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RESEARCH MEMORANDUM

A WIND-TUNNEL INVESTIGATION OF THE
WING LOADS DUE TO DEFLECTED INBOARD AILERONS ON A
45° SWEEPBACK WING AT TRANSONIC SPEEDS

By Atwood R. Heath, Jr., and Ann W. Igoe

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RESEARCH MEMORANDUM

A WIND-TUNNEL INVESTIGATION OF THE
WING LOADS DUE TO DEFLECTED INBOARD AILERONS ON A
45° SWEEPBACK WING AT TRANSONIC SPEEDS*

By Atwood R. Heath, Jr., and Ann W. Igoe

SUMMARY

The effects of deflected inboard ailerons on the wing loads of a 45° sweptback wing-body combination have been investigated in the Langley 16-foot transonic tunnel. The model had a wing with an aspect ratio of 3, a taper ratio of 0.2, and NACA 65A004 airfoil sections. The flap-type ailerons had chords equal to 30 percent of the wing local chords and had spans that extended outboard from the 18.5-percent-semispan station for 39.5 percent of the wing semispan. Pressure measurements were obtained at six spanwise stations on the wing for model angles of attack from 0° to about 21° in the Mach number range from 0.80 to 1.03 at Reynolds numbers of 6.4×10^6 to 7.7×10^6 .

The deflected aileron caused a significant added loading over the wing sections outboard of the aileron at all Mach numbers and at model angles of attack from 0° up to about 8° or 12°. In the low angle-of-attack range (from 0° to 8°), the shape of the additional spanwise loading was predicted fairly well by subsonic theory in the Mach number range from 0.80 to 0.98. The deflected aileron also caused a carry-over load to the opposite wing that was essentially constant with both Mach number and model angle of attack.

INTRODUCTION

Pressure-field measurements on thin sweptback wings with deflected ailerons operating in the transonic speed range are scanty. Some data for outboard ailerons are available and reported in references 1, 2, and 3. Pressure measurements at one wing spanwise location are presented in reference 4 for a midspan aileron and in reference 5 for a full-span aileron. The present investigation was undertaken to determine the effects of inboard ailerons and is part of a program in the Langley

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16-foot transonic tunnel to obtain data on thin wings of unswept, swept, and delta plan forms in the transonic speed range. The program includes studies of the effects of lateral controls for all three plan forms. The present paper presents the loadings on a thin wing having 45° of sweepback for several inboard-aileron deflections, as well as the effects of carryover loads to the opposite wing induced by the deflected ailerons.

The model used for the investigation had a wing with 45° of sweepback, an aspect ratio of 3.0, a taper ratio of 0.2, and NACA 65A004 airfoil sections parallel to the free stream. Previous investigations made of this wing are presented in references 6, 7, 8, and 9. For the present investigation, each wing was fitted with trailing-edge flap-type inboard ailerons. The ailerons had a chord which was 30 percent of the local wing chord and a span which was 39.5 percent of the wing semispan. Data were obtained in the angle-of-attack range from 0° to about 21° at Mach numbers from 0.80 to 1.03 and test Reynolds numbers from 6.4×10^6 to 7.7×10^6 for nominal aileron deflections to $\pm 15^\circ$.

SYMBOLS

b	wing span
c	local wing chord measured parallel to body center line
c'	wing mean aerodynamic chord
$\bar{c}$	wing average chord, S/b
$c_{m_c/4}$	wing section pitching-moment coefficient about $0.25c$, $\int_0^1 (c_{p,l} - c_{p,u}) \left(0.25 - \frac{x}{c}\right) d\left(\frac{x}{c}\right)$
c_n	wing section normal-force coefficient, $\int_0^1 (c_{p,l} - c_{p,u}) d\left(\frac{x}{c}\right)$
Δc_n	additional wing section normal-force coefficient due to deflection of the aileron
c_m	wing section pitching-moment coefficient about $0.25c'$, $c_{m_c/4} - c_n \left(0.25 - \frac{x'}{c}\right)$

C_m

wing pitching-moment coefficient about 0.25c',

$$\int_{0.16}^{1.0} c_m \frac{c^2}{c'} d\left(\frac{y}{b/2}\right)$$

C_N

wing normal-force coefficient, $\int_{0.16}^{1.0} c_n \frac{c}{c'} d\left(\frac{y}{b/2}\right)$

ΔC_N

wing additional normal-force coefficient due to aileron deflection

C_p

pressure coefficient, $\frac{p_{\text{local}} - p}{q}$

$C_{N,F}$

total model normal-force coefficient, $\frac{N_F}{qS/2}$

$\Delta C_{N,F}$

total model additional normal-force coefficient due to aileron deflection

$\Delta C_{N,c}$

carryover wing normal-force coefficient

M

Mach number

N_F

total model normal force (from strain-gage balance measurements)

p

free-stream static pressure

q

free-stream dynamic pressure

S

wing area (includes area covered by body)

x

distance from leading edge of wing or nose of body (positive rearward)

x'

distance from wing leading edge to a line perpendicular to plane of symmetry and passing through 0.25c' (negative when leading edge is downstream of perpendicular line)

$\frac{x_{cp}}{c}$

section chordwise center-of-pressure location, $0.25 - \frac{c_{m,c}/4}{c_n}$

$\frac{x_{cp}}{c'}$

wing chordwise center-of-pressure location, $0.25 - \frac{C_m}{C_N}$

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y

spanwise distance measured from body center line

$\frac{y_{cp}}{b/2}$

wing spanwise center-of-pressure location

$\left(\frac{y_{cp}}{b/2}\right)_{add}$

wing spanwise center-of-pressure location of the additional load due to aileron deflection

α

angle of attack of body center line

δ

angle of aileron deflection, in plane normal to aileron hinge line (positive when trailing edge deflected down)

δ_N

nominal aileron deflection angle (at zero load)

Subscripts:

L

refers to aileron on left wing (wing opposite to the wing on which the pressures were measured)

l

wing lower surface

u

wing upper surface

MODEL AND APPARATUS

Model

The wing, which was constructed of aluminum alloy, had a sweepback of the quarter-chord of 45° , a taper ratio of 0.2, an aspect ratio of 3.0, and NACA 65A004 airfoil sections parallel to the air flow. A sketch of the wing is given in figure 1 and photographs are shown in figure 2. The right wing had pressure orifices located at six spanwise stations; however, the orifices at station A were actually on the body about 1/16 inch from the wing surface. The tables in figure 1 give the locations of all pressure-measuring orifices. The wing was located in the midwing position at zero angle of attack on a body that had an ogival nose and a cylindrical midsection. Body ordinates are given in figure 1.

Trailing-edge flap-type ailerons with their hinge lines at 70 percent of the local chord and spans that extended from 18.55 percent to 58.05 percent of the wing semispan were located on each wing. The aileron on the right wing, the wing on which pressures were measured, was

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attached to the wing by a full aileron span tongue so that no gap between the wing and the aileron existed at the hinge line. A prebent tongue was provided for each nominal aileron deflection investigated. The aileron was made in two sections so that at the aileron midspan a small spanwise gap existed for the full aileron chord. The left wing had four aileron sections but only the two inboard ones, which were identical in geometry to the two sections of the aileron on the right wing, were deflected. Each section was attached to the wing with two prebent tongues. Each tongue was only 0.86 inch in width so a chordwise gap of about 0.4 percent wing chord existed at the hinge line over 71 percent of the aileron span.

Apparatus

The investigation was made in the Langley 16-foot transonic tunnel, which is an atmospheric wind tunnel with a slotted test section that allows interference-free testing to Mach numbers slightly over 1.00. Additional details of the tunnel are given in reference 10.

The model was supported by a sting attached to a support strut which changed model angle of attack in such a way that the model was kept close to the tunnel center line. Model forces and moments were measured by an internal six-component strain-gage balance. Since the force and moment data for the model are presented in reference 8, only a small part of the data are shown in this paper for comparison with forces obtained from pressure measurements.

TESTS

The test conditions included a Mach number range from 0.80 to 1.03 and an angle-of-attack range from approximately 0° to about 21° . Data were taken at angle-of-attack increments of 2° for the wing with zero aileron deflection and at increments of 4° for all other configurations. The Reynolds number based on the wing mean aerodynamic chord varied from 6.4×10^6 to 7.7×10^6 .

The model was tested in several different configurations that may be divided into four main groups. The first group consisted of the basic wing for which all nominal aileron deflections were zero. The second group consisted of four configurations that had zero nominal deflection of the left-wing aileron in conjunction with nominal aileron deflections perpendicular to the hinge line on the right wing (pressure-measurement wing) of 7.5° , -7.5° , 15° , and -15° . The third group consisted of two configurations that had zero nominal deflection of the

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right-wing aileron in conjunction with nominal aileron deflections on the left wing of 15° and -15° . The fourth group had one configuration with oppositely deflected ailerons for which the left-wing aileron was deflected 15° and the right-wing aileron was deflected -15° .

REDUCTION OF DATA AND ACCURACY

Reduction of Data

In the reduction of the manometer data to pressure coefficients and wing section normal-force and pitching-moment coefficients, the data on the manometer film were read on a film reader connected to a card punch. The cards were processed through electronic computers to determine pressure coefficients. The pressure coefficients were then integrated on electronic computers, using rectangular step integrations, to obtain wing section normal-force and pitching-moment coefficients.

Corrections and Accuracy

Corrections were made to the model angles of attack for deflections due to normal force and pitching moment. A calibration of the model deflection due to static loading in normal force and pitching moment was obtained. A tunnel upwash angle of 0.17° , determined by testing the model in the inverted as well as in the normal upright position, has been added to the angles of attack presented. In view of all the factors present, the angle of attack is believed to be accurate to $\pm 0.1^\circ$.

From film-reading accuracy and repeatability of data, the pressure coefficients are considered to be accurate within ± 0.005 . The wing section normal-force and pitching-moment coefficients include the section forces and moments contributed by the aileron for the two spanwise pressure-measurement stations (stations B and C) at which some pressure orifices were located on the aileron.

Corrections to the nominal aileron deflections due to deflection under load were obtained from static calibration of the ailerons and from hinge moments obtained during the tests. The hinge moments were obtained from four pressure-measurement stations and the data are presented in reference 9. (The investigation of reference 9 was run simultaneously with this investigation.) The corrected aileron deflections are considered to be accurate to $\pm 0.25^\circ$.

No corrections have been made for either sting interference or wing aeroelasticity. However, the elastic properties of the right wing

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(pressure-measurement wing) obtained from static loadings are given in reference 7.

RESULTS AND DISCUSSION

The results of the present investigation are presented as follows:

	Table
Pressure coefficients:	
Basic wing; $\delta_N = 0^\circ$	I
Deflected aileron; $\delta_N = 7.5^\circ$	II
Deflected aileron; $\delta_N = -7.5^\circ$	III
Deflected aileron; $\delta_N = 15.0^\circ$	IV
Deflected aileron; $\delta_N = -15.0^\circ$	V
Wing section normal-force and pitching-moment coefficients	VI

	Figure
Pressure distributions	3, 4
Span loading parameters	5 to 10
Wing loading parameters	11 to 13
Wing carryover loadings	14 to 16

Table VI presents the integrated chordwise pressures for each of the six spanwise stations of the five configurations listed in tables I to V as well as the section data obtained on the three configurations investigated for carryover loading effects.

In the following discussion of the results, average values of angle of attack are used for the comparisons made between the data of different configurations at given angles of attack. The data from actual test points have been used for most comparisons because the angles of attack agree with the average values within the previously quoted accuracy of $\pm 0.1^\circ$. For several comparisons, where data of the test points were not obtained at the desired angles of attack, interpolated data have been used. It should also be noted that comparisons of data are made for nominal aileron deflections; that is, the data have not been cross plotted to remove the effects of aileron deflection due to load. This simplification is not believed to affect any conclusions drawn from the comparisons.

Chordwise Pressure Distributions

Figures 3 and 4 show comparisons of the chordwise pressure distributions on the basic wing with those on a wing with the aileron deflected

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first positively and then negatively. Only the data from two aileron configurations are deemed necessary to illustrate the effects of aileron deflection on the wing pressure field. A complete discussion of the basic-wing chordwise pressure distributions and flow characteristics is given in reference 7; therefore, only the effects due to the deflected ailerons will be discussed herein. Slight differences between the pressure distributions of the present data and those of reference 7 may be noted, which are considered to be due to differences in the wing construction for the two investigations.

The curves of figure 3(a) show that at a Mach number of 0.80 and an angle of attack of 0.2° , the positively deflected aileron caused not only more negative pressures over the inboard section of the upper surface of the wing, but also that this effect extended to the wing tip to a lesser although still significant degree. At station $0.60b/2$, which is immediately outboard of the aileron tip, the pressures due to the aileron are distributed in a pattern roughly similar to a distribution over a station on the aileron, with the peak negative pressures located toward the rear of the chord. Farther outboard, the more negative pressures on the upper surface are located forward, and at the $0.95b/2$ station, the more negative pressures are located at the wing leading edge.

The incremental pressures on the lower surface outboard of the aileron are affected in roughly the same manner as the upper surface pressures.

With an increase in angle of attack to $\alpha = 8^\circ$, flow separation at the wing leading edge is present on the upper surface at the $0.95b/2$ station, but a decrement in pressure is in evidence for the deflected-aileron distributions. However, at the next inboard station, there is little difference between the pressure distribution due to the deflected aileron and that of the basic wing; thus, the aileron deflection gives no additional load. Analysis of the basic-wing pressure distributions and wing spanwise loadings of reference 7 shows that a similar situation exists in the angle-of-attack range above about 8° ; that is, for an increase in wing angle of attack, which may be considered analogous to deflecting an aileron positively, an increase in loading at the tip station resulted in no increase in loading at the next inboard station. It may be assumed, therefore, that the decrease in pressure coefficients at the tip with little or no decrease inboard is a phenomenon associated with the basic-wing flow field. Since no flow visualization information on the wing with deflected aileron is available, positive identification of the exact cause is difficult.

As the angle of attack is increased above 8° , flow separation over the upper surface of the wing spreads inboard over the aileron decreasing its effectiveness. The change in pressure distributions due to the deflected aileron also becomes less apparent over the outboard section

of the wing. At the highest angle of attack reached, about 21° , the flow over the upper surface of the wing is almost completely separated in to the body for both the basic wing and the wing with the deflected aileron, and little or no effect of the aileron is observed over the whole upper wing surface. The wing lower surface pressures are still affected by the deflected aileron, but the effect does not extend any distance toward the wing tip.

The effect of Mach number on the pressure distributions due to a positively deflected aileron on the wing is shown in figures 3(a) to 3(e). At low angles of attack (around 0° to 4°), the effect of the deflected aileron is noticed in the pressure distributions over the outboard part of the wing at all Mach numbers. The center-of-pressure difference on the upper surface due to aileron deflection moves aft with increase in Mach number. In the intermediate angle-of-attack range (from 8° to 16°), the effect noted at a Mach number of 0.80 of a greater change in pressures at the tip station with aileron deflection than is seen at the next inboard stations is observed at all Mach numbers. At the highest angle of attack (about $\alpha = 21^\circ$) at Mach numbers of 0.90 and 0.94 (see figs. 3(b) and 3(c)), aileron deflection results in complete chordwise separation of the flow from the upper surface in the spanwise region of the aileron. This separation causes a loss in lift over the upper surface where an increase in lift would be expected for the positively deflected aileron. No effect of the aileron is noted over the upper surface of the outboard wing section and little effect of the aileron on the lower surface pressures is observed. The combined effects of the deflected aileron indicate that the aileron would be ineffective as a roll device at $\alpha \approx 21^\circ$ in the Mach number range of 0.90 to 0.94.

For the negatively deflected aileron configuration in the low angle-of-attack range ($\alpha = 0^\circ$ to 4°) at a Mach number of 0.80, there are large effects of the deflected aileron in the pressures outboard of the aileron to the wing tip (see fig. 4(a)), just as for the positively deflected aileron. The chordwise pressure distributions due to the negatively deflected aileron on the wing show a similarity to those for the positively deflected aileron in that, immediately outboard of the aileron, the peak pressures due to the aileron are toward the rear of the wing, and at the wing tip, the peak pressures are located at the wing leading edge. With increase in Mach number (see figs. 4(a) to 4(e)), the peak pressures over the outer section of the wing due to aileron deflection move aft toward the trailing edge of the wing, as they did for the positively deflected aileron.

In the angle-of-attack range from 8° to 21° in figure 4(a), upper-surface flow separation starts at the tip and moves inboard with increased angle of attack without causing the pronounced change of additional pressures at the 0.75b/2 station that was noticed for the positively deflected aileron. High negative pressures occur over the upper

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surface of the wing over the last 20 percent of the wing chord at the 0.60b/2 station for $\alpha = 12^\circ$ of figure 4(a). These pressures are of interest because they act in the direction to reduce the decrement of load induced by the negatively deflected aileron. The pressures appear to be caused by a locally high velocity flow through the outboard aileron-wing gap, and are the result of the large pressure differential between the upper and lower wing surfaces that occurs once the flow separation on the wing has progressed inboard to this station. Figure 3, which presents the wing pressures for a positively deflected aileron, also shows that the same type situation exists but on the lower surface of the 0.60b/2 station at all angles of attack and Mach numbers. The effect is noted at the lower angles of attack, but is less pronounced because the pressure differential between the upper and lower surfaces is much less as long as the flow remains attached. The high negative pressures are noticed at all angles of attack and Mach numbers to some extent, but are most pronounced from $M = 0.80$ to 0.94 .

At the highest angle of attack reached, about 21° , at Mach numbers of 0.80 and 0.90 (see figs. 4(a) and 4(b)), the negatively deflected aileron delays wing leading-edge flow separation to a higher angle of attack over the inboard section of the wing; thus, the overall decrement in pressures due to aileron deflection is reduced.

Effect of Ailerons on Wing Section Loadings

Measured wing section loadings.— The variation of measured section normal-load parameter $c_n \frac{c}{c}$ with fraction of semispan $\frac{y}{b/2}$ is presented in figure 5. The basic wing data are shown with the data for the two aileron deflections that were presented in connection with the discussion of the chordwise pressure distributions in the preceding section. Although the spanwise load distributions are a summary of the chordwise pressure distributions which have already been discussed, a brief discussion of the more important aspects of the load distributions is included. At all Mach numbers and low angles of attack (up to about 8°), the additional loading due to aileron deflection extends beyond the aileron outboard tip to the wing tip. Above $\alpha = 8^\circ$, the additional loading outboard of the aileron is reduced below the additional loading obtained at the lower angles of attack and, for many conditions, becomes negative for the positively deflected aileron. At the highest angle of attack reached, about 21° , the positively deflected aileron causes little additional load over the whole wing at Mach numbers of 0.90 and 0.94 . (See figs. 5(b) and 5(c).)

The wing section center-of-pressure locations for the spanwise-loading curves shown in figure 5 are presented in figure 6. In general, at lifting conditions, the positively deflected aileron causes the

section center-of-pressure location to move aft, and the negatively deflected aileron causes a forward movement with respect to the center-of-pressure location for the basic wing. At angles of attack from about 12° up, the center-of-pressure locations for both aileron deflections cross the center-of-pressure location of the basic wing at about the $0.60b/2$ station. This shift in the center-of-pressure location is believed to be a result of the flow through the outboard aileron-wing gap which caused a loss in either increment or decrement in additional normal force over the aft part of the $0.60b/2$ station.

Comparison of theoretical and measured wing section normal loading.-
Figure 7(a) presents the measured additional span loading parameters

$\Delta C_n \frac{c}{c}$ on the pressure-measurement wing for the case of oppositely deflected ailerons ($\delta_{N,L} = 15^\circ$, $\delta_N = -15^\circ$) at a Mach number of 0.80 and an angle of attack of 0° . A method of calculating the theoretical antisymmetric span loading of wings at subsonic speeds is given in reference 11. With the use of this method, the additional span loading parameters have been calculated for oppositely deflected ailerons and compared with the measured distribution in figure 7(a). Poor agreement between the measured and the calculated distributions is noted. The poor agreement may be partially caused by a factor in the calculations which is applied to account for partial-chord ailerons. The factor is strongly affected by low aspect ratios and is not considered valid if the product of aspect ratio and compressibility parameter $\sqrt{1 - M^2}$ is much below 2. In the present case, the factor is only 1.8.

Figure 7(b) shows a comparison of the measured and theoretical span load distribution normalized by the additional wing normal-force coefficient ΔC_N . The relatively good overall agreement between the measured and theoretical normalized coefficients indicates that the lateral center of pressure of additional load $\left(\frac{y_{cp}}{b/2}\right)_{add}$, which is dependent only on the spanwise distribution of load, may be calculated with good accuracy. The rather poor agreement at the most inboard station may be due to the effects of the body flow field which have not been taken into account in the theoretical calculations.

The spanwise loadings of figure 7 were for a configuration with antisymmetric aileron deflections; yet, most of the data of the present investigation were obtained on a configuration with the aileron deflected on one wing only. Figure 8 shows a comparison of the lateral center-of-pressure locations of additional load on a wing with only one aileron deflected ($\delta_N = -15^\circ$) with the locations on a wing with antisymmetrically deflected ailerons ($\delta_{N,L} = 15^\circ$, $\delta_N = -15^\circ$). The lateral center-of-pressure

locations of additional load for the two configurations are within 1 percent of wing semispan of each other for all Mach numbers up to angles of attack of about 8° , which shows that the shape of the span load distribution is little affected by the aileron on the opposite wing at low angles of attack for the present wing-fuselage configuration.

Since it appears that the shape of the additional span load distribution on a wing with a deflected aileron is negligibly affected by the aileron on the opposite wing in the low angle-of-attack range, comparisons are made in figure 9 of the theoretical normalized distributions with the measured normalized distributions for one aileron deflected both positively and negatively at $\alpha \approx 0^\circ$ and all Mach numbers of the investigation. In general, the measured distributions agree fairly well with the theoretical up through a Mach number of 0.98. However, the loadings at both the most inboard station 0.1604b/2 and the station just outboard of the aileron 0.60b/2 appear to be consistently below the theoretical curves. In both cases, the loss in loading is probably partially due to the flow through the aileron-wing gaps, which has previously been discussed. At a Mach number of 1.03 the agreement has become poorer, but the general shape of the measured curves is still similar to the theoretical. Better agreement would be considered fortuitous as the theoretical curve is based on subsonic theory.

Figure 10 shows the effect of angle of attack on the lateral center-of-pressure location of additional load for the two aileron deflections and also the comparison with the theoretical values. The best agreement between the theoretical and the measured values is near $\alpha = 0^\circ$. At higher angles of attack, above the range of 8° to 12° , the agreement becomes worse as would be expected because flow separation occurs over the wing outboard of the aileron. The flow separation reduces the additional loading and thus moves the lateral center-of-pressure location inboard.

Effect of Aileron on Wing Loading

The wing normal-force coefficients are presented in figure 11, and the longitudinal and spanwise center-of-pressure locations are given in figures 12 and 13, respectively. These figures are presented without discussion because the effects of ailerons discussed in the sections on chordwise pressure distributions and wing section loadings are reflected in the wing loadings.

Effects of a Deflected Aileron on Opposite-Wing Loading

The use of flap-type ailerons located inboard on the wing for lateral control presents a problem not usually encountered when ailerons

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are located more toward the tip of the wing. The additional loads due to aileron deflection are distributed as carryover loads to the body and the opposite wing as well as being distributed over the wing on which the aileron is deflected. In order to illustrate the amount of carryover load to the opposite wing and the body, a comparison is made in figure 14 of the total model additional normal-force coefficient $\Delta C_{N,F}$, as determined from the strain-gage balance, with the wing additional normal-force coefficient ΔC_N , as determined from pressure measurements, for two nominal aileron deflections. If the additional normal-force coefficient were all on the wing with the deflected aileron, ΔC_N from pressure measurements would be equal to the total additional normal-force coefficient $\Delta C_{N,F}$. For both nominal aileron deflections at all Mach numbers and angles of attack, the additional wing normal-force coefficients are lower than the total model normal-force coefficients; thus, an appreciable amount of carryover load to the opposite wing and the body is indicated.

The effect of aileron deflection on the opposite wing is illustrated in figures 15 and 16. These figures show the carryover loads to the opposite wing $\Delta C_{N,c}$ as a function of angle of attack in figure 15 and of Mach number in figure 16. Within reasonable accuracy, there is little effect of angle of attack or Mach number on the carryover loads. Near 0° angle of attack at all Mach numbers, a carryover load $\Delta C_{N,c}$ of about 0.02 exists, which is about 13 percent of the additional load on the wing with deflected aileron. It is therefore necessary to take carryover loads into account when applying the data of this paper to configurations with oppositely deflected ailerons.

One fact in regard to the relative insensitivity of carryover normal-force coefficients to angle of attack should be noted. In figure 14(a), the additional wing normal-force coefficient goes to zero around an angle of attack of 21° for Mach numbers of 0.90 and 0.94, while the carryover load (fig. 15) remains essentially constant. This can be explained by inspecting the pressure distributions of figures 3(b) and 3(c) for angles of attack near 21° . The positively deflected aileron induces an angle-of-attack increase over the inboard section of the wing sufficient to separate the flow over the upper surface, thus actually decreasing the wing additional normal-force coefficient. At the same time, this aileron induces a smaller angle-of-attack increase on the opposite wing which does not separate the flow, so that a carryover normal-force coefficient results.

Wing spanwise center-of-pressure locations for the carryover loads are not shown because the locations were too erratic to be considered reliable. The center-of-pressure locations of additional load for the wing with aileron deflected ($\delta_N = -15^\circ$) and the wing with oppositely

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deflected ailerons ($\delta_N = -15^\circ$, $\delta_{N,L} = 15^\circ$) are shown in figure 8. For all Mach numbers in the low angle-of-attack range (up to about 8°), the center-of-pressure locations are essentially the same for both configurations; thus, the carryover load affects the shape of the additional loading due to aileron deflection very little.

CONCLUSIONS

From the results of an investigation of the wing loads due to deflected inboard ailerons on a 45° sweptback wing operating in the transonic speed range, the following conclusions may be drawn:

1. The deflected inboard aileron causes a significant added loading over the wing sections outboard of the aileron at all Mach numbers and at model angles of attack from 0° up to about 8° or 12° .
2. In the low angle-of-attack range (from 0° to 8°), subsonic theory predicts the shape of the additional spanwise loading fairly well in the Mach number range from 0.80 to 0.98, but not so well at a Mach number of 1.03.
3. The deflected inboard aileron causes a carryover load on the opposite wing that is essentially constant with both Mach number and model angle of attack.

Langley Aeronautical Laboratory,
National Advisory Committee for Aeronautics,
Langley Field, Va., April 18, 1958.

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TABLE II. - Concluded
PRESSURE COEFFICIENTS, WING WITH DEFLECTED AILERON, $\delta_N = 7.5^\circ$

	Fraction of chord	Pressure coefficient, C_p , at												Fraction of chord
		0.18b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2	1.18b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2	
Upper surface		$M = 1.03$						$M = 1.03$						
		$\alpha = 16.8$						$\alpha = 21.1$						
		$\delta = 6.7$						$\delta = 6.6$						
	-0.0500	.134						.164						-0.0500
	.0000	.134	-1.003	-1.018	-.956	-.719								

[REDACTED]

TABLE III. - Concluded
PRESSURE COEFFICIENTS, WING WITH DEFLECTED AILERON, $\delta_N = -7.5^\circ$

	Fraction of chord	Pressure coefficient, C_p , at										Fraction of chord		
		0.18b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2	0.16b/2	0.25b/2	0.40b/2	0.60b/2		0.75b/2	0.95b/2
M = 1.03 $\alpha = 16.8$ $\delta = -7.8$														
Upper surface	+.0500	.150												+.0500
	.0000	.112	-.995	-1.025	-.944	-.869	-.881							.0000
	.0125	-.516	-1.166	-.977	-.965	-.961	-.995							.0125
	.0250	-.620	-1.169	-.965	-.960	-.958	-.990							.0250
	.0500	-.710	-1.184	-1.001	-.959	-.956	-.967							.0500
	.0750	-.682	-1.183	-.988	-.963	-.945	-.985							.0750
	.1000													

[REDACTED]

TABLE IV. - Concluded
PRESSURE COEFFICIENTS, WING WITH DEFLECTED AILERON, $\delta_N = 15^\circ$

	Fraction of chord	Pressure coefficient, C_p , at												Fraction of chord
		0.18b/2	0.25b/2	0.40b/2	0.60b/2</									

TABLE V. - Concluded
 PRESSURE COEFFICIENTS, WING WITH DEFLECTED AILERON, $\delta_N = -15^\circ$

	Fraction of chord	Pressure coefficient, C_p , at												Fraction of chord
		0.16b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2	0.16b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2	
Upper surface		$M = 1.03 \quad \alpha = 16.8 \quad \delta = -15.0$						$M = 1.03 \quad \alpha = 21.1 \quad \delta = -15.3$						
	-0.0500	.152	-.987	-1.021	-.923	-.666	-.377	.166	.077	-1.109	-1.108	-.991	-.812	-.524
	.0000	.161	-.987	-1.021	-.923	-.666	-.377	.166	.077	-1.109	-1.108	-.991	-.812	-.524
	.0125	-.499	-1.151	-.958	-.954	-.885	-.368	-.819	-1.229	-1.084	-1.033	-1.005	-.516	.0125
	.0250	-.609	-1.151	-.958	-.954	-.885	-.368	-.861	-1.226	-1.082	-1.033	-1.000	-.516	.0250
	.0500	-.720	-1.155	-.996	-.954	-.879	-.366	-.884	-1.212	-1.099	-1.035	-.999	-.511	.0500
	.0750	-.674	-1.177	-.987	-.952	-.869	-.366	-.844	-1.216	-1.071	-1.038	-.995	-.507	.0750
	.1000	-.626	-1.166	-1.021	-.946	-.840	-.362	-.755	-1.229	-1.105	-1.039	-.956	-.506	.1000
	.1500	-.516	-1.199	-1.080	-.955	-.859	-.356	-.599	-1.243	-1.133	-1.040	-.956	-.496	.1500
	.2000	-.428	-1.124	-1.105	-.947	-.805	-.350	-.537	-1.184	-1.152	-1.033	-.913	-.487	.2000
	.2500	-.394	-.775	-1.123	-.910	-.773	-.349	-.521	-1.020	-1.168	-1.059	-.881	-.481	.2500
	.3000	-.392	-.494	-1.072	-.973	-.746	-.349	-.520	-.823	-1.182	-1.061	-.842	-.476	.3000
	.3500	-.380	-.442	-1.092	-.967	-.718	-.354	-.506	-.689	-1.174	-1.059	-.806	-.471	.3500
	.4000	-.390	-.426	-1.168	-.943	-.690	-.361	-.530	-.613	-1.192	-1.033	-.796	-.467	.4000
	.4500	-.420	-.429	-1.182	-.943	-.666	-.369	-.550	-.579	-1.175	-1.035	-.781	-.458	.4500
	.5000	-.437	-.457	-1.119	-.939	-.702	-.378	-.552	-.594	-1.164	-1.032	-.762	-.450	.5000
	.5500	-.444	-.455	-1.038	-.920	-.770	-.386	-.563	-.590	-1.139	-1.016	-.755	-.449	.5500
	.6000	-.452	-.463	-.894	-.913	-.830	-.394	-.589	-.595	-1.080	-.965	-.758	-.452	.6000
	.6500	-.409	-.377	-.604	-.914	-.857	-.401	-.535	-.547	-.964	-.986	-.763	-.457	.6500
	.7000	-.366	-.167	-.413	-.890	-.840	-.406	-.499	-.293	-.878	-.991	-.754	-.444	.7000
	.7500	-.288	-.158	-.231	-.860	-.810	-.413	-.419	-.258	-.827	-.977	-.743	-.449	.7500
	.8000	-.260	-.174	-.125	-.949	-.775	-.422	-.393	-.269	-.706	-1.075	-.688	-.476	.8000
	.8500	-.234	-.174	-.079	-.987	-.686	-.442	-.346	-.263	-.593	-1.056	-.610	-.484	.8500
	.9000	-.199	-.161	-.071	-1.017	-.602	-.452	-.341	-.255	-.486	-1.144	-.586	-.492	.9000
	.9500	-.187	-.146	-.050	-1.130	-.602	-.473	-.360	-.250	-.385	-1.186	-.610	-.506	.9500
Lower surface	.0125	.648	.754	.615	.507	.445	.417	.657	.766	.590	.469	.392	.371	.0125
	.0250	.774	.770	.654	.557	.491	.420	.858	.820	.673	.549	.472	.402	.0250
	.0500	.926	.736	.640	.551	.488	.420	1.044	.810	.693	.575	.500	.433	.0500
	.0750	.872	.698	.611	.530	.472	.400	.967	.787	.674	.566	.499	.432	.0750
	.1000	.747	.660	.590	.508	.448	.357	.836	.754	.657	.551	.483	.400	.1000
	.1500	.697	.608	.541	.463	.402	.329	.791	.702	.613	.510	.446	.389	.1500
	.2000	.652	.554	.496	.435	.366	.272	.748	.648	.570	.486	.412	.343	.2000
	.2500	.590	.522	.454	.379	.320	.233	.686	.615	.532	.431	.372	.313	.2500
	.3000	.519	.475	.415	.338	.283	.174	.613	.566	.490	.395	.329	.263	.3000
	.3500	.496	.427	.381	.297	.244	.122	.585	.519	.453	.350	.294	.220	.3500
	.4000	.478	.409	.352	.264	.211	.062	.565	.498	.421	.319	.264	.186	.4000
	.4500	.421	.375	.310	.214	.164	.024	.506	.458	.373	.262	.220	.130	.4500
	.5000	.360	.334	.264	.172	.120	-.019	.430	.413	.321	.218	.170	.079	.5000
	.5500	.322	.300	.220	.127	.084	-.065	.400	.374	.269	.168	.118	.045	.5500
	.6000	.319	.248	.155	.065	.013	-.082	.391	.308	.195	.102	.071	.045	.6000
	.6500	.274	.164	.090	.007	-.035	-.072	.334	.210	.111	.029	.065	.012	.6500
	.7000	.137	-.785	-.772	-.215	-.100	-.055	.183	-.736	-.758	-.208	.097	-.018	.7000
	.7500	-.139	-.230	-.667	-.391	-.117	-.036	-.108	-.193	-.595	-.354	.116	-.027	.7500
	.8000	-.093	-.203	-.313	-.431	-.130		-.058	-.170	-.210	-.372	.132		.8000
	.8500	-.096	-.180	-.223	-.417	-.084	-.045	-.065	-.176	-.152	.112	.122	-.050	.8500
	.9000	-.110	-.172	-.171	-.165	.084	-.086	-.117	-.173	-.136	.127	.124	-.086	.9000
	.9500	-.131	-.191	-.057	-.160	.058	-.131	-.137	-.182	-.053	.128	.070	-.132	.9500
	1.0000	-.160						-.187						1.0000

TABLE VI
WING SECTION NORMAL-FORCE AND PITCHING-MOMENT COEFFICIENTS

$$\delta_N = 0^\circ$$

M	α	δ	C_n						$C_{m_c/4}$					
			0.16b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2	0.16b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2
0.80	0.2	0.0	.016	.013	.015	.001	.003	-.009	-.003	.000	.000	.003	.005	.009
0.80	2.1	0.0	.107	.113	.126	.133	.145	.120	-.011	-.004	-.003	.001	.005	.015
0.80	4.0	0.0	.213	.222	.252	.279	.311	.309	-.023	-.013	-.009	-.004	.008	-.014
0.80	6.0	-0.1	.327	.351	.407	.464	.479	.354	-.035	-.018	-.008	-.003	.003	-.034
0.80	8.0	-0.1	.448	.479	.544	.708	.696	.279	-.046	-.018	-.002	-.046	-.108	-.013
0.80	10.0	-0.1	.538	.591	.670	.861	.587	.281	-.047	-.014	-.005	-.130	-.087	-.018
0.80	12.0	-0.2	.652	.732	.911	.856	.643	.337	-.063	-.026	-.057	-.155	-.093	-.024
0.80	14.4	-0.3	.767	.889	1.049	.889	.639	.367	-.070	-.040	-.127	-.157	-.093	-.032
0.80	16.5	-0.4	.873	1.054	1.117	.866	.676	.413	-.083	-.073	-.165	-.148	-.100	-.042
0.80	18.5	-0.4	.990	1.101	1.066	.846	.702	.449	-.113	-.128	-.176	-.144	-.109	-.044
0.80	20.5	-0.5	1.069	1.069	1.019	.885	.773	.508	-.169	-.182	-.185	-.157	-.127	-.062
0.90	0.2	0.0	.019	.014	.015	.004	.005	-.001	-.005	.001	.001	.003	.006	.009
0.90	2.1	-0.0	.116	.118	.136	.139	.153	.133	-.017	-.008	-.006	.002	.007	.021
0.90	4.0	-0.1	.225	.239	.271	.294	.334	.340	-.031	-.018	-.015	-.004	.007	-.009
0.90	6.0	-0.1	.353	.373	.436	.506	.511	.396	-.050	-.033	-.025	-.014	.016	-.043
0.90	8.0	-0.1	.473	.501	.576	.728	.688	.306	-.067	-.039	-.022	-.061	-.099	-.020
0.90	10.0	-0.1	.565	.613	.702	.917	.676	.324	-.071	-.037	-.018	-.132	-.092	-.027
0.90	12.1	-0.3	.653	.725	.856	.819	.617	.389	-.075	-.047	-.065	-.146	-.098	-.039
0.90	14.5	-0.4	.803	.902	1.054	.875	.711	.430	-.109	-.079	-.149	-.161	-.113	-.043
0.90	16.7	-0.5	.908	1.046	1.118	.918	.748	.470	-.124	-.105	-.179	-.166	-.122	-.052
0.90	18.7	-0.6	1.004	1.147	1.108	.910	.770	.525	-.140	-.147	-.193	-.169	-.133	-.067
0.90	20.8	-0.6	1.098	1.154	1.111	.951	.834	.582	-.169	-.189	-.206	-.177	-.151	-.080
0.94	0.3	0.0	.022	.014	.018	.004	.006	.003	-.006	.001	-.000	.003	.007	.009
0.94	2.0	-0.0	.118	.126	.144	.154	.166	.145	-.020	-.015	-.013	-.005	.007	.027
0.94	4.0	-0.1	.242	.258	.295	.329	.368	.348	-.045	-.034	-.030	-.020	.001	.038
0.94	6.0	-0.2	.369	.391	.447	.530	.566	.483	-.069	-.051	-.043	-.018	-.042	-.018
0.94	8.0	-0.2	.489	.526	.603	.752	.751	.402	-.083	-.065	-.053	-.087	-.086	-.032
0.94	10.0	-0.2	.611	.655	.750	.962	.740	.369	-.109	-.074	-.060	-.155	-.111	-.033
0.94	12.0	-0.2	.703	.759	.856	1.035	.735	.396	-.112	-.074	-.057	-.168	-.120	-.047
0.94	14.6	-0.4	.792	.894	1.078	.911	.743	.506	-.111	-.087	-.143	-.180	-.132	-.066
0.94	16.7	-0.6	.923	1.038	1.175	.979	.835	.561	-.148	-.119	-.186	-.191	-.150	-.076
0.94	18.8	-0.6	1.018	1.165	1.236	1.031	.879	.601	-.156	-.149	-.213	-.204	-.159	-.086
0.94	20.9	-0.7	1.134	1.259	1.243	1.058	.920	.650	-.180	-.193	-.235	-.210	-.172	-.098
0.98	0.3	0.0	.021	.015	.022	.006	.008	.008	-.004	-.000	-.002	.003	.008	.014
0.98	2.1	-0.1	.115	.119	.139	.146	.177	.160	-.020	-.014	-.015	-.009	-.010	.019
0.98	4.0	-0.1	.219	.237	.277	.310	.370	.382	-.038	-.030	-.030	-.022	-.026	.020
0.98	6.0	-0.2	.337	.368	.424	.494	.549	.652	-.061	-.049	-.053	-.059	-.037	-.028
0.98	8.0	-0.3	.457	.498	.576	.723	.728	.680	-.082	-.066	-.059	-.096	-.064	-.085
0.98	10.0	-0.4	.576	.628	.736	.945	.871	.543	-.102	-.077	-.079	-.175	-.140	-.065
0.98	12.0	-0.4	.686	.747	.883	1.126	.986	.556	-.123	-.093	-.101	-.239	-.176	-.068
0.98	14.6	-0.5	.825	.932	1.074	1.277	1.017	.563	-.144	-.121	-.140	-.286	-.181	-.030
0.98	16.8	-0.5	.935	1.053	1.200	1.298	1.002	.610	-.163	-.137	-.160	-.276	-.195	-.096
0.98	18.9	-0.6	1.029	1.145	1.329	1.220	.982	.699	-.173	-.145	-.222	-.256	-.195	-.110
0.98	21.0	-0.8	1.117	1.264	1.412	1.245	1.044	.746	-.187	-.190	-.260	-.263	-.206	-.121
1.03	0.3	0.0	.020	.016	.022	.002	.010	.010	-.004	-.001	-.002	.006	.007	.014
1.03	2.1	-0.1	.108	.117	.135	.135	.173	.159	-.019	-.014	-.015	-.005	-.011	.017
1.03	4.0	-0.2	.223	.239	.278	.311	.373	.404	-.042	-.032	-.033	-.028	-.031	.008
1.03	6.0	-0.3	.345	.372	.428	.490	.578	.673	-.067	-.054	-.055	-.048	-.045	-.048
1.03	8.0	-0.3	.458	.495	.569	.704	.735	.729	-.086	-.070	-.062	-.087	-.075	-.057
1.03	10.0	-0.3	.565	.619	.728	.936	.849	.547	-.100	-.076	-.076	-.178	-.137	-.068
1.03	12.0	-0.4	.657	.731	.864	1.097	.965	.571	-.111	-.089	-.096	-.236	-.173	-.075
1.03	14.6	-0.5	.783	.899	1.034	1.229	1.072	.601	-.133	-.117	-.128	-.276	-.205	-.084
1.03	16.8	-0.6	.891	1.016	1.195	1.293	1.181	.637	-.150	-.135	-.180	-.283	-.238	-.093
1.03	18.0	-0.7	.990	1.126	1.314	1.316	1.201	.700	-.171	-.161	-.222	-.283	-.241	-.105
1.03	21.1	-0.8	1.094	1.227	1.391	1.327	1.137	.787	-.194	-.196	-.250	-.288	-.223	-.132

TABLE VI. - Continued
WING SECTION NORMAL-FORCE AND PITCHING-MOMENT COEFFICIENTS

M	α	δ	C_n						$C_{m,c/4}$					
			0.16b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2	0.16b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2
0.80	0.3	7.4	.098	.132	.177	.126	.097	.052	-.038	-.051	-.062	-.029	-.006	.009
0.80	4.0	7.4	.286	.348	.415	.411	.414	.397	-.054	-.065	-.069	-.036	-.001	-.041
0.80	8.0	7.3	.514	.609	.714	.829	.720	.324	-.073	-.089	-.066	-.075	-.102	-.022
0.80	12.0	7.2	.695	.875	1.021	.882	.648	.395	-.086	-.074	-.114	-.171	-.094	-.041
0.80	16.5	7.1	.935	1.162	1.164	.880	.692	.463	-.114	-.117	-.190	-.153	-.107	-.053
0.80	20.6	6.9	1.095	1.117	1.061	.879	.783	.512	-.183	-.210	-.208	-.147	-.130	-.062
0.90	0.3	7.4	.107	.140	.190	.145	.118	.067	-.046	-.064	-.075	-.043	-.014	.012
0.90	4.0	7.3	.317	.376	.442	.444	.455	.429	-.077	-.085	-.092	-.059	-.019	-.032
0.90	8.0	7.2	.545	.629	.735	.848	.751	.355	-.104	-.102	-.099	-.104	-.101	-.026
0.90	12.0	7.1	.707	.827	.970	.843	.653	.413	-.097	-.092	-.115	-.137	-.106	-.047
0.90	16.7	7.0	.960	1.139	1.176	.929	.756	.503	-.151	-.147	-.206	-.164	-.124	-.062
0.90	20.8	6.8	1.128	1.177	1.117	.921	.843	.581	-.196	-.226	-.226	-.159	-.152	-.079
0.94	0.2	7.3	.099	.142	.190	.148	.125	.076	-.045	-.068	-.085	-.059	-.033	.005
0.94	4.0	7.2	.299	.379	.453	.452	.471	.410	-.072	-.095	-.107	-.077	-.044	.003
0.94	7.9	7.1	.532	.634	.754	.827	.803	.489	-.110	-.122	-.133	-.119	-.097	-.045
0.94	12.0	7.1	.771	.865	1.010	1.161	.801	.471	-.152	-.131	-.130	-.218	-.127	-.060
0.94	16.7	6.8	.980	1.133	1.252	.995	.847	.589	-.173	-.160	-.219	-.187	-.151	-.084
0.94	21.0	6.7	1.190	1.314	1.270	1.034	.918	.671	-.206	-.234	-.253	-.190	-.172	-.104
0.98	0.2	7.2	.080	.127	.180	.137	.110	.063	-.038	-.064	-.090	-.069	-.048	-.013
0.98	4.0	7.1	.286	.359	.437	.432	.448	.407	-.073	-.096	-.113	-.087	-.060	.013
0.98	7.9	7.0	.508	.604	.729	.797	.812	.776	-.109	-.119	-.139	-.121	-.099	-.101
0.98	12.1	7.0	.741	.856	1.039	1.166	1.050	.627	-.148	-.144	-.174	-.241	-.190	-.087
0.98	16.8	6.9	.994	1.156	1.337	1.310	1.078	.697	-.189	-.186	-.225	-.265	-.192	-.111
0.98	21.1	6.7	1.186	1.359	1.479	1.258	1.057	.621	-.218	-.227	-.285	-.252	-.206	-.025
1.03	0.3	7.2	.068	.116	.166	.113	.075	.037	-.032	-.058	-.085	-.062	-.037	-.005
1.03	4.0	7.0	.282	.348	.432	.417	.441	.416	-.075	-.094	-.117	-.087	-.059	.009
1.03	7.9	6.9	.509	.600	.715	.778	.817	.788	-.113	-.122	-.136	-.115	-.107	-.098
1.03	12.5	6.9	.726	.850	1.031	1.137	1.041	.653	-.140	-.139	-.173	-.236	-.194	-.098
1.03	16.8	6.7	.947	1.104	1.312	1.275	1.132	.778	-.181	-.179	-.237	-.263	-.215	-.134
1.03	21.1	6.6	1.161	1.323	1.469	1.326	1.164	.842	-.227	-.230	-.288	-.264	-.228	-.151
$\delta_N = -7.5^\circ$														
0.80	0.2	-7.4	-.062	-.098	-.140	-.126	-.084	-.053	.035	.050	.061	.031	.015	.005
0.80	4.0	-7.4	.124	.100	.094	.141	.204	.220	.015	.039	.052	.031	.019	-.002
0.80	8.0	-7.5	.335	.349	.388	.560	.611	.227	.002	.038	.054	-.012	-.102	-.007
0.80	12.0	-7.5	.547	.599	.755	.817	.600	.286	-.014	.033	.010	-.154	-.087	-.016
0.80	16.5	-7.7	.781	.944	1.048	.843	.651	.364	-.035	-.013	-.131	-.149	-.096	-.033
0.80	20.6	-7.9	.977	1.001	.987	.866	.738	.482	-.101	-.128	-.157	-.146	-.117	-.058
0.90	0.3	-7.4	-.068	-.095	-.144	-.137	-.101	-.055	.043	.054	.071	.051	.025	.005
0.90	4.0	-7.4	.131	.129	.110	.151	.222	.240	.017	.036	.054	.039	.026	-.004
0.90	8.0	-7.5	.374	.387	.407	.576	.640	.253	-.016	.017	.050	-.004	-.105	-.011
0.90	12.0	-7.6	.567	.617	.719	.780	.587	.348	-.028	.011	.003	-.137	-.094	-.027
0.90	16.7	-7.7	.807	.918	1.031	.860	.712	.422	-.073	-.044	-.139	-.150	-.114	-.042
0.90	20.8	-8.0	1.003	1.100	1.102	.943	.821	.548	-.104	-.129	-.182	-.173	-.145	-.073
0.94	0.2	-7.3	-.068	-.098	-.145	-.143	-.110	-.065	.045	.061	.080	.068	.046	.014
0.94	4.0	-7.4	.161	.148	.130	.174	.231	.271	-.000	.029	.052	.046	.044	.042
0.94	8.0	-7.5	.385	.396	.426	.574	.701	.301	-.032	.001	.031	-.012	-.098	-.021
0.94	12.0	-7.5	.594	.626	.694	.891	.656	.382	-.053	.005	.016	-.135	-.110	-.041
0.94	16.7	-7.8	.805	.905	1.059	.901	.782	.493	-.082	-.052	-.142	-.168	-.136	-.059
0.94	20.9	-8.0	1.024	1.154	1.195	1.028	.901	.619	-.119	-.131	-.209	-.201	-.167	-.090
0.98	0.3	-7.2	-.047	-.079	-.132	-.113	-.093	-.048	.036	.055	.082	.070	.065	.040
0.98	4.0	-7.4	.158	.143	.128	.175	.249	.310	-.002	.027	.051	.047	.047	.073
0.98	8.0	-7.5	.378	.379	.412	.554	.653	.382	-.036	.000	.027	-.013	-.073	-.028
0.98	12.0	-7.6	.584	.617	.718	.977	.932	.440	-.064	-.022	-.018	-.172	-.176	-.040
0.98	16.8	-7.8	.775	.906	1.053	1.188	.932	.584	-.108	-.065	-.096	-.243	-.173	-.096
1.03	0.3	-7.2	-.038	-.073	-.126	-.134	-.077	-.040	.031	.050	.079	.086	.060	.042
1.03	4.0	-7.4	.159	.146	.133	.179	.256	.336	-.005	.022	.046	.046	.040	.063
1.03	8.0	-7.5	.373	.382	.407	.536	.634	.546	-.036	-.004	.023	.001	-.032	-.052
1.03	12.0	-7.6	.569	.607	.699	.983	.904	.454	-.061	-.020	-.013	-.187	-.166	-.050
1.03	16.8	-7.8	.792	.882	1.057	1.210	1.104	.561	-.095	-.061	-.110	-.254	-.227	-.080

TABLE VI. - Continued
WING SECTION NORMAL-FORCE AND PITCHING-MOMENT COEFFICIENTS

 $\delta_N = 15^\circ$

M	α	δ	C_n						$C_{m_c}/4$					
			0.16b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2	0.16b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2
0.80	0.2	14.8	.137	.241	.304	.226	.170	.091	-.050	-.100	-.114	-.053	-.015	.011
0.80	4.1	14.8	.332	.462	.549	.513	.499	.419	-.068	-.114	-.121	-.057	-.010	-.044
0.80	7.9	14.7	.536	.694	.810	.896	.705	.352	-.083	-.113	-.112	-.095	-.095	-.030
0.80	12.0	14.6	.714	.921	1.125	.852	.673	.421	-.087	-.118	-.161	-.142	-.102	-.050
0.80	16.6	14.5	.910	1.194	1.194	.850	.704	.472	-.098	-.150	-.213	-.134	-.112	-.057
0.80	20.6	14.4	1.060	1.138	1.091	.852	.768	.508	-.166	-.227	-.226	-.132	-.126	-.063
0.90	0.2	14.6	.139	.238	.309	.215	.179	.103	-.063	-.111	-.134	-.067	-.031	.011
0.90	4.0	14.6	.338	.469	.549	.490	.512	.449	-.087	-.132	-.144	-.073	-.034	-.031
0.90	8.0	14.5	.570	.722	.849	.930	.806	.396	-.117	-.149	-.152	-.132	-.109	-.035
0.90	12.0	14.5	.712	.898	1.054	.845	.666	.420	-.098	-.129	-.154	-.129	-.108	-.049
0.90	16.7	14.3	.960	1.215	1.228	.924	.772	.520	-.145	-.180	-.236	-.150	-.127	-.066
0.90	20.8	14.2	1.083	1.172	1.128	.883	.817	.565	-.180	-.242	-.242	-.141	-.144	-.077
0.94	0.2	14.5	.113	.229	.305	.205	.182	.111	-.053	-.116	-.146	-.083	-.060	-.010
0.94	3.9	14.4	.311	.458	.557	.502	.503	.420	-.078	-.139	-.162	-.100	-.065	-.003
0.94	8.0	14.3	.535	.717	.862	.880	.845	.528	-.109	-.164	-.186	-.136	-.111	-.054
0.94	12.0	14.5	.771	.944	1.095	1.123	.804	.507	-.147	-.167	-.173	-.185	-.128	-.068
0.94	16.8	14.2	.973	1.189	1.303	.980	.854	.604	-.165	-.190	-.249	-.168	-.151	-.088
0.94	20.9	14.1	1.148	1.284	1.250	.977	.898	.653	-.190	-.259	-.270	-.163	-.166	-.100
0.98	0.1	14.4	.096	.222	.312	.185	.135	.063	-.048	-.116	-.159	-.079	-.043	-.000
0.98	4.0	14.4	.301	.447	.558	.473	.472	.413	-.078	-.140	-.172	-.091	-.057	.018
0.98	7.9	14.2	.515	.686	.832	.820	.849	.786	-.108	-.160	-.189	-.123	-.115	-.108
0.98	12.1	14.2	.780	.979	1.184	1.187	1.087	.709	-.145	-.187	-.231	-.230	-.198	-.115
0.98	16.8	14.2	.979	1.213	1.417	1.265	1.067	.772	-.178	-.218	-.266	-.233	-.198	-.132
0.98	21.1	13.9	1.181	1.419	1.548	1.221	1.068	.796	-.209	-.255	-.318	-.220	-.208	-.138
1.03	0.2	14.4	.083	.195	.292	.166	.122	.057	-.042	-.108	-.157	-.079	-.044	.003
1.03	3.9	14.3	.295	.438	.552	.469	.479	.443	-.079	-.139	-.173	-.087	-.055	.012
1.03	8.0	14.2	.507	.676	.819	.818	.841	.782	-.108	-.160	-.183	-.122	-.114	-.100
1.03	12.5	14.2	.718	.924	1.125	1.136	1.052	.693	-.132	-.174	-.217	-.222	-.200	-.107
1.03	16.8	14.0	.934	1.166	1.410	1.255	1.148	.819	-.168	-.210	-.285	-.241	-.221	-.149
1.03	21.1	13.9	1.145	1.368	1.563	1.281	1.137	.874	-.214	-.251	-.327	-.236	-.229	-.161
$\delta_N = -15^\circ$														
0.80	0.2	-14.8	-.087	-.194	-.264	-.209	-.158	-.092	.042	.095	.114	.059	.025	.005
0.80	4.1	-14.8	-.085	.004	-.038	.046	.124	.159	.032	.085	.106	.054	.028	.013
0.80	8.0	-14.8	.300	.245	.254	.487	.534	.197	.016	.085	.108	.012	-.091	-.006
0.80	12.1	-14.9	.505	.500	.635	.797	.542	.235	.005	.080	.062	.168	-.078	-.010
0.80	16.5	-15.1	.741	.841	.975	.816	.610	.333	-.013	.036	-.108	.159	-.088	-.029
0.80	20.6	-15.3	.917	.958	.931	.856	.708	.454	-.064	-.094	-.125	.155	-.110	-.053
0.90	0.2	-14.6	-.082	-.200	-.272	-.200	-.162	-.095	.047	.108	.135	.072	.041	.008
0.90	4.1	-14.7	.107	.024	-.026	.070	.151	.181	.029	.091	.121	.068	.041	.003
0.90	8.0	-14.8	.331	.275	.274	.518	.567	.212	.005	.076	.114	.016	-.097	-.010
0.90	12.0	-14.9	.538	.514	.587	.770	.528	.291	-.014	.064	.068	-.149	-.079	-.015
0.90	16.6	-15.2	.758	.851	.949	.819	.666	.390	-.044	.003	-.113	.145	-.102	-.036
0.90	20.8	-15.4	.921	1.011	1.041	.921	.789	.527	-.059	-.076	-.154	.181	-.138	-.068
0.94	0.3	-14.5	-.072	-.194	-.271	-.202	-.173	-.105	.046	.115	.146	.093	.078	.037
0.94	3.9	-14.6	.056	-.037	-.100	.000	.050	.101	.034	.099	.133	.086	.064	.033
0.94	8.0	-14.7	.352	.295	.298	.526	.634	.228	-.012	.065	.103	.013	-.088	-.013
0.94	12.0	-14.8	.547	.527	.576	.795	.558	.318	-.025	.053	.077	-.118	-.083	-.028
0.94	16.7	-15.2	.739	.806	.975	.874	.725	.461	-.047	.002	-.103	.169	-.119	-.053
0.94	20.9	-15.5	.936	1.049	1.111	1.004	.850	.596	-.070	-.077	-.174	.209	-.156	-.085
0.98	0.3	-14.5	-.054	-.187	-.282	-.220	-.134	-.071	.036	.112	.156	.112	.061	.033
0.98	4.1	-14.5	.149	.051	-.009	.084	.202	.266	.005	.083	.130	.103	.070	.079
0.98	8.0	-14.7	.347	.290	.279	.486	.647	.311	-.017	.060	.104	.035	-.053	-.000
0.98	12.1	-14.8	.561	.545	.601	.907	.613	.299	-.046	.031	.062	-.121	-.141	-.017
0.98	16.8	-15.0	.761	.799	.933	1.028	.832	.569	-.062	.006	-.026	-.186	-.158	-.095
0.98	21.1	-15.4	.936	1.021	1.211	1.114	.935	.659	-.077	-.047	-.174	-.237	-.179	-.101
1.03	0.3	-14.4	-.051	-.161	-.254	-.174	-.110	-.056	.041	.103	.152	.099	.062	.032
1.03	4.1	-14.5	.145	.061	.009	.110	.240	.319	.005	.075	.119	.093	.058	.074
1.03	8.1	-14.7	.353	.303	.293	.514	.660	.356	-.023	.047	.098	.028	-.054	-.013
1.03	12.0	-14.8	.529	.528	.586	.875	.667	.317	-.040	.029	.059	-.118	-.157	-.015
1.03	16.8	-15.0	.725	.777	.924	1.069	.914	.666	-.058	.001	-.034	-.188	-.164	-.079
1.03	21.1	-15.3	.924	.970	1.190	1.253	1.021	.608	-.098	-.040	-.141	-.257	-.183	-.099

TABLE VI. - Continued
WING SECTION NORMAL-FORCE AND PITCHING-MOMENT COEFFICIENTS

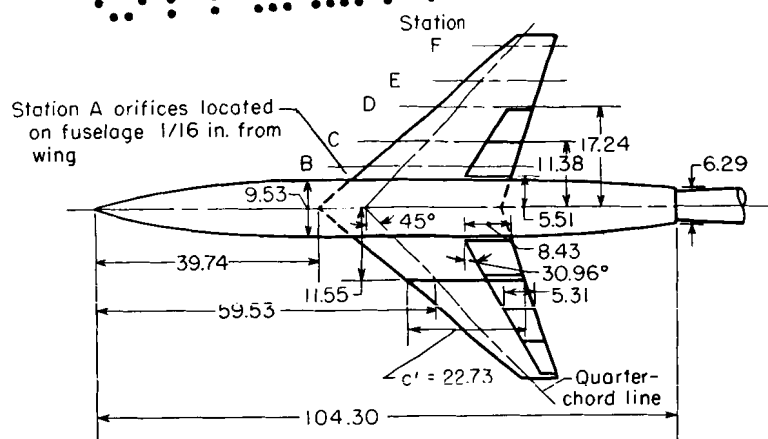
 $\delta_{N,L} = 15^\circ, \delta_N = 0^\circ$

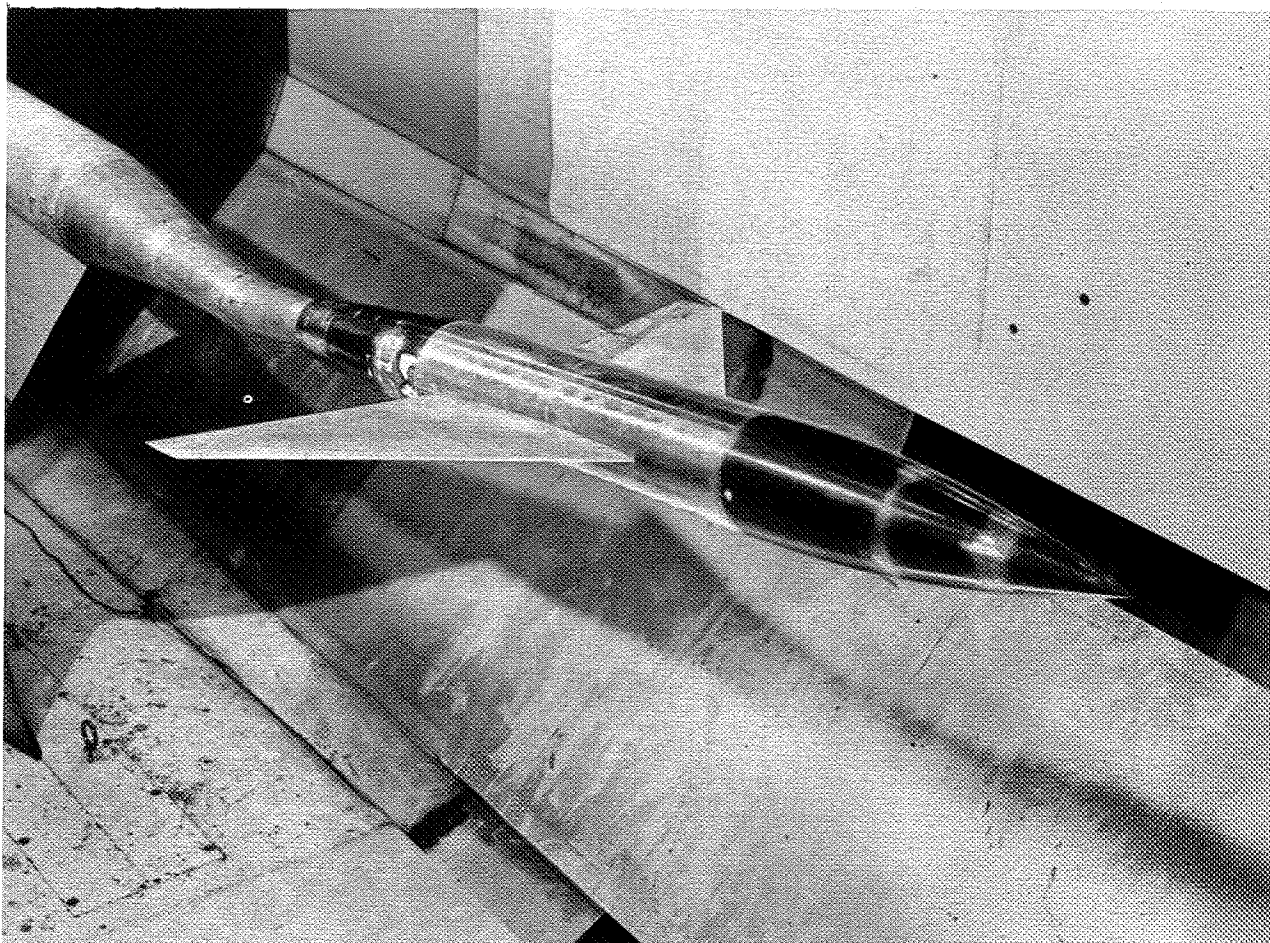
M	α	δ	C_n						$C_{m_c}/4$					
			0.16b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2	0.16b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2
0.80	0.1	0.0	.052	.051	.052	.039	.038	.022	-.014	-.010	-.006	.000	.004	.009
0.80	4.1	-0.1	.263	.269	.303	.329	.357	.352	-.039	-.024	-.017	-.010	.010	-.028
0.80	8.0	-0.1	.475	.508	.569	.740	.678	.286	-.059	-.027	-.009	-.055	-.104	-.015
0.80	12.0	-0.2	.672	.754	.929	.857	.641	.347	-.070	-.033	-.064	-.155	-.092	-.027
0.80	16.5	-0.4	.891	1.062	1.126	.879	.685	.419	-.093	-.074	-.165	-.154	-.102	-.044
0.80	20.6	-0.5	1.090	1.101	1.052	.908	.787	.517	-.169	-.185	-.191	-.161	-.130	-.063
0.90	0.2	0.0	.053	.048	.051	.036	.037	.024	-.020	-.014	-.010	-.002	.003	.010
0.90	4.0	-0.1	.273	.283	.311	.343	.382	.401	-.054	-.035	-.027	-.017	.003	-.033
0.90	8.0	-0.1	.518	.542	.612	.778	.703	.317	-.089	-.055	-.033	-.078	-.101	-.022
0.90	12.0	-0.3	.668	.743	.864	.835	.630	.394	-.079	-.052	-.064	-.148	-.102	-.041
0.90	16.7	-0.5	.914	1.053	1.145	.941	.772	.489	-.124	-.108	-.182	-.174	-.127	-.057
0.90	20.8	-0.7	1.117	1.229	1.213	1.020	.872	.600	-.162	-.183	-.222	-.196	-.157	-.084
0.94	0.2	-0.1	.046	.043	.045	.034	.038	.028	-.020	-.016	-.014	-.007	.000	.011
0.94	4.0	-0.1	.262	.280	.315	.352	.390	.369	-.056	-.043	-.039	-.031	-.009	.030
0.94	8.0	-0.3	.503	.542	.620	.769	.771	.416	-.095	-.071	-.060	-.093	-.103	-.035
0.94	12.0	-0.2	.738	.789	.888	1.073	.774	.400	-.132	-.088	-.070	-.178	-.127	-.049
0.94	16.7	-0.5	.945	1.055	1.202	1.015	.854	.578	-.153	-.123	-.188	-.202	-.155	-.079
0.94	20.9	-0.7	1.118	1.278	1.330	1.134	.964	.671	-.172	-.181	-.245	-.233	-.182	-.102
0.98	0.1	-0.1	.035	.032	.035	.023	.026	.024	-.015	-.013	-.013	-.008	-.003	.005
0.98	4.0	-0.2	.249	.264	.301	.340	.398	.411	-.052	-.041	-.039	-.035	-.027	.021
0.98	7.9	-0.3	.482	.512	.588	.741	.733	.682	-.093	-.070	-.061	-.099	-.065	-.088
0.98	12.0	-0.4	.702	.764	.901	1.165	1.008	.573	-.127	-.096	-.103	-.254	-.181	-.072
0.98	16.8	-0.5	.953	1.074	1.248	1.339	1.058	.643	-.165	-.143	-.178	-.285	-.189	-.105
0.98	21.1	-0.8	1.132	1.284	1.431	1.265	1.055	.751	-.183	-.183	-.266	-.267	-.208	-.121
1.03	0.2	-0.1	.026	.018	.025	.003	.014	.017	-.008	-.005	-.007	.000	-.001	.004
1.03	3.9	-0.2	.253	.271	.306	.344	.402	.424	-.058	-.049	-.047	-.043	-.036	.011
1.03	8.0	-0.3	.475	.515	.585	.742	.732	.695	-.089	-.071	-.059	-.100	-.067	-.090
1.03	12.5	-0.4	.689	.773	.908	1.155	.996	.578	-.118	-.095	-.106	-.259	-.183	-.078
1.03	16.8	-0.6	.899	1.024	1.205	1.286	1.188	.645	-.152	-.136	-.183	-.278	-.241	-.096
1.03	21.1	-0.8	1.100	1.241	1.418	1.343	1.156	.793	-.191	-.187	-.258	-.292	-.227	-.133
$\delta_{N,L} = -15^\circ, \delta_N = 0^\circ$														
0.80	0.2	0.0	-.024	-.026	-.028	-.037	-.037	-.033	.014	.012	.010	.007	.007	.007
0.80	4.1	0.0	.168	.182	.207	.237	.269	.267	-.007	-.000	.000	.000	.009	-.000
0.80	8.0	-0.1	.403	.433	.495	.688	.684	.261	-.024	-.006	.005	-.068	-.107	-.011
0.80	12.1	-0.1	.606	.692	.852	.845	.629	.322	-.046	-.014	-.039	-.155	-.091	-.022
0.80	16.5	-0.3	.841	1.015	1.090	.863	.664	.395	-.078	-.061	-.155	-.153	-.099	-.038
0.80	20.6	-0.5	1.043	1.046	.990	.863	.748	.486	-.161	-.176	-.178	-.151	-.122	-.058
0.90	0.2	0.0	-.020	-.027	-.026	-.035	-.038	-.028	.014	.015	.013	.009	.009	.006
0.90	4.1	0.0	.185	.199	.225	.253	.287	.302	-.014	-.003	-.000	.002	.010	-.009
0.90	8.0	0.0	.421	.455	.525	.670	.680	.290	-.044	-.020	-.005	-.041	-.102	-.016
0.90	12.0	-0.2	.620	.690	.805	.792	.601	.375	-.060	-.032	-.053	-.141	-.094	-.035
0.90	16.6	-0.5	.885	1.012	1.080	.891	.730	.454	-.120	-.096	-.170	-.160	-.119	-.049
0.90	20.8	-0.6	1.059	1.075	1.021	.891	.803	.546	-.169	-.186	-.190	-.164	-.144	-.071
0.94	0.3	0.1	-.011	-.019	-.020	-.034	-.036	-.026	.013	.017	.017	.016	.015	.008
0.94	4.0	0.0	.188	.214	.245	.279	.301	.308	-.025	-.010	-.007	-.001	.019	.041
0.94	8.0	-0.1	.458	.485	.556	.704	.663	.450	-.074	-.044	-.030	-.069	-.025	-.040
0.94	12.0	-0.1	.655	.710	.810	.959	.683	.383	-.089	-.050	-.038	-.148	-.110	-.041
0.94	16.7	-0.5	.893	1.008	1.134	.938	.806	.532	-.134	-.108	-.178	-.179	-.141	-.068
0.94	20.9	-0.6	1.102	1.219	1.184	1.005	.882	.626	-.169	-.184	-.219	-.195	-.164	-.093
0.98	0.2	0.0	.000	-.007	-.006	-.022	-.029	-.027	.009	.013	.013	.017	.023	.023
0.98	4.1	-0.1	.214	.228	.264	.295	.355	.371	-.034	-.023	-.021	-.018	-.015	.030
0.98	8.0	-0.2	.440	.478	.552	.694	.695	.648	-.074	-.056	-.049	-.084	-.054	.076
0.98	11.0	-0.4	.610	.674	.792	1.022	.912	.526	-.104	-.077	-.081	-.198	-.154	-.060
0.98	12.1	-0.4	.672	.740	.875	1.120	.978	.532	-.116	-.087	-.096	-.235	-.173	-.062
0.98	16.8	-0.4	.915	1.021	1.152	1.242	.970	.586	-.155	-.124	-.144	-.259	-.179	-.092
0.98	21.0	-0.8	1.104	1.239	1.375	1.200	1.016	.724	-.178	-.173	-.251	-.249	-.199	-.115
1.03	0.3	0.0	.015	.007	.012	-.007	-.003	-.004	.001	.005	.005	.015	.018	.025
1.03	4.1	-0.1	.219	.235	.271	.305	.368	.398	-.039	-.028	-.028	-.026	-.027	.015
1.03	8.1	-0.3	.448	.483	.556	.704	.715	.710	-.079	-.062	-.052	-.089	-.068	-.082
1.03	12.0	-0.4	.638	.716	.845	1.074	.954	.555	-.104	-.081	-.090	-.227	-.170	-.070
1.03	16.8	-0.6	.870	.988	1.164	1.249	1.125	.611	-.145	-.126	-.171	-.267	-.222	-.090
1.03	21.1	-0.8	1.080	1.205	1.381	1.302	1.106	.761						

TABLE VI. - Concluded
WING SECTION NORMAL-FORCE AND PITCHING-MOMENT COEFFICIENTS

 $\delta_{N,L} = 15^\circ, \delta_N = -15^\circ$

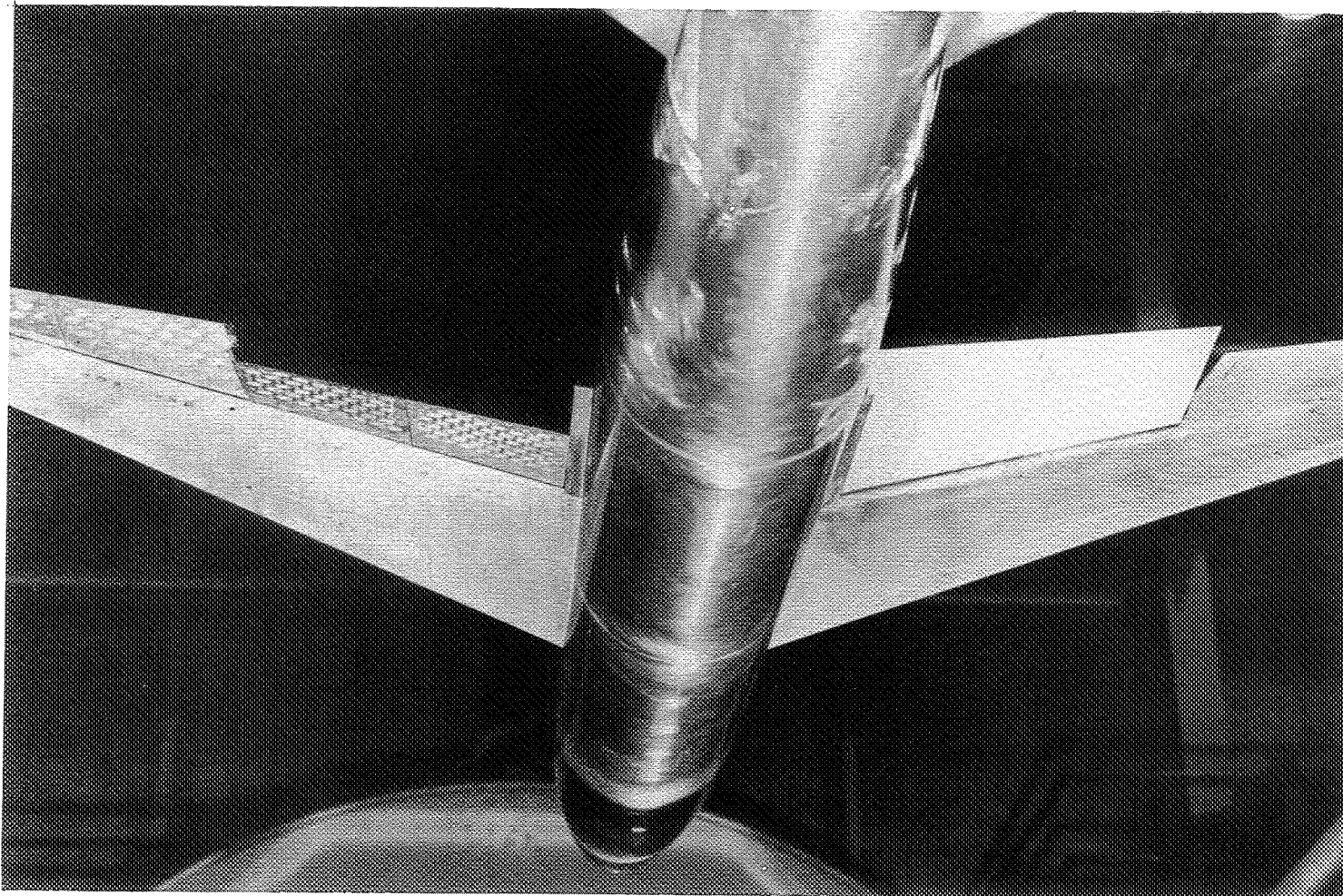
M	α	δ	c_n						$c_{m,c/4}$					
			0.16b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2	0.16b/2	0.25b/2	0.40b/2	0.60b/2	0.75b/2	0.95b/2
0.80	0.3	-14.8	-.060	-.178	-.239	-.192	-.129	-.072	.032	.094	.110	.061	.024	.006
0.80	4.1	-14.7	.132	.026	-.007	.085	.160	.192	.012	.083	.102	.050	.027	.010
0.80	8.0	-14.8	.335	.271	.276	.540	.551	.204	.005	.082	.108	-.027	-.093	-.005
0.80	12.1	-15.1	.528	.524	.667	.810	.558	.243	-.001	.076	.054	-.168	-.080	-.011
0.80	16.5	-15.2	.736	.839	.980	.844	.615	.336	-.015	.037	-.106	-.170	-.089	-.030
0.80	20.6	-15.3	.929	.976	.966	.880	.716	.448	-.060	-.084	-.130	-.163	-.111	-.052
0.90	0.3	-14.7	-.041	-.174	-.241	-.180	-.132	-.071	.024	.100	.125	.073	.040	.008
0.90	4.0	-14.7	.158	.040	.002	.106	.175	.202	-.000	.087	.112	.058	.042	-.001
0.90	8.0	-14.8	.372	.307	.306	.543	.591	.219	-.015	.068	.106	.015	-.102	-.011
0.90	12.1	-15.1	.547	.527	.618	.799	.549	.306	-.017	.062	.059	-.157	-.084	-.018
0.90	16.7	-15.3	.773	.858	.980	.855	.687	.405	-.052	.001	-.122	-.159	-.108	-.039
0.90	20.8	-15.4	.933	1.024	1.102	.968	.810	.531	-.059	-.067	-.172	-.196	-.142	-.067
0.94	0.3	-14.6	-.035	-.174	-.248	-.193	-.149	-.081	.026	.106	.137	.098	.074	.034
0.94	4.0	-14.7	.146	.051	.006	.108	.158	.229	-.003	.085	.117	.074	.067	.008
0.94	8.0	-14.7	.378	.314	.315	.554	.657	.232	-.024	.061	.101	.006	-.094	-.012
0.94	12.1	-14.8	.569	.541	.588	.855	.601	.359	-.039	.049	.076	-.135	-.099	-.034
0.94	16.7	-15.2	.765	.822	1.006	.900	.747	.472	-.057	.001	-.110	-.178	-.125	-.056
0.94	20.9	-15.5	.930	1.049	1.198	1.064	.888	.609	-.068	-.056	-.187	-.225	-.163	-.086
0.98	0.3	-14.5	-.033	-.173	-.252	-.204	-.117	-.057	.025	.106	.144	.113	.062	.036
0.98	4.0	-14.6	.159	.059	.009	.094	.197	.256	-.002	.078	.120	.098	.075	.084
0.98	8.0	-14.7	.365	.306	.294	.516	.656	.305	-.028	.053	.099	.021	-.058	-.001
0.98	12.1	-14.8	.563	.545	.606	.919	.652	.307	-.050	.030	.058	-.130	-.157	-.019
0.98	16.8	-15.0	.769	.808	.935	1.038	.833	.565	-.064	.004	-.036	-.199	-.158	-.092
0.98	21.1	-15.4	.943	1.031	1.246	1.125	.953	.665	-.081	-.045	-.185	-.233	-.183	-.103
1.03	0.3	-14.5	-.043	-.161	-.248	-.191	-.117	-.061	.033	.101	.146	.109	.065	.032
1.03	4.1	-14.6	.166	.081	.030	.126	.242	.326	-.007	.065	.108	.088	.064	.076
1.03	8.0	-14.7	.371	.320	.316	.557	.685	.316	-.030	.043	.093	.007	-.071	-.006
1.03	12.0	-14.8	.548	.545	.609	.908	.874	.317	-.045	.028	.054	-.133	-.164	-.017
1.03	16.8	-15.0	.745	.793	.946	1.141	.946	.481	-.064	-.003	-.042	-.223	-.178	-.079
1.03	21.1	-15.3	.934	.986	1.205	1.253	1.031	.614	-.100	-.044	-.149	-.255	-.188	-.100





(a) Model installed in test section of Langley 16-foot transonic tunnel. L-87668

Figure 2.- Photographs of model.



(b) View of oppositely deflected ailerons. L-92575

Figure 2.- Concluded.

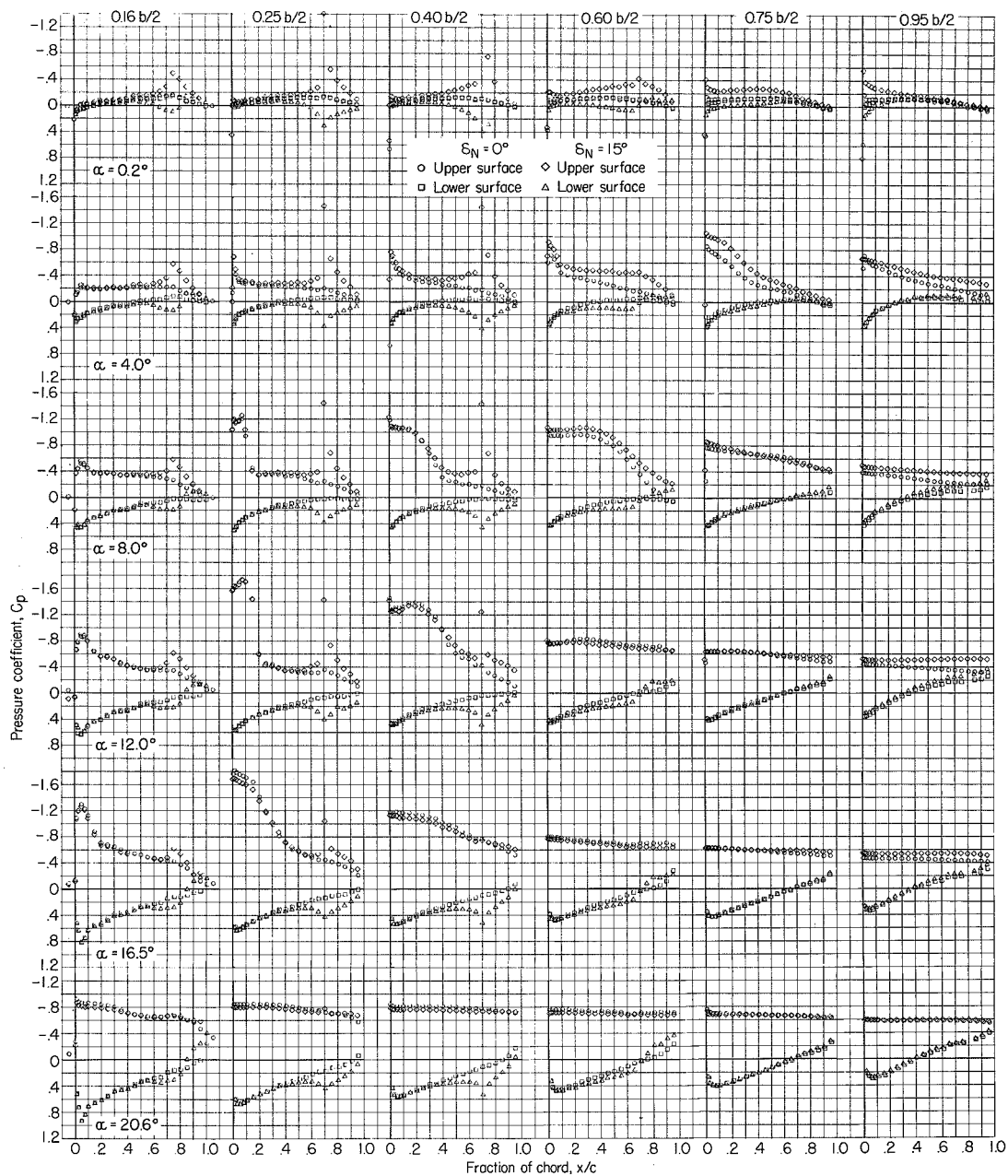
(a) $M = 0.80$.

Figure 3.- Comparison of chordwise pressure distributions on the basic wing, $\delta_N = 0^\circ$, with distributions on the wing with deflected aileron, $\delta_N = 15^\circ$.

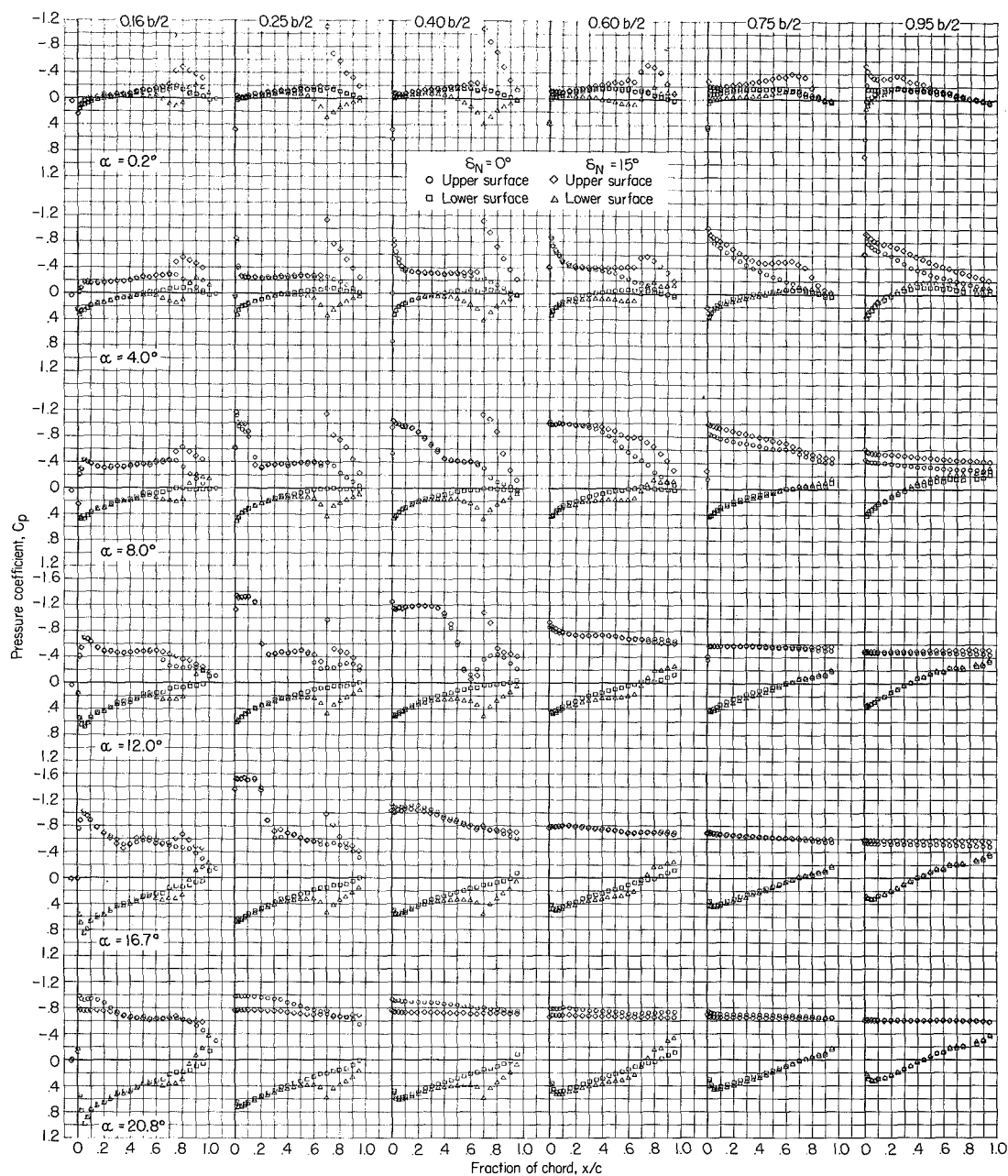
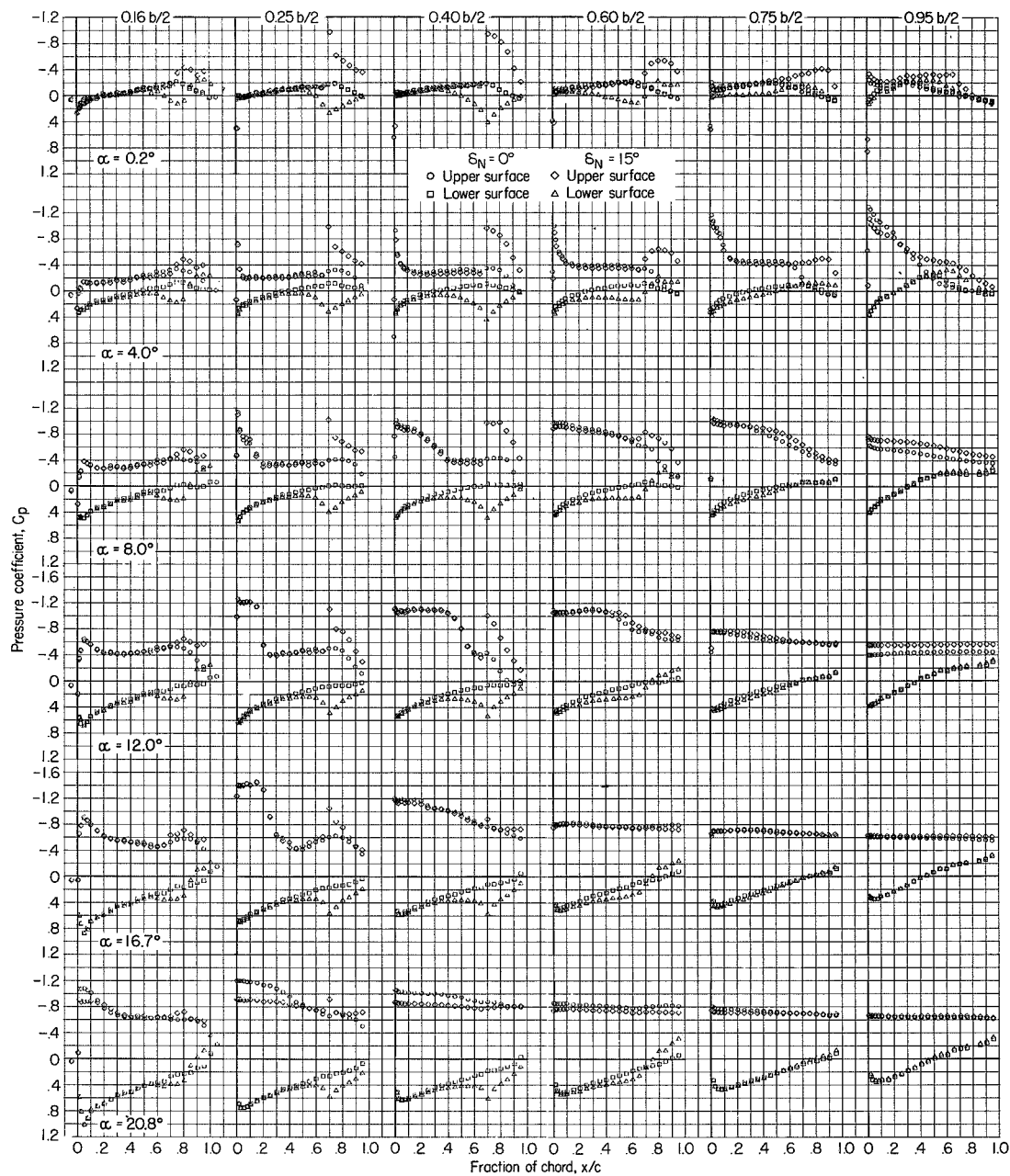
(b) $M = 0.90$.

Figure 3.- Continued.



(c) $M = 0.94$.

Figure 3.- Continued.

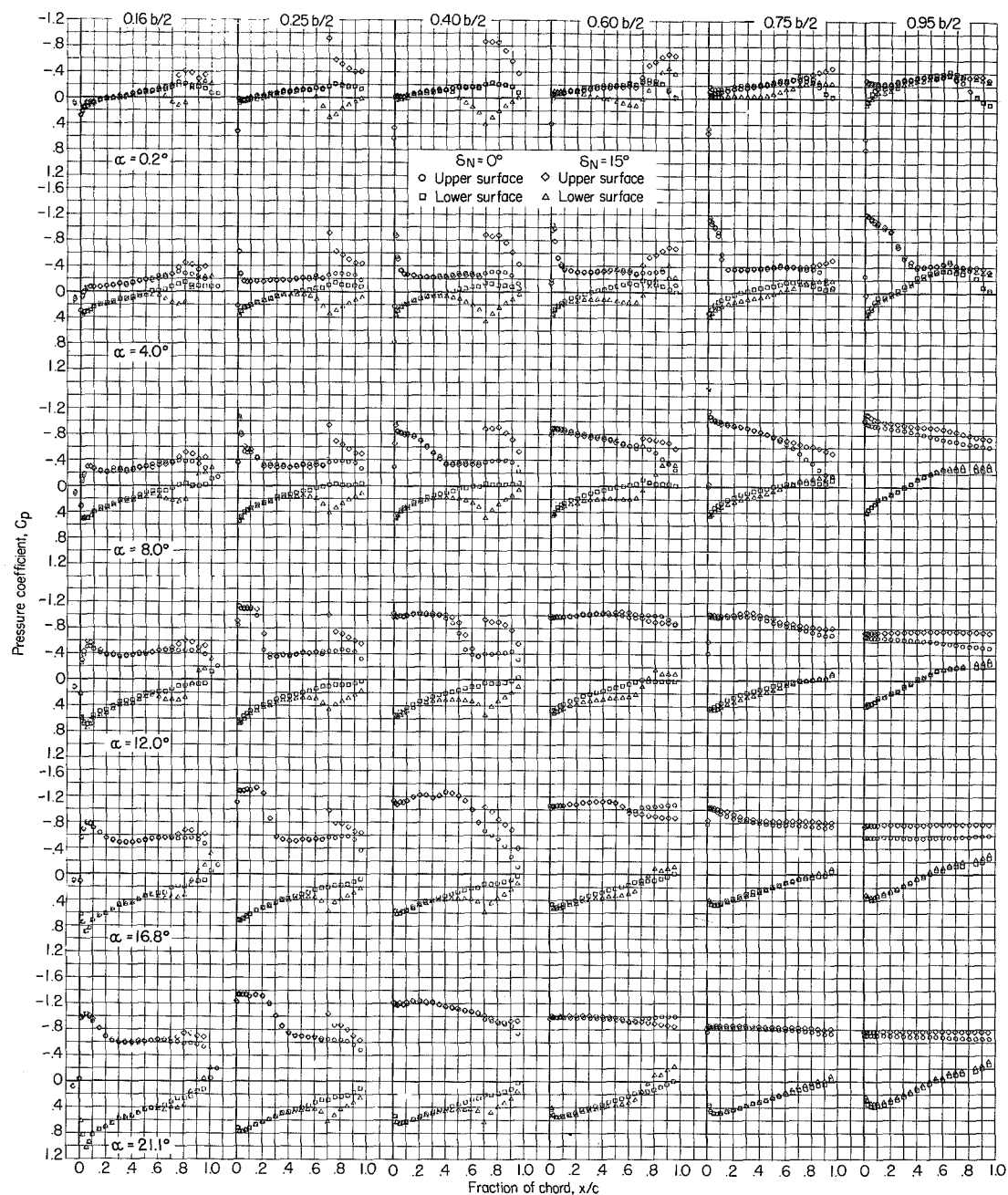
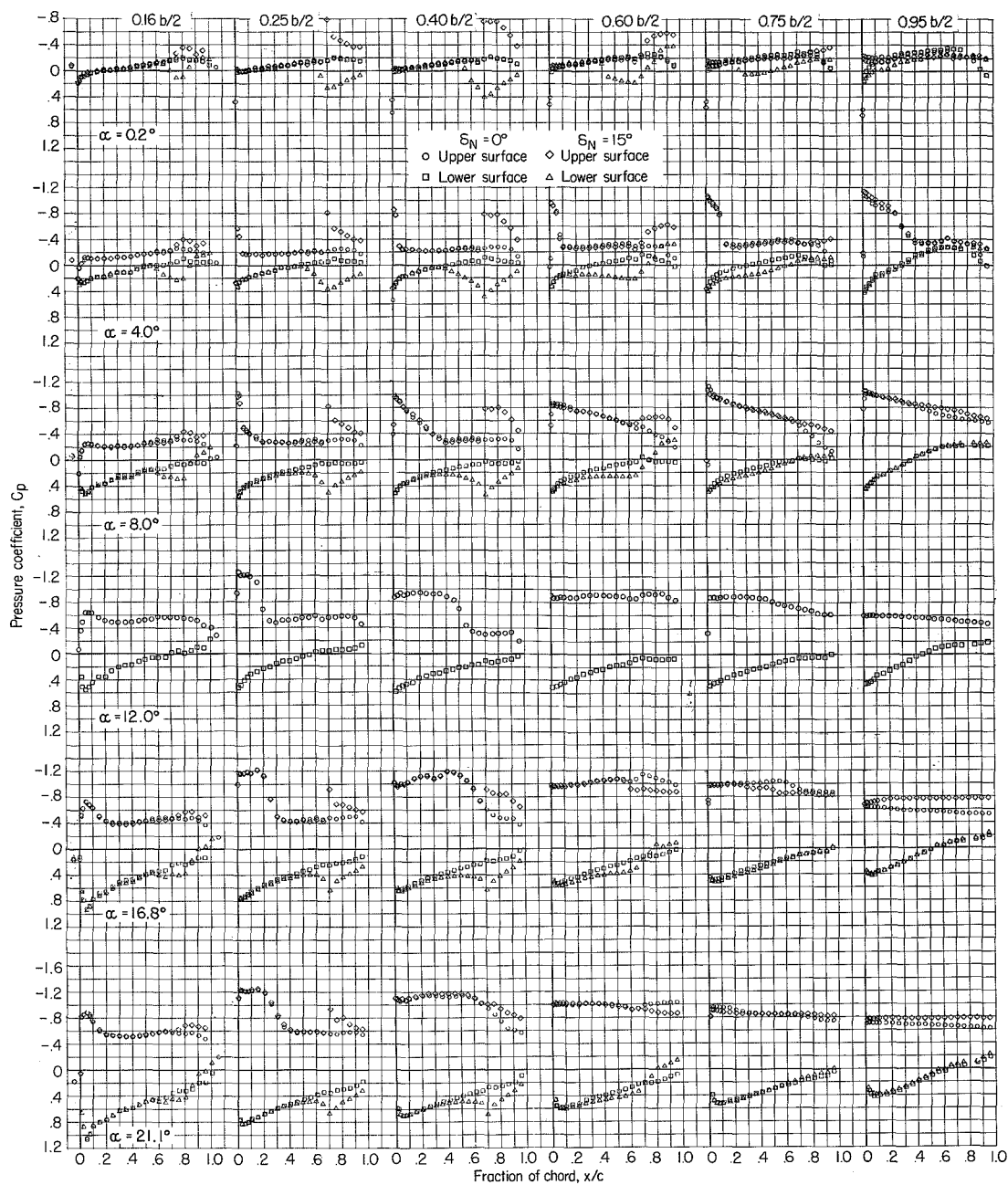
(d) $M = 0.98$.

Figure 3.- Continued.



(e) $M = 1.03$.

Figure 3.- Concluded.

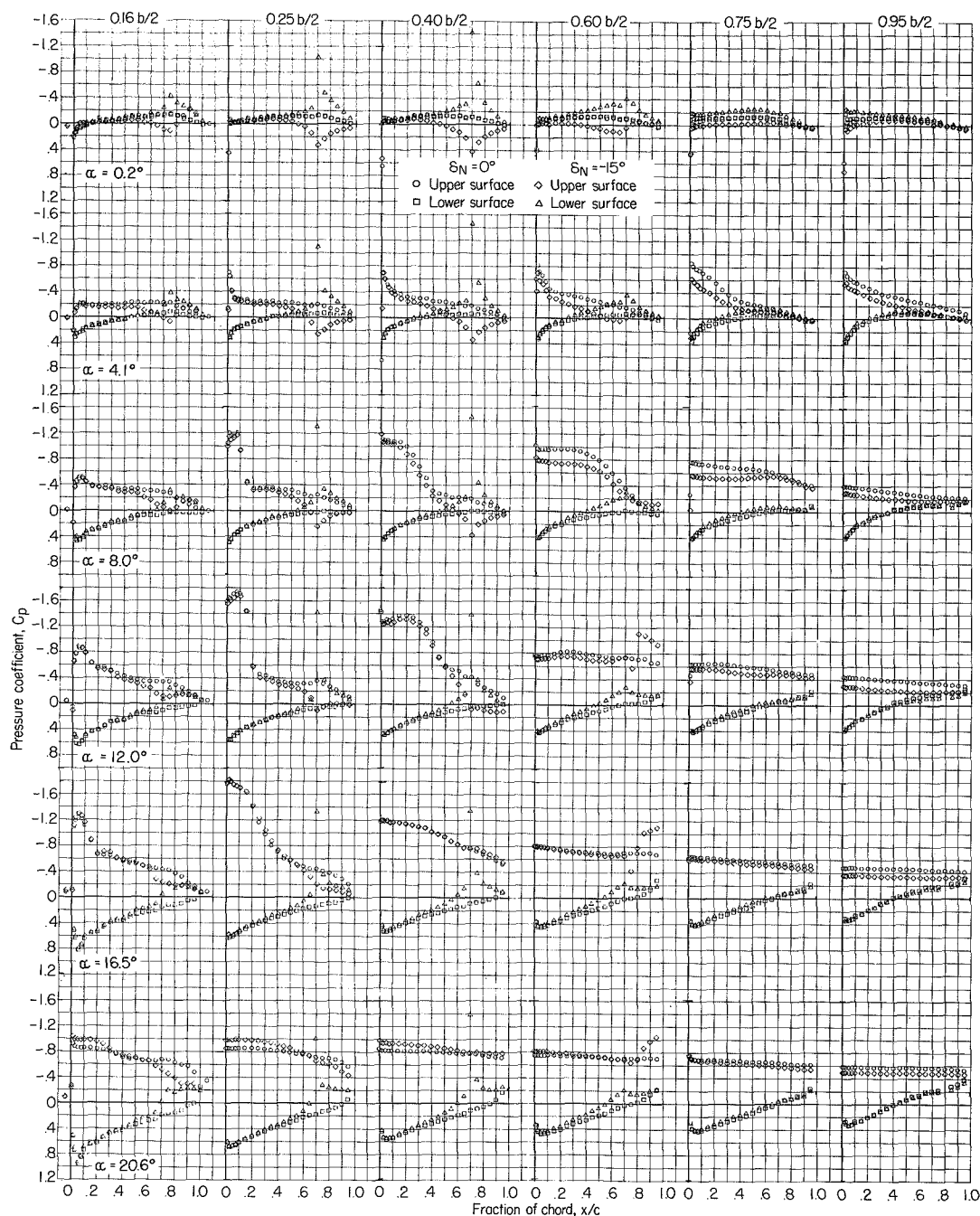
(a) $M = 0.80$.

Figure 4.- Comparison of chordwise pressure distributions on the basic wing, $\delta_N = 0^\circ$, with distributions on the wing with deflected aileron, $\delta_N = -15^\circ$.

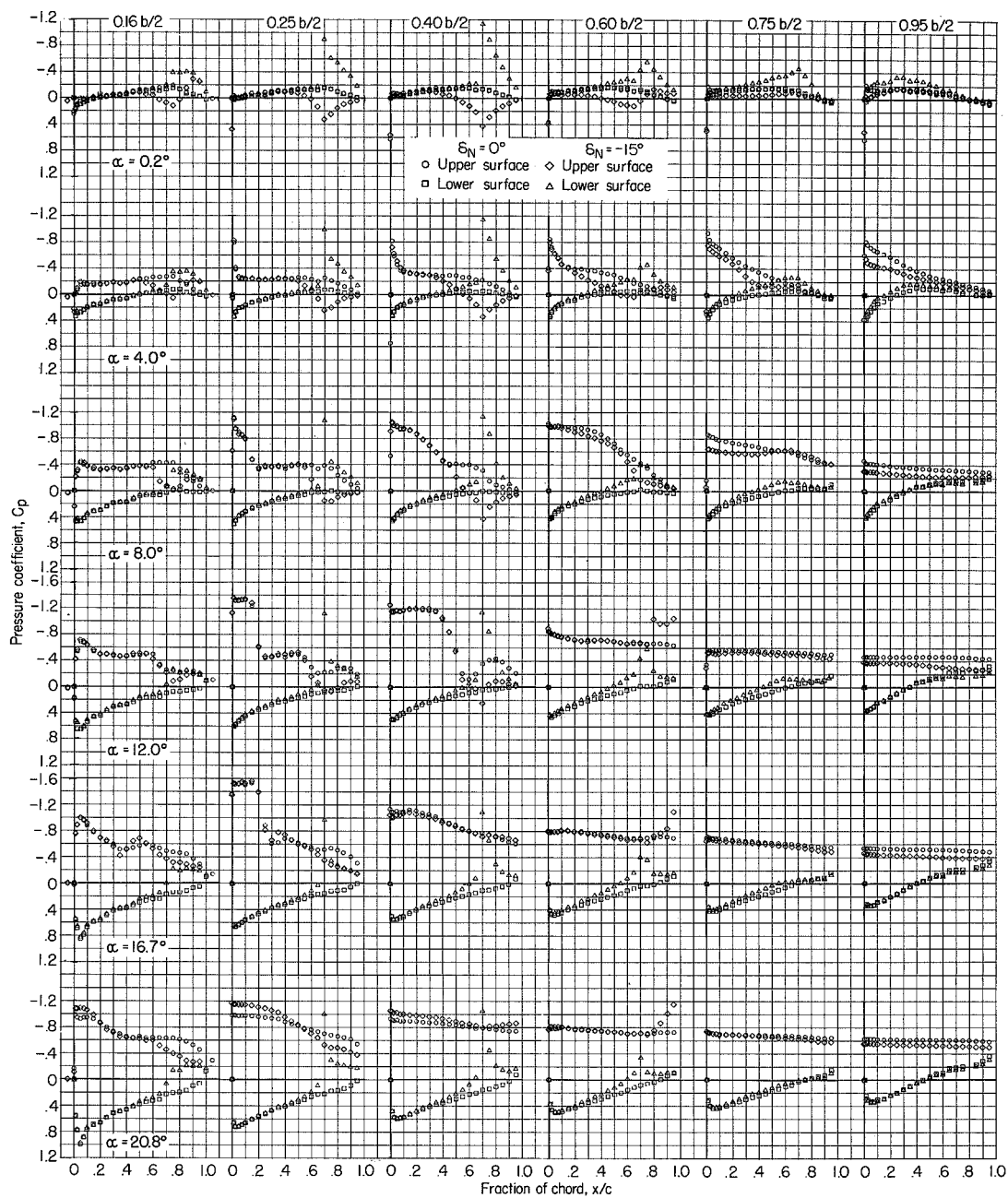
(b) $M = 0.90$.

Figure 4.- Continued.

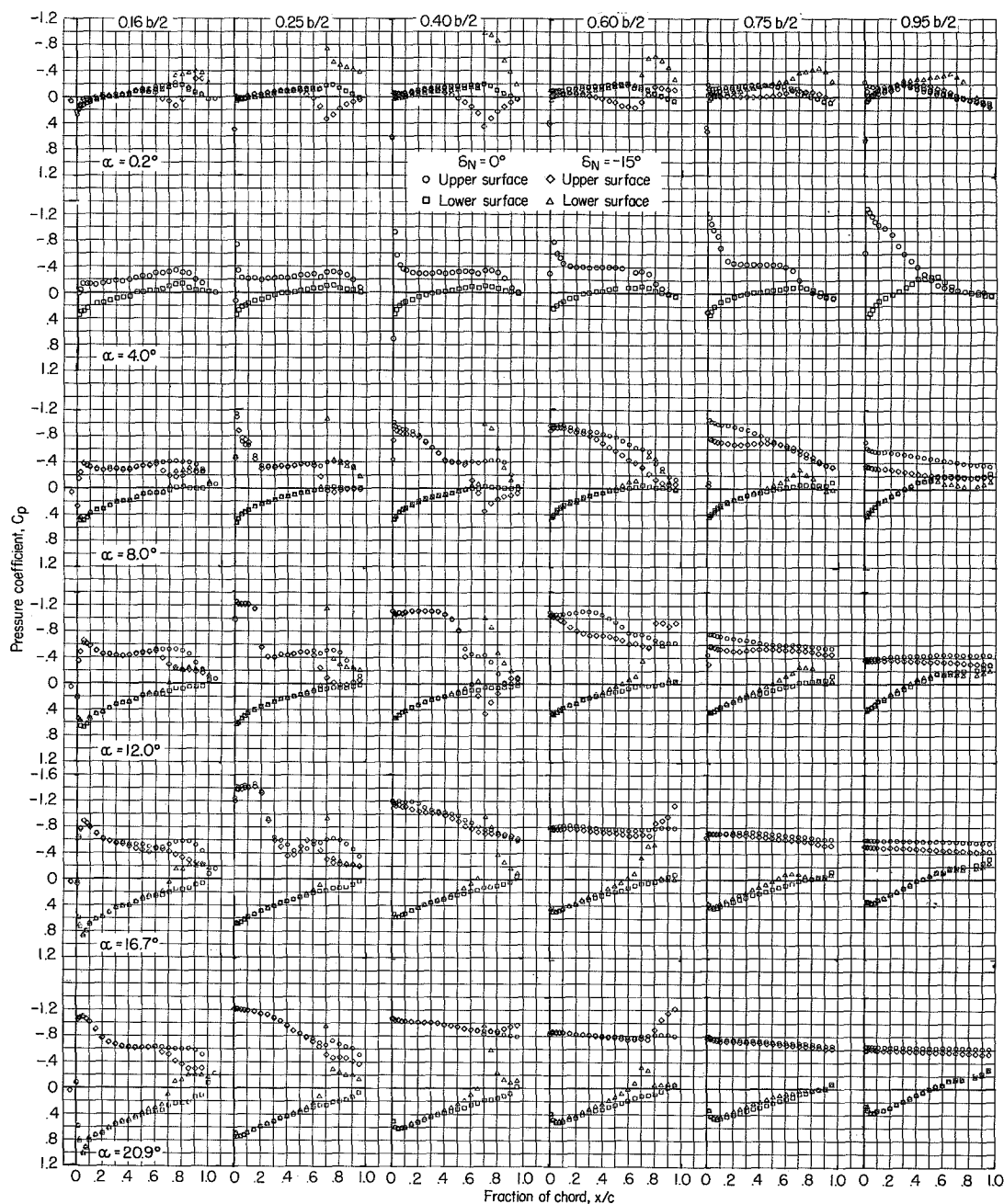
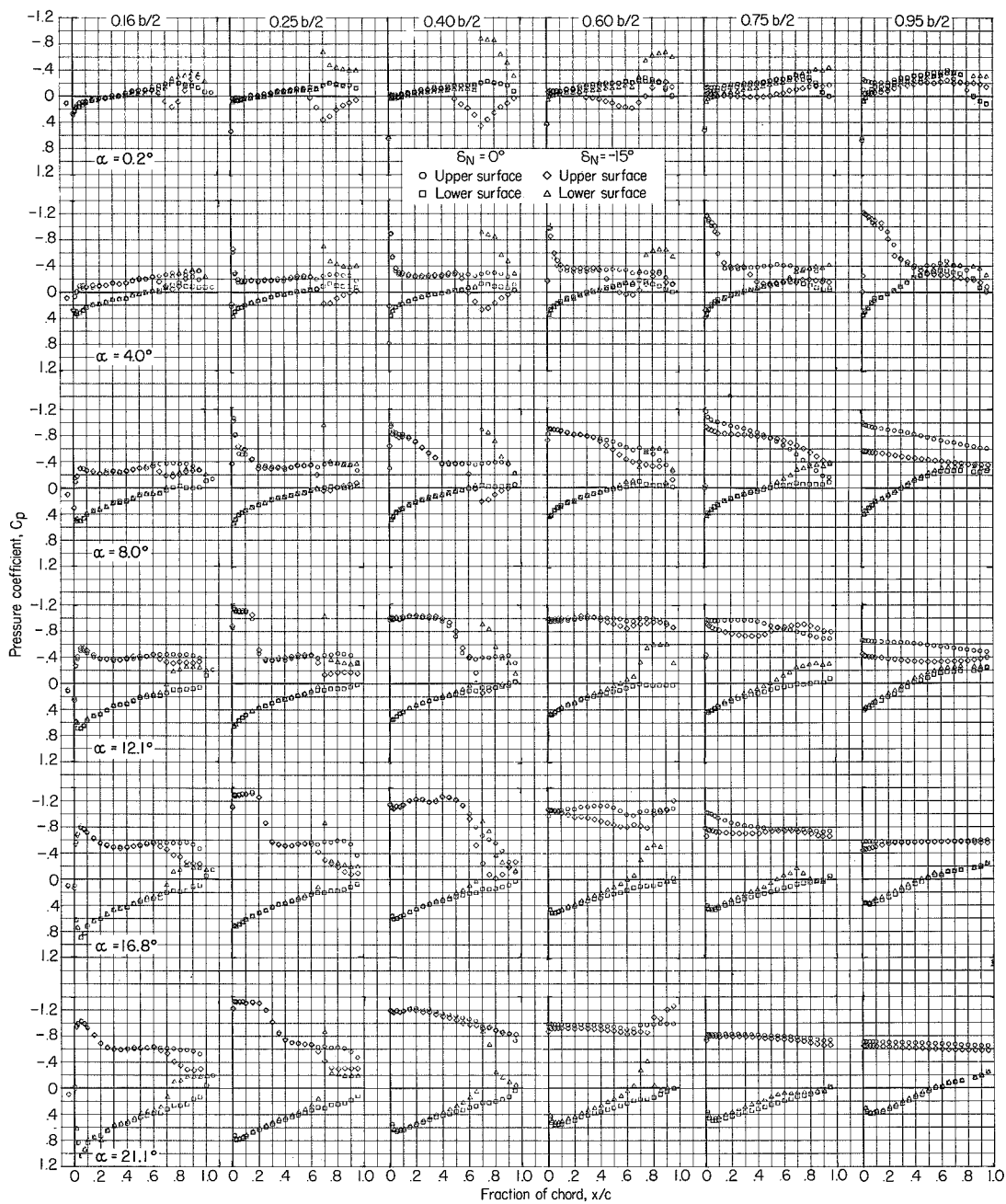
(c) $M = 0.94$.

Figure 4.- Continued.



(d) $M = 0.98$.

Figure 4.- Continued.

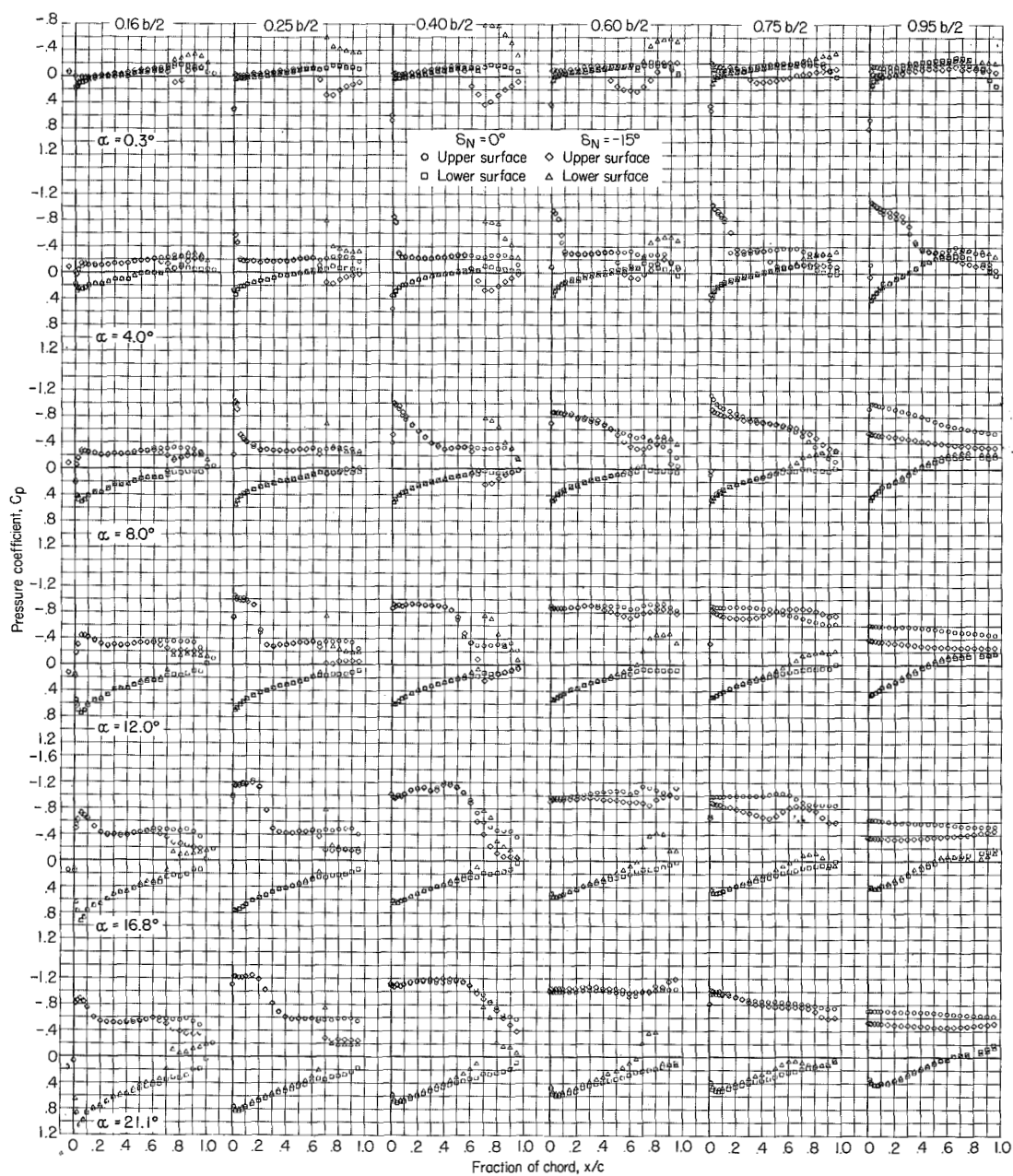
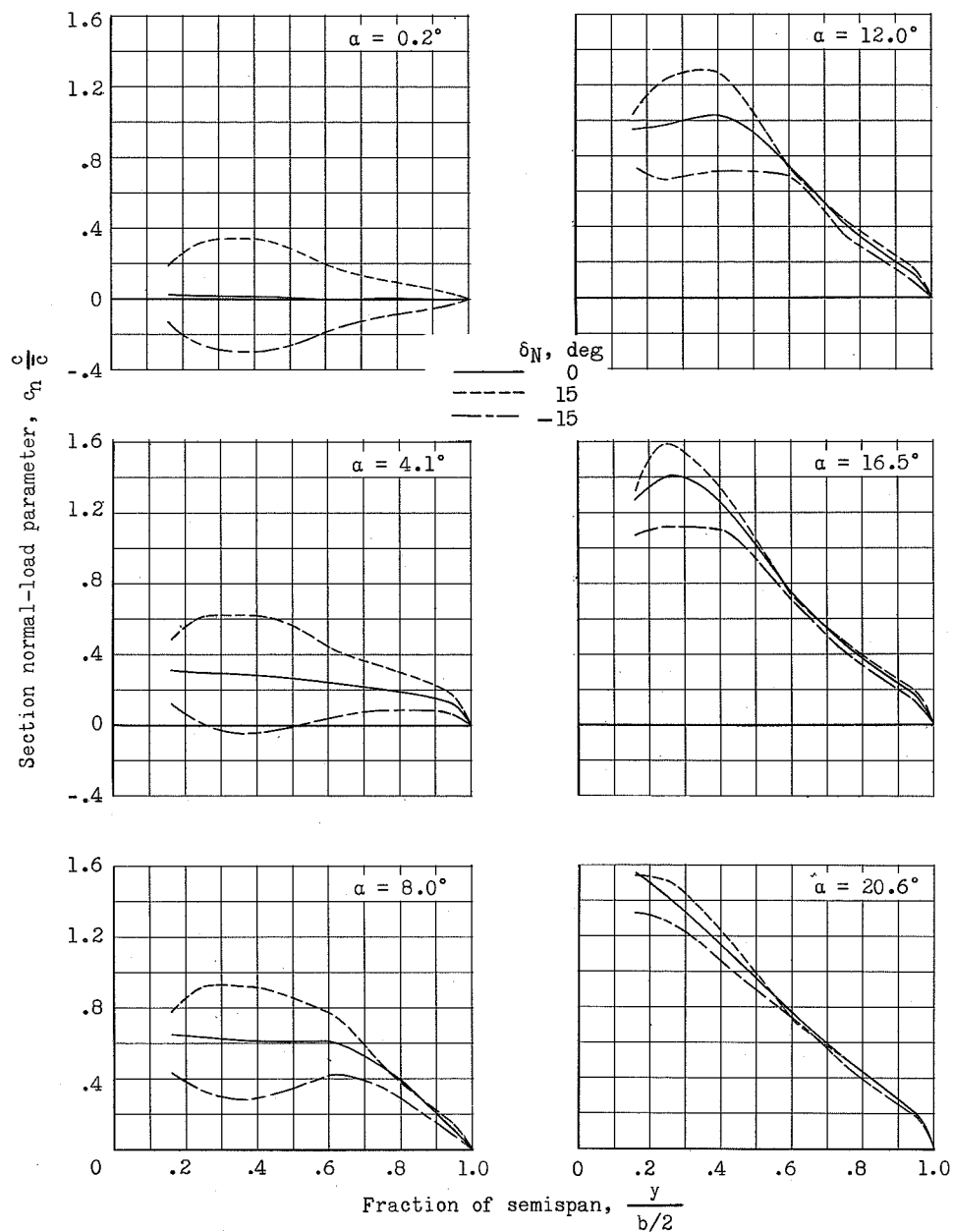
(e) $M = 1.03$.

Figure 4.- Concluded.



(a) $M = 0.80$.

Figure 5.- Spanwise variation of wing section normal-load parameter c_n^c for different aileron deflections.

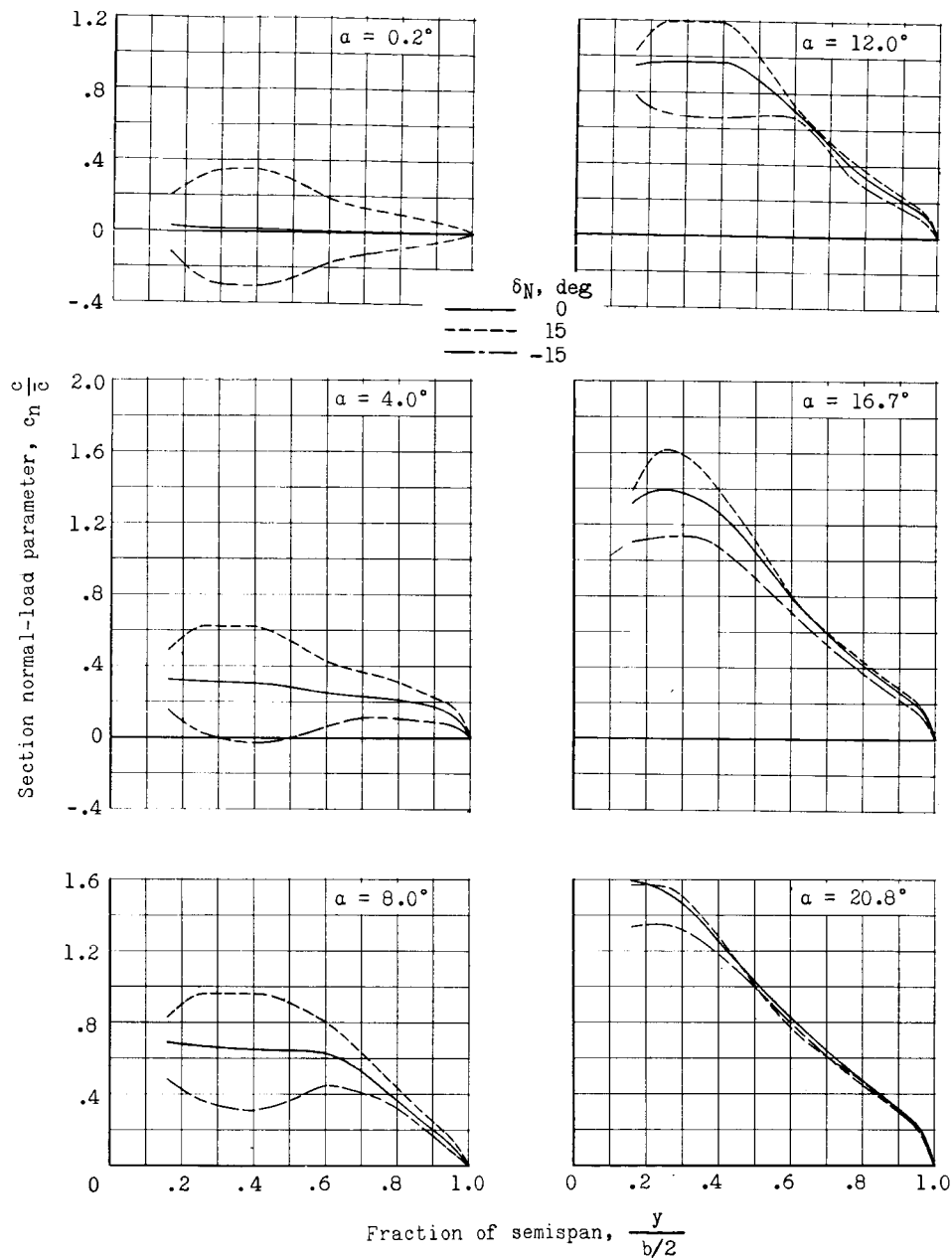
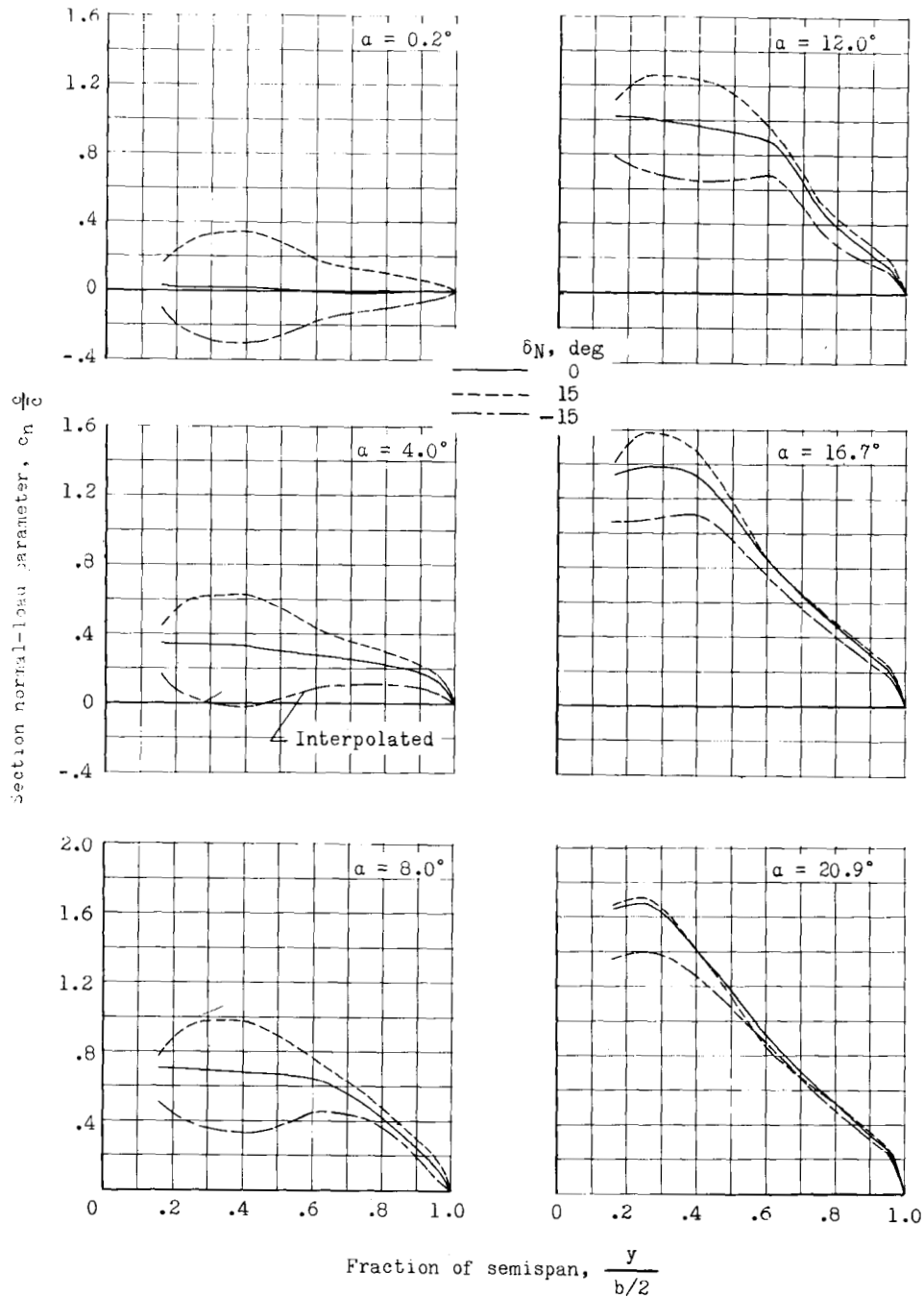


Figure 5.- Continued.

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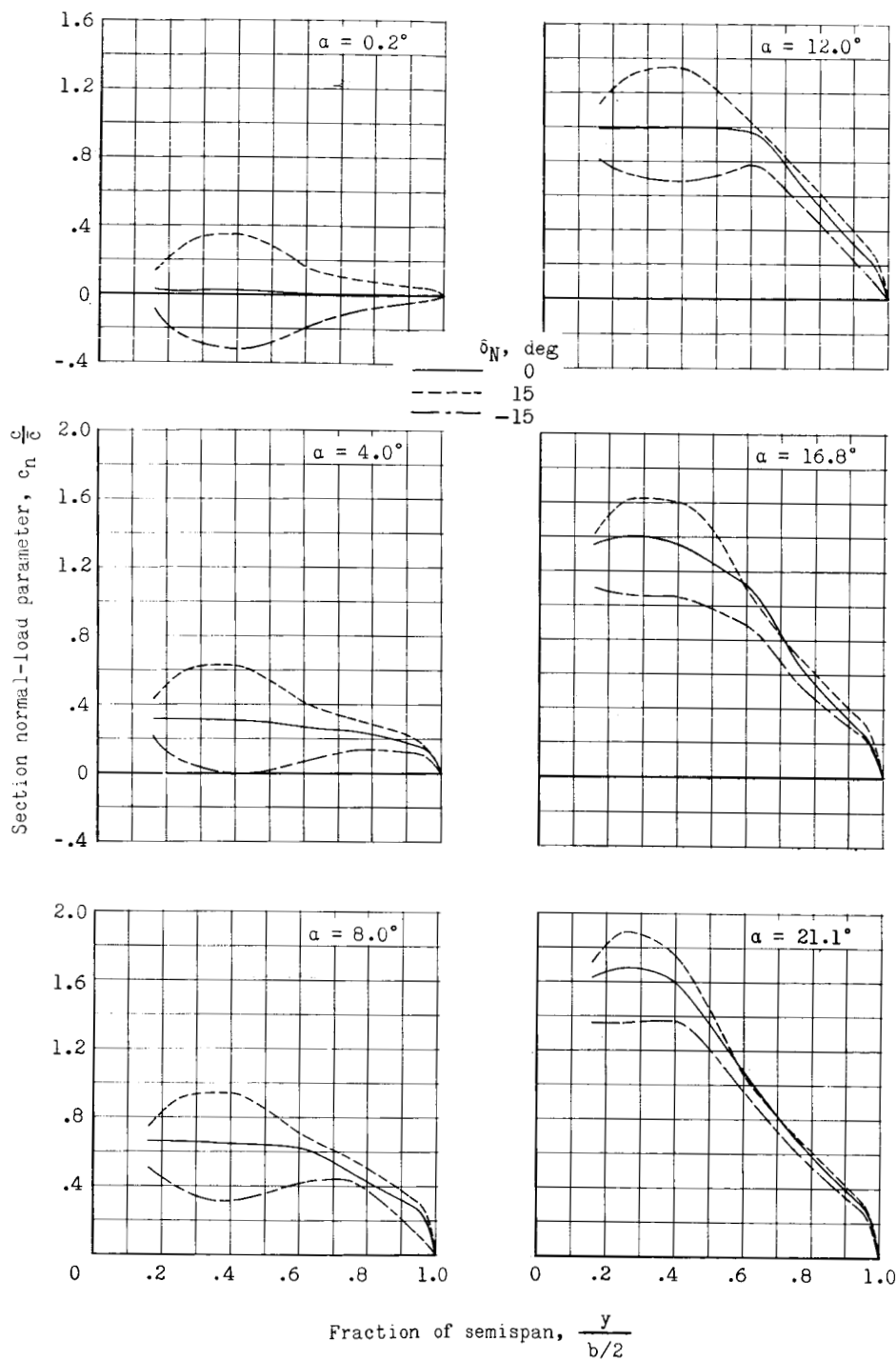
(c) $M = 0.94$.

Figure 5.- Continued.

031715-0100

031715-0100

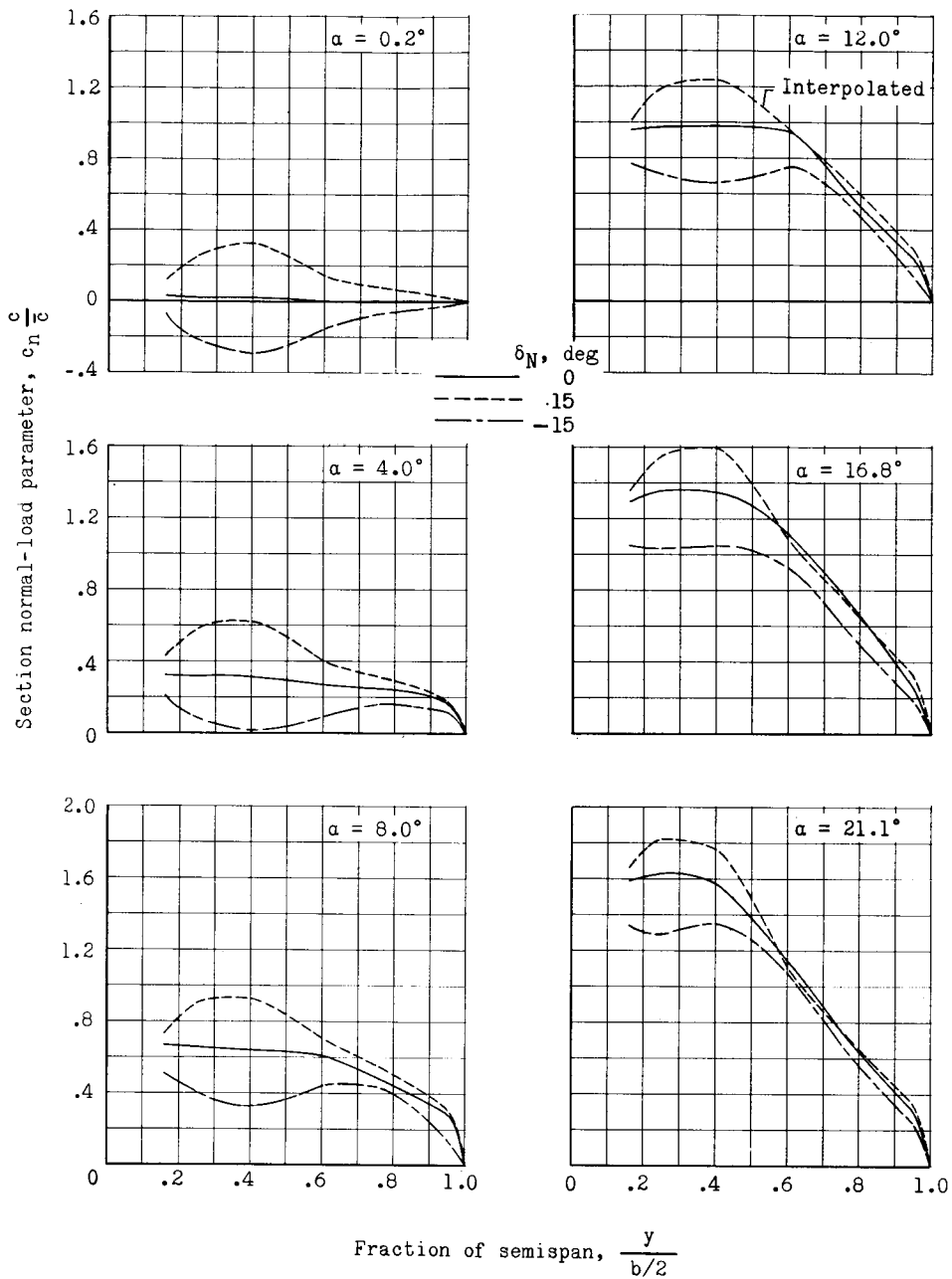
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(d) $M = 0.98$.

UNCLASSIFIED

Figure 5.- Continued.

UNCLASSIFIED



(e) $M = 1.03$.

Figure 5.- Concluded.

UNCLASSIFIED

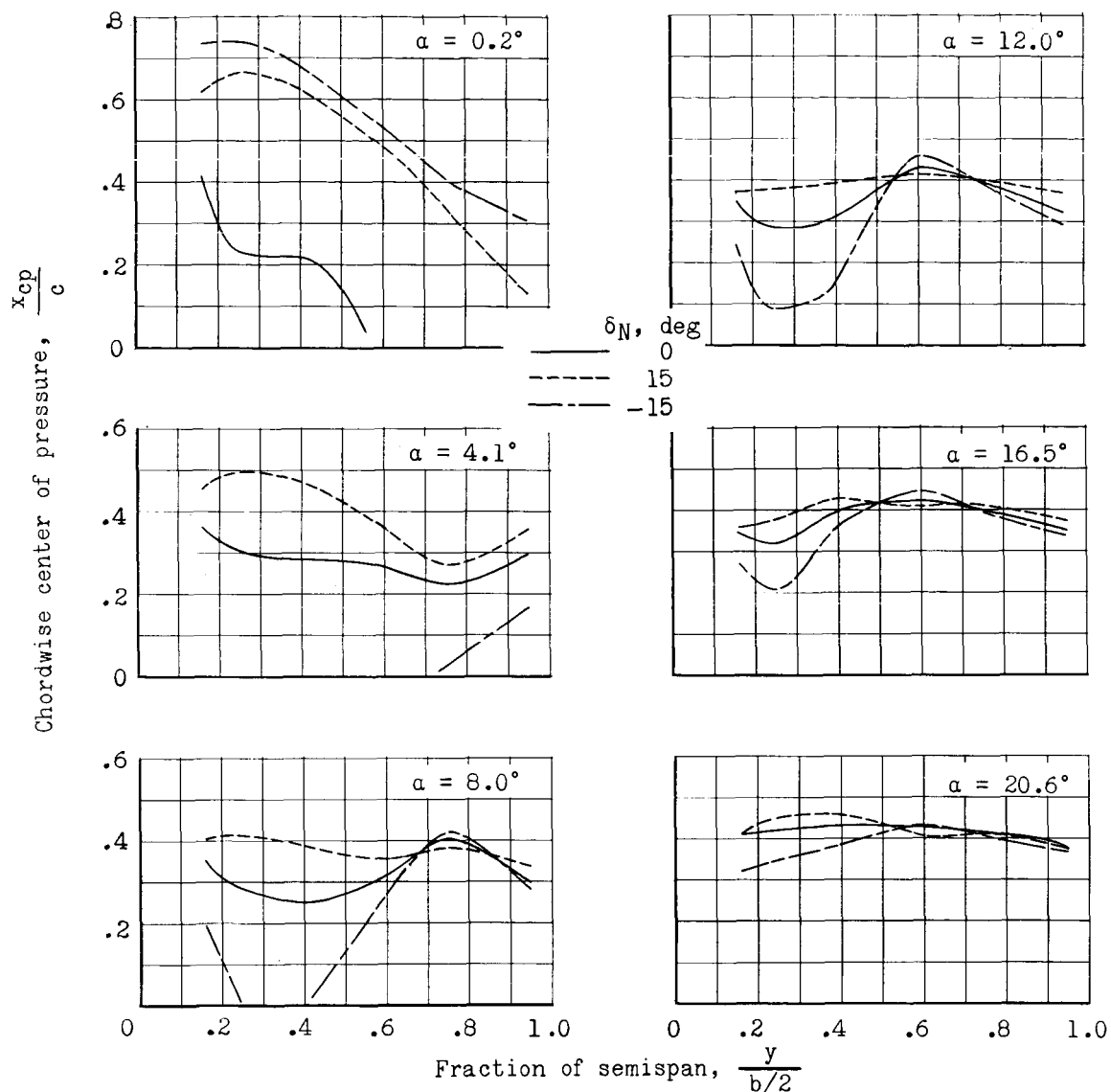
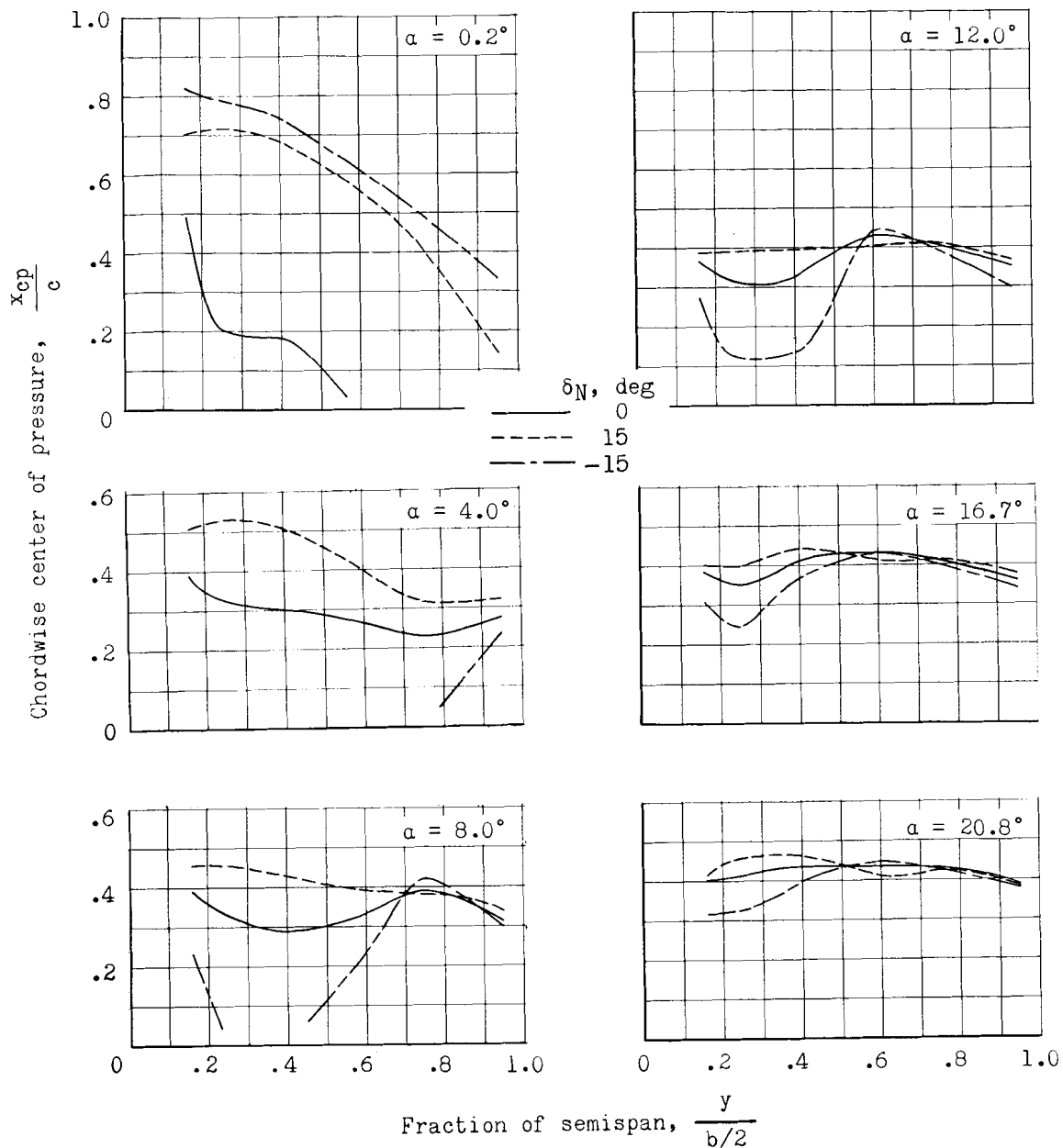
(a) $M = 0.80$.

Figure 6.- Spanwise variation of wing section center-of-pressure location x_{cp}/c for different aileron deflections.

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(b) $M = 0.90$.

Figure 6.- Continued.

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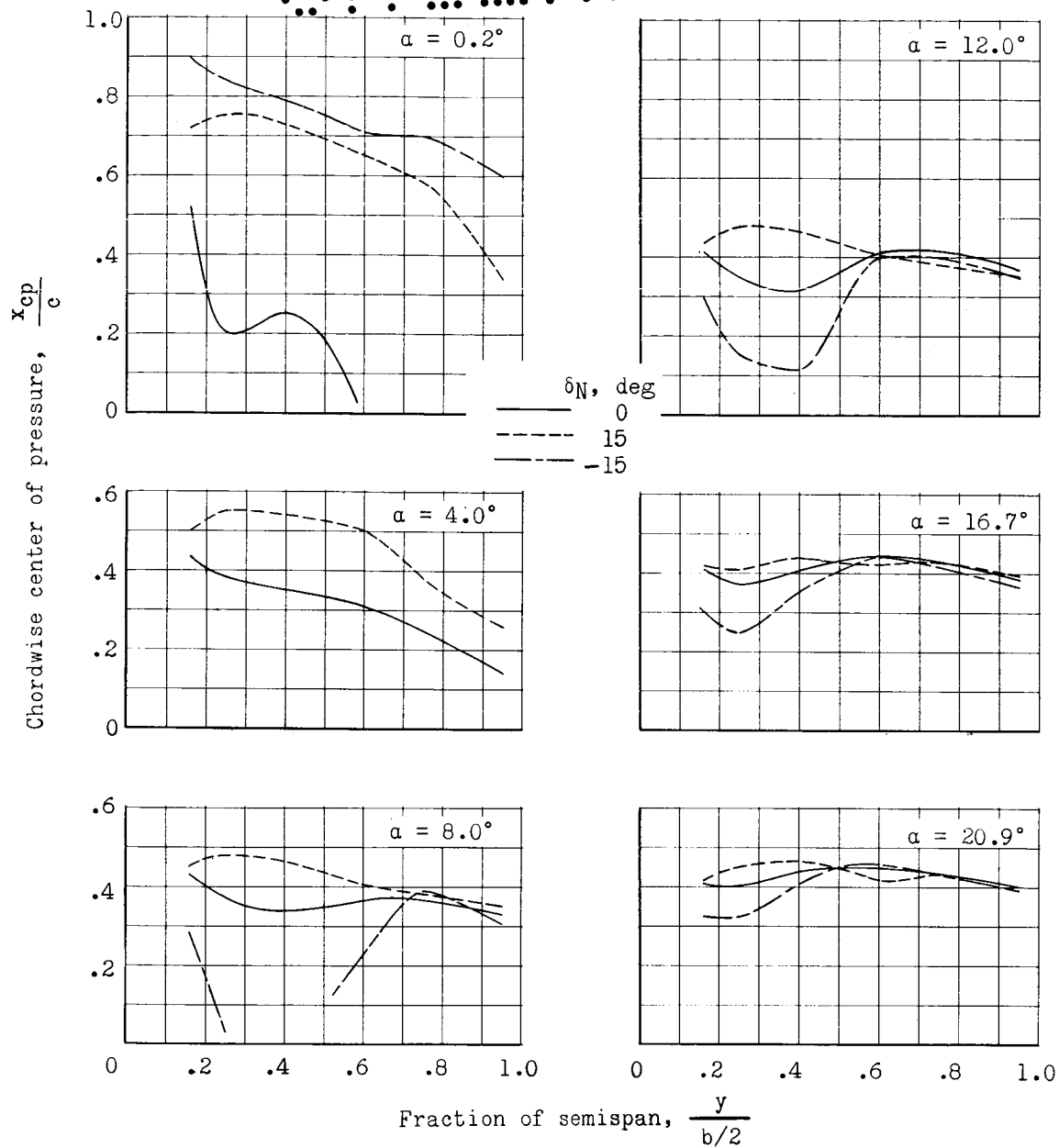
(c) $M = 0.94$.

Figure 6.- Continued.

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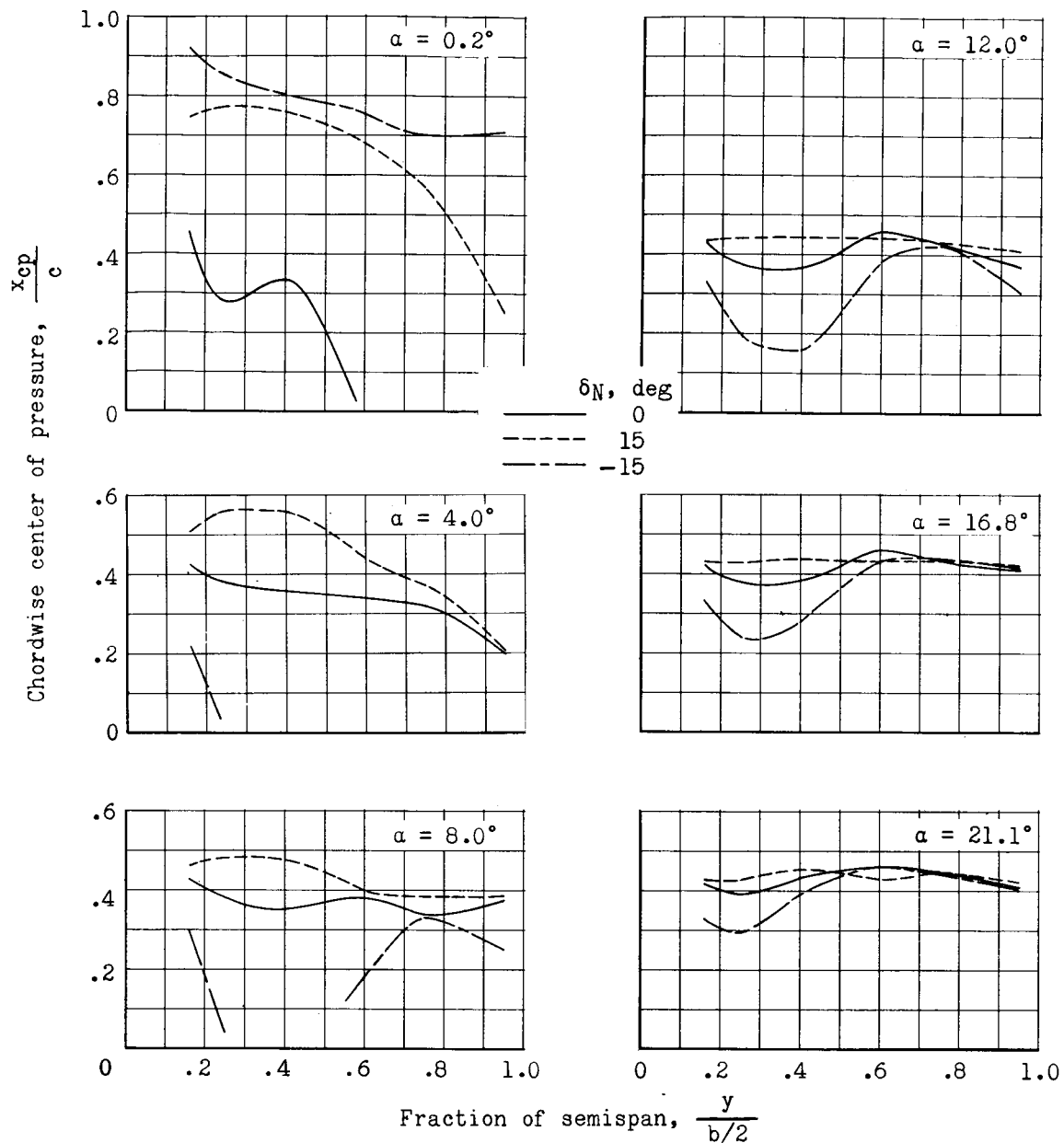
(d) $M = 0.98$.

Figure 6.- Continued.

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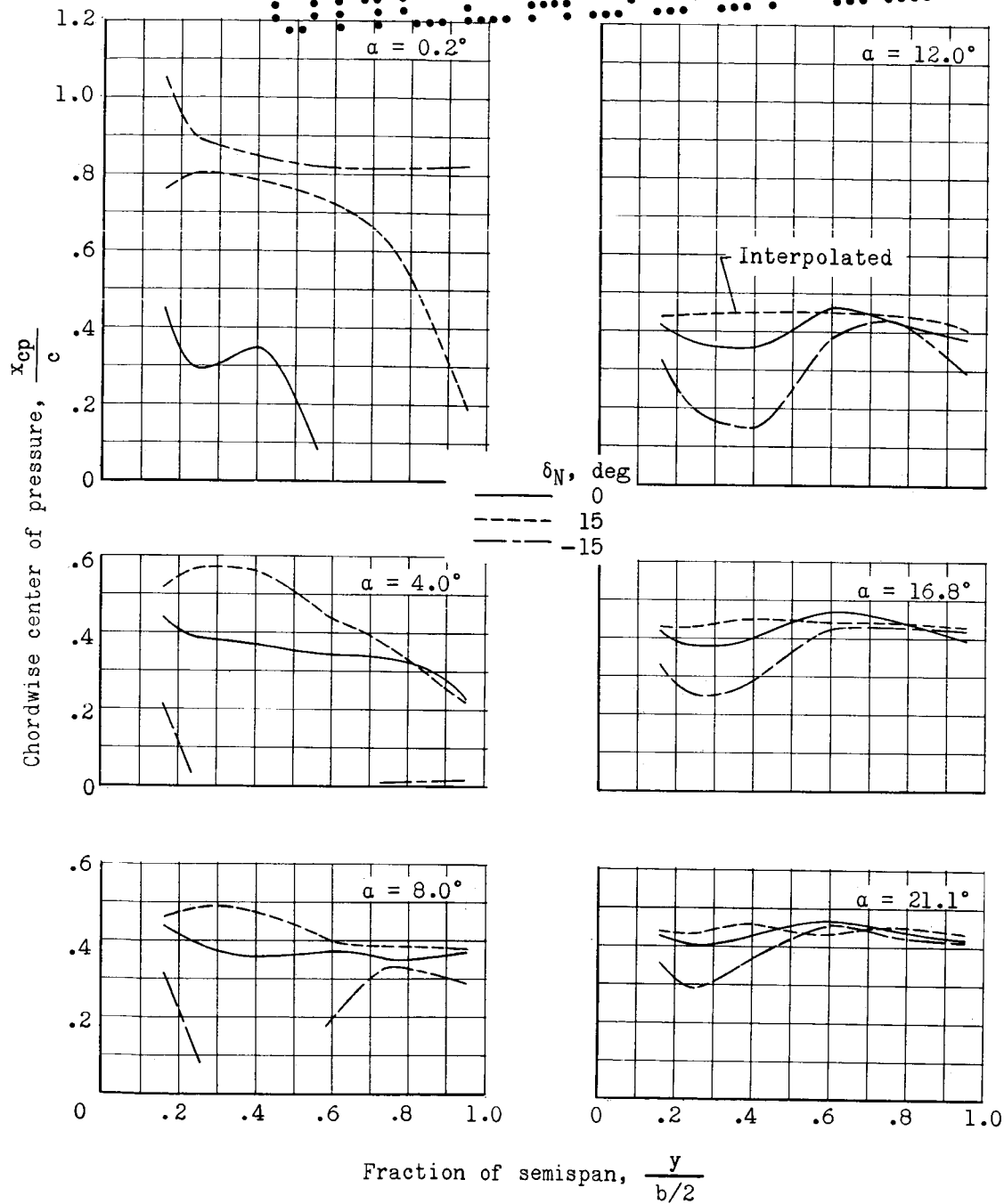
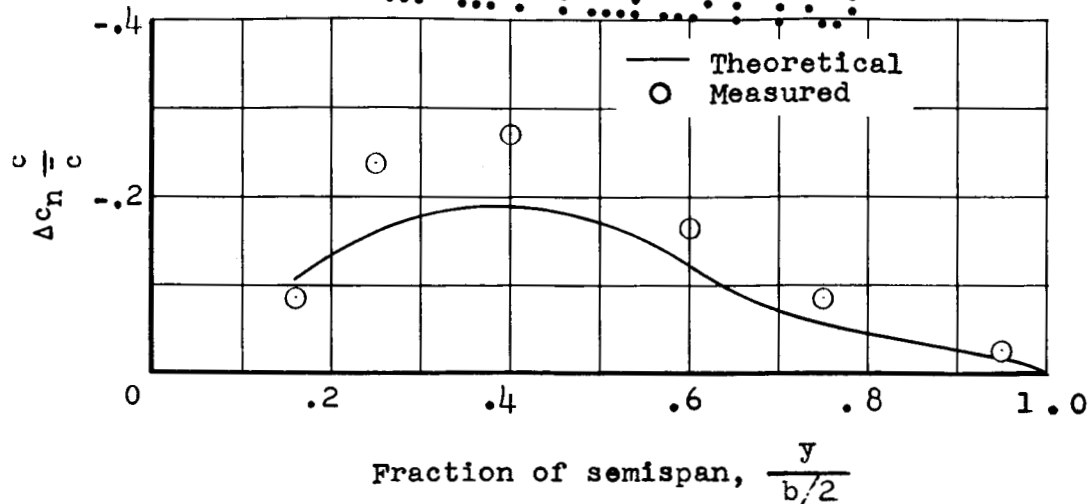
(e) $M = 1.03$.

Figure 6. Concluded.



(a) Additional normal-force coefficients.

