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AN EXPERIMENTAL INVESTIGATION OF THE AERODYNAMIC
EFFECTS OF FORWARD FACIN. (U) AERONAUTICAL RESEARCH
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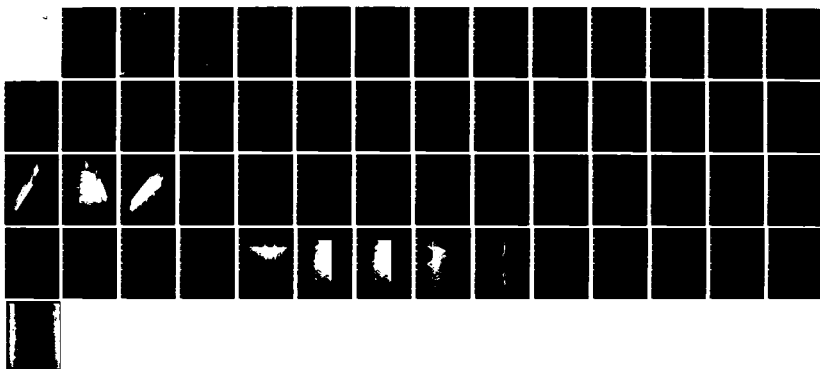
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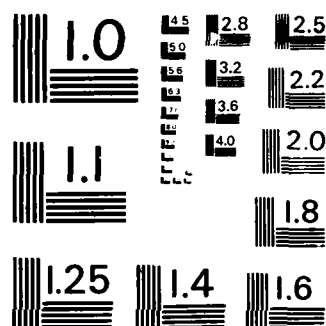
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MICROCOPY RESOLUTION TEST CHART
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MELBOURNE, VICTORIA

Aerodynamics Technical Memorandum 356

**AN EXPERIMENTAL INVESTIGATION OF THE AERODYNAMIC EFFECTS OF
 FORWARD FACING WEDGES ON THE UPPER SURFACE AND LEADING EDGE
 OF AN AEROFOIL, WITH EMPHASIS AT HIGH ANGLES OF ATTACK**

A.P. BROWN

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by

A.P. BROWN

SUMMARY

A NACA 64-106 aerofoil model has been wind tunnel tested with forward facing wedges at the leading edge and upper surface at the mid-chord position. Of particular interest is their effect on low speed, high incidence aerofoil aerodynamics. The majority of tests were conducted at Mach 0.2 (corresponding to a chord Reynolds number of 0.57×10^6) over the incidence range -10 to $+20$ degrees. The upper surface wedges increased drag by over 100% and reduced lift by only 10% at moderate lift coefficients, delayed the stall by about 2° and maintained $C_{L_{MAX}}$. The leading edge wedges with a 2% chord slot under them on the other hand increased $C_{L_{MAX}}$ by between 11 and 17% (depending on wedge size and deflection), had little effect on C_D (for a wedge deflection from the aerofoil surface of zero degrees) and markedly reduced variations in pitching moment prior to and following stall.



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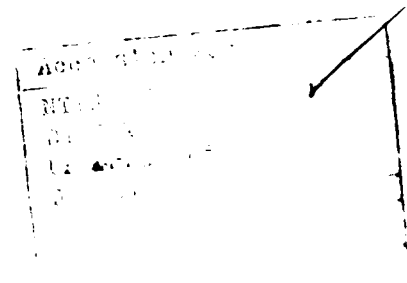
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NOMENCLATURE

b_s	Slot width
b_w	Wedge base width
c	Model chord
C_L	Lift coefficient
C_D	Drag coefficient
C_m	Pitching moment coefficient, about quarter chord point
$C_{L_{MAX}}$	Maximum lift coefficient
$C_{D_{MIN}}$	Minimum drag coefficient
L/D	Lift to drag ratio
Re_c	Reynolds number, based on model chord
α	Model angle of attack
δ_w	Deflection of wedges from local aerofoil surface
ϵ_s	Wedge-aerofoil surface slot height

1. INTRODUCTION

Wind tunnel tests ^{were} ~~have been~~ carried out to determine the effect on the longitudinal aerodynamic characteristics of a two-dimensional (2D) aerofoil fitted with discrete forward-facing wedges (base to aerofoil chord ratio 0.24 and 0.39) at the leading edge and on the upper surface of the aerofoil. The forward-facing wedges were conceived as a means of delaying stall and enhancing lift at high incidence. Thus they may be useful in low speed flight (approach and landing) where they would be extended from the clean wing surface along with the trailing edge flaps.

^{these} Tests were conducted at Mach numbers 0.2/0.3, over an incidence range of -10 to +20 degrees. Corresponding chord Reynolds numbers were 0.57 and 0.84 million (compared to an inflight value of 2.5 million for a wing of chord 1.25 metres and airspeed of 60 knots). The results at $M=0.2$ are more extensive than those at $M=0.3$.

The tests were conducted during January and February 1983.

2. TEST DETAILS

2.1 Wind Tunnel

The tests were carried out in the ARL transonic wind tunnel at atmospheric pressure. The test section was fitted with solid sidewalls and longitudinally-slotted top and bottom walls. The open area ratio of the slotted walls was 16.5% at the model location (see Figure 1).

The aerofoil model was supported by integrally machined end tongues in sidewall strain gauge balances which resolved aerodynamic loads into normal and axial forces and pitching moment. The balances were bolted to supporting frames which were in turn bolted to rotating frames in the sidewalls and were covered by sealing enclosures to prevent air leakage through the sidewall gaps surrounding the model end tongues.

2.2 Test Model

The 2D model consisted of a 127 mm chord aerofoil of section NACA 64-106 with a quarter chord plain trailing edge flap deflected 6° . This model was chosen because it was available. It is not representative of a typical aerofoil section (larger leading edge radius and thicker) used on lower speed aircraft. The aerofoil completely spanned the test section, giving an aspect ratio of 4.1.

The aerofoil was drilled and tapped for attaching the forward-facing wedges with flush mounting screws. The assortment of removable fixtures is shown in Figure 2, and consists of:

- (a) upper surface forward facing wedges: leading edge sweep 70° , base 30 mm (24% model chord), deflected 20° , to be attached at half chord; and
- (b) leading edge forward facing wedges:
 - (i) leading edge sweep 60° , base 30 mm (24% c), deflection 10° , 20° ; and
 - (ii) leading edge sweep 60° , base 50 mm (39% c), deflection 0° , 10° and 30° .

Also, in each case the wedges were tested with various size slots between the wedges and aerofoil surface, obtained by using brass washers as spacers. The wedges were spaced one base width apart (see Figure 2) so that, in all, 8 of (a) and (b)(i) wedges were fitted over the aerofoil span (and 5 of (b)(ii) wedges).

Although test chord Reynolds number was about one-fifth that in flight, no transition-fixing strips were used on the aerofoil, as, with the wedges fitted, at moderate/high incidence much of the flow would be vortical in nature, and hence not greatly affected by transition fixing strips.

2.3 Test Program

The test program was as scheduled in Table 1. Nominal running conditions were atmospheric stagnation pressure, Mach number 0.2 and chord Reynolds number $0.57 \pm 0.03 \times 10^6$. Limited running was conducted at M0.3 to obtain the trend of aerodynamic behaviour with Reynolds number; above this Mach number compressibility effects may also begin to emerge. No corrections were applied to the data for wind tunnel wall interference.

2.4 Data Reduction

The strain gauge bridge signal for each of the 2 sides x 3 channels was amplified and analysed separately. The 6 digital outputs were then appropriately summed using the wind tunnel's PDP8I 6 component force reduction program with the balance calibration matrix suitably arranged, to give the three components of aerodynamic force on the aerofoil - lift, drag and pitching moment, referred to the quarter chord point.

3. RESULTS AND DISCUSSION

3.1 Upper Surface Wedges

Lift, drag and pitching moment curves for the upper surface wedges are shown in Figure 3. Over the limited chord Reynolds number range 0.57 to 0.84 million, Re_c effects on aerodynamic coefficients

are slight and for this reason test results are discussed for the one value of Re_c (0.57×10^6) only. It is seen from the lift curve that the addition of the upper surface wedges results in an incremental loss of lift (whilst maintaining the lift curve slope), a delay of about 1.5° to stall and a similar value of $C_{L_{MAX}}$. The $C_D \sim \alpha$ curve shows the minimum drag coefficient (0.0067 at $\alpha = -3^\circ$ for the clean aerofoil) is increased over six times (0.044 at $\alpha = -3.5^\circ$ for $\epsilon_s = 0$), but close to and following stall, there is little difference between clean aerofoil drag and that with the wedges fitted. However, fitment of the upper surface wedges smooths the variation in pitching moment above $\alpha = 0^\circ$ and attenuates the rate of increase of nose-down pitching moment at the stall. The slot size does not make significant changes to the aerodynamic behaviour of the aerofoil fitted with the wedges.

3.2 Leading Edge Wedges

3.2.1 30 mm Leading edge wedges

Comparative C_L , C_D and $C_m \sim \alpha$ curves are plotted in Figure 4 for $\delta_w = 10^\circ$ and 20° and $\epsilon_s = 0$. From the $C_L \sim \alpha$ curve it is seen that these wedges cause a slight incremental reduction in C_L up to stall, that the stall of the clean aerofoil is replaced by a gradual reduction in lift curve slope, and that $C_{L_{MAX}}$ is increased 10% for $\delta_w = 10^\circ$ (i.e. $C_{L_{MAX}} = 0.976$ at $\alpha = 14^\circ$) and 8% for $\delta_w = 20^\circ$ ($C_{L_{MAX}} = 0.960$ at $\alpha = 14^\circ$ compared with $C_{L_{MAX}} = 0.887$ at $\alpha = 10^\circ$ for the clean aerofoil). $\delta_w < 0$ was briefly investigated. For $\delta_w = -20^\circ$ (data not presented) $C_{L_{MAX}} = 0.949$ at $\alpha = 13^\circ$, which is 3% less than for $\delta_w = 10^\circ$.

Fitment of the 30 mm leading edge wedges doubles $C_{D_{MIN}}$ (to 0.015 at $\alpha = -3^\circ$); between this incidence and stall, C_D is less than doubled. However, C_D for $\delta_w = 20^\circ$ is significantly greater than for $\delta_w = 10^\circ$. C_m behaviour is significantly altered: by providing a lift increment well ahead of the clean aerofoil centre of pressure, C_m is less negative over most of the unstalled incidence range, and $\partial C_m / \partial \alpha$ at stall (both positive and negative) is attenuated from -0.0244 per degree for the clean aerofoil to about -0.0053 and -0.0043 per degree for $\delta_w = 10$ and 20 degrees respectively.

Figure 5 shows the comparative effect of a slot ($\epsilon/c = 0.006$ with $\delta_w = 10^\circ$) beneath the wedges. There is a very slight increase in C_L over the range $\alpha = -10^\circ$ to $+5^\circ$. Stall behaviour is unchanged. The slot is formed by adding washers (9 mm outside diameter x 0.8 mm thick) to the mounting screws between the wedges and aerofoil surface. Thus blockage due to the washers is significant and for the 30 mm wedges, $b_s/b_w = 0.37$ only.

3.2.2 50 mm Leading edge wedges

C_L , C_D and C_m curves are plotted in Figure 6 for the 50 mm leading edge wedges for various deflections with $\epsilon_s = 0$. Considering $C_L \sim \alpha$, it is seen that over the range $\alpha = -8^\circ$ to $+3^\circ$, fitment of the wedges results in a small loss of C_L (5% at $C_L = 0.4$, $\alpha = 1^\circ$, for example). $C_L \sim \alpha$ curves for $\delta_w = 0^\circ$ and 10° are nearly identical up to $\alpha = 8^\circ$, above which C_L is slightly greater for $\delta_w = 10^\circ$ than for $\delta_w = 0^\circ$. C_{LMAX} for $\delta_w = 0^\circ$ and 10° over the incidence range tested are respectively 1.13 and 1.15 times C_{LMAX} for the clean aerofoil. Again the relatively abrupt stall of the clean aerofoil is replaced by a gradual reduction in lift curve slope. For $\delta_w = 30^\circ$, $C_L \sim \alpha$ behaviour is different in that $\partial C_L / \partial \alpha$ becomes noticeably less from about $\alpha = 2^\circ$, clean aerofoil stall C_L being at $\alpha = 10^\circ$. The most likely explanation of this behaviour is breakdown of the wedge leading edge vortices, considering the local angle of attack of the wedges is considerably greater in this case.

For $\delta_w = 0^\circ$, C_D over the range $\alpha = 0^\circ$ to 12° is little different from that for the clean aerofoil. C_D for $\delta_w = 10^\circ$ is on the other hand noticeably larger, indicating L/D at C_{LMAX} is greater for $\delta_w = 0^\circ$ compared to $\delta_w = 10^\circ$.

As with the 30 mm wedges, the 50 mm wedges drastically reduce the drop in C_m at the stall (see Figure 6(c)).

Figure 7 shows C_L , C_D and C_m behaviour for the 50 mm leading edge wedges set $\delta_w = 10^\circ$ with various slot depths ϵ_s/c (from 0 to 0.044). It is seen that for this value of δ_w , $\epsilon_s/c = 0.02$ is about an optimum depth for maximising C_{LMAX} . C_D over the whole range of incidence increases directly with ϵ_s . However, there appears to be a small drop in C_D for $\epsilon_s/c = 0.044$ compared to $\epsilon_s/c = 0.019$ or 0.031. Due to the slight lift augmentation effect the slots provide, C_m for $\epsilon_s > 0$ is less negative than for $\epsilon_s = 0$. Likewise $\partial C / \partial \alpha$ near and after stall is favourably affected by the existence of the slots, in that $\partial^2 C / \partial \epsilon \partial \alpha > 0$. Figure 8 presents a C_L comparison between the two sets of leading edge wedges. It is observed that over the tested incidence range the larger wedges are slightly more lift enhancing.

The 50 mm wedges have also been tested with 60° bevelled edges as compared to straight edges (see Figure 2), to determine whether such edges could assist the formation of more stable vortices. Also curved wedges of base deflection 30° and apex deflection 10° with bevelled edges were tested at the leading edge (see Figure 2) for the same reason. In both cases however, there was virtually no positive effect on C_L compared with the flat straight-edged wedges deflected $0-10^\circ$. As stowage of the latter in an actual wing leading edge is much more readily accomplished, no further results for these differing wedges are presented.

3.3 Surface Flow Visualisation

Surface flow visualisation studies were carried out using a mixture of titanium dioxide, silicon oil and oleic acid. Two cases were studied:

- (i) 30 mm leading edge wedges: $\delta_w = 10^\circ$, $\epsilon_s = 0$; and
- (ii) 50 mm leading edge wedges: $\delta_w = 10^\circ$, $\epsilon_s/c = 0.031$.

Surface oil flow pattern photographs for $\alpha = 10^\circ$ appear as Figures 9 and 10 respectively. In each case the three dimensional vortical nature of the flow over the aerofoil is apparent. The oil patterns are similar for the two wedge sizes, however vortex breakdown may be occurring further upstream of the aerofoil trailing edge in the case of the smaller wedges. Interference on the flow through the slots under the wedges (Figure 10) from the mounting screws and washers is quite significant and indicate further tests with less obtrusive slot-forming spacers (such as smaller diameter screw collars) are desirable.

4. CONCLUSIONS

For the aerofoil section tested, forward facing wedges of leading edge sweep 70° , base to aerofoil chord ratio 0.24 and deflection 20° fitted to the upper surface at the mid-chord position have the following effects on section aerodynamic behaviour:

- (i) C_L is reduced somewhat - 12% at $C_L = 0.6$;
- (ii) C_D is increased drastically = 125% at $C_L = 0.6$; and
- (iii) $\partial C_m / \partial \alpha$ is reduced slightly prior to and following stall.

Therefore such devices could be usefully employed as speed brakes or descent rate controllers, in that, unlike spoilers, they augment drag whilst reducing lift a relatively small amount and have little effect on pitch trim.

On the other hand forward facing wedges of 60° sweep, base to aerofoil chord ratios 0.24 and 0.39, deflection $0-10^\circ$, and with a 2% chord slot between base and aerofoil surface have the following effects:

- (i) stall onset is delayed by 2° ;
- (ii) for both wedge sizes, the abrupt stall of the clean aerofoil is replaced by a gradual reduction of lift curve slope;
- (iii) $C_{L_{MAX}}$ is increased by between 11 and 17% and occurs at 5 to 8° greater incidence;

- (iv) for the $b_w/c = 0.39$ wedges with $\delta_w = 0^\circ$, C_D is increased by about 10° ; and
- (v) the slope of the pitching moment curve through stall is reduced drastically.

Therefore such devices could be used as low speed handling and control aids, in that they have little effect on aerodynamic performance at moderate incidence, whilst at high incidence they reduce significantly the nose-down pitching moment associated with stall and maintain and increase lift coefficient through the normal stall regime.

TABLE 1
TEST SCHEDULE

MODEL CONFIGURATION	MACH NO.	Re_{c6} $\times 10^6$	RESULTS
Clean	0.2/0.3	0.57/0.84	TABLE 2A
Upper Surface Wedges			
$\epsilon_s = 0; \delta_w = 20^\circ$	0.2/0.3	0.57/0.84	TABLE 2B-1
$\epsilon_s = 1.6 \text{ mm}; \delta_s = 20^\circ$	"	"	TABLE 2B-2
$\epsilon_s = 3.2 \text{ mm}; \delta_w = 20^\circ$	"	"	TABLE 2B-3
30 mm Leading Edge Wedges			
$\epsilon_s = 0; \delta_w = 10^\circ$	0.2/0.3	0.57/0.84	TABLE 2C-1
$\epsilon_s = 0; \delta_w = 20^\circ$	0.2	0.57	TABLE 2C-2
$\epsilon_s = 0.8 \text{ mm}; \delta_w = 10^\circ$	0.2/0.3	0.57/0.84	TABLE 2C-3
50 mm Leading Edge Wedges			
$\epsilon_s = 0; \delta_w = 0^\circ$	0.2	0.57	TABLE 2D-1
$\epsilon_s = 0; \delta_w = 10^\circ$	"	"	TABLE 2D-2
$\epsilon_s = 0; \delta_w = 30^\circ$	"	"	TABLE 2D-3
$\epsilon_s = 2.4 \text{ mm}; \delta_w = 10^\circ$	"	"	TABLE 2D-4
$\epsilon_s = 4.0 \text{ mm}; \delta_w = 10^\circ$	"	"	TABLE 2D-5
$\epsilon_s = 5.6 \text{ mm}; \delta_w = 10^\circ$	"	"	TABLE 2D-6

TABLE 2

RESULTS

(SEE TABLE 1 FOR INDEX)

TABLE 2A

STEP	THRU	BECH	DRCD	LIFT	PITCH	DRAW	NORMAL	RETAIL
002	0.525	0.203	-10.03	-0.4754	0.0054	0.0926	0.4841	-0.0088
003	0.525	0.203	-09.03	-0.4129	-0.0310	0.0697	0.4186	-0.0043
004	0.525	0.203	-08.00	-0.3342	-0.0630	0.0443	0.3172	-0.0000
005	0.568	0.200	-07.00	-0.2123	-0.0716	0.0262	0.2139	-0.0002
006	0.568	0.200	-06.00	-0.1355	-0.0721	0.0125	0.1359	0.0026
007	0.568	0.200	-05.00	-0.0542	-0.0728	0.0090	0.0547	-0.0043
008	0.568	0.200	-04.03	0.0238	-0.0757	0.0076	-0.0233	-0.0094
009	0.523	0.203	-03.00	0.0982	-0.0776	0.0067	-0.0970	-0.0119
010	0.523	0.203	-02.00	0.1769	-0.0807	0.0079	-0.1766	-0.0141
011	0.568	0.200	-01.00	0.2545	-0.0798	0.0102	-0.2544	-0.0147
012	0.563	0.198	00.00	0.3295	-0.0791	0.0129	-0.3296	-0.0130
013	0.568	0.200	01.00	0.4046	-0.0777	0.0170	-0.4049	-0.0100
014	0.568	0.200	02.00	0.4776	-0.0770	0.0223	-0.4782	-0.0057
015	0.568	0.200	03.00	0.5421	-0.0733	0.0277	-0.5429	0.0007
016	0.568	0.200	04.00	0.6161	-0.0735	0.0343	-0.6171	0.0087
017	0.523	0.203	05.00	0.6766	-0.0681	0.0445	-0.6780	0.0147
018	0.568	0.200	06.00	0.7467	-0.0637	0.0619	-0.7492	0.0166
019	0.523	0.203	07.00	0.7957	-0.0603	0.0794	-0.7996	0.0182
020	0.568	0.200	07.99	0.8538	-0.0698	0.1047	-0.8602	0.0150
021	0.568	0.200	09.00	0.8789	-0.0939	0.1337	-0.8892	0.0055
022	0.568	0.200	10.00	0.8874	-0.1185	0.1624	-0.9022	-0.0058
023	0.523	0.203	10.99	0.8732	-0.1309	0.1836	-0.8923	-0.0138
024	0.523	0.203	12.00	0.8497	-0.1348	0.1989	-0.8726	-0.0179
025	0.523	0.203	13.00	0.8348	-0.1365	0.2147	-0.8618	-0.0214
026	0.568	0.200	13.99	0.8188	-0.1330	0.2275	-0.8497	-0.0228
027	0.568	0.200	15.00	0.8118	-0.1318	0.2429	-0.8471	-0.0246
028	0.568	0.200	15.99	0.7941	-0.1359	0.2577	-0.8344	-0.0290
029	0.568	0.200	16.99	0.7916	-0.1421	0.2763	-0.8379	-0.0340
030	0.568	0.200	17.99	0.8024	-0.1467	0.2965	-0.8548	-0.0342
031	0.568	0.200	18.99	0.8017	-0.1468	0.3131	-0.8601	-0.0353
032	0.523	0.203	20.00	0.8097	-0.1509	0.3327	-0.8748	-0.0357
033	0.843	0.299	-10.03	-0.4846	0.0106	0.0984	0.4943	-0.0128
034	0.847	0.303	-09.03	-0.4329	-0.0225	0.0770	0.4395	-0.0084
035	0.847	0.303	-08.03	-0.3367	-0.0590	0.0510	0.3404	-0.0037
036	0.843	0.299	-07.03	-0.2370	-0.0708	0.0320	0.2391	-0.0030
037	0.847	0.303	-06.03	-0.1515	-0.0721	0.0155	0.1522	0.0000
038	0.843	0.300	-05.03	-0.0685	-0.0736	0.0124	0.0692	-0.0065
039	0.843	0.300	-04.03	0.0127	-0.0762	0.0111	-0.0120	-0.0120
040	0.843	0.299	-03.00	0.0894	-0.0772	0.0102	-0.0889	-0.0149
041	0.847	0.303	-02.03	0.1653	-0.0789	0.0110	-0.1649	-0.0169
042	0.843	0.299	-01.00	0.2426	-0.0775	0.0127	-0.2425	-0.0170
043	0.843	0.300	00.00	0.3216	-0.0786	0.0150	-0.3217	-0.0159
044	0.843	0.300	01.00	0.3982	-0.0780	0.0198	-0.3986	-0.0129
045	0.843	0.300	02.00	0.4710	-0.0769	0.0250	-0.4717	-0.0086
046	0.843	0.299	03.00	0.5491	-0.0760	0.0303	-0.5501	-0.0016
047	0.843	0.299	03.99	0.6221	-0.0732	0.0359	-0.6232	0.0025
048	0.843	0.299	05.00	0.6858	-0.0683	0.0479	-0.6874	0.0120
049	0.843	0.299	06.00	0.7450	-0.0631	0.0642	-0.7478	0.0141
050	0.843	0.299	07.00	0.7982	-0.0610	0.0831	-0.8025	0.0148
051	0.843	0.299	07.99	0.8469	-0.0723	0.1085	-0.8539	0.0103
052	0.843	0.300	09.00	0.8607	-0.0961	0.1364	-0.8715	-0.0003
053	0.843	0.300	10.00	0.8652	-0.1167	0.1626	-0.8804	-0.0100
054	0.847	0.303	10.98	0.8452	-0.1286	0.1815	-0.8644	-0.0172
055	0.847	0.303	11.99	0.8160	-0.1311	0.1957	-0.8390	-0.0219
056	0.847	0.303	12.99	0.8104	-0.1322	0.2117	-0.8373	-0.0241
057	0.843	0.300	13.98	0.8187	-0.1353	0.2297	-0.8500	-0.0251
058	0.843	0.300	14.99	0.8279	-0.1379	0.2496	-0.8644	-0.0270
059	0.843	0.300	15.98	0.8014	-0.1501	0.2656	-0.8437	-0.0347
060	0.843	0.300	16.99	0.8109	-0.1635	0.2899	-0.8604	-0.0403
061	0.843	0.300	17.99	0.8113	-0.1688	0.3045	-0.8658	-0.0390
062	0.847	0.303	18.98	0.8194	-0.1592	0.3220	-0.8797	-0.0380
063	0.843	0.300	19.99	0.8008	-0.1497	0.3307	-0.8658	-0.0370

TABLE 2B-1

SER	REVR	HOCH	THC DP	LIFT	PITCH	DRAG	NORMAL	AXIAL
001	0.575	0.200	-10.05	-0.4865	0.0133	0.1272	0.5011	-0.0409
002	0.575	0.201	-09.05	-0.4536	-0.0117	0.1090	0.4649	-0.0368
004	0.575	0.203	-08.05	-0.3675	-0.0503	0.0847	0.3756	-0.0329
005	0.575	0.204	-07.05	-0.2678	-0.0684	0.0651	0.2737	-0.0321
006	0.575	0.200	-06.00	-0.1832	-0.0727	0.0516	0.1875	-0.0323
007	0.575	0.200	-05.00	-0.1091	-0.0738	0.0448	0.1125	-0.0352
008	0.575	0.201	-04.05	-0.0321	-0.0767	0.0441	0.0350	-0.0419
009	0.575	0.200	-03.00	0.0407	-0.0772	0.0444	-0.0385	-0.0465
010	0.575	0.201	-02.00	0.1112	-0.0793	0.0459	-0.1096	-0.0498
011	0.575	0.201	-01.00	0.1793	-0.0801	0.0485	-0.1785	-0.0517
012	0.575	0.200	00.00	0.2491	-0.0802	0.0531	-0.2493	-0.0522
013	0.575	0.200	01.00	0.3197	-0.0797	0.0582	-0.3208	-0.0527
014	0.575	0.200	02.00	0.3933	-0.0813	0.0645	-0.3954	-0.0508
015	0.575	0.202	03.00	0.4602	-0.0801	0.0702	-0.4633	-0.0460
016	0.575	0.200	03.99	0.5198	-0.0784	0.0755	-0.5239	-0.0392
017	0.575	0.200	05.00	0.5889	-0.0771	0.0836	-0.5940	-0.0319
018	0.575	0.200	06.00	0.6566	-0.0746	0.0939	-0.6629	-0.0247
019	0.575	0.200	07.00	0.7404	-0.0705	0.1070	-0.7480	-0.0160
020	0.575	0.200	08.00	0.8004	-0.0741	0.1222	-0.8098	-0.0096
021	0.575	0.200	09.00	0.8509	-0.0835	0.1403	-0.8625	-0.0054
022	0.575	0.200	10.00	0.8677	-0.0931	0.1588	-0.8822	-0.0057
023	0.575	0.201	10.99	0.8624	-0.1100	0.1779	-0.8806	-0.0102
024	0.599	0.200	11.99	0.8693	-0.1241	0.1999	-0.8920	-0.0150
025	0.843	0.299	-10.05	-0.4885	0.0160	0.1309	0.5038	-0.0442
026	0.853	0.301	-09.05	-0.4583	-0.0074	0.1131	0.4703	-0.0401
027	0.847	0.300	-08.00	-0.3899	-0.0453	0.0909	0.3986	-0.0358
028	0.850	0.301	-07.02	-0.2916	-0.0702	0.0699	0.2979	-0.0338
029	0.850	0.301	-06.05	-0.1981	-0.0742	0.0551	0.2027	-0.0342
030	0.850	0.301	-05.05	-0.1201	-0.0749	0.0454	0.1235	-0.0349
031	0.850	0.301	-04.02	-0.0436	-0.0773	0.0457	0.0466	-0.0427
032	0.853	0.302	-03.05	0.0321	-0.0788	0.0460	-0.0297	-0.0478
033	0.847	0.300	-02.00	0.1040	-0.0807	0.0471	-0.1024	-0.0508
034	0.843	0.299	-01.00	0.1746	-0.0819	0.0506	-0.1738	-0.0538
035	0.843	0.299	00.00	0.2462	-0.0826	0.0549	-0.2463	-0.0549
036	0.847	0.300	01.00	0.3147	-0.0821	0.0597	-0.3158	-0.0543
037	0.853	0.301	02.00	0.3885	-0.0822	0.0658	-0.3907	-0.0523
038	0.840	0.298	03.00	0.4573	-0.0817	0.0718	-0.4606	-0.0479
039	0.847	0.300	04.00	0.5342	-0.0814	0.0791	-0.5385	-0.0417
040	0.853	0.301	04.99	0.5986	-0.0805	0.0861	-0.6040	-0.0338
041	0.847	0.300	06.00	0.6609	-0.0758	0.0962	-0.6674	-0.0267
042	0.847	0.300	07.00	0.7426	-0.0717	0.1081	-0.7504	-0.0168
043	0.847	0.300	08.00	0.7995	-0.0752	0.1234	-0.8090	-0.0109
044	0.843	0.299	09.00	0.8479	-0.0845	0.1417	-0.8597	-0.0073
045	0.843	0.299	10.00	0.8548	-0.0967	0.1587	-0.8695	-0.0079
046	0.843	0.299	10.99	0.8557	-0.1104	0.1783	-0.8741	-0.0120
047	0.843	0.299	11.99	0.8556	-0.1231	0.1974	-0.8781	-0.0154

TABLE 2B-2

SER	RESR.	H6CR.	INCID.	LIFT	PITCH.	DRAW	NORMAL	AXIAL
058	0.552	0.203	-10.03	-0.4840	0.0129	0.1290	0.4989	-0.0433
059	0.552	0.203	-09.03	-0.4606	-0.0112	0.1141	0.4727	-0.0407
060	0.552	0.203	-08.00	-0.3734	-0.0491	0.0885	0.3820	-0.0358
061	0.545	0.199	-07.00	-0.2712	-0.0685	0.0684	0.2774	-0.0349
062	0.552	0.203	-06.00	-0.1857	-0.0710	0.0551	0.1904	-0.0355
063	0.552	0.203	-05.00	-0.1097	-0.0719	0.0478	0.1133	-0.0382
064	0.552	0.203	-04.03	-0.0332	-0.0756	0.0474	0.0363	-0.0451
065	0.552	0.203	-03.00	0.0392	-0.0786	0.0484	-0.0367	-0.0505
066	0.545	0.199	-02.00	0.1080	-0.0797	0.0501	-0.1063	-0.0539
067	0.545	0.199	-01.00	0.1793	-0.0802	0.0532	-0.1785	-0.0564
068	0.545	0.199	00.00	0.2509	-0.0823	0.0573	-0.2510	-0.0574
069	0.545	0.199	01.00	0.3215	-0.0821	0.0631	-0.3227	-0.0575
070	0.545	0.199	02.00	0.4027	-0.0847	0.0692	-0.4050	-0.0551
071	0.552	0.202	03.00	0.4696	-0.0837	0.0748	-0.4729	-0.0501
072	0.552	0.203	03.99	0.5539	-0.0858	0.0832	-0.5585	-0.0445
073	0.552	0.203	04.99	0.6187	-0.0841	0.0902	-0.6243	-0.0361
074	0.545	0.199	06.00	0.6748	-0.0767	0.0994	-0.6816	-0.0284
075	0.552	0.203	07.00	0.7516	-0.0721	0.1112	-0.7597	-0.0188
076	0.545	0.199	07.99	0.8152	-0.0747	0.1245	-0.8247	-0.0099
077	0.545	0.199	08.99	0.8522	-0.0826	0.1407	-0.8638	-0.0058
078	0.545	0.199	10.00	0.8709	-0.0937	0.1611	-0.8857	-0.0074
079	0.545	0.199	10.99	0.8726	-0.1071	0.1813	-0.8913	-0.0117
080	0.545	0.199	12.00	0.8763	-0.1219	0.2023	-0.8993	-0.0157
081	0.552	0.203	13.00	0.8589	-0.1288	0.2184	-0.8862	-0.0196
082	0.552	0.203	13.99	0.8336	-0.1299	0.2300	-0.8646	-0.0216
083	0.813	0.299	-10.03	-0.4954	0.0135	0.1337	0.5110	-0.0457
084	0.814	0.303	-09.03	-0.4669	-0.0060	0.1170	0.4794	-0.0426
085	0.814	0.303	-08.00	-0.3944	-0.0442	0.0943	0.4036	-0.0387
086	0.814	0.303	-07.02	-0.2950	-0.0703	0.0729	0.3016	-0.0365
087	0.814	0.303	-06.02	-0.2005	-0.0748	0.0582	0.2054	-0.0370
088	0.814	0.303	-05.03	-0.1208	-0.0753	0.0484	0.1245	-0.0377
089	0.814	0.303	-04.02	-0.0424	-0.0776	0.0484	0.0456	-0.0454
090	0.814	0.303	-03.03	0.0339	-0.0794	0.0494	-0.0314	-0.0512
091	0.814	0.303	-02.00	0.1060	-0.0814	0.0507	-0.1043	-0.0545
092	0.814	0.303	-01.00	0.1755	-0.0807	0.0538	-0.1747	-0.0570
093	0.813	0.299	00.00	0.2482	-0.0826	0.0581	-0.2483	-0.0582
094	0.813	0.299	01.00	0.3228	-0.0845	0.0634	-0.3240	-0.0578
095	0.809	0.298	02.00	0.3986	-0.0855	0.0697	-0.4009	-0.0559
096	0.813	0.300	03.00	0.4756	-0.0869	0.0766	-0.4791	-0.0517
097	0.813	0.300	04.00	0.5515	-0.0867	0.0834	-0.5561	-0.0448
098	0.813	0.299	05.00	0.6206	-0.0844	0.0906	-0.6263	-0.0362
099	0.813	0.299	05.99	0.6727	-0.0762	0.0993	-0.6795	-0.0286
100	0.813	0.300	07.00	0.7503	-0.0714	0.1111	-0.7583	-0.0189
101	0.813	0.300	07.99	0.8126	-0.0743	0.1253	-0.8222	-0.0111
102	0.813	0.299	08.99	0.8567	-0.0833	0.1435	-0.8687	-0.0079
103	0.813	0.300	09.99	0.8816	-0.0951	0.1606	-0.8765	-0.0087
104	0.813	0.300	11.00	0.8644	-0.1059	0.1803	-0.8830	-0.0121
105	0.813	0.300	12.00	0.8569	-0.1185	0.1984	-0.8795	-0.0160
106	0.813	0.300	13.00	0.8486	-0.1258	0.2148	-0.8752	-0.0185

TABLE 2B-3

SER	REV.	ROCK	INCID.	LIFT	PITCH	DRAG	NORMAL	AXIAL
109	0.552	0.200	-10.01	-0.4866	0.0133	0.1323	0.5021	-0.0459
110	0.552	0.201	-09.01	-0.4533	-0.0104	0.1140	0.4655	-0.0418
111	0.548	0.199	-08.00	-0.3760	-0.0489	0.0913	0.3850	-0.0382
112	0.552	0.200	-07.01	-0.2742	-0.0708	0.0714	0.2807	-0.0375
113	0.552	0.201	-06.00	-0.1855	-0.0730	0.0572	0.1904	-0.0376
114	0.552	0.201	-05.00	-0.1072	-0.0744	0.0502	0.1110	-0.0408
115	0.552	0.201	-04.01	-0.0327	-0.0769	0.0498	0.0360	-0.0475
116	0.548	0.199	-03.00	0.0424	-0.0795	0.0507	-0.0398	-0.0529
117	0.555	0.201	-02.00	0.1099	-0.0806	0.0517	-0.1081	-0.0556
118	0.555	0.201	-01.00	0.1822	-0.0831	0.0557	-0.1813	-0.0590
119	0.552	0.200	00.00	0.2529	-0.0833	0.0603	-0.2530	-0.0604
120	0.548	0.199	00.99	0.3249	-0.0838	0.0654	-0.3261	-0.0599
121	0.548	0.199	02.00	0.4024	-0.0853	0.0721	-0.4048	-0.0580
122	0.548	0.199	03.00	0.4718	-0.0860	0.0784	-0.4754	-0.0536
123	0.552	0.200	03.99	0.5437	-0.0854	0.0847	-0.5484	-0.0467
124	0.552	0.200	04.99	0.6196	-0.0860	0.0928	-0.6255	-0.0385
125	0.552	0.200	05.99	0.6818	-0.0784	0.1022	-0.6888	-0.0305
126	0.552	0.200	07.00	0.7494	-0.0719	0.1127	-0.7577	-0.0205
127	0.552	0.200	07.99	0.8076	-0.0745	0.1267	-0.8175	-0.0132
128	0.552	0.200	09.00	0.8519	-0.0850	0.1443	-0.8641	-0.0092
129	0.552	0.200	10.00	0.8731	-0.0948	0.1638	-0.8884	-0.0097
130	0.552	0.201	11.00	0.8737	-0.1041	0.1822	-0.8925	-0.0122
131	0.552	0.201	12.00	0.8806	-0.1201	0.2032	-0.9037	-0.0157
132	0.552	0.201	12.99	0.8709	-0.1284	0.2207	-0.8984	-0.0193
133	0.807	0.299	-10.01	-0.4850	0.0155	0.1346	0.5010	-0.0484
134	0.807	0.299	-09.01	-0.4673	-0.0057	0.1196	0.4802	-0.0451
135	0.811	0.300	-08.01	-0.3957	-0.0432	0.0966	0.4052	-0.0406
136	0.811	0.301	-07.01	-0.2963	-0.0702	0.0751	0.3032	-0.0386
137	0.807	0.300	-06.01	-0.1981	-0.0754	0.0599	0.2032	-0.0390
138	0.804	0.299	-05.01	-0.1193	-0.0766	0.0505	0.1231	-0.0400
139	0.807	0.300	-04.02	-0.0401	-0.0773	0.0506	0.0434	-0.0478
140	0.804	0.299	-03.00	0.0359	-0.0797	0.0513	-0.0333	-0.0532
141	0.807	0.300	-02.00	0.1070	-0.0806	0.0535	-0.1051	-0.0573
142	0.811	0.301	-01.00	0.1812	-0.0829	0.0560	-0.1803	-0.0593
143	0.811	0.301	00.00	0.2538	-0.0841	0.0606	-0.2539	-0.0607
144	0.811	0.301	01.00	0.3234	-0.0841	0.0659	-0.3246	-0.0603
145	0.807	0.300	02.00	0.3978	-0.0857	0.0721	-0.4001	-0.0583
146	0.804	0.299	03.00	0.4757	-0.0864	0.0793	-0.4793	-0.0544
147	0.807	0.300	04.00	0.5507	-0.0865	0.0860	-0.5554	-0.0475
148	0.801	0.298	05.00	0.6256	-0.0859	0.0939	-0.6315	-0.0390
149	0.807	0.300	05.99	0.6834	-0.0780	0.1024	-0.6905	-0.0306
150	0.804	0.299	07.00	0.7576	-0.0724	0.1138	-0.7659	-0.0206
151	0.807	0.300	07.99	0.8198	-0.0744	0.1287	-0.8299	-0.0135
152	0.807	0.300	08.99	0.8575	-0.0855	0.1462	-0.8699	-0.0104
153	0.804	0.299	09.99	0.8745	-0.0950	0.1653	-0.8900	-0.0111
154	0.804	0.299	10.99	0.8802	-0.1062	0.1843	-0.8993	-0.0131

TABLE 2C-1

SER	REAR	ROCK	TRC D	LEFT	PITCH	DRAG	HORIZONTAL	AXIAL
157	0.552	0.199	-10.03	-0.4882	-0.0551	0.0840	0.4953	0.0019
158	0.555	0.200	-09.03	-0.4026	-0.0616	0.0626	0.4074	0.0010
159	0.552	0.199	-08.00	-0.3248	-0.0688	0.0470	0.3281	-0.0015
160	0.555	0.203	-07.03	-0.2395	-0.0715	0.0333	0.2417	-0.0040
161	0.555	0.203	-06.00	-0.1505	-0.0699	0.0217	0.1519	-0.0060
162	0.552	0.199	-05.00	-0.0769	-0.0703	0.0165	0.0779	-0.0098
163	0.555	0.200	-04.03	-0.0013	-0.0696	0.0144	0.0022	-0.0143
164	0.555	0.203	-03.00	0.0748	-0.0702	0.0135	-0.0741	-0.0175
165	0.555	0.200	-02.00	0.1445	-0.0672	0.0142	-0.1440	-0.0193
166	0.555	0.200	-01.00	0.2202	-0.0658	0.0171	-0.2200	-0.0210
167	0.555	0.200	00.00	0.2929	-0.0639	0.0214	-0.2930	-0.0215
168	0.555	0.200	01.00	0.3722	-0.0631	0.0282	-0.3727	-0.0217
169	0.555	0.200	02.00	0.4529	-0.0631	0.0354	-0.4539	-0.0196
170	0.555	0.203	03.00	0.5264	-0.0596	0.0437	-0.5281	-0.0161
171	0.555	0.200	04.00	0.6009	-0.0582	0.0544	-0.6033	-0.0124
172	0.555	0.200	05.00	0.6704	-0.0539	0.0694	-0.6740	-0.0107
173	0.555	0.203	05.99	0.7255	-0.0523	0.0846	-0.7304	-0.0085
174	0.558	0.202	07.00	0.7764	-0.0488	0.1026	-0.7832	-0.0071
175	0.555	0.203	07.99	0.8403	-0.0503	0.1250	-0.8496	-0.0069
176	0.555	0.203	09.03	0.8767	-0.0490	0.1456	-0.8888	-0.0066
177	0.552	0.199	10.03	0.9124	-0.0517	0.1688	-0.9280	-0.0078
178	0.552	0.199	11.00	0.9395	-0.0574	0.1918	-0.9589	-0.0090
179	0.552	0.199	12.00	0.9596	-0.0627	0.2155	-0.9836	-0.0112
180	0.552	0.199	13.00	0.9686	-0.0700	0.2387	-0.9976	-0.0147
181	0.552	0.199	13.99	0.9760	-0.0739	0.2600	-1.0100	-0.0162
182	0.555	0.200	15.00	0.9675	-0.0721	0.2774	-1.0065	-0.0175
183	0.552	0.199	15.99	0.9741	-0.0786	0.2991	-1.0190	-0.0191
184	0.817	0.299	-10.02	-0.5003	-0.0521	0.0872	0.5078	0.0010
185	0.821	0.300	-09.02	-0.4199	-0.0621	0.0662	0.4250	0.0002
186	0.821	0.300	-08.03	-0.3383	-0.0682	0.0490	0.3416	-0.0016
187	0.821	0.303	-07.02	-0.2497	-0.0720	0.0347	0.2520	-0.0040
188	0.821	0.300	-06.03	-0.1647	-0.0733	0.0232	0.1661	-0.0059
189	0.821	0.300	-05.00	-0.0846	-0.0726	0.0163	0.0856	-0.0090
190	0.821	0.303	-04.03	-0.0032	-0.0723	0.0140	0.0041	-0.0138
191	0.821	0.303	-03.00	0.0738	-0.0716	0.0131	-0.0731	-0.0170
192	0.821	0.303	-02.00	0.1488	-0.0702	0.0143	-0.1483	-0.0196
193	0.821	0.300	-01.00	0.2247	-0.0675	0.0170	-0.2245	-0.0210
194	0.821	0.300	00.00	0.2997	-0.0651	0.0213	-0.2998	-0.0214
195	0.821	0.303	01.00	0.3763	-0.0643	0.0275	-0.3768	-0.0210
196	0.824	0.303	02.00	0.4556	-0.0634	0.0352	-0.4567	-0.0193
197	0.821	0.303	03.00	0.5338	-0.0612	0.0439	-0.5355	-0.0160
198	0.821	0.303	03.99	0.6105	-0.0586	0.0548	-0.6129	-0.0122
199	0.817	0.300	04.99	0.6758	-0.0541	0.0694	-0.6794	-0.0104
200	0.814	0.299	06.00	0.7352	-0.0518	0.0857	-0.7403	-0.0084
201	0.814	0.299	07.00	0.7882	-0.0495	0.1043	-0.7951	-0.0074
202	0.814	0.299	08.03	0.8374	-0.0498	0.1248	-0.8468	-0.0069
203	0.814	0.299	09.00	0.8727	-0.0498	0.1453	-0.8848	-0.0071
204	0.812	0.298	10.00	0.9119	-0.0533	0.1691	-0.9275	-0.0082
205	0.814	0.299	11.03	0.9342	-0.0588	0.1920	-0.9538	-0.0102

TABLE 2C-2

SER	REV.	ROCK	DRCD	LIFT	PITCH	DRAG	NORMAL	AXIAL
002	0.573	0.199	-10.02	-0.5049	-0.0497	0.0824	0.5115	0.0065
003	0.573	0.201	-09.01	-0.4118	-0.0600	0.0599	0.4161	0.0052
004	0.573	0.201	-08.00	-0.3256	-0.0657	0.0429	0.3283	0.0027
005	0.573	0.201	-07.00	-0.2392	-0.0670	0.0296	0.2410	-0.0003
006	0.573	0.200	-06.00	-0.1562	-0.0672	0.0187	0.1573	-0.0024
007	0.573	0.199	-05.01	-0.0757	-0.0677	0.0146	0.0766	-0.0081
008	0.573	0.199	-04.01	0.0016	-0.0672	0.0141	-0.0007	-0.0142
009	0.563	0.196	-03.00	0.0730	-0.0645	0.0137	-0.0723	-0.0176
010	0.573	0.200	-03.00	0.0775	-0.0674	0.0143	-0.0767	-0.0185
011	0.573	0.201	-02.00	0.1514	-0.0671	0.0164	-0.1508	-0.0218
012	0.573	0.199	-01.00	0.2276	-0.0637	0.0198	-0.2274	-0.0238
013	0.573	0.200	00.00	0.2983	-0.0609	0.0252	-0.2984	-0.0253
014	0.573	0.200	01.00	0.3811	-0.0607	0.0325	-0.3817	-0.0259
015	0.181	0.200	02.00	0.4609	-0.0588	0.0412	-0.4622	-0.0251
016	0.573	0.200	03.00	0.5379	-0.0584	0.0516	-0.5400	-0.0234
017	0.573	0.201	03.99	0.6045	-0.0542	0.0633	-0.6075	-0.0211
018	0.573	0.199	04.99	0.6636	-0.0521	0.0786	-0.6680	-0.0205
019	0.573	0.199	06.00	0.7273	-0.0497	0.0968	-0.7335	-0.0203
020	0.573	0.200	07.00	0.7731	-0.0469	0.1157	-0.7816	-0.0205
021	0.573	0.199	07.99	0.8301	-0.0484	0.1386	-0.8414	-0.0218
022	0.573	0.199	08.99	0.8725	-0.0501	0.1613	-0.8871	-0.0229
023	0.573	0.200	10.01	0.9020	-0.0510	0.1836	-0.9203	-0.0241
024	0.573	0.200	11.00	0.9342	-0.0556	0.2084	-0.9569	-0.0264
025	0.573	0.200	12.00	0.9548	-0.0574	0.2317	-0.9822	-0.0282
026	0.573	0.201	13.00	0.9567	-0.0635	0.2520	-0.9890	-0.0303
027	0.573	0.201	13.99	0.9602	-0.0677	0.2720	-0.9976	-0.0317
028	0.573	0.201	15.00	0.9568	-0.0719	0.2910	-0.9997	-0.0333
029	0.573	0.201	15.99	0.9478	-0.0798	0.3081	-0.9962	-0.0351

TABLE 2C-3

SER	REAR	ROCK	INCID	LEFT	PITCH	DRAG	NORMAL	AXIAL
208	0.525	0.203	-10.03	-0.4684	-0.0579	0.0785	0.4748	0.0040
209	0.568	0.200	-09.03	-0.3923	-0.0622	0.0597	0.3967	0.0023
210	0.523	0.203	-08.00	-0.3035	-0.0723	0.0424	0.3063	0.0002
211	0.523	0.203	-07.03	-0.2181	-0.0759	0.0294	0.2199	-0.0027
212	0.523	0.203	-06.03	-0.1397	-0.0738	0.0187	0.1408	-0.0041
213	0.568	0.200	-05.00	-0.0619	-0.0726	0.0139	0.0628	-0.0086
214	0.568	0.200	-04.03	0.0141	-0.0720	0.0119	-0.0134	-0.0129
215	0.523	0.203	-03.00	0.0891	-0.0726	0.0116	-0.0885	-0.0164
216	0.568	0.200	-01.99	0.1612	-0.0716	0.0132	-0.1607	-0.0189
217	0.567	0.199	-01.00	0.2363	-0.0697	0.0167	-0.2361	-0.0209
218	0.568	0.200	00.00	0.3095	-0.0682	0.0219	-0.3096	-0.0220
219	0.525	0.202	01.00	0.3805	-0.0656	0.0284	-0.3810	-0.0218
220	0.523	0.203	02.00	0.4632	-0.0654	0.0370	-0.4644	-0.0208
221	0.523	0.203	03.00	0.5400	-0.0650	0.0466	-0.5418	-0.0183
222	0.523	0.203	03.99	0.6018	-0.0617	0.0569	-0.6044	-0.0149
223	0.568	0.200	05.00	0.6636	-0.0580	0.0708	-0.6674	-0.0127
224	0.567	0.199	06.00	0.7308	-0.0555	0.0874	-0.7361	-0.0105
225	0.567	0.199	07.00	0.7905	-0.0544	0.1066	-0.7977	-0.0094
226	0.568	0.200	07.99	0.8338	-0.0529	0.1261	-0.8434	-0.0089
227	0.520	0.199	09.00	0.8781	-0.0533	0.1481	-0.8906	-0.0089
228	0.520	0.199	10.00	0.9193	-0.0549	0.1717	-0.9353	-0.0094
229	0.520	0.199	11.03	0.9474	-0.0561	0.1946	-0.9673	-0.0102
230	0.520	0.199	12.00	0.9665	-0.0612	0.2176	-0.9908	-0.0118
231	0.520	0.199	13.00	0.9707	-0.0687	0.2400	-0.9999	-0.0154
232	0.520	0.199	13.99	0.9621	-0.0732	0.2585	-0.9961	-0.0182
233	0.520	0.199	15.00	0.9728	-0.0754	0.2804	-1.0123	-0.0190
234	0.568	0.200	15.99	0.9739	-0.0789	0.2999	-1.0189	-0.0200
235	0.834	0.300	-10.05	-0.4979	-0.0487	0.0880	0.5055	0.0001
236	0.834	0.300	-09.04	-0.4238	-0.0595	0.0682	0.4292	-0.0009
237	0.837	0.303	-08.03	-0.3377	-0.0674	0.0495	0.3412	-0.0020
238	0.837	0.303	-07.03	-0.2489	-0.0716	0.0345	0.2511	-0.0039
239	0.837	0.303	-06.02	-0.1650	-0.0709	0.0229	0.1664	-0.0056
240	0.837	0.303	-04.03	-0.0056	-0.0705	0.0145	0.0065	-0.0142
241	0.837	0.303	-02.00	0.1454	-0.0678	0.0150	-0.1449	-0.0201
242	0.831	0.303	-02.00	0.1458	-0.0678	0.0150	-0.1453	-0.0201
243	0.837	0.303	-00.02	0.2976	-0.0644	0.0231	-0.2977	-0.0233
244	0.837	0.303	-02.02	0.4550	-0.0624	0.0207	-0.4541	-0.0368
245	0.834	0.300	-04.02	0.6073	-0.0596	0.0031	-0.6057	-0.0457
246	0.837	0.303	02.00	0.5241	-0.0602	0.0418	-0.5254	-0.0235
247	0.837	0.303	03.99	0.6030	-0.0572	0.0588	-0.6058	-0.0167
248	0.834	0.300	06.00	0.7230	-0.0506	0.0888	-0.7285	-0.0127
249	0.830	0.299	08.00	0.8224	-0.0478	0.1264	-0.8321	-0.0108
250	0.834	0.300	10.03	0.9084	-0.0507	0.1717	-0.9245	-0.0113
251	0.834	0.300	12.00	0.9428	-0.0604	0.2158	-0.9672	-0.0152
252	0.834	0.300	14.00	0.9338	-0.0683	0.2538	-0.9676	-0.0203

TABLE 2D-1

SER	REVR.	HECH.	DRCD	LIFT.	PITCH.	DRAG	NORMAL	AXIAL.
163	0.523	0.199	-10.02	-0.4661	-0.0663	0.0890	0.4744	-0.0067
164	0.525	0.200	-09.03	-0.3981	-0.0737	0.0702	0.4041	-0.0070
165	0.528	0.201	-08.02	-0.3234	-0.0776	0.0533	0.3276	-0.0078
166	0.528	0.201	-07.00	-0.2332	-0.0804	0.0373	0.2359	-0.0087
167	0.568	0.199	-06.00	-0.1520	-0.0805	0.0246	0.1537	-0.0087
168	0.568	0.199	-05.01	-0.0761	-0.0793	0.0170	0.0772	-0.0104
169	0.525	0.201	-04.01	0.0016	-0.0770	0.0130	-0.0008	-0.0132
170	0.525	0.201	-03.01	0.0776	-0.0745	0.0108	-0.0770	-0.0150
171	0.525	0.201	-02.01	0.1537	-0.0756	0.0106	-0.1533	-0.0161
172	0.525	0.201	-00.99	0.2276	-0.0706	0.0116	-0.2275	-0.0156
173	0.568	0.199	00.00	0.3039	-0.0683	0.0144	-0.3040	-0.0145
174	0.568	0.199	01.00	0.3825	-0.0653	0.0189	-0.3829	-0.0122
175	0.568	0.199	02.00	0.4561	-0.0612	0.0246	-0.4568	-0.0087
176	0.568	0.199	03.00	0.5312	-0.0582	0.0310	-0.5322	-0.0031
177	0.568	0.199	03.99	0.6037	-0.0548	0.0401	-0.6052	0.0020
178	0.568	0.199	05.00	0.6691	-0.0495	0.0530	-0.6713	0.0055
179	0.568	0.199	06.00	0.7331	-0.0465	0.0681	-0.7364	0.0089
180	0.568	0.199	07.00	0.7870	-0.0436	0.0862	-0.7918	0.0104
181	0.568	0.199	08.00	0.8355	-0.0456	0.1065	-0.8423	0.0108
182	0.525	0.201	09.01	0.8684	-0.0484	0.1283	-0.8779	0.0092
183	0.525	0.201	10.00	0.9021	-0.0571	0.1527	-0.9150	0.0063
184	0.525	0.201	10.99	0.9247	-0.0682	0.1775	-0.9417	0.0021
185	0.525	0.201	11.99	0.9417	-0.0735	0.2003	-0.9629	-0.0002
186	0.528	0.202	13.00	0.9560	-0.0782	0.2231	-0.9818	-0.0023
187	0.525	0.201	13.99	0.9628	-0.0825	0.2452	-0.9936	-0.0051
188	0.525	0.201	15.00	0.9664	-0.0820	0.2648	-1.0021	-0.0055
189	0.568	0.199	15.99	0.9861	-0.0854	0.2888	-1.0276	-0.0060
190	0.528	0.201	17.00	0.9982	-0.0850	0.3120	-1.0459	-0.0064
191	0.528	0.202	18.00	0.9956	-0.0858	0.3308	-1.0492	-0.0069
192	0.568	0.199	18.99	0.9887	-0.0873	0.3483	-1.0483	-0.0075
193	0.528	0.201	20.00	1.0095	-0.0902	0.3770	-1.0777	-0.0089

TABLE 2D-2

SER	REYN	ROCH	INCID	LIFT	PITCH	DRAG	NORMAL	AXIAL
097	0.565	0.199	-10.03	-0.4920	-0.0557	0.0871	0.4995	-0.0002
098	0.571	0.200	-09.03	-0.4120	-0.0649	0.0666	0.4173	-0.0014
099	0.565	0.200	-08.00	-0.3257	-0.0701	0.0487	0.3293	-0.0031
100	0.565	0.200	-07.00	-0.2413	-0.0729	0.0344	0.2436	-0.0049
101	0.571	0.201	-06.00	-0.1559	-0.0722	0.0226	0.1573	-0.0063
102	0.571	0.201	-05.00	-0.0737	-0.0716	0.0162	0.0747	-0.0099
103	0.575	0.202	-04.03	0.0043	-0.0693	0.0142	-0.0034	-0.0146
104	0.571	0.201	-03.03	0.0782	-0.0657	0.0128	-0.0775	-0.0169
105	0.568	0.200	-01.99	0.1544	-0.0663	0.0137	-0.1540	-0.0192
106	0.571	0.201	-01.00	0.2308	-0.0639	0.0168	-0.2306	-0.0209
107	0.571	0.201	00.00	0.3061	-0.0602	0.0212	-0.3062	-0.0213
108	0.568	0.200	01.00	0.3839	-0.0574	0.0273	-0.3844	-0.0207
109	0.568	0.200	02.00	0.4593	-0.0546	0.0347	-0.4603	-0.0187
110	0.568	0.200	03.00	0.5348	-0.0534	0.0438	-0.5364	-0.0158
111	0.568	0.200	03.99	0.6062	-0.0489	0.0548	-0.6086	-0.0125
112	0.568	0.200	04.99	0.6714	-0.0447	0.0699	-0.6750	-0.0113
113	0.568	0.200	06.00	0.7382	-0.0423	0.0876	-0.7435	-0.0099
114	0.568	0.200	07.03	0.7912	-0.0409	0.1067	-0.7984	-0.0094
115	0.571	0.200	08.00	0.8433	-0.0410	0.1284	-0.8531	-0.0094
116	0.568	0.200	09.00	0.8841	-0.0399	0.1512	-0.8970	-0.0111
117	0.568	0.200	10.00	0.9098	-0.0443	0.1733	-0.9262	-0.0127
118	0.568	0.200	11.00	0.9408	-0.0492	0.1983	-0.9614	-0.0152
119	0.568	0.200	12.00	0.9591	-0.0532	0.2217	-0.9843	-0.0175
120	0.568	0.200	13.00	0.9806	-0.0619	0.2475	-1.0112	-0.0205
121	0.568	0.200	13.99	0.9821	-0.0658	0.2687	-1.0180	-0.0232
122	0.568	0.200	15.00	0.9896	-0.0697	0.2912	-1.0313	-0.0250
123	0.571	0.201	15.99	0.9947	-0.0791	0.3128	-1.0425	-0.0267
124	0.575	0.201	16.99	1.0140	-0.0883	0.3395	-1.0691	-0.0283
125	0.571	0.201	18.00	1.0209	-0.0930	0.3633	-1.0834	-0.0300
126	0.571	0.201	18.99	1.0225	-0.0932	0.3844	-1.0920	-0.0307
127	0.571	0.201	20.00	0.9946	-0.0911	0.3949	-1.0697	-0.0308

TABLE 2D-3

SER	RESID.	NOCH.	INCID.	LIFT.	PITCH.	DRAG	NORMAL	AXIAL.
130	0.565	0.200	-10.02	-0.4673	-0.0190	0.0894	0.4757	-0.0069
131	0.565	0.200	-09.02	-0.3937	-0.0381	0.0679	0.3994	-0.0055
132	0.571	0.201	-08.02	-0.3097	-0.0464	0.0520	0.3138	-0.0084
133	0.571	0.202	-07.02	-0.2214	-0.0496	0.0398	0.2245	-0.0126
134	0.571	0.201	-06.03	-0.1460	-0.0485	0.0315	0.1484	-0.0161
135	0.565	0.200	-05.01	-0.0684	-0.0485	0.0297	0.0706	-0.0238
136	0.568	0.201	-04.01	0.0052	-0.0466	0.0303	-0.0031	-0.0307
137	0.565	0.200	-03.03	0.0801	-0.0460	0.0331	-0.0783	-0.0374
138	0.565	0.200	-02.00	0.1500	-0.0441	0.0387	-0.1486	-0.0440
139	0.565	0.200	-01.02	0.2224	-0.0431	0.0466	-0.2216	-0.0506
140	0.565	0.200	00.00	0.2939	-0.0410	0.0579	-0.2940	-0.0580
141	0.565	0.200	01.00	0.3696	-0.0396	0.0714	-0.3709	-0.0650
142	0.571	0.201	02.00	0.4432	-0.0395	0.0871	-0.4461	-0.0716
143	0.571	0.201	03.00	0.4977	-0.0376	0.1008	-0.5024	-0.0746
144	0.565	0.200	04.00	0.5702	-0.0378	0.1195	-0.5773	-0.0794
145	0.571	0.201	04.99	0.6207	-0.0370	0.1356	-0.6302	-0.0810
146	0.571	0.201	06.00	0.6714	-0.0372	0.1549	-0.6841	-0.0838
147	0.571	0.201	07.00	0.7119	-0.0382	0.1730	-0.7278	-0.0849
148	0.571	0.201	08.01	0.7562	-0.0378	0.1914	-0.7756	-0.0847
149	0.565	0.200	09.01	0.8209	-0.0425	0.2125	-0.8442	-0.0814
150	0.571	0.201	10.01	0.8460	-0.0486	0.2263	-0.8726	-0.0758
151	0.571	0.201	10.99	0.8616	-0.0570	0.2437	-0.8924	-0.0749
152	0.565	0.200	11.99	0.8786	-0.0653	0.2627	-0.9142	-0.0744
153	0.571	0.201	13.00	0.8478	-0.0793	0.2743	-0.8880	-0.0765
154	0.571	0.201	13.99	0.8170	-0.0890	0.2829	-0.8613	-0.0770
155	0.565	0.200	15.00	0.7918	-0.0900	0.2920	-0.8405	-0.0771
156	0.565	0.200	15.99	0.7920	-0.0917	0.3079	-0.8463	-0.0778
157	0.565	0.200	17.00	0.7909	-0.0938	0.3229	-0.8509	-0.0775
158	0.565	0.198	18.00	0.8051	-0.0976	0.3443	-0.8722	-0.0786
159	0.565	0.200	19.00	0.8017	-0.0984	0.3585	-0.8749	-0.0779
160	0.565	0.198	20.00	0.8153	-0.1022	0.3811	-0.8966	-0.0793

TABLE 2D-4

SUR	REVR.	ROCH.	INCID.	LIFT.	PITCH.	DRAG	NORMAL	AXIAL.
196	0.578	0.200	-10.03	-0.5021	-0.0306	0.0893	0.5099	-0.0009
197	0.576	0.199	-09.03	-0.4149	-0.0526	0.0652	0.4199	0.0004
198	0.574	0.199	-08.03	-0.3246	-0.0650	0.0452	0.3277	0.0003
199	0.578	0.203	-07.03	-0.2365	-0.0692	0.0306	0.2384	-0.0016
200	0.578	0.203	-06.03	-0.1528	-0.0669	0.0194	0.1539	-0.0034
201	0.578	0.203	-05.03	-0.0736	-0.0660	0.0156	0.0746	-0.0092
202	0.583	0.203	-04.03	0.0043	-0.0638	0.0149	-0.0033	-0.0153
203	0.574	0.199	-03.03	0.0824	-0.0639	0.0159	-0.0816	-0.0203
204	0.574	0.199	-03.99	0.1560	-0.0624	0.0186	-0.1553	-0.0241
205	0.575	0.199	-03.00	0.2312	-0.0596	0.0230	-0.2309	-0.0271
206	0.578	0.203	00.00	0.3052	-0.0561	0.0285	-0.3053	-0.0285
207	0.578	0.203	01.00	0.3822	-0.0537	0.0362	-0.3829	-0.0296
208	0.578	0.203	02.00	0.4567	-0.0501	0.0448	-0.4581	-0.0288
209	0.578	0.203	03.00	0.5329	-0.0487	0.0550	-0.5352	-0.0271
210	0.578	0.203	03.99	0.6079	-0.0456	0.0676	-0.6112	-0.0252
211	0.578	0.203	05.00	0.6773	-0.0433	0.0833	-0.6821	-0.0239
212	0.578	0.203	06.00	0.7430	-0.0404	0.1015	-0.7497	-0.0232
213	0.578	0.203	07.03	0.7994	-0.0382	0.1218	-0.8081	-0.0235
214	0.578	0.203	08.03	0.8512	-0.0364	0.1439	-0.8631	-0.0239
215	0.578	0.203	09.03	0.8975	-0.0354	0.1682	-0.9128	-0.0256
216	0.578	0.203	10.03	0.9386	-0.0362	0.1937	-0.9581	-0.0277
217	0.578	0.203	11.00	0.9627	-0.0385	0.2172	-0.9866	-0.0295
218	0.578	0.203	12.00	0.9854	-0.0416	0.2416	-1.0139	-0.0316
219	0.578	0.203	13.03	1.0078	-0.0459	0.2672	-1.0422	-0.0336
220	0.578	0.203	14.00	1.0160	-0.0510	0.2898	-1.0561	-0.0354
221	0.574	0.199	15.03	1.0106	-0.0602	0.3097	-1.0564	-0.0375
222	0.573	0.198	15.99	1.0085	-0.0704	0.3305	-1.0607	-0.0398
223	0.574	0.199	17.00	0.9927	-0.0766	0.3475	-1.0510	-0.0420
224	0.574	0.199	18.00	0.9984	-0.0815	0.3688	-1.0633	-0.0422
225	0.573	0.198	18.99	1.0039	-0.0871	0.3922	-1.0770	-0.0441
226	0.578	0.203	20.00	0.9731	-0.0864	0.4007	-1.0516	-0.0437

TABLE 2D5

SER	RIVE	RECB	TRCD	DTT	PITCH	DRAO	NORIAL	RETRAL		
123	0	501	0	199	-09 99	-0.5083	-0.0265	0.0935	0.5168	-0.0040
122	0	501	0	202	-09 01	-0.4236	-0.0487	0.0693	0.4291	-0.0022
123	0	521	0	202	-06 00	-0.3335	-0.0622	0.0493	0.3370	-0.0026
124	0	521	0	203	-07 00	-0.2445	-0.0643	0.0355	0.2469	-0.0055
125	0	521	0	203	-06 00	-0.1604	-0.0644	0.0233	0.1619	-0.0065
126	0	521	0	203	-05 00	-0.0819	-0.0617	0.0196	0.0832	-0.0125
127	0	521	0	203	-04 01	-0.0024	-0.0616	0.0179	0.0036	-0.0178
128	0	528	0	204	-02 03	0.0727	-0.0598	0.0121	-0.0724	-0.0148
129	0	583	0	206	-03 02	0.0712	-0.0610	0.0179	-0.0702	-0.0217
130	0	583	0	206	-02 02	0.1424	-0.0585	0.0206	-0.1417	-0.0257
131	0	583	0	206	-01 02	0.2276	-0.0573	0.0248	-0.2223	-0.0288
132	0	585	0	207	00 01	0.2944	-0.0538	0.0307	-0.2945	-0.0307
133	0	585	0	207	01 00	0.3699	-0.0511	0.0384	-0.3706	-0.0320
134	0	585	0	207	02 00	0.4496	-0.0501	0.0474	-0.4511	-0.0317
135	0	585	0	207	03 00	0.5248	-0.0469	0.0573	-0.5272	-0.0297
136	0	585	0	207	03 99	0.5968	-0.0446	0.0692	-0.6003	-0.0275
137	0	585	0	206	04 99	0.6723	-0.0413	0.0849	-0.6772	-0.0261
138	0	585	0	206	06 01	0.7357	-0.0383	0.1030	-0.7425	-0.0255
139	0	585	0	206	07 01	0.7967	-0.0369	0.1232	-0.8059	-0.0251
140	0	585	0	206	08 00	0.8504	-0.0339	0.1455	-0.8625	-0.0258
141	0	585	0	206	09 01	0.8940	-0.0337	0.1682	-0.9094	-0.0262
142	0	528	0	204	10 01	0.9401	-0.0348	0.1942	-0.9597	-0.0279
143	0	585	0	206	11 00	0.9592	-0.0363	0.2166	-0.9830	-0.0296
144	0	528	0	204	12 01	0.9805	-0.0393	0.2411	-1.0093	-0.0319
145	0	521	0	203	13 01	1.0053	-0.0425	0.2666	-1.0396	-0.0335
146	0	521	0	203	14 01	1.0238	-0.0481	0.2917	-1.0640	-0.0353
147	0	521	0	203	15 01	1.0221	-0.0521	0.3122	-1.0682	-0.0370
148	0	528	0	204	16 00	1.0204	-0.0579	0.3312	-1.0723	-0.0372
149	0	528	0	204	18 00	1.0008	-0.0744	0.3689	-1.0659	-0.0415
150	0	528	0	204	17 00	1.0271	-0.0707	0.3618	-1.0881	-0.0456
151	0	528	0	204	18 00	1.0165	-0.0756	0.3745	-1.0826	-0.0420
152	0	585	0	207	18 99	0.9910	-0.0762	0.3840	-1.0622	-0.0406
153	0	585	0	206	20 00	0.9922	-0.0873	0.4086	-1.0722	-0.0446
154	1	101	0	400	-10 03	-0.5196	-0.0206	0.0992	0.5289	-0.0074
155	1	101	0	400	-09 04	-0.4479	-0.0411	0.0768	0.4543	-0.0056
156	1	101	0	400	-08 03	-0.3594	-0.0612	0.0551	0.3634	-0.0044
157	1	097	0	399	-07 03	-0.2665	-0.0696	0.0389	0.2692	-0.0061
158	1	104	0	401	-06 02	-0.1765	-0.0705	0.0259	0.1782	-0.0073
159	1	101	0	401	-05 02	-0.0908	-0.0691	0.0187	0.0920	-0.0108
160	1	101	0	401	-04 02	-0.0078	-0.0674	0.0170	0.0089	-0.0105
161	1	101	0	401	-03 02	0.0725	-0.0655	0.0170	-0.0716	-0.0209
162	1	097	0	399	-02 03	0.1543	-0.0634	0.0198	-0.1536	-0.0213
163	1	101	0	401	-01 01	0.2345	-0.0618	0.0244	-0.2341	-0.0286
164	1	101	0	401	00 00	0.3113	-0.0592	0.0307	-0.3114	-0.0308
165	1	097	0	399	01 00	0.3905	-0.0570	0.0389	-0.3912	-0.0327
166	1	094	0	398	02 00	0.4694	-0.0543	0.0482	-0.4709	-0.0318
167	1	097	0	399	03 00	0.5531	-0.0515	0.0596	-0.5556	-0.0306
168	1	097	0	399	03 99	0.6272	-0.0478	0.0720	-0.6307	-0.0282
169	1	097	0	399	04 99	0.7035	-0.0449	0.0888	-0.7087	-0.0272
170	1	101	0	400	06 00	0.7625	-0.0412	0.1073	-0.7696	-0.0273
171	1	097	0	399	07 01	0.8236	-0.0389	0.1288	-0.8333	-0.0273
172	1	101	0	400	08 01	0.8754	-0.0377	0.1515	-0.8881	-0.0281
173	1	101	0	402	09 01	0.9156	-0.0375	0.1747	-0.9317	-0.0292
174	1	097	0	399	10 01	0.9475	-0.0389	0.1985	-0.9677	-0.0308
175	1	097	0	399	11 01	0.9733	-0.0413	0.2230	-0.9981	-0.0330
176	1	097	0	399	12 00	0.9963	-0.0453	0.2476	-1.0261	-0.0351
177	1	104	0	401	13 01	1.0014	-0.0491	0.2687	-1.0361	-0.0354
178	1	102	0	401	14 00	1.0045	-0.0551	0.2895	-1.0448	-0.0380
179	1	097	0	399	15 01	1.0207	-0.0591	0.3128	-1.0670	-0.0378
180	1	101	0	401	16 00	1.0363	-0.0636	0.3310	-1.0683	-0.0381
181	1	097	0	399	16 99	1.0124	-0.0694	0.3506	-1.0708	-0.0394
182	1	101	0	400	17 99	1.0092	-0.0751	0.3704	-1.0744	-0.0405

TABLE 2D-6

SER	RENR	ROCR	DRCD	DETT	DOTCH	DRAB	NORIAL	AXIAL
202	0.528	0.203	-10.03	-0.5040	-0.0204	0.0940	0.5125	-0.0050
203	0.528	0.203	-09.03	-0.4196	-0.0505	0.0711	0.4255	-0.0046
204	0.523	0.199	-08.00	-0.3304	-0.0611	0.0526	0.3344	-0.0062
205	0.523	0.199	-07.00	-0.2409	-0.0660	0.0383	0.2436	-0.0080
206	0.528	0.203	-06.00	-0.1566	-0.0649	0.0260	0.1505	-0.0104
207	0.528	0.203	-05.03	-0.0825	-0.0637	0.0219	0.0840	-0.0140
208	0.523	0.199	-04.03	-0.0044	-0.0623	0.0202	0.0057	-0.0199
209	0.523	0.199	-03.03	0.0717	-0.0607	0.0202	-0.0706	-0.0241
210	0.523	0.199	-02.00	0.1461	-0.0590	0.0229	-0.1453	-0.0280
211	0.523	0.199	-01.00	0.2226	-0.0568	0.0269	-0.2222	-0.0309
212	0.568	0.199	00.00	0.2971	-0.0545	0.0326	-0.2972	-0.0327
213	0.523	0.199	01.00	0.3735	-0.0514	0.0400	-0.3743	-0.0385
214	0.510	0.196	02.00	0.4544	-0.0504	0.0493	-0.4560	-0.0434
215	0.568	0.199	03.00	0.5238	-0.0480	0.0590	-0.5263	-0.0515
216	0.568	0.199	04.00	0.6032	-0.0451	0.0708	-0.6048	-0.0587
217	0.568	0.199	05.99	0.6722	-0.0417	0.0854	-0.6772	-0.0666
218	0.568	0.199	06.00	0.7373	-0.0397	0.1026	-0.7442	-0.0759
219	0.568	0.199	07.03	0.7946	-0.0375	0.1229	-0.8030	-0.0855
220	0.523	0.203	08.03	0.8450	-0.0354	0.1444	-0.8570	-0.0959
221	0.568	0.199	09.03	0.8920	-0.0342	0.1674	-0.9074	-0.0957
222	0.568	0.199	10.03	0.9362	-0.0349	0.1929	-0.9555	-0.0973
223	0.528	0.203	11.00	0.9583	-0.0368	0.2163	-0.9821	-0.0995
224	0.568	0.199	12.00	0.9863	-0.0403	0.2421	-1.0152	-0.0998
225	0.568	0.199	13.03	1.0032	-0.0426	0.2658	-1.0374	-0.0932
226	0.568	0.199	14.00	1.0144	-0.0456	0.2881	-1.0540	-0.0942
227	0.568	0.199	15.03	1.0137	-0.0508	0.3090	-1.0592	-0.0960
228	0.568	0.199	16.00	1.0260	-0.0562	0.3324	-1.0780	-0.0968
229	0.568	0.199	17.00	1.0255	-0.0616	0.3519	-1.0837	-0.0968
230	0.568	0.199	18.00	1.0247	-0.0675	0.3730	-1.0899	-0.0980
231	0.568	0.199	18.99	1.0242	-0.0737	0.3946	-1.0970	-0.0998
232	0.568	0.199	20.00	1.0053	-0.0858	0.4124	-1.0859	-0.0947
233	1.094	0.403	-10.04	-0.5161	-0.0192	0.1009	0.5257	-0.0096
234	1.086	0.400	-09.02	-0.4453	-0.0412	0.0790	0.4521	-0.0084
235	1.084	0.403	-10.03	-0.5152	-0.0179	0.1011	0.5253	-0.0099
236	1.084	0.402	-08.03	-0.3600	-0.0591	0.0588	0.3646	-0.0082
237	1.083	0.403	-08.03	-0.2644	-0.0680	0.0490	0.2685	-0.0118
238	1.025	0.400	-07.03	-0.2637	-0.0679	0.0421	0.2668	-0.0097
239	1.025	0.400	-06.03	-0.1734	-0.0693	0.0288	0.1754	-0.0106
240	1.081	0.403	-05.03	-0.0880	-0.0679	0.0218	0.0895	-0.0142
241	1.084	0.402	-04.02	-0.0060	-0.0667	0.0194	0.0072	-0.0190
242	1.083	0.403	-03.03	0.0750	-0.0647	0.0195	-0.0740	-0.0235
243	1.078	0.400	-02.00	0.1546	-0.0632	0.0220	-0.1539	-0.0275
244	1.084	0.402	-01.03	0.2347	-0.0613	0.0263	-0.2343	-0.0305
245	1.025	0.400	00.00	0.3126	-0.0586	0.0323	-0.3127	-0.0324
246	1.025	0.400	01.00	0.3902	-0.0559	0.0404	-0.3910	-0.0336
247	1.025	0.400	02.00	0.4709	-0.0537	0.0498	-0.4725	-0.0334
248	1.025	0.400	03.00	0.5530	-0.0509	0.0608	-0.5555	-0.0318
249	1.025	0.399	03.99	0.6274	-0.0470	0.0730	-0.6311	-0.0291
250	1.025	0.399	05.00	0.6973	-0.0442	0.0883	-0.7025	-0.0272
251	1.025	0.399	06.03	0.7654	-0.0414	0.1080	-0.7726	-0.0273
252	1.025	0.399	07.03	0.8206	-0.0396	0.1296	-0.8384	-0.0276
253	1.025	0.399	08.03	0.8804	-0.0386	0.1524	-0.8932	-0.0282
254	1.025	0.399	09.03	0.9211	-0.0384	0.1756	-0.9374	-0.0292
255	1.025	0.399	10.03	0.9575	-0.0396	0.2003	-0.9779	-0.0308
256	1.025	0.400	11.00	0.9844	-0.0421	0.2249	-1.0093	-0.0329
257	1.02	0.399	12.03	1.0036	-0.0452	0.2490	-1.0336	-0.0347
258	1.021	0.400	13.03	1.0047	-0.0491	0.2694	-1.0396	-0.0363

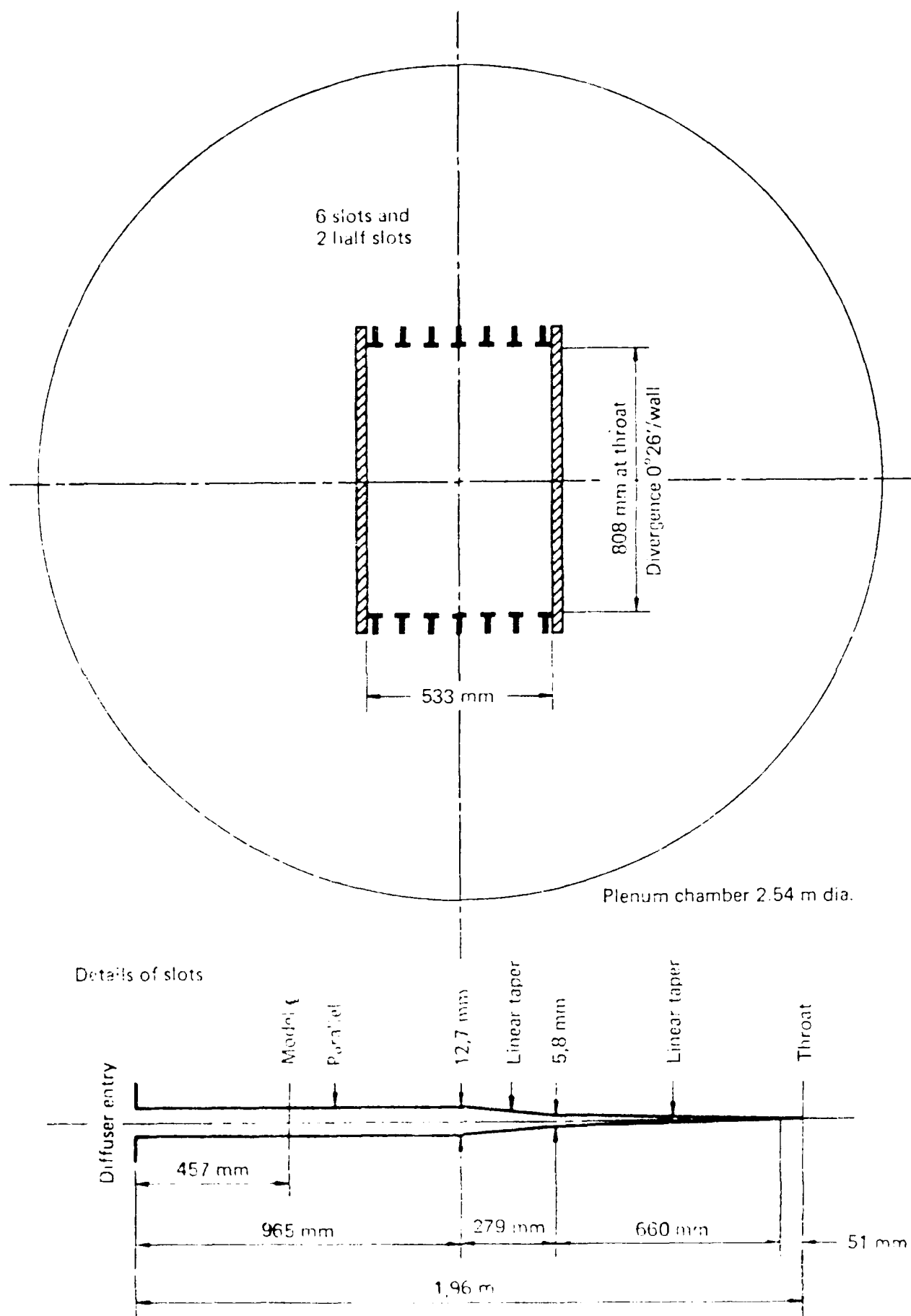


FIG. 1 DETAILS OF SLOTTED WORKING SECTION

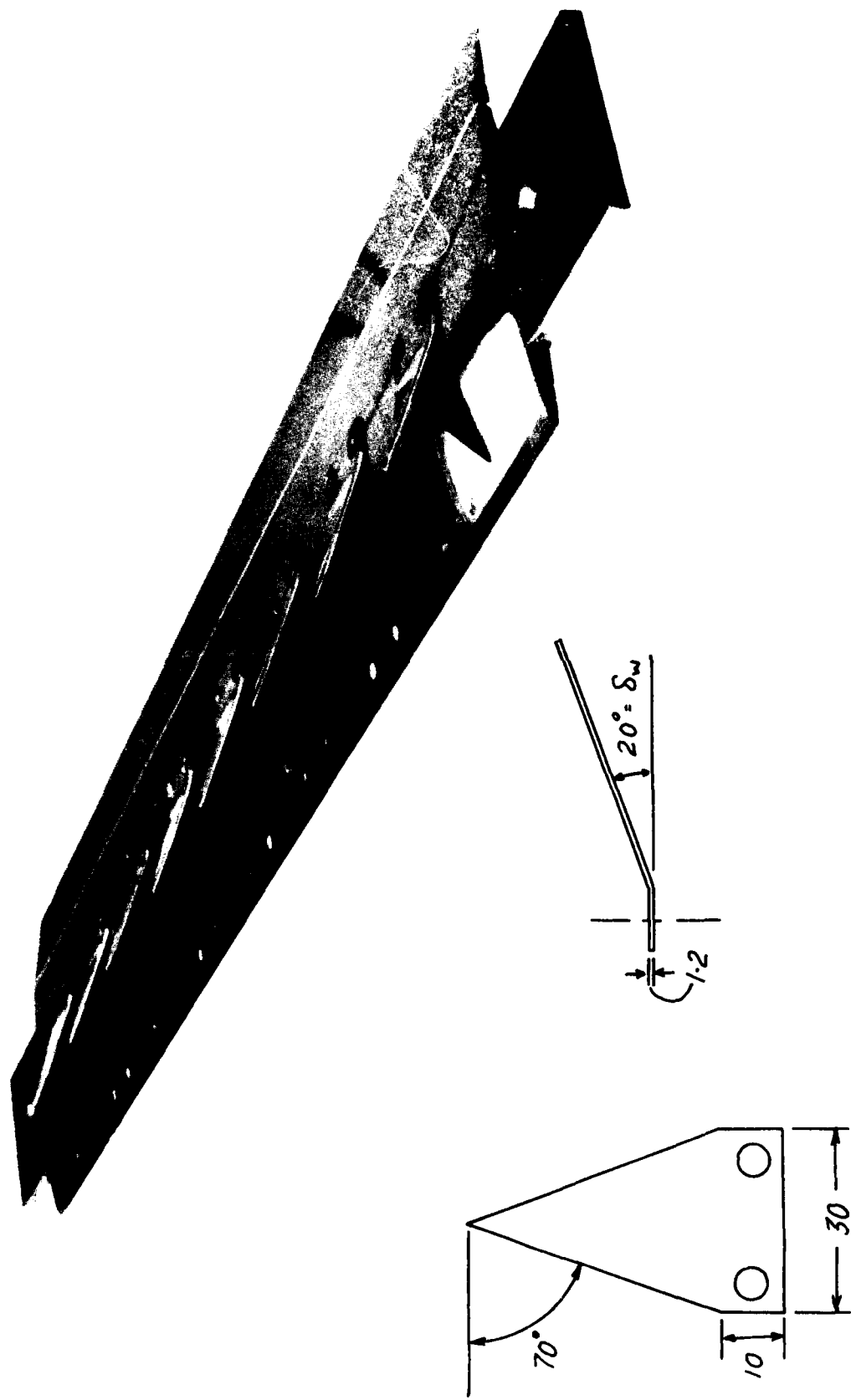


FIG. 2 (a) AEROFOIL MODEL WITH UPPER SURFACE WEDGES (dimensions in mm)

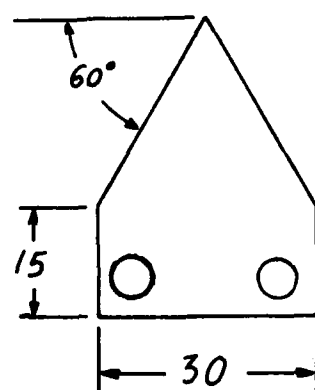
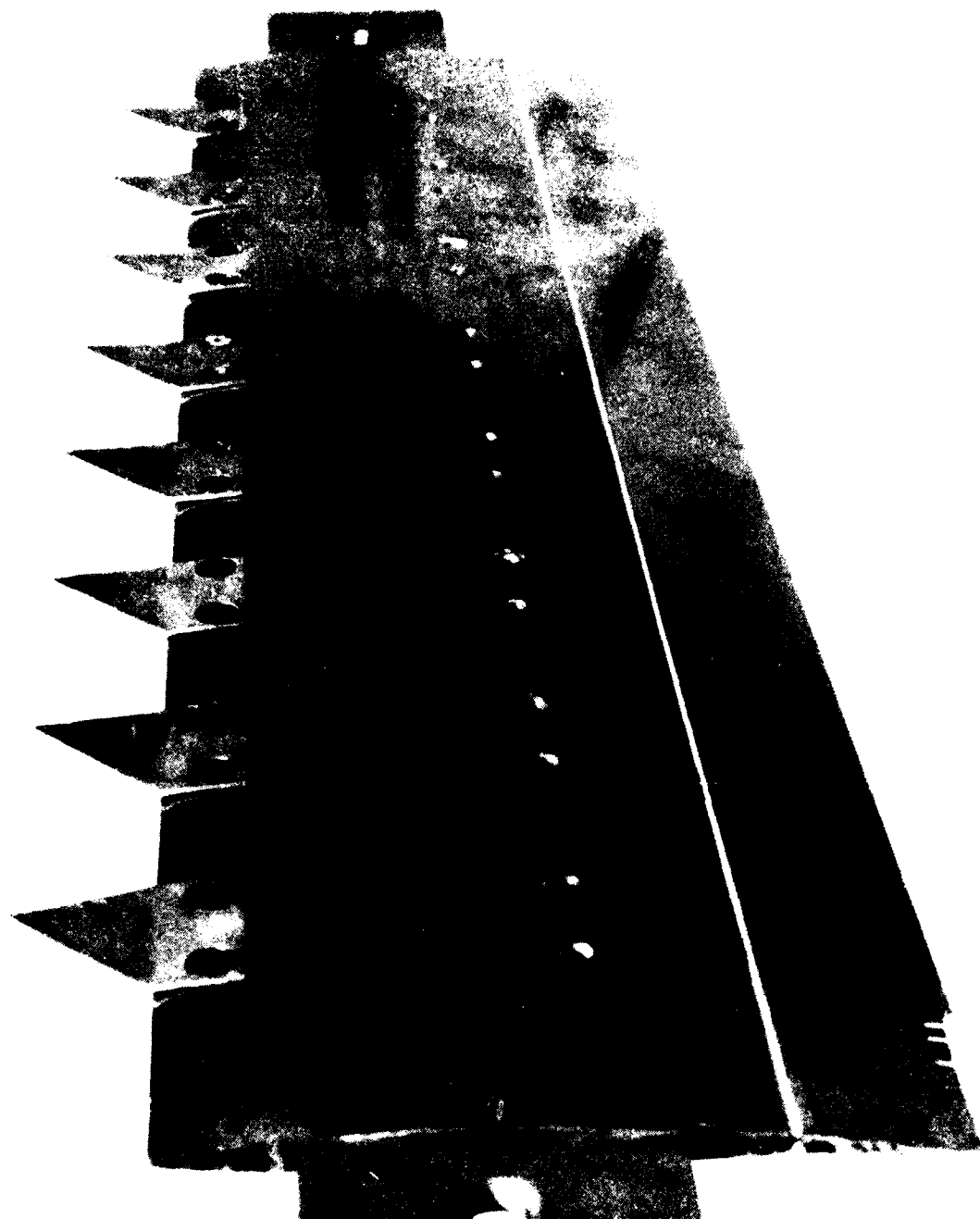


FIG. 2(b) AEROFOIL MODEL WITH 30mm LEADING EDGE WEDGES

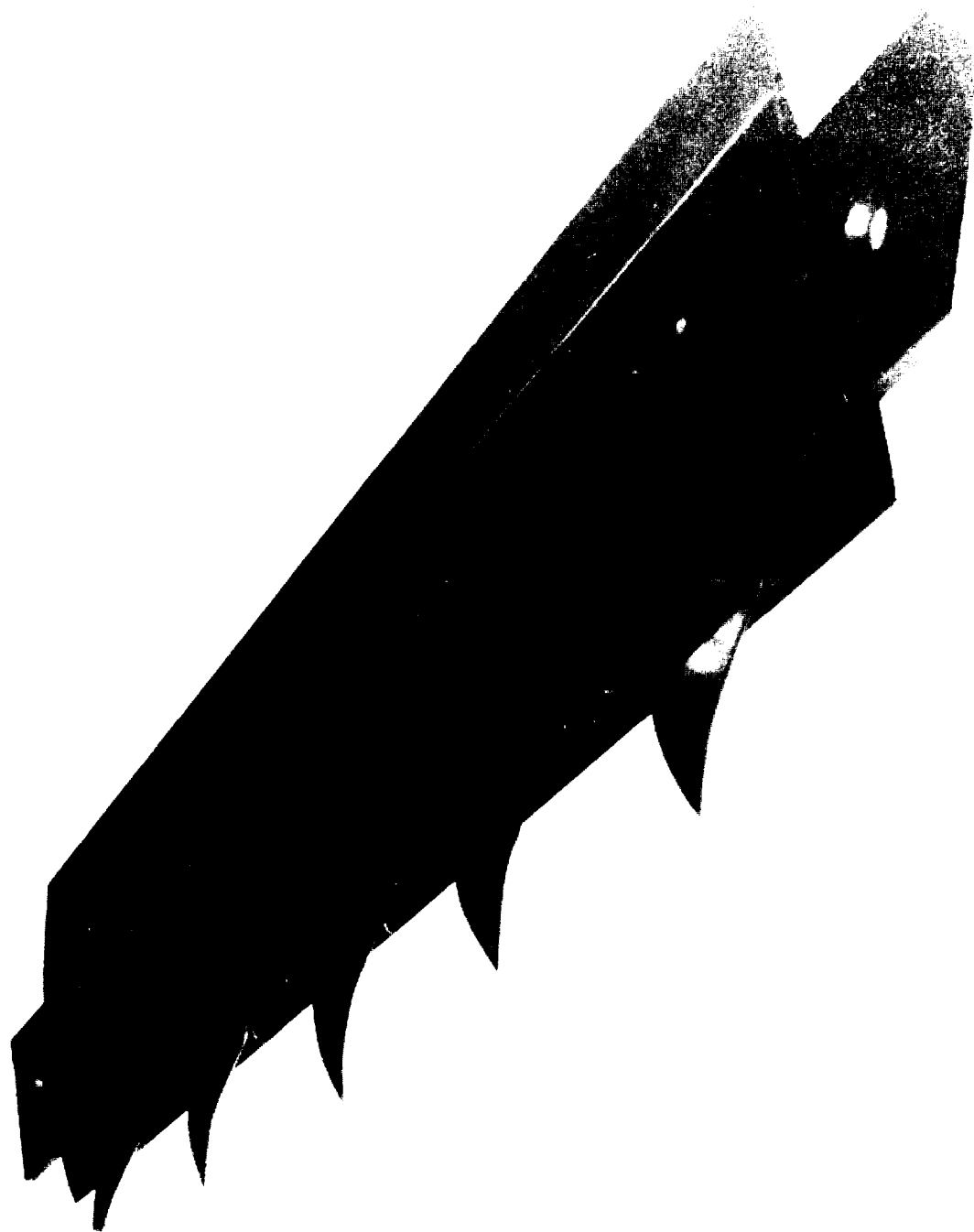
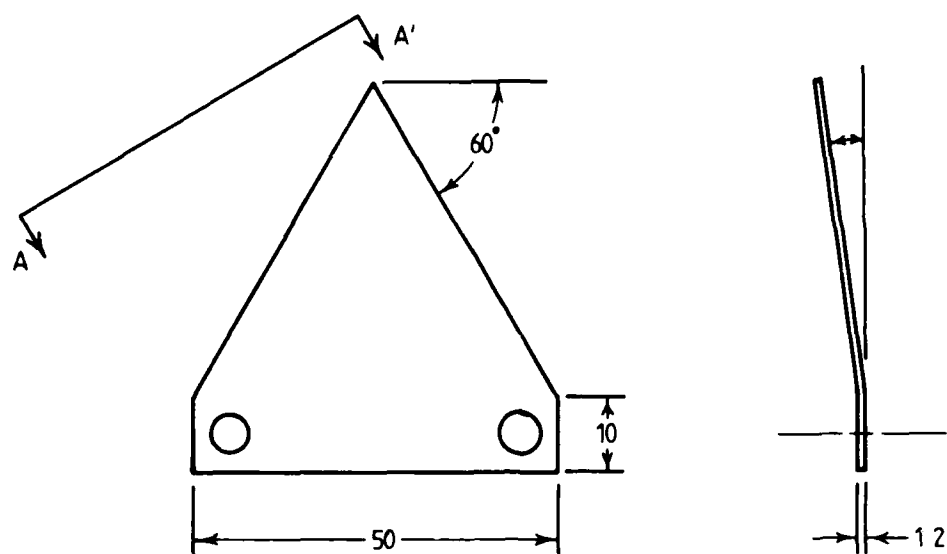
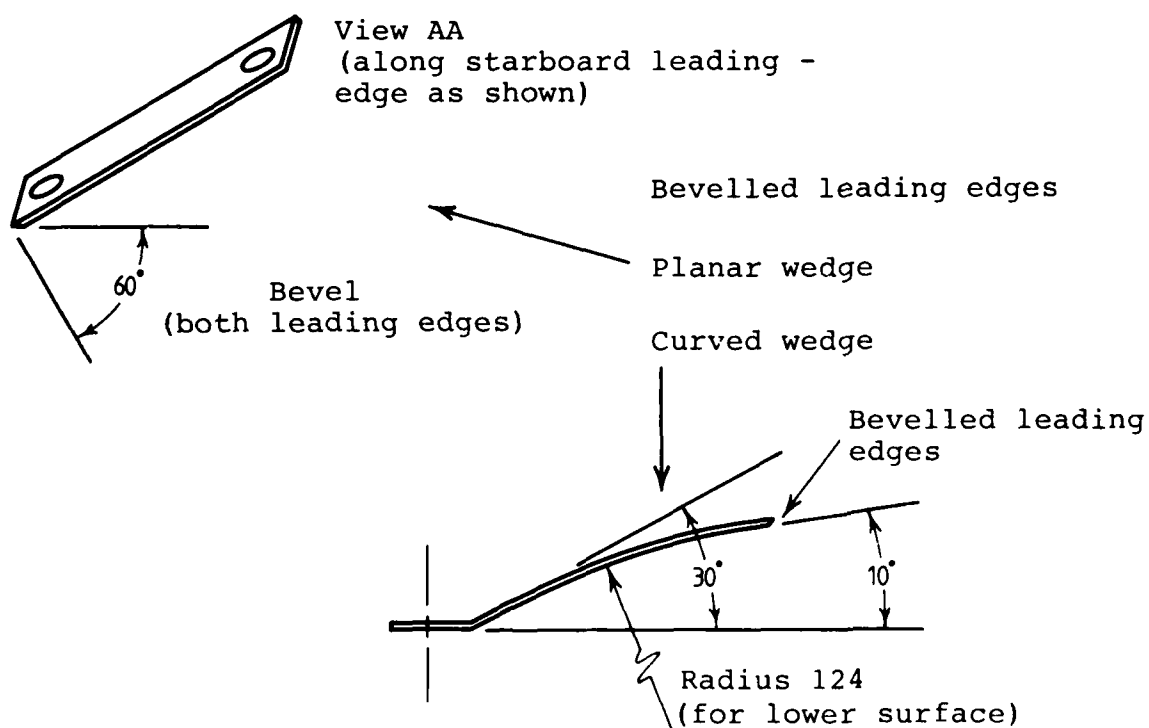


FIG. 2(c) AEROFOIL MODEL WITH 40mm LEADING EDGE WEDGES



(i) Standard wedge configuration



(ii) Alternate configurations

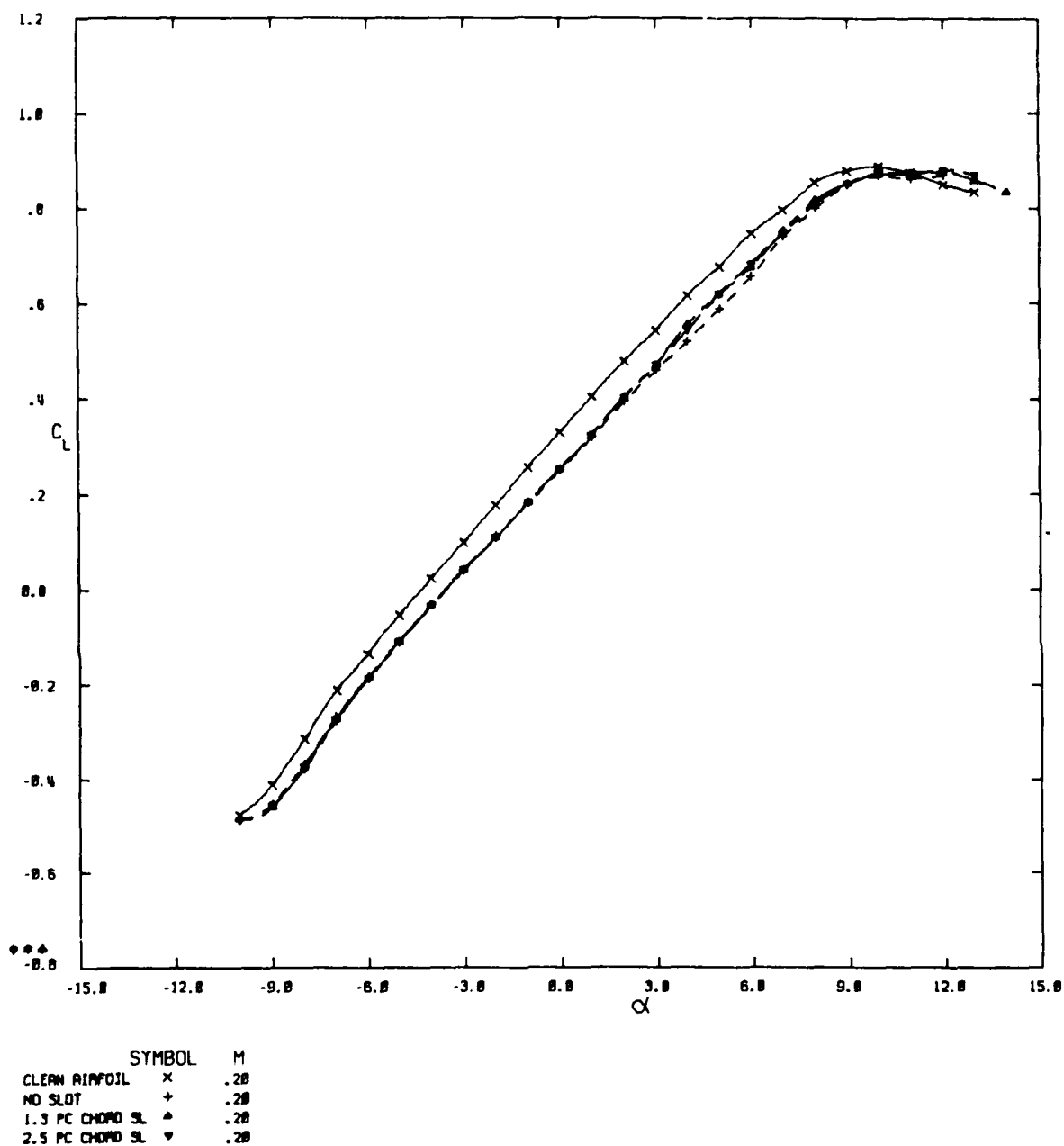


FIG. 3 (a) UPPER SURFACE WEDGES DEFLECTED 20 DEGREES
EFFECT ON LIFT - VARIOUS SLOT SIZES
REC=570000, M=0.2.

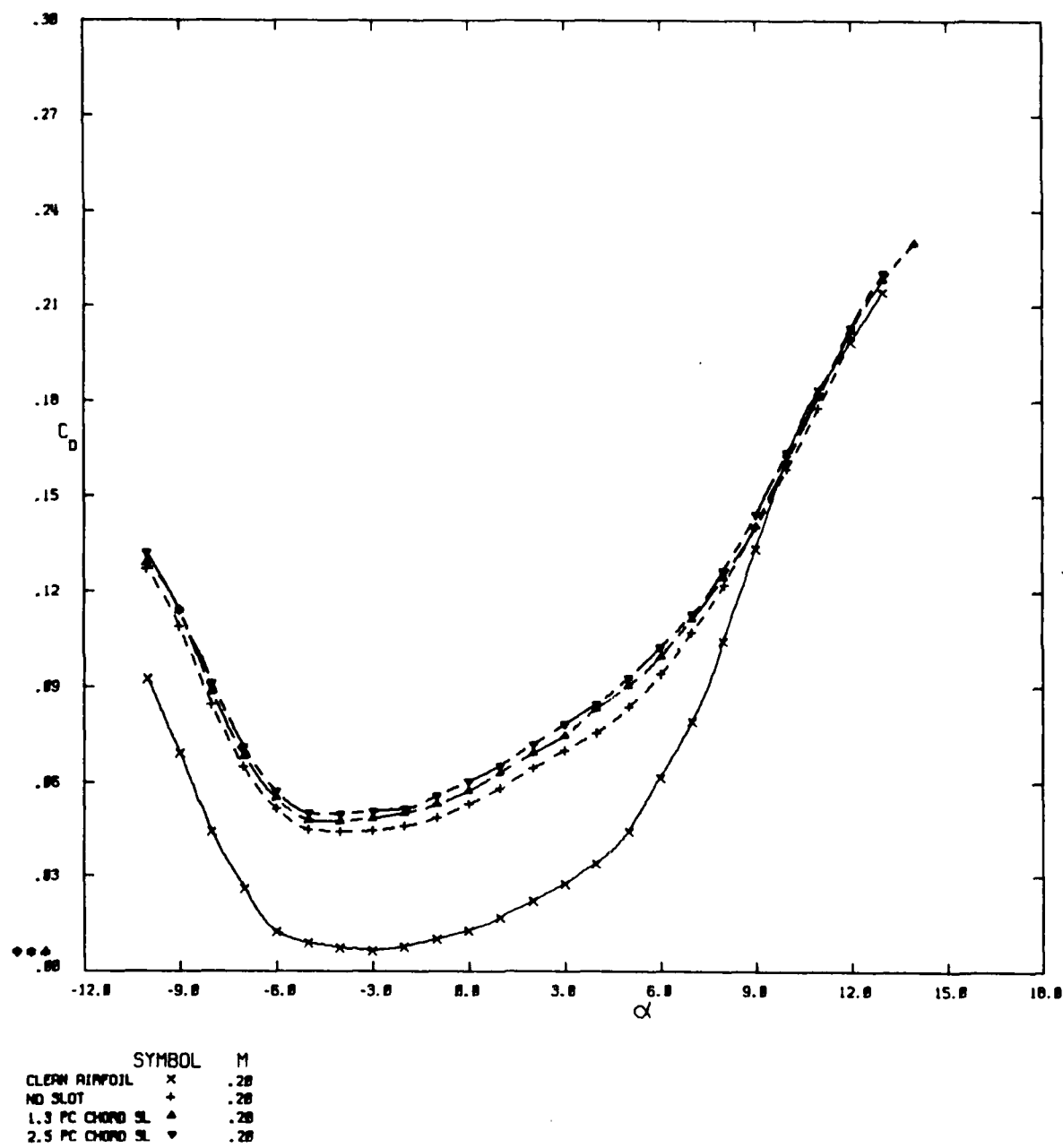


FIG.3 (b) UPPER SURFACE WEDGES DEFLECTED 20 DEGREES
EFFECT ON DRAG OF VARIOUS SLOT SIZES
REC=570000, $M=0.2$,

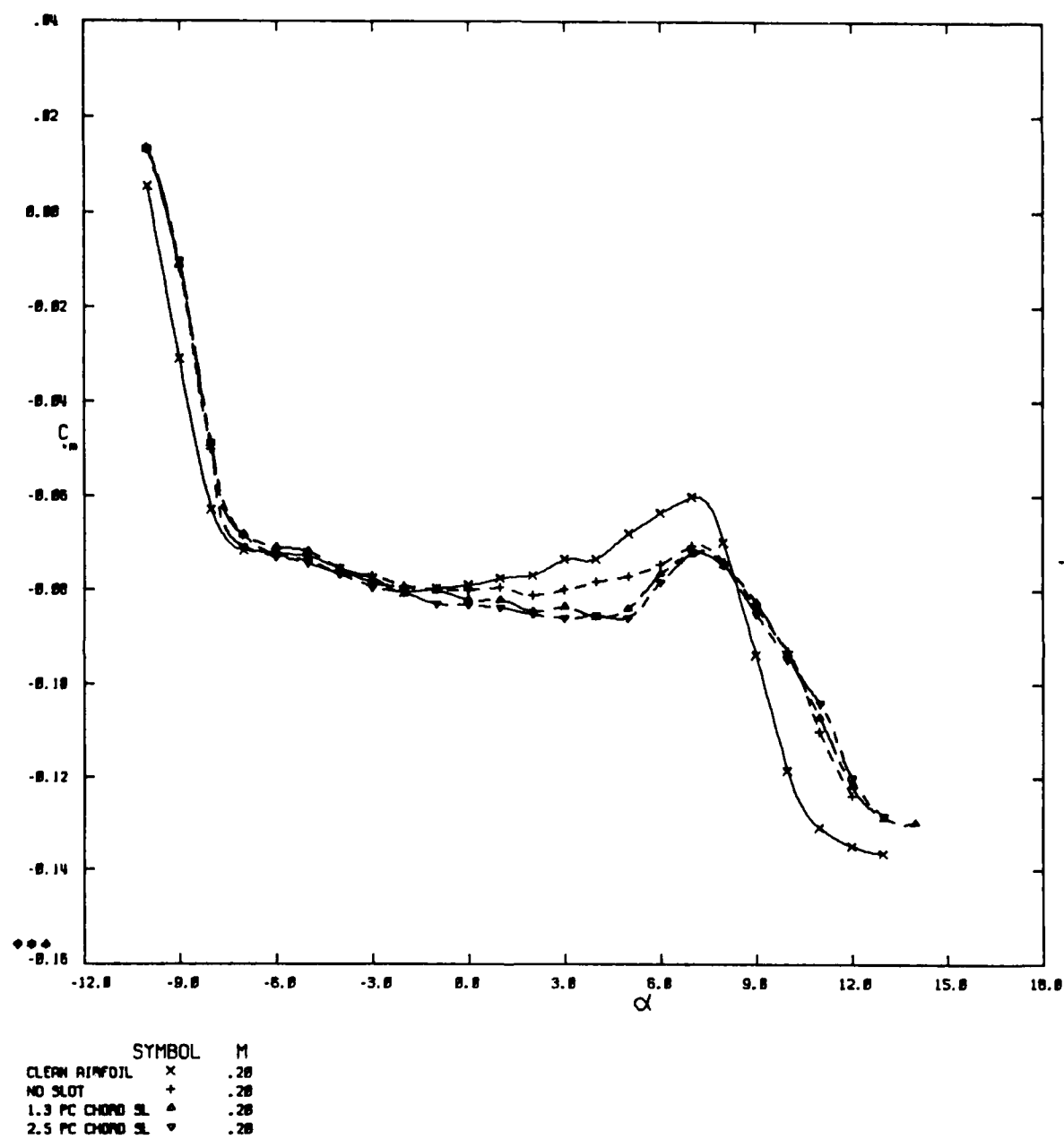


FIG. 3 (c) UPPER SURFACE WEDGES DEFLECTED 20 DEGREES
EFFECT ON PITCHING MOMENT - VARIOUS SLOT SIZES
REC=570000; M=0.2;

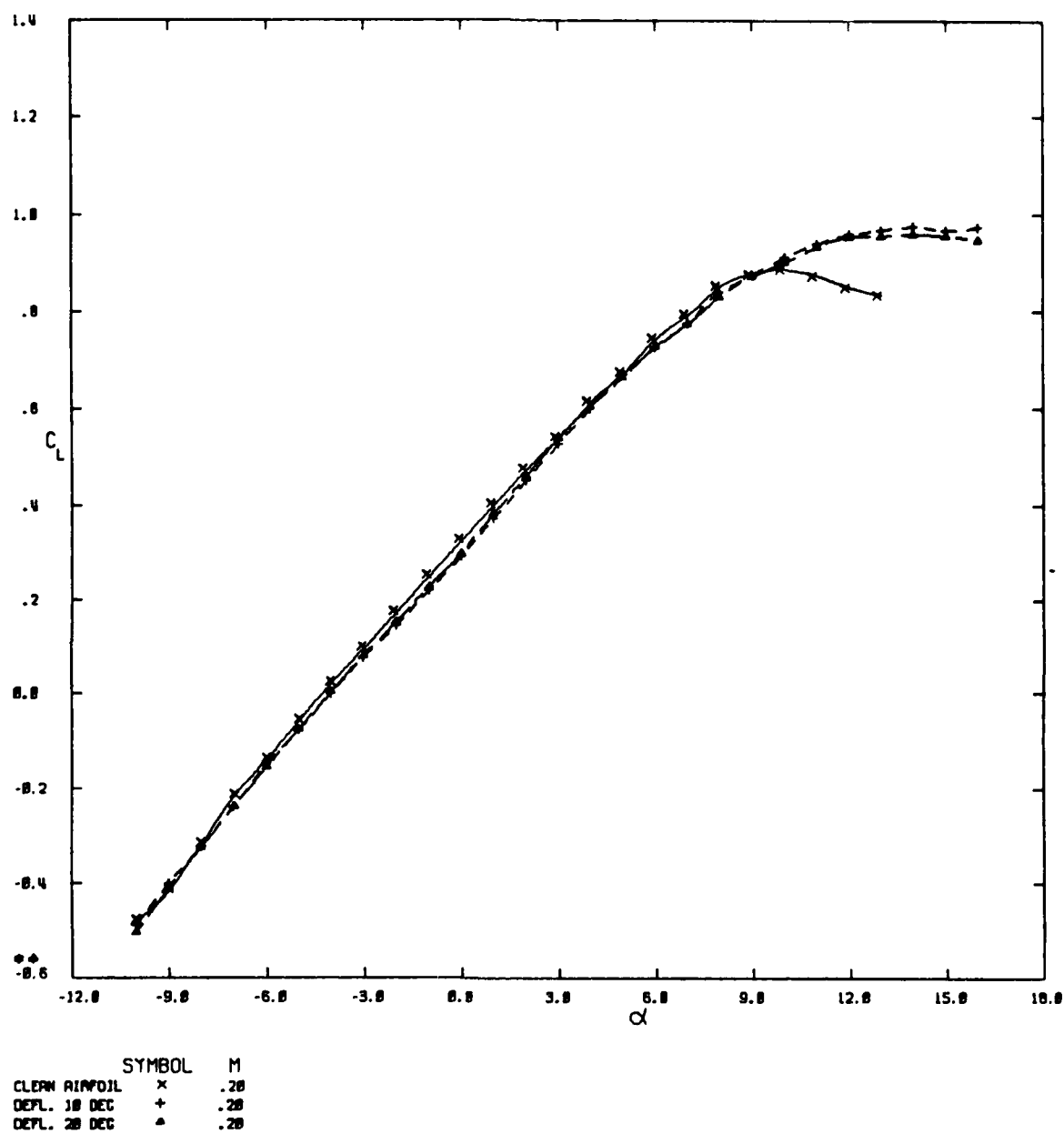


FIG. 4 (a) 30MM LEADING EDGE WEDGES - NO SLOT
EFFECT ON LIFT - VARIOUS DEFLECTIONS
REC=570000; $M=0.2$

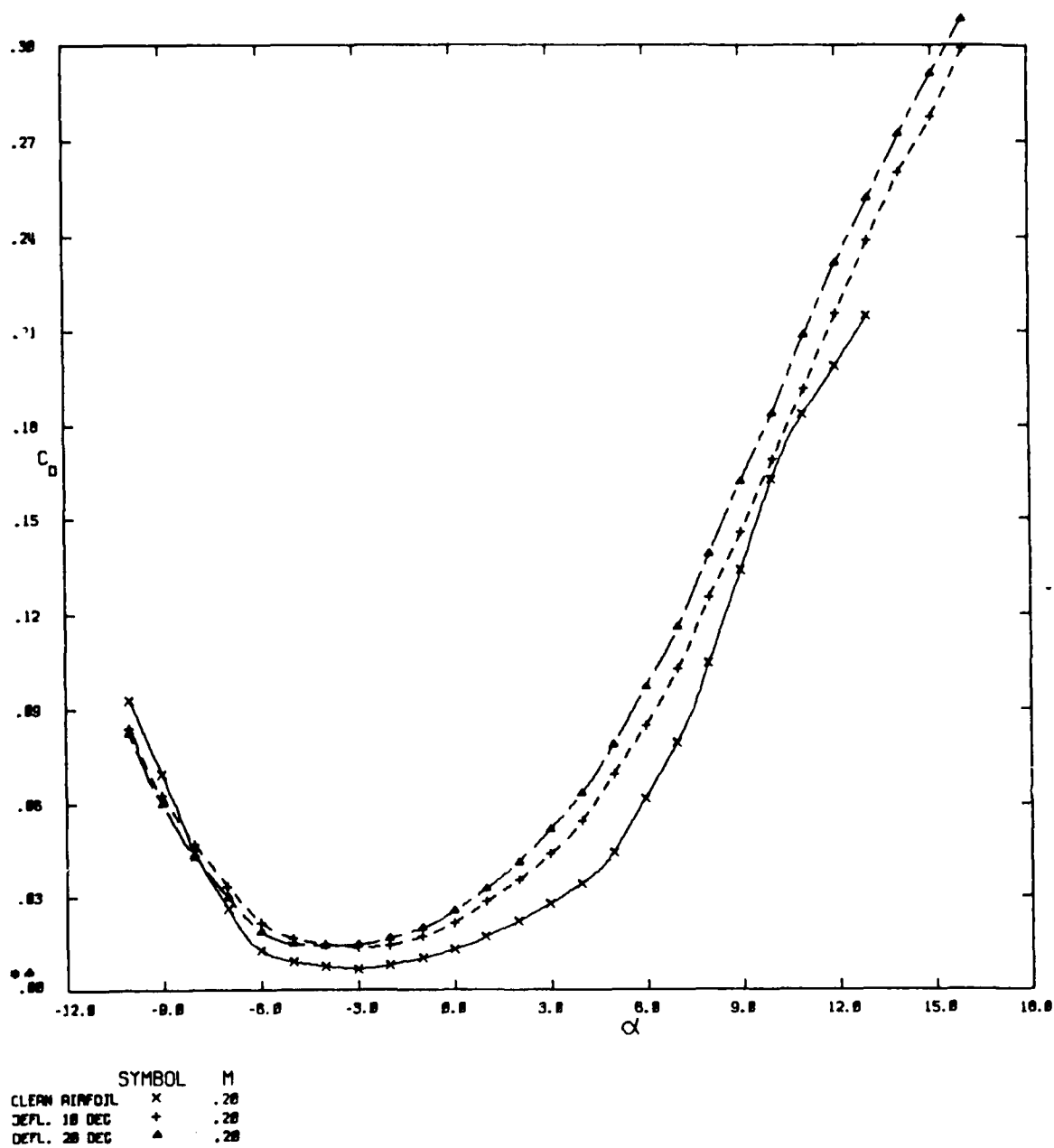


FIG. 4 (b) 30MM LEADING EDGE WEDGES - NO SLOT
EFFECT ON DRAG - VARIOUS DEFLECTIONS
REC=570000; $M=0.2$

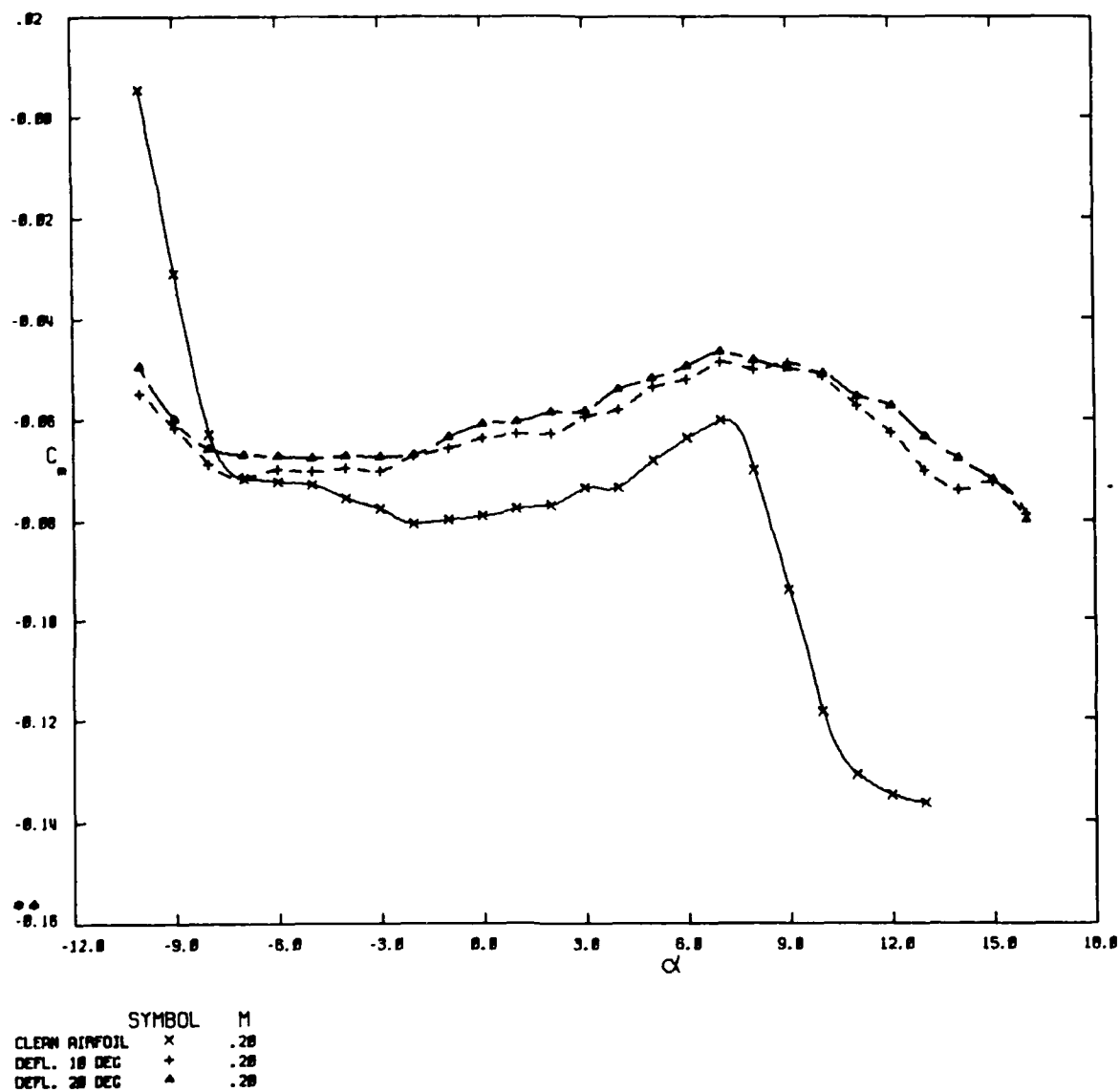


FIG.4 (c) 30MM LEADING EDGE WEDGES - NO SLOT
EFFECT ON PITCHING MOMENT - VARIOUS DEFLECTIONS
REC=570000, M=0.2,

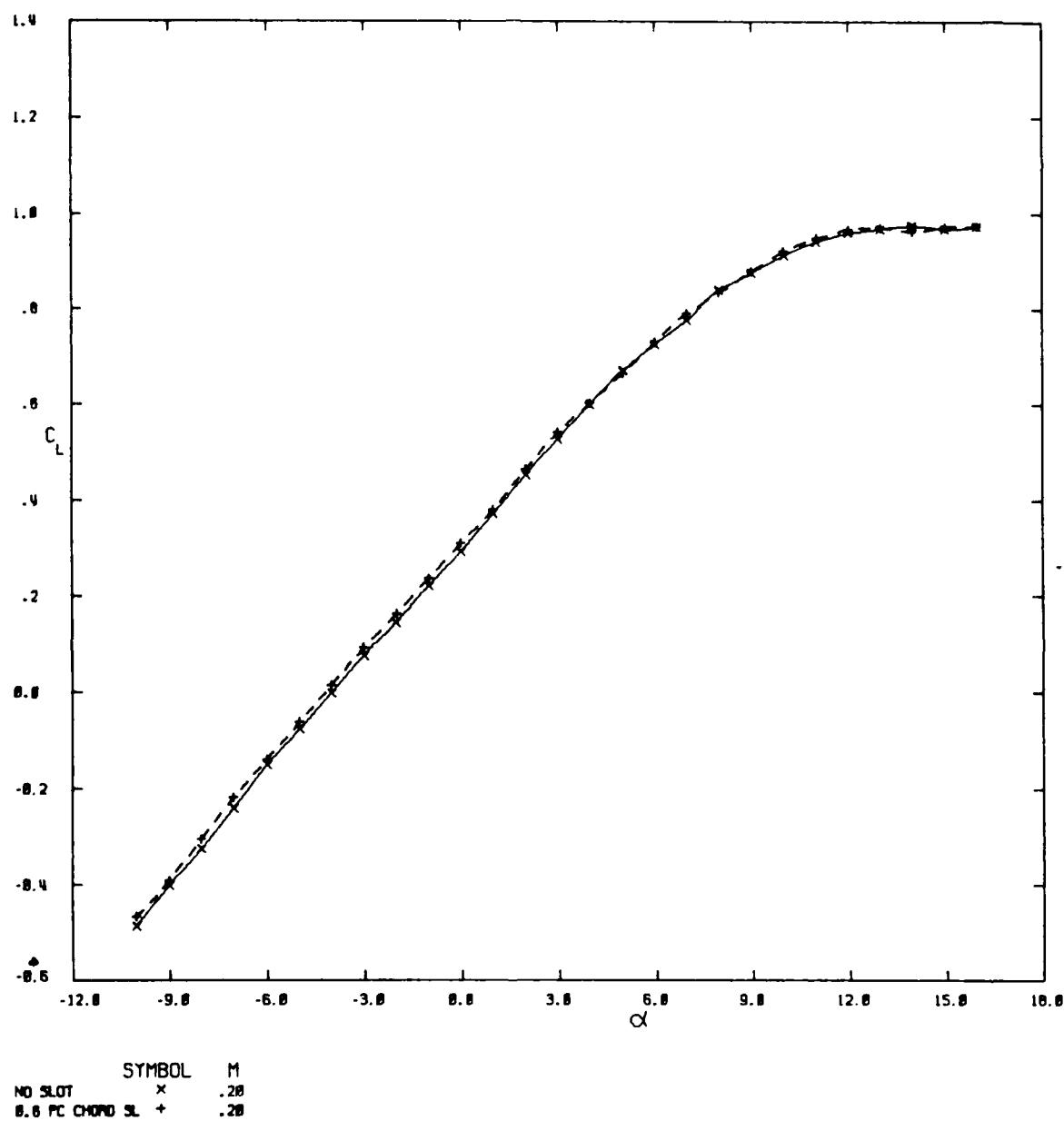
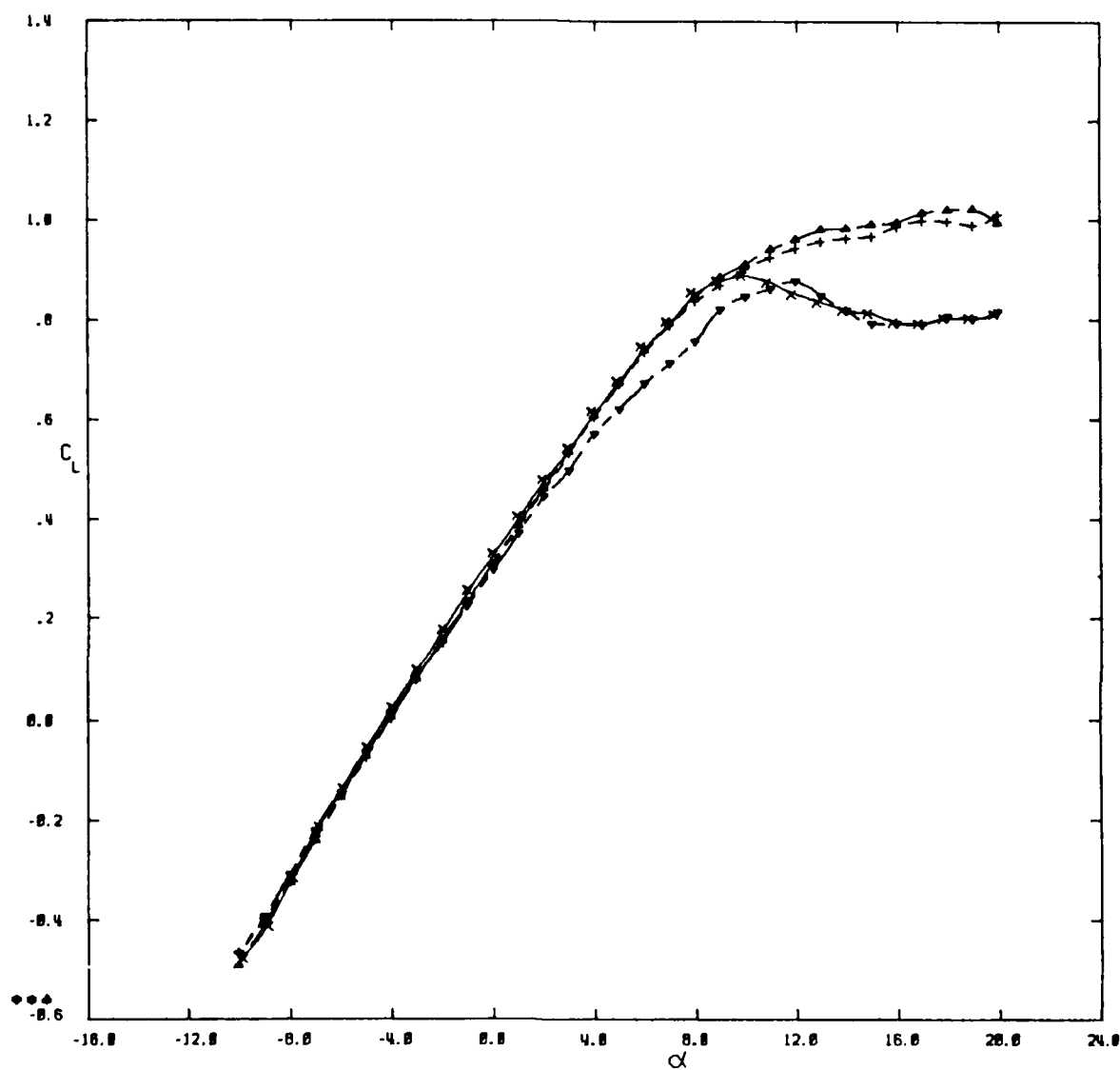


FIG.5 30MM LEADING EDGE WEDGES DEFLECTED 10 DEGREES
EFFECT ON LIFT OF A SLOT
REC=570000, M=0.2,



	SYMBOL	M
CLEAN AIRFOIL	$\times$	.20
DEFL. 0 DEG	+	.20
DEFL. 10 DEG	$\triangle$	.20
DEFL. 30 DEG	∇	.20

FIG. 6 (a) 50MM LEADING EDGE WEDGES - NO SLOT
EFFECT ON LIFT - VARIOUS DEFLECTIONS
REC=570000, M=0.2,

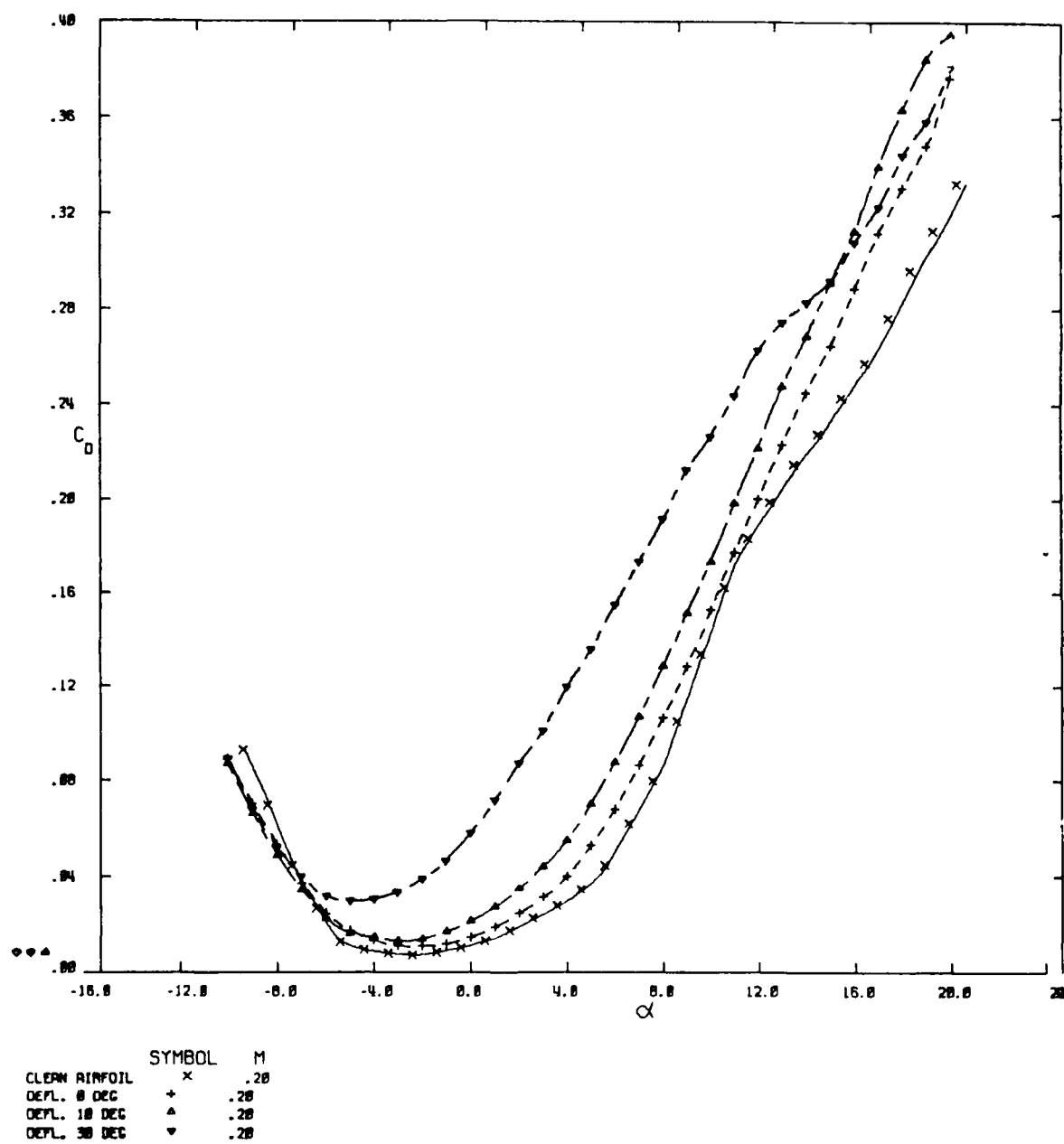


FIG. 6 (b) 50MM LEADING EDGE WEDGES - NO SLOT
EFFECT ON DRAG - VARIOUS DEFLECTIONS
REC=570000, M=0.2,

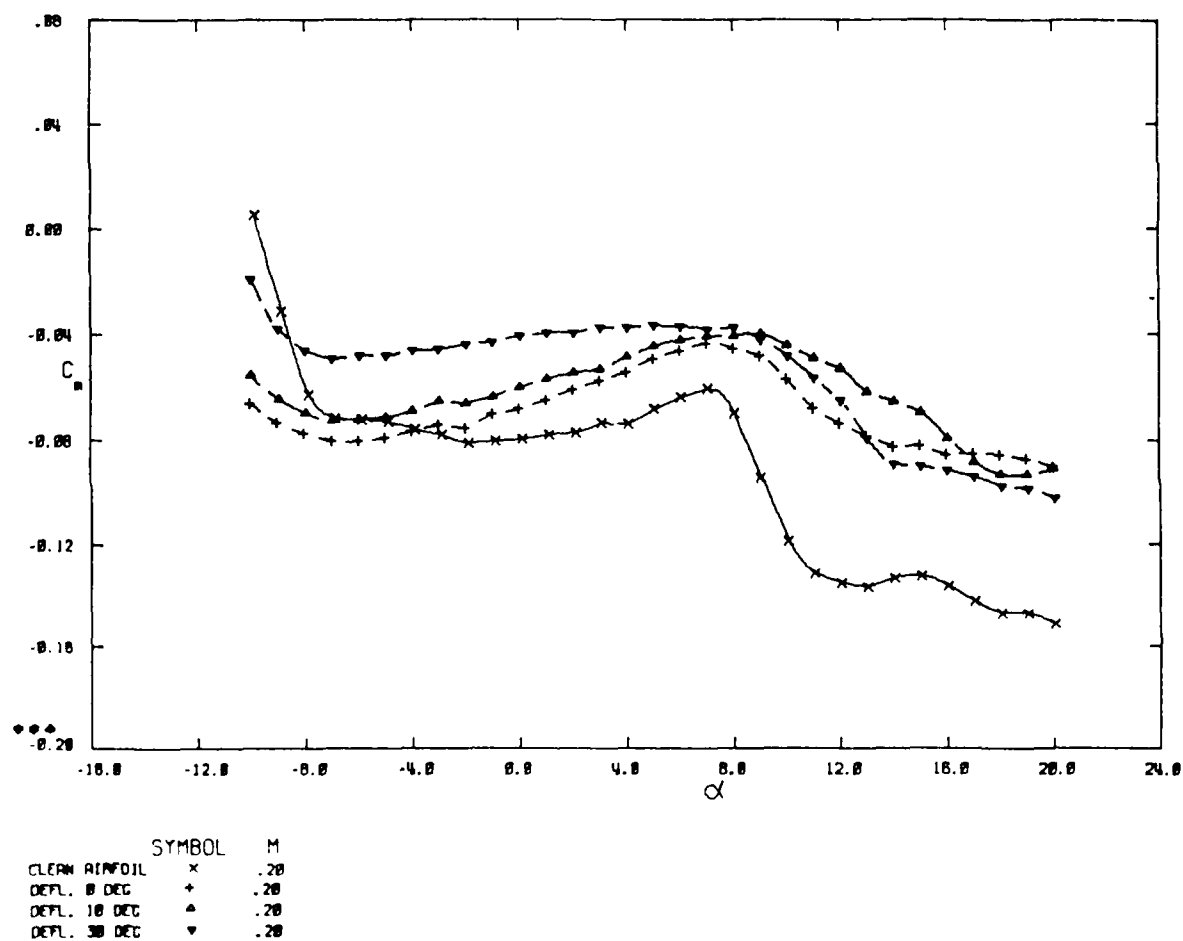


FIG. 6 (c) 50MM LEADING EDGE WEDGES - NO SLOT
EFFECT ON PITCHING MOMENT - VARIOUS DEFLECTIONS
REC=570000, $M=0.2$

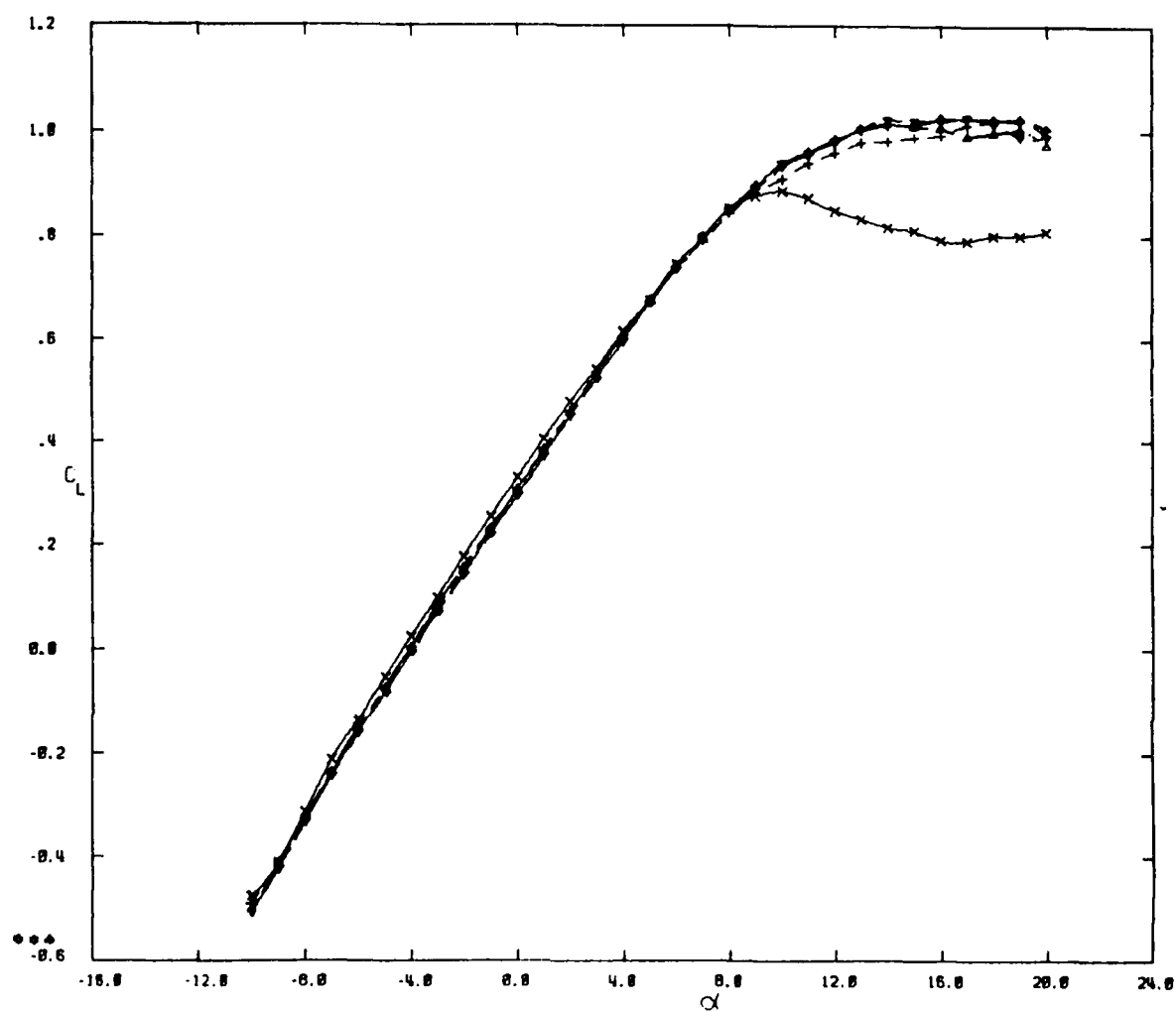


FIG. 7 (a) 50MM LEADING EDGE WEDGES - DEFLECTION 10 DEGREES
EFFECT ON LIFT - VARIOUS SLOT SIZES
REC=570000, M=0.2,

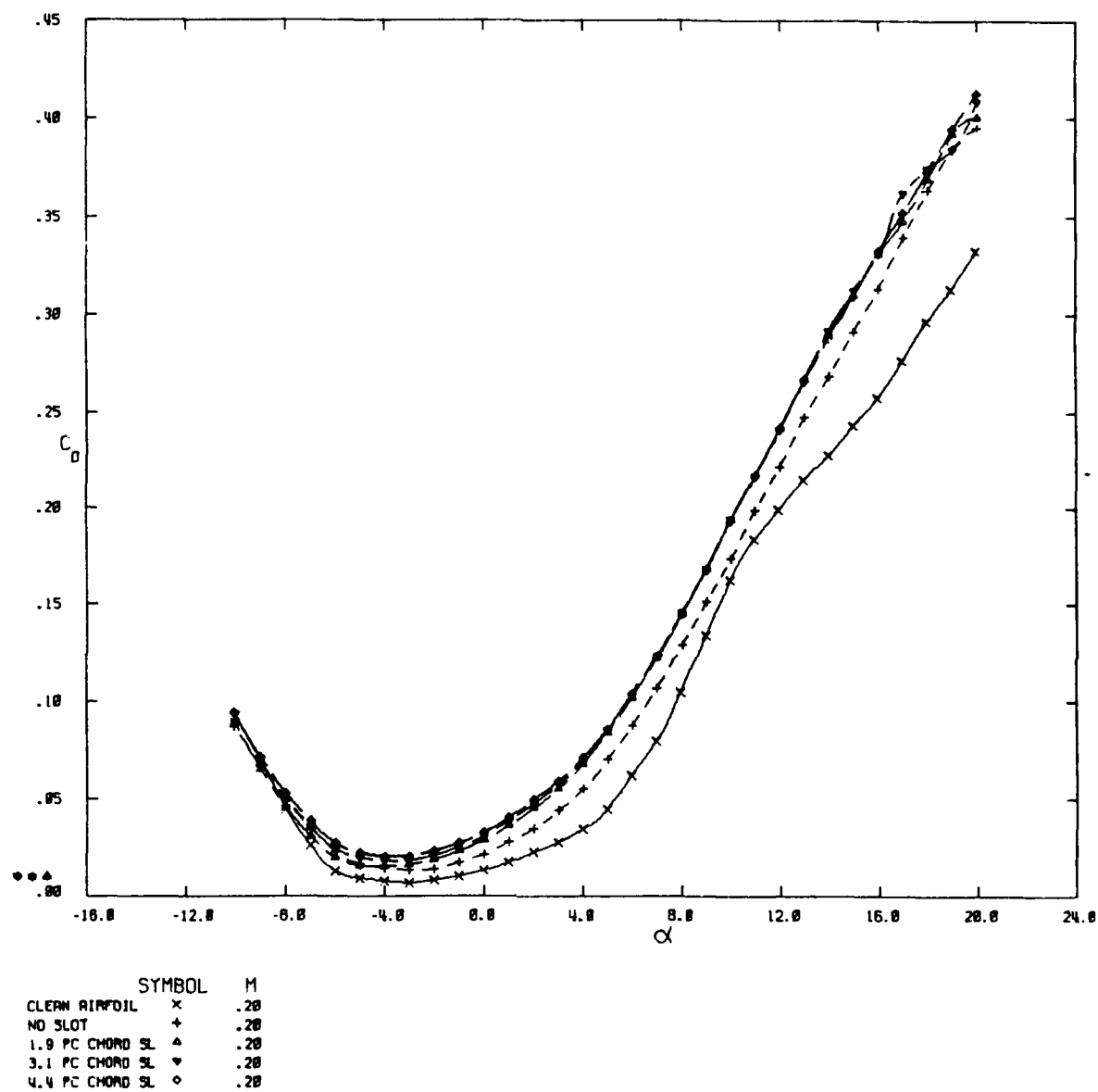
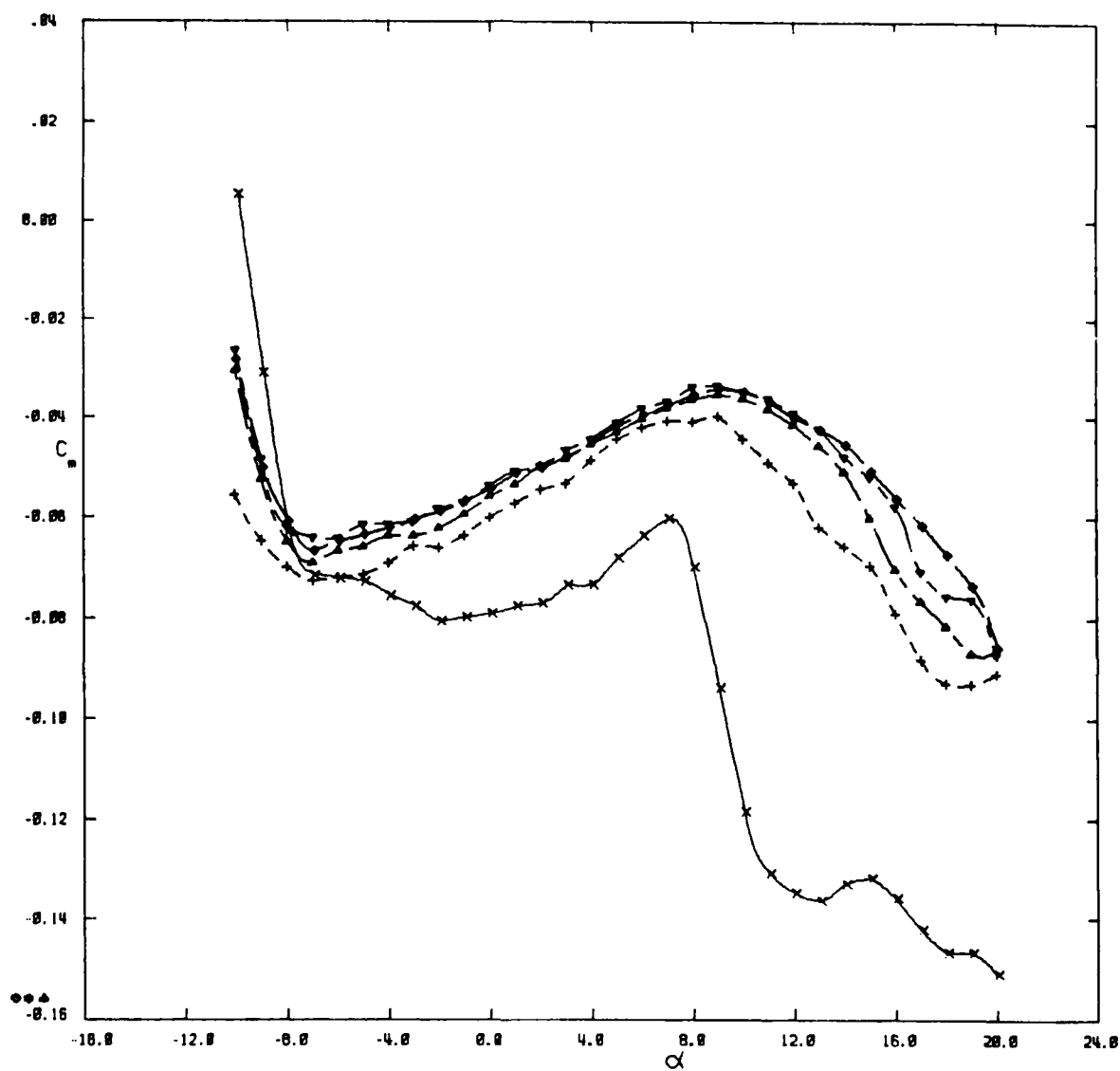


FIG.7 (b) 50MM LEADING EDGE WEDGES - DEFLECTION 10 DEGREES
EFFECT ON DRAG - VARIOUS SLOT SIZES
ERC=570000, M=0.2,



	SYMBOL	M
CLEAN AIRFOIL	x	.20
NO SLOT	+	.20
1.9 PC CHORD SL	Δ	.20
3.1 PC CHORD SL	∇	.20
4.4 PC CHORD SL	$\diamond$	.20

FIG.7(c) 50MM LEADING EDGE WEDGES - DEFLECTION 10 DEGREES
EFFECT ON PITCHING MOMENT - VARIOUS SLOT SIZES
REC=570000; M=0.2;

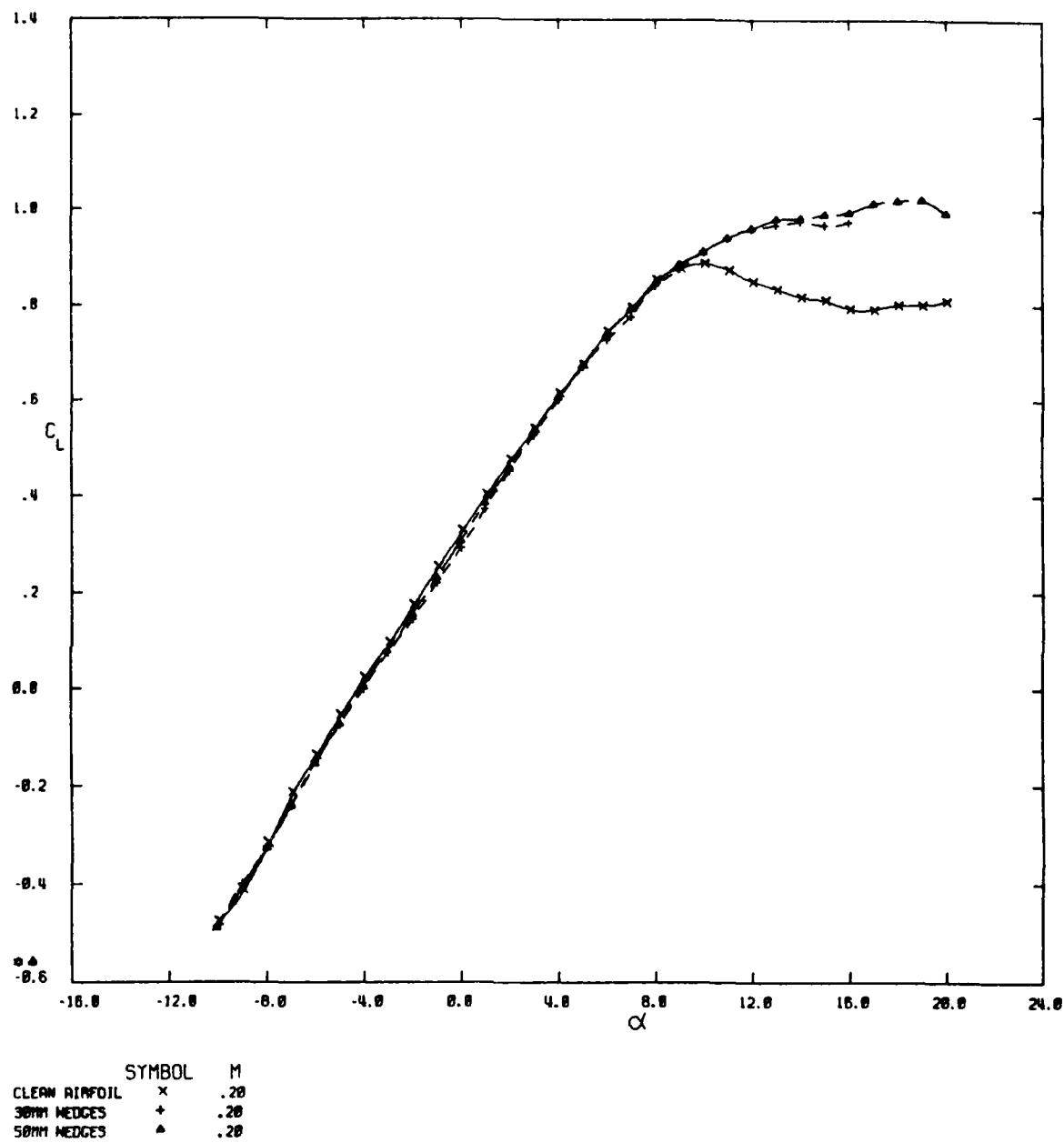


FIG.8 COMPARISON - 30MM & 50MM LEADING EDGE WEDGES
 DEFLECTED 10 DEGREES, NO SLOT
 EFFECT ON LIFT
 REC=570000, M=0.2,

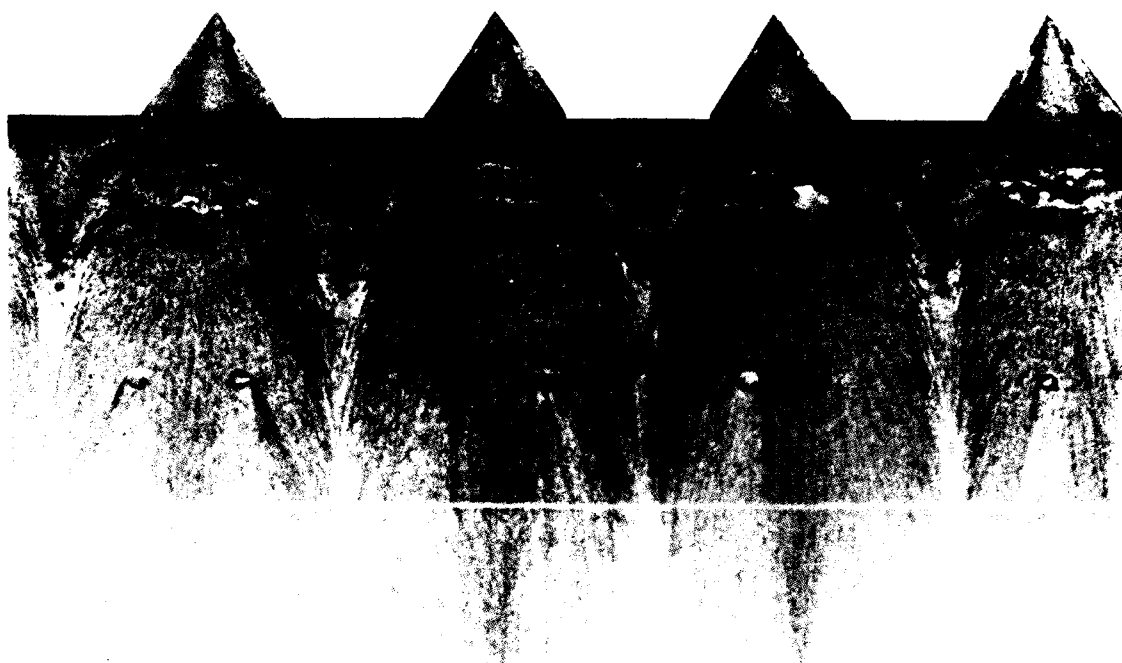


FIG. 9 OIL FLOW PATTERN-MODEL UPPER SURFACE 30mm LEADING
EDGE WEDGES WITH $\delta_w = 10^\circ$; $\epsilon_s = 0$

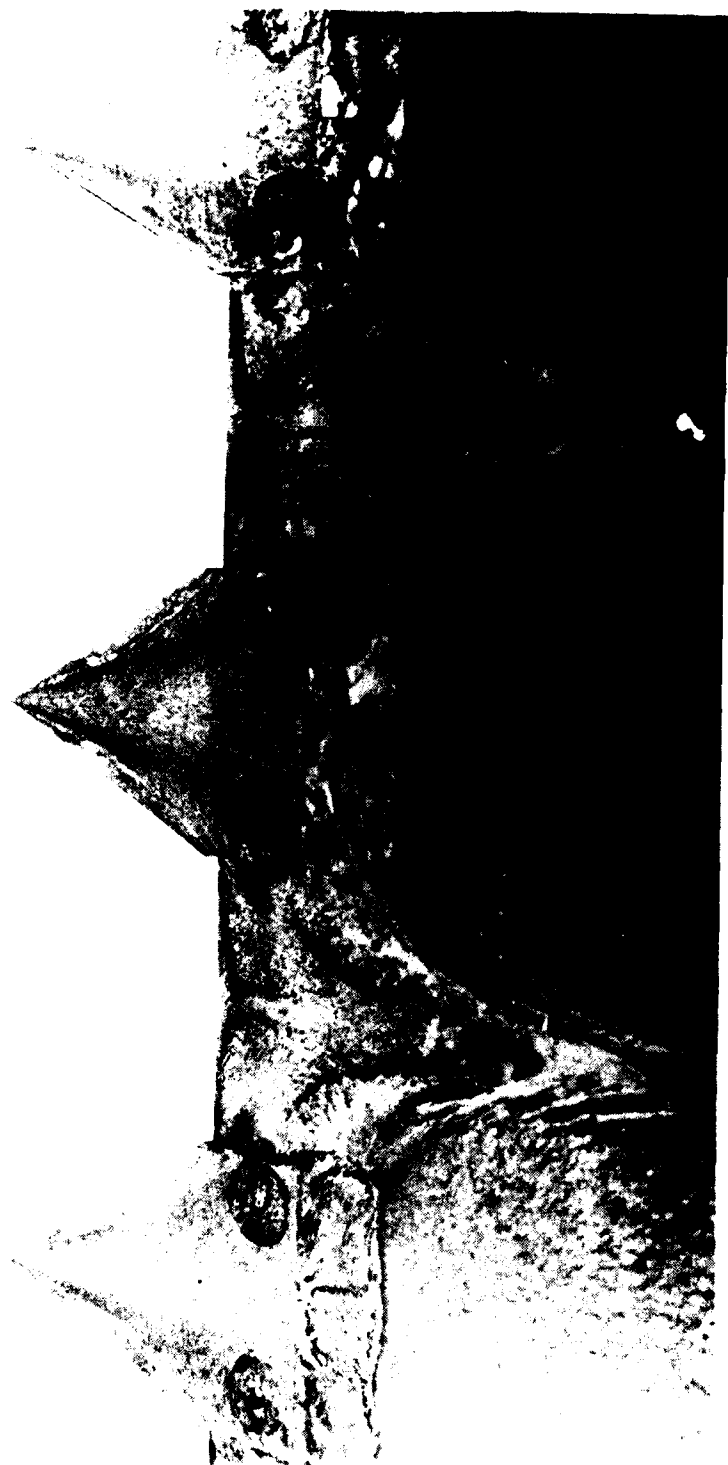


FIG. 9 (Continued) LEADING EDGE CLOSE UP

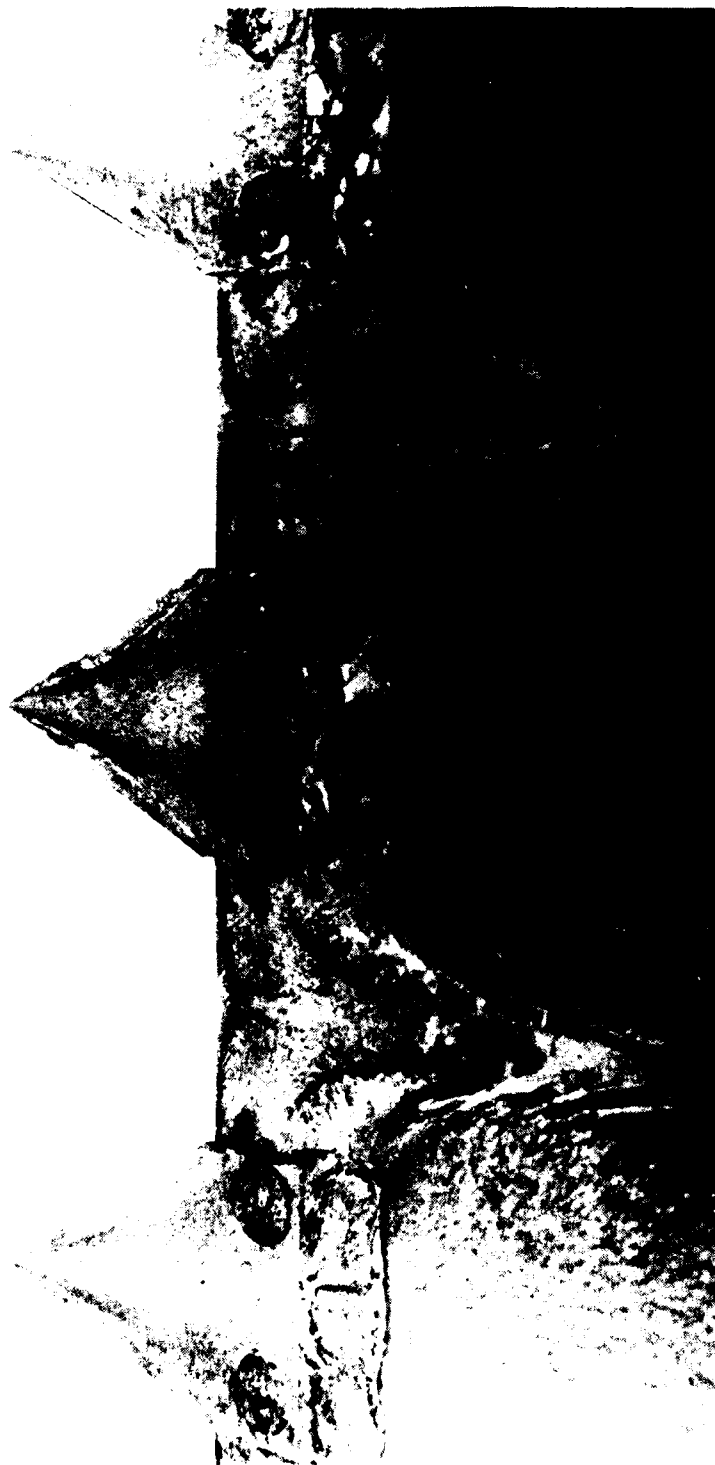


FIG. 9 (Continued) LEADING EDGE CLOSE UP

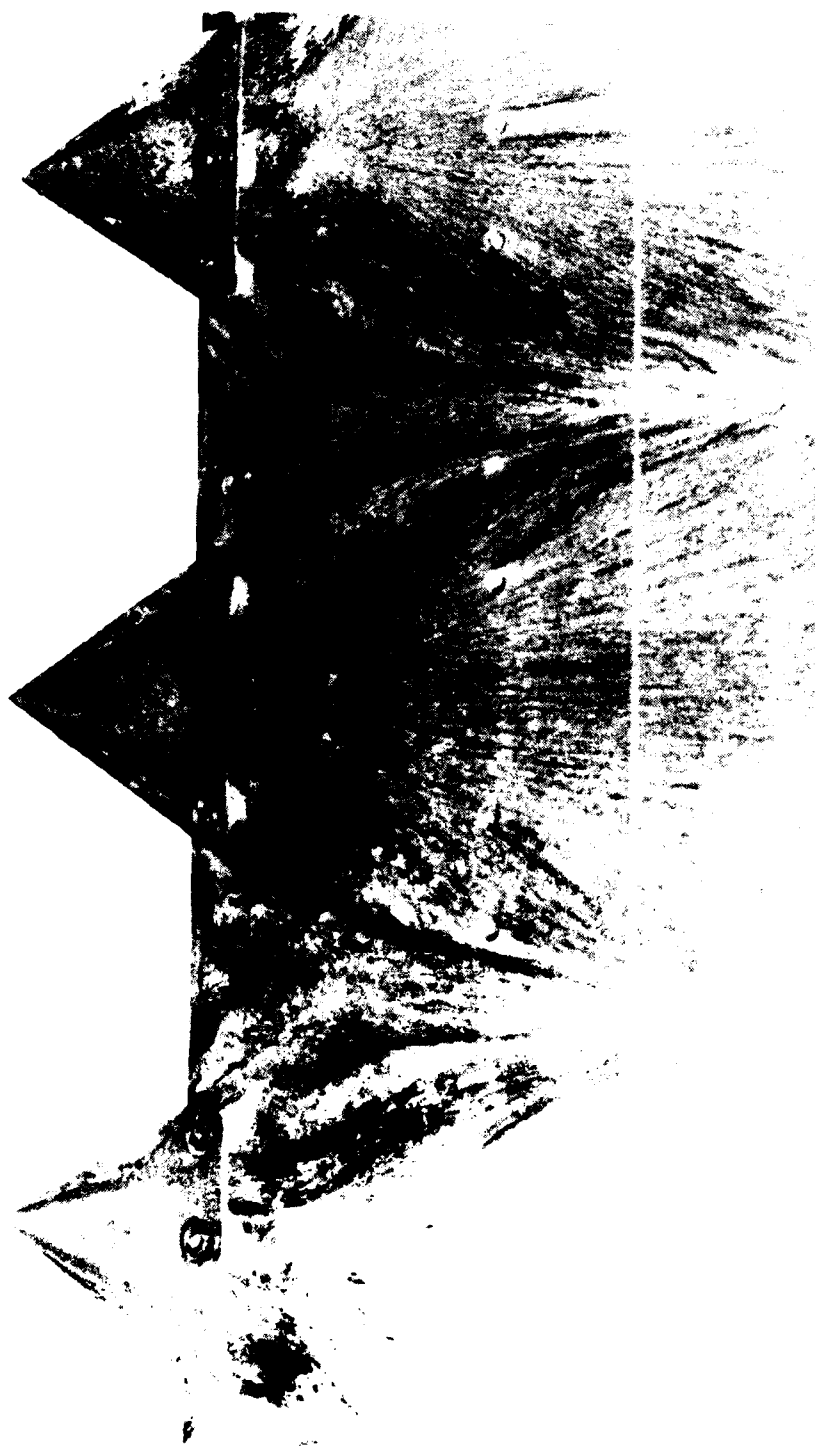


FIG. 10 OIL FLOW PATTERN-MODEL UPPER SURFACE 50m LEADING
EDGE WEDGES WITH $\delta_w = 10^\circ$; $\epsilon_{s/c} = 0.031$

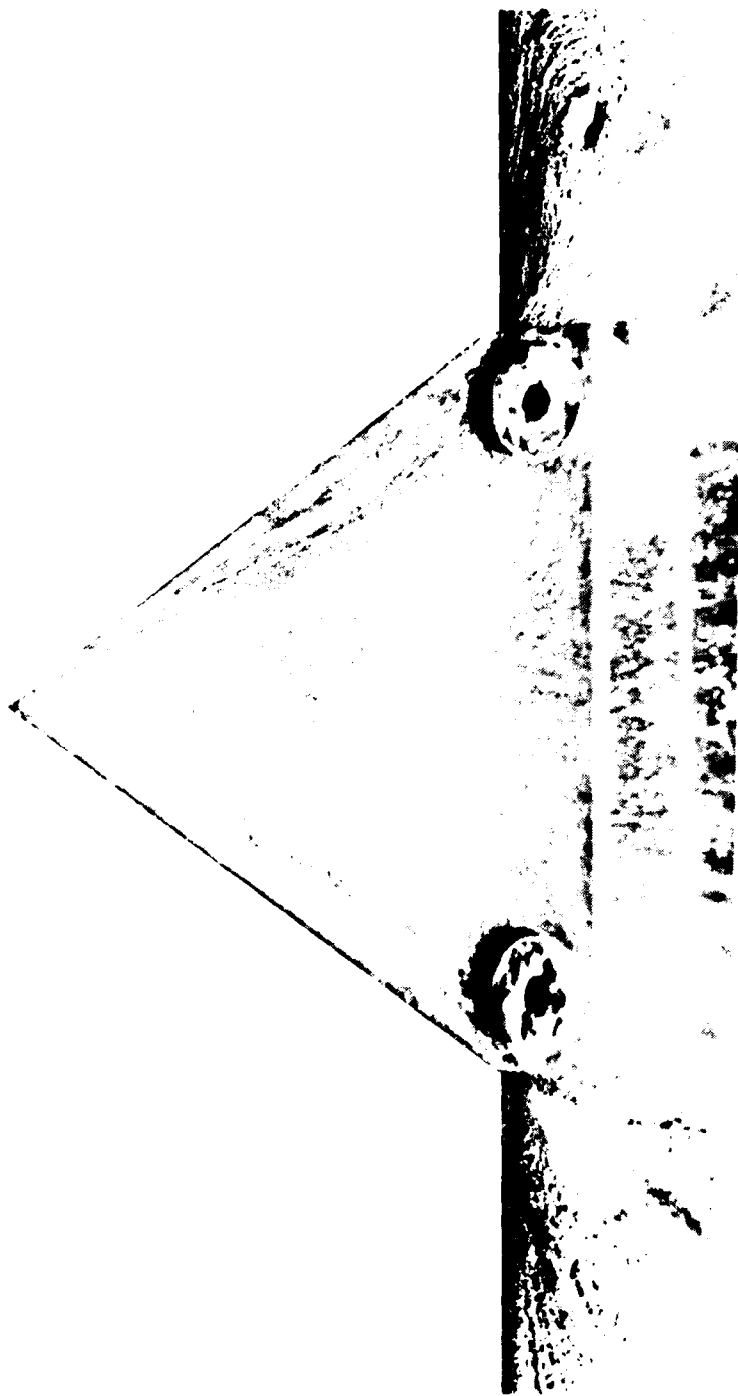


FIG. 10 (Continued) CLOSE-UP VIEW OF CENTRAL WEDGE

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16. Abstract A NACA 64-106 aerofoil model has been wind tunnel tested with forward facing wedges at the leading edge and upper surface at the midchord position. Of particular interest is their effect on low speed, high incidence aerofoil aerodynamics. The majority of tests were conducted at Mach 0.2 (corresponding to a chord Reynolds number of 0.57×10^6) over the incidence range -10 to +20 degrees. The upper surface wedges increased drag by over 100% and reduced lift by only 10% at moderate lift coefficients, delayed the stall by about 2° and maintained $C_{L_{MAX}}$. The leading edge wedges with a 2% chord slot under them on the other hand increased $C_{L_{MAX}}$ by between 11 and 17% (depending on wedge size and deflection), had little effect on C_D (for			

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16 Abstract (Contd)

a wedge deflection from the aerofoil surface of zero degrees) and markedly reduced variations in pitching moment prior to and following stall.

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