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Experimental Investigation of Leading-Edge Thrust at Supersonic Speeds

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SUMMARY

An experimental investigation of wings, designed for leading-edge thrust at supersonic speeds, has been conducted in the Langley Unitary Plan Wind Tunnel at Mach numbers 1.60, 1.80, 2.00, 2.16, and 2.36. Experimental results were obtained on an uncambered wing which had a planform of varying leading-edge sweep and three interchangeable leading edges. The three leading-edge geometries consisted of a sharp, constant, and varying leading-edge-radii distribution. The purpose of this investigation was to evaluate the leading-edge-thrust concept. Results from the investigation showed that leading-edge flow-separation characteristics of all wings tested agree well with theoretical predictions. However, the theoretically predicted thrust forces did not agree with those experimentally measured on the wings with sharp and varying leading-edge radii; large differences in both levels and trends were evident. Experimental data showed that significant changes in wing leading-edge bluntness do not affect the zero-lift drag of uncambered wings.

INTRODUCTION

Efficient supersonic flight has, in the past, been largely directed at transport aircraft in which the linear theory, zero-thrust optimization procedures were successfully applied (refs. 1 and 2). However, recent studies (e.g., ref. 3) indicated that future military aircraft would require both efficient supersonic cruise and maneuver capability. Attempts to apply this linearized-theory wing-design methodology (ref. 4) to the fighter wing-design problem have met with limited success (refs. 5 and 6). It has been suggested (refs. 7 and 8) that additional aerodynamic performance benefits may be obtained by employing nonlinear aerodynamic effects, such as leading-edge thrust, in the supersonic wing-design process.

The existence of theoretical leading-edge thrust on highly swept wings at supersonic speeds has been known for some time (refs. 9 and 10); however, typical supersonic wings with thin airfoils and sharp leading edges usually failed to produce any significant amount of thrust. Recent developments in supersonic wing research have led to a review of leading-edge thrust as a possible mechanism for improving supersonic aircraft performance. These developments include the testing of a wing which produced significant amounts of thrust (ref. 11) and the evolution of methods for predicting both full theoretical (refs. 12 and 13) and attainable (ref. 14) levels of leading-edge thrust. Results from the prediction methods and thrust-producing wing designs have shown some significant performance benefits (ref. 15) over conventionally designed zero-thrust wings.

The current leading-edge-thrust study involved the design and wind-tunnel testing of a wing with a complex planform selected to have desirable leading-edge thrust characteristics. The wing was uncambered and tested with three different leading-edge radii distributions. The purpose of the investigation was to evaluate the leading-edge-thrust concept. The model was tested at Mach numbers of 1.60, 1.80, 2.00, 2.16, and 2.36 in the Langley Unitary Plan Wind Tunnel.

SYMBOLS

b	wing span, 24.40 in.
C_A	axial-force coefficient, $\frac{\text{Axial force}}{q_\infty S}$
ΔC_A	incremental change in axial force, $C_{A,\alpha} - C_{A,\alpha=0}$
C_D	drag coefficient, $\frac{\text{Drag}}{q_\infty S}$
$C_{D,o}$	zero-lift drag coefficient
C_L	lift coefficient, $\frac{\text{Lift}}{q_\infty S}$
C_m	pitching-moment coefficient, $\frac{\text{Pitching moment}}{q_\infty S\bar{c}}$
C_N	normal-force coefficient, $\frac{\text{Normal force}}{q_\infty S}$
C_p	pressure coefficient, $\frac{p - p_\infty}{q_\infty}$
$C_{p,0}$	pressure coefficient at zero angle of attack
c	local wing chord, in. (C in computer-generated tables)
$\bar{c}$	wing mean aerodynamic chord, 15.86 in.
c_t	full theoretical section thrust coefficient
$\bar{c}_t$	maximum-attainable section thrust coefficient
K_T	thrust factor
M	free-stream Mach number
p	static pressure, psf
q	dynamic pressure, psf
R	Reynolds number
r_{le}	leading-edge radius, streamwise direction (LER in computer-generated tables)
S	wing reference area, 324.61 in^2
x	Cartesian coordinate in streamwise direction, in.
y	Cartesian coordinate in spanwise direction, in.
α	angle of attack, deg
α_{sep}	angle of attack at which leading-edge separation occurs, deg

β $= \sqrt{M^2 - 1}$

Λ wing leading-edge sweepback, deg

Subscripts:

max maximum

∞ free-stream conditions

ANALYSIS

Leading-Edge-Thrust Concept

The leading-edge-thrust phenomenon results from the upwash field ahead of the wing and the high local velocities and accompanying low pressures which occur as the air flows around the wing leading edge from the lower surface stagnation point to the upper surface (ref. 13).

A detailed discussion of a method for calculating the attainable leading-edge thrust for uncambered and cambered wings of arbitrary planform at supersonic speeds is given in reference 14; the essential elements of the concept as applied to the uncambered wing of interest in this investigation are presented in figure 1. The attainable thrust factor K_T is the ratio of the theoretically attainable thrust to the full theoretical thrust. The thrust factor K_T can have values ranging from 1, for fully attached flow, to a value of 0, for complete leading-edge separation. In this investigation, the change in thrust factor from 1 to a value less than 1 was assumed to indicate the onset of leading-edge separation (ref. 16).

In general, the thrust factor and the thrust magnitude can vary along the wing leading edge and, as indicated in figure 1, can be controlled by the selection of the local leading-edge sweep and the airfoil leading-edge radius, providing other wing-geometry parameters and flow conditions are held constant. This method provides a quantitative means of selecting wing leading-edge geometries which promote attached flow and desirable leading-edge thrust characteristics.

Model Geometry

With the use of the attainable-thrust concept, a wind-tunnel model was developed in reference 16 by first selecting a planform which had desirable leading-edge thrust characteristics for a constant value of the ratio of airfoil leading-edge radius to chord r_{le}/c. Three distributions of r_{le}/c were chosen to produce different thrust characteristics for the single planform. The aerodynamic analysis and selection process of planform shapes and leading-edge radii distributions were based on a Mach number of 1.80 and a Reynolds number per foot of 2×10^6.

Shown in figures 2 and 3 are some selected characteristics of the wing geometry. Figure 2 shows the characteristics of the planform. The gradual sweepback variation of the planform was found to produce a smooth thrust and thrust-factor variation, such that at an angle of attack of 6° the theoretical separation point ($K_T < 1.0$) was located at 23 percent of the semispan. The baseline airfoil shape selected for the investigation was a 4-percent-thick NACA 65A004 airfoil. Two additional leading-edge geometries (airfoil shape forward of 0.25c) were defined to investigate the effect of airfoil bluntness on leading-edge flow characteristics. The three leading-edge shapes and their theoretical thrust characteristics are shown in figure 3. The baseline leading edge had a constant value of $0.001r_{le}/c$ across the entire wing; this geometry corresponds to the NACA 65A004 airfoil section. The second leading-edge geometry shape (varying r_{le}/c) varied spanwise from a value of r_{le}/c of 0.001 at the wing apex to a maximum value of 0.004 at 30 percent span and gradually decreased to a value of 0.00225 at the tip. The third leading-edge geometry (sharp r_{le}/c) varied spanwise from a value of r_{le}/c of 0.001 at the wing apex to less than or equal to 0.0001 at 20 percent span, where it remained sharp out to the wing tip.

Theoretical thrust-factor characteristics for the three shapes are shown at the left of figure 3 for angles of attack of 2° and 6°. Separation locations (assumed to be where K_T breaks away from 1.0) are distinctly different for each leading edge.

Theoretical sectional thrust-factor characteristics are shown at the right of figure 3. The full theoretical section thrust c_t distribution is independent of leading-edge radius and is shown for angles of attack of 2°, 4°, and 6°. Also presented in this figure is the maximum attainable section thrust coefficient $\bar{c}_t$, which is the maximum level of theoretical thrust available. The point at which the curves for c_t and $\bar{c}_t$ cross corresponds to the theoretical separation point ($K_T < 1.0$). The area bounded to the left by the curve for c_t and above by the curve for $\bar{c}_t$ represents the maximum total wing thrust achievable with attached leading-edge flow. The potential for producing leading-edge thrust and maintaining attached flow is essentially zero for the sharp leading edge and is increasingly greater for $0.001r_{le}/c$ and varying r_{le}/c.

The wind-tunnel model consisted of a wing with a minimum fuselage to house the balance. Details of the wind-tunnel model are presented in figure 4. From figure 4, it can be seen that the wing consists of a fixed portion at the center line to provide attachment support for the three interchangeable leading edges. All leading edges fair smoothly into the basic airfoil shape at 0.25c. The model was instrumented for measuring both forces and upper surface pressures; 29 pressure orifices were located on the left-side upper surface in chordwise rows at locations depicted in figure 5. A photograph of the model installed in the wind tunnel is shown in figure 6. Tables I, II, and III contain a listing of the wave drag input geometry (ref. 17) of the three wings tested. A detailed description of the test conditions and a tabulation of the data are presented in the appendix.

DISCUSSION OF RESULTS

The method of reference 14 was used to develop a wing planform and a series of wing leading edges to demonstrate the effects of leading-edge geometry on leading-edge thrust. Experimental data were obtained from which the axial-force variation with angle of attack, Mach number, and leading-edge radius for these wings was derived. An analysis of these data was performed to evaluate the effectiveness of the method of reference 14 for prediction of leading-edge thrust effects.

For the purpose of this paper, changes in axial force are attributed totally to leading-edge thrust; therefore, a decrease in incremental axial force ΔC_A corresponds to an increase in leading-edge thrust. The theoretical axial-force predictions in figure 7 show that increasing both leading-edge bluntness and angle of attack produces an increasing amount of leading-edge thrust, and increasing Mach number reduces both the thrust levels and increments in thrust due to bluntness. At the lower angles of attack, the experimental thrust forces increase with decreasing bluntness; this effect becomes more pronounced with increasing Mach number. However, as angle of attack is increased, the axial forces merge and cross over and produce a thrust force which increases with increasing bluntness. Also, the crossover point of the thrust forces occurs at a higher angle of attack with increasing Mach number.

Comparing theory with experiment reveals that large differences exist between predicted and measured thrust levels for both the sharp r_{le}/c and varying r_{le}/c geometries. The sharp r_{le}/c produced thrust levels higher than those predicted by theory and the varying r_{le}/c produced thrust levels lower than those predicted by theory. However, experimental thrust forces for the $0.001r_{le}/c$ geometry agree well with theoretical predictions over the Mach number range. This agreement between measured and predicted thrust for the $0.001r_{le}/c$ geometry (NACA 65A004 airfoil) is probably a result of the methodology of reference 14 employed in estimating the attainable leading-edge thrust. The method employs an empirical relationship, derived from existing wind-tunnel data of standard NACA airfoil sections, for estimating the level of thrust associated with a given standard airfoil section. And as a result, for nonstandard airfoil sections, such as the sharp r_{le}/c and varying r_{le}/c geometries, the attainable thrust empirical relationships of reference 14 may not be applicable and should be used with caution.

It was first thought that perhaps these unexpected experimental axial-force results were due to the leading edge affecting portions of the wing behind the leading edge ($x/c = 0.25$); however, a close examination of pressures aft of the leading edge on each wing indicated this was not true. Typical experimental chordwise pressures for two spanwise locations are presented in figures 8(a) and 8(b) for Mach numbers of 1.80 and 2.36, respectively. For both Mach numbers, the chordwise pressures nearest the leading edge vary with leading-edge bluntness and they converge to essentially the same pressure level at the 40-percent-chord station. These results do not contradict the assumption that the change in axial force can be used as a measure of the leading-edge thrust. Further insight can be obtained by correlating the change in axial force with the measured pressures nearest the leading edge ($x/c = 0.02$). This correlation rests on the hypothesis that a wing which exhibits a larger decrease in axial force (increase in thrust) would also exhibit a larger incremental decrease in leading-edge pressures. Typical incremental variations of leading-edge pressure with angle of attack are shown in figure 9. The pressure data are presented for the 60-percent-spanwise location for each of the three leading-edge geometries at Mach numbers of 1.80 and 2.36. In the low-angle-of-attack range ($\alpha < 4°$), the slopes of the curves for $C_p - C_{p,0}$ versus α indicate that the varying r_{le}/c wing should develop less thrust than the other two wings and this observation is more pronounced at the higher Mach number of 2.36; the axial force data of figure 7 reflect this situation exactly. From $\alpha = 0°$ to $4°$, at $M = 1.80$, slopes of the curves for $C_p - C_{p,0}$ versus α exhibit large differences, but between $\alpha = 4°$ and $8°$, they all become similar; the axial-force data of figure 7(b) reflect this leading-edge pressure behavior as a gradual merging of the axial forces. Unfortunately, the leading-edge pressures at $M = 2.36$ were not measured above $\alpha = 12°$ where the axial forces of figure 7(e) merge; thus, further relationships between axial force and leading-edge behavior could not be established.

Another objective of this leading-edge-thrust study was to experimentally and theoretically examine wing leading-edge separation. Leading-edge-separation characteristics were extracted from the experimental pressure data by using the procedure illustrated in figure 10. First, the leading-edge pressures ($x/c = 0.02$) were plotted against angle of attack (upper portion of fig. 10), and departures from linearity were noted. The first procedure failed to provide an exact angle of attack at which nonlinearity occurred; therefore, a second procedure was employed in which the pressures at the first three chordwise stations (x/c = 0.02, 0.10, and 0.20) were plotted against angle of attack (lower portion of fig. 10), and the angle of attack at which these three pressures converged was noted. This latter approach is based upon the assumption that the loss of a pressure gradient indicates the departure from attached leading-edge flow conditions. As shown in figure 10, both of these criteria are subjective and can only be used to locate, within several degrees, the angle of attack at which leading-edge separation α_{sep} occurs. Experimental and theoretical separation results are presented in figure 11 and indicate that flow over the leading edge of the sharp wing has begun separating across its entire span at about an angle of attack of 1°, whereas the other leading edges have an orderly development of separation beginning outboard and moving inboard with increasing angle of attack.

Experimental and theoretical zero-lift drag results are shown in figure 12. Theoretical results were obtained by using the method of reference 18 to calculate the skin friction drag; the method of reference 4 was used to calculate the near-field wave drag. Experimental results show that the zero-lift drag for the varying r_{le}/c wing is consistently higher than the $0.001r_{le}/c$, with the sharp wing zero-lift drag being bracketed by $0.001r_{le}/c$ and varying r_{le}/c geometries over the Mach number range. Comparing theoretical zero-lift drag predictions with the experimental data reveals that the method of reference 4 overpredicts the drag level by approximately 15 percent and incorrectly predicts the effect of leading-edge bluntness. The trends in experimental and theoretical results indicate that the zero-lift drag of this complex-planform, uncambered wing at supersonic speeds is not very sensitive to leading-edge bluntness effects.

SUMMARY OF RESULTS

An experimental and theoretical investigation was conducted to assess the attainable leading-edge-thrust concept and the application of the concept as a wing design tool. Force and pressure data were obtained on a complex-planform, wing model with three different leading-edge radii distributions. The results of this investigation are as follows:

1. For the sharp and varying leading-edge radii geometries, large differences exist between the theoretically predicted and experimentally measured leading-edge-thrust levels and trends.

2. Results indicate that the method of NASA Technical Paper 1500 can be used for estimating the leading-edge thrust of wings which employ standard NACA airfoils sections.

3. The assumption that axial force can be used as a measure of leading-edge thrust is not contradicted by pressure data obtained aft of the leading edge.

4. Leading-edge-separation characteristics can be predicted with acceptable accuracy using the method of NASA Technical Paper 1500.

5. Experimentally measured zero-lift drag levels are not significantly affected by changes in leading-edge bluntness on this complex-planform wing.

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APPENDIX

TEST DESCRIPTION

The wind-tunnel test program was conducted in test section 1 of the Unitary Plan Wind Tunnel (ref. 19) at Mach numbers of 1.60, 1.80, 2.00, 2.16, and 2.36 and a stagnation pressure of 1777 lb/ft^2. The Reynolds number per foot for the test was 2×10^6 and the stagnation temperature was held constant at 125°. The dew point was maintained sufficiently low to prevent condensation effects in the tunnel. Strips of No. 60 sand grit to induce boundary-layer transition were applied at appropriate distances aft of the wing leading edge.

Wind-tunnel data were obtained with two separate entries. Pressure data were obtained first with pressure tubes which exited from the lower-surface aft portion of the balance housing and ran to an external pressure transducer scanning valve. Following the pressure data entry, force and moment data were collected on a clean model.

Pressure data were obtained at angles of attack from -8° to 8° in order to assess leading-edge separation characteristics. The data were measured by means of a pressure transducer scanning valve which was mounted external to the model.

Force and moment data were obtained at angles of attack from -4° to 16°. The data were measured by means of a six-component electrical strain-gage balance which was contained within the model and connected through a supporting sting to the permanent model actuating system in the wind tunnel.

Balance chamber pressure was measured throughout the test and the force data were corrected to free-stream conditions. All angles of attack have been adjusted for tunnel flow misalignment and sting deflections.

Table AI gives the headings which appear on the tabulated data and their corresponding symbols. Table AII contains the tabulated force data. Pressure data have only been tabulated for orifice locations forward of $0.50x/c$ at each span station due to leakage of the remaining ports. Table AIII contains the revised pressure orifice numbering scheme and table AIV contains the tabulated pressure data.

TABLE AI.- SYMBOLS FOR TABULATED DATA

Headings	Symbol
ALPHA	α
CA	C_A
CD	C_D
CL	C_L
CM	C_m
CN	C_N
CP1 to CP23	C_p (for revised pressure-orifice location)
MACH	M

APPENDIX

TABLE AII.- TABULATED FORCE DATA

Leading-edge-thrust wing; varying r_{le}/c

MACH	ALPHA	CN	CA	CM	CL	CD
1.60000	-4.14484	-.15501	.00862	.01210	-.15398	.01980
1.60000	-3.14707	-.11623	.00921	.00954	-.11555	.01558
1.60000	-2.09129	-.07445	.00982	.00556	-.07405	.01253
1.60000	-1.14606	-.04019	.01025	.00257	-.03998	.01105
1.60000	-.15296	-.00465	.01051	-.00020	-.00462	.01053
1.60000	.84708	.03297	.01038	-.00313	.03281	.01087
1.60000	1.82358	.07069	.01004	-.00634	.07034	.01228
1.60000	2.85128	.11006	.00944	-.00988	.10945	.01491
1.60000	3.84574	.14927	.00889	-.01287	.14834	.01889
1.60000	4.84976	.18711	.00848	-.01511	.18572	.02427
1.60000	5.84977	.22384	.00810	-.01670	.22184	.03087
1.60000	6.88205	.26356	.00763	-.01855	.26075	.03916
1.60000	7.86757	.29942	.00721	-.01970	.29562	.04813
1.60000	8.88606	.33947	.00685	-.02031	.33433	.05921
1.60000	9.86538	.37269	.00653	-.02074	.36606	.07029
1.60000	10.88305	.40909	.00604	-.02069	.40059	.08316
1.60000	11.84353	.44263	.00563	-.02086	.43206	.09635
1.60000	12.83108	.47591	.00527	-.02097	.46286	.11083
1.60000	13.83290	.51141	.00492	-.02142	.49540	.12705
1.60000	14.86537	.54770	.00458	-.02166	.52820	.14493
1.60000	15.86235	.58165	.00421	-.02172	.55835	.16303
1.60000	-.17131	-.00465	.01051	-.00026	-.00462	.01053

MACH	ALPHA	CN	CA	CM	CL	CD
1.80000	-4.23594	-.14805	.00858	.01055	-.14702	.01950
1.80000	-3.19992	-.11224	.00901	.00839	-.11156	.01527
1.80000	-2.19613	-.07682	.00946	.00544	-.07640	.01240
1.80000	-1.20405	-.04112	.00978	.00248	-.04090	.01065
1.80000	-.20427	-.00726	.00999	.00026	-.00723	.01002
1.80000	.79933	.02652	.00995	-.00235	.02638	.01031
1.80000	1.76395	.06118	.00971	-.00496	.06085	.01159
1.80000	2.81481	.09949	.00929	-.00824	.09892	.01416
1.80000	3.79733	.13419	.00885	-.01062	.13331	.01771
1.80000	4.78491	.16811	.00848	-.01175	.16682	.02247
1.80000	5.81896	.20391	.00817	-.01319	.20204	.02880
1.80000	6.79713	.23691	.00789	-.01426	.23431	.03588
1.80000	7.77582	.26928	.00759	-.01523	.26578	.04395
1.80000	8.81688	.30364	.00725	-.01567	.29894	.05371
1.80000	9.82170	.33635	.00696	-.01625	.33023	.06424
1.80000	10.82555	.36856	.00665	-.01631	.36075	.07575
1.80000	11.81384	.40002	.00637	-.01663	.39025	.08813
1.80000	12.79474	.43005	.00605	-.01686	.41804	.10114
1.80000	13.78664	.46113	.00576	-.01687	.44647	.11548
1.80000	14.83824	.49392	.00546	-.01682	.47605	.13177
1.80000	15.82142	.52352	.00514	-.01704	.50229	.14768
1.80000	-.19324	-.00616	.01001	0.00000	-.00613	.01003

TABLE AII.- Continued

Leading-edge-thrust wing; varying r_{le}/c

MACH	ALPHA	CN	CA	CM	CL	CD
2.00000	-4.41151	-.13678	.00854	.00857	-.13572	.01904
2.00000	-3.38933	-.10465	.00886	.00693	-.10394	.01503
2.00000	-2.40512	-.07238	.00915	.00464	-.07193	.01218
2.00000	-1.40838	-.03873	.00935	.00210	-.03849	.01029
2.00000	-.42562	-.00715	.00947	-.00008	-.00708	.00952
2.00000	.57831	.02511	.00948	-.00228	.02501	.00973
2.00000	1.59116	.05931	.00933	-.00475	.05902	.01097
2.00000	2.59390	.09351	.00909	-.00699	.09300	.01331
2.00000	3.59241	.12556	.00881	-.00884	.12476	.01666
2.00000	4.60057	.15777	.00855	-.01006	.15658	.02118
2.00000	5.59907	.18838	.00831	-.01076	.18667	.02665
2.00000	6.60349	.21944	.00806	-.01121	.21706	.03325
2.00000	7.57565	.24804	.00785	-.01160	.24484	.04048
2.00000	8.59432	.27917	.00757	-.01200	.27490	.04921
2.00000	9.59273	.30790	.00737	-.01202	.30237	.05858
2.00000	10.59201	.33647	.00718	-.01196	.32942	.06891
2.00000	11.60013	.36475	.00695	-.01197	.35591	.08015
2.00000	12.59533	.39339	.00674	-.01203	.38245	.09236
2.00000	13.62614	.42237	.00650	-.01195	.40895	.10582
2.00000	14.58550	.44916	.00624	-.01184	.43311	.11915
2.00000	15.61105	.47776	.00600	-.01168	.45852	.13435
2.00000	-.38025	-.00437	.00949	-.00031	-.00431	.00952

MACH	ALPHA	CN	CA	CM	CL	CD
2.16000	-4.17105	-.12953	.00855	.00726	-.12857	.01795
2.16000	-3.22112	-.10062	.00878	.00614	-.09997	.01442
2.16000	-2.20326	-.06929	.00898	.00432	-.06890	.01163
2.16000	-1.19548	-.03738	.00911	.00213	-.03718	.00989
2.16000	-.18790	-.00591	.00919	.00007	-.00588	.00921
2.16000	.80327	.02527	.00922	-.00191	.02514	.00957
2.16000	1.83358	.05796	.00916	-.00423	.05763	.01101
2.16000	2.78854	.08834	.00903	-.00610	.08780	.01331
2.16000	3.80557	.11900	.00884	-.00756	.11815	.01672
2.16000	4.78411	.14822	.00864	-.00830	.14699	.02097
2.16000	5.78117	.17772	.00843	-.00903	.17596	.02629
2.16000	6.77904	.20619	.00825	-.00942	.20377	.03253
2.16000	7.79586	.23533	.00801	-.00972	.23207	.03986
2.16000	8.81066	.26343	.00781	-.00967	.25912	.04807
2.16000	9.79227	.28981	.00765	-.00976	.28429	.05683
2.16000	10.79387	.31700	.00750	-.00964	.30998	.06673
2.16000	11.78679	.34327	.00730	-.00950	.33454	.07726
2.16000	12.80817	.37127	.00712	-.00942	.36046	.08925
2.16000	13.81200	.39727	.00692	-.00908	.38413	.10156
2.16000	14.82186	.42409	.00671	-.00911	.40826	.11497
2.16000	15.81866	.45053	.00650	-.00874	.43170	.12906
2.16000	-.18761	-.00501	.00920	.00005	-.00498	.00921

TABLE AII.- Continued

Leading-edge-thrust wing; varying r_{le}/c

MACH	ALPHA	CN	CA	CM	CL	CD
2.36000	-4.25353	-.12107	.00844	.00619	-.12011	.01740
2.36000	-3.28305	-.09351	.00866	.00478	-.09286	.01400
2.36000	-2.26038	-.06562	.00874	.00365	-.06522	.01132
2.36000	-1.25537	-.03330	.00888	.00191	-.03310	.00960
2.36000	-.24135	-.00305	.00887	.00033	-.00301	.00889
2.36000	.70155	.02303	.00893	-.00176	.02292	.00921
2.36000	1.75644	.05695	.00891	-.00365	.05665	.01065
2.36000	2.69290	.07656	.00887	-.00531	.07606	.01245
2.36000	3.74609	.11476	.00876	-.00610	.11394	.01624
2.36000	4.71269	.13901	.00859	-.00726	.13784	.01999
2.36000	5.76728	.17134	.00840	-.00770	.16963	.02557
2.36000	6.75164	.19497	.00827	-.00826	.19264	.03114
2.36000	7.72628	.21827	.00809	-.00874	.21520	.03736
2.36000	8.76205	.24764	.00801	-.00877	.24353	.04564
2.36000	9.71704	.27059	.00789	-.00845	.26538	.05344
2.36000	10.74474	.29791	.00774	-.00859	.29124	.06314
2.36000	11.72877	.32291	.00756	-.00832	.31463	.07304
2.36000	12.72638	.34923	.00742	-.00823	.33902	.08417
2.36000	13.76833	.37665	.00719	-.00763	.36412	.09662
2.36000	14.77003	.39784	.00708	-.00797	.38289	.10827
2.36000	15.72112	.42508	.00686	-.00785	.40732	.12178
2.36000	-.26184	-.00946	.00893	.00004	-.00942	.00898

TABLE AII.- Continued

Leading-edge-thrust wing; $0.001 r_{le}/c$

MACH	ALPHA	CN	CA	CM	CL	CD
1.60000	-4.14649	-.15263	.00812	.01266	-.15165	.01914
1.60000	-3.13541	-.11392	.00877	.00956	-.11327	.01499
1.60000	-2.13778	-.07547	.00946	.00582	-.07506	.01227
1.60000	-1.14841	-.03976	.00998	.00266	-.03956	.01078
1.60000	-.14163	-.00316	.01026	-.00049	-.00313	.01027
1.60000	.88097	.03407	.01005	-.00375	.03391	.01057
1.60000	1.83549	.06983	.00960	-.00675	.06948	.01183
1.60000	2.86909	.10935	.00898	-.01048	.10877	.01444
1.60000	3.87535	.14803	.00834	-.01361	.14713	.01832
1.60000	4.84619	.18677	.00795	-.01559	.18543	.02370
1.60000	5.84903	.22452	.00763	-.01779	.22257	.03047
1.60000	6.86474	.26282	.00724	-.01949	.26008	.03860
1.60000	7.85990	.30036	.00682	-.02023	.29660	.04783
1.60000	8.82963	.33519	.00656	-.02103	.33021	.05793
1.60000	9.85301	.37363	.00618	-.02127	.36706	.07002
1.60000	10.83294	.40751	.00590	-.02106	.39914	.08239
1.60000	11.88253	.44500	.00559	-.02120	.43431	.09710
1.60000	12.86687	.47864	.00534	-.02087	.46543	.11179
1.60000	13.84133	.51254	.00508	-.02135	.49644	.12755
1.60000	14.88472	.54998	.00485	-.02130	.53028	.14596
1.60000	15.85551	.58369	.00464	-.02125	.56022	.16394
1.60000	-.14210	-.00238	.01024	-.00036	-.00236	.01025

MACH	ALPHA	CN	CA	CM	CL	CD
1.80000	-4.19486	-.14565	.00799	.01068	-.14467	.01862
1.80000	-3.17347	-.10917	.00855	.00807	-.10853	.01458
1.80000	-2.20757	-.07606	.00902	.00489	-.07566	.01195
1.80000	-1.19511	-.03995	.00947	.00224	-.03974	.01030
1.80000	-.19435	-.00513	.00971	-.00035	-.00510	.00973
1.80000	.78784	.02607	.00955	-.00288	.02593	.00990
1.80000	1.81017	.06185	.00921	-.00541	.06152	.01116
1.80000	2.80070	.09799	.00873	-.00879	.09745	.01351
1.80000	3.79348	.13285	.00822	-.01144	.13202	.01699
1.80000	4.79018	.16665	.00784	-.01312	.16541	.02173
1.80000	5.80397	.20262	.00758	-.01429	.20081	.02803
1.80000	6.79708	.23530	.00731	-.01540	.23278	.03511
1.80000	7.81193	.27044	.00704	-.01605	.26697	.04374
1.80000	8.81996	.30338	.00678	-.01657	.29875	.05321
1.80000	9.81436	.33676	.00651	-.01686	.33072	.06381
1.80000	10.80600	.36879	.00633	-.01689	.36106	.07536
1.80000	11.82024	.40060	.00615	-.01731	.39085	.08808
1.80000	12.82408	.43200	.00592	-.01734	.41991	.10166
1.80000	13.80052	.46279	.00571	-.01726	.44806	.11594
1.80000	14.79897	.49334	.00554	-.01693	.47556	.13137
1.80000	15.81693	.52501	.00531	-.01685	.50369	.14821
1.80000	-.19349	-.00566	.00970	-.00033	-.00563	.00972

TABLE AII.- Continued

Leading-edge-thrust wing; $0.001r_{le}/c$

MACH	ALPHA	CN	CA	CM	CL	CD
2.00000	-4.31341	-.13603	.00788	.00886	-.13505	.01809
2.00000	-3.30645	-.10346	.00826	.00693	-.10282	.01421
2.00000	-2.29719	-.07125	.00866	.00452	-.07085	.01150
2.00000	-1.31774	-.03921	.00867	.00218	-.03900	.00977
2.00000	-.31097	-.00692	.00913	-.00033	-.00687	.00917
2.00000	.68160	.02502	.00894	-.00244	.02491	.00924
2.00000	1.71014	.05840	.00875	-.00487	.05811	.01049
2.00000	2.68435	.09033	.00849	-.00722	.08983	.01271
2.00000	3.71117	.12536	.00811	-.00932	.12459	.01621
2.00000	4.69643	.15570	.00780	-.01067	.15454	.02052
2.00000	5.69026	.18749	.00758	-.01147	.18582	.02613
2.00000	6.70129	.21882	.00740	-.01180	.21646	.03289
2.00000	7.71669	.24749	.00721	-.01238	.24428	.04037
2.00000	8.74188	.27929	.00700	-.01254	.27499	.04936
2.00000	9.70205	.30720	.00684	-.01263	.30165	.05852
2.00000	10.68618	.33605	.00672	-.01231	.32898	.06892
2.00000	11.69110	.36423	.00658	-.01230	.35534	.08025
2.00000	12.70326	.39315	.00643	-.01215	.38212	.09272
2.00000	13.71723	.42243	.00629	-.01208	.40889	.10628
2.00000	14.68500	.44906	.00615	-.01199	.43284	.11979
2.00000	15.68546	.47654	.00600	-.01192	.45717	.13461
2.00000	-.30143	-.00621	.00914	-.00021	-.00617	.00917

MACH	ALPHA	CN	CA	CM	CL	CD
2.16000	-4.27386	-.12906	.00786	.00694	-.12812	.01746
2.16000	-3.24025	-.09756	.00817	.00553	-.09694	.01368
2.16000	-2.23350	-.06655	.00841	.00357	-.06617	.01100
2.16000	-1.24810	-.03652	.00859	.00171	-.03633	.00938
2.16000	-.24034	-.00501	.00885	-.00047	-.00498	.00887
2.16000	.74138	.02528	.00867	-.00259	.02516	.00899
2.16000	1.74424	.05632	.00850	-.00452	.05604	.01021
2.16000	2.76543	.08851	.00836	-.00649	.08801	.01262
2.16000	3.73651	.11832	.00813	-.00811	.11754	.01582
2.16000	4.73507	.14889	.00787	-.00913	.14773	.02013
2.16000	5.72769	.17772	.00767	-.00983	.17606	.02537
2.16000	6.73771	.20699	.00750	-.01039	.20468	.03173
2.16000	7.73197	.23499	.00732	-.01039	.23187	.03887
2.16000	8.73585	.26292	.00718	-.01052	.25878	.04703
2.16000	9.76297	.29199	.00705	-.01026	.28657	.05647
2.16000	10.74596	.31848	.00695	-.01015	.31160	.06621
2.16000	11.74778	.34523	.00685	-.00979	.33660	.07700
2.16000	12.75991	.37222	.00672	-.00955	.36154	.08877
2.16000	13.74351	.39812	.00662	-.00938	.38515	.10101
2.16000	14.75334	.42481	.00651	-.00933	.40915	.11448
2.16000	15.75127	.45133	.00639	-.00899	.43265	.12867
2.16000	-.24309	-.00436	.00888	-.00050	-.00432	.00890

TABLE AII.- Continued

Leading-edge-thrust wing; $0.001 r_{le}/c$

MACH	ALPHA	CN	CA	CM	CL	CD
2.36000	-4.28560	-.11719	.00788	.00577	-.11627	.01661
2.36000	-3.28378	-.09353	.00806	.00447	-.09291	.01341
2.36000	-2.32790	-.06543	.00822	.00275	-.06504	.01087
2.36000	-1.28556	-.03622	.00833	.00129	-.03603	.00914
2.36000	-.25667	.00019	.00855	-.00020	.00023	.00855
2.36000	.73345	.02618	.00842	-.00212	.02607	.00875
2.36000	1.71872	.05430	.00830	-.00427	.05403	.00992
2.36000	2.67464	.07913	.00822	-.00583	.07866	.01191
2.36000	3.66779	.11044	.00805	-.00707	.10970	.01509
2.36000	4.71865	.13994	.00781	-.00794	.13882	.01930
2.36000	5.69095	.16601	.00763	-.00852	.16443	.02405
2.36000	6.71632	.19625	.00752	-.00893	.19402	.03042
2.36000	7.65775	.22097	.00734	-.00913	.21802	.03672
2.36000	8.69834	.24906	.00724	-.00902	.24510	.04482
2.36000	9.68626	.27138	.00720	-.00965	.26630	.05276
2.36000	10.68781	.29625	.00715	-.00889	.28978	.06197
2.36000	11.70571	.32420	.00708	-.00865	.31602	.07271
2.36000	12.68449	.34577	.00699	-.00923	.33579	.08274
2.36000	13.72561	.37638	.00684	-.00839	.36401	.09595
2.36000	14.70679	.40022	.00681	-.00840	.38538	.10820
2.36000	15.71465	.42418	.00673	-.00821	.40650	.12136
2.36000	-.28032	-.00192	.00859	-.00016	-.00187	.00859

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TABLE AII.- Continued

Leading-edge-thrust wing; sharp r_{le}/c

MACH	ALPHA	CN	CA	CM	CL	CD
1.60000	-4.14845	-.15424	.00808	.01276	-.15325	.01921
1.60000	-3.12761	-.11566	.00871	.00955	-.11501	.01501
1.60000	-2.15142	-.07748	.00953	.00602	-.07707	.01243
1.60000	-1.12230	-.03918	.01011	.00284	-.03897	.01087
1.60000	-.11991	-.00356	.01033	-.00054	-.00354	.01033
1.60000	.85364	.03167	.01020	-.00381	.03152	.01067
1.60000	1.87987	.06986	.00974	-.00702	.06950	.01202
1.60000	2.83935	.10664	.00901	-.01017	.10626	.01429
1.60000	3.84463	.14658	.00837	-.01319	.14569	.01818
1.60000	4.89834	.18890	.00810	-.01555	.18751	.02420
1.60000	5.85042	.22357	.00777	-.01727	.22162	.03052
1.60000	6.88807	.26301	.00732	-.01875	.26024	.03881
1.60000	7.87791	.30072	.00702	-.01990	.29692	.04817
1.60000	8.86552	.33741	.00685	-.02014	.33233	.05877
1.60000	9.86679	.37193	.00668	-.02031	.36529	.07032
1.60000	10.88827	.40962	.00645	-.02049	.40103	.08371
1.60000	11.85423	.44366	.00625	-.02020	.43291	.09725
1.60000	12.87913	.47997	.00604	-.02069	.46655	.11287
1.60000	13.88956	.51620	.00591	-.02021	.49969	.12965
1.60000	14.86599	.54981	.00574	-.02043	.52994	.14660
1.60000	15.85260	.58447	.00559	-.02046	.56071	.16503
1.60000	-.11525	-.00153	.01030	-.00049	-.00151	.01031

MACH	ALPHA	CN	CA	CM	CL	CD
1.80000	-4.18361	-.14250	.00783	.01060	-.14155	.01820
1.80000	-6.19911	-.21278	.00729	.01323	-.21075	.03022
1.80000	-3.19006	-.10666	.00843	.00801	-.10603	.01436
1.80000	-2.21737	-.07209	.00909	.00522	-.07169	.01188
1.80000	-1.19028	-.03675	.00962	.00218	-.03655	.01038
1.80000	-.19884	-.00482	.00980	-.00053	-.00479	.00982
1.80000	.78083	.02874	.00969	-.00297	.02861	.01008
1.80000	1.82230	.06448	.00928	-.00581	.06415	.01132
1.80000	2.81618	.09974	.00868	-.00887	.09919	.01357
1.80000	3.77933	.13471	.00811	-.01149	.13388	.01697
1.80000	4.80134	.16983	.00780	-.01310	.16858	.02199
1.80000	5.80215	.20499	.00761	-.01416	.20317	.02829
1.80000	6.82842	.24063	.00726	-.01521	.23806	.03582
1.80000	7.81466	.27280	.00709	-.01596	.26930	.04411
1.80000	8.78798	.30450	.00696	-.01654	.29987	.05340
1.80000	9.77724	.33812	.00686	-.01649	.33204	.06418
1.80000	10.82213	.37105	.00672	-.01698	.36319	.07627
1.80000	11.79407	.40328	.00659	-.01694	.39342	.08888
1.80000	12.78911	.43520	.00642	-.01675	.42298	.10260
1.80000	13.77106	.46414	.00624	-.01683	.44931	.11654
1.80000	14.80070	.49692	.00616	-.01653	.47886	.13290
1.80000	15.78831	.52738	.00606	-.01652	.50584	.14933
1.80000	-.17747	-.00366	.00984	-.00052	-.00363	.00985

TABLE AII.- Continued

Leading-edge-thrust wing; sharp r_{le}/c

MACH	ALPHA	CN	CA	CM	CL	CD
2.00000	-4.33496	-.13901	.00779	.00894	-.13803	.01827
2.00000	-3.34601	-.10605	.00829	.00717	-.10539	.01446
2.00000	-2.33822	-.07280	.00883	.00476	-.07238	.01179
2.00000	-1.34124	-.04074	.00929	.00246	-.04052	.01024
2.00000	-.34986	-.00896	.00951	.00012	-.00890	.00957
2.00000	.67282	.02298	.00943	-.00245	.02287	.00970
2.00000	1.67222	.05517	.00916	-.00470	.05488	.01076
2.00000	2.63101	.08730	.00868	-.00721	.08681	.01267
2.00000	3.63495	.12063	.00821	-.00931	.11986	.01584
2.00000	4.65944	.15546	.00784	-.01093	.15431	.02044
2.00000	5.63085	.18527	.00765	-.01168	.18362	.02579
2.00000	6.64414	.21671	.00747	-.01196	.21439	.03249
2.00000	7.66558	.24866	.00729	-.01228	.24547	.04039
2.00000	8.66666	.27831	.00720	-.01238	.27405	.04906
2.00000	9.63648	.30729	.00711	-.01227	.30176	.05845
2.00000	10.63258	.33642	.00704	-.01233	.32935	.06899
2.00000	11.63462	.36583	.00693	-.01178	.35692	.08057
2.00000	12.61779	.39413	.00683	-.01168	.38312	.09276
2.00000	13.61531	.42244	.00677	-.01143	.40897	.10602
2.00000	14.65557	.45248	.00670	-.01111	.43606	.12096
2.00000	15.63676	.48002	.00662	-.01083	.46047	.13576
2.00000	-.36172	-.01006	.00954	-.00002	-.01000	.00960

MACH	ALPHA	CN	CA	CM	CL	CD
2.16000	-4.14311	-.12293	.00771	.00717	-.12205	.01657
2.16000	-3.13920	-.09223	.00815	.00555	-.09165	.01319
2.16000	-2.13553	-.06120	.00866	.00371	-.06084	.01094
2.16000	-.12478	-.00044	.00912	-.00056	-.00042	.00912
2.16000	.85873	.02913	.00896	-.00287	.02899	.00939
2.16000	1.87210	.05959	.00875	-.00474	.05928	.01069
2.16000	2.86845	.09129	.00831	-.00692	.09076	.01287
2.16000	3.84283	.12200	.00793	-.00843	.12119	.01609
2.16000	4.84062	.15220	.00763	-.00962	.15101	.02045
2.16000	5.87833	.18323	.00745	-.01055	.18150	.02618
2.16000	6.85069	.21149	.00730	-.01092	.20910	.03248
2.16000	7.86014	.23987	.00718	-.01089	.23664	.03991
2.16000	8.83586	.26669	.00712	-.01072	.26243	.04800
2.16000	9.84154	.29571	.00709	-.01066	.29014	.05753
2.16000	10.84804	.32250	.00702	-.01057	.31542	.06759
2.16000	11.83167	.34931	.00696	-.01042	.34046	.07843
2.16000	12.84855	.37703	.00690	-.00990	.36605	.09057
2.16000	13.88997	.40517	.00687	-.00958	.39167	.10393
2.16000	14.85487	.43069	.00683	-.00939	.41454	.11702
2.16000	15.84396	.45728	.00679	-.00939	.43805	.13137
2.16000	-.17405	-.00175	.00915	-.00054	-.00172	.00915
2.16000	-1.16012	-.03106	.00903	.00161	-.03087	.00965

TABLE AII.- Concluded

Leading-edge-thrust wing; sharp r_{le}/c

MACH	ALPHA	CN	CA	CM	CL	CD
2.36000	-4.25009	-.12003	.00770	.00526	-.11913	.01657
2.36000	-3.20583	-.08689	.00806	.00427	-.08630	.01291
2.36000	-2.23713	-.06212	.00846	.00293	-.06174	.01088
2.36000	-1.22822	-.02791	.00878	.00151	-.02772	.00938
2.36000	-.26589	-.00434	.00890	-.00047	-.00430	.00892
2.36000	.77542	.02620	.00879	-.00239	.02607	.00914
2.36000	1.71886	.05046	.00859	-.00407	.05018	.01010
2.36000	2.80408	.08824	.00815	-.00565	.08774	.01245
2.36000	3.73950	.11102	.00788	-.00696	.11027	.01510
2.36000	4.78311	.14606	.00758	-.00800	.14492	.01974
2.36000	5.76133	.17275	.00741	-.00844	.17113	.02471
2.36000	6.69382	.19337	.00730	-.00968	.19120	.02979
2.36000	7.73558	.22333	.00718	-.00982	.22033	.03718
2.36000	8.73450	.25132	.00715	-.00956	.24732	.04523
2.36000	9.73221	.27726	.00711	-.00972	.27207	.05388
2.36000	10.69899	.30281	.00713	-.00928	.29622	.06323
2.36000	11.66413	.32209	.00716	-.00930	.31399	.07213
2.36000	12.74490	.35063	.00710	-.00926	.34043	.08427
2.36000	13.70978	.37566	.00705	-.00851	.36328	.09588
2.36000	14.70480	.40285	.00709	-.00831	.38786	.10912
2.36000	15.69638	.42894	.00706	-.00825	.41103	.12284
2.36000	16.72036	.45336	.00696	-.00780	.43219	.13710
2.36000	17.75723	.48048	.00702	-.00792	.45545	.15322
2.36000	-.24063	-.00137	.00896	-.00046	-.00133	.00897

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TABLE AIII.- REVISED PRESSURE ORIFICE NUMBERING SCHEME

Original orifice number	Revised orifice number	$\frac{y}{b/2}$	x/c
1	1	0.0	0.02
2	2	.0	.10
3	3	.1	.02
4	4	.1	.10
6	5	.2	.02
7	6	.3	.02
8	7	.3	.10
9	8	.3	.20
12	9	.4	.02
13	10	.5	.02
14	11	.5	.10
15	12	.5	.20
16	13	.5	.40
18	14	.6	.02
19	15	.7	.02
20	16	.7	.10
21	17	.7	.20
22	18	.7	.40
24	19	.8	.02
25	20	.9	.02
26	21	.9	.10
27	22	.9	.20
28	23	.9	.40

TABLE AIV.- TABULATED PRESSURE DATA

Leading-edge-thrust wing; varying r_{le}/c; M = 1.60

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.16732	.36590	.20788	.30480	.18432	.18753	.15176	.15176	.13904	.14811	.19309	.17856	.16027
-6.14500	.30189	.16293	.25033	.13880	.16338	.13488	.11525	.09884	.14077	.17757	.13845	.11591
-4.15862	.25455	.12792	.20354	.10846	.13585	.11803	.08359	.06961	.12666	.15320	.10388	.08167
-8.13790	.37032	.20920	.30690	.18095	.18361	.14509	.14230	.12893	.14452	.19790	.18079	.15941
-6.14587	.31018	.16581	.25924	.14423	.16556	.13785	.11607	.10143	.14214	.18428	.14644	.12324
-4.13387	.24991	.12508	.20124	.10588	.13370	.11482	.08041	.06698	.12692	.15014	.10372	.08051
-2.13542	.19997	.08628	.14760	.07147	.08956	.07280	.04519	.03404	.08395	.08422	.05665	.04403
-.14464	.15197	.05158	.09736	.03741	.03590	.00157	.00749	.00340	-.00044	-.02687	-.00499	.00281
.85601	.12629	.03298	.06738	.02025	.00104	-.04899	-.01409	-.01396	-.06424	-.10420	-.04652	-.02029
1.84530	.09935	.01644	.04031	.00715	-.03989	-.10234	-.05965	-.02777	-.12349	-.17100	-.14109	-.03552
2.84818	.07387	.00261	.00841	-.00699	-.08582	-.14610	-.13379	-.03987	-.17816	-.20617	-.18938	-.11086
3.84470	.04823	-.00854	-.02486	-.02335	-.13261	-.17671	-.18087	-.06115	-.20317	-.20960	-.20532	-.20374
4.84132	.02068	-.02784	-.05972	-.04319	-.17979	-.21035	-.21889	-.13151	-.22083	-.22949	-.22962	-.24332
5.84952	.00654	-.03589	-.08425	-.05399	-.20821	-.23949	-.25393	-.21963	-.23955	-.25235	-.25473	-.26502
7.84841	-.03165	-.06380	-.14615	-.08097	-.28512	-.28216	-.29110	-.34854	-.27405	-.28342	-.28553	-.29608
-.13248	.14935	.04966	.09396	.03486	.03303	-.00263	.00405	.00052	-.00446	-.02771	-.00465	.00287

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.16732	.10771	.20240	.22709	.19817	.17466	.11609	.23991	.21930	.21098	.17704	.13432
-6.14500	.06308	.18585	.20700	.15171	.13030	.06931	.22298	.21502	.16842	.13447	.07799
-4.15862	.02890	.16241	.17408	.10759	.08757	.02632	.19052	.19198	.11780	.09049	.02473
-8.13790	.10673	.19864	.22314	.18905	.16554	.10886	.23147	.21482	.20603	.17619	.13390
-6.14587	.07104	.18849	.20978	.15679	.13366	.07309	.22619	.21848	.17024	.13774	.08001
-4.13387	.02965	.16095	.17706	.10823	.08695	.02733	.19072	.19417	.11871	.09132	.02528
-2.13542	-.00509	.10524	.11172	.05236	.03973	-.01745	.12620	.13546	.05467	.03986	-.02968
-.14464	-.03949	-.02026	-.03315	-.03546	-.01669	-.06256	-.02991	-.01860	-.06276	-.03744	-.08404
.85601	-.05753	-.11647	-.14039	-.10130	-.04310	-.08594	-.13519	-.11673	-.16202	-.16136	-.10605
1.84530	-.07144	-.19002	-.21537	-.18110	-.11072	-.10373	-.21299	-.20322	-.24059	-.24561	-.14136
2.84818	-.08918	-.23354	-.25264	-.23149	-.22514	-.14510	-.28582	-.28860	-.31002	-.31834	-.24193
3.84470	-.13178	-.22896	-.24772	-.24542	-.25602	-.22428	-.32956	-.35234	-.33930	-.34648	-.32772
4.84132	-.22179	-.24424	-.26519	-.26695	-.27739	-.27113	-.31067	-.35068	-.32967	-.33528	-.33384
5.84952	-.28178	-.26416	-.28389	-.28818	-.29656	-.29452	-.30943	-.33463	-.32876	-.33061	-.33047
7.84841	-.35078	-.29601	-.31506	-.32138	-.32896	-.32534	-.33463	-.35302	-.35104	-.35097	-.34669
-.13248	-.03925	-.02317	-.03588	-.03687	-.01809	-.06284	-.03055	-.01934	-.06805	-.03885	-.08492

TABLE AIV.- Continued

Leading-edge-thrust wing; varying r_{le}/c; M = 1.80

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.20751	.34408	.19701	.29289	.17738	.18988	.15270	.14298	.12821	.15339	.19197	.16958	.15553
-6.17729	.28999	.15690	.24254	.13926	.16283	.13655	.10637	.09313	.14058	.17449	.13632	.12218
-6.19297	.29053	.15647	.24257	.13816	.16201	.13577	.10763	.09353	.13992	.17311	.13490	.12090
-4.19800	.23982	.11804	.20007	.10198	.12900	.10998	.07375	.06122	.12157	.13211	.09077	.08357
-2.20191	.19158	.08167	.15282	.06718	.08810	.06459	.03806	.02999	.08003	.07336	.04010	.04749
-.19104	.14283	.04688	.10224	.03664	.03614	-.00389	.00032	.00359	.00214	-.02820	-.01634	.00034
.80582	.11713	.02969	.07322	.01947	.00134	-.05078	-.02851	-.01057	-.05297	-.10023	-.06438	-.02437
1.80436	.09565	.01536	.04884	.00504	-.03522	-.10167	-.07015	-.02321	-.10551	-.15337	-.12383	-.05216
2.79655	.07338	-.00090	.01948	-.01078	-.07984	-.14029	-.12350	-.03015	-.15608	-.18236	-.16172	-.13008
3.80004	.05408	-.01194	-.00515	-.02408	-.12442	-.16479	-.15687	-.05501	-.18302	-.19186	-.18237	-.18362
4.79258	.03378	-.02659	-.03257	-.03881	-.16655	-.19393	-.19381	-.14256	-.20029	-.20658	-.20296	-.20737
5.80557	.01334	-.04318	-.05929	-.05513	-.20415	-.22140	-.22215	-.22429	-.21850	-.22689	-.22550	-.22808
7.81715	-.02219	-.06443	-.10503	-.07832	-.24325	-.25444	-.25481	-.28442	-.24708	-.25395	-.25356	-.25678
-.18656	.14245	.04760	.10080	.03591	.03598	-.00423	.00049	.00300	.00030	-.02921	-.01656	-.00180

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.20751	.10512	.20899	.22589	.19005	.16911	.11566	.24430	.24443	.21953	.19170	.13069
-6.17729	.07304	.19701	.20672	.15540	.13434	.07938	.22542	.23334	.18063	.15336	.08744
-6.19297	.07173	.19568	.20552	.15562	.13305	.07774	.22532	.23053	.17925	.15305	.08632
-4.19800	.03709	.16136	.16975	.10900	.09189	.03920	.18910	.20191	.13000	.10893	.03894
-2.20191	.00520	.09824	.10345	.05290	.04756	.00110	.12774	.14483	.07112	.06195	-.00516
-.19104	-.02833	-.01779	-.02939	-.02761	-.00612	-.04079	-.00427	.01966	-.03460	-.01357	-.05154
.80582	-.04539	-.09364	-.11809	-.09186	-.04915	-.06022	-.08955	-.05614	-.13194	-.11302	-.07024
1.80436	-.05888	-.14928	-.17288	-.16510	-.14552	-.07530	-.14163	-.11961	-.20288	-.20084	-.11769
2.79655	-.07899	-.19739	-.21717	-.21228	-.21036	-.11274	-.19136	-.17846	-.26072	-.25344	-.23577
3.80004	-.12736	-.22019	-.24167	-.22236	-.23073	-.16748	-.23712	-.23073	-.28324	-.28015	-.27507
4.79258	-.18537	-.22409	-.23799	-.22831	-.23423	-.21902	-.27091	-.27651	-.28119	-.28547	-.29087
5.80557	-.22603	-.23686	-.24889	-.24704	-.24955	-.24928	-.28099	-.30762	-.27888	-.28364	-.29051
7.81715	-.27936	-.25830	-.26890	-.27107	-.27443	-.27522	-.28470	-.30214	-.29161	-.29503	-.29878
-.18656	-.02914	-.02044	-.03131	-.02795	-.00602	-.04199	-.00786	.01427	-.03797	-.01649	-.05226

TABLE AIV.- Continued

Leading-edge-thrust wing; varying r_{le}/c; M = 2.00

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.29611	.31985	.17848	.27264	.16210	.18257	.15225	.13600	.12122	.16031	.18793	.15805	.14476
-6.30504	.26531	.13662	.22683	.12497	.15148	.13060	.10307	.08553	.14488	.16689	.12359	.11226
-4.31340	.21653	.10492	.18859	.09252	.12314	.10492	.07245	.05928	.12135	.13089	.08478	.07378
-2.29252	.17248	.07035	.14157	.06071	.08255	.06384	.03803	.02826	.07846	.07195	.03760	.03117
-.30875	.12869	.03884	.09557	.03144	.03240	-.00283	-.00168	.00004	.00617	-.02190	-.02043	-.00972
.68878	.10882	.02696	.07424	.01695	.00278	-.04220	-.02791	-.01125	-.04207	-.08322	-.05963	-.02547
1.69579	.08812	.01245	.05252	.00280	-.03255	-.09154	-.06834	-.02341	-.08968	-.12456	-.10915	-.07043
2.70376	.06982	.00001	.02849	-.01021	-.06738	-.12448	-.10807	-.02478	-.13292	-.15870	-.14118	-.13235
3.68540	.05367	-.01209	.00664	-.02356	-.10391	-.14858	-.13616	-.07078	-.16681	-.18309	-.16613	-.16820
4.70957	.03643	-.02633	-.01325	-.03947	-.14311	-.17672	-.16868	-.14942	-.18820	-.19320	-.18175	-.18403
5.69331	.01967	-.03698	-.03302	-.05301	-.17449	-.20189	-.19314	-.20240	-.20445	-.20721	-.20024	-.20104
7.71580	-.01394	-.06247	-.07816	-.07854	-.21443	-.23005	-.22463	-.23853	-.23056	-.23055	-.22808	-.22821
-.30700	.12784	.03803	.09489	.03064	.03197	-.00283	-.00085	-.00060	.00539	-.02449	-.02281	-.01162

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.29611	.10010	.21473	.22849	.18122	.16316	.10863	.24353	.24051	.20606	.18182	.12884
-6.30504	.06896	.19116	.20711	.14799	.13030	.07687	.22206	.22796	.17406	.14471	.09249
-4.31340	.03913	.15080	.16535	.10308	.09168	.04107	.18257	.19732	.12922	.10147	.05367
-2.29252	.00545	.08474	.08682	.04396	.04677	.00465	.11032	.13396	.06646	.05260	.01175
-.30875	-.02538	-.01146	-.02009	-.03683	-.01608	-.03081	.00340	.03025	-.04433	-.02009	-.02639
.68878	-.04034	-.06861	-.07967	-.08978	-.06540	-.05099	-.04671	-.01247	-.11671	-.09836	-.04617
1.69579	-.05515	-.10701	-.11538	-.14332	-.13495	-.06413	-.08128	-.05435	-.18191	-.16101	-.13515
2.70376	-.07316	-.14172	-.14794	-.17609	-.17562	-.12011	-.11704	-.09878	-.21629	-.20117	-.18425
3.68540	-.11839	-.18101	-.18637	-.19623	-.19911	-.16613	-.15969	-.14876	-.24423	-.23075	-.21667
4.70957	-.16088	-.20518	-.21615	-.20250	-.20504	-.19019	-.19460	-.19005	-.24540	-.23710	-.23268
5.69331	-.19241	-.22294	-.23285	-.21303	-.21437	-.21444	-.22589	-.22575	-.23928	-.24002	-.24283
7.71580	-.23323	-.23577	-.24052	-.23309	-.23390	-.23570	-.25644	-.27055	-.24574	-.24861	-.25095
-.30700	-.02676	-.01390	-.02140	-.03822	-.01598	-.03313	.00023	.02884	-.04586	-.02228	-.02877

TABLE AIV.- Continued

Leading-edge-thrust wing; varying r_{le}/c; M = 2.16

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.25046	.32941	.18625	.28369	.17052	.18959	.16079	.13904	.12480	.15582	.19759	.16033	.14910
-6.25177	.27238	.14449	.23775	.13073	.15857	.13705	.10575	.09316	.13960	.16882	.12265	.11150
-4.23871	.22099	.10482	.19292	.09471	.12642	.10521	.07173	.06332	.11350	.12934	.08493	.07241
-2.23707	.17412	.06963	.14687	.06127	.08682	.05924	.04003	.03402	.07218	.07092	.04038	.03359
-.23407	.13171	.04098	.10369	.03255	.03477	-.00096	.00100	.00969	.00551	-.01851	-.02118	.00061
.75403	.11155	.02625	.08225	.01813	.00485	-.03944	-.02668	-.00365	-.03937	-.06691	-.05978	-.02035
1.77553	.09247	.01318	.06039	.00490	-.02633	-.08091	-.06461	-.01421	-.08065	-.10427	-.09694	-.07921
2.75640	.07414	-.00023	.03986	-.01126	-.05951	-.11168	-.09386	-.03659	-.11769	-.13349	-.12248	-.12254
3.77068	.05636	-.01370	.01996	-.02422	-.09049	-.13813	-.12434	-.09454	-.15061	-.16058	-.14447	-.14838
4.75986	.04049	-.02579	-.00065	-.03617	-.12244	-.16527	-.14967	-.15385	-.17376	-.18000	-.16273	-.16533
5.75598	.02419	-.03691	-.01969	-.04904	-.14960	-.18847	-.17086	-.18592	-.19088	-.19500	-.17940	-.18035
7.74588	-.00686	-.05774	-.06146	-.07437	-.18938	-.21769	-.20073	-.21136	-.21716	-.21844	-.20768	-.20782
-.24729	.13051	.04001	.10280	.03198	.03387	-.00291	-.00122	.00898	.00388	-.01869	-.02123	.00014

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.25046	.10630	.21669	.23696	.18574	.16684	.11411	.24737	.25292	.21430	.18663	.12733
-6.25177	.07449	.18996	.20248	.14426	.12791	.07873	.21903	.23046	.17511	.14447	.08919
-4.23871	.04265	.14898	.15391	.09718	.08774	.04326	.17334	.19270	.12702	.10307	.05161
-2.23707	.00964	.08718	.08190	.03812	.03860	.00505	.10255	.12149	.05774	.05363	.01390
-.23407	-.02289	-.00159	-.01255	-.03687	-.01673	-.02782	.01437	.04445	-.04961	-.02789	-.02570
.75403	-.03825	-.04696	-.05690	-.08666	-.06479	-.04360	-.02083	.01415	-.10943	-.08879	-.07137
1.77553	-.05532	-.07798	-.08661	-.13514	-.11967	-.07914	-.05183	-.02274	-.14753	-.13705	-.13076
2.75640	-.07226	-.10722	-.11187	-.15607	-.15128	-.14088	-.07931	-.05762	-.17276	-.16448	-.15955
3.77068	-.11191	-.13960	-.14228	-.16853	-.16963	-.16565	-.11287	-.09772	-.19493	-.18725	-.18183
4.75986	-.14978	-.16725	-.17143	-.17945	-.18157	-.18068	-.14649	-.13690	-.21371	-.20686	-.20089
5.75598	-.17488	-.19055	-.19650	-.19123	-.19267	-.19281	-.17618	-.17200	-.22785	-.22073	-.21382
7.74588	-.20754	-.22509	-.22776	-.21227	-.21323	-.21563	-.22194	-.22331	-.22317	-.22639	-.22399
-.24729	-.02308	-.00157	-.01205	-.03801	-.01746	-.02794	.01425	.04494	-.05068	-.02835	-.02547

TABLE AIV.- Continued

Leading-edge-thrust wing; varying r_{le}/c; M = 2.36

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.23864	.31205	.17600	.28164	.16922	.19536	.16929	.14308	.12798	.17600	.20471	.15796	.14185
-6.24176	.26153	.14339	.23808	.13187	.16237	.13844	.10543	.09459	.15254	.17166	.12534	.10758
-4.25420	.21895	.10725	.19924	.09769	.13116	.10738	.07703	.06714	.12255	.13000	.08304	.07130
-2.24357	.17391	.07227	.15122	.06428	.08819	.06395	.04126	.03693	.07695	.07160	.03654	.03654
-.24445	.13133	.04037	.10798	.03272	.04260	.00416	-.00301	.00829	.01323	-.01043	-.02039	-.00524
0.74922	.11161	.02750	.08829	.01883	.01178	-.03051	-.02461	-.00333	-.02373	-.04868	-.05450	-.03292
1.77344	.09453	.01207	.06889	.00537	-.01615	-.06905	-.06181	-.02020	-.05822	-.07450	-.08210	-.07905
2.74539	.07668	-.00109	.05155	-.00882	-.04113	-.09411	-.08348	-.05888	-.08415	-.09919	-.10529	-.10812
3.76718	.05838	-.01480	.03160	-.02244	-.06972	-.12037	-.10975	-.10184	-.11401	-.12562	-.12619	-.13031
4.75510	.04022	-.02662	.01431	-.03777	-.09671	-.14431	-.13350	-.13540	-.13710	-.14777	-.14378	-.14677
5.73723	.02749	-.03464	-.00053	-.04580	-.11470	-.15653	-.14753	-.15274	-.15206	-.16212	-.15572	-.15601
7.74902	-.00232	-.05519	-.04353	-.07058	-.15029	-.18324	-.17463	-.17964	-.17917	-.18846	-.17888	-.17859
-.25246	.13145	.04141	.11204	.03403	.04269	.00941	.00014	.00839	.01049	-.00816	-.01739	-.00148

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.23864	.10972	.22756	.23948	.18563	.16917	.11951	.25409	.26757	.21961	.18889	.13462
-6.24176	.07888	.19433	.20150	.13905	.12683	.08698	.22026	.23901	.18012	.14886	.09806
-4.25420	.04362	.14850	.14850	.09051	.08610	.05053	.16793	.18870	.12438	.10930	.05978
-2.24357	.00944	.08827	.08203	.03654	.04087	.01419	.10005	.12482	.05499	.05698	.02540
-.24445	-.02188	.01310	.00521	-.03774	-.01975	-.01861	.03657	.06701	-.03995	-.02473	-.02772
0.74922	-.03349	-.01865	-.02554	-.07664	-.05670	-.04151	.00974	.04381	-.07671	-.06777	-.06514
1.77344	-.04615	-.04323	-.04934	-.11714	-.10150	-.09148	-.01609	.01675	-.10257	-.09674	-.10001
2.74539	-.06925	-.06720	-.07174	-.13848	-.12529	-.12011	-.03890	-.01166	-.12515	-.11912	-.12018
3.76718	-.10764	-.09477	-.09690	-.15583	-.14460	-.14339	-.06791	-.04495	-.14602	-.14126	-.14118
4.75510	-.13681	-.12314	-.12343	-.16692	-.15845	-.15944	-.09588	-.08122	-.16528	-.16087	-.15909
5.73723	-.15203	-.13866	-.14221	-.16809	-.16340	-.16617	-.11925	-.10915	-.17712	-.17364	-.17016
7.74902	-.17725	-.17412	-.17646	-.18115	-.17994	-.18214	-.16333	-.16127	-.19855	-.19741	-.18804
-.25246	-.01924	.01231	.00542	-.03118	-.01526	-.01746	.03284	.06702	-.04233	-.02634	-.02634

TABLE AIV.- Continued

Leading-edge-thrust wing; $0.001 r_{le}/c$; M = 1.60

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.15045	.36159	.20103	.26264	.17335	.18243	.15304	.15582	.13501	.14258	.19568	.18656	.15682
-6.15627	.30048	.16438	.22029	.13752	.16299	.13815	.12416	.10045	.13185	.18584	.15731	.12309
-4.15689	.24354	.12289	.17294	.10366	.13279	.11873	.08929	.06546	.11904	.15872	.11678	.08256
-2.14842	.18983	.08282	.12023	.06827	.09333	.08502	.05453	.03268	.08527	.10574	.06917	.04243
-.14670	.13919	.04707	.07165	.03346	.04127	.02294	.01248	-.00239	.01286	.00970	.00732	-.00206
.84597	.11604	.03092	.04678	.01820	.00983	-.01788	-.00673	-.01838	-.03746	-.06081	-.03077	-.02417
1.84425	.09136	.01533	.02056	.00468	-.02411	-.06511	-.02782	-.03576	-.10203	-.13249	-.09399	-.04626
2.83949	.06649	.00240	-.00956	-.00881	-.06182	-.10143	-.06220	-.04948	-.14600	-.19492	-.18891	-.06912
3.86577	.03847	-.01171	-.04388	-.02462	-.10010	-.15154	-.12780	-.06308	-.19284	-.23144	-.24358	-.15830
4.85588	.01921	-.02478	-.07816	-.03959	-.13381	-.19595	-.21353	-.08774	-.22387	-.24348	-.25095	-.24665
5.81914	.00123	-.03794	-.11061	-.05614	-.18662	-.23738	-.23826	-.16301	-.24582	-.25942	-.26524	-.27363
7.85187	-.03658	-.06388	-.16069	-.08250	-.27946	-.28217	-.30199	-.34237	-.28349	-.28764	-.28936	-.30249
-.14690	.14008	.04568	.07038	.02934	.03990	.02236	.01319	-.00234	.01369	.00976	.00640	-.00178

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.15045	.10507	.21088	.23150	.20751	.16832	.11512	.24168	.22820	.20533		.13396
-6.15627	.07004	.19608	.21068	.16523	.12626	.07149	.23044	.22555	.16873		.08312
-4.15689	.03157	.17035	.18237	.12127	.08058	.02635	.20166	.20377	.12041		.03005
-2.14842	-.00576	.12205	.13136	.06732	.03213	-.01817	.14674	.15110	.05550		-.02233
-.14670	-.04162	.01307	.00587	-.01586	-.03112	-.06732	.00613	.01049	-.04664		-.08040
.84597	-.05837	-.07791	-.09891	-.06616	-.05976	-.09085	-.11891	-.13489	-.11363		-.10491
1.84425	-.07597	-.15461	-.18808	-.16286	-.08251	-.11367	-.22598	-.28772	-.23523		-.12608
2.83949	-.09143	-.22297	-.24039	-.24389	-.18713	-.13525	-.28983	-.33292	-.31286		-.18106
3.86577	-.10669	-.24946	-.26550	-.26946	-.26662	-.21236	-.30576	-.34774	-.34622		-.26728
4.85588	-.18883	-.25346	-.27329	-.27725	-.28571	-.26873	-.29761	-.33310	-.33521		-.30091
5.81914	-.27825	-.26795	-.28803	-.29153	-.29906	-.29549	-.30560	-.33440	-.33652		-.31340
7.85187	-.35957	-.29794	-.32004	-.32374	-.33317	-.32875	-.33225	-.35514	-.35541		-.32532
-.14690	-.04187	.01002	.00317	-.01569	-.03020	-.06705	.00442	.01002	-.04694		-.08096

TABLE AIV.- Continued

Leading-edge-thrust wing; 0.001r_{le}/c; M = 1.80

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.18597	.33541	.19432	.25581	.17131	.18401	.14949	.14679	.12623	.14623	.19505	.18246	.15733
-6.19605	.28128	.15388	.21229	.13740	.15721	.13407	.11476	.09193	.13262	.17903	.14698	.12272
-4.18832	.23053	.11447	.17017	.09964	.12673	.11378	.08178	.05903	.11781	.14465	.10152	.08451
-2.17063	.18134	.07758	.12537	.06475	.08745	.07758	.04588	.02677	.08217	.09455	.05048	.04474
-.19993	.13512	.04426	.07714	.03401	.04155	.02150	.00754	-.00183	.01458	.00957	-.00606	-.00316
.78425	.11140	.02919	.05100	.01844	.00983	-.01607	-.01211	-.01682	-.03248	-.05466	-.03699	-.02770
1.79941	.08896	.01290	.02120	.00373	-.02418	-.06177	-.03568	-.03285	-.09212	-.12744	-.08446	-.05262
3.80209	.04967	-.01392	-.03887	-.02586	-.09661	-.13564	-.15612	-.05577	-.16944	-.19634	-.19944	-.16062
4.78519	.03003	-.02810	-.06160	-.03948	-.11928	-.17678	-.19614	-.07046	-.19589	-.21440	-.21473	-.21446
5.77982	.01267	-.04161	-.08032	-.05336	-.15502	-.21207	-.22005	-.16137	-.22193	-.23094	-.23200	-.23463
7.81276	-.02497	-.06600	-.11483	-.07983	-.23481	-.25818	-.26956	-.27723	-.25498	-.26003	-.25825	-.26207
-.18708	.13403	.04381	.07623	.02804	.03954	.02000	.00731	-.00212	.01422	.00701	-.00814	-.00373

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.18597	.10833	.22078	.22777	.20092	.16426	.11822	.24722	.25474	.21998		.13557
-6.19605	.07326	.20231	.20647	.16492	.12634	.07787	.23153	.23931	.17910		.09139
-4.18832	.03802	.17267	.17801	.12302	.08524	.03961	.20254	.21065	.13278		.04640
-2.17063	.00338	.11619	.12476	.06981	.03914	-.00110	.15069	.15827	.07331		.00259
-.19993	-.02960	.01108	.01451	-.00290	-.01411	-.04391	.02757	.04122	-.01180		-.04378
.78425	-.04543	-.06461	-.07971	-.05327	-.04754	-.06342	-.08478	-.07654	-.07252		-.06843
1.79941	-.06251	-.15301	-.18762	-.12935	-.09204	-.08295	-.20779	-.21530	-.17509		-.10338
3.80209	-.10163	-.22125	-.24518	-.24116	-.24215	-.16273	-.29303	-.32427	-.29586		-.23648
4.78519	-.16779	-.22619	-.24340	-.24478	-.24768	-.21664	-.27451	-.32408	-.29817		-.26528
5.77982	-.22330	-.23509	-.24894	-.25078	-.25513	-.24762	-.26291	-.29092	-.28809		-.26218
7.81276	-.28369	-.26122	-.27255	-.27453	-.27769	-.27769	-.27868	-.29615	-.29549		-.27453
-.18708	-.03022	.00972	.01156	-.00544	-.01487	-.04439	.02652	.04102	-.01269		-.04584

TABLE AIV.- Continued

Leading-edge-thrust wing; $0.001 r_{le}/c$; M = 2.00

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.30772	.29821	.16747	.23184	.14621	.16879	.13912	.13366	.11114	.14514	.18259	.16384	.14009
-6.29692	.25853	.13742	.20120	.12605	.14891	.13154	.11296	.08647	.14163	.17197	.13459	.11362
-4.34344	.21046	.10367	.16246	.09180	.11893	.11242	.08235	.05752	.12097	.14368	.09580	.07545
-2.32256	.16742	.06863	.11704	.06180	.08268	.07808	.04749	.02520	.08504	.09906	.05305	.03249
-.30502	.12492	.03747	.06753	.03051	.03606	.02425	.01053	-.00422	.01940	.01598	-.00284	-.01208
.70199	.10390	.02523	.04126	.01623	.00799	-.01231	-.01033	-.01927	-.02827	-.04442	-.03343	-.03611
1.67582	.08495	.01235	.01860	.00271	-.02089	-.05362	-.03301	-.03270	-.08022	-.11226	-.07290	-.05911
2.70139	.06772	-.00090	-.00288	-.00957	-.05376	-.09094	-.07200	-.04343	-.11033	-.14837	-.13339	-.10669
3.72406	.05060	-.01402	-.02059	-.02359	-.08637	-.11661	-.13052	-.04860	-.14723	-.17273	-.17166	-.17039
4.69062	.03495	-.02626	-.03449	-.03710	-.10978	-.15059	-.16258	-.07006	-.17412	-.19267	-.19280	-.19662
5.72088	.01853	-.03877	-.04935	-.05177	-.13916	-.18576	-.19391	-.17441	-.19774	-.20989	-.20909	-.21370
7.72480	-.01381	-.06161	-.08449	-.07518	-.19563	-.22986	-.23629	-.23113	-.22954	-.23382	-.23369	-.23496
-.31777	.12403	.03733	.06704	.02089	.03561	.02369	.00980	-.00499	.01796	.01399	-.00366	-.01295

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.30772	.09674	.21581	.22035	.18430	.15266	.10470	.24016	.24029	.20029		.13351
-6.29692	.07008	.19729	.20975	.15931	.12501	.07678	.23105	.23534	.17445		.10384
-4.34344	.03969	.16317	.17837	.12011	.08750	.04257	.20013	.20817	.13237		.06601
-2.32256	.00825	.10985	.12163	.06497	.04113	.00503	.14387	.15820	.07710		.02693
-.30502	-.02560	.01451	.01899	-.00759	-.01978	-.03304	.03071	.04953	-.00558		-.01696
.70199	-.04341	-.05875	-.06076	-.05219	-.05406	-.05982	-.05774	-.04080	-.06062		-.05205
1.67582	-.06012	-.13749	-.14546	-.11052	-.09472	-.08348	-.14184	-.13221	-.13515		-.09372
2.70139	-.07564	-.18464	-.19882	-.17106	-.15466	-.11786	-.19842	-.19381	-.18651		-.14965
3.72406	-.10092	-.19796	-.23617	-.20532	-.19716	-.17761	-.23751	-.23631	-.22326		-.18163
4.69062	-.14952	-.20284	-.23013	-.21622	-.21903	-.20003	-.26231	-.26438	-.25013		-.20324
5.72088	-.19337	-.21116	-.22407	-.22179	-.22373	-.21658	-.24961	-.28579	-.25938		-.21363
7.72480	-.23482	-.23248	-.23944	-.23843	-.23877	-.24265	-.24211	-.25455	-.24967		-.22085
-.31777	-.02693	.01225	.01720	-.00908	-.02098	-.03422	.02830	.04775	-.00741		-.01931

TABLE AIV.- Continued

Leading-edge-thrust wing; $0.001 r_{le}/c$; $M = 2.16$

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.27087	.31720	.18245	.25440	.15686	.18200	.15471	.14439	.12213	.14877	.19753	.17096	.14898
-6.21116	.26428	.14094	.20875	.12815	.15197	.13409	.11098	.09003	.13611	.17471	.13280	.11164
-4.27113	.21737	.10312	.16765	.09516	.12217	.11095	.08139	.06155	.11532	.14536	.09730	.07416
-2.22035	.17055	.06897	.11953	.06258	.08437	.07504	.04862	.03113	.08052	.09837	.05285	.03512
-.22903	.12834	.03956	.06970	.03518	.03675	.02455	.01216	.00296	.01946	.01905	.00297	-.00593
.75925	.10872	.02576	.04944	.01917	.01154	-.00842	-.00744	-.01188	-.02440	-.03437	-.02678	-.03041
1.76613	.09126	.01214	.03112	.00653	-.01695	-.04747	-.02856	-.02888	-.07558	-.09842	-.06455	-.05401
2.73117	.07406	.00004	.01517	-.00727	-.04711	-.08377	-.05944	-.04203	-.10588	-.13729	-.11088	-.09836
3.76107	.05688	-.01349	.00001	-.02046	-.07642	-.10538	-.10597	-.04355	-.13486	-.15359	-.14484	-.14675
4.73625	.04117	-.02521	-.01517	-.03258	-.10275	-.13223	-.14233	-.10008	-.15557	-.16922	-.16594	-.16922
5.77198	.02438	-.03612	-.03130	-.04558	-.12551	-.16118	-.16528	-.16959	-.17448	-.18495	-.18304	-.18447
7.77349	-.00497	-.05837	-.06730	-.06925	-.16946	-.20467	-.20695	-.20291	-.20649	-.20991	-.20855	-.21046
-.24247	.12743	.03938	.07001	.01630	.03670	.02458	.01181	.00255	.01819	.01774	.00242	-.00571

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.27087	.10706	.22246	.23602	.19418	.16000	.11343	.25150	.25725	.21260		.13679
-6.21116	.07397	.19622	.20670	.15561	.12212	.07794	.22841	.23574	.17437		.09821
-4.27113	.04390	.16213	.17178	.11195	.08237	.04335	.19485	.20547	.13173		.06437
-2.22035	.01034	.10967	.11624	.05936	.03663	.00583	.13363	.14937	.07421		.02917
-.22903	-.02571	.02083	.02227	-.00449	-.01983	-.03571	.03445	.05204	.00269		-.02003
.75925	-.04231	-.04361	-.04580	-.04546	-.04950	-.05990	-.03834	-.02219	-.04484		-.05148
1.76613	-.05941	-.11210	-.11237	-.09862	-.08713	-.08521	-.10410	-.08986	-.10273		-.09014
2.73117	-.07263	-.15632	-.15214	-.14701	-.13230	-.12395	-.14749	-.13894	-.14119		-.12566
3.76107	-.09482	-.18507	-.18897	-.17850	-.16611	-.15941	-.18445	-.18130	-.17426		-.15024
4.73625	-.14199	-.19126	-.21370	-.18825	-.18435	-.18558	-.21035	-.20994	-.20015		-.16936
5.77198	-.17572	-.19528	-.21525	-.19665	-.19774	-.19870	-.23030	-.23256	-.22175		-.18427
7.77349	-.20670	-.21169	-.21723	-.21422	-.21463	-.21395	-.22469	-.24719	-.22783		-.19090
-.24247	-.02548	.01959	.02178	-.00435	-.02021	-.03614	.03340	.05084	.00277		-.02226

TABLE AIV.- Continued

Leading-edge-thrust wing; $0.001 r_{le}/c$; M = 2.36

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.39014	.30908	.17587	.25632	.16537	.19063	.16219	.14973	.12738	.16984	.20614	.16876	.14594
-6.31397	.25298	.14021	.21092	.13107	.15796	.14245	.11576	.09361	.15206	.17298	.13253	.10367
-4.36580	.21266	.10561	.16889	.09992	.12546	.11699	.08542	.06422	.12729	.14793	.09837	.07142
-2.38329	.17047	.07286	.12299	.06724	.08716	.08018	.05106	.03168	.08851	.09882	.05928	.03852
-.36212	.13069	.04022	.07929	.03676	.04306	.03453	.01652	.00487	.02952	.02625	.00713	-.00402
.68546	.11308	.02596	.06308	.02210	.01729	-.00446	-.00392	-.00839	-.01232	-.02100	-.02150	-.02548
1.64872	.09244	.01163	.04916	.00818	-.00706	-.03626	-.02386	-.02684	-.05719	-.08257	-.06053	-.05548
2.65435	.07599	-.00087	.03218	-.00480	-.03819	-.07448	-.05363	-.04611	-.09805	-.11942	-.09518	-.09148
3.66376	.06126	-.01180	.01813	-.01769	-.06414	-.09847	-.08845	-.06719	-.11621	-.14323	-.12027	-.11977
4.66872	.04490	-.02482	.00153	-.02977	-.09271	-.11914	-.11704	-.11460	-.13750	-.15793	-.14128	-.14185
5.64632	.02815	-.03586	-.01405	-.04210	-.11018	-.13762	-.14155	-.14371	-.15455	-.17020	-.15882	-.15946
7.63047	-.00005	-.05507	-.04903	-.06354	-.14288	-.17073	-.17317	-.17513	-.18157	-.18994	-.18347	-.18247
-.34437	.12919	.04013	.07914	.01731	.04142	.02943	.01297	.00444	.02956	.02237	.00594	-.00216

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.39014	.11283	.23379	.24083	.19506	.16407	.11922	.26080	.27174	.22156		.14587
-6.31397	.07624	.20248	.21065	.15563	.12351	.08406	.23261	.24555	.17760		.10901
-4.36580	.04596	.16783	.17466	.11422	.08422	.05016	.19343	.21178	.13548		.07732
-2.38329	.01300	.11517	.11787	.06241	.03909	.00987	.13778	.15555	.08360		.03746
-.36212	-.02343	.03236	.03556	.00813	-.00729	-.02684	.04288	.07081	.02092		-.00864
.68546	-.03849	-.02185	-.02086	-.03636	-.03756	-.04887	-.00479	.01433	-.01837		-.03636
1.64872	-.05391	-.07283	-.06934	-.07510	-.07212	-.07624	-.05868	-.04126	-.06330		-.06621
2.65435	-.06909	-.11515	-.10826	-.11202	-.10939	-.11131	-.09653	-.08309	-.09482		-.09063
3.66376	-.09660	-.14302	-.13598	-.13875	-.13619	-.13676	-.13001	-.12205	-.12446		-.11060
4.66872	-.13232	-.16625	-.16156	-.15935	-.15508	-.15544	-.15416	-.14982	-.14605		-.12564
5.64632	-.15470	-.18115	-.17994	-.17433	-.16814	-.16636	-.17433	-.17276	-.16558		-.13955
7.63047	-.17927	-.19791	-.20360	-.18517	-.18169	-.18254	-.19990	-.20424	-.19556		-.15367
-.34437	-.02243	.02529	.03062	.00345	-.01013	-.02713	.04407	.06903	.02052		-.01041

TABLE AIV.- Continued

Leading-edge-thrust wing; sharp r_{le}/c; $M = 1.60$

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.11000	.35680	.19760	.26670	.16910	.18960	.16090	.15920	.13810	.16300	.19480	.18900	.16220
-6.15000	.30160	.15950	.22240	.13230	.16830	.14620	.13020	.10300	.15010	.18390	.15820	.12580
-4.12000	.24670	.11980	.17290	.09790	.14500	.12880	.09640	.06760	.13490	.16350	.12200	.08530
-2.11000	.19300	.08110	.12210	.06390	.11490	.10160	.06280	.03330	.10540	.12540	.07780	.04640
-.10000	.14210	.04470	.07420	.03090	.08110	.06070	.02410	-.00330	.05410	.05620	.01610	.00110
.86000	.11860	.02840	.04880	.01640	.06010	.02660	.00300	-.02040	.01300	-.00500	-.02000	-.02320
1.85000	.09220	.01320	.02150	.00380	.04660	-.05090	-.01760	-.03800	-.08700	-.13310	-.05400	-.05070
2.85000	.06830	.00050	-.00590	-.00810	-.07830	-.10990	-.04180	-.05460	-.15660	-.20430	-.11550	-.07730
3.88000	.04460	-.01250	-.03850	-.02390	-.16210	-.14840	-.11640	-.07040	-.18560	-.21880	-.20970	-.15960
4.83000	.02380	-.02500	-.06940	-.03710	-.19900	-.18420	-.18990	-.11730	-.20920	-.23250	-.23720	-.23190
5.88000	.00290	-.03870	-.10240	-.05400	-.24090	-.22280	-.24250	-.21920	-.24040	-.25680	-.25860	-.26550
7.84000	-.04050	-.07160	-.15960	-.09010	-.32820	-.28410	-.30040	-.33880	-.28850	-.29740	-.29540	-.30550
2.37000	.07990	.00530	.00670	-.00210	-.00370	-.08670	-.02850	-.04730	-.12970	-.17570	-.07580	-.06390

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.11000	.10640	.21540	.24070	.21550	.17260	.11130	.23840	.23440	.20130	.17120	.12540
-6.15000	.07030	.20130	.22430	.17850	.13160	.06850	.22620	.22080	.17240	.13020	.07500
-4.12000	.03070	.17950	.19870	.13280	.08520	.02450	.20750	.20110	.13360	.08480	.02060
-2.11000	-.00610	.14490	.15730	.07900	.03500	-.02110	.16860	.15550	.08110	.02860	-.03500
-.10000	-.04150	.06710	.06740	.00710	-.02450	-.06850	.06220	.03420	-.01250	-.06810	-.09570
.86000	-.05940	-.02590	-.02610	-.03930	-.06000	-.09310	-.06190	-.09800	-.06920	-.12410	-.12500
1.85000	-.07840	-.15300	-.16720	-.08040	-.09410	-.11910	-.20450	-.24970	-.25020	-.16440	-.15650
2.85000	-.09380	-.22040	-.25110	-.22310	-.14370	-.14570	-.29140	-.36420	-.35610	-.32150	-.18380
3.88000	-.12040	-.23050	-.25640	-.26890	-.22660	-.20600	-.29890	-.36070	-.36530	-.36710	-.27690
4.83000	-.20100	-.23720	-.26020	-.26770	-.25870	-.24960	-.28710	-.32700	-.33190	-.33990	-.31500
5.88000	-.28320	-.25920	-.28130	-.28610	-.28530	-.27920	-.30020	-.32780	-.33130	-.33560	-.33470
7.84000	-.36080	-.29720	-.31850	-.32100	-.32640	-.32340	-.33330	-.35520	-.35680	-.35580	-.35590
2.37000	-.08670	-.19710	-.22360	-.14880	-.11200	-.13160	-.25930	-.31210	-.30760	-.24880	-.16750

TABLE AIV.- Continued

Leading-edge-thrust wing; sharp r_{le}/c; M = 1.80

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.21000	.33900	.19230	.25710	.16840	.19160	.15760	.15200	.12940	.16200	.19100	.18330	.16220
-6.17000	.28380	.15170	.21120	.13260	.16280	.14220	.12160	.09460	.14670	.17540	.14820	.12630
-4.20000	.23530	.11480	.17100	.09610	.13890	.12300	.09020	.05940	.12850	.15160	.10910	.08960
-2.18000	.18450	.07710	.12470	.06110	.11140	.09700	.05610	.02680	.10320	.11600	.05760	.04870
-.18000	.13740	.04440	.07660	.03120	.07880	.05850	.01810	-.00430	.05500	.05400	.00780	-.00100
0.83000	.11290	.02770	.05100	.01690	.05500	.02500	-.00270	-.02030	.01130	-.00490	-.02620	-.02950
1.80000	.09060	.01270	.02260	.00270	.04360	-.04710	-.02100	-.03720	-.07070	-.11670	-.05550	-.05580
2.82000	.07050	-.00140	-.00610	-.01110	-.04980	-.10380	-.04020	-.05350	-.13990	-.17960	-.10040	-.08000
3.79000	.05200	-.01320	-.03250	-.02390	-.13070	-.13740	-.09090	-.06960	-.17360	-.20580	-.18320	-.12750
4.78000	.03280	-.02780	-.05550	-.03680	-.17730	-.17070	-.16610	-.10970	-.19150	-.21150	-.21120	-.18840
5.76000	.01440	-.04170	-.07450	-.05190	-.21700	-.20300	-.21070	-.18090	-.21260	-.22780	-.22880	-.22200
7.82000	-.02410	-.06600	-.11250	-.08040	-.28800	-.25400	-.26660	-.28890	-.25290	-.26150	-.25800	-.26100
-.20000	.13790	.04530	.07760	.03160	.07890	.05940	.01890	-.00440	.05420	.05420	.00840	-.00030

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.21000	.10770	.22340	.23790	.21120	.17010	.11540	.24500	.25060	.22160	.18640	.12580
-6.17000	.07130	.20490	.21780	.17580	.13180	.07500	.23060	.23290	.18640	.14590	.07890
-4.20000	.03790	.18170	.19420	.13500	.09140	.03720	.21130	.20970	.15070	.10360	.03470
-2.18000	.00280	.14180	.15390	.08640	.04520	-.00310	.17410	.16730	.10110	.05180	-.01110
-.18000	-.03080	.06820	.07450	.01430	-.00960	-.04620	.08100	.06600	.01980	-.03550	-.06260
0.83000	-.04720	-.00720	-.00570	-.03110	-.04370	-.06900	-.03190	-.06110	-.03290	-.08210	-.09000
1.80000	-.06430	-.11530	-.14300	-.07870	-.07800	-.09110	-.17240	-.20190	-.17990	-.12280	-.11930
2.82000	-.08130	-.19230	-.23000	-.21090	-.12280	-.11500	-.27690	-.29780	-.26210	-.24330	-.20160
3.79000	-.10590	-.22850	-.26360	-.26160	-.20550	-.15230	-.31050	-.33790	-.30510	-.28780	-.27020
4.78000	-.17260	-.21930	-.24060	-.24760	-.22590	-.20050	-.27080	-.31840	-.31490	-.31140	-.28560
5.76000	-.22230	-.22890	-.24330	-.24800	-.24310	-.23190	-.25910	-.28720	-.28780	-.29110	-.28530
7.82000	-.28630	-.25720	-.27050	-.27230	-.27040	-.27010	-.27840	-.29370	-.29420	-.29740	-.30380
-.20000	-.02930	.06950	.07550	.01640	-.00820	-.04600	.07910	.06560	.02180	-.03360	-.06140

TABLE AIV.- Continued

Leading-edge-thrust wing; sharp r_{le}/c; M = 2.00

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.37000	.31170	.17540	.24060	.15410	.17930	.15470	.14520	.11900	.16700	.18750	.17200	.14990
-6.35000	.26200	.13760	.20050	.12130	.15650	.13830	.11710	.08580	.14830	.17280	.13710	.11570
-4.35000	.21050	.10100	.15930	.08610	.12990	.12040	.08800	.05480	.12940	.14910	.09870	.07440
-2.34000	.16790	.06690	.11320	.05480	.10270	.09640	.05410	.02130	.10330	.11680	.05800	.03030
-.33000	.12490	.03450	.06570	.02650	.07080	.05990	.01960	-.00990	.05460	.05700	.00610	-.01640
0.66000	.10550	.02200	.06580	.01380	.05040	.03290	.00020	-.02580	.02150	.01190	-.02350	-.03950
1.61000	.08610	.00970	.01960	.00080	.03870	-.02620	-.01630	-.03960	-.04950	-.08500	-.04810	-.06260
2.66000	.06790	-.00320	-.00080	-.01120	-.02330	-.08490	-.03440	-.05500	-.12230	-.14460	-.10880	-.08330
3.66000	.05070	-.01610	-.01800	-.02510	-.10870	-.11980	-.07900	-.06830	-.16410	-.18750	-.17660	-.11460
4.66000	.03290	-.02980	-.03250	-.04000	-.15900	-.15110	-.14740	-.09980	-.18060	-.20520	-.20000	-.16200
5.66000	.01760	-.04200	-.04750	-.05250	-.19970	-.18220	-.18500	-.15350	-.19650	-.21240	-.21470	-.19580
7.65000	-.01430	-.06480	-.08630	-.07760	-.24590	-.23590	-.24150	-.23640	-.23360	-.23880	-.24030	-.23390
-.33000	.12510	.03570	.06580	.02680	.07100	.05920	.01950	-.01010	.05500	.05680	.00650	-.01620

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.37000	.10100	.22240	.23710	.19980	.16100	.10510	.24610	.24660	.21110	.17140	.12110
-6.35000	.06700	.19900	.21740	.16420	.12470	.06840	.22720	.22700	.17880	.13560	.08110
-4.35000	.03360	.17070	.19090	.12540	.08630	.03270	.20370	.20050	.14240	.09280	.04100
-2.34000	.00210	.13260	.14900	.07520	.03920	-.00530	.16250	.16060	.09490	.03800	.00120
-.33000	-.03190	.06630	.07370	.00740	-.01830	-.04550	.07540	.06960	.02330	-.03280	-.04740
0.66000	-.04950	.00640	.01750	-.03060	-.05170	-.07020	.00580	-.01670	-.02110	-.06960	-.08680
1.61000	-.06780	-.08810	-.10270	-.06480	-.07650	-.09680	-.11900	-.13540	-.10980	-.10320	-.11820
2.66000	-.08510	-.16830	-.19670	-.15660	-.13230	-.12220	-.20970	-.21830	-.18420	-.17750	-.17440
3.66000	-.10150	-.20600	-.24240	-.20770	-.19360	-.16290	-.25030	-.25590	-.22300	-.21600	-.21260
4.66000	-.14210	-.21870	-.25480	-.23770	-.22140	-.19080	-.27650	-.28250	-.25390	-.24460	-.23830
5.66000	-.18630	-.21810	-.23370	-.23540	-.23830	-.19450	-.25900	-.29780	-.27650	-.26620	-.25500
7.65000	-.23460	-.23470	-.24290	-.24430	-.24260	-.23380	-.24620	-.25800	-.25650	-.25860	-.25850
-.33000	-.03150	.06590	.07370	.00690	-.01880	-.04480	.07510	.06820	.02270	-.03220	-.04520

TABLE AIV.- Continued

Leading-edge-thrust wing; sharp r_{le}/c; $M = 2.16$

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.16000	.31530	.18070	.24920	.16050	.18350	.16190	.14830	.12250	.16140	.19650	.17450	.15390
-6.15000	.26400	.14000	.20570	.12300	.15900	.14160	.11850	.09160	.14390	.17820	.13890	.11660
-4.15000	.21680	.10160	.16350	.08970	.13280	.12090	.08930	.06110	.12650	.15420	.10500	.07740
-2.14000	.17130	.06750	.11740	.05740	.10750	.09680	.05810	.03020	.10300	.12160	.06540	.03820
-.14000	.12840	.03780	.07050	.03100	.07230	.06280	.02580	0.00000	.05890	.06700	.01480	-.00450
0.86000	.10900	.02440	.04940	.01770	.05140	.03700	.00770	-.01650	.02890	.02570	-.00980	-.02860
1.86000	.09130	.01110	.03210	.00420	.03570	-.01510	-.00870	-.03220	-.03850	-.06160	-.03430	-.05010
2.86000	.07330	-.00140	.01540	-.00990	-.06310	-.06930	-.02420	-.04740	-.10130	-.11690	-.09230	-.06980
3.85000	.05660	-.01440	.00050	-.02270	-.09900	-.10180	-.06360	-.06120	-.14540	-.15530	-.14860	-.09740
4.84000	.04110	-.02590	-.01450	-.03430	-.14080	-.13190	-.12630	-.08590	-.16730	-.18280	-.17610	-.13650
5.86000	.02420	-.03750	-.03120	-.04700	-.17410	-.16140	-.16330	-.13500	-.18130	-.19310	-.19030	-.16500
7.86000	-.00510	-.05880	-.06810	-.07130	-.20730	-.21170	-.21490	-.19860	-.21140	-.21420	-.21500	-.20730
-.14000	.12830	.03760	.06970	.03060	.07220	.06260	.02510	-.00050	.05800	.06650	.01470	-.00510

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.16000	.10760	.22370	.24580	.20490	.16690	.11210	.25350	.25560	.22220	.18330	.12160
-6.15000	.07500	.20090	.21870	.16640	.13010	.07690	.23390	.23450	.18980	.14470	.08430
-4.15000	.04360	.17590	.19260	.12790	.08990	.04140	.20840	.20560	.15150	.10000	.04700
-2.14000	.01030	.14310	.15470	.07970	.04280	.00400	.16810	.16390	.10290	.04630	.00880
-.14000	-.02620	.07940	.08580	.01760	-.00730	-.03960	.09170	.08110	.03880	-.01250	-.04380
0.86000	-.04350	.03210	.03580	-.01680	-.04000	-.06410	.03370	.01260	.00060	-.04740	-.07630
1.86000	-.06270	-.06070	-.06520	-.04900	-.06780	-.09100	-.07840	-.09240	-.05930	-.07810	-.10410
2.86000	-.07970	-.14540	-.15180	-.12050	-.11260	-.11360	-.15760	-.16460	-.13120	-.13350	-.14630
3.85000	-.09480	-.18630	-.19350	-.16390	-.15860	-.15240	-.19540	-.20040	-.16770	-.16780	-.17470
4.84000	-.11710	-.20160	-.22190	-.19320	-.18710	-.18100	-.22310	-.22750	-.19800	-.19490	-.19750
5.86000	-.15260	-.20350	-.23120	-.21380	-.20480	-.19710	-.24270	-.24720	-.22140	-.21700	-.21600
7.86000	-.19950	-.21550	-.22520	-.22530	-.22570	-.20550	-.23200	-.25170	-.24530	-.24460	-.23750
-.14000	-.02660	.07800	.08550	.01730	-.00820	-.04040	.09080	.07960	.03780	-.01300	-.04470

TABLE AIV.- Concluded

Leading-edge-thrust wing; sharp r_{le}/c; M = 2.36

ALPHA	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11	CP12
-8.25000	.30810	.17840	.24960	.16420	.19380	.17220	.15490	.12850	.17780	.20500	.17400	.14870
-6.25000	.26100	.14290	.20870	.12940	.16650	.14930	.12420	.09440	.16040	.18380	.14080	.11300
-4.27000	.21370	.10610	.16270	.09380	.13980	.12940	.09470	.06170	.14160	.15870	.10870	.07570
-2.25000	.17380	.07100	.12150	.06260	.10960	.10400	.06070	.03280	.11280	.12830	.06600	.03840
-.21000	.13090	.04220	.08090	.03260	.07370	.06600	.02990	.00110	.06810	.07320	.02630	-.00300
.74000	.11510	.02690	.06480	.01890	.05760	.04330	.01190	-.01420	.03800	.03610	-.00080	-.02370
1.75000	.09550	.01380	.04630	.00530	.03110	-.00570	-.00340	-.02930	-.02370	-.03190	-.02270	-.04460
2.75000	.07690	-.00130	.03300	-.00740	-.01960	-.04470	-.01570	-.04100	-.06930	-.09790	-.07010	-.06470
3.75000	.05960	-.01340	.01740	-.01930	-.07440	-.08390	-.05930	-.05730	-.11740	-.13190	-.11390	-.09610
4.75000	.04420	-.02460	.00070	-.03150	-.10610	-.11340	-.11670	-.07980	-.14420	-.15940	-.14680	-.13700
5.77000	.03800	-.02780	-.00810	-.03670	-.12470	-.13220	-.13580	-.09790	-.15500	-.17180	-.16710	-.18190
7.75000	.00100	-.05540	-.04900	-.06560	-.16890	-.17920	-.18440	-.16220	-.18930	-.19430	-.19560	-.18580
-.24000	.13260	.04040	.07910	.03240	.07540	.06830	.02880	.00080	.06440	.07270	.02180	-.00160

ALPHA	CP13	CP14	CP15	CP16	CP17	CP18	CP19	CP20	CP21	CP22	CP23
-8.25000	.10800	.23290	.25060	.20640	.17090	.11730	.26090	.26830	.23270	.19160	.12790
-6.25000	.07700	.21260	.22460	.16660	.13090	.08220	.23980	.24260	.19590	.15230	.09320
-4.27000	.04110	.18660	.19860	.12960	.09140	.04470	.21030	.21250	.15460	.10300	.05560
-2.25000	.00910	.15280	.15960	.08360	.04800	.00830	.16910	.16840	.11370	.05790	.01790
-.21000	-.02450	.08700	.09510	.02530	-.00010	-.03400	.10210	.09180	.05270	.00620	-.03290
.74000	-.04020	.04300	.05210	-.00090	-.02650	-.05760	.04770	.04250	.02690	-.02470	-.05730
1.75000	-.06000	-.03720	-.03920	-.03660	-.05270	-.08020	-.04190	-.05130	-.02610	-.05350	-.08250
2.75000	-.07400	-.10380	-.10120	-.08110	-.08430	-.10000	-.10320	-.10740	-.07980	-.09020	-.11040
3.75000	-.08890	-.14720	-.14150	-.12000	-.12260	-.13180	-.14200	-.14480	-.11480	-.12040	-.13310
4.75000	-.11360	-.17480	-.16990	-.14680	-.14760	-.15570	-.16840	-.17030	-.14140	-.14460	-.15240
5.77000	-.12870	-.18430	-.18210	-.16010	-.15670	-.15980	-.17890	-.18210	-.15680	-.15670	-.16000
7.75000	-.16290	-.20130	-.21320	-.19720	-.19150	-.18770	-.21150	-.21600	-.19830	-.19710	-.18530
-.24000	-.02510	.08540	.09320	.02820	.00110	-.03370	.10090	.09270	.05290	.00610	-.03470

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TABLE I.- NUMERICAL DESCRIPTION OF SHARP WING IN FORMAT OF REFERENCE 6

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SHARP,UNCAMBERED WING          LER/C=0.000        DIMENSIONS IN INCHES
  1 -1                       20 20
324.61 15.86   22.53
  0.000   1.250   2.500   5.000   7.500  10.000  15.000  20.000  25.000  30.000
 35.000  40.000  45.000  50.000  55.000  60.000  70.000  80.000  90.000100.000
  4.531   0.000   0.000  26.396
  4.707   0.406   0.000  26.143
  5.148   0.815   0.000  25.624
  5.788   1.221   0.000  24.905
  6.710   1.627   0.000  23.904
  7.848   2.035   0.000  22.687
  9.088   2.442   0.000  21.369
 11.045   3.052   0.000  19.293
 13.031   3.663   0.000  17.706
 15.005   4.274   0.000  16.132
 16.895   4.884   0.000  14.639
 18.668   5.494   0.000  13.266
 20.310   6.105   0.000  12.023
 21.851   6.715   0.000  10.880
 23.320   7.326   0.000   9.810
 24.737   7.936   0.000   8.792
 26.112   8.547   0.000   7.815
 28.762   9.767   0.000   5.963
 31.312  10.988   0.000   4.210
 33.786  12.209   0.000   2.533
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4425   .6176   .8500  1.0382  1.1960  1.4520  1.6426  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .3725   .5391   .7865   .9854  1.1522  1.4346  1.6366  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .2237   .3790   .6521   .8904  1.0931  1.4095  1.6302  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .1453   .2957   .5814   .8430  1.0673  1.3981  1.6278  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
```

TABLE II.- NUMERICAL DESCRIPTION OF CONSTANT WING IN FORMAT OF REFERENCE 6

```
CONSTANT,UNCAMBERED WING     LER/C=0.001        DIMENSIONS IN INCHES
 1 -1                       20 20
324.61 15.86   22.53
  0.000   1.250   2.500   5.000   7.500  10.000  15.000  20.000  25.000  30.000
 35.000  40.000  45.000  50.000  55.000  60.000  70.000  80.000  90.000 100.000
  4.531   0.000   0.000  26.396
  4.707   0.406   0.000  26.143
  5.148   0.815   0.000  25.624
  5.788   1.221   0.000  24.905
  6.710   1.627   0.000  23.904
  7.848   2.035   0.000  22.687
  9.088   2.442   0.000  21.369
 11.045   3.052   0.000  19.293
 13.031   3.663   0.000  17.706
 15.005   4.274   0.000  16.132
 16.895   4.884   0.000  14.639
 18.668   5.494   0.000  13.266
 20.310   6.105   0.000  12.023
 21.851   6.715   0.000  10.880
 23.320   7.326   0.000   9.810
 24.737   7.936   0.000   8.792
 26.112   8.547   0.000   7.815
 28.762   9.767   0.000   5.963
 31.312  10.988   0.000   4.210
 33.786  12.209   0.000   2.533
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
 0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
 1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
```

TABLE III.- NUMERICAL DESCRIPTION OF VARYING WING IN FORMAT OF REFERENCE 6

```
VARYING,UNCAMBERED WING      LER/C=0.004        DIMENSIONS IN INCHES
  1 -1                        20 20
324.61 15.86   22.53
   0.000   1.250   2.500   5.000   7.500  10.000  15.000  20.000  25.000  30.000
  35.000  40.000  45.000  50.000  55.000  60.000  70.000  80.000  90.000100.000
   4.531   0.000   0.000  26.396
   4.707   0.406   0.000  26.143
   5.148   0.815   0.000  25.624
   5.788   1.221   0.000  24.905
   6.710   1.627   0.000  23.904
   7.848   2.035   0.000  22.687
   9.088   2.442   0.000  21.369
  11.045   3.052   0.000  19.293
  13.031   3.663   0.000  17.706
  15.005   4.274   0.000  16.132
  16.895   4.884   0.000  14.639
  18.668   5.494   0.000  13.266
  20.310   6.105   0.000  12.023
  21.851   6.715   0.000  10.880
  23.320   7.326   0.000   9.810
  24.737   7.936   0.000   8.792
  26.112   8.547   0.000   7.815
  28.762   9.767   0.000   5.963
  31.312  10.988   0.000   4.210
  33.786  12.209   0.000   2.533
  0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .4690   .6470   .8750  1.0590  1.2130  1.4590  1.6450  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .5023   .6821   .9156  1.0937  1.2387  1.4720  1.6495  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .5678   .7507   .9918  1.1582  1.2868  1.4963  1.6579  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .6832   .8698  1.1083  1.2537  1.3593  1.5327  1.6702  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .7359   .9227  1.1483  1.2838  1.3834  1.5446  1.6739  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .7631   .9494  1.1628  1.2931  1.3917  1.5486  1.6750  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .7662   .9524  1.1640  1.2938  1.3924  1.5489  1.6750  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .7662   .9524  1.1640  1.2938  1.3924  1.5489  1.6750  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .7631   .9494  1.1628  1.2931  1.3917  1.5486  1.6750  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .7573   .9438  1.1602  1.2916  1.3903  1.5479  1.6748  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .7479   .9346  1.1554  1.2886  1.3876  1.5466  1.6745  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .7381   .9249  1.1496  1.2848  1.3842  1.5450  1.6741  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .7269   .9139  1.1424  1.2797  1.3800  1.5429  1.6734  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .7161   .9030  1.1347  1.2740  1.3754  1.5407  1.6728  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .7047   .8916  1.1261  1.2675  1.3702  1.5381  1.6719  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .6805   .8671  1.1059  1.2519  1.3579  1.5320  1.6700  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .6534   .8394  1.0811  1.2321  1.3426  1.5243  1.6675  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
  0.0000   .6252   .8104  1.0534  1.2094  1.3253  1.5157  1.6646  1.7880  1.8920
  1.9620  1.9970  1.9960  1.9540  1.8680  1.7430  1.4020   .9670   .4900   .0090
```

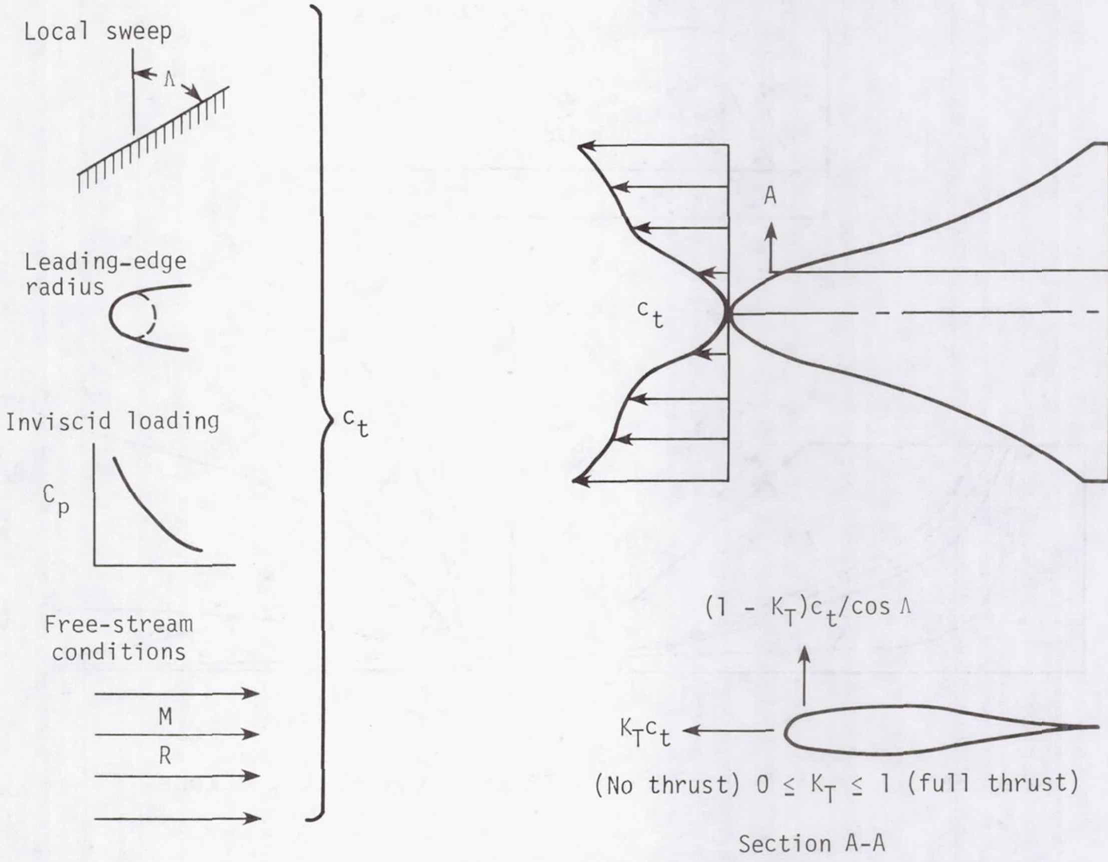


Figure 1.- Attainable leading-edge-thrust concept.

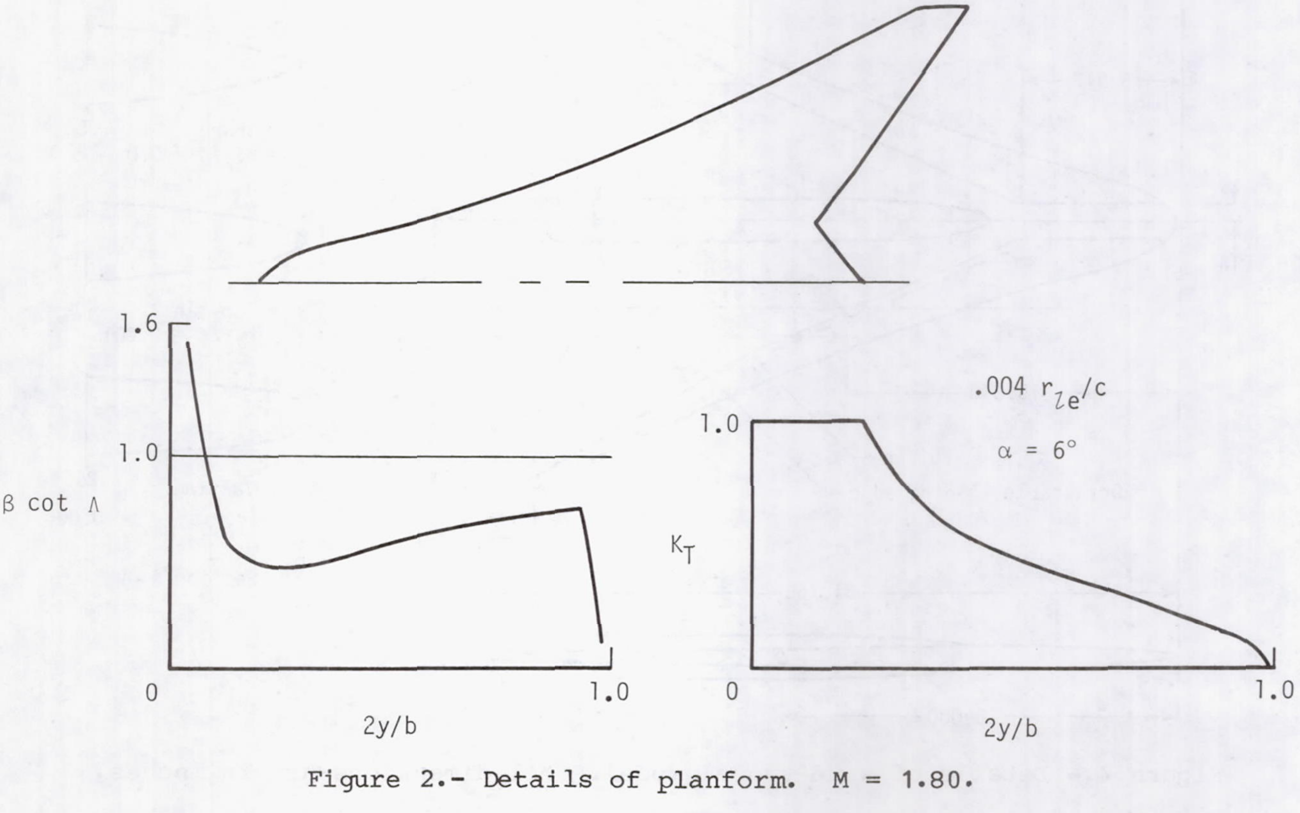


Figure 2.- Details of planform. M = 1.80.

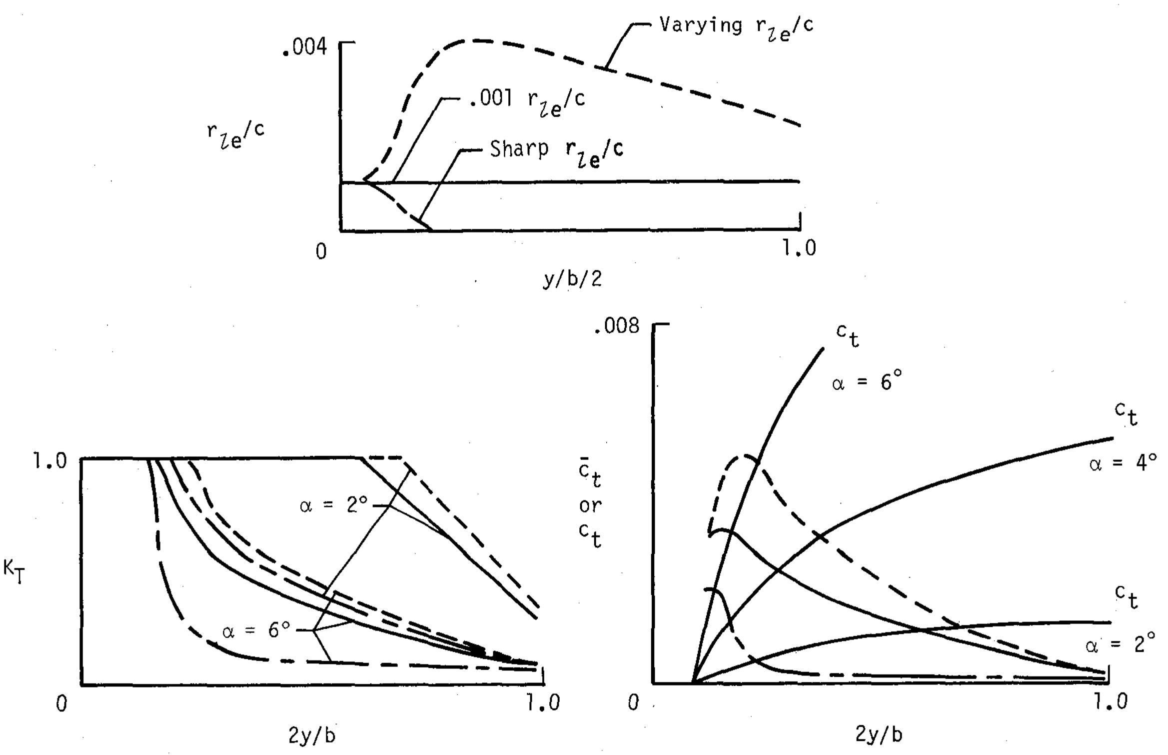


Figure 3.- Details of leading-edge-radius distributions.

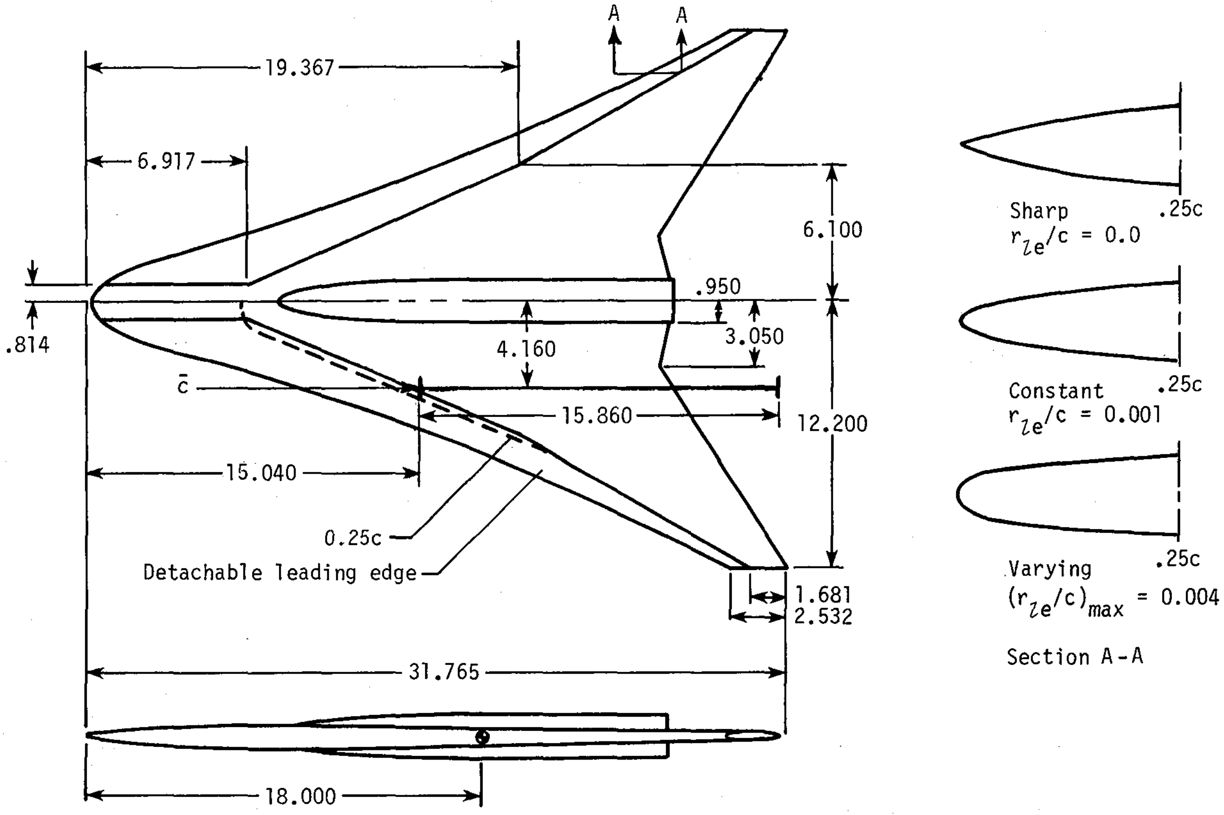


Figure 4.- Details of wind-tunnel model. All dimensions are in inches.

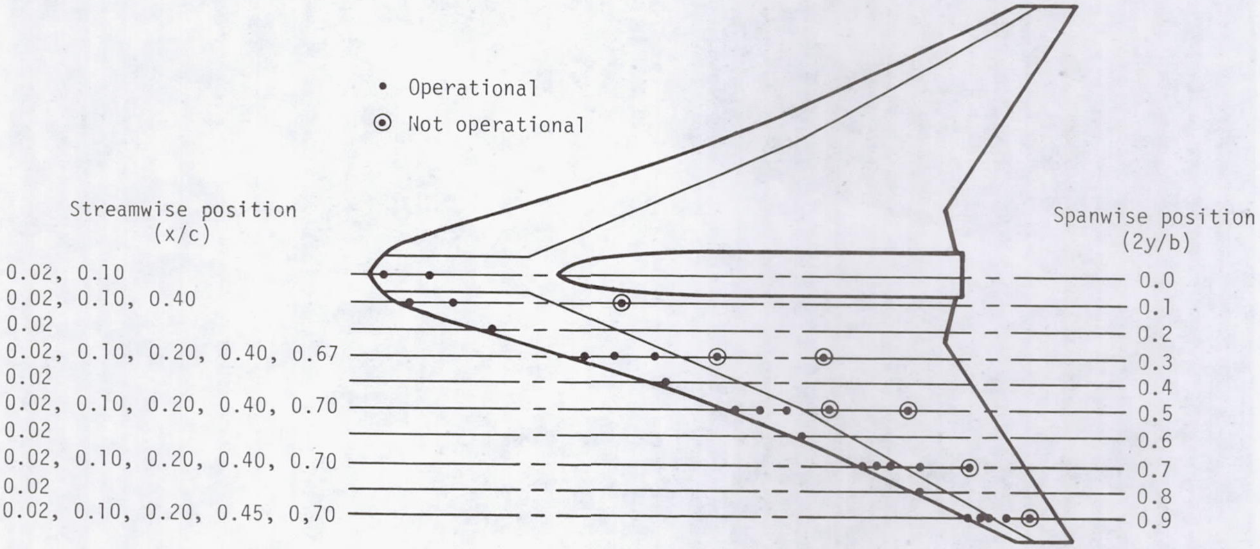
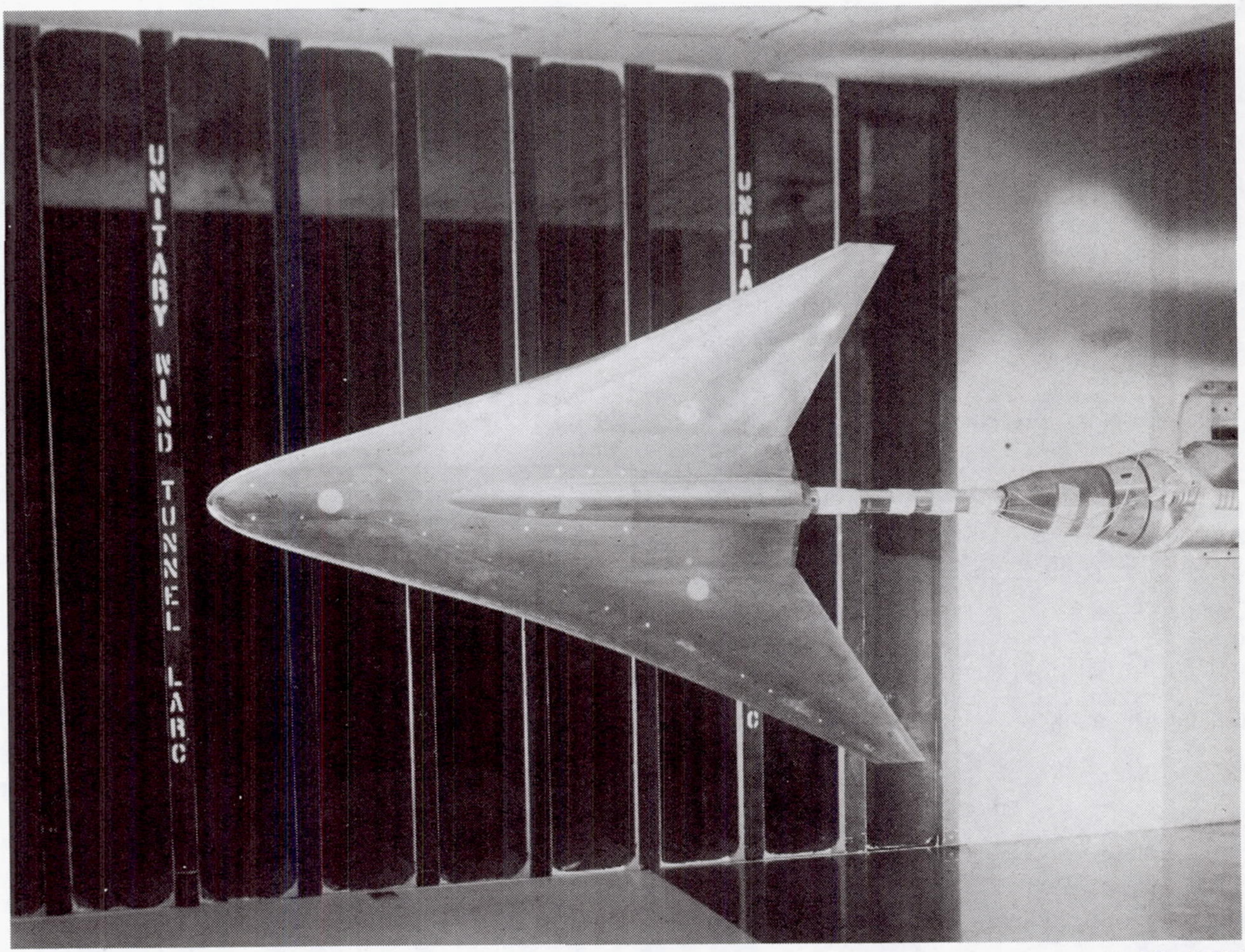
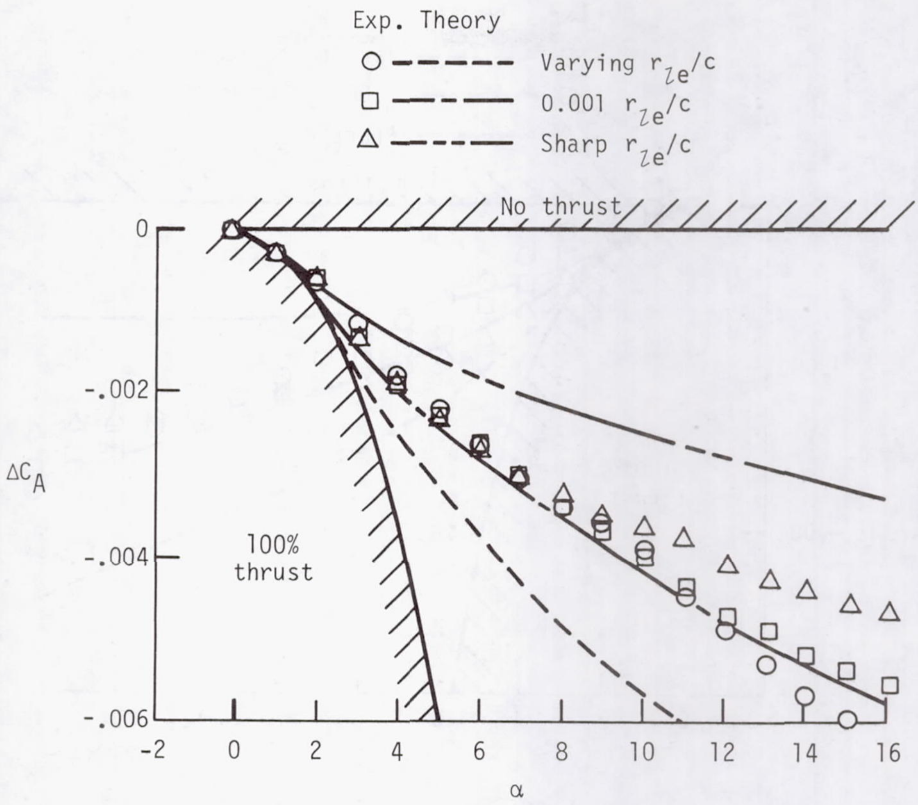


Figure 5.- Orifice locations on wind-tunnel model.

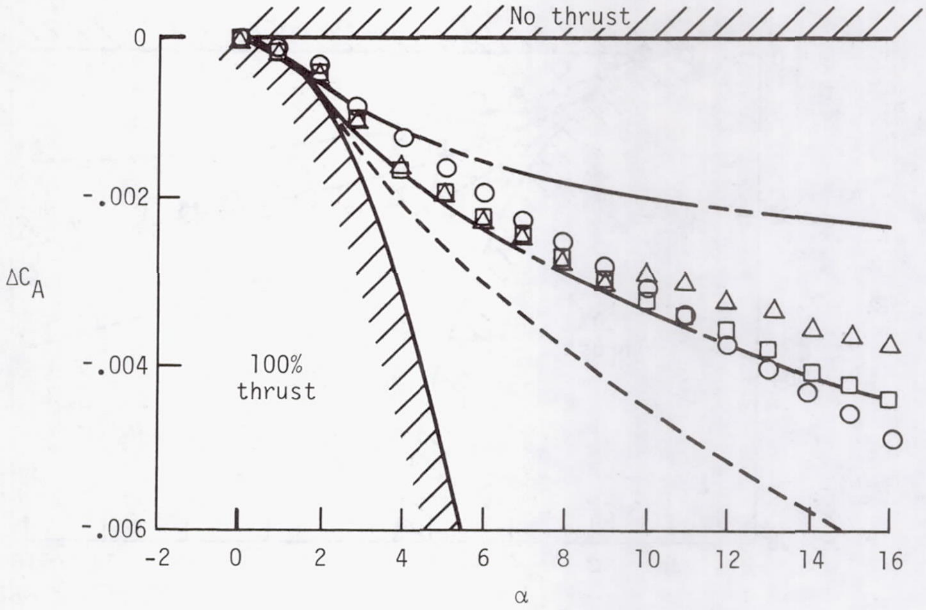


L-82-4620

Figure 6.- Leading-edge-thrust wing wind-tunnel model.

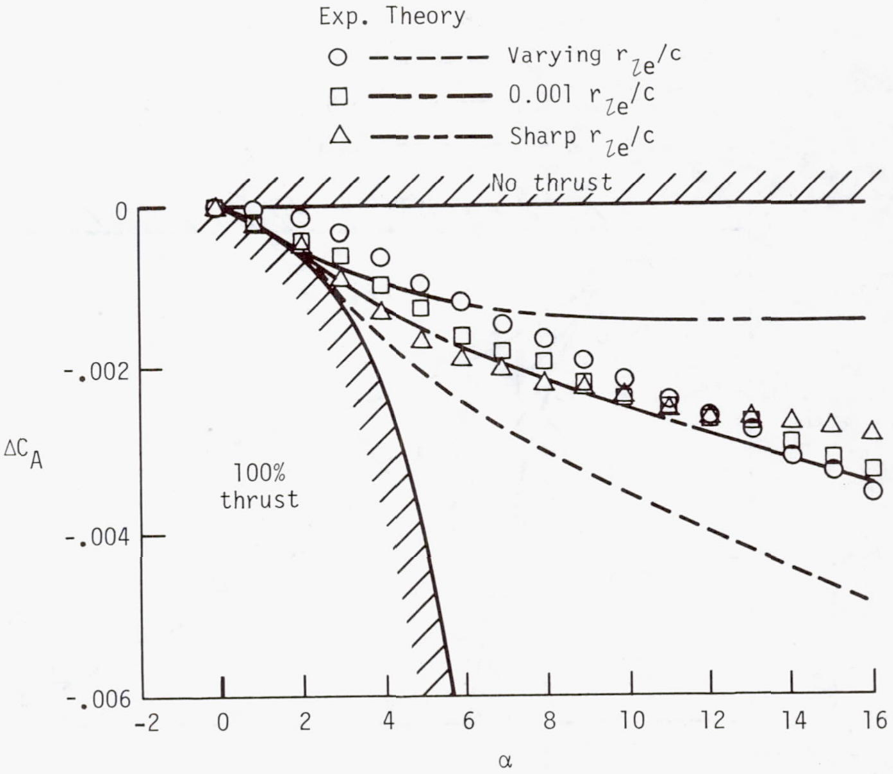


(a) M = 1.60.

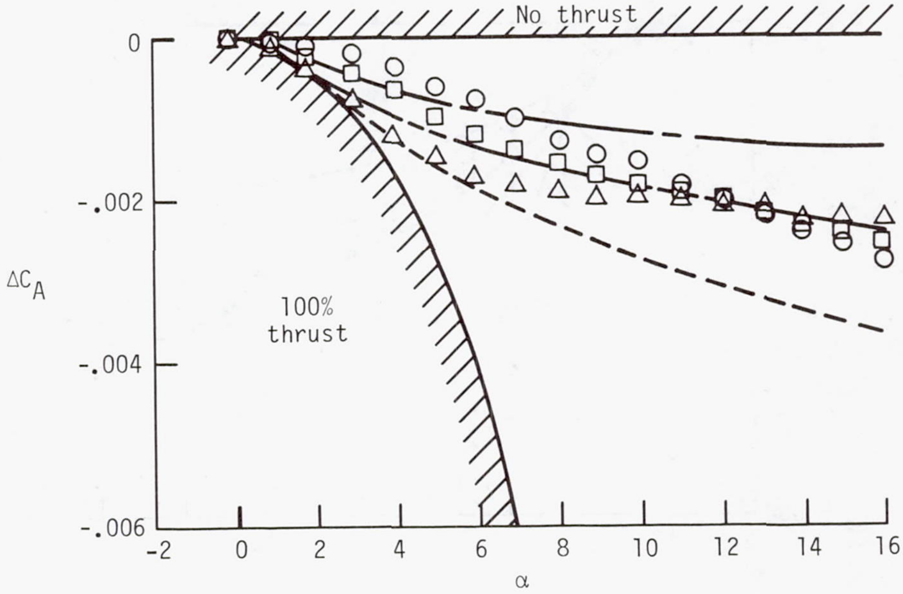


(b) M = 1.80.

Figure 7.- Effect of leading-edge bluntness on axial force.

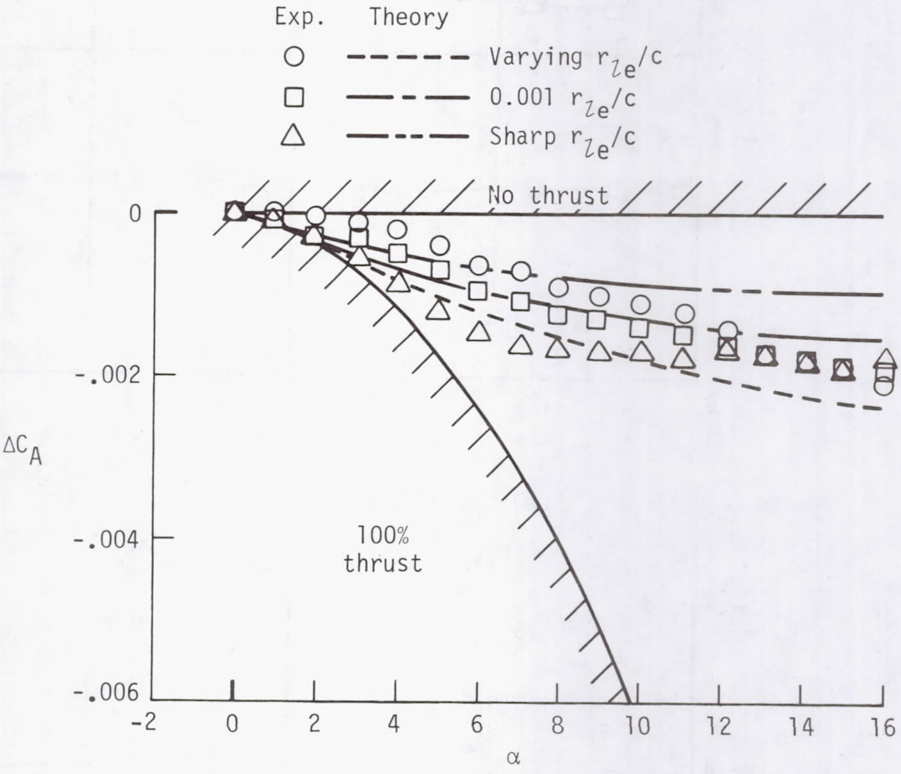


(c) M = 2.00.



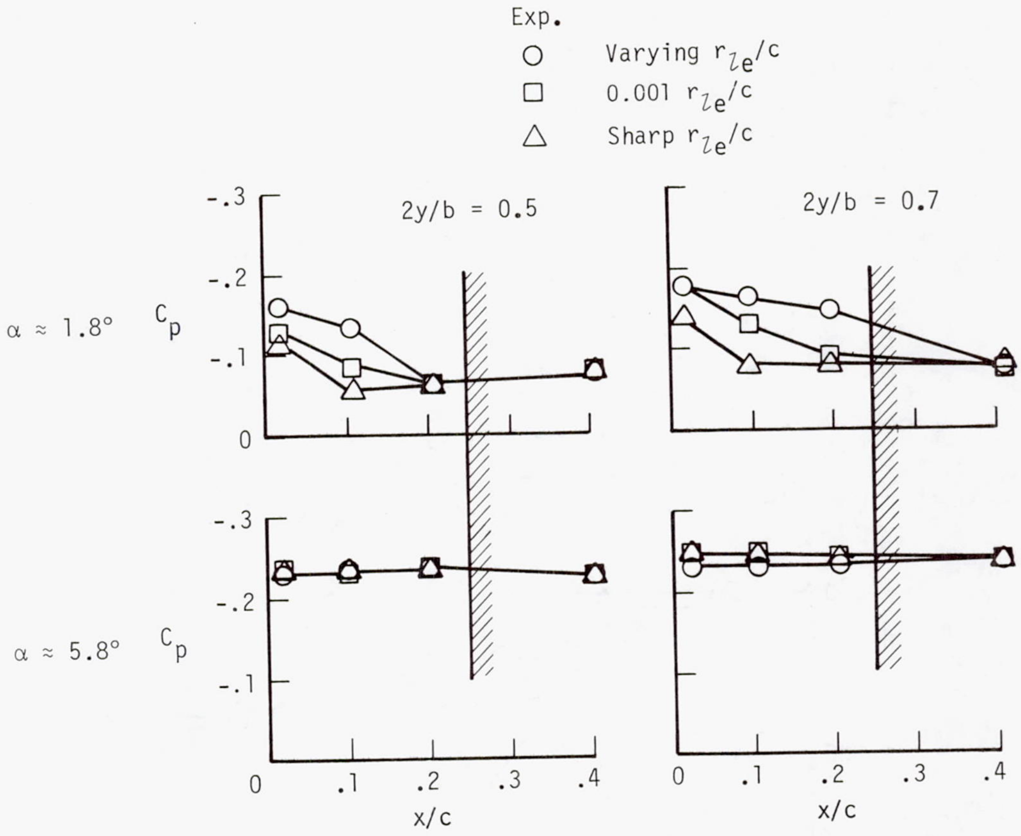
(d) M = 2.16.

Figure 7.- Continued.

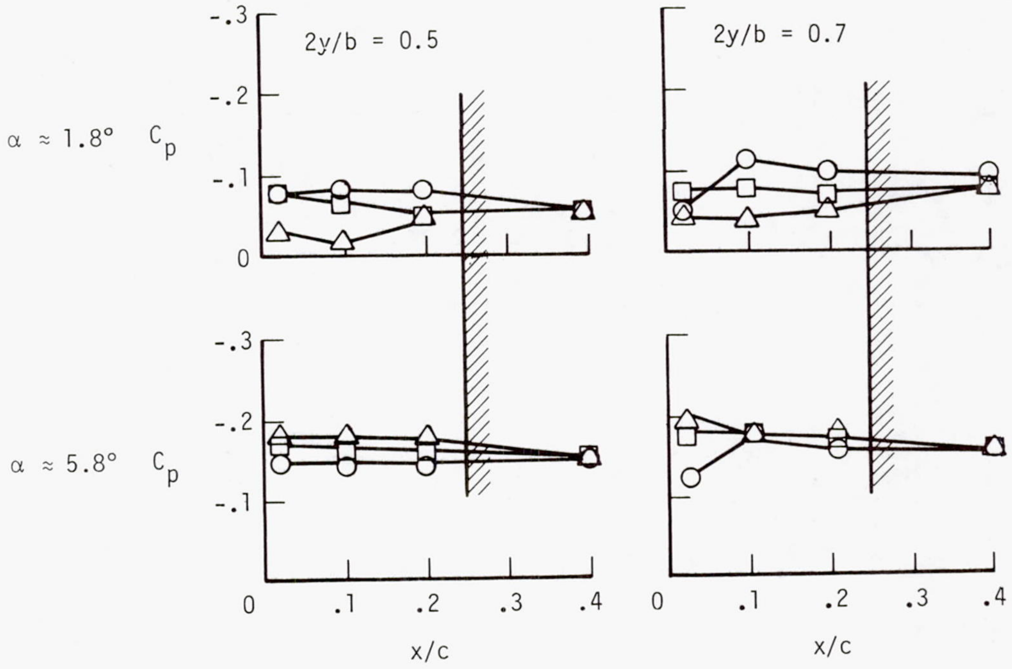


(e) M = 2.36.

Figure 7.- Concluded.

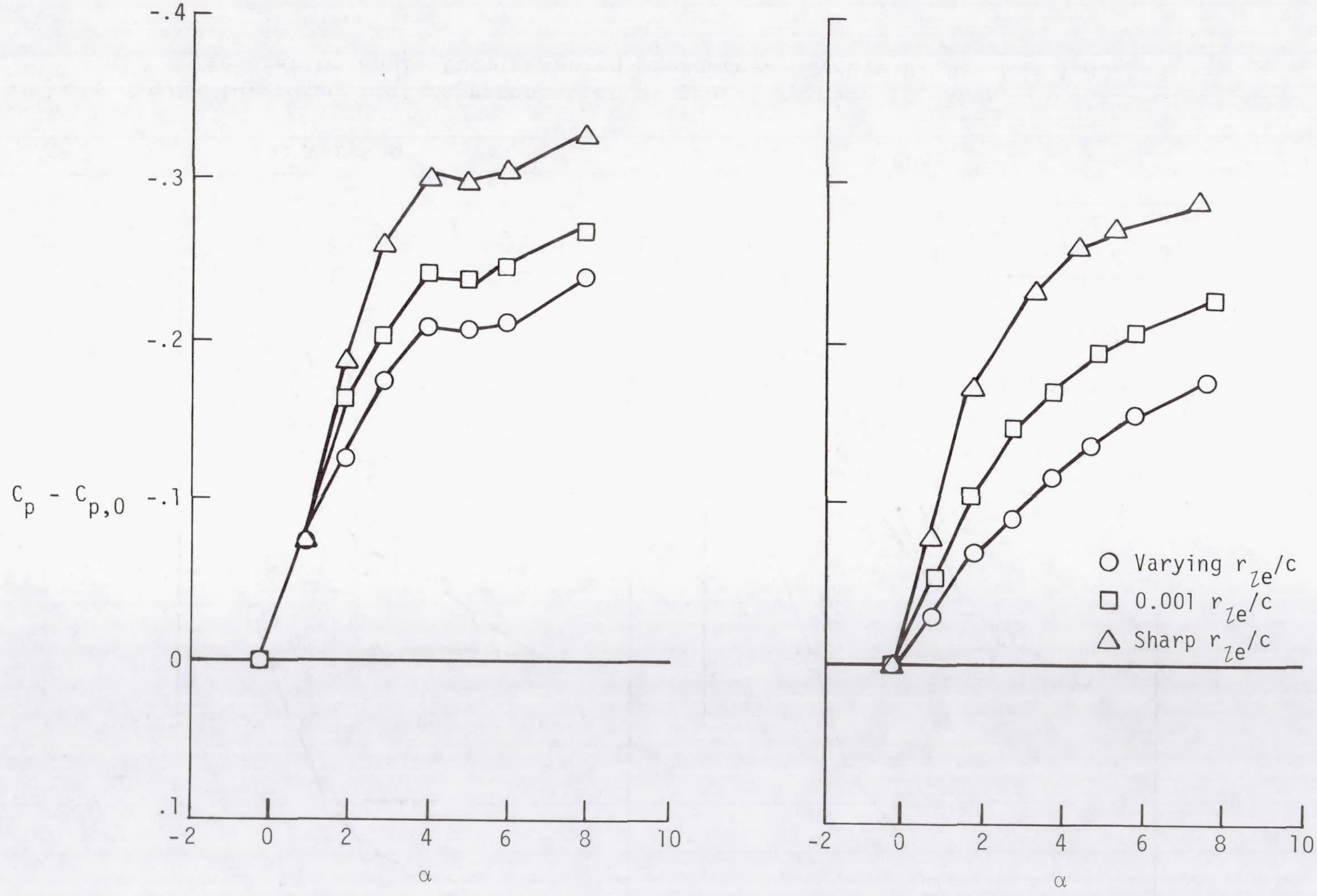


(a) M = 1.80.



(b) M = 2.36.

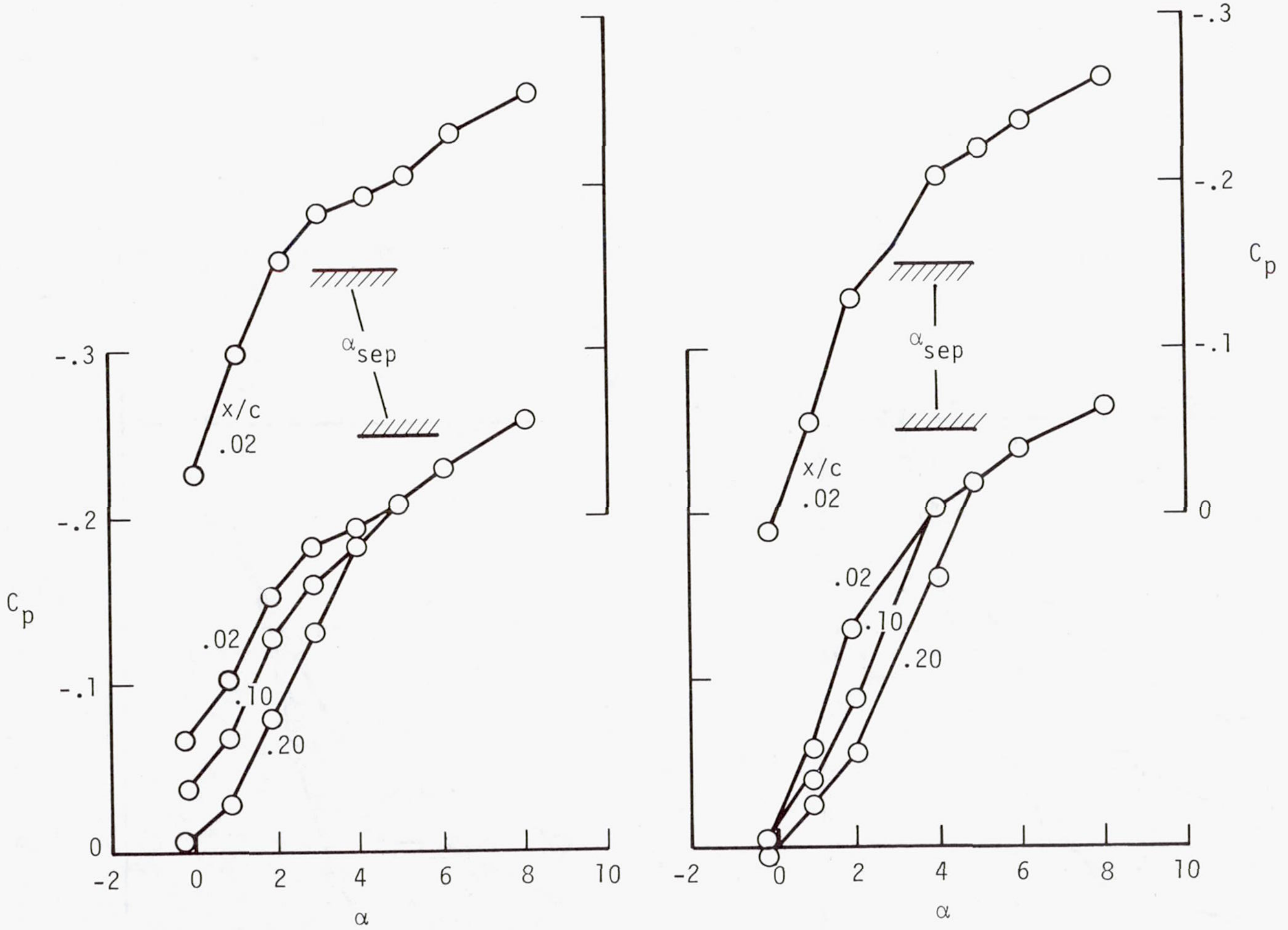
Figure 8.- Chordwise upper surface pressure plots.



(a) M = 1.80.

(b) M = 2.36.

Figure 9.- Effect of leading-edge bluntness on leading-edge pressure. 2y/b = 0.60; x/c = 0.02.



(a) Varying r_{le}/c.

(b) $0.001 r_{le}/c$.

Figure 10.- Graphical representation of procedure used to extract leading-edge separation angle from measured pressures. $2y/b = 0.50$; $M = 1.80$.

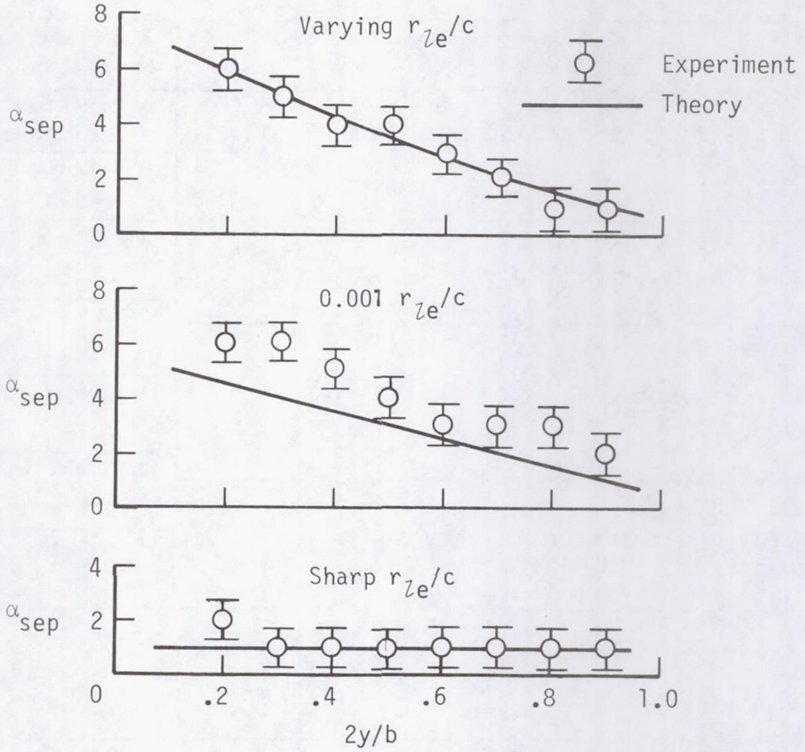


Figure 11.- Experimental and theoretical location of leading-edge separation. M = 1.80.

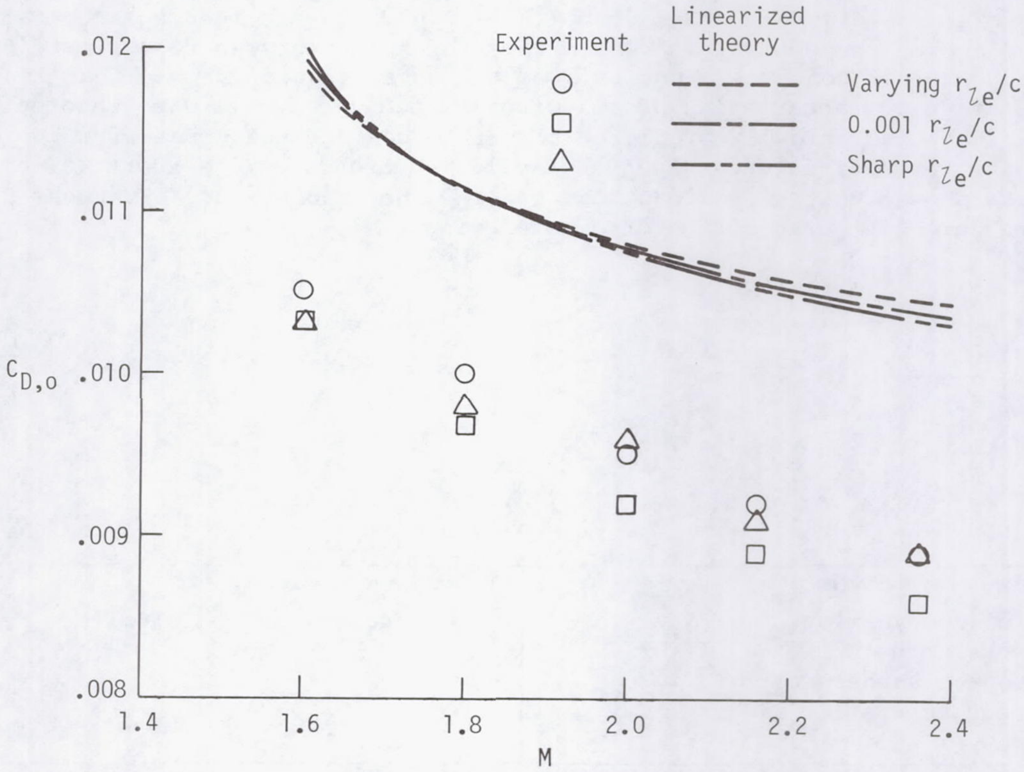


Figure 12.- Experimental and theoretical zero-lift drag trends.

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16. Abstract

An investigation of wings, designed for leading-edge thrust at supersonic speeds, has been conducted in the Langley Unitary Plan Wind Tunnel at Mach numbers of 1.60, 1.80, 2.00, 2.16, and 2.36. Experimental data were obtained on an uncambered wing which had three interchangeable leading edges that varied from sharp ($r_{le}/c = 0.0$) to blunt ($(r_{le}/c)_{max} = 0.004$). (The symbols r_{le} and c are leading-edge radius and local wing chord, respectively.) The purpose of this test was to evaluate the leading-edge-thrust concept. Results from the investigation showed that leading-edge flow-separation characteristics of all wings tested agree well with theoretical predictions. The theoretically predicted thrust forces did not agree with the experimental data; large differences in both levels and trends were evident. The experimental data showed that significant changes in wing leading-edge bluntness did not affect the zero-lift drag of the uncambered wings.

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