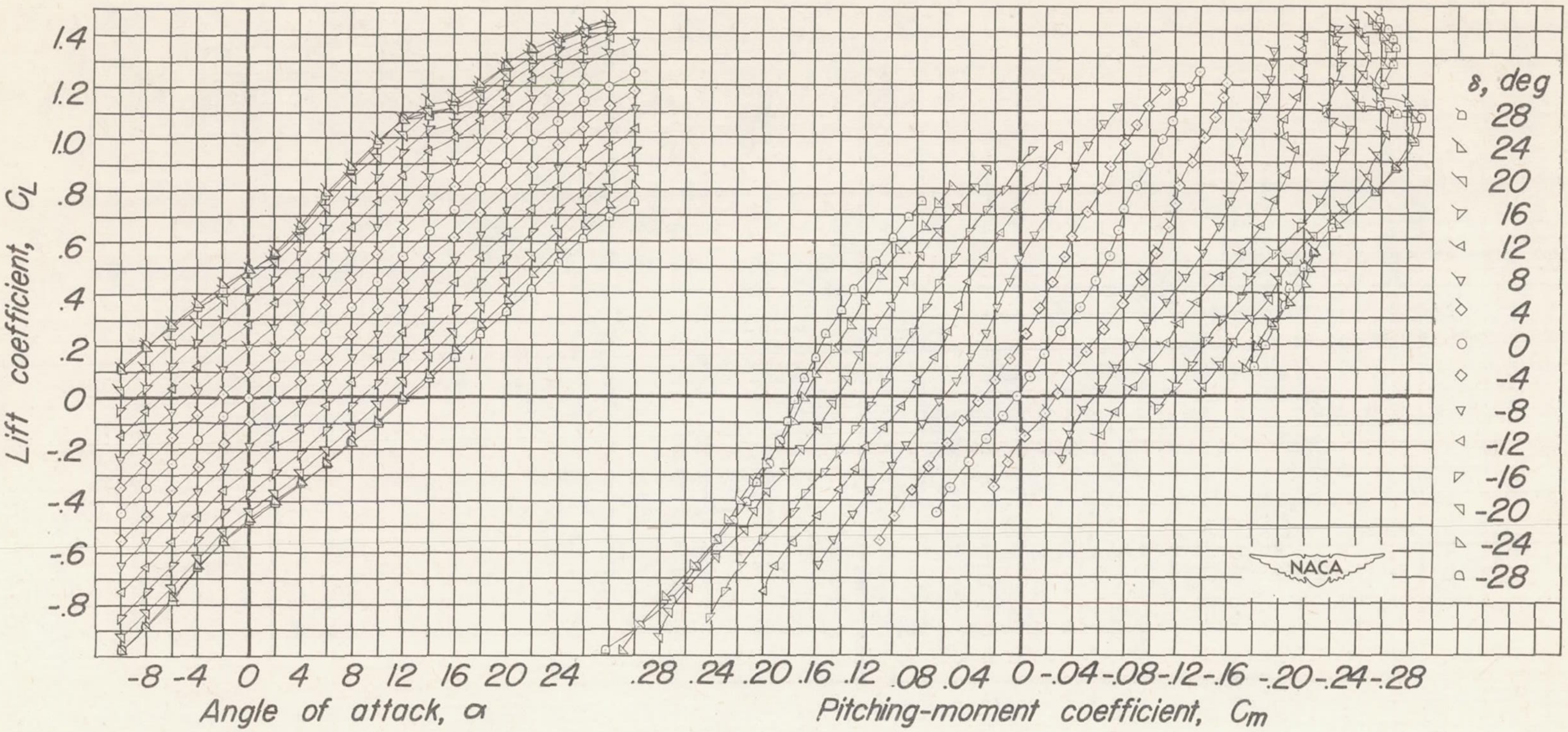


(b) C_L vs C_D

Figure 5.-Continued.

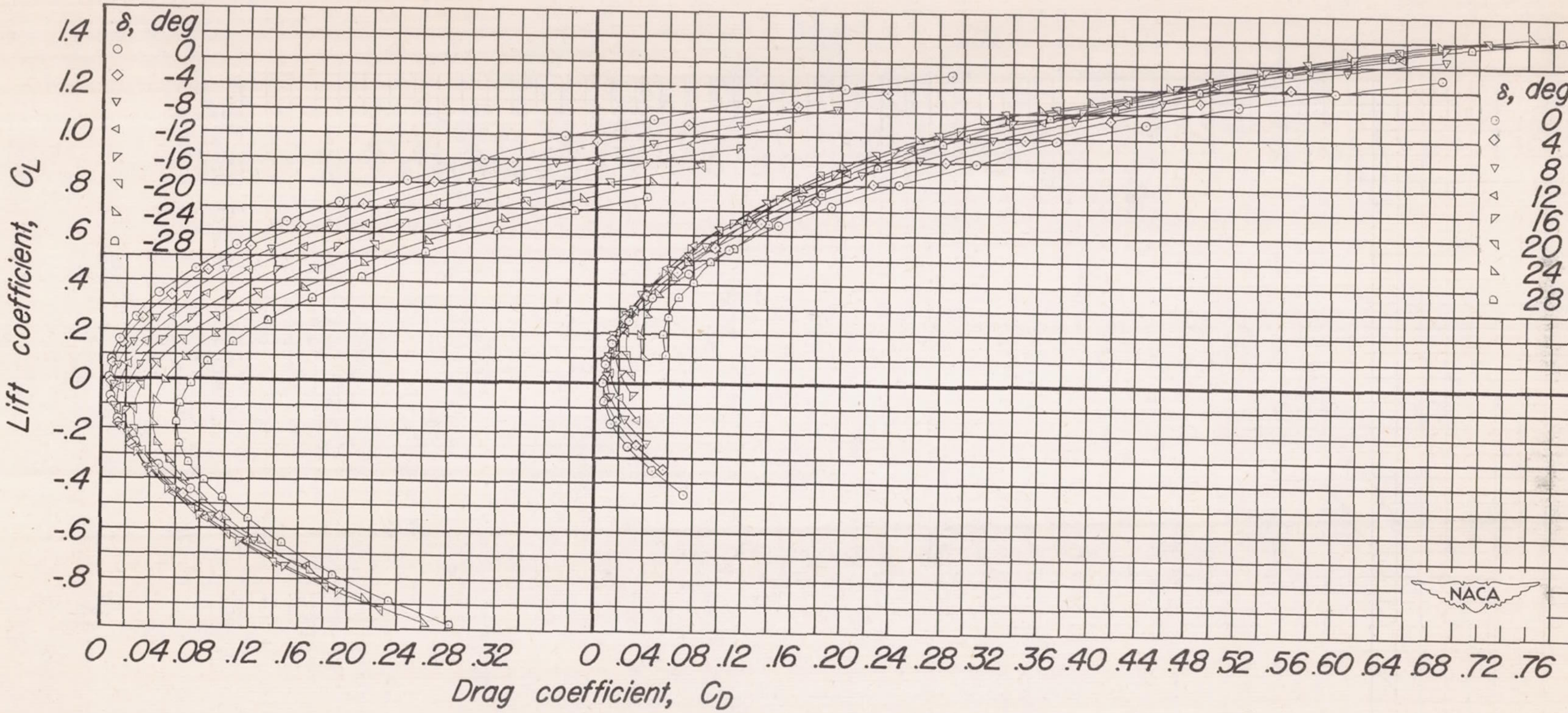


(c) C_h vs α
Figure 5.-Concluded.



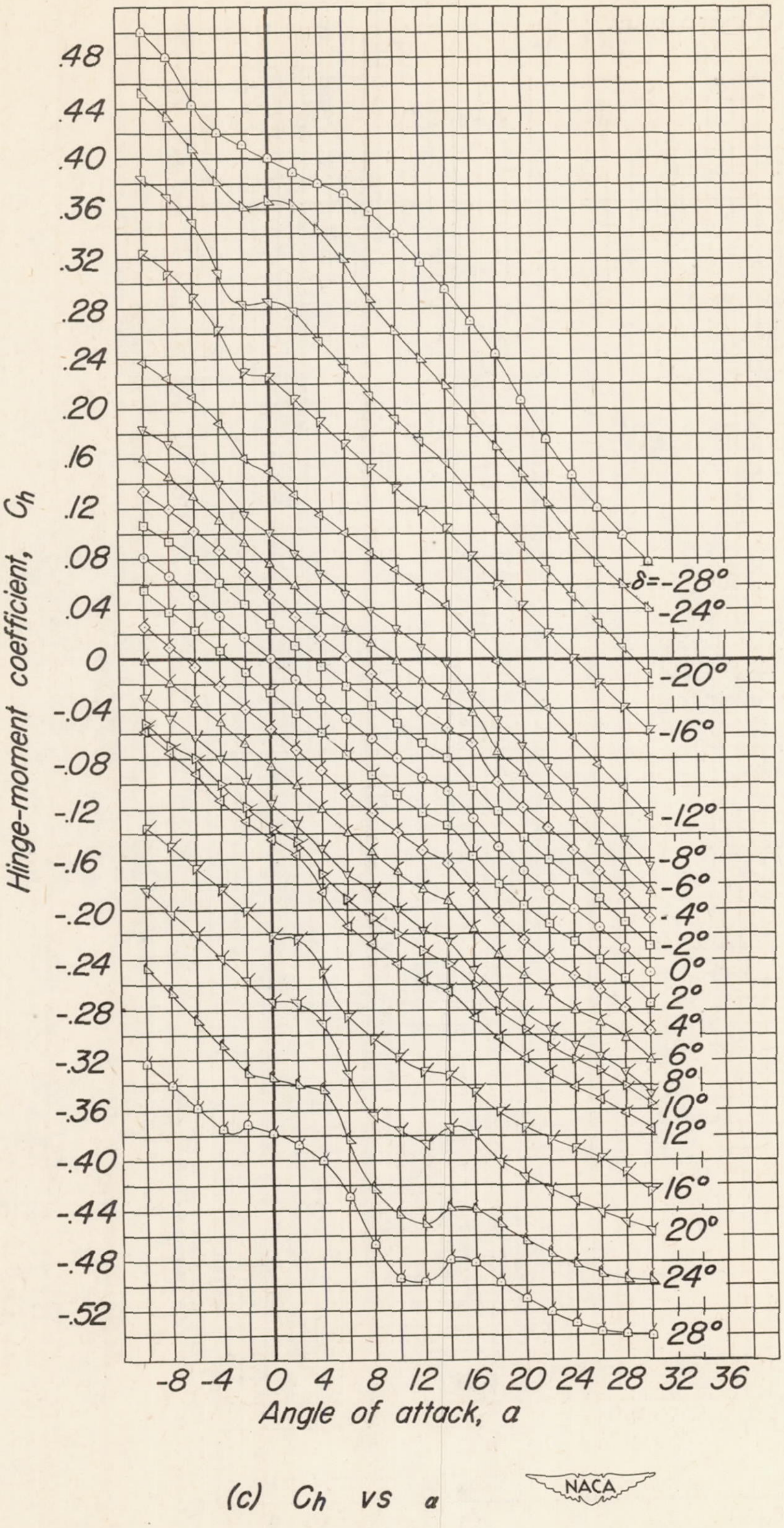
(a) C_L vs α, C_L vs C_m

Figure 6.- The aerodynamic characteristics of a triangular wing with various flap angles Reynolds number, 5,300,000; Mach number, 0.18



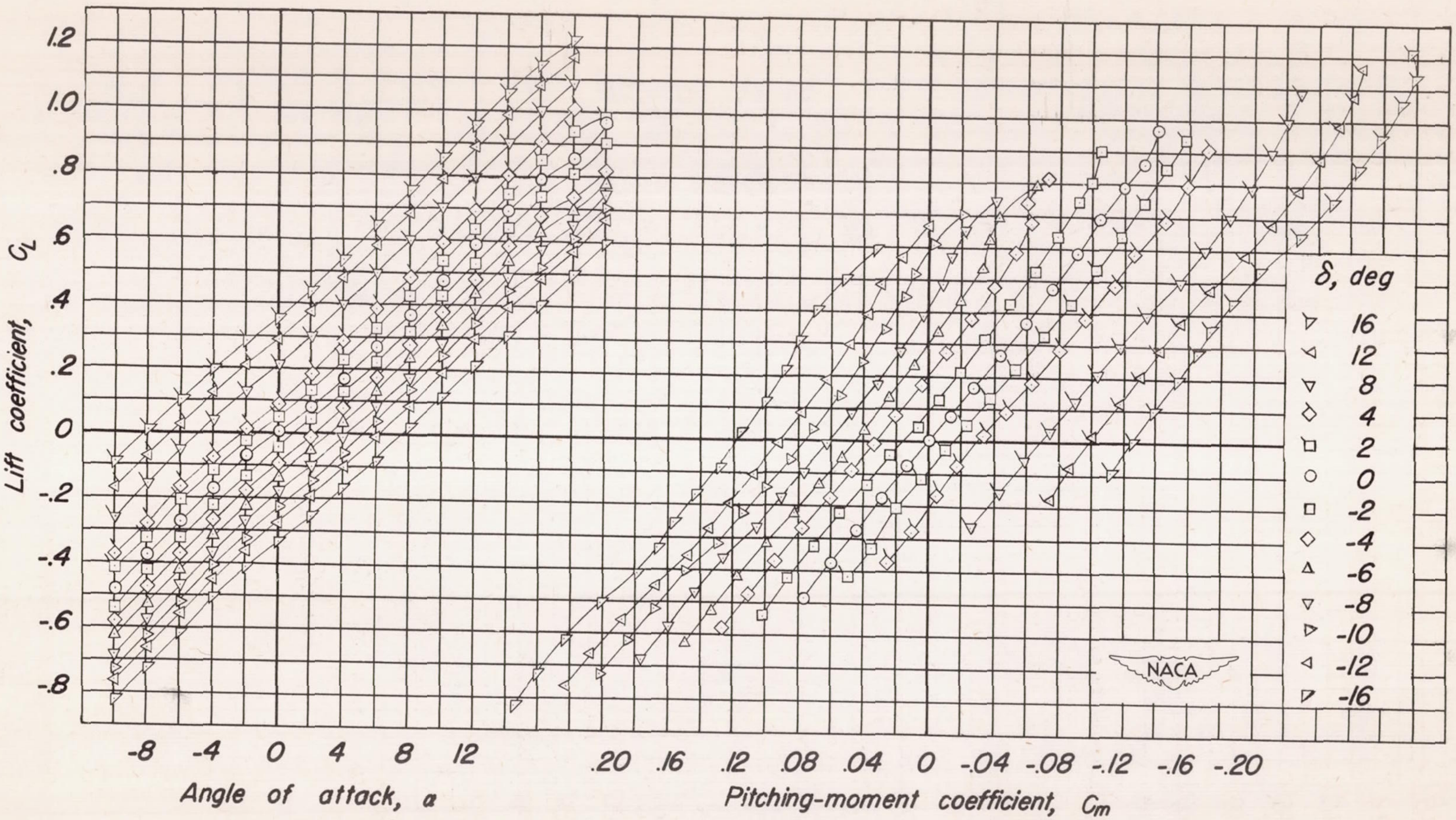
(b) C_L vs C_D

Figure 6.-Continued.



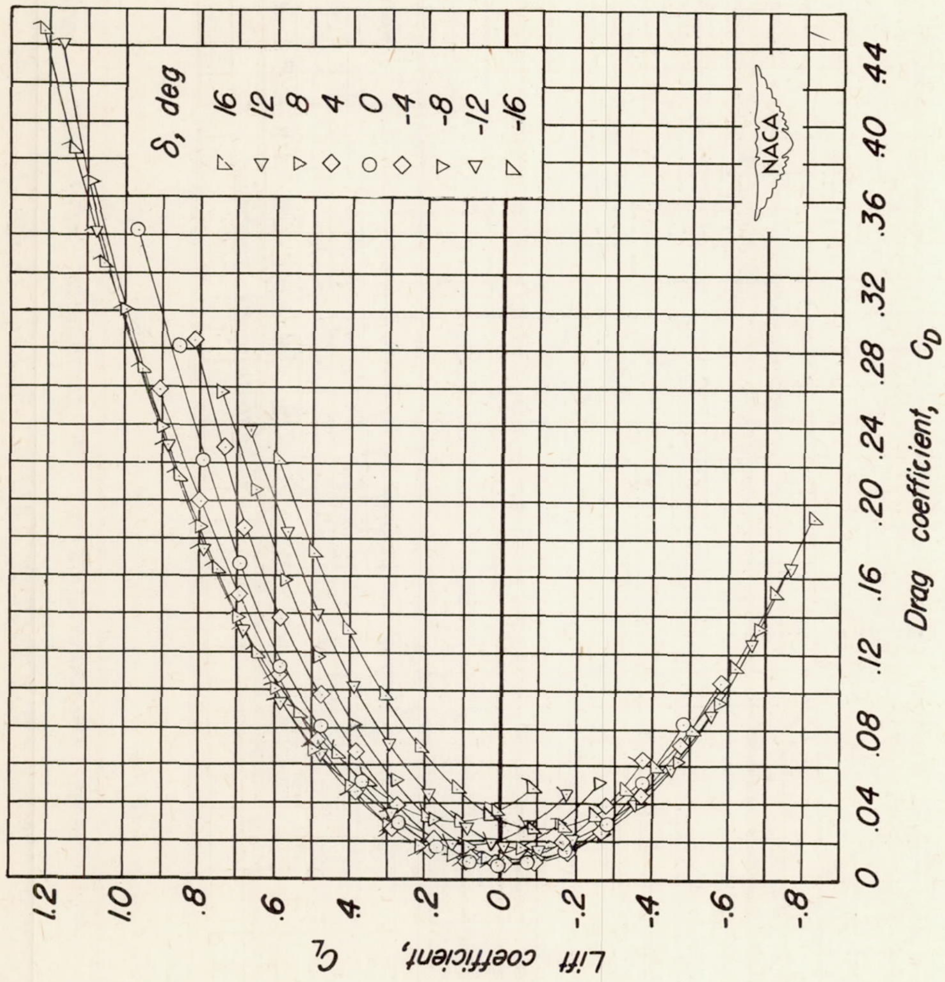
(c) C_h vs α

Figure 6.-Concluded.



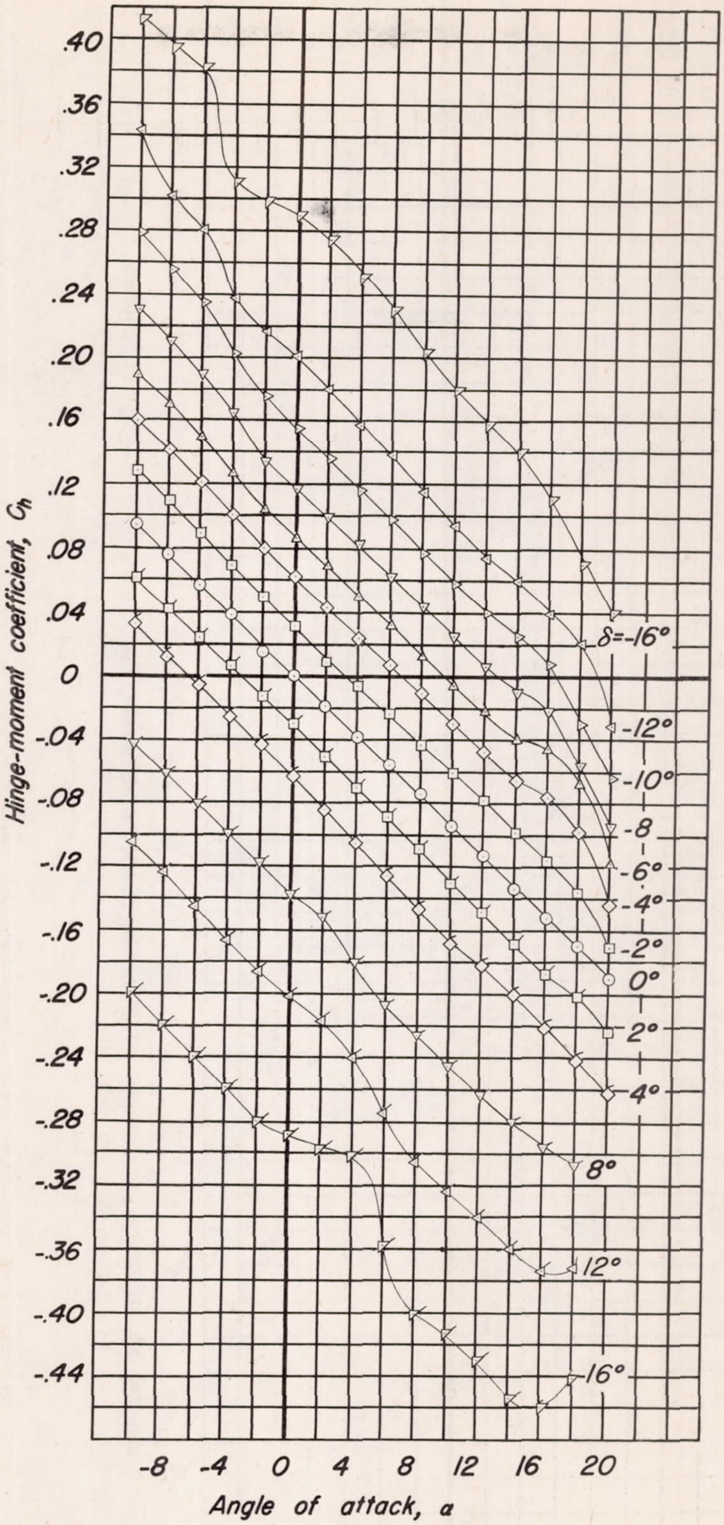
(a) C_L vs α, C_L vs C_m

Figure 7.- The aerodynamic characteristics of a triangular wing with various flap angles. Reynold number, 5,300,000; Mach number, 0.70.



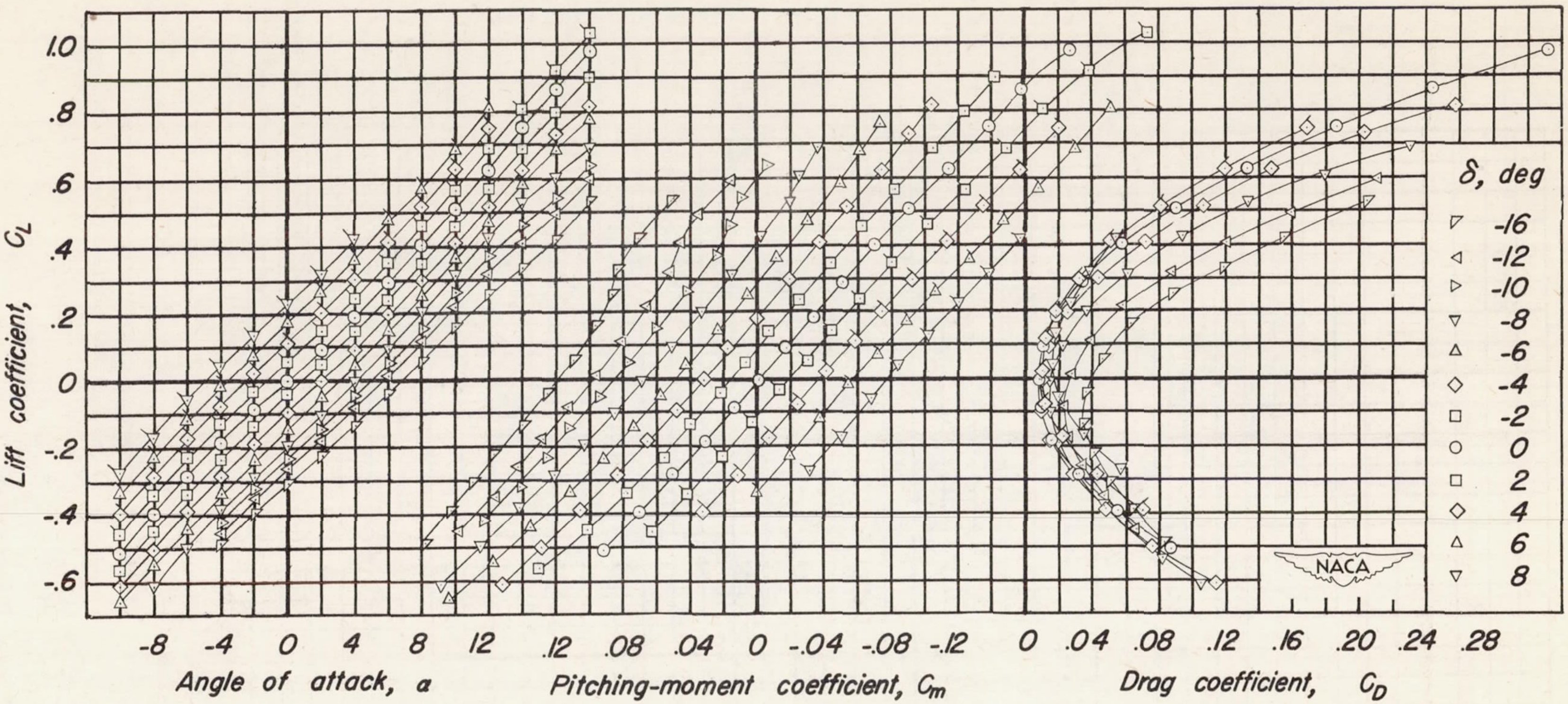
(b) C_L vs C_D

Figure 7.-Continued.



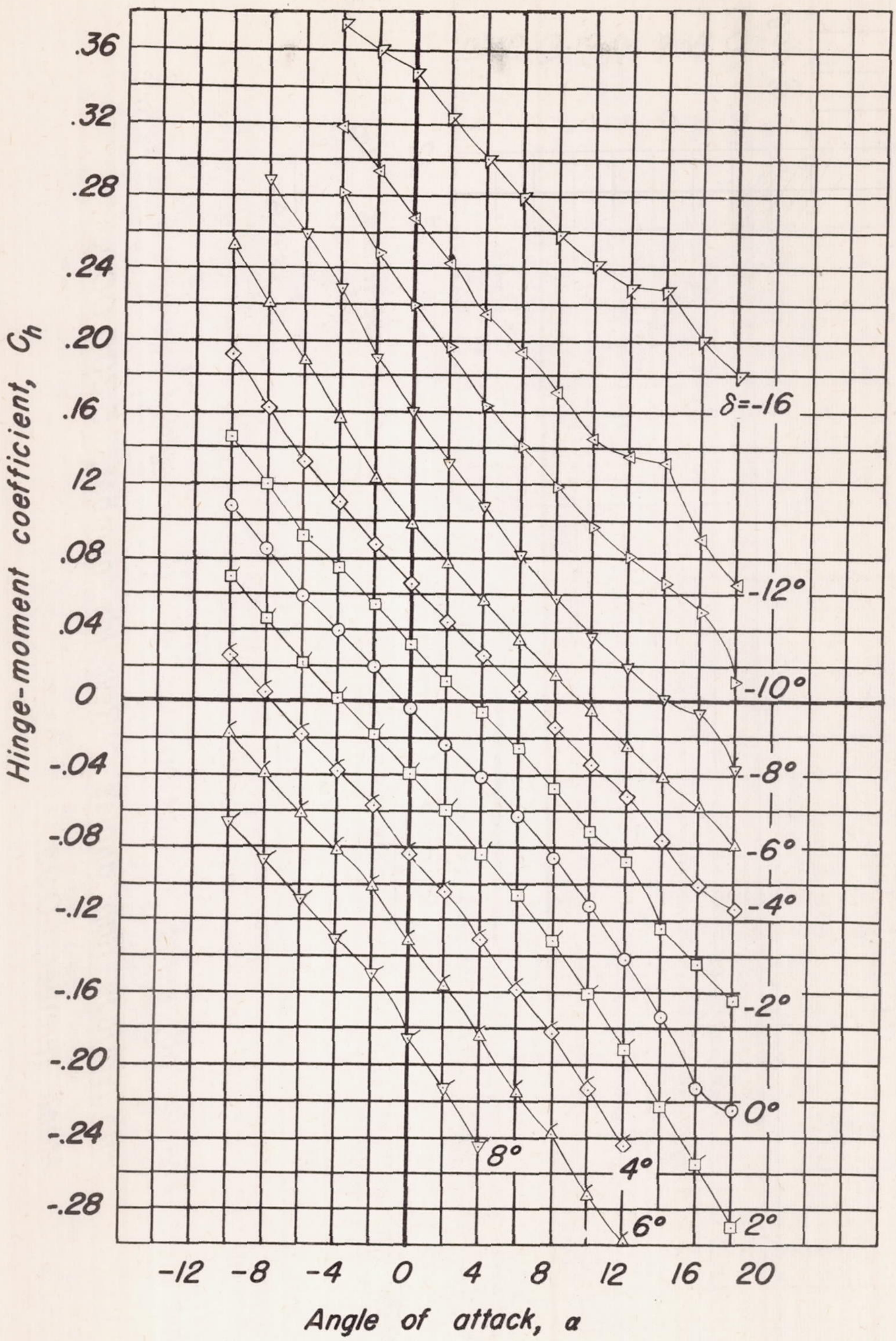
(c) C_h vs α

Figure 7.-Concluded.



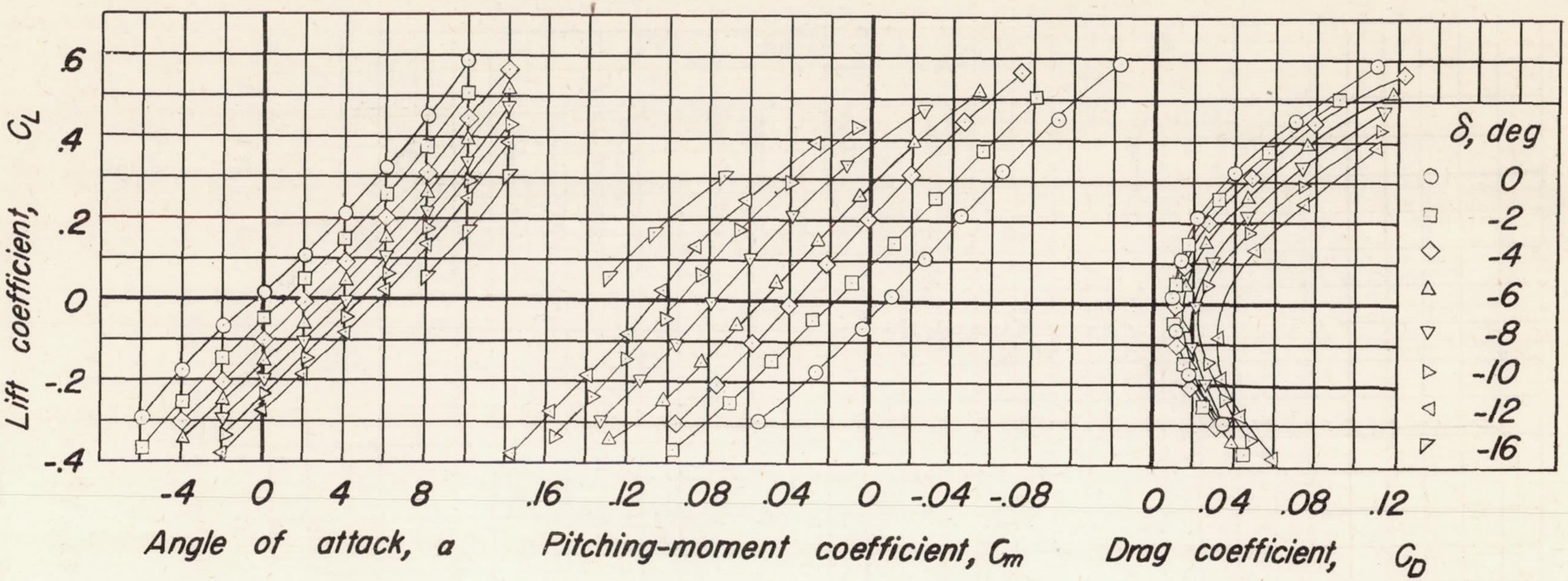
(a) C_L vs α, C_L vs C_m, C_L vs C_D

Figure 8.- The aerodynamic characteristics of a triangular wing with various flap angles. Reynolds number, 5,300,000; Mach number, 0.85.



(b) C_h vs α

Figure 8.-Concluded.



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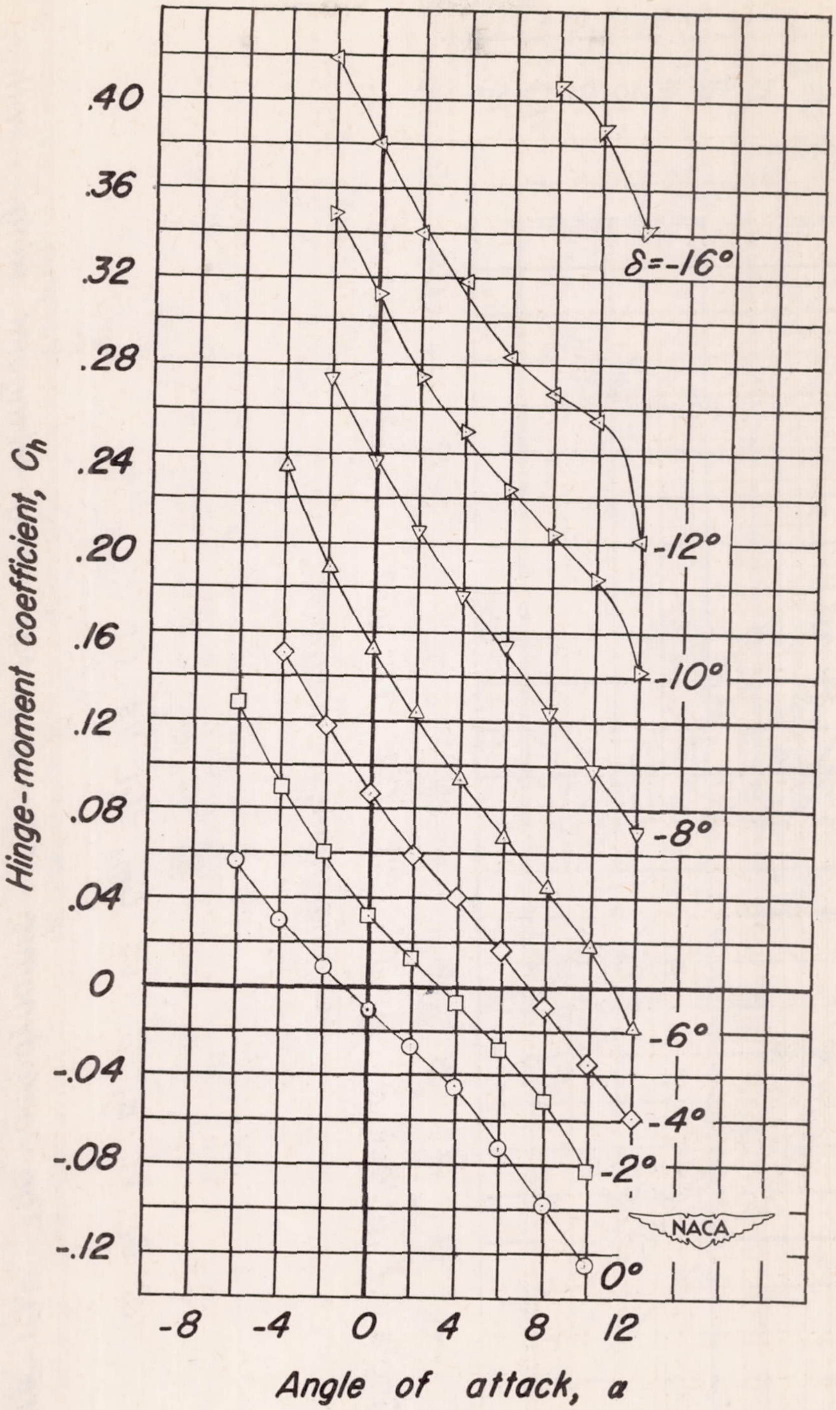
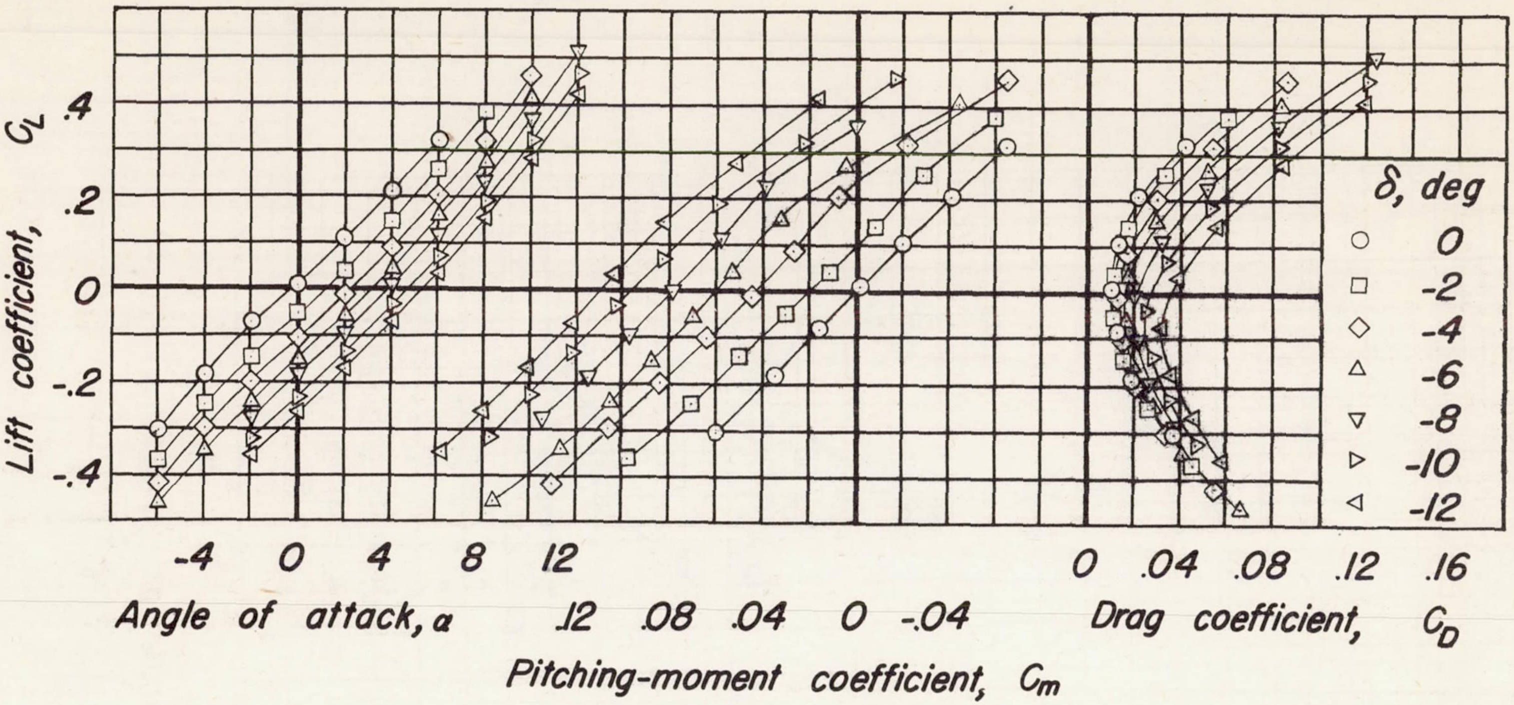
(a) C_L vs α, C_L vs C_m, C_L vs C_D

Figure 9.- The aerodynamic characteristics of a triangular wing with various flap angles. Reynolds number, 5,300,000; Mach number, 0.93.



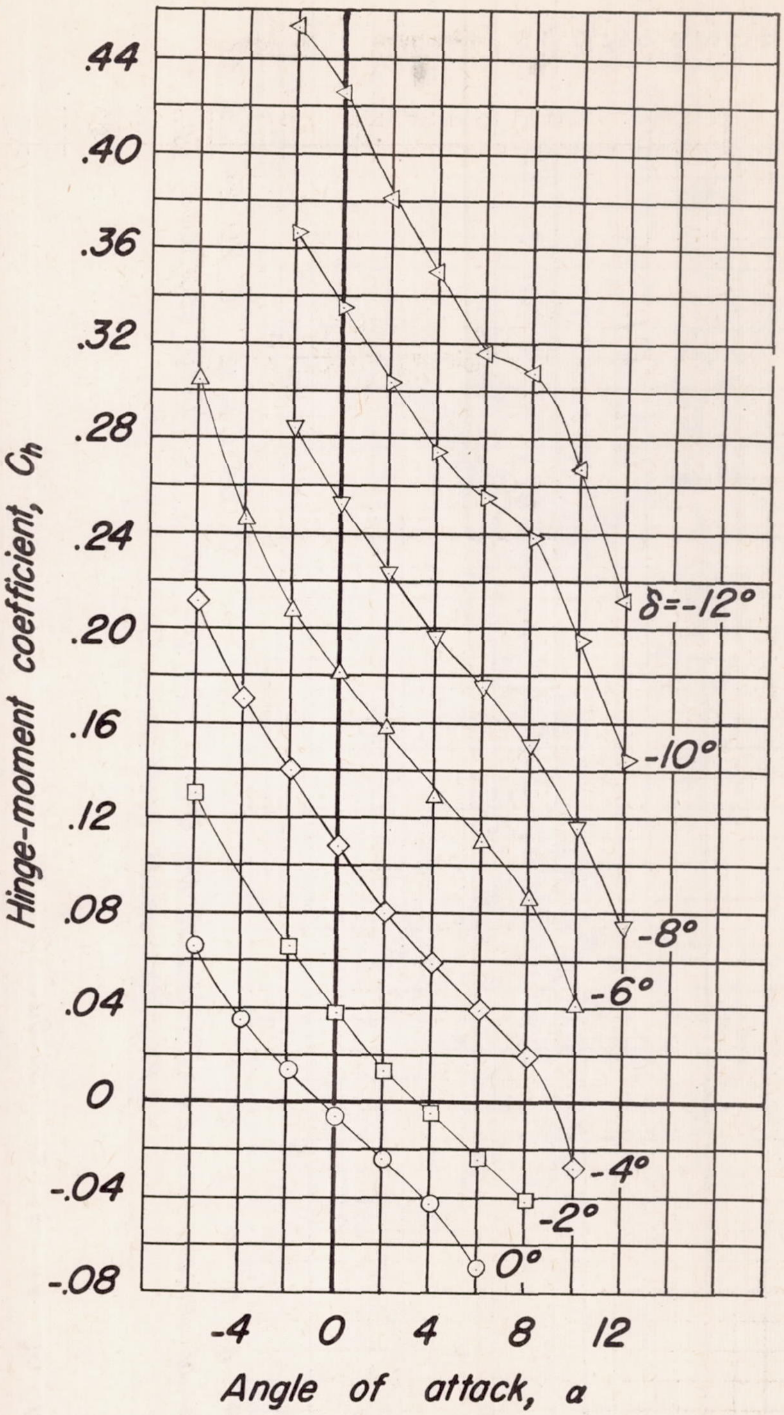
(b) C_h vs α

Figure 9.-Concluded.



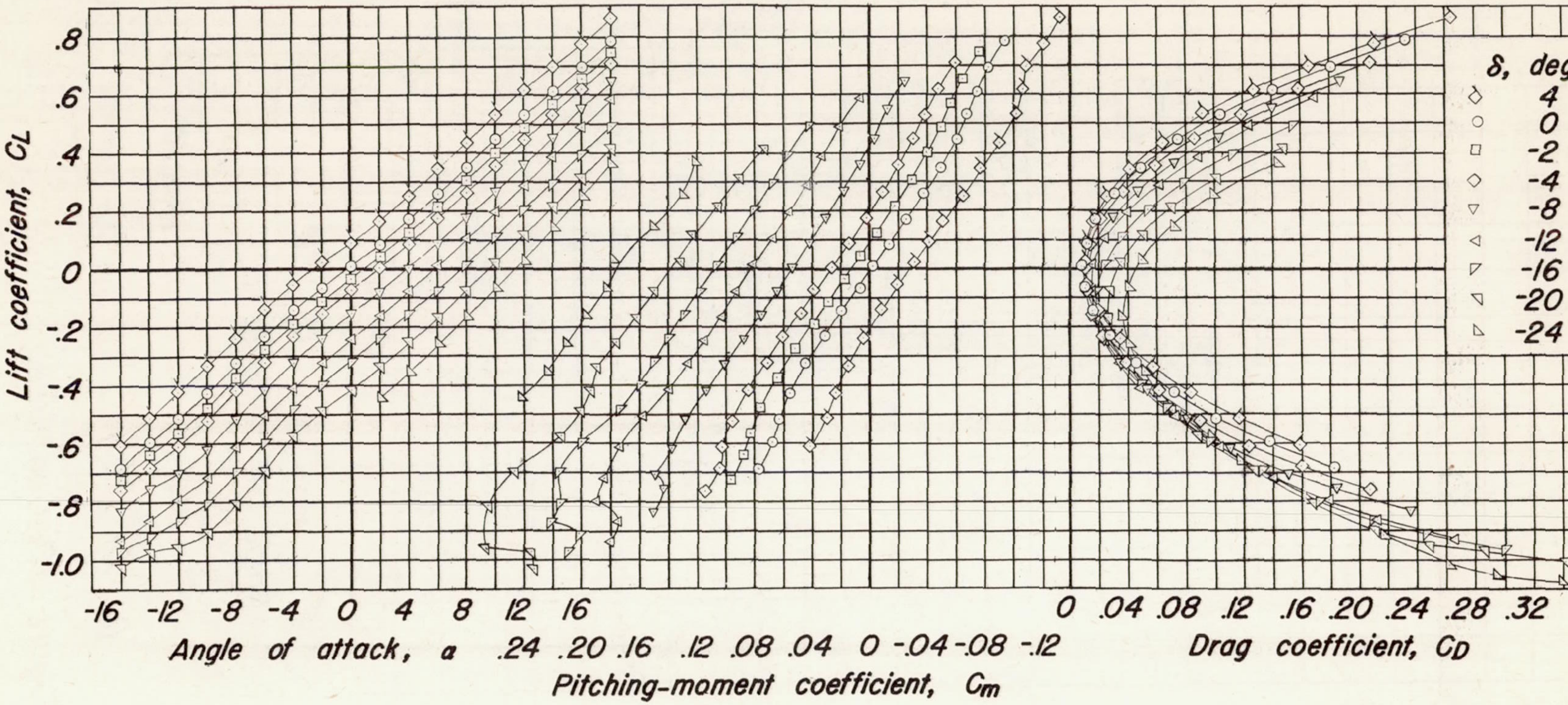
(a) C_L vs α, C_L vs C_m, C_L vs C_D

Figure 10.- The aerodynamic characteristics of a triangular wing with various flap angles. Reynolds number, 5,300,000; Mach number, 0.95.



(b) C_h vs α

Figure 10.-Concluded.



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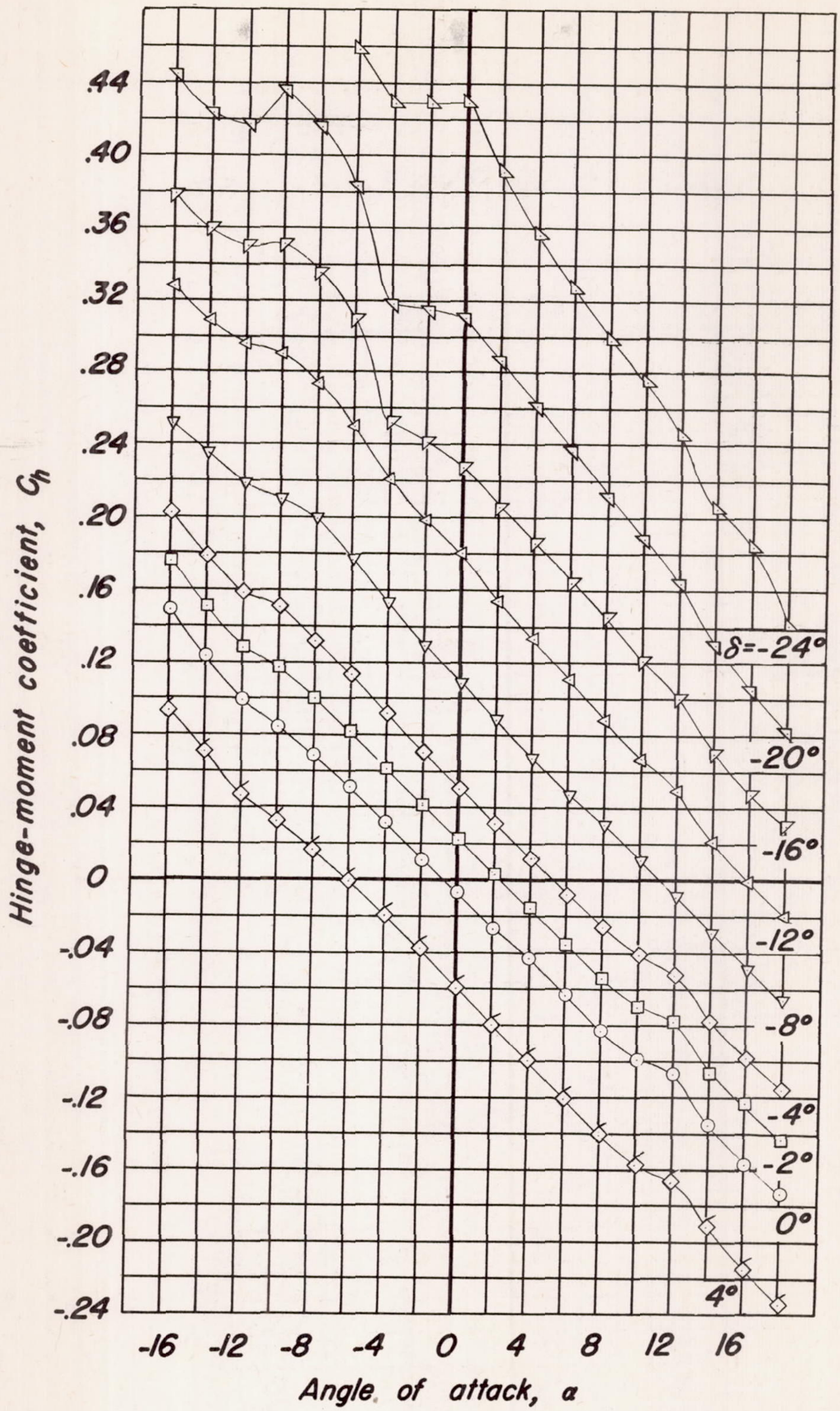
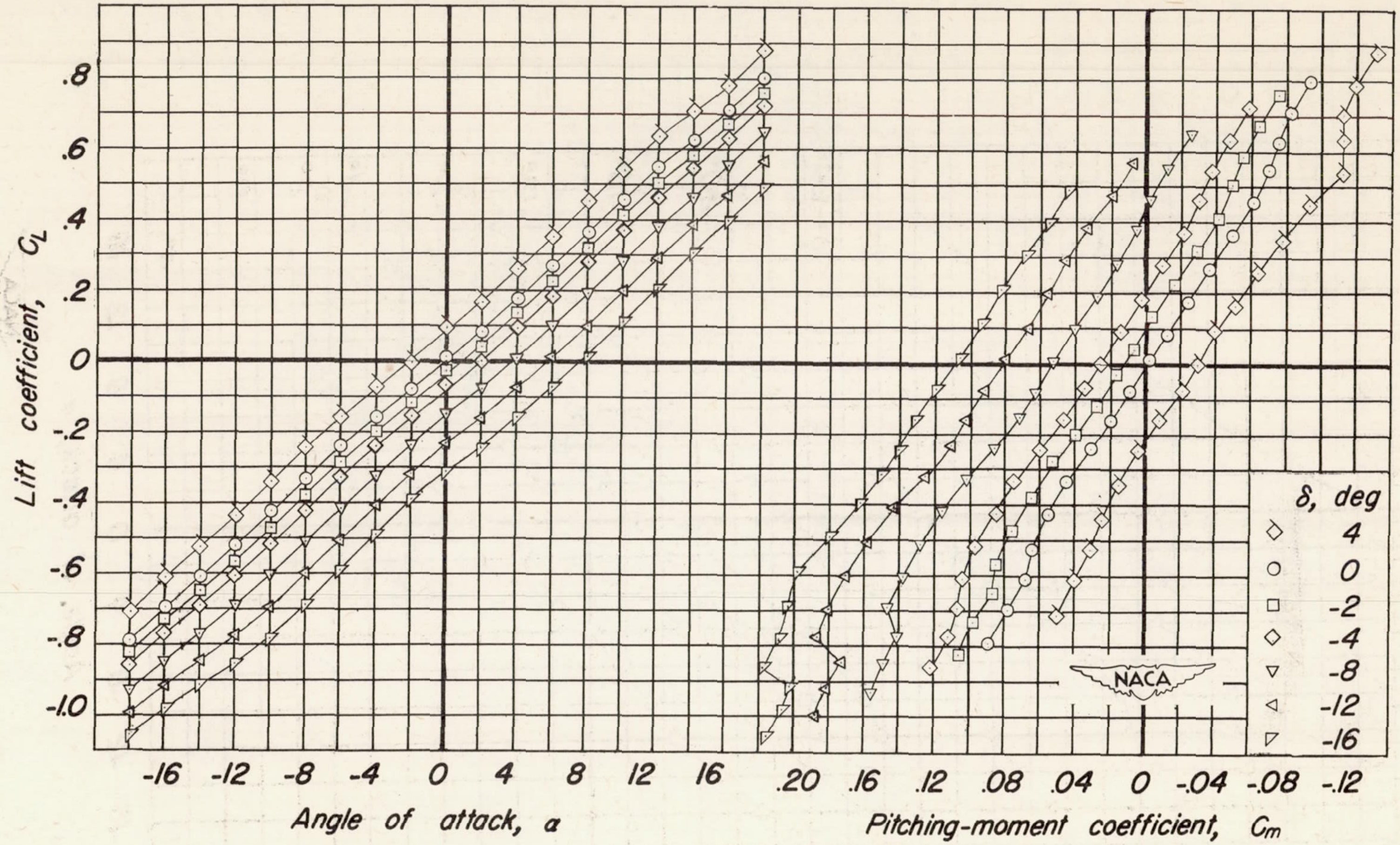
(a) C_L vs α, C_L vs C_m, C_L vs C_D

Figure 11.- The aerodynamic characteristics of a triangular wing and a fuselage for various flap angles. Reynolds number, 15,000,000; Mach number, 0.18.



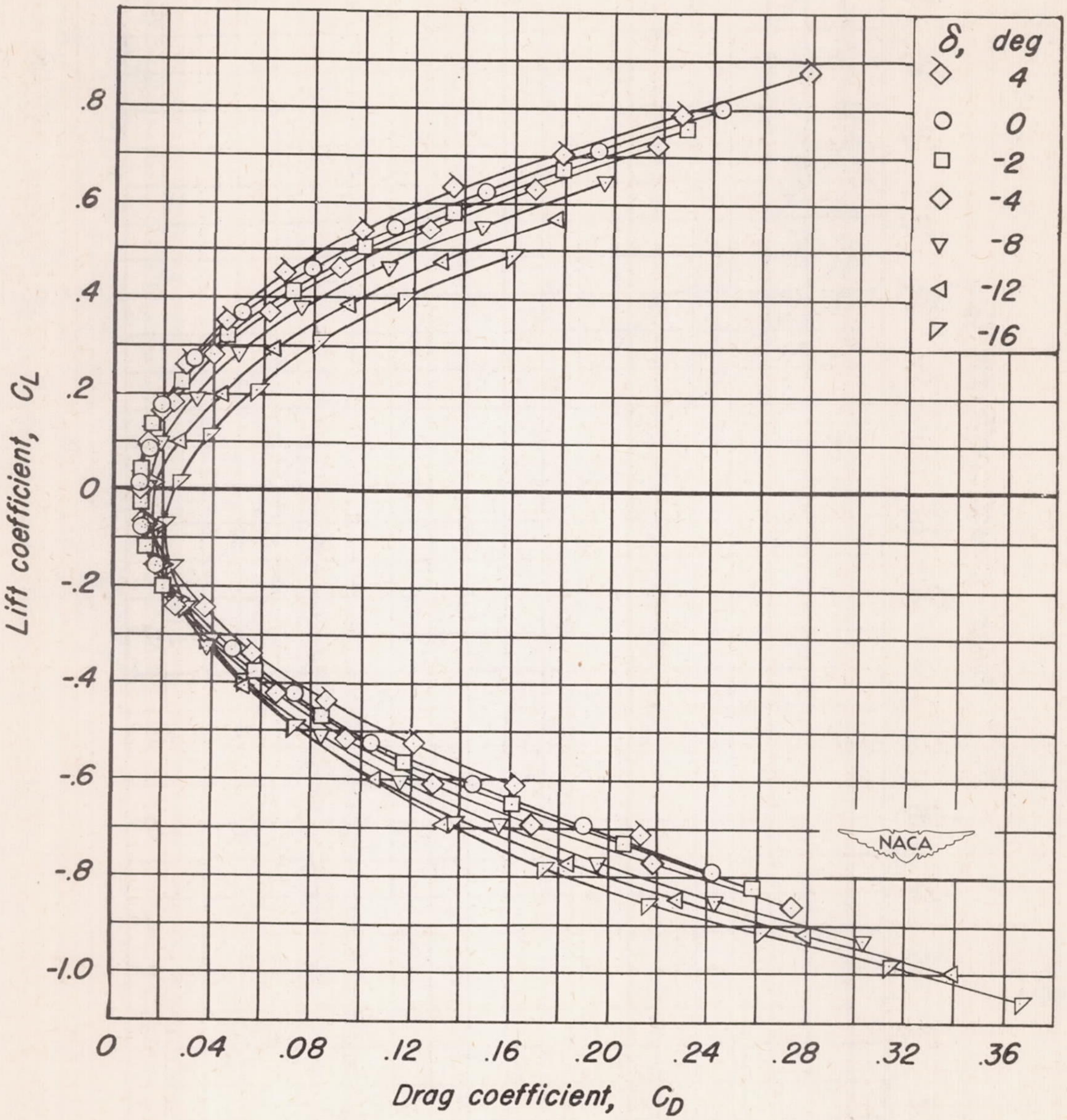
(b) Ch vs α

Figure 11.-Concluded.



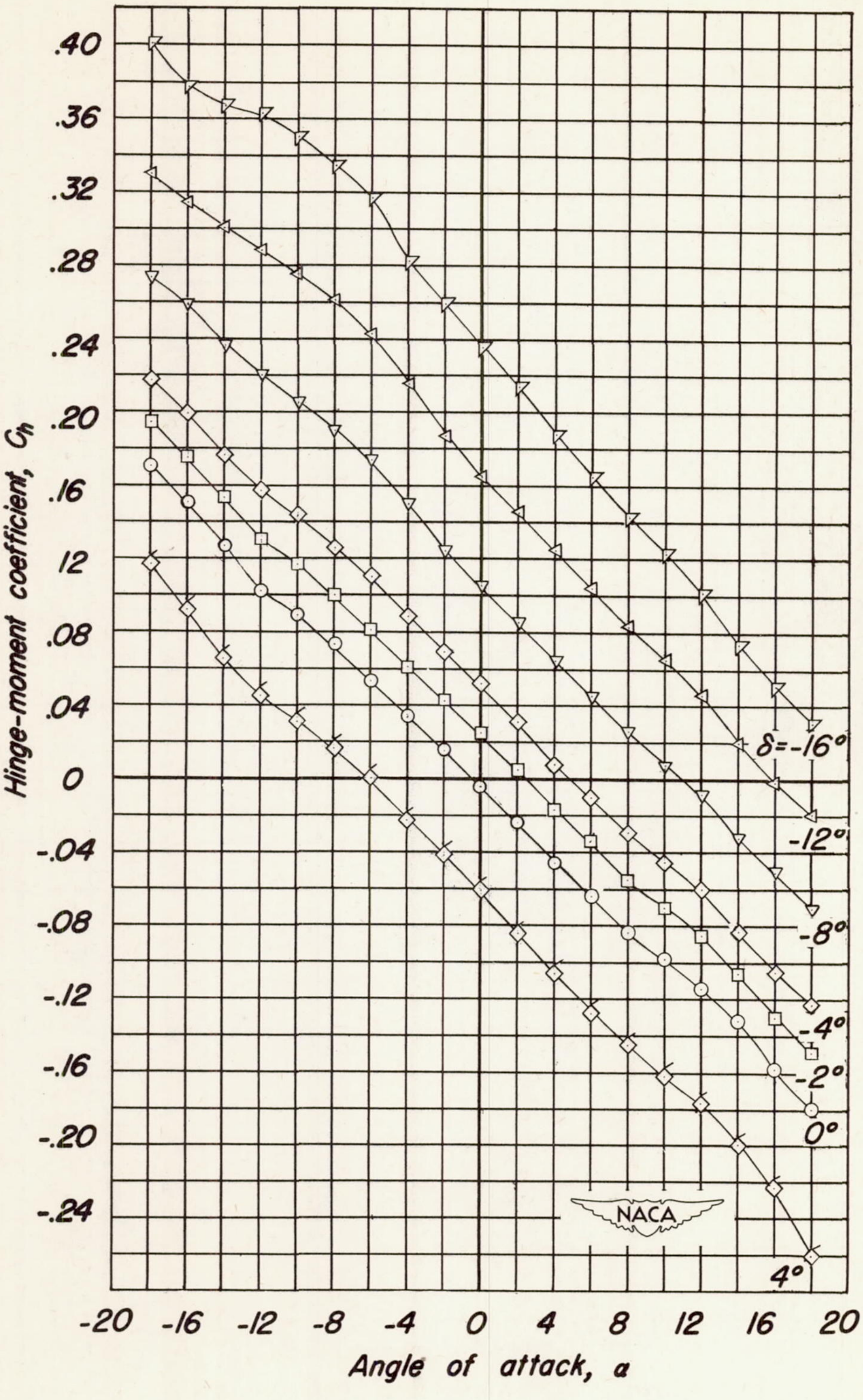
(a) C_L vs α, C_L vs C_m

Figure 12.- The aerodynamic characteristics of a triangular wing and a fuselage for various flap angles. Reynolds number, 5,300,000; Mach number, 0.3.



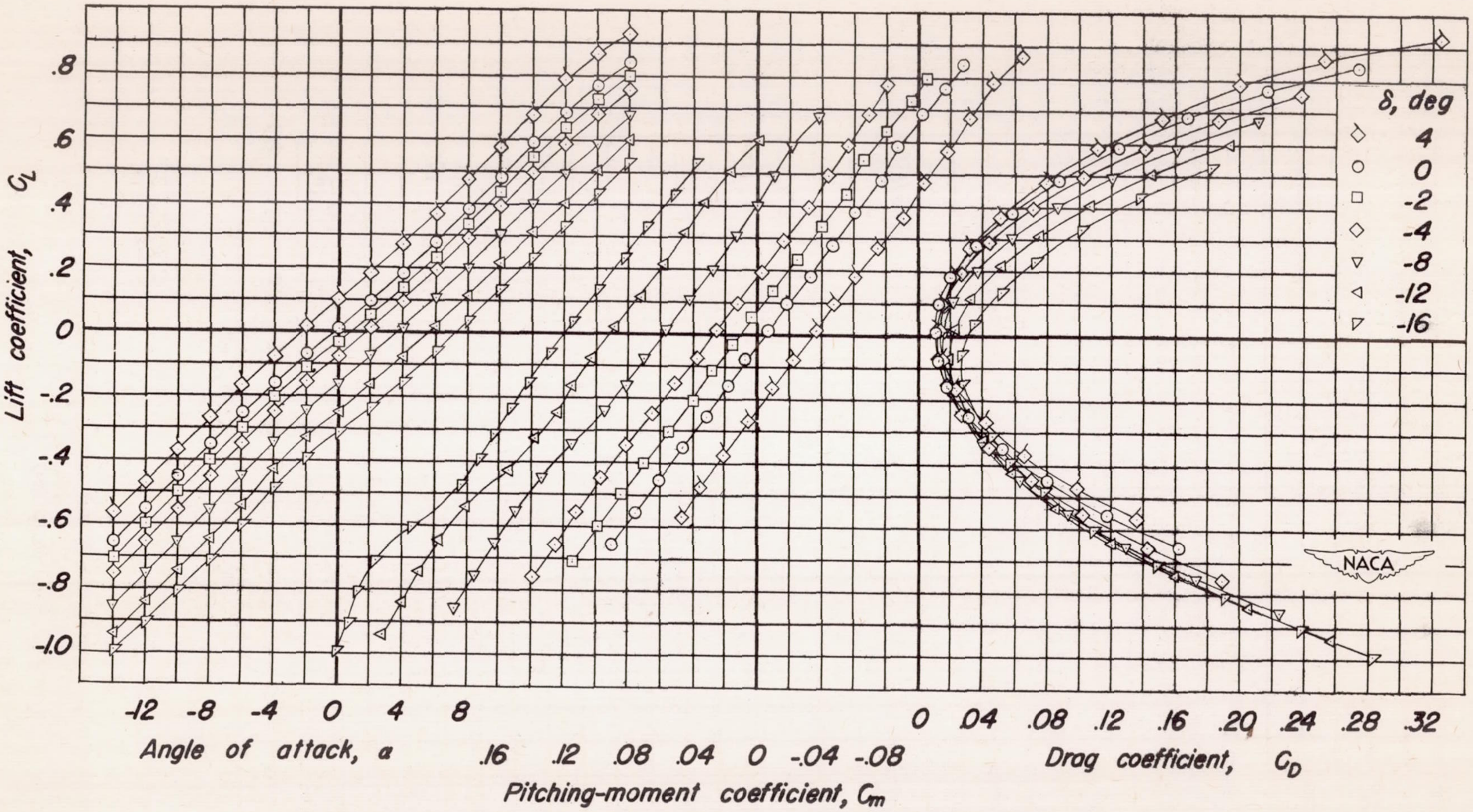
(b) C_L vs C_D

Figure 12.-Continued



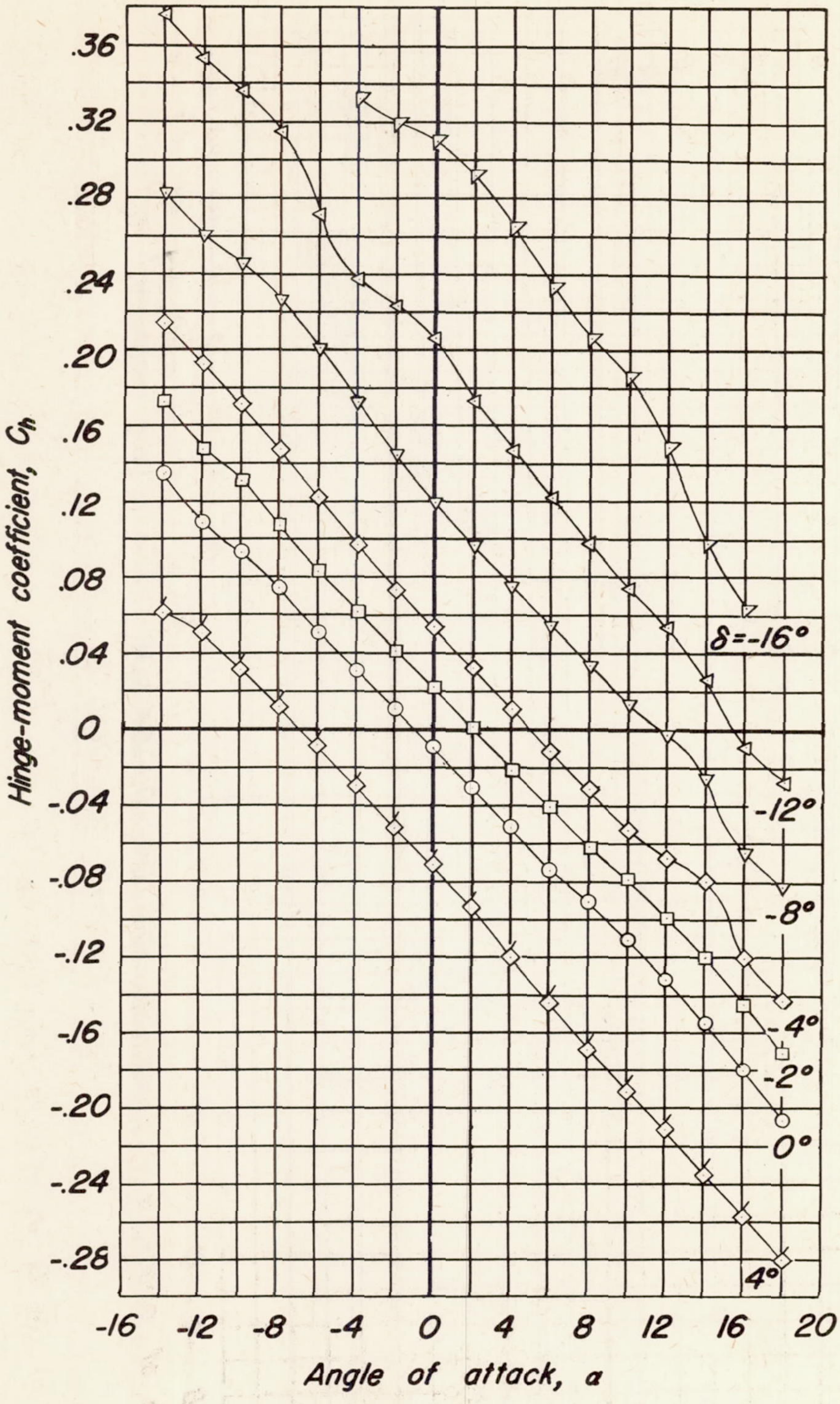
(c) C_h vs α

Figure 12.-Concluded.



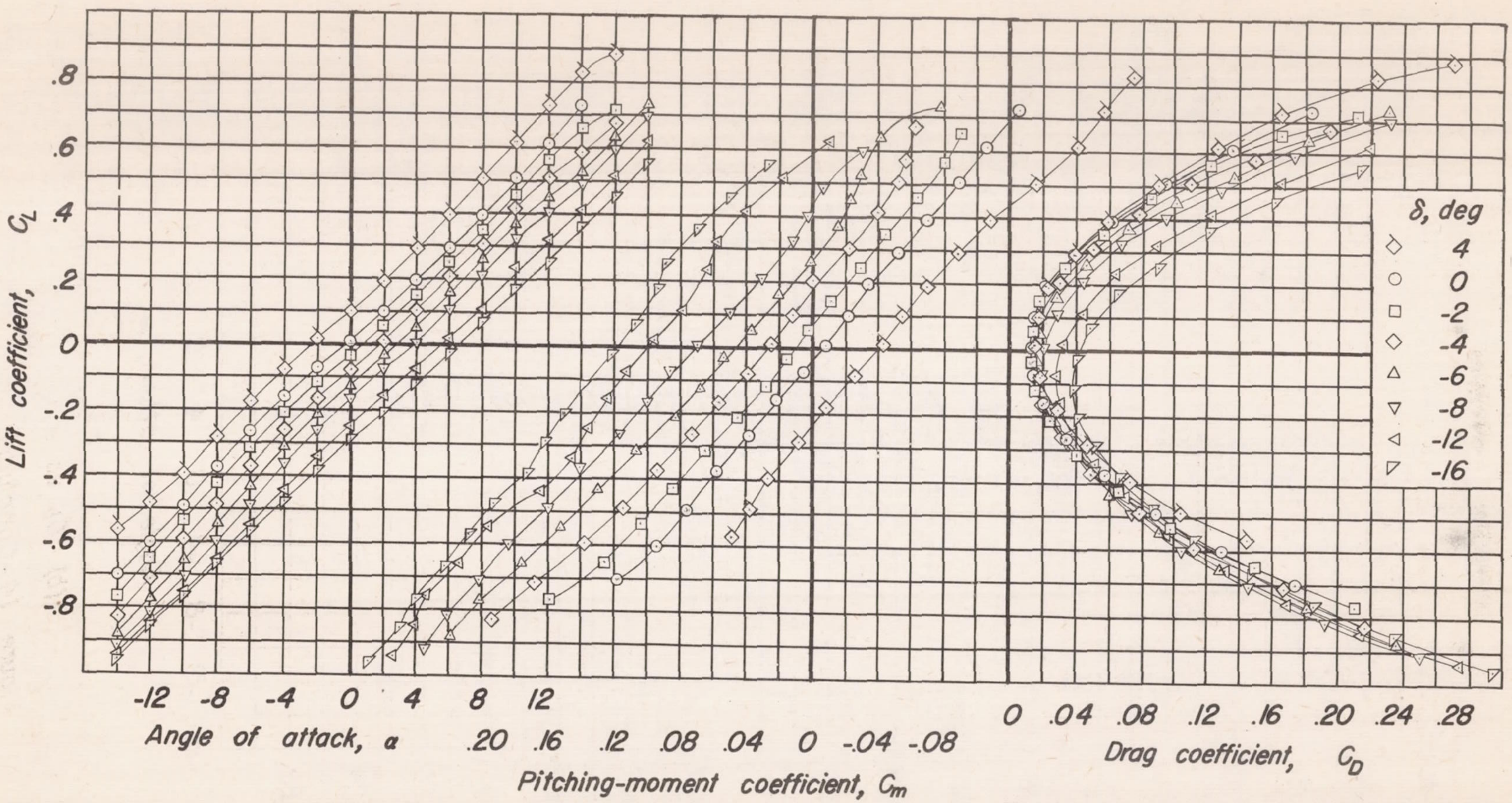
(a) C_L vs α, C_L vs C_m, C_L vs C_D

Figure 13.- The aerodynamic characteristics of a triangular wing and fuselage for various flap angles. Reynolds number, 5,300,000; Mach number, 0.70.



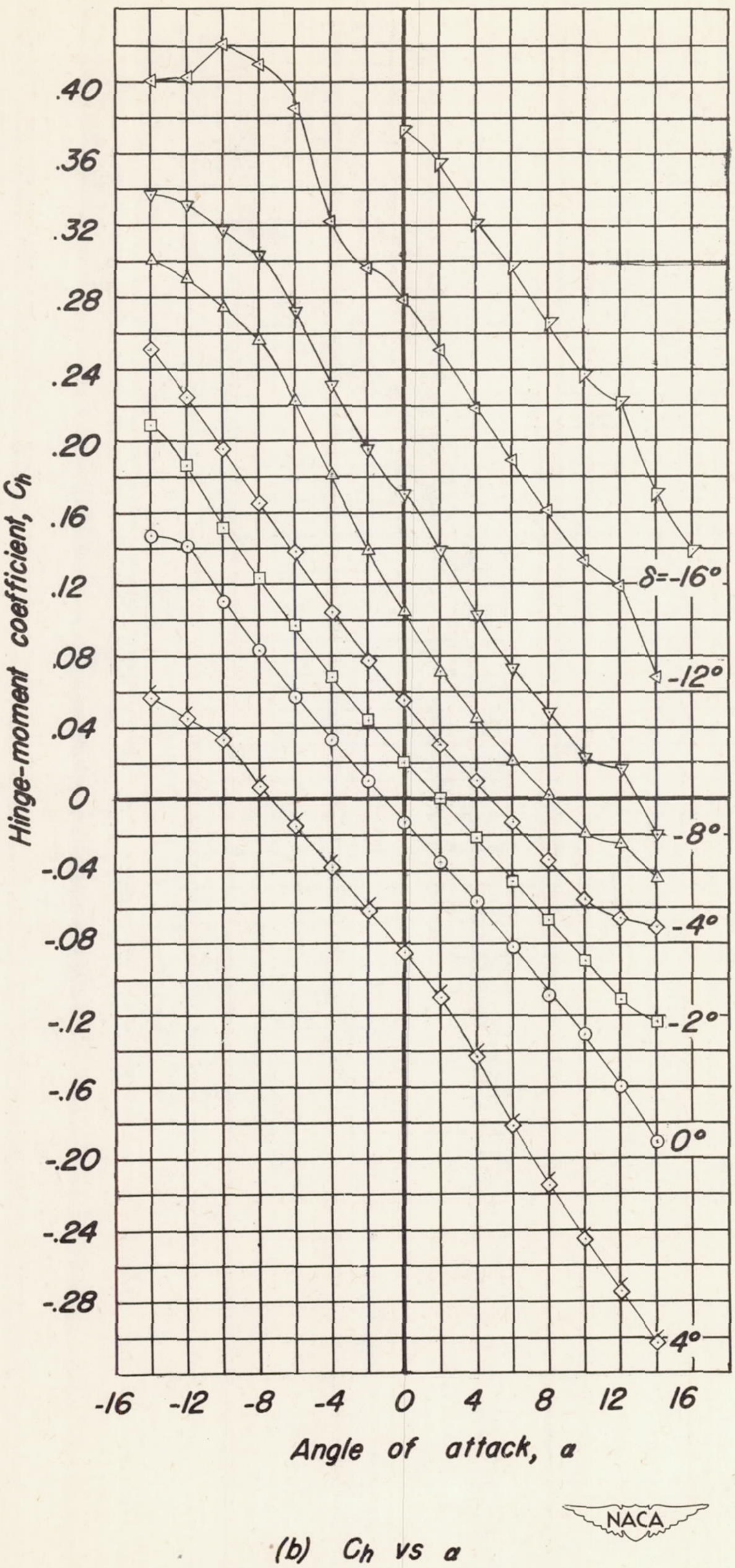
(b) C_h vs α

Figure 13.-Concluded.



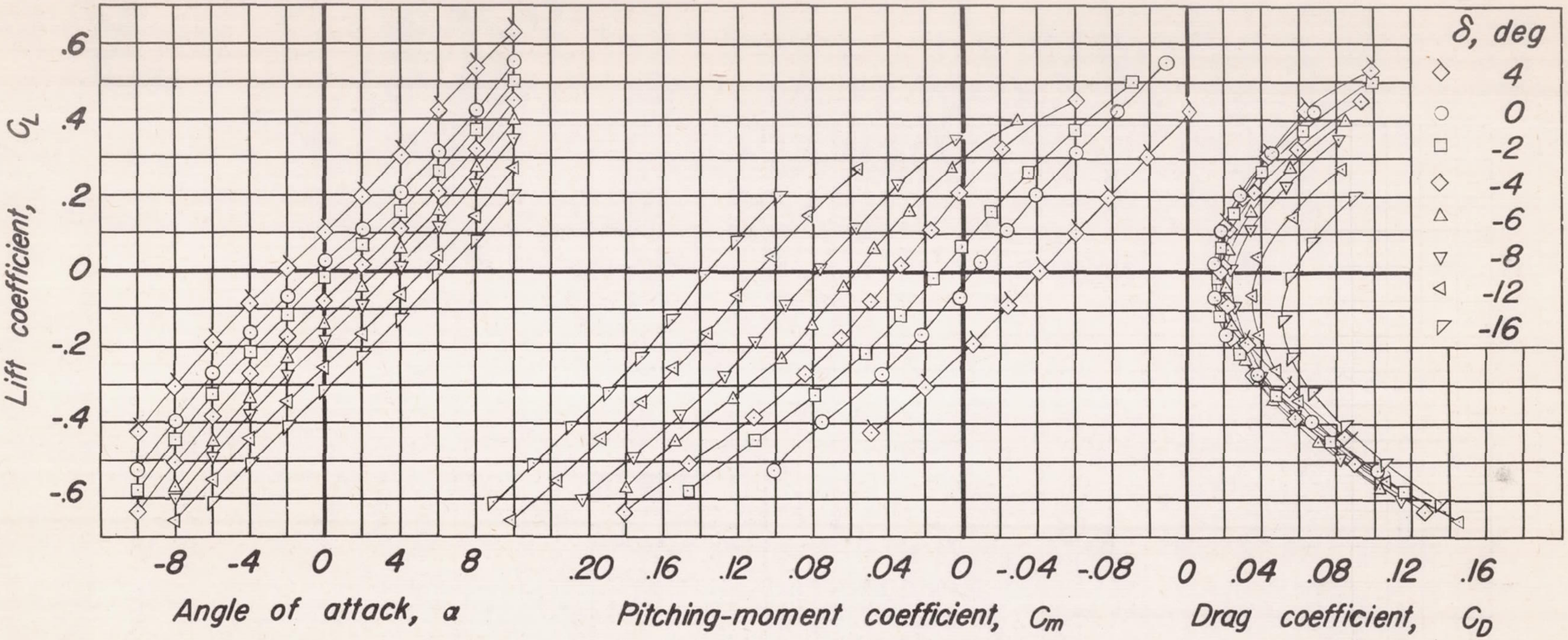
(a) C_L vs α, C_L vs C_m, C_L vs C_D

Figure 14.- The aerodynamic characteristics of a triangular wing and a fuselage for various flap angles. Reynolds number, 5,300,000; Mach number, 0.85.



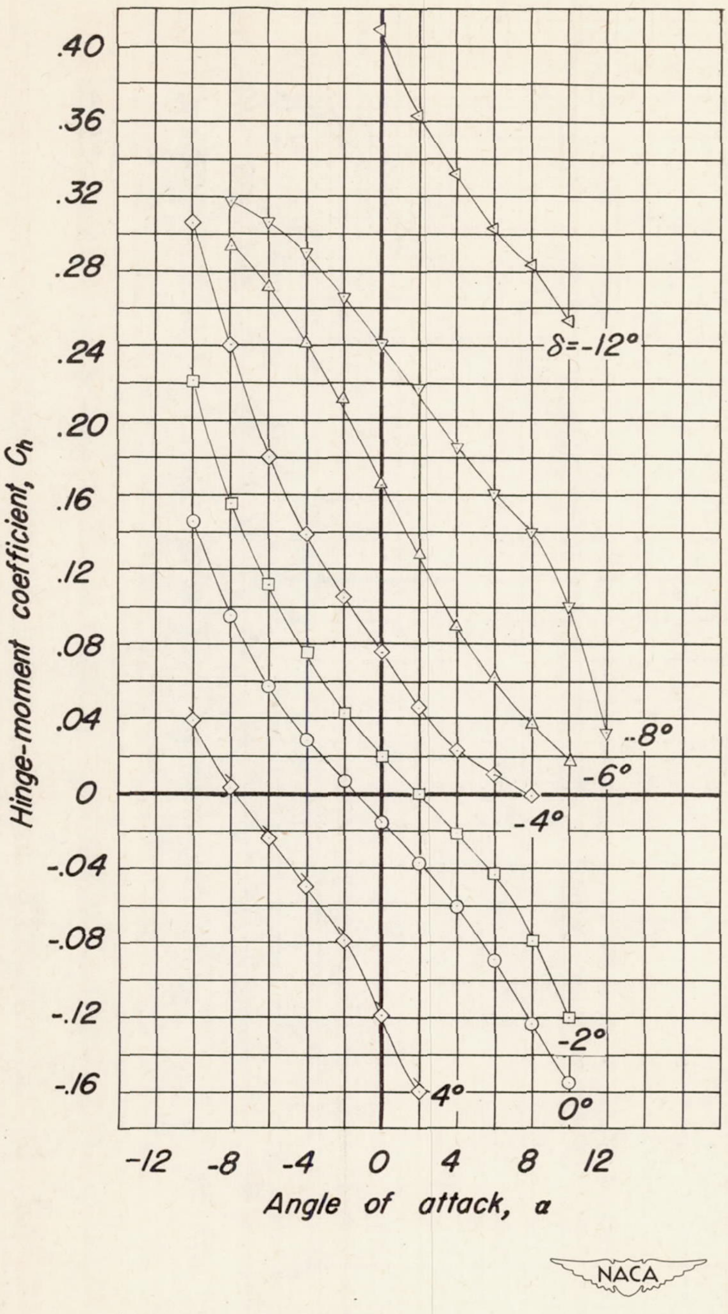
(b) C_h vs α

Figure 14.-Concluded.



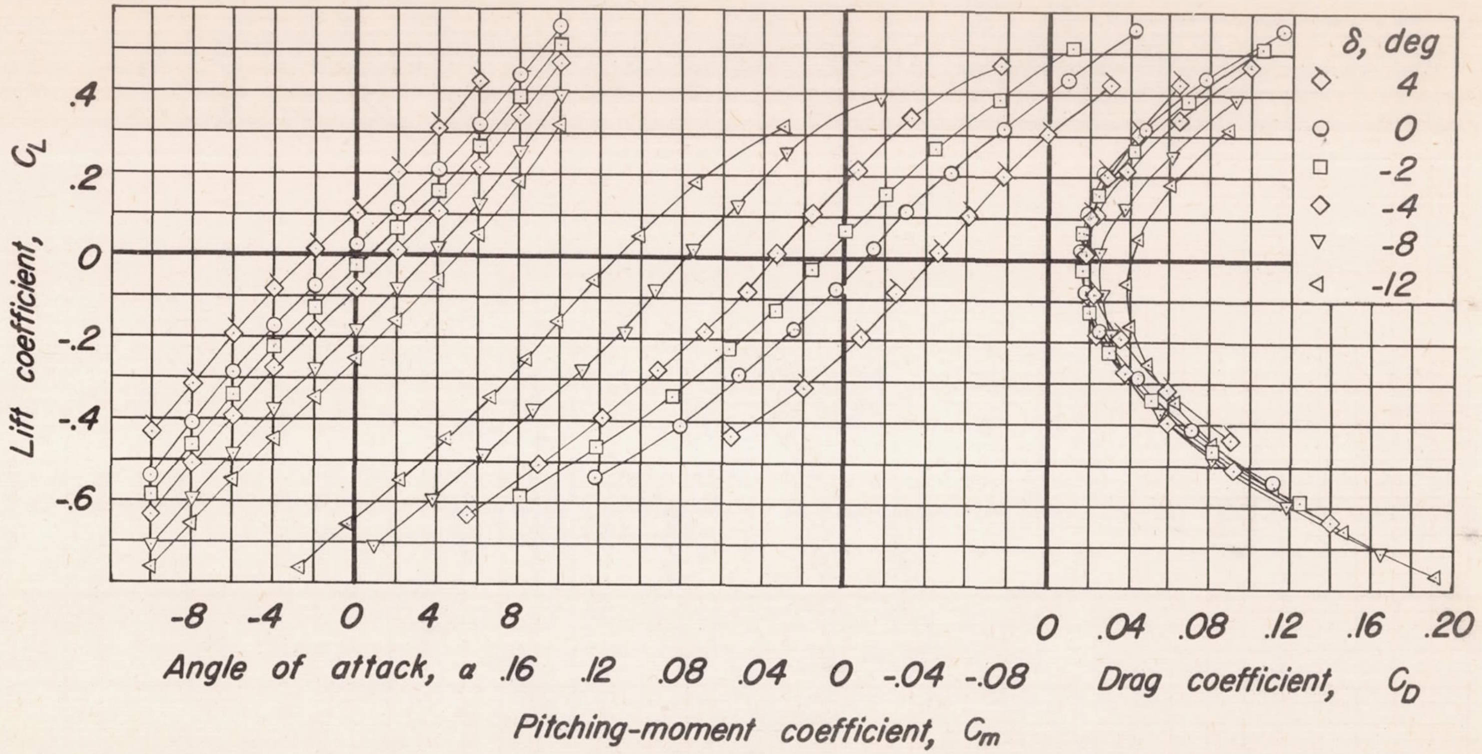
(a) C_L vs α, C_L vs C_m, C_L vs C_D

Figure 15.- The aerodynamic characteristics of a triangular wing and a fuselage for various flap angles. Reynolds number, 5,300,000; Mach number, 0.93.



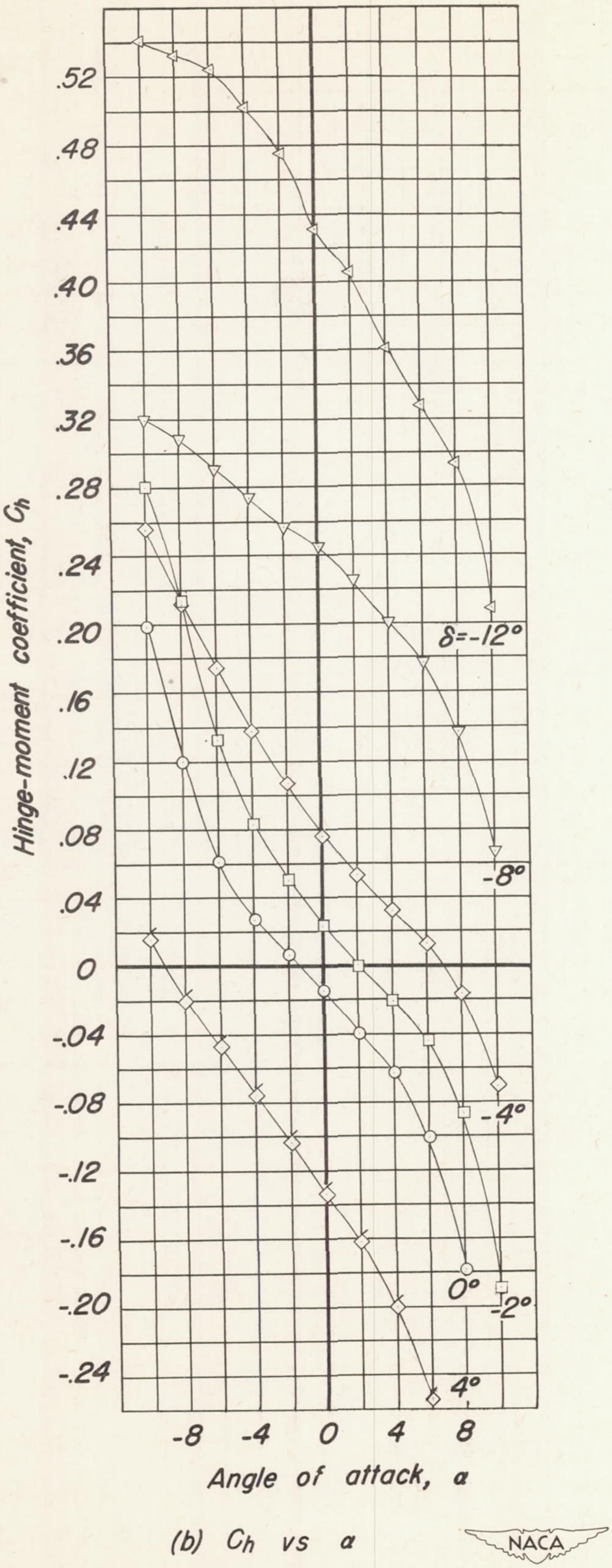
(b) C_h vs α

Figure 15.-Concluded.



(a) C_L vs α, C_L vs C_m, C_L vs C_D

Figure 16.- The aerodynamic characteristics of a triangular wing and a fuselage for various flap angles. Reynolds number, 5,300,000, Mach number, 0.95.



(b) C_h vs α

Figure 16.-Concluded.

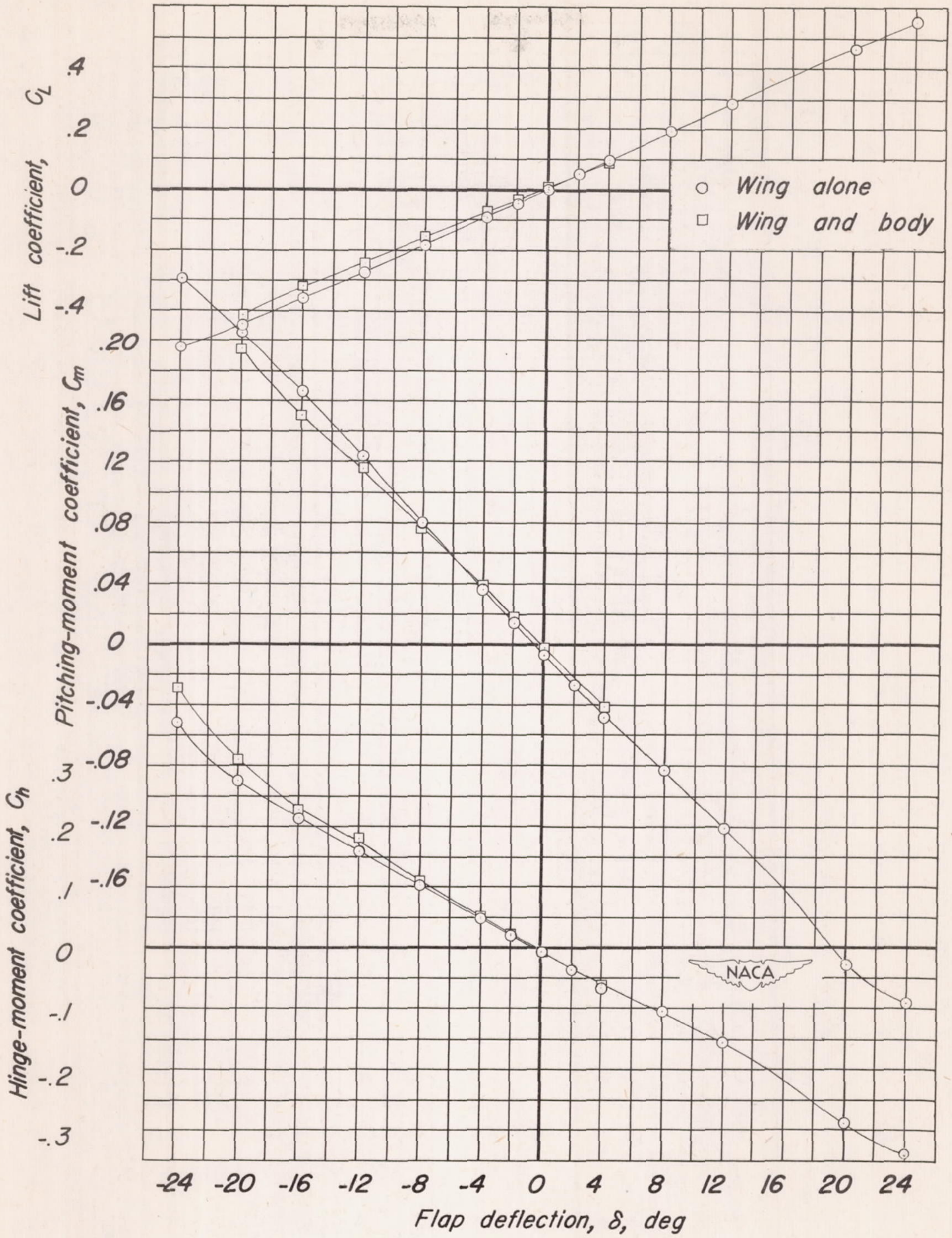
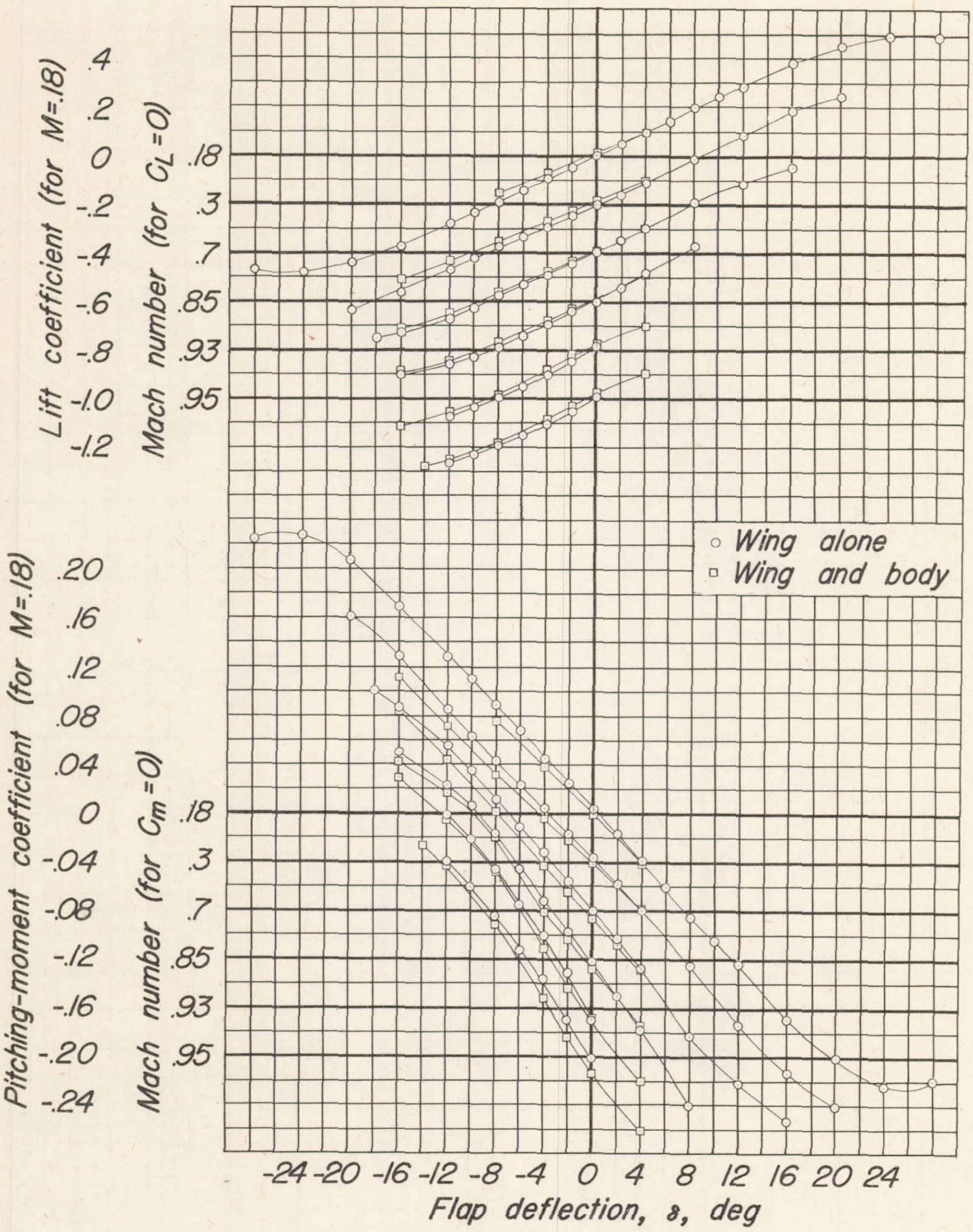
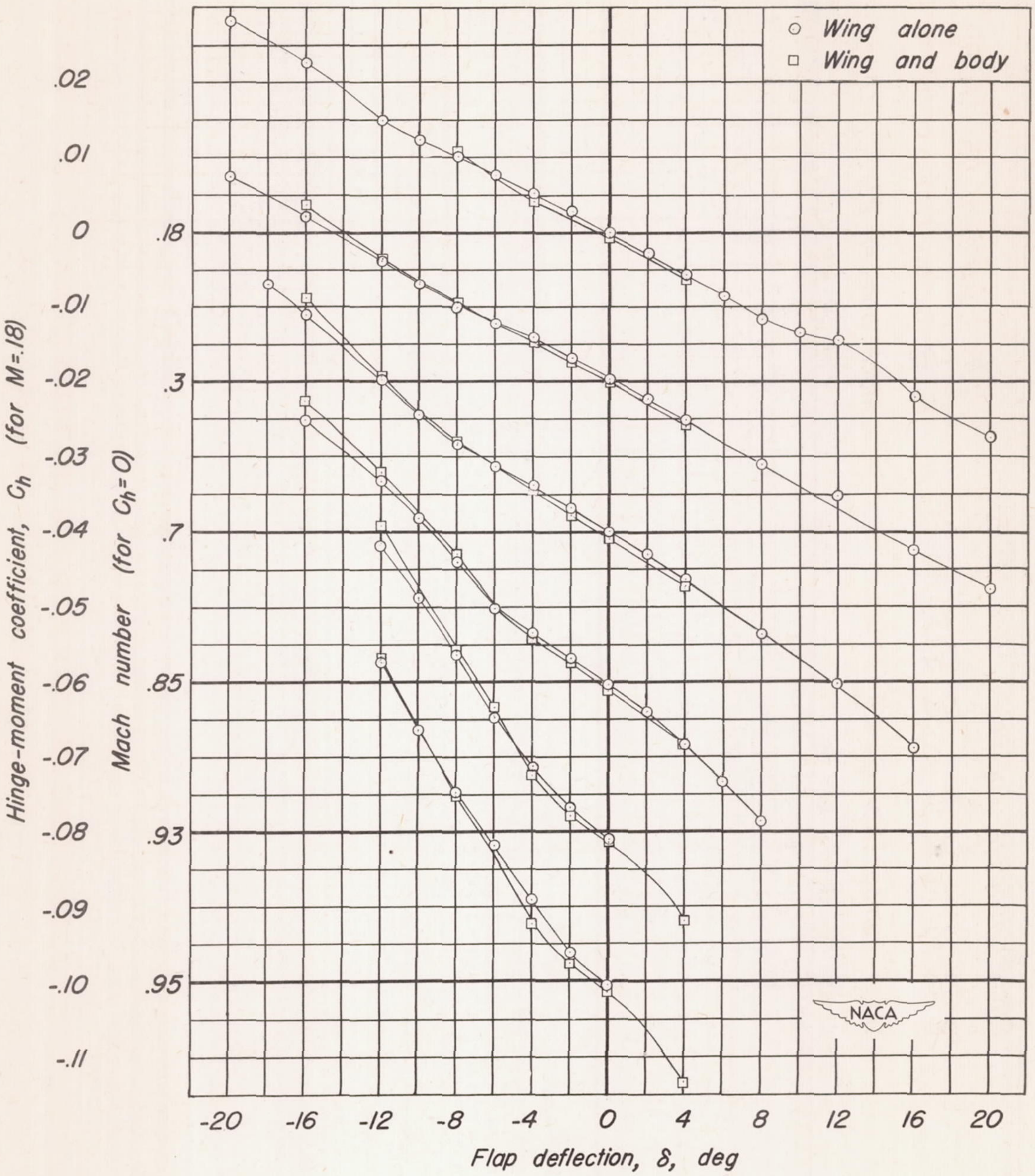


Figure 17.- The variation of lift, pitching-moment, and hinge-moment coefficient with flap deflection for a triangular wing alone and with a fuselage. Reynolds number, 15,000,000: Mach number, 0.18; Angle of attack, 0°.



(a) C_L vs δ, C_m vs δ

Figure 18.- The variation of lift, pitching-moment and hinge-moment coefficients with flap deflection for a triangular wing alone and with a fuselage at several Mach numbers. Reynolds number, 5,300,000; Angle of attack, 0°.



(b) C_h vs δ

Figure 18.-Concluded

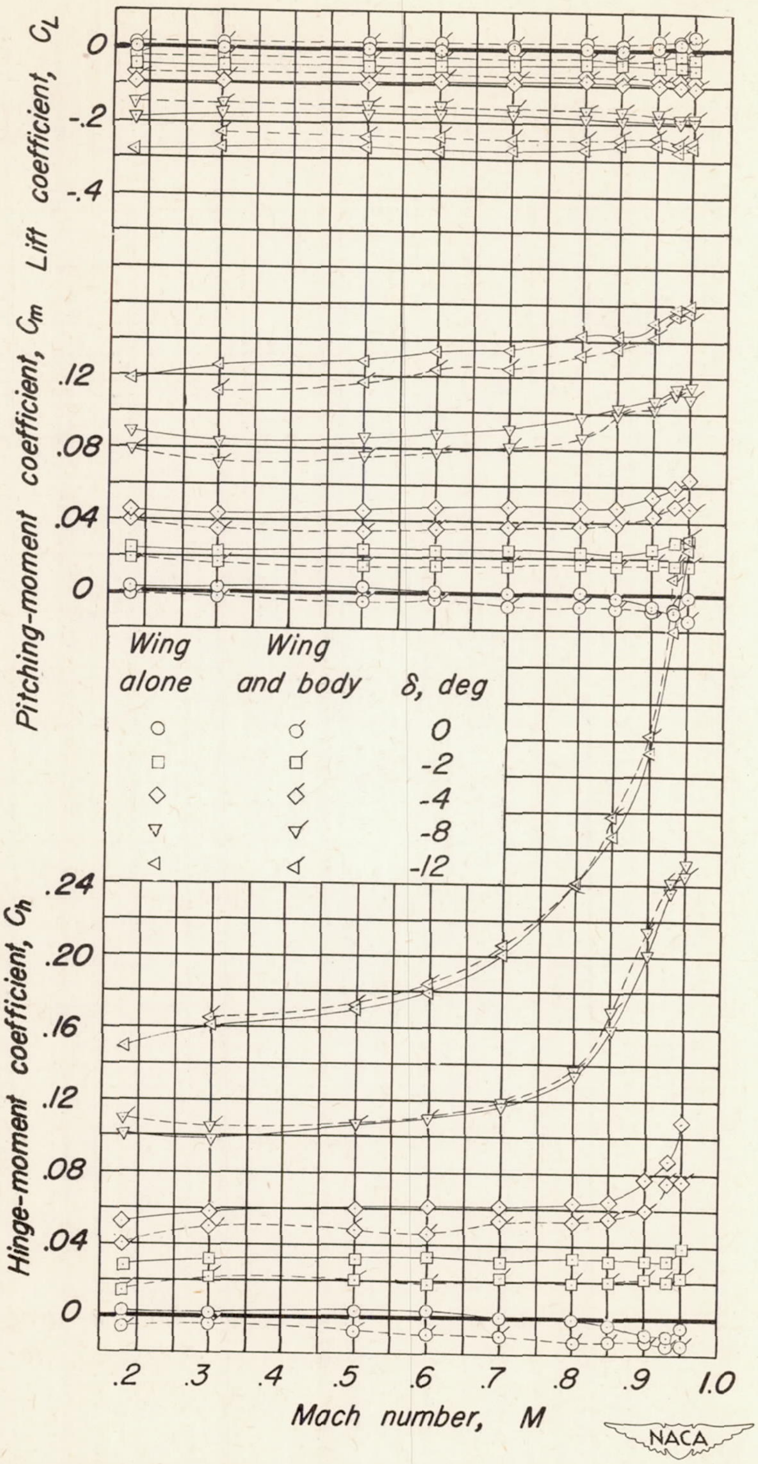


Figure 19.- The effect of Mach number on the lift, pitching-moment and hinge-moment coefficients of a triangular wing alone and with a fuselage for various flap angles. Reynolds number, 5,300,000. Angle of attack, 0°.

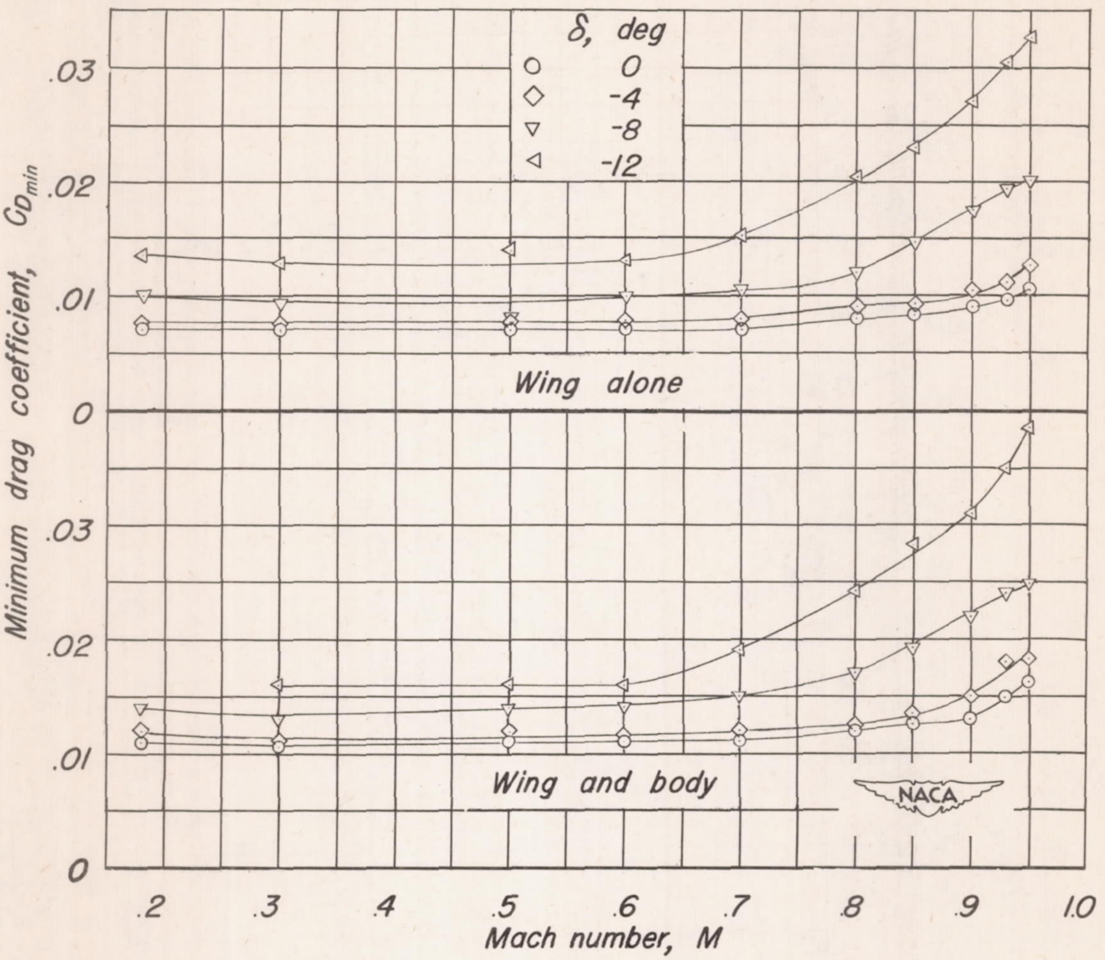


Figure 20.- The effect of Mach number on the minimum drag coefficient of a triangular wing alone and with a fuselage for various flap angles. Reynolds number, 5,300,000.

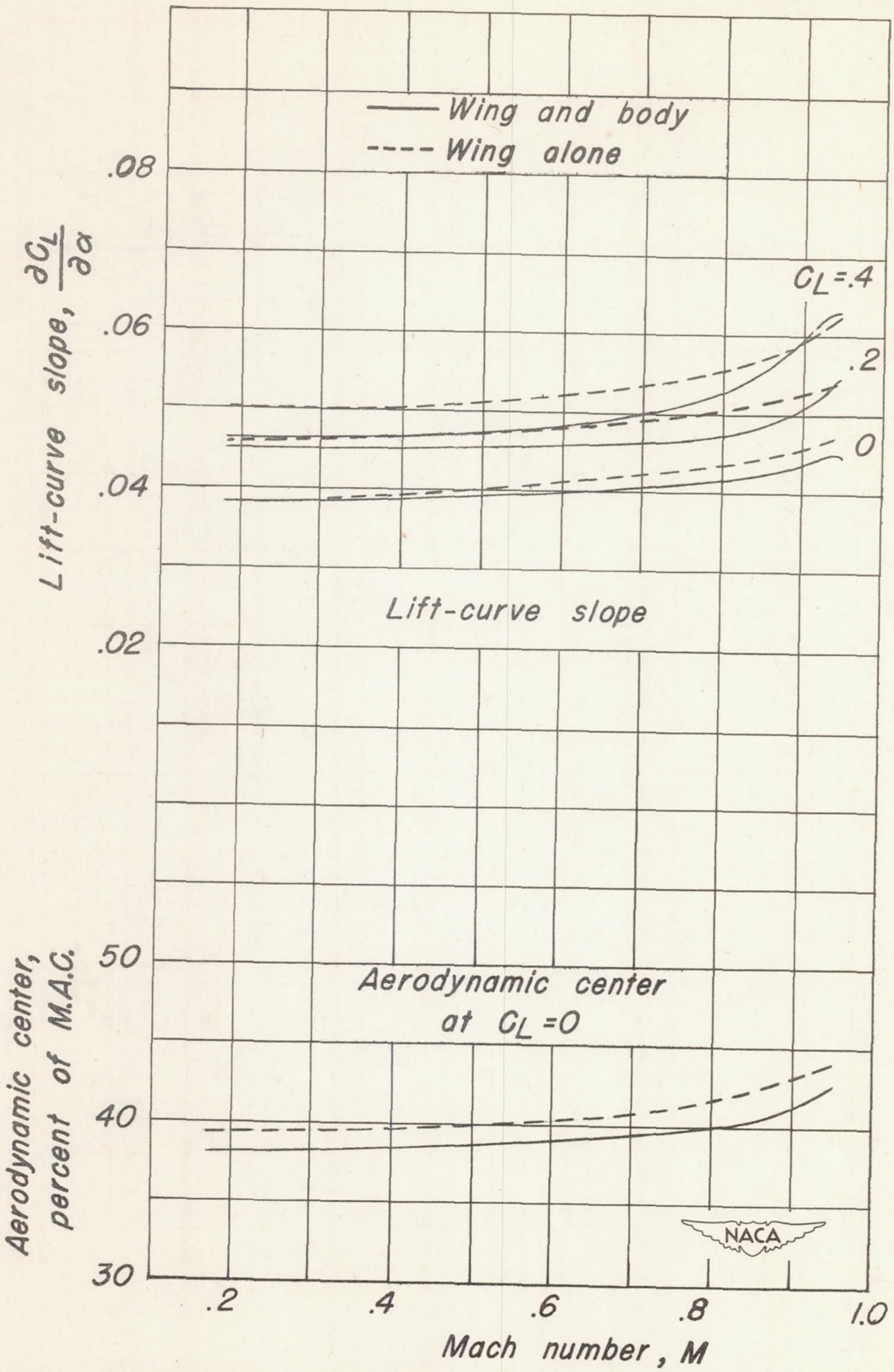


Figure 21.- The effect of Mach number on lift-curve slope and aerodynamic center of a triangular wing alone and with a fuselage at a Reynolds number of 5,300,000.

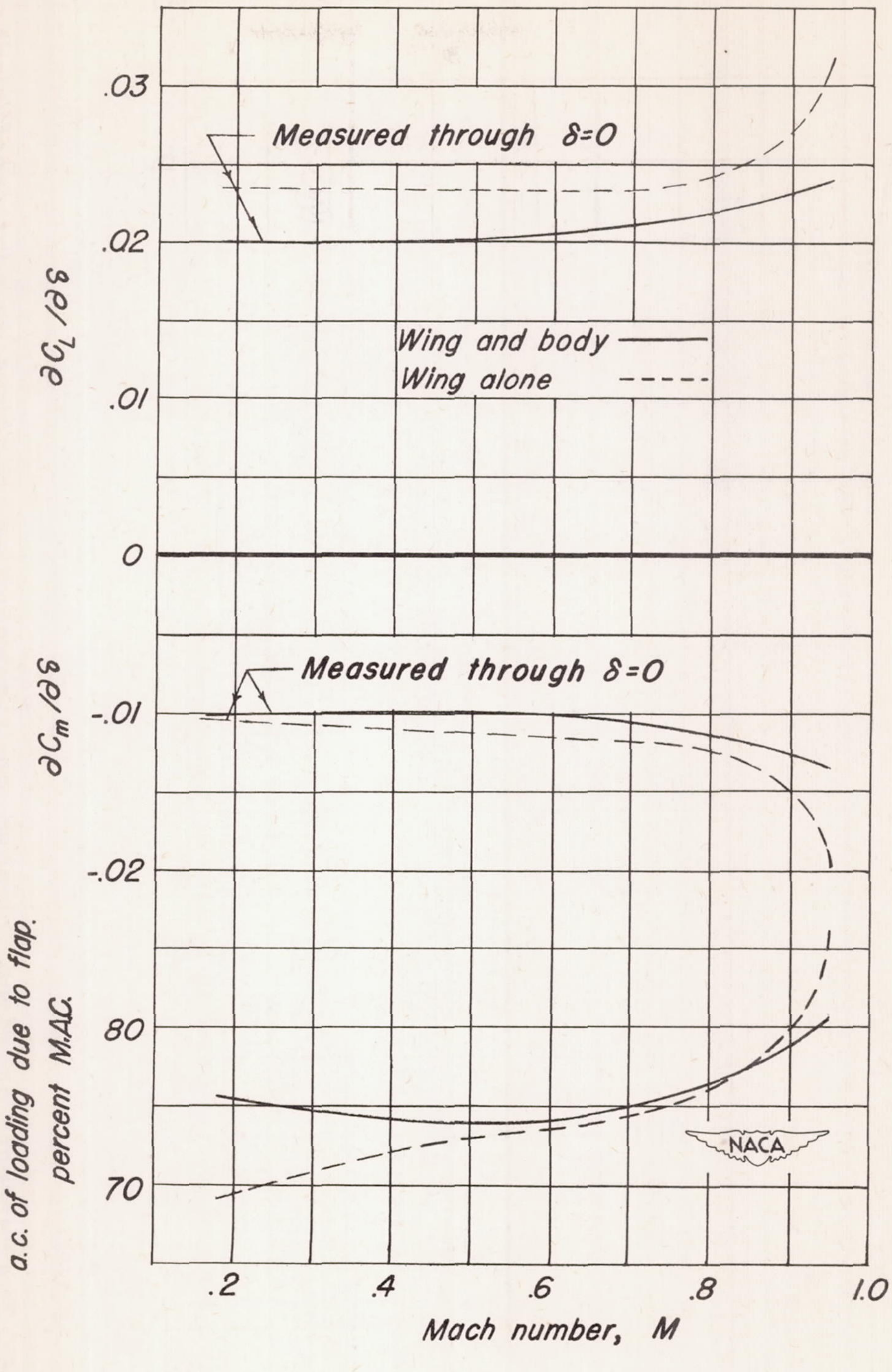


Figure 22.- The variation with Mach number of the flap effectiveness and aerodynamic center of the loading due to the flap for a triangular wing alone and with a fuselage. Reynolds number, 5,300,000. Angle of attack, 0°.

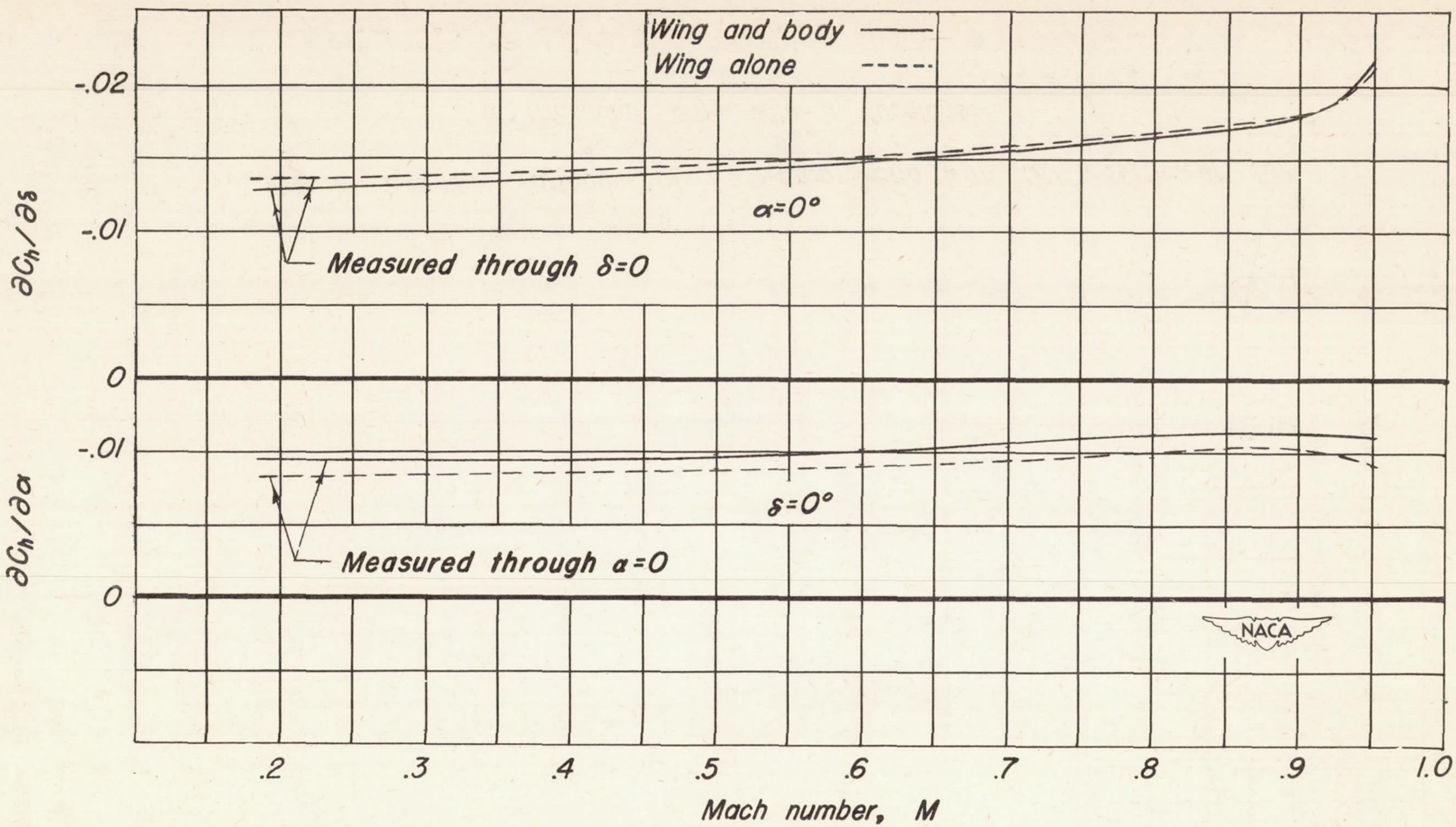


Figure 23.- The effect of Mach number on the variation of hinge-moment coefficient with angle of attack and with flap deflection for a triangular wing alone and with a fuselage. Reynolds number, 5,300,000.

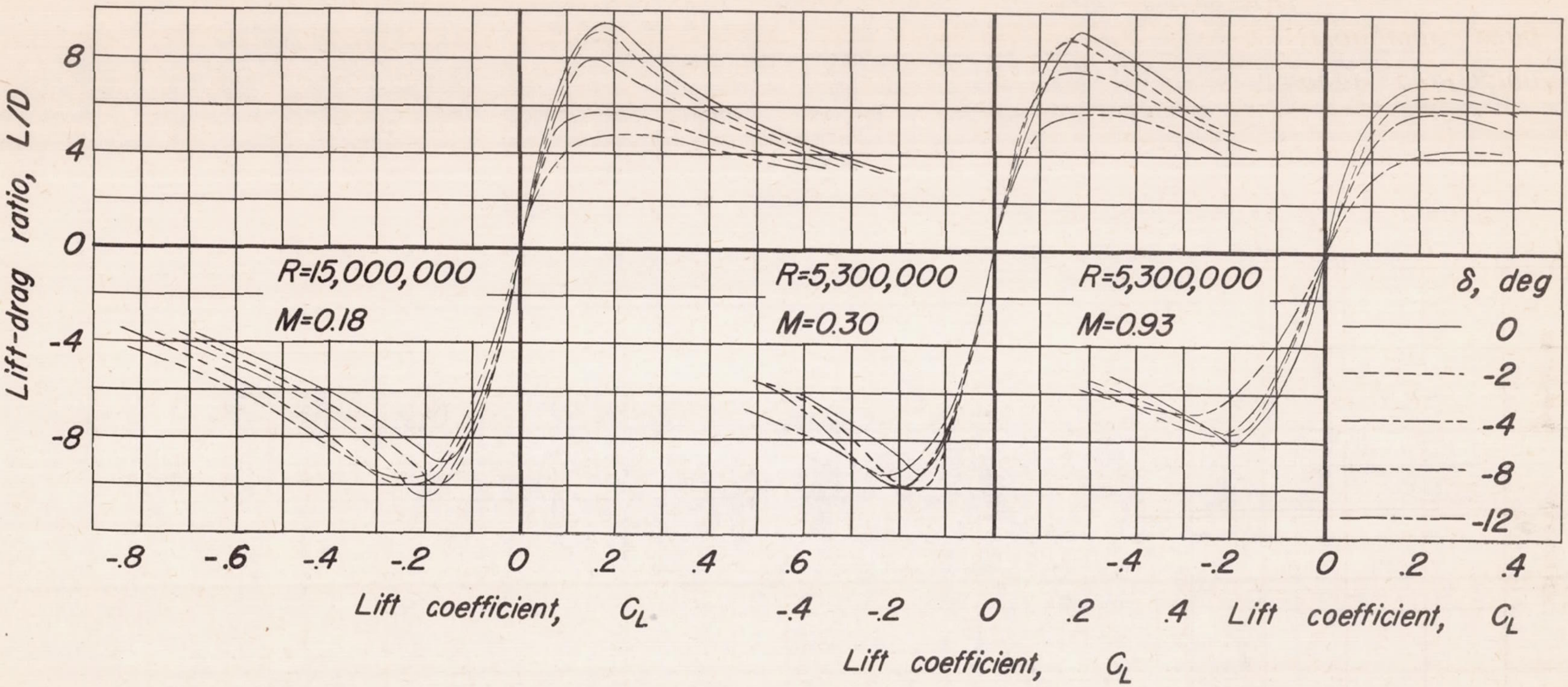


Figure 24.-The variation of lift-drag ratio with lift coefficient for a triangular wing with a fuselage.

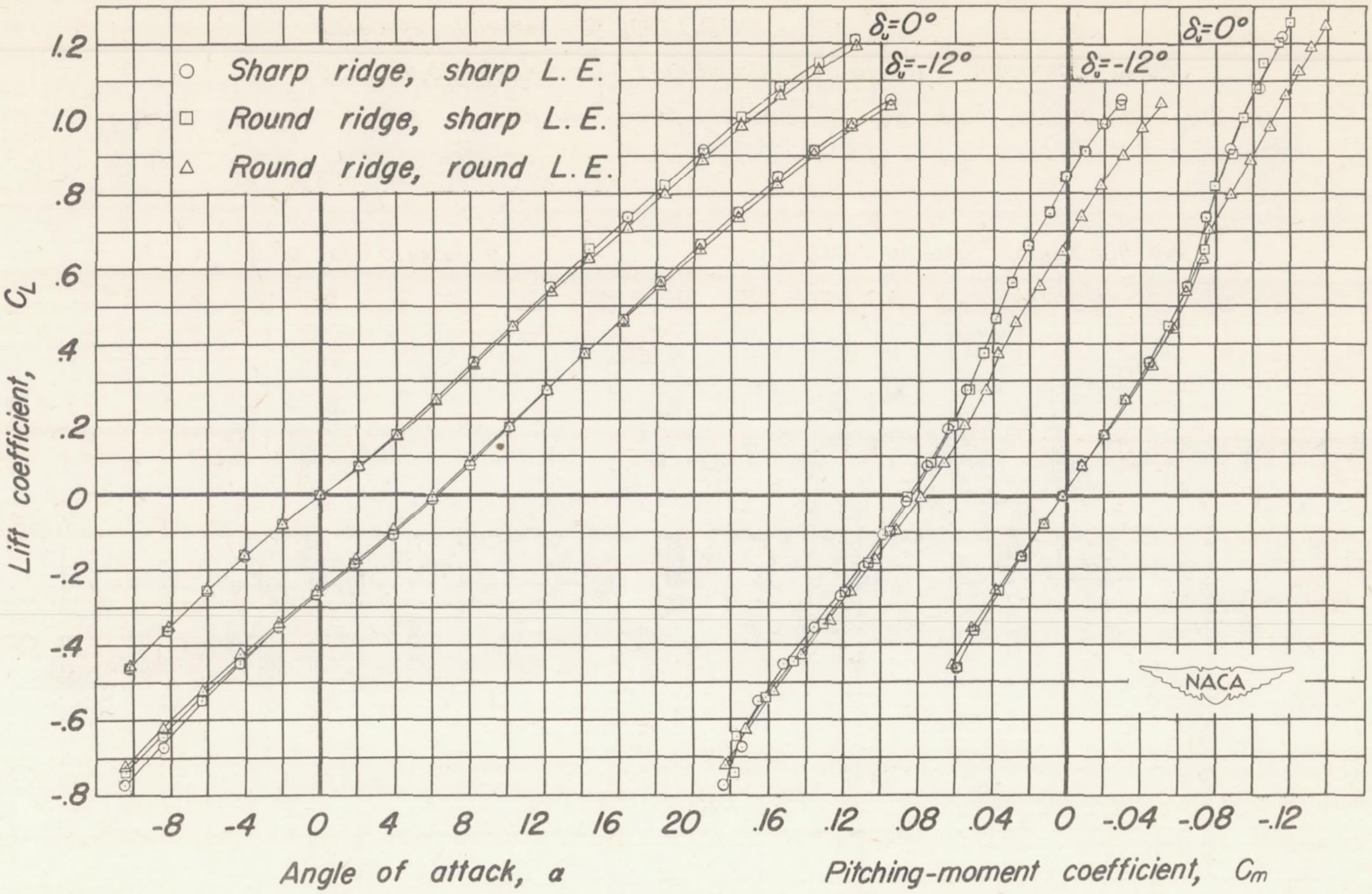
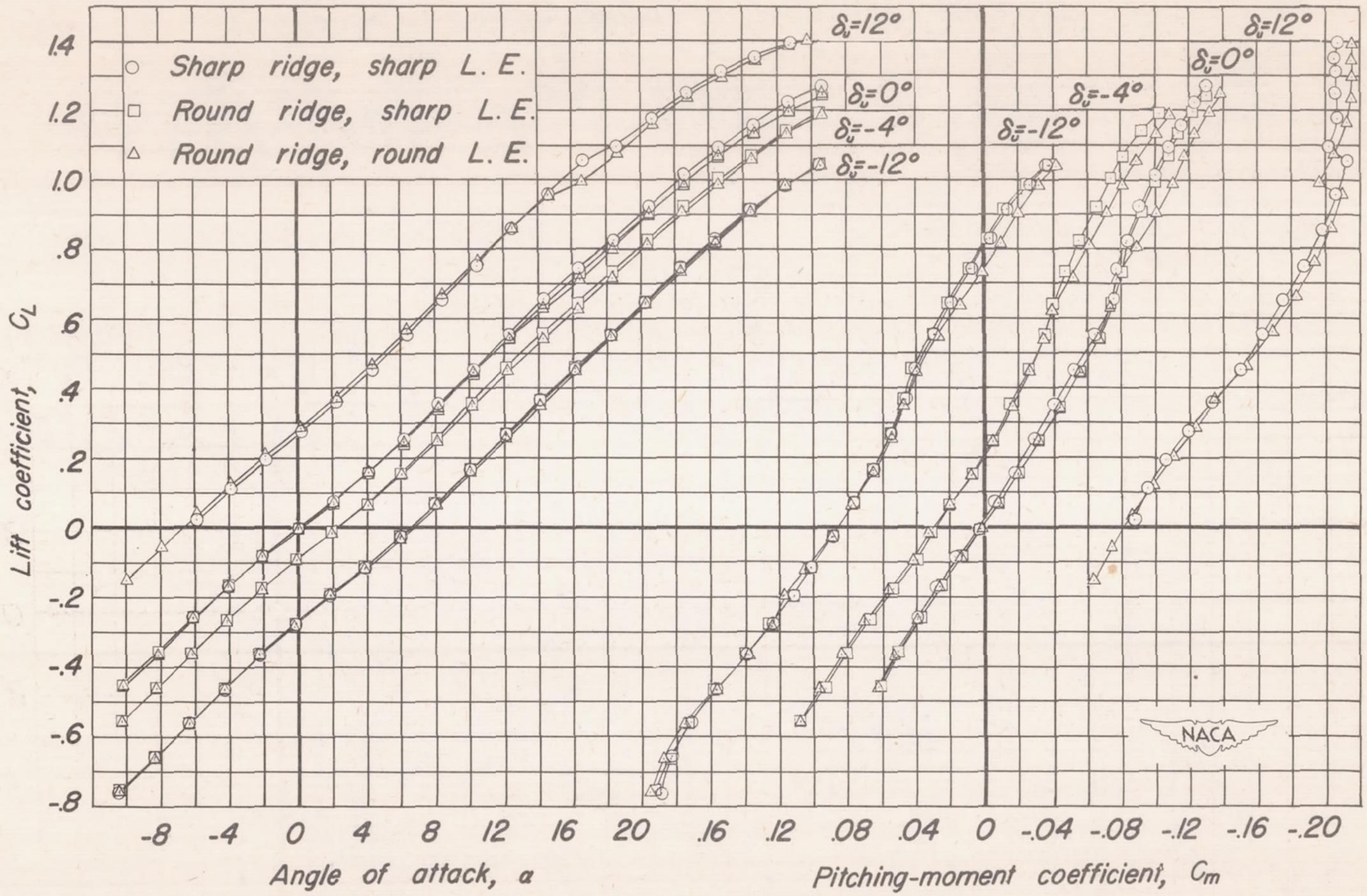
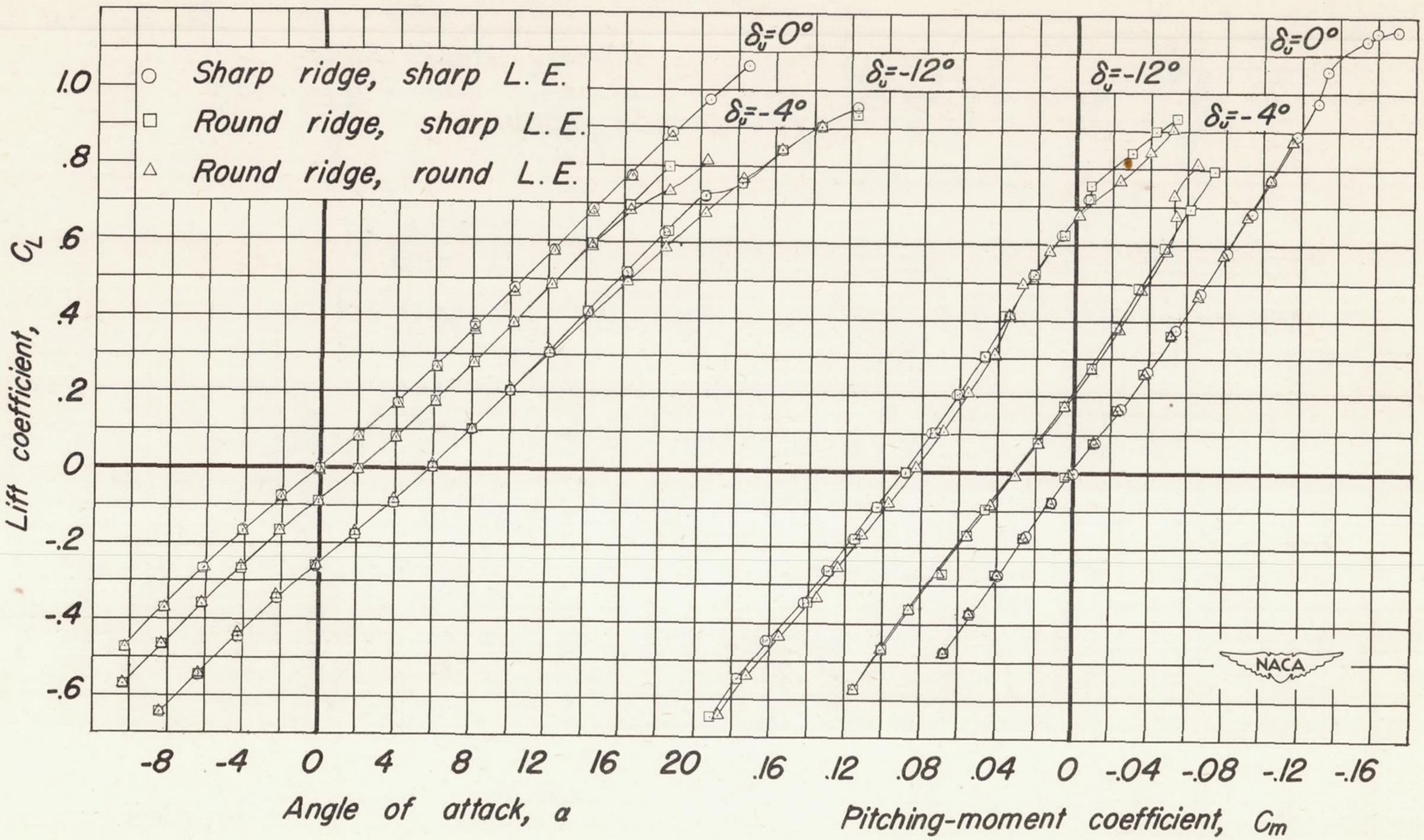


Figure 25.-The effect of minor modifications to the wing profile on the lift and pitching-moment characteristics of a triangular wing. Reynolds number, 15,000,000; Mach number, 0.18.



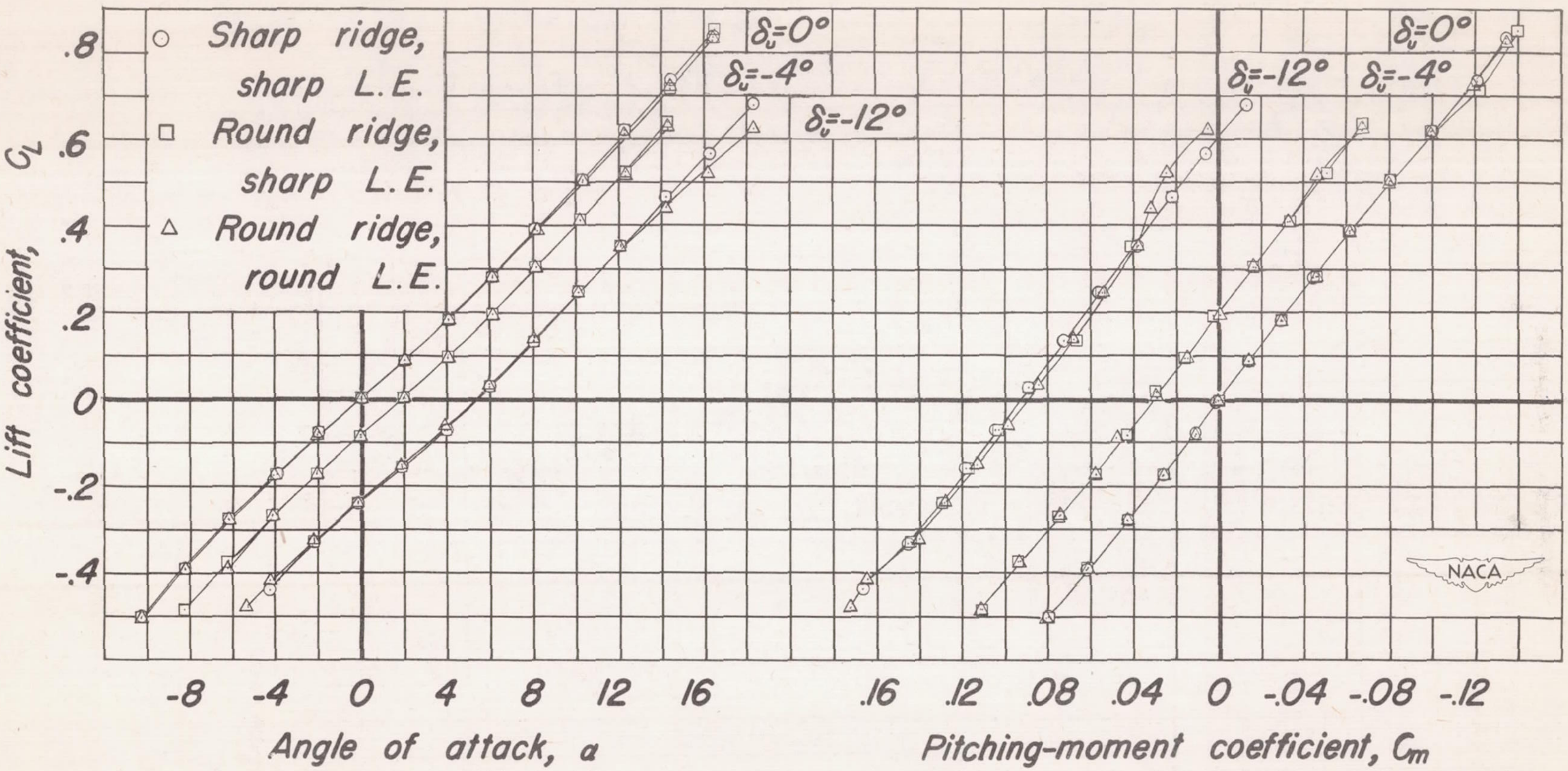
(a) Mach number, 0.18.

Figure 26.-The effect of minor modifications to the wing profile on the lift and pitching-moment characteristics of a triangular wing. Reynolds number, 5,300,000.



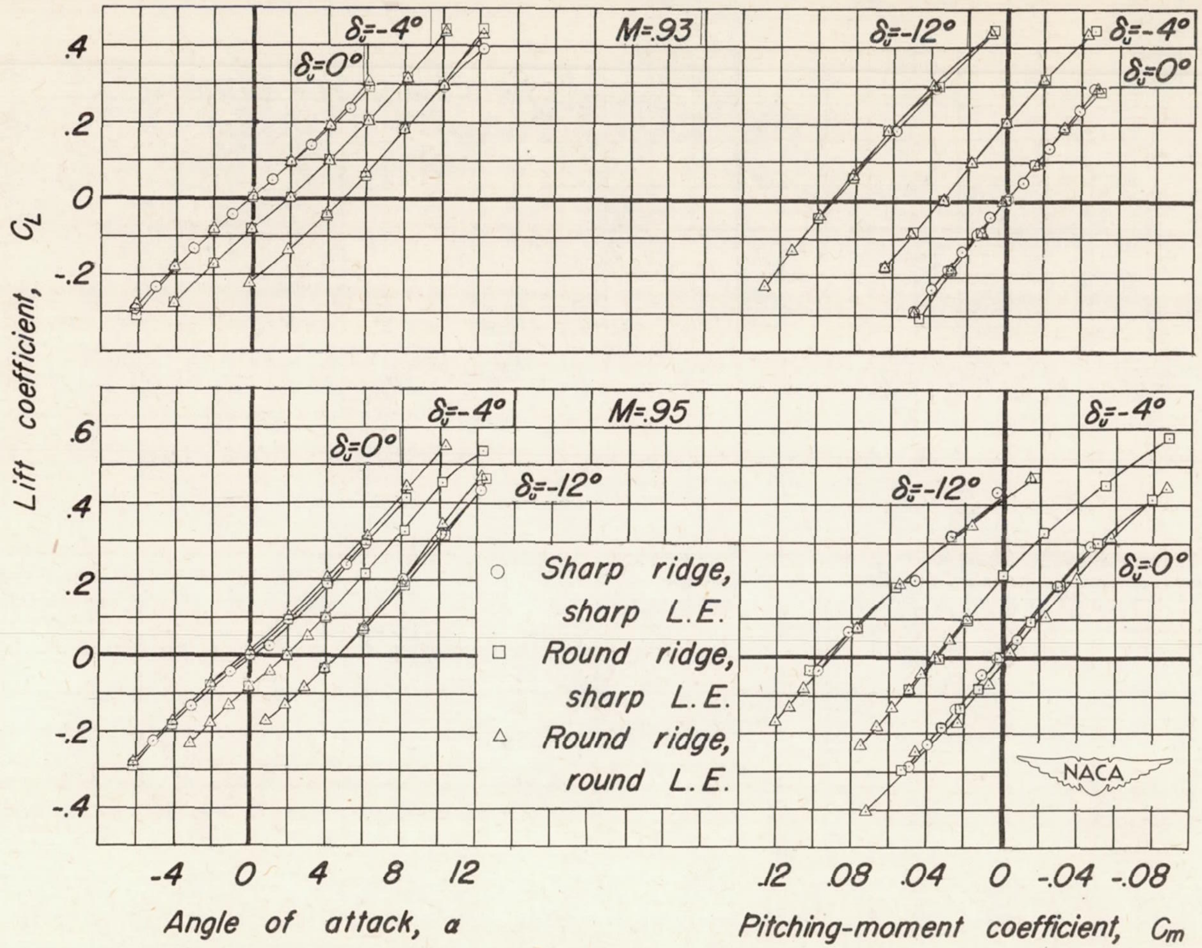
(b) Mach number, 0.70.

Figure 26.-Continued.



(c) Mach number, 0.85.

Figure 26.-Continued.



(d) Mach numbers, 0.93, 0.95.

Figure 26.-Concluded.

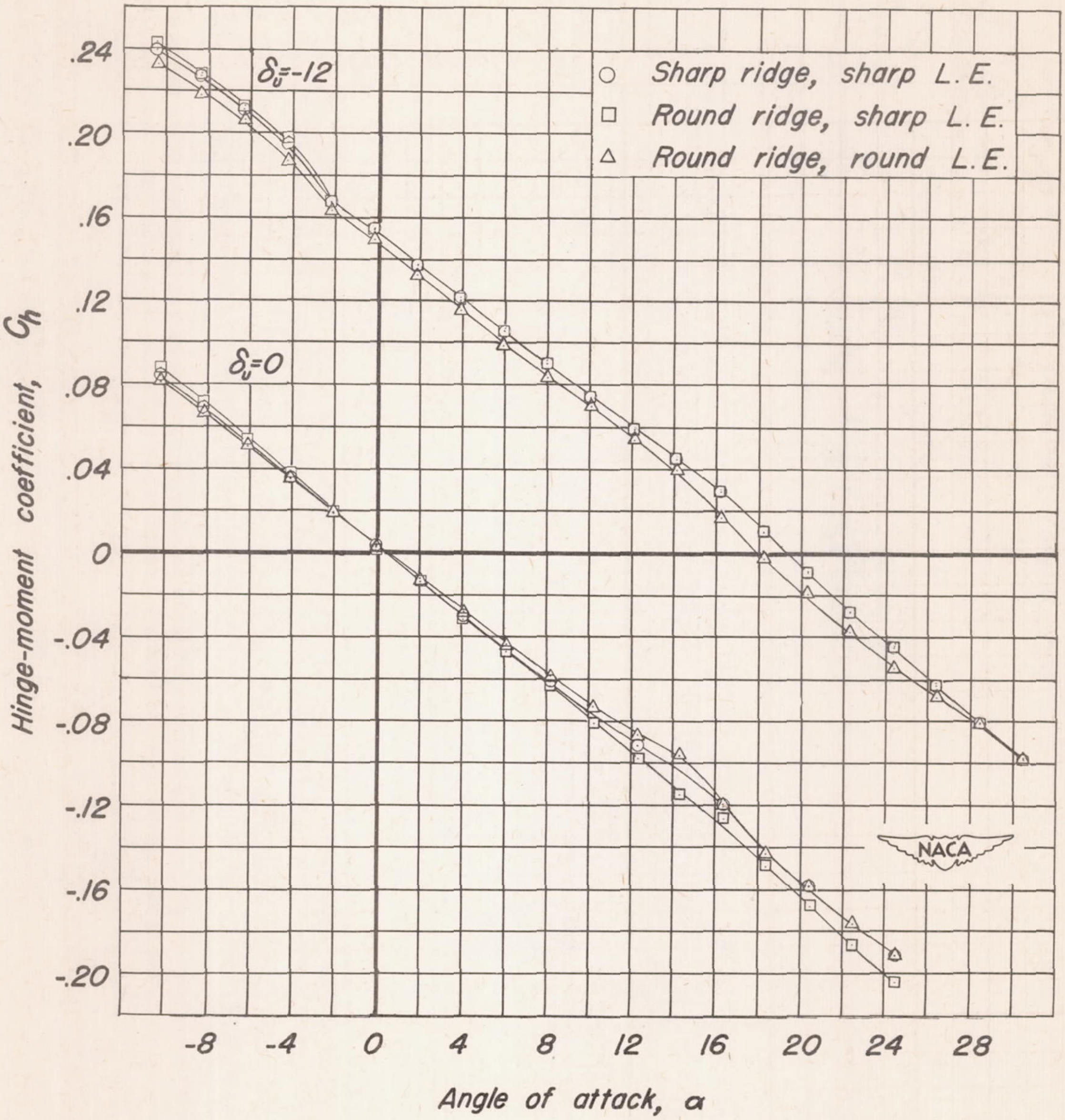
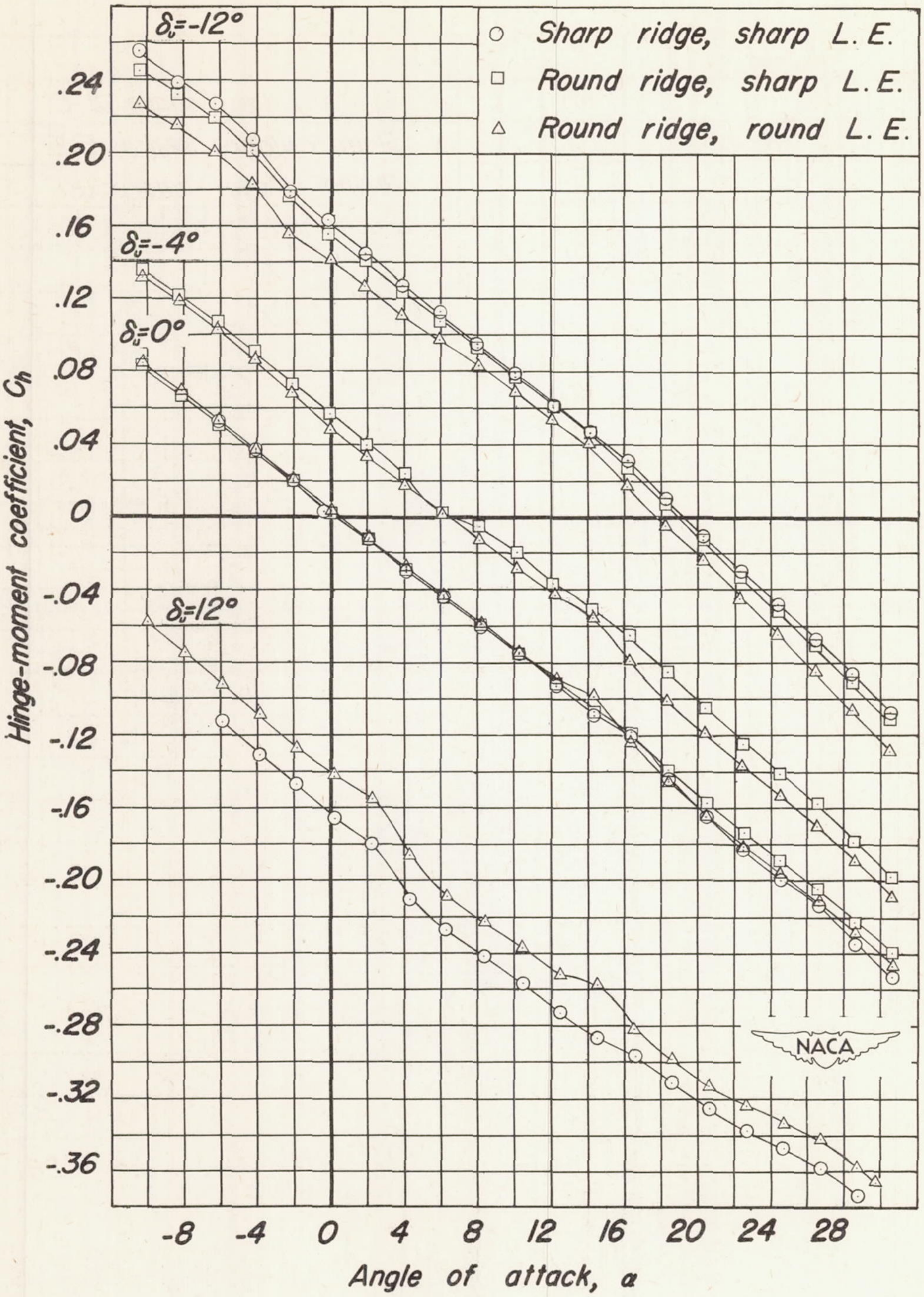
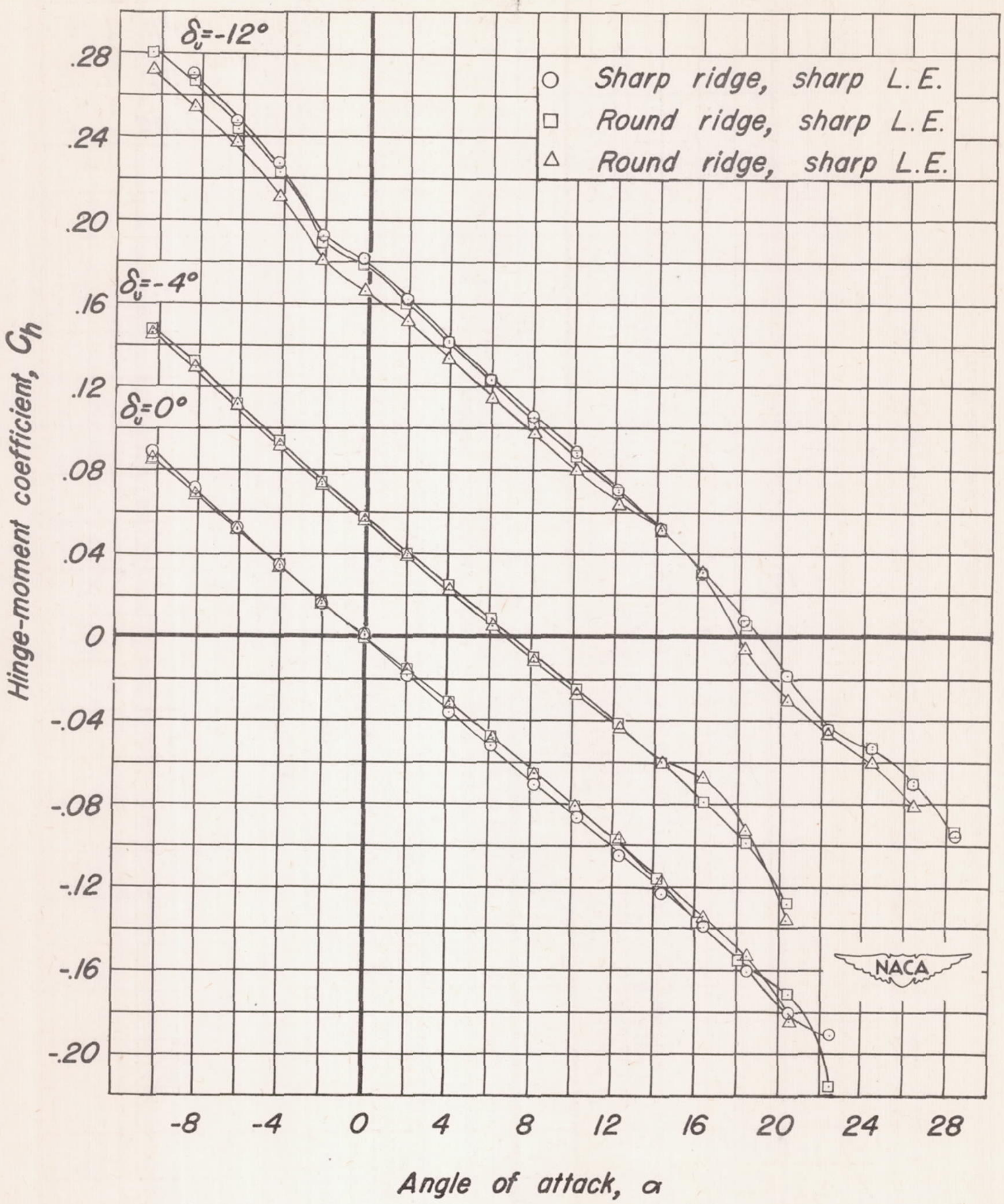


Figure 27.- The effect of minor modifications to the wing profile on the hinge-moment characteristics of a triangular wing. Reynolds number, 15,000,000; Mach number, 0.18.



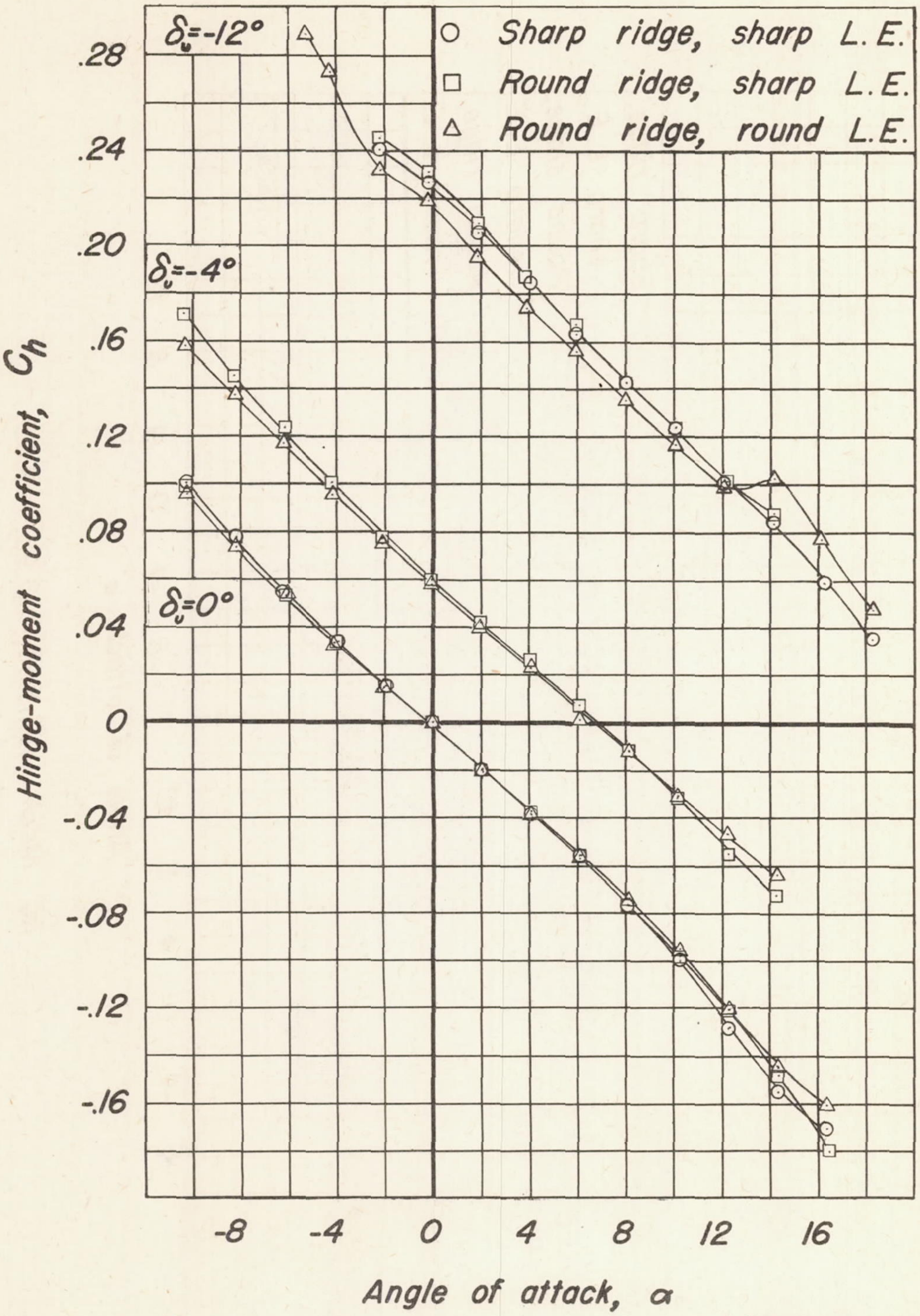
(a) Mach number, 0.18.

Figure 28.-The effect of minor modifications to the wing profile on the hinge-moment characteristics of a triangular wing. Reynolds number, 5,300,000.



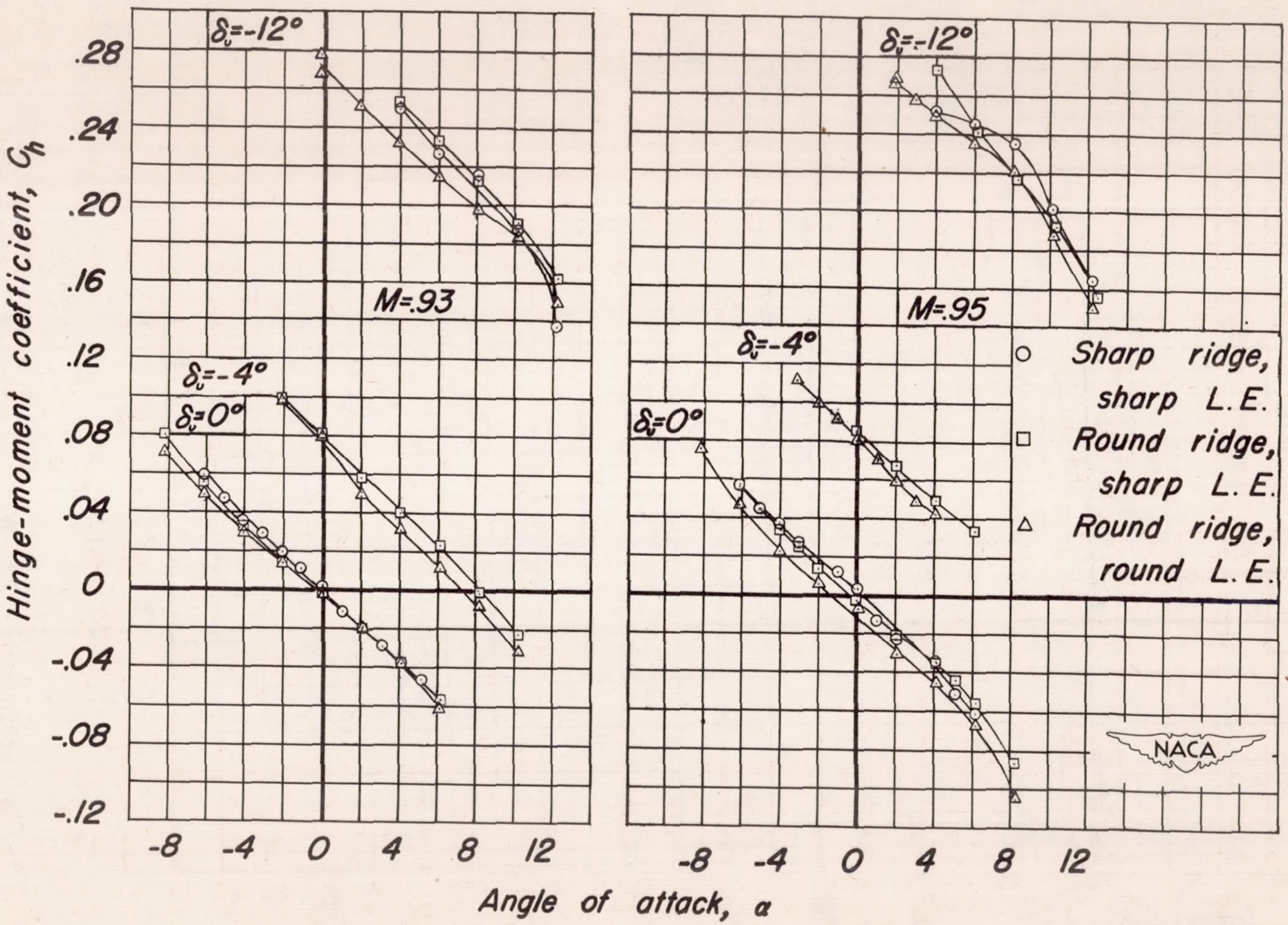
(b) Mach number, 0.70

Figure 28.-Continued.



(c) Mach number, 0.85.

Figure 28.-Continued.



(d) Mach numbers, 0.93, 0.95.

Figure 28.-Concluded.

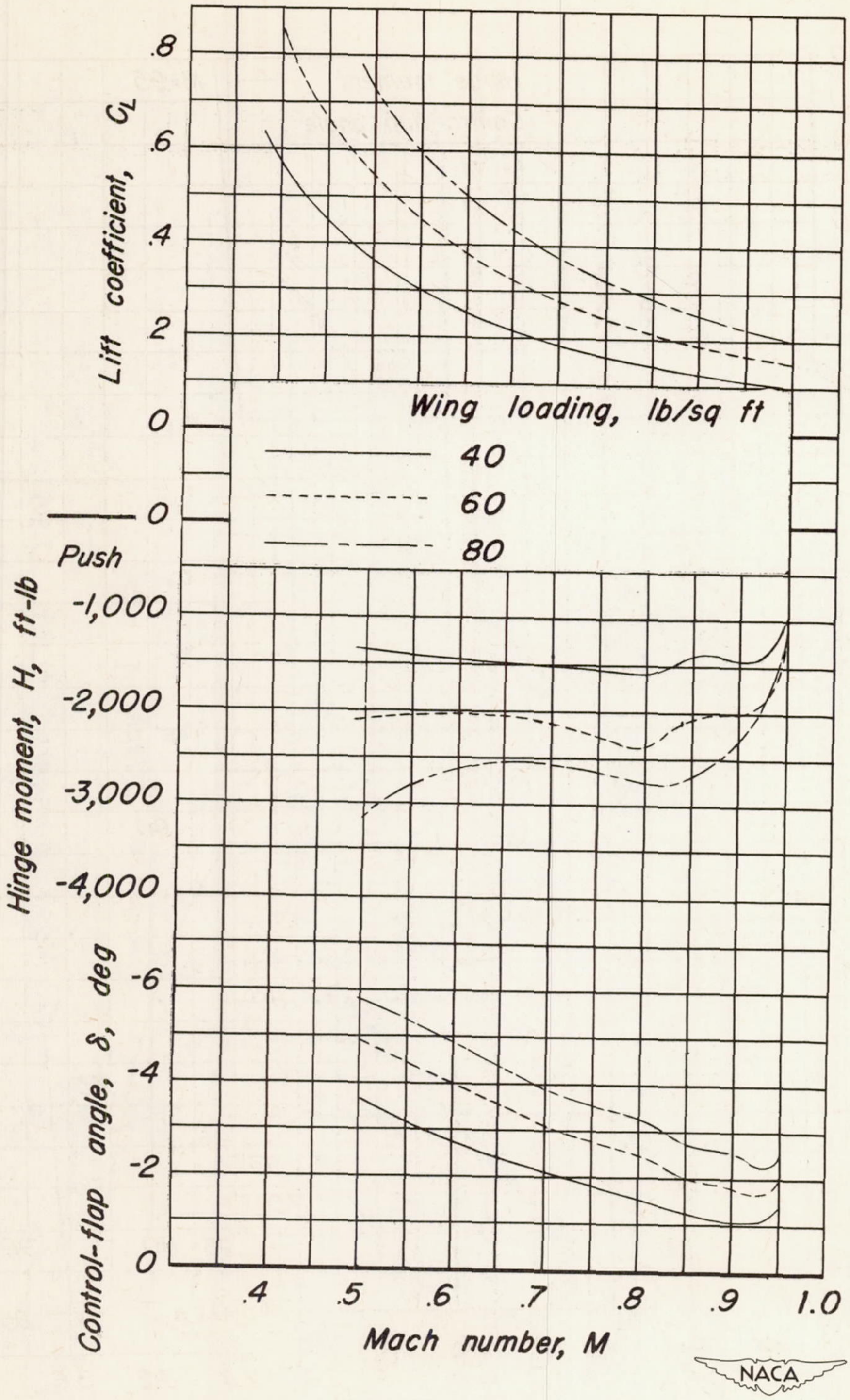


Figure 29.-The variations of lift coefficient, hinge moment, and control-flap angle with Mach number for level flight of a triangular winged aircraft at 30,000 feet altitude. Wing area, 500 sq ft; c.g. at 0.32 M.A.C.

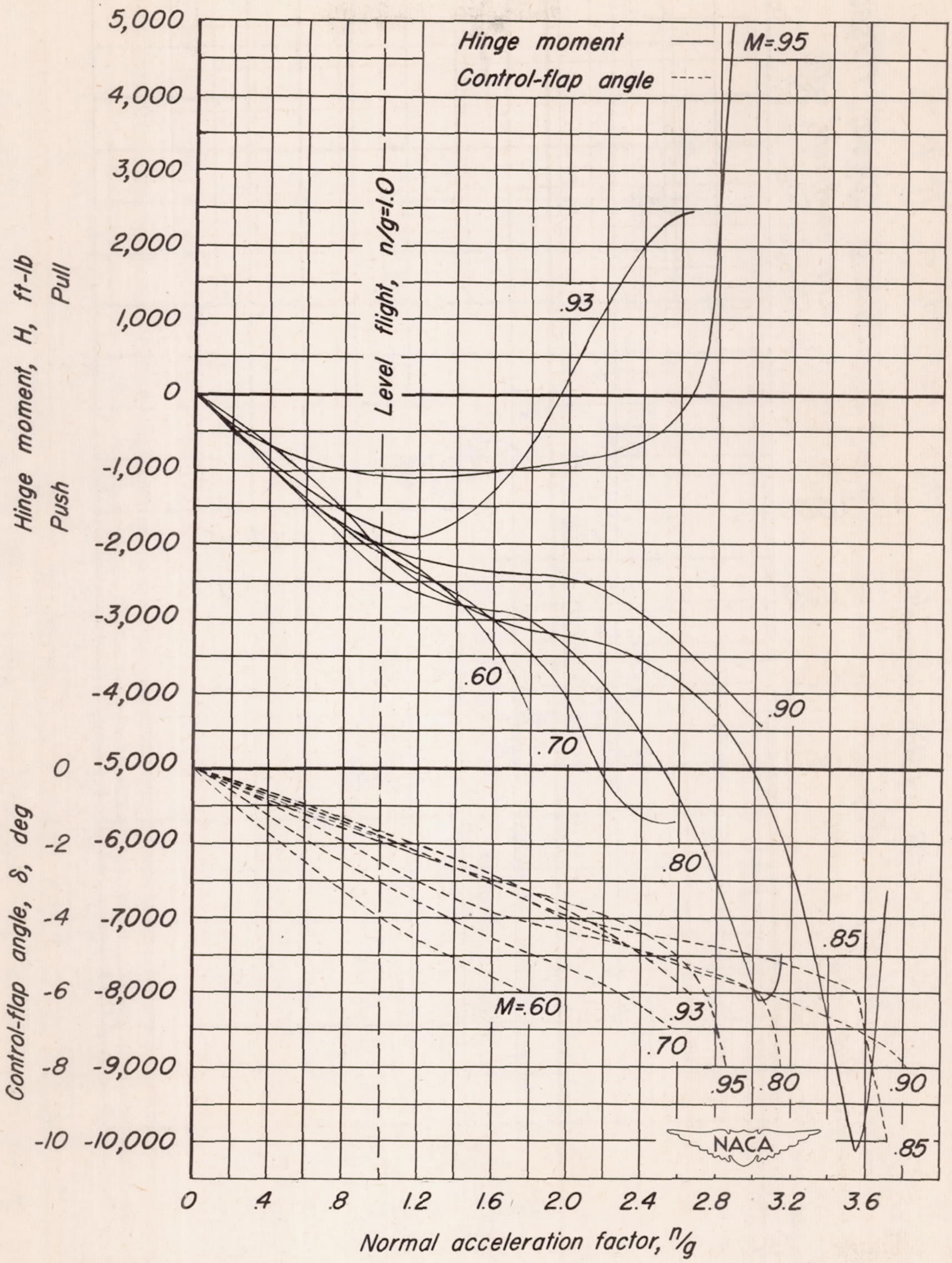


Figure 30.-The variations of hinge moment and control-flap angle with normal acceleration factor, at several Mach numbers, for a triangular winged aircraft at 30,000 feet altitude. Wing loading, 60lb per sq ft; Wing area, 500sq ft; c.g. at 0.32 M.A.C.

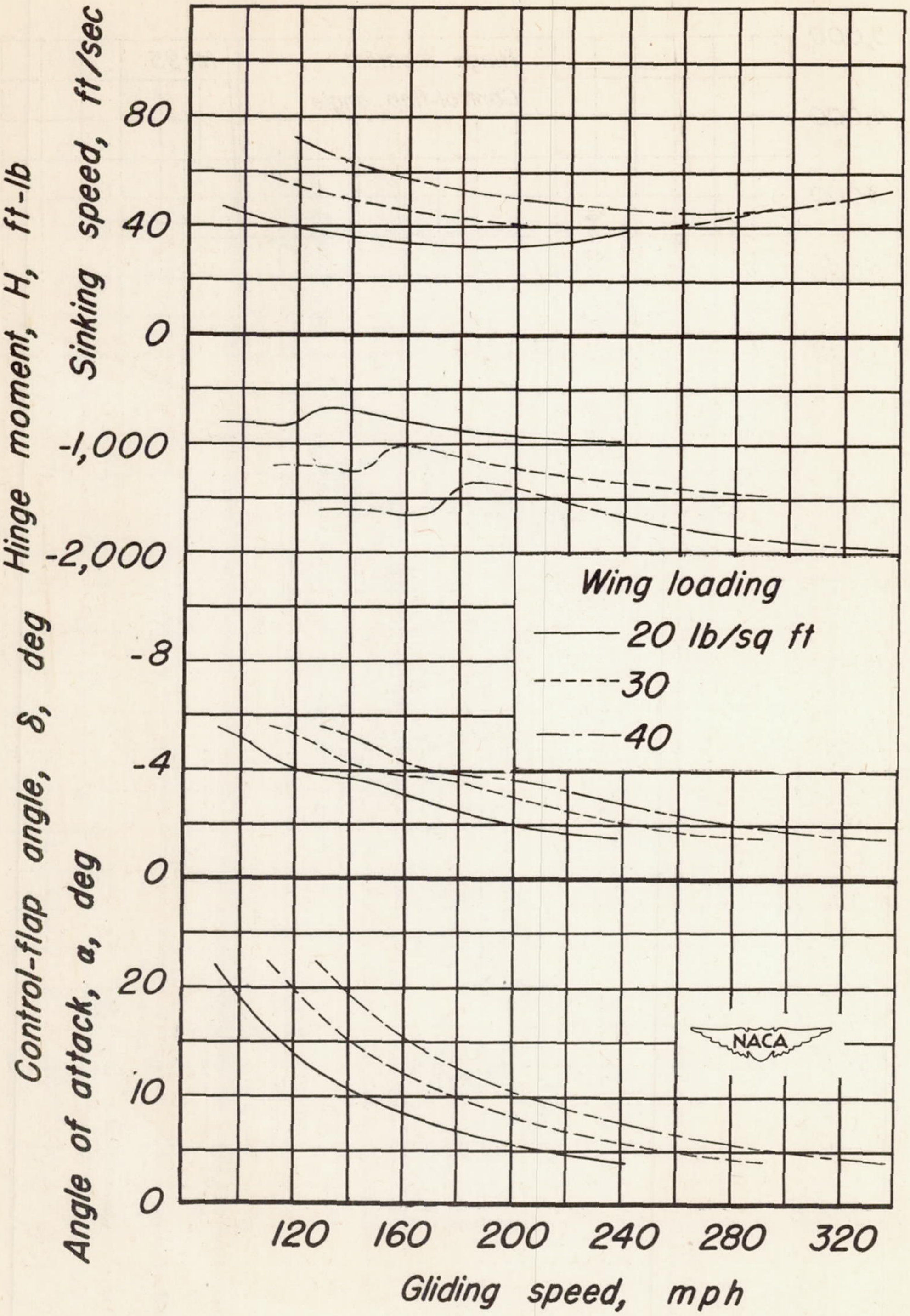


Figure 31.-The variations of sinking speed, hinge moment, and control-flap angle with gliding speed for a triangular winged aircraft at sea level. Wing area, 500 sq ft; c.g. at 0.32 M.A.C.