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National Aeronautics
and Space Administration

Scientific and Technical
Information Branch

SUMMARY

An investigation of the aerodynamic characteristics of canard, tailless, and aft-tail configurations was conducted on a general research model in the Langley Unitary Plan Wind Tunnel at Mach numbers of 1.60 and 2.00. Two uncambered wing planforms were tested for each configuration: a trapezoidal wing of 44° leading-edge sweep and a delta wing of 60° leading-edge sweep. A generic fuselage without canopy, inlets, or vertical tails was utilized.

The purpose of the investigation was to determine the relative merits of canard, tailless, and aft-tail configurations and to evaluate the capabilities of a linear theory code for analysis of such configurations. The canard and aft-tail configurations have similar values of lift-curve slope, maximum lift-drag ratio, and zero-lift drag for a given wing planform and Mach number; these values are greater than those for the tailless configuration. At low lift coefficients the tailless configuration exhibits the lowest trimmed drag level, while at higher lift conditions the aft-tail configuration has the least drag, followed next by the canard configuration. The stability decrease as Mach number increases is greatest for the tailless configuration and least for the canard configuration. Because of very limited accuracy in predicting the aerodynamic parameter increments between configurations, the linear theory code is not adequate for determining the relative merits of canard, tailless, and aft-tail configurations.

INTRODUCTION

Recent interest in canard and tailless fighter configurations has resulted in considerable debate about their advantages and disadvantages as compared with conventional aft-tail configurations. Previous comparisons of canard, tailless, and aft-tail configurations (refs. 1 and 2, for example) have involved such changes between configurations as fuselage length, wing planform, and addition of strakes. These changes might tend to compromise the comparisons from a generic viewpoint. Investigations of a more generic nature (refs. 3 and 4) have provided only limited comparative data. Hence, investigations are desired to provide a generic set of experimental data for canard, tailless, and aft-tail configurations that are also amenable for analysis with standard theoretical methods.

The purpose of the present investigation was to determine the relative merits of generic-type canard, tailless, and aft-tail configurations at supersonic speeds, and to evaluate the capability of a supersonic linear theory analysis to predict these relative merits. Two wing planforms were investigated for each configuration: a 44° trapezoidal wing planform and a 60° delta wing planform. Strake effects were also examined on the tailless and aft-tail configurations (44° trapezoidal wing planform only). The experiments were conducted at Mach numbers of 1.60 and 2.00 in the Langley Unitary Plan Wind Tunnel (UPWT). The supersonic linear theory analysis was performed on each configuration and compared with the experimental results to evaluate the capability of the code to determine the relative merits of canard, tailless, and aft-tail configurations.

The experimental tests were part of a cooperative fighter configuration study between the National Aeronautics and Space Administration and the General Dynamics Corporation.

SYMBOLS

$\bar{c}$ wing mean aerodynamic chord, in.

C_A axial force coefficient, $\frac{\text{Axial force}}{qS}$

C_D drag coefficient, $\frac{\text{Drag}}{qS}$

$\Delta C_D/C_L^2$ drag-due-to-lift factor, $(C_D - C_{D,o})/C_L^2$, computed for $C_L < 0.2$

$C_{D,c}$ base cavity drag coefficient, $\frac{\text{Base cavity drag}}{qS}$

$C_{D,o}$ zero-lift drag coefficient

$\Delta C_{D,o}$ incremental zero-lift drag coefficient due to control surface deflection

C_L lift coefficient, $\frac{\text{Lift}}{qS}$

ΔC_L incremental lift coefficient at $\alpha = 0$ due to control surface deflection

C_{L_α} lift-curve slope, $\partial C_L/\partial\alpha$ at $C_L = 0$, deg^{-1}

C_{L_δ} lift effectiveness due to control surface deflection at $\alpha = 0°$, $\Delta C_L/\delta$, deg^{-1}

C_m pitching-moment coefficient, $\frac{\text{Pitching moment}}{qS\bar{c}}$

ΔC_m incremental pitching-moment coefficient at $C_L = 0$ due to control surface deflection

$\partial C_m/\partial C_L$ longitudinal-stability parameter at $C_L = 0$

C_{m_δ} pitching-control effectiveness at $C_L = 0$, $\Delta C_m/\delta$, deg^{-1}

C_N normal-force coefficient, $\frac{\text{Normal force}}{qS}$

L/D lift-drag ratio

M Mach number

q dynamic pressure, psf

R Reynolds number, per foot

S wing reference area, ft^2

α angle of attack, deg

δ control surface deflection angle, positive trailing edge down, deg

$\Delta(\ )$ incremental parameter value based on the tailless configuration

$|\ |$ absolute value

Abbreviations:

max   maximum

MS   model station, measured from nose, in.

UPWT   Unitary Plan Wind Tunnel

DESCRIPTION OF MODEL

Planform sketches of the five configurations tested with the 44° trapezoidal wing are shown in figure 1. The wing position relative to the fuselage was constant for all the configurations, the aft-tail control surface was located in the plane of the wing for the aft-tail configurations, and the canard control surface was located 1.65 in. above the wing for the canard configuration. Elevons were used as the control surface for the tailless configurations. The wing airfoil varied linearly from an NACA 64A006 section at the root to an NACA 64A004 section at the tip. The strake was attached to the fuselage separate from the wing with the gap sealed by a thin metal strip on the strake lower surface. Wing and strake planform geometry is shown in figure 2. The strake design methodology is reported in reference 5. The canard and aft tail were of identical planform, as shown in figure 3. A biconvex airfoil, which varied linearly from 6-percent root thickness to 4-percent tip thickness, was used on the canard and aft tail. Shown in figure 4 is the fuselage geometry. A slab-sided section provided for mounting the canard above the wing plane.

Planform sketches of the three configurations tested with the 60° delta wing are shown in figure 5. Again, a constant wing position was maintained for each configuration. The wing employed an NACA 64A006 airfoil section. The wing planform details are shown in figure 6. The canard and aft tail were the same ones used on the 44° trapezoidal wing configurations. The fuselage geometry used for the 60° delta wing configurations is shown in figure 7. Note the increased fuselage length and the different transition section locations as compared with the 44° trapezoidal wing case. Photographs of the 60° canard configuration and the 44° canard configuration mounted in the wind tunnel are presented in figure 8.

TEST DESCRIPTION

The experimental tests were performed in the Langley Unitary Plan Wind Tunnel (ref. 6) at Mach numbers of 1.60 and 2.00. The Reynolds number per foot was 2×10^6 for all data points, which corresponds to a stagnation pressure of 1079 psf for Mach 1.60 and 1253 psf for Mach 2.00. The stagnation temperature was maintained at 125°F, and dew point was held below the minimum value at which condensation effects become significant.

Boundary-layer transition strips consisting of a 0.063-in. band of No. 50 grit were located 1.2 in. aft of the fuselage nose apex and 0.4 in. aft of the wing, strake, canard, and aft-tail leading edges. The method described in reference 7 was used to size the grit in order to provide for fully turbulent flow over the model.

The aerodynamic forces and moments were measured by means of a six-component strain-gauge balance contained within the model and attached to a supporting sting which, in turn, was connected to the permanent model-actuating system in the wind tunnel. The model angles of attach were corrected for tunnel flow misalignment and for sting and balance deflection due to aerodynamic loading. Base cavity pressures were measured by means of sting-mounted tubes which were routed from the cavity to pressure transducers located outside of the wind tunnel. These pressures were measured throughout the test and used to correct the force data to a condition of free-stream static pressure acting over the model base.

The data were reduced about a moment reference center which was located to provide a 10-percent stable static margin with control surfaces undeflected at $M = 1.60$. Locations of the moment reference center for each configuration are shown in table I.

EXPERIMENTAL RESULTS

The results presented for the five 44° trapezoidal wing configurations were determined from the data tabulated in appendix A. These five configurations are specifically referred to as the 44° canard, 44° tailless/strake, 44° aft-tail/strake, 44° tailless, and 44° aft-tail configurations. Appendix B contains the tabulated data from which the results for the three 60° delta wing configurations were obtained. These three configurations are specifically referred to as the 60° canard, 60° tailless, and 60° aft-tail configurations. Figures 9 to 17 contain summary data for all the configurations tested, except as indicated.

Presented in figure 9 is the variation of lift-curve slope with Mach number. The lift-curve slopes for the canard and aft-tail configurations are approximately 15 percent greater than for the tailless configurations at constant Mach number. This difference is due to the additional lift of the canard or aft-tail, either of which increases the exposed area by about 15 percent. Each configuration has roughly the same decrease in lift-curve slope, about 15 to 20 percent, from $M = 1.60$ to $M = 2.00$. Each 44° trapezoidal wing configuration has roughly a 10- to 15-percent greater lift-curve slope than its 60° delta wing counterpart, primarily because of the larger aspect ratio of the 44° trapezoidal wing configurations (2.5 versus 2.2). Finally, the strake slightly increases the lift-curve slope.

Figure 10 shows the longitudinal-stability variation with Mach number. Recall that the moment reference center (table I) was located to provide a 10-percent positive stability level at $M = 1.60$ for each configuration. The stability level decrease with increased Mach number is least for the canard configuration, followed by the aft-tail and then the tailless configurations. The 44° configurations with the strake experience a further decrease in stability level over their strake-off counterparts.

The maximum lift-drag ratio $(L/D)_{max}$ and the lift coefficient at $(L/D)_{max}$ are shown in figures 11 and 12, respectively. Generally, the canard and aft-tail configurations exhibit slightly higher $(L/D)_{max}$ values than the tailless configurations. At $M = 2.00$, the $(L/D)_{max}$ values are about 10 percent less than those at $M = 1.60$. The 60° delta wing configurations have a 5- to 10-percent greater $(L/D)_{max}$ than the 44° trapezoidal wing configurations. Note that the strake-off configurations have slightly lower $(L/D)_{max}$ levels than comparable strake-on configurations. The lift coefficients at $(L/D)_{max}$ for the canard and aft-tail configurations are about 10 percent greater than the values for the tailless configurations. A decrease in lift coefficient at $(L/D)_{max}$ of about 10 to 15 percent occurs between $M = 1.60$ and $M = 2.00$ for each configuration. Negligible strake effects on the lift coefficient at $(L/D)_{max}$ are observed.

The zero-lift drag values are presented in figure 13. A 5- to 10-percent reduction in zero-lift drag results for the tailless configurations, and increasing the Mach number from 1.60 to 2.00 decreases the zero-lift drag by about 5 percent for all configurations. Effects of wing sweep are shown in the zero-lift drag differences for the two wing planforms. In general, the zero-lift drag values of the 60° delta wing configurations are about 20 percent less than those for the 44° trapezoidal wing configurations.

Shown in figure 14 are the drag-due-to-lift results. The canard and aft-tail configurations exhibit the best performance, with the tailless configurations having a considerably higher (10 to 15 percent) drag-due-to-lift factor. A constant incremental increase in the drag-due-to-lift factor occurs as the Mach number is increased. The 44° trapezoidal wing configurations have lower drag-due-to-lift levels than the 60° delta wing configurations because their wings have higher aspect ratios. The strake improves the drag-due-to-lift characteristics of the 44° tailless and aft-tail configurations.

Configuration control surface effectiveness is shown in figure 15. These effects were obtained from 10° control surface deflections on all configurations except the 44° tailless/strake and 44° tailless configurations, for which the elevons were deflected 12°. The aft-tail configurations yield the greatest pitch effectiveness, followed next by the canard configurations. The magnitude of the lift effectiveness decrease for the aft-tail configurations is about twice the lift effectiveness increase for the canard configurations. This difference is due to the canard downwash effects on the wing. Note that these results are strongly influenced by control surface size and location. Hence, these results may only apply to the present configurations.

Trimmed drag characteristics for all configurations except the 44° aft-tail (data not available) are shown in figure 16. The tailless configurations have the least drag at lower values of lift coefficient ($C_L < 0.15$) because of their lower zero-lift drag. At higher lift conditions ($C_L > 0.30$), the aft-tail configurations have the best drag characteristics, followed next by the canard configurations. The performance improvements of the aft-tail and canard configurations at higher lift coefficients are partly due to the better drag-due-to-lift characteristics noted previously. The strake improves the drag performance of the 44° tailless configuration slightly; this improvement is expected since the strake has been observed to reduce the drag due to lift. Hence, it is likely that the drag performance of the 44° aft-tail configuration should be between those of the 44° aft-tail/strake and 44° canard configurations.

Variations of pitching moment and angle of attack with lift coefficient are shown in figure 17. A destabilizing break in the pitching-moment curve is most pronounced for the tailless configurations, followed by the aft-tail configurations and then the canard configurations. The strake increases the magnitude of this destabilizing break for the 44° tailless/strake and 44° aft-tail/strake configurations. The nonlinear break in the lift curve for all configurations occurs for a given wing planform and Mach number at about the same C_L, except for the 44° canard configuration, which experiences a greater loss of lift at the higher angles of attack. This may be due to canard flow separations caused by fuselage upwash effects, which increase the local angle of attack of the canard.

THEORETICAL ANALYSIS

Analytical results from the Supersonic Design and Analysis System (SDAS) of reference 8 were selected for comparison with the experimental results. The SDAS options employed were the skin friction analysis, the far-field wave-drag analysis (supersonic area rule), and the lift analysis (linear theory). In the lift analysis, the wing was treated as a zero-thickness surface (chord plane), with leading-edge thrust and vortex effects not included. Note that the upwash effects due to the fuselage are accounted for in the lift analysis by slender-body theory. Shown in figure 18 is a representative geometry input to the SDAS. The numerical input for all test configuration geometries is contained in table II in the format presented in reference 8. The numerical input is obtained by combining the components listed below the GEOM 2-4 cards according to the configuration code.

The SDAS was chosen because it is typical of the methods currently employed to perform preliminary design analysis. The capability of such methods to predict the absolute levels of the aerodynamic characteristics is very good for slender, high-fineness-ratio vehicles such as supersonic cruise transports (ref. 9) but is marginal for low-fineness-ratio fighter vehicles (ref. 10). In reference 11, however, the SDAS provided adequate incremental results between fighter configurations which differed only in wing planform. The purpose of the present analysis was to evaluate the suitability of the SDAS for predicting the incremental levels of the aerodynamic parameters between canard, tailless, and aft-tail configurations of a given wing planform and fuselage length.

The theoretical and experimental aerodynamic characteristics are presented in figures 19 to 22 as increments based on the tailless configuration. Results for both the 44° trapezoidal and 60° delta wing planforms are generally independent of wing planform and hence the following discussion is made without reference to wing planform. Notice, however, that the strake discussion applies only to the 44° trapezoidal wing planform.

Shown in figure 19 are the lift-curve slope comparisons. Generally, the increase in lift-curve slope is underpredicted for the canard configuration and overpredicted for the aft-tail configuration. Note that a large variation with Mach number occurs for the predicted canard values. The effect of the strake is well predicted. The increments in stability level are shown in figure 20. An increase in stability is predicted for the aft-tail configuration, while a decrease is predicted for the canard. Again, the strake effect is well predicted. Evidently, the theory does not account well for the interference effects of the canard and aft-tail lifting surfaces.

Figure 21 contains the theoretical and experimental comparison of zero-lift drag increment. The drag increase is well predicted for both the canard and aft-tail configurations. Note that a decrease in zero-lift drag was predicted by the addition of the strake. This theoretical decrease is due to the area distribution smoothing effect of the strake at the wing leading-edge and fuselage juncture.

The incremental drag-due-to-lift factor comparisons are presented in figure 22. Generally, the analysis underpredicts the canard decrease and overpredicts the aft-tail decrease in drag due to lift. The increment in drag-due-to-lift factor resulting from the strake addition is fairly well predicted.

The increments due to control surface deflection are shown in figure 23. The pitching-moment increments due to canard and aft-tail deflection are overpredicted, while the increment due to elevon deflection is well predicted. The lift increment is well predicted for the elevon and aft-tail deflection but is incorrect for the canard deflection. The drag increments are consistently overpredicted in each case.

Comparisons of the theoretical and experimental absolute levels of lift-curve slope, stability, zero-lift drag, and drag-due-to-lift factor are shown in figure 24. Generally, the predictions are reasonable, although in some cases the trend with Mach number is slightly exaggerated. The large increase in the predicted zero-lift drag at $M = 2.00$ for the 60° tailless configuration is due to the well-known fact that high wave-drag levels are associated with the large area distribution gradients at the cutting plane (Mach plane) azimuthal angles where a sonic wing leading edge is intersected. Hence, comparisons in drag level at these conditions should be avoided.

In summary, the SDAS method, which is typical of the analytical techniques currently employed in initial analysis, is generally not adequate for providing the incremental differences between generic canard, tailless, and aft-tail configurations. Hence, it appears that higher order nonlinear methods are required.

CONCLUDING REMARKS

An investigation of the relative merits of canard, tailless, and aft-tail configurations was conducted on a general research model at Mach numbers of 1.60 and 2.00. Two wing planforms were tested for each configuration: a trapezoidal wing with 44° leading-edge sweep and a delta wing with 60° leading-edge sweep. Strake effects were also investigated on the 44° tailless and aft-tail configurations.

The canard and aft-tail configurations have similar values of lift-curve slope, maximum lift-drag ratio, and zero-lift drag for a given wing planform and Mach number; these values are greater than those for the tailless configuration. At low lift coefficients the tailless configuration exhibits the best trimmed drag performance, while at the higher lift conditions the aft-tail configuration is best, followed next by the canard configuration. The effect of increased Mach number is to decrease the lift-curve slope, maximum lift-drag ratio, zero-lift drag and pitching-control effectiveness in approximately constant increments regardless of configuration. The stability decrease for increased Mach number is greatest for the tailless configuration and least for the canard configuration. A destabilizing break in the pitching-moment curve at constant Mach number is most pronounced for the tailless configuration, while the canard configuration is least affected. A given 44° trapezoidal wing configuration has a greater lift-curve slope and zero-lift drag and a lower maximum lift-drag ratio than its 60° delta wing counterpart. The effect of the strake on the 44° tailless and aft-tail configurations is to increase the lift-curve slope, maximum lift-drag ratio, trimmed drag performance, and pitching-moment curve nonlinearity.

A supersonic linear theory analysis was performed on each configuration and compared with the experimental results. The theoretical analysis indicated that simple linear theory is not adequate for determining the relative merits of canard, tailless, and aft-tail configurations because of its very limited accuracy in predicting the aerodynamic parameter increments between configurations.

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Hampton, VA 23665
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TABLE I.- MOMENT REFERENCE CENTER LOCATIONS

Configuration	Moment reference center location		$\bar{c}$, in.	S, ft^2
	Model station, in.	Percent of $\bar{c}$		
44° canard	22.341	14	9.176	1.1111
44° tailless/strake	23.607	27		
44° aft-tail/strake	24.830	41		
44° tailless	23.855	30		
44° aft-tail	25.150	44		
60° canard	22.770	17	12.129	1.2635
60° tailless	24.921	35	12.129	1.2635
60° aft-tail	26.224	45	12.129	1.2635

TABLE II.- NUMERICAL DESCRIPTION OF MODEL GEOMETRY

Input card	Card	Configuration code
GEOM NEW	GEOM 1	**CONFIGURATION CODE**
44 CANARD CONFIGURATION DIMENSIONS IN INCHES	GEOM 2	
1 -1 1 0 0 1 0 2 16 1 19 19 0 0 0 0 0 0 0 0 0 0 1 10	GEOM 3	A_1BC_1
160.00 9.176 22.341	GEOM 4	
44 TAILLESS/STRAKE CONFIGURATION DIMENSIONS IN INCHES	GEOM 2	
1 -1 1 0 0 0 0 5 16 1 19 19 0 0 0 0 0 0 0 0 0 0 0 0	GEOM 3	A_2B
160.00 9.176 23.607	GEOM 4	
44 AFT-TAIL/STRAKE CONFIGURATION DIMENSIONS IN INCHES	GEOM 2	
1 -1 1 0 0 1 0 5 16 1 19 19 0 0 0 0 0 0 0 0 0 0 1 10	GEOM 3	A_2BC_2
160.00 9.176 24.830	GEOM 4	
44 TAILLESS CONFIGURATION DIMENSIONS IN INCHES	GEOM 2	
1 -1 1 0 0 0 0 2 16 1 19 19 0 0 0 0 0 0 0 0 0 0 0 0	GEOM 3	A_1B
160.00 9.176 23.855	GEOM 4	
44 AFT-TAIL CONFIGURATION DIMENSIONS IN INCHES	GEOM 2	
1 -1 1 0 0 1 0 2 16 1 19 19 0 0 0 0 0 0 0 0 0 0 1 10	GEOM 3	A_1BC_2
160.00 9.176 25.150	GEOM 4	
60 CANARD CONFIGURATION DIMENSIONS IN INCHES	GEOM 2	
1 -1 1 0 0 1 0 2 16 1 19 19 0 0 0 0 0 0 0 0 0 0 1 10	GEOM 3	A_3BC_3
181.94 12.129 22.770	GEOM 4	
60 TAILLESS CONFIGURATION DIMENSIONS IN INCHES	GEOM 2	
1 -1 1 0 0 0 0 2 16 1 19 19 0 0 0 0 0 0 0 0 0 0 0 0	GEOM 3	A_3B
181.94 12.129 24.921	GEOM 4	
60 AFT-TAIL CONFIGURATION DIMENSIONS IN INCHES	GEOM 2	
1 -1 1 0 0 1 0 2 16 1 19 19 0 0 0 0 0 0 0 0 0 0 1 10	GEOM 3	A_3BC_4
181.94 12.129 26.224	GEOM 4	
		COMPONENTS
0.0 .50 .75 1.25 2.50 5.0 10.0 20.0 30.0 40.0	GEOM 5A	
50.0 60.0 70.0 80.0 90.0 100.0	GEOM 5B	
18.784 1.500 0.000 11.732	GEOM 6A	
27.001 10.000 0.000 2.665	GEOM 6B	
0.0 .486 .588 .742 1.014 1.398 1.918 2.557 2.898 3.000	GEOM 8A1	
2.821 2.438 1.909 1.287 .648 .017	GEOM 8A2	A_1
0.0 .338 .375 .488 .675 .938 1.276 1.689 1.914 2.000	GEOM 8B1	
1.876 1.651 1.276 .863 .450 .000	GEOM 8B2	
0.000 1.000 2.000 3.000 4.000 5.000 6.000 7.000 8.750 11.850	GEOM 10A	
12.850 13.850 15.350 20.150 21.150 22.150 23.650 25.150 38.034	GEOM 10B	
0.0 .50 .75 1.25 2.50 5.0 10.0 20.0 30.0 40.0	GEOM 5A	
50.0 60.0 70.0 80.0 90.0 100.0	GEOM 5B	
11.373 1.500 0.000 19.143	GEOM 6A	
12.301 1.807 0.000 18.184	GEOM 6B	
14.675 2.236 0.000 15.768	GEOM 6C	
19.970 2.727 0.000 10.423	GEOM 6D	
27.001 10.000 0.000 2.665	GEOM 6E	
0.0 .037 .057 .094 .183 .326 .326 .326 .326 .569	GEOM 8A1	
1.515 1.818 1.719 1.269 .643 .010	GEOM 8A2	
0.0 .024 .036 .060 .120 .240 .346 .346 .346 .847	GEOM 8B1	
1.618 1.869 1.725 1.261 .640 .011	GEOM 8B2	A_2
0.0 .012 .019 .038 .070 .140 .285 .400 .400 1.527	GEOM 8C1	
1.937 2.076 1.784 1.284 .646 .013	GEOM 8C2	
0.0 .486 .588 .742 1.014 1.398 1.918 2.557 2.898 3.000	GEOM 8D1	
2.821 2.438 1.909 1.287 .648 .017	GEOM 8D2	
0.0 .338 .375 .488 .675 .938 1.276 1.689 1.914 2.000	GEOM 8E1	
1.876 1.651 1.276 .863 .450 .000	GEOM 8E2	
0.000 1.000 2.000 3.000 4.000 5.000 6.000 7.000 8.750 11.850	GEOM 10A	
12.850 13.850 15.350 20.150 21.150 22.150 23.650 25.150 38.034	GEOM 10B	
0.0 .50 .75 1.25 2.50 5.0 10.0 20.0 30.0 40.0	GEOM 5A	
50.0 60.0 70.0 80.0 90.0 100.0	GEOM 5B	
17.534 1.500 0.000 15.465	GEOM 6A	
32.256 10.000 0.000 0.001	GEOM 6B	
0.0 .485 .582 .737 1.015 1.397 1.920 2.554 2.897 3.000	GEOM 8A1	
2.826 2.438 1.908 1.287 .647 .019	GEOM 8A2	A_3
0.0 .485 .582 .737 1.015 1.397 1.920 2.554 2.897 3.000	GEOM 8B1	
2.826 2.438 1.908 1.287 .647 .019	GEOM 8B2	
0.000 1.000 2.000 3.000 4.000 5.000 6.000 7.000 8.750 10.250	GEOM 10A	
11.250 12.250 13.750 20.150 21.150 22.150 23.650 25.150 41.634	GEOM 10B	

TABLE II.- Continued

0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Y 1
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Z 1
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
0.000	0.051	0.120	0.208	0.286	0.345	0.393	0.422	0.421	0.421	Y 2
0.431	0.420	0.400	0.359	0.299	0.230	0.180	0.111	0.000		
-0.453	-0.433	-0.422	-0.382	-0.312	-0.242	-0.153	-0.073	-0.001	0.000	Z 2
0.001	0.075	0.153	0.252	0.310	0.369	0.398	0.426	0.435		
-0.000	0.178	0.286	0.434	0.590	0.707	0.774	0.821	0.829	0.829	Y 3
0.829	0.807	0.766	0.695	0.594	0.475	0.356	0.227	-0.000		
-0.839	-0.827	-0.786	-0.715	-0.584	-0.455	-0.296	-0.147	-0.001	0.000	Z 3
0.001	0.139	0.316	0.473	0.580	0.667	0.735	0.783	0.819		
-0.000	0.289	0.456	0.623	0.828	0.974	1.071	1.137	1.155	1.155	Y 4
1.155	1.142	1.071	0.940	0.800	0.641	0.492	0.284	0.000		
-1.155	-1.132	-1.071	-0.980	-0.800	-0.621	-0.432	-0.224	-0.001	0.000	Z 4
0.001	0.210	0.456	0.662	0.828	0.954	1.032	1.099	1.145		
-0.000	0.303	0.569	0.774	0.979	1.155	1.280	1.375	1.401	1.401	Y 5
1.401	1.378	1.266	1.145	0.994	0.785	0.606	0.329	0.000		
-1.401	-1.378	-1.296	-1.175	-0.994	-0.795	-0.576	-0.299	-0.001	0.000	Z 5
0.001	0.274	0.588	0.794	0.999	1.155	1.261	1.356	1.402		
0.000	0.354	0.629	0.854	1.079	1.225	1.370	1.456	1.500	1.500	Y 6
1.500	1.455	1.353	1.232	1.072	0.843	0.644	0.416	0.000		
-1.618	-1.595	-1.493	-1.362	-1.182	-0.993	-0.744	-0.447	-0.151	-0.000	Z 6
0.135	0.451	0.755	0.981	1.177	1.371	1.478	1.564	1.619		
0.000	0.385	0.641	0.896	1.111	1.246	1.382	1.457	1.500	1.500	Y 7
1.500	1.454	1.351	1.250	1.090	0.861	0.662	0.404	0.000		
-1.796	-1.742	-1.631	-1.490	-1.309	-1.111	-0.862	-0.575	-0.298	0.000	Z 7
0.304	0.599	0.904	1.130	1.335	1.530	1.656	1.742	1.796		
0.000	0.365	0.630	0.904	1.108	1.263	1.358	1.462	1.500	1.500	Y 8
1.500	1.440	1.346	1.244	1.083	0.872	0.633	0.375	0.000		
-1.905	-1.869	-1.766	-1.604	-1.423	-1.223	-0.985	-0.687	-0.420	0.000	Z 8
0.418	0.694	0.999	1.234	1.419	1.632	1.757	1.842	1.895		
0.000	0.355	0.640	0.904	1.079	1.273	1.389	1.483	1.500	1.500	Y 9
1.500	1.448	1.365	1.223	1.042	0.882	0.633	0.375	0.000		
-2.000	-1.919	-1.816	-1.693	-1.513	-1.303	-1.094	-0.796	-0.480	0.000	Z 9
0.497	0.812	1.107	1.341	1.536	1.691	1.826	1.930	2.000		
0.000	0.290	0.588	0.837	1.055	1.234	1.354	1.453	1.500	1.500	Y 10
1.500	1.462	1.362	1.242	1.063	0.844	0.635	0.347	0.000		
-2.000	-1.979	-1.870	-1.730	-1.551	-1.352	-1.133	-0.825	-0.496	0.000	Z 10
0.498	0.797	1.095	1.344	1.562	1.731	1.851	1.950	2.000		
0.000	0.301	0.600	0.838	1.047	1.236	1.355	1.444	1.500	1.500	Y 11
1.500	1.470	1.410	1.321	1.191	1.071	0.882	0.484	0.000		
-2.000	-1.979	-1.879	-1.749	-1.570	-1.361	-1.142	-0.823	-0.505	0.000	Z 11
0.997	1.186	1.385	1.564	1.703	1.812	1.921	1.990	2.000		
0.000	0.320	0.598	0.846	1.055	1.253	1.382	1.471	1.500	1.500	Y 12
1.500	1.498	1.449	1.399	1.329	1.250	1.100	0.902	0.000		
-2.000	-1.986	-1.887	-1.747	-1.568	-1.350	-1.131	-0.833	-0.505	0.000	Z 12
1.392	1.502	1.631	1.730	1.829	1.899	1.968	1.998	2.000		
0.000	0.242	0.571	0.819	1.047	1.236	1.345	1.444	1.500	1.500	Y 13
1.500	1.479	1.469	1.459	1.429	1.409	1.369	1.309	0.000		
-2.000	-1.969	-1.879	-1.749	-1.570	-1.340	-1.121	-0.823	-0.495	0.000	Z 13
1.783	1.823	1.863	1.903	1.942	1.962	1.982	1.998	2.000		
0.000	0.254	0.582	0.830	1.029	1.217	1.346	1.444	1.500	1.500	Y 14
1.500	1.487	1.477	1.457	1.437	1.397	1.357	1.278	0.000		
-2.000	-1.959	-1.868	-1.748	-1.569	-1.340	-1.110	-0.802	-0.473	0.000	Z 14
1.804	1.844	1.884	1.924	1.943	1.973	1.993	1.998	2.000		
0.000	0.321	0.580	0.838	1.047	1.245	1.355	1.444	1.500	1.500	Y 15
1.500	1.499	1.489	1.449	1.400	1.350	1.320	1.181	0.000		
-2.000	-1.939	-1.859	-1.729	-1.570	-1.341	-1.122	-0.813	-0.485	0.000	Z 15
1.673	1.723	1.783	1.842	1.912	1.952	1.972	2.000	2.000		
0.000	0.302	0.550	0.818	1.026	1.224	1.343	1.422	1.500	1.500	Y 16
1.500	1.487	1.467	1.427	1.337	1.248	1.178	0.990	0.000		
-2.000	-1.956	-1.876	-1.727	-1.558	-1.329	-1.110	-0.802	-0.484	0.000	Z 16
1.473	1.533	1.632	1.751	1.860	1.930	1.969	1.999	2.000		
0.000	0.318	0.606	0.844	1.052	1.210	1.339	1.456	1.500	1.500	Y 17
1.500	1.486	1.456	1.355	1.205	1.075	0.896	0.458	0.000		
-2.000	-1.968	-1.877	-1.746	-1.576	-1.377	-1.157	-0.808	-0.490	0.000	Z 17
1.042	1.181	1.350	1.539	1.727	1.836	1.924	2.000	2.000		
0.000	0.265	0.513	0.780	1.047	1.254	1.411	1.468	1.500	1.500	Y 18
1.500	1.456	1.395	1.253	1.042	0.782	0.472	0.243	0.000		
-2.000	-1.977	-1.906	-1.774	-1.553	-1.313	-0.993	-0.754	-0.505	0.000	Z 18
0.489	0.738	0.986	1.283	1.550	1.767	1.904	1.962	2.000		
0.000	0.265	0.513	0.780	1.047	1.254	1.411	1.468	1.500	1.500	Y 19
1.500	1.456	1.395	1.253	1.042	0.782	0.472	0.243	0.000		
-2.000	-1.977	-1.906	-1.774	-1.553	-1.313	-0.993	-0.754	-0.505	0.000	Z 19
0.489	0.738	0.986	1.283	1.550	1.767	1.904	1.962	2.000		

B

TABLE II.- Concluded

13.214	1.500	1.690	5.332	17.081	5.500	1.690	1.067			GEOM 22	C_1
0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	100.0	GEOM 23	
0.0	1.082	1.922	2.522	2.880	3.000	2.880	2.522	1.922	0.0	GEOM 24	
33.130	1.500	0.000	5.332	36.997	5.500	0.000	1.067			GEOM 22	C_2
0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	100.0	GEOM 23	
0.0	1.082	1.922	2.522	2.880	3.000	2.880	2.522	1.922	0.0	GEOM 24	
11.580	1.500	1.690	5.332	15.447	5.500	1.690	1.067			GEOM 22	C_3
0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	100.0	GEOM 23	
0.0	1.082	1.922	2.522	2.880	3.000	2.880	2.522	1.922	0.0	GEOM 24	
36.238	1.500	0.000	5.332	40.105	5.500	0.000	1.067			GEOM 22	C_4
0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	100.0	GEOM 23	
0.0	1.082	1.922	2.522	2.880	3.000	2.880	2.522	1.922	0.0	GEOM 24	

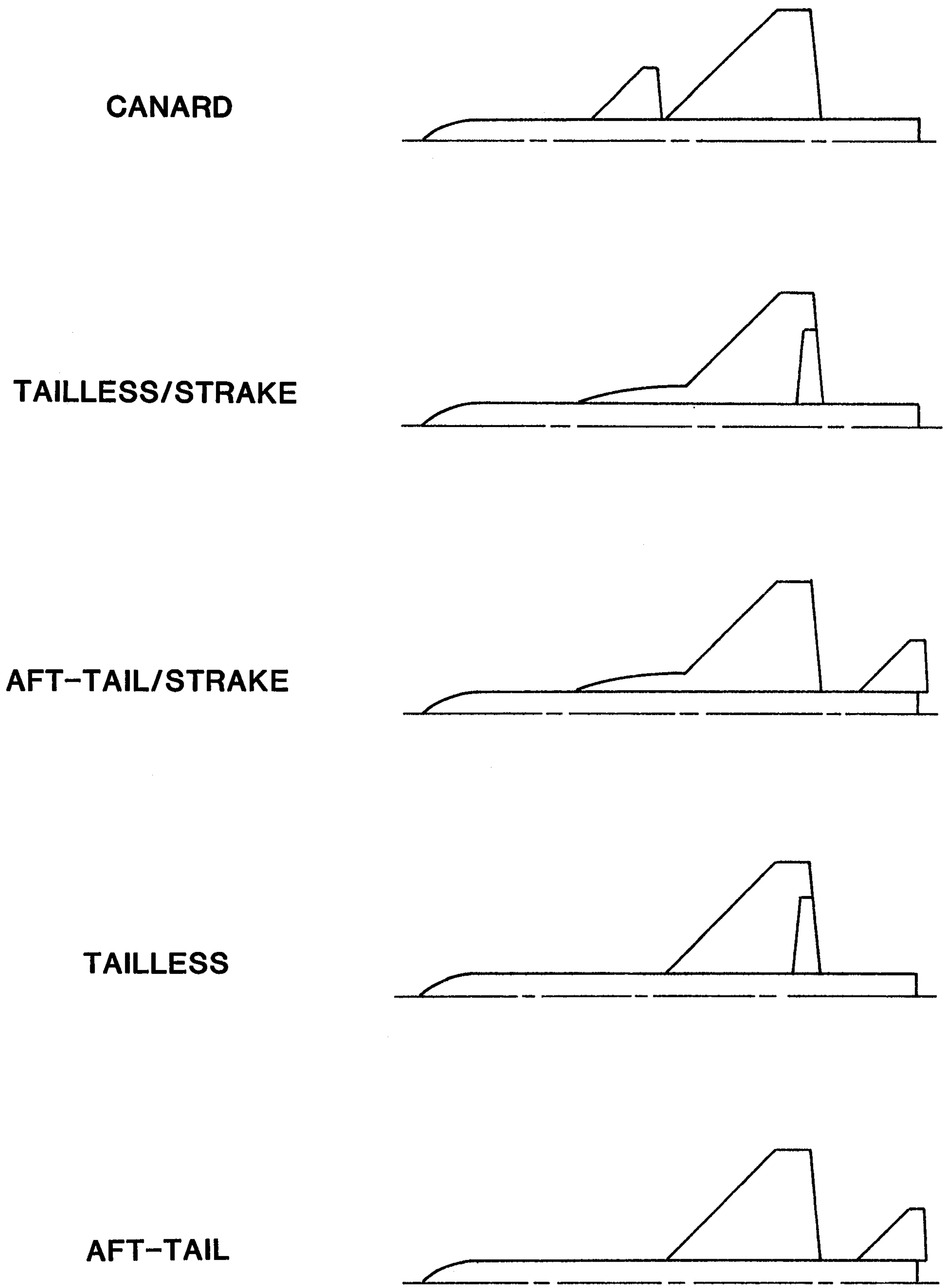
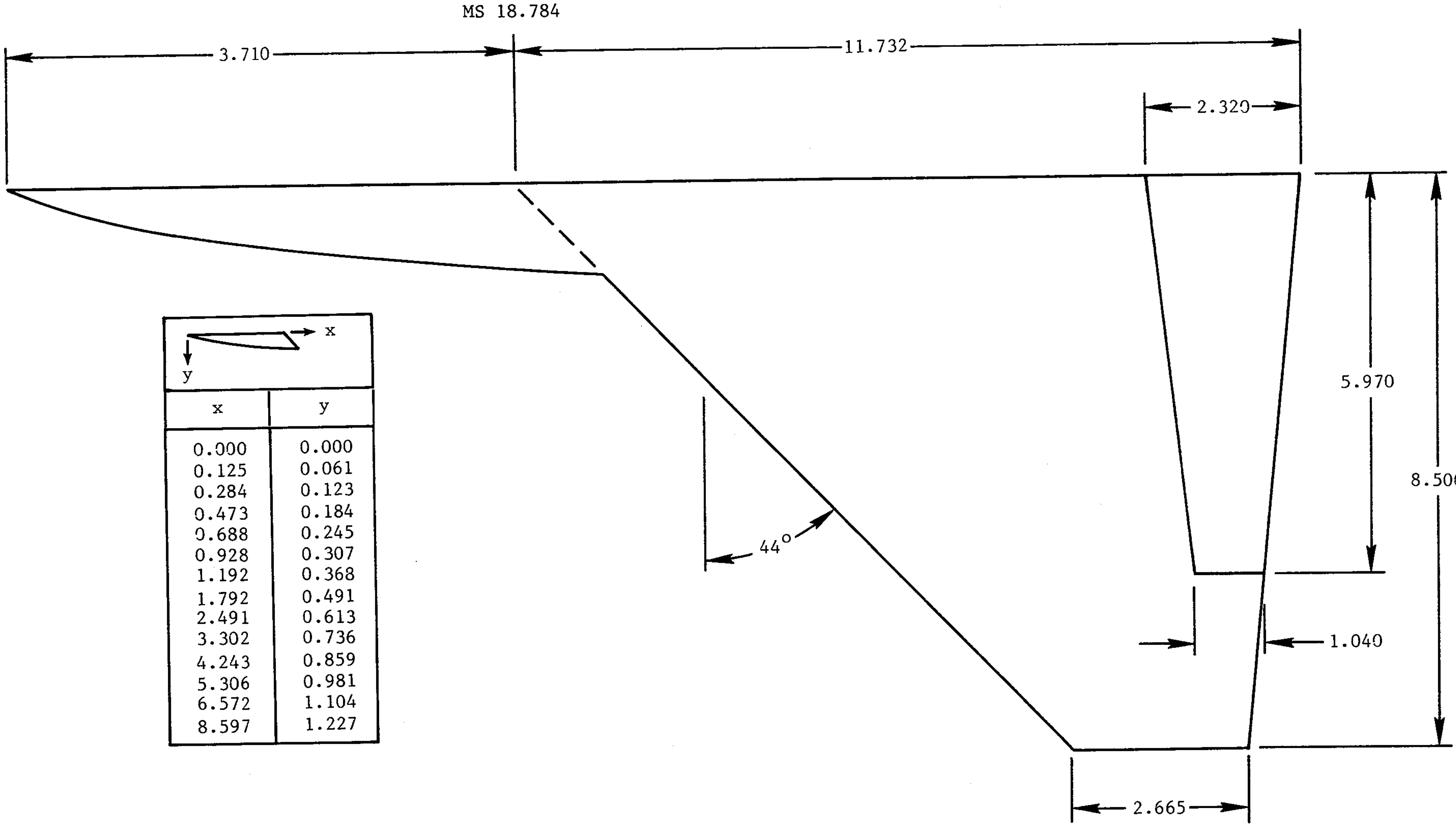


Figure 1.- Component layout of the 44° trapezoidal wing configurations.



x	y
0.000	0.000
0.125	0.061
0.284	0.123
0.473	0.184
0.688	0.245
0.928	0.307
1.192	0.368
1.792	0.491
2.491	0.613
3.302	0.736
4.243	0.859
5.306	0.981
6.572	1.104
8.597	1.227

Figure 2.- Details of the 44° trapezoidal wing and strake. Linear dimensions in inches.

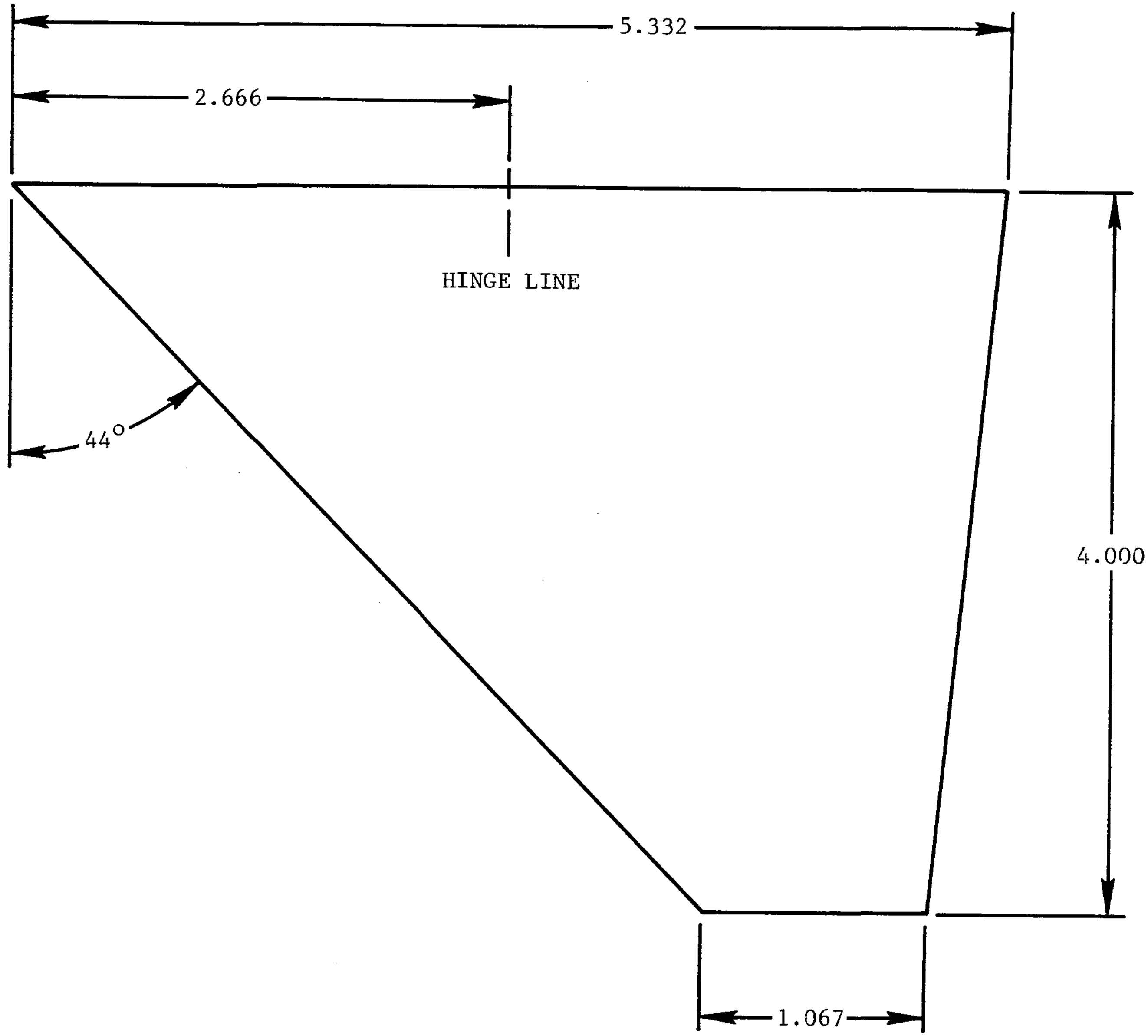


Figure 3.- Details of canard and aft-tail planforms. Linear dimensions in inches.

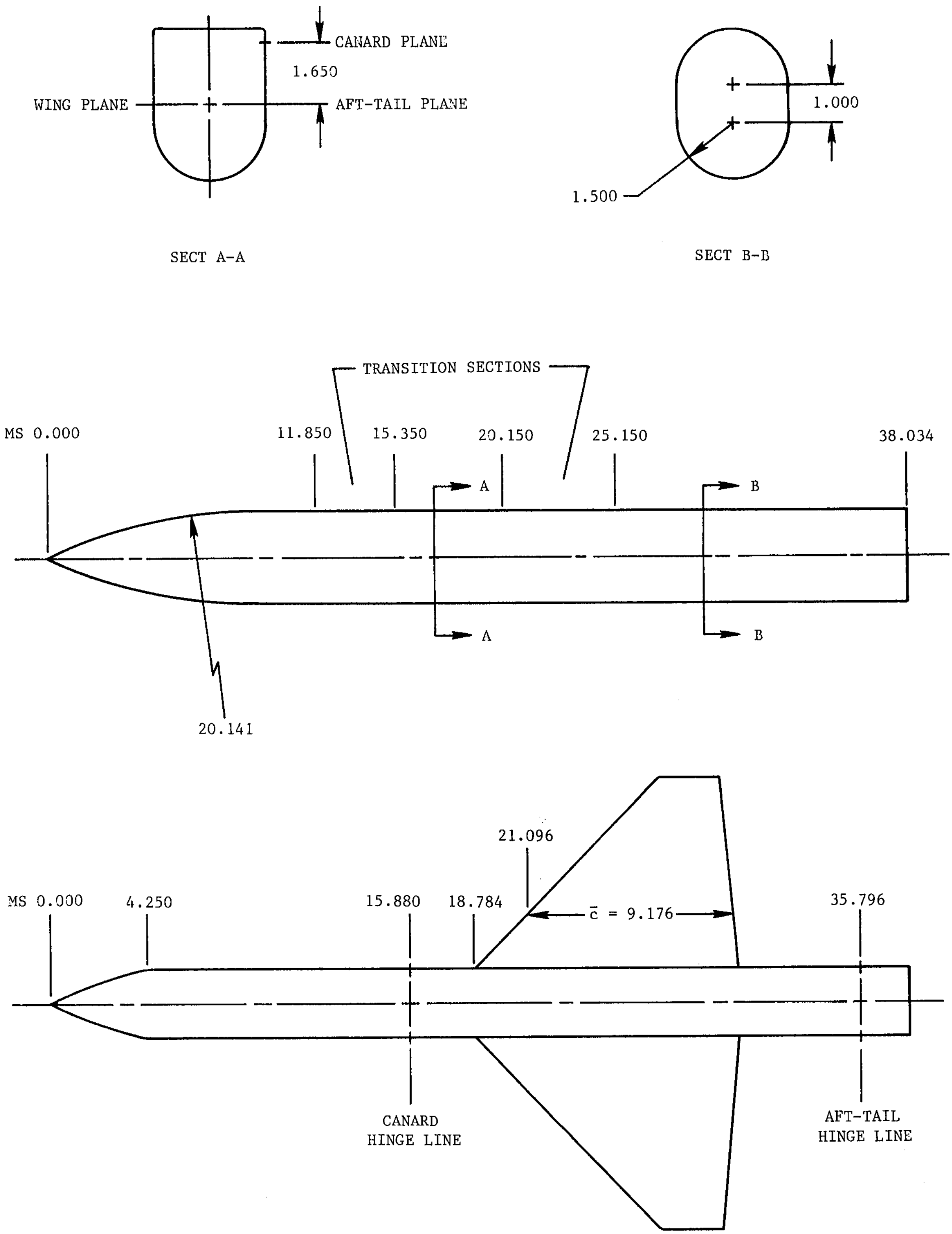


Figure 4.- Fuselage detail for the 44° trapezoidal wing configurations. Linear dimensions in inches.

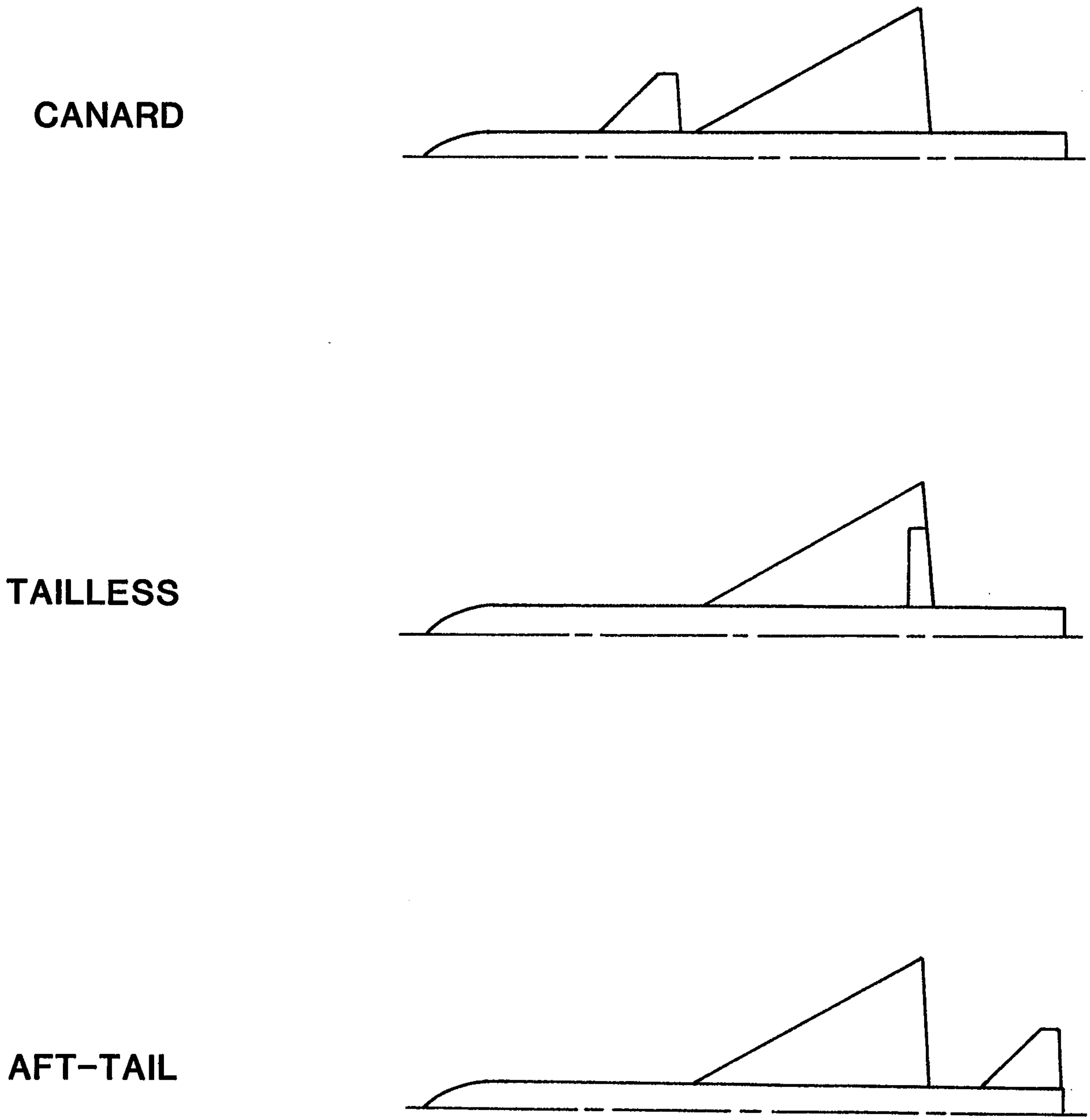


Figure 5.- Component layout of the 60° delta wing configurations.

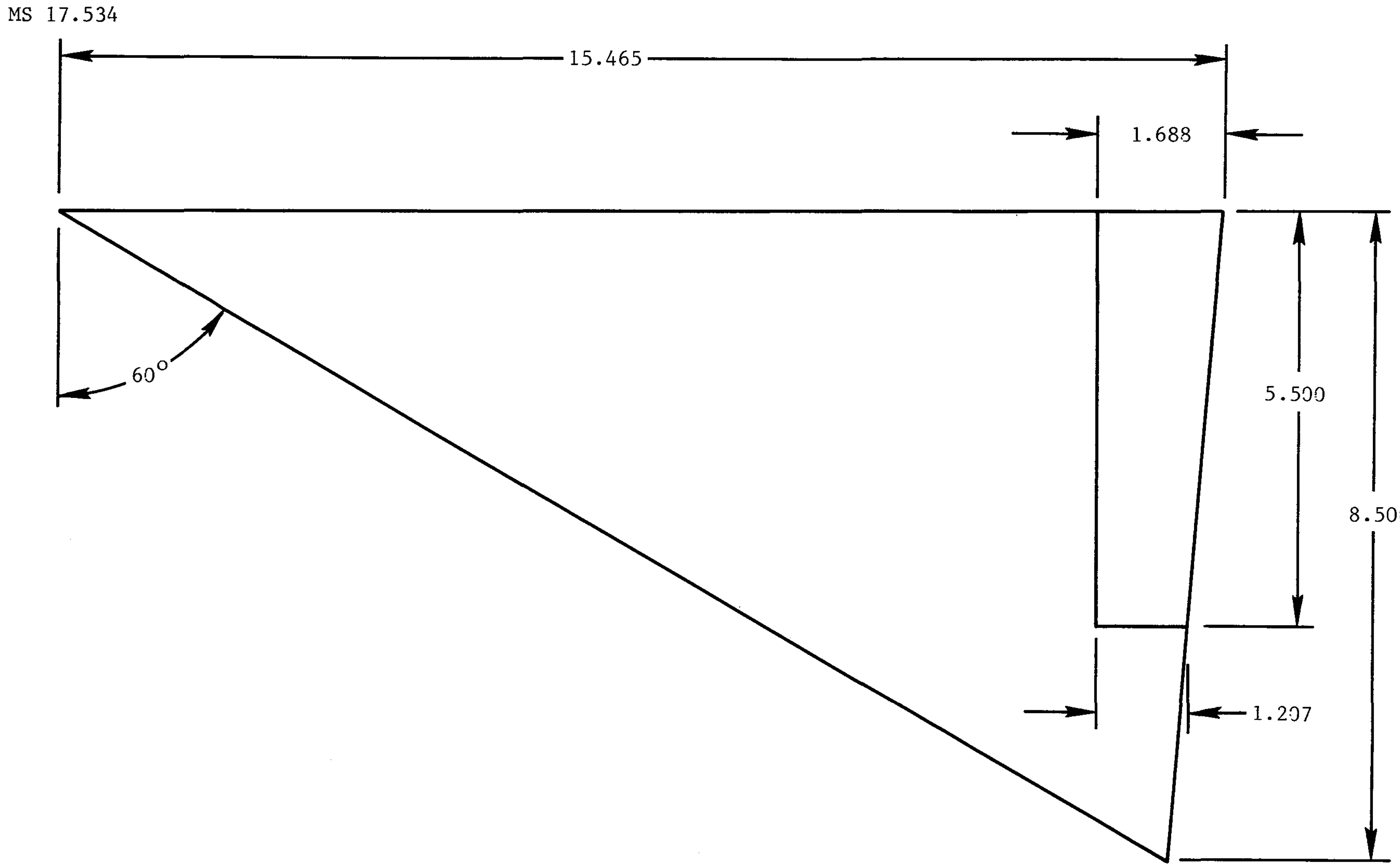


Figure 6.- Details of 60° delta wing. Linear dimensions in inches.

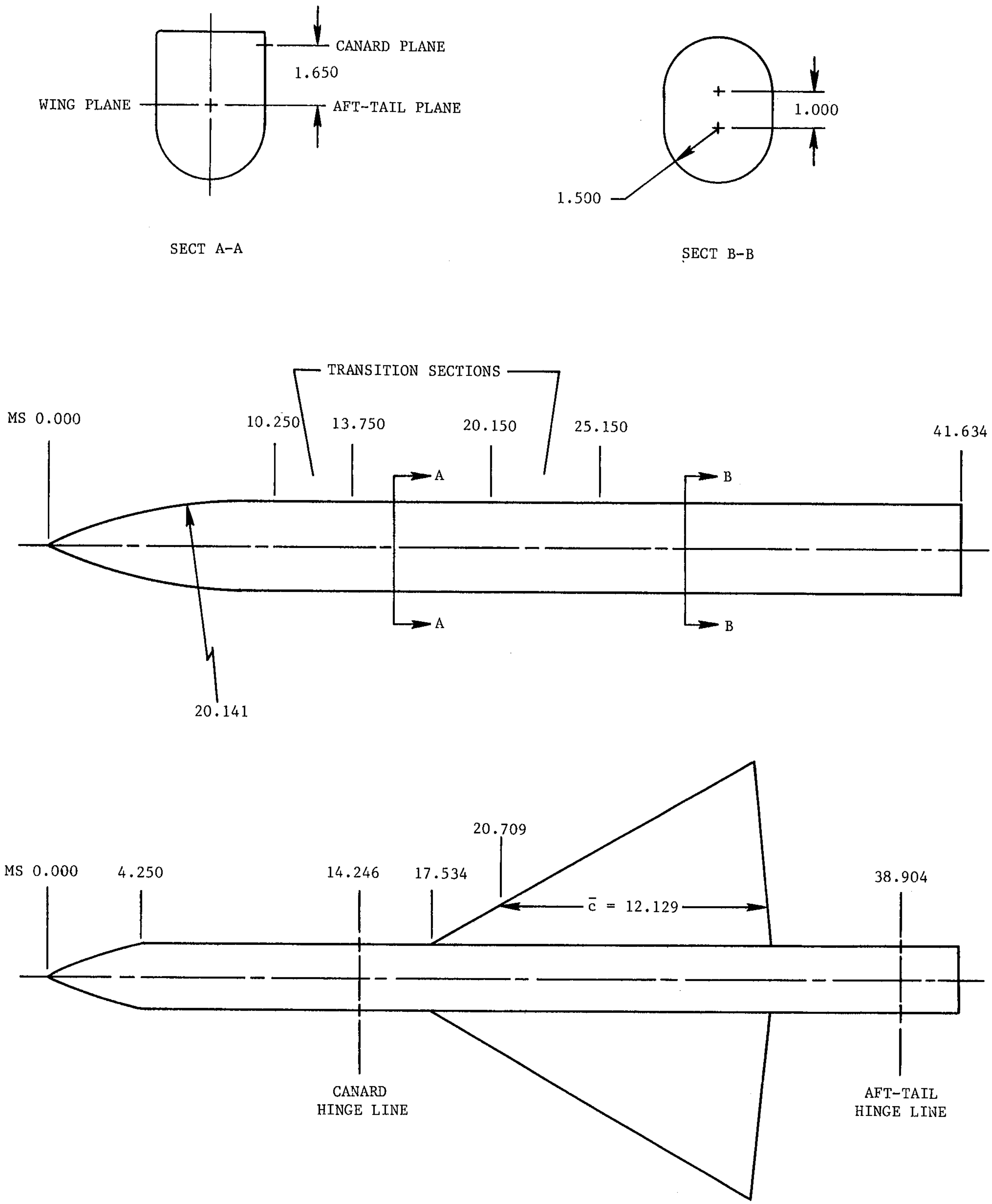


Figure 7.- Fuselage detail for the 60° delta wing configurations. Linear dimensions in inches.

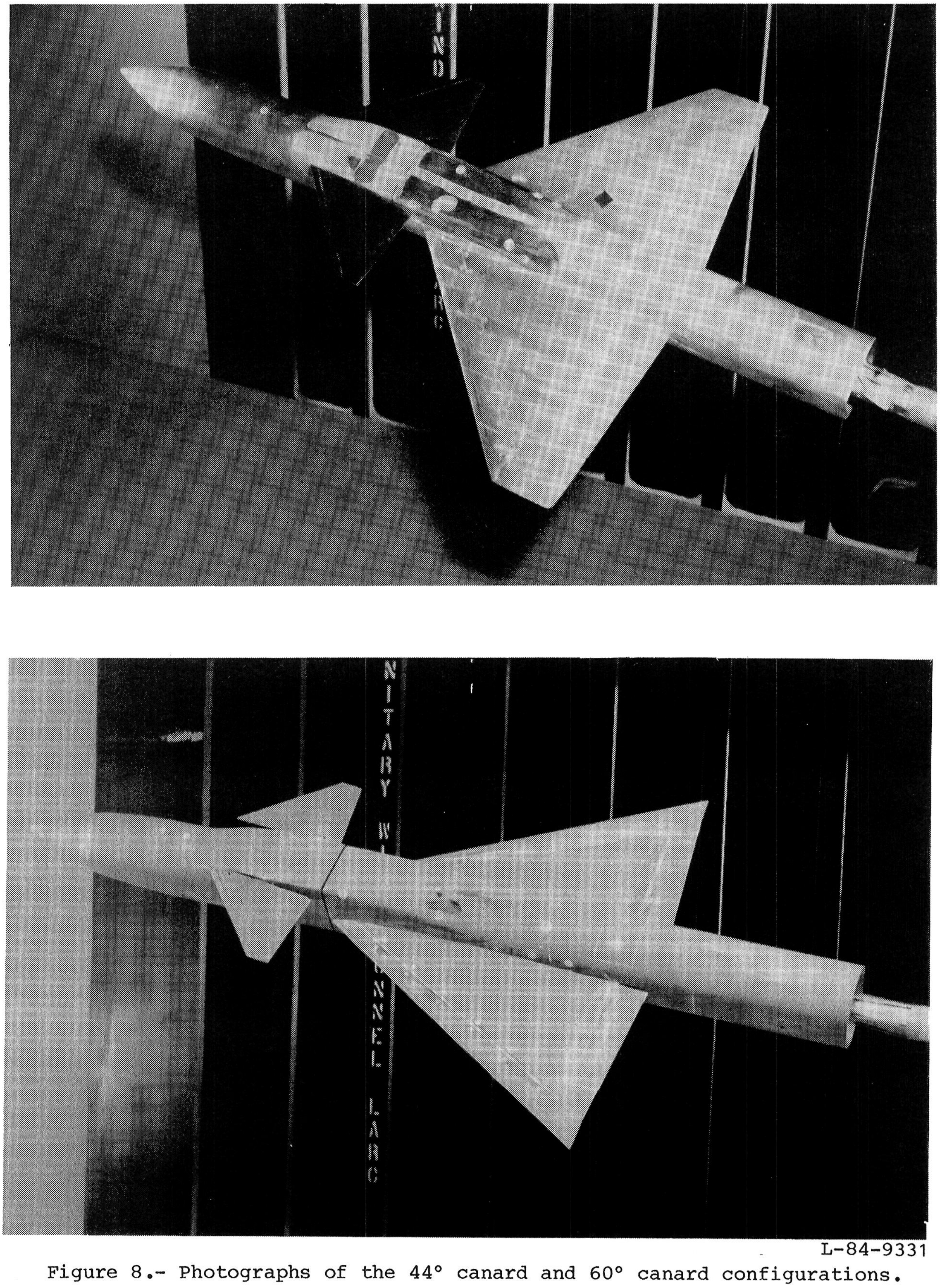


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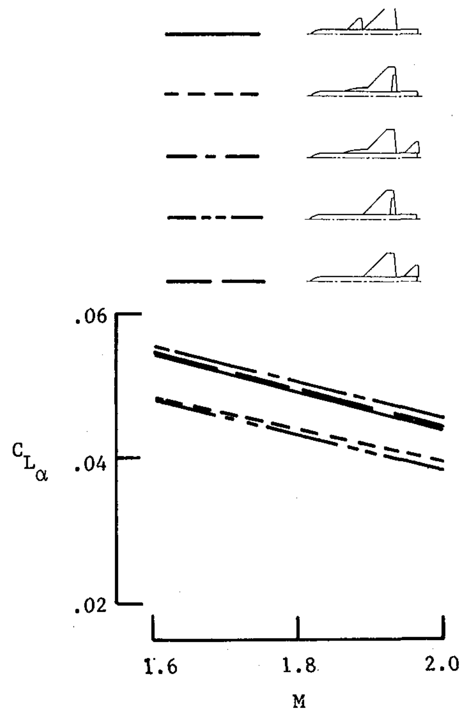
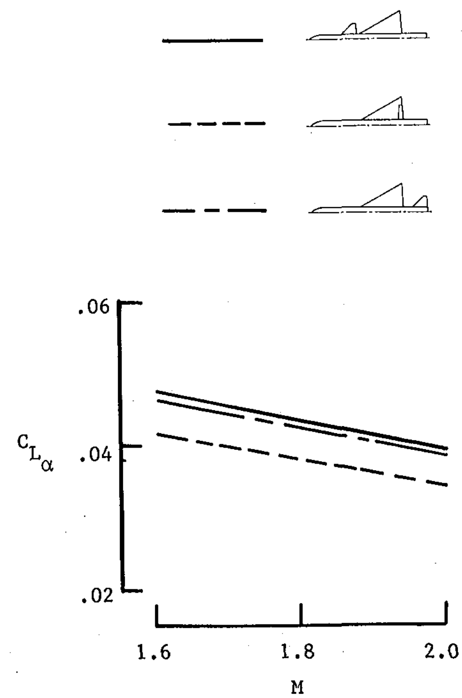
Figure 8.- Photographs of the 44° canard and 60° canard configurations.

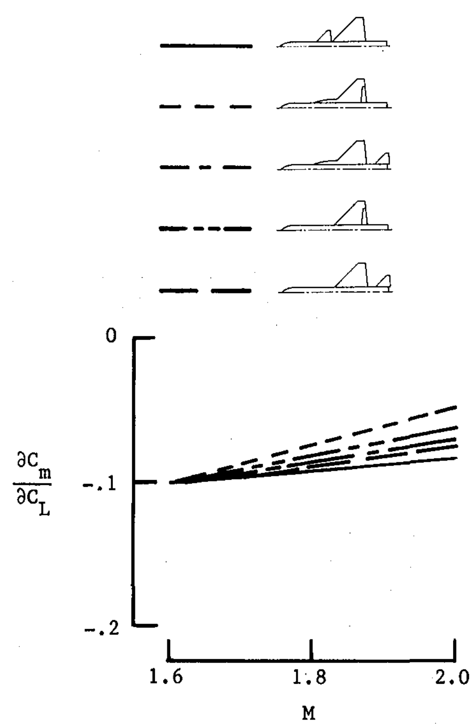


(a) 44° trapezoidal wing.

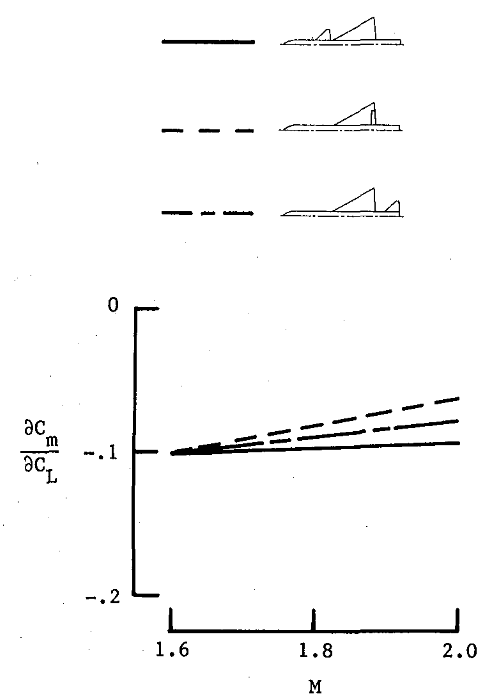


(b) 60° delta wing.

Figure 9.- Effect of configuration and Mach number on lift-curve slope.

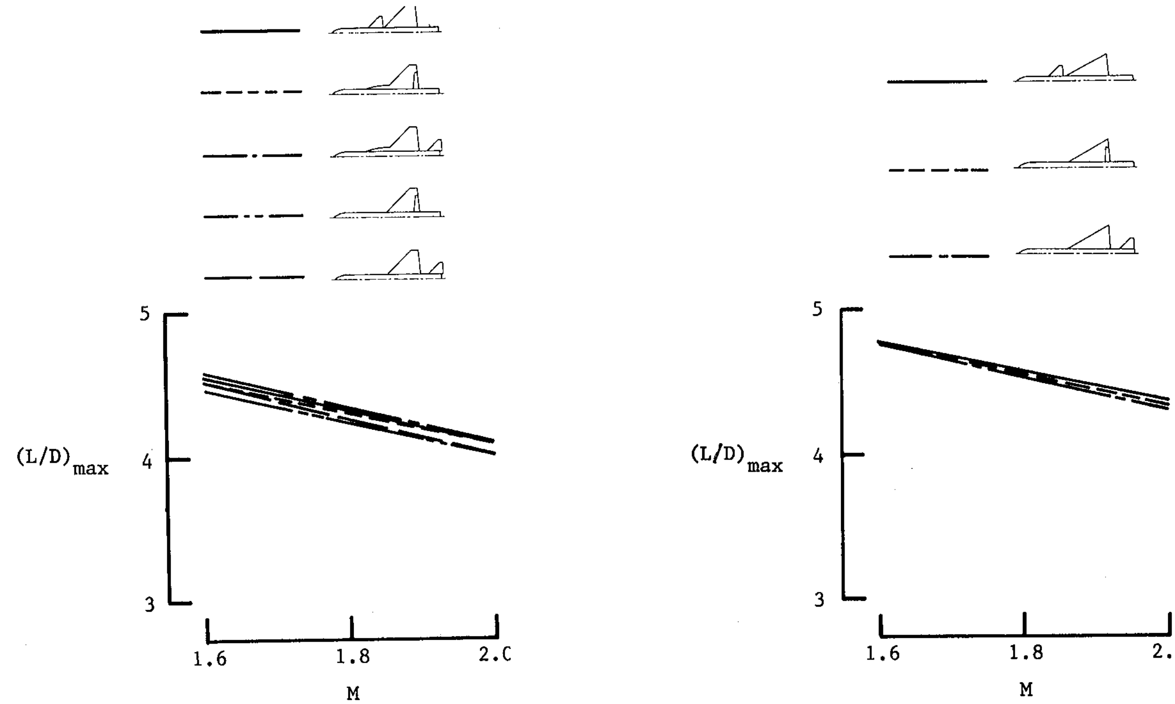


(a) 44° trapezoidal wing.



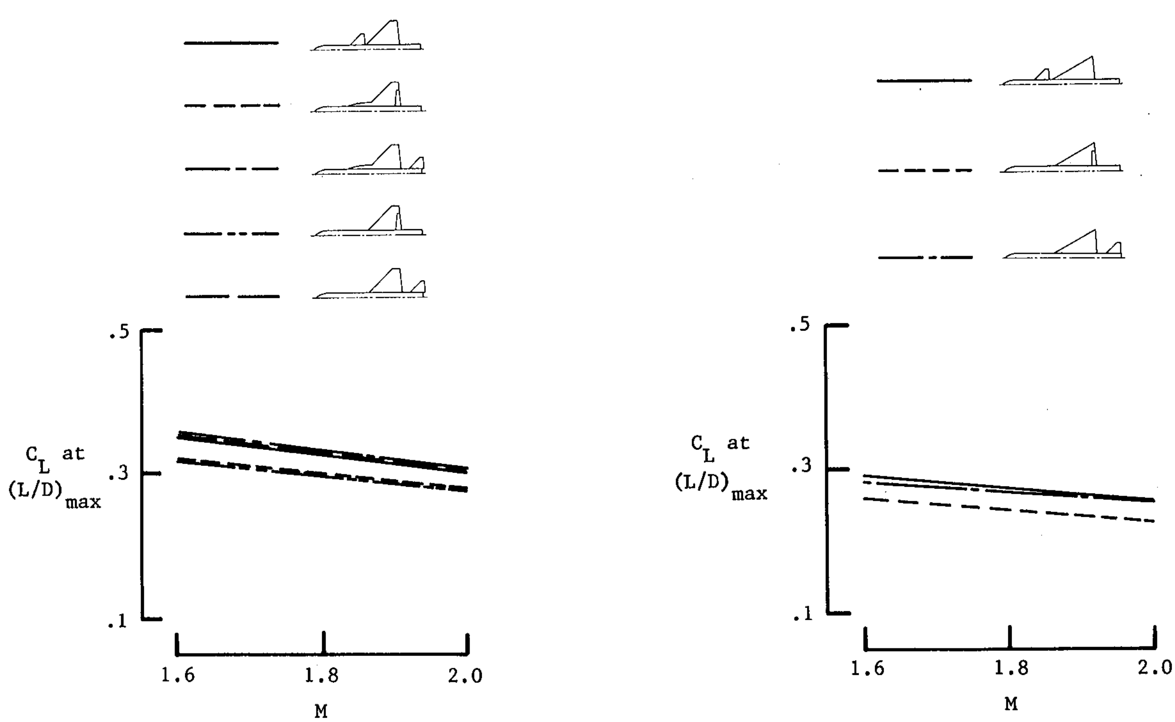
(b) 60° delta wing.

Figure 10.- Effect of configuration and Mach number on longitudinal stability.



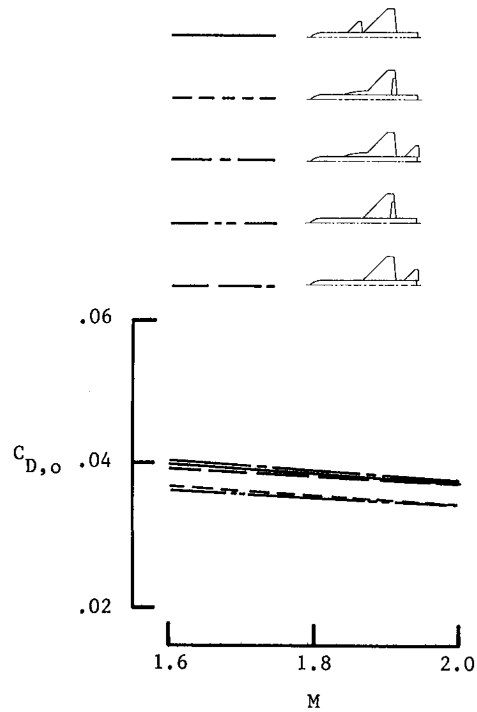
(a) 44° trapezoidal wing. (b) 60° delta wing.

Figure 11.- Effect of configuration and Mach number on maximum lift-drag ratio.

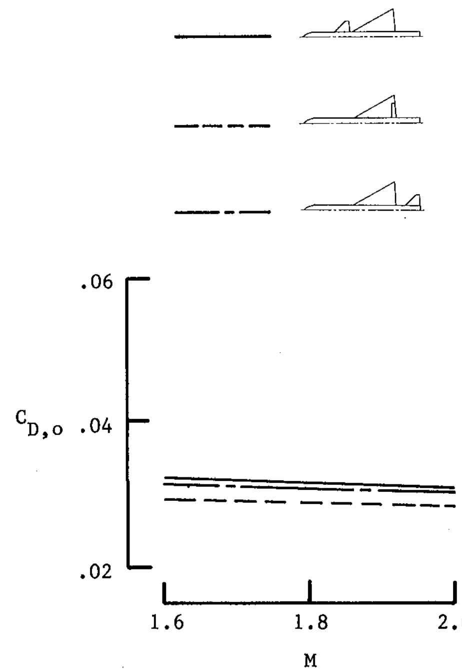


(a) 44° trapezoidal wing. (b) 60° delta wing.

Figure 12.- Effect of configuration and Mach number on lift coefficient at maximum lift-drag ratio.

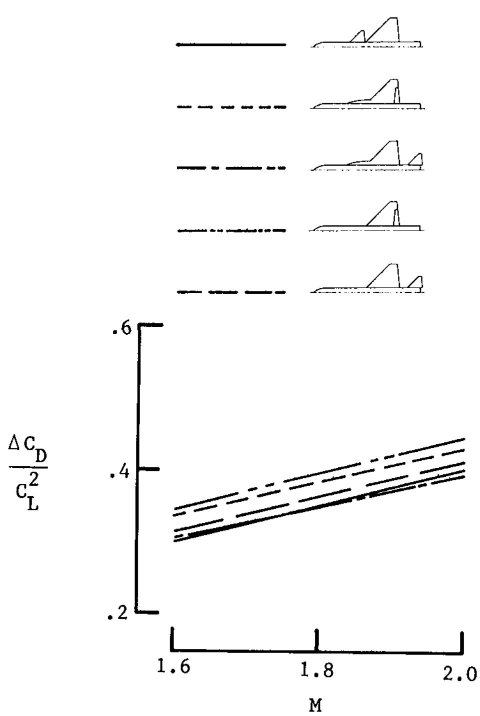


(a) 44° trapezoidal.

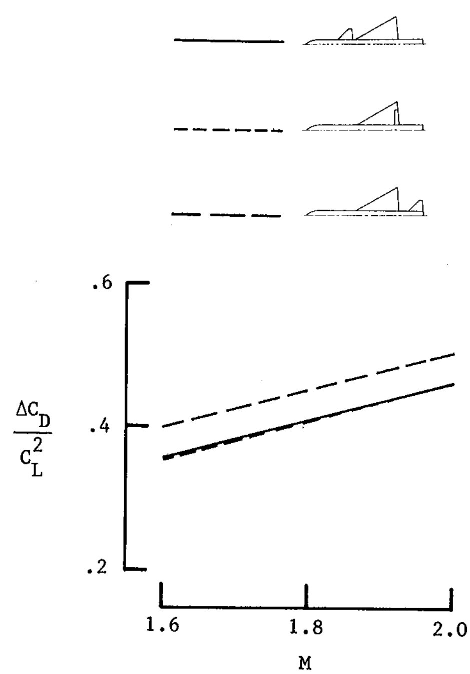


(b) 60° delta wing.

Figure 13.- Effect of configuration and Mach number on zero-lift drag.

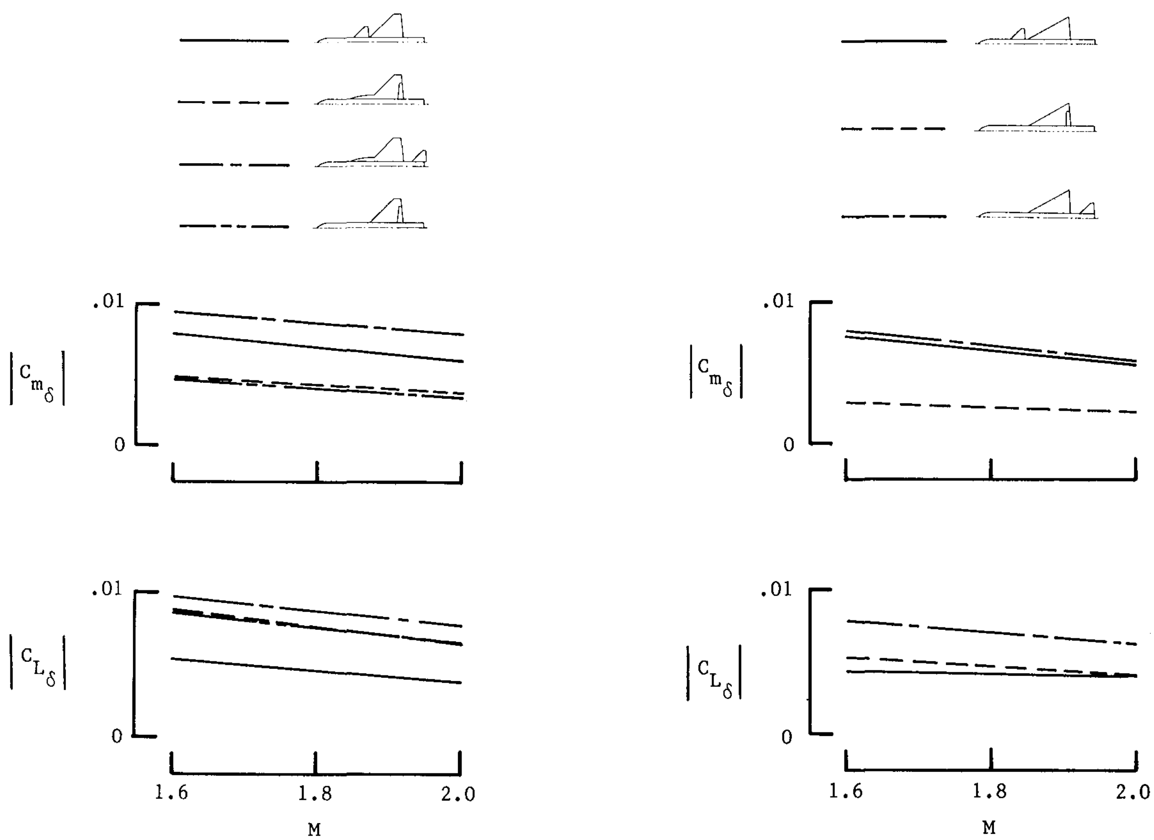


(a) 44° trapezoidal wing.



(b) 60° delta wing.

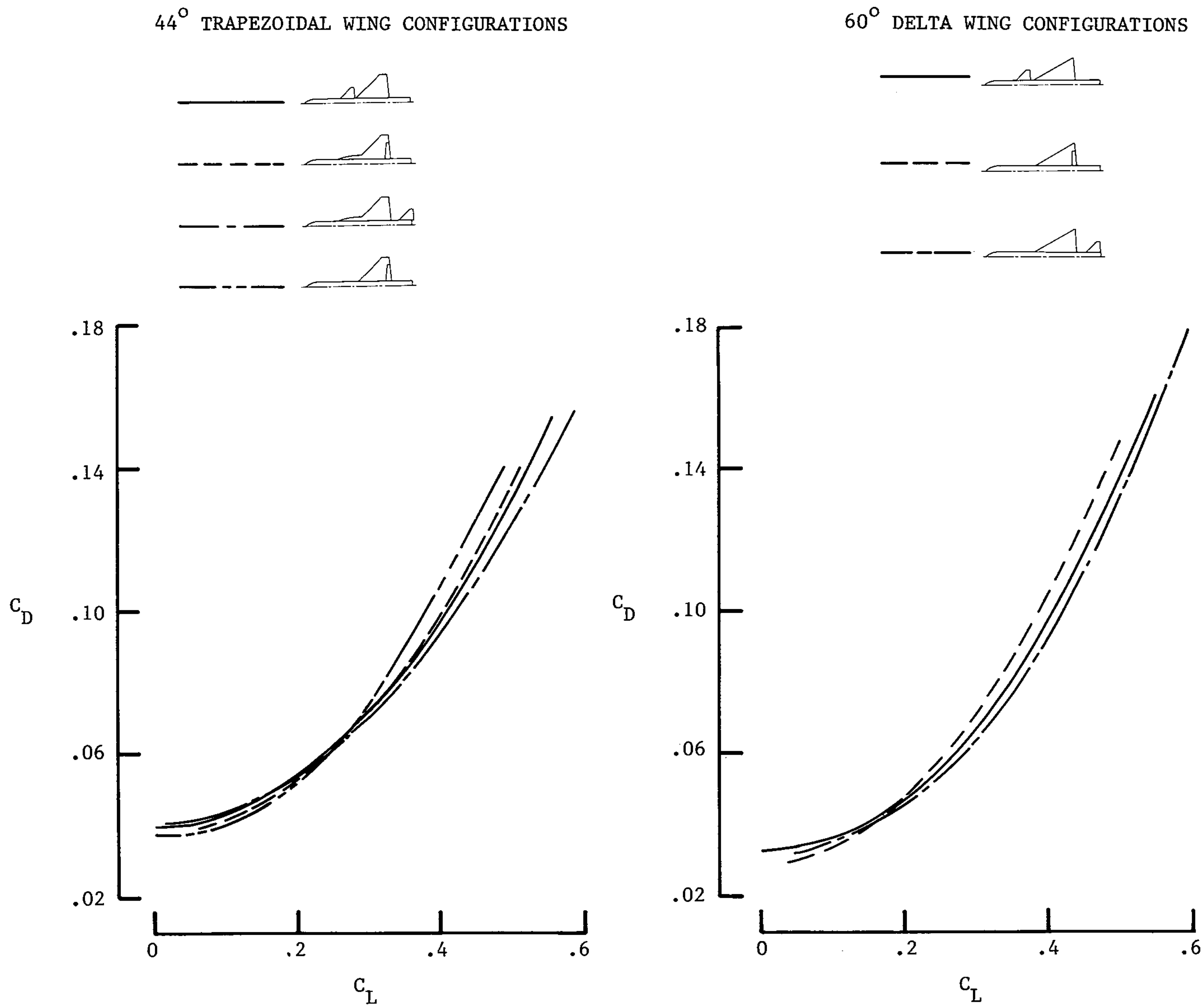
Figure 14.- Effect of configuration and Mach number on the drag-due-to-lift factor.



(a) 44° trapezoidal wing.

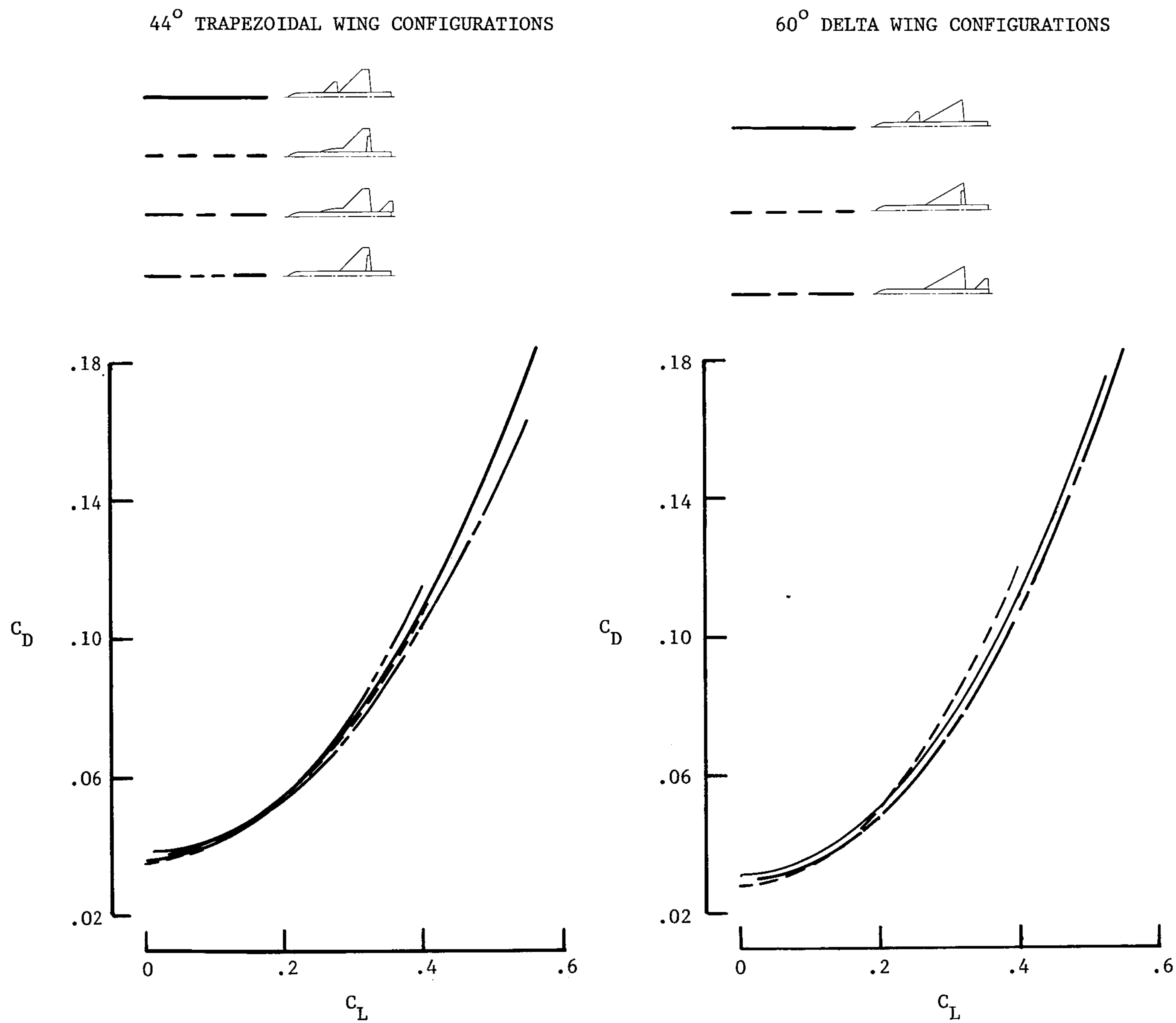
(b) 60° delta wing.

Figure 15.- Effect of configuration control surface and Mach number on pitching effectiveness and lift effectiveness.



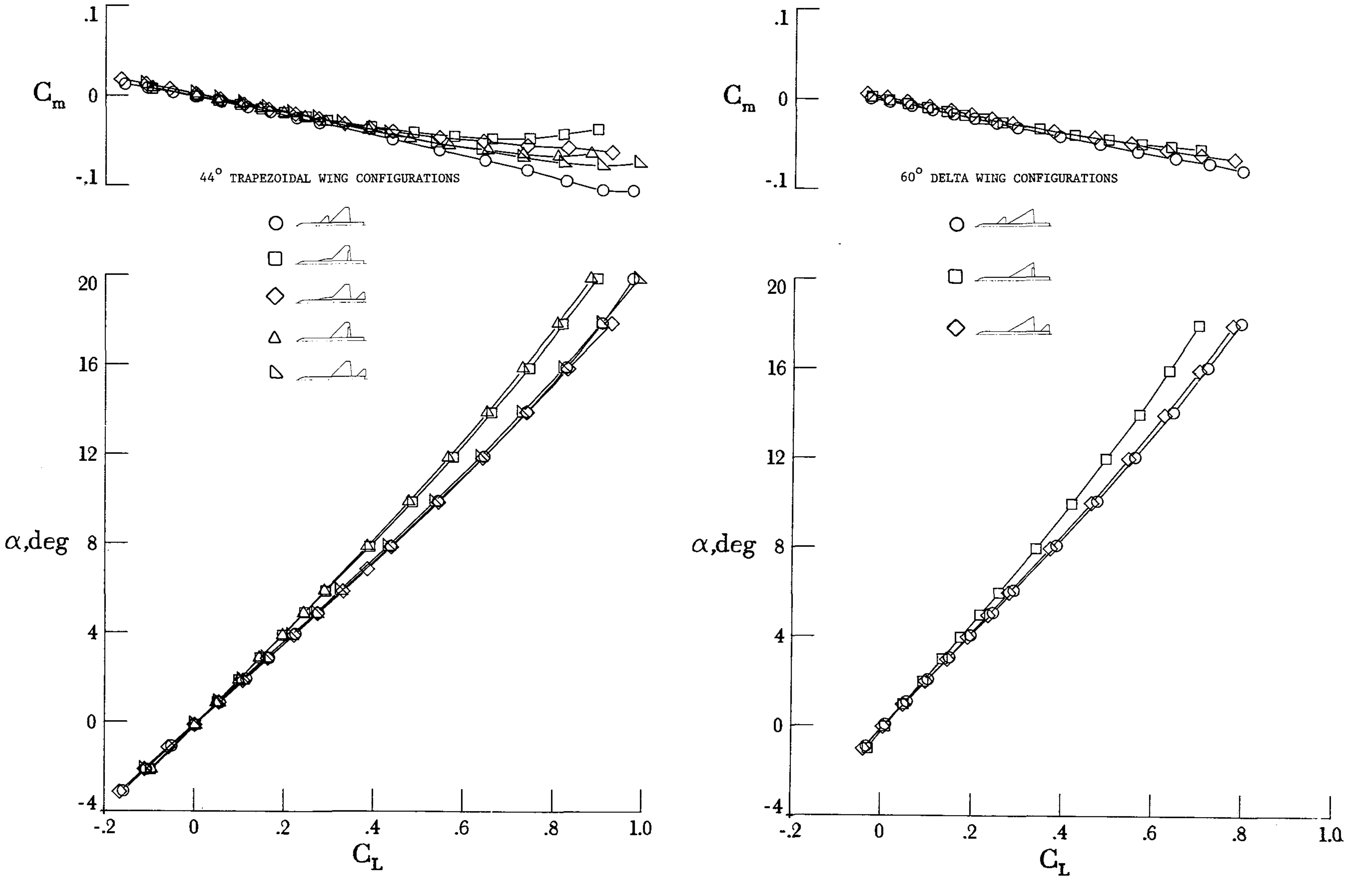
(a) M = 1.60.

Figure 16.- Effect of configuration on trimmed drag characteristics.



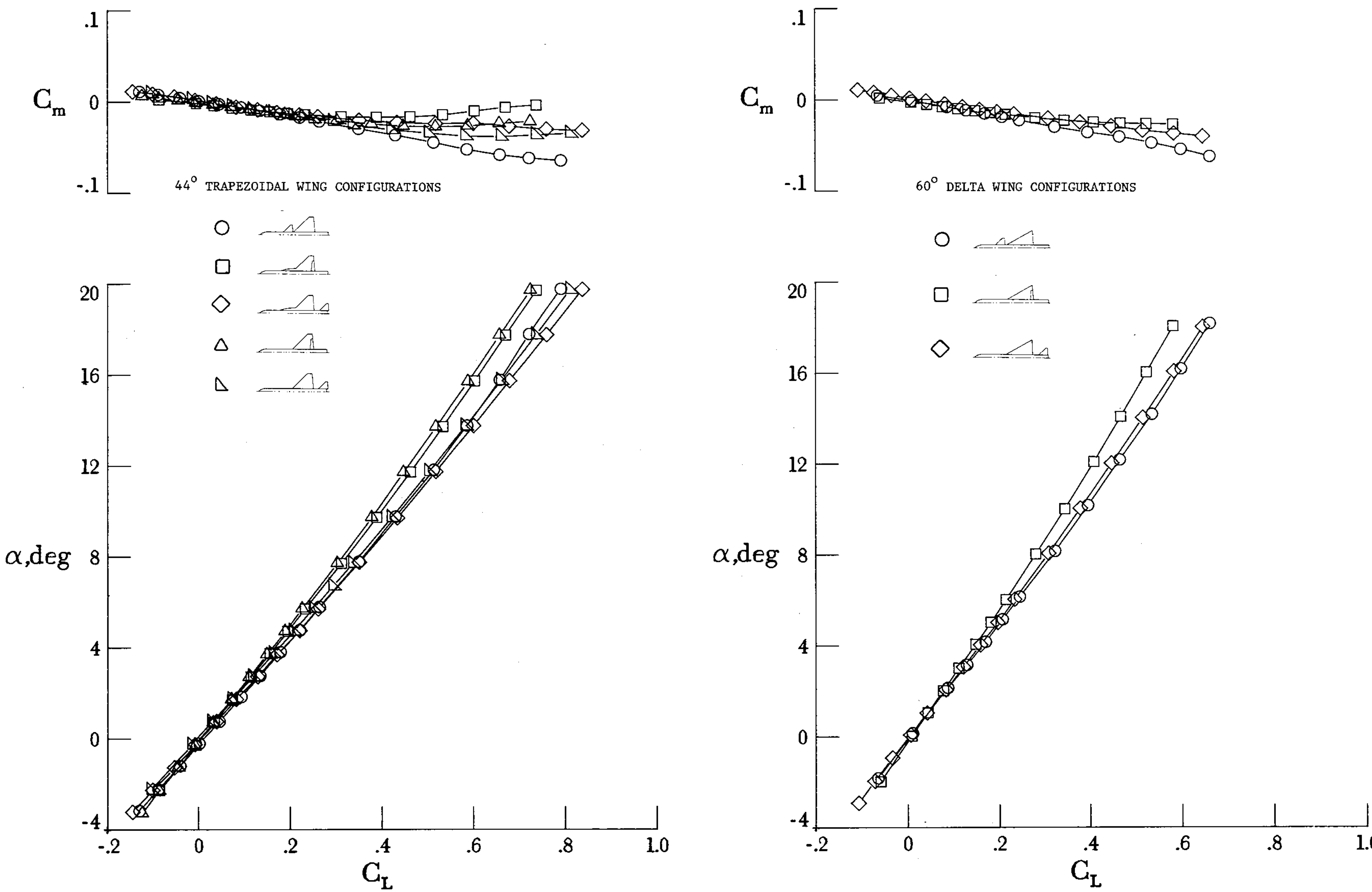
(b) M = 2.00.

Figure 16.- Concluded.



(a) M = 1.60.

Figure 17.- Effect of configuration on pitching moment and lift characteristics.



(b) M = 2.00.

Figure 17.- Concluded.

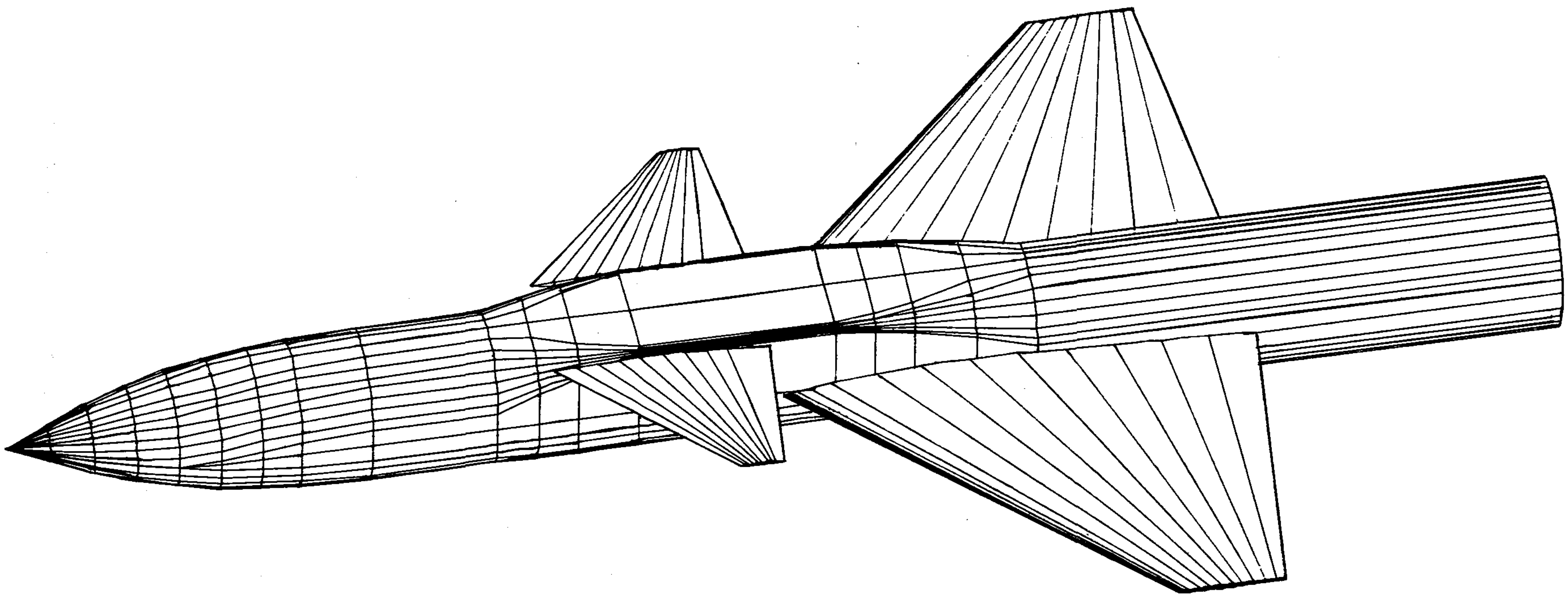


Figure 18.- Input geometry for the 44° canard configuration.

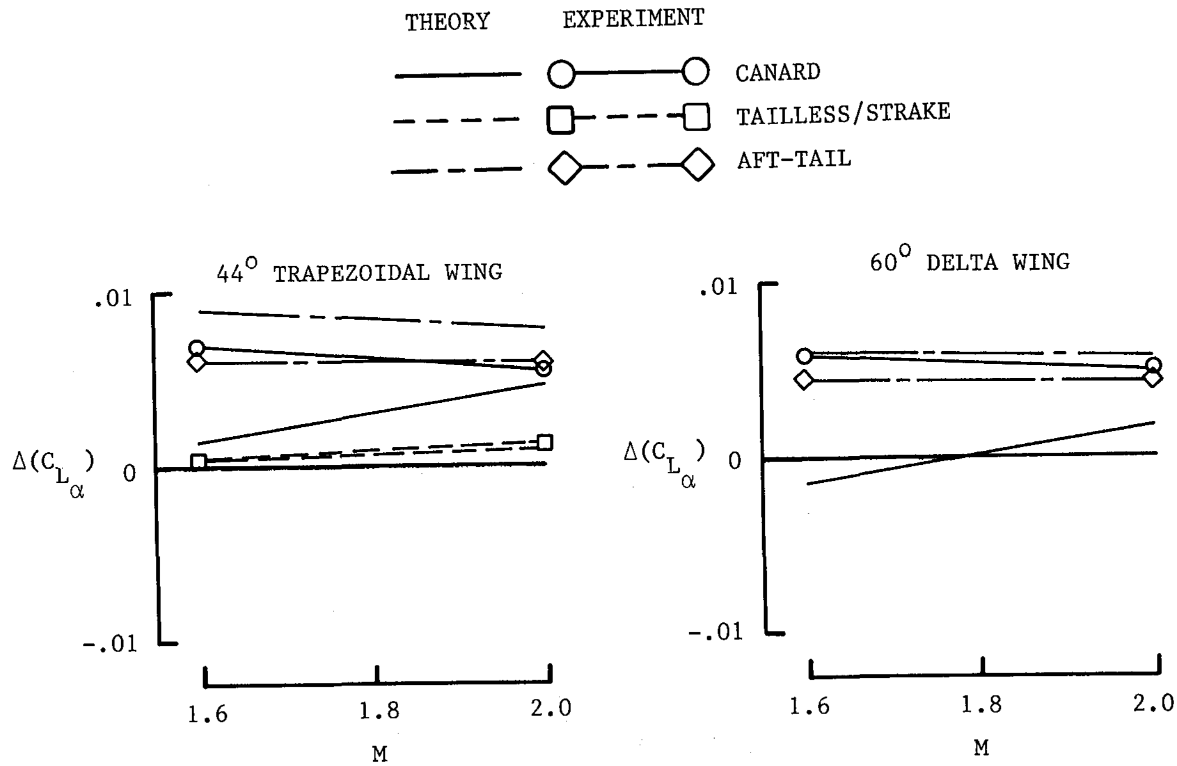


Figure 19.- Theoretical and experimental lift-curve slope increments based on the tailless configuration.

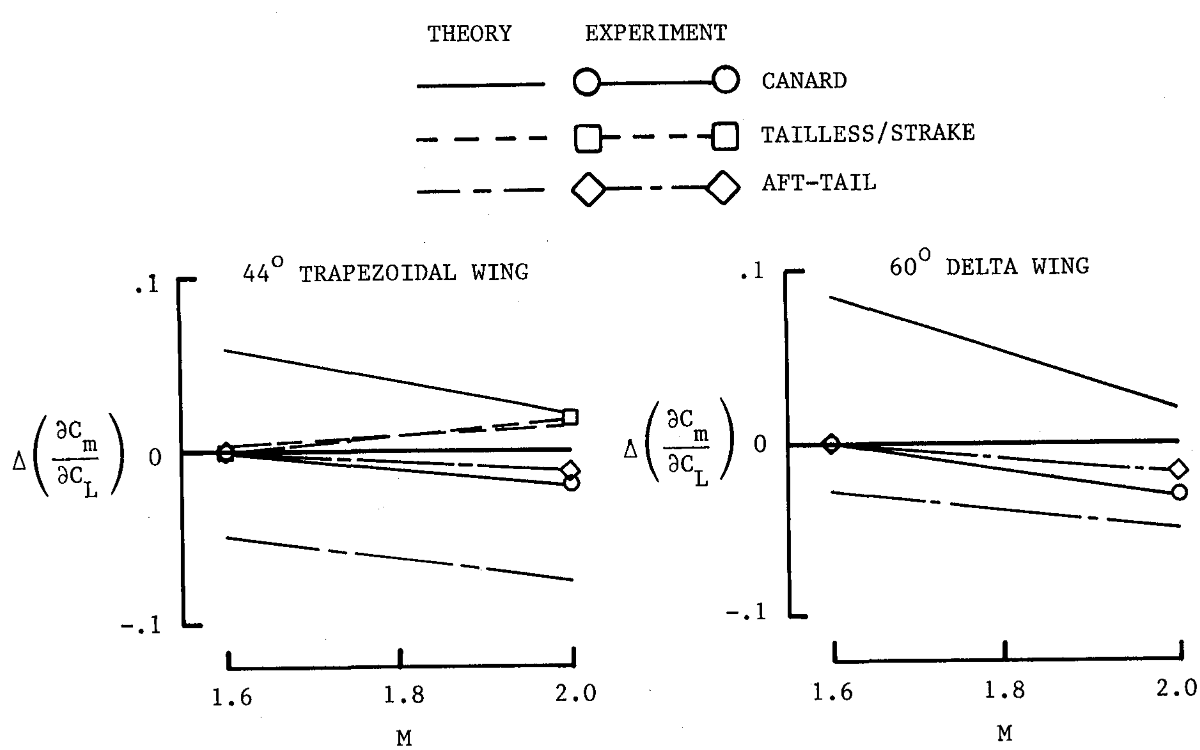


Figure 20.- Theoretical and experimental stability increments based on the tailless configuration.

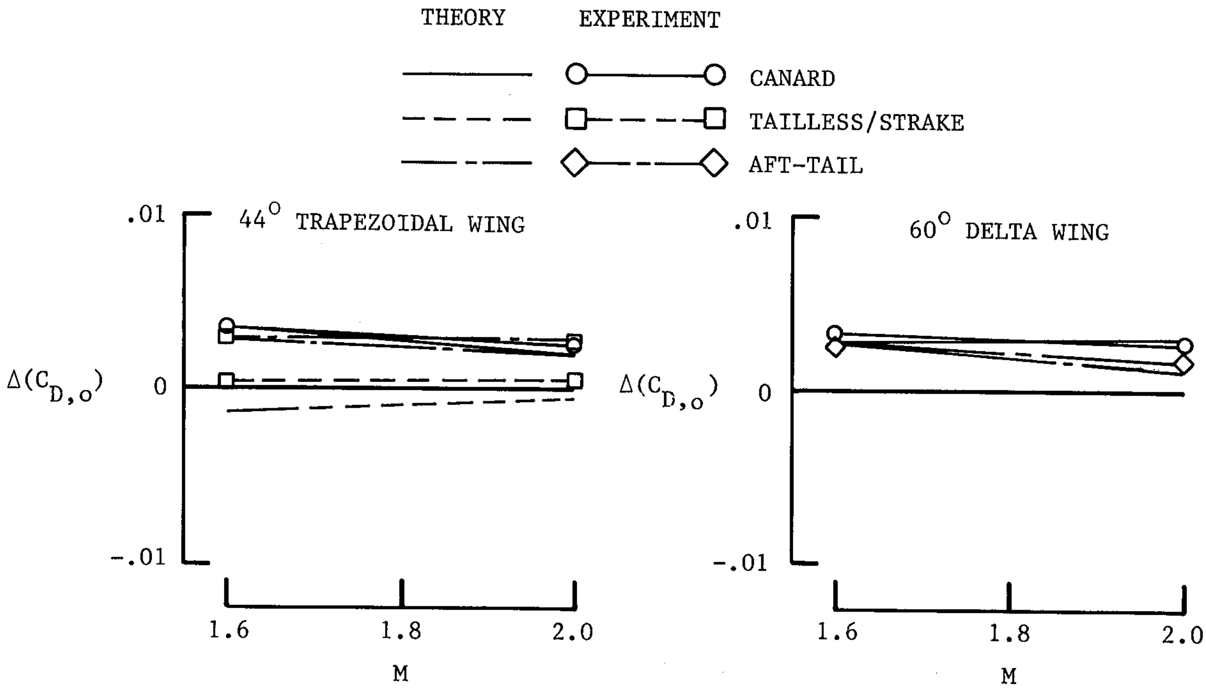


Figure 21.- Theoretical and experimental zero-lift drag increments based on the tailless configuration.

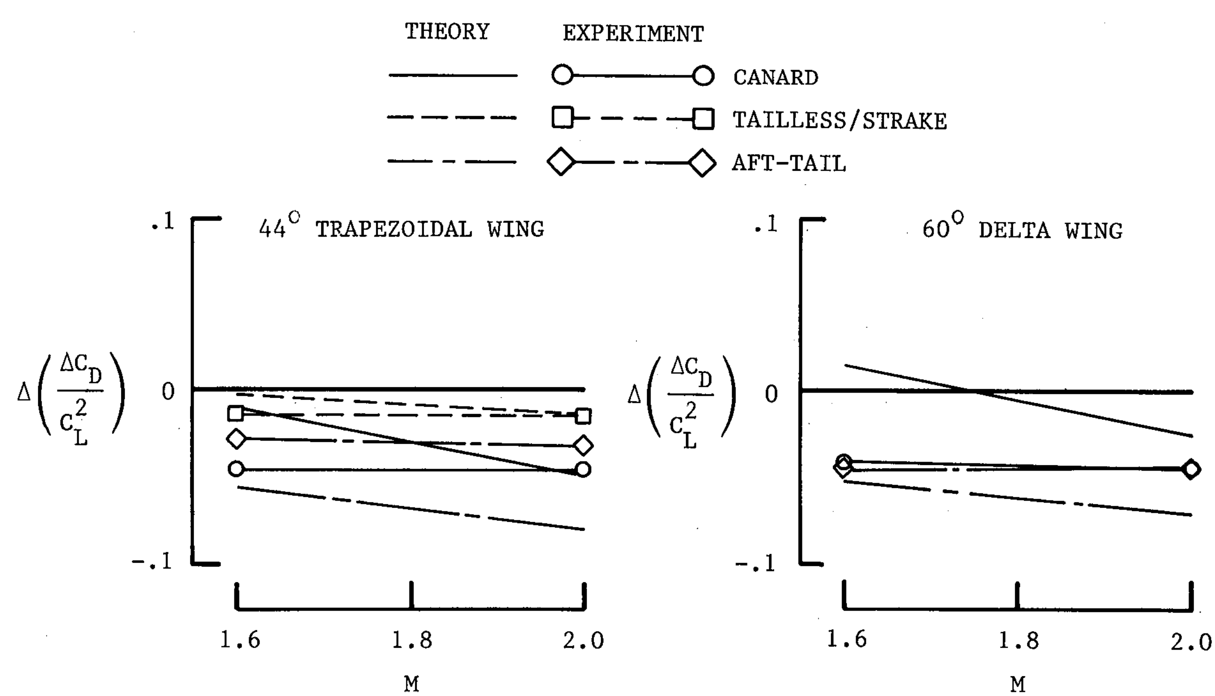


Figure 22.- Theoretical and experimental drag-due-to-lift factor increments based on the tailless configuration.

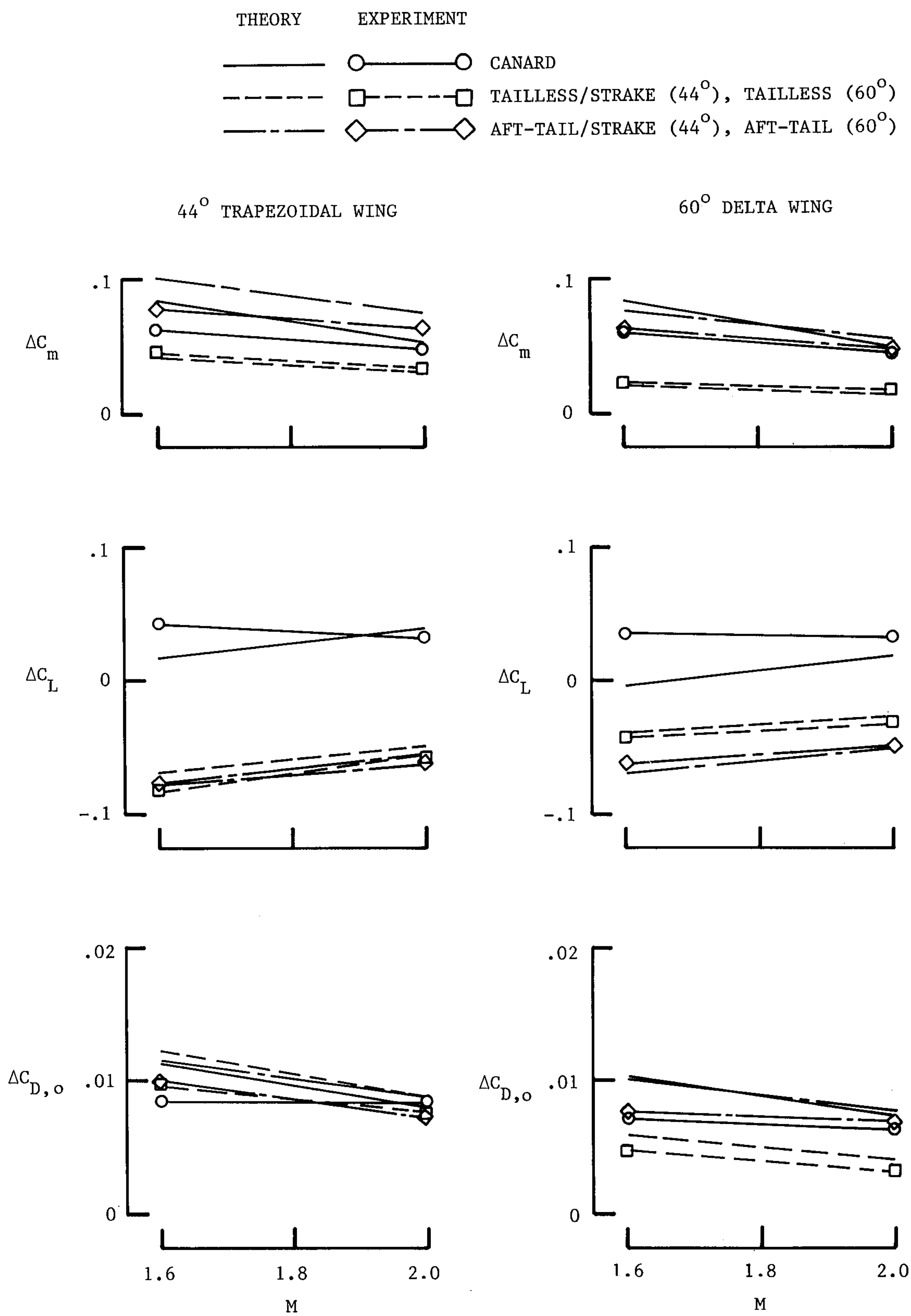


Figure 23.- Theoretical and experimental pitching-moment, lift, and drag increments due to control surface deflection.

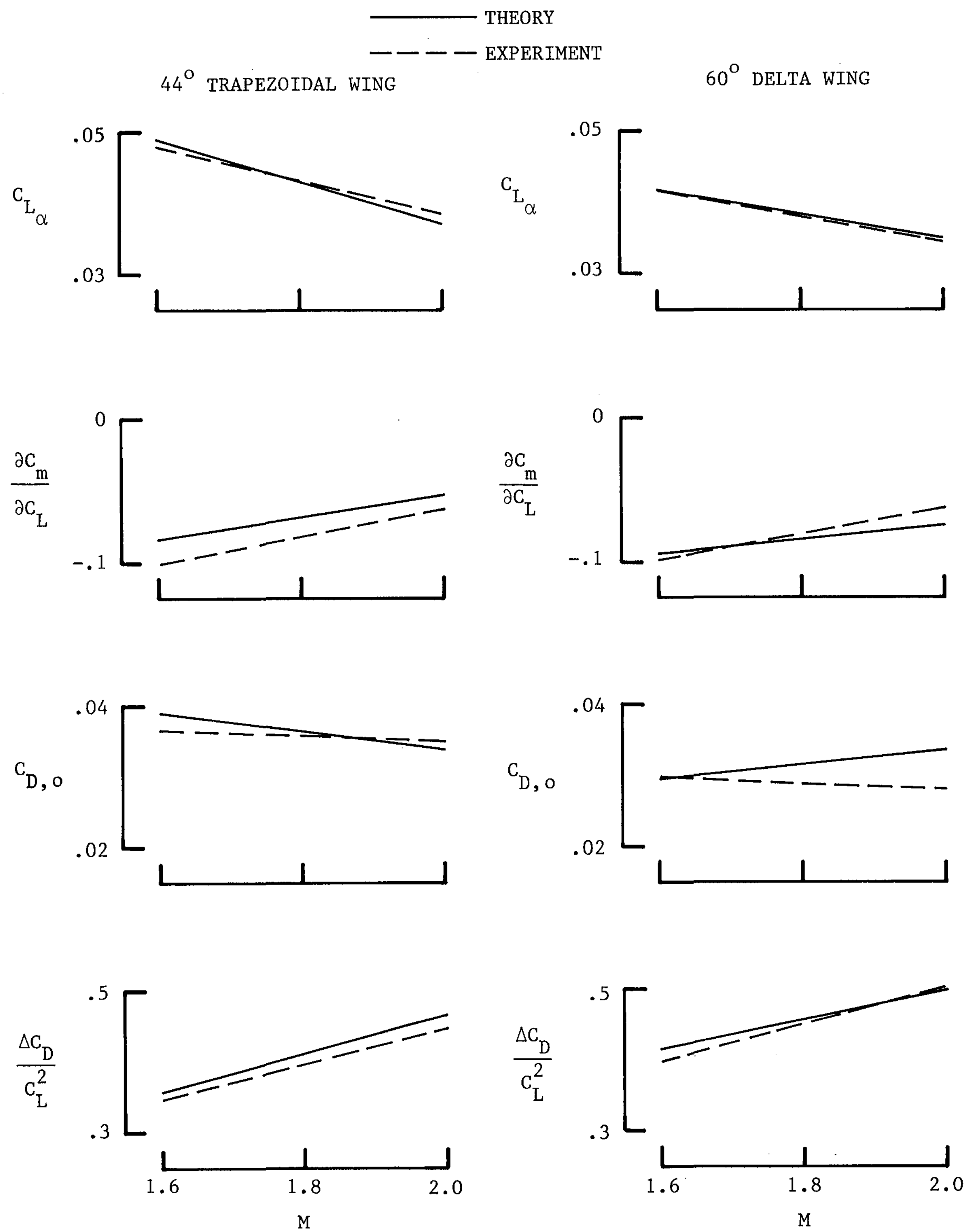


Figure 24.- Theoretical and experimental levels of lift-curve slope, stability, zero-lift drag, and drag-due-to-lift factor for the tailless configuration.

APPENDIX A

TABULATED DATA FOR THE 44° TRAPEZOIDAL WING CONFIGURATIONS

Table AI gives the symbols corresponding to the column headings which appear on the tabulated data. Table AII is an index to the tabulated data (UPWT Project 1414), which are presented in table AIII.

TABLE AI.- TABULATED DATA SYMBOLS

Tabulated data heading	Definition
ALPHA	α
BETA	β
CA	C_A
CD	C_D
CDC	$C_{D,c}$
CD UNC	$C_D + C_{D,c}$
CL	C_L
CM	C_m
CN	C_N
L/D	L/D
MACH	M
R/FT	$R \times 10^{-6}$

TABLE AII.- INDEX TO TABULATED DATA

[UPWT Project 1414]

Run	Configuration	δ, deg	M
4	44° Tailless	0	1.60
5	44° Tailless	0	2.00
8	44° Canard	0	1.60
12		0	2.00
14		5	1.60
16		5	2.00
18		-5	1.60
20		-5	2.00
22		10	1.60
24		10	2.00
26	44° Aft-tail/strake	0	1.60
30	44° Aft-tail/strake	0	2.00
39	44° Tailless/strake	0	1.60
41	44° Tailless/strake	0	2.00
43	44° Aft-tail/strake	-10	1.60
45		-10	2.00
50		-5	1.60
52		-5	2.00
54	44° Aft-Tail	0	1.60
56	44° Aft-Tail	0	2.00
74	44° Tailless	-4	1.60
75	44° Tailless	-4	2.00
76	44° Tailless/strake	-4	1.60
77		-4	2.00
78		4	1.60
79		4	2.00
80	44° Tailless	4	1.60
81		4	2.00
82		-12	1.60
83		-12	2.00
84	44° Tailless/strake	-12	1.60
85	44° Tailless/strake	-12	2.00

TABLE AIII.- FORCE AND MOMENT DATA FOR 44° TRAPEZOIDAL WING CONFIGURATIONS

UPWT PROJECT 1414 RUN 4 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.008	.01	-4.13	-.1905	.0487	.0172	-3.9118	.0085	.0572	-.1935	.0348
2.007	.00	-2.13	-.0938	.0393	.0085	-2.3885	.0069	.0462	-.0951	.0357
2.005	.00	-.14	.0024	.0363	-.0005	.0671	.0058	.0421	.0023	.0363
2.006	.00	.85	.0481	.0370	-.0048	1.3003	.0060	.0430	.0486	.0363
2.005	.00	1.87	.0990	.0395	-.0095	2.5062	.0068	.0463	.1002	.0363
2.006	.00	2.86	.1450	.0435	-.0141	3.3300	.0078	.0513	.1469	.0362
2.006	.01	3.87	.1974	.0494	-.0193	3.9994	.0092	.0585	.2003	.0359
2.006	.01	4.86	.2444	.0566	-.0238	4.3163	.0102	.0668	.2483	.0357
2.005	.01	5.87	.2918	.0656	-.0288	4.4473	.0109	.0766	.2970	.0354
2.006	.01	7.87	.3871	.0885	-.0382	4.3758	.0122	.1007	.3956	.0347
2.006	.01	9.88	.4790	.1178	-.0471	4.0655	.0130	.1309	.4922	.0339
2.006	.01	11.85	.5669	.1529	-.0547	3.7083	.0137	.1666	.5862	.0332
2.001	.01	13.88	.6536	.1949	-.0599	3.3541	.0140	.2089	.6813	.0323
2.006	.01	15.86	.7331	.2405	-.0644	3.0479	.0144	.2550	.7710	.0310
2.006	.01	17.87	.8111	.2924	-.0668	2.7741	.0147	.3071	.8617	.0294
2.005	.02	19.87	.8857	.3498	-.0639	2.5323	.0148	.3646	.9518	.0279
2.005	.00	-.14	.0031	.0368	.0001	.0836	.0057	.0426	.0030	.0368

UPWT PROJECT 1414 RUN 5 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.999	.02	-5.25	-.2027	.0532	.0110	-3.8108	.0108	.0640	-.2068	.0344
2.000	.02	-4.28	-.1641	.0470	.0087	-3.4906	.0106	.0576	-.1672	.0346
1.999	.02	-3.27	-.1235	.0419	.0065	-2.9474	.0102	.0521	-.1256	.0348
2.000	.02	-2.28	-.0862	.0384	.0039	-2.2453	.0098	.0482	-.0876	.0349
2.000	.02	-1.26	-.0448	.0359	.0016	-1.2476	.0092	.0452	-.0456	.0349
2.000	.02	-.27	-.0075	.0349	-.0008	-.2136	.0085	.0434	-.0076	.0349
2.000	.02	.72	.0323	.0354	-.0030	.9119	.0086	.0440	.0328	.0350
2.000	.02	1.74	.0721	.0372	-.0055	1.9392	.0091	.0463	.0732	.0350
1.999	.02	2.72	.1106	.0403	-.0079	2.7455	.0095	.0498	.1124	.0350
2.000	.02	3.72	.1496	.0449	-.0103	3.3347	.0098	.0547	.1522	.0351
1.999	.02	4.73	.1892	.0508	-.0130	3.7261	.0101	.0609	.1928	.0350
1.999	.02	5.73	.2265	.0579	-.0153	3.9130	.0103	.0682	.2312	.0350
2.000	.02	7.73	.3030	.0762	-.0202	3.9765	.0107	.0869	.3105	.0347
1.999	.02	9.75	.3777	.1000	-.0241	3.7791	.0112	.1112	.3892	.0346
2.001	.02	11.73	.4477	.1277	-.0265	3.5073	.0118	.1395	.4643	.0340
1.999	.02	13.72	.5184	.1606	-.0271	3.2276	.0123	.1730	.5417	.0331
1.999	.03	15.71	.5886	.1989	-.0263	2.9594	.0124	.2113	.6205	.0321
1.999	.03	17.75	.6579	.2435	-.0238	2.7021	.0127	.2561	.7008	.0313
1.999	.03	19.73	.7248	.2926	-.0217	2.4774	.0128	.3054	.7811	.0308

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 8 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.002	.03	-4.13	-.2148	.0548	.0177	-3.9212	.0077	.0625	-.2182	.0392
1.999	.03	-3.10	-.1578	.0481	.0126	-3.2789	.0072	.0553	-.1602	.0395
1.988	.02	-2.14	-.1065	.0441	.0087	-2.4127	.0061	.0503	-.1080	.0401
1.999	.02	-1.09	-.0507	.0408	.0037	-1.2431	.0054	.0462	-.0515	.0399
2.002	.02	-.15	-.0004	.0398	-.0012	-.0096	.0050	.0449	-.0005	.0398
2.002	.02	.86	.0554	.0408	-.0067	1.3581	.0054	.0462	.0560	.0400
2.003	.02	1.93	.1146	.0436	-.0127	2.6259	.0068	.0505	.1160	.0398
2.003	.02	2.86	.1656	.0479	-.0181	3.4578	.0079	.0558	.1678	.0396
2.004	.02	3.94	.2252	.0549	-.0247	4.1004	.0091	.0640	.2285	.0393
2.004	.02	4.88	.2763	.0628	-.0301	4.3988	.0097	.0726	.2806	.0391
2.004	.01	5.89	.3334	.0733	-.0363	4.5467	.0103	.0837	.3391	.0388
2.004	.01	7.88	.4389	.0994	-.0480	4.4162	.0112	.1106	.4484	.0383
2.004	.01	9.90	.5439	.1333	-.0599	4.0816	.0120	.1453	.5588	.0377
2.004	.01	11.90	.6464	.1743	-.0714	3.7086	.0126	.1869	.6685	.0372
2.003	.01	13.90	.7410	.2211	-.0822	3.3514	.0127	.2339	.7724	.0366
2.004	.01	15.89	.8299	.2736	-.0943	3.0331	.0127	.2863	.8731	.0359
2.005	.01	17.88	.9101	.3298	-.1045	2.7598	.0126	.3423	.9674	.0344
2.001	.01	19.87	.9786	.3876	-.1051	2.5248	.0139	.4015	1.0521	.0320
2.006	.02	-.12	.0029	.0405	-.0010	.0716	.0049	.0454	.0028	.0405

UPWT PROJECT 1414 RUN 12 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.998	.01	-5.22	-.2196	.0569	.0179	-3.8613	.0097	.0666	-.2238	.0367
1.998	.01	-4.17	-.1745	.0497	.0145	-3.5124	.0096	.0593	-.1777	.0369
1.998	.01	-3.17	-.1302	.0443	.0112	-2.9408	.0093	.0536	-.1324	.0370
1.998	.01	-2.23	-.0889	.0406	.0081	-2.1859	.0090	.0497	-.0904	.0372
1.998	.00	-1.20	-.0426	.0382	.0045	-1.1151	.0085	.0467	-.0434	.0373
1.999	.00	-.21	.0011	.0373	.0010	.0299	.0079	.0453	.0010	.0373
1.998	.00	.76	.0446	.0380	-.0022	1.1721	.0078	.0458	.0451	.0374
1.999	.00	1.84	.0924	.0408	-.0058	2.2670	.0088	.0496	.0936	.0378
1.999	.00	2.77	.1335	.0444	-.0095	3.0064	.0093	.0537	.1355	.0379
1.998	.00	3.82	.1780	.0500	-.0132	3.5601	.0095	.0595	.1809	.0380
1.998	.00	4.78	.2205	.0567	-.0170	3.8862	.0097	.0665	.2245	.0382
1.999	-.00	5.80	.2631	.0651	-.0212	4.0378	.0100	.0751	.2683	.0383
1.999	-.00	7.79	.3486	.0865	-.0294	4.0329	.0104	.0969	.3571	.0384
1.999	-.00	9.77	.4292	.1131	-.0365	3.7963	.0108	.1238	.4422	.0386
1.998	-.00	11.82	.5129	.1469	-.0446	3.4912	.0112	.1581	.5321	.0387
1.999	-.00	13.77	.5858	.1832	-.0523	3.1979	.0114	.1946	.6126	.0385
1.998	-.00	15.77	.6577	.2248	-.0582	2.9253	.0115	.2363	.6940	.0377
1.999	-.01	17.78	.7213	.2694	-.0619	2.6776	.0115	.2808	.7691	.0362
1.999	-.00	19.76	.7901	.3213	-.0647	2.4589	.0117	.3331	.8522	.0352
1.999	.00	-.22	.0031	.0376	.0011	.0835	.0079	.0454	.0030	.0376

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 14 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.005	.01	-4.10	-.1907	.0528	.0451	-3.6111	.0081	.0609	-.1939	.0390
2.004	.00	-2.13	-.0861	.0443	.0359	-1.9450	.0075	.0517	-.0877	.0410
1.999	.00	-.13	.0236	.0427	.0266	.5520	.0064	.0491	.0235	.0427
1.995	-.00	.89	.0795	.0445	.0213	1.7872	.0063	.0508	.0802	.0433
1.992	-.00	1.88	.1364	.0488	.0167	2.7978	.0069	.0557	.1379	.0443
1.998	-.00	2.88	.1903	.0545	.0105	3.4930	.0079	.0624	.1928	.0448
1.997	-.00	3.87	.2448	.0621	.0049	3.9403	.0089	.0710	.2485	.0455
1.998	-.00	4.88	.3016	.0719	-.0014	4.1923	.0095	.0814	.3066	.0460
1.997	-.01	5.89	.3561	.0835	-.0074	4.2651	.0101	.0936	.3628	.0465
1.997	-.01	7.87	.4627	.1116	-.0198	4.1462	.0110	.1226	.4736	.0472
1.997	-.01	9.87	.5646	.1469	-.0309	3.8438	.0119	.1588	.5814	.0479
1.998	-.01	11.86	.6632	.1889	-.0426	3.5106	.0123	.2012	.6879	.0486
1.999	-.01	13.87	.7578	.2380	-.0534	3.1846	.0126	.2505	.7928	.0493
2.000	-.01	15.89	.8472	.2926	-.0650	2.8953	.0126	.3052	.8950	.0495
2.000	-.02	17.88	.9248	.3496	-.0741	2.6455	.0129	.3625	.9874	.0487
2.000	-.01	19.90	.9864	.4079	-.0750	2.4179	.0142	.4221	1.0663	.0479
1.999	.00	-.12	.0240	.0433	.0266	.5541	.0062	.0495	.0239	.0434

UPWT PROJECT 1414 RUN 16 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.001	.01	-4.23	-.1665	.0508	.0354	-3.2791	.0099	.0607	-.1698	.0383
2.002	.00	-2.16	-.0739	.0426	.0285	-1.7320	.0095	.0522	-.0754	.0398
2.001	.00	-.21	.0143	.0412	.0223	.3476	.0090	.0502	.0142	.0413
2.002	.00	.79	.0583	.0427	.0188	1.3649	.0087	.0514	.0589	.0419
2.002	.00	1.80	.1049	.0458	.0156	2.2869	.0089	.0548	.1062	.0425
2.002	.00	2.80	.1484	.0505	.0119	2.9378	.0093	.0598	.1507	.0432
2.001	-.00	3.81	.1934	.0569	.0081	3.4014	.0094	.0662	.1968	.0439
2.001	.00	4.80	.2366	.0645	.0041	3.6696	.0097	.0742	.2411	.0445
2.001	-.00	5.80	.2802	.0737	.0003	3.8009	.0100	.0837	.2863	.0450
2.001	-.00	7.82	.3664	.0970	-.0078	3.7784	.0101	.1071	.3761	.0462
2.000	-.00	9.80	.4496	.1257	-.0144	3.5763	.0105	.1363	.4644	.0474
2.000	-.00	11.80	.5289	.1601	-.0227	3.3046	.0108	.1708	.5505	.0485
2.001	-.00	13.79	.6031	.1987	-.0290	3.0348	.0110	.2097	.6331	.0493
2.001	-.00	15.79	.6714	.2413	-.0349	2.7829	.0111	.2524	.7118	.0495
2.001	-.01	17.82	.7353	.2873	-.0399	2.5596	.0111	.2984	.7879	.0485
2.001	-.00	19.81	.7983	.3377	-.0417	2.3638	.0115	.3492	.8656	.0473
2.001	.00	-.20	.0146	.0409	.0217	.3555	.0090	.0499	.0144	.0410

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 18 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.004	.01	-4.13	-.2358	.0622	-.0073	-3.7910	.0071	.0693	-.2396	.0450
2.006	.01	-2.10	-.1267	.0487	-.0174	-2.6010	.0061	.0548	-.1284	.0440
2.002	.01	-.12	-.0196	.0427	-.0270	-.4573	.0056	.0484	-.0196	.0427
2.003	.01	.86	.0316	.0425	-.0314	.7428	.0061	.0486	.0322	.0420
2.002	.00	1.87	.0877	.0440	-.0370	1.9957	.0069	.0508	.0891	.0411
2.003	.00	2.88	.1442	.0474	-.0431	3.0426	.0075	.0549	.1464	.0401
2.004	.00	3.89	.1983	.0527	-.0493	3.7601	.0082	.0609	.2014	.0392
2.003	.00	4.88	.2549	.0601	-.0564	4.2399	.0090	.0692	.2591	.0382
2.003	.00	5.86	.3066	.0690	-.0629	4.4467	.0099	.0789	.3120	.0373
2.004	-.00	7.85	.4115	.0922	-.0748	4.4612	.0111	.1033	.4202	.0352
2.004	-.00	9.89	.5176	.1237	-.0872	4.1825	.0117	.1355	.5311	.0330
2.005	-.00	11.87	.6201	.1620	-.0984	3.8280	.0126	.1746	.6401	.0310
2.004	-.00	13.86	.7180	.2070	-.1102	3.4681	.0128	.2198	.7467	.0290
2.005	-.01	15.91	.8148	.2601	-.1224	3.1328	.0128	.2729	.8548	.0267
2.006	-.01	17.88	.8944	.3137	-.1300	2.8515	.0132	.3268	.9475	.0239
2.005	.00	19.89	.9719	.3741	-.1337	2.5979	.0141	.3883	1.0412	.0212
2.004	.01	-.13	-.0220	.0433	-.0259	-.5072	.0056	.0489	-.0221	.0433

UPWT PROJECT 1414 RUN 20 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.998	.01	-4.22	-.2032	.0560	-.0024	-3.6303	.0090	.0650	-.2067	.0408
1.998	.01	-2.21	-.1135	.0447	-.0104	-2.5408	.0086	.0533	-.1151	.0402
1.999	.01	-.21	-.0238	.0397	-.0185	-.5995	.0079	.0477	-.0240	.0397
1.999	.01	.83	.0218	.0395	-.0223	.5516	.0083	.0478	.0224	.0392
1.998	.01	1.78	.0630	.0408	-.0257	1.5419	.0086	.0495	.0642	.0389
1.999	.01	2.83	.1096	.0439	-.0299	2.4992	.0090	.0528	.1117	.0384
1.998	.00	3.79	.1521	.0482	-.0336	3.1546	.0090	.0572	.1549	.0381
1.999	.00	4.83	.1970	.0542	-.0377	3.6334	.0092	.0634	.2008	.0374
1.999	.00	5.82	.2392	.0615	-.0417	3.8882	.0093	.0709	.2442	.0369
1.999	.00	7.80	.3245	.0807	-.0494	4.0203	.0100	.0907	.3325	.0359
1.998	.00	9.77	.4063	.1054	-.0574	3.8557	.0105	.1159	.4183	.0349
1.998	.00	11.79	.4890	.1367	-.0662	3.5763	.0108	.1476	.5066	.0339
1.999	.00	13.82	.5693	.1736	-.0745	3.2789	.0112	.1848	.5942	.0327
1.998	-.00	15.83	.6431	.2146	-.0796	2.9961	.0115	.2262	.6773	.0310
1.998	-.00	17.82	.7118	.2594	-.0832	2.7443	.0118	.2712	.7570	.0291
1.998	.00	19.79	.7796	.3098	-.0867	2.5168	.0119	.3217	.8385	.0276
1.998	.01	-.22	-.0250	.0396	-.0179	-.6302	.0080	.0476	-.0251	.0395

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 22 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.001	.00	-4.11	-.1736	.0555	.0742	-3.1283	.0093	.0648	-.1771	.0429
2.001	-.00	-2.11	-.0635	.0488	.0657	-1.2999	.0093	.0581	-.0652	.0465
2.001	-.00	-.11	.0452	.0496	.0558	.9113	.0084	.0580	.0451	.0497
2.001	-.01	.88	.1019	.0528	.0507	1.9288	.0082	.0610	.1027	.0513
2.001	-.00	1.89	.1580	.0580	.0453	2.7262	.0084	.0663	.1599	.0527
2.001	-.01	2.85	.2094	.0645	.0391	3.2451	.0087	.0732	.2124	.0540
2.002	-.01	3.88	.2649	.0734	.0329	3.6103	.0095	.0828	.2693	.0553
2.001	-.01	4.86	.3193	.0837	.0266	3.8152	.0103	.0940	.3252	.0563
2.002	-.01	5.87	.3721	.0959	.0200	3.8806	.0109	.1068	.3799	.0573
2.002	-.01	7.89	.4800	.1263	.0088	3.8000	.0116	.1379	.4928	.0592
2.003	-.01	9.86	.5776	.1621	-.0030	3.5631	.0123	.1744	.5968	.0608
2.003	-.02	11.88	.6758	.2055	-.0161	3.2889	.0131	.2185	.7037	.0620
2.003	-.02	13.89	.7672	.2543	-.0276	3.0167	.0135	.2678	.8058	.0628
2.004	-.02	15.87	.8514	.3085	-.0365	2.7603	.0138	.3223	.9033	.0639
2.003	-.02	17.90	.9294	.3678	-.0458	2.5271	.0137	.3815	.9975	.0643
2.004	-.02	19.86	.9775	.4212	-.0493	2.3206	.0146	.4359	1.0624	.0641
2.005	-.00	-.13	.0425	.0497	.0561	.8534	.0084	.0581	.0423	.0498

UPWT PROJECT 1414 RUN 24 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.998	.02	-4.23	-.1442	.0522	.0589	-2.7657	.0106	.0628	-.1477	.0414
1.996	.02	-2.19	-.0544	.0462	.0523	-1.1770	.0104	.0566	-.0562	.0441
1.996	.02	-.18	.0343	.0466	.0458	.7347	.0101	.0568	.0341	.0468
1.996	.01	.80	.0773	.0490	.0424	1.5798	.0102	.0591	.0780	.0479
1.996	.01	1.80	.1233	.0531	.0388	2.3234	.0102	.0632	.1249	.0491
1.996	.01	2.80	.1661	.0584	.0352	2.8417	.0102	.0687	.1687	.0503
1.996	.01	3.82	.2112	.0656	.0316	3.2208	.0102	.0758	.2151	.0514
1.996	.01	4.83	.2544	.0740	.0273	3.4365	.0103	.0843	.2598	.0524
1.997	.01	5.79	.2969	.0837	.0234	3.5469	.0104	.0941	.3039	.0533
1.997	.01	7.83	.3838	.1084	.0161	3.5417	.0105	.1189	.3950	.0551
1.997	.01	9.76	.4622	.1374	.0096	3.3626	.0108	.1482	.4788	.0571
1.997	.01	11.79	.5427	.1735	.0011	3.1282	.0110	.1845	.5667	.0589
1.997	.00	13.79	.6152	.2132	-.0055	2.8853	.0113	.2246	.6483	.0604
1.998	.01	15.78	.6791	.2559	-.0091	2.6542	.0112	.2671	.7231	.0615
1.997	.01	17.79	.7401	.3022	-.0158	2.4493	.0111	.3132	.7970	.0616
1.997	.01	19.81	.7991	.3535	-.0155	2.2608	.0115	.3650	.8716	.0617
1.997	.02	-.20	.0336	.0464	.0455	.7242	.0101	.0565	.0334	.0465

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 26 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.003	.00	-4.12	-.2209	.0550	.0226	-4.0200	.0086	.0636	-.2243	.0389
2.001	.00	-3.13	-.1654	.0485	.0178	-3.4077	.0081	.0566	-.1678	.0394
2.003	.00	-2.12	-.1100	.0439	.0129	-2.5034	.0077	.0516	-.1116	.0398
2.002	.00	-1.14	-.0573	.0414	.0075	-1.3845	.0073	.0486	-.0581	.0402
2.002	.00	-.13	.0007	.0403	.0020	.0175	.0069	.0472	.0006	.0403
2.003	.00	.87	.0538	.0413	-.0039	1.3037	.0069	.0482	.0544	.0405
2.003	.00	1.85	.1073	.0440	-.0097	2.4387	.0071	.0512	.1087	.0405
2.003	.00	2.85	.1632	.0486	-.0153	3.3601	.0073	.0559	.1654	.0404
2.003	-.00	3.88	.2223	.0553	-.0204	4.0217	.0077	.0630	.2255	.0401
2.003	-.00	4.85	.2747	.0632	-.0254	4.3499	.0085	.0717	.2791	.0397
2.004	.00	5.85	.3327	.0735	-.0309	4.5287	.0093	.0828	.3384	.0391
2.004	.00	6.85	.3868	.0854	-.0352	4.5297	.0100	.0954	.3943	.0387
2.004	.00	7.84	.4399	.0993	-.0395	4.4274	.0105	.1099	.4493	.0384
2.004	-.00	9.85	.5450	.1327	-.0461	4.1077	.0114	.1440	.5596	.0375
2.003	.00	11.84	.6434	.1724	-.0500	3.7323	.0121	.1845	.6651	.0367
2.004	-.00	13.89	.7417	.2202	-.0550	3.3682	.0126	.2328	.7728	.0357
2.004	.00	15.84	.8341	.2724	-.0573	3.0624	.0127	.2850	.8768	.0343
2.004	.00	17.87	.9312	.3343	-.0625	2.7859	.0124	.3466	.9888	.0324
2.005	.01	19.88	1.0204	.4016	-.0674	2.5407	.0127	.4144	1.0961	.0307
2.003	.00	-.14	-.0009	.0406	.0029	-.0214	.0068	.0475	-.0010	.0406

UPWT PROJECT 1414 RUN 30 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.997	.02	-5.25	-.2367	.0592	.0158	-3.9998	.0097	.0688	-.2411	.0373
1.998	.02	-4.28	-.1917	.0521	.0136	-3.6757	.0096	.0617	-.1950	.0377
1.996	.02	-3.22	-.1449	.0461	.0114	-3.1433	.0096	.0557	-.1472	.0379
1.997	.02	-2.26	-.1007	.0419	.0088	-2.4038	.0096	.0515	-.1022	.0379
1.998	.02	-1.27	-.0535	.0390	.0058	-1.3698	.0096	.0487	-.0543	.0379
1.996	.02	-.25	-.0078	.0378	.0020	-.2068	.0096	.0474	-.0080	.0378
1.998	.02	.77	.0390	.0384	-.0019	1.0142	.0096	.0480	.0395	.0379
1.997	.02	1.74	.0819	.0406	-.0054	2.0190	.0094	.0500	.0831	.0381
1.997	.02	2.74	.1290	.0444	-.0085	2.9032	.0090	.0535	.1310	.0382
1.997	.02	3.70	.1711	.0496	-.0114	3.4520	.0091	.0586	.1739	.0384
1.997	.02	4.76	.2205	.0569	-.0141	3.8751	.0093	.0662	.2245	.0384
1.997	.02	5.71	.2607	.0646	-.0159	4.0381	.0094	.0740	.2659	.0383
1.997	.02	7.77	.3502	.0862	-.0200	4.0640	.0098	.0960	.3587	.0380
1.997	.02	9.72	.4338	.1125	-.0225	3.8556	.0105	.1230	.4466	.0377
1.997	.02	11.75	.5178	.1455	-.0238	3.5595	.0102	.1557	.5366	.0369
1.997	.02	13.77	.6003	.1845	-.0236	3.2542	.0103	.1948	.6269	.0363
1.998	.02	15.74	.6789	.2278	-.0270	2.9800	.0101	.2379	.7152	.0351
1.998	.02	17.76	.7593	.2791	-.0303	2.7205	.0098	.2889	.8083	.0343
1.997	.02	19.75	.8364	.3360	-.0316	2.4893	.0101	.3461	.9007	.0336
1.997	.02	-.24	-.0069	.0379	.0024	-.1828	.0096	.0475	-.0071	.0378

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 39 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.019	.01	-3.73	-.1748	.0470	.0141	-3.7176	.0082	.0552	-.1775	.0355
2.015	.01	-4.10	-.1907	.0493	.0151	-3.8699	.0083	.0576	-.1938	.0355
2.008	.01	-2.13	-.0964	.0398	.0078	-2.4213	.0075	.0473	-.0978	.0362
2.005	.01	-.13	.0022	.0367	-.0005	.0586	.0066	.0433	.0021	.0367
2.005	.01	.88	.0503	.0375	-.0054	1.3414	.0067	.0442	.0509	.0367
2.004	.00	1.86	.0980	.0398	-.0099	2.4590	.0073	.0472	.0992	.0366
2.006	.00	2.86	.1460	.0438	-.0146	3.3350	.0080	.0518	.1480	.0365
2.003	.00	3.87	.1961	.0495	-.0189	3.9616	.0088	.0583	.1990	.0361
2.000	.01	4.89	.2459	.0569	-.0232	4.3204	.0096	.0665	.2499	.0357
1.998	.01	5.86	.2939	.0657	-.0271	4.4712	.0100	.0758	.2990	.0354
1.999	.00	7.86	.3921	.0889	-.0343	4.4098	.0109	.0998	.4006	.0345
2.001	.01	9.86	.4866	.1187	-.0402	4.0985	.0114	.1301	.4997	.0336
2.002	.01	11.88	.5778	.1550	-.0446	3.7282	.0120	.1670	.5974	.0327
2.002	.01	13.88	.6626	.1963	-.0473	3.3756	.0124	.2087	.6904	.0317
2.002	.01	15.86	.7465	.2436	-.0469	3.0650	.0126	.2561	.7847	.0303
2.002	.01	17.85	.8231	.2955	-.0422	2.7857	.0128	.3083	.8741	.0290
2.001	.00	19.87	.8995	.3543	-.0368	2.5388	.0139	.3682	.9663	.0275
2.003	.01	-.13	.0010	.0367	-.0003	.0282	.0066	.0432	.0010	.0367

UPWT PROJECT 1414 RUN 41 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.006	.01	-4.26	-.1661	.0463	.0058	-3.5903	.0091	.0554	-.1691	.0338
2.005	.01	-2.28	-.0870	.0378	.0025	-2.3013	.0087	.0465	-.0884	.0343
2.001	.01	-.28	-.0055	.0344	-.0016	-.1591	.0082	.0426	-.0056	.0344
2.002	.00	.73	.0338	.0348	-.0039	.9697	.0081	.0430	.0342	.0344
2.002	.01	1.71	.0734	.0367	-.0065	2.0021	.0084	.0450	.0745	.0345
2.002	.00	2.72	.1142	.0399	-.0086	2.8628	.0085	.0484	.1160	.0344
2.002	.00	3.75	.1556	.0447	-.0106	3.4846	.0087	.0534	.1582	.0344
2.002	.01	4.73	.1944	.0506	-.0125	3.8438	.0089	.0594	.1979	.0344
2.002	.00	5.72	.2325	.0578	-.0138	4.0264	.0090	.0668	.2371	.0343
2.002	.00	7.72	.3113	.0764	-.0161	4.0736	.0093	.0857	.3188	.0339
2.002	.00	9.74	.3881	.1005	-.0167	3.8619	.0098	.1103	.3995	.0334
2.002	.00	11.73	.4622	.1294	-.0163	3.5720	.0103	.1396	.4788	.0327
2.002	.00	13.72	.5334	.1632	-.0142	3.2682	.0105	.1737	.5569	.0320
2.002	.00	15.73	.6024	.2021	-.0101	2.9811	.0103	.2123	.6347	.0312
2.002	.01	17.74	.6704	.2465	-.0062	2.7195	.0107	.2573	.7137	.0305
2.002	.01	19.71	.7371	.2960	-.0038	2.4907	.0113	.3072	.7938	.0300
2.003	.01	-.27	-.0064	.0343	-.0014	-.1859	.0082	.0425	-.0065	.0343

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 43 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.001	.00	-4.15	-.2955	.0745	.1119	-3.9652	.0083	.0828	-.3001	.0530
2.002	.00	-4.16	-.2959	.0749	.1120	-3.9511	.0083	.0832	-.3006	.0532
2.004	.01	-2.17	-.1874	.0597	.1029	-3.1408	.0078	.0674	-.1895	.0525
2.001	.00	-.16	-.0776	.0515	.0914	-1.5074	.0076	.0591	-.0777	.0513
2.002	.00	.83	-.0251	.0502	.0858	-.5001	.0078	.0580	-.0244	.0506
2.004	.00	1.85	.0314	.0508	.0803	.6175	.0080	.0589	.0330	.0498
2.003	.00	2.84	.0844	.0531	.0753	1.5871	.0083	.0614	.0869	.0489
2.004	.00	3.88	.1424	.0576	.0701	2.4718	.0087	.0663	.1460	.0479
2.004	.00	4.83	.1962	.0635	.0661	3.0883	.0091	.0726	.2008	.0468
2.003	.00	5.83	.2485	.0713	.0622	3.4830	.0095	.0809	.2544	.0457
2.004	.00	7.86	.3597	.0933	.0544	3.8550	.0106	.1039	.3691	.0433
2.004	.01	9.88	.4658	.1225	.0481	3.8007	.0115	.1341	.4799	.0408
2.005	.01	11.84	.5642	.1573	.0422	3.5862	.0123	.1696	.5845	.0382
2.003	.01	13.84	.6642	.2001	.0377	3.3202	.0125	.2125	.6928	.0354
2.005	.01	15.87	.7615	.2496	.0338	3.0515	.0126	.2622	.8008	.0317
2.004	.01	17.88	.8603	.3057	.0246	2.8143	.0124	.3181	.9126	.0268
2.004	.01	19.87	.9592	.3691	.0138	2.5985	.0125	.3817	1.0275	.0212
2.005	.01	-.15	-.0748	.0516	.0913	-1.4504	.0076	.0592	-.0749	.0514

UPWT PROJECT 1414 RUN 45 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.999	.01	-4.25	-.2516	.0678	.0830	-3.7098	.0087	.0765	-.2560	.0490
1.999	.01	-2.25	-.1599	.0542	.0780	-2.9523	.0084	.0626	-.1620	.0478
1.999	.01	-.28	-.0701	.0464	.0695	-1.5131	.0083	.0546	-.0704	.0460
1.999	.01	.72	-.0247	.0450	.0654	-.5486	.0083	.0533	-.0241	.0453
1.999	.01	1.74	.0206	.0455	.0621	.4535	.0083	.0537	.0220	.0448
1.999	.01	2.73	.0638	.0475	.0600	1.3434	.0084	.0558	.0660	.0444
1.999	.01	3.74	.1104	.0512	.0576	2.1563	.0085	.0597	.1135	.0439
1.999	.01	4.76	.1563	.0565	.0560	2.7670	.0087	.0652	.1604	.0433
1.999	.01	5.74	.1979	.0630	.0547	3.1430	.0088	.0718	.2032	.0429
1.999	.01	7.74	.2852	.0804	.0514	3.5467	.0093	.0898	.2935	.0413
1.999	.01	9.74	.3705	.1035	.0500	3.5789	.0101	.1136	.3827	.0393
1.999	.01	11.70	.4536	.1316	.0476	3.4462	.0105	.1422	.4709	.0369
1.999	.01	13.71	.5386	.1667	.0459	3.2303	.0103	.1771	.5628	.0343
1.999	.00	15.71	.6228	.2072	.0404	3.0061	.0099	.2171	.6556	.0308
1.999	.01	17.71	.7075	.2547	.0343	2.7782	.0100	.2646	.7514	.0273
1.997	.01	19.72	.7903	.3091	.0320	2.5569	.0105	.3196	.8482	.0243
1.999	.01	-.27	-.0683	.0463	.0695	-1.4756	.0083	.0546	-.0686	.0460

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 50 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.004	.01	-4.15	-.2608	.0622	.0690	-4.1947	.0070	.0692	-.2646	.0431
2.003	.01	-2.15	-.1491	.0486	.0582	-3.0641	.0067	.0554	-.1508	.0430
2.002	.00	-.16	-.0400	.0425	.0461	-.9400	.0067	.0492	-.0401	.0424
2.000	.00	.85	.0149	.0423	.0397	.3515	.0069	.0492	.0155	.0421
2.003	.00	1.85	.0697	.0441	.0338	1.5825	.0071	.0512	.0711	.0418
2.005	.00	2.88	.1279	.0477	.0283	2.6816	.0076	.0553	.1302	.0412
2.006	.00	3.88	.1832	.0531	.0235	3.4490	.0081	.0612	.1863	.0406
2.005	.00	4.84	.2358	.0600	.0187	3.9294	.0088	.0688	.2400	.0399
2.006	.00	5.85	.2922	.0692	.0147	4.2239	.0097	.0789	.2977	.0390
2.002	.00	7.84	.3982	.0927	.0074	4.2934	.0108	.1035	.4071	.0376
2.003	.00	9.84	.5029	.1235	.0012	4.0728	.0115	.1350	.5166	.0357
2.004	.01	11.83	.6049	.1613	-.0045	3.7498	.0120	.1733	.6251	.0339
2.005	.00	13.83	.7024	.2058	-.0099	3.4133	.0122	.2180	.7312	.0319
2.005	.00	15.87	.8011	.2583	-.0123	3.1010	.0122	.2705	.8412	.0294
2.005	.01	17.88	.8954	.3165	-.0204	2.8294	.0119	.3284	.9494	.0262
2.006	.00	19.86	.9910	.3822	-.0293	2.5926	.0120	.3942	1.0619	.0228
2.007	.00	-.16	-.0388	.0425	.0458	-.9111	.0067	.0492	-.0389	.0424

UPWT PROJECT 1414 RUN 52 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.000	.03	-4.27	-.2205	.0573	.0478	-3.8491	.0076	.0649	-.2242	.0407
2.001	.02	-2.25	-.1285	.0452	.0425	-2.8434	.0078	.0530	-.1302	.0401
2.001	.02	-.28	-.0381	.0394	.0343	-.9664	.0079	.0473	-.0383	.0392
2.001	.02	.73	.0072	.0390	.0302	.1851	.0080	.0470	.0077	.0389
2.001	.02	1.73	.0524	.0404	.0272	1.2955	.0081	.0485	.0535	.0388
2.001	.02	2.72	.0967	.0433	.0248	2.2354	.0083	.0515	.0986	.0386
2.001	.02	3.71	.1407	.0476	.0228	2.9549	.0085	.0561	.1434	.0384
2.001	.02	4.73	.1860	.0536	.0206	3.4708	.0089	.0625	.1898	.0381
2.001	.02	5.75	.2300	.0612	.0188	3.7614	.0092	.0704	.2350	.0378
2.001	.02	7.70	.3147	.0797	.0160	3.9501	.0098	.0894	.3225	.0368
2.001	.02	9.72	.4011	.1047	.0138	3.8308	.0103	.1150	.4130	.0355
2.001	.02	11.71	.4856	.1353	.0117	3.5881	.0104	.1457	.5030	.0339
2.001	.02	13.72	.5690	.1721	.0104	3.3068	.0101	.1821	.5936	.0322
2.001	.02	15.71	.6495	.2139	.0063	3.0355	.0097	.2237	.6831	.0301
2.002	.02	17.71	.7316	.2633	.0017	2.7784	.0093	.2726	.7770	.0283
2.001	.02	19.74	.8139	.3206	.0003	2.5391	.0095	.3300	.8744	.0268
2.002	.02	-.28	-.0390	.0393	.0345	-.9906	.0079	.0472	-.0391	.0391

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 54 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.000	.01	-4.14	-.2187	.0542	.0227	-4.0348	.0083	.0625	-.2220	.0383
1.999	.01	-2.13	-.1116	.0431	.0127	-2.5869	.0080	.0511	-.1131	.0390
1.999	.00	-.13	-.0011	.0392	.0026	-.0286	.0079	.0471	-.0012	.0392
2.000	.01	.87	.0512	.0400	-.0029	1.2795	.0079	.0479	.0518	.0392
2.000	.00	1.86	.1040	.0428	-.0078	2.4290	.0080	.0508	.1054	.0394
2.000	.00	2.85	.1581	.0474	-.0131	3.3329	.0083	.0558	.1603	.0395
2.000	.00	3.86	.2151	.0540	-.0189	3.9826	.0089	.0630	.2183	.0394
2.000	.00	3.88	.2171	.0542	-.0189	4.0037	.0090	.0632	.2203	.0394
2.000	.00	4.86	.2711	.0623	-.0244	4.3504	.0095	.0718	.2754	.0391
2.000	.01	5.87	.3250	.0723	-.0301	4.4944	.0099	.0822	.3307	.0387
2.001	.00	7.86	.4313	.0978	-.0414	4.4122	.0103	.1081	.4406	.0379
2.000	.00	9.86	.5350	.1306	-.0522	4.0980	.0107	.1413	.5494	.0370
2.000	.00	11.87	.6368	.1708	-.0600	3.7289	.0110	.1818	.6583	.0361
2.001	.01	13.86	.7294	.2162	-.0678	3.3740	.0113	.2275	.7599	.0352
2.001	.00	15.86	.8221	.2687	-.0742	3.0594	.0116	.2803	.8642	.0338
2.001	.00	17.86	.9079	.3261	-.0772	2.7844	.0114	.3375	.9642	.0320
2.001	.00	19.86	.9908	.3901	-.0741	2.5398	.0113	.4014	1.0644	.0303
2.001	.00	-.14	-.0031	.0395	.0027	-.0794	.0079	.0474	-.0032	.0395

UPWT PROJECT 1414 RUN 56 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.000	.01	-4.27	-.1941	.0521	.0155	-3.7236	.0080	.0602	-.1975	.0375
2.000	.01	-2.26	-.1048	.0418	.0094	-2.5065	.0086	.0504	-.1063	.0376
1.999	.01	-.27	-.0164	.0376	.0027	-.4362	.0088	.0464	-.0166	.0375
1.999	.01	.74	.0288	.0379	-.0014	.7585	.0089	.0468	.0293	.0376
2.000	.00	1.73	.0729	.0400	-.0048	1.8215	.0088	.0488	.0740	.0378
2.000	.00	2.73	.1180	.0437	-.0082	2.7013	.0087	.0523	.1199	.0380
2.000	.00	3.74	.1630	.0490	-.0115	3.3278	.0086	.0576	.1658	.0382
2.000	.01	4.74	.2071	.0555	-.0150	3.7287	.0087	.0642	.2110	.0383
2.000	.00	5.74	.2504	.0637	-.0183	3.9319	.0086	.0723	.2555	.0383
2.000	.01	6.72	.2933	.0731	-.0214	4.0104	.0086	.0818	.2999	.0383
2.000	.00	7.72	.3362	.0840	-.0250	4.0014	.0087	.0927	.3444	.0381
2.001	.00	9.73	.4206	.1105	-.0305	3.8079	.0089	.1194	.4332	.0378
2.000	.00	11.75	.5027	.1424	-.0343	3.5302	.0093	.1517	.5212	.0371
2.000	.01	13.74	.5828	.1797	-.0375	3.2437	.0094	.1891	.6088	.0361
2.000	.00	15.74	.6604	.2225	-.0382	2.9677	.0090	.2316	.6960	.0350
2.001	.01	17.75	.7362	.2716	-.0364	2.7102	.0089	.2805	.7839	.0343
2.001	.01	19.74	.8103	.3266	-.0350	2.4806	.0088	.3354	.8730	.0338
2.000	.01	-.27	-.0134	.0373	.0027	-.3597	.0088	.0462	-.0136	.0373

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 74 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.002	.01	-4.13	-.2117	.0521	.0319	-4.0603	.0085	.0607	-.2149	.0368
2.003	.01	-2.15	-.1192	.0416	.0235	-2.8680	.0079	.0494	-.1207	.0371
2.003	.01	-.18	-.0253	.0370	.0150	-.6835	.0069	.0439	-.0254	.0370
2.003	.01	.87	.0261	.0373	.0104	.6999	.0069	.0441	.0266	.0369
2.005	.01	1.88	.0747	.0391	.0058	1.9097	.0073	.0464	.0760	.0367
2.005	.00	2.89	.1228	.0426	.0014	2.8826	.0079	.0505	.1248	.0364
2.005	.01	3.86	.1711	.0476	-.0037	3.5928	.0087	.0563	.1739	.0360
2.005	.00	4.85	.2171	.0541	-.0079	4.0101	.0093	.0634	.2208	.0356
2.005	.01	5.86	.2652	.0625	-.0126	4.2410	.0098	.0723	.2702	.0352
2.006	.01	7.84	.3580	.0836	-.0215	4.2825	.0108	.0944	.3660	.0340
2.006	.01	9.84	.4513	.1115	-.0305	4.0473	.0115	.1231	.4637	.0328
2.006	.00	11.83	.5373	.1447	-.0377	3.7122	.0121	.1568	.5556	.0315
2.007	.00	13.83	.6241	.1848	-.0430	3.3771	.0123	.1971	.6502	.0302
2.007	.01	15.86	.7061	.2306	-.0471	3.0628	.0127	.2432	.7423	.0287
2.006	.01	17.86	.7823	.2802	-.0498	2.7918	.0128	.2930	.8306	.0268
2.007	.01	19.90	.8584	.3369	-.0447	2.5480	.0132	.3501	.9218	.0247
2.007	.01	-.15	-.0215	.0373	.0151	-.5763	.0068	.0441	-.0216	.0373

UPWT PROJECT 1414 RUN 75 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.002	.01	-4.27	-.1838	.0497	.0184	-3.6987	.0089	.0586	-.1870	.0359
1.999	.01	-2.26	-.1049	.0401	.0138	-2.6175	.0086	.0487	-.1064	.0359
2.000	.01	-.28	-.0281	.0358	.0089	-.7844	.0081	.0439	-.0283	.0357
2.000	.00	.73	.0114	.0357	.0066	.3203	.0079	.0436	.0119	.0356
2.000	.01	1.74	.0516	.0371	.0042	1.3911	.0079	.0450	.0527	.0355
2.000	.00	2.74	.0893	.0397	.0018	2.2488	.0081	.0478	.0911	.0354
2.000	.00	3.73	.1289	.0437	-.0005	2.9507	.0084	.0520	.1314	.0352
2.000	.00	4.73	.1678	.0491	-.0029	3.4192	.0087	.0577	.1713	.0351
2.000	.00	5.71	.2049	.0556	-.0053	3.6875	.0089	.0645	.2094	.0349
2.001	.01	7.73	.2827	.0732	-.0097	3.8624	.0094	.0826	.2899	.0345
2.001	.00	9.73	.3565	.0956	-.0137	3.7287	.0099	.1055	.3675	.0340
2.000	.00	11.71	.4279	.1225	-.0163	3.4925	.0105	.1330	.4439	.0331
2.000	.00	13.72	.4992	.1548	-.0173	3.2240	.0108	.1656	.5217	.0320
2.001	.00	15.72	.5695	.1921	-.0157	2.9645	.0106	.2027	.6002	.0306
2.000	.01	17.72	.6358	.2340	-.0128	2.7171	.0107	.2447	.6768	.0294
2.000	.01	19.73	.7034	.2825	-.0092	2.4904	.0107	.2932	.7575	.0285
2.001	.01	-.26	-.0274	.0357	.0091	-.7690	.0081	.0437	-.0276	.0355

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 76 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.997	.01	-4.14	-.2189	.0529	.0311	-4.1371	.0084	.0613	-.2221	.0370
2.002	.01	-2.13	-.1204	.0419	.0236	-2.8761	.0076	.0495	-.1219	.0374
2.000	.00	-.13	-.0207	.0374	.0148	-.5536	.0067	.0441	-.0208	.0374
2.002	.00	.87	.0245	.0376	.0103	.6510	.0067	.0443	.0251	.0372
2.001	.01	1.86	.0748	.0396	.0057	1.8909	.0071	.0467	.0761	.0371
2.001	.01	2.86	.1229	.0429	.0013	2.8658	.0075	.0504	.1249	.0367
2.002	.00	3.86	.1748	.0481	-.0027	3.6364	.0084	.0565	.1776	.0362
2.003	.00	4.86	.2220	.0547	-.0069	4.0596	.0092	.0639	.2258	.0357
2.003	.00	5.85	.2701	.0630	-.0105	4.2877	.0097	.0727	.2751	.0351
2.002	.01	7.86	.3681	.0850	-.0176	4.3284	.0107	.0957	.3763	.0339
2.001	.00	9.86	.4617	.1134	-.0238	4.0725	.0113	.1247	.4743	.0326
2.002	.00	11.85	.5510	.1476	-.0277	3.7323	.0118	.1595	.5696	.0314
2.003	.00	13.87	.6409	.1892	-.0303	3.3878	.0119	.2010	.6676	.0300
2.004	.01	15.88	.7236	.2351	-.0306	3.0777	.0123	.2474	.7603	.0282
2.003	.00	17.87	.8020	.2865	-.0260	2.7989	.0127	.2992	.8512	.0266
2.003	.00	19.88	.8769	.3433	-.0196	2.5542	.0138	.3571	.9414	.0248
2.005	.01	-.14	-.0218	.0378	.0154	-.5766	.0066	.0444	-.0219	.0377

UPWT PROJECT 1414 RUN 77 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.997	.01	-4.29	-.1894	.0496	.0173	-3.8195	.0090	.0586	-.1926	.0353
1.997	.00	-2.23	-.1072	.0397	.0140	-2.6973	.0085	.0483	-.1086	.0355
1.999	.00	-.27	-.0273	.0356	.0097	-.7662	.0079	.0435	-.0274	.0355
2.000	.00	.73	.0128	.0356	.0070	.3592	.0078	.0433	.0132	.0354
2.000	.00	1.73	.0515	.0369	.0046	1.3976	.0080	.0448	.0526	.0353
2.000	.00	2.72	.0922	.0395	.0024	2.3331	.0081	.0476	.0940	.0351
1.999	.00	3.71	.1317	.0435	.0006	3.0238	.0083	.0519	.1342	.0349
2.000	.00	4.71	.1722	.0492	-.0011	3.5039	.0085	.0577	.1757	.0348
2.001	.00	5.73	.2117	.0560	-.0031	3.7821	.0088	.0647	.2162	.0346
2.000	.00	7.71	.2911	.0737	-.0051	3.9518	.0091	.0828	.2983	.0339
2.000	.00	9.71	.3660	.0962	-.0062	3.8027	.0096	.1059	.3770	.0331
2.000	.00	11.74	.4440	.1251	-.0058	3.5486	.0101	.1352	.4602	.0322
2.000	.00	13.72	.5158	.1581	-.0044	3.2616	.0101	.1682	.5386	.0313
2.000	.00	15.73	.5858	.1962	-.0012	2.9849	.0100	.2062	.6170	.0301
2.001	.00	17.72	.6544	.2397	.0035	2.7305	.0108	.2504	.6963	.0291
2.001	.00	19.75	.7239	.2899	.0063	2.4970	.0114	.3013	.7793	.0283
2.000	.01	-.28	-.0277	.0355	.0097	-.7801	.0079	.0434	-.0279	.0354

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 78 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.001	.01	-4.13	-.1716	.0478	-.0027	-3.5885	.0081	.0560	-.1746	.0353
2.004	.01	-2.14	-.0725	.0395	-.0100	-1.8349	.0073	.0468	-.0739	.0368
2.000	.01	-.14	.0239	.0377	-.0182	.6344	.0067	.0444	.0238	.0377
2.001	.01	.85	.0735	.0391	-.0229	1.8821	.0069	.0460	.0741	.0380
2.001	.01	1.83	.1214	.0421	-.0275	2.8842	.0075	.0496	.1227	.0382
2.000	.01	2.84	.1717	.0467	-.0321	3.6729	.0082	.0549	.1738	.0382
2.000	.01	3.88	.2208	.0531	-.0362	4.1586	.0090	.0621	.2239	.0380
2.001	.01	4.84	.2686	.0608	-.0403	4.4157	.0097	.0705	.2728	.0379
2.001	.01	5.85	.3203	.0707	-.0444	4.5288	.0101	.0809	.3258	.0377
2.001	.01	7.84	.4142	.0947	-.0511	4.3757	.0110	.1057	.4232	.0373
2.001	.01	9.84	.5081	.1255	-.0568	4.0495	.0116	.1371	.5221	.0368
2.003	.01	11.86	.6001	.1634	-.0615	3.6733	.0122	.1755	.6209	.0365
2.002	.01	13.84	.6865	.2061	-.0638	3.3312	.0126	.2187	.7159	.0359
2.002	.01	15.87	.7702	.2553	-.0628	3.0169	.0126	.2679	.8106	.0350
2.002	.01	17.86	.8503	.3099	-.0596	2.7438	.0130	.3229	.9043	.0341
2.002	.01	19.85	.9269	.3698	-.0548	2.5069	.0139	.3837	.9974	.0330

UPWT PROJECT 1414 RUN 79 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.997	.01	-4.26	-.1492	.0447	-.0072	-3.3362	.0091	.0538	-.1521	.0335
1.995	.01	-4.26	-.1500	.0448	-.0075	-3.3479	.0091	.0539	-.1530	.0335
1.998	.01	-2.27	-.0691	.0372	-.0103	-1.8581	.0086	.0458	-.0705	.0344
2.002	.00	-.28	.0117	.0349	-.0143	.3347	.0082	.0430	.0115	.0349
2.004	.00	.74	.0527	.0359	-.0167	1.4702	.0081	.0440	.0532	.0352
2.003	.00	1.73	.0916	.0382	-.0190	2.3990	.0083	.0465	.0927	.0354
2.003	.00	2.72	.1311	.0418	-.0215	3.1389	.0085	.0503	.1329	.0355
2.004	.00	3.73	.1730	.0471	-.0230	3.6761	.0087	.0558	.1757	.0357
2.004	.00	4.73	.2121	.0535	-.0246	3.9634	.0088	.0623	.2158	.0358
2.004	.00	5.72	.2507	.0612	-.0265	4.0946	.0090	.0702	.2556	.0359
2.004	.00	7.72	.3298	.0809	-.0282	4.0765	.0094	.0903	.3377	.0359
2.002	.00	9.72	.4038	.1055	-.0288	3.8292	.0100	.1154	.4159	.0357
1.996	-.00	11.72	.4787	.1354	-.0274	3.5348	.0105	.1459	.4962	.0353
1.995	-.00	13.71	.5496	.1702	-.0256	3.2289	.0107	.1810	.5743	.0352
1.998	-.00	15.72	.6199	.2105	-.0213	2.9447	.0103	.2208	.6537	.0347
1.997	.00	17.72	.6878	.2560	-.0183	2.6865	.0107	.2668	.7331	.0345
1.997	.00	19.74	.7569	.3082	-.0153	2.4562	.0113	.3194	.8165	.0344
1.997	.00	-.27	.0103	.0349	-.0142	.2963	.0081	.0430	.0102	.0349

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 80 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.004	.01	-4.12	-.1667	.0471	-.0007	-3.5402	.0085	.0556	-.1697	.0350
2.003	.01	-2.12	-.0695	.0386	-.0089	-1.8014	.0075	.0461	-.0709	.0360
2.003	.00	-.14	.0254	.0368	-.0176	.6915	.0070	.0438	.0253	.0368
2.004	.00	.85	.0728	.0382	-.0218	1.9051	.0073	.0455	.0733	.0371
2.006	.01	1.85	.1216	.0414	-.0264	2.9377	.0079	.0493	.1229	.0375
2.006	.01	2.84	.1698	.0461	-.0309	3.6791	.0083	.0545	.1718	.0377
2.005	.01	3.85	.2174	.0524	-.0358	4.1482	.0089	.0613	.2205	.0377
2.001	.01	4.84	.2653	.0603	-.0403	4.4014	.0093	.0696	.2694	.0377
2.002	.01	5.83	.3119	.0696	-.0452	4.4811	.0099	.0795	.3174	.0375
2.003	.01	7.83	.4065	.0934	-.0541	4.3500	.0110	.1044	.4155	.0372
2.003	.01	9.84	.4982	.1237	-.0634	4.0260	.0116	.1353	.5120	.0368
2.003	.01	11.83	.5875	.1602	-.0705	3.6665	.0124	.1726	.6079	.0364
2.001	.00	13.87	.6757	.2039	-.0770	3.3134	.0127	.2166	.7048	.0359
2.003	.00	15.85	.7576	.2517	-.0818	3.0095	.0131	.2648	.7975	.0352
2.005	.01	17.84	.8332	.3037	-.0854	2.7434	.0131	.3168	.8862	.0339
2.004	.00	19.86	.9117	.3639	-.0833	2.5052	.0132	.3771	.9811	.0326
2.004	.01	-.12	.0263	.0371	-.0172	.7093	.0070	.0440	.0262	.0371

UPWT PROJECT 1414 RUN 81 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.001	.01	-4.27	-.1502	.0456	-.0038	-3.2964	.0092	.0547	-.1532	.0342
2.000	.01	-2.28	-.0724	.0379	-.0085	-1.9135	.0087	.0466	-.0739	.0350
1.999	.00	-.27	.0060	.0354	-.0131	.1693	.0083	.0437	.0058	.0355
2.000	.01	.73	.0447	.0362	-.0153	1.2329	.0082	.0445	.0451	.0357
2.001	.01	1.74	.0841	.0385	-.0181	2.1859	.0083	.0468	.0852	.0359
2.001	.00	2.73	.1224	.0418	-.0204	2.9253	.0085	.0503	.1243	.0360
2.000	.00	3.72	.1621	.0468	-.0229	3.4625	.0086	.0554	.1648	.0362
2.000	.00	4.72	.2013	.0531	-.0256	3.7907	.0088	.0619	.2050	.0364
2.001	.01	5.70	.2391	.0606	-.0279	3.9473	.0089	.0695	.2439	.0365
2.001	.00	7.72	.3150	.0798	-.0325	3.9476	.0094	.0892	.3229	.0368
2.001	.01	9.73	.3910	.1044	-.0362	3.7462	.0099	.1143	.4030	.0368
2.000	.00	11.72	.4619	.1332	-.0388	3.4670	.0105	.1437	.4793	.0366
2.001	.01	13.73	.5332	.1675	-.0401	3.1825	.0109	.1784	.5577	.0362
2.000	.01	15.74	.6042	.2071	-.0394	2.9173	.0109	.2181	.6377	.0355
2.001	.01	17.74	.6709	.2515	-.0364	2.6680	.0111	.2625	.7156	.0350
2.001	.01	19.74	.7364	.3012	-.0334	2.4444	.0110	.3123	.7948	.0348
2.001	.01	-.27	.0062	.0353	-.0132	.1765	.0083	.0436	.0061	.0353

TABLE AIII.- Continued

UPWT PROJECT 1414 RUN 82 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.999	.01	-4.14	-.2708	.0685	.0701	-3.9509	.0092	.0778	-.2750	.0488
1.998	.01	-2.11	-.1743	.0546	.0617	-3.1910	.0087	.0634	-.1762	.0482
2.003	.01	-.13	-.0793	.0474	.0535	-1.6727	.0080	.0554	-.0794	.0472
2.006	.00	.86	-.0326	.0461	.0493	-.7078	.0077	.0538	-.0319	.0466
2.005	.00	1.84	.0146	.0464	.0450	.3155	.0078	.0542	.0161	.0459
2.005	.00	2.85	.0637	.0485	.0404	1.3142	.0081	.0565	.0660	.0452
2.000	.00	3.86	.1132	.0521	.0353	2.1708	.0084	.0605	.1164	.0444
2.004	.00	4.87	.1628	.0575	.0304	2.8331	.0089	.0664	.1671	.0434
2.005	.00	5.87	.2100	.0641	.0253	3.2754	.0094	.0736	.2155	.0423
2.003	.00	7.86	.3050	.0825	.0167	3.6952	.0106	.0931	.3134	.0401
2.002	.00	9.85	.3956	.1071	.0083	3.6954	.0113	.1183	.4081	.0378
2.002	.00	11.85	.4865	.1385	.0012	3.5131	.0116	.1501	.5046	.0356
2.002	.00	13.88	.5719	.1758	-.0045	3.2522	.0120	.1878	.5973	.0335
2.003	.00	15.86	.6530	.2179	-.0085	2.9967	.0124	.2303	.6877	.0311
2.002	.00	17.87	.7295	.2648	-.0100	2.7549	.0128	.2776	.7756	.0282
2.003	.01	19.88	.8057	.3182	-.0062	2.5323	.0133	.3314	.8659	.0253
2.002	.01	-.13	-.0791	.0481	.0538	-1.6442	.0080	.0560	-.0792	.0479

UPWT PROJECT 1414 RUN 83 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.001	.01	-4.27	-.2223	.0619	.0450	-3.5936	.0094	.0713	-.2263	.0452
2.002	.01	-2.27	-.1438	.0502	.0405	-2.8640	.0091	.0593	-.1457	.0445
2.003	.01	-.28	-.0650	.0438	.0357	-1.4853	.0085	.0523	-.0653	.0435
2.003	.00	.71	-.0272	.0426	.0335	-.6394	.0081	.0507	-.0267	.0429
2.003	.00	1.73	.0134	.0428	.0315	.3134	.0082	.0510	.0147	.0423
2.002	.00	2.73	.0528	.0444	.0289	1.1893	.0084	.0528	.0549	.0418
2.004	.00	3.73	.0912	.0472	.0262	1.9324	.0086	.0558	.0941	.0412
2.003	.01	4.72	.1305	.0514	.0237	2.5367	.0090	.0604	.1343	.0405
2.003	.00	5.73	.1693	.0571	.0216	2.9650	.0091	.0662	.1742	.0399
2.004	.00	7.71	.2451	.0722	.0171	3.3946	.0095	.0817	.2526	.0387
2.003	.00	9.73	.3204	.0927	.0129	3.4577	.0102	.1028	.3315	.0372
2.003	.00	11.71	.3938	.1178	.0106	3.3435	.0106	.1284	.4095	.0354
2.004	.00	13.74	.4673	.1486	.0098	3.1444	.0106	.1592	.4892	.0334
2.004	.00	15.73	.5349	.1833	.0106	2.9189	.0107	.1939	.5646	.0313
2.003	.01	17.74	.6043	.2241	.0138	2.6968	.0110	.2350	.6439	.0293
2.003	.00	19.72	.6703	.2696	.0169	2.4857	.0112	.2808	.7219	.0276
2.003	.01	-.27	-.0648	.0434	.0361	-1.4932	.0085	.0519	-.0650	.0431

TABLE AIII.- Concluded

UPWT PROJECT 1414 RUN 84 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.002	.01	-4.13	-.2762	.0693	.0703	-3.9859	.0090	.0783	-.2804	.0492
2.004	.01	-2.14	-.1783	.0553	.0632	-3.2221	.0089	.0642	-.1803	.0487
2.004	.00	-.13	-.0821	.0479	.0549	-1.7129	.0079	.0558	-.0822	.0477
2.004	.00	.89	-.0331	.0465	.0502	-.7124	.0075	.0540	-.0324	.0470
2.005	.00	1.84	.0148	.0469	.0463	.3159	.0075	.0545	.0163	.0464
2.004	.00	2.85	.0636	.0489	.0420	1.3019	.0077	.0566	.0660	.0456
2.005	.00	3.89	.1166	.0528	.0377	2.2108	.0080	.0607	.1199	.0447
2.004	.00	4.82	.1627	.0576	.0338	2.8261	.0084	.0660	.1670	.0437
2.003	.00	5.85	.2128	.0644	.0295	3.3011	.0092	.0737	.2182	.0424
2.003	.00	7.82	.3090	.0831	.0231	3.7158	.0102	.0934	.3174	.0403
2.003	.00	9.83	.4040	.1085	.0171	3.7240	.0109	.1194	.4166	.0380
2.004	.00	11.86	.4964	.1405	.0125	3.5332	.0113	.1519	.5147	.0355
2.005	.01	13.84	.5843	.1779	.0099	3.2849	.0118	.1897	.6099	.0330
2.004	.00	15.84	.6695	.2214	.0100	3.0232	.0123	.2337	.7045	.0303
2.000	.01	17.83	.7478	.2695	.0128	2.7751	.0127	.2821	.7944	.0276
1.999	.00	19.83	.8226	.3234	.0183	2.5435	.0136	.3370	.8835	.0252
2.001	.01	-.15	-.0820	.0484	.0550	-1.6918	.0078	.0562	-.0821	.0482

UPWT PROJECT 1414 RUN 85 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.999	.01	-4.27	-.2219	.0612	.0443	-3.6267	.0095	.0707	-.2259	.0445
1.996	.01	-2.27	-.1436	.0495	.0415	-2.8998	.0090	.0586	-.1455	.0438
2.000	.00	-.28	-.0647	.0431	.0371	-1.5001	.0085	.0516	-.0649	.0428
2.000	.00	.72	-.0225	.0419	.0347	-.5369	.0081	.0501	-.0220	.0422
2.000	.00	1.70	.0159	.0422	.0327	.3769	.0082	.0504	.0172	.0418
1.999	.00	2.71	.0556	.0438	.0308	1.2680	.0084	.0522	.0576	.0412
2.000	.00	3.75	.0983	.0471	.0287	2.0881	.0086	.0557	.1012	.0406
2.000	.00	4.72	.1367	.0513	.0267	2.6646	.0089	.0602	.1405	.0399
1.999	.00	5.71	.1761	.0570	.0252	3.0926	.0091	.0660	.1809	.0392
1.999	.00	7.73	.2563	.0727	.0229	3.5271	.0094	.0820	.2637	.0375
1.999	.00	9.74	.3320	.0933	.0215	3.5597	.0098	.1031	.3430	.0358
2.000	.00	11.69	.4053	.1186	.0218	3.4165	.0101	.1287	.4210	.0341
2.000	.00	13.77	.4824	.1515	.0235	3.1844	.0103	.1618	.5046	.0323
2.000	.00	15.74	.5503	.1868	.0262	2.9461	.0104	.1972	.5804	.0305
2.000	.00	17.72	.6190	.2282	.0306	2.7129	.0112	.2394	.6591	.0289
2.000	.01	19.72	.6867	.2753	.0333	2.4941	.0117	.2870	.7393	.0275
2.000	.00	-.28	-.0629	.0427	.0373	-1.4729	.0085	.0512	-.0631	.0424

APPENDIX B

TABULATED DATA FOR THE 60° DELTA WING CONFIGURATIONS

Table BI gives the symbols corresponding to the column headings which appear on the tabulated data. Table BII is an index to the tabulated data (UPWT Project 1434), which are presented in table BIII.

TABLE BI.- TABULATED DATA SYMBOLS

Tabulated data heading	Definition
ALPHA	α
BETA	β
CA	C_A
CD	C_D
CDC	$C_{D,c}$
CD UNC	$C_D + C_{D,c}$
CL	C_L
CM	C_m
CN	C_N
L/D	L/D
MACH	M
R/FT	$R \times 10^{-6}$

TABLE BII.- INDEX TO TABULATED DATA

[UPWT Project 1434]

Run	Configuration	δ, deg	M
6	60° Aft-tail	0	1.60
8		0	2.00
10		10	1.60
11		10	2.00
12		-10	1.60
13		-10	2.00
14	60° Tailless	0	1.60
15	60° Tailless	0	2.00
16	60° Canard	-10	1.60
18		-10	2.00
20		10	1.60
21		10	2.00
22		0	1.60
23		0	2.00
34	60° Tailless	-5	1.60
35		-5	2.00
50		5	1.60
51		5	2.00
62		-10	1.60
63		-10	2.00
64		-20	1.60
65		-20	2.00

TABLE BIII.- FORCE AND MOMENT DATA FOR 60° DELTA WING CONFIGURATIONS

UPWT PROJECT 1434 RUN 6 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.003	.01	-1.01	-.0389	.0324	.0064	-1.1981	.0061	.0385	-.0394	.0317
2.000	.00	-.03	.0049	.0318	.0023	.1538	.0057	.0375	.0049	.0318
2.004	.00	.97	.0491	.0326	-.0022	1.5085	.0055	.0380	.0497	.0317
2.004	.00	2.01	.0980	.0349	-.0074	2.8081	.0055	.0404	.0991	.0314
2.001	.00	2.99	.1453	.0387	-.0118	3.7590	.0058	.0444	.1472	.0310
2.002	.00	3.99	.1898	.0439	-.0163	4.3258	.0064	.0503	.1924	.0306
2.008	.00	4.97	.2347	.0504	-.0209	4.6529	.0074	.0578	.2381	.0299
2.004	.00	5.98	.2815	.0589	-.0255	4.7764	.0085	.0674	.2861	.0293
2.000	.00	7.96	.3738	.0810	-.0345	4.6141	.0099	.0909	.3814	.0285
1.997	.01	10.01	.4644	.1101	-.0414	4.2176	.0105	.1207	.4765	.0277
1.996	.01	12.00	.5459	.1437	-.0475	3.7999	.0106	.1543	.5639	.0271
1.993	.01	13.96	.6253	.1825	-.0550	3.4254	.0111	.1936	.6508	.0263
1.998	.01	15.95	.7020	.2272	-.0606	3.0895	.0117	.2390	.7374	.0256
2.003	.01	17.97	.7762	.2773	-.0654	2.7987	.0123	.2896	.8239	.0243
2.000	.00	-.01	.0076	.0318	.0031	.2388	.0056	.0374	.0076	.0318

UPWT PROJECT 1434 RUN 8 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.997	.00	-4.94	-.1832	.0453	.0157	-4.0397	.0077	.0530	-.1864	.0294
2.005	.00	-3.95	-.1472	.0401	.0131	-3.6677	.0080	.0481	-.1496	.0299
2.001	.00	-2.92	-.1069	.0358	.0108	-2.9870	.0082	.0440	-.1086	.0303
2.007	.00	-1.95	-.0717	.0328	.0080	-2.1820	.0083	.0412	-.0727	.0304
2.005	.00	-.94	-.0334	.0310	.0047	-1.0783	.0083	.0393	-.0339	.0305
1.998	.00	.07	.0057	.0303	.0016	.1892	.0082	.0385	.0058	.0303
2.003	.00	1.04	.0417	.0310	-.0014	1.3424	.0081	.0391	.0422	.0303
2.003	.00	2.06	.0824	.0331	-.0049	2.4928	.0079	.0410	.0836	.0301
2.004	.00	3.06	.1206	.0364	-.0081	3.3136	.0078	.0442	.1224	.0299
2.005	.00	4.03	.1576	.0409	-.0109	3.8496	.0079	.0489	.1601	.0298
2.000	.00	5.01	.1956	.0468	-.0136	4.1757	.0081	.0549	.1989	.0296
2.001	.00	6.04	.2333	.0542	-.0158	4.3047	.0082	.0624	.2377	.0294
1.999	.01	8.06	.3083	.0731	-.0205	4.2156	.0084	.0816	.3155	.0292
2.004	.00	10.04	.3781	.0963	-.0248	3.9279	.0088	.1051	.3891	.0289
2.002	.00	12.02	.4467	.1245	-.0292	3.5875	.0089	.1334	.4628	.0287
2.004	.01	14.02	.5145	.1573	-.0341	3.2709	.0089	.1662	.5373	.0279
2.001	.01	16.06	.5817	.1955	-.0373	2.9763	.0091	.2045	.6131	.0269
2.000	.01	18.02	.6444	.2367	-.0406	2.7224	.0092	.2459	.6860	.0258
2.003	.00	.06	.0052	.0302	.0010	.1717	.0081	.0384	.0052	.0302

TABLE BIII.- Continued

UPWT PROJECT 1434 RUN 10 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.003	.00	-1.01	.0243	.0380	-.0606	.6379	.0069	.0449	.0236	.0385
1.999	.00	-.01	.0667	.0390	-.0647	1.7100	.0067	.0457	.0667	.0390
1.997	.00	.98	.1127	.0414	-.0691	2.7187	.0068	.0482	.1134	.0395
2.000	.00	1.97	.1578	.0453	-.0739	3.4859	.0069	.0522	.1593	.0398
2.003	.00	2.99	.2044	.0507	-.0789	4.0281	.0071	.0578	.2068	.0400
2.004	.00	3.99	.2522	.0579	-.0837	4.3557	.0072	.0651	.2556	.0402
2.006	.00	4.98	.2970	.0665	-.0889	4.4683	.0074	.0739	.3016	.0404
2.000	-.00	5.98	.3450	.0770	-.0936	4.4834	.0078	.0848	.3511	.0406
2.002	.00	7.96	.4351	.1025	-.1017	4.2471	.0091	.1116	.4451	.0412
2.004	.00	10.00	.5208	.1343	-.1080	3.8776	.0101	.1444	.5362	.0418
2.005	.00	11.97	.5987	.1702	-.1122	3.5181	.0107	.1809	.6210	.0423
2.005	.00	-.03	.0652	.0389	-.0637	1.6734	.0067	.0456	.0651	.0390

UPWT PROJECT 1434 RUN 11 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.998	.00	-3.94	-.0975	.0409	-.0404	-2.3823	.0093	.0502	-.1001	.0341
2.001	.00	-1.92	-.0240	.0362	-.0446	-.6621	.0086	.0448	-.0252	.0354
1.996	.00	.06	.0500	.0361	-.0493	1.3853	.0079	.0440	.0501	.0361
2.004	.00	1.06	.0878	.0381	-.0524	2.3043	.0079	.0460	.0885	.0365
1.993	.00	2.02	.1246	.0413	-.0557	3.0193	.0079	.0491	.1259	.0368
1.996	.00	3.07	.1661	.0463	-.0593	3.5842	.0079	.0542	.1683	.0374
1.995	.00	4.05	.2040	.0522	-.0627	3.9054	.0078	.0600	.2071	.0377
1.997	.00	5.04	.2419	.0596	-.0658	4.0600	.0078	.0674	.2462	.0381
1.999	.00	6.02	.2790	.0682	-.0684	4.0929	.0080	.0761	.2846	.0385
1.998	.00	8.06	.3551	.0905	-.0742	3.9251	.0084	.0989	.3643	.0398
1.999	.00	10.05	.4242	.1166	-.0783	3.6369	.0088	.1255	.4381	.0409
1.998	.00	12.05	.4912	.1477	-.0816	3.3248	.0091	.1568	.5112	.0420
1.994	.00	14.05	.5551	.1828	-.0846	3.0367	.0093	.1921	.5829	.0426
1.999	.01	16.08	.6201	.2236	-.0861	2.7734	.0094	.2329	.6578	.0430
1.997	.01	18.04	.6802	.2670	-.0886	2.5474	.0097	.2767	.7295	.0433
1.994	.00	.06	.0498	.0361	-.0496	1.3814	.0079	.0439	.0499	.0360

TABLE BIII.- Continued

UPWT PROJECT 1434 RUN 12 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.010	.00	-.99	-.1008	.0428	.0751	-2.3534	.0067	.0495	-.1016	.0411
2.004	.00	-.01	-.0570	.0406	.0706	-1.4043	.0066	.0472	-.0570	.0406
2.009	.00	.95	-.0136	.0397	.0668	-.3429	.0067	.0464	-.0130	.0400
2.007	.00	2.02	.0343	.0404	.0623	.8482	.0068	.0472	.0357	.0392
2.008	.01	3.02	.0803	.0423	.0576	1.8973	.0070	.0494	.0824	.0380
1.998	.00	4.00	.1260	.0460	.0535	2.7423	.0073	.0532	.1289	.0371
1.999	.01	5.00	.1716	.0514	.0492	3.3407	.0076	.0589	.1754	.0362
2.007	.01	5.97	.2180	.0581	.0451	3.7493	.0081	.0662	.2228	.0351
2.002	.01	8.00	.3089	.0769	.0365	4.0192	.0096	.0865	.3166	.0331
2.010	.01	9.99	.3970	.1019	.0300	3.8957	.0111	.1130	.4086	.0315
2.009	.01	11.99	.4786	.1320	.0238	3.6246	.0118	.1438	.4956	.0297
2.002	.01	13.97	.5618	.1680	.0147	3.3446	.0121	.1801	.5858	.0273
2.003	.01	15.95	.6405	.2088	.0071	3.0671	.0126	.2214	.6732	.0248
1.997	.01	17.96	.7189	.2559	.0009	2.8092	.0130	.2689	.7628	.0217
1.998	.00	.01	-.0545	.0405	.0709	-1.3435	.0067	.0472	-.0545	.0406

UPWT PROJECT 1434 RUN 13 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.003	.01	-3.94	-.1935	.0529	.0654	-3.6537	.0075	.0604	-.1966	.0395
1.998	.00	-1.94	-.1195	.0430	.0594	-2.7763	.0074	.0504	-.1209	.0390
2.007	.00	.06	-.0447	.0379	.0534	-1.1777	.0073	.0453	-.0446	.0380
2.002	.00	1.08	-.0054	.0372	.0506	-.1451	.0074	.0446	-.0047	.0373
2.006	.00	2.05	.0317	.0378	.0474	.8394	.0076	.0454	.0331	.0367
2.001	.00	3.08	.0717	.0398	.0451	1.8020	.0080	.0477	.0737	.0359
2.001	.00	4.04	.1083	.0429	.0426	2.5246	.0083	.0512	.1111	.0352
1.996	.00	5.05	.1455	.0475	.0409	3.0613	.0086	.0562	.1492	.0345
2.005	.00	6.05	.1822	.0535	.0394	3.4065	.0089	.0624	.1868	.0340
2.001	.00	8.07	.2569	.0695	.0349	3.6967	.0094	.0789	.2641	.0327
2.003	.01	10.10	.3294	.0907	.0310	3.6302	.0096	.1004	.3402	.0316
2.003	.00	12.05	.3973	.1154	.0261	3.4432	.0098	.1252	.4127	.0299
1.995	.01	14.03	.4653	.1448	.0204	3.2128	.0098	.1546	.4866	.0277
2.003	.01	16.04	.5340	.1798	.0156	2.9701	.0096	.1894	.5629	.0252
1.997	.01	18.04	.6019	.2192	.0098	2.7454	.0096	.2288	.6402	.0221
2.001	.00	.07	-.0426	.0379	.0533	-1.1235	.0073	.0452	-.0425	.0380

TABLE BIII.- Continued

UPWT PROJECT 1434 RUN 14 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.005	.00	-.99	-.0285	.0294	.0033	-.9679	.0045	.0340	-.0290	.0289
1.994	.00	-.02	.0096	.0293	-.0005	.3291	.0037	.0329	.0096	.0293
1.996	.00	.98	.0497	.0302	-.0044	1.6461	.0033	.0335	.0502	.0293
1.997	.00	2.00	.0927	.0323	-.0087	2.8661	.0034	.0357	.0938	.0291
1.998	.00	3.01	.1348	.0359	-.0129	3.7558	.0037	.0396	.1365	.0287
2.002	.00	3.98	.1743	.0403	-.0169	4.3228	.0046	.0449	.1766	.0281
2.003	.00	4.99	.2167	.0464	-.0207	4.6660	.0060	.0525	.2199	.0274
1.999	.00	5.97	.2589	.0541	-.0247	4.7833	.0080	.0622	.2631	.0269
1.999	.00	7.96	.3417	.0740	-.0317	4.6163	.0104	.0844	.3487	.0260
2.005	.00	9.97	.4205	.0995	-.0385	4.2244	.0112	.1107	.4314	.0252
1.999	.00	12.00	.4957	.1306	-.0435	3.7951	.0113	.1419	.5121	.0247
1.992	.01	13.99	.5691	.1666	-.0481	3.4163	.0114	.1780	.5924	.0241
1.998	.00	15.96	.6346	.2058	-.0509	3.0838	.0120	.2177	.6667	.0234
2.006	.01	17.99	.7006	.2513	-.0541	2.7884	.0125	.2638	.7440	.0225
1.997	.00	-.00	.0120	.0294	-.0002	.4097	.0037	.0331	.0120	.0294

UPWT PROJECT 1434 RUN 15 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.006	.01	-3.95	-.1265	.0362	.0065	-3.4952	.0084	.0446	-.1287	.0274
2.006	.00	-1.98	-.0590	.0301	.0019	-1.9629	.0079	.0380	-.0600	.0280
2.010	.01	.02	.0083	.0282	-.0028	.2956	.0072	.0355	.0083	.0282
2.007	.00	1.05	.0433	.0290	-.0053	1.4954	.0074	.0363	.0438	.0282
2.004	.00	2.02	.0771	.0307	-.0078	2.5112	.0075	.0382	.0781	.0280
1.992	.00	3.01	.1105	.0335	-.0101	3.2955	.0077	.0412	.1121	.0277
1.996	.00	4.05	.1474	.0379	-.0124	3.8901	.0080	.0459	.1497	.0274
1.998	.00	5.02	.1805	.0430	-.0144	4.1938	.0081	.0512	.1836	.0271
1.997	.00	6.02	.2137	.0495	-.0164	4.3192	.0083	.0578	.2177	.0268
2.000	.01	8.02	.2798	.0662	-.0201	4.2237	.0088	.0750	.2863	.0265
1.992	.01	10.01	.3438	.0875	-.0229	3.9297	.0092	.0967	.3538	.0264
1.993	.01	12.08	.4077	.1141	-.0250	3.5744	.0097	.1237	.4225	.0262
1.997	.01	14.07	.4662	.1433	-.0262	3.2542	.0097	.1530	.4871	.0257
1.998	.01	16.02	.5222	.1759	-.0267	2.9686	.0099	.1858	.5504	.0250
1.998	.01	18.04	.5797	.2144	-.0273	2.7039	.0101	.2245	.6176	.0243
1.993	.00	.03	.0095	.0282	-.0030	.3367	.0072	.0354	.0095	.0282

TABLE BIII.- Continued

UPWT PROJECT 1434 RUN 16 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.005	.01	-.93	-.0666	.0443	-.0479	-1.5033	.0062	.0505	-.0673	.0432
2.005	.02	.08	-.0233	.0422	-.0519	-.5523	.0055	.0477	-.0233	.0423
2.007	.01	1.09	.0192	.0411	-.0559	.4662	.0052	.0463	.0200	.0408
2.009	.01	2.06	.0622	.0412	-.0599	1.5097	.0050	.0462	.0636	.0389
2.007	.01	3.07	.1094	.0429	-.0653	2.5468	.0054	.0483	.1115	.0370
2.006	.01	4.04	.1558	.0463	-.0701	3.3652	.0065	.0528	.1587	.0352
2.010	.01	5.06	.2059	.0517	-.0748	3.9804	.0079	.0596	.2097	.0334
1.994	.01	6.05	.2515	.0586	-.0800	4.2893	.0088	.0674	.2562	.0318
2.000	.01	8.05	.3430	.0774	-.0895	4.4332	.0099	.0873	.3505	.0286
2.000	.01	10.08	.4350	.1031	-.0986	4.2196	.0104	.1135	.4463	.0254
2.002	.01	12.09	.5223	.1346	-.1068	3.8798	.0104	.1451	.5390	.0223
2.004	.01	14.07	.6071	.1717	-.1152	3.5367	.0106	.1823	.6306	.0189
2.004	.01	16.05	.6865	.2139	-.1211	3.2096	.0109	.2248	.7189	.0158
2.006	.00	18.07	.7663	.2631	-.1306	2.9124	.0115	.2746	.8102	.0125
2.008	.01	.07	-.0244	.0423	-.0513	-.5766	.0053	.0476	-.0243	.0423

UPWT PROJECT 1434 RUN 18 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.998	.02	-4.85	-.2005	.0597	-.0213	-3.3580	.0081	.0679	-.2049	.0425
2.000	.01	-3.86	-.1659	.0531	-.0239	-3.1223	.0080	.0612	-.1691	.0419
2.001	.02	-2.87	-.1327	.0478	-.0267	-2.7742	.0080	.0558	-.1349	.0411
2.002	.01	-1.87	-.0956	.0433	-.0299	-2.2060	.0080	.0513	-.0970	.0402
2.004	.01	-.85	-.0584	.0401	-.0334	-1.4592	.0079	.0479	-.0590	.0392
2.005	.01	.13	-.0221	.0381	-.0370	-.5799	.0079	.0459	-.0220	.0381
2.004	.01	1.13	.0165	.0372	-.0408	.4419	.0079	.0451	.0172	.0369
1.995	.01	2.14	.0537	.0377	-.0445	1.4228	.0078	.0456	.0551	.0357
1.997	.01	3.14	.0933	.0395	-.0484	2.3605	.0080	.0475	.0953	.0344
1.999	.01	4.19	.1340	.0429	-.0521	3.1201	.0081	.0510	.1368	.0330
2.000	.01	5.17	.1712	.0475	-.0558	3.6056	.0081	.0556	.1748	.0319
2.000	.01	6.13	.2074	.0532	-.0585	3.9020	.0082	.0613	.2119	.0307
2.002	.01	8.13	.2832	.0691	-.0653	4.0986	.0086	.0777	.2901	.0284
2.003	.01	10.17	.3593	.0911	-.0722	3.9427	.0089	.1000	.3698	.0263
2.004	.00	12.15	.4315	.1178	-.0783	3.6626	.0093	.1272	.4467	.0243
2.005	.01	14.12	.5011	.1491	-.0848	3.3599	.0096	.1587	.5223	.0224
2.006	.01	16.16	.5706	.1862	-.0918	3.0650	.0095	.1956	.5999	.0201
2.006	.02	18.14	.6354	.2270	-.0987	2.7992	.0096	.2365	.6744	.0178
1.993	.01	.17	-.0206	.0380	-.0372	-.5418	.0079	.0459	-.0205	.0381

TABLE BIII.- Continued

UPWT PROJECT 1434 RUN 20 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.002	-.00	-.91	-.0019	.0398	.0578	-.0490	.0064	.0461	-.0026	.0397
2.002	-.00	.06	.0421	.0415	.0540	1.0134	.0060	.0475	.0421	.0415
1.998	-.00	1.07	.0893	.0448	.0498	1.9959	.0056	.0504	.0902	.0431
2.005	-.01	2.10	.1389	.0494	.0450	2.8091	.0053	.0548	.1406	.0443
2.004	-.01	3.09	.1824	.0550	.0403	3.3186	.0055	.0604	.1851	.0451
2.006	-.01	4.09	.2308	.0627	.0354	3.6827	.0058	.0685	.2347	.0461
2.010	-.01	5.10	.2776	.0717	.0304	3.8698	.0061	.0779	.2828	.0468
2.010	-.01	6.07	.3198	.0817	.0252	3.9133	.0068	.0885	.3266	.0474
1.998	-.01	8.09	.4104	.1078	.0154	3.8068	.0095	.1173	.4215	.0490
1.993	-.01	10.08	.4976	.1395	.0051	3.5672	.0102	.1497	.5143	.0503
1.992	-.01	12.06	.5813	.1761	-.0052	3.3013	.0105	.1866	.6052	.0508
1.991	-.01	14.06	.6568	.2174	-.0139	3.0211	.0106	.2280	.6900	.0513
2.000	-.01	16.12	.7336	.2663	-.0209	2.7549	.0111	.2773	.7786	.0522
1.999	-.03	18.08	.7978	.3153	-.0289	2.5307	.0112	.3265	.8563	.0521
2.000	-.01	.08	.0429	.0413	.0527	1.0399	.0059	.0471	.0430	.0412

UPWT PROJECT 1434 RUN 21 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.003	.00	-3.82	-.1116	.0413	.0542	-2.7017	.0085	.0498	-.1141	.0338
2.001	-.00	-1.81	-.0356	.0377	.0476	-.9441	.0082	.0458	-.0367	.0365
2.005	-.00	.16	.0427	.0389	.0401	1.0988	.0080	.0469	.0428	.0388
1.999	-.01	1.17	.0828	.0415	.0365	1.9934	.0080	.0495	.0836	.0398
2.005	-.01	2.15	.1221	.0454	.0327	2.6905	.0080	.0534	.1237	.0408
2.007	-.01	3.16	.1618	.0507	.0291	3.1936	.0079	.0586	.1643	.0417
2.009	-.01	4.15	.2016	.0573	.0256	3.5211	.0080	.0652	.2052	.0425
2.003	-.01	5.15	.2402	.0651	.0223	3.6932	.0080	.0731	.2451	.0432
2.007	-.01	6.15	.2779	.0742	.0187	3.7429	.0080	.0823	.2842	.0441
2.007	-.01	8.14	.3528	.0963	.0127	3.6635	.0083	.1046	.3629	.0454
2.006	-.01	10.15	.4253	.1238	.0073	3.4355	.0087	.1325	.4405	.0469
2.004	-.01	12.17	.4941	.1560	.0027	3.1667	.0090	.1650	.5159	.0483
2.002	-.01	14.18	.5591	.1923	-.0037	2.9068	.0092	.2015	.5892	.0495
1.997	-.01	16.18	.6208	.2323	-.0118	2.6721	.0090	.2414	.6609	.0502
1.997	.00	18.17	.6801	.2766	-.0224	2.4591	.0092	.2857	.7324	.0507
1.996	-.00	.16	.0432	.0389	.0398	1.1100	.0080	.0469	.0433	.0388

TABLE BIII.- Continued

UPWT PROJECT 1434 RUN 22 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.000	.01	-.91	-.0321	.0327	.0012	-.9791	.0049	.0377	-.0326	.0322
2.003	.00	.07	.0099	.0326	-.0024	.3036	.0041	.0367	.0099	.0326
2.000	.00	1.09	.0573	.0335	-.0068	1.7079	.0039	.0374	.0579	.0324
2.004	.01	2.09	.1033	.0360	-.0113	2.8661	.0042	.0402	.1045	.0322
2.007	.00	3.08	.1498	.0397	-.0159	3.7715	.0054	.0451	.1517	.0316
1.998	-.00	4.07	.1962	.0451	-.0206	4.3471	.0066	.0517	.1989	.0311
2.005	.00	5.08	.2457	.0524	-.0256	4.6881	.0076	.0600	.2493	.0304
2.004	.00	6.09	.2925	.0612	-.0305	4.7798	.0085	.0697	.2973	.0298
2.001	-.00	8.10	.3873	.0843	-.0402	4.5960	.0098	.0940	.3953	.0289
2.010	.00	10.10	.4768	.1135	-.0485	4.2026	.0103	.1238	.4893	.0281
1.999	-.00	12.08	.5601	.1478	-.0569	3.7893	.0103	.1581	.5786	.0274
2.001	-.00	14.09	.6444	.1894	-.0641	3.4018	.0102	.1996	.6711	.0268
2.009	-.00	16.09	.7198	.2346	-.0700	3.0683	.0110	.2456	.7567	.0259
2.001	-.00	18.08	.7947	.2855	-.0780	2.7834	.0116	.2971	.8440	.0248
2.005	.01	.10	.0096	.0327	-.0036	.2938	.0040	.0367	.0097	.0327

UPWT PROJECT 1434 RUN 23 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.004	.01	-3.85	-.1387	.0400	.0098	-3.4704	.0082	.0482	-.1411	.0306
2.008	.01	-1.83	-.0648	.0330	.0046	-1.9621	.0079	.0409	-.0658	.0309
2.008	.00	.15	.0099	.0309	-.0013	.3205	.0074	.0383	.0100	.0309
2.000	.00	2.14	.0866	.0338	-.0082	2.5619	.0077	.0415	.0878	.0305
2.008	.00	1.17	.0496	.0318	-.0046	1.5619	.0074	.0392	.0502	.0307
2.000	.00	3.15	.1278	.0374	-.0118	3.4213	.0079	.0453	.1297	.0303
2.006	.00	4.16	.1684	.0424	-.0153	3.9683	.0081	.0505	.1711	.0301
2.002	.00	5.15	.2058	.0486	-.0190	4.2335	.0081	.0567	.2094	.0299
2.005	-.00	6.15	.2443	.0560	-.0227	4.3584	.0082	.0642	.2489	.0296
1.987	-.00	8.15	.3221	.0758	-.0300	4.2484	.0085	.0843	.3296	.0294
1.999	.00	10.17	.3946	.1004	-.0360	3.9317	.0089	.1093	.4062	.0292
1.991	.00	12.17	.4639	.1298	-.0410	3.5729	.0092	.1391	.4808	.0291
1.996	.00	14.17	.5336	.1646	-.0477	3.2427	.0096	.1742	.5577	.0289
1.997	.00	16.16	.5966	.2024	-.0547	2.9471	.0097	.2121	.6294	.0284
1.998	.01	18.16	.6597	.2454	-.0626	2.6886	.0098	.2551	.7033	.0275
2.002	.01	.15	.0100	.0310	-.0021	.3214	.0074	.0383	.0100	.0309

TABLE BIII.- Continued

UPWT PROJECT 1434 RUN 34 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.005	.01	-1.00	-.0572	.0324	.0213	-1.7628	.0062	.0386	-.0577	.0314
2.007	.01	-.02	-.0183	.0315	.0175	-.5794	.0056	.0371	-.0183	.0315
2.006	.00	.98	.0214	.0318	.0136	.6720	.0051	.0369	.0219	.0314
2.007	.00	2.01	.0658	.0334	.0095	1.9724	.0049	.0382	.0669	.0310
2.009	.00	2.98	.1036	.0359	.0054	2.8819	.0049	.0409	.1053	.0305
2.009	.01	3.99	.1475	.0401	.0013	3.6804	.0053	.0454	.1499	.0297
2.007	.00	4.98	.1872	.0455	-.0028	4.1167	.0062	.0517	.1905	.0290
2.008	.00	6.00	.2308	.0527	-.0065	4.3788	.0077	.0604	.2350	.0283
2.013	.00	7.98	.3124	.0711	-.0133	4.3967	.0098	.0809	.3193	.0270
2.011	.01	9.98	.3887	.0946	-.0190	4.1093	.0106	.1052	.3992	.0258
2.010	.01	11.98	.4651	.1239	-.0237	3.7536	.0106	.1345	.4807	.0247
2.013	.01	14.00	.5391	.1587	-.0279	3.3961	.0109	.1697	.5615	.0236
2.003	.01	15.98	.6061	.1967	-.0301	3.0817	.0116	.2083	.6368	.0222
1.992	.01	17.98	.6712	.2398	-.0328	2.7985	.0122	.2521	.7124	.0209
2.000	.00	-.01	-.0175	.0316	.0178	-.5538	.0055	.0371	-.0175	.0316

UPWT PROJECT 1434 RUN 35 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.000	.00	-3.92	-.1421	.0396	.0189	-3.5845	.0085	.0482	-.1445	.0298
2.004	.00	-1.93	-.0753	.0328	.0146	-2.2980	.0081	.0409	-.0764	.0302
2.003	.00	.06	-.0085	.0300	.0099	-.2827	.0077	.0377	-.0085	.0300
2.001	.00	1.04	.0255	.0303	.0076	.8422	.0076	.0379	.0261	.0298
2.006	.00	2.06	.0600	.0316	.0053	1.8976	.0075	.0391	.0611	.0294
2.005	.00	3.04	.0939	.0341	.0030	2.7565	.0075	.0415	.0955	.0290
2.002	.00	4.05	.1288	.0378	.0008	3.4084	.0076	.0454	.1312	.0286
2.006	.00	5.05	.1633	.0427	-.0012	3.8246	.0078	.0505	.1664	.0281
2.009	.00	6.07	.1970	.0488	-.0031	4.0407	.0080	.0567	.2011	.0277
2.006	.00	8.04	.2625	.0644	-.0064	4.0756	.0085	.0730	.2689	.0270
1.997	.00	10.04	.3263	.0847	-.0087	3.8505	.0091	.0938	.3361	.0266
1.987	.00	12.03	.3866	.1092	-.0102	3.5417	.0092	.1184	.4009	.0262
1.989	.01	14.05	.4461	.1376	-.0114	3.2414	.0093	.1469	.4661	.0252
1.990	.01	16.04	.5040	.1700	-.0119	2.9638	.0097	.1798	.5313	.0241
1.991	.01	18.06	.5612	.2072	-.0118	2.7091	.0101	.2173	.5978	.0230
1.995	.01	20.06	.6193	.2495	-.0130	2.4818	.0104	.2600	.6673	.0220
1.992	.00	.05	-.0075	.0300	.0097	-.2486	.0077	.0377	-.0074	.0300

TABLE BIII.- Continued

UPWT PROJECT 1434 RUN 50 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.018	.00	-.01	.0352	.0308	-.0165	1.1417	.0047	.0355	.0352	.0308
2.005	-.00	1.00	.0759	.0324	-.0201	2.3448	.0048	.0372	.0764	.0310
2.009	.00	1.99	.1161	.0350	-.0242	3.3167	.0054	.0404	.1173	.0310
2.008	-.00	2.97	.1583	.0389	-.0282	4.0691	.0063	.0452	.1601	.0306
2.008	-.00	3.96	.1976	.0440	-.0323	4.4907	.0072	.0512	.2001	.0302
2.010	-.00	4.99	.2421	.0511	-.0364	4.7388	.0082	.0593	.2456	.0298
2.011	-.00	5.97	.2834	.0594	-.0403	4.7736	.0089	.0683	.2880	.0296
2.010	.00	7.97	.3662	.0807	-.0479	4.5371	.0101	.0908	.3738	.0292
2.011	.00	9.96	.4426	.1070	-.0539	4.1378	.0110	.1179	.4544	.0288
2.013	.01	12.00	.5195	.1400	-.0589	3.7114	.0113	.1512	.5372	.0289
2.012	.01	13.98	.5907	.1767	-.0633	3.3435	.0113	.1879	.6158	.0288
2.002	.01	16.02	.6601	.2193	-.0662	3.0095	.0117	.2310	.6950	.0286
1.996	.01	18.03	.7254	.2658	-.0695	2.7291	.0120	.2779	.7721	.0282
2.001	-.00	-.02	.0341	.0309	-.0160	1.1039	.0046	.0355	.0341	.0309

UPWT PROJECT 1434 RUN 51 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
1.985	-.00	-3.94	-.1072	.0355	-.0047	-3.0218	.0079	.0434	-.1093	.0280
1.987	-.00	-1.94	-.0404	.0304	-.0089	-1.3306	.0077	.0380	-.0414	.0290
1.997	-.00	.04	.0269	.0295	-.0135	.9126	.0073	.0368	.0269	.0295
1.998	-.00	1.03	.0588	.0307	-.0159	1.9176	.0074	.0380	.0594	.0296
1.998	-.00	2.04	.0929	.0328	-.0182	2.8291	.0076	.0404	.0940	.0295
2.000	-.00	3.04	.1275	.0362	-.0205	3.5176	.0078	.0441	.1292	.0294
2.001	-.00	4.02	.1615	.0407	-.0226	3.9621	.0079	.0487	.1639	.0293
2.002	-.00	5.07	.1979	.0469	-.0250	4.2171	.0080	.0549	.2013	.0292
2.002	-.00	6.01	.2289	.0534	-.0265	4.2896	.0081	.0615	.2332	.0291
2.003	.00	8.02	.2949	.0710	-.0301	4.1535	.0086	.0796	.3019	.0292
2.005	-.00	10.10	.3618	.0944	-.0333	3.8338	.0090	.1034	.3727	.0295
2.006	.00	12.07	.4223	.1208	-.0347	3.4966	.0094	.1302	.4382	.0298
2.001	.00	14.04	.4796	.1504	-.0364	3.1886	.0097	.1601	.5017	.0296
1.994	.01	16.03	.5367	.1846	-.0370	2.9065	.0097	.1944	.5668	.0292
1.995	.01	18.03	.5940	.2237	-.0373	2.6555	.0100	.2337	.6341	.0289
1.998	.01	20.03	.6512	.2679	-.0378	2.4307	.0104	.2783	.7036	.0286
1.998	.00	.04	.0250	.0295	-.0141	.8482	.0074	.0368	.0250	.0294

TABLE BIII.- Continued

UPWT PROJECT 1434 RUN 62 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.003	.00	-1.00	-.0712	.0353	.0299	-2.0203	.0066	.0419	-.0718	.0340
2.001	.00	-.01	-.0305	.0340	.0261	-.8967	.0062	.0402	-.0305	.0340
2.001	.00	1.01	.0100	.0340	.0220	.2933	.0057	.0398	.0106	.0338
2.002	.00	1.98	.0494	.0351	.0181	1.4076	.0056	.0407	.0506	.0334
2.002	.00	2.99	.0916	.0374	.0140	2.4490	.0059	.0433	.0935	.0326
2.003	-.00	4.01	.1344	.0413	.0101	3.2508	.0062	.0475	.1369	.0318
2.003	.00	5.03	.1777	.0467	.0060	3.8085	.0071	.0538	.1811	.0309
2.003	.00	5.98	.2167	.0530	.0023	4.0906	.0078	.0608	.2211	.0301
2.004	.00	7.99	.3010	.0712	-.0043	4.2281	.0096	.0808	.3079	.0286
2.004	.00	10.00	.3780	.0942	-.0104	4.0135	.0103	.1045	.3886	.0271
2.004	.01	11.97	.4530	.1223	-.0148	3.7030	.0105	.1328	.4686	.0257
2.004	.01	13.97	.5253	.1557	-.0192	3.3733	.0107	.1664	.5474	.0243
2.008	.01	17.99	.6588	.2361	-.0233	2.7899	.0121	.2482	.6995	.0211
1.998	.00	.02	-.0282	.0341	.0262	-.8277	.0061	.0402	-.0282	.0341

UPWT PROJECT 1434 RUN 63 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.001	.00	-3.92	-.1555	.0428	.0260	-3.6372	.0085	.0512	-.1581	.0320
2.005	-.00	-1.97	-.0903	.0353	.0216	-2.5572	.0081	.0434	-.0914	.0322
2.006	-.00	.05	-.0222	.0318	.0166	-.6966	.0077	.0395	-.0222	.0319
2.007	-.00	1.07	.0125	.0318	.0143	.3937	.0076	.0394	.0131	.0316
2.007	.00	2.05	.0456	.0329	.0119	1.3863	.0075	.0404	.0467	.0312
2.007	-.00	3.03	.0794	.0349	.0093	2.2728	.0075	.0424	.0812	.0307
2.007	-.00	4.12	.1169	.0386	.0072	3.0275	.0075	.0461	.1194	.0301
2.008	-.00	5.03	.1494	.0428	.0053	3.4874	.0077	.0505	.1526	.0296
2.007	.00	6.04	.1827	.0485	.0029	3.7643	.0078	.0563	.1868	.0290
2.007	.00	8.05	.2498	.0637	-.0007	3.9230	.0083	.0720	.2563	.0281
2.007	.00	10.04	.3135	.0834	-.0035	3.7608	.0087	.0921	.3233	.0274
2.007	.00	12.08	.3762	.1078	-.0056	3.4897	.0090	.1168	.3905	.0267
2.009	.01	14.04	.4328	.1347	-.0064	3.2125	.0091	.1438	.4525	.0257
2.001	.01	16.06	.4913	.1668	-.0070	2.9449	.0096	.1764	.5183	.0244
2.000	.01	18.04	.5485	.2031	-.0069	2.7008	.0100	.2131	.5844	.0232
2.005	.01	20.04	.6062	.2447	-.0075	2.4773	.0103	.2550	.6533	.0222
2.007	-.00	.07	-.0208	.0319	.0164	-.6535	.0077	.0395	-.0208	.0319

TABLE BIII.- Concluded

UPWT PROJECT 1434 RUN 64 MACH 1.60

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.004	.00	-1.02	-.1102	.0461	.0518	-2.3896	.0076	.0537	-.1110	.0442
2.002	.00	-.00	-.0703	.0440	.0482	-1.5977	.0074	.0513	-.0703	.0440
2.004	.00	1.04	-.0272	.0430	.0445	-.6331	.0071	.0501	-.0264	.0435
2.002	.00	1.97	.0091	.0432	.0415	.2111	.0071	.0502	.0106	.0428
2.002	.00	3.01	.0520	.0447	.0379	1.1636	.0072	.0518	.0543	.0419
2.006	.00	3.98	.0928	.0476	.0346	1.9487	.0074	.0550	.0959	.0411
2.007	.00	5.01	.1351	.0523	.0313	2.5831	.0081	.0604	.1392	.0403
2.007	.00	6.01	.1749	.0586	.0287	2.9827	.0089	.0676	.1801	.0400
2.012	.00	7.95	.2530	.0747	.0242	3.3890	.0101	.0848	.2609	.0389
2.003	.00	9.99	.3318	.0955	.0190	3.4742	.0106	.1061	.3434	.0365
1.995	.01	12.00	.4078	.1218	.0139	3.3483	.0103	.1321	.4242	.0344
1.997	.01	13.98	.4836	.1536	.0089	3.1476	.0106	.1643	.5064	.0323
2.004	.01	15.98	.5518	.1890	.0058	2.9201	.0116	.2005	.5825	.0297
2.003	.01	17.98	.6201	.2301	.0030	2.6947	.0122	.2423	.6609	.0274
2.001	.00	-.02	-.0689	.0440	.0487	-1.5668	.0074	.0514	-.0690	.0440

UPWT PROJECT 1434 RUN 65 MACH 2.00

R/FT	BETA	ALPHA	CL	CD	CM	L/D	CDC	CD UNC	CN	CA
2.002	.00	-3.97	-.1893	.0549	.0425	-3.4503	.0086	.0634	-.1926	.0416
2.000	.00	-1.94	-.1207	.0454	.0378	-2.6579	.0083	.0537	-.1222	.0413
2.003	.00	.08	-.0522	.0406	.0331	-1.2860	.0080	.0486	-.0521	.0406
2.000	-.00	1.02	-.0205	.0397	.0310	-.5157	.0080	.0477	-.0198	.0401
2.004	-.00	2.09	.0163	.0401	.0286	.4071	.0081	.0482	.0178	.0395
2.002	-.00	3.08	.0507	.0415	.0265	1.2214	.0083	.0498	.0528	.0387
2.001	.00	4.03	.0839	.0441	.0240	1.9024	.0084	.0526	.0868	.0381
2.006	.00	5.08	.1199	.0481	.0223	2.4929	.0086	.0567	.1237	.0373
2.002	.00	6.04	.1531	.0530	.0200	2.8884	.0088	.0618	.1579	.0366
2.005	.00	8.04	.2211	.0667	.0163	3.3172	.0090	.0756	.2283	.0351
2.007	.00	10.04	.2855	.0851	.0138	3.3538	.0089	.0940	.2960	.0340
1.998	.00	12.07	.3484	.1081	.0123	3.2243	.0090	.1171	.3633	.0328
2.000	.01	14.03	.4071	.1337	.0104	3.0459	.0095	.1432	.4274	.0310
2.002	.01	16.05	.4661	.1644	.0096	2.8360	.0102	.1745	.4934	.0291
1.999	.01	18.05	.5250	.1997	.0091	2.6295	.0107	.2103	.5610	.0271
2.004	.01	20.07	.5842	.2406	.0083	2.4281	.0110	.2516	.6313	.0255
2.003	.00	.05	-.0532	.0405	.0336	-1.3119	.0080	.0485	-.0532	.0406

REFERENCES

1. Fellers, W. E.; Bowman, W. S.; and Wooler, P. T.: Tail Configurations for Highly Maneuverable Combat Aircraft. AGARD-CP-319, 1981, pp. 20-1 - 20-18.

2. Wedekind, G.: Tail Versus Canard Configuration - An Aerodynamic Comparison With Regard to the Suitability for Future Tactical Combat Aircraft. ICAS Proceedings 1982, 13th Congress of the International Council of the Aeronautical Sciences/AIAA Aircraft Systems and Technology Conference, Volume 1, B. Laschka and R. Staufenbiel, eds., 1982, pp. 247-254. (Available as ICAS-82-1.2.2.)

3. McKinney, Linwood W.; and Dollyhigh, Samuel M.: Some Trim Drag Considerations for Maneuvering Aircraft. J. Aircr., vol. 8, no. 8, Aug. 1971, pp. 623-629.

4. Dollyhigh, Samuel M.: Static Longitudinal Aerodynamic Characteristics of Close-Coupled Wing-Canard Configurations at Mach Numbers From 1.60 to 2.86. NASA TN D-6597, 1971.

5. Lamar, John E.; and Frink, Neal T.: Experimental and Analytical Study of the Longitudinal Aerodynamic Characteristics of Analytically and Empirically Designed Strake-Wing Configurations at Subcritical Speeds. NASA TP-1803, 1981.

6. Jackson, Charlie M., Jr.; Corlett, William A.; and Monta, William J.: Description and Calibration of the Langley Unitary Plan Wind Tunnel. NASA TP-1905, 1981.

7. Braslow, Albert L.; Hicks, Raymond M.; and Harris, Roy V., Jr.: Use of Grit-Type Boundary-Layer-Transition Trips on Wind Tunnel Models. NASA TN D-3579, 1966.

8. Middleton, W. D.; Lundry, J. L.; and Coleman, R. G.: A System for Aerodynamic Design and Analysis of Supersonic Aircraft. Part 2 - User's Manual. NASA CR-3352, 1980.

9. Dollyhigh, Samuel M.: Theoretical Evaluation of High-Speed Aerodynamics for Arrow-Wing Configurations. NASA TP-1358, 1979.

10. Dollyhigh, Samuel M.: Subsonic and Supersonic Longitudinal Stability and Control Characteristics of an Aft-Tail Fighter Configuration With Cambered and Uncambered Wings and Cambered Fuselage. NASA TN D-8472, 1977.

11. Wood, Richard M.; Miller, David S.; and Hahne, David E.: Status Review of a Supersonically-Biased Fighter Wing-Design Study. AIAA-83-1857, July 1983.

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16. Abstract

Aerodynamic characteristics of canard, tailless, and aft-tail configurations were compared in tests on a general research model (generic fuselage without canopy, inlets, or vertical tails) at Mach 1.60 and 2.00 in the Langley Unitary Plan Wind Tunnel. Two uncambered wing planforms (trapezoidal with 44° leading-edge sweep and delta with 60° leading-edge sweep) were tested for each configuration. The relative merits of the configurations were also determined theoretically, to evaluate the capabilities of a linear theory code for such analyses. The canard and aft-tail configurations have similar measured values for lift-curve slope, maximum lift-drag ratio, and zero-lift drag; these values are greater than those for the tailless configuration. At low lift coefficients, the tailless configuration exhibits the lowest trimmed drag level; at higher lift conditions, the aft-tail configuration has the least drag, followed by the canard configuration. The stability decrease as Mach number increases is greatest for the tailless configuration and least for the canard configuration. Because of very limited accuracy in predicting the aerodynamic parameter increments between configurations, the linear theory code is not adequate for determining the relative merits of canard, tailless, and aft-tail configurations.

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