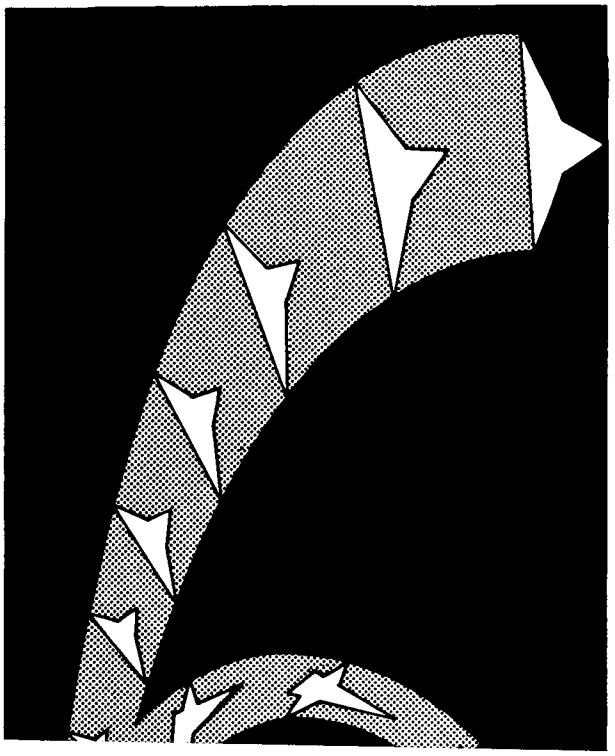
DMS-DR-1167
NASA CR-120,006
NOVEMBER 1971



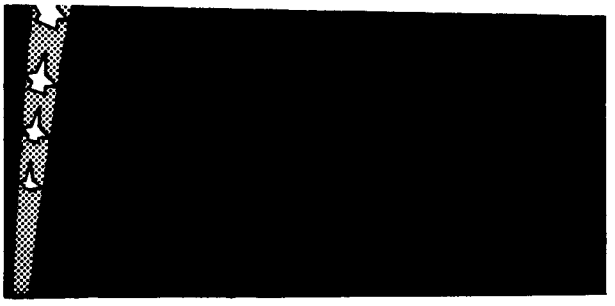
—SPACE SHUTTLE—

BASIC SUBSONIC STATIC AERODYNAMIC CHARACTERISTICS FOR GRUMMAN H-33 ORBITER CONFIGURATION (M=0.17)

by

W. Jung, GAC

F. Carlucci, GAC



GRUMMAN 7 X 10-FOOT LOW SPEED WIND TUNNEL

GRUMMAN AEROSPACE CORPORATION

SADSAC SPACE SHUTTLE
AEROTHERMODYNAMIC
DATA MANAGEMENT SYSTEM

THIS DOCUMENT SHOULD BE REFERENCED AS NASA CR-120,006

CONTRACT NAS8-401
MARSHALL SPACE FLIGHT CENTER

SPACE DIVISION CHRYSLER CORPORATION

A B S T R A C T

This report presents the results of an experimental aerodynamic investigation of the Grumman Aerospace Corporation H-33 Space Orbiter. The purpose of the investigation was to determine static aerodynamic characteristics of the orbiter at a Mach number of 0.17. These data were determined by employing a 1/25 scale model of the orbiter for pitch and yaw variations of -4 degrees to 24 degrees and -15 degrees to 15 degrees, respectively. This investigation was conducted in the Grumman Aerospace Corporation 7 - by - 10 Foot Wind Tunnel.

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NASA Series Number: S-0615

DMS-DR-1167
November, 1971

SADSAC/SPACE SHUTTLE

WIND TUNNEL TEST DATA REPORT

CONFIGURATION: GAC H-33 Orbiter

TEST PURPOSE: To Determine Basic Subsonic Aerodynamic Data on the H-33 Orbiter (M = 0.17)

TEST FACILITY: Grumman 7 x 10 Foot Low Speed Wind Tunnel

TESTING AGENCY: Grumman Aerospace Corporation

TEST NO. & DATE: GWTT 292, June 21 - July 6, 1971

FACILITY COORDINATOR: Mr. M. Quan - GAC

PROJECT ENGINEER(S): Mr. W. Jung - GAC

Mr. F. Carlucci - GAC

DATA MANAGEMENT SERVICES

LIAISON: FOR T. L. Mulkey

DATA OPERATIONS: J. R. Ziler

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CONTRACT NAS 8-4016 AMENDMENT 153 DRL 184-58

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SUMMARY

Presented herein are the results of an experimental static aerodynamic investigation of the Grumman Aerospace H-33 Space Orbiter configuration. The purpose of the investigation was to determine basic subsonic aerodynamic characteristics for pitch and yaw variations of -4 degrees to 24 degrees and -15 degrees to 15 degrees, respectively, for freestream Mach number of 0.17. Primary test parameters included a basic component buildup, and effects on the basic aerodynamics due to elevon and rudder deflections. Also investigated were the effects of the rudder speed brake at flare angles of 0 degrees, -10 degrees, and -15 degrees along with top rudder panel variations.

TABLE I. SADSAC NOMENCLATURE OF AERODYNAMIC COEFFICIENTS

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	-	-

CONFIGURATIONS INVESTIGATED

Tests were conducted on the 1/25 Scale Grumman Orbiter Configuration H-33 without external tanks as shown in Figures 2 and 3. The delta wing (W_4) had adjustable elevons and the vertical tail (V_5) had upper and lower rudder segments. The lower segments were capable of splitting into a "V" section to form a speed brake while functioning as a rudder.

Base pressures were taken at 10 locations on the model. Boundary layer transition was fixed by the use of strips of pinked electrician's tape (0.007 thick) located 1.5 in. streamwise aft of the fuselage nose and 0.75 in. aft of the leading edges of the wing and tail surfaces.

TEST GWTT 292 DATA SET COLLATION SHEET

LOW SPEED AERODYNAMIC CHARACTERISTICS OF A 1/25 SCALE MODEL OF THE GRUMMAN CONF. H-33 ORBITER

☐ PRETEST
☒ POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD. α	SCHD. β	MACH NUMBERS 0.17	NO. of RUNS	CONTROL DEFLECTIONS δ_{eL}	δ_{eR}	δ_R	δ_{RT}	δ_{RU}	δ_{RLR}
RD1 002	$B_5W_4V_5$	A	0	2	1	0	0	0	–	–	–
004	$B_5W_4V_5$	A	3	4		0	0	0	–	–	–
006	$B_5W_4^{-5,-5}V_5$	A	0	6		-5	-5	0	–	–	–
007	$B_5W_4^{-10,-10}V_5$	A	0	7		-10	-10	0	–	–	–
008	$B_5W_4^{-15,-15}V_5$	A	0	8		-15	-15	0	–	–	–
009	$B_5W_4^{-35,-35}V_5$	A	0	9		-35	-35	0	–	–	–
010	$B_5W_4^{+5,-5}V_5$	A	0	10		-5	-5	0	–	–	–
011	$B_5W_4^{+5,-15}V_5$	A	0	11		+5	-15	0	–	–	–
012	$B_5W_4^{-5,-15}V_5$	A	0	12		-5	-15	0	–	–	–
013	$B_5W_4^{0,-10}V_5$	A	0	13		0	-10	0	–	–	–
014	$B_5W_4V_5^{0,+15,-15}$	A	0	14		0	0	–	0	+15	-15
015	$B_5W_4V_5^{0,+30,-30}$	A	0	15		0	0	–	0	+30	-30
016	$B_5W_4V_5^{-10,+5,-25}$	A	0	16		0	0	–	-10	+5	-25
017	$B_5W_4V_5^{-15,0,-30}$	A	0	17		0	0	–	-15	0	-30
018	$B_5W_4V_5^{-15,+25,-35}$	A	0	18		0	0	–	-15	+25	-35
019	$B_5W_4V_5^{-5}$	A	0	19		0	0	-5	–	–	–
020	$B_5W_4V_5^{-10}$	A	0	20		0	0	-10	–	–	–
021	$B_5W_4V_5^{-15}$	A	0	21		0	0	-15	–	–	–
023	B_5	A	0	23		–	–	–	–	–	–

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

CL CD CY CLM CLN CSL

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

α or β SCHEDULES

α A = -4° to 24° by 2°

β B = 0, ±1, ±2, ±3, ±5, ±7, ±9, ±12, ±15

TEST GWTT 292 DATA SET COLLATION SHEET

☐ PRETEST
☒ POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD. α	SCHD. β	MACH NUMBERS 0.17				NO. of RUNS	CONTROL DEFLECTIONS δ_{eL}	δ_{eR}	δ_R	δ_{RT}	δ_{RLL}	δ_{RLR}
RD1025	B_5W_4	O	B	25				1	O	O	–	–	–	–
027	$B_5W_4V_5$	O	B	27					O	O	O	–	–	–
028	$B_5W_4^{0,-10}V_5$	O	B	28					O	-10	O	–	–	–
029	$B_5W_4^{-10,-10}V_5$	O	B	29					-10	-10	O	–	–	–
030	$B_5W_4^{-5,-15}V_5$	O	B	30					-5	-15	O	–	–	–
031	$B_5W_4^{+5,-15}V_5$	O	B	31					+5	-15	O	–	–	–
032	$B_5W_4^{+5,-5}V_5$	O	B	32					+5	-5	O	–	–	–
033	$B_5W_4^{-5,-5}V_5$	O	B	33					-5	-5	O	–	–	–
034	$B_5W_4V_5^{0,+30,-30}$	O	B	34					O	O	–	O	+30	-30
035	$B_5W_4V_5^{-10,+25,-35}$	O	B	35					O	O	–	-10	+25	-35
036	$B_5W_4V_5^{-15,+25,-35}$	O	B	36					O	O	–	-15	+25	-35
037	$B_5W_4V_5^{-15,0,-30}$	O	B	37					O	O	–	-15	O	-30
038	$B_5W_4V_5^{-10,+5,-25}$	O	B	38					O	O	–	-10	+5	-25
039	$B_5W_4V_5^{0,+15,-15}$	O	B	39					O	O	–	O	+15	-15
040	$B_5W_4V_5^{-10,-10}$	O	B	40					O	O	-10	–	–	–
041	$B_5W_4V_5^{-15,-15}$	O	B	41					O	O	-15	–	–	–
042	$B_5W_4V_5^{-5,+25,-35}$	O	B	42					O	O	–	-5	+25	-35
054	$B_5W_4^{-25,-25}V_5$	A	O	54					-25	-25	O	–	–	–
055	$B_5W_4V_5^{-5,+25,-35}$	A	O	55					O	O	–	-5	+25	-35

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

CL CD CY CLM CLN CSL

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

α or β SCHEDULES

αA = -4° to 24° by 2°

βB = 0, ±1, ±2, ±3, ±5, ±7, ±9, ±12, ±15

7

TEST FACILITY DESCRIPTION

This is a continuous flow, open circuit, closed throat tunnel. The test section is 7 feet by 10 feet by 20 feet. A 12-foot diameter propeller is driven at speeds up to 1200 rpm by a 1750 HP induction electric motor.

PERFORMANCE PARAMETERS:

Speed Range (mph):	134 maximum
Reynolds Number (x 10^6/ft):	1.7 maximum
Operating Pressure:	Atmospheric
Dynamic Pressure (psf):	46 maximum
Stagnation Temperature:	Ambient
Power (HP):	1750

TESTING CAPABILITIES:

The GAC Low Speed Wind Tunnel is equipped for Aerodynamic force and pressure testing on 3-dimensional, 2-dimensional, and reflection plane models. Capability also exists for conducting powered model, flutter, jet flap, flow visualization, and wake survey tests.

A variable frequency power unit having a range from 0 to 660 HZ, and a maximum output of 100 KW is available for the 3 phase induction motors used in powered models.

Available model supports include: two and three point supports, a single mount with fixed linkages for setting model pitch attitude, wire supports, and a

pedestal mount for half model tests. Special installations can be provided to sting support models. Image systems are available for evaluating model support tare and interference effects.

The tunnel primary balance is a six-component mechanical external yoke type. The balance incorporates a pitch arm with $\pm 45^{\circ}$ pitch capability and a yaw table which can provide $\pm 45^{\circ}$ of yaw. Capability also exists for conducting tests with internal strain gage balance installations.

Removable wall inserts are available for 2-dimensional tests and a stationary ground plane is available for investigating ground effects.

An IBM 1800 computer system serves as the facilities data acquisition and reduction center. It is dedicated to the facility and provides on-line data reduction capability. On-site plotting is also available on a Calcomp drum-type plotter.

The facility can provide photographic, closed-circuit and play-back television documentation. Manometers and scanivalves are available for pressure recording.

TEST CONDITIONS
TEST GWIT 292

MACH NUMBER	REYNOLDS NUMBER per unit length	DYNAMIC PRESSURE (pounds/sq. inch)	STAGNATION TEMPERATURE (degrees Fahrenheit)
.17	1.6×10^6	.278	80 degrees

BALANCE UTILIZED: YOKE-TYPE LOW SPEED WIND TUNNEL

	CAPACITY:	ACCURACY:	COEFFICIENT TOLERANCE:
NF	+ 4000 lb. to -2000 lb.	± .5 lb.	± .002
SF	± 500 lbs.	± .2 lb.	± .001
AF	± 500 lbs.	± .2 lb.	± .0005
PM	± 1200 ft.-lbs.	± 1 ft. lb.	± .005
YM	± 1200 ft.-lbs.	± 1 ft. lb.	± .005
RM	± 1200 ft.-lbs.	± 1 ft. lb.	± .005

COMMENTS:

DATA REDUCTION

All force data collected by the six component mechanical balance were reduced to standard NASA coefficient form along and about a system of stability axis. This axis system originated from a nominal c.g. located at F.S. 1285, W.L. 403 and B.L. 0.

The data were reduced with the following reference values:

$$S_{ref} = 7.74 \text{ ft.}^2$$

$$b_{ref} = 3.78 \text{ ft.}$$

$$\ell_{ref} = 5.40 \text{ ft.}$$

Corrections were applied to the data for effects due to tunnel flow alignment and model support tare and interference. The values of these corrections were determined from GWTT 290 which was run in April, 1971.

The data was corrected for tunnel wall effects by employing the following equations:

$$\Delta\alpha = 1.04\ C_L$$

$$\Delta C_D = .0182\ C_L^2$$

$$\Delta C_M = .00055\ C_L^2$$

The free stream dynamic pressure was corrected for model blockage by the following equation:

$$q_\infty = 1.030\ q_{INDICATED}$$

Transition was fixed with strips of pinked electrician's tape, 1.5 inches streamwise aft of the fuselage nose and 0.75 inches aft of the leading edges of the wing and tail surfaces.

SUMMARY DATA PLOT INDEX

TITLE	PLOTTED COEFFICIENTS SCHEDULE	CONDITIONS VARYING	PAGES
Elevator Effectiveness	A	Elevon Deflection Angle	1
Elevator Effectiveness	B	Elevon Deflection Angle	2-3
Effect of Body	C	Configuration	4-6
Yaw Polar, Beta = 3. Degrees	D	Beta Angle	7-12
Aileron Effectiveness in Pitch, Elevtr = 0. Degrees	D	Aileron Deflection Angle	13-18
Aileron Effectiveness in Pitch, Elevtr = -5. Degrees	D	Aileron Deflection Angle	19-24
Aileron Effectiveness in Pitch, Elevtr = -10. Degrees	D	Aileron Deflection Angle	25-30
Speed Brake Effect in Pitch - Brakes at -15., 15. and -30., 30. Degrees	C	Speed Brake Deflection Angle	31-33
Rudder Effectiveness in Pitch - Speed Brakes at 15. and -15. Degrees	D	Rudder and Speed Brake Deflection Angle	34-39
Rudder Effectiveness in Pitch - Speed Brakes at 30. and -30. Degrees	D	Rudder and Speed Brake Deflection Angle	40-45
Rudder Effectiveness in Pitch - No Speed Brakes	D	Rudder Deflection Angle	46-51
Effect of Vertical Tail in Yaw	E	Configuration	52-54

SUMMARY DATA PLOT INDEX
(CONTINUED)

TITLE	PLOTTED COEFFICIENTS SCHEDULE	CONDITIONS VARYING	PAGES
Effect of Speed Brakes in Yaw - Brakes at 15., -15. and 30., -30. Degrees	F	Speed Brake Deflection Angle	55-60
Aileron Effectiveness in Yaw, Elevtr = 0. Degrees	F	Aileron Deflection	61-66
Aileron Effectiveness in Yaw, Elevtr = -5. Degrees	F	Aileron Deflection Angle	67-72
Aileron Effectiveness in Yaw, Elevtr = -10. Degrees	F	Aileron Deflection Angle	73-78
Rudder Effectiveness in Yaw - Speed Brakes at 30. and -30. Degrees	F	Rudder Deflection Angle	79-84
Rudder Effectiveness in Yaw - Speed Brakes at 15. and -15. Degrees	F	Rudder and Speed Brake Deflection Angle	85-90
Rudder Effectiveness in Yaw - No Speed Brakes	F	Rudder Deflection Angle	91-96

Note: Plotted Coefficients Schedule on following page.

PLOTTED COEFFICIENTS SCHEDULE:

SCHEDULE A

CL vs. α

SCHEDULE B

CL vs. CD
CL vs. CLM

SCHEDULE C

CL vs. α
CD vs. α
CLM vs. α

SCHEDULE D

CL vs. α
CD vs. α
CLM vs. α
CLN vs. α
CSL vs. α
CY vs. α

SCHEDULE E

CLN vs. β
CSL vs. β
CY vs. β

SCHEDULE F

CLN vs. β
CSL vs. β
CY vs. β
CL vs. β
CD vs. β
CLM vs. β

F I G U R E S

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.

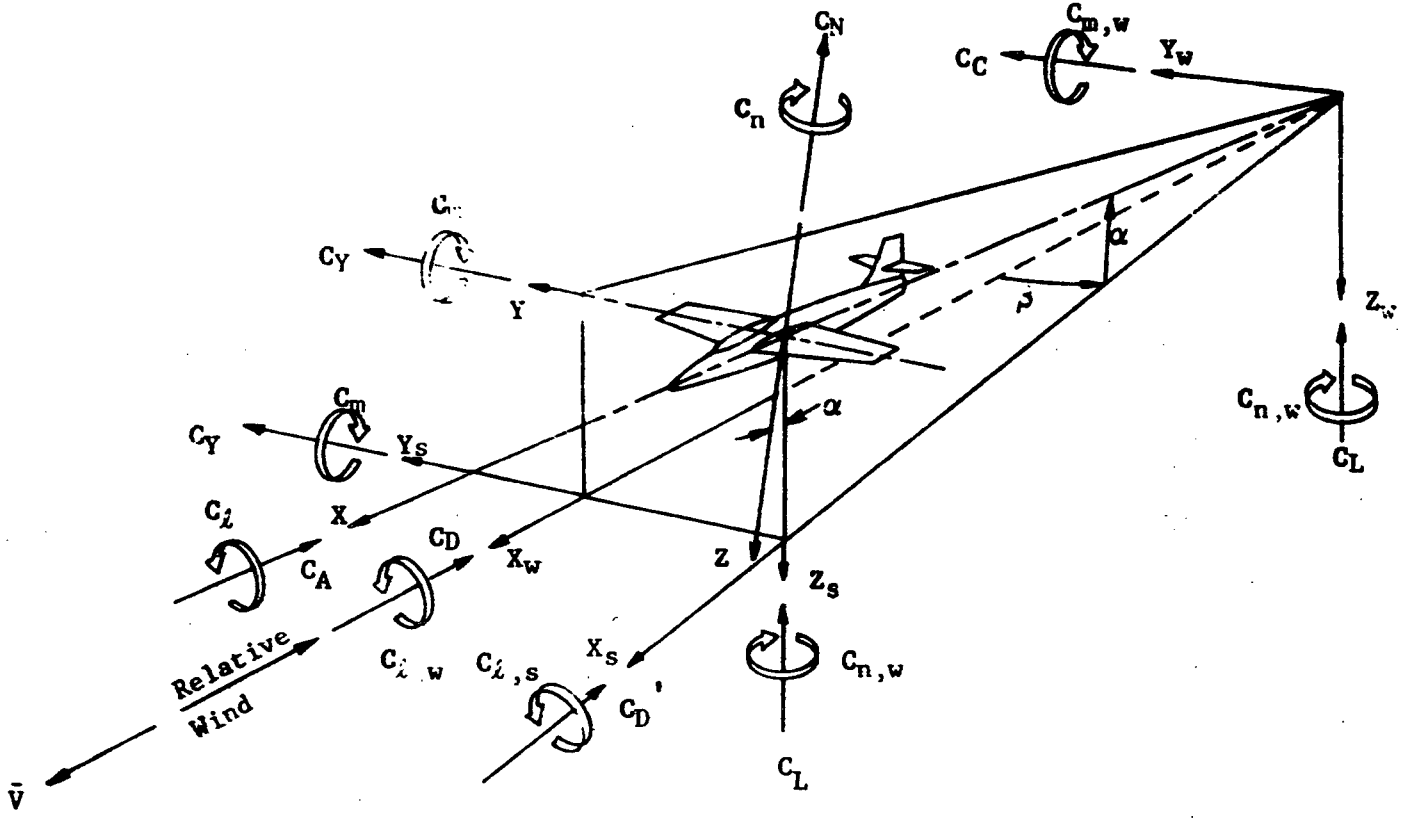


Figure 1. Axis systems, showing direction and sense of force and moment coefficients, angle of attack, and sideslip angle

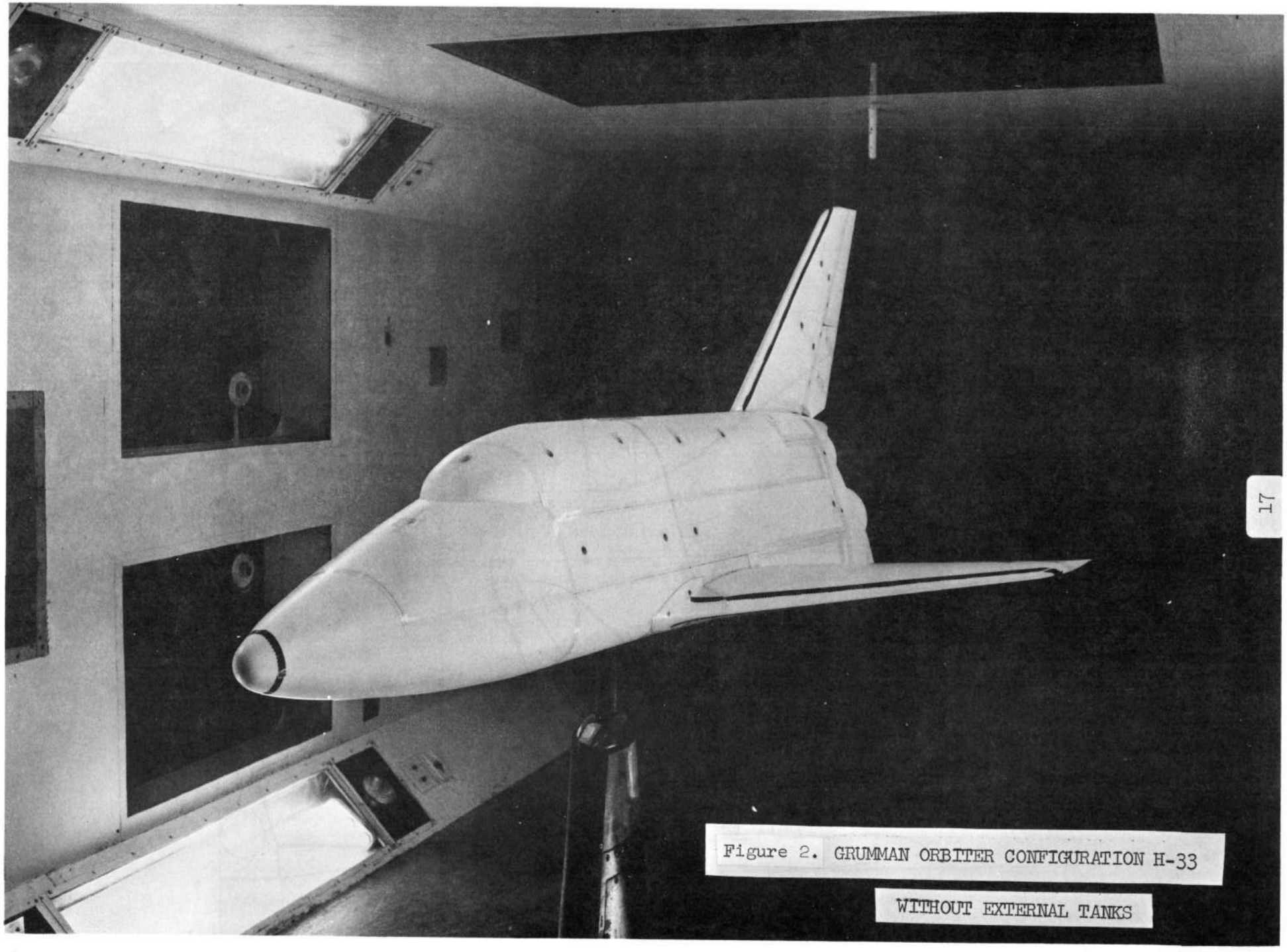


Figure 2. GRUMMAN ORBITER CONFIGURATION H-33

WITHOUT EXTERNAL TANKS

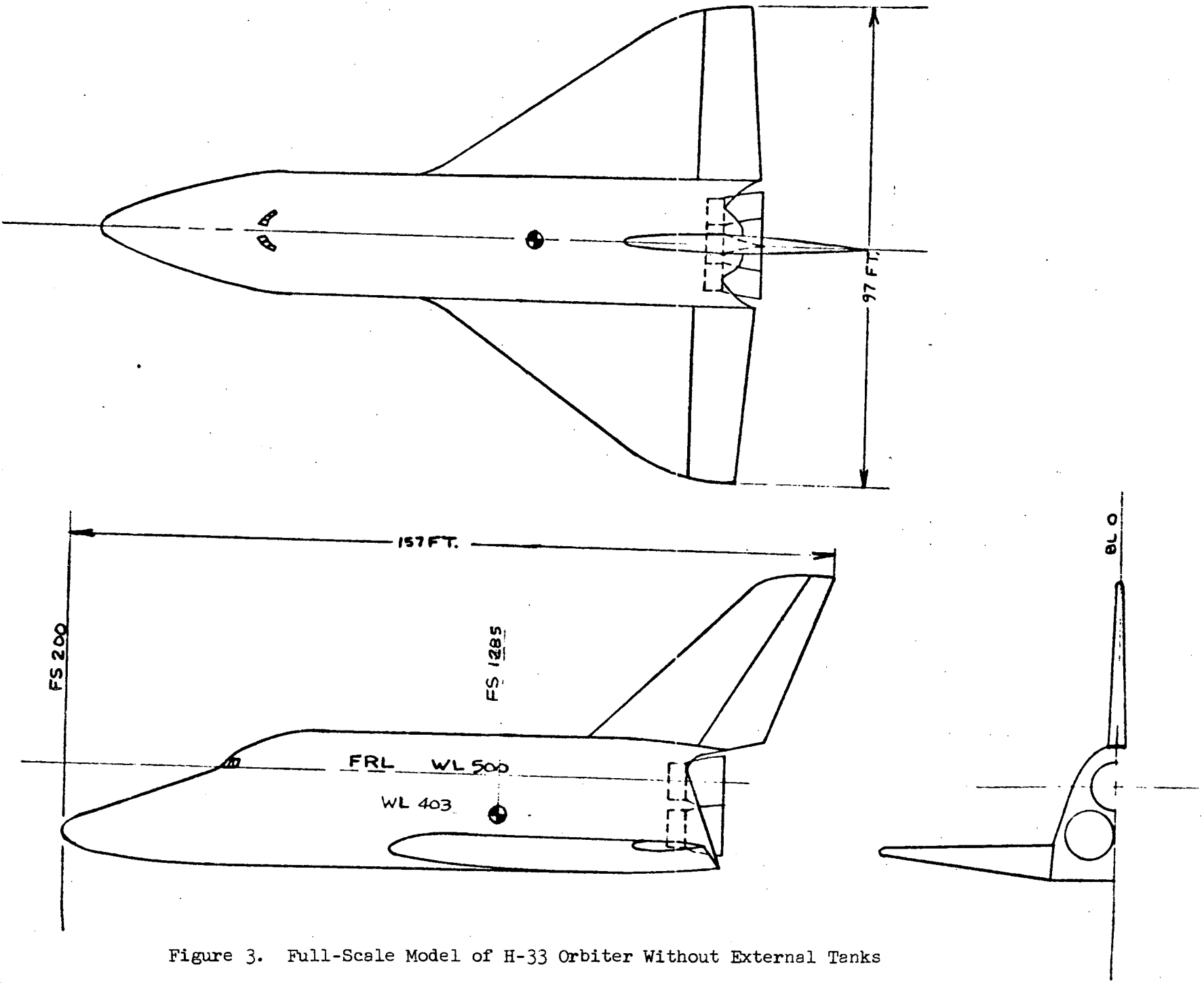


Figure 3. Full-Scale Model of H-33 Orbiter Without External Tanks

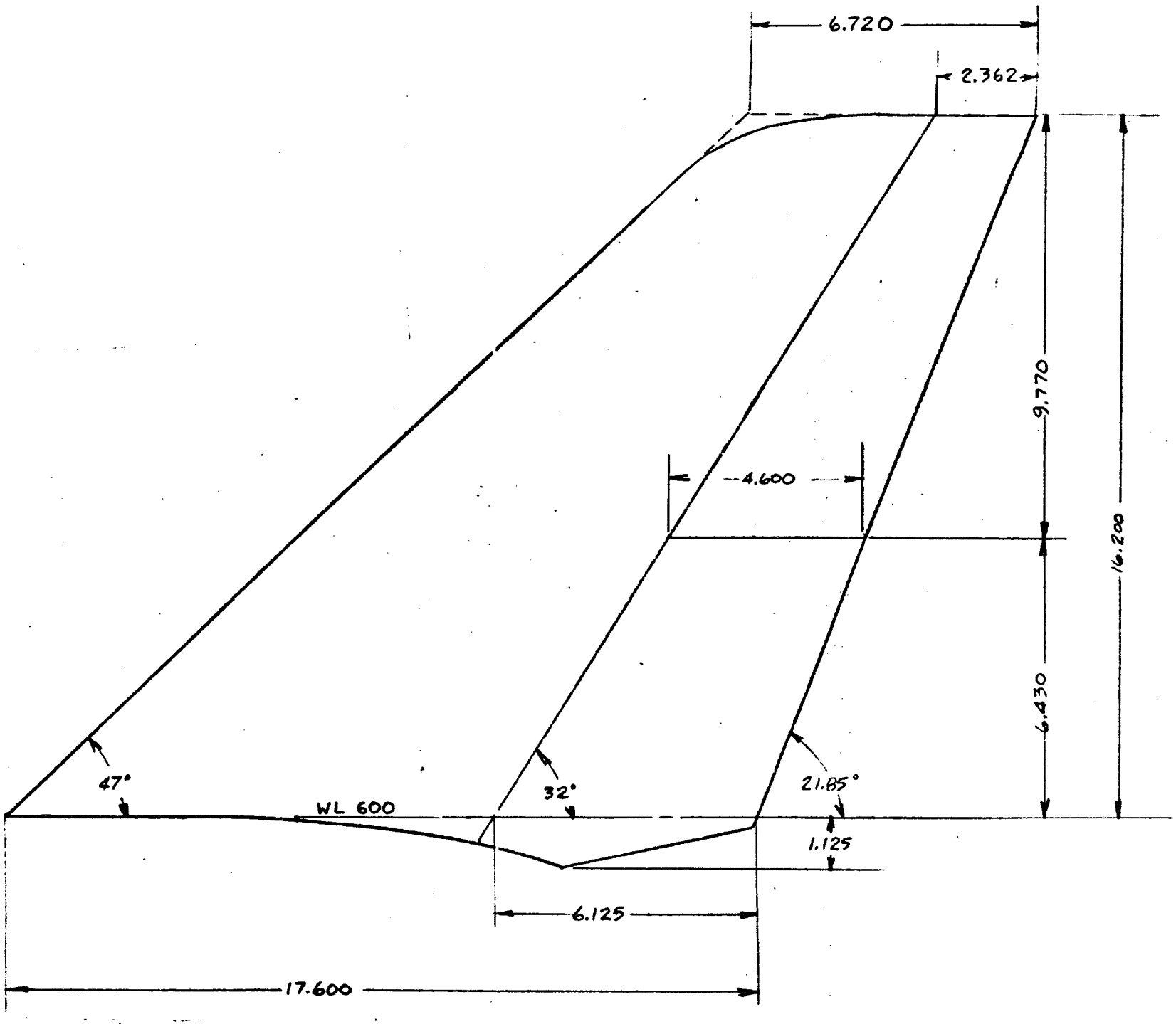


Figure 4. H-33 Orbiter Vertical Tail With Segmented Rudder (1/25 Scale)

MODEL COMPONENT DESCRIPTION SHEETS

MODEL COMPONENT: BODY - B_5

GENERAL DESCRIPTION: BASIC H-33 ORBITER BODY

DRAWING NUMBER: 518 MOD 826

DIMENSIONS:	FULL-SCALE (ft. or ft.^{2})	MODEL SCALE (in. or in.^{2})
Length	135	64.80
Max. Width	25	12.00
Max. Depth	27.5	13.20
Fineness Ratio	4.92	4.92
Area		
Max. Cross-Sectional	530	122.11
Planform	3120	718.85
Wetted	10,345	2383.49
Base	461	106.21

MODEL COMPONENT: WING - W_4

GENERAL DESCRIPTION: BASIC H-33 ORBITER WING

DRAWING NUMBER: 518 MOD 827

DIMENSIONS:

	FULL-SCALE (ft. or ft.^{2})	MODEL SCALE (in. or in.^{2})
TOTAL DATA		
Area		
Planform	4840	1115.14
Wetted	5940	1368.58
Span (equivalent)	94.5	45.36
Aspect Ratio	1.845	1.845
Rate of Taper		
Taper Ratio	.178	.178
Diehedral Angle, degrees	5°	5°
Incidence Angle, degrees	2°@body-3°@tip	2°@body-3°@ tip
Aerodynamic Twist, degrees		
Toe-In Angle		
Cant Angle		
Sweep Back Angles, degrees		
Leading Edge	55°	55°
Trailing Edge	-5°	-5°
0.25 Element Line	46.32°	46.32°
Chords:		
Root (Wing Sta. 0.0)	86.96	41.74
Tip, (equivalent)	15.48	7.43
MAC, ~~Inches~~	59.5	28.56
Fus. Sta. of .25 MAC		
W.P. of .25 MAC		
Airfoil Section		
Root	t/c=9.5%cambered sect.	t/c=9.5%cambered sect.
Tip	" " "	" " "
EXPOSED DATA		
Area	2900	668.16
Span, (equivalent)	69.5	33.36
Aspect Ratio	1.666	1.666
Taper Ratio	.228	.228
Chords		
Root	67.98	32.63
Tip	15.48	7.43
MAC	47.2	22.66
Fus. Sta. of .25 MAC		
W.P. of .25 MAC		

MODEL COMPONENT: ELEVON (FOR W_4 WING)

GENERAL DESCRIPTION: INDIVIDUAL MOVABLE CONTROL SURFACE ASSOCIATED WITH THE W_4 WING

DRAWING NUMBER: 518 MOD 827

DIMENSIONS:	FULL-SCALE (ft. or ft.^{2})	MODEL SCALE (in. or in.^{2})
Area	410	94.46
Span (equivalent)	34.75	16.68
Inb'd equivalent chord	13.6	6.53
Outb'd equivalent chord	10.0	4.80
Ratio movable surface chord/ total surface chord		
At Inb'd equiv. chord		
At Outb'd equiv. chord		
Sweep Back Angles, degrees		
Leading Edge	0°	0°
Tailing Edge	-5°	-5°
Hingeline	0°	0°
Area Moment (Normal to hinge line)		

MODEL COMPONENT: ℄ VERTICAL TAIL - V_5

GENERAL DESCRIPTION: BASIC H-33 ORBITER VERTICAL TAIL

DRAWING NUMBER: 518 MOD 825

DIMENSIONS:

	FULL-SCALE (ft. or ft.^{2})	MODEL SCALE (in. or in.^{2})
Area	855	196.99
Span (equivalent)	33.75	16.20
Inb'd equivalent chord	36.66	17.60
Outb'd equivalent chord	14.0	6.72
Ratio Elevator chord/horizontal tail chord		
At Inb'd equiv. chord	.348	.348
At Outb'd equiv. chord	.351	.351
Sweep Back Angles, degrees		
Leading Edge	47	47°
Tailing Edge	21.85°	21.85°
Hingeline	32	32°
Area Moment (Normal to hinge line)		
ASPECT RATIO	1.33	1.33
TAPER RATIO	.38	.38
MAC	27	12.96
AIRFOIL SECTION	NACA 64A010	NACA 64A010

MODEL COMPONENT: RUDDER (FOR V_5 VERTICAL TAIL)

GENERAL DESCRIPTION: MOVABLE CONTROL SURFACE ASSOCIATED WITH THE V_5 VERTICAL TAIL

DRAWING NUMBER: 518 MOD 825

DIMENSIONS:

	FULL-SCALE (ft. or ft.^{2})	MODEL SCALE (in. or in.^{2})
Area	292	67.28
Span (equivalent)	34.75	16.68
Inb'd equivalent chord	12.76	6.12
Outb'd equivalent chord	4.92	2.36
Ratio movable surface chord/ total surface chord		
At Inb'd equiv. chord		
At Outb'd equiv. chord		
Sweep Back Angles, degrees		
Leading Edge	32	32°
Tailing Edge	21.85°	21.85°
Hingeline	32	32°
Area Moment (Normal to hinge line)		

NOMENCLATURE

(General)

SYMBOL	SADSAC SYMBOL	DEFINITION
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; degrees
β	BETA	sideslip angle, angle between the wind X_w-axis and the projection of this axis on the body X-Z-plane; degrees
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; degrees
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; degrees
ρ		air density; K_g/m^3, slugs/ft^3
a		speed of sound; m/sec, ft/sec
V		speed of vehicle relative to surrounding atmosphere; m/sec, ft/sec
q	Q(PSI) Q(PSF)	dynamic pressure; $1/2\rho V^2$, psi, psf
M	MACH	Mach number; V/a
RN/L	RN/L	Reynolds number per unit length; million/ft
p		static pressure; psi
P		total pressure; psi
C_p	CP	pressure coefficient; $(p-p_\infty)/q$

NOMENCLATURE (Continued)

Reference & C. G. Definitions

SYMBOL	SADSAC SYMBOL	DEFINITION
S		wing area; m^2, ft^2
S	SREF	reference area; m^2, ft^2
$\bar{c}$		wing mean aerodynamic chord or reference chord; m, ft, in (see ℓ_{ref} or LREF)
ℓ_{ref}	LREF	reference length; m, ft, in.; (see $\bar{c}$)
b_{ref}	BREF	wing span or reference span; m, ft, in
A_b		base area; m^2, ft^2, in^2
c. g.		center of gravity
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

NOMENCLATURE (Continued)

Axis System General

SYMBOL	DEFINITION
F	force; F, lbs
M	moment; M, in-lb

Subscript	Definition
N	normal force
A	axial force
L	lift force
D	drag force
Y	force or moment about the Y axis
Z	moment about the Z axis
X	moment about the X axis
s	stability axis system
w	wind axis system
ref	reference conditions
∞	free stream conditions
t	total conditions
b	base

NOMENCLATURE (Continued)

Body Axis System

SYMBOL	SADSAC SYMBOL	DEFINITION
C_N	CN	normal force coefficient; F_N/qS
C_A	CA	axial force coefficient; F_A/qS
C_{A_b}	CAB	base axial force coefficient; $\left[-1\right] \left[(p_b - p_\infty)/q\right] (A_b/S)$
C_{A_f}	CAF	forebody axial force coefficient; $C_A - C_{A_b}$
C_m	CLM	pitching moment coefficient; $M_Y/qS\ \ell_{ref}$
C_y	CY	side force coefficient; F_Y/qS
C_n	CYN	yawing moment coefficient; $M_Z/qS\ b_{ref}$
C_ℓ	CBL	rolling moment coefficient, $M_X/qS\ b_{ref}$

NOMENCLATURE (Continued)

Stability Axis System

SYMBOL	SADSAC SYMBOL	DEFINITION
C_L	CL	lift force coefficient; F_L/qS
C_D	CD	drag force coefficient; F_D/qS
C_{D_b}	CDB	base drag coefficient
C_{D_f}	CDF	forebody drag coefficient; $C_D - C_{D_b}$
C_m	CIM	pitching moment coefficient; $M_{Y,s}/qS\ \ell_{ref}$
C_y	CY	side force coefficient; F_Y/qS
C_n	CIN	yawing moment coefficient; $M_{Z,s}/qS\ b_{ref}$
C_ℓ	CSL	rolling moment coefficient; $M_{X,s}/qS\ b_{ref}$
L/D	L/D	lift-to-drag ratio; C_L/C_D
L/D_f	L/DF	lift to forebody drag ratio; C_L/C_{D_f}

NOMENCLATURE (Continued)

Surface Definitions

SYMBOL	SADSAC SYMBOL	DEFINITION
i_t	HORIZT	horizontal tail incidence; positive when trailing edge down; degrees
δ		symmetrical surface deflection angle; degrees; positive deflections are:
	AILRON	aileron - total aileron deflection; (left aileron - right aileron)/2
	CANARD	canard - trailing edge down
	ELEVON	elevon - trailing edge down
	ELEVTR	elevator - trailing edge down
	FLAP	flap - trailing edge down
	RUDDER	rudder - trailing edge to the left
	SPOILR	spoiler - trailing edge down
	TAB	tab - trailing edge down with respect to control surface
δ		antisymmetrical surface deflection angle, degrees; positive trailing edge down:
	AIL-L	left aileron - trailing edge down
	AIL-R	right aileron - trailing edge down
	ELVN-L	left elevon - trailing edge down
	ELVN-R	right elevon - trailing edge down
	SPLR-L	left spoiler - trailing edge down
	SPLR-R	right spoiler - trailing edge down

SURFACE SUBSCRIPTS	DEFINITION
a	aileron
b	base
c	canard
e	elevator or elevon
f	flap
r	rudder or ruddervator
s	spoiler
t	tail

NON-STANDARD NOMENCLATURE

SYMBOL	SADSAC SYMBOL	DEFINITION
δ_{EL}	LELEVN	Left wing elevon deflection angle, positive is trailing edge down, in degrees.
δ_{ER}	RELEVN	Right wing elevon deflection angle, positive is trailing edge down, in degrees.
δ_{RT}	TRUDDR	Top portion of segmented rudder, positive is trailing edge left, in degrees.
δ_{RLL}	LLRUDD	Left (pilot's view) part of split lower rudder segment in the V-shaped, speed brake configuration. Positive is trailing edge left, in degrees.
δ_{RLR}	LRRUDD	Right (pilot's view) part of split lower rudder segment in the V-shaped speed brake configuration. Positive is trailing edge left, in degrees.

$W_4^{x,y}$ Superscripts x and y indicate the deflections of the left and right elevons, respectively, where positive deflections are T.E. down.

V_5 The rudder is segmented into upper and lower panels. The lower panel splits open along its chord line to become a V-shaped speed brake.

Superscripts: 1) a single superscript indicates the deflection of the entire full span rudder. 2) three superscripts, x, y, z, denotes the segmented rudder with speed brakes flared. x denotes upper segment deflection, y the left half of the lower segment, and z the right half of the lower segment.

For any of these surfaces, positive deflection is T.E. left.

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) a 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
GAC	Mr. M. Quan

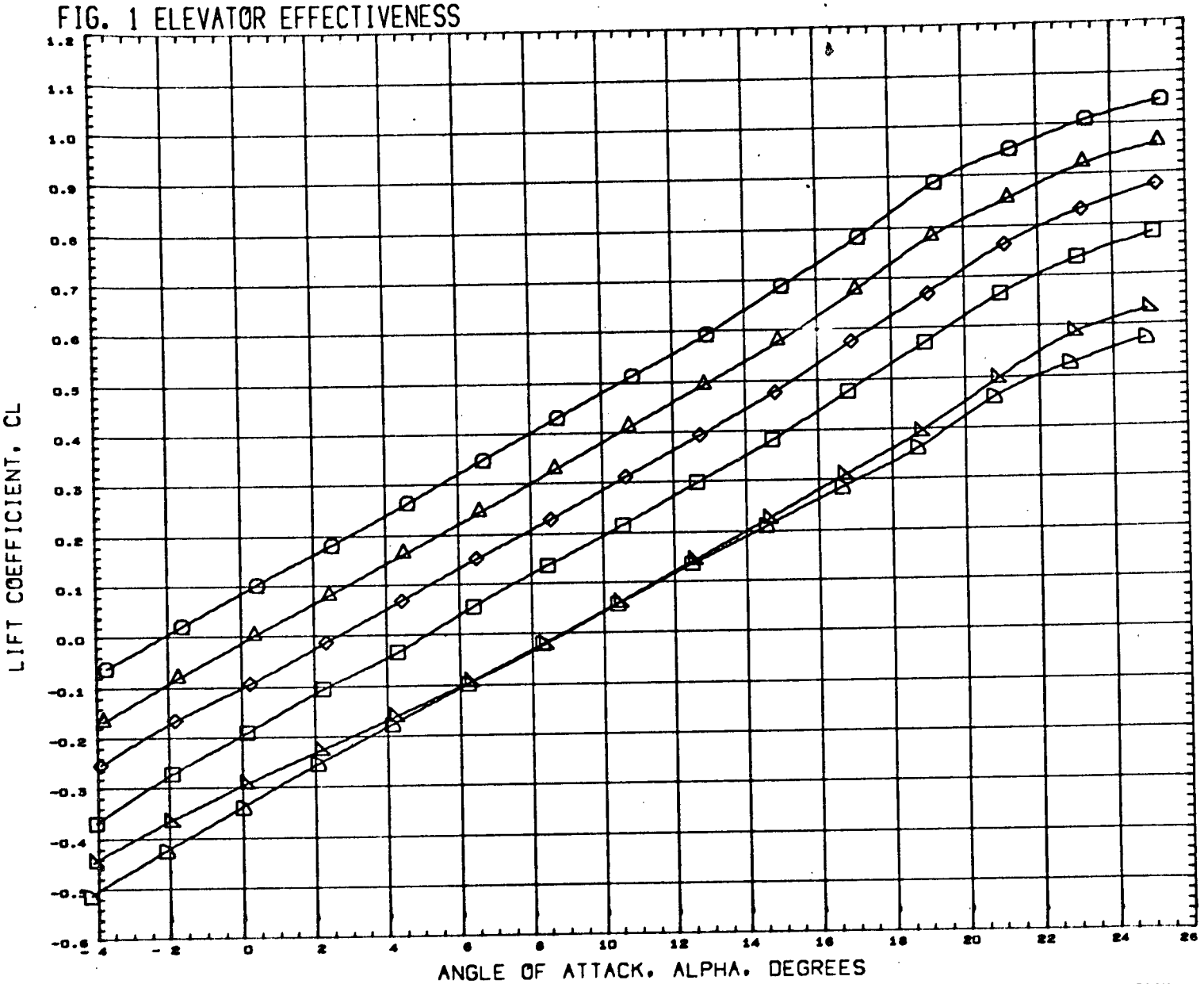
If copies of this listing are desired, please contact the above or the cognizant SADSAC personnel who, for this data, is:

Mr. J. R. Ziler
Department 2780
Chrysler Corporation Space Division
New Orleans, La. 70129

(504) 255-2304

PLOTTED DATA

FIG. 1 ELEVATOR EFFECTIVENESS

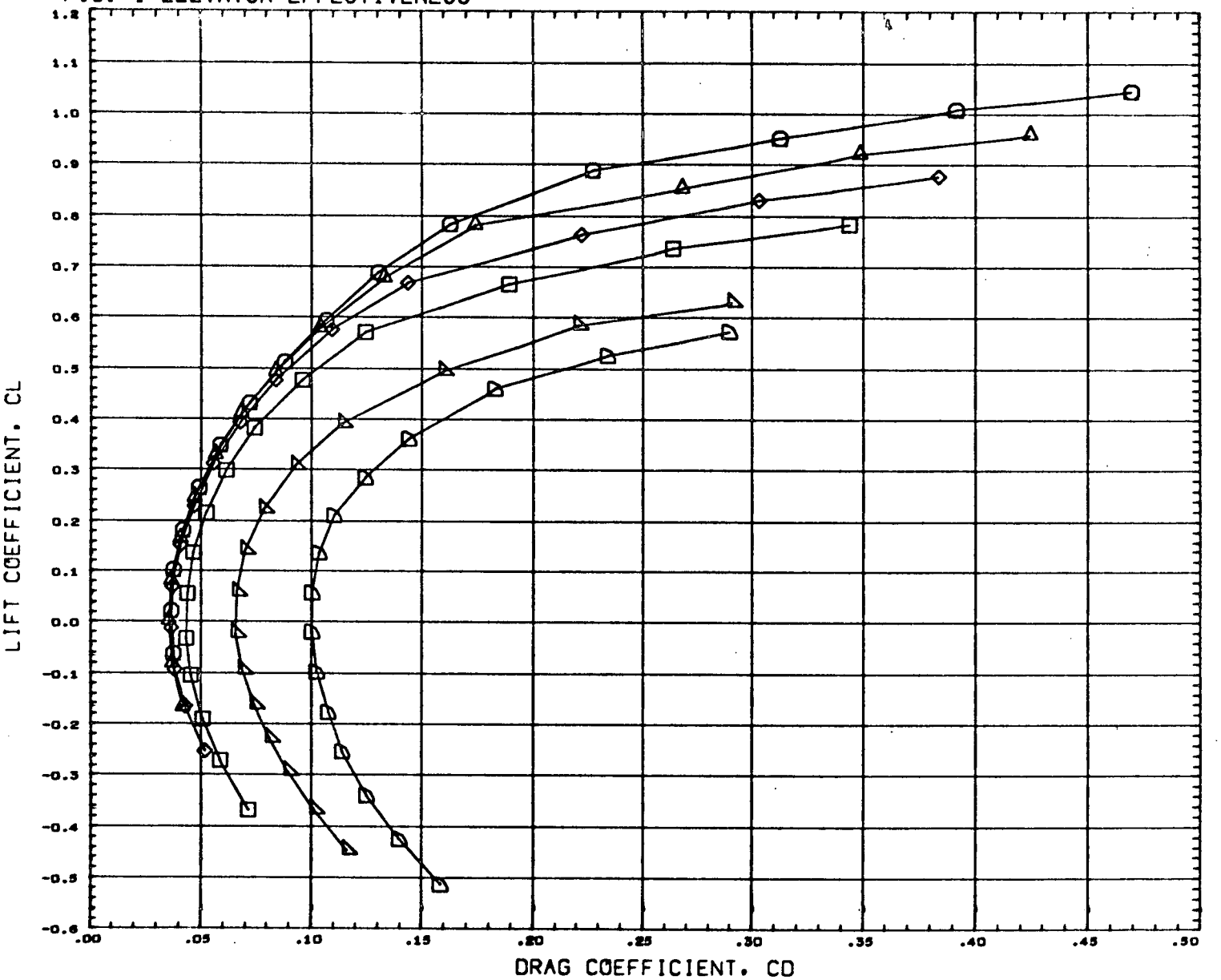


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1006)	△	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5	-5.000	-5.000	0.000
(RD1007)	◇	GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1008)	□	GWTT 292 CONF.H-33 ORBITER B5W4(-15,-15)V5	-15.000	-15.000	0.000
(RD1054)	▷	GWTT 292 CONF.H-33 ORBITER B5W4(-25,-25)V5	-25.000	-25.000	
(RD1009)	▷	GWTT 292 CONF.H-33 ORBITER B5W4(-35,-35)V5	-35.000	-35.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 1 ELEVATOR EFFECTIVENESS

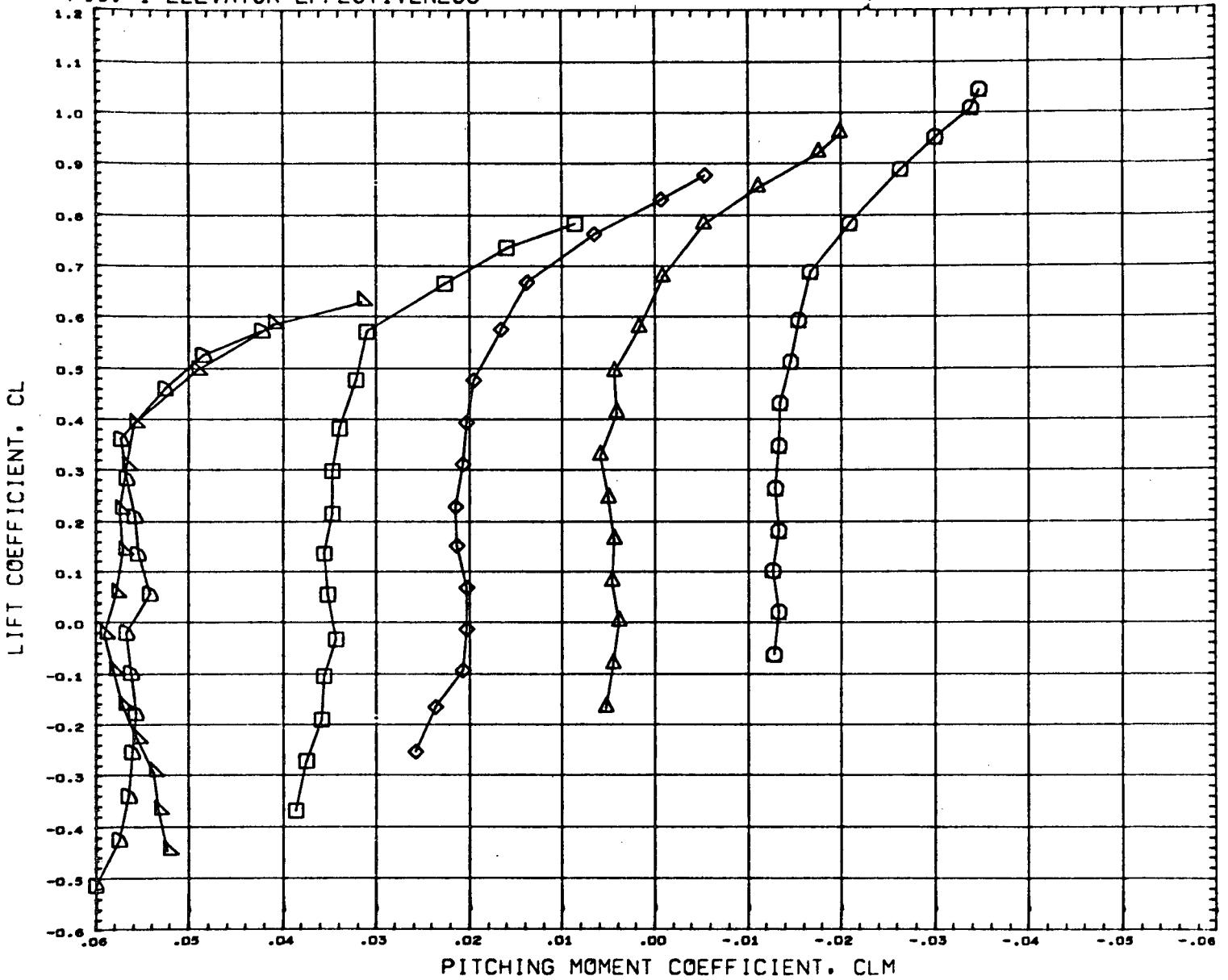


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)		GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1006)		GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5	-5.000	-5.000	0.000
(RD1007)		GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1008)		GWTT 292 CONF.H-33 ORBITER B5W4(-15,-15)V5	-15.000	-15.000	0.000
(RD1054)		GWTT 292 CONF.H-33 ORBITER B5W4(-25,-25)V5	-25.000	-25.000	
(RD1009)		GWTT 292 CONF.H-33 ORBITER B5W4(-35,-35)V5	-35.000	-35.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 1 ELEVATOR EFFECTIVENESS

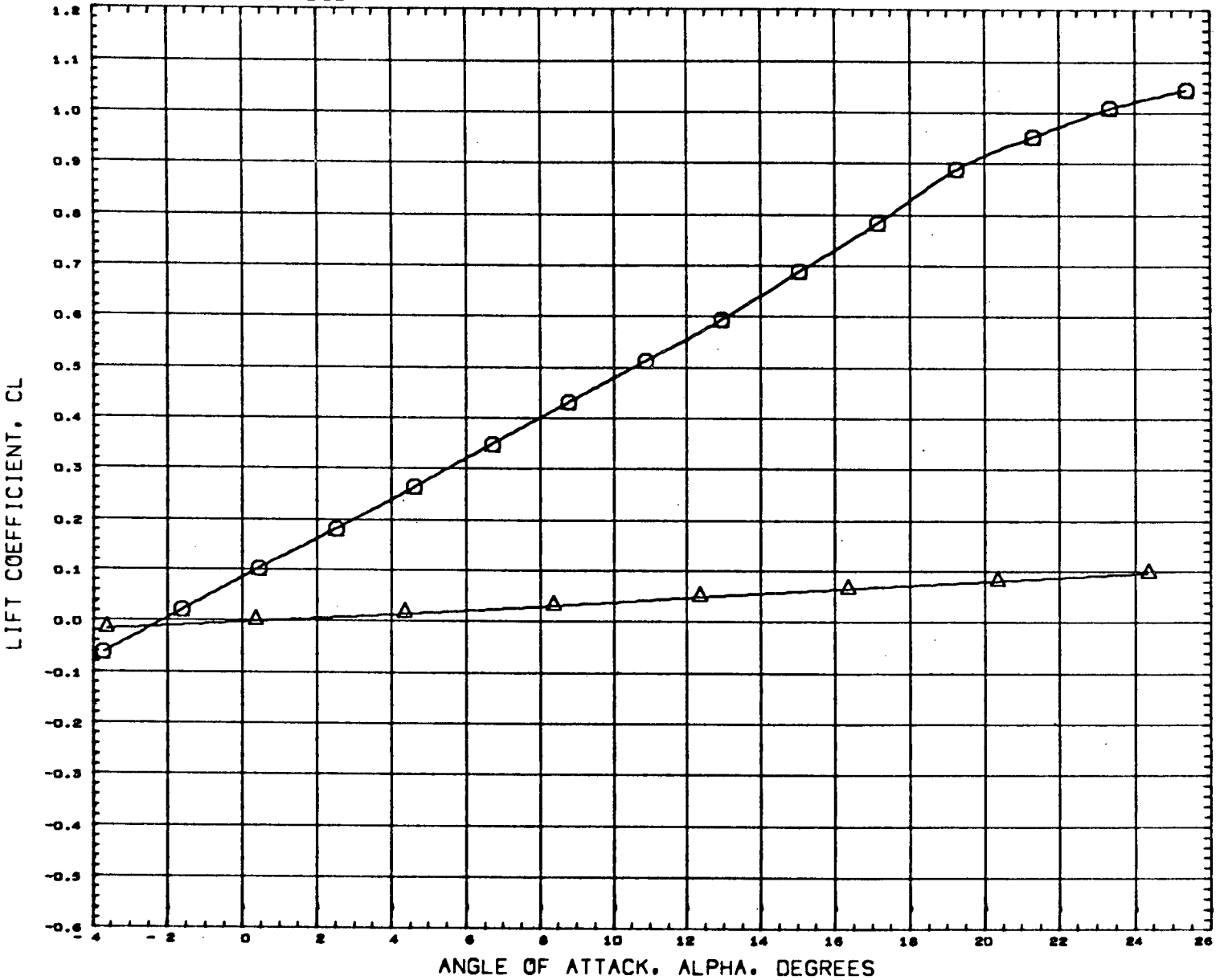


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)		GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1006)		GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5	-5.000	-5.000	0.000
(RD1007)		GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1008)		GWTT 292 CONF.H-33 ORBITER B5W4(-15,-15)V5	-15.000	-15.000	0.000
(RD1054)		GWTT 292 CONF.H-33 ORBITER B5W4(-25,-25)V5	-25.000	-25.000	
(RD1009)		GWTT 292 CONF.H-33 ORBITER B5W4(-35,-35)V5	-35.000	-35.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 2 EFFECT OF BODY



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5
(RD1023)	△	GWTT 292 CONF.H-33 ORBITER B5

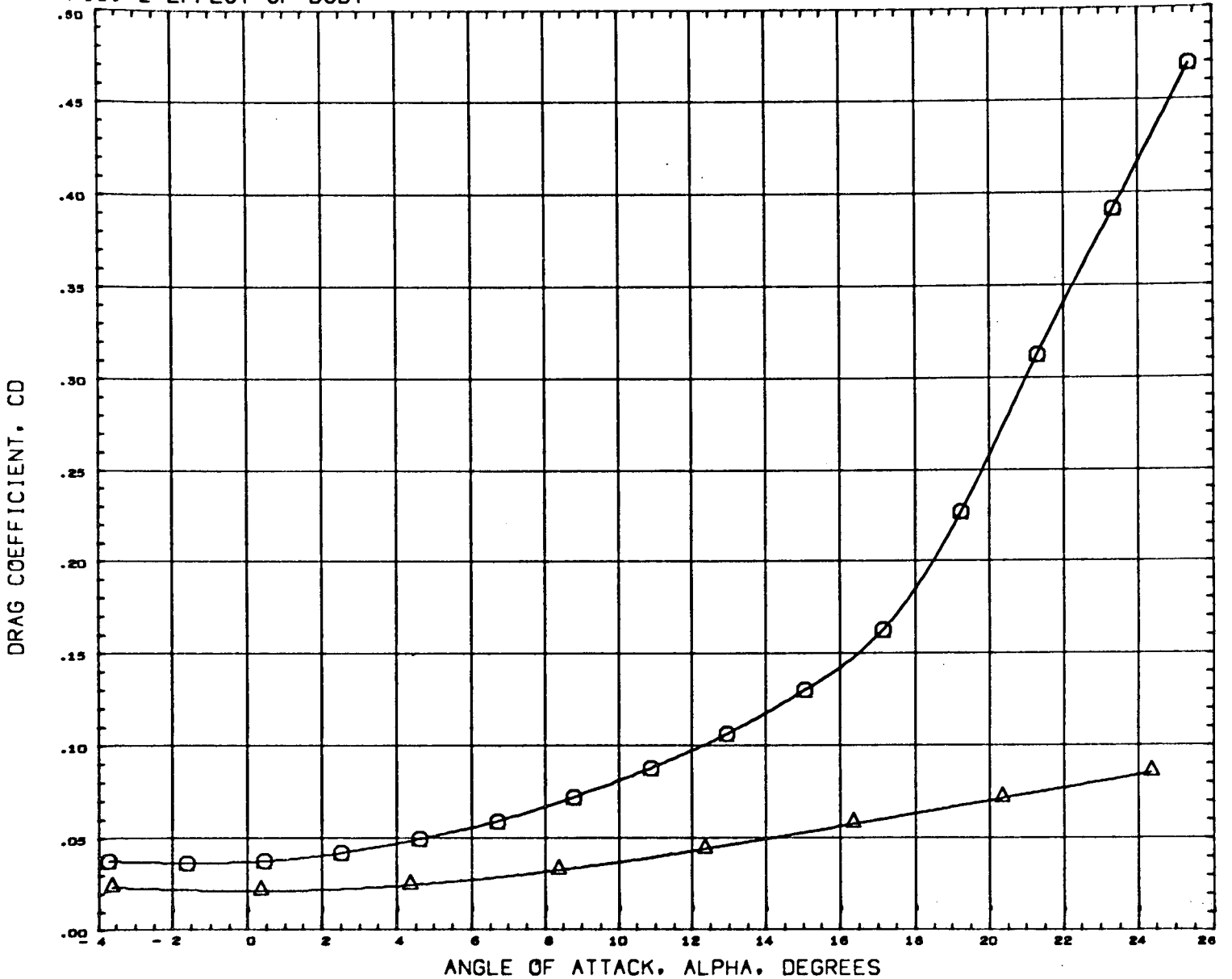
LELEVN	RELEVN	BETA
0.000	0.000	0.000
		0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 2 EFFECT OF BODY

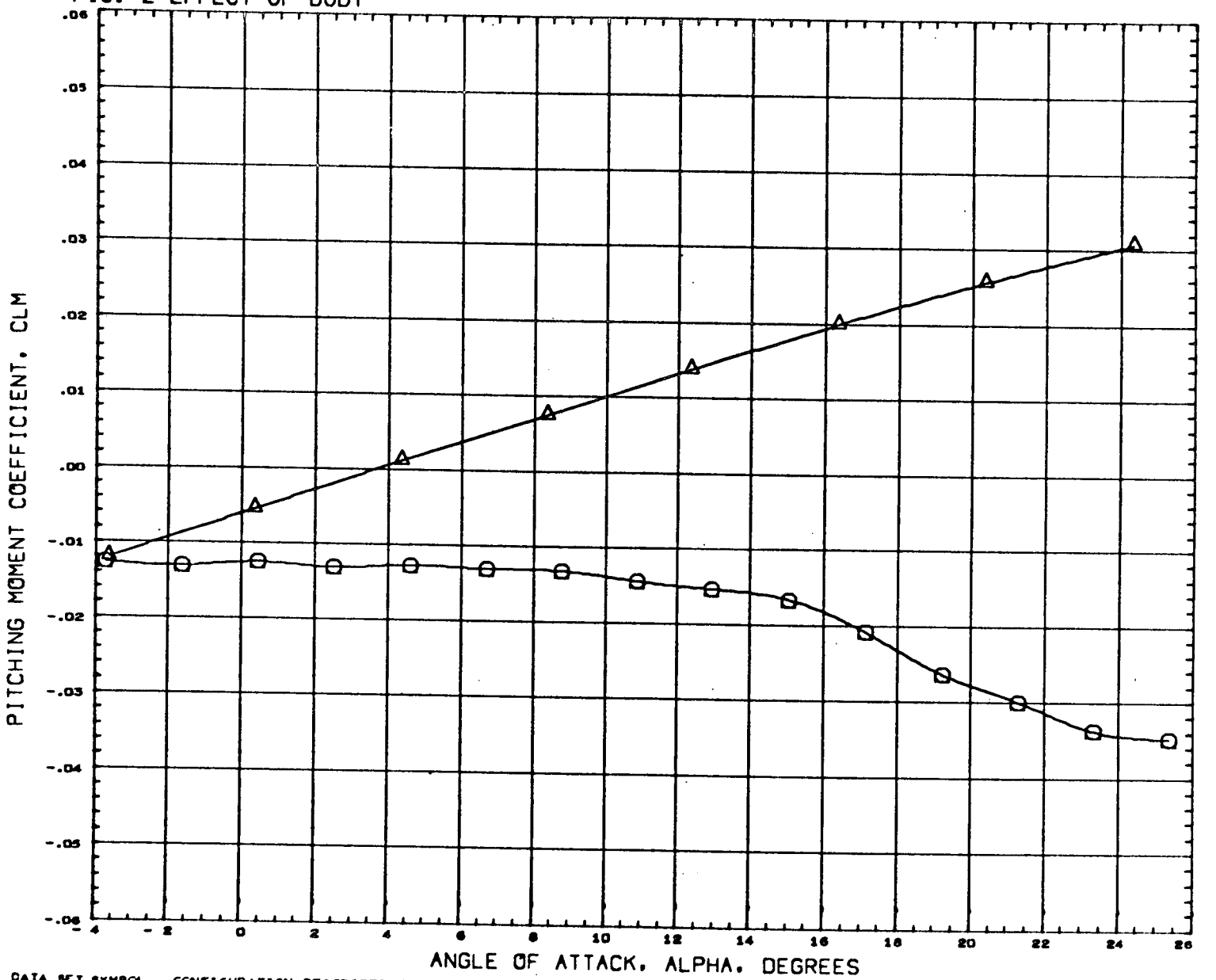


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1023)	△	GWTT 292 CONF.H-33 ORBITER B5			0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 2 EFFECT OF BODY



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1002)		GWTT 292 CONF.H-33 ORBITER B5W4V5
(RD1023)		GWTT 292 CONF.H-33 ORBITER B5

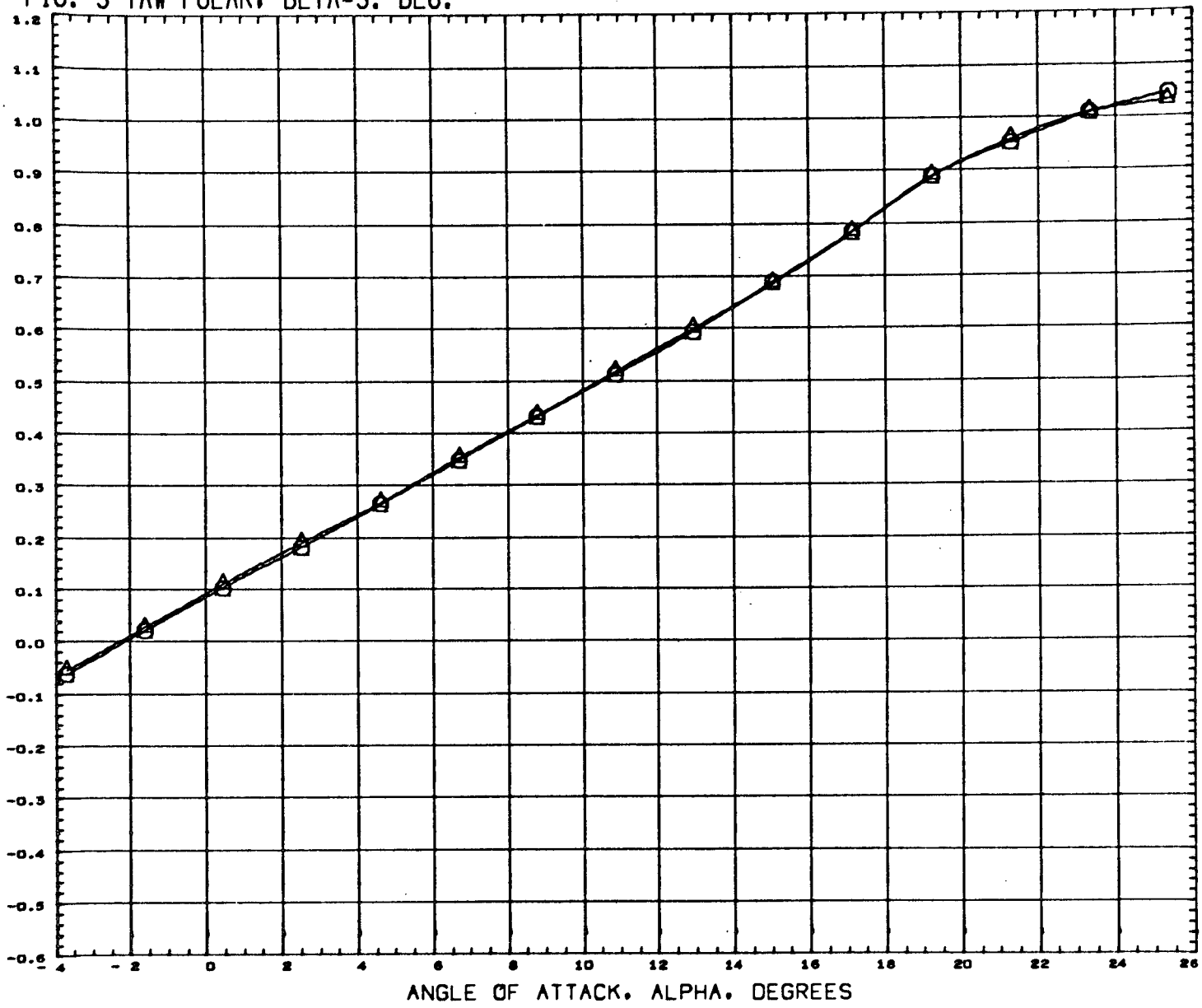
LELEVN	RELEVN	BETA
0.000	0.000	0.000
		0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 3 YAW POLAR, BETA=3. DEG.



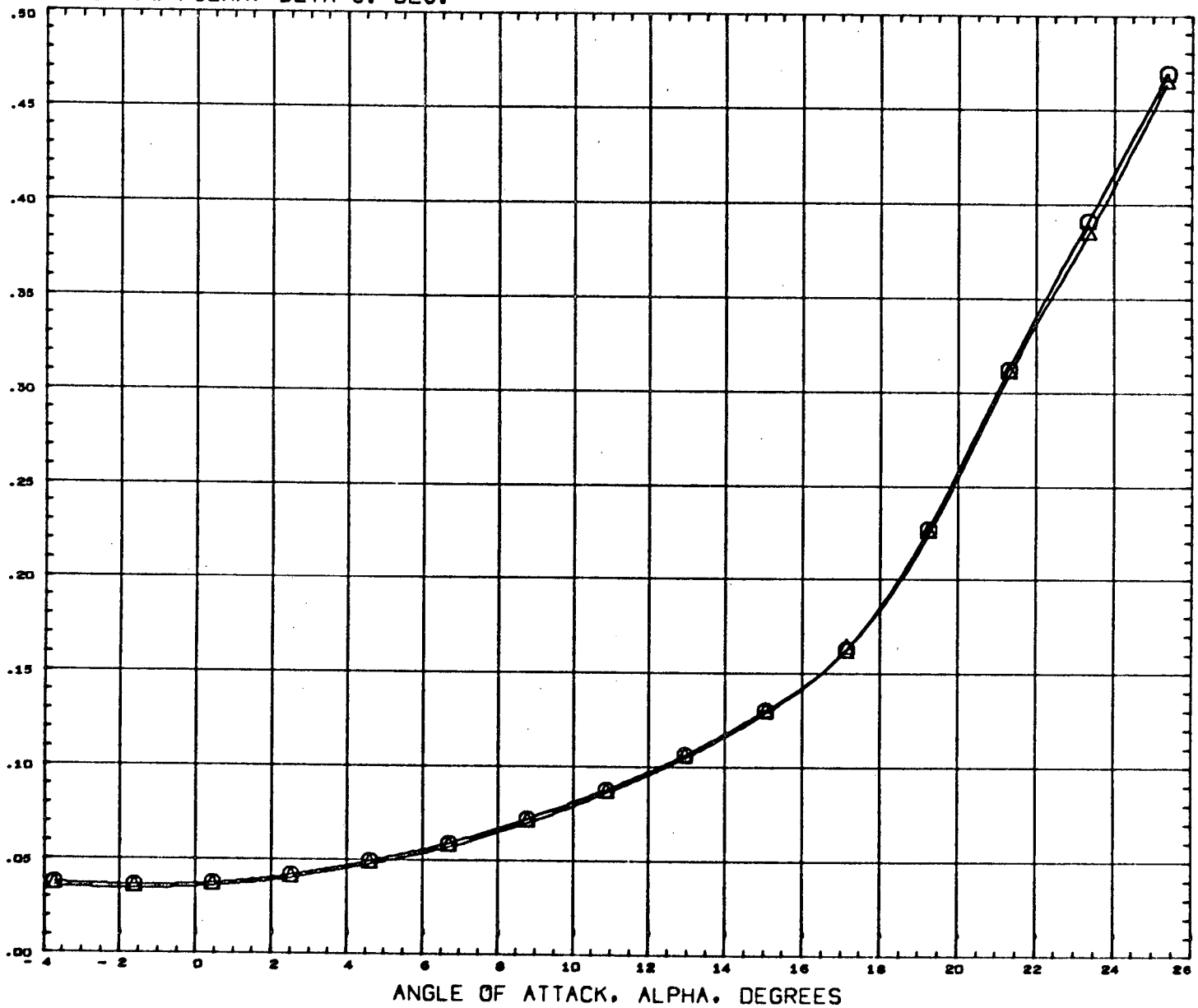
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)		GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1004)		GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	3.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 3 YAW POLAR, BETA=3. DEG.



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1002)		GWTT 292 CONF.H-33 ORBITER B5W4V5
(RD1004)		GWTT 292 CONF.H-33 ORBITER B5W4V5

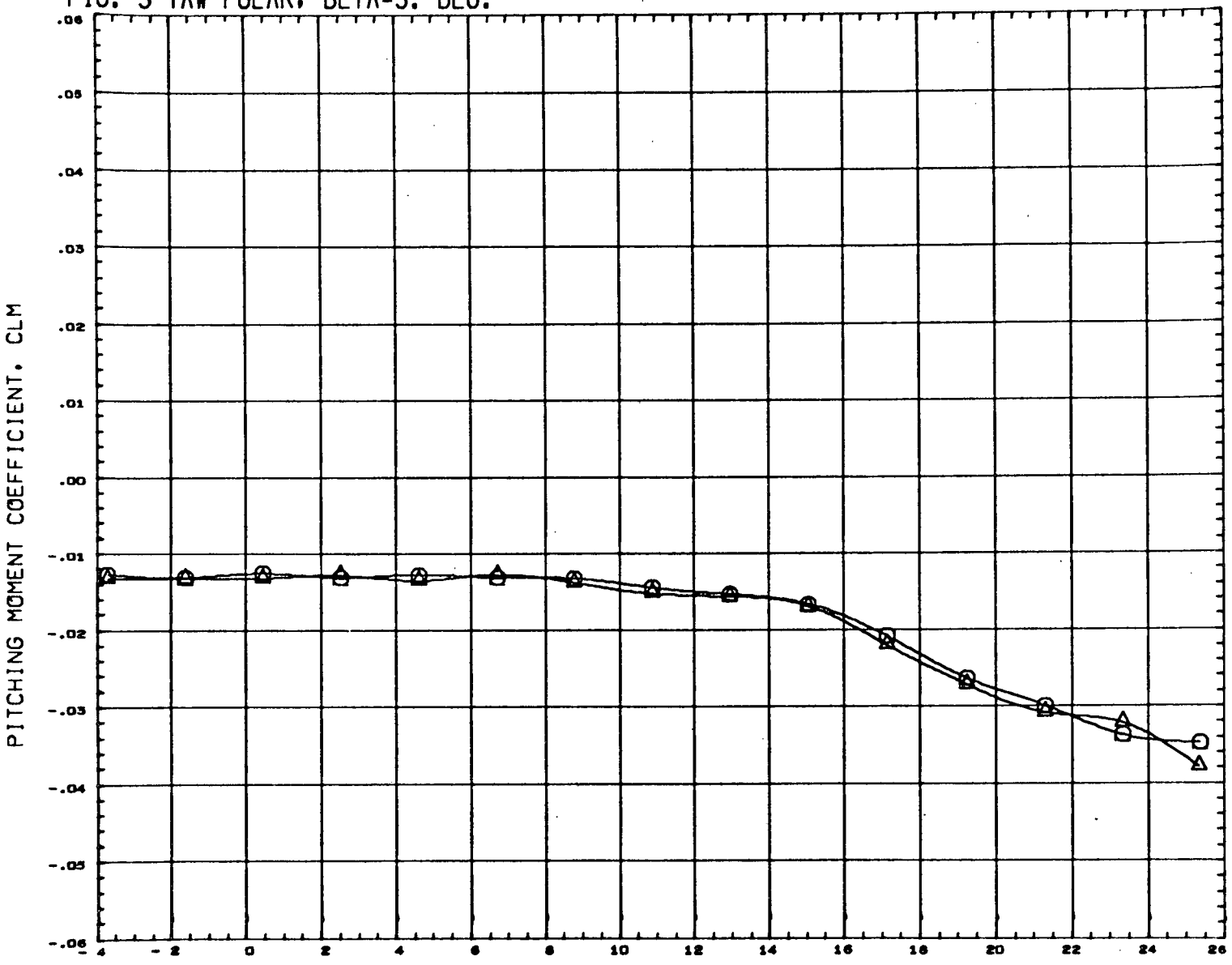
LELEVN	RELEVN	BETA
0.000	0.000	0.000
0.000	0.000	3.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 3 YAW POLAR, BETA=3. DEG.

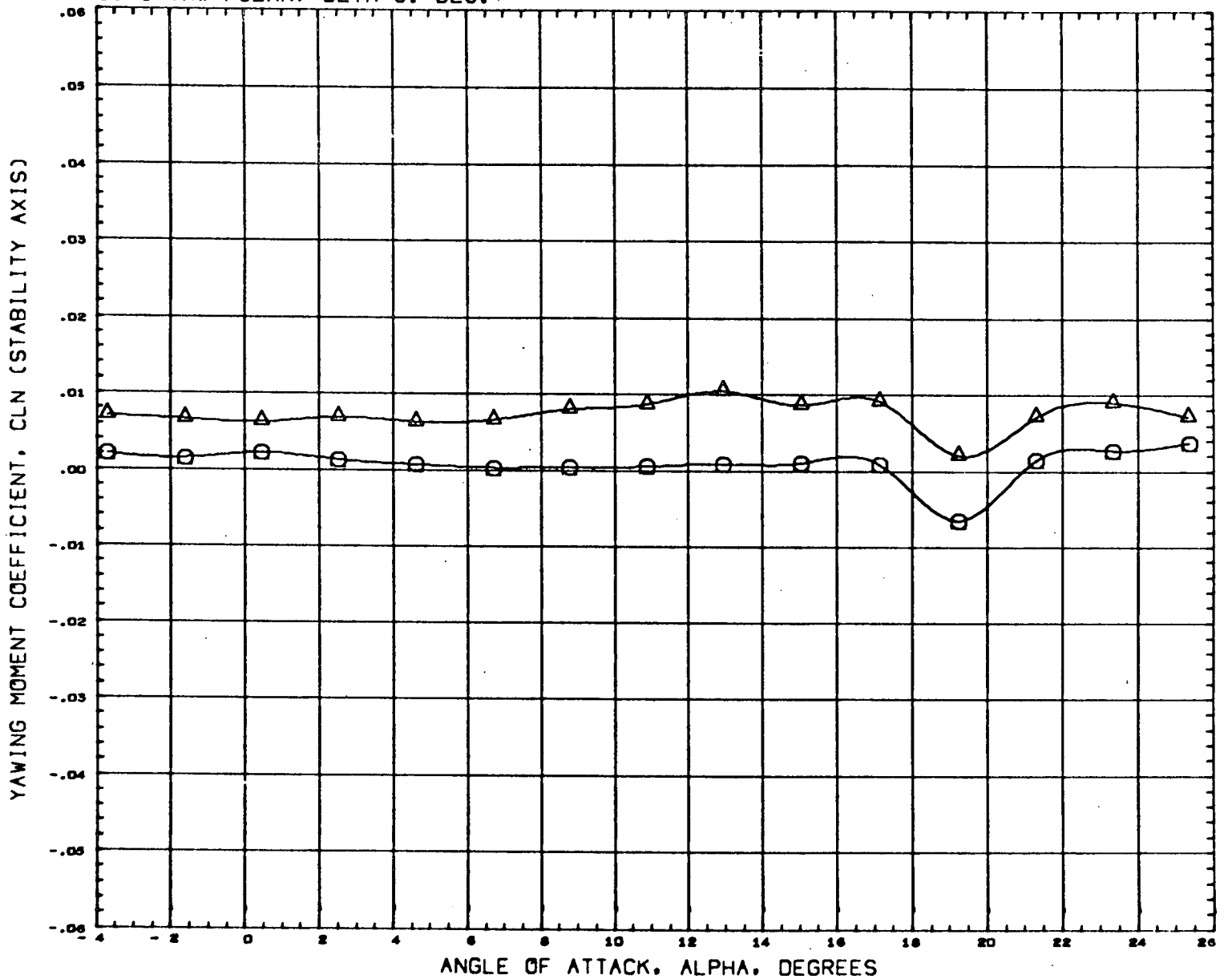


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)		GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1004)		GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	3.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 3 YAW POLAR, BETA=3. DEG.



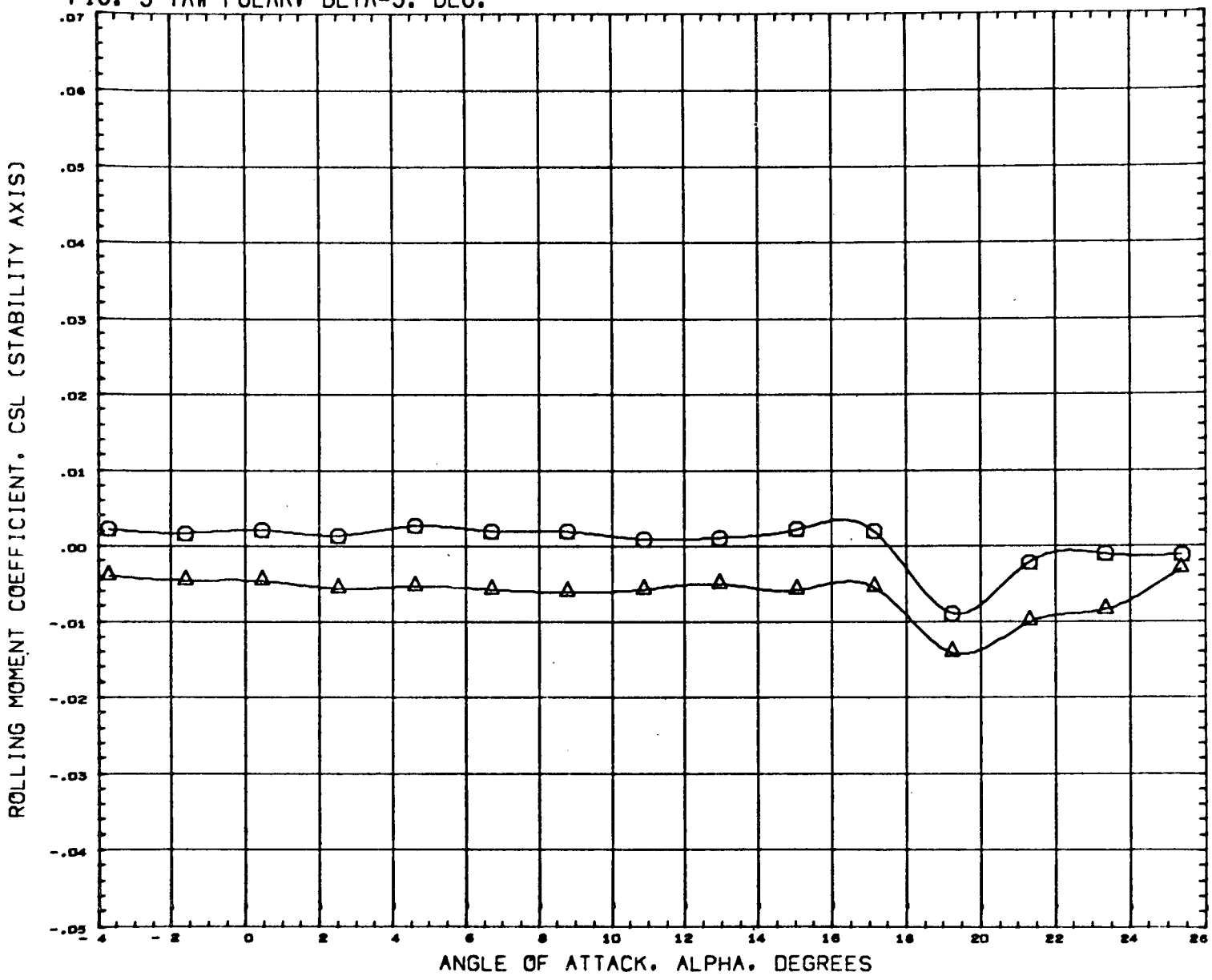
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1004)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	3.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 3 YAW POLAR, BETA=3. DEG.



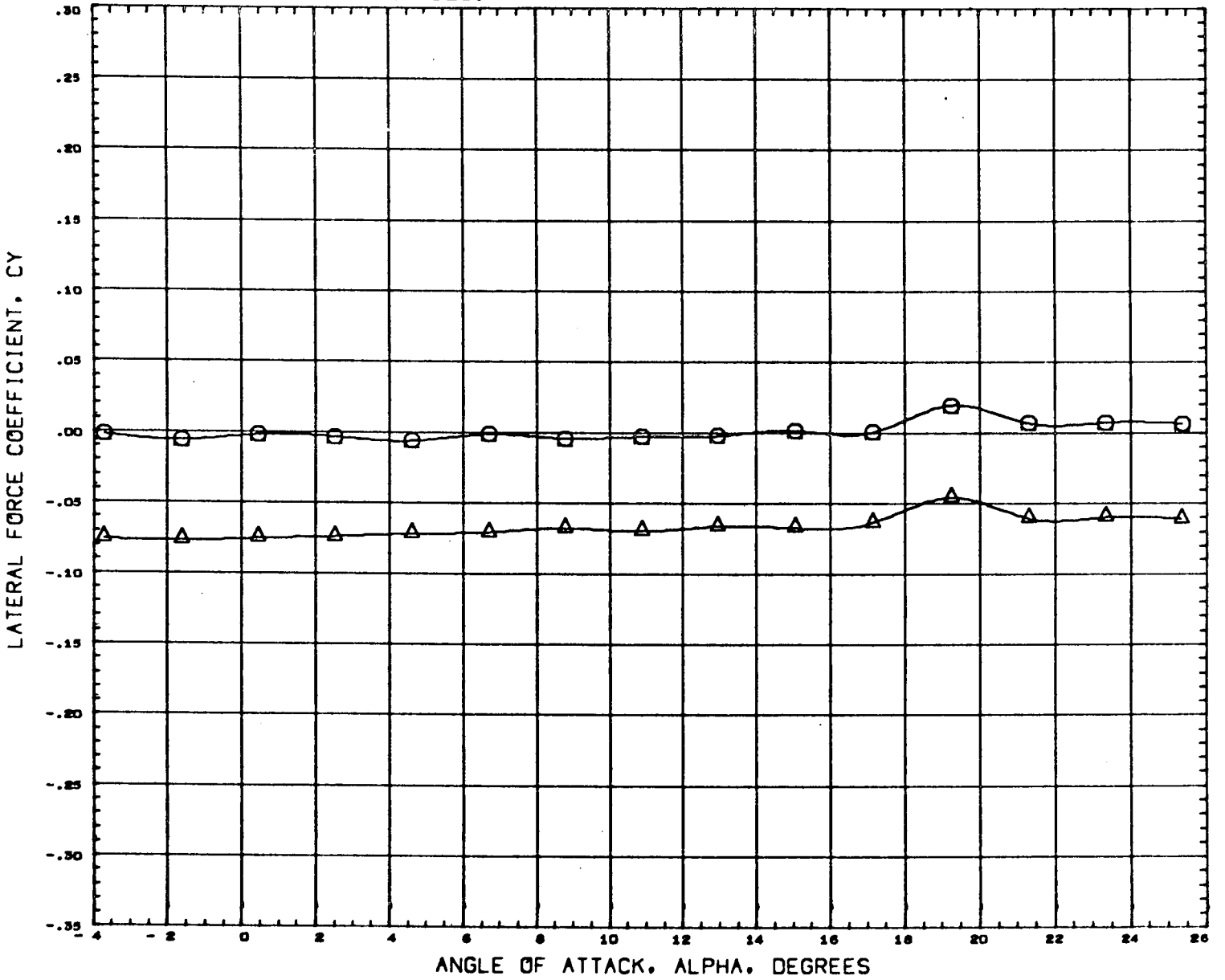
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1004)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	3.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 3 YAW POLAR. BETA=3. DEG.



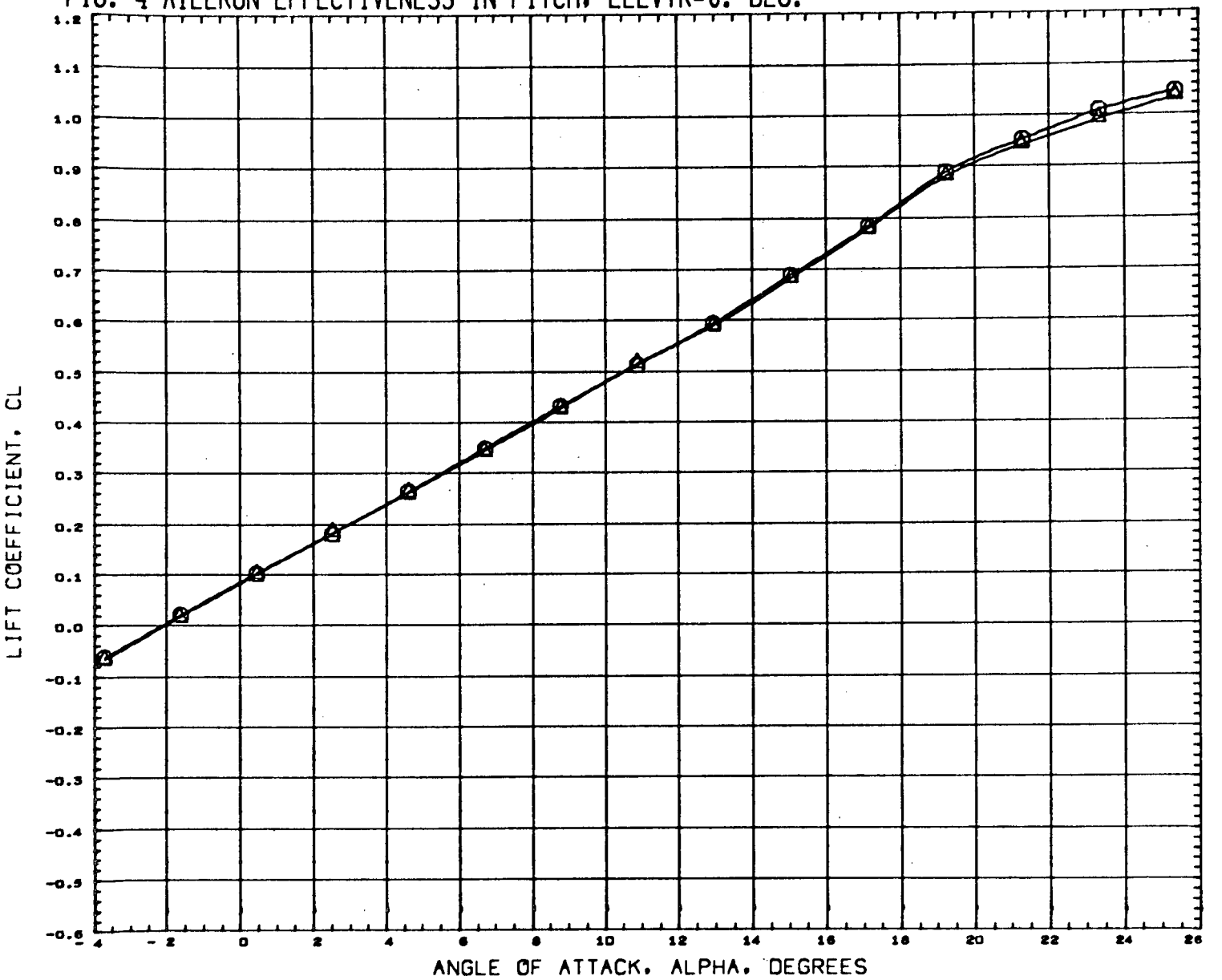
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1004)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	3.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 4 AILERON EFFECTIVENESS IN PITCH, ELEVTR=0. DEG.

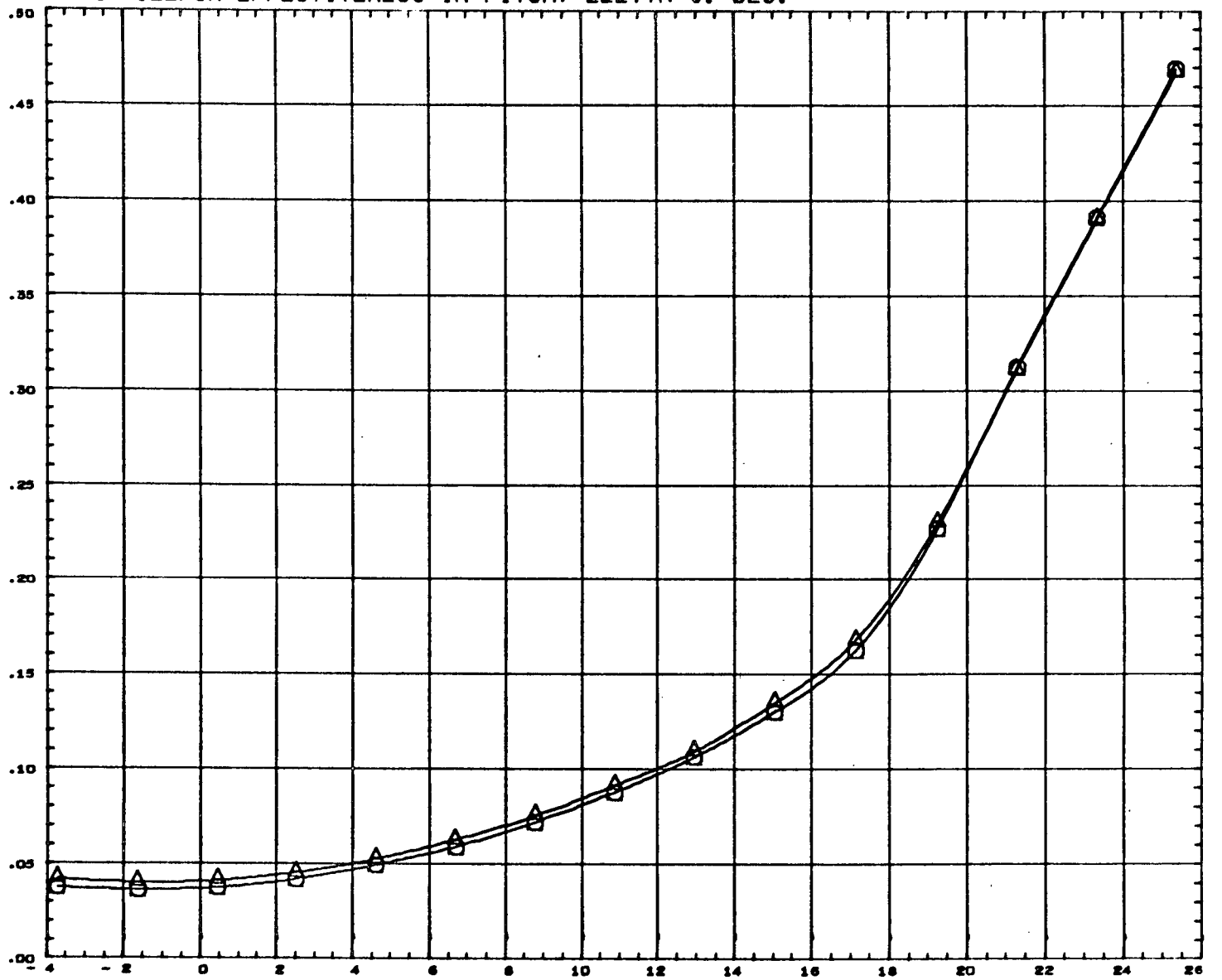


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1010)	△	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-5)V5	5.000	-5.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 4 AILERON EFFECTIVENESS IN PITCH, ELEVTR=0. DEG.

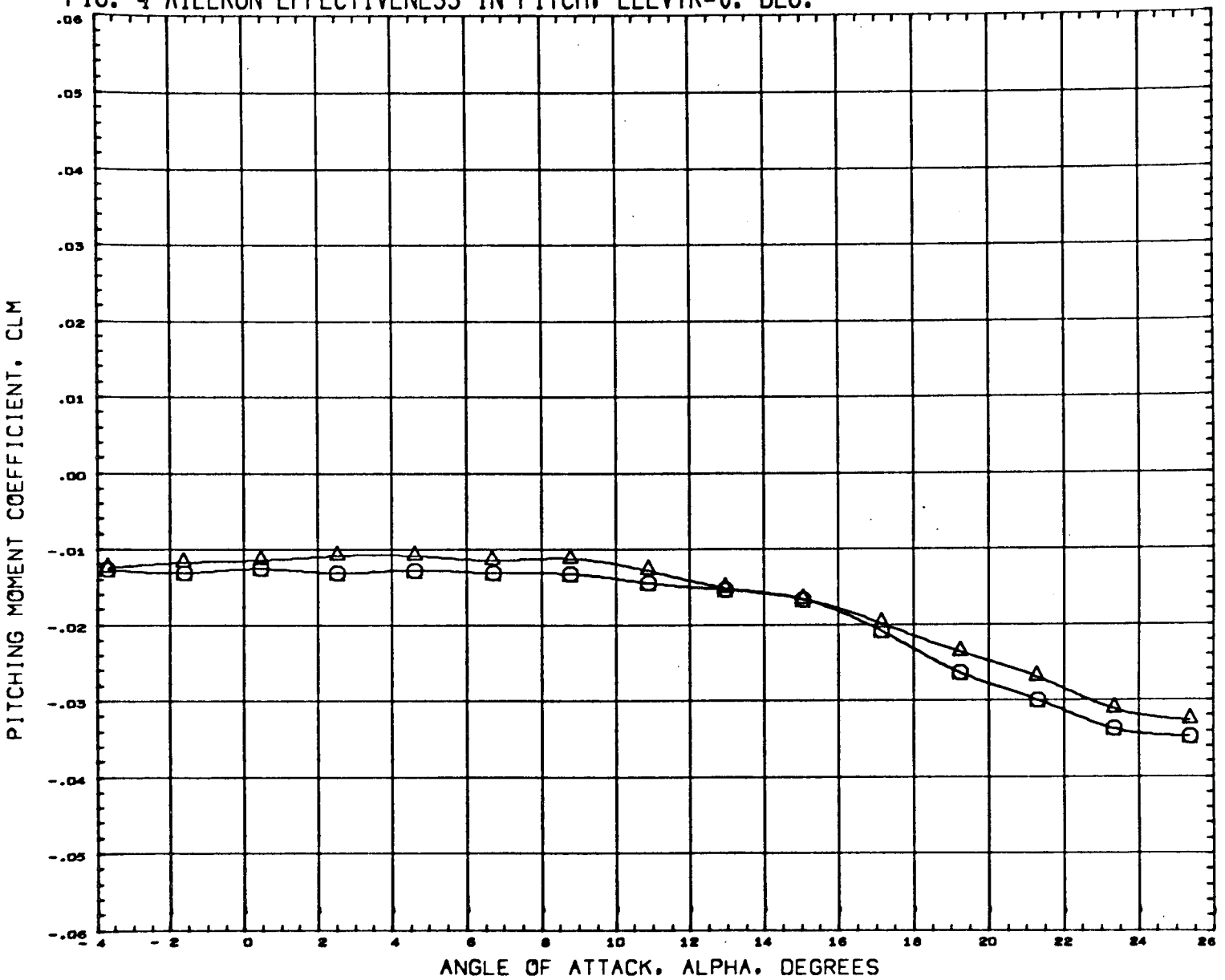


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1010)	△	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-5)V5	5.000	-5.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 4 AILERON EFFECTIVENESS IN PITCH, ELEVTR=0. DEG.



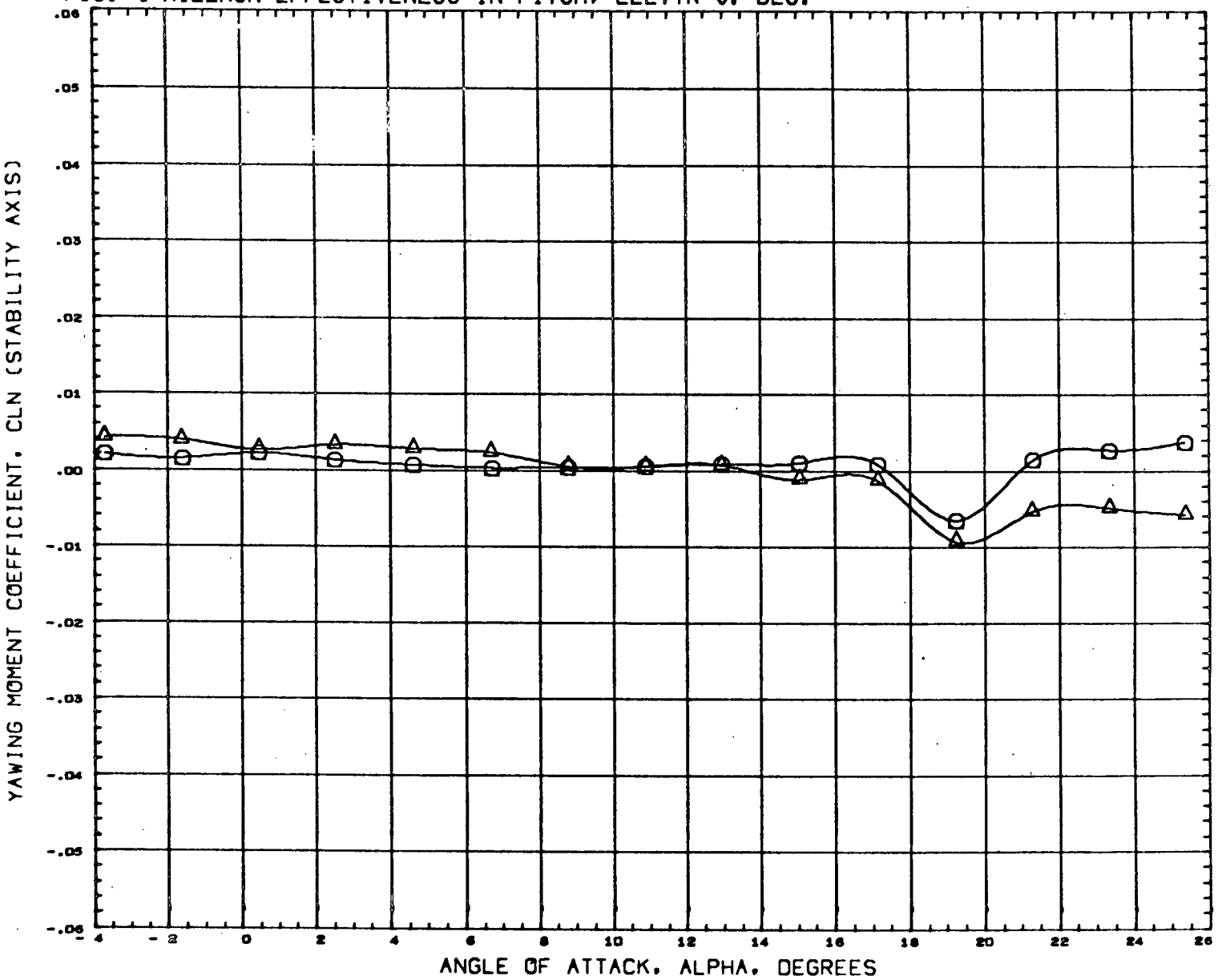
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1010)	△	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-5)V5	5.000	-5.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 4 AILERON EFFECTIVENESS IN PITCH, ELEVTR=0. DEG.

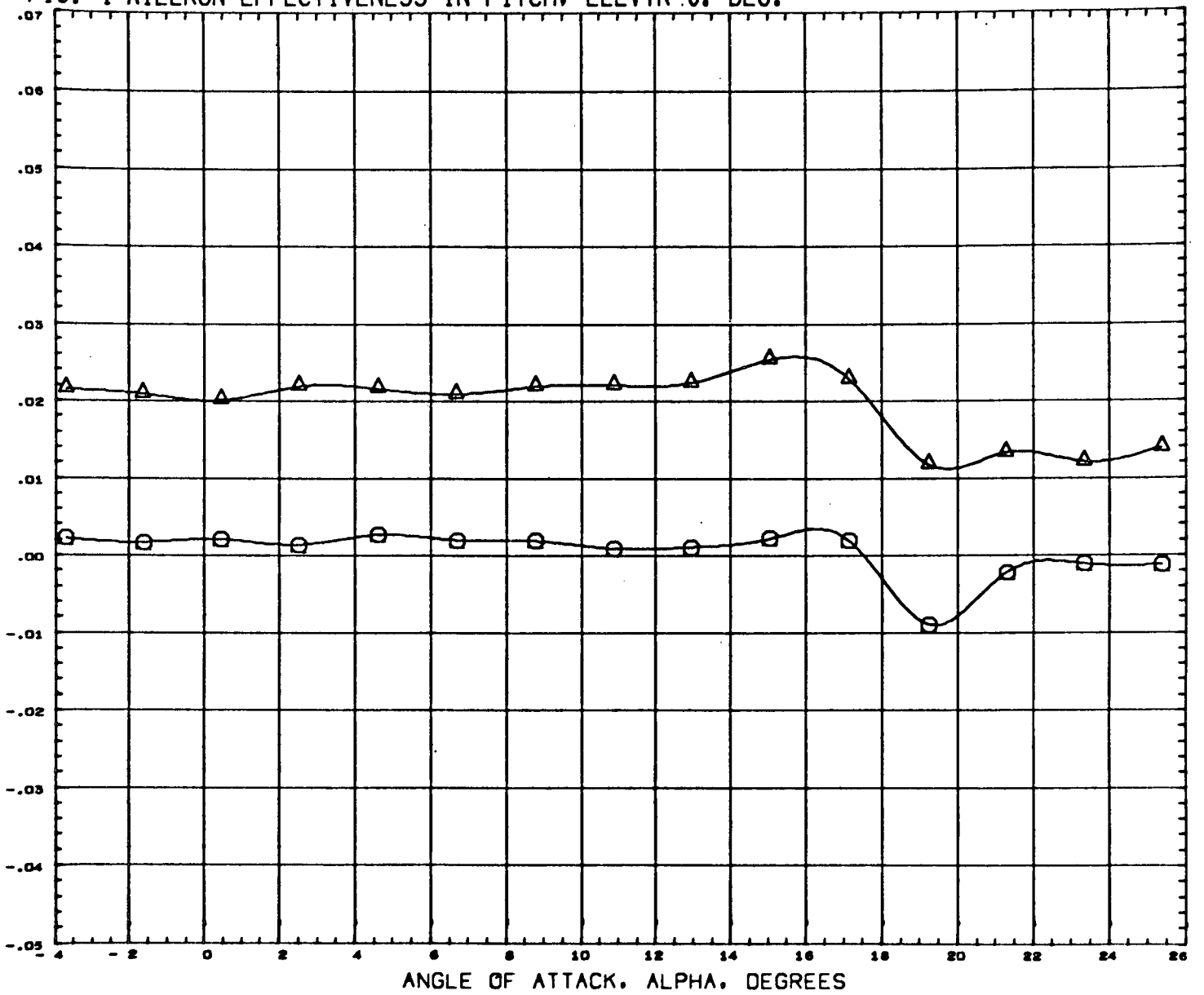


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1010)	△	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-5)V5	5.000	-5.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 4 AILERON EFFECTIVENESS IN PITCH, ELEVTR=0. DEG.

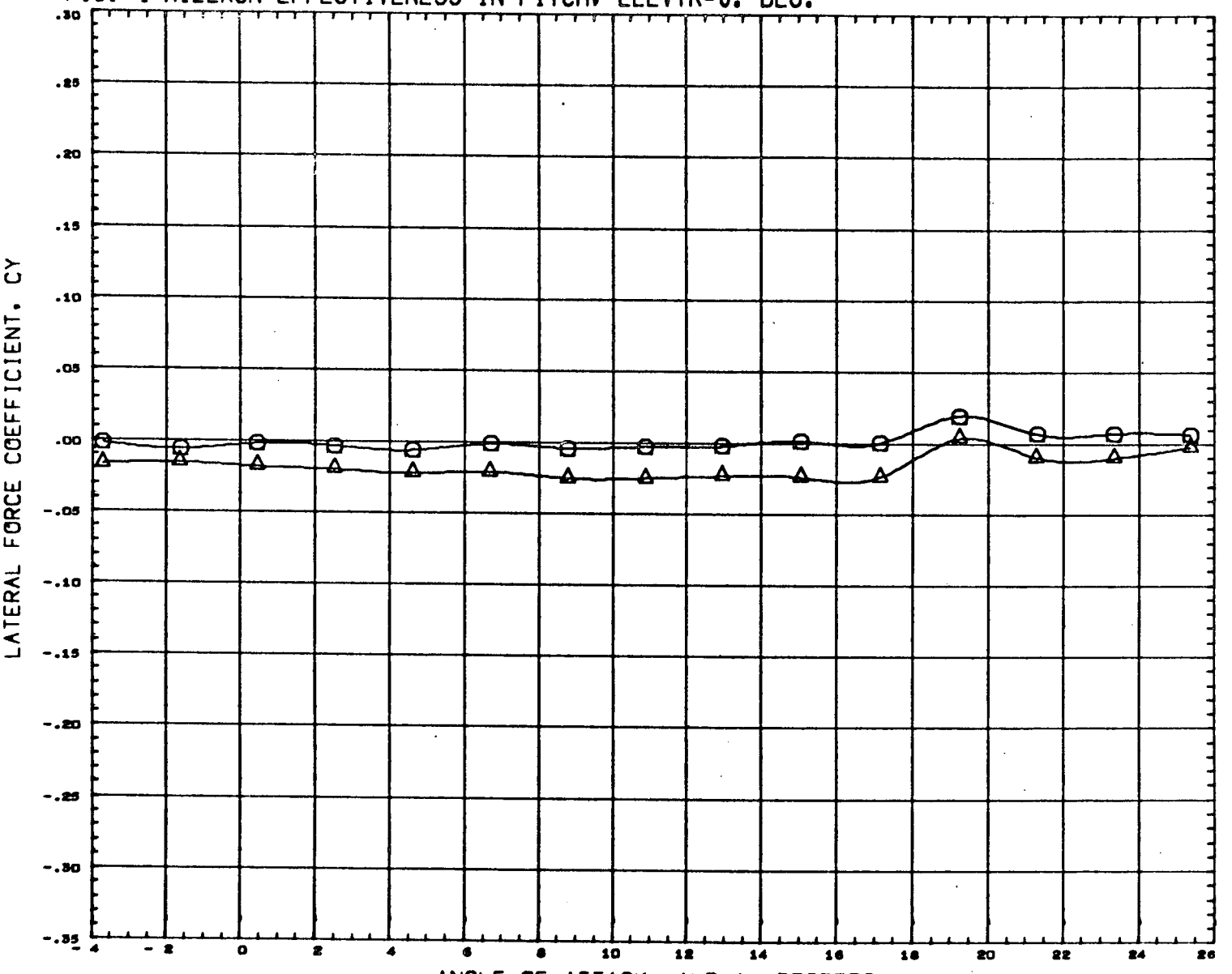


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1010)	△	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-5)V5	5.000	-5.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 4 AILERON EFFECTIVENESS IN PITCH, ELEVTR=0. DEG.



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5
(RD1010)	△	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-5)V5

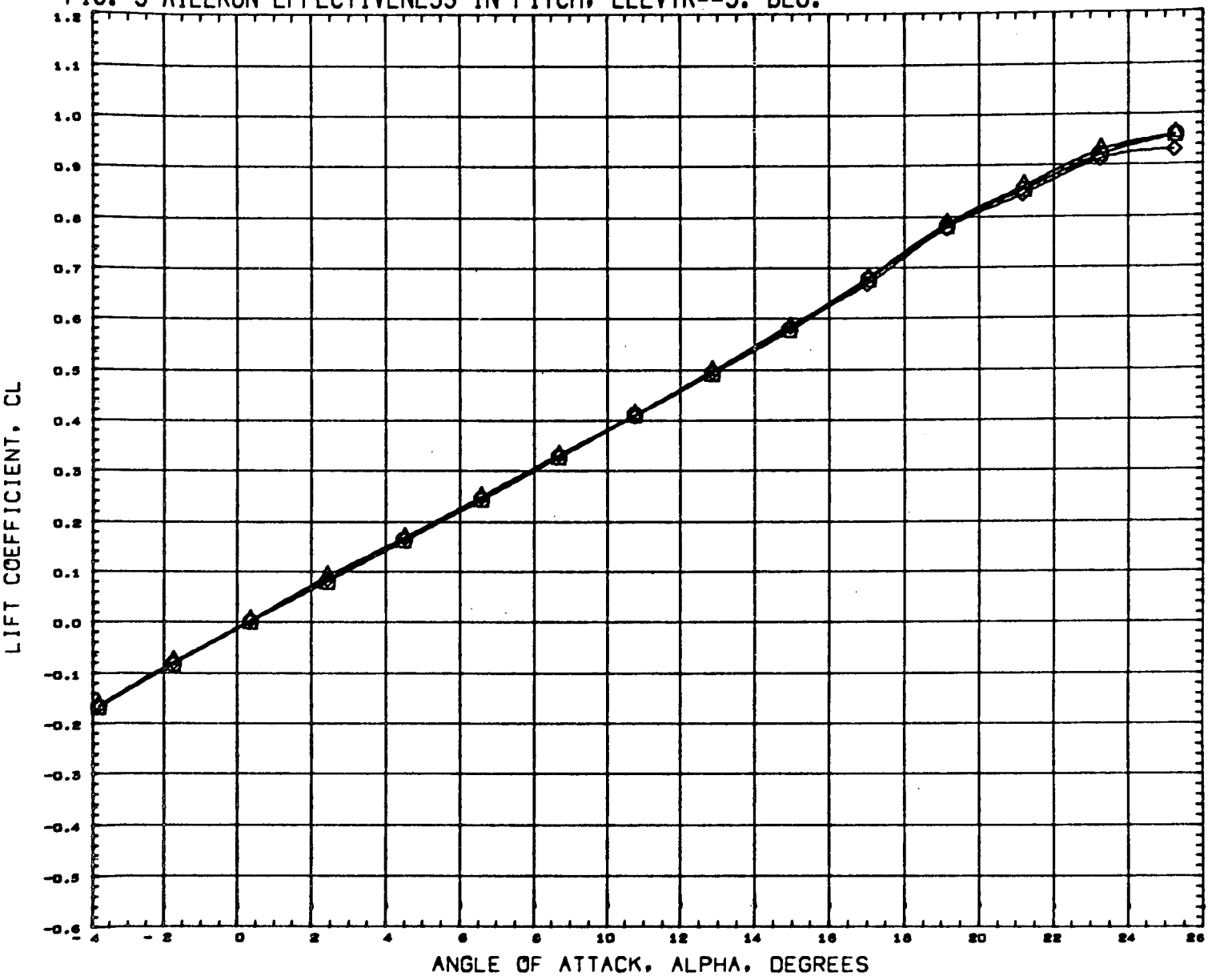
LELEVN	RELEVN	BETA
0.000	0.000	0.000
5.000	-5.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 5 AILERON EFFECTIVENESS IN PITCH, ELEVTR=-5. DEG.

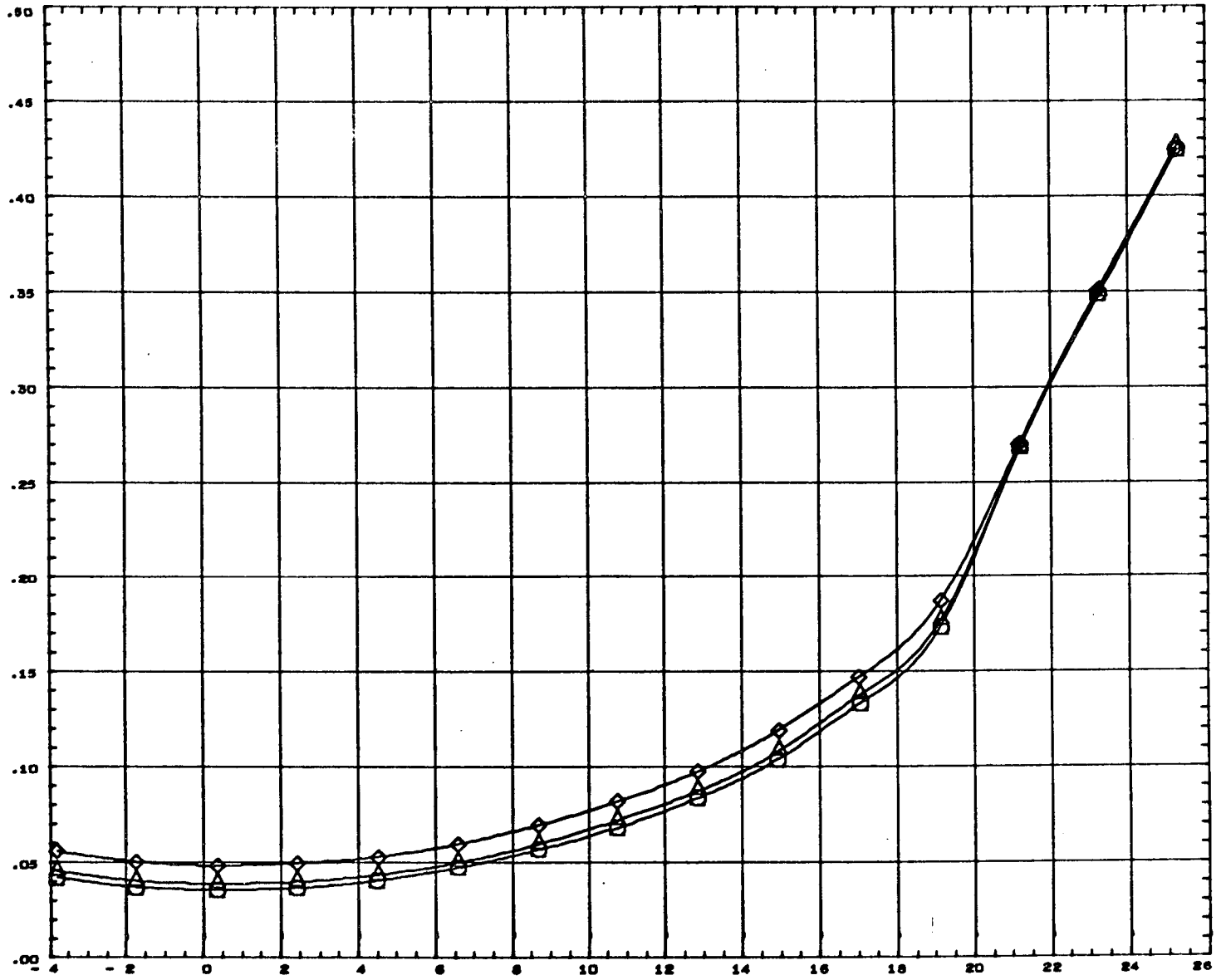


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1006)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5	-5.000	-5.000	0.000
(RD1013)	△	GWTT 292 CONF.H-33 ORBITER B5W4(0,-10)V5	0.000	-10.000	0.000
(RD1011)	◇	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-15)V5	5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 5 AILERON EFFECTIVENESS IN PITCH, ELEVTR=-5. DEG.

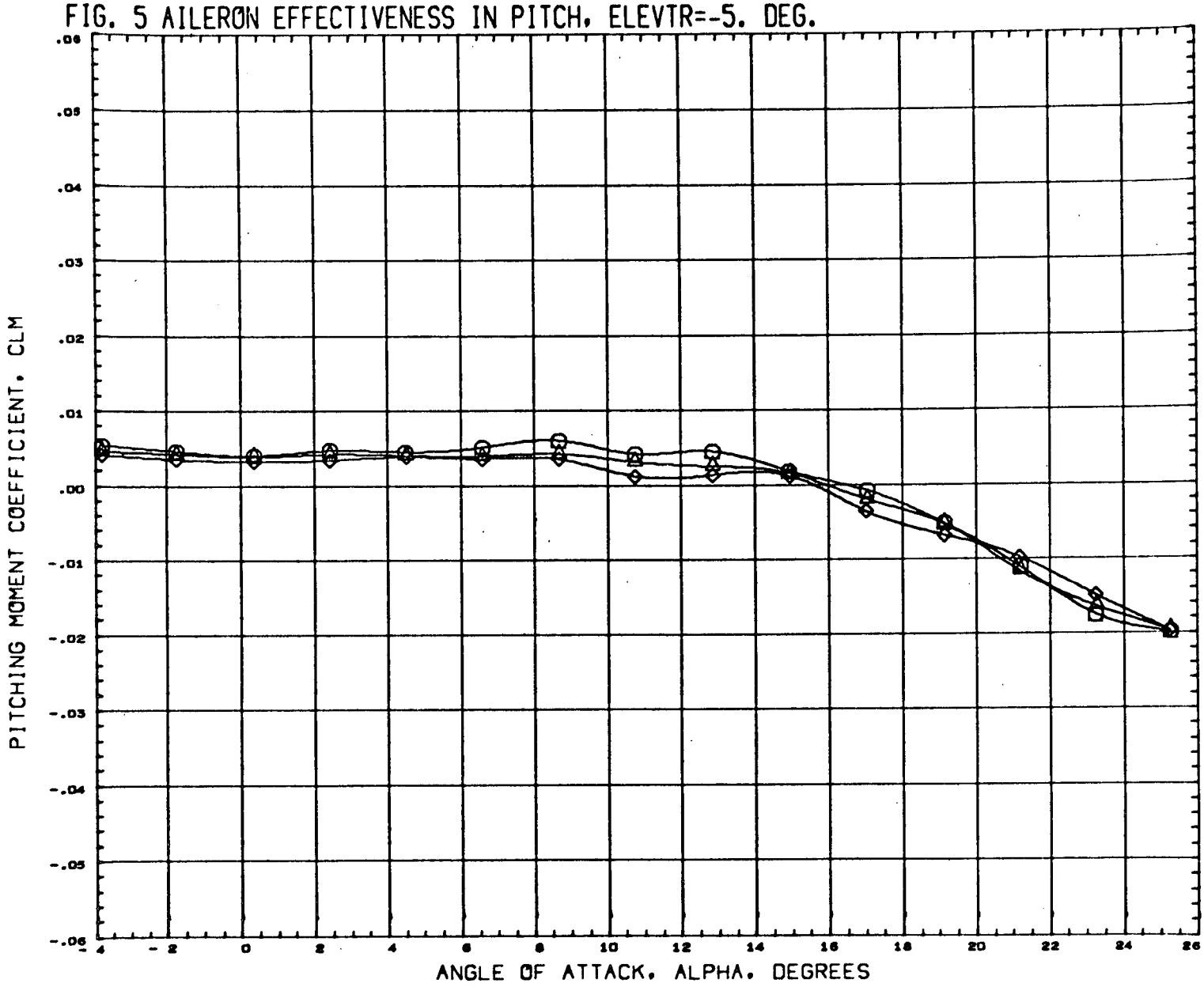


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1006)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5	-5.000	-5.000	0.000
(RD1013)	△	GWTT 292 CONF.H-33 ORBITER B5W4(0,-10)V5	0.000	-10.000	0.000
(RD1011)	◇	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-15)V5	5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 5 AILERON EFFECTIVENESS IN PITCH, ELEVTR=-5. DEG.

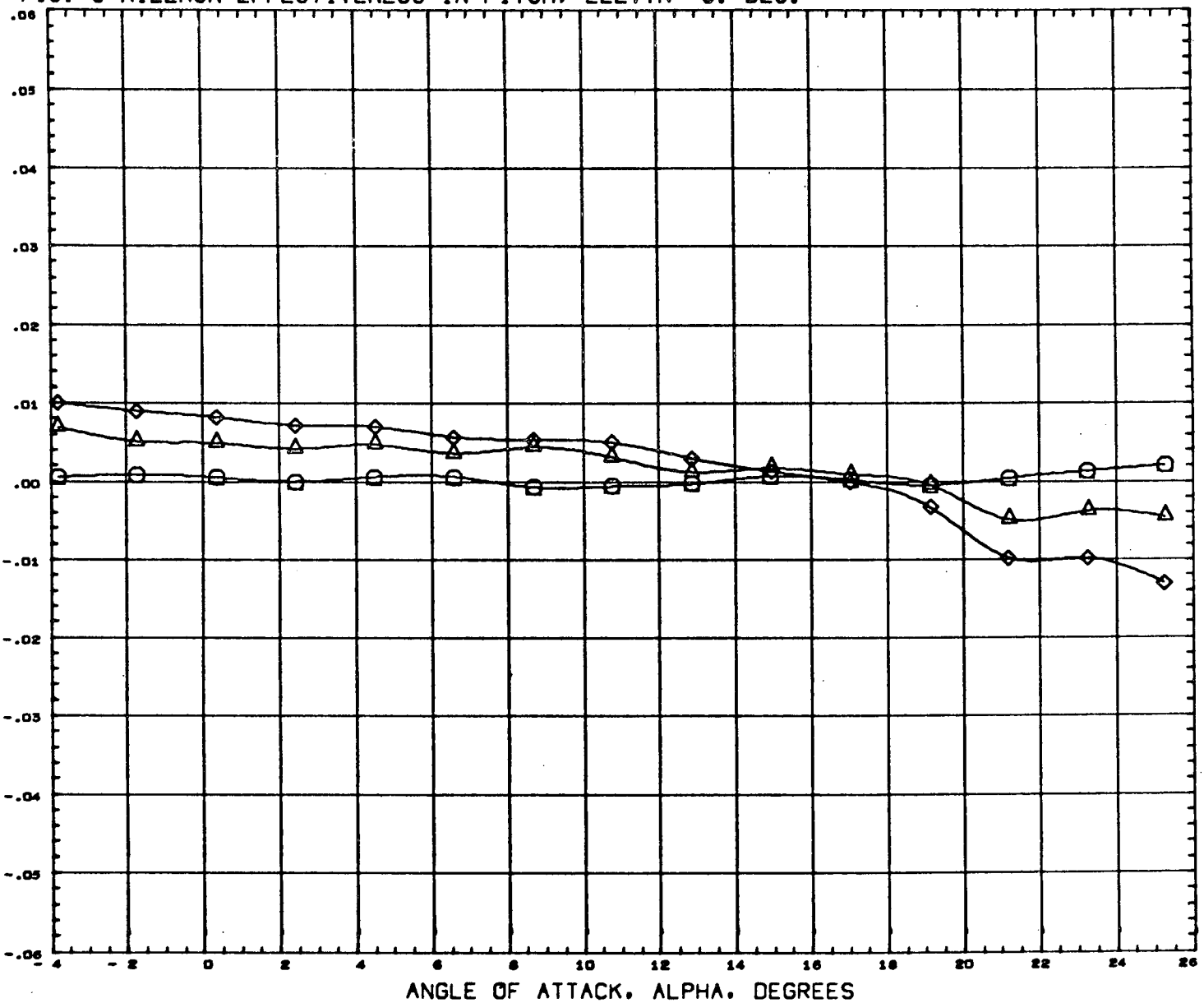


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1006)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5	-5.000	-5.000	0.000
(RD1013)	△	GWTT 292 CONF.H-33 ORBITER B5W4(0,-10)V5	0.000	-10.000	0.000
(RD1011)	◇	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-15)V5	5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 5 AILERON EFFECTIVENESS IN PITCH, ELEVTR=-5. DEG.

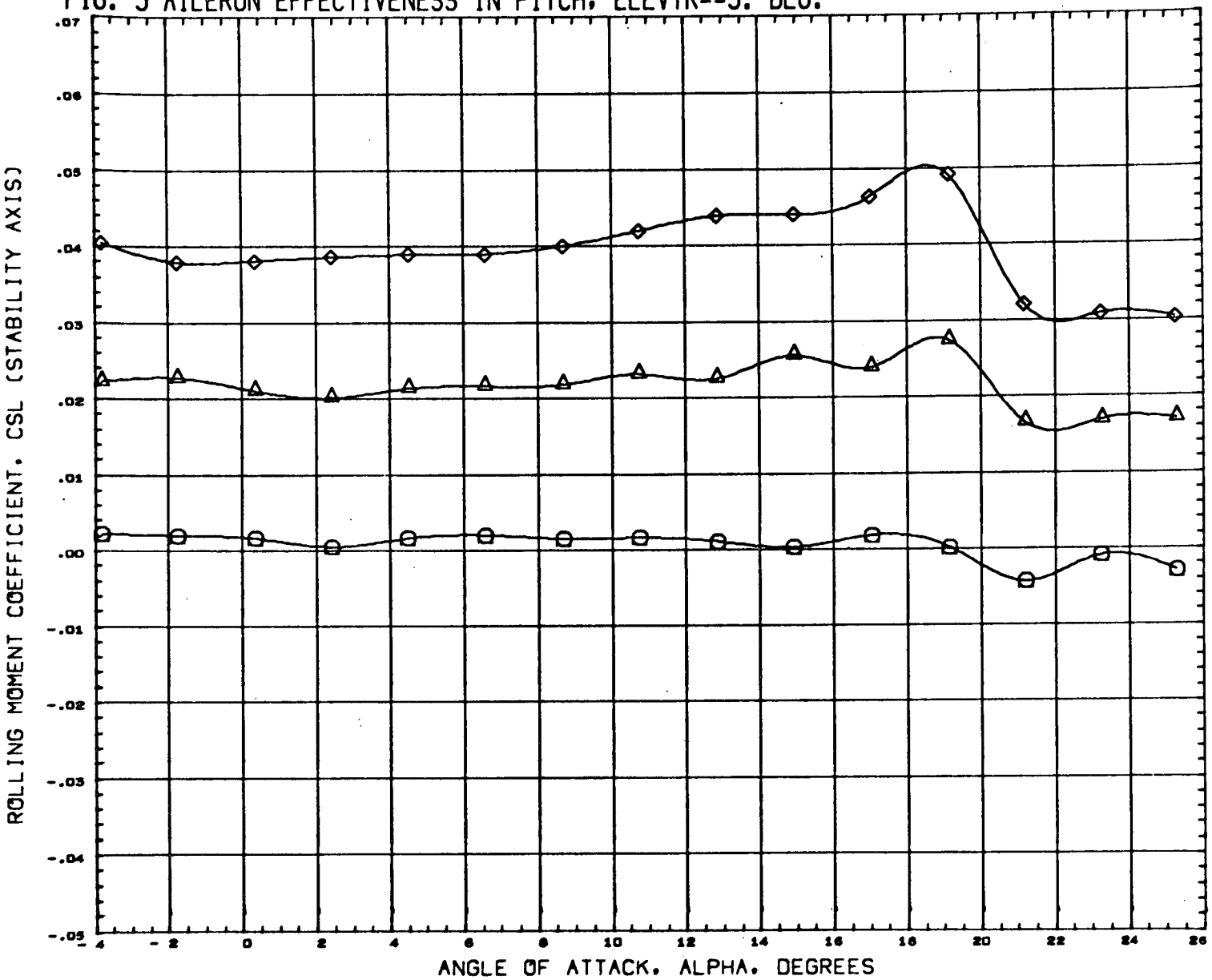


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1006)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5	-5.000	-5.000	0.000
(RD1013)	△	GWTT 292 CONF.H-33 ORBITER B5W4(0,-10)V5	0.000	-10.000	0.000
(RD1011)	◇	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-15)V5	5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 5 AILERON EFFECTIVENESS IN PITCH, ELEVTR=-5. DEG.

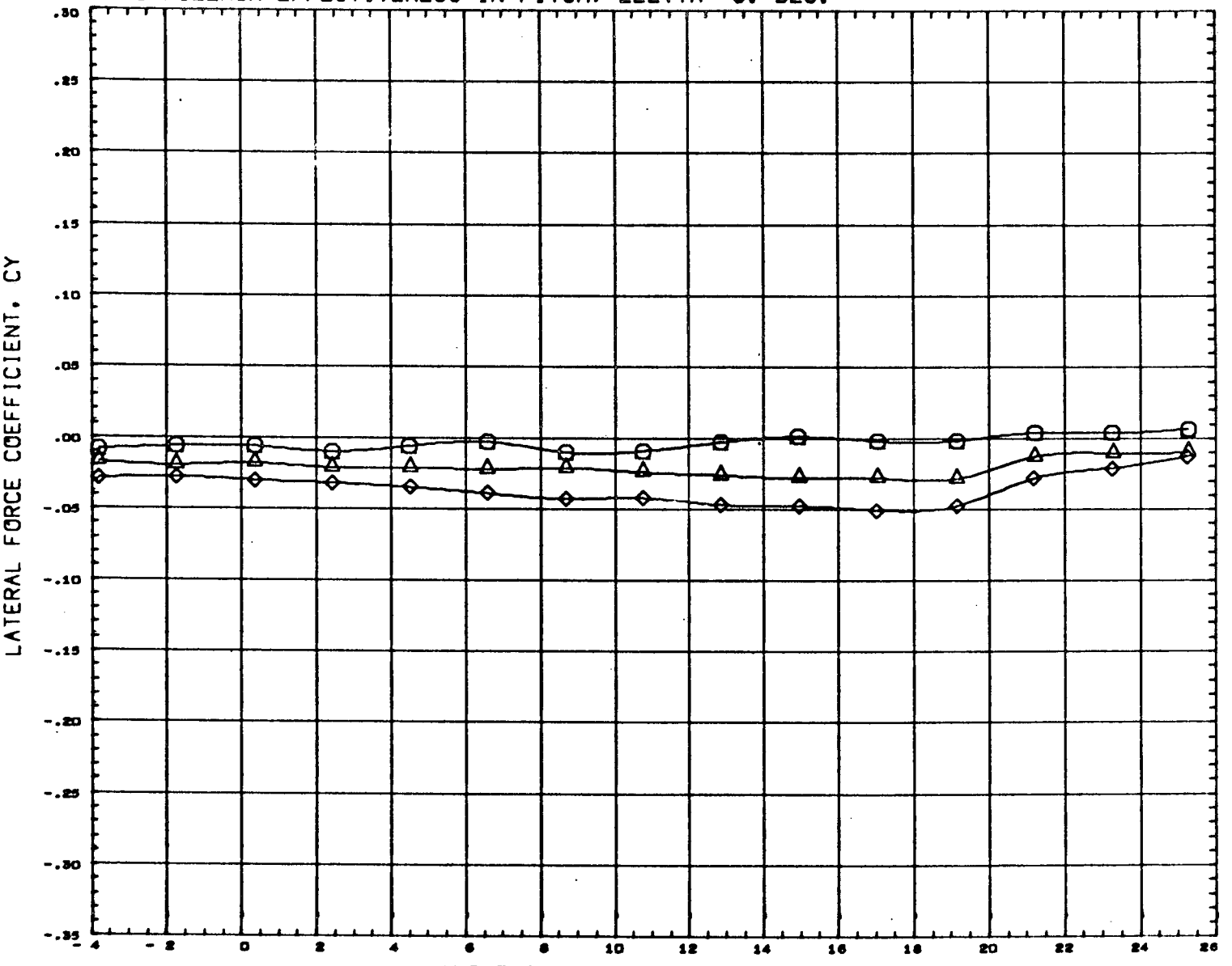


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1006)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5	-5.000	-5.000	0.000
(RD1013)	△	GWTT 292 CONF.H-33 ORBITER B5W4(0,-10)V5	0.000	-10.000	0.000
(RD1011)	◇	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-15)V5.	5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 5 AILERON EFFECTIVENESS IN PITCH, ELEVTR=-5. DEG.

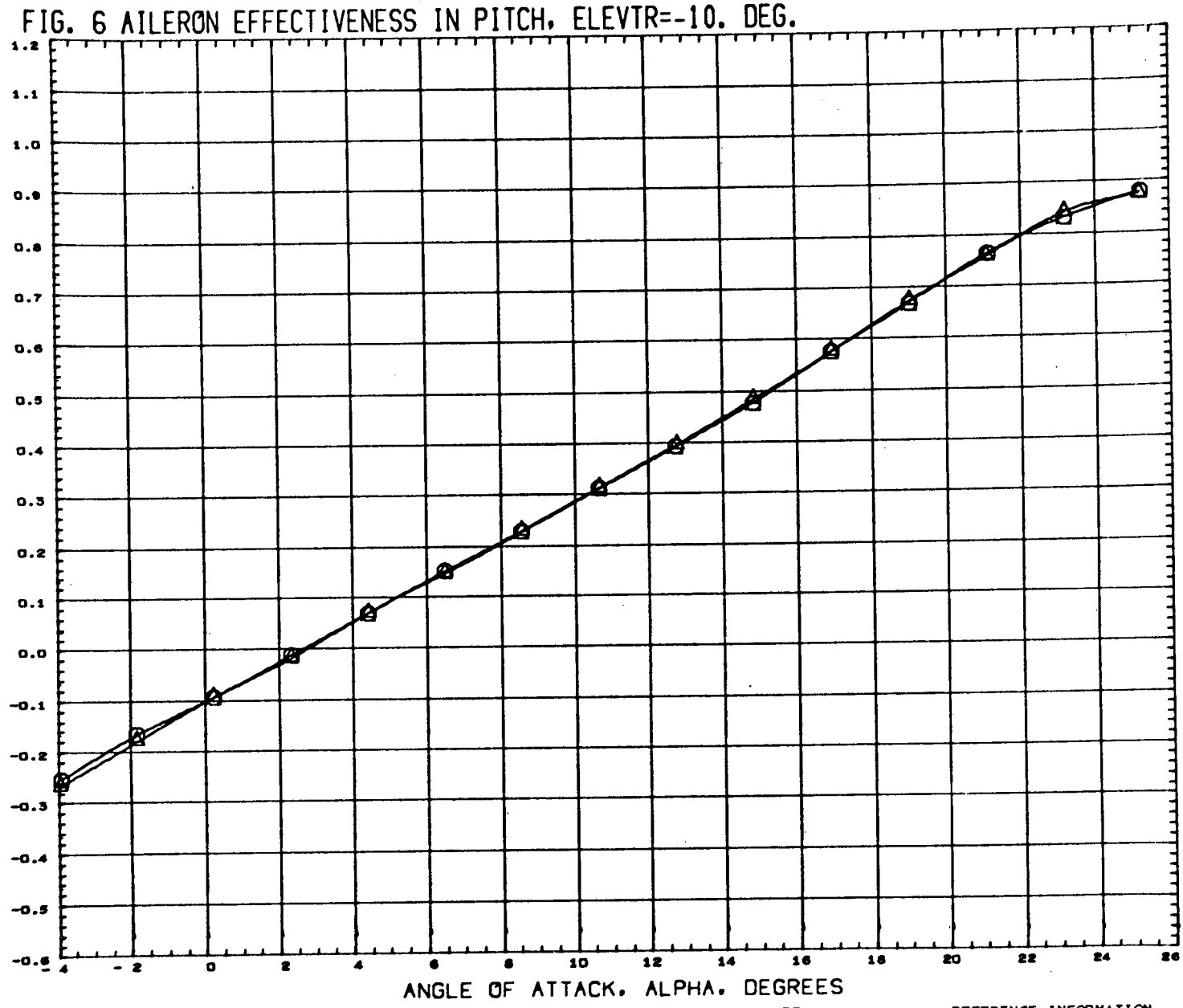


DATA SET SYMBOL		CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1006)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5	-5.000	-5.000	0.000
(RD1013)	△	GWTT 292 CONF.H-33 ORBITER B5W4(0,-10)V5	0.000	-10.000	0.000
(RD1011)	◇	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-15)V5	5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 6 AILERON EFFECTIVENESS IN PITCH, ELEVTR=-10. DEG.



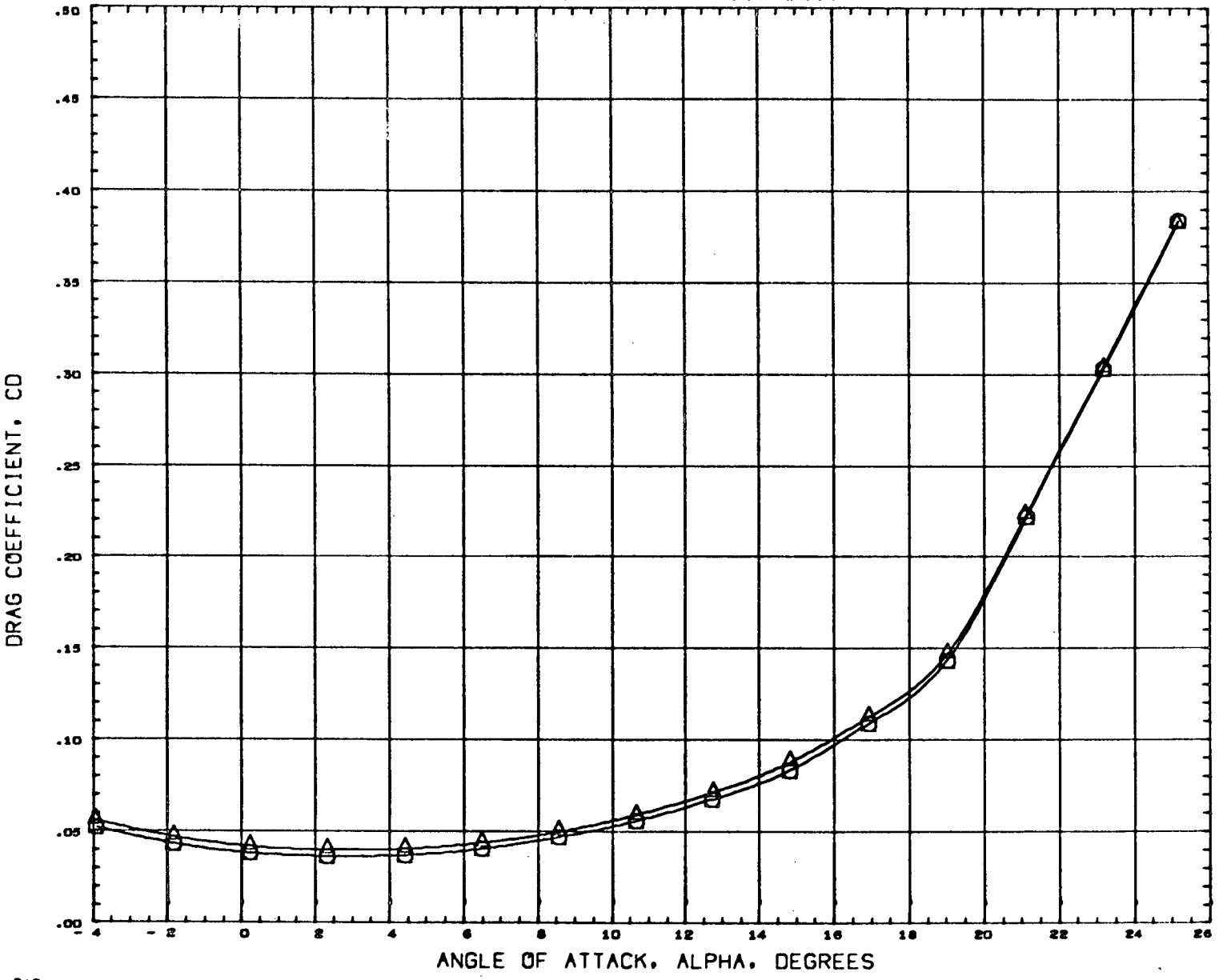
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1007)		GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1012)		GWTT 292 CONF.H-33 ORBITER B5W4(-5,-15)V5	-5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 6 AILERON EFFECTIVENESS IN PITCH, ELEVTR=-10. DEG.



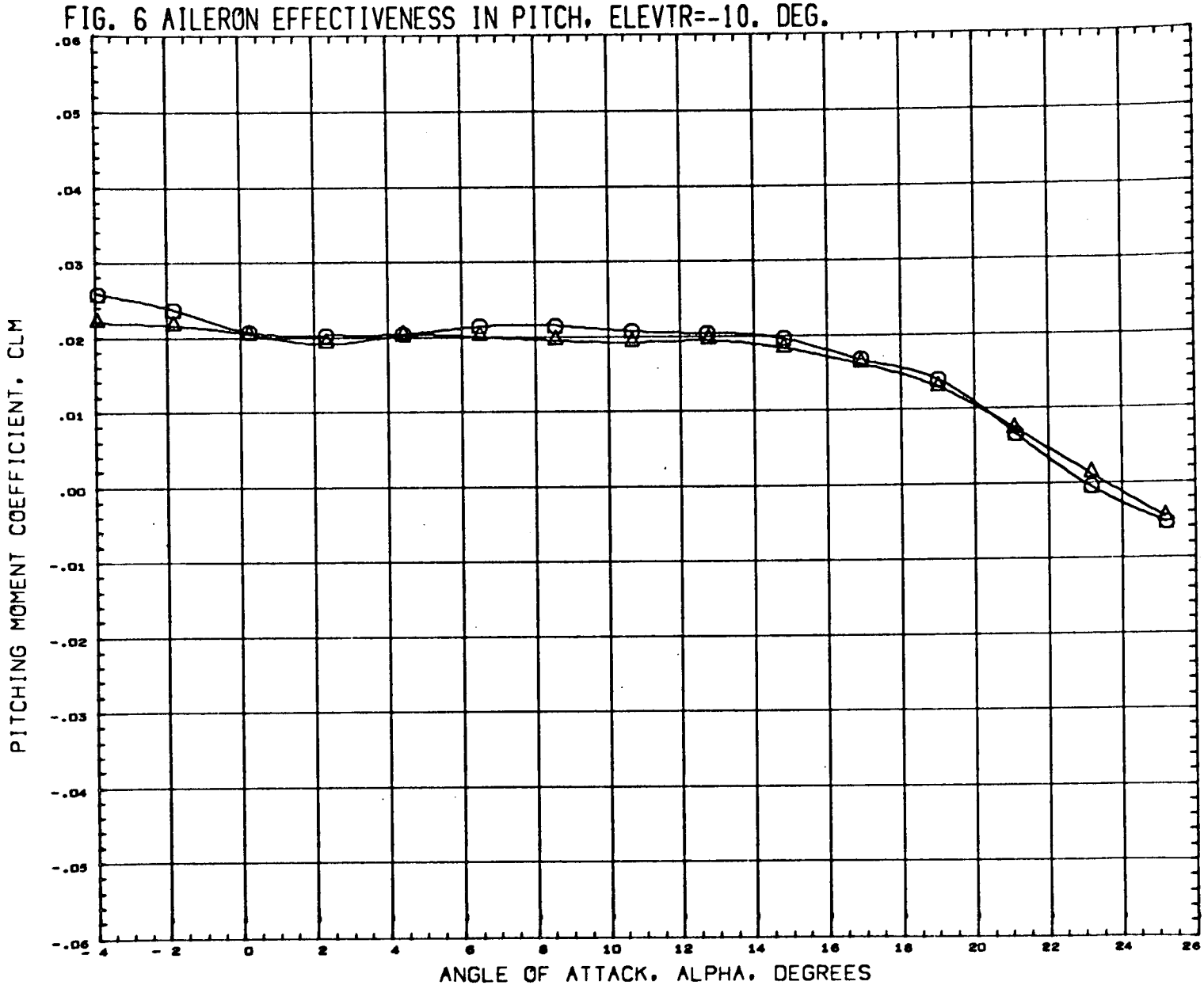
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1007)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1012)	△	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-15)V5	-5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 6 AILERON EFFECTIVENESS IN PITCH, ELEVTR=-10. DEG.

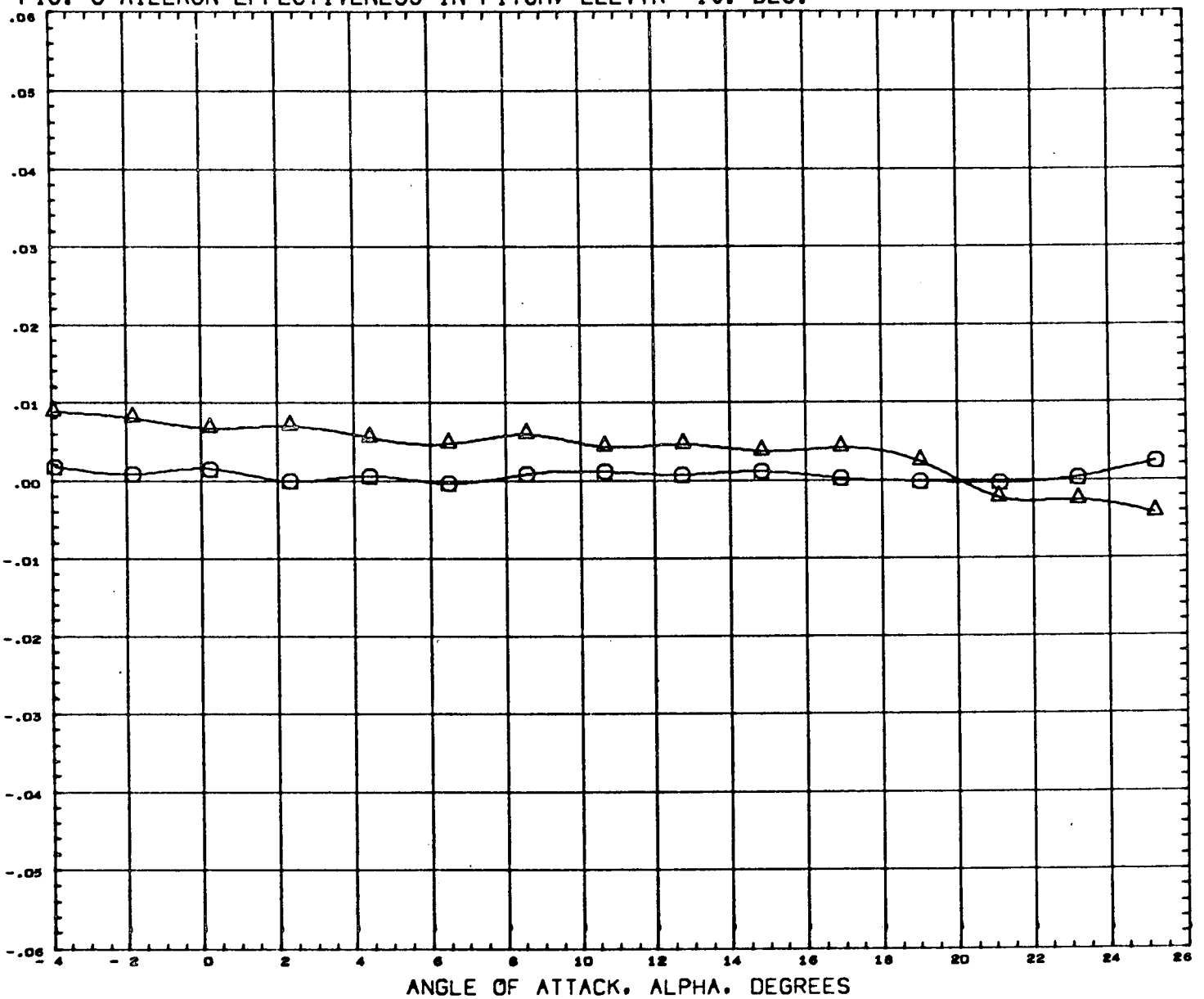


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1007)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1012)	△	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-15)V5	-5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 6 AILERØN EFFECTIVENESS IN PITCH, ELEVTR=-10. DEG.



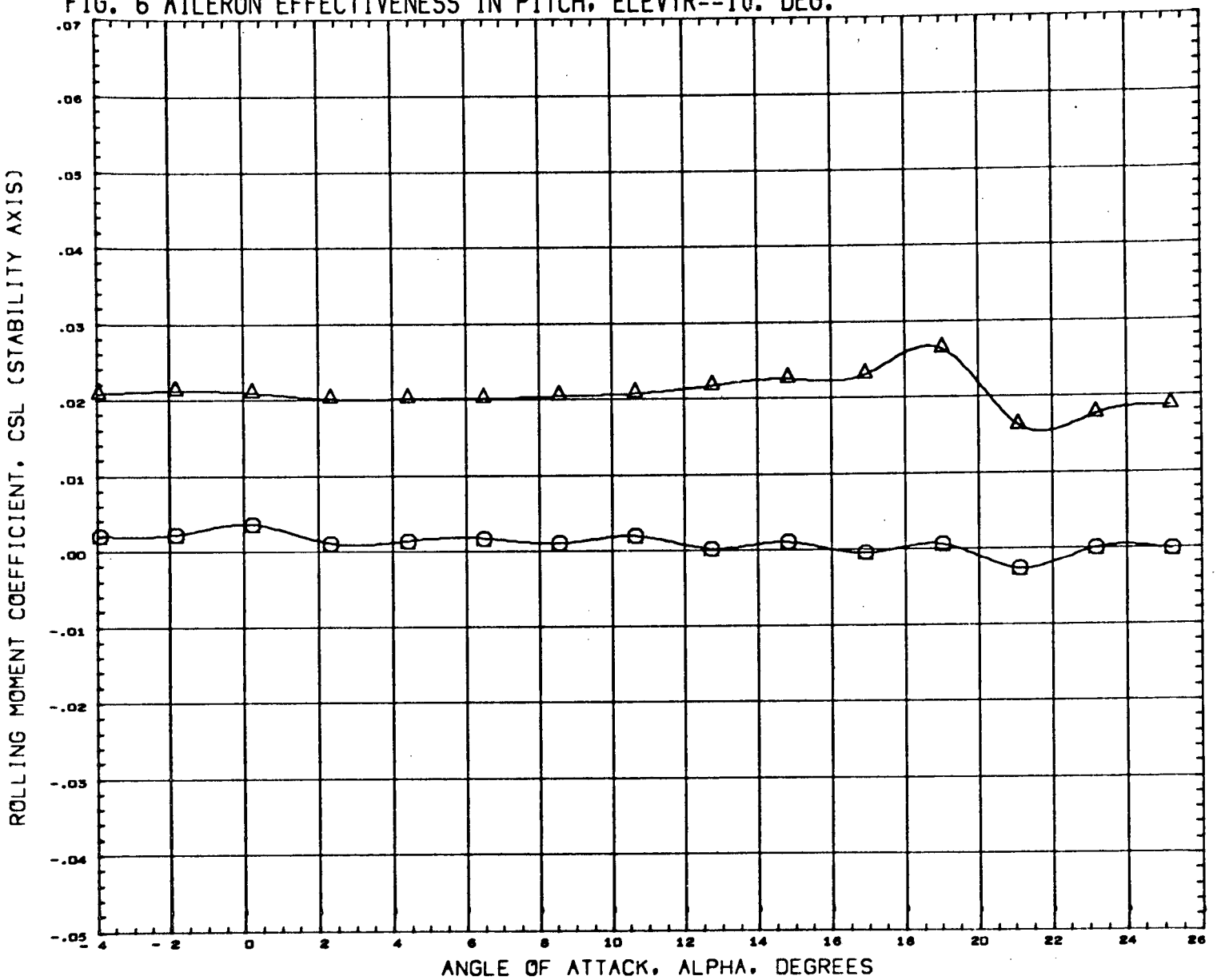
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1007)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1012)	△	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-15)V5	-5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 6 AILERON EFFECTIVENESS IN PITCH, ELEVTR=-10. DEG.

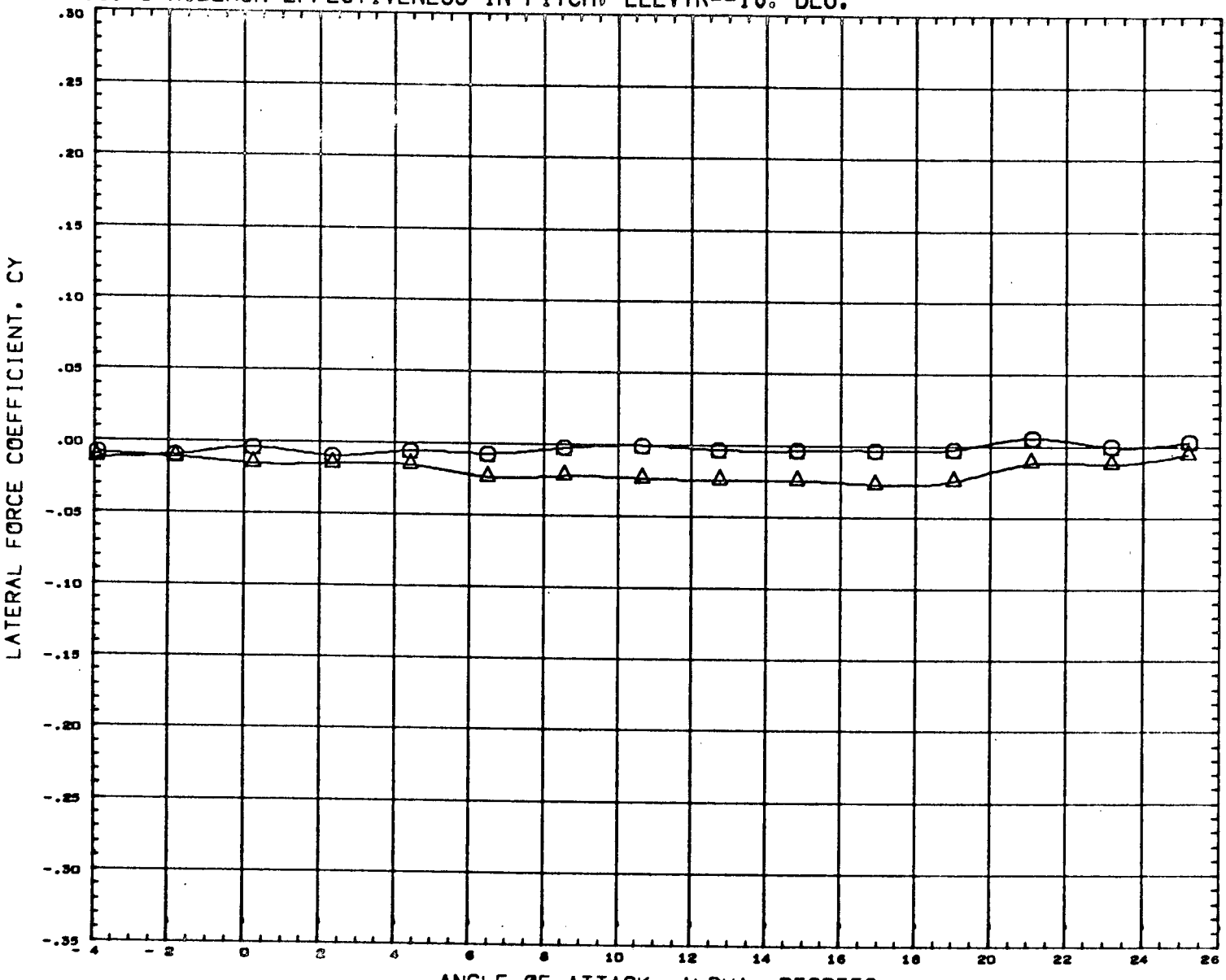


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1007)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1012)	△	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-15)V5	-5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 6 AILERON EFFECTIVENESS IN PITCH. ELEVTR=-10. DEG.

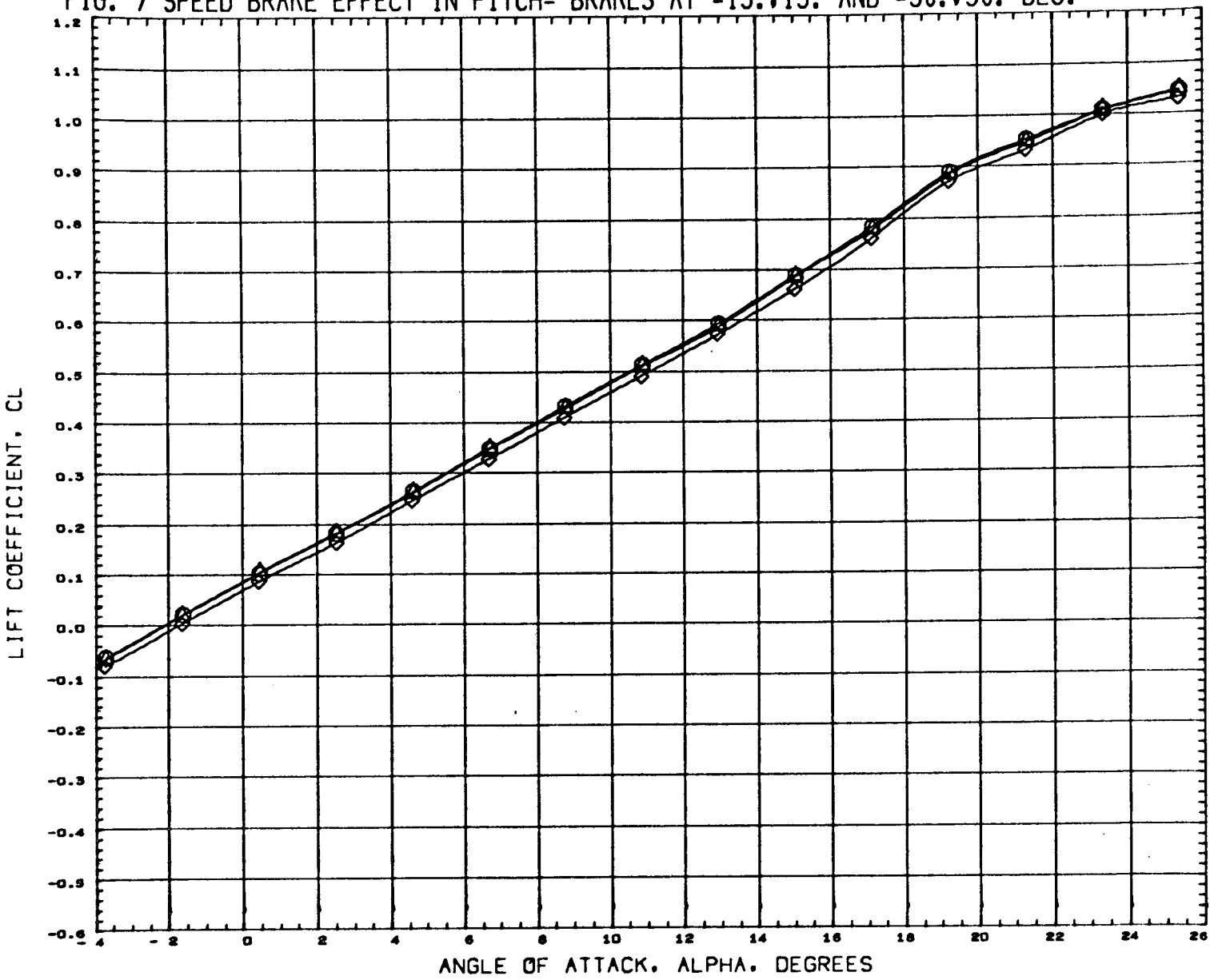


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	BETA
(RD1007)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1012)	△	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-15)V5	-5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 7 SPEED BRAKE EFFECT IN PITCH- BRAKES AT -15.,15. AND -30.,30. DEG.

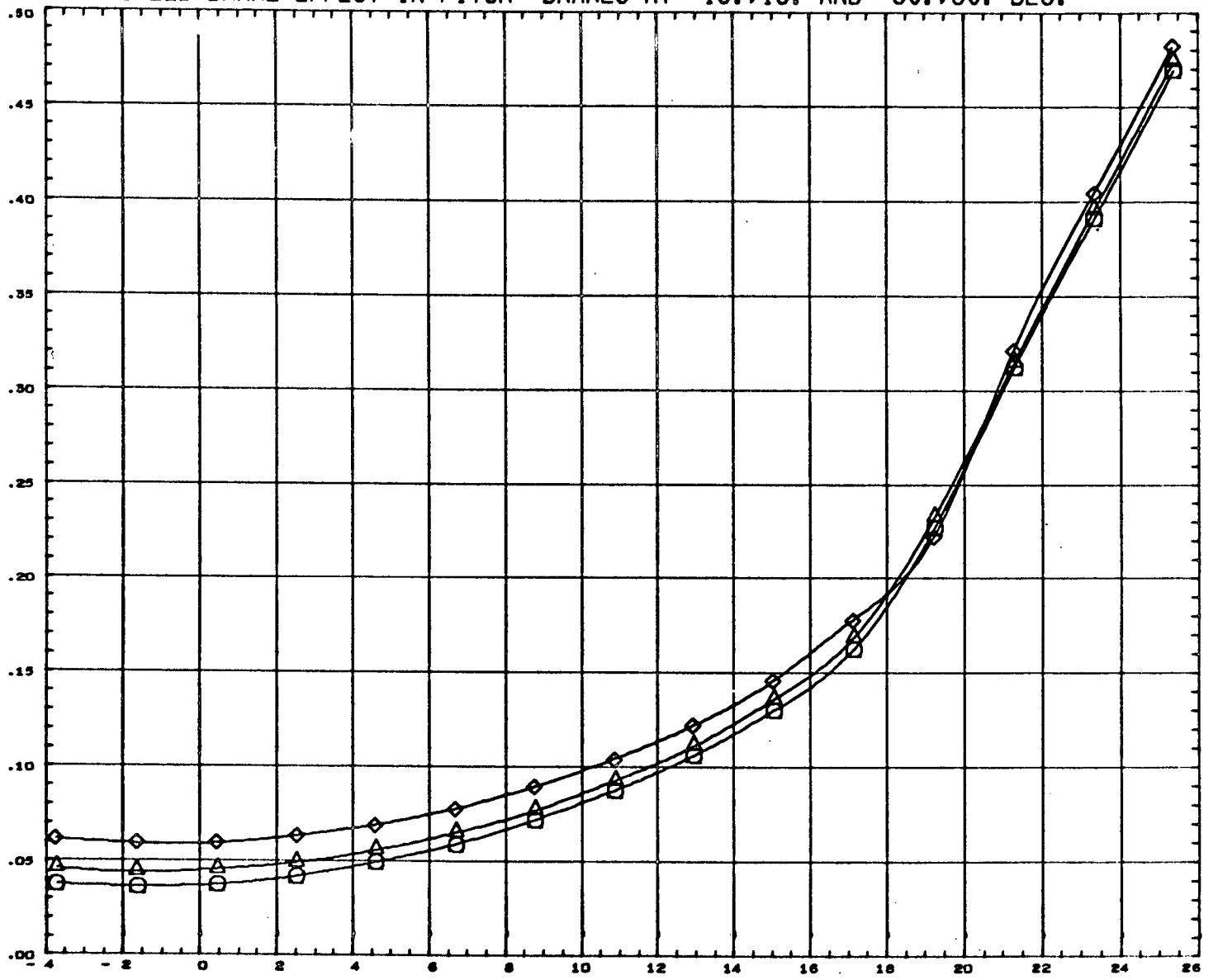


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000	0.000
(RD1014)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000	15.000	-15.000	0.000
(RD1015)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 7 SPEED BRAKE EFFECT IN PITCH- BRAKES AT -15.,15. AND -30.,30. DEG.

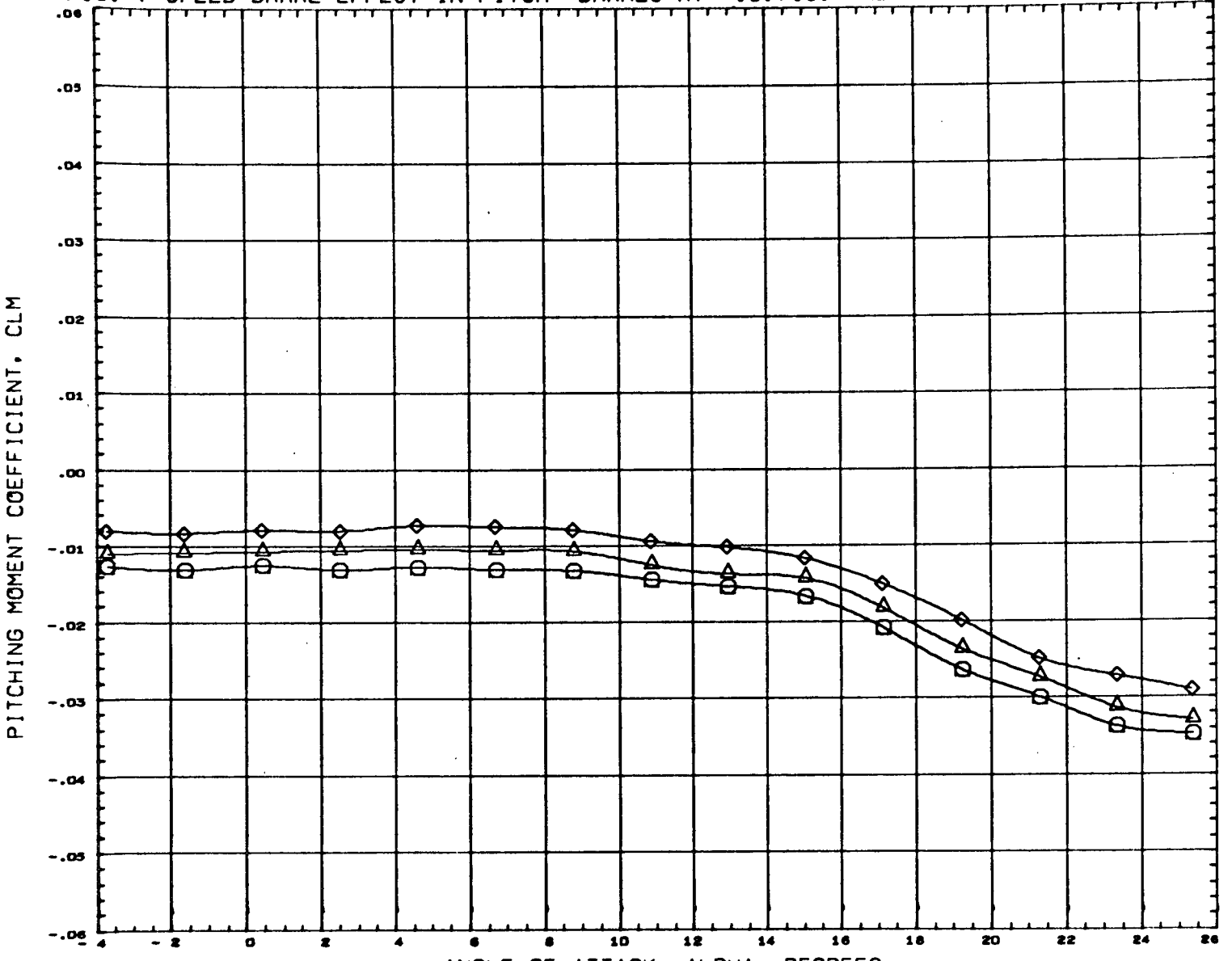


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000	0.000
(RD1014)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000	15.000	-15.000	0.000
(RD1015)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 7 SPEED BRAKE EFFECT IN PITCH- BRAKES AT -15.,15. AND -30.,30. DEG.

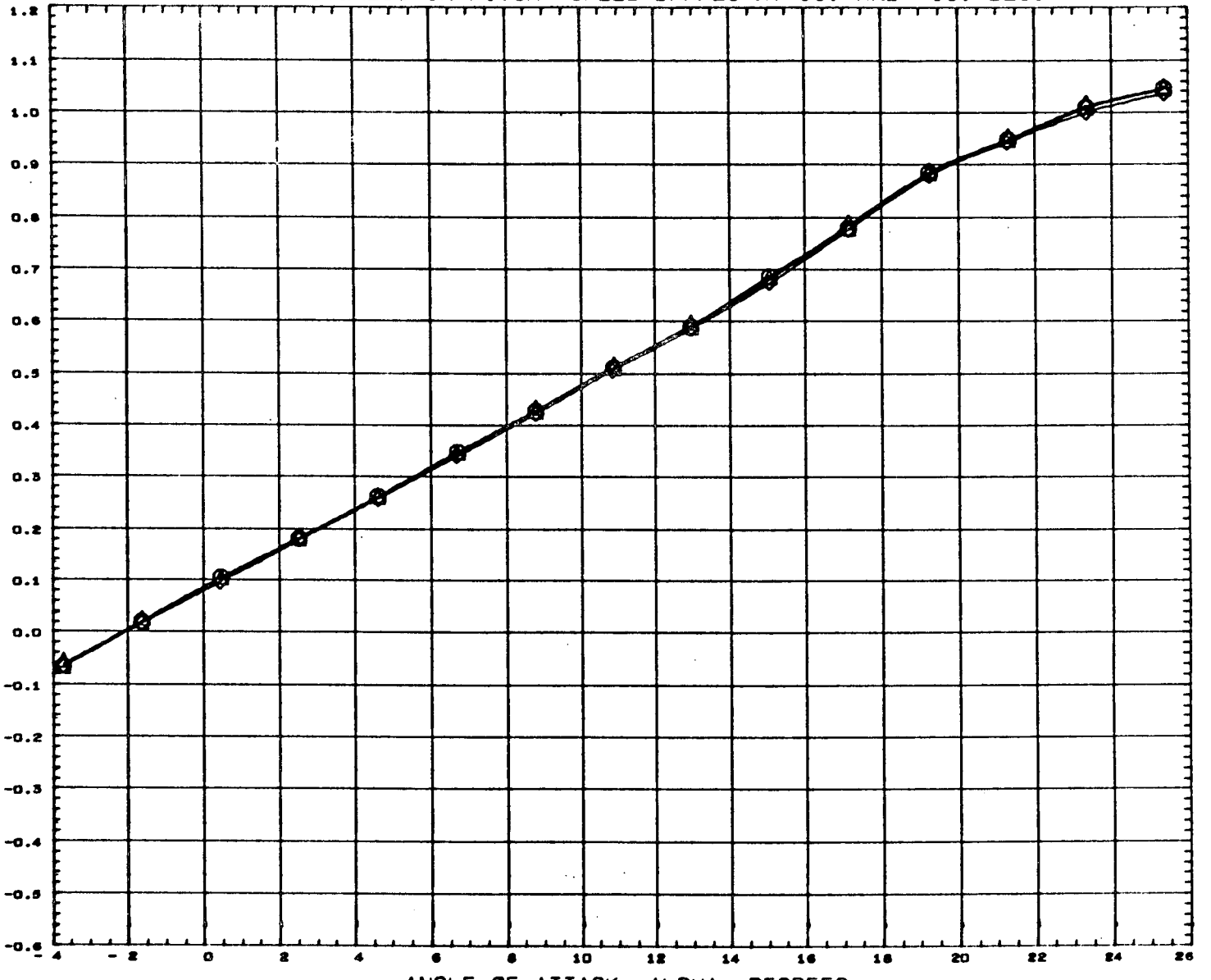


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000	0.000
(RD1014)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000	15.000	-15.000	0.000
(RD1015)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 8 RUDDER EFFECTIVENESS IN PITCH- SPEED BRAKES AT 15. AND -15. DEG.

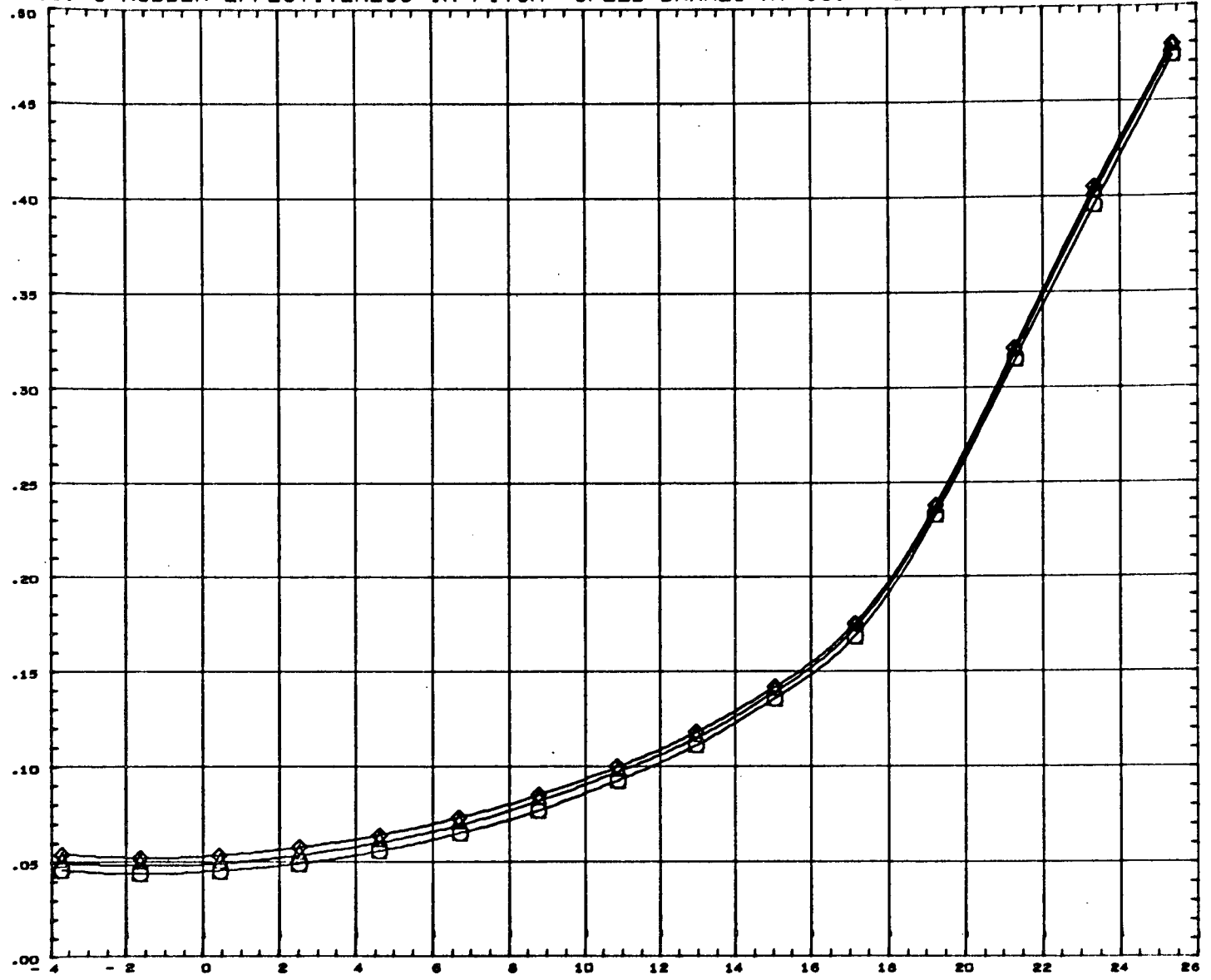


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1014)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000	15.000	-15.000	0.000
(RD1016)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+5,-25)	-10.000	5.000	-25.000	0.000
(RD1017)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,0,-30)	-15.000	0.000	-30.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 8 RUDDER EFFECTIVENESS IN PITCH- SPEED BRAKES AT 15. AND -15. DEG.

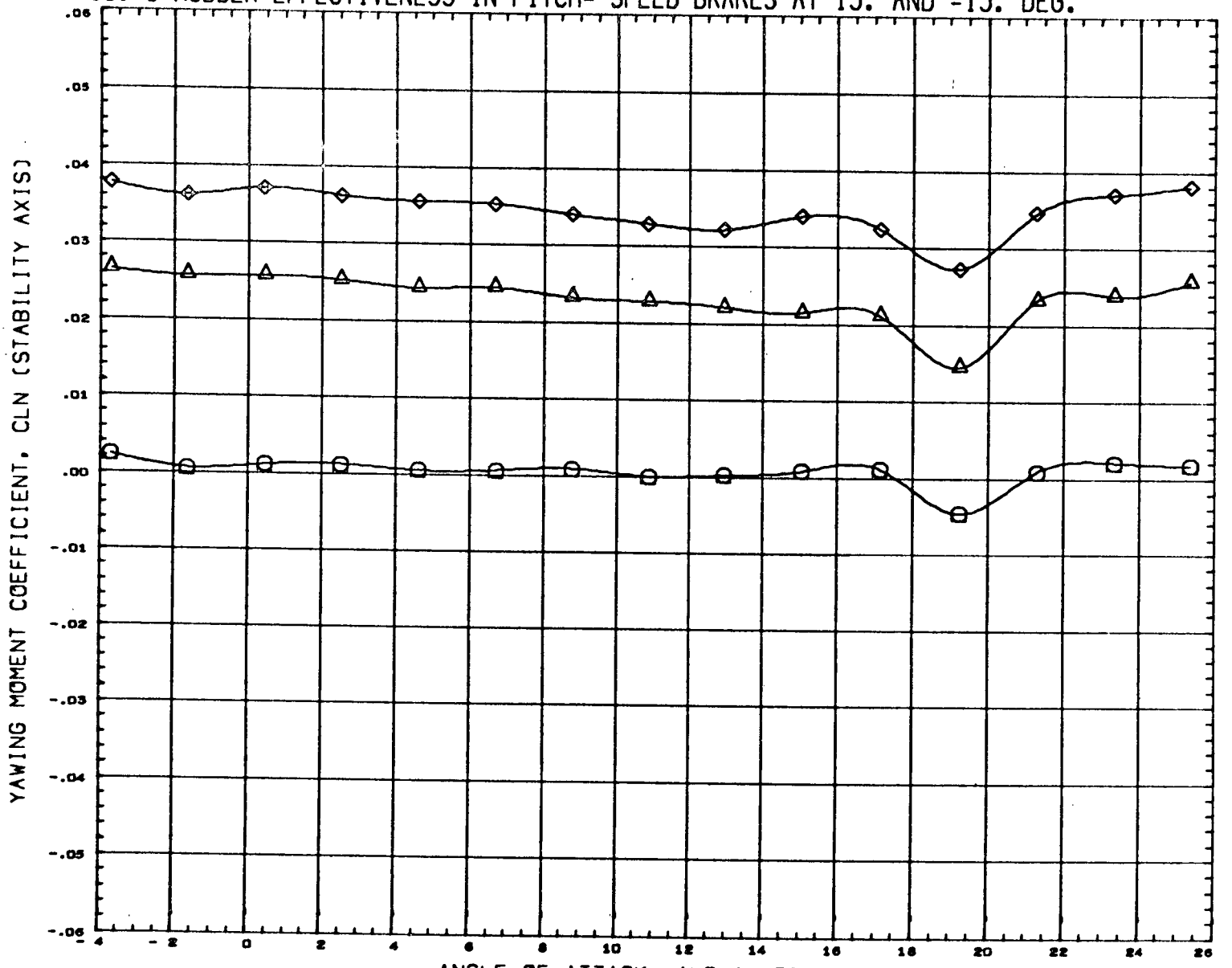


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1014)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000	15.000	-15.000	0.000
(RD1016)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+5,-25)	-10.000	5.000	-25.000	0.000
(RD1017)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,0,-30)	-15.000	0.000	-30.000	0.000

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 8 RUDDER EFFECTIVENESS IN PITCH- SPEED BRAKES AT 15. AND -15. DEG.



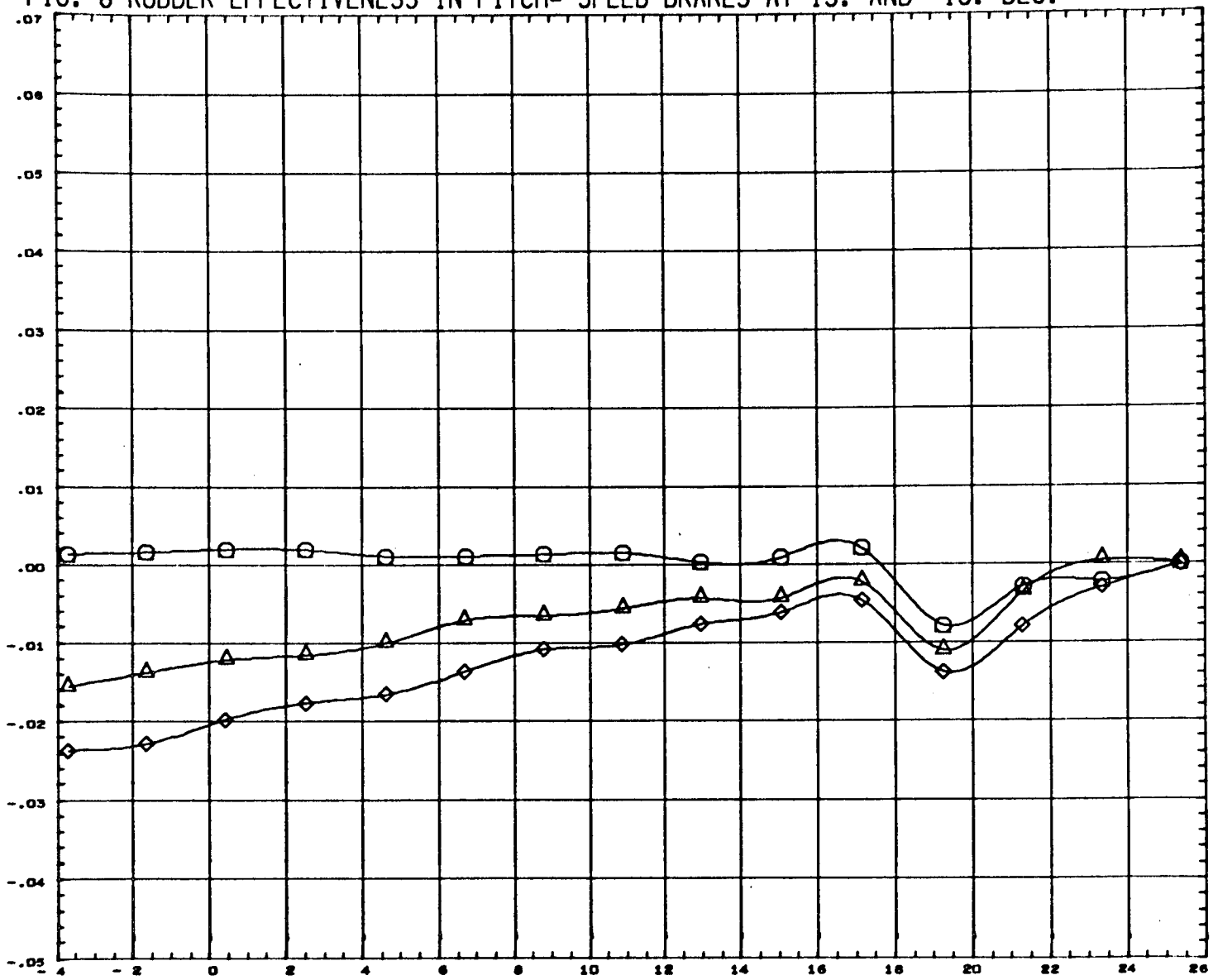
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1014)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)
(RD1016)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+5,-25)
(RD1017)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,0,-30)

TRUDDR	LLRUDD	LRRUDD	BETA
0.000	15.000	-15.000	0.000
-10.000	5.000	-25.000	0.000
-15.000	0.000	-30.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 8 RUDDER EFFECTIVENESS IN PITCH- SPEED BRAKES AT 15. AND -15. DEG.

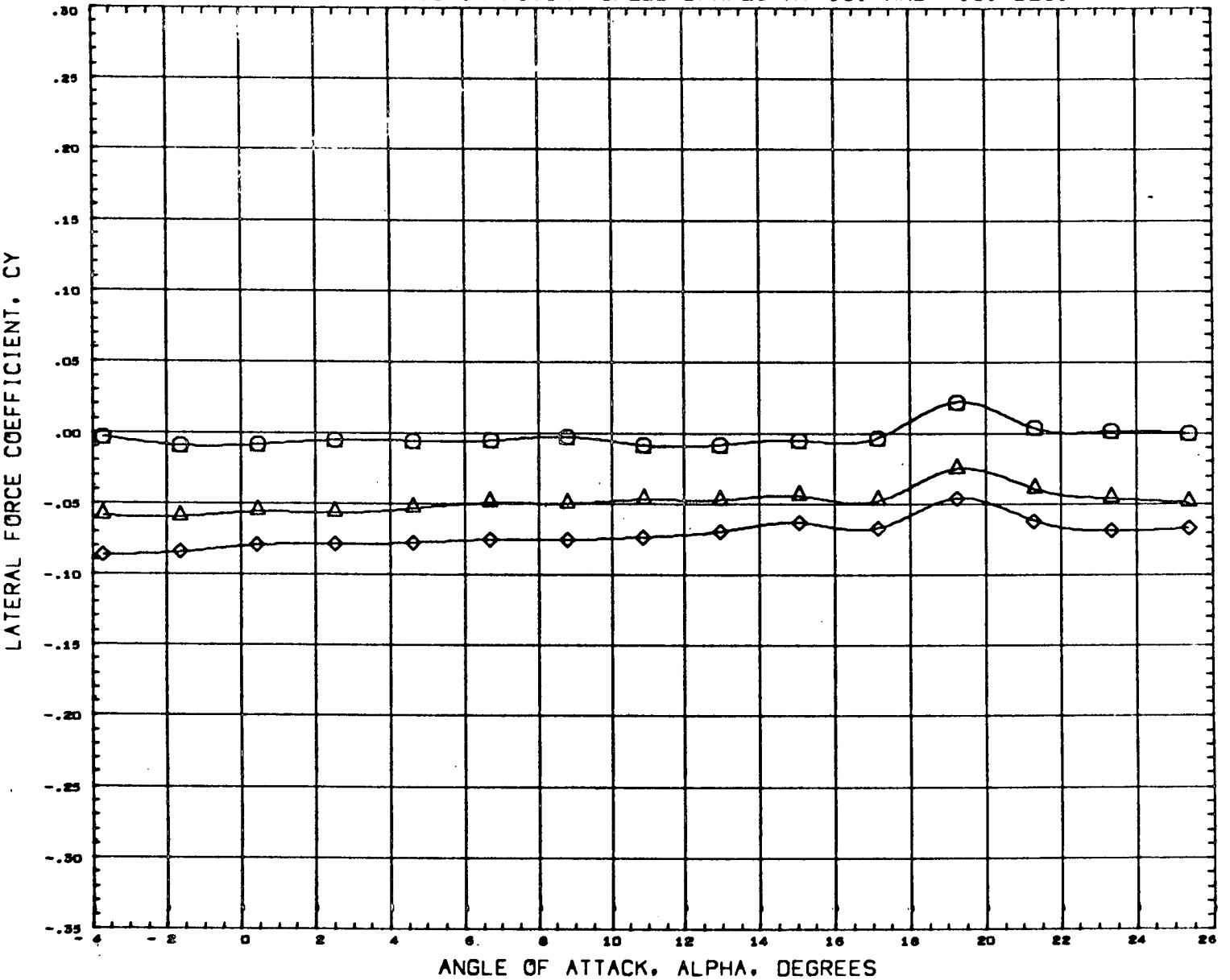


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1014)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000	15.000	-15.000	0.000
(RD1016)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+5,-25)	-10.000	5.000	-25.000	0.000
(RD1017)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,0,-30)	-15.000	0.000	-30.000	0.000

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 8 RUDDER EFFECTIVENESS IN PITCH- SPEED BRAKES AT 15. AND -15. DEG.

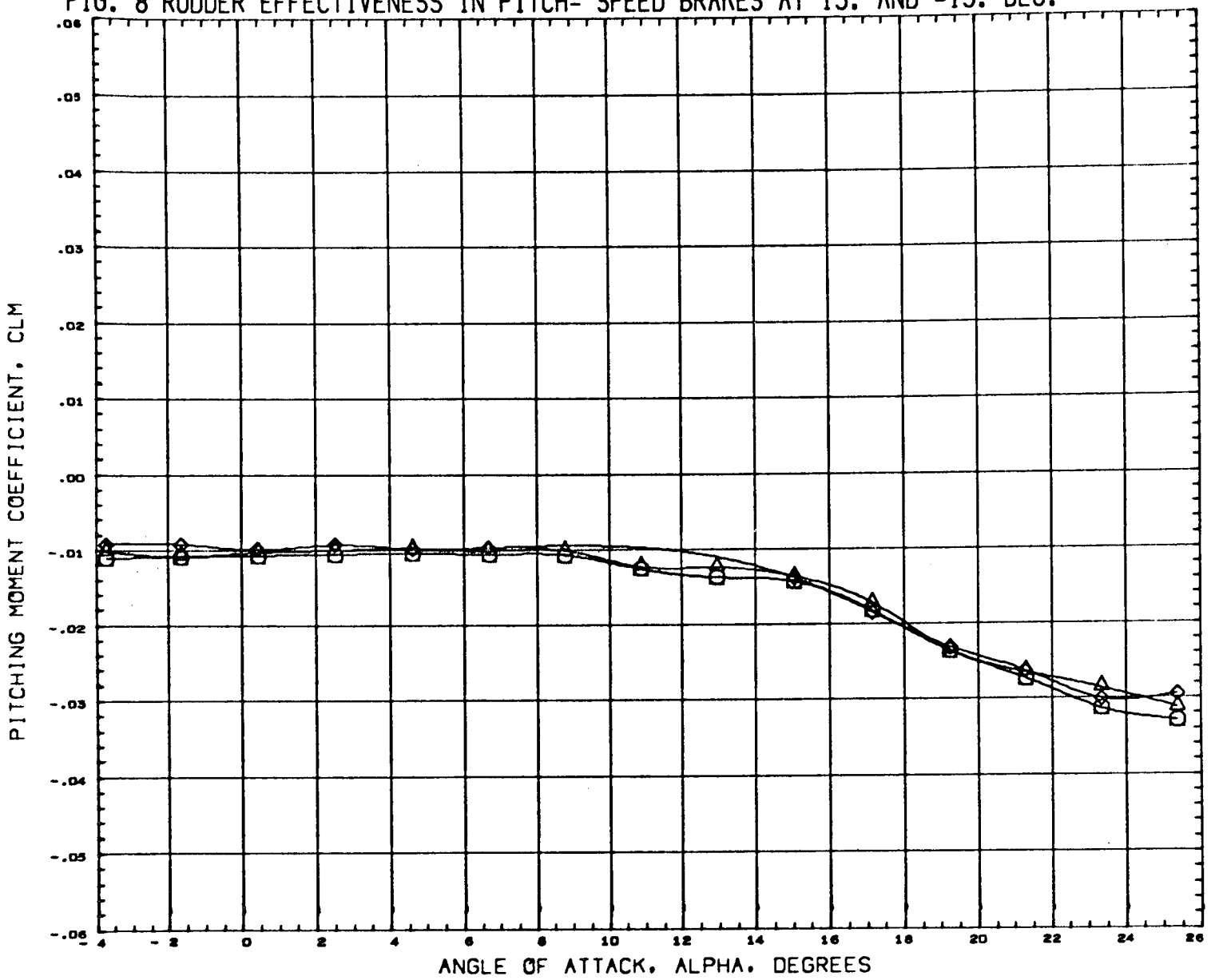


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1014)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000	15.000	-15.000	0.000
(RD1016)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+5,-25)	-10.000	5.000	-25.000	0.000
(RD1017)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,0,-30)	-15.000	0.000	-30.000	0.000

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 8 RUDDER EFFECTIVENESS IN PITCH- SPEED BRAKES AT 15. AND -15. DEG.

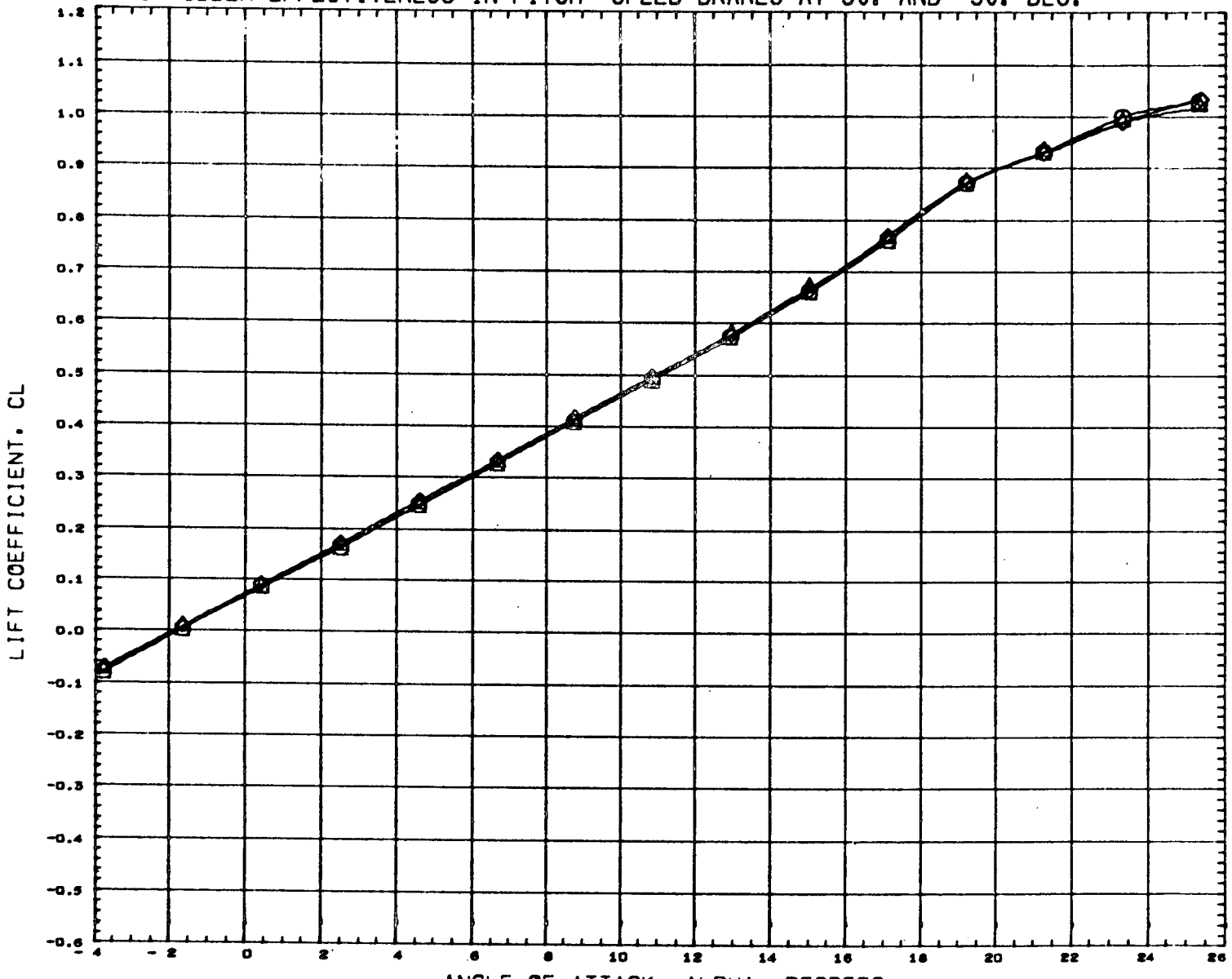


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1014)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000	15.000	-15.000	0.000
(RD1016)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+5,-25)	-10.000	5.000	-25.000	0.000
(ZD1017)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,0,-30)	-15.000	0.000	-30.000	0.000

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 9 RUDDER EFFECTIVENESS IN PITCH- SPEED BRAKES AT 30. AND -30. DEG.

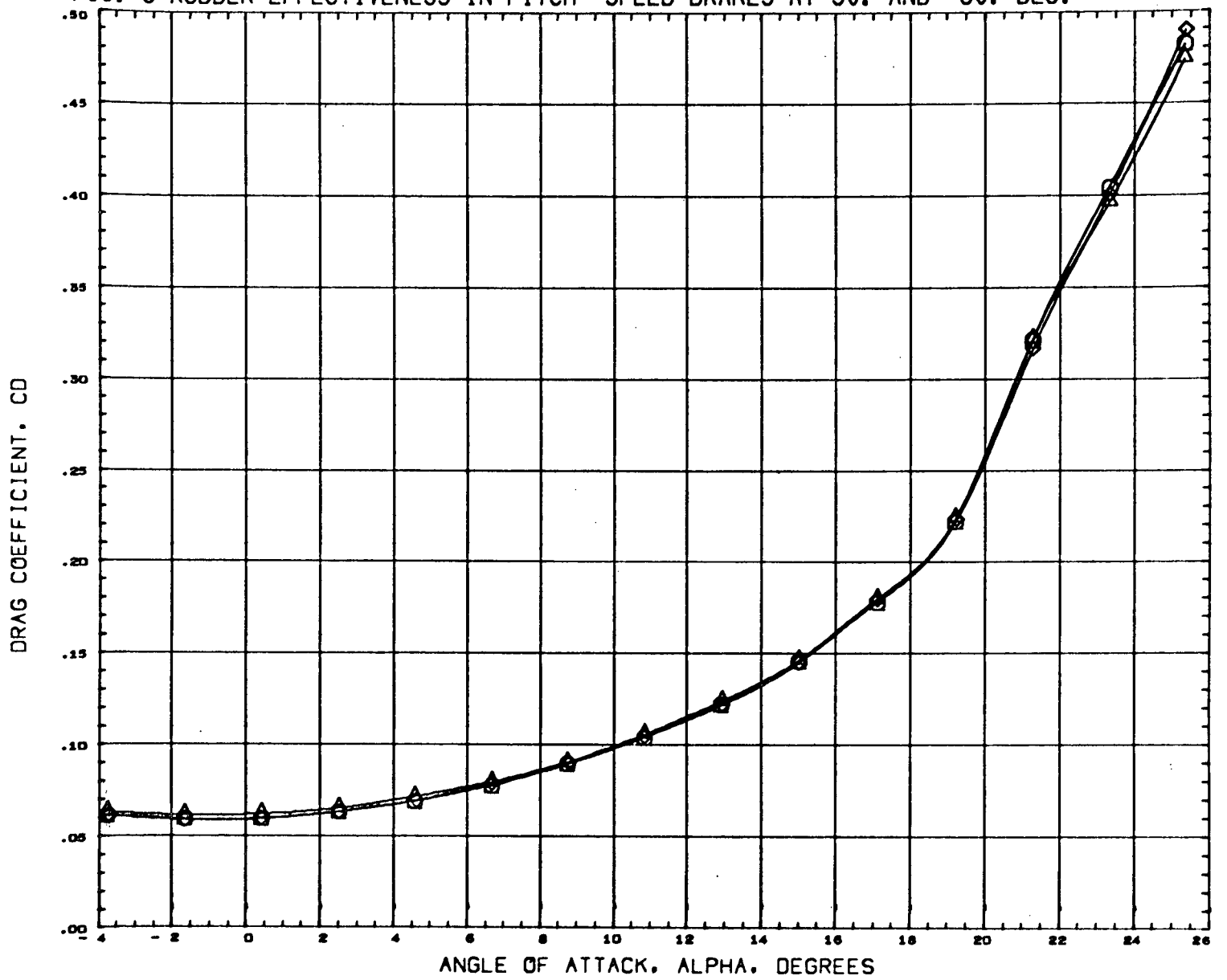


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1015)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000
(RD1018)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,+25,-35)	-15.000	25.000	-35.000	0.000
(RD1055)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5,+25,-35)	-5.000	25.000	-35.000	

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 9 RUDDER EFFECTIVENESS IN PITCH- SPEED BRAKES AT 30. AND -30. DEG.



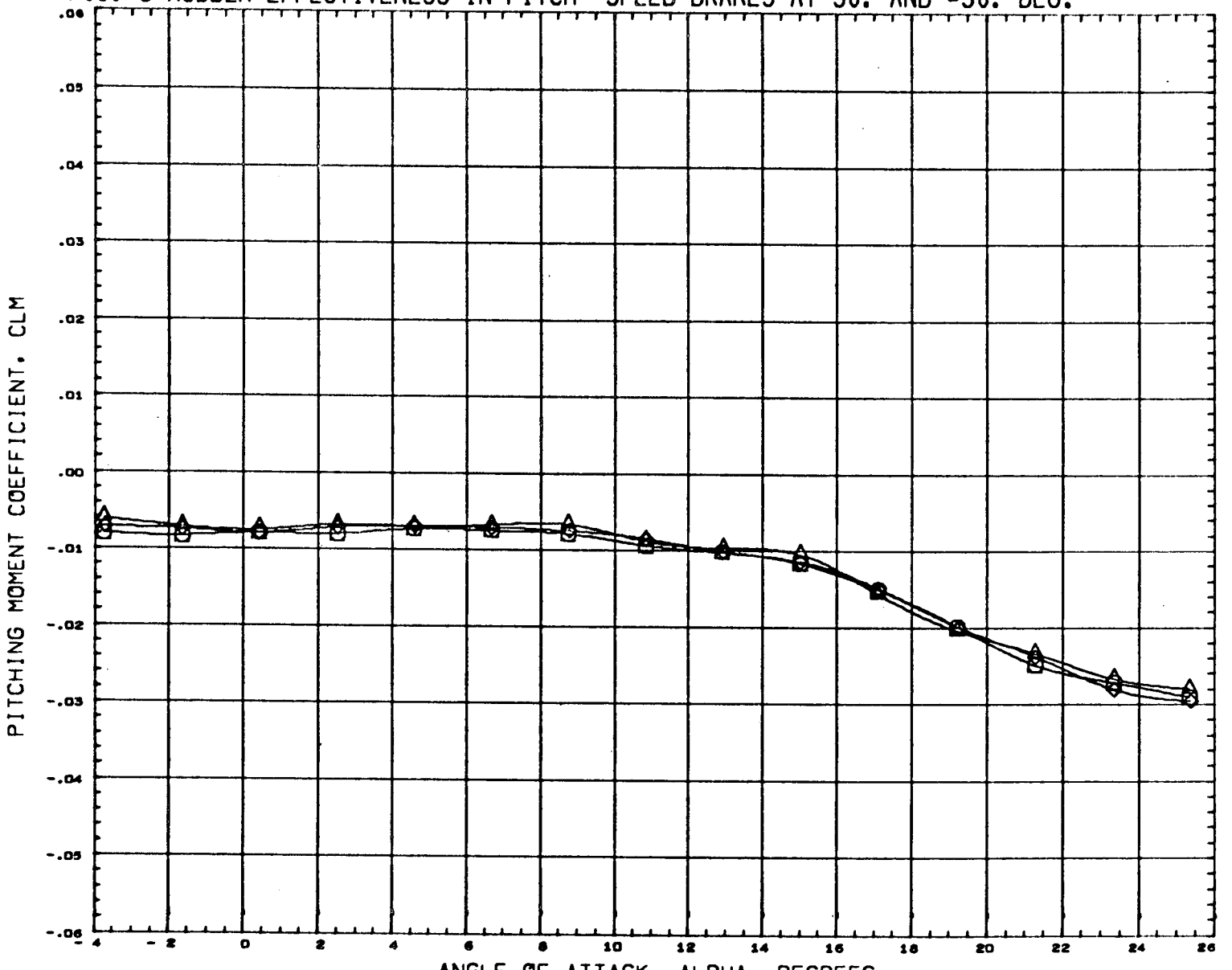
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1015)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000
(RD1018)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,+25,-35)	-15.000	25.000	-35.000	0.000
(RD1055)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5,+25,-35)	-5.000	25.000	-35.000	

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 9 RUDDER EFFECTIVENESS IN PITCH- SPEED BRAKES AT 30. AND -30. DEG.

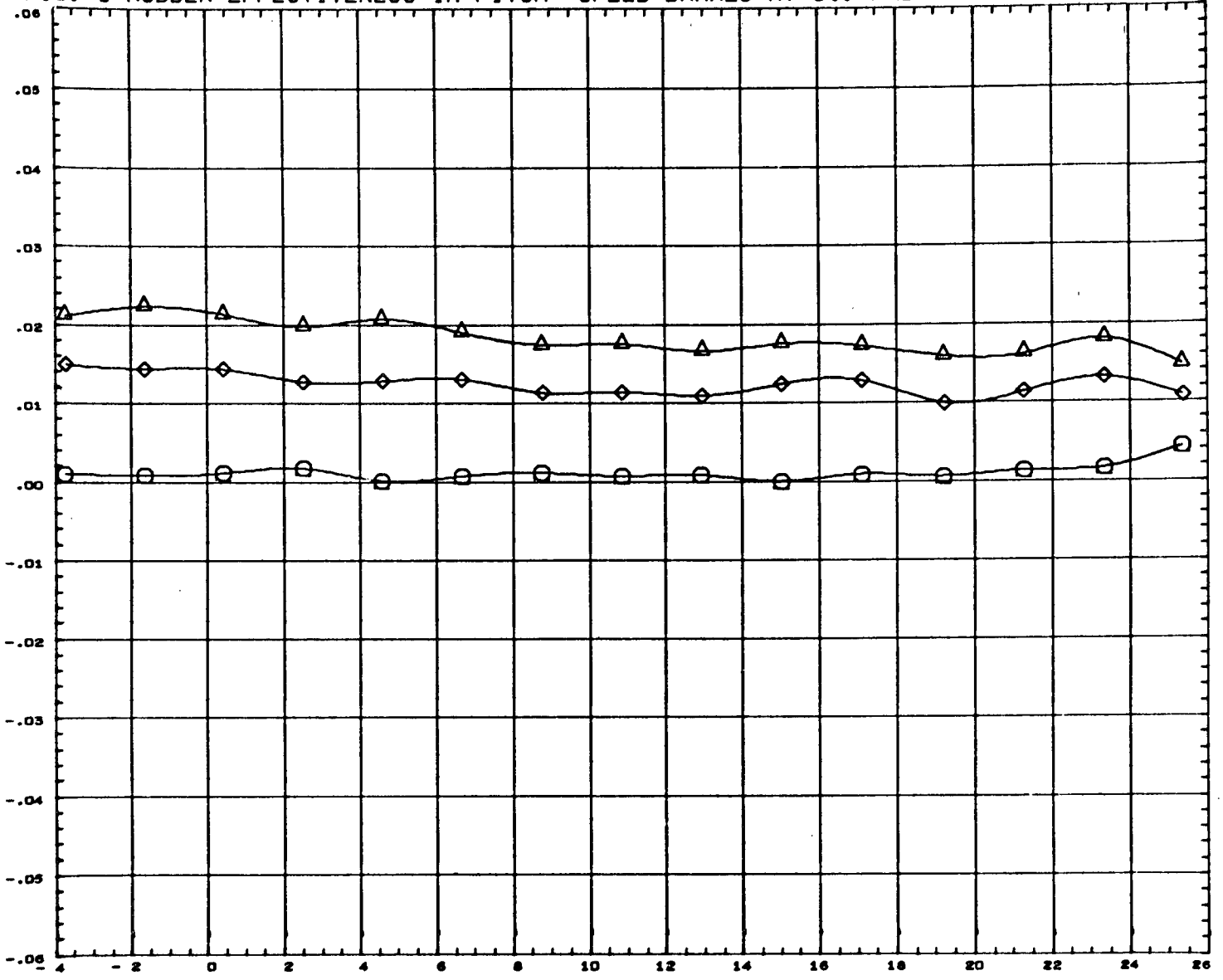


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1015)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000
(RD1018)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,+25,-35)	-15.000	25.000	-35.000	0.000
(RD1035)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5,+25,-35)	-5.000	25.000	-35.000	

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 9 RUDDER EFFECTIVENESS IN PITCH- SPEED BRAKES AT 30. AND -30. DEG.

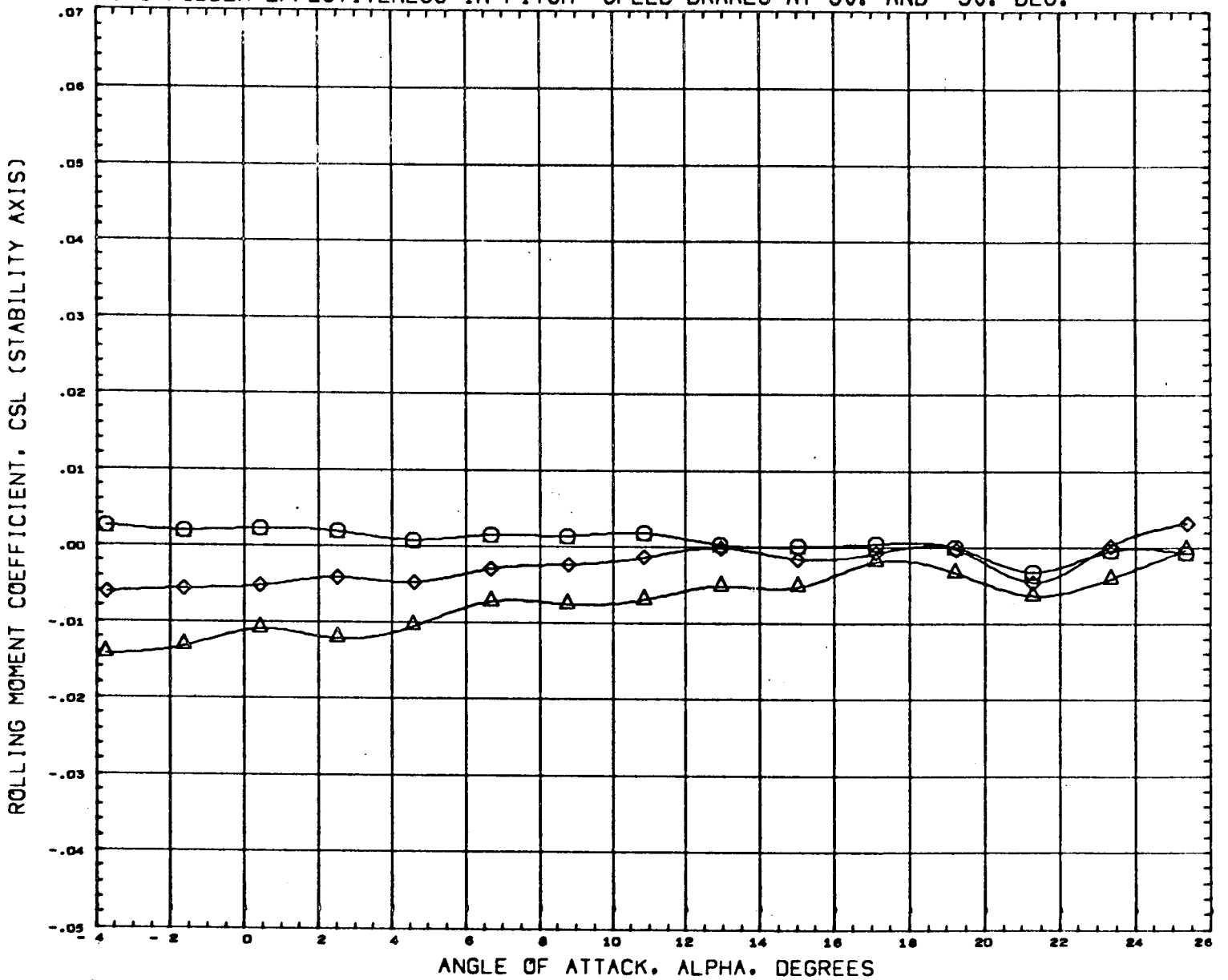


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1015)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000
(RD1018)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,+25,-35)	-15.000	25.000	-35.000	0.000
(RD1055)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5,+25,-35)	-5.000	25.000	-35.000	

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 9 RUDDER EFFECTIVENESS IN PITCH- SPEED BRAKES AT 30. AND -30. DEG.

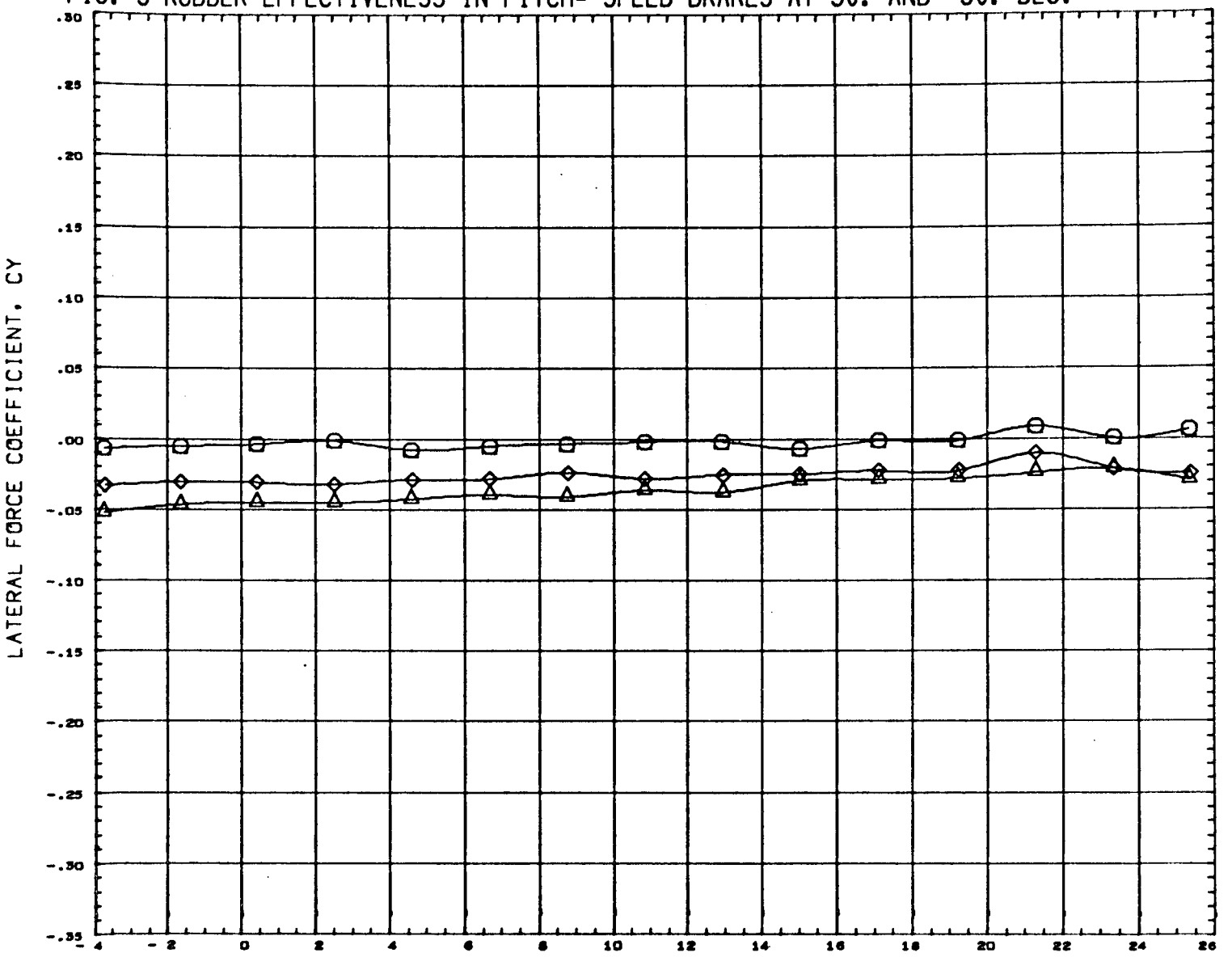


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1015)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000
(RD1018)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,+25,-35)	-15.000	25.000	-35.000	0.000
(RD1055)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5,+25,-35)	-5.000	25.000	-35.000	

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 9 RUDDER EFFECTIVENESS IN PITCH- SPEED BRAKES AT 30. AND -30. DEG.

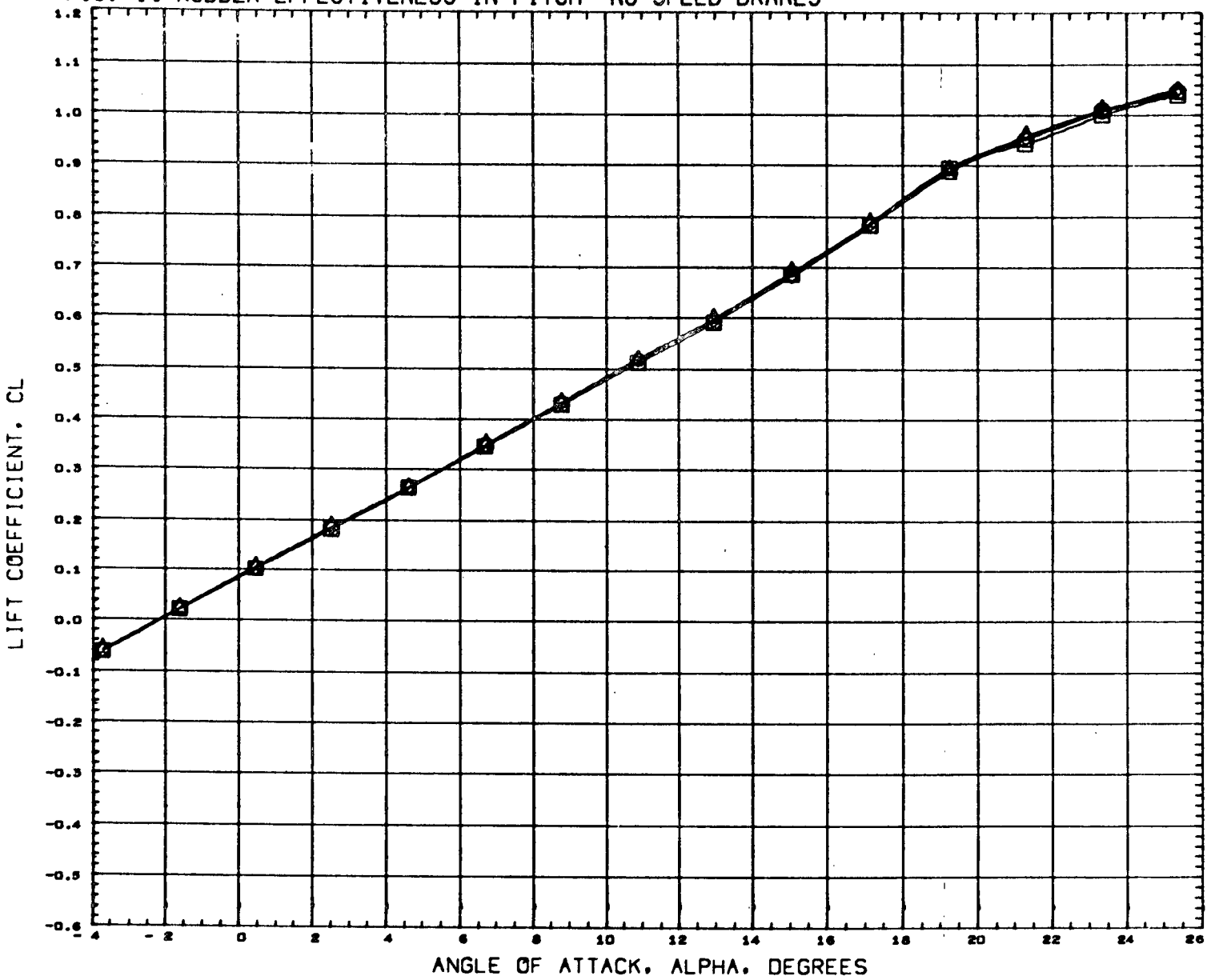


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	BETA
(RD1015)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000
(RD1018)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,+25,-35)	-15.000	25.000	-35.000	0.000
(RD1055)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5,+25,-35)	-5.000	25.000	-35.000	

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 10 RUDDER EFFECTIVENESS IN PITCH- NO SPEED BRAKES



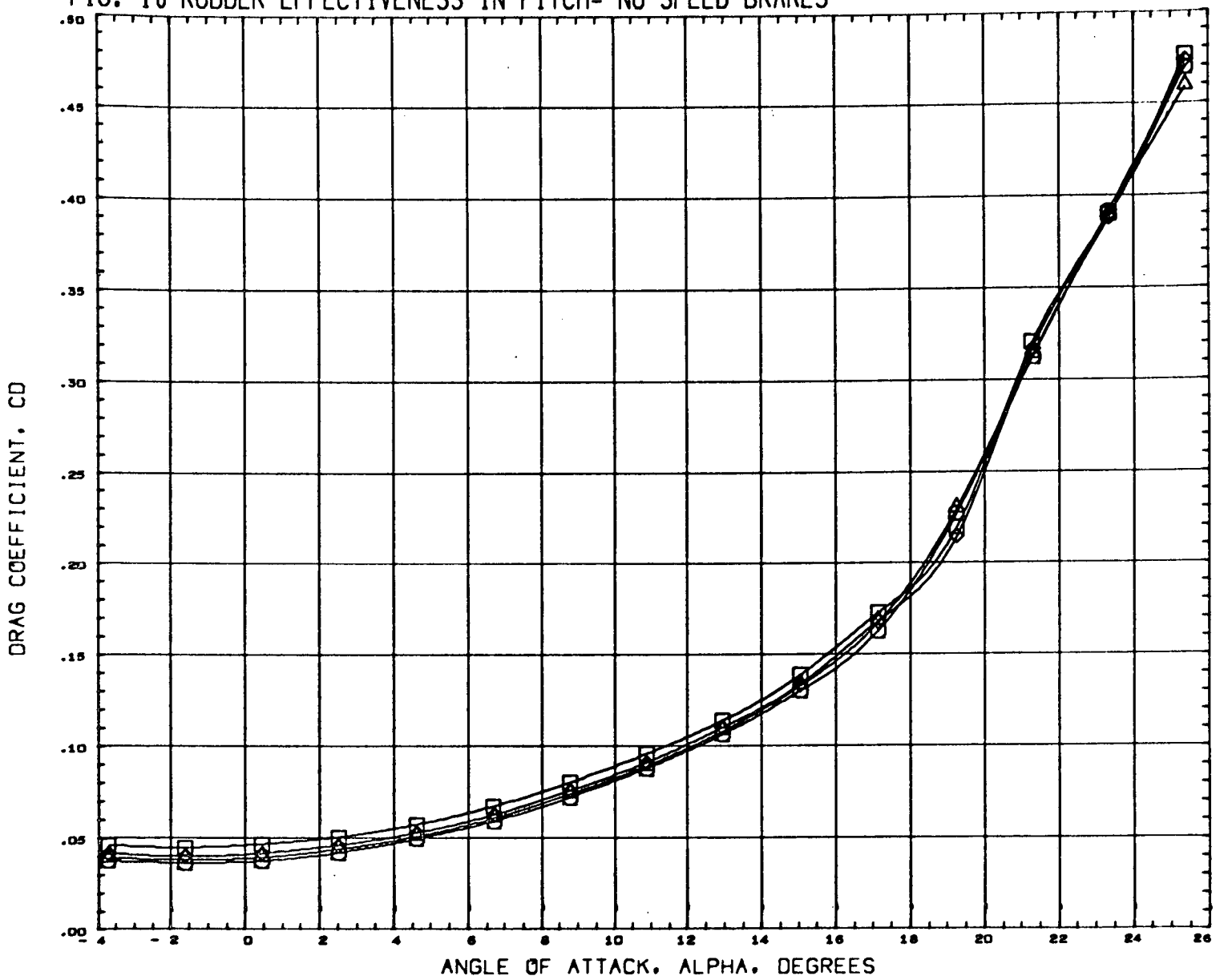
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	RUDDER	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000
(RD1019)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5)	-5.000	0.000
(RD1020)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10)	-10.000	0.000
(RD1021)	□	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15)	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 10 RUDDER EFFECTIVENESS IN PITCH- NO SPEED BRAKES



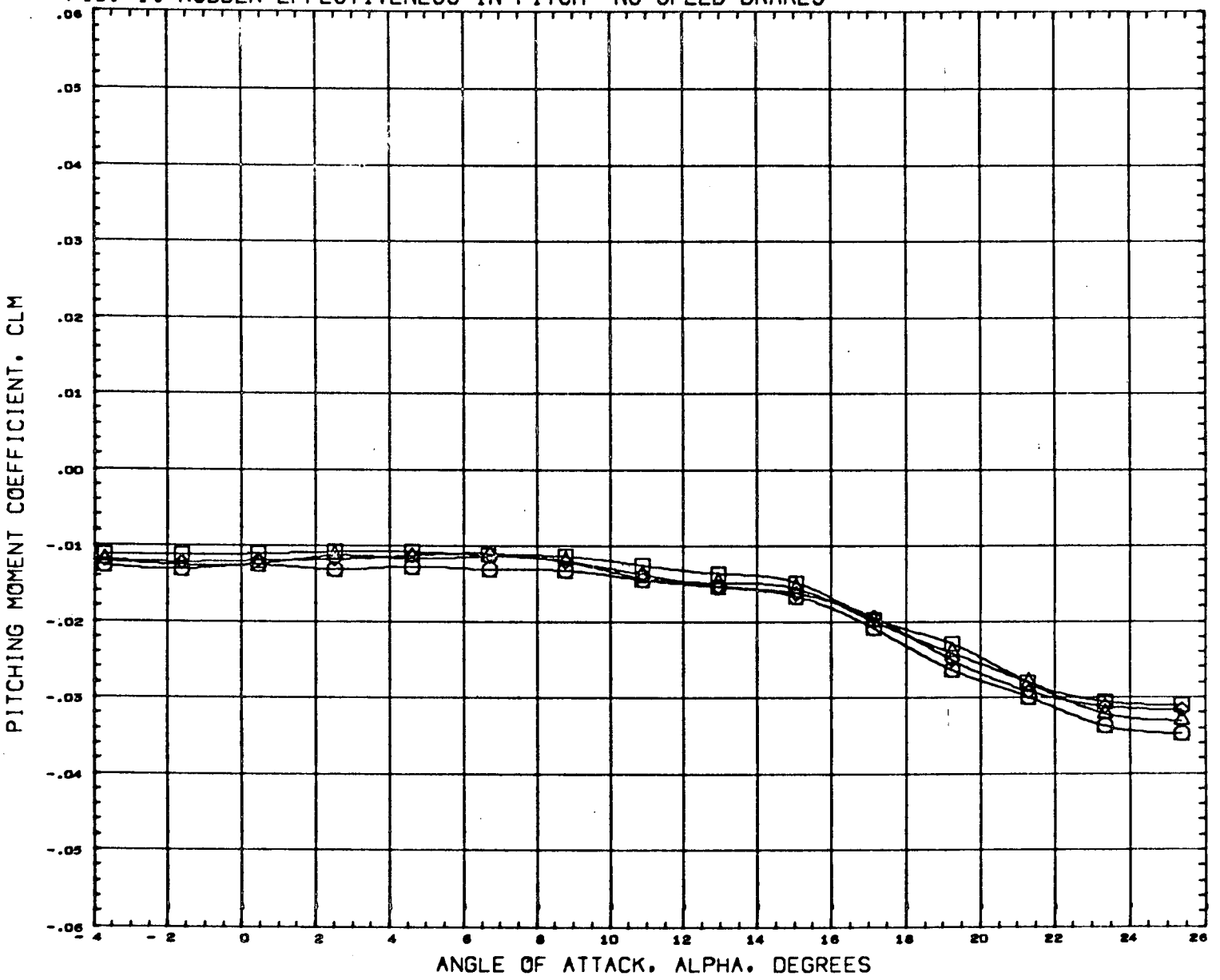
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	RUDDER	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000
(RD1019)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5)	-5.000	0.000
(RD1020)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10)	-10.000	0.000
(RD1021)	□	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15)	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 10 RUDDER EFFECTIVENESS IN PITCH- NO SPEED BRAKES



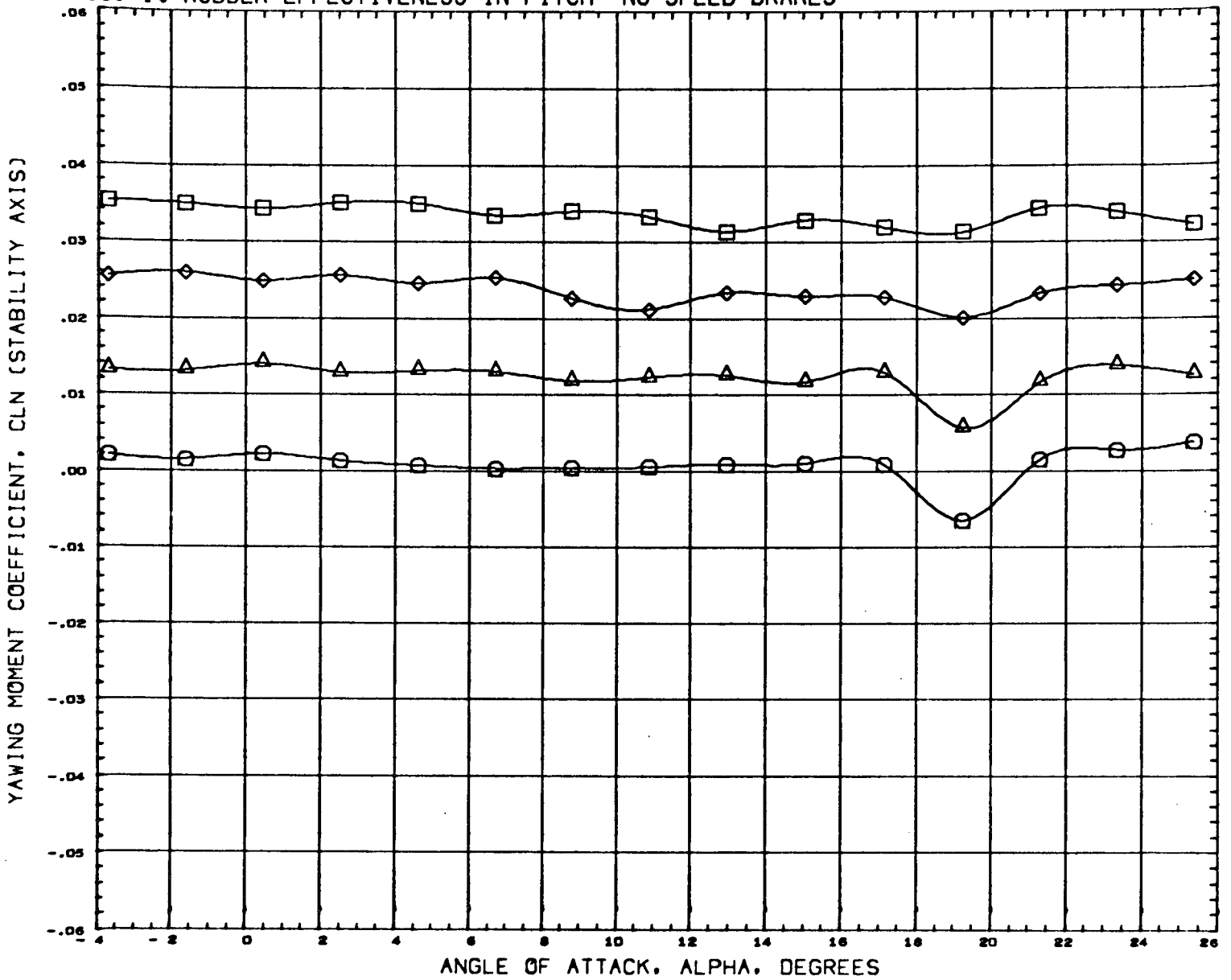
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	RUDDER	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000
(RD1019)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5)	-5.000	0.000
(RD1020)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10)	-10.000	0.000
(RD1021)	□	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15)	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 10 RUDDER EFFECTIVENESS IN PITCH- NO SPEED BRAKES

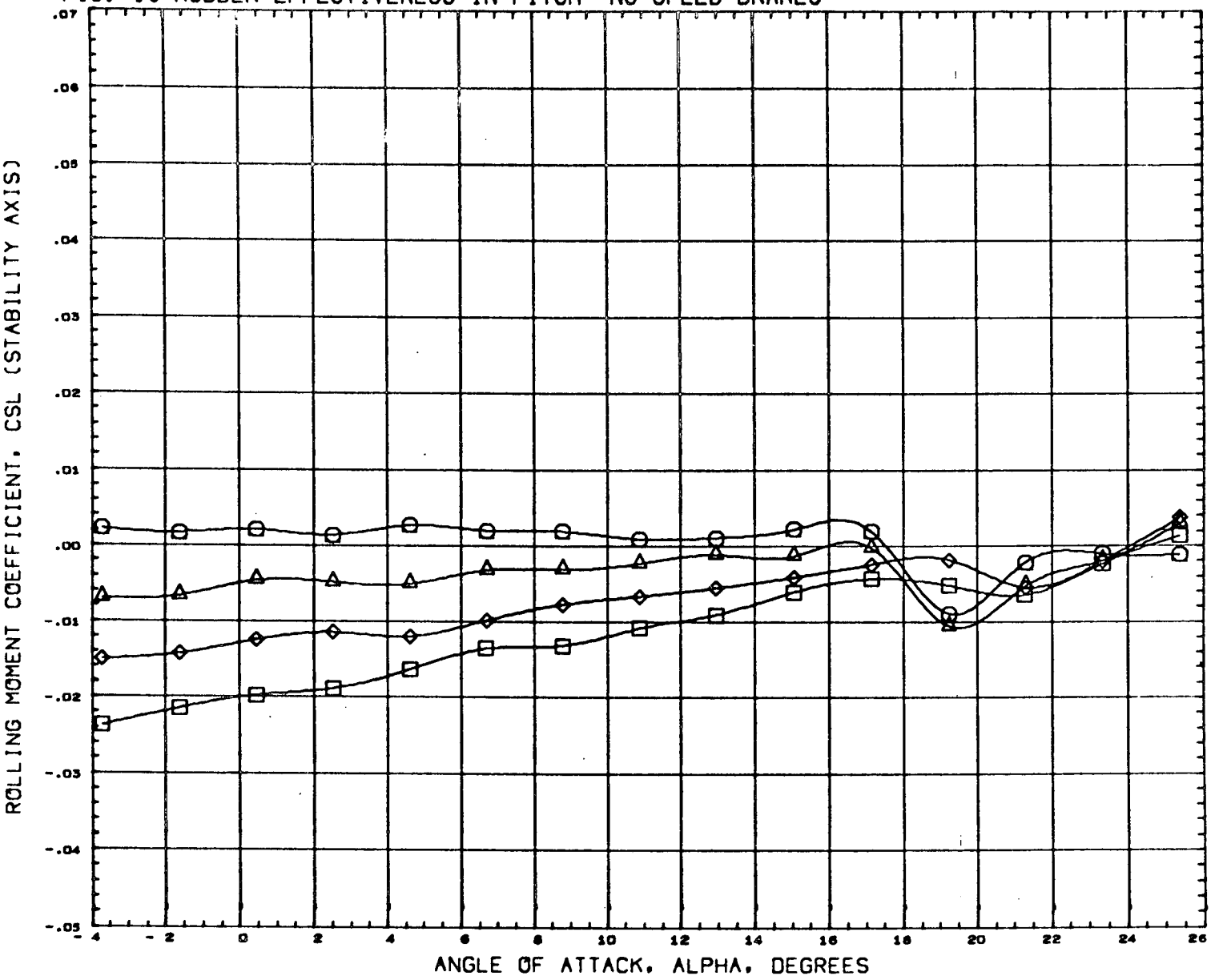


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	RUDDER	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000
(RD1019)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5)	-5.000	0.000
(RD1020)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10)	-10.000	0.000
(RD1021)	□	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15)	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 10 RUDDER EFFECTIVENESS IN PITCH- NO SPEED BRAKES

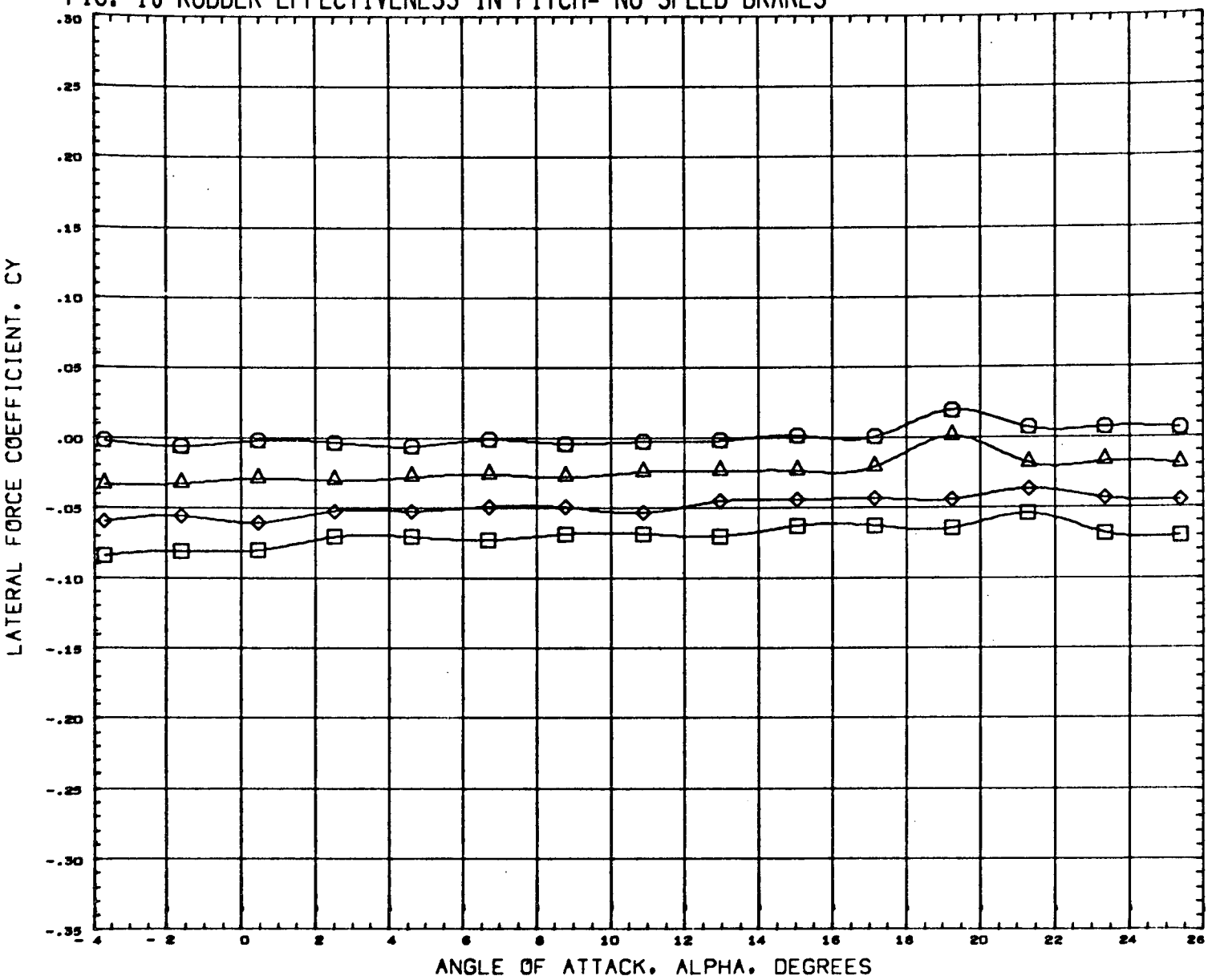


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	RUDDER	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000
(RD1019)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5)	-5.000	0.000
(RD1020)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10)	-10.000	0.000
(RD1021)	□	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15)	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 10 RUDDER EFFECTIVENESS IN PITCH- NO SPEED BRAKES

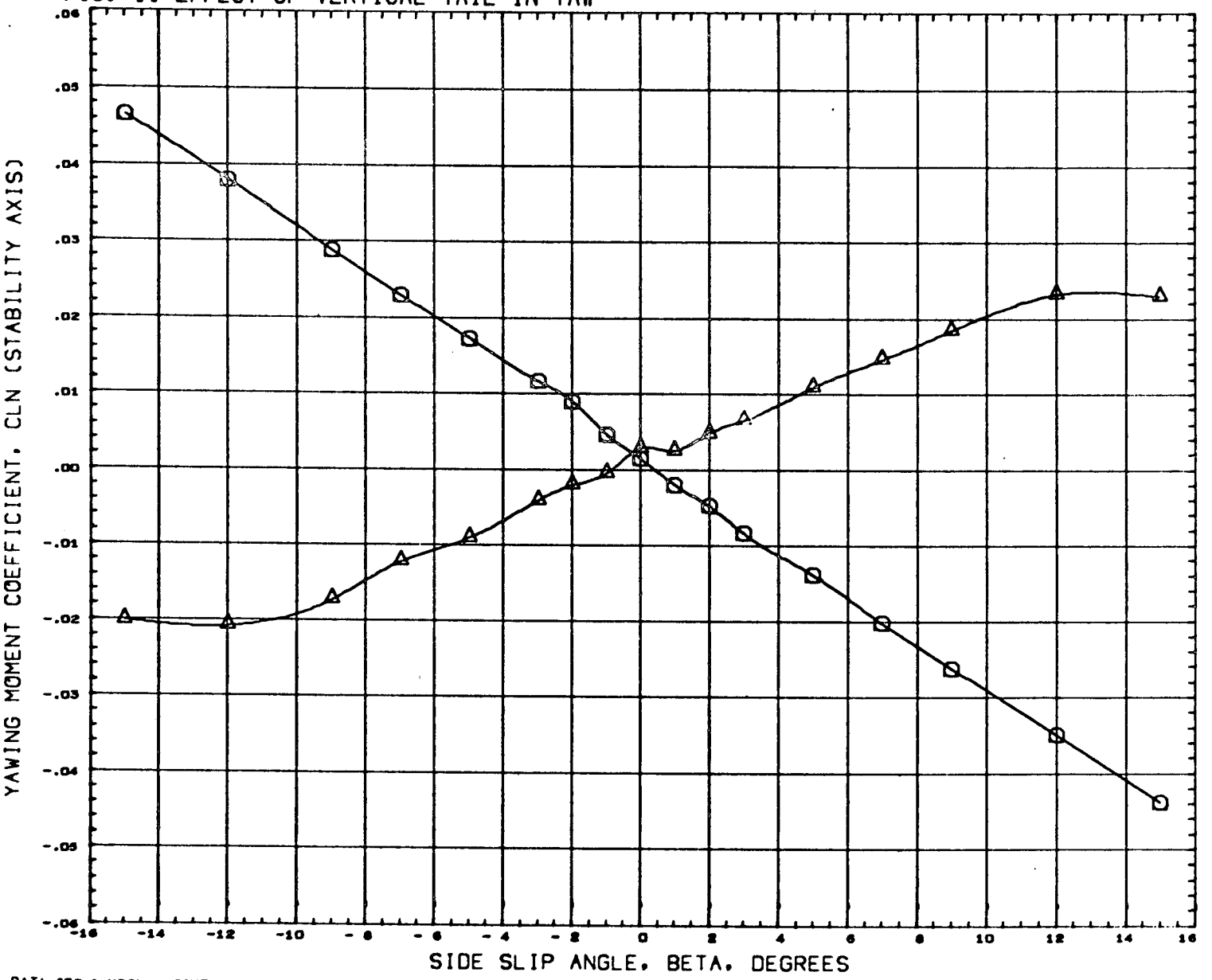


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	RUDDER	BETA
(RD1002)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000
(RD1019)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5)	-5.000	0.000
(RD1020)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10)	-10.000	0.000
(RD1021)	□	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15)	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 11 EFFECT OF VERTICAL TAIL IN YAW



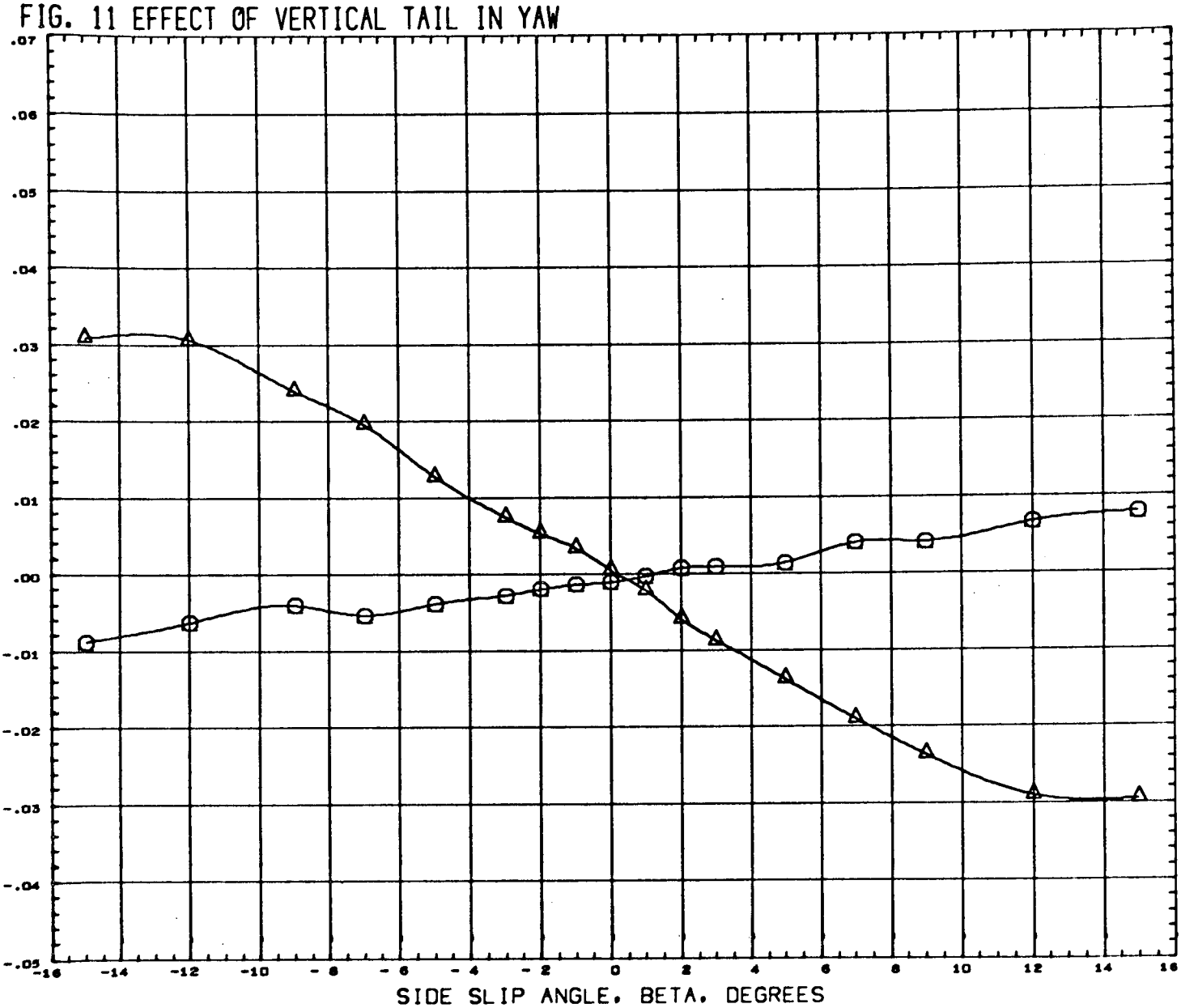
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	ALPHA
(RD1025)	○	GWTT 292 CONF.H-33 ORBITER B5W4	0.000
(RD1027)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 11 EFFECT OF VERTICAL TAIL IN YAW



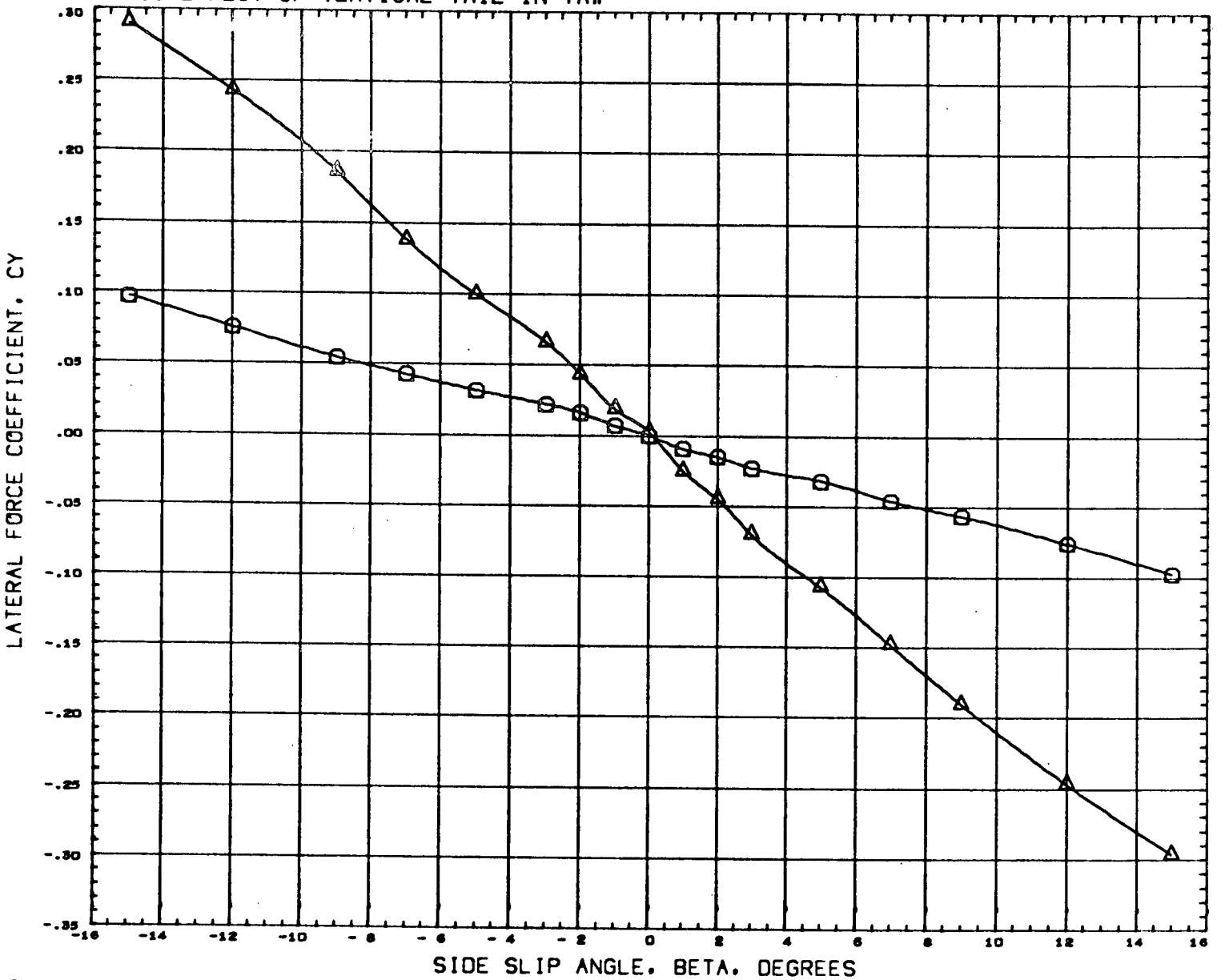
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	ALPHA
(RD1025)	○	GWTT 292 CONF.H-33 ORBITER B5W4	0.000
(RD1027)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 11 EFFECT OF VERTICAL TAIL IN YAW



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1025)	○	GWTT 292 CONF.H-33 ORBITER B5W4
(RD1027)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5

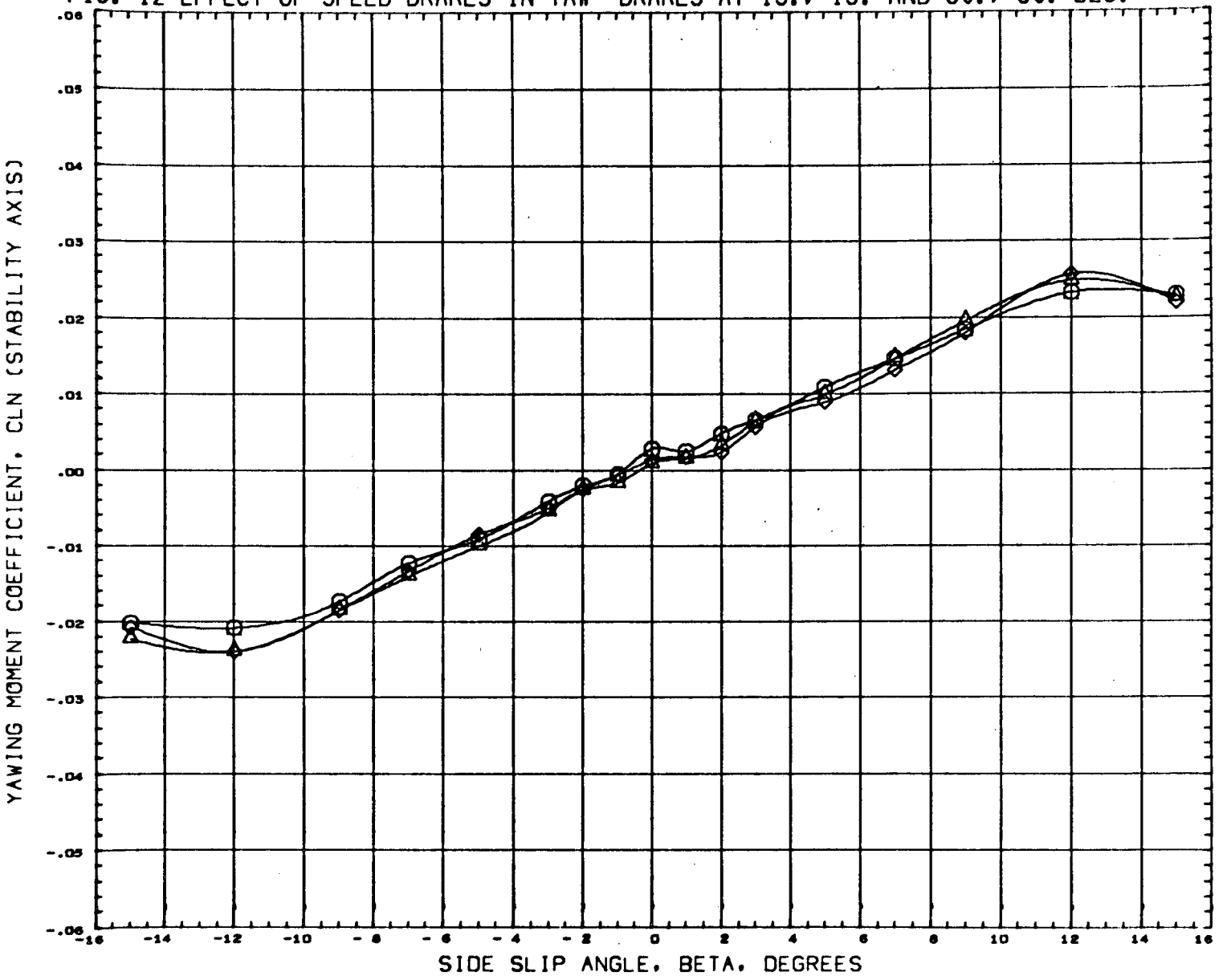
ALPHA
0.000
0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 12 EFFECT OF SPEED BRAKES IN YAW- BRAKES AT 15.,-15. AND 30.,-30. DEG.



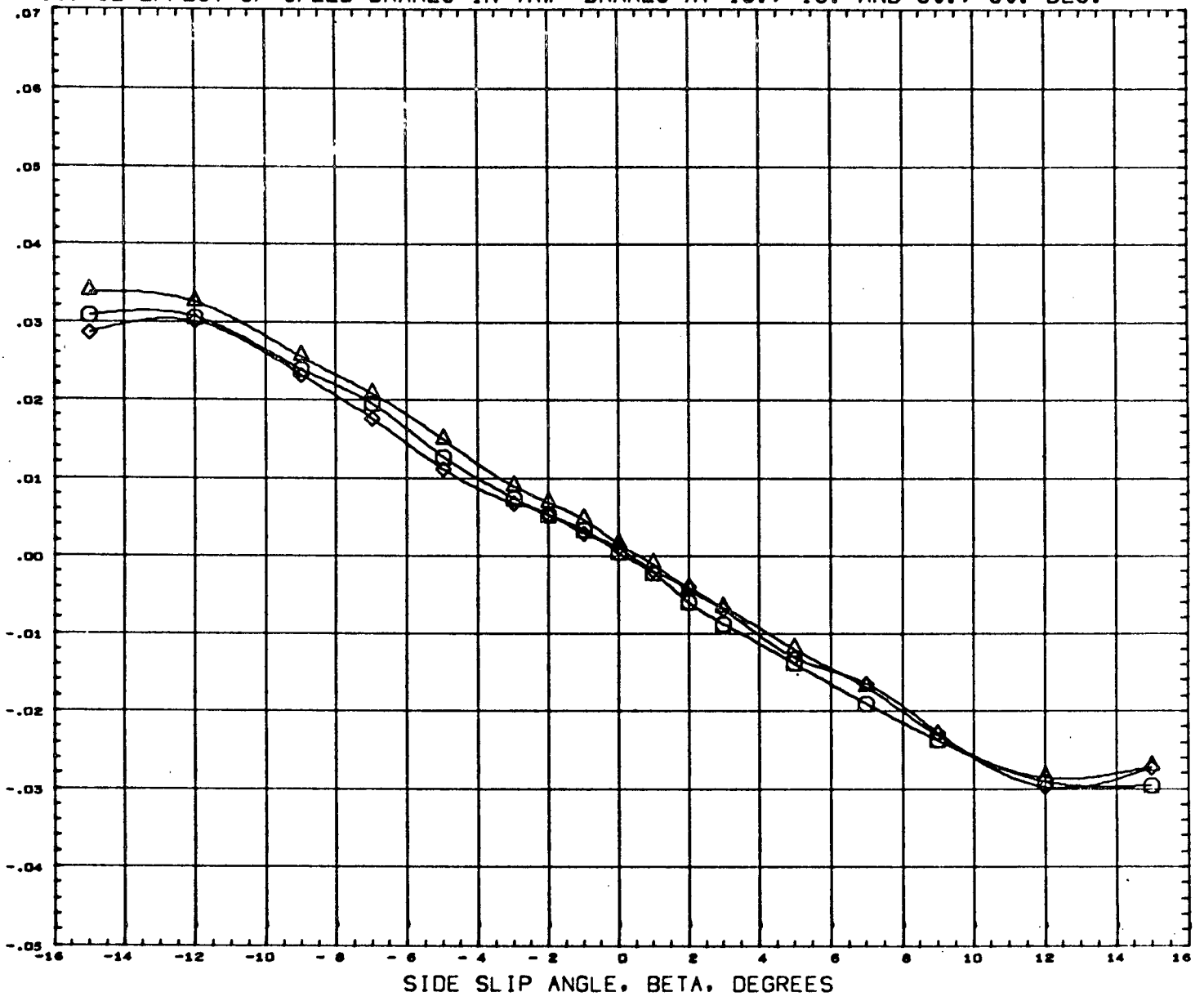
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	ALPHA
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000
(RD1039)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000
(RD1034)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 12 EFFECT OF SPEED BRAKES IN YAW- BRAKES AT 15.,-15. AND 30.,-30. DEG.



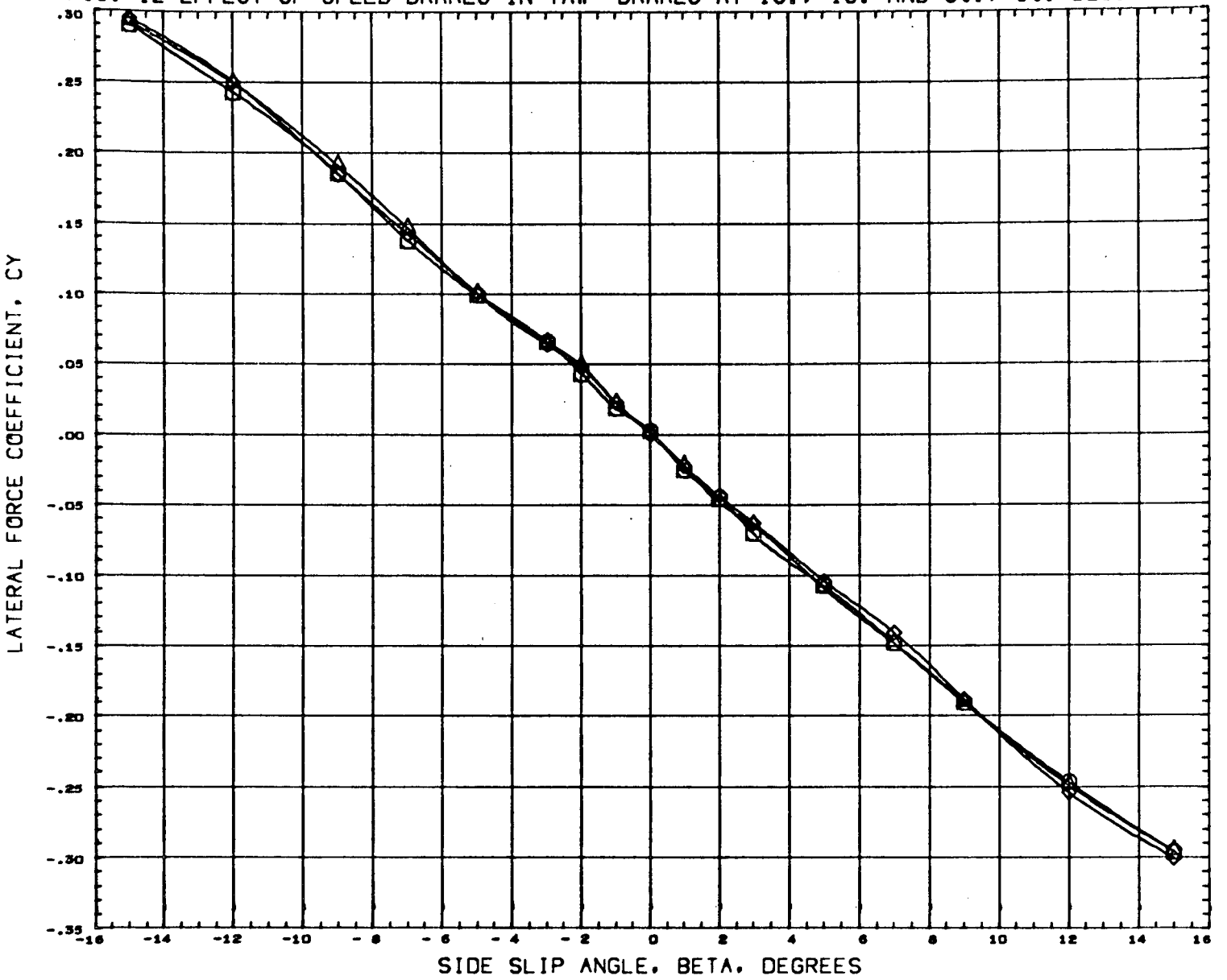
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	ALPHA
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000
(RD1039)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000
(RD1034)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 12 EFFECT OF SPEED BRAKES IN YAW- BRAKES AT 15.,-15. AND 30.,-30. DEG.



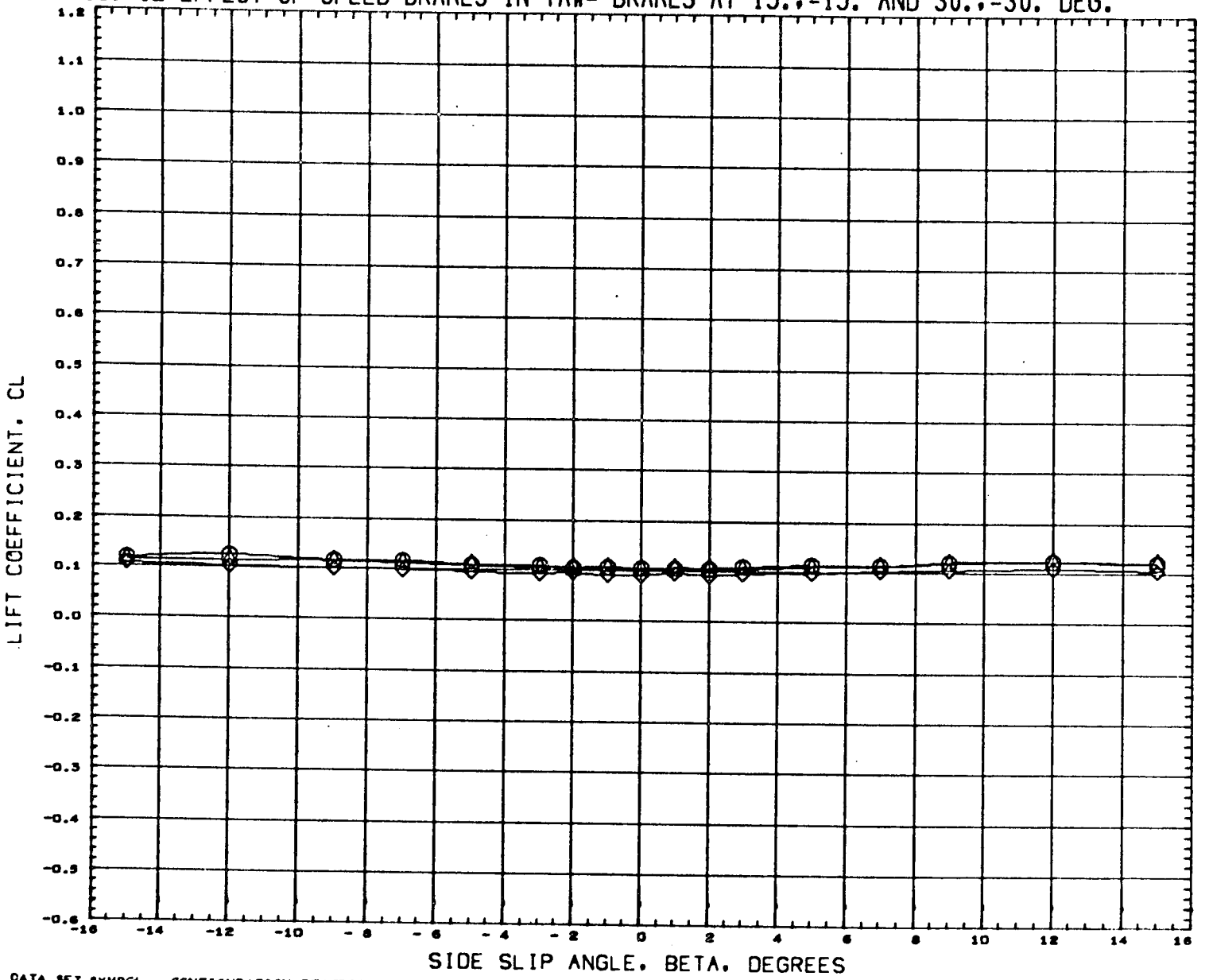
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	ALPHA
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000
(RD1039)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000
(RD1034)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 12 EFFECT OF SPEED BRAKES IN YAW- BRAKES AT 15.,-15. AND 30.,-30. DEG.



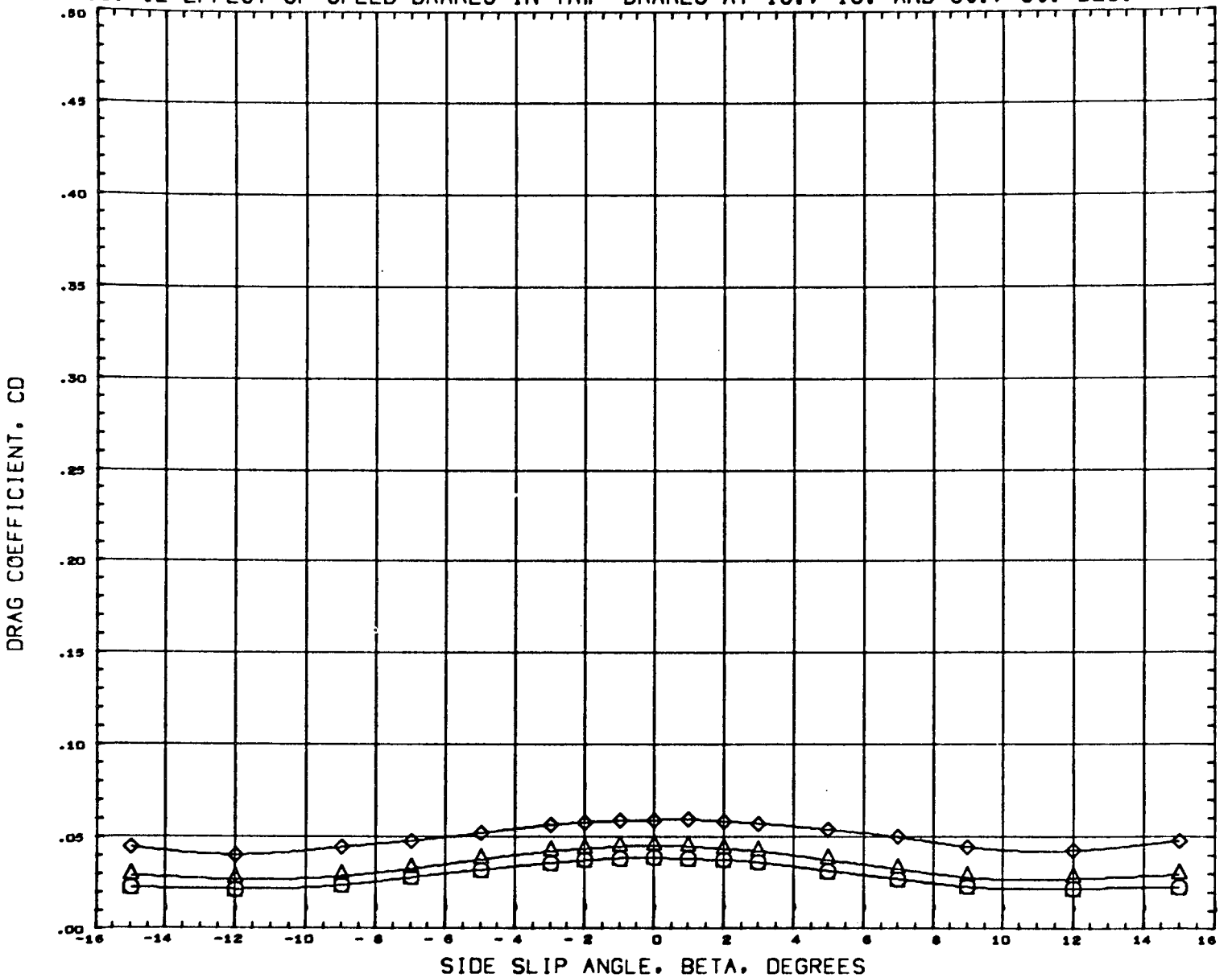
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	ALPHA
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000
(RD1039)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000
(RD1034)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 12 EFFECT OF SPEED BRAKES IN YAW- BRAKES AT 15.,-15. AND 30.,-30. DEG.

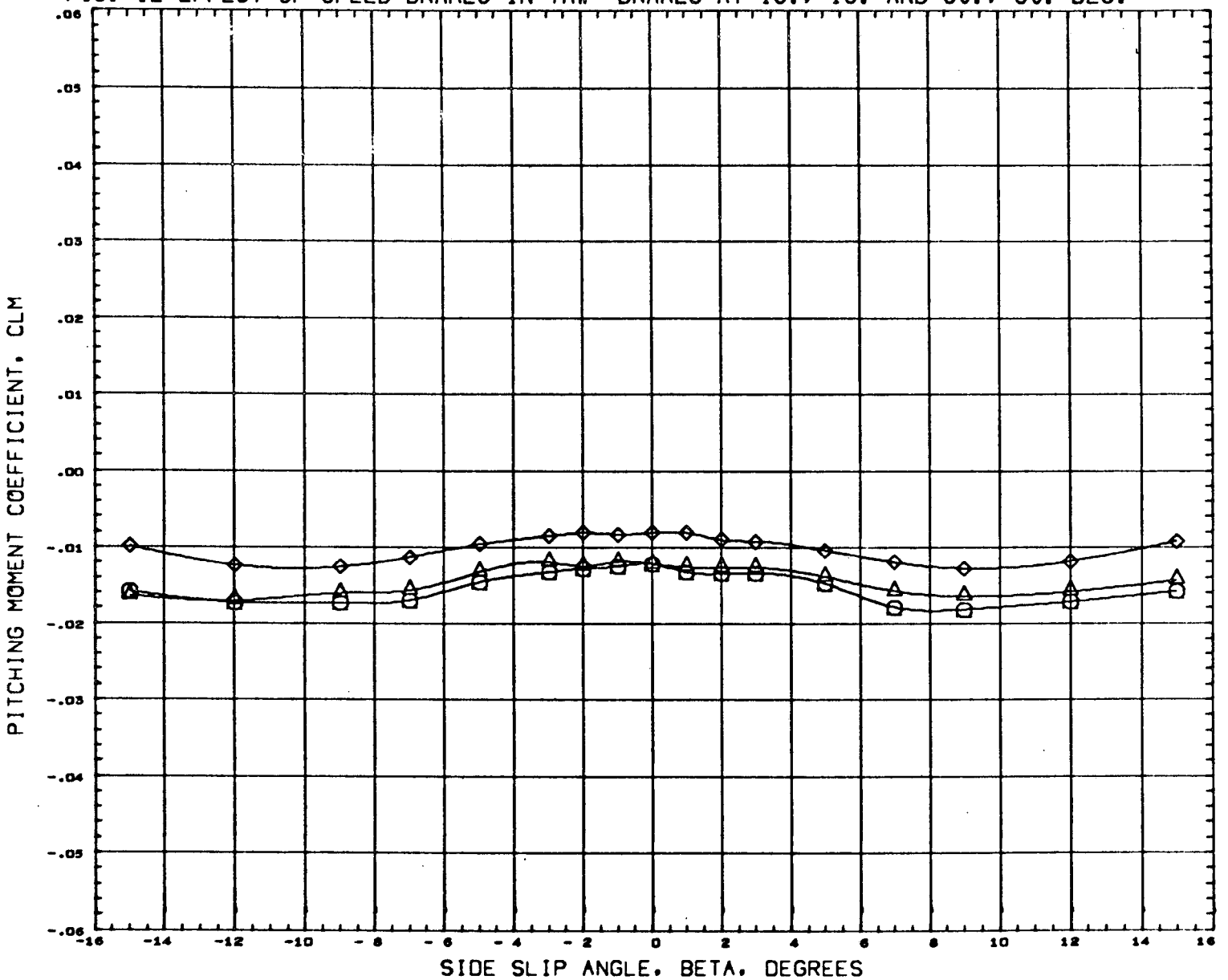


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	ALPHA
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000
(RD1039)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000
(RD1034)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 12 EFFECT OF SPEED BRAKES IN YAW- BRAKES AT 15.,-15. AND 30.,-30. DEG.



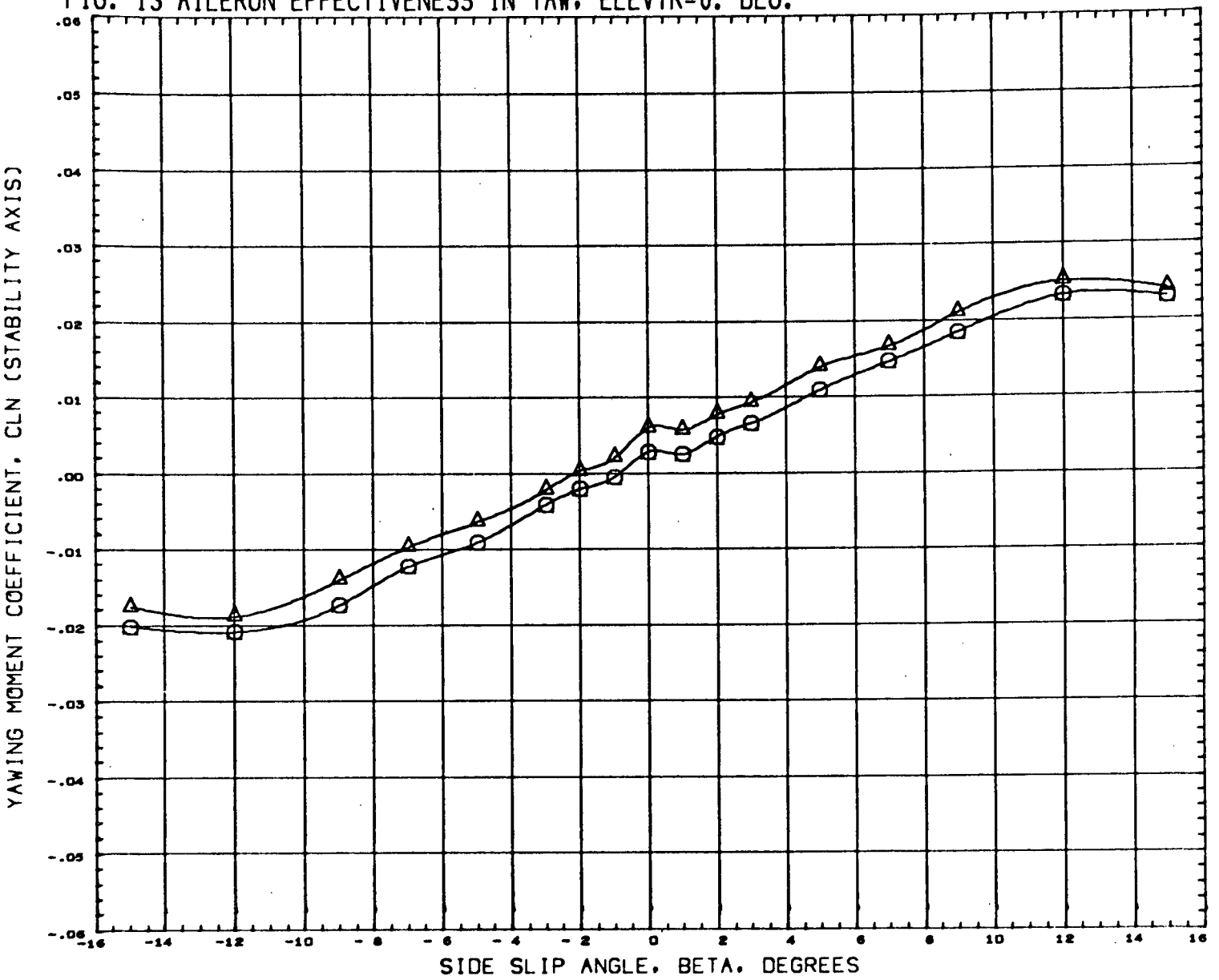
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	ALPHA
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000
(RD1039)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000
(RD1034)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 13 AILERON EFFECTIVENESS IN YAW, ELEVTR=0. DEG.



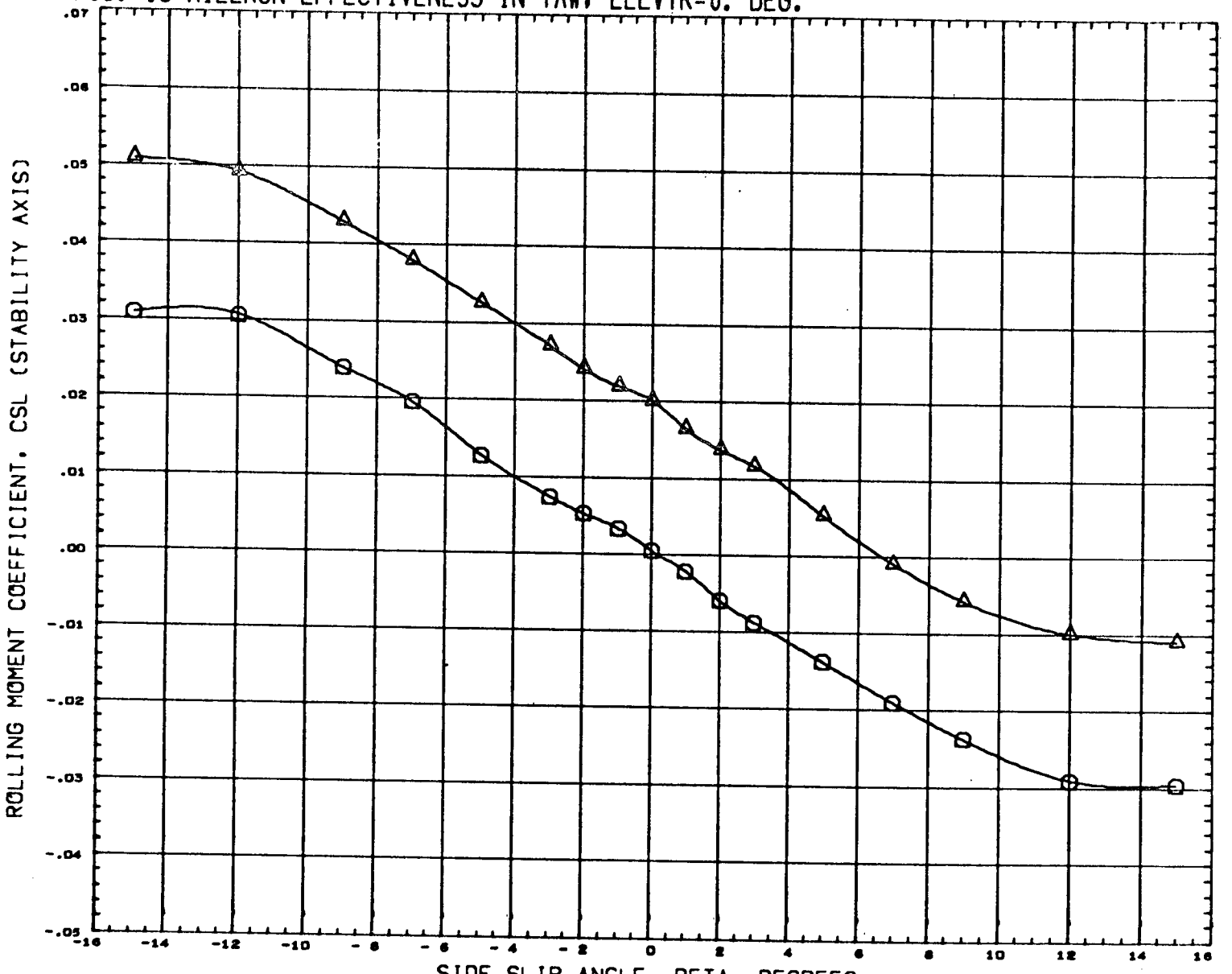
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1032)	△	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-5)V5	5.000	-5.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 13 AILERON EFFECTIVENESS IN YAW, ELEVTR=0. DEG.



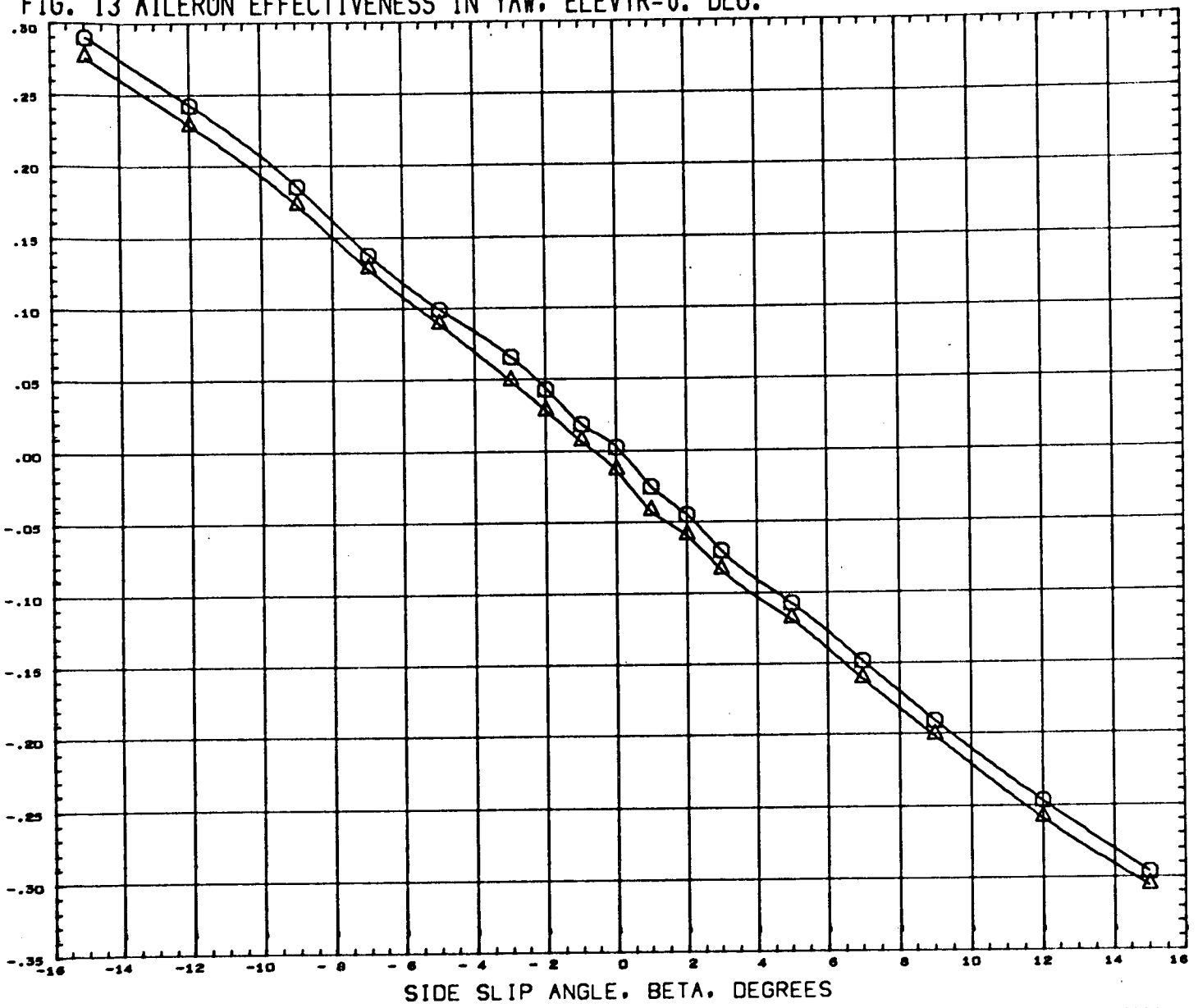
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1032)	△	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-5)V5	5.000	-5.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 13 AILERON EFFECTIVENESS IN YAW, ELEVTR=0. DEG.



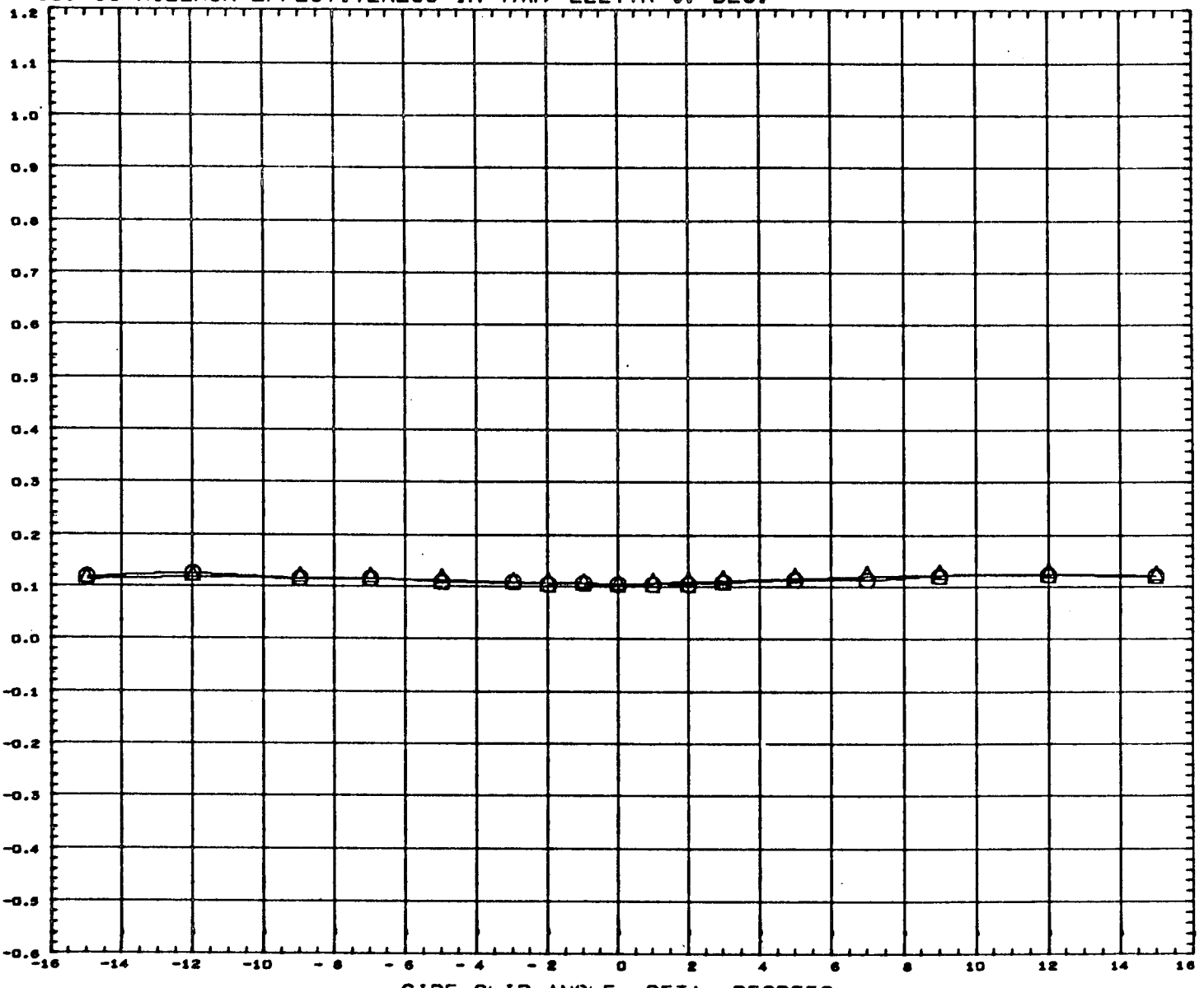
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1032)	△	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-5)V5	5.000	-5.000	0.000

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170

FIG. 13 AILERON EFFECTIVENESS IN YAW, ELEVTR=0. DEG.

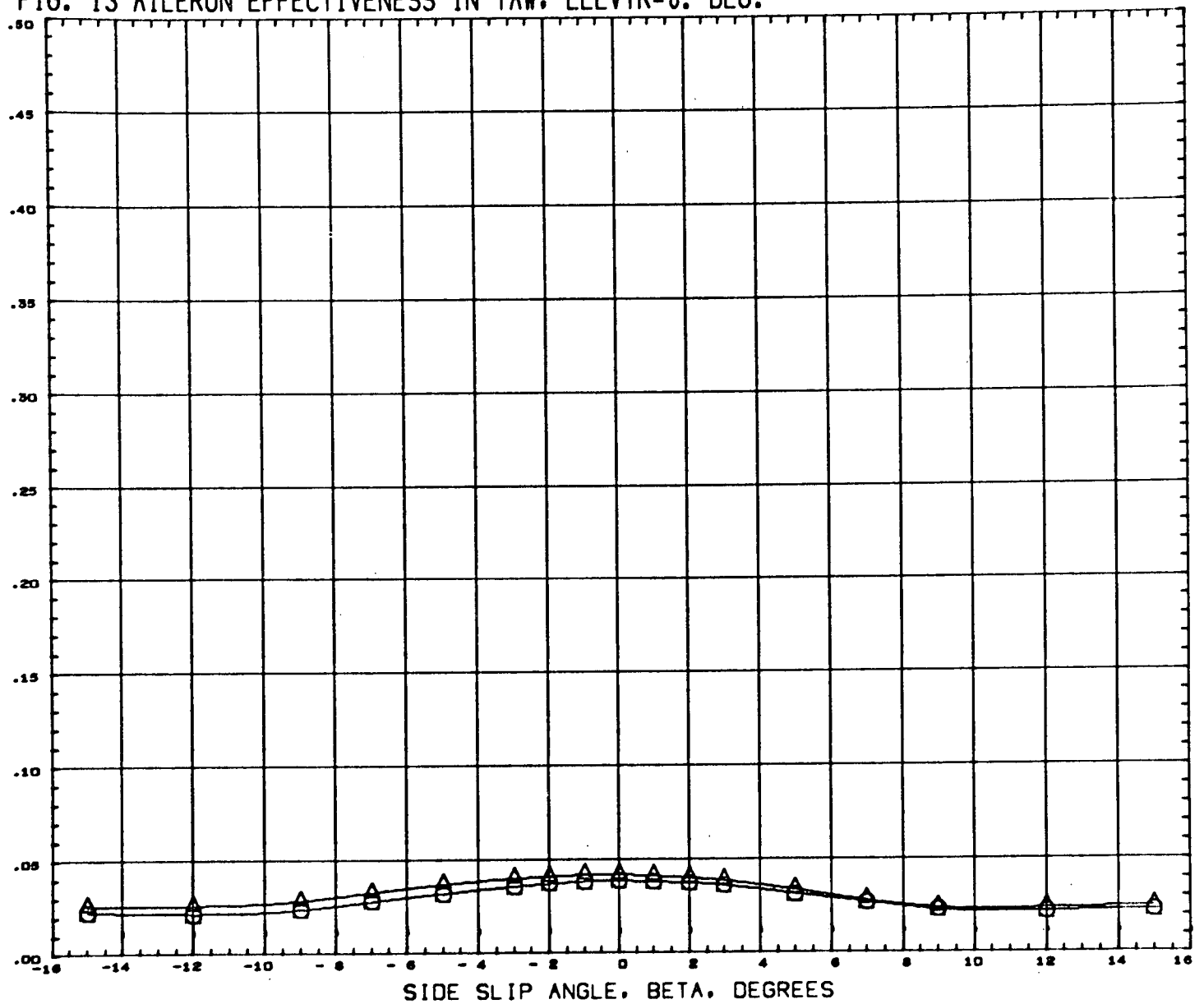


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1032)	△	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-5)V5	5.000	-5.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 13 AILERON EFFECTIVENESS IN YAW, ELEVTR=0. DEG.



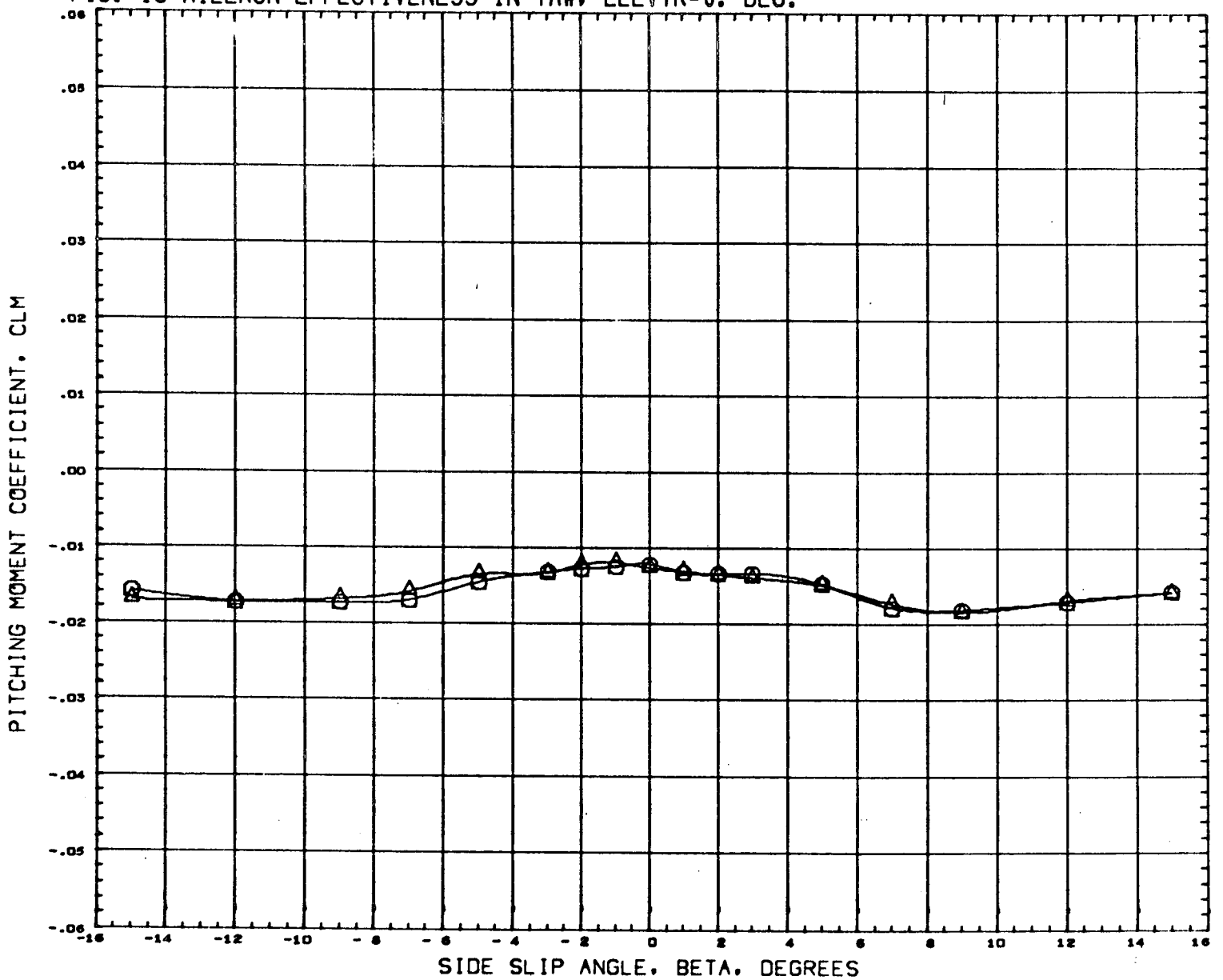
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1027)		GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1032)		GWTT 292 CONF.H-33 ORBITER B5W4(+5,-5)V5	5.000	-5.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 13 AILERON EFFECTIVENESS IN YAW, ELEVTR=0. DEG.



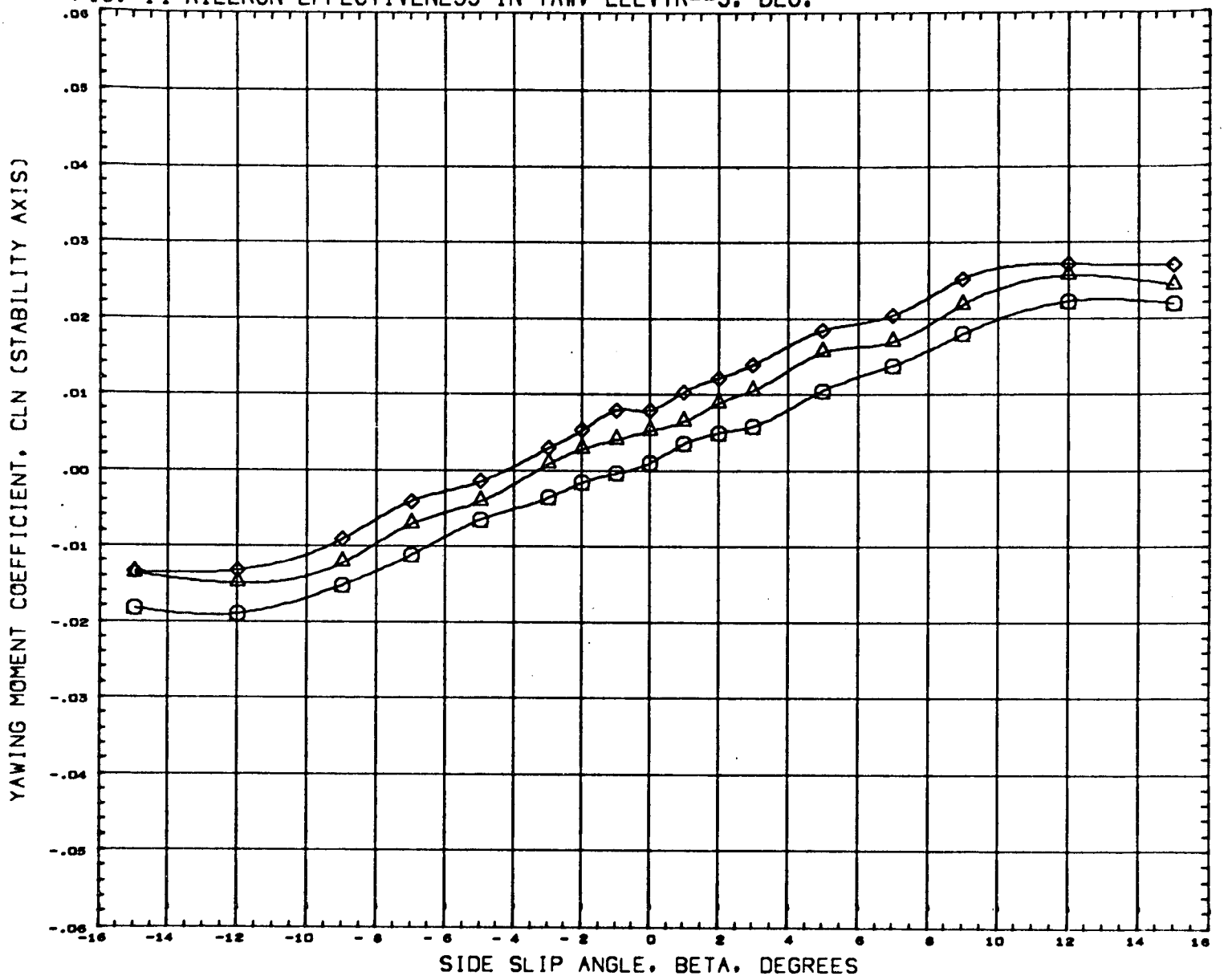
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000	0.000
(RD1032)	△	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-5)V5	5.000	-5.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 14 AILERØN EFFECTIVENESS IN YAW, ELEVTR=-5. DEG.

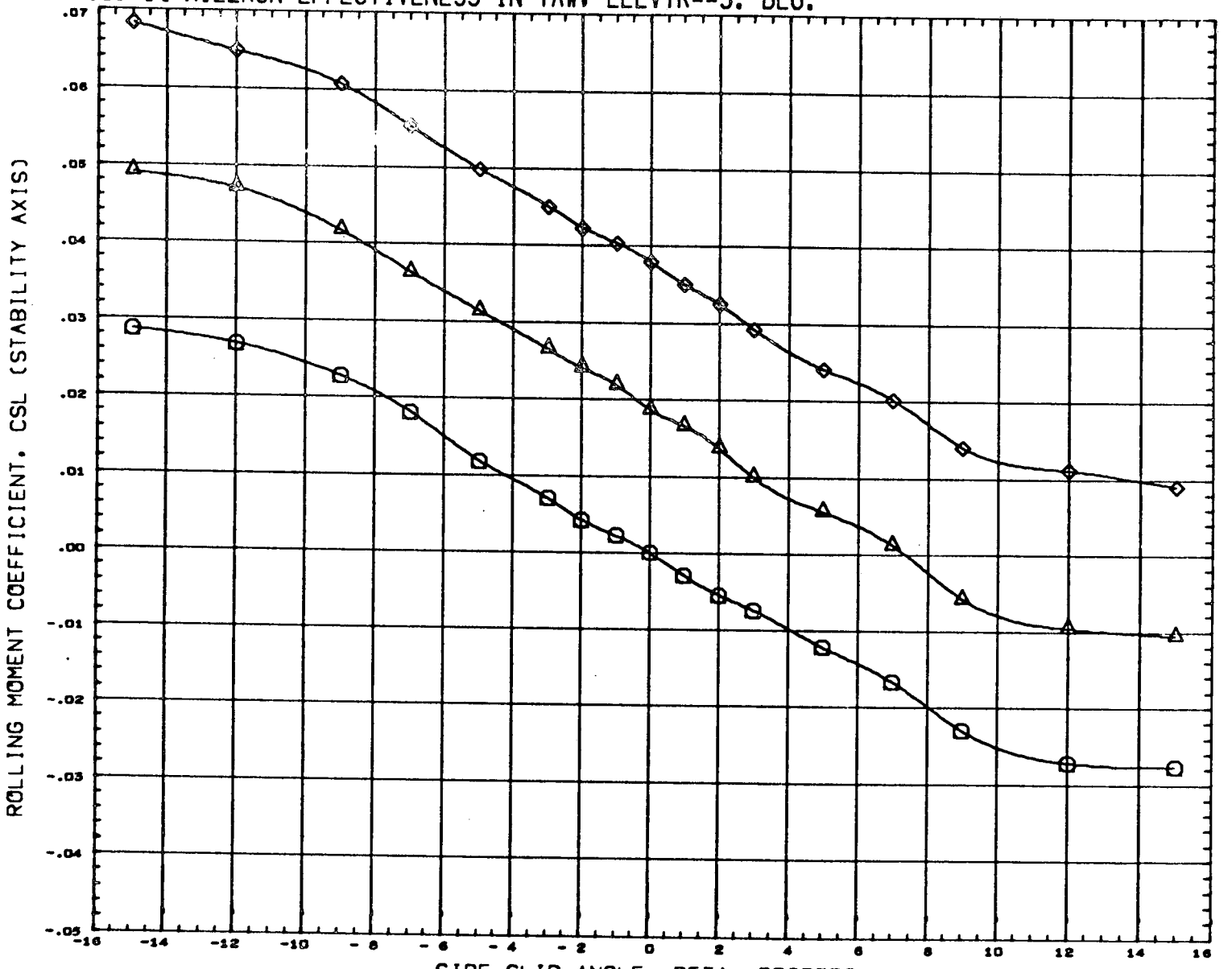


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1033)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5	-5.000	-5.000	0.000
(RD1028)	△	GWTT 292 CONF.H-33 ORBITER B5W4(0,-10)V5	0.000	-10.000	0.000
(RD1031)	◇	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-15)V5	5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 14 AILERON EFFECTIVENESS IN YAW, ELEVTR=-5. DEG.

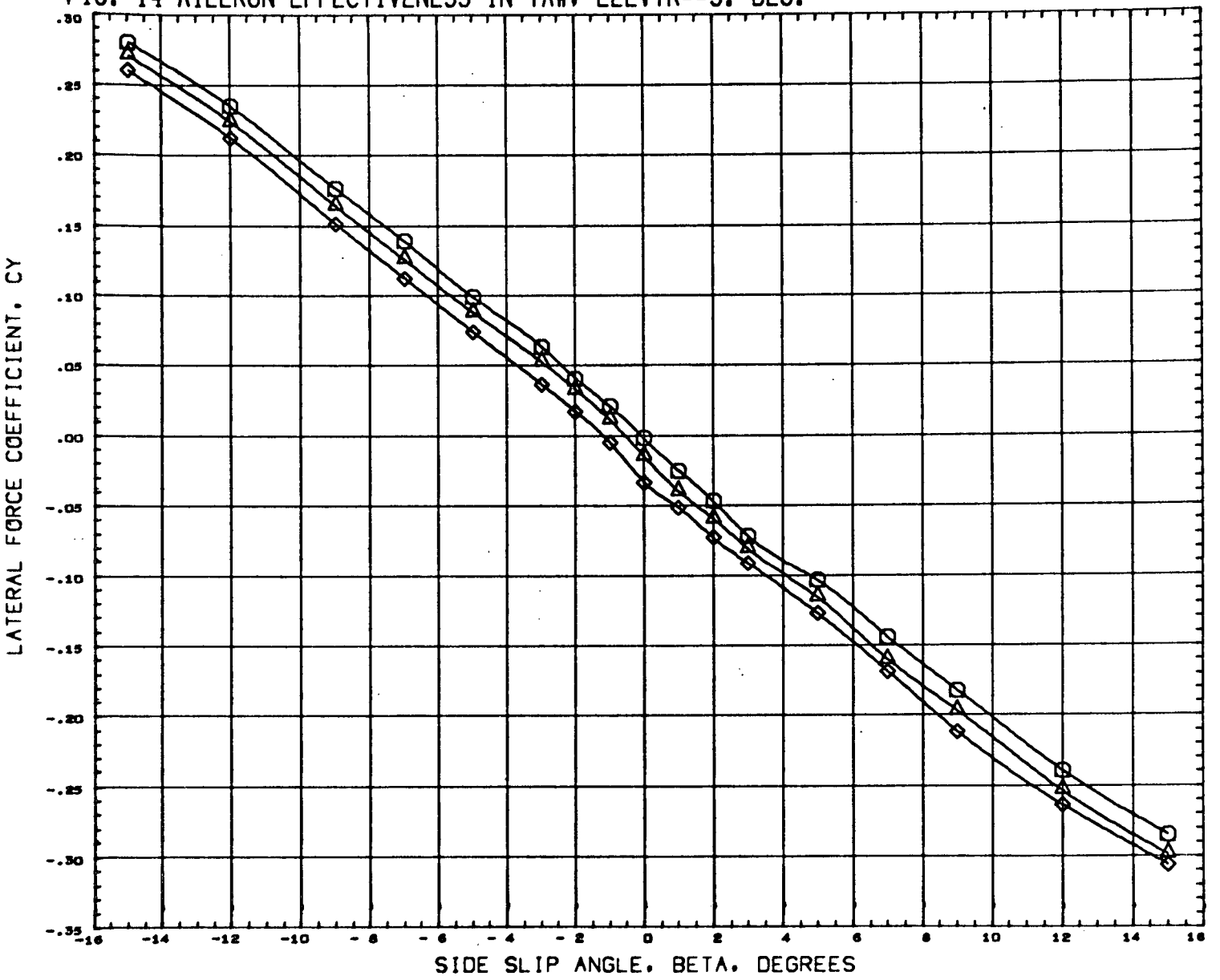


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1033)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5	-5.000	-5.000	0.000
(RD1028)	△	GWTT 292 CONF.H-33 ORBITER B5W4(0,-10)V5	0.000	-10.000	0.000
(RD1031)	◇	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-15)V5	5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 14 AILERØN EFFECTIVENESS IN YAW, ELEVTR=-5. DEG.

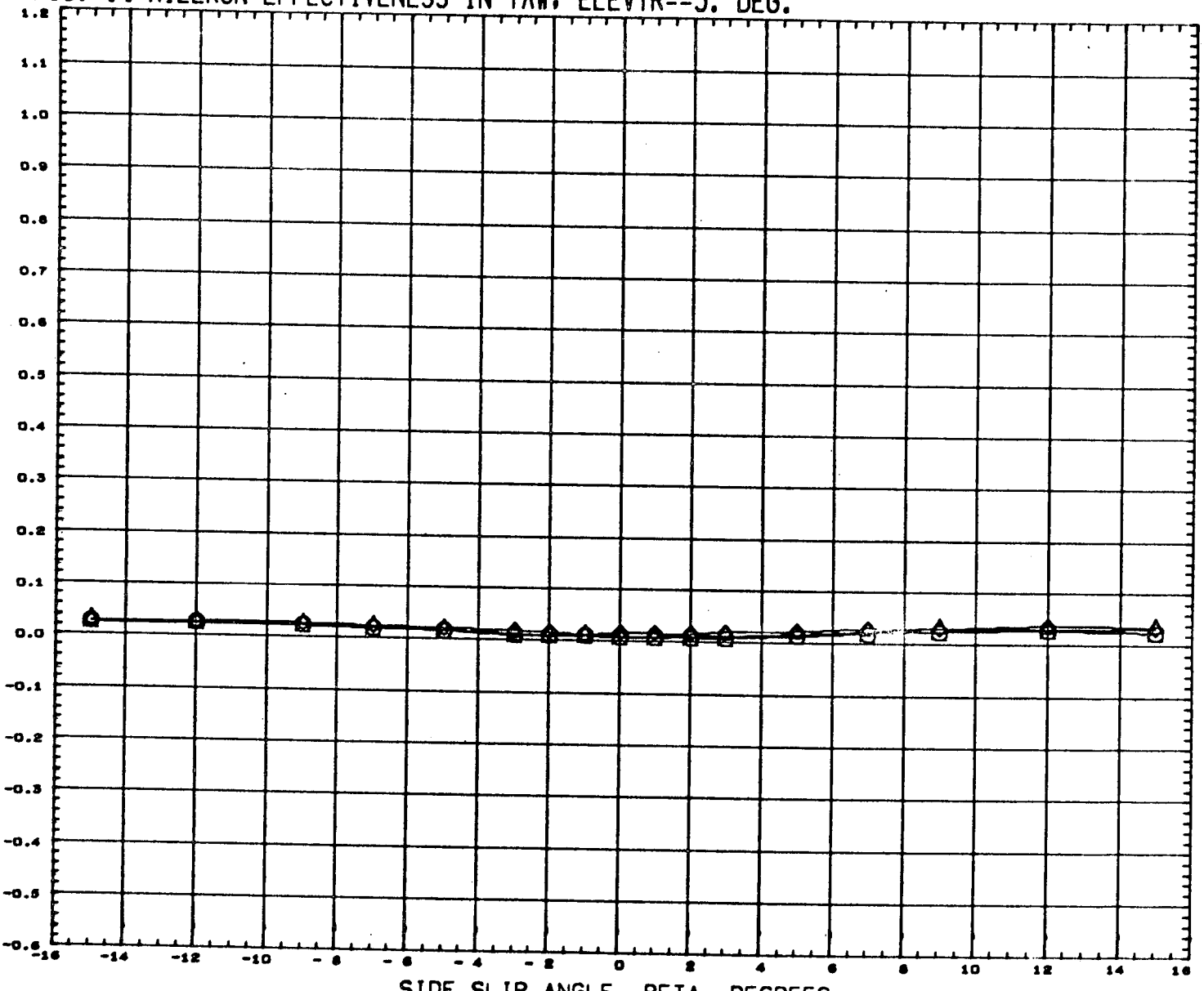


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1033)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5	-5.000	-5.000	0.000
(RD1028)	△	GWTT 292 CONF.H-33 ORBITER B5W4(0,-10)V5	0.000	-10.000	0.000
(RD1031)	◇	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-15)V5	5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 14 AILERON EFFECTIVENESS IN YAW, ELEVTR=-5. DEG.



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1033)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5
(RD1028)	△	GWTT 292 CONF.H-33 ORBITER B5W4(0,-10)V5
(RD1031)	◇	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-15)V5

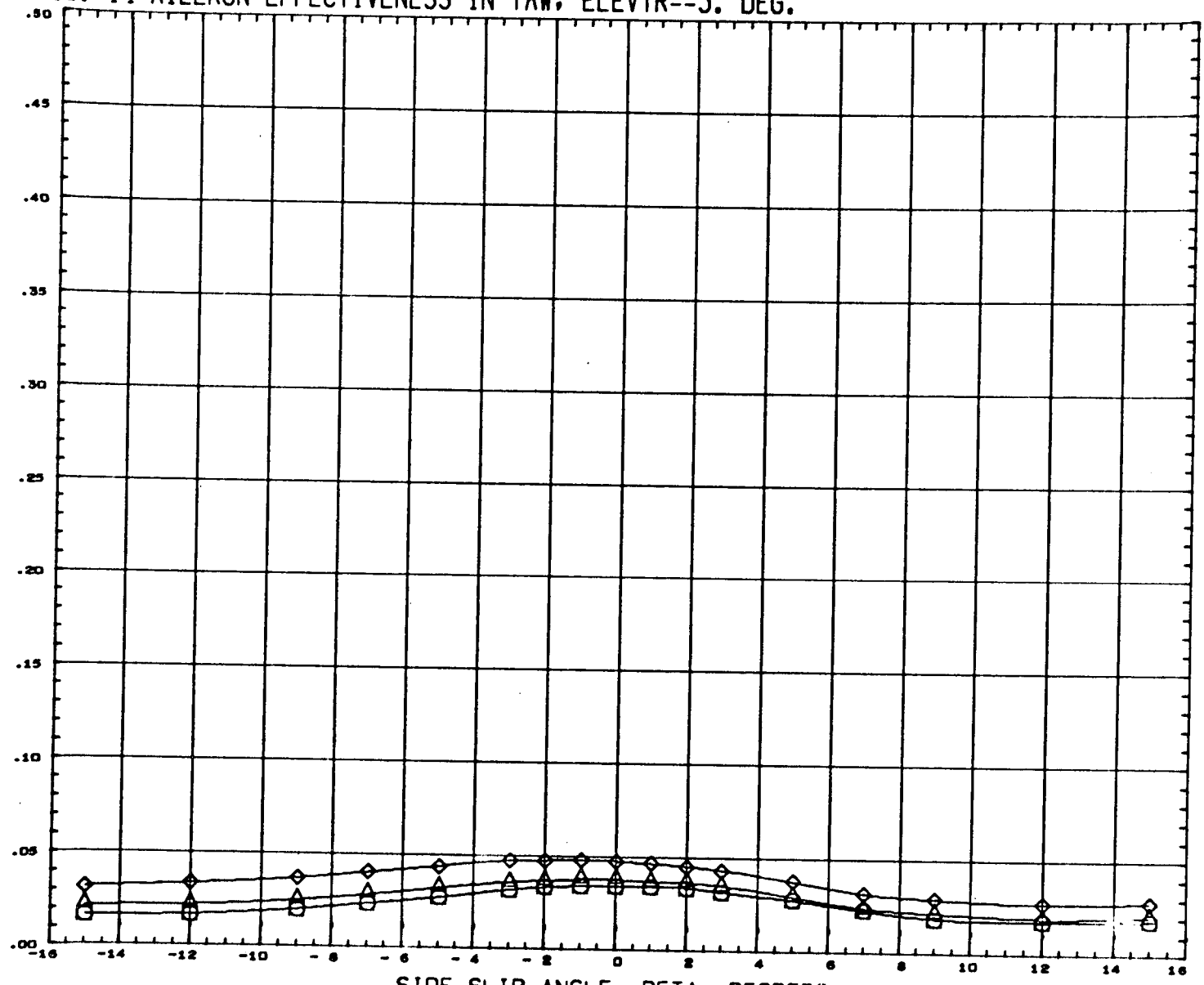
LELEVN	RELEVN	ALPHA
-5.000	-5.000	0.000
0.000	-10.000	0.000
5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 14 AILERON EFFECTIVENESS IN YAW, ELEVTR=-5. DEG.



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1033)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5
(RD1028)	△	GWTT 292 CONF.H-33 ORBITER B5W4(0,-10)V5
(RD1031)	◇	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-15)V5

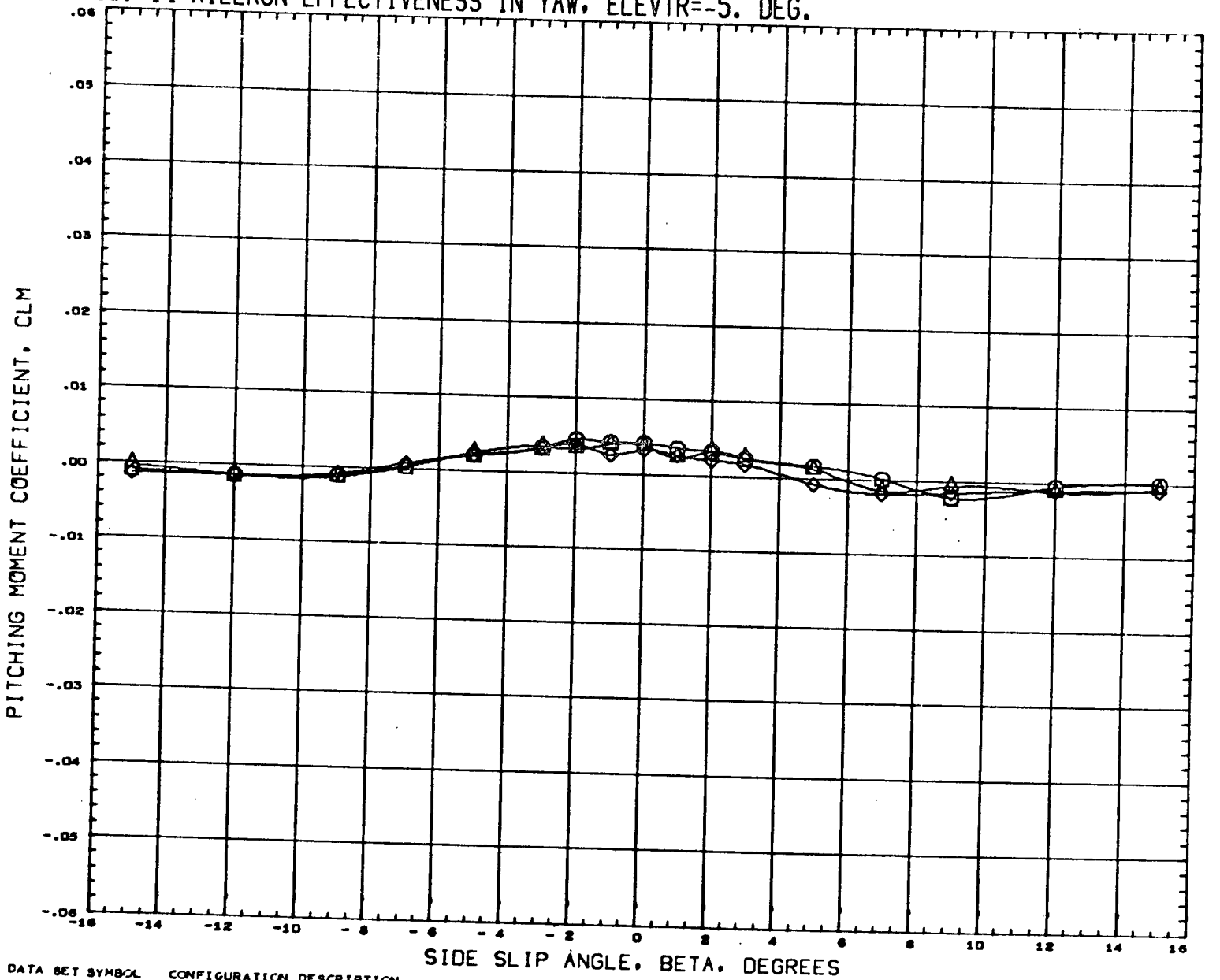
LELEVN	RELEVN	ALPHA
-5.000	-5.000	0.000
0.000	-10.000	0.000
5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 14 AILERON EFFECTIVENESS IN YAW, ELEVTR=-5. DEG.



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1033)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-5)V5
(RD1028)	△	GWTT 292 CONF.H-33 ORBITER B5W4(0,-10)V5
(RD1031)	◇	GWTT 292 CONF.H-33 ORBITER B5W4(+5,-15)V5

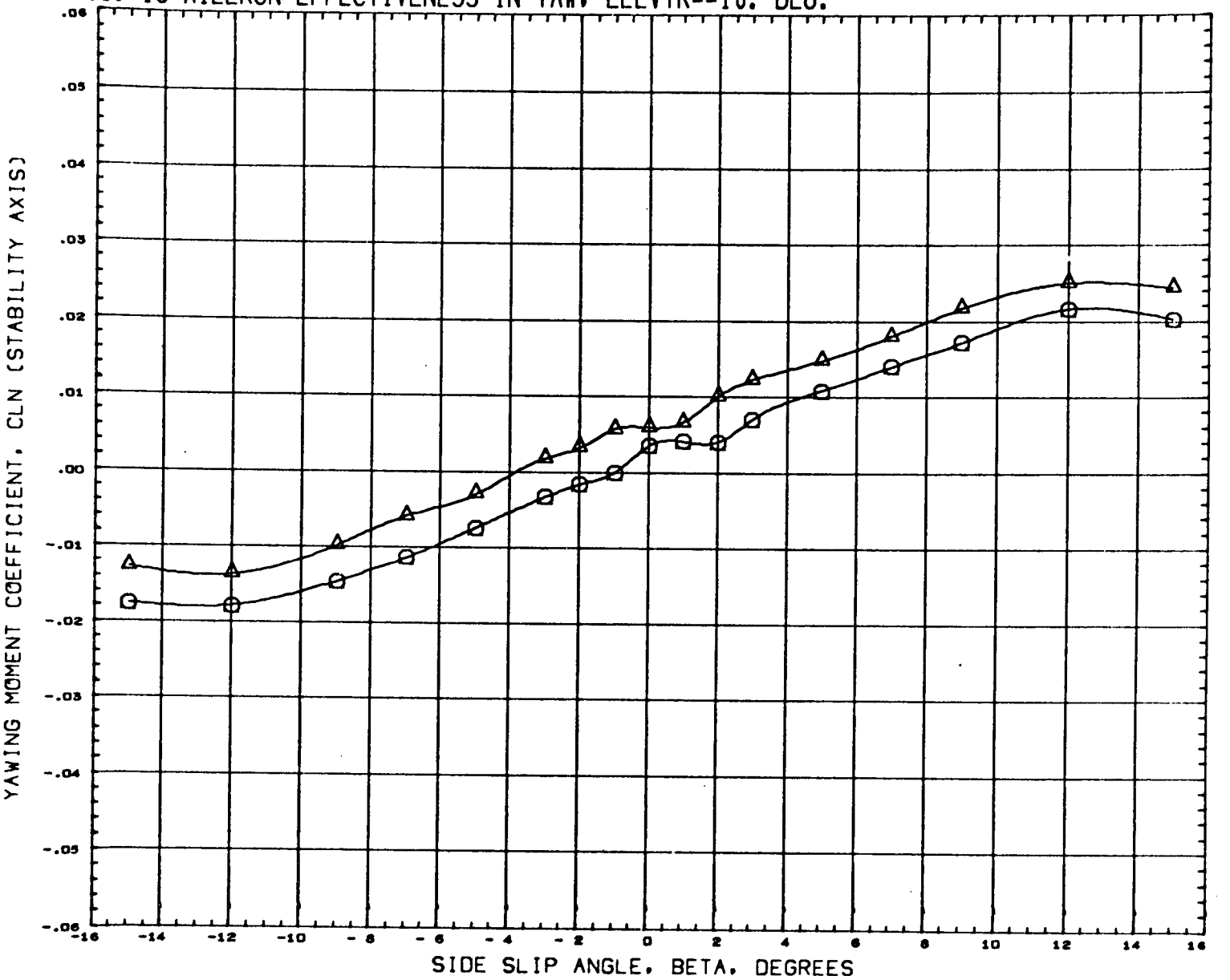
LELEVN	RELEVN	ALPHA
-5.000	-5.000	0.000
0.000	-10.000	0.000
5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 15 AILERON EFFECTIVENESS IN YAW, ELEVTR=-10. DEG.



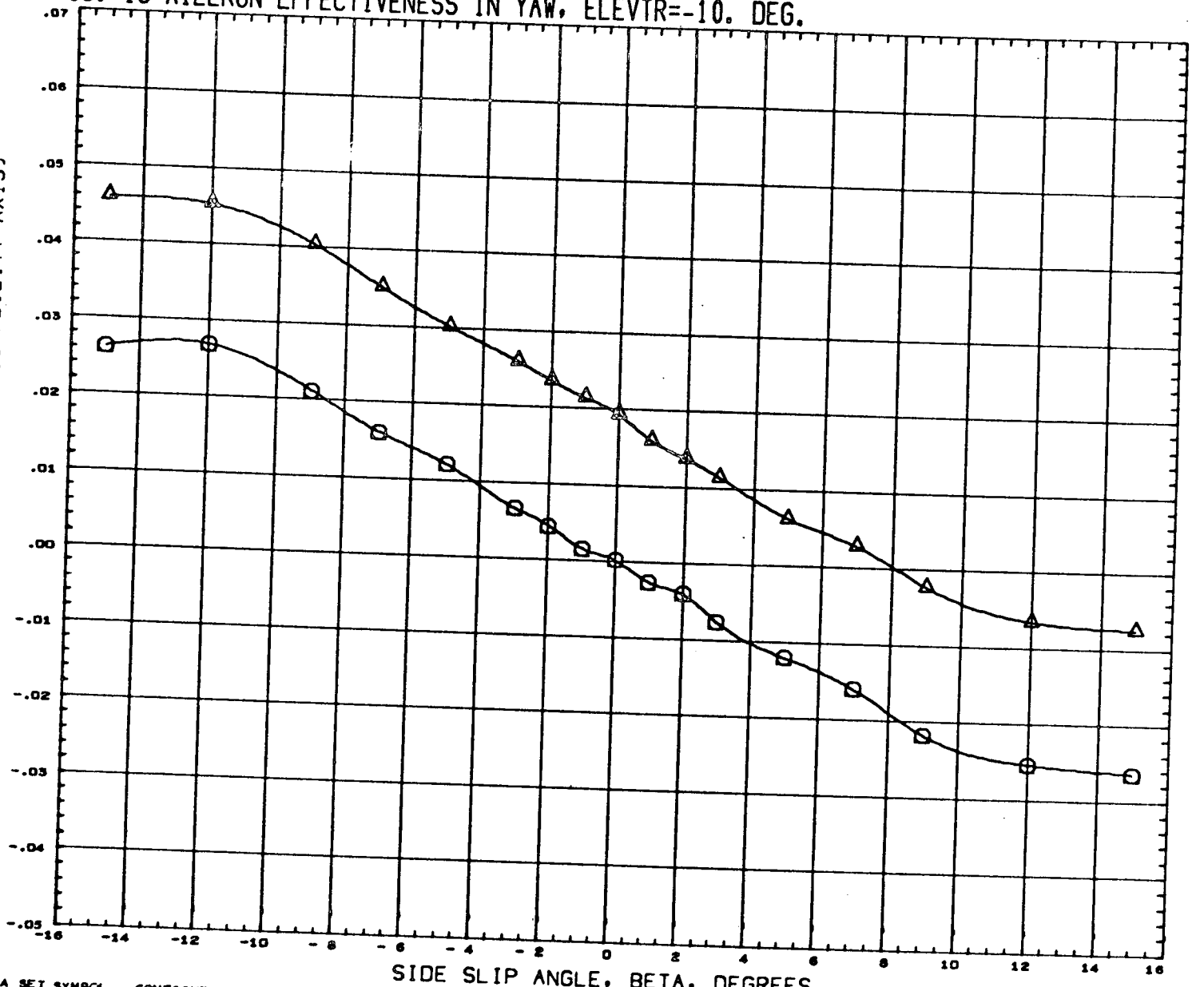
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1029)		GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1030)		GWTT 292 CONF.H-33 ORBITER B5W4(-5,-15)V5	-5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 15 AILERON EFFECTIVENESS IN YAW, ELEVTR=-10. DEG.



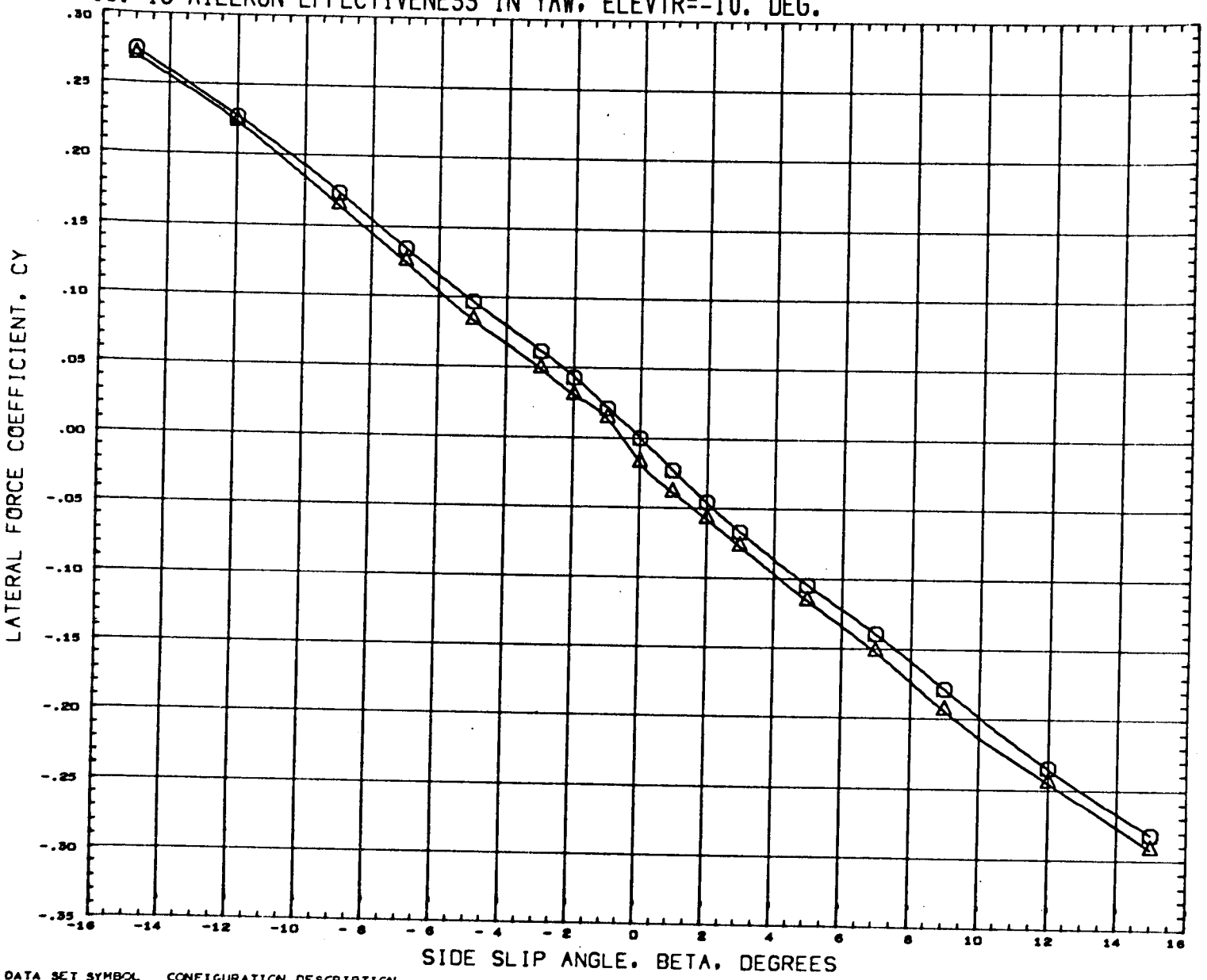
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1029)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1030)	△	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-15)V5	-5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 15 AILERON EFFECTIVENESS IN YAW, ELEVTR=-10. DEG.



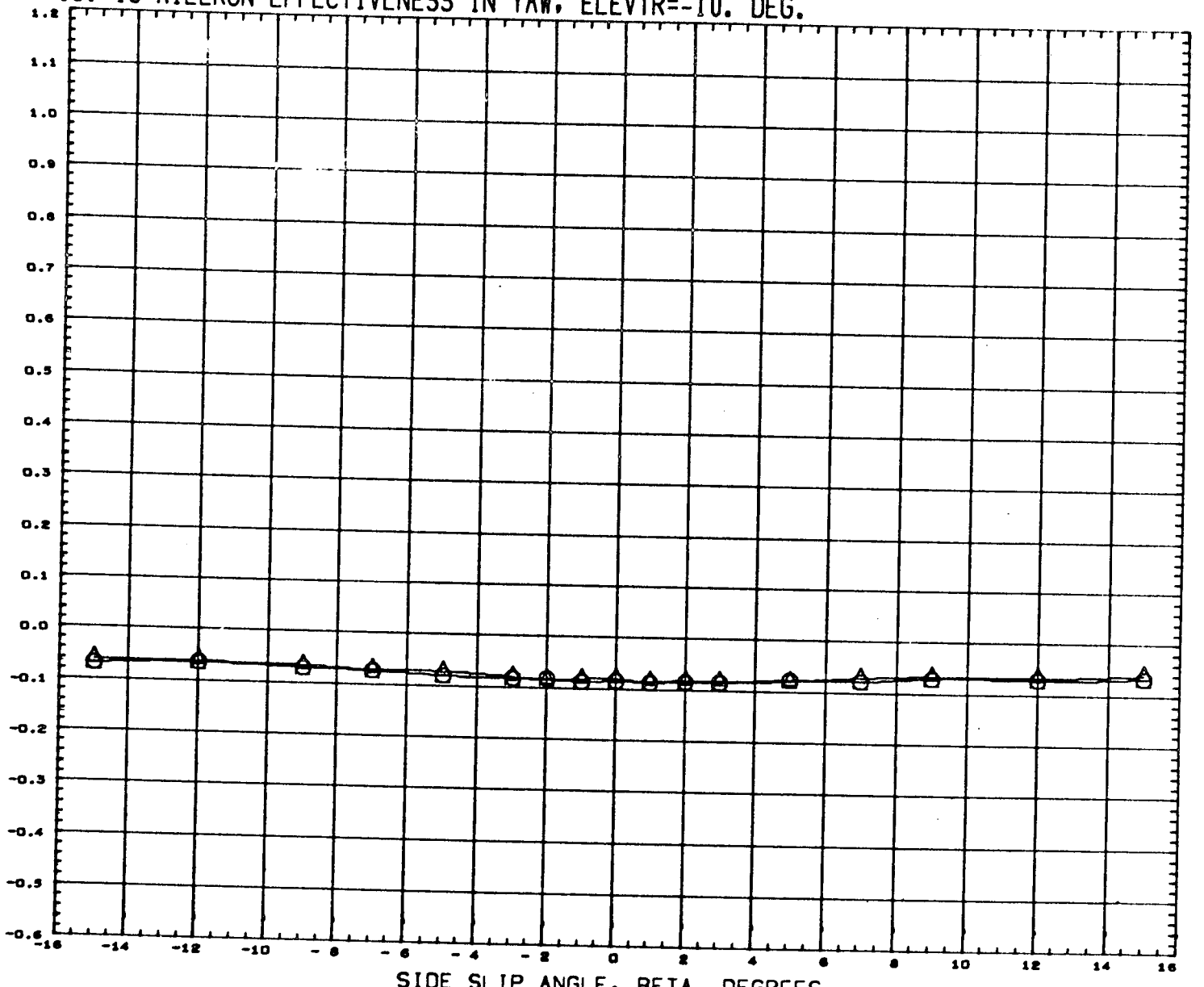
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1029)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1030)	△	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-15)V5	-5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 15 AILERON EFFECTIVENESS IN YAW, ELEVTR=-10. DEG.



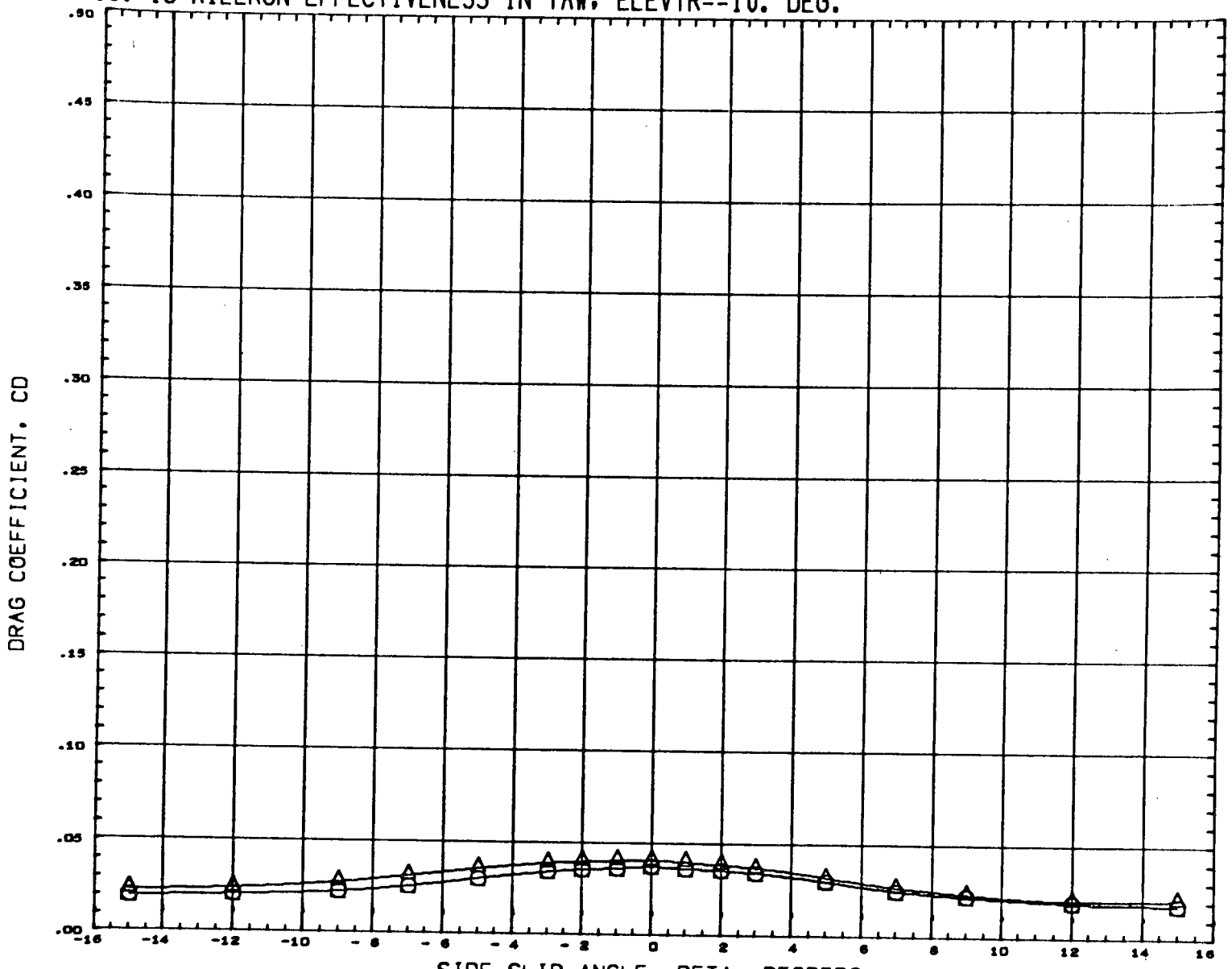
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1029)		GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1030)		GWTT 292 CONF.H-33 ORBITER B5W4(-5,-15)V5	-5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 15 AILERON EFFECTIVENESS IN YAW, ELEVTR=-10. DEG.



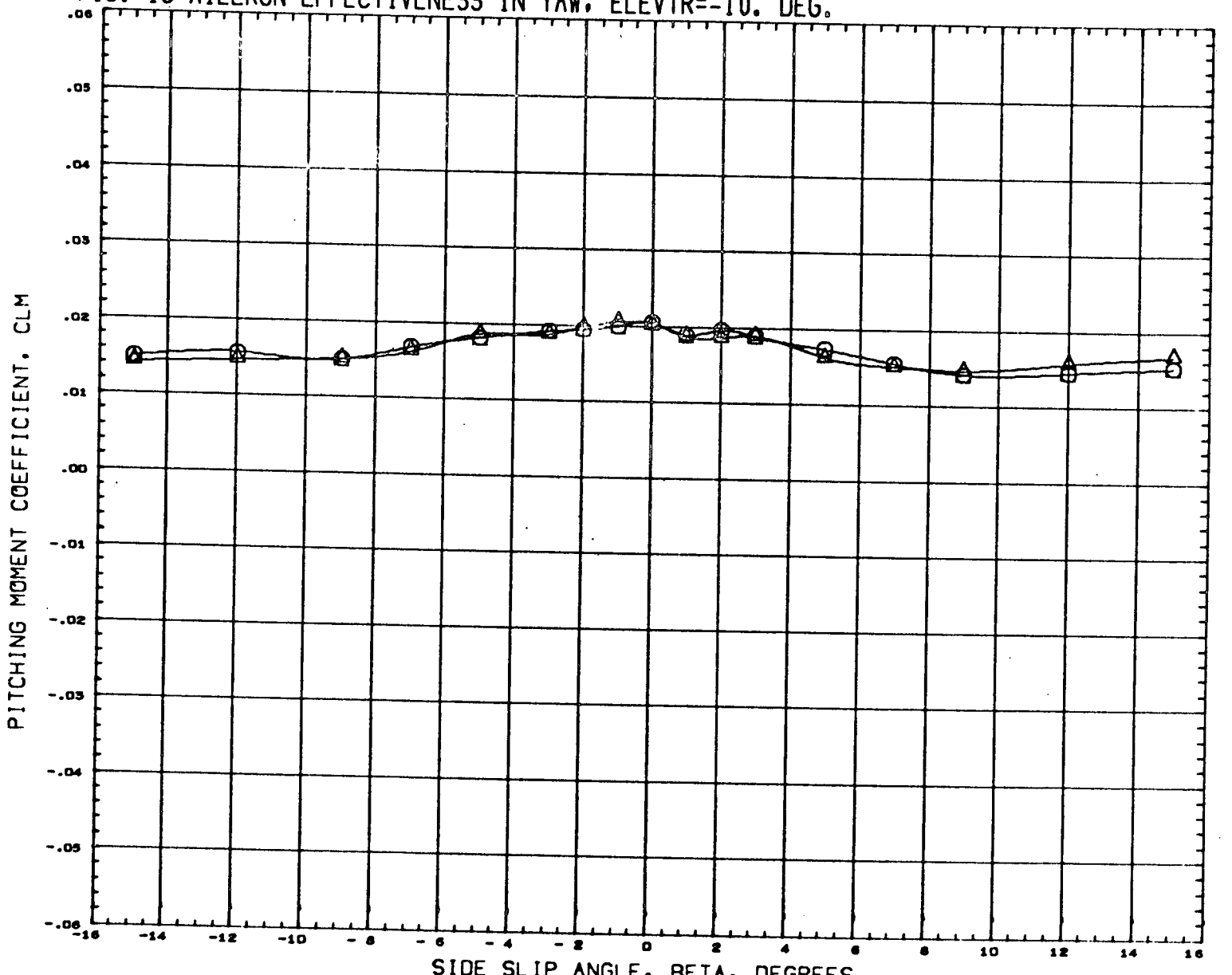
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1029)		GWTT 292 CONF.H-33 ORBITER 85W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1030)		GWTT 292 CONF.H-33 ORBITER 85W4(-5,-15)V5	-5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 15 AILERON EFFECTIVENESS IN YAW, ELEVTR=-10. DEG.



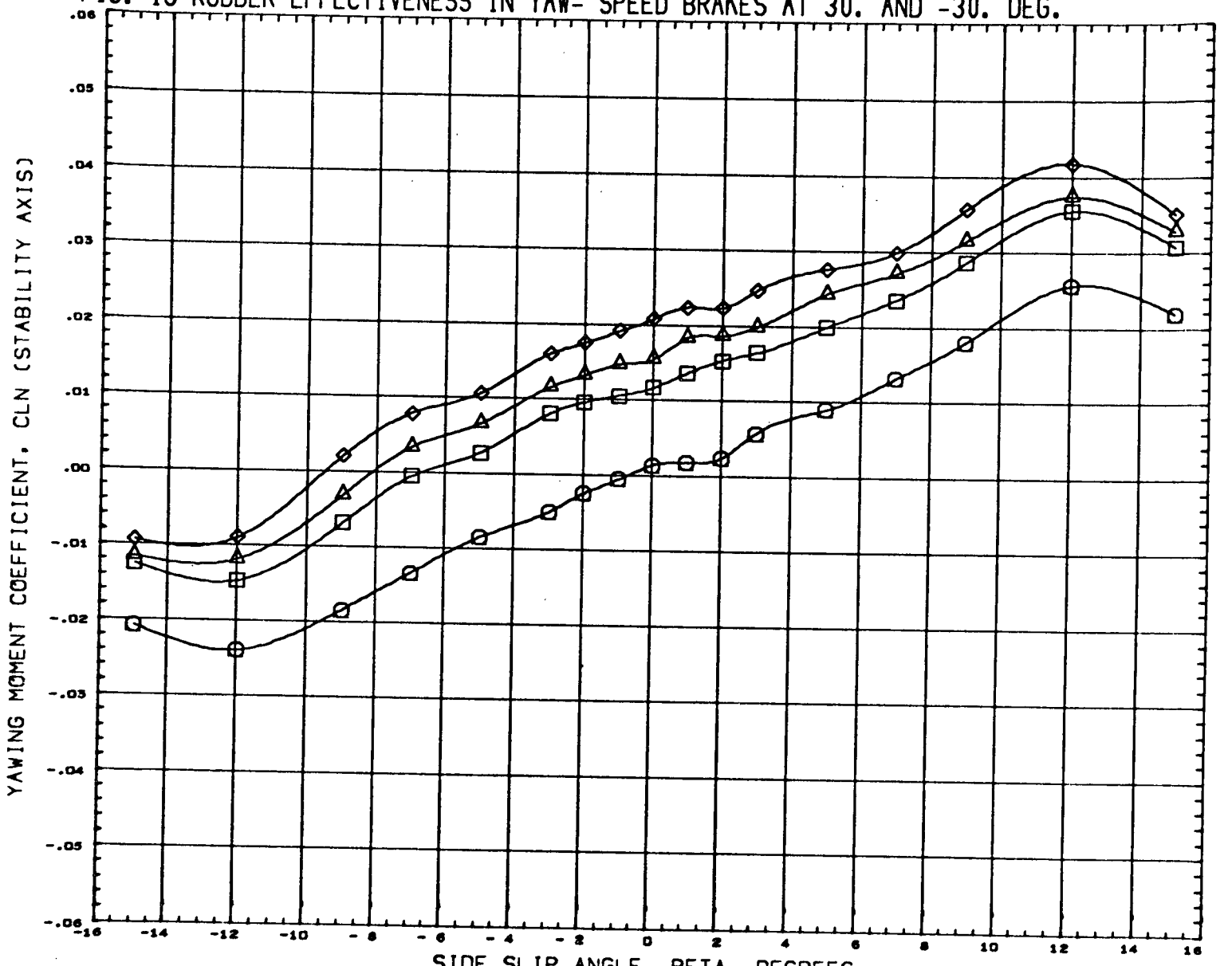
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	LELEVN	RELEVN	ALPHA
(RD1029)	○	GWTT 292 CONF.H-33 ORBITER B5W4(-10,-10)V5	-10.000	-10.000	0.000
(RD1030)	△	GWTT 292 CONF.H-33 ORBITER B5W4(-5,-15)V5	-5.000	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 16 RUDDER EFFECTIVENESS IN YAW- SPEED BRAKES AT 30. AND -30. DEG.

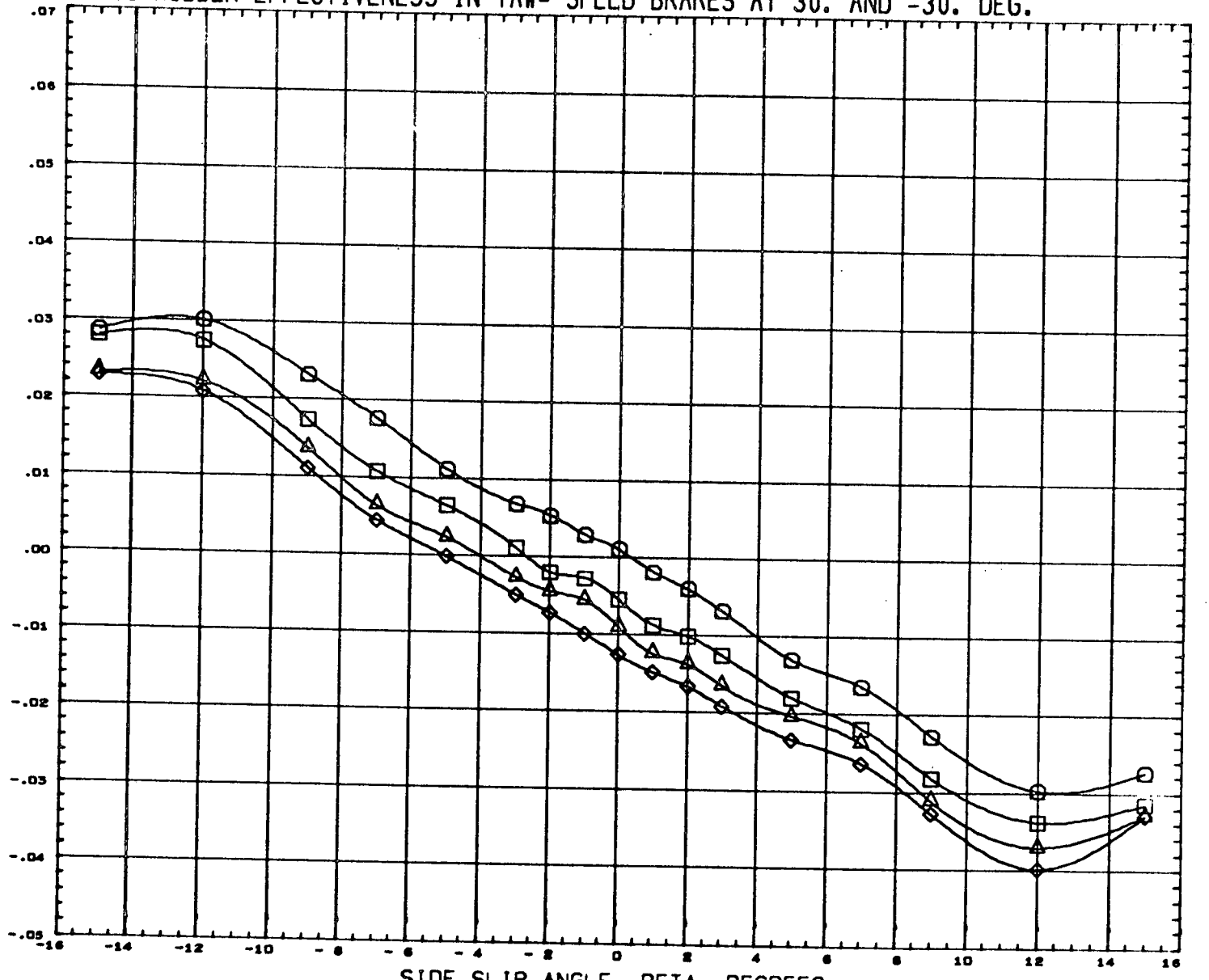


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	ALPHA
(RD1034)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000
(RD1035)	⊠	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+25,-35)	-10.000	25.000	-35.000	0.000
(RD1036)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,+25,-35)	-15.000	25.000	-35.000	0.000
(RD1042)	□	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5,+25,-35)	-5.000	25.000	-35.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 16 RUDDER EFFECTIVENESS IN YAW- SPEED BRAKES AT 30. AND -30. DEG.

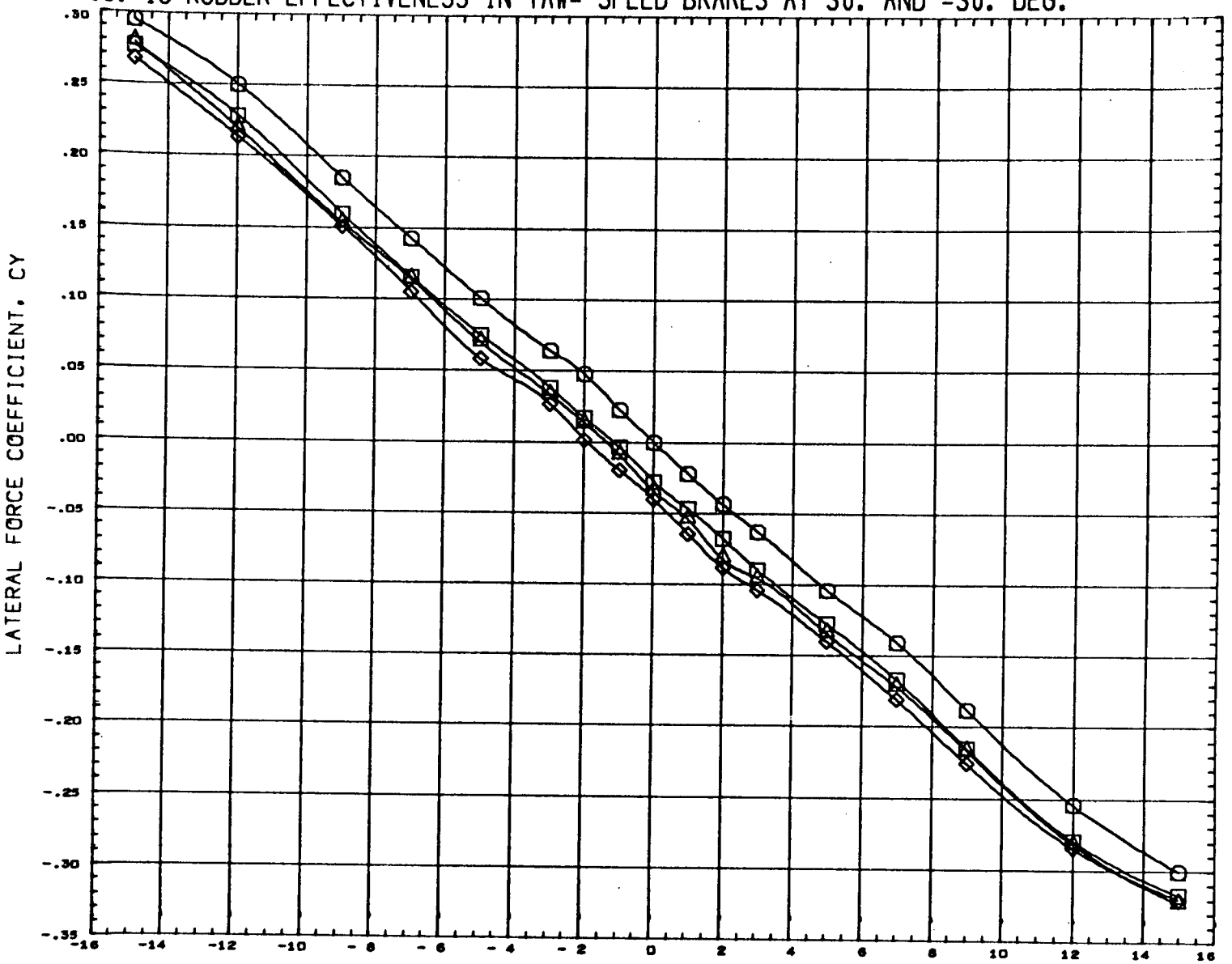


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	ALPHA
(RD1034)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000
(RD1035)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+25,-35)	-10.000	25.000	-35.000	0.000
(RD1036)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,+25,-35)	-15.000	25.000	-35.000	0.000
(RD1042)	□	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5,+25,-35)	-5.000	25.000	-35.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 16 RUDDER EFFECTIVENESS IN YAW- SPEED BRAKES AT 30. AND -30. DEG.

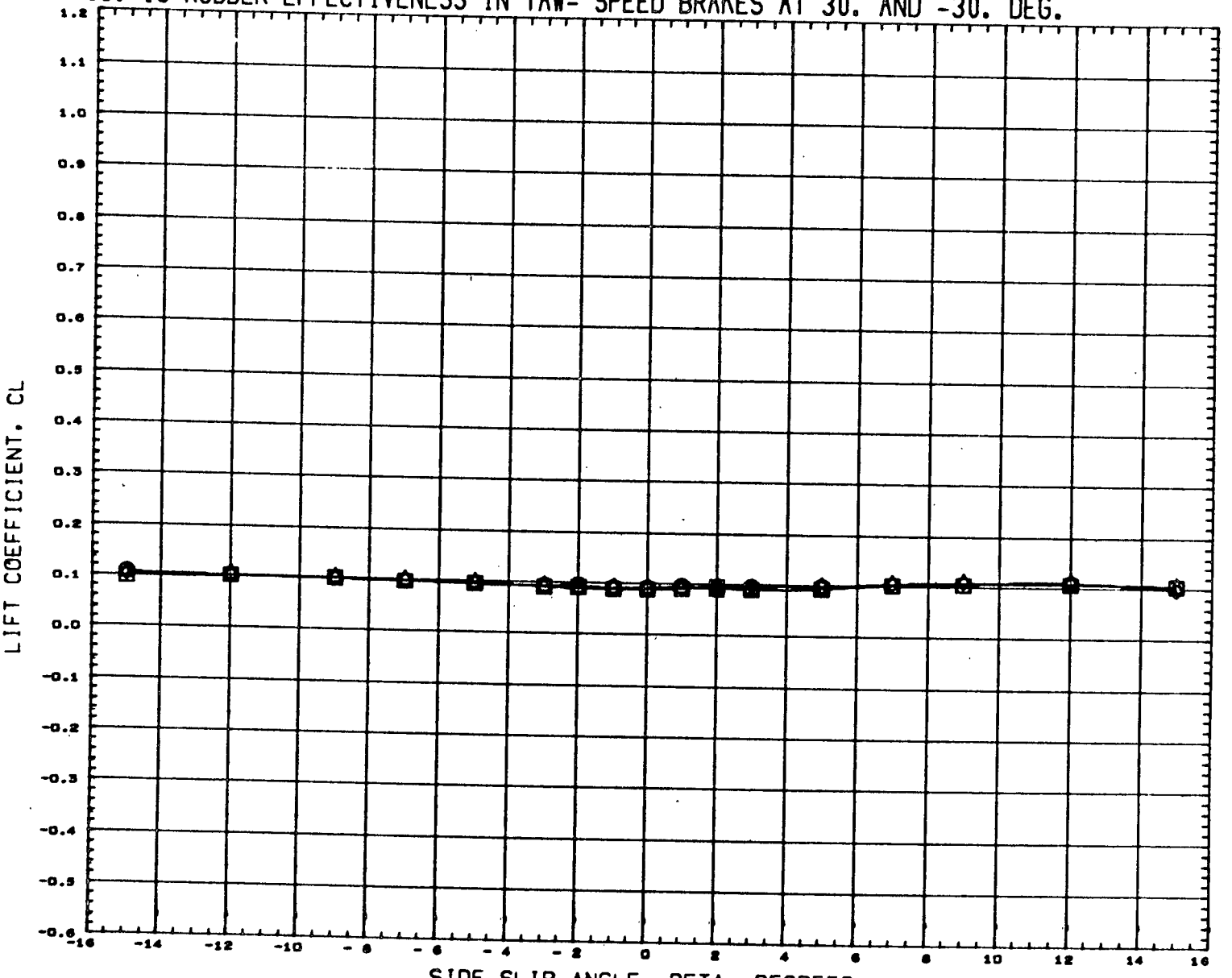


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	ALPHA
(RD1034)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000
(RD1035)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+25,-35)	-10.000	25.000	-35.000	0.000
(RD1036)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,+25,-35)	-15.000	25.000	-35.000	0.000
(RD1042)	□	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5,+25,-35)	-5.000	25.000	-35.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 16 RUDDER EFFECTIVENESS IN YAW- SPEED BRAKES AT 30. AND -30. DEG.

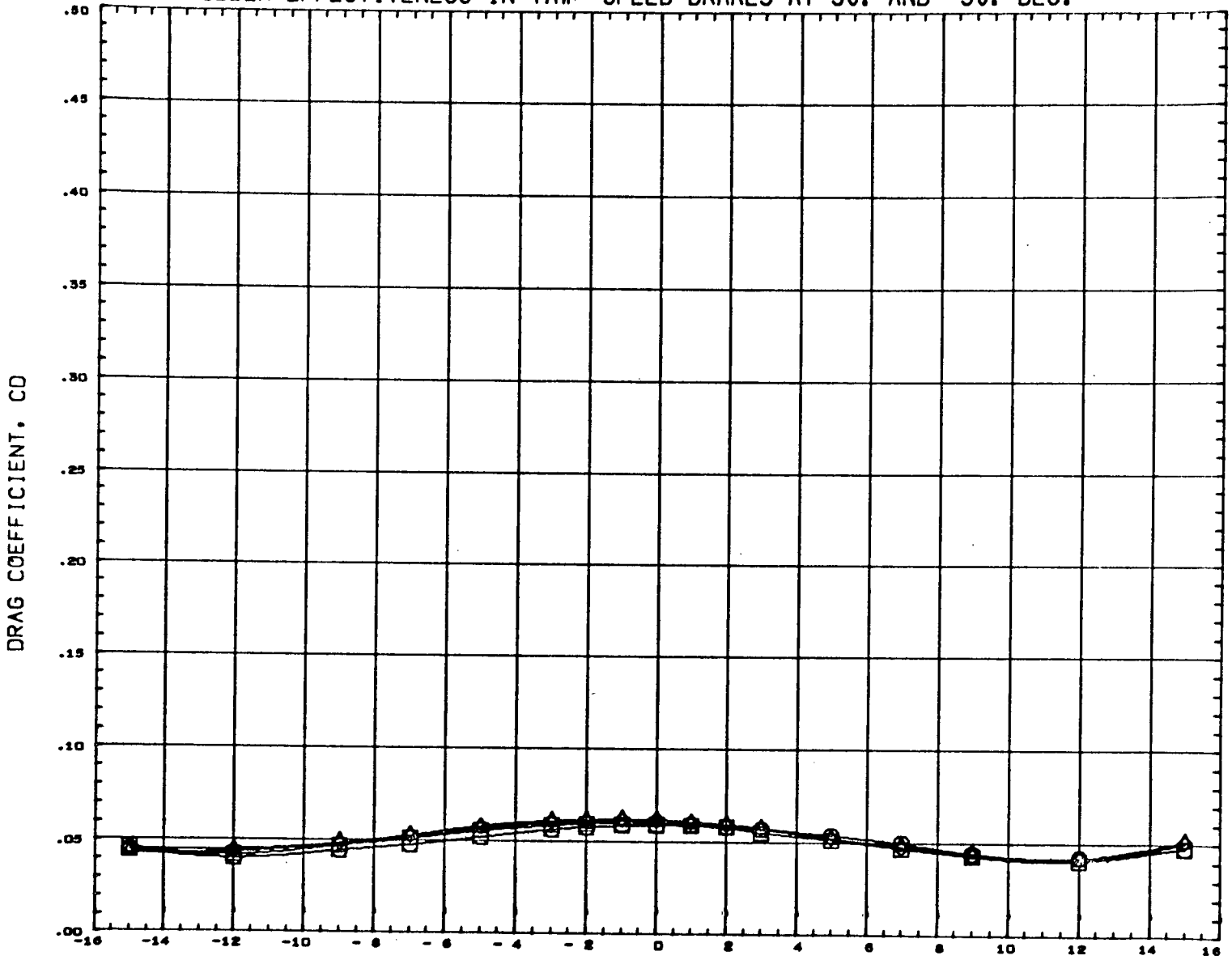


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	ALPHA
(RD1034)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000
(RD1035)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+25,-35)	-10.000	25.000	-35.000	0.000
(RD1036)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,+25,-35)	-15.000	25.000	-35.000	0.000
(RD1042)	□	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5,+25,-35)	-5.000	25.000	-35.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 16 RUDDER EFFECTIVENESS IN YAW- SPEED BRAKES AT 30. AND -30. DEG.

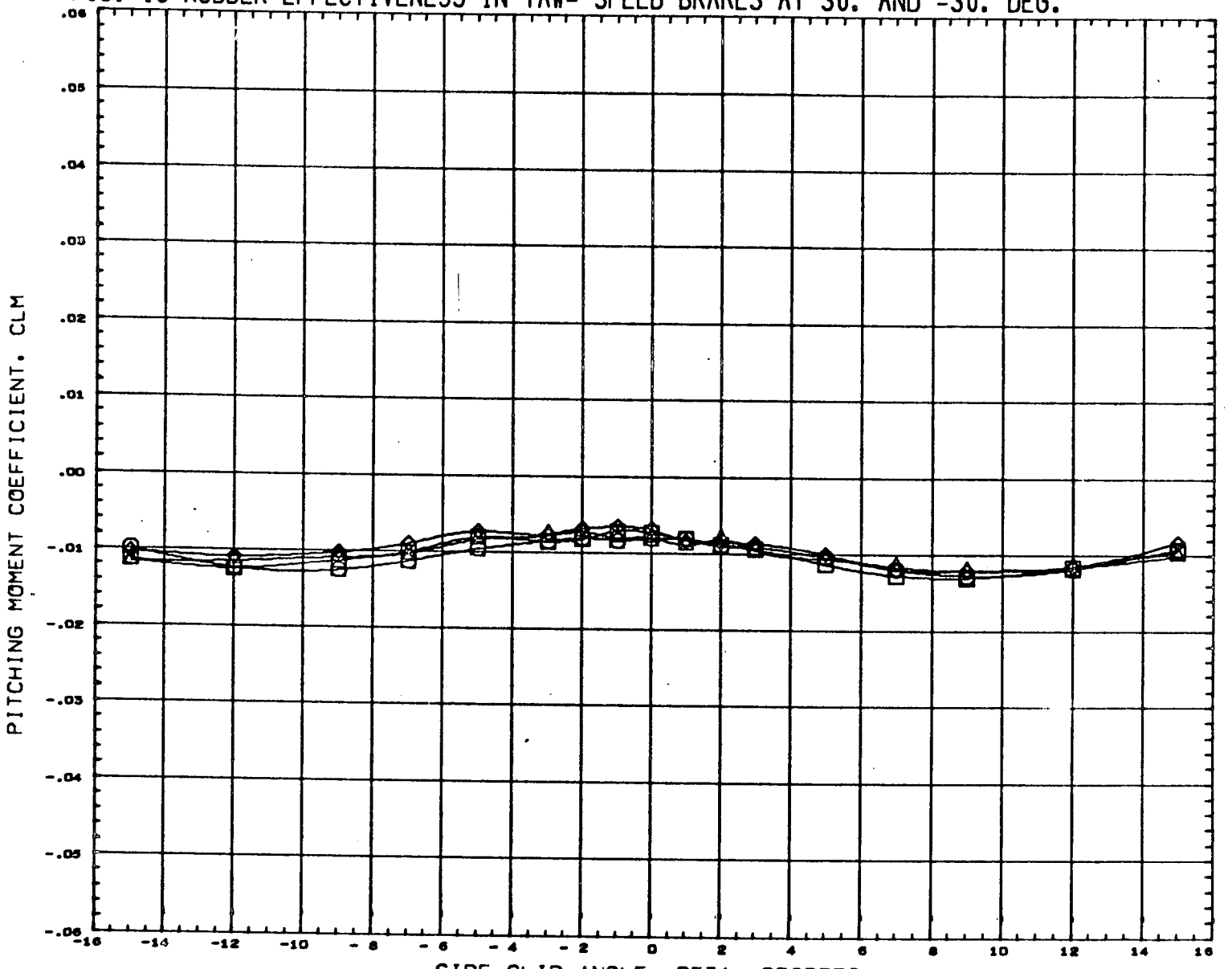


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	ALPHA
(RD1034)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000
(RD1035)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+25,-35)	-10.000	25.000	-35.000	0.000
(RD1036)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,+25,-35)	-15.000	25.000	-35.000	0.000
(RD1042)	□	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5,+25,-35)	-5.000	25.000	-35.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 16 RUDDER EFFECTIVENESS IN YAW- SPEED BRAKES AT 30. AND -30. DEG.

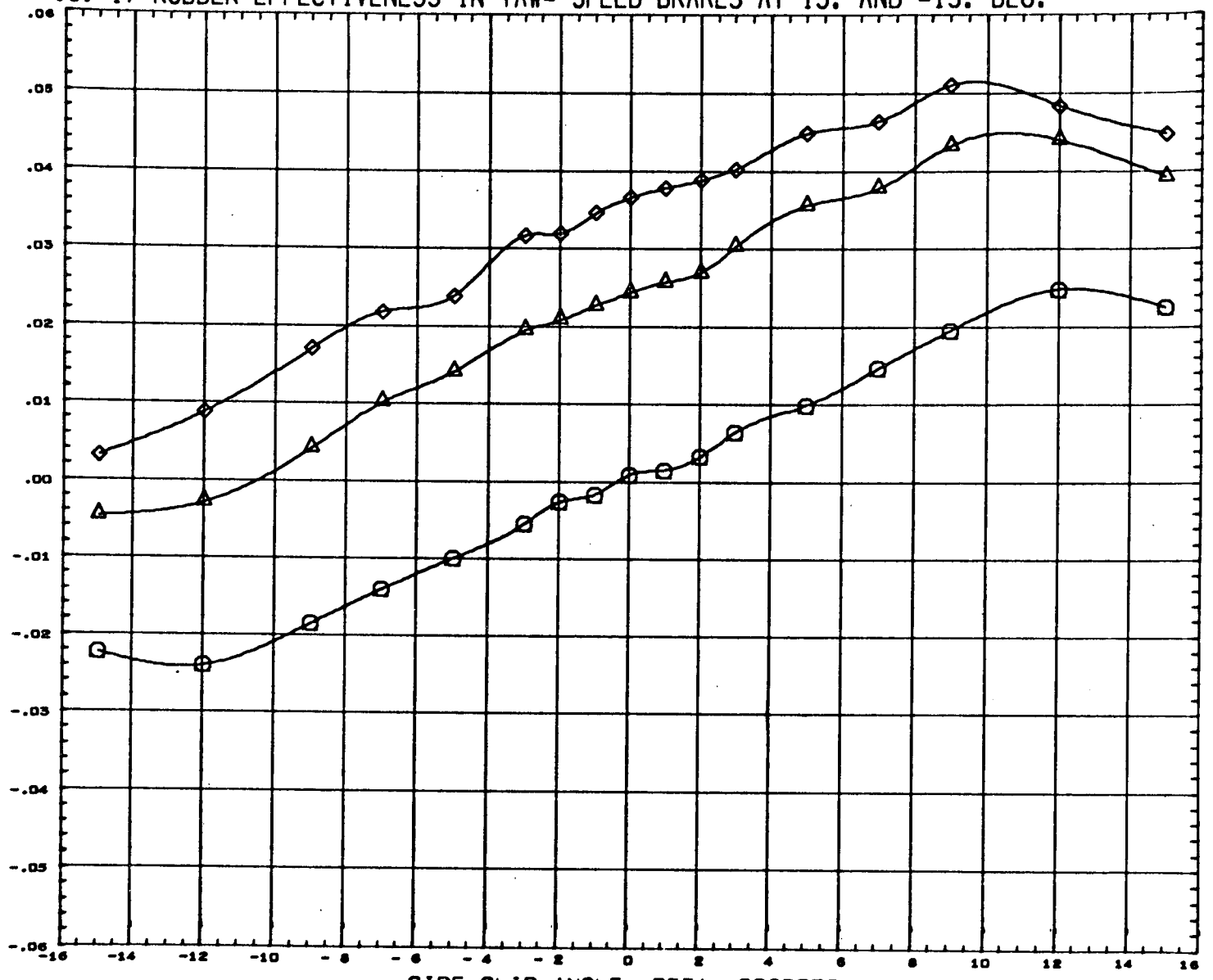


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	ALPHA
(RD1034)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+30,-30)	0.000	30.000	-30.000	0.000
(RD1035)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+25,-35)	-10.000	25.000	-35.000	0.000
(RD1036)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,+25,-35)	-15.000	25.000	-35.000	0.000
(RD1042)	□	GWTT 292 CONF.H-33 ORBITER B5W4V5(-5,+25,-35)	-5.000	25.000	-35.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 17 RUDDER EFFECTIVENESS IN YAW- SPEED BRAKES AT 15. AND -15. DEG.

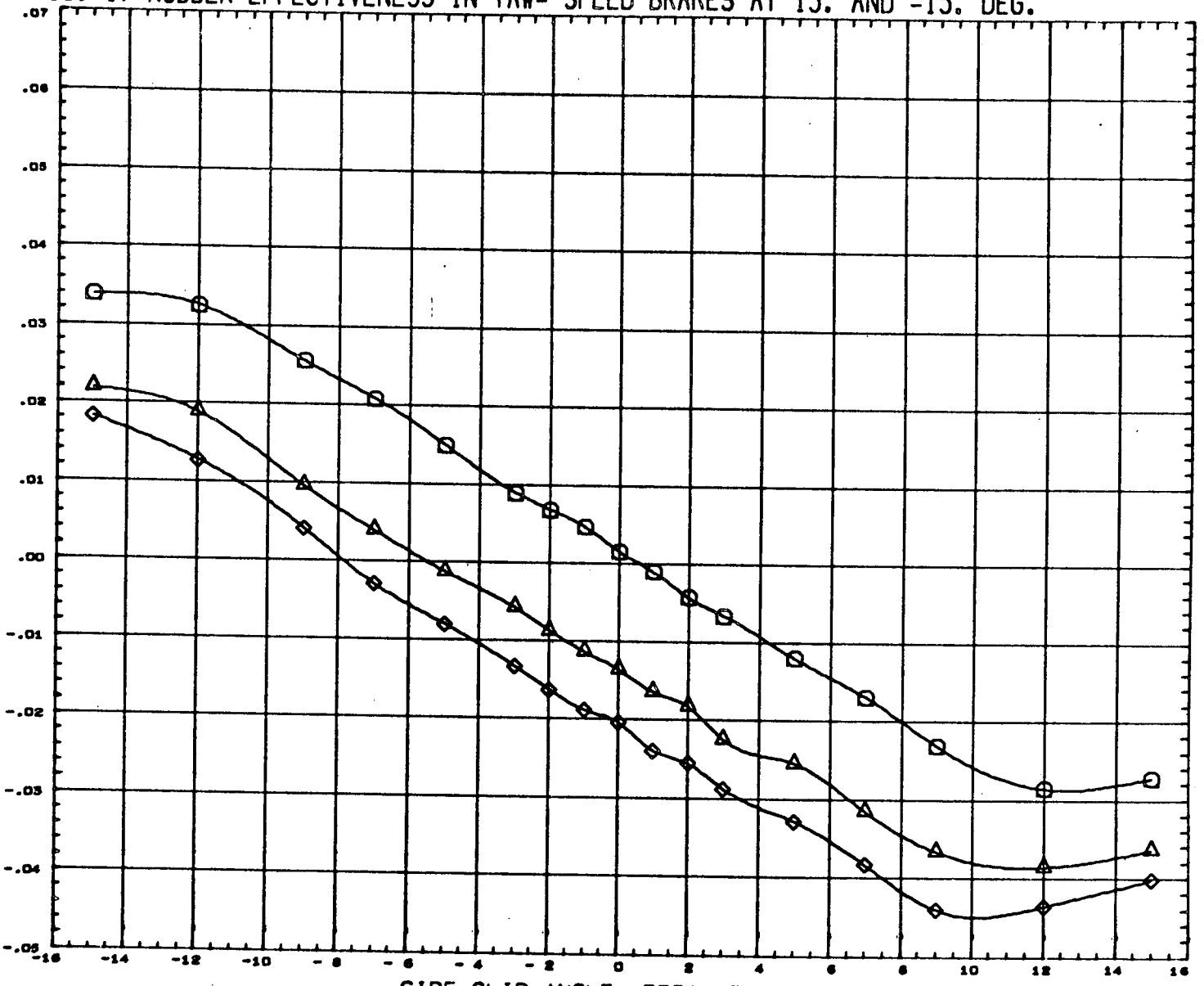


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	ALPHA
(RD1039)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000	15.000	-15.000	0.000
(RD1038)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+5,-25)	-10.000	5.000	-25.000	0.000
(RD1037)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,0,-30)	-15.000	0.000	-30.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 17 RUDDER EFFECTIVENESS IN YAW- SPEED BRAKES AT 15. AND -15. DEG.

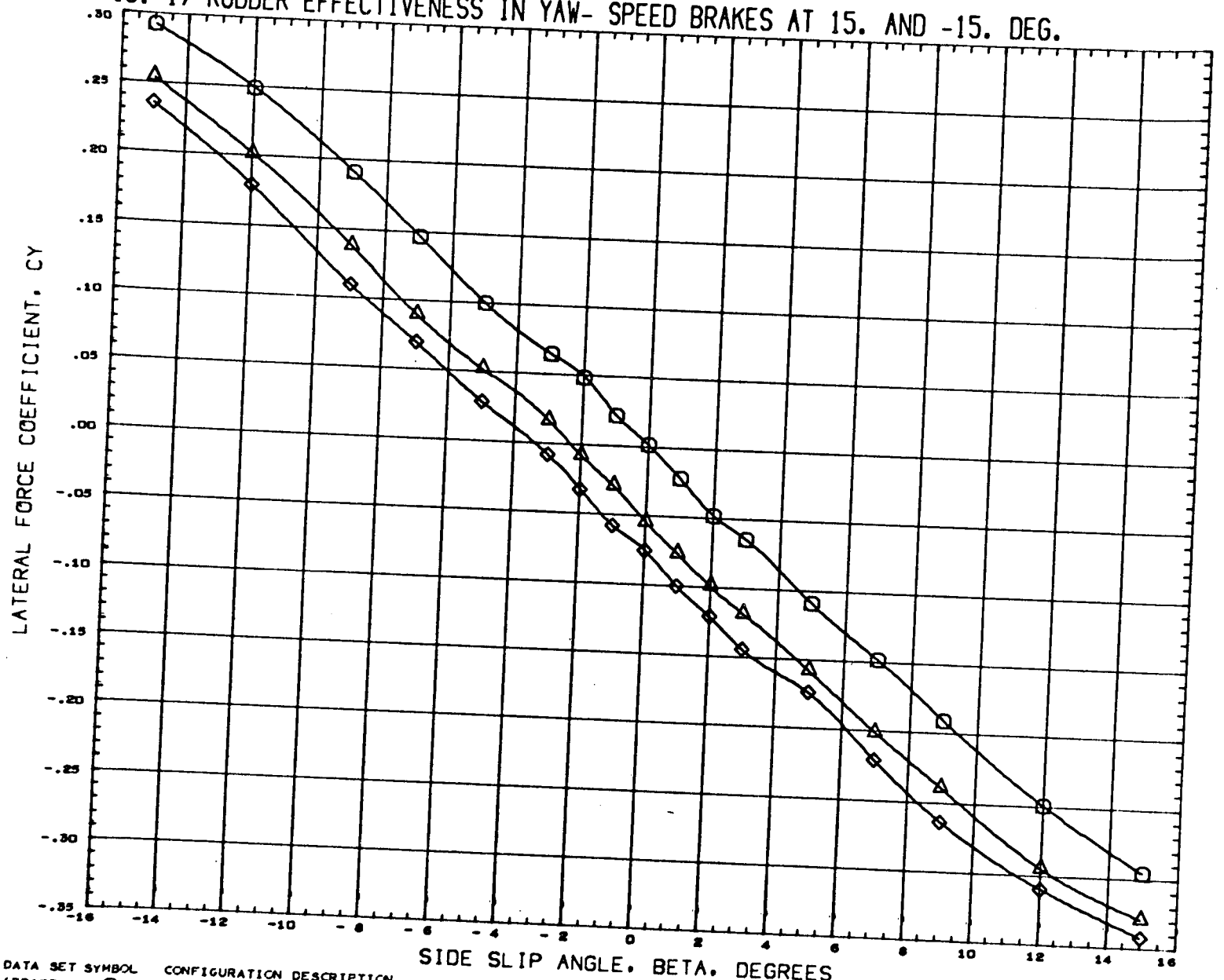


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	ALPHA
(RD1039)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000	15.000	-15.000	0.000
(RD1038)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+5,-25)	-10.000	5.000	-25.000	0.000
(RD1037)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,0,-30)	-15.000	0.000	-30.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 17 RUDDER EFFECTIVENESS IN YAW- SPEED BRAKES AT 15. AND -15. DEG.



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1039)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)
(RD1038)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+5,-25)
(RD1037)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,0,-30)

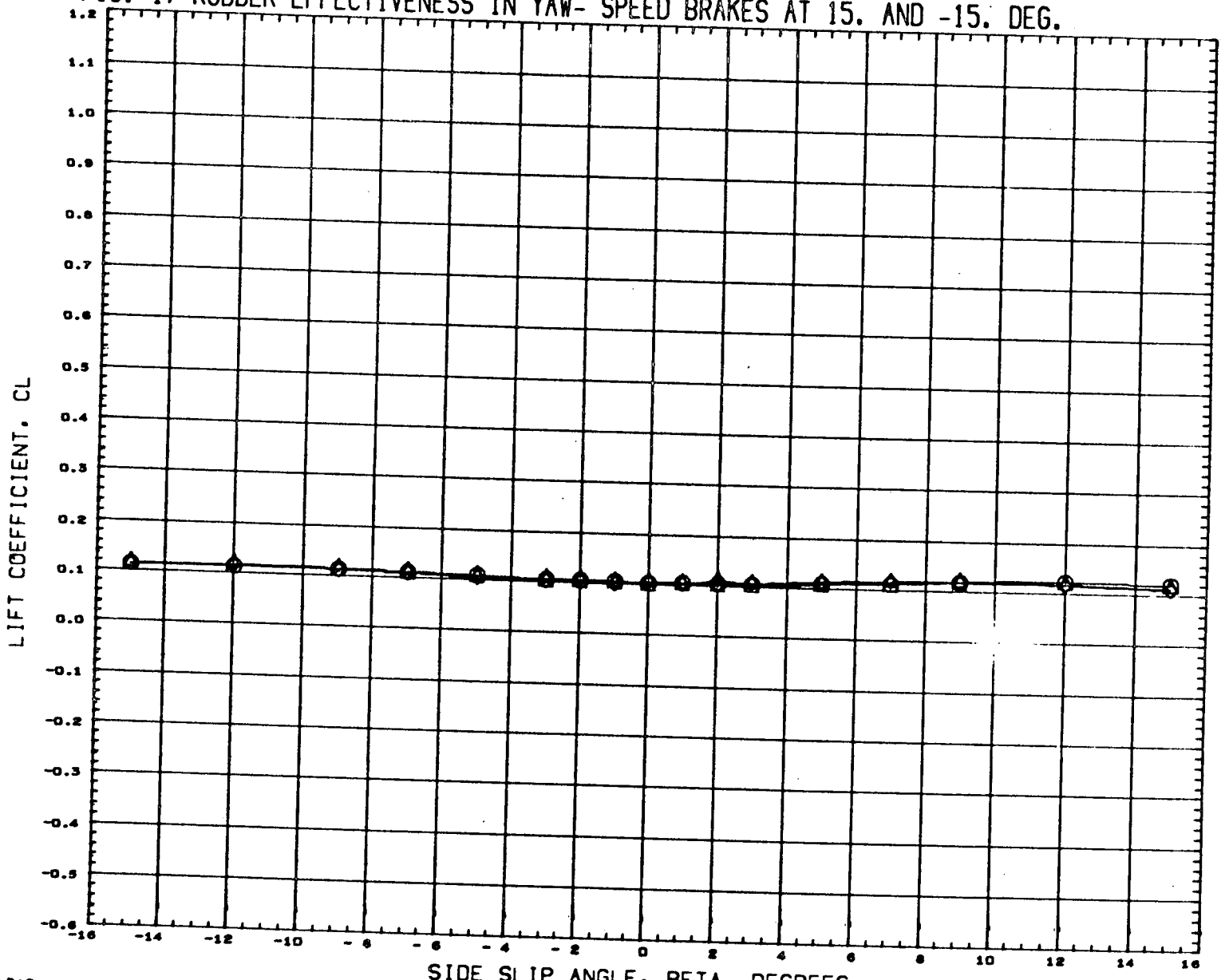
TRUDDR	LLRUDD	LRRUDD	ALPHA
0.000	15.000	-15.000	0.000
-10.000	5.000	-25.000	0.000
-15.000	0.000	-30.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 17 RUDDER EFFECTIVENESS IN YAW- SPEED BRAKES AT 15. AND -15. DEG.

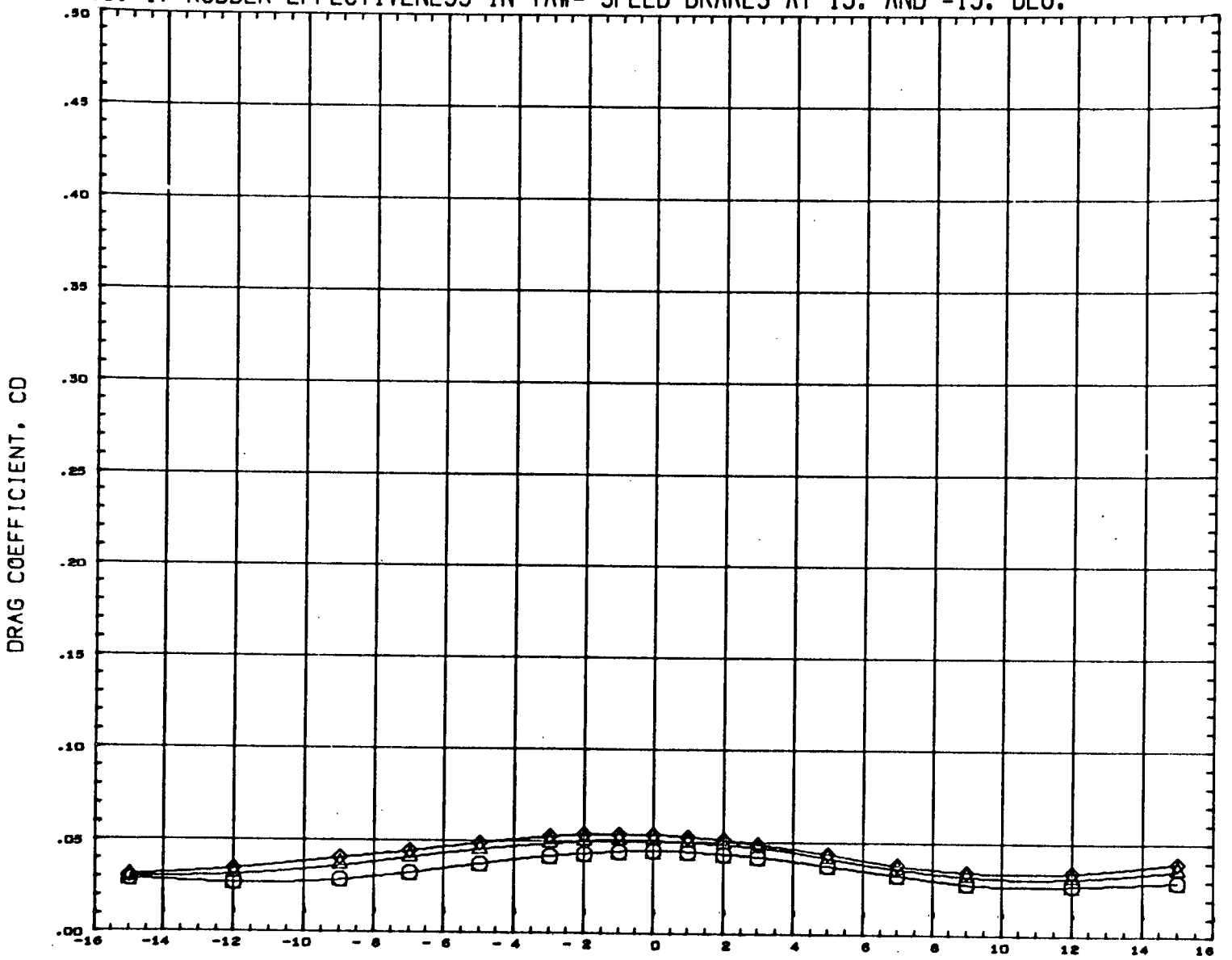


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	ALPHA
(RD1039)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000	15.000	-15.000	0.000
(RD1038)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+5,-25)	-10.000	5.000	-25.000	0.000
(RD1037)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,0,-30)	-15.000	0.000	-30.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 17 RUDDER EFFECTIVENESS IN YAW- SPEED BRAKES AT 15. AND -15. DEG.

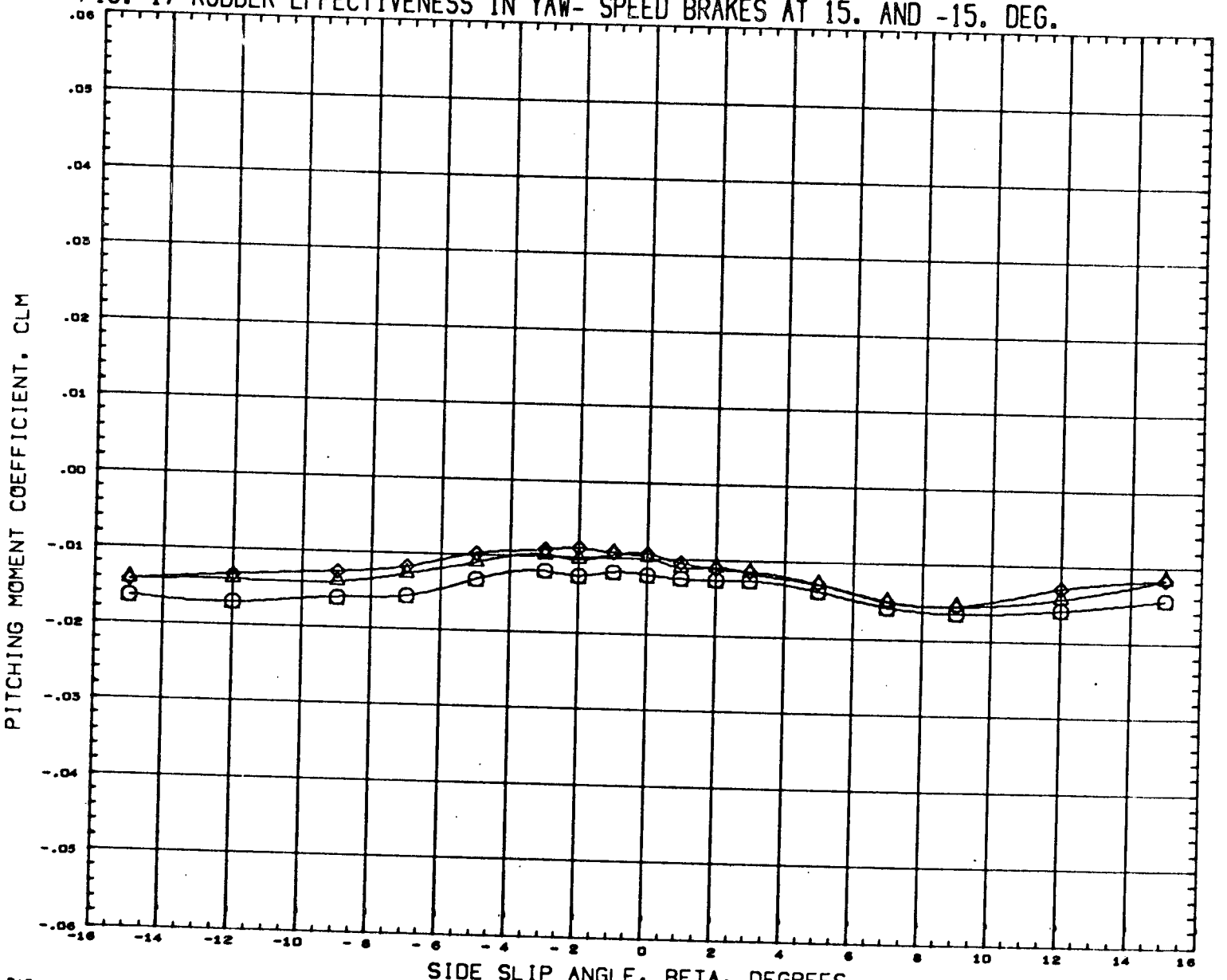


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	ALPHA
(RD1039)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000	15.000	-15.000	0.000
(RD1038)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+5,-25)	-10.000	5.000	-25.000	0.000
(RD1037)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,0,-30)	-15.000	0.000	-30.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 17 RUDDER EFFECTIVENESS IN YAW- SPEED BRAKES AT 15. AND -15. DEG.

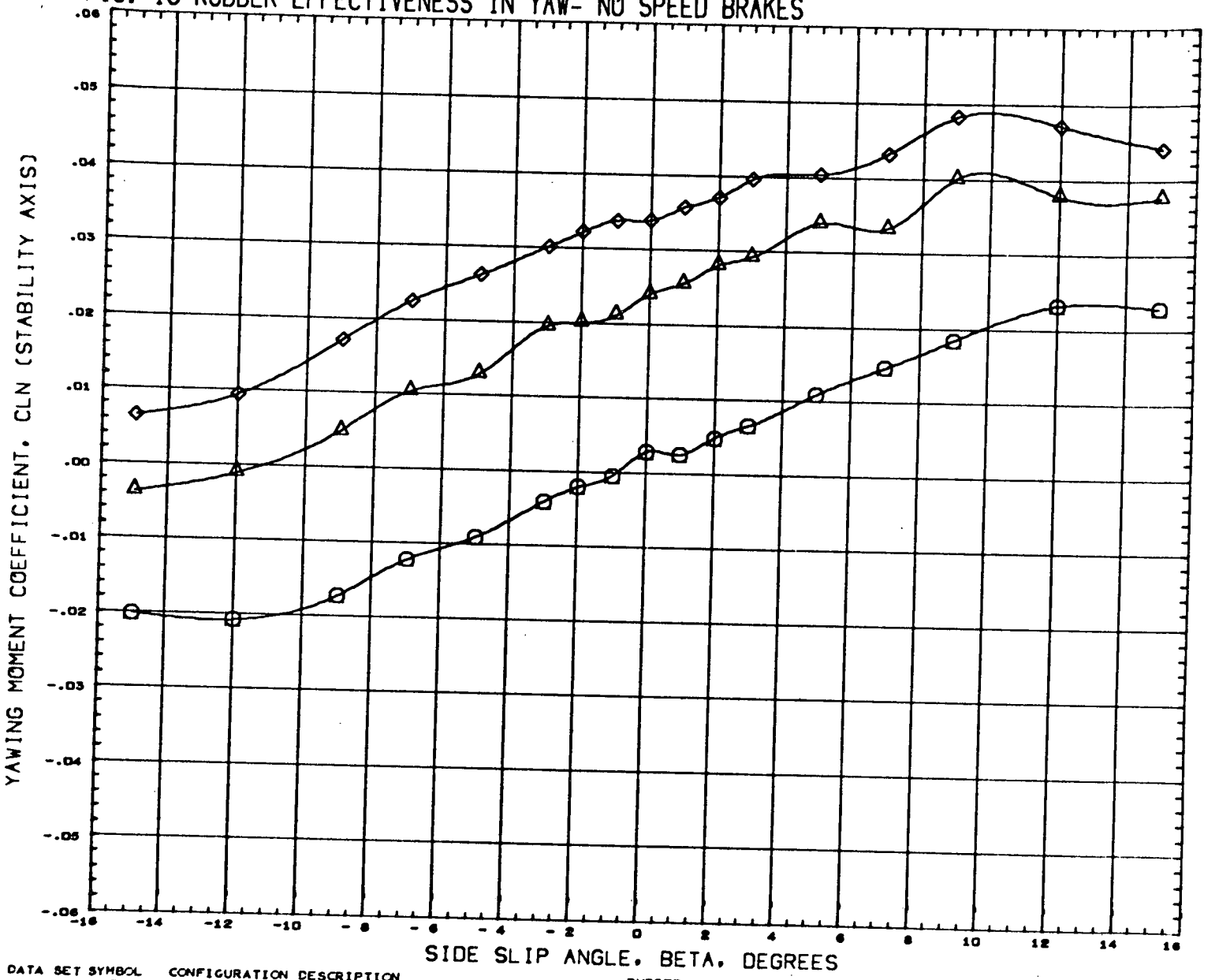


DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	TRUDDR	LLRUDD	LRRUDD	ALPHA
(RD1039)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5(0,+15,-15)	0.000	15.000	-15.000	0.000
(RD1038)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10,+5,-25)	-10.000	5.000	-25.000	0.000
(RD1037)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15,0,-30)	-15.000	0.000	-30.000	0.000

MACH 0.170

REFERENCE INFORMATION		
SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 18 RUDDER EFFECTIVENESS IN YAW- NO SPEED BRAKES



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5
(RD1040)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10)
(RD1041)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15)

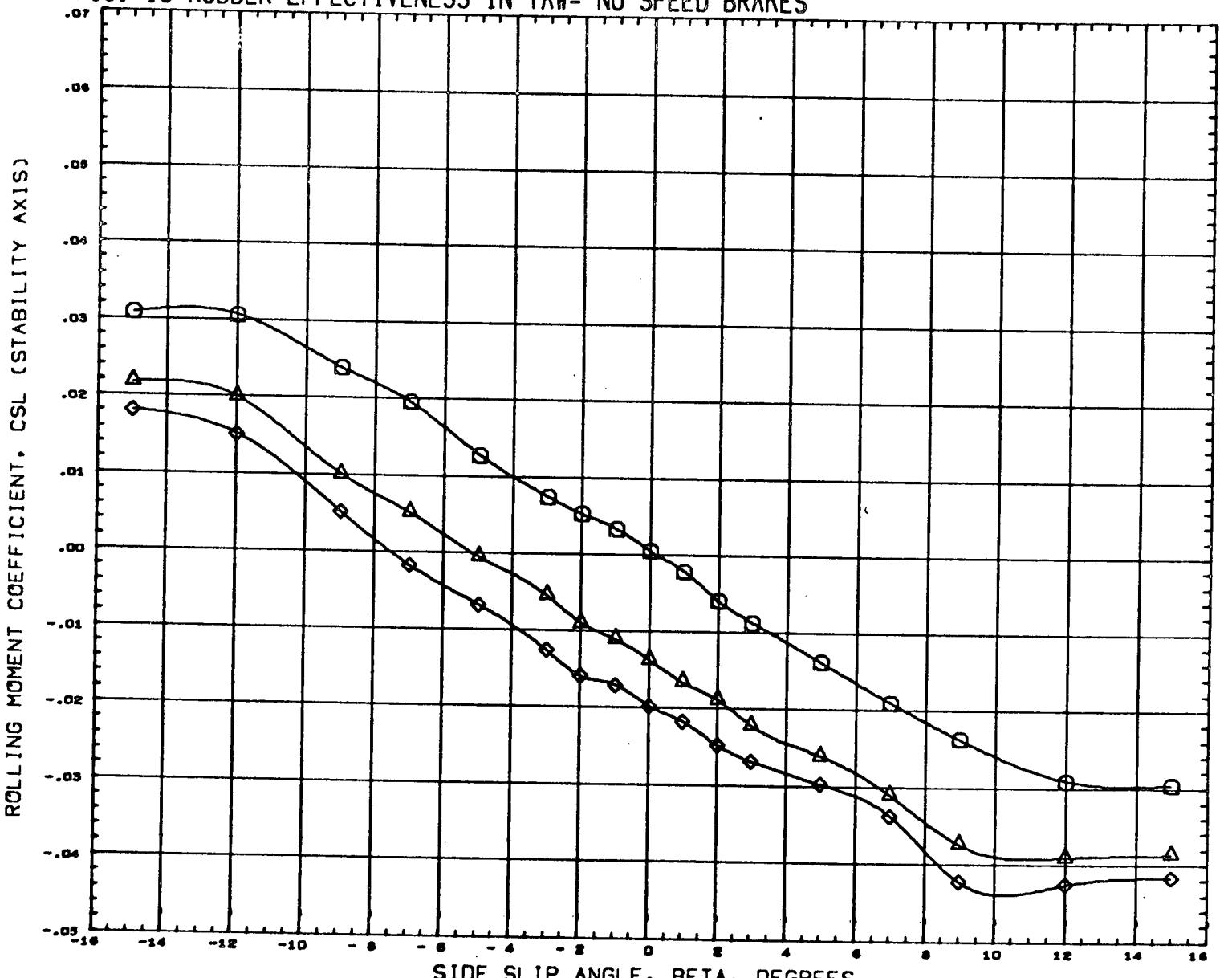
RUDDER	ALPHA
0.000	0.000
-10.000	0.000
-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1265.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 18 RUDDER EFFECTIVENESS IN YAW- NO SPEED BRAKES



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5
(RD1040)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10)
(RD1041)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15)

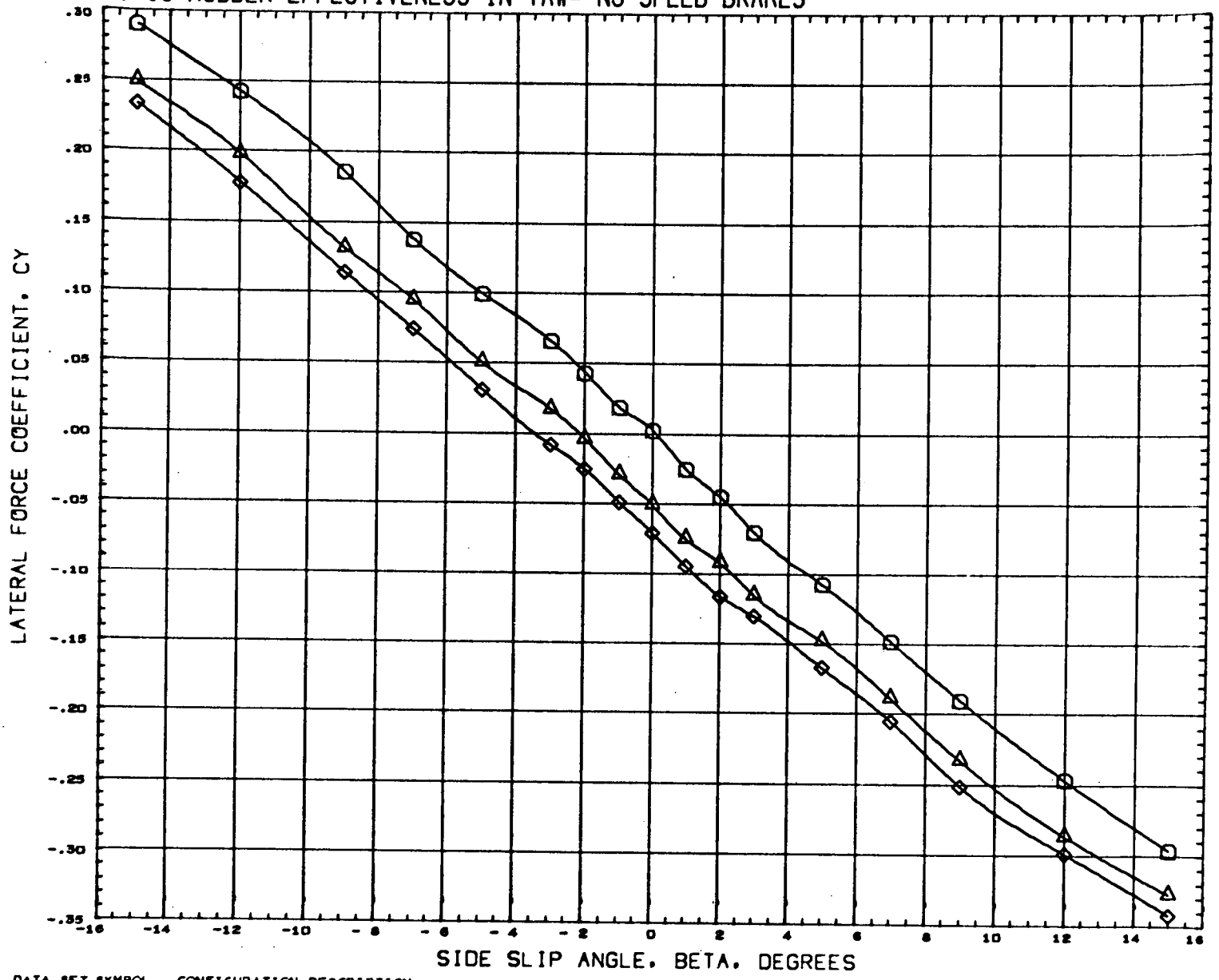
RUDDER	ALPHA
0.000	0.000
-10.000	0.000
-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 18 RUDDER EFFECTIVENESS IN YAW- NØ SPEED BRAKES



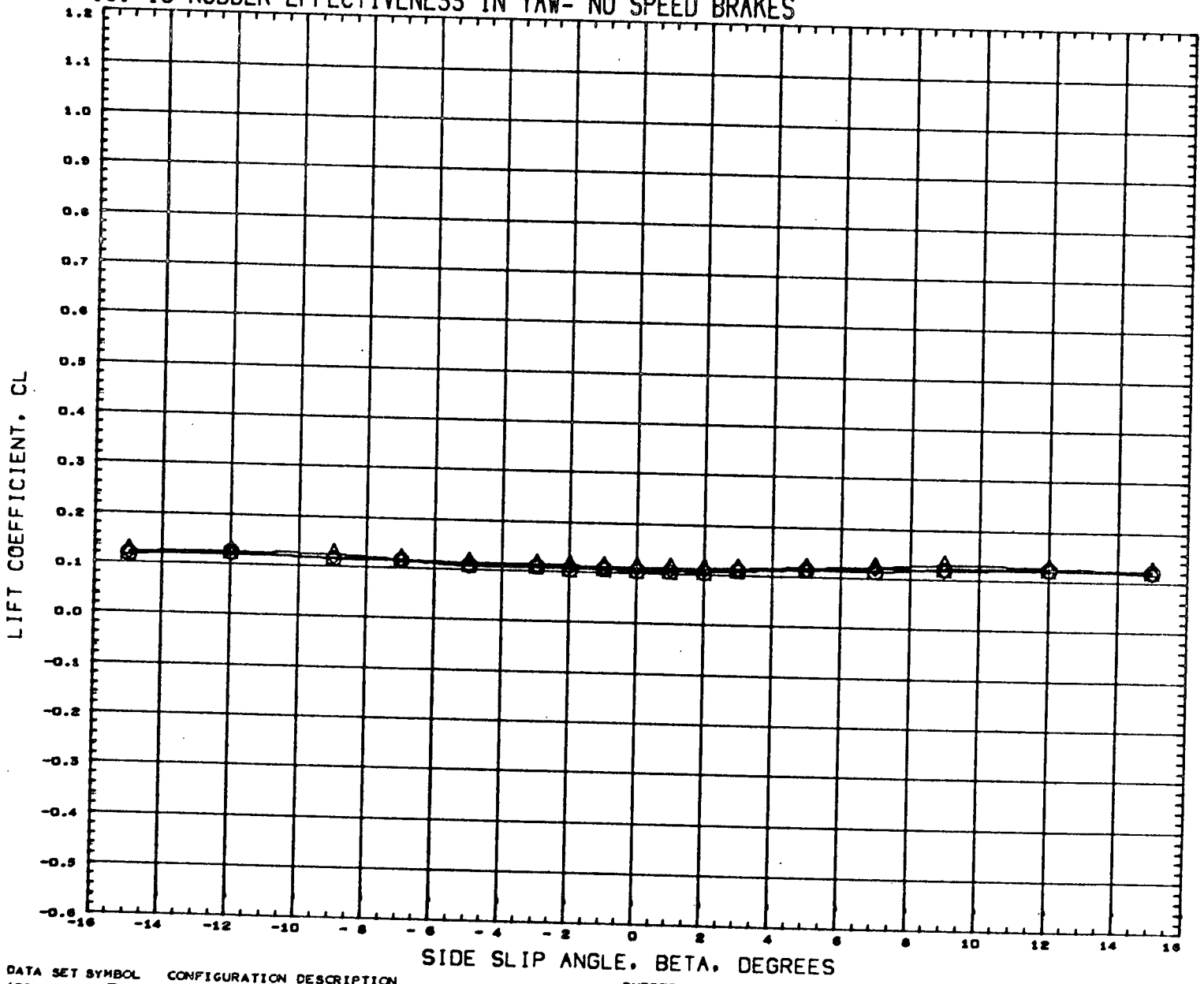
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	RUDDER	ALPHA
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000
(RD1040)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10)	-10.000	0.000
(RD1041)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15)	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 18 RUDDER EFFECTIVENESS IN YAW- NO SPEED BRAKES



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5
(RD1040)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10)
(RD1041)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15)

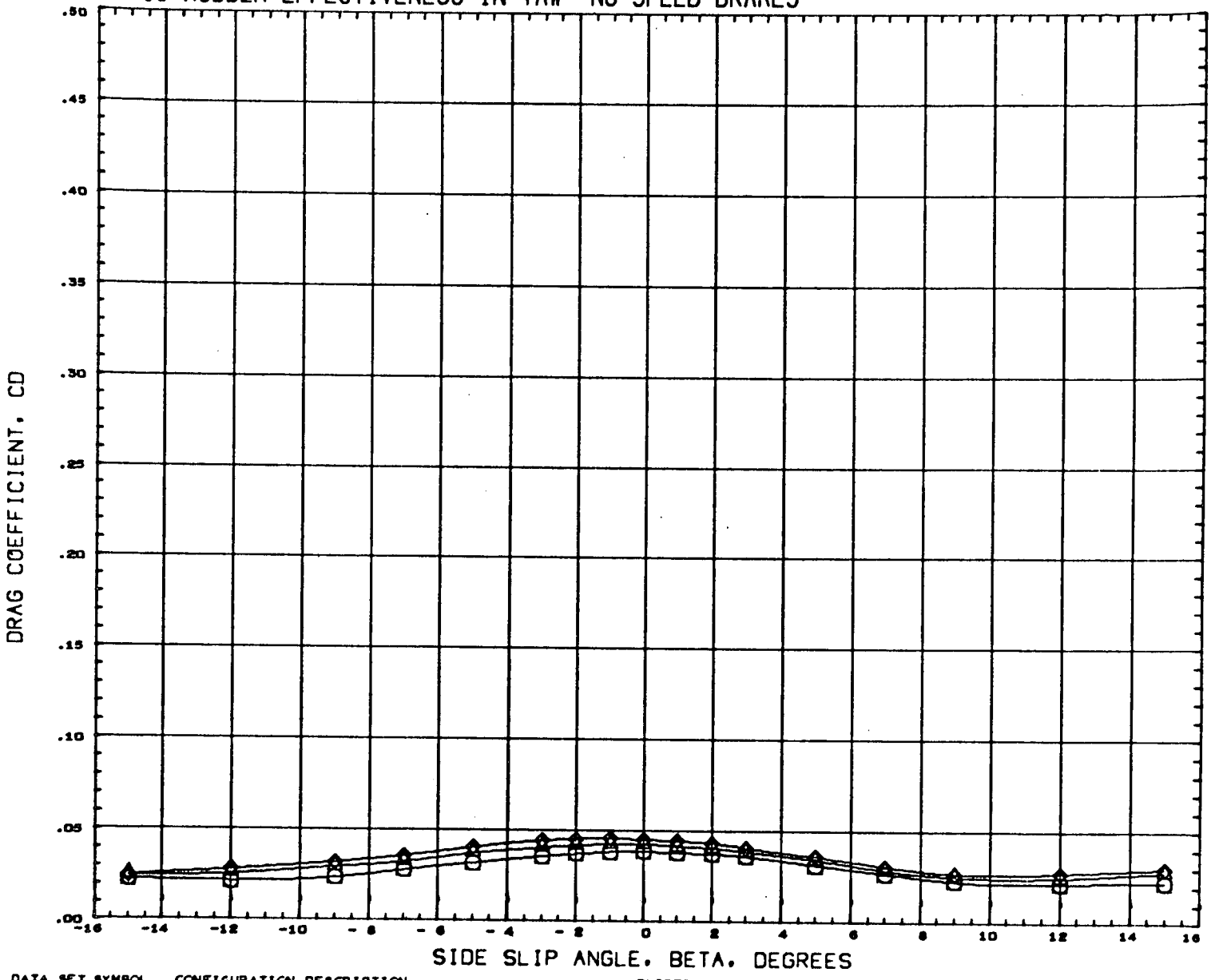
RUDDER	ALPHA
0.000	0.000
-10.000	0.000
-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 18 RUDDER EFFECTIVENESS IN YAW- NO SPEED BRAKES



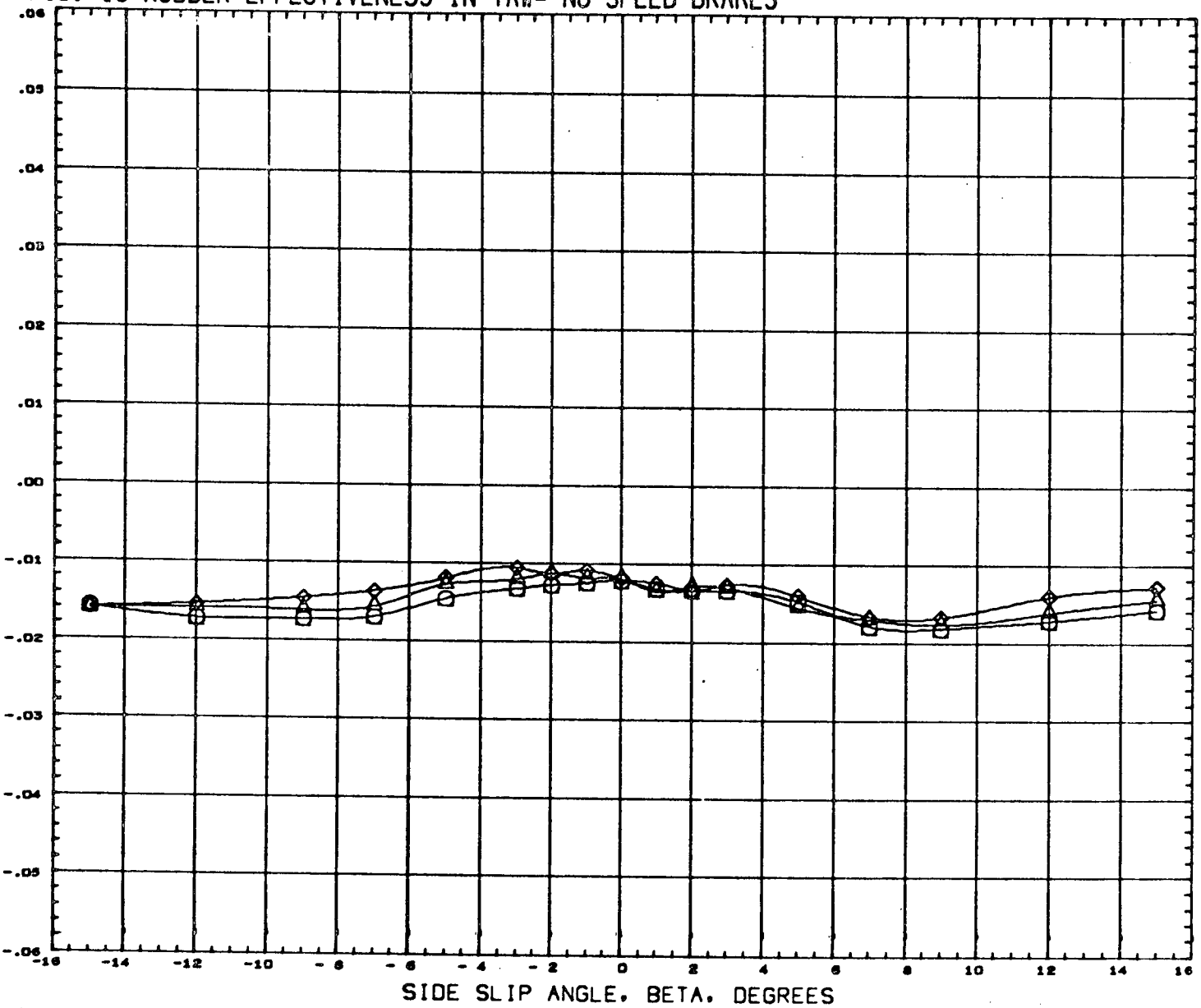
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	RUDDER	ALPHA
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5	0.000	0.000
(RD1040)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10)	-10.000	0.000
(RD1041)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15)	-15.000	0.000

MACH 0.170

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

FIG. 18 RUDDER EFFECTIVENESS IN YAW- NO SPEED BRAKES



DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RD1027)	○	GWTT 292 CONF.H-33 ORBITER B5W4V5
(RD1040)	△	GWTT 292 CONF.H-33 ORBITER B5W4V5(-10)
(RD1041)	◇	GWTT 292 CONF.H-33 ORBITER B5W4V5(-15)

RUDDER	ALPHA
0.000	0.000
-10.000	0.000
-15.000	0.000

REFERENCE INFORMATION

SREF	7.7440	SQ FT
LREF	5.4000	FT.
BREF	3.7800	FT.
XMRP	1285.0040	IN.
YMRP	0.0000	IN.
ZMRP	403.0004	IN.
SCALE	0.0400	

MACH 0.170