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November 2001 – November 2002

Dan M. Somers
Airfoils Incorporated
Port Matilda, Pennsylvania

Subcontract Report
NREL/SR-500-36340
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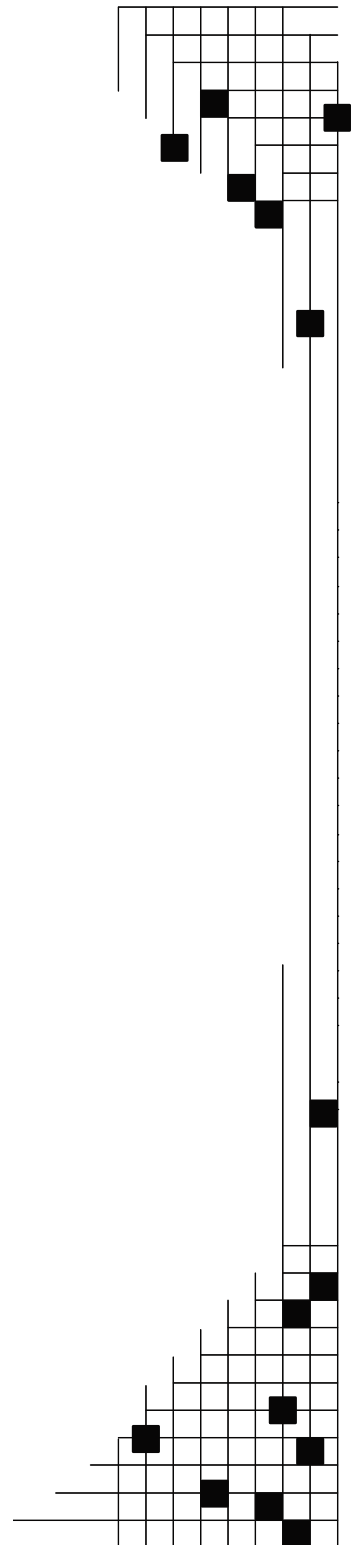
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NREL Technical Monitor: Jim Tangler
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ABSTRACT

A family of quiet, thick, natural-laminar-flow airfoils, the S833, S834, and S835, for 1- to 3-meter-diameter, variable-speed/variable-pitch, horizontal-axis wind turbines has been designed and analyzed theoretically. The two primary objectives of high maximum lift, relatively insensitive to roughness, and low profile drag have generally been achieved. The airfoils should exhibit docile stalls, which meets the design goal. The constraints on the pitching moment and the airfoil thicknesses have been satisfied.

INTRODUCTION

The majority of the airfoils in use on horizontal-axis wind turbines today were originally developed for aircraft. The design requirements for these airfoils, primarily National Advisory Committee for Aeronautics (NACA) and National Aeronautics and Space Administration (NASA) airfoils (refs. 1–6), are significantly different from those for wind-turbine airfoils (ref. 7). Accordingly, several families of airfoils have been designed specifically for horizontal-axis wind-turbine applications, both in the United States, as shown in the following table, and in Europe (e.g., ref. 8).

Wind Turbine		Airfoil-Thickness Category	Airfoil			Reference
Diameter	Type		Primary	Tip	Root	
3–10 m	Variable speed Variable pitch	Thick	—	S822	S823	14
10–20 m	Variable speed Variable pitch	Thin	S801	S802 S803	S804	9
	Stall regulated	Thin	S805 S805A	S806 S806A	S807 S808	
20–30 m	Stall regulated	Thick	S819	S820	S821	13
		Thick	S809	S810	S811	10
20–30 m	Stall regulated	Thick	S812	S813	S814 S815	10 and 11
20–40 m	Variable speed Variable pitch	—	S825	S826	S814 S815	15 and 11
30–50 m	Stall regulated	Thick	S816	S817	S818	12
40–50 m	Stall regulated	Thick	S827	S828	S818	16 and 12
	Variable speed Variable pitch		S830	S831 S832	S818	17 and 12

An overview of almost all the airfoil families in the preceding table is given in reference 18.

The family of airfoils designed under the present study is intended for 1- to 3-meter-diameter, variable-speed/variable-pitch, horizontal-axis wind turbines. It is meant to not only augment the table but also to be quieter than the previous families. The airfoils of the present family should be more suitable for variable-speed/variable-pitch wind turbines than the S822 and S823 airfoils (ref. 14) and appropriate for lower Reynolds numbers (i.e., smaller machines).

Because of the limitations of the theoretical method (refs. 19 and 20) employed in this study, the results presented are in no way guaranteed to be accurate—either in an absolute or in a relative sense. This statement applies to the entire study.

SYMBOLS

C_p	pressure coefficient
c	airfoil chord, m
c_d	section profile-drag coefficient
c_l	section lift coefficient
c_m	section pitching-moment coefficient about quarter-chord point
R	Reynolds number based on free-stream conditions and airfoil chord
t	airfoil thickness, m
x	airfoil abscissa, m
y	airfoil ordinate, m
α	angle of attack relative to x-axis, deg

Subscripts:

ll	lower limit of low-drag range
max	maximum
S	separation
T	transition

ul upper limit of low-drag range

0 zero lift

Abbreviations:

L. lower surface

NACA National Advisory Committee for Aeronautics

NASA National Aeronautics and Space Administration

NREL National Renewable Energy Laboratory

S. boundary-layer separation location, x_S/c

T. boundary-layer transition location, x_T/c

U. upper surface

AIRFOIL DESIGN

OBJECTIVES AND CONSTRAINTS

The aerodynamic noise produced by wind-turbine blades is generated primarily by the outboard portion of the blades, where the flow velocity is highest (ref. 21). Recent research suggests that the lift (lift coefficient times blade chord) produced by the outboard portion of the blade should be constrained to alleviate the noise. Accordingly, a decreasing, as opposed to increasing outboard, maximum lift coefficient is specified. In addition, the airfoil thickness decreases toward the blade tip to reduce the noise due to thickness. The remainder of the design specifications for the family of airfoils are consistent with those for previous airfoil families having large thickness or high maximum lift coefficient.

The design specifications were originally outlined by, and later refined during discussions with, James L. Tangler of the National Renewable Energy Laboratory (NREL). The final specifications are contained in table I. The family consists of three airfoils, primary, tip, and root, corresponding to the 0.75, 0.95, and 0.40 blade radial stations, respectively.

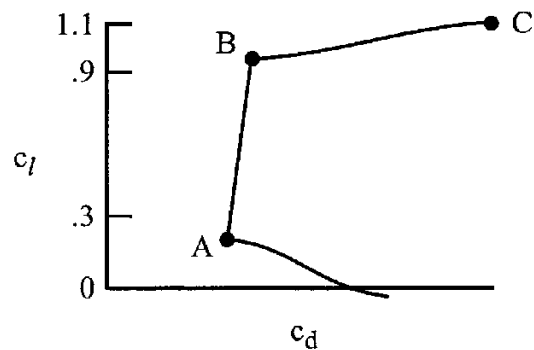
Two primary objectives are evident from the specifications. The first objective is to achieve high maximum lift coefficients. A requirement related to this objective is that the maximum lift coefficients not decrease significantly with transition fixed near the leading edge on both surfaces. In addition, the airfoils should exhibit docile stall characteristics. The second objective is to obtain low profile-drag coefficients over the specified ranges of lift coefficients.

Two major constraints were placed on the design of these airfoils. First, the zero-lift pitching-moment coefficient must be no more negative than -0.15 . Second, the airfoil thicknesses must equal those specified.

The specifications for these airfoils are similar to those for the S822 and S823 airfoils (ref. 14), except the Reynolds numbers are lower. In addition, the present family contains one more airfoil to more precisely define the blade.

PHILOSOPHY

Given the above objectives and constraints, certain characteristics of the designs are apparent. The following sketch illustrates a drag polar that meets the goals for the primary airfoil. (The polars for the tip and root airfoils should be qualitatively similar.)

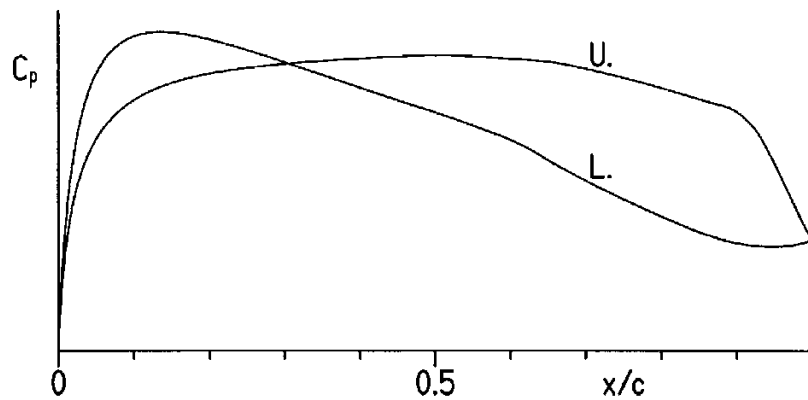


Sketch 1

The desired airfoil shape can be traced to the pressure distributions that occur at the various points in sketch 1. Point A is the lower limit of the low-drag, lift-coefficient range. The lift coefficient at point A is lower than the objective specified in table I. The difference is intended as a margin against such contingencies as manufacturing tolerances, operational deviations, three-dimensional effects, and inaccuracies in the theoretical method. A similar margin is also desirable at the upper limit of the low-drag range, point B, although this margin is constrained by the proximity of the upper limit to the maximum lift coefficient. The profile-drag coefficient at point B is not as low as at point A, unlike the polars of many laminar-flow airfoils where the drag coefficient within the laminar bucket is nearly constant. This characteristic is related to the mitigation of drag- and noise-producing laminar separation bubbles on the upper surface. (See ref. 22.) The small increase in profile-drag coefficient with increasing lift coefficient is relatively inconsequential because the ratio of the profile drag to the total drag of the wind-turbine blade decreases with increasing lift coefficient. The profile-drag coefficient increases very rapidly outside the low-drag range because boundary-layer transition moves quickly toward the leading edge with increasing (or decreasing) lift coefficient.

This feature results in a leading edge that produces a suction peak at higher lift coefficients, which ensures that transition on the upper surface will occur very near the leading edge. Thus, the maximum lift coefficient, point C, occurs with turbulent flow along the entire upper surface and, therefore, should be relatively insensitive to roughness at the leading edge. Note that, because the large thickness of the primary airfoil allows a wider low-drag range to be achieved than specified, the lower limit of the low-drag range should be below point A.

From the preceding discussion, the pressure distributions along the polar can be deduced. The pressure distribution at point A for the primary airfoil should look something like sketch 2. (The pressure distributions for the tip and root airfoils should be qualitatively similar.)



Sketch 2

To achieve low drag, a favorable pressure gradient is desirable along the upper surface to about 50-percent chord. Aft of this point, a region having a shallow, adverse pressure gradient (“transition ramp”) promotes the efficient transition from laminar to turbulent flow (ref. 23). The curved transition ramp (ref. 22) is followed by a convex pressure recovery, which further alleviates laminar separation bubbles. The pressure recovery begins farther forward than dictated by transition-free minimum-drag requirements to decrease the boundary-layer thickness and increase the skin-friction coefficient at the trailing edge with transition fixed, which reduces the noise due to the interaction between the turbulent boundary layer and the trailing edge, a primary noise source for wind turbines. (See ref. 24.) Thus, the specific pressure recovery employed represents a compromise between maximum lift, drag, pitching moment, stall characteristics, and noise. The steep, adverse pressure gradient aft of about 90-percent chord is a “separation ramp,” originally proposed by F. X. Wortmann,¹ which confines turbulent separation to a small region near the trailing edge. By constraining the movement of the separation point at high angles of attack, high lift coefficients can be achieved with little drag

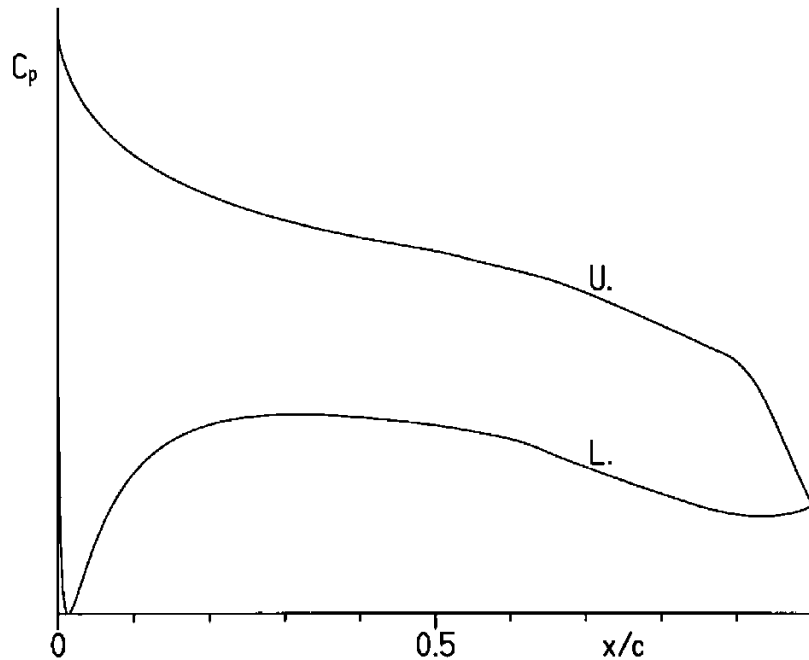
¹Director, Institute for Aerodynamics and Gas Dynamics, University of Stuttgart, Germany.

penalty. This feature has the added benefit of initiating docile stall characteristics. (See ref. 25.)

A moderately adverse pressure gradient is desirable along the lower surface to about 60-percent chord to achieve low drag and alleviate laminar separation bubbles. This region is followed by a curved transition ramp and then a concave pressure recovery, which exhibits lower drag and has less tendency to separate than the corresponding linear or convex pressure recovery (ref. 23). The pressure recovery must begin farther forward than dictated by transition-free minimum-drag requirements to alleviate separation at lower lift coefficients, especially with transition fixed near the leading edge.

The amounts of pressure recovery on the upper and lower surfaces are determined by the airfoil-thickness and pitching-moment constraints.

At point B, the pressure distribution should look like sketch 3.



Sketch 3

No suction spike exists at the leading edge. Instead, a rounded peak occurs just aft of the leading edge. Transition is essentially imminent over the entire forward portion of the upper surface. This feature allows a wider low-drag range to be achieved and higher lift coefficients to be reached without significant separation. It also causes transition to move very quickly

toward the leading edge with increasing lift coefficient, which leads to the roughness insensitivity of the maximum lift coefficient.

Mitigation of laminar separation bubbles, especially on the upper surface, was increasingly emphasized with increasing blade radial station, because of the increasing flow velocity, to eliminate this possible noise source.

EXECUTION

Given the pressure distributions previously discussed, the design of the airfoils is reduced to the inverse problem of transforming the pressure distributions into airfoil shapes. The Eppler Airfoil Design and Analysis Code (refs. 19 and 20) was used because of its unique capability for multipoint design and because of confidence gained during the design, analysis, and experimental verification of many other airfoils. (See refs. 26–31, for example.)

The primary airfoil, which corresponds to the 0.75 blade radial station, is designated the S833. The tip and root airfoils, the S834 and S835, which correspond to the 0.95 and 0.40 blade radial stations, respectively, were derived from the S833 airfoil to increase the aerodynamic and geometric compatibilities of the three airfoils. The airfoil shapes are shown in figure 1 and the coordinates are contained in tables II, III, and IV. The S833 airfoil thickness is 18-percent chord; the S834, 15-percent chord; and the S835, 21-percent chord, which satisfy the design constraints.

THEORETICAL PROCEDURE

The section characteristics are predicted for Reynolds numbers of 0.15×10^6 to 0.70×10^6 . The computations were performed with transition free using transition mode 3, with transition fixed at 2-percent chord on the upper surface and 5-percent chord on the lower surface using transition mode 1, and “rough” using transition mode 9, which simulates distributed roughness due to, for example, leading-edge contamination by water drops or insects. (See ref. 20.)

Because the free-stream Mach number for all relevant wind-turbine operating conditions remains below 0.3, all results are incompressible.

DISCUSSION OF RESULTS

S833 AIRFOIL

Pressure Distributions

The inviscid pressure distributions for the S833 airfoil at various angles of attack are shown in figure 2 and tabulated in appendix A.

Transition and Separation Locations

The variation of boundary-layer transition location with lift coefficient for the S833 airfoil is shown in figure 3 and tabulated in appendix A. In the method of references 19 and 20, the transition location is defined as the end of the laminar boundary layer whether due to natural transition or laminar separation. Transition is normally confirmed in experiments, however, by the detection of an attached turbulent boundary layer. Thus, for conditions that result in relatively long laminar separation bubbles (low lift coefficients for the upper surface, high lift coefficients for the lower surface, and low Reynolds numbers), the apparent agreement between the theoretical and experimental transition locations is poor. In actuality, the difference between the predicted and measured transition locations represents the length of the laminar separation bubble (from laminar separation to turbulent reattachment). Accordingly, for conditions that result in shorter laminar separation bubbles (high lift coefficients for the upper surface, low lift coefficients for the lower surface, and high Reynolds numbers), the apparent agreement between theory and experiment improves. (See refs. 28 and 31.)

The variation of turbulent boundary-layer separation location with lift coefficient for the S833 airfoil is shown in figure 3 and tabulated in appendix A. A small, trailing-edge separation is predicted on the upper surface at all lift coefficients. This separation is caused by the separation ramp (fig. 2). Separation is predicted on the lower surface at lift coefficients in the lower half of the operating range for the intended application. Such separation usually has little effect on the section characteristics. (See ref. 28.)

Section Characteristics

Reynolds number effects.- The section characteristics of the S833 airfoil are shown in figure 3 and tabulated in appendix A. It should be noted that the maximum lift coefficient computed by the method of references 19 and 20, as well as other theoretical methods, is not always realistic. Accordingly, an empirical criterion has been applied to the computed results. This criterion assumes that the maximum lift coefficient has been reached if the drag coefficient of the upper surface is greater than $0.01719 (1 \times 10^6/R)^{1/8}$, which is based on correlations with results for Reynolds numbers from 0.7×10^6 to 1.5×10^6 from the Pennsylvania State University Low-Speed, Low-Turbulence Wind Tunnel. Thus, the maximum lift coefficient for the design Reynolds number of 0.40×10^6 is estimated to be 1.10, which meets the design objective. Based on the variation of the upper-surface separation location with lift coefficient, the stall characteristics are expected to be docile, which meets the design goal. Low profile-drag coefficients are predicted over the range of lift coefficients from below 0 to 0.86. Thus, the lower limit of the low-drag, lift-coefficient range is below the design objective of $c_{l,ll} = 0.30$, although the upper limit of the low-drag range is also below the design objective of $c_{l,ul} = 0.90$, primarily to meet other, more important goals. The zero-lift pitching-moment coefficient is predicted to be -0.14 , which satisfies the design constraint. Because of boundary-layer displacement effects not accounted for in the present analysis, the pitching-moment coefficient is generally overpredicted by about 20 percent. Therefore, the actual zero-lift pitching-moment coefficient should be about -0.12 .

Effect of roughness.- The effect of roughness on the section characteristics of the S833 airfoil is shown in figure 3. The maximum lift coefficient for the design Reynolds number of 0.40×10^6 with transition fixed is estimated to be 1.11, an increase of 1 percent from that with transition free. For the rough condition, the maximum lift coefficient for the design Reynolds number is estimated to be 1.13, an increase of 3 percent from that with transition free. Thus, the design requirement has been satisfied. The effect of roughness on the maximum lift coefficient is nearly constant with Reynolds number. The drag coefficients are, of course, adversely affected by the roughness.

S834 AIRFOIL

Pressure Distributions

The inviscid pressure distributions for the S834 airfoil at various angles of attack are shown in figure 4 and tabulated in appendix B.

Transition and Separation Locations

The variations of transition and separation locations with lift coefficient for the S834 airfoil are shown in figure 5 and tabulated in appendix B. A small, trailing-edge separation is predicted on the upper surface at all lift coefficients. This separation is caused by the separation ramp (fig. 4). Separation is predicted on the lower surface at lift coefficients below the operating range for the intended application. Such separation usually has little effect on the section characteristics.

Section Characteristics

Reynolds number effects.- The section characteristics of the S834 airfoil are shown in figure 5 and tabulated in appendix B. Using the previously described criterion, the maximum lift coefficient for the design Reynolds number of 0.40×10^6 is estimated to be 1.00, which meets the design objective. The stall characteristics are expected to be docile, which meets the design goal. Low drag coefficients are predicted over the range of lift coefficients from below 0 to 0.78. Thus, the lower limit of the low-drag range is below the design objective of $c_{l,11} = 0.20$, although the upper limit is also below the design objective of $c_{l,u1} = 0.80$, primarily to meet other, more important goals. The zero-lift pitching-moment coefficient is predicted to be -0.08 , which satisfies the design constraint. The actual zero-lift pitching-moment coefficient should be about -0.06 .

Effect of roughness.- The effect of roughness on the section characteristics of the S834 airfoil is shown in figure 5. The maximum lift coefficient for the design Reynolds number of 0.40×10^6 is unaffected by fixing transition because transition on the upper surface is predicted to occur forward of 2-percent chord at the maximum lift coefficient. For the rough condition, the maximum lift coefficient for the design Reynolds number is estimated to be 1.02,

an increase of 2 percent from that with transition free. Thus, the design requirement has been satisfied. The effect of roughness on the maximum lift coefficient is nearly constant with Reynolds number. The drag coefficients are, of course, adversely affected by the roughness.

S835 AIRFOIL

Pressure Distributions

The inviscid pressure distributions for the S835 airfoil at various angles of attack are shown in figure 6 and tabulated in appendix C.

Transition and Separation Locations

The variations of transition and separation locations with lift coefficient for the S835 airfoil are shown in figure 7 and tabulated in appendix C. A small, trailing-edge separation is predicted on the upper surface at all lift coefficients. This separation is caused by the separation ramp (fig. 6). Separation is predicted on the lower surface at all lift coefficients within the operating range for the intended application. Such separation usually has little effect on the section characteristics.

Section Characteristics

Reynolds number effects.- The section characteristics of the S835 airfoil are shown in figure 7 and tabulated in appendix C. Using the previously described criterion, the maximum lift coefficient for the design Reynolds number of 0.25×10^6 is estimated to be 1.04, which does not meet the design objective of $c_{l,max} = 1.20$, primarily because the objective is incompatible with the other requirements, especially the combination of large airfoil thickness and low Reynolds number. The stall characteristics are expected to be docile, which meets the design goal. Low drag coefficients are predicted over the range of lift coefficients from below 0 to 0.94. Thus, the lower limit of the low-drag range is below the design objective of $c_{l,II} = 0.40$, although the upper limit is also below the design objective of $c_{l,UI} = 1.00$, primarily to meet other, more important goals. The zero-lift pitching-moment coefficient is predicted to be -0.14 , which satisfies the design constraint. The actual zero-lift pitching-moment coefficient should be about -0.12 .

Effect of roughness.- The effect of roughness on the section characteristics of the S835 airfoil is shown in figure 7. The maximum lift coefficient for the design Reynolds number of 0.25×10^6 with transition fixed is estimated to be 1.00, a reduction of 4 percent from that with transition free. For the rough condition, the maximum lift coefficient for the design Reynolds number is estimated to be 1.03, a reduction of 1 percent from that with transition free. Thus, the design requirement has been satisfied. The effect of roughness on the maximum lift coefficient is nearly constant with Reynolds number. The drag coefficients are, of course, adversely affected by the roughness.

CONCLUDING REMARKS

A family of quiet, thick, natural-laminar-flow airfoils, the S833, S834, and S835, for 1- to 3-meter-diameter, variable-speed/variable-pitch, horizontal-axis wind turbines has been designed and analyzed theoretically. The two primary objectives of high maximum lift coefficients, relatively insensitive to leading-edge roughness, and low profile-drag coefficients have generally been achieved. The airfoils should exhibit docile stall characteristics, which meets the design goal. The constraints on the zero-lift pitching-moment coefficient and the airfoil thicknesses have been satisfied.

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TABLE I.- AIRFOIL DESIGN SPECIFICATIONS

Blade radial station	0.75	0.95	0.40
Parameter	Objective/Constraint		
Reynolds number R	0.40×10^6	0.40×10^6	0.25×10^6
Maximum lift coefficient $c_{l,max}$	1.10	1.00	1.20
Lower limit of low-drag, lift-coefficient range $c_{l,ll}$	0.30	0.20	0.40
Upper limit of low-drag, lift-coefficient range $c_{l,ul}$	0.90	0.80	1.00
Zero-lift pitching-moment coefficient $c_{m,0}$	≥ -0.15		
Airfoil thickness t/c	18%	15%	21%

TABLE II.- S833 AIRFOIL COORDINATES

Upper Surface		Lower Surface	
x/c	y/c	x/c	y/c
0.00014	0.00190	0.00001	-0.00039
.00080	.00413	.00027	-.00284
.00134	.00533	.00051	-.00405
.00192	.00645	.00516	-.01488
.00863	.01509	.01423	-.02612
.02100	.02526	.02762	-.03732
.03816	.03549	.04509	-.04794
.05981	.04544	.06670	-.05772
.08580	.05491	.09216	-.06635
.11583	.06370	.12149	-.07365
.14969	.07168	.15434	-.07944
.18700	.07875	.19065	-.08363
.22744	.08480	.23002	-.08613
.27056	.08979	.27228	-.08696
.31595	.09364	.31695	-.08611
.36309	.09632	.36379	-.08365
.41151	.09778	.41225	-.07967
.46067	.09798	.46198	-.07426
.51005	.09685	.51236	-.06755
.55925	.09430	.56300	-.05952
.60790	.09049	.61351	-.05025
.65539	.08546	.66384	-.03971
.70140	.07919	.71399	-.02876
.74562	.07192	.76337	-.01823
.78759	.06394	.81124	-.00889
.82683	.05549	.85669	-.00152
.86284	.04678	.89844	.00302
.89510	.03796	.93446	.00453
.92323	.02883	.96316	.00388
.94764	.01954	.98373	.00224
.96844	.01109	.99596	.00068
.98502	.00465	1.00000	.00000
.99606	.00100		
1.00000	.00000		

TABLE III.- S834 AIRFOIL COORDINATES

Upper Surface		Lower Surface	
x/c	y/c	x/c	y/c
0.00000	0.00009	0.00025	-0.00167
.00031	.00185	.00063	-.00286
.00104	.00375	.00092	-.00356
.00139	.00447	.00610	-.01100
.00812	.01297	.01637	-.01945
.01966	.02200	.03135	-.02779
.03587	.03119	.05077	-.03562
.05652	.04019	.07463	-.04274
.08148	.04879	.10266	-.04895
.11050	.05682	.13476	-.05414
.14337	.06413	.17060	-.05824
.17974	.07061	.20996	-.06119
.21930	.07620	.25241	-.06300
.26160	.08080	.29766	-.06367
.30625	.08437	.34519	-.06325
.35274	.08686	.39461	-.06181
.40059	.08820	.44534	-.05943
.44927	.08834	.49692	-.05621
.49829	.08714	.54874	-.05227
.54733	.08453	.60025	-.04770
.59606	.08071	.65083	-.04259
.64386	.07578	.69997	-.03702
.69034	.06973	.74713	-.03111
.73517	.06273	.79183	-.02494
.77797	.05503	.83359	-.01867
.81829	.04693	.87225	-.01217
.85565	.03870	.90787	-.00651
.88950	.03056	.93921	-.00253
.91941	.02247	.96502	-.00033
.94548	.01465	.98421	.00039
.96754	.00791	.99602	.00024
.98482	.00310	1.00000	.00000
.99606	.00061		
1.00000	.00000		

TABLE IV.- S835 AIRFOIL COORDINATES

Upper Surface		Lower Surface	
x/c	y/c	x/c	y/c
0.00002	0.00099	0.00111	-0.00887
.00023	.00376	.00638	-.02253
.00026	.00397	.01577	-.03657
.00087	.00677	.02908	-.05033
.00200	.00947	.04631	-.06347
.00357	.01220	.06721	-.07550
.00537	.01477	.09182	-.08620
.01649	.02603	.11982	-.09519
.03266	.03735	.15121	-.10230
.05347	.04838	.18563	-.10723
.07871	.05889	.22322	-.10980
.10805	.06868	.26372	-.11014
.14127	.07759	.30684	-.10829
.17797	.08549	.35227	-.10430
.21782	.09226	.39970	-.09827
.26037	.09783	.44881	-.09036
.30519	.10211	.49928	-.08081
.35178	.10500	.55072	-.06993
.39966	.10638	.60277	-.05811
.44851	.10620	.65496	-.04582
.49774	.10448	.70679	-.03361
.54703	.10115	.75764	-.02211
.59600	.09636	.80676	-.01199
.64420	.09028	.85324	-.00393
.69117	.08310	.89582	.00127
.73644	.07503	.93260	.00343
.77953	.06631	.96201	.00332
.81994	.05718	.98319	.00204
.85715	.04786	.99583	.00064
.89062	.03853	1.00000	.00000
.91994	.02902		
.94546	.01950		
.96719	.01097		
.98447	.00455		
.99593	.00097		
1.00000	.00000		

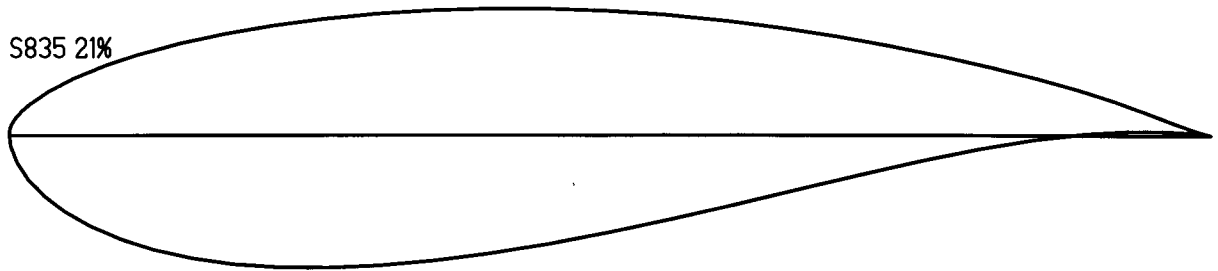
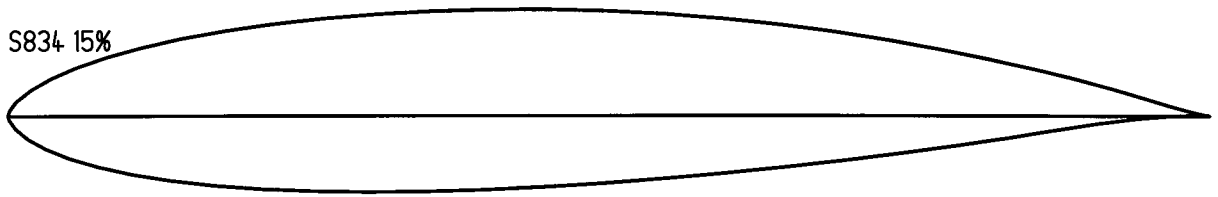
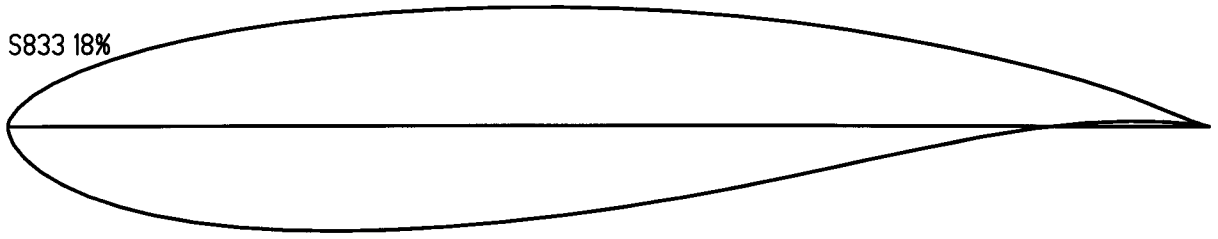
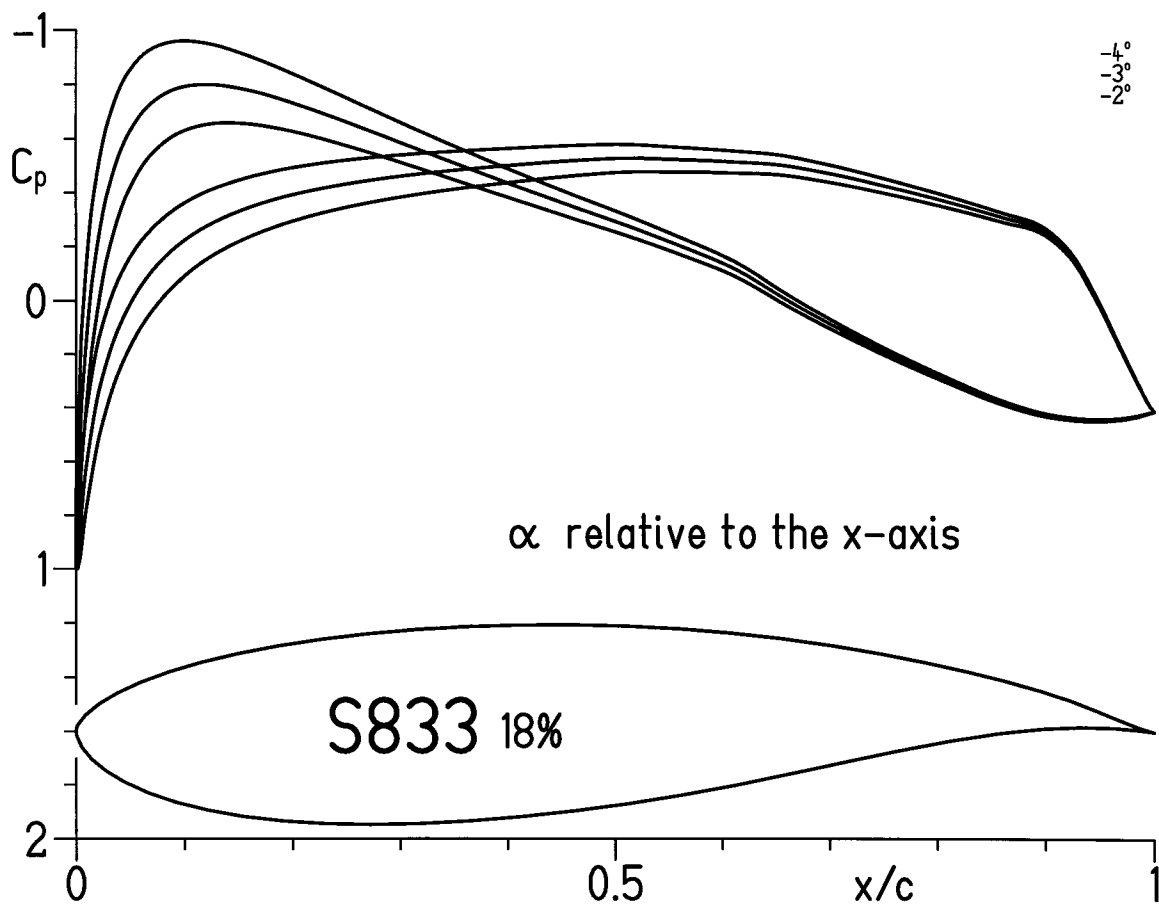
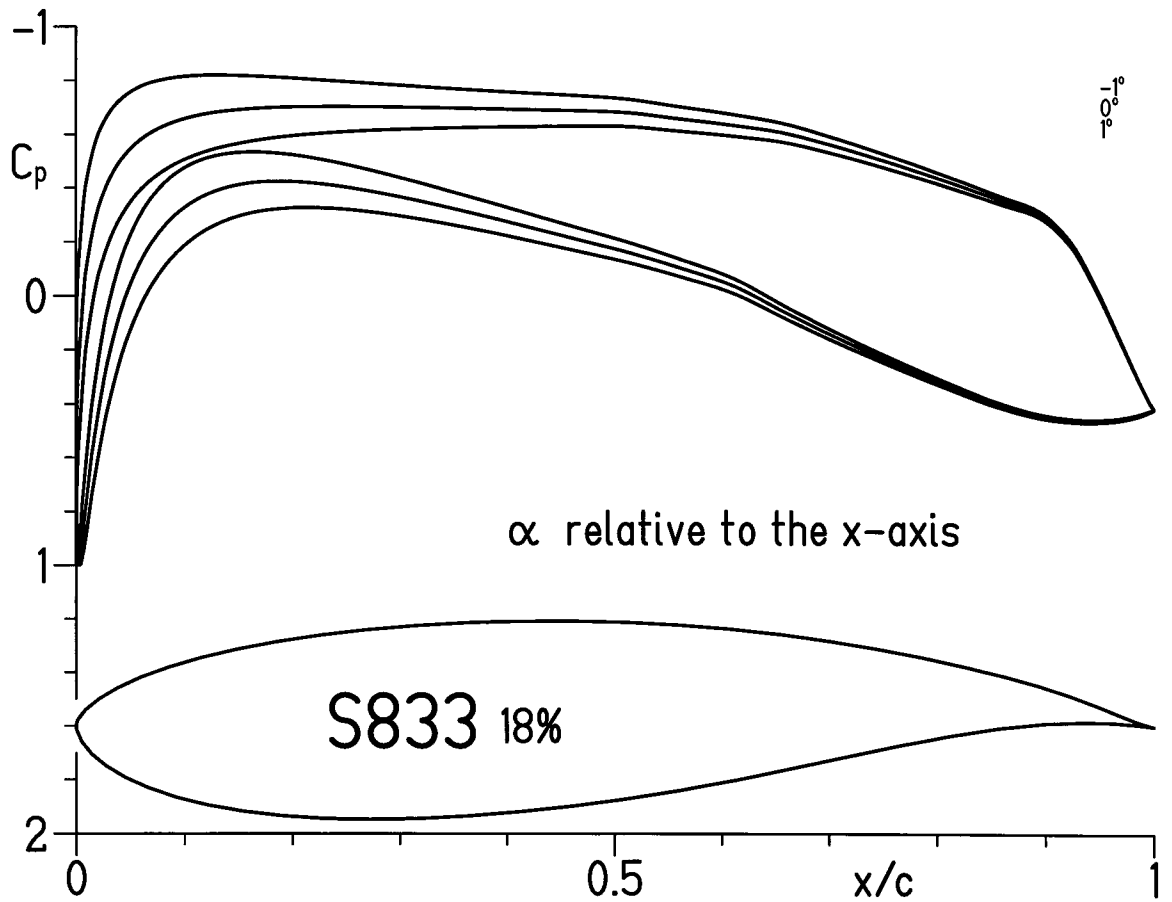


Figure 1.- Airfoil shapes.



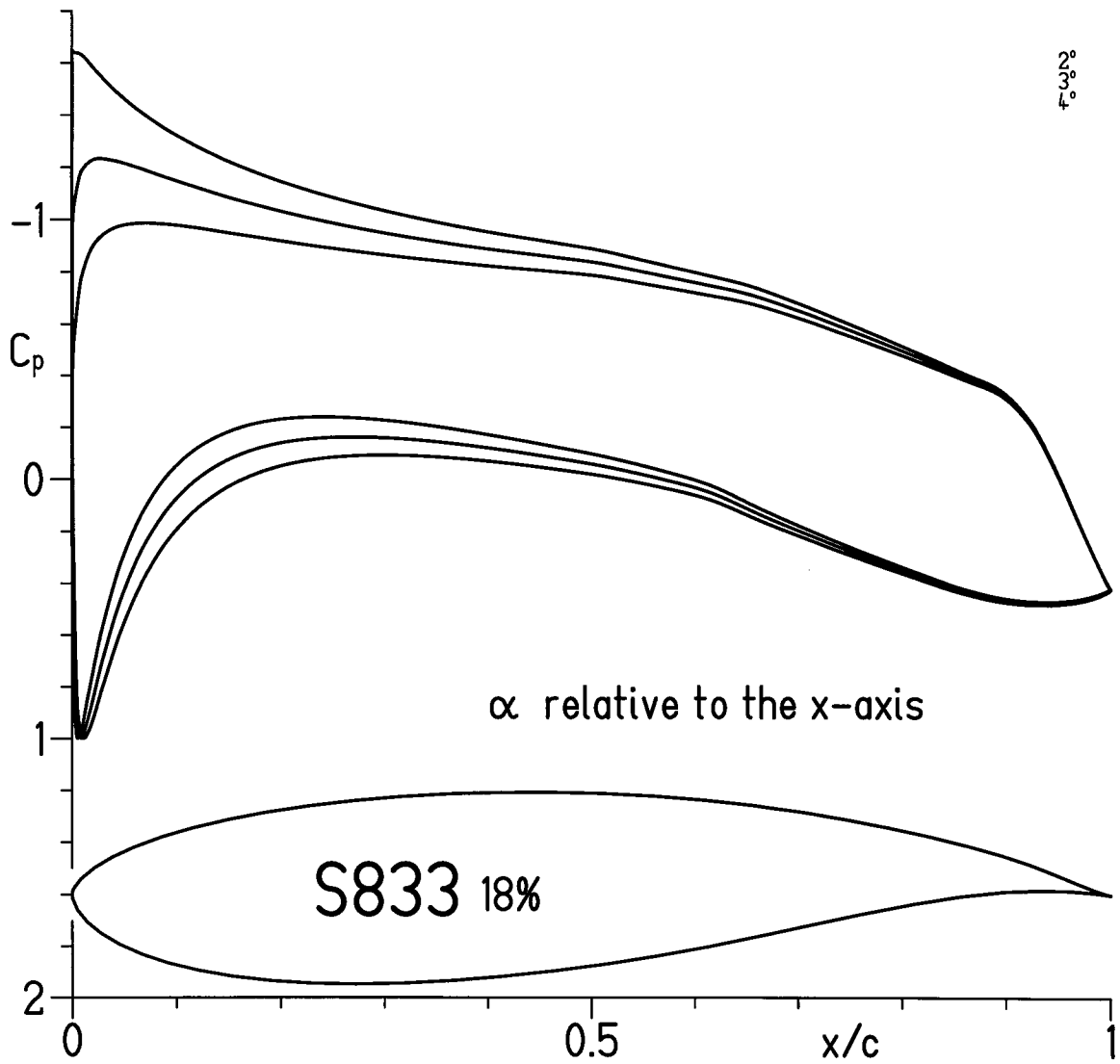
(a) $\alpha = -4^\circ, -3^\circ, \text{ and } -2^\circ$.

Figure 2.- Inviscid pressure distributions for S833 airfoil.



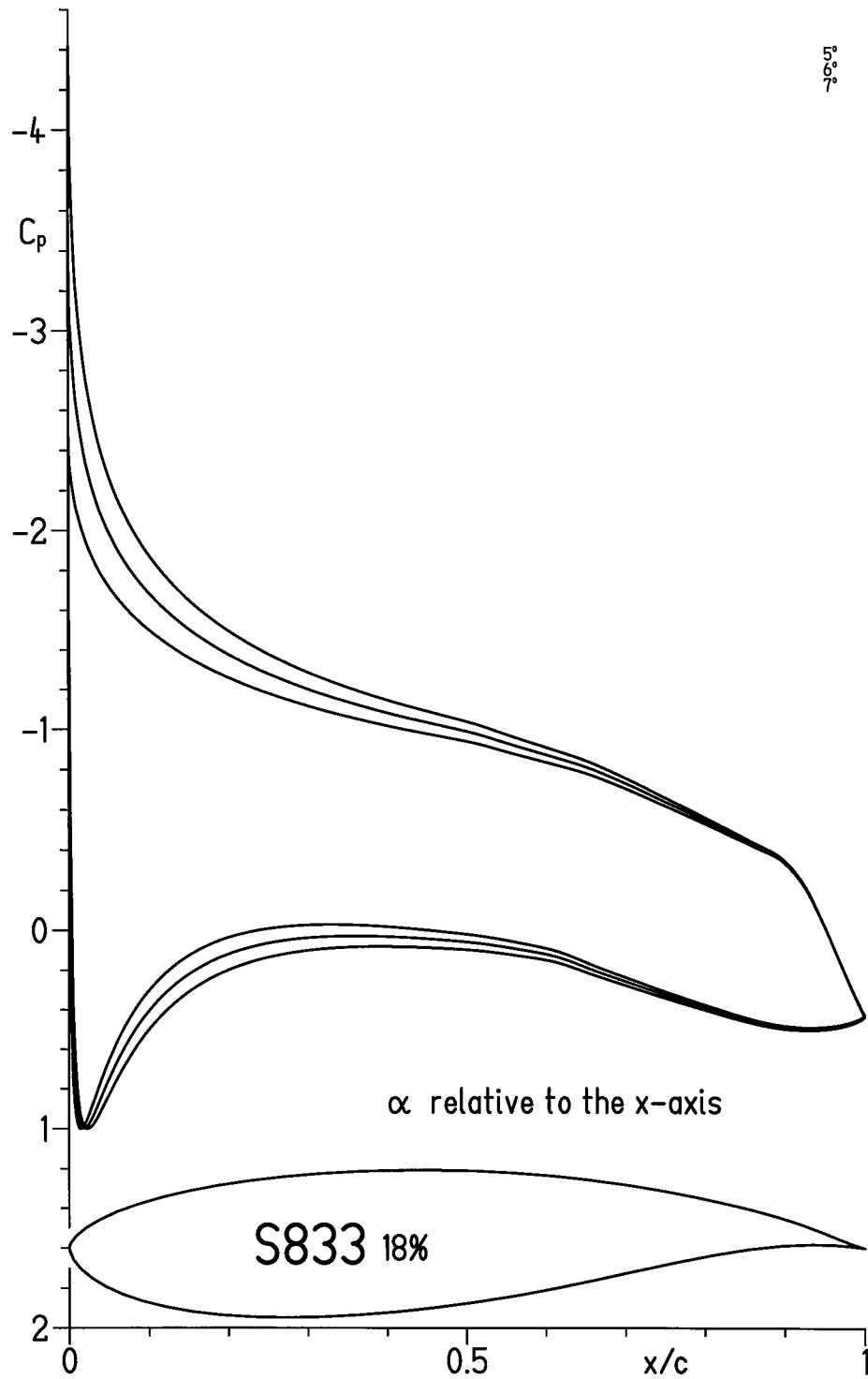
(b) $\alpha = -1^\circ, 0^\circ,$ and 1° .

Figure 2.- Continued.



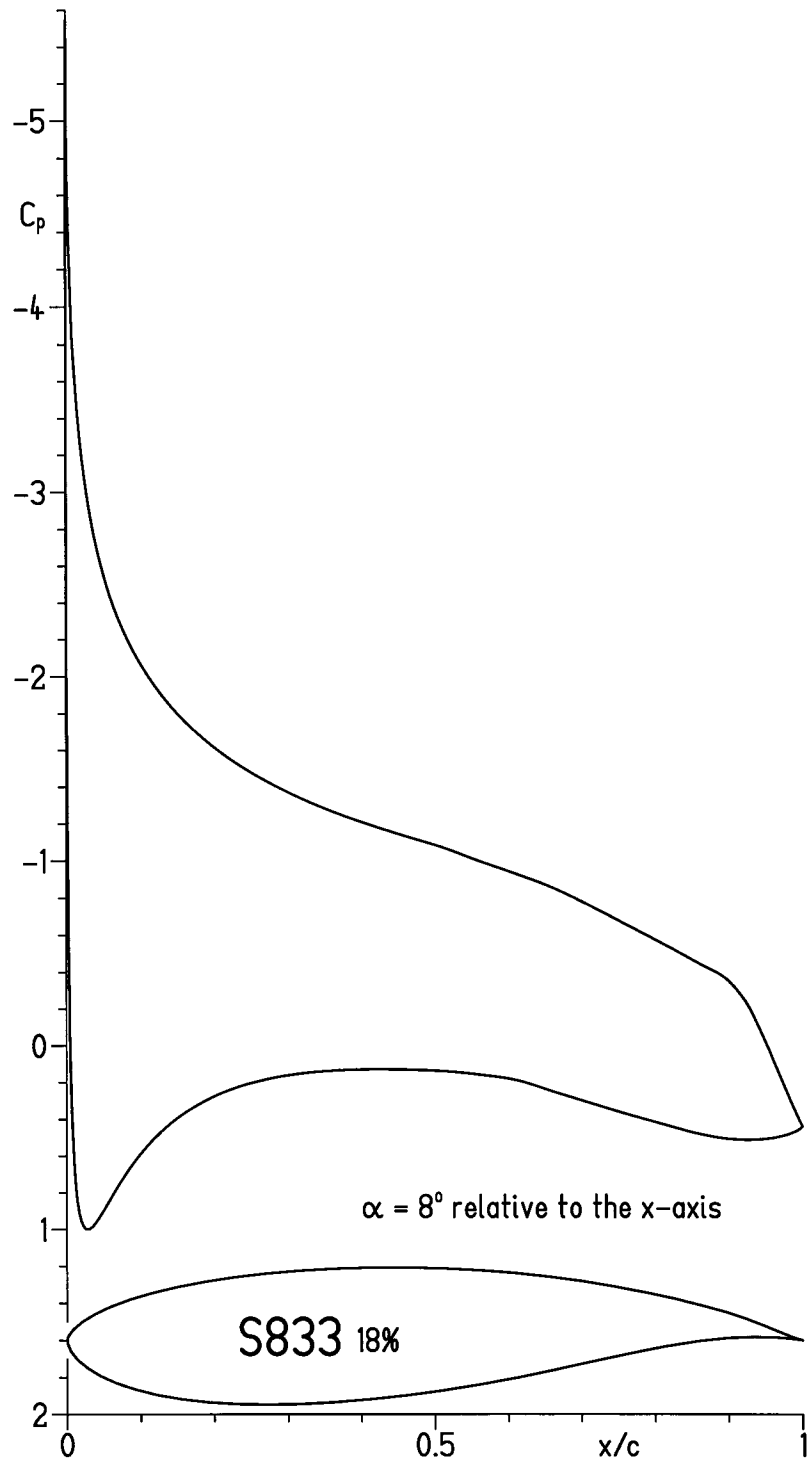
(c) $\alpha = 2^\circ, 3^\circ, \text{ and } 4^\circ$.

Figure 2.- Continued.



(d) $\alpha = 5^\circ, 6^\circ, \text{ and } 7^\circ$.

Figure 2.- Continued.

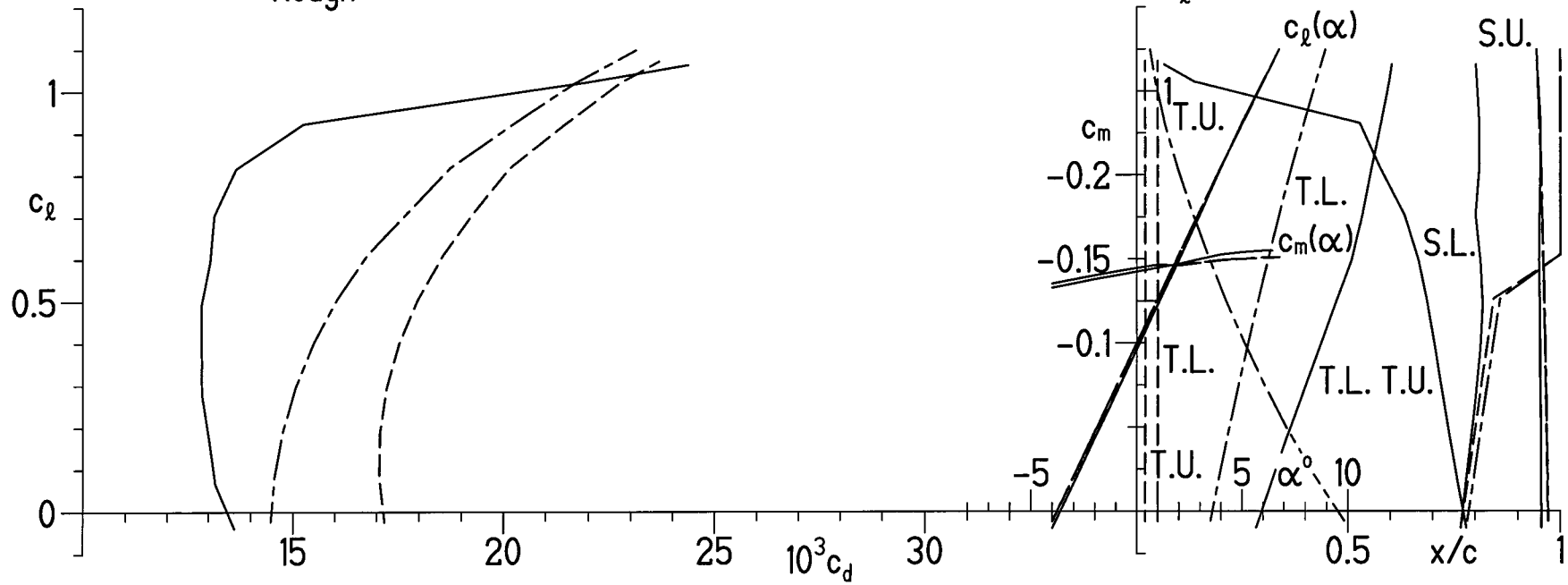


(e) $\alpha = 8^\circ$.

Figure 2.- Concluded.

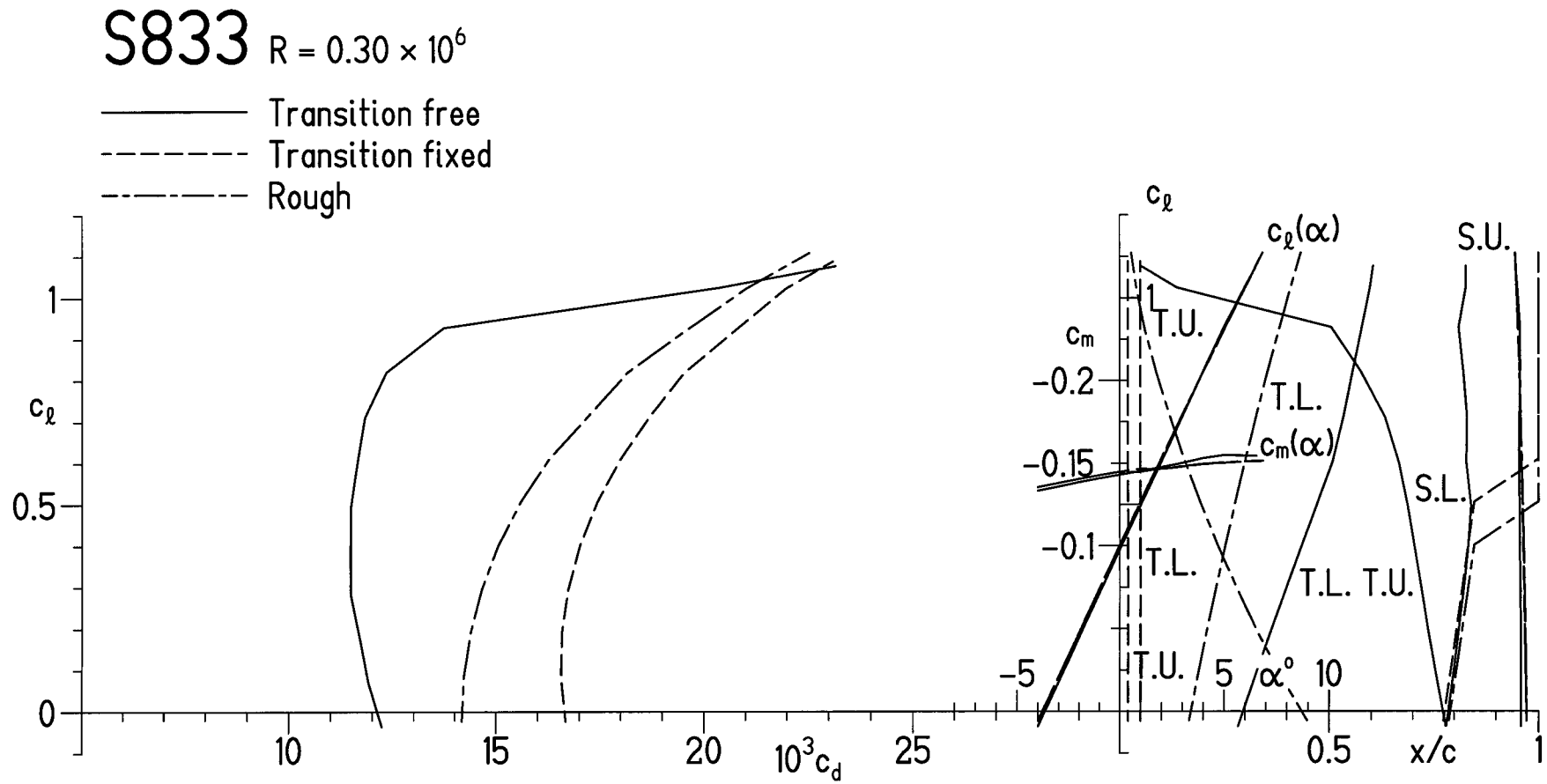
S833 $R = 0.25 \times 10^6$

— Transition free
 - - - Transition fixed
 - · - Rough



(a) $R = 0.25 \times 10^6$.

Figure 3.- Section characteristics of S833 airfoil with transition free, transition fixed, and rough.

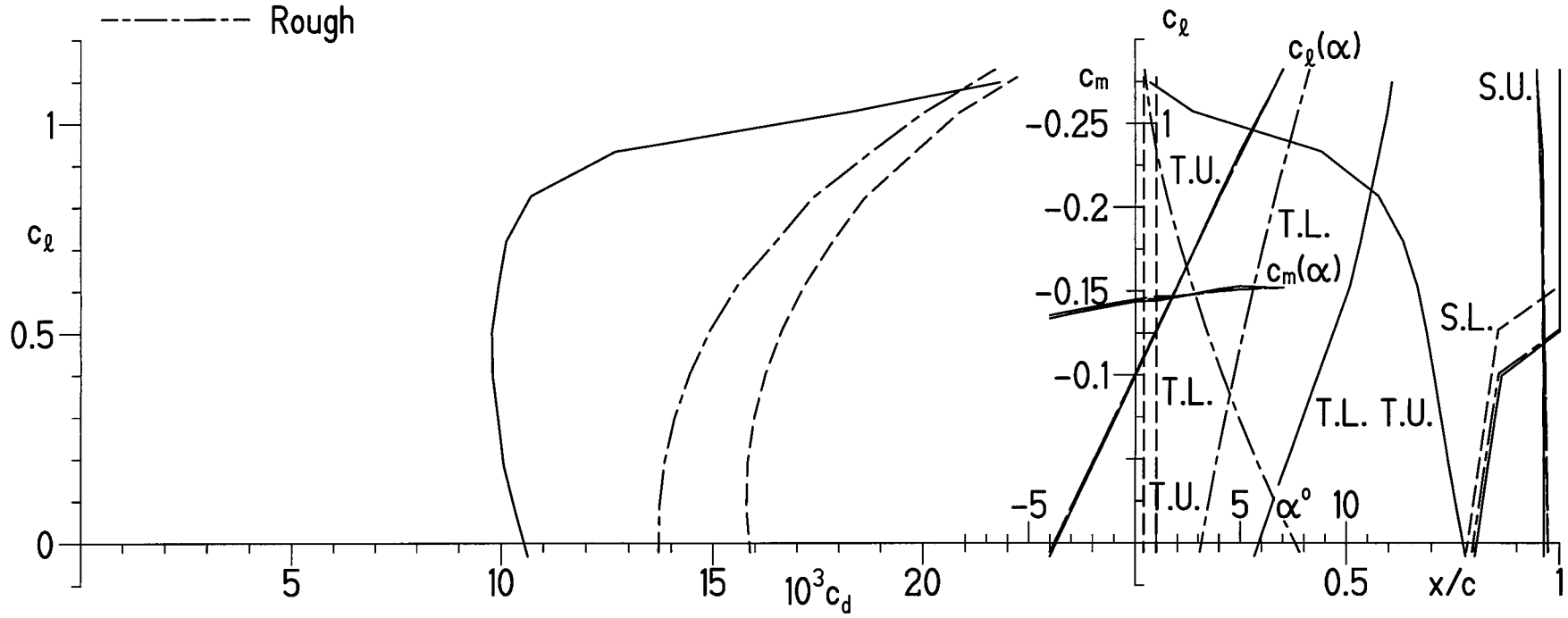


(b) $R = 0.30 \times 10^6$.

Figure 3.- Continued.

S833 $R = 0.40 \times 10^6$

- Transition free
- - - Transition fixed
- · - · - Rough

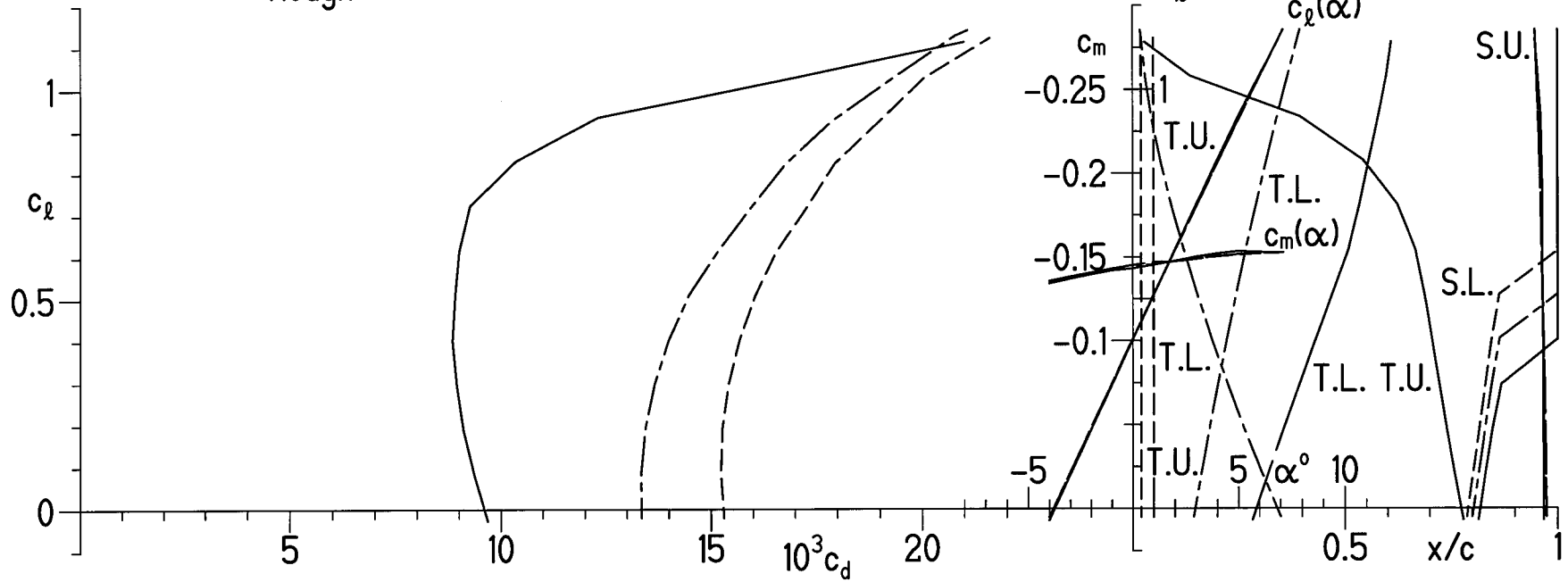


(c) $R = 0.40 \times 10^6$.

Figure 3.- Continued.

S833 $R = 0.50 \times 10^6$

- Transition free
- - - Transition fixed
- · - · - Rough

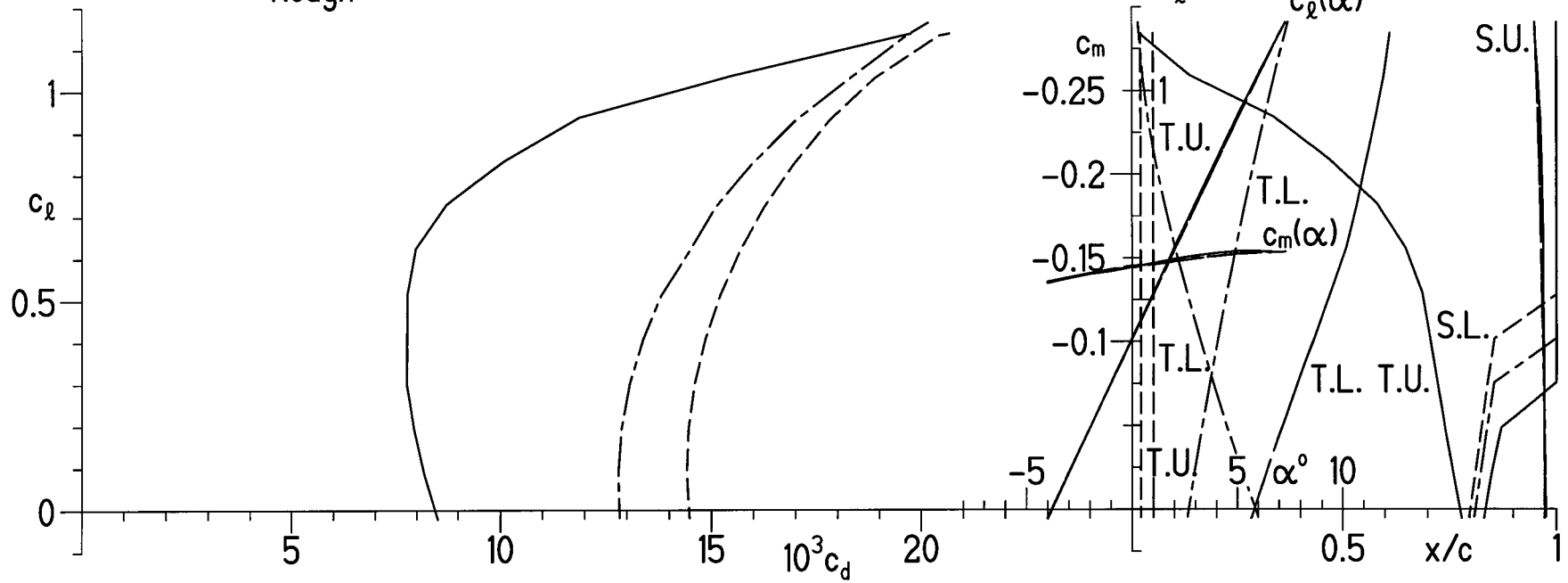


(d) $R = 0.50 \times 10^6$.

Figure 3.- Continued.

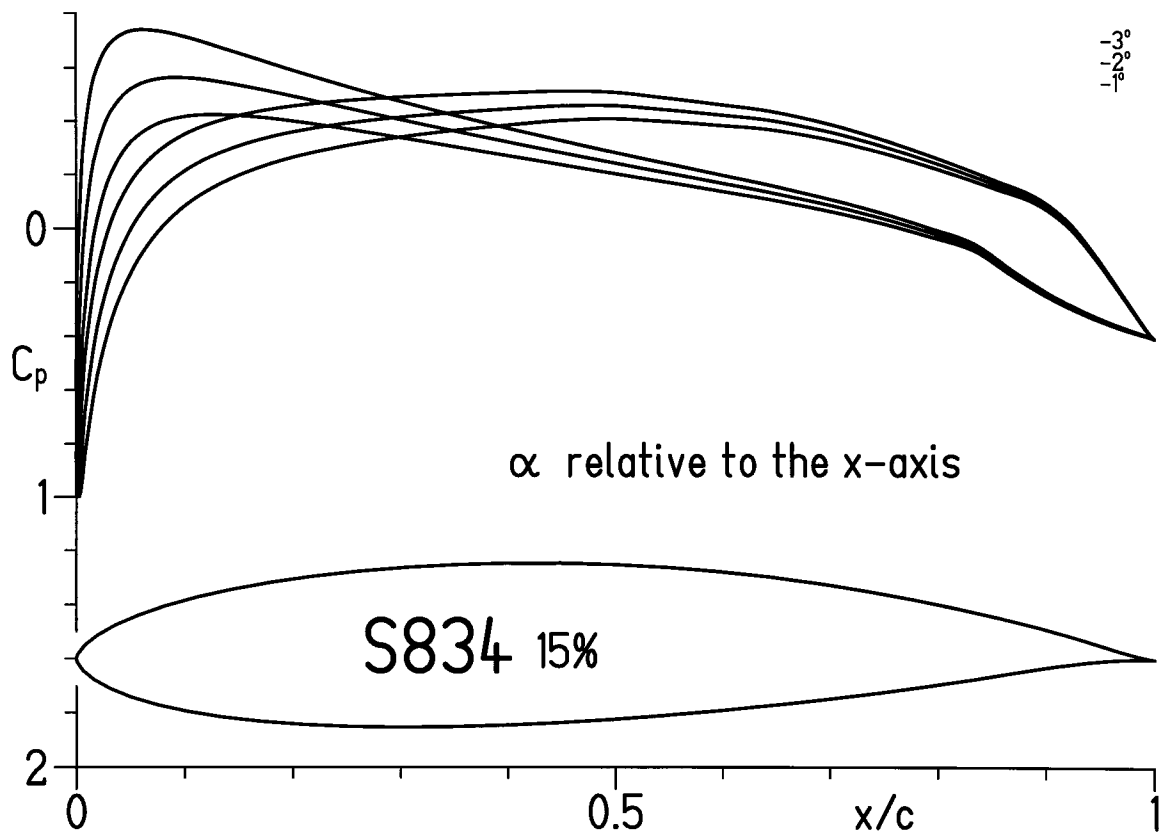
S833 $R = 0.70 \times 10^6$

— Transition free
 - - - Transition fixed
 - · - · - Rough



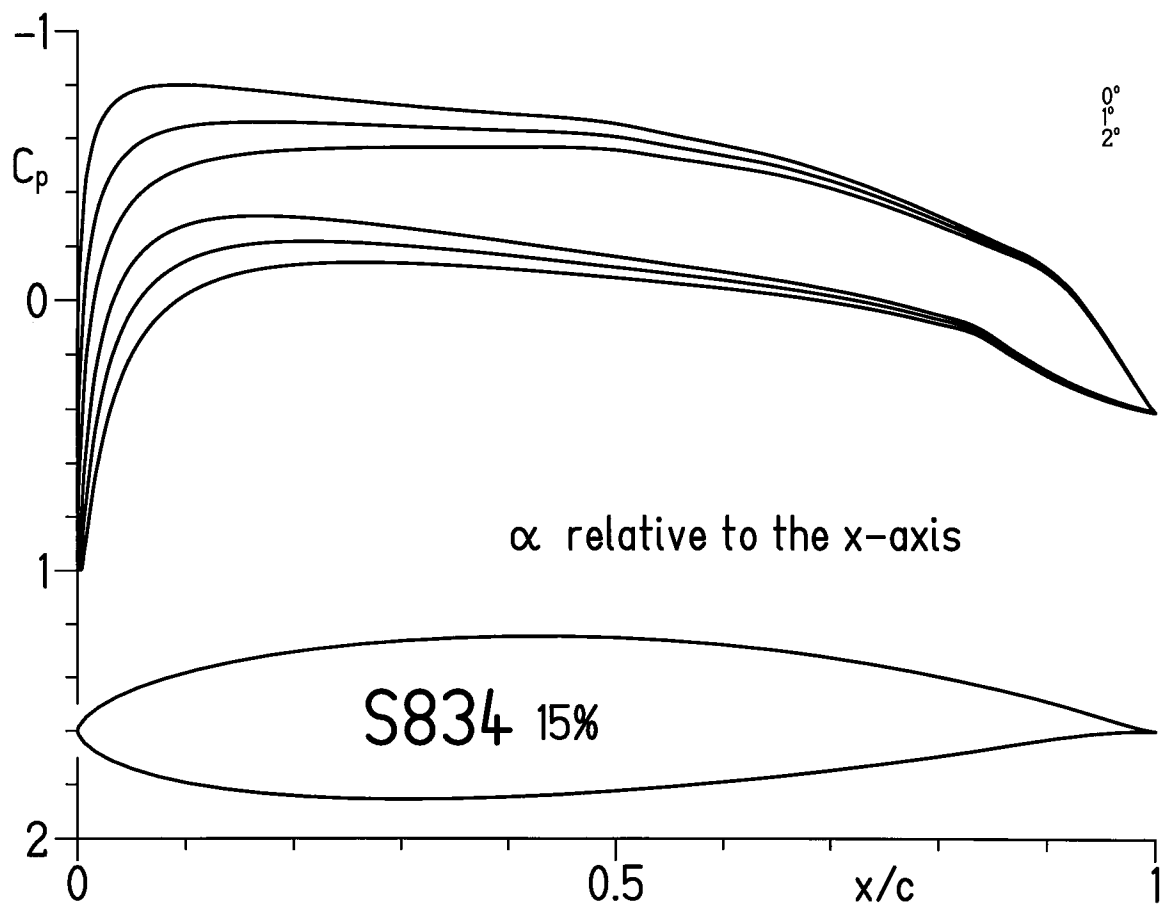
(e) $R = 0.70 \times 10^6$.

Figure 3.- Concluded.



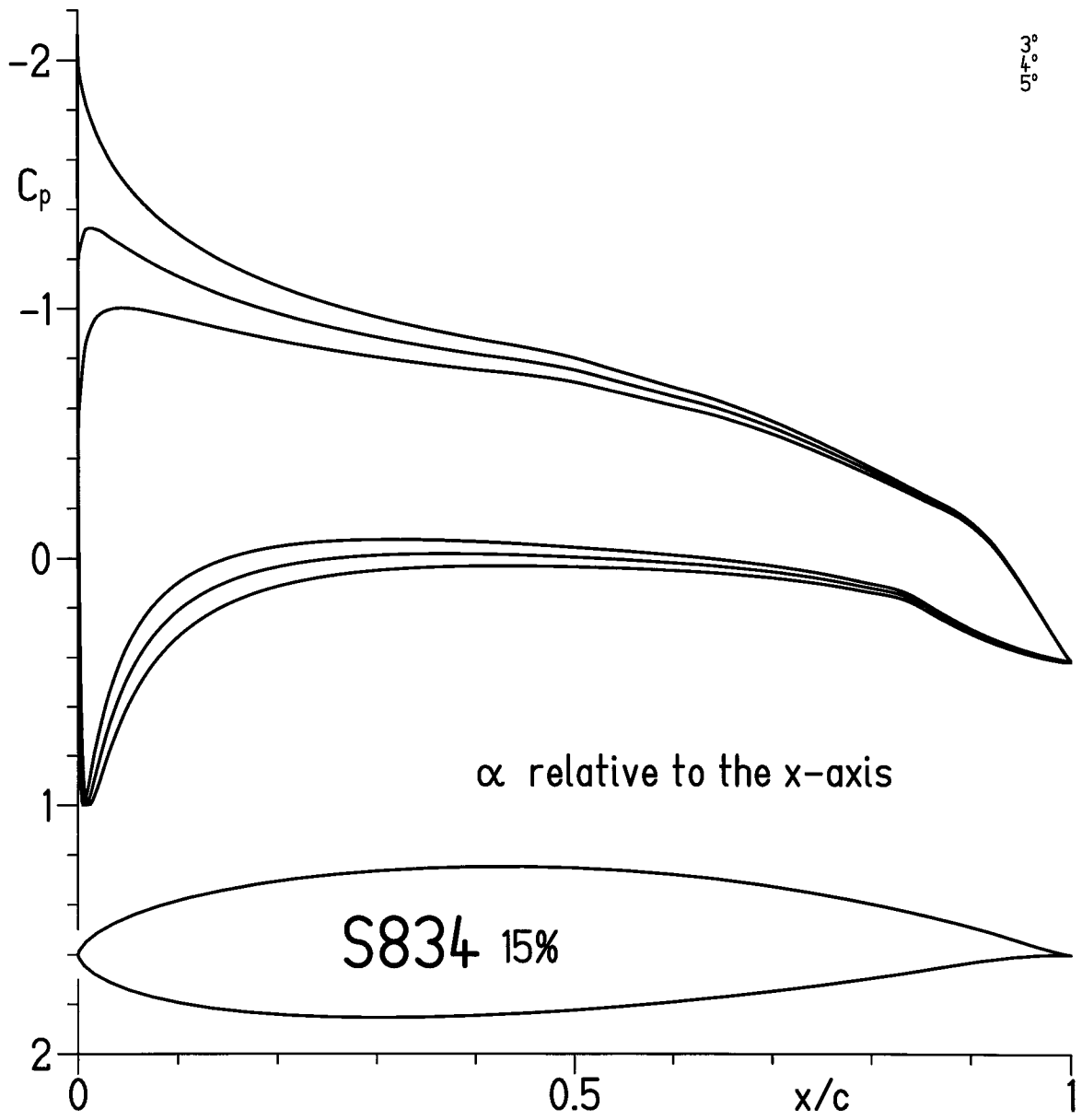
(a) $\alpha = -3^\circ, -2^\circ, \text{ and } -1^\circ$.

Figure 4.- Inviscid pressure distributions for S834 airfoil.



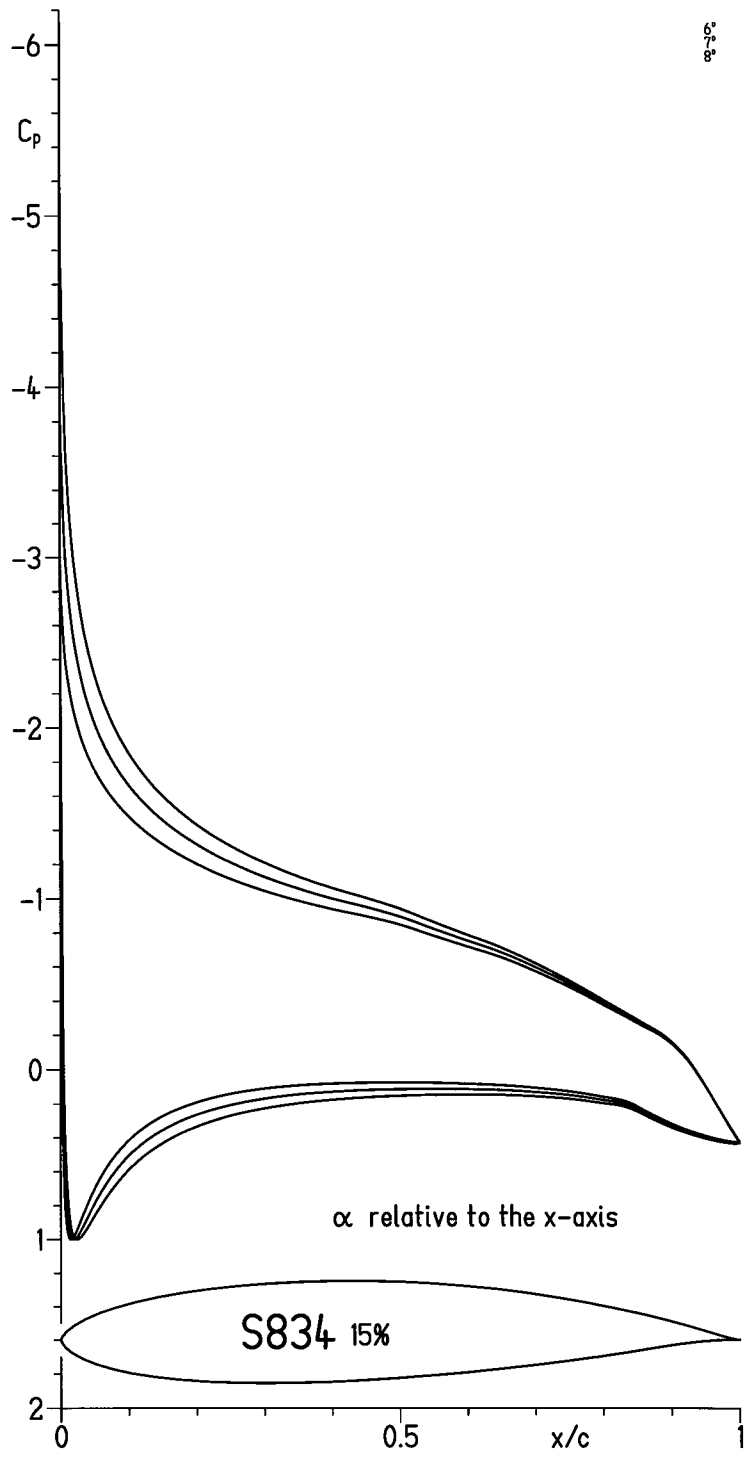
(b) $\alpha = 0^\circ, 1^\circ, \text{ and } 2^\circ$.

Figure 4.- Continued.



(c) $\alpha = 3^\circ, 4^\circ, \text{ and } 5^\circ$.

Figure 4.- Continued.



(d) $\alpha = 6^\circ, 7^\circ, \text{ and } 8^\circ$.

Figure 4.- Concluded.

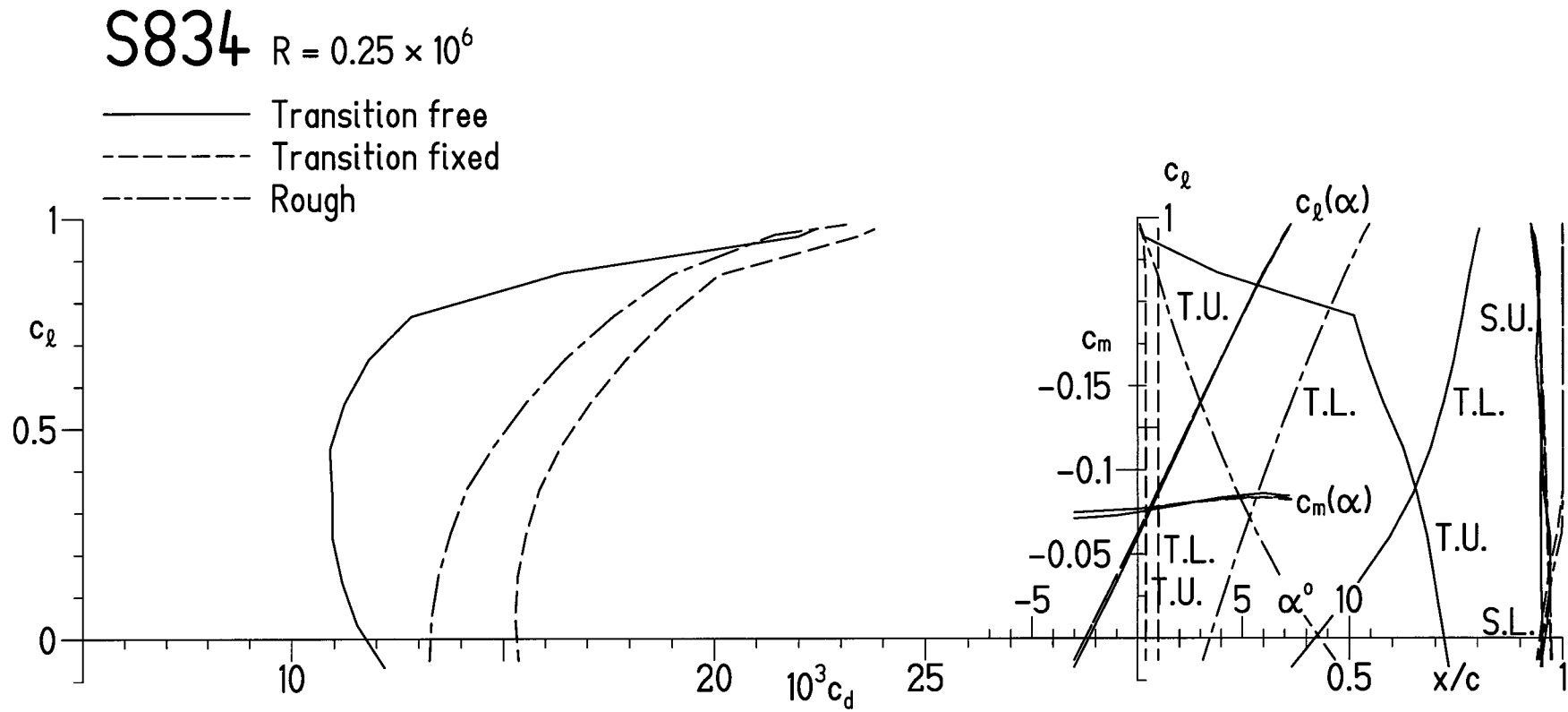
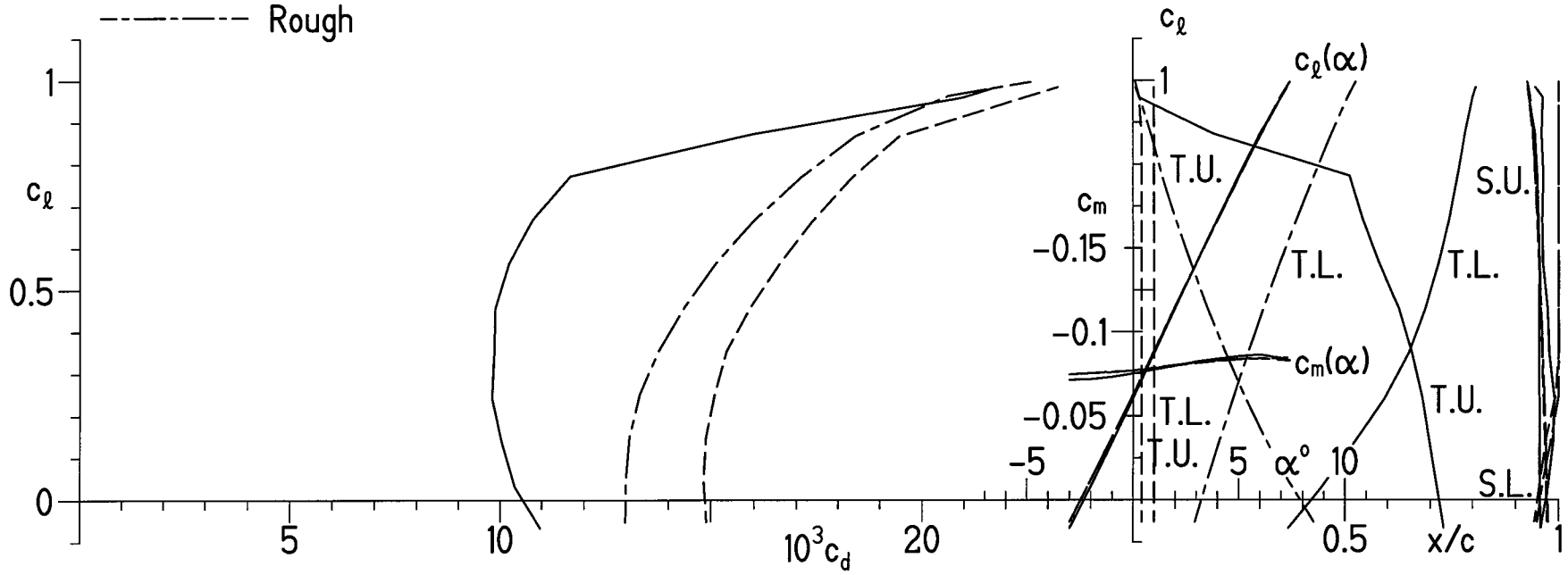
(a) $R = 0.25 \times 10^6$.

Figure 5.- Section characteristics of S834 airfoil with transition free, transition fixed, and rough.

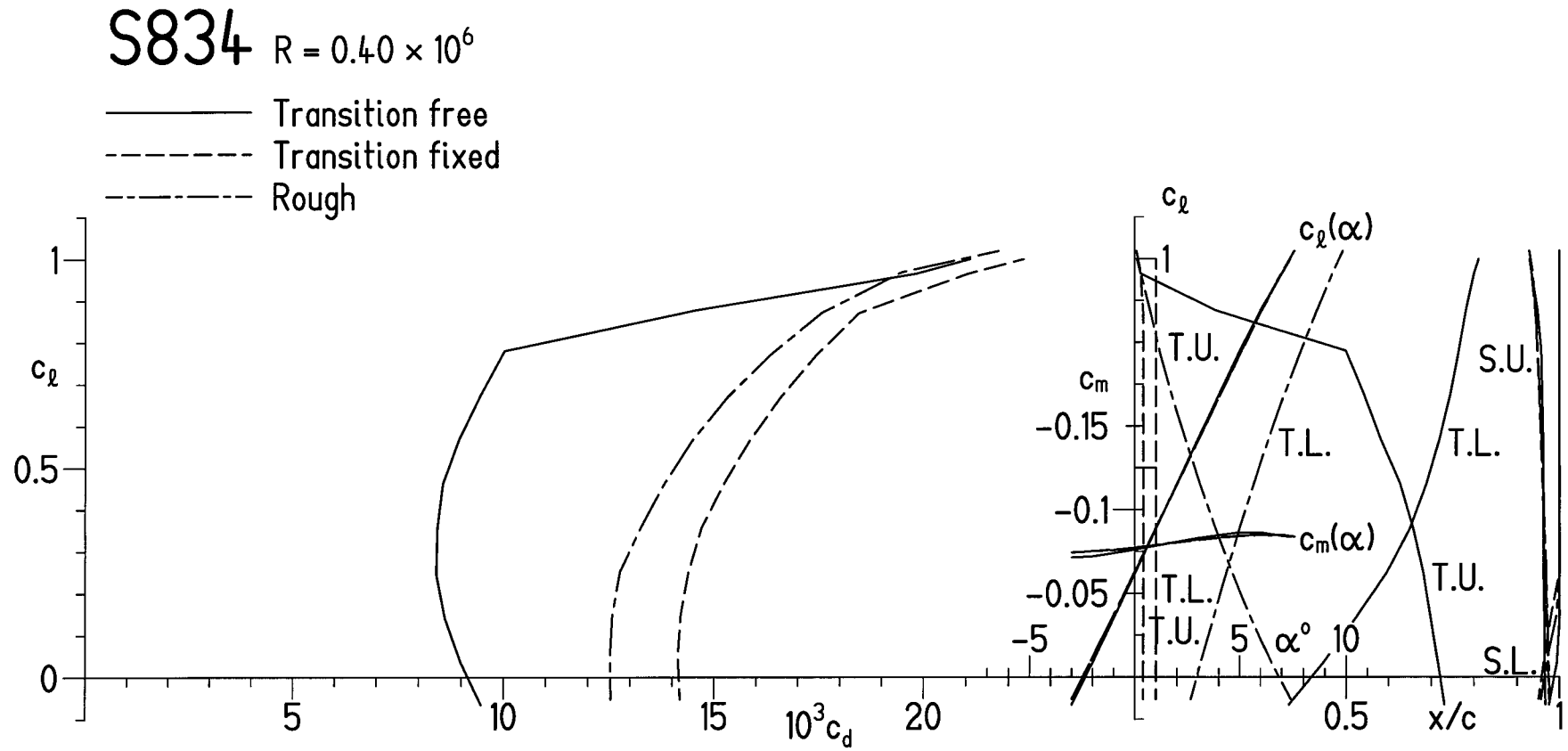
S834 $R = 0.30 \times 10^6$

— Transition free
 - - - Transition fixed
 - - - Rough



(b) $R = 0.30 \times 10^6$.

Figure 5.- Continued.

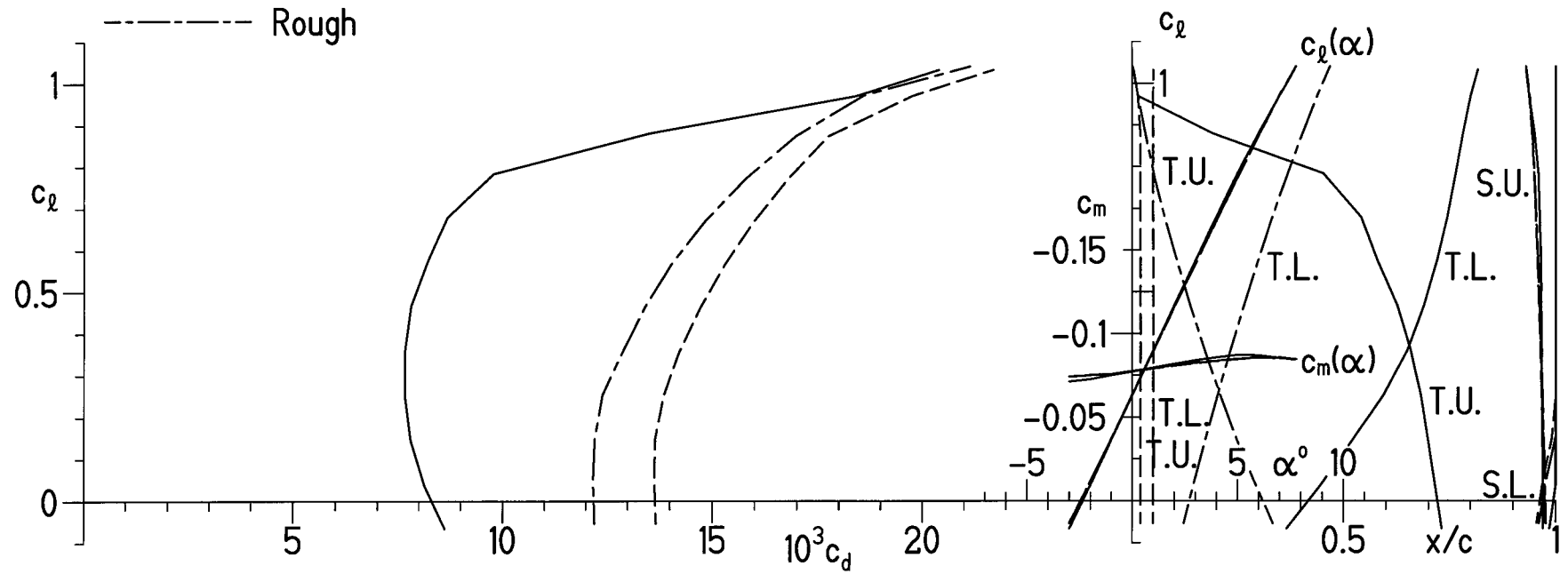


(c) $R = 0.40 \times 10^6$.

Figure 5.- Continued.

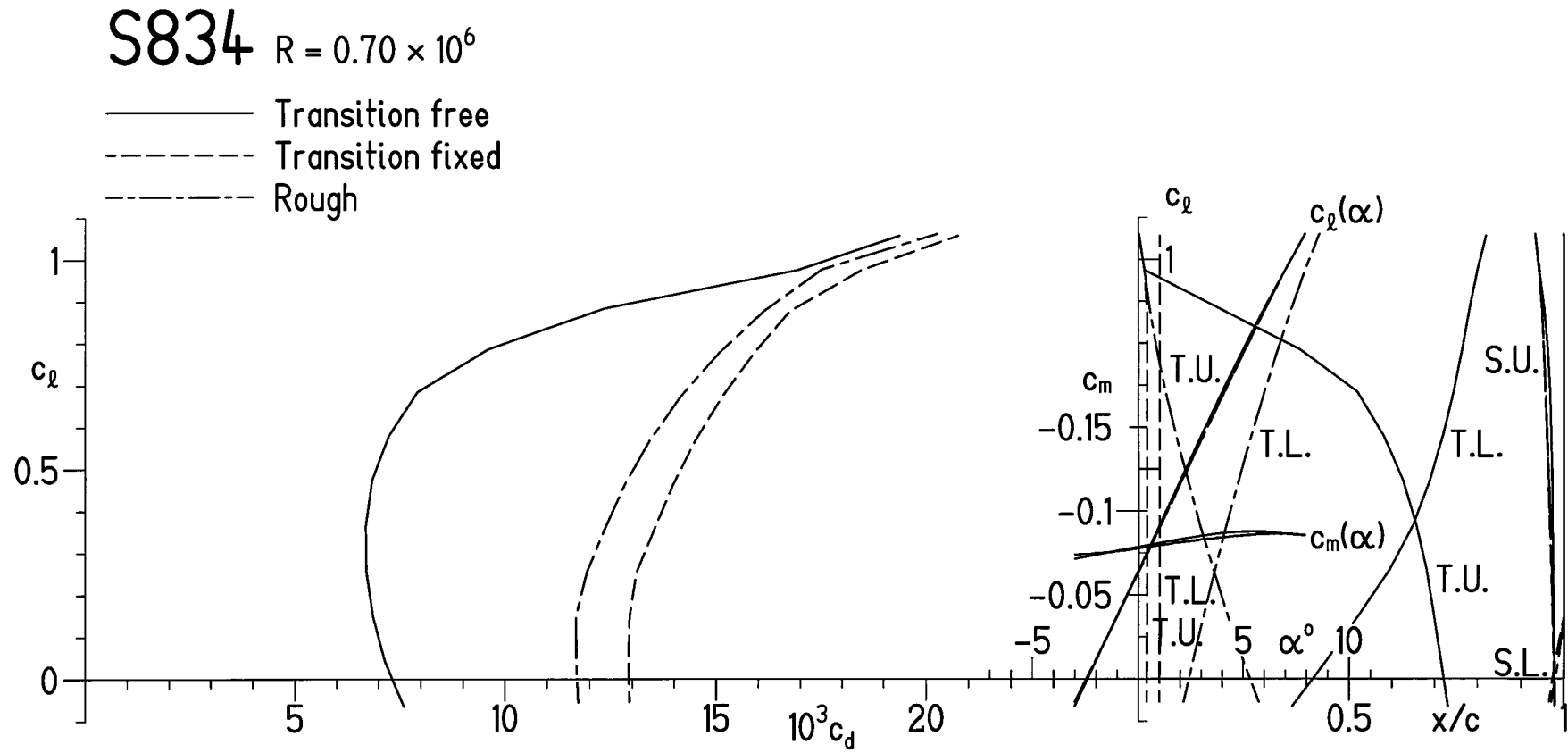
S834 $R = 0.50 \times 10^6$

- Transition free
- - - Transition fixed
- · - · - Rough



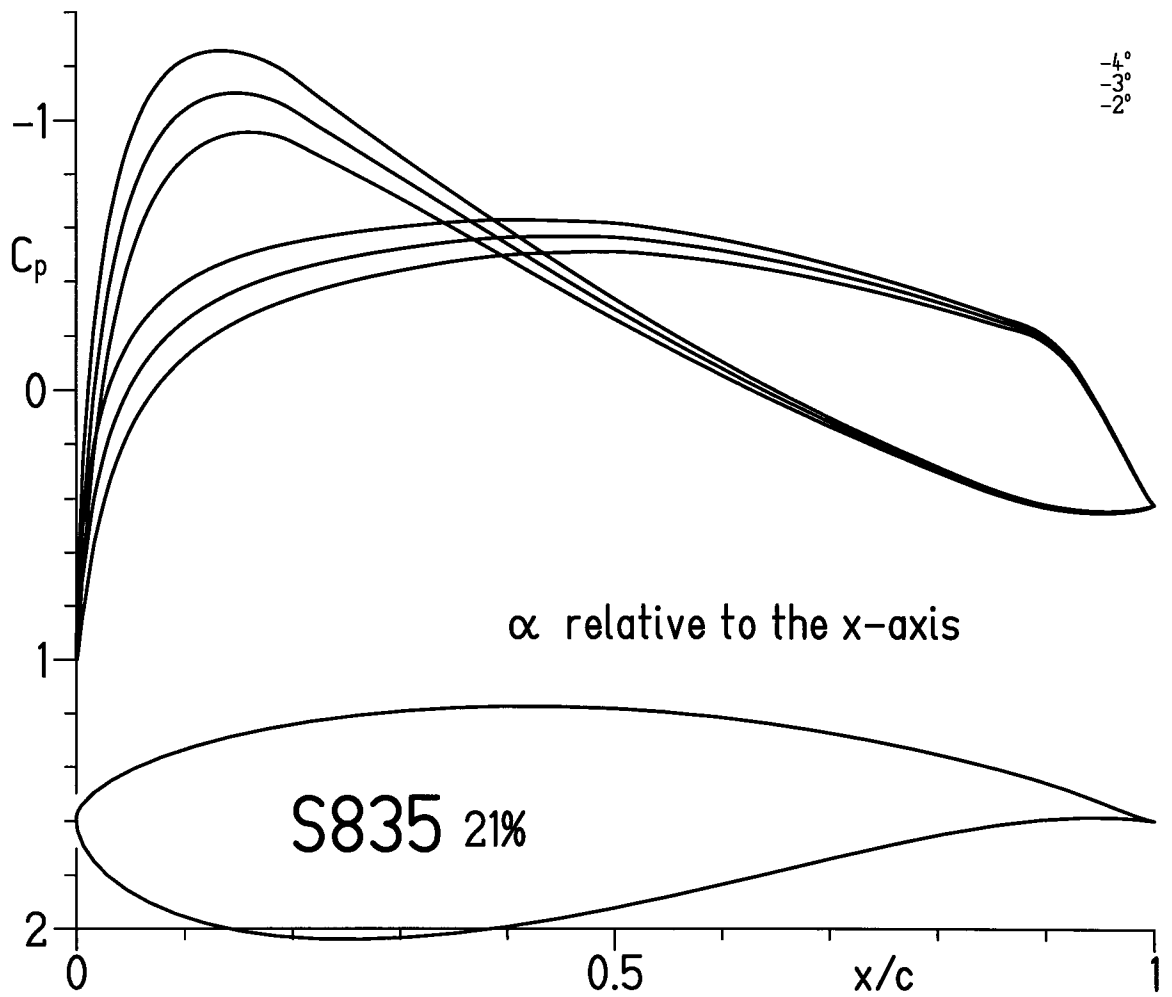
(d) $R = 0.50 \times 10^6$.

Figure 5.- Continued.



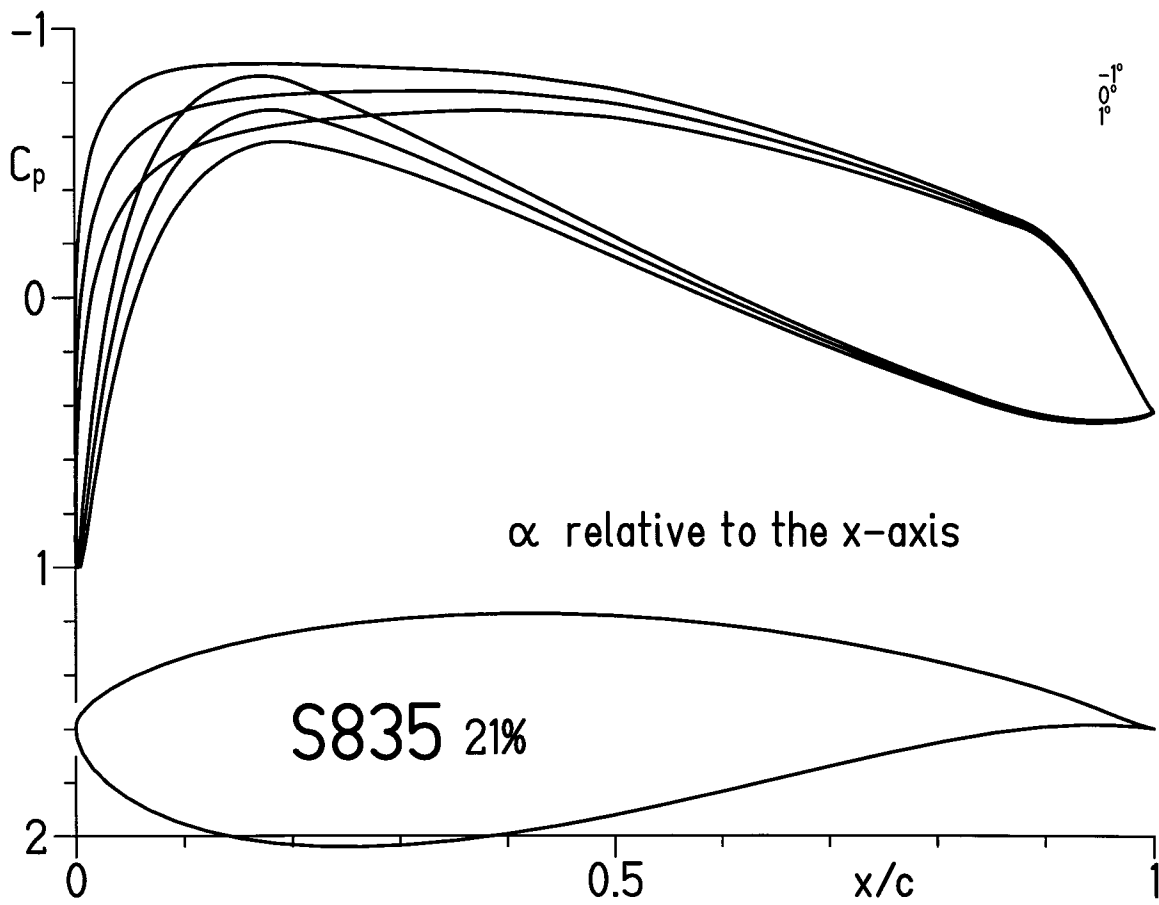
(e) $R = 0.70 \times 10^6$.

Figure 5.- Concluded.



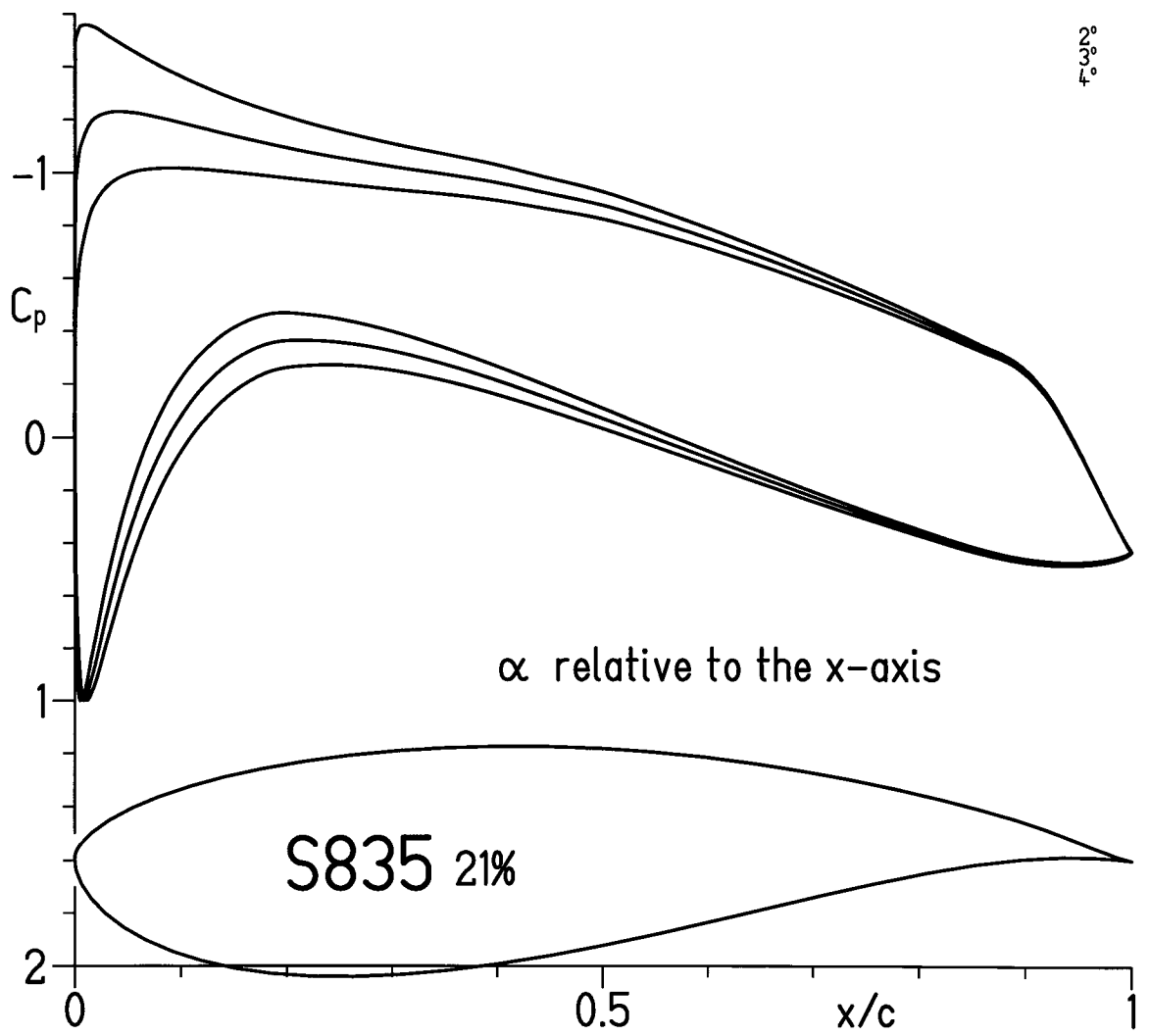
(a) $\alpha = -4^\circ, -3^\circ, \text{ and } -2^\circ$.

Figure 6.- Inviscid pressure distributions for S835 airfoil.



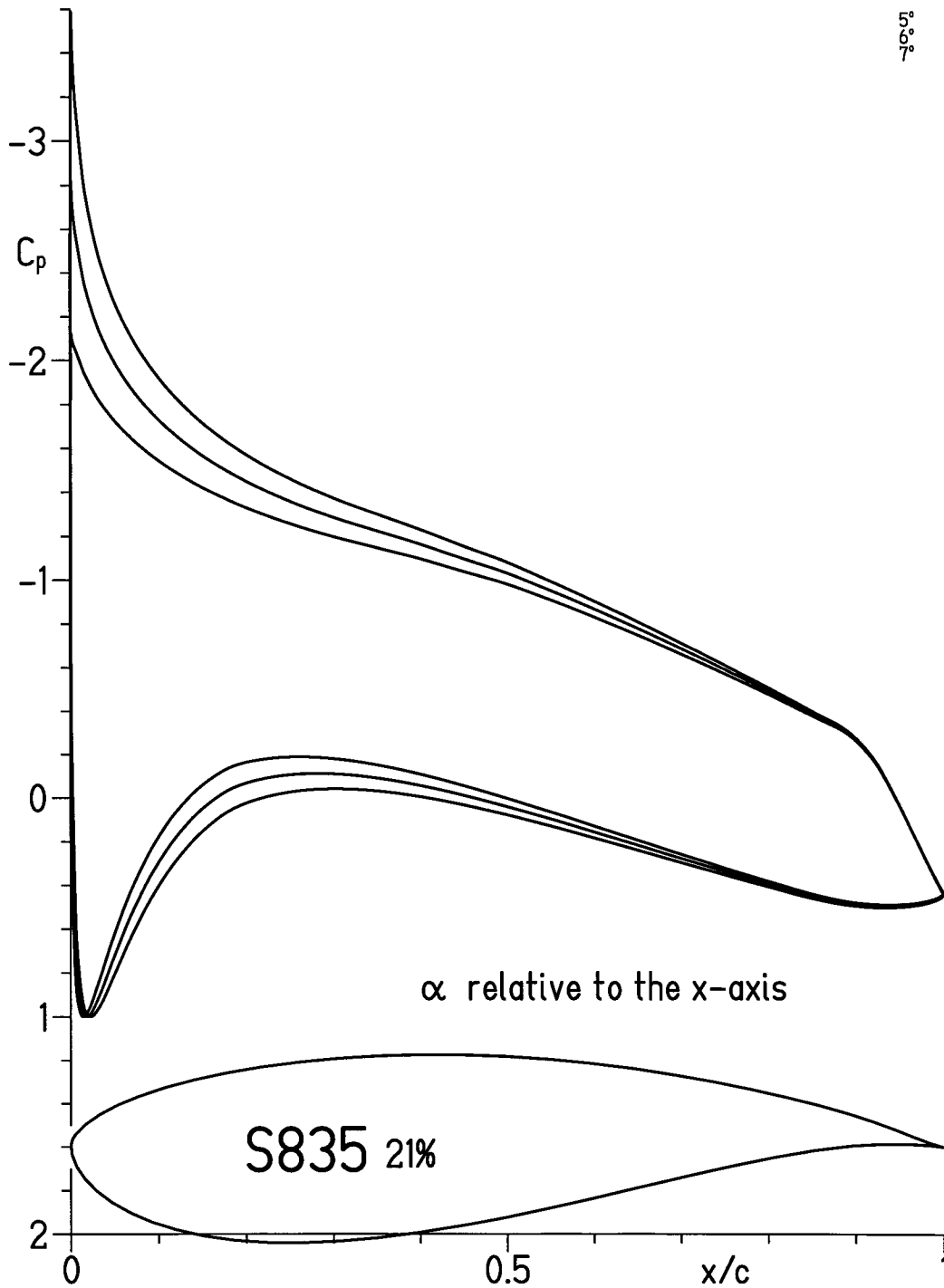
(b) $\alpha = -1^\circ, 0^\circ, \text{ and } 1^\circ$.

Figure 6.- Continued.



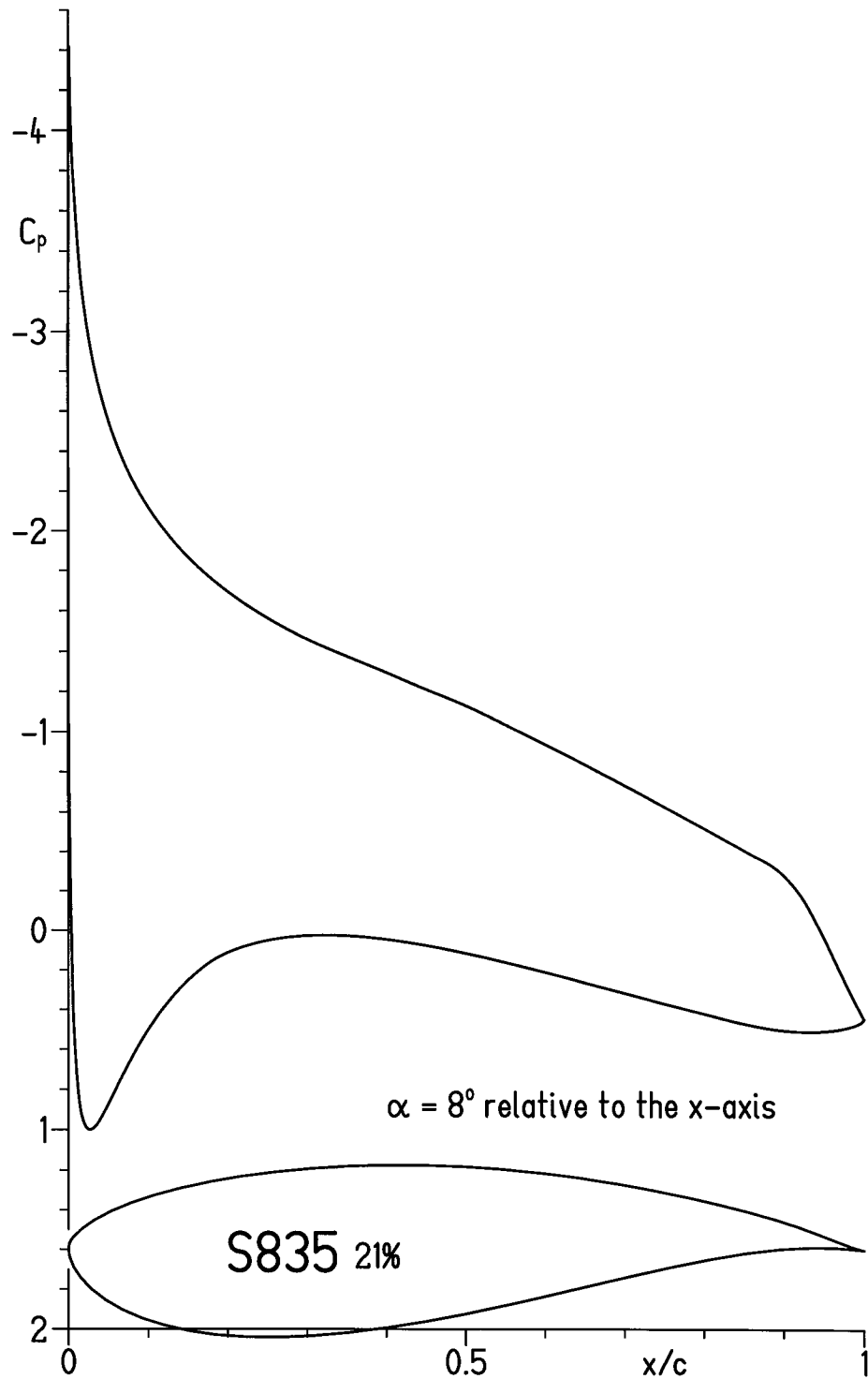
(c) $\alpha = 2^\circ, 3^\circ, \text{ and } 4^\circ$.

Figure 6.- Continued.



(d) $\alpha = 5^\circ, 6^\circ,$ and 7° .

Figure 6.- Continued.



(e) $\alpha = 8^\circ$.

Figure 6.- Concluded.

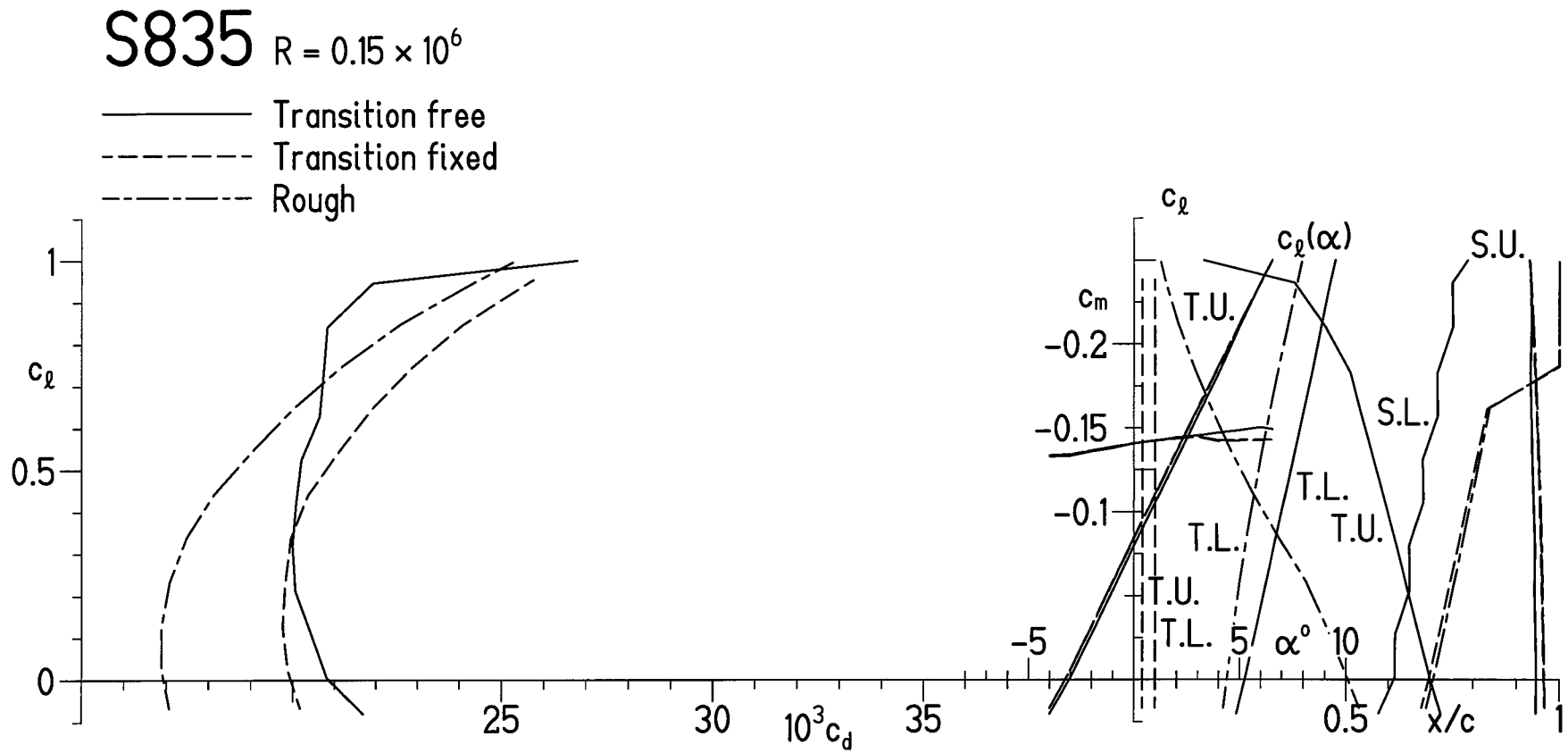
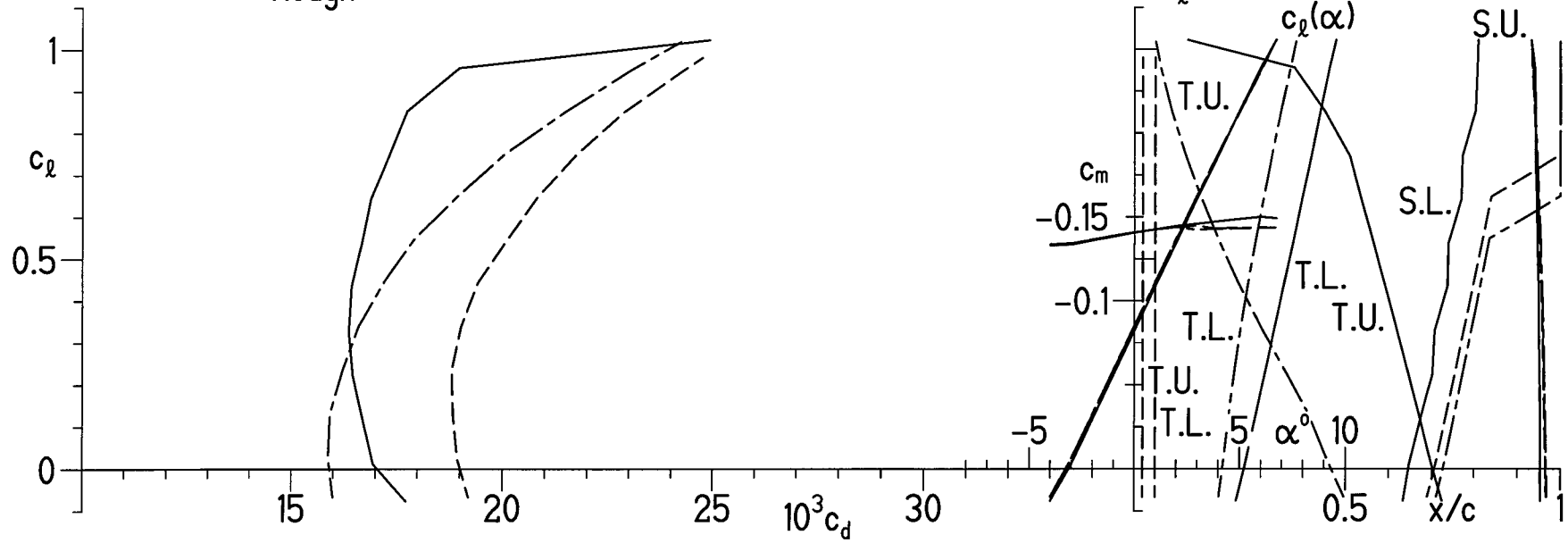
(a) $R = 0.15 \times 10^6$.

Figure 7.- Section characteristics of S835 airfoil with transition free, transition fixed, and rough.

S835 $R = 0.20 \times 10^6$

- Transition free
- - - Transition fixed
- · - Rough

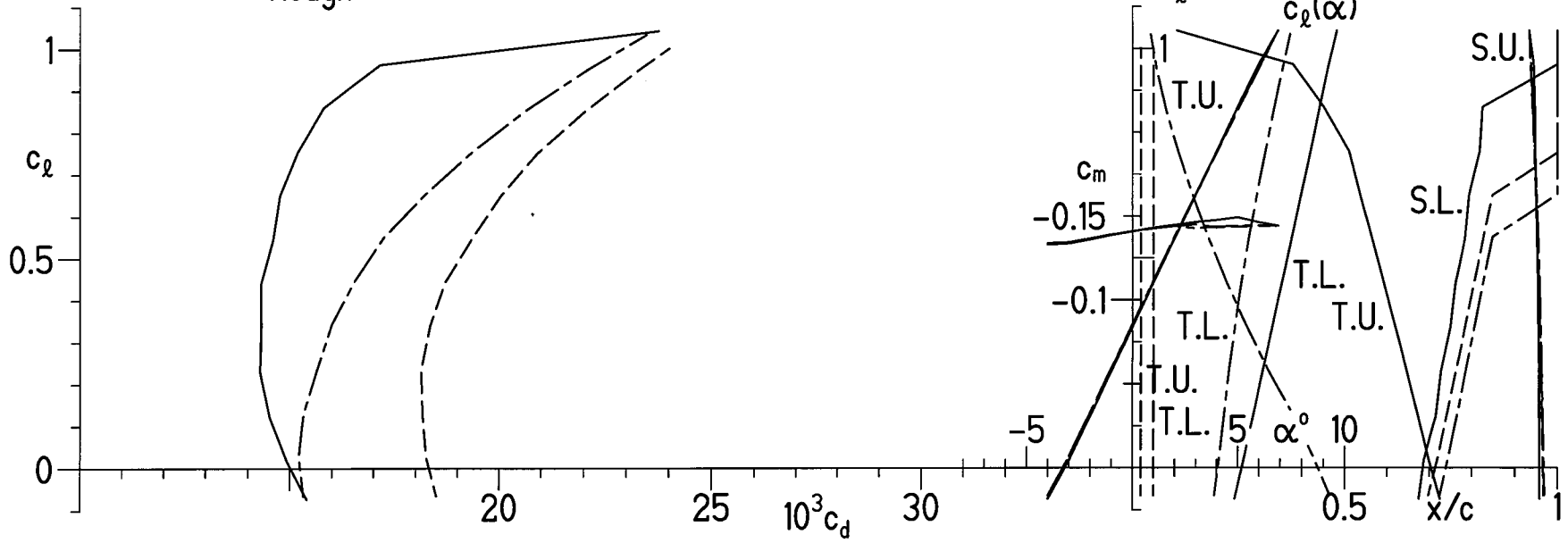


(b) $R = 0.20 \times 10^6$.

Figure 7.- Continued.

S835 $R = 0.25 \times 10^6$

- Transition free
- - - Transition fixed
- · - · - Rough

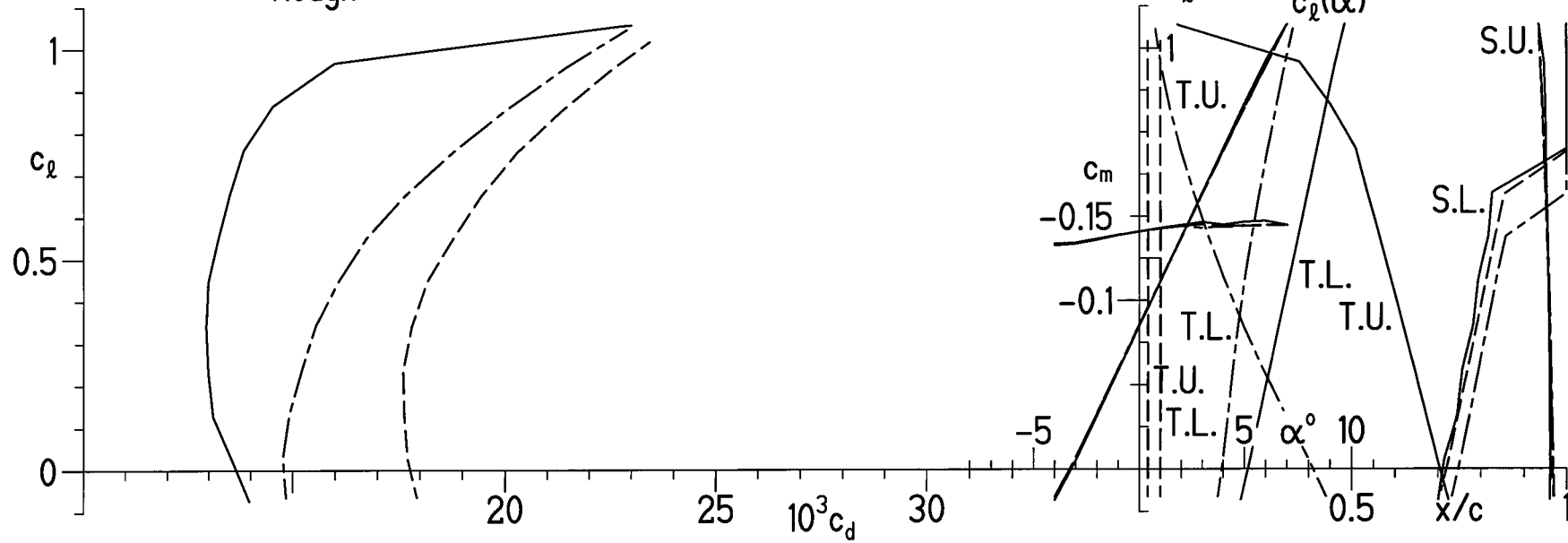


(c) $R = 0.25 \times 10^6$.

Figure 7.- Continued.

S835 $R = 0.30 \times 10^6$

— Transition free
 - - - Transition fixed
 - · - Rough

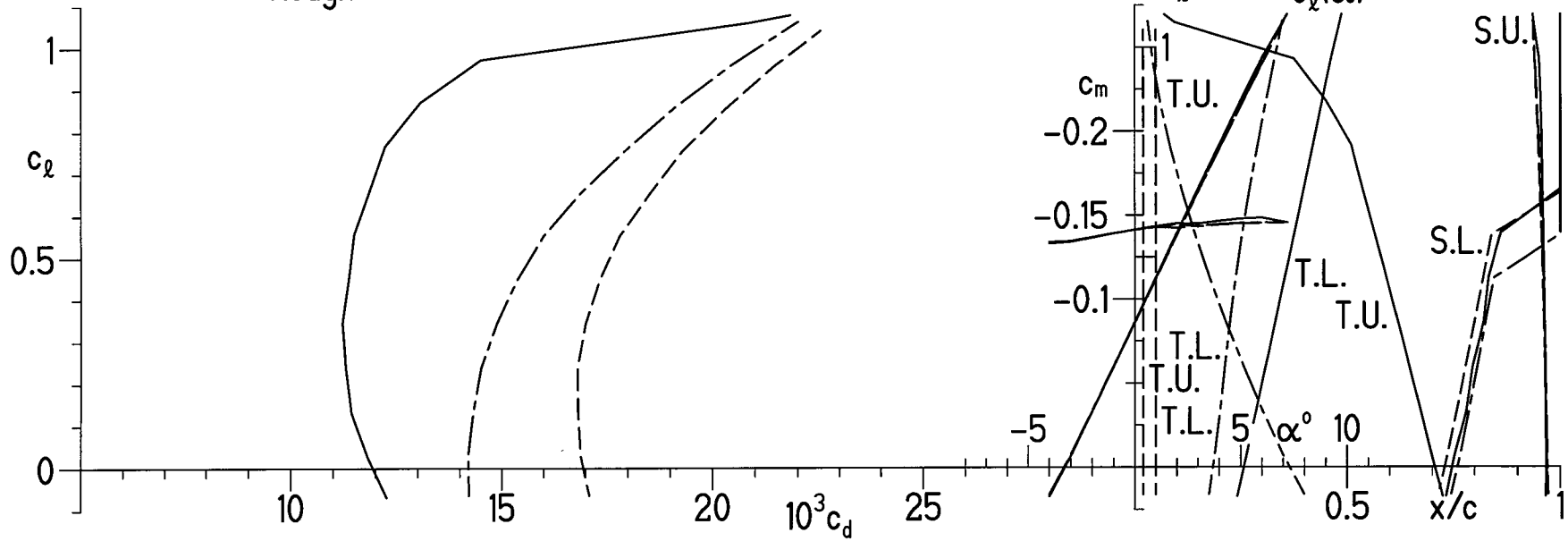


(d) $R = 0.30 \times 10^6$.

Figure 7.- Continued.

S835 $R = 0.40 \times 10^6$

- Transition free
- - - Transition fixed
- · - Rough



(e) $R = 0.40 \times 10^6$.

Figure 7.- Concluded.

APPENDIX A

PRESSURE DISTRIBUTIONS, TRANSITION AND SEPARATION LOCATIONS, AND
SECTION CHARACTERISTICS OF S833 AIRFOIL

AIRFOIL S833 18%			-4.00 -3.00 -2.00 -1.00 0.00 1.00 2.00																	
N	X	Y	NU	CP(X) FOR THE ABOVE ALPHA REL. CHORD LINE																
1	1.00000	0.00000	0.00	0.414	0.414	0.414	0.415	0.417	0.418	0.420										
2	0.99606	0.00100	1.00	0.393	0.392	0.391	0.391	0.391	0.392	0.393										
3	0.98502	0.00465	2.00	0.309	0.307	0.305	0.303	0.302	0.302	0.301										
4	0.96844	0.01109	3.00	0.172	0.167	0.164	0.160	0.158	0.155	0.153										
5	0.94764	0.01954	4.00	0.002	-0.005	-0.012	-0.017	-0.023	-0.027	-0.031										
6	0.92323	0.02883	5.00	-0.160	-0.171	-0.180	-0.190	-0.198	-0.206	-0.213										
7	0.89510	0.03796	6.00	-0.253	-0.267	-0.280	-0.292	-0.304	-0.315	-0.325										
8	0.86284	0.04678	7.00	-0.288	-0.305	-0.321	-0.337	-0.351	-0.365	-0.379										
9	0.82683	0.05549	8.00	-0.325	-0.346	-0.365	-0.384	-0.402	-0.420	-0.436										
10	0.78759	0.06394	9.00	-0.364	-0.387	-0.411	-0.433	-0.455	-0.476	-0.497										
11	0.74562	0.07192	10.00	-0.401	-0.429	-0.456	-0.483	-0.509	-0.534	-0.558										
12	0.70140	0.07919	11.00	-0.436	-0.468	-0.500	-0.531	-0.561	-0.591	-0.620										
13	0.65539	0.08546	12.00	-0.463	-0.500	-0.536	-0.572	-0.607	-0.642	-0.676										
14	0.60790	0.09049	13.00	-0.471	-0.513	-0.553	-0.594	-0.634	-0.674	-0.713										
15	0.55925	0.09430	14.00	-0.474	-0.520	-0.566	-0.612	-0.657	-0.702	-0.747										
16	0.51005	0.09685	15.00	-0.475	-0.526	-0.577	-0.628	-0.679	-0.730	-0.780										
17	0.46067	0.09798	16.00	-0.460	-0.517	-0.573	-0.630	-0.687	-0.744	-0.800										
18	0.41151	0.09778	17.00	-0.440	-0.502	-0.564	-0.627	-0.690	-0.754	-0.817										
19	0.36309	0.09632	18.00	-0.417	-0.485	-0.555	-0.624	-0.694	-0.765	-0.836										
20	0.31595	0.09364	19.00	-0.391	-0.466	-0.542	-0.620	-0.698	-0.777	-0.856										
21	0.27056	0.08979	20.00	-0.360	-0.443	-0.527	-0.613	-0.700	-0.789	-0.878										
22	0.22744	0.08480	21.00	-0.322	-0.414	-0.507	-0.603	-0.701	-0.800	-0.902										
23	0.18700	0.07875	22.00	-0.276	-0.377	-0.481	-0.588	-0.698	-0.811	-0.926										
24	0.14969	0.07168	23.00	-0.216	-0.328	-0.445	-0.565	-0.689	-0.817	-0.949										
25	0.11583	0.06370	24.00	-0.139	-0.264	-0.394	-0.530	-0.672	-0.818	-0.970										
26	0.08580	0.05491	25.00	-0.037	-0.175	-0.322	-0.476	-0.638	-0.807	-0.983										
27	0.05981	0.04544	26.00	0.099	-0.054	-0.219	-0.394	-0.581	-0.778	-0.985										
28	0.03816	0.03549	27.00	0.279	0.113	-0.070	-0.270	-0.485	-0.717	-0.964										
29	0.02100	0.02526	28.00	0.514	0.341	0.142	-0.082	-0.332	-0.607	-0.907										
30	0.00863	0.01509	29.00	0.797	0.642	0.445	0.204	-0.080	-0.405	-0.773										
31	0.00192	0.00645	29.88	0.994	0.925	0.782	0.563	0.270	-0.097	-0.539										
32	0.00134	0.00533	30.00	1.000	0.955	0.827	0.618	0.328	-0.044	-0.497										
33	0.00080	0.00413	30.13	0.995	0.980	0.875	0.679	0.394	0.018	-0.447										
34	0.00014	0.00190	30.38	0.934	1.000	0.954	0.797	0.528	0.149	-0.340										
35	0.00001	-0.00039	30.63	0.837	0.966	0.999	0.935	0.776	0.520	0.169										
36	0.00027	-0.00284	30.88	0.719	0.894	0.985	0.993	0.916	0.756	0.512										
37	0.00051	-0.00405	31.00	0.658	0.850	0.965	1.000	0.956	0.834	0.633										
38	0.00516	-0.01488	32.00	0.116	0.388	0.610	0.782	0.905	0.977	1.000										
39	0.01423	-0.02612	33.00	-0.330	-0.051	0.196	0.410	0.591	0.739	0.855										
40	0.02762	-0.03732	34.00	-0.637	-0.378	-0.140	0.076	0.270	0.441	0.590										
41	0.04509	-0.04794	35.00	-0.825	-0.594	-0.377	-0.176	0.011	0.181	0.336										
42	0.06670	-0.05772	36.00	-0.923	-0.721	-0.529	-0.348	-0.177	-0.017	0.132										
43	0.09216	-0.06635	37.00	-0.958	-0.783	-0.615	-0.455	-0.302	-0.156	-0.019										
44	0.12149	-0.07365	38.00	-0.949	-0.798	-0.653	-0.512	-0.377	-0.247	-0.123										
45	0.15434	-0.07944	39.00	-0.911	-0.781	-0.655	-0.533	-0.414	-0.300	-0.189										
46	0.19065	-0.08363	40.00	-0.853	-0.742	-0.634	-0.527	-0.424	-0.323	-0.225										
47	0.23002	-0.08613	41.00	-0.784	-0.689	-0.595	-0.503	-0.413	-0.325	-0.239										
48	0.27228	-0.08696	42.00	-0.708	-0.626	-0.546	-0.466	-0.388	-0.311	-0.235										
49	0.31695	-0.08611	43.00	-0.628	-0.558	-0.489	-0.420	-0.352	-0.285	-0.219										
50	0.36379	-0.08365	44.00	-0.548	-0.488	-0.428	-0.369	-0.310	-0.251	-0.194										
51	0.41225	-0.07967	45.00	-0.467	-0.416	-0.365	-0.314	-0.263	-0.212	-0.162										
52	0.46198	-0.07426	46.00	-0.388	-0.345	-0.301	-0.257	-0.213	-0.169	-0.125										
53	0.51236	-0.06755	47.00	-0.312	-0.274	-0.237	-0.199	-0.161	-0.123	-0.086										
54	0.56300	-0.05952	48.00	-0.228	-0.197	-0.165	-0.133	-0.101	-0.069	-0.036										
55	0.61351	-0.05025	49.00	-0.139	-0.113	-0.086	-0.059	-0.032	-0.005	0.023										
56	0.66384	-0.03971	50.00	-0.014	0.007	0.028	0.049	0.071	0.093	0.115										
57	0.71399	-0.02876	51.00	0.099	0.116	0.132	0.149	0.167	0.184	0.202										
58	0.76337	-0.01823	52.00	0.201	0.214	0.227	0.240	0.254	0.268	0.282										
59	0.81124	-0.00889	53.00	0.291	0.301	0.311	0.321	0.332	0.343	0.355										
60	0.85669	-0.00152	54.00	0.369	0.377	0.384	0.392	0.401	0.409	0.418										
61	0.89844	0.00302	55.00	0.420	0.426	0.432	0.438	0.445	0.451	0.459										
62	0.93446	0.00453	56.00	0.440	0.445	0.449	0.454	0.460	0.465	0.471										
63	0.96316	0.00388	57.00	0.441	0.444	0.447	0.451	0.456	0.460	0.465										
64	0.98373	0.00224	58.00	0.429	0.432	0.434	0.437	0.441	0.444	0.448										
65	0.99596	0.00068	59.00	0.417	0.418	0.420	0.422	0.424	0.427	0.430										
66	1.00000	0.00000	60.00	0.414	0.414	0.414	0.415	0.417	0.418	0.420										

ALPHA= 4.05 DEGREES CM0=-0.1411 ETA= 1.144

AIRFOIL S833 18%			3.00	4.00	5.00	6.00	7.00	8.00	
N	X	Y	NU	CP(X) FOR THE ABOVE ALPHA REL. CHORD LINE					
1	1.00000	0.00000	0.00	0.422	0.425	0.428	0.432	0.435	0.439
2	0.99606	0.00100	1.00	0.394	0.396	0.398	0.400	0.403	0.406
3	0.98502	0.00465	2.00	0.302	0.302	0.303	0.305	0.307	0.309
4	0.96844	0.01109	3.00	0.152	0.151	0.151	0.151	0.152	0.154
5	0.94764	0.01954	4.00	-0.035	-0.038	-0.040	-0.041	-0.042	-0.043
6	0.92323	0.02883	5.00	-0.219	-0.225	-0.230	-0.234	-0.237	-0.240
7	0.89510	0.03796	6.00	-0.335	-0.343	-0.351	-0.358	-0.364	-0.370
8	0.86284	0.04678	7.00	-0.391	-0.403	-0.414	-0.424	-0.433	-0.441
9	0.82683	0.05549	8.00	-0.452	-0.467	-0.481	-0.495	-0.507	-0.519
10	0.78759	0.06394	9.00	-0.516	-0.535	-0.553	-0.570	-0.586	-0.602
11	0.74562	0.07192	10.00	-0.582	-0.605	-0.627	-0.649	-0.669	-0.689
12	0.70140	0.07919	11.00	-0.648	-0.676	-0.703	-0.729	-0.754	-0.778
13	0.65539	0.08546	12.00	-0.709	-0.742	-0.774	-0.805	-0.835	-0.864
14	0.60790	0.09049	13.00	-0.751	-0.789	-0.826	-0.862	-0.898	-0.933
15	0.55925	0.09430	14.00	-0.791	-0.834	-0.877	-0.919	-0.960	-1.001
16	0.51005	0.09685	15.00	-0.831	-0.880	-0.929	-0.978	-1.026	-1.073
17	0.46067	0.09798	16.00	-0.856	-0.913	-0.968	-1.024	-1.078	-1.133
18	0.41151	0.09778	17.00	-0.880	-0.943	-1.006	-1.069	-1.132	-1.194
19	0.36309	0.09632	18.00	-0.907	-0.978	-1.050	-1.121	-1.192	-1.263
20	0.31595	0.09364	19.00	-0.936	-1.017	-1.098	-1.179	-1.261	-1.342
21	0.27056	0.08979	20.00	-0.969	-1.060	-1.153	-1.246	-1.339	-1.433
22	0.22744	0.08480	21.00	-1.004	-1.109	-1.214	-1.321	-1.429	-1.538
23	0.18700	0.07875	22.00	-1.043	-1.163	-1.284	-1.408	-1.533	-1.660
24	0.14969	0.07168	23.00	-1.084	-1.222	-1.363	-1.507	-1.654	-1.803
25	0.11583	0.06370	24.00	-1.127	-1.288	-1.453	-1.623	-1.797	-1.974
26	0.08580	0.05491	25.00	-1.167	-1.357	-1.553	-1.756	-1.965	-2.179
27	0.05981	0.04544	26.00	-1.203	-1.430	-1.668	-1.914	-2.170	-2.434
28	0.03816	0.03549	27.00	-1.227	-1.505	-1.797	-2.104	-2.424	-2.758
29	0.02100	0.02526	28.00	-1.230	-1.578	-1.949	-2.344	-2.760	-3.199
30	0.00863	0.01509	29.00	-1.182	-1.632	-2.123	-2.653	-3.223	-3.831
31	0.00192	0.00645	29.88	-1.053	-1.640	-2.299	-3.030	-3.830	-4.700
32	0.00134	0.00533	30.00	-1.029	-1.642	-2.333	-3.102	-3.948	-4.870
33	0.00080	0.00413	30.13	-1.001	-1.644	-2.373	-3.189	-4.091	-5.077
34	0.00014	0.00190	30.38	-0.939	-1.647	-2.464	-3.387	-4.417	-5.551
35	0.00001	-0.00039	30.63	-0.277	-0.818	-1.453	-2.181	-3.001	-3.913
36	0.00027	-0.00284	30.88	0.185	-0.225	-0.717	-1.291	-1.946	-2.682
37	0.00051	-0.00405	31.00	0.354	-0.003	-0.438	-0.950	-1.539	-2.203
38	0.00516	-0.01488	32.00	0.972	0.894	0.767	0.589	0.362	0.085
39	0.01423	-0.02612	33.00	0.936	0.985	1.000	0.981	0.930	0.844
40	0.02762	-0.03732	34.00	0.716	0.819	0.899	0.956	0.990	1.000
41	0.04509	-0.04794	35.00	0.476	0.599	0.705	0.796	0.870	0.927
42	0.06670	-0.05772	36.00	0.269	0.396	0.510	0.613	0.704	0.783
43	0.09216	-0.06635	37.00	0.110	0.231	0.343	0.447	0.543	0.629
44	0.12149	-0.07365	38.00	-0.005	0.107	0.213	0.313	0.406	0.493
45	0.15434	-0.07944	39.00	-0.083	0.019	0.116	0.209	0.298	0.381
46	0.19065	-0.08363	40.00	-0.131	-0.039	0.049	0.134	0.216	0.294
47	0.23002	-0.08613	41.00	-0.155	-0.073	0.006	0.083	0.157	0.229
48	0.27228	-0.08696	42.00	-0.161	-0.089	-0.018	0.051	0.118	0.183
49	0.31695	-0.08611	43.00	-0.154	-0.090	-0.027	0.035	0.095	0.154
50	0.36379	-0.08365	44.00	-0.136	-0.080	-0.024	0.030	0.084	0.137
51	0.41225	-0.07967	45.00	-0.112	-0.062	-0.013	0.035	0.083	0.130
52	0.46198	-0.07426	46.00	-0.082	-0.038	0.005	0.048	0.090	0.132
53	0.51236	-0.06755	47.00	-0.048	-0.010	0.028	0.066	0.103	0.141
54	0.56300	-0.05952	48.00	-0.003	0.029	0.062	0.095	0.128	0.160
55	0.61351	-0.05025	49.00	0.050	0.078	0.106	0.135	0.163	0.191
56	0.66384	-0.03971	50.00	0.138	0.161	0.184	0.207	0.230	0.254
57	0.71399	-0.02876	51.00	0.221	0.239	0.258	0.277	0.296	0.315
58	0.76337	-0.01823	52.00	0.297	0.312	0.327	0.342	0.358	0.374
59	0.81124	-0.00889	53.00	0.366	0.378	0.390	0.403	0.415	0.428
60	0.85669	-0.00152	54.00	0.427	0.437	0.447	0.456	0.467	0.477
61	0.89844	0.00302	55.00	0.466	0.474	0.482	0.490	0.498	0.507
62	0.93446	0.00453	56.00	0.477	0.484	0.490	0.497	0.505	0.512
63	0.96316	0.00388	57.00	0.470	0.476	0.481	0.488	0.494	0.500
64	0.98373	0.00224	58.00	0.452	0.457	0.462	0.467	0.473	0.478
65	0.99596	0.00068	59.00	0.433	0.437	0.441	0.445	0.450	0.455
66	1.00000	0.00000	60.00	0.422	0.425	0.428	0.432	0.435	0.439

ALPHA= 4.05 DEGREES CM0=-0.1411 ETA= 1.144

B.L.SUMMARY AIRFOIL S833 18% ALPHA0= 4.052 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 250000 MU= 300	R= 250000 MU= 100	R= 250000 MU= 900
-4.00	S TURB S SEP 100CD UPPER 0.2298 0.0447 0.6008* LOWER 0.7243 0.2332 0.7605* TOTAL CL=-0.039 100CD=1.3613 CM=-0.1329	S TURB S SEP 100CD 1.0030 0.0296 0.8642 0.9627 0.2306 0.8548 CL=-0.024 100CD=1.7191 CM=-0.1353	S TURB S SEP 100CD 0.5207 0.0284 0.6869 0.8329 0.2177 0.7604 CL=-0.023 100CD=1.4473 CM=-0.1353
-3.00	S TURB S SEP 100CD UPPER 0.2503 0.0456 0.6482* LOWER 0.6884 0.2213 0.6678* TOTAL CL= 0.066 100CD=1.3160 CM=-0.1354	S TURB S SEP 100CD 1.0030 0.0313 0.9318 0.9627 0.2153 0.7748 CL= 0.082 100CD=1.7066 CM=-0.1378	S TURB S SEP 100CD 0.5904 0.0302 0.7722 0.8119 0.2021 0.6842 CL= 0.083 100CD=1.4564 CM=-0.1378
-2.00	S TURB S SEP 100CD UPPER 0.2698 0.0457 0.7046* LOWER 0.6514 0.2090 0.5966* TOTAL CL= 0.174 100CD=1.3012 CM=-0.1380	S TURB S SEP 100CD 1.0030 0.0331 1.0060 0.9627 0.2002 0.7023 CL= 0.188 100CD=1.7083 CM=-0.1402	S TURB S SEP 100CD 0.6517 0.0320 0.8595 0.7898 0.1867 0.6159 CL= 0.189 100CD=1.4755 CM=-0.1402
-1.00	S TURB S SEP 100CD UPPER 0.2876 0.0477 0.7522* LOWER 0.6139 0.1975 0.5320* TOTAL CL= 0.279 100CD=1.2842 CM=-0.1401	S TURB S SEP 100CD 1.0030 0.0349 1.0871 0.9627 0.1853 0.6365 CL= 0.294 100CD=1.7237 CM=-0.1425	S TURB S SEP 100CD 0.7068 0.0340 0.9510 0.7669 0.1720 0.5550 CL= 0.295 100CD=1.5060 CM=-0.1425
0.00	S TURB S SEP 100CD UPPER 0.3053 0.0484 0.8103* LOWER 0.5759 0.1871 0.4728* TOTAL CL= 0.385 100CD=1.2831 CM=-0.1424	S TURB S SEP 100CD 1.0030 0.0369 1.1758 0.9627 0.1710 0.5769 CL= 0.400 100CD=1.7527 CM=-0.1446	S TURB S SEP 100CD 0.7573 0.0360 1.0486 0.7431 0.1572 0.5002 CL= 0.401 100CD=1.5488 CM=-0.1445
1.00	S TURB S SEP 100CD UPPER 0.3235 0.0490 0.8594* LOWER 0.5372 0.1811 0.4236* TOTAL CL= 0.491 100CD=1.2829 CM=-0.1447	S TURB S SEP 100CD 1.0030 0.0390 1.2737 0.9627 0.1564 0.5229 CL= 0.505 100CD=1.7966 CM=-0.1464	S TURB S SEP 100CD 0.8034 0.0381 1.1541 0.7184 0.1406 0.4516 CL= 0.506 100CD=1.6057 CM=-0.1464
2.00	S TURB S SEP 100CD UPPER 0.3449 0.0508 0.9058* LOWER 0.4986 0.1869 0.3982* TOTAL CL= 0.596 100CD=1.3040 CM=-0.1469	S TURB S SEP 100CD 1.0030 0.0413 1.3815 0.9627 0.0000 0.4743 CL= 0.609 100CD=1.8558 CM=-0.1460	S TURB S SEP 100CD 0.8453 0.0404 1.2700 0.6928 0.0000 0.4076 CL= 0.610 100CD=1.6776 CM=-0.1462
3.00	S TURB S SEP 100CD UPPER 0.3785 0.0494 0.9356* LOWER 0.4725 0.1984 0.3780* TOTAL CL= 0.705 100CD=1.3136 CM=-0.1498	S TURB S SEP 100CD 1.0030 0.0438 1.5000 0.9627 0.0000 0.4306 CL= 0.713 100CD=1.9306 CM=-0.1475	S TURB S SEP 100CD 0.8836 0.0430 1.3985 0.6664 0.0000 0.3769 CL= 0.714 100CD=1.7754 CM=-0.1477
4.00	S TURB S SEP 100CD UPPER 0.4360 0.0468 0.9996* LOWER 0.4505 0.1891 0.3657* TOTAL CL= 0.816 100CD=1.3653 CM=-0.1524	S TURB S SEP 100CD 1.0030 0.0460 1.6154 0.9627 0.0000 0.3993 CL= 0.817 100CD=2.0147 CM=-0.1489	S TURB S SEP 100CD 0.9190 0.0452 1.5282 0.6397 0.0000 0.3454 CL= 0.818 100CD=1.8737 CM=-0.1492
5.00	S TURB S SEP 100CD UPPER 0.4842 0.0471 1.0889* LOWER 0.4280 0.1890 0.4359* TOTAL CL= 0.923 100CD=1.5249 CM=-0.1538	S TURB S SEP 100CD 1.0030 0.0497 1.7738 0.9627 0.0000 0.3679 CL= 0.919 100CD=2.1417 CM=-0.1497	S TURB S SEP 100CD 0.9498 0.0490 1.7039 0.6115 0.0000 0.3155 CL= 0.920 100CD=2.0195 CM=-0.1500
6.00	S TURB S SEP 100CD UPPER 0.8773 0.0520 1.7998* LOWER 0.4083 0.1949 0.3964* TOTAL CL= 1.022 100CD=2.1961 CM=-0.1547	S TURB S SEP 100CD 1.0030 0.0533 1.9359* 0.9627 0.0000 0.3384 CL= 1.020 100CD=2.2743 CM=-0.1504	S TURB S SEP 100CD 0.9743 0.0527 1.8822 0.5829 0.0000 0.2880 CL= 1.021 100CD=2.1702 CM=-0.1506

B.L.SUMMARY AIRFOIL S833 18% ALPHA0= 4.052 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEC.)	R=	250000	MU=	300	R=	250000	MU=	100	R=	250000	MU=	900
6.44	S	TURB	S	SEP	100CD							
	UPPER	0.9522	0.0555	2.0407*								
	LOWER	0.4019	0.1973	0.3973*								
	TOTAL	CL=	1.063	100CD=	2.4380							
		CM=	-0.1546									
6.52				S	TURB	S	SEP	100CD				
	UPPER			1.0030	0.0555	2.0439*						
	LOWER			0.9627	0.0000	0.3240						
	TOTAL			CL=	1.072	100CD=	2.3679					
				CM=	-0.1505							
6.78					S	TURB	S	SEP	100CD			
	UPPER			0.9888	0.0561	2.0447*						
	LOWER			0.5600	0.0000	0.2679						
	TOTAL			CL=	1.099	100CD=	2.3126					
				CM=	-0.1508							

B.L.SUMMARY AIRFOIL S833 18% ALPHA0= 4.052 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 300000 MU= 300	R= 300000 MU= 100	R= 300000 MU= 900
-4.00	S TURB S SEP 100CD UPPER 0.2298 0.0412 0.5330* LOWER 0.7243 0.2186 0.6897* TOTAL CL=-0.036 100CD=1.2228 CM=-0.1332	S TURB S SEP 100CD 1.0030 0.0287 0.8406 0.9627 0.2256 0.8264 CL=-0.023 100CD=1.6670 CM=-0.1354	S TURB S SEP 100CD 0.5644 0.0276 0.6826 0.8414 0.2124 0.7347 CL=-0.022 100CD=1.4173 CM=-0.1354
-3.00	S TURB S SEP 100CD UPPER 0.2503 0.0418 0.5767* LOWER 0.6884 0.2044 0.6142* TOTAL CL= 0.071 100CD=1.1910 CM=-0.1358	S TURB S SEP 100CD 1.0030 0.0304 0.9062 0.9627 0.2104 0.7498 CL= 0.083 100CD=1.6559 CM=-0.1379	S TURB S SEP 100CD 0.6261 0.0294 0.7609 0.8211 0.1967 0.6611 CL= 0.084 100CD=1.4221 CM=-0.1379
-2.00	S TURB S SEP 100CD UPPER 0.2698 0.0418 0.6241* LOWER 0.6514 0.1909 0.5462* TOTAL CL= 0.178 100CD=1.1703 CM=-0.1384	S TURB S SEP 100CD 1.0030 0.0322 0.9780 0.9627 0.1954 0.6802 CL= 0.189 100CD=1.6582 CM=-0.1403	S TURB S SEP 100CD 0.6816 0.0312 0.8432 0.7997 0.1814 0.5952 CL= 0.190 100CD=1.4384 CM=-0.1403
-1.00	S TURB S SEP 100CD UPPER 0.2876 0.0429 0.6639* LOWER 0.6139 0.1781 0.4844* TOTAL CL= 0.284 100CD=1.1483 CM=-0.1407	S TURB S SEP 100CD 1.0030 0.0341 1.0563 0.9627 0.1807 0.6171 CL= 0.295 100CD=1.6734 CM=-0.1426	S TURB S SEP 100CD 0.7313 0.0331 0.9292 0.7776 0.1667 0.5364 CL= 0.296 100CD=1.4656 CM=-0.1426
0.00	S TURB S SEP 100CD UPPER 0.3053 0.0442 0.7201* LOWER 0.5759 0.1666 0.4284* TOTAL CL= 0.390 100CD=1.1485 CM=-0.1429	S TURB S SEP 100CD 1.0030 0.0360 1.1422 0.9627 0.1665 0.5597 CL= 0.401 100CD=1.7018 CM=-0.1447	S TURB S SEP 100CD 0.7779 0.0351 1.0226 0.7543 0.1514 0.4835 CL= 0.402 100CD=1.5061 CM=-0.1447
1.00	S TURB S SEP 100CD UPPER 0.3235 0.0449 0.7669* LOWER 0.5372 0.1590 0.3823* TOTAL CL= 0.497 100CD=1.1492 CM=-0.1451	S TURB S SEP 100CD 1.0030 0.0381 1.2361 0.9627 0.1516 0.5078 CL= 0.506 100CD=1.7439 CM=-0.1466	S TURB S SEP 100CD 0.8203 0.0372 1.1235 0.7306 0.0000 0.4363 CL= 0.507 100CD=1.5598 CM=-0.1448
2.00	S TURB S SEP 100CD UPPER 0.3449 0.0464 0.8131* LOWER 0.4986 0.1705 0.3518* TOTAL CL= 0.602 100CD=1.1650 CM=-0.1475	S TURB S SEP 100CD 1.0030 0.0404 1.3396 0.9627 0.0000 0.4609 CL= 0.610 100CD=1.8005 CM=-0.1463	S TURB S SEP 100CD 0.8593 0.0395 1.2347 0.7056 0.0000 0.3942 CL= 0.612 100CD=1.6289 CM=-0.1465
3.00	S TURB S SEP 100CD UPPER 0.3785 0.0454 0.8506* LOWER 0.4725 0.1688 0.3321* TOTAL CL= 0.711 100CD=1.1827 CM=-0.1500	S TURB S SEP 100CD 1.0030 0.0428 1.4534 0.9627 0.0000 0.4188 CL= 0.714 100CD=1.8722 CM=-0.1478	S TURB S SEP 100CD 0.8950 0.0420 1.3580 0.6801 0.0000 0.3661 CL= 0.716 100CD=1.7241 CM=-0.1480
4.00	S TURB S SEP 100CD UPPER 0.4360 0.0438 0.9225* LOWER 0.4505 0.1774 0.3111* TOTAL CL= 0.820 100CD=1.2336 CM=-0.1529	S TURB S SEP 100CD 1.0030 0.0450 1.5638 0.9627 0.0000 0.3897 CL= 0.819 100CD=1.9535 CM=-0.1493	S TURB S SEP 100CD 0.9280 0.0442 1.4829 0.6540 0.0000 0.3352 CL= 0.820 100CD=1.8181 CM=-0.1495
5.00	S TURB S SEP 100CD UPPER 0.5067 0.0435 1.0265 LOWER 0.4280 0.1886 0.3468* TOTAL CL= 0.928 100CD=1.3733 CM=-0.1548	S TURB S SEP 100CD 1.0030 0.0485 1.7154 0.9627 0.0000 0.3590 CL= 0.921 100CD=2.0743 CM=-0.1501	S TURB S SEP 100CD 0.9566 0.0479 1.6520 0.6266 0.0000 0.3061 CL= 0.922 100CD=1.9580 CM=-0.1503
6.00	S TURB S SEP 100CD UPPER 0.8773 0.0502 1.7008* LOWER 0.4083 0.1715 0.3367* TOTAL CL= 1.025 100CD=2.0375 CM=-0.1545	S TURB S SEP 100CD 1.0030 0.0520 1.8670* 0.9627 0.0000 0.3303 CL= 1.022 100CD=2.1973 CM=-0.1509	S TURB S SEP 100CD 0.9791 0.0515 1.8230 0.5987 0.0000 0.2793 CL= 1.023 100CD=2.1023 CM=-0.1510

B.L.SUMMARY AIRFOIL S833 18% ALPHA0= 4.052 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 300000	MU= 300	R= 300000	MU= 100	R= 300000	MU= 900			
6.55	S	TURB	S	SEP	100CD				
	UPPER	0.9666	0.0546	1.9947*					
	LOWER	0.4005	0.1713	0.3215*					
	TOTAL	CL= 1.077	100CD=2.3162						
		CM=-0.1543							
6.66			S	TURB	S	SEP	100CD		
	UPPER		1.0030	0.0548	1.9981*				
	LOWER		0.9627	0.0000	0.3125				
	TOTAL		CL= 1.088	100CD=2.3106					
			CM=-0.1510						
6.86					S	TURB	S	SEP	100CD
	UPPER				0.9934	0.0552	1.9969*		
	LOWER				0.5740	0.0000	0.2578		
	TOTAL				CL= 1.109	100CD=2.2547			
					CM=-0.1512				

B.L.SUMMARY AIRFOIL S833 18% ALPHA0= 4.052 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 400000 MU= 300	R= 400000 MU= 100	R= 400000 MU= 900
-4.00	S TURB S SEP 100CD UPPER 0.2298 0.0367 0.4485* LOWER 0.7243 0.1975 0.6150* TOTAL CL=-0.031 100CD=1.0634 CM=-0.1337	S TURB S SEP 100CD 1.0030 0.0273 0.8046 0.9627 0.2178 0.7840 CL=-0.022 100CD=1.5886 CM=-0.1355	S TURB S SEP 100CD 0.6230 0.0264 0.6712 0.8544 0.2045 0.6985 CL=-0.021 100CD=1.3697 CM=-0.1356
-3.00	S TURB S SEP 100CD UPPER 0.2503 0.0364 0.4883* LOWER 0.6884 0.1822 0.5451* TOTAL CL= 0.077 100CD=1.0333 CM=-0.1365	S TURB S SEP 100CD 1.0030 0.0290 0.8670 0.9627 0.2027 0.7124 CL= 0.085 100CD=1.5795 CM=-0.1381	S TURB S SEP 100CD 0.6751 0.0281 0.7425 0.8351 0.1888 0.6287 CL= 0.086 100CD=1.3712 CM=-0.1381
-2.00	S TURB S SEP 100CD UPPER 0.2698 0.0371 0.5243* LOWER 0.6514 0.1674 0.4817* TOTAL CL= 0.184 100CD=1.0060 CM=-0.1390	S TURB S SEP 100CD 1.0030 0.0307 0.9352 0.9627 0.1879 0.6472 CL= 0.191 100CD=1.5824 CM=-0.1405	S TURB S SEP 100CD 0.7223 0.0299 0.8171 0.8150 0.1738 0.5663 CL= 0.192 100CD=1.3834 CM=-0.1405
-1.00	S TURB S SEP 100CD UPPER 0.2876 0.0379 0.5694* LOWER 0.6139 0.1519 0.4237* TOTAL CL= 0.290 100CD=0.9931 CM=-0.1413	S TURB S SEP 100CD 1.0030 0.0326 1.0095 0.9627 0.1735 0.5879 CL= 0.297 100CD=1.5974 CM=-0.1428	S TURB S SEP 100CD 0.7660 0.0318 0.8971 0.7939 0.1589 0.5104 CL= 0.298 100CD=1.4075 CM=-0.1428
0.00	S TURB S SEP 100CD UPPER 0.3053 0.0380 0.6053* LOWER 0.5759 0.1359 0.3741* TOTAL CL= 0.398 100CD=0.9794 CM=-0.1437	S TURB S SEP 100CD 1.0030 0.0346 1.0907 0.9627 0.1592 0.5339 CL= 0.402 100CD=1.6245 CM=-0.1449	S TURB S SEP 100CD 0.8066 0.0338 0.9838 0.7720 0.1423 0.4604 CL= 0.404 100CD=1.4443 CM=-0.1448
1.00	S TURB S SEP 100CD UPPER 0.3235 0.0395 0.6464* LOWER 0.5372 0.0000 0.3315* TOTAL CL= 0.504 100CD=0.9779 CM=-0.1441	S TURB S SEP 100CD 1.0030 0.0366 1.1793 0.9627 0.1433 0.4849 CL= 0.508 100CD=1.6642 CM=-0.1468	S TURB S SEP 100CD 0.8444 0.0358 1.0784 0.7491 0.0000 0.4155 CL= 0.509 100CD=1.4940 CM=-0.1452
2.00	S TURB S SEP 100CD UPPER 0.3449 0.0400 0.6896* LOWER 0.4986 0.0000 0.3032* TOTAL CL= 0.611 100CD=0.9928 CM=-0.1464	S TURB S SEP 100CD 1.0030 0.0388 1.2766 0.9627 0.0000 0.4406 CL= 0.613 100CD=1.7172 CM=-0.1467	S TURB S SEP 100CD 0.8790 0.0381 1.1825 0.7255 0.0000 0.3760 CL= 0.614 100CD=1.5585 CM=-0.1470
3.00	S TURB S SEP 100CD UPPER 0.3785 0.0397 0.7326* LOWER 0.4725 0.0000 0.2791* TOTAL CL= 0.719 100CD=1.0118 CM=-0.1488	S TURB S SEP 100CD 1.0030 0.0412 1.3833 0.9627 0.0000 0.4011 CL= 0.717 100CD=1.7843 CM=-0.1483	S TURB S SEP 100CD 0.9114 0.0405 1.2989 0.7011 0.0000 0.3510 CL= 0.718 100CD=1.6499 CM=-0.1485
4.00	S TURB S SEP 100CD UPPER 0.4368 0.0393 0.8113* LOWER 0.4505 0.0000 0.2601* TOTAL CL= 0.827 100CD=1.0713 CM=-0.1511	S TURB S SEP 100CD 1.0030 0.0433 1.4863 0.9627 0.0000 0.3750 CL= 0.821 100CD=1.8613 CM=-0.1498	S TURB S SEP 100CD 0.9409 0.0427 1.4162 0.6762 0.0000 0.3210 CL= 0.822 100CD=1.7372 CM=-0.1500
5.00	S TURB S SEP 100CD UPPER 0.5719 0.0405 1.0142 LOWER 0.4280 0.0000 0.2551* TOTAL CL= 0.933 100CD=1.2693 CM=-0.1528	S TURB S SEP 100CD 1.0030 0.0467 1.6282 0.9627 0.0000 0.3454 CL= 0.923 100CD=1.9736 CM=-0.1507	S TURB S SEP 100CD 0.9664 0.0462 1.5752 0.6500 0.0000 0.2931 CL= 0.924 100CD=1.8683 CM=-0.1509
6.00	S TURB S SEP 100CD UPPER 0.8773 0.0478 1.5691* LOWER 0.4083 0.0000 0.2650* TOTAL CL= 1.029 100CD=1.8341 CM=-0.1523	S TURB S SEP 100CD 1.0030 0.0500 1.7676 0.9627 0.0000 0.3178 CL= 1.025 100CD=2.0854 CM=-0.1515	S TURB S SEP 100CD 0.9860 0.0496 1.7359 0.6231 0.0000 0.2673 CL= 1.026 100CD=2.0032 CM=-0.1517

B.L.SUMMARY AIRFOIL S833 18% ALPHA0= 4.052 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R=	400000	MU=	300	R=	400000	MU=	100	R=	400000	MU=	900
6.73			S TURB	S SEP	100CD							
			UPPER	0.9850	0.0533	1.9265*						
			LOWER	0.3982	0.0000	0.2550*						
			TOTAL	CL=	1.098	100CD=	2.1814					
				CM=	-0.1517							
6.85			S TURB	S SEP	100CD							
			UPPER	1.0030	0.0535	1.9265*						
			LOWER	0.9627	0.0000	0.2961						
			TOTAL	CL=	1.110	100CD=	2.2225					
				CM=	-0.1518							
7.00			S TURB	S SEP	100CD							
			UPPER	0.9998	0.0537	1.9222*						
			LOWER	0.5958	0.0000	0.2437						
			TOTAL	CL=	1.126	100CD=	2.1659					
				CM=	-0.1520							
7.02			S TURB	S SEP	100CD							
			UPPER	1.0006	0.0538	1.9276*						
			LOWER	0.5952	0.0000	0.2432						
			TOTAL	CL=	1.128	100CD=	2.1709					
				CM=	-0.1520							

B.L.SUMMARY AIRFOIL S833 18% ALPHA0= 4.052 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 500000 MU= 300	R= 500000 MU= 100	R= 500000 MU= 900
-4.00	S TURB S SEP 100CD UPPER 0.2298 0.0328 0.4003* LOWER 0.7243 0.1840 0.5679* TOTAL CL=-0.027 100CD=0.9682 CM=-0.1342	S TURB S SEP 100CD 1.0030 0.0262 0.7777 0.9627 0.2116 0.7531 CL=-0.020 100CD=1.5308 CM=-0.1357	S TURB S SEP 100CD 0.6618 0.0254 0.6612 0.8640 0.1987 0.6734 CL=-0.020 100CD=1.3346 CM=-0.1357
-3.00	S TURB S SEP 100CD UPPER 0.2503 0.0325 0.4347* LOWER 0.6884 0.1682 0.5017* TOTAL CL= 0.081 100CD=0.9364 CM=-0.1370	S TURB S SEP 100CD 1.0030 0.0279 0.8378 0.9627 0.1967 0.6851 CL= 0.086 100CD=1.5229 CM=-0.1382	S TURB S SEP 100CD 0.7074 0.0271 0.7270 0.8457 0.1831 0.6064 CL= 0.087 100CD=1.3334 CM=-0.1382
-2.00	S TURB S SEP 100CD UPPER 0.2698 0.0333 0.4692* LOWER 0.6514 0.1516 0.4412* TOTAL CL= 0.188 100CD=0.9104 CM=-0.1395	S TURB S SEP 100CD 1.0030 0.0296 0.9033 0.9627 0.1820 0.6230 CL= 0.192 100CD=1.5263 CM=-0.1407	S TURB S SEP 100CD 0.7501 0.0288 0.7974 0.8264 0.1682 0.5464 CL= 0.193 100CD=1.3438 CM=-0.1407
-1.00	S TURB S SEP 100CD UPPER 0.2876 0.0340 0.5078* LOWER 0.6139 0.1315 0.3863* TOTAL CL= 0.295 100CD=0.8941 CM=-0.1419	S TURB S SEP 100CD 1.0030 0.0315 0.9747 0.9627 0.1678 0.5664 CL= 0.298 100CD=1.5411 CM=-0.1430	S TURB S SEP 100CD 0.7897 0.0307 0.8732 0.8062 0.1529 0.4926 CL= 0.299 100CD=1.3658 CM=-0.1429
0.00	S TURB S SEP 100CD UPPER 0.3053 0.0343 0.5406* LOWER 0.5759 0.0000 0.3434* TOTAL CL= 0.403 100CD=0.8841 CM=-0.1431	S TURB S SEP 100CD 1.0030 0.0334 1.0526 0.9627 0.1531 0.5148 CL= 0.404 100CD=1.5674 CM=-0.1451	S TURB S SEP 100CD 0.8267 0.0327 0.9556 0.7852 0.1352 0.4446 CL= 0.405 100CD=1.4002 CM=-0.1450
1.00	S TURB S SEP 100CD UPPER 0.3235 0.0356 0.5793* LOWER 0.5372 0.0000 0.3109* TOTAL CL= 0.509 100CD=0.8902 CM=-0.1453	S TURB S SEP 100CD 1.0030 0.0355 1.1372 0.9627 0.1363 0.4680 CL= 0.509 100CD=1.6052 CM=-0.1470	S TURB S SEP 100CD 0.8611 0.0347 1.0457 0.7632 0.0000 0.4015 CL= 0.510 100CD=1.4473 CM=-0.1455
2.00	S TURB S SEP 100CD UPPER 0.3449 0.0362 0.6169* LOWER 0.4986 0.0000 0.2835* TOTAL CL= 0.616 100CD=0.9004 CM=-0.1475	S TURB S SEP 100CD 1.0030 0.0376 1.2302 0.9627 0.0000 0.4257 CL= 0.614 100CD=1.6558 CM=-0.1471	S TURB S SEP 100CD 0.8930 0.0369 1.1449 0.7405 0.0000 0.3714 CL= 0.615 100CD=1.5163 CM=-0.1473
3.00	S TURB S SEP 100CD UPPER 0.3885 0.0357 0.6665 LOWER 0.4725 0.0000 0.2596* TOTAL CL= 0.725 100CD=0.9261 CM=-0.1501	S TURB S SEP 100CD 1.0030 0.0400 1.3318 0.9627 0.0000 0.3957 CL= 0.719 100CD=1.7275 CM=-0.1487	S TURB S SEP 100CD 0.9229 0.0393 1.2561 0.7169 0.0000 0.3394 CL= 0.720 100CD=1.5955 CM=-0.1489
4.00	S TURB S SEP 100CD UPPER 0.4698 0.0369 0.7934 LOWER 0.4505 0.0000 0.2422* TOTAL CL= 0.831 100CD=1.0356 CM=-0.1519	S TURB S SEP 100CD 1.0030 0.0420 1.4296 0.9627 0.0000 0.3640 CL= 0.823 100CD=1.7936 CM=-0.1502	S TURB S SEP 100CD 0.9499 0.0415 1.3680 0.6930 0.0000 0.3107 CL= 0.824 100CD=1.6787 CM=-0.1504
5.00	S TURB S SEP 100CD UPPER 0.6167 0.0392 1.0059 LOWER 0.4280 0.0000 0.2261* TOTAL CL= 0.935 100CD=1.2320 CM=-0.1533	S TURB S SEP 100CD 1.0030 0.0453 1.5642 0.9627 0.0000 0.3353 CL= 0.926 100CD=1.8996 CM=-0.1512	S TURB S SEP 100CD 0.9732 0.0444 1.5060 0.6675 0.0000 0.2836 CL= 0.927 100CD=1.7896 CM=-0.1515
6.00	S TURB S SEP 100CD UPPER 0.8773 0.0462 1.4847* LOWER 0.4083 0.0000 0.2266* TOTAL CL= 1.032 100CD=1.7112 CM=-0.1528	S TURB S SEP 100CD 1.0030 0.0485 1.6966 0.9627 0.0000 0.3084 CL= 1.028 100CD=2.0050 CM=-0.1520	S TURB S SEP 100CD 0.9907 0.0482 1.6730 0.6420 0.0000 0.2588 CL= 1.028 100CD=1.9318 CM=-0.1521

B.L.SUMMARY AIRFOIL S833 18% ALPHA0= 4.052 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R=	500000	MU=	300	R=	500000	MU=	100	R=	500000	MU=	900
6.86			S TURB	S SEP	100CD							
			UPPER	0.9933	0.0522	1.8758*						
			LOWER	0.3962	0.0000	0.2237*						
			TOTAL	CL= 1.114	100CD=2.0995							
				CM=-0.1523								
6.95			S TURB	S SEP	100CD							
			UPPER	1.0030	0.0524	1.8759*						
			LOWER	0.9627	0.0000	0.2850						
			TOTAL	CL= 1.123	100CD=2.1609							
				CM=-0.1524								
7.00			S TURB	S SEP	100CD							
			UPPER	1.0030	0.0521	1.8430*						
			LOWER	0.6154	0.0000	0.2365						
			TOTAL	CL= 1.129	100CD=2.0795							
				CM=-0.1526								
7.13			S TURB	S SEP	100CD							
			UPPER	1.0054	0.0527	1.8747*						
			LOWER	0.6119	0.0000	0.2337						
			TOTAL	CL= 1.142	100CD=2.1084							
				CM=-0.1525								

B.L.SUMMARY AIRFOIL S833 18% ALPHA0= 4.052 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 700000 MU= 300	R= 700000 MU= 100	R= 700000 MU= 900
-4.00	S TURB S SEP 100CD UPPER 0.2298 0.0274 0.3415* LOWER 0.7243 0.1671 0.5099* TOTAL CL=-0.022 100CD=0.8514 CM=-0.1350	S TURB S SEP 100CD 1.0030 0.0246 0.7387 0.9627 0.2023 0.7095 CL=-0.019 100CD=1.4482 CM=-0.1359	S TURB S SEP 100CD 0.7119 0.0239 0.6437 0.8781 0.1902 0.6397 CL=-0.018 100CD=1.2833 CM=-0.1359
-3.00	S TURB S SEP 100CD UPPER 0.2503 0.0274 0.3699* LOWER 0.6884 0.1494 0.4482* TOTAL CL= 0.086 100CD=0.8180 CM=-0.1378	S TURB S SEP 100CD 1.0030 0.0262 0.7956 0.9627 0.1874 0.6463 CL= 0.088 100CD=1.4419 CM=-0.1384	S TURB S SEP 100CD 0.7507 0.0255 0.7038 0.8610 0.1749 0.5764 CL= 0.088 100CD=1.2802 CM=-0.1384
-2.00	S TURB S SEP 100CD UPPER 0.2698 0.0282 0.4023* LOWER 0.6514 0.1271 0.3908* TOTAL CL= 0.194 100CD=0.7932 CM=-0.1404	S TURB S SEP 100CD 1.0030 0.0279 0.8573 0.9627 0.1731 0.5885 CL= 0.194 100CD=1.4458 CM=-0.1409	S TURB S SEP 100CD 0.7872 0.0273 0.7686 0.8429 0.1599 0.5196 CL= 0.195 100CD=1.2883 CM=-0.1409
-1.00	S TURB S SEP 100CD UPPER 0.2876 0.0285 0.4303* LOWER 0.6139 0.0000 0.3452* TOTAL CL= 0.302 100CD=0.7755 CM=-0.1420	S TURB S SEP 100CD 1.0030 0.0297 0.9245 0.9627 0.1589 0.5357 CL= 0.300 100CD=1.4601 CM=-0.1432	S TURB S SEP 100CD 0.8210 0.0291 0.8384 0.8240 0.1436 0.4690 CL= 0.301 100CD=1.3074 CM=-0.1432
0.00	S TURB S SEP 100CD UPPER 0.3053 0.0296 0.4626* LOWER 0.5759 0.0000 0.3135* TOTAL CL= 0.409 100CD=0.7762 CM=-0.1444	S TURB S SEP 100CD 1.0030 0.0316 0.9977 0.9627 0.1432 0.4875 CL= 0.406 100CD=1.4852 CM=-0.1454	S TURB S SEP 100CD 0.8535 0.0310 0.9151 0.8042 0.0000 0.4236 CL= 0.407 100CD=1.3387 CM=-0.1440
1.00	S TURB S SEP 100CD UPPER 0.3235 0.0306 0.4964* LOWER 0.5372 0.0000 0.2807* TOTAL CL= 0.516 100CD=0.7771 CM=-0.1467	S TURB S SEP 100CD 1.0030 0.0337 1.0772 0.9627 0.0000 0.4438 CL= 0.512 100CD=1.5210 CM=-0.1458	S TURB S SEP 100CD 0.8831 0.0330 0.9986 0.7837 0.0000 0.3832 CL= 0.513 100CD=1.3817 CM=-0.1460
2.00	S TURB S SEP 100CD UPPER 0.3638 0.0306 0.5448 LOWER 0.4986 0.0000 0.2525* TOTAL CL= 0.624 100CD=0.7974 CM=-0.1493	S TURB S SEP 100CD 1.0030 0.0358 1.1637 0.9627 0.0000 0.4043 CL= 0.617 100CD=1.5680 CM=-0.1477	S TURB S SEP 100CD 0.9119 0.0352 1.0916 0.7623 0.0000 0.3567 CL= 0.618 100CD=1.4483 CM=-0.1478
3.00	S TURB S SEP 100CD UPPER 0.4310 0.0321 0.6418 LOWER 0.4725 0.0000 0.2306* TOTAL CL= 0.730 100CD=0.8724 CM=-0.1512	S TURB S SEP 100CD 1.0030 0.0376 1.2469 0.9627 0.0000 0.3785 CL= 0.722 100CD=1.6254 CM=-0.1494	S TURB S SEP 100CD 0.9382 0.0370 1.1845 0.7403 0.0000 0.3258 CL= 0.723 100CD=1.5104 CM=-0.1496
4.00	S TURB S SEP 100CD UPPER 0.5434 0.0346 0.7982 LOWER 0.4505 0.0000 0.2123* TOTAL CL= 0.834 100CD=1.0104 CM=-0.1527	S TURB S SEP 100CD 1.0030 0.0401 1.3491 0.9627 0.0000 0.3480 CL= 0.826 100CD=1.6970 CM=-0.1509	S TURB S SEP 100CD 0.9621 0.0396 1.3000 0.7175 0.0000 0.2980 CL= 0.827 100CD=1.5981 CM=-0.1510
5.00	S TURB S SEP 100CD UPPER 0.6755 0.0377 0.9940 LOWER 0.4280 0.0000 0.1946* TOTAL CL= 0.937 100CD=1.1886 CM=-0.1538	S TURB S SEP 100CD 1.0030 0.0428 1.4605 0.9627 0.0000 0.3205 CL= 0.930 100CD=1.7810 CM=-0.1521	S TURB S SEP 100CD 0.9822 0.0424 1.4288 0.6938 0.0000 0.2723 CL= 0.930 100CD=1.7011 CM=-0.1522
6.00	S TURB S SEP 100CD UPPER 0.8773 0.0433 1.3607* LOWER 0.4083 0.0000 0.1855* TOTAL CL= 1.036 100CD=1.5462 CM=-0.1539	S TURB S SEP 100CD 1.0030 0.0462 1.5948 0.9627 0.0000 0.2949 CL= 1.031 100CD=1.8897 CM=-0.1528	S TURB S SEP 100CD 0.9971 0.0461 1.5829 0.6693 0.0000 0.2486 CL= 1.032 100CD=1.8316 CM=-0.1529

B.L.SUMMARY AIRFOIL S833 18% ALPHA0= 4.052 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 700000	MU= 300		R= 700000	MU= 100		R= 700000	MU= 900							
7.00	S	TURB	S	SEP	100CD	S	TURB	S	SEP	100CD	S	TURB	S	SEP	100CD
	UPPER	0.9996	0.0502	1.7745*		1.0030	0.0501	1.7723*		1.0073	0.0497	1.7390*			
	LOWER	0.3947	0.0000	0.1795*		0.9627	0.0000	0.2714		0.6446	0.0000	0.2269			
	TOTAL	CL= 1.132	100CD=1.9540		CL= 1.132	100CD=2.0437		CL= 1.133	100CD=1.9659						
		CM=-0.1532			CM=-0.1533			CM=-0.1534							
7.05	S	TURB	S	SEP	100CD	S	TURB	S	SEP	100CD					
	UPPER	1.0020	0.0506	1.7975*		1.0030	0.0506	1.7977*							
	LOWER	0.3942	0.0000	0.1790*		0.9627	0.0000	0.2703							
	TOTAL	CL= 1.137	100CD=1.9765		CL= 1.137	100CD=2.0680									
		CM=-0.1532			CM=-0.1532										
7.30										S	TURB	S	SEP	100CD	
	UPPER									1.0103	0.0510	1.7966*			
	LOWER									0.6369	0.0000	0.2207			
	TOTAL									CL= 1.163	100CD=2.0173				
										CM=-0.1535					

APPENDIX B

PRESSURE DISTRIBUTIONS, TRANSITION AND SEPARATION LOCATIONS, AND
SECTION CHARACTERISTICS OF S834 AIRFOIL

AIRFOIL S834 15%				-3.00	-2.00	-1.00	0.00	1.00	2.00
N	X	Y	NU	CP(X) FOR THE ABOVE ALPHA REL. CHORD LINE					
1	1.00000	0.00000	0.00	0.411	0.411	0.412	0.412	0.414	0.415
2	0.99606	0.00061	1.00	0.397	0.396	0.395	0.395	0.395	0.395
3	0.98482	0.00310	2.00	0.335	0.332	0.330	0.329	0.328	0.327
4	0.96754	0.00791	3.00	0.234	0.230	0.226	0.223	0.220	0.217
5	0.94548	0.01465	4.00	0.110	0.103	0.097	0.091	0.086	0.082
6	0.91941	0.02247	5.00	-0.012	-0.022	-0.030	-0.039	-0.046	-0.054
7	0.88950	0.03056	6.00	-0.094	-0.107	-0.119	-0.130	-0.140	-0.150
8	0.85565	0.03870	7.00	-0.143	-0.158	-0.173	-0.187	-0.201	-0.214
9	0.81829	0.04693	8.00	-0.194	-0.213	-0.231	-0.248	-0.265	-0.281
10	0.77797	0.05503	9.00	-0.245	-0.267	-0.289	-0.310	-0.331	-0.350
11	0.73517	0.06273	10.00	-0.293	-0.320	-0.345	-0.371	-0.395	-0.419
12	0.69034	0.06973	11.00	-0.335	-0.365	-0.395	-0.425	-0.454	-0.482
13	0.64386	0.07578	12.00	-0.365	-0.400	-0.435	-0.469	-0.503	-0.536
14	0.59606	0.08071	13.00	-0.382	-0.421	-0.461	-0.499	-0.538	-0.576
15	0.54733	0.08453	14.00	-0.396	-0.440	-0.484	-0.528	-0.572	-0.616
16	0.49829	0.08714	15.00	-0.406	-0.456	-0.506	-0.556	-0.606	-0.655
17	0.44927	0.08834	16.00	-0.400	-0.455	-0.510	-0.566	-0.621	-0.677
18	0.40059	0.08820	17.00	-0.383	-0.443	-0.505	-0.566	-0.628	-0.690
19	0.35274	0.08686	18.00	-0.363	-0.430	-0.498	-0.566	-0.635	-0.705
20	0.30625	0.08437	19.00	-0.341	-0.415	-0.490	-0.566	-0.643	-0.721
21	0.26160	0.08080	20.00	-0.314	-0.396	-0.479	-0.564	-0.650	-0.738
22	0.21930	0.07620	21.00	-0.281	-0.371	-0.464	-0.559	-0.656	-0.755
23	0.17974	0.07061	22.00	-0.239	-0.340	-0.443	-0.550	-0.660	-0.772
24	0.14337	0.06413	23.00	-0.184	-0.296	-0.413	-0.534	-0.659	-0.787
25	0.11050	0.05682	24.00	-0.112	-0.238	-0.369	-0.507	-0.650	-0.798
26	0.08148	0.04879	25.00	-0.014	-0.155	-0.304	-0.461	-0.626	-0.799
27	0.05652	0.04019	26.00	0.119	-0.038	-0.207	-0.388	-0.580	-0.784
28	0.03587	0.03119	27.00	0.300	0.128	-0.062	-0.270	-0.496	-0.740
29	0.01966	0.02200	28.00	0.541	0.361	0.152	-0.085	-0.352	-0.646
30	0.00812	0.01297	29.00	0.833	0.677	0.470	0.212	-0.096	-0.454
31	0.00139	0.00447	30.00	0.989	0.984	0.875	0.662	0.344	-0.076
32	0.00104	0.00375	30.09	0.971	0.996	0.908	0.708	0.395	-0.030
33	0.00031	0.00185	30.34	0.845	0.984	0.980	0.834	0.545	0.113
34	0.00000	0.00009	30.59	0.540	0.861	0.995	0.944	0.706	0.282
35	0.00025	-0.00167	30.84	0.356	0.716	0.931	1.000	0.923	0.700
36	0.00063	-0.00286	31.00	0.248	0.620	0.867	0.987	0.981	0.848
37	0.00092	-0.00356	31.09	0.189	0.566	0.826	0.969	0.995	0.904
38	0.00610	-0.01100	32.00	-0.284	0.082	0.387	0.631	0.814	0.935
39	0.01637	-0.01945	33.00	-0.563	-0.252	0.025	0.268	0.477	0.651
40	0.03135	-0.02779	34.00	-0.689	-0.432	-0.195	0.020	0.215	0.389
41	0.05077	-0.03562	35.00	-0.735	-0.522	-0.323	-0.136	0.037	0.196
42	0.07463	-0.04274	36.00	-0.735	-0.557	-0.389	-0.229	-0.078	0.063
43	0.10266	-0.04895	37.00	-0.710	-0.561	-0.418	-0.281	-0.150	-0.026
44	0.13476	-0.05414	38.00	-0.672	-0.545	-0.423	-0.305	-0.191	-0.082
45	0.17060	-0.05824	39.00	-0.626	-0.518	-0.413	-0.311	-0.212	-0.116
46	0.20996	-0.06119	40.00	-0.576	-0.484	-0.393	-0.304	-0.218	-0.133
47	0.25241	-0.06300	41.00	-0.526	-0.446	-0.367	-0.290	-0.214	-0.140
48	0.29766	-0.06367	42.00	-0.475	-0.406	-0.337	-0.270	-0.203	-0.138
49	0.34519	-0.06325	43.00	-0.425	-0.365	-0.305	-0.246	-0.187	-0.129
50	0.39461	-0.06181	44.00	-0.376	-0.324	-0.271	-0.219	-0.168	-0.117
51	0.44534	-0.05943	45.00	-0.328	-0.283	-0.237	-0.192	-0.146	-0.101
52	0.49692	-0.05621	46.00	-0.282	-0.243	-0.203	-0.163	-0.123	-0.083
53	0.54874	-0.05227	47.00	-0.238	-0.203	-0.168	-0.133	-0.098	-0.063
54	0.60025	-0.04770	48.00	-0.195	-0.165	-0.134	-0.104	-0.073	-0.042
55	0.65083	-0.04259	49.00	-0.151	-0.125	-0.099	-0.072	-0.046	-0.018
56	0.69997	-0.03702	50.00	-0.105	-0.083	-0.061	-0.038	-0.014	0.009
57	0.74713	-0.03111	51.00	-0.056	-0.037	-0.018	0.002	0.022	0.042
58	0.79183	-0.02494	52.00	-0.001	0.015	0.031	0.047	0.064	0.081
59	0.83359	-0.01867	53.00	0.057	0.069	0.082	0.096	0.110	0.124
60	0.87225	-0.01217	54.00	0.164	0.173	0.183	0.193	0.204	0.215
61	0.90787	-0.00651	55.00	0.254	0.261	0.268	0.276	0.284	0.293
62	0.93921	-0.00253	56.00	0.317	0.322	0.328	0.333	0.340	0.346
63	0.96502	-0.00033	57.00	0.360	0.363	0.367	0.372	0.376	0.381
64	0.98421	0.00039	58.00	0.387	0.389	0.392	0.395	0.398	0.402
65	0.99602	0.00024	59.00	0.403	0.404	0.406	0.407	0.410	0.412
66	1.00000	0.00000	60.00	0.411	0.411	0.412	0.412	0.414	0.415

ALPHA= 2.55 DEGREES CMO=-0.0769 ETA= 1.121

AIRFOIL S834 15%			3.00	4.00	5.00	6.00	7.00	8.00	
N	X	Y	NU	CP(X)	FOR THE ABOVE	ALPHA	REL.	CHORD LINE	
1	1.00000	0.00000	0.00	0.417	0.419	0.421	0.424	0.427	0.431
2	0.99606	0.00061	1.00	0.396	0.397	0.399	0.400	0.403	0.405
3	0.98482	0.00310	2.00	0.326	0.326	0.327	0.328	0.329	0.331
4	0.96754	0.00791	3.00	0.215	0.214	0.213	0.213	0.213	0.213
5	0.94548	0.01465	4.00	0.078	0.075	0.072	0.070	0.068	0.067
6	0.91941	0.02247	5.00	-0.060	-0.066	-0.071	-0.076	-0.080	-0.083
7	0.88950	0.03056	6.00	-0.160	-0.168	-0.176	-0.183	-0.190	-0.196
8	0.85565	0.03870	7.00	-0.226	-0.237	-0.248	-0.258	-0.268	-0.276
9	0.81829	0.04693	8.00	-0.296	-0.311	-0.325	-0.339	-0.351	-0.363
10	0.77797	0.05503	9.00	-0.370	-0.388	-0.406	-0.423	-0.439	-0.454
11	0.73517	0.06273	10.00	-0.442	-0.465	-0.487	-0.508	-0.528	-0.547
12	0.69034	0.06973	11.00	-0.510	-0.537	-0.563	-0.589	-0.614	-0.638
13	0.64386	0.07578	12.00	-0.568	-0.600	-0.631	-0.662	-0.691	-0.720
14	0.59606	0.08071	13.00	-0.613	-0.650	-0.687	-0.722	-0.757	-0.792
15	0.54733	0.08453	14.00	-0.659	-0.701	-0.743	-0.784	-0.825	-0.866
16	0.49829	0.08714	15.00	-0.704	-0.753	-0.801	-0.849	-0.896	-0.943
17	0.44927	0.08834	16.00	-0.732	-0.787	-0.842	-0.897	-0.951	-1.005
18	0.40059	0.08820	17.00	-0.752	-0.814	-0.876	-0.938	-1.000	-1.062
19	0.35274	0.08686	18.00	-0.774	-0.844	-0.915	-0.985	-1.055	-1.126
20	0.30625	0.08437	19.00	-0.799	-0.878	-0.958	-1.038	-1.118	-1.199
21	0.26160	0.08080	20.00	-0.826	-0.916	-1.007	-1.098	-1.191	-1.284
22	0.21930	0.07620	21.00	-0.856	-0.958	-1.062	-1.167	-1.273	-1.381
23	0.17974	0.07061	22.00	-0.887	-1.005	-1.125	-1.246	-1.370	-1.496
24	0.14337	0.06413	23.00	-0.920	-1.055	-1.195	-1.337	-1.482	-1.631
25	0.11050	0.05682	24.00	-0.952	-1.111	-1.275	-1.443	-1.616	-1.793
26	0.08148	0.04879	25.00	-0.980	-1.168	-1.363	-1.565	-1.774	-1.989
27	0.05652	0.04019	26.00	-0.999	-1.225	-1.462	-1.709	-1.966	-2.233
28	0.03587	0.03119	27.00	-1.000	-1.277	-1.571	-1.881	-2.207	-2.548
29	0.01966	0.02200	28.00	-0.969	-1.319	-1.696	-2.099	-2.529	-2.985
30	0.00812	0.01297	29.00	-0.862	-1.319	-1.824	-2.378	-2.978	-3.625
31	0.00139	0.00447	30.00	-0.600	-1.226	-1.953	-2.781	-3.708	-4.734
32	0.00104	0.00375	30.09	-0.566	-1.213	-1.970	-2.837	-3.811	-4.893
33	0.00031	0.00185	30.34	-0.460	-1.173	-2.027	-3.020	-4.151	-5.418
34	0.00000	0.00009	30.59	-0.328	-1.123	-2.101	-3.262	-4.604	-6.126
35	0.00025	-0.00167	30.84	0.332	-0.181	-0.838	-1.639	-2.582	-3.667
36	0.00063	-0.00286	31.00	0.589	0.204	-0.307	-0.942	-1.702	-2.585
37	0.00092	-0.00356	31.09	0.696	0.371	-0.070	-0.627	-1.300	-2.087
38	0.00610	-0.01100	32.00	0.994	0.991	0.926	0.799	0.610	0.360
39	0.01637	-0.01945	33.00	0.790	0.894	0.963	0.996	0.995	0.958
40	0.03135	-0.02779	34.00	0.541	0.672	0.781	0.868	0.934	0.977
41	0.05077	-0.03562	35.00	0.341	0.472	0.589	0.691	0.779	0.853
42	0.07463	-0.04274	36.00	0.195	0.317	0.430	0.533	0.626	0.709
43	0.10266	-0.04895	37.00	0.092	0.204	0.308	0.406	0.496	0.579
44	0.13476	-0.05414	38.00	0.023	0.123	0.218	0.308	0.392	0.472
45	0.17060	-0.05824	39.00	-0.023	0.066	0.152	0.234	0.312	0.386
46	0.20996	-0.06119	40.00	-0.052	0.028	0.105	0.179	0.251	0.319
47	0.25241	-0.06300	41.00	-0.067	0.004	0.073	0.140	0.205	0.268
48	0.29766	-0.06367	42.00	-0.073	-0.010	0.052	0.112	0.171	0.228
49	0.34519	-0.06325	43.00	-0.072	-0.016	0.039	0.094	0.147	0.199
50	0.39461	-0.06181	44.00	-0.066	-0.016	0.033	0.082	0.130	0.178
51	0.44534	-0.05943	45.00	-0.056	-0.011	0.033	0.077	0.120	0.163
52	0.49692	-0.05621	46.00	-0.043	-0.003	0.036	0.076	0.115	0.153
53	0.54874	-0.05227	47.00	-0.028	0.008	0.043	0.078	0.113	0.148
54	0.60025	-0.04770	48.00	-0.011	0.021	0.052	0.083	0.115	0.146
55	0.65083	-0.04259	49.00	0.009	0.037	0.065	0.093	0.121	0.149
56	0.69997	-0.03702	50.00	0.033	0.058	0.082	0.107	0.132	0.157
57	0.74713	-0.03111	51.00	0.063	0.084	0.105	0.127	0.149	0.171
58	0.79183	-0.02494	52.00	0.099	0.117	0.135	0.154	0.173	0.192
59	0.83359	-0.01867	53.00	0.139	0.154	0.170	0.186	0.202	0.219
60	0.87225	-0.01217	54.00	0.227	0.239	0.251	0.264	0.277	0.290
61	0.90787	-0.00651	55.00	0.302	0.311	0.321	0.331	0.341	0.352
62	0.93921	-0.00253	56.00	0.353	0.361	0.368	0.376	0.385	0.393
63	0.96502	-0.00033	57.00	0.387	0.392	0.398	0.405	0.412	0.419
64	0.98421	0.00039	58.00	0.406	0.411	0.415	0.420	0.426	0.432
65	0.99602	0.00024	59.00	0.415	0.418	0.422	0.426	0.430	0.435
66	1.00000	0.00000	60.00	0.417	0.419	0.421	0.424	0.427	0.431

ALPHA0= 2.55 DEGREES CM0=-0.0769 ETA= 1.121

B.L.SUMMARY AIRFOIL S834 15% ALPHA0= 2.549 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 200000 MU= 300	R= 200000 MU= 100	R= 200000 MU= 900
-3.00	S TURB S SEP 100CD UPPER 0.2762 0.0564 0.7302* LOWER 0.6372 0.0646 0.6825* TOTAL CL=-0.071 100CD=1.4127 CM=-0.0708	S TURB S SEP 100CD 0.9981 0.0295 0.7803 0.9563 0.0660 0.8150 CL=-0.051 100CD=1.5953 CM=-0.0748	S TURB S SEP 100CD 0.4993 0.0273 0.6179 0.8349 0.0603 0.7519 CL=-0.051 100CD=1.3698 CM=-0.0748
-2.00	S TURB S SEP 100CD UPPER 0.2923 0.0566 0.7707* LOWER 0.5573 0.0519 0.5807* TOTAL CL= 0.029 100CD=1.3514 CM=-0.0715	S TURB S SEP 100CD 0.9981 0.0322 0.8452 0.9563 0.0532 0.7408 CL= 0.049 100CD=1.5860 CM=-0.0755	S TURB S SEP 100CD 0.5638 0.0300 0.6947 0.8017 0.0467 0.6755 CL= 0.049 100CD=1.3702 CM=-0.0755
-1.00	S TURB S SEP 100CD UPPER 0.3095 0.0568 0.8030* LOWER 0.4814 0.0487 0.5056* TOTAL CL= 0.133 100CD=1.3086 CM=-0.0730	S TURB S SEP 100CD 0.9981 0.0356 0.9223 0.9563 0.0395 0.6742 CL= 0.149 100CD=1.5965 CM=-0.0761	S TURB S SEP 100CD 0.6331 0.0330 0.7811 0.7671 0.0320 0.6084 CL= 0.149 100CD=1.3895 CM=-0.0762
0.00	S TURB S SEP 100CD UPPER 0.3267 0.0608 0.8308* LOWER 0.4098 0.0529 0.4520* TOTAL CL= 0.233 100CD=1.2828 CM=-0.0741	S TURB S SEP 100CD 0.9981 0.0386 1.0021 0.9563 0.0207 0.6091 CL= 0.249 100CD=1.6113 CM=-0.0768	S TURB S SEP 100CD 0.6943 0.0367 0.8776 0.7307 0.0107 0.5443 CL= 0.250 100CD=1.4219 CM=-0.0768
1.00	S TURB S SEP 100CD UPPER 0.3511 0.0591 0.8521* LOWER 0.3534 0.0653 0.4179* TOTAL CL= 0.340 100CD=1.2701 CM=-0.0764	S TURB S SEP 100CD 0.9981 0.0418 1.0904 0.9563 0.0001 0.5563 CL= 0.351 100CD=1.6468 CM=-0.0777	S TURB S SEP 100CD 0.7495 0.0401 0.9756 0.6932 0.0000 0.4885 CL= 0.353 100CD=1.4641 CM=-0.0780
2.00	S TURB S SEP 100CD UPPER 0.3825 0.0589 0.8727* LOWER 0.3140 0.0707 0.3854* TOTAL CL= 0.443 100CD=1.2581 CM=-0.0780	S TURB S SEP 100CD 0.9981 0.0453 1.1889 0.9563 0.0000 0.5056 CL= 0.456 100CD=1.6944 CM=-0.0792	S TURB S SEP 100CD 0.7988 0.0437 1.0807 0.6539 0.0000 0.4482 CL= 0.457 100CD=1.5288 CM=-0.0796
3.00	S TURB S SEP 100CD UPPER 0.4287 0.0572 0.9082* LOWER 0.2830 0.0768 0.3597* TOTAL CL= 0.550 100CD=1.2679 CM=-0.0804	S TURB S SEP 100CD 0.9981 0.0492 1.2986 0.9563 0.0000 0.4724 CL= 0.559 100CD=1.7711 CM=-0.0806	S TURB S SEP 100CD 0.8443 0.0476 1.1989 0.6133 0.0000 0.4130 CL= 0.561 100CD=1.6118 CM=-0.0810
4.00	S TURB S SEP 100CD UPPER 0.4669 0.0582 0.9986* LOWER 0.2576 0.0705 0.2793 TOTAL CL= 0.656 100CD=1.2779 CM=-0.0822	S TURB S SEP 100CD 0.9981 0.0535 1.4215 0.9563 0.0000 0.4394 CL= 0.661 100CD=1.8608 CM=-0.0817	S TURB S SEP 100CD 0.8865 0.0520 1.3321 0.5711 0.0000 0.3785 CL= 0.663 100CD=1.7107 CM=-0.0821
5.00	S TURB S SEP 100CD UPPER 0.4980 0.0616 1.0823* LOWER 0.2378 0.0738 0.2572 TOTAL CL= 0.758 100CD=1.3396 CM=-0.0836	S TURB S SEP 100CD 0.9981 0.0584 1.5583 0.9563 0.0000 0.4077 CL= 0.762 100CD=1.9660 CM=-0.0825	S TURB S SEP 100CD 0.9255 0.0571 1.4848 0.5275 0.0000 0.3457 CL= 0.764 100CD=1.8305 CM=-0.0829
6.00	S TURB S SEP 100CD UPPER 0.8188 0.0611 1.5319* LOWER 0.2202 0.0769 0.2372 TOTAL CL= 0.865 100CD=1.7692 CM=-0.0858	S TURB S SEP 100CD 0.9981 0.0640 1.7178* 0.9563 0.0000 0.3779 CL= 0.861 100CD=2.0957 CM=-0.0830	S TURB S SEP 100CD 0.9590 0.0629 1.6606 0.4829 0.0000 0.3151 CL= 0.863 100CD=1.9757 CM=-0.0833
7.00	S TURB S SEP 100CD UPPER 1.0058 0.0762 2.1183* LOWER 0.2016 0.0856 0.2180 TOTAL CL= 0.950 100CD=2.3363 CM=-0.0843	S TURB S SEP 100CD 1.0058 0.0762 2.1183* 0.9563 0.0000 0.3502 CL= 0.950 100CD=2.4685 CM=-0.0814	S TURB S SEP 100CD 1.0058 0.0722 1.9699* 0.4367 0.0000 0.2863 CL= 0.956 100CD=2.2563 CM=-0.0825

B.L.SUMMARY AIRFOIL S834 15% ALPHA0= 2.549 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 200000	MU= 300		R= 200000	MU= 100		R= 200000	MU= 900
7.19	S TURB	S SEP	100CD	S TURB	S SEP	100CD		
	UPPER	1.0156	0.0799	2.2012*	1.0156	0.0799	2.2012*	
	LOWER	0.1961	0.0908	0.2140	0.9563	0.0000	0.3452	
	TOTAL	CL= 0.965	100CD=2.4152	CL= 0.965	100CD=2.5464			
		CM=-0.0840		CM=-0.0807				
7.30						S TURB	S SEP	100CD
	UPPER					1.0170	0.0792	2.1769*
	LOWER					0.4226	0.0000	0.2781
	TOTAL					CL= 0.978	100CD=2.4549	
						CM=-0.0811		

B.L.SUMMARY AIRFOIL S834 15% ALPHA0= 2.549 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 300000 MU= 300	R= 300000 MU= 100	R= 300000 MU= 900
-3.00	S TURB S SEP 100CD UPPER 0.2762 0.0418 0.5188* LOWER 0.6372 0.0422 0.5780* TOTAL CL=-0.067 100CD=1.0968 CM=-0.0714	S TURB S SEP 100CD 0.9981 0.0270 0.7338 0.9563 0.0568 0.7554 CL=-0.052 100CD=1.4892 CM=-0.0746	S TURB S SEP 100CD 0.5834 0.0248 0.5988 0.8572 0.0509 0.6989 CL=-0.052 100CD=1.2977 CM=-0.0746
-2.00	S TURB S SEP 100CD UPPER 0.2923 0.0445 0.5466* LOWER 0.5573 0.0249 0.4881* TOTAL CL= 0.033 100CD=1.0347 CM=-0.0718	S TURB S SEP 100CD 0.9981 0.0297 0.7941 0.9563 0.0434 0.6885 CL= 0.048 100CD=1.4827 CM=-0.0754	S TURB S SEP 100CD 0.6440 0.0276 0.6706 0.8274 0.0362 0.6284 CL= 0.048 100CD=1.2990 CM=-0.0753
-1.00	S TURB S SEP 100CD UPPER 0.3095 0.0448 0.5811* LOWER 0.4814 0.0132 0.4229* TOTAL CL= 0.136 100CD=1.0040 CM=-0.0732	S TURB S SEP 100CD 0.9981 0.0325 0.8604 0.9563 0.0287 0.6282 CL= 0.149 100CD=1.4885 CM=-0.0762	S TURB S SEP 100CD 0.6983 0.0306 0.7458 0.7964 0.0166 0.5618 CL= 0.149 100CD=1.3076 CM=-0.0759
0.00	S TURB S SEP 100CD UPPER 0.3267 0.0452 0.6112* LOWER 0.4098 0.0101 0.3691* TOTAL CL= 0.242 100CD=0.9802 CM=-0.0751	S TURB S SEP 100CD 0.9981 0.0360 0.9397 0.9563 0.0072 0.5689 CL= 0.250 100CD=1.5086 CM=-0.0768	S TURB S SEP 100CD 0.7471 0.0337 0.8254 0.7637 0.0000 0.5065 CL= 0.251 100CD=1.3319 CM=-0.0769
1.00	S TURB S SEP 100CD UPPER 0.3511 0.0464 0.6467* LOWER 0.3534 0.0221 0.3384* TOTAL CL= 0.349 100CD=0.9851 CM=-0.0775	S TURB S SEP 100CD 0.9981 0.0391 1.0211 0.9563 0.0000 0.5155 CL= 0.354 100CD=1.5365 CM=-0.0782	S TURB S SEP 100CD 0.7928 0.0375 0.9182 0.7297 0.0000 0.4591 CL= 0.356 100CD=1.3773 CM=-0.0786
2.00	S TURB S SEP 100CD UPPER 0.3825 0.0458 0.6812* LOWER 0.3140 0.0258 0.3064* TOTAL CL= 0.456 100CD=0.9876 CM=-0.0797	S TURB S SEP 100CD 0.9981 0.0425 1.1112 0.9563 0.0000 0.4807 CL= 0.458 100CD=1.5919 CM=-0.0798	S TURB S SEP 100CD 0.8345 0.0409 1.0145 0.6941 0.0000 0.4240 CL= 0.460 100CD=1.4386 CM=-0.0802
3.00	S TURB S SEP 100CD UPPER 0.4287 0.0448 0.7393* LOWER 0.2830 0.0372 0.2813* TOTAL CL= 0.564 100CD=1.0206 CM=-0.0822	S TURB S SEP 100CD 0.9981 0.0461 1.2113 0.9563 0.0000 0.4481 CL= 0.562 100CD=1.6594 CM=-0.0813	S TURB S SEP 100CD 0.8730 0.0447 1.1220 0.6571 0.0000 0.3897 CL= 0.564 100CD=1.5117 CM=-0.0816
4.00	S TURB S SEP 100CD UPPER 0.4669 0.0475 0.8198* LOWER 0.2576 0.0386 0.2583* TOTAL CL= 0.668 100CD=1.0781 CM=-0.0839	S TURB S SEP 100CD 0.9981 0.0502 1.3224 0.9563 0.0000 0.4163 CL= 0.665 100CD=1.7388 CM=-0.0825	S TURB S SEP 100CD 0.9092 0.0488 1.2439 0.6187 0.0000 0.3571 CL= 0.667 100CD=1.6010 CM=-0.0828
5.00	S TURB S SEP 100CD UPPER 0.4980 0.0502 0.8955* LOWER 0.2378 0.0360 0.2731* TOTAL CL= 0.772 100CD=1.1687 CM=-0.0854	S TURB S SEP 100CD 0.9981 0.0548 1.4462 0.9563 0.0000 0.3862 CL= 0.767 100CD=1.8323 CM=-0.0835	S TURB S SEP 100CD 0.9427 0.0536 1.3837 0.5788 0.0000 0.3263 CL= 0.768 100CD=1.7101 CM=-0.0838
6.00	S TURB S SEP 100CD UPPER 0.8188 0.0555 1.3439* LOWER 0.2202 0.0403 0.2548* TOTAL CL= 0.873 100CD=1.5987 CM=-0.0863	S TURB S SEP 100CD 0.9981 0.0600 1.5875* 0.9563 0.0000 0.3580 CL= 0.866 100CD=1.9455 CM=-0.0841	S TURB S SEP 100CD 0.9711 0.0592 1.5445 0.5376 0.0000 0.2976 CL= 0.868 100CD=1.8422 CM=-0.0843
7.00	S TURB S SEP 100CD UPPER 1.0058 0.0698 1.9124* LOWER 0.2016 0.0374 0.1845 TOTAL CL= 0.959 100CD=2.0969 CM=-0.0843	S TURB S SEP 100CD 1.0058 0.0698 1.9124* 0.9563 0.0000 0.3318 CL= 0.959 100CD=2.2443 CM=-0.0832	S TURB S SEP 100CD 1.0058 0.0669 1.7920* 0.4954 0.0000 0.2707 CL= 0.963 100CD=2.0627 CM=-0.0840

B.L.SUMMARY AIRFOIL S834 15% ALPHA0= 2.549 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 300000 MU= 300 R= 300000 MU= 100 R= 300000 MU= 900

7.27 S TURB S SEP 100CD S TURB S SEP 100CD
UPPER 1.0166 0.0729 1.9978* 1.0166 0.0729 1.9978*
LOWER 0.1938 0.0548 0.1789 0.9563 0.0000 0.3251
TOTAL CL= 0.983 100CD=2.1767 CL= 0.983 100CD=2.3229
CM=-0.0845 CM=-0.0828

7.40 S TURB S SEP 100CD
UPPER 1.0179 0.0733 1.9990*
LOWER 0.4779 0.0000 0.2604
TOTAL CL= 0.997 100CD=2.2594
CM=-0.0829

B.L.SUMMARY AIRFOIL S834 15% ALPHA0= 2.549 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 400000 MU= 300	R= 400000 MU= 100	R= 400000 MU= 900
-3.00	S TURB S SEP 100CD UPPER 0.2762 0.0333 0.4288* LOWER 0.6372 0.0248 0.5177* TOTAL CL=-0.066 100CD=0.9465 CM=-0.0714	S TURB S SEP 100CD 0.9981 0.0252 0.7024 0.9563 0.0499 0.7167 CL=-0.052 100CD=1.4191 CM=-0.0744	S TURB S SEP 100CD 0.6381 0.0233 0.5879 0.8717 0.0440 0.6663 CL=-0.053 100CD=1.2542 CM=-0.0744
-2.00	S TURB S SEP 100CD UPPER 0.2923 0.0356 0.4575* LOWER 0.5573 0.0061 0.4410* TOTAL CL= 0.035 100CD=0.8985 CM=-0.0720	S TURB S SEP 100CD 0.9981 0.0278 0.7598 0.9563 0.0359 0.6542 CL= 0.048 100CD=1.4140 CM=-0.0752	S TURB S SEP 100CD 0.6894 0.0260 0.6529 0.8441 0.0286 0.5997 CL= 0.048 100CD=1.2525 CM=-0.0751
-1.00	S TURB S SEP 100CD UPPER 0.3095 0.0362 0.4863* LOWER 0.4814 0.0000 0.3748* TOTAL CL= 0.141 100CD=0.8611 CM=-0.0740	S TURB S SEP 100CD 0.9981 0.0306 0.8228 0.9563 0.0201 0.5980 CL= 0.149 100CD=1.4208 CM=-0.0761	S TURB S SEP 100CD 0.7360 0.0289 0.7214 0.8153 0.0072 0.5366 CL= 0.148 100CD=1.2580 CM=-0.0757
0.00	S TURB S SEP 100CD UPPER 0.3267 0.0381 0.5156* LOWER 0.4098 0.0000 0.3253* TOTAL CL= 0.247 100CD=0.8410 CM=-0.0760	S TURB S SEP 100CD 0.9981 0.0340 0.8979 0.9563 0.0000 0.5413 CL= 0.251 100CD=1.4392 CM=-0.0768	S TURB S SEP 100CD 0.7791 0.0319 0.7955 0.7852 0.0000 0.4809 CL= 0.253 100CD=1.2764 CM=-0.0773
1.00	S TURB S SEP 100CD UPPER 0.3511 0.0382 0.5525* LOWER 0.3534 0.0000 0.2911* TOTAL CL= 0.355 100CD=0.8436 CM=-0.0784	S TURB S SEP 100CD 0.9981 0.0371 0.9748 0.9563 0.0000 0.4954 CL= 0.356 100CD=1.4702 CM=-0.0786	S TURB S SEP 100CD 0.8191 0.0356 0.8823 0.7536 0.0000 0.4438 CL= 0.357 100CD=1.3261 CM=-0.0789
2.00	S TURB S SEP 100CD UPPER 0.3825 0.0385 0.5927* LOWER 0.3140 0.0000 0.2636* TOTAL CL= 0.462 100CD=0.8564 CM=-0.0807	S TURB S SEP 100CD 0.9981 0.0404 1.0597 0.9563 0.0000 0.4633 CL= 0.460 100CD=1.5230 CM=-0.0803	S TURB S SEP 100CD 0.8565 0.0390 0.9726 0.7203 0.0000 0.4092 CL= 0.462 100CD=1.3818 CM=-0.0806
3.00	S TURB S SEP 100CD UPPER 0.4287 0.0388 0.6535* LOWER 0.2830 0.0000 0.2419* TOTAL CL= 0.570 100CD=0.8954 CM=-0.0830	S TURB S SEP 100CD 0.9981 0.0440 1.1537 0.9563 0.0000 0.4313 CL= 0.564 100CD=1.5850 CM=-0.0818	S TURB S SEP 100CD 0.8905 0.0426 1.0732 0.6860 0.0000 0.3760 CL= 0.566 100CD=1.4492 CM=-0.0821
4.00	S TURB S SEP 100CD UPPER 0.4669 0.0411 0.7236* LOWER 0.2576 0.0000 0.2227* TOTAL CL= 0.675 100CD=0.9463 CM=-0.0847	S TURB S SEP 100CD 0.9981 0.0479 1.2576 0.9563 0.0000 0.4007 CL= 0.668 100CD=1.6583 CM=-0.0831	S TURB S SEP 100CD 0.9233 0.0467 1.1881 0.6503 0.0000 0.3449 CL= 0.669 100CD=1.5330 CM=-0.0834
5.00	S TURB S SEP 100CD UPPER 0.5101 0.0434 0.7976* LOWER 0.2378 0.0000 0.2049* TOTAL CL= 0.780 100CD=1.0025 CM=-0.0864	S TURB S SEP 100CD 0.9981 0.0522 1.3729 0.9563 0.0000 0.3716 CL= 0.770 100CD=1.7444 CM=-0.0841	S TURB S SEP 100CD 0.9533 0.0512 1.3196 0.6131 0.0000 0.3156 CL= 0.771 100CD=1.6352 CM=-0.0844
6.00	S TURB S SEP 100CD UPPER 0.8188 0.0521 1.2433* LOWER 0.2202 0.0000 0.2127* TOTAL CL= 0.877 100CD=1.4561 CM=-0.0862	S TURB S SEP 100CD 0.9981 0.0572 1.5017* 0.9563 0.0000 0.3445 CL= 0.870 100CD=1.8462 CM=-0.0848	S TURB S SEP 100CD 0.9784 0.0566 1.4697 0.5747 0.0000 0.2883 CL= 0.871 100CD=1.7580 CM=-0.0850
7.00	S TURB S SEP 100CD UPPER 1.0058 0.0660 1.7865* LOWER 0.2016 0.0000 0.1968* TOTAL CL= 0.965 100CD=1.9833 CM=-0.0843	S TURB S SEP 100CD 1.0058 0.0660 1.7865* 0.9563 0.0000 0.3194 CL= 0.965 100CD=2.1059 CM=-0.0843	S TURB S SEP 100CD 1.0058 0.0637 1.6851* 0.5351 0.0000 0.2627 CL= 0.968 100CD=1.9478 CM=-0.0849

B.L.SUMMARY AIRFOIL S834 15% ALPHA0= 2.549 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 400000 MU= 300 R= 400000 MU= 100 R= 400000 MU= 900

7.39	S	TURB	S	SEP	100CD	S	TURB	S	SEP	100CD
UPPER	1.0178	0.0707	1.9263*	1.0178	0.0707	1.9263*				
LOWER	0.1905	0.0000	0.1837*	0.9555	0.0000	0.3100				
TOTAL	CL= 0.999	100CD=2.1099	CM=-0.0836	CL= 0.999	100CD=2.2363	CM=-0.0836				

7.58

UPPER
LOWER
TOTAL

S	TURB	S	SEP	100CD
1.0192	0.0713	1.9284*		
0.5115	0.0000	0.2481		
CL= 1.019	100CD=2.1765	CM=-0.0838		

B.L.SUMMARY AIRFOIL S834 15% ALPHA0= 2.549 DEG.
 *-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 500000 MU= 300	R= 500000 MU= 100	R= 500000 MU= 900
-3.00	S TURB S SEP 100CD UPPER 0.2762 0.0292 0.3790* LOWER 0.6372 0.0143 0.4833* TOTAL CL=-0.066 100CD=0.8624 CM=-0.0713	S TURB S SEP 100CD 0.9981 0.0238 0.6789 0.9563 0.0442 0.6885 CL=-0.053 100CD=1.3674 CM=-0.0743	S TURB S SEP 100CD 0.6747 0.0221 0.5783 0.8820 0.0386 0.6432 CL=-0.054 100CD=1.2215 CM=-0.0742
-2.00	S TURB S SEP 100CD UPPER 0.2923 0.0297 0.4052* LOWER 0.5573 0.0000 0.4079* TOTAL CL= 0.038 100CD=0.8131 CM=-0.0727	S TURB S SEP 100CD 0.9981 0.0264 0.7342 0.9563 0.0297 0.6292 CL= 0.048 100CD=1.3634 CM=-0.0751	S TURB S SEP 100CD 0.7198 0.0248 0.6385 0.8563 0.0224 0.5794 CL= 0.047 100CD=1.2179 CM=-0.0749
-1.00	S TURB S SEP 100CD UPPER 0.3095 0.0305 0.4312* LOWER 0.4814 0.0000 0.3490* TOTAL CL= 0.146 100CD=0.7802 CM=-0.0750	S TURB S SEP 100CD 0.9981 0.0291 0.7948 0.9563 0.0093 0.5706 CL= 0.148 100CD=1.3653 CM=-0.0758	S TURB S SEP 100CD 0.7620 0.0276 0.7032 0.8294 0.0013 0.5189 CL= 0.148 100CD=1.2221 CM=-0.0757
0.00	S TURB S SEP 100CD UPPER 0.3267 0.0324 0.4616* LOWER 0.4098 0.0000 0.3045* TOTAL CL= 0.252 100CD=0.7661 CM=-0.0772	S TURB S SEP 100CD 0.9981 0.0325 0.8669 0.9563 0.0000 0.5186 CL= 0.252 100CD=1.3855 CM=-0.0772	S TURB S SEP 100CD 0.8008 0.0305 0.7735 0.8007 0.0000 0.4669 CL= 0.254 100CD=1.2403 CM=-0.0775
1.00	S TURB S SEP 100CD UPPER 0.3511 0.0329 0.4948* LOWER 0.3534 0.0000 0.2715* TOTAL CL= 0.360 100CD=0.7663 CM=-0.0795	S TURB S SEP 100CD 0.9981 0.0356 0.9405 0.9563 0.0000 0.4821 CL= 0.357 100CD=1.4226 CM=-0.0790	S TURB S SEP 100CD 0.8375 0.0342 0.8562 0.7709 0.0000 0.4328 CL= 0.359 100CD=1.2890 CM=-0.0793
2.00	S TURB S SEP 100CD UPPER 0.3825 0.0338 0.5365* LOWER 0.3140 0.0000 0.2451* TOTAL CL= 0.467 100CD=0.7816 CM=-0.0818	S TURB S SEP 100CD 0.9981 0.0388 1.0216 0.9563 0.0000 0.4501 CL= 0.462 100CD=1.4717 CM=-0.0806	S TURB S SEP 100CD 0.8714 0.0375 0.9420 0.7396 0.0000 0.3988 CL= 0.463 100CD=1.3409 CM=-0.0809
3.00	S TURB S SEP 100CD UPPER 0.4287 0.0348 0.5976* LOWER 0.2830 0.0000 0.2237* TOTAL CL= 0.574 100CD=0.8213 CM=-0.0839	S TURB S SEP 100CD 0.9981 0.0423 1.1111 0.9563 0.0000 0.4189 CL= 0.566 100CD=1.5300 CM=-0.0822	S TURB S SEP 100CD 0.9029 0.0411 1.0381 0.7073 0.0000 0.3667 CL= 0.567 100CD=1.4047 CM=-0.0824
4.00	S TURB S SEP 100CD UPPER 0.4669 0.0373 0.6636* LOWER 0.2576 0.0000 0.2053* TOTAL CL= 0.679 100CD=0.8689 CM=-0.0856	S TURB S SEP 100CD 0.9981 0.0461 1.2101 0.9563 0.0000 0.3892 CL= 0.670 100CD=1.5993 CM=-0.0835	S TURB S SEP 100CD 0.9330 0.0450 1.1478 0.6736 0.0000 0.3364 CL= 0.671 100CD=1.4842 CM=-0.0838
5.00	S TURB S SEP 100CD UPPER 0.5563 0.0404 0.7909 LOWER 0.2378 0.0000 0.1884* TOTAL CL= 0.784 100CD=0.9792 CM=-0.0871	S TURB S SEP 100CD 0.9981 0.0503 1.3192 0.9563 0.0000 0.3612 CL= 0.772 100CD=1.6803 CM=-0.0846	S TURB S SEP 100CD 0.9606 0.0494 1.2732 0.6383 0.0000 0.3080 CL= 0.773 100CD=1.5812 CM=-0.0848
6.00	S TURB S SEP 100CD UPPER 0.8188 0.0497 1.1751* LOWER 0.2202 0.0000 0.1738* TOTAL CL= 0.880 100CD=1.3489 CM=-0.0869	S TURB S SEP 100CD 0.9981 0.0551 1.4402 0.9563 0.0000 0.3350 CL= 0.873 100CD=1.7752 CM=-0.0855	S TURB S SEP 100CD 0.9833 0.0546 1.4164 0.6023 0.0000 0.2817 CL= 0.874 100CD=1.6981 CM=-0.0856
7.00	S TURB S SEP 100CD UPPER 1.0058 0.0625 1.6652* LOWER 0.2016 0.0000 0.1766* TOTAL CL= 0.970 100CD=1.8417 CM=-0.0853	S TURB S SEP 100CD 1.0058 0.0625 1.6652* 0.9563 0.0000 0.3107 CL= 0.970 100CD=1.9759 CM=-0.0853	S TURB S SEP 100CD 1.0058 0.0611 1.6038* 0.5648 0.0000 0.2571 CL= 0.972 100CD=1.8608 CM=-0.0857

B.L.SUMMARY AIRFOIL S834 15% ALPHA0= 2.549 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 500000 MU= 300 R= 500000 MU= 100 R= 500000 MU= 900

7.69 S TURB S SEP 100CD S TURB S SEP 100CD
UPPER 1.0199 0.0699 1.8758* 1.0199 0.0699 1.8758*
LOWER 0.1842 0.0000 0.1648* 0.9555 0.0000 0.2942
TOTAL CL= 1.032 100CD=2.0406 CL= 1.032 100CD=2.1700
CM=-0.0844 CM=-0.0844

7.77

UPPER
LOWER
TOTAL

S TURB S SEP 100CD
1.0244 0.0699 1.8754*
0.5351 0.0000 0.2392
CL= 1.041 100CD=2.1146
CM=-0.0845

B.L.SUMMARY AIRFOIL S834 15% ALPHA0= 2.549 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 700000 MU= 300	R= 700000 MU= 100	R= 700000 MU= 900
-3.00	S TURB S SEP 100CD UPPER 0.2762 0.0217 0.3223* LOWER 0.6372 0.0009 0.4378* TOTAL CL=-0.064 100CD=0.7601 CM=-0.0715	S TURB S SEP 100CD 0.9981 0.0217 0.6449 0.9563 0.0353 0.6486 CL=-0.054 100CD=1.2936 CM=-0.0740	S TURB S SEP 100CD 0.7218 0.0202 0.5621 0.8967 0.0300 0.6111 CL=-0.055 100CD=1.1732 CM=-0.0739
-2.00	S TURB S SEP 100CD UPPER 0.2923 0.0228 0.3454* LOWER 0.5573 0.0000 0.3692* TOTAL CL= 0.043 100CD=0.7146 CM=-0.0739	S TURB S SEP 100CD 0.9981 0.0242 0.6971 0.9563 0.0195 0.5937 CL= 0.047 100CD=1.2909 CM=-0.0749	S TURB S SEP 100CD 0.7603 0.0228 0.6172 0.8733 0.0127 0.5515 CL= 0.046 100CD=1.1686 CM=-0.0747
-1.00	S TURB S SEP 100CD UPPER 0.3095 0.0238 0.3674* LOWER 0.4814 0.0000 0.3185 TOTAL CL= 0.151 100CD=0.6860 CM=-0.0763	S TURB S SEP 100CD 0.9981 0.0269 0.7543 0.9563 0.0000 0.5390 CL= 0.149 100CD=1.2933 CM=-0.0757	S TURB S SEP 100CD 0.7963 0.0256 0.6769 0.8487 0.0000 0.4909 CL= 0.150 100CD=1.1678 CM=-0.0760
0.00	S TURB S SEP 100CD UPPER 0.3267 0.0253 0.3958* LOWER 0.4103 0.0000 0.2741 TOTAL CL= 0.258 100CD=0.6699 CM=-0.0786	S TURB S SEP 100CD 0.9981 0.0297 0.8169 0.9563 0.0000 0.4927 CL= 0.255 100CD=1.3097 CM=-0.0777	S TURB S SEP 100CD 0.8298 0.0284 0.7418 0.8225 0.0000 0.4514 CL= 0.256 100CD=1.1932 CM=-0.0780
1.00	S TURB S SEP 100CD UPPER 0.3511 0.0264 0.4268* LOWER 0.3534 0.0000 0.2420* TOTAL CL= 0.366 100CD=0.6688 CM=-0.0809	S TURB S SEP 100CD 0.9981 0.0332 0.8911 0.9563 0.0000 0.4619 CL= 0.360 100CD=1.3530 CM=-0.0795	S TURB S SEP 100CD 0.8620 0.0319 0.8188 0.7954 0.0000 0.4174 CL= 0.361 100CD=1.2362 CM=-0.0797
2.00	S TURB S SEP 100CD UPPER 0.3830 0.0277 0.4663* LOWER 0.3140 0.0000 0.2174* TOTAL CL= 0.473 100CD=0.6836 CM=-0.0831	S TURB S SEP 100CD 0.9981 0.0364 0.9671 0.9563 0.0000 0.4305 CL= 0.465 100CD=1.3976 CM=-0.0812	S TURB S SEP 100CD 0.8914 0.0352 0.8986 0.7668 0.0000 0.3845 CL= 0.466 100CD=1.2831 CM=-0.0814
3.00	S TURB S SEP 100CD UPPER 0.4289 0.0297 0.5271 LOWER 0.2830 0.0000 0.1968* TOTAL CL= 0.580 100CD=0.7239 CM=-0.0851	S TURB S SEP 100CD 0.9981 0.0398 1.0505 0.9563 0.0000 0.4004 CL= 0.569 100CD=1.4509 CM=-0.0827	S TURB S SEP 100CD 0.9197 0.0387 0.9887 0.7372 0.0000 0.3536 CL= 0.570 100CD=1.3423 CM=-0.0830
4.00	S TURB S SEP 100CD UPPER 0.4904 0.0325 0.6118 LOWER 0.2576 0.0000 0.1802* TOTAL CL= 0.685 100CD=0.7920 CM=-0.0868	S TURB S SEP 100CD 0.9981 0.0434 1.1424 0.9563 0.0000 0.3720 CL= 0.673 100CD=1.5144 CM=-0.0841	S TURB S SEP 100CD 0.9462 0.0425 1.0910 0.7066 0.0000 0.3249 CL= 0.674 100CD=1.4159 CM=-0.0844
5.00	S TURB S SEP 100CD UPPER 0.6266 0.0382 0.7931 LOWER 0.2378 0.0000 0.1654* TOTAL CL= 0.786 100CD=0.9585 CM=-0.0877	S TURB S SEP 100CD 0.9981 0.0474 1.2434 0.9563 0.0000 0.3453 CL= 0.775 100CD=1.5887 CM=-0.0853	S TURB S SEP 100CD 0.9704 0.0468 1.2083 0.6744 0.0000 0.2980 CL= 0.776 100CD=1.5063 CM=-0.0855
6.00	S TURB S SEP 100CD UPPER 0.8188 0.0464 1.0839* LOWER 0.2202 0.0000 0.1519* TOTAL CL= 0.884 100CD=1.2358 CM=-0.0877	S TURB S SEP 100CD 0.9981 0.0519 1.3550 0.9563 0.0000 0.3203 CL= 0.877 100CD=1.6754 CM=-0.0863	S TURB S SEP 100CD 0.9899 0.0516 1.3413 0.6412 0.0000 0.2730 CL= 0.878 100CD=1.6143 CM=-0.0864
7.00	S TURB S SEP 100CD UPPER 1.0058 0.0587 1.5504* LOWER 0.2016 0.0000 0.1433* TOTAL CL= 0.975 100CD=1.6937 CM=-0.0864	S TURB S SEP 100CD 1.0058 0.0587 1.5504* 0.9563 0.0000 0.2971 CL= 0.975 100CD=1.8475 CM=-0.0864	S TURB S SEP 100CD 1.0058 0.0576 1.5018* 0.6072 0.0000 0.2497 CL= 0.977 100CD=1.7515 CM=-0.0867

B.L.SUMMARY AIRFOIL S834 15% ALPHA0= 2.549 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 700000 MU= 300 R= 700000 MU= 100 R= 700000 MU= 900

7.88 S TURB S SEP 100CD S TURB S SEP 100CD
UPPER 1.0247 0.0673 1.7980* 1.0247 0.0673 1.7980*
LOWER 0.1812 0.0000 0.1392* 0.9555 0.0000 0.2780
TOTAL CL= 1.056 100CD=1.9371 CL= 1.056 100CD=2.0760
CM=-0.0855 CM=-0.0855

7.92 S TURB S SEP 100CD
UPPER 1.0248 0.0674 1.7965*
LOWER 0.5744 0.0000 0.2296
TOTAL CL= 1.060 100CD=2.0261
CM=-0.0855

APPENDIX C

PRESSURE DISTRIBUTIONS, TRANSITION AND SEPARATION LOCATIONS, AND
SECTION CHARACTERISTICS OF S835 AIRFOIL

AIRFOIL S835 21%				-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00
N	X	Y	NU	CP(X) FOR THE ABOVE ALPHA REL. CHORD LINE						
1	1.00000	0.00000	0.00	0.424	0.424	0.424	0.425	0.426	0.427	0.429
2	0.99593	0.00097	1.00	0.405	0.404	0.403	0.403	0.403	0.403	0.404
3	0.98447	0.00455	2.00	0.328	0.326	0.324	0.322	0.321	0.320	0.320
4	0.96719	0.01097	3.00	0.202	0.198	0.194	0.190	0.187	0.185	0.183
5	0.94546	0.01950	4.00	0.046	0.039	0.032	0.026	0.021	0.016	0.012
6	0.91994	0.02902	5.00	-0.105	-0.116	-0.125	-0.134	-0.143	-0.151	-0.158
7	0.89062	0.03853	6.00	-0.197	-0.210	-0.223	-0.236	-0.247	-0.258	-0.268
8	0.85715	0.04786	7.00	-0.238	-0.255	-0.271	-0.286	-0.301	-0.315	-0.328
9	0.81994	0.05718	8.00	-0.281	-0.301	-0.321	-0.340	-0.358	-0.375	-0.391
10	0.77953	0.06631	9.00	-0.325	-0.349	-0.372	-0.394	-0.416	-0.437	-0.458
11	0.73644	0.07503	10.00	-0.367	-0.395	-0.422	-0.449	-0.475	-0.500	-0.525
12	0.69117	0.08310	11.00	-0.407	-0.439	-0.471	-0.502	-0.532	-0.562	-0.592
13	0.64420	0.09028	12.00	-0.442	-0.479	-0.516	-0.552	-0.587	-0.622	-0.656
14	0.59600	0.09636	13.00	-0.472	-0.514	-0.555	-0.597	-0.638	-0.678	-0.718
15	0.54703	0.10115	14.00	-0.494	-0.542	-0.589	-0.636	-0.683	-0.730	-0.776
16	0.49774	0.10448	15.00	-0.508	-0.561	-0.615	-0.668	-0.721	-0.774	-0.827
17	0.44851	0.10620	16.00	-0.504	-0.564	-0.623	-0.683	-0.743	-0.802	-0.862
18	0.39966	0.10638	17.00	-0.495	-0.561	-0.627	-0.694	-0.760	-0.827	-0.895
19	0.35178	0.10500	18.00	-0.473	-0.545	-0.619	-0.692	-0.767	-0.842	-0.917
20	0.30519	0.10211	19.00	-0.442	-0.521	-0.602	-0.683	-0.766	-0.850	-0.934
21	0.26037	0.09783	20.00	-0.405	-0.492	-0.581	-0.672	-0.764	-0.858	-0.953
22	0.21782	0.09226	21.00	-0.360	-0.456	-0.555	-0.656	-0.759	-0.864	-0.971
23	0.17797	0.08549	22.00	-0.305	-0.411	-0.521	-0.634	-0.749	-0.868	-0.989
24	0.14127	0.07759	23.00	-0.236	-0.353	-0.475	-0.601	-0.732	-0.866	-1.004
25	0.10805	0.06868	24.00	-0.148	-0.278	-0.414	-0.556	-0.703	-0.857	-1.016
26	0.07871	0.05889	25.00	-0.032	-0.176	-0.327	-0.488	-0.656	-0.832	-1.016
27	0.05347	0.04838	26.00	0.118	-0.038	-0.207	-0.388	-0.581	-0.785	-1.001
28	0.03266	0.03735	27.00	0.316	0.148	-0.038	-0.242	-0.463	-0.701	-0.956
29	0.01649	0.02603	28.00	0.566	0.396	0.198	-0.027	-0.280	-0.559	-0.865
30	0.00537	0.01477	29.00	0.850	0.709	0.522	0.289	0.010	-0.314	-0.683
31	0.00357	0.01220	29.23	0.910	0.786	0.610	0.381	0.100	-0.233	-0.618
32	0.00200	0.00947	29.48	0.963	0.865	0.706	0.486	0.205	-0.137	-0.538
33	0.00087	0.00677	29.73	0.996	0.935	0.802	0.596	0.319	-0.029	-0.448
34	0.00026	0.00397	29.98	0.995	0.988	0.916	0.777	0.572	0.302	-0.034
35	0.00023	0.00376	30.00	0.993	0.990	0.922	0.788	0.588	0.322	-0.008
36	0.00002	0.00099	30.23	0.959	0.999	0.978	0.896	0.753	0.550	0.285
37	0.00111	-0.00887	31.00	0.710	0.853	0.948	0.995	0.993	0.943	0.844
38	0.00638	-0.02253	32.00	0.249	0.463	0.641	0.784	0.891	0.961	0.996
39	0.01577	-0.03657	33.00	-0.211	0.029	0.244	0.432	0.594	0.729	0.837
40	0.02908	-0.05033	34.00	-0.597	-0.355	-0.131	0.073	0.257	0.422	0.566
41	0.04631	-0.06347	35.00	-0.889	-0.658	-0.440	-0.237	-0.049	0.124	0.282
42	0.06721	-0.07550	36.00	-1.086	-0.873	-0.670	-0.478	-0.297	-0.127	0.032
43	0.09182	-0.08620	37.00	-1.202	-1.010	-0.826	-0.650	-0.481	-0.321	-0.169
44	0.11982	-0.09519	38.00	-1.251	-1.081	-0.916	-0.757	-0.604	-0.457	-0.316
45	0.15121	-0.10230	39.00	-1.248	-1.099	-0.954	-0.813	-0.676	-0.543	-0.415
46	0.18563	-0.10723	40.00	-1.197	-1.068	-0.941	-0.818	-0.697	-0.580	-0.466
47	0.22322	-0.10980	41.00	-1.088	-0.979	-0.871	-0.765	-0.661	-0.560	-0.461
48	0.26372	-0.11014	42.00	-0.971	-0.878	-0.787	-0.697	-0.608	-0.520	-0.434
49	0.30684	-0.10829	43.00	-0.848	-0.770	-0.692	-0.616	-0.540	-0.465	-0.391
50	0.35227	-0.10430	44.00	-0.721	-0.655	-0.590	-0.525	-0.461	-0.397	-0.333
51	0.39970	-0.09827	45.00	-0.592	-0.537	-0.483	-0.428	-0.374	-0.320	-0.266
52	0.44881	-0.09036	46.00	-0.464	-0.418	-0.373	-0.327	-0.282	-0.236	-0.191
53	0.49928	-0.08081	47.00	-0.337	-0.300	-0.262	-0.224	-0.187	-0.148	-0.110
54	0.55072	-0.06993	48.00	-0.214	-0.184	-0.153	-0.122	-0.091	-0.059	-0.028
55	0.60277	-0.05811	49.00	-0.097	-0.072	-0.047	-0.022	0.004	0.029	0.056
56	0.65496	-0.04582	50.00	0.014	0.033	0.053	0.074	0.095	0.116	0.137
57	0.70679	-0.03361	51.00	0.117	0.132	0.148	0.164	0.181	0.198	0.215
58	0.75764	-0.02211	52.00	0.210	0.223	0.235	0.248	0.261	0.275	0.289
59	0.80676	-0.01199	53.00	0.294	0.304	0.314	0.324	0.334	0.345	0.356
60	0.85324	-0.00393	54.00	0.368	0.375	0.383	0.391	0.399	0.407	0.416
61	0.89582	0.00127	55.00	0.418	0.424	0.429	0.436	0.442	0.449	0.456
62	0.93260	0.00343	56.00	0.441	0.445	0.450	0.455	0.460	0.465	0.471
63	0.96201	0.00332	57.00	0.446	0.449	0.452	0.456	0.460	0.464	0.469
64	0.98319	0.00204	58.00	0.439	0.441	0.443	0.446	0.449	0.453	0.456
65	0.99583	0.00064	59.00	0.429	0.430	0.431	0.433	0.435	0.438	0.440
66	1.00000	0.00000	60.00	0.424	0.424	0.424	0.425	0.426	0.427	0.429

ALPHA= 3.54 DEGREES CM0=-0.1386 ETA= 1.167

AIRFOIL S835 21%			3.00 4.00 5.00 6.00 7.00 8.00							
N	X	Y	NU	CP(X) FOR THE ABOVE ALPHA REL. CHORD LINE						
1	1.00000	0.00000	0.00	0.431	0.433	0.436	0.439	0.443	0.447	
2	0.99593	0.00097	1.00	0.405	0.407	0.408	0.411	0.413	0.416	
3	0.98447	0.00455	2.00	0.320	0.320	0.321	0.322	0.324	0.326	
4	0.96719	0.01097	3.00	0.181	0.180	0.180	0.180	0.181	0.182	
5	0.94546	0.01950	4.00	0.008	0.005	0.003	0.001	0.000	-0.001	
6	0.91994	0.02902	5.00	-0.164	-0.170	-0.175	-0.179	-0.183	-0.185	
7	0.89062	0.03853	6.00	-0.278	-0.286	-0.294	-0.301	-0.308	-0.313	
8	0.85715	0.04786	7.00	-0.340	-0.352	-0.363	-0.373	-0.382	-0.391	
9	0.81994	0.05718	8.00	-0.407	-0.422	-0.437	-0.450	-0.463	-0.475	
10	0.77953	0.06631	9.00	-0.477	-0.496	-0.514	-0.531	-0.548	-0.563	
11	0.73644	0.07503	10.00	-0.549	-0.572	-0.594	-0.616	-0.636	-0.656	
12	0.69117	0.08310	11.00	-0.620	-0.648	-0.675	-0.701	-0.726	-0.751	
13	0.64420	0.09028	12.00	-0.690	-0.723	-0.755	-0.787	-0.817	-0.847	
14	0.59600	0.09636	13.00	-0.758	-0.796	-0.834	-0.872	-0.908	-0.944	
15	0.54703	0.10115	14.00	-0.821	-0.866	-0.911	-0.954	-0.998	-1.040	
16	0.49774	0.10448	15.00	-0.879	-0.931	-0.983	-1.033	-1.084	-1.133	
17	0.44851	0.10620	16.00	-0.921	-0.980	-1.039	-1.098	-1.156	-1.213	
18	0.39966	0.10638	17.00	-0.962	-1.029	-1.096	-1.163	-1.229	-1.296	
19	0.35178	0.10500	18.00	-0.993	-1.069	-1.145	-1.221	-1.297	-1.373	
20	0.30519	0.10211	19.00	-1.019	-1.105	-1.191	-1.278	-1.364	-1.451	
21	0.26037	0.09783	20.00	-1.048	-1.145	-1.243	-1.342	-1.441	-1.541	
22	0.21782	0.09226	21.00	-1.079	-1.190	-1.302	-1.415	-1.529	-1.644	
23	0.17797	0.08549	22.00	-1.113	-1.239	-1.367	-1.498	-1.631	-1.765	
24	0.14127	0.07759	23.00	-1.146	-1.292	-1.440	-1.592	-1.747	-1.905	
25	0.10805	0.06868	24.00	-1.180	-1.349	-1.523	-1.702	-1.885	-2.072	
26	0.07871	0.05889	25.00	-1.208	-1.407	-1.613	-1.825	-2.044	-2.270	
27	0.05347	0.04838	26.00	-1.227	-1.464	-1.712	-1.969	-2.237	-2.514	
28	0.03266	0.03735	27.00	-1.228	-1.515	-1.819	-2.138	-2.472	-2.820	
29	0.01649	0.02603	28.00	-1.197	-1.554	-1.937	-2.344	-2.776	-3.232	
30	0.00537	0.01477	29.00	-1.096	-1.554	-2.055	-2.598	-3.184	-3.811	
31	0.00357	0.01220	29.23	-1.053	-1.539	-2.074	-2.659	-3.292	-3.973	
32	0.00200	0.00947	29.48	-1.000	-1.520	-2.098	-2.735	-3.428	-4.177	
33	0.00087	0.00677	29.73	-0.938	-1.498	-2.127	-2.824	-3.590	-4.421	
34	0.00026	0.00397	29.98	-0.435	-0.901	-1.430	-2.023	-2.679	-3.396	
35	0.00023	0.00376	30.00	-0.403	-0.862	-1.385	-1.971	-2.619	-3.329	
36	0.00002	0.00099	30.23	-0.039	-0.423	-0.867	-1.369	-1.930	-2.548	
37	0.00111	-0.00887	31.00	0.697	0.502	0.259	-0.032	-0.369	-0.754	
38	0.00638	-0.02253	32.00	0.995	0.957	0.884	0.774	0.629	0.448	
39	0.01577	-0.03657	33.00	0.917	0.971	0.997	0.996	0.968	0.912	
40	0.02908	-0.05033	34.00	0.689	0.792	0.875	0.937	0.978	0.998	
41	0.04631	-0.06347	35.00	0.425	0.552	0.663	0.759	0.839	0.903	
42	0.06721	-0.07550	36.00	0.179	0.314	0.438	0.550	0.649	0.737	
43	0.09182	-0.08620	37.00	-0.026	0.108	0.234	0.350	0.458	0.555	
44	0.11982	-0.09519	38.00	-0.182	-0.054	0.067	0.181	0.289	0.389	
45	0.15121	-0.10230	39.00	-0.292	-0.174	-0.060	0.048	0.151	0.249	
46	0.18563	-0.10723	40.00	-0.355	-0.248	-0.144	-0.044	0.051	0.143	
47	0.22322	-0.10980	41.00	-0.364	-0.269	-0.178	-0.089	-0.003	0.081	
48	0.26372	-0.11014	42.00	-0.350	-0.267	-0.187	-0.108	-0.031	0.043	
49	0.30684	-0.10829	43.00	-0.318	-0.246	-0.176	-0.107	-0.039	0.027	
50	0.35227	-0.10430	44.00	-0.271	-0.209	-0.148	-0.088	-0.029	0.030	
51	0.39970	-0.09827	45.00	-0.212	-0.159	-0.107	-0.055	-0.003	0.047	
52	0.44881	-0.09036	46.00	-0.145	-0.100	-0.055	-0.011	0.034	0.077	
53	0.49928	-0.08081	47.00	-0.072	-0.034	0.004	0.042	0.080	0.117	
54	0.55072	-0.06993	48.00	0.004	0.036	0.068	0.100	0.132	0.164	
55	0.60277	-0.05811	49.00	0.082	0.108	0.135	0.162	0.189	0.216	
56	0.65496	-0.04582	50.00	0.159	0.181	0.203	0.225	0.247	0.270	
57	0.70679	-0.03361	51.00	0.233	0.251	0.269	0.287	0.306	0.325	
58	0.75764	-0.02211	52.00	0.303	0.318	0.332	0.347	0.363	0.378	
59	0.80676	-0.01199	53.00	0.367	0.379	0.391	0.403	0.416	0.428	
60	0.85324	-0.00393	54.00	0.425	0.434	0.444	0.454	0.464	0.474	
61	0.89582	0.00127	55.00	0.463	0.470	0.478	0.486	0.495	0.503	
62	0.93260	0.00343	56.00	0.477	0.483	0.490	0.496	0.503	0.511	
63	0.96201	0.00332	57.00	0.474	0.479	0.485	0.491	0.497	0.503	
64	0.98319	0.00204	58.00	0.460	0.465	0.469	0.474	0.480	0.485	
65	0.99583	0.00064	59.00	0.443	0.447	0.451	0.455	0.459	0.464	
66	1.00000	0.00000	60.00	0.431	0.433	0.436	0.439	0.443	0.447	

ALPHA= 3.54 DEGREES CMO=-0.1386 ETA= 1.167

B.L.SUMMARY AIRFOIL S835 21% ALPHA0= 3.539 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEC.)	R= 150000 MU= 300	R= 150000 MU= 100	R= 150000 MU= 900
-4.00	S TURB S SEP 100CD UPPER 0.2866 0.0553 0.8704* LOWER 0.7687 0.4232 1.2990* TOTAL CL=-0.081 100CD=2.1694 CM=-0.1329	S TURB S SEP 100CD 1.0055 0.0350 0.9340 0.9686 0.3204 1.0840 CL=-0.067 100CD=2.0179 CM=-0.1337	S TURB S SEP 100CD 0.4813 0.0341 0.7539 0.8003 0.3094 0.9531 CL=-0.067 100CD=1.7070 CM=-0.1337
-3.00	S TURB S SEP 100CD UPPER 0.3125 0.0543 0.9285* LOWER 0.7475 0.3842 1.1534* TOTAL CL= 0.005 100CD=2.0818 CM=-0.1334	S TURB S SEP 100CD 1.0056 0.0371 1.0104 0.9686 0.2978 0.9778 CL= 0.023 100CD=1.9882 CM=-0.1341	S TURB S SEP 100CD 0.5183 0.0359 0.8247 0.7886 0.2870 0.8642 CL= 0.024 100CD=1.6889 CM=-0.1342
-2.00	S TURB S SEP 100CD UPPER 0.3394 0.0562 0.9892* LOWER 0.7251 0.3834 1.0553* TOTAL CL= 0.108 100CD=2.0445 CM=-0.1360	S TURB S SEP 100CD 1.0056 0.0394 1.0945 0.9686 0.2754 0.8817 CL= 0.127 100CD=1.9762 CM=-0.1364	S TURB S SEP 100CD 0.5605 0.0379 0.9057 0.7757 0.2648 0.7831 CL= 0.129 100CD=1.6888 CM=-0.1365
-1.00	S TURB S SEP 100CD UPPER 0.3661 0.0585 1.0551* LOWER 0.7021 0.3491 0.9512* TOTAL CL= 0.212 100CD=2.0062 CM=-0.1379	S TURB S SEP 100CD 1.0056 0.0419 1.1875 0.9686 0.2531 0.7947 CL= 0.232 100CD=1.9822 CM=-0.1386	S TURB S SEP 100CD 0.6075 0.0401 0.9987 0.7612 0.2433 0.7091 CL= 0.234 100CD=1.7079 CM=-0.1387
0.00	S TURB S SEP 100CD UPPER 0.3933 0.0579 1.1258* LOWER 0.6793 0.3505 0.8732* TOTAL CL= 0.320 100CD=1.9990 CM=-0.1408	S TURB S SEP 100CD 1.0056 0.0440 1.2786 0.9686 0.2311 0.7164 CL= 0.337 100CD=1.9949 CM=-0.1406	S TURB S SEP 100CD 0.6710 0.0422 1.1065 0.7447 0.2221 0.6413 CL= 0.339 100CD=1.7478 CM=-0.1408
1.00	S TURB S SEP 100CD UPPER 0.4208 0.0610 1.2107* LOWER 0.6567 0.3165 0.7972* TOTAL CL= 0.422 100CD=2.0079 CM=-0.1422	S TURB S SEP 100CD 1.0056 0.0468 1.3903 0.9686 0.2093 0.6459 CL= 0.441 100CD=2.0362 CM=-0.1423	S TURB S SEP 100CD 0.7317 0.0451 1.2333 0.7267 0.2012 0.5796 CL= 0.443 100CD=1.8129 CM=-0.1425
2.00	S TURB S SEP 100CD UPPER 0.4482 0.0640 1.2887* LOWER 0.6342 0.3179 0.7319* TOTAL CL= 0.525 100CD=2.0206 CM=-0.1443	S TURB S SEP 100CD 1.0056 0.0506 1.5270 0.9686 0.1877 0.5825 CL= 0.543 100CD=2.1095 CM=-0.1435	S TURB S SEP 100CD 0.7847 0.0489 1.3798 0.7075 0.1809 0.5237 CL= 0.545 100CD=1.9035 CM=-0.1437
3.00	S TURB S SEP 100CD UPPER 0.4761 0.0657 1.3929* LOWER 0.6121 0.2824 0.6714* TOTAL CL= 0.628 100CD=2.0643 CM=-0.1453	S TURB S SEP 100CD 1.0056 0.0542 1.6637 0.9686 0.1668 0.5254 CL= 0.645 100CD=2.1892 CM=-0.1445	S TURB S SEP 100CD 0.8322 0.0525 1.5284 0.6873 0.1611 0.4732 CL= 0.647 100CD=2.0016 CM=-0.1448
4.00	S TURB S SEP 100CD UPPER 0.5025 0.0684 1.4540* LOWER 0.5902 0.2838 0.6198* TOTAL CL= 0.730 100CD=2.0738 CM=-0.1471	S TURB S SEP 100CD 1.0056 0.0582 1.8131 0.9686 0.0000 0.4746 CL= 0.746 100CD=2.2877 CM=-0.1419	S TURB S SEP 100CD 0.8751 0.0566 1.6906 0.6667 0.0000 0.4281 CL= 0.748 100CD=2.1186 CM=-0.1424
5.00	S TURB S SEP 100CD UPPER 0.5620 0.0653 1.5153* LOWER 0.5686 0.2464 0.5676* TOTAL CL= 0.841 100CD=2.0829 CM=-0.1486	S TURB S SEP 100CD 1.0056 0.0625 1.9784 0.9686 0.0000 0.4293 CL= 0.846 100CD=2.4078 CM=-0.1424	S TURB S SEP 100CD 0.9121 0.0611 1.8708 0.6457 0.0000 0.3882 CL= 0.848 100CD=2.2589 CM=-0.1429
6.00	S TURB S SEP 100CD UPPER 0.6333 0.0661 1.6632* LOWER 0.5468 0.2482 0.5294* TOTAL CL= 0.946 100CD=2.1926 CM=-0.1504	S TURB S SEP 100CD 1.0056 0.0674 2.1597 0.9686 0.0000 0.4001 CL= 0.944 100CD=2.5598 CM=-0.1425	S TURB S SEP 100CD 0.9429 0.0662 2.0702 0.6247 0.0000 0.3633 CL= 0.946 100CD=2.4335 CM=-0.1429

B.L.SUMMARY AIRFOIL S835 21% ALPHA0= 3.539 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 150000	MU= 300	R= 150000	MU= 100	R= 150000	MU= 900
6.10			S TURB	S SEP	100CD	
UPPER			1.0056	0.0680	2.1788	
LOWER			0.9686	0.0000	0.3968	
TOTAL			CL= 0.954	100CD=2.5756		
			CM=-0.1425			
6.51				S TURB	S SEP	100CD
UPPER				0.9556	0.0690	2.1787
LOWER				0.6139	0.0000	0.3482
TOTAL				CL= 0.995	100CD=2.5269	
				CM=-0.1427		
6.57	S TURB	S SEP	100CD			
UPPER	0.8499	0.0704	2.1759*			
LOWER	0.5346	0.2118	0.5041*			
TOTAL	CL= 1.000	100CD=2.6800				
	CM=-0.1491					

B.L.SUMMARY AIRFOIL S835 21% ALPHA0= 3.539 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 200000 MU= 300	R= 200000 MU= 100	R= 200000 MU= 900
-4.00	S TURB S SEP 100CD UPPER 0.2866 0.0469 0.6892* LOWER 0.7687 0.3665 1.0840* TOTAL CL=-0.076 100CD=1.7732 CM=-0.1329	S TURB S SEP 100CD 1.0055 0.0335 0.8940 0.9686 0.3101 1.0266 CL=-0.066 100CD=1.9206 CM=-0.1338	S TURB S SEP 100CD 0.5166 0.0318 0.7135 0.8094 0.2889 0.8857 CL=-0.066 100CD=1.5993 CM=-0.1337
-3.00	S TURB S SEP 100CD UPPER 0.3125 0.0478 0.7369* LOWER 0.7475 0.3524 0.9581* TOTAL CL= 0.012 100CD=1.6950 CM=-0.1335	S TURB S SEP 100CD 1.0056 0.0357 0.9667 0.9686 0.2879 0.9276 CL= 0.024 100CD=1.8943 CM=-0.1342	S TURB S SEP 100CD 0.5578 0.0338 0.7847 0.7977 0.2673 0.8030 CL= 0.026 100CD=1.5877 CM=-0.1342
-2.00	S TURB S SEP 100CD UPPER 0.3394 0.0474 0.7918* LOWER 0.7251 0.3267 0.8779* TOTAL CL= 0.118 100CD=1.6697 CM=-0.1360	S TURB S SEP 100CD 1.0056 0.0379 1.0464 0.9686 0.2659 0.8378 CL= 0.129 100CD=1.8842 CM=-0.1365	S TURB S SEP 100CD 0.6002 0.0360 0.8634 0.7859 0.2462 0.7286 CL= 0.131 100CD=1.5920 CM=-0.1365
-1.00	S TURB S SEP 100CD UPPER 0.3661 0.0490 0.8526* LOWER 0.7021 0.2988 0.7933* TOTAL CL= 0.224 100CD=1.6459 CM=-0.1382	S TURB S SEP 100CD 1.0056 0.0398 1.1246 0.9686 0.2440 0.7563 CL= 0.234 100CD=1.8809 CM=-0.1388	S TURB S SEP 100CD 0.6564 0.0384 0.9612 0.7727 0.2250 0.6604 CL= 0.236 100CD=1.6217 CM=-0.1387
0.00	S TURB S SEP 100CD UPPER 0.3933 0.0508 0.9150* LOWER 0.6793 0.2932 0.7214* TOTAL CL= 0.329 100CD=1.6364 CM=-0.1406	S TURB S SEP 100CD 1.0056 0.0424 1.2200 0.9686 0.2222 0.6826 CL= 0.339 100CD=1.9026 CM=-0.1408	S TURB S SEP 100CD 0.7149 0.0406 1.0626 0.7577 0.2041 0.5978 CL= 0.341 100CD=1.6603 CM=-0.1408
1.00	S TURB S SEP 100CD UPPER 0.4208 0.0517 0.9924* LOWER 0.6567 0.2630 0.6505* TOTAL CL= 0.434 100CD=1.6428 CM=-0.1425	S TURB S SEP 100CD 1.0056 0.0452 1.3252 0.9686 0.2007 0.6163 CL= 0.443 100CD=1.9414 CM=-0.1425	S TURB S SEP 100CD 0.7677 0.0435 1.1789 0.7409 0.1834 0.5405 CL= 0.445 100CD=1.7194 CM=-0.1425
2.00	S TURB S SEP 100CD UPPER 0.4482 0.0542 1.0688* LOWER 0.6342 0.2605 0.5984* TOTAL CL= 0.538 100CD=1.6672 CM=-0.1445	S TURB S SEP 100CD 1.0056 0.0489 1.4535 0.9686 0.1795 0.5564 CL= 0.545 100CD=2.0099 CM=-0.1437	S TURB S SEP 100CD 0.8142 0.0466 1.3040 0.7225 0.1632 0.4883 CL= 0.548 100CD=1.7923 CM=-0.1439
3.00	S TURB S SEP 100CD UPPER 0.4761 0.0555 1.1466* LOWER 0.6121 0.2293 0.5422* TOTAL CL= 0.643 100CD=1.6887 CM=-0.1459	S TURB S SEP 100CD 1.0056 0.0522 1.5800 0.9686 0.1586 0.5024 CL= 0.648 100CD=2.0824 CM=-0.1448	S TURB S SEP 100CD 0.8564 0.0506 1.4533 0.7031 0.0000 0.4413 CL= 0.650 100CD=1.8946 CM=-0.1422
4.00	S TURB S SEP 100CD UPPER 0.5025 0.0588 1.2318* LOWER 0.5902 0.2267 0.4998* TOTAL CL= 0.745 100CD=1.7316 CM=-0.1473	S TURB S SEP 100CD 1.0056 0.0561 1.7205 0.9686 0.0000 0.4543 CL= 0.749 100CD=2.1748 CM=-0.1426	S TURB S SEP 100CD 0.8941 0.0545 1.6065 0.6829 0.0000 0.3993 CL= 0.751 100CD=2.0057 CM=-0.1431
5.00	S TURB S SEP 100CD UPPER 0.5620 0.0579 1.3167* LOWER 0.5686 0.1960 0.4582* TOTAL CL= 0.853 100CD=1.7749 CM=-0.1487	S TURB S SEP 100CD 1.0056 0.0603 1.8742 0.9686 0.0000 0.4121 CL= 0.849 100CD=2.2863 CM=-0.1431	S TURB S SEP 100CD 0.9273 0.0590 1.7759 0.6623 0.0000 0.3722 CL= 0.851 100CD=2.1482 CM=-0.1435
6.00	S TURB S SEP 100CD UPPER 0.6333 0.0600 1.4792* LOWER 0.5468 0.1916 0.4195* TOTAL CL= 0.956 100CD=1.8986 CM=-0.1499	S TURB S SEP 100CD 1.0056 0.0650 2.0423 0.9686 0.0000 0.3853 CL= 0.948 100CD=2.4275 CM=-0.1433	S TURB S SEP 100CD 0.9544 0.0638 1.9618 0.6414 0.0000 0.3419 CL= 0.950 100CD=2.3037 CM=-0.1437

B.L.SUMMARY AIRFOIL S835 21% ALPHA0= 3.539 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 200000 MU= 300	R= 200000 MU= 100	R= 200000 MU= 900
6.33		S TURB S SEP 100CD	
UPPER		1.0056 0.0666 2.1013	
LOWER		0.9686 0.0000 0.3747	
TOTAL		CL= 0.980 100CD=2.4760	
		CM=-0.1432	
6.70		S TURB S SEP 100CD	
UPPER		0.9693 0.0676 2.1023	
LOWER		0.6267 0.0000 0.3219	
TOTAL		CL= 1.018 100CD=2.4242	
		CM=-0.1435	
6.75	S TURB S SEP 100CD		
UPPER	0.8874 0.0682 2.1016*		
LOWER	0.5309 0.1894 0.3915*		
TOTAL	CL= 1.022 100CD=2.4931		
	CM=-0.1491		

B.L.SUMMARY AIRFOIL S835 21% ALPHA0= 3.539 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEC.)	R= 250000 MU= 300	R= 250000 MU= 100	R= 250000 MU= 900
-4.00	S TURB S SEP 100CD UPPER 0.2866 0.0418 0.5932* LOWER 0.7687 0.3256 0.9471* TOTAL CL=-0.073 100CD=1.5403 CM=-0.1329	S TURB S SEP 100CD 1.0055 0.0323 0.8642 0.9686 0.3023 0.9850 CL=-0.066 100CD=1.8492 CM=-0.1338	S TURB S SEP 100CD 0.5479 0.0305 0.6908 0.8171 0.2762 0.8416 CL=-0.065 100CD=1.5324 CM=-0.1337
-3.00	S TURB S SEP 100CD UPPER 0.3125 0.0425 0.6388* LOWER 0.7475 0.3135 0.8542* TOTAL CL= 0.017 100CD=1.4930 CM=-0.1336	S TURB S SEP 100CD 1.0056 0.0345 0.9341 0.9686 0.2803 0.8911 CL= 0.025 100CD=1.8252 CM=-0.1343	S TURB S SEP 100CD 0.5876 0.0325 0.7591 0.8049 0.2550 0.7623 CL= 0.027 100CD=1.5215 CM=-0.1343
-2.00	S TURB S SEP 100CD UPPER 0.3394 0.0433 0.6856* LOWER 0.7251 0.2856 0.7661* TOTAL CL= 0.123 100CD=1.4517 CM=-0.1360	S TURB S SEP 100CD 1.0056 0.0367 1.0107 0.9686 0.2585 0.8056 CL= 0.130 100CD=1.8163 CM=-0.1366	S TURB S SEP 100CD 0.6366 0.0348 0.8412 0.7933 0.2342 0.6916 CL= 0.132 100CD=1.5329 CM=-0.1366
-1.00	S TURB S SEP 100CD UPPER 0.3661 0.0436 0.7433* LOWER 0.7021 0.2734 0.6856* TOTAL CL= 0.230 100CD=1.4289 CM=-0.1386	S TURB S SEP 100CD 1.0056 0.0386 1.0853 0.9686 0.2369 0.7281 CL= 0.236 100CD=1.8134 CM=-0.1389	S TURB S SEP 100CD 0.6934 0.0373 0.9378 0.7813 0.2135 0.6278 CL= 0.237 100CD=1.5656 CM=-0.1388
0.00	S TURB S SEP 100CD UPPER 0.3933 0.0452 0.8041* LOWER 0.6793 0.2508 0.6273* TOTAL CL= 0.335 100CD=1.4314 CM=-0.1407	S TURB S SEP 100CD 1.0056 0.0412 1.1767 0.9686 0.2153 0.6578 CL= 0.340 100CD=1.8346 CM=-0.1409	S TURB S SEP 100CD 0.7448 0.0394 1.0308 0.7672 0.1928 0.5688 CL= 0.342 100CD=1.5996 CM=-0.1408
1.00	S TURB S SEP 100CD UPPER 0.4208 0.0462 0.8710* LOWER 0.6567 0.2389 0.5604* TOTAL CL= 0.441 100CD=1.4314 CM=-0.1430	S TURB S SEP 100CD 1.0056 0.0439 1.2770 0.9686 0.1939 0.5944 CL= 0.444 100CD=1.8714 CM=-0.1426	S TURB S SEP 100CD 0.7921 0.0423 1.1407 0.7516 0.1726 0.5146 CL= 0.446 100CD=1.6553 CM=-0.1425
2.00	S TURB S SEP 100CD UPPER 0.4482 0.0484 0.9435* LOWER 0.6342 0.2167 0.5168* TOTAL CL= 0.546 100CD=1.4603 CM=-0.1446	S TURB S SEP 100CD 1.0056 0.0474 1.3981 0.9686 0.1732 0.5370 CL= 0.547 100CD=1.9352 CM=-0.1439	S TURB S SEP 100CD 0.8345 0.0453 1.2593 0.7341 0.1516 0.4651 CL= 0.550 100CD=1.7243 CM=-0.1439
3.00	S TURB S SEP 100CD UPPER 0.4761 0.0504 1.0123* LOWER 0.6121 0.2066 0.4643* TOTAL CL= 0.650 100CD=1.4766 CM=-0.1463	S TURB S SEP 100CD 1.0056 0.0507 1.5197 0.9686 0.1518 0.4853 CL= 0.650 100CD=2.0051 CM=-0.1450	S TURB S SEP 100CD 0.8730 0.0492 1.4014 0.7153 0.0000 0.4204 CL= 0.652 100CD=1.8219 CM=-0.1426
4.00	S TURB S SEP 100CD UPPER 0.5025 0.0524 1.0916* LOWER 0.5902 0.1820 0.4277* TOTAL CL= 0.754 100CD=1.5193 CM=-0.1475	S TURB S SEP 100CD 1.0056 0.0545 1.6529 0.9686 0.0000 0.4393 CL= 0.751 100CD=2.0921 CM=-0.1431	S TURB S SEP 100CD 0.9075 0.0530 1.5469 0.6956 0.0000 0.3880 CL= 0.753 100CD=1.9349 CM=-0.1435
5.00	S TURB S SEP 100CD UPPER 0.5620 0.0533 1.1924* LOWER 0.5686 0.1752 0.3886* TOTAL CL= 0.860 100CD=1.5810 CM=-0.1492	S TURB S SEP 100CD 1.0056 0.0586 1.7984 0.9686 0.0000 0.4064 CL= 0.852 100CD=2.2048 CM=-0.1436	S TURB S SEP 100CD 0.9379 0.0573 1.7085 0.6753 0.0000 0.3570 CL= 0.854 100CD=2.0655 CM=-0.1441
6.00	S TURB S SEP 100CD UPPER 0.6333 0.0562 1.3604* LOWER 0.5468 0.0000 0.3554* TOTAL CL= 0.962 100CD=1.7158 CM=-0.1462	S TURB S SEP 100CD 1.0056 0.0631 1.9578 0.9686 0.0000 0.3741 CL= 0.951 100CD=2.3319 CM=-0.1439	S TURB S SEP 100CD 0.9624 0.0621 1.8858 0.6547 0.0000 0.3275 CL= 0.953 100CD=2.2133 CM=-0.1442

B.L.SUMMARY AIRFOIL S835 21% ALPHA0= 3.539 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 250000 MU= 300	R= 250000 MU= 100	R= 250000 MU= 900
6.51		S TURB S SEP 100CD	
UPPER		1.0056 0.0656 2.0442*	
LOWER		0.9686 0.0000 0.3584	
TOTAL		CL= 1.001 100CD=2.4026	
		CM=-0.1439	
6.83		S TURB S SEP 100CD	
UPPER		0.9780 0.0664 2.0446	
LOWER		0.6374 0.0000 0.3045	
TOTAL		CL= 1.034 100CD=2.3491	
		CM=-0.1441	
6.92	S TURB S SEP 100CD		
UPPER	0.9106 0.0669 2.0475*		
LOWER	0.5273 0.0000 0.3302*		
TOTAL	CL= 1.042 100CD=2.3777		
	CM=-0.1440		

B.L.SUMMARY AIRFOIL S835 21% ALPHA0= 3.539 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 300000	MU= 300	R= 300000	MU= 100	R= 300000	MU= 900				
-4.00	S TURB	S SEP	100CD	S TURB	S SEP	100CD	S TURB	S SEP	100CD	
	UPPER	0.2866	0.0395	0.5338*	1.0055	0.0314	0.8406	0.5723	0.0295	0.6744
	LOWER	0.7687	0.2992	0.8633*	0.9686	0.2959	0.9528	0.8238	0.2675	0.8101
	TOTAL	CL=-0.073	100CD=1.3971	CM=-0.1328	CL=-0.065	100CD=1.7934	CM=-0.1339	CL=-0.065	100CD=1.4845	CM=-0.1337
-3.00	S TURB	S SEP	100CD	S TURB	S SEP	100CD	S TURB	S SEP	100CD	
	UPPER	0.3125	0.0386	0.5752*	1.0056	0.0335	0.9083	0.6153	0.0316	0.7439
	LOWER	0.7475	0.2856	0.7819*	0.9686	0.2741	0.8627	0.8110	0.2462	0.7329
	TOTAL	CL= 0.021	100CD=1.3570	CM=-0.1338	CL= 0.026	100CD=1.7710	CM=-0.1344	CL= 0.028	100CD=1.4768	CM=-0.1343
-2.00	S TURB	S SEP	100CD	S TURB	S SEP	100CD	S TURB	S SEP	100CD	
	UPPER	0.3394	0.0394	0.6213*	1.0056	0.0358	0.9824	0.6678	0.0339	0.8274
	LOWER	0.7251	0.2550	0.6885*	0.9686	0.2525	0.7806	0.7992	0.2254	0.6646
	TOTAL	CL= 0.127	100CD=1.3098	CM=-0.1361	CL= 0.131	100CD=1.7630	CM=-0.1367	CL= 0.133	100CD=1.4919	CM=-0.1366
-1.00	S TURB	S SEP	100CD	S TURB	S SEP	100CD	S TURB	S SEP	100CD	
	UPPER	0.3661	0.0399	0.6730*	1.0056	0.0376	1.0545	0.7198	0.0364	0.9174
	LOWER	0.7021	0.2437	0.6250*	0.9686	0.2310	0.7060	0.7879	0.2052	0.6038
	TOTAL	CL= 0.234	100CD=1.2979	CM=-0.1388	CL= 0.237	100CD=1.7604	CM=-0.1390	CL= 0.238	100CD=1.5211	CM=-0.1388
0.00	S TURB	S SEP	100CD	S TURB	S SEP	100CD	S TURB	S SEP	100CD	
	UPPER	0.3933	0.0414	0.7313*	1.0056	0.0401	1.1426	0.7670	0.0385	1.0069
	LOWER	0.6793	0.2187	0.5619*	0.9686	0.2097	0.6384	0.7748	0.1848	0.5475
	TOTAL	CL= 0.340	100CD=1.2931	CM=-0.1409	CL= 0.341	100CD=1.7810	CM=-0.1410	CL= 0.343	100CD=1.5543	CM=-0.1409
1.00	S TURB	S SEP	100CD	S TURB	S SEP	100CD	S TURB	S SEP	100CD	
	UPPER	0.4208	0.0430	0.7892*	1.0056	0.0428	1.2392	0.8103	0.0413	1.1115
	LOWER	0.6567	0.2073	0.5086*	0.9686	0.1884	0.5772	0.7600	0.1648	0.4957
	TOTAL	CL= 0.445	100CD=1.2977	CM=-0.1430	CL= 0.446	100CD=1.8164	CM=-0.1427	CL= 0.448	100CD=1.6072	CM=-0.1426
2.00	S TURB	S SEP	100CD	S TURB	S SEP	100CD	S TURB	S SEP	100CD	
	UPPER	0.4482	0.0446	0.8613*	1.0056	0.0463	1.3556	0.8500	0.0443	1.2255
	LOWER	0.6342	0.1833	0.4608*	0.9686	0.1679	0.5216	0.7434	0.1425	0.4484
	TOTAL	CL= 0.551	100CD=1.3221	CM=-0.1447	CL= 0.549	100CD=1.8773	CM=-0.1440	CL= 0.551	100CD=1.6739	CM=-0.1440
3.00	S TURB	S SEP	100CD	S TURB	S SEP	100CD	S TURB	S SEP	100CD	
	UPPER	0.4761	0.0467	0.9307*	1.0056	0.0495	1.4725	0.8854	0.0481	1.3616
	LOWER	0.6121	0.1739	0.4192*	0.9686	0.1457	0.4719	0.7252	0.0000	0.4055
	TOTAL	CL= 0.655	100CD=1.3500	CM=-0.1464	CL= 0.651	100CD=1.9444	CM=-0.1451	CL= 0.653	100CD=1.7671	CM=-0.1429
4.00	S TURB	S SEP	100CD	S TURB	S SEP	100CD	S TURB	S SEP	100CD	
	UPPER	0.5025	0.0486	1.0037*	1.0056	0.0532	1.6002	0.9176	0.0518	1.5019
	LOWER	0.5902	0.0000	0.3791*	0.9686	0.0000	0.4274	0.7060	0.0000	0.3764
	TOTAL	CL= 0.760	100CD=1.3829	CM=-0.1449	CL= 0.753	100CD=2.0276	CM=-0.1435	CL= 0.755	100CD=1.8783	CM=-0.1439
5.00	S TURB	S SEP	100CD	S TURB	S SEP	100CD	S TURB	S SEP	100CD	
	UPPER	0.5620	0.0497	1.1039*	1.0056	0.0572	1.7395	0.9458	0.0560	1.6571
	LOWER	0.5686	0.0000	0.3490*	0.9686	0.0000	0.3968	0.6860	0.0000	0.3458
	TOTAL	CL= 0.865	100CD=1.4529	CM=-0.1465	CL= 0.854	100CD=2.1363	CM=-0.1441	CL= 0.856	100CD=2.0029	CM=-0.1445
6.00	S TURB	S SEP	100CD	S TURB	S SEP	100CD	S TURB	S SEP	100CD	
	UPPER	0.6333	0.0534	1.2747*	1.0056	0.0616	1.8919	0.9684	0.0606	1.8272
	LOWER	0.5468	0.0000	0.3234*	0.9686	0.0000	0.3653	0.6656	0.0000	0.3169
	TOTAL	CL= 0.967	100CD=1.5982	CM=-0.1471	CL= 0.953	100CD=2.2572	CM=-0.1444	CL= 0.955	100CD=2.1441	CM=-0.1447

B.L.SUMMARY AIRFOIL S835 21% ALPHA0= 3.539 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEC.)	R= 300000 MU= 300	R= 300000 MU= 100	R= 300000 MU= 900
6.64		S TURB S SEP 100CD	
UPPER		1.0056 0.0647 1.9980*	
LOWER		0.9685 0.0000 0.3460	
TOTAL		CL= 1.016 100CD=2.3440	
		CM=-0.1443	
6.92		S TURB S SEP 100CD	
UPPER		0.9840 0.0654 1.9976	
LOWER		0.6465 0.0000 0.2921	
TOTAL		CL= 1.045 100CD=2.2897	
		CM=-0.1445	
7.00	S TURB S SEP 100CD		
UPPER	0.9220 0.0652 1.9700*		
LOWER	0.5256 0.0000 0.3021*		
TOTAL	CL= 1.054 100CD=2.2722		
	CM=-0.1447		
7.03	S TURB S SEP 100CD		
UPPER	0.9264 0.0658 1.9988*		
LOWER	0.5249 0.0000 0.3013*		
TOTAL	CL= 1.056 100CD=2.3002		
	CM=-0.1446		

B.L.SUMMARY AIRFOIL S835 21% ALPHA0= 3.539 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEG.)	R= 400000 MU= 300	R= 400000 MU= 100	R= 400000 MU= 900
-4.00	S TURB S SEP 100CD UPPER 0.2866 0.0339 0.4607* LOWER 0.7687 0.2675 0.7659* TOTAL CL=-0.069 100CD=1.2266 CM=-0.1331	S TURB S SEP 100CD 1.0055 0.0298 0.8039 0.9686 0.2858 0.9047 CL=-0.064 100CD=1.7087 CM=-0.1339	S TURB S SEP 100CD 0.6141 0.0280 0.6544 0.8350 0.2557 0.7672 CL=-0.064 100CD=1.4216 CM=-0.1338
-3.00	S TURB S SEP 100CD UPPER 0.3125 0.0334 0.4960* LOWER 0.7475 0.2483 0.6858* TOTAL CL= 0.026 100CD=1.1818 CM=-0.1341	S TURB S SEP 100CD 1.0056 0.0319 0.8683 0.9686 0.2644 0.8202 CL= 0.028 100CD=1.6885 CM=-0.1345	S TURB S SEP 100CD 0.6635 0.0302 0.7266 0.8215 0.2344 0.6930 CL= 0.030 100CD=1.4196 CM=-0.1344
-2.00	S TURB S SEP 100CD UPPER 0.3394 0.0343 0.5403* LOWER 0.7251 0.2201 0.6031* TOTAL CL= 0.133 100CD=1.1434 CM=-0.1365	S TURB S SEP 100CD 1.0056 0.0341 0.9387 0.9686 0.2430 0.7430 CL= 0.133 100CD=1.6817 CM=-0.1368	S TURB S SEP 100CD 0.7119 0.0325 0.8044 0.8088 0.2135 0.6272 CL= 0.134 100CD=1.4317 CM=-0.1367
-1.00	S TURB S SEP 100CD UPPER 0.3661 0.0353 0.5842* LOWER 0.7021 0.2045 0.5460* TOTAL CL= 0.239 100CD=1.1303 CM=-0.1390	S TURB S SEP 100CD 1.0056 0.0360 1.0076 0.9686 0.2217 0.6728 CL= 0.239 100CD=1.6805 CM=-0.1391	S TURB S SEP 100CD 0.7566 0.0345 0.8812 0.7977 0.1934 0.5697 CL= 0.240 100CD=1.4510 CM=-0.1390
0.00	S TURB S SEP 100CD UPPER 0.3933 0.0365 0.6392* LOWER 0.6793 0.1784 0.4831* TOTAL CL= 0.346 100CD=1.1223 CM=-0.1412	S TURB S SEP 100CD 1.0056 0.0385 1.0909 0.9686 0.2007 0.6091 CL= 0.343 100CD=1.7000 CM=-0.1412	S TURB S SEP 100CD 0.7982 0.0370 0.9712 0.7860 0.1738 0.5174 CL= 0.345 100CD=1.4886 CM=-0.1410
1.00	S TURB S SEP 100CD UPPER 0.4208 0.0382 0.6954* LOWER 0.6567 0.1662 0.4417* TOTAL CL= 0.452 100CD=1.1371 CM=-0.1433	S TURB S SEP 100CD 1.0056 0.0412 1.1822 0.9686 0.1799 0.5511 CL= 0.448 100CD=1.7334 CM=-0.1429	S TURB S SEP 100CD 0.8364 0.0397 1.0685 0.7728 0.1535 0.4693 CL= 0.450 100CD=1.5377 CM=-0.1428
2.00	S TURB S SEP 100CD UPPER 0.4482 0.0398 0.7566* LOWER 0.6342 0.1379 0.3933* TOTAL CL= 0.557 100CD=1.1500 CM=-0.1450	S TURB S SEP 100CD 1.0056 0.0440 1.2816 0.9686 0.1593 0.4987 CL= 0.552 100CD=1.7803 CM=-0.1444	S TURB S SEP 100CD 0.8718 0.0427 1.1756 0.7576 0.0000 0.4251 CL= 0.553 100CD=1.6006 CM=-0.1423
3.00	S TURB S SEP 100CD UPPER 0.4761 0.0419 0.8247* LOWER 0.6121 0.0000 0.3620* TOTAL CL= 0.662 100CD=1.1867 CM=-0.1448	S TURB S SEP 100CD 1.0056 0.0476 1.4015 0.9686 0.0000 0.4514 CL= 0.654 100CD=1.8529 CM=-0.1431	S TURB S SEP 100CD 0.9033 0.0463 1.3036 0.7407 0.0000 0.3855 CL= 0.656 100CD=1.6891 CM=-0.1435
4.00	S TURB S SEP 100CD UPPER 0.5025 0.0438 0.8891* LOWER 0.5902 0.0000 0.3335* TOTAL CL= 0.767 100CD=1.2226 CM=-0.1464	S TURB S SEP 100CD 1.0056 0.0511 1.5212 0.9686 0.0000 0.4094 CL= 0.756 100CD=1.9306 CM=-0.1441	S TURB S SEP 100CD 0.9323 0.0499 1.4358 0.7222 0.0000 0.3599 CL= 0.758 100CD=1.7956 CM=-0.1445
5.00	S TURB S SEP 100CD UPPER 0.5620 0.0458 0.9963* LOWER 0.5686 0.0000 0.3101* TOTAL CL= 0.871 100CD=1.3064 CM=-0.1477	S TURB S SEP 100CD 1.0056 0.0550 1.6517 0.9686 0.0000 0.3822 CL= 0.857 100CD=2.0339 CM=-0.1448	S TURB S SEP 100CD 0.9572 0.0539 1.5817 0.7031 0.0000 0.3302 CL= 0.859 100CD=1.9119 CM=-0.1451
6.00	S TURB S SEP 100CD UPPER 0.6378 0.0497 1.1646 LOWER 0.5468 0.0000 0.2854* TOTAL CL= 0.972 100CD=1.4500 CM=-0.1483	S TURB S SEP 100CD 1.0056 0.0593 1.7935 0.9686 0.0000 0.3517 CL= 0.957 100CD=2.1452 CM=-0.1451	S TURB S SEP 100CD 0.9769 0.0585 1.7416 0.6829 0.0000 0.3022 CL= 0.959 100CD=2.0438 CM=-0.1454

B.L.SUMMARY AIRFOIL S835 21% ALPHA0= 3.539 DEG.

*-WARNING 1998 ALPHA REL. CHORD LINE

ALPHA(DEC.)	R= 400000 MU= 300	R= 400000 MU= 100	R= 400000 MU= 900
6.85		S TURB S SEP 100CD	
UPPER		1.0056 0.0633 1.9276*	
LOWER		0.9686 0.0000 0.3272	
TOTAL		CL= 1.041 100CD=2.2548	
		CM=-0.1451	
7.00	S TURB S SEP 100CD	S TURB S SEP 100CD	
UPPER	0.9220 0.0619 1.8225*	0.9915 0.0634 1.9159	
LOWER	0.5256 0.0000 0.2623*	0.6626 0.0000 0.2764	
TOTAL	CL= 1.059 100CD=2.0848	CL= 1.057 100CD=2.1923	
	CM=-0.1458	CM=-0.1453	
7.06		S TURB S SEP 100CD	
UPPER		0.9922 0.0638 1.9268	
LOWER		0.6614 0.0000 0.2750	
TOTAL		CL= 1.063 100CD=2.2018	
		CM=-0.1453	
7.21	S TURB S SEP 100CD		
UPPER	0.9481 0.0641 1.9249*		
LOWER	0.5210 0.0000 0.2581*		
TOTAL	CL= 1.078 100CD=2.1830		
	CM=-0.1454		

REPORT DOCUMENTATION PAGE

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15. SUBJECT TERMS airfoils; horizontal-axis wind turbine; airfoil design; Pennsylvania State University; wind energy					
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