DATA MANAGEMENT COPY #2

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CR-103157

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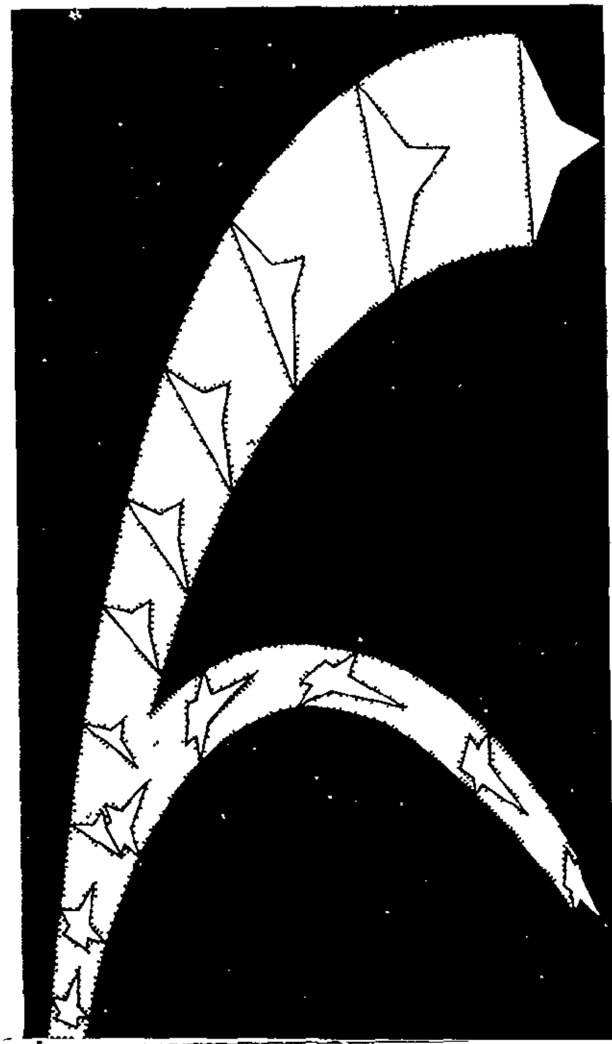

—SPACE SHUTTLE—

M/DAC DELTA WING BOOSTER

DETERMINATION OF LOW SPEED DIRECTIONAL STABILITY CHARACTERISTICS

McDONNELL-DOUGLAS
LONG BEACH LSWT
WIND TUNNEL TEST RESULTS
DATA REPORT

OCTOBER, 1970

CONTRACT NAS8-4016

SCHEDULE II

DRL 184-58

AMENDMENT 130

MARSHALL
SPACE FLIGHT CENTER

SADSAC SPACE SHUTTLE
AEROTHERMODYNAMIC
DATA MANAGEMENT SYSTEM

SPACE DIVISION CHRYSLER CORPORATION

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16 ABSTRACT

Low speed (M = .18) wind tunnel tests have been conducted on the McDonnell-Douglas Corporation delta-wing booster to determine directional stability characteristics. The investigations were conducted in the Douglas-Long Beach Low Speed Wind Tunnel in April of 1970. A 1% scale model of the booster configuration was used. Test results are included herein and consist of plotted coefficient data and sketches of flow field studies. Alpha and beta was varied between ± 16 degrees. No data were obtained with control surfaces deflected.

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SADSAC/SPACE SHUTTLE

WIND TUNNEL TEST DATA REPORT

CONFIGURATION: M/DAC Delta Wing Booster

TEST PURPOSE: Determination of Low Speed Directional Stability Characteristics

MODEL SCALE: 1%

MACH NUMBER: 0.18

TEST FACILITY: McDonnell-Douglas Long Beach LSWT - TEST #132

TESTING AGENCY: McDonnell-Douglas Corporation - West

TEST NO. & DATE: Test #132 -- 15-28 April 1970

TEST CONDUCTOR(S): C. M. Finch

DATA MANAGEMENT SERVICES

LIAISON: John E. Vaughn for James R. Seer DATA OPERATIONS: James L. Glynn Jr.

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

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ABSTRACT

Low speed (M = .18) wind tunnel tests have been conducted on the McDonnell-Douglas Corporation delta-wing booster to determine directional stability characteristics. The investigations were conducted in the Douglas-Long Beach Low Speed Wind Tunnel in April of 1970. A 1% scale model of the booster configuration was used. Test results are included herein and consist of plotted coefficient data and sketches of flow field studies.

TEST CONDITIONS
TEST 1321

MACH NUMBER	REYNOLDS NUMBER per unit length/FT	DYNAMIC PRESSURE (pounds/sq. inch)	STAGNATION TEMPERATURE (degrees Fahrenheit)
0.18	1.2150	4.17	78
0.20	1.3450	3.47	76

BALANCE UTILIZED: MDC (WD) A10 BAL. NO. 5 (0.75 "D.)

	CAPACITY:	ACCURACY:	COEFFICIENT TOLERANCE:
(2 GAGES) NF	100 LB / EACH GAGE	0.5 % FULL RANGE	
(2 GAGES) SF	50 LB / EACH GAGE	0.5 % " "	
AF	50 LB.	0.5 % " "	
PM	LIMITED BY NF GAGE		
YM	LIMITED BY SF GAGE		
RM	20 IN.-LB.	0.5 % FULL RANGE	

COMMENTS: Due to excessive buffeting of the model at high angles of attack during the first run which was made at q = 50 psf and M = 0.2, all subsequent runs were made at q - 50 psf, M = .18 and RN/L = 1.3×10^6 per ft. The model was sting mounted and instrumented with a 6-component force and moment internal balance, and with 2 balance cavity pressure taps, 2 model base pressure taps, and 2 model nozzle base pressure taps.

DATA REDUCTION

A six component internal strain gage balance (see test conditions) was utilized to measure aerodynamic forces in the body axis system. Coefficient data have been reduced about a reference c.g. location 1.260 ft. aft of the nose, (70% body length) and 0.067 feet below the vertical reference line using the following reference values:

S_{REF} = theoretical wing area = 10,000 ft^2f/s = 1.0 ft^2

l_{REF} = $\bar{c}$ = wing mean aerodynamic chort = 0.8 ft.

b = wing equivalent span = 1.38 ft.

Axial force has been corrected to correspond to a base pressure equal to free-stream static pressure. Stability axis data were calculated utilizing the corrected values of axial force coefficient.

CONFIGURATIONS INVESTIGATED

The wind tunnel model is a 1% scale model which is shown in Figures 2 thru 4. As shown in the figures, the lox lines, orbiter mounts, boat tailed and filleted base design, and rocket nozzles are all simulated on the model. Model components tested were:

B_1 = body or fuselage

W_1 = delta wing

V_1 = small vertical tail

V_2 = large vertical tail

L = parallel wing fences

K = booster rocket nozzles

R = fodnicks (mating attachments, LOX lines, etc.)

Z = transition strips

The immediately following pages describe the components dimensional characteristics.

Combinations of the components tested were:

$B_1 W_o R_1 Z$

$B_1 W_O Z \; K_1$

$B_1 W_O R_1 Z K_1$

$B_1 W_O R_1 Z_1 K_1 V_1$

$B_1 W_O R_1 Z_1 K_1 V_2$

$B_1 W_O R_1 K_1 V_2$

$B_1 W_O R_1 Z K_1 V_2 L_1 L_2$

Refer to Figures 2 through 7 for configuration definition.

MODEL COMPONENT: BODY - B1

GENERAL DESCRIPTION: BOOSTER BODY

DRAWING NUMBER: WT-31170

DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	190 FT.	1.90 FT.
Max. Width		
Max. Depth		
Fineness Ratio		
Area		
Max. Cross-Sectional		
Planform		
Wetted		
Base		

MODEL COMPONENT: W0

GENERAL DESCRIPTION: BOOSTER DELTA WING

DRAWING NUMBER: WT-33070

DIMENSIONS:	FULL-SCALE	MODEL SCALE
TOTAL DATA		
Area		
Planform	10,000 FT^2	1.0 FT^2
Wetted	—	—
½ Span (equivalent)	830 IN	8.3 IN.
Aspect Ratio	1.91	1.91
Rate of Taper	—	—
Taper Ratio	0.317	0.317
Diehedral Angle, degrees	13°	13°
Incidence Angle, degrees	3°	3°
Aerodynamic Twist, degrees	—	—
Toe-In Angle	—	—
Cant Angle	—	—
Sweep Back Angles, degrees		
Leading Edge	55°	55°
Trailing Edge	19°	19°
0.25 Element Line		
Chords:		
Root (Wing Sta. 0.0)	1317 IN.	13.17 IN
Tip, (equivalent)	418 IN.	4.18 IN
MAC, inches	946 IN	9.46 IN
Fus. Sta. of .25 MAC	1678 IN.	16.78 IN
W.P. of .25 MAC	342.5 IN.	3.42 IN.
Airfoil Section		
Root	NACA 0009	NACA 0009
Tip	NACA 0005	NACA 0005
EXPOSED DATA		
Area	6580 FT^2	0.658 FT^2
½ Span, (equivalent)	626 IN	6.26 IN.
Aspect Ratio	1.655	1.655
Taper Ratio	0.382	0.382
Chords		
Root	1096 IN	10.96 IN
Tip	418 IN.	4.18 IN.
MAC	807 IN	8.07 IN.
Fus. Sta. of .25 MAC	1826.25 IN.	18.26 IN.
W.P. of .25 MAC	47075 IN	4.707 IN.

MODEL COMPONENT: V1

GENERAL DESCRIPTION: WING TIP VERTICAL FIN (BOOSTER)

DRAWING NUMBER: WT-33070

DIMENSIONS:

	FULL-SCALE	MODEL SCALE
TOTAL DATA		
Area		
Planform	1039 FT^2	0.1039 FT^2
Wetted	—	—
Span (equivalent)	530 IN.	5.30 IN.
Aspect Ratio	1.875	1.875
Rate of Taper	—	—
Taper Ratio	0.215	0.215
Diehedral Angle, degrees	—	—
Incidence Angle, degrees	—	—
Aerodynamic Twist, degrees	—	—
Toe-In Angle	6°	6°
Cant Angle	15°	15°
Sweep Back Angles, degrees		
Leading Edge	48° 8'	48° 8'
Trailing Edge	23° 12'	23° 12'
0.25 Element Line		
Chords:		
Root (Wing Sta. 0.0)	465 IN.	4.65 IN.
Tip, (equivalent)	100 IN.	1.00 IN.
MAC, inches	322 IN	3.22 IN.
Fus. Sta. of .25 MAC	2426 IN.	24.26 IN.
W.P. of .25 MAC	208 IN	2.08 IN
Airfoil Section		
Root	NACA 0009	NACA 0009
Tip	NACA 0005	NACA 0005
EXPOSED DATA		
Area	—	—
Span, (equivalent)	—	—
Aspect Ratio	—	—
Taper Ratio	—	—
Chords		
Root	—	—
Tip	—	—
MAC	—	—
Fus. Sta. of .25 MAC	—	—
W.P. of .25 MAC	—	—

MODEL COMPONENT: V2

GENERAL DESCRIPTION: WING TIP VERTICAL FIN (BOOSTER)

DRAWING NUMBER: WT-33070

DIMENSIONS:	FULL-SCALE	MODEL SCALE
TOTAL DATA		
Area		
Planform	1245 FT^2	0.1245 FT^2
Wetted	—	—
Span (equivalent)	530 IN.	5.30 IN
Aspect Ratio	1.565	1.565
Rate of Taper	—	—
Taper Ratio	0.456	0.456
Diehedral Angle, degrees	—	—
Incidence Angle, degrees	—	—
Aerodynamic Twist, degrees	—	—
Toe-In Angle	6°	6°
Cant Angle	15°	15°
Sweep Back Angles, degrees		
Leading Edge	48° 8'	48° 8'
Trailing Edge	32° 36'	32° 36'
0.25 Element Line		
Chords:		
Root (Wing Sta. 0.0)	465 IN.	4.65 IN.
Tip, (equivalent)	212 IN.	2.12 IN.
MAC, inches	355 IN	3.55 IN.
Fus. Sta. of .25 MAC	2460 IN.	24.60 IN.
W.P. of .25 MAC	232 IN	2.32 IN.
Airfoil Section		
Root	NACA 0009	NACA 0009
Tip	NACA 0005	NACA 0005
EXPOSED DATA		
Area	—	—
Span, (equivalent)	—	—
Aspect Ratio	—	—
Taper Ratio	—	—
Chords		
Root	—	—
Tip	—	—
MAC	—	—
Fus. Sta. of .25 MAC	—	—
W.P. of .25 MAC	—	—

Configuration $B_1W_0V_1K_1R_1Z$ Basic Aerodynamics

$C_{D_0} = 0.037$

$C_{D_B} = 0.0084$ at $C_L = 0$

$C_{L\alpha} = 0.0471$

$\alpha_{C_L = 0} = -3.5°$

$N_0 = 0.76L$ for $-6° \leq \alpha < 5°$

$N_0 = 0.70L$ for $\alpha > 5°$

$C_{n\beta} = 0.00035$ for $-4° \leq \alpha \leq 5°$

$C_{n\beta} = -0.002$ for $\alpha > 9°$

$\Delta C_{n\beta}|_{fins} = 0.00348$ for $-4° \leq \alpha \leq 5°$

$\Delta C_{n\beta}|_{fins} = 0.00161$ for $\alpha \geq 9°$

$L/D_{MAX} = 5.9$

$\alpha|_{L/D_{MAX}} = 2.5°$ and $5°$

Configuration $B_1W_0V_2K_1R_1Z$ Basic Aerodynamics

$C_{D_0} = 0.038$

$C_{D_B} = 0.0082$ at $C_L = 0$

$C_{L\alpha} = 0.0472$

$\alpha_{C_L = 0} = -4°$

$N_0 = 0.76L$ $\alpha < 5°$

$N_0 = 0.72L$ $5° < \alpha < 9°$

$N_0 = 0.68L \quad 9° < \alpha < 17°$

$C_{n\beta} = 0.00075 \quad -4° < \alpha < 7°$

$C_{n\beta} = -0.00185 \quad \alpha \geq 11°$

$\Delta C_{n\beta}|fins = 0.00403 \quad -4° \leq \alpha \leq 7°$

$\Delta C_{n\beta}|fins = 0.00194 \quad \alpha \geq 11°$

$L/D_{MAX} = 6.3$

$\alpha_{L/DMAX} = 2.6°$

Configuration $B_1 W \; K_1 R_1 Z$ Basic Aerodynamics *

$C_{D_0} = 0.032$

$C_{D_\beta} = 0.0076$ at $C_L = 0$

$C_{L_\alpha} = 0.0392$

$\alpha_{C_L = 0} = -3.3°$

$N_0 = 0.72L \quad -6° \leq \alpha < 0°$

$N_0 = 0.75L \quad 2° \leq \alpha < 10°$

$N_0 = 0.71L \quad 10° < \alpha < 17°$

* This configuration not tested during this test series.

$C_{n\beta}$ = -0.00310 to -0.00400 decreasing (more negative) with increasing angle of attack

$L/D|_{MAX}$ = 5.6

$\alpha|_{L/DMAX} \doteq 4.7°$

Flow field studies with tuft wand:

Due to the directional instability discovered during the initial series of runs, an extensive amount of time was devoted to isolating the cause.

As can be seen from Figures 5 and 6, the apparent cause of the loss in fin effectiveness results from the strong wing leading edge vortex washing out the leeward (low pressure) side of the windward fin. At low angles of attack the vortex has not experienced the bursting phenomena which results in significant increases in the local pressure, while at high angles of attack this phenomenon has occurred resulting in the almost total loss of the windward fin effectiveness.
In addition to the tuft wand studies, the following data support these conclusions:

1. The consistent reduction at high angles of attack in fin effectiveness to one half the low angle of attack values indicate the loss of one fin.

2. The forward motion of the aerodynamic center indicated above for both finned configurations indicates a redistribution of lift forward of the trailing edge and can be explained by a loss of lift on the wing tips near the wing fin intersection which is consistent with a local increase in pressure due to vortex bursting.

Fences

Configuration $B_1W_oV_2K_1R_1ZL_1L_2$ The addition of two fences (0.05c) at Y/b/2 = 0.381 and Y/b/2 = 0.692 had little effect at the low angles of attack on the directional stability. For the range $7 < \alpha < 10$ the fins improved the directional stability to an acceptable level. For $\alpha = 11.5°$ and $\alpha = 13.0°$, the addition of fences produced neutral directional stability. For $\alpha = 15.8$ the fences lost their effectiveness as they were jumped by the strong leading edge vortex. The addition of the fences produced a decrease in L/D max of approximately 0.2, and an increase in zero lift drag of 0.0038.

Protuberances

The 3 orbiter mounts produced a destablizing moment of $\Delta C_{n\beta} = -0.00026$. The protuberances produced no change in zero lift drag or L/D. The protuberances decreased base drag at zero lift by 0.0006. This change can be traced to the effects of the orbiter mount vortices on the ability of the flow to turn the corner on the top of the base region. Thus, the increase in profile drag caused by these protuberances is offset by the decrease in base drag.

Rocket Nozzles

The effect of the rocket nozzles on directional stability is negligible. The effect of the rocket nozzles is as follows: base drag is reduced by $\Delta C_{D_B} = -0.0024$, zero-lift drag is reduced by $\Delta C_{DO} = -0.0016$ and L/D max is increased by $\Delta L/D/max = 0.3$.

High Wing Configuration

Runs at high negative angles of attack of Configuration $B_1W_0V_2K_1R_1Z$ indicate that the booster maintains excellent directional stability to the maximum C_L tested ($C_L = -0.65$, $\alpha = -16.4°$). In addition, the directional stability increases with angle of attack which can be attributed to the reduced sweep of the tip fins relative to the free stream.

FACILITY DESCRIPTION

The Douglas Long Beach Low Speed Wind Tunnel has a test section with dimensions of 54 inches wide x 38" high x 10 feet long.

TEST DAC LSWT 1321 DATA SET COLLATION SHEET

☐ PRETEST

☒ POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD α	SCHD β	CONTROL DEFLECTION δ_e	δ_{VT}	δ_R		NO. of RUNS	MACH NUMBERS 0.18	0.20
RC2072	BIWORIZ	A	0	0	0	0			19	
071	↓	↓	-6	↓	↓	↓			18	
032	BIWORIZKI	↓	0	↓	↓	↓			15	
031	↓	↓	-6	↓	↓	↓			3	
062	BIWO ZKI	↓	0	↓	↓	↓			16	
061	↓	↓	-6	↓	↓	↓			17	
012	BIWORIZKIVI	↓	0	↓	↓	↓			14	
011	↓	↓	-6	↓	↓	↓				1
022	BIWORIZKIV2	↓	0	↓	↓	↓			5	
021	↓	↓	-6	↓	↓	↓			2	
027	↓	B	0	↓	↓	↓			10	
023	↓	B	6	↓	↓	↓			9	
024	↓	.3	C	↓	↓	↓			11	
025	↓	6.9	C	↓	↓	↓			12	
026	↓	-6.3	D	↓	↓	↓			13	
041	BIWORI KIV2	A	-6	↓	↓	↓			4	
051	BIWORIZKIV2L1L2	A	-6	↓	↓	↓			7	

1	7	13	19	25	31	37	43	49	55	61	67	75 76
CN	CLM	CY	CYN	CBL	CA	CAF	CL	CDF	L/D	IDPVAR(1)	IDPVAR(2)	NDV

COEFFICIENTS:

α or β SCHEDULES

A = $-6 \xrightarrow{\Delta 2^\circ} 16$

B = $-15, -14 \xrightarrow{\Delta 2^\circ} 6$

C = $-6 \xrightarrow{\Delta 2^\circ} 14$

D = $-14 \xrightarrow{\Delta 2^\circ} 6$

TEST 1321 DATA SET DESCRIPTOR SHEET

DATA SET IDENTIFIER	DATA SET DESCRIPTOR		CURVE SLOPE RANGE LOWER LIMIT	CURVE SLOPE RANGE UPPER LIMIT
RC2011	1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z (0,.01,.05CL)	1.1	-25	25
RC2021	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z (0,.01,.05CL)	1.1	-25	25
RC2031	-B1W2K1R1Z (	1.1		
RC2041	-B1W0V2K1R1 (	1.1		
RC2022	-B1W0V2K1L1Z (	1.1		
RC2051	-B1W0V2K1R1L1L2Z(	1.1		
RC2023	-B1W0V2K1L1Z (	1.1		
RC2027	-B1W0V2K1R1Z (	1.1		
RC2024	-B1W0V2K1R1Z (	2.1		
RC2025	-B1W0V2K1L1Z (	2.1		
RC2026	-B1W0V2K1K1Z (	2.1		
RC2012	-B1W0V2K1R1Z (	1.1		
RC2032	-B1W2K1R1Z (	1.1		
RC2062	-B1W0K1Z (	1.1		
RC2061	-B1W0L1Z (	1.1		
RC2071	-B1W0R1Z	1.1		
RC2072	1321-DAC-LSWT-DELBOOST-B1W0R1Z (0,.01,.05CL)	1.1	-25	25

REFERENCE AREA S_R	REFERENCE LENGTH LONGITUDINAL ℓ_R	REFERENCE LENGTH LATERAL b_R	MOMENT REFERENCE POINT LONGITUDINAL XMRP	MOMENT REFERENCE POINT LATERAL YMRP	MOMENT REFERENCE POINT VERTICAL ZMRP	SOURCE DOCUMENT
1.000	0.800	1.320	1.262	0.000	-0.067	NDC(WD)SPACTS/VT-A

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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	base axial force coefficient, $[(p_\infty - p_b)/q]\,(A_b/S_{ref})$
C_{A_f}	CAF	forebody axial force coefficient, $C_A - C_{A_b}$
C_D	CDTOTL	drag force coefficient in the wind axis system, $F_D/q\,S_{ref}$

NOMENCLATURE (continued)

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, $F_N/q\,S_{ref}$

NOMENCLATURE (continued)

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

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
N_o		stick fixed neutral point
L		body length

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
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

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

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

FIGURES

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.

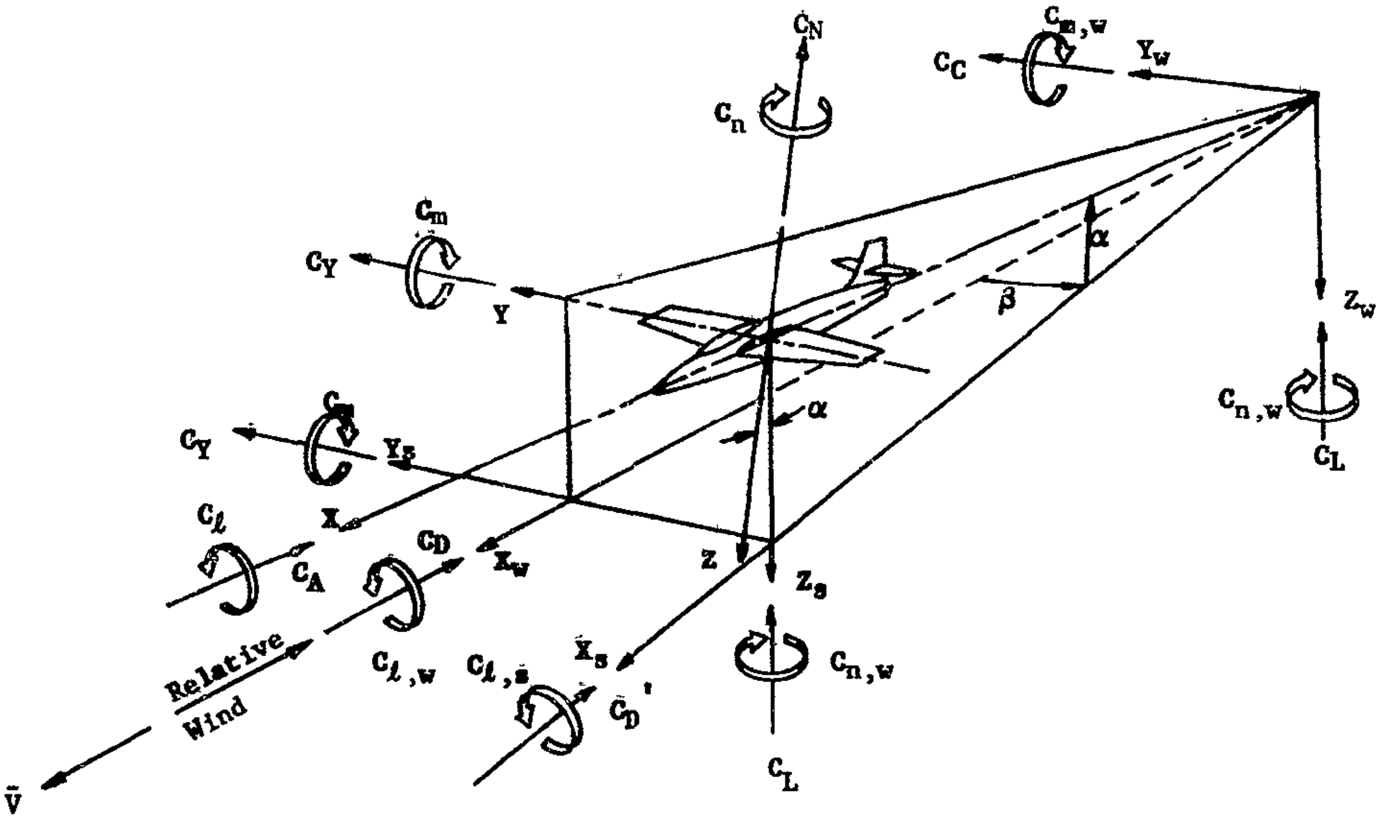


Figure 1. Axis systems, showing direction and sense of force and moment coefficients, angle of attack, and sideslip angle

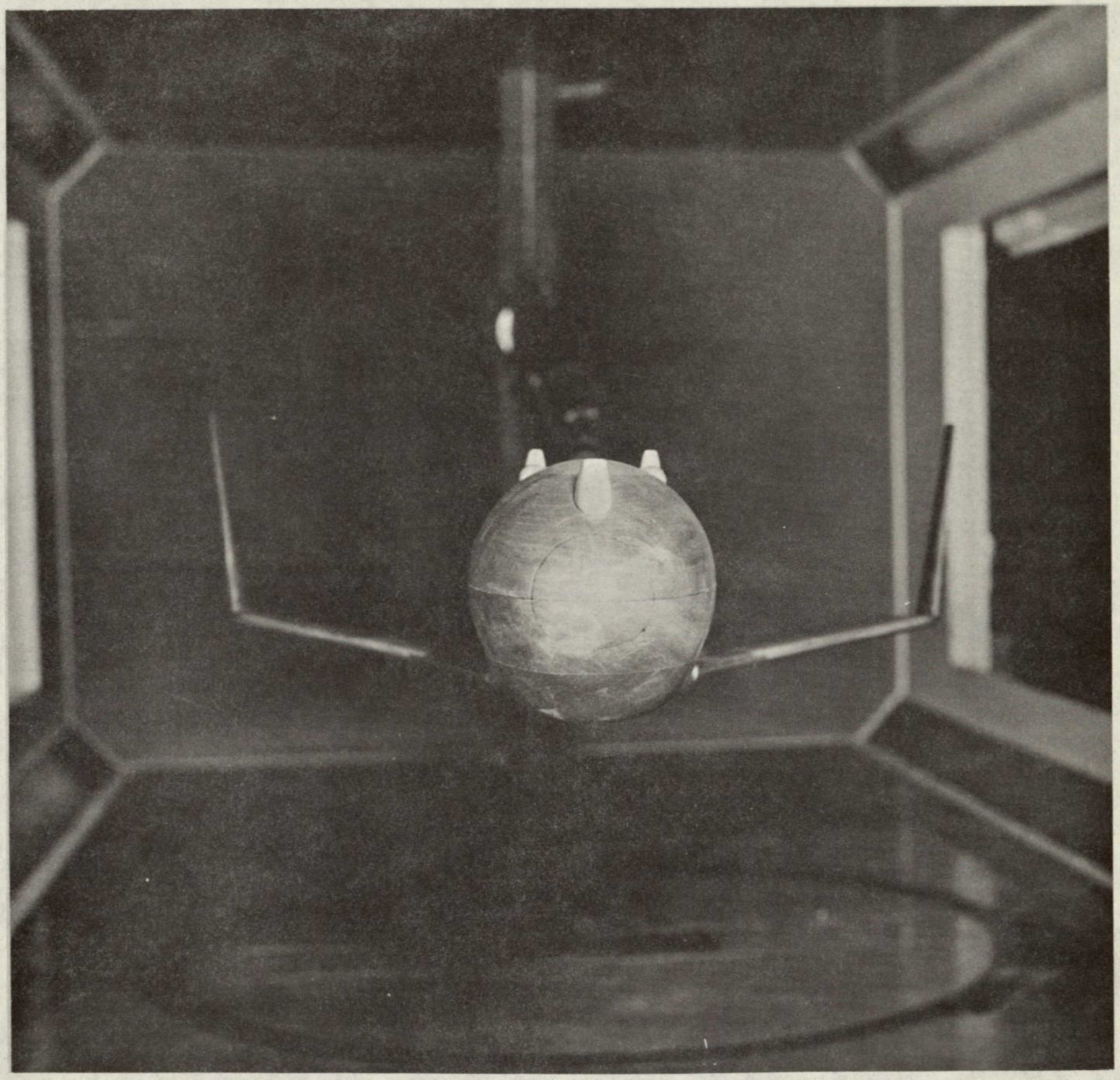


FIGURE 2. FRONTAL VIEW OF $B_1W_oV_1K_1R_1$ INSTALLED IN DAC-LSWT

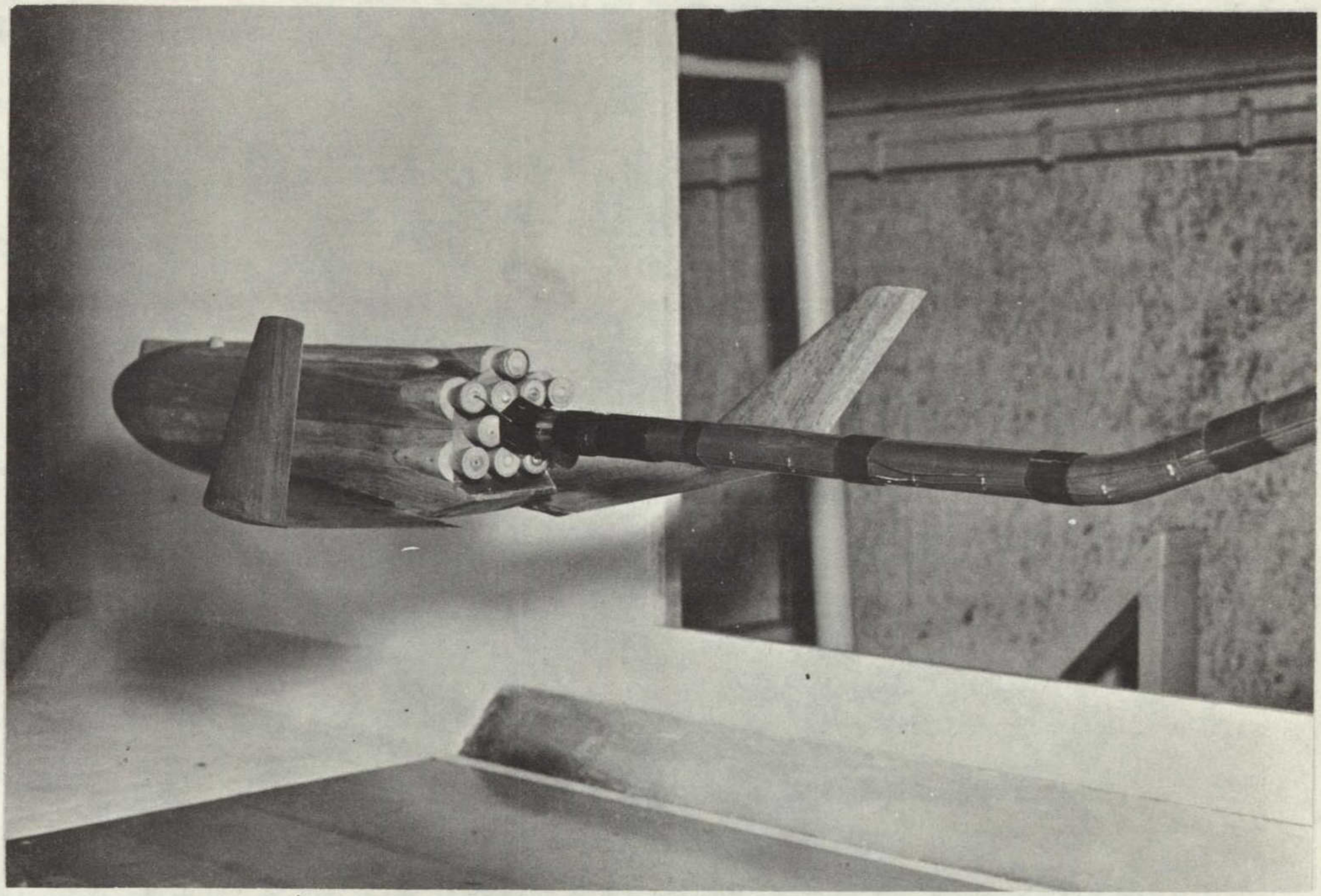


FIGURE 3. THREE-QUARTER LEFT REAR VIEW OF $B_1W_oV_1K_1R_1$ INSTALLED IN DAC-LSWT

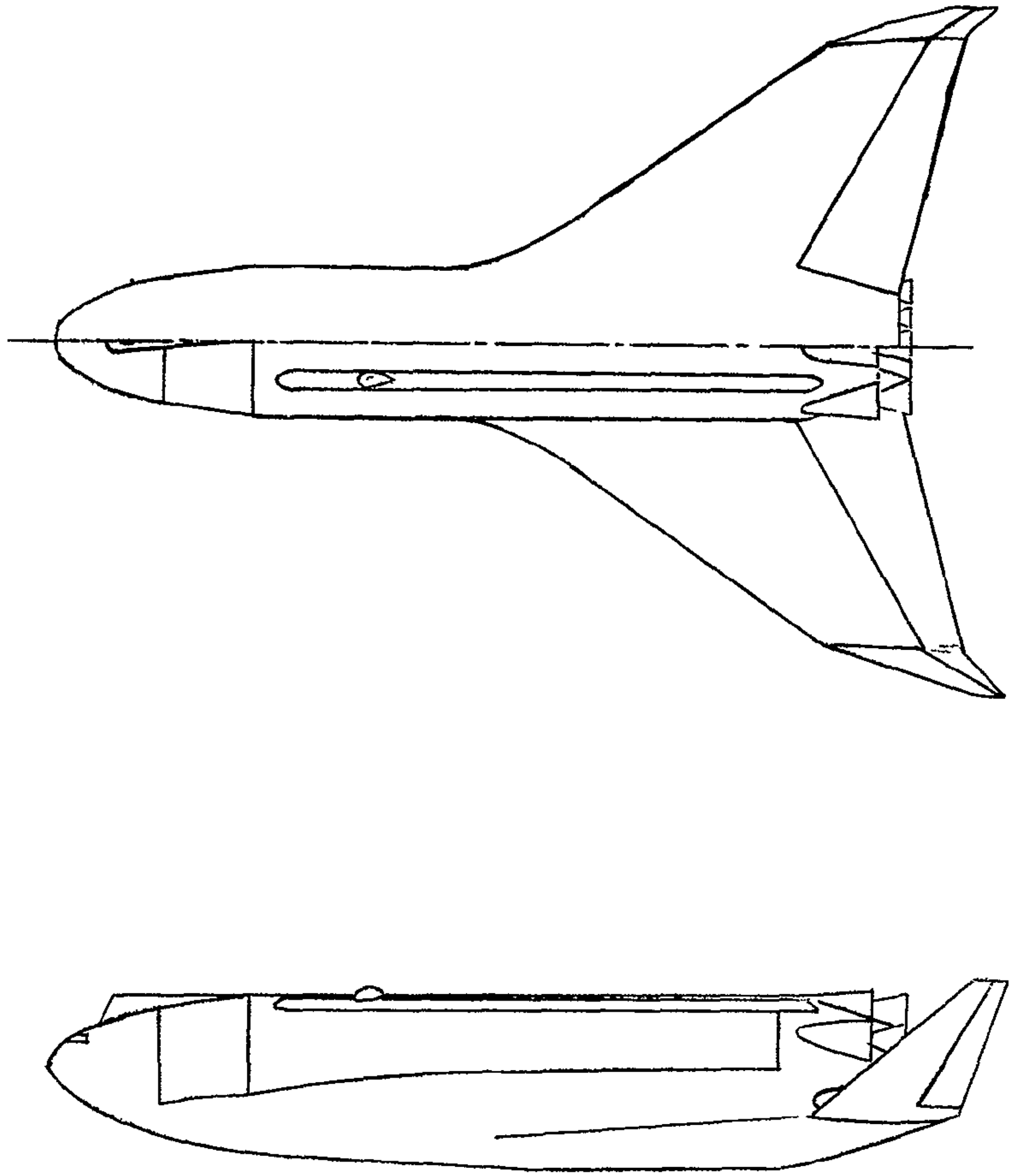
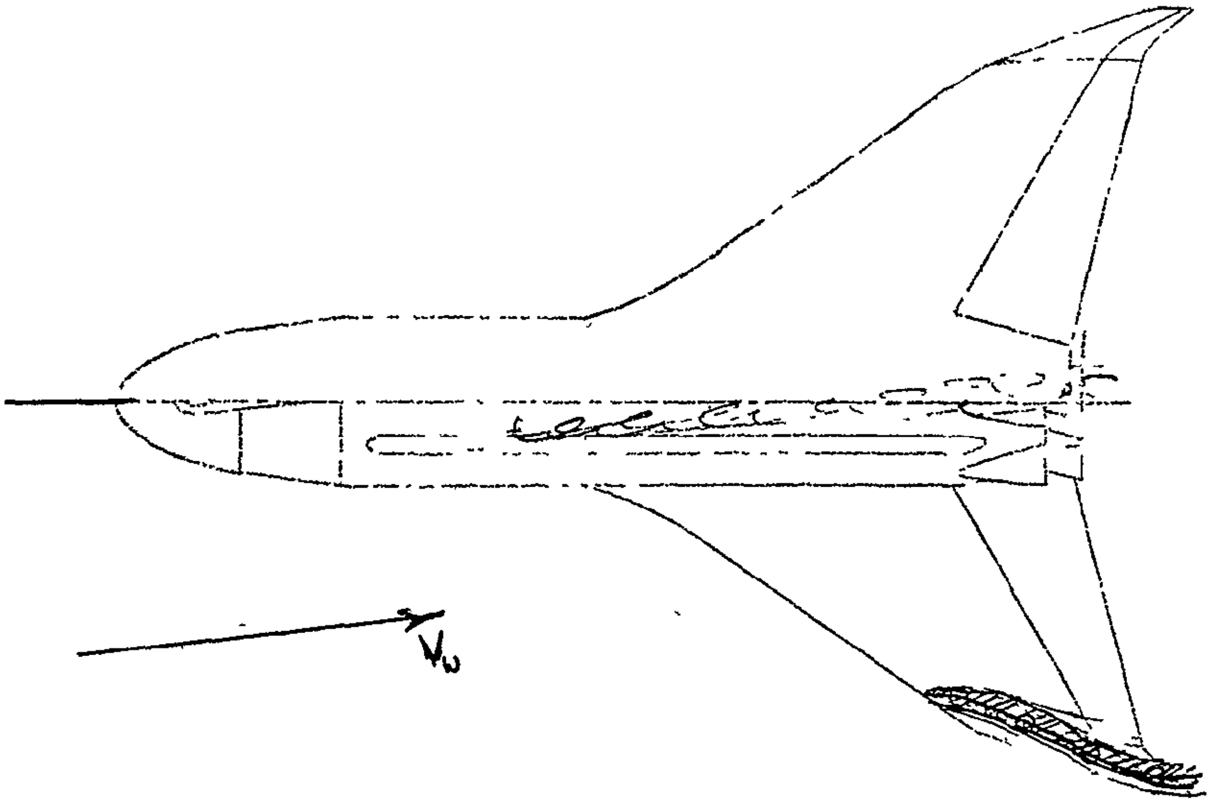


FIGURE 4. McDONNELL-DOUGLAS DELTA WING BOOSTER CONFIGURATION



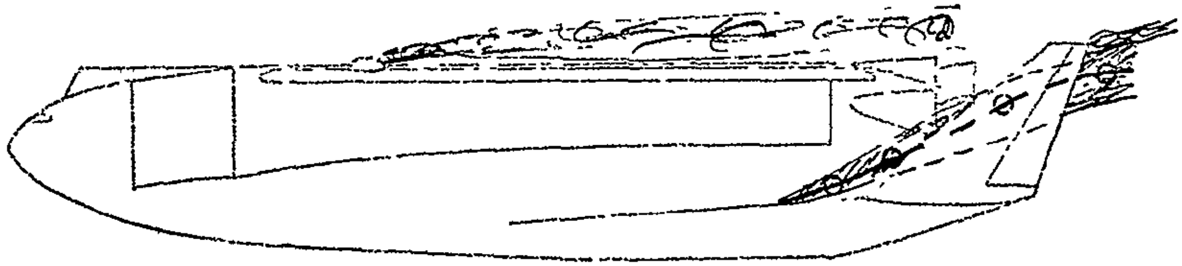
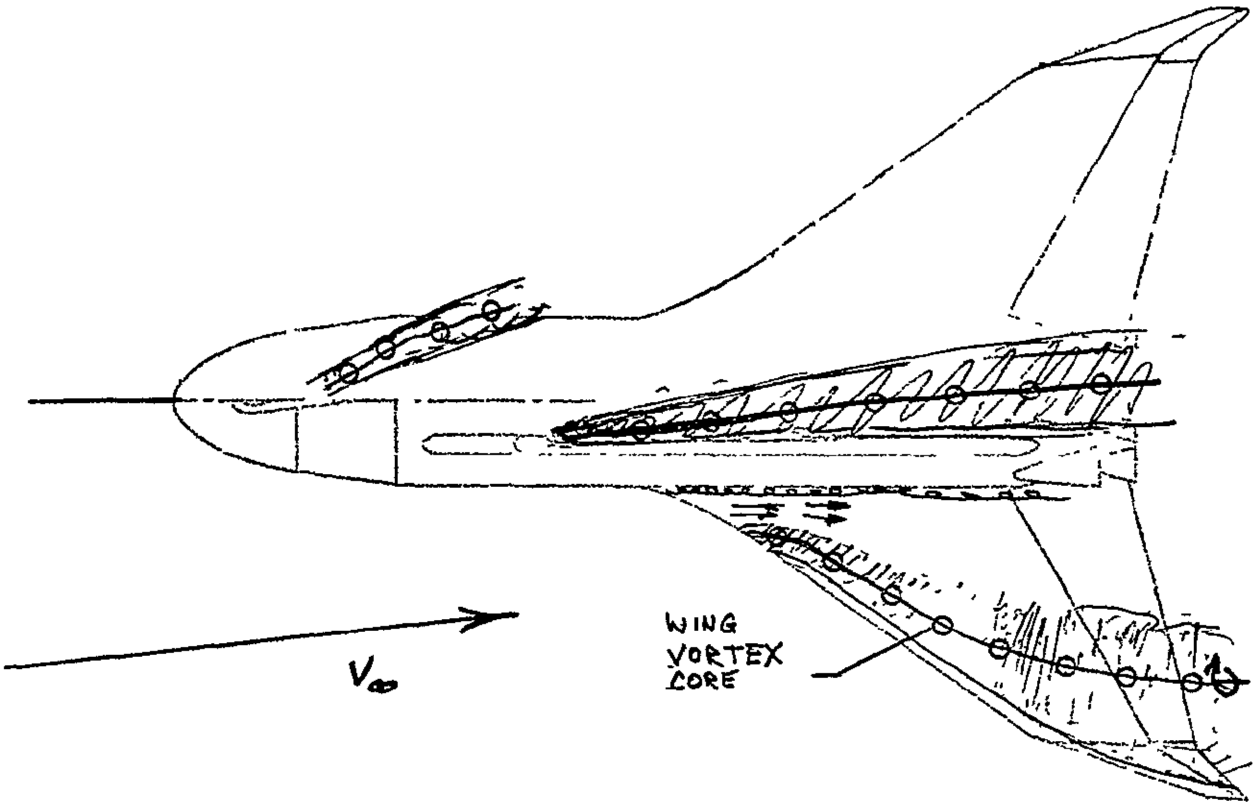


FIGURE 5. FLOWFIELD STUDIES CONFIGURATION
$B_1W_0V_2K_1R_1Z$ $\alpha = 4.9^{\circ}$, $\beta = -6^{\circ}$



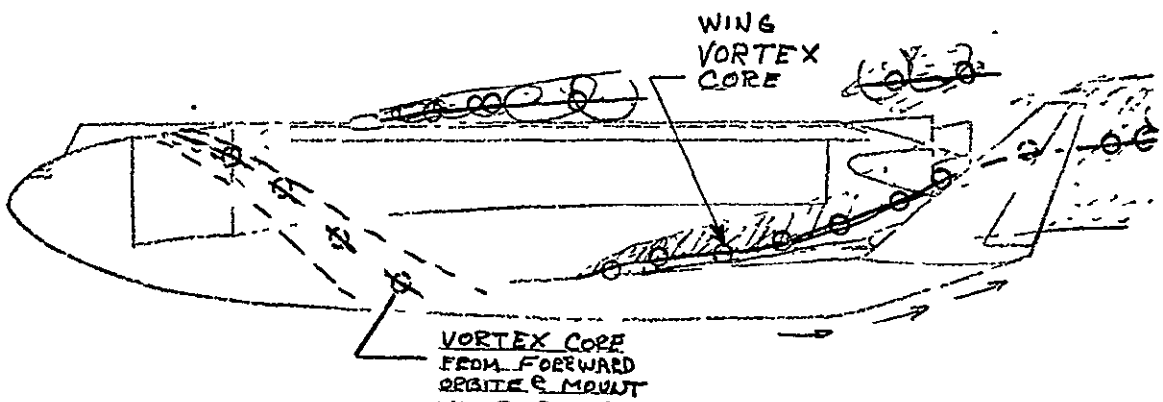


FIGURE 6. FLOWFIELD STUDIES CONFIGURATION
$B_1W_oV_2K_1R_1Z$ $\alpha = 9.5^o$, $\beta = -6^o$

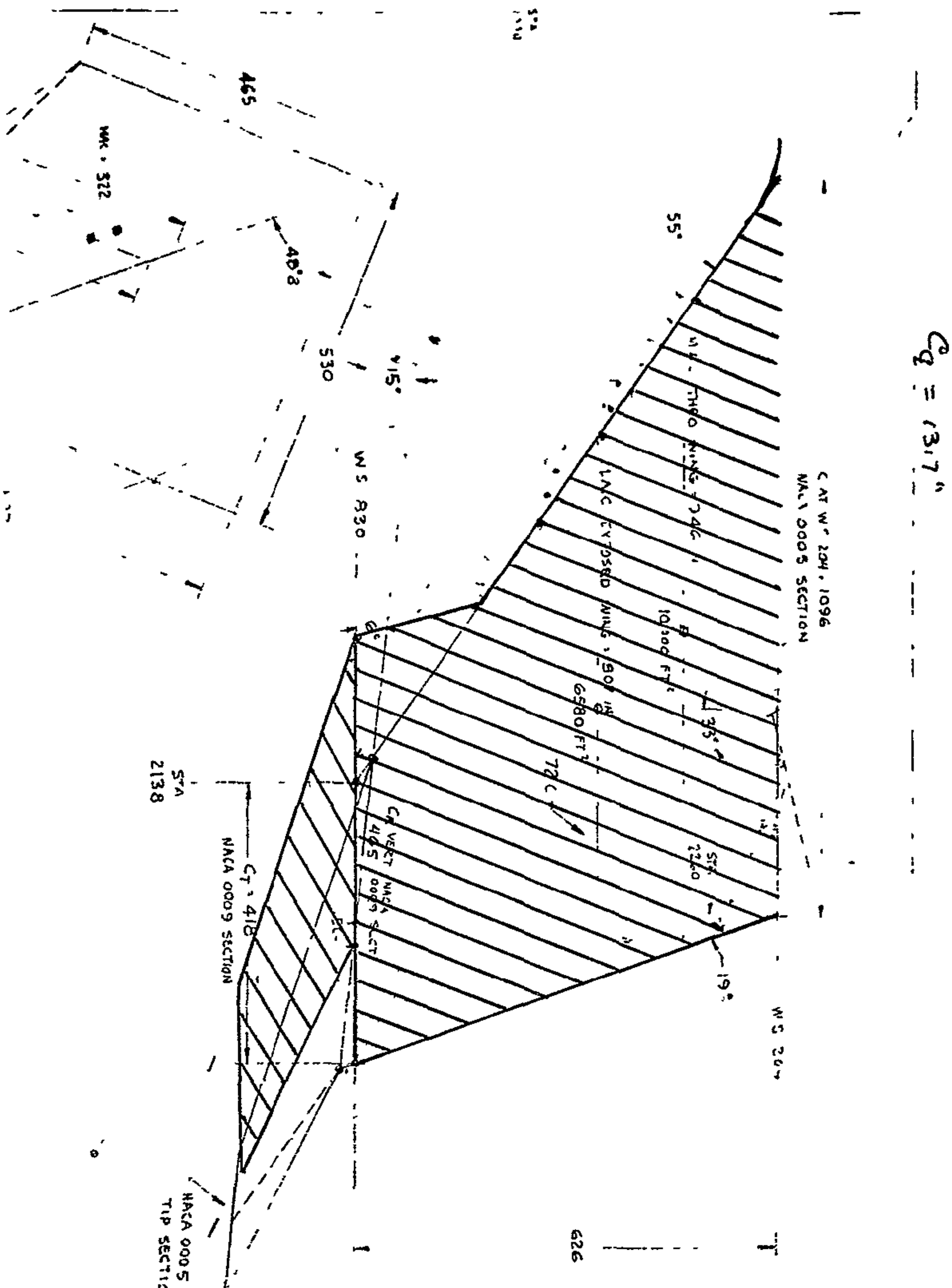


FIGURE 7. MODIFIED WING FIN FOR LONG BEACH LOW SPEED WIND TUNNEL TESTS

DATA DISPLAY INDEX

1 CONFIGURATION COMPONENT EFFECTS AT BETA = 0 DEGREES

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, MULTIPLE DATASETS

DATASETS PLOTTED:
RC2072 RC2062 RC2032 RC2012 RC2022

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CL	ALPHA	1	1
CDF	ALPHA	2	2
CN	ALPHA	3	3
CAF	ALPHA	4	4
CLM	ALPHA	5	5
L/D	ALPHA	6	6

2 CONFIGURATION COMPONENT EFFECTS AT BETA = -6 DEGREES

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, MULTIPLE DATASETS

DATASETS PLOTTED:
RC2071 RC2061 RC2031 RC2011 RC2021 RC2051

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CL	ALPHA	7	7
CDF	ALPHA	8	8
CN	ALPHA	9	9
CAF	ALPHA	10	10
CLM	ALPHA	11	11
L/D	ALPHA	12	12
CY	ALPHA	13	13
CYN	ALPHA	14	14
CBL	ALPHA	15	15

3 CONFIGURATION COMPONENT EFFECTS AT BETA = 0 DEGREES

DEPENDENT VARIABLE VS DEPENDENT VARIABLE, MULTIPLE DATASETS

DATASETS PLOTTED:
RC2072 RC2062 RC2032 RC2012 RC2022

DEPENDENT VARIABLE	DEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CL	CDF	16	16
CL	CLM	17	17

4. CONFIGURATION COMPONENT EFFECTS AT BETA = -6 DEGREES

DEPENDENT VARIABLE VS DEPENDENT VARIABLE, MULTIPLE DATASETS

DATASETS PLOTTED:
RC2071 RC2061 RC2031 RC2011 RC2021 RC2051

DEPENDENT VARIABLE	DEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CL	CDF	18	18
CL	CLM	19	19

5. EFFECTS OF SIDESLIP ANGLE ON BASIC AERODYNAMIC CHARACTERISTICS

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:
RC2021 AB2022 RC2023

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CL	ALPHA	20	20
CDF	ALPHA	21	21
CN	ALPHA	22	22
CAF	ALPHA	23	23
CLM	ALPHA	24	24
L/D	ALPHA	25	25
CY	ALPHA	26	26
CYN	ALPHA	27	27
CBL	ALPHA	28	28

6 EFFECTS OF ANGLE OF ATTACK ON BASIC AERODYNAMIC CHARACTERISTICS

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:
RC2026 RC2024 RC2025

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CL	BETA	29	29
CDF	BETA	30	30
CN	BETA	31	31
CAF	BETA	32	32
CLM	BETA	33	33
L/D	BETA	34	34
CY	BETA	35	35
CYN	BETA	36	36
CBL	BETA	37	37

7. EFFECTS OF SIDESLIP ANGLE ON BASIC AERODYNAMIC CHARACTERISTICS

DEPENDENT VARIABLE VS DEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:
RC2021 AB2022 RC2023

DEPENDENT VARIABLE	DEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CL	CDF	38	38
CL	CLM	39	39

8. EFFECTS OF ANGLE OF ATTACK ON BASIC AERODYNAMIC CHARACTERISTICS

DEPENDENT VARIABLE VS DEPENDENT VARIABLE, PARAMETRIC STUDY

DATASETS PLOTTED:
RC2026 RC2024 RC2025

DEPENDENT VARIABLE	DEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CY	CYN	40	40
CY	CDF	41	41

9. EFFECTS OF TRANSITION STRIPS (BETA = -6 DEGREES)

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE, MULTIPLE DATASETS

DATASETS PLOTTED:
RC2051 RC2041

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CL	ALPHA	42	42
CDF	ALPHA	43	43
CN	ALPHA	44	44
CAF	ALPHA	45	45
CLM	ALPHA	46	46
L/D	ALPHA	47	47
CY	ALPHA	48	48
CYN	ALPHA	49	49
CBL	ALPHA	50	50

10 EFFECTS OF TRANSITION STRIPS (BETA = -6 DEGREES)

DEPENDENT VARIABLE VS DEPENDENT VARIABLE, MULTIPLE DATASETS

DATASETS PLOTTED:
RC2051 RC2041

DEPENDENT VARIABLE	DEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
CL	CDF	51	51
CL	CLM	52	52

11 CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1WORIZ

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE

DATASETS PLOTTED	DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
RC2BT1	CYBETA	ALPHA	53	53
RC2BT1	DCBLDB	ALPHA	54	54
RC2BT1	DCYNDB	ALPHA	55	55

12 CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1WOZK1

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE

DATASETS PLOTTED	DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
RC2BT2	CYBETA	ALPHA	56	56
RC2BT2	DCBLDB	ALPHA	57	57
RC2BT2	DCYNDB	ALPHA	58	58

13 CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1WORIZK1

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE

DATASETS PLOTTED	DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
RC2BT3	CYBETA	ALPHA	59	59
RC2BT3	DCBLDB	ALPHA	60	60
RC2BT3	DCYNDB	ALPHA	61	61

14 CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1WORIZKIV1

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE

DATASETS PLOTTED	DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
RC2BT4	CYBETA	ALPHA	62	62
RC2BT4	DCBLDB	ALPHA	63	63
RC2BT4	DCYNDB	ALPHA	64	64

15 CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1WORIZKIV2 (ALPHA SCHEDULE A)

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE

DATASETS PLOTTED	DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
RC2BT5	CYBETA	ALPHA	65	65
RC2BT5	DCBLDB	ALPHA	66	66
RC2BT5	DCYNDB	ALPHA	67	67

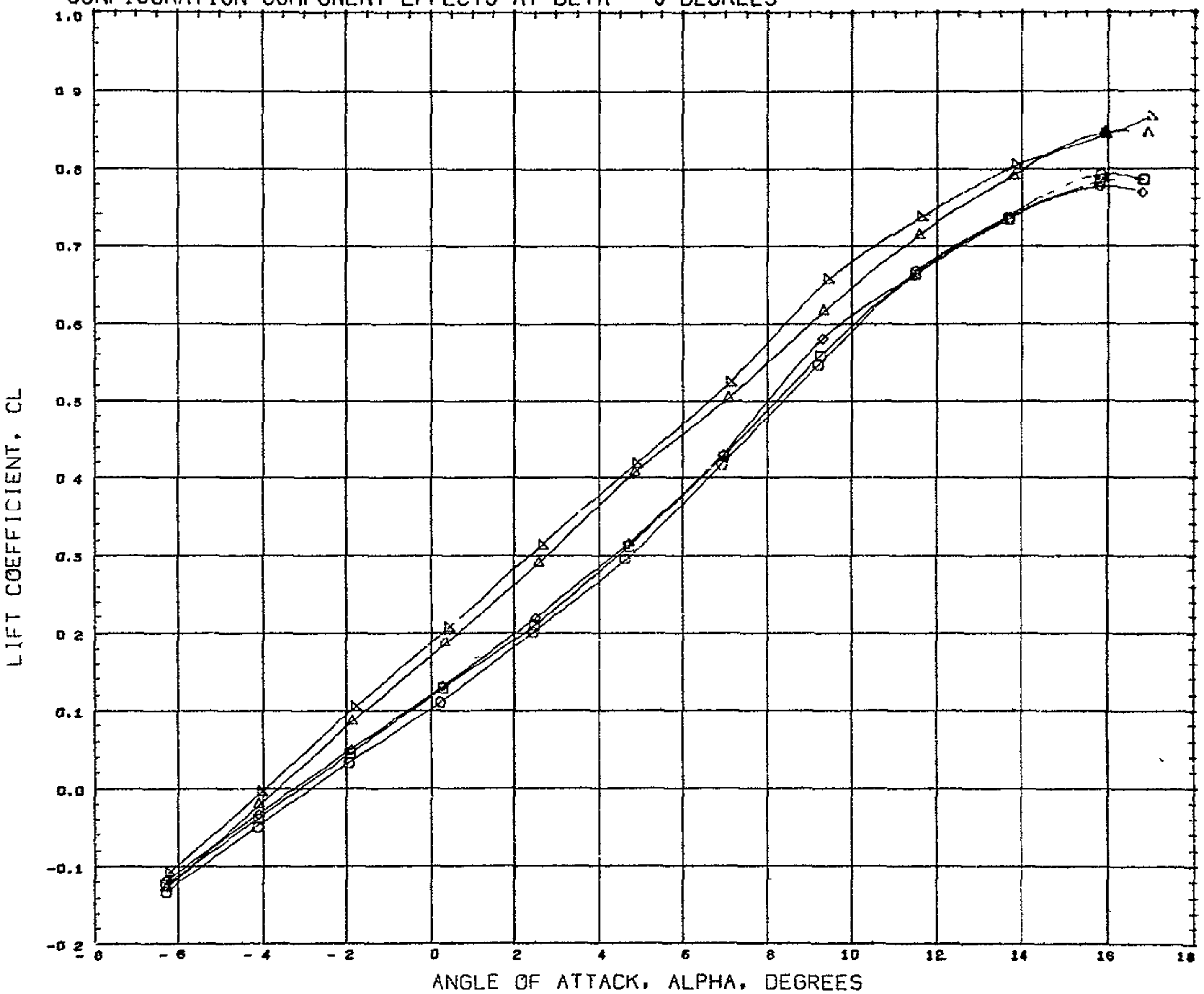
16 CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1WORIZKIV2 (ALPHA SCHEDULE B)

DEPENDENT VARIABLE VS INDEPENDENT VARIABLE

DATASETS PLOTTED	DEPENDENT VARIABLE	INDEPENDENT VARIABLE	PLOT PAGE BEGINNING	/ ENDING
RC2BT6	CYBETA	ALPHA	68	68
RC2BT6	DCBLDB	ALPHA	69	69
RC2BT6	DCYNDB	ALPHA	70	70

DATA

CONFIGURATION COMPONENT EFFECTS AT BETA = 0 DEGREES



SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0R1Z	(0 010SCL)	(RC2072)	18 SEP 70	0.181
□	1321-DAC-LSWT-DELBOOST-B1W0K1Z	(0 010SCL)	(RC2062)	18 SEP 70	
◇	1321-DAC-LSWT-DELBOOST-B1W0K1P1Z	(0 010SCL)	(RC2032)	18 SEP 70	
△	1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z	(0.010SCL)	(RC2012)	18 SEP 70	
◁	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z	(0 010SCL)	(RC2022)	18 SEP 70	

REFERENCE FILE MDC (WD) SPACESHUT-A

REFERENCE INFORMATION		
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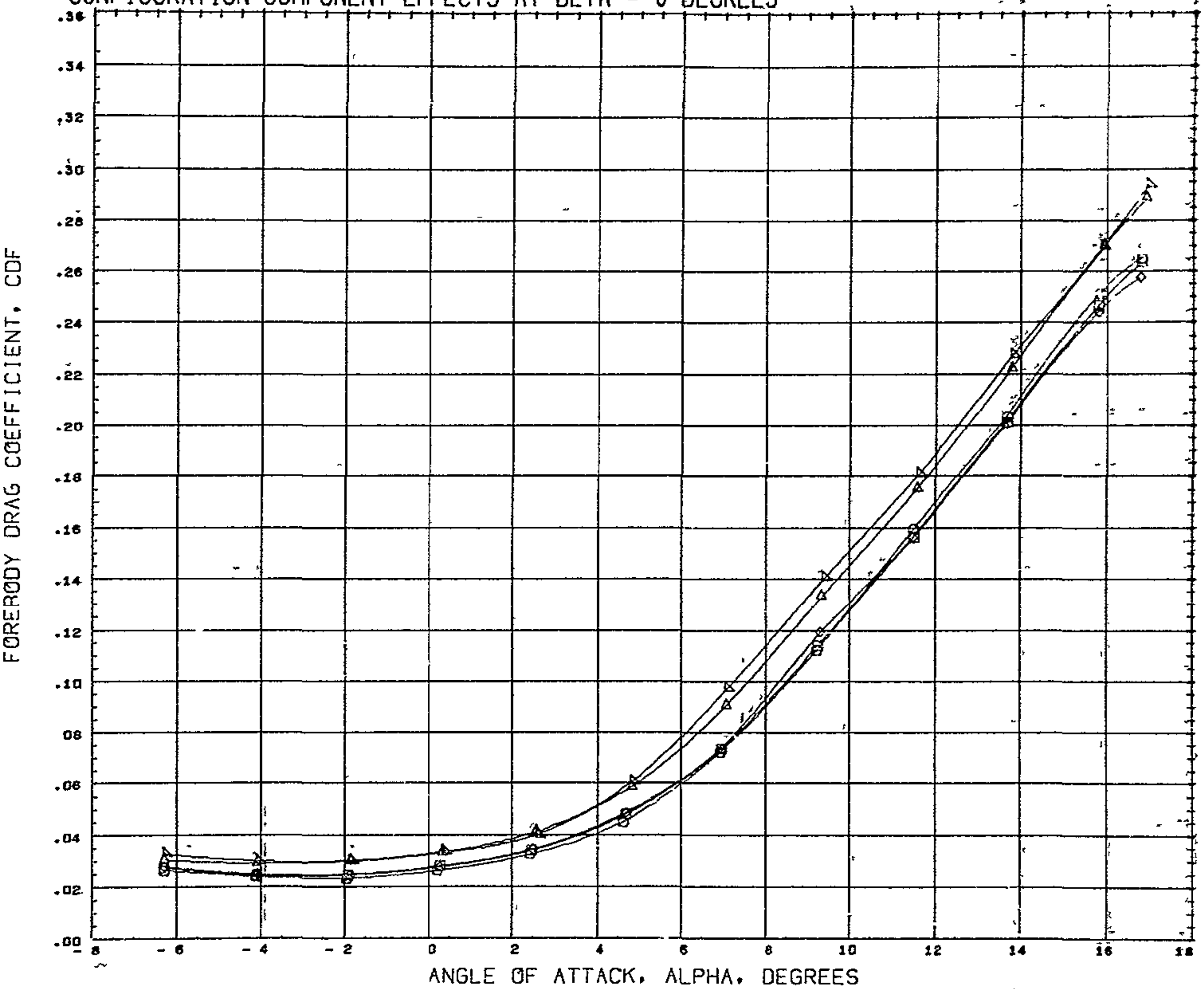
REFL	0 8000	FT.
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0 0000	FT.
ZMRP -	0 0667	FT.
SCALE	0.0100	SCALE

PAGE

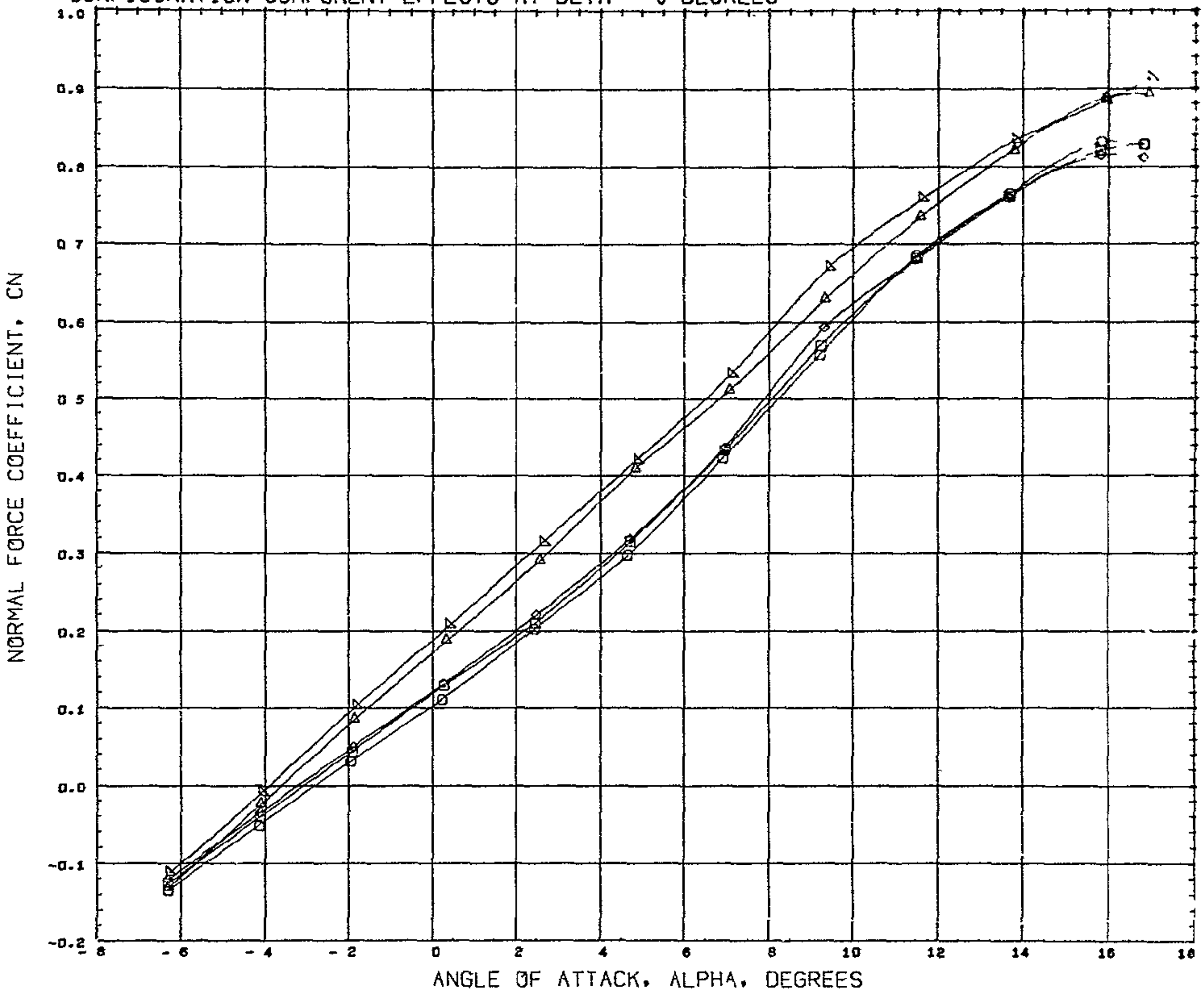
CONFIGURATION COMPONENT EFFECTS AT BETA = 0 DEGREES



SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH	REFERENCE INFORMATION		
○	1321-DAC-LSWT-DELBOOST-B1W0R1Z	(0 010SCL)	(RC2072)	18 SEP 70	0.181	REFS	1 0000	SQ.FT
□	1321-DAC-LSWT-DELBOOST-B1W0K1Z	(0 010SCL)	(RC2062)	18 SEP 70		REFL	0 8000	FT
◇	1321-DAC-LSWT-DELBOOST-B1W0K1R1Z	(0 010SCL)	(RC2032)	18 SEP 70		REFB	1 3800	FT
△	1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z	(0 010SCL)	(RC2012)	18 SEP 70		XMRP	1 2600	FT
◺	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z	(0 010SCL)	(RC2022)	18 SEP 70		YMRP	0 0000	FT
						ZMRP	- 0 0667	FT
						SCALE	0 0100	SCALE

REFERENCE FILE HDC(WD)SPACESHUT-A

CONFIGURATION COMPONENT EFFECTS AT BETA = 0 DEGREES



SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH	REFERENCE INFORMATION		
○	1321-DAC-LSWT-DELBOOST-B1WOR1Z	(0.010SCL)	(RC2072)	18 SEP 70	0.181	REFS	1.0000	SQ FT
□	1321-DAC-LSWT-DELBOOST-B1WOK1Z	(0.010SCL)	(RC2062)	18 SEP 70		REFL	0.8000	FT
◇	1321-DAC-LSWT-DELBOOST-B1WOK1R1Z	(0.010SCL)	(RC2032)	18 SEP 70		REFB	1.3800	FT
△	1321-DAC-LSWT-DELBOOST-B1WOV1K1R1Z	(0.010SCL)	(RC2012)	18 SEP 70		XMRP	1.2600	FT
◺	1321-DAC-LSWT-DELBOOST-B1WOV2K1R1Z	(0.010SCL)	(RC2022)	18 SEP 70		YMRP	0.0000	FT
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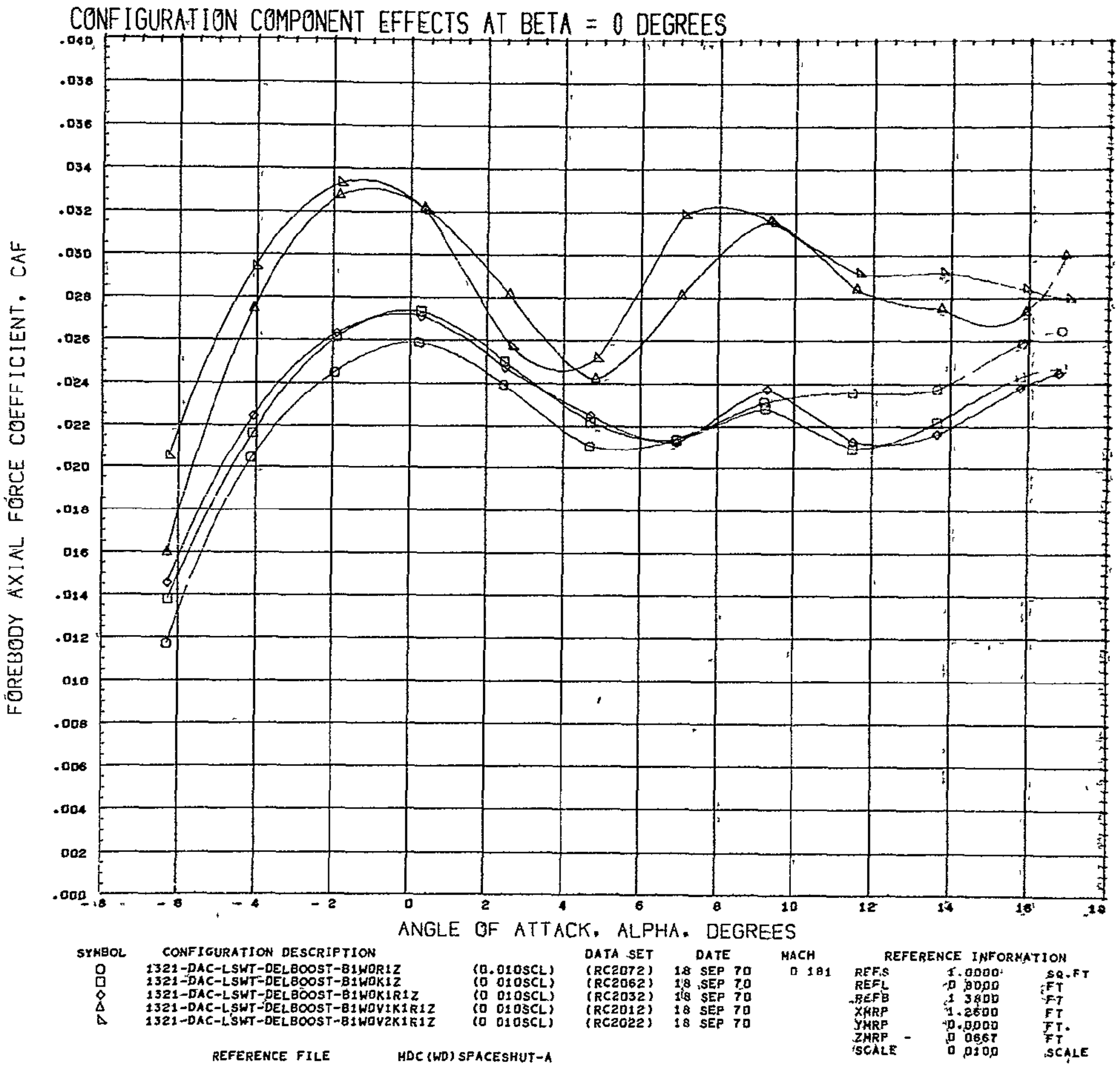

CONFIGURATION COMPONENT EFFECTS AT BETA = 0 DEGREES
FOREBODY AXIAL FORCE COEFFICIENT, CAF
ANGLE OF ATTACK, ALPHA, DEGREES
.040
.038
.036
.034
.032
.030
.028
.026
.024
.022
.020
.018
.016
.014
.012
.010
.008
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6
8
10
12
14
16
18
SYMBOL
CONFIGURATION DESCRIPTION
DATA SET
DATE
MACH
REFERENCE INFORMATION
1321-DAC-LSWT-DELBOOST-B1W0R1Z (0.010SCL) (RC2072) 18 SEP 70 0.181
1321-DAC-LSWT-DELBOOST-B1W0K1Z (0.010SCL) (RC2062) 18 SEP 70
1321-DAC-LSWT-DELBOOST-B1W0K1R1Z (0.010SCL) (RC2032) 18 SEP 70
1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z (0.010SCL) (RC2012) 18 SEP 70
1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z (0.010SCL) (RC2022) 18 SEP 70
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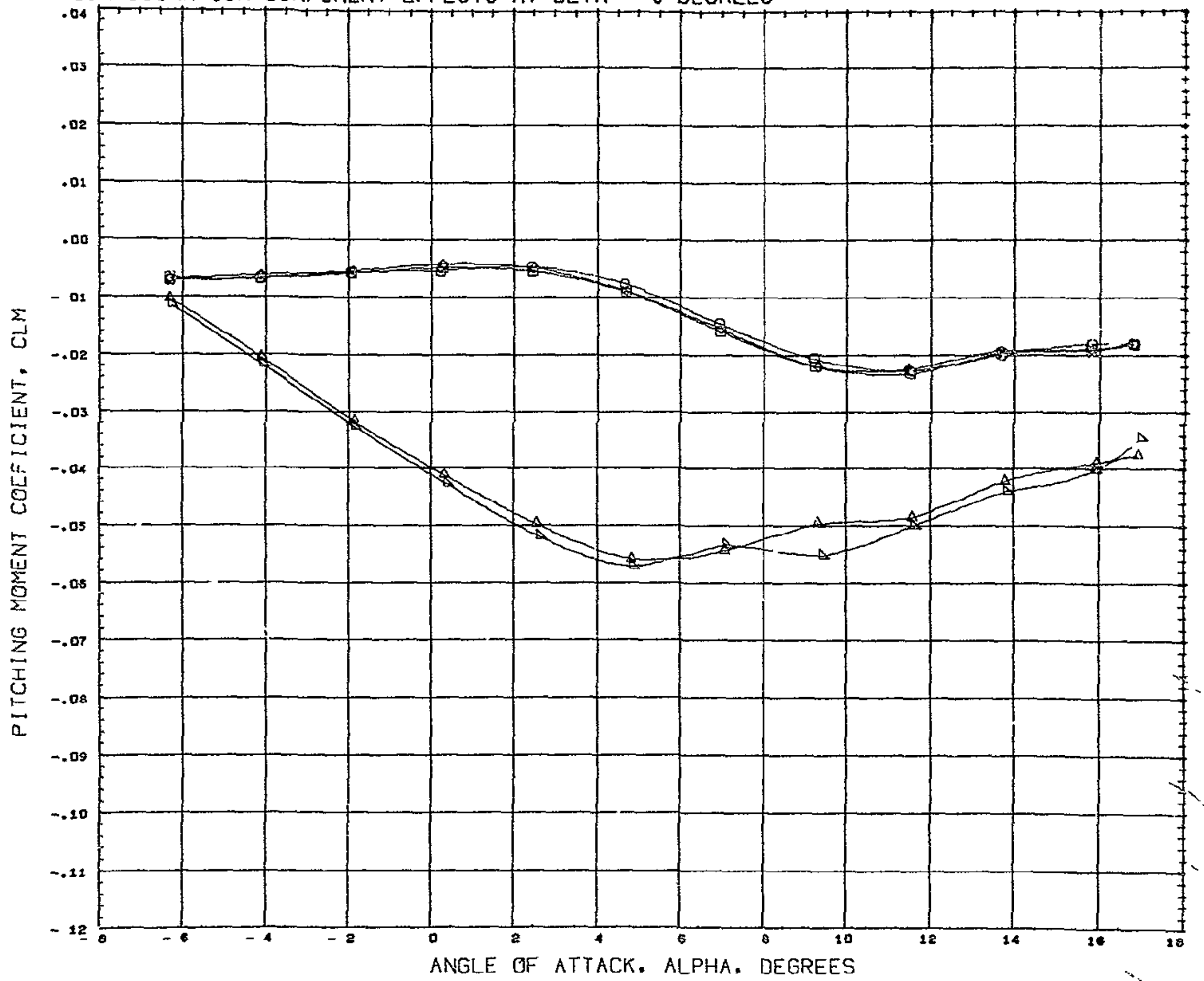
REFL 0.8000 FT
REFB 1.3800 FT
XMRP 1.2600 FT
YMRP 0.0000 FT.
ZMRP - 0.0667 FT
SCALE 0.0100 SCALE
REFERENCE FILE HDC(WD)SPACESHUT-A

CONFIGURATION COMPONENT EFFECTS AT BETA = 0 DEGREES



SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1WDR1Z	(0 010SCL)	(RC2072)	18 SEP 70	0 181
□	1321-DAC-LSWT-DELBOOST-B1WDK1Z	(0 010SCL)	(RC2062)	18 SEP 70	
◇	1321-DAC-LSWT-DELBOOST-B1WDK1R1Z	(0 010SCL)	(RC2032)	18 SEP 70	
△	1321-DAC-LSWT-DELBOOST-B1WDV1K1R1Z	(0 010SCL)	(RC2012)	18 SEP 70	
◺	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1Z	(0 010SCL)	(RC2022)	18 SEP 70	

REFERENCE FILE HDC(WD)SPACESHUT-A

REFERENCE INFORMATION		
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REFL	0 8000	FT
REFB	1 3800	FT
XMRP	1 2600	FT
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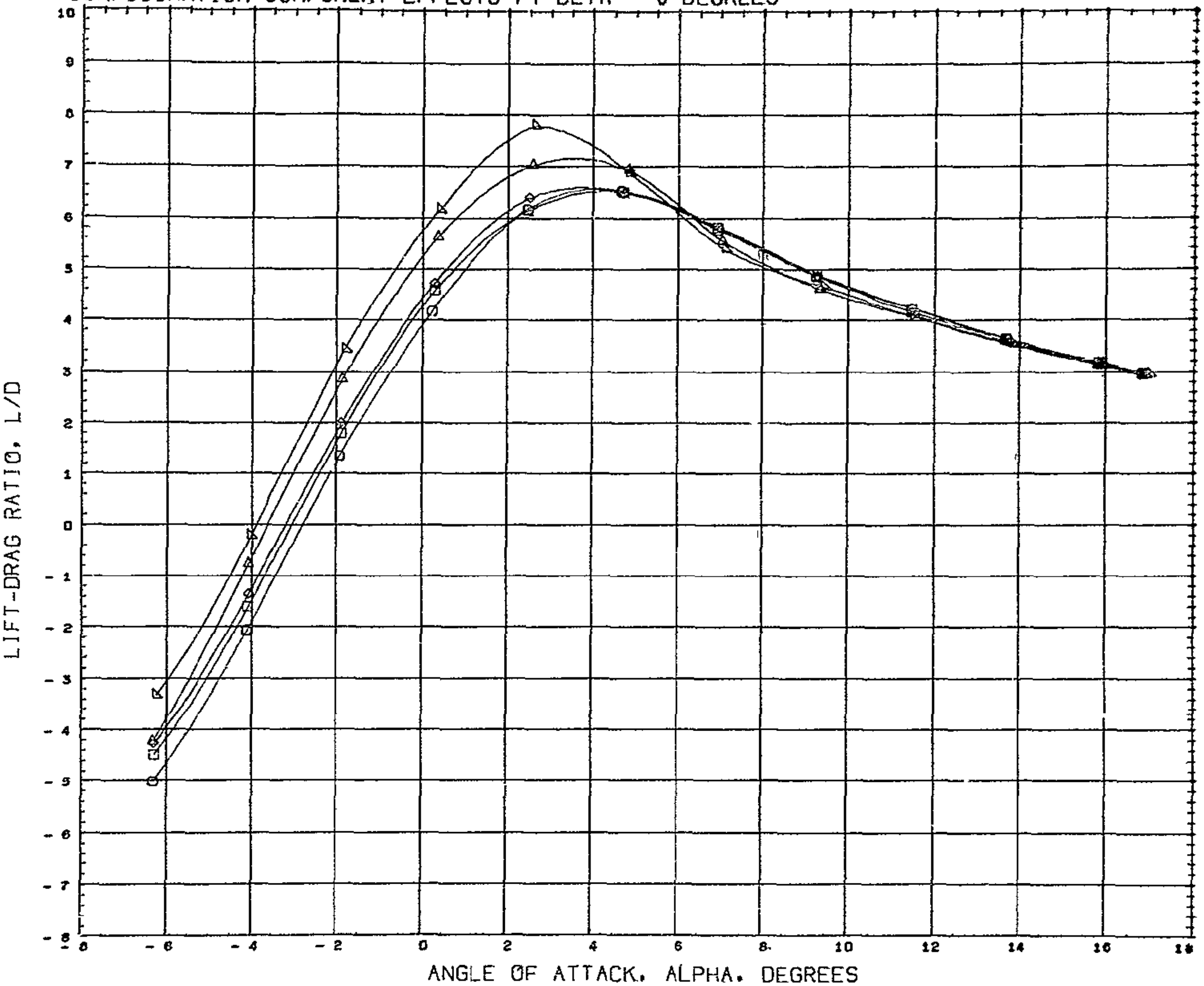
ZMRP -	0.0667	FT
SCALE	0 0100	SCALE

CONFIGURATION COMPONENT EFFECTS AT BETA = 0 DEGREES



SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0R1Z	(0 010SCL)	(RC2072)	18 SEP 70	0 181
□	1321-DAC-LSWT-DELBOOST-B1W0K1Z	(0 010SCL)	(RC2062)	18 SEP 70	
◇	1321-DAC-LSWT-DELBOOST-B1W0K1R1Z	(0 010SCL)	(RC2032)	18 SEP 70	
△	1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z	(0 010SCL)	(RC2012)	18 SEP 70	
◺	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z	(0 010SCL)	(RC2022)	18 SEP 70	

REFERENCE INFORMATION

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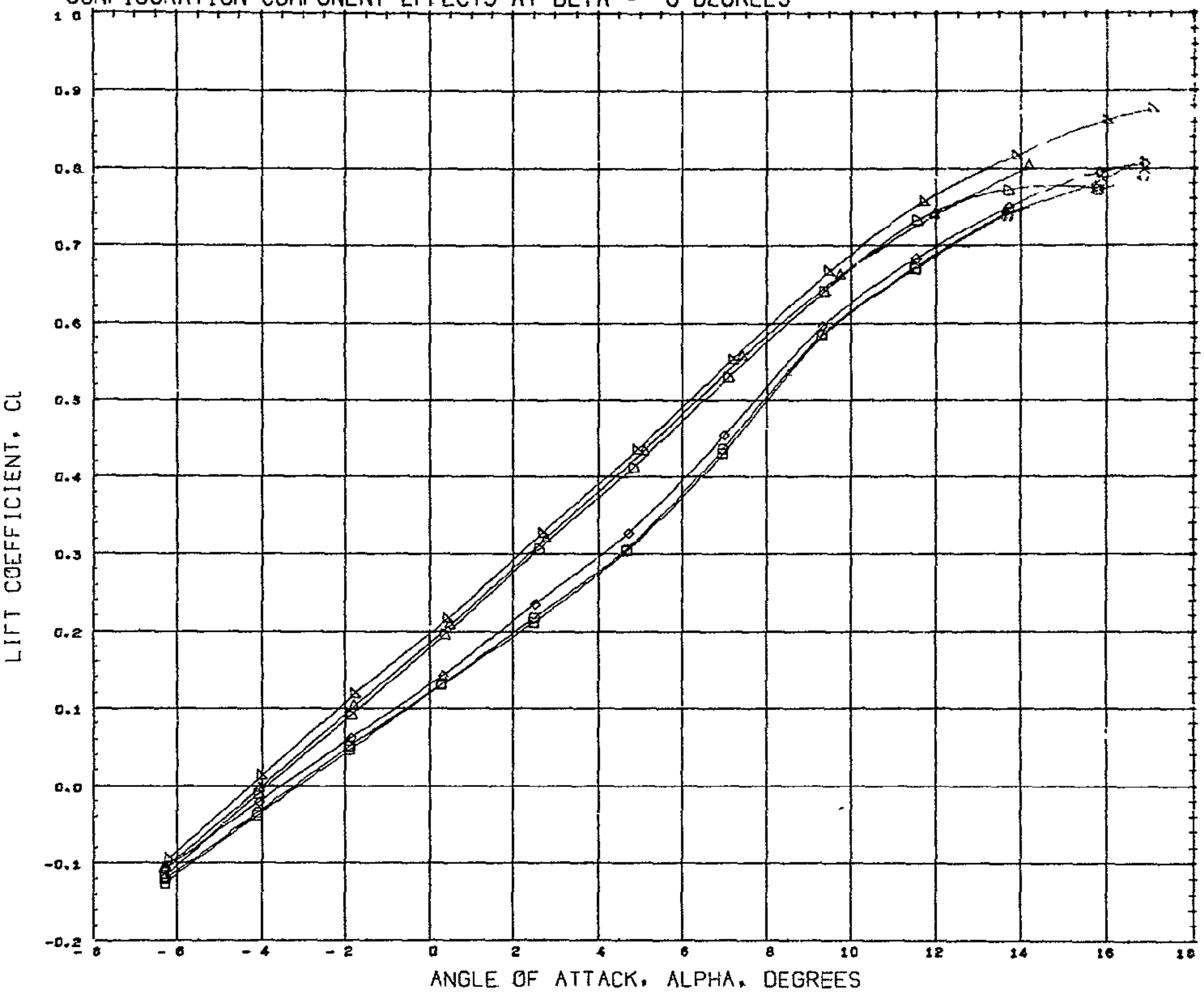
REFB	1 3800	FT
XMRP	1 2600	FT.
YMRP	0 0000	FT.
ZMRP -	0 0667	FT
SCALE	0.0100	SCALE

REFERENCE FILE HDC(WD)SPACESHUT-A

CONFIGURATION COMPONENT EFFECTS AT BETA = -6 DEGREES



SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0R1Z	(0.010SCL)	(RC2071)	18 SEP 70	0.181
□	1321-DAC-LSWT-DELBOOST-B1W0K1Z	(0.010SCL)	(RC2061)	18 SEP 70	
◇	1321-DAC-LSWT-DELBOOST-B1W0K1R1Z	(0.010SCL)	(RC2031)	18 SEP 70	
△	1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z	(0.010SCL)	(RC2011)	18 SEP 70	
◺	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z	(0.010SCL)	(RC2021)	18 SEP 70	
D	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z	(0.010SCL)	(RC2051)	18 SEP 70	

REFERENCE FILE MDC(WD)SPACESHUT-A

REFERENCE INFORMATION		
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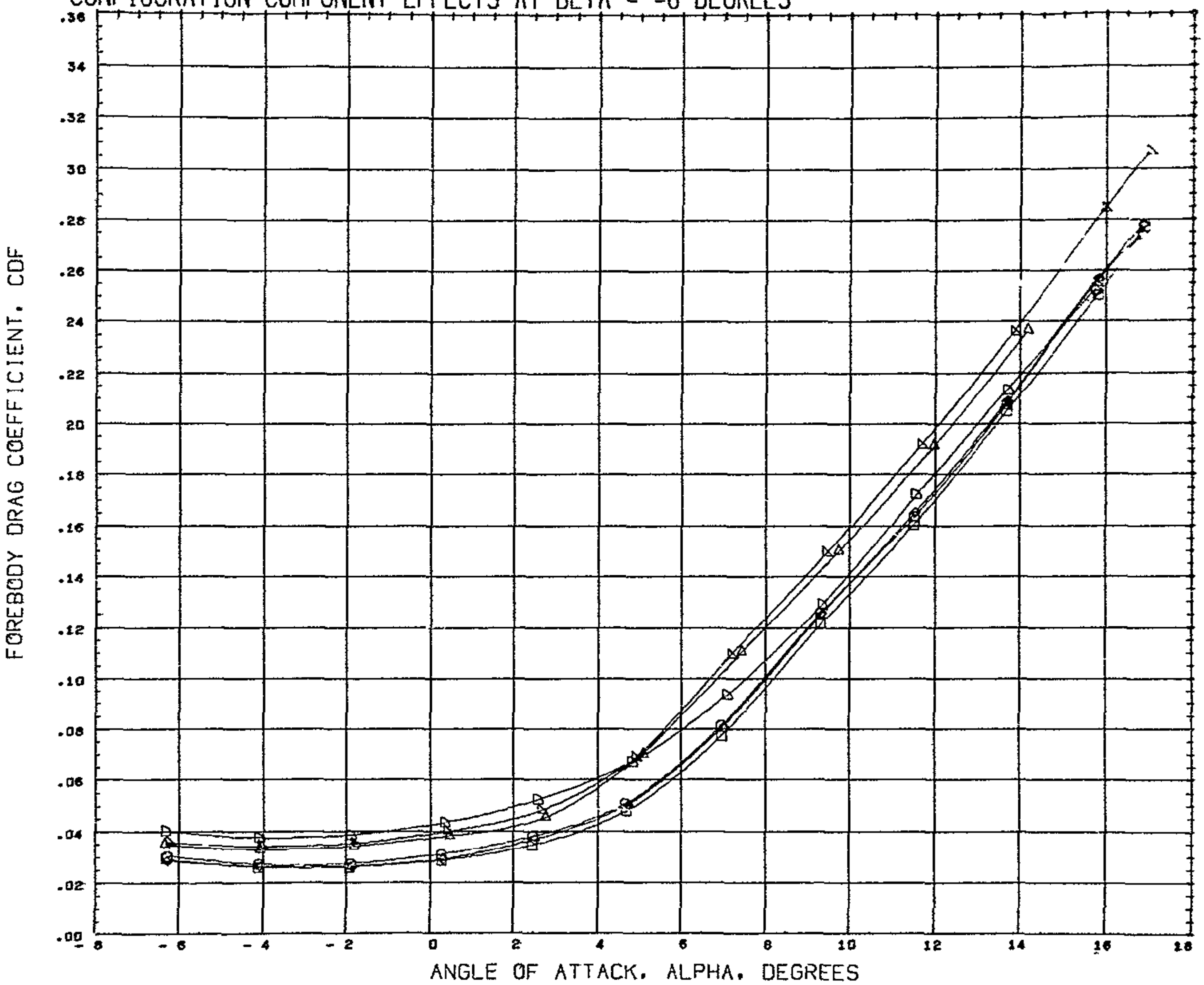
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE

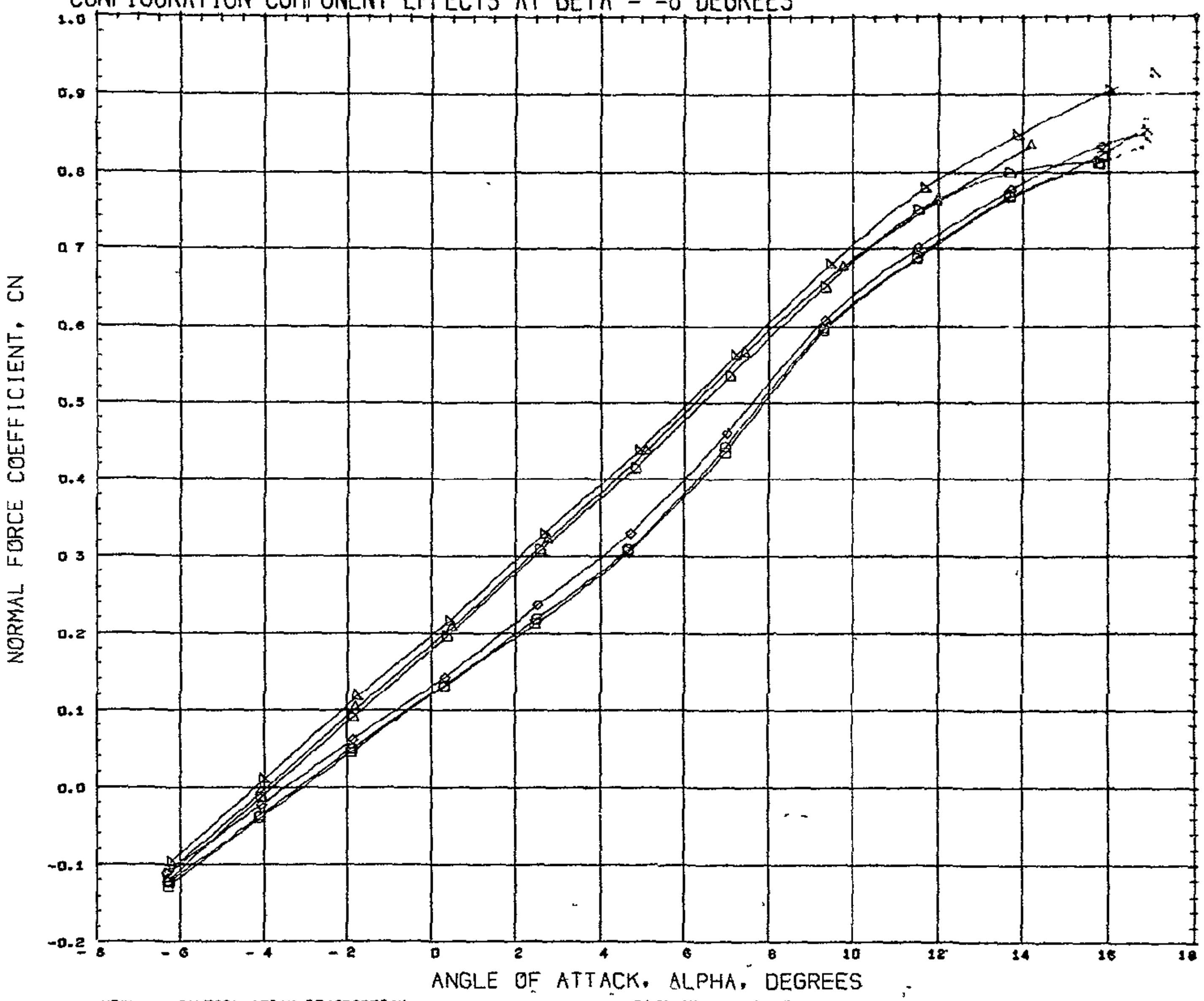
CONFIGURATION COMPONENT EFFECTS AT BETA = -6 DEGREES



SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH	REFERENCE INFORMATION		
○	1321-DAC-LSWT-DELBOOST-B1WDR1Z	(0 010SCL)	(RC2071)	18 SEP 70	0 181	REFS	1 0000	SQ FT
□	1321-DAC-LSWT-DELBOOST-B1WDK1Z	(0.010SCL)	(RC2061)	18 SEP 70		REFL	0 8000	FT
◇	1321-DAC-LSWT-DELBOOST-B1WDK1R1Z	(0 010SCL)	(RC2031)	18 SEP 70		REFB	1 3600	FT
Δ	1321-DAC-LSWT-DELBOOST-B1WDV1K1R1Z	(0 010SCL)	(RC2011)	18 SEP 70		XMRP	1,2600	FT
◺	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1Z	(0 010SCL)	(RC2021)	18 SEP 70		YMRP	0,0000	FT
D	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1L1L2Z	(0 010SCL)	(RC2051)	18 SEP 70		ZMRP -	0 0667	FT
						SCALE	0 0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A

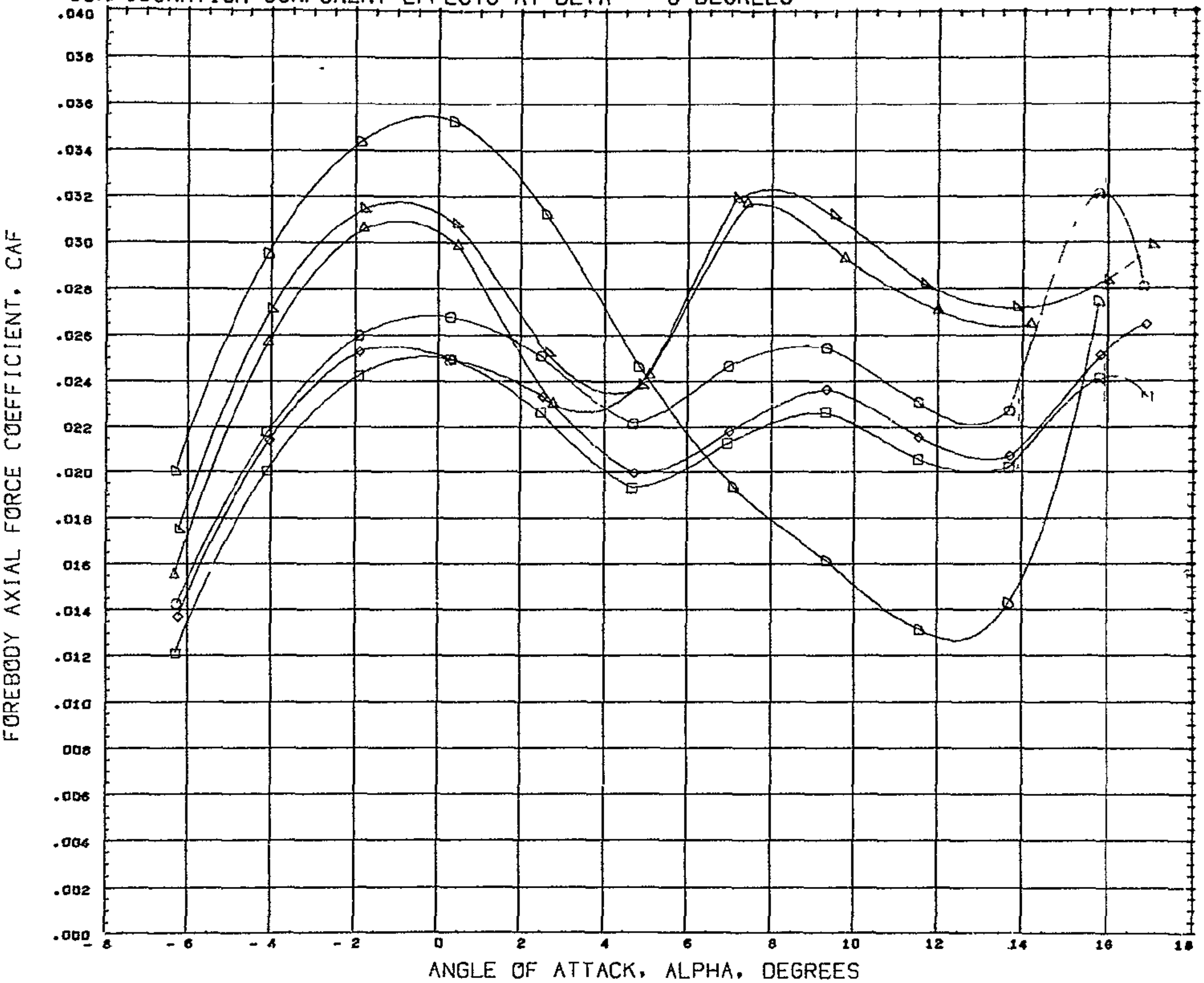
CONFIGURATION COMPONENT EFFECTS AT BETA = -6 DEGREES



SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH	REFERENCE INFORMATION		
○	1321-DAC-LSWT-DELBOOST-B1W0R1Z	(0 010SCL)	(RC2071)	18 SEP 70	0.181	REFS	1.0000	SQ FT
□	1321-DAC-LSWT-DELBOOST-B1W0K1Z	(0 010SCL)	(RC2061)	18 SEP 70		REFL	0 8000	FT
◇	1321-DAC-LSWT-DELBOOST-B1W0K1R1Z	(0 010SCL)	(RC2031)	18 SEP 70		REFB	1.3600	FT
△	1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z	(0.010SCL)	(RC2011)	18 SEP 70		XMRP	1.2600	FT.
◺	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z	(0 010SCL)	(RC2021)	18 SEP 70		YMRP	0 0000	FT
D	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z	(0.010SCL)	(RC2051)	18 SEP 70		ZMRP -	0 0667	FT
						SCALE	0 0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A

CONFIGURATION COMPONENT EFFECTS AT BETA = -6 DEGREES

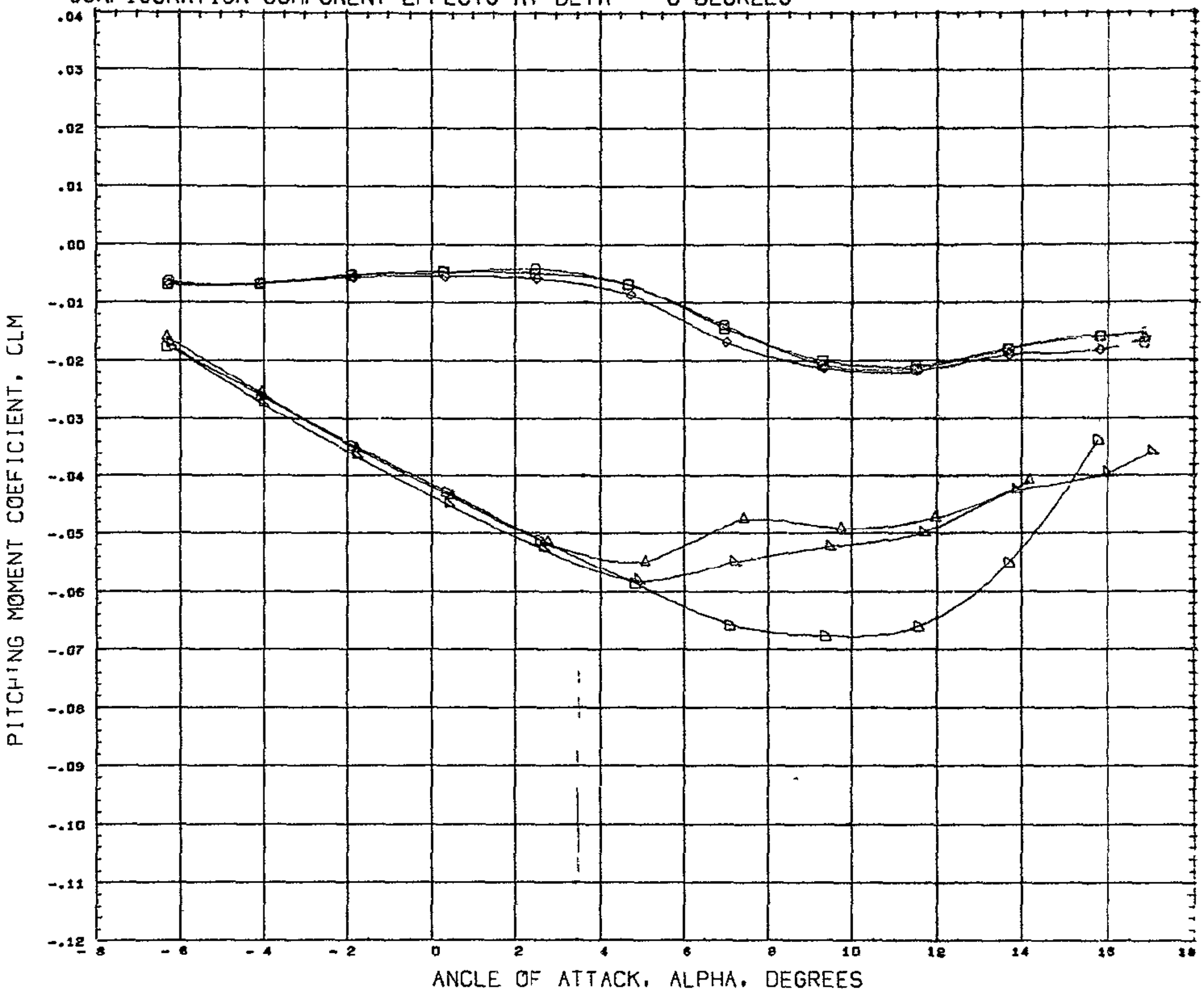


SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0R1Z	(0 010SCL)	(RC2071)	18 SEP 70	0 181
□	1321-DAC-LSWT-DELBOOST-B1W0K1Z	(0 010SCL)	(RC2061)	18 SEP 70	
◇	1321-DAC-LSWT-DELBOOST-B1W0K1R1Z	(0 010SCL)	(RC2031)	18 SEP 70	
△	1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z	(0 0.0SCL)	(RC2011)	18 SEP 70	
◺	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z	(0.010SCL)	(RC2021)	18 SEP 70	
D	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z	(0 010SCL)	(RC2051)	18 SEP 70	

REFERENCE FILE MDC(WD)SPACESHUT-A

REFERENCE INFORMATION		
REFS	1 0000	SQ.FT
REFL	0 8000	FT
REFB	1.3800	FT
XMRP	1 2600	FT
YMRP	0.0000	FT
ZMRP -	0.0667	FT
SCALE	0 0100	SCALE

CONFIGURATION COMPONENT EFFECTS AT BETA = -6 DEGREES

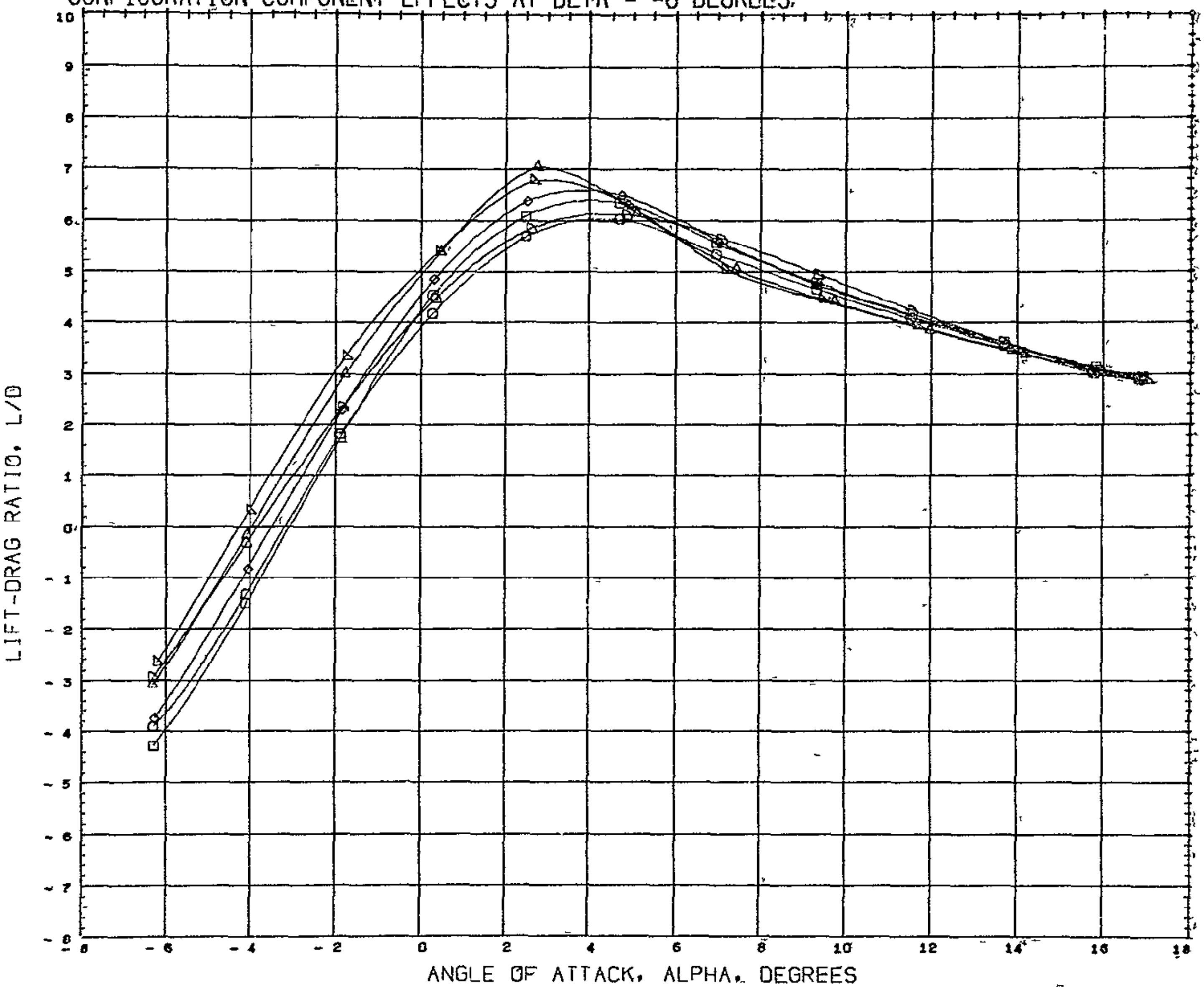


SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0R1Z	(0.010SCL)	(RC2071)	18 SEP 70	0.181
□	1321-DAC-LSWT-DELBOOST-B1W0K1Z	(0.010SCL)	(RC2061)	18 SEP 70	
◇	1321-DAC-LSWT-DELBOOST-B1W0K1R1Z	(0 010SCL)	(RC2031)	18 SEP 70	
△	1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z	(0 010SCL)	(RC2011)	18 SEP 70	
◺	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z	(0 010SCL)	(RC2021)	18 SEP 70	
▷	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z	(0 010SCL)	(RC2051)	18 SEP 70	

REFERENCE FILE HDC(WD)SPACESHUT-A

REFERENCE INFORMATION		
REFS	1 0000	SQ FT
REFL	0 8000	FT.
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0 0000	FT
ZMRP	- 0 0667	FT
SCALE	0 0100	SCALE

CONFIGURATION COMPONENT EFFECTS AT BETA = -6 DEGREES



SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1WOR1Z	(0 010SCL)	(RC2071)	18 SEP 70	0 181
□	1321-DAC-LSWT-DELBOOST-B1WOK1Z	(0 010SCL)	(RC2061)	18 SEP 70	
◇	1321-DAC-LSWT-DELBOOST-B1WOK1R1Z	(0 010SCL)	(RC2031)	18 SEP 70	
△	1321-DAC-LSWT-DELBOOST-B1WOV1K1R1Z	(0 010SCL)	(RC2011)	18 SEP 70	
◺	1321-DAC-LSWT-DELBOOST-B1WOV2K1R1Z	(0 010SCL)	(RC2021)	18 SEP 70	
▷	1321-DAC-LSWT-DELBOOST-B1WOV2K1R1L1L2Z	(0 010SCL)	(RC2051)	18 SEP 70	

REFERENCE FILE HDC(WD)SPACESHUT-A

REFERENCE INFORMATION		
REFS	1 0000	SQ FT
REFL	0 8000	FT
REFB	1 3800	FT
XMRP	1 2600	FT
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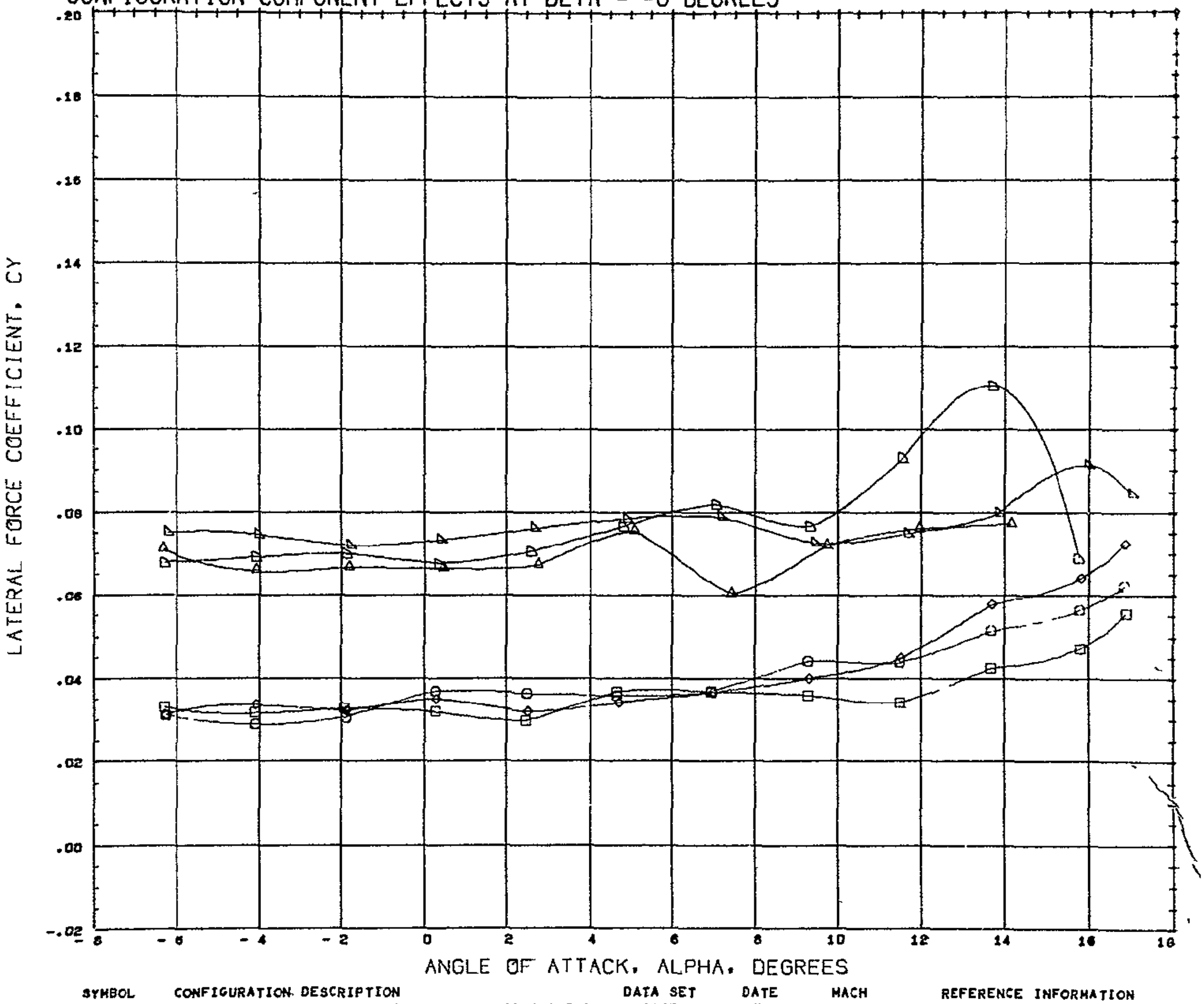
ZMRP	0 0667	FT.
SCALE	0.0100	SCALE

CONFIGURATION COMPONENT EFFECTS AT BETA = -6 DEGREES



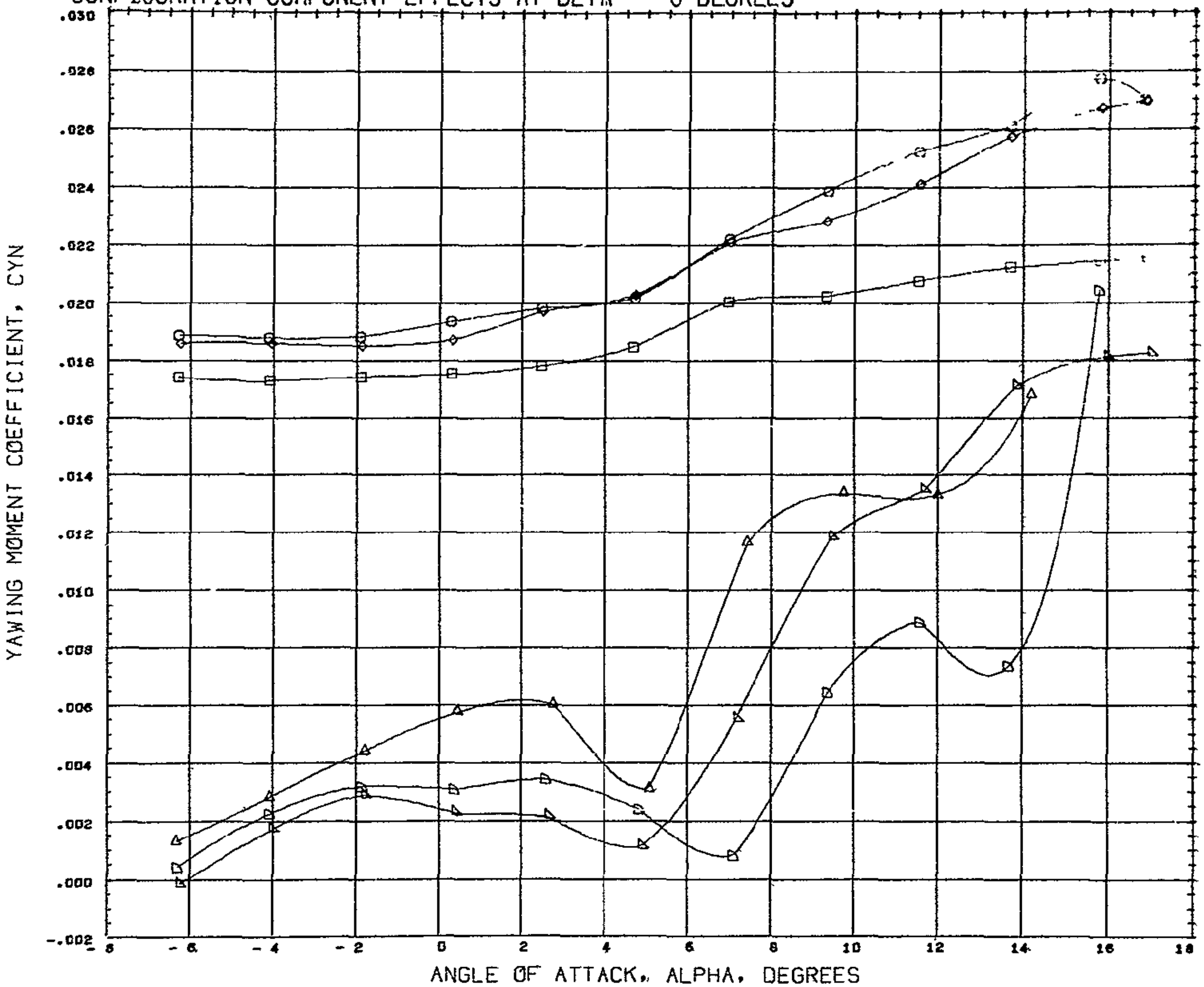
SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0R1Z	(0 010SCL)	(RC2071)	18 SEP 70	0 181
□	1321-DAC-LSWT-DELBOOST-B1W0K1Z	(0 010SCL)	(RC2061)	18 SEP 70	
◇	1321-DAC-LSWT-DELBOOST-B1W0K1R1Z	(0 010SCL)	(RC2031)	18 SEP 70	
△	1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z	(0 010SCL)	(RC2011)	18 SEP 70	
◺	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z	(0 010SCL)	(RC2021)	18 SEP 70	
◻	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z	(0 010SCL)	(RC2051)	18 SEP 70	

REFERENCE FILE HDC(WD)SPACESHUT-A

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0 8000	FT
REFB	1 3800	FT.
XMRP	1.2600	FT.
YMRP	0 0000	FT
ZMRP -	0 0667	FT.
SCALE	0 0100	SCALE

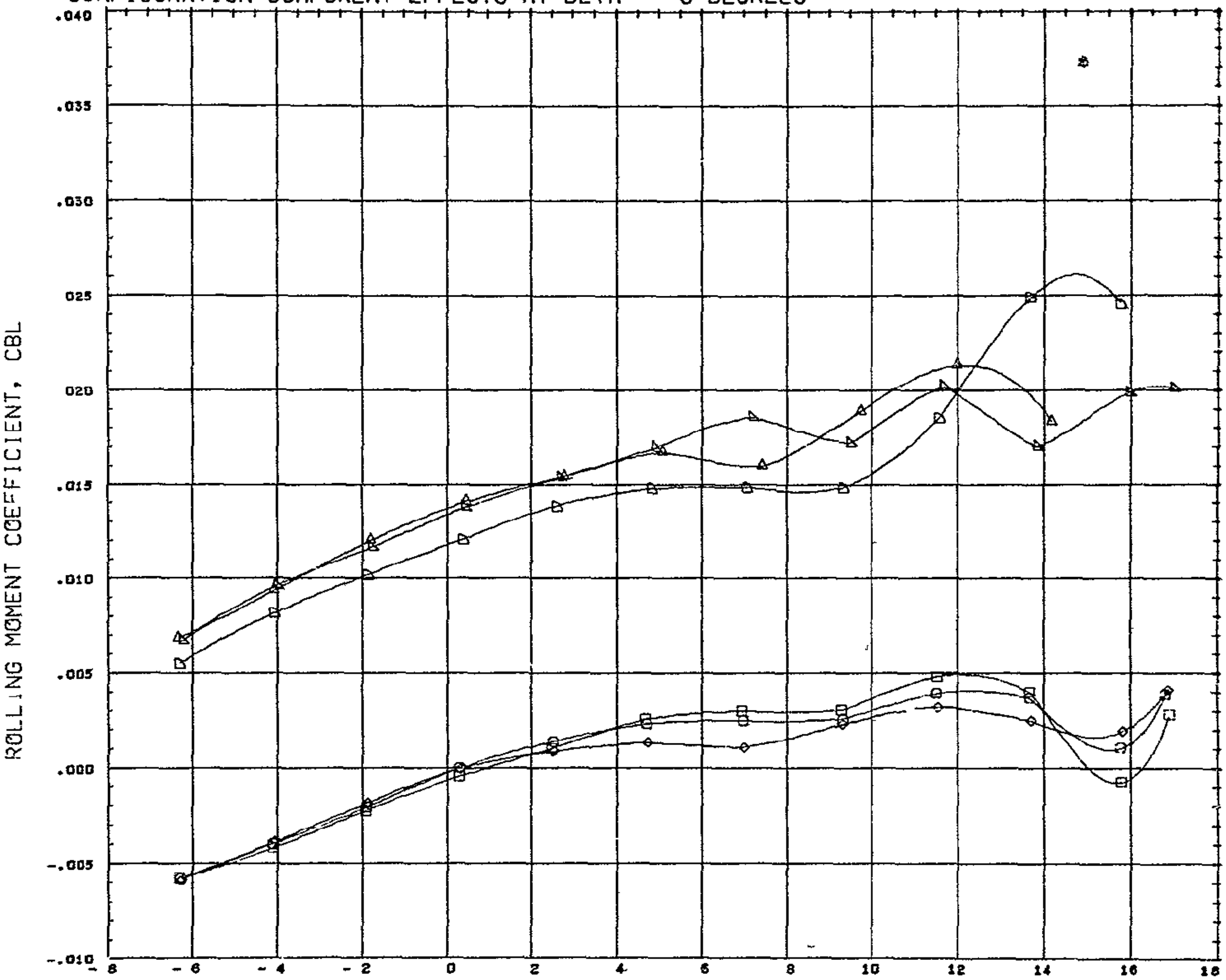
CONFIGURATION COMPONENT EFFECTS AT BETA = -6 DEGREES



SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH	REFERENCE INFORMATION		
O	1321-DAC-LSWT-DELBOOST-B1W0R1Z	(0.010SCL)	(RC2071)	18 SEP 70	0 181	REFS	1 0000	SQ.FT
□	1321-DAC-LSWT-DELBOOST-B1W0K1Z	(0.010SCL)	(RC2061)	18 SEP 70		REFL	0 8000	FT
◇	1321-DAC-LSWT-DELBOOST-B1W0K1R1Z	(0.010SCL)	(RC2031)	18 SEP 70		REFB	1 3900	FT
△	1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z	(0.010SCL)	(RC2011)	18 SEP 70		XMRP	1 2600	FT.
◺	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z	(0 010SCL)	(RC2021)	18 SEP 70		YMRP	0 0000	FT
D	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z	(0.010SCL)	(RC2051)	18 SEP 70		ZMRP	-0 0667	FT
						SCALE	0 0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A

CONFIGURATION COMPONENT EFFECTS AT BETA = -6 DEGREES



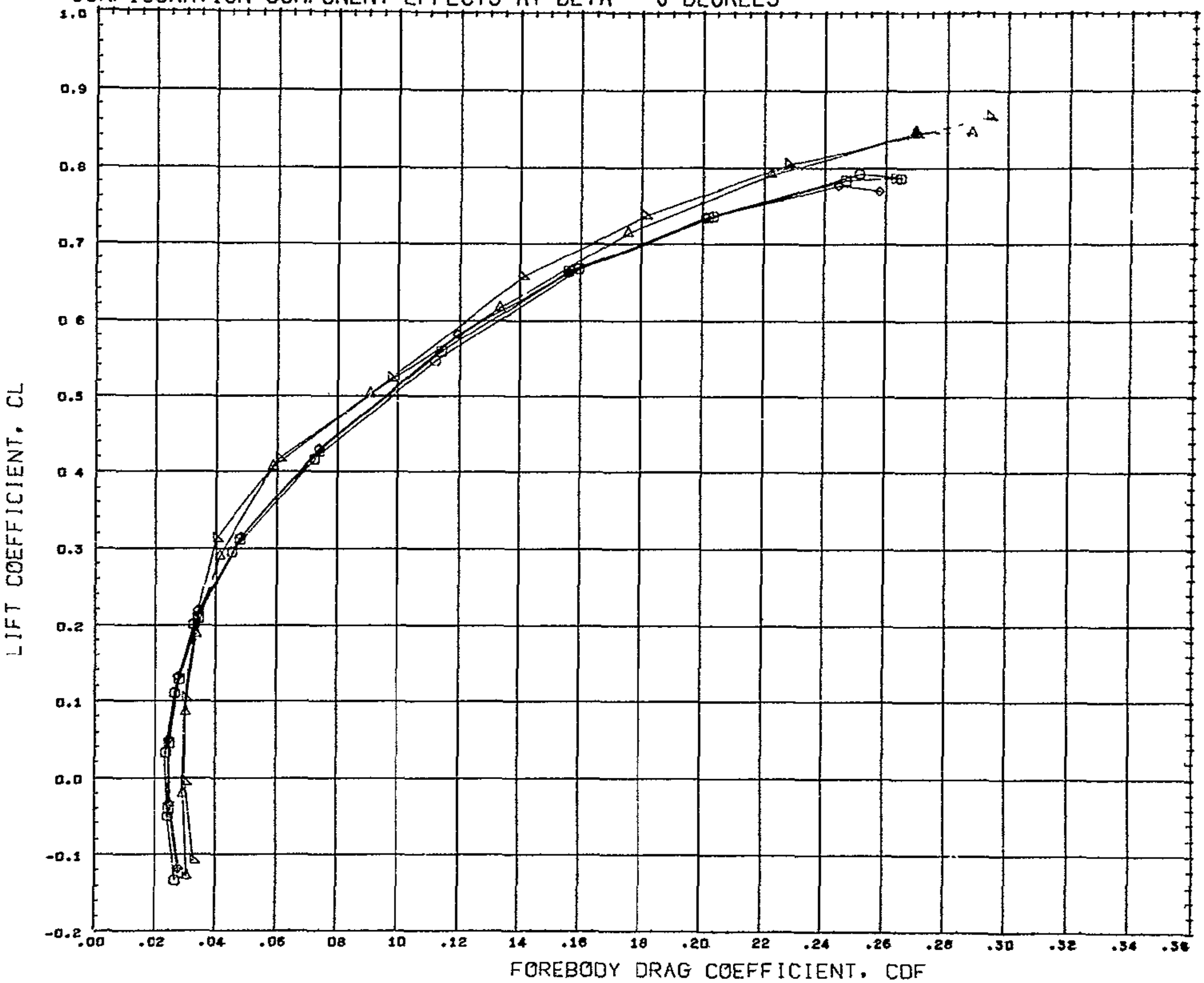
SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0R1Z	(0 010SCL)	(RC2071)	18 SEP 70	0 181
□	1321-DAC-LSWT-DELBOOST-B1W0K1Z	(0.010SCL)	(RC2061)	18 SEP 70	
◇	1321-DAC-LSWT-DELBOOST-B1W0K1R1Z	(0 010SCL)	(RC2031)	18 SEP 70	
△	1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z	(0 010SCL)	(RC2011)	18 SEP 70	
◺	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z	(0 010SCL)	(RC2021)	18 SEP 70	
D	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z	(0 010SCL)	(RC2051)	18 SEP 70	

REFERENCE FILE HDC(WD)SPACESHUT-A

REFERENCE INFORMATION		
REFS	1.0000	SQ FT
REFL	0 8000	FT
REFB	1 3800	FT
XHRP	1 2600	FT
YHRP	0 0000	FT
ZHRP -	0 0667	FT
SCALE,	0 0100	SCALE

20

CONFIGURATION COMPONENT EFFECTS AT BETA = 0 DEGREES



SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1WDR1Z	(0 010SCL)	(RC2072)	18 SEP 70	0 181
□	1321-DAC-LSWT-DELBOOST-B1WDK1Z	(0.010SCL)	(RC2062)	18 SEP 70	
◇	1321-DAC-LSWT-DELBOOST-B1WDK1R1Z	(0 010SCL)	(RC2032)	18 SEP 70	
△	1321-DAC-LSWT-DELBOOST-B1WDV1K1R1Z	(0 010SCL)	(RC2012)	18 SEP 70	
◺	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1Z	(0 010SCL)	(RC2022)	18 SEP 70	

REFERENCE FILE MDC (WD) SPACESHUT-A

REFERENCE INFORMATION		
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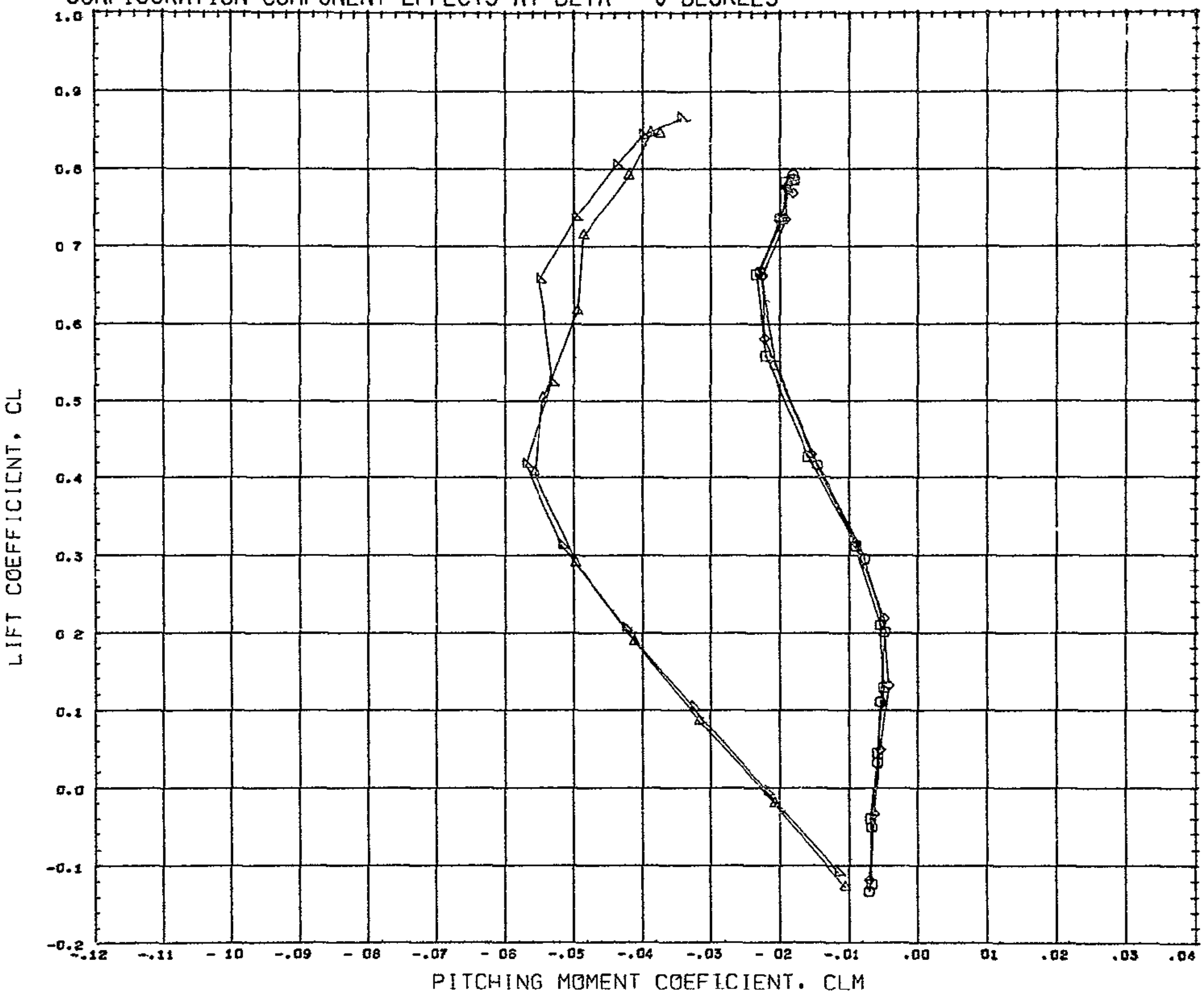
REFL	0 8000	FT
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0 0000	FT
ZMRP -	0 0667	FT
SCALE	0 0100	SCALE

CONFIGURATION COMPONENT EFFECTS AT BETA = 0 DEGREES



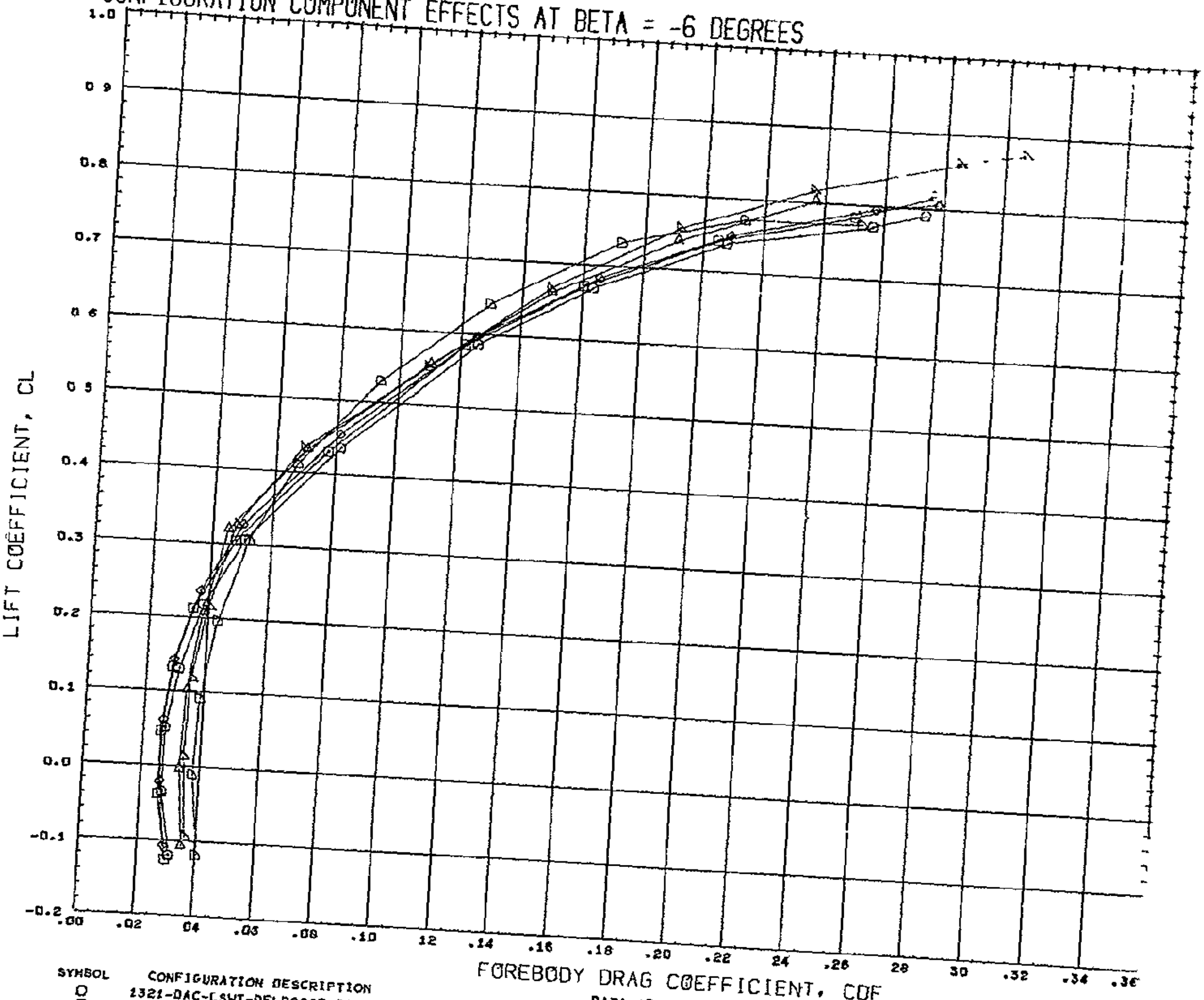
SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0R1Z	(0 010SCL)	(RC2072)	18 SEP 70	0 181
□	1321-DAC-LSWT-DELBOOST-B1W0K1Z	(0.010SCL)	(RC2062)	18 SEP 70	
◇	1321-DAC-LSWT-DELBOOST-B1W0K1R1Z	(0 010SCL)	(RC2032)	18 SEP 70	
Δ	1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z	(0 010SCL)	(RC2012)	18 SEP 70	
⊿	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z	(0 010SCL)	(RC2022)	18 SEP 70	

REFERENCE FILE MDC(WD)SPACESHUT-A

REFERENCE INFORMATION

REFS	1 0000	SQ FT
REFL	0 8000	FT
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0.0000	FT
ZMRP -	0 0667	FT
SCALE	0 0100	SCALE

CONFIGURATION COMPONENT EFFECTS AT BETA = -6 DEGREES



SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1WDR1Z	(0 010SCL)	(RC2071)	18 SEP 70	0.181
□	1321-DAC-LSWT-DELBOOST-B1WDK1Z	(0 010SCL)	(RC2061)	18 SEP 70	
◇	1321-DAC-LSWT-DELBOOST-B1WDK1R1Z	(0 010SCL)	(RC2031)	18 SEP 70	
△	1321-DAC-LSWT-DELBOOST-B1WDV1K1R1Z	(0.010SCL)	(RC2011)	18 SEP 70	
◁	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1Z	(0 010SCL)	(RC2021)	18 SEP 70	
▷	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1L1L2Z	(0 010SCL)	(RC2051)	18 SEP 70	

REFERENCE FILE HDC(WD)SFACESHUT-A

REFERENCE INFORMATION

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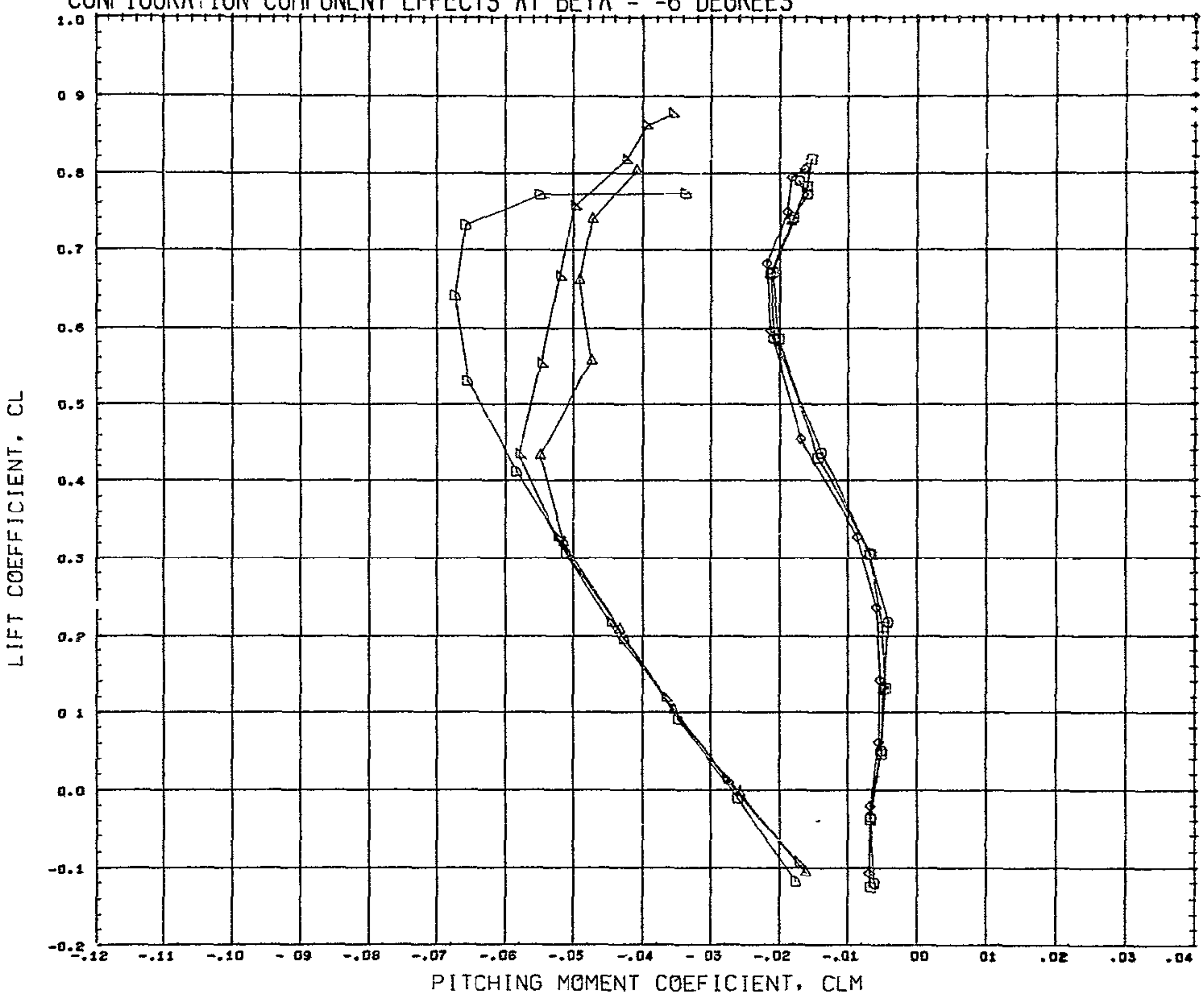
REFL	0 8000	FT
REFB	1 3800	FT
XMRP	1.2800	FT.
YMRP	0 0000	FT
ZMRP	- 0 0667	FT
SCALE	0 0100	SCALE

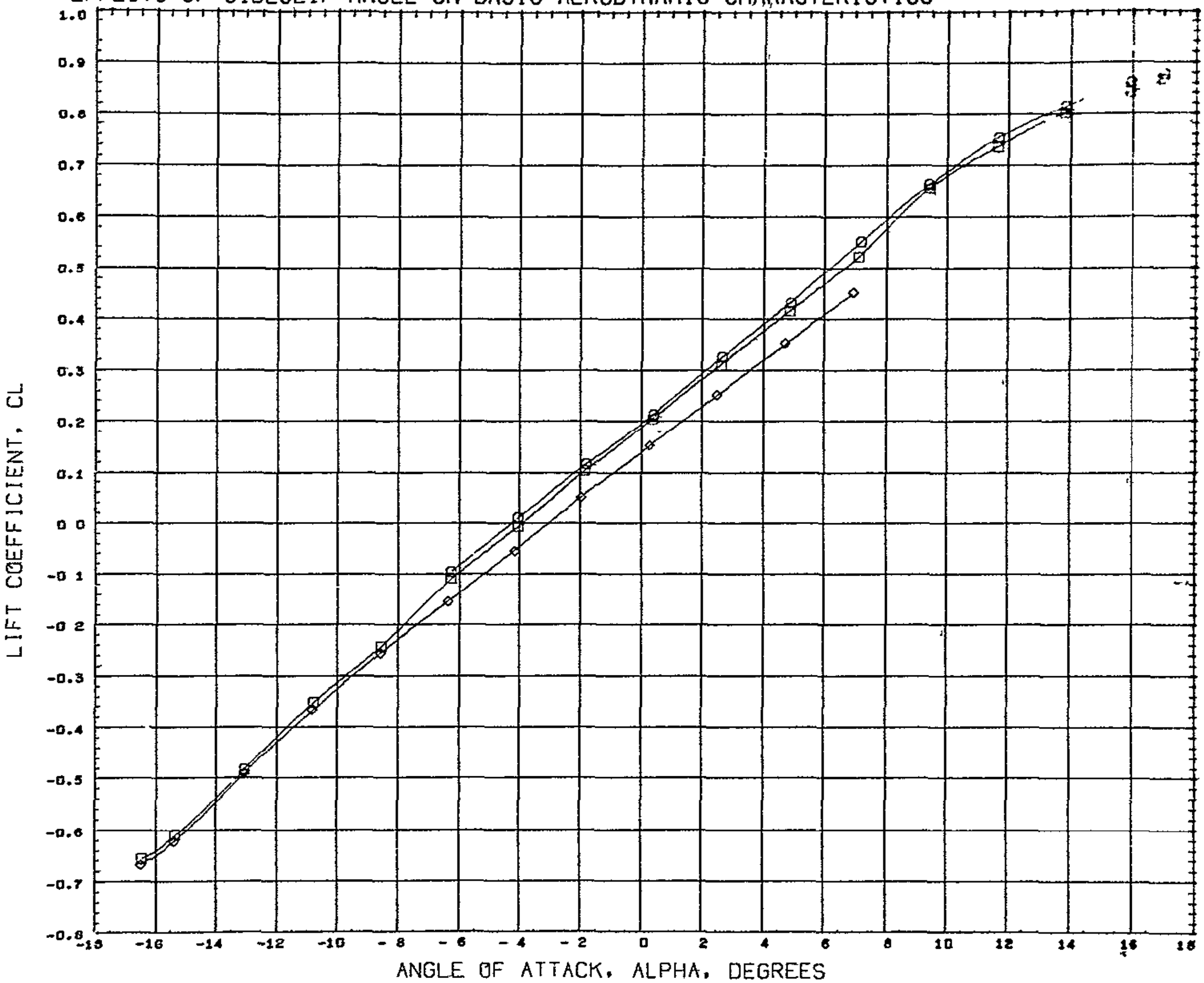
CONFIGURATION COMPONENT EFFECTS AT BETA = -6 DEGREES



SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH	REFERENCE INFORMATION		
○	1321-DAC-LSWT-DELBOOST-B1W0R1Z	(0 010SCL)	(RC2071)	18 SEP 70	0.181	REFS	1 0000	SQ FT
□	1321-DAC-LSWT-DELBOOST-B1W0K1Z	(0 010SCL)	(RC2061)	18 SEP 70		REFL	0 8000	FT
◇	1321-DAC-LSWT-DELBOOST-B1W0K1R1Z	(0 010SCL)	(RC2031)	18 SEP 70		REFB	1 3800	FT
△	1321-DAC-LSWT-DELBOOST-B1W0V1K1R1Z	(0 010SCL)	(PC2011)	18 SEP 70		XMRP	1 2600	FT
◺	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z	(0.010SCL)	(RC2021)	18 SEP 70		YMRP	0 0000	FT.
D	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z	(0 010SCL)	(RC2051)	18 SEP 70		ZMRP -	0 0667	FT
						SCALE	0 0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A

EFFECTS OF SIDESLIP ANGLE ON BASIC AERODYNAMIC CHARACTERISTICS



SYMBOL	BETA	PARAMETRIC VALUES			
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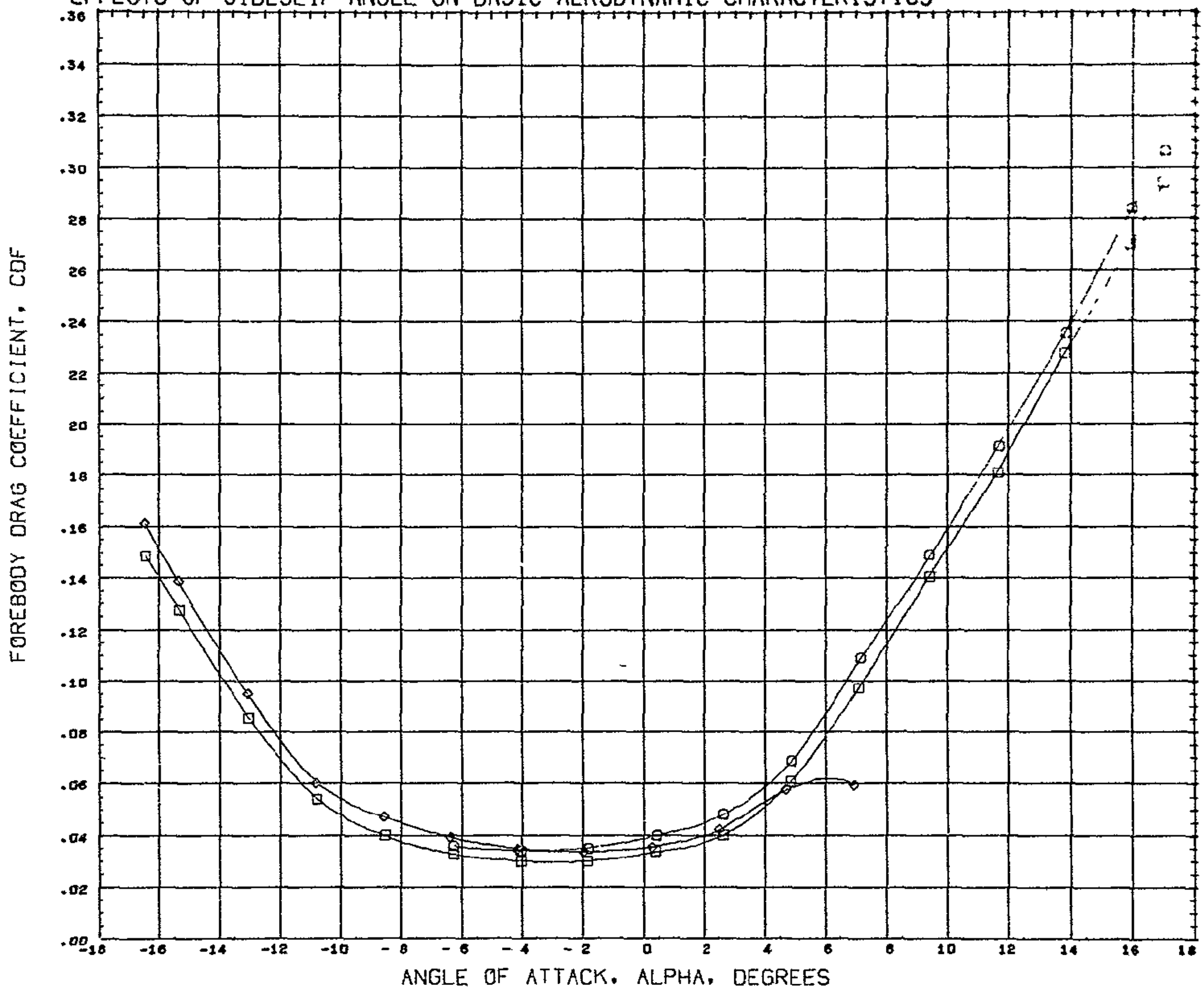
□	0.000	ELEVON	0.000	VTAIL	0.000
◇	6.000	RUDDER	0.000		

REFERENCE FILE MDC(WD)SPACESHUT-A

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0.6000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE

EFFECTS OF SIDESLIP ANGLE ON BASIC AERODYNAMIC CHARACTERISTICS

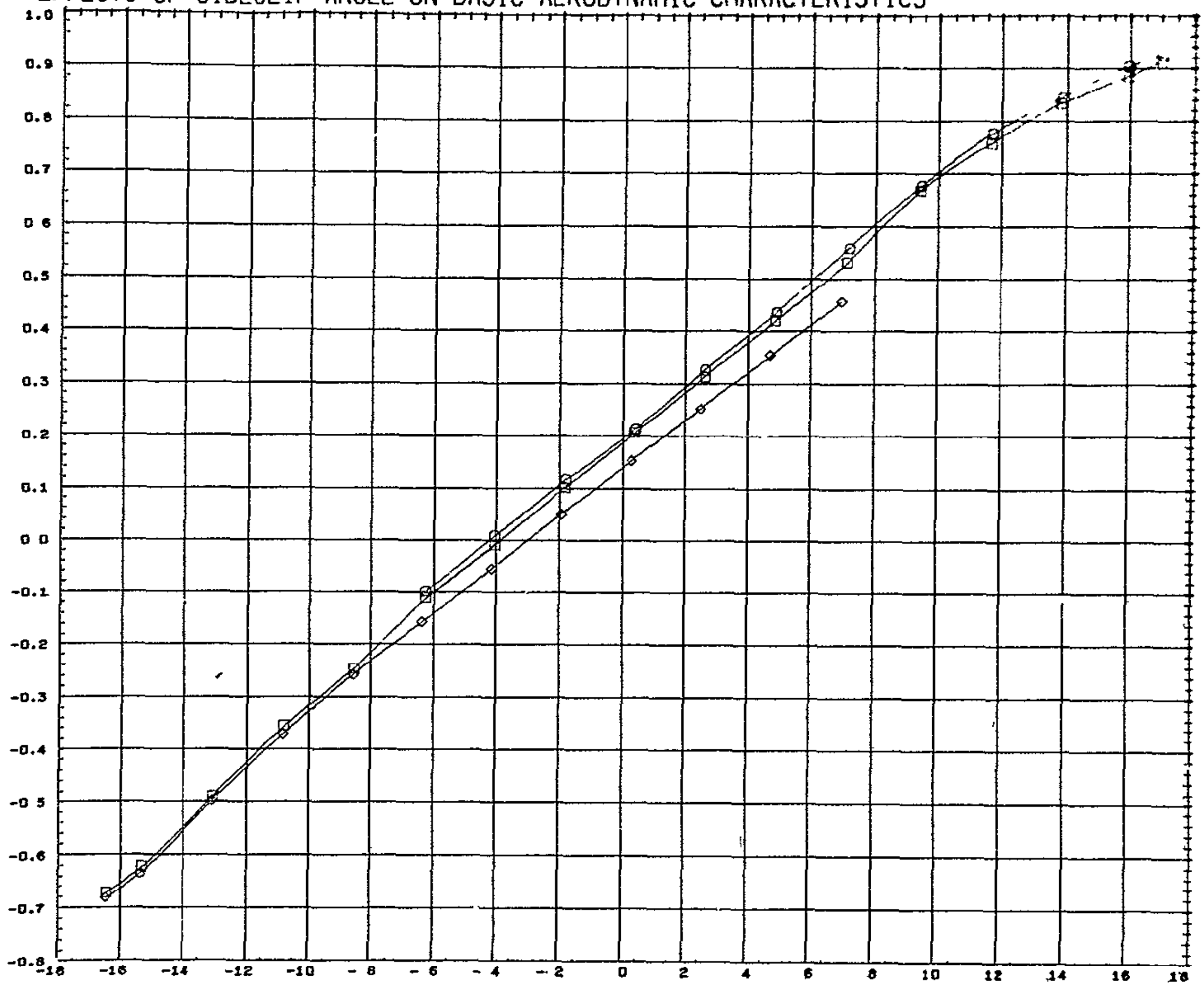


SYMBOL	BETA	PARAMETRIC VALUES			
○	- 6.000	MACH	0 183	PHI	0 000
□	0 000	ELEVON	0 000	VTAIL	0 000
◇	6.000	RUDDEP	0.000		

REFERENCE FILE HDC (WD) SPACESHUT-A

REFERENCE INFORMATION		
REFS	1 0000	SQ.FT
REFL	0 8000	FT.
REFB	1 3800	FT
XMRP	1 2600	FT.
YMRP	0 0000	FT
ZMRP -	0 0667	FT
SCALE	0 0100	SCALE

EFFECTS OF SIDESLIP ANGLE ON BASIC AERODYNAMIC CHARACTERISTICS



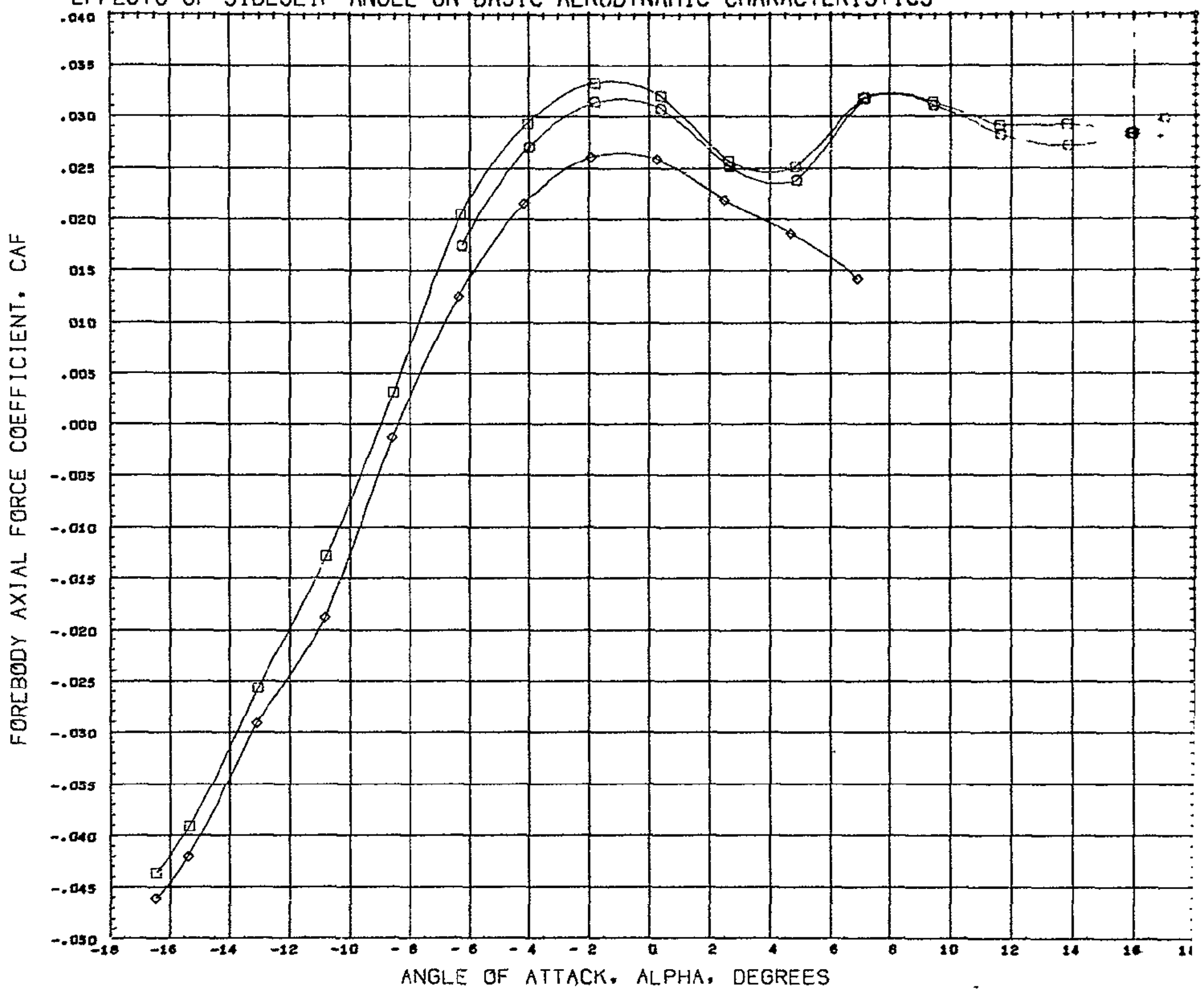
SYMBOL	BETA	PARAMETRIC VALUES			
○	-6.000	MACH	0.183	PHI	0.000
□	0.000	ELEVON	0.000	VTAIL	0.000
◇	6.000	RUDDER	0.000		

REFERENCE FILE HDC(WD)SPACESHUT-A

REFERENCE INFORMATION

REFS	1.0000	SQ.FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT.
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE

EFFECTS OF SIDESLIP ANGLE ON BASIC AERODYNAMIC CHARACTERISTICS



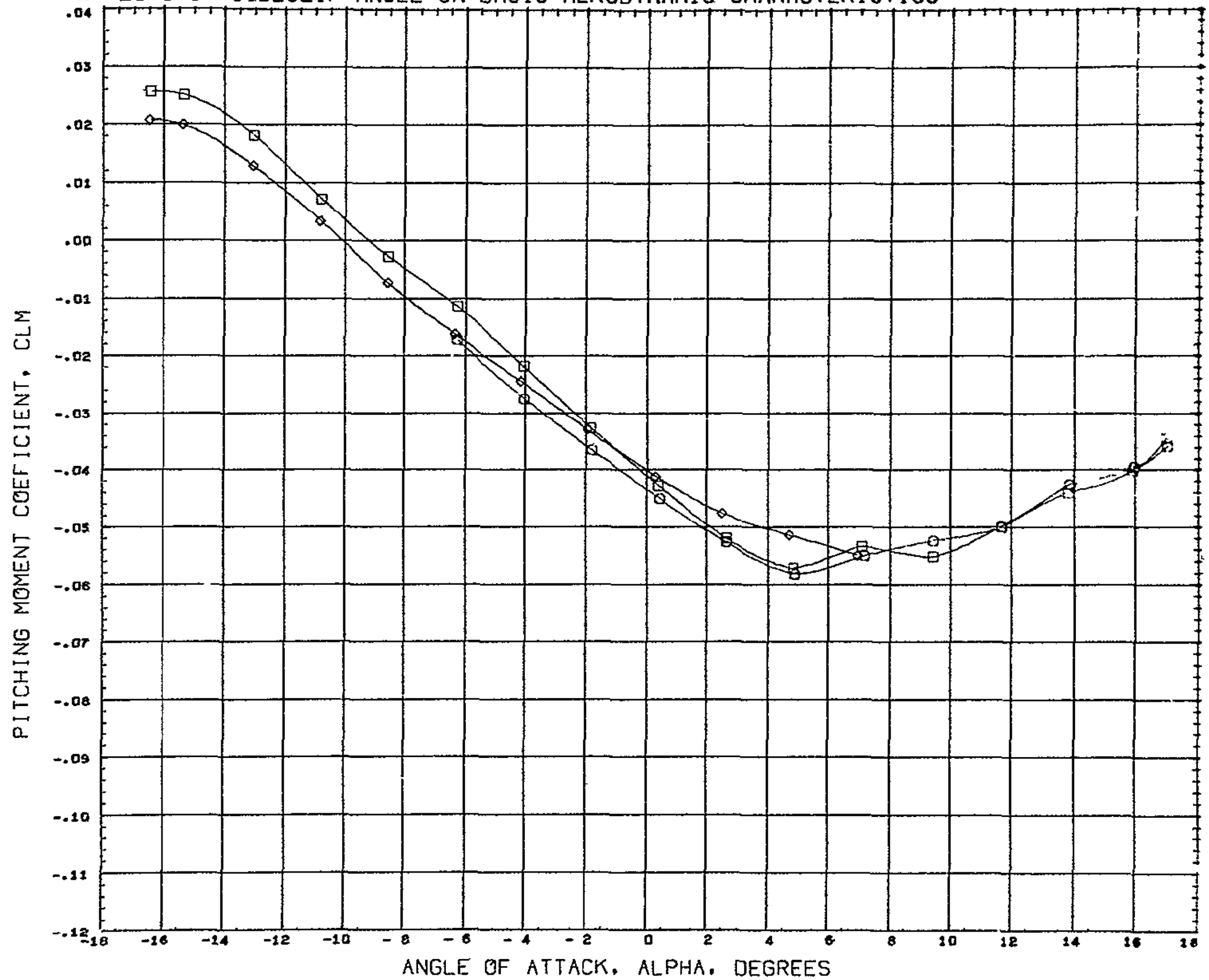
SYMBOL	BETA	PARAMETRIC VALUES			
O	-6.000	MACH	0.183	PHI	0.000
□	0.000	ELEVON	0.000	VTAIL	0.000
◇	6.000	RUDDER	0.000		

REFERENCE FILE MDC(WD)SPACESHUT-A

REFERENCE INFORMATION

REFS	1.0000	SQ.FT
REFL	0.8000	FT.
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE

EFFECTS OF SIDESLIP ANGLE ON BASIC AERODYNAMIC CHARACTERISTICS



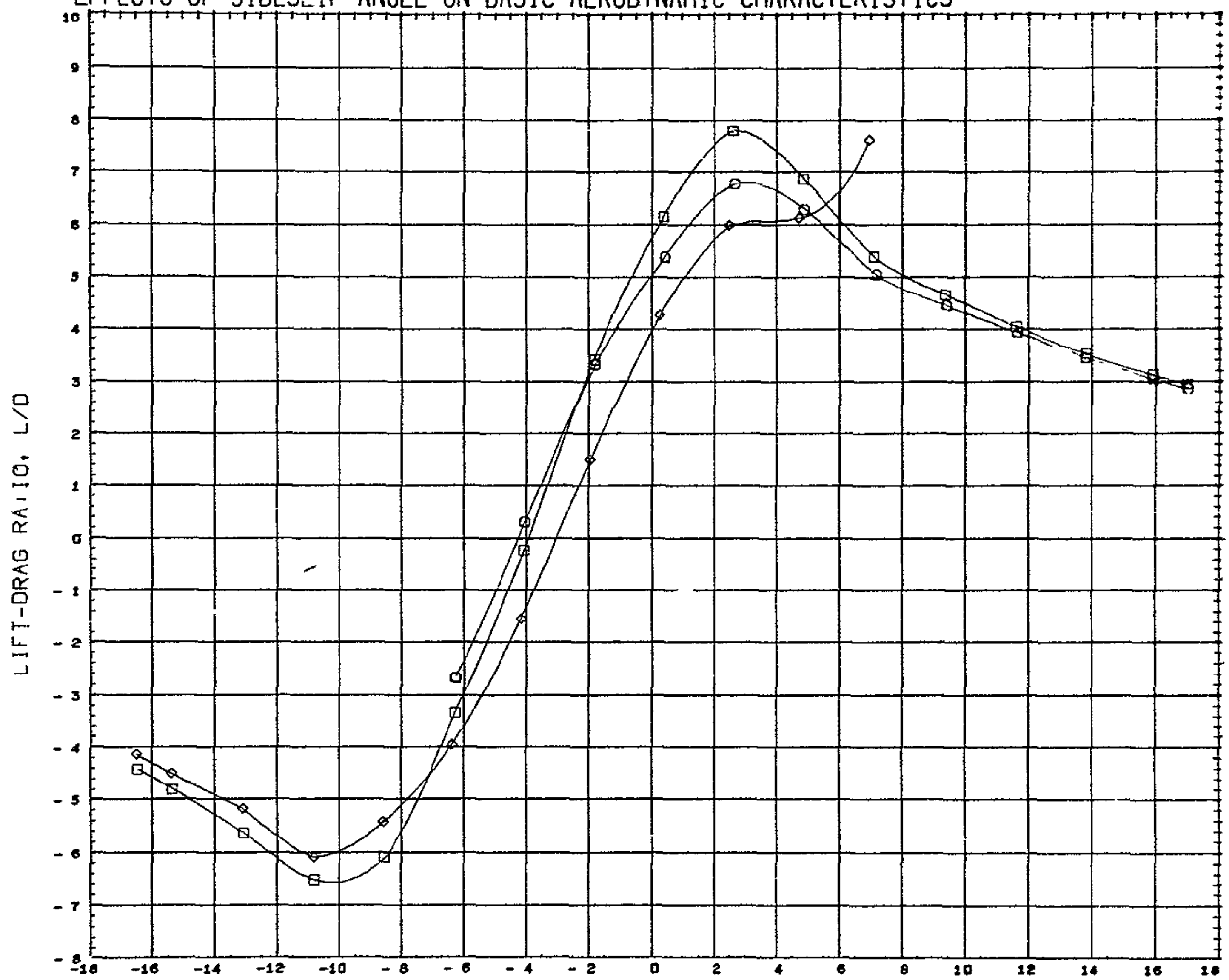
SYMBOL	BETA	PARAMETRIC VALUES			
○	-6.000	MACH	0 183	PHI	0.000
□	0 000	ELEVON	0.000	VTAIL	0 000
◇	6 000	RUDDER	0 000		

REFERENCE FILE HDC(WD)SPACESHUT-A

REFERENCE INFORMATION

REFS	1 0000	SQ FT
REFL	0 8000	FT
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0 0000	FT
ZMRP -	0 0667	FT
SCALE	0 0100	SCALE

EFFECTS OF SIDESLIP ANGLE ON BASIC AERODYNAMIC CHARACTERISTICS



SYMBOL	BETA	PARAMETRIC VALUES			
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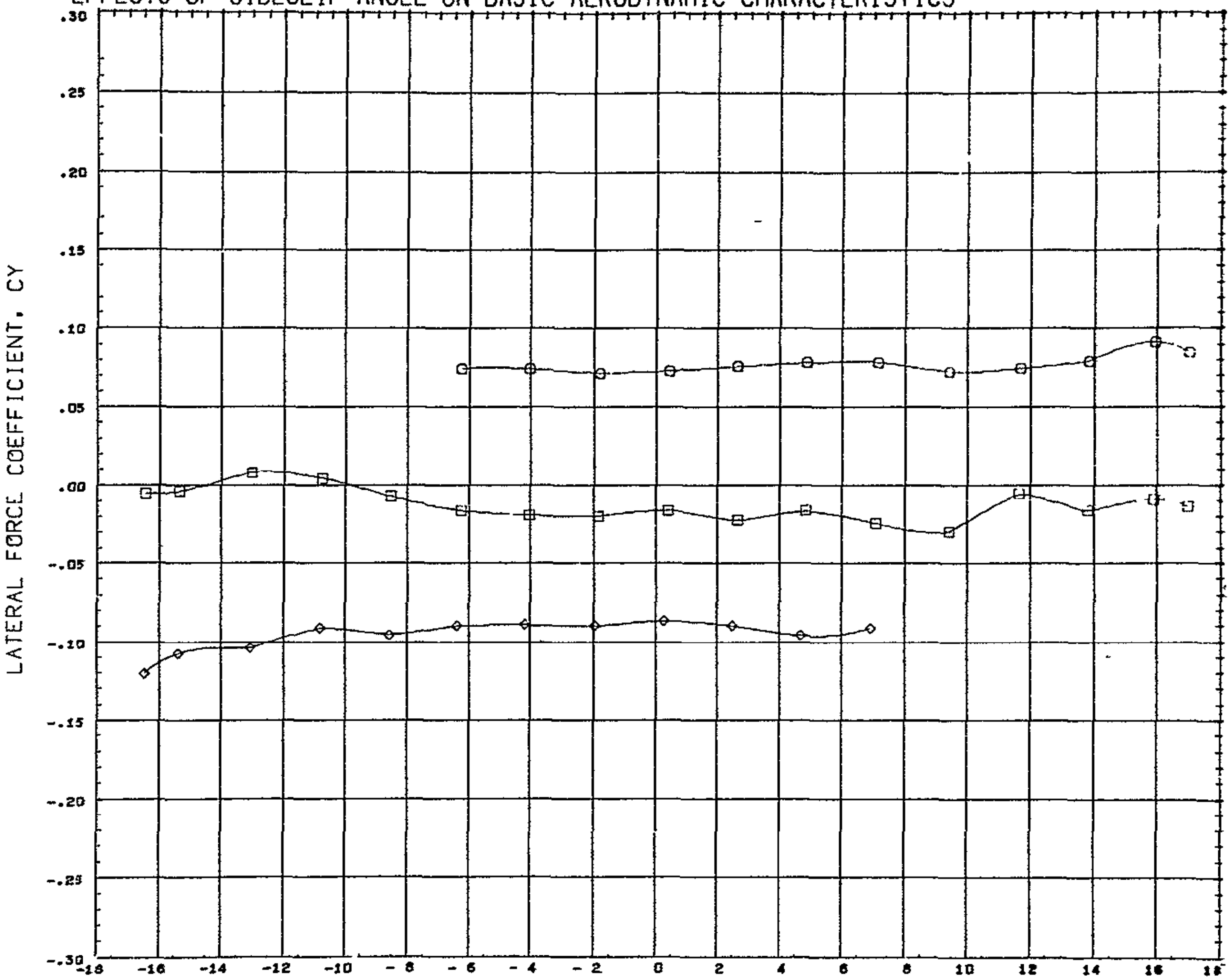
□	0 000	ELEVON	0 000	VTAIL	0 000
◇	6 000	RUDDER	0 000		

REFERENCE INFORMATION

REFS	1 0000	SQ FT
REFL	0 8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0 0000	FT
ZMRP -	0.0667	FT
SCALE	0.0100	SCALE

REFERENCE FILE HDC(WD)SPACESHUT-A

EFFECTS OF SIDESLIP ANGLE ON BASIC AERODYNAMIC CHARACTERISTICS



SYMBOL	BETA	PARAMETRIC VALUES			
○	-6.000	MACH	0.183	PHI	0.000
□	0.000	ELEVON	0.000	VTAIL	0.000
◇	6.000	RUDDER	0.000		

REFERENCE FILE HDC(WD)SPACESHUT-A

REFERENCE INFORMATION

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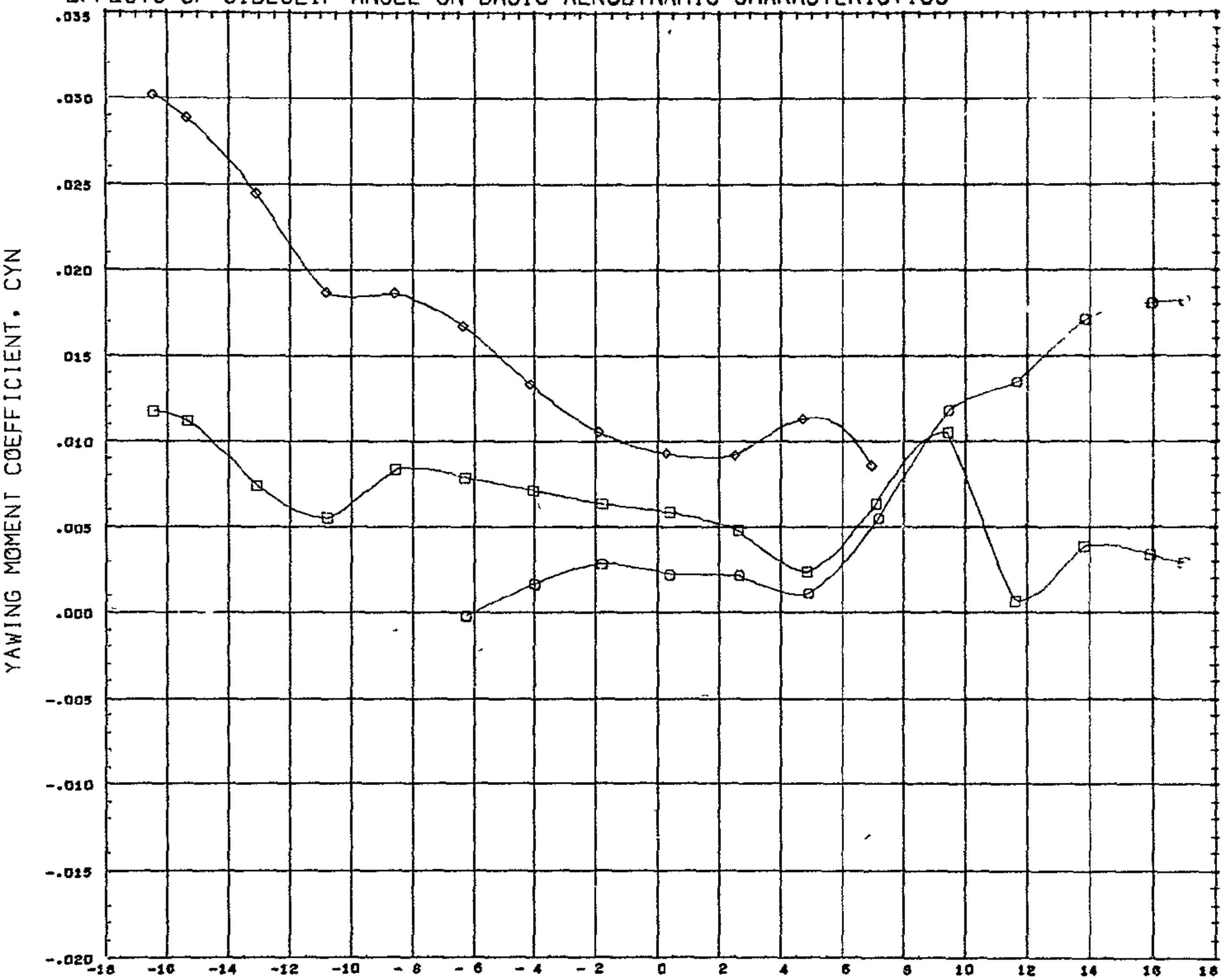
REFB	1.3800	FT
XMRP	1.2600	FT.
YMRP	0.0000	FT.
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE

EFFECTS OF SIDESLIP ANGLE ON BASIC AERODYNAMIC CHARACTERISTICS



SYMBOL	BETA	PARAMETRIC VALUES			
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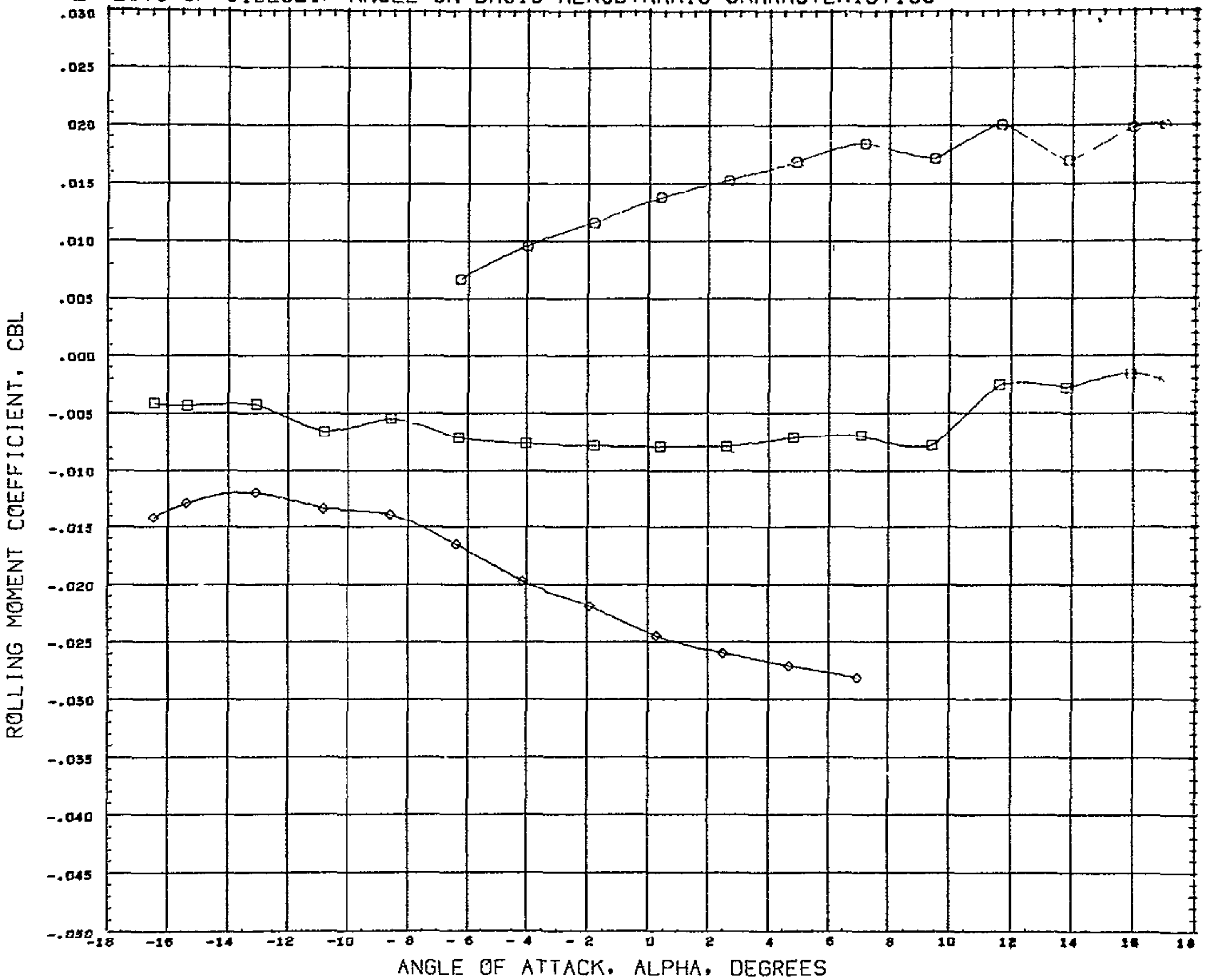
▢	0.000	ELEVON	0.000	VTAIL	0.000
◇	6.000	RUDDER	0.000		

REFERENCE INFORMATION

REFS	1.0000	SQ.FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP -	0.0667	FT
SCALE	0.0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A

EFFECTS OF SIDESLIP ANGLE ON BASIC AERODYNAMIC CHARACTERISTICS

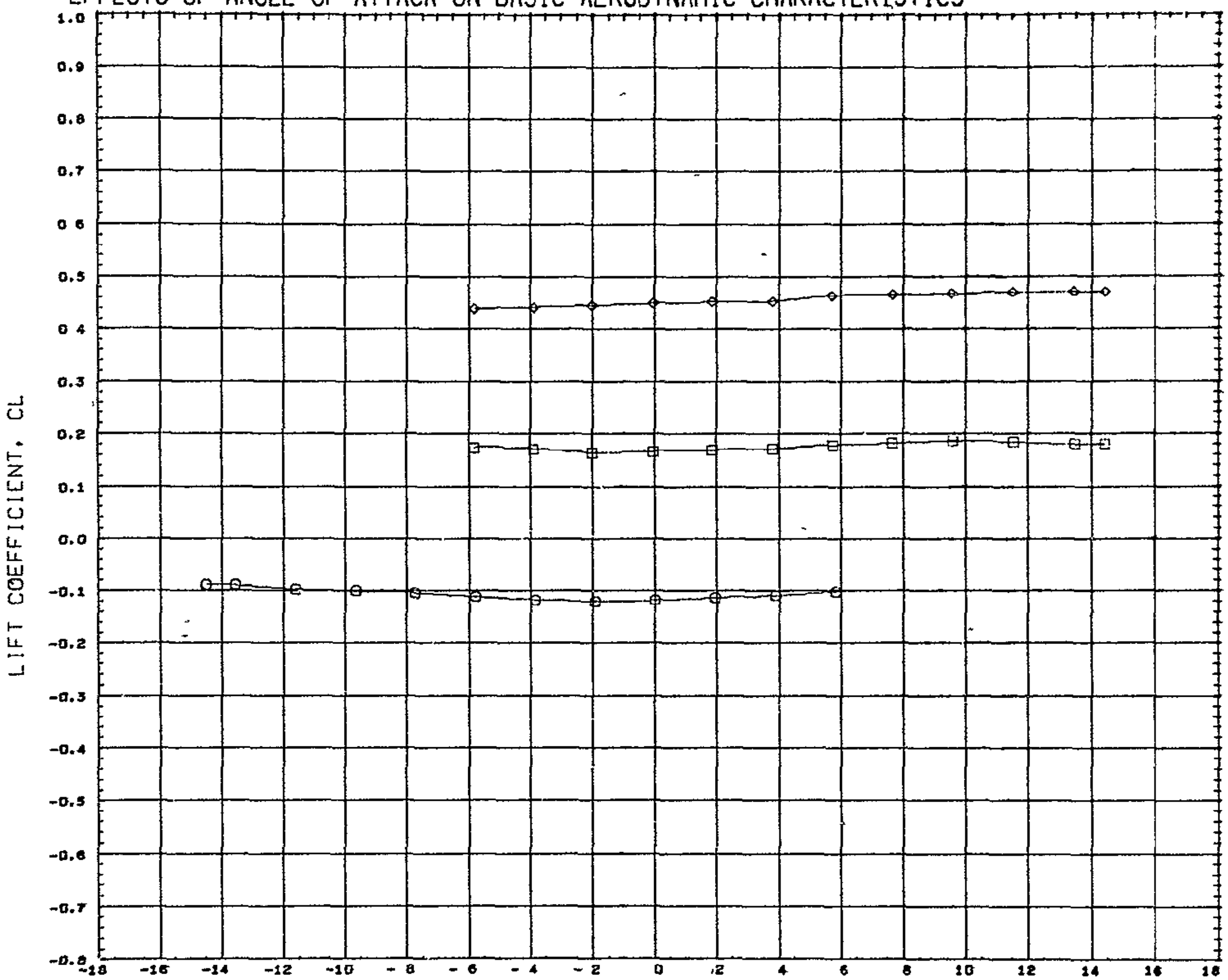


SYMBOL	BETA	PARAMETRIC VALUES			
○	- 6.000	MACH	0 183	PHI	0 000
□	0 000	ELEVON	0.000	VTAIL	0 000
◇	6.000	RUDDER	0 000		

REFERENCE FILE HDC (WD) SPACESHUT-A

REFERENCE INFORMATION		
REFS	1.0000	SQ FT
REFL	0 8000	FT
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0.0000	FT
ZMRP -	0.0667	FT
SCALE	0 0100	SCALE

EFFECTS OF ANGLE OF ATTACK ON BASIC AERODYNAMIC CHARACTERISTICS

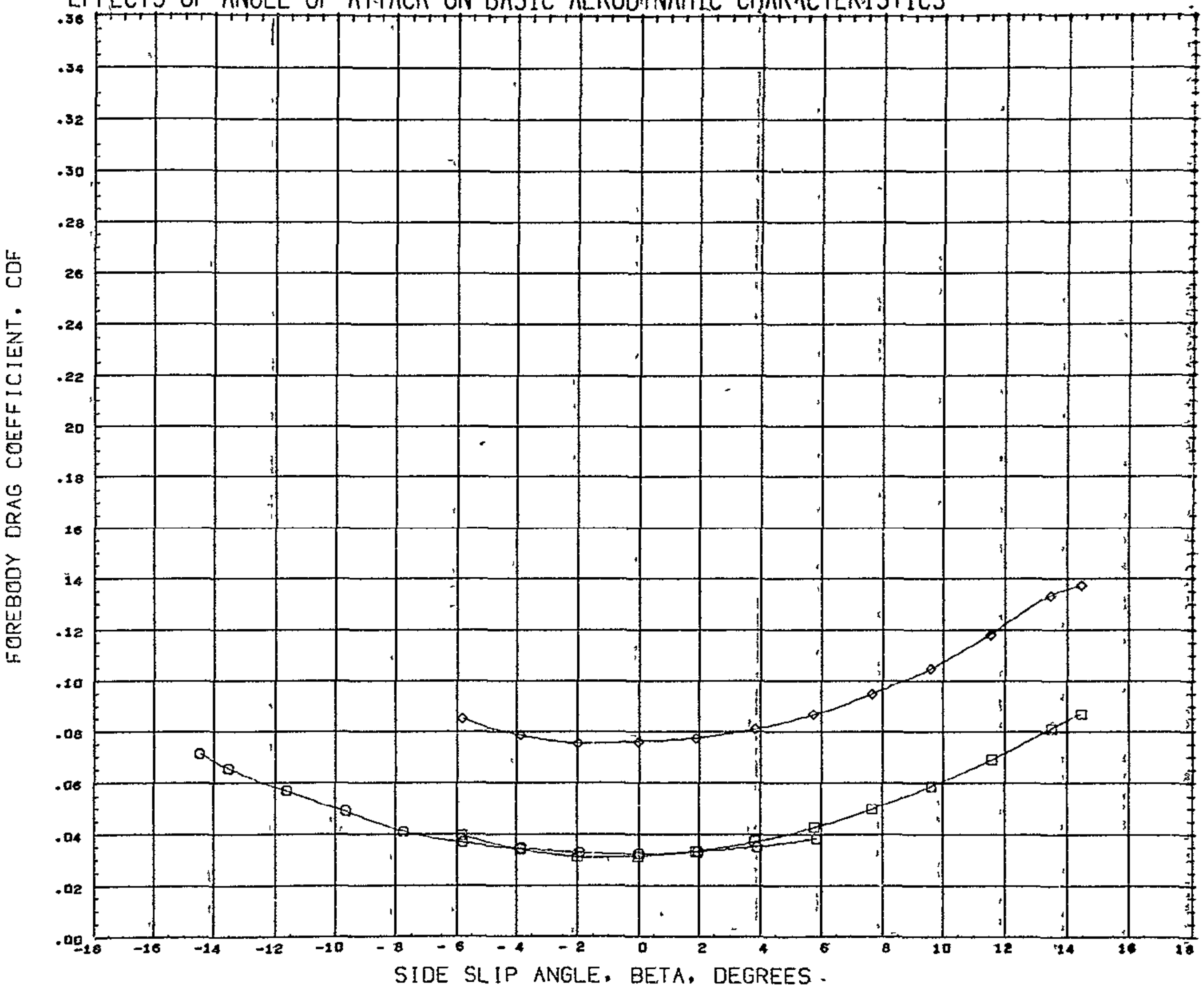


SYMBOL	ALPHA	PARAMETRIC VALUES			
○	-6.300	MACH	0 182	PHI	0 000
□	0 300	ELEVON	0 000	VTAIL	0.000
◇	6 900	RUDDER	0 000		

REFERENCE FILE HDC(WD) SPACESHUT-A

REFERENCE INFORMATION		
REFS	1 0000	SQ FT
REFL	0 8000	FT
REFB	1 3800	FT
XMRP	1.2600	FT
YMRP	0 0000	FT
ZMRP -	0 0667	FT
SCALE	0 0100	SCALE

EFFECTS OF ANGLE OF ATTACK ON BASIC AERODYNAMIC CHARACTERISTICS



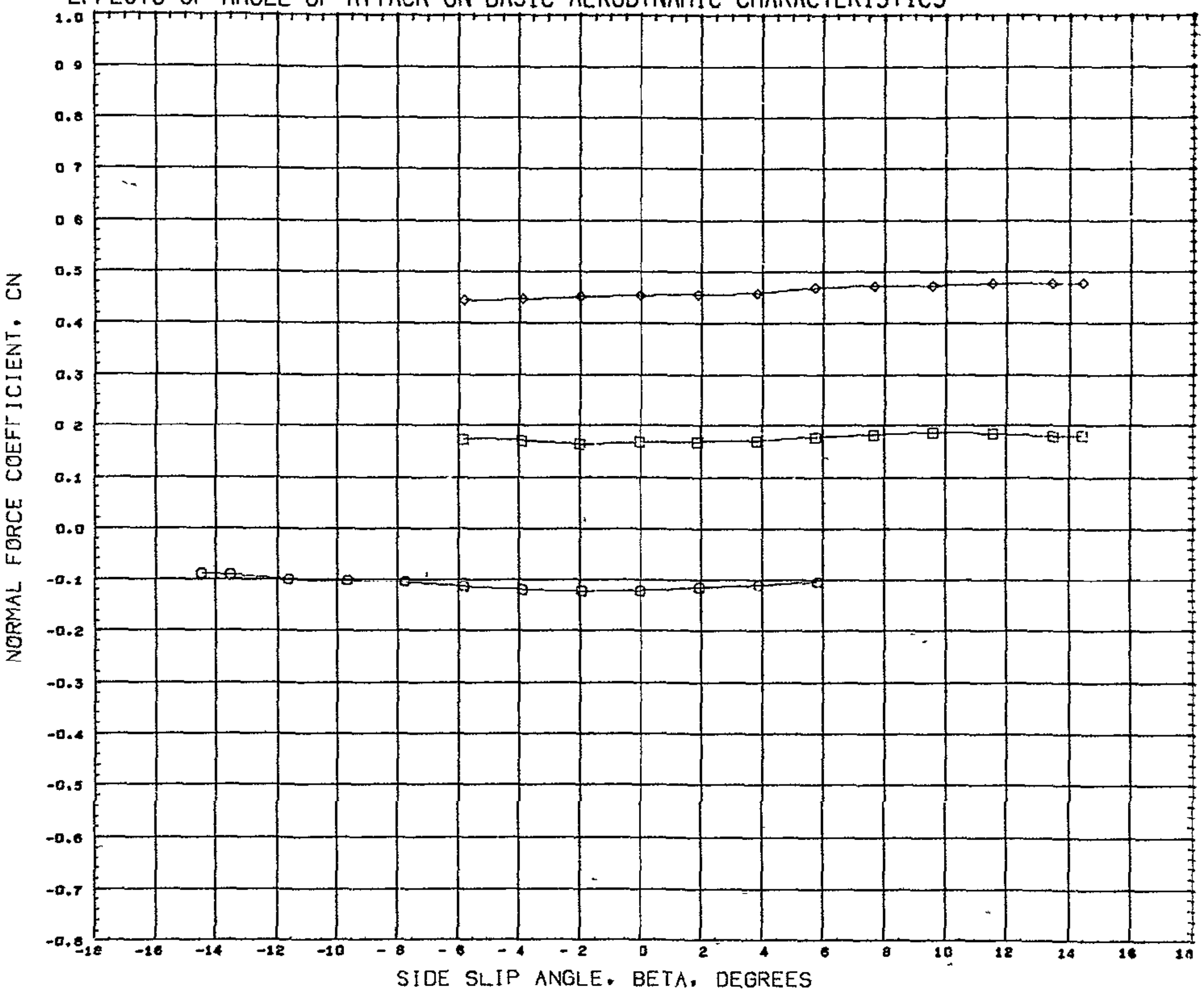
SYMBOL	ALPHA	PARAMETRIC VALUES			
○	-6.300	MACH	0.182	PHI	0.000
□	0.300	ELEVON	0.000	VTAIL	0.000
◇	6.900	RUDDER	0.000		

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A

EFFECTS OF ANGLE OF ATTACK ON BASIC AERODYNAMIC CHARACTERISTICS

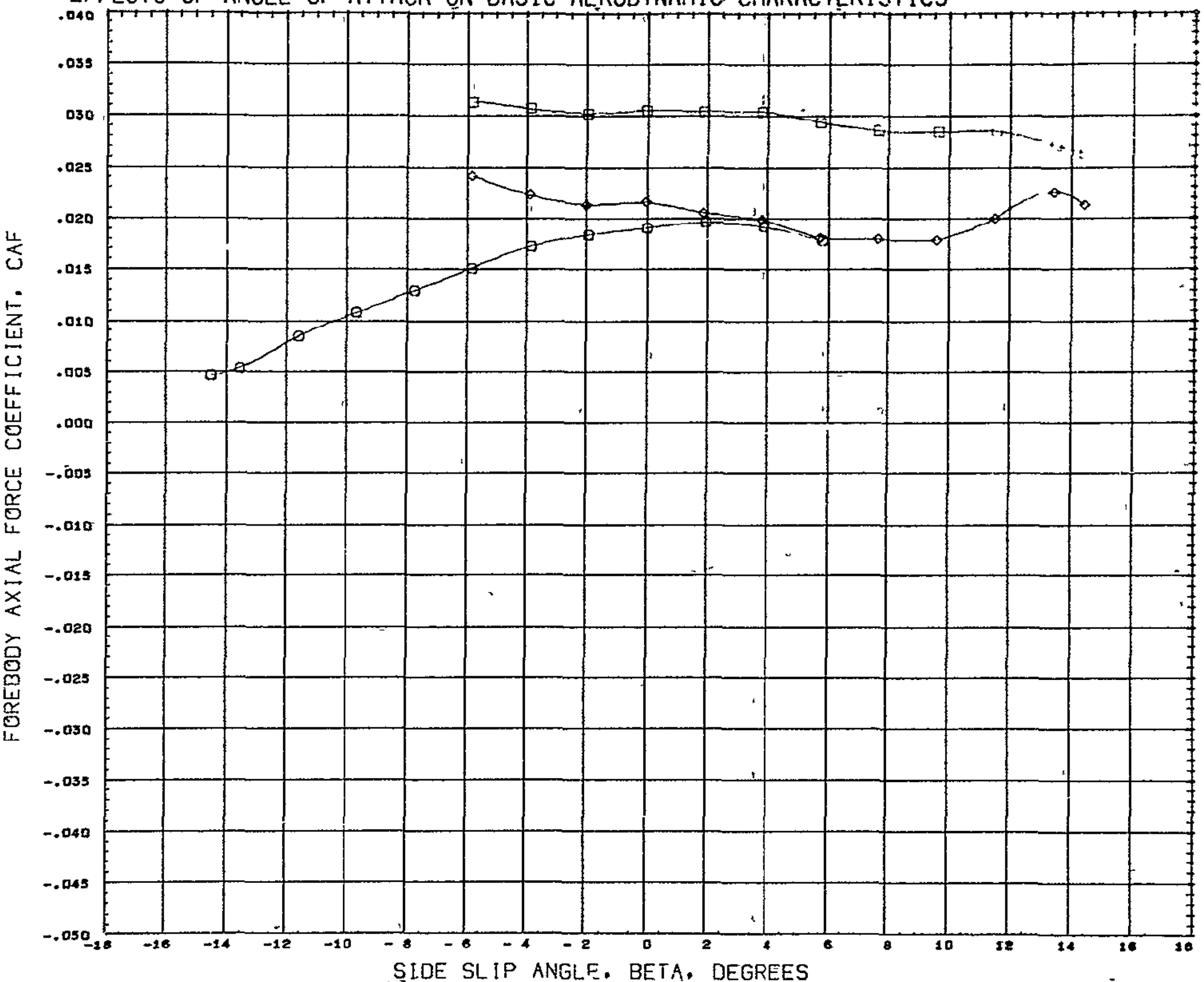


SYMBOL	ALPHA	PARAMETRIC VALUES			
O	-6.300	MACH	0.182	PHI	0.000
□	0.300	ELEVON	0.000	VTAIL	0.000
◇	6.900	RUDDER	0.000		

REFERENCE FILE MDC(WD)SPACESHUT-A

REFERENCE INFORMATION		
REFS	1.0000	SQ FT.
REFL	0.8000	FT.
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	-0.0667	FT
SCALE	0.0.00	SCALE

EFFECTS OF ANGLE OF ATTACK ON BASIC AERODYNAMIC CHARACTERISTICS



SYMBOL	ALPHA
O	-6.300
□	0.300
◇	6.900

PARAMETRIC VALUES

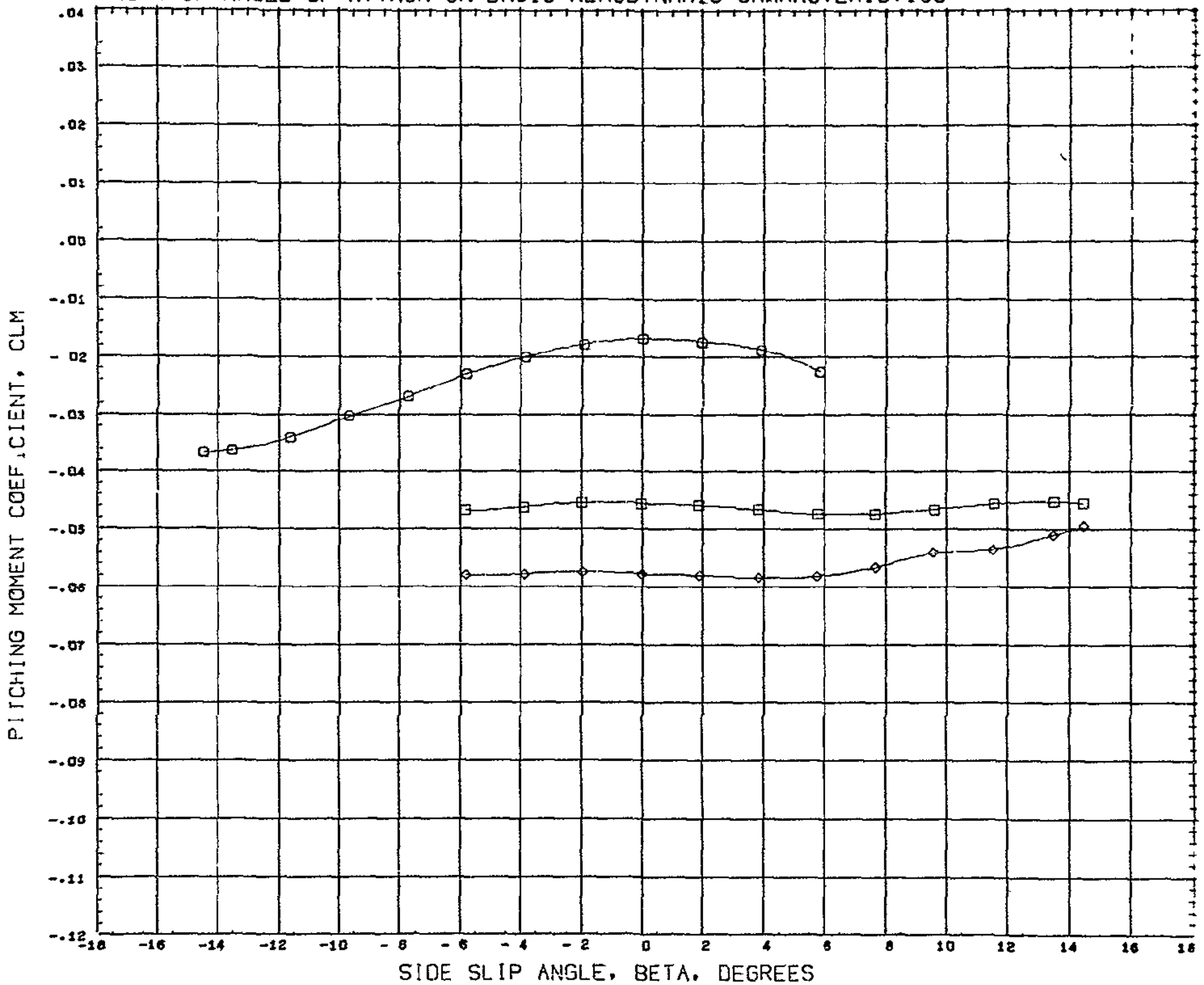
MACH	0.162	PHI	0.000
ELEVON	0.000	VTAIL	0.000
RUDDER	0.000		

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0.8000	FT.
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE

REFERENCE FILE HDC(WD)SPACESHUT-A

EFFECTS OF ANGLE OF ATTACK ON BASIC AERODYNAMIC CHARACTERISTICS



SYMBOL	ALPHA	PARAMETRIC VALUES			
○	-6.300	MACH	0.182	PHI	0.000
□	0.300	ELEVON	0.000	VTAIL	0.000
◇	6.900	RUDDER	0.000		

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP -	0.0667	FT
SCALE	0.0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A

EFFECTS OF ANGLE OF ATTACK ON BASIC AERODYNAMIC CHARACTERISTICS

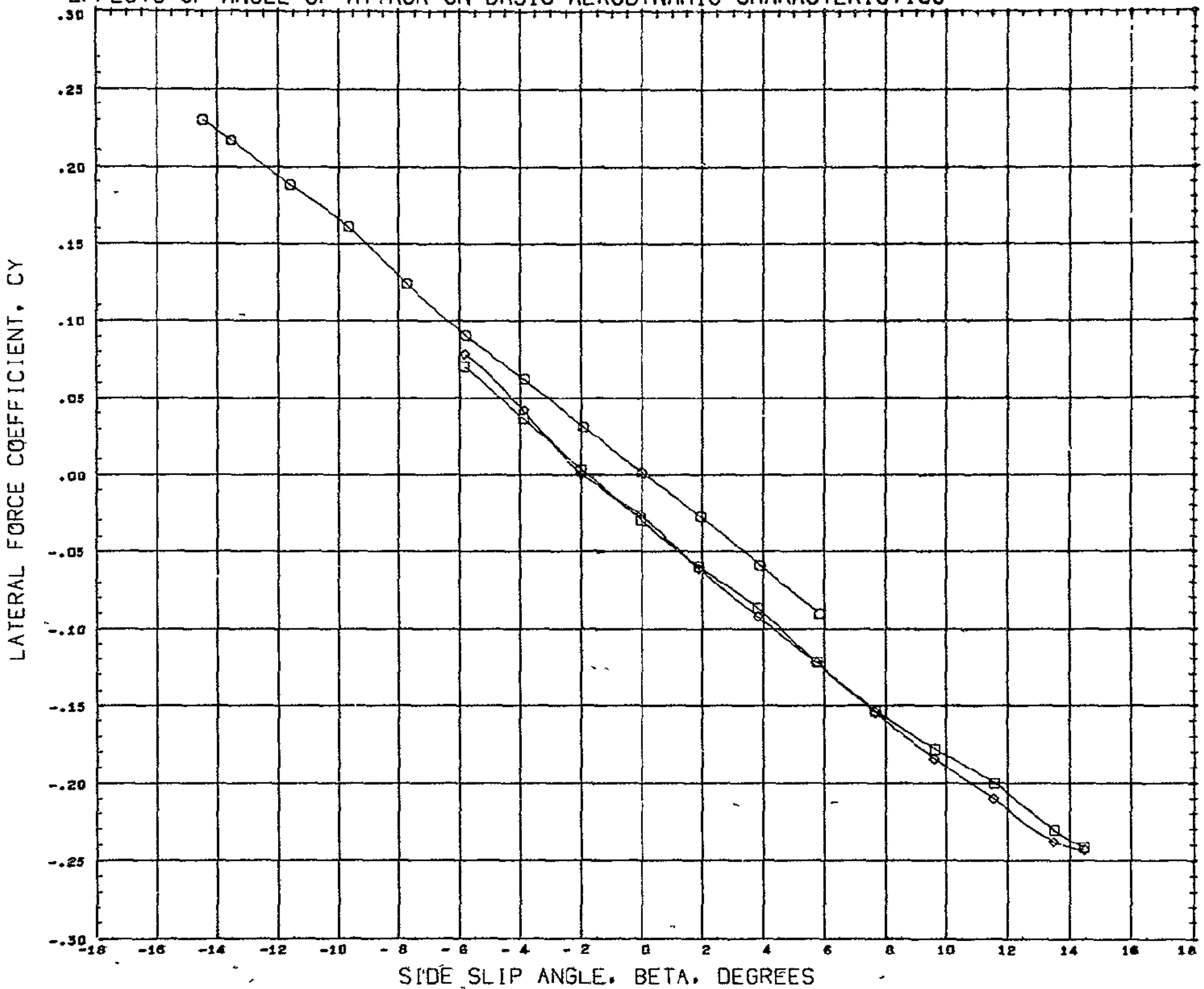
SYMBOL	ALPHA	PARAMETRIC VALUES			
○	6 300	MACH	0 182	PHI	0 000
□	0 300	ELEVON	0 000	VTAIL	0 000
◇	6.900	RUDDER	0.000		

REFERENCE FILE NDC (WD) SPACESHUT-A

REFERENCE INFORMATION

REFS	1 0000	SQ FT
REFL	0 8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	0 0667	FT
SCALE	0 0100	SCALE

EFFECTS OF ANGLE OF ATTACK ON BASIC AERODYNAMIC CHARACTERISTICS

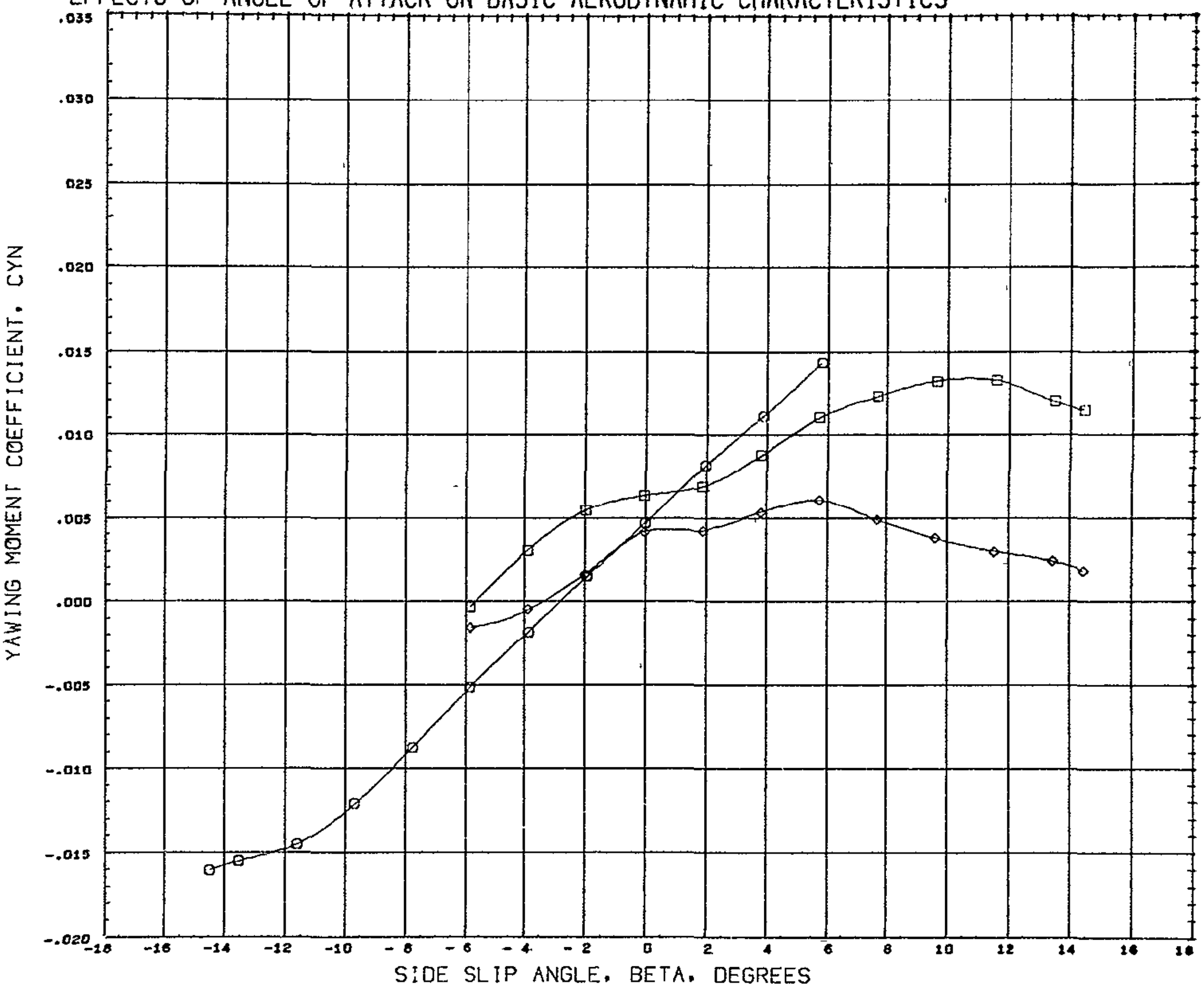


SYMBOL	ALPHA	PARAMETRIC VALUES			
○	- 6.300	MACH	0 182	PHI	0 000
□	0.300	ELEVON	0.000	VTAIL	0 000
◇	6.900	RUDDER	0 000		

REFERENCE FILE MDC(WD)SPACESHUT-A

REFERENCE INFORMATION		
REFS	1 0000	SQ.FT
REFL	0 8000	FT
REFB	1.3800	FT
XMRP	1 2800	FT
YMRP	0 0000	FT.
ZMRP	- 0 0667	FT
SCALE	0.0100	SCALE

EFFECTS OF ANGLE OF ATTACK ON BASIC AERODYNAMIC CHARACTERISTICS



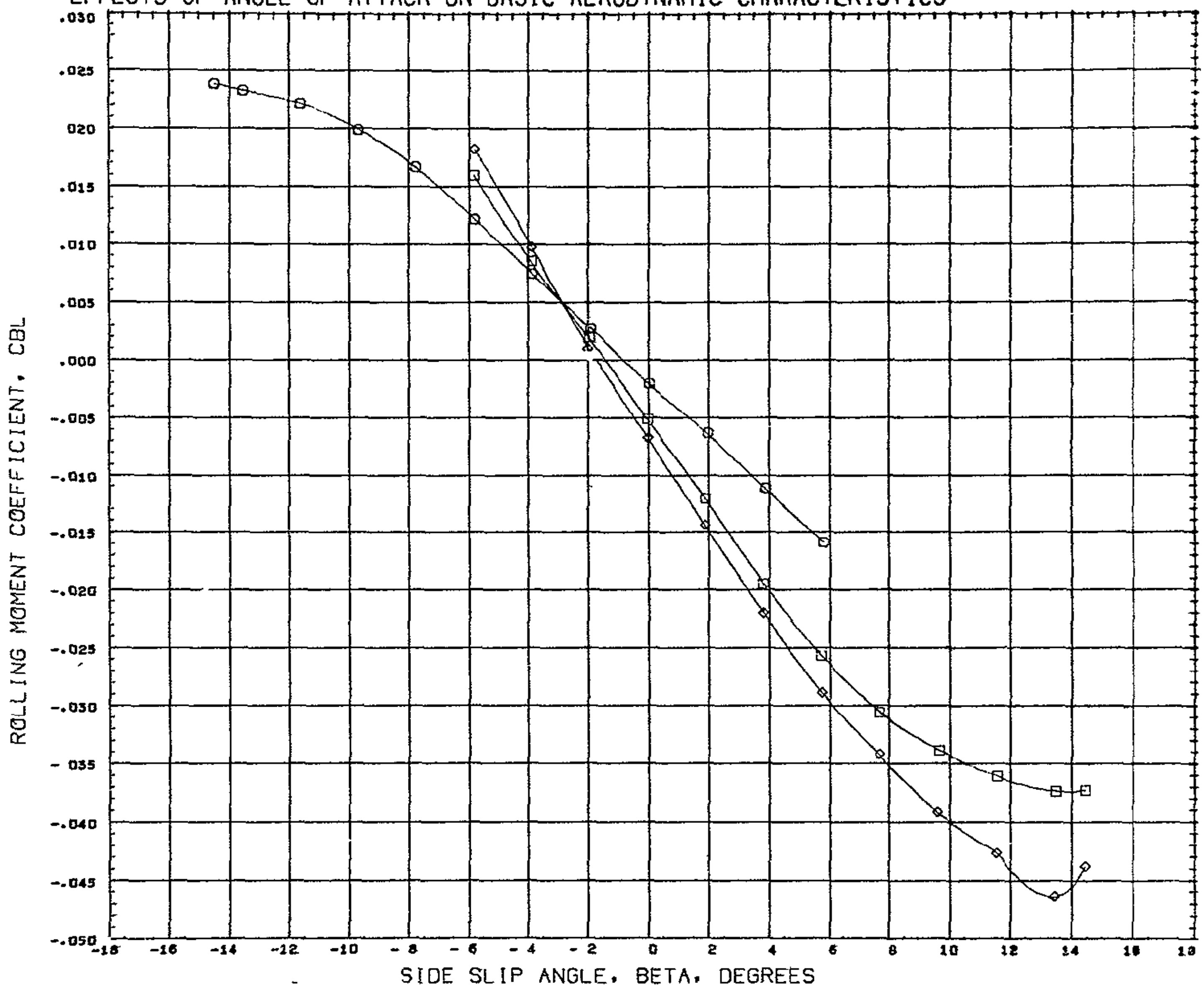
SYMBOL	ALPHA	PARAMETRIC VALUES			
○	- 6.300	MACH	0.182	PHI	0.000
□	0.300	ELEVON	0.000	VTAIL	0.000
◇	6.900	RUDDER	0.000		

REFERENCE FILE HDC(WD)SPACESHUT-A

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	- 0.0667	FT
SCALE	0.0100	SCALE

EFFECTS OF ANGLE OF ATTACK ON BASIC AERODYNAMIC CHARACTERISTICS



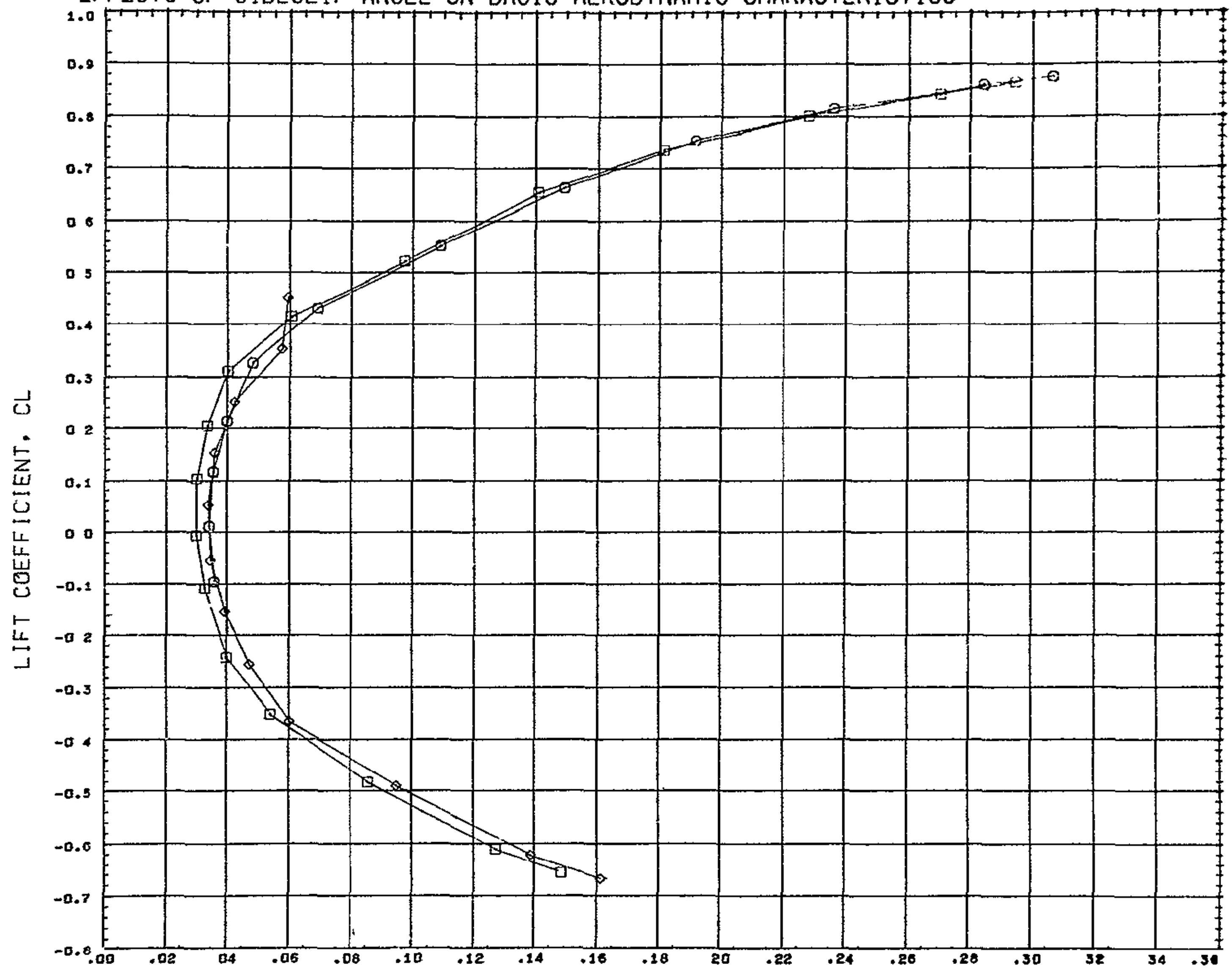
SYMBOL	ALPHA	PARAMETRIC VALUES			
○	-6.300	MACH	0.182	PHI	0.000
□	0.300	ELEVON	0.000	VTAIL	0.000
◇	6.900	RUDDER	0.000		

REFERENCE FILE MDC(WD)SPACESHUT-A

REFERENCE INFORMATION

REFS	1.0000	SQ.FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE

EFFECTS OF SIDESLIP ANGLE ON BASIC AERODYNAMIC CHARACTERISTICS



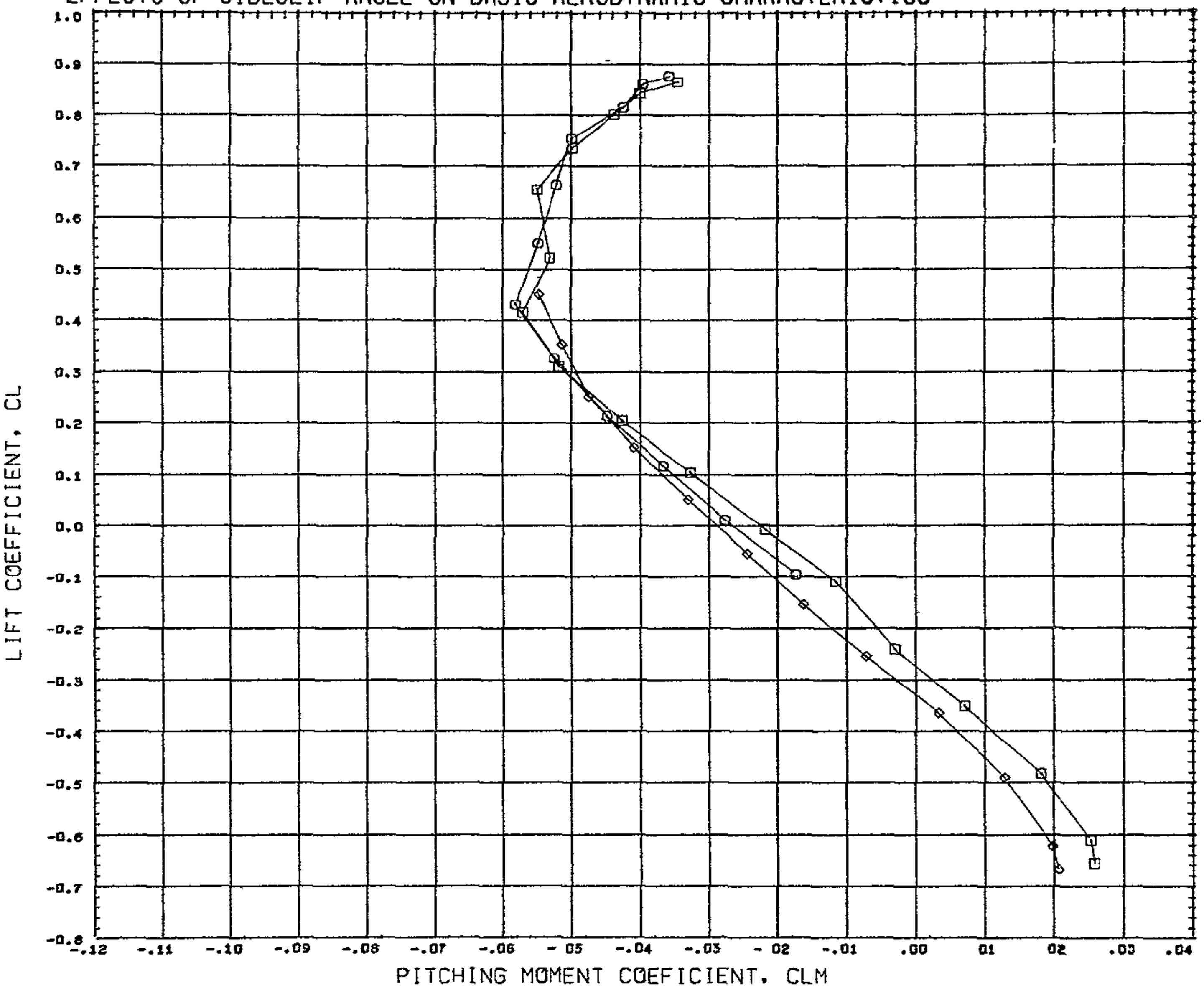
SYMBOL	BETA	PARAMETRIC VALUES			
O	-6.000	MACH	0.183	PHI	0.000
□	0.000	ELEVON	0.000	VTAIL	0.000
◇	6.000	RUDDER	0.000		

REFERENCE FILE HDC(WD)SPACESHUT-A

REFERENCE INFORMATION

REFS	1.0000	SQ.FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE

EFFECTS OF SIDESLIP ANGLE ON BASIC AERODYNAMIC CHARACTERISTICS

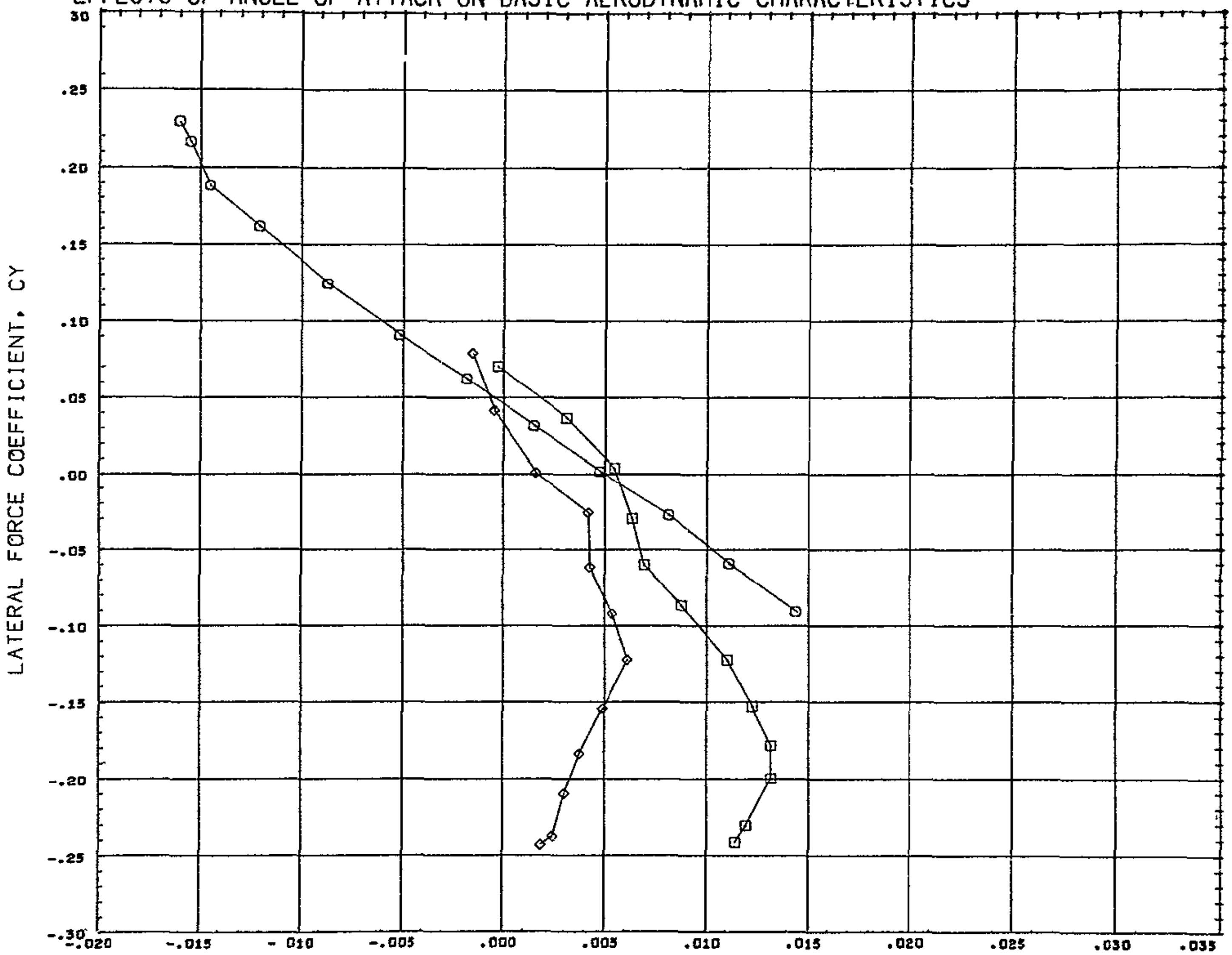


SYMBOL	BETA	PARAMETRIC VALUES			
O	- 6.000	MACH	0 183	PHI	0.000
□	0 000	ELEVON	0 000	VTAIL	0 000
◇	6 000	RUDDER	0 000		

REFERENCE FILE HDC(WD)SPACESHUT-A

REFERENCE INFORMATION		
REFS	1 0000	SQ FT
REFL	0 8000	FT
REFB	1.3800	FT
XMRP	1 2600	FT.
YMRP	0 0000	FT
ZMRP -	0 0667	FT
SCALE	0.0100	SCALE

EFFECTS OF ANGLE OF ATTACK ON BASIC AERODYNAMIC CHARACTERISTICS



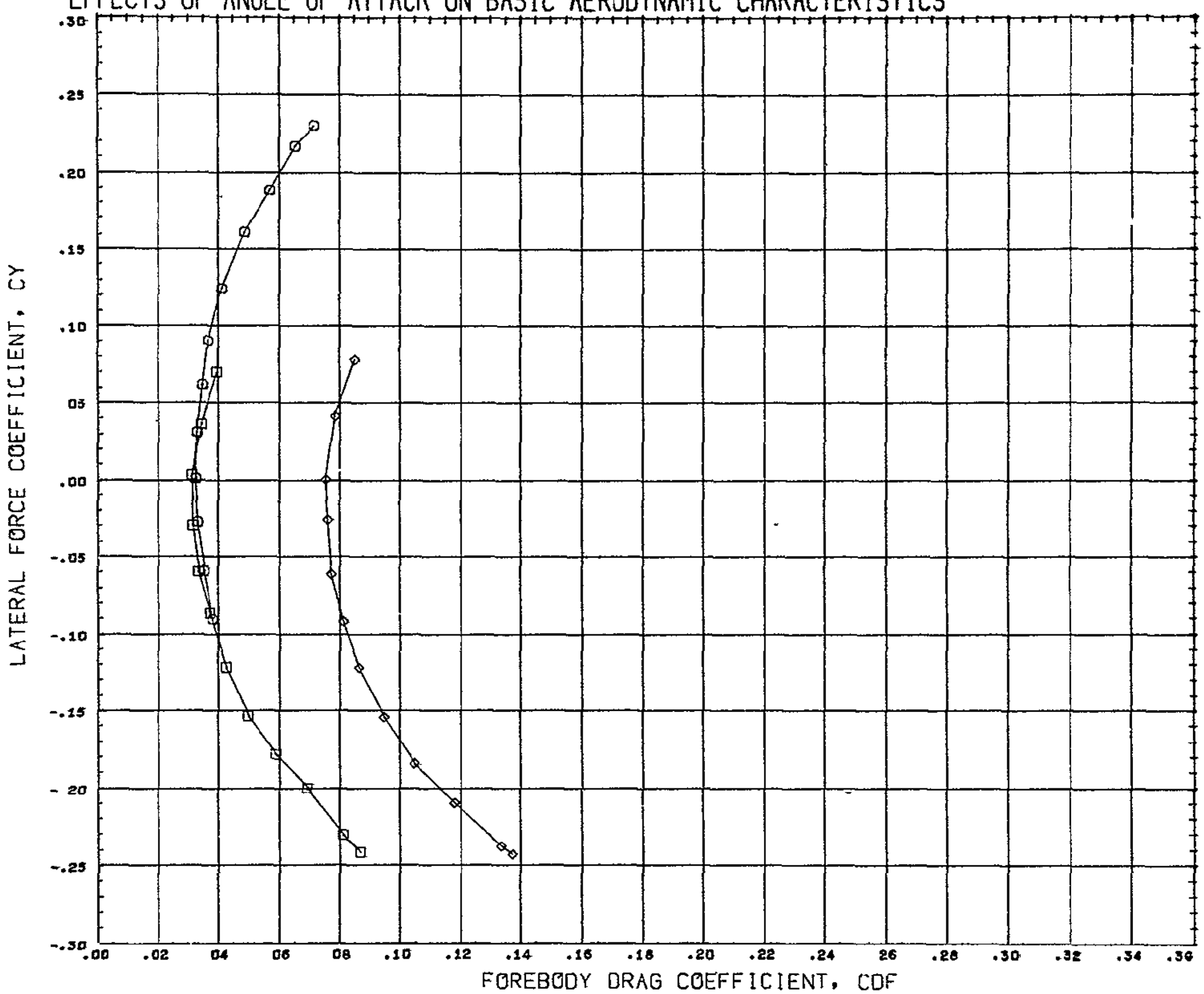
SYMBOL	ALPHA	PARAMETRIC VALUES			
○	-6.300	MACH	0.182	PHI	0.000
□	0.300	ELEVON	0.000	VTAIL	0.000
◇	6.900	RUDDER	0.000		

REFERENCE FILE HDC(WD)SPACESHUT-A

REFERENCE INFORMATION

REFS	1.0000	SQ.FT.
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE

EFFECTS OF ANGLE OF ATTACK ON BASIC AERODYNAMIC CHARACTERISTICS



SYMBOL	ALPHA
○	-6.300
□	0.300
◇	6.900

PARAMETRIC VALUES

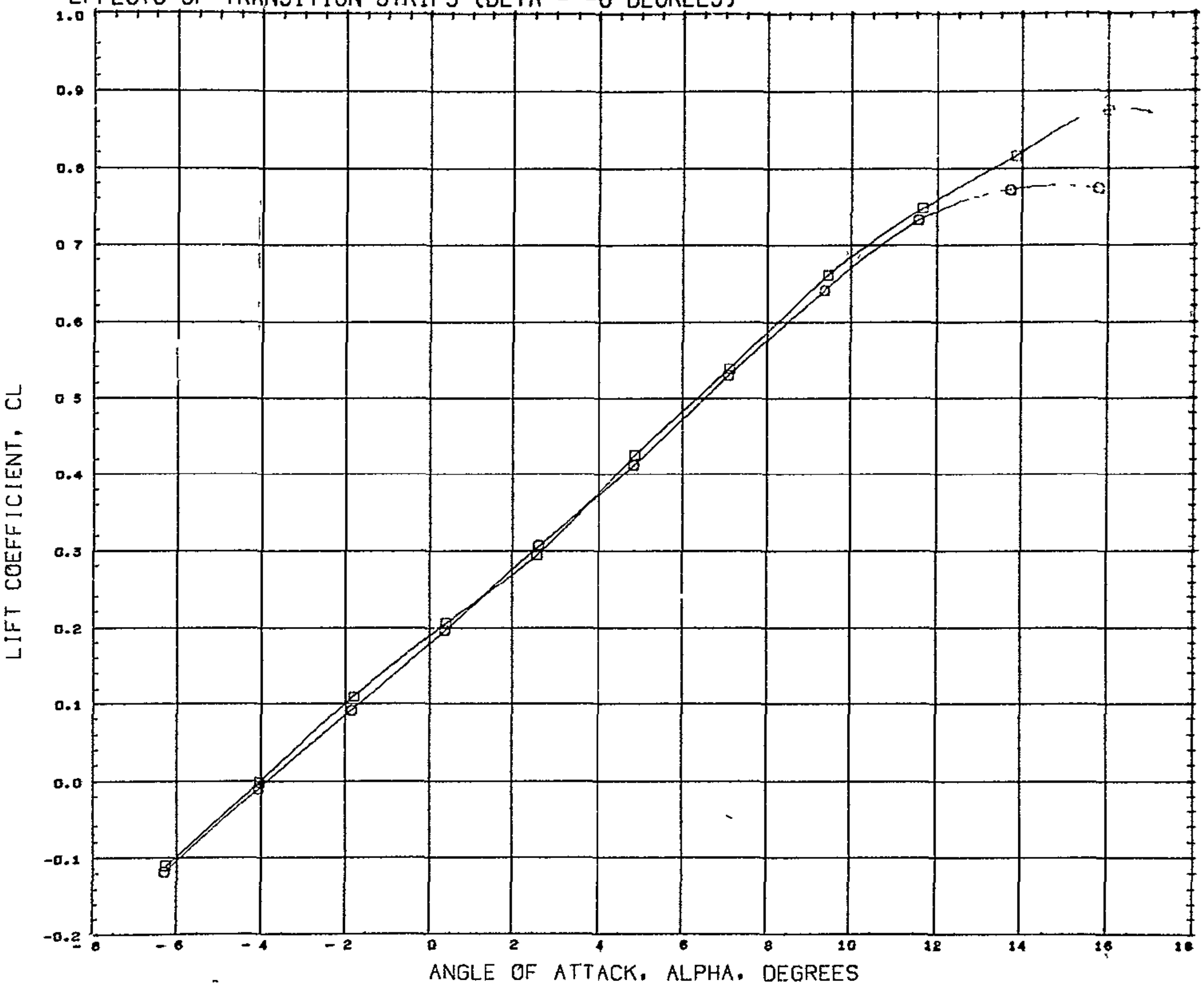
MACH	0.182	PHI	0.000
ELEVON	0.000	VTAIL	0.000
RUDDER	0.000		

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	-0.0667	FT.
SCALE	0.0100	SCALE

REFERENCE FILE HDC(WD)SPACESHUT-A

EFFECTS OF TRANSITION STRIPS (BETA = -6 DEGREES)



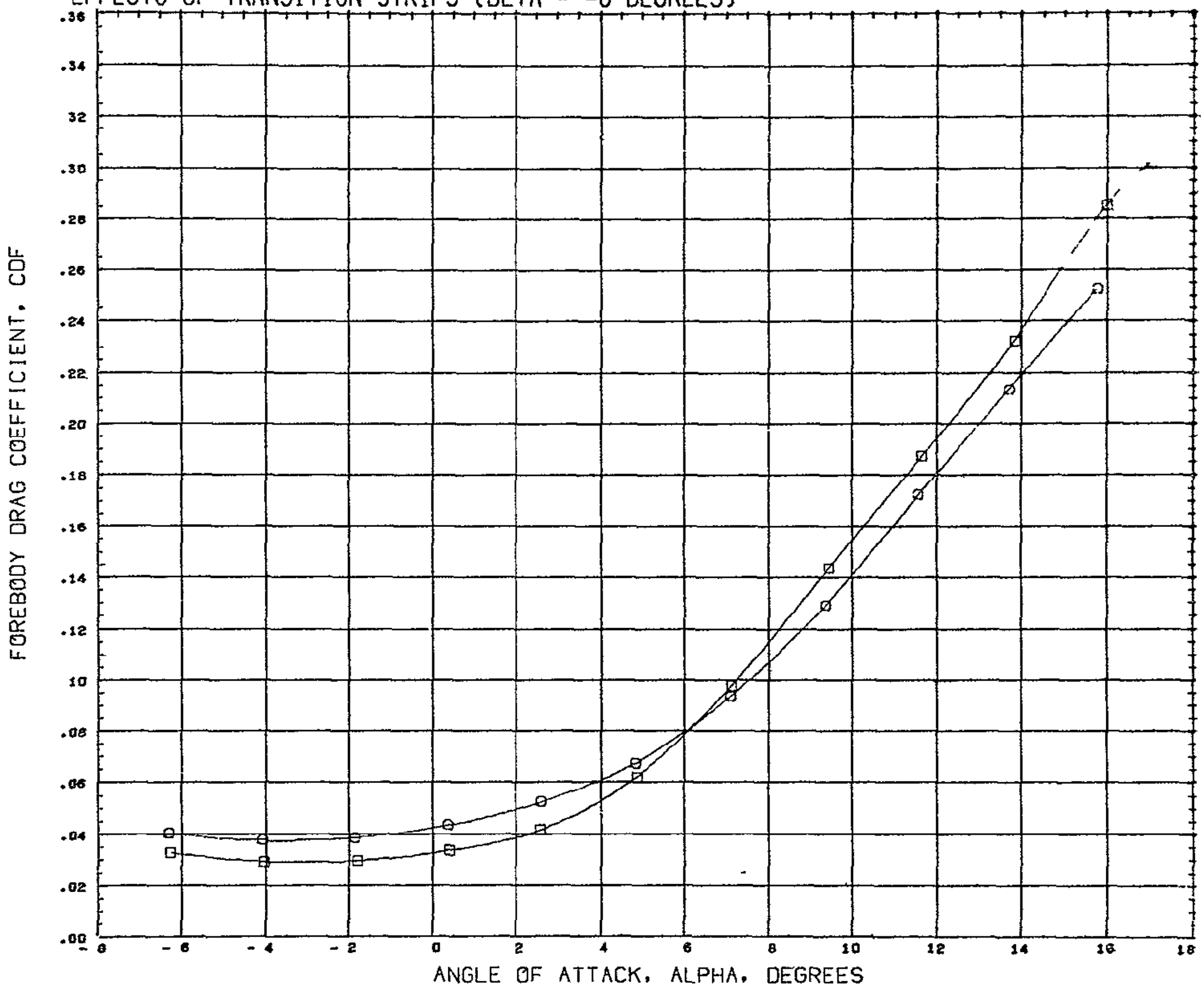
SYMBOL	CONFIGURATION DESCRIPTION	DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z (0.010SCL)	(RC2051)	18 SEP 70	0.180
□	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1 (0 0.0SCL)	(RC2041)	18 SEP 70	

REFERENCE INFORMATION

REFS	1 0000	SQ FT
REFL	0 8000	FT.
REFB	1 3600	FT
XMRP	1 2600	FT
YMRP	0 0000	FT.
ZMRP	- 0 0667	FT.
SCALE	0 0100	SCALE

REFERENCE FILE MDC (WD) SPACESHUT-A

EFFECTS OF TRANSITION STRIPS (BETA = -6 DEGREES)

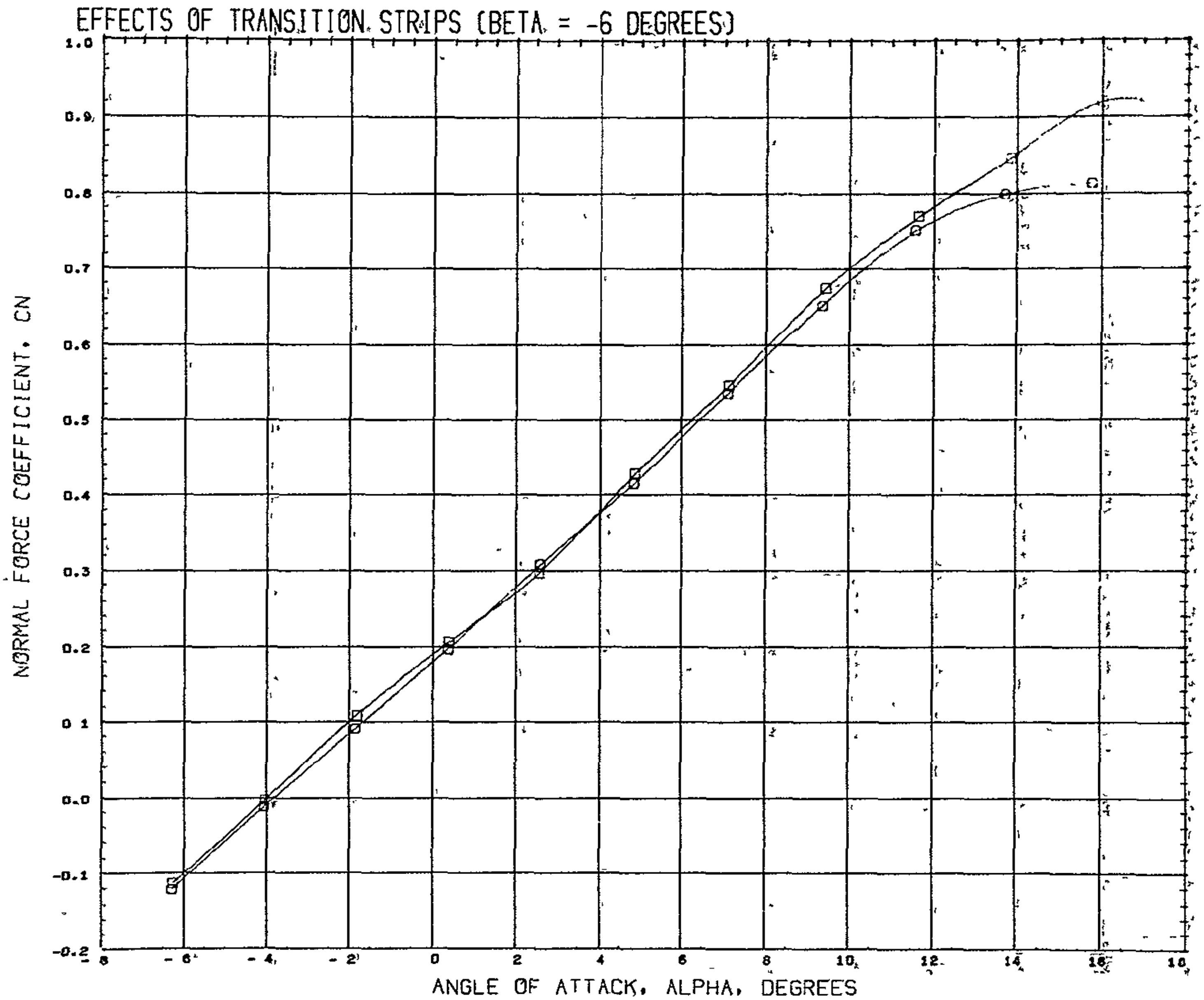


SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1L1L2Z	(0 010SCL)	(RC2051)	18 SEP 70	0.180
□	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1	(0 010SCL)	(RC2041)	18 SEP 70	

REFERENCE INFORMATION

REFS	1 0000	SQ FT.
REFL	0 8000	FT.
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0.0000	FT
ZMRP -	0 0667	FT
SCALE	0 0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A



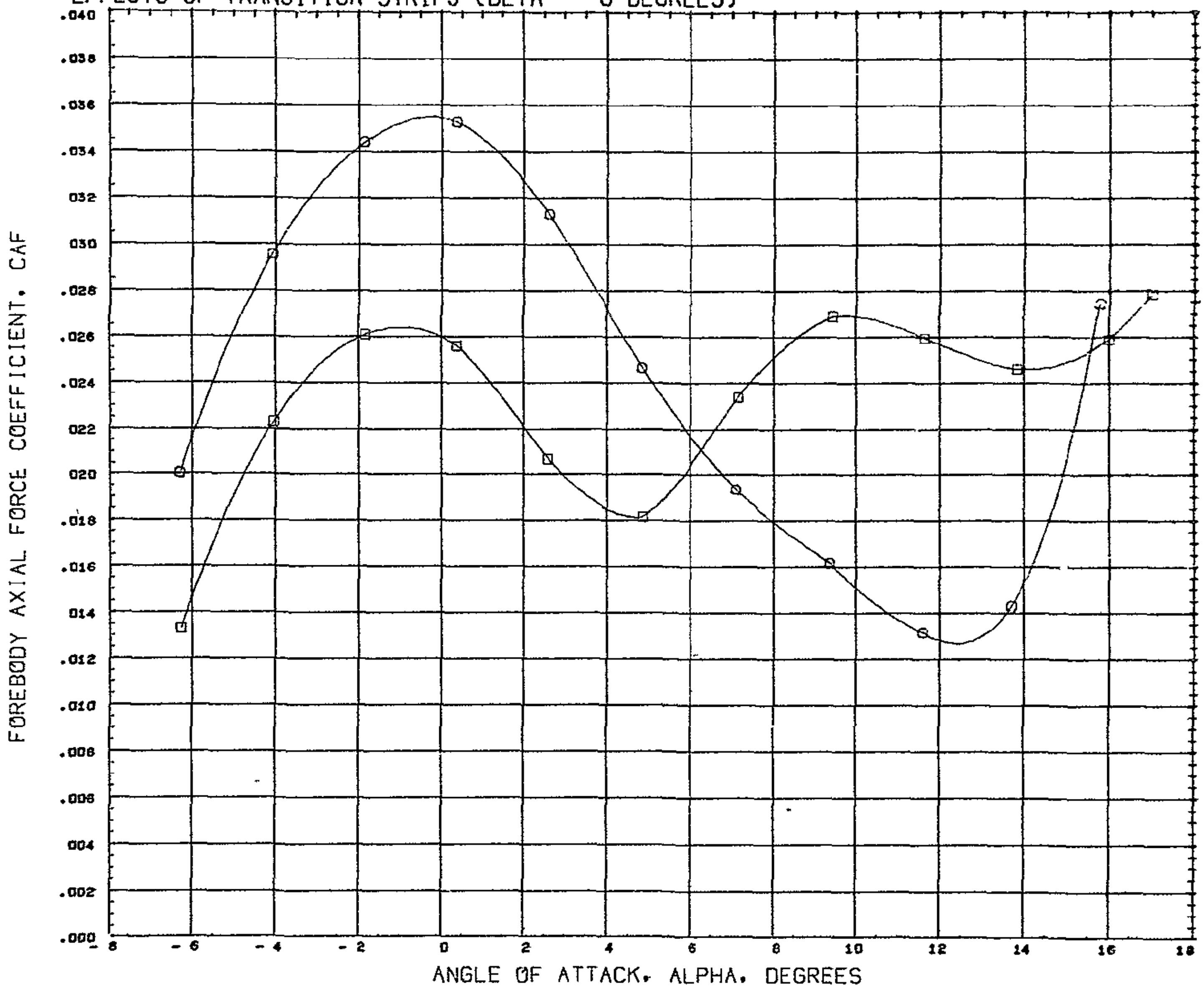
SYMBOL	CONFIGURATION DESCRIPTION	DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z (0 010SCL)	(RC2051)	18 SEP 70	0.180
□	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1 (0 010SCL)	(RC2041)	18 SEP 70	

REFERENCE INFORMATION

REFS	1 0000	SQ FT
REFL	0.8000	FT
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0 0000	FT
ZMRP	0.0667	FT
SCALE	0 0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A

EFFECTS OF TRANSITION STRIPS (BETA = -6 DEGREES)



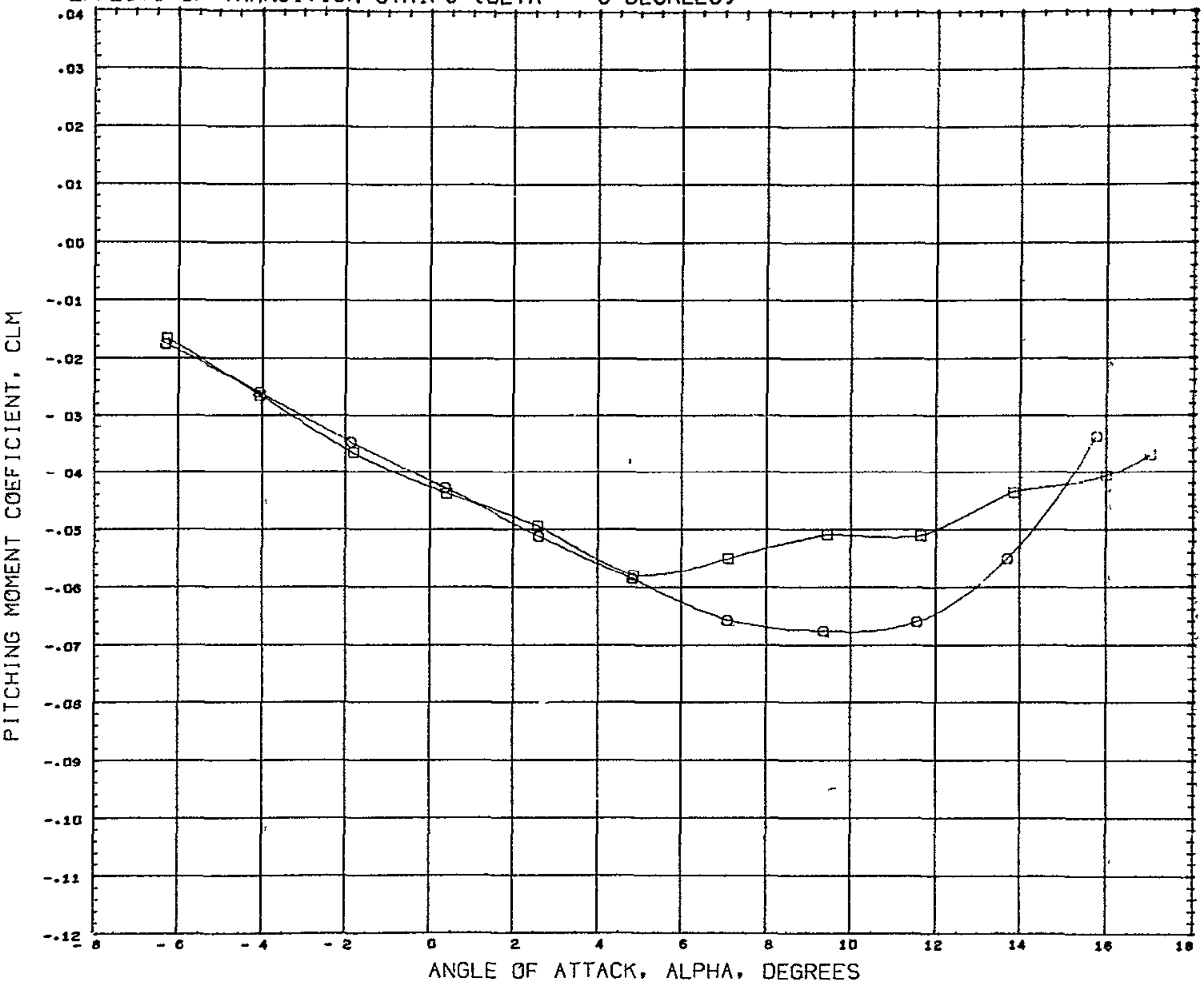
SYMBOL	CONFIGURATION DESCRIPTION	DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z (0.010SCL)	(RC2051)	18 SEP 70	0 180
□	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1 (0 010SCL)	(RC2041)	18 SEP 70	

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0 8000	FT.
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0 0000	FT
ZMRP	- 0 0667	FT.
SCALE	0 0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A

EFFECTS OF TRANSITION STRIPS (BETA = -6 DEGREES)



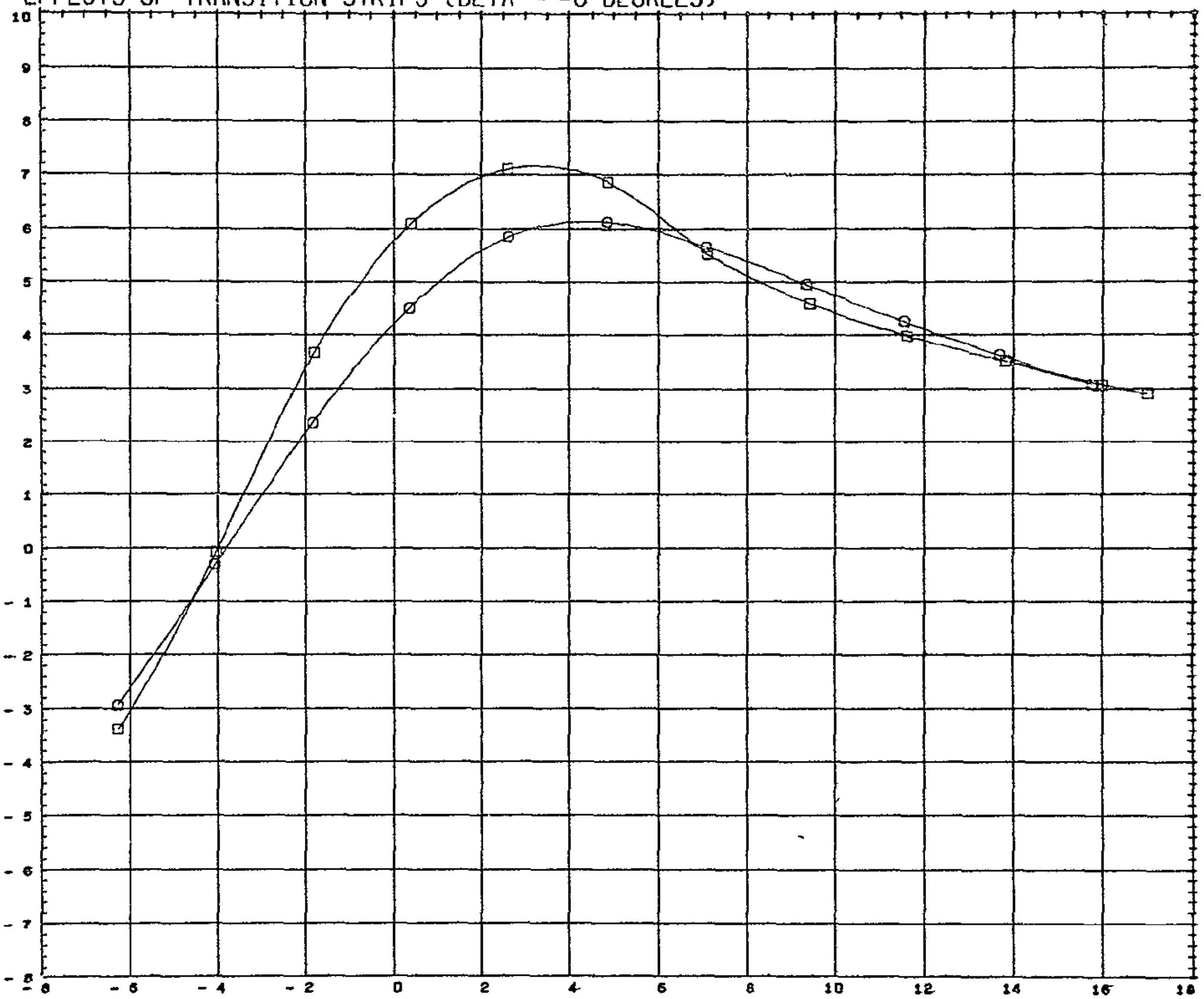
SYMBOL	CONFIGURATION DESCRIPTION	DATA SET	DATE	MACH
O	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1L1L2Z (0 010SCL)	(RC2051)	18 SEP 70	0 180
□	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1 (0 010SCL)	(RC2041)	18 SEP 70	

REFERENCE INFORMATION

REFS	1 0000	SQ FT
REFL	0.8000	FT
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0.0000	FT
ZMRP	- 0 0667	FT
SCALE	0 0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A

EFFECTS OF TRANSITION STRIPS (BETA = -6 DEGREES)

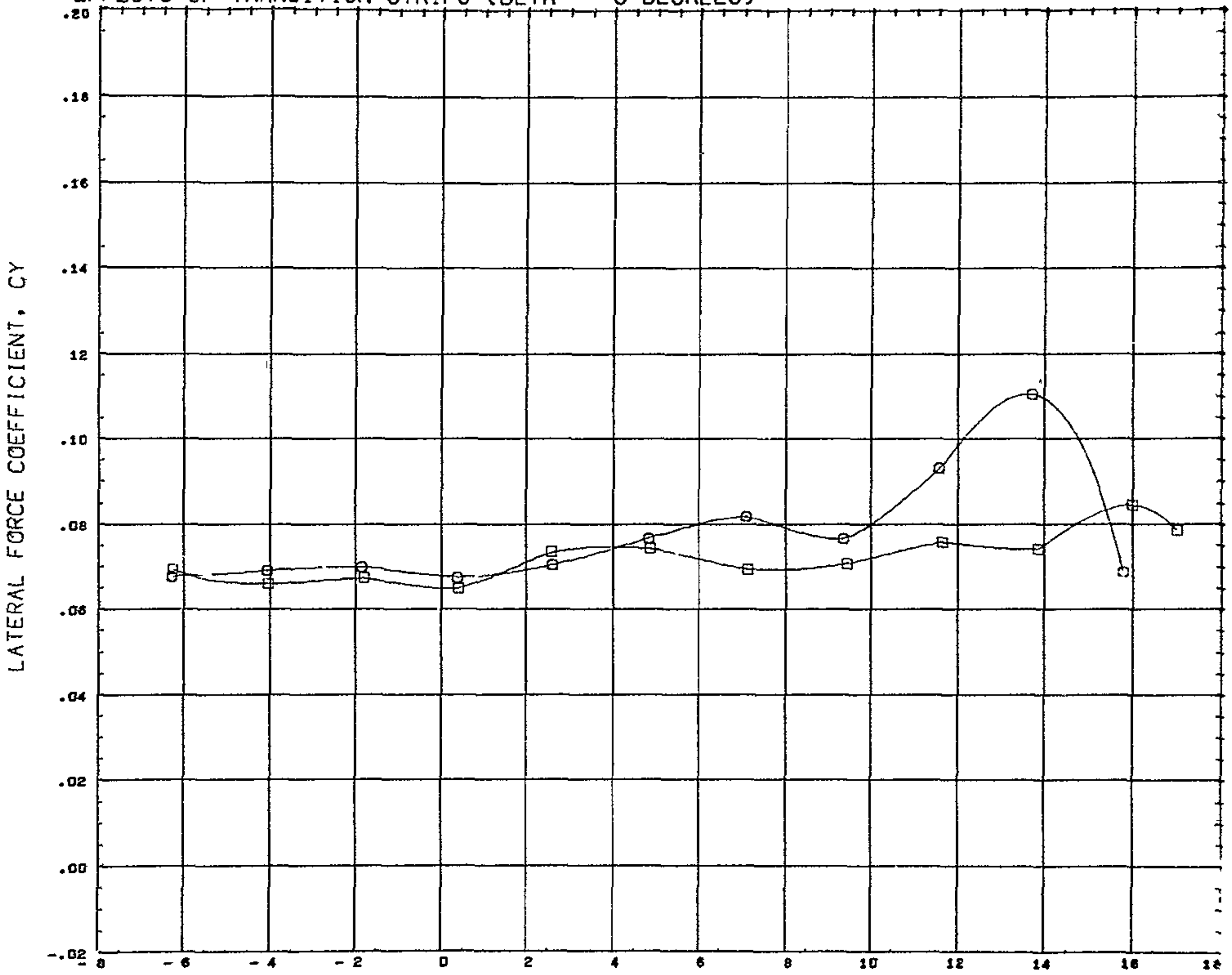


SYMBOL	CONFIGURATION DESCRIPTION	DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z (0.010SCL)	(RC2051)	.3 SEP 70	0.180
□	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1 (0 010SCL)	(RC2041)	18 SEP 70	

REFERENCE INFORMATION		
REFS	1 0000	SQ FT
REFL	0 8000	FT
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0 0000	FT
ZMRP -	0 0667	FT
SCALE	0 0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A

EFFECTS OF TRANSITION STRIPS (BETA = -6 DEGREES)



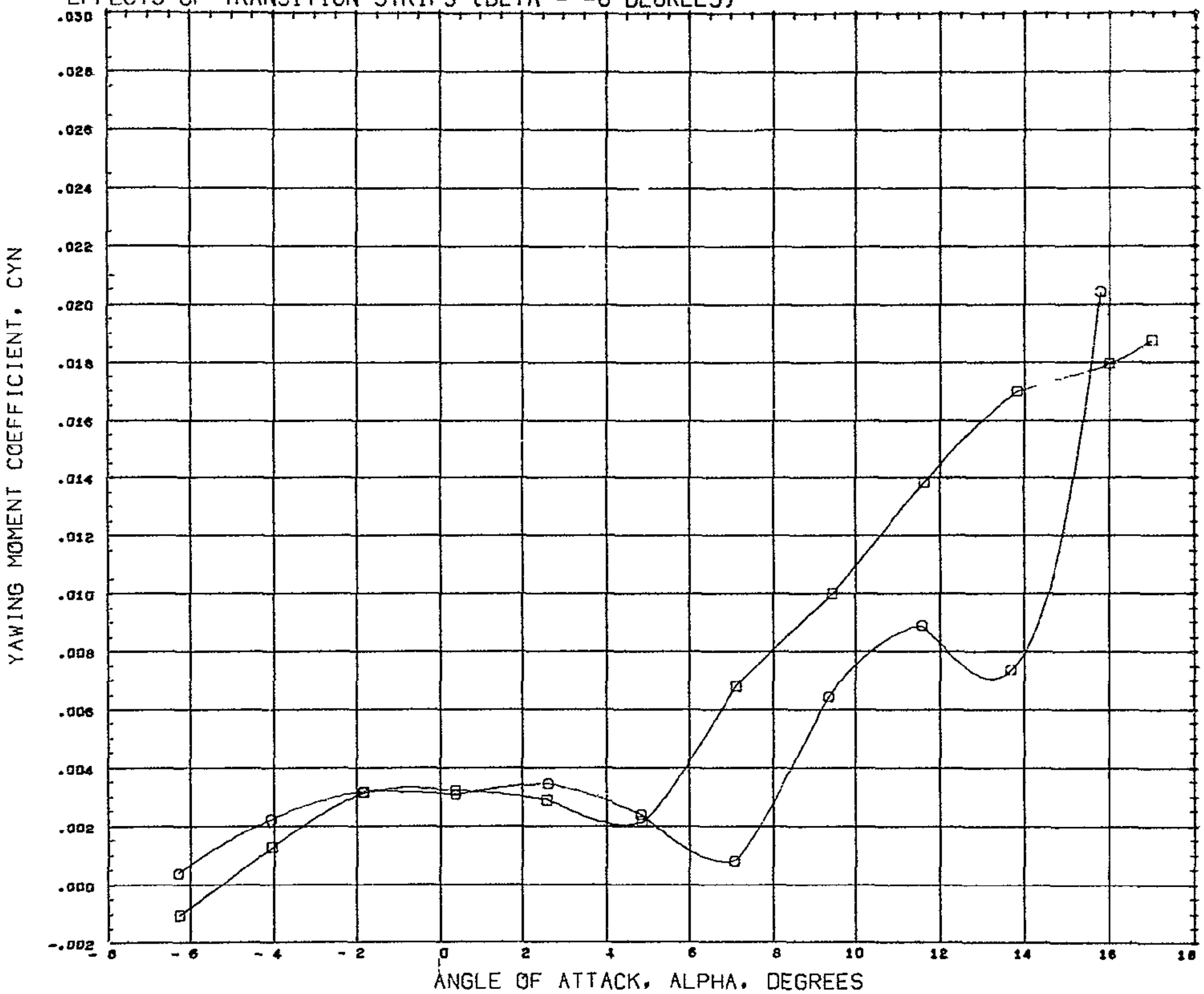
SYMBOL	CONFIGURATION DESCRIPTION	DATA SET	DATE	MACH
O	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1L1L2Z (0 010SCL)	(RC2051)	18 SEP 70	0.180
□	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1 (0 010SCL)	(RC2041)	18 SEP 70	

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0 8000	FT
REFB	1 3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	- 0 0667	FT
SCALE	0 0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A

EFFECTS OF TRANSITION STRIPS (BETA = -6 DEGREES)

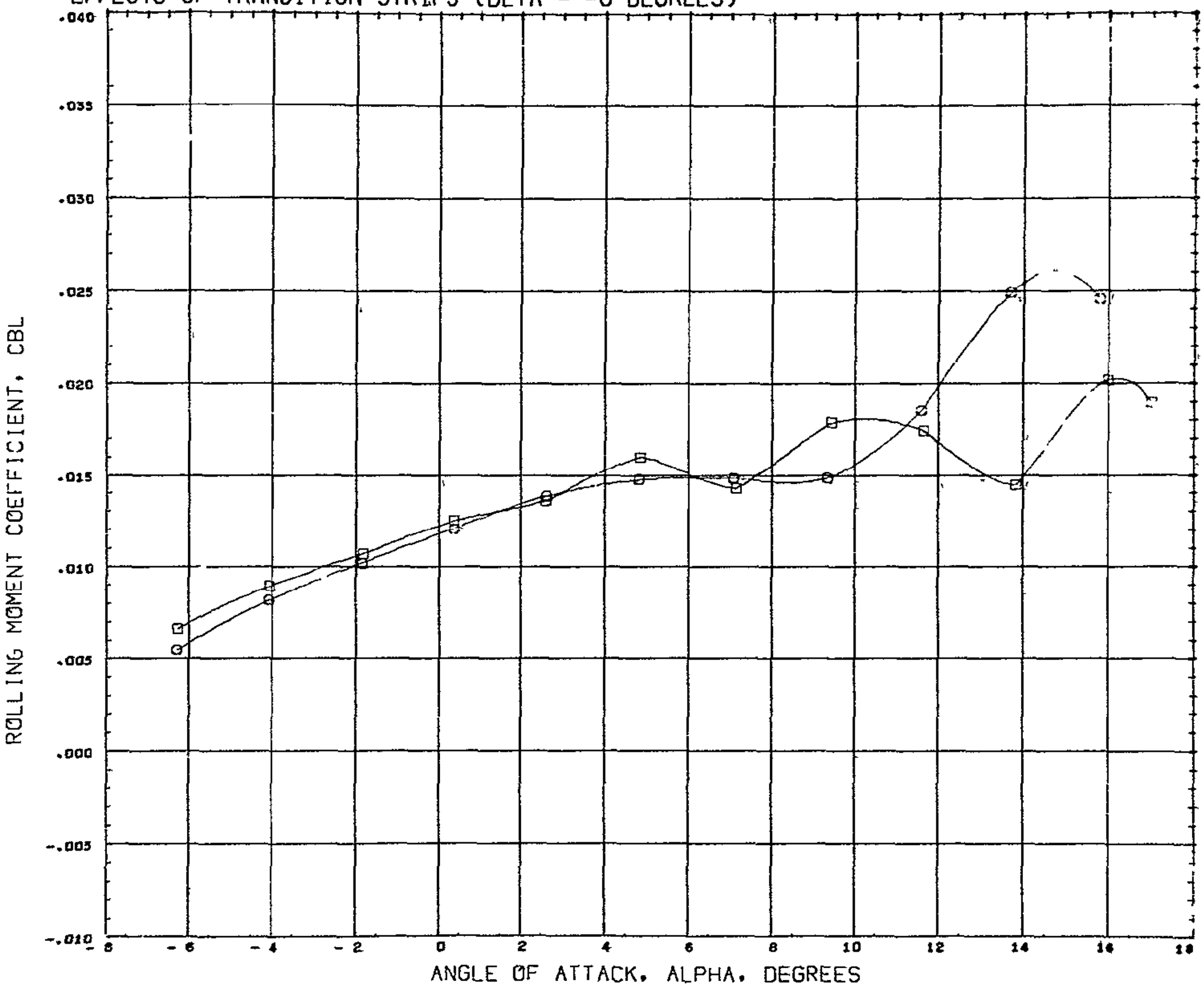


SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
O	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z	(0 010SCL)	(RC2051)	18 SEP 70	0 180
□	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1	(0 010SCL)	(RC2041)	18 SEP 70	

REFERENCE FILE MDC(WD)SPACESHUT-A

REFERENCE INFORMATION		
REFS	1 0000	SQ.FT
REFL	0 8000	FT.
REFB	1.3800	FT
XMRP	1 2600	FT
YMRP	0 0000	FT
ZMRP -	0 0667	FT
SCALE	0 0100	SCALE

EFFECTS OF TRANSITION STRIPS (BETA = -6 DEGREES)



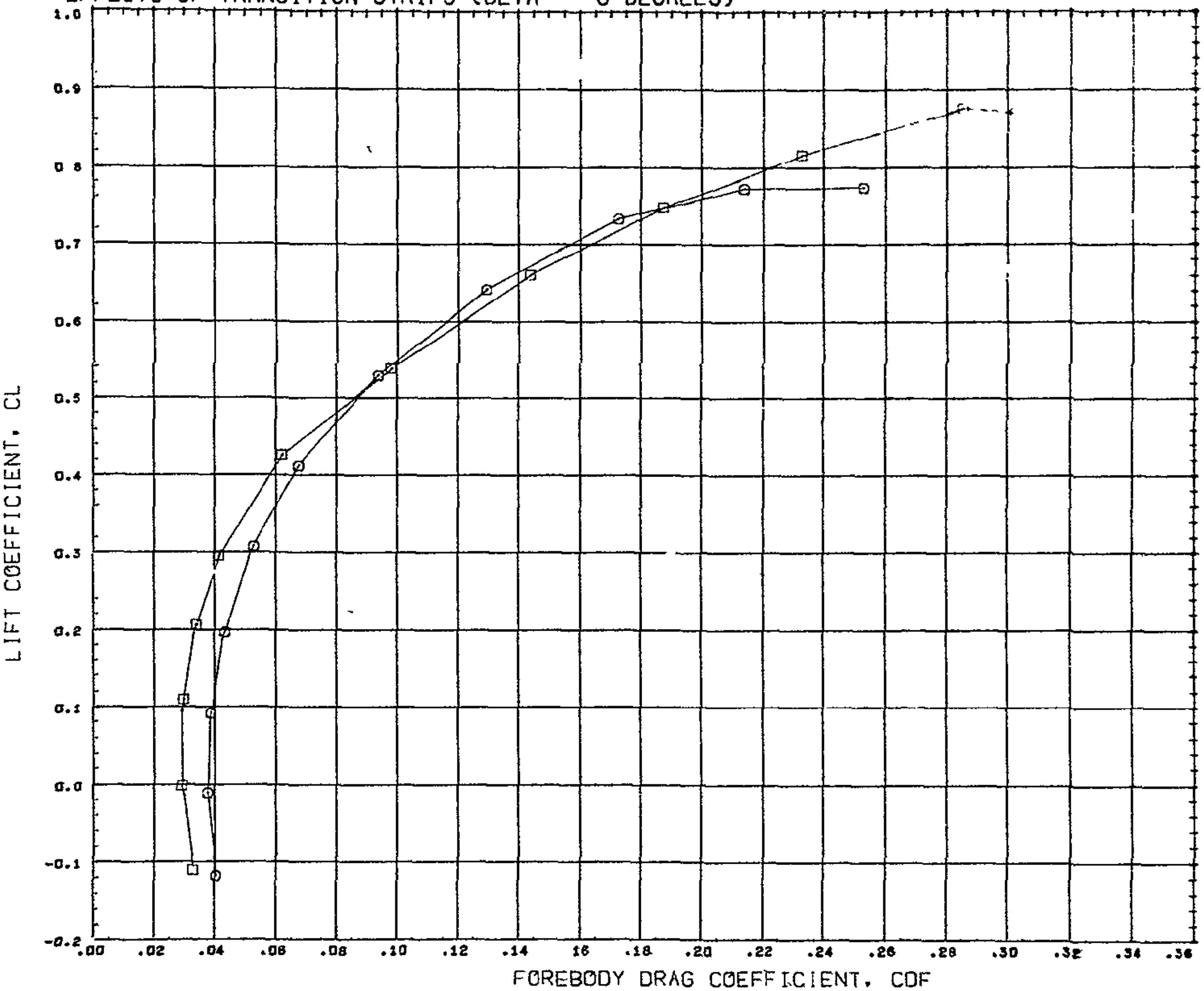
SYMBOL	CONFIGURATION DESCRIPTION	DATA SET	DATE	MACH
O	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1L1L2Z(0.010SCL)	(RC2051)	18 SEP 70	0 180
□	1321-DAC-LSWT-DELBOOST-B1WDV2K1R1 (0 010SCL)	(RC2041)	18 SEP 70	

REFERENCE INFORMATION

REFS	1.0000	SQ.FT
REFL	0 8000	FT
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0 0000	FT
ZMRP -	0 0667	FT
SCALE	0 0100	SCALE

REFERENCE FILE MDC(WD)SPACESHUT-A

EFFECTS OF TRANSITION STRIPS (BETA = -6 DEGREES)

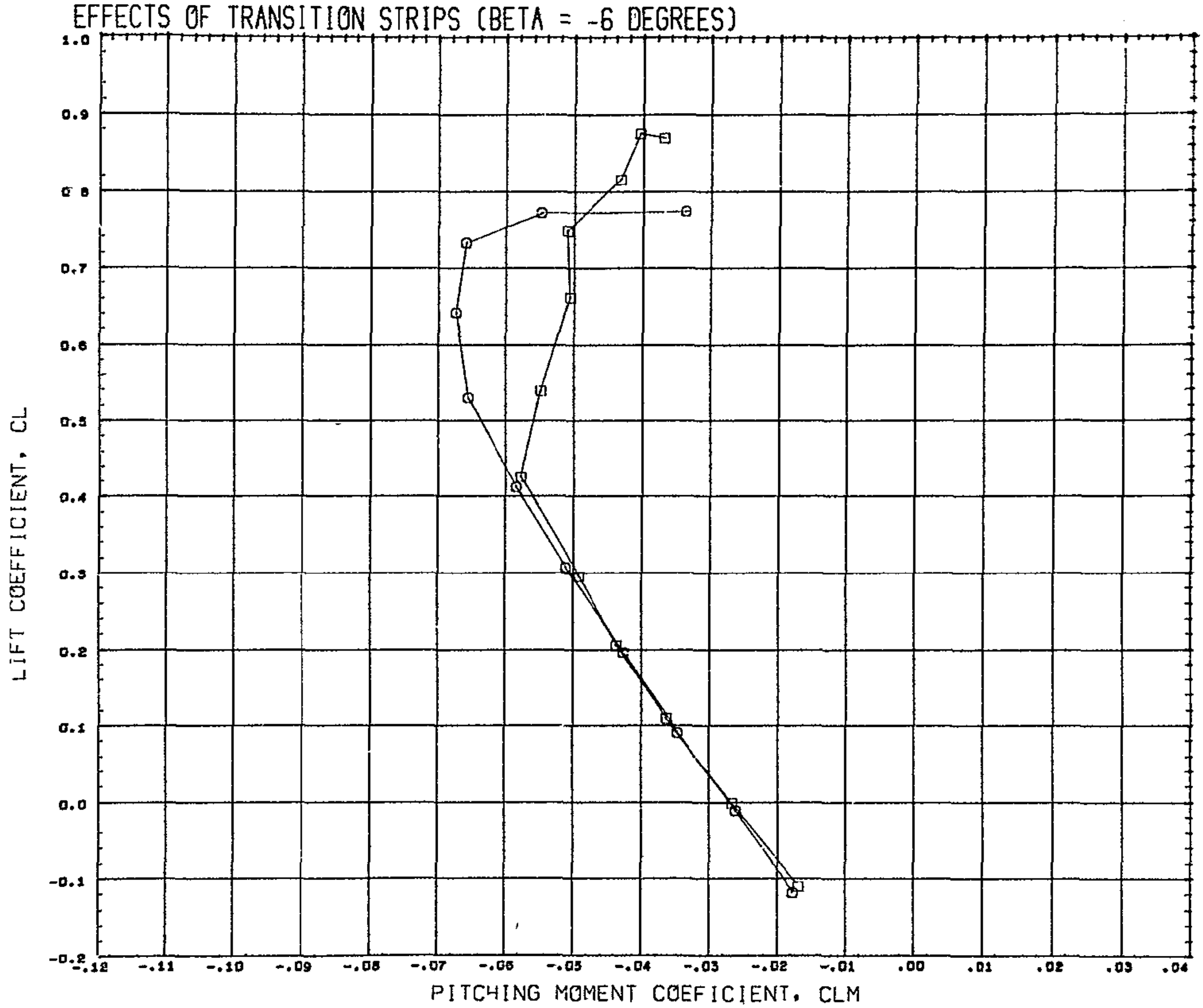


SYMBOL	CONFIGURATION DESCRIPTION		DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z	(0 010SCL)	(RC2051)	18 SEP 70	0 180
□	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1	(0 010SCL)	(RC2041)	18 SEP 70	

REFERENCE INFORMATION

REFS	1 0000	SQ FT
REFL	0 8000	FT
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0 0000	FT.
ZMRP	- 0.0667	FT
SCALE	0 0100	SCALE

REFERENCE FILE HDC(WD)SPACESHUT-A



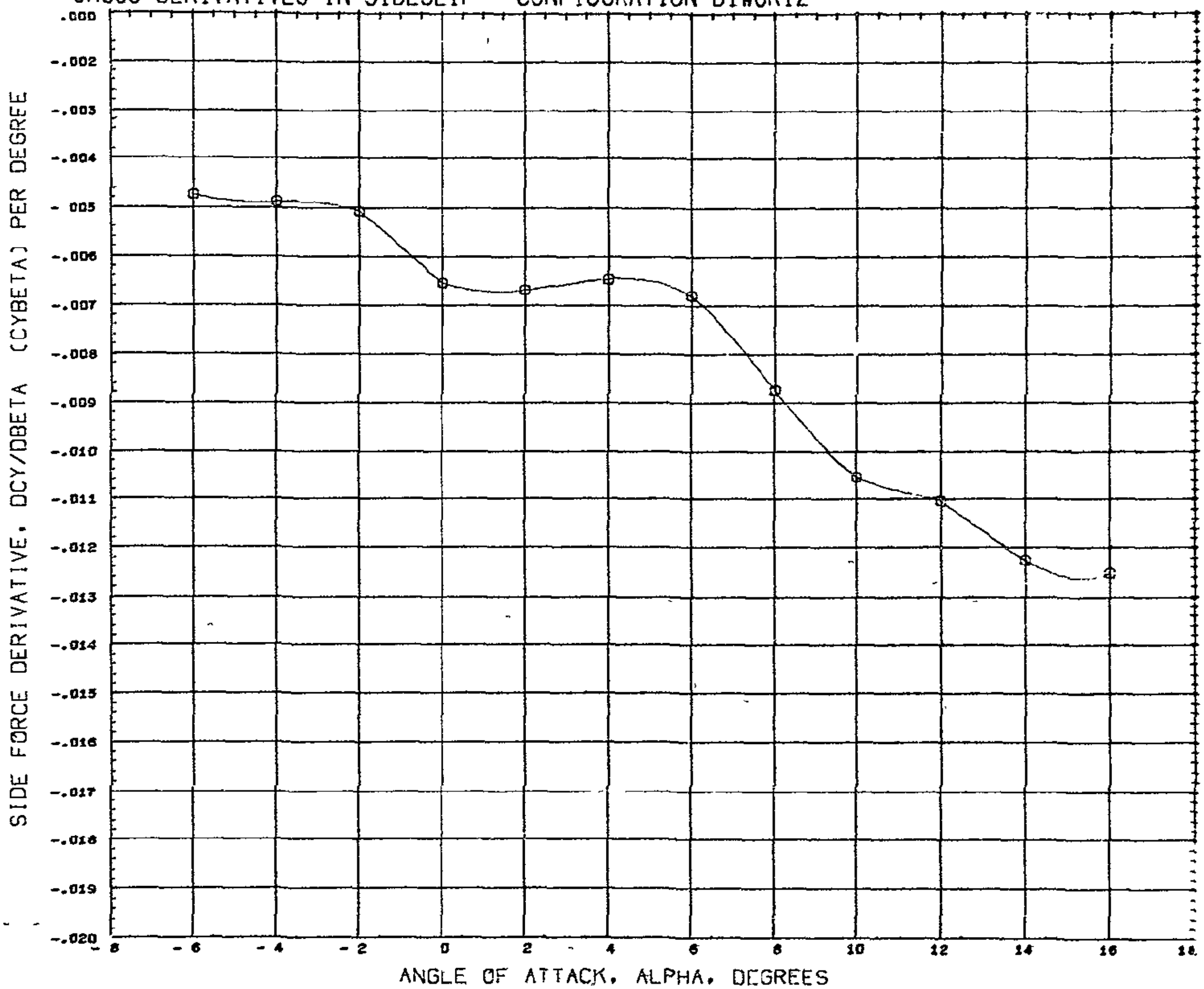
SYMBOL	CONFIGURATION DESCRIPTION	DATA SET	DATE	MACH
○	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1L1L2Z(0.010SCL)	(RC2051)	18 SEP 70	0.180
□	1321-DAC-LSWT-DELBOOST-B1W0V2K1R1 (0.010SCL)	(RC2041)	18 SEP 70	

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	0.0667	FT
SCALE	0.0100	SCALE

REFERENCE FILE HDC(WD)SPACESHUT-A

CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1W0R1Z



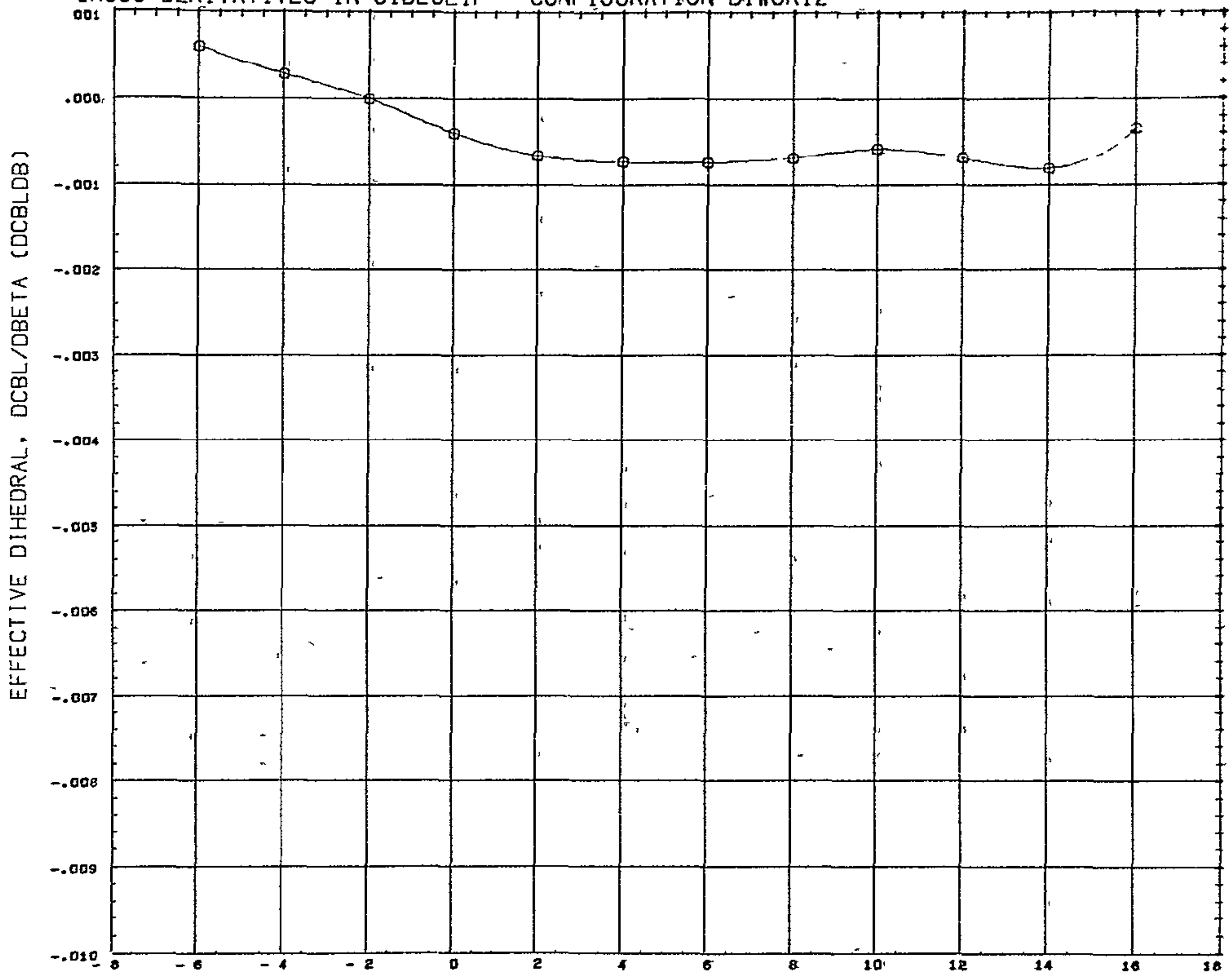
SYMBOL	MACH	PARAMETRIC VALUES			
O	0.180	BETA	- 6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE INFORMATION

REFS	1 0000	SQ FT
REFL	0.8000	FT
REFB	1 3800	FT.
XMRP	1.2600	FT.
YMRP	0.0000	FT
ZMRP -	0.0667	FT.
SCALE	0 0100	SCALE

REFERENCE FILE

CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1W0R1Z

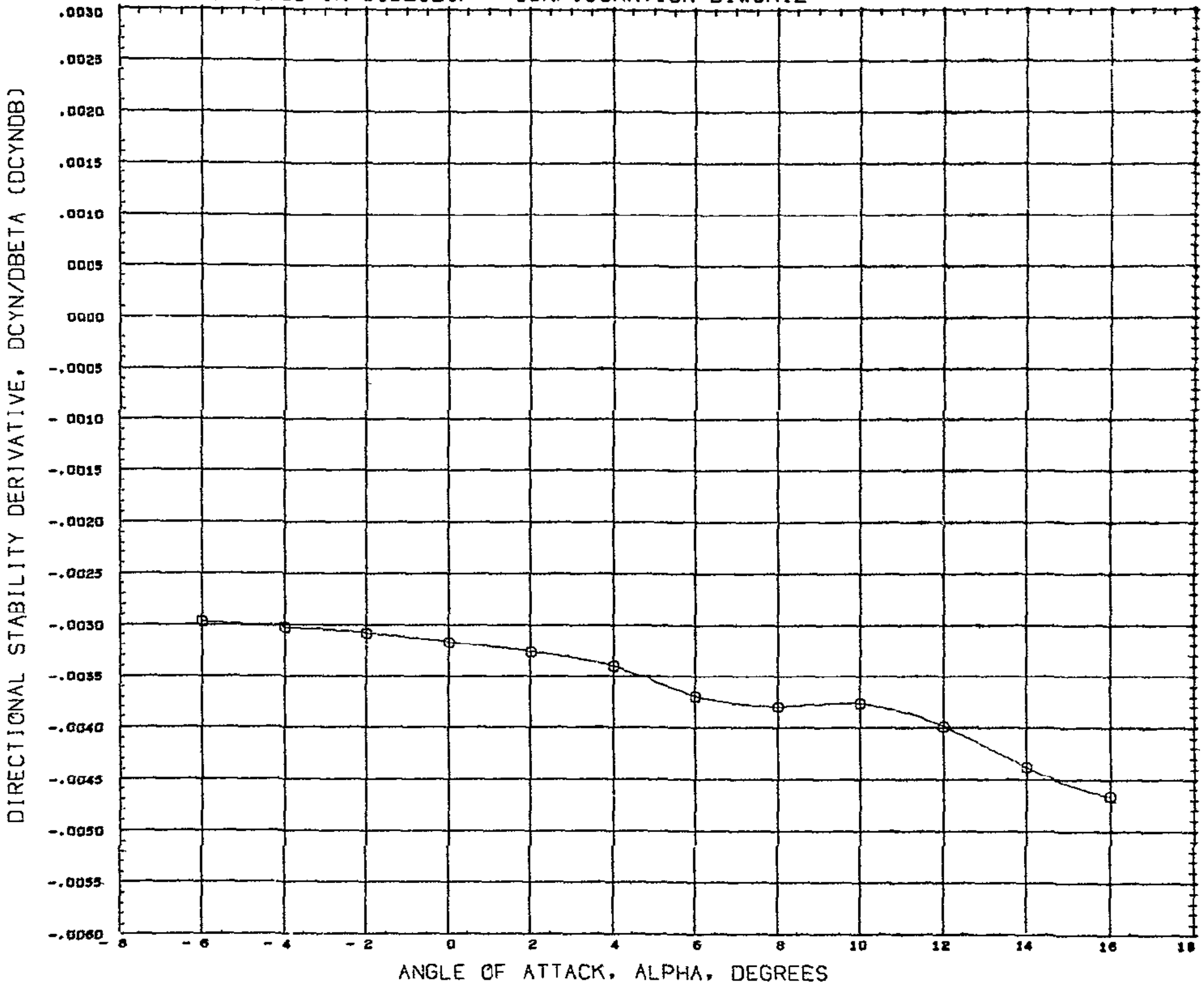


SYMBOL	MACH	PARAMETRIC VALUES			
O	0.180	BETA	- 6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE FILE

REFERENCE INFORMATION		
REFS	1.0000	SQ FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP -	0.0667	FT
SCALE	0.0100	SCALE

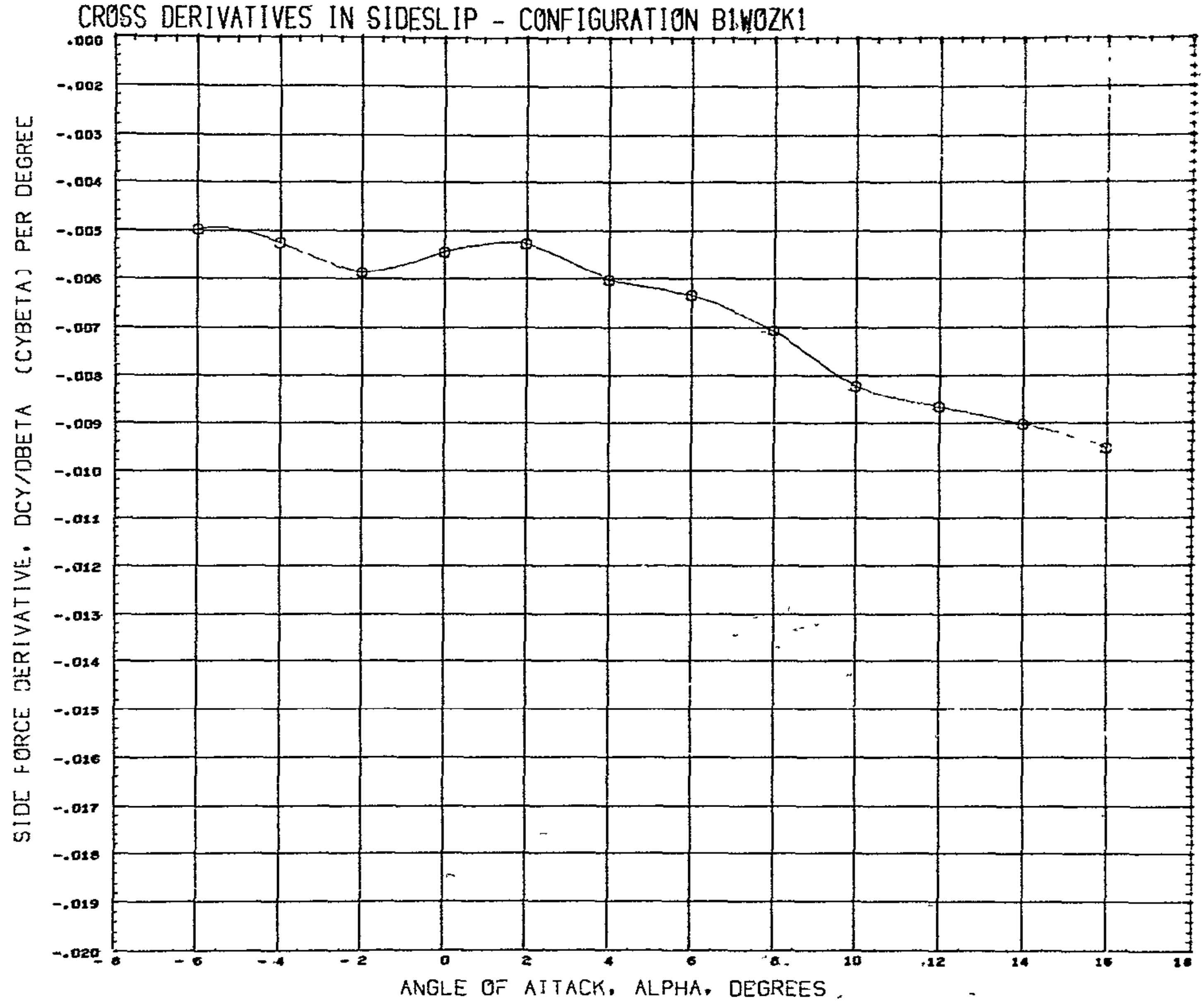
CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1W0R1Z



SYMBOL	MACH	PARAMETRIC VALUES			
O	0.180	BETA	-6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE FILE

REFERENCE INFORMATION		
REFS	1.0000	SQ FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE



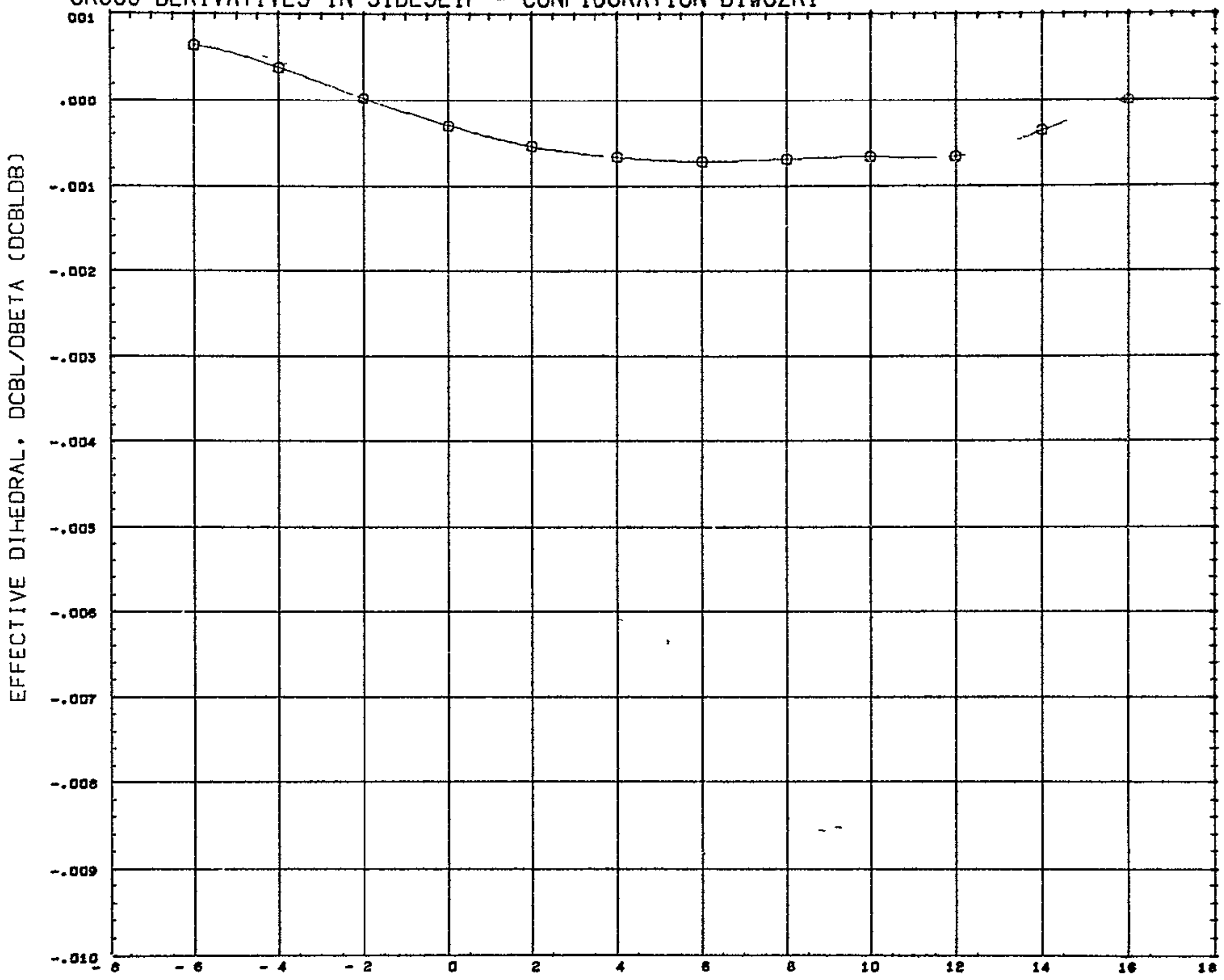
SYMBOL	MACH	PARAMETRIC VALUES			
O	0.180	BETA	6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0.8000	FT.
REFB	1.3800	FT.
XMRP	1.2600	FT.
YMRP	0.0000	FT.
ZMRP	0.0667	FT.
SCALE	0.0100	SCALE

REFERENCE FILE

CRØSS DERIVATIVES IN SIDESLIP - CØNFIGURATIØN B1WØZK1

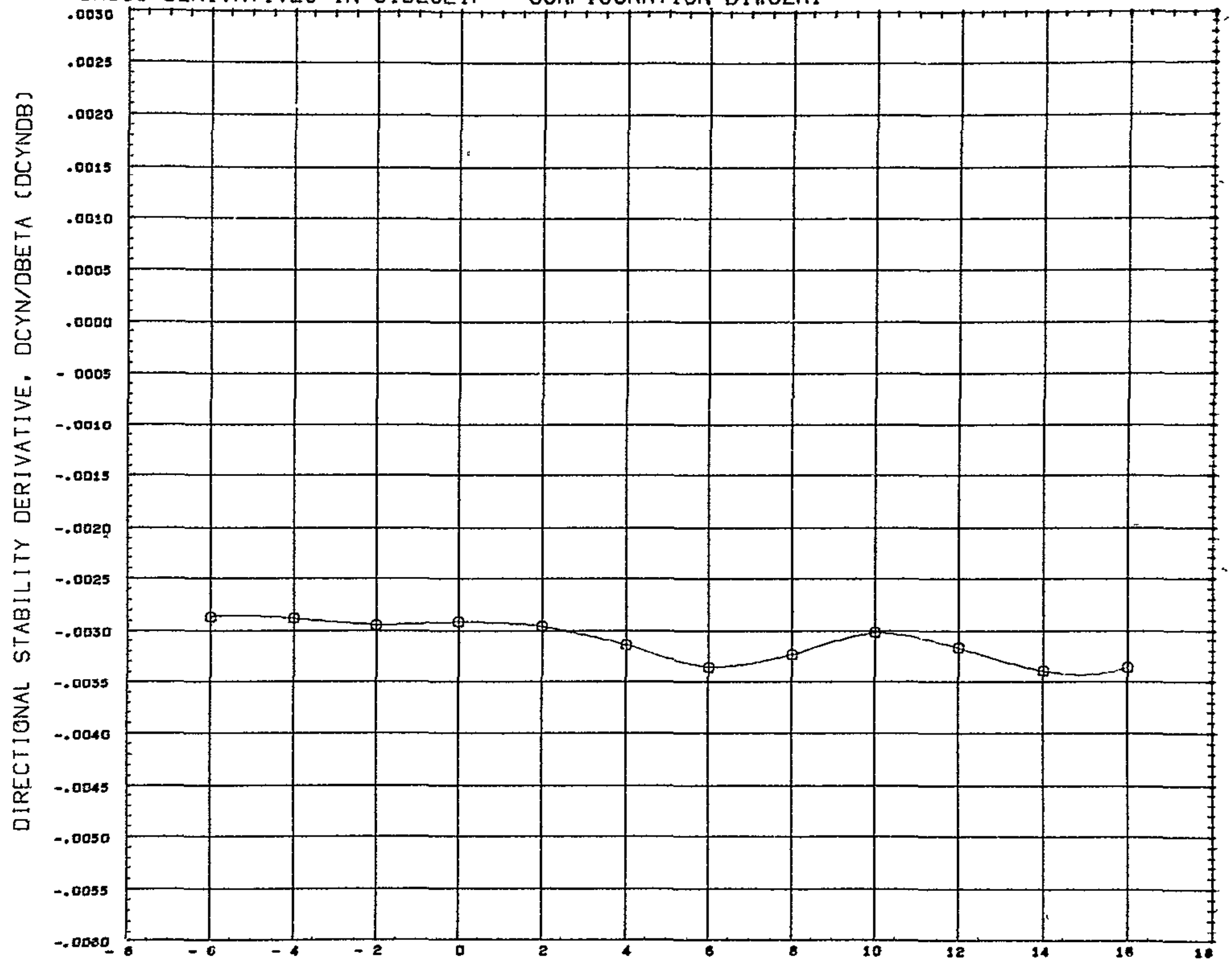


SYMBOL	MACH	PARAMETRIC VALUES			
O	0 180	BETA	- 6.000	PHI	0 000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0 000		

REFERENCE FILE

REFERENCE INFORMATION		
REFS	1 0000	SQ.FT.
REFL	0 6000	FT.
REFB	1.3800	FT.
XMRP	1.2600	FT.
YMRP	0 0000	FT
ZMRP -	0 0667	FT
SCALE	0 0100	SCALE

CRØSS DERIVATIVES IN SIDESLIP - CØNFIGURATIØN B1W0ZK1

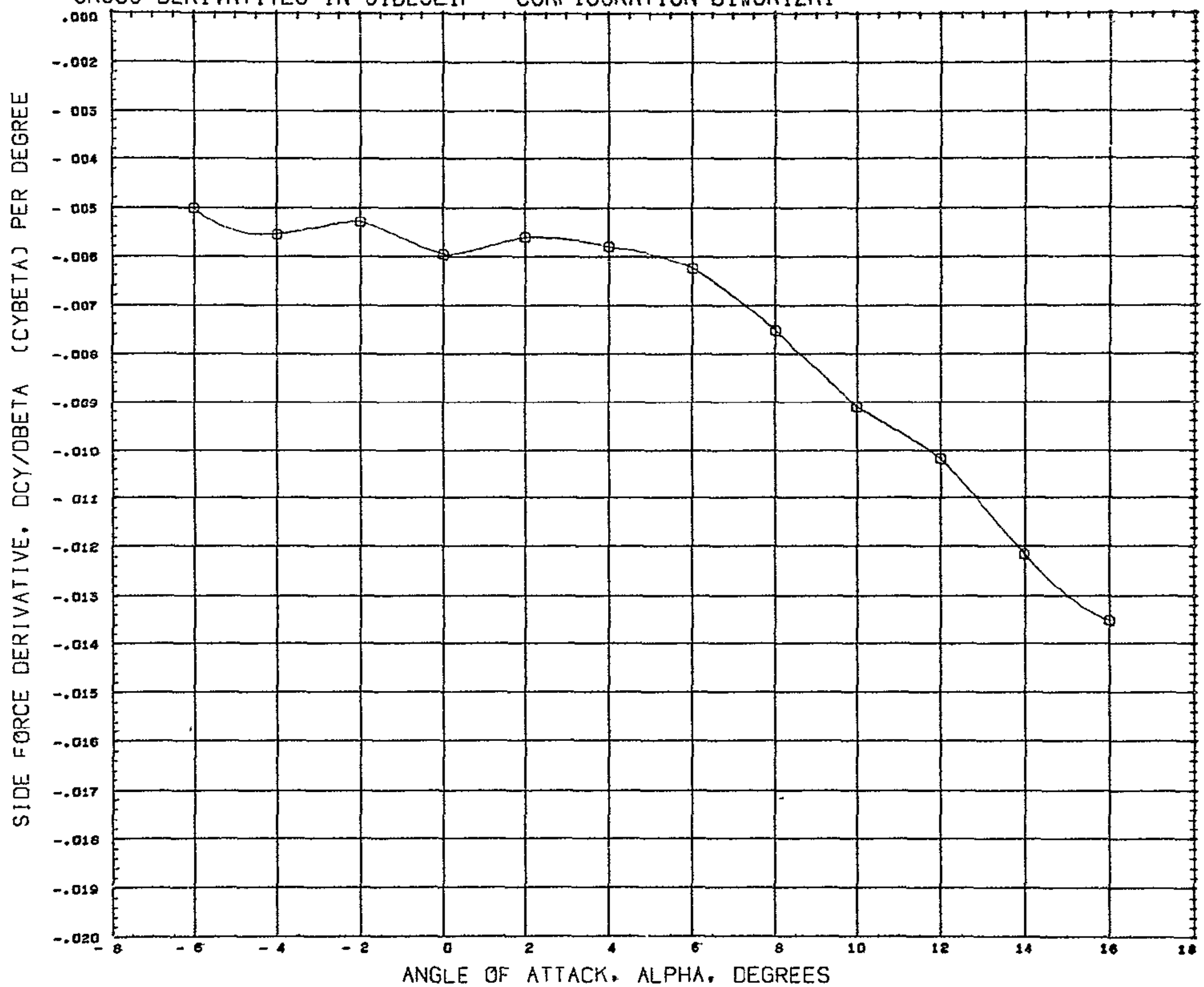


SYMBOL	MACH	PARAMETRIC VALUES			
O	0.180	BETA	-6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE FILE

REFERENCE INFORMATION		
REFS	1.0000	SQ FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT.
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE

CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1W0R1ZK1



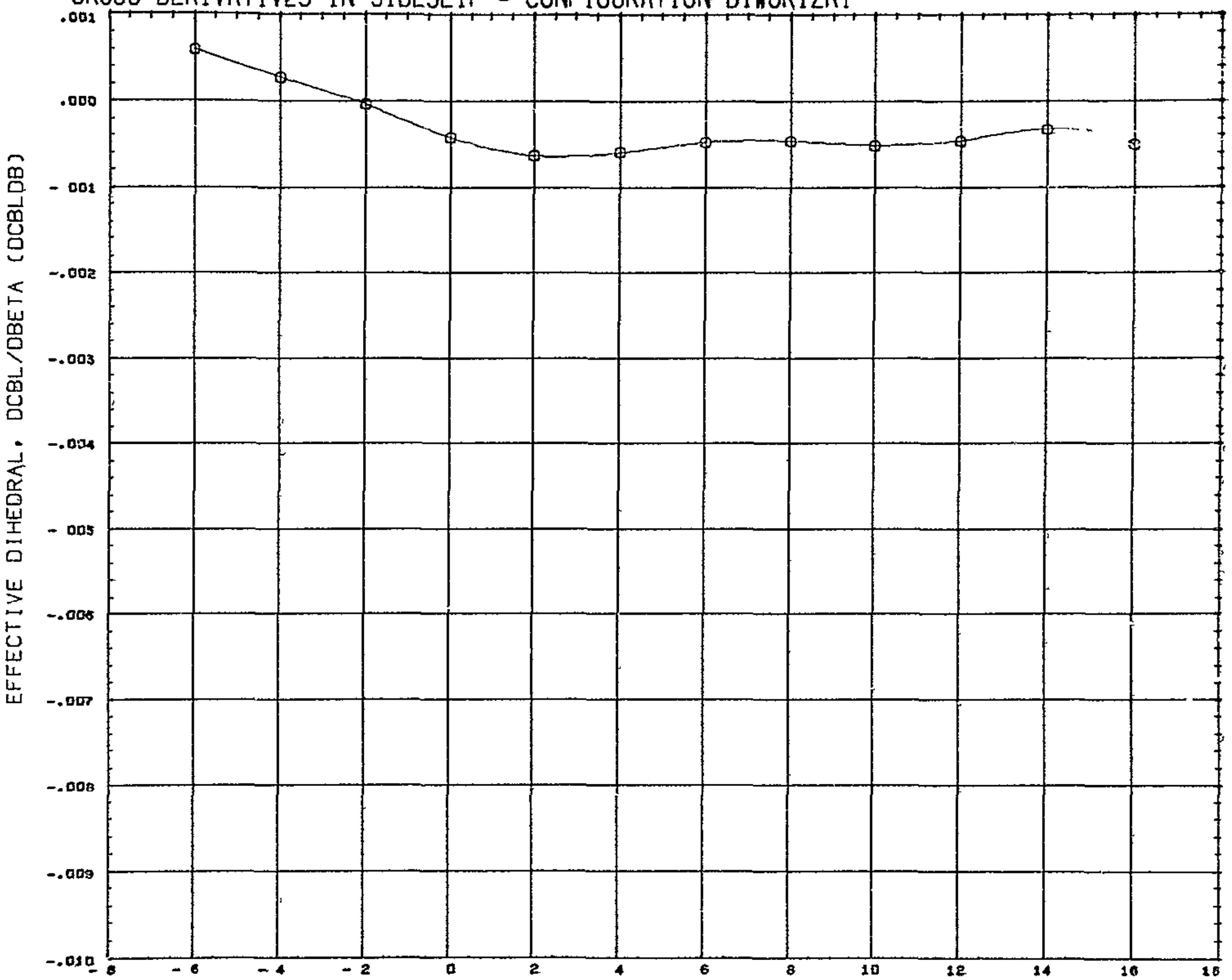
SYMBOL	MACH	PARAMETRIC VALUES			
○	0.180	BETA	-6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0.8000	FT.
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE

REFERENCE FILE

CRØSS DERIVATIVES IN SIDESLIP - CØNFIGURATIØN B1WØR1ZK1

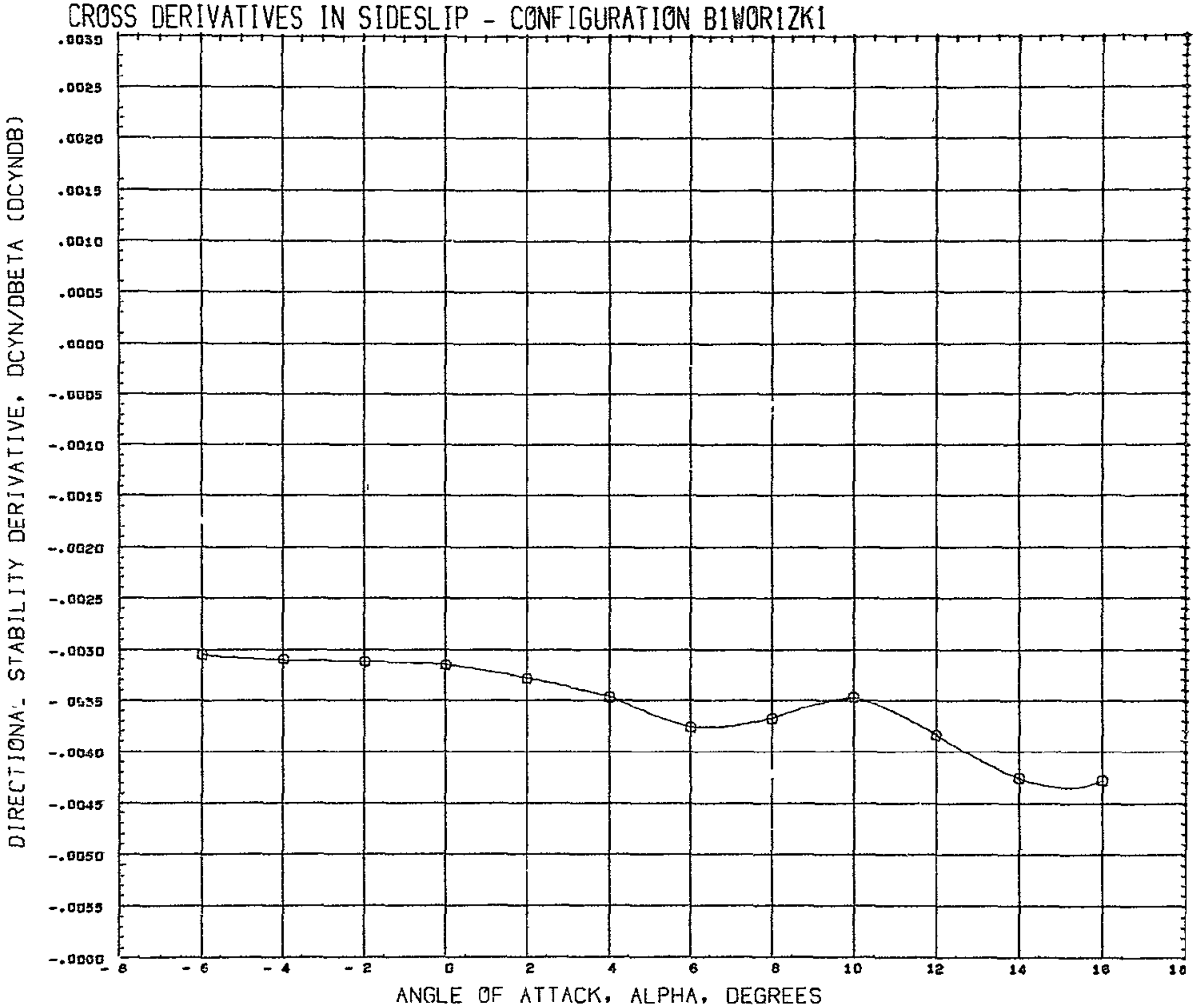


ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL	MACH	PARAMETRIC VALUES			
O	0.180	BETA	-6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE FILE

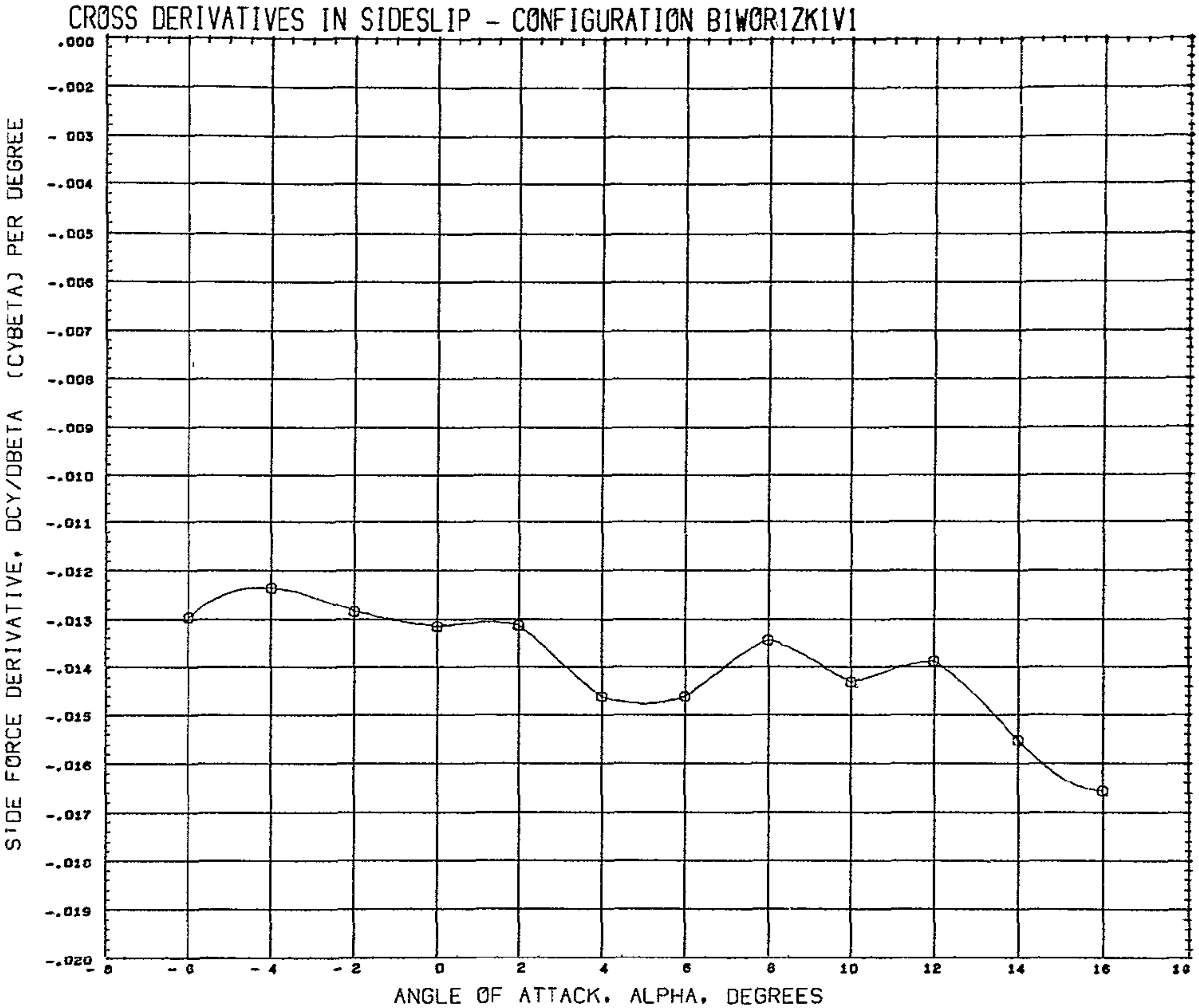
REFERENCE INFORMATION		
REFS	1.0000	SQ FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP	-0.0667	FT
SCALE	0.0100	SCALE



SYMBOL	MACH	PARAMETRIC VALUES			
O	0.180	BETA	- 6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE FILE

REFERENCE INFORMATION		
REFS	1.0000	SQ.FT.
REFL	0.8000	FT.
REFB	1.3800	FT.
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP -	0.0667	FT
SCALE	0.0100	SCALE



SYMBOL	MACH	PARAMETRIC VALUES			
O	0.180	BETA	- 6 000	PHI	0 000
		ELEVON	0 000	VTAIL	0 000
		RUDDER	0.000		

REFERENCE INFORMATION

REFS	1 0000	SQ FT
REFL	0 8000	FT
REFB	1 3800	FT
XMRP	1 2600	FT
YMRP	0 0000	FT
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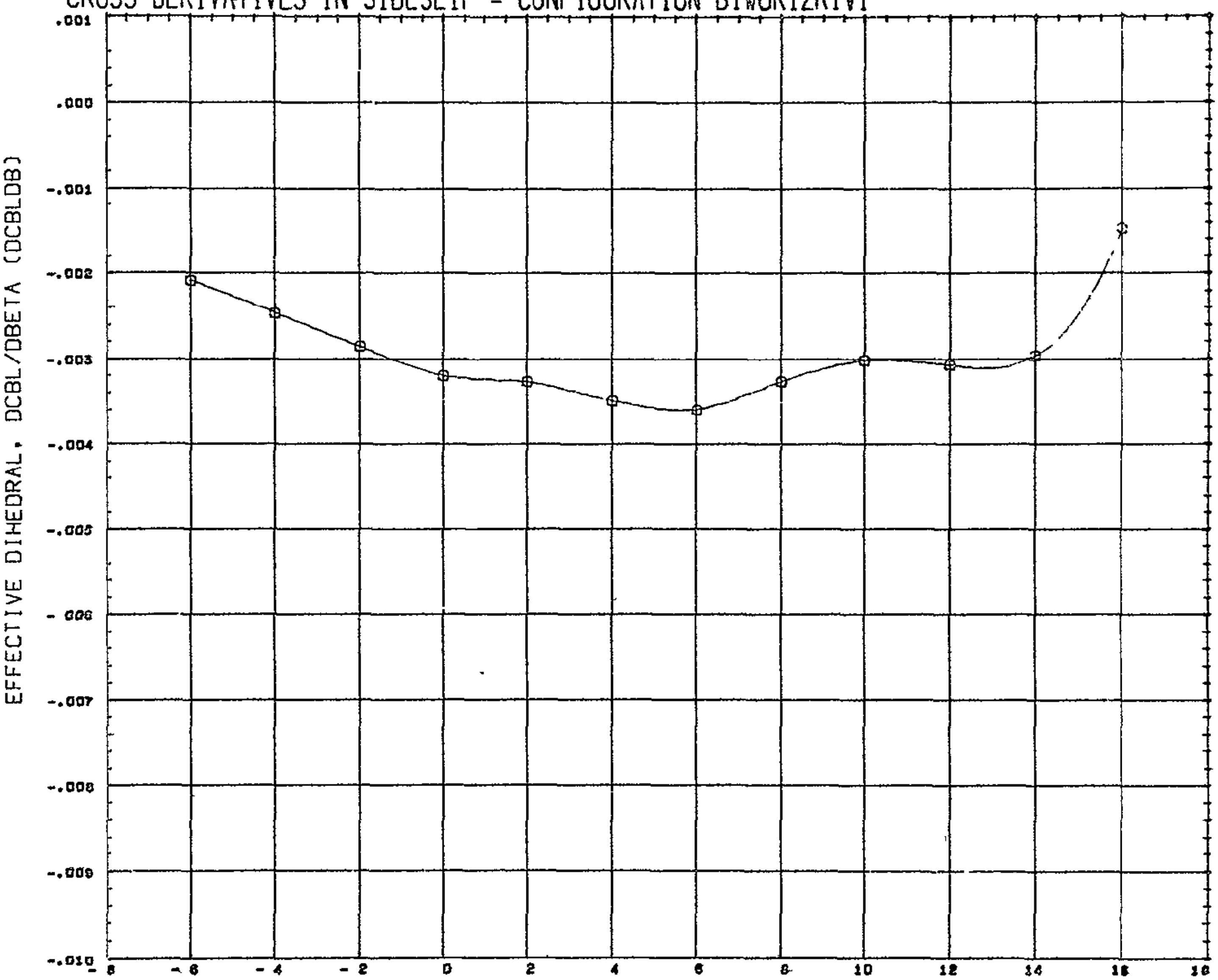
SCALE	0 0100	SCALE

REFERENCE FILE

CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1WØR1ZK1V1



SYMBOL	MACH	PARAMETRIC VALUES			
O	0.180	BETA	-6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE FILE

REFERENCE INFORMATION		
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YMRP	0.0000	FT
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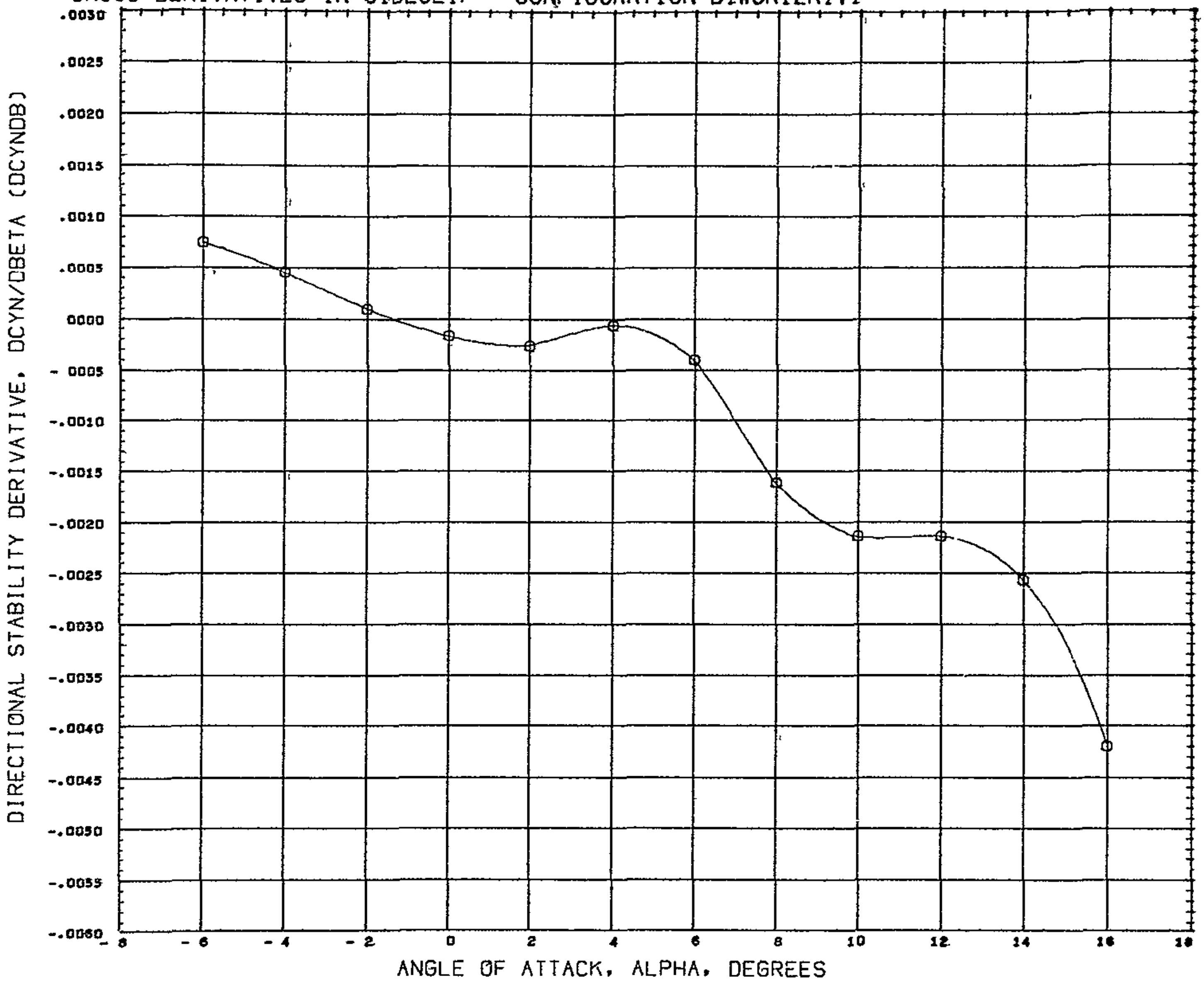
SCALE	0.0100	SCALE

CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1W0R1ZK1V1



SYMBOL	MACH	PARAMETRIC VALUES			
O	0.180	BETA	- 6 000	PHI	0 000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0 000		

REFERENCE INFORMATION

REFS	1 0000	SQ FT
REFL	0 8000	FT
REFB	1 3600	FT
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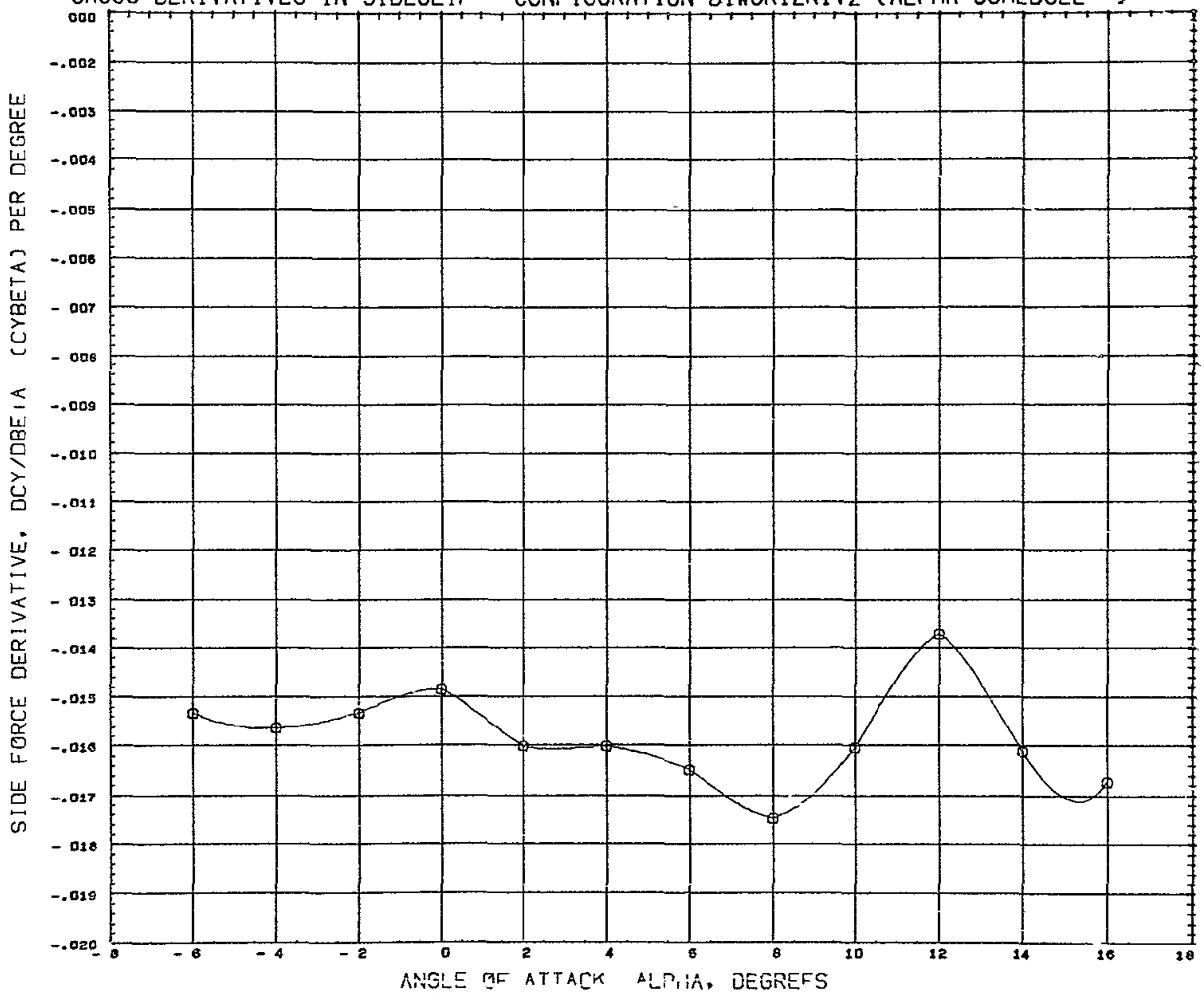
YMRP	0 0000	FT
ZMRP -	0 0667	FT
SCALE	0 0100	SCALE

REFERENCE FILE

CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1W0R1ZK1V2 (ALPHA SCHEDULE A)

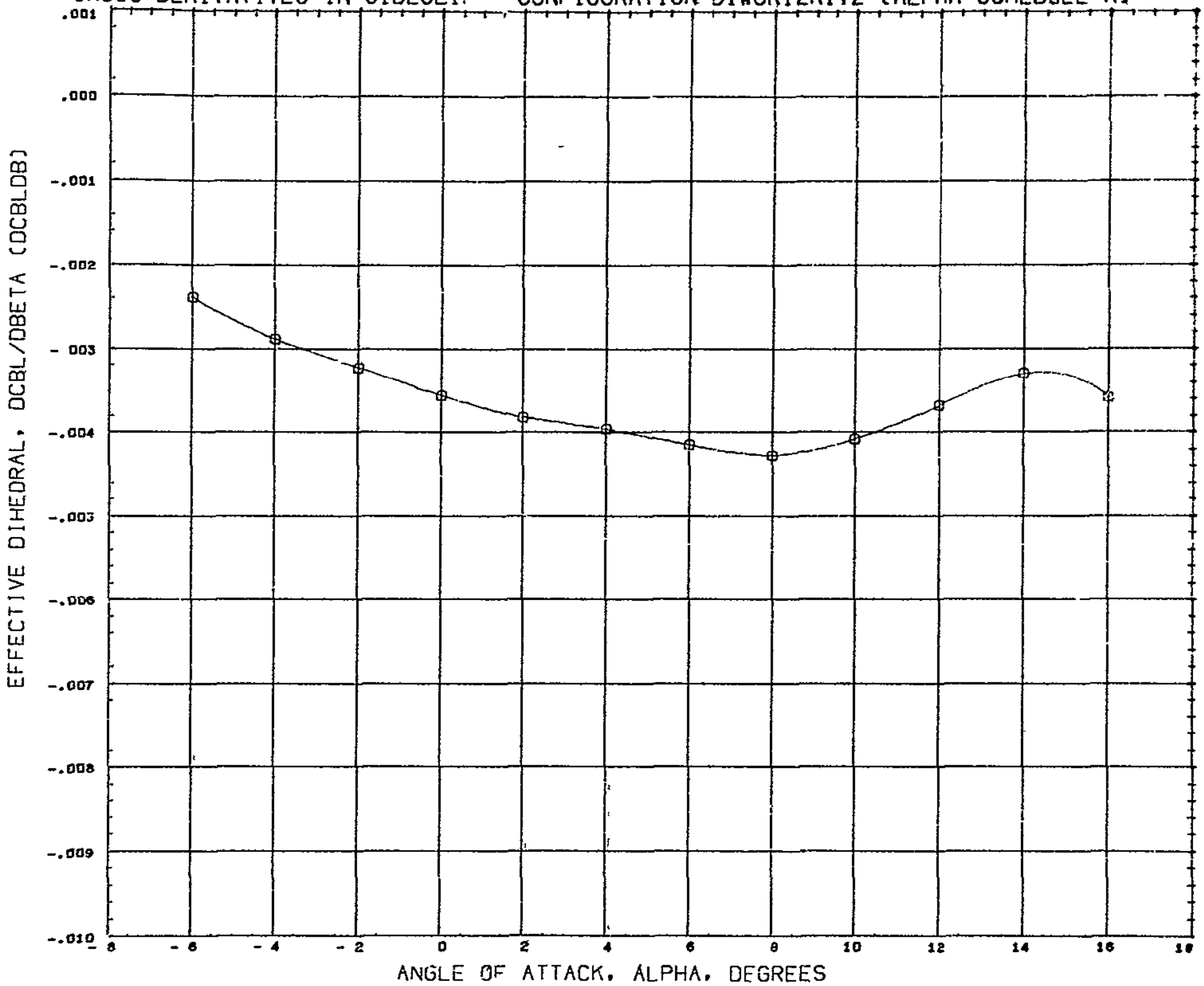


SYMBOL	MACH	PARAMETRIC VALUES			
O	0.200	BETA	-6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE FILE

REFERENCE INFORMATION		
REFS	1.0000	SQ FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP -	0.0667	FT.
SCALE	0.0100	SCALE

CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1W0R1ZK1V2 (ALPHA SCHEDULE A)



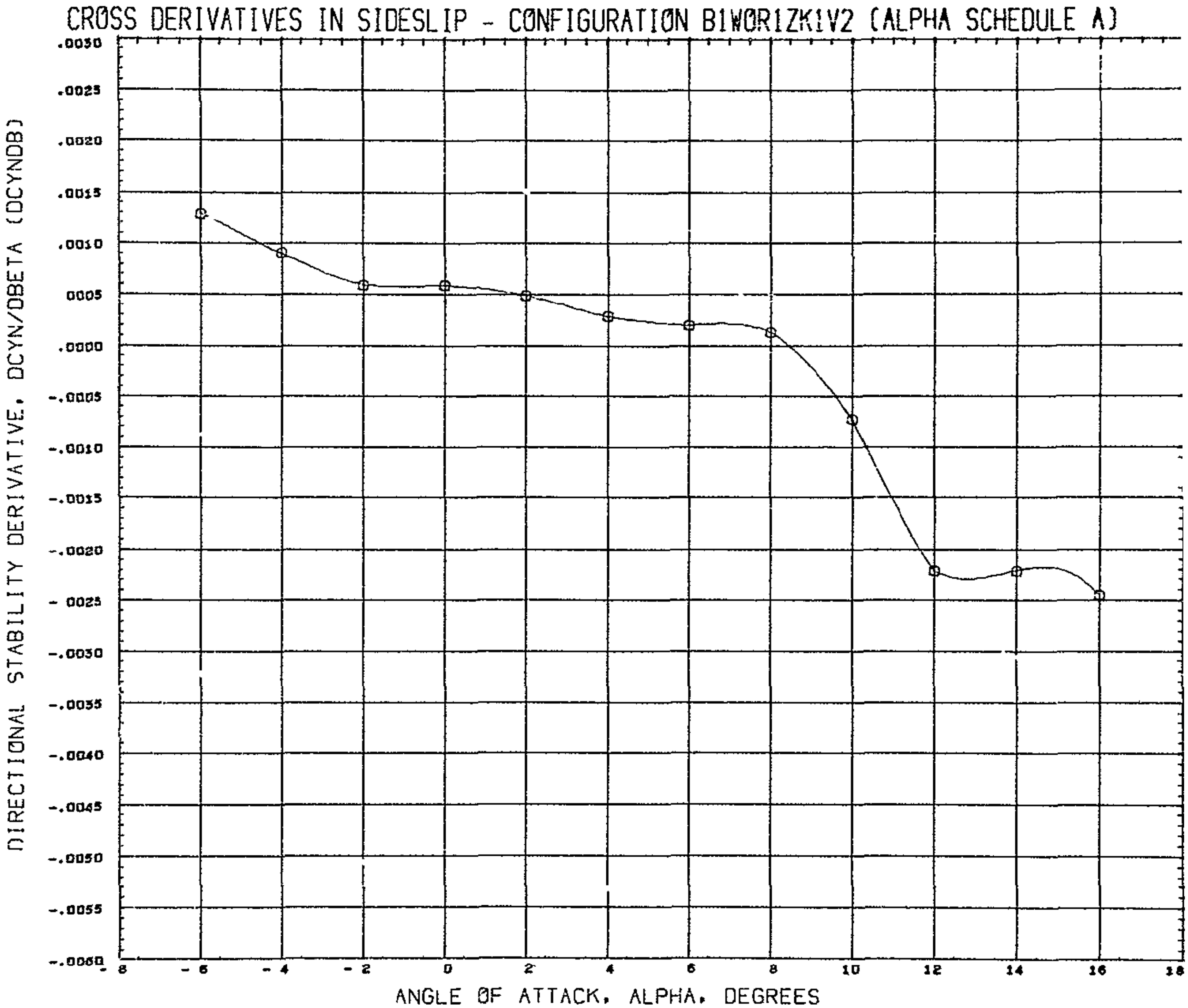
SYMBOL	MACH	PARAMETRIC VALUES			
O	0.200	BETA	- 6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT.
YMRP	0.0000	FT
ZMRP -	0.0667	FT
SCALE	0.0100	SCALE

REFERENCE FILE

1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z (0.010SCL) (RC2BT5) 03 OCT 70 PAGE 66



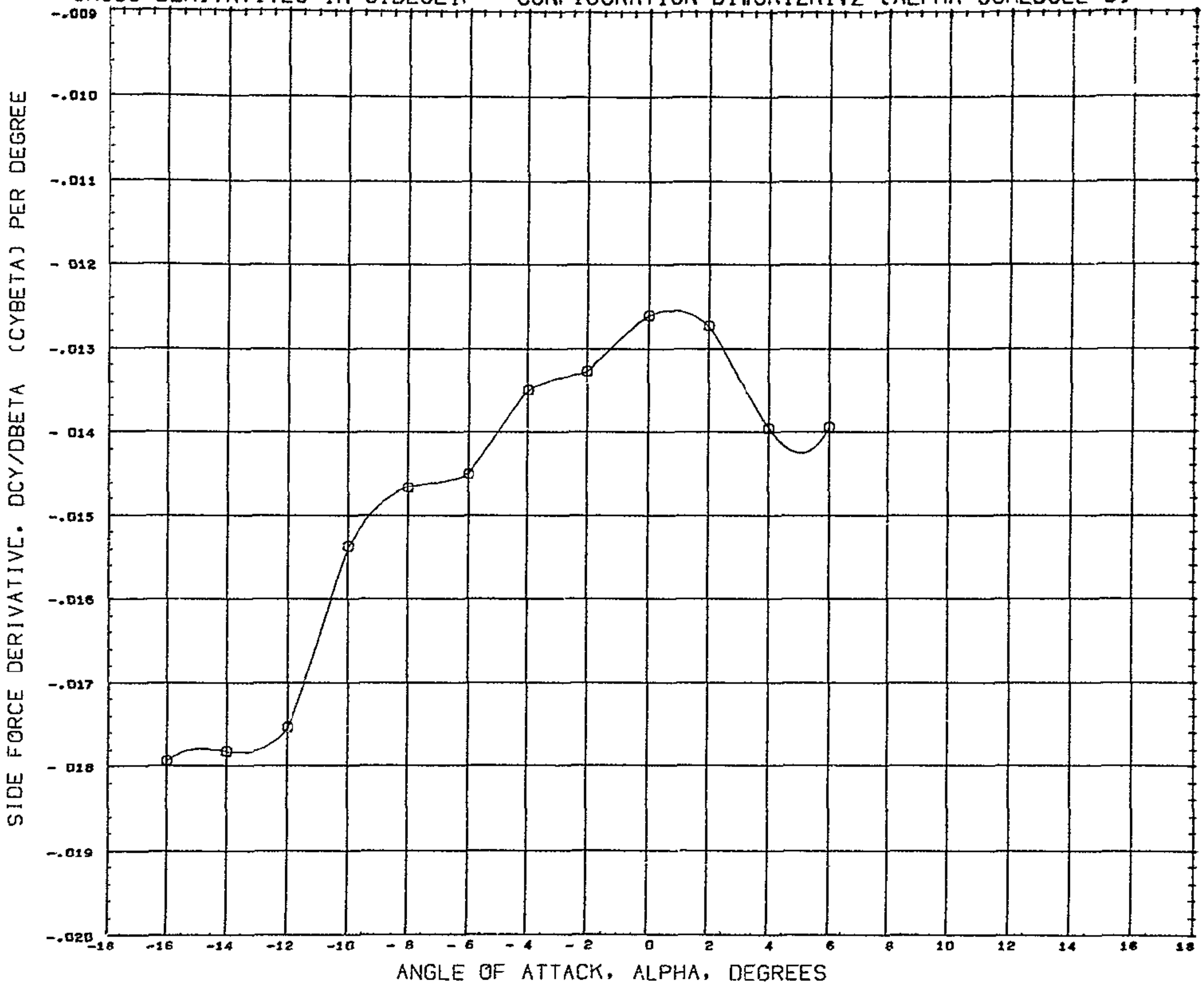
SYMBOL	MACH	PARAMETRIC VALUES			
O	0.200	BETA	- 6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE INFORMATION		
REFS	1.0000	SQ FT
REFL	0.8000	FT.
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP -	0.0667	FT
SCALE	0.0100	SCALE

REFERENCE FILE

1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z (0.010SCL) (RC2BT5) 03 OCT 70 PAGE 67

CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1W0R1ZK1V2 (ALPHA SCHEDULE B)



SYMBOL	MACH	PARAMETRIC VALUES			
O	0.160	BETA	6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

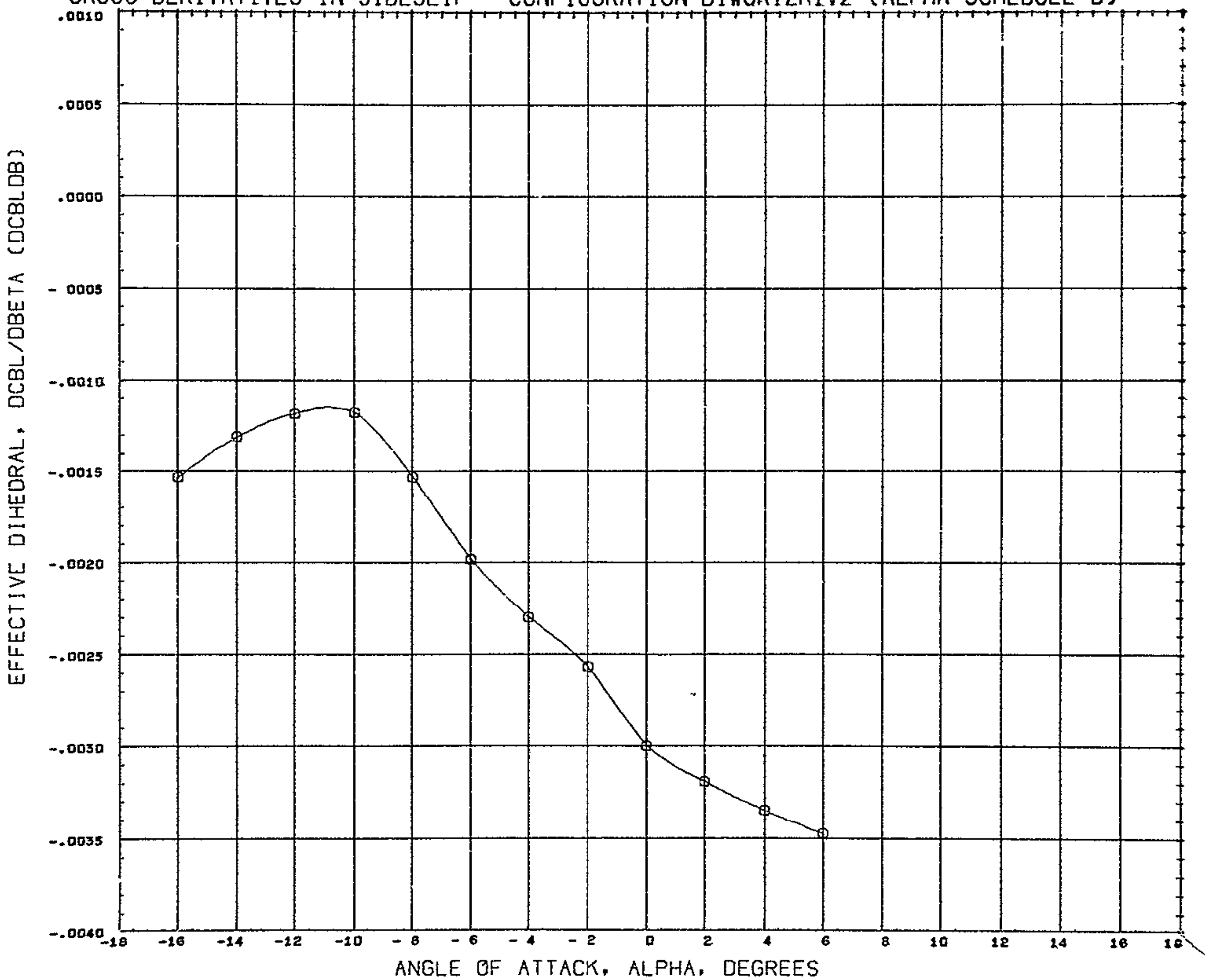
REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0.8000	FT.
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
ZMRP -	0.0667	FT
SCALE	0.0100	SCALE

REFERENCE FILE

1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z (0.010SCL) (RC2BT6) 03 OCT 70

CROSS DERIVATIVES IN SIDESLIP - CONFIGURATION B1W0R1ZK1V2 (ALPHA SCHEDULE B)



SYMBOL	MACH	PARAMETRIC VALUES			
O	0.180	BETA	6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT
YMRP	0.0000	FT
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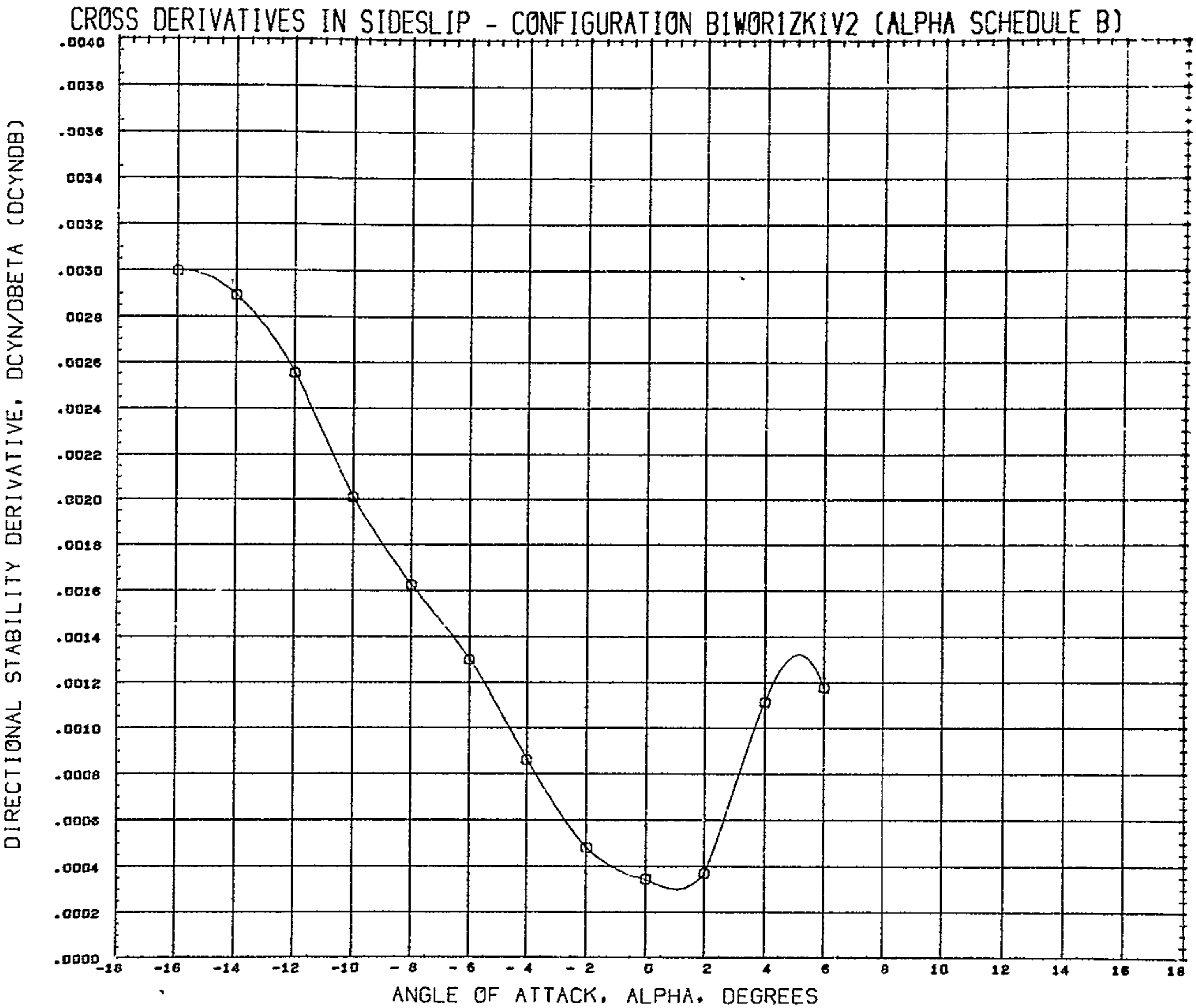
SCALE	0.0100	SCALE

REFERENCE FILE



SYMBOL	MACH		PARAMETRIC VALUES		
O	0.180	BETA	6.000	PHI	0.000
		ELEVON	0.000	VTAIL	0.000
		RUDDER	0.000		

REFERENCE INFORMATION

REFS	1.0000	SQ FT
REFL	0.8000	FT
REFB	1.3800	FT
XMRP	1.2600	FT.
YMRP	0.0000	FT
ZMRP -	0.0667	FT
SCALE	0.0100	SCALE

REFERENCE FILE

1321-DAC-LSWT-DELBOOST-B1W0V2K1R1Z (0.010SCL) (RC2BT6) 03 OCT 70 PAGE 70

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