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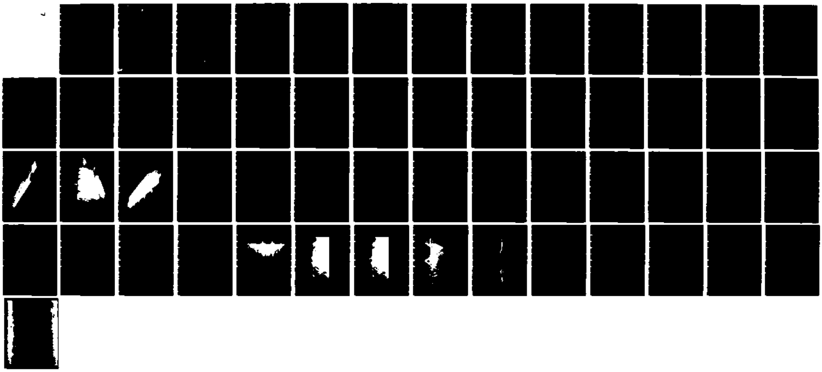

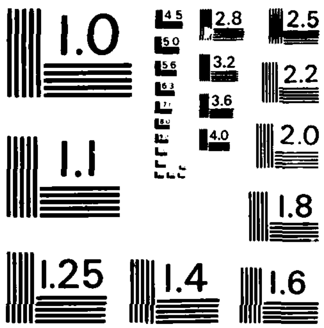
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MELBOURNE, VICTORIA

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.

POSTAL ADDRESS: Director, Aeronautical Research Laboratories, P.O. Box 4331, Melbourne, Victoria, 3001, Australia.

CONTENTS

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 ~~have been~~ were carried out to determine the effect on the longitudinal aerodynamic characteristics of a two-dimensional (2D) aerofoil fitted with descrete 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~~ these 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.

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 x 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 $\alpha = -3°$ for the clean aerofoil) is increased over six times (0.044 at $\alpha = -3.5°$ for $\varepsilon_s = 0$), 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 $\alpha = 0°$ 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 $\delta_w = 10°$ and 20° and $\varepsilon_s = 0$. 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 $\delta_w = 10°$ (i.e. $C_{L_{MAX}} = 0.976$ at $\alpha = 14°$) and 8% for $\delta_w = 20°$ ($C_{L_{MAX}} = 0.960$ at $\alpha = 14°$ compared with $C_{L_{MAX}} = 0.887$ at $\alpha = 10°$ for the clean aerofoil). $\delta_w < 0$ was briefly investigated. For $\delta_w = -20°$ (data not presented) $C_{L_{MAX}} = 0.949$ at $\alpha = 13°$, which is 3% less than for $\delta_w = 10°$.

Fitment of the 30 mm leading edge wedges doubles $C_{D_{MIN}}$ (to 0.015 at $\alpha = -3°$); between this incidence and stall, C_D is less than doubled. However, C_D for $\delta_w = 20°$ is significantly greater than for $\delta_w = 10°$. 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 ($\varepsilon/c = 0.006$ with $\delta_w = 10°$) beneath the wedges. There is a very slight increase in C_L over the range $\alpha = -10°$ to +5°. 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 $\varepsilon_s = 0$. Considering $C_L \sim \alpha$, it is seen that over the range $\alpha = -8°$ to $+3°$, fitment of the wedges results in a small loss of C_L (5% at $C_L = 0.4$, $\alpha = 1°$, for example). $C_L \sim \alpha$ curves for $\delta_w = 0°$ and 10° are nearly identical up to $\alpha = 8°$, above which C_L is slightly greater for $\delta_w = 10°$ than for $\delta_w = 0°$. $C_{L_{MAX}}$ for $\delta_w = 0°$ and 10° over the incidence range tested are respectively 1.13 and 1.15 times $C_{L_{MAX}}$ for the clean aerofoil. Again the relatively abrupt stall of the clean aerofoil is replaced by a gradual reduction in lift curve slope. For $\delta_w = 30°$, $C_L \sim \alpha$ behaviour is different in that $\partial C_L/\partial\alpha$ becomes noticeably less from about $\alpha = 2°$, clean aerofoil stall being at $\alpha = 10°$. 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 $\delta_w = 0°$, C_D over the range $\alpha = 0°$ to 12° is little different from that for the clean aerofoil. C_D for $\delta_w = 10°$ is on the other hand noticeably larger, indicating L/D at $C_{L_{MAX}}$ is greater for $\delta_w = 0°$ compared to $\delta_w = 10°$.

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 $\delta_w = 10°$ with various slot depths ε_s/c (from 0 to 0.044). It is seen that for this value of δ_w, $\varepsilon_s/c = 0.02$ is about an optimum depth for maximising $C_{L_{MAX}}$. 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 $\varepsilon_s/c = 0.044$ compared to $\varepsilon_s/c = 0.019$ or 0.031. Due to the slight lift augmentation effect the slots provide, C_m for $\varepsilon_s > 0$ is less negative than for $\varepsilon_s = 0$. Likewise $\partial C_m/\partial\alpha$ near and after stall is favourably affected by the existence of the slots, in that $\partial^2 C_m/\partial\varepsilon_s\partial\alpha > 0$. 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°. 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: $\delta_w = 10°$, $\varepsilon_s = 0$; and

(ii) 50 mm leading edge wedges: $\delta_w = 10°$, $\varepsilon_s/c = 0.031$.

Surface oil flow pattern photographs for $\alpha = 10°$ 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°, 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 $\delta_w = 0°$, 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.	$Re_c \times 10^6$	RESULTS
Clean	0.2/0.3	0.57/0.84	TABLE 2A
Upper Surface Wedges			
$\varepsilon_s = 0$; $\delta_w = 20°$	0.2/0.3	0.57/0.84	TABLE 2B-1
$\varepsilon_s = 1.6$ mm; $\delta_s = 20°$	"	"	TABLE 2B-2
$\varepsilon_s = 3.2$ mm; $\delta_w = 20°$	"	"	TABLE 2B-3
30 mm Leading Edge Wedges			
$\varepsilon_s = 0$; $\delta_w = 10°$	0.2/0.3	0.57/0.84	TABLE 2C-1
$\varepsilon_s = 0$; $\delta_w = 20°$	0.2	0.57	TABLE 2C-2
$\varepsilon_s = 0.8$ mm; $\delta_w = 10°$	0.2/0.3	0.57/0.84	TABLE 2C-3
50 mm Leading Edge Wedges			
$\varepsilon_s = 0$; $\delta_w = 0°$	0.2	0.57	TABLE 2D-1
$\varepsilon_s = 0$; $\delta_w = 10°$	"	"	TABLE 2D-2
$\varepsilon_s = 0$; $\delta_w = 30°$	"	"	TABLE 2D-3
$\varepsilon_s = 2.4$ mm; $\delta_w = 10°$	"	"	TABLE 2D-4
$\varepsilon_s = 4.0$ mm; $\delta_w = 10°$	"	"	TABLE 2D-5
$\varepsilon_s = 5.6$ mm; $\delta_w = 10°$	"	"	TABLE 2D-6

TABLE 2

RESULTS

(SEE TABLE 1 FOR INDEX)

TABLE 2A

SEQ	TRNSN	MACH	INCID	LIFT	PITCH	DRAG	NORMAL	AXIAL
002	0.575	0.201	-10.01	-0.4754	0.0054	0.0926	0.4841	-0.0088
003	0.575	0.201	-09.01	-0.4129	-0.0310	0.0697	0.4186	-0.0043
004	0.575	0.201	-08.00	-0.3142	-0.0630	0.0443	0.3172	-0.0003
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	0.0016
007	0.568	0.200	-05.00	-0.0542	-0.0728	0.0090	0.0547	-0.0043
008	0.568	0.200	-04.01	0.0238	-0.0757	0.0076	-0.0233	-0.0094
009	0.575	0.201	-03.00	0.0982	-0.0776	0.0067	-0.0978	-0.0119
010	0.575	0.201	-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	0.575	0.201	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	0.575	0.201	07.00	0.7957	-0.0603	0.0794	-0.7996	0.0182
020	0.568	0.200	07.99	0.8530	-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	-0.0056
023	0.575	0.201	10.99	0.8732	-0.1309	0.1836	-0.8923	-0.0138
024	0.575	0.201	12.00	0.8497	-0.1348	0.1989	-0.8726	-0.0179
025	0.575	0.201	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	-0.0330
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	0.575	0.201	20.00	0.8097	-0.1509	0.3327	-0.8748	-0.0357
033	0.843	0.299	-10.01	-0.4846	0.0106	0.0984	0.4943	-0.0128
034	0.847	0.301	-09.01	-0.4329	-0.0225	0.0770	0.4395	-0.0084
035	0.847	0.301	-08.01	-0.3367	-0.0590	0.0510	0.3404	-0.0037
036	0.843	0.299	-07.01	-0.2370	-0.0708	0.0320	0.2391	-0.0030
037	0.847	0.301	-06.01	-0.1515	-0.0721	0.0155	0.1522	0.0003
038	0.843	0.300	-05.01	-0.0685	-0.0736	0.0124	0.0692	-0.0065
039	0.843	0.300	-04.01	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	0.301	-02.01	0.1653	-0.0709	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	-0.0706	0.0150	-0.3217	-0.0159
044	0.843	0.[illegible]00	01.00	0.3982	-0.0700	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	0.0075
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	-0.0001
053	0.843	0.300	10.00	0.8652	-0.1167	0.1626	-0.8804	-0.0100
054	0.847	0.301	10.98	0.8452	-0.1286	0.1815	-0.8644	-0.0172
055	0.847	0.301	11.99	0.8160	-0.1311	0.1957	-0.8390	-0.0219
056	0.847	0.301	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	-0.1600	0.3045	-0.8650	-0.0390
062	0.847	0.301	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	REYN.	MACH.	INCID	LIFT.	PITCH.	DRAG	NORMAL	AXIAL.
002	0.571	0.200	-10.01	-0.4865	0.0133	0.1272	0.5011	-0.0409
003	0.575	0.201	-09.01	-0.4536	-0.0117	0.1090	0.4649	-0.0368
004	0.575	0.201	-08.01	-0.3675	-0.0503	0.0847	0.3756	-0.0329
005	0.575	0.201	-07.01	-0.2678	-0.0684	0.0651	0.2737	-0.0321
006	0.571	0.200	-06.00	-0.1832	-0.0727	0.0516	0.1875	-0.0323
007	0.571	0.200	-05.00	-0.1091	-0.0738	0.0448	0.1125	-0.0352
008	0.575	0.201	-04.01	-0.0321	-0.0767	0.0441	0.0350	-0.0419
009	0.571	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	0.571	0.200	00.00	0.2491	-0.0802	0.0531	-0.2493	-0.0522
013	0.571	0.200	01.00	0.3197	-0.0797	0.0582	-0.3208	-0.0527
014	0.571	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	0.571	0.200	03.99	0.5198	-0.0784	0.0755	-0.5239	-0.0392
017	0.571	0.200	05.00	0.5889	-0.0771	0.0836	-0.5940	-0.0319
018	0.571	0.200	06.00	0.6566	-0.0746	0.0939	-0.6629	-0.0247
019	0.571	0.200	07.00	0.7404	-0.0705	0.1070	-0.7480	-0.0160
020	0.571	0.200	08.00	0.8004	-0.0741	0.1222	-0.8098	-0.0096
021	0.571	0.200	09.00	0.8509	-0.0835	0.1403	-0.8625	-0.0054
022	0.571	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	-10.01	-0.4885	0.0160	0.1309	0.5038	-0.0442
026	0.853	0.301	-09.01	-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	-06.01	-0.1981	-0.0742	0.0551	0.2027	-0.0342
030	0.850	0.301	-05.01	-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	-03.01	0.0321	-0.0708	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	0.0548	-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	-0.1101	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	REYN.	MACH.	INCID.	LIFT	PITCH.	DRAG	NORMAL	AXIAL.
058	0.552	0.201	-10.01	-0.4840	0.0129	0.1290	0.4989	-0.0431
059	0.552	0.201	-09.01	-0.4606	-0.0112	0.1141	0.4727	-0.0407
060	0.552	0.201	-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	0.201	-06.00	-0.1857	-0.0710	0.0551	0.1904	-0.0355
063	0.552	0.201	-05.00	-0.1097	-0.0719	0.0478	0.1133	-0.0382
064	0.552	0.201	-04.01	-0.0332	-0.0756	0.0474	0.0363	-0.0451
065	0.552	0.201	-03.00	0.0392	-0.0706	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	0.201	03.99	0.5539	-0.0858	0.0832	-0.5585	-0.0445
073	0.552	0.201	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	0.201	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	0.201	13.00	0.8589	-0.1288	0.2184	-0.8862	-0.0196
082	0.552	0.201	13.99	0.8336	-0.1299	0.2300	-0.8646	-0.0216
083	0.811	0.299	-10.01	-0.4954	0.0135	0.1337	0.5110	-0.0457
084	0.814	0.301	-09.01	-0.4669	-0.0060	0.1170	0.4794	-0.0426
085	0.814	0.301	-08.00	-0.3944	-0.0442	0.0943	0.4036	-0.0387
086	0.814	0.301	-07.02	-0.2950	-0.0703	0.0729	0.3016	-0.0365
087	0.814	0.301	-06.02	-0.2005	-0.0748	0.0582	0.2054	-0.0370
088	0.814	0.301	-05.01	-0.1208	-0.0753	0.0484	0.1245	-0.0377
089	0.814	0.301	-04.02	-0.0424	-0.0776	0.0484	0.0456	-0.0454
090	0.814	0.301	-03.01	0.0339	-0.0794	0.0494	-0.0314	-0.0512
091	0.814	0.301	-02.00	0.1060	-0.0814	0.0507	-0.1043	-0.0545
092	0.814	0.301	-01.00	0.1755	-0.0807	0.0538	-0.1747	-0.0570
093	0.811	0.299	00.00	0.2482	-0.0826	0.0581	-0.2483	-0.0582
094	0.811	0.299	01.00	0.3220	-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	0.811	0.300	03.00	0.4756	-0.0869	0.0766	-0.4791	-0.0517
097	0.811	0.300	04.00	0.5515	-0.0867	0.0834	-0.5561	-0.0440
098	0.811	0.299	05.00	0.6206	-0.0844	0.0906	-0.6263	-0.0362
099	0.811	0.299	05.99	0.6727	-0.0762	0.0993	-0.6795	-0.0286
100	0.811	0.300	07.00	0.7503	-0.0714	0.1111	-0.7583	-0.0189
101	0.811	0.300	07.99	0.8126	-0.0743	0.1253	-0.8222	-0.0111
102	0.811	0.299	08.99	0.8567	-0.0833	0.1435	-0.8687	-0.0079
103	0.811	0.300	09.99	0.8616	-0.0951	0.1606	-0.8765	-0.0087
104	0.811	0.300	11.00	0.8644	-0.1059	0.1803	-0.8830	-0.0121
105	0.811	0.300	12.00	0.8569	-0.1105	0.1984	-0.8795	-0.0160
106	0.811	0.300	13.00	0.8486	-0.1258	0.2148	-0.8752	-0.0185

TABLE 2B-3

SER	REYN.	MACH.	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	-0.0410
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	-0.0470
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

SEQ	REYN.	MACH.	ALPHA	LIFT	PITCH	DRAG	NORMAL	AXIAL
157	0.552	0.199	-10.01	-0.4882	-0.0551	0.0840	0.4953	0.0019
158	0.555	0.200	-09.01	-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	0.201	-07.01	-0.2395	-0.0715	0.0333	0.2417	-0.0040
161	0.555	0.201	-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	-04.01	-0.0013	-0.0696	0.0144	0.0022	-0.0143
164	0.555	0.201	-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	0.201	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	0.201	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	0.201	07.99	0.8403	-0.0503	0.1250	-0.8496	-0.0069
176	0.555	0.201	09.01	0.8767	-0.0490	0.1456	-0.8888	-0.0066
177	0.552	0.199	10.01	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	0.857	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	-08.01	-0.3381	-0.0682	0.0490	0.3416	-0.0016
187	0.821	0.301	-07.02	-0.2497	-0.0720	0.0347	0.2520	-0.0040
188	0.821	0.300	-06.01	-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	0.301	-04.01	-0.0032	-0.0723	0.0140	0.0041	-0.0130
191	0.821	0.301	-03.00	0.0738	-0.0716	0.0131	-0.0731	-0.0170
192	0.821	0.301	-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	0.301	01.00	0.3763	-0.0643	0.0275	-0.3768	-0.0210
196	0.824	0.301	02.00	0.4556	-0.0634	0.0352	-0.4567	-0.0193
197	0.821	0.301	03.00	0.5338	-0.0612	0.0439	-0.5355	-0.0160
198	0.821	0.301	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	08.01	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	11.01	0.9342	-0.0508	0.1920	-0.9538	-0.0102

TABLE 2C-2

SER	REYN.	MACH.	INCID.	LIFT.	PITCH.	DRAG	NORMAL	AXIAL.
002	0.573	0.199	-10.02	-0.5049	-0.0497	0.0824	0.5115	0.0065
003	0.575	0.201	-09.01	-0.4118	-0.0600	0.0599	0.4161	0.0052
004	0.575	0.201	-08.00	-0.3256	-0.0657	0.0429	0.3283	0.0027
005	0.575	0.201	-07.00	-0.2392	-0.0670	0.0296	0.2410	-0.0003
006	0.571	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	0.571	0.200	-03.00	0.0775	-0.0674	0.0143	-0.0767	-0.0185
011	0.575	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	0.571	0.200	00.00	0.2983	-0.0609	0.0252	-0.2984	-0.0253
014	0.571	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	0.571	0.200	03.00	0.5379	-0.0584	0.0516	-0.5400	-0.0234
017	0.575	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	0.571	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	0.1306	-0.8414	-0.0218
022	0.573	0.199	08.99	0.8725	-0.0501	0.1613	-0.8871	-0.0229
023	0.571	0.200	10.01	0.9020	-0.0510	0.1836	-0.9203	-0.0241
024	0.571	0.200	11.00	0.9342	-0.0556	0.2084	-0.9569	-0.0264
025	0.571	0.200	12.00	0.9548	-0.0574	0.2317	-0.9822	-0.0282
026	0.575	0.201	13.00	0.9567	-0.0635	0.2520	-0.9890	-0.0303
027	0.575	0.201	13.99	0.9602	-0.0677	0.2720	-0.9976	-0.0317
028	0.575	0.201	15.00	0.9568	-0.0719	0.2910	-0.9997	-0.0333
029	0.575	0.201	15.99	0.9478	-0.0798	0.3081	-0.9962	-0.0351

TABLE 2C-3

SER	REYN.	MACH.	INCID	LIFT	PITCH	DRAG	NORMAL	AXIAL
208	0.575	0.201	-10.01	-0.4684	-0.0579	0.0785	0.4748	0.0040
209	0.568	0.200	-09.01	-0.3923	-0.0672	0.0597	0.3967	0.0023
210	0.571	0.201	-08.00	-0.3035	-0.0723	0.0424	0.3063	0.0002
211	0.571	0.201	-07.01	-0.2181	-0.0759	0.0294	0.2199	-0.0027
212	0.571	0.201	-06.01	-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	-04.01	0.0141	-0.0720	0.0119	-0.0134	-0.0129
215	0.571	0.201	-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	0.575	0.202	01.00	0.3805	-0.0656	0.0284	-0.3810	-0.0218
220	0.571	0.201	02.00	0.4632	-0.0654	0.0370	-0.4644	-0.0208
221	0.571	0.201	03.00	0.5400	-0.0650	0.0466	-0.5418	-0.0183
222	0.571	0.201	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	0.570	0.199	09.00	0.8781	-0.0533	0.1481	-0.8906	-0.0089
228	0.570	0.199	10.00	0.9193	-0.0549	0.1717	-0.9353	-0.0094
229	0.570	0.199	11.01	0.9474	-0.0561	0.1946	-0.9673	-0.0102
230	0.570	0.199	12.00	0.9665	-0.0612	0.2176	-0.9908	-0.0118
231	0.570	0.199	13.00	0.9707	-0.0687	0.2400	-0.9999	-0.0154
232	0.570	0.199	13.99	0.9621	-0.0732	0.2585	-0.9961	-0.0182
233	0.570	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	0.301	-08.03	-0.3377	-0.0674	0.0495	0.3412	-0.0020
238	0.837	0.301	-07.03	-0.2489	-0.0716	0.0345	0.2511	-0.0039
239	0.837	0.301	-06.02	-0.1650	-0.0709	0.0229	0.1664	-0.0056
240	0.837	0.301	-04.01	-0.0056	-0.0705	0.0145	0.0065	-0.0142
241	0.837	0.301	-02.00	0.1454	-0.0678	0.0150	-0.1449	-0.0201
242	0.837	0.301	-02.00	0.1458	-0.0678	0.0150	-0.1453	-0.0201
243	0.837	0.301	-00.02	0.2976	-0.0644	0.0231	-0.2977	-0.0233
244	0.837	0.301	-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	-0.0452
246	0.837	0.301	02.00	0.5241	-0.0602	0.0418	-0.5254	-0.0235
247	0.837	0.301	03.99	0.6030	-0.0572	0.0588	-0.6050	-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	10.01	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	REYN.	MACH.	INCID	LIFT.	PITCH.	DRAG	NORMAL	AXIAL.
163	0.573	0.199	-10.02	-0.4661	-0.0663	0.0890	0.4744	-0.0067
164	0.575	0.200	-09.03	-0.3981	-0.0737	0.0702	0.4041	-0.0070
165	0.578	0.201	-08.02	-0.3234	-0.0776	0.0533	0.3276	-0.0078
166	0.578	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	0.575	0.201	-04.01	0.0016	-0.0770	0.0130	-0.0008	-0.0132
170	0.575	0.201	-03.01	0.0776	-0.0745	0.0108	-0.0770	-0.0150
171	0.575	0.201	-02.01	0.1537	-0.0756	0.0106	-0.1533	-0.0161
172	0.575	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	0.575	0.201	09.01	0.8684	-0.0484	0.1283	-0.8779	0.0092
183	0.575	0.201	10.00	0.9021	-0.0571	0.1527	-0.9150	0.0062
184	0.575	0.201	10.99	0.9247	-0.0682	0.1775	-0.9417	0.0021
185	0.575	0.201	11.99	0.9417	-0.0735	0.2003	-0.9629	-0.0002
186	0.578	0.202	13.00	0.9560	-0.0782	0.2231	-0.9818	-0.0023
187	0.575	0.201	13.99	0.9628	-0.0825	0.2452	-0.9936	-0.0051
188	0.575	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	0.578	0.201	17.00	0.9982	-0.0850	0.3120	-1.0459	-0.0064
191	0.578	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	0.578	0.201	20.00	1.0095	-0.0902	0.3770	-1.0777	-0.0089

TABLE 2D-2

SER	REYN.	MACH.	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	-09.01	-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	-04.01	0.0043	-0.0693	0.0142	-0.0034	-0.0146
104	0.571	0.201	-03.01	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	07.01	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	-0.0099
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	REYN.	MACH.	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	-06.01	-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	-0.0830
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	-0.0843
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	0.563	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	0.563	0.198	20.00	0.8153	-0.1022	0.3811	-0.8966	-0.0793

TABLE 2D-4

SEQ	REYN.	MACH.	INCID.	LIFT.	PITCH.	DRAG	NORMAL	AXIAL.
196	0.578	0.200	-10.01	-0.5021	-0.0306	0.0893	0.5099	-0.0009
197	0.576	0.199	-09.01	-0.4149	-0.0526	0.0652	0.4199	0.0004
198	0.571	0.199	-08.01	-0.3246	-0.0650	0.0452	0.3277	0.0003
199	0.578	0.201	-07.01	-0.2365	-0.0692	0.0306	0.2384	-0.0016
200	0.578	0.201	-06.01	-0.1528	-0.0669	0.0194	0.1539	-0.0034
201	0.578	0.201	-05.01	-0.0736	-0.0660	0.0156	0.0746	-0.0092
202	0.581	0.201	-04.01	0.0043	-0.0638	0.0149	-0.0033	-0.0153
203	0.571	0.199	-03.01	0.0824	-0.0639	0.0159	-0.0816	-0.0203
204	0.571	0.199	-01.99	0.1560	-0.0624	0.0186	-0.1553	-0.0241
205	0.575	0.199	-01.00	0.2312	-0.0596	0.0230	-0.2309	-0.0271
206	0.578	0.201	00.00	0.3052	-0.0561	0.0285	-0.3053	-0.0285
207	0.578	0.201	01.00	0.3822	-0.0537	0.0362	-0.3829	-0.0296
208	0.578	0.201	02.00	0.4567	-0.0501	0.0448	-0.4581	-0.0288
209	0.578	0.201	03.00	0.5329	-0.0487	0.0550	-0.5352	-0.0271
210	0.578	0.201	03.99	0.6079	-0.0456	0.0676	-0.6112	-0.0252
211	0.578	0.201	05.00	0.6773	-0.0433	0.0833	-0.6821	-0.0239
212	0.578	0.201	06.00	0.7430	-0.0404	0.1015	-0.7497	-0.0232
213	0.578	0.201	07.01	0.7991	-0.0382	0.1218	-0.8081	-0.0235
214	0.578	0.201	08.01	0.8512	-0.0364	0.1439	-0.8631	-0.0239
215	0.578	0.201	09.01	0.8975	-0.0354	0.1682	-0.9128	-0.0256
216	0.578	0.201	10.01	0.9386	-0.0362	0.1937	-0.9581	-0.0277
217	0.578	0.201	11.00	0.9627	-0.0385	0.2172	-0.9866	-0.0295
218	0.578	0.201	12.00	0.9851	-0.0416	0.2416	-1.0139	-0.0316
219	0.578	0.201	13.01	1.0078	-0.0459	0.2672	-1.0422	-0.0336
220	0.578	0.201	14.00	1.0160	-0.0510	0.2898	-1.0561	-0.0354
221	0.571	0.199	15.01	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	0.571	0.199	17.00	0.9927	-0.0766	0.3475	-1.0510	-0.0420
224	0.571	0.199	18.00	0.9981	-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	0.201	20.00	0.9731	-0.0864	0.4007	-1.0516	-0.0437

TABLE 2D5

SEQ	RENR	MACH	[illegible]	LIFT	PITCH	DRAG	NORMAL	AXIAL
321	0.565	0.199	-09.99	-0.5083	-0.0265	0.0935	0.5168	-0.0040
322	0.573	0.202	-09.01	-0.4236	-0.0407	0.0693	0.4291	-0.0022
323	0.571	0.202	-08.00	-0.3335	-0.0622	0.0493	0.3370	-0.0026
324	0.571	0.203	-07.00	-0.2445	-0.0643	0.0355	0.2469	-0.0055
325	0.571	0.203	-06.00	-0.1604	-0.0644	0.0233	0.1619	-0.0065
326	0.571	0.203	-05.00	-0.0819	-0.0617	0.0196	0.0832	-0.0125
327	0.571	0.203	-04.01	-0.0024	-0.0616	0.0179	0.0036	-0.0178
328	0.578	0.204	-02.03	0.0727	-0.0598	0.0121	-0.0724	-0.0140
329	0.583	0.206	-03.02	0.0712	-0.0610	0.0179	-0.0702	-0.0217
330	0.583	0.206	-02.02	0.1424	-0.0585	0.0206	-0.1417	-0.0257
331	0.583	0.206	-01.02	0.2226	-0.0573	0.0248	-0.2223	-0.0288
332	0.585	0.207	00.01	0.2944	-0.0538	0.0307	-0.2945	-0.0307
333	0.585	0.207	01.00	0.3699	-0.0511	0.0384	-0.3706	-0.0320
334	0.585	0.207	02.00	0.4496	-0.0501	0.0474	-0.4511	-0.0317
335	0.585	0.207	03.00	0.5248	-0.0469	0.0573	-0.5272	-0.0297
336	0.585	0.207	03.99	0.5968	-0.0446	0.0692	-0.6003	-0.0275
337	0.585	0.206	04.99	0.6723	-0.0413	0.0849	-0.6772	-0.0261
338	0.585	0.206	06.01	0.7357	-0.0383	0.1030	-0.7425	-0.0255
339	0.585	0.206	07.01	0.7967	-0.0369	0.1232	-0.8059	-0.0251
340	0.585	0.206	08.00	0.8504	-0.0339	0.1485	-0.8625	-0.0258
341	0.585	0.206	09.01	0.8940	-0.0337	0.1682	-0.9094	-0.0262
342	0.578	0.204	10.01	0.9401	-0.0348	0.1942	-0.9597	-0.0279
343	0.585	0.206	11.00	0.9592	-0.0363	0.2166	-0.9830	-0.0296
344	0.578	0.204	12.01	0.9805	-0.0393	0.2411	-1.0093	-0.0319
345	0.571	0.203	13.01	1.0053	-0.0425	0.2666	-1.0396	-0.0335
346	0.571	0.203	14.01	1.0238	-0.0481	0.2917	-1.0640	-0.0353
347	0.571	0.203	15.01	1.0221	-0.0521	0.3122	-1.0682	-0.0370
348	0.578	0.204	16.00	1.0204	-0.0579	0.3312	-1.0723	-0.0372
349	0.578	0.204	18.00	1.0008	-0.0744	0.3689	-1.0659	-0.0415
350	0.578	0.204	17.00	1.0271	-0.0707	0.3618	-1.0881	-0.0456
351	0.578	0.204	18.00	1.0165	-0.0756	0.3745	-1.0826	-0.0420
352	0.585	0.207	18.99	0.9910	-0.0762	0.3840	-1.0622	-0.0406
353	0.585	0.206	20.00	0.9922	-0.0873	0.4086	-1.0722	-0.0446
354	1.101	0.400	-10.03	-0.5196	-0.0206	0.0992	0.5289	-0.0074
355	1.101	0.400	-09.04	-0.4479	-0.0411	0.0768	0.4543	-0.0056
356	1.101	0.400	-08.03	-0.3594	-0.0612	0.0551	0.3634	-0.0044
357	1.097	0.399	-07.03	-0.2665	-0.0696	0.0389	0.2692	-0.0061
358	1.104	0.401	-06.02	-0.1765	-0.0705	0.0259	0.1782	-0.0073
359	1.101	0.401	-05.02	-0.0908	-0.0691	0.0187	0.0920	-0.0108
360	1.101	0.401	-04.02	-0.0078	-0.0674	0.0170	0.0089	-0.0165
361	1.101	0.401	-03.02	0.0725	-0.0655	0.0170	-0.0716	-0.0209
362	1.097	0.399	-02.01	0.1543	-0.0634	0.0198	-0.1536	-0.0253
363	1.101	0.401	-01.01	0.2345	-0.0618	0.0244	-0.2341	-0.0286
364	1.101	0.401	00.00	0.3113	-0.0592	0.0307	-0.3114	-0.0308
365	1.097	0.399	01.00	0.3905	-0.0570	0.0389	-0.3912	-0.0322
366	1.094	0.398	02.00	0.4694	-0.0543	0.0482	-0.4709	-0.0318
367	1.097	0.399	03.00	0.5531	-0.0515	0.0596	-0.5556	-0.0306
368	1.097	0.399	03.99	0.6272	-0.0478	0.0720	-0.6307	-0.0282
369	1.097	0.399	04.99	0.7035	-0.0449	0.0888	-0.7087	-0.0272
370	1.101	0.400	06.00	0.7625	-0.0412	0.1073	-0.7696	-0.0271
371	1.097	0.399	07.01	0.8236	-0.0389	0.1288	-0.8333	-0.0273
372	1.101	0.400	08.01	0.8754	-0.0377	0.1515	-0.8881	-0.0281
373	1.107	0.402	09.01	0.9156	-0.0375	0.1747	-0.9317	-0.0292
374	1.097	0.399	10.01	0.9475	-0.0389	0.1985	-0.9677	-0.0308
375	1.097	0.399	11.01	0.9733	-0.0413	0.2230	-0.9981	[illegible]
376	1.097	0.399	12.00	0.9963	-0.0453	0.2476	-1.0261	[illegible]
377	1.104	0.401	13.01	1.0014	-0.0491	0.2687	-1.0361	[illegible]
378	1.107	0.401	14.00	1.0045	-0.0551	0.2895	-1.0448	-0.0380
379	1.097	0.399	15.01	1.0207	-0.0591	0.3128	-1.0670	-0.0378
380	1.107	0.401	16.00	1.0563	-0.0636	0.3310	-1.0683	-0.0381
381	1.097	0.399	16.99	1.0324	-0.0694	0.3506	-1.0708	-0.0394
382	1.101	0.400	17.99	1.0092	-0.0751	0.3704	-1.0744	-0.0405

TABLE 2D-6

SER	REYN	MACH	ALPHA	LIFT	PITCH	DRAG	NORMAL	AXIAL
262	0.578	0.201	-10.03	-0.5040	-0.0204	0.0940	0.5125	-0.0050
263	0.578	0.201	-09.03	0.4196	-0.0505	0.0711	0.4255	-0.0046
264	0.573	0.199	-08.00	-0.3304	-0.0611	0.0526	0.3344	-0.0062
265	0.573	0.199	-07.00	-0.2409	-0.0668	0.0383	0.2436	-0.0080
266	0.578	0.201	-06.00	-0.1566	-0.0649	0.0260	0.1585	-0.0104
267	0.578	0.201	-05.01	-0.0825	-0.0637	0.0219	0.0840	-0.0140
268	0.573	0.199	-04.01	-0.0044	-0.0623	0.0202	0.0057	-0.0199
269	0.573	0.199	-03.01	0.0717	-0.0607	0.0202	-0.0706	-0.0241
270	0.573	0.199	-02.00	0.1461	-0.0590	0.0229	-0.1453	-0.0280
271	0.573	0.199	-01.00	0.2226	-0.0568	0.0269	-0.2222	-0.0309
272	0.568	0.199	00.00	0.2971	-0.0545	0.0326	-0.2972	-0.0327
273	0.573	0.199	01.00	0.3735	-0.0514	0.0400	-0.3743	-0.0335
274	0.560	0.196	02.00	0.4544	-0.0504	0.0493	-0.4560	-0.0334
275	0.568	0.199	03.00	0.5238	-0.0480	0.0590	-0.5263	-0.0315
276	0.568	0.199	04.00	0.6012	-0.0451	0.0708	-0.6048	-0.0287
277	0.568	0.199	04.99	0.6722	-0.0417	0.0854	-0.6772	-0.0266
278	0.568	0.199	06.00	0.7373	-0.0397	0.1036	-0.7442	-0.0259
279	0.568	0.199	07.01	0.7946	-0.0375	0.1229	-0.8030	-0.0251
280	0.575	0.201	08.01	0.8450	-0.0354	0.1444	-0.8570	-0.0253
281	0.568	0.199	09.01	0.8920	-0.0342	0.1674	-0.9074	-0.0257
282	0.568	0.199	10.01	0.9362	-0.0349	0.1929	-0.9555	-0.0273
283	0.578	0.201	11.00	0.9583	-0.0368	0.2163	-0.9821	-0.0295
284	0.568	0.199	12.00	0.9863	-0.0403	0.2421	-1.0152	-0.0318
285	0.568	0.199	13.01	1.0032	-0.0426	0.2658	-1.0374	-0.0332
286	0.568	0.199	14.00	1.0144	-0.0456	0.2801	-1.0540	-0.0342
287	0.568	0.199	15.01	1.0137	-0.0508	0.3090	-1.0592	-0.0360
288	0.568	0.199	16.00	1.0260	-0.0562	0.3324	-1.0780	-0.0368
289	0.568	0.199	17.00	1.0255	-0.0616	0.3519	-1.0837	-0.0368
290	0.568	0.199	18.00	1.0247	-0.0675	0.3730	-1.0899	-0.0380
291	0.568	0.199	18.99	1.0242	-0.0737	0.3946	-1.0970	-0.0398
292	0.568	0.199	20.00	1.0053	-0.0858	0.4124	-1.0859	-0.0437
293	1.094	0.401	-10.04	-0.5161	-0.0192	0.1009	0.5257	-0.0096
294	1.088	0.400	-09.02	-0.4453	-0.0412	0.0790	0.4521	-0.0084
295	1.084	0.401	-10.03	-0.5157	-0.0179	0.1011	0.5253	-0.0099
296	1.084	0.402	-08.01	-0.3600	-0.0591	0.0588	0.3646	-0.0082
297	1.083	0.401	-08.01	-0.2644	-0.0680	0.0490	0.2685	-0.0118
298	1.075	0.400	-07.01	-0.2637	-0.0679	0.0421	0.2668	-0.0097
299	1.075	0.400	-06.01	-0.1734	-0.0693	0.0288	0.1754	-0.0106
300	1.083	0.401	-05.01	-0.0880	-0.0679	0.0218	0.0895	-0.0142
301	1.084	0.402	-04.02	-0.0060	-0.0667	0.0194	0.0072	-0.0190
302	1.083	0.401	-03.01	0.0750	-0.0647	0.0195	-0.0740	-0.0235
303	1.078	0.400	-02.00	0.1546	-0.0632	0.0220	-0.1539	-0.0275
304	1.084	0.402	-01.01	0.2347	-0.0613	0.0263	-0.2343	-0.0305
305	1.075	0.400	00.00	0.3126	-0.0586	0.0323	-0.3127	-0.0324
306	1.075	0.400	01.00	0.3902	-0.0559	0.0404	-0.3910	-0.0336
307	1.075	0.400	02.00	0.4709	-0.0537	0.0498	-0.4725	-0.0334
308	1.075	0.400	03.00	0.5530	-0.0509	0.0608	-0.5555	-0.0318
309	1.075	0.399	03.99	0.6274	-0.0470	0.0730	-0.6311	-0.0291
310	1.075	0.399	05.00	0.6973	-0.0442	0.0883	-0.7025	-0.0272
311	1.075	0.399	06.01	0.7654	-0.0414	0.1080	-0.7726	-0.0273
312	1.075	0.399	07.01	0.8206	-0.0396	0.1296	-0.8304	-0.0276
313	1.075	0.399	08.01	0.8804	-0.0306	0.1524	-0.8932	-0.0282
314	1.075	0.399	09.01	0.9211	-0.0304	0.1756	-0.9374	-0.0292
315	1.075	0.399	10.01	0.9575	-0.0396	0.2003	-0.9779	-0.0308
316	1.075	0.400	11.00	0.9844	0.0421	0.2249	-1.0093	-0.0329
317	1.07	0.399	12.01	1.0036	0.0452	0.2490	-1.0336	-0.0347
318	1.071	0.400	13.01	1.0047	0.0491	0.2694	-1.0396	-0.0363

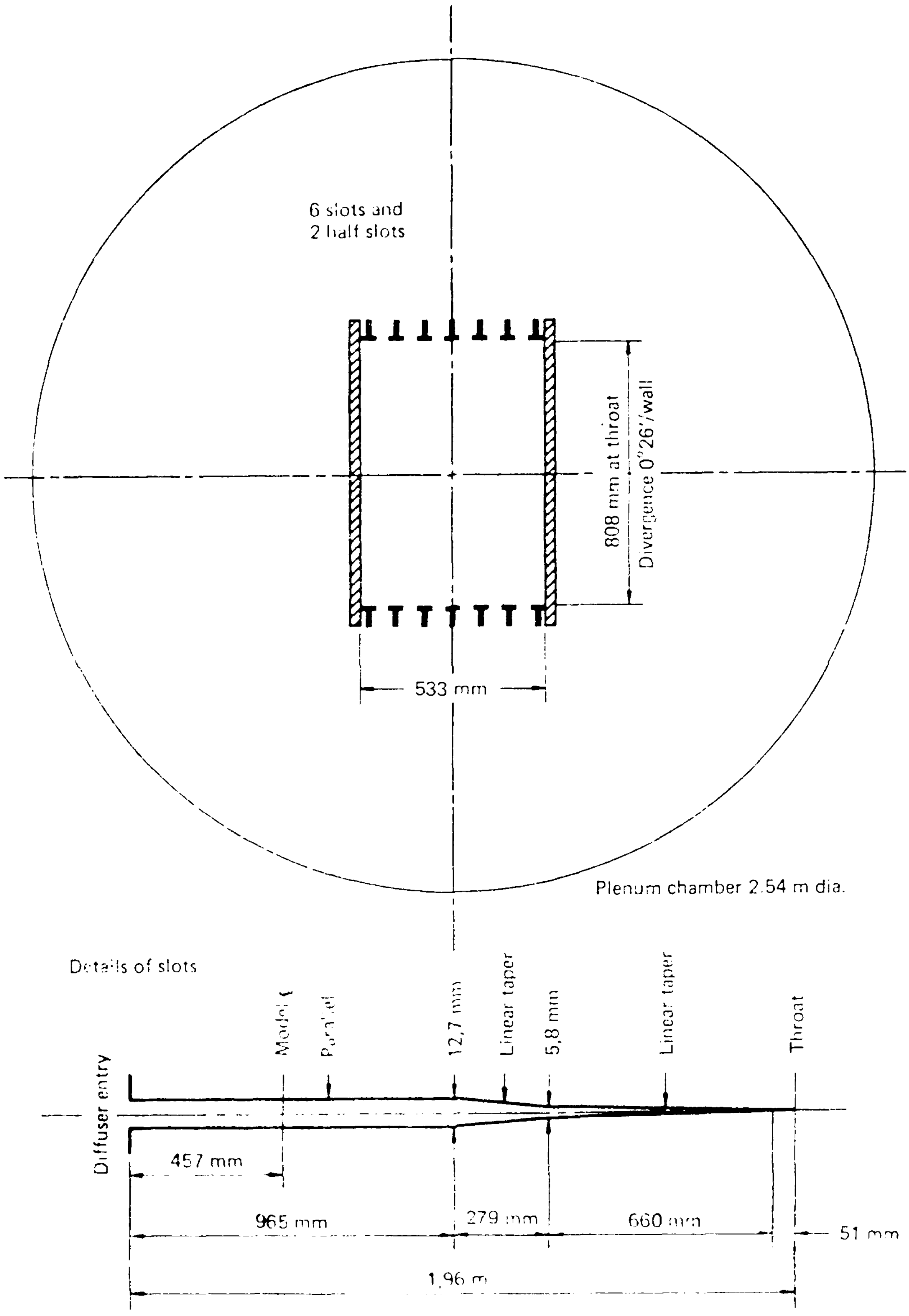


FIG. 1 DETAILS OF SLOTTED WORKING SECTION

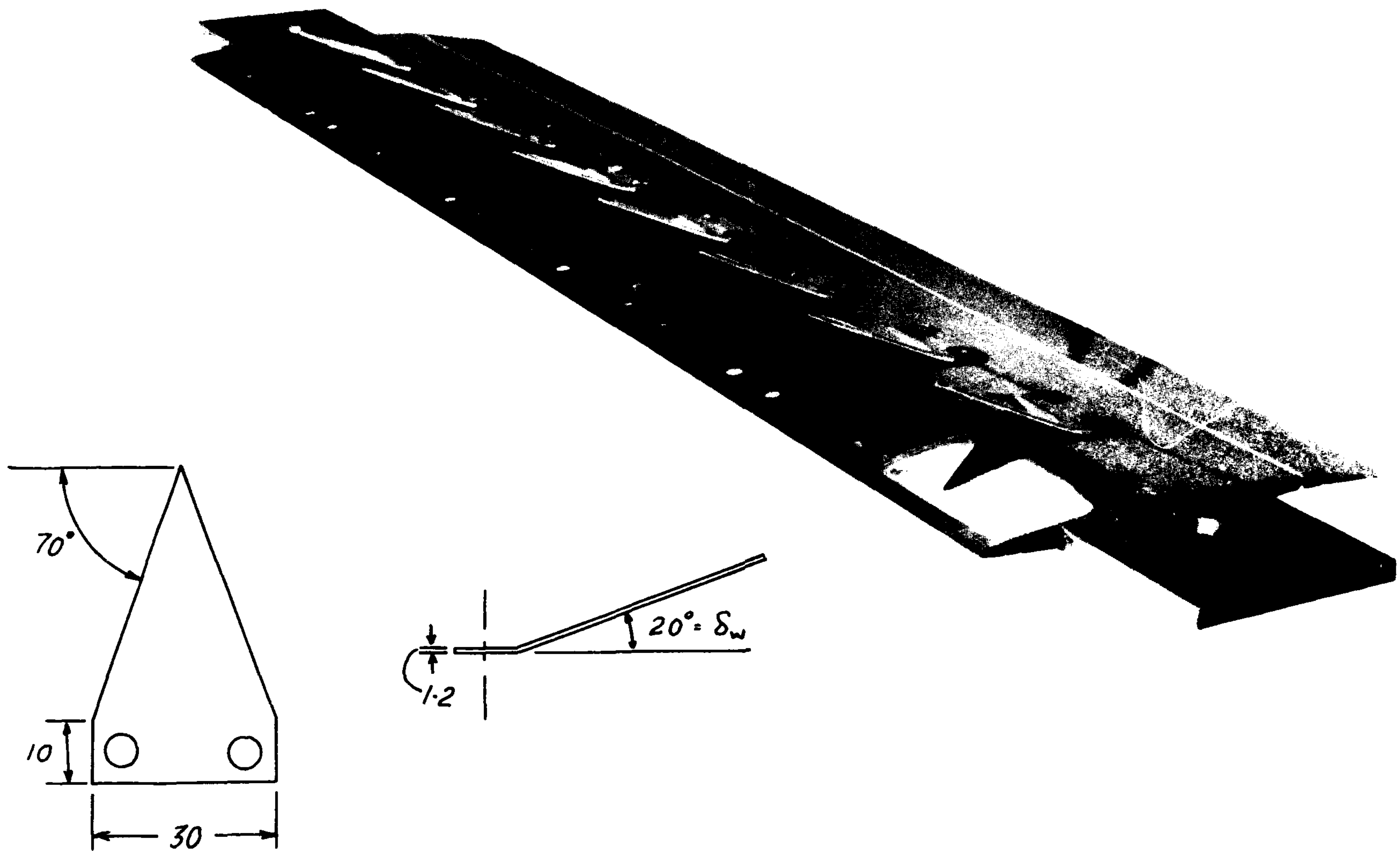
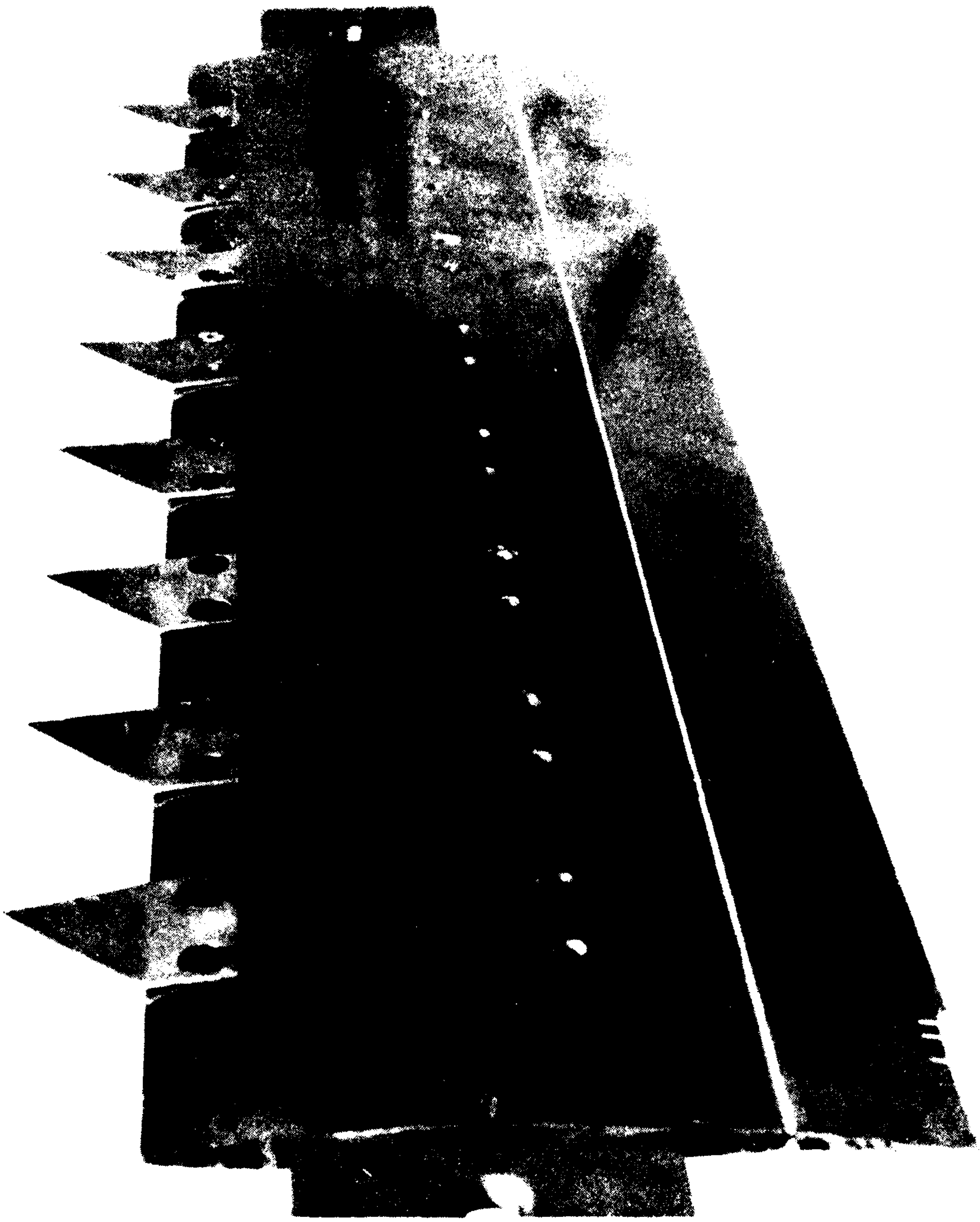


FIG. 2(a) AEROFOIL MODEL WITH UPPER SURFACE WEDGES (dimensions in mm)



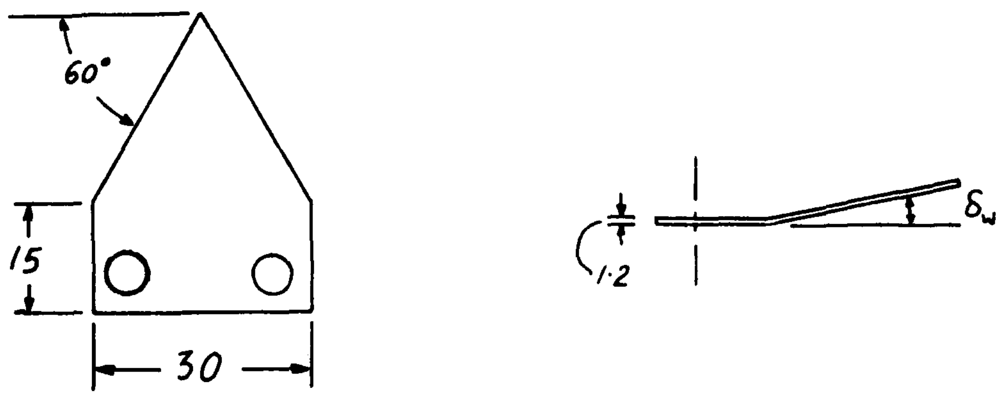


FIG. 2(b) AEROFOIL MODEL WITH 30mm LEADING EDGE WEDGES

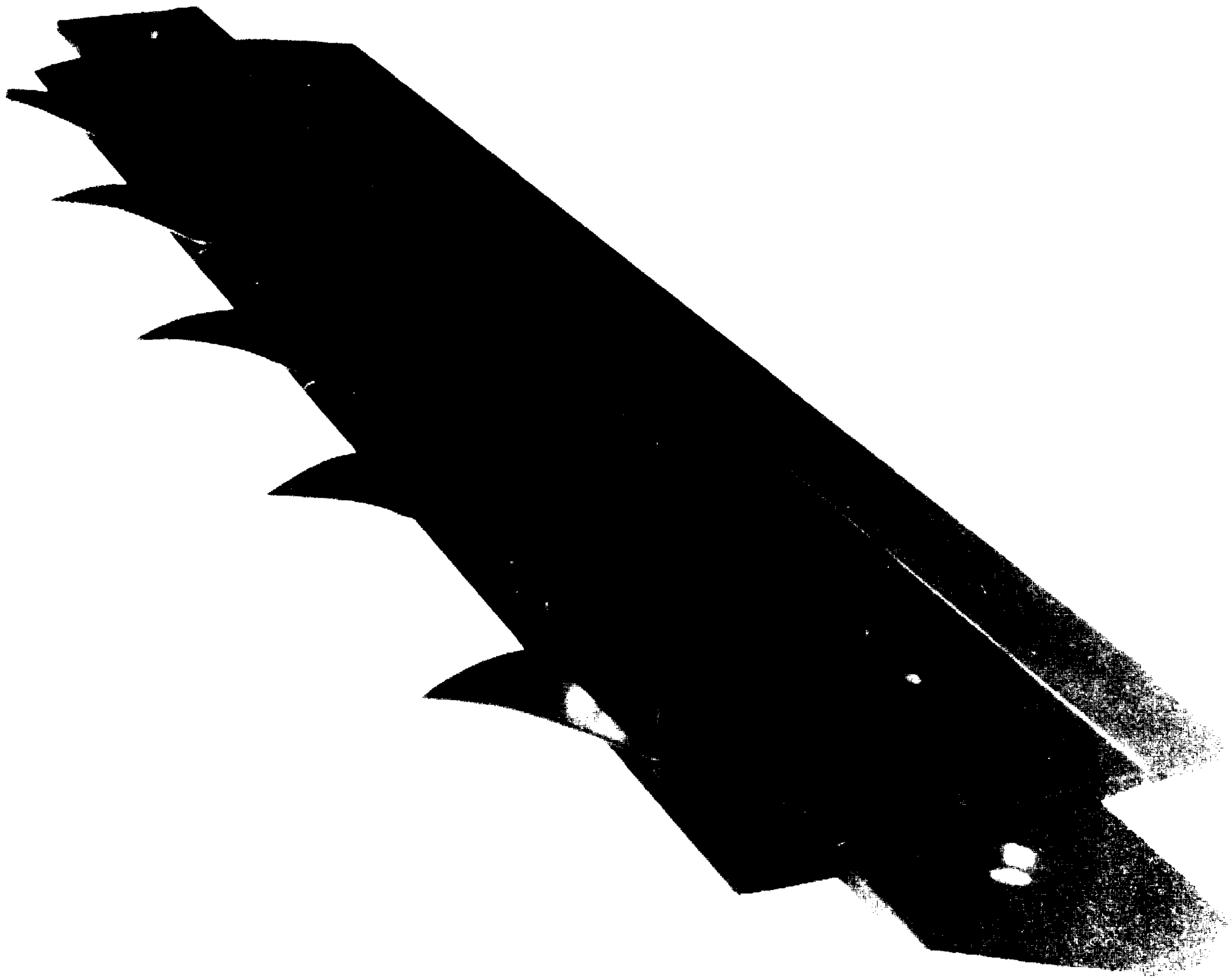
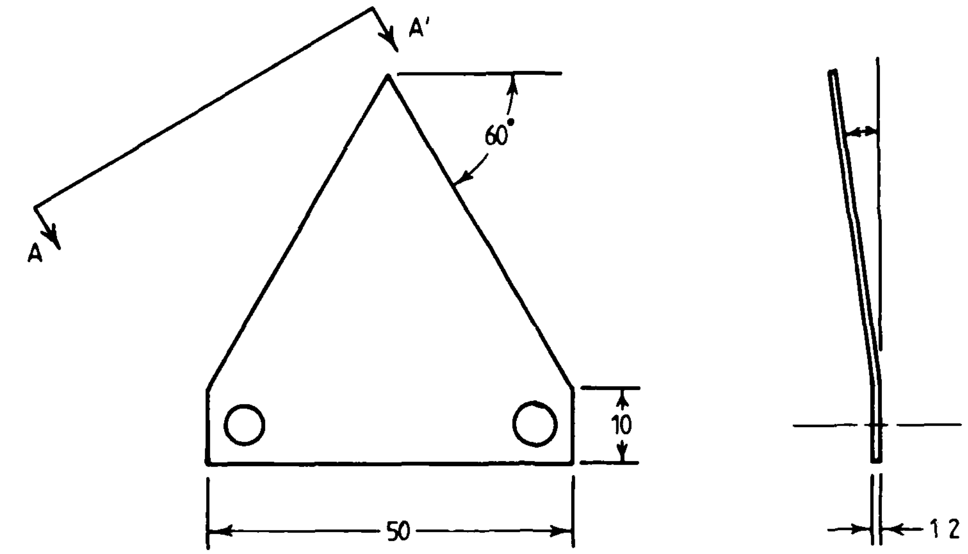
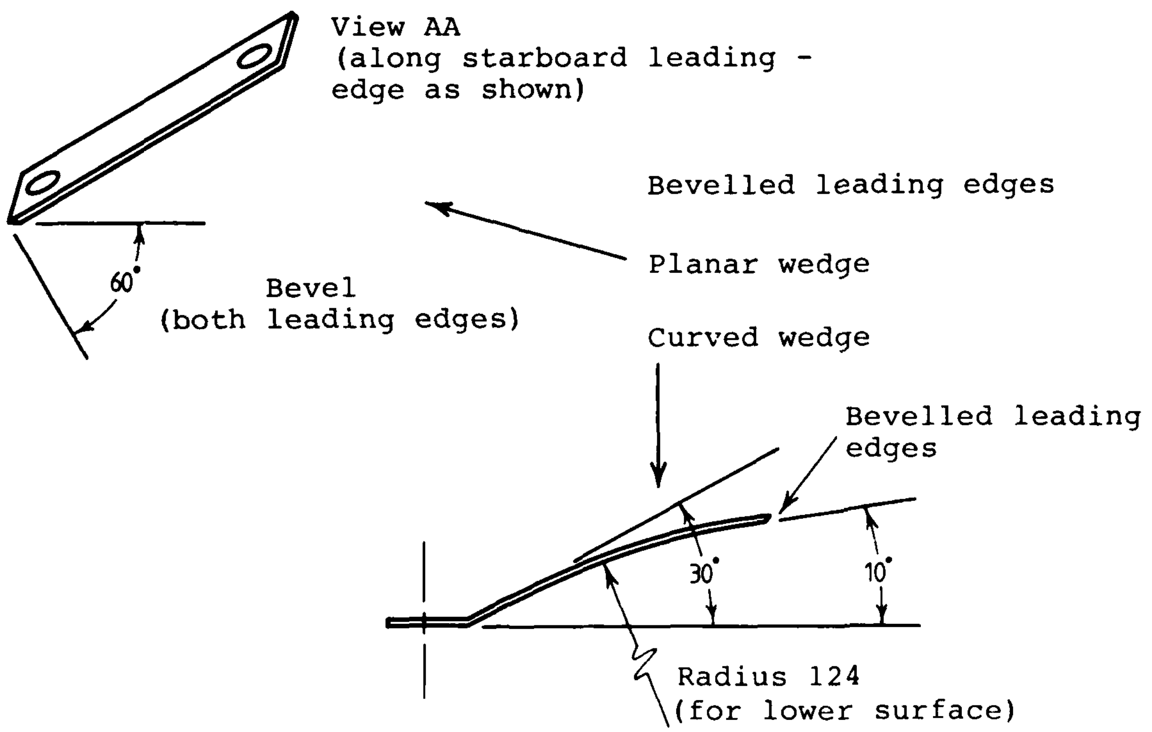


FIG. 2(c) AEROFOIL MODEL WITH 40mm LEADING EDGE WEDGES

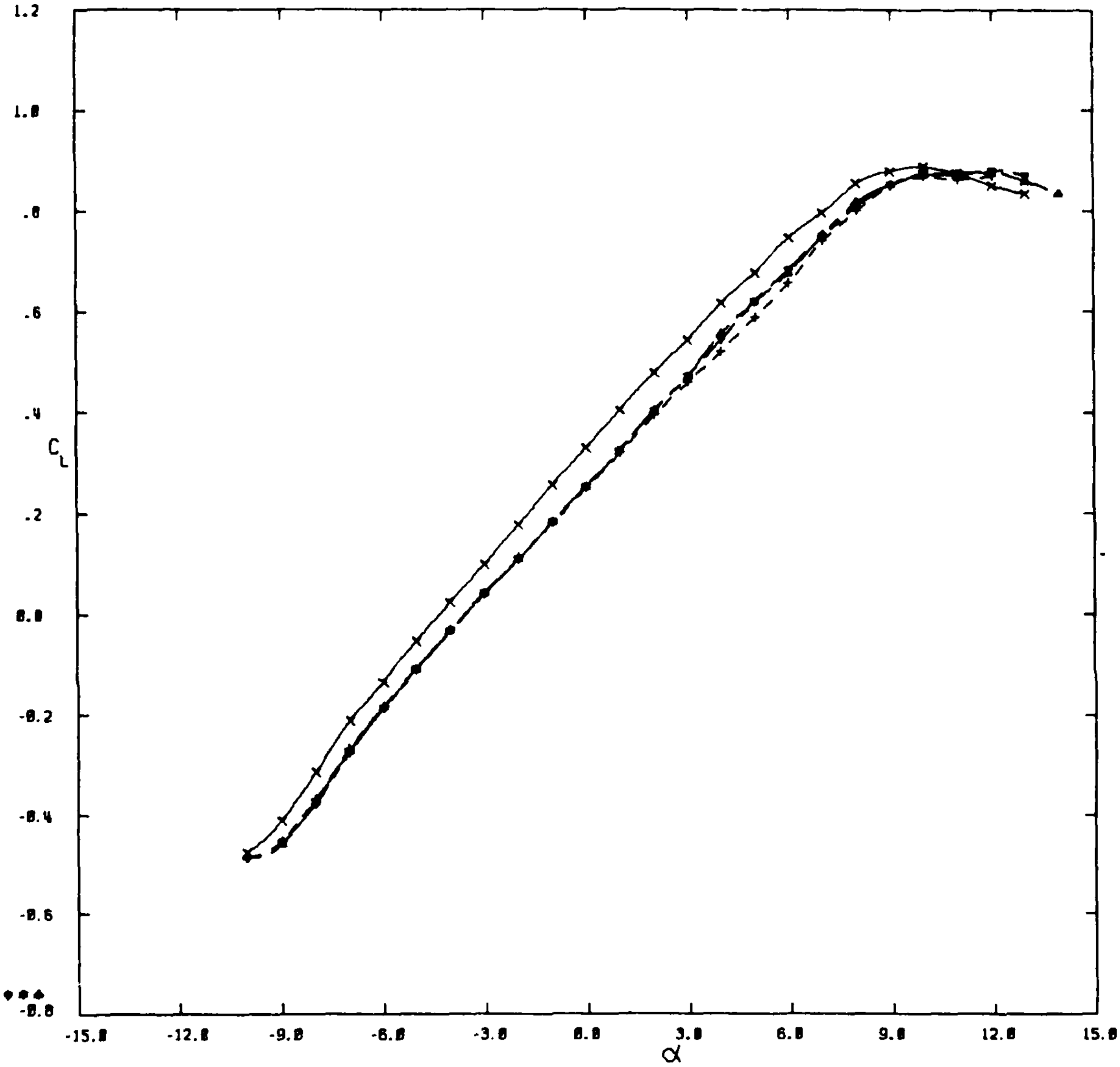


(i) Standard wedge configuration



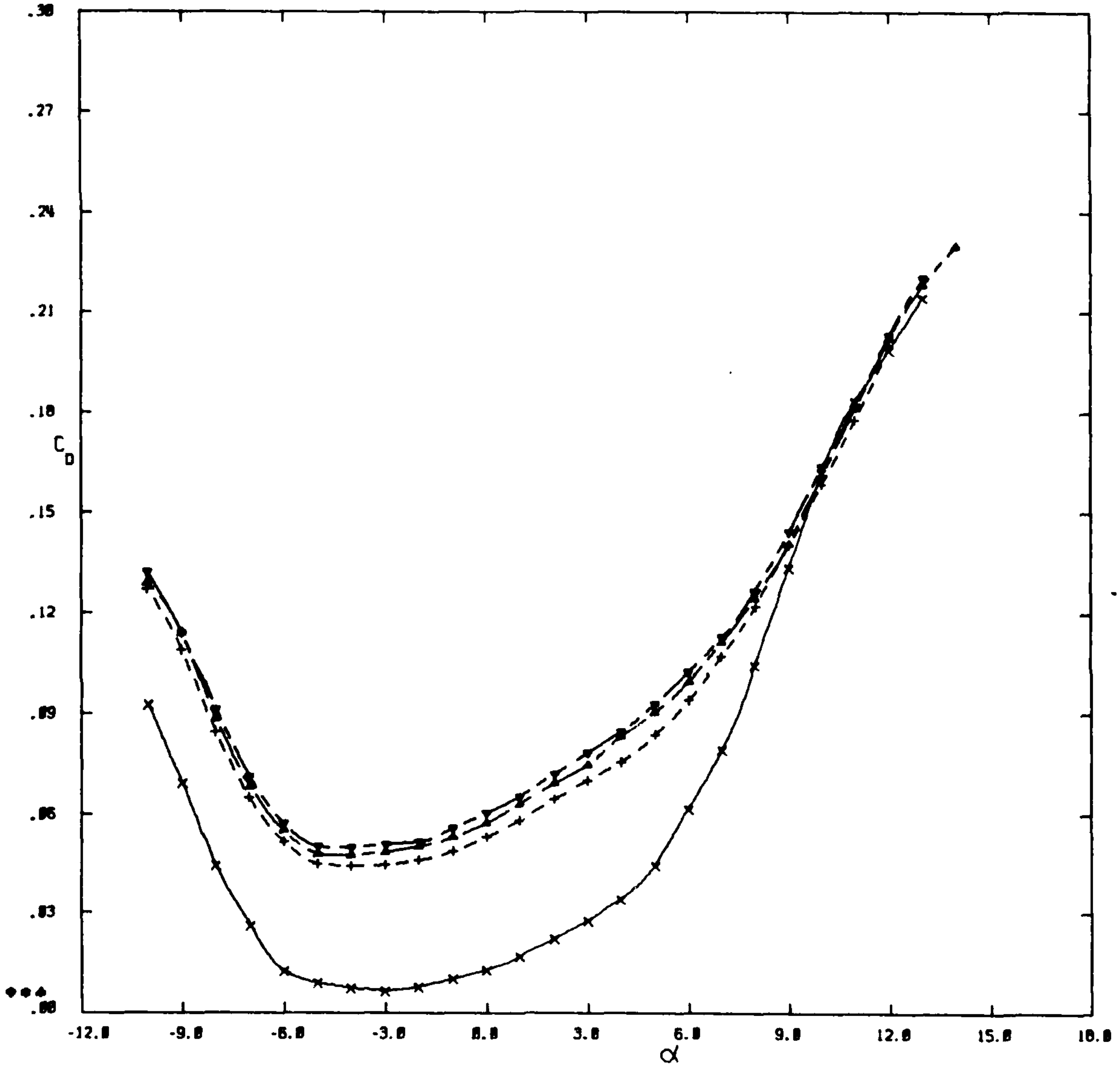
(ii) Alternate configurations

FIG. 2(c) Continued



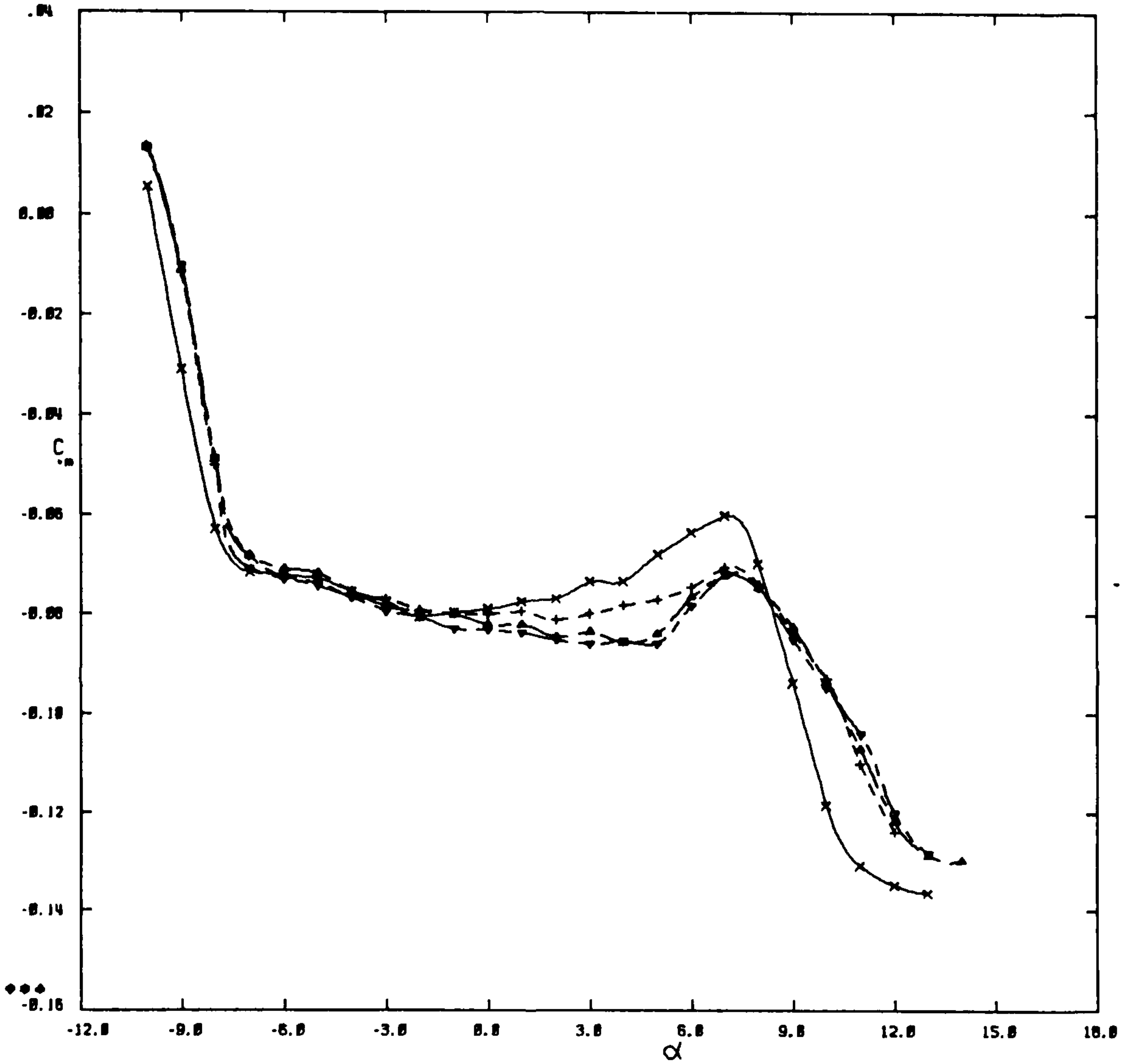
	SYMBOL	M
CLEAN AIRFOIL	×	.20
NO SLOT	+	.20
1.3 PC CHORD SL	▲	.20
2.5 PC CHORD SL	▼	.20

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



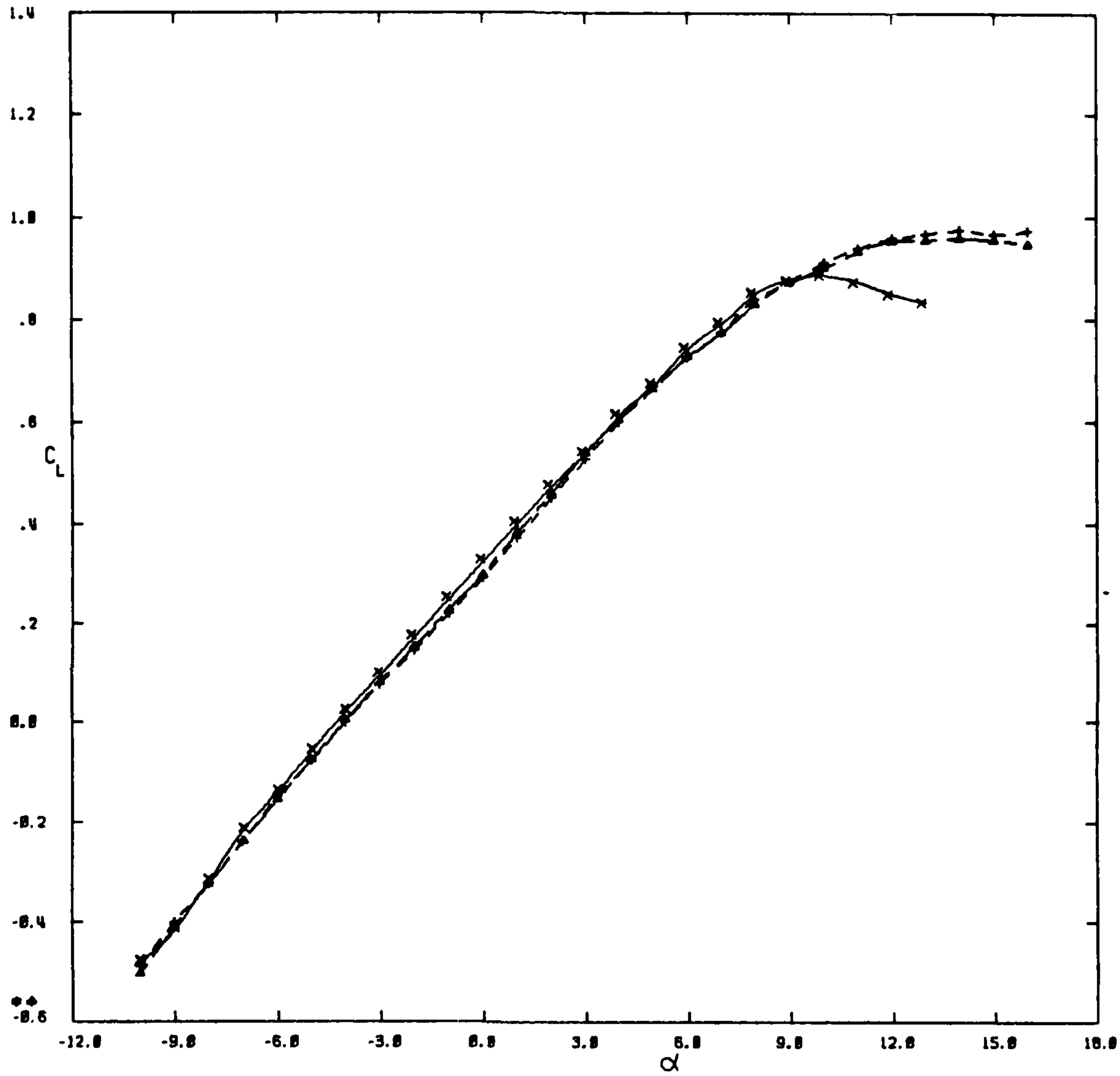
SYMBOL		M
CLEAN AIRFOIL	×	.20
NO SLOT	+	.20
1.3 PC CHORD SL	▲	.20
2.5 PC CHORD SL	▼	.20

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



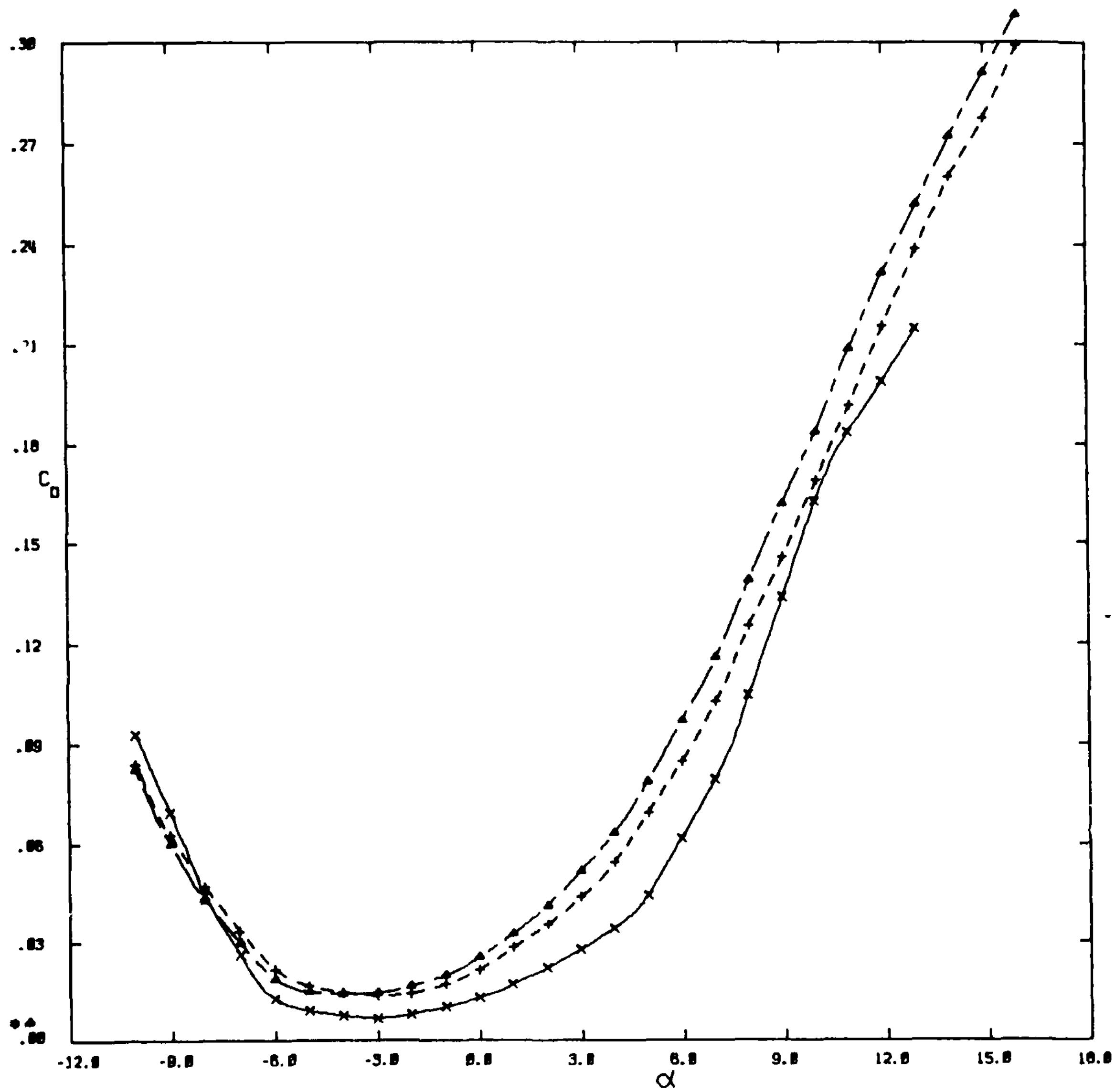
SYMBOL		M
CLEAN AIRFOIL	×	.20
NO SLOT	+	.20
1.3 PC CHORD SL	△	.20
2.5 PC CHORD SL	▽	.20

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



	SYMBOL	M
CLEAN AIRFOIL	×	.20
DEFL. 10 DEG	+	.20
DEFL. 20 DEG	▲	.20

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



	SYMBOL	M
CLEAN AIRFOIL	×	.20
DEFL. 10 DEG	+	.20
DEFL. 20 DEG	▲	.20

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

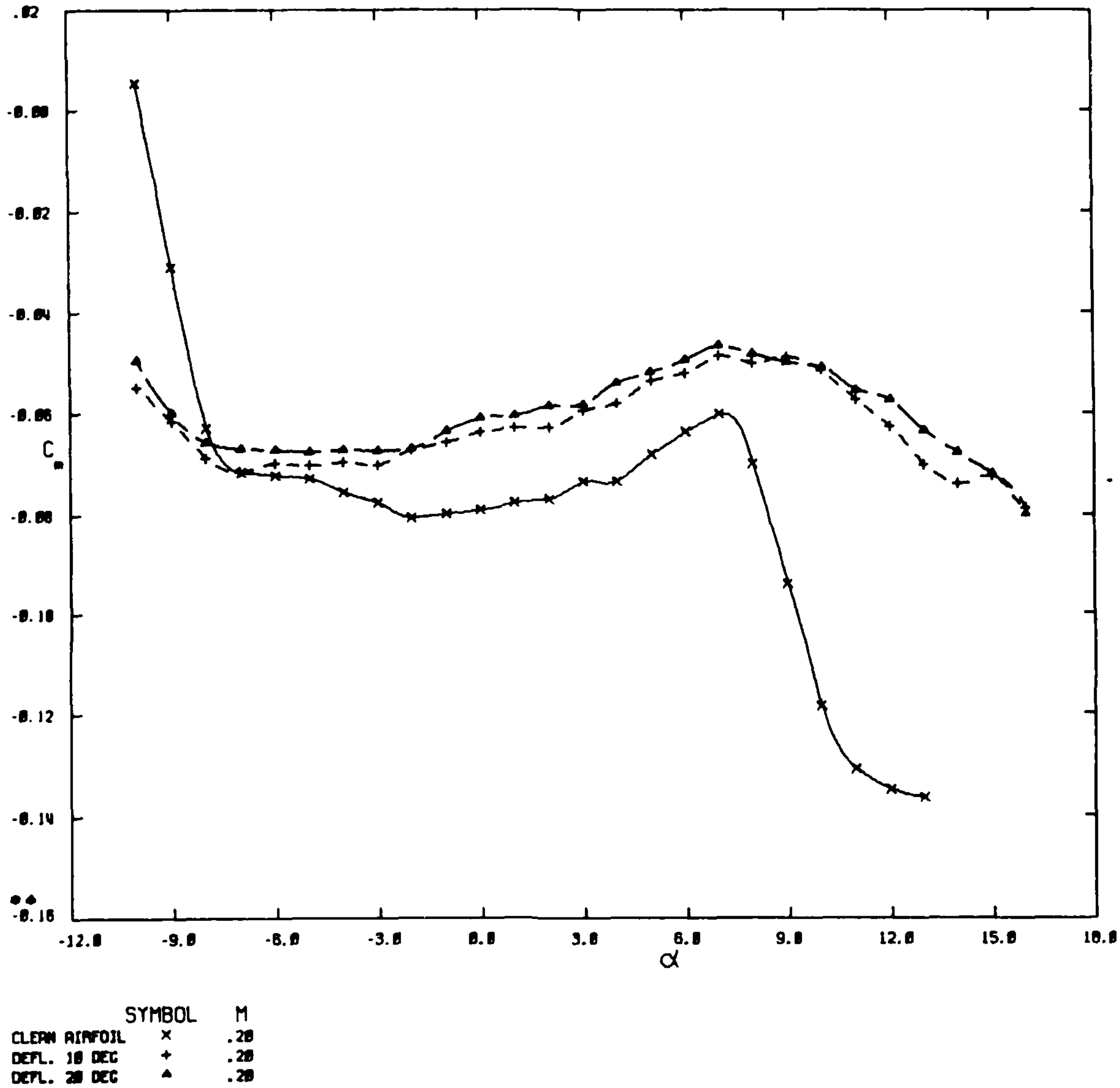


FIG. 4 (c) 30MM LEADING EDGE WEDGES - NO SLOT
EFFECT ON PITCHING MOMENT - VARIOUS DEFLECTIONS
REC=570000, M=0.2,

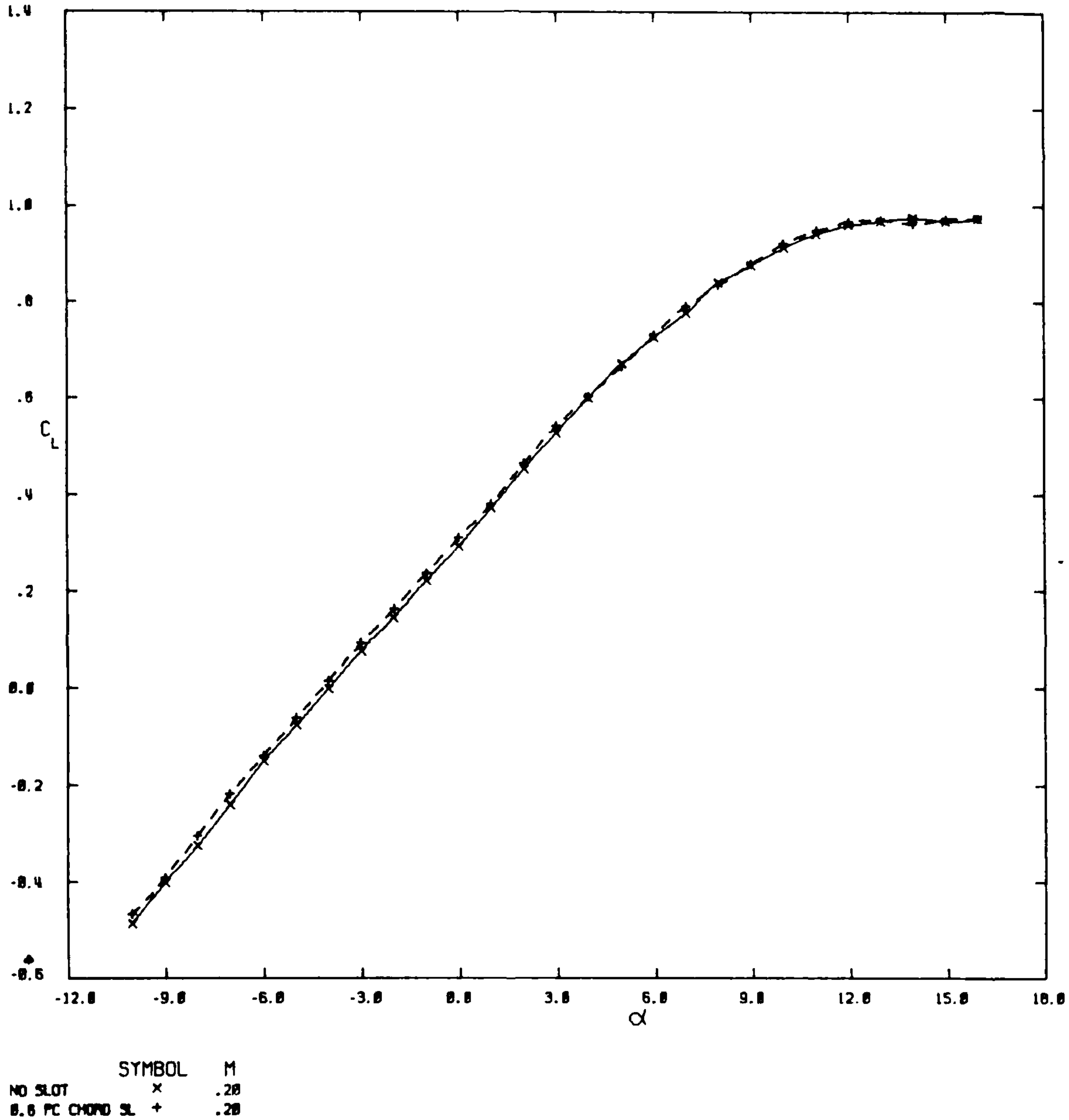
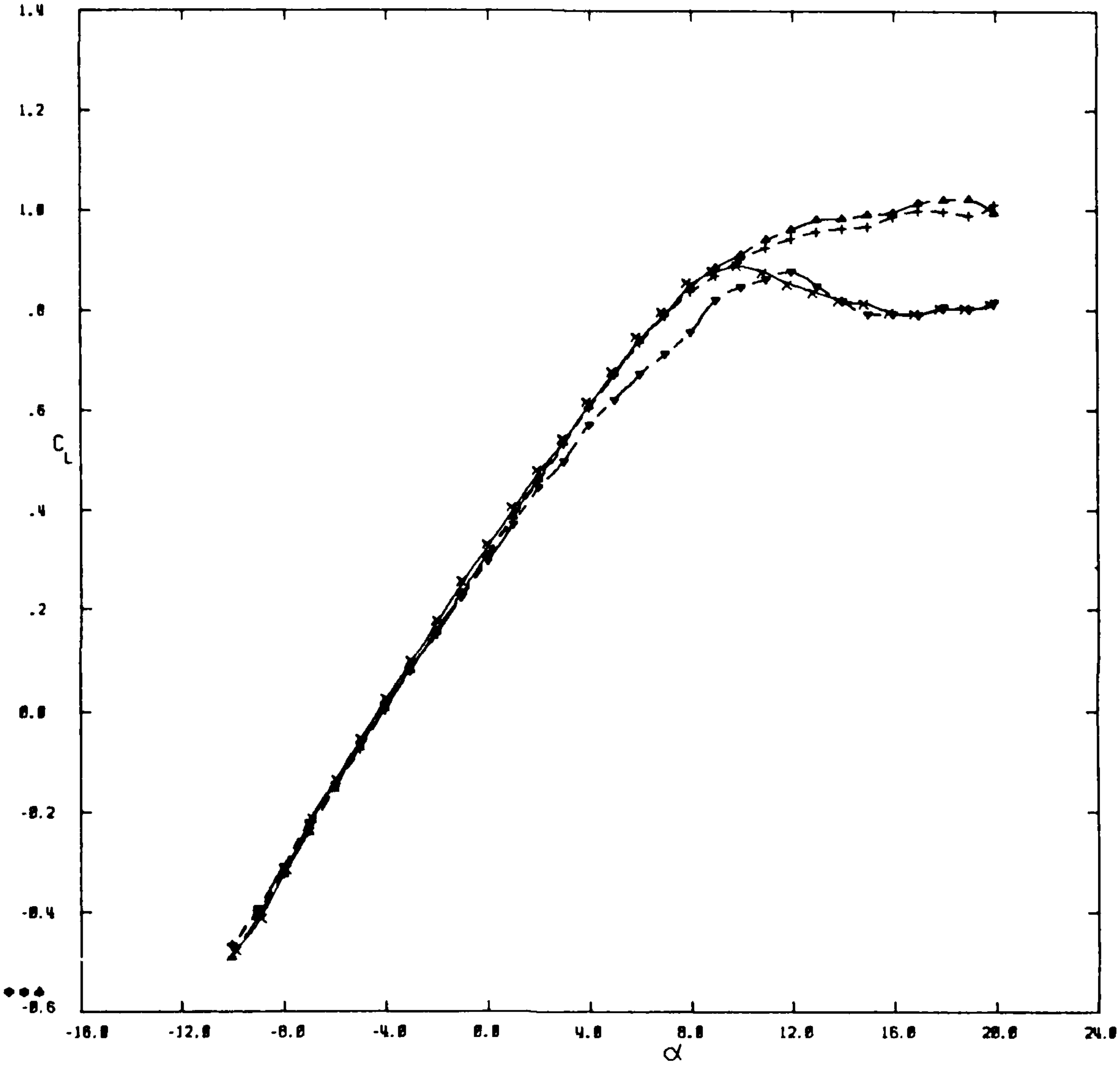
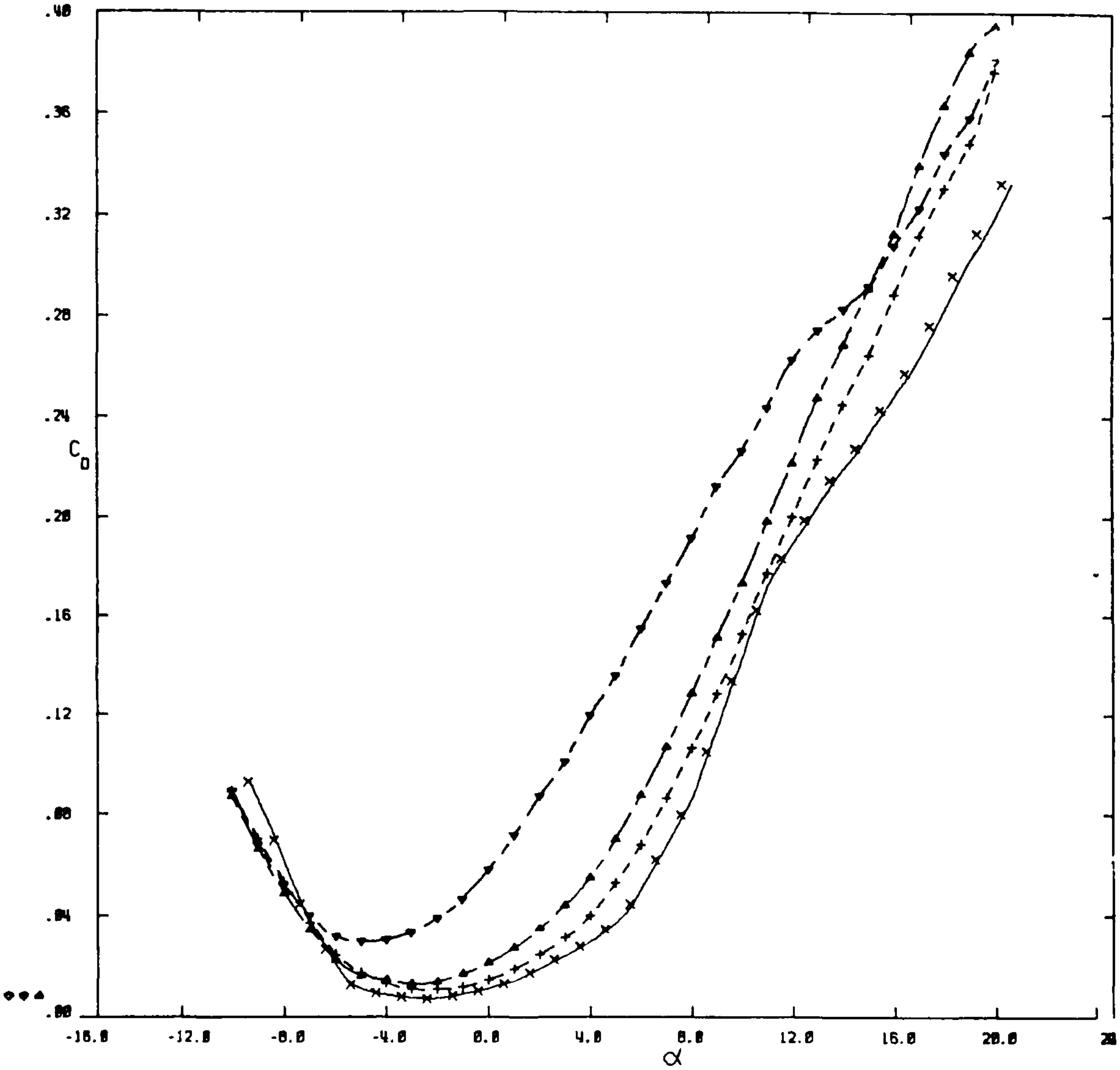


FIG.5 30MM LEADING EDGE WEDGES DEFLECTED 10 DEGREES
EFFECT ON LIFT OF A SLOT
REC=570000, M=0.2,



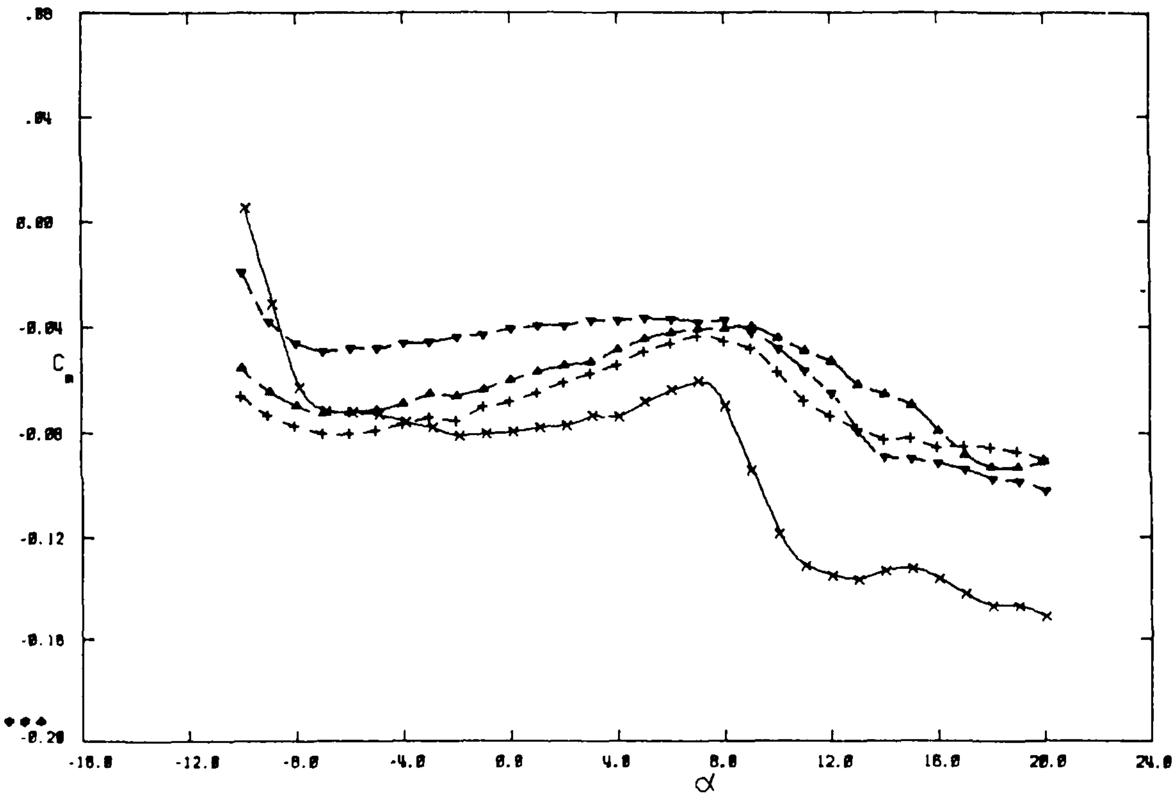
	SYMBOL	M
CLEAN AIRFOIL	×	.20
DEFL. 0 DEG	+	.20
DEFL. 10 DEG	△	.20
DEFL. 30 DEG	▽	.20

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



	SYMBOL	M
CLEAN AIRFOIL	×	.20
DEFL. 0 DEG	+	.20
DEFL. 10 DEG	▲	.20
DEFL. 30 DEG	▼	.20

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



	SYMBOL	M
CLEAN AIRFOIL	×	.20
DEFL. 0 DEG	+	.20
DEFL. 10 DEG	▲	.20
DEFL. 30 DEG	▼	.20

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

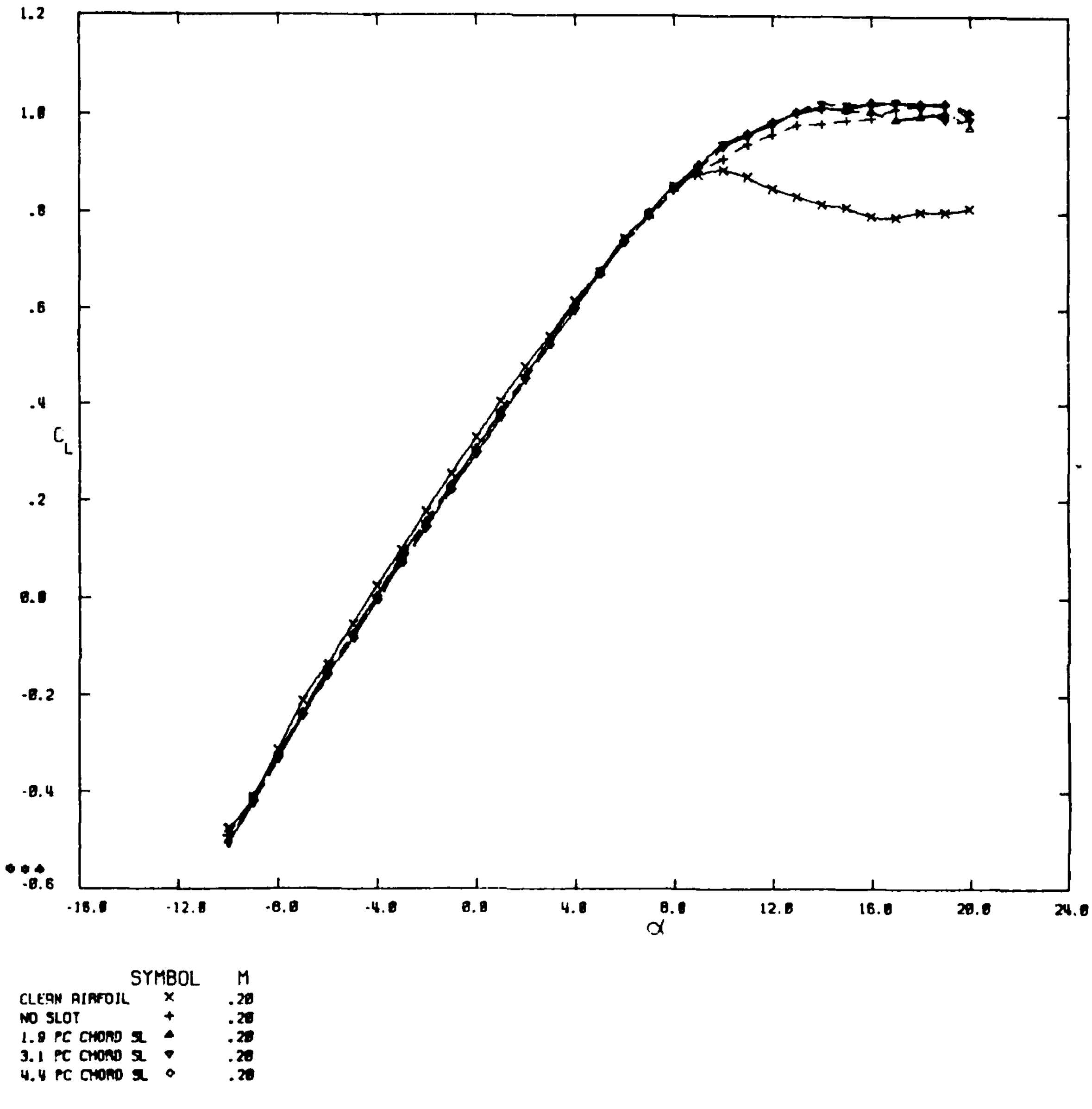


FIG. 7 (a) 50MM LEADING EDGE WEDGES - DEFLECTION 10 DEGREES
EFFECT ON LIFT - VARIOUS SLOT SIZES
REC=570000, M=0.2,

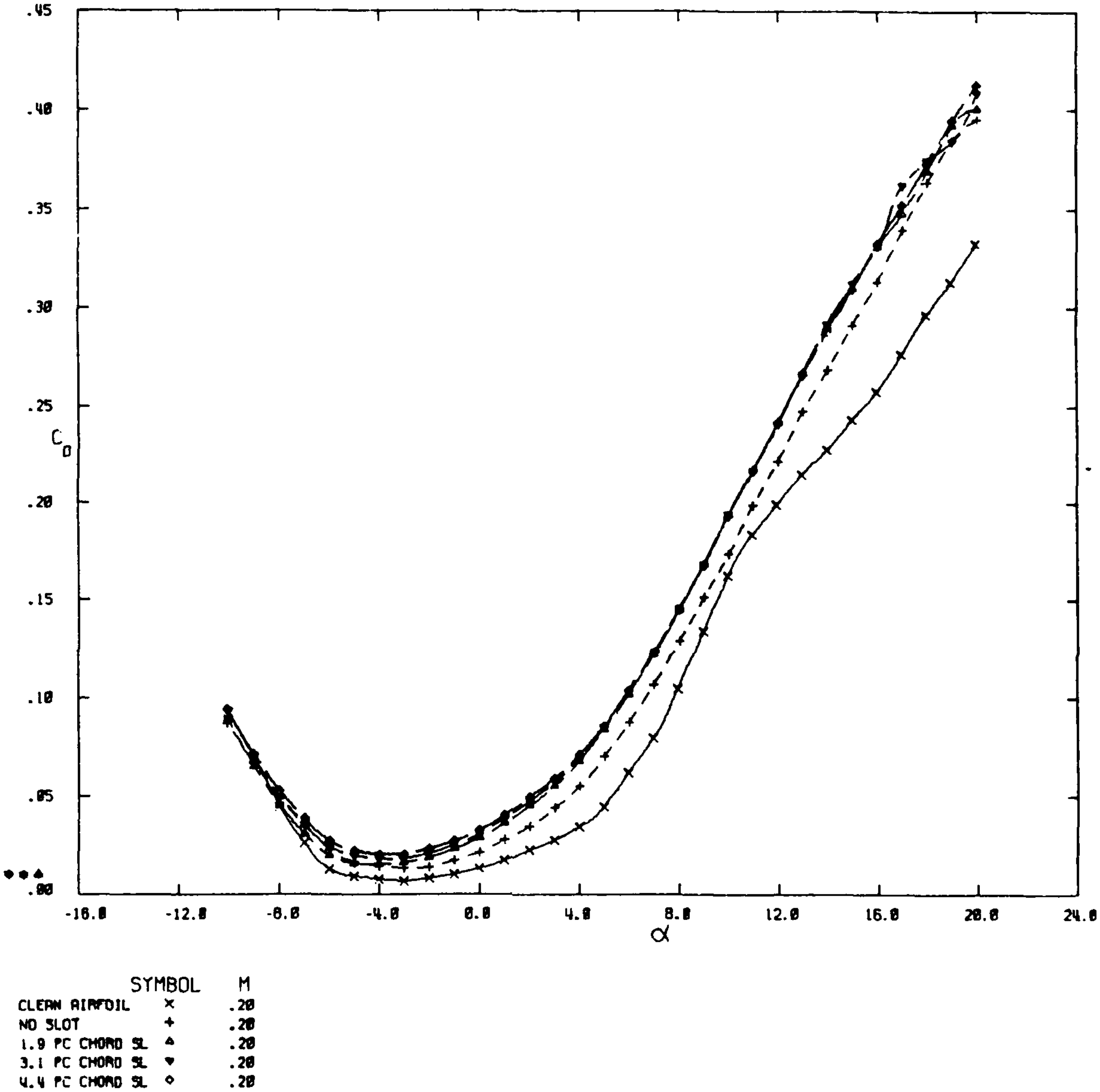


FIG.7 (b) 50MM LEADING EDGE WEDGES - DEFLECTION 10 DEGREES
EFFECT ON DRAG - VARIOUS SLOT SIZES
ERC=570000, M=0.2,

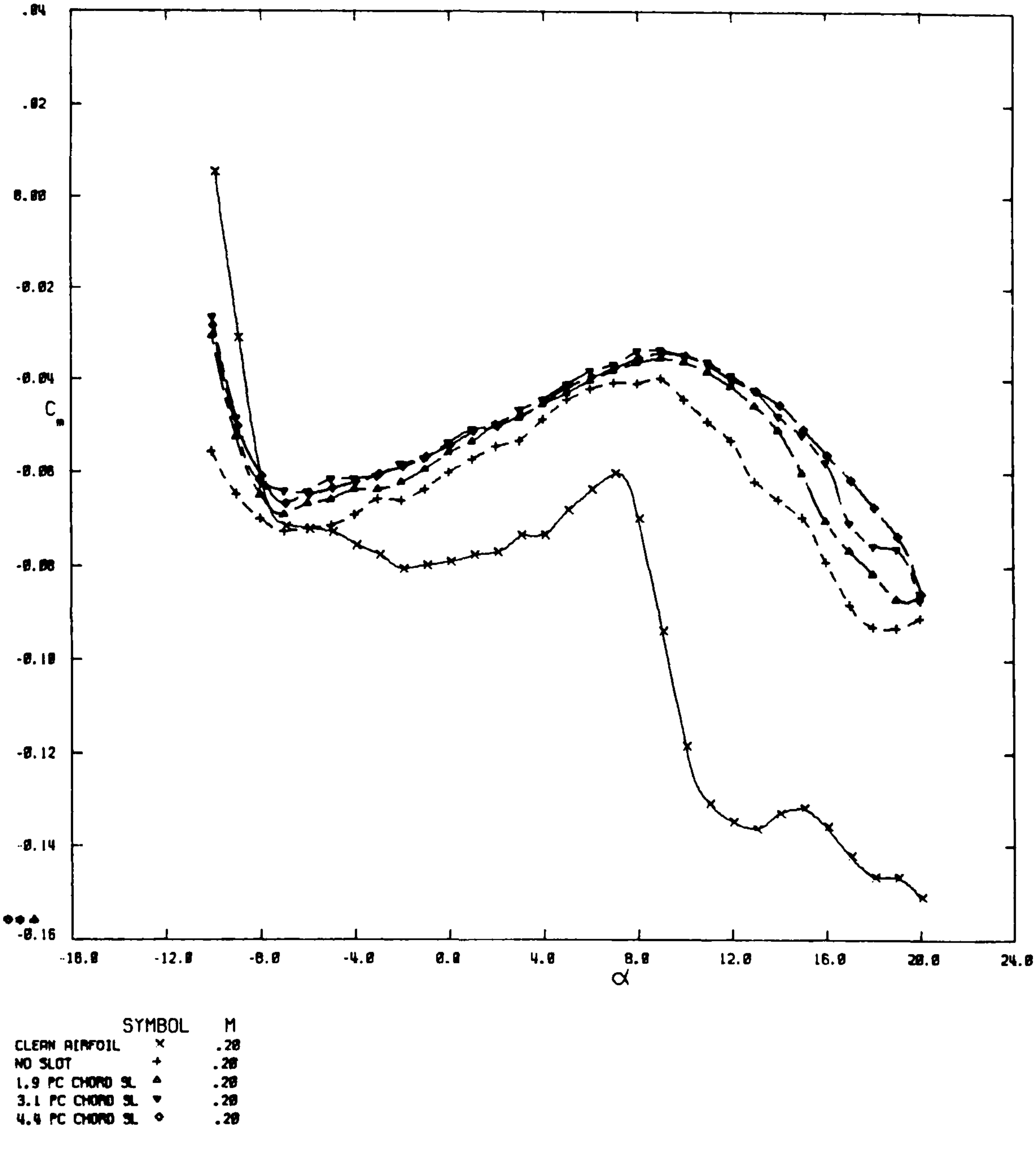
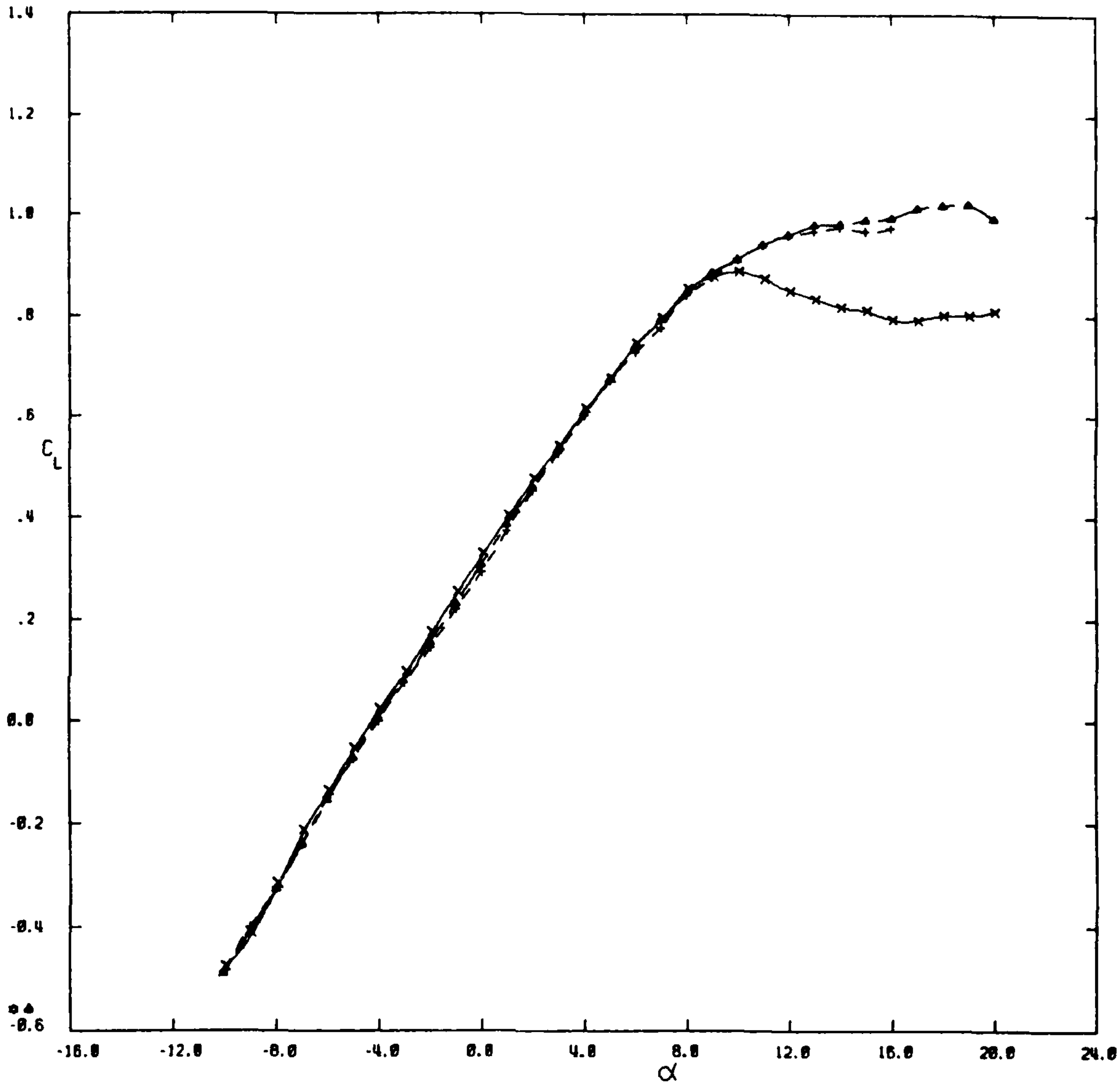


FIG.7(c) 50MM LEADING EDGE WEDGES - DEFLECTION 10 DEGREES
EFFECT ON PITCHING MOMENT - VARIOUS SLOT SIZES
REC=570000, M=0.2,



	SYMBOL	M
CLEAN AIRFOIL	×	.20
30MM WEDGES	+	.20
50MM WEDGES	▲	.20

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

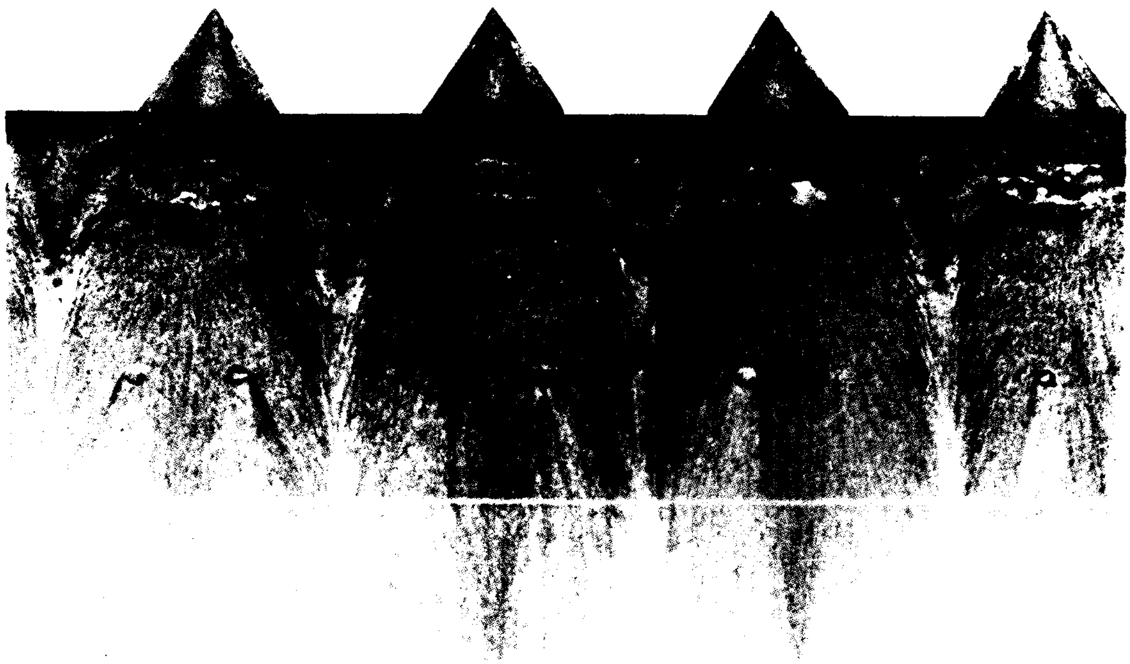


FIG. 9 OIL FLOW PATTERN-MODEL UPPER SURFACE 30mm LEADING EDGE WEDGES WITH $\delta_W = 10°$; $\varepsilon_S = 0$

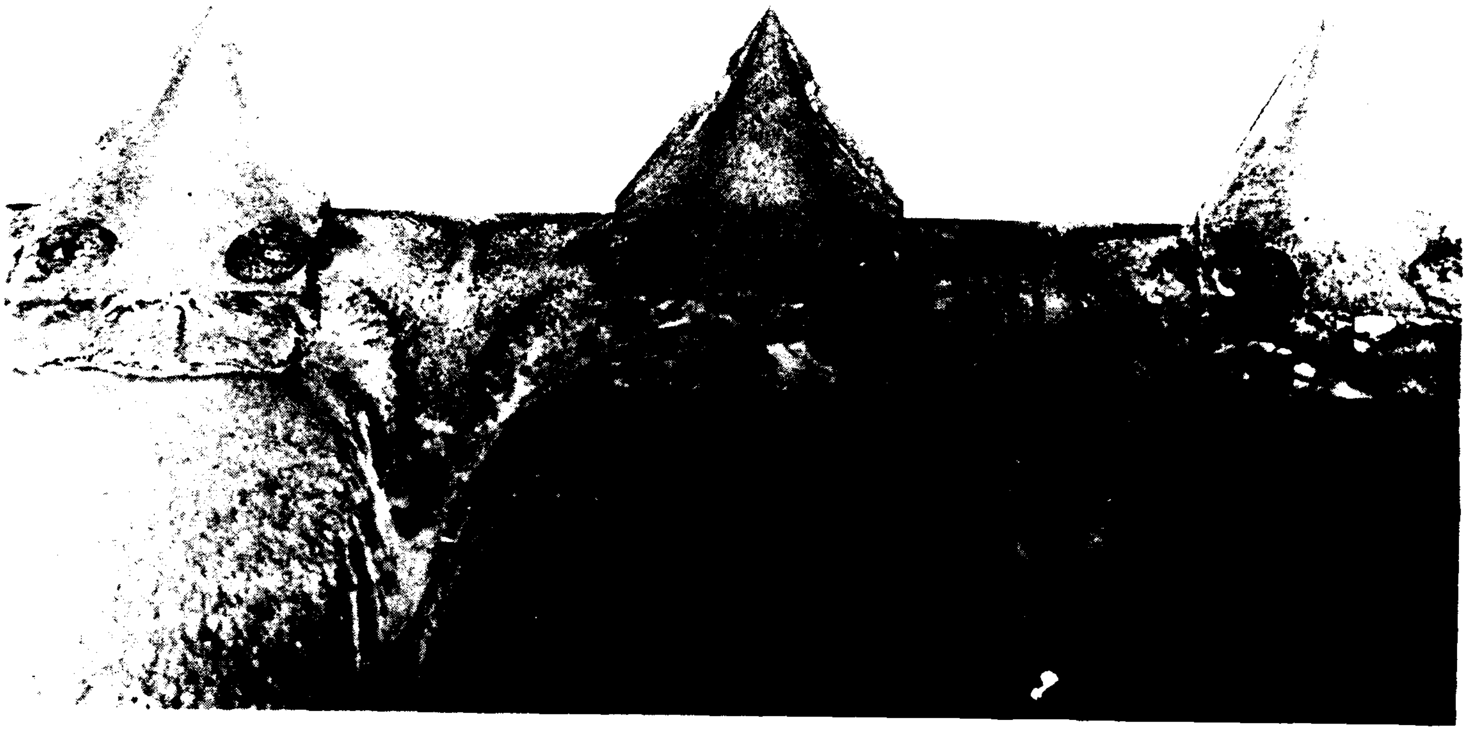


FIG. 9 (Continued) LEADING EDGE CLOSE UP

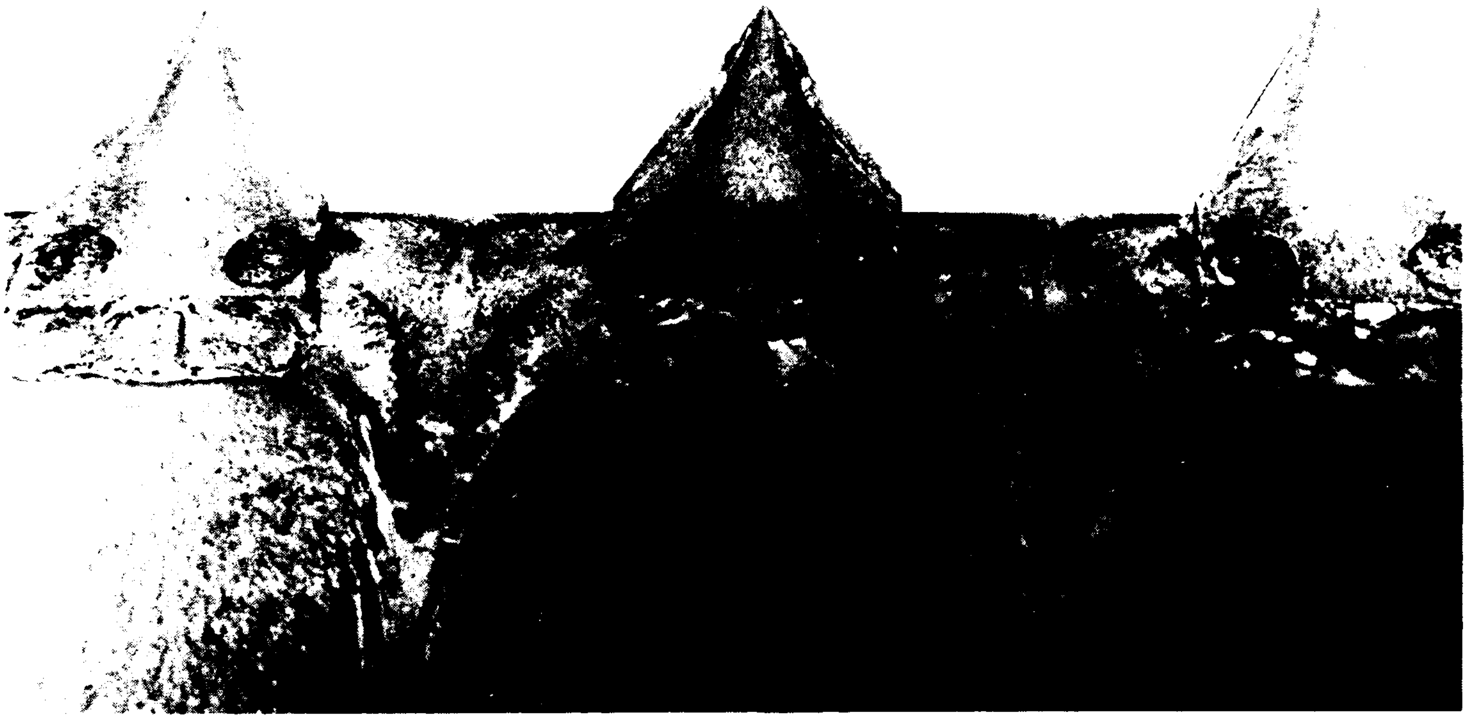


FIG. 9 (Continued) LEADING EDGE CLOSE UP

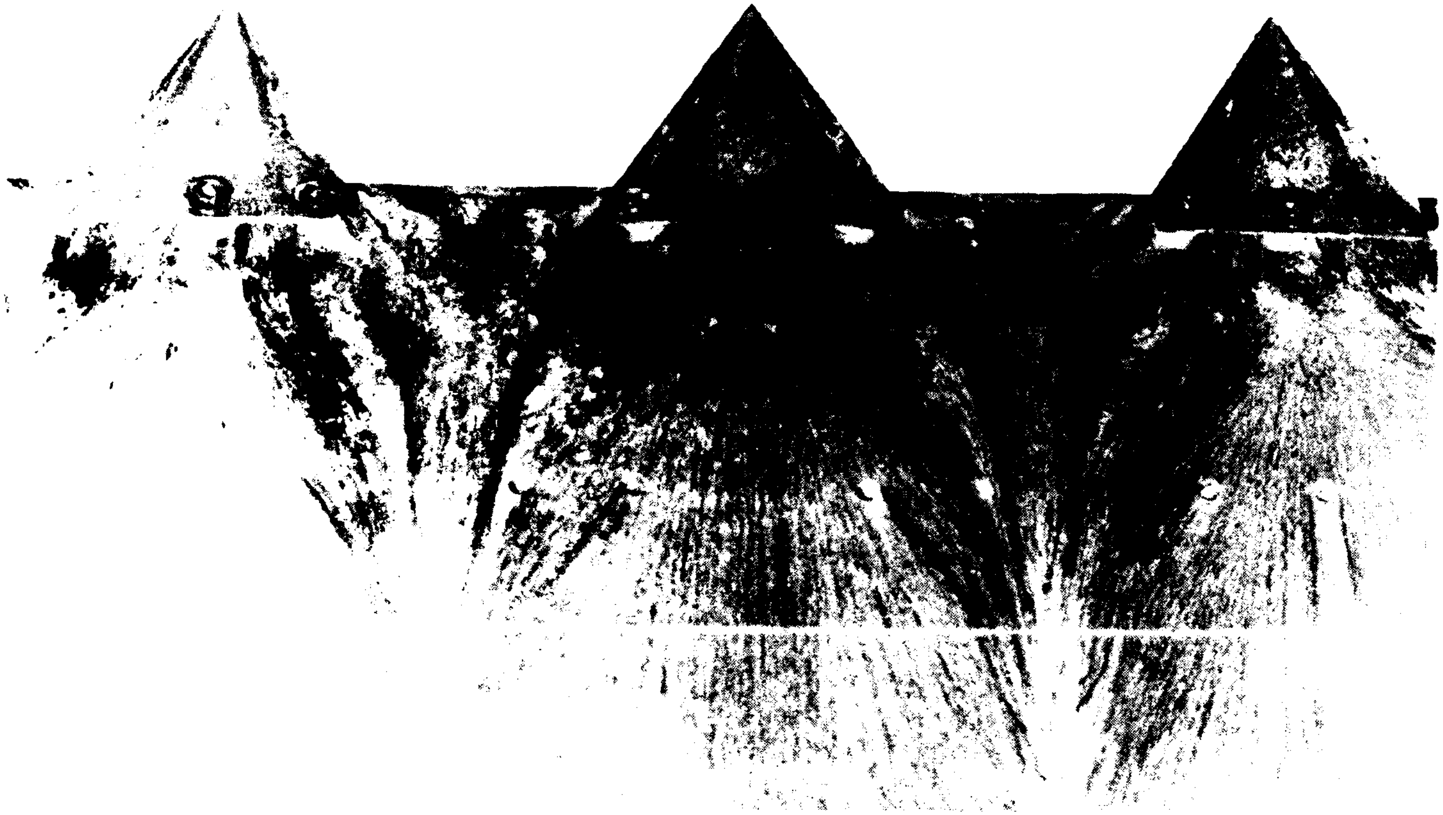


FIG. 10 OIL FLOW PATTERN-MODEL UPPER SURFACE 50m LEADING EDGE WEDGES WITH $\delta_w = 10°$; $\varepsilon_{s/c} = 0.031$

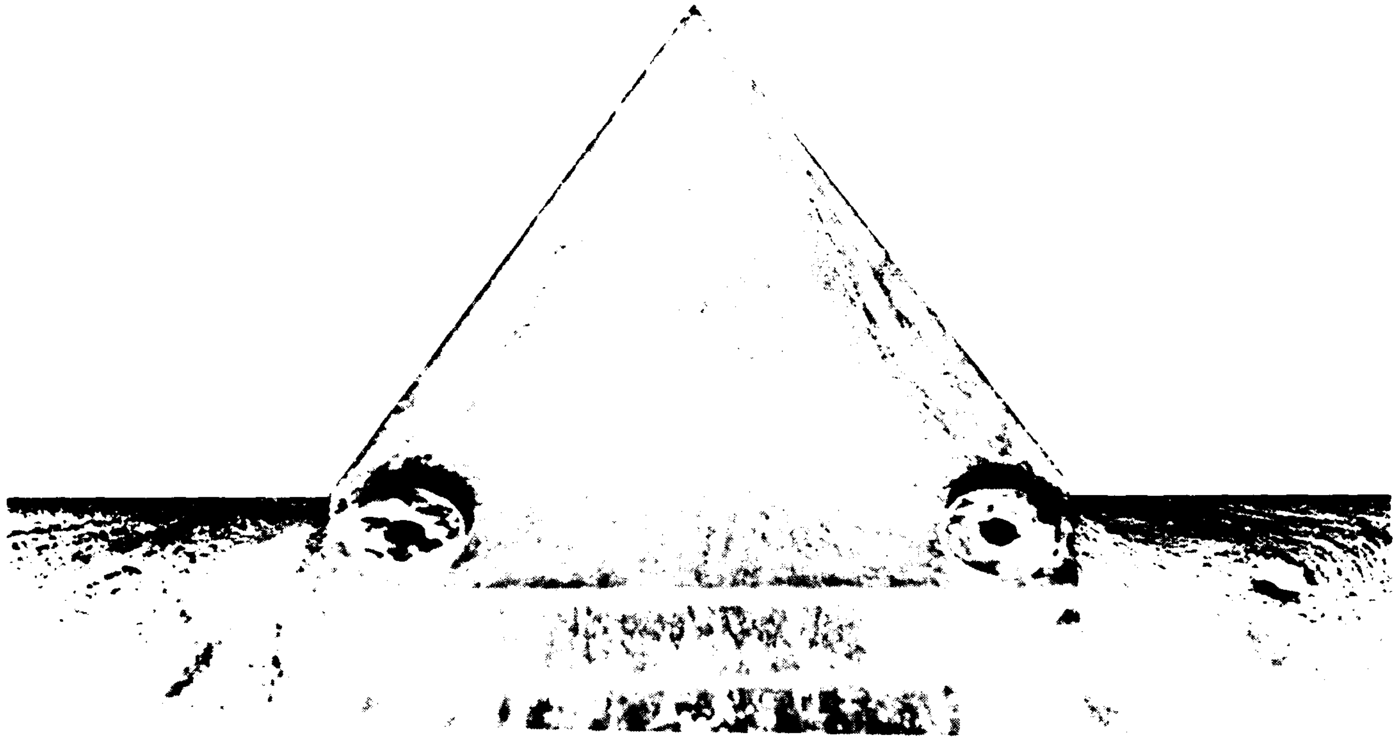


FIG. 10 (Continued) CLOSE-UP VIEW OF CENTRAL WEDGE

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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.

17 Imprint

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