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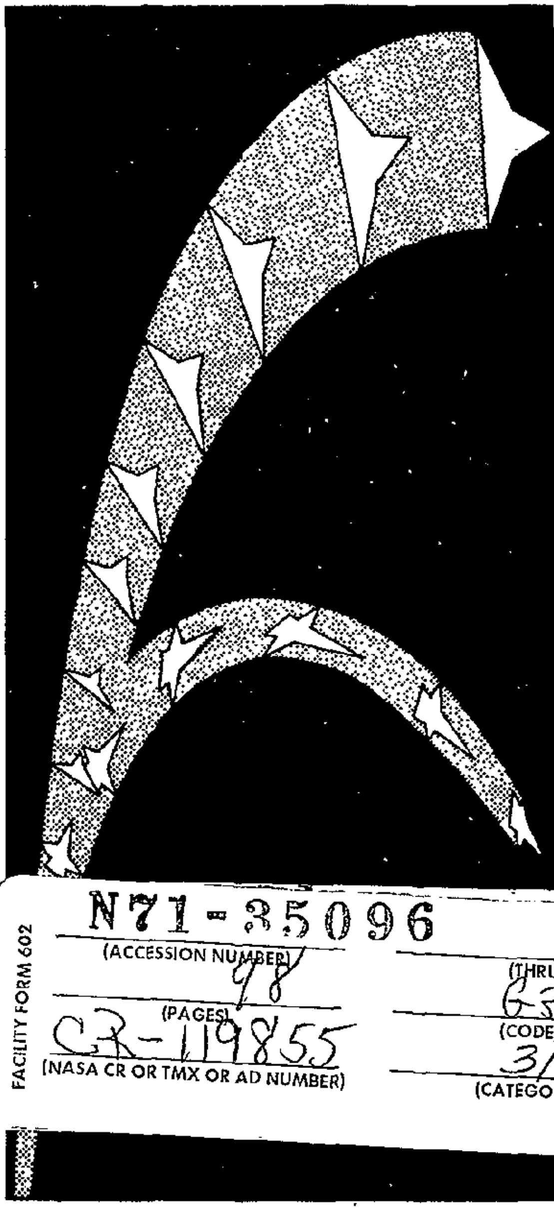

SPACE SHUTTLE

AERODYNAMIC CHARACTERISTICS OF THE NASA-MSC S-4 ORBITER IN CRUISE AND LANDING

by
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TEXAS A&M
LOW SPEED
WIND TUNNEL TEST RESULTS
DATA REPORT

SADSAC SPACE SHUTTLE
AERОTHERMODYNAMIC
DATA MANAGEMENT SYSTEM

CONTRACT NAS8-4016
SCHEDULE II
DRL 184-58
AMENDMENT 130
MARSHALL
SPACE FLIGHT CENTER

SPACE DIVISION CHRYSLER CORPORATION

DMS-DR-1060
March, 1971

SADSAC/SPACE SHUTTLE

WIND TUNNEL TEST DATA REPORT

NASA - MSC TEST SERIES SVIII - PHASE 1

CONFIGURATION: NASA - MSC AUGUST 1969 BASELINE ORBITER MODEL S-4

TEST PURPOSE: DIFINE THE CRUISE AND LANDING AERODYNAMIC CHARACTERISTICS OF THE NASA - MSC AUGUST 1969 BASELINE ORBITER CONFIGURATION

TEST FACILITY: TEXAS A AND M UNIVERSITY LOW SPEED WIND TUNNEL

TESTING AGENCY: NASA - MSC

TEST NO. & DATE: NASA - MSC TEST S-VIII--PHASE 1 - JUNE, 1970

MODEL SCALE: 0.05

MACH NUMBER: 0.25

TEST CONDUCTOR(S): NASA - MSC --- EDMOND B. CHAMBLISS AND ROBERT H. MOORE
TEXAS A & M --- DAVID MILLIKAN

FACILITY COORDINATOR: RAY NELSON

DATA MANAGEMENT SERVICES

LIAISON: G. G. McDonald

DATA OPERATIONS: W. R. Morgan

RELEASE APPROVAL: N. D. Kemp, Supervisor
Aero Thermo Data Group

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NASA - MICHOUD ASSEMBLY FACILITY 1971
NEW ORLEANS, LOUISIANA 70129

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Plotted Coefficients Schedule

(a) CN, CA, CLM vs α

(b) CY, CYN vs β

NOTE:

See Appendix A for Comprehensive Plotted Data Display Index

ABSTRACT

A 5.0 percent scale model of the NASA/MSC August 1969 Baseline Orbiter (Model S-4) was tested in the Texas A & M Low Speed Wind Tunnel during June, 1970, (MSC Test Series VIII, Phase 1), to define the cruise and landing aerodynamic characteristics. These tests were conducted at a Mach number of 0.25, Reynolds number of 1.7×10^6 per foot, and dynamic pressure of 70 psf. Variables applicable to this test were component buildup, horizontal tail incidence angle, elevator deflection, rudder deflection, flap configuration and deflection, spoiler configuration, and landing gear deployment.

Notes:

1. Positive directions of force coefficients moment coefficients, and angles are indicated by arrows.

2. For clarity, origins of wind and stability axes have been displaced from the center of gravity.

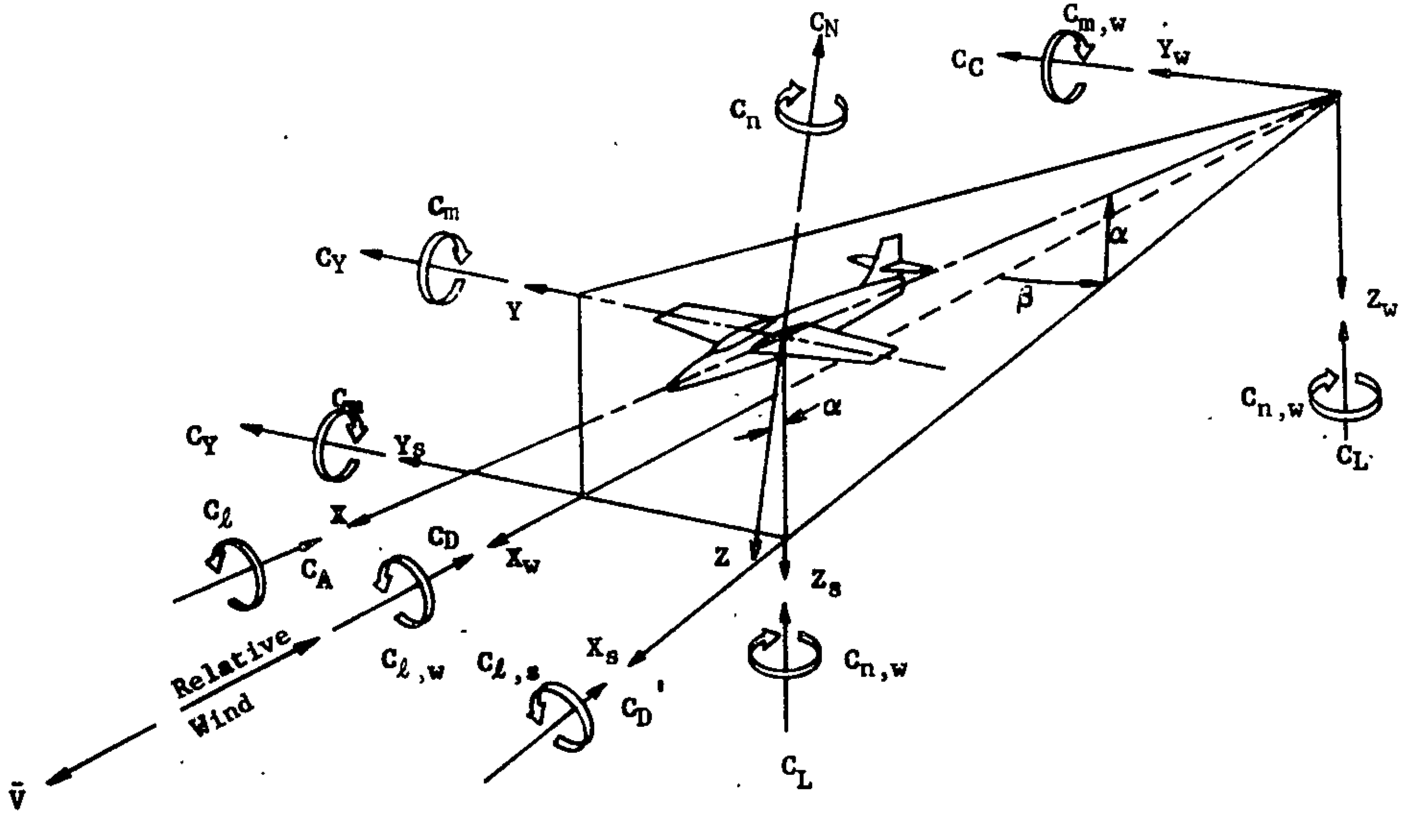


Figure 1. Axis systems, showing direction and sense of force and moment coefficients, angle of attack, and sideslip angle

TABLE I

COEFFICIENT	COEFFICIENT NAME	SADSAC NOMENCLATURE		
		BODY AXIS	STABILITY AXIS	WIND AXIS
C_A	Total Axial Force	CA	-	-
C_{AB}	Base Axial Force	CAB	-	-
C_{AF}	Forebody Axial Force	CAF	-	-
C_D	Total Drag Force	-	CD	CDTOTL
C_{DB}	Base Drag Force	-	CDB	CDBASE
C_{DF}	Forebody Drag Force	-	CDF	CDFORE
C_L	Lift Force	-	CL	CL
C_N	Normal Force	CN	-	-
C_Y	Side Force	CY	CY	CC
C_ℓ	Rolling Moment	CBL	CSL	CWL
C_m	Pitching Moment	CLM	CLM	CPM
C_n	Yawing Moment	CYN	CLN	CLN
L/D	Lift-To-Drag Force Ratio	-	L/D	CL/CD
L/D	Lift-To-Forebody Drag Force Ratio	-	L/DF	CL/CDF
N/A	Normal-To-Axial Force Ratio	N/A	-	-
N/A	Normal-To-Forebody Axial Force Ratio	CN/CAF	-	-

SUMMARY OF SADSAC NOMENCLATURE - AERODYNAMIC FORCE AND MOMENT COEFFICENTS

TEST FACILITY DESCRIPTION

The Texas A&M University Low Speed Wind Tunnel is a continuous closed circuit horizontal single return facility. The overall circuit length is 397.5 feet; the tunnel is constructed of steel supported above the ground on concrete pillars. The rectangular 7 foot by 10 foot test section is 16 feet long, and it is operated at atmospheric pressure through a speed range from zero to 300 feet per second. The tunnel is powered by a 1250 KVA synchronous electric motor which drives a $12\frac{1}{2}$-foot diameter Curtiss Electric propeller; the controls for the motor and its auxiliaries are located in the control room. Cooling of the tunnel circuit during warm weather is accomplished by spraying the outside of the tunnel shell with water; this keeps the tunnel circuit temperature within $10^{\circ}F$ of ambient temperatures to protect models and to maintain tolerable test section working conditions for model configuration changes. The 7 x 10 test section incorporates an external pyramid balance system which separates and independently measures the aerodynamic components; a variety of support systems for this balance are available. Internal balances are also available for use in this tunnel. For a more detailed description of this tunnel refer to the Low Speed Wind Tunnel Facility Handbook published by the Space Technology Division, Texas A&M University, College Station, Texas.

TABLE II

TEST CONDITIONS

NASA - MSC TEST SVIII - PHASE 1

MACH NUMBER	REYNOLDS NUMBER per ~~unit length~~ FOOT	DYNAMIC PRESSURE (pounds/sq. ~~inch~~ FOOT)	STAGNATION TEMPERATURE (degrees Fahrenheit)
0.25	1.700 X 10^6	70.0	95.0

BALANCE UTILIZED: Dynametrics Inc. - External Pyramid Balance

	CAPACITY:	RESOLUTION:	COEFFICIENT TOLERANCE:
LF	-1000 to 3000 lb	± 0.1 lb	± 0.008
SF	-1000 to 1000 lb	± 0.1 lb	± 0.002
DF	-1000 to 1000 lb	± 0.1 lb	± 0.0021
PM	-2000 to 2000 ft-lb	± 0.1 ft-lb	± 0.041
YM	-1000 to 1000 ft-lb	± 0.1 ft-lb	± 0.002
RM	-2000 to 2000 ft-lb	± 0.1 ft-lb	± 0.016

COMMENTS:

DATA REDUCTION

An external pyramid balance was utilized to measure data for this test and the measured data were reduced relative to the body axis system. Listed below are the dimensional data used to reduce the measured data to coefficient form:

S_{ref} = Wing W2 planform area = 2.3 ft^2

ℓ_{ref} = Wing W2 mean aerodynamic chord = 0.6121 ft

b_{ref} = Wing W2 span = 3.9946 ft

The moment reference point (MRP) applicable to the reduced moment coefficients in 41.396 inches aft of the fuselage nose, on the fuselage lateral centerline, and 6.396 inches above the bottom of the fuselage. Corrections applicable to tunnel blockage and flow alignment were utilized in the data reduction.

No roll data was plotted due to its questionable values. These data may be found in the tabulated listing.

Base pressures were measured, but are not presented for this report. See Figure 12 for pressure orifices location. A base pressure coefficient is available in the tabulated data.

CONFIGURATIONS INVESTIGATED

NOMENCLATURE

B1 = Orbiter fuselage

W2 = Orbiter wing

H6 = Horizontal tail

V3 = Vertical stabilizer

L = Landing gear

S = Spoilers

Refer to Figures 3 through 11 for detailed information on the above components.

COMBINATIONS TESTED

B1	B1W2H6V3
B1W2	B1W2H6V3L
B1V3H6	B1W2H6V3S
B1W2H6	B1W2H6V3SL
B1W2V3	

The above configurations were tested at an angle of attack range of -13° to 11° at fixed sideslip angles of -5°, -1°, 0°, 1°, and 5°, an angle of attack range of -14° to 25° at zero sideslip, and an angle of sideslip range of ∓ 15 at zero pitch angle. Two flap configurations (see Figure 10) and six spoiler configurations at two locations were tested (see Figures 8 and 9); these spoilers were installed normal to the wing surface. Control deflections applicable are listed below:

CONFIGURATIONS INVESTIGATED (Continued)

1. Elevator deflections of -30°, -25°, -20°, -15°, -10°, -5°, -2.5°, 0°, 2.5°, 5°, 7.5°, 10°, 15°, 20°, 25°, and 30°

2. Rudder feflections of 0°, 5°, 10°, and 20°

3. Flap deflections of 0°, 15°, 25°, and 45°

4. Horizontal tail incidence angles of 0°, -2°, -4°, and -6°

NASA - MSC TEST SVIII - PHASE 1 DATA SET COLLATION SHEET

☐ PRETEST

☒ POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD. α	SCHD. β	CONTROL DEFLECTION i_H	δe	δr	δf	NO. of RUNS	MACH NUMBERS 0.25											
RG6001	$B_1W_2H_6V_3$	AP	0	0	0	0	0		50											
002		AN	0						52											
003		AP	-1						53											
004		AN	-1						54											
005		AP	-5						55											
006		AN	-5						56											
007		AP	1						57											
008		AN	1						58											
009		AP	5						59											
010		AN	5						60											
011		A1	0						62											
012		0	B1			↓			63											
013		A1	0			5			64											
014		0	B1			↓			65											
015		A1	0			10			67											
016		0	B1			↓			68											
017		A1	0			15			69											
018		0	B1			↓			70											
019		A1	0			20			72											
↓ 020	↓	0	B1	↓	↓	↓	↓		73											

1	7	13	19	25	31	37	43	49	55	61	67	75 76
CN	CA	CLM	CY	CYN	CBL	CPBASE						

COEFFICIENTS: → IDPVAR(1) | IDPVAR(2) | NDV

α or β SCHEDULES

α ~ A

β ~ B

AP — 0, 2.5, 4.5, 5.5, 6.0, 6.5, 7, 7.5, 8, 8.5, 9, 11

AN — -13, -12.5, -12, -11.5, -11, -10.5, -10, -9.5, -9, -8.5, -8, -7.5, -6.5, -4.5, -2.5, -1, 0

A1 — -14, -10, -8, -6, -4, -2, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 20, 25

B1 — -15, -10, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 10, 15

NASA - MSC TEST SVIII - PHASE 1 DATA SET COLLATION SHEET

☐ PRETEST

☒ POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD. α	SCHD. β	CONTROL DEFLECTION i_H	δ_e	δ_r	δ_f	NO. of RUNS	MACH NUMBERS 0.25
RG60 21	$B_1W_2H_6V_3$	A1	0	0	0	0	15		74
22		0	B1						75
23	$B_1W_2H_6V_3L$	A1	0						77
24		0	B1						78
25		A1	0				15.6		80
26		0	B1						81
27	$B_1W_2H_6V_3$	A1	0						83
28		0	B1						84
29		A1	0				25		86
30		0	B1						87
31	$B_1W_2H_6V_3L$	A1	0						89
32		0	B1						90
33		A1	0				25.6		92
34		0	B1						93
35	$B_1W_2H_6V_3$	A1	0						95
36		0	B1						96
37	$B_1W_2H_6V_3L$	A1	0				45.6		98
38		0	B1						99
39		A1	0				45		101
40		0	B1						102

1 7 13 19 25 31 37 43 49 55 61 67 75 76

CN CA CLM CY CYN CBL [illegible]

NASA - MSC TEST SVIII - PHASE 1 DATA SET COLLATION SHEET

☐ PRETEST

☒ POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD. α	SCHD. β	CONTROL DEFLECTION Λ_y	δ_e	δ_r	δ_c	NO. of RUNS	MACH NUMBERS 0.25											
RG6041	$B_1W_2H_6V_3$	A1	0	0	-7.5	0	0		104											
42		0	B1		-2.5				105											
43		A1	0		2.5				106											
44		0	B1		2.5				107											
45		A1	0		-5				108											
46		0	B1		-5				109											
47		A1	0		5				110											
48		0	B1		5				111											
49		A1	0		-7.5				112											
50		0	B1		-7.5				113											
51		A1	0		7.5				114											
52		0	B1		7.5				115											
53		A1	0		-10				116											
54		0	B1		-10				117											
55		A1	0		10				118											
56		0	B1		10				119											
57		A1	0		-15				120											
58		0	B1		-15				121											
59		A1	0		15				122											
60		0	B1		15				126											

1 7 13 19 25 31 37 43 49 55 61 67 73

CN | CA | CLM | CY | CYN | CBL | CPB...

NASA - MSC TEST SVIII - PHASE I DATA SET COLLATION SHEET

☐ PRETEST
☒ POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD. α	SCHD. β	CONTROL DEFLECTION ι_H	δ_e	δ_r	δ_c	NO. of PTS.	MACH NUMBERS 0.25											
R66061	$B_1W_2H_6V_3$	A1	0	0	-20	0	0		127											
62		0	B1		-20				128											
63		A1	0		20				129											
64		0	B1		20				130											
65		A1	0		-25				131											
66		0	B1		-25				132											
67		A1	0		25				133											
68		0	B1		25				134											
69		A1	0		-30				135											
70		0	B1		-30				136											
71		A1	0		20				137											
72		0	B1		30				138											
73		A1	0	-2	0				139											
74		0	B1	-2					140											
75		A1	0	-4					141											
76		0	B1	-4					142											
22		A1	0	-6					143											
78		0	B1	-6					144											
79	$B_1W_2V_3$	A1	0	—	—				145											
80		0	B1	—	—				146											

1 7 13 19 25 31 37 43 49 55 61 67 73 76

CN	CA	CLM	CY	CYN	CBL	CPBASE

NASA - MSC TEST SVIII - PHASE 1 DATA SET COLLATION SHEET

☐ PRETEST

☒ POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD. α	SCHD. β	CONTROL DEFLECTION i_H	δ_a	δ_r	δ_e	NO. of RUN	MACH NUMBERS .25
RG6081	$B_1 W_2 H_6$	A1	0	0	0	—	0		147
082	↓	0	B1	↓	↓	—			148
083	$B_1 W_2$	A1	0	—	—	—			149
084	↓	0	B1	—	—	—	↓		150
085	B_1	A1	0	—	—	—	—		151
086	↓	0	B1	—	—	—	—		152
087	$B_1 V_3 H_6$	A1	0	0	0	0	—		153
088		0	B1	↓			—		154
089		A1	0	-2			—		155
090		0	B1	↓			—		156
091		A1	0	-6			—		157
092	↓	0	B1	↓			—		158
093	$B_1 W_2 H_6 V_3 S_{1.5}$	A1	0	0			0		159
094	↓	0	B1						160
095	$B_1 W_2 H_6 V_3 S_{1.7}$	A1	0						161
096	↓	0	B1						162
097	$B_1 W_2 H_6 V_3 S_{2.5}$	A1	0						163
098	↓	0	B1						164
099	$B_1 W_2 H_6 V_3 S_{2.7}$	A1	0						165
100	↓	0	B1	↓	↓	↓	↓		166

CN CA CLM CY CYN CBL CPBASE

NASA - MSC TEST SVIII - PHASE 1 DATA SET COLLATION SHEET

☐ PRETEST
☒ POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD. α	SCHD. β	CONTROL DEFLECTION δ_H	δ_e	δ_r	δ_c	NO. OF RUNS	MACH NUMBERS 0.25
RG6 101	$B_1W_2H_6V_3S_{3.5}$	A1	0	0	0	0	0		167
102	↓	0	B1						168
103	$B_1W_2H_6V_3S_{3.7}$	A1	0						169
104	↓	0	B1						170
105	$B_1W_2H_6V_3S_{4.5}$	A1	0						171
106	↓	0	B1						182
107	$B_1W_2H_6V_3S_{4.7}$	A1	0						180
108	↓	0	B1						181
109	$B_1W_2H_6V_3S_{5.5}$	A1	0						173
110	↓	0	B1						174
111	$B_1W_2H_6V_3S_{6.5}$	A1	0						176
112	↓	0	B1						177
113	$B_1W_2H_6V_3S_{6.7}$	A1	0						178
114	↓	0	B1				↓		179
115	$B_1W_2H_6V_3S_{5.5}$	A1	0				45.6		183
116	↓	0	B1						184
117	$B_1W_2H_6V_3S_{5.5}L$	A1	0						185
118		0	B1			↓			186
119		A1	0			10			187
120	↓	0	B1	↓	↓	↓	↓		188

1	7	13	19	25	31	37	43	49	55	61	67	73
CN	CA	CLM	CY	CYN	CBL	CBASE						

NASA - MSC TEST SVIII - PHASE 1 DATA SET COLLATION SHEET

☐ PRETEST

☒ POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD. α	SCHD. β	CONTROL DEFLECTION i_H	δ_e	δ_r	δ_f	NO. of RUNS	MACH NUMBERS 0.25
RG6 121	$B_1W_2H_6V_3S_{5.5}L$	A1	0	0	0	20	45.6		189
122		0	B1						190
123		A1	0		-30				191
124		0	B1						192
125		A1	0			10			193
126		0	B1						194
127		A1	0			0			195
128		0	B1						196
129		A1	0		-15				197
130		0	B1						198
131		A1	0		-5				199
132		0	B1						200
133		A1	0			20			201
134		0	B1						202
135		A1	0		5				203
136		0	B1						204
137		A1	0			0			205
138		0	B1						206
139	$B_1W_2H_6V_3L$	A1	0						207
140		0	B1						208

1 7 13 19 25 31 37 43 49 55 61 67 73

CN CA CLM CY CYN CBL CP...

NASA - MSC TEST SVIII - PHASE 1 DATA SET COLLATION SHEET

☐ PRETEST

☒ POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD. α	SCHD. β	CONTROL DEFLECTIONS i_H	δ_e	δ_r	δ_c	NO. of RUNS	MACH NUMBERS 0.25
RG6 141	$B_1W_2H_6V_3L$	A1	0	0	5	20	456		209
142		0	B1						210
143		A1	0		-5				211
144		0	B1						212
145		A1	0			0			213
146		0	B1						214
147		A1	0		-15				215
148		0	B1						216
149		A1	0		-30				217
150		0	B1						218
151		A1	0			10			219
152		0	B1						220
153		A1	0			30			221
154		0	B1						222
155		A1	0				0		223
156		0	B1						224
157		A1	0			10			225
158		0	B1						226
159		A1	0		-5	20			227
160		0	B1						228

1 7 13 19 25 31 37 43 49 55 61 67 73-76

CN CA CLM CY CYN CBL CPB[illegible]

NASA - MSC TEST SVIII - PHASE 1 DATA SET COLLATION SHEET

☐ PRETEST

☒ POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD. α	SCHD. β	CONTROL DEFLECTION i_H	δ_e	δ_r	δ_F	NO. of RUNS	MACH NUMBERS 0.25
RG6161	$B_1 W_2 H_6 V_3 L$	A1	0	0	5	20	0		229
162	↓	0	B1	↓	↓	↓	↓		230
↓ 163	$B_1 W_2 H_6 V_3$	20	B	↓	0	0	↓		231

1 7 13 19 25 31 37 43 49 55 61 67 75 76

CN CA CLM CY CYN CBL CPBASE

COEFFICIENTS: → IDPVAR(1) | IDPVAR(2) | NDV

α or β SCHEDULES

B — -30, -25, -20, -15, -10, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 10, 15, 20, 25

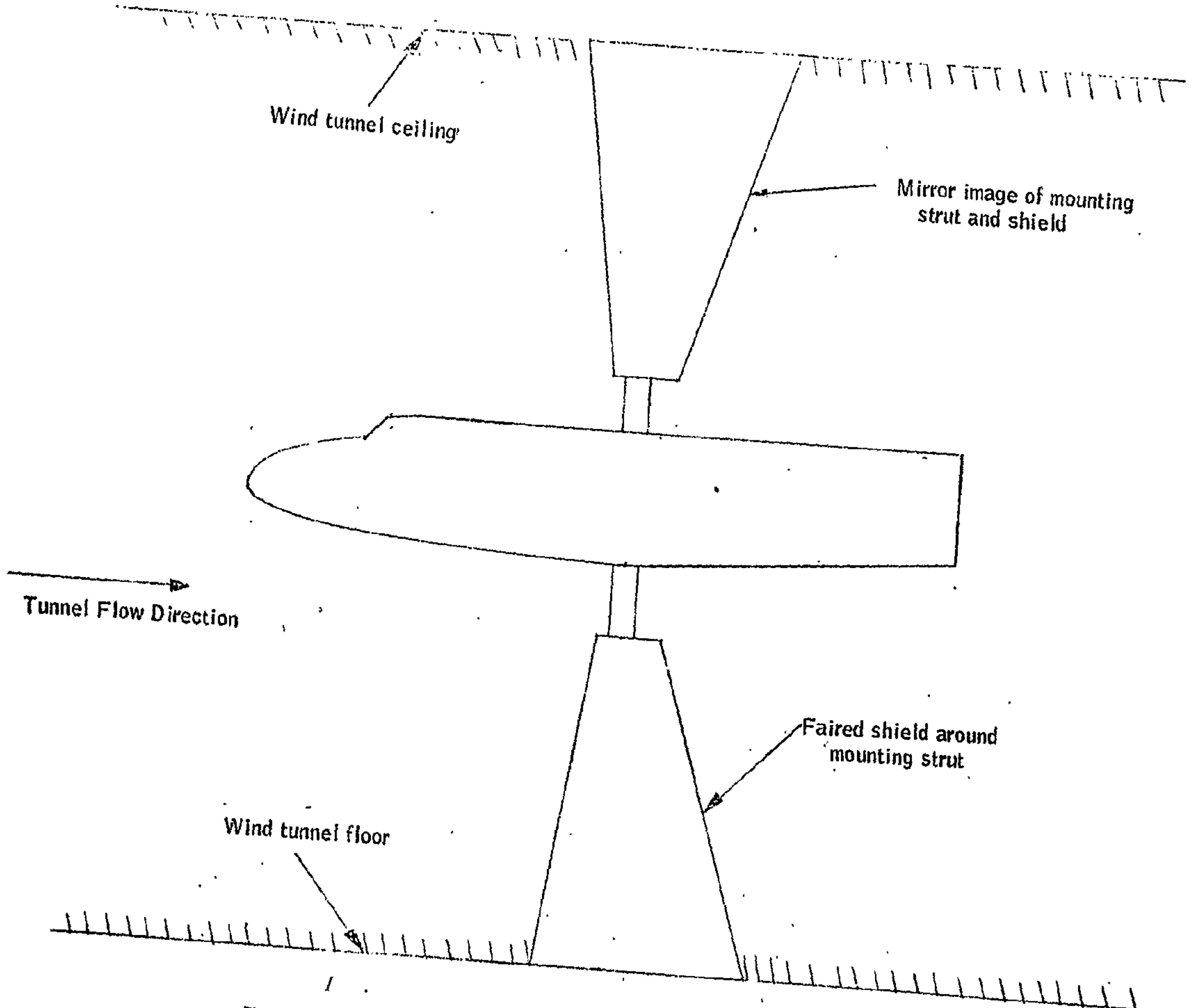


Figure 2 - Configuration mounted on single strut with mirror image system.

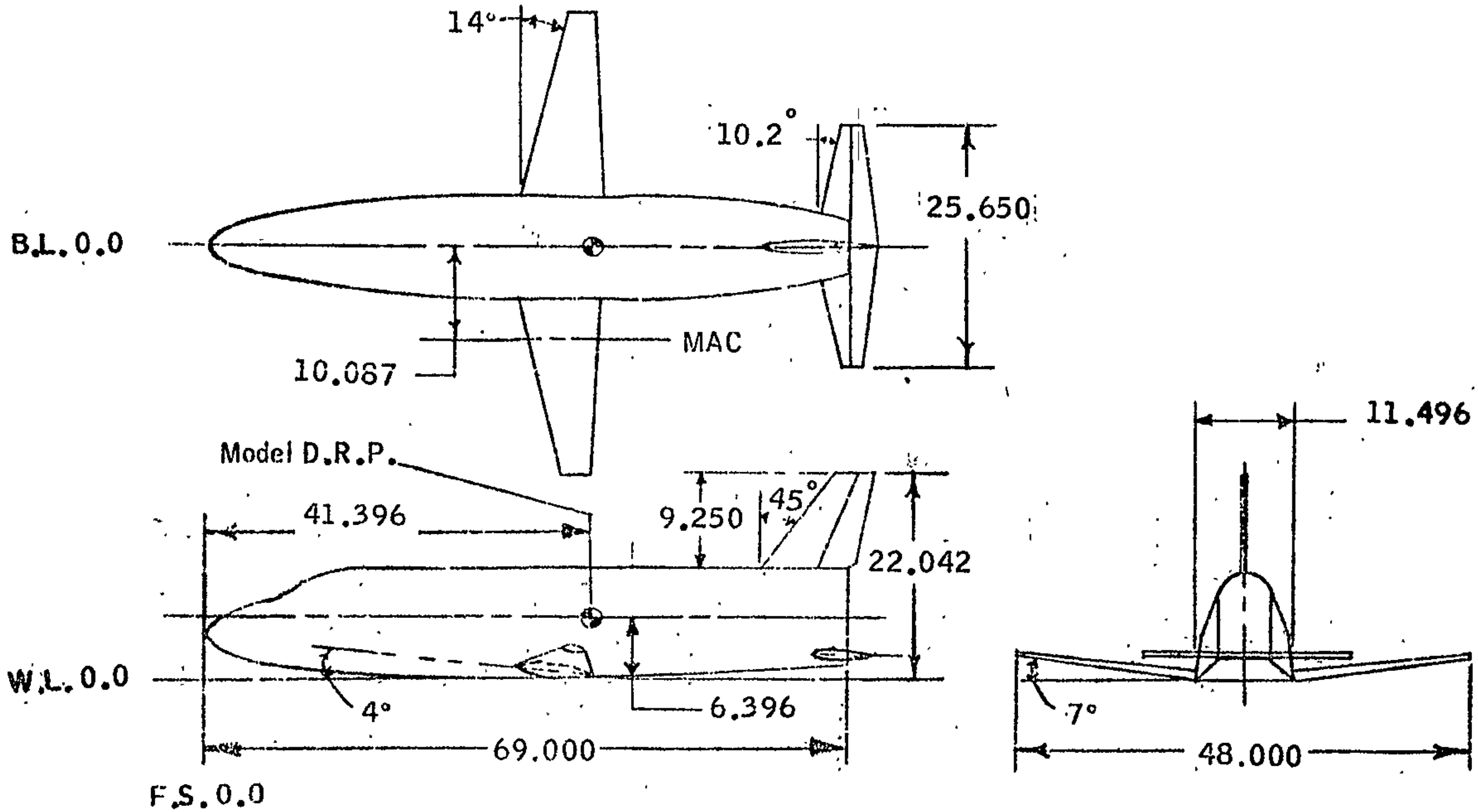


Figure 3 - Model geometry. Configuration $B_1W_2H_6V_3$ (all dimensions in inches)

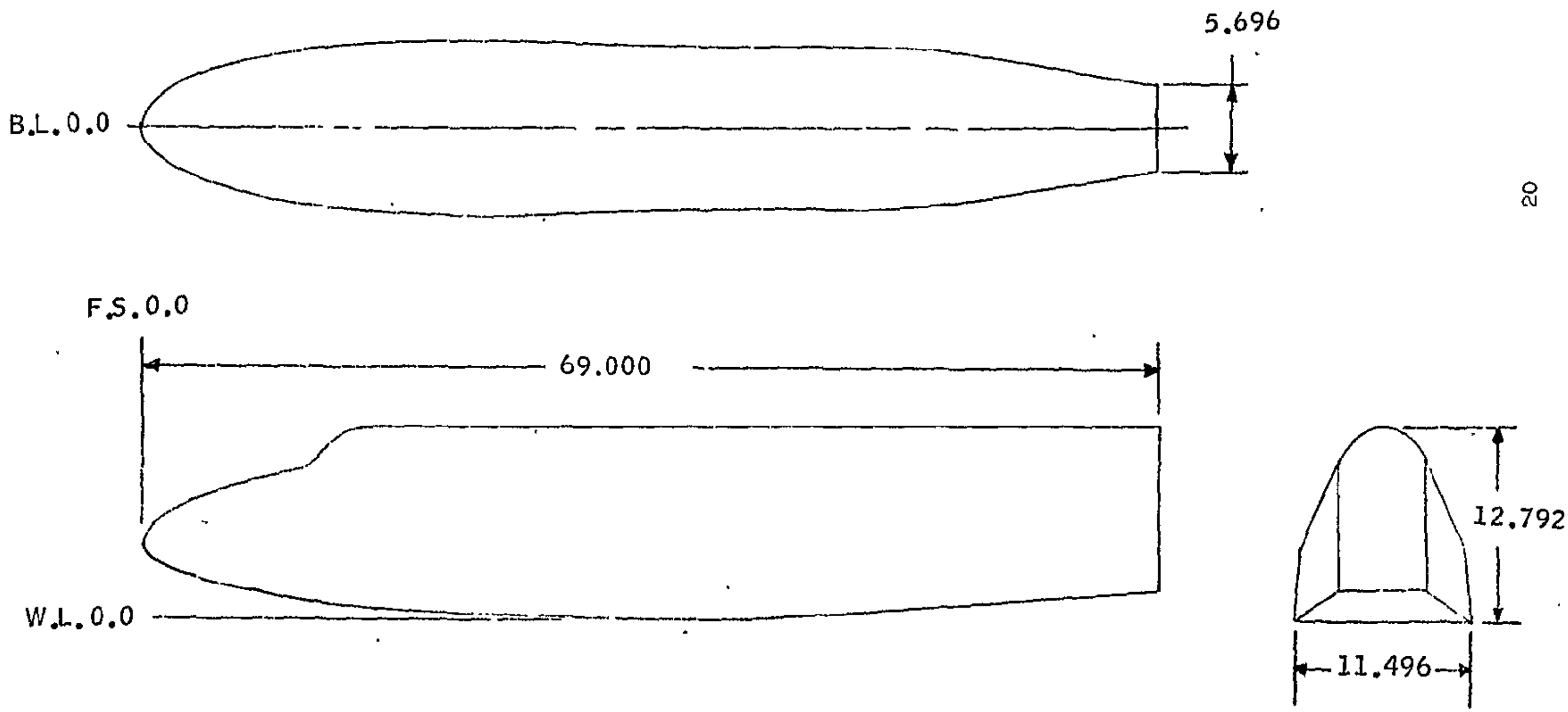


Figure 4 - Fuselage B_1 (all dimensions in inches).

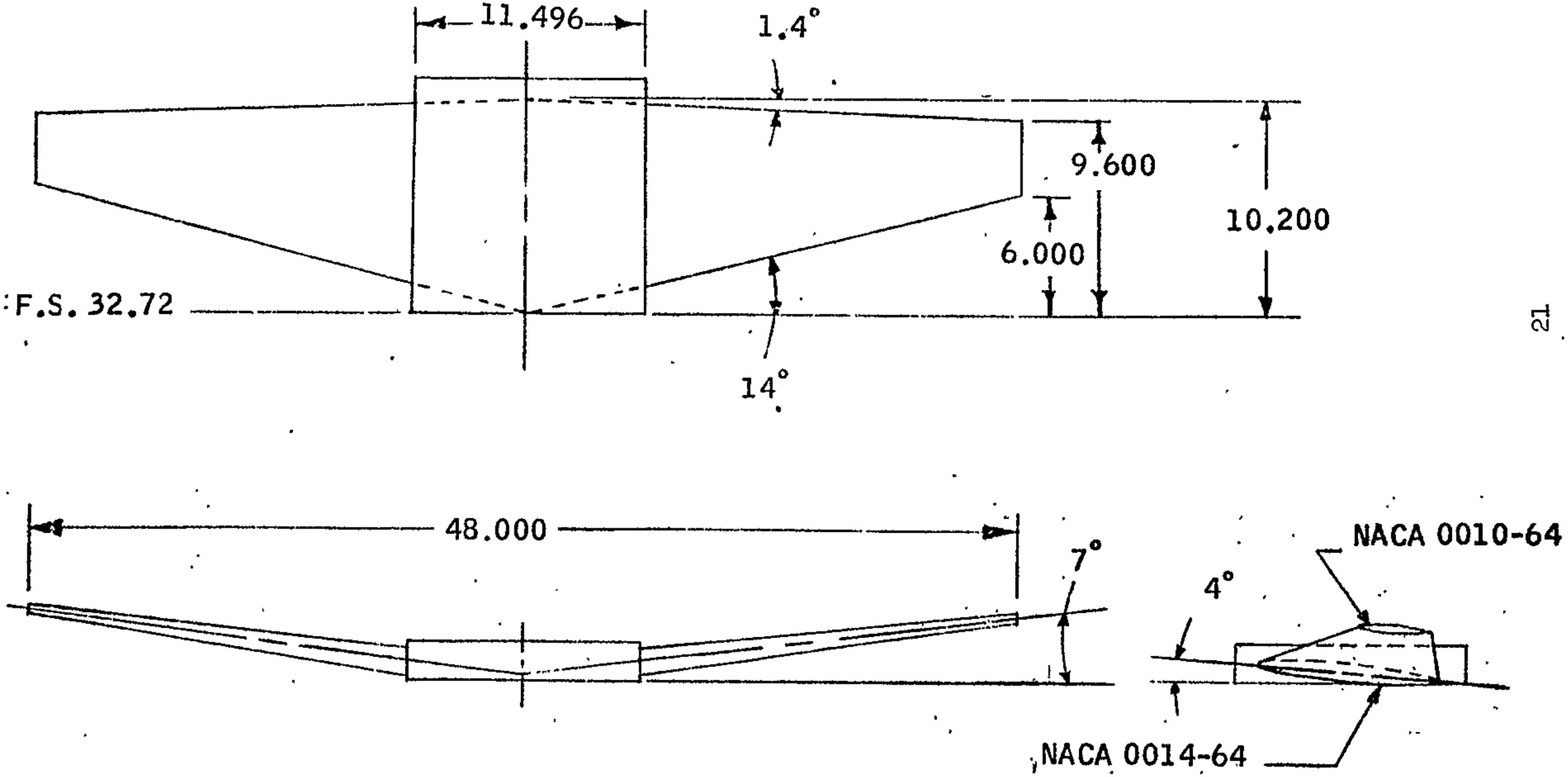


Figure 5 - Wing W_2 (all dimensions in inches)

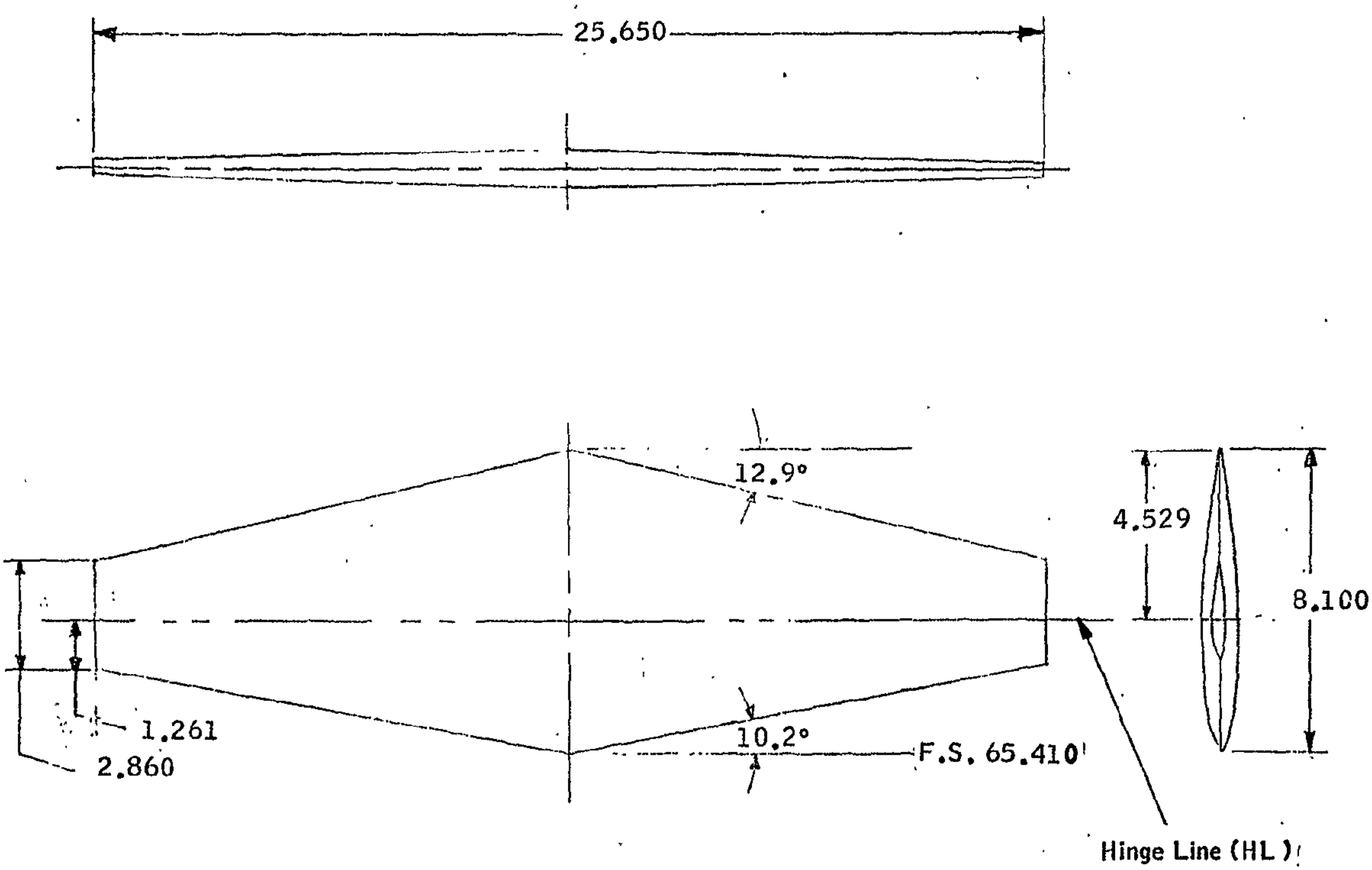


Figure 6 - Horizontal tail H_6 (all dimensions in inches)

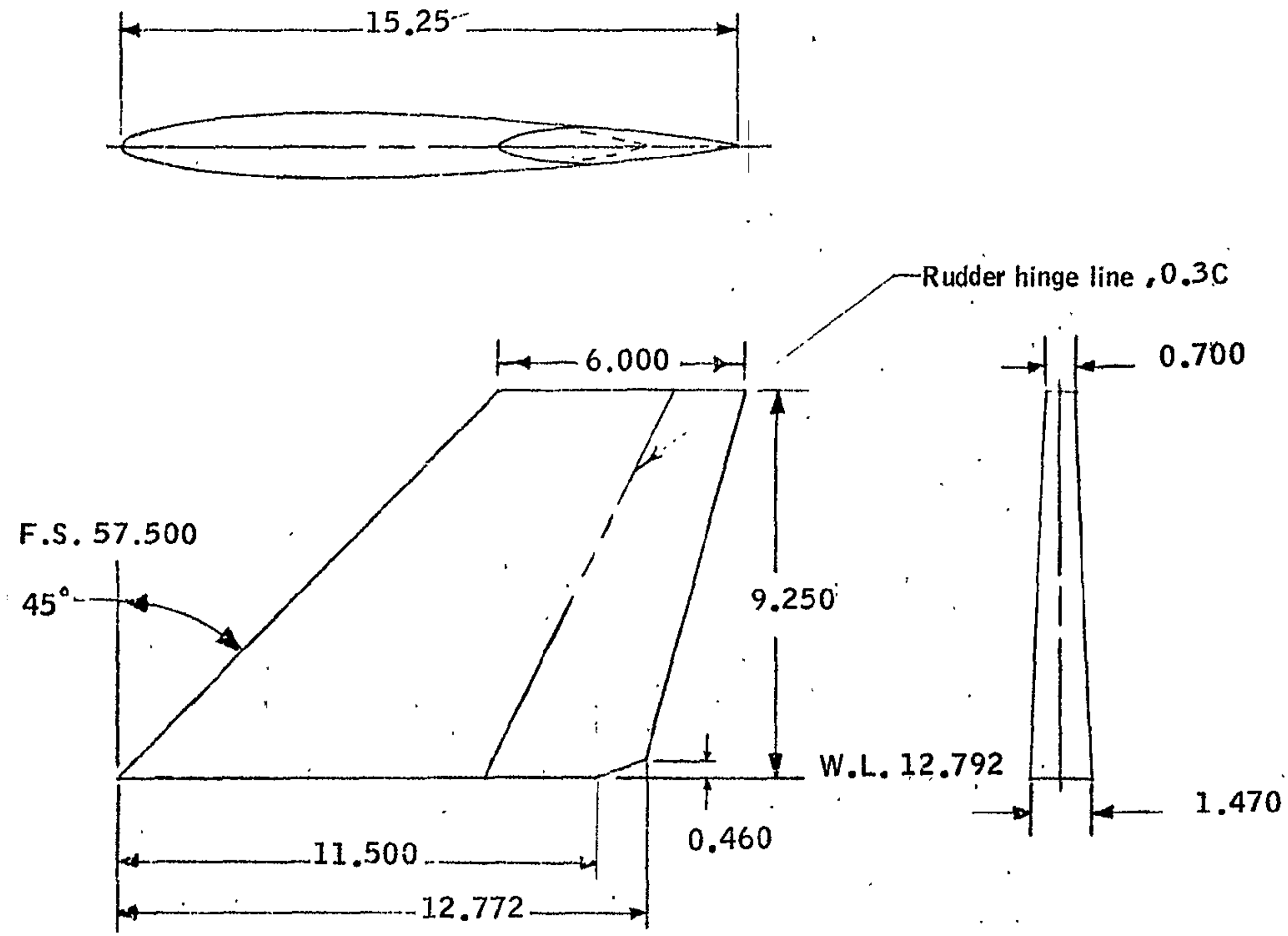


Figure 7 - Vertical Tail V_3 (all dimensions in inches)

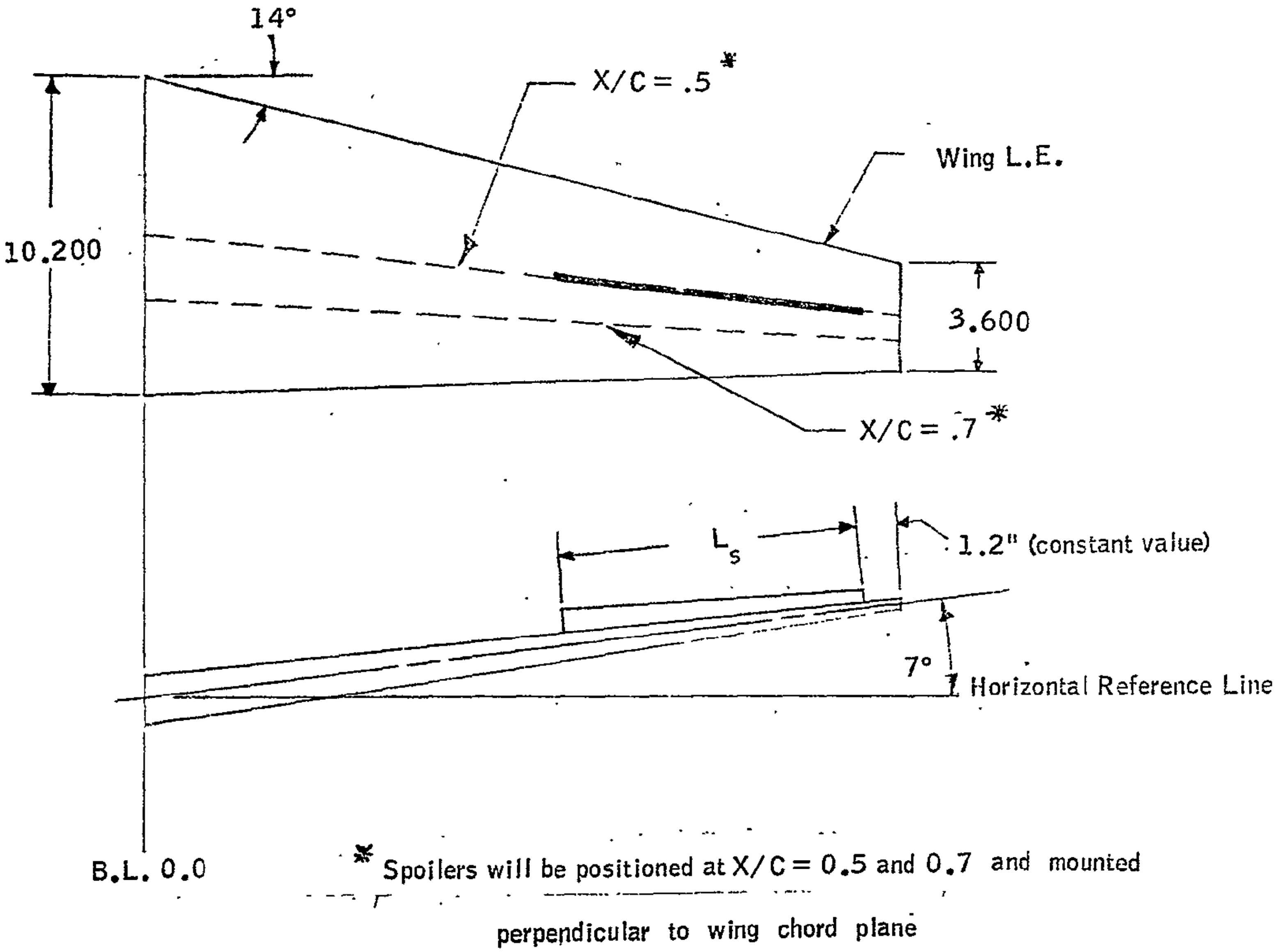


Figure 8 - Spoiler configuration. (all dimensions in inches)

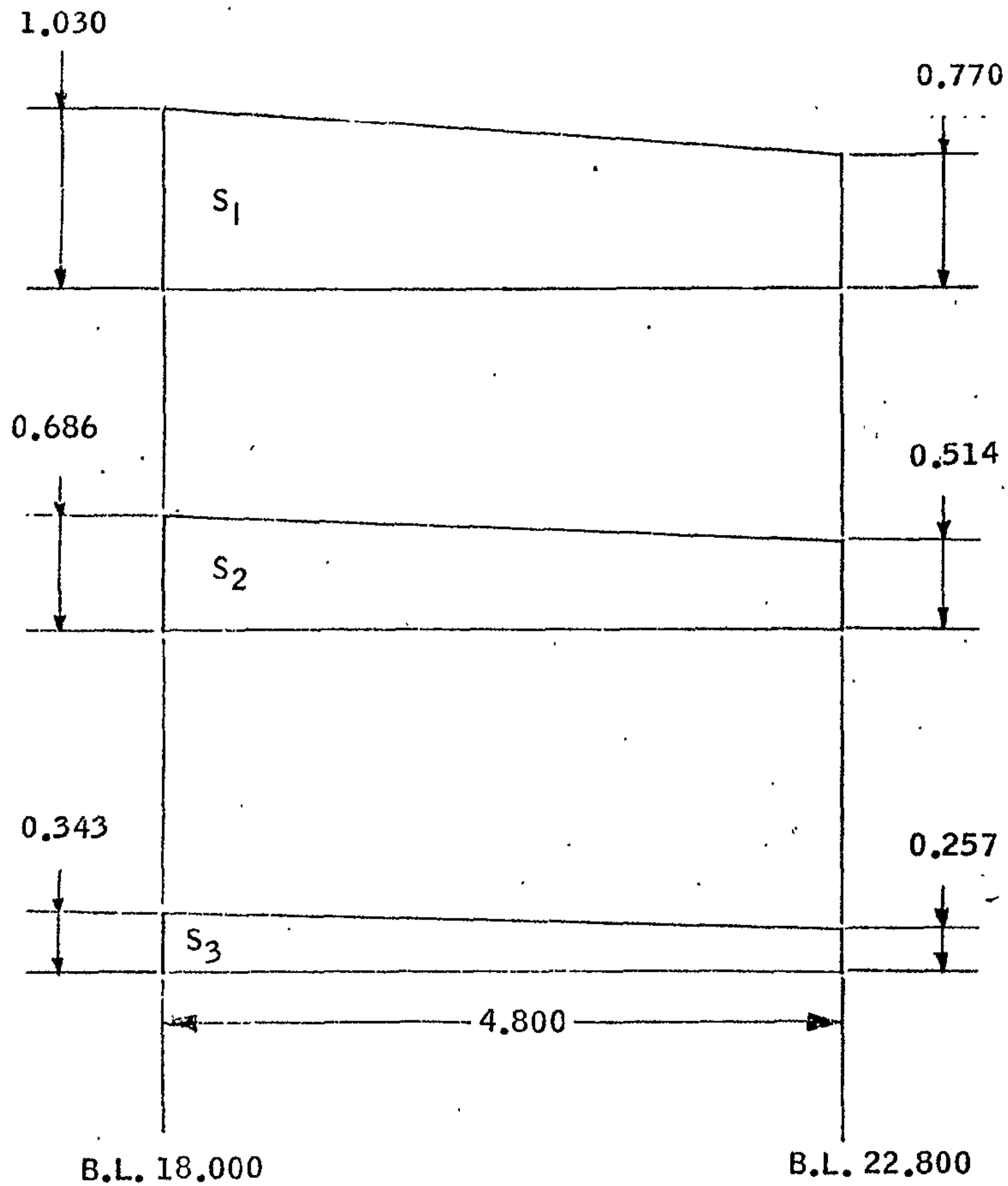


Figure 9 - Model Spoilers (all dimensions in inches)

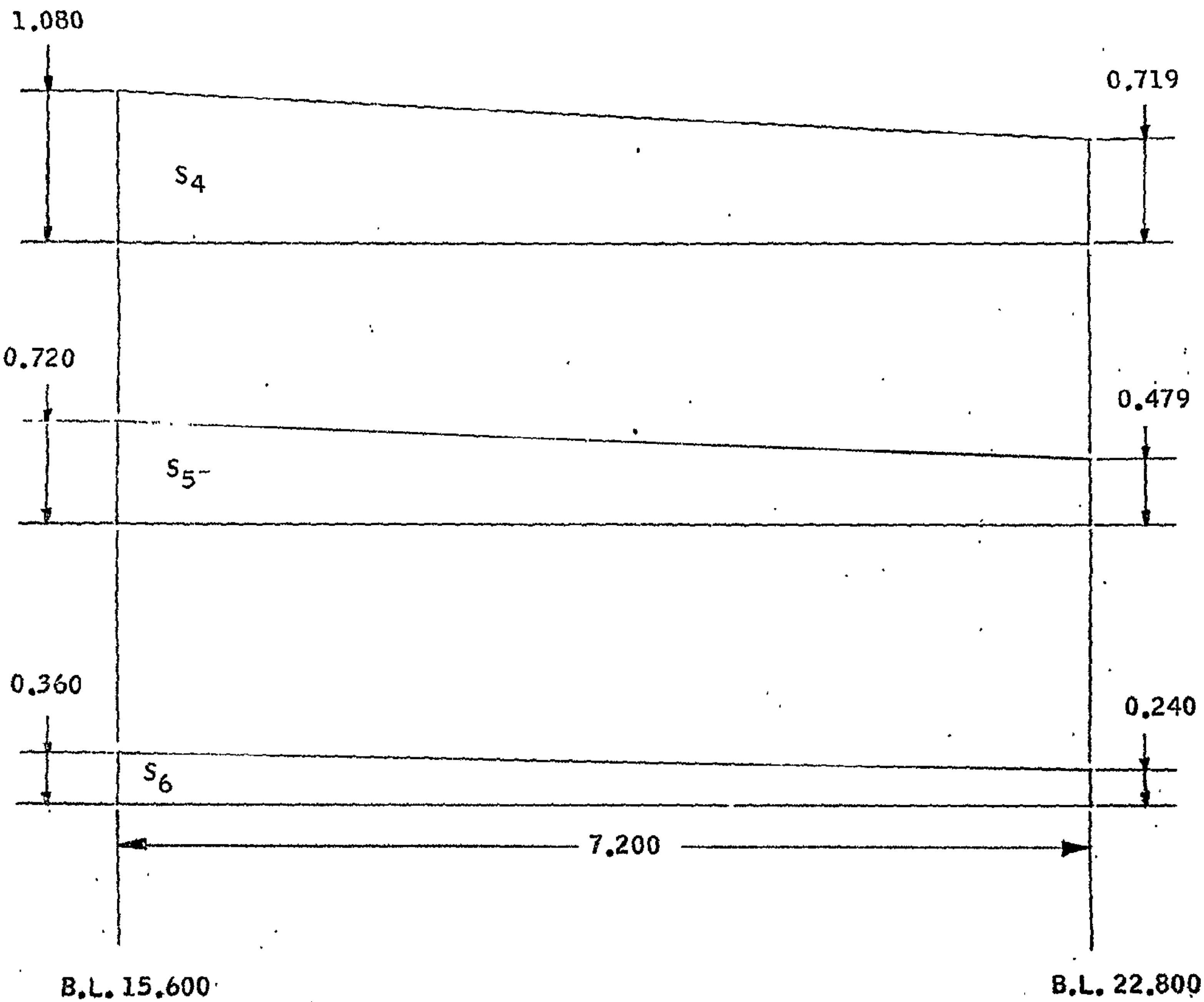


Figure 9 - Continued.

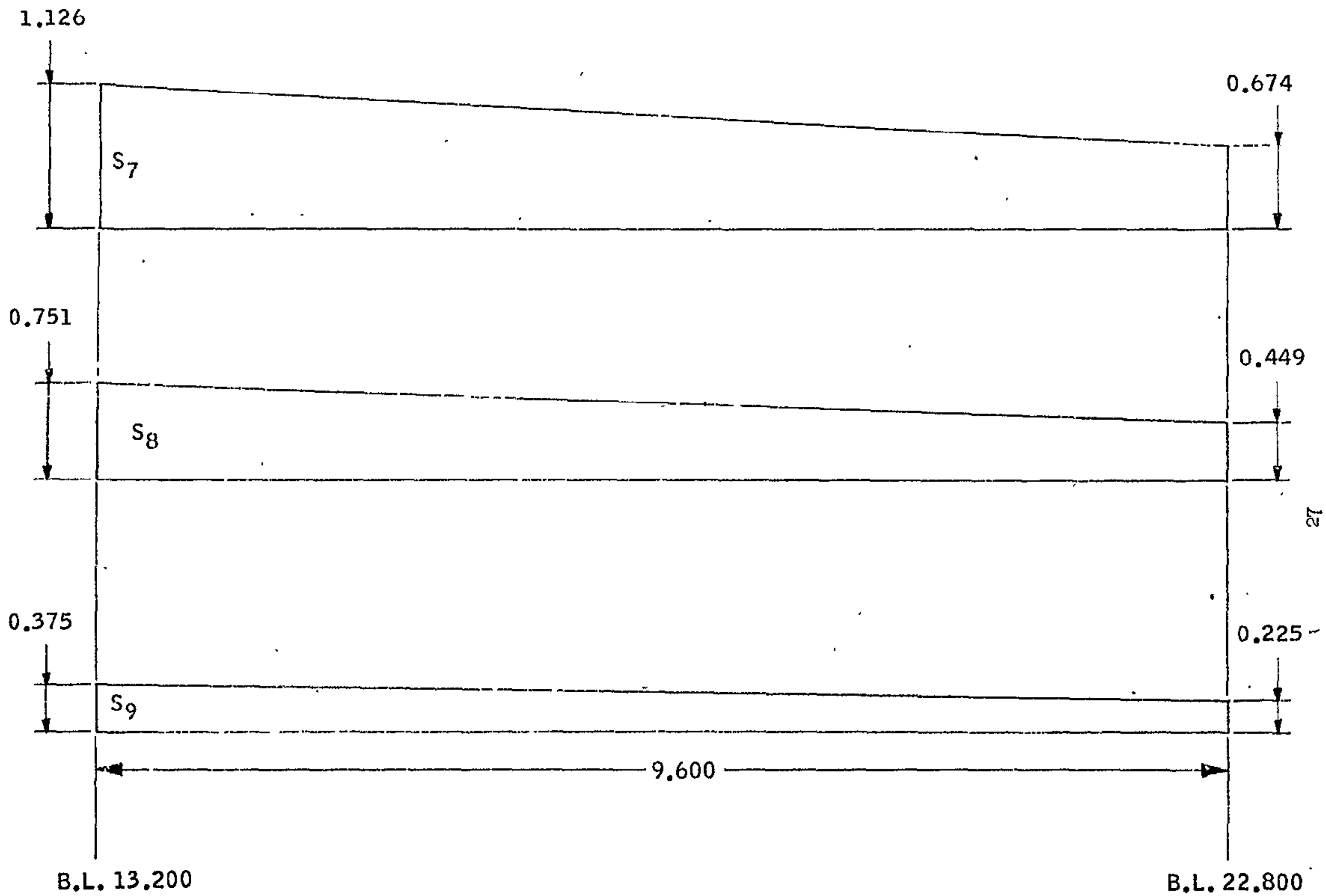


Figure 9 - Concluded.

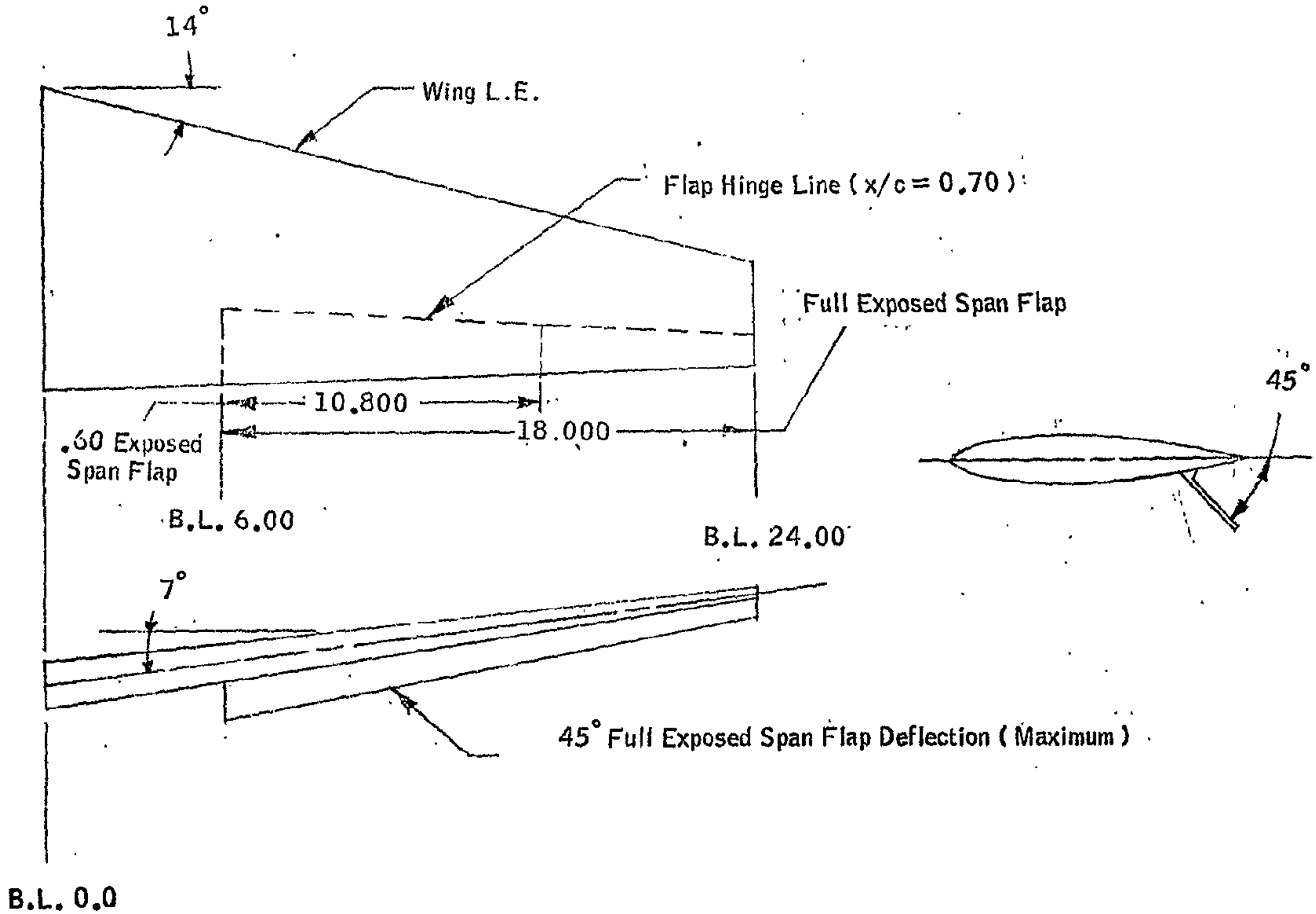


Figure 10 - Flap configuration. (all dimensions in inches)

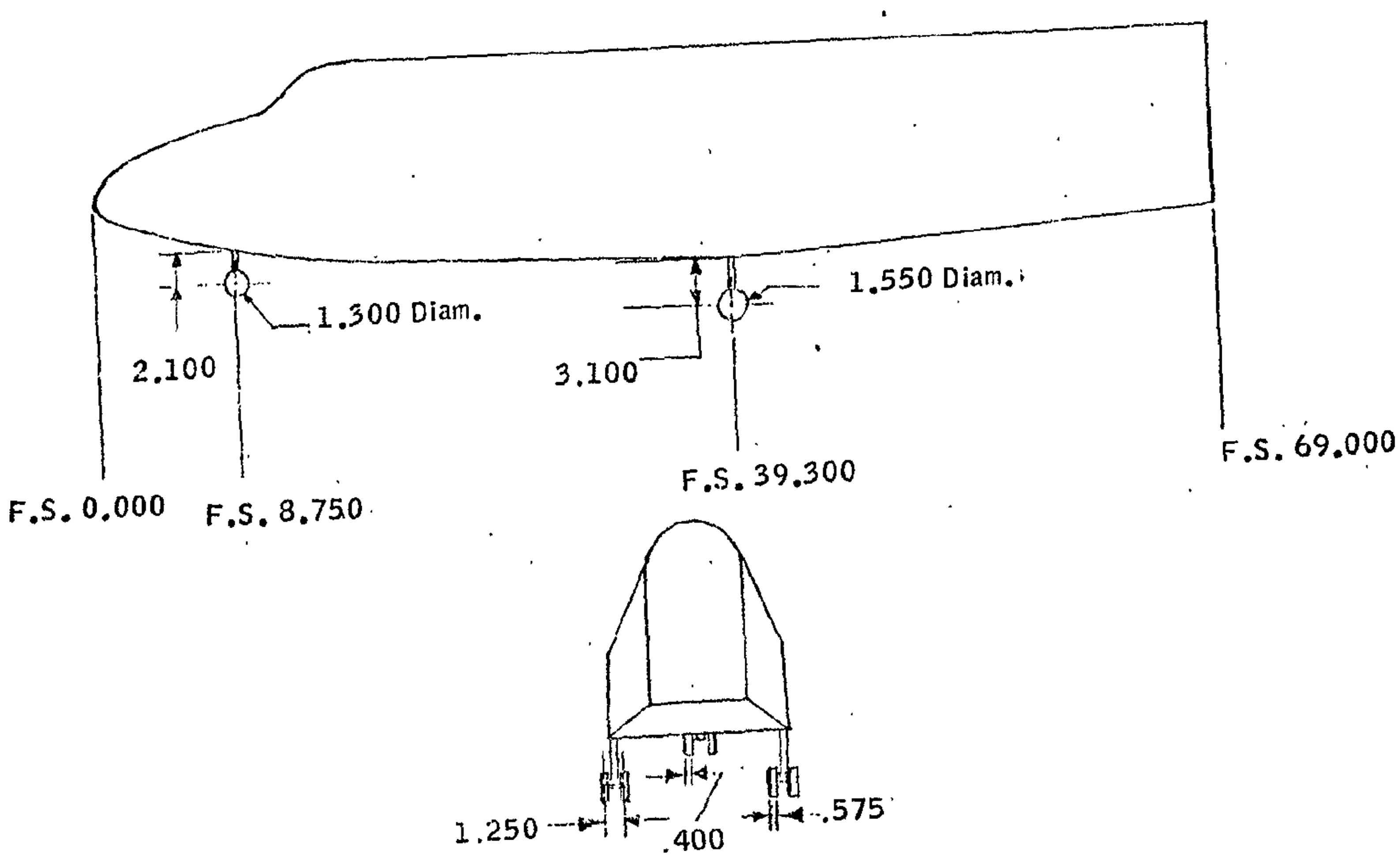


Figure 11. - Landing gear configuration. (all dimensions in inches)

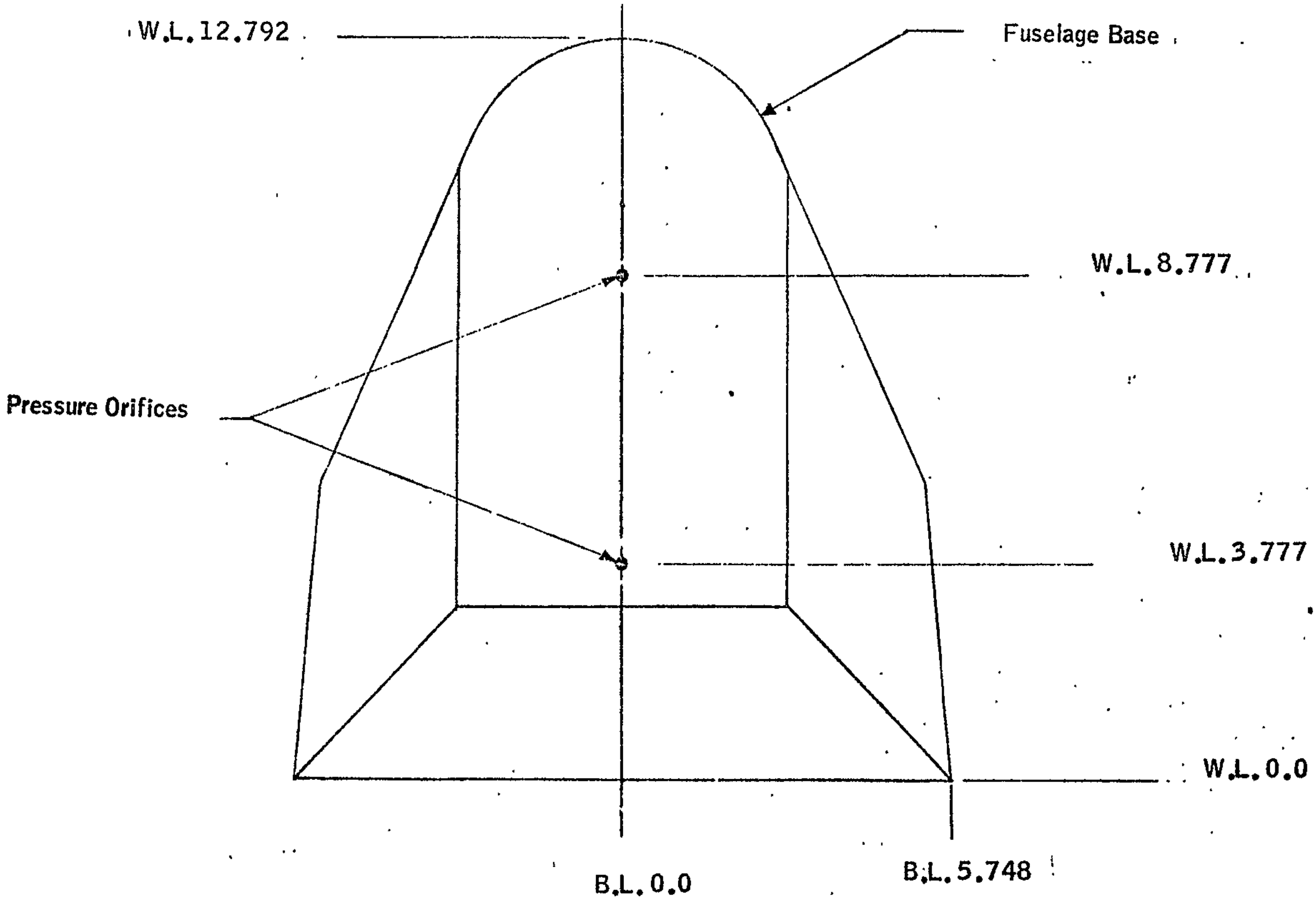


Figure 12. - Model Pressure Orifices (all dimensions in inches)

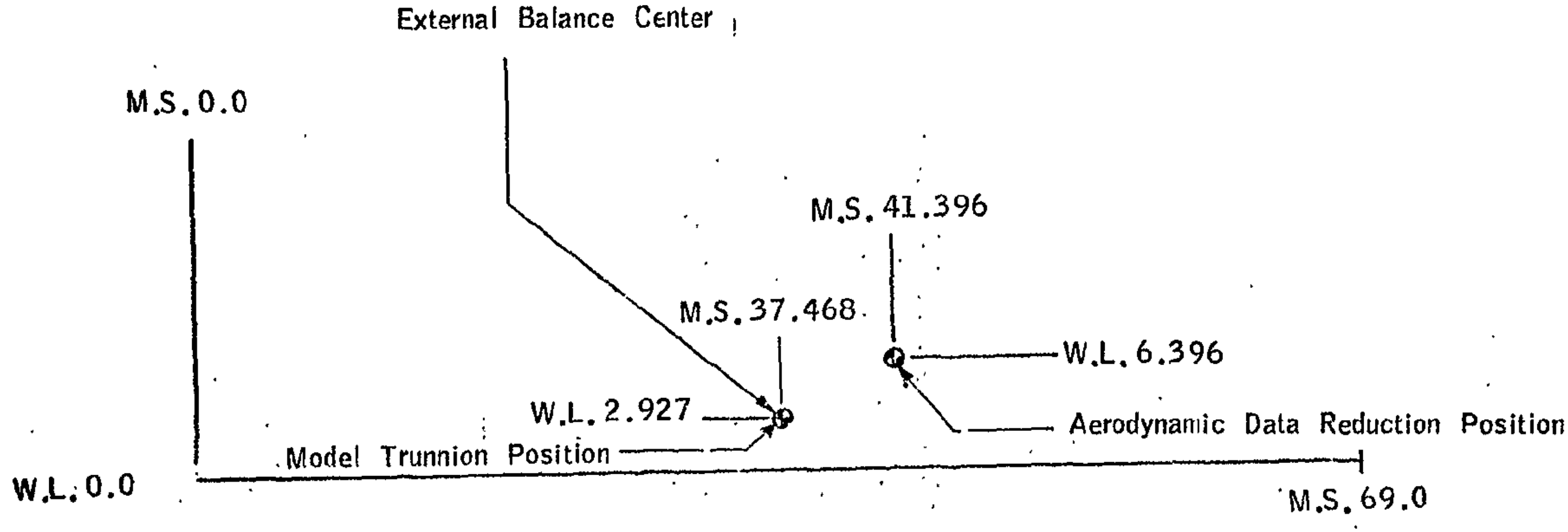


FIGURE 13. - Location of External Balance Center, Model Trunnion Position, and Aerodynamic Data Reduction Position; Moment Transfer Diagram

TABLE III

MODEL COMPONENT: BODY - B_1

GENERAL DESCRIPTION: 0.05 Scale Model of NASA - MSC August 1969 Baseline Orbiter Fuselage

DRAWING NUMBER: Texas A and M Research and Instrument Shops Drawing Number Orbiter - 1

DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	1380 in.	69.0 in.
Max. Width	229.92 in.	11.496 in.
Max. Depth	255.84 in.	12.792 in.
Fineness Ratio (total length to max. width)	6.002	6.002
Area		
Max. Cross-Sectional	324.0 ft^2.	0.810 ft^2.
Planform	1919.6 ft^2.	4.799 ft^2.
Wetted	--------	---------
Base (Horizontal Tail Off)	158.4 ft^2.	0.396 ft^2.
(Horizontal Tail On)	146.0 ft^2	0.365 ft^2

TABLE IV

MODEL COMPONENT- WING (W2)

GFNFRAL DFSCRIPTION- MSC ORBITFR S-4, 0.05 SCALF

DRAWING NUMBER- ORBITER-7 TEXAS A+M UNIV

DIMENSIONS

TOTAL DATA	FULL SCALE (FT)	MODEL (IN)
AREA	920.0	331.200
SPAN (EQUIVALENT)	80.00	48.000
ASPECT RATIO	6.957	6.957
TAPER RATIO	0.353	0.353
DIEHEDRAL ANGLE, DEG	7.000	7.000
INCIDENCE ANGLE, DEG	4.000	4.000
SWEEP BACK ANGLE, DEG		
LEADING EDGE	14.000	14.000
TRAILING EDGE	-1.400	-1.400
0.25 FLEMENT LINF	9.262	9.262
CHORDS		
ROOT (WING STA. 0.0)	17.00	10.200
TIP, (EQUIVALENT)	6.00	3.600
MEAN AERODYNAMIC	12.38	7.430
.25 MAC COORDINATES		
X (FROM BODY NOSE)	61.82	37.092
Y (FROM BODY CL)	16.81	10.087
AIRFOIL SECTION		
ROOT	NACA 0014-64	
TIP	NACA 0010-64	

EXPOSED DATA	FULL SCALE (FT)	MODEL (IN)
AREA	619.9	223.156
SPAN (EQUIVALENT)	60.84	36.504
ASPFCT RATIO	5.971	5.971
TAPER RATIO	0.417	0.417
CHORDS		
ROOT (WING STA. 0.0)	14.38	8.626
TIP, (EQUIVALENT)	6.00	3.600
MEAN AERODYNAMIC	10.77	6.461
.25 MAC COORDINATES		
X (FROM BODY NOSE)	62.89	37.732
Y (FROM BODY CL)	22.71	13.623

DIMENSIONS OBTAINFD FROM MODEL DRAWINGS

TABLE V

MODFL COMPONENT- HORIZONTAL TAIL (H6)

GENERAL DESCRIPTION- MSC ORBITER S-4, 0.05 SCALE

DRAWING NUMBER- ORBITFR-4 TEXAS A+M UNIV

DIMENSIONS

TOTAL DATA	FULL SCALE (FT)	MODEL (IN)
AREA	390.4	140.562
SPAN (EQUIVALENT)	42.75	25.650
ASPECT RATIO	4.681	4.681
TAPER RATIO	0.353	0.353
DIEHEDRAL ANGLE,DEG	0.000	0.000
INCIDENCE ANGLE,DEG	0.000	0.000
SWEEP BACK ANGLE, DEG		
LEADING EDGE	10.200	10.200
TRAILING EDGE	-12.900	-12.900
0.25 ELEMENT LINE	2.962	2.962
CHORDS		
ROOT (WING STA. 0.0)	13.50	8.100
TIP, (EQUIVALENT)	4.77	2.860
MEAN AERODYNAMIC	9.83	5.900
.25 MAC COORDINATES		
X (FROM BODY NOSE)	113.09	67.855
Y (FROM BODY CL)	8.98	5.391
AIRFOIL SFCTION		
ROOT	NACA 0012-64	
TIP	NACA 0012-64	

EXPOSED DATA	FULL SCALE (FT)	MODEL (IN)
AREA	239.5	86.203
SPAN (EQUIVALENT)	30.42	18.250
ASPECT RATIO	3.864	3.864
TAPER RATIO	0.434	0.434
CHORDS		
ROOT (WING STA. 0.0)	10.98	6.587
TIP, (EQUIVALENT)	4.77	2.860
MEAN AFRODYNAMIC	8.28	4.971
.25 MAC COORDINATES		
X (FROM BODY NOSE)	113.39	68.031
Y (FROM BODY CL)	12.77	7.663

DIMENSIONS OBTAINED FROM MODEL DRAWINGS

TABLE VI

MODEL COMPONENT- VERTICAL STABLIZER (V3)

GENERAL DESCRIPTION- MSC ORBITER S-4, 0.05 SCALE

DRAWING NUMBER- ORBITER-6 TEXAS A+M UNIV

DIMENSIONS

EXPOSED DATA	FULL SCALE (FT)	MODEL (IN)
AREA	241.2	86.821
SPAN (EQUIVALENT)	15.42	9.250
ASPECT RATIO	0.986	0.986
TAPER RATIO	0.470	0.470
DIEHEDRAL ANGLE, DEG	0.000	0.000
INCIDENCE ANGLE, DEG	0.000	0.000
SWEEP BACK ANGLE, DEG		
LEADING EDGE	45.000	45.000
TRAILING EDGE	14.997	14.997
0.25 ELEMENT LINE	34.822	34.822
CHORDS		
ROOT (WING STA. 0.0)	21.29	12.772
TIP, (EQUIVALENT)	10.00	6.000
MEAN AERODYNAMIC	16.33	9.798
.25 MAC COORDINATES		
X (FROM BODY NOSE)	106.70	64.018
Z (FROM EXPOSED ROOT CHORD)	6.78	4.069
AIRFOIL SECTION		
ROOT	NACA 0012-64	
TIP	NACA 0012-64	

DIMENSIONS OBTAINED FROM MODEL DRAWINGS

NOMENCLATURE

SYMBOL	SADSAC SYMBOL	DEFINITION
A_b		base area; m^2, ft^2, in^2
a		speed of sound; m/sec, ft/sec
AR	ASPECT	aspect ratio, b^2/S
b	REFB	wing span or reference span; m, ft, in
c		wing chord; m, ft, in
$\bar{c}$		wing mean aerodynamic chord or reference chord; m, ft, in (see ℓ_{ref} or refl)
c.g.		center of gravity
C.P.		center of pressure
C_A	CA	axial force coefficient, F_A/qS_{ref}
C_{A_b}	CAB	see page 44
C_{A_f}	CAF	forebody axial force coefficient, $C_A - C_{A_b}$
C_D	CDTOTL	drag force coefficient in the wind axis system, $F_D/q\,S_{ref}$

SYMBOL	SADSAC SYMBOL	DEFINITION
C'_D	CD	drag force coefficient in the stability axis system, $F'_D/q\,S_{ref}$
C_L	CL	lift force coefficient (stability or wind axis) $F_L/q\,S_{ref}$
C_ℓ	CBL	rolling moment coefficient in body axis system, $M_x/q\,S_{ref}\,b$
$C_{\ell,s}$	CSL	rolling moment coefficient in the stability axis system, $M_{x,s}/q\,S_{ref}\,b$
$C_{\ell,w}$	CWL	rolling moment coefficient in the wind axis system, $M_{x,w}/q\,S_{ref}\,b$
C_m	CLM	pitching moment coefficient in the body axis system, $M_y/q\,S_{ref}\,\ell_{ref}$
$C_{m,s}$	CLM	pitching moment coefficient in the stability axis system, $C_{m,s} = C_m$
$C_{m,w}$	CPM	pitching moment coefficient in the wind axis system, $M_{y,w}/q\,S_{ref}\,\ell_{ref}$
C_N	CN	normal force coefficient in the body axis system, $F_N/q\,S_{ref}$

SYMBOL	SADSAC SYMBOL	DEFINITION
C_n	CYN	yawing moment coefficient in the body axis system, $M_z/q\,S_{ref}\,b$
$C_{n,s}$	CLN	yawing moment coefficient in the stability axis system, $C_{n,s} = C_n$
$C_{n,w}$	CLN	yawing moment coefficient in the wind axis system, $M_{z,w}/q\,S_{ref}\,b$
C_p	CP	pressure coefficient, $(p-p_\infty)/q$
C_y	CY	side force coefficient (body or stability axis system), $F_y/q\,S_{ref}$
C_c	CC	side force coefficient (wind axis system), $F_y/q\,S_{ref}$
F_A		axial force; N, lb
F_D		drag force in wind axis system; N, lb
F'_D		drag force in the stability axis system; N, lb
F_L		lift force (stability or wind axis system); N, lb
F_N		normal force; N, lb

NOMENCLATURE (continued)

SYMBOL	SADSAC SYMBOL	DEFINITION
F_Y		side force; N, lb
	N/A	normal to axial force ratio
ℓ_{ref}	REFL	reference length; m, ft, in (see $\bar{c}$)
L/D	L/D	lift-to-drag ratio, C_L/C_D (stability axis system)
L/D	CL/CD	lift-to-drag ratio, C_L/C_D (wind axis system)
M	MACH	Mach number
MRP	MRP	abbreviation for moment reference point
	XMRP	abbreviation for moment reference point on x-axis
	YMRP	abbreviation for moment reference point on y-axis
	ZMRP	abbreviation for moment reference point on z-axis
M_x		rolling moment in the body axis system; N-m, ft-lb
$M_{x,s}$		rolling moment in the stability axis system; N-m, ft-lb

NOMENCLATURE (continued)

SYMBOL	SADSAC SYMBOL	DEFINITION
$M_{x,w}$		rolling moment in the wind axis system; N-m, ft-lb
M_y		pitching moment in the body (or stability) axis system; N-m, ft-lb
$M_{y,w}$		pitching moment in the wind axis system; N-m, ft-lb
M_z		yawing moment in the body axis system; N-m, ft-lb
$M_{z,w}$		yawing moment in the wind axis system; N-m, ft-lb
p		static pressure; N/m^2; psi
P		total pressure; N/m^2; psi
q	Q(PSI) Q(PSF)	dynamic pressure; N/m^2, psi, psf
RN/L	RN/L	Reynold's number per unit length; million/ft.
S		wing area; m^2, ft^2
S_{ref}	REFS	reference area; m^2, ft^2
T		temperature; °K, °C, °R, °F
V		speed of vehicle relative to surrounding atmosphere; m/sec, ft/sec

NOMENCLATURE (continued)

SYMBOL	SADSAC SYMBOL	DEFINITION
θ		pitch angle, angle of rotation about the body Y-axis, positive when the positive Z-axis is rotated toward the positive X-axis; deg
ϕ	PHI	roll angle, angle of rotation about the body X-axis, positive when the positive Y-axis is rotated toward the positive Z-axis; deg
ψ	PSI	yaw angle, angle of rotation about the body Z-axis, positive when the positive X-axis is rotated toward the positive Y-axis; deg

SYMBOL	SADSAC SYMBOL	DEFINITION
i_T		tail incidence positive when trailing edge down, deg
$\bar{V}$		velocity of vehicle relative to surrounding atmosphere; m/sec, ft/sec
α	ALPHA	angle of attack, angle between the projection of the wind X_W-axis on the body X, Z-plane and the body X-axis; deg
β	BETA	sideslip angle, angle between the wind X_W-axis and the projection of this axis on the body X-Z-plane; deg
γ		ratio of specific heats
Γ	DIHDRL	wing dihedral angle; deg
δ		control surface deflection angle; deg positive deflections are:
	AILRON	aileron - left aileron trailing edge down
	ELVATR	elevator - trailing edge down
	RUDDER	rudder - trailing edge to the left
	FLAP	flap - trailing edge down
	TAB	tab - trailing edge down with respect to control surface
ρ		air density; K_g/m^3, slugs/ft^3

NOMENCLATURE (continued)

SUBSCRIPTS	DEFINITION
a	aileron
b	base
c	canard
e	elevator or elevon
f	flap
r	rudder or ruddervator
s	stability axis system
t	tail, or total conditions
w	wind axis system
ref	reference conditions
∞	freestream condition

ADDITIONS OR CHANGES TO SADSAC NOMENCLATURE

Symbols used in NASA-MSC Tests S-VIII - Phase 1 which do not appear in the Standard SADSAC Nomenclature.

SYMBOL	SADSAC SYMBOL	DEFINITION
i_H		horizontal tail incidence angle, positive with trailing edge down, degrees
C_{p_b}	CPBASE	base pressure coefficient, $(P_b - P_\infty)/q$
S_s	SPOLER	parameter name to denote spoiler, configuration and location, a parameter valve of 1.5 means spoiler S1 was positioned at 50% of the wing chord, a parameter valve of 1.7 means spoiler S1 was positioned at 70% of the wing chord (see Figures 8 & 9)
S_f	FLAPS	parameter name to denote flap deflection angle and flap configuration. A parameter valve of 150° means the full exposed span flaps were deflected 15°, a parameter valve of 15.6 means the 60% exposed span flaps were deflected 15 (see Figure 10), a positive deflection in trailing edge down.

TABULATED DATA LISTING

A tabulated data listing, consisting of all aero data sets, both original and those created in arriving at the plotted material to be presented subsequently, is available as an addendum to this report. The tabular listing is made up in two sections:

(a) a brief summary list of all data sets containing the identifier, the descriptor, and the resident dependent variables.

(b) the full list of all data sets containing all resident or selected aerodynamic coefficients of the data sets as well as the above mentioned information.

The listing is currently sent on limited distribution to the following organizations:

NASA AMES	Mr. V. Stevens
MASA MSC	Mr. R. Nelson

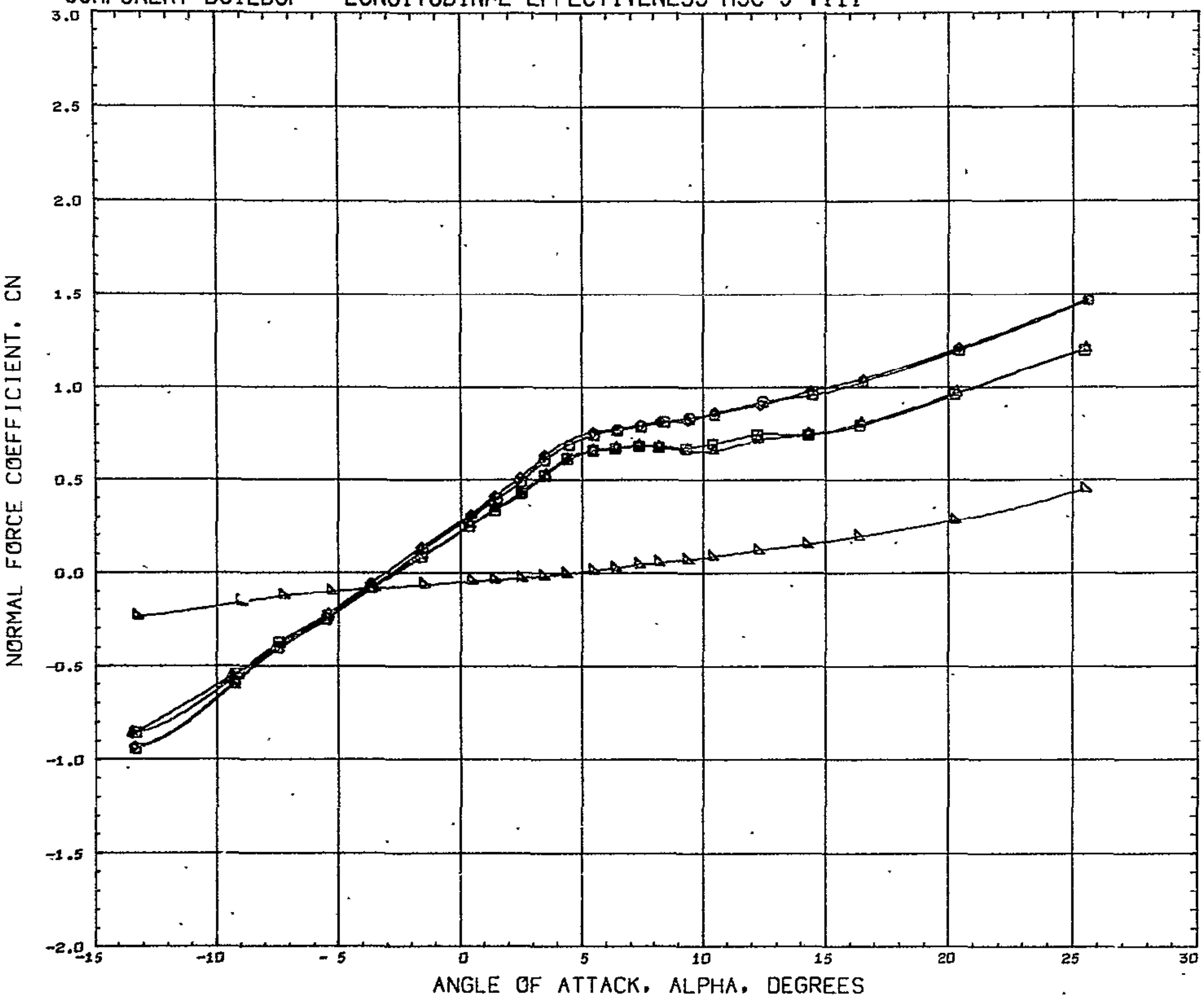
If copies of this listing are desired, please contact the above or the cognizant SADSAC personnel who, for this data, is:

W. R. Morgan
Department 2780
Chrysler Corporation Space Division
New Orleans, La. 70129

(504) 255-2304

PLOTTED DATA

COMPONENT BUILDUP - LONGITUDINAL EFFECTIVENESS MSC S-VIII



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RG6011)	O	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2V3H6
(RG6079)	□	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2V3
(RG6081)	◇	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2H6
(RG6083)	Δ	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2
(RG6085)	◺	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1

MACH 0.250

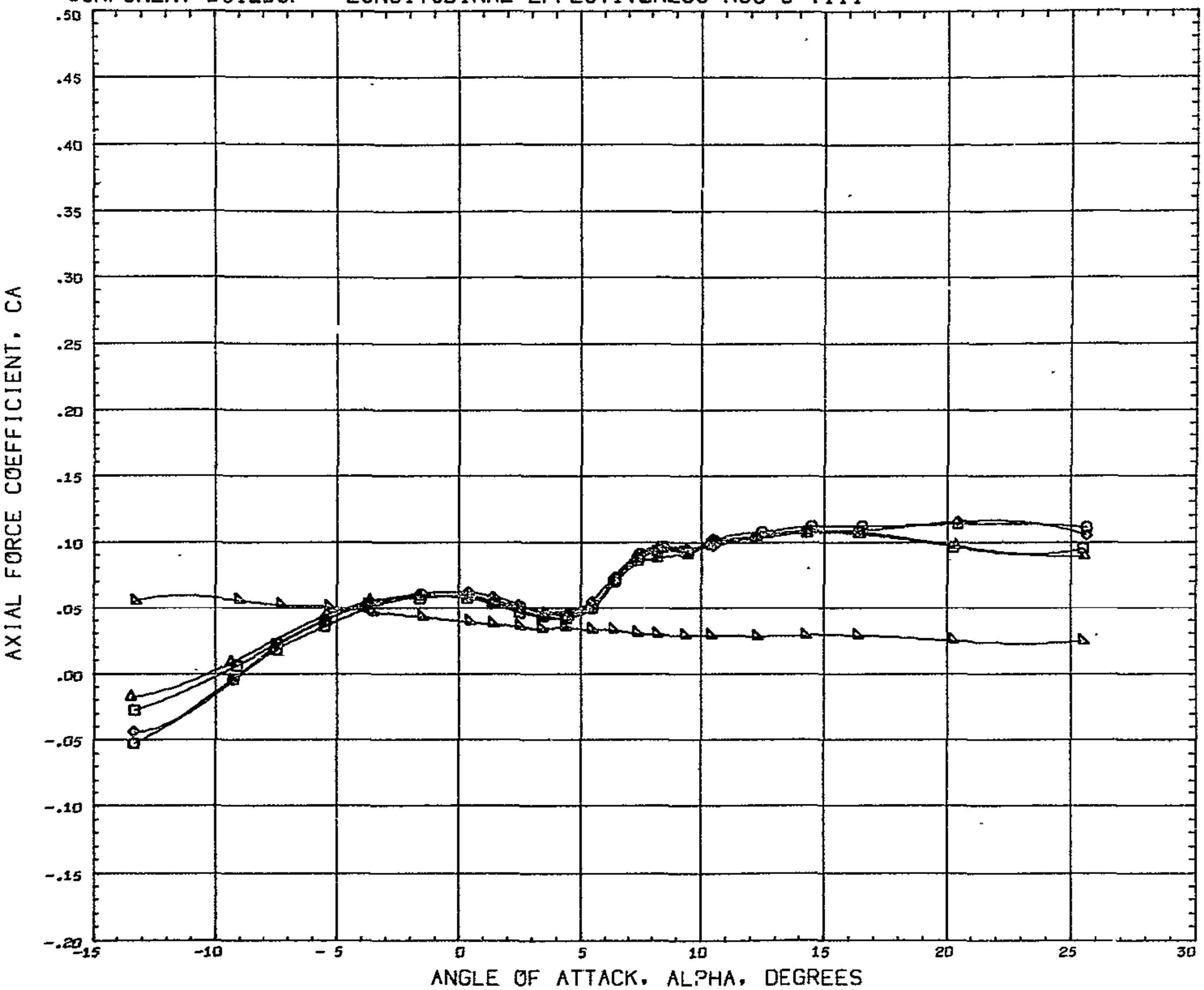
PARAMETRIC VALUES

BETA	0.000	RUDDER	0.000
ELEVTR	0.000	FLAPS	0.000
HORIT	0.000		

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

COMPONENT BUILDUP - LONGITUDINAL EFFECTIVENESS MSC S-VIII



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RG6011)	O	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2V3H6
(RG6079)	□	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2V3
(RG6081)	◇	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2H6
(RG6083)	Δ	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2
(RG6085)	⊿	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1

MACH 0.250

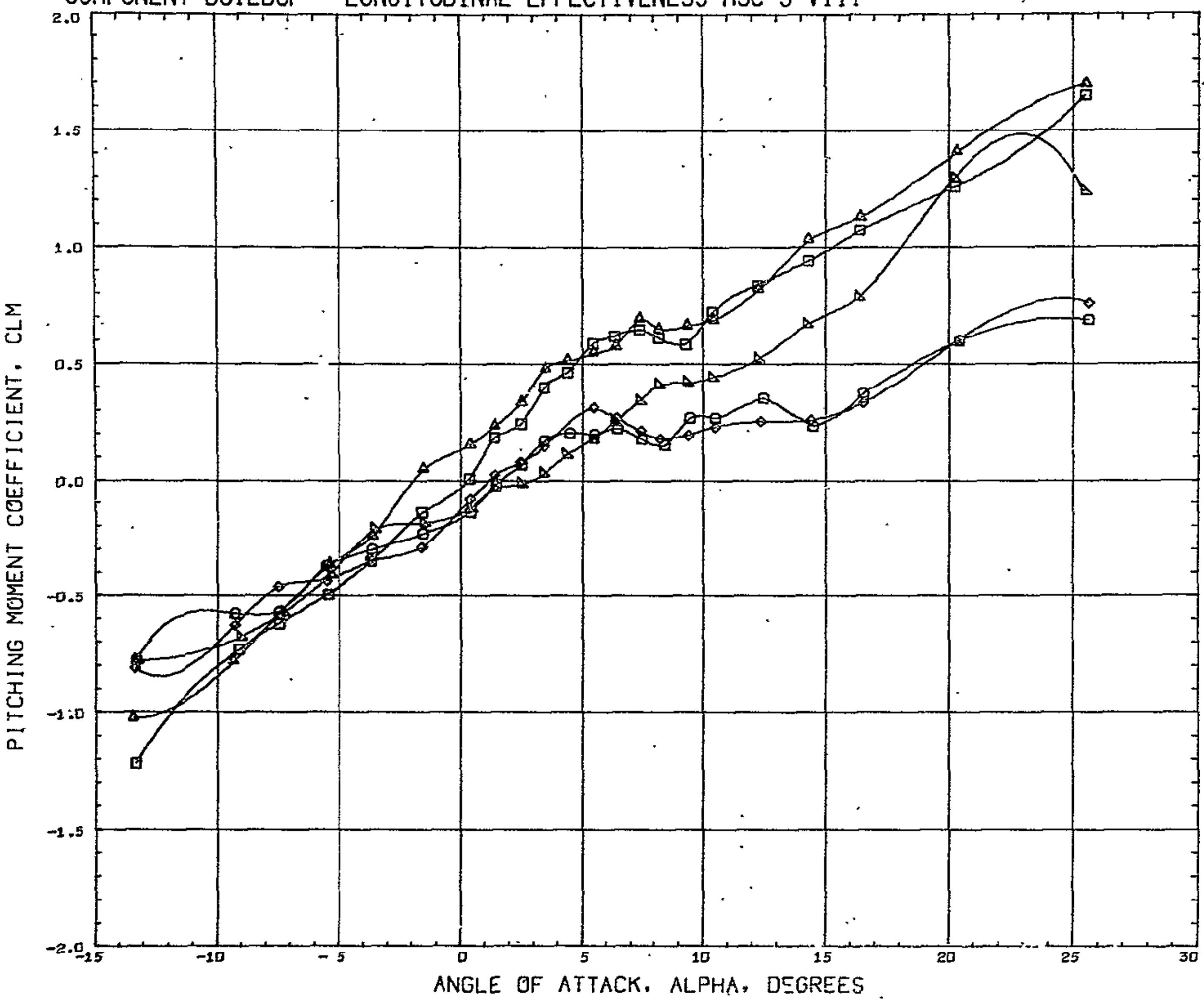
PARAMETRIC VALUES

BETA	0.000	RUDDER	0.000
ELEVTR	0.000	FLAPS	0.000
HORIT	0.000		

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

COMPONENT BUILDUP - LONGITUDINAL EFFECTIVENESS MSC S-VIII



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RG6011)	○	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2V3H6
(RG6079)	□	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2V3
(RG6081)	◇	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2H6
(RG6083)	△	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2
(RG6085)	◺	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1

MACH 0.250

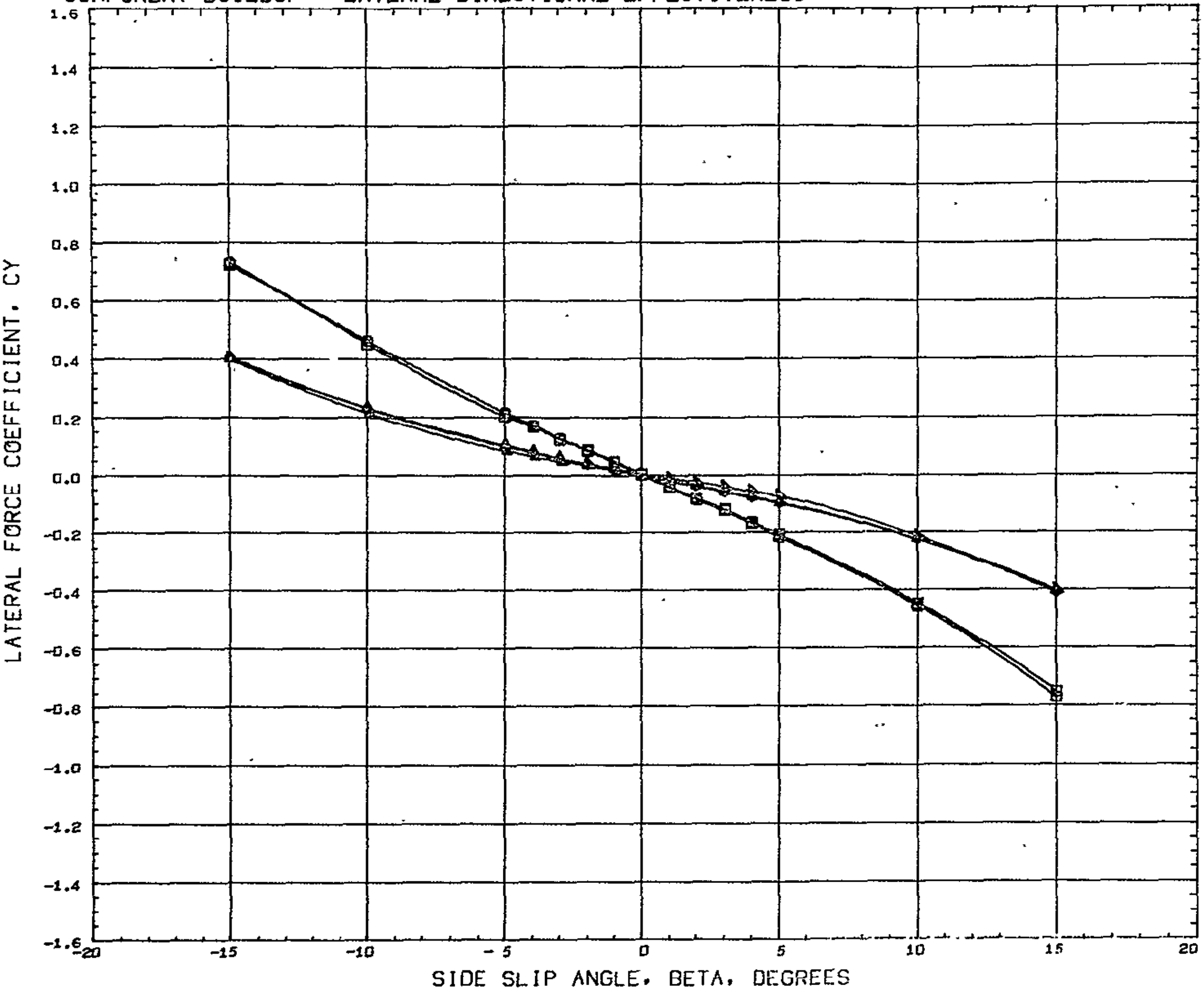
PARAMETRIC VALUES

BETA	0.000	RUDDER	0.000
ELEVTR	0.000	FLAPS	0.000
HORIT	0.000		

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

COMPONENT BUILDUP - LATERAL-DIRECTIONAL EFFECTIVENESS



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RG6012)	○	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2V3H6
(RG6080)	□	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2V3
(RG6082)	◇	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2H6
(RG6084)	△	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2
(RG6086)	◺	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1

MACH 0.250

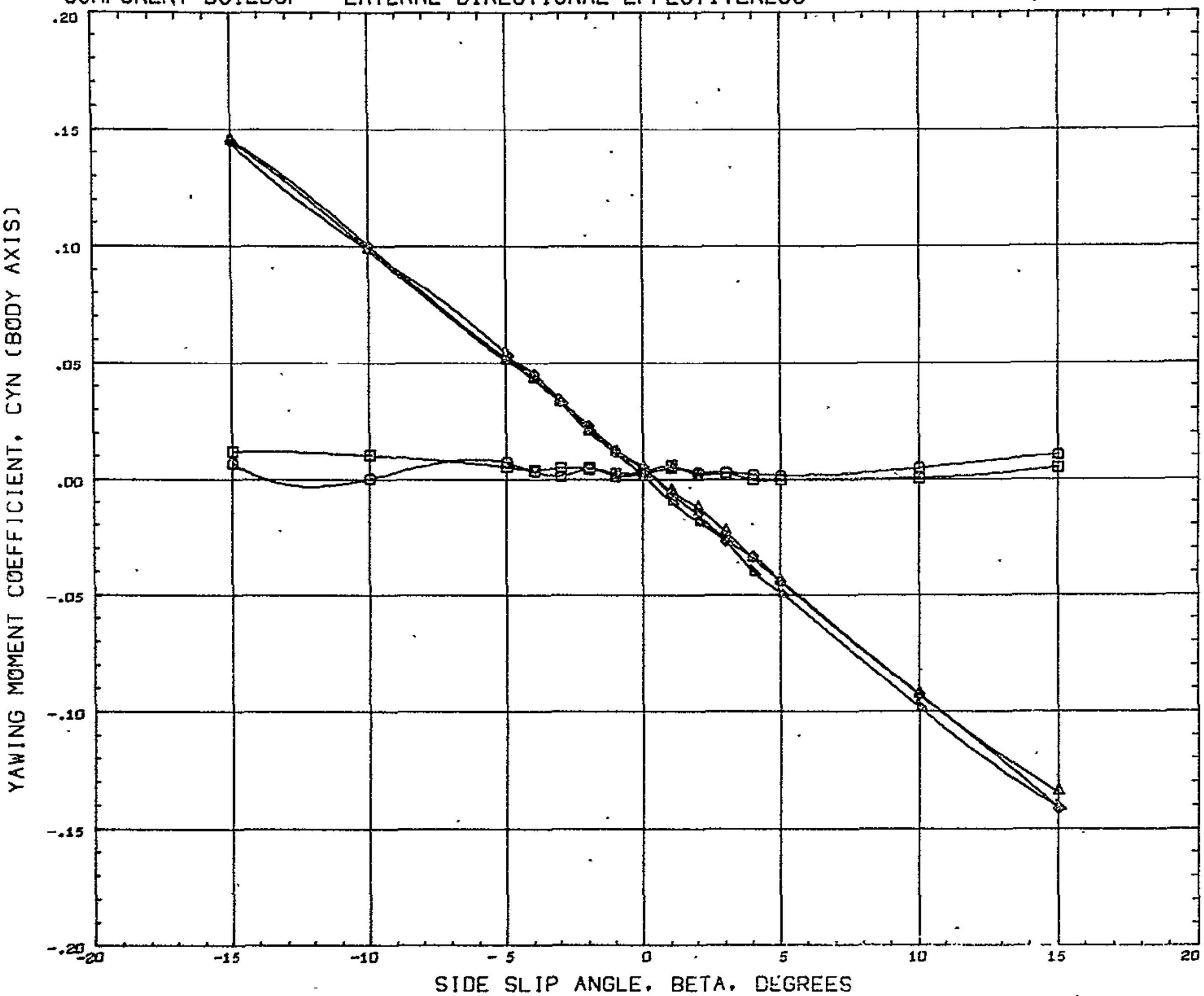
PARAMETRIC VALUES

ALPHA 0.370 RUDDER 0.000

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

COMPONENT BUILDUP - LATERAL-DIRECTIONAL EFFECTIVENESS



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RG6012)	□	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2V3H6
(RG6080)	□	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2V3
(RG6082)	◇	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2H6
(RG6084)	△	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1W2
(RG6086)	⊿	MSC S-8 PART 1 S-4 SHUTTLECRAFT B1

MACH 0.250

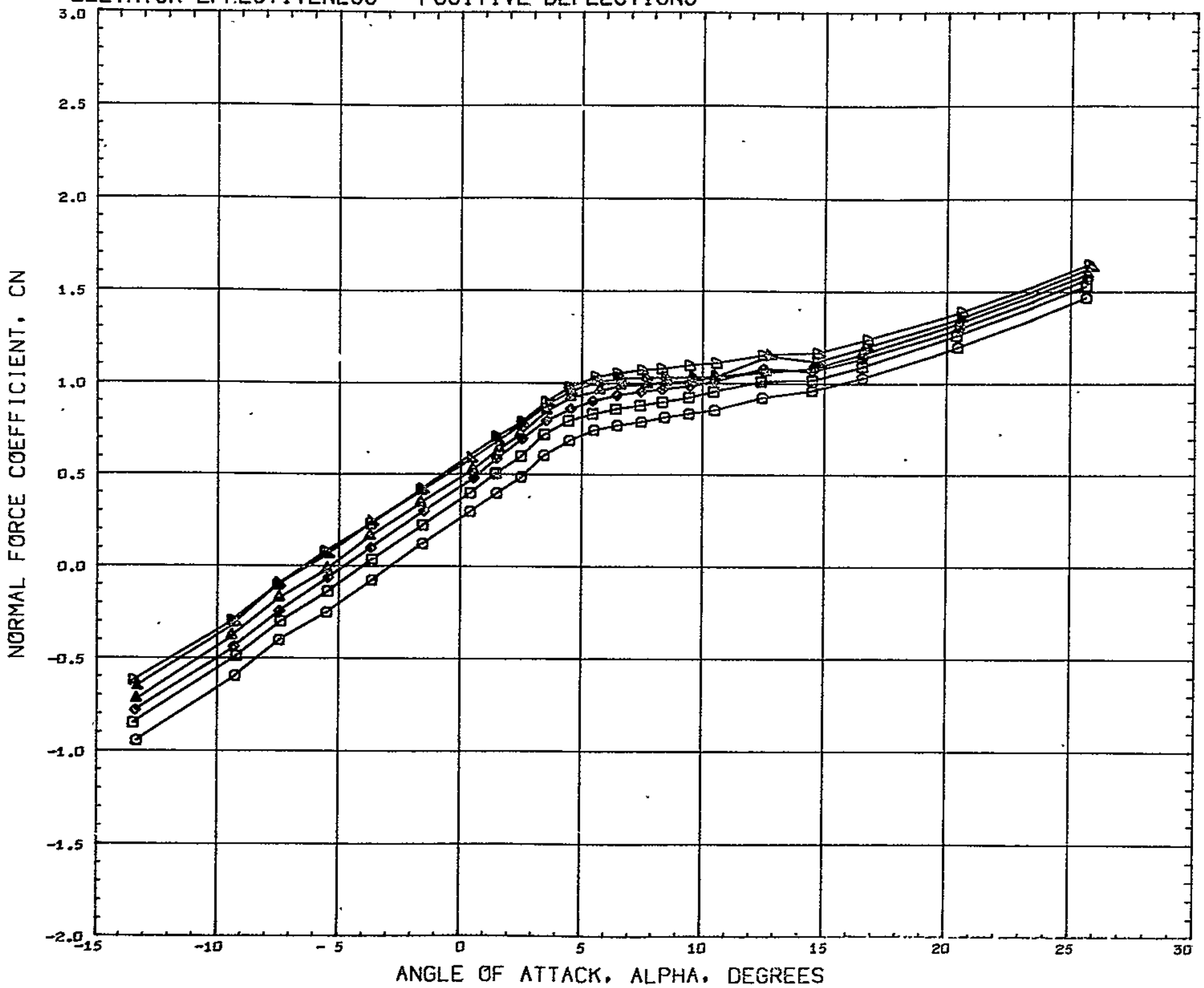
PARAMETRIC VALUES

ALPHA 0.370 RUDDER 0.000

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

ELEVATOR EFFECTIVENESS - POSITIVE DEFLECTIONS

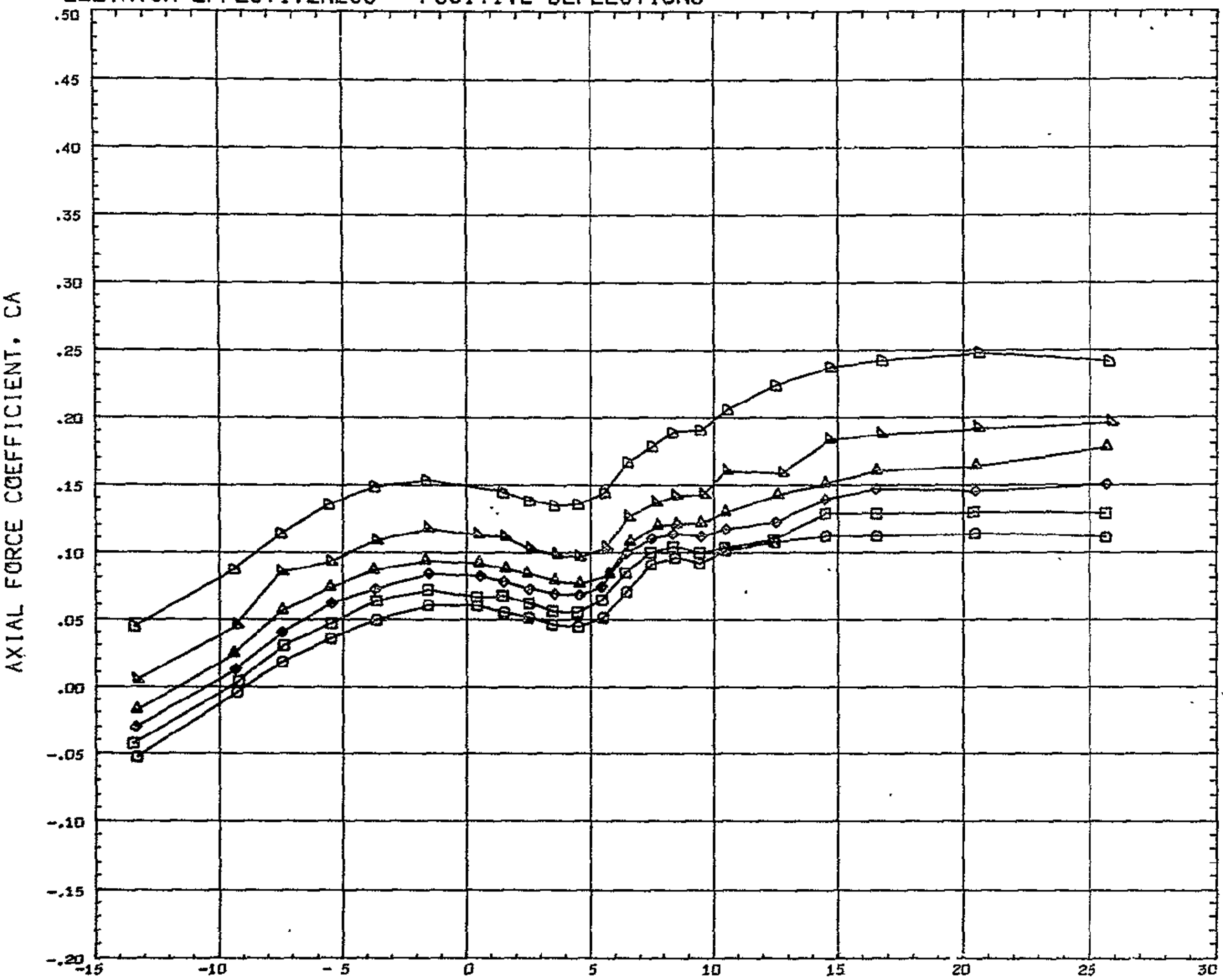


SYMBOL	ELEVTR	PARAMETRIC VALUES			
O	0.000	MACH	0.250	BETA	0.000
□	5.000	RUDDER	0.000	FLAPS	0.000
◇	10.000	HORIT	0.000		
△	15.000				
◺	20.000				
▷	30.000	REFERENCE FILE			

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

ELEVATOR EFFECTIVENESS - POSITIVE DEFLECTIONS

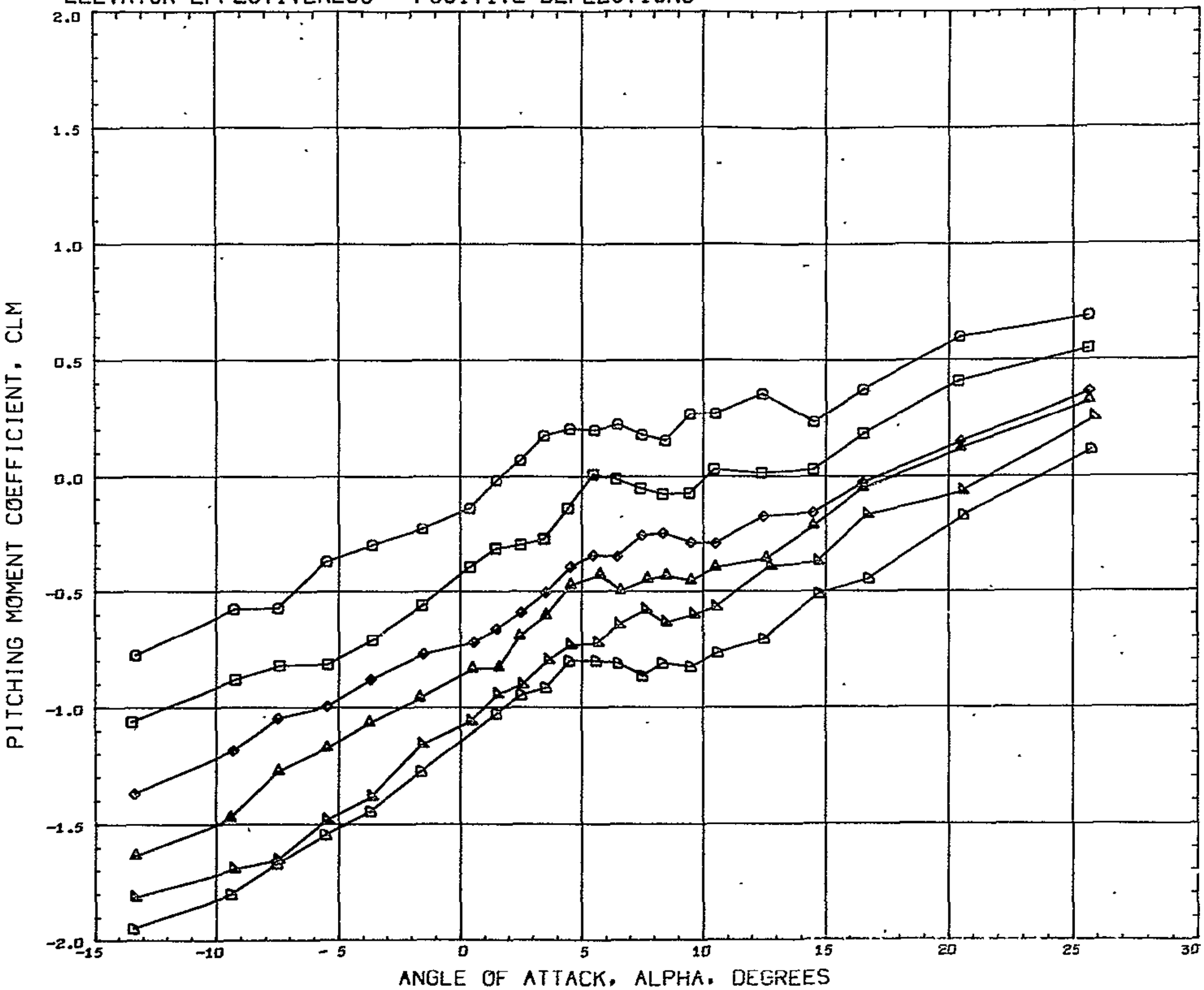


SYMBOL	ELEVTR	PARAMETRIC VALUES			
O	0.000	MACH	0.250	BETA	0.000
□	5.000	RUDDER	0.000	FLAPS	0.000
◇	10.000	HORIT	0.000		
Δ	15.000				
◣	20.000				
Δ	30.000	REFERENCE FILE			

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

ELEVATOR EFFECTIVENESS - POSITIVE DEFLECTIONS

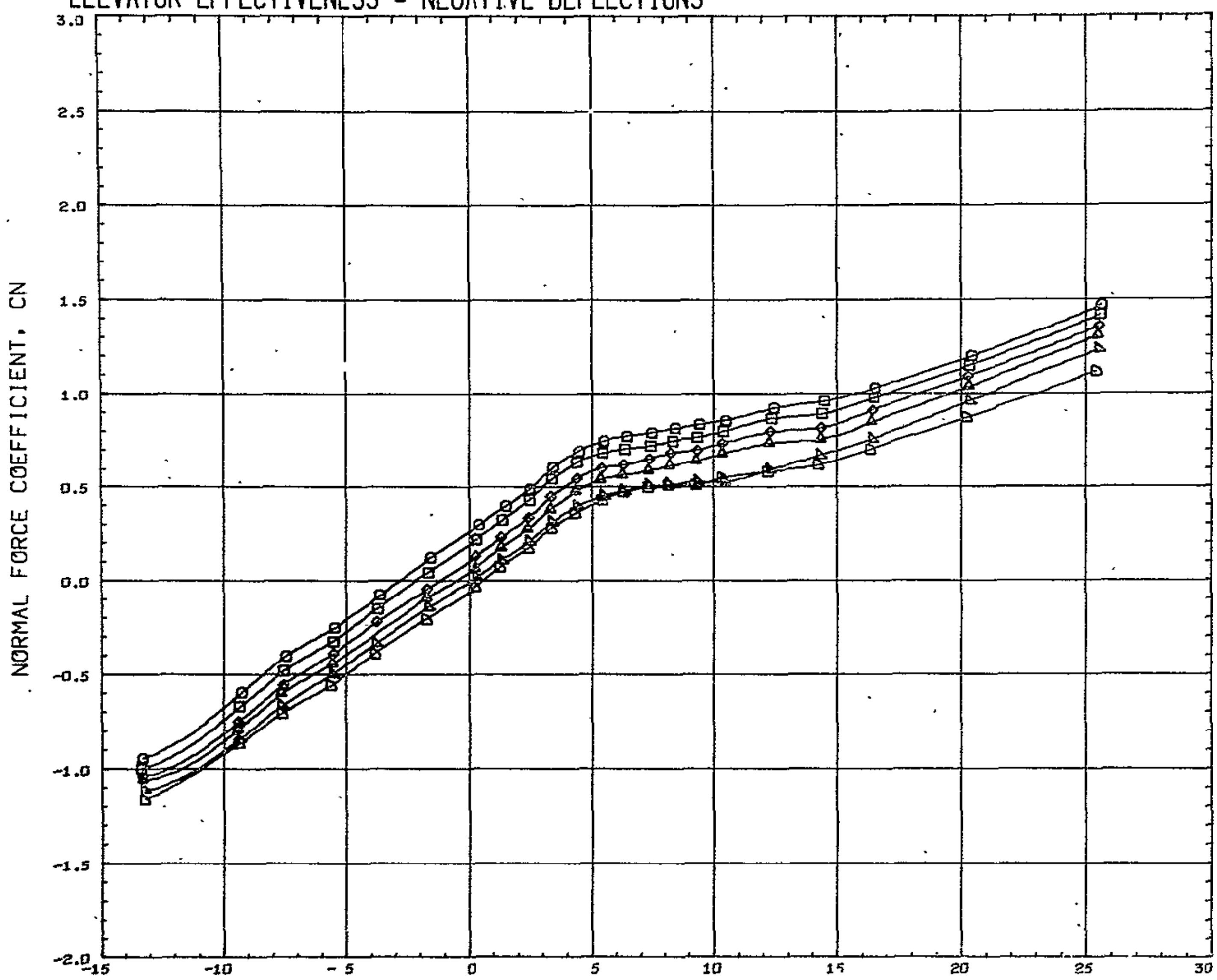


SYMBOL	ELEVTR	PARAMETRIC VALUES			
O	0.000	MACH	0.250	BETA	0.000
□	5.000	RUDDER	0.000	FLAPS	0.000
◇	10.000	HORIT	0.000		
Δ	15.000				
▷	20.000				
◁	30.000	REFERENCE FILE			

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

ELEVATOR EFFECTIVENESS - NEGATIVE DEFLECTIONS

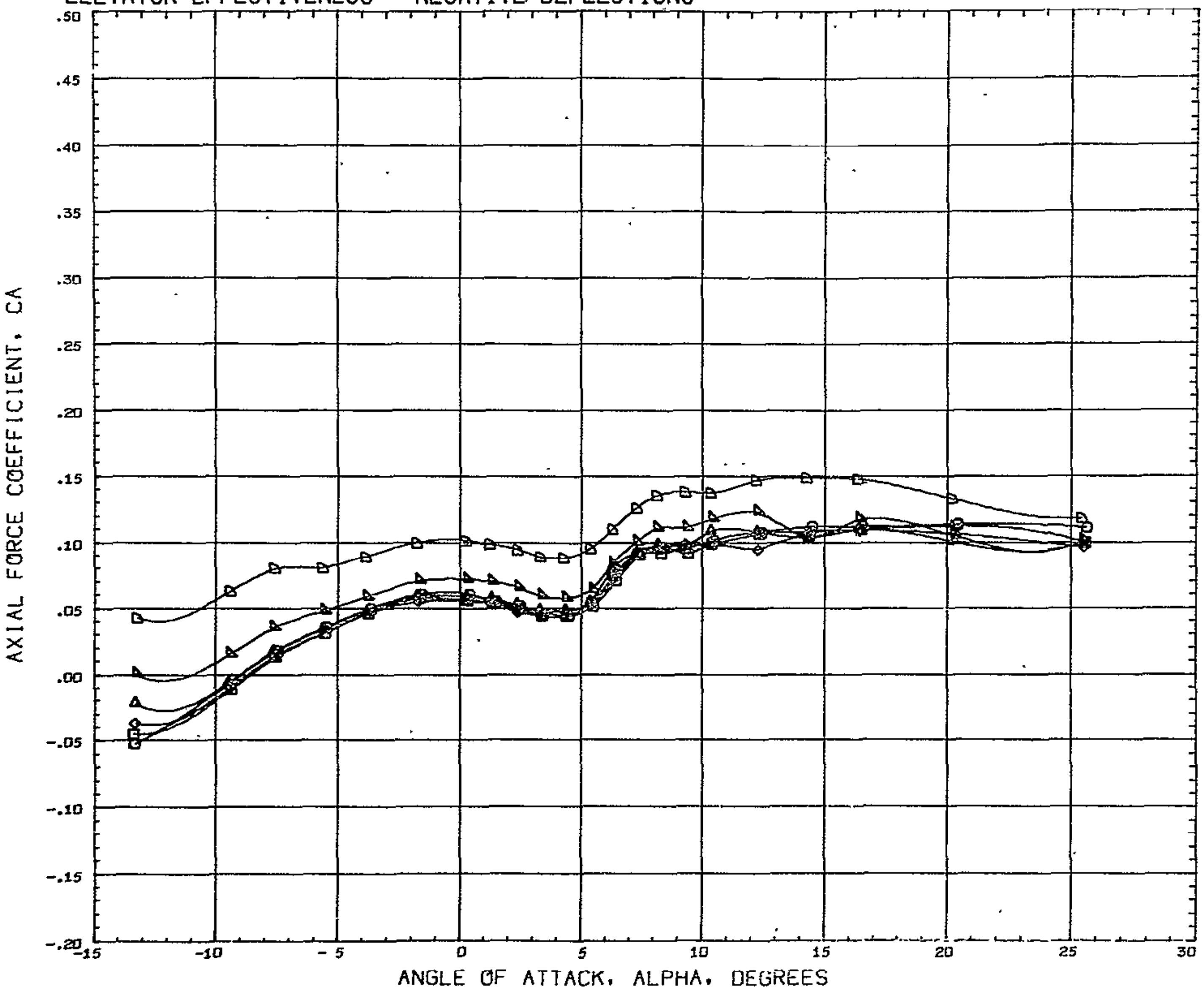


SYMBOL	ELEVTR	PARAMETRIC VALUES			
○	0.000	MACH	0.250	BETA	0.000
□	- 5.000	RUDDER	0.000	FLAPS	0.000
◇	- 10.000	HORIT	0.000		
△	- 15.000				
◺	- 20.000				
◻	- 30.000	REFERENCE FILE			

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

ELEVATOR EFFECTIVENESS - NEGATIVE DEFLECTIONS

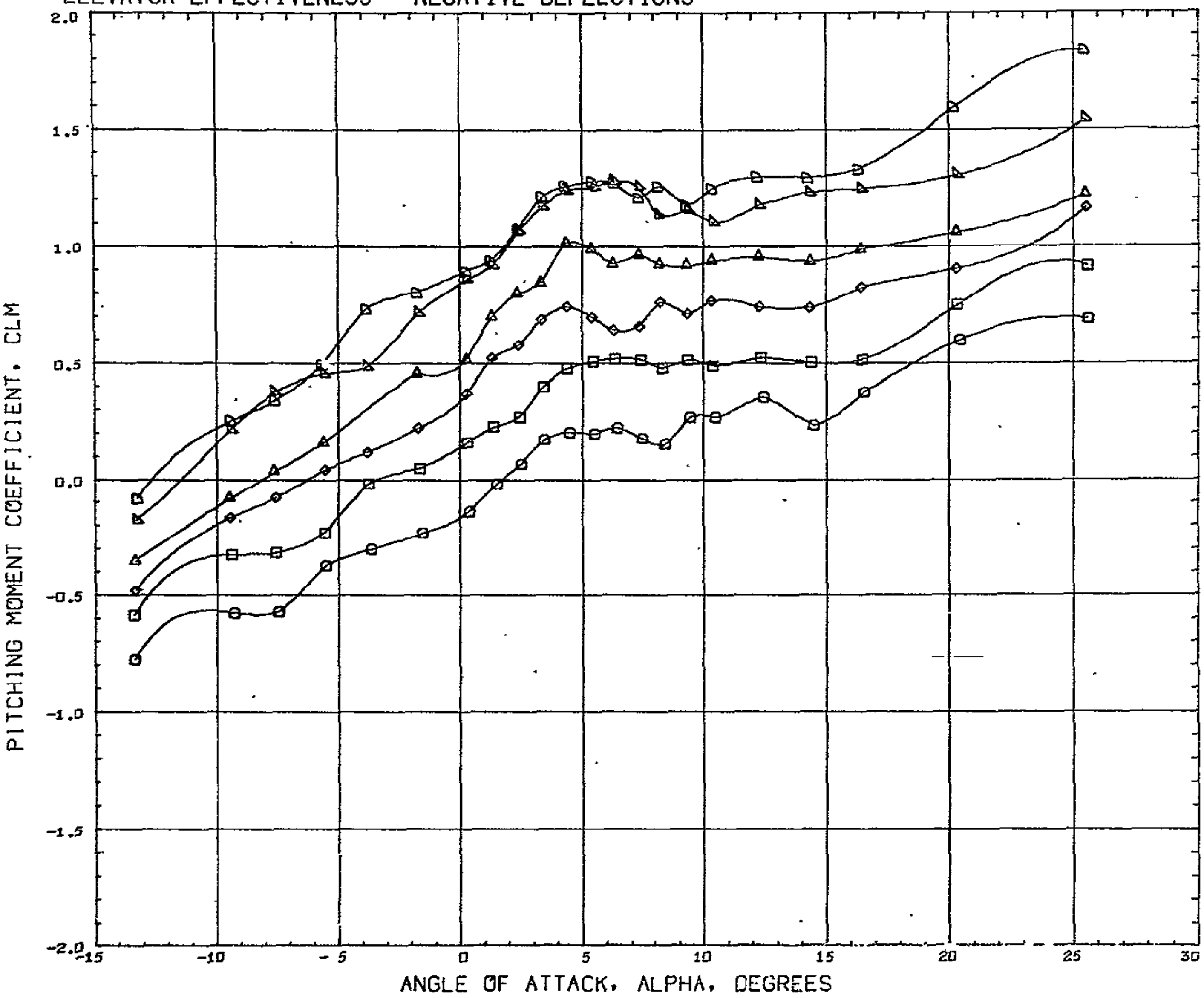


SYMBOL	ELEVTR	PARAMETRIC VALUES			
○	0.000	MACH	0.250	BETA	0.000
□	- 5.000	RUDDER	0.000	FLAPS	0.000
◇	- 10.000	HORIT	0.000		
△	- 15.000				
◺	- 20.000				
◻	- 30.000	REFERENCE FILE			

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

ELEVATOR EFFECTIVENESS - NEGATIVE DEFLECTIONS

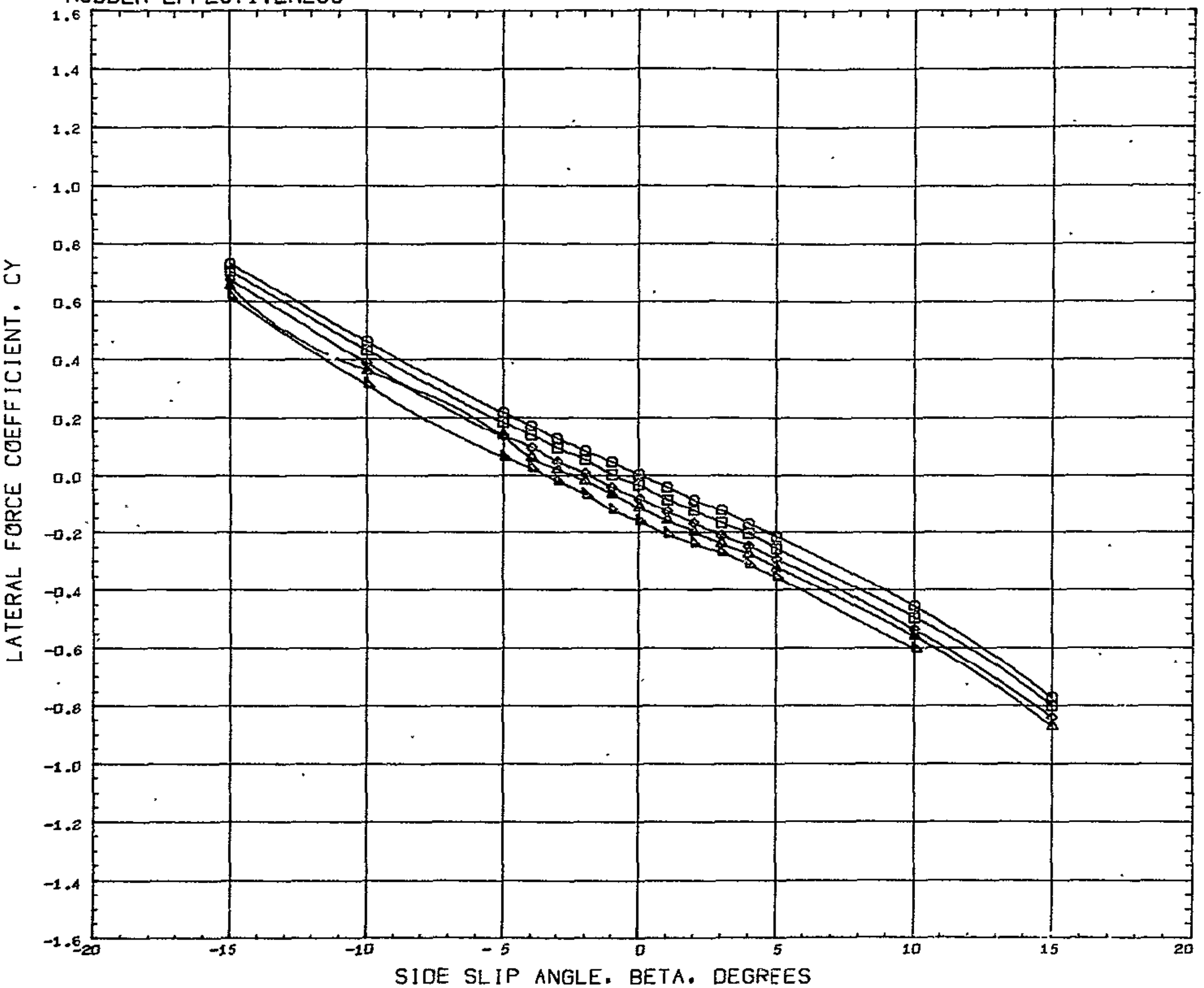


SYMBOL	ELEVTR	PARAMETRIC VALUES			
◻	0.000	MACH	0.250	BETA	0.000
◻	-5.000	RUDDER	0.000	FLAPS	0.000
◇	-10.000	HORIT	0.000		
△	-15.000				
◺	-20.000				
◻	-30.000	REFERENCE FILE			

REFERENCE INFORMATION

REFS	2.5000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

RUDDER EFFECTIVENESS



SYMBOL	RUDDER
O	0.000
□	5.000
◇	10.000
Δ	15.000
◺	20.000

PARAMETRIC VALUES

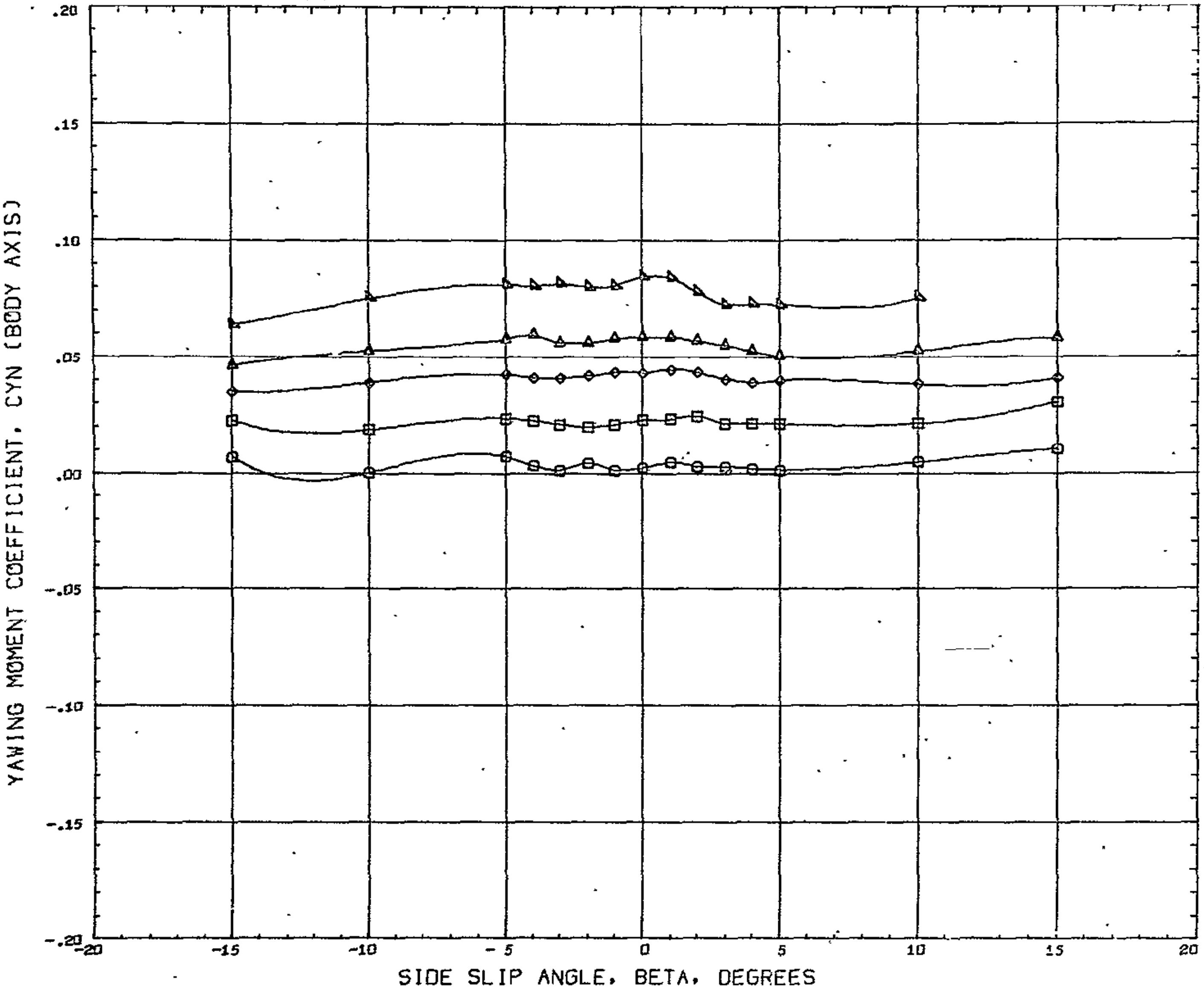
MACH 0.250 ALPHA 0.370

REFERENCE FILE

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

RUDDER EFFECTIVENESS

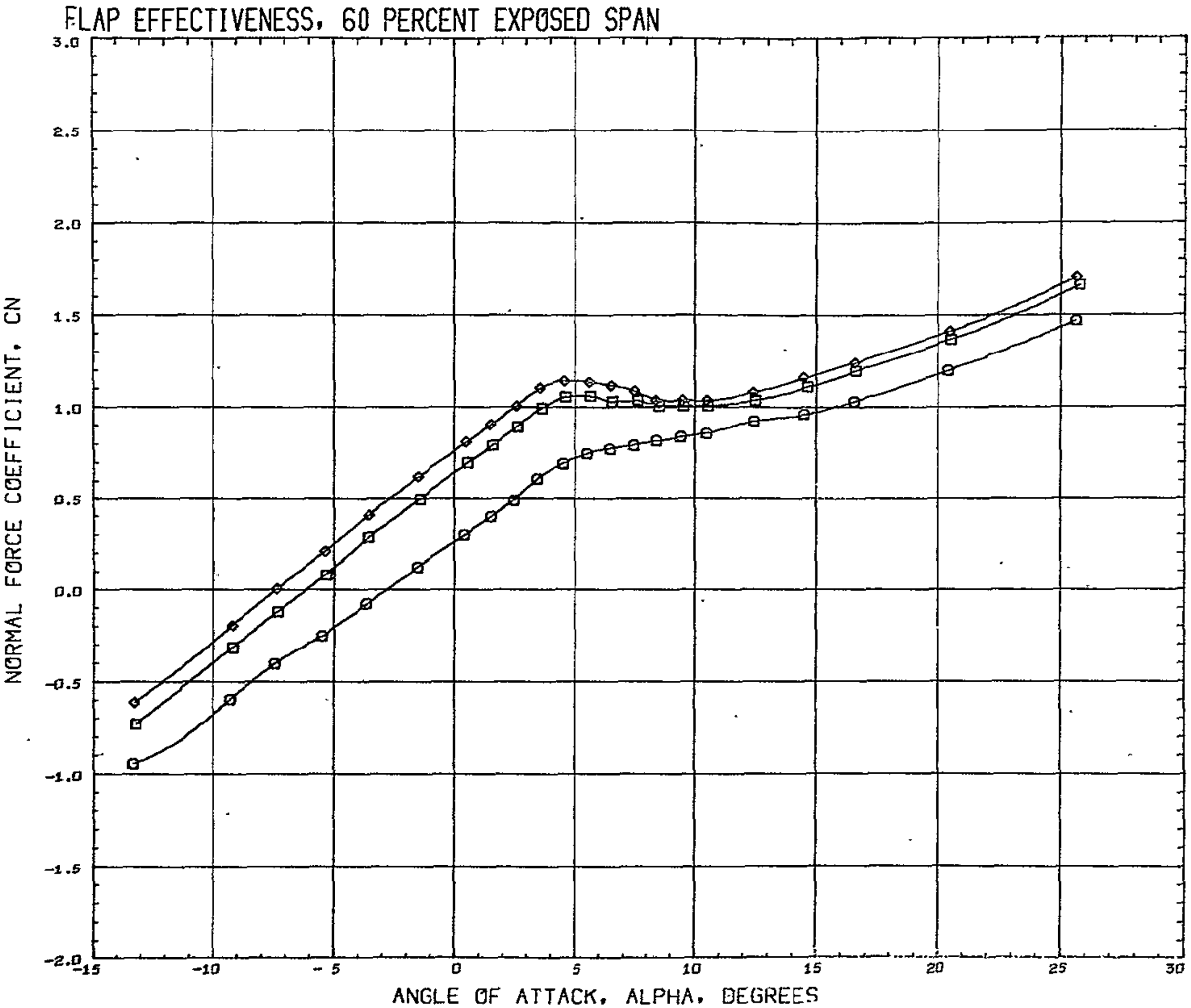


SYMBOL	RUDDER	PARAMETRIC VALUES			
○	0.000	MACH	0.250	ALPHA	0.370
□	5.000				
◇	10.000				
△	15.000				
◺	20.000				

REFERENCE FILE

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

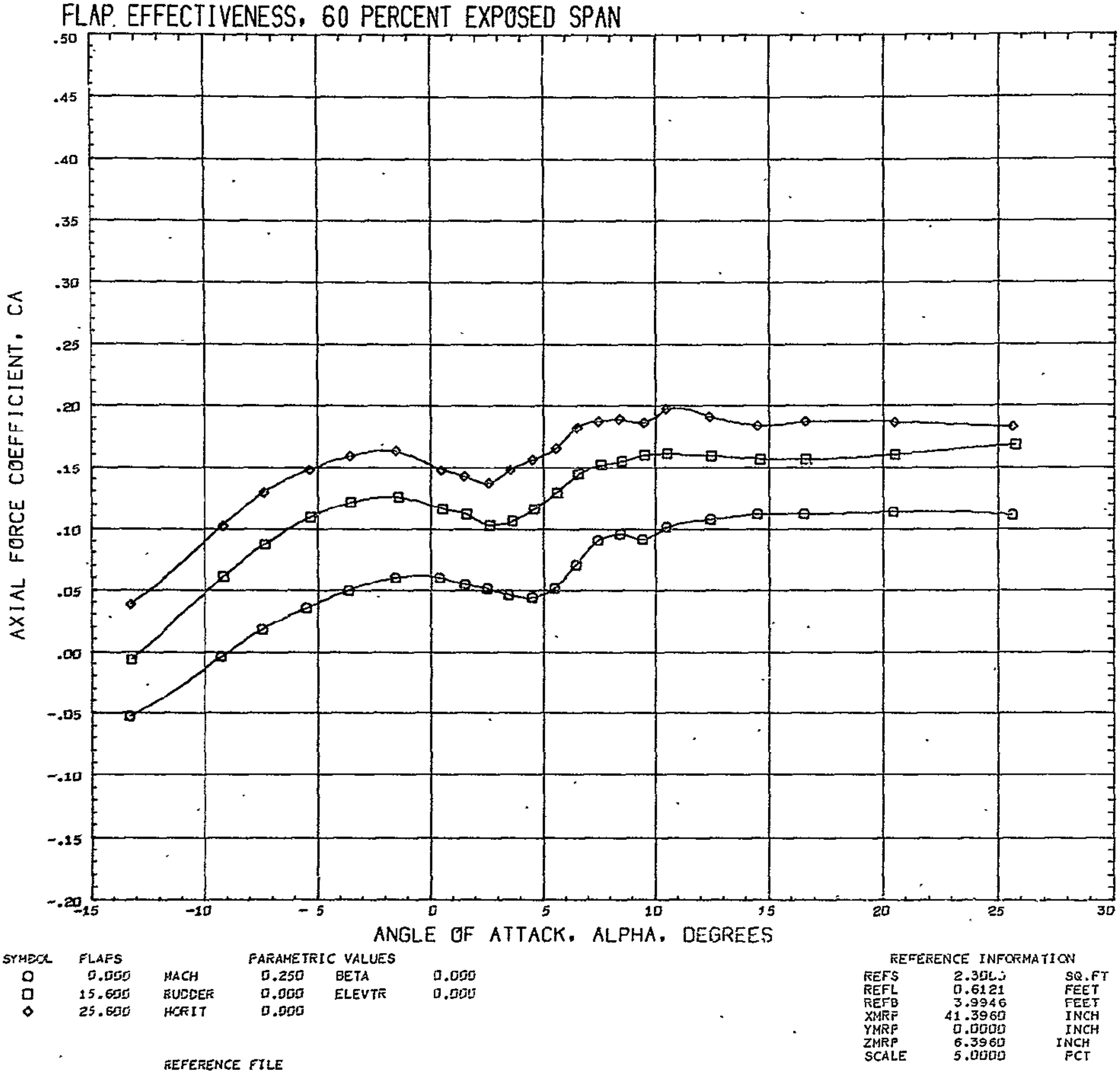


SYMBOL	FLAPS	PARAMETRIC VALUES			
○	0.000	MACH	0.250	BETA	0.000
□	15.600	RUDDER	0.000	ELEVTR	0.000
◇	25.600	HORIT	0.000		

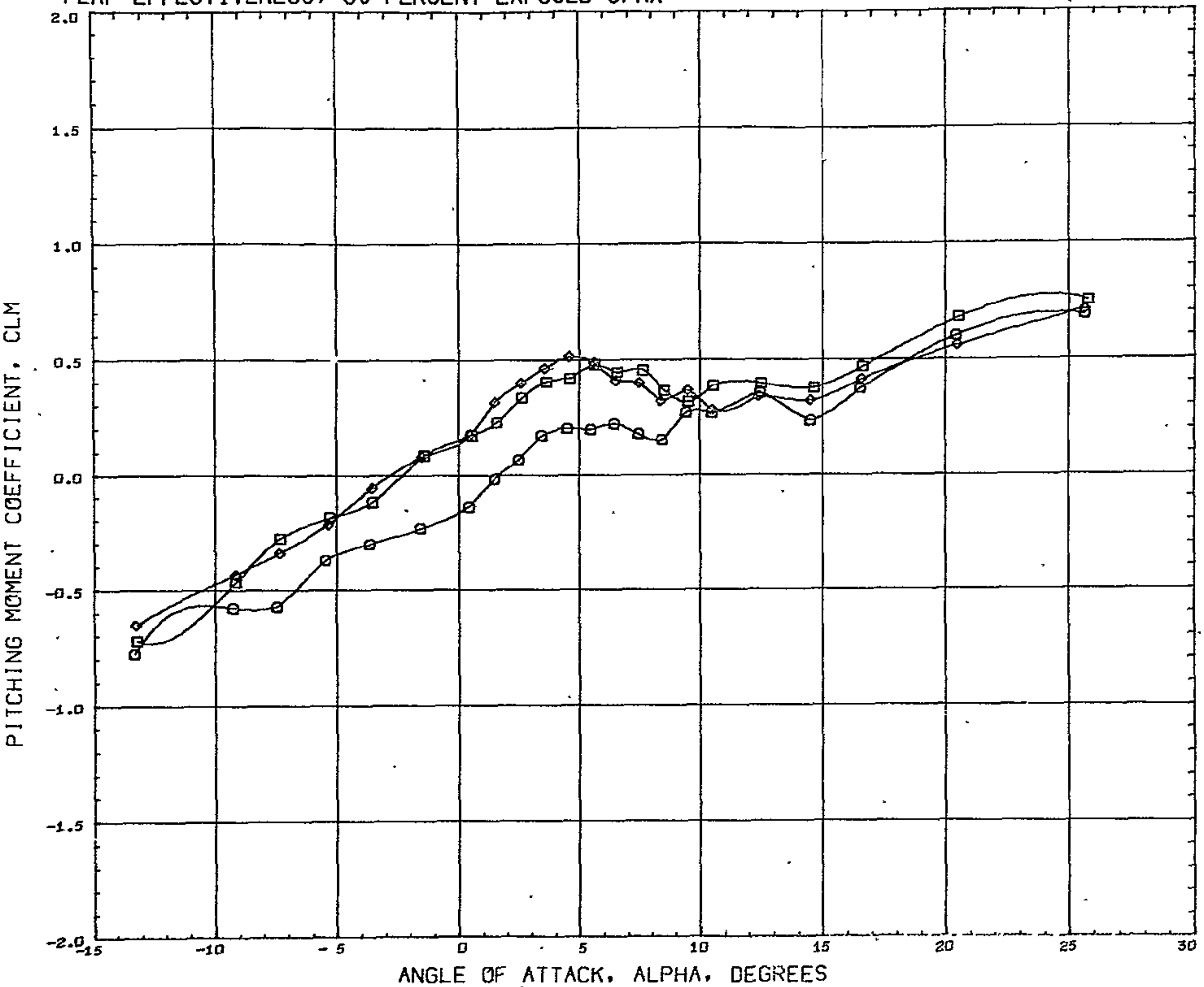
REFERENCE FILE

REFERENCE INFORMATION

REFS	2.3003	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	FCT


FLAP EFFECTIVENESS, 60 PERCENT EXPOSED SPAN
AXIAL FORCE COEFFICIENT, CA
ANGLE OF ATTACK, ALPHA, DEGREES
.50
.45
.40
.35
.30
.25
.20
.15
.10
.05
.00
-.05
-.10
-.15
-.20
-15
-10
-5
0
5
10
15
20
25
30
SYMBOL FLAPS PARAMETRIC VALUES
O 0.000 MACH 0.250 BETA 0.000
□ 15.600 RUDDER 0.000 ELEVTR 0.000
◇ 25.600 HORIT 0.000
REFERENCE INFORMATION
REFS 2.30[illegible] SQ.FT
REFL 0.6121 FEET
REFB 3.9946 FEET
XMRP 41.3960 INCH
YMRP 0.0000 INCH
ZMRP 6.3960 INCH
SCALE 5.0000 PCT
REFERENCE FILE

FLAP EFFECTIVENESS, 60 PERCENT EXPØSED SPAN



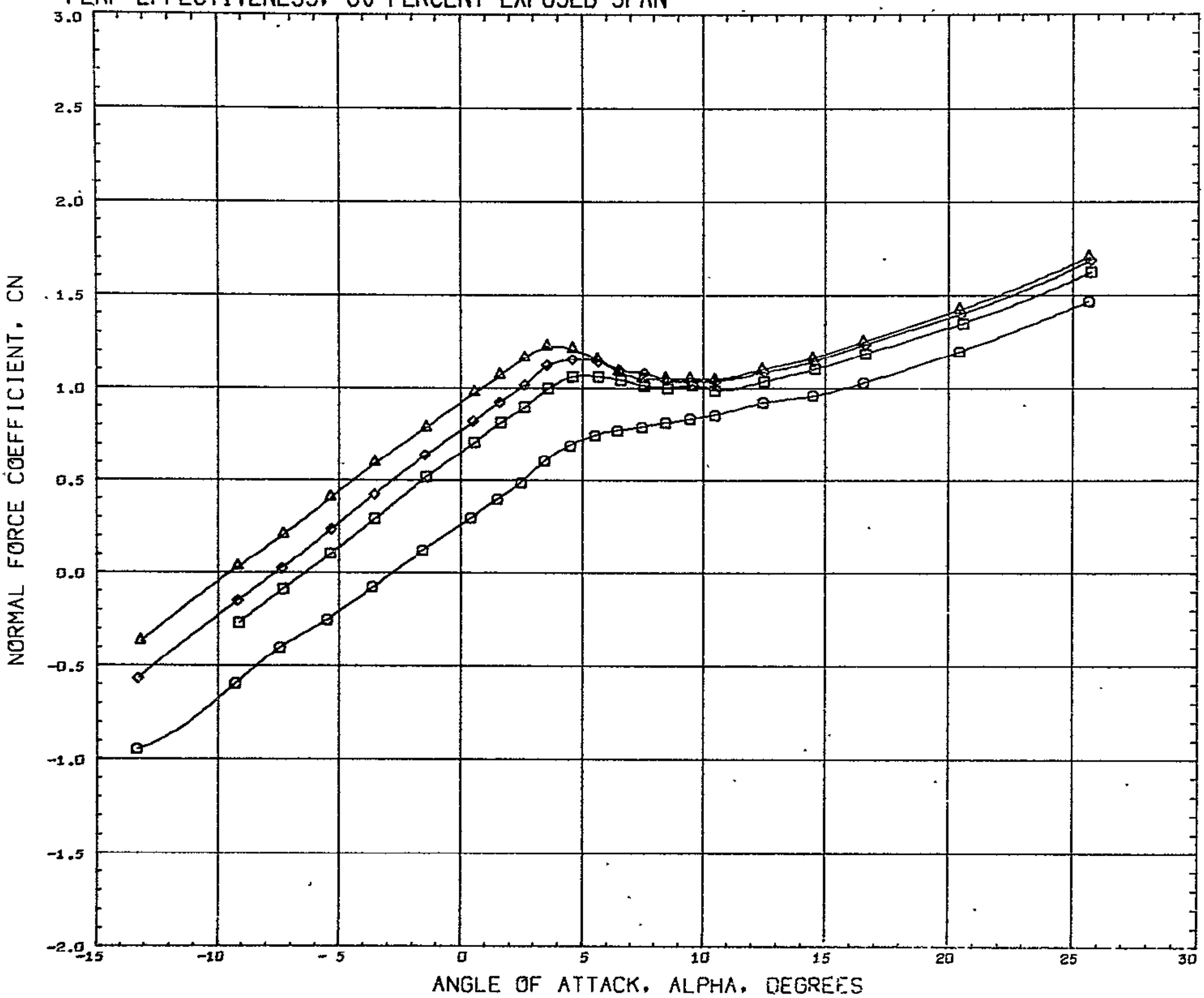
SYMBOL	FLAPS	PARAMETRIC VALUES			
○	0.000	MACH	0.250	BETA	0.000
□	15.600	RUDDER	0.000	ELEVTR	0.000
◇	25.600	HORIT	0.000		

REFERENCE INFORMATION

REFS	2.3600	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

REFERENCE FILE

FLAP EFFECTIVENESS, 60 PERCENT EXPOSED SPAN



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(SG6011)	○	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6 FLP= 0.0
(SG6025)	□	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=15.6
(SG6033)	◇	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=25.6
(SG6037)	△	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=45.6

PARAMETRIC VALUES

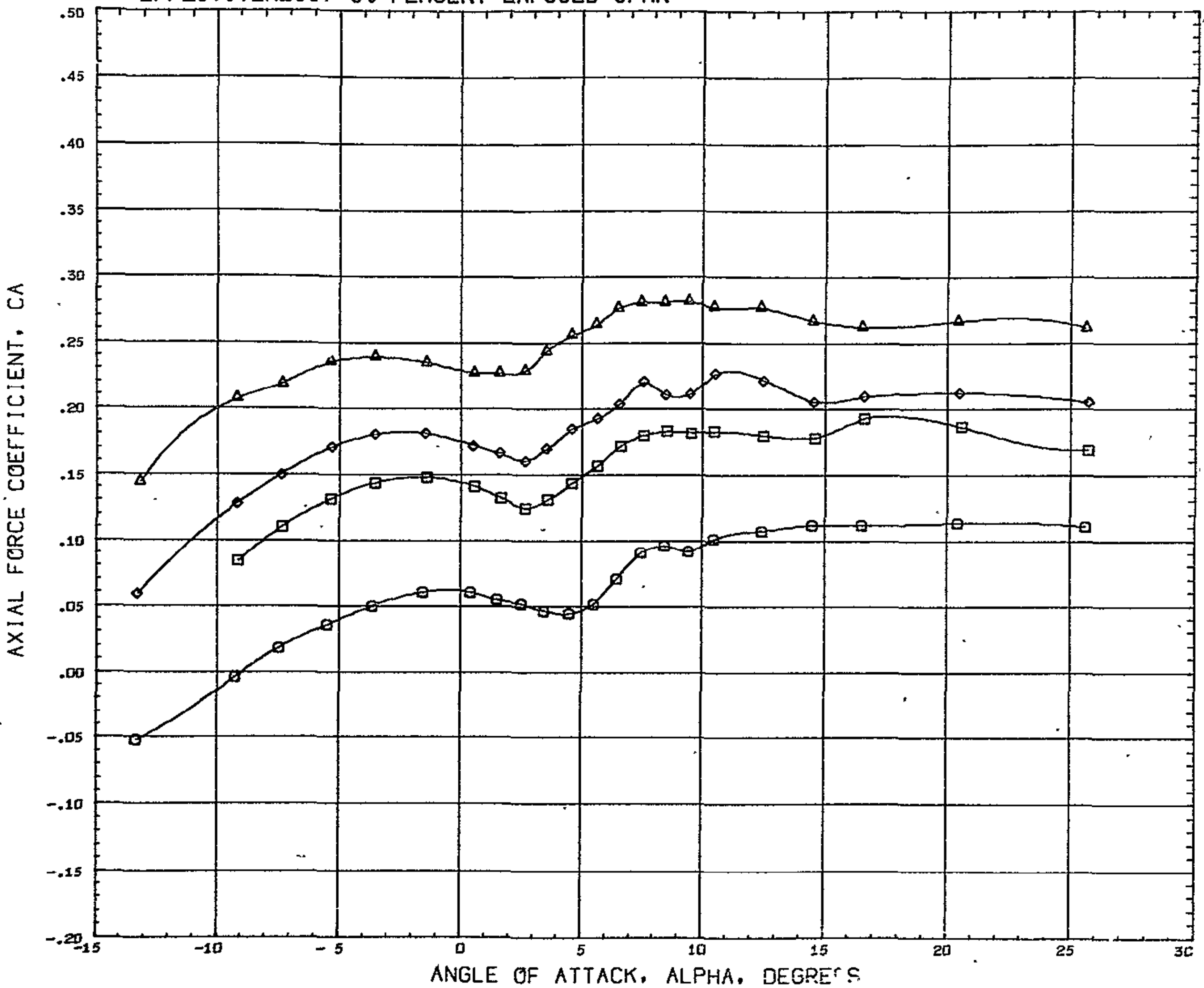
BETA	0.000	RUDDER	0.000
ELEVTR	0.000	HORIT	0.000

REFERENCE INFORMATION

REFS	2.300L	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

MACH 0.250

FLAP EFFECTIVENESS, 60 PERCENT EXPOSED SPAN



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(SG6011)	O	MSC S-8 PT 1 S-4 SHUTTLECRAFT B1W2V3H6 FLP= 0.0
(SG6025)	□	MSC S-8 PT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=15.6
(SG6033)	◇	MSC S-8 PT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=25.6
(SG6037)	Δ	MSC S-8 PT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=45.6

PARAMETRIC VALUES

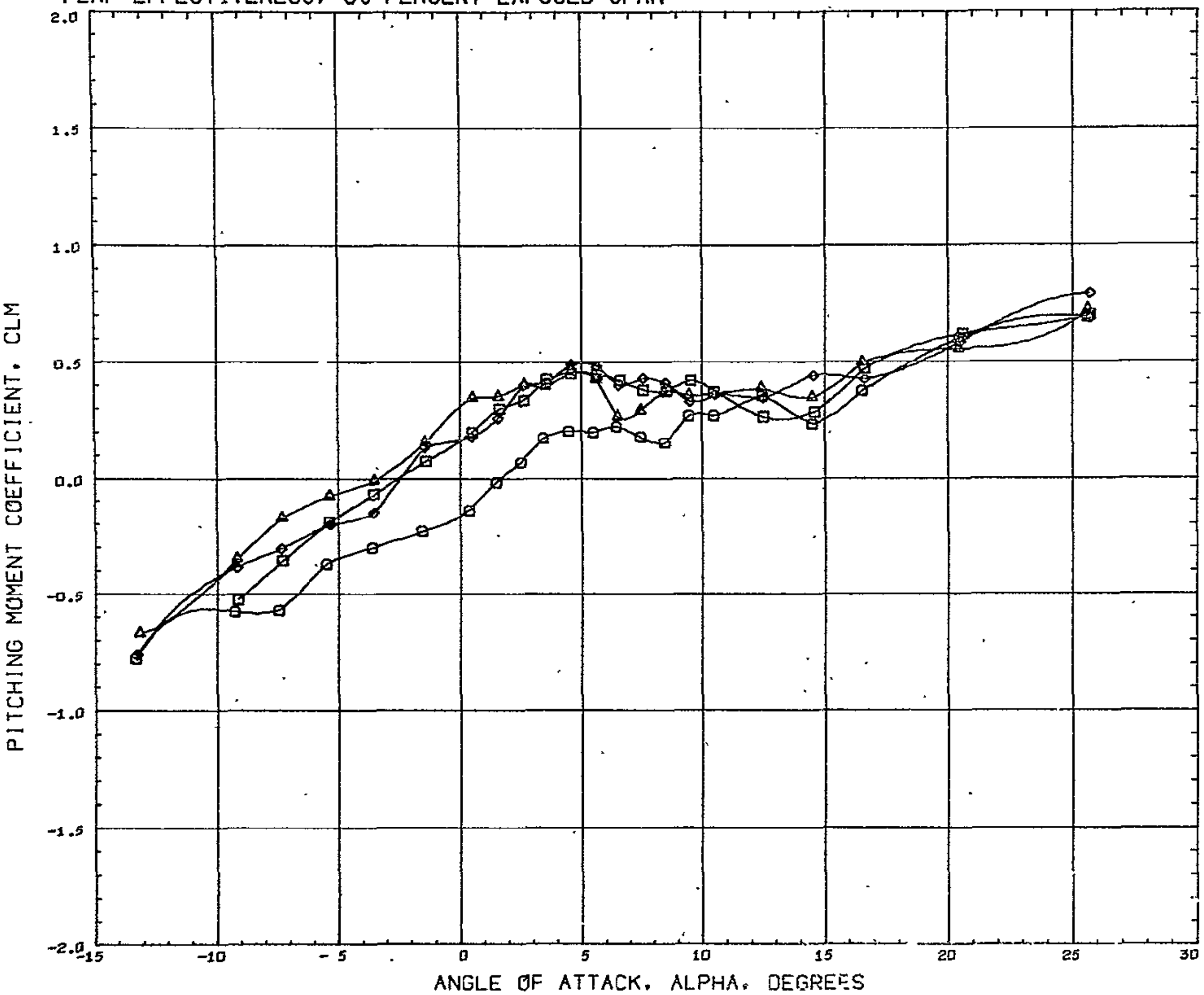
BETA	0.000	RUDDER	0.000
ELEVTR	0.000	HORIT	0.000

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

MACH 0.250

FLAP EFFECTIVENESS, 60 PERCENT EXPØSED SPAN



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(SG6011)	○	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6 FLP= 0.0
(SG6025)	□	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=15.6
(SG6033)	◇	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=25.6
(SG6037)	△	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=45.6

MACH 0.250

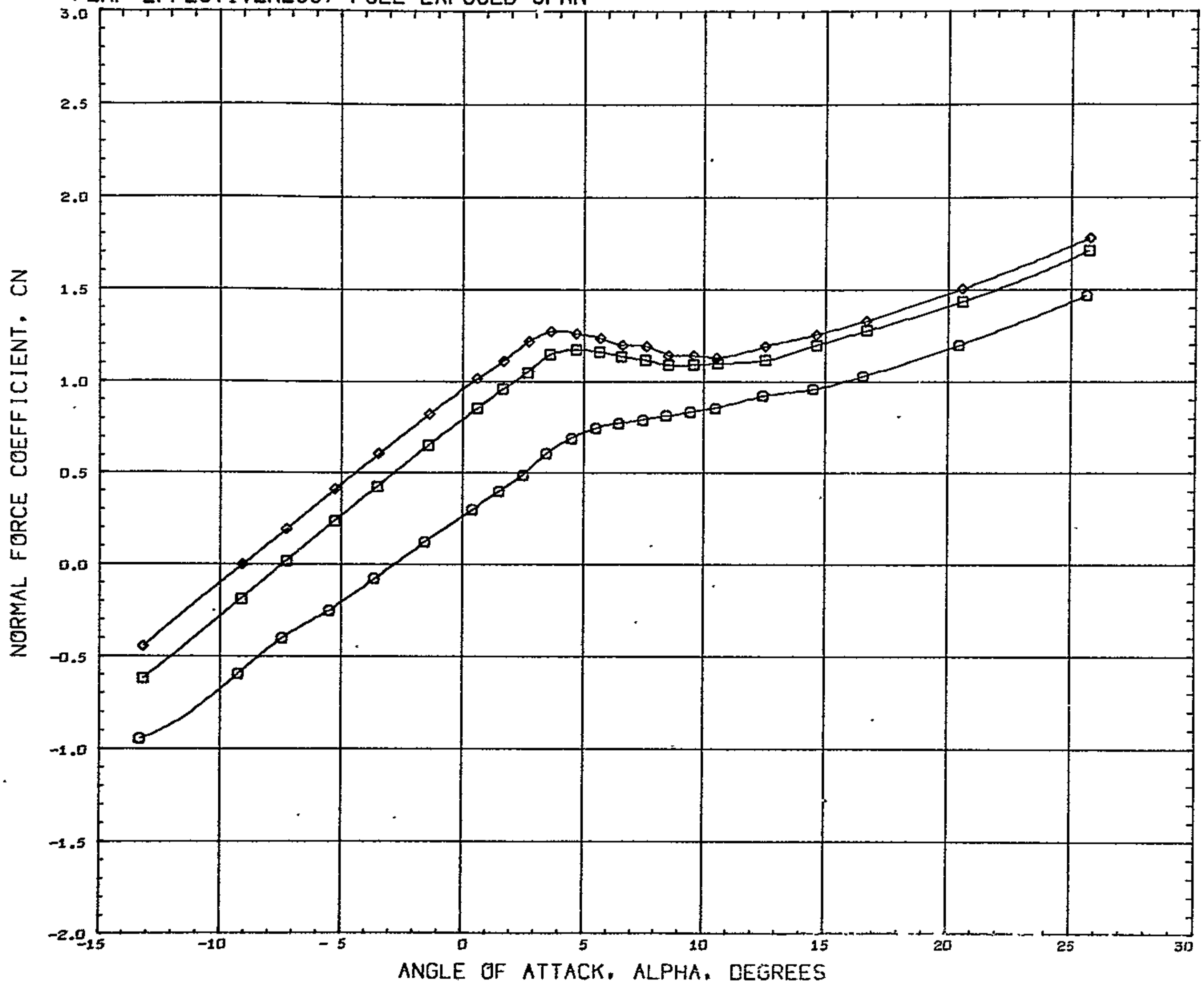
PARAMETRIC VALUES

BETA	0.000	RUDDER	0.000
ELEVTR	0.000	HORIT	0.000

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

FLAP EFFECTIVENESS, FULL EXPOSED SPAN



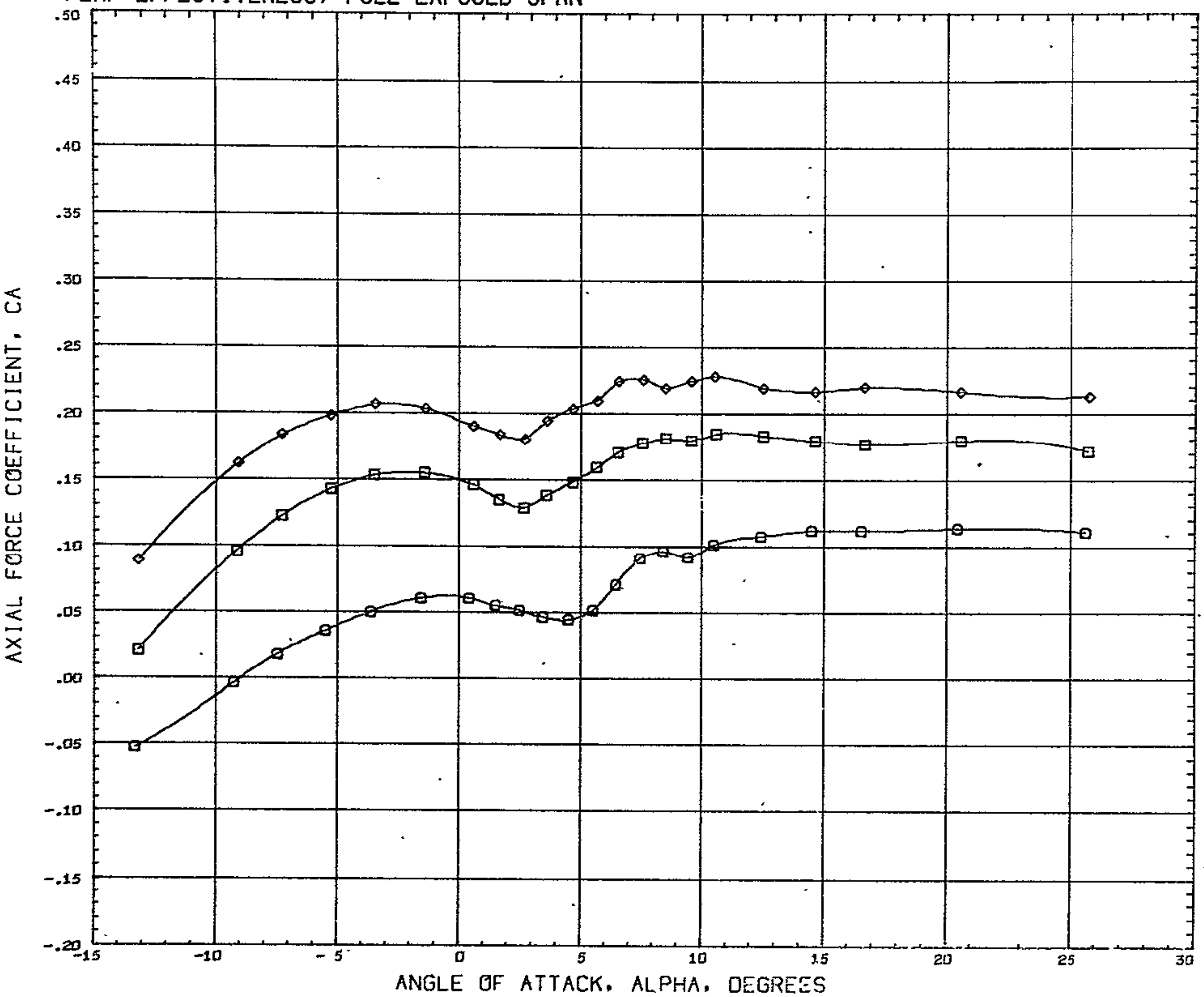
SYMBOL	FLAPS	PARAMETRIC VALUES			
○	0.000	MACH	0.250	BETA	0.000
□	15.000	RUDDER	0.000	ELEVTR	0.000
◇	25.000	HORIT	0.000		

REFERENCE FILE

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

FLAP EFFECTIVENESS, FULL EXPOSED SPAN



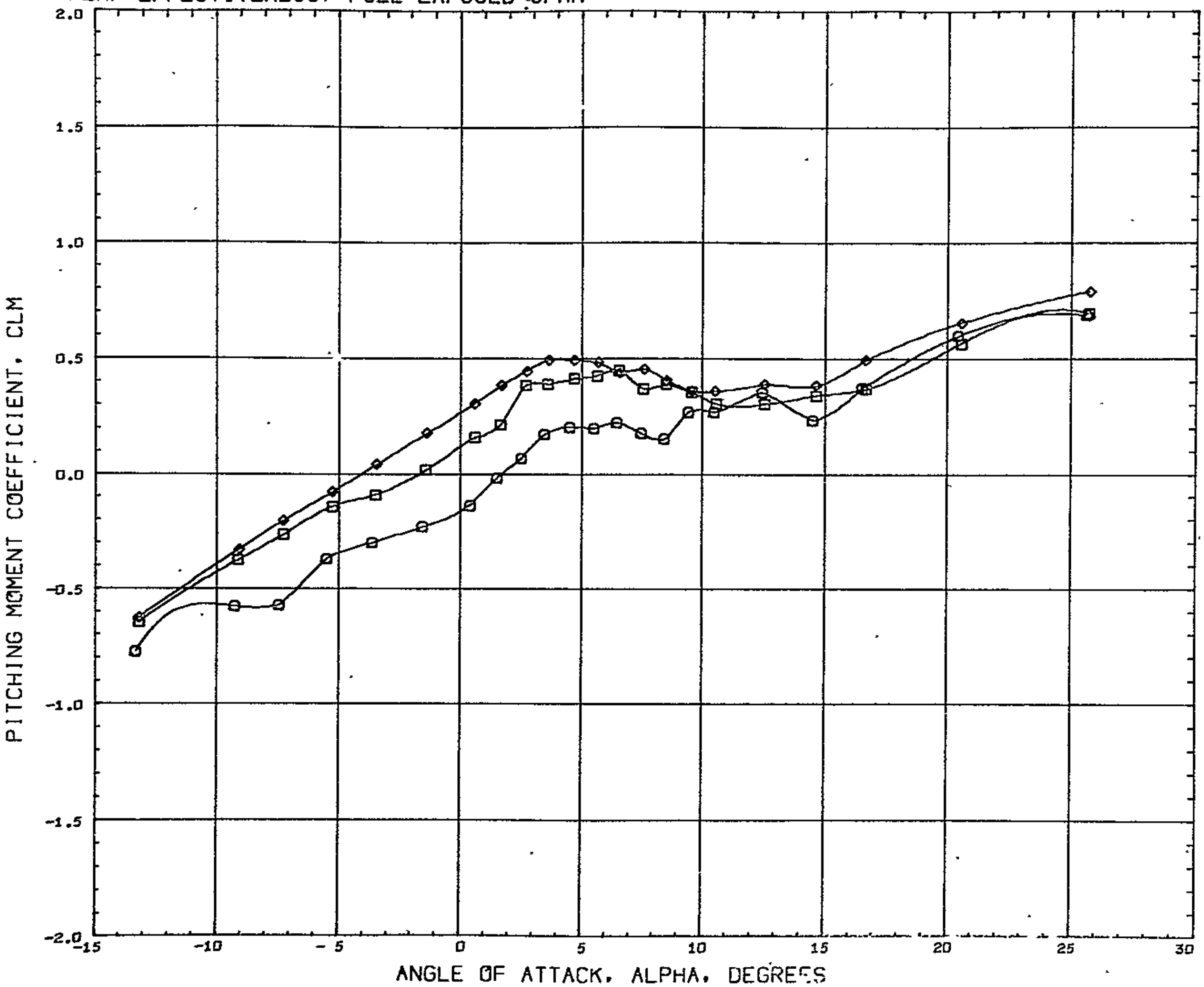
SYMBOL	FLAPS	PARAMETRIC VALUES			
○	0.000	MACH	0.250	BETA	0.000
□	15.000	RUDDER	0.000	ELEVTR	0.000
◇	25.000	HORIT	0.000		

REFERENCE INFORMATION

REFS	2.0000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

REFERENCE FILE

FLAP EFFECTIVENESS, FULL EXPOSED SPAN



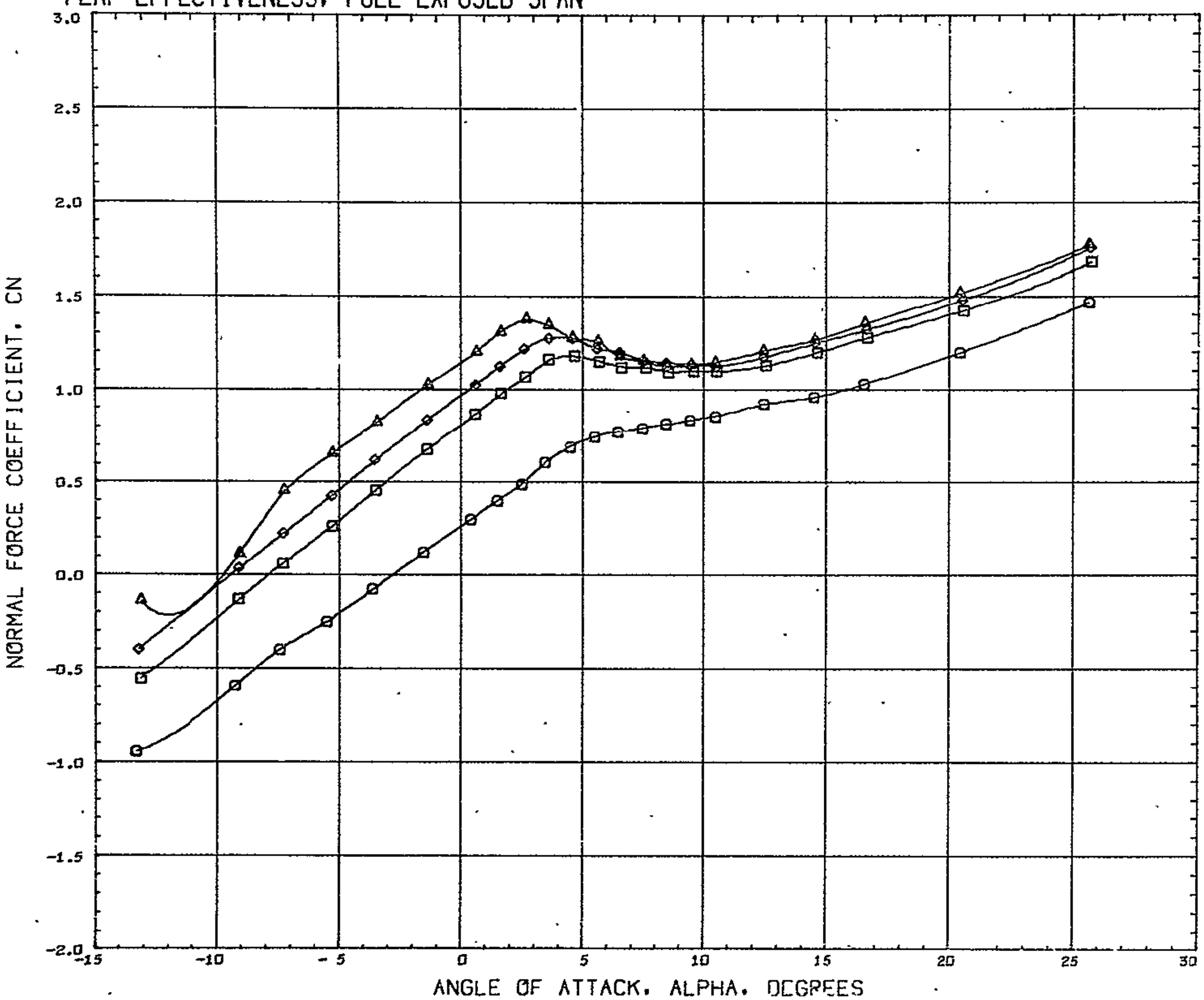
SYMBOL	FLAPS	PARAMETRIC VALUES			
O	0.000	MACH	0.250	BETA	0.000
□	15.000	RUDDER	0.000	ELEVTR	0.000
◇	25.000	HORIT	0.000		

REFERENCE FILE

REFERENCE INFORMATION

REFS	2.5000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

FLAP EFFECTIVENESS, FULL EXPOSED SPAN



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(SG6011)	○	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6 FLP= 0.0
(SG6023)	□	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=15.0
(SG6031)	◇	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=25.0
(SG6039)	△	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=45.0

PARAMETRIC VALUES

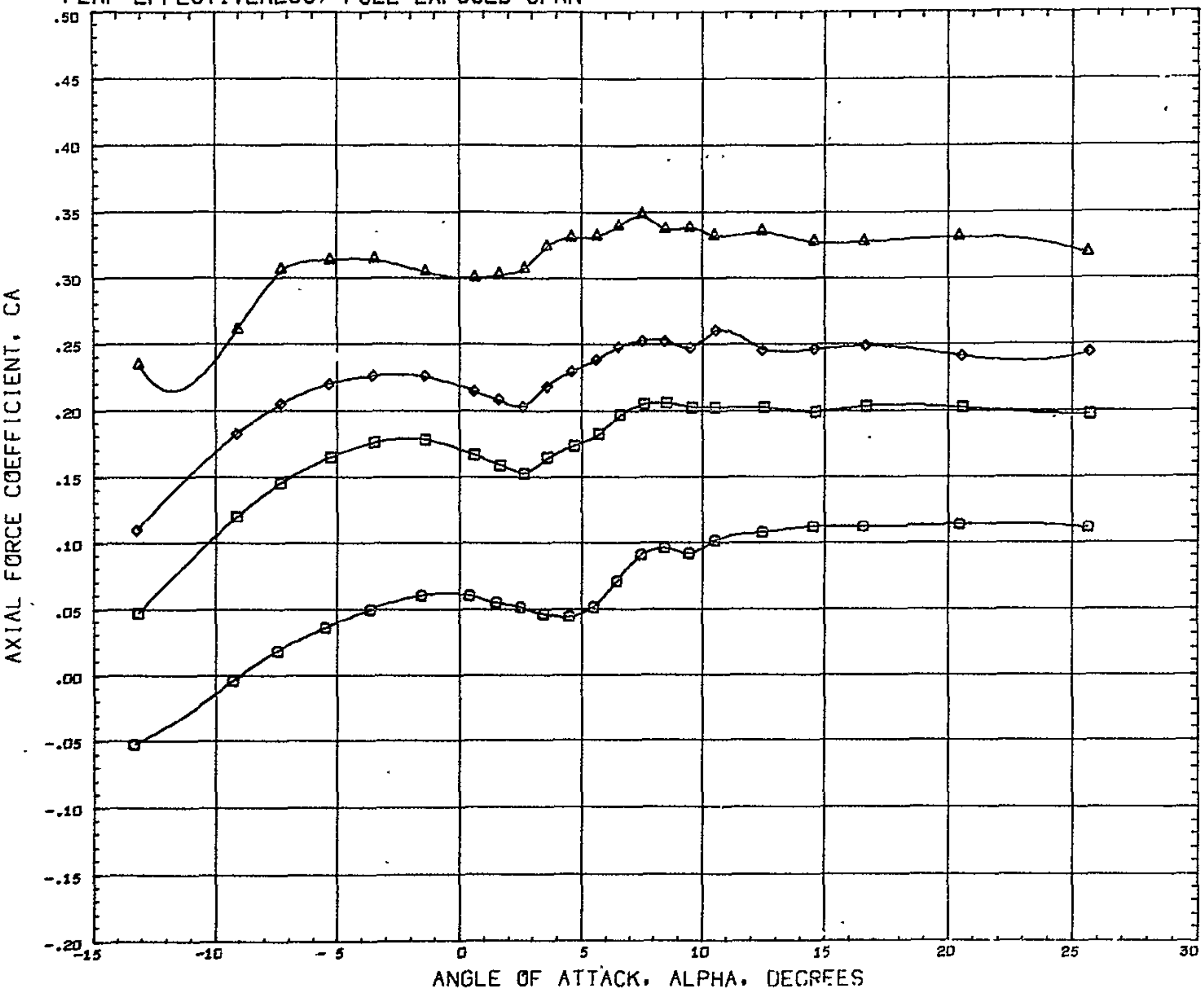
BETA	0.000	RUDDER	0.000
ELEVTR	0.000	HORIT	0.000

REFERENCE INFORMATION

REFS.	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

MACH 0.250

FLAP EFFECTIVENESS, FULL EXPOSED SPAN



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(SG6011)	O	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6 FLP= 0.0
(SG6023)	□	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=15.0
(SG6031)	◇	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=25.0
(SG6039)	Δ	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLP=45.0

MACH 0.250

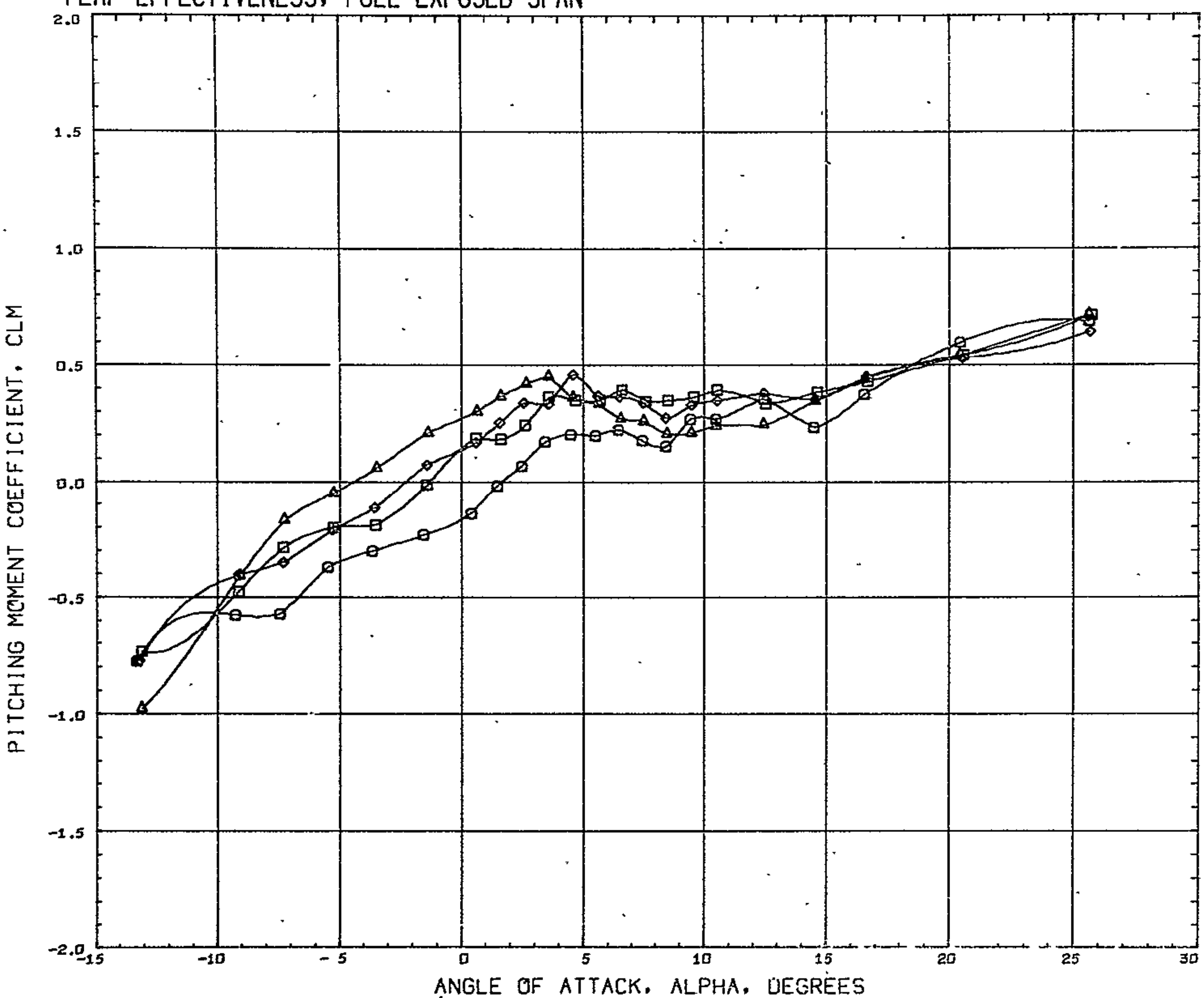
PARAMETRIC VALUES

BETA	0.000	RUDDER	0.000
ELEVTR	0.000	HORIT	0.000

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

FLAP EFFECTIVENESS, FULL EXPOSED SPAN



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(SG6011)	○	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6 FLF= 0.0
(SG6023)	□	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLF=15.0
(SG6031)	◇	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLF=25.0
(SG6039)	△	MSC S-8 FT 1 S-4 SHUTTLECRAFT B1W2V3H6L FLF=45.0

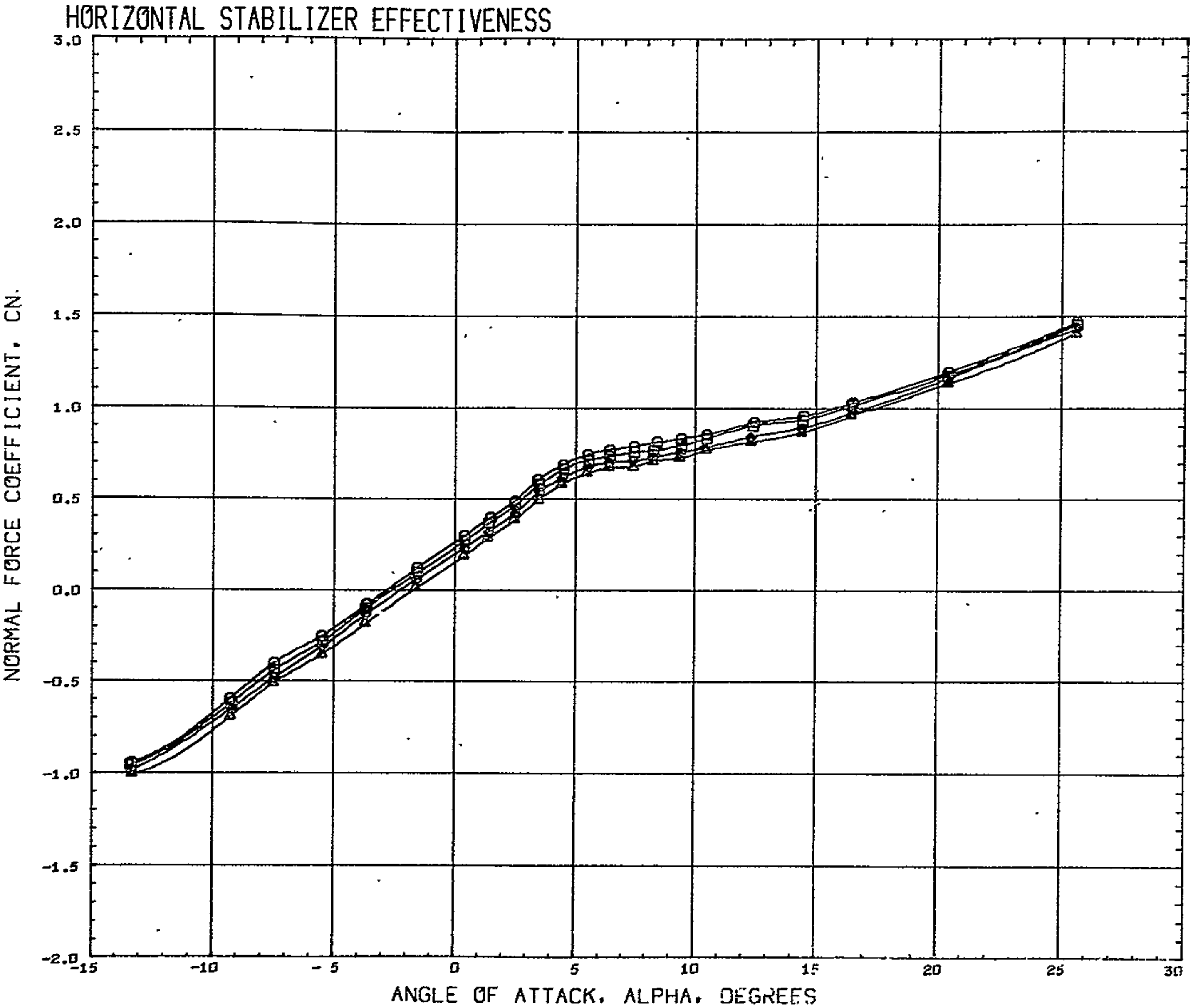
PARAMETRIC VALUES

BETA	0.000	RUDDER	0.000
ELEVTR	0.000	HORIT	0.000

REFERENCE INFORMATION

REFS	2.3500	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

MACH 0.250



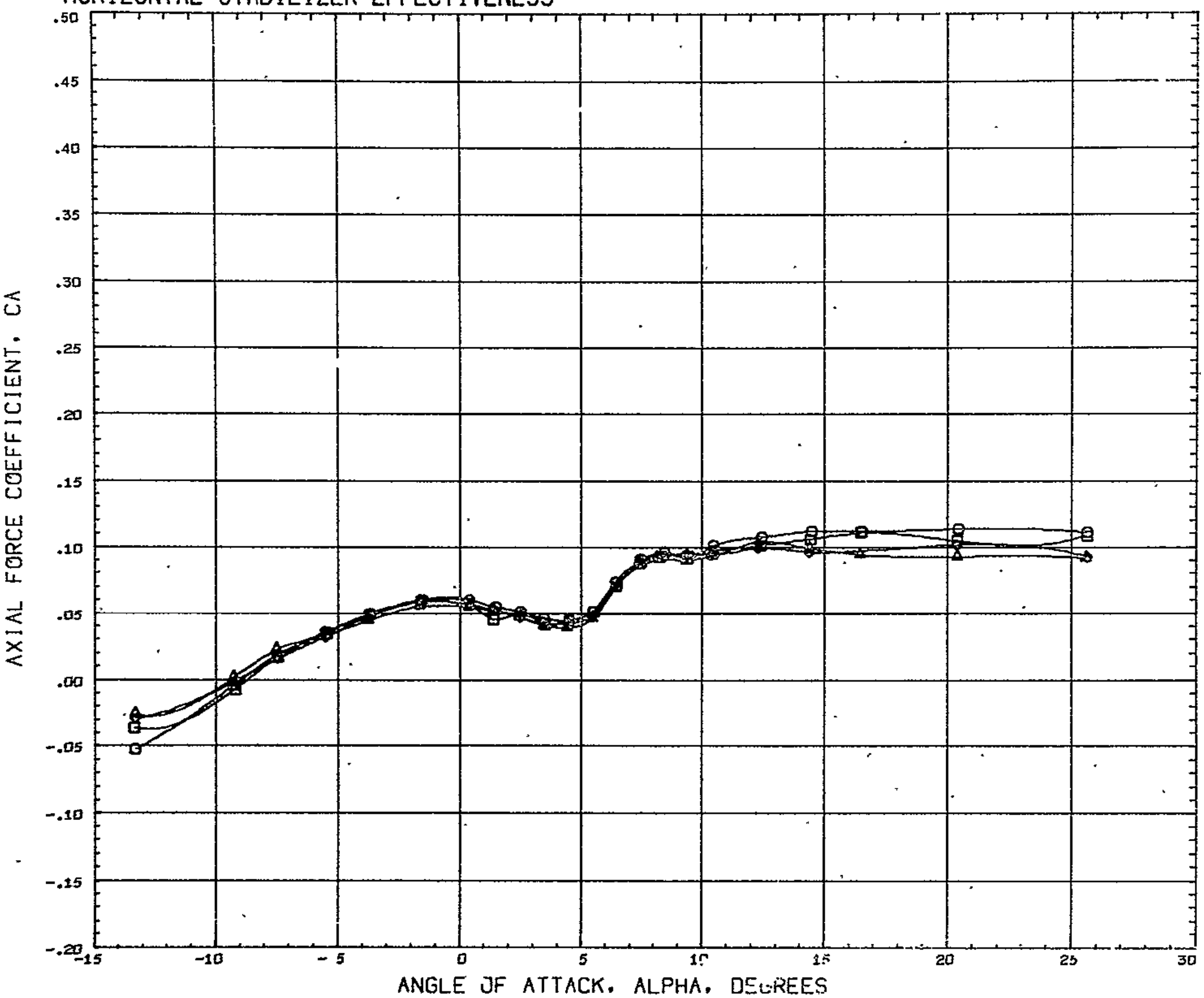
SYMBOL	HORIT	PARAMETRIC VALUES			
○	0.000	MACH	0.250	BETA	0.000
□	- 2.000	RUDDER	0.000	ELEVTR	0.000
◇	- 4.000	FLAPS	0.000		
△	- 6.000				

REFERENCE FILE

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

HORIZONTAL STABILIZER EFFECTIVENESS

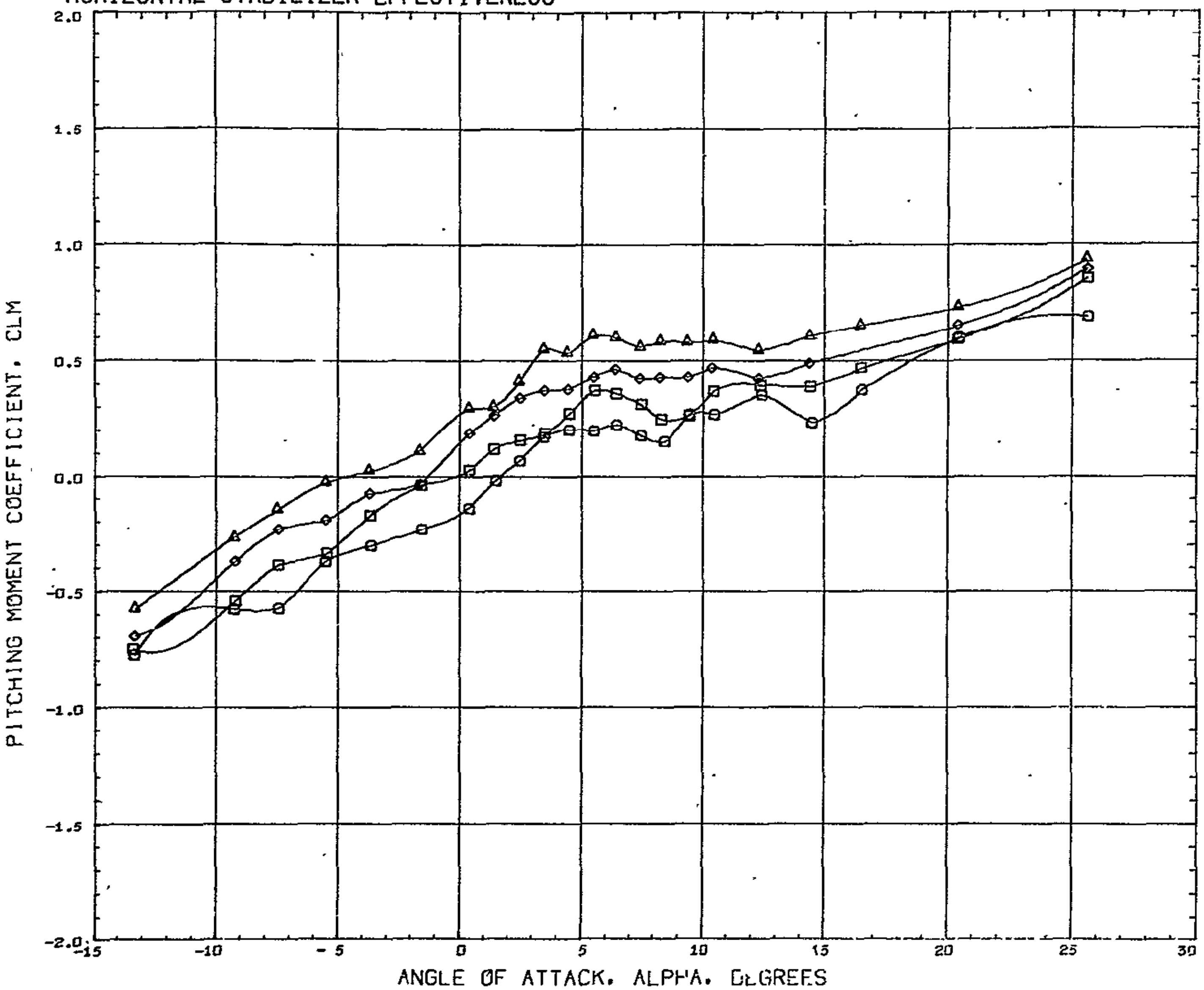


SYMBOL	HORIT	PARAMETRIC VALUES			
○	0.000	MACH	0.250	BETA	0.000
□	- 2.000	RUDDER	0.000	ELEVTR	0.000
◇	- 4.000	FLAPS	0.000		
△	- 6.000				

REFERENCE FILE

REFERENCE INFORMATION		
REFS	2.5000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

HORIZONTAL STABILIZER EFFECTIVENESS



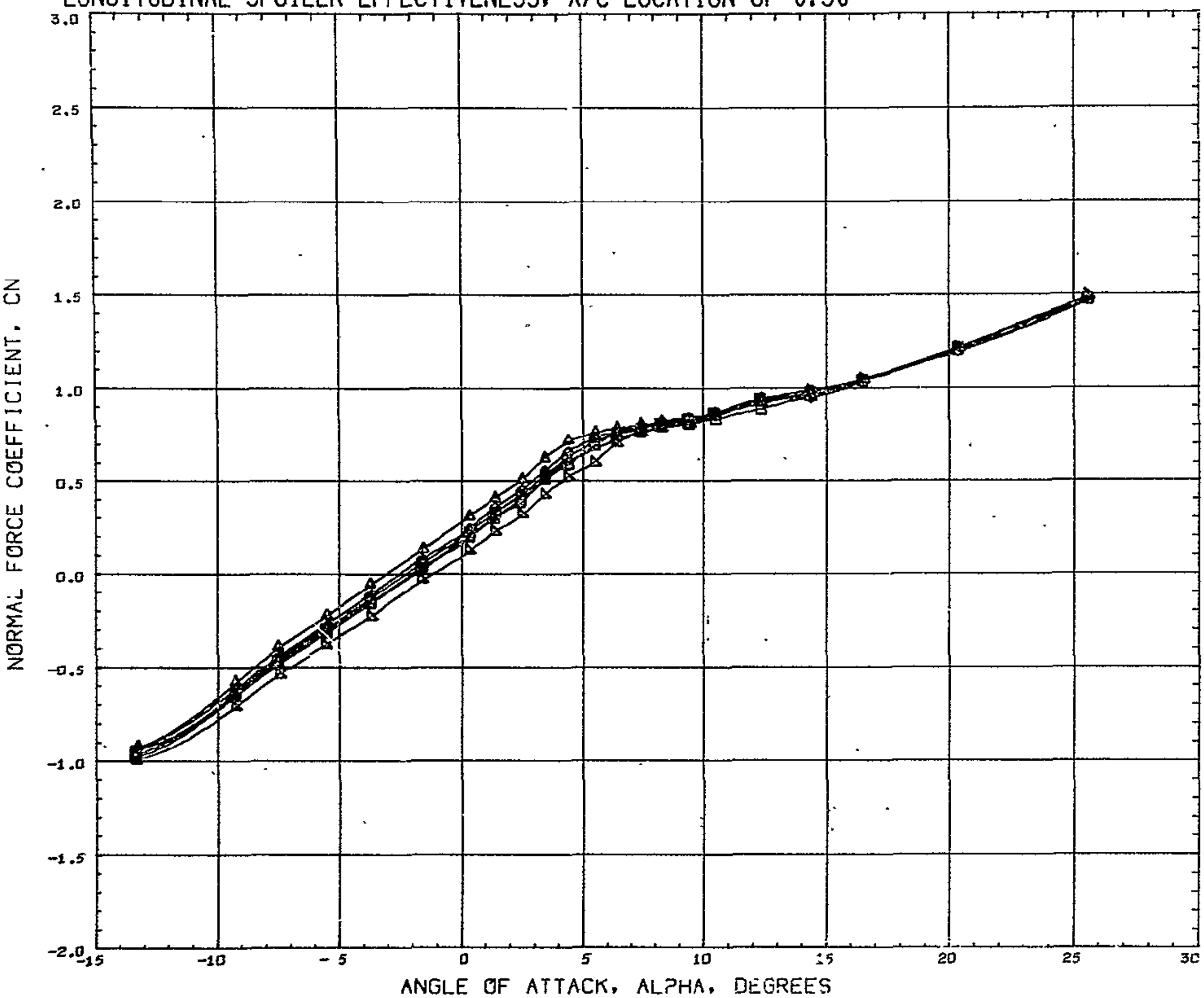
SYMBOL	HORIT	PARAMETRIC VALUES			
O	0.000	MACH	0.250	BETA	0.000
□	- 2.000	RUDDER	0.000	ELEVTR	0.000
◇	- 4.000	FLAPS	0.000		
Δ	- 6.000				

REFERENCE FILE

REFERENCE INFORMATION

REFS	2.3030	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

LONGITUDINAL SPOILER EFFECTIVENESS, X/C LOCATION OF 0.50

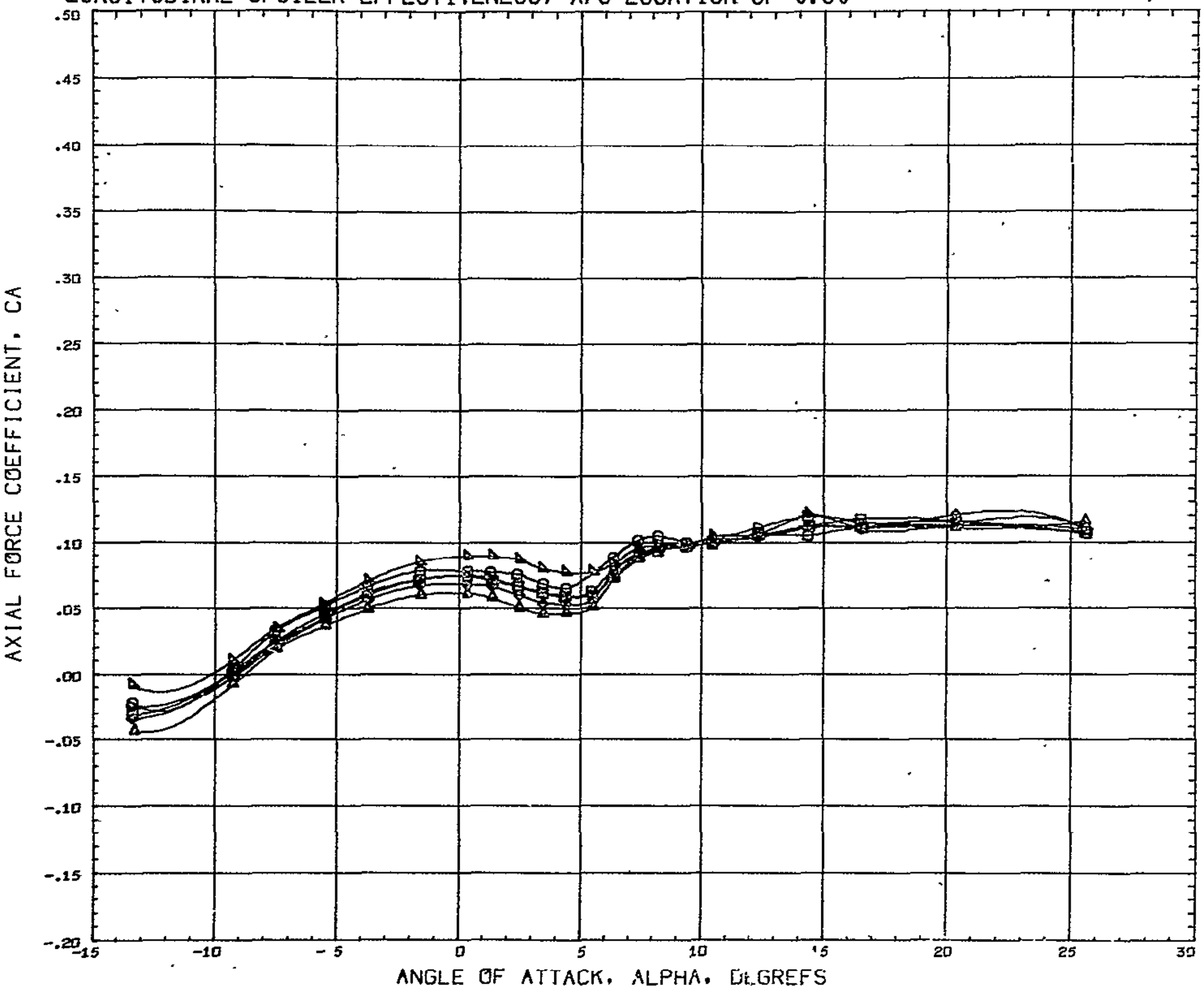


SYMBOL	SPOLER	PARAMETRIC VALUES			
○	1.500	MACH	0.250	BETA	0.000
□	2.500				
◇	3.500				
△	4.500				
◺	5.500				
D	6.500	REFERENCE FILE			

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

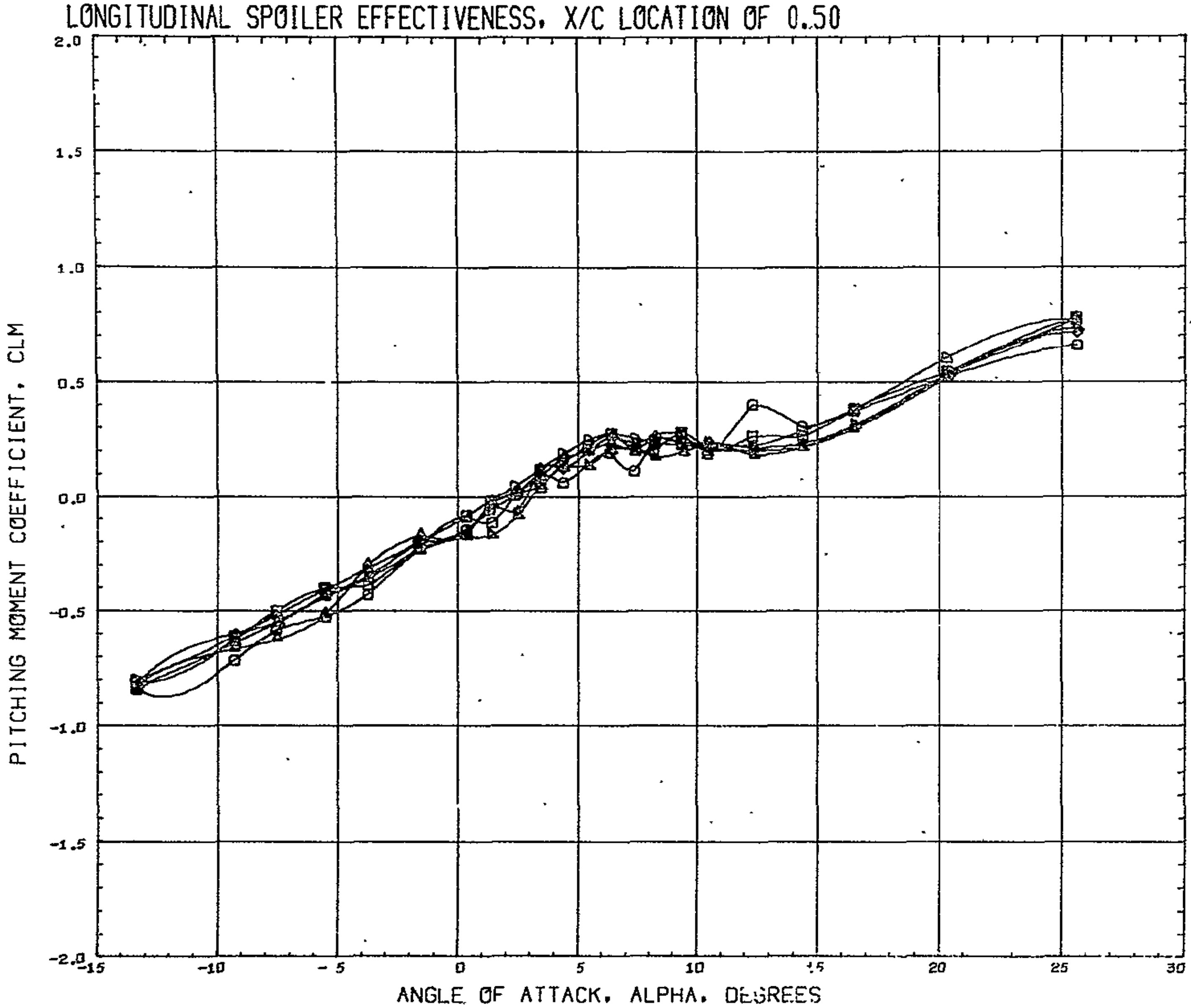
LONGITUDINAL SPOILER EFFECTIVENESS, X/C LOCATION OF 0.50



SYMBOL	SPOILER	PARAMETRIC VALUES			
○	1.500	MACH	0.250	BETA	0.000
□	2.500				
◇	3.500				
△	4.500				
◺	5.500				
D	6.500	REFERENCE FILE			

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

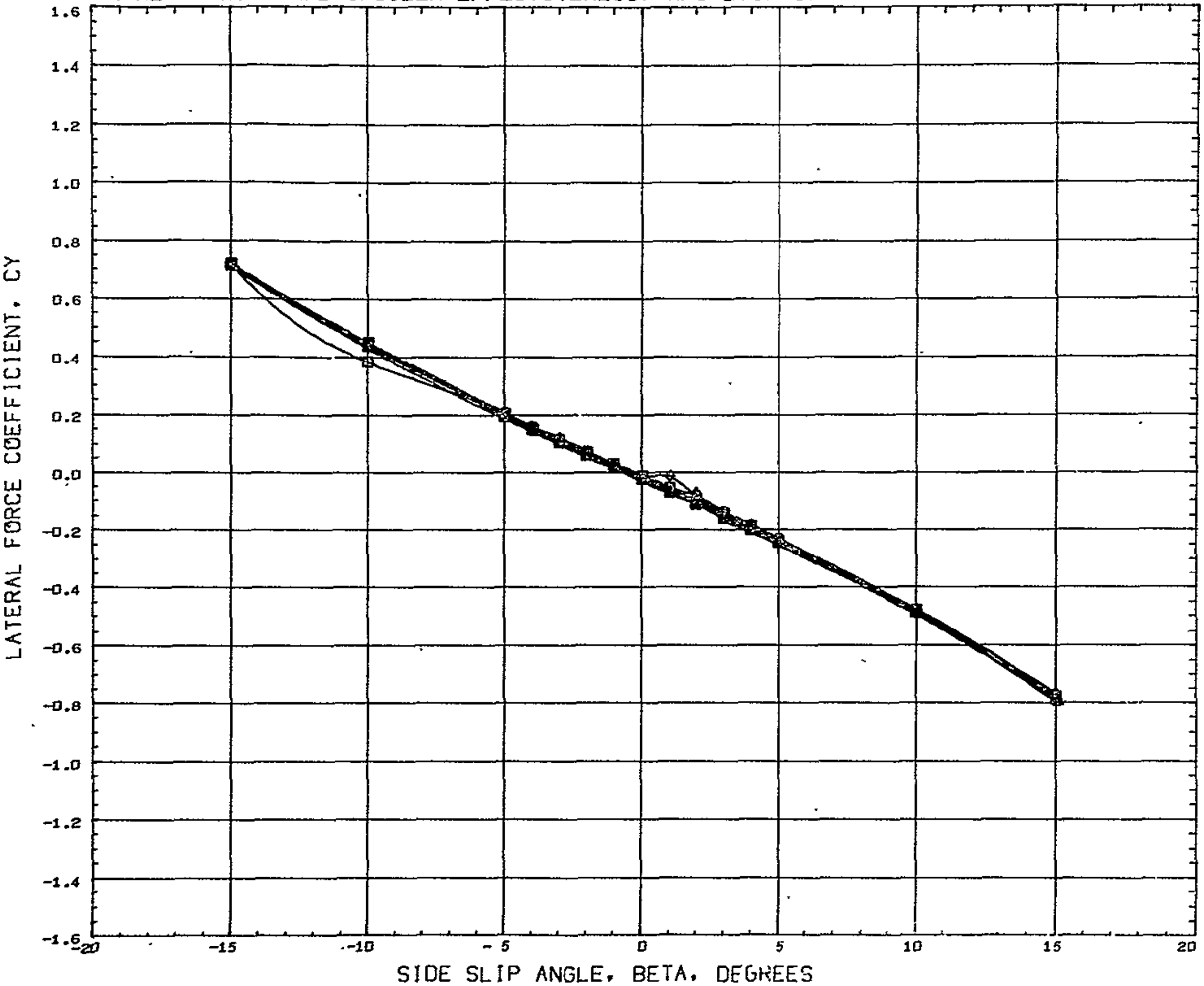


SYMBOL	SPOILER	PARAMETRIC VALUES			
O	1.500	MACH	0.250	BETA	0.000
□	2.500				
◇	3.500				
Δ	4.500				
◣	5.500				
◺	6.500	REFERENCE FILE			

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

LATERAL-DIRECTIONAL SPOILER EFFECTIVENESS, X/C LOCATION OF 0.50

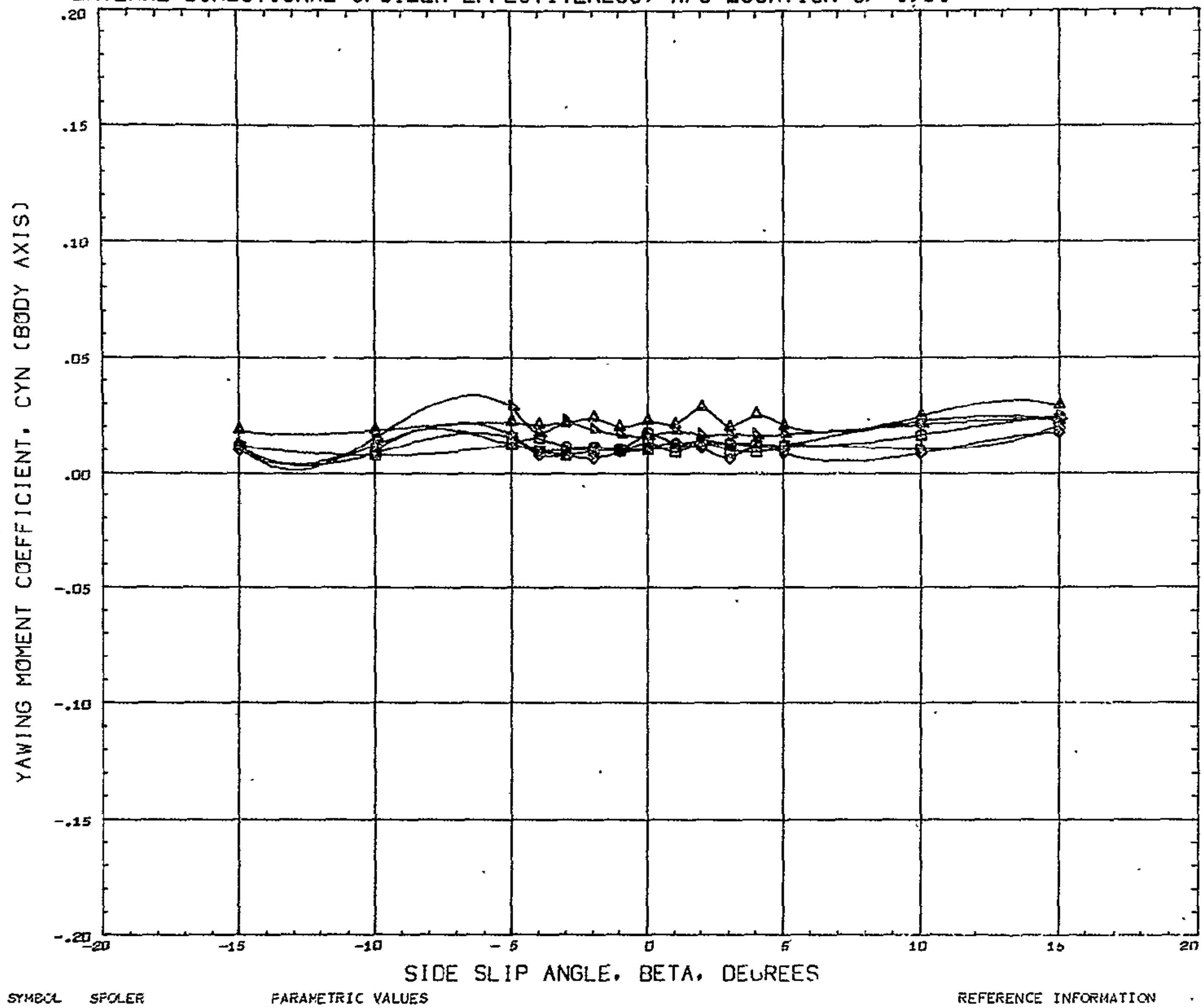


SYMBOL	SPOILER	PARAMETRIC VALUES			
○	1.500	MACH	0.250	ALPHA	0.350
□	2.500				
◇	3.500				
△	4.500				
◮	5.500				
◫	6.500	REFERENCE FILE			

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

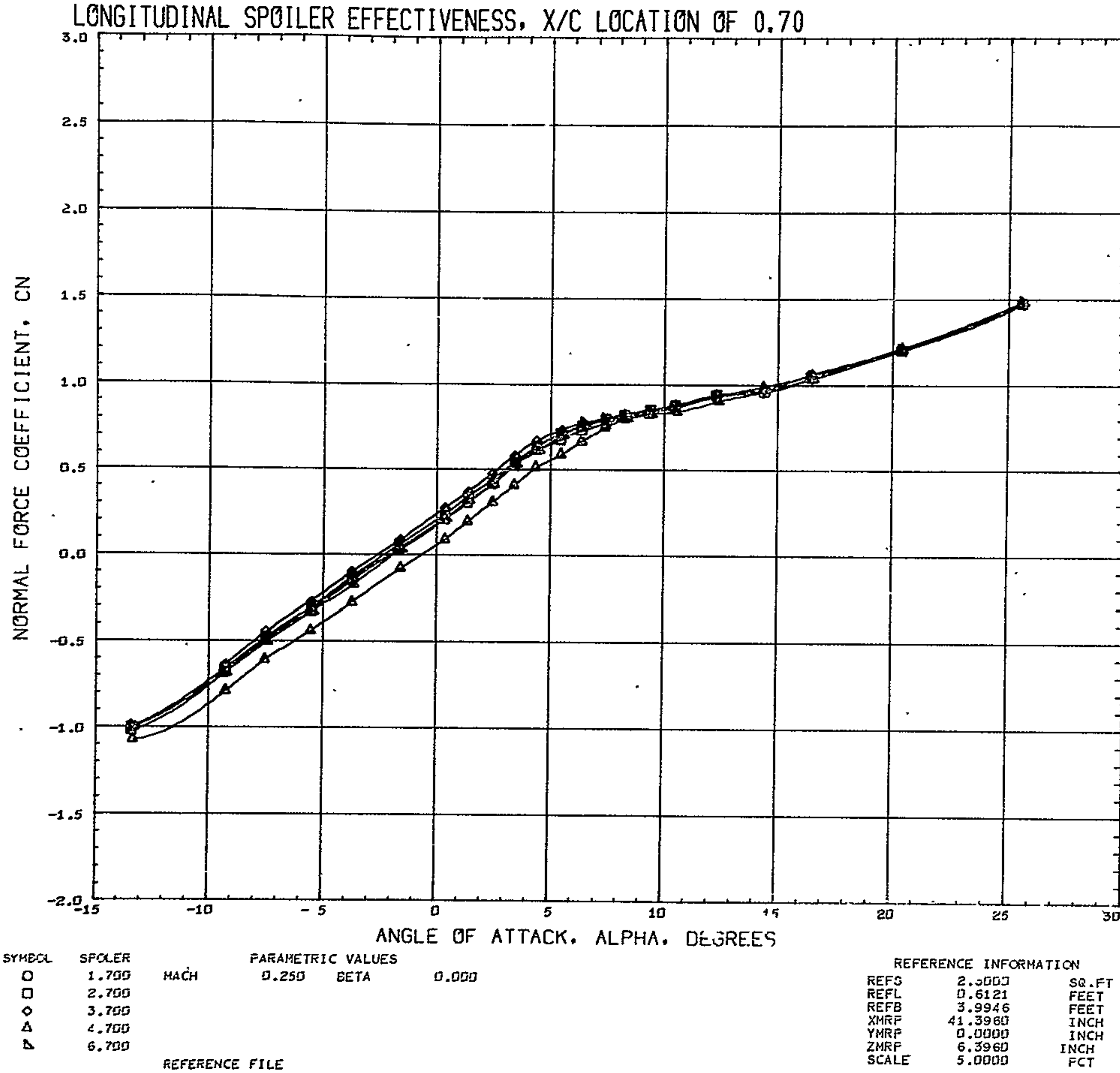
LATERAL-DIRECTIONAL SPOILER EFFECTIVENESS, X/C LOCATION OF 0.50



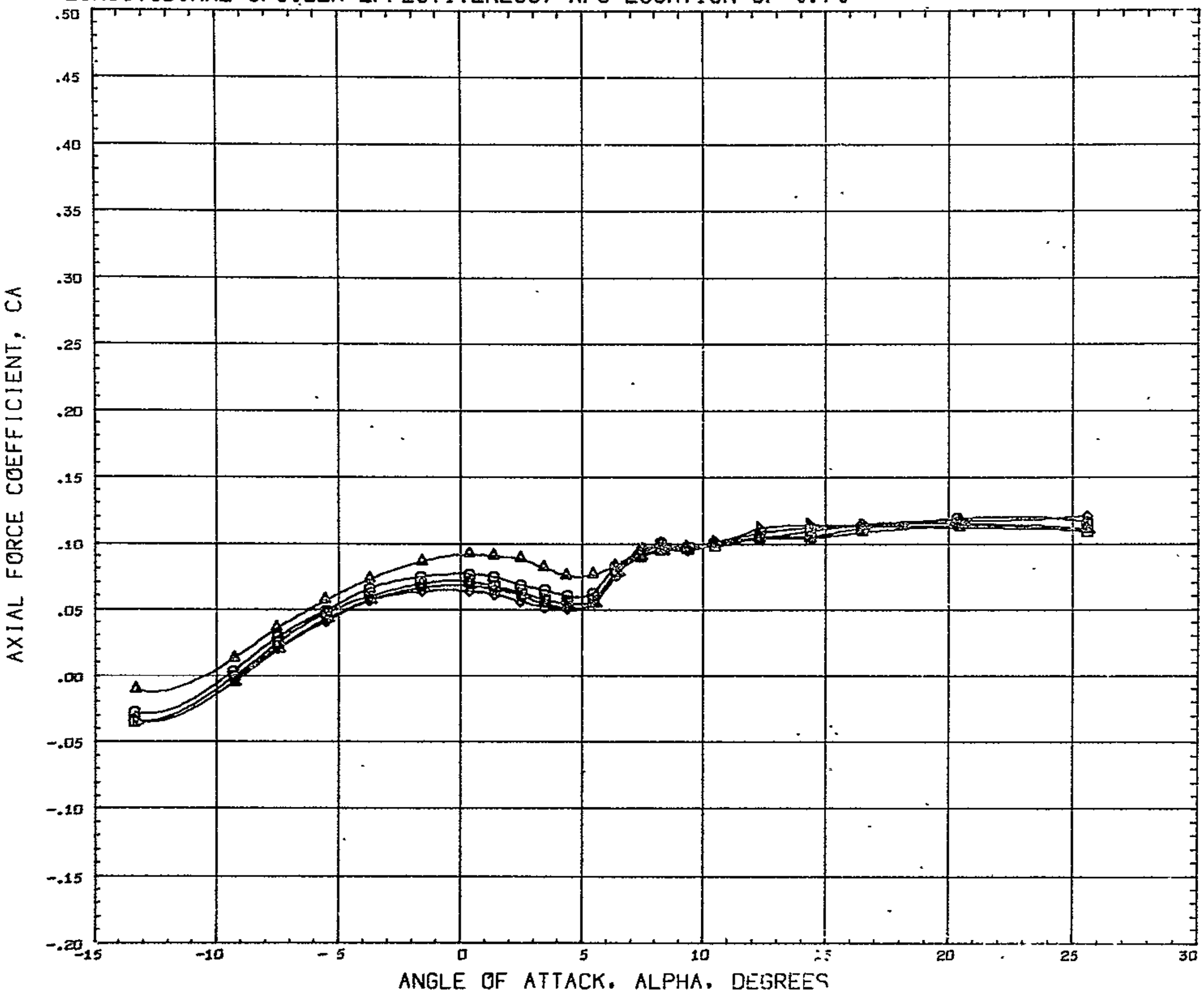
SYMBOL	SPOILER	PARAMETRIC VALUES			
O	1.500	MACH	0.250	ALPHA	0.350
□	2.500				
◇	3.500				
△	4.500				
◺	5.500				
◻	6.500	REFERENCE FILE			

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT


LONGITUDINAL SPOILER EFFECTIVENESS, X/C LOCATION OF 0.70
NORMAL FORCE COEFFICIENT, CN
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-15
-10
-5
0
5
10
15
20
25
30
ANGLE OF ATTACK, ALPHA, DEGREES
SYMBOL SPOILER
1.700
2.700
3.700
4.700
6.700
PARAMETRIC VALUES
MACH 0.250 BETA 0.000
REFERENCE FILE
REFERENCE INFORMATION
REFS 2.5000 SQ.FT
REFL 0.6121 FEET
REFB 3.9946 FEET
XMRP 41.3960 INCH
YMRP 0.0000 INCH
ZMRP 6.3960 INCH
SCALE 5.0000 PCT

LONGITUDINAL SPOILER EFFECTIVENESS, X/C LOCATION OF 0.70



SYMBOL	SPOILER
○	1.700
□	2.700
◇	3.700
△	4.700
◺	6.700

PARAMETRIC VALUES

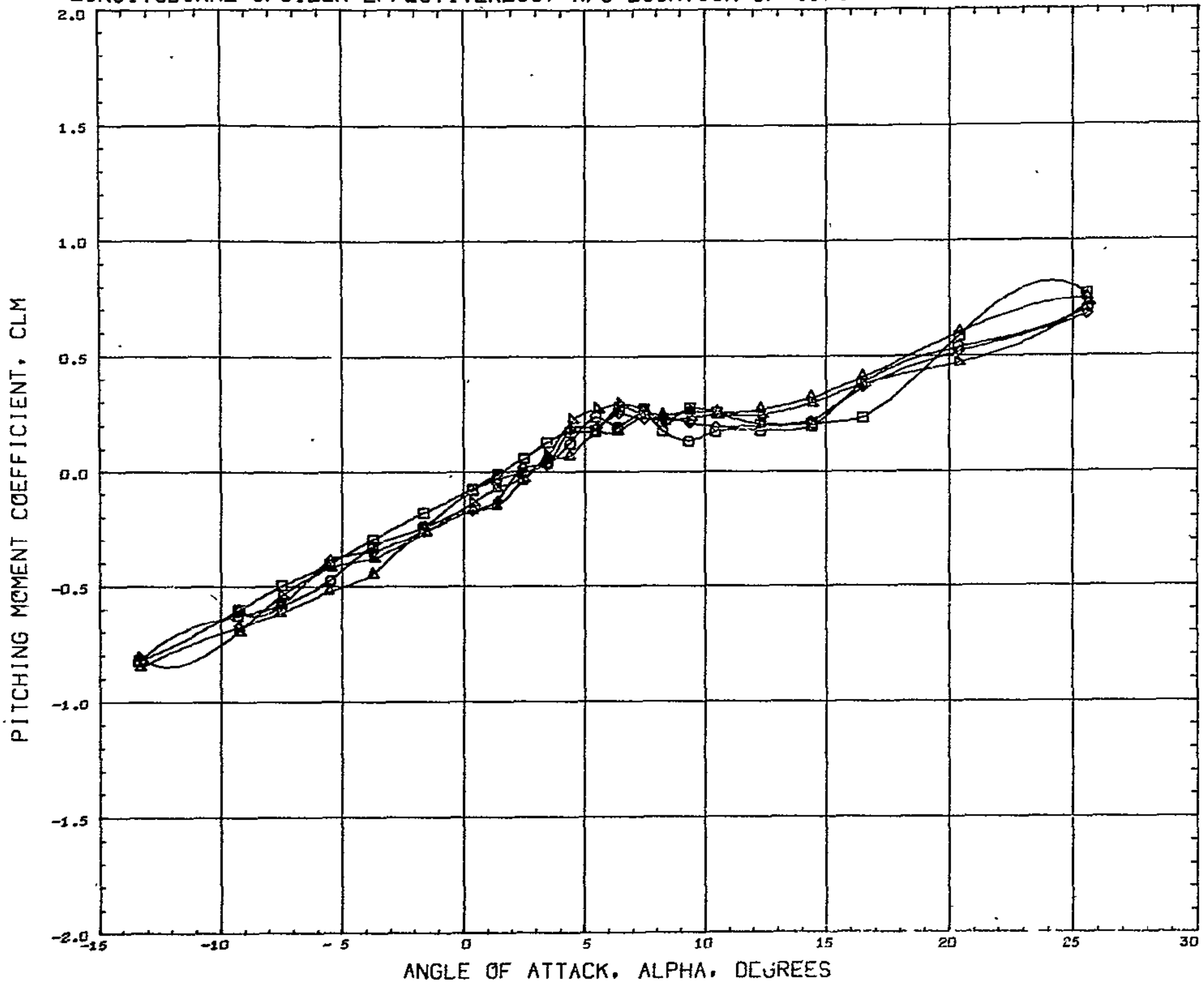
MACH 0.250 BETA 0.000

REFERENCE FILE

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

LONGITUDINAL SPOILER EFFECTIVENESS, X/C LOCATION OF 0.70



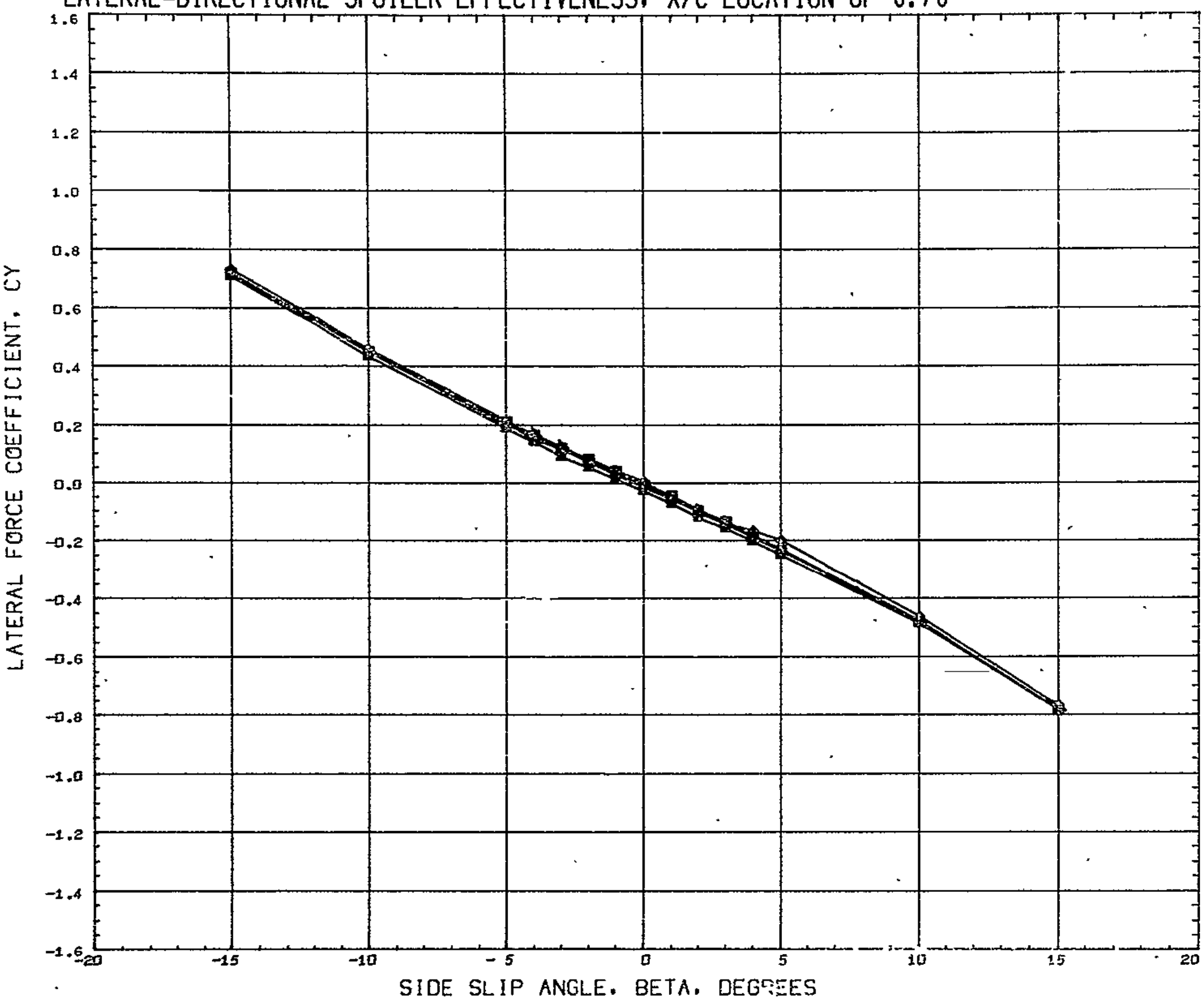
SYMBOL	SPOILER	PARAMETRIC VALUES			
□	1.700	MACH	0.250	BETA	0.000
□	2.700				
◇	3.700				
△	4.700				
◺	6.700				

REFERENCE FILE

REFERENCE INFORMATION

REFS	2.[illegible]	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

LATERAL-DIRECTIONAL SPOILER EFFECTIVENESS, X/C LOCATION OF 0.70

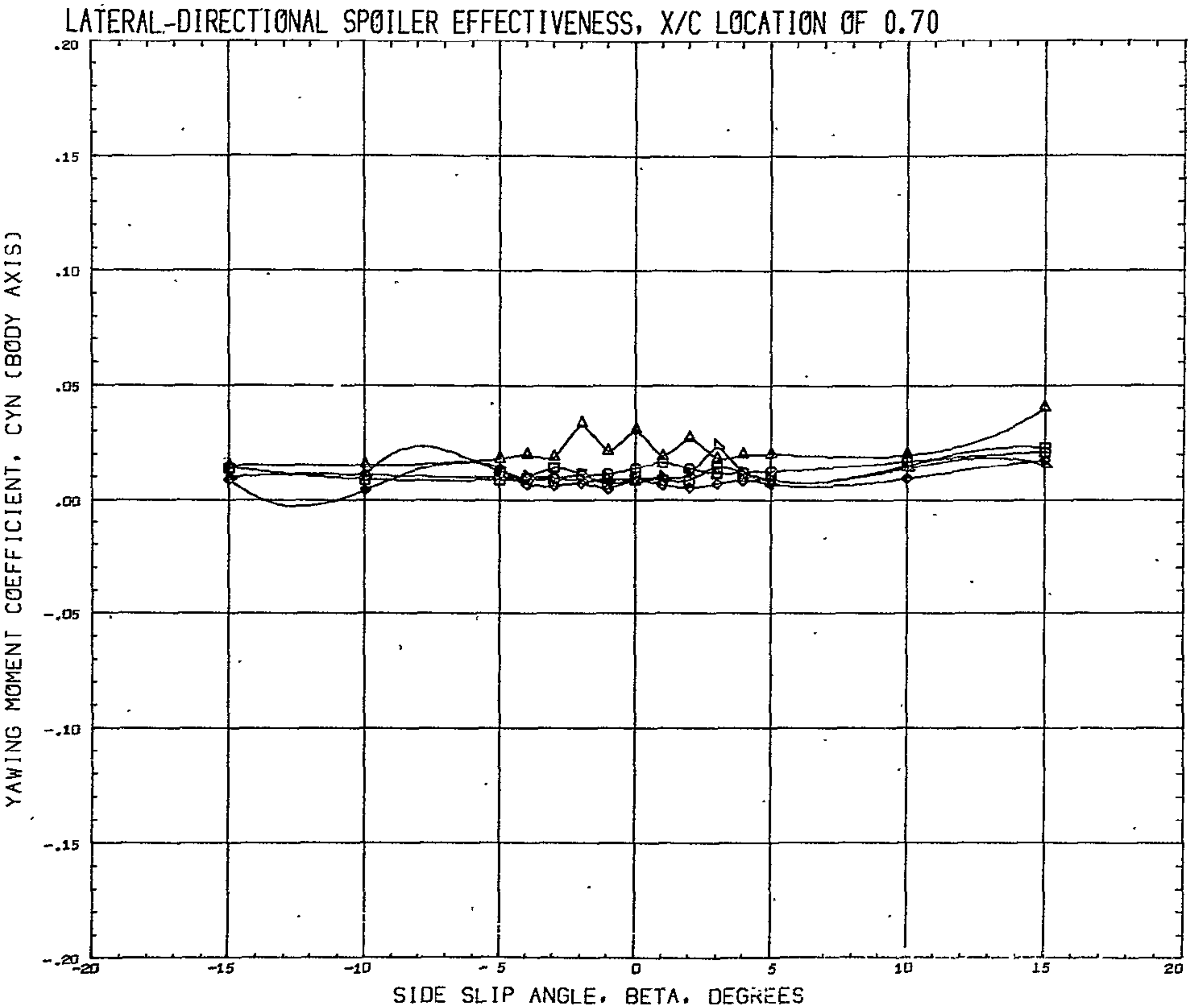


SYMBOL	SPOILER	PARAMETRIC VALUES			
○	1.700	MACH	0.250	ALPHA	0.350
□	2.700				
◇	3.700				
△	4.700				
◺	6.700				

REFERENCE FILE

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT



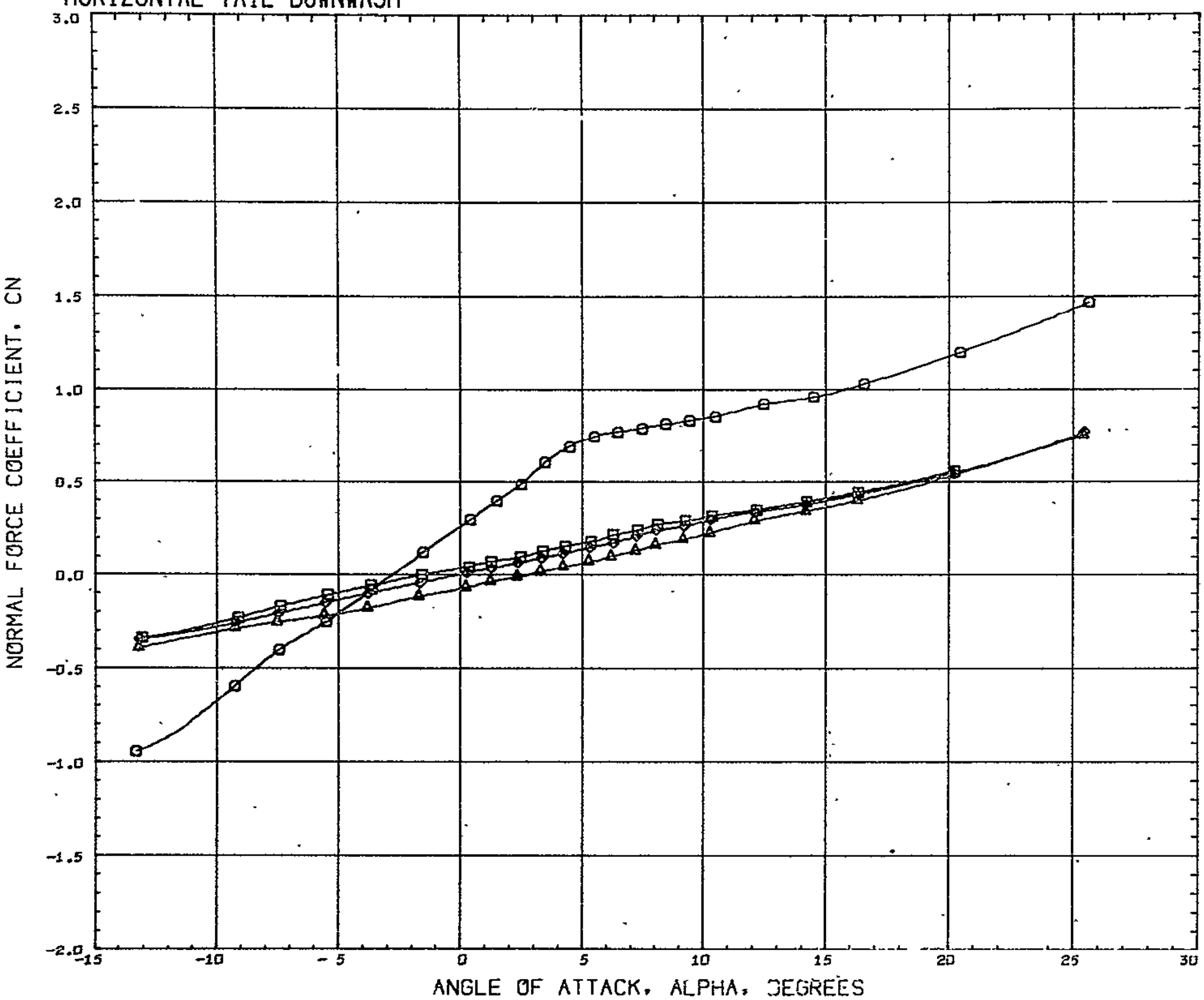
SYMBOL	SPOILER		PARAMETRIC VALUES		
O	1.700	MACH	0.250	ALPHA	0.350
□	2.700				
◇	3.700				
Δ	4.700				
◺	6.700				

REFERENCE FILE

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

HORIZONTAL TAIL DOWNWASH



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	
(AG6011)	○	MSC S-8 PART1 S-4 SHUTTLECRAFT B1W2V3H6	H6= 0
(AG6087)	□	MSC S-8 PART1 S-4 SHUTTLECRAFT B1V3H6	H6= 0
(AG6089)	◇	MSC S-8 PART1 S-4 SHUTTLECRAFT B1V3H6	H6=-2
(AG6091)	△	MSC S-8 PART1 S-4 SHUTTLECRAFT B1V3H6	H6=-6

PARAMETRIC VALUES

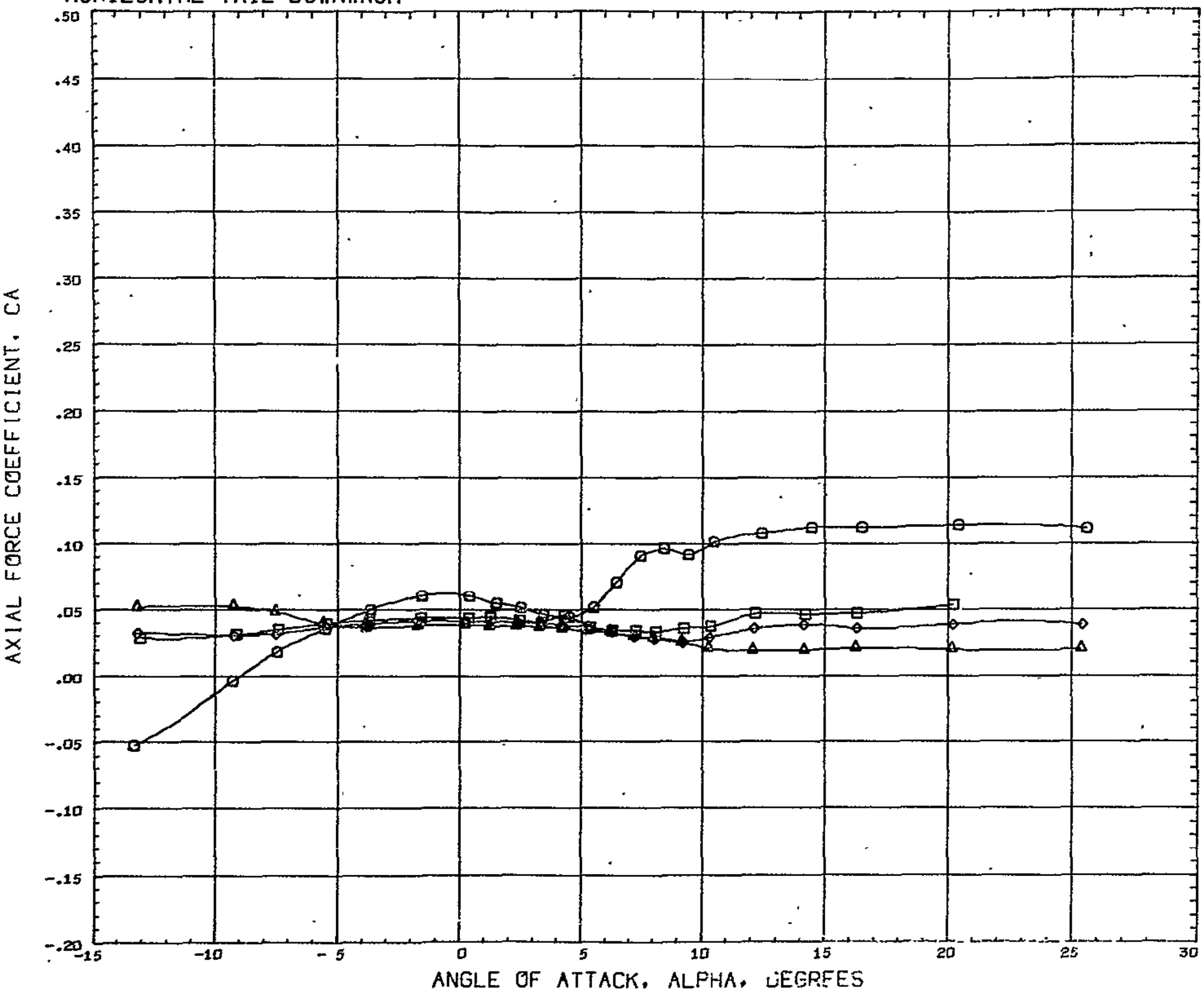
BETA	0.000	RUDDER	0.000
ELEVTR	0.000	FLAPS	0.000

REFERENCE INFORMATION

REFS	?.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

MACH 0.250

HORIZONTAL TAIL DOWNWASH



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	
(AG6011)	O	MSC S-8 PART1 S-4 SHUTTLECRAFT B1W2V3H6	H6= 0
(AG6087)	□	MSC S-8 PART1 S-4 SHUTTLECRAFT B1V3H6	H6= 0
(AG6089)	◇	MSC S-8 PART1 S-4 SHUTTLECRAFT B1V3H6	H6=-2
(AG6091)	Δ	MSC S-8 PART1 S-4 SHUTTLECRAFT B1V3H6	H6=-6

PARAMETRIC VALUES

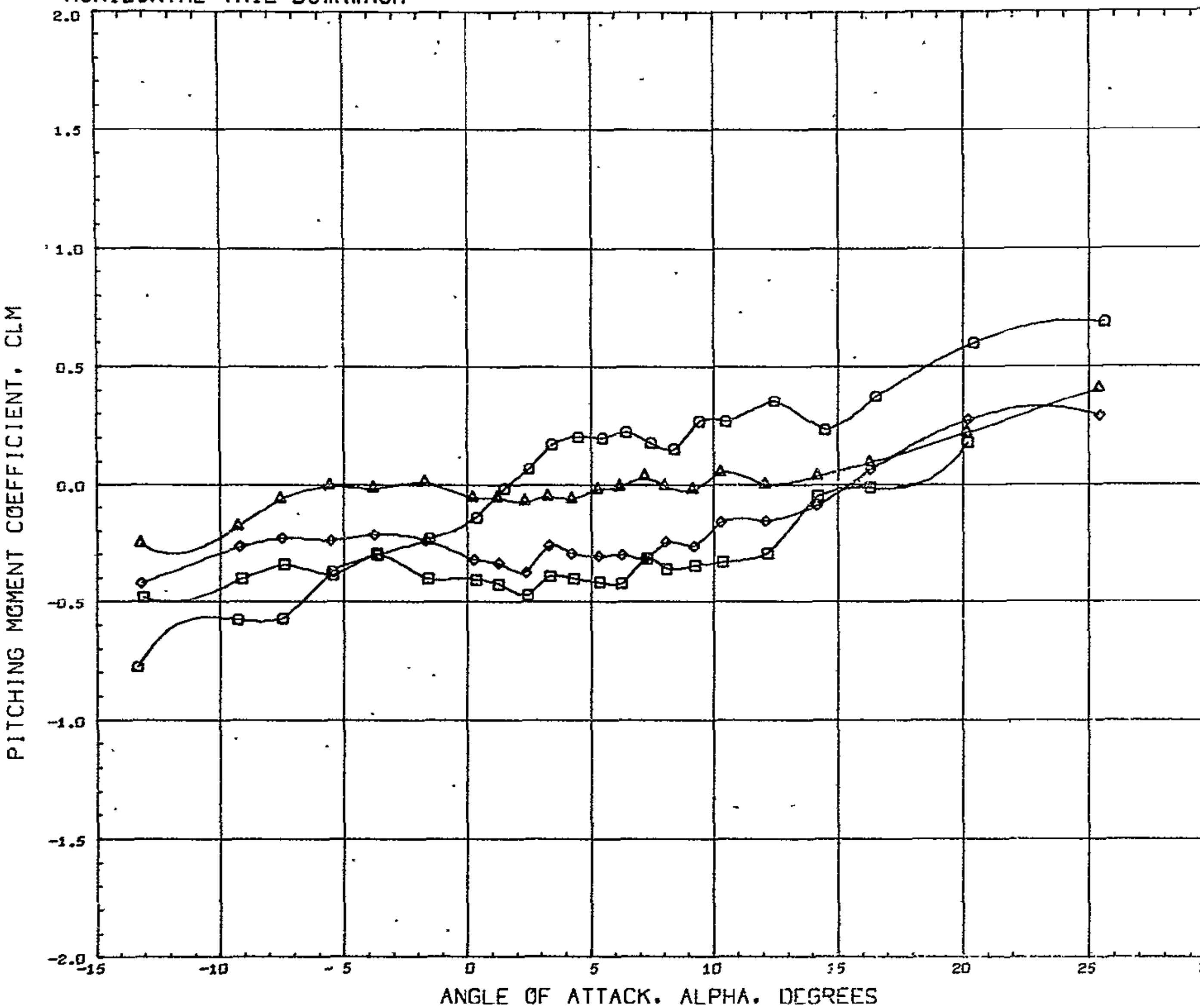
BETA	0.000	RUDDER	0.000
ELEVTR	0.000	FLAPS	0.000

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

MACH 0.250

HORIZONTAL TAIL DOWNWASH



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	
(AG6011)	○	MSC S-8 PART1 S-4 SHUTTLECRAFT B1W2V3H6	H6= 0
(AG6087)	□	MSC S-8 PART1 S-4 SHUTTLECRAFT B1V3H6	H6= 0
(AG6089)	◇	MSC S-8 PART1 S-4 SHUTTLECRAFT B1V3H6	H6=-2
(AG6091)	△	MSC S-8 PART1 S-4 SHUTTLECRAFT B1V3H6	H6=-6

MACH 0.250

PARAMETRIC VALUES

BETA	0.000	RUDDER	0.000
ELEVTR	0.000	FLAPS	0.000

REFERENCE INFORMATION

REFS	2.3000	SQ.FT
REFL	0.6121	FEET
REFB	3.9946	FEET
XMRP	41.3960	INCH
YMRP	0.0000	INCH
ZMRP	6.3960	INCH
SCALE	5.0000	PCT

APPENDIX A

COMPREHENSIVE PLOTTED DATA DISPLAY INDEX

NOTE:

See Page v for Consilidated Data Display Index

DATA PLOT INDEX

COMPONENT BUILDUP - LONGITUDINAL EFFECTIVENESS MSC S-VIII

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, MULTIPLE DATASETS

DATASETS PLOTTED:

RG6011 RG6079 RG6081 RG6083 RG6085

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CN	ALPHA	1	1
CA	ALPHA	2	2
CLM	ALPHA	3	3

COMPONENT BUILDUP - LATERAL-DIRECTIONAL EFFECTIVENESS

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, MULTIPLE DATASETS

DATASETS PLOTTED:

RG6012 RG6080 RG6082 RG6084 RG6086

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CY	BETA	4	4
CYN	BETA	5	5

ELEVATOR EFFECTIVENESS - POSITIVE DEFLECTIONS

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:

RG6011 RG6047 RG6055 RG6059 RG6063 RG6071

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CN	ALPHA	6	6
CA	ALPHA	7	7
CLM	ALPHA	8	8

ELEVATOR EFFECTIVENESS - NEGATIVE DEFLECTIONS

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:

RG6011 RG6045 RG6053 RG6057 RG6061 RG6069

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CN	ALPHA	9	9
CA	ALPHA	10	10
CLM	ALPHA	11	11

RUDDER EFFECTIVENESS

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:

RG6012 RG6014 RG6016 RG6018 RG6020

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CY	BETA	12	12
CYN	BETA	13	13

FLAP EFFECTIVENESS, 60 PERCENT EXPOSED SPAN

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:

RG6011 RG6027 RG6035

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CN	ALPHA	14	14
CA	ALPHA	15	15
CLM	ALPHA	16	16

FLAP EFFECTIVENESS, 60 PERCENT EXPOSED SPAN

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, MULTIPLE DATASETS

DATASETS PLOTTED:

SG6011 SG6025 SG6033 SG6037

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CN	ALPHA	17	17
CA	ALPHA	18	18
CLM	ALPHA	19	19

FLAP EFFECTIVENESS, FULL EXPOSED SPAN

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:

RG6011 RG6021 RG6029

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CN	ALPHA	20	20
CA	ALPHA	21	21
CLM	ALPHA	22	22

FLAP EFFECTIVENESS, FULL EXPOSED SPAN

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, MULTIPLE DATASETS

DATASETS PLOTTED:

SG6011 SG6023 SG6031 SG6039

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CN	ALPHA	23	23
CA	ALPHA	24	24
CLM	ALPHA	25	25

HORIZONTAL STABILIZER EFFECTIVENESS

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:

RG6011 RG6073 RG6075 RG6077

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CN	ALPHA	26	26
CA	ALPHA	27	27
CLM	ALPHA	28	28

LONGITUDINAL SPOILER EFFECTIVENESS, X/C LOCATION OF 0.50

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:

RG6093 RG6097 RG6101 RG6105 RG6109 RG6111

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CN	ALPHA	29	29
CA	ALPHA	30	30
CLM	ALPHA	31	31

LATERAL-DIRECTIONAL SPOILER EFFECTIVENESS, X/C LOCATION OF 0.50

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:

RG6094 RG6098 RG6102 RG6106 RG6110 RG6112

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CY	BETA	32	32
CYN	BETA	33	33

LONGITUDINAL SPOILER EFFECTIVENESS, X/C LOCATION OF 0.70

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:

RG6095 RG6099 RG6103 RG6107 RG6113

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CN	ALPHA	34	34
CA	ALPHA	35	35
CLM	ALPHA	36	36

LATERAL-DIRECTIONAL SPOILER EFFECTIVENESS, X/C LOCATION OF 0.70

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:

RG6096 RG6100 RG6104 RG6108 RG6114

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CY	BETA	37	37
CYN	BETA	38	38

HORIZONTAL TAIL DOWNWASH

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, MULTIPLE DATASETS

DATASETS PLOTTED:

AG6011 AG6087 AG6089 AG6091

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CN	ALPHA	39	39
CA	ALPHA	40	40
CLM	ALPHA	41	41