Subcontractor Report

The S825 and S826 Airfoils

Period of Performance: 1994 – 1995

D.M. Somers
Airfoils, Inc.
State College, Pennsylvania

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NREL

National Renewable Energy Laboratory
1617 Cole Boulevard, Golden, Colorado 80401-3393
303-275-3000 • www.nrel.gov

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Table of Contents

List of Tables

List of Figures

ABSTRACT

A family of airfoils, the S825 and S826, for 20- to 40-meter, variable-speed and variable-pitch (toward feather), horizontal-axis wind turbines has been designed and analyzed theoretically. The two primary objectives of high maximum lift, insensitive to roughness, and low profile drag have been achieved. The constraints on the pitching moments and the airfoil thicknesses have been satisfied. The airfoils should exhibit docile stalls.

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, as shown in the following table.

Diameter	Type	Thickness Category	Airfoil			Reference
			Primary	Tip	Root	
2–10 m	Variable speed Variable pitch	Thick		S822	S823	13
10–20 m	Variable speed Variable pitch	Thin	S801	S802 S803	S804	8
	Stall regulated	Thin	S805 S805A	S806 S806A	S807 S808	8
	Stall regulated	Thick	S819	S820	S821	12
20–30 m	Stall regulated	Thick	S809	S810	S811	9
	Stall regulated	Thick	S812	S813	S814 S815	9 and 10
30–50 m	Stall regulated	Thick	S816	S817	S818	11

An overview of all these airfoil families is given in reference 14.

The family of airfoils designed under the present study is intended for 20- to 40-meter, variable-speed and variable-pitch (toward feather), horizontal-axis wind turbines. The specific tasks performed under this study are described in National Renewable Energy Laboratory (NREL) Subcontract Number AAF-4-14289-01. The specifications for the airfoils are outlined in the Statement of Work. These specifications were later refined during discussions with James L. Tangler of NREL.

Because of the limitations of the theoretical methods (refs. 15 and 16) 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
L.	lower surface
R	Reynolds number based on free-stream conditions and airfoil chord
S.	boundary-layer separation location, $1 - s_{sep}/c$
s_{sep}	arc length along which boundary layer is separated, m
s_{turb}	arc length along which boundary layer is turbulent including s_{sep}, m
T.	boundary-layer transition location, $1 - s_{turb}/c$
U.	upper surface
x	airfoil abscissa, m
y	airfoil ordinate, m
α	angle of attack relative to x-axis, deg

AIRFOIL DESIGN

OBJECTIVES AND CONSTRAINTS

The design specifications for the family of airfoils are contained in table I. The family consists of two airfoils, primary and tip, corresponding to the 0.75 and 0.95 blade radial stations, respectively. (It is recommended that the S814 and S815 airfoils (ref. 10) be used for the root region of a wind-turbine blade incorporating this family.)

Two primary objectives are evident from the specifications. The first objective is to achieve a maximum lift coefficient of at least 1.40 for the primary and tip airfoils for the corresponding Reynolds numbers of 2.0×10^6 and 1.5×10^6, respectively. A requirement related to this objective is that the maximum lift coefficient not decrease 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 range of lift coefficients from 0.40 to 1.20 for both airfoils.

Two major constraints were placed on the designs of these airfoils. First, the zero-lift pitching-moment coefficient must be no more negative than -0.15 for both airfoils. Second, the airfoil thickness must equal 17-percent chord for the primary airfoil and 14-percent chord for the tip airfoil.

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 these designs.
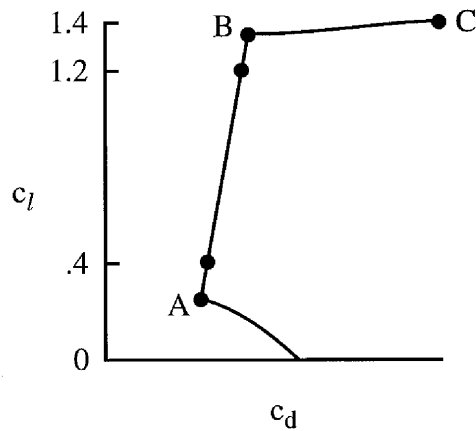
Sketch 1

The desired airfoil shapes 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 0.15 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 drag at point B is not as low as at point A, unlike the polars of many laminar-flow airfoils where the drag within the laminar bucket is nearly constant. This characteristic is related to the elimina-

tion of significant (drag-producing) laminar separation bubbles on the upper surface. (See ref. 17.) It is acceptable because the ratio of the profile drag to the total drag of the wind-turbine blade decreases with increasing lift coefficient. The drag increases very rapidly outside the low-drag range because the boundary-layer transition point 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.

Because the large thickness of the primary airfoil allows a wider low-drag range 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 distribution for the tip airfoil should be qualitatively similar.)
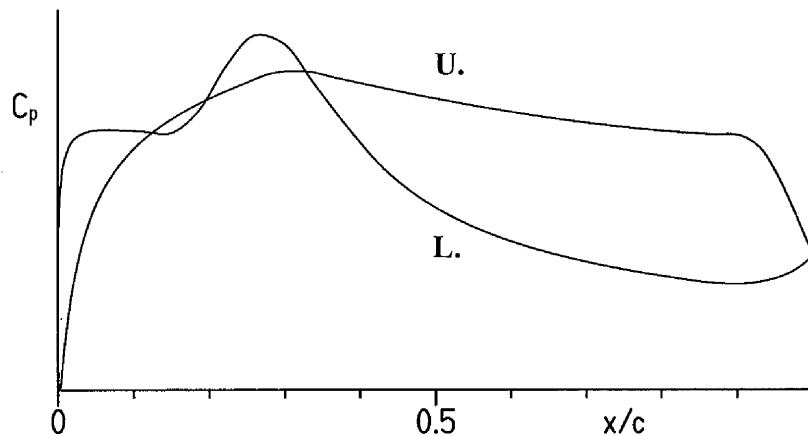
Sketch 2

To achieve low drag, a favorable pressure gradient is desirable along the upper surface to about 30-percent chord. Aft of this point, a short region having a shallow, adverse pressure gradient ("transition ramp") promotes the efficient transition from laminar to turbulent flow (ref. 18). The transition ramp is followed by a concave pressure recovery. The specific pressure recovery employed represents a compromise between maximum lift, drag, and stall characteristics. 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

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

high angles of attack, high lift coefficients can be achieved with little drag penalty. This feature has the added benefit of promoting docile stall characteristics. (See ref. 19.)

A generally favorable pressure gradient is desirable along the lower surface to about 30-percent chord to achieve low drag. The specific pressure gradients employed along the forward portion of the lower surface increase the amount of camber in the leading-edge region while maintaining low drag at the lower lift coefficients. The forward camber serves to balance, with respect to the pitching-moment constraint, the aft camber, both of which contribute to the achievement of a high maximum lift coefficient. This region is followed by a curved transition ramp (ref. 17) that is longer than the one on the upper surface. The ramp is followed by a concave pressure recovery that produces lower drag and has less tendency to separate than the corresponding linear or convex pressure recovery (ref. 18). The pressure recovery must begin relatively far forward 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

5
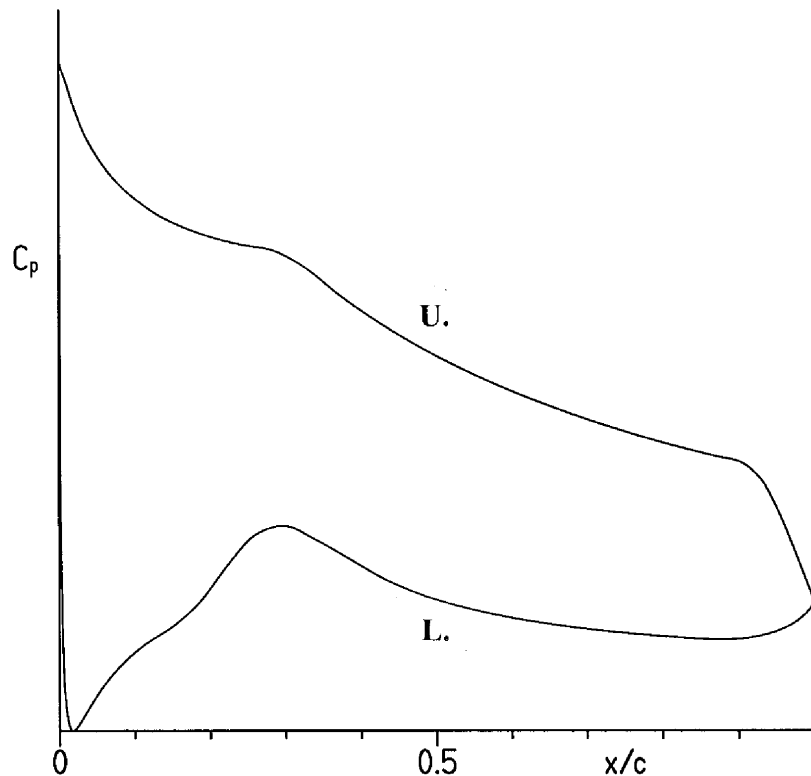
No suction spike exists at the leading edge. Transition is essentially imminent over the entire forward portion of the upper surface. This feature allows a wider low-drag range to be achieved and higher lift coefficients to be reached without significant separation. It also causes the transition point to move very quickly toward the leading edge with increasing lift coefficient, which leads to the roughness insensitivity of the maximum lift coefficient.

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. 15 and 16) was used because of its unique capability for multipoint design and because of confidence gained during the design, analysis, and experimental verification of several other airfoils. (See refs. 20–23.)

The primary airfoil is designated the S825. The tip airfoil, the S826, was derived from the S825 airfoil to increase the aerodynamic and geometric compatibilities of the two airfoils. The airfoil shapes are shown in figure 1 and the coordinates are contained in tables II and III. The S825 airfoil thickness is 17-percent chord and the S826, 14-percent chord.

THEORETICAL PROCEDURE

The section characteristics are predicted for Reynolds numbers of 1.0×10^6, 1.5×10^6, 2.0×10^6, 2.5×10^6, and 3.0×10^6. The computations were performed with transition free using transition mode 3.0, with transition fixed at 2-percent chord on the upper surface and 5-percent chord on the lower surface using transition mode 1.3, and "rough" using transition mode 9.0, which simulates distributed roughness due to, for example, leading-edge contamination by insects or rain. (See ref. 16.) Because the free-stream Mach number for all relevant operating conditions remains below 0.3, all results are incompressible.

DISCUSSION OF RESULTS

S825 AIRFOIL

Pressure Distributions

The inviscid pressure distributions for the S825 airfoil at various angles of attack are shown in figure 2 and tabulated in the appendix.

Transition and Separation Locations

The variation of boundary-layer transition location with lift coefficient for the S825 airfoil is shown in figure 3 and tabulated in the appendix. It should be remembered that the

method of references 15 and 16 "defines" the transition location as the end of the laminar boundary layer whether due to natural transition or laminar separation. 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), poor agreement between the predicted "transition" locations and the locations measured experimentally can be expected. This poor agreement is worsened by the fact that transition is normally confirmed in the wind tunnel only by the detection of attached turbulent flow. 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 agreement between theory and experiment should be quite good. (See refs. 20 and 24.)

The variation of turbulent boundary-layer separation location with lift coefficient for the S825 airfoil is shown in figure 3 and tabulated in the appendix. A small, trailing-edge separation is predicted on the upper surface at most lift coefficients. This separation, which is caused by the separation ramp (fig. 2), increases in length with transition fixed and rough. Separation is predicted on the lower surface at lower lift coefficients. Such separation usually has little effect on the section characteristics. (See ref. 20.)

Section Characteristics

Reynolds number effects.– The section characteristics of the S825 airfoil are shown in figure 3 and tabulated in the appendix. It should be noted that the maximum lift coefficient computed by the method of references 15 and 16 is not always realistic. Accordingly, an empirical criterion should be 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 0.0150 or if the length of turbulent separation on the upper surface is greater than 0.10. Thus, the maximum lift coefficient for the design Reynolds number of 2.0×10^6 is estimated to be 1.44, which exceeds the design objective by 3 percent. 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 about 0 to more than 1.3, which exceeds the range specified (0.40 to 1.20). The drag coefficient at the specified lower limit of the low-drag range ($c_l = 0.40$) is predicted to be 0.0076, which is 5 percent below the design objective. The zero-lift pitching-moment coefficient is predicted to be −0.18, which exceeds the design constraint. However, the method of references 15 and 16 generally overpredicts the pitching-moment coefficient by about 20 percent. Thus, the actual zero-lift pitching-moment coefficient should be about −0.15, which satisfies the constraint.

An additional analysis (not shown) indicates that significant (drag-producing) laminar separation bubbles should not occur on either surface for any relevant operating condition.

Effect of roughness.– The effect of roughness on the section characteristics of the S825 airfoil is shown in figure 3. The maximum lift coefficient for the design Reynolds number of 2.0×10^6 with transition fixed is estimated to be 1.37, a reduction of less than 5 percent from that for the transition-free condition. For the rough condition, the maximum lift coeffi-

cient for the design Reynolds number is estimated to be 1.31, a reduction of 9 percent from that for the transition-free condition. Thus, the design requirement has essentially been satisfied. The effect of roughness on the maximum lift coefficient increases with decreasing Reynolds number. The drag coefficients are, of course, adversely affected by the roughness.

S826 AIRFOIL

Pressure Distributions

The inviscid pressure distributions for the S826 airfoil at various angles of attack are shown in figure 4 and tabulated in the appendix.

Transition and Separation Locations

The variations of transition and turbulent-separation locations with lift coefficient for the S826 airfoil are shown in figure 5 and tabulated in the appendix. A small, trailing-edge separation is predicted on the upper surface at most lift coefficients. This separation, which is caused by the separation ramp (fig. 4), increases in length with transition fixed and rough. Separation is predicted on the lower surface at lower lift coefficients. This separation is not considered important because it occurs at lift coefficients that are not typical of normal wind-turbine operations. Also, such separation usually has little effect on the section characteristics.

Section Characteristics

Reynolds number effects.– The section characteristics of the S826 airfoil are shown in figure 5 and tabulated in the appendix. Using the previously-described criterion, the maximum lift coefficient for the design Reynolds number of 1.5×10^6 is estimated to be 1.42, which exceeds the design objective by 1 percent. 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 less than 0.3 to more than 1.3, which exceeds the range specified (0.40 to 1.20). The drag coefficient at the specified lower limit of the low-drag range ($c_l = 0.40$) is predicted to be 0.0073, which exceeds the design objective by 22 percent. The achievement of this objective was sacrificed to meet the other, more important objectives and constraints. The zero-lift pitching-moment coefficient is predicted to be –0.18, which exceeds the design constraint. Again, because the method of references 15 and 16 generally overpredicts the pitching-moment coefficient, the actual zero-lift pitching-moment coefficient should be about –0.15, which satisfies the constraint. Significant (drag-producing) laminar separation bubbles should not occur on either surface for any relevant operating condition.

Effect of roughness.– The effect of roughness on the section characteristics of the S826 airfoil is shown in figure 5. The maximum lift coefficient for the design Reynolds number of 1.5×10^6 with transition fixed is estimated to be 1.35, a reduction of less than 5 percent

from that for the transition-free condition. For the rough condition, the maximum lift coefficient for the design Reynolds number is estimated to be 1.31, a reduction of less than 8 percent from that for the transition-free condition. Thus, the design requirement has essentially been satisfied. The effect of roughness on the maximum lift coefficient increases with decreasing Reynolds number. The drag coefficients are, of course, adversely affected by the roughness.

CONCLUDING REMARKS

A family of airfoils, the S825 and S826, for 20- to 40-meter, variable-speed and variable-pitch (toward feather), horizontal-axis wind turbines has been designed and analyzed theoretically. The two primary objectives of a high maximum lift coefficient, insensitive to leading-edge roughness, and low profile-drag coefficients have been achieved. The constraints on the zero-lift pitching-moment coefficients and the airfoil thicknesses have been satisfied. The airfoils should exhibit docile stall characteristics.

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TABLE I.– AIRFOIL DESIGN SPECIFICATIONS

Parameter	Objective/Constraint	
Airfoil	Primary	Tip
Blade radial station	0.75	0.95
Reynolds number	2.0×10^6	1.5×10^6
Maximum lift coefficient	≥ 1.40	≥ 1.40
Low-drag, lift-coefficient range		
Lower limit	0.40	0.40
Upper limit	1.20	1.20
Minimum profile-drag coefficient	≤ 0.0080	≤ 0.0060
Zero-lift pitching-moment coefficient	≥ -0.15	≥ -0.15
Thickness	0.17c	0.14c

TABLE II.– S825 AIRFOIL COORDINATES

Upper Surface		Lower Surface	
x/c	y/c	x/c	y/c
0.00001	0.00030	0.00014	−0.00143
.00028	.00224	.00081	−.00307
.00129	.00543	.00197	−.00477
.00721	.01481	.00650	−.00920
.01766	.02500	.01819	−.01650
.03250	.03549	.03502	−.02381
.05161	.04596	.05670	−.03093
.07479	.05616	.08297	−.03780
.10185	.06588	.11351	−.04443
.13251	.07494	.14790	−.05114
.16643	.08315	.18480	−.05834
.20324	.09032	.22231	−.06499
.24253	.09625	.25997	−.06891
.28387	.10060	.29879	−.06869
.32709	.10296	.34011	−.06415
.37230	.10329	.38475	−.05600
.41930	.10195	.43307	−.04520
.46763	.09920	.48499	−.03306
.51676	.09525	.53974	−.02082
.56616	.09029	.59631	−.00935
.61526	.08450	.65355	.00060
.66350	.07806	.71026	.00854
.71028	.07112	.76514	.01410
.75503	.06385	.81692	.01713
.79720	.05636	.86437	.01757
.83624	.04878	.90608	.01553
.87165	.04117	.94062	.01168
.90294	.03351	.96717	.00727
.92994	.02560	.98566	.00342
.95294	.01758	.99646	.00088
.97208	.01022	1.00000	.00000
.98695	.00450		
.99661	.00108		
1.00000	.00000		

TABLE III.– S826 AIRFOIL COORDINATES

Upper Surface		Lower Surface	
x/c	y/c	x/c	y/c
0.00018	0.00159	0.00000	−0.00005
.00255	.00748	.00021	−.00146
.00954	.01638	.00093	−.00274
.02088	.02596	.00216	−.00403
.03651	.03580	.00367	−.00525
.05636	.04562	.01367	−.01035
.08026	.05519	.02920	−.01518
.10801	.06434	.04998	−.01960
.13934	.07288	.07580	−.02362
.17395	.08068	.10637	−.02729
.21146	.08758	.14133	−.03091
.25149	.09343	.17965	−.03486
.29361	.09807	.21987	−.03855
.33736	.10133	.26153	−.04064
.38228	.10294	.30497	−.04051
.42820	.10249	.35027	−.03794
.47526	.10005	.39779	−.03280
.52324	.09607	.44785	−.02563
.57161	.09094	.50032	−.01720
.61980	.08489	.55484	−.00841
.66724	.07816	.61055	−.00015
.71333	.07095	.66644	.00699
.75749	.06341	.72142	.01254
.79915	.05572	.77434	.01621
.83778	.04798	.82409	.01784
.87287	.04029	.86953	.01741
.90391	.03262	.90945	.01498
.93072	.02479	.94257	.01113
.95355	.01695	.96813	.00689
.97251	.00982	.98604	.00324
.98719	.00431	.99655	.00084
.99668	.00103	1.00000	.00000
1.00000	.00000		
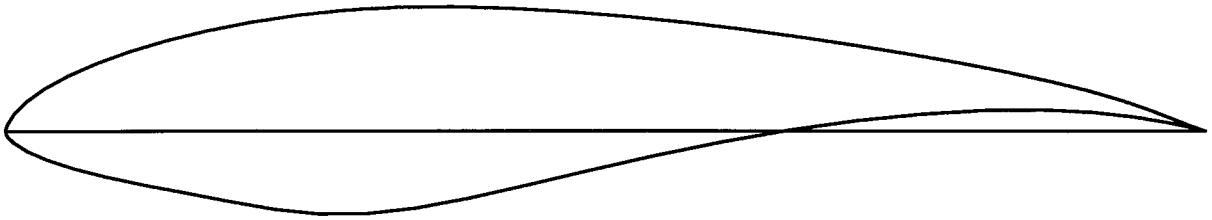
(a) S825.
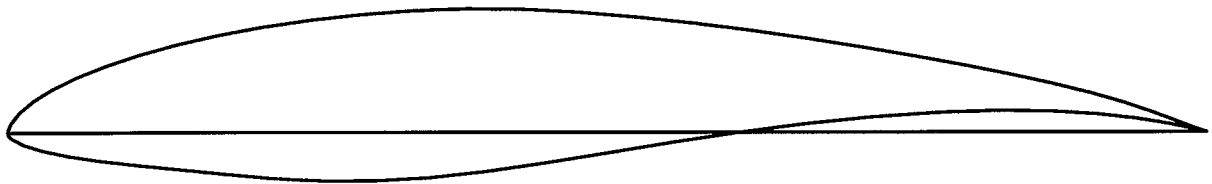
(b) S826.

Figure 1.– Airfoil shapes.
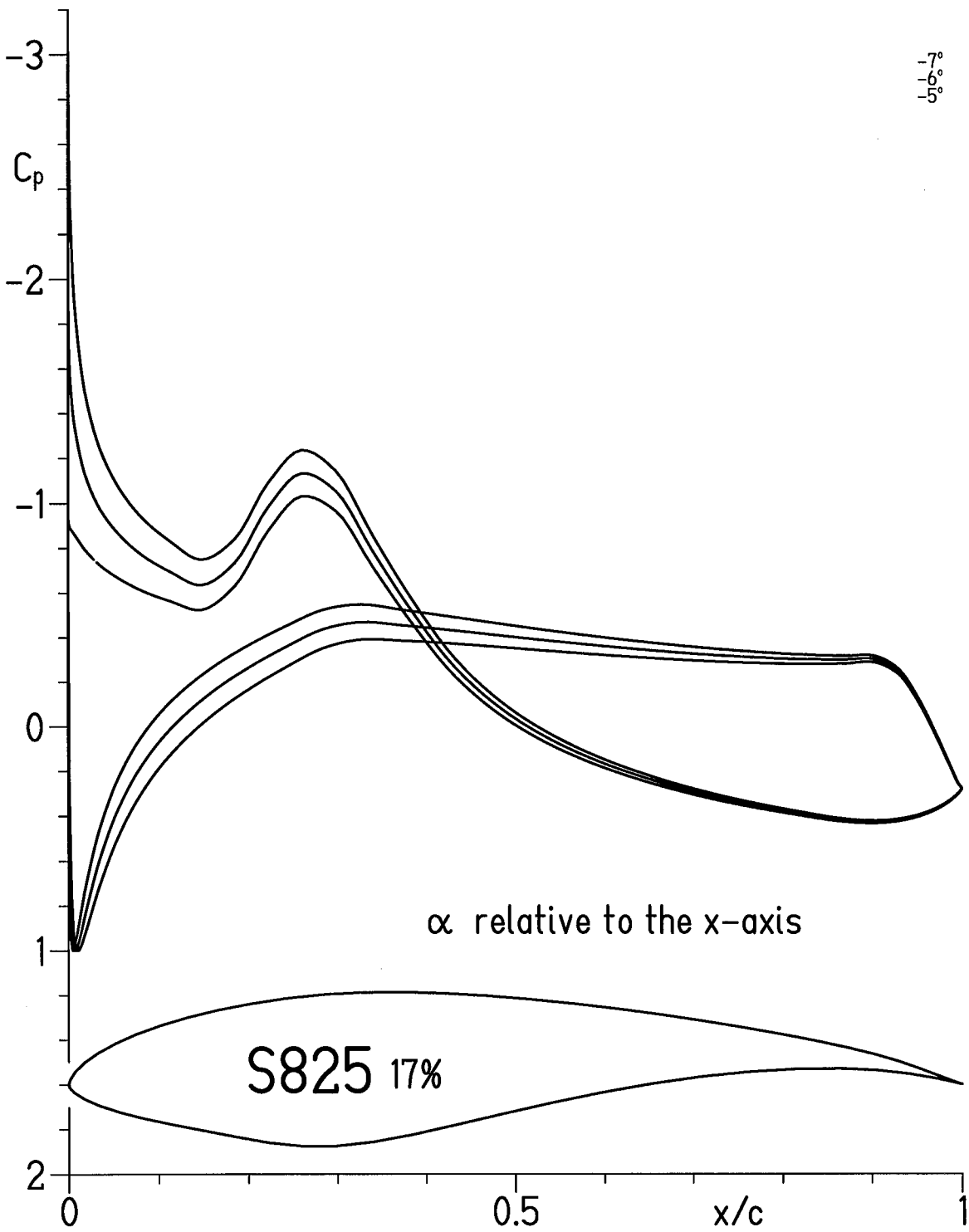
(a) $\alpha = -7°$, $-6°$, and $-5°$.

Figure 2.– Inviscid pressure distributions for S825 airfoil.
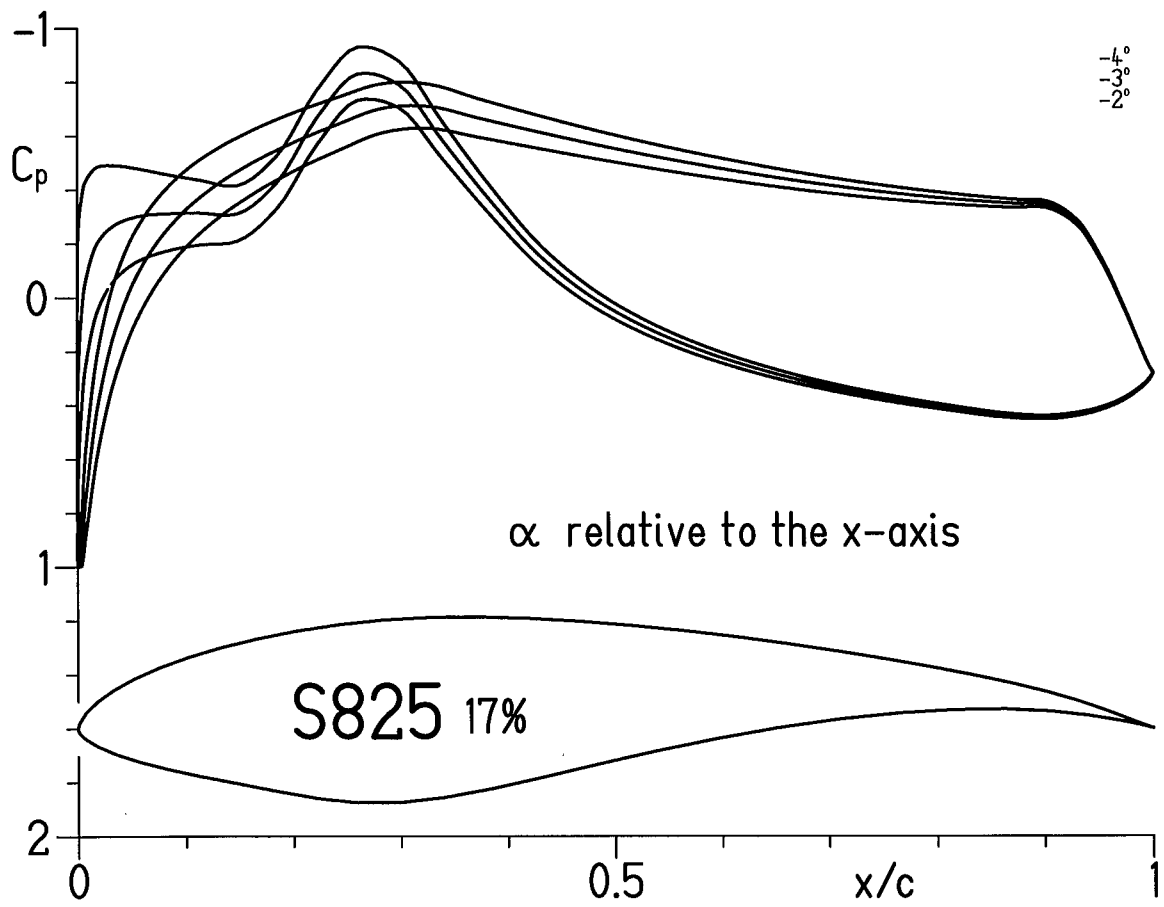
(b) $\alpha = -4°$, $-3°$, and $-2°$.

Figure 2.– Continued.

-1°
0°
1°

α relative to the x-axis

S825 17%
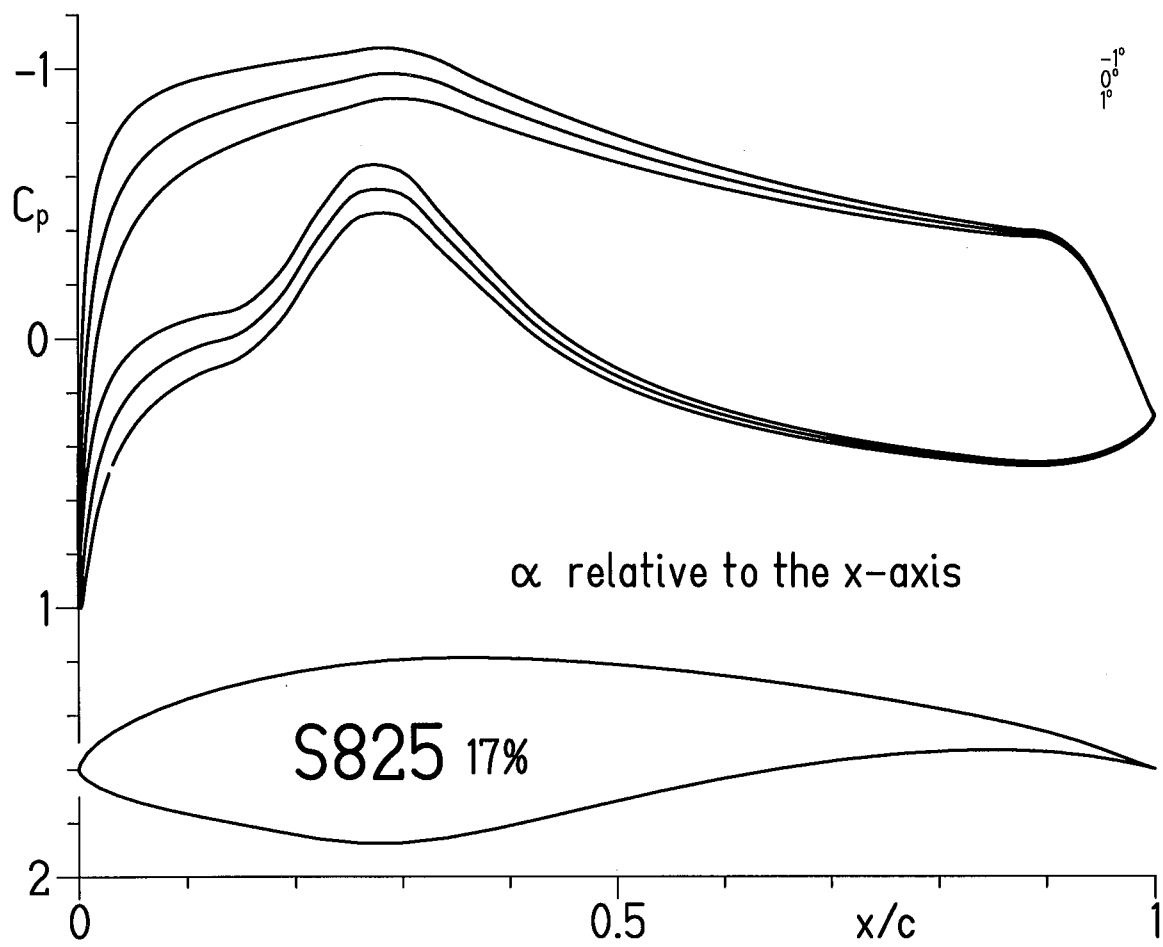
(c) α = −1°, 0°, and 1°.

Figure 2.– Continued.

C_p

α relative to the x-axis

S825 17%
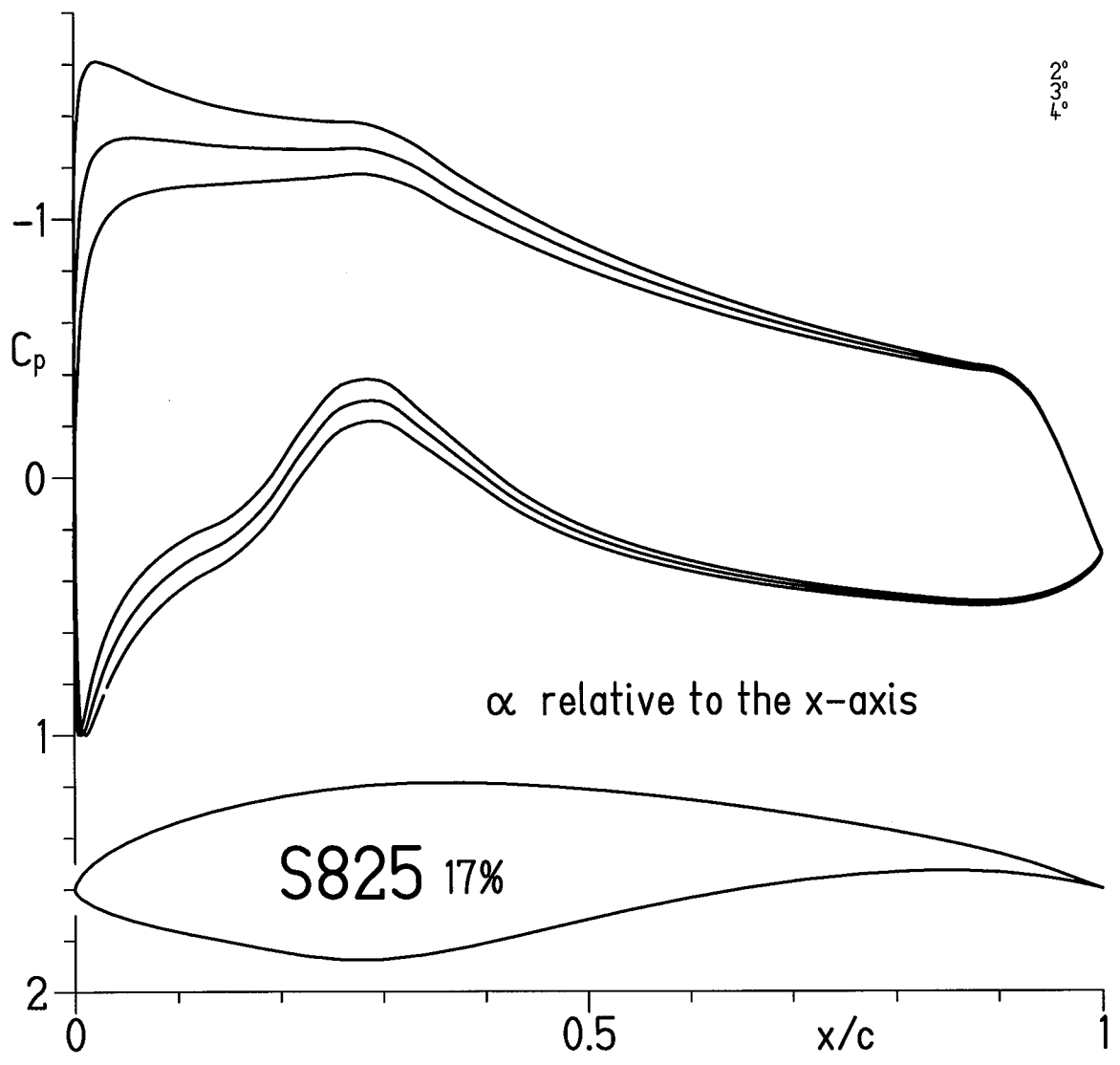
(d) $\alpha = 2°$, $3°$, and $4°$.

Figure 2.– Continued.

5°
6°
7°

α relative to the x-axis

S825 17%
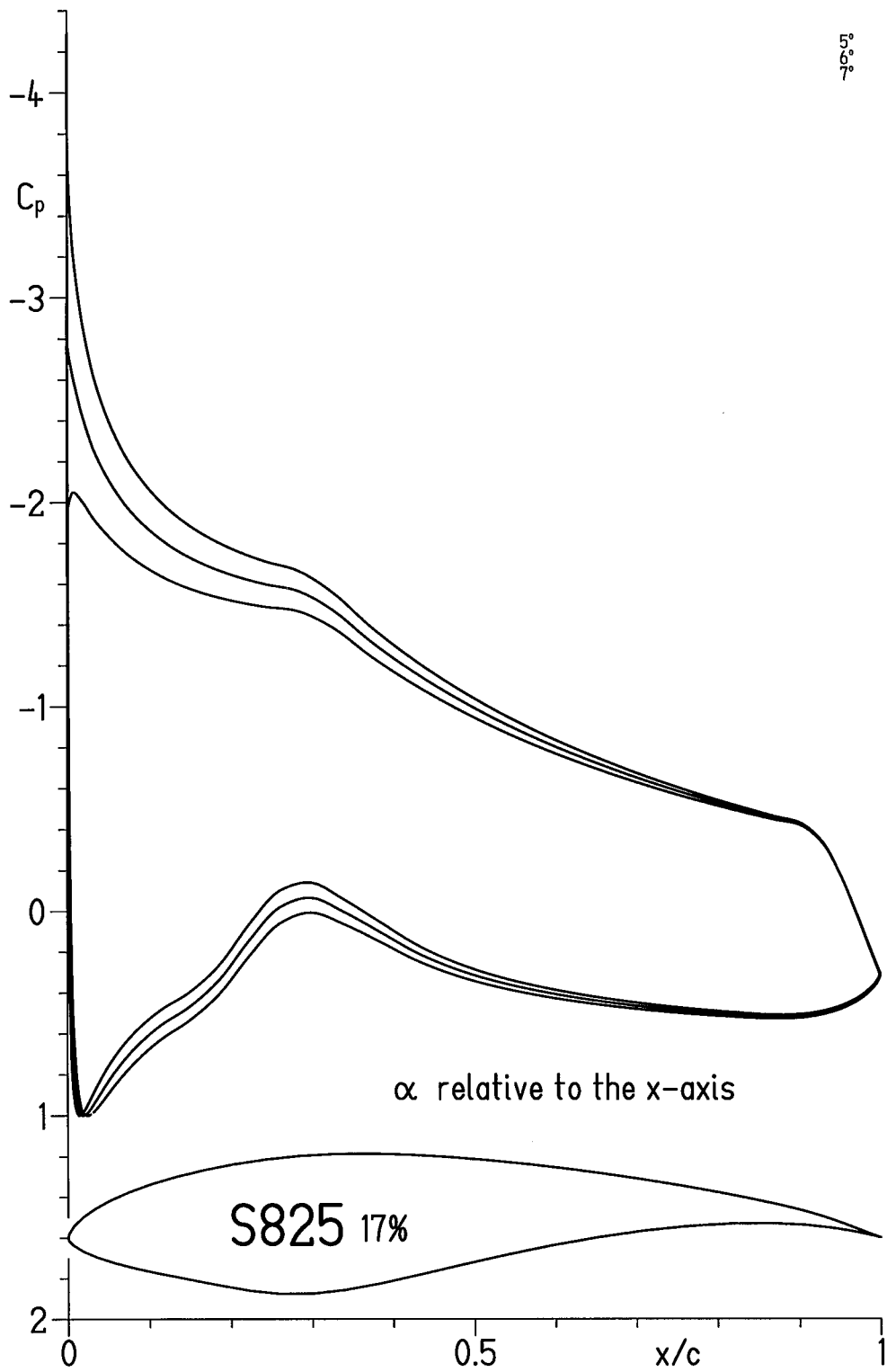
(e) α = 5°, 6°, and 7°.

Figure 2.– Continued.

$\alpha = 8°$ relative to the x-axis

S825 17%

(f) $\alpha = 8°$.

Figure 2.– Concluded.

S825 R = 1.0 × 10⁶

Separation bubble warning
△ Upper surface
▽ Lower surface

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

(a) $R = 1.0 \times 10^6$.

Figure 3.– Section characteristics of S825 airfoil with transition free, transition fixed, and rough.

S825 $R = 1.5 \times 10^6$

Separation bubble warning
△ Upper surface
▽ Lower surface

——— Transition free
– – – – Transition fixed
–·–·– Rough

(b) $R = 1.5 \times 10^6$.

Figure 3.– Continued.

S825 $R = 2.0 \times 10^6$

Separation bubble warning
△ Upper surface
▽ Lower surface
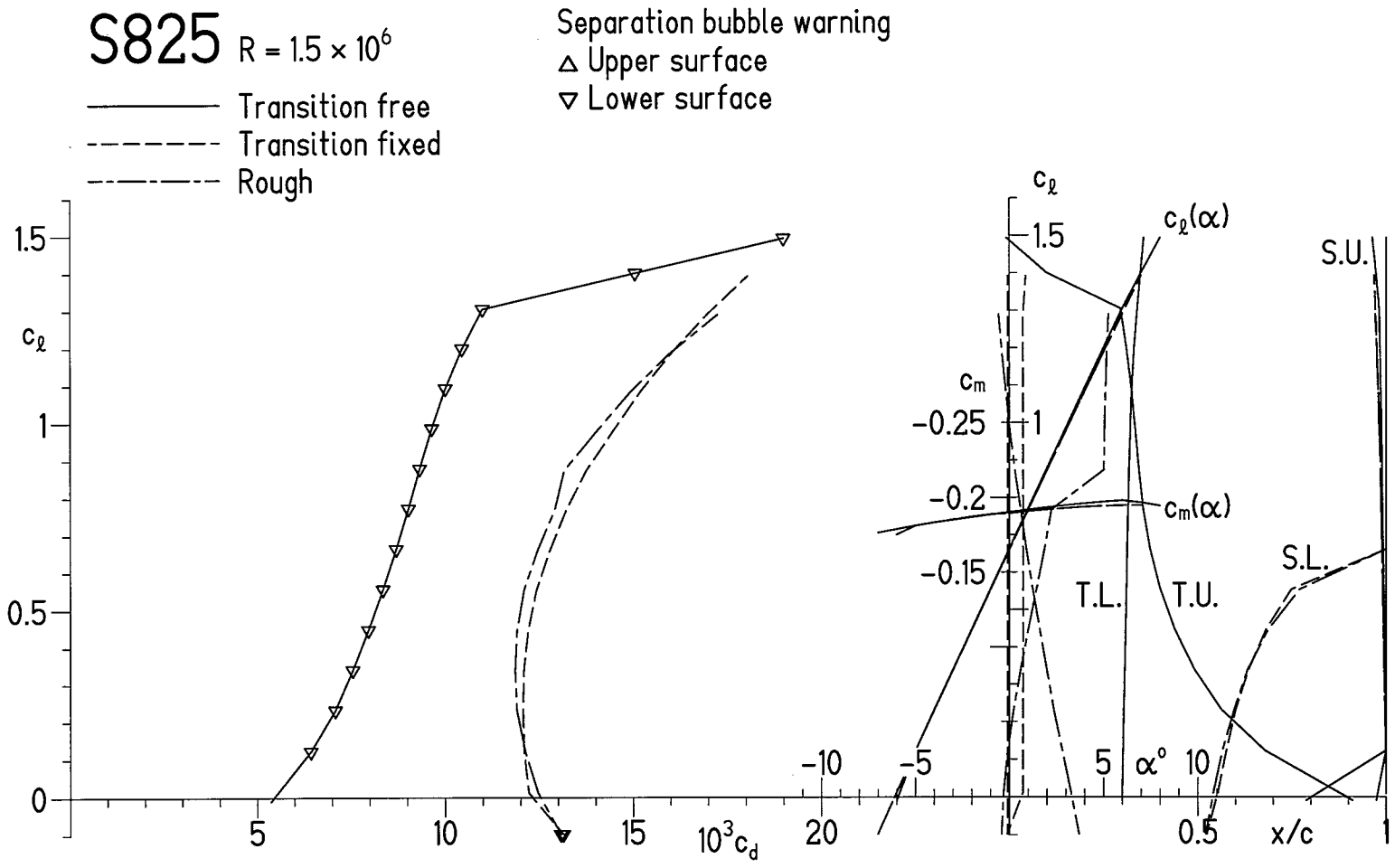
——————— Transition free
– – – – – – Transition fixed
– · – · – · – Rough
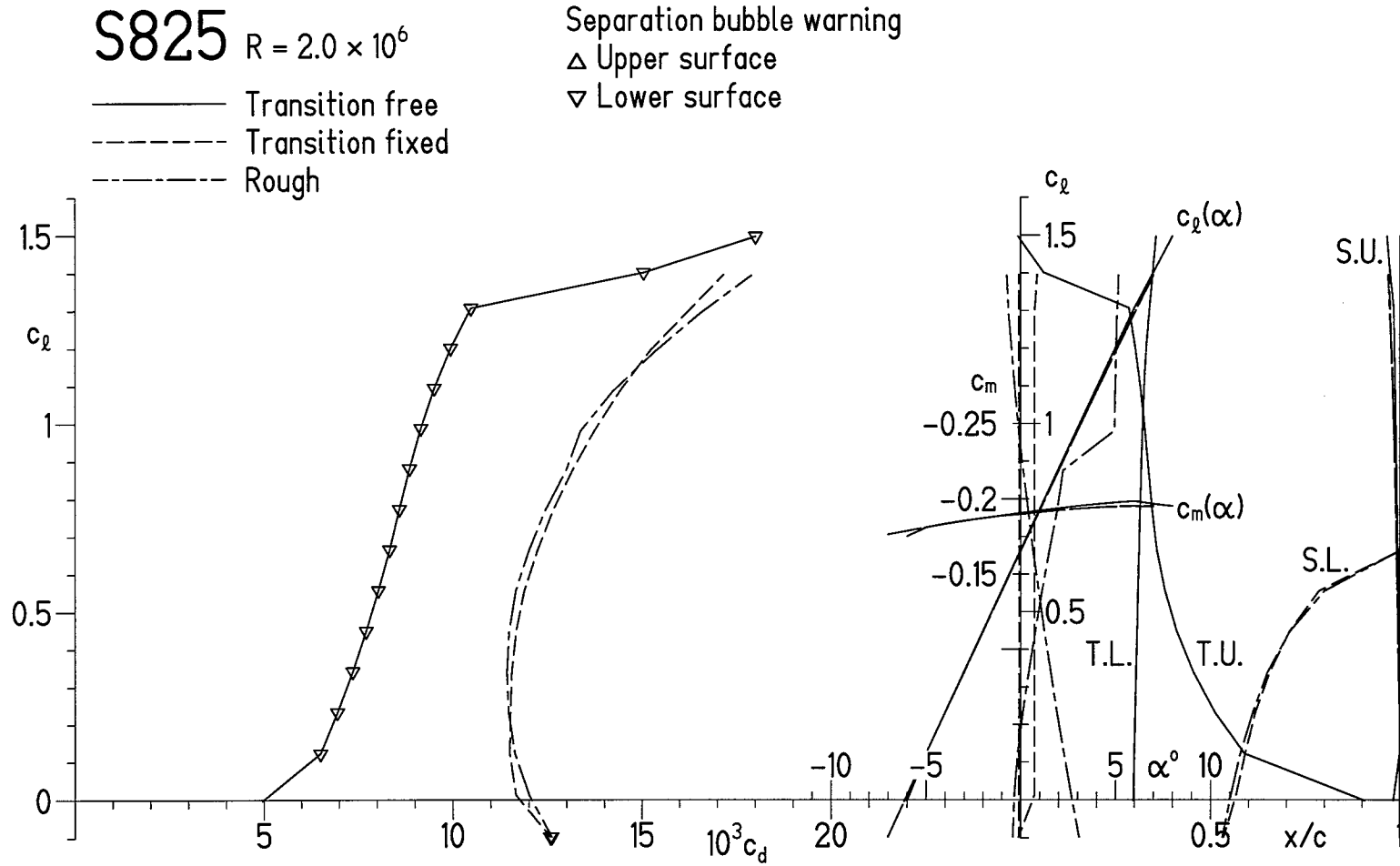
(c) $R = 2.0 \times 10^6$.

Figure 3.– Continued.

S825 R = 2.5 × 10⁶

Separation bubble warning
△ Upper surface
▽ Lower surface

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

(d) R = 2.5 × 10⁶.

Figure 3.– Continued.

S825 R = 3.0 × 10⁶

Separation bubble warning
△ Upper surface
▽ Lower surface

——————— Transition free
-------- Transition fixed
—·—·—·— Rough
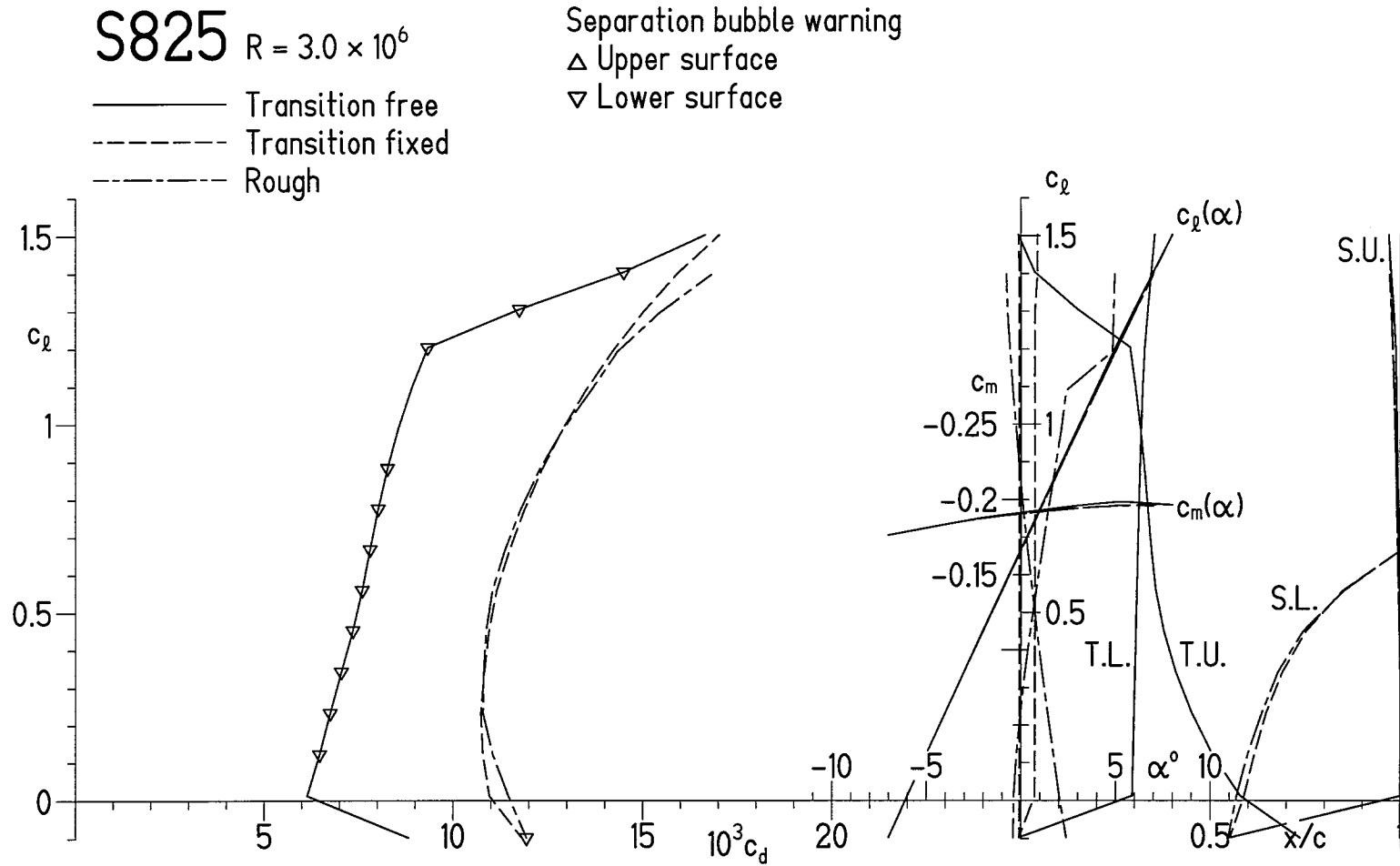
(e) R = 3.0 × 10⁶.

Figure 3.– Concluded.
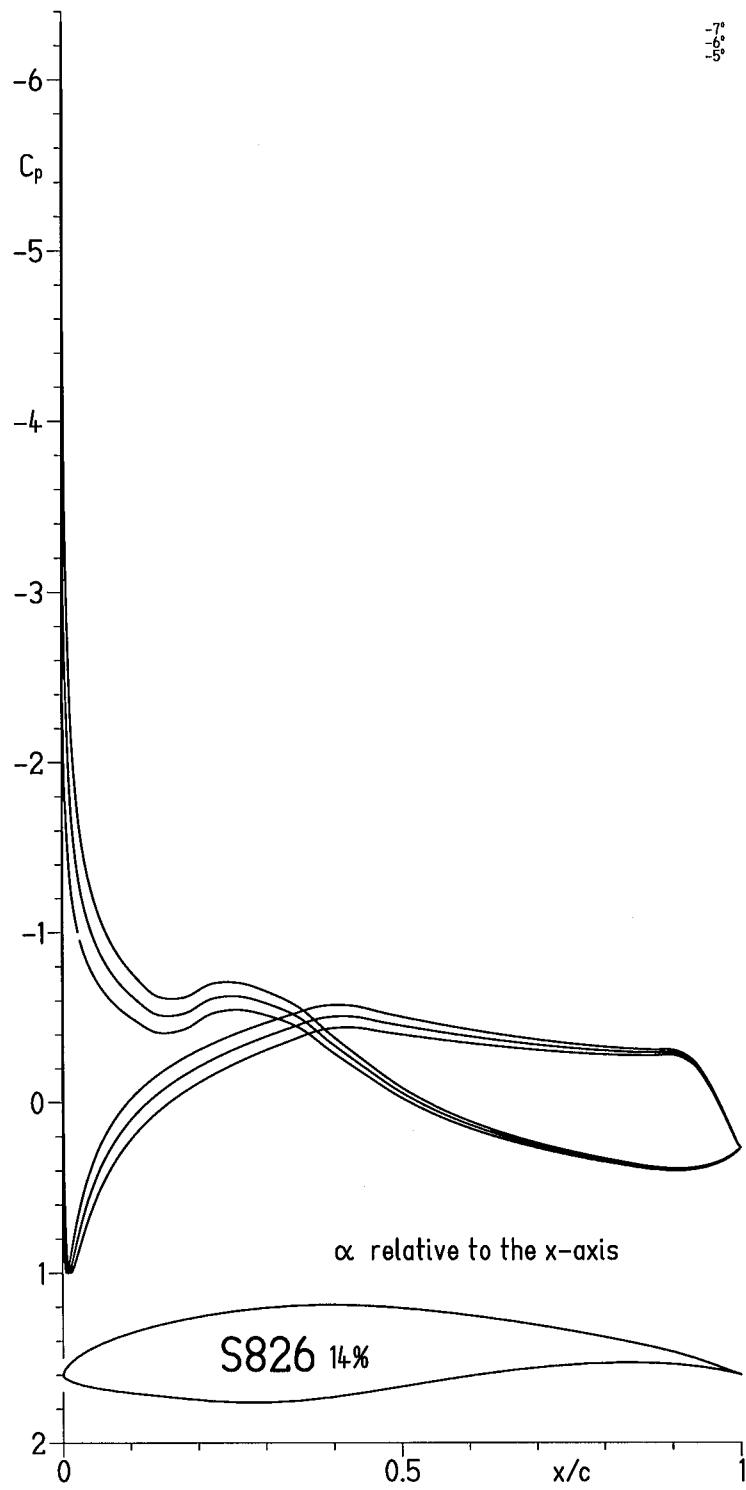
(a) $\alpha = -7°$, $-6°$, and $-5°$.

Figure 4.– Inviscid pressure distributions for S826 airfoil.

α relative to the x-axis

S826 14%
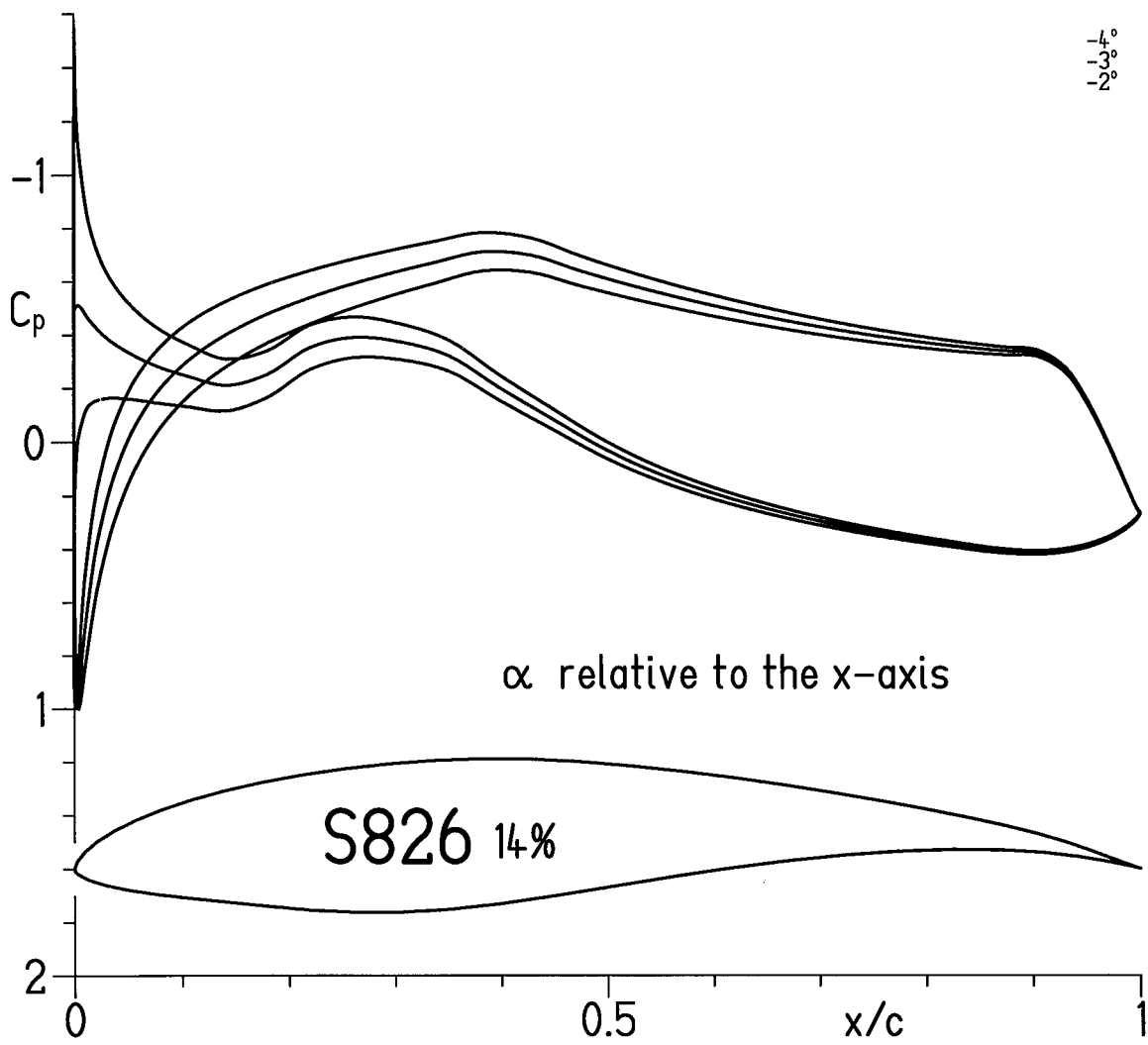
(b) α = –4°, –3°, and –2°.

Figure 4.– Continued.

C_p

-1

0

1

α relative to the x-axis

S826 14%

2

0 0.5 x/c 1

$-1°$
$0°$
$1°$
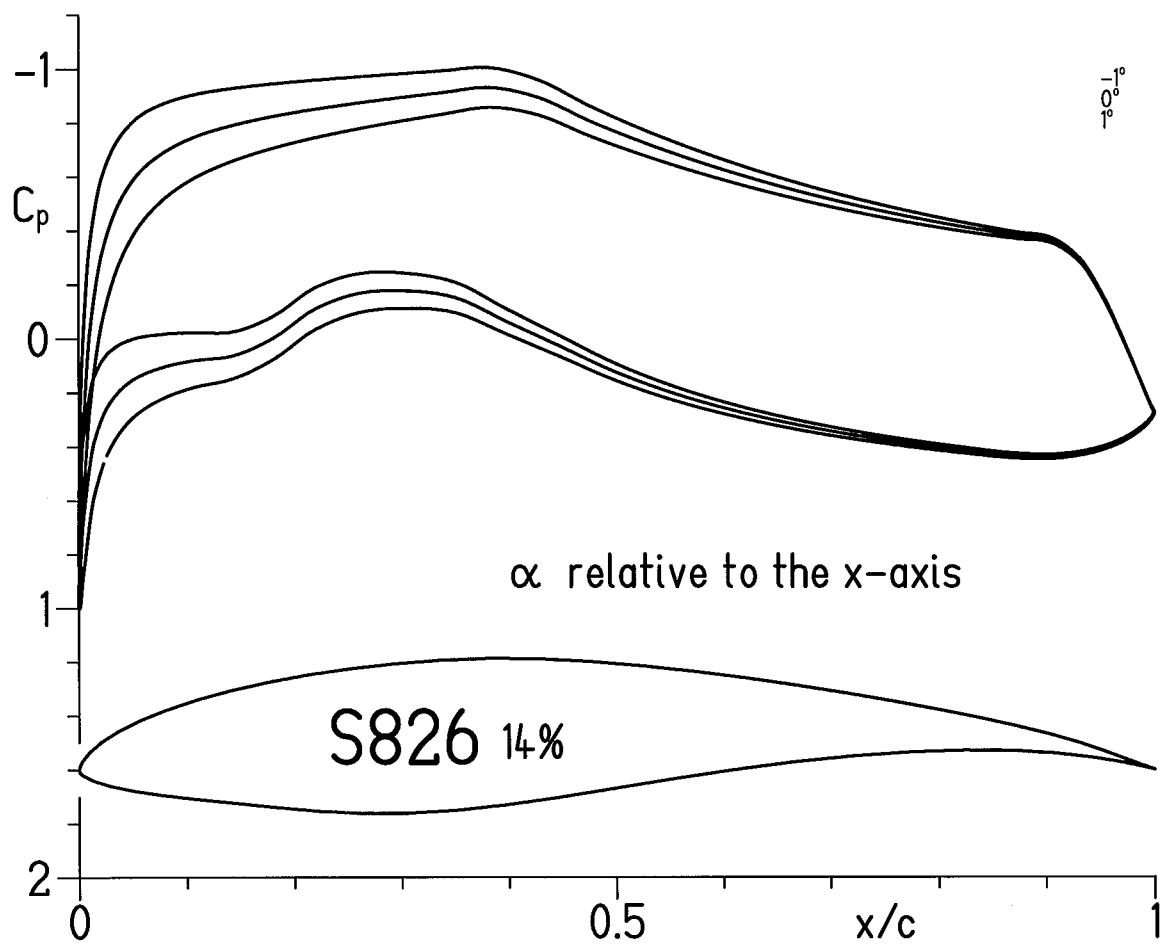
(c) $\alpha = -1°$, $0°$, and $1°$.

Figure 4.– Continued.
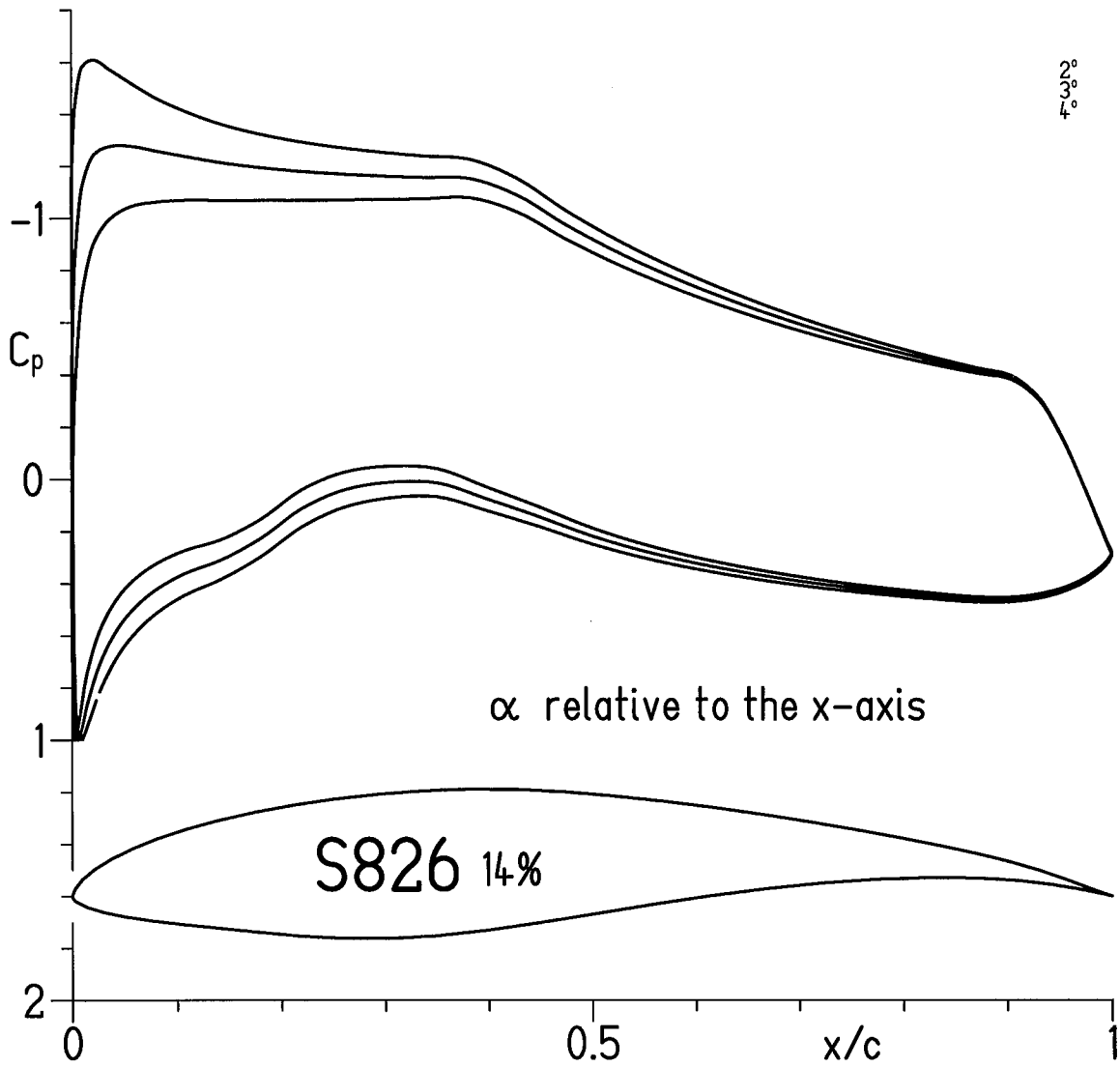
(d) $\alpha = 2°$, $3°$, and $4°$.

Figure 4.– Continued.
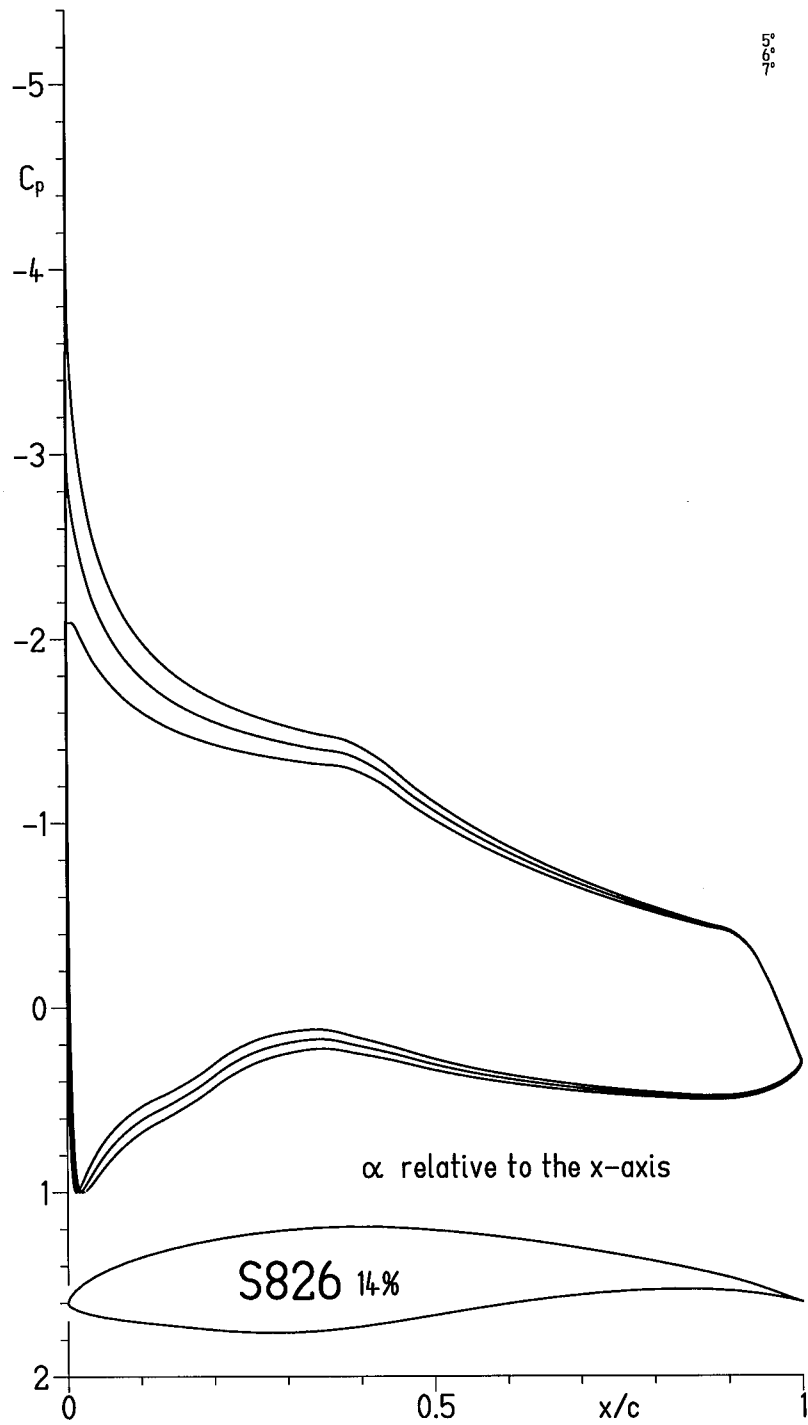
(e) α = 5°, 6°, and 7°.

Figure 4.– Continued.
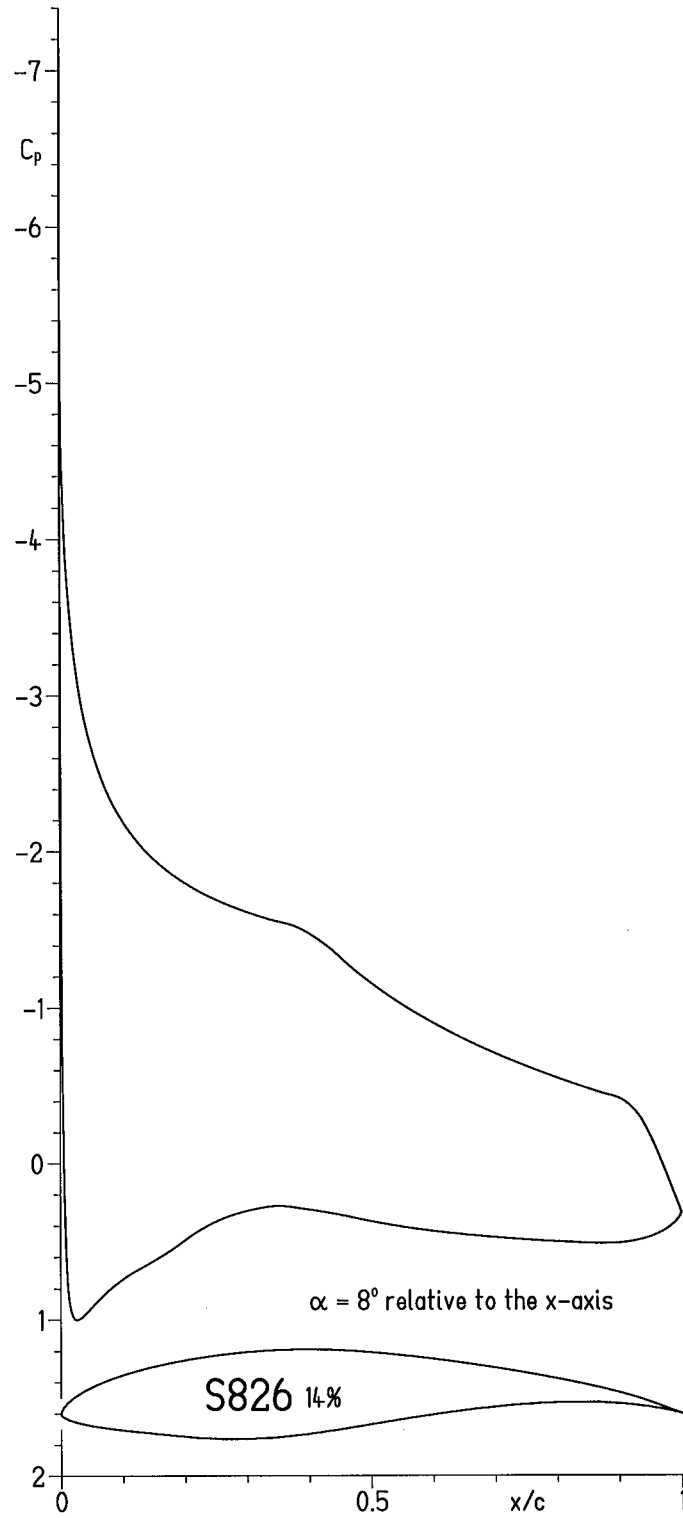
(f) $\alpha = 8°$.

Figure 4.– Concluded.
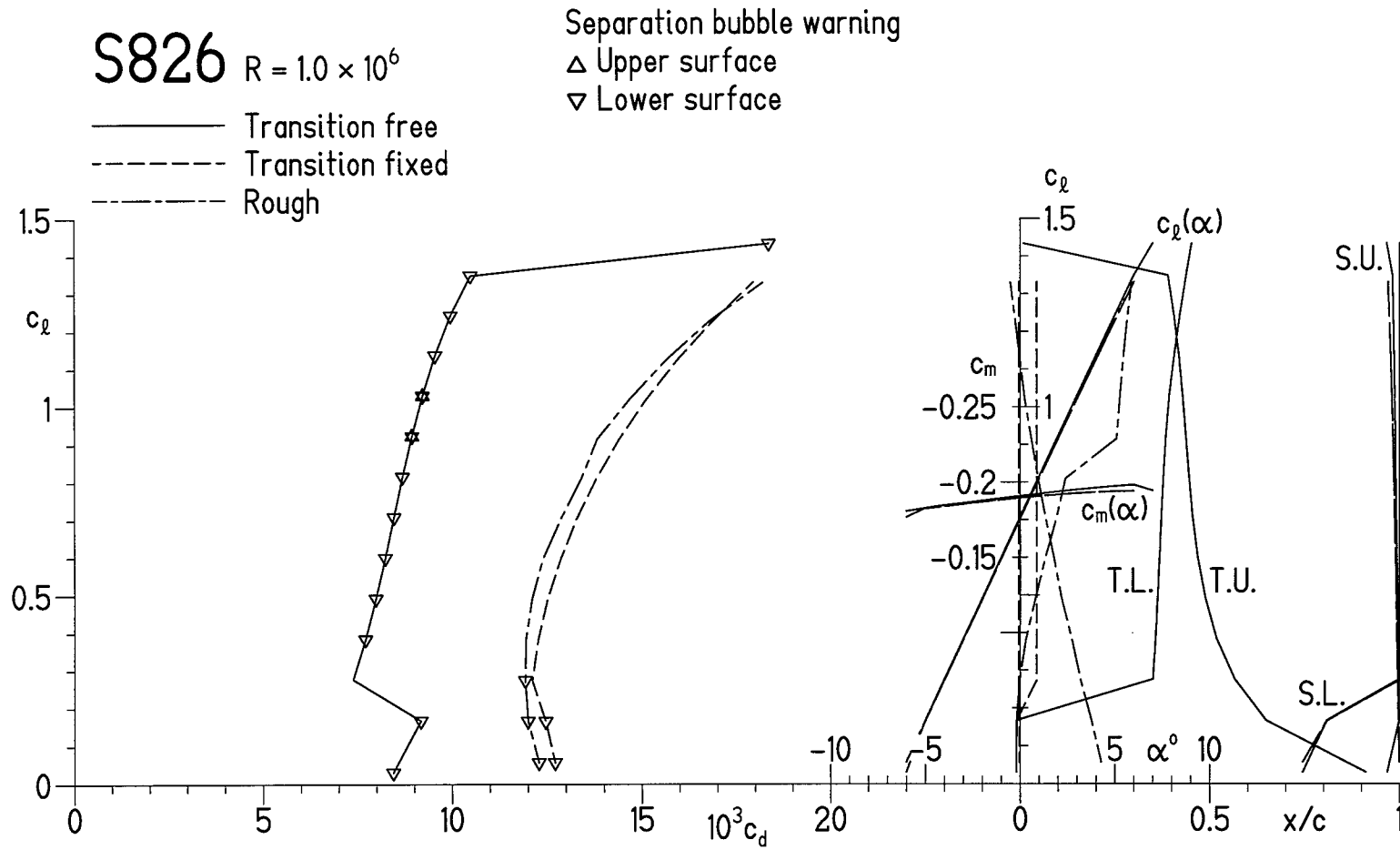
(a) $R = 1.0 \times 10^6$.

Figure 5.– Section characteristics of S826 airfoil with transition free, transition fixed, and rough.

S826 R = 1.5 × 10⁶

Separation bubble warning
△ Upper surface
▽ Lower surface

———— Transition free
– – – – – Transition fixed
–·–·–·– Rough
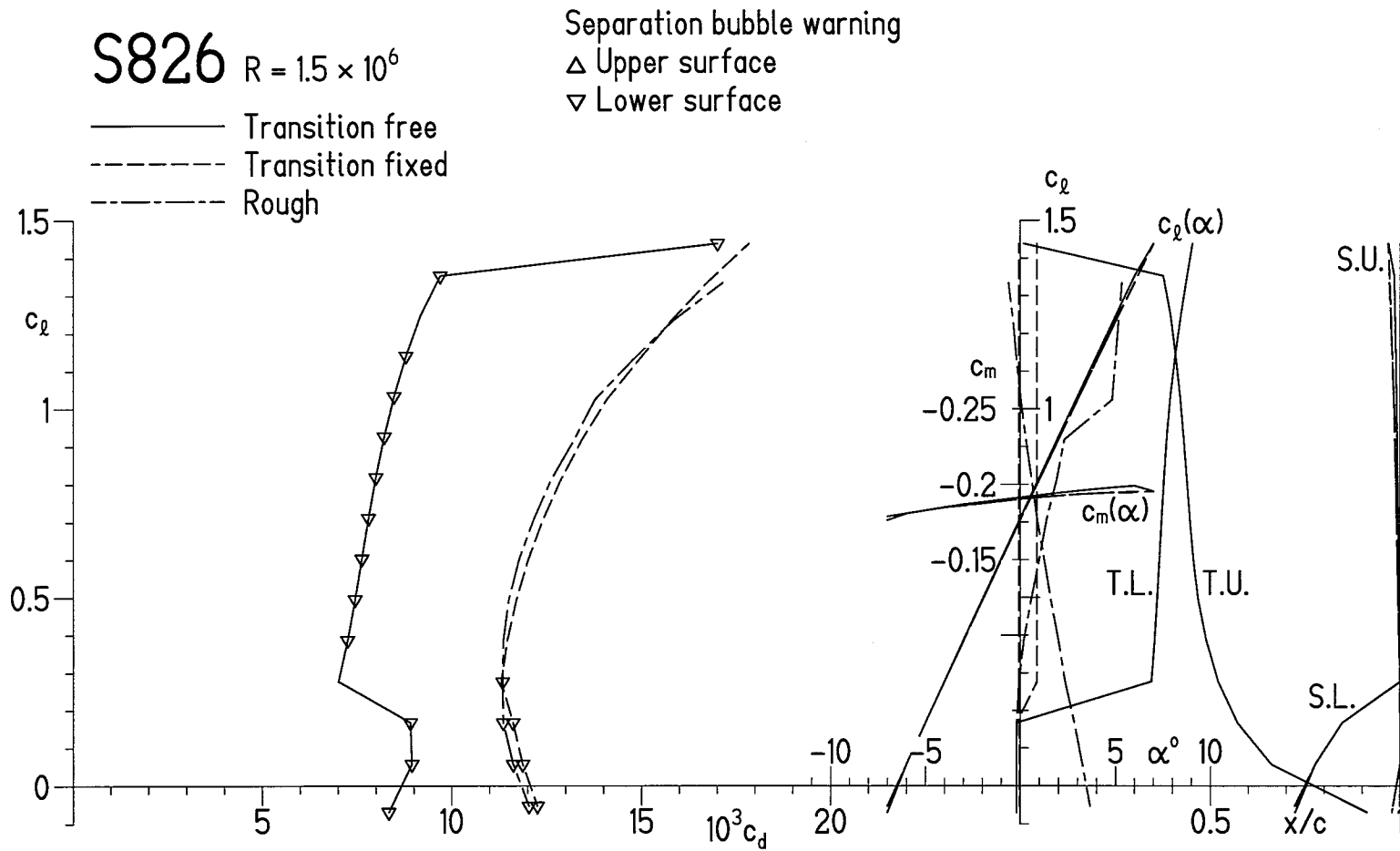
(b) $R = 1.5 \times 10^6$.

Figure 5.– Continued.

S826 R = 2.0 × 10⁶

Transition free
Transition fixed
Rough

Separation bubble warning
△ Upper surface
▽ Lower surface

(c) R = 2.0 × 10⁶.

Figure 5.– Continued.

S826 $R = 2.5 \times 10^6$

Separation bubble warning
△ Upper surface
▽ Lower surface

——— Transition free
– – – – – Transition fixed
–·–·–·– Rough

(d) $R = 2.5 \times 10^6$.

Figure 5.– Continued.

S826 R = 3.0 × 10⁶

Separation bubble warning
△ Upper surface
▽ Lower surface
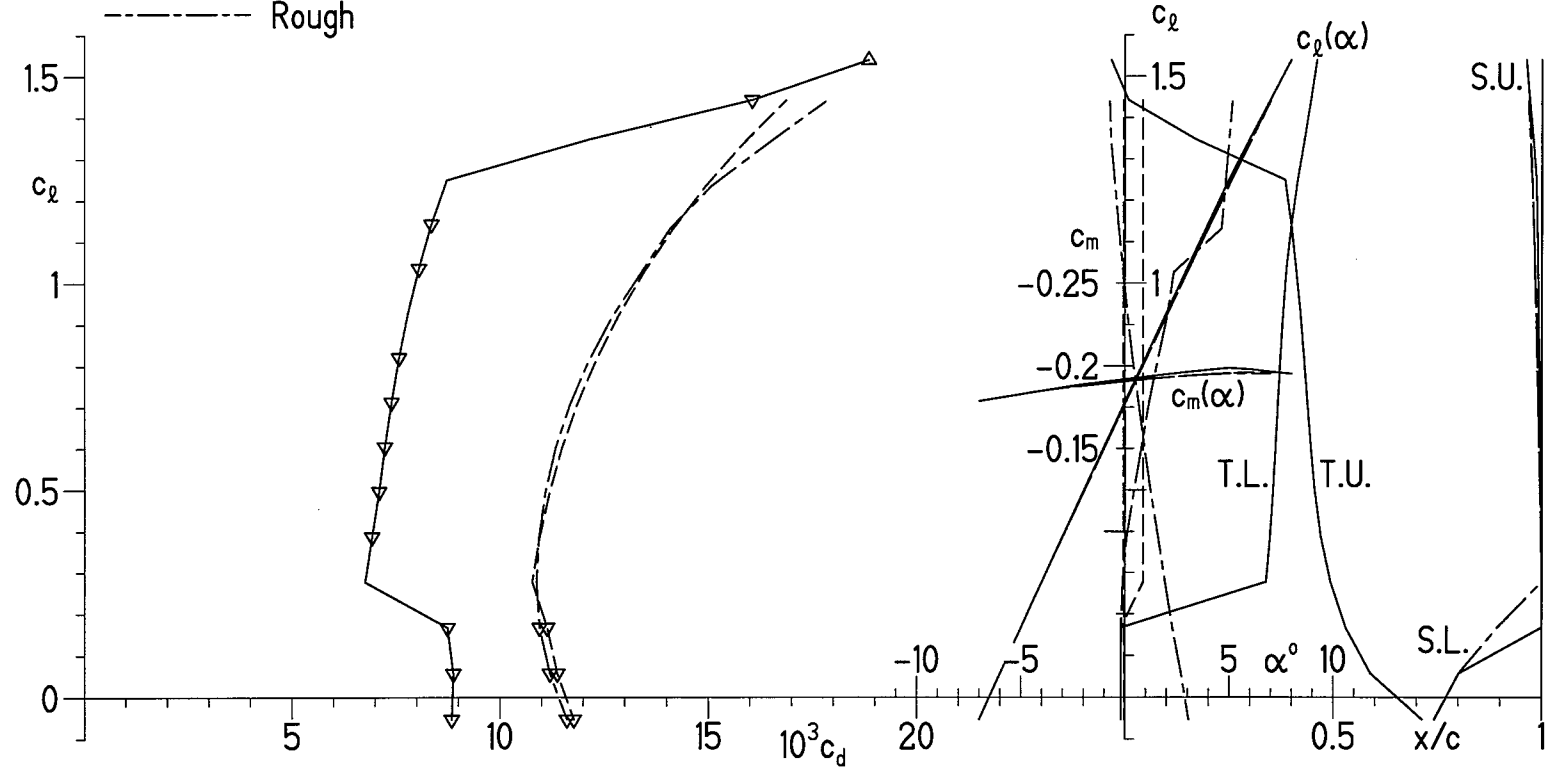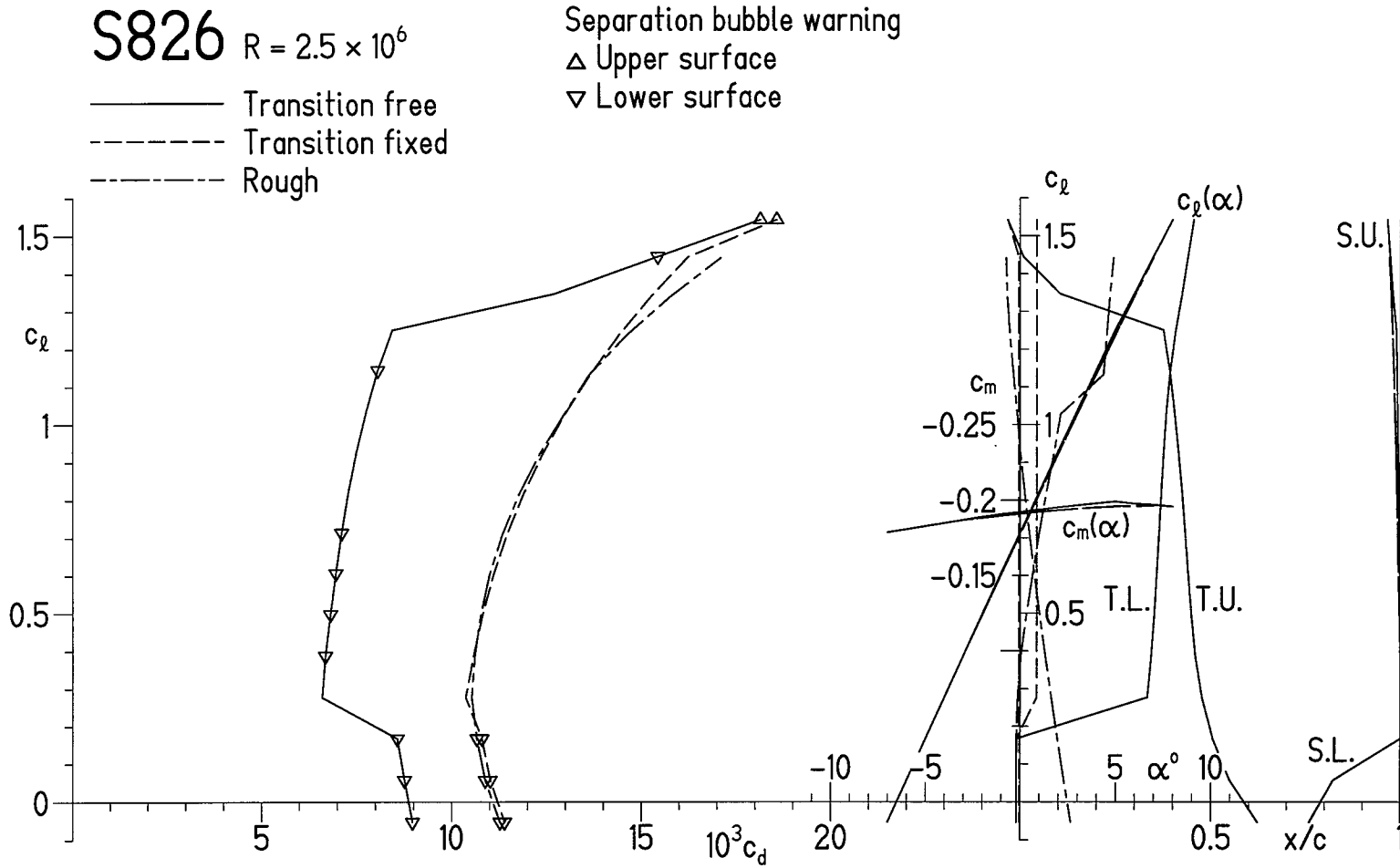
——— Transition free
– – – – Transition fixed
–·–·– Rough
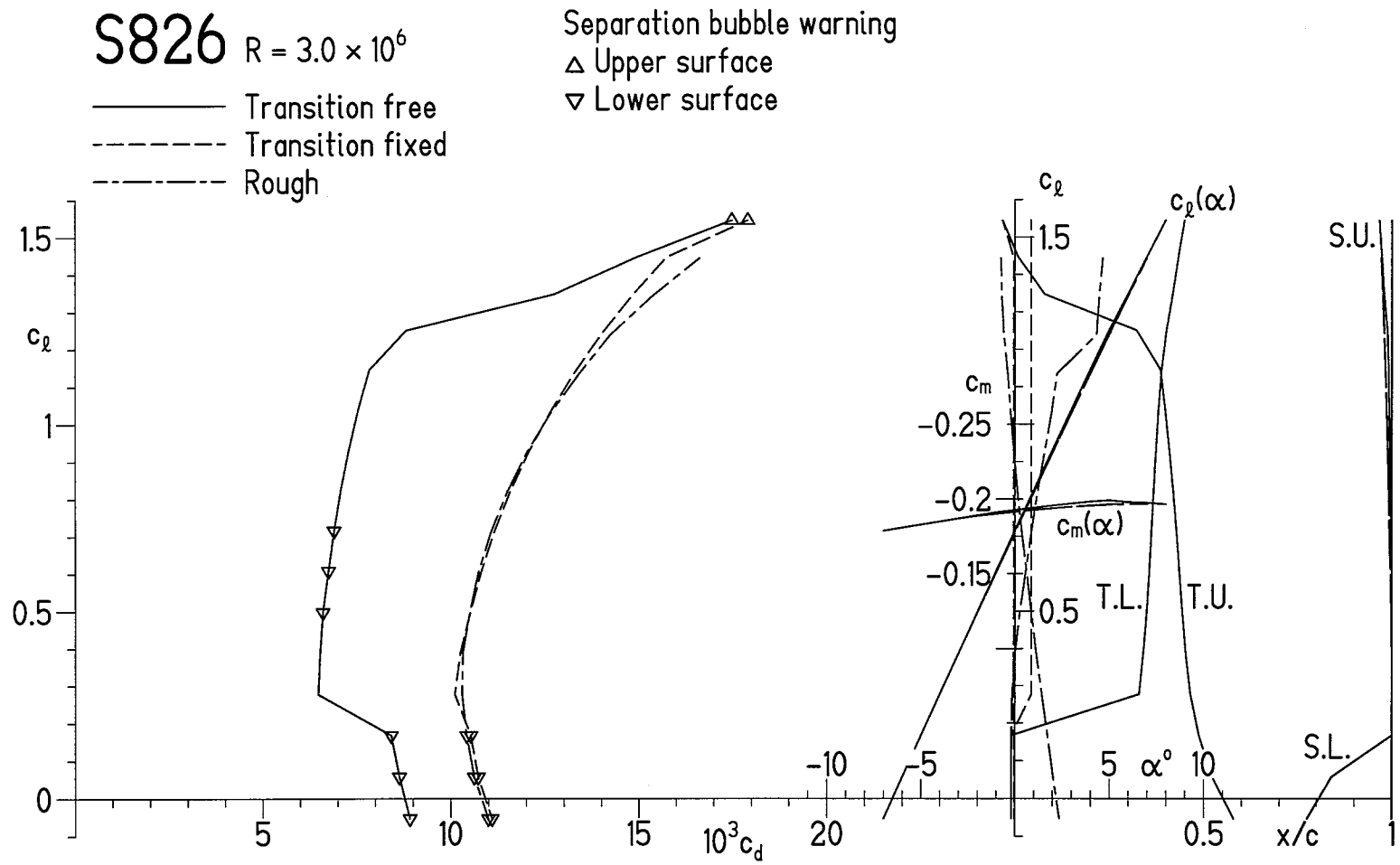
(e) R = 3.0 × 10⁶.

Figure 5.– Concluded.

37

APPENDIX

PRESSURE DISTRIBUTIONS, TRANSITION AND SEPARATION LOCATIONS, AND SECTION CHARACTERISTICS

AIRFOIL S825   17%   -7.00 -6.00 -5.00 -4.00 -3.00 -2.00 -1.00   0.00   1.00

N	X	Y	NUE	CP-DISTR. FOR THE ABOVE ALPHA REL. CHORD LINE								
1	1.00000	0.00000	0.00	0.279	0.278	0.279	0.279	0.281	0.282	0.284	0.287	0.289
2	0.99661	0.00108	1.00	0.262	0.260	0.259	0.258	0.258	0.258	0.259	0.260	0.262
3	0.98695	0.00450	2.00	0.180	0.177	0.174	0.172	0.170	0.169	0.168	0.168	0.168
4	0.97208	0.01022	3.00	0.049	0.043	0.038	0.034	0.030	0.027	0.024	0.022	0.021
5	0.95294	0.01758	4.00	-0.105	-0.113	-0.121	-0.128	-0.135	-0.140	-0.146	-0.150	-0.154
6	0.92994	0.02560	5.00	-0.236	-0.248	-0.259	-0.270	-0.279	-0.288	-0.297	-0.304	-0.311
7	0.90294	0.03351	6.00	-0.289	-0.304	-0.318	-0.332	-0.345	-0.357	-0.368	-0.379	-0.388
8	0.87165	0.04117	7.00	-0.283	-0.301	-0.318	-0.334	-0.350	-0.364	-0.379	-0.392	-0.404
9	0.83624	0.04878	8.00	-0.281	-0.302	-0.321	-0.341	-0.359	-0.377	-0.394	-0.410	-0.425
10	0.79720	0.05636	9.00	-0.283	-0.306	-0.329	-0.351	-0.372	-0.393	-0.414	-0.433	-0.452
11	0.75503	0.06385	10.00	-0.287	-0.314	-0.340	-0.365	-0.390	-0.414	-0.438	-0.461	-0.483
12	0.71028	0.07112	11.00	-0.294	-0.325	-0.354	-0.383	-0.412	-0.440	-0.467	-0.494	-0.520
13	0.66350	0.07806	12.00	-0.305	-0.339	-0.372	-0.405	-0.438	-0.470	-0.502	-0.533	-0.563
14	0.61526	0.08450	13.00	-0.317	-0.355	-0.393	-0.431	-0.468	-0.505	-0.541	-0.577	-0.612
15	0.56616	0.09029	14.00	-0.331	-0.374	-0.417	-0.459	-0.502	-0.544	-0.586	-0.627	-0.668
16	0.51676	0.09525	15.00	-0.346	-0.394	-0.443	-0.491	-0.539	-0.587	-0.635	-0.683	-0.730
17	0.46763	0.09920	16.00	-0.361	-0.415	-0.470	-0.525	-0.580	-0.635	-0.690	-0.744	-0.799
18	0.41930	0.10195	17.00	-0.375	-0.436	-0.498	-0.560	-0.623	-0.685	-0.748	-0.811	-0.874
19	0.37230	0.10329	18.00	-0.385	-0.455	-0.525	-0.595	-0.666	-0.738	-0.810	-0.883	-0.956
20	0.32709	0.10296	19.00	-0.391	-0.468	-0.548	-0.628	-0.709	-0.791	-0.874	-0.958	-1.043
21	0.28387	0.10060	20.00	-0.351	-0.436	-0.523	-0.612	-0.703	-0.794	-0.888	-0.982	-1.077
22	0.24253	0.09625	21.00	-0.265	-0.357	-0.450	-0.546	-0.644	-0.744	-0.846	-0.949	-1.054
23	0.20324	0.09032	22.00	-0.172	-0.270	-0.370	-0.474	-0.580	-0.689	-0.801	-0.915	-1.031
24	0.16643	0.08315	23.00	-0.069	-0.173	-0.281	-0.393	-0.509	-0.629	-0.752	-0.878	-1.008
25	0.13251	0.07494	24.00	0.047	-0.064	-0.180	-0.301	-0.428	-0.559	-0.695	-0.836	-0.982
26	0.10185	0.06588	25.00	0.181	0.063	-0.061	-0.193	-0.332	-0.477	-0.629	-0.788	-0.952
27	0.07479	0.05616	26.00	0.339	0.216	0.084	-0.058	-0.210	-0.371	-0.541	-0.721	-0.908
28	0.05161	0.04596	27.00	0.523	0.399	0.262	0.110	-0.054	-0.232	-0.423	-0.627	-0.844
29	0.03250	0.03549	28.00	0.732	0.617	0.483	0.328	0.154	-0.040	-0.253	-0.485	-0.736
30	0.01766	0.02500	29.00	0.931	0.851	0.739	0.598	0.426	0.223	-0.009	-0.271	-0.562
31	0.00721	0.01481	30.00	0.980	1.000	0.969	0.888	0.758	0.578	0.348	0.069	-0.259
32	0.00129	0.00543	31.00	0.314	0.622	0.838	0.964	0.999	0.944	0.797	0.559	0.231
33	0.00028	0.00224	31.38	-0.514	0.029	0.452	0.755	0.938	1.000	0.941	0.762	0.462
34	0.00001	0.00030	31.63	-1.474	-0.692	-0.057	0.430	0.768	0.956	0.996	0.886	0.627
35	0.00014	-0.00143	31.88	-3.011	-1.878	-0.931	-0.171	0.400	0.782	0.975	0.978	0.790
36	0.00081	-0.00307	32.13	-2.625	-1.699	-0.908	-0.253	0.265	0.646	0.890	0.995	0.963
37	0.00197	-0.00477	32.38	-2.350	-1.570	-0.892	-0.317	0.155	0.523	0.787	0.946	1.000
38	0.00650	-0.00920	33.00	-1.921	-1.364	-0.865	-0.424	-0.042	0.281	0.545	0.749	0.893
39	0.01819	-0.01650	34.00	-1.505	-1.137	-0.796	-0.485	-0.202	0.052	0.276	0.470	0.635
40	0.03502	-0.02381	35.00	-1.245	-0.977	-0.725	-0.490	-0.271	-0.068	0.117	0.285	0.436
41	0.05670	-0.03093	36.00	-1.066	-0.860	-0.664	-0.478	-0.302	-0.136	0.019	0.163	0.297
42	0.08297	-0.03780	37.00	-0.932	-0.767	-0.608	-0.456	-0.311	-0.173	-0.042	0.083	0.199
43	0.11351	-0.04443	38.00	-0.830	-0.694	-0.563	-0.436	-0.313	-0.195	-0.082	0.025	0.128
44	0.14790	-0.05114	39.00	-0.748	-0.634	-0.523	-0.415	-0.310	-0.209	-0.110	-0.016	0.075
45	0.18480	-0.05834	40.00	-0.837	-0.731	-0.627	-0.525	-0.426	-0.329	-0.235	-0.143	-0.055
46	0.22231	-0.06499	41.00	-1.087	-0.980	-0.874	-0.769	-0.667	-0.567	-0.469	-0.373	-0.280
47	0.25997	-0.06891	42.00	-1.235	-1.132	-1.030	-0.929	-0.829	-0.731	-0.635	-0.540	-0.448
48	0.29879	-0.06869	43.00	-1.143	-1.053	-0.965	-0.877	-0.790	-0.704	-0.620	-0.536	-0.454
49	0.34011	-0.06415	44.00	-0.857	-0.787	-0.718	-0.649	-0.580	-0.512	-0.444	-0.377	-0.311
50	0.38475	-0.05600	45.00	-0.568	-0.515	-0.462	-0.409	-0.356	-0.303	-0.251	-0.199	-0.147
51	0.43307	-0.04520	46.00	-0.303	-0.263	-0.223	-0.183	-0.143	-0.103	-0.063	-0.023	0.016
52	0.48499	-0.03306	47.00	-0.108	-0.078	-0.047	-0.016	0.015	0.046	0.077	0.108	0.140
53	0.53974	-0.02082	48.00	0.034	0.058	0.082	0.107	0.131	0.156	0.181	0.206	0.231
54	0.59631	-0.00935	49.00	0.142	0.161	0.180	0.200	0.219	0.239	0.260	0.280	0.300
55	0.65355	0.00060	50.00	0.225	0.240	0.255	0.271	0.287	0.304	0.320	0.337	0.354
56	0.71026	0.00854	51.00	0.289	0.301	0.314	0.327	0.340	0.354	0.367	0.381	0.396
57	0.76514	0.01410	52.00	0.340	0.350	0.360	0.371	0.381	0.393	0.404	0.416	0.428
58	0.81692	0.01713	53.00	0.379	0.388	0.396	0.405	0.414	0.423	0.433	0.442	0.452
59	0.86437	0.01757	54.00	0.411	0.417	0.424	0.431	0.438	0.446	0.454	0.462	0.471
60	0.90608	0.01553	55.00	0.421	0.427	0.432	0.438	0.444	0.451	0.458	0.465	0.472
61	0.94062	0.01168	56.00	0.406	0.411	0.415	0.420	0.425	0.431	0.437	0.443	0.450
62	0.96717	0.00727	57.00	0.374	0.377	0.381	0.385	0.389	0.394	0.399	0.404	0.410
63	0.98566	0.00342	58.00	0.333	0.335	0.338	0.341	0.344	0.348	0.352	0.357	0.362
64	0.99646	0.00088	59.00	0.296	0.297	0.299	0.301	0.303	0.306	0.309	0.313	0.317
65	1.00000	0.00000	60.00	0.279	0.278	0.279	0.279	0.281	0.282	0.284	0.287	0.289

ALPHA0= 6.11 DEGREES   CM0=-0.1803   ETA= 1.117

```
AIRFOIL S825  17%                    2.00   3.00   4.00   5.00   6.00   7.00   8.00   9.00  10.00
   N      X        Y       NUE   CP-DISTR. FOR THE ABOVE ALPHA REL. CHORD LINE
   1  1.00000  0.00000   0.00    0.293  0.297  0.301  0.305  0.310  0.316  0.321  0.327  0.334
   2  0.99661  0.00108   1.00    0.264  0.267  0.270  0.273  0.277  0.281  0.286  0.291  0.296
   3  0.98695  0.00450   2.00    0.169  0.170  0.172  0.174  0.177  0.181  0.184  0.189  0.193
   4  0.97208  0.01022   3.00    0.020  0.020  0.020  0.021  0.023  0.025  0.027  0.031  0.035
   5  0.95294  0.01758   4.00   -0.157 -0.159 -0.161 -0.162 -0.162 -0.162 -0.161 -0.159 -0.156
   6  0.92994  0.02560   5.00   -0.317 -0.322 -0.326 -0.330 -0.333 -0.335 -0.336 -0.336 -0.336
   7  0.90294  0.03351   6.00   -0.397 -0.405 -0.413 -0.419 -0.424 -0.429 -0.433 -0.436 -0.438
   8  0.87165  0.04117   7.00   -0.416 -0.427 -0.437 -0.446 -0.455 -0.462 -0.469 -0.475 -0.479
   9  0.83624  0.04878   8.00   -0.440 -0.454 -0.467 -0.479 -0.491 -0.501 -0.511 -0.520 -0.528
  10  0.79720  0.05636   9.00   -0.470 -0.487 -0.503 -0.519 -0.533 -0.547 -0.560 -0.572 -0.583
  11  0.75503  0.06385  10.00   -0.505 -0.525 -0.545 -0.564 -0.583 -0.600 -0.617 -0.632 -0.647
  12  0.71028  0.07112  11.00   -0.546 -0.570 -0.594 -0.617 -0.640 -0.661 -0.682 -0.701 -0.720
  13  0.66350  0.07806  12.00   -0.593 -0.622 -0.651 -0.678 -0.705 -0.731 -0.756 -0.780 -0.803
  14  0.61526  0.08450  13.00   -0.647 -0.681 -0.715 -0.747 -0.779 -0.810 -0.840 -0.870 -0.898
  15  0.56616  0.09029  14.00   -0.708 -0.748 -0.787 -0.826 -0.863 -0.900 -0.937 -0.972 -1.006
  16  0.51676  0.09525  15.00   -0.777 -0.823 -0.869 -0.914 -0.959 -1.002 -1.046 -1.088 -1.129
  17  0.46763  0.09920  16.00   -0.853 -0.907 -0.960 -1.013 -1.066 -1.118 -1.169 -1.219 -1.269
  18  0.41930  0.10195  17.00   -0.937 -1.000 -1.062 -1.125 -1.186 -1.248 -1.308 -1.368 -1.428
  19  0.37230  0.10329  18.00   -1.029 -1.102 -1.175 -1.248 -1.321 -1.393 -1.465 -1.537 -1.608
  20  0.32709  0.10296  19.00   -1.127 -1.213 -1.298 -1.384 -1.470 -1.556 -1.642 -1.727 -1.812
  21  0.28387  0.10060  20.00   -1.173 -1.270 -1.368 -1.467 -1.566 -1.665 -1.764 -1.864 -1.963
  22  0.24253  0.09625  21.00   -1.161 -1.269 -1.378 -1.488 -1.599 -1.711 -1.824 -1.937 -2.051
  23  0.20324  0.09032  22.00   -1.150 -1.271 -1.393 -1.517 -1.643 -1.770 -1.898 -2.028 -2.158
  24  0.16643  0.08315  23.00   -1.141 -1.276 -1.414 -1.555 -1.699 -1.844 -1.992 -2.141 -2.292
  25  0.13251  0.07494  24.00   -1.132 -1.285 -1.443 -1.605 -1.769 -1.938 -2.109 -2.284 -2.461
  26  0.10185  0.06588  25.00   -1.123 -1.299 -1.482 -1.669 -1.862 -2.059 -2.261 -2.468 -2.679
  27  0.07479  0.05616  26.00   -1.105 -1.310 -1.522 -1.743 -1.971 -2.206 -2.448 -2.697 -2.952
  28  0.05161  0.04596  27.00   -1.073 -1.314 -1.567 -1.831 -2.106 -2.392 -2.689 -2.996 -3.312
  29  0.03250  0.03549  28.00   -1.006 -1.293 -1.598 -1.921 -2.260 -2.616 -2.989 -3.377 -3.780
  30  0.01766  0.02500  29.00   -0.882 -1.230 -1.607 -2.011 -2.443 -2.901 -3.385 -3.895 -4.430
  31  0.00721  0.01481  30.00   -0.635 -1.059 -1.531 -2.050 -2.615 -3.225 -3.881 -4.580 -5.323
  32  0.00129  0.00543  31.00   -0.187 -0.694 -1.290 -1.975 -2.750 -3.605 -4.548 -5.576 -6.687
  33  0.00028  0.00224  31.38    0.042 -0.497 -1.155 -1.931 -2.825 -3.834 -4.959 -6.196 -7.546
  34  0.00001  0.00030  31.63    0.218 -0.339 -1.043 -1.895 -2.892 -4.034 -5.320 -6.747 -8.314
  35  0.00014 -0.00143  31.88    0.414 -0.152 -0.907 -1.849 -2.977 -4.291 -5.788 -7.466 -9.324
  36  0.00081 -0.00307  32.13    0.792  0.483  0.037 -0.546 -1.265 -2.120 -3.109 -4.231 -5.485
  37  0.00197 -0.00477  32.38    0.949  0.793  0.532  0.167 -0.302 -0.875 -1.550 -2.327 -3.205
  38  0.00650 -0.00920  33.00    0.976  1.000  0.963  0.865  0.708  0.490  0.213 -0.124 -0.520
  39  0.01819 -0.01650  34.00    0.769  0.872  0.945  0.988  1.000  0.981  0.931  0.851  0.741
  40  0.03502 -0.02381  35.00    0.569  0.685  0.783  0.862  0.924  0.968  0.993  1.000  0.989
  41  0.05670 -0.03093  36.00    0.419  0.529  0.629  0.717  0.793  0.857  0.909  0.950  0.979
  42  0.08297 -0.03780  37.00    0.309  0.410  0.504  0.590  0.668  0.738  0.800  0.854  0.899
  43  0.11351 -0.04443  38.00    0.226  0.318  0.405  0.486  0.562  0.632  0.695  0.753  0.806
  44  0.14790 -0.05114  39.00    0.163  0.246  0.326  0.401  0.473  0.540  0.603  0.661  0.715
  45  0.18480 -0.05834  40.00    0.031  0.114  0.193  0.269  0.342  0.412  0.478  0.540  0.598
  46  0.22231 -0.06499  41.00   -0.189 -0.101 -0.016  0.067  0.147  0.223  0.296  0.367  0.433
  47  0.25997 -0.06891  42.00   -0.357 -0.269 -0.183 -0.099 -0.017  0.062  0.138  0.211  0.282
  48  0.29879 -0.06869  43.00   -0.373 -0.294 -0.216 -0.140 -0.066  0.007  0.077  0.146  0.212
  49  0.34011 -0.06415  44.00   -0.246 -0.182 -0.119 -0.056  0.005  0.064  0.123  0.180  0.236
  50  0.38475 -0.05600  45.00   -0.096 -0.045  0.005  0.054  0.103  0.151  0.198  0.245  0.290
  51  0.43307 -0.04520  46.00    0.056  0.095  0.134  0.173  0.211  0.249  0.286  0.323  0.359
  52  0.48499 -0.03306  47.00    0.171  0.202  0.233  0.264  0.294  0.325  0.355  0.385  0.414
  53  0.53974 -0.02082  48.00    0.256  0.281  0.307  0.332  0.357  0.382  0.407  0.431  0.456
  54  0.59631 -0.00935  49.00    0.321  0.342  0.363  0.383  0.404  0.425  0.446  0.467  0.488
  55  0.65355  0.00060  50.00    0.371  0.388  0.406  0.423  0.441  0.459  0.476  0.494  0.512
  56  0.71026  0.00854  51.00    0.410  0.424  0.439  0.454  0.469  0.484  0.499  0.515  0.530
  57  0.76514  0.01410  52.00    0.440  0.452  0.465  0.478  0.490  0.504  0.517  0.530  0.543
  58  0.81692  0.01713  53.00    0.463  0.473  0.484  0.495  0.506  0.518  0.529  0.541  0.552
  59  0.86437  0.01757  54.00    0.480  0.489  0.498  0.507  0.517  0.527  0.537  0.547  0.558
  60  0.90608  0.01553  55.00    0.480  0.487  0.496  0.504  0.513  0.521  0.530  0.540  0.549
  61  0.94062  0.01168  56.00    0.456  0.463  0.471  0.478  0.486  0.494  0.503  0.511  0.520
  62  0.96717  0.00727  57.00    0.416  0.423  0.430  0.437  0.444  0.452  0.460  0.468  0.476
  63  0.98566  0.00342  58.00    0.367  0.373  0.379  0.386  0.392  0.400  0.407  0.415  0.423
  64  0.99646  0.00088  59.00    0.322  0.326  0.332  0.337  0.343  0.350  0.356  0.364  0.371
  65  1.00000  0.00000  60.00    0.293  0.297  0.301  0.305  0.310  0.316  0.321  0.327  0.334
ALPHA0= 6.11 DEGREES  CM0=-0.1803  ETA= 1.117
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B.L.SUMMARY AIRFOIL S825  17%  ALPHA0=  6.114 DEG.
 *-WARNING WITH VARIABLE LIMIT  ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 1000000 MU=3.0        R= 1000000 MU=1.3        R= 1000000 MU=9.0
-7.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.0801 0.0369 0.0021    1.0043 0.0000 0.0061    0.7282 0.0000 0.0055
   LOWER 1.0055 0.4907 0.0080*   1.0055 0.4907 0.0080*   1.0191 0.4924 0.0082*
   TOTAL CL=-0.127 CD=0.01012    CL=-0.097 CD=0.01409    CL=-0.097 CD=0.01367
         CM=-0.1740              CM=-0.1764              CM=-0.1764
-6.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.0845 0.0366 0.0022    1.0043 0.0012 0.0065    0.7815 0.0011 0.0061
   LOWER 0.6984 0.3624 0.0039    0.9635 0.4650 0.0066    1.0117 0.4739 0.0071
   TOTAL CL=-0.018 CD=0.00611    CL= 0.012 CD=0.01318    CL= 0.012 CD=0.01319
         CM=-0.1752              CM=-0.1787              CM=-0.1787
-5.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.0902 0.0357 0.0024    1.0043 0.0039 0.0070    0.8128 0.0038 0.0066
   LOWER 0.6968 0.2847 0.0036*   0.9635 0.4451 0.0060    0.9976 0.4520 0.0062
   TOTAL CL= 0.090 CD=0.00595    CL= 0.119 CD=0.01298    CL= 0.119 CD=0.01280
         CM=-0.1766              CM=-0.1808              CM=-0.1808
-4.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.3426 0.0041 0.0038    1.0043 0.0057 0.0075    0.8358 0.0055 0.0071
   LOWER 0.6951 0.1793 0.0033*   0.9635 0.4204 0.0054    0.9776 0.4237 0.0055
   TOTAL CL= 0.229 CD=0.00716    CL= 0.227 CD=0.01289    CL= 0.227 CD=0.01254
         CM=-0.1827              CM=-0.1829              CM=-0.1829
-3.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.4506 0.0054 0.0047    1.0043 0.0074 0.0081    0.8603 0.0072 0.0077
   LOWER 0.6932 0.0000 0.0032*   0.9635 0.3932 0.0049    0.9561 0.3910 0.0048
   TOTAL CL= 0.337 CD=0.00787    CL= 0.335 CD=0.01295    CL= 0.335 CD=0.01250
         CM=-0.1844              CM=-0.1849              CM=-0.1849
-2.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.5185 0.0069 0.0054    1.0043 0.0092 0.0087    0.8876 0.0089 0.0083
   LOWER 0.6913 0.0000 0.0030*   0.9635 0.3529 0.0044    0.9303 0.3406 0.0043
   TOTAL CL= 0.445 CD=0.00839    CL= 0.443 CD=0.01307    CL= 0.443 CD=0.01257
         CM=-0.1862              CM=-0.1868              CM=-0.1868
-1.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.5684 0.0083 0.0061    1.0043 0.0110 0.0093    0.9085 0.0107 0.0090
   LOWER 0.6893 0.0000 0.0028*   0.9635 0.2963 0.0040    0.9033 0.2647 0.0038
   TOTAL CL= 0.553 CD=0.00887    CL= 0.550 CD=0.01330    CL= 0.551 CD=0.01276
         CM=-0.1879              CM=-0.1885              CM=-0.1884
 0.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6042 0.0098 0.0067    1.0043 0.0131 0.0101    0.9312 0.0128 0.0097
   LOWER 0.6871 0.0000 0.0026*   0.9635 0.2059 0.0036    0.8835 0.0000 0.0035
   TOTAL CL= 0.661 CD=0.00930    CL= 0.657 CD=0.01365    CL= 0.658 CD=0.01319
         CM=-0.1896              CM=-0.1898              CM=-0.1887
 1.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6293 0.0114 0.0072    1.0043 0.0154 0.0108    0.9521 0.0150 0.0105
   LOWER 0.6848 0.0000 0.0025*   0.9635 0.0000 0.0028    0.7428 0.0000 0.0028
   TOTAL CL= 0.769 CD=0.00970    CL= 0.764 CD=0.01416    CL= 0.764 CD=0.01331
         CM=-0.1911              CM=-0.1900              CM=-0.1901
 2.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6461 0.0131 0.0078    1.0043 0.0178 0.0117    0.9689 0.0175 0.0114
   LOWER 0.6821 0.0000 0.0023*   0.9635 0.0000 0.0031    0.7402 0.0000 0.0026
   TOTAL CL= 0.876 CD=0.01008    CL= 0.870 CD=0.01474    CL= 0.870 CD=0.01402
         CM=-0.1926              CM=-0.1911              CM=-0.1912
 3.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6574 0.0148 0.0083    1.0043 0.0205 0.0126    0.9865 0.0203 0.0125
   LOWER 0.6790 0.0000 0.0022*   0.9635 0.0000 0.0028    0.7368 0.0000 0.0024
   TOTAL CL= 0.983 CD=0.01044    CL= 0.975 CD=0.01543    CL= 0.975 CD=0.01487
         CM=-0.1939              CM=-0.1921              CM=-0.1922
 4.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6674 0.0166 0.0088    1.0043 0.0235 0.0136    1.0015 0.0235 0.0136
   LOWER 0.6749 0.0000 0.0020*   0.9635 0.0000 0.0026    0.7325 0.0000 0.0022
   TOTAL CL= 1.089 CD=0.01083    CL= 1.080 CD=0.01622    CL= 1.080 CD=0.01585
         CM=-0.1951              CM=-0.1929              CM=-0.1929
 5.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6783 0.0186 0.0094    1.0043 0.0269 0.0148    1.0136 0.0271 0.0149
   LOWER 0.6688 0.0000 0.0019*   0.9635 0.0000 0.0024    0.7274 0.0000 0.0021
   TOTAL CL= 1.196 CD=0.01129    CL= 1.184 CD=0.01714    CL= 1.183 CD=0.01699
         CM=-0.1962              CM=-0.1934              CM=-0.1933
 6.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6929 0.0208 0.0101    1.0043 0.0307 0.0160    1.0228 0.0314 0.0164
   LOWER 0.6603 0.0000 0.0017*   0.9635 0.0000 0.0022    0.7220 0.0000 0.0019
   TOTAL CL= 1.301 CD=0.01186    CL= 1.286 CD=0.01818    CL= 1.285 CD=0.01831
         CM=-0.1971              CM=-0.1936              CM=-0.1934
 7.00     S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.7121 0.0235 0.0110    1.0043 0.0350 0.0174    1.0316 0.0364 0.0181
   LOWER 0.6517 0.0000 0.0016*   0.9564 0.0000 0.0020    0.7171 0.0000 0.0018
   TOTAL CL= 1.406 CD=0.01261    CL= 1.388 CD=0.01938    CL= 1.386 CD=0.01992
         CM=-0.1977              CM=-0.1936              CM=-0.1931
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B.L.SUMMARY AIRFOIL S825 17% ALPHA0= 6.114 DEG.
 *-WARNING WITH VARIABLE LIMIT ALPHA REL. CHORD LINE

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ALPHA(DEG.) R= 1000000 MU=3.0        R= 1000000 MU=1.3        R= 1000000 MU=9.0
   8.00    S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
      UPPER 1.0070 0.0400 0.0190*   1.0070 0.0400 0.0190*   1.0363 0.0422 0.0200
      LOWER 0.6431 0.0000 0.0015*   0.9564 0.0000 0.0018    0.7128 0.0000 0.0017
      TOTAL CL= 1.488 CD=0.02046    CL= 1.488 CD=0.02081    CL= 1.484 CD=0.02171
            CM=-0.1931              CM=-0.1931              CM=-0.1923
   9.00    S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
      UPPER 1.0277 0.0480 0.0217*   1.0277 0.0480 0.0217*   1.0385 0.0494 0.0222*
      LOWER 0.6337 0.0000 0.0014*   0.9564 0.0000 0.0017    0.7090 0.0000 0.0015
      TOTAL CL= 1.582 CD=0.02303    CL= 1.582 CD=0.02335    CL= 1.580 CD=0.02374
            CM=-0.1914              CM=-0.1914              CM=-0.1910
  10.00    S TURB  S SEP   CD       S TURB  S SEP   CD       S TURB  S SEP   CD
      UPPER 1.0363 0.0580 0.0244*   1.0363 0.0580 0.0244*   1.0388 0.0586 0.0246*
      LOWER 0.6225 0.0000 0.0013*   0.9293 0.0000 0.0016    0.7055 0.0000 0.0014
      TOTAL CL= 1.672 CD=0.02572    CL= 1.672 CD=0.02600    CL= 1.671 CD=0.02605
            CM=-0.1889              CM=-0.1889              CM=-0.1887
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B.L.SUMMARY AIRFOIL S825  17%  ALPHA0=  6.114 DEG.
 *-WARNING WITH VARIABLE LIMIT  ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 1500000 MU=3.0        R= 1500000 MU=1.3         R= 1500000 MU=9.0
-7.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.0840 0.0263 0.0017     1.0043 0.0000 0.0057      0.8151 0.0000 0.0054
  LOWER 1.0055 0.4765 0.0075*    1.0055 0.4765 0.0075*     1.0203 0.4790 0.0077*
  TOTAL CL=-0.118 CD=0.00924     CL=-0.097 CD=0.01314      CL=-0.097 CD=0.01307
        CM=-0.1746                CM=-0.1764                CM=-0.1764
-6.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.0890 0.0256 0.0019     1.0043 0.0000 0.0060      0.8361 0.0000 0.0058
  LOWER 0.7007 0.2120 0.0035     0.9635 0.4469 0.0062      1.0151 0.4587 0.0067
  TOTAL CL=-0.009 CD=0.00537     CL= 0.013 CD=0.01222      CL= 0.013 CD=0.01247
        CM=-0.1752                CM=-0.1788                CM=-0.1788
-5.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.3221 0.0000 0.0031     1.0043 0.0001 0.0065      0.8590 0.0000 0.0063
  LOWER 0.6984 0.0000 0.0033*    0.9635 0.4245 0.0056      1.0045 0.4348 0.0059
  TOTAL CL= 0.123 CD=0.00643     CL= 0.122 CD=0.01209      CL= 0.123 CD=0.01213
        CM=-0.1811                CM=-0.1811                CM=-0.1811
-4.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.4379 0.0007 0.0040     1.0043 0.0027 0.0070      0.8816 0.0026 0.0067
  LOWER 0.6961 0.0000 0.0031*    0.9635 0.4002 0.0051      0.9887 0.4042 0.0052
  TOTAL CL= 0.232 CD=0.00709     CL= 0.230 CD=0.01206      CL= 0.230 CD=0.01191
        CM=-0.1833                CM=-0.1831                CM=-0.1832
-3.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.5094 0.0031 0.0047     1.0043 0.0049 0.0075      0.9002 0.0047 0.0073
  LOWER 0.6937 0.0000 0.0029*    0.9635 0.3659 0.0046      0.9701 0.3681 0.0046
  TOTAL CL= 0.339 CD=0.00755     CL= 0.338 CD=0.01209      CL= 0.338 CD=0.01186
        CM=-0.1850                CM=-0.1851                CM=-0.1852
-2.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.5615 0.0048 0.0053     1.0043 0.0067 0.0081      0.9190 0.0065 0.0078
  LOWER 0.6913 0.0000 0.0027*    0.9635 0.3194 0.0041      0.9503 0.3135 0.0041
  TOTAL CL= 0.447 CD=0.00797     CL= 0.445 CD=0.01221      CL= 0.446 CD=0.01191
        CM=-0.1867                CM=-0.1870                CM=-0.1870
-1.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.6000 0.0063 0.0058     1.0043 0.0086 0.0087      0.9377 0.0084 0.0085
  LOWER 0.6893 0.0000 0.0026*    0.9635 0.2519 0.0037      0.9284 0.2297 0.0036
  TOTAL CL= 0.555 CD=0.00835     CL= 0.553 CD=0.01242      CL= 0.553 CD=0.01210
        CM=-0.1885                CM=-0.1887                CM=-0.1887
 0.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.6269 0.0078 0.0063     1.0043 0.0106 0.0094      0.9548 0.0104 0.0091
  LOWER 0.6871 0.0000 0.0024*    0.9635 0.0000 0.0034      0.9071 0.0000 0.0033
  TOTAL CL= 0.663 CD=0.00871     CL= 0.660 CD=0.01278      CL= 0.660 CD=0.01246
        CM=-0.1901                CM=-0.1894                CM=-0.1894
 1.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.6451 0.0094 0.0068     1.0043 0.0128 0.0101      0.9698 0.0126 0.0099
  LOWER 0.6848 0.0000 0.0023*    0.9635 0.0000 0.0031      0.8884 0.0000 0.0030
  TOTAL CL= 0.771 CD=0.00903     CL= 0.767 CD=0.01322      CL= 0.767 CD=0.01291
        CM=-0.1917                CM=-0.1907                CM=-0.1908
 2.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.6563 0.0109 0.0072     1.0043 0.0152 0.0109      0.9851 0.0151 0.0107
  LOWER 0.6821 0.0000 0.0021*    0.9635 0.0000 0.0029      0.7490 0.0000 0.0024
  TOTAL CL= 0.879 CD=0.00933     CL= 0.873 CD=0.01375      CL= 0.873 CD=0.01316
        CM=-0.1932                CM=-0.1919                CM=-0.1920
 3.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.6662 0.0125 0.0077     1.0043 0.0182 0.0118      0.9987 0.0182 0.0118
  LOWER 0.6790 0.0000 0.0020*    0.9635 0.0000 0.0027      0.7471 0.0000 0.0023
  TOTAL CL= 0.986 CD=0.00965     CL= 0.978 CD=0.01446      CL= 0.978 CD=0.01403
        CM=-0.1946                CM=-0.1928                CM=-0.1928
 4.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.6762 0.0143 0.0082     1.0043 0.0211 0.0127      1.0094 0.0212 0.0128
  LOWER 0.6749 0.0000 0.0019*    0.9635 0.0000 0.0024      0.7445 0.0000 0.0021
  TOTAL CL= 1.093 CD=0.01001     CL= 1.083 CD=0.01519      CL= 1.083 CD=0.01493
        CM=-0.1959                CM=-0.1936                CM=-0.1936
 5.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.6889 0.0163 0.0087     1.0043 0.0243 0.0138      1.0195 0.0247 0.0140
  LOWER 0.6688 0.0000 0.0017*    0.9635 0.0000 0.0022      0.7410 0.0000 0.0020
  TOTAL CL= 1.199 CD=0.01045     CL= 1.187 CD=0.01603      CL= 1.187 CD=0.01599
        CM=-0.1970                CM=-0.1942                CM=-0.1941
 6.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.7045 0.0184 0.0094     1.0043 0.0279 0.0149      1.0283 0.0288 0.0154
  LOWER 0.6603 0.0000 0.0016*    0.9635 0.0000 0.0021      0.7363 0.0000 0.0018
  TOTAL CL= 1.305 CD=0.01100     CL= 1.291 CD=0.01697      CL= 1.289 CD=0.01724
        CM=-0.1979                CM=-0.1946                CM=-0.1943
 7.00     S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
  UPPER 0.9012 0.0269 0.0136     1.0043 0.0320 0.0161      1.0351 0.0336 0.0170
  LOWER 0.6517 0.0000 0.0015*    0.9564 0.0000 0.0019      0.7306 0.0000 0.0017
  TOTAL CL= 1.401 CD=0.01505     CL= 1.393 CD=0.01804      CL= 1.390 CD=0.01870
        CM=-0.1964                CM=-0.1946                CM=-0.1941
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B.L.SUMMARY AIRFOIL S825 17% ALPHA0= 6.114 DEG.
 *-WARNING WITH VARIABLE LIMIT   ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 1500000 MU=3.0				R= 1500000 MU=1.3			R= 1500000 MU=9.0		
8.00	S TURB	S SEP	CD	S TURB	S SEP	CD	S TURB	S SEP	CD
UPPER	1.0070	0.0368	0.0176	1.0070	0.0368	0.0176	1.0379	0.0391	0.0188
LOWER	0.6431	0.0000	0.0014*	0.9564	0.0000	0.0017	0.7246	0.0000	0.0016
TOTAL	CL= 1.493 CD=0.01899			CL= 1.493 CD=0.01936			CL= 1.489 CD=0.02036		
	CM=-0.1943			CM=-0.1943			CM=-0.1934		
9.00	S TURB	S SEP	CD	S TURB	S SEP	CD	S TURB	S SEP	CD
UPPER	1.0277	0.0442	0.0201*	1.0277	0.0442	0.0201*	1.0388	0.0456	0.0208*
LOWER	0.6337	0.0000	0.0013*	0.9564	0.0000	0.0016	0.7193	0.0000	0.0015
TOTAL	CL= 1.589 CD=0.02142			CL= 1.589 CD=0.02175			CL= 1.586 CD=0.02221		
	CM=-0.1928			CM=-0.1928			CM=-0.1923		
10.00	S TURB	S SEP	CD	S TURB	S SEP	CD	S TURB	S SEP	CD
UPPER	1.0363	0.0534	0.0228*	1.0363	0.0534	0.0228*	1.0390	0.0539	0.0230*
LOWER	0.6225	0.0000	0.0012*	0.9293	0.0000	0.0015	0.7148	0.0000	0.0014
TOTAL	CL= 1.680 CD=0.02394			CL= 1.680 CD=0.02424			CL= 1.679 CD=0.02432		
	CM=-0.1906			CM=-0.1906			CM=-0.1903		

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B.L.SUMMARY AIRFOIL S825  17%  ALPHA0=  6.114 DEG.
*-WARNING WITH VARIABLE LIMIT  ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 2000000 MU=3.0        R= 2000000 MU=1.3        R= 2000000 MU=9.0
-7.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.0873 0.0180 0.0015*   1.0043 0.0000 0.0054     0.8461 0.0000 0.0052
    LOWER 1.0055 0.4654 0.0071*   1.0055 0.4654 0.0071*    1.0205 0.4687 0.0074*
    TOTAL CL=-0.112 CD=0.00867    CL=-0.097 CD=0.01257     CL=-0.097 CD=0.01261
          CM=-0.1751              CM=-0.1764               CM=-0.1764
-6.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.0931 0.0172 0.0016    1.0043 0.0000 0.0058     0.8667 0.0000 0.0056
    LOWER 0.7027 0.0000 0.0033    0.9635 0.4329 0.0059     1.0167 0.4468 0.0064
    TOTAL CL=-0.002 CD=0.00496    CL= 0.013 CD=0.01166     CL= 0.013 CD=0.01201
          CM=-0.1752              CM=-0.1788               CM=-0.1788
-5.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.4112 0.0000 0.0034    1.0043 0.0000 0.0062     0.8859 0.0000 0.0060
    LOWER 0.7004 0.4087 0.0031*   0.9635 0.4087 0.0053     1.0081 0.4213 0.0056
    TOTAL CL= 0.123 CD=0.00651    CL= 0.123 CD=0.01150     CL= 0.123 CD=0.01164
          CM=-0.1811              CM=-0.1811               CM=-0.1811
-4.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.4887 0.0000 0.0040    1.0043 0.0004 0.0067     0.9045 0.0003 0.0065
    LOWER 0.6980 0.0000 0.0029*   0.9635 0.3820 0.0048     0.9946 0.3887 0.0050
    TOTAL CL= 0.233 CD=0.00695    CL= 0.232 CD=0.01152     CL= 0.232 CD=0.01147
          CM=-0.1834              CM=-0.1834               CM=-0.1834
-3.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.5462 0.0009 0.0046    1.0043 0.0030 0.0072     0.9207 0.0029 0.0070
    LOWER 0.6956 0.0000 0.0027*   0.9635 0.3442 0.0044     0.9790 0.3497 0.0044
    TOTAL CL= 0.342 CD=0.00736    CL= 0.339 CD=0.01155     CL= 0.340 CD=0.01143
          CM=-0.1855              CM=-0.1853               CM=-0.1854
-2.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.5891 0.0032 0.0051    1.0043 0.0051 0.0077     0.9378 0.0050 0.0075
    LOWER 0.6932 0.0000 0.0026*   0.9635 0.2922 0.0039     0.9617 0.2915 0.0039
    TOTAL CL= 0.449 CD=0.00771    CL= 0.447 CD=0.01167     CL= 0.447 CD=0.01148
          CM=-0.1872              CM=-0.1872               CM=-0.1872
-1.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.6201 0.0048 0.0056    1.0043 0.0071 0.0083     0.9524 0.0069 0.0081
    LOWER 0.6907 0.0000 0.0024*   0.9635 0.2144 0.0036     0.9440 0.1999 0.0035
    TOTAL CL= 0.557 CD=0.00803    CL= 0.555 CD=0.01188     CL= 0.555 CD=0.01166
          CM=-0.1889              CM=-0.1889               CM=-0.1889
 0.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.6412 0.0064 0.0061    1.0043 0.0091 0.0089     0.9676 0.0089 0.0088
    LOWER 0.6881 0.0000 0.0023*   0.9635 0.0000 0.0033     0.9246 0.0000 0.0032
    TOTAL CL= 0.665 CD=0.00833    CL= 0.662 CD=0.01223     CL= 0.662 CD=0.01201
          CM=-0.1906              CM=-0.1898               CM=-0.1898
 1.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.6537 0.0079 0.0065    1.0043 0.0112 0.0096     0.9804 0.0111 0.0095
    LOWER 0.6853 0.0000 0.0021*   0.9635 0.0000 0.0030     0.9039 0.0000 0.0029
    TOTAL CL= 0.773 CD=0.00859    CL= 0.769 CD=0.01264     CL= 0.769 CD=0.01243
          CM=-0.1922              CM=-0.1912               CM=-0.1912
 2.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.6634 0.0094 0.0069    1.0043 0.0136 0.0104     0.9937 0.0135 0.0103
    LOWER 0.6821 0.0000 0.0020*   0.9635 0.0000 0.0028     0.8886 0.0000 0.0027
    TOTAL CL= 0.881 CD=0.00885    CL= 0.875 CD=0.01315     CL= 0.875 CD=0.01299
          CM=-0.1937              CM=-0.1924               CM=-0.1924
 3.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.6730 0.0110 0.0073    1.0043 0.0162 0.0112     1.0055 0.0162 0.0112
    LOWER 0.6790 0.0000 0.0019*   0.9635 0.0000 0.0026     0.7527 0.0000 0.0022
    TOTAL CL= 0.988 CD=0.00915    CL= 0.981 CD=0.01373     CL= 0.981 CD=0.01337
          CM=-0.1951              CM=-0.1935               CM=-0.1935
 4.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.6839 0.0127 0.0078    1.0043 0.0190 0.0121     1.0148 0.0192 0.0122
    LOWER 0.6749 0.0000 0.0018*   0.9635 0.0000 0.0023     0.7506 0.0000 0.0020
    TOTAL CL= 1.095 CD=0.00951    CL= 1.086 CD=0.01441     CL= 1.086 CD=0.01422
          CM=-0.1964              CM=-0.1943               CM=-0.1943
 5.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.6976 0.0146 0.0083    1.0043 0.0221 0.0130     1.0229 0.0230 0.0134
    LOWER 0.6688 0.0000 0.0016*   0.9635 0.0000 0.0022     0.7486 0.0000 0.0019
    TOTAL CL= 1.201 CD=0.00994    CL= 1.190 CD=0.01519     CL= 1.189 CD=0.01532
          CM=-0.1975              CM=-0.1950               CM=-0.1947
 6.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.7144 0.0168 0.0090    1.0043 0.0260 0.0142     1.0318 0.0270 0.0148
    LOWER 0.6603 0.0000 0.0015*   0.9635 0.0000 0.0020     0.7458 0.0000 0.0018
    TOTAL CL= 1.307 CD=0.01048    CL= 1.292 CD=0.01618     CL= 1.292 CD=0.01653
          CM=-0.1985              CM=-0.1953               CM=-0.1949
 7.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
    UPPER 0.9394 0.0264 0.0136    1.0043 0.0299 0.0153     1.0365 0.0316 0.0163
    LOWER 0.6517 0.0000 0.0014*   0.9564 0.0000 0.0018     0.7417 0.0000 0.0016
    TOTAL CL= 1.401 CD=0.01505    CL= 1.396 CD=0.01718     CL= 1.393 CD=0.01790
          CM=-0.1966              CM=-0.1954               CM=-0.1948
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B.L.SUMMARY AIRFOIL S825  17%  ALPHA0=  6.114 DEG.
 *-WARNING WITH VARIABLE LIMIT  ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 2000000 MU=3.0         R= 2000000 MU=1.3          R= 2000000 MU=9.0
    8.00    S TURB  S SEP    CD      S TURB  S SEP    CD        S TURB  S SEP    CD
      UPPER 1.0070 0.0344 0.0167     1.0070 0.0344 0.0167      1.0386 0.0369 0.0179
      LOWER 0.6431 0.0000 0.0013*    0.9564 0.0000 0.0017      0.7360 0.0000 0.0015
      TOTAL CL= 1.497 CD=0.01801     CL= 1.497 CD=0.01839      CL= 1.493 CD=0.01946
            CM=-0.1951               CM=-0.1951                CM=-0.1942
    9.00    S TURB  S SEP    CD      S TURB  S SEP    CD        S TURB  S SEP    CD
      UPPER 1.0277 0.0416 0.0192*    1.0277 0.0416 0.0192*     1.0389 0.0431 0.0198
      LOWER 0.6337 0.0000 0.0012     0.9564 0.0000 0.0015      0.7294 0.0000 0.0014
      TOTAL CL= 1.593 CD=0.02036     CL= 1.593 CD=0.02070      CL= 1.591 CD=0.02120
            CM=-0.1938               CM=-0.1938                CM=-0.1932
   10.00    S TURB  S SEP    CD      S TURB  S SEP    CD        S TURB  S SEP    CD
      UPPER 1.0363 0.0502 0.0217*    1.0363 0.0502 0.0217*     1.0391 0.0508 0.0219*
      LOWER 0.6225 0.0000 0.0011*    0.9293 0.0000 0.0014      0.7233 0.0000 0.0013
      TOTAL CL= 1.686 CD=0.02277     CL= 1.686 CD=0.02308      CL= 1.685 CD=0.02319
            CM=-0.1917               CM=-0.1917                CM=-0.1915
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B.L.SUMMARY AIRFOIL S825  17%  ALPHA0=  6.114 DEG.
*-WARNING WITH VARIABLE LIMIT  ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 2500000 MU=3.0        R= 2500000 MU=1.3         R= 2500000 MU=9.0
-7.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.0903 0.0114 0.0014    1.0043 0.0000 0.0053     0.8671 0.0000 0.0051
   LOWER 1.0055 0.4562 0.0069*   1.0055 0.4562 0.0069*    1.0206 0.4600 0.0071*
   TOTAL CL=-0.106 CD=0.00827    CL=-0.097 CD=0.01215     CL=-0.097 CD=0.01224
         CM=-0.1755              CM=-0.1764               CM=-0.1764
-6.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.3673 0.0000 0.0029    1.0043 0.0000 0.0056     0.8861 0.0000 0.0055
   LOWER 0.7045 0.0000 0.0032    0.9635 0.4211 0.0056     1.0184 0.4394 0.0063
   TOTAL CL= 0.013 CD=0.00608    CL= 0.013 CD=0.01128     CL= 0.013 CD=0.01174
         CM=-0.1788              CM=-0.1788               CM=-0.1788
-5.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.4600 0.0000 0.0035    1.0043 0.0000 0.0060     0.9027 0.0000 0.0058
   LOWER 0.7021 0.0000 0.0030*   0.9635 0.3954 0.0051     1.0104 0.4111 0.0055
   TOTAL CL= 0.123 CD=0.00650    CL= 0.123 CD=0.01109     CL= 0.123 CD=0.01131
         CM=-0.1811              CM=-0.1811               CM=-0.1811
-4.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.5226 0.0000 0.0040    1.0043 0.0000 0.0064     0.9189 0.0000 0.0063
   LOWER 0.6997 0.0000 0.0028*   0.9635 0.3666 0.0046     0.9985 0.3757 0.0048
   TOTAL CL= 0.233 CD=0.00683    CL= 0.233 CD=0.01109     CL= 0.233 CD=0.01110
         CM=-0.1834              CM=-0.1834               CM=-0.1834
-3.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.5717 0.0000 0.0046    1.0043 0.0011 0.0070     0.9345 0.0010 0.0068
   LOWER 0.6972 0.0000 0.0026*   0.9635 0.3259 0.0042     0.9849 0.3345 0.0043
   TOTAL CL= 0.343 CD=0.00720    CL= 0.341 CD=0.01115     CL= 0.342 CD=0.01109
         CM=-0.1857              CM=-0.1856               CM=-0.1856
-2.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6085 0.0015 0.0051    1.0043 0.0038 0.0075     0.9496 0.0037 0.0073
   LOWER 0.6948 0.0000 0.0025*   0.9635 0.2691 0.0038     0.9695 0.2724 0.0038
   TOTAL CL= 0.451 CD=0.00752    CL= 0.449 CD=0.01127     CL= 0.449 CD=0.01115
         CM=-0.1876              CM=-0.1874               CM=-0.1874
-1.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6341 0.0036 0.0055    1.0043 0.0058 0.0080     0.9633 0.0057 0.0079
   LOWER 0.6923 0.0000 0.0023*   0.9635 0.1806 0.0035     0.9536 0.1732 0.0034
   TOTAL CL= 0.559 CD=0.00780    CL= 0.556 CD=0.01148     CL= 0.556 CD=0.01132
         CM=-0.1892              CM=-0.1890               CM=-0.1890
 0.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6496 0.0052 0.0059    1.0043 0.0079 0.0086     0.9757 0.0077 0.0085
   LOWER 0.6897 0.0000 0.0022*   0.9635 0.0000 0.0032     0.9362 0.0000 0.0031
   TOTAL CL= 0.666 CD=0.00804    CL= 0.663 CD=0.01182     CL= 0.663 CD=0.01165
         CM=-0.1909              CM=-0.1901               CM=-0.1902
 1.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6598 0.0067 0.0062    1.0043 0.0100 0.0093     0.9887 0.0099 0.0092
   LOWER 0.6870 0.0000 0.0020*   0.9635 0.0000 0.0029     0.9184 0.0000 0.0029
   TOTAL CL= 0.774 CD=0.00827    CL= 0.770 CD=0.01221     CL= 0.770 CD=0.01208
         CM=-0.1925              CM=-0.1916               CM=-0.1916
 2.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6690 0.0082 0.0066    1.0043 0.0123 0.0100     0.9995 0.0123 0.0100
   LOWER 0.6840 0.0000 0.0019*   0.9635 0.0000 0.0027     0.8995 0.0000 0.0026
   TOTAL CL= 0.882 CD=0.00852    CL= 0.877 CD=0.01270     CL= 0.877 CD=0.01259
         CM=-0.1941              CM=-0.1928               CM=-0.1928
 3.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6788 0.0098 0.0070    1.0043 0.0149 0.0108     1.0092 0.0149 0.0108
   LOWER 0.6805 0.0000 0.0018*   0.9635 0.0000 0.0025     0.8860 0.0000 0.0024
   TOTAL CL= 0.989 CD=0.00881    CL= 0.983 CD=0.01326     CL= 0.983 CD=0.01323
         CM=-0.1955              CM=-0.1939               CM=-0.1939
 4.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6910 0.0115 0.0075    1.0043 0.0177 0.0116     1.0187 0.0179 0.0118
   LOWER 0.6762 0.0000 0.0017*   0.9635 0.0000 0.0023     0.7556 0.0000 0.0020
   TOTAL CL= 1.097 CD=0.00917    CL= 1.088 CD=0.01390     CL= 1.088 CD=0.01377
         CM=-0.1968              CM=-0.1948               CM=-0.1947
 5.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.7049 0.0134 0.0080    1.0043 0.0207 0.0125     1.0259 0.0212 0.0129
   LOWER 0.6702 0.0000 0.0016*   0.9635 0.0000 0.0021     0.7532 0.0000 0.0018
   TOTAL CL= 1.203 CD=0.00959    CL= 1.193 CD=0.01464     CL= 1.192 CD=0.01473
         CM=-0.1980              CM=-0.1955               CM=-0.1953
 6.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.7242 0.0156 0.0087    1.0043 0.0241 0.0136     1.0340 0.0255 0.0143
   LOWER 0.6613 0.0000 0.0015*   0.9635 0.0000 0.0019     0.7508 0.0000 0.0017
   TOTAL CL= 1.309 CD=0.01015    CL= 1.294 CD=0.01548     CL= 1.294 CD=0.01599
         CM=-0.1989              CM=-0.1959               CM=-0.1954
 7.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.9549 0.0255 0.0134    1.0043 0.0282 0.0148     1.0375 0.0300 0.0157
   LOWER 0.6525 0.0000 0.0013*   0.9564 0.0000 0.0018     0.7484 0.0000 0.0016
   TOTAL CL= 1.403 CD=0.01478    CL= 1.398 CD=0.01654     CL= 1.396 CD=0.01730
         CM=-0.1970              CM=-0.1960               CM=-0.1953
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B.L.SUMMARY AIRFOIL S825  17%  ALPHA0=  6.114 DEG.
 *-WARNING WITH VARIABLE LIMIT  ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 2500000 MU=3.0      R= 2500000 MU=1.3       R= 2500000 MU=9.0
  8.00    S TURB  S SEP   CD     S TURB  S SEP   CD      S TURB  S SEP   CD
    UPPER 1.0070 0.0327 0.0161   1.0070 0.0327 0.0161   1.0388 0.0352 0.0173
    LOWER 0.6436 0.0000 0.0013*  0.9564 0.0000 0.0016   0.7446 0.0000 0.0015
    TOTAL CL= 1.500 CD=0.01731   CL= 1.500 CD=0.01770   CL= 1.496 CD=0.01879
          CM=-0.1958             CM=-0.1958             CM=-0.1948
  9.00    S TURB  S SEP   CD     S TURB  S SEP   CD      S TURB  S SEP   CD
    UPPER 1.0277 0.0397 0.0184*  1.0277 0.0397 0.0184*  1.0391 0.0412 0.0191
    LOWER 0.6339 0.0000 0.0012   0.9564 0.0000 0.0015   0.7391 0.0000 0.0014
    TOTAL CL= 1.596 CD=0.01958   CL= 1.596 CD=0.01993   CL= 1.594 CD=0.02046
          CM=-0.1945             CM=-0.1945             CM=-0.1939
 10.00    S TURB  S SEP   CD     S TURB  S SEP   CD      S TURB  S SEP   CD
    UPPER 1.0363 0.0478 0.0208*  1.0363 0.0478 0.0208*  1.0392 0.0485 0.0211
    LOWER 0.6227 0.0000 0.0011*  0.9293 0.0000 0.0014   0.7320 0.0000 0.0013
    TOTAL CL= 1.690 CD=0.02191   CL= 1.690 CD=0.02223   CL= 1.689 CD=0.02236
          CM=-0.1926             CM=-0.1926             CM=-0.1923
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B.L.SUMMARY AIRFOIL S825  17%  ALPHA0=  6.114 DEG.
 *-WARNING WITH VARIABLE LIMIT  ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 3000000 MU=3.0      R= 3000000 MU=1.3        R= 3000000 MU=9.0
-7.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.2640 0.0000 0.0022   1.0043 0.0000 0.0052     0.8806 0.0000 0.0050
    LOWER 1.0055 0.4483 0.0067   1.0055 0.4483 0.0067     1.0207 0.4524 0.0069*
    TOTAL CL=-0.097 CD=0.00882   CL=-0.097 CD=0.01181     CL=-0.097 CD=0.01194
          CM=-0.1764             CM=-0.1764               CM=-0.1764
-6.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.4212 0.0000 0.0031   1.0043 0.0000 0.0055     0.8991 0.0000 0.0054
    LOWER 0.7062 0.0000 0.0031   0.9635 0.4110 0.0055     1.0192 0.4309 0.0061
    TOTAL CL= 0.013 CD=0.00615   CL= 0.013 CD=0.01097     CL= 0.013 CD=0.01146
          CM=-0.1788             CM=-0.1788               CM=-0.1788
-5.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.4945 0.0000 0.0036   1.0043 0.0000 0.0058     0.9144 0.0000 0.0057
    LOWER 0.7037 0.0000 0.0029*  0.9635 0.3838 0.0049     1.0121 0.4015 0.0053
    TOTAL CL= 0.123 CD=0.00647   CL= 0.123 CD=0.01079     CL= 0.123 CD=0.01105
          CM=-0.1811             CM=-0.1811               CM=-0.1811
-4.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.5483 0.0000 0.0041   1.0043 0.0000 0.0062     0.9296 0.0000 0.0061
    LOWER 0.7011 0.0000 0.0027*  0.9635 0.3532 0.0045     1.0014 0.3644 0.0047
    TOTAL CL= 0.233 CD=0.00676   CL= 0.233 CD=0.01074     CL= 0.233 CD=0.01080
          CM=-0.1834             CM=-0.1834               CM=-0.1834
-3.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.5910 0.0000 0.0045   1.0043 0.0000 0.0068     0.9444 0.0000 0.0066
    LOWER 0.6987 0.0000 0.0025*  0.9635 0.3096 0.0041     0.9893 0.3211 0.0042
    TOTAL CL= 0.343 CD=0.00705   CL= 0.343 CD=0.01083     CL= 0.343 CD=0.01082
          CM=-0.1857             CM=-0.1857               CM=-0.1857
-2.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.6228 0.0003 0.0050   1.0043 0.0024 0.0073     0.9578 0.0023 0.0071
    LOWER 0.6962 0.0000 0.0024*  0.9635 0.2481 0.0037     0.9754 0.2552 0.0037
    TOTAL CL= 0.452 CD=0.00736   CL= 0.450 CD=0.01095     CL= 0.450 CD=0.01088
          CM=-0.1879             CM=-0.1876               CM=-0.1876
-1.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.6437 0.0024 0.0054   1.0043 0.0047 0.0078     0.9700 0.0046 0.0077
    LOWER 0.6937 0.0000 0.0022*  0.9635 0.1515 0.0034     0.9602 0.1487 0.0034
    TOTAL CL= 0.560 CD=0.00761   CL= 0.557 CD=0.01116     CL= 0.557 CD=0.01105
          CM=-0.1896             CM=-0.1892               CM=-0.1892
 0.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.6553 0.0041 0.0057   1.0043 0.0068 0.0084     0.9821 0.0067 0.0083
    LOWER 0.6911 0.0000 0.0021*  0.9635 0.0000 0.0031     0.9442 0.0000 0.0031
    TOTAL CL= 0.668 CD=0.00781   CL= 0.665 CD=0.01149     CL= 0.665 CD=0.01137
          CM=-0.1912             CM=-0.1904               CM=-0.1905
 1.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.6647 0.0057 0.0060   1.0043 0.0090 0.0090     0.9935 0.0089 0.0090
    LOWER 0.6885 0.0000 0.0020*  0.9635 0.0000 0.0028     0.9284 0.0000 0.0028
    TOTAL CL= 0.776 CD=0.00803   CL= 0.772 CD=0.01188     CL= 0.772 CD=0.01178
          CM=-0.1929             CM=-0.1919               CM=-0.1919
 2.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.6738 0.0072 0.0064   1.0043 0.0112 0.0097     1.0039 0.0112 0.0097
    LOWER 0.6856 0.0000 0.0019*  0.9635 0.0000 0.0026     0.9108 0.0000 0.0026
    TOTAL CL= 0.883 CD=0.00828   CL= 0.878 CD=0.01234     CL= 0.878 CD=0.01228
          CM=-0.1944             CM=-0.1931               CM=-0.1931
 3.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.6845 0.0088 0.0068   1.0043 0.0138 0.0105     1.0122 0.0139 0.0105
    LOWER 0.6823 0.0000 0.0017   0.9635 0.0000 0.0024     0.8940 0.0000 0.0024
    TOTAL CL= 0.991 CD=0.00857   CL= 0.984 CD=0.01288     CL= 0.984 CD=0.01289
          CM=-0.1958             CM=-0.1942               CM=-0.1942
 4.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.6970 0.0105 0.0073   1.0043 0.0165 0.0113     1.0212 0.0168 0.0115
    LOWER 0.6783 0.0000 0.0016   0.9635 0.0000 0.0022     0.8808 0.0000 0.0022
    TOTAL CL= 1.098 CD=0.00892   CL= 1.089 CD=0.01350     CL= 1.089 CD=0.01364
          CM=-0.1972             CM=-0.1951               CM=-0.1950
 5.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.7114 0.0124 0.0078   1.0043 0.0195 0.0122     1.0285 0.0201 0.0125
    LOWER 0.6730 0.0000 0.0015*  0.9635 0.0000 0.0020     0.7580 0.0000 0.0018
    TOTAL CL= 1.205 CD=0.00934   CL= 1.194 CD=0.01421     CL= 1.193 CD=0.01434
          CM=-0.1983             CM=-0.1959               CM=-0.1957
 6.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.8511 0.0178 0.0103   1.0043 0.0228 0.0131     1.0352 0.0239 0.0138
    LOWER 0.6646 0.0000 0.0014*  0.9635 0.0000 0.0019     0.7552 0.0000 0.0017
    TOTAL CL= 1.306 CD=0.01176   CL= 1.298 CD=0.01502     CL= 1.296 CD=0.01546
          CM=-0.1981             CM=-0.1964               CM=-0.1960
 7.00      S TURB  S SEP   CD     S TURB  S SEP   CD       S TURB  S SEP   CD
    UPPER 0.9638 0.0246 0.0132   1.0043 0.0265 0.0142     1.0383 0.0287 0.0153
    LOWER 0.6556 0.0000 0.0013*  0.9564 0.0000 0.0017     0.7524 0.0000 0.0016
    TOTAL CL= 1.404 CD=0.01451   CL= 1.401 CD=0.01593     CL= 1.398 CD=0.01682
          CM=-0.1973             CM=-0.1966               CM=-0.1958
```

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B.L.SUMMARY AIRFOIL S825  17%  ALPHA0=  6.114 DEG.
 *-WARNING WITH VARIABLE LIMIT  ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 3000000 MU=3.0        R= 3000000 MU=1.3        R= 3000000 MU=9.0
  8.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 1.0070 0.0308 0.0154   1.0070 0.0308 0.0154   1.0389 0.0338 0.0168
   LOWER 0.6467 0.0000 0.0012   0.9564 0.0000 0.0016   0.7498 0.0000 0.0015
   TOTAL CL= 1.503 CD=0.01666   CL= 1.503 CD=0.01703   CL= 1.498 CD=0.01824
         CM=-0.1965             CM=-0.1965             CM=-0.1954
  9.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 1.0277 0.0381 0.0179   1.0277 0.0381 0.0179   1.0391 0.0396 0.0185
   LOWER 0.6372 0.0000 0.0011   0.9564 0.0000 0.0015   0.7464 0.0000 0.0014
   TOTAL CL= 1.599 CD=0.01898   CL= 1.599 CD=0.01932   CL= 1.596 CD=0.01987
         CM=-0.1951             CM=-0.1951             CM=-0.1945
 10.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 1.0363 0.0459 0.0202*  1.0363 0.0459 0.0202*  1.0393 0.0466 0.0205
   LOWER 0.6265 0.0000 0.0010*  0.9293 0.0000 0.0014   0.7406 0.0000 0.0012
   TOTAL CL= 1.693 CD=0.02124   CL= 1.693 CD=0.02155   CL= 1.692 CD=0.02171
         CM=-0.1933             CM=-0.1933             CM=-0.1930
```

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AIRFOIL S826  14%                      -7.00  -6.00  -5.00  -4.00  -3.00  -2.00  -1.00   0.00   1.00
   N      X        Y       NUE  CP-DISTR. FOR THE ABOVE ALPHA REL. CHORD LINE
   1   1.00000  0.00000   0.00    0.265  0.265  0.265  0.266  0.267  0.269  0.271  0.274  0.277
   2   0.99668  0.00103   1.00    0.249  0.247  0.246  0.246  0.246  0.246  0.247  0.249  0.250
   3   0.98719  0.00431   2.00    0.170  0.167  0.164  0.162  0.161  0.160  0.159  0.159  0.160
   4   0.97251  0.00982   3.00    0.044  0.039  0.034  0.030  0.027  0.024  0.021  0.019  0.018
   5   0.95355  0.01695   4.00   -0.102 -0.110 -0.117 -0.124 -0.130 -0.136 -0.141 -0.145 -0.148
   6   0.93072  0.02479   5.00   -0.227 -0.238 -0.249 -0.259 -0.269 -0.277 -0.285 -0.292 -0.299
   7   0.90391  0.03262   6.00   -0.279 -0.293 -0.307 -0.320 -0.333 -0.344 -0.355 -0.365 -0.374
   8   0.87287  0.04029   7.00   -0.276 -0.293 -0.310 -0.326 -0.341 -0.355 -0.369 -0.382 -0.394
   9   0.83778  0.04798   8.00   -0.278 -0.298 -0.317 -0.336 -0.354 -0.371 -0.388 -0.403 -0.418
  10   0.79915  0.05572   9.00   -0.283 -0.306 -0.329 -0.350 -0.371 -0.392 -0.412 -0.431 -0.449
  11   0.75749  0.06341  10.00   -0.292 -0.319 -0.344 -0.370 -0.394 -0.418 -0.441 -0.464 -0.486
  12   0.71333  0.07095  11.00   -0.305 -0.335 -0.364 -0.393 -0.422 -0.449 -0.477 -0.503 -0.529
  13   0.66724  0.07816  12.00   -0.321 -0.355 -0.389 -0.422 -0.455 -0.487 -0.518 -0.549 -0.579
  14   0.61980  0.08489  13.00   -0.341 -0.379 -0.418 -0.455 -0.493 -0.530 -0.566 -0.602 -0.637
  15   0.57161  0.09094  14.00   -0.364 -0.407 -0.450 -0.494 -0.536 -0.579 -0.621 -0.662 -0.704
  16   0.52324  0.09607  15.00   -0.389 -0.438 -0.487 -0.536 -0.585 -0.634 -0.683 -0.731 -0.779
  17   0.47526  0.10005  16.00   -0.415 -0.471 -0.527 -0.584 -0.640 -0.696 -0.752 -0.808 -0.864
  18   0.42820  0.10249  17.00   -0.443 -0.506 -0.570 -0.635 -0.699 -0.764 -0.829 -0.894 -0.959
  19   0.38228  0.10294  18.00   -0.427 -0.497 -0.568 -0.640 -0.712 -0.785 -0.858 -0.931 -1.005
  20   0.33736  0.10133  19.00   -0.364 -0.440 -0.516 -0.594 -0.672 -0.751 -0.831 -0.912 -0.993
  21   0.29361  0.09807  20.00   -0.297 -0.377 -0.460 -0.543 -0.629 -0.715 -0.803 -0.891 -0.981
  22   0.25149  0.09343  21.00   -0.222 -0.309 -0.397 -0.488 -0.581 -0.675 -0.771 -0.869 -0.968
  23   0.21146  0.08758  22.00   -0.139 -0.232 -0.328 -0.426 -0.528 -0.631 -0.737 -0.845 -0.956
  24   0.17395  0.08068  23.00   -0.047 -0.146 -0.250 -0.357 -0.467 -0.581 -0.698 -0.819 -0.942
  25   0.13934  0.07288  24.00    0.060 -0.047 -0.158 -0.275 -0.396 -0.522 -0.652 -0.787 -0.926
  26   0.10801  0.06434  25.00    0.183  0.070 -0.050 -0.177 -0.311 -0.450 -0.596 -0.748 -0.906
  27   0.08026  0.05519  26.00    0.331  0.211  0.083 -0.055 -0.202 -0.357 -0.521 -0.693 -0.874
  28   0.05636  0.04562  27.00    0.504  0.382  0.247  0.100 -0.061 -0.234 -0.419 -0.616 -0.825
  29   0.03651  0.03580  28.00    0.706  0.590  0.455  0.302  0.130 -0.060 -0.269 -0.495 -0.738
  30   0.02088  0.02596  29.00    0.908  0.820  0.703  0.558  0.384  0.182 -0.048 -0.306 -0.592
  31   0.00954  0.01638  30.00    0.995  0.994  0.946  0.850  0.708  0.519  0.284  0.002 -0.326
  32   0.00255  0.00748  31.00    0.481  0.736  0.906  0.990  0.988  0.901  0.728  0.469  0.125
  33   0.00018  0.00159  31.77   -1.668 -0.826 -0.142  0.382  0.747  0.952  0.996  0.880  0.603
  34   0.00000 -0.00005  32.02   -3.399 -2.158 -1.121 -0.288  0.339  0.758  0.971  0.977  0.775
  35   0.00021 -0.00146  32.27   -6.338 -4.467 -2.868 -1.543 -0.494  0.279  0.773  0.989  0.927
  36   0.00093 -0.00274  32.52   -4.942 -3.560 -2.359 -1.339 -0.502  0.151  0.619  0.902  1.000
  37   0.00216 -0.00403  32.77   -4.064 -2.983 -2.029 -1.204 -0.508  0.056  0.490  0.791  0.960
  38   0.00367 -0.00525  33.00   -3.498 -2.606 -1.810 -1.112 -0.512 -0.012  0.389  0.690  0.889
  39   0.01367 -0.01035  34.00   -2.135 -1.659 -1.221 -0.821 -0.460 -0.138  0.145  0.388  0.590
  40   0.02920 -0.01518  35.00   -1.505 -1.199 -0.911 -0.642 -0.393 -0.163  0.046  0.235  0.404
  41   0.04998 -0.01960  36.00   -1.147 -0.928 -0.720 -0.523 -0.336 -0.161  0.002  0.153  0.293
  42   0.07580 -0.02362  37.00   -0.911 -0.744 -0.585 -0.432 -0.286 -0.147 -0.015  0.109  0.226
  43   0.10637 -0.02729  38.00   -0.746 -0.615 -0.487 -0.364 -0.245 -0.131 -0.022  0.082  0.182
  44   0.14133 -0.03091  39.00   -0.624 -0.516 -0.412 -0.310 -0.211 -0.115 -0.023  0.066  0.152
  45   0.17965 -0.03486  40.00   -0.619 -0.524 -0.431 -0.340 -0.251 -0.164 -0.080  0.001  0.080
  46   0.21987 -0.03855  41.00   -0.699 -0.610 -0.523 -0.437 -0.352 -0.270 -0.189 -0.110 -0.033
  47   0.26153 -0.04064  42.00   -0.705 -0.625 -0.546 -0.468 -0.391 -0.315 -0.241 -0.168 -0.097
  48   0.30497 -0.04051  43.00   -0.649 -0.579 -0.510 -0.442 -0.374 -0.307 -0.241 -0.176 -0.112
  49   0.35027 -0.03794  44.00   -0.559 -0.499 -0.440 -0.381 -0.323 -0.265 -0.208 -0.151 -0.095
  50   0.39779 -0.03280  45.00   -0.395 -0.347 -0.300 -0.252 -0.204 -0.157 -0.110 -0.063 -0.016
  51   0.44785 -0.02563  46.00   -0.241 -0.202 -0.164 -0.125 -0.087 -0.048 -0.009  0.029  0.067
  52   0.50032 -0.01720  47.00   -0.090 -0.060 -0.029  0.001  0.032  0.063  0.094  0.126  0.157
  53   0.55484 -0.00841  48.00    0.030  0.054  0.079  0.103  0.128  0.154  0.179  0.204  0.230
  54   0.61055 -0.00015  49.00    0.124  0.144  0.164  0.184  0.204  0.225  0.246  0.267  0.288
  55   0.66644  0.00699  50.00    0.199  0.215  0.231  0.248  0.265  0.282  0.299  0.317  0.334
  56   0.72142  0.01254  51.00    0.259  0.272  0.285  0.299  0.313  0.327  0.342  0.357  0.372
  57   0.77434  0.01621  52.00    0.307  0.318  0.329  0.340  0.352  0.364  0.376  0.388  0.401
  58   0.82409  0.01784  53.00    0.346  0.354  0.363  0.373  0.382  0.392  0.403  0.413  0.424
  59   0.86953  0.01741  54.00    0.376  0.383  0.391  0.399  0.407  0.415  0.423  0.432  0.442
  60   0.90945  0.01498  55.00    0.388  0.394  0.400  0.406  0.413  0.420  0.427  0.435  0.443
  61   0.94257  0.01113  56.00    0.376  0.380  0.385  0.391  0.396  0.402  0.409  0.415  0.422
  62   0.96813  0.00689  57.00    0.347  0.350  0.354  0.359  0.364  0.369  0.374  0.380  0.386
  63   0.98604  0.00324  58.00    0.311  0.313  0.316  0.319  0.323  0.327  0.332  0.337  0.342
  64   0.99655  0.00084  59.00    0.279  0.280  0.282  0.284  0.287  0.290  0.293  0.297  0.302
  65   1.00000  0.00000  60.00    0.265  0.265  0.265  0.266  0.267  0.269  0.271  0.274  0.277
ALPHA0= 6.52 DEGREES  CM0=-0.1802  ETA= 1.102
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AIRFOIL S826  14%                    2.00   3.00   4.00   5.00   6.00   7.00   8.00   9.00  10.00
   N       X         Y      NUE   CP-DISTR. FOR THE ABOVE ALPHA REL. CHORD LINE
   1   1.00000   0.00000   0.00    0.281  0.285  0.289  0.294  0.299  0.305  0.311  0.317  0.324
   2   0.99668   0.00103   1.00    0.253  0.255  0.259  0.262  0.266  0.271  0.276  0.281  0.287
   3   0.98719   0.00431   2.00    0.161  0.162  0.164  0.167  0.170  0.174  0.178  0.182  0.187
   4   0.97251   0.00982   3.00    0.018  0.018  0.018  0.020  0.021  0.024  0.027  0.030  0.034
   5   0.95355   0.01695   4.00   -0.151 -0.153 -0.155 -0.155 -0.155 -0.155 -0.153 -0.151 -0.148
   6   0.93072   0.02479   5.00   -0.304 -0.309 -0.313 -0.316 -0.318 -0.320 -0.321 -0.321 -0.320
   7   0.90391   0.03262   6.00   -0.383 -0.391 -0.397 -0.403 -0.408 -0.413 -0.416 -0.419 -0.420
   8   0.87287   0.04029   7.00   -0.405 -0.415 -0.425 -0.434 -0.442 -0.449 -0.455 -0.460 -0.465
   9   0.83778   0.04798   8.00   -0.433 -0.446 -0.459 -0.471 -0.481 -0.492 -0.501 -0.509 -0.516
  10   0.79915   0.05572   9.00   -0.466 -0.483 -0.499 -0.514 -0.528 -0.542 -0.554 -0.566 -0.576
  11   0.75749   0.06341  10.00   -0.507 -0.527 -0.547 -0.565 -0.583 -0.600 -0.616 -0.631 -0.645
  12   0.71333   0.07095  11.00   -0.554 -0.578 -0.602 -0.625 -0.646 -0.667 -0.688 -0.707 -0.725
  13   0.66724   0.07816  12.00   -0.609 -0.638 -0.666 -0.693 -0.720 -0.745 -0.770 -0.794 -0.817
  14   0.61980   0.08489  13.00   -0.672 -0.706 -0.739 -0.772 -0.804 -0.834 -0.865 -0.894 -0.922
  15   0.57161   0.09094  14.00   -0.744 -0.784 -0.823 -0.862 -0.900 -0.937 -0.973 -1.009 -1.043
  16   0.52324   0.09607  15.00   -0.826 -0.873 -0.919 -0.965 -1.010 -1.054 -1.098 -1.140 -1.182
  17   0.47526   0.10005  16.00   -0.919 -0.974 -1.028 -1.083 -1.136 -1.189 -1.241 -1.292 -1.343
  18   0.42820   0.10249  17.00   -1.023 -1.088 -1.152 -1.216 -1.280 -1.343 -1.405 -1.467 -1.528
  19   0.38228   0.10294  18.00   -1.078 -1.152 -1.226 -1.300 -1.373 -1.446 -1.519 -1.591 -1.662
  20   0.33736   0.10133  19.00   -1.075 -1.157 -1.239 -1.321 -1.403 -1.486 -1.568 -1.650 -1.732
  21   0.29361   0.09807  20.00   -1.071 -1.163 -1.254 -1.347 -1.439 -1.532 -1.625 -1.719 -1.812
  22   0.25149   0.09343  21.00   -1.069 -1.171 -1.274 -1.377 -1.482 -1.587 -1.693 -1.800 -1.906
  23   0.21146   0.08758  22.00   -1.068 -1.182 -1.298 -1.415 -1.534 -1.654 -1.775 -1.897 -2.020
  24   0.17395   0.08068  23.00   -1.068 -1.197 -1.328 -1.462 -1.598 -1.736 -1.875 -2.017 -2.160
  25   0.13934   0.07288  24.00   -1.068 -1.215 -1.365 -1.519 -1.676 -1.836 -1.998 -2.164 -2.332
  26   0.10801   0.06434  25.00   -1.069 -1.237 -1.411 -1.590 -1.773 -1.962 -2.154 -2.350 -2.551
  27   0.08026   0.05519  26.00   -1.062 -1.259 -1.462 -1.673 -1.891 -2.115 -2.346 -2.583 -2.826
  28   0.05636   0.04562  27.00   -1.046 -1.277 -1.520 -1.774 -2.038 -2.311 -2.595 -2.888 -3.190
  29   0.03651   0.03580  28.00   -0.999 -1.277 -1.572 -1.882 -2.209 -2.551 -2.908 -3.280 -3.665
  30   0.02088   0.02596  29.00   -0.905 -1.244 -1.610 -2.002 -2.419 -2.861 -3.327 -3.818 -4.331
  31   0.00954   0.01638  30.00   -0.699 -1.117 -1.580 -2.087 -2.637 -3.230 -3.865 -4.541 -5.258
  32   0.00255   0.00748  31.00   -0.303 -0.816 -1.412 -2.091 -2.852 -3.694 -4.616 -5.617 -6.696
  33   0.00018   0.00159  31.77    0.167 -0.429 -1.184 -2.096 -3.165 -4.390 -5.769 -7.299 -8.980
  34   0.00000  -0.00005  32.02    0.365 -0.250 -1.072 -2.099 -3.330 -4.762 -6.395 -8.227-10.254
  35   0.00021  -0.00146  32.27    0.586 -0.033 -0.930 -2.103 -3.551 -5.271 -7.263 -9.524-12.050
  36   0.00093  -0.00274  32.52    0.912  0.638  0.180 -0.464 -1.291 -2.301 -3.493 -4.865 -6.416
  37   0.00216  -0.00403  32.77    0.997  0.901  0.672  0.312 -0.180 -0.804 -1.557 -2.440 -3.452
  38   0.00367  -0.00525  33.00    0.988  0.986  0.883  0.679  0.375 -0.030 -0.535 -1.138 -1.841
  39   0.01367  -0.01035  34.00    0.753  0.874  0.955  0.995  0.994  0.953  0.870  0.747  0.583
  40   0.02920  -0.01518  35.00    0.552  0.679  0.785  0.870  0.934  0.977  0.998  0.997  0.975
  41   0.04998  -0.01960  36.00    0.420  0.535  0.638  0.728  0.805  0.870  0.921  0.960  0.986
  42   0.07580  -0.02362  37.00    0.335  0.436  0.529  0.613  0.690  0.759  0.819  0.870  0.913
  43   0.10637  -0.02729  38.00    0.275  0.364  0.447  0.525  0.597  0.664  0.724  0.779  0.828
  44   0.14133  -0.03091  39.00    0.234  0.312  0.386  0.457  0.523  0.586  0.644  0.698  0.748
  45   0.17965  -0.03486  40.00    0.156  0.230  0.300  0.368  0.432  0.494  0.552  0.607  0.658
  46   0.21987  -0.03855  41.00    0.041  0.114  0.184  0.251  0.316  0.379  0.439  0.496  0.551
  47   0.26153  -0.04064  42.00   -0.027  0.041  0.108  0.172  0.234  0.295  0.353  0.410  0.464
  48   0.30497  -0.04051  43.00   -0.049  0.012  0.073  0.132  0.189  0.245  0.300  0.353  0.404
  49   0.35027  -0.03794  44.00   -0.040  0.015  0.068  0.121  0.172  0.223  0.272  0.321  0.368
  50   0.39779  -0.03280  45.00    0.030  0.075  0.120  0.165  0.208  0.252  0.294  0.335  0.376
  51   0.44785  -0.02563  46.00    0.105  0.143  0.180  0.218  0.254  0.291  0.326  0.362  0.396
  52   0.50032  -0.01720  47.00    0.188  0.219  0.249  0.280  0.310  0.341  0.370  0.400  0.429
  53   0.55484  -0.00841  48.00    0.255  0.281  0.307  0.332  0.357  0.383  0.408  0.433  0.458
  54   0.61055  -0.00015  49.00    0.309  0.331  0.352  0.374  0.395  0.417  0.438  0.459  0.481
  55   0.66644   0.00699  50.00    0.352  0.370  0.389  0.407  0.425  0.444  0.462  0.481  0.499
  56   0.72142   0.01254  51.00    0.387  0.402  0.418  0.433  0.449  0.465  0.481  0.497  0.513
  57   0.77434   0.01621  52.00    0.414  0.427  0.440  0.454  0.468  0.481  0.495  0.509  0.524
  58   0.82409   0.01784  53.00    0.435  0.446  0.458  0.470  0.481  0.494  0.506  0.518  0.531
  59   0.86953   0.01741  54.00    0.451  0.461  0.471  0.481  0.491  0.502  0.512  0.523  0.534
  60   0.90945   0.01498  55.00    0.451  0.460  0.468  0.477  0.486  0.496  0.506  0.515  0.526
  61   0.94257   0.01113  56.00    0.430  0.437  0.445  0.453  0.462  0.470  0.479  0.488  0.498
  62   0.96813   0.00689  57.00    0.393  0.400  0.407  0.414  0.422  0.430  0.439  0.447  0.456
  63   0.98604   0.00324  58.00    0.348  0.354  0.360  0.367  0.374  0.382  0.390  0.398  0.406
  64   0.99655   0.00084  59.00    0.306  0.311  0.317  0.323  0.329  0.336  0.343  0.350  0.358
  65   1.00000   0.00000  60.00    0.281  0.285  0.289  0.294  0.299  0.305  0.311  0.317  0.324
ALPHA0= 6.52 DEGREES  CM0=-0.1802  ETA= 1.102
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B.L.SUMMARY AIRFOIL S826  14%  ALPHA0=  6.520 DEG.
*-WARNING WITH VARIABLE LIMIT  ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 1000000 MU=3.0        R= 1000000 MU=1.3        R= 1000000 MU=9.0
-7.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.0829 0.0332 0.0021      1.0022 0.0000 0.0060      0.7555 0.0000 0.0056
    LOWER 1.0097 1.0084 0.0023*     1.0097 1.0084 0.0023*     1.0097 1.0079 0.0024*
    TOTAL CL=-0.078 CD=0.00445      CL=-0.053 CD=0.00837      CL=-0.053 CD=0.00798
          CM=-0.1786                CM=-0.1787                CM=-0.1787
-6.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.0888 0.0321 0.0022      1.0022 0.0000 0.0065      0.7862 0.0000 0.0061
    LOWER 1.0096 0.2550 0.0062*     1.0096 0.2550 0.0062*     1.0096 0.2550 0.0062*
    TOTAL CL= 0.031 CD=0.00844      CL= 0.057 CD=0.01271      CL= 0.057 CD=0.01229
          CM=-0.1768                CM=-0.1807                CM=-0.1807
-5.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.3519 0.0000 0.0037      1.0022 0.0018 0.0070      0.8116 0.0008 0.0065
    LOWER 1.0093 0.1912 0.0055*     1.0093 0.1912 0.0055*     1.0093 0.1912 0.0055*
    TOTAL CL= 0.167 CD=0.00917      CL= 0.166 CD=0.01247      CL= 0.167 CD=0.01201
          CM=-0.1828                CM=-0.1825                CM=-0.1826
-4.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.4343 0.0011 0.0044      1.0033 0.0044 0.0075      0.8404 0.0037 0.0071
    LOWER 0.6496 0.0000 0.0030      0.9564 0.0000 0.0046      1.0015 0.0000 0.0049*
    TOTAL CL= 0.276 CD=0.00738      CL= 0.273 CD=0.01212      CL= 0.274 CD=0.01193
          CM=-0.1845                CM=-0.1838                CM=-0.1839
-3.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.4818 0.0035 0.0050      1.0034 0.0064 0.0081      0.8631 0.0057 0.0076
    LOWER 0.6425 0.0000 0.0027*     0.9564 0.0000 0.0042      0.9849 0.0000 0.0043
    TOTAL CL= 0.384 CD=0.00771      CL= 0.381 CD=0.01227      CL= 0.382 CD=0.01194
          CM=-0.1860                CM=-0.1853                CM=-0.1854
-2.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.5118 0.0052 0.0054      1.0034 0.0083 0.0087      0.8902 0.0076 0.0082
    LOWER 0.6372 0.0000 0.0026*     0.9564 0.0000 0.0038      0.9601 0.0000 0.0039
    TOTAL CL= 0.492 CD=0.00798      CL= 0.489 CD=0.01251      CL= 0.489 CD=0.01210
          CM=-0.1876                CM=-0.1867                CM=-0.1869
-1.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.5316 0.0067 0.0058      1.0034 0.0103 0.0093      0.9104 0.0096 0.0089
    LOWER 0.6321 0.0000 0.0024*     0.9564 0.0000 0.0035      0.9341 0.0000 0.0035
    TOTAL CL= 0.600 CD=0.00823      CL= 0.596 CD=0.01286      CL= 0.597 CD=0.01239
          CM=-0.1891                CM=-0.1881                CM=-0.1883
 0.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.5449 0.0082 0.0062      1.0034 0.0125 0.0100      0.9326 0.0122 0.0097
    LOWER 0.6270 0.0000 0.0023*     0.9564 0.0000 0.0033      0.9043 0.0000 0.0032
    TOTAL CL= 0.708 CD=0.00846      CL= 0.703 CD=0.01328      CL= 0.703 CD=0.01287
          CM=-0.1906                CM=-0.1894                CM=-0.1895
 1.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.5542 0.0096 0.0066      1.0034 0.0150 0.0108      0.9527 0.0146 0.0105
    LOWER 0.6215 0.0000 0.0021*     0.9564 0.0000 0.0030      0.8803 0.0000 0.0029
    TOTAL CL= 0.816 CD=0.00869      CL= 0.809 CD=0.01379      CL= 0.810 CD=0.01340
          CM=-0.1921                CM=-0.1906                CM=-0.1907
 2.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.5626 0.0112 0.0069*     1.0034 0.0176 0.0116      0.9705 0.0173 0.0114
    LOWER 0.6151 0.0000 0.0020*     0.9564 0.0000 0.0028      0.7453 0.0000 0.0024
    TOTAL CL= 0.923 CD=0.00893      CL= 0.915 CD=0.01440      CL= 0.915 CD=0.01382
          CM=-0.1936                CM=-0.1916                CM=-0.1917
 3.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.5712 0.0129 0.0074*     1.0034 0.0204 0.0126      0.9881 0.0202 0.0124
    LOWER 0.6063 0.0000 0.0019*     0.9564 0.0000 0.0025      0.7373 0.0000 0.0022
    TOTAL CL= 1.030 CD=0.00921      CL= 1.020 CD=0.01512      CL= 1.021 CD=0.01468
          CM=-0.1949                CM=-0.1925                CM=-0.1926
 4.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.5812 0.0147 0.0078      1.0034 0.0235 0.0136      1.0010 0.0235 0.0136
    LOWER 0.5934 0.0000 0.0017*     0.9564 0.0000 0.0023      0.7283 0.0000 0.0021
    TOTAL CL= 1.137 CD=0.00954      CL= 1.125 CD=0.01594      CL= 1.125 CD=0.01565
          CM=-0.1961                CM=-0.1933                CM=-0.1933
 5.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.5939 0.0167 0.0084      1.0034 0.0270 0.0147      1.0131 0.0272 0.0149
    LOWER 0.5786 0.0000 0.0016*     0.9564 0.0000 0.0022      0.7179 0.0000 0.0019
    TOTAL CL= 1.243 CD=0.00995      CL= 1.229 CD=0.01688      CL= 1.228 CD=0.01679
          CM=-0.1972                CM=-0.1938                CM=-0.1937
 6.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.6099 0.0190 0.0090      1.0034 0.0309 0.0160      1.0259 0.0317 0.0164
    LOWER 0.5621 0.0000 0.0015*     0.9564 0.0000 0.0020      0.7060 0.0000 0.0018
    TOTAL CL= 1.349 CD=0.01048      CL= 1.331 CD=0.01795      CL= 1.330 CD=0.01820
          CM=-0.1981                CM=-0.1941                CM=-0.1938
 7.00     S TURB  S SEP    CD       S TURB  S SEP    CD       S TURB  S SEP    CD
    UPPER 0.9914 0.0347 0.0170      1.0034 0.0353 0.0173*     1.0335 0.0368 0.0182*
    LOWER 0.5478 0.0000 0.0014*     0.9565 0.0000 0.0018      0.6915 0.0000 0.0016
    TOTAL CL= 1.434 CD=0.01836      CL= 1.433 CD=0.01917      CL= 1.431 CD=0.01983
          CM=-0.1943                CM=-0.1941                CM=-0.1936
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B.L.SUMMARY AIRFOIL S826 14% ALPHA0= 6.520 DEG.
*-WARNING WITH VARIABLE LIMIT ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 1000000 MU=3.0			R= 1000000 MU=1.3			R= 1000000 MU=9.0		
8.00	S TURB	S SEP	CD	S TURB	S SEP	CD	S TURB	S SEP	CD
UPPER	1.0324	0.0422	0.0200*	1.0324	0.0422	0.0200*	1.0367	0.0425	0.0201*
LOWER	0.5341	0.0000	0.0013*	0.9564	0.0000	0.0017	0.6765	0.0000	0.0015
TOTAL	CL= 1.530 CD=0.02123			CL= 1.530 CD=0.02166			CL= 1.530 CD=0.02163		
	CM=-0.1931			CM=-0.1931			CM=-0.1930		
9.00	S TURB	S SEP	CD	S TURB	S SEP	CD	S TURB	S SEP	CD
UPPER	1.0368	0.0498	0.0223*	1.0368	0.0498	0.0223*	1.0370	0.0498	0.0223*
LOWER	0.5195	0.0000	0.0012*	0.9564	0.0000	0.0016	0.6655	0.0000	0.0014
TOTAL	CL= 1.625 CD=0.02345			CL= 1.625 CD=0.02384			CL= 1.625 CD=0.02369		
	CM=-0.1918			CM=-0.1918			CM=-0.1918		
10.00	S TURB	S SEP	CD	S TURB	S SEP	CD	S TURB	S SEP	CD
UPPER	1.0370	0.0588	0.0247*	1.0370	0.0588	0.0247*	1.0371	0.0588	0.0247*
LOWER	0.4949	0.0000	0.0011	0.9303	0.0000	0.0014	0.6571	0.0000	0.0013
TOTAL	CL= 1.717 CD=0.02577			CL= 1.717 CD=0.02614			CL= 1.717 CD=0.02602		
	CM=-0.1898			CM=-0.1898			CM=-0.1898		

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B.L.SUMMARY AIRFOIL S826  14%  ALPHA0=  6.520 DEG.
*-WARNING WITH VARIABLE LIMIT  ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 1500000 MU=3.0      R= 1500000 MU=1.3        R= 1500000 MU=9.0
-7.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.0876 0.0216 0.0018   1.0022 0.0000 0.0057   0.8173 0.0000 0.0054
   LOWER 1.0097 0.2765 0.0066*  1.0097 0.2765 0.0066*  1.0098 0.2777 0.0066*
   TOTAL CL=-0.069 CD=0.00834   CL=-0.053 CD=0.01226   CL=-0.053 CD=0.01204
         CM=-0.1763             CM=-0.1787             CM=-0.1787
-6.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.3395 0.0000 0.0031   1.0022 0.0000 0.0061   0.8374 0.0000 0.0058
   LOWER 1.0096 0.2236 0.0058*  1.0096 0.2236 0.0058*  1.0097 0.2238 0.0058*
   TOTAL CL= 0.057 CD=0.00895   CL= 0.057 CD=0.01187   CL= 0.057 CD=0.01162
         CM=-0.1807             CM=-0.1807             CM=-0.1807
-5.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.4292 0.0000 0.0038   1.0022 0.0000 0.0065   0.8586 0.0000 0.0062
   LOWER 1.0093 0.1526 0.0051*  1.0093 0.1526 0.0051*  1.0094 0.1527 0.0051*
   TOTAL CL= 0.167 CD=0.00891   CL= 0.167 CD=0.01162   CL= 0.167 CD=0.01136
         CM=-0.1828             CM=-0.1828             CM=-0.1828
-4.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.4801 0.0000 0.0043   1.0033 0.0007 0.0070   0.8827 0.0005 0.0068
   LOWER 0.6556 0.0000 0.0027   0.9564 0.0000 0.0043   1.0036 0.0000 0.0046*
   TOTAL CL= 0.277 CD=0.00701   CL= 0.277 CD=0.01131   CL= 0.277 CD=0.01134
         CM=-0.1848             CM=-0.1846             CM=-0.1847
-3.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.5117 0.0005 0.0047   1.0034 0.0037 0.0075   0.8999 0.0034 0.0073
   LOWER 0.6474 0.0000 0.0025*  0.9564 0.0000 0.0039   0.9916 0.0000 0.0041
   TOTAL CL= 0.387 CD=0.00725   CL= 0.384 CD=0.01146   CL= 0.384 CD=0.01136
         CM=-0.1867             CM=-0.1859             CM=-0.1860
-2.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.5327 0.0027 0.0051   1.0034 0.0058 0.0081   0.9200 0.0056 0.0078
   LOWER 0.6407 0.0000 0.0024*  0.9564 0.0000 0.0036   0.9721 0.0000 0.0037
   TOTAL CL= 0.494 CD=0.00745   CL= 0.491 CD=0.01170   CL= 0.491 CD=0.01150
         CM=-0.1882             CM=-0.1874             CM=-0.1874
-1.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.5457 0.0044 0.0054   1.0034 0.0079 0.0087   0.9373 0.0076 0.0084
   LOWER 0.6346 0.0000 0.0022*  0.9564 0.0000 0.0033   0.9508 0.0000 0.0033
   TOTAL CL= 0.602 CD=0.00762   CL= 0.599 CD=0.01201   CL= 0.599 CD=0.01177
         CM=-0.1897             CM=-0.1888             CM=-0.1889
 0.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.5549 0.0059 0.0057   1.0034 0.0100 0.0093   0.9553 0.0098 0.0091
   LOWER 0.6287 0.0000 0.0021*  0.9564 0.0000 0.0031   0.9313 0.0000 0.0030
   TOTAL CL= 0.710 CD=0.00780   CL= 0.706 CD=0.01240   CL= 0.706 CD=0.01216
         CM=-0.1913             CM=-0.1901             CM=-0.1902
 1.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.5630 0.0074 0.0060   1.0034 0.0123 0.0101   0.9698 0.0121 0.0099
   LOWER 0.6226 0.0000 0.0019*  0.9564 0.0000 0.0028   0.9048 0.0000 0.0028
   TOTAL CL= 0.818 CD=0.00799   CL= 0.812 CD=0.01288   CL= 0.813 CD=0.01262
         CM=-0.1928             CM=-0.1913             CM=-0.1914
 2.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.5712 0.0089 0.0064   1.0034 0.0149 0.0108   0.9853 0.0148 0.0107
   LOWER 0.6154 0.0000 0.0018*  0.9564 0.0000 0.0026   0.8846 0.0000 0.0025
   TOTAL CL= 0.926 CD=0.00821   CL= 0.918 CD=0.01343   CL= 0.919 CD=0.01323
         CM=-0.1942             CM=-0.1924             CM=-0.1925
 3.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.5805 0.0105 0.0068   1.0034 0.0177 0.0117   0.9986 0.0176 0.0116
   LOWER 0.6063 0.0000 0.0017*  0.9564 0.0000 0.0024   0.7592 0.0000 0.0021
   TOTAL CL= 1.033 CD=0.00848   CL= 1.024 CD=0.01408   CL= 1.024 CD=0.01377
         CM=-0.1956             CM=-0.1934             CM=-0.1934
 4.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.5921 0.0123 0.0072   1.0034 0.0210 0.0127   1.0096 0.0211 0.0128
   LOWER 0.5934 0.0000 0.0016*  0.9564 0.0000 0.0022   0.7507 0.0000 0.0020
   TOTAL CL= 1.140 CD=0.00879   CL= 1.128 CD=0.01492   CL= 1.128 CD=0.01476
         CM=-0.1969             CM=-0.1941             CM=-0.1940
 5.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.6053 0.0142 0.0077   1.0034 0.0243 0.0137   1.0187 0.0247 0.0140
   LOWER 0.5786 0.0000 0.0015   0.9564 0.0000 0.0020   0.7423 0.0000 0.0018
   TOTAL CL= 1.247 CD=0.00917   CL= 1.233 CD=0.01578   CL= 1.232 CD=0.01581
         CM=-0.1981             CM=-0.1947             CM=-0.1945
 6.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.6247 0.0165 0.0084   1.0034 0.0280 0.0149   1.0312 0.0290 0.0154
   LOWER 0.5621 0.0000 0.0013*  0.9564 0.0000 0.0019   0.7332 0.0000 0.0017
   TOTAL CL= 1.353 CD=0.00970   CL= 1.334 CD=0.01675   CL= 1.334 CD=0.01715
         CM=-0.1990             CM=-0.1950             CM=-0.1947
 7.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 0.9914 0.0316 0.0158   1.0034 0.0321 0.0161   1.0355 0.0338 0.0170
   LOWER 0.5478 0.0000 0.0012*  0.9564 0.0000 0.0017   0.7221 0.0000 0.0016
   TOTAL CL= 1.439 CD=0.01702   CL= 1.438 CD=0.01784   CL= 1.435 CD=0.01861
         CM=-0.1954             CM=-0.1952             CM=-0.1946
```

B.L.SUMMARY AIRFOIL S826 14% ALPHA0= 6.520 DEG.
 *-WARNING WITH VARIABLE LIMIT ALPHA REL. CHORD LINE

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ALPHA(DEG.) R= 1500000 MU=3.0        R= 1500000 MU=1.3        R= 1500000 MU=9.0
  8.00     S TURB  S SEP   CD     S TURB  S SEP   CD      S TURB  S SEP    CD
     UPPER 1.0324 0.0389 0.0186*  1.0324 0.0389 0.0186*  1.0369 0.0393 0.0188*
     LOWER 0.5341 0.0000 0.0012*  0.9564 0.0000 0.0016   0.7090 0.0000 0.0015
     TOTAL CL= 1.535 CD=0.01980   CL= 1.535 CD=0.02024   CL= 1.535 CD=0.02029
           CM=-0.1943            CM=-0.1943             CM=-0.1942
  9.00     S TURB  S SEP   CD     S TURB  S SEP   CD      S TURB  S SEP    CD
     UPPER 1.0368 0.0457 0.0208*  1.0368 0.0457 0.0208*  1.0371 0.0458 0.0208*
     LOWER 0.5195 0.0000 0.0011   0.9564 0.0000 0.0015   0.6956 0.0000 0.0013
     TOTAL CL= 1.632 CD=0.02188   CL= 1.632 CD=0.02228   CL= 1.632 CD=0.02217
           CM=-0.1932            CM=-0.1932             CM=-0.1932
 10.00     S TURB  S SEP   CD     S TURB  S SEP   CD      S TURB  S SEP    CD
     UPPER 1.0370 0.0542 0.0231*  1.0370 0.0542 0.0231*  1.0372 0.0543 0.0231*
     LOWER 0.4949 0.0000 0.0010   0.9303 0.0000 0.0014   0.6795 0.0000 0.0012
     TOTAL CL= 1.725 CD=0.02406   CL= 1.725 CD=0.02444   CL= 1.725 CD=0.02435
           CM=-0.1914            CM=-0.1914             CM=-0.1914
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B.L.SUMMARY AIRFOIL S826  14%  ALPHA0=  6.520 DEG.
*-WARNING WITH VARIABLE LIMIT   ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 2000000 MU=3.0      R= 2000000 MU=1.3       R= 2000000 MU=9.0
-7.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.2873 0.0000 0.0025     1.0022 0.0000 0.0055    0.8474 0.0000 0.0053
    LOWER 1.0097 0.2571 0.0063*    1.0097 0.2571 0.0063*   1.0098 0.2579 0.0063*
    TOTAL CL=-0.053 CD=0.00885     CL=-0.053 CD=0.01178    CL=-0.053 CD=0.01161
          CM=-0.1787               CM=-0.1787              CM=-0.1787
-6.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.4107 0.0000 0.0033     1.0022 0.0000 0.0058    0.8652 0.0000 0.0056
    LOWER 1.0096 0.1985 0.0056*    1.0096 0.1985 0.0056*   1.0097 0.1988 0.0056*
    TOTAL CL= 0.057 CD=0.00888     CL= 0.057 CD=0.01139    CL= 0.057 CD=0.01121
          CM=-0.1807               CM=-0.1807              CM=-0.1807
-5.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.4698 0.0000 0.0038     1.0022 0.0000 0.0062    0.8858 0.0000 0.0060
    LOWER 1.0093 0.0000 0.0049*    1.0093 0.0000 0.0049*   1.0095 0.1062 0.0049*
    TOTAL CL= 0.167 CD=0.00874     CL= 0.167 CD=0.01114    CL= 0.167 CD=0.01096
          CM=-0.1828               CM=-0.1828              CM=-0.1828
-4.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.5062 0.0000 0.0042     1.0033 0.0000 0.0067    0.9038 0.0000 0.0065
    LOWER 0.6613 0.0000 0.0026     0.9564 0.0000 0.0041    1.0059 0.0000 0.0044
    TOTAL CL= 0.277 CD=0.00676     CL= 0.277 CD=0.01078    CL= 0.277 CD=0.01088
          CM=-0.1848               CM=-0.1848              CM=-0.1848
-3.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.5297 0.0000 0.0045     1.0034 0.0014 0.0072    0.9204 0.0011 0.0070
    LOWER 0.6518 0.0000 0.0024*    0.9564 0.0000 0.0038    0.9961 0.0000 0.0039
    TOTAL CL= 0.387 CD=0.00693     CL= 0.386 CD=0.01096    CL= 0.386 CD=0.01094
          CM=-0.1868               CM=-0.1865              CM=-0.1866
-2.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.5443 0.0006 0.0049     1.0034 0.0041 0.0077    0.9377 0.0039 0.0075
    LOWER 0.6445 0.0000 0.0022*    0.9564 0.0000 0.0035    0.9792 0.0000 0.0035
    TOTAL CL= 0.497 CD=0.00710     CL= 0.493 CD=0.01119    CL= 0.493 CD=0.01110
          CM=-0.1887               CM=-0.1878              CM=-0.1879
-1.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.5537 0.0026 0.0051     1.0034 0.0063 0.0083    0.9529 0.0061 0.0081
    LOWER 0.6382 0.0000 0.0021*    0.9564 0.0000 0.0032    0.9607 0.0000 0.0032
    TOTAL CL= 0.604 CD=0.00724     CL= 0.600 CD=0.01149    CL= 0.601 CD=0.01134
          CM=-0.1902               CM=-0.1892              CM=-0.1893
 0.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.5618 0.0043 0.0054     1.0034 0.0085 0.0089    0.9669 0.0083 0.0088
    LOWER 0.6324 0.0000 0.0020*    0.9564 0.0000 0.0029    0.9427 0.0000 0.0029
    TOTAL CL= 0.712 CD=0.00740     CL= 0.708 CD=0.01187    CL= 0.708 CD=0.01169
          CM=-0.1917               CM=-0.1906              CM=-0.1906
 1.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.5697 0.0058 0.0057     1.0034 0.0107 0.0096    0.9811 0.0106 0.0095
    LOWER 0.6265 0.0000 0.0018*    0.9564 0.0000 0.0027    0.9210 0.0000 0.0027
    TOTAL CL= 0.820 CD=0.00758     CL= 0.814 CD=0.01231    CL= 0.814 CD=0.01215
          CM=-0.1933               CM=-0.1918              CM=-0.1919
 2.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.5784 0.0074 0.0061     1.0034 0.0132 0.0103    0.9933 0.0131 0.0103
    LOWER 0.6199 0.0000 0.0017     0.9564 0.0000 0.0025    0.8982 0.0000 0.0024
    TOTAL CL= 0.928 CD=0.00779     CL= 0.921 CD=0.01284    CL= 0.921 CD=0.01271
          CM=-0.1947               CM=-0.1929              CM=-0.1930
 3.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.5889 0.0089 0.0064     1.0034 0.0160 0.0111    1.0039 0.0160 0.0112
    LOWER 0.6119 0.0000 0.0016*    0.9564 0.0000 0.0023    0.8823 0.0000 0.0022
    TOTAL CL= 1.035 CD=0.00805     CL= 1.026 CD=0.01345    CL= 1.026 CD=0.01340
          CM=-0.1961               CM=-0.1939              CM=-0.1939
 4.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.6006 0.0106 0.0069     1.0034 0.0189 0.0120    1.0146 0.0191 0.0122
    LOWER 0.5998 0.0000 0.0015*    0.9564 0.0000 0.0021    0.7678 0.0000 0.0019
    TOTAL CL= 1.143 CD=0.00835     CL= 1.131 CD=0.01416    CL= 1.131 CD=0.01408
          CM=-0.1974               CM=-0.1947              CM=-0.1947
 5.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.6150 0.0126 0.0073     1.0034 0.0221 0.0130    1.0235 0.0226 0.0133
    LOWER 0.5850 0.0000 0.0014     0.9564 0.0000 0.0020    0.7589 0.0000 0.0018
    TOTAL CL= 1.249 CD=0.00873     CL= 1.236 CD=0.01495    CL= 1.235 CD=0.01508
          CM=-0.1986               CM=-0.1954              CM=-0.1953
 6.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.8290 0.0200 0.0109     1.0034 0.0256 0.0140    1.0328 0.0270 0.0148
    LOWER 0.5682 0.0000 0.0013     0.9564 0.0000 0.0018    0.7501 0.0000 0.0017
    TOTAL CL= 1.348 CD=0.01215     CL= 1.337 CD=0.01586    CL= 1.337 CD=0.01642
          CM=-0.1978               CM=-0.1959              CM=-0.1954
 7.00     S TURB  S SEP    CD      S TURB  S SEP    CD     S TURB  S SEP    CD
    UPPER 0.9914 0.0289 0.0149     1.0034 0.0295 0.0152    1.0366 0.0317 0.0163
    LOWER 0.5531 0.0000 0.0012*    0.9564 0.0000 0.0017    0.7414 0.0000 0.0015
    TOTAL CL= 1.443 CD=0.01606     CL= 1.442 CD=0.01687    CL= 1.439 CD=0.01781
          CM=-0.1963               CM=-0.1961              CM=-0.1953
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B.L.SUMMARY AIRFOIL S826  14%  ALPHA0=  6.520 DEG.
 *-WARNING WITH VARIABLE LIMIT  ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 2000000 MU=3.0       R= 2000000 MU=1.3        R= 2000000 MU=9.0
  8.00    S TURB  S SEP   CD     S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 1.0324 0.0366 0.0178*  1.0324 0.0366 0.0178*  1.0371 0.0370 0.0180*
   LOWER 0.5386 0.0000 0.0011   0.9564 0.0000 0.0015   0.7309 0.0000 0.0014
   TOTAL CL= 1.539 CD=0.01885   CL= 1.539 CD=0.01930   CL= 1.538 CD=0.01939
         CM=-0.1951             CM=-0.1951             CM=-0.1950
  9.00    S TURB  S SEP   CD     S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 1.0368 0.0430 0.0198*  1.0368 0.0430 0.0198*  1.0372 0.0431 0.0199*
   LOWER 0.5242 0.0000 0.0010   0.9564 0.0000 0.0014   0.7181 0.0000 0.0013
   TOTAL CL= 1.636 CD=0.02085   CL= 1.636 CD=0.02125   CL= 1.636 CD=0.02117
         CM=-0.1942             CM=-0.1942             CM=-0.1941
 10.00    S TURB  S SEP   CD     S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 1.0370 0.0510 0.0220*  1.0370 0.0510 0.0220*  1.0373 0.0512 0.0220*
   LOWER 0.5046 0.0000 0.0009   0.9303 0.0000 0.0013   0.7043 0.0000 0.0012
   TOTAL CL= 1.730 CD=0.02292   CL= 1.730 CD=0.02330   CL= 1.730 CD=0.02323
         CM=-0.1926             CM=-0.1926             CM=-0.1925
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B.L.SUMMARY AIRFOIL S826  14%  ALPHA0=  6.520 DEG.
*-WARNING WITH VARIABLE LIMIT  ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 2500000 MU=3.0        R= 2500000 MU=1.3         R= 2500000 MU=9.0
-7.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.3774 0.0000 0.0029    1.0022 0.0000 0.0053     0.8675 0.0000 0.0052
   LOWER 1.0097 0.2400 0.0061*   1.0097 0.2400 0.0061*    1.0099 0.2408 0.0061*
   TOTAL CL=-0.053 CD=0.00897    CL=-0.053 CD=0.01140     CL=-0.053 CD=0.01127
         CM=-0.1787              CM=-0.1787               CM=-0.1787
-6.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.4508 0.0000 0.0034    1.0022 0.0000 0.0057     0.8852 0.0000 0.0055
   LOWER 1.0096 0.1773 0.0054*   1.0096 0.1773 0.0054*    1.0098 0.1777 0.0054*
   TOTAL CL= 0.057 CD=0.00876    CL= 0.057 CD=0.01102     CL= 0.057 CD=0.01089
         CM=-0.1807              CM=-0.1807               CM=-0.1807
-5.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.4953 0.0000 0.0038    1.0022 0.0000 0.0060     0.9021 0.0000 0.0059
   LOWER 1.0093 0.0000 0.0048*   1.0093 0.0000 0.0048*    1.0096 0.0000 0.0048*
   TOTAL CL= 0.167 CD=0.00857    CL= 0.167 CD=0.01080     CL= 0.167 CD=0.01067
         CM=-0.1828              CM=-0.1828               CM=-0.1828
-4.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.5234 0.0000 0.0041    1.0033 0.0000 0.0064     0.9183 0.0000 0.0063
   LOWER 0.6663 0.0000 0.0025    0.9564 0.0000 0.0040     1.0068 0.0000 0.0043
   TOTAL CL= 0.277 CD=0.00660    CL= 0.277 CD=0.01038     CL= 0.277 CD=0.01053
         CM=-0.1848              CM=-0.1848               CM=-0.1848
-3.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.5410 0.0000 0.0044    1.0034 0.0000 0.0069     0.9342 0.0000 0.0068
   LOWER 0.6560 0.0000 0.0023*   0.9564 0.0000 0.0036     0.9982 0.0000 0.0038
   TOTAL CL= 0.387 CD=0.00669    CL= 0.387 CD=0.01058     CL= 0.387 CD=0.01061
         CM=-0.1868              CM=-0.1868               CM=-0.1868
-2.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.5514 0.0000 0.0047    1.0034 0.0025 0.0075     0.9487 0.0024 0.0073
   LOWER 0.6479 0.0000 0.0022*   0.9564 0.0000 0.0034     0.9840 0.0000 0.0035
   TOTAL CL= 0.497 CD=0.00682    CL= 0.495 CD=0.01082     CL= 0.495 CD=0.01077
         CM=-0.1889              CM=-0.1882               CM=-0.1883
-1.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.5596 0.0010 0.0049    1.0034 0.0050 0.0080     0.9624 0.0048 0.0079
   LOWER 0.6414 0.0000 0.0020*   0.9564 0.0000 0.0031     0.9671 0.0000 0.0031
   TOTAL CL= 0.606 CD=0.00696    CL= 0.602 CD=0.01111     CL= 0.602 CD=0.01100
         CM=-0.1907              CM=-0.1896               CM=-0.1896
 0.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.5674 0.0029 0.0052    1.0034 0.0072 0.0086     0.9751 0.0071 0.0085
   LOWER 0.6355 0.0000 0.0019*   0.9564 0.0000 0.0029     0.9505 0.0000 0.0028
   TOTAL CL= 0.714 CD=0.00711    CL= 0.709 CD=0.01146     CL= 0.709 CD=0.01134
         CM=-0.1921              CM=-0.1909               CM=-0.1910
 1.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.5754 0.0046 0.0055    1.0034 0.0095 0.0093     0.9877 0.0094 0.0092
   LOWER 0.6297 0.0000 0.0018    0.9564 0.0000 0.0026     0.9321 0.0000 0.0026
   TOTAL CL= 0.822 CD=0.00729    CL= 0.816 CD=0.01189     CL= 0.816 CD=0.01178
         CM=-0.1936              CM=-0.1922               CM=-0.1922
 2.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.5851 0.0061 0.0058    1.0034 0.0119 0.0100     0.9988 0.0119 0.0099
   LOWER 0.6235 0.0000 0.0017    0.9564 0.0000 0.0024     0.9114 0.0000 0.0024
   TOTAL CL= 0.930 CD=0.00750    CL= 0.922 CD=0.01240     CL= 0.922 CD=0.01232
         CM=-0.1951              CM=-0.1933               CM=-0.1934
 3.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.5959 0.0077 0.0062    1.0034 0.0146 0.0107     1.0079 0.0147 0.0108
   LOWER 0.6163 0.0000 0.0016    0.9564 0.0000 0.0022     0.8935 0.0000 0.0022
   TOTAL CL= 1.037 CD=0.00776    CL= 1.028 CD=0.01299     CL= 1.028 CD=0.01297
         CM=-0.1965              CM=-0.1943               CM=-0.1943
 4.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6079 0.0094 0.0066    1.0034 0.0175 0.0116     1.0173 0.0177 0.0118
   LOWER 0.6063 0.0000 0.0015*   0.9564 0.0000 0.0021     0.7809 0.0000 0.0019
   TOTAL CL= 1.144 CD=0.00806    CL= 1.133 CD=0.01366     CL= 1.133 CD=0.01363
         CM=-0.1978              CM=-0.1952               CM=-0.1951
 5.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.6242 0.0113 0.0071    1.0034 0.0206 0.0125     1.0267 0.0212 0.0129
   LOWER 0.5921 0.0000 0.0013    0.9564 0.0000 0.0019     0.7727 0.0000 0.0017
   TOTAL CL= 1.251 CD=0.00844    CL= 1.238 CD=0.01441     CL= 1.237 CD=0.01461
         CM=-0.1991              CM=-0.1959               CM=-0.1957
 6.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.8948 0.0205 0.0115    1.0034 0.0240 0.0135     1.0338 0.0251 0.0142
   LOWER 0.5754 0.0000 0.0012    0.9564 0.0000 0.0018     0.7645 0.0000 0.0016
   TOTAL CL= 1.347 CD=0.01271    CL= 1.342 CD=0.01527     CL= 1.340 CD=0.01578
         CM=-0.1976              CM=-0.1964               CM=-0.1960
 7.00    S TURB  S SEP   CD      S TURB  S SEP   CD       S TURB  S SEP   CD
   UPPER 0.9914 0.0272 0.0143    1.0034 0.0278 0.0146     1.0368 0.0296 0.0156
   LOWER 0.5602 0.0000 0.0011*   0.9564 0.0000 0.0016     0.7545 0.0000 0.0015
   TOTAL CL= 1.445 CD=0.01544    CL= 1.445 CD=0.01624     CL= 1.442 CD=0.01710
         CM=-0.1969              CM=-0.1967               CM=-0.1961
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B.L.SUMMARY AIRFOIL S826  14%  ALPHA0=  6.520 DEG.
 *-WARNING WITH VARIABLE LIMIT  ALPHA REL. CHORD LINE

ALPHA(DEG.) R= 2500000 MU=3.0        R= 2500000 MU=1.3        R= 2500000 MU=9.0
  8.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 1.0324 0.0347 0.0171*   1.0324 0.0347 0.0171*   1.0371 0.0352 0.0173*
   LOWER 0.5447 0.0000 0.0011    0.9564 0.0000 0.0015    0.7454 0.0000 0.0014
   TOTAL CL= 1.542 CD=0.01814    CL= 1.542 CD=0.01858    CL= 1.541 CD=0.01871
         CM=-0.1958              CM=-0.1958              CM=-0.1956
  9.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 1.0368 0.0410 0.0191*   1.0368 0.0410 0.0191*   1.0373 0.0411 0.0191*
   LOWER 0.5306 0.0000 0.0010    0.9564 0.0000 0.0014    0.7353 0.0000 0.0013
   TOTAL CL= 1.640 CD=0.02009    CL= 1.640 CD=0.02048    CL= 1.640 CD=0.02043
         CM=-0.1949              CM=-0.1949              CM=-0.1949
 10.00    S TURB  S SEP   CD      S TURB  S SEP   CD      S TURB  S SEP   CD
   UPPER 1.0370 0.0485 0.0212*   1.0370 0.0485 0.0212*   1.0374 0.0487 0.0212*
   LOWER 0.5142 0.0000 0.0009    0.9303 0.0000 0.0013    0.7226 0.0000 0.0012
   TOTAL CL= 1.735 CD=0.02208    CL= 1.735 CD=0.02245    CL= 1.734 CD=0.02241
         CM=-0.1935              CM=-0.1935              CM=-0.1934
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B.L.SUMMARY AIRFOIL S826 14% ALPHA0= 6.520 DEG.
*-WARNING WITH VARIABLE LIMIT ALPHA REL. CHORD LINE

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ALPHA(DEG.) R= 3000000 MU=3.0        R= 3000000 MU=1.3          R= 3000000 MU=9.0
-7.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.4215 0.0000 0.0030     1.0022 0.0000 0.0052      0.8823 0.0000 0.0051
   LOWER 1.0097 0.2251 0.0059*    1.0097 0.2251 0.0059*     1.0099 0.2260 0.0059*
   TOTAL CL=-0.053 CD=0.00892     CL=-0.053 CD=0.01109      CL=-0.053 CD=0.01100
         CM=-0.1787                CM=-0.1787                CM=-0.1787
-6.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.4777 0.0000 0.0034     1.0022 0.0000 0.0055      0.8984 0.0000 0.0054
   LOWER 1.0096 0.1601 0.0052*    1.0096 0.1601 0.0052*     1.0098 0.1607 0.0052*
   TOTAL CL= 0.057 CD=0.00864     CL= 0.057 CD=0.01073      CL= 0.057 CD=0.01062
         CM=-0.1807                CM=-0.1807                CM=-0.1807
-5.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.5129 0.0000 0.0038     1.0022 0.0000 0.0059      0.9132 0.0000 0.0058
   LOWER 1.0093 0.0000 0.0047*    1.0093 0.0000 0.0047*     1.0096 0.0000 0.0047*
   TOTAL CL= 0.167 CD=0.00842     CL= 0.167 CD=0.01053      CL= 0.167 CD=0.01042
         CM=-0.1828                CM=-0.1828                CM=-0.1828
-4.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.5354 0.0000 0.0040     1.0033 0.0000 0.0063      0.9286 0.0000 0.0061
   LOWER 0.6711 0.0000 0.0024     0.9564 0.0000 0.0039      1.0076 0.0000 0.0042
   TOTAL CL= 0.277 CD=0.00648     CL= 0.277 CD=0.01011      CL= 0.277 CD=0.01030
         CM=-0.1848                CM=-0.1848                CM=-0.1848
-3.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.5479 0.0000 0.0043     1.0034 0.0000 0.0067      0.9435 0.0000 0.0066
   LOWER 0.6601 0.0000 0.0022     0.9564 0.0000 0.0035      0.9997 0.0000 0.0037
   TOTAL CL= 0.387 CD=0.00652     CL= 0.387 CD=0.01025      CL= 0.387 CD=0.01032
         CM=-0.1868                CM=-0.1868                CM=-0.1868
-2.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.5567 0.0000 0.0045     1.0034 0.0010 0.0072      0.9567 0.0009 0.0071
   LOWER 0.6511 0.0000 0.0021*    0.9564 0.0000 0.0033      0.9872 0.0000 0.0034
   TOTAL CL= 0.497 CD=0.00660     CL= 0.496 CD=0.01052      CL= 0.496 CD=0.01051
         CM=-0.1889                CM=-0.1886                CM=-0.1887
-1.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.5645 0.0000 0.0048     1.0034 0.0038 0.0078      0.9689 0.0037 0.0077
   LOWER 0.6441 0.0000 0.0020*    0.9564 0.0000 0.0030      0.9718 0.0000 0.0031
   TOTAL CL= 0.607 CD=0.00675     CL= 0.603 CD=0.01080      CL= 0.603 CD=0.01073
         CM=-0.1909                CM=-0.1899                CM=-0.1899
 0.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.5722 0.0016 0.0051     1.0034 0.0061 0.0084      0.9816 0.0060 0.0083
   LOWER 0.6382 0.0000 0.0018*    0.9564 0.0000 0.0028      0.9565 0.0000 0.0028
   TOTAL CL= 0.715 CD=0.00690     CL= 0.710 CD=0.01114      CL= 0.710 CD=0.01106
         CM=-0.1925                CM=-0.1912                CM=-0.1912
 1.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.5807 0.0035 0.0053     1.0034 0.0084 0.0090      0.9925 0.0084 0.0089
   LOWER 0.6324 0.0000 0.0017     0.9564 0.0000 0.0026      0.9401 0.0000 0.0025
   TOTAL CL= 0.823 CD=0.00707     CL= 0.817 CD=0.01156      CL= 0.817 CD=0.01149
         CM=-0.1939                CM=-0.1925                CM=-0.1925
 2.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.5910 0.0051 0.0057     1.0034 0.0108 0.0097      1.0025 0.0108 0.0097
   LOWER 0.6264 0.0000 0.0016     0.9564 0.0000 0.0024      0.9213 0.0000 0.0023
   TOTAL CL= 0.931 CD=0.00729     CL= 0.924 CD=0.01205      CL= 0.924 CD=0.01201
         CM=-0.1954                CM=-0.1937                CM=-0.1937
 3.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.6019 0.0067 0.0060     1.0034 0.0135 0.0104      1.0112 0.0136 0.0105
   LOWER 0.6198 0.0000 0.0015     0.9564 0.0000 0.0022      0.9028 0.0000 0.0021
   TOTAL CL= 1.038 CD=0.00754     CL= 1.030 CD=0.01262      CL= 1.029 CD=0.01264
         CM=-0.1968                CM=-0.1947                CM=-0.1947
 4.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.6146 0.0084 0.0064     1.0034 0.0163 0.0112      1.0191 0.0166 0.0114
   LOWER 0.6114 0.0000 0.0014     0.9564 0.0000 0.0020      0.8880 0.0000 0.0020
   TOTAL CL= 1.146 CD=0.00784     CL= 1.135 CD=0.01326      CL= 1.134 CD=0.01340
         CM=-0.1982                CM=-0.1956                CM=-0.1955
 5.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.6777 0.0113 0.0075     1.0034 0.0194 0.0121      1.0289 0.0200 0.0125
   LOWER 0.5983 0.0000 0.0013     0.9564 0.0000 0.0019      0.7834 0.0000 0.0017
   TOTAL CL= 1.251 CD=0.00882     CL= 1.240 CD=0.01399      CL= 1.239 CD=0.01424
         CM=-0.1990                CM=-0.1963                CM=-0.1961
 6.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.9209 0.0200 0.0115     1.0034 0.0228 0.0131      1.0346 0.0239 0.0138
   LOWER 0.5818 0.0000 0.0012     0.9564 0.0000 0.0017      0.7763 0.0000 0.0016
   TOTAL CL= 1.348 CD=0.01274     CL= 1.344 CD=0.01482      CL= 1.342 CD=0.01535
         CM=-0.1978                CM=-0.1968                CM=-0.1965
 7.00    S TURB  S SEP    CD       S TURB  S SEP    CD        S TURB  S SEP    CD
   UPPER 0.9914 0.0259 0.0138     1.0034 0.0264 0.0142      1.0370 0.0282 0.0151
   LOWER 0.5666 0.0000 0.0011     0.9564 0.0000 0.0016      0.7668 0.0000 0.0015
   TOTAL CL= 1.448 CD=0.01496     CL= 1.447 CD=0.01574      CL= 1.444 CD=0.01662
         CM=-0.1974                CM=-0.1972                CM=-0.1966
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B.L.SUMMARY AIRFOIL S826 14% ALPHA0= 6.520 DEG.
 *-WARNING WITH VARIABLE LIMIT ALPHA REL. CHORD LINE

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ALPHA(DEG.) R= 3000000 MU=3.0        R= 3000000 MU=1.3        R= 3000000 MU=9.0
 8.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB   S SEP    CD
   UPPER 1.0324 0.0328 0.0164*   1.0324 0.0328 0.0164*   1.0372 0.0332 0.0167*
   LOWER 0.5502 0.0000 0.0010    0.9564 0.0000 0.0015    0.7566 0.0000 0.0014
   TOTAL CL= 1.545 CD=0.01748    CL= 1.545 CD=0.01791    CL= 1.544 CD=0.01805
         CM=-0.1965              CM=-0.1965              CM=-0.1963
 9.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB  S SEP    CD
   UPPER 1.0368 0.0389 0.0184*   1.0368 0.0389 0.0184*   1.0373 0.0395 0.0186*
   LOWER 0.5361 0.0000 0.0010    0.9564 0.0000 0.0013    0.7469 0.0000 0.0013
   TOTAL CL= 1.643 CD=0.01934    CL= 1.643 CD=0.01973    CL= 1.642 CD=0.01984
         CM=-0.1957              CM=-0.1957              CM=-0.1955
10.00     S TURB  S SEP    CD      S TURB  S SEP    CD      S TURB   S SEP    CD
   UPPER 1.0370 0.0466 0.0205*   1.0370 0.0466 0.0205*   1.0374 0.0467 0.0206*
   LOWER 0.5209 0.0000 0.0009    0.9303 0.0000 0.0012    0.7368 0.0000 0.0012
   TOTAL CL= 1.738 CD=0.02142    CL= 1.738 CD=0.02178    CL= 1.738 CD=0.02176
         CM=-0.1942              CM=-0.1942              CM=-0.1941
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14. ABSTRACT *(Maximum 200 Words)*
A family of airfoils, the S825 and S826, for 20- to 40-meter, variable-speed and variable-pitch (toward feather), horizontal-axis wind turbines has been designed and analyzed theoretically. The two primary objectives of high maximum lift, insensitive to roughness, and low profile drag have been achieved. The constraints on the pitching moments and the airfoil thicknesses have been satisfied. The airfoils should exhibit docile stalls.

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

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