NASA Contractor Report 159180

OPTIMIZED AERODYNAMIC DESIGN PROCESS FOR

SUBSONIC TRANSPORT WING FITTED WITH WINGLETS

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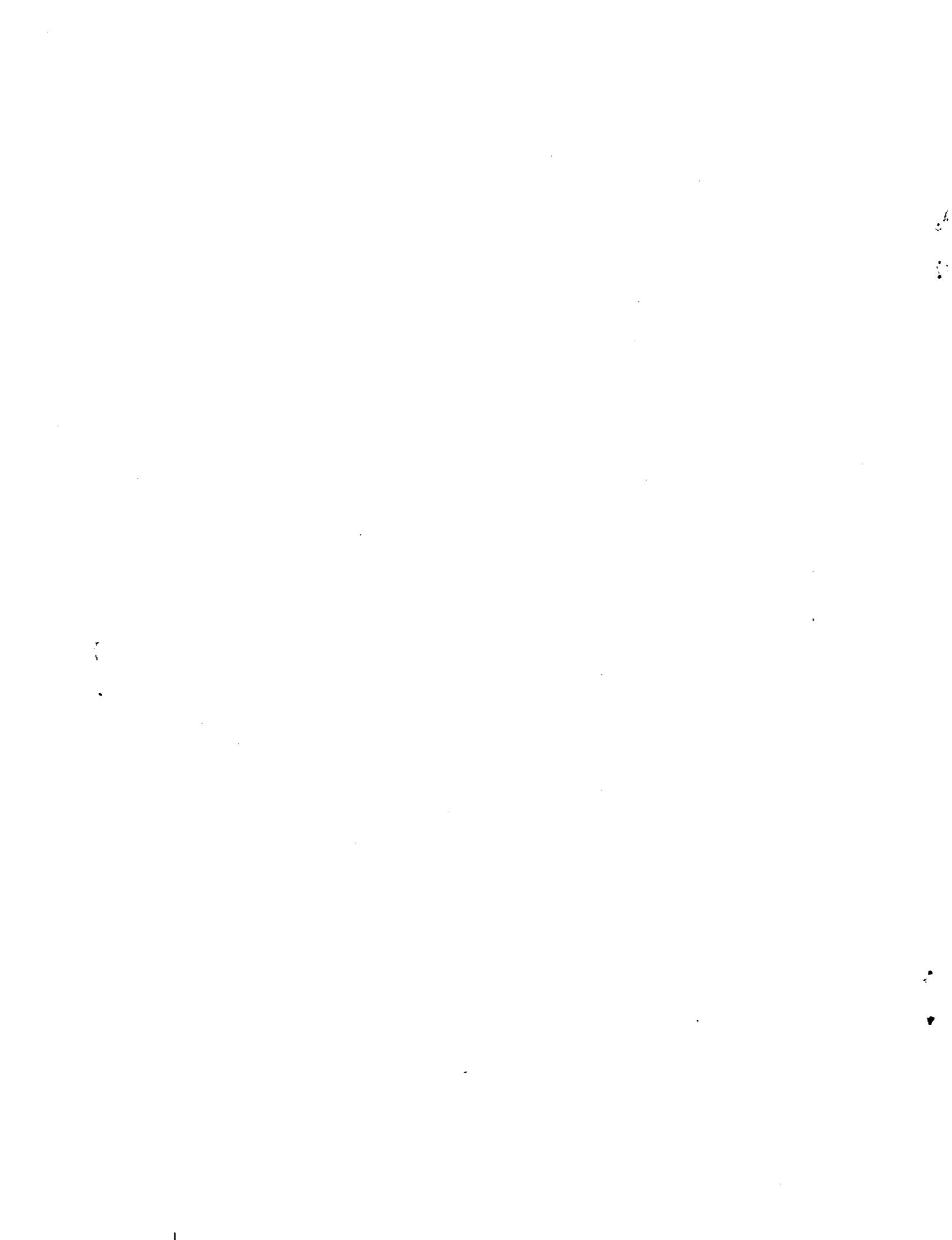
SUMMARY

The aerodynamic design of a wind-tunnel model of a wing representative of that of a subsonic jet transport aircraft, fitted with winglets, has been performed using two recently developed optimal wing-design computer programs. Both potential flow codes use a vortex lattice representation of the near-field of the aerodynamic surfaces for determination of the required mean camber surfaces for minimum induced drag, and both codes use far-field induced drag minimization procedures to obtain the required spanloads. One code uses a discrete vortex wake model for this far-field drag computation, while the second uses a 2-D advanced panel wake model. Wing camber shapes for the two codes are very similar, but the resulting winglet camber shapes differ widely. Design techniques and considerations for these two wind-tunnel models are detailed herein, inlcuding a description of the necessary modifications of the design geometry to format it for use by a numerically controlled (NC) machine for the actual model construction.

INTRODUCTION

The current emphasis on improving the fuel efficiency at cruise of existing transport aircraft, and designing future generations of aircraft with even further increases in fuel efficiency, has resulted in the consideration of several new, novel aircraft configurations. Examples are the so-called box plane studied in references 1 and 2, the joined wing concept of reference 3, and winglets as discussed in reference 4. Further model studies of improved transport performance may be found in references 5-7. These concepts generally use nonplanar lifting surfaces to reduce the induced drag.

Recently a vortex lattice wing-design computer program has been developed, described in reference 8, which computes for subcritical flow, using thin wing potential flow theory, the wing camber surfaces for one or two interacting planforms for minimum induced drag. The user specifies the configuration geometry in planview, dihedral angles, the reference wing area and span, the subsonic design Mach number and design lift coefficient. The desired

chordwise loading function must also be specified on each planform. The camber shape is computed directly which will achieve the desired lift, have zero pitching moment (for two planforms) and will have minimum induced drag. This program may be used as a preliminary design tool for constructing wind-tunnel models to investigate the above-mentioned new aircraft configurations, so long as the design is subcritical. Further, for configurations which are subcritical, this program is relatively inexpensive to run compared to more sophisticated transonic codes which use iterative techniques to achieve optimal solutions.

However, there is concern that the vortex lattice theory could lead to errors in design shape in the vicinity of a change in wing dihedral angle (refs. 9 and 10). This has lead to the development of an advanced panel far-field wake model (ref. 11) where the wing wakes are broken into flat panels, and where the wake vortex strength is assumed to vary linearly on each wake panel. This theory has been shown to be more accurate than a discrete vortex wake model (ref. 11). This wake model has been extended to obtain the bound circulation and spanload distributions for minimum induced drag for use in the vortex lattice wing-design code of reference 8. Extensions of this theory, as well as sample results from the modified design code, have been given in reference 12. Design results to date (refs. 12 and 13) have shown that the original code (ref. 8) and the modified code (ref. 12) give identical results except where there is a change in wing dihedral.

In an attempt to determine the capabilities of both of these subcritical design codes, two wind-tunnel models are currently being designed for a single transport type wing fitted with winglets. The design point is M = 0.8, C_L = 0.5, and it is expected that there will be only a very limited region of slightly supercritical flow. The wing planform for both models is the same as that used in one of the sample results given in reference 8. The winglet planforms for both models are identical; this planform has been chosen using the recommendations of reference 4. The two computer programs give essentially identical camber shapes on the wing, but yield widely different shapes on the winglet. Hence, a single wing model is to be built, using the results of the modified code, while both winglet models are to be constructed and tested for comparison. This report details the considerations used to design these two models. In particular, the data required for using a numerically controlled machine to cut the model surfaces is discussed.

A wing aspect ratio, defined as b^2/S

a chordwise pressure loading parameter

b wing span, cm (in.), equal to 71.491 cm (28.146 in.)

c local chord, m (ft)

$\bar{c}$ mean chord, m (ft), equal to 0.2136 m (0.7008 ft)

C_p pressure coefficient

ΔC_p pressure difference coefficient

c_t wing tip chord, cm (in.), equal to 8.113 cm (3.194 in.)

C_B wing root bending moment coefficient

C_D induced drag coefficient

C_L lift coefficient

C_m pitching moment coefficient about origin of body axis coordinate system shown in figure 1

M Mach number

q dynamic pressure, Pa (lb/ft^2)

S projected wing area, m^2 (ft^2), equal to 0.30595 m^2 (3.293 ft^2)

t local semithickness, cm (in.)

X streamwise body axis coordinate, cm (in.)

x streamwise coordinate measured from local wing leading edge, cm (in.)

Y spanwise coordinate, cm (in.)

Z vertical coordinate, cm (in.)

z coordinate normal to local wing chordplane, cm (in.)

α angle of attack, radians (degrees)

ε nondimensional chordwise coordinate

η nondimensional spanwise coordinate

ϕ dihedral angle, radians (degrees)
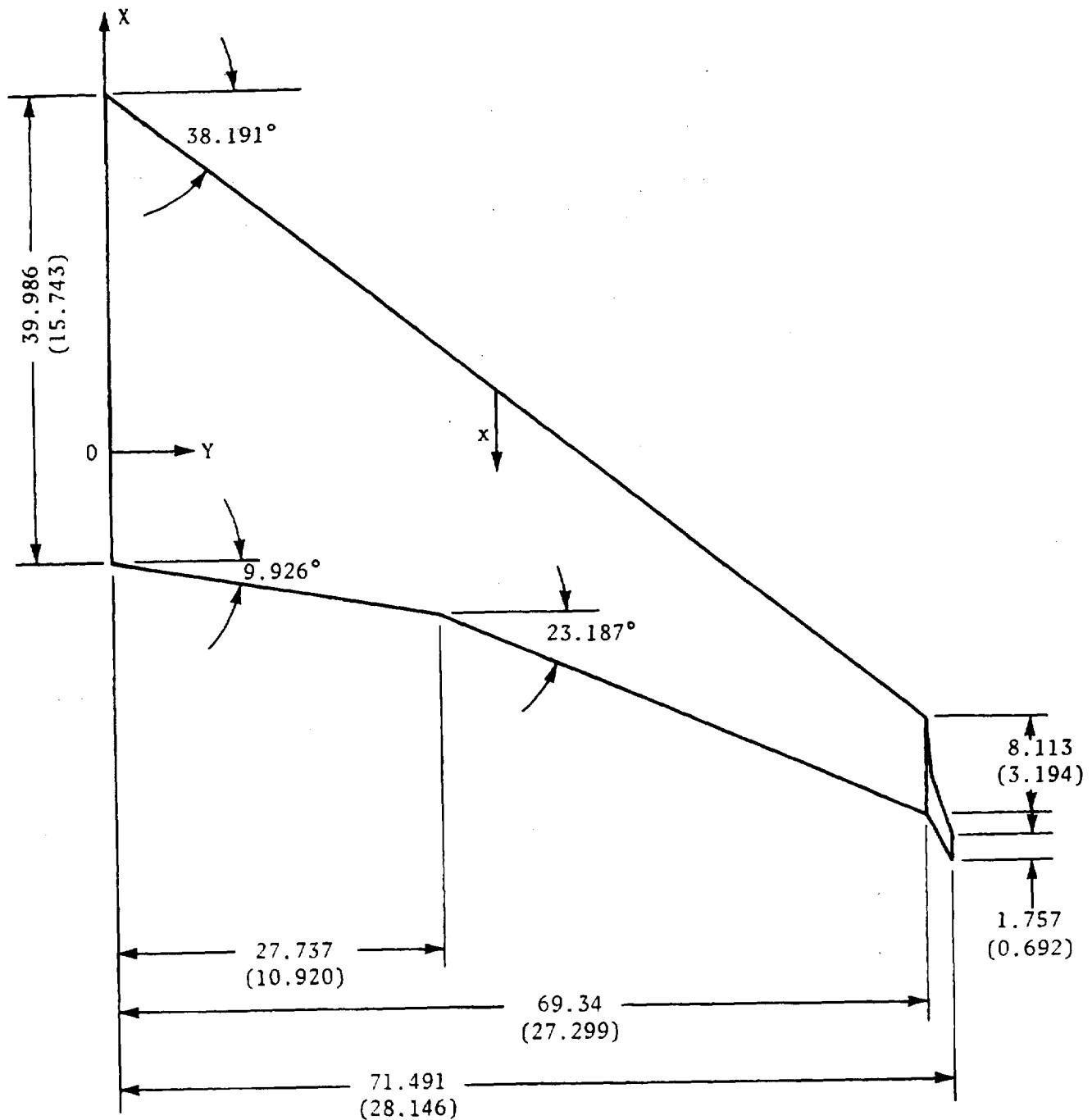
Figure 1. Planview of wing-winglet model. Dimensions are given in cm (in.); wing has 6° dihedral and winglet has 77.5° dihedral.

MODEL WING-WINGLET DESCRIPTION

The current wind-tunnel wing-winglet models have been designed for
use on an existing fuselage model, which has been used in a series of
tests of previous wing-winglet models (ref. 5) and high-aspect ratio wing
tests (ref. 7). The wing planform (fig. 1) was the same as that used in
the single planform example of reference 8; however, the winglet plan
view (fig. 2) has been altered to conform to recommended winglet-design
criteria given in reference 4. The wing has been scaled so its projected
span equals the span of the configurations tested in reference 5, using
the same fuselage model. This wing planform is representative of current
subsonic jet transport wings. Model wing projected area was 0.30595 m^2
(3.293 ft^2), and mean chord equaled 0.2136 m (0.7008 ft). The design
point chosen was a Mach number of 0.8 and a lift coefficient of 0.5.
These were chosen as being representative of current jet transports.
Also it was felt desirable to attempt a model design at the highest values
of Mach number and lift coefficient which seemed advisable. It is
likely that for the model size chosen (b = 1.430 m), the maximum Mach
number achievable in the NASA-Langley 7 × 10 foot high-speed tunnel
where the model is to be tested will be no greater than M = 0.8 (ref. 14).
This design point was chosen such that once the wing thickness dis-
tribution was superimposed on the designed camber shape, the flow over
the wing and winglet would be everywhere subcritical. Wing and winglet
leading edge sweeps were 38.19 and 35.28 degrees, respectively. The
wing had a trailing edge break at 0.388 times the total configuration
projected semispan and a constant 6 degrees of dihedral. The winglet
length was 0.143 times the projected span of the wing alone. The winglet
trailing edge was straight, with a leading edge break at 0.25 times the
winglet height. The lower 25 percent of the winglet was swept 61.6 degrees.
The upper 75 percent of the winglet had a leading edge sweep of 35.28
degrees which, when projected down to the wing tip, intersected the
tip at 0.65 times the wing tip chord. The winglet dihedral was 77.5
degrees (see fig. 2). These values, as well as the eight percent maximum
thickness type NACA 64A008 thickness distribution (ref. 15), all followed
the recommendations of reference 4. A design using a constant chordwise
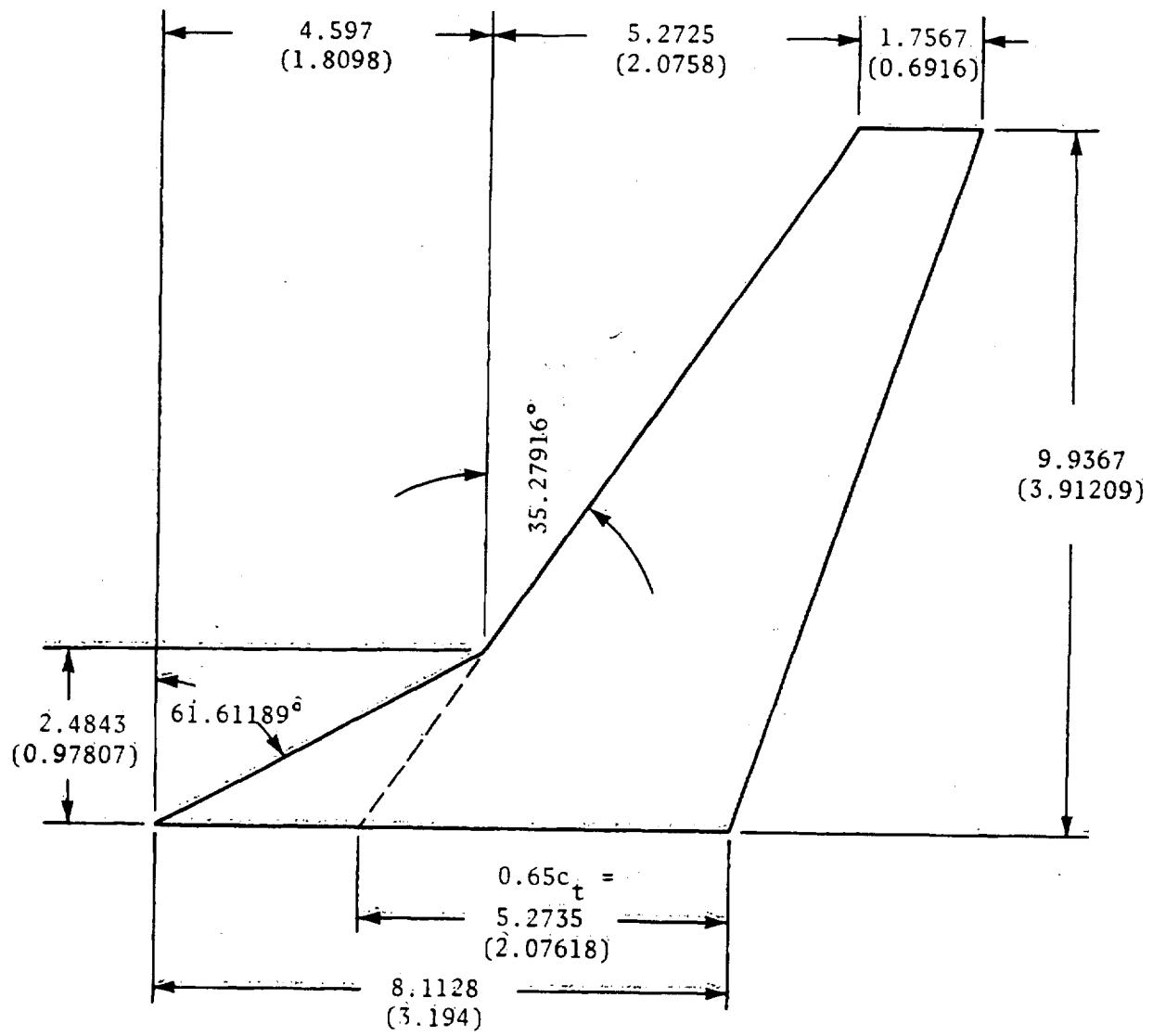
Figure 2. Winglet plan view. Dimensions are given in cm (in.).

loading function (a = 1.0) like that used in reference 8 has been
chosen.

CAMBER SURFACE DESIGN

Once the model planform, scale, and design point had been chosen, the
two inviscid design codes of references 8 and 12 were used to obtain the
camber shapes predicted by each which would lead to minimum induced drag.
In both codes, a vortex lattice near-field representation of 18 chordwise
vortices by 21 spanwise was chosen. This was close to the maximum number
of near-field singularities allowable in either code. The design camber
shape was insensitive to these values over the limited range of 18 × 21
to 16 × 25. The adopted lattice layout led to three camber lines on
the winglet: one below the leading edge break and two above the break.
The original design code was modified to use 96 discrete vortex unknowns,
rather than the usual 100, in the Trefftz plane to determine the optimum
span load. This was done to duplicate as nearly as possible the true wake
shape for the wing-winglet model, given the restriction of equally spaced
wake vortices (ref. 8). The modified code (ref. 12) used 50 wake panels
having a cosine spacing. Thirty-five panels were used on the wing and
15 on the winglet. It is believed that the calculations for the modified
code were more accurate, based upon results shown in references 11 and
12. The computed induced drag for the original code was 0.009034, while
for the modified code using the advanced panel wake model C_D = 0.008141.
This is inconsistent with results of reference 11, where the discrete
vortex model was seen to underpredict the induced drag, but is believed
to be due to inaccuracies in the discrete vortex wake shape. Further
study as to the reason for these C_D values is required.

The necessary input data cards for both computer programs, as well
as the resultant outputs are shown in Appendix A. The different optimum
spanloads from these two programs are plotted in figure 3. They differ
most significantly on the winglet and near the wing tip. Examples of the
computed optimum camber shapes are shown in figure 4. Again, the dif-
ferences in the two methods are confined to the region near the winglet
on the wing and on the winglet itself. Similar results have been
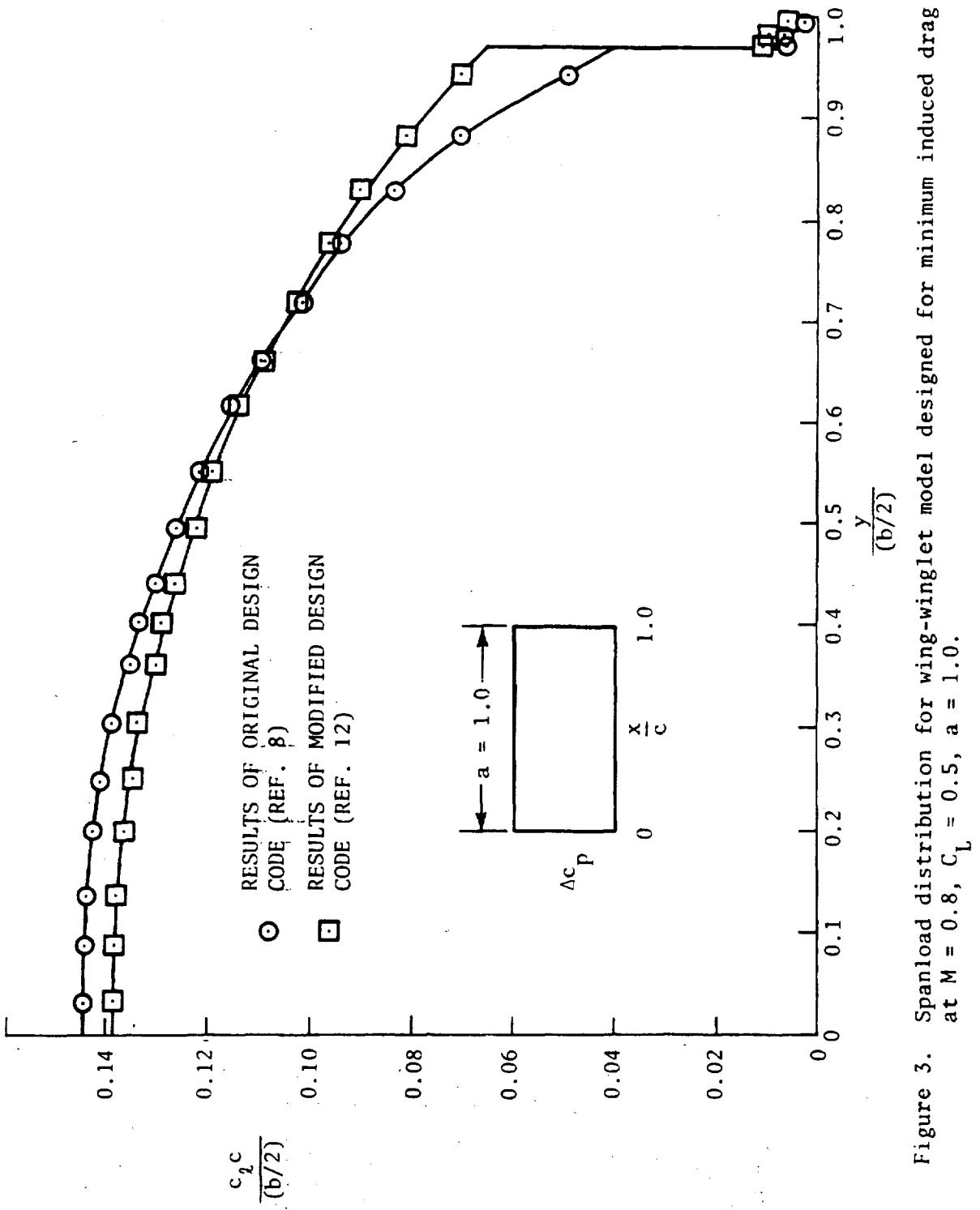
Figure 3. Spanload distribution for wing-winglet model designed for minimum induced drag at M = 0.8, C_L = 0.5, a = 1.0.
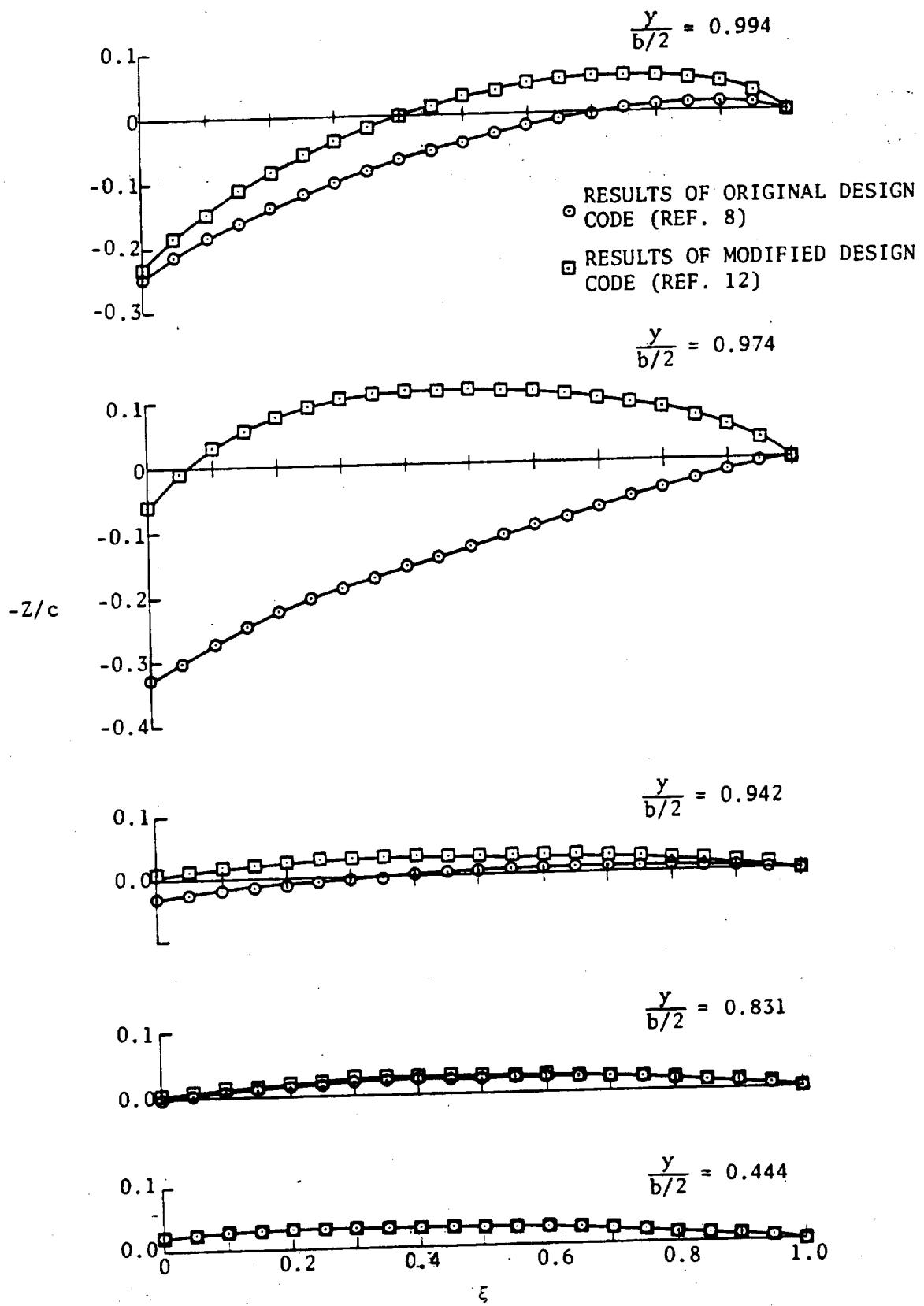
Figure 4. Camber shapes for wing-winglet model designed for minimum induced drag at $M = 0.8$, $C_L = 0.5$, $a = 1.0$.

presented previously in reference 12 for a similar wing-winglet config-
uration, having a different winglet planform.

Once these design results had been obtained, and the NACA 64A008
thickness distribution chosen, the three-dimensional potential flow code
of reference 16 was utilized to check for any locally supercritical
regions on the designed wing-winglet. All of the design camber surface
Z/c values were rescaled by multiplying by the cosine of the local di-
hedral to obtain local airfoil cambers perpendicular to the plane of the
wing or winglet. Also, the local η values had to be recomputed in
terms of the fractional wing-winglet peripheral length. These input data
were in a simplified namelist format developed under contract for NASA/
Langley Research Center (LaRC) by the Computer Sciences Corporation. The result-
ant panel geometry for the modified code design is shown in figure 5,
and sample chordwise pressure plots are shown in figure 6. There was a
region of nearly constant ΔC_p, over about the middle 70 percent of
the local chord, with the pressure difference falling to zero at the
trailing edge, and with a slight rise at the leading edge. The minimum
pressure coefficient computed on the configuration designed using the
original code (ref. 8) was -0.5675, while the minimum found on the shape
computed using the modified code (ref. 12) was -0.7461. These values
occurred near the winglet root. The value of C_p for sonic conditions
at M = 0.8 is -0.6910, so it is felt that there will not be any regions
of supercritical flow on the model designed using the original code
(ref. 8). The modified code model will have a small region of slightly
supercritical flow near the root of the winglet. It is also noted that
the chosen design point, C_L = 0.5 and M = 0.8, is as high as possible
without appreciably violating the assumption of subcritical flow.

This summarizes the aerodynamic considerations undertaken for the
design of the current models. The more complete design process, such as
described in reference 17, was not undertaken, largely because these models
must be tested to discover how useful the computer codes of references 8
and 12 are as design tools. The wing-winglet configuration chosen should
provide a good test, while at the same time yielding information about
which version of the design code is preferable. More sophisticated analy-
sis programs modeling the flow over complete aircraft configurations,

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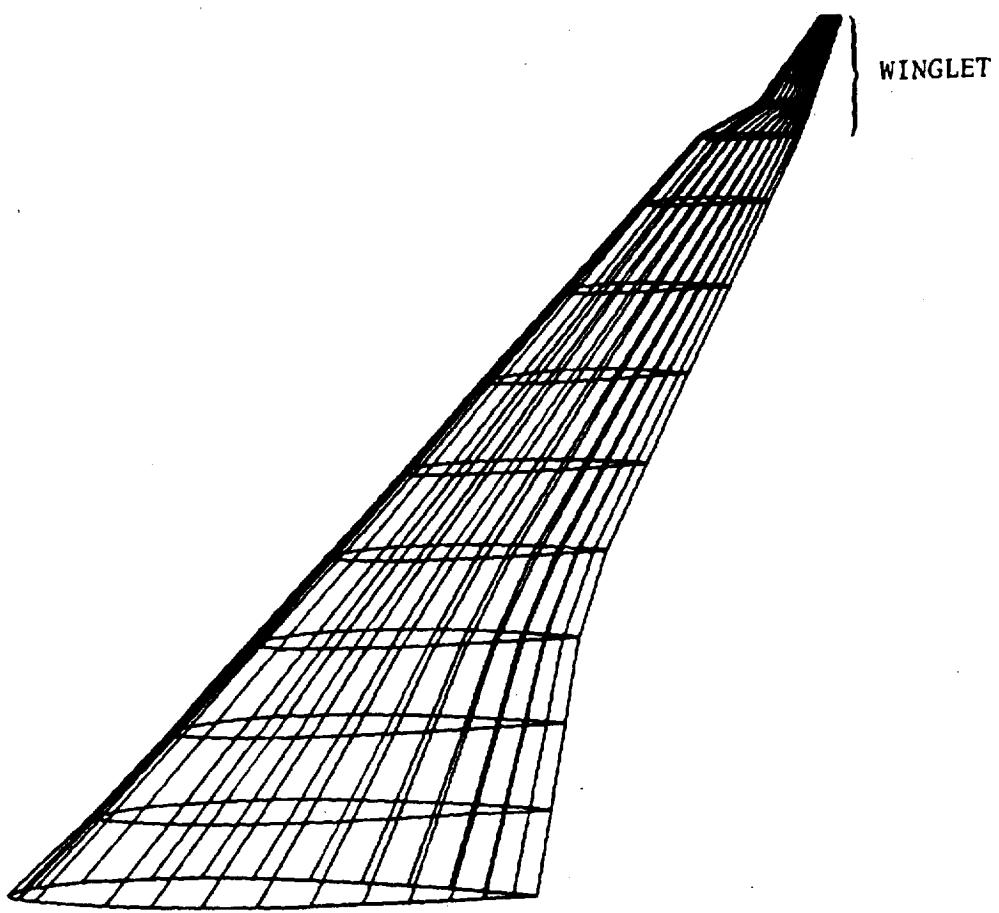
WINGLET

Figure 5. Perspective view of wing-winglet panel geometry for code of reference 16; design results of reference 12.
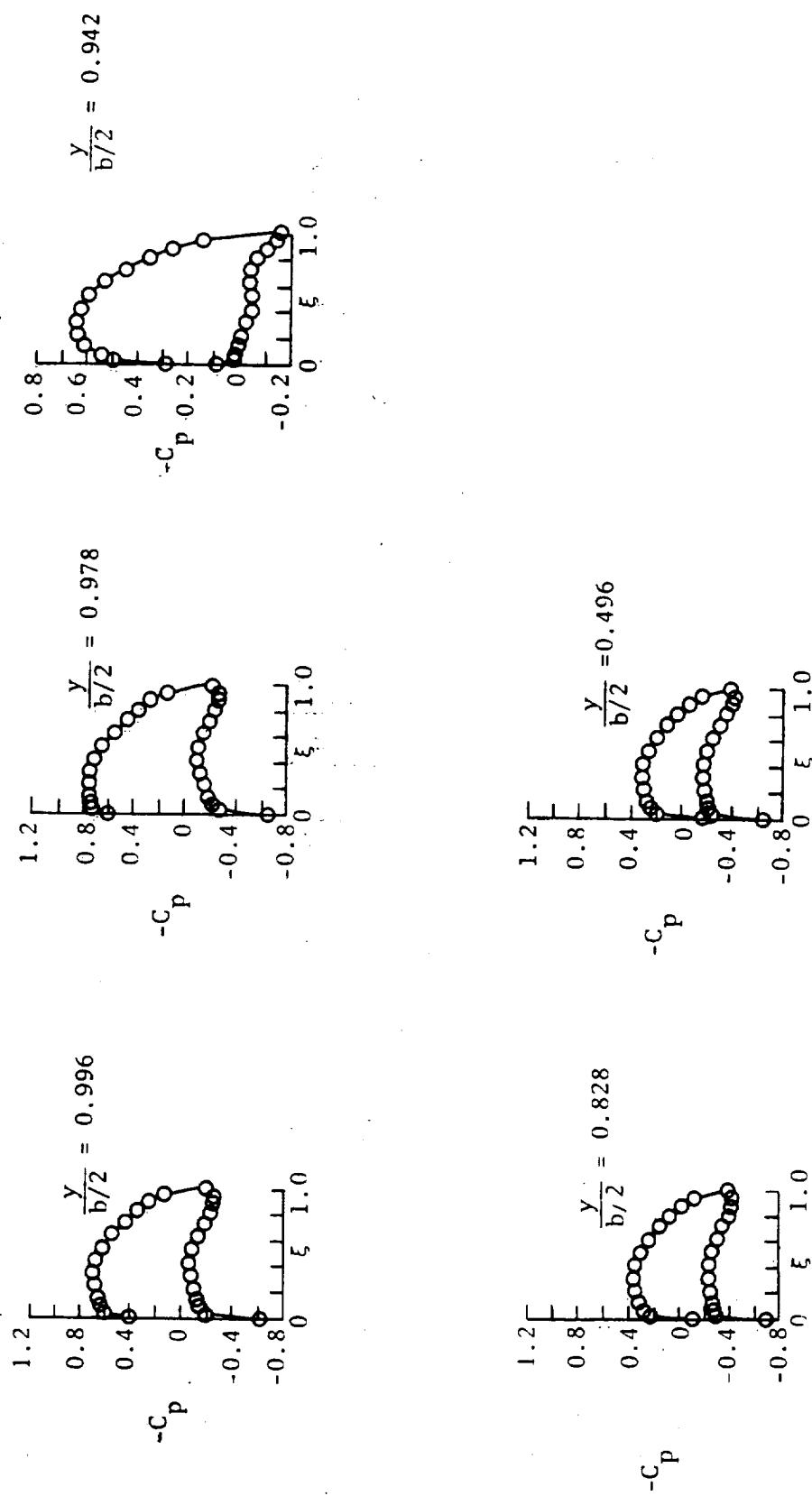
Figure 6. Hess code chordwise pressure coefficient distributions for wing-winglet designed by method of reference 12.

including the effects of bodies, thickness, shocks, and even viscous effects, as described in references 18 and 19 would be expected to yield more accurate performance predictions. The recent aerodynamic optimization programs of references 20 and 21 should allow determination of optimum configurations including the above nonideal effects.

DESIGN DETAILS

Several other basic model design specifications and criteria have been developed relating to the construction of the model itself. Since the wing cambers from both codes differed only in the region immediately adjacent to the wing-winglet junction, it was decided to build only one wing model, using the camber values from the modified design code (ref 12). The wing and winglet models will be cut using numerically controlled machining from steel, since the test dynamic pressures will be in the vicinity of $q = 34,100$ Pa (720 lb/ft^2) at the design point (ref. 14). The wing and all winglet models will be cut separately so all surface coordinates will be measured perpendicular to the plane of the wing or the winglets. Four separate pairs of winglets will be constructed. These winglets will bolt to the model wing tip. Two pairs of winglets will be machined having the camber shape computed using the original design code (ref. 8). One of these winglet pairs will have static pressure ports at the 12.5 and 42.5 percent peripheral distance stations. Upper surface pressures will be sensed on one winglet; lower surface pressure taps will be placed at the same x/c values on the other winglet. The pressure tubing will join to larger tubing in the wing itself in a cutout cavity in the wing near the wing-winglet junction. The second winglet pair will have no pressure instrumentation, but will be fitted with full span 0.2 c trailing edge flaps which bolt to the winglet. The flat deflection angles will be 0°, ±2°, ±4°. The remaining two pairs of winglet models will be constructed having the camber shape of the modified design code (ref. 12); one pair will be fitted with pressure taps, while the second pair will be fitted with flaps, as described above. The wing model will have two chordwise rows of static pressure taps, at the 31 and 74 percent peripheral distance locations. All pressure tubing will be carried inside the fuselage to three scannivalves. The region of the junction between wing and winglets

will be formed by handwork using templates. The wing root region will be beveled to allow it to bolt to the fuselage strongback. Also, if feasible, the wing root region will be gaged to allow measurement of the wing root bending moment.

NUMERICALLY CONTROLLED MACHINE INPUT

Finally, a description is now given of the steps necessary to prepare an input deck to prepare a tape for use on the numerically controlled machine (type TX-23). A small computer program was written to rescale the camber shapes to be perpendicular to the local ϕ, by multiplying by cos ϕ. Then the t/c values were added to get upper and lower surface values, which were then multiplied by the local chord value in inches. This yielded a set of upper and lower surface coordinates, in inches, measured perpendicular to the wing or winglet planes. Next, these coordinates were extrapolated linearly to obtain coordinates at the wing root and tip, the location of the trailing edge break on the wing, the winglet root and tip, and the location of the leading edge break on the winglet. These values were then punched on cards in a 7F10.6 format. The airfoil shapes were also plotted using LaRC subroutine INFOPLT. The program listing and output are shown in Appendix B, along with the final decks to cut the wing and the winglet. Both decks shown were for the modified design code results (ref. 12). Also included are the N/C machine input deck preparation instructions. Examples of the wing and winglet airfoil sections are shown in figure 7.

The NASA/LaRC model shop personnel can supply sample data checks which aid in building an input deck for numerically controlled machining of a general wing. Categories I and II (see TX-23 Input, Appendix B) must be largely defined by the engineer, while items III, IV, and V are fairly standard and any needed changes in these cards can be made by the personnel in the model shop. Item II contains the bulk of the geometrical information, beginning with (X, Y) pairs, in inches, for the leading edge and trailing edge [Item (3), Link (1)]. These are followed by the Y values, in inches, at which the airfoil upper and lower surface coordinates are specified [Item (5), Link (1)]. The Items (8) and (9), Link (1), contain the percent chord locations, followed by the corresponding upper surface coordinates, in

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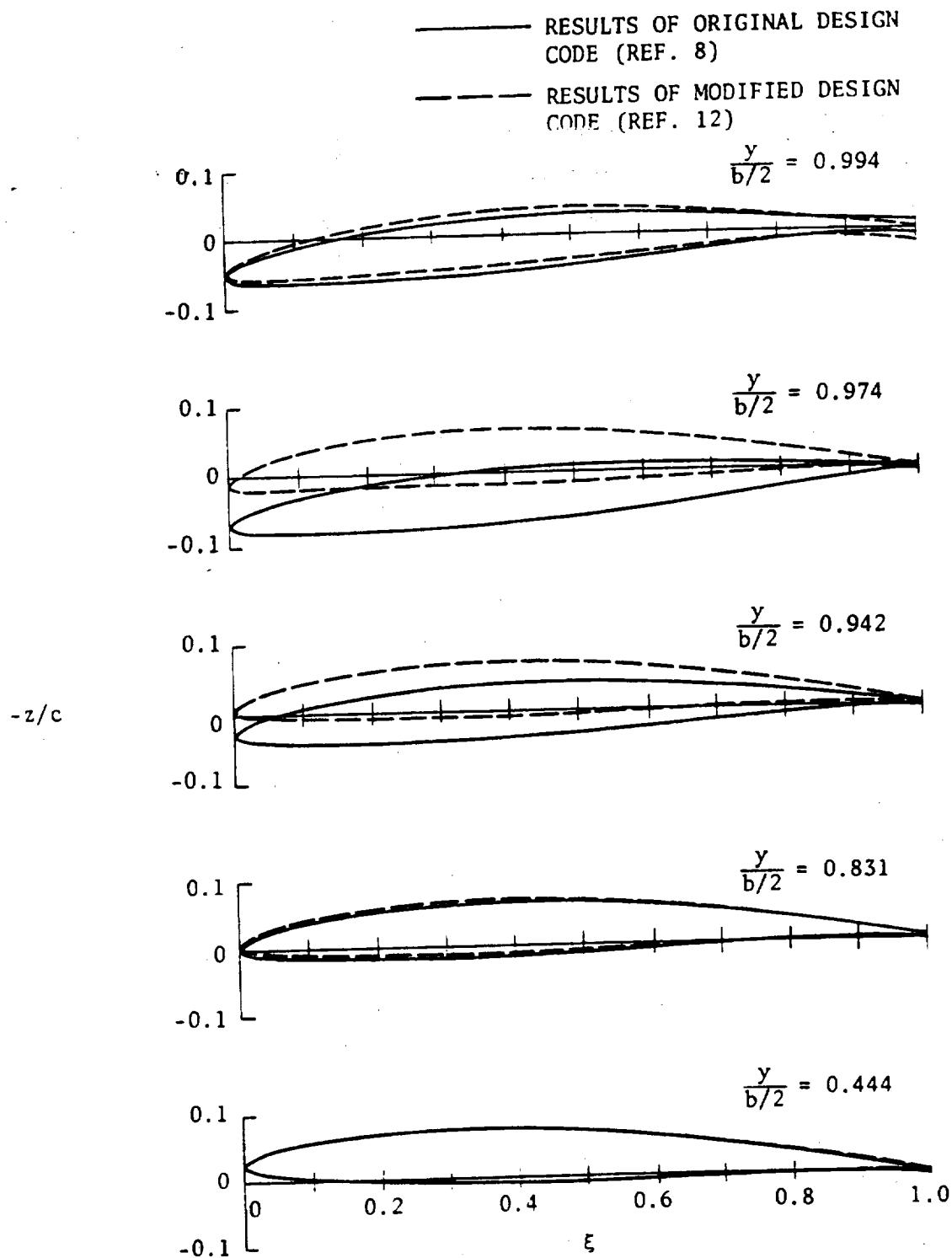
Figure 7. Comparison of wing-winglet model airfoil sections.

inches, and lower surface coordinates, in inches, at each airfoil station.
A maximum of 21 airfoils may be specified, as has been done for the current
wing model (Appendix B). A maximum of 30 coordinate triples may be specified
for each airfoil. Straight line curve fitting in the spanwise direction
an cubic curve fitting chordwise was used for the current models.

The detailed design work is currently being implemented under contract
by LTV, and the final design will be constructed in-house by the model
shop at NASA/LaRC.

CONCLUSIONS

The design process for construction of a wind-tunnel model of a sub-
sonic transport wing fitted with winglets has been described. The camber
shapes of the winglet models have been computed using two potential-flow
wing-design programs. The two codes give quite different results on
these winglets. As a result, these wind-tunnel models are to be used to
determine which program gives a design shape with better performance. Also,
the wind-tunnel test will provide information as to the utility of these
potential flow programs in the design process. Also documented were the
data preparation procedures necessary to obtain an input deck for numer-
ically controlled machining of the models.

APPENDIX A

INPUT DATA AND OUTPUT FOR WING-WINGLET
DESIGN USING CODES OF REFERENCES 8
AND 12

```
                                      20.9696   2353.6295
    1.                           1.        0.        0.
    4.                           0.        0.        1.
   30.6332    -0.                1.        6.        1.
  -23.7143   -69.36              0.       77.5       1.
  -26.2111   -59.8777          77.5       77.5       1.
  -23.5697   -71.4907          77.5        0.        1.
  -35.3402   -71.4907            0.       77.5       3.
  -32.7053   -69.9777          77.5       77.5       1.
  -31.6771   -64.34            77.5        6.        1.
  -14.0667   -27.736             6.        6.        1.
   -0.1529    -0.                6.
  100.   19.   20.   0.8   0.5

   2.0   1.0
   3.    35.
  25.    10.
```

Input for Modified Design Code of Reference 12

18

GEOMETRY DATA

ROOT CHORD HEIGHT = 0.00000

REFERENCE PLANFORM HAS 8 CURVES

VARIABLE SWEEP PIVOT POSITION   X(S) = 0.00000   Y(S) = 0.00000

BREAK POINTS FOR THE REFERENCE PLANFORM

POINT	X REF	Y REF	SWEEP ANGLE	DIHEDRAL ANGLE	MOVE CODE
1	30.83320	0.00000	30.19097	6.00000	1
2	-23.71430	-69.34000	83.32828	77.50000	1
3	-28.31110	-69.87770	72.99002	77.50000	1
4	-33.58370	-71.43070	90.00000	0.00000	1
5	-35.34020	-71.43070	58.52736	77.50000	2
6	-32.70530	-69.87770	58.52190	77.50000	1
7	-31.02710	-69.34000	23.18709	6.00000	1
8	-14.00670	-27.73600	9.92625	6.00000	1
9	-9.15290	0.00000			

Output for Modified Design Code of Reference 12

CONFIGURATION NO. 100.

CURVE 1 IS SWEPT 38.19097 DEGREES ON PLANFORM 1

BREAK POINTS FOR THIS CONFIGURATION

POINT	X	Y	Z	SWEEP ANGLE	DIHEDRAL ANGLE	MOVE CODE
1	39.83320	0.00000	0.00000	39.19097	6.00000	1
2	-23.71420	-62.34000	-7.28793	83.32828	77.50000	1
3	-44.81140	-47.87770	-9.71334	72.09002	77.50000	1
4	-23.56370	-71.46070	-16.58911	90.00000	0.00000	1
5	-35.24050	-71.49070	-16.58911	58.52736	77.50000	1
6	-22.70530	-69.67770	-9.71334	58.52190	77.50000	1
7	-31.22710	-43.34000	-7.28793	23.18709	6.00000	1
8	-14.00670	-27.73600	-2.01517	9.92625	6.00000	1
9	-6.15290	0.00000	0.00000			

-.71425+02

378 HORSESHOE VORTICES USED ON THE LEFT HALF OF THE CONFIGURATION

PLANFORM	TOTAL	SPANWISE
1	378	21

18. HORSESHOE VORTICES IN EACH CHORDWISE ROW

X SHIFT OF ORIGIN = 0.0000 UNITS

MINIMUM FIELD LENGTH = 63000

X C/4	X 3C/4	Y	Z	S	C/4 SWEEP ANGLE	DIHEDRAL ANGLE	GAMMA/U AT CLDES= .5000
-32.20592	-32.27729	-71.05967	-15.04485	1.99147	72.87795	77.50000	.04911
-32.34607	-32.41404	-71.05967	-15.04485	1.99147	72.41497	77.50000	.04911
-32.49241	-32.55079	-71.05967	-15.04485	1.99147	71.92712	77.50000	.04911
-32.61916	-32.68753	-71.05967	-15.04485	1.99147	71.41240	77.50000	.04911
-32.75591	-32.82420	-71.05967	-15.04485	1.99147	70.86654	77.50000	.04911
-32.88946	-32.96102	-71.05967	-15.04485	1.99147	70.29340	77.50000	.04911
-33.02946	-33.09777	-71.05967	-15.04485	1.99147	69.65400	77.50000	.04911
-33.16616	-33.23452	-71.05967	-15.04485	1.99147	69.03746	77.50000	.04911
-33.30299	-33.37126	-71.05967	-15.04485	1.99147	68.35044	77.50000	.04911
-33.43954	-33.50801	-71.05967	-15.04485	1.99147	67.61925	77.50000	.04911
-33.57639	-33.64476	-71.05967	-15.04485	1.99147	66.83975	77.50000	.04911
-33.71313	-33.78150	-71.05967	-15.04485	1.99147	66.00730	77.50000	.04911
-33.84972	-33.91825	-71.05967	-15.04485	1.99147	65.11471	77.50000	.04911
-33.98662	-34.05499	-71.05967	-15.04485	1.99147	64.16215	77.50000	.04911
-34.12337	-34.19174	-71.05967	-15.04485	1.99147	63.13706	77.50000	.04911
-34.26011	-34.32849	-71.05967	-15.04485	1.99147	62.03406	77.50000	.04911
-34.39686	-34.46523	-71.05967	-15.04485	1.99147	60.84483	77.50000	.04911
-34.36406	-34.40198	-71.05967	-15.04485	1.99147	59.56000	77.50000	.04911
-29.95064	-29.99790	-70.25317	-11.40696	1.73475	72.87795	77.50000	.08540
-30.09095	-30.11967	-70.25317	-11.40696	1.73475	72.41497	77.50000	.08540
-30.22559	-30.25298	-70.25317	-11.40696	1.73475	71.92712	77.50000	.08540
-30.43069	-30.53499	-70.25317	-11.40696	1.73475	71.41240	77.50000	.08540
-30.64100	-30.74601	-70.25317	-11.40696	1.73475	70.86654	77.50000	.08540
-30.05101	-30.05662	-70.25317	-11.40696	1.73475	70.29340	77.50000	.08540
-31.09000	-31.16603	-70.25317	-11.40696	1.73475	69.68400	77.50000	.08540
-31.27104	-31.74455	-70.25317	-11.40696	1.73475	69.03746	77.50000	.08540
-31.41405	-31.56606	-70.25317	-11.40696	1.73475	68.35044	77.50000	.08540
-31.60105	-31.74607	-70.25317	-11.40696	1.73475	67.61925	77.50000	.08540
-32.01103	-32.02508	-70.25317	-11.40696	1.73475	66.83975	77.50000	.08540
-32.21120	-32.21610	-70.25317	-11.40696	1.73475	66.00730	77.50000	.08540
-32.33112	-32.42611	-70.25217	-11.40696	1.73475	65.11671	77.50000	.08540
-32.53112	-32.63512	-70.25317	-11.40696	1.73475	64.16215	77.50000	.08540
-32.74012	-32.84214	-70.25317	-11.40696	1.73475	63.13706	77.50000	.08540
-32.95314	-33.05005	-70.25317	-11.40696	1.73475	62.03405	77.50000	.08540
-33.16116	-33.26414	-60.50605	-8.50063	1.24215	60.84483	77.50000	.08540
-26.00995	-26.27226	-69.60425	-8.50063	1.24215	59.56000	77.50000	.05549
-26.79439	-26.95610	-69.40385	-8.50063	1.24215	83.25316	77.50000	.10927
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-24.18405	-28.25776	-69.60385	-8.50063	1.24215	81.77264	77.50000	.10927
				1.24215	81.29591	77.50000	.10927
				1.24215	80.76105	77.50000	.10927

22

.17771	6.00000	36.57081	1.99147	-6.24710	-59.43721	-17.70567	-17.35177
.17771	6.00000	35.82808	1.99147	-6.24710	-59.43721	-18.85718	-18.02562
.17771	6.00000	35.07118	1.99147	-6.24710	-59.43721	-19.50130	-18.47745
.17771	6.00000	34.29698	1.99147	-6.24710	-59.43721	-17.26924	-19.32037
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.17771	6.00000	32.71419	1.99147	-6.24710	-59.43721	-20.64494	-20.62102
.17771	6.00000	31.89942	1.99147	-6.24710	-59.43721	-21.20979	-21.26647
.17771	6.00000	31.06996	1.99147	-6.24710	-59.43721	-22.24954	-21.71572
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.17771	6.00000	29.36684	1.99147	-6.24710	-59.43721	-23.21242	-23.21242
.17771	6.00000	28.49317	1.99147	-6.24710	-59.43721	-23.45302	-23.65022
.17771	6.00000	27.60490	1.99147	-6.24710	-59.43721	-24.62204	-24.50011
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.17771	6.00000	25.78422	1.99147	-6.24710	-59.43721	-26.12774	-25.80381
.17771	6.00000	24.85224	1.99147	-6.24710	-59.43721	-26.77559	-26.45166
.17771	6.00000	23.90600	1.99147	-6.24710	-59.43721	-27.47344	-27.09951
.19289	6.00000	38.01439	1.99147	-5.83077	-55.47610	-27.29951	-12.96070
.19289	6.00000	37.29953	1.99147	-5.83077	-55.47610	-13.33305	-13.66341
.19289	6.00000	36.57081	1.99147	-5.83077	-55.47610	-14.07975	-14.43311
.19289	6.00000	35.82808	1.99147	-5.83077	-55.47610	-14.43311	-15.16582
.19289	6.00000	35.07118	1.99147	-5.83077	-55.47610	-15.53817	-15.89552
.19289	6.00000	34.29998	1.99147	-5.83077	-55.47610	-15.25986	-16.62323
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.19289	6.00000	32.71419	1.99147	-5.83077	-55.47610	-17.71329	-18.07761
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.24535	6.00000	35.07118	1.99147	-3.74912	-35.67053	-1.43132	-1.69181
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							2.24961	2.87016

1.62005	.09050	-29.73243	-1.01990	1.00192	34.29998	6.00000	.25695
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0.86044	8.21632	-25.75544	-2.70701	1.99147	36.65626	6.00000	.26109
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6.10696	5.52293	-25.75544	-2.70701	1.99147	34.05763	6.00000	.26109
4.85071	4.17759	-25.75544	-2.70701	1.99147	32.71043	6.00000	.26109
3.59447	2.82135	-25.75544	-2.70701	1.99147	31.31065	6.00000	.26109
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13.31811	12.57769	-21.79433	-2.29068	1.99147	37.88905	6.00000	.26576
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10.36641	9.61990	-21.79433	-2.29068	1.99147	35.38270	6.00000	.26576
8.87557	8.13515	-21.79433	-2.29068	1.99147	34.04763	6.00000	.26576
7.39472	6.54430	-21.79433	-2.29068	1.99147	32.71043	6.00000	.26576
5.91388	5.17845	-21.79433	-2.29068	1.99147	31.31065	6.00000	.26576
4.43301	3.62261	-21.79433	-2.29068	1.99147	29.66801	6.00000	.26576
2.95210	2.71176	-21.79433	-2.29068	1.99147	28.36241	6.00000	.26576
1.47134	1.73092	-21.79433	-2.29068	1.99147	26.05399	6.00000	.26576
-.00951	-.74003	-21.79433	-2.29068	1.99147	25.28316	6.00000	.26576
-1.47035	-2.23079	-21.79433	-2.29068	1.99147	23.67056	6.00000	.26576
-3.71160	-3.71162	-21.79433	-2.29068	1.99147	22.01719	6.00000	.26576
-4.45794	-5.22247	-21.79433	-2.29068	1.99147	20.32431	6.00000	.26576
-5.79260	-6.67031	-21.79433	-2.29068	1.99147	18.59357	6.00000	.26576
-7.41374	-0.15416	-21.79433	-2.29068	1.99147	16.82593	6.00000	.26576
-8.94558	-0.63600	-21.79433	-2.29068	1.99147	15.02672	6.00000	.26576
-10.37543	-11.12585	-21.79433	-2.29068	1.99147	13.19564	6.00000	.26576
-11.45627	-13.58470	-21.79433	-2.29068	1.99147	11.33671	6.00000	.26576

16.40053	15.59261	-17.53321	-1.87435	1.99147	37.88905	6.00000	.26961
14.74600	13.87736	-17.53321	-1.87435	1.99147	36.65626	6.00000	.26961
13.16963	12.26751	-17.53321	-1.87435	1.99147	35.32270	6.00000	.26961
11.55419	10.74645	-17.53321	-1.87435	1.99147	34.06763	6.00000	.26961
9.93972	9.23107	-17.53321	-1.87435	1.99147	32.71043	6.00000	.26961
8.32256	7.71056	-17.53321	-1.87435	1.99147	31.31065	6.00000	.26961
6.70702	5.60011	-17.53321	-1.87435	1.99147	29.86601	6.00000	.26961
5.17446	4.47466	-17.53321	-1.87435	1.99147	28.38241	6.00000	.26961
3.47743	2.46420	-17.53321	-1.87435	1.99147	26.85399	6.00000	.26961
1.96245	1.05375	-17.53321	-1.87435	1.99147	25.28316	6.00000	.26961
.34603	-.54170	-17.53321	-1.87435	1.99147	23.67056	6.00000	.26961
-1.36045	-2.17715	-17.53321	-1.87435	1.99147	22.01719	6.00000	.26961
-2.98687	-3.79240	-17.53321	-1.87435	1.99147	20.32431	6.00000	.26961
-4.60932	-5.40605	-17.53321	-1.87435	1.99147	18.59257	6.00000	.26961
-6.09577	-7.02552	-17.53321	-1.87435	1.99147	16.82693	6.00000	.26961
-7.53122	-8.63965	-17.53321	-1.87435	1.99147	15.02672	6.00000	.26961
-9.44467	-10.25440	-17.53321	-1.87435	1.99147	13.19564	6.00000	.26961
-11.06212	-11.86925	-17.53321	-1.87435	1.99147	11.33671	6.00000	.26961
16.60793	18.60793	-13.27210	-1.45602	1.99147	27.83905	6.00000	.27266
16.73291	16.95784	-13.27210	-1.45602	1.99147	35.65626	6.00000	.27266
14.93265	15.19762	-13.27210	-1.45602	2.99147	35.39270	6.00000	.27266
13.25280	13.59277	-13.27210	-1.45602	1.99147	34.06763	6.00000	.27266
12.40274	11.60771	-13.27210	-1.45602	1.99147	32.71043	6.00000	.27266
10.79263	9.89766	-13.27210	-1.45602	1.99147	31.31065	6.00000	.27266
8.73953	8.35755	-13.27210	-1.45602	1.99147	29.86601	6.00000	.27266
7.22204	6.40749	-13.27210	-1.45602	1.99147	28.39241	6.00000	.27266
5.64262	4.40744	-13.27210	-1.45602	1.99147	25.85399	6.00000	.27266
3.73624	2.45744	-13.27210	-1.45602	1.99147	25.24316	6.00000	.27266
1.96241	1.16795	-13.27210	-1.45602	1.99147	23.47056	6.00000	.27266
-.23754	-.46247	-13.27210	-1.45602	1.99147	27.01719	6.00000	.27266
-1.83775	-2.06673	-13.27210	-1.45602	1.99147	20.32431	6.00000	.27266
-3.26774	-3.14270	-13.27210	-1.45602	1.99147	18.59357	6.00000	.27266
-5.06795	-5.54484	-13.27210	-1.45602	1.99147	16.82693	6.00000	.27266
-6.79702	-7.64239	-13.27210	-1.45602	1.99147	15.02672	6.00000	.27266
-8.17762	-4.36795	-13.27210	-1.45602	1.99147	13.19564	6.00000	.27266
-9.25762	-11.14260	-13.27210	-1.45602	1.99147	11.33671	6.00000	.27266
-10.26769	21.62905	-13.27210	-1.45602	1.99147	37.88905	6.00000	.27266
22.54539	19.73649	-9.01099	-1.04169	1.99147	36.65626	6.00000	.27495
20.68072	17.96574	-9.01099	-1.04169	1.99147	35.38270	6.00000	.27495
19.79067	15.96608	-9.01099	-1.04169	1.99147	34.06763	6.00000	.27495
17.91141	14.06442	-9.01099	-1.04169	1.99147	32.71043	6.00000	.27495
15.06676	12.16976	-9.01099	-1.04169	1.99147	31.31065	6.00000	.27495
14.44370	10.41510	-9.01099	-1.04169	1.99147	29.86201	6.00000	.27495
12.35743	8.42044	-9.01099	-1.04169	1.99147	28.38241	6.00000	.27495
10.43277	6.54575	-9.01099	-1.04169	1.99147	26.38399	6.00000	.27495
7.48611	4.65112	-9.01099	-1.04169	1.99147	25.23216	6.00000	.27495
5.60245	2.77466	-9.01099	-1.04169	1.99147	23.67056	6.00000	.27495
2.71472	.89130	-9.01099	-1.04169	1.99147	22.01719	6.00000	.27495
1.03413	-.69226	-9.01099	-1.04169	1.99147	20.32431	6.00000	.27495
-.05053							

REFERENCE AREA		B/2	REF. AR	TRUE AR	MACH NUMBER
	-1.04169	1.99147	18.59357	6.00000	.27495
	-1.04169	1.99147	16.82693	6.00000	.27495
	-1.04159	1.99147	15.02672	5.00000	.27495
	-1.04159	1.99147	13.19554	6.00000	.27495
	-1.04159	1.99147	11.33671	6.00000	.27495
	-.62536	1.99147	37.86905	5.00000	.27649
	-.62526	1.99147	36.65626	6.00000	.27649
	-.62526	1.99147	35.38270	6.00000	.27649
	-.62526	1.99147	34.06763	6.00000	.27649
	-.62536	1.99147	32.71043	6.00000	.27649
	-.62536	1.99147	31.31065	6.00000	.27649
	-.62536	1.99147	29.86601	6.00000	.27649
	-.62536	1.99147	28.38241	6.00000	.27649
	-.62536	1.99147	26.85299	6.00000	.27649
	-.62535	1.99147	25.28316	6.00000	.27649
	-.62536	1.99147	23.67056	6.00000	.27649
	-.62536	1.99147	22.01719	6.00000	.27649
	-.62536	1.99147	20.32431	6.00000	.27649
	-.62536	1.99147	18.59357	6.00000	.27649
	-.62536	1.99147	16.82693	5.00000	.27649
	-.62536	1.99147	15.02672	6.00000	.27649
	-.62536	1.99147	13.19554	6.00000	.27649
	-.62536	1.99147	11.33671	6.00000	.27649
	-1.20860	1.99559	37.86905	6.00000	.27726
	-1.20860	1.99559	36.65626	6.00000	.27726
	-1.20860	1.99559	35.38270	6.00000	.27726
	-1.20860	1.99559	34.06763	6.00000	.27726
	-1.20860	1.99559	32.71043	6.00000	.27726
	-1.20860	1.99559	31.31065	6.00000	.27726
	-1.20860	1.99559	29.86801	6.00000	.27726
	-1.20860	1.99559	28.38241	6.00000	.27726
	-1.20860	1.99559	26.85399	6.00000	.27726
	-1.20860	1.99559	25.28316	6.00000	.27726
	-1.20860	1.99559	23.67056	6.00000	.27726
	-1.20860	1.99559	22.01719	6.00000	.27726
	-1.20860	1.99559	20.32431	6.00000	.27726
	-1.20860	1.99559	18.59357	6.00000	.27726
	-1.20860	1.99559	16.82693	6.00000	.27726
	-1.20860	1.99559	15.02672	6.00000	.27726
	-1.20860	1.99559	13.19554	6.00000	.27726
	-1.20860	1.99559	11.33671	6.00000	.27726

REF. CHORD	C AVERAGE	TRUE AREA	REFERENCE AREA	B/2	REF. AR	TRUE AR	MACH NUMBER
20.84960	21.39705	3059.49435	2353.62950	71.49070	8.68602	6.68204	.80000

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FIRST PLANFORM SPAN LOADING

Y	CL*C
-71.05967	.38265
-70.25317	.65546
-69.60895	.65137
-67.35944	4.98427
-65.30533	5.73609
-59.43721	6.35234
-55.47610	6.90517
-51.51400	7.38248
-47.55397	7.85560
-43.59276	8.17397
-39.63164	8.49878
-35.67053	8.78426
-31.70941	9.03333
-28.73243	9.19649
-25.75544	9.34767
-21.79433	9.51510
-17.83321	9.65245
-13.87210	9.75213
-9.91099	9.84404
-5.94937	9.89900
-1.98456	9.92670

CL DEVELOPED ON THIS PLANFORM= .500091
CM DEVELOPED ON THIS PLANFORM= -.128556

CL COMPUTED= .500091   CM COMPUTED= -.128556   CD V= .008141

CL DESIGN = .500000

LOCAL ELEVATION DATA

Y= -73.0597   Y/B/2= -.8940   CHORD= 2.4614

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0084 .7334 .4834 .5245 .4550 .3950 .3411 .2818 .2432 .1964 .1432 .1003 .0430 .0101 -.0783 -.1651 -.3010 -.6781
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1525 .2082 .3124 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
-.0000	.2304	-.0000	.5671
.0250	.2077	.0615	.5111
.0500	.1860	.1231	.4555
.0750	.1636	.1846	.4031
.1000	.1448	.2461	.3565
.1250	.1278	.3077	.3145
.1500	.1119	.3692	.2755
.1750	.0971	.4308	.2389
.2000	.0832	.4923	.2047
.2500	.0705	.5538	.1728
.2500	.0585	.6154	.1429
.2750	.0463	.5769	.1148
.3000	.0359	.7384	.0894
.3750	.0252	.8000	.0637
.3500	.0164	.8615	.0405
.3750	.0076	.9230	.0198
.4000	-.0003	.9846	-.0015
.4000	-.0083	1.0461	-.0204
.4500	-.0159	1.1076	-.0379
.5000	-.0230	1.1692	-.0542
.5000	-.0291	1.2307	-.0690
.5250	-.0346	1.2923	-.0826
.5500	-.0395	1.3538	-.0949
.5750	-.0430	1.4153	-.1059
.6000	-.0470	1.4769	-.1156
.6250	-.0478	1.5384	-.1240
.6500	-.0504	1.5999	-.1310
.6750	-.0532		

-.1266
-.1409
-.1425
-.1446
-.1441
-.1419
-.1377
-.1310
-.1219
-.1108
-.0971
-.0753
-.0412
0.0000

1.6615
1.7220
1.7845
1.8461
1.9075
1.9691
2.0307
2.0922
2.1538
2.2153
2.2768
2.3384
2.3999
2.4614

-.0555
-.0572
-.0583
-.0588
-.0586
-.0578
-.0562
-.0532
-.0450
-.0304
-.0147
0.0000

.6750
.7000
.7250
.7500
.7750
.8000
.8250
.8500
.9000
.9250
.9500
.9750
1.0000

Y= -7C.2532   Y/B/2= -.9827   CHORD= 3.7C02

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR
.0752 .2491 .1364 .5372 .4552 .3935 .3144 .2572 .1983 .1402 .0817 .0712 -.0430 -.1137 -.1957 -.2996 -.4566 -.8874
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR
.C417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
-.0000	.1804	-.0000	.6821
-.0250	.1550	.0945	.5893
-.0500	.1715	.1490	.4971
-.0750	.1097	.2835	.4107
-.1000	.0874	.3730	.3243
-.1250	.0764	.4725	.2642
-.1500	.0629	.5670	.2035
-.1750	.0503	.6615	.1450
-.2000	.0240	.7560	.0907
-.2250	.0107	.8506	.0406
-.2500	-.0013	.9451	-.0059
-.2750	-.0130	1.0395	-.0491
-.3000	-.0233	1.1341	-.0692
-.3250	-.0334	1.2286	-.1263
-.3500	-.0424	1.3231	-.1604
-.3750	-.0508	1.4176	-.1919
-.4000	-.0594	1.5121	-.2206
-.4250	-.0653	1.6066	-.2468
-.4500	-.0715	1.7011	-.2704
-.4750	-.0771	1.7956	-.2915
-.5000	-.0820	1.8901	-.3101
-.5250	-.0843	1.9846	-.3262
-.5500	-.0893	2.0791	-.3399
-.5750	-.0929	2.1736	-.3511
-.6000	-.0952	2.2681	-.3598
-.6250	-.0963	2.3626	-.3660
-.6500	-.0974	2.4571	-.3695
-.6750	-.0978	2.5517	-.3705
-.7000	-.0976	2.6462	-.3688
-.7250	-.0963	2.7407	-.3642

.7500	-.0944	2.8352	-.3567
.7750	-.0916	2.9297	-.3461
.8000	-.0879	3.0742	-.3324
.8250	-.0833	3.1187	-.3151
.8500	-.0775	3.2132	-.2931
.8750	-.0705	3.3077	-.2647
.9000	-.0627	3.4022	-.2370
.9250	-.0535	3.4967	-.2023
.9500	-.0406	3.5412	-.1534
.9750	-.0213	0.6897	-.0929
1.0000	0.0000	3.7802	0.0000

Y= -59.6090   Y/P/2= -.9737   CHORD= 6.2535

.5904 .4672 .4573 .3279 .2226 .1408 .0764 .0250-.0172-.0533-.0250-.0259-.1175-.1504-.1879-.2349-.3008-.4092-.7255

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3154 .3750 .4206 .4661 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
-.0000	.0598	-.0000	.3738
.0250	.0266	.1563	.2162
.0500	.0095	.3127	.0599
.0750	-.0129	.4590	-.0807
.1000	-.0312	.5254	-.1050
.1250	-.0460	.7847	-.2877
.1400	-.0587	.9380	-.3672
.1750	.0466	1.0944	-.4364
.2000	-.0591	1.2507	-.4955
.2500	-.0672	1.4070	-.5454
.2500	-.0699	1.5634	-.5874
.2750	-.0896	1.7197	-.6226
.3000	-.1042	1.8761	-.6517
.3750	-.1080	2.0324	-.6751
.3500	-.1109	2.1807	-.6936
.3750	-.1132	2.3451	-.7077
.4000	-.1148	2.5014	-.7177
.4250	-.1158	2.6577	-.7240
.4500	-.1163	2.8141	-.7270
.4750	-.1163	2.9704	-.7270
.5000	-.1153	3.1268	-.7242
.5250	-.1140	3.2831	-.7187
.5500	-.1137	3.4394	-.7108
.5750	-.1129	3.5958	-.7005
.6000	-.1100	3.7521	-.6860
.6250	-.1076	3.9084	-.6732
.6500	-.1043	4.0648	-.6562
.6750	-.1019	4.2211	-.6369
.7000	-.0984	4.3775	-.6154
.7240	-.0966	4.5338	-.5915

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.7500	-.0903	4.6901	-.5649
.7750	-.0857	4.8455	-.5357
.8000	-.0805	5.0028	-.5037
.8250	-.0748	5.1591	-.4681
.8500	-.0684	5.3155	-.4278
.8750	-.0612	5.4719	-.3826
.9000	-.0534	5.6282	-.3342
.9250	-.0448	5.7845	-.2803
.9500	-.0335	5.9408	-.2094
.9750	-.0177	6.0972	-.1122
1.0000	0.0000	6.2535	0.0000

Y = -67.3894   Y/R/2 = -.9422   CHORD = 0.8225

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.1260 .0924 .0707 .0536 .0383 .0257 .0135 .0024-.0090-.0275-.0367-.0460-.0559-.0671-.0816-.1042-.1707

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0055	0.0000	-.0577
.0250	-.0087	.2206	-.0857
.0500	-.0122	.4411	-.1135
.0750	-.0153	.6617	-.1391
.1000	-.0188	.8422	-.1609
.1250	-.0224	1.1028	-.1796
.1500	-.0222	1.3234	-.1962
.1750	-.0235	1.5439	-.2111
.2000	-.0254	1.7645	-.2243
.2250	-.0257	1.9851	-.2359
.2500	-.0279	2.2056	-.2460
.2750	-.0293	2.4262	-.2546
.3000	-.0297	2.6467	-.2620
.3250	-.0304	2.8673	-.2680
.3500	-.0309	3.0879	-.2728
.3750	-.0313	3.3034	-.2764
.4000	-.0316	3.5290	-.2788
.4250	-.0317	3.7496	-.2901
.4500	-.0318	3.9701	-.2803
.4750	-.0317	4.1907	-.2795
.5000	-.0315	4.4112	-.2776
.5250	-.0311	4.6318	-.2748
.5500	-.0307	4.8524	-.2710
.5750	-.0302	5.0729	-.2662
.6000	-.0295	5.2935	-.2605
.6250	-.0289	5.5141	-.2539
.6500	-.0279	5.7346	-.2464
.6750	-.0279	5.9552	-.2379
.7000	-.0259	6.1757	-.2285
.7250	-.0247	6.3963	-.2152

.7500	-.0235	6.6169	-.2069
.7750	-.0221	6.8374	-.1946
.8000	-.0206	7.0520	-.1814
.8250	-.0189	7.2766	-.1669
.8500	-.0171	7.4971	-.1510
.8750	-.0151	7.7127	-.1336
.9000	-.0131	7.9402	-.1152
.9250	-.0108	8.1608	-.0952
.9500	-.0079	8.3814	-.0701
.9750	-.0042	8.6019	-.0373
1.0000	0.0000	8.3225	0.0000

Y = -62.3983   Y/B/2 = -.8868   CHORD = 10.2419

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.1221 .0895 .0539 .0532 .0404 .0290 .0197 .0089-.0005-.0098-.0191-.0288-.0390-.0502-.0632-.0797-.1046-.1730

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0035	0.0000	-.0355
.0250	-.0055	.2560	-.0670
.0500	-.0096	.5121	-.0983
.0750	-.0124	.7681	-.1271
.1000	-.0146	1.0242	-.1516
.1250	-.0169	1.2802	-.1726
.1500	-.0187	1.5363	-.1914
.1750	-.0203	1.7923	-.2003
.2000	-.0218	2.0484	-.2234
.2250	-.0231	2.3044	-.2368
.2500	-.0243	2.5605	-.2486
.2750	-.0253	2.8165	-.2591
.3000	-.0262	3.0726	-.2681
.3250	-.0269	3.3285	-.2759
.3500	-.0276	3.5847	-.2825
.3750	-.0281	3.8407	-.2878
.4000	-.0285	4.0968	-.2920
.4250	-.0288	4.3529	-.2951
.4500	-.0290	4.6090	-.2971
.4750	-.0291	4.8649	-.2980
.5000	-.0291	5.1209	-.2978
.5250	-.0290	5.3770	-.2956
.5500	-.0287	5.6330	-.2943
.5750	-.0284	5.8891	-.2909
.6000	-.0280	6.1451	-.2864
.6250	-.0274	6.4012	-.2808
.6500	-.0763	6.6572	-.2741
.6750	-.0742	6.9133	-.2663
.7000	-.0751	7.1693	-.2574
.7250	-.0741	7.4254	-.2472

-.2357	7.6614	-.0270	.7500
-.2229	7.9375	-.0219	.7750
-.2028	8.1935	-.0204	.8000
-.1831	8.4426	-.0189	.8250
-.1754	8.7056	-.0171	.8500
-.1556	8.9617	-.0152	.8750
-.1345	9.2177	-.0132	.9000
-.1117	9.4731	-.0109	.9250
-.0824	9.7287	-.0080	.9500
-.0459		-.0041	.9720
0.0000	10.2419	0.0000	1.0000

Y= -90.4272   Y/(B/2)= -.8314   CHORD= 11.6613

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR
.0157 .0064-.0025-.0212-.0199-.0290-.0385-.0493-.0617-.0776-.1018-.1685
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0051	0.0000	-.0591
.0250	-.0080	.2615	-.0932
.0500	-.0108	.5431	-.1270
.0750	-.0135	.7744	-.1580
.1000	-.0158	1.1461	-.1842
.1250	-.0177	1.4577	-.2066
.1500	-.0194	1.7492	-.2255
.1750	-.0210	2.0407	-.2444
.2000	-.0223	2.3223	-.2603
.2250	-.0235	2.6730	-.2743
.2500	-.0245	2.9153	-.2845
.2750	-.0255	3.2050	-.2972
.3000	-.0263	3.4864	-.3055
.3250	-.0270	3.7469	-.3143
.3500	-.0275	4.0815	-.3208
.3750	-.0280	4.2730	-.3260
.4000	-.0283	4.6645	-.3299
.4250	-.0285	4.9561	-.3226
.4500	-.0287	5.2476	-.3342
.4750	-.0287	5.5391	-.3346
.5000	-.0286	5.8306	-.3338
.5250	-.0285	6.1222	-.3219
.5500	-.0282	6.4137	-.3268
.5750	-.0278	6.7052	-.3246
.6000	-.0274	6.9968	-.3192
.6250	-.0268	7.2693	-.3127
.6500	-.0262	7.5799	-.3050
.6750	-.0254	7.3714	-.2961
.7000	-.0245	8.1629	-.2859
.7250	-.0235	8.4544	-.2744

-.2615   8.7460
-.2473   9.0375
-.2315   9.3290
-.2141   9.6206
-.1945   9.9121
-.1727   10.2056
-.1494   10.4962
-.1238   10.7882
-.0914   11.0782
-.0446   11.3698
0.0000   11.6613

-.0224   .7500
-.0212   .7750
-.0199   .8000
-.0184   .8250
-.0167   .8500
-.0145   .8750
-.0121   .9000
-.0101   .9250
-.0072   .9500
-.0042   .9750
0.0000   1.0000

41

Y = -55.4761   Y/R/2= -.7760   CHORD= 13.0307

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0591 .0676 .0660 .0443 .0372 .0217 .0122 .0023 -.0003 -.0122 -.0052 -.0156 -.0219 -.0305 -.0399 -.0499 -.0618 -.0771 -.1003 -.1648

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0872 .152 .2093 .2629 .3194 .3759 .4305 .4803 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0075	0.0000	-.0985
.0250	-.0103	.3270	-.1345
.0500	-.0130	.6540	-.1702
.0750	-.0155	.9611	-.2029
.1000	-.0176	1.3081	-.2305
.1250	-.0194	1.6351	-.2528
.1500	-.0210	1.9621	-.2744
.1750	-.0224	2.2291	-.2929
.2000	-.0236	2.5161	-.3091
.2250	-.0247	2.8432	-.3233
.2500	-.0257	3.1702	-.3356
.2750	-.0266	3.5072	-.3463
.3000	-.0272	3.8242	-.3553
.3250	-.0277	4.1512	-.3626
.3500	-.0278	4.4782	-.3689
.3750	-.0278	4.8051	-.3735
.4000	-.0278	5.2353	-.3768
.4250	-.0278	5.5523	-.3786
.4500	-.0278	5.8063	-.3796
.4750	-.0279	6.2131	-.3790
.5000	-.0278	6.5403	-.3773
.5250	-.0276	6.8674	-.3743
.5500	-.0279	7.1944	-.3700
.5750	-.0272	7.5214	-.3645
.6000	-.0274	7.8484	-.3579
.6250	-.0268	8.1754	-.3499
.6500	-.0260	8.5025	-.3407
.6750	-.0252	8.8295	-.3302
.7000	-.0243	9.1565	-.3184
.7250	-.0233	9.4835	-.3051

-.2904	9.8105	-.0222	.7500
-.2741	10.1375	-.0210	.7750
-.2503	10.4546	-.0196	.8000
-.2367	10.7916	-.0181	.8250
-.2147	11.1136	-.0164	.8500
-.1905	11.4555	-.0146	.8750
-.1645	11.7726	-.0126	.9000
-.1361	12.0994	-.0104	.9250
-.1004	12.4257	-.0077	.9500
-.0534	12.7537	-.0041	.9750
0.0000	13.0867	0.0000	1.0000

43

Y= -51.5150   Y/B/2= -.7206   CHORD= 14.5001

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.1803 .0733 .0561 .0390 .0261 .0181 .0082 .0004 .0078-.0078-.0158-.0218-.0320-.0408-.0505-.0619-.0765-.0988-.1609

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1522 .2043 .2632 .3164 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0000	0.0000	-.1428
.0250	-.0124	.3625	-.1803
.0500	-.0150	.7250	-.2175
.0750	-.0173	1.0875	-.2514
.1000	-.0193	1.4500	-.2799
.1250	-.0210	1.8125	-.3039
.1500	-.0224	2.1750	-.3248
.1750	-.0237	2.5375	-.3435
.2000	-.0243	2.9000	-.3599
.2250	-.0256	3.2625	-.3740
.2500	-.0266	3.6250	-.3862
.2750	-.0273	3.9875	-.3965
.3000	-.0278	4.3500	-.4052
.3250	-.0284	4.7125	-.4122
.3500	-.0283	5.0750	-.4176
.3750	-.0281	5.4375	-.4216
.4000	-.0282	5.8000	-.4241
.4250	-.0285	6.1625	-.4253
.4500	-.0293	6.5250	-.4250
.4750	-.0292	6.8875	-.4235
.5000	-.0290	7.2500	-.4206
.5250	-.0287	7.6126	-.4164
.5500	-.0282	7.9751	-.4109
.5750	-.0277	8.3376	-.4041
.6000	-.0273	8.7001	-.3960
.6250	-.0267	9.0626	-.3865
.6500	-.0259	9.4251	-.3758
.6750	-.0251	9.7876	-.3636
.7000	-.0241	10.1501	-.3500
.7250	-.0231	10.5126	-.3340

44

-.3183	10.8751	-.0220	.7500
-.3001	11.2376	-.0207	.7750
-.2802	11.6001	-.0193	.8000
-.2524	11.9626	-.0174	.8250
-.2341	12.3252	-.0161	.8500
-.2073	12.6876	-.0143	.8750
-.1729	13.0501	-.0123	.9000
-.1477	13.4126	-.0103	.9250
-.1087	13.7751	-.0075	.9500
-.0578	14.1375	-.0040	.9750
0.0000	14.5002	0.0000	1.0000

Y= -47.5529   Y/3/2= -.6652   CHORD= 15.9195

SLOPES,DZ/DY,AT SLOPE POINTS,FROM FRONT TO REAR

.0603 .0673 .0493 .0356 .0243 .0145 .0097 -.0025 -.0101 -.0248 -.0337 -.0421 -.0514 -.0623 -.0763 -.0977 -.1574

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1520 .2053 .2432 .3194 .3760 .4306 .4861 .5417 .5972 .6529 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0123	0.0000	-.1953
.0250	-.0147	.3030	-.2338
.0500	-.0171	.7960	-.2720
.0750	-.0191	1.1940	-.3069
.1000	-.0211	1.5919	-.3359
.1250	-.0226	1.9899	-.3601
.1500	-.0239	2.3879	-.3812
.1750	-.0251	2.7859	-.3998
.2000	-.0261	3.1839	-.4150
.2250	-.0270	3.5819	-.4290
.2500	-.0277	3.9799	-.4415
.2750	-.0283	4.3779	-.4513
.3000	-.0288	4.7759	-.4592
.3250	-.0292	5.1738	-.4675
.3500	-.0295	5.5718	-.4701
.3750	-.0297	5.9698	-.4732
.4000	-.0298	6.3678	-.4747
.4250	-.0298	6.7658	-.4747
.4500	-.0297	7.1638	-.4733
.4750	-.0296	7.5618	-.4705
.5000	-.0293	7.9597	-.4653
.5250	-.0290	8.3577	-.4607
.5500	-.0285	8.7557	-.4538
.5750	-.0280	9.1537	-.4454
.6000	-.0274	9.5517	-.4357
.6250	-.0267	9.9497	-.4246
.6500	-.0259	10.3477	-.4121
.6750	-.0250	10.7457	-.3981
.7000	-.0240	11.1436	-.3826
.7250	-.0230	11.5416	-.3655

-.3469	11.9396	-.0219	.7500
-.3266	12.3576	-.0205	.7750
-.3045	12.7556	-.0191	.8000
-.2803	13.1336	-.0176	.8250
-.2536	13.5316	-.0159	.8500
-.2243	13.9296	-.0141	.8750
-.1931	14.3275	-.0121	.9000
-.1592	14.7255	-.0100	.9250
-.1159	15.1735	-.0073	.9500
-.0620	15.5215	-.0033	.9750
0.0000	15.4195	0.0000	1.0000

Yr -43.5028   Y/B/2= -.6048   CHORD= 17.3369

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0035 .0020 .0046 .0315 .0256 .0210 .0027-.0051-.0124-.0200-.0273-.0349-.0429-.0518-.0622-.0756-.0961-.1534
.0417 .0667 -.1128 .2053 .2623 .3154 .3750 .4356 .4861 .5417 .5972 .6528 .7003 .7539 .8194 .8750 .9305 .9861

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

LOCAL ELEVATION

Y/C	Z/C	DELTA X	DELTA Z
0.0000	-.0143	0.0000	-.2488
.0250	-.0166	.4335	-.2680
.0500	-.0190	.8669	-.3269
.0750	-.0206	1.3004	-.3622
.1000	-.0226	1.7338	-.3914
.1250	-.0240	2.1674	-.4155
.1500	-.0252	2.6008	-.4365
.1750	-.0262	3.0243	-.4546
.2000	-.0271	3.4678	-.4705
.2250	-.0279	3.9013	-.4838
.2500	-.0286	4.3347	-.4948
.2750	-.0290	4.7682	-.5039
.3000	-.0295	5.2017	-.5110
.3250	-.0298	5.6351	-.5164
.3500	-.0300	6.0616	-.5200
.3750	-.0301	6.5021	-.5220
.4000	-.0301	6.9356	-.5224
.4250	-.0301	7.3690	-.5213
.4500	-.0300	7.8025	-.5186
.4750	-.0297	8.2360	-.5145
.5000	-.0294	8.6694	-.5090
.5250	-.0290	9.1029	-.5020
.5500	-.0285	9.5364	-.4935
.5750	-.0279	9.9698	-.4837
.6000	-.0272	10.4033	-.4724
.6250	-.0265	10.8368	-.4597
.6500	-.0257	11.2703	-.4454
.6750	-.0243	11.7038	-.4297
.7000	-.0238	12.1372	-.4125
.7250	-.0227	12.5707	-.3936

Y= -39.6315   Y/B/2= -.5544   CHORD= 18.7583

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0158 .0072 -.0003 -.0079 -.0152 -.0221 -.0291 -.0363 -.0439 -.0524 -.0623 -.0750 -.0947 -.1496
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1523 .2081 .2639 .3104 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0165	0.0000	-.3107
.0250	-.0187	.4609	-.3501
.0500	-.0203	.9379	-.3892
.0750	-.0224	1.4069	-.4246
.1000	-.0242	1.9753	-.4536
.1250	-.0254	2.3448	-.4774
.1500	-.0265	2.8157	-.4978
.1750	-.0275	3.2927	-.5154
.2000	-.0283	3.7017	-.5304
.2250	-.0290	4.2296	-.5428
.2500	-.0299	4.4036	-.5529
.2750	-.0302	5.1395	-.5609
.3000	-.0304	5.6275	-.5669
.3250	-.0306	6.0654	-.5711
.3500	-.0306	6.5604	-.5735
.3750	-.0305	7.0344	-.5741
.4000	-.0305	7.5033	-.5731
.4250	-.0304	7.9723	-.5705
.4500	-.0303	8.4412	-.5664
.4750	-.0302	8.9102	-.5608
.5000	-.0299	9.3791	-.5536
.5250	-.0291	9.8481	-.5459
.5500	-.0283	10.3171	-.5240
.5750	-.0272	10.7860	-.5235
.6000	-.0264	11.2550	-.5102
.6250	-.0255	11.7239	-.4957
.6500	-.0246	12.1029	-.4796
.6750	-.0236	12.6619	-.4619
.7000	-.0235	13.1308	-.4427
.7250	-.0225	13.5968	-.4213

-.3991
-.3747
-.3493
-.?198
-.2?.?
-.?2?4
-.???4
-.1?0?
-.1213
-.0695
0.0000

14.0637
14.5377
15.6666
15.4756
1?.4446
1?.??35
17.3614
17.?204
18.2893
18.7523

-.021?
-.?5??
-.01?.?
-.017?
-.??.?
-.?1?.?
-.50??
-.50??
-.?5?7
0.0000

.7??9
.7?50
.8???
.8??0
.?1??
.?010
.?500
.?75?
1.0000

ORIGINAL PAGE IS
OF POOR QUALITY

Y= -35.4705   Y/B/2= -.4990.   CHORD= 20.1777

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0742 .0573 .0350 .0223 .0127 .0040-.0038-.0111-.0160-.0247-.0313-.0392-.0454-.0534-.0628-.0749-.0936-.1463

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0101	0.0000	-.3860
.0250	-.0211	.5644	-.4251
.0500	-.0230	1.0039	-.4639
.0750	-.0247	1.5133	-.4960
.1000	-.0261	2.0174	-.5273
.1250	-.0273	2.5722	-.5501
.1500	-.0282	3.0247	-.5695
.1750	-.0290	3.2311	-.5761
.2000	-.0297	4.0365	-.5900
.2250	-.0303	4.5430	-.6110
.2500	-.0307	5.0444	-.6197
.2750	-.0610	5.5449	-.6262
.3000	-.0613	6.0533	-.6307
.3250	-.0614	6.5578	-.6332
.3500	-.0714	7.0622	-.6337
.3750	-.0616	7.5666	-.6328
.4000	-.0617	8.0711	-.6301
.4250	-.0610	8.5755	-.6256
.4500	-.0607	9.0800	-.6166
.4750	-.0603	9.5444	-.6120
.5000	-.0299	10.0588	-.6028
.5250	-.0293	10.5933	-.5921
.5500	-.0287	11.0977	-.5769
.5750	-.0281	11.6022	-.5567
.6000	-.0273	12.1056	-.5510
.6250	-.0265	12.6111	-.5343
.6500	-.0256	13.1155	-.5160
.6750	-.0246	13.6122	-.4961
.7000	-.0235	14.1244	-.4746
.7250	-.0000	14.6988	-.4514

.7500	-.0211	15.1333	-.4264
.7740	-.0195	15.6377	-.3906
.5090	-.0184	16.1422	-.3709
.5710	-.0169	16.6466	-.3399
.8500	-.0152	17.1510	-.3061
.8750	-.0134	17.6555	-.2695
.9000	-.0114	18.1499	-.2309
.9250	-.0094	18.6644	-.1592
.9500	-.0066	19.1688	-.1392
.9750	-.0035	19.6733	-.0731
1.0000	0.0000	20.1777	0.0000

Y = -59.7064   Y/B/2 = -.4625   CHORD = 21.5971

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0701 .0452 .0255 .0175 .0076-.0009-.0036-.0157-.0224-.0289-.0353-.0418-.0487-.0561-.0649-.0761-.0937-.1439

.0453 .0373 .2003 .1503 .7650 .3104 .3740 .4206 .4862 .5417 .5972 .6529 .7083 .7639 .8194 .8750 .9306 .9861

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

LOCAL ELEVATION

X/C	Z/C	DELTA Y	DELTA Z
0.0000	-.0229	0.0000	-.4953
.0210	-.0247	.5203	-.5236
.0500	-.0265	1.0709	-.5714
.0720	-.0258	1.6729	-.6053
.0940	-.0260	2.1297	-.6229
.1400	-.0364	2.7986	-.6237
.1500	-.0311	3.2316	-.6714
.1750	-.0315	3.7705	-.6962
.2000	-.0323	4.3196	-.6989
.2250	-.0327	4.8501	-.7070
.2500	-.0330	5.3903	-.7135
.2750	-.0328	5.9392	-.7177
.3000	-.0338	6.4791	-.7199
.3250	-.0332	7.0091	-.7193
.3750	-.0338	7.5500	-.7260
.3750	-.0331	8.0989	-.7143
.4000	-.0338	8.6069	-.7086
.4250	-.0335	9.1709	-.7616
.4500	-.0331	9.7197	-.6926
.4750	-.0316	10.2505	-.6821
.5000	-.0310	10.7985	-.6690
.5000	-.0304	11.3355	-.6562
.5500	-.0297	11.8704	-.6438
.5750	-.0291	12.4183	-.6340
.6000	-.0280	12.9503	-.6055
.6250	-.0271	13.4636	-.5855
.6500	-.0261	14.0291	-.5639
.6750	-.0253	14.5736	-.5637
.7000	-.0249	15.1186	-.5199
.7250	-.0241	15.6570	-.4893

-.4600
-.4107
-.3986
-.3643
-.3271
-.2872
-.2453
-.2003
-.1459
-.0770
0.0000

14.1673
16.7577
17.7777
18.0175
18.5275
18.7275
19.4374
19.9773
20.6172
21.0572
21.5971

-.0013
-.
-.
-.0410
-.
-.0114
-.0093
-.
-.
0.0000

.7590
.
.
.
.
.3600
.9600
.
.9100
1.0000

Y= -63.7024   Y/B/2= -.4019   CHORD= 22.6639

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.7647 .0401 .0243 .0127 .0021-.0044-.0145-.0218-.0298-.0354-.0420-.0487-.0556-.0629-.0713-.0816-.0972-.1434

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .1072 .1755 .2653 .3284 .3750 .4304 .4653 .5027 .5472 .5528 .7039 .7583 .8194 .8750 .9306 .9861

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0016	0.0000	-.6471
.0500	-.0038	.5666	-.6941
.0500	-.0058	1.1332	-.7208
.0750	-.0044	1.6995	-.7533
.0600	-.0020	2.2666	-.7798
.1250	-.0050	2.8330	-.7983
.1500	-.0040	3.3995	-.8139
.1750	-.0050	3.7562	-.8265
.2000	-.0068	4.5324	-.8359
.2250	-.0072	5.0694	-.0423
.2500	-.0074	5.6630	-.8451
.3000	-.0074	6.2926	-.8473
.3250	-.0072	6.7992	-.8465
.3500	-.0070	7.3458	-.8434
.3750	-.0057	7.9023	-.8381
.4000	-.0053	8.4789	-.8309
.4000	-.0042	9.0655	-.8217
.4250	-.0010	9.5321	-.8107
.4500	-.0018	10.1091	-.7979
.4750	-.0010	10.7708	-.7931
.5000	.0000	11.3312	-.7668
.5250	.0002	11.8925	-.7486
.5500	-.0022	12.4691	-.7288
.5750	-.0012	13.0017	-.7074
.6000	.0000	13.5983	-.6842
.6250	.0002	14.1649	-.6593
.6500	-.0001	14.7315	-.6328
.6750	-.0013	15.2981	-.6045
.7000	-.0054	15.8647	-.5745
.7250	-.0060	16.4312	-.5458

ORIGINAL PAGE IS
OF POOR QUALITY

Y = -29.7554   Y/B/2= -.3603   CHORD= 24.2323

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0275	0.0000	-.6693
	-.0305	.6559	-.7047
	-.0305	1.2216	-.7555
	-.0318	2.0174	-.7706
	-.0315	2.4222	-.7642
	-.0331	3.0240	-.8116
	-.0341	3.6040	-.8256
	-.0355	4.2497	-.8452
	-.0345	4.8445	-.8435
	-.0372	5.4727	-.8485
	-.0391	6.0591	-.8506
	-.0353	6.6697	-.8501
	-.0401	7.2697	-.8476
	-.0441	7.8795	-.8429
	-.0445	8.4918	-.8362
	-.0441	9.0171	-.8275
	-.0353	9.6905	-.8170
	-.0356	10.2937	-.8048
	-.0395	10.8946	-.7909
	-.0320	11.5104	-.7751
	-.0373	12.1162	-.7578
	-.0395	12.7220	-.7388
	-.0304	13.3274	-.7183
	-.0357	13.9335	-.6961
	-.0373	14.5274	-.6725
	-.0363	15.1452	-.6472
	-.0356	15.7510	-.6203
	-.0344	16.3563	-.5919
	-.0333	16.9525	-.5618
	-.0310	17.5704	-.4300

Y= -21.7962   Y/b/2= -.3049   CHORD= 26.6552

.0000 .0206 .0400 ... AT SLOPE POINTS, FROM FRONT TO REAR
... -.0277 -.0320 ... -.0471 -.0429 -.0406 -.0537 -.0602 -.0585 -.0813 -.1175
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR
... .3760 .4305 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
		.0000	-.7121
		.0634	-.7402
		.3929	-.7709
		.9941	-.8003
		2.0055	-.8014
		3.3819	-.8473
		3.7403	-.8504
		4.6547	-.8742
		5.3019	-.8771
		5.8074	-.8774
		6.4615	-.8754
		7.3202	-.8711
		7.9266	-.8648
		8.2009	-.8551
		9.6957	-.8483
		10.6601	-.8243
		11.3605	-.8206
		11.9042	-.8052
		12.6012	-.7863
		13.2276	-.7667
		13.8940	-.7496
		14.4030	-.7280
		15.3743	-.7048
		15.9931	-.6903
		16.6595	-.6542
		17.3259	-.6266
		17.6023	-.5975
		18.0417	-.5564
		19.2730	-.5165

Y = -.77.?????   Y/?/?= -.2494   CHORD= 29.073?

SLOPE=DY/DX AT SLOPE POINTS-FROM FRONT TO REAR

.???? .???? .???? .???-.???-.?722-.0160-.0241-.0290-.0335-.0??5-.0472-.0522-.0581-.0657-.0775-.1111

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.???? .???? .???? .???? .???? .???? .?? ?1 .??77 .???? .??72 .?522 .70?5 .76?? .8194 .8750 .9306 .9061

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.?000	-.?376	0.0000	-.5082
.?25?	-.0239	.7270	-.4402
.?5??	-.0390	1.4539	-.6719
.?7??	-.0???	2.1603	-.6991
.1???	-.0???	2.907B	-.9160
.1???	-.0??1	?.????	-.5325
.1???	-.0?76	?.?4??	-.5471
.?0??	-.0??7	?.0??7	-.9466
.2???	-.0??7	?.?1??	-.9513
.?90?	-.0??7	6.542?	-.6522
.??7?	-.0???	7.2?0?	-.6496
.??7?	-.0???	7.????	-.6451
.??0?	-.0???	?.?2??	-.0362
.?90?	-.0???	?.?2??	-.5262
.??16	-.0?11	10.1?70	-.9162
.?1??	-.0?0?	10.9???	-.5054
.??0?	-.0?0?	11.??15	-.6503
.??0?	-.0?01	12.3??2	-.9744
.??0?	-.0???	13.0??1	-.8664
.??0?	-.0???	??.????	-.6369
.??0?	-.0???	14.?3?1	-.6157
.?0??	-.0???	15.?0??	-.7931
.?00?	-.0764	15.?6?0	-.7659
.??0?	-.0???	16.7199	-.7433
.?0??	-.0?4?	17.446?	-.7163
.?0??	-.0237	1?.173?	-.6078
.?0??	-.0???	1?.???6	-.6578
.?75?	-.0?1?	1?.?277	-.6263
.?70?	-.0???	20.3?47	-.5673
.?9?	-.0???	??.????	-.5547

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

CHORDS 3L.5010

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z

-.5524
-.5114
-.4637
-.4240
-.3748
-.3271
-.2757
-.2216
-.1633
-.0822
0.0000

23.8257
24.4153
25.2005
25.0?3
26.7754
27.5634
28.?509
29.12??
29.9?4?
30.7135
31.5?10

-.0175
-.0162
-.0150
-.0135
-.0170
-.0104
-.?0?
-.?050
-.0026
0.0000

.7500
.7750
.8000
.8250
.8500
.8750
.9000
.9?0?
.9500
.9750
1.0000

(= -7.0010   Y/R/2- -.1386   CHORD. 33.9239

SLOPES,DZ/DY,AT SLOPE POINTS,FROM FRONT TO REAR

-.0353 -.0395 -.0425 -.0492 -.0494 -.0536 -.0582 -.0543 -.0741 -.1030

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.5729 .4804 .4662 .5417 .5972 .6970 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000		0.0000	-1.1331
		.8491	-1.1875
		1.6762	-1.1915
		2.5443	-1.2005
		3.3924	-1.2126
		4.2405	-1.2175
		5.0839	-1.2169
		5.9367	-1.2157
		6.7849	-1.2112
		7.5322	-1.2035
		8.4310	-1.1913
		9.4791	-1.1776
		10.1772	-1.1616
		11.3255	-1.1435
		11.8714	-1.1234
		12.7631	-1.1015
		13.9775	-1.0775
		15.2657	-1.0525
		16.1136	-1.0255
		16.9519	-.9970
		17.6100	-.9670
		18.6501	-.9356
		19.6531	-.9208
		20.3513	-.8555
		21.2624	-.8331
		22.0505	-.7962
		22.7467	-.7560
		23.5053	-.7144
			-.6775

Y= -5.94??   Y/B/2= -.0832   CHORD= 36.3468

SLOPES=(Z/DY) AT SLOPE POINTS, FROM FRONT TO REAR

.0?77 .0?0?-.0104-.0189-.0263-.0264-.0310-.0399-.0424-.0465-.0465-.0483-.0513-.0542-.0574-.0612-.0662-.0747-.1011

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0?7? .1?7? .2063 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9661

LOCAL ELEVATION

Y/C	Z/C	DELTA X	DELTA Z
.?000	-?.?0??	.0999	-1.4418
.0?10	-?.?0??	.0637	-1.4534
.0?00	-?.?0??	1.3173	-1.4745
.0?50	-?.?40?	2.7250	-1.4659
.0?50	-?.?4??	3.6547	-1.4802
.1?00	-?.?0??	4.5?33	-1.4?58
.1?50	-?.?0??	5.?09?	-1.47?1
.1?50	-?.?00?	6.?097	-1.4?50
.2?00	-?.?0??	7.?0?4	-1.4?25
.2?50	-?.?60?	8.1720	-1.4349
.2?50	-?.?0??	9.0807	-1.4145
.3?00	-?.?0??	9.?0?4	-1.3616
.3?50	-?.?0??	10.?040	-1.3665
.3?50	-?.?0??	11.?1?7	-1.3373
.4?00	-?.?0??	12.7?1?	-1.3122
.4?50	-?.?0??	13.?5?0	-1.2?2?
.4?00	-?.?0??	14.?9??	-1.2465
.4?50	-?.?0??	15.?4?4	-1.2123
.5?00	-?.?0??	16.3?4?	-1.1765
.5?00	-?.?0??	17.?6?7	-1.1393
.5?00	-?.?0??	18.1?7?	-1.1007
.6?00	-?.?0??	19.?4?0	-1.0?5?
.6?00	-?.?0??	19.?0?7	-1.0107
.6?00	-?.?0??	20.?0?4	-.9774
.7?00	-?.?0??	21.3081	-.9338
.7?50	-?.?0??	22.7157	-.8890
.?0??	-?.?0??	23.6254	-.5451
.?7?0	-?.?0??	24.5341	-.79?1
.?000	-?.?0??	25.?4?7	-.7?7?

Y = -1.9947   Y/B/2 = -.0278   CHORD= 39.7722

SLOPES, DZ/DX, AT SLOPE POINTS, FROM FRONT TO REAR

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
.0000		.0000	-2.1743
			-2.1706
			-2.1654
			-2.1569
			-2.1354
			-2.1125
			-2.0912
			-2.0476
			-2.0101
			-1.9592
			-1.9296
			-1.8796
			-1.8316
			-1.7814
			-1.7295
			-1.6767
			-1.6221
			-1.5662
			-1.5092
			-1.4512
			-1.3922
			-1.3364
			-1.2717
			-1.2103
			-1.1452
			-1.0856
			-1.0219

-.7616
-.6478
-.6372
-.5565
-.4685
-.4171
-.3449
-.2712
-.1805
-.0?3?
0.0000

22.0721
20.?4??
31.5477
31.9870
32.?9??
33.?256
34.3949
3?.?442
3?.???
37.?021
3?.7722

-.0196
-.0179
-.016?
-.016?
-.012?
-.010?
-.00?0
-.0070
-.004?
-.00?0
0.?0?0

```
1.              1.        20.9696    2353.6296
0.              0.         0.         0.
30.8332        -0.         6.         1.
-23.7143      -69.34      77.5        1.
-28.3111      -69.8777    77.5        1.
-33.5837      -71.4907     0.         1.
-35.3403      -71.4907    77.5        1.
-32.7053      -69.8777    77.5        1.
-31.8271      -69.34       6.         1.
-14.0067      -27.736      6.         1.
-9.1529       -0.
100.   18.   20.   0.8   0.5
      1.0
```

Input for Original Design Code of Reference 8

GEOMETRY DATA

REFERENCE PLANFORM HAS 8 CURVES

ROOT CHORD HEIGHT = 0.00000   VARIABLE SWEEP PIVOT POSITION   X(S) = 0.00000   Y(S) = 0.00000

BREAK POINTS FOR THE REFERENCE PLANFORM

POINT	X REF	Y REF	SWEEP ANGLE	DIHEDRAL ANGLE	MOVE CODE
1	30.83320	0.00000	38.19097	6.00000	1
2	-23.71430	-69.34000	83.32828	77.50000	1
3	-28.31110	-69.87770	72.99002	77.50000	1
4	-33.58370	-71.49070	90.00000	0.00000	1
5	-35.34030	-71.49070	58.52736	77.50000	1
6	-32.70530	-69.87770	58.52190	77.50000	1
7	-31.82710	-69.34000	23.18709	6.00000	1
8	-14.00670	-27.73600	9.92625	6.00000	1
9	-9.15290	0.00000			

Output for Original Design Code of Reference 8

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CONFIGURATION NO. 100.

CURVE 1 IS SWEPT   38.19097 DEGREES ON PLANFORM 1

BREAK POINTS FOR THIS CONFIGURATION

POINT	X	Y	Z	SWEEP ANGLE	DIHEDRAL ANGLE	MOVE CODE
1	30.83320	0.00000	0.00000	38.19097	6.00000	1
2	-23.71430	-69.34000	-7.28793	83.32828	77.50000	1
3	-28.31110	-69.87770	-9.71334	72.99002	77.50000	1
4	-33.58370	-71.49070	-16.98911	90.00000	0.00000	1
5	-35.34030	-71.49070	-16.98911	58.52736	77.50000	1
6	-32.70530	-69.87770	-9.71334	58.52190	77.50000	1
7	-31.62710	-69.34000	-7.28793	23.18709	6.00000	1
8	-14.06670	-27.73600	-2.91517	9.92625	6.00000	1
9	-9.15290	0.00000	0.00000			

378 HORSESHOE VORTICES USED ON THE LEFT HALF OF THE CONFIGURATION

PLANFORM	TOTAL	SPANWISE
1	378	21

18. HORSESHOE VORTICES IN EACH CHORDWISE ROW

MINIMUM FIELD LENGTH = 63000

X C/4	X 3C/4	Y	Z	S	C/4 SWEEP ANGLE	DIHEDRAL ANGLE	GAMMA/U AT CLDES= .5000
-32.20892	-32.27729	-71.05967	-15.04485	1.99147	72.87795	77.50000	.02889
-32.34567	-32.41404	-71.05967	-15.04485	1.99147	72.41497	77.50000	.02889
-32.48241	-32.55079	-71.05967	-15.04485	1.99147	71.92712	77.50000	.02889
-32.61916	-32.68753	-71.05967	-15.04485	1.99147	71.41240	77.50000	.02889
-32.75591	-32.82428	-71.05967	-15.04485	1.99147	70.86864	77.50000	.02889
-32.89265	-32.96102	-71.05967	-15.04485	1.99147	70.29340	77.50000	.02889
-33.02940	-33.09777	-71.05967	-15.04485	1.99147	69.68400	77.50000	.02889
-33.16614	-33.23452	-71.05967	-15.04485	1.99147	69.03746	77.50000	.02889
-33.30289	-33.37126	-71.05967	-15.04485	1.99147	68.35044	77.50000	.02889
-33.43964	-33.50801	-71.05967	-15.04485	1.99147	67.61925	77.50000	.02889
-33.57638	-33.64476	-71.05967	-15.04485	1.99147	66.83975	77.50000	.02889
-33.71313	-33.78150	-71.05967	-15.04485	1.99147	66.00730	77.50000	.02889
-33.84987	-33.91825	-71.05967	-15.04485	1.99147	65.11671	77.50000	.02889
-33.98662	-34.05499	-71.05967	-15.04485	1.99147	64.16215	77.50000	.02889
-34.12337	-34.19174	-71.05967	-15.04485	1.99147	63.13706	77.50000	.02889
-34.26011	-34.32849	-71.05967	-15.04485	1.99147	62.03406	77.50000	.02889
-34.39686	-34.46523	-71.05967	-15.04485	1.99147	60.84483	77.50000	.02889
-34.53361	-34.60198	-71.05967	-15.04485	1.99147	59.56000	77.50000	.02889
-29.59094	-29.69594	-70.25317	-11.40696	1.73475	72.87795	77.50000	.05996
-29.80095	-29.90596	-70.25317	-11.40696	1.73475	72.41497	77.50000	.05996
-30.01096	-30.11597	-70.25317	-11.40696	1.73475	71.92712	77.50000	.05996
-30.22098	-30.32598	-70.25317	-11.40696	1.73475	71.41240	77.50000	.05996
-30.43099	-30.53600	-70.25317	-11.40696	1.73475	70.86864	77.50000	.05996
-30.64100	-30.74601	-70.25317	-11.40696	1.73475	70.29340	77.50000	.05996
-30.85101	-30.95602	-70.25317	-11.40696	1.73475	70.68400	77.50000	.05996
-31.06103	-31.16603	-70.25317	-11.40696	1.73475	69.68400	77.50000	.05996
-31.27104	-31.37605	-70.25317	-11.40696	1.73475	69.03746	77.50000	.05996
-31.48105	-31.58606	-70.25317	-11.40696	1.73475	68.35044	77.50000	.05996
-31.69107	-31.79607	-70.25317	-11.40696	1.73475	67.61925	77.50000	.05996
-31.90108	-32.00608	-70.25317	-11.40696	1.73475	66.83975	77.50000	.05996
-32.11109	-32.21610	-70.25317	-11.40696	1.73475	66.00730	77.50000	.05996
-32.32110	-32.42611	-70.25317	-11.40696	1.73475	65.11671	77.50000	.05996
-32.53112	-32.63612	-70.25317	-11.40696	1.73475	64.16215	77.50000	.05996
-32.74113	-32.84614	-70.25317	-11.40696	1.73475	63.13706	77.50000	.05996
-32.95114	-33.05615	-70.25317	-11.40696	1.73475	62.03406	77.50000	.05996
-33.16116	-33.26616	-70.25317	-11.40696	1.73475	60.84483	77.50000	.05996
		-70.25317	-11.40696	1.73475	59.56000	77.50000	.05996
-26.09955	-26.27326	-69.60885	-8.50063	1.24215	83.25316	77.50000	.05629
-26.44697	-26.62068	-69.60885	-8.50063	1.24215	82.93507	77.50000	.05629
-26.79439	-26.96810	-69.60885	-8.50063	1.24215	82.58568	77.50000	.05629
-27.14180	-27.31551	-69.60885	-8.50063	1.24215	82.20016	77.50000	.05629
-27.48922	-27.66293	-69.60885	-8.50063	1.24215	81.77264	77.50000	.05629
-27.83664	-28.01035	-69.60885	-8.50063	1.24215	81.29591	77.50000	.05629
-28.18405	-28.35776	-69.60885	-8.50063	1.24215	80.76105	77.50000	.05629

75

-28.53147	-28.70518	-69.60885	-8.50063	1.24215	80.15684	77.50000	.05629
-28.87889	-29.05260	-69.60885	-8.50063	1.24215	79.46902	77.50000	.05629
-29.22630	-29.40001	-69.60885	-8.50063	1.24215	78.67921	77.50000	.05629
-29.57372	-29.74743	-69.60885	-8.50063	1.24215	77.76326	77.50000	.05629
-29.92114	-30.09485	-69.60885	-8.50063	1.24215	76.68896	77.50000	.05629
-30.26855	-30.44226	-69.60885	-8.50063	1.24215	75.41234	77.50000	.05629
-30.61597	-30.78968	-69.60885	-8.50063	1.24215	73.87202	77.50000	.05629
-30.96339	-31.13710	-69.60885	-8.50063	1.24215	71.98001	77.50000	.05629
-31.31080	-31.48451	-69.60885	-8.50063	1.24215	69.60631	77.50000	.05629
-31.65822	-31.83193	-69.60885	-8.50063	1.24215	66.55250	77.50000	.05629
-32.00564	-32.17935	-69.60885	-8.50063	1.24215	62.50521	77.50000	.05629
-22.27880	-22.52386	-67.35944	-7.07976	1.99147	38.01439	6.00000	.09776
-22.76893	-23.01400	-67.35944	-7.07976	1.99147	37.29953	6.00000	.09776
-23.25907	-23.50414	-67.35944	-7.07976	1.99147	36.57081	6.00000	.09776
-23.74921	-23.99428	-67.35944	-7.07976	1.99147	35.82808	6.00000	.09776
-24.23935	-24.48442	-67.35944	-7.07976	1.99147	35.07118	6.00000	.09776
-24.72949	-24.97456	-67.35944	-7.07976	1.99147	34.29998	6.00000	.09776
-25.21963	-25.46470	-67.35944	-7.07976	1.99147	33.51435	6.00000	.09776
-25.70977	-25.95484	-67.35944	-7.07976	1.99147	32.71419	6.00000	.09776
-26.19991	-26.44498	-67.35944	-7.07976	1.99147	31.89942	6.00000	.09776
-26.69005	-26.93511	-67.35944	-7.07976	1.99147	31.06996	6.00000	.09776
-27.18018	-27.42525	-67.35944	-7.07976	1.99147	30.22577	6.00000	.09776
-27.67032	-27.91539	-67.35944	-7.07976	1.99147	29.36684	6.00000	.09776
-28.16046	-28.40553	-67.35944	-7.07976	1.99147	28.49317	6.00000	.09776
-28.65060	-28.89567	-67.35944	-7.07976	1.99147	27.60480	6.00000	.09776
-29.14074	-29.38581	-67.35944	-7.07976	1.99147	26.70178	6.00000	.09776
-29.63088	-29.87595	-67.35944	-7.07976	1.99147	25.78422	6.00000	.09776
-30.12102	-30.36609	-67.35944	-7.07976	1.99147	24.85224	6.00000	.09776
-30.61116	-30.85623	-67.35944	-7.07976	1.99147	23.90600	6.00000	.09776
-19.18243	-19.46693	-63.39833	-6.66343	1.99147	38.01439	6.00000	.13985
-19.75143	-20.03592	-63.39833	-6.66343	1.99147	37.29953	6.00000	.13985
-20.32042	-20.60492	-63.39833	-6.66343	1.99147	36.57081	6.00000	.13985
-20.88941	-21.17391	-63.39833	-6.66343	1.99147	35.82808	6.00000	.13985
-21.45841	-21.74291	-63.39833	-6.66343	1.99147	35.07118	6.00000	.13985
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-22.59640	-22.88089	-63.39833	-6.66343	1.99147	33.51435	6.00000	.13985
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-3.76061	-4.18224	-43.59276	-4.58178	1.99147	38.01439	6.00000	.23172
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-18.14969	-18.63132	-43.59276	-4.58178	1.99147	25.78422	6.00000	.23172
-19.11296	-19.59460	-43.59276	-4.58178	1.99147	24.85224	6.00000	.23172
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-.60424	-1.12531	-39.63164	-4.16545	1.99147	38.01439	6.00000	.24290
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-9.71187	-10.34142	-28.73243	-3.01990	1.00192	26.70178	6.00000	.26658
-10.97097	-11.60052	-28.73243	-3.01990	1.00192	25.78422	6.00000	.26658
-12.23007	-12.85963	-28.73243	-3.01990	1.00192	24.85224	6.00000	.26658
-13.48918	-14.11873	-28.73243	-3.01990	1.00192	23.90600	6.00000	.26658
10.23568	9.56256	-25.75544	-2.70701	1.99147	37.88905	6.00000	.27148
8.89944	8.21632	-25.75544	-2.70701	1.99147	36.65626	6.00000	.27148
7.54320	6.87008	-25.75544	-2.70701	1.99147	35.38270	6.00000	.27148
6.19696	5.52383	-25.75544	-2.70701	1.99147	34.06763	6.00000	.27148
4.85071	4.17759	-25.75544	-2.70701	1.99147	32.71043	6.00000	.27148
3.50447	2.83135	-25.75544	-2.70701	1.99147	31.31065	6.00000	.27148
2.15823	1.48511	-25.75544	-2.70701	1.99147	29.86801	6.00000	.27148
.81199	.13887	-25.75544	-2.70701	1.99147	28.38241	6.00000	.27148
-.53425	-1.20737	-25.75544	-2.70701	1.99147	26.85399	6.00000	.27148
-1.88049	-2.55361	-25.75544	-2.70701	1.99147	25.28316	6.00000	.27148
-3.22673	-3.89985	-25.75544	-2.70701	1.99147	23.67056	6.00000	.27148
-4.57297	-5.24609	-25.75544	-2.70701	1.99147	22.01719	6.00000	.27148
-5.91922	-6.59234	-25.75544	-2.70701	1.99147	20.32431	6.00000	.27148
-7.26546	-7.93858	-25.75544	-2.70701	1.99147	18.59357	6.00000	.27148
-8.61170	-9.28482	-25.75544	-2.70701	1.99147	16.82693	6.00000	.27148
-9.95794	-10.63106	-25.75544	-2.70701	1.99147	15.02672	6.00000	.27148
-11.30418	-11.97730	-25.75544	-2.70701	1.99147	13.19564	6.00000	.27148
-12.65042	-13.32354	-25.75544	-2.70701	1.99147	11.33671	6.00000	.27148
13.31811	12.57768	-21.79433	-2.29068	1.99147	37.88905	6.00000	.27706
11.83726	11.09684	-21.79433	-2.29068	1.99147	36.65626	6.00000	.27706
10.35641	9.61599	-21.79433	-2.29068	1.99147	35.38270	6.00000	.27706
8.87557	8.13515	-21.79433	-2.29068	1.99147	34.06763	6.00000	.27706
7.39472	6.65430	-21.79433	-2.29068	1.99147	32.71043	6.00000	.27706
5.91388	5.17345	-21.79433	-2.29068	1.99147	31.31065	6.00000	.27706
4.43303	3.69261	-21.79433	-2.29068	1.99147	29.86801	6.00000	.27706
2.95219	2.21176	-21.79433	-2.29068	1.99147	28.38241	6.00000	.27706
1.47134	.73092	-21.79433	-2.29068	1.99147	26.85399	6.00000	.27706
-.00951	-.74993	-21.79433	-2.29068	1.99147	25.28316	6.00000	.27706
-1.49035	-2.23078	-21.79433	-2.29068	1.99147	23.67056	6.00000	.27706
-2.97120	-3.71162	-21.79433	-2.29068	1.99147	22.01719	6.00000	.27706
-4.45204	-5.19247	-21.79433	-2.29068	1.99147	20.32431	6.00000	.27706
-5.93289	-6.67331	-21.79433	-2.29068	1.99147	18.59357	6.00000	.27706
-7.41374	-8.15416	-21.79433	-2.29068	1.99147	16.82693	6.00000	.27706
-8.89458	-9.63500	-21.79433	-2.29068	1.99147	15.02672	6.00000	.27706
-10.37543	-11.11585	-21.79433	-2.29068	1.99147	13.19564	6.00000	.27706
-11.85627	-12.59670	-21.79433	-2.29068	1.99147	11.33671	6.00000	.27706

16.40053	15.59281	-17.83321	-1.87435	1.99147	37.88905	6.00000	.28166
14.75508	13.97736	-17.83321	-1.87435	1.99147	36.65626	6.00000	.28166
13.16963	12.36191	-17.83321	-1.87435	1.99147	35.38270	6.00000	.28166
11.55418	10.74646	-17.83321	-1.87435	1.99147	34.06763	6.00000	.28166
9.93873	9.13101	-17.83321	-1.87435	1.99147	32.71043	6.00000	.28166
8.32328	7.51556	-17.83321	-1.87435	1.99147	31.31065	6.00000	.28166
6.70783	5.90011	-17.83321	-1.87435	1.99147	29.86801	6.00000	.28166
5.09238	4.28465	-17.83321	-1.87435	1.99147	28.38241	6.00000	.28166
3.47693	2.66920	-17.83321	-1.87435	1.99147	26.85399	6.00000	.28166
1.86148	1.05375	-17.83321	-1.87435	1.99147	25.28316	6.00000	.28166
.24603	-.56170	-17.83321	-1.87435	1.99147	23.67056	6.00000	.28166
-1.36942	-2.17715	-17.83321	-1.87435	1.99147	22.01719	6.00000	.28166
-2.98487	-3.79260	-17.83321	-1.87435	1.99147	20.32431	6.00000	.28166
-4.60032	-5.40805	-17.83321	-1.87435	1.99147	18.59357	6.00000	.28166
-6.21577	-7.02350	-17.83321	-1.87435	1.99147	16.82693	6.00000	.28166
-7.83122	-8.63895	-17.83321	-1.87435	1.99147	15.02672	6.00000	.28166
-9.44667	-10.25440	-17.83321	-1.87435	1.99147	13.19564	6.00000	.28166
-11.06212	-11.86985	-17.83321	-1.87435	1.99147	11.33671	6.00000	.28166
19.48296	18.60296	-13.87210	-1.45802	1.99147	37.88905	6.00000	.28531
17.73291	16.85788	-13.87210	-1.45802	1.99147	36.65626	6.00000	.28531
15.98285	15.10782	-13.87210	-1.45802	1.99147	35.38270	6.00000	.28531
14.23280	13.35777	-13.87210	-1.45802	1.99147	34.06763	6.00000	.28531
12.48274	11.60771	-13.87210	-1.45802	1.99147	32.71043	6.00000	.28531
10.73269	9.85766	-13.87210	-1.45802	1.99147	31.31065	6.00000	.28531
8.98263	8.10760	-13.87210	-1.45802	1.99147	29.86801	6.00000	.28531
7.23258	6.35755	-13.87210	-1.45802	1.99147	28.38241	6.00000	.28531
5.48252	4.60749	-13.87210	-1.45802	1.99147	26.85399	6.00000	.28531
3.73246	2.85744	-13.87210	-1.45802	1.99147	25.28316	6.00000	.28531
1.98241	1.10738	-13.87210	-1.45802	1.99147	23.67056	6.00000	.28531
.23235	-.64267	-13.87210	-1.45802	1.99147	22.01719	6.00000	.28531
-1.51770	-2.39273	-13.87210	-1.45802	1.99147	20.32431	6.00000	.28531
-3.26776	-4.14278	-13.87210	-1.45802	1.99147	18.59357	6.00000	.28531
-5.01781	-5.89284	-13.87210	-1.45802	1.99147	16.82693	6.00000	.28531
-6.76787	-7.64789	-13.87210	-1.45802	1.99147	15.02672	6.00000	.28531
-8.51792	-9.39295	-13.87210	-1.45802	1.99147	13.19564	6.00000	.28531
-10.26798	-11.14300	-13.87210	-1.45802	1.99147	11.33671	6.00000	.28531
22.56539	21.62306	-9.91099	-1.04169	1.99147	37.88905	6.00000	.28802
20.68073	19.73840	-9.91099	-1.04169	1.99147	36.65626	6.00000	.28802
18.79607	17.85374	-9.91099	-1.04169	1.99147	35.38270	6.00000	.28802
16.91141	15.96908	-9.91099	-1.04169	1.99147	34.06763	6.00000	.28802
15.02675	14.08442	-9.91099	-1.04169	1.99147	32.71043	6.00000	.28802
13.14209	12.19976	-9.91099	-1.04169	1.99147	31.31065	6.00000	.28802
11.25743	10.31510	-9.91099	-1.04169	1.99147	29.86801	6.00000	.28802
9.37277	8.43044	-9.91099	-1.04169	1.99147	28.38241	6.00000	.28802
7.48811	6.54578	-9.91099	-1.04169	1.99147	26.85399	6.00000	.28802
5.60345	4.66112	-9.91099	-1.04169	1.99147	25.28316	6.00000	.28802
3.71879	2.77646	-9.91099	-1.04169	1.99147	23.67056	6.00000	.28802
1.83413	.89180	-9.91099	-1.04169	1.99147	22.01719	6.00000	.28802
-.05053	-.99286	-9.91099	-1.04169	1.99147	20.32431	6.00000	.28802

				B/2	REF. AR	TRUE AR	MACH NUMBER
-1.93519	-2.87752	-9.91099	-1.04169	1.99147	18.59357	6.00000	.28802
-3.61985	-4.76218	-9.91099	-1.04169	1.99147	16.82693	6.00000	.28802
-5.70451	-6.64684	-9.91099	-1.04169	1.99147	15.02672	6.00000	.28802
-7.58917	-8.53150	-9.91099	-1.04169	1.99147	13.19564	6.00000	.28802
-9.47383	-10.41616	-9.91099	-1.04169	1.99147	11.33671	6.00000	.28802
25.64782	24.63818	-5.94987	-.62536	1.99147	37.88905	6.00000	.28986
23.62855	22.61892	-5.94987	-.62536	1.99147	36.65626	6.00000	.28986
21.60929	20.59965	-5.94987	-.62536	1.99147	35.38270	6.00000	.28986
19.59002	18.58039	-5.94987	-.62536	1.99147	34.06763	6.00000	.28986
17.57076	16.56113	-5.94987	-.62536	1.99147	32.71043	6.00000	.28986
15.55149	14.54186	-5.94987	-.62536	1.99147	31.31065	6.00000	.28986
13.53223	12.52260	-5.94987	-.62536	1.99147	29.86801	6.00000	.28986
11.51296	10.50333	-5.94987	-.62536	1.99147	28.38241	6.00000	.28986
9.49370	8.48407	-5.94987	-.62536	1.99147	26.85399	6.00000	.28986
7.47444	6.46480	-5.94987	-.62536	1.99147	25.28316	6.00000	.28986
5.45517	4.44554	-5.94987	-.62536	1.99147	23.67056	6.00000	.28986
3.43591	2.42627	-5.94987	-.62536	1.99147	22.01719	6.00000	.28986
1.41664	.40701	-5.94987	-.62536	1.99147	20.32431	6.00000	.28986
-.60262	-1.61225	-5.94987	-.62536	1.99147	18.59357	6.00000	.28986
-2.62189	-3.63152	-5.94987	-.62536	1.99147	16.82693	6.00000	.28986
-4.64115	-5.65078	-5.94987	-.62536	1.99147	15.02672	6.00000	.28986
-6.66041	-7.67005	-5.94987	-.62536	1.99147	13.19564	6.00000	.28986
-8.67968	-9.68931	-5.94987	-.62536	1.99147	11.33671	6.00000	.28986
28.73343	27.65643	-1.98466	-.20860	1.99559	37.88905	6.00000	.29076
26.57942	25.50242	-1.98466	-.20860	1.99559	36.65626	6.00000	.29076
24.42542	23.34341	-1.98466	-.20860	1.99559	35.38270	6.00000	.29076
22.27141	21.19440	-1.98466	-.20860	1.99559	34.06763	6.00000	.29076
20.11740	19.04040	-1.98466	-.20860	1.99559	32.71C43	6.00000	.29076
17.96339	16.88639	-1.98466	-.20860	1.99559	31.31065	6.00000	.29076
15.80938	14.73238	-1.98466	-.20860	1.99559	29.86801	6.00000	.29076
13.65537	12.57837	-1.98466	-.20860	1.99559	28.38241	6.00000	.29076
11.50137	10.42436	-1.98466	-.20860	1.99559	26.85399	6.00000	.29076
9.34736	8.27035	-1.98466	-.20860	1.99559	25.28316	6.00000	.29076
7.19335	6.11635	-1.98466	-.20860	1.99559	23.67056	6.00000	.29076
5.03934	3.96234	-1.98466	-.20860	1.99559	22.01719	6.00000	.29076
2.88533	1.80833	-1.98466	-.20860	1.99559	20.32431	6.00000	.29076
.73132	-.34568	-1.98466	-.20860	1.99559	18.59357	6.00000	.29076
-1.42268	-2.49969	-1.98466	-.20860	1.99559	16.82693	6.00000	.29076
-3.57669	-4.65370	-1.98466	-.20860	1.99559	15.02672	6.00000	.29076
-5.73070	-6.80770	-1.98466	-.20860	1.99559	13.19564	6.00000	.29076
-7.88471	-8.96171	-1.98466	-.20860	1.99559	11.33671	6.00000	.29076

REF. CHORD	C AVERAGE	TRUE AREA	REFFRENCE AREA	B/2	REF. AR	TRUE AR	MACH NUMBER
20.96960	21.39785	3659.49486	2353.62960	71.49070	8.68602	6.68204	.80000

FIRST PLANFORM SPAN LOADING

Y	CL*C
-71.05967	.22514
-70.25317	.46723
-69.60885	.43858
-67.35944	3.49994
-63.39833	5.00692
-59.43721	5.92968
-55.47610	6.67577
-51.51499	7.29915
-47.55387	7.83347
-43.59276	8.29622
-39.63164	8.69643
-35.67053	9.04525
-31.70941	9.34595
-28.73243	9.54440
-25.75544	9.71972
-21.79433	9.91962
-17.83321	10.08410
-13.87210	10.21487
-9.91099	10.31195
-5.94987	10.37792
-1.98466	10.40996

CL DEVELOPED ON THIS PLANFORM= .502247
CM DEVELOPED ON THIS PLANFORM= -.112756

CL DESIGN = .500000   CL COMPUTED= .502247   CM COMPUTED= -.112756   CD V= .009034

LOCAL ELEVATION DATA

Y= -71.0597   Y/B/2= -.9940   CHORD= 2.4614

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.6355 .5304 .4646 .4156 .3758 .3415 .3108 .2823 .2551 .2284 .2014 .1734 .1433 .1098 .0702 .0191-.0599-.2813
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
-.0000	.2471	-.0000	.6082
.0250	.2311	.0615	.5689
.0500	.2152	.1231	.5298
.0750	.2001	.1846	.4926
.1000	.1864	.2461	.4587
.1250	.1737	.3077	.4276
.1500	.1617	.3692	.3981
.1750	.1504	.4308	.3701
.2000	.1395	.4923	.3434
.2250	.1292	.5538	.3180
.2500	.1194	.6154	.2938
.2750	.1099	.6769	.2706
.3000	.1009	.7384	.2484
.3250	.0923	.8000	.2271
.3500	.0840	.8615	.2068
.3750	.0761	.9230	.1872
.4000	.0685	.9846	.1685
.4250	.0612	1.0461	.1506
.4500	.0542	1.1076	.1334
.4750	.0475	1.1692	.1170
.5000	.0412	1.2307	.1013
.5250	.0351	1.2923	.0864
.5500	.0294	1.3538	.0722
.5750	.0239	1.4153	.0588
.6000	.0187	1.4769	.0461
.6250	.0139	1.5384	.0342
.6500	.0094	1.5999	.0230

.6750	.0052	1.6615	.0127
.7000	.0013	1.7230	.0032
.7250	-.0022	1.7845	-.0055
.7500	-.0054	1.8461	-.0133
.7750	-.0082	1.9076	-.0201
.8000	-.0105	1.9691	-.0259
.8250	-.0124	2.0307	-.0306
.8500	-.0137	2.0922	-.0338
.8750	-.0144	2.1538	-.0356
.9000	-.0147	2.2153	-.0363
.9250	-.0144	2.2768	-.0354
.9500	-.0121	2.3384	-.0298
.9750	-.0069	2.3999	-.0170
1.0000	0.0000	2.4614	0.0000

Y= -70.2532   Y/B/2= -.9827   CHORD= 3.7802

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.6965 .5482 .4529 .3800 .3193 .2658 .2167 .1705 .1258 .0817 .0373-.0084-.0566-.1091-.1694-.2448-.3573-.6618

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
-.0000	.1128	-.0000	.4264
.0250	.0953	.0945	.3602
.0500	.0778	.1890	.2943
.0750	.0615	.2835	.2326
.1000	.0471	.3780	.1781
.1250	.0343	.4725	.1295
.1500	.0224	.5670	.0848
.1750	.0114	.6615	.0432
.2000	.0013	.7560	.0048
.2250	-.0081	.8506	-.0307
.2500	-.0168	.9451	-.0634
.2750	-.0248	1.0396	-.0937
.3000	-.0322	1.1341	-.1217
.3250	-.0390	1.2286	-.1474
.3500	-.0452	1.3231	-.1710
.3750	-.0509	1.4176	-.1925
.4000	-.0561	1.5121	-.2120
.4250	-.0607	1.6066	-.2295
.4500	-.0648	1.7011	-.2451
.4750	-.0685	1.7956	-.2588
.5000	-.0716	1.8901	-.2705
.5250	-.0742	1.9846	-.2805
.5500	-.0763	2.0791	-.2885
.5750	-.0779	2.1736	-.2946
.6000	-.0791	2.2681	-.2989
.6250	-.0797	2.3626	-.3013
.6500	-.0798	2.4571	-.3017
.6750	-.0794	2.5517	-.3001
.7000	-.0784	2.6462	-.2965
.7250	-.0769	2.7407	-.2908

.7500	-.0748	2.8352	-.2829
.7750	-.0721	2.9297	-.2727
.8000	-.0688	3.0242	-.2602
.8250	-.0648	3.1187	-.2450
.8500	-.0599	3.2132	-.2265
.8750	-.0542	3.3077	-.2047
.9000	-.0478	3.4022	-.1806
.9250	-.0404	3.4967	-.1528
.9500	-.0304	3.5912	-.1150
.9750	-.0164	3.6857	-.0618
1.0000	0.0000	3.7802	0.0000

Y= -69.6089   Y/B/2= -.9737   CHORD= 6.2535

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.7046 .5460 .4554 .3956 .3539 .3249 .3056 .2941 .2884 .2867 .2872 .2884 .2888 .2863 .2778 .2579 .2142 .0616
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
-.00C0	.3377	-.0000	2.1118
.0250	.3200	.1563	2.0009
.0500	.3023	.3127	1.8907
.0750	.2859	.4690	1.7880
.1000	.2715	.6254	1.6979
.1250	.2587	.7817	1.6179
.1500	.2469	.9380	1.5440
.1750	.2358	1.0944	1.4745
.2000	.2254	1.2507	1.4093
.2250	.2156	1.4070	1.3480
.2500	.2063	1.5634	1.2899
.2750	.1974	1.7197	1.2344
.3000	.1889	1.8761	1.1812
.3250	.1807	2.0324	1.1299
.3500	.1727	2.1887	1.0803
.3750	.1650	2.3451	1.0319
.4000	.1575	2.5014	.9846
.4250	.1500	2.6577	.9382
.4500	.1427	2.8141	.8923
.4750	.1354	2.9704	.8470
.5000	.1282	3.1268	.8019
.5250	.1210	3.2831	.7570
.5500	.1139	3.4394	.7121
.5750	.1067	3.5958	.6673
.6000	.0995	3.7521	.6225
.6250	.0924	3.9084	.5775
.6500	.0851	4.0648	.5325
.6750	.0779	4.2211	.4874
.7000	.0707	4.3775	.4422
.7250	.0635	4.5338	.3971

.7500	.0563	4.6901	.3521
.7750	.0491	4.8465	.3073
.8000	.0420	5.0028	.2629
.8250	.0350	5.1591	.2192
.8500	.0283	5.3155	.1768
.8750	.0217	5.4718	.1360
.9000	.0153	5.6282	.0960
.9250	.0093	5.7845	.0579
.9500	.0044	5.9408	.0277
.9750	.0016	6.0972	.0102
1.0000	0.0000	6.2535	0.0000

89

Y= -67.3594   Y/B/2= -.9422   CHORD= 8.8225

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR
.1142 .0922 .0785 .0681 .0592 .0511 .0437 .0368 .0302 .0238 .0176 .0113 .0048-.0022-.0104-.0209-.0375-.0849
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR
.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	.0292	0.0000	.2578
.0250	.0264	.2206	.2325
.0500	.0235	.4411	.2073
.0750	.0208	.6617	.1835
.1000	.0184	.8822	.1622
.1250	.0162	1.1028	.1430
.1500	.0142	1.3234	.1251
.1750	.0123	1.5439	.1081
.2000	.0105	1.7645	.0923
.2250	.0088	1.9851	.0774
.2500	.0072	2.2056	.0635
.2750	.0057	2.4262	.0504
.3000	.0043	2.6467	.0381
.3250	.0030	2.8673	.0266
.3500	.0018	3.0879	.0159
.3750	.0007	3.3084	.0059
.4000	-.0004	3.5290	-.0034
.4250	-.0014	3.7496	-.0120
.4500	-.0023	3.9701	-.0200
.4750	-.0031	4.1907	-.0272
.5000	-.0038	4.4112	-.0339
.5250	-.0045	4.6318	-.0398
.5500	-.0051	4.8524	-.0452
.5750	-.0057	5.0729	-.0499
.6000	-.0061	5.2935	-.0540
.6250	-.0065	5.5141	-.0575
.6500	-.0068	5.7346	-.0604
.6750	-.0071	5.9552	-.0627
.7000	-.0073	6.1757	-.0643
.7250	-.0074	6.3963	-.0652

.7500	-.0074	6.6169	-.0655
.7750	-.0074	6.8374	-.0651
.8000	-.0072	7.0580	-.0639
.8250	-.0070	7.2786	-.0619
.8500	-.0067	7.4991	-.0588
.8750	-.0062	7.7197	-.0546
.9000	-.0056	7.9402	-.0497
.9250	-.0049	8.1608	-.0435
.9500	-.0038	8.3814	-.0338
.9750	-.0021	8.6019	-.0185
1.0000	0.0000	8.8225	0.0000

91

Y= -63.3983   Y/B/2= -.8868   CHORD= 10.2419

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.1166 .0886 .0709 .0574 .0460 .0359 .0264 .0174 .0086 .0002-.0092-.0184-.0283-.0391-.0516-.0672-.0902-.1513

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	.0044	0.0000	.0455
.0250	.0015	.2560	.0155
.0500	-.0014	.5121	-.0144
.0750	-.0041	.7681	-.0421
.1000	-.0065	1.0242	-.0662
.1250	-.0085	1.2802	-.0872
.1500	-.0104	1.5363	-.1063
.1750	-.0121	1.7923	-.1239
.2000	-.0137	2.0484	-.1398
.2250	-.0151	2.3044	-.1543
.2500	-.0163	2.5605	-.1674
.2750	-.0175	2.8165	-.1793
.3000	-.0185	3.0726	-.1899
.3250	-.0195	3.3286	-.1994
.3500	-.0203	3.5847	-.2078
.3750	-.0210	3.8407	-.2151
.4000	-.0216	4.0968	-.2214
.4250	-.0221	4.3528	-.2266
.4500	-.0225	4.6089	-.2308
.4750	-.0228	4.8649	-.2339
.5000	-.0230	5.1209	-.2361
.5250	-.0232	5.3770	-.2372
.5500	-.0232	5.6330	-.2373
.5750	-.0231	5.8891	-.2364
.6000	-.0229	6.1451	-.2345
.6250	-.0226	6.4012	-.2315
.6500	-.0222	6.6572	-.2274
.6750	-.0217	6.9133	-.2223
.7000	-.0211	7.1693	-.2160
.7250	-.0204	7.4254	-.2085

.7500	-.0195	7.6814	-.1999
.7750	-.0185	7.9375	-.1899
.8000	-.0174	8.1935	-.1787
.8250	-.0162	8.4496	-.1659
.8500	-.C148	8.7056	-.1513
.8750	-.C132	8.9617	-.1349
.9000	-.0114	9.2177	-.1171
.9250	-.0095	9.4738	-.0973
.9500	-.0070	9.7298	-.0720
.9750	-.0037	9.9859	-.0383
1.0000	0.0000	10.2419	0.0000

93

Y= -59.4372   Y/B/2= -.8314   CHORD= 11.6613

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.1139 .0846 .0662 .0523 .0467 .0305 .0211 .0123 .0038-.0046-.0132-.0221-.0315-.0420-.0542-.0696-.0929-.1558

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	.0004	0.0000	.0050
.0250	-.0024	.2915	-.0285
.0500	-.0053	.5831	-.0617
.0750	-.0079	.8746	-.0924
.1000	-.0102	1.1661	-.1187
.1250	-.0121	1.4577	-.1414
.1500	-.0139	1.7492	-.1619
.1750	-.0155	2.0407	-.1805
.2000	-.0169	2.3323	-.1972
.2250	-.0182	2.6238	-.2122
.2500	-.0193	2.9153	-.2255
.2750	-.0204	3.2069	-.2375
.3000	-.0213	3.4984	-.2480
.3250	-.0221	3.7899	-.2573
.3500	-.0227	4.0815	-.2652
.3750	-.0233	4.3730	-.2720
.4000	-.0238	4.6645	-.2776
.4250	-.0242	4.9561	-.2820
.4500	-.0245	5.2476	-.2853
.4750	-.0246	5.5391	-.2874
.5000	-.0247	5.8306	-.2885
.5250	-.0247	6.1222	-.2884
.5500	-.0246	6.4137	-.2872
.5750	-.0244	6.7052	-.2850
.6000	-.0241	6.9968	-.2816
.6250	-.0238	7.2883	-.2770
.6500	-.0233	7.5798	-.2713
.6750	-.0227	7.8714	-.2644
.7000	-.0220	8.1629	-.2563
.7250	-.0212	8.4544	-.2469

.7500	-.0202	8.7460	-.2361
.7750	-.0192	9.0375	-.2239
.8000	-.0180	9.3290	-.2103
.8250	-.0167	9.6206	-.1951
.8500	-.0152	9.9121	-.1777
.8750	-.0136	10.2036	-.1583
.9000	-.C118	10.4952	-.1373
.9250	-.0098	10.7867	-.1141
.9500	-.0072	11.0782	-.0844
.9750	-.0039	11.3698	-.0450
1.0000	0.0000	11.6613	0.0000

Y= -55.4761   Y/B/2= -.7760   CHORD= 13.0807

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.1093 .0798 .0612 .0471 .0355 .0252 .0159 .0072-.0012-.0095-.0178-.0265-.0357-.0459-.0578-.0729-.0959-.1587
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0040	0.0000	-.0529
.0250	-.0068	.3270	-.0890
.0500	-.0095	.6540	-.1247
.0750	-.0120	.9811	-.1576
.1000	-.0142	1.3081	-.1856
.1250	-.0160	1.6351	-.2095
.1500	-.0176	1.9621	-.2308
.1750	-.0191	2.2891	-.2500
.2000	-.0204	2.6161	-.2671
.2250	-.0216	2.9432	-.2822
.2500	-.0226	3.2702	-.2955
.2750	-.0235	3.5972	-.3072
.3000	-.0243	3.9242	-.3173
.3250	-.0249	4.2512	-.3260
.3500	-.0255	4.5782	-.3332
.3750	-.0259	4.9053	-.3391
.4000	-.0263	5.2323	-.3436
.4250	-.0265	5.5593	-.3469
.4500	-.0267	5.8863	-.3489
.4750	-.0267	6.2133	-.3497
.5000	-.0267	6.5403	-.3493
.5250	-.0266	6.8674	-.3476
.5500	-.0264	7.1944	-.3447
.5750	-.0260	7.5214	-.3406
.6000	-.0256	7.8484	-.3352
.6250	-.0251	8.1754	-.3286
.6500	-.0245	8.5025	-.3208
.6750	-.0238	8.8295	-.3116
.7000	-.0230	9.1565	-.3011
.7250	-.0221	9.4835	-.2892

.7500	-.0211	9.8105	-.2758
.7750	-.0199	10.1375	-.2609
.8000	-.0187	10.4646	-.2444
.8250	-.0173	10.7916	-.2261
.8500	-.0157	11.1186	-.2054
.8750	-.0140	11.4456	-.1825
.9000	-.0121	11.7726	-.1580
.9250	-.0100	12.0996	-.1309
.9500	-.0074	12.4267	-.0966
.9750	-.0039	12.7537	-.0514
1.0000	0.0000	13.0807	0.0000

C-2

Y= -51.5150   Y/B/2= -.7206   CHORD= 14.5001

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.1039 .0747 .0563 .0424 .0308 .0208 .0116 .0031-.0051-.0132-.0213-.0297-.0386-.0485-.0600-.0748-.0972-.1589
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0076	0.0000	-.1105
.0250	-.0102	.3625	-.1485
.0500	-.0128	.7250	-.1862
.0750	-.0152	1.0875	-.2208
.1000	-.0172	1.4500	-.2499
.1250	-.0189	1.8125	-.2746
.1500	-.0204	2.1750	-.2964
.1750	-.0218	2.5375	-.3159
.2000	-.0230	2.9000	-.3331
.2250	-.0240	3.2625	-.3481
.2500	-.0249	3.6250	-.3612
.2750	-.0257	3.9875	-.3725
.3000	-.0263	4.3500	-.3820
.3250	-.0269	4.7125	-.3900
.3500	-.0273	5.0750	-.3964
.3750	-.0277	5.4375	-.4014
.4000	-.0279	5.8000	-.4049
.4250	-.0281	6.1625	-.4070
.4500	-.0281	6.5250	-.4077
.4750	-.0281	6.8875	-.4071
.5000	-.0279	7.2500	-.4052
.5250	-.0277	7.6126	-.4020
.5530	-.0274	7.9751	-.3974
.5750	-.0270	8.3376	-.3915
.6000	-.0265	8.7001	-.3843
.6250	-.0259	9.0626	-.3758
.6500	-.0252	9.4251	-.3659
.6750	-.0245	9.7876	-.3546
.7000	-.0236	10.1501	-.3418
.7250	-.0226	10.5126	-.3276

.7500	-.0215	10.8751	-.3117
.7750	-.0203	11.2376	-.2942
.8000	-.0190	11.6001	-.2751
.8250	-.0175	11.9626	-.2539
.8500	-.0159	12.3251	-.2303
.8750	-.0141	12.6876	-.2042
.9000	-.0122	13.0501	-.1764
.9250	-.0101	13.4126	-.1458
.9500	-.0074	13.7751	-.1074
.9750	-.0039	14.1376	-.0571
1.0000	0.0000	14.5001	0.0000

Y= -47.5539   Y/B/2= -.6652   CHORD= 15.9195

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0982 .0696 .0515 .0378 .0265 .0167 .0078-.0005-.0085-.0163-.0242-.0323-.0409-.0504-.0616-.0759-.0977-.1578

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0107	0.0000	-.1711
.0250	-.0132	.3980	-.2105
.0500	-.0157	.7960	-.2496
.0750	-.0179	1.1940	-.2853
.1000	-.0198	1.5919	-.3152
.1250	-.0214	1.9899	-.3403
.1500	-.0228	2.3879	-.3623
.1750	-.0240	2.7859	-.3818
.2000	-.0251	3.1839	-.3988
.2250	-.0260	3.5819	-.4135
.2500	-.0268	3.9799	-.4261
.2750	-.0274	4.3779	-.4368
.3000	-.0280	4.7758	-.4456
.3250	-.0284	5.1738	-.4527
.3500	-.0288	5.5718	-.4582
.3750	-.0290	5.9698	-.4620
.4000	-.0292	6.3678	-.4644
.4250	-.0292	6.7658	-.4652
.4500	-.0292	7.1638	-.4646
.4750	-.0291	7.5618	-.4626
.5000	-.0288	7.9597	-.4591
.5250	-.0285	8.3577	-.4542
.5500	-.0281	8.7557	-.4460
.5750	-.0277	9.1537	-.4403
.6000	-.0271	9.5517	-.4312
.6250	-.0264	9.9497	-.4207
.6500	-.0257	10.3477	-.4088
.6750	-.0248	10.7457	-.3953
.7000	-.0239	11.1436	-.3804
.7250	-.0229	11.5416	-.3638

.7500	-.0217	11.9396	-.3455
.7750	-.0205	12.3376	-.3256
.8000	-.0191	12.7356	-.3038
.8250	-.0176	13.1336	-.2799
.8500	-.0159	13.5316	-.2534
.8750	-.0141	13.9296	-.2243
.9000	-.0121	14.3275	-.1933
.9250	-.0100	14.7255	-.1594
.9500	-.0074	15.1235	-.1172
.9750	-.0039	15.5215	-.0622
1.0000	0.0000	15.9195	0.0000

Y = -43.5928   Y/B/2 = -.6098   CHORD = 17.3389

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0922 .0643 .0467 .0333 .0223 .0128 .0041-.0039-.0116-.0192-.0268-.0346-.0429-.0521-.0628-.0765-.0976-.1560

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4366 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0136	0.0000	-.2364
.0250	-.0160	.4335	-.2768
.0500	-.0183	.8669	-.3168
.0750	-.0204	1.3004	-.3531
.1000	-.0221	1.7339	-.3834
.1250	-.0236	2.1674	-.4085
.1500	-.0248	2.6008	-.4303
.1750	-.0259	3.0343	-.4495
.2000	-.0269	3.4678	-.4661
.2250	-.0277	3.9013	-.4802
.2500	-.0284	4.3347	-.4920
.2750	-.0289	4.7682	-.5018
.3000	-.0294	5.2017	-.5097
.3250	-.0297	5.6351	-.5157
.3500	-.0300	6.0686	-.5200
.3750	-.0301	6.5021	-.5226
.4000	-.0302	6.9356	-.5236
.4250	-.0302	7.3690	-.5230
.4500	-.0300	7.8025	-.5209
.4750	-.0298	8.2360	-.5172
.5000	-.0295	8.6694	-.5121
.5250	-.0292	9.1029	-.5055
.5500	-.0287	9.5364	-.4974
.5750	-.0281	9.9699	-.4879
.6000	-.0275	10.4033	-.4768
.6250	-.0268	10.8368	-.4643
.6500	-.0260	11.2703	-.4503
.6750	-.0251	11.7038	-.4347
.7000	-.0241	12.1372	-.4175
.7250	-.0230	12.5707	-.3986

.7500	-.0218	13.0042	-.3780
.7750	-.0205	13.4376	-.3555
.8000	-.0191	13.8711	-.3312
.8250	-.0176	14.3046	-.3046
.8500	-.0159	14.7381	-.2753
.8750	-.0140	15.1715	-.2433
.9000	-.0121	15.6050	-.2093
.9250	-.0099	16.0385	-.1722
.9500	-.0073	16.4720	-.1263
.9750	-.0039	16.9054	-.0670
1.0000	0.0000	17.3389	0.0000

Y= -39.6316   Y/B/2= -.5544   CHORD= 18.7583

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0861 .0590 .0418 .0289 .0182 .0089 .0006-.0072-.0146-.0219-.0291-.0366-.0446-.0533-.0636-.0768-.0971-.1535
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0164	0.0000	-.3068
.0250	-.0185	.4690	-.3476
.0500	-.0207	.9379	-.3880
.0750	-.0226	1.4069	-.4246
.1000	-.0242	1.8758	-.4547
.1250	-.0256	2.3448	-.4795
.1500	-.0267	2.8137	-.5008
.1750	-.0277	3.2827	-.5193
.2000	-.0285	3.7517	-.5351
.2250	-.0292	4.2206	-.5482
.2500	-.0298	4.6896	-.5590
.2750	-.0303	5.1585	-.5677
.3000	-.0306	5.6275	-.5743
.3250	-.0309	6.0964	-.5790
.3500	-.0310	6.5654	-.5819
.3750	-.0311	7.0344	-.5830
.4000	-.0310	7.5033	-.5824
.4250	-.0309	7.9723	-.5802
.4500	-.0307	8.4412	-.5764
.4750	-.0304	8.9102	-.5710
.5000	-.0301	9.3791	-.5640
.5250	-.0296	9.8481	-.5556
.5500	-.0291	10.3171	-.5456
.5750	-.0285	10.7860	-.5340
.6000	-.0278	11.2550	-.5210
.6250	-.0270	11.7239	-.5063
.6500	-.0261	12.1929	-.4901
.6750	-.0252	12.6618	-.4723
.7000	-.0241	13.1308	-.4529
.7250	-.0230	13.5998	-.4317

.7500	-.0218	14.0687	-.4086
.7750	-.0205	14.5377	-.3837
.8000	-.0190	15.0066	-.3569
.8250	-.0175	15.4756	-.3278
.8500	-.0158	15.9446	-.2958
.8750	-.0139	16.4135	-.2609
.9000	-.0119	16.8825	-.2240
.9250	-.0098	17.3514	-.1840
.9500	-.0072	17.8204	-.1347
.9750	-.0038	18.2893	-.0713
1.0000	0.0000	18.7583	0.0000

Y= -35.6705   Y/B/2= -.4990   CHORD= 20.1777

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0797 .0534 .0367 .0241 .0137 .0047-.0034-.0109-.0181-.0250-.0320-.0391-.0467-.0550-.0648-.0774-.0968-.1512

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0194	0.0000	-.3919
.0250	-.0214	.5044	-.4325
.0500	-.0234	1.0089	-.4728
.0750	-.0252	1.5133	-.5091
.1000	-.0267	2.0178	-.5386
.1250	-.0279	2.5222	-.5625
.1500	-.0289	3.0267	-.5827
.1750	-.0297	3.5311	-.6001
.2000	-.0305	4.0355	-.6146
.2250	-.0310	4.5400	-.6263
.2500	-.0315	5.0444	-.6356
.2750	-.0318	5.5489	-.6427
.3000	-.0321	6.0533	-.6476
.3250	-.0322	6.5578	-.6505
.3500	-.0323	7.0622	-.6515
.3750	-.0322	7.5666	-.6507
.4000	-.0321	8.0711	-.6481
.4250	-.0319	8.5755	-.6438
.4500	-.0316	9.0800	-.6378
.4750	-.0312	9.5844	-.6302
.5000	-.0308	10.0888	-.6210
.5250	-.0302	10.5933	-.6102
.5500	-.0296	11.0977	-.5979
.5750	-.0289	11.6022	-.5839
.6000	-.0282	12.1066	-.5684
.6250	-.0273	12.6111	-.5513
.6500	-.0264	13.1155	-.5326
.6750	-.0254	13.6199	-.5122
.7000	-.0243	14.1244	-.4901
.7250	-.0231	14.6288	-.4663

.7500	-.0218	15.1333	-.4406
.7750	-.0205	15.6377	-.4129
.8000	-.0190	16.1422	-.3833
.8250	-.0174	16.6466	-.3514
.8500	-.0157	17.1510	-.3165
.8750	-.0138	17.6555	-.2786
.9000	-.0118	18.1599	-.2387
.9250	-.0097	18.6644	-.1956
.9500	-.0071	19.1688	-.1429
.9750	-.0037	19.6733	-.0756
1.0000	0.0000	20.1777	0.0000

Y = -31.7094   Y/R/2 = -.4435   CHORD = 21.5971

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0728 .0472 .0308 .0185 .0082 -.0006 -.0086 -.0160 -.0230 -.0298 -.0365 -.0433 -.0505 -.0583 -.0675 -.0792 -.0975 -.1497

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0237	0.0000	-.5121
.0250	-.0256	.5399	-.5519
.0500	-.0274	1.0799	-.5913
.0750	-.0290	1.6198	-.6265
.1000	-.0303	2.1597	-.6546
.1250	-.0313	2.6996	-.6769
.1500	-.0322	3.2396	-.6954
.1750	-.0329	3.7795	-.7109
.2000	-.0335	4.3194	-.7233
.2250	-.0339	4.8593	-.7328
.2500	-.0343	5.3993	-.7398
.2750	-.0345	5.9392	-.7443
.3000	-.0346	6.4791	-.7467
.3250	-.0346	7.0191	-.7469
.3500	-.0345	7.5590	-.7451
.3750	-.0343	8.0989	-.7414
.4000	-.0341	8.6388	-.7359
.4250	-.0337	9.1788	-.7285
.4500	-.0333	9.7187	-.7194
.4750	-.0328	10.2586	-.7086
.5000	-.0322	10.7985	-.6960
.5250	-.0316	11.3385	-.6819
.5500	-.0308	11.8784	-.6661
.5750	-.0300	12.4183	-.6486
.6000	-.0292	12.9583	-.6296
.6250	-.0282	13.4982	-.6088
.6500	-.0272	14.0381	-.5865
.6750	-.0260	14.5780	-.5624
.7000	-.0248	15.1180	-.5366
.7250	-.0236	15.6579	-.5091

.7500	-.0222	16.1978	-.4796
.7750	-.0208	16.7377	-.4482
.8000	-.0192	17.2777	-.4148
.8250	-.0176	17.8176	-.3791
.8500	-.0158	18.3575	-.3405
.8750	-.0138	18.8975	-.2989
.9000	-.0118	19.4374	-.2552
.9250	-.0096	19.9773	-.2083
.9500	-.0070	20.5172	-.1517
.9750	-.0037	21.0572	-.0801
1.0000	0.0000	21.5971	0.0000

Y = -28.7324   Y/B/2 = -.4019   CHORD = 22.6638

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0674 .0419 .0255 .0129 .0025-.0066-.0149-.0225-.0298-.0368-.0437-.0507-.0579-.0656-.0744-.0852-.1015-.1495
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0297	0.0000	-.6727
.0250	-.0314	.5666	-.7113
.0500	-.0331	1.1332	-.7495
.0750	-.0346	1.6998	-.7834
.1000	-.0357	2.2664	-.8100
.1250	-.0366	2.8330	-.8304
.1500	-.0374	3.3996	-.8468
.1750	-.0379	3.9662	-.8600
.2000	-.0384	4.5328	-.8699
.2250	-.0307	5.0994	-.8767
.2500	-.0389	5.6660	-.8808
.2750	-.0389	6.2326	-.8823
.3000	-.0389	6.7992	-.8815
.3250	-.0388	7.3658	-.8784
.3500	-.0385	7.9323	-.8730
.3750	-.0382	8.4989	-.8656
.4000	-.0378	9.0655	-.8562
.4250	-.0373	9.6321	-.8448
.4500	-.0367	10.1987	-.8315
.4750	-.0360	10.7653	-.8164
.5000	-.0353	11.3319	-.7994
.5250	-.0344	11.8985	-.7806
.5500	-.0335	12.4651	-.7601
.5750	-.0326	13.0317	-.7378
.6000	-.0315	13.5983	-.7137
.6250	-.0303	14.1649	-.6878
.6500	-.0291	14.7315	-.6602
.6750	-.0278	15.2981	-.6308
.7000	-.0265	15.8647	-.5996
.7250	-.0250	16.4313	-.5664

.7500	-.0234	16.9979	-.5313
.7750	-.0218	17.5645	-.4943
.8000	-.0201	18.1311	-.4552
.8250	-.0183	18.6977	-.4137
.8500	-.0163	19.2643	-.3694
.8750	-.0142	19.8309	-.3222
.9000	-.0121	20.3975	-.2732
.9250	-.0098	20.9641	-.2212
.9500	-.0071	21.5307	-.1598
.9750	-.0037	22.0973	-.0840
1.0000	0.0000	22.6638	0.0000

Y = -25.7554   Y/B/2 = -.3603   CHORD = 24.2323

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0602 .0360 .0206 .0089 .0005-.0089-.0163-.0231-.0295-.0357-.0418-.0479-.0542-.0610-.0687-.0784-.0928-.1333
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0288	0.0000	-.6972
.0250	-.0303	.6058	-.7341
.0500	-.0318	1.2116	-.7706
.0750	-.0331	1.8174	-.8028
.1000	-.0341	2.4232	-.8274
.1250	-.0349	3.0290	-.8458
.1500	-.0355	3.6349	-.8602
.1750	-.0360	4.2407	-.8715
.2000	-.0363	4.8465	-.8794
.2250	-.0365	5.4523	-.8844
.2500	-.0366	6.0581	-.8866
.2750	-.0366	6.6639	-.8663
.3000	-.0365	7.2697	-.8838
.3250	-.0363	7.8755	-.8790
.3500	-.0360	8.4813	-.8721
.3750	-.0356	9.0871	-.8632
.4000	-.0352	9.6929	-.8523
.4250	-.0346	10.2987	-.8396
.4500	-.0341	10.9046	-.8251
.4750	-.0334	11.5104	-.8088
.5000	-.0326	12.1162	-.7909
.5250	-.0318	12.7220	-.7712
.5500	-.0309	13.3278	-.7498
.5750	-.0300	13.9336	-.7268
.6000	-.0290	14.5394	-.7021
.6250	-.0279	15.1452	-.6758
.6500	-.0267	15.7510	-.6478
.6750	-.0255	16.3568	-.6182
.7000	-.0242	16.9626	-.5868
.7250	-.0228	17.5684	-.5536

.7500	-.0214	18.1743	-.5186
.7750	-.0199	18.7801	-.4818
.8000	-.0183	19.3859	-.4430
.8250	-.0166	19.9917	-.4021
.8500	-.0148	20.5975	-.3584
.8750	-.0129	21.2033	-.3120
.9000	-.0109	21.8091	-.2637
.9250	-.0088	22.4149	-.2125
.9500	-.0063	23.0207	-.1528
.9750	-.0033	23.6265	-.0801
1.0000	0.0000	24.2323	0.0000

Y= -21.7943   Y/B/2= -.3049   CHORD= 26.6552

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0527 .0302 .0159 .0053-.0034-.0108-.0174-.0234-.0290-.0344-.0397-.0450-.0505-.0564-.0633-.0720-.0854-.1233
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
.0000	-.0281	.0000	-.7486
.0250	-.0294	.6664	-.7841
.0500	-.0307	1.3328	-.8193
.0750	-.0319	1.9991	-.8500
.1000	-.0328	2.6655	-.8730
.1250	-.0334	3.3319	-.8897
.1500	-.0339	3.9983	-.9023
.1750	-.0342	4.6647	-.9117
.2000	-.0344	5.3310	-.9178
.2250	-.0345	5.9974	-.9208
.2500	-.0346	6.6638	-.9211
.2750	-.0345	7.3302	-.9190
.3000	-.0343	7.9966	-.9146
.3250	-.0341	8.6629	-.9080
.3500	-.0337	9.3293	-.8993
.3750	-.0333	9.9957	-.8886
.4000	-.0329	10.6621	-.8761
.4250	-.0323	11.3285	-.8618
.4500	-.0317	11.9949	-.8457
.4750	-.0311	12.6612	-.8279
.5000	-.0303	13.3276	-.8085
.5250	-.0295	13.9940	-.7874
.5500	-.0287	14.6604	-.7648
.5750	-.0278	15.3268	-.7405
.6000	-.0268	15.9931	-.7147
.6250	-.0258	16.6595	-.6873
.6500	-.0247	17.3259	-.6584
.6750	-.0236	17.9923	-.6278
.7000	-.0223	18.6587	-.5956
.7250	-.0211	19.3250	-.5616

.7500	-.0197	19.9914	-.5259
.7750	-.0183	20.6578	-.4884
.8000	-.0168	21.3242	-.4491
.8250	-.0153	21.9906	-.4076
.8500	-.0136	22.6569	-.3634
.8750	-.0119	23.3233	-.3164
.9000	-.0100	23.9897	-.2677
.9250	-.0081	24.6561	-.2159
.9500	-.0058	25.3225	-.1555
.9750	-.0031	25.9888	-.0815
1.0000	0.0000	26.6552	0.0000

Y= -17.8332   Y/B/2= -.2494   CHORD= 29.0781

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0454 .0243 .0110 .0010 -.0070 -.0139 -.0199 -.0254 -.0305 -.0353 -.0401 -.0448 -.0498 -.0551 -.0614 -.0693 -.0817 -.1170

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0294	0.0000	-.8539
.0250	-.0305	.7270	-.8873
.0500	-.0317	1.4539	-.9203
.0750	-.0326	2.1809	-.9488
.1000	-.0333	2.9078	-.9694
.1250	-.0338	3.6348	-.9836
.1500	-.0342	4.3617	-.9936
.1750	-.0344	5.0887	-1.0003
.2000	-.0345	5.8156	-1.0037
.2250	-.0345	6.5426	-1.0040
.2500	-.0344	7.2695	-1.0015
.2750	-.0343	7.9965	-.9966
.3000	-.0340	8.7234	-.9893
.3250	-.0337	9.4504	-.9798
.3500	-.0333	10.1773	-.9682
.3750	-.0328	10.9043	-.9547
.4000	-.0323	11.6312	-.9393
.4250	-.0317	12.3582	-.9220
.4500	-.0311	13.0851	-.9031
.4750	-.0303	13.8121	-.8825
.5000	-.0296	14.5391	-.8602
.5250	-.0288	15.2660	-.8364
.5500	-.0279	15.9930	-.8109
.5750	-.0270	16.7199	-.7839
.6000	-.0260	17.4469	-.7554
.6250	-.0249	18.1738	-.7253
.6500	-.0239	18.9008	-.6937
.6750	-.0227	19.6277	-.6605
.7000	-.0215	20.3547	-.6257
.7250	-.0203	21.0816	-.5892

.7500	-.0190	21.8086	-.5510
.7750	-.0176	22.5355	-.5111
.8000	-.0161	23.2625	-.4693
.8250	-.0146	23.9894	-.4253
.8500	-.0130	24.7164	-.3787
.8750	-.0113	25.4433	-.3293
.9000	-.0096	26.1703	-.2782
.9250	-.0077	26.8973	-.2240
.9500	-.0055	27.6242	-.1610
.9750	-.0029	28.3512	-.0844
1.0000	0.0000	29.0781	0.0000

Y= -13.8721   Y/B/2= -.1940   CHORD= 31.5010

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0379 .0180 .0055-.0039-.0114-.0178-.0234-.0285-.0331-.0375-.0418-.0461-.0505-.0553-.0609-.0682-.0795-.1123
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0317	0.0000	-.9994
.0250	-.0327	.7875	-1.0297
.0500	-.0336	1.5750	-1.0595
.0750	-.0344	2.3626	-1.0847
.1000	-.0350	3.1501	-1.1019
.1250	-.0353	3.9376	-1.1125
.1500	-.0355	4.7251	-1.1189
.1750	-.0356	5.5127	-1.1219
.2000	-.0356	6.3002	-1.1216
.2250	-.0355	7.0877	-1.1180
.2500	-.0353	7.8752	-1.1117
.2750	-.0350	8.6628	-1.1028
.3000	-.0347	9.4503	-1.0916
.3250	-.0342	10.2378	-1.0781
.3500	-.0337	11.0253	-1.0626
.3750	-.0332	11.8129	-1.0451
.4000	-.0326	12.6004	-1.0257
.4250	-.0319	13.3879	-1.0045
.4500	-.0312	14.1754	-.9816
.4750	-.0304	14.9630	-.9570
.5000	-.0295	15.7505	-.9308
.5250	-.0287	16.5380	-.9031
.5500	-.0277	17.3255	-.8738
.5750	-.0268	18.1131	-.8430
.6000	-.0257	18.9006	-.8106
.6250	-.0247	19.6881	-.7768
.6500	-.0235	20.4756	-.7415
.6750	-.0224	21.2632	-.7046
.7000	-.0211	22.0507	-.6662
.7250	-.0199	22.8382	-.6261

.7500	-.0186	23.6257	-.5844
.7750	-.0172	24.4133	-.5410
.8000	-.0157	25.2008	-.4957
.8250	-.0142	25.9883	-.4484
.8500	-.0126	26.7758	-.3985
.8750	-.0110	27.5634	-.3458
.9000	-.0093	28.3509	-.2914
.9250	-.0074	29.1384	-.2341
.9500	-.0053	29.9259	-.1678
.9750	-.0028	30.7135	-.0878
1.0000	0.0000	31.5010	0.0000

Y= -9.9110   Y/B/2= -.1386   CHORD= 33.9239

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0295 .0106-.0013-.0102-.0173-.0233-.0285-.0331-.0373-.0412-.0450-.0488-.0526-.0568-.0617-.0682-.0785-.1089
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
0.0000	-.0354	0.0000	-1.2019
.0250	-.0362	.8481	-1.2274
.0500	-.0369	1.6962	-1.2525
.0750	-.0375	2.5443	-1.2727
.1000	-.0379	3.3924	-1.2848
.1250	-.0380	4.2405	-1.2901
.1500	-.0381	5.0886	-1.2911
.1750	-.0380	5.9367	-1.2887
.2000	-.0378	6.7848	-1.2828
.2250	-.0375	7.6329	-1.2736
.2500	-.0372	8.4810	-1.2616
.2750	-.0368	9.3291	-1.2471
.3000	-.0363	10.1772	-1.2301
.3250	-.0357	11.0253	-1.2110
.3500	-.0351	11.8734	-1.1897
.3750	-.0344	12.7215	-1.1665
.4000	-.0336	13.5696	-1.1414
.4250	-.0329	14.4176	-1.1146
.4500	-.0320	15.2657	-1.0861
.4750	-.0311	16.1138	-1.0559
.5000	-.0302	16.9619	-1.0242
.5250	-.0292	17.8100	-.9909
.5500	-.0282	18.6581	-.9562
.5750	-.0271	19.5062	-.9200
.6000	-.0260	20.3543	-.8824
.6250	-.0249	21.2024	-.8433
.6500	-.0237	22.0505	-.8029
.6750	-.0224	22.8986	-.7610
.7000	-.0212	23.7467	-.7176
.7250	-.0198	24.5948	-.6727

.7500	-.0185	25.4429	-.6262
.7750	-.0170	26.2910	-.5781
.8000	-.0156	27.1391	-.5284
.8250	-.0141	27.9872	-.4767
.8500	-.0125	28.8353	-.4224
.8750	-.0108	29.6834	-.3656
.9000	-.0091	30.5315	-.3070
.9250	-.0072	31.3796	-.2457
.9500	-.0052	32.2277	-.1756
.9750	-.0027	33.0758	-.0917
1.0000	0.0000	33.9239	0.0000

Y = -5.9499   Y/B/2 = -.0832   CHORD= 36.3468

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

.0184 .0001-.0115-.0200-.0268-.0323-.0371-.0412-.0449-.0482-.0514-.0544-.0576-.0610-.0650-.0703-.0793-.1070
CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
.0000	-.0421	.0000	-1.5300
.0250	-.0426	.9087	-1.5472
.0500	-.0430	1.8173	-1.5640
.0750	-.0434	2.7260	-1.5758
.1000	-.0434	3.6347	-1.5791
.1250	-.0433	4.5433	-1.5754
.1500	-.0431	5.4520	-1.5671
.1750	-.0428	6.3607	-1.5553
.2000	-.0424	7.2694	-1.5399
.2250	-.0419	8.1780	-1.5212
.2500	-.0413	9.0867	-1.4996
.2750	-.0406	9.9954	-1.4755
.3000	-.0399	10.9040	-1.4489
.3250	-.0391	11.8127	-1.4201
.3500	-.0382	12.7214	-1.3892
.3750	-.0373	13.6300	-1.3565
.4000	-.0364	14.5387	-1.3219
.4250	-.0354	15.4474	-1.2856
.4500	-.0343	16.3560	-1.2478
.4750	-.0332	17.2647	-1.2084
.5000	-.0321	18.1734	-1.1676
.5250	-.0310	19.0820	-1.1253
.5500	-.0298	19.9907	-1.0817
.5750	-.0285	20.8994	-1.0368
.6000	-.0273	21.8081	-.9907
.6250	-.0260	22.7167	-.9432
.6500	-.0246	23.6254	-.8946
.6750	-.0232	24.5341	-.8446
.7000	-.0218	25.4427	-.7934
.7250	-.0204	26.3514	-.7409

.7500	-.0189	27.2601	-.6870
.7750	-.0174	28.1687	-.6317
.8000	-.0158	29.0774	-.5749
.8250	-.0142	29.9861	-.5164
.8500	-.0125	30.8947	-.4557
.8750	-.0108	31.8034	-.3926
.9000	-.0090	32.7121	-.3281
.9250	-.0072	33.6208	-.2611
.9500	-.0051	34.5294	-.1656
.9750	-.0027	35.4381	-.0966
1.0000	0.0000	36.3468	0.0000

Y= -1.9847   Y/B/2= -.0278   CHORD= 38.7722

SLOPES,DZ/DX,AT SLOPE POINTS,FROM FRONT TO REAR

-.0047-.0239-.0357-.0439-.0501-.0549-.0587-.0617-.0642-.0680-.0696-.0713-.0730-.0753-.0787-.0850-.1081

CORRESPONDING X/C LOCATIONS FROM FRONT TO REAR

.0417 .0972 .1528 .2083 .2639 .3194 .3750 .4306 .4861 .5417 .5972 .6528 .7083 .7639 .8194 .8750 .9306 .9861

LOCAL ELEVATION

X/C	Z/C	DELTA X	DELTA Z
.0000	-.0593	.0000	-2.2982
.0250	-.0592	.9693	-2.2942
.0500	-.0591	1.9386	-2.2897
.0750	-.0588	2.9079	-2.2796
.1000	-.0583	3.8772	-2.2600
.1250	-.0576	4.8465	-2.2327
.1500	-.0568	5.8158	-2.2005
.1750	-.0558	6.7851	-2.1645
.2000	-.0548	7.7544	-2.1248
.2250	-.0537	8.7237	-2.0817
.2500	-.0525	9.6930	-2.0357
.2750	-.0513	10.6623	-1.9873
.3000	-.0499	11.6316	-1.9366
.3250	-.0486	12.6009	-1.8839
.3500	-.0472	13.5703	-1.8294
.3750	-.0457	14.5396	-1.7733
.4000	-.0443	15.5089	-1.7158
.4250	-.0427	16.4782	-1.6569
.4500	-.0412	17.4475	-1.5967
.4750	-.0396	18.4168	-1.5355
.5000	-.0380	19.3861	-1.4733
.5250	-.0364	20.3554	-1.4101
.5500	-.0347	21.3247	-1.3460
.5750	-.0330	22.2940	-1.2811
.6000	-.0314	23.2633	-1.2155
.6250	-.0296	24.2326	-1.1491
.6500	-.0279	25.2019	-1.0821
.6750	-.0262	26.1712	-1.0143
.7000	-.0244	27.1405	-.9458
.7250	-.0226	28.1098	-.8766

.7500	-.0208	29.0791	-.8067
.7750	-.0190	30.0484	-.7359
.8000	-.0171	31.0177	-.6644
.8250	-.0153	31.9870	-.5917
.8500	-.0133	32.9563	-.5175
.8750	-.0114	33.9256	-.4418
.9000	-.0094	34.8949	-.3653
.9250	-.0074	35.8642	-.2871
.9500	-.0052	36.8335	-.2016
.9750	-.0027	37.8028	-.1042
1.0000	0.0000	38.7722	0.0000

APPENDIX B

DETAILS OF DATA PREPARATION FOR
NUMERICALLY CONTROLLED MACHINING
OF WING-WINGLET MODELS

```
      PROGRAM TX23Z(INPUT,OUTPUT,TAPE5,TAPE6=OUTPUT,TAPE10)
C
C     PROGRAM WRITTEN BY J KUHLMAN FOR PREPARING AIRFOIL
C     COORDINATES, IN INCHES, FOR WING WITH WINGLET
C     MODEL TO BE TESTED IN 7X10 FOOT TUNNEL.
C     DESIGNED USING TN D-8090 DESIGN CODE BY LAMAR OR
C     MODIFIED VERSION OF THIS CODE USING TREFFTZ
C     PLANE WAKE MODEL OF CR-3154 BY KUHLMAN.
C
C     NAMELIST DATA INPUT INCLUDES CAMBERS (Z/C) FROM
C     DESIGN CODES AT 21 SPAN STATIONS (PCTY HEREIN)
C     AND 30 X/C STATIONS (PCTX HEREIN), AS WELL
C     AS CHORD VALUES FOR WING, IN INCHES. THESE DATA
C     SETS ARE STORRED ON PERMANENT FILES ZOCJK AND ZCCOR.
C
C     TOC ARRAY IS SEMI-THICKNESS/C FOR NACA 64A008
C     BASIC THICKNESS FORM.
C
C     SINCH IS DISTANCE IN PLANE OF WING OR WINGLET
C     MEASURED FROM ROOT.
C
C     LINEAR INTERPOLATION OR EXTRAPOLATION IN SPAN
C     DIRECTION USING IUNI PERFORMED TO GENERATE ZS AT ROOT,
C     TE BREAK, JCT OF WING AND WINGLET, LE BREAK ON
C     WINGLET, AND WINGLET TIP.
C
C     THE Z/C TABLE IS SCALED BY THE LOCAL CHORD VALUE
C     TIMES COSINE OF THE LOCAL DIHEDRAL ANGLE, SINCE
C     WING AND WINGLET ARE TO BE MACHINED SEPARATELY.
C
C     THE YOB,CORD VALUES ARE THE INTERPOLATION STATIONS.
C
C     PCTX,YUP,YLO, ARE WRITTEN ON TAPE10 WHICH MAY
C     THEN BE DISPOSED TO THE KEYPUNCH, TO OBTAIN
C     PUNCHED INPUT CARDS FORMATTED FOR USE BY THE TX23
C     NUMERICAL CONTROL MACHINE.
C
C     INFOPLT PLOTS ZUP AND ZLO (UPPER AND LOWER SUP-
C     FACE AIRFOIL COORDINATES) OVER CHORDS, VS PCTX.
C
      DIMENSION CAMBER(30,21),PCTY(21),YOB(5),CHORD(21)
      DIMENSION PCTX(30),CORD(5)
```

Listing of Computer Program for Rescaling of Geometry

```
      DIMENSION ZTERP(30,6),PCTW(18),PCTT(3)
      DIMENSION TOC(30)
      DIMENSION CAM(21),ZUP(30),ZLO(30),ZUPC(30),ZLOC(30)
      NAMELIST/DATA/CAMBER,CHORD
      READ(5,DATA)
      IF(EOF(5)) 10,20
   10 WRITE(6,11)
   11 FORMAT(/10X,13HNO DATA FOUND)
      STOP
   20 CONTINUE
      REWIND 10
      CALL PSEUDO
C     CAMBER TABLES MUST BE INCREASING INDICES AS MOVE AFT AND AS MOVE
C     OUTBOARD IN SPANWISE DIRECTION
      TOC(1)=0.0
      TOC(2)=1.353
      TOC(3)=1.863
      TOC(4)=2.245
      TOC(5)=2.559
      TOC(6)=2.830
      TOC(7)=3.047
      TOC(8)=3.233
      TOC(9)=3.414
      TOC(10)=3.556
      TOC(11)=3.681
      TOC(12)=3.781
      TOC(13)=3.866
      TOC(14)=3.929
      TOC(15)=3.972
      TOC(16)=3.990
      TOC(17)=3.998
      TOC(18)=3.972
      TOC(19)=3.921
      TOC(20)=3.757
      TOC(21)=3.524
      TOC(22)=3.234
      TOC(23)=2.897
      TOC(24)=2.521
      TOC(25)=2.117
      TOC(26)=1.698
      TOC(27)=1.278
      TOC(28)=0.858
```

```
      TOC(29)=0.438
      TOC(30)=0.018
      RAD=4.*ATAN(1.)/180.
      ANG1=6.*RAD
      ANG2=77.5*RAD
      WRITE(6,12) ANG1,ANG2
   12 FORMAT(/20X,3F12.5/)
      PCTY(1)=0.0278
      PCTY(2)=0.0832
      PCTY(3)=0.1386
      PCTY(4)=0.1940
      PCTY(5)=0.2494
      PCTY(6)=0.3049
      PCTY(7)=0.3603
      PCTY(8)=0.4019
      PCTY(9)=0.4435
      PCTY(10)=0.4990
      PCTY(11)=0.5544
      PCTY(12)=0.6098
      PCTY(13)=0.6652
      PCTY(14)=0.7206
      PCTY(15)=0.7760
      PCTY(16)=0.8314
      PCTY(17)=0.8868
      PCTY(18)=0.9422
      PCTY(19)=0.9737
      PCTY(20)=0.9827
      PCTY(21)=0.9940
      YM=28.1459
      YOB(1)=0.
      YOB(2)=10.9197/YM
      YOB(3)=27.2992/YM
      YOB(4)=27.5109/YM
      YOB(5)=1.0
      CORD(1)=15.7426
      CORD(2)=9.0633
      CORD(3)=3.194
      CORD(4)=1.73
      CORD(5)=0.6916
      DO 1 I=1,19
    1 PCTX(I)=0.025*FLOAT(I-1)*100.
      DO 2 I=20,30
```

```
      PCTX(I)=0.05*FLOAT(I)-0.50
    2 PCTX(I)=PCTX(I)*100.
      ANG=ANG1
      DO 30 I=1,21
      IF(I.GE.19) ANG=ANG2
      DO 22 J=1,30
      CAMBER(J,I)=CAMBER(J,I)*COS(ANG)*CHORD(I)
      THK=CHORD(I)*TOC(J)/100.
      IF(J.EQ.1) GO TO 77
      IF(THK.LT.0.01) THK=0.01
   77 CONTINUE
C     ASK HOW THIN THE TRAILING EDGE CAN BE
      ZUP(J)=CAMBER(J,I)+THK
      ZLO(J)=ZUP(J)-2.*THK
      ZUPC(J)=ZUP(J)/CHORD(I)+0.5
      ZLOC(J)=ZLO(J)/CHORD(I)+0.5
   22 CONTINUE
      XI=FLOAT(I)
      SINCH=28.1459*PCTY(I)/COS(ANG1)
      IF(I.GE.19) SINCH=130.043125*PCTY(I)-126.131098
      WRITE(10,120) XI,SINCH
  120 FORMAT(7F10.6)
      WRITE(10,120) (PCTX(L),L=1,30)
      WRITE(10,120) (ZUP(L),L=1,30)
      WRITE(10,120) (ZLO(L),L=1,30)
      WRITE(6,129)
  129 FORMAT(1H1)
      WRITE(6,130) XI,SINCH
      WRITE(6,833) CHORD(I),PCTY(I)
  833 FORMAT(20X,6HCHORD=,F10.6,6HY/B/2=,F10.6/)
  130 FORMAT(20X,2HI=,F8.2,3X,8HS(INCH)=,F10.6/)
      CALL INFOPLT(0,30,PCTX,1,ZUPC,1,0.,1.,0.,1.,0.0,3.
     13HX/C,12,12HZ COS(PHI)/C,0)
      CALL INFOPLT(0,30,PCTX,1,ZLOC,1,0.,1.,0.,1.,0.0,3.
     13HX/C,12,12HZ COS(PHI)/C,0)
      THET=0.
      XL=5.5
      YL=8.
      HT=0.3
      CALL NOTATE(XL,YL,HT,6HCHORD=,THET,6)
      YL=7.
      CALL NOTATE(XL,YL,HT,6HY/B/2=,THET,6)
```

```
      XL=8.
      YL=8.
      CALL NUMBER(XL,YL,HT,CHORD(I),THET,3)
      YL=7.
      CALL NUMBER(XL,YL,HT,PCTY(I),THET,3)
      CALL INFOPLT(1,0)
      WRITE(6,135)
  135 FORMAT(/24X,1HI,6X,4HPCTX,6X,7HZUP(IN),4X,7HZLO(IN)/)
      WRITE(6,140) (L,PCTX(L),ZUP(L),ZLO(L),L=1,30)
  140 FORMAT(21X,I5,3F11.6)
   30 CONTINUE
      IPT=-1
      IORDER=1
      DO 4 J=1,3
      DO 3 I=1,30
      DO 14 L=1,18
      PCTW(L)=PCTY(L)
   14 CAM(L)=CAMBER(I,L)
      XO=YOB(J)
      IPT=-1
      CALL IUNI(18,18,PCTW,1,CAM,IORDER,XO,ZO,IPT,IERR)
      WRITE(6,100) IERR
      ZTERP(I,J)=ZO
    3 CONTINUE
    4 CONTINUE
      DO 5 I=1,3
      WRITE(6,101) YOB(I)
      WRITE(6,111) (PCTX(J),ZTERP(J,I),J=1,30)
    5 CONTINUE
      DO 6 I=1,3
      WRITE(10,110) (ZTERP(J,I),J=1,30)
    6 CONTINUE
      DO 8 J=3,5
      J1=J+1
      DO 7 I=1,30
      DO 31 L=1,3
      LP=18+L
      PCTT(L)=PCTY(LP)
   31 CAM(L)=CAMBER(I,LP)
      XO=YOB(J)
      IPT=-1
      IORDER=1
```

```
      CALL IUNI(18,3,PCTT,1,CAM,IORDER,XO,ZO,IPT,IERR)
      WRITE(6,100) IERR
      ZTERP(I,J1)=ZO
    7 CONTINUE
    8 CONTINUE
      DO 9 J=3,5
      J1=J+1
      WRITE(6,101) YOB(J)
      WRITE(6,111) (PCTX(I),ZTERP(I,J1),I=1,30)
    9 CONTINUE
C     ADD SCALING CODING HERE TO COMPUTE ZUP AND ZLO INTERP
      DO 909 J=1,3
      DO 908 I=1,30
      THK=CORD(J)*TOC(I)/100.
      IF(I.EQ.1) GO TO 967
      IF(THK.LT.0.01) THK=0.01
  967 CONTINUE
      ZUP(I)=ZTERP(I,J)+THK
      ZLO(I)=ZUP(I)-2.*THK
  908 CONTINUE
      WRITE(10,120) (PCTX(L),L=1,30)
      WRITE(10,120) (ZUP(L),L=1,30)
      WRITE(10,120) (ZLO(L),L=1,30)
      WRITE(6,129)
      WRITE(6,920)
      WRITE(6,833) CORD(J),YOB(J)
  901 FORMAT(/20X,6HY/B/2=,F15.5/)
      WRITE(6,135)
      WRITE(6,140) (L,PCTX(L),ZUP(L),ZLO(L),L=1,30)
  920 FORMAT(/25X,25HINTERP ZS ON WING (INCH) /)
  909 CONTINUE
      DO 919 J=3,5
      J1=J+1
      DO 918 I=1,30
      THK=CORD(J)*TOC(I)/100.
      IF(I.EQ.1) GO TO 977
      IF(THK.LT.0.01) THK=0.01
  977 CONTINUE
      ZUP(I)=ZTERP(I,J1)+THK
      ZLO(I)=ZUP(I)-2.*THK
  918 CONTINUE
      WRITE(10,120) (PCTX(L),L=1,30)
```

133

```
      WRITE(10,120) (ZUP(L),L=1,30)
      WRITE(10,120) (ZLO(L),L=1,30)
      WRITE(6,129)
      WRITE(6,921)
      WRITE(6,833) CORD(J),YOB(J)
      WRITE(6,135)
      WRITE(6,140) (L,PCTX(L),ZUP(L),ZLO(L),L=1,30)
  921 FORMAT(/25X,28HINTERP ZS ON WINGLET (INCH) /)
  919 CONTINUE
      END FILE 10
      REWIND 10
  100 FORMAT(20X,2I10)
  101 FORMAT(/7H Y/B/2=,F15.5//26X,3HXOC,10X,8HINTERP Z//)
  111 FORMAT(20X,2F15.5)
  110 FORMAT(10F7.5)
      END
```

```
I=      1.00    S(INCH)=    .786766  -

CHORD= 15.264600Y/B/2=    .027800


        I       PCTX        ZUP(IN)     ZLO(IN)

        1     0.000000      .851330     .851330
        2     2.500000     1.056410     .643350
        3     5.000000     1.132631     .563872
        4     7.500000     1.187220     .501839
        5    10.000000     1.227910     .446668
        6    12.500000     1.259126     .395150
        7    15.000000     1.280283     .350058
        8    17.500000     1.295299     .308289
        9    20.000000     1.308178     .265911
       10    22.500000     1.313844     .228226
       11    25.000000     1.315845     .192065
       12    27.500000     1.313112     .158803
       13    30.000000     1.307265     .127006
       14    32.500000     1.297313     .097821
       15    35.000000     1.283640     .071020
       16    37.500000     1.265551     .047436
       17    40.000000     1.245394     .024837
       18    42.500000     1.219557     .006937
       19    45.000000     1.189457    -.007593
       20    50.000000     1.118607    -.028375
       21    55.000000     1.035852    -.039997
       22    60.000000      .943213    -.044101
       23    65.000000      .842337    -.042094
       24    70.000000      .734507    -.035134
       25    75.000000      .621346    -.024958
       26    80.000000      .504767    -.013619
       27    85.000000      .386381    -.003782
       28    90.000000      .266029     .004088
       29    95.000000      .141446     .007728
       30   100.000000      .010000    -.010000
```

Output of Computer Program for Rescaling of Wing-Winglet Geometry

```
I=    2.00   S(INCH)=  2.354638

CHORD= 14.309800Y/B/2=    .083200


    I       PCTX        ZUP(IN)        ZLO(IN)

    1     0.000000      .564536         .564536
    2     2.500000      .764623         .377400
    3     5.000000      .843919         .310736
    4     7.500000      .903030         .260520
    5    10.000000      .949259         .216884
    6    12.500000      .986706         .176772
    7    15.000000     1.014749         .142710
    8    17.500000     1.037020         .111748
    9    20.000000     1.057253         .080180
   10    22.500000     1.070669         .052956
   11    25.000000     1.080571         .027083
   12    27.500000     1.085937         .003830
   13    30.000000     1.088273        -.018161
   14    32.500000     1.086636        -.037828
   15    35.000000     1.081373        -.055397
   16    37.500000     1.071824        -.070098
   17    40.000000     1.060180        -.084031
   18    42.500000     1.043046        -.093725
   19    45.000000     1.021743        -.100431
   20    50.000000      .968609        -.106629
   21    55.000000      .903546        -.105009
   22    60.000000      .828402        -.097156
   23    65.000000      .744680        -.084430
   24    70.000000      .653542        -.067958
   25    75.000000      .556460        -.049417
   26    80.000000      .455181        -.030780
   27    85.000000      .351105        -.014653
   28    90.000000      .243985        -.001571
   29    95.000000      .131297         .005943
   30   100.000000      .010000        -.010000
```

I=   3.00   S(INCH)=   3.922510

CHORD= 13.355900Y/B/2=   .138600

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.443664	.443664
2	2.500000	.633925	.272514
3	5.000000	.711442	.213802
4	7.500000	.770064	.170384
5	10.000000	.816571	.133016
6	12.500000	.854802	.098858
7	15.000000	.884207	.070298
8	17.500000	.908179	.044587
9	20.000000	.930201	.018261
10	22.500000	.945807	-.004065
11	25.000000	.956079	-.025182
12	27.500000	.966064	-.043909
13	30.000000	.971162	-.061517
14	32.500000	.972441	-.077016
15	35.000000	.970372	-.090620
16	37.500000	.964187	-.101614
17	40.000000	.955078	-.111960
18	42.500000	.942572	-.118421
19	45.000000	.925202	-.122166
20	50.000000	.886400	-.123162
21	55.000000	.824135	-.117189
22	60.000000	.754110	-.105750
23	65.000000	.683704	-.090137
24	70.000000	.601675	-.071430
25	75.000000	.514265	-.051224
26	80.000000	.422167	-.031399
27	85.000000	.326917	-.014460
28	90.000000	.225223	-.000964
29	95.000000	.123530	.006532
30	100.000000	.010000	-.010000

```
I =    4.00    S(INCH)=   5.490381

CHORD= 12.402000Y/B/2=    .194000


        I       PCTX        ZUP(IN)        ZLO(IN)

        1     0.000000      .368965        .368965
        2     2.500000      .548121        .212523
        3     5.000000      .622578        .160480
        4     7.500000      .679399        .122550
        5    10.000000      .724820        .090085
        6    12.500000      .762431        .060478
        7    15.000000      .791767        .035989
        8    17.500000      .815995        .014082
        9    20.000000      .838346       -.008462
       10    22.500000      .854674       -.027357
       11    25.000000      .867846       -.045189
       12    27.500000      .876980       -.060859
       13    30.000000      .883378       -.075545
       14    32.500000      .886220       -.088330
       15    35.000000      .885804       -.099411
       16    37.500000      .881557       -.108123
       17    40.000000      .875374       -.116290
       18    42.500000      .864309       -.120906
       19    45.000000      .849504       -.123060
       20    50.000000      .810377       -.121509
       21    55.000000      .760360       -.113733
       22    60.000000      .701026       -.101135
       23    65.000000      .633640       -.084932
       24    70.000000      .559168       -.066141
       25    75.000000      .478834       -.046267
       26    80.000000      .394095       -.027077
       27    85.000000      .306043       -.010952
       28    90.000000      .214376        .001557
       29    95.000000      .116554        .007913
       30   100.000000      .010000       -.010000
```

I =   5.00   S(INCH) =   7.058253

CHORD = 11.448100 Y/B/2 =   .249400

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.316432	.316432
2	2.500000	.483867	.174082
3	5.000000	.554648	.128091
4	7.500000	.609044	.095024
5	10.000000	.652741	.066827
6	12.500000	.689084	.041122
7	15.000000	.717696	.020048
8	17.500000	.741517	.001283
9	20.000000	.763530	-.018147
10	22.500000	.779909	-.034280
11	25.000000	.793310	-.049499
12	27.500000	.802921	-.062784
13	30.000000	.809947	-.075220
14	32.500000	.813632	-.085959
15	35.000000	.814255	-.095183
16	37.500000	.811283	-.102275
17	40.000000	.806470	-.108920
18	42.500000	.797096	-.112341
19	45.000000	.784215	-.113545
20	50.000000	.749500	-.110710
21	55.000000	.704509	-.102353
22	60.000000	.650687	-.089776
23	65.000000	.589195	-.074108
24	70.000000	.520913	-.056300
25	75.000000	.446955	-.037758
26	80.000000	.368651	-.020126
27	85.000000	.286967	-.005647
28	90.000000	.201597	.005147
29	95.000000	.110036	.009750
30	100.000000	.010000	-.010000

I=   6.00   S(INCH)= 8.628955

CHORD= 10.494200Y/B/2=   .304900

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.278829	.278829
2	2.500000	.434163	.150190
3	5.000000	.500886	.109872
4	7.500000	.552476	.081287
5	10.000000	.594067	.056974
6	12.500000	.628757	.034785
7	15.000000	.656257	.016740
8	17.500000	.679282	.000727
9	20.000000	.700565	-.015979
10	22.500000	.716602	-.029745
11	25.000000	.729836	-.042747
12	27.500000	.739527	-.054045
13	30.000000	.746782	-.064630
14	32.500000	.750910	-.073724
15	35.000000	.752167	-.081492
16	37.500000	.750069	-.087368
17	40.000000	.746221	-.092895
18	42.500000	.738131	-.095528
19	45.000000	.726767	-.096188
20	50.000000	.695652	-.092883
21	55.000000	.654876	-.084755
22	60.000000	.605762	-.073003
23	65.000000	.549368	-.058666
24	70.000000	.486498	-.042620
25	75.000000	.418159	-.026165
26	80.000000	.345564	-.010819
27	85.000000	.269558	.001326
28	90.000000	.189844	.009764
29	95.000000	.113972	.012043
30	100.000000	.010000	-.010000

I= 7.00 S(INCH)= 10.196827

CHORD= 9.540270Y/B/2= .360300

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.262052	.262052
2	2.500000	.405002	.146842
3	5.000000	.467384	.111914
4	7.500000	.515886	.087528
5	10.000000	.555088	.066817
6	12.500000	.587837	.047858
7	15.000000	.613931	.032547
8	17.500000	.635856	.018982
9	20.000000	.656093	.004683
10	22.500000	.671458	-.007046
11	25.000000	.684178	-.018177
12	27.500000	.693585	-.027851
13	30.000000	.700687	-.036967
14	32.500000	.704857	-.044818
15	35.000000	.706329	-.051550
16	37.500000	.704663	-.056650
17	40.000000	.701321	-.061519
18	42.500000	.694038	-.063841
19	45.000000	.683692	-.064456
20	50.000000	.655123	-.061733
21	55.000000	.617434	-.054964
22	60.000000	.571826	-.045238
23	65.000000	.519262	-.033501
24	70.000000	.460469	-.020551
25	75.000000	.396358	-.007577
26	80.000000	.328029	.004041
27	85.000000	.256228	.012379
28	90.000000	.180691	.016980
29	95.000000	.099089	.015516
30	100.000000	.010000	-.010000

```
        I=      8.00    S(INCH)= 11.374146

      CHORD=  8.922740Y/B/2=     .401900


              I        PCTX        ZUP(IN)      ZLO(IN)

              1      0.000000       .253355       .253355
              2      2.500000       .388587       .147138
              3      5.000000       .448461       .116000
              4      7.500000       .495273       .094642
              5     10.000000       .533250       .076584
              6     12.500000       .565066       .060039
              7     15.000000       .590561       .046809
              8     17.500000       .612069       .035124
              9     20.000000       .631907       .022663
             10     22.500000       .647100       .012515
             11     25.000000       .659732       .002840
             12     27.500000       .669183      -.005554
             13     30.000000       .676396      -.013510
             14     32.500000       .680785      -.020364
             15     35.000000       .682569      -.026254
             16     37.500000       .681338      -.030696
             17     40.000000       .678460      -.035002
             18     42.500000       .671815      -.037007
             19     45.000000       .662227      -.037494
             20     50.000000       .635443      -.035011
             21     55.000000       .599810      -.029064
             22     60.000000       .556449      -.020673
             23     65.000000       .506255      -.010729
             24     70.000000       .449901       .000016
             25     75.000000       .388224       .010435
             26     80.000000       .322249       .019233
             27     85.000000       .252601       .024536
             28     90.000000       .179044       .025930
             29     95.000000       .099073       .020909
             30    100.000000       .010000      -.010000
```

I= 9.00 ' S(INCH)= 12.551465

CHORD= 8.502760Y/B/2= .443500

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.193940	.193940
2	2.500000	.323953	.093868
3	5.000000	.382153	.065340
4	7.500000	.427888	.046114
5	10.000000	.465175	.030004
6	12.500000	.496577	.015321
7	15.000000	.521960	.003802
8	17.500000	.543554	-.006234
9	20.000000	.563570	-.016999
10	22.500000	.579172	-.025544
11	25.000000	.592351	-.033622
12	27.500000	.602517	-.040462
13	30.000000	.610569	-.046864
14	32.500000	.615952	-.052195
15	35.000000	.618873	-.056586
16	37.500000	.618943	-.059577
17	40.000000	.617465	-.062415
18	42.500000	.612420	-.063039
19	45.000000	.604592	-.062195
20	50.000000	.581749	-.057149
21	55.000000	.550553	-.048722
22	60.000000	.512063	-.037895
23	65.000000	.467116	-.025534
24	70.000000	.416332	-.012377
25	75.000000	.360470	.000463
26	80.000000	.300453	.011699
27	85.000000	.236758	.019428
28	90.000000	.168994	.023087
29	95.000000	.094360	.019876
30	100.000000	.010000	-.010000

I=   10.00   S(INCH)= 14.122167

CHORD= 7.943940Y/B/2=   .499000

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.151121	.151121
2	2.500000	.273935	.058972
3	5.000000	.329651	.033660
4	7.500000	.373674	.016991
5	10.000000	.409726	.003156
6	12.500000	.440219	-.009408
7	15.000000	.465051	-.019053
8	17.500000	.486319	-.027337
9	20.000000	.506085	-.036327
10	22.500000	.521704	-.043269
11	25.000000	.535038	-.049795
12	27.500000	.545540	-.055181
13	30.000000	.554051	-.060175
14	32.500000	.560051	-.064184
15	35.000000	.563737	-.067330
16	37.500000	.564745	-.069182
17	40.000000	.564291	-.070906
18	42.500000	.560491	-.070576
19	45.000000	.554075	-.068889
20	50.000000	.534483	-.062424
21	55.000000	.507018	-.052871
22	60.000000	.472657	-.041157
23	65.000000	.432167	-.028105
24	70.000000	.386102	-.014431
25	75.000000	.335140	-.001206
26	80.000000	.280105	.010329
27	85.000000	.221383	.018336
28	90.000000	.158563	.022245
29	95.000000	.088912	.019323
30	100.000000	.010000	-.010000

I= 11.00   S(INCH)= 15.690039

CHORD= 7.385130Y/B/2=   .554400

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.121660	.121660
2	2.500000	.237017	.037176
3	5.000000	.289993	.014823
4	7.500000	.332045	.000452
5	10.000000	.366599	-.011372
6	12.500000	.395911	-.022087
7	15.000000	.419918	-.030132
8	17.500000	.440575	-.036948
9	20.000000	.459801	-.044456
10	22.500000	.475136	-.050094
11	25.000000	.488318	-.055376
12	27.500000	.498838	-.059626
13	30.000000	.507480	-.063538
14	32.500000	.513762	-.066561
15	35.000000	.517868	-.068807
16	37.500000	.519459	-.069874
17	40.000000	.519667	-.070848
18	42.500000	.516739	-.069936
19	45.000000	.511355	-.067786
20	50.000000	.494228	-.060691
21	55.000000	.469677	-.050827
22	60.000000	.438607	-.039064
23	65.000000	.401718	-.026176
24	70.000000	.359520	-.012838
25	75.000000	.312626	-.000061
26	80.000000	.261790	.010991
27	85.000000	.207340	.018576
28	90.000000	.148875	.022146
29	95.000000	.083752	.019059
30	100.000000	.010000	-.010000

I=   12.00   S(INCH)= 17.257910

CHORD= 6.826300Y/B/2=   .609800

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.097412	.097412
2	2.500000	.205119	.020399
3	5.000000	.255160	.000812
4	7.500000	.295052	-.011449
5	10.000000	.327926	-.021444
6	12.500000	.355883	-.030486
7	15.000000	.378889	-.037106
8	17.500000	.398763	-.042626
9	20.000000	.417277	-.048823
10	22.500000	.432159	-.053327
11	25.000000	.445018	-.057534
12	27.500000	.455388	-.060817
13	30.000000	.463994	-.063815
14	32.500000	.470391	-.066020
15	35.000000	.474750	-.067532
16	37.500000	.476758	-.067981
17	40.000000	.477463	-.068368
18	42.500000	.475243	-.067038
19	45.000000	.470729	-.064590
20	50.000000	.455746	-.057182
21	55.000000	.433801	-.047316
22	60.000000	.405726	-.035799
23	65.000000	.372165	-.023351
24	70.000000	.333583	-.010599
25	75.000000	.290538	.001512
26	80.000000	.243717	.011896
27	85.000000	.193396	.018916
28	90.000000	.139186	.022046
29	95.000000	.078542	.018743
30	100.000000	.010000	-.010000

I= 13.00 S(INCH)= 18.825782

CHORD= 6.267480Y/B/2= .665200

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.076455	.076455
2	2.500000	.176343	.006745
3	5.000000	.223281	-.010245
4	7.500000	.260851	-.020559
5	10.000000	.291892	-.028877
6	12.500000	.318349	-.036390
7	15.000000	.340217	-.041723
8	17.500000	.359174	-.046081
9	20.000000	.376845	-.051098
10	22.500000	.391149	-.054594
11	25.000000	.403563	-.057849
12	27.500000	.413662	-.060284
13	30.000000	.422115	-.062486
14	32.500000	.428513	-.063986
15	35.000000	.433013	-.064875
16	37.500000	.435331	-.064814
17	40.000000	.436427	-.064721
18	42.500000	.434814	-.063075
19	45.000000	.431070	-.060426
20	50.000000	.418044	-.052895
21	55.000000	.398530	-.043202
22	60.000000	.373291	-.032090
23	65.000000	.342916	-.020222
24	70.000000	.307826	-.008180
25	75.000000	.268525	.003160
26	80.000000	.225635	.012792
27	85.000000	.179383	.019186
28	90.000000	.129392	.021842
29	95.000000	.073232	.018329
30	100.000000	.010000	-.010000

I=   14.00   S(INCH)= 20.393654

CHORD=   5.708670Y/B/2=   .720600

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.055906	.055906
2	2.500000	.147816	-.006660
3	5.000000	.191494	-.021211
4	7.500000	.226594	-.029725
5	10.000000	.255672	-.036498
6	12.500000	.280511	-.042599
7	15.000000	.301132	-.046754
8	17.500000	.319070	-.050052
9	20.000000	.335807	-.053981
10	22.500000	.349446	-.056555
11	25.000000	.361337	-.058935
12	27.500000	.371096	-.060594
13	30.000000	.379331	-.062064
14	32.500000	.385672	-.062916
15	35.000000	.390262	-.063235
16	37.500000	.392843	-.062708
17	40.000000	.394291	-.062174
18	42.500000	.393252	-.060245
19	45.000000	.390251	-.057423
20	50.000000	.379145	-.049804
21	55.000000	.362050	-.040297
22	60.000000	.339659	-.029577
23	65.000000	.312506	-.018255
24	70.000000	.280968	-.006863
25	75.000000	.245498	.003793
26	80.000000	.206653	.012786
27	85.000000	.164613	.018700
28	90.000000	.119021	.021060
29	95.000000	.067574	.017566
30	100.000000	.010000	-.010000

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I =    15.00    S(INCH)= 21.961526

CHORD= 5.149850Y/B/2=    .776000


         I      PCTX        ZUP(IN)      ZLO(IN)

         1     0.000000     .038585      .038585
         2     2.500000     .122350     -.017005
         3     5.000000     .162600     -.029283
         4     7.500000     .195071     -.036158
         5    10.000000     .222039     -.041531
         6    12.500000     .245126     -.046356
         7    15.000000     .264372     -.049460
         8    17.500000     .281169     -.051821
         9    20.000000     .296853     -.054779
        10    22.500000     .309715     -.056543
        11    25.000000     .320975     -.058157
        12    27.500000     .330288     -.059144
        13    30.000000     .338205     -.059982
        14    32.500000     .344391     -.060285
        15    35.000000     .348977     -.060127
        16    37.500000     .351730     -.059228
        17    40.000000     .353440     -.058342
        18    42.500000     .352886     -.056218
        19    45.000000     .350544     -.053307
        20    50.000000     .341195     -.045765
        21    55.000000     .326364     -.036598
        22    60.000000     .306673     -.026419
        23    65.000000     .282601     -.015781
        24    70.000000     .254485     -.005170
        25    75.000000     .222723      .004679
        26    80.000000     .187812      .012923
        27    85.000000     .149891      .018261
        28    90.000000     .108620      .020249
        29    95.000000     .061848      .016735
        30   100.000000     .010000     -.010000
```

I=   16.00   S(INCH)= 23.529398

CHORD=   4.591040Y/B/2=   .831400

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.023149	.023149
2	2.500000	.098591	-.025642
3	5.000000	.135238	-.035824
4	7.500000	.164914	-.041224
5	10.000000	.189626	-.045343
6	12.500000	.210831	-.049022
7	15.000000	.228580	-.051198
8	17.500000	.244123	-.052733
9	20.000000	.258650	-.054826
10	22.500000	.270638	-.055877
11	25.000000	.281176	-.056816
12	27.500000	.289960	-.057215
13	30.000000	.297479	-.057500
14	32.500000	.303436	-.057328
15	35.000000	.307949	-.056763
16	37.500000	.310809	-.055556
17	40.000000	.312722	-.054377
18	42.500000	.312599	-.052114
19	45.000000	.310862	-.049168
20	50.000000	.303176	-.041795
21	55.000000	.290527	-.033050
22	60.000000	.273467	-.023481
23	65.000000	.252420	-.013585
24	70.000000	.227681	-.003800
25	75.000000	.199597	.005213
26	80.000000	.168605	.012694
27	85.000000	.134811	.017464
28	90.000000	.097901	.019118
29	95.000000	.035893	.015676
30	100.000000	.010000	-.010000

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I =    17.00    S(INCH) = 25.097270

CHORD=  4.032220Y/B/2=    .886800


     I     PCTX        ZUP(IN)       ZLO(IN)

     1    0.000000      .013899       .013899
     2    2.500000      .080797      -.028315
     3    5.000000      .113618      -.036622
     4    7.500000      .140291      -.040756
     5   10.000000      .162559      -.043811
     6   12.500000      .181707      -.046517
     7   15.000000      .197796      -.047927
     8   17.500000      .211927      -.048797
     9   20.000000      .225143      -.050177
    10   22.500000      .236108      -.050664
    11   25.000000      .245780      -.051072
    12   27.500000      .253891      -.051026
    13   30.000000      .260871      -.050900
    14   32.500000      .266460      -.050392
    15   35.000000      .270758      -.049562
    16   37.500000      .273584      -.048188
    17   40.000000      .275555      -.046861
    18   42.500000      .275715      -.044605
    19   45.000000      .274434      -.041772
    20   50.000000      .268101      -.034880
    21   55.000000      .257307      -.026884
    22   60.000000      .242535      -.018269
    23   65.000000      .224153      -.009474
    24   70.000000      .202422      -.000883
    25   75.000000      .177648       .006923
    26   80.000000      .150216       .013282
    27   85.000000      .120218       .017155
    28   90.000000      .087383       .018190
    29   95.000000      .049940       .014618
    30  100.000000      .010000      -.010000
```

I= 18.00   S(INCH)= 26.665141

CHORD= 3.473410Y/B/2=   .942200

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.022580	.022580
2	2.500000	.080541	-.013450
3	5.000000	.109147	-.020273
4	7.500000	.132434	-.023522
5	10.000000	.151886	-.025883
6	12.500000	.168607	-.027988
7	15.000000	.182650	-.029019
8	17.500000	.194957	-.029633
9	20.000000	.206422	-.030743
10	22.500000	.215884	-.031145
11	25.000000	.224166	-.031546
12	27.500000	.231032	-.031627
13	30.000000	.236852	-.031712
14	32.500000	.241400	-.031540
15	35.000000	.244765	-.031162
16	37.500000	.246793	-.030385
17	40.000000	.248022	-.029712
18	42.500000	.247631	-.028297
19	45.000000	.245948	-.026437
20	50.000000	.239205	-.021787
21	55.000000	.228506	-.016300
22	60.000000	.214335	-.010325
23	65.000000	.197082	-.004168
24	70.000000	.177042	.001912
25	75.000000	.154548	.007484
26	80.000000	.129994	.012037
27	85.000000	.103511	.014731
28	90.000000	.074902	.015299
29	95.000000	.042669	.012242
30	100.000000	.010000	-.010000

I= 19.00   S(INCH)= .491893

CHORD= 2.461800Y/B/2= .973700

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	-.031850	-.031850
2	2.500000	.014890	-.051726
3	5.000000	.040762	-.050964
4	7.500000	.062146	-.048389
5	10.000000	.079614	-.046381
6	12.500000	.094184	-.045154
7	15.000000	.106296	-.043726
8	17.500000	.116772	-.042408
9	20.000000	.126269	-.041822
10	22.500000	.134015	-.041068
11	25.000000	.140670	-.040568
12	27.500000	.146129	-.040032
13	30.000000	.150697	-.039649
14	32.500000	.154250	-.039199
15	35.000000	.156884	-.038682
16	37.500000	.158522	-.037930
17	40.000000	.159571	-.037275
18	42.500000	.159472	-.036094
19	45.000000	.158474	-.034580
20	50.000000	.154195	-.030785
21	55.000000	.147319	-.026188
22	60.000000	.138233	-.020996
23	65.000000	.127227	-.015410
24	70.000000	.114498	-.009626
25	75.000000	.100252	-.003981
26	80.000000	.084717	.001114
27	85.000000	.067909	.004985
28	90.000000	.049601	.007357
29	95.000000	.028627	.007061
30	100.000000	.010000	-.010000

I= 20.00   S(INCH)= 1.662281

CHORD= 1.488240Y/B/2=   .982700

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	-.058118	-.058118
2	2.500000	-.030079	-.070351
3	5.000000	-.014629	-.070081
4	7.500000	-.001587	-.068409
5	10.000000	.009596	-.066573
6	12.500000	.019431	-.064804
7	15.000000	.028010	-.062684
8	17.500000	.035763	-.060466
9	20.000000	.043077	-.058540
10	22.500000	.049464	-.056380
11	25.000000	.055287	-.054277
12	27.500000	.060456	-.052084
13	30.000000	.065135	-.049935
14	32.500000	.069231	-.047715
15	35.000000	.072784	-.045442
16	37.500000	.075731	-.043031
17	40.000000	.078301	-.040699
18	42.500000	.080143	-.038083
19	45.000000	.081395	-.035312
20	50.000000	.082337	-.029489
21	55.000000	.081409	-.023483
22	60.000000	.078787	-.017472
23	65.000000	.074604	-.011625
24	70.000000	.068944	-.006093
25	75.000000	.061901	-.001111
26	80.000000	.053597	.003056
27	85.000000	.043998	.005959
28	90.000000	.032962	.007423
29	95.000000	.023073	.003073
30	100.000000	.010000	-.010000

I= 21.00 S(INCH)= 3.131768

CHORD= .969010Y/B/2= .994000

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	-.048322	-.048322
2	2.500000	-.030443	-.056664
3	5.000000	-.020756	-.056862
4	7.500000	-.012596	-.056105
5	10.000000	-.005577	-.055171
6	12.500000	.000625	-.054221
7	15.000000	.006049	-.053003
8	17.500000	.010968	-.051688
9	20.000000	.015636	-.050528
10	22.500000	.019733	-.049183
11	25.000000	.023493	-.047846
12	27.500000	.026856	-.046420
13	30.000000	.029928	-.044996
14	32.500000	.032647	-.043498
15	35.000000	.035040	-.041938
16	37.500000	.037065	-.040262
17	40.000000	.038870	-.038612
18	42.500000	.040228	-.036750
19	45.000000	.041228	-.034762
20	50.000000	.042289	-.030522
21	55.000000	.042238	-.026058
22	60.000000	.041191	-.021485
23	65.000000	.039235	-.016909
24	70.000000	.036429	-.012428
25	75.000000	.032838	-.008190
26	80.000000	.028545	-.004363
27	85.000000	.023545	-.001223
28	90.000000	.019442	-.000558
29	95.000000	.016416	-.003584
30	100.000000	.010000	-.010000

INTERP ZS ON WING (INCH)

CHORD= 15.742600Y/B/2= 0.000000

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.995245	.995245
2	2.500000	1.202815	.776821
3	5.000000	1.277488	.690918
4	7.500000	1.329803	.622960
5	10.000000	1.367710	.562004
6	12.500000	1.395796	.504764
7	15.000000	1.413495	.454141
8	17.500000	1.424868	.406951
9	20.000000	1.434055	.359150
10	22.500000	1.435831	.316217
11	25.000000	1.433866	.274895
12	27.500000	1.427067	.236611
13	30.000000	1.417113	.199895
14	32.500000	1.402988	.165935
15	35.000000	1.385094	.134502
16	37.500000	1.362719	.106459
17	40.000000	1.338290	.079512
18	42.500000	1.308086	.057494
19	45.000000	1.273572	.039037
20	50.000000	1.193835	.010936
21	55.000000	1.102205	-.007333
22	60.000000	1.000790	-.017442
23	65.000000	.891310	-.020817
24	70.000000	.775107	-.018635
25	75.000000	.653882	-.012660
26	80.000000	.529630	-.004989
27	85.000000	.404069	.001688
28	90.000000	.277081	.006938
29	95.000000	.146534	.008629
30	100.000000	.010000	-.010000

INTERP ZS ON WING (INCH)

CHORD= 9.063300Y/B/2= .387968

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.256268	.256268
2	2.500000	.393188	.147935
3	5.000000	.453564	.115866
4	7.500000	.500689	.093747
5	10.000000	.538868	.075008
6	12.500000	.570817	.057834
7	15.000000	.596369	.044051
8	17.500000	.617893	.031860
9	20.000000	.637745	.018903
10	22.500000	.652902	.008320
11	25.000000	.665480	-.001760
12	27.500000	.674850	-.010516
13	30.000000	.681970	-.018805
14	32.500000	.686243	-.025951
15	35.000000	.687894	-.032094
16	37.500000	.686506	-.036745
17	40.000000	.683467	-.041234
18	42.500000	.676626	-.043362
19	45.000000	.666818	-.043926
20	50.000000	.639545	-.041471
21	55.000000	.603378	-.035404
22	60.000000	.559457	-.026758
23	65.000000	.508692	-.016436
24	70.000000	.451770	-.005202
25	75.000000	.389545	.005805
26	80.000000	.323060	.015270
27	85.000000	.252969	.021311
28	90.000000	.179027	.023501
29	95.000000	.098788	.019393
30	100.000000	.010000	-.010000

INTERP ZS ON WING (INCH)

CHORD= 3.194000Y/B/2=   .969917

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	.026923	.026923
2	2.500000	.080415	-.006014
3	5.000000	.106913	-.012096
4	7.500000	.128507	-.014904
5	10.000000	.146550	-.016919
6	12.500000	.162058	-.018722
7	15.000000	.175078	-.019565
8	17.500000	.186473	-.020051
9	20.000000	.197061	-.021025
10	22.500000	.205772	-.021385
11	25.000000	.213359	-.021784
12	27.500000	.219603	-.021928
13	30.000000	.224842	-.022118
14	32.500000	.228869	-.022115
15	35.000000	.231768	-.021964
16	37.500000	.233397	-.021484
17	40.000000	.234253	-.021139
18	42.500000	.233587	-.020144
19	45.000000	.231703	-.018771
20	50.000000	.224755	-.015242
21	55.000000	.214103	-.011010
22	60.000000	.200232	-.006356
23	65.000000	.183542	-.001518
24	70.000000	.164348	.003306
25	75.000000	.142994	.007760
26	80.000000	.119879	.011411
27	85.000000	.095154	.013516
28	90.000000	.068660	.013851
29	95.000000	.039033	.011053
30	100.000000	.010000	-.010000

INTERP ZS ON WINGLET (INCH)

CHORD= 3.194000Y/B/2=   .969917

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	-.020809	-.020809
2	2.500000	.038160	-.048269
3	5.000000	.070060	-.048948
4	7.500000	.096184	-.047227
5	10.000000	.117308	-.046161
6	12.500000	.134743	-.046037
7	15.000000	.149040	-.045602
8	17.500000	.161262	-.045262
9	20.000000	.172261	-.045825
10	22.500000	.181038	-.046119
11	25.000000	.188445	-.046697
12	27.500000	.194350	-.047180
13	30.000000	.199146	-.047814
14	32.500000	.202673	-.048311
15	35.000000	.205060	-.048671
16	37.500000	.206207	-.048675
17	40.000000	.206642	-.048750
18	42.500000	.205643	-.048088
19	45.000000	.203535	-.046938
20	50.000000	.196531	-.043466
21	55.000000	.186404	-.038709
22	60.000000	.173664	-.032924
23	65.000000	.158701	-.026359
24	70.000000	.141787	-.019255
25	75.000000	.123208	-.012026
26	80.000000	.103281	-.005188
27	85.000000	.082087	.000448
28	90.000000	.059366	.004557
29	95.000000	.033839	.005859
30	100.000000	.010000	-.010000

INTERP ZS ON WINGLET (INCH)

CHORD= 1.730000 Y/B/2=   .977439

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	-.042763	-.042763
2	2.500000	-.008221	-.055035
3	5.000000	.011652	-.052808
4	7.500000	.028320	-.049357
5	10.000000	.042149	-.046393
6	12.500000	.053865	-.044053
7	15.000000	.063798	-.041628
8	17.500000	.072535	-.039327
9	20.000000	.080532	-.037592
10	22.500000	.087249	-.035789
11	25.000000	.093149	-.034214
12	27.500000	.098160	-.032662
13	30.000000	.102496	-.031267
14	32.500000	.106068	-.029875
15	35.000000	.108943	-.028488
16	37.500000	.111066	-.026988
17	40.000000	.112721	-.025610
18	42.500000	.113513	-.023918
19	45.000000	.113617	-.022049
20	50.000000	.112044	-.017948
21	55.000000	.108402	-.013529
22	60.000000	.102951	-.008946
23	65.000000	.095882	-.004355
24	70.000000	.087320	.000094
25	75.000000	.077389	.004141
26	80.000000	.066230	.007479
27	85.000000	.053792	.009573
28	90.000000	.^39880	.010193
29	95.000000	.025862	.005862
30	100.000000	.010000	-.010000

INTERP ZS ON WINGLET (INCH)

CHORD=   .691600Y/B/2= 1.000000

I	PCTX	ZUP(IN)	ZLO(IN)
1	0.000000	-.043121	-.043121
2	2.500000	-.030016	-.050016
3	5.000000	-.024042	-.049811
4	7.500000	-.018481	-.049534
5	10.000000	-.013677	-.049073
6	12.500000	-.009409	-.048554
7	15.000000	-.005664	-.047810
8	17.500000	-.002252	-.046971
9	20.000000	.001007	-.046215
10	22.500000	.003885	-.045301
11	25.000000	.006548	-.044367
12	27.500000	.008951	-.043348
13	30.000000	.011168	-.042307
14	32.500000	.013155	-.041191
15	35.000000	.014931	-.040010
16	37.500000	.016466	-.038724
17	40.000000	.017865	-.037435
18	42.500000	.018966	-.035974
19	45.000000	.019833	-.034402
20	50.000000	.020960	-.031006
21	55.000000	.021379	-.027365
22	60.000000	.021173	-.023560
23	65.000000	.020406	-.019665
24	70.000000	.019121	-.015749
25	75.000000	.017370	-.011913
26	80.000000	.015213	-.008273
27	85.000000	.013825	-.006175
28	90.000000	.013734	-.006266
29	95.000000	.012881	-.007119
30	100.000000	.010000	-.010000

I. <u>Link (0)</u> - <u>(System Control)</u>

Item (1) -- Alphanumeric Identification
(2) cards, (72 columns each)

Item (2) -- Next Link Number
(Col. 1-5, Right Justified)

II. <u>Link (1)</u> - <u>(Planform and Airfoil Sections)</u>

Item (1) -- (1) card, (Col. 1-10, Right-Justified)
KASE (= 0, New Case)
($\neq$ 0, Link 1 Def. on File 1)

Item (2) -- (1) card, (4 fields of 10 col. each)
Leading and Trailing Edge Data

(a) - (Col. 1-10, Right-Justified)
= 1 (Straight Line(s) on leading edge)
= 2 (Cubic curve on leading edge)

(b) - (Col. 11-20, Right-Justified)
(No. of points on leading edge)

(c) - (Col. 21-30, Right-Justified)
Same as (a) above for T.E.

(d) - (Col. 31-40, Right-Justified)
Same as (b) above for T.E.

Item (3) -- See form for L.E. and T.E. data

Item (4) -- (1) card, (9 data fields)
Airfoil Definition Data (21 Limit)

(a) - (Col. 1-5, Right-Justified)
= 1 (No airfoil fit)
= 2 (Fit straight lines)
= 3 (Fit cubics)

(b) - (Col. 6-10, R-J)
No. of given airfoils. (Max. 21)

(c) - (Col. 11-15, R-J)
No. of points per airfoil. (Max. 30)

User Input Instructions for Preparation of Cards for Numerically
Controlled (NC) Machining

(d) - (Col. 16-20, R-J)
No. of camber line points

(e) - (Col. 21-50, Left-Justified with decimal)
L.E. Radius

(f) - (Col. 31-40, L-J w D)
T.E. Radius

(g) - (Col. 41-50, L-J w D)
L.E. Thickness

(h) - (Col. 51-60, L-J w D)
T.E. Thickness

(i) - (Col. 61-70, L-J w D) (FAC = 1.0)

Item (5) - See form for airfoil WB lines.
YDEM for WB (lines)

Item (6) -- (1) card, (Max. of 20, one Col. fields)
A one in the (ith) column will apply a cubic fit to all
surface lines between the (ith) and (i + 1st) airfoils.
A zero will cause a straight line fit.

Item (7) -- (1) card, (Max. of 31, one Col. fields)
A one in the (ith) column will cause the (ith) airfoil
to be read from cards. A zero will make the (ith)
airfoil identical with the (i - 1st) airfoil.

Item (8) -- See form for airfoil ordinates percent-of-chord
locations.

Item (9) -- See form for airfoil ordinates. (order: percent, upper, lower)

CONTROL RETURNS TO LINK (0) FOR ITEM (2).

III. Link (3) - (Spanwise Percent Line Arrays)

Item (1) -- (1) card, (3 fields of 10 Col. each)

(a) - (Col. 1-10, R-J)
(No. of percent line values in this set - Max. 31)

(b) - (Col. 11-20, R-J)
= 1 (Read another set of line values)
= 0 (This is the last set of lines)

(c) - (Col. 21-30, R-J)
    = 0 (In all cases)

Item (2) -- See form for percent line values.

CONTROL RETURNS TO LINK (0) FOR ITEM (2).

IV. Link (5) - (Cutter Motion and Surface Parameters)

    Item (1) -- (1) card, (7 fields of 10 Col. each)

        (a) - (Col. 1-10 R-J)
           = 0 (Output both surfaces)
           = 1 (Output upper surface only)
           = 2 (Output lower surface only)

        (b) - (Col. 11-20, R-J)
           = 1 (MDI)

        (c) - (Col. 21-30, R-J)
           = 0 (Do not invert lower surf. Z)
           = 1 (Do invert lower surf. Z)

        (d) - (Col. 31-40, R-J)
           = 0 (This is last case)
           $\neq$ 0 (Another case follows)

        (e) - (Col. 41-50, R-J)
           = 0 (Output cutter center)
           = 1 (Output surf. points and normals)

        (f) - (Col. 51-60, R-J)
           = 0 (No plot output)
           $\neq$ 0 (Generate plot tape)

        (g) - (Col. 61-70, R-J)
           (Line print increment)

    Item (2) -- (2) cards, (8 fields of 10 Col. each)

        (a) - (Col. 1-10, L-J w decimal)
           YS = (Outboard WBL for line cuts)

        (b) - (Col. 11-20, L-J w dec.)
           YE = (Inboard WBL for line cuts)

(c) - (Col. 21-30, L-J w dec.)
    DY = (Point increment for line cuts)

(d) - (Col. 31-40, L-J w dec.)
    PS = (First cut percent line)

(e) - (Col. 41-50, L-J w dec.)
    PE = (Last cut percent line)

(f) - (Col. 51-60, L-J e dec.)
    a = (Rotation angle, usually 0)

(g) - (Col. 61-70, L-J w dec.)
    R = (Cutter radius)

(h) - (Col. 1-10. L-J w dec.)
    PM = (1.0, Not used currently)

Item (3) -- (1) card, (1 field of 10 Col.)
    (a) - (Col. 1-10, R-J)
        NB = (No. of Butt Blocks.)

IF NB $\neq$ 0   Include ITEM (3.1)

Item (3.1) -- (1) card, ($3 \leq N \leq 7$ (10) Col. fields)

    (a) - (Col. 1-10, L-J w dec.)
        YB = (Y line at butt blocks)

    (b) - (Cols. 11-20, 21-30, ...61-70)
        $X_{N,M}$ = (Butt block $\times$ locations)
        ($1 \leq N \leq 3$; M = 1, 2)

CONTROL RETURNS TO LINK (0) FOR ITEM (2).

V.   Link (6) - (Postprocessor Control Commands)

Items (1-N) -- (One statement per card.)

The input for Link (6) must be selected from the list that

follows:

STATEMENT		FUNCTION
(1)	PARTNO - 66 Characters -	Part I.D.
(2)	MACHIN/"Name", N, Mode	Postprocessor Selection
(3)	CLEARP/XYPLAN, Z	Clearance Plane
	YZPLAN, X	Clearance Plane
	ZXPLAN, Y	Clearnace Plane
(4)	TRANS /"X", "Y", "Z"	Coordinate Translation
(5)	FROM /"X", "Y", "Z"	Set Point
(6)	GO TO /"X", "Y", "Z"	Go to point
(7)	GODLTA/"X", "Y", "Z"	End-of-line retract
(8)	COOLNT/FLOOD	Coolant Control
	MIST	Coolant Control
	OFF	Coolant Control
(9)	SPINDL/ON, CLW	Spindle Control
	ON, CCLW	Spindle Control
	OFF	Spindle Control
(10)	TMARK /N	Manual Rewind Stop
	N, AUTO	Auto Rewind Stop
(11)	MCHTOL/e	Corner Tolerance
(12)	INTOL/e	Surface Tolerance
(13)	OUTTOL/e	Surface Tolerance
(14)	REWIND/N	Automatic Rewind
(15)	RETRCT	Move to CLEARP
(16)	OPSTOP	Optional Stop Code
(17)	STOP	Stop Code
(18)	END	Process Points
(19)	FINI	Program End

CONTROL RETURNS TO LINK (0) FOR ITEM (2).

```
C
     1
         0
         1          3          1          3
0.0         0.0        8.5902     10.979849  21.4754    27.449572
15.7426     0.0        17.6535    10.979849  24.6694    27.449572
     3   21   30      00.0       0.0        0.0        0.0        1.0
0.0         .786766    2.354638   3.922510   5.490381   7.058253   8.628955
10.196827   10.979849  11.374146  12.551465  14.122167  15.690039  17.25791
18.825782   20.393654  21.961526  23.529398  25.09727   26.665141  27.449572
000000000000000000000
111111111111111111111111
  0.000000    2.500000   5.000000   7.500000  10.000000  12.500000  15.000000
 17.500000   20.000000  22.500000  25.000000  27.500000  30.000000  32.500000
 35.000000   37.500000  40.000000  42.500000  45.000000  50.000000  55.000000
 60.000000   65.000000  70.000000  75.000000  80.000000  85.000000  90.000000
 95.000000  100.000000
   .995245    1.202815   1.277488   1.329803   1.367710   1.395796   1.413495
  1.424868    1.434055   1.435831   1.433866   1.427067   1.417113   1.402988
  1.385094    1.362719   1.338290   1.308086   1.273572   1.193835   1.102205
  1.000790     .891310    .775107    .653882    .529630    .404069    .277081
   .146534     .010000
   .995245     .776821    .690918    .622960    .562004    .504764    .454141
   .406951     .359150    .316217    .274895    .236611    .199895    .165935
   .134502     .106459    .079512    .057494    .039037    .010936   -.007333
  -.017442    -.020817   -.018635   -.012660   -.004989    .001688    .006938
   .008629    -.010000
  0.000000    2.500000   5.000000   7.500000  10.000000  12.500000  15.000000
 17.500000   20.000000  22.500000  25.000000  27.500000  30.000000  32.500000
 35.000000   37.500000  40.000000  42.500000  45.000000  50.000000  55.000000
 60.000000   65.000000  70.000000  75.000000  80.000000  85.000000  90.000000
 95.000000  100.000000
   .851330    1.056410   1.132631   1.187220   1.227910   1.259126   1.280283
  1.295299    1.308178   1.313844   1.315845   1.313112   1.307265   1.297313
  1.283640    1.265551   1.245394   1.219557   1.189457   1.118607   1.035852
   .943213     .842337    .734507    .621346    .504767    .386381    .266029
   .141446     .010000
   .851330     .643350    .563872    .501839    .446668    .395150    .350058
   .308289     .265911    .228226    .192065    .158803    .127006    .097821
   .071020     .047436    .024837    .006937   -.007593   -.028375   -.039997
  -.044101    -.042094   -.035134   -.024958   -.013619   -.003782    .004088
   .007728    -.010000
  0.000000    2.500000   5.000000   7.500000  10.000000  12.500000  15.000000
 17.500000   20.000000  22.500000  25.000000  27.500000  30.000000  32.500000
 35.000000   37.500000  40.000000  42.500000  45.000000  50.000000  55.000000
 60.000000   65.000000  70.000000  75.000000  80.000000  85.000000  90.000000
 95.000000  100.000000
   .564534     .764623    .843919    .903030    .945259    .986706   1.014749
```

Input Deck for Numerically Controlled (NC) Machining of Wing

1.037020	1.057253	1.070669	1.080571	1.085937	1.038273	1.086636
1.081373	1.071824	1.060180	1.043046	1.021743	.968609	.903546
.828402	.744680	.653542	.556460	.455181	.351105	.243985
.131297	.010000					
.564536	.377400	.310736	.260520	.216884	.176772	.142710
.111748	.080180	.052956	.027083	.003830	-.018161	-.037828
-.055397	-.070098	-.084031	-.093725	-.100431	-.106629	-.105009
-.097156	-.084430	-.067958	-.049417	-.030780	-.014653	-.001571
.005943	-.010000					
0.000000	2.500000	5.000000	7.500000	10.000000	12.500000	15.000000
17.500000	20.000000	22.500000	25.000000	27.500000	30.000000	32.500000
35.000000	37.500000	40.000000	42.500000	45.000000	50.000000	55.000000
60.000000	65.000000	70.000000	75.000000	80.000000	85.000000	90.000000
95.000000	100.000000					
.443664	.623925	.711442	.770064	.816571	.854802	.884207
.908179	.930201	.945507	.956079	.966064	.971162	.972491
.970372	.964147	.955978	.942572	.925202	.880400	.824135
.758110	.683704	.601975	.514265	.422167	.326917	.228223
.123530	.010000					
.443664	.272514	.213802	.170384	.133016	.092858	.070298
.044557	.018261	-.004565	-.025162	-.043905	-.061517	-.077016
-.090520	-.101614	-.111960	-.119421	-.122168	-.123162	-.117189
-.105750	-.090137	-.071430	-.051224	-.031398	-.014460	-.000964
.006522	-.010000					
0.000000	2.500000	5.000000	7.500000	10.000000	12.500000	15.000000
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35.000000	37.500000	40.000000	42.500000	45.000000	50.000000	55.000000
60.000000	65.000000	70.000000	75.000000	80.000000	85.000000	90.000000
95.000000	100.000000					
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.116554	.010000					
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35.000000	37.500000	40.000000	42.500000	45.000000	50.000000	55.000000
60.000000	65.000000	70.000000	75.000000	80.000000	85.000000	90.000000
95.000000	100.000000					
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56.0         60.0         64.0        68.0       72.0       76.0       80.0
84.0         88.0         92.0        96.0      100.0
         25               1          0
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56.5         60.5         64.5        68.5       72.5       76.5       80.5
84.5         88.5         92.5        96.5
         25               1          0
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86.0        90.0        94.0        98.0
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86.5        90.5        94.5        98.5
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31.0        35.0        39.0        43.0        47.0        51.0        55.0
59.0        63.0        67.0        71.0        75.0        79.0        83.0
87.0        91.0        95.0        99.0
            25                   0           0
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31.5        35.5        39.5        43.5        47.5        51.5        55.5
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87.5        91.5        95.5        99.5
     5
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1.0
            0
     6
PARTNO      WING KUHLMAN UPPER 1.0 MILL 6/4/79 JMK   50-99 PERCENT
            MACHIN/SUNTRN.3..LINEAR
            CLEARP/XYPLAN.3.0
            FEDRAT/60.0
            COOLNT/MIST
            SPINDL/ON.CLW
            FROM/-1.0.-1.0.2.0.60.0
            GOTO/7.0.3.0.2.0.60.0
            CODLTA/0.0.0.0..1.20.0
            OPSTOP
            CUTPTS
            RFTPCT
            GOTO/-1.0,-1.0.2.0.60.0
            COOLNT/OFF
            SPINDL/OFF
            STOP
            END
```

```
            FINI
     0
R
PARTNO    TX 23.WING
          MACHIN/SUNTRN
          PTONLY/2
          FINI
```

WINGLET KUHLMAN   1/4 MILL 6/4/79 JMK

```
C
   1
          0
          1          6          1          6
0.0        0.0        0.9051     0.489151   1.8098     0.978070
2.2931     1.661108   3.3311     3.12814    3.8856     3.912094
3.912094   0.0        3.36690    0.489151   3.53980    0.978070
3.78134    1.661108   4.30011    3.12814    4.57720    3.912094
     3     6     30     00.0       0.0        0.0        0.0        1.0
0.0        0.489151   0.978070   1.661108   3.12814    3.912094
00000
111111
  0.000000   2.500000   5.000000   7.500000  10.000000  12.500000  15.000000
 17.500000  20.000000  22.500000  25.000000  27.500000  30.000000  32.500000
 35.000000  37.500000  40.000000  42.500000  45.000000  50.000000  55.000000
 60.000000  65.000000  70.000000  75.000000  80.000000  85.000000  90.000000
 95.000000 100.000000
  -.020809    .038160    .070060    .096184    .117308    .134743    .149040
   .161262    .172261    .181038    .188445    .194350    .199146    .202673
   .205060    .206207    .206642    .205643    .203535    .196531    .186404
   .173664    .158701    .141787    .123208    .103281    .082087    .059366
   .033839    .010000
  -.020809   -.048269   -.048948   -.047227   -.046161   -.046037   -.045602
  -.045262   -.045825   -.046119   -.046697   -.047180   -.047814   -.048311
  -.048671   -.048675   -.048750   -.048088   -.046938   -.043466   -.038709
  -.032924   -.026359   -.019255   -.012026   -.005188    .000448    .004557
   .005859   -.010000
  0.000000   2.500000   5.000000   7.500000  10.000000  12.500000  15.000000
 17.500000  20.000000  22.500000  25.000000  27.500000  30.000000  32.500000
 35.000000  37.500000  40.000000  42.500000  45.000000  50.000000  55.000000
 60.000000  65.000000  70.000000  75.000000  80.000000  85.000000  90.000000
 95.000000 100.000000
  -.031850    .014890    .040762    .062146    .079614    .094184    .106296
   .116772    .126269    .134015    .140670    .146129    .150697    .154250
   .156884    .158522    .159571    .159472    .158474    .154195    .147319
   .138233    .127227    .114498    .100252    .084717    .067909    .049601
   .028627    .010000
  -.031850   -.051726   -.050964   -.048389   -.046381   -.045154   -.043726
  -.042408   -.041822   -.041068   -.040568   -.040032   -.039649   -.039199
  -.038682   -.037930   -.037275   -.036094   -.034580   -.030785   -.026188
  -.020996   -.015410   -.009626   -.003981    .001114    .004985    .007357
   .007061   -.010000
  0.000000   2.500000   5.000000   7.500000  10.000000  12.500000  15.000000
 17.500000  20.000000  22.500000  25.000000  27.500000  30.000000  32.500000
 35.000000  37.500000  40.000000  42.500000  45.000000  50.000000  55.000000
 60.000000  65.000000  70.000000  75.000000  80.000000  85.000000  90.000000
 95.000000 100.000000
  -.042763   -.008221    .011652    .028320    .042149    .053865    .063796
```

Input Deck for Numerically Controlled (NC) Machining of Winglet

```
 .072535    .080532    .087249    .093149    .098160    .102496    .106068
 .108943    .111066    .112721    .113513    .113617    .112044    .108402
 .102951    .095882    .087320    .077389    .066230    .053792    .039880
 .025862    .010000
-.042763   -.055035   -.052808   -.049357   -.046393   -.044053   -.041628
-.039327   -.037592   -.035789   -.034214   -.032662   -.031267   -.029875
-.028488   -.026988   -.025610   -.023918   -.022049   -.017948   -.013529
-.008946   -.004355    .000094    .004141    .007479    .009573    .010193
 .005862   -.010000
 0.000000   2.500000   5.000000   7.500000  10.000000  12.500000  15.000000
17.500000  20.000000  22.500000  25.000000  27.500000  30.000000  32.500000
35.000000  37.500000  40.000000  42.500000  45.000000  50.000000  55.000000
60.000000  65.000000  70.000000  75.000000  80.000000  85.000000  90.000000
95.000000 100.000000
-.058118   -.030079   -.014629   -.001587    .009596    .019431    .028010
 .035763    .043077    .049464    .055287    .060456    .065135    .069231
 .072784    .075731    .078301    .080143    .081395    .082337    .081409
 .078787    .074604    .068944    .061901    .053597    .043998    .032962
 .023073    .010000
-.058118   -.070351   -.070081   -.068409   -.066573   -.064804   -.062684
-.060466   -.058540   -.056380   -.054277   -.052084   -.049935   -.047715
-.045442   -.043031   -.040699   -.038083   -.035312   -.029489   -.023483
-.017472   -.011625   -.006093   -.001111    .003056    .005959    .007423
 .003073   -.010000
 0.000000   2.500000   5.000000   7.500000  10.000000  12.500000  15.000000
17.500000  20.000000  22.500000  25.000000  27.500000  30.000000  32.500000
35.000000  37.500000  40.000000  42.500000  45.000000  50.000000  55.000000
60.000000  65.000000  70.000000  75.000000  80.000000  85.000000  90.000000
95.000000 100.000000
-.048322   -.030443   -.020756   -.012596   -.005577    .000625    .006049
 .010968    .015636    .019733    .023493    .026856    .029928    .032647
 .035040    .037065    .038870    .040228    .041228    .042289    .042238
 .041191    .039235    .036429    .032838    .028545    .023545    .019442
 .016416    .010000
-.048322   -.056664   -.056862   -.056105   -.055171   -.054221   -.053003
-.051688   -.050528   -.049183   -.047846   -.046420   -.044996   -.043498
-.041938   -.040262   -.038612   -.036750   -.034762   -.030522   -.026058
-.021485   -.016909   -.012428   -.008190   -.004363   -.001223   -.000558
-.003584   -.010000
 0.000000   2.500000   5.000000   7.500000  10.000000  12.500000  15.000000
17.500000  20.000000  22.500000  25.000000  27.500000  30.000000  32.500000
35.000000  37.500000  40.000000  42.500000  45.000000  50.000000  55.000000
60.000000  65.000000  70.000000  75.000000  80.000000  85.000000  90.000000
95.000000 100.000000
-.043121   -.030016   -.024042   -.018481   -.013677   -.009409   -.005664
-.002252    .001007    .003885    .006548    .008951    .011168    .013155
 .014931    .016466    .017865    .018966    .019833    .020960    .021379
 .021173    .020406    .019121    .017370    .015213    .013825    .013734
 .012881    .010000
```

```
  -.043121    -.050016    -.049811    -.049534    -.049073    -.048554    -.047810
  -.046971    -.046215    -.045301    -.044367    -.04334R    -.042307    -.041191
  -.040010    -.03P724    -.037435    -.035974    -.034402    -.031006    -.027365
  -.023560    -.019665    -.015749    -.011913    -.008273    -.006175    -.006266
  -.007119    -.010000
        3
            26           1           0
  0.0          4.0         P.0         12.0        16.0        20.0        24.0
  2P.0        32.0        36.0        40.0        44.0        48.0        52.0
  56.0        60.0        64.0        6P.0        72.0        76.0        80.0
  P4.0        8P.0        92.0        96.0       100.0
            25           1           0
  1.0          5.0         9.0         13.0        17.0        21.0        25.0
  29.0        33.0        37.0        41.0        45.0        49.0        53.0
  57.0        61.0        65.0        69.0        73.0        77.0        81.0
  P5.0        89.0        93.0        97.0
            25           1           0
  2.0          6.0         10.0        14.0        18.0        22.0        26.0
  30.0        34.0        3P.0        42.0        46.0        50.0        54.0
  5P.0        62.0        66.0        70.0        74.0        78.0        82.0
  86.0        90.0        94.0        9R.0
            25           0           0
  3.0          7.0         11.0        15.0        19.0        23.0        27.0
  31.0        35.0        39.0        43.0        47.0        51.0        55.0
  5C.0        63.0        67.0        71.0        75.0        79.0        83.0
  P7.0        91.0        95.0        99.0
        5
             1           1           1
  4.0000       0.0         1.511       1.0         99.0        0.0         .1255
  1.0
             0
        6
PARTNO    WINGLET KUHLMAN    1/4 MILL 6/4/79 JMK
          MACHIN/SUNTPN.3..LINEAR
          CLEAPP/XYPLAN.3.0
          FEDPAT/60.0
          COOLNT/MIST
          SPINDL/ON.CLW
          FROM/-1.0.-1.0,2.0,60.00
          GOTO/0.0,2.0,1.0,60.0
          GODLTA/0.0,0.0,.1,20.0
          OPSTOP
          CUTPTS
          PETRCT
          GOTO/-1.0.-1.0,2.0,60.0
          COOLNT/OFF
          SPINDL/OFF
          STOP
          END
```

```
              FINI
         0
R
PARTNO    TX 23.WING
          MACHIN/SUNTRN
          PTONLY/2
          FINI
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REFERENCES

1. Lange, R.H.; Cahill, J.F.; Bradley, E.S.; Eudaily, R.R.; Jenness, C.M.; and MacWilkinson, D.G.: Feasibility Study of the Transonic Biplane Concept for Transonic Aircraft Application. NASA CR 132462, June 1974.

2. Henderson, William P.; and Huffman, Jarrett K.: Aerodynamic Characteristics of a Tandem Wing Configuration at a Mach Number of 0.30. NASA TM X-72779, 1975.

3. Wolkovitch, Julian: Engel Engineering Company, Arlington, Texas. U.S. Patent No. 3,842,747. Other patents pending.

4. Whitcomb, Richard T.: A Design Approach and Selected Wind-Tunnel Results at High Subsonic Speeds for Wing-Tip Mounted Winglets. NASA TN D-9260, 1976.

5. Jacobs, Peter F.: Effects of Winglets on a First-Generation Jet Transport Wing. V - Stability Characteristics of a Full-Span Wing with a Generalized Fuselage at High Subsonic Speeds. NASA TP-1163, March 1978.

6. Flechner, Stuart T.; Jacobs, Peter F.; and Whitcomb, Richard T.: A High Subsonic Speed Wing-Tunnel Investigation of Winglets on a Representative Second-Generation Jet Transport Wing. NASA TN D-8264, July 1976.

7. Bartlett, Dennis W.; and Patterson, James C., Jr.: NASA Supercritical-Wing Technology. NASA Technical Memorandum 78731, July 1978.

8. Lamar, John E.: A Vortex-Lattice Method for the Mean Camber Shapes of Trimmed Noncoplanar Planforms with Minimum Vortex Drag. NASA TN D-8090, June 1976.

9. Fiefel, Winfried M.: Optimization and Design of Three Dimensional Aerodynamic Configurations of Arbitrary Shape by a Vortex Lattice Method. NASA SP-405, Presented at Vortex-Lattice Utilization Workshop, NASA Langley Research Center, Hampton, VA, May 17-18, 1976.

10. Lamar, John E.: Minimum Trim Drag Design for Interfering Lifting Surfaces Using Vortex Lattice Methodology. NASA SP-405, Presented at Vortex-Lattice Utilization Workshop, NASA Langley Research Center, Hampton, VA, May 17-18, 1976.

11. Kuhlman, John M.: Numerical Optimization Techniques for Bound Circulation Distribution for Minimum Induced Drag of Nonplanar Wing: Basic Formulations. NASA CR-3154, June 1979.

12. Kuhlman, John M.: Integration of Advanced Panel Trefftz Plane Drag Minimization Technique in Vortex Lattice Wing Design Code. Published in ASME book number G00147, pp. 201-210, 1979. Presented at ASME/ AIAA/SAE Joint Symposium on Aerodynamics of Transportation, Niagara Falls, New York, June 18-20, 1979.

13. Kuhlman, John M.: Results for Advanced Trefftz Plane Drag Optimization Technique in Vortex Lattice Wing Design Program. NASA Technical Progress Report, NSG-1357, March 1979.

14. Fox, Charles H., Jr.; and Huffman, Jarrett K.: Calibration and Test Capabilities of the Langley 7- by 10-Foot High Speed Tunnel. NASA TM X-74027, May 1977.

15. Abott, Ira H.; and VonDoenhoff, Albert E.: Theory of Wing Sections. Dover Publications, 1959.

16. Hess, John L.: Calculation of Potential Flow About Arbitrary Three Dimensional Lifting Bodies. Report No. MDC J5679-01, McDonnel-Douglas Corp., 1972.

17. Tulinius, Jan R.; and Margason, Richard J.: Aircraft Aerodynamic
     Design and Evaluation Methods. AIAA Paper 76-15, Presented at 14th
     Aerospace Sciences Meeting and 12th Annual Meeting, Washington, D.C.,
     January 26-30, 1976.

18. Bailey, F.R.; and Balhaus, W.F.: Relaxation Methods for Transonic
     Flow About Wing-Cylinder Combinations and Lifting Swept Wings.
     Presented at 3rd International Conference on Numerical Methods
     in Fluid Dynamics, Paris, France, July 1972.

19. Nash, John; and Scruggs, Roy.: An Automated Procedure for Computing
     the Three Dimensional Transonic Flow over Wing-Body Combinations,
     Including Viscous Effects. Vols. I, II, and III. Grumman Aerospace
     Corporation, AFFDL-TR-77-122, February 1977.

20. Vanderplatts, Garret N.: An Efficient Algorithm for Numerical Air-
     foil Optimization. AIAA Paper No. 79-0079, Presented at 17th Aero-
     space Sciences Meeting, New Orleans, LA, January 15-17, 1979.

21. Bonner, E.; Clever, W.; and Dunn, K.: Aerodynamic Preliminary Analysis
     System. NASA CR 145284, April 1978.

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA CR-159180		

4. Title and Subtitle	5. Report Date
Optimized Aerodynamic Design Process for Subsonic Transport Wing Fitted with Winglets	December 1979
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
John M. Kuhlman	
	10. Work Unit No.

9. Performing Organization Name and Address	11. Contract or Grant No.
Old Dominion University Research Foundation P. O. Box 6369 Norfolk, Virginia 23508	NSG-1357
	13. Type of Report and Period Covered

12. Sponsoring Agency Name and Address	
National Aeronautics and Space Administration Washington, DC 20546	Contractor Report
	14. Sponsoring Agency Code

15. Supplementary Notes

Langley Technical Monitors: John E. Lamar and John B. Peterson, Jr.

16. Abstract

The aerodynamic design of a wind-tunnel model of a wing representative of that of a subsonic jet transport aircraft, fitted with winglets, has been performed using two recently developed optimal wing-design computer programs. Both potential flow codes use a vortex lattice representation of the near-field of the aerodynamic surfaces for determination of the required mean camber surfaces for minimum induced drag, and both codes use far-field induced drag minimization procedures to obtain the required spanloads. One code uses a discrete vortex wake model for this far-field drag computation, while the second uses a 2-D advanced panel wake model. Wing camber shapes for the two codes are very similar, but the resulting winglet camber shapes differ widely. Design techniques and considerations for these two wind-tunnel models are detailed herein, including a description of the necessary modifications of the design geometry to format it for use by a numerically controlled (NC) machine for the actual model construction.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Subsonic Aerodynamics Wing Design Winglets	Unclassified - Unlimited Subject Category 02

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified	182	