

SADSAC/SPACE SHUTTLE
WIND TUNNEL TEST DATA REPORT

CONFIGURATION: Grumman Configuration ROS-NBL and ROS-WBL

TEST PURPOSE: Determine basic transonic force data for two delta wing
orbiter configurations (M = 0.7 - 1.16)

TEST FACILITY: Grumman Farmingdale 26" transonic tunnel

TESTING AGENCY: Grumman Aerospace Corporation

TEST NO. & DATE: GFTT - 035, 3/17/71 to 4/21/71

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CONTRACT NAS 8-4016

AMENDMENT 153

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ABSTRACT

Two 1/200 scale models of the Grumman ROS-NBl and ROS-WBl space shuttles were tested in the G.A.C. 26 inch Transonic Wind Tunnel in Farmingdale, New York. Mach number was varied from .7 to 1.15. Model angle of attack was varied from -3° to 13° at 0° sideslip. Sideslip angle was varied from -2° to 10° at set angles of attack of 0° and 10° . Data were taken during a sweep at approximately every $.7^{\circ}$.

Two different basic configurations were tested, the narrow body ROS-NBl, and the wide body ROS-WBl. Test configurations included a model build-up: body alone, body-wing, and body-wing-tail. Symmetric elevon deflections were tested to determine longitudinal control effectiveness. The effect of the rudder, wing tip fins and an auxiliary ventral fin was also determined.

All testing was conducted without transition.

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SUMMARY

This report presents the details and results of the first series of transonic tests conducted on 1/200 scale models of the Grumman Aerospace ROS-NB1 and ROS-WB1 orbiter vehicles in the Grumman Farmingdale 26" Transonic Tunnel. The period of occupancy was from March 17 to April 21, 1971 on a one shift per day basis.

Additional tests were conducted on these same models in other Grumman facilities to more fully cover the Mach number range. This series of tests are covered in the following reports:

<u>SADSAC Report Number</u>	<u>Mach No. Range</u>
DMS-DR-1081	0.17
DMS-DR-1161	0.7 to 1.15
DMS-DR-1163	2.0 and 2.5
DMS-DR-1159	10.0

Six component aerodynamic force and moment coefficient data are presented herein in plotted form and cover an angle of attack range from -3° to 13° at zero degrees sideslip and -2° to 10° sideslip at 0° and 10° angle of attack.

CONFIGURATIONS INVESTIGATED

The following model components were tested:

- B₁ - basic ROS NB1 fuselage
- B₂ - ROS WB1 fuselage which is wider than -NB1
- W₁ - basic ROS NB1 wing
- W₂ - same wing as W₁ except tips have been clipped
- V₁ - single vertical tail for ROS NB1
- V₂ - twin vertical tails for ROS WB1
- V₃ - tip fins for wing W₂
- U₁ - basic ventral fin mounted to body flap when body flap is at 0°

Pertinent dimensional information for each of these components is given in the section entitled "Model Component Description Sheets". Sketches of the components are shown in Figures 3 through 6. The Data Set Collation Sheet which follows immediately contains a summary of the test run schedule and configurations tested.

BASIC TRANSONIC AERODYNAMIC DATA ON TWO $1/200$ SCALE
MODELS OF THE GRUMMAN ROS-NBI AND ROS-WBI ORBITERS

POSTTEST

[illegible]

	7	13	19	25	31	37	43	49	55	61	67	73	79
CD	CL	CM	CSL	CLN									

α or β
SCHEDULES

$\alpha A = -3^\circ$ to 13° approx. every $.7^\circ$
 $\beta B = -2^\circ$ to 10° approx. every $.7^\circ$

→ IDPVAR(1) | IDPVAR(2) | NDV

TEST FACILITY DESCRIPTION

GRUMMAN 26-INCH TRANSONIC WIND TUNNEL

DESCRIPTION: This is an intermittent blowdown to atmosphere type facility. The slotted test section is octagonal measuring 26 inches across the flats. The Mach number is controlled by a sliding gate valve downstream of the section.

PERFORMANCE PARAMETERS:

Mach Range:	0.6 to 1.3
Reynolds Number ($\times 10^6/\text{ft}$):	7 to 29
Stagnation Pressure (psia) :	25 to 75
Dynamic pressure (psf):	835 to 4600
Stagnation Temperature ($^{\circ}\text{R}$):	460
Run Time (seconds):	20 to 40

TESTING CAPABILITIES: This tunnel was intended primarily for flutter tests, although it also is suitable for general aerodynamic testing. This facility is equipped with a computer controlled Data Acquisition System.

TEST GETT 035

BALANCE UTILIZED: TASK .75 MK XLIII A

COEFFICIENT
TOLERANCE:

.0039
.0063
.0007
.0003
.0013
.0003

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DATA REDUCTION

The 0.75 inch TASK MK XLIII six component strain gage balance was used to measure orbiter forces and moments. All final data were presented along and about the stability axis passing through a nominal center of gravity located at F.S. 1485 (7.425 model scale), W. L. 377 (1.885 model scale), and B. L. O. Data were converted to standard NASA coefficients using the following constants: (model scale)

reference area: $S_{\text{ref}} = 20.689 \text{ sq. in.} = \text{wing, } W_1, \text{ planform area}$

reference length: $l_{\text{ref}} = 9.648 \text{ in.} = \text{body length,}$

reference span: $b_{\text{ref}} = 5.838 \text{ in.} = \text{wing, } W_1, \text{ span}$

No adjustment to the final data was made to account for the base and cavity pressure contributions.

TABLE I. SADSAC NOMENCLATURE OF AERODYNAMIC COEFFICIENTS

COEFFICIENT	COEFFICIENT NAME	SADSAC NOMENCLATURE		
		BODY AXIS	STABILITY AXIS	WIND AXIS
C_A	Total Axial Force	C_A	-	-
C_{AB}	Base Axial Force	C_{AB}	--	-
C_{AF}	Forebody Axial Force	C_{AF}	-	-
C_D	Total Drag Force	-	C_D	C_{DTOTL}
C_{DB}	Base Drag Force	-	C_{DB}	C_{DBASE}
C_{DF}	Forebody Drag Force	-	C_{DF}	C_{DFORE}
C_L	Lift Force	-	C_L	C_L
C_N	Normal Force	C_N	-	-
C_Y	Side Force	C_Y	C_Y	C_C
C_l	Rolling Moment	C_{BL}	C_{SL}	C_{WL}
C_m	Pitching Moment	C_{LM}	C_{LM}	C_{PM}
C_n	Yawing Moment	C_{YN}	C_{LN}	C_{LN}
L/D	Lift-To-Drag Force Ratio	-	L/D	C_L/C_D
L/D	Lift-To-Forebody Drag Force Ratio	-	L/DF	C_L/C_{DF}
N/A	Normal-To-Axial Force Ratio	N/A	-	-
N/A	Normal-To-Forebody Axial Force Ratio	C_N/C_{AF}	-	-

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SUMMARY DATA PLOT INDEX

PLOT TITLE	PLOTTED COEFFICIENTS SCHEDULE	CONDITIONS VARYING	NOMINAL MACH NUMBER	NOMINAL α SCHEDULE (DEGREES)	NOMINAL β SCHEDULE (DEGREES)	PAGES
Characteristics in Pitch - Narrow Body Orbiter	A	Configuration	0.7-1.16	-3 - 13	0	1-5
Characteristics in Pitch - Narrow Body Orbiter	B	Configuration	0.7-1.16	-3 - 13	0	6-15
Elevon Effectiveness - Narrow Body Orbiter	A	Elevon Deflec- tion Angle	0.7-1.16	-3 - 13	0	16-18
Elevon Effectiveness - Narrow Body Orbiter	B	Elevon Deflec- tion Angle	0.7-1.16	-3 - 13	0	19-24
Rudder Effectiveness - Narrow Body Orbiter	C	Rudder Deflec- tion Angle	0.7-1.16	-3 - 13	0	25-33
Characteristics In Sideslip - Narrow Body Orbiter - (ALPHA = 0)	D	Configuration	0.7-1.16	0	-4 - 12	34-42
Characteristics In Sideslip - Narrow Body Orbiter (ALPHA = 10)	D	Mach Number	0.7-1.16	10	-2 - 11	43-45
Characteristics In Pitch - Wide Body Orbiter	A	Configuration	0.7-1.16	-4 - 12	0	46-48
Characteristics In Pitch - Wide Body Orbiter	B	Configuration	0.7-1.16	-4 - 12	0	49-54
Characteristics In Sideslip - Wide Body Orbiter (ALPHA = 0)	D	Configuration	0.7-1.16	0	-4 - 12	55-63

SUMMARY DATA PLOT INDEX
(CONTINUED)

PLOT TITLE	PLOTTED COEFFICIENTS SCHEDULE	CONDITIONS VARYING	NOMINAL MACH NUMBER	NOMINAL α SCHEDULE (DEGREES)	NOMINAL β SCHEDULE (DEGREES)	PAGES
Characteristics In Sideslip - Wide Body Orbiter (ALPHA = 10)	D	Mach Number	0.7-1.16	10	-2 - 11	64-66
Longitudinal Characteristics - Narrow and Wide Body Configu- rations	E	Configuration	0.7-1.16	± 5	0	67-69
Lateral-Directional Characteris- tics - Narrow and Wide Body Con- figuration (ALPHA = 0)	F	Configuration	0.7-1.16	0	-5 - 5	70-72
Lateral-Directional Characteris- tics - Narrow and Wide Body Con- figuration (ALPHA = 10)	F	Configuration	0.7-1.16	10	-5 - 5	73-75

PLOTTED COEFFICIENTS SCHEDULE

SCHEDULE A

CL vs. α

SCHEDULE B

CL vs. CD
CL vs. CLM

SCHEDULE C

CLN vs. α
CSL vs. α
CY vs. α

SCHEDULE D

CLN vs. β
CSL vs. β
CY vs. β

SCHEDULE E

d(CL) vs. MACH No.
d(CLM/CL) vs. MACH No.
CD(MIN) vs. MACH No.

SCHEDULE F

d(CLN) vs. MACH No.
d(CSL) vs. MACH No.
d(CY) vs. MACH No.

FIGURES

Notes:

1. Positive directions of force coefficients, moment coefficients, and angles are indicated by arrows.
2. For clarity, origins of wind and stability axes have been displaced from the center of gravity.

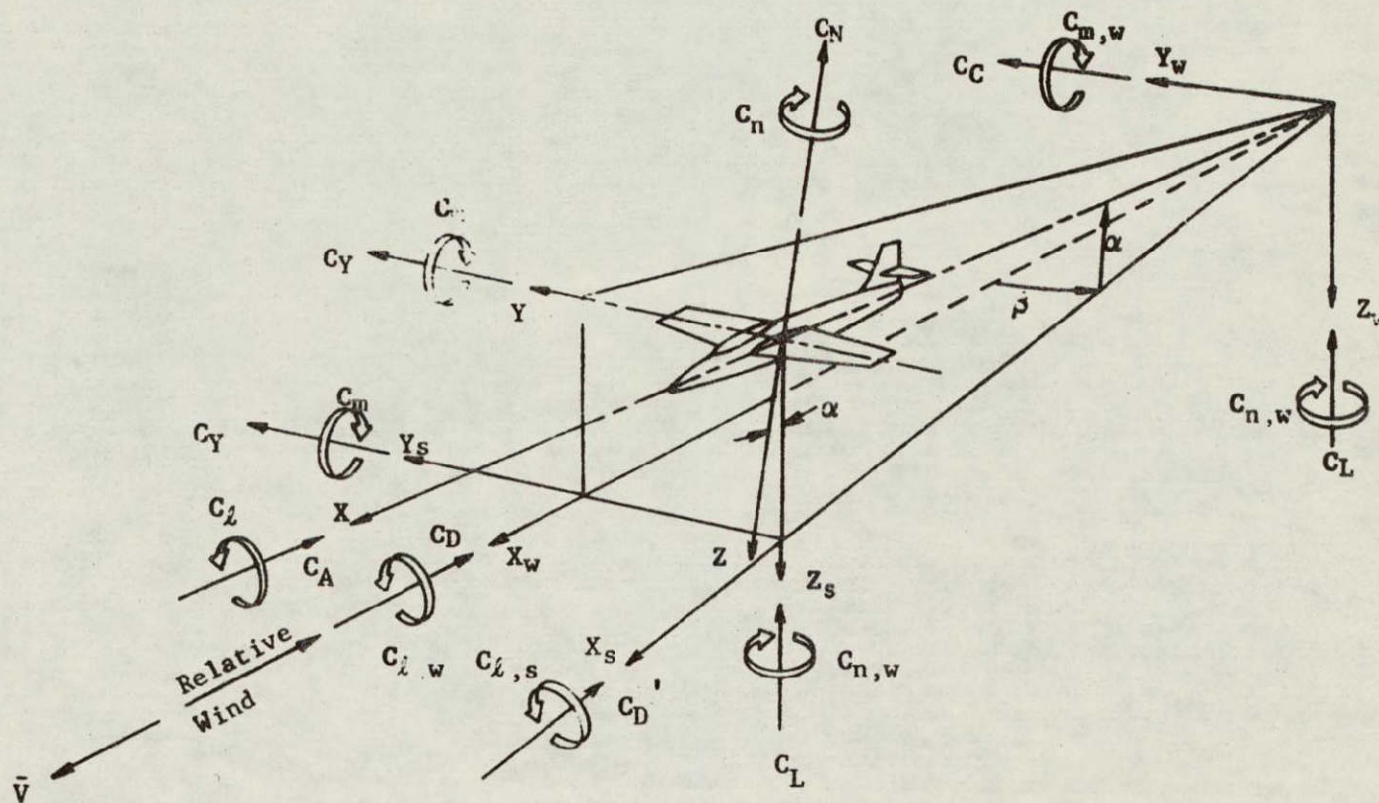


Figure 1. Axis systems, showing direction and sense of force and moment coefficients, angle of attack, and sideslip angle

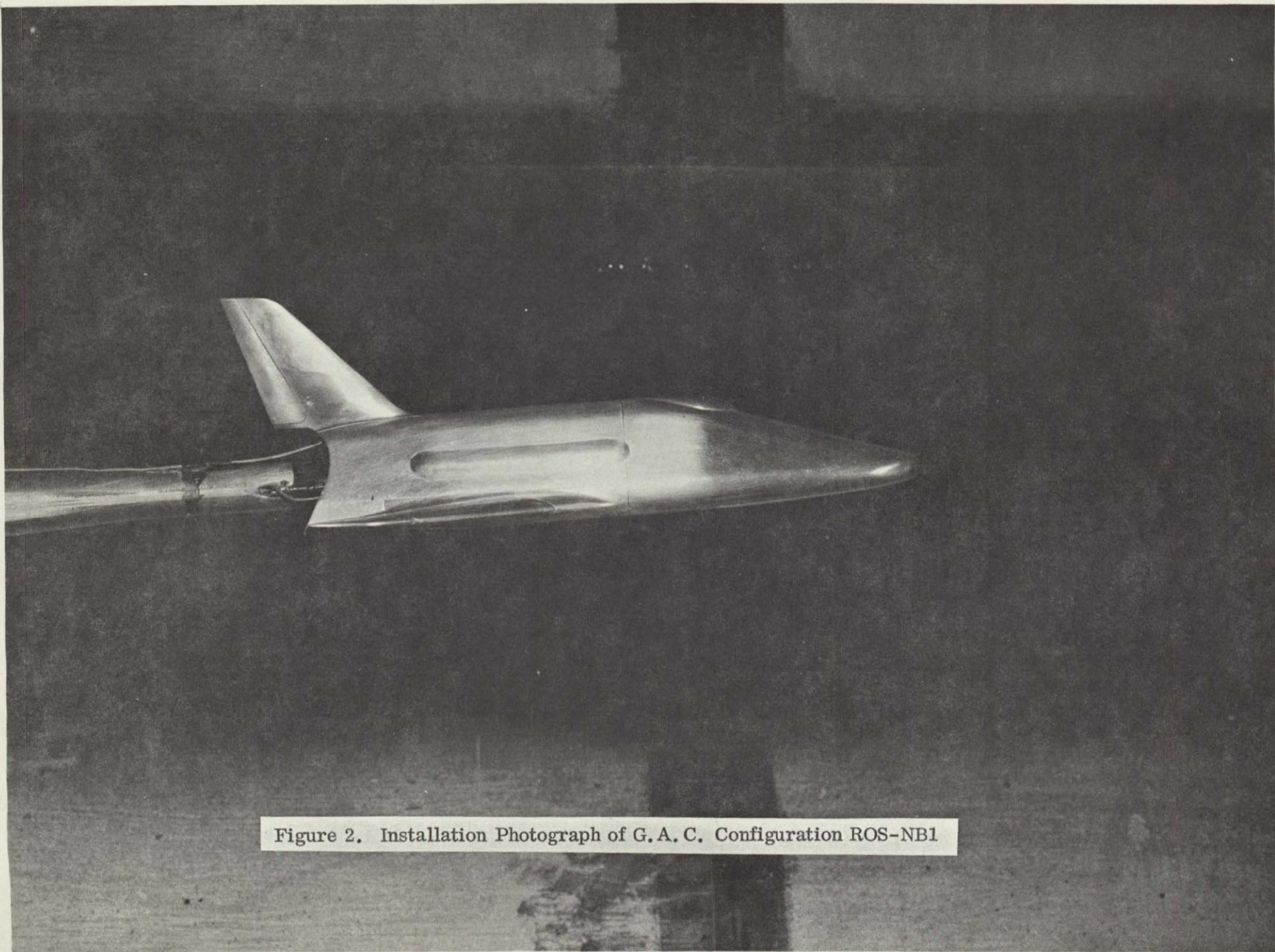


Figure 2. Installation Photograph of G.A.C. Configuration ROS-NB1

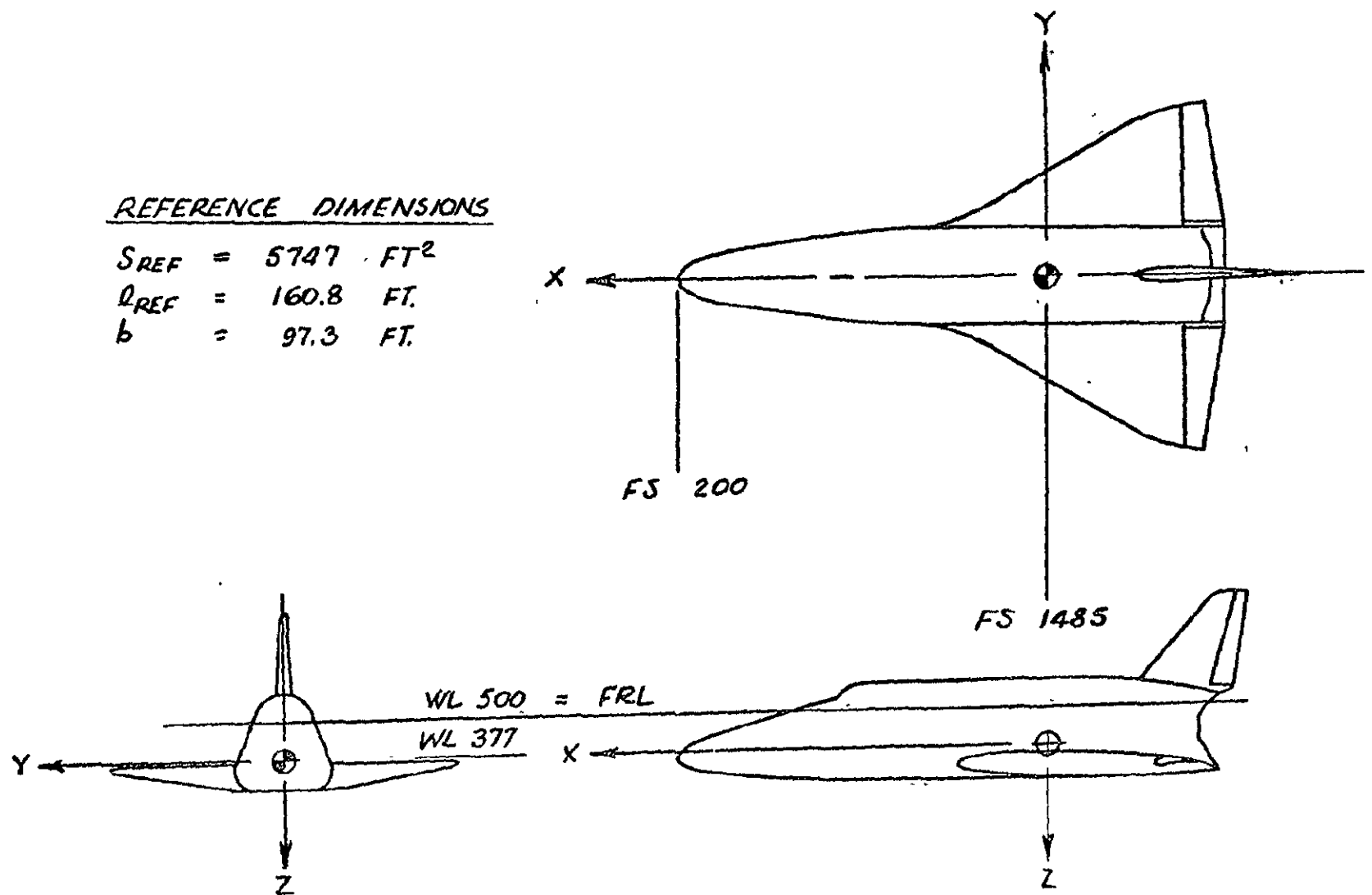


Figure 3. Three View Sketch-Configuration ROS-NBI

REFERENCE DIMENSIONS

$$S_{REF} = 5747 \text{ FT}^2$$

$$L_{REF} = 160.8 \text{ FT}$$

$$b = 97.3 \text{ FT}$$

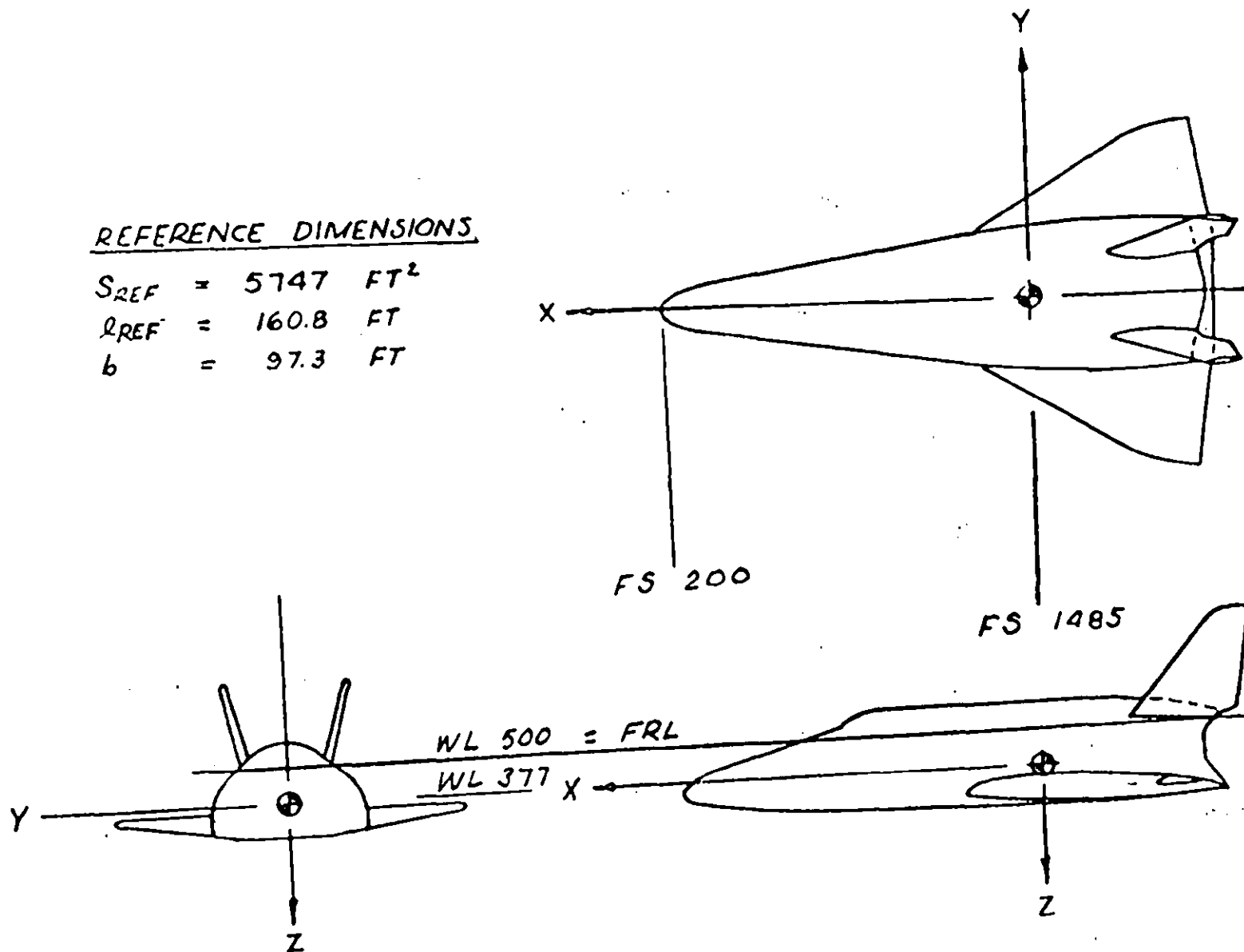


Figure 4. Three View Sketch-Configuration ROS-WB1

W_2

Basic W_1 wing clipped to accomodate V_3 wing tip fins. Ref. drawing
518 MOD 802.

— W_1
- - - W_2

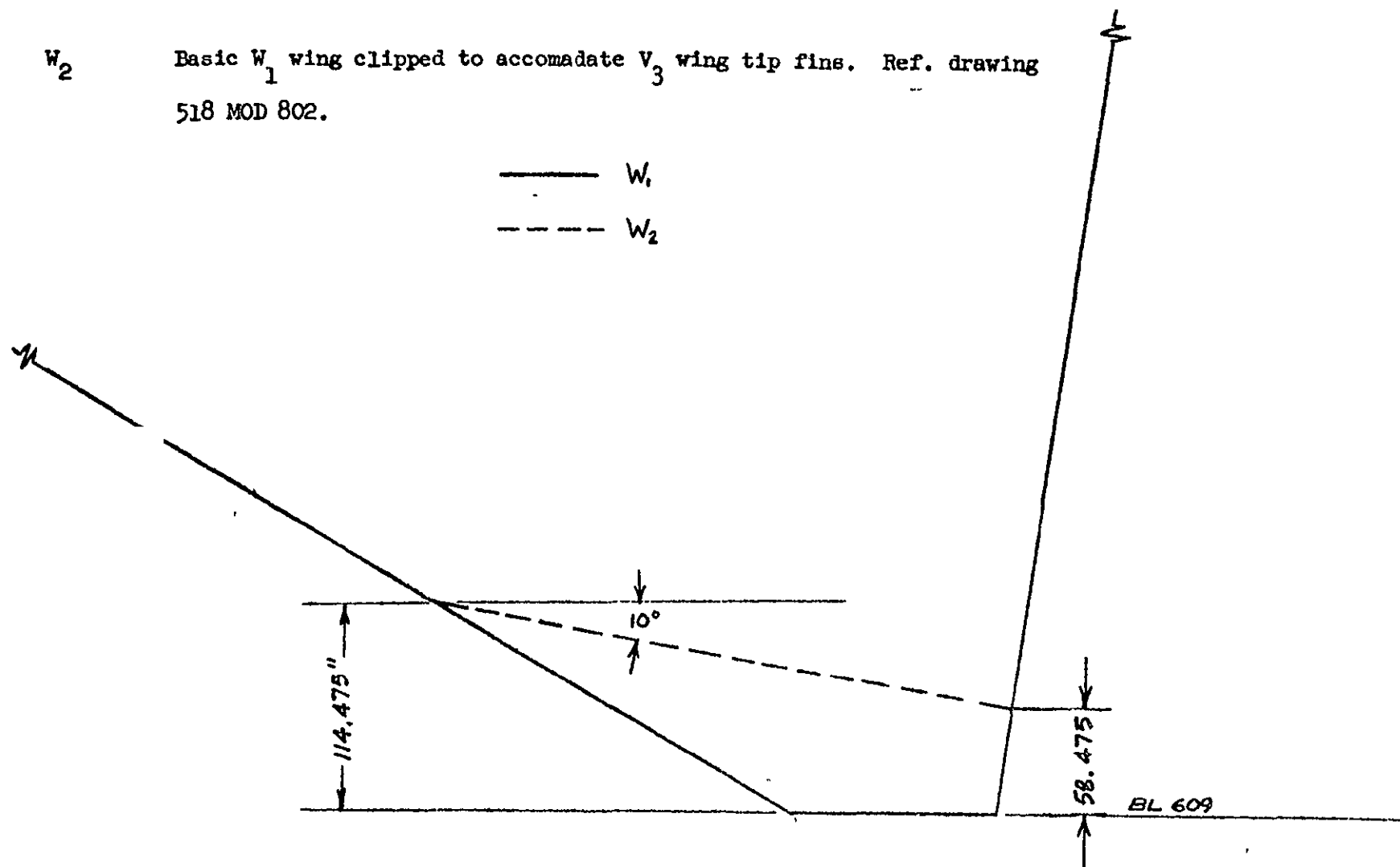


FIGURE 5. W_2 - WING (FULL SCALE)

U₁ - VENTRAL FIN
(1/200 SCALE)

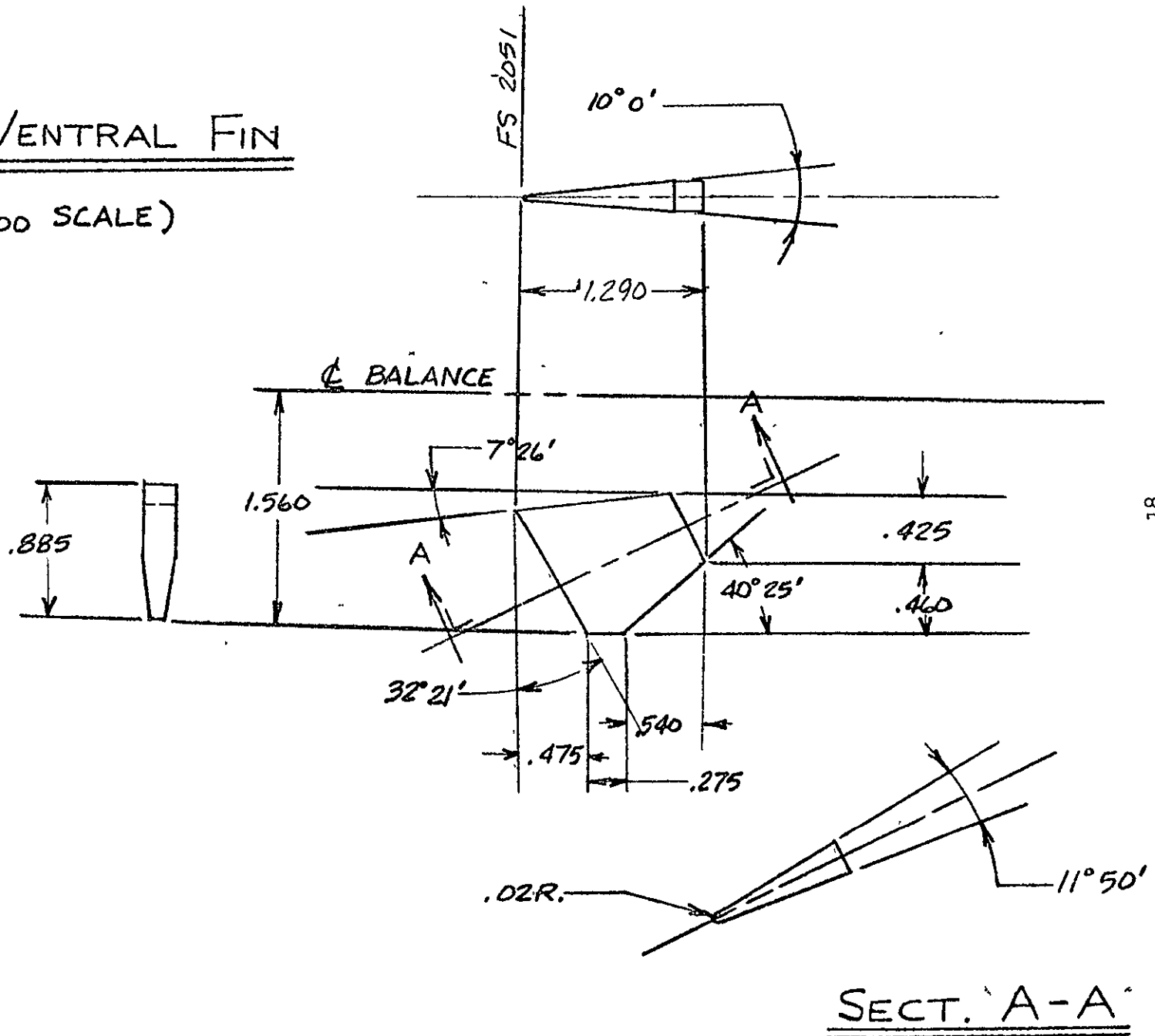


Figure 6. U₁ - Ventral Fin

MODEL COMPONENT DESCRIPTION SHEETS

MODEL COMPONENT: BODY - B₁

GENERAL DESCRIPTION: BASIC ROS-NB1 BODY

DRAWING NUMBER: 518 MOD 900

<u>DIMENSIONS:</u>	<u>FULL-SCALE</u> (FT. or FT ²)	^{1/200} <u>MODEL SCALE</u> (in. or in ²)
Length	<u>160.8</u>	<u>9.648</u>
Max. Width	<u>28.0</u>	<u>1.680</u>
Max. Depth	<u>28.7</u>	<u>1.722</u>
Fineness Ratio	<u>5.61</u>	<u>5.61</u>
Area		
Max. Cross-Sectional	<u>616</u>	<u>2.218</u>
Planform	<u>3990</u>	<u>14.364</u>
Wetted	<u>12,610</u>	<u>45.396</u>
Base	<u>590</u>	<u>2.124</u>

MODEL COMPONENT: BODY - B₂

GENERAL DESCRIPTION: BASIC ROS-WBI BODY

DRAWING NUMBER: 518 MOD 903

<u>DIMENSIONS:</u>	<u>FULL-SCALE</u> (FT. OR FT. ²)	<u>MODEL SCALE</u> ^{1/200} (IN. OR IN. ²)
Length	<u>160.8</u>	<u>9.648</u>
Max. Width	<u>44.8</u>	<u>2.688</u>
Max. Depth	<u>28.8</u>	<u>1.728</u>
Fineness Ratio	<u>3.6</u>	<u>3.6</u>
Area		
Max. Cross-Sectional	<u>956</u>	<u>3.442</u>
Planform	<u>5160</u>	<u>18.576</u>
Wetted	<u>13,230</u>	<u>47.628</u>
Base	<u>744</u>	<u>2.678</u>

MODEL COMPONENT: WING - W₁

GENERAL DESCRIPTION: BASIC ROS-NB 1 WING

DRAWING NUMBER: 518 MOD 902

DIMENSIONS:

	FULL-SCALE (FT. OR FT. ²)	1/200 MODEL SCALE (IN. OR IN. ²)
--	--	--

TOTAL DATA

Area		
Planform	<u>5747</u>	<u>20.689</u>
Wetted	<u>7780</u>	<u>28.008</u>
Span (equivalent)	<u>97.3</u>	<u>5.838</u>
Aspect Ratio	<u>1.65</u>	<u>1.65</u>
Rate of Taper	<u>1.87</u>	<u>1.87</u>
Taper Ratio	<u>.129</u>	<u>.129</u>
Diehedral Angle, degrees	<u>5°</u>	<u>5°</u>
Incidence Angle, degrees	<u>+ 2° @body - 3° @tip</u>	
Aerodynamic Twist, degrees		
Toe-In Angle		
Cant Angle		
Sweep Back Angles, degrees		
Leading Edge	<u>60°</u>	<u>60°</u>
Trailing Edge	<u>-8.4°</u>	<u>-8.4°</u>
0.25 Element Line	<u>42.9°</u>	<u>42.9°</u>
Chords:		
Root (Wing Sta. 0.0)	<u>104.6</u>	<u>6.276</u>
Tip, (equivalent)	<u>13.5</u>	<u>.810</u>
MAC	<u>59.0</u>	<u>3.540</u>
Fus. Sta. of .25 MAC	<u>1580 in.</u>	<u>7.90</u>
W.P. of .25 MAC	<u>302.6 in.</u>	<u>1.51</u>
B.L. of .25 MAC		
Airfoil Section		
Root	<u>18% max.camber 10% thickness</u>	
Tip	<u>3% max.camber 10% thickness</u>	

EXPOSED DATA

Area	<u>3217</u>	<u>11.581</u>
Span, (equivalent)	<u>69.3</u>	<u>4.158</u>
Aspect Ratio	<u>1.5</u>	<u>1.5</u>
Taper Ratio	<u>.172</u>	<u>.172</u>
Chords		
Root	<u>78.25</u>	<u>4.695</u>
Tip	<u>13.5</u>	<u>.810</u>
MAC	<u>46.4</u>	<u>2.784</u>
Fus. Sta. of .25 MAC		
W.P. of .25 MAC		
B.L. of .25 MAC		

MODEL COMPONENT: Elevon (For the W₁ Wing)

GENERAL DESCRIPTION: Moveable Control Surface Associated With the W₁ Wing

DRAWING NUMBER: 518 MOD 902

<u>DIMENSIONS:</u>	<u>FULL-SCALE</u> (ft. or ft. ²)	<u>1/200</u> <u>MODEL SCALE</u> (in. or in. ²)
Area	<u>364</u>	<u>1.310</u>
Span (equivalent)	<u>35.5</u>	<u>2.130</u>
Root ^{Root} chord	<u>12.75</u>	<u>.765</u>
Outb'd equivalent chord	<u>7.75</u>	<u>.465</u>
Ratio Elevator chord/horizontal tail chord		
At Inb'd equiv. chord	<u> </u>	<u> </u>
At Outb'd equiv. chord	<u> </u>	<u> </u>
Sweep Back Angles, degrees		
Leading Edge	<u>0°</u>	<u>0°</u>
Tailing Edge	<u>-8.4°</u>	<u>-8.4°</u>
Hingeline	<u> </u>	<u> </u>
Area Moment (Normal to hinge line)	<u> </u>	<u> </u>

MODEL COMPONENT: E VERTICAL TAIL - V₁

GENERAL DESCRIPTION: BASIC ROS-NB 1 VERTICAL TAIL

DRAWING NUMBER: 518 MOD 902

<u>DIMENSIONS:</u>	<u>FULL-SCALE</u> (<u>FT. OR FT.²</u>)	<u>MODEL SCALE</u> (<u>IN. OR IN.²</u>)
Area	<u>805</u>	<u>2.898</u>
Span (equivalent)	<u>33.3</u>	<u>1.998</u>
Inb'd equivalent chord	<u>34.6</u>	<u>2.076</u>
Outb'd equivalent chord	<u>13.75</u>	<u>.825</u>
Ratio movable surface chord/ total surface chord		
At Inb'd equiv. chord	<u>.3</u>	<u>.3</u>
At Outb'd equiv. chord	<u>.3</u>	<u>.3</u>
Sweep Back Angles, degrees		
Leading Edge	<u>45°</u>	<u>45°</u>
Tailing Edge	<u>19.7°</u>	<u>19.7°</u>
Hingeline	<u>28.7°</u>	<u>28.7°</u>
Area Moment (Normal to hinge line)	<u>.945</u>	<u>.204</u>
AIRFOIL SECTION	<u>64A010</u>	<u>64A010</u>

MODEL COMPONENT: Rudder (for the V₁ vertical tail)

GENERAL DESCRIPTION: Movable Control Surface Associated With the V₁
Vertical Tail

DRAWING NUMBER: 518 MOD 902

<u>DIMENSIONS:</u>	<u>FULL-SCALE</u> <u>(ft. or ft²)</u>	^{1/200} <u>MODEL SCALE</u> <u>(in. or in.²)</u>
Area	<u>240</u>	<u>.864</u>
Span (equivalent) ROOT	<u>33.3</u>	<u>1.998</u>
Inb'd equivalent chord	<u>10.4</u>	<u>.624</u>
Outb'd equivalent chord RUDDER	<u>4.02</u>	<u>.241</u>
Ratio Elevator chord/horizontal tail chord		
At Inb'd equiv. chord	<u>.3</u>	<u>.3</u>
At Outb'd equiv. chord	<u>.3</u>	<u>.3</u>
Sweep Back Angles, degrees		
Leading Edge	<u>29.5°</u>	<u>29.5°</u>
Tailing Edge	<u>19.7°</u>	<u>19.7°</u>
Hingeline	<u></u>	<u></u>
Area Moment (Normal to hinge line)	<u></u>	<u></u>

MODEL COMPONENT: TWIN BODY TAILS - V₂

GENERAL DESCRIPTION: BASIC ROS-WBI VERTICAL TAILS

DRAWING NUMBER: 518 MOD 905

<u>DIMENSIONS:</u>	<u>FULL-SCALE</u> (FT. OR FT. ²)	<u>1/200</u> <u>MODEL SCALE</u> (IN. OR IN. ²)
Area	<u>670</u>	<u>2.412</u>
Span (equivalent)	<u>35.5</u>	<u>2.130</u>
Inb'd equivalent chord	<u>33.17</u>	<u>1.990</u>
Outb'd equivalent chord	<u>9.08</u>	<u>.545</u>
Ratio movable surface chord/ total surface chord		
At Inb'd equiv. chord	<u> </u>	<u> </u>
At Outb'd equiv. chord	<u> </u>	<u> </u>
Sweep Back Angles, degrees		
Leading Edge	<u>40°</u>	<u>40°</u>
Tailing Edge	<u>8.5°</u>	<u>8.5°</u>
Hingeline	<u> </u>	<u> </u>
Area Moment (Normal to hinge line)	<u> </u>	<u> </u>
AIRFOIL SECTION	<u>NACA 64A010</u>	<u>NACA 64A010</u>
CANT ANGLE (OUTBOARD)	<u>15°</u>	<u>15°</u>

MODEL COMPONENT: WING TIP FINS - V₃

GENERAL DESCRIPTION: VERTICAL FINS LOCATED AT THE TIPS OF THE CLIPPED
BASIC WING (DESIGNATED W₂)

DRAWING NUMBER: 518 MOD 907

<u>DIMENSIONS:</u>	<u>FULL-SCALE</u> (FT. OR FT. ²)	<u>1/200</u> <u>MODEL SCALE</u> (IN. OR IN. ²)
Area	<u>684</u>	<u>2.462</u>
Span (equivalent)	<u>30.17</u>	<u>1.810</u>
Inb'd equivalent chord	<u>30.25</u>	<u>1.815</u>
Outb'd equivalent chord	<u>15.17</u>	<u>.910</u>
Ratio movable surface chord/ total surface chord		
At Inb'd equiv. chord	<u>.274</u>	<u>.274</u>
At Outb'd equiv. chord	<u>.546</u>	<u>.546</u>
Sweep Back Angles, degrees		
Leading Edge	<u>40°</u>	<u>40°</u>
Tailing Edge	<u>18.44°</u>	<u>18.44°</u>
Hingeline	<u>18.44°</u>	<u>18.44°</u>
Area Moment (Normal to hinge line)	<u>805</u>	<u>.1739</u>
CANT ANGLE	<u>15° (OUTBOARD)</u>	<u>15° (OUTBOARD)</u>
TOE-IN ANGLE	<u>10°</u>	<u>10°</u>

NOMENCLATURE

(General)

<u>SYMBOL</u>	<u>SADSAC SYMBOL</u>	<u>DEFINITION</u>
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; Kg/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
Re/L	Re/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

<u>SYMBOL</u>	<u>SADSAC SYMBOL</u>	<u>DEFINITION</u>
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
l_{ref}	LREF	reference length; m, ft, in.;
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

<u>SYMBOL</u>	<u>DEFINITION</u>
F	force; F, lbs
M	moment; M, in-lb

<u>Subscript</u>	<u>Definition</u>
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)

Stability Axis System

<u>SYMBOL</u>	<u>SADSAC SYMBOL</u>	<u>DEFINITION</u>
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	CLM	pitching moment coefficient; $M_{Y,s}/qS \ell_{ref}$
C_y	CY	side force coefficient; F_Y/qS
C_n	CLN	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

<u>SYMBOL</u>	<u>SADSAC SYMBOL</u>	<u>DEFINITION</u>
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
	SPOILER	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
<u>SURFACE SUBSCRIPTS</u>		<u>DEFINITION</u>
a		aileron
b		base
c		canard
e		elevator or elevon
f		flap
r		rudder or ruddervator
s		spoiler
t		tail

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
NASA MSC	Mr. Ray Nelson
GAC	Mr. M. Quan

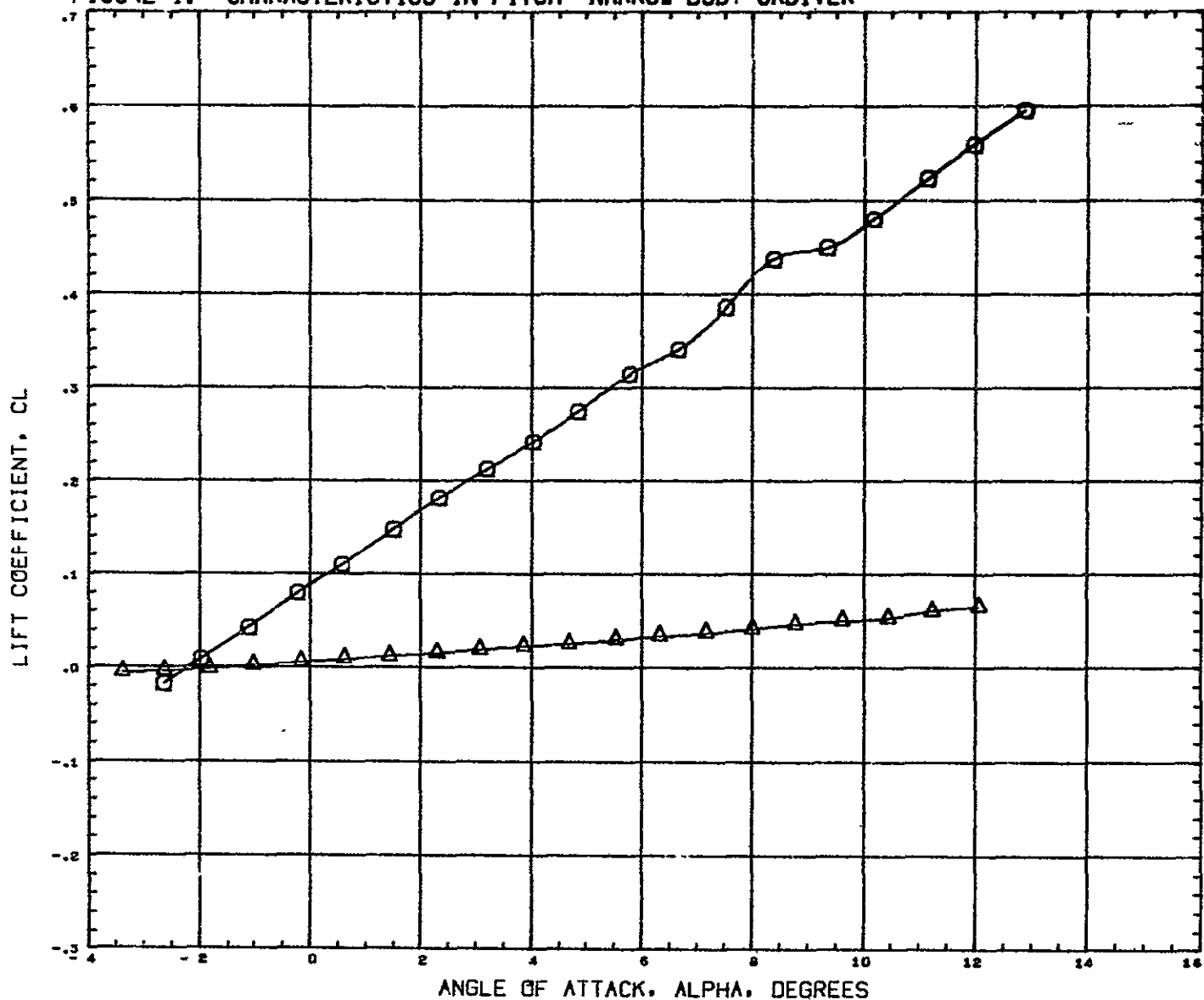
If copies of this listing are desired, please contact the above or the cognizant SADSAC personnel who, for this data, is:

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

(504) 255-2304

PLOTTED DATA

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



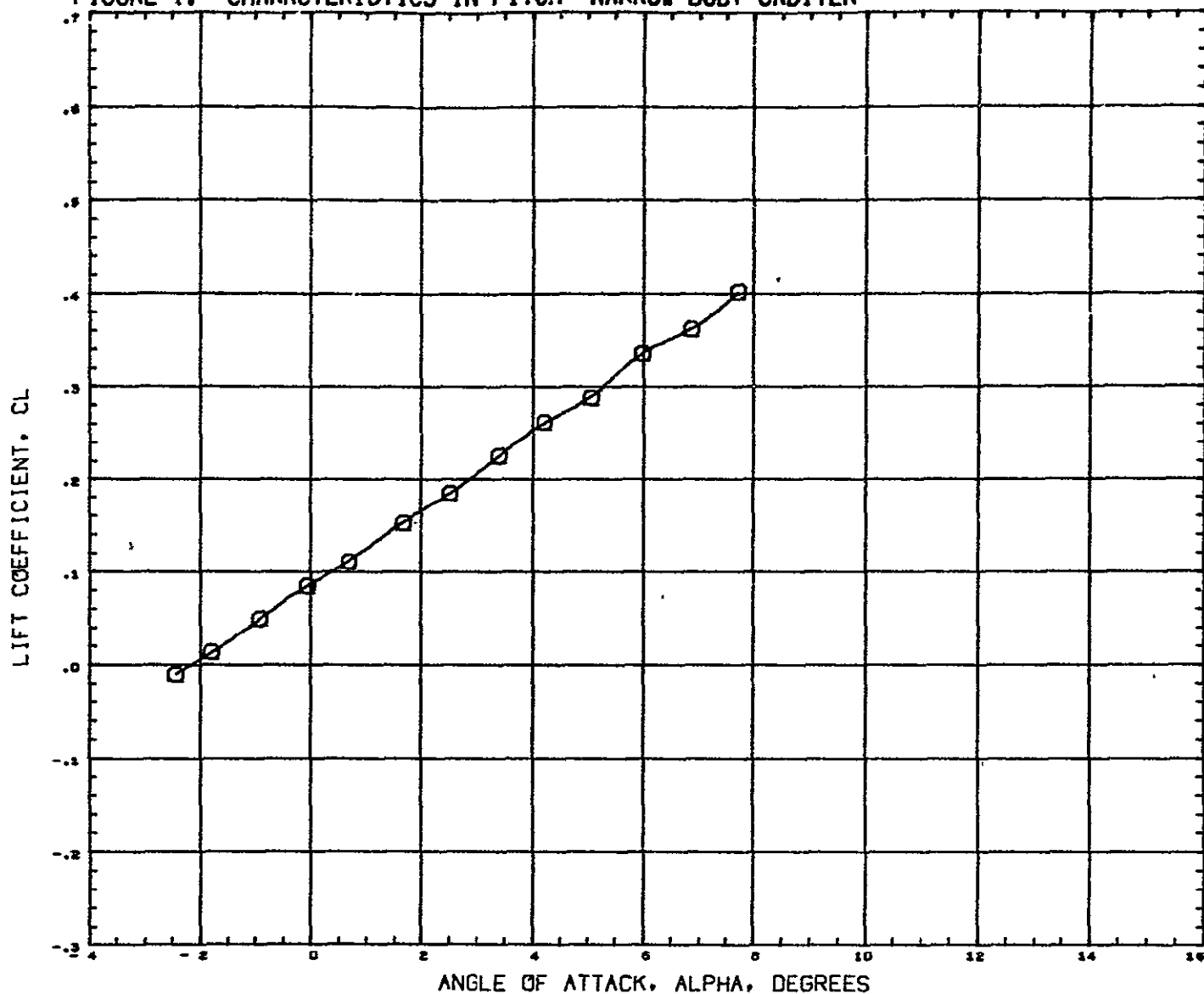
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR021) ○	GFTT-D35 CONF ROS-NB1 B1W1V1
(RCR051) △	GFTT-D35 CONF ROS-NB1 B1

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000		

REFERENCE INFORMATION		
SREF	20.6900	sq. in.
LREF	9.6500	in.
BREF	5.0300	in.
XMRP	1485.0040	in.
YMRP	0.0000	in.
ZMRP	377.0004	in.
SCALE	0.0050	

MACH 0.700

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



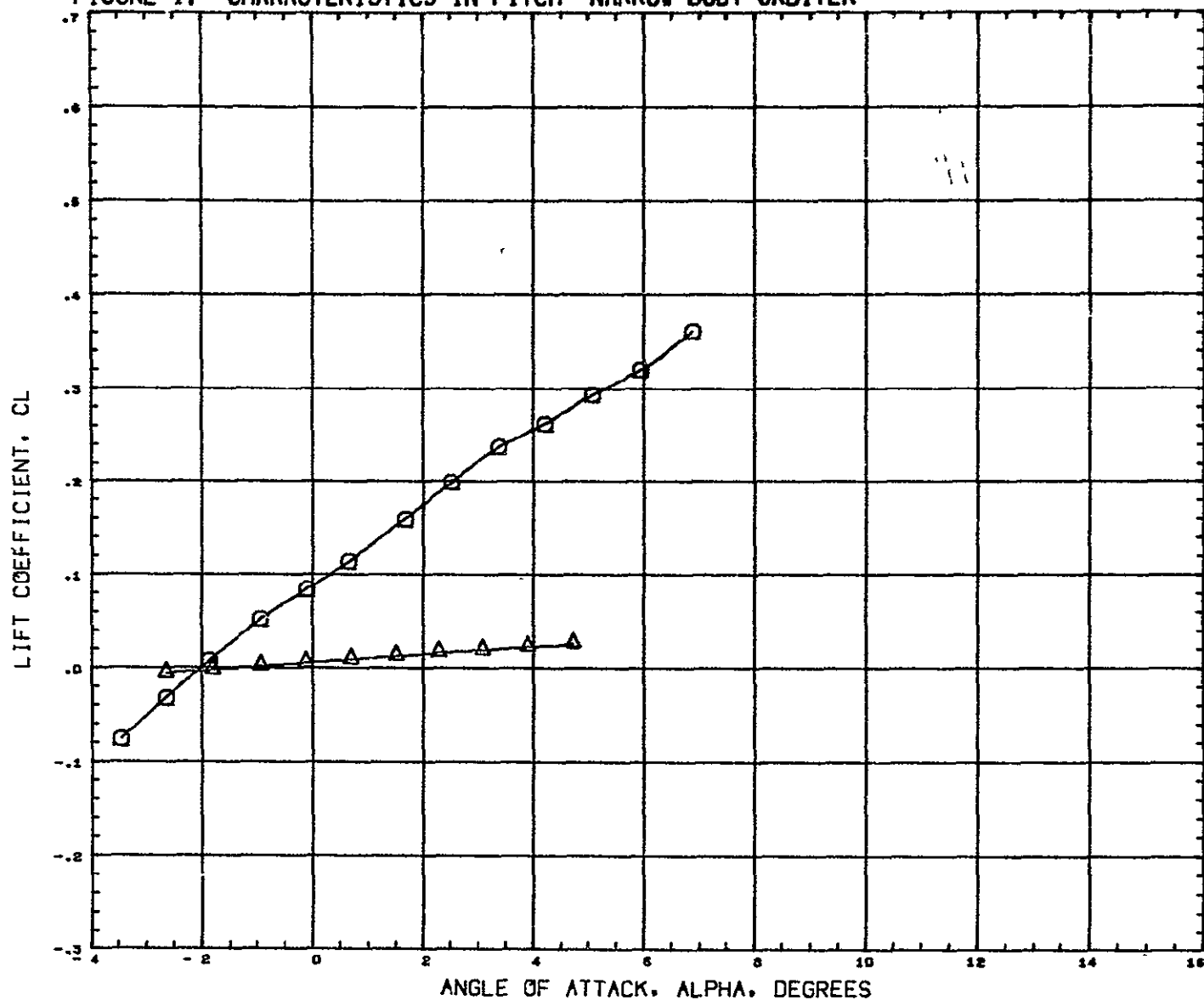
DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (RCR021) GFTT-035 CONF ROS-NB1 BW1V1
 (RCR051) DATA NOT AVAILABLE FOR ALL CONDITIONS

BETA ELEVNS RUDDER
 0.000 0.000 0.000
 0.000

REFERENCE INFORMATION
 SREF 20.6900 SQ. IN.
 LREF 9.6500 IN.
 BREF 5.8380 IN.
 XMRP 1465.0040 IN.
 YMRP 0.0010 IN.
 ZMRP 377.0004 IN.
 SCALE 0.0050

MACH 0.820

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



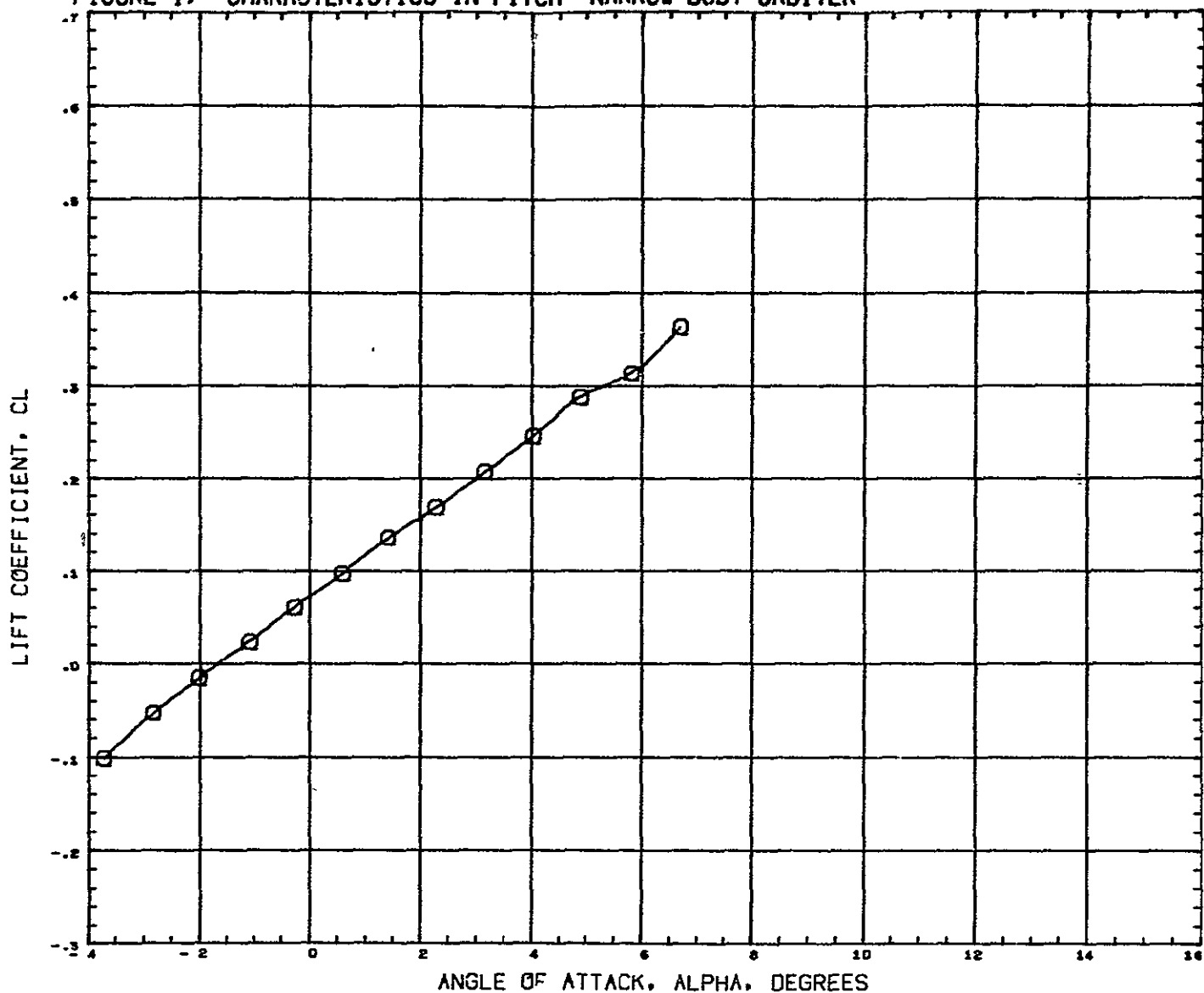
DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (RCD021) $\bigcirc$ GFTT-035 CONF ROS-NB1 B1W1V1
 (RCD051) $\triangle$ GFTT-035 CONF ROS-NB1 B1

BETA ELEVNS RUDDER
 0.000 0.000 0.000
 0.000

REFERENCE INFORMATION
 SREF 20.6900 SQ.IN.
 LREF 9.6500 IN.
 BREF 5.8380 IN.
 XMRP 1485.0040 IN.
 YMRP 0.0000 IN.
 ZMRP 377.0004 IN.
 SCALE 0.0030

MACH 0.890

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



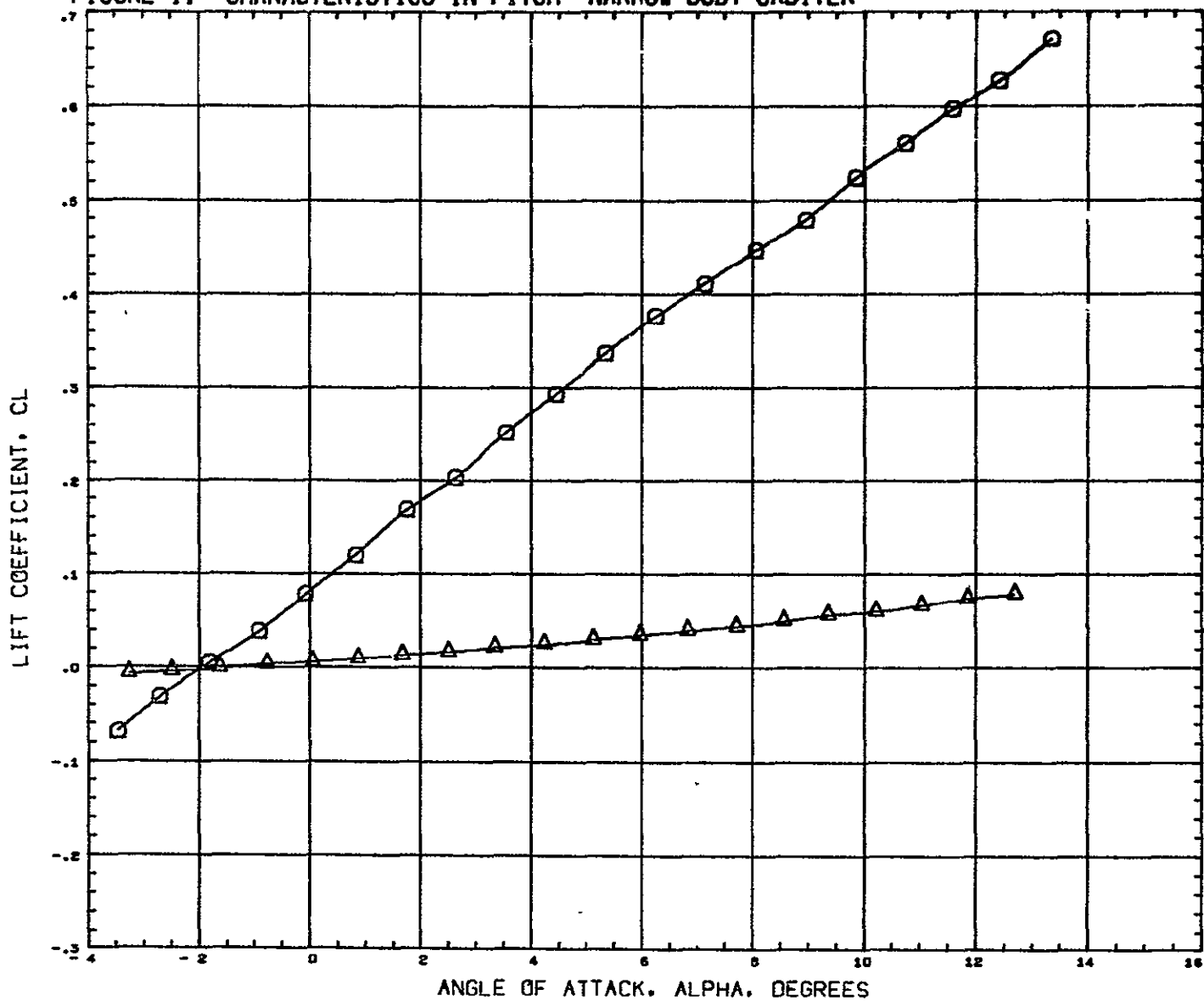
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RCR021) GFTT-035 CONF ROS-NB1 BIW1V1
(RCR051) DATA NOT AVAILABLE FOR ALL CONDITIONS

BETA ELEVNS RUDDER
0.000 0.000 0.000
0.000

REFERENCE INFORMATION
SREF 20.6900 50. IN.
LREF 9.6590 IN.
BREF 5.8380 IN.
XMRP 1485.0040 IN.
YMRP 0.0000 IN.
ZMRP 377.0004 IN.
SCALE 0.0050

MACH 0.940

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



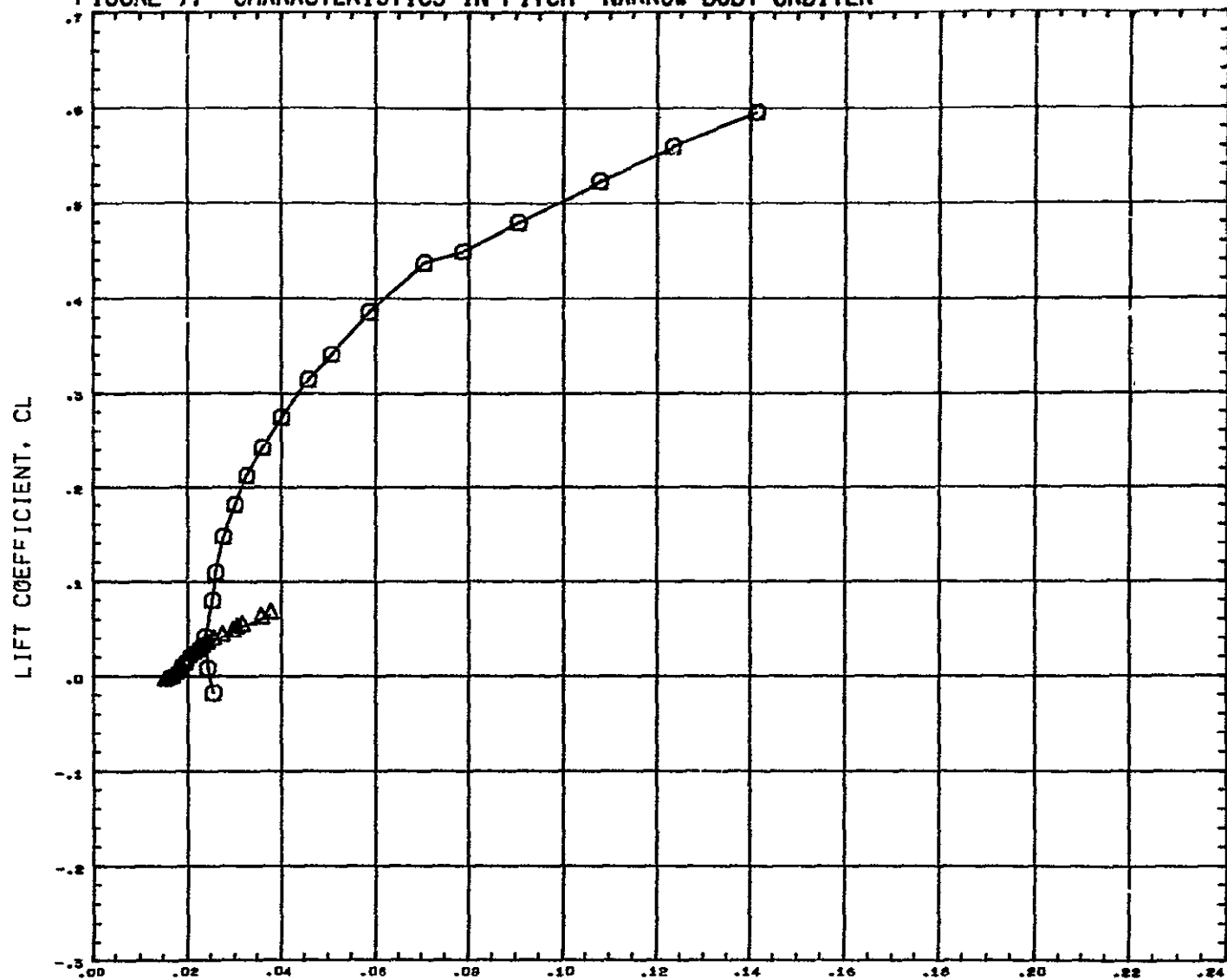
DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (RCR021) $\square$ GFTT-035 CONF ROS-NB1 B1W1V1
 (RCR051) $\triangle$ GFTT-035 CONF ROS-NB1 B1

BETA ELEVNS RUDDER
 0.000 0.000 0.000
 0.000

REFERENCE INFORMATION
 SREF 20.6900 SQ.IN.
 LREF 9.6500 IN.
 BREF 5.0380 IN.
 XMRP 1485.0040 IN.
 YMRP 0.0000 IN.
 ZMRP 377.0004 IN.
 SCALE 0.0050

MACH 1.160

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



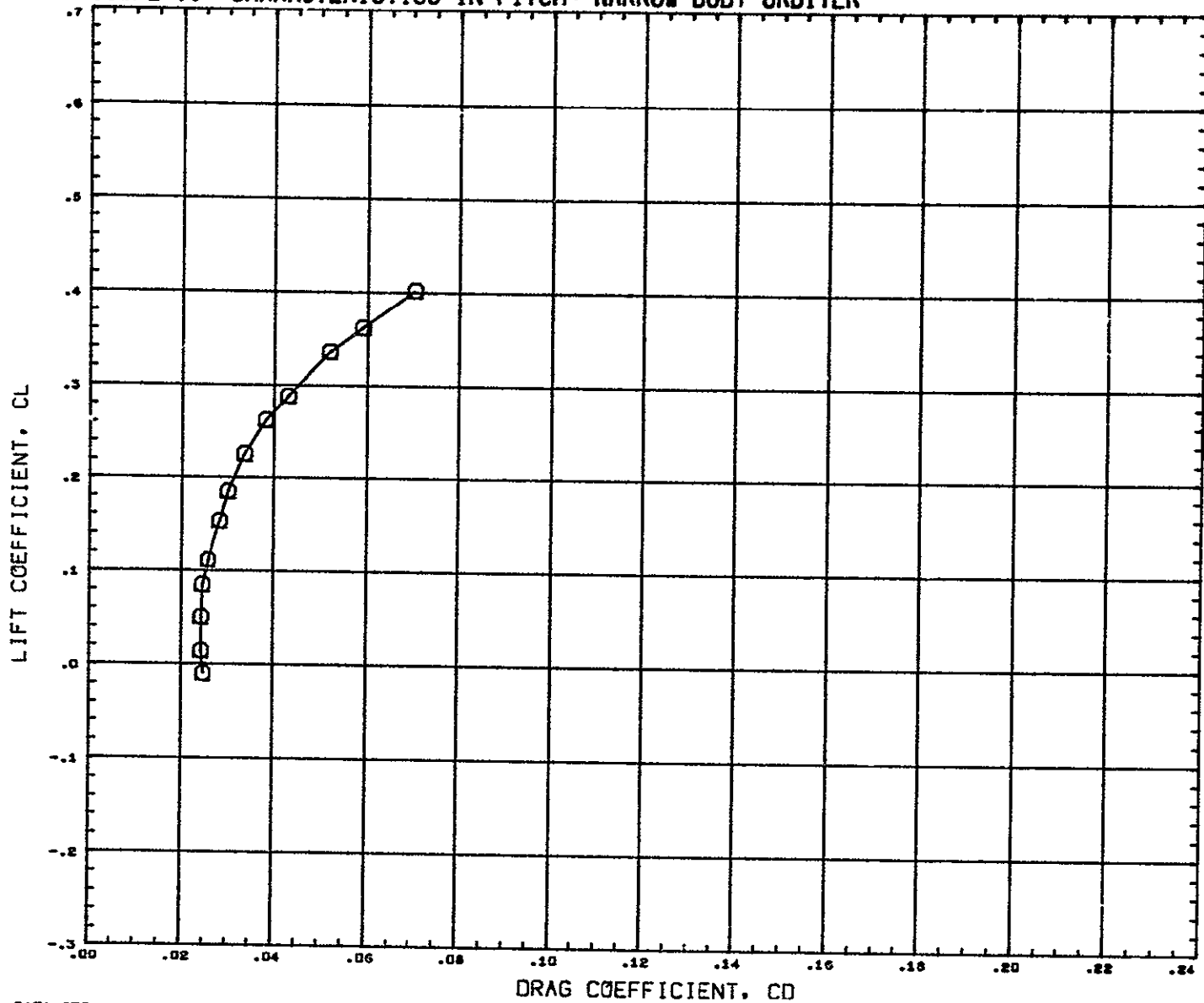
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR021)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR031)	GFTT-035 CONF ROS-NB1 B1

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000		

REFERENCE INFORMATION		
SREF	20.6900	SQ. IN.
LREF	9.6500	IN.
BREF	5.8300	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.700

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



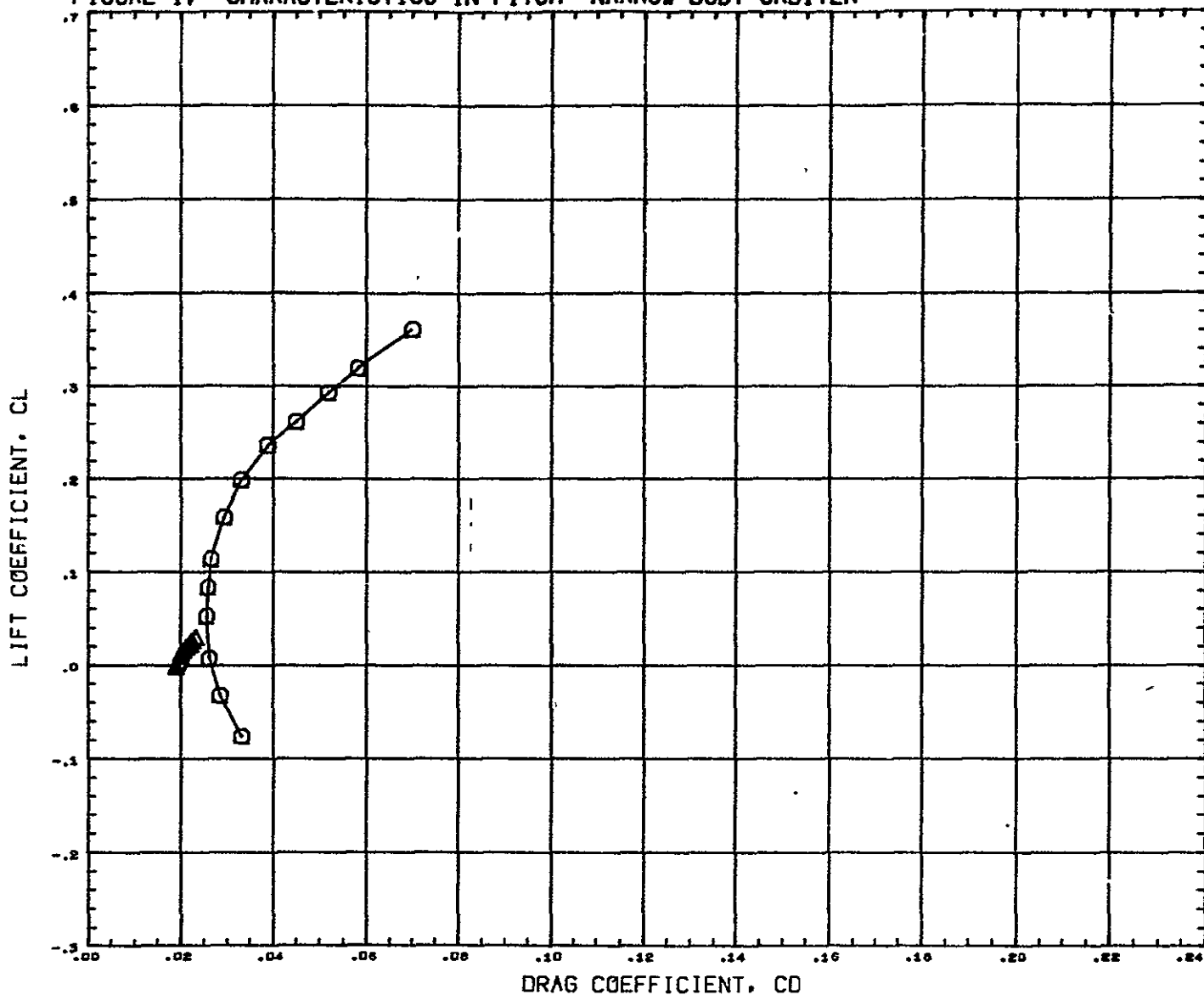
DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (RCR021) $\square$ GFTT-835 CONF ROS-NB1 B1W1V1
 (RCR051) $\triangle$ DATA NOT AVAILABLE FOR ALL CONDITIONS

BETA ELEVNS RUDDER
 0.000 0.000 0.000
 0.000

REFERENCE INFORMATION
 SREF 20.6900 SQ. IN.
 LREF 9.6500 IN.
 BREF 5.8300 IN.
 XMRF 1485.0040 IN.
 YMRF 0.0060 IN.
 ZMRF 377.0004 IN.
 SCALE 0.0050

MACH 0.820

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



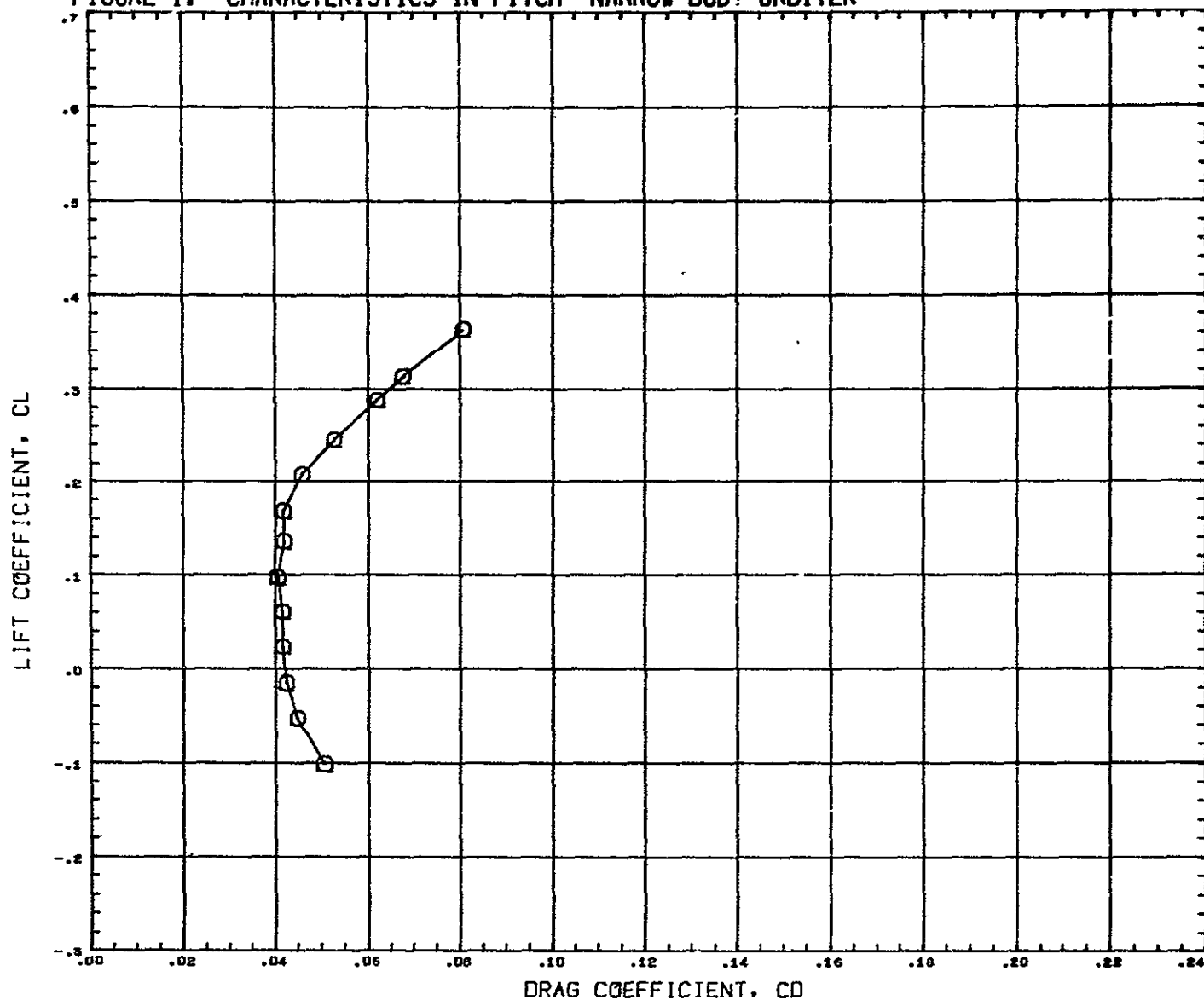
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR021)	Q CFTT-035 CONF ROS-NB1 B1W1V1
(RCR051)	Δ CFTT-035 CONF ROS-NB1 B1

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000		

REFERENCE INFORMATION		
SREF	20.6900	30 IN.
LREF	9.6500	IN.
BREF	5.8300	IN.
XMRP	1495.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0650	

MACH 0.890

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



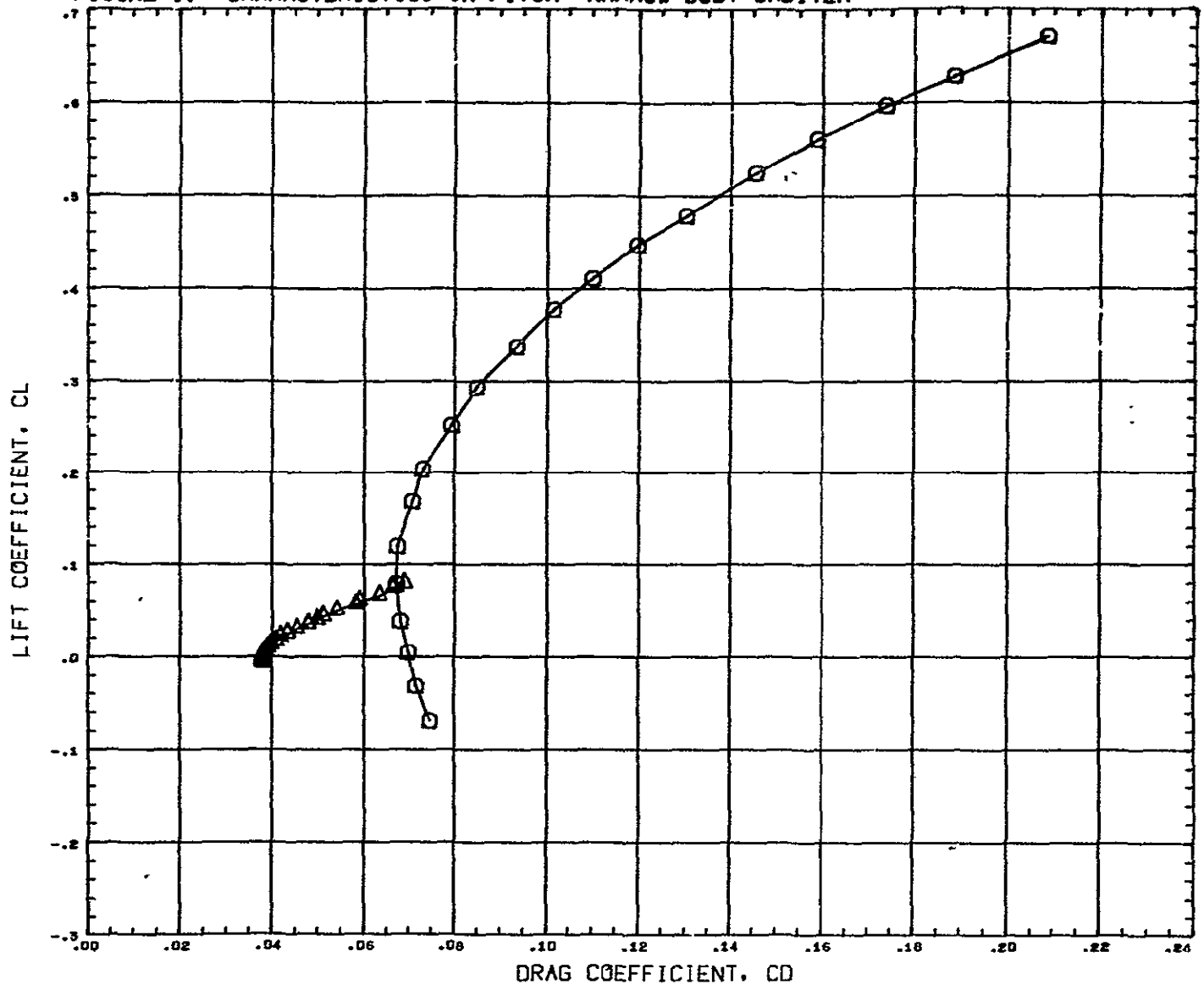
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RCRO21) $\square$ GFTT-D35 CONF ROS-NB1 B1W1V1
(RCRO51) $\triangle$ DATA NOT AVAILABLE FOR ALL CONDITIONS

BETA ELEVNS RUDDER
0.000 0.000 0.000
0.000

REFERENCE INFORMATION
SREF 20.6900 SQ.IN.
LREF 9.6500 IN.
BREF 5.8380 IN.
XMRP 1485.0040 IN.
YMRP 0.0001 IN.
ZMRP 377.0024 IN.
SCALE 0.0050

MACH 0.940

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



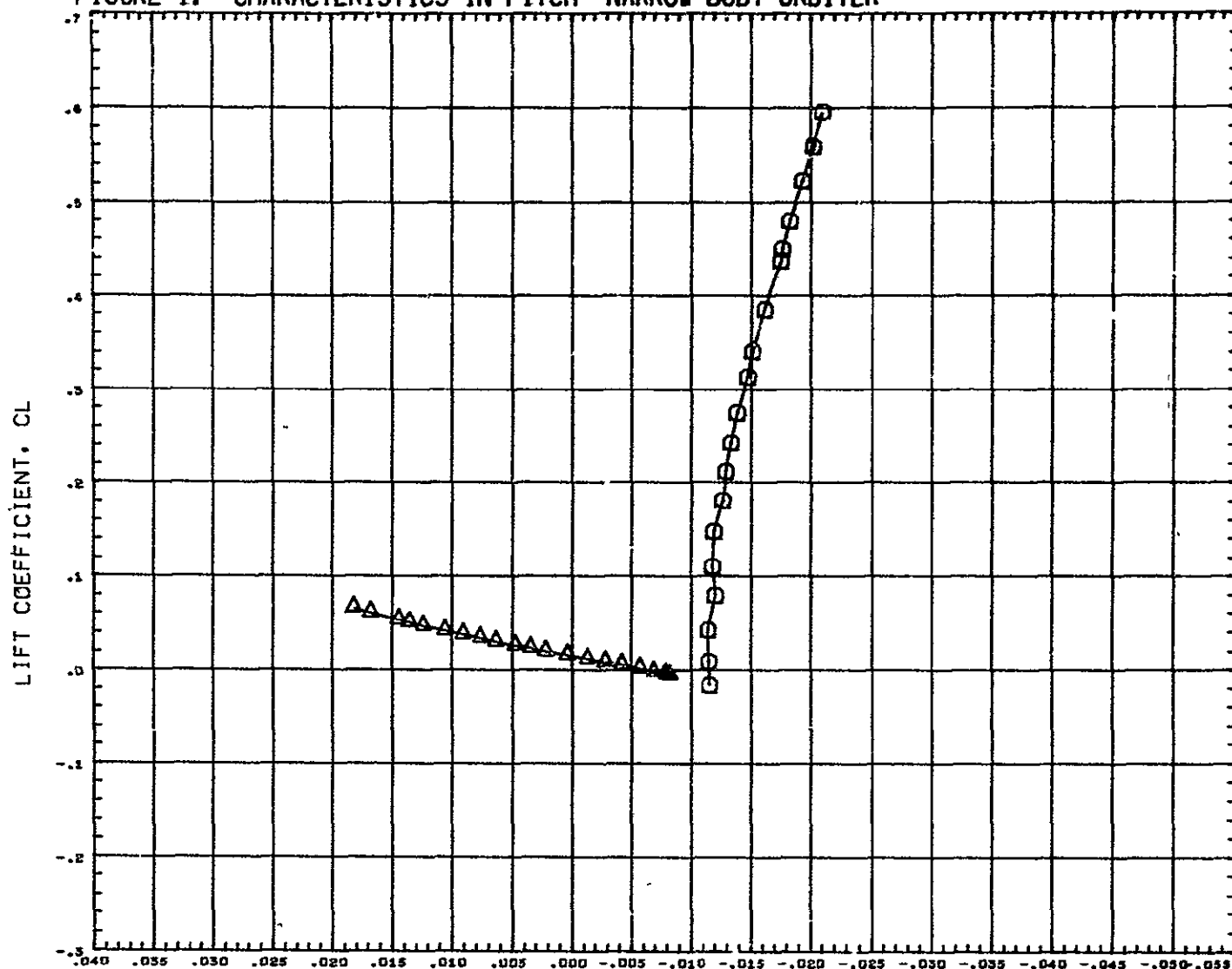
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR021) 	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR051) 	GFTT-035 CONF ROS-NB1 B1

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	50 IN.
LREF	9.6500	IN.
BREF	5.8360	IN.
XMRP	1485.0040	IN.
YMRP	0.0002	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 1.160

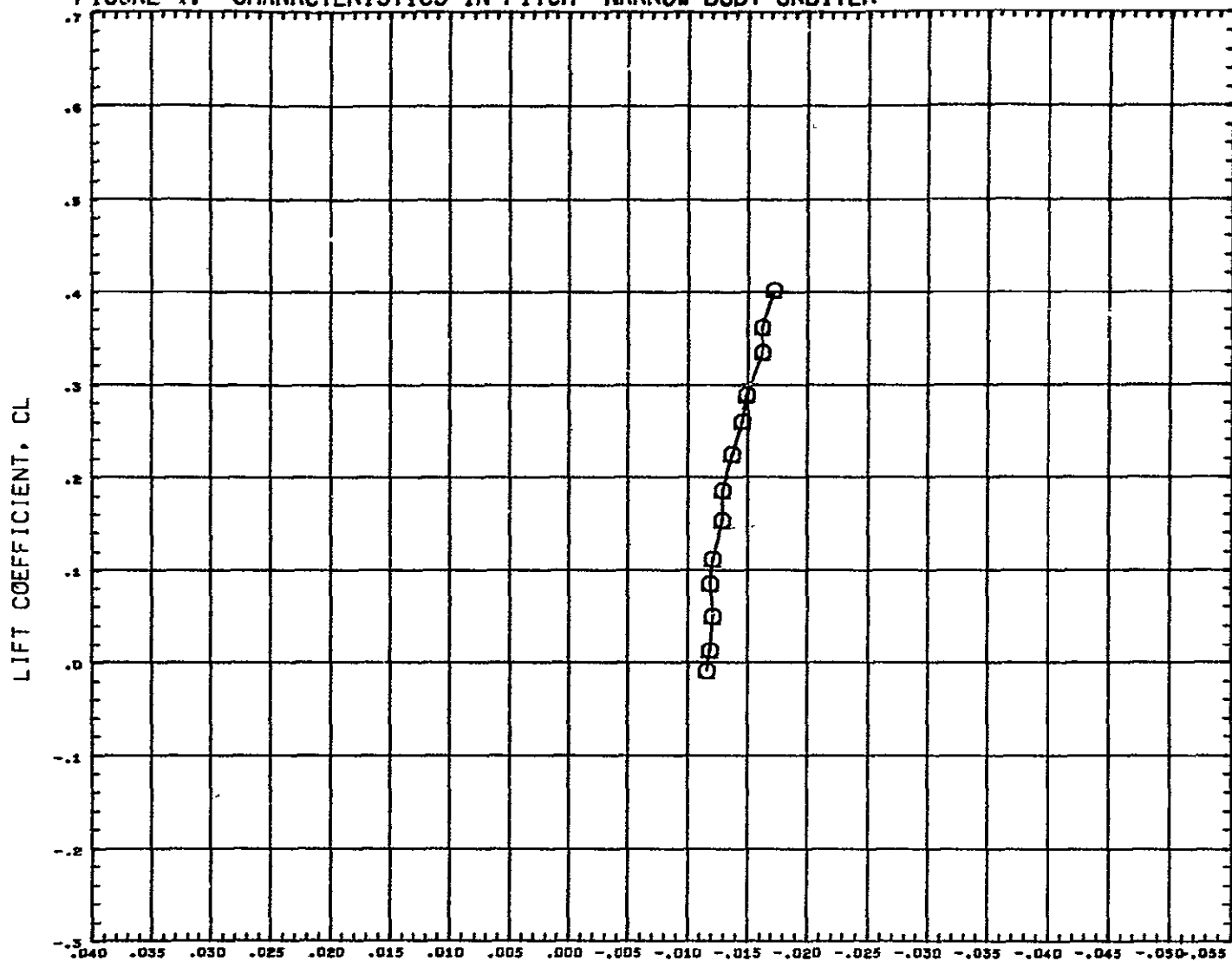
FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



DATA SET SYMBOL CONFIGURATION DESCRIPTION				BETA	ELEVNS	RUDDER	REFERENCE INFORMATION	
(RCR021)	Q	GFTT-035 CONF ROS-NB1	B1W1V1	0.000	0.000	0.000	SREF	20.6900 sq.in.
(RCR051)	A	GFTT-035 CONF ROS-MB1	B1	0.000			LREF	9.6500 in.
							BREF	5.8300 in.
							YMRF	1405.0040 in.
							YNRF	0.0090 in.
							ZMRF	277.0004 in.
							SCALE	0.0050

MACH 0.700

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



PITCHING MOMENT COEFFICIENT, CLM

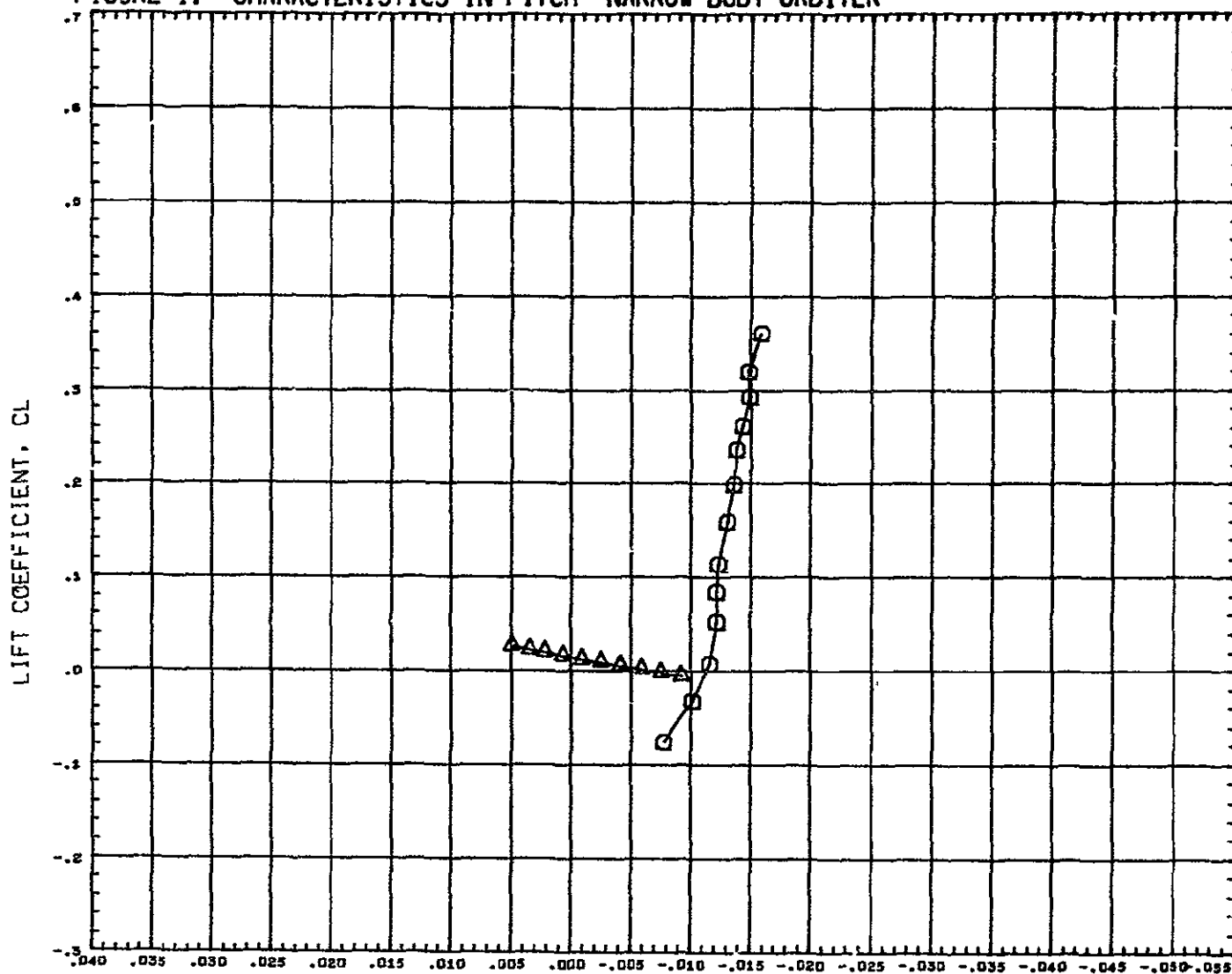
DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (RCR021)  6FTT-035 CONF ROS-NB1 BIWIV1
 (RCR081)  DATA NOT AVAILABLE FOR ALL CONDITIONS

BETA ELEVNS RUDDER
 0.000 0.000 0.000
 0.000

REFERENCE INFORMATION
 SREF 20.6900 SQ. IN.
 LREF 9.6500 IN.
 BREF 5.8380 IN.
 XHRP 1485.0040 IN.
 YHRP 0.0080 IN.
 ZHRP 377.0004 IN.
 SCALE 0.0050

MACH 0.820

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



PITCHING MOMENT COEFFICIENT, CLM

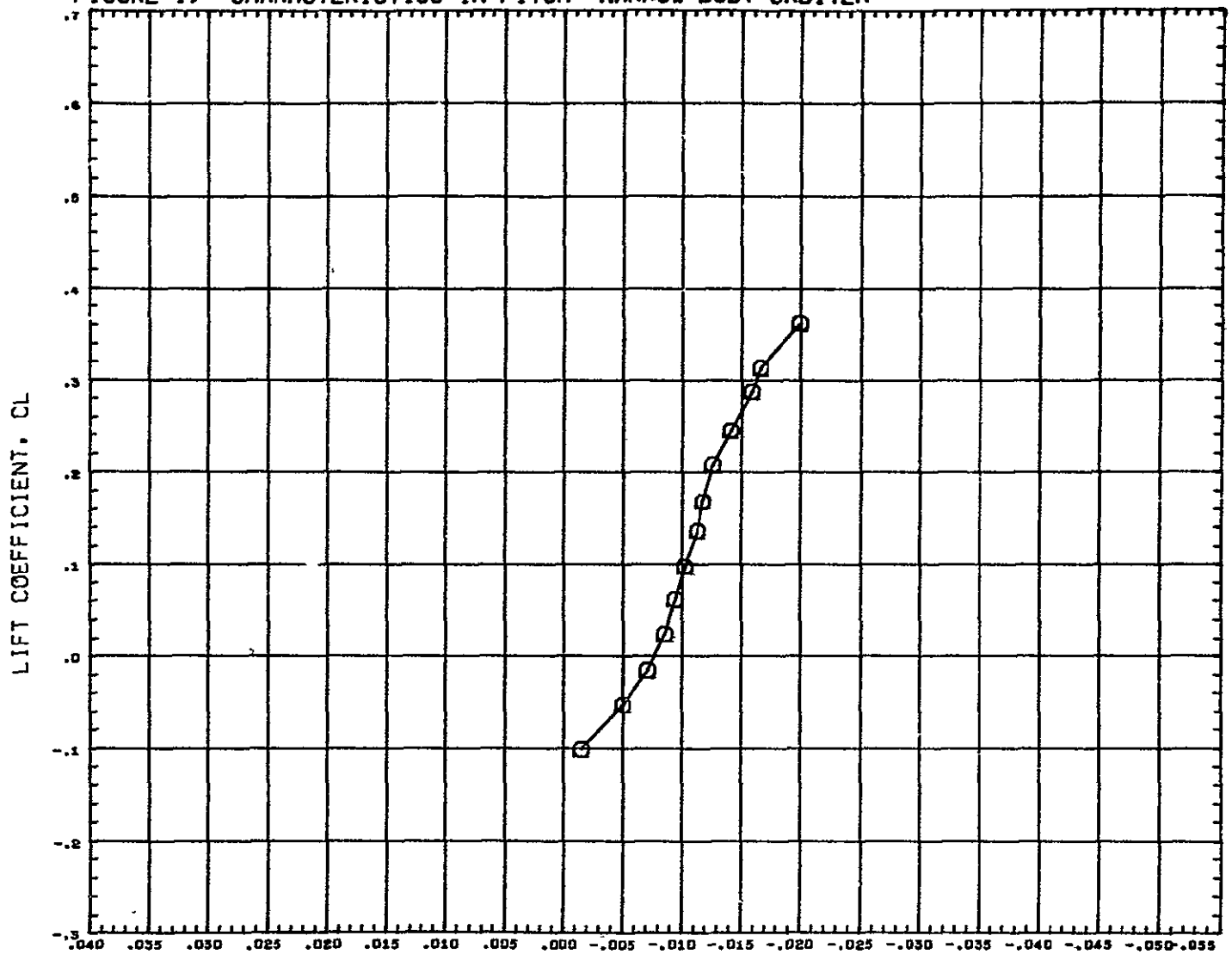
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RCR021) Q GFTT-035 CONF ROS-NB1 BIWIV1
(RCR051) A GFTT-035 CONF ROS-NB1 B1

BETA ELEVNS RUDDER
0.000 0.000 0.000
0.000

REFERENCE INFORMATION
SREF 20.6900 SQ.IN.
LREF 9.6500 IN.
BREF 5.8300 IN.
XMRP 1485.0040 IN.
YMRP 0.0090 IN.
ZMRP 377.0004 IN.
SCALE 0.0050

MACH 0.890

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



PITCHING MOMENT COEFFICIENT, CLM

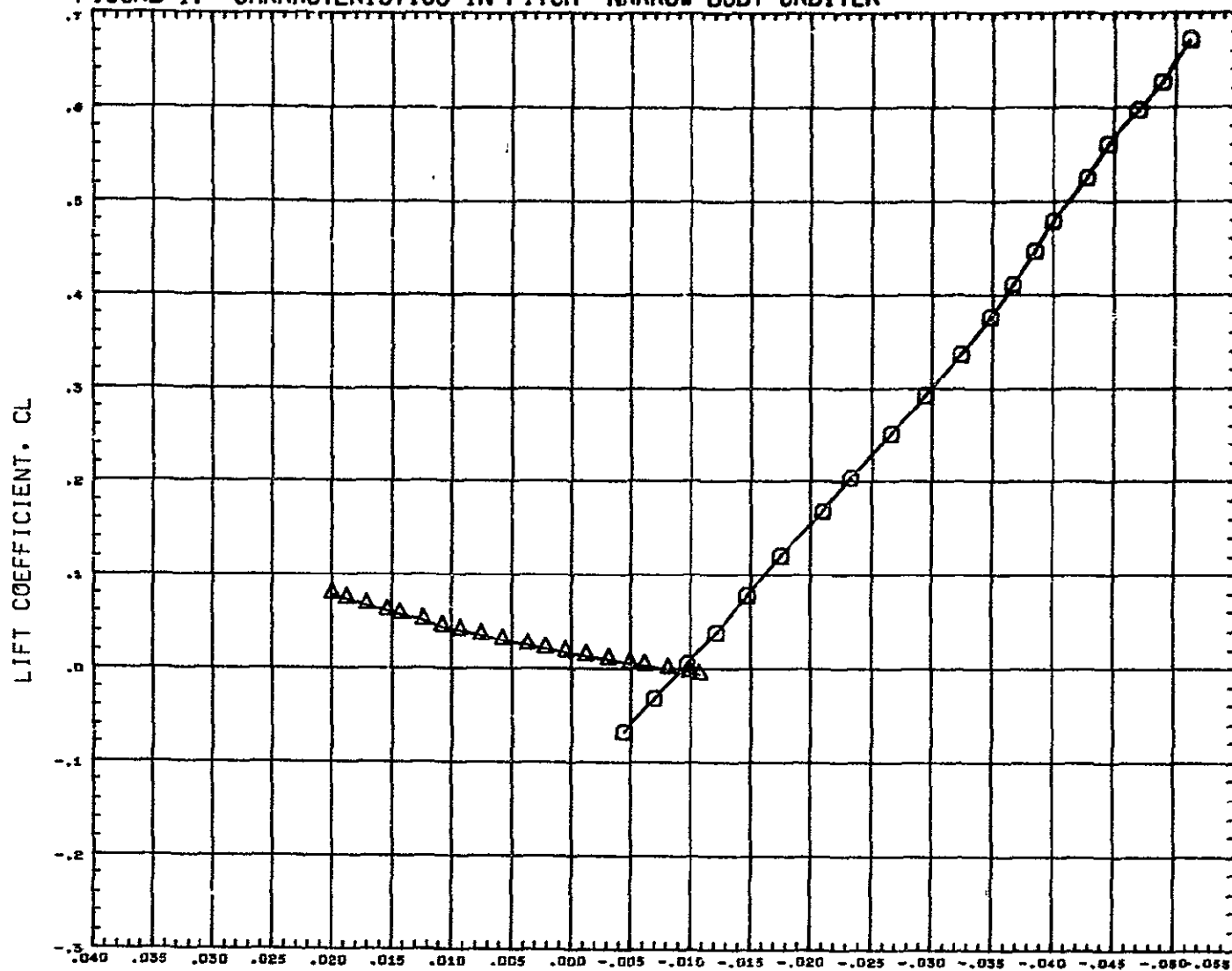
DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (RCR021) 6FTT-035 CONF ROS-NB1 B1W1V1
 (RCR051) DATA NOT AVAILABLE FOR ALL CONDITIONS

BETA ELEVNS RUDDER
 0.000 0.000 0.000
 0.000

REFERENCE INFORMATION
 SREF 20.6900 SQ.IN.
 LREF 9.6500 IN.
 BREF 5.8380 IN.
 XMRP 1485.0040 IN.
 YMRP 0.0000 IN.
 ZMRP 377.0004 IN.
 SCALE 0.0050

MACH 0.940

FIGURE 1. CHARACTERISTICS IN PITCH- NARROW BODY ORBITER



PITCHING MOMENT COEFFICIENT, CLM

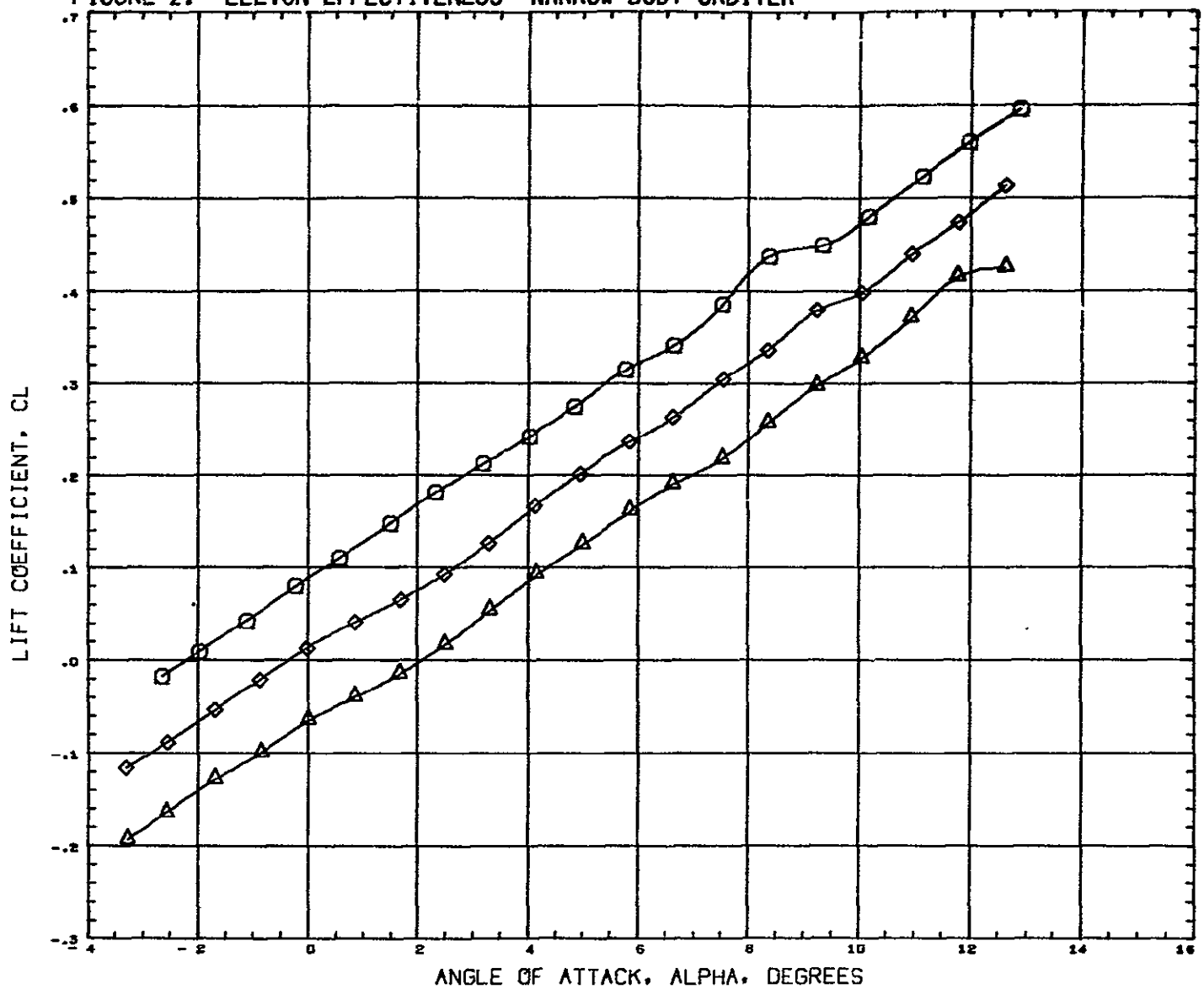
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR021) $\square$	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR051) $\triangle$	GFTT-035 CONF ROS-NR1 B1

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000		

REFERENCE INFORMATION		
SREF	20.6900	54.1N.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.6050	

MACH 1.160

FIGURE 2. ELEVON EFFECTIVENESS- NARROW BODY ORBITER



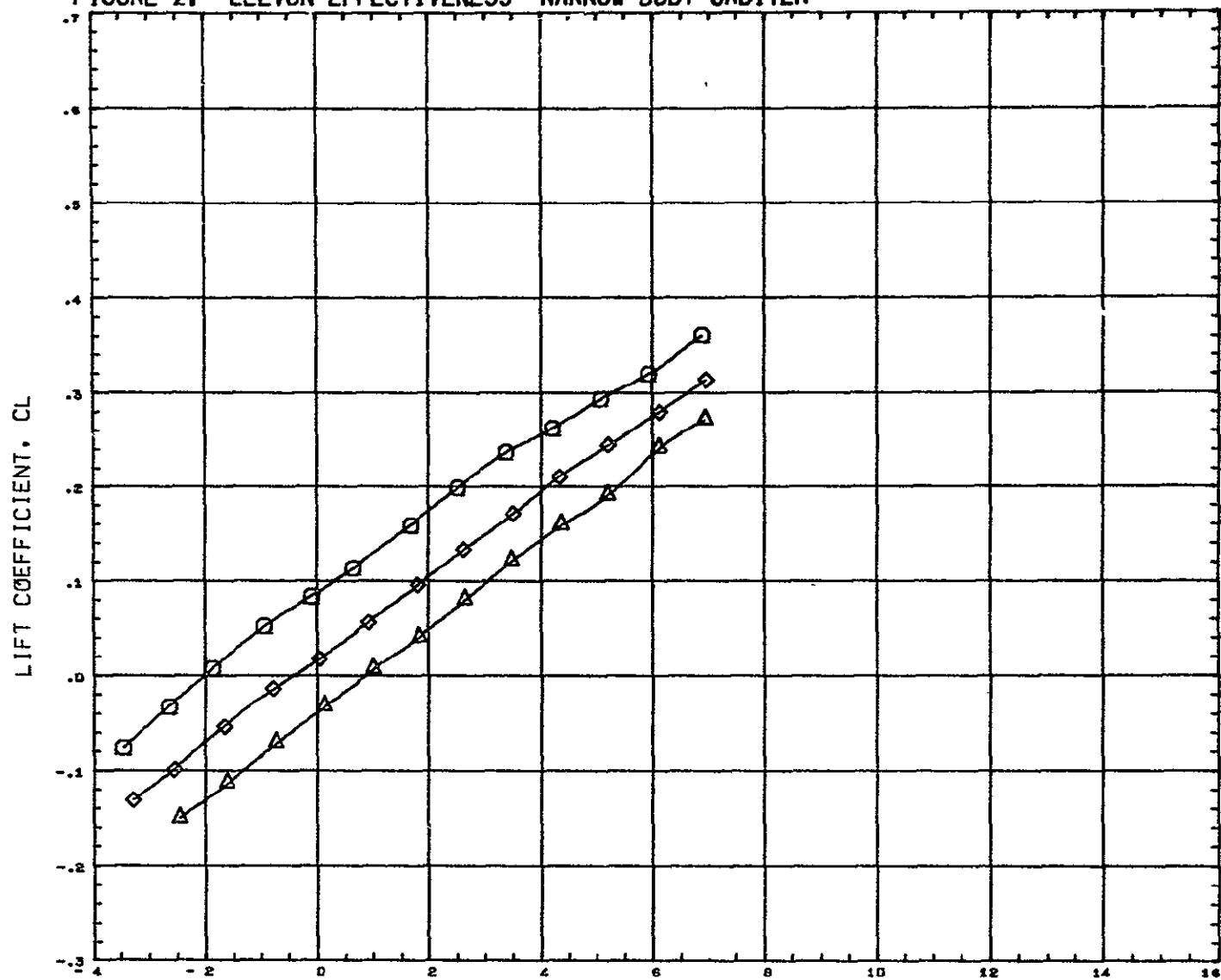
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(ACR021)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR035)	GFTT-035 CONF ROS-NB1 B1W1(-10,-10)V1
(RCR039)	GFTT-035 CONF ROS-NB1 B1W1(-5,-5)V1
(RCR041)	DATA NOT AVAILABLE FOR ALL CONDITIONS

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	-10.000	0.000
0.000	-5.000	0.000
0.000	-20.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	SQ.IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.700

FIGURE 2. ELEVON EFFECTIVENESS- NARROW BODY ORBITER



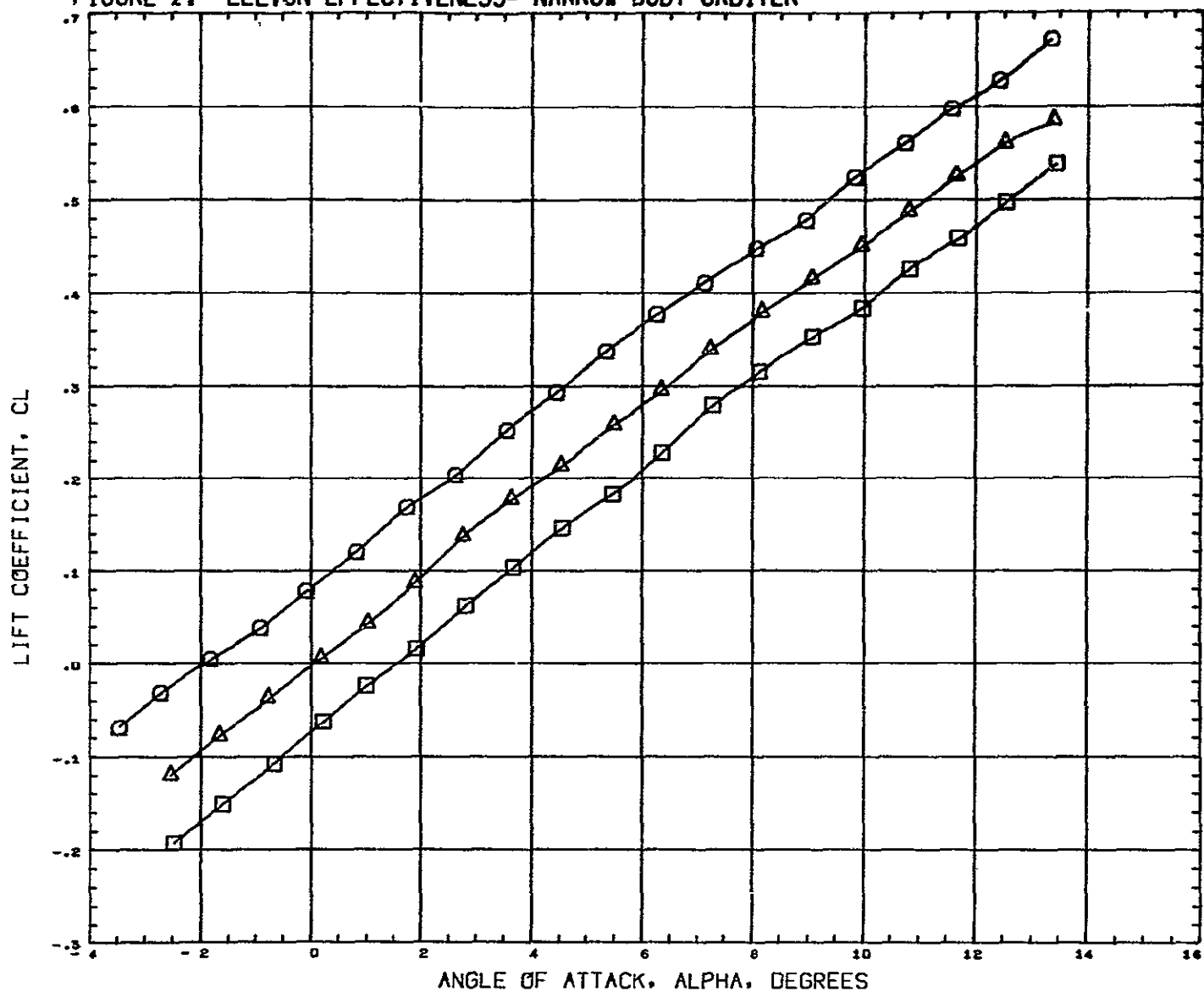
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(ACR021)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR035)	GFTT-035 CONF ROS-NR1 B1W1 (-10,-10)V1
(RCR039)	GFTT-035 CONF ROS-NB1 B1W1 (-5,-5)V1
(RCR041)	DATA NOT AVAILABLE FOR α CONDITIONS

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	-10.000	0.000
0.000	-5.000	0.000
0.063	-20.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	50 IN.
LREF	9.6500	IN.
BREF	5.8300	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.890

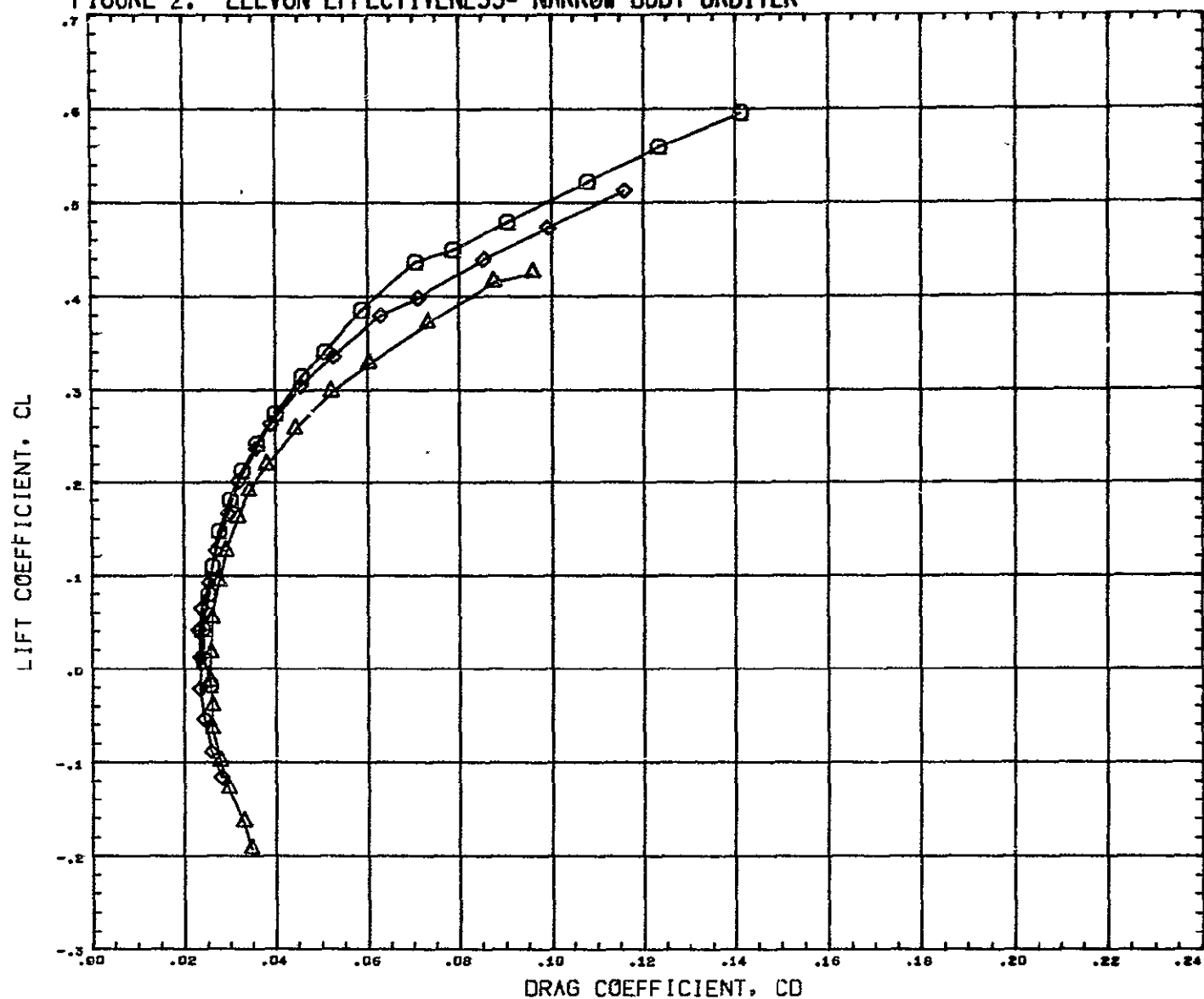
FIGURE 2. ELEVON EFFECTIVENESS- NARROW BODY ORBITER



DATA SET SYMBOL	CONFIGURATION DESCRIPTION	BETA	ELEVNS	RUDDER	REFERENCE INFORMATION		
(ACR021)	GFTT-035 CONF ROS-NB1 B1W1V1	0.000	0.000	0.000	SREF	20.6900	Sq. IN.
(RCR035)	GFTT-035 CONF ROS-NB1 B1W1(-10,-10)V1	0.000	-10.000	0.000	LREF	9.6500	IN.
(RCR039)	DATA NOT AVAILABLE FOR ALL CONDITIONS	0.000	-5.000	0.000	BREF	5.8380	IN.
(RCR041)	GFTT-035 CONF ROS-NB1 B1W1(-20,-20)V1	0.000	-20.000	0.000	XMRP	1485.0040	IN.
					YMRP	0.0000	IN.
					ZMRP	377.0004	IN.
					SCALE	0.0050	

MACH 1.160

FIGURE 2. ELEVON EFFECTIVENESS- NARROW BODY ORBITER



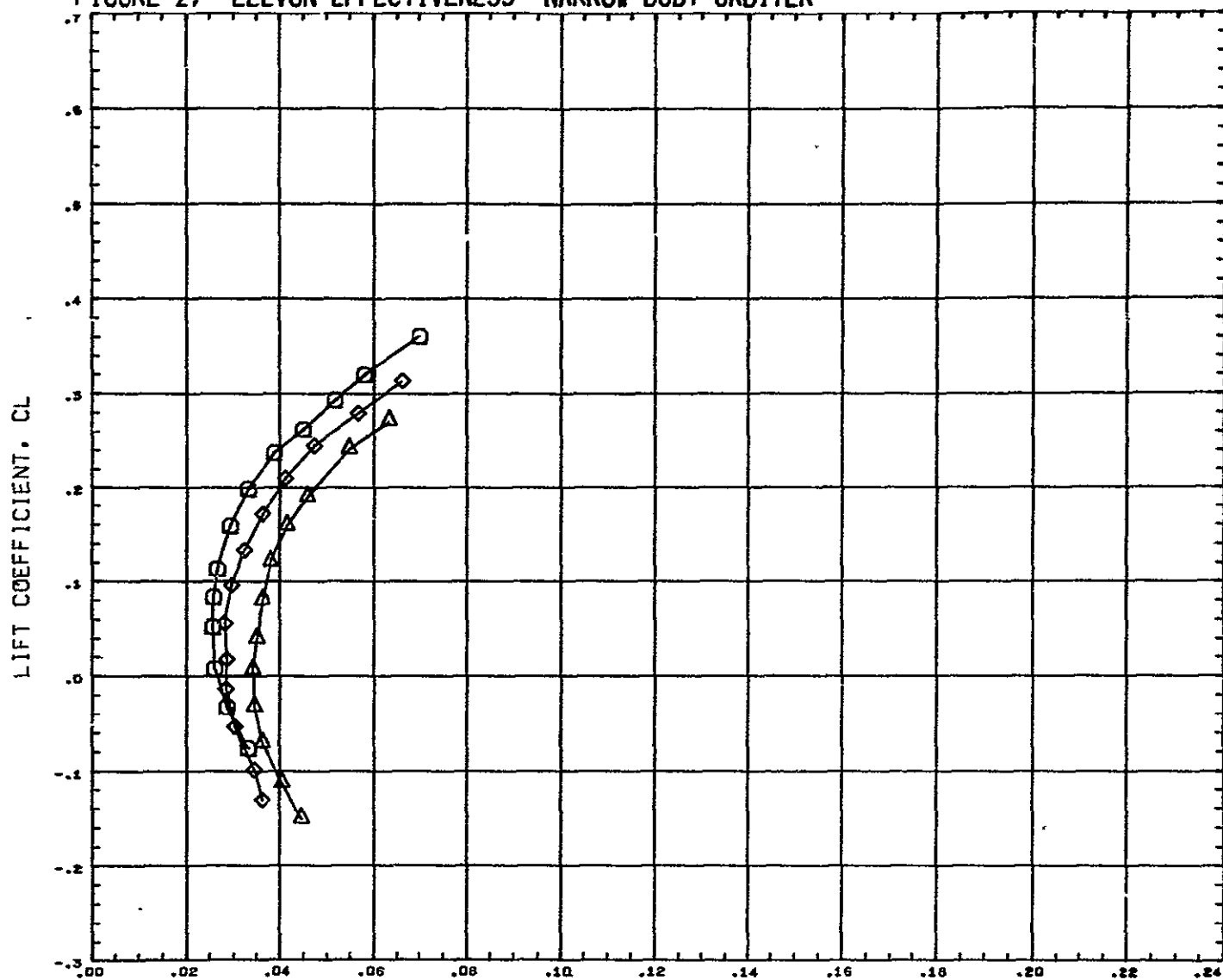
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(ACR021)	GFTT-035 CONF ROS-NB1 81W1V1
(RCR035)	GFTT-035 CONF ROS-NB1 81W1(-10,-10)V1
(RCR039)	GFTT-035 CONF ROS-NB1 81W1(-5,-5)V1
(RCR041)	DATA NOT AVAILABLE FOR ALL CONDITIONS

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	-10.000	0.000
0.000	-5.000	0.000
0.000	-20.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	sq.in.
LREF	9.6500	in.
BREF	5.6380	in.
XMRP	1485.0040	in.
YMRP	0.0000	in.
ZMRP	377.0004	in.
SCALE	0.0050	

MACH 0.700

FIGURE 2. ELEVON EFFECTIVENESS- NARROW BODY ORBITER



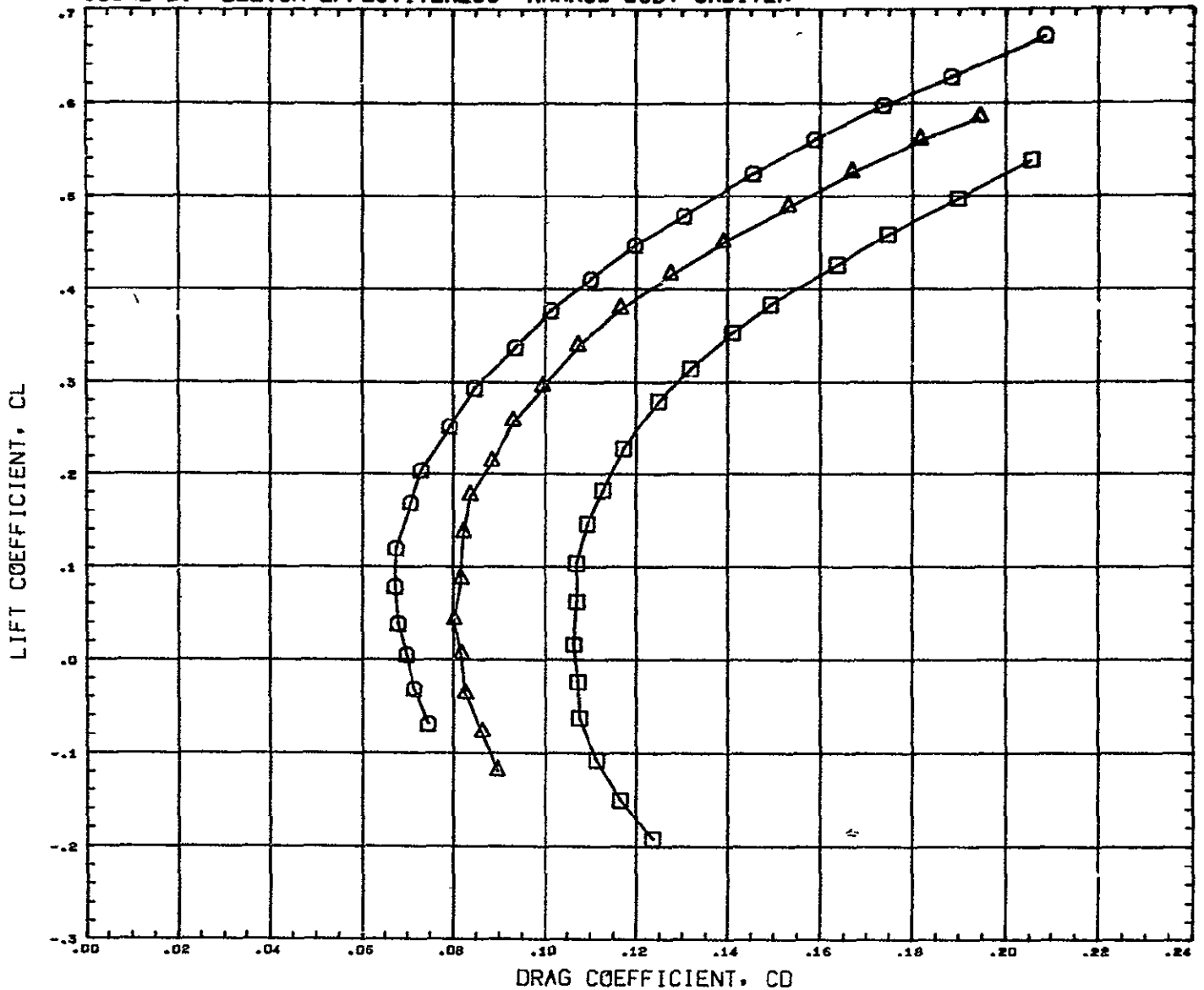
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(ACR021)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR035)	GFTT-035 CONF ROS-NB1 B1W1 (-10,-10)V1
(RCR039)	GFTT-035 CONF ROS-NB1 B1W1 (-5,-5)V1
(RCR041)	DATA NOT AVAILABLE FOR ALL CONDITIONS

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	-10.000	0.000
0.000	-5.000	0.000
0.000	-20.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	Sq. IN.
LREF	9.6500	IN.
BREF	5.8360	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.890

FIGURE 2. ELEVON EFFECTIVENESS- NARROW BODY ORBITER



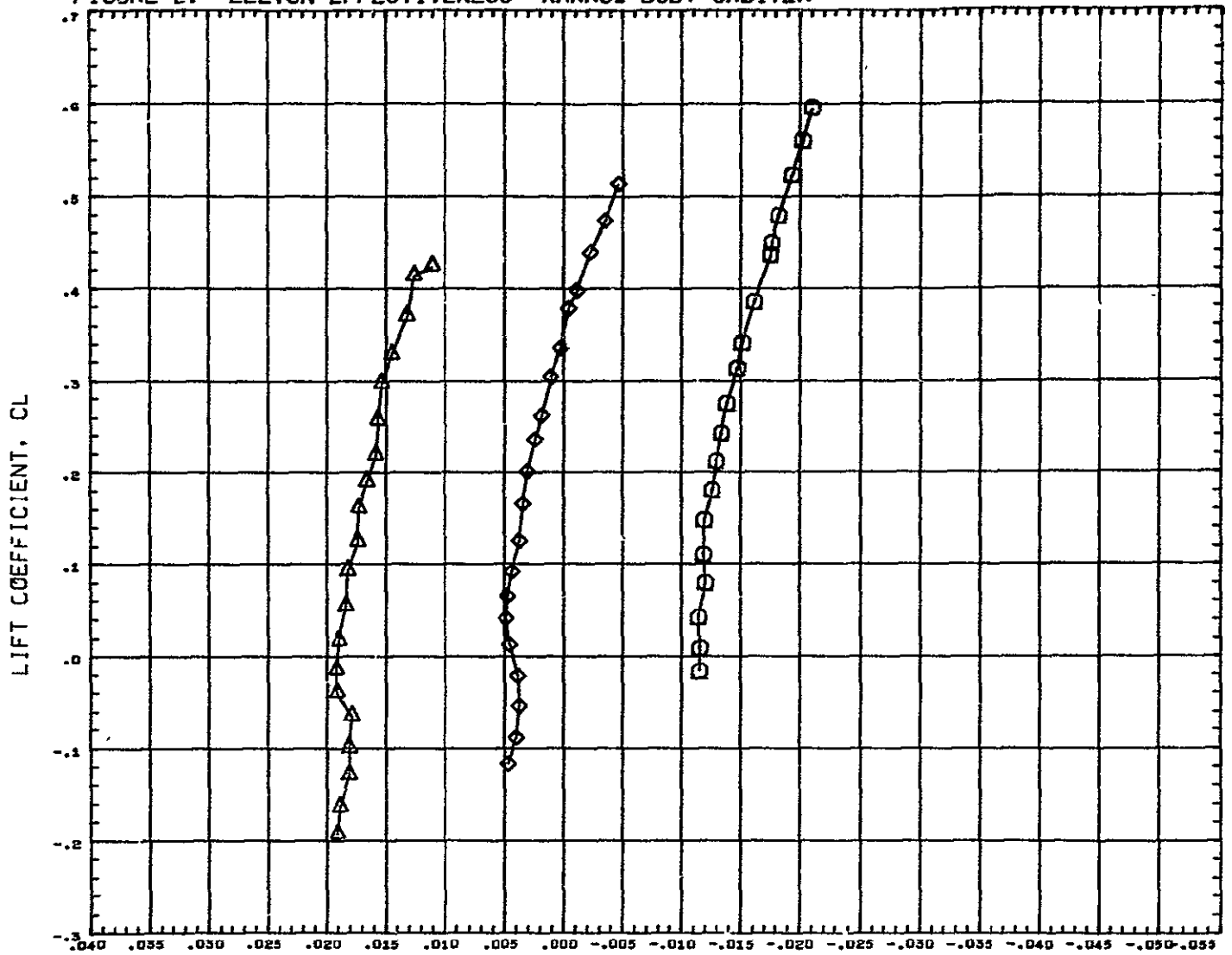
DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (ACR021) (O) GFTT-035 CONF ROS-NB1 B1W1V1
 (RCR035) (Δ) GFTT-035 CONF ROS-NB1 B1W1(-10,-10)V1
 (RCR039) (X) DATA NOT AVAILABLE FOR ALL CONDITIONS
 (RCR041) (□) GFTT-035 CONF ROS-NB1 B1W1(-20,-20)V1

BETA ELEVNS RUDDER
 0.000 0.000 0.000
 0.000 -10.000 0.000
 0.000 -5.000 0.000
 0.000 -20.000 0.000

REFERENCE INFORMATION
 SREF 20.6900 SQ. IN.
 LREF 9.6500 IN.
 BREF 5.8380 IN.
 XMRF 1485.0040 IN.
 YMRP 0.0000 IN.
 ZMRP 377.0004 IN.
 SCALE 0.0050

MACH 1.160

FIGURE 2. ELEVON EFFECTIVENESS- NARROW BODY ORBITER



DATA SET SYMBOL	CONFIGURATION DESCRIPTION	BETA	ELEVNS	RUDDER	REFERENCE INFORMATION	
(ACR021)	6FTT-035 CONF ROS-NB1 B1W1V1	0.000	0.000	0.000	SREF	20.6900 SQ. IN.
(RCR035)	6FTT-035 CONF ROS-NB1 B1W1 (-10,-10)V1	0.000	-10.000	0.000	LREF	9.6500 IN.
(RCR039)	6FTT-035 CONF ROS-NB1 B1W1 (-5,-5)V1	0.000	-5.000	0.000	BREF	5.8380 IN.
(RCR041)	DATA NOT AVAILABLE FOR ALL CONDITIONS	0.000	-20.000	0.000	XMRP	1485.0040 IN.
					YMRP	0.0000 IN.
					ZMRP	377.0004 IN.
					SCALE	0.0050

MACH 8.700

Figure 21 is a line graph with three data series plotted on a grid. The x-axis is labeled 'a' and ranges from -0.040 to -0.055. The y-axis is labeled 'f(a, b)' and ranges from -0.3 to 0.7. The three series are:

- $b = 0.001$ (represented by triangles): This series starts at approximately (-0.018, -0.15) and increases to about (-0.004, 0.28).
- $b = 0.002$ (represented by diamonds): This series starts at approximately (-0.002, -0.12) and increases to about (-0.001, 0.32).
- $b = 0.005$ (represented by circles): This series starts at approximately (-0.010, -0.08) and increases to about (-0.014, 0.37).

All three curves show a similar trend, increasing as 'a' becomes more negative, with the rate of increase being steeper for larger values of 'b'.

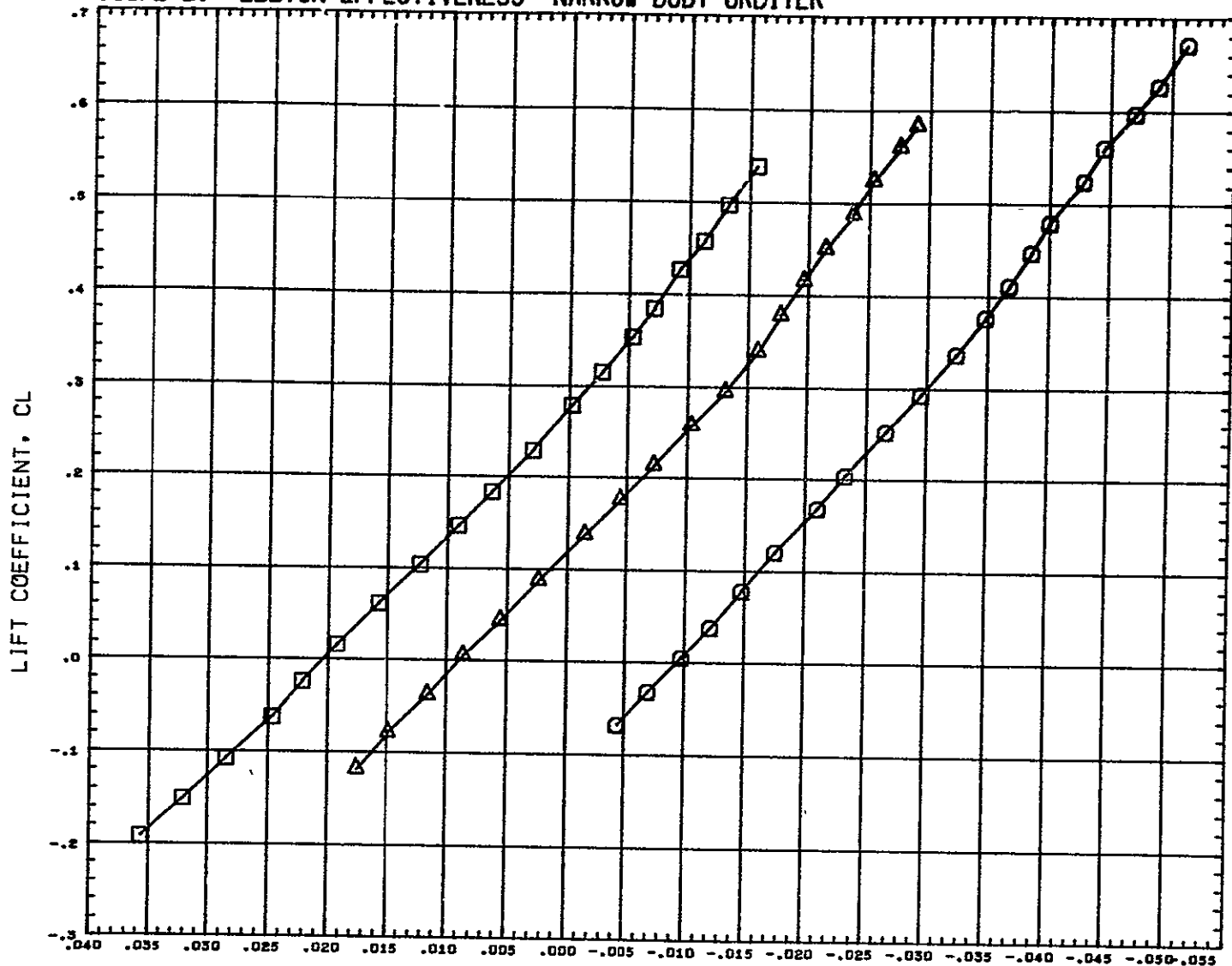
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(ACR021)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR035)	GFTT-035 CONF ROS-NB1 B1W1 (-10,-10)V1
(RCR039)	GFTT-035 CONF ROS-NB1 B1W1 (-5,-5)V1
(RCR041)	DATA NOT AVAILABLE FOR ALL CONDITIONS

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	-10.000	0.000
0.000	-5.000	0.000
0.000	-20.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	sq. in.
LREF	9.6500	in.
BREF	5.8300	in.
XMRP	1485.0040	in.
YMRP	0.0000	in.
ZMRP	377.0004	in.
SCALE	0.0050	

NACH 0.890

FIGURE 2. ELEVON EFFECTIVENESS- NARROW BODY ORBITER



PITCHING MOMENT COEFFICIENT, CLM

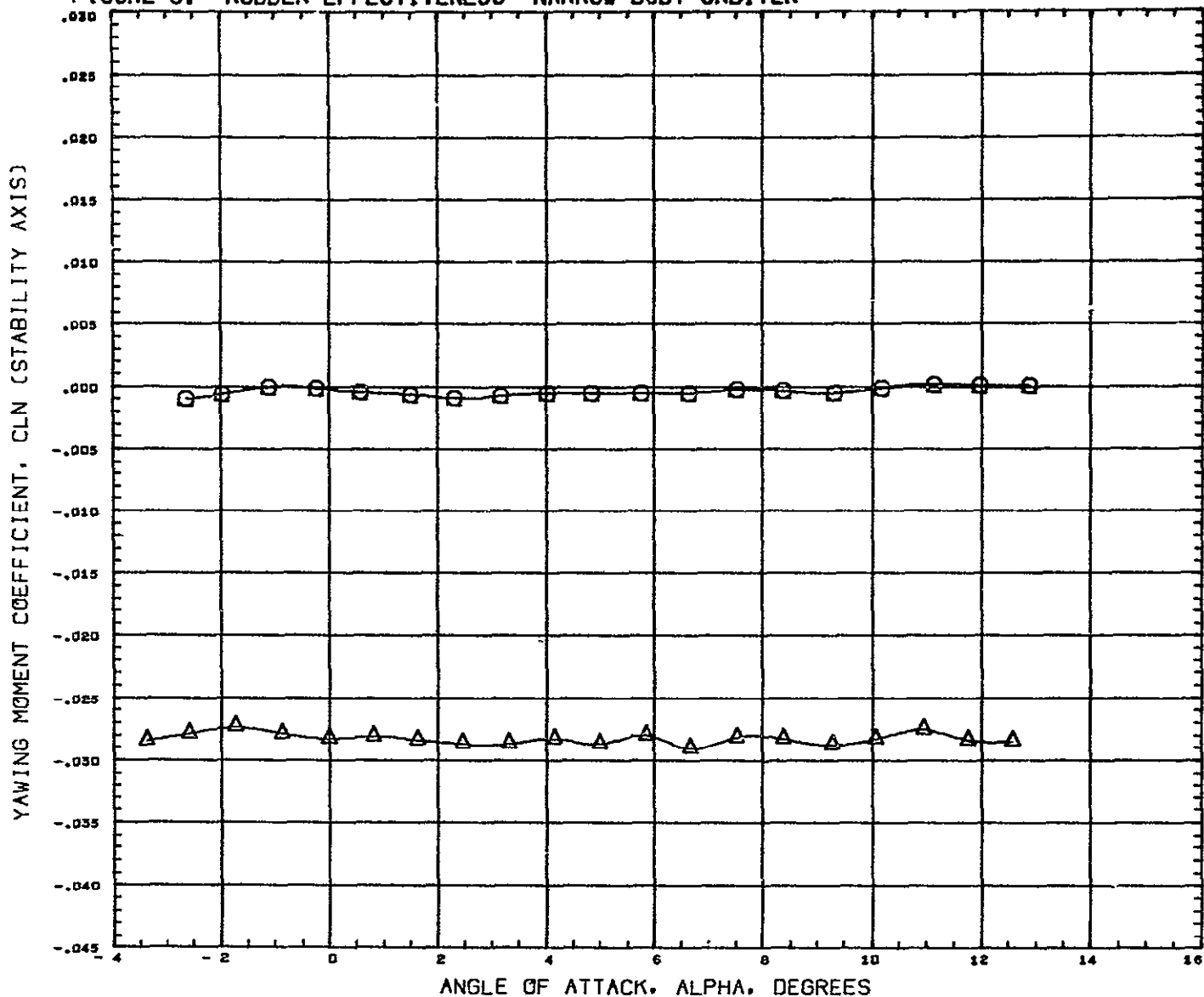
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(ACR021)	□ GFTT-035 CONF ROS-NB1 B1W1V1
(RCR035)	△ GFTT-035 CONF ROS-NB1 B1W1(-10,-10)V1
(RCR039)	○ DATA NOT AVAILABLE FOR ALL CONDITIONS
(RCR041)	□ GFTT-035 CONF ROS-NB1 B1W1(-20,-20)V1

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	-10.000	0.000
0.000	-5.000	0.000
0.003	-20.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	Sq. IN.
LREF	9.6500	IN.
BREF	5.8360	IN.
XMRP	1485.0040	IN.
YMRP	0.0006	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 1.160

FIGURE 3. RUDDER EFFECTIVENESS- NARROW BODY ORBITER



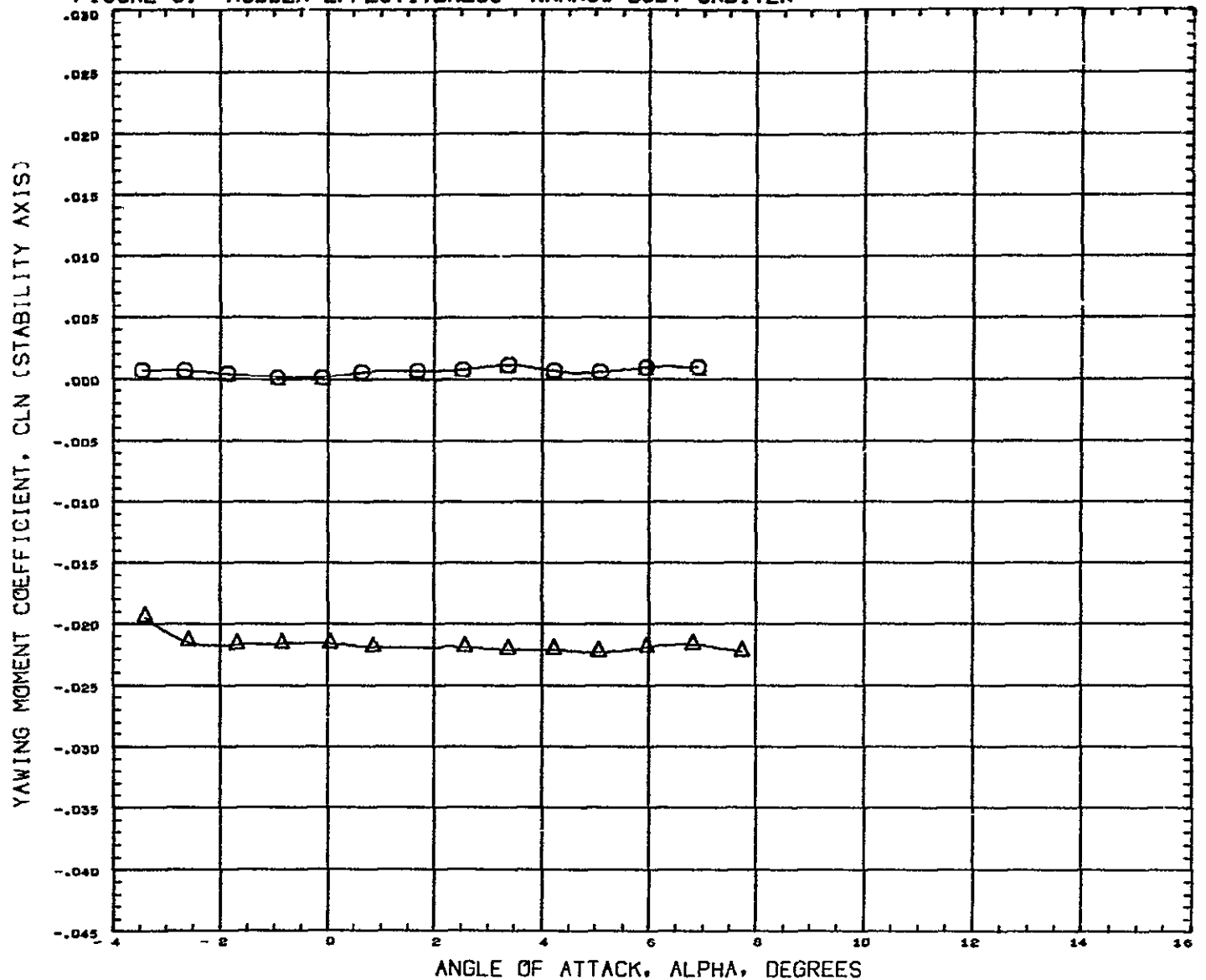
DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (ACR021) 6FTT-035 CONF RCS-NB1 B1W1V1
 (RCR042) 6FTT-035 CONF RCS-NB1 B1W1V1 (10)

BETA ELEVNS RUDDER
 0.000 0.000 0.000
 0.000 0.000 10.000

REFERENCE INFORMATION
 SREF 20.6900 SQ. IN.
 LREF 9.6500 IN.
 BREF 5.8380 IN.
 XMRP 1485.0040 IN.
 YMRP 0.0000 IN.
 ZMRP 377.0004 IN.
 SCALE 0.0050

MACH 0.700

FIGURE 3. RUDDER EFFECTIVENESS- NARROW BODY ORBITER



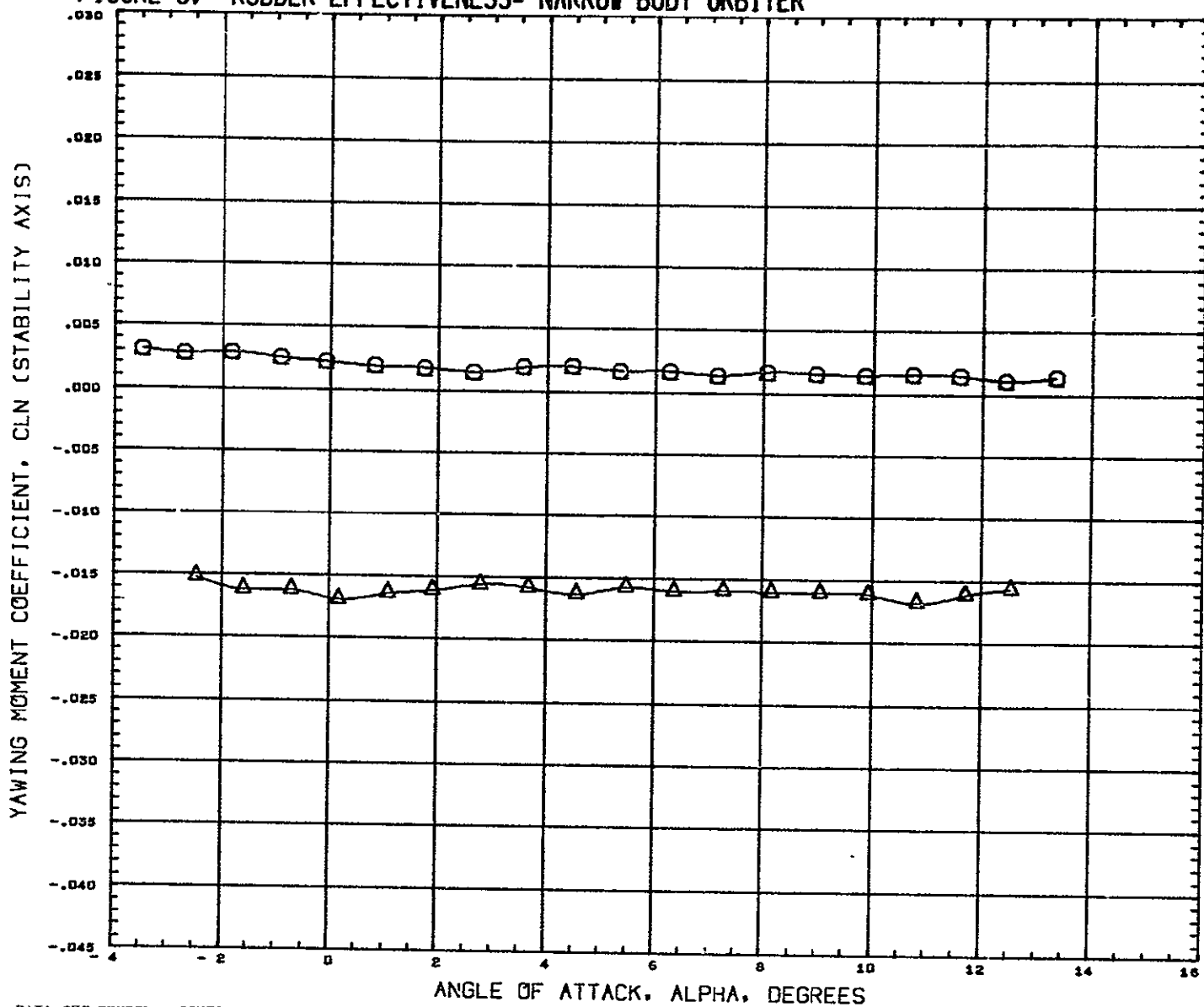
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(ACR021)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR042)	GFTT-035 CONF ROS-NB1 B1W1V1 (10)

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	10.000

REFERENCE INFORMATION		
SREF	20.6900	92. IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.890

FIGURE 3. RUDDER EFFECTIVENESS- NARROW BODY ORBITER



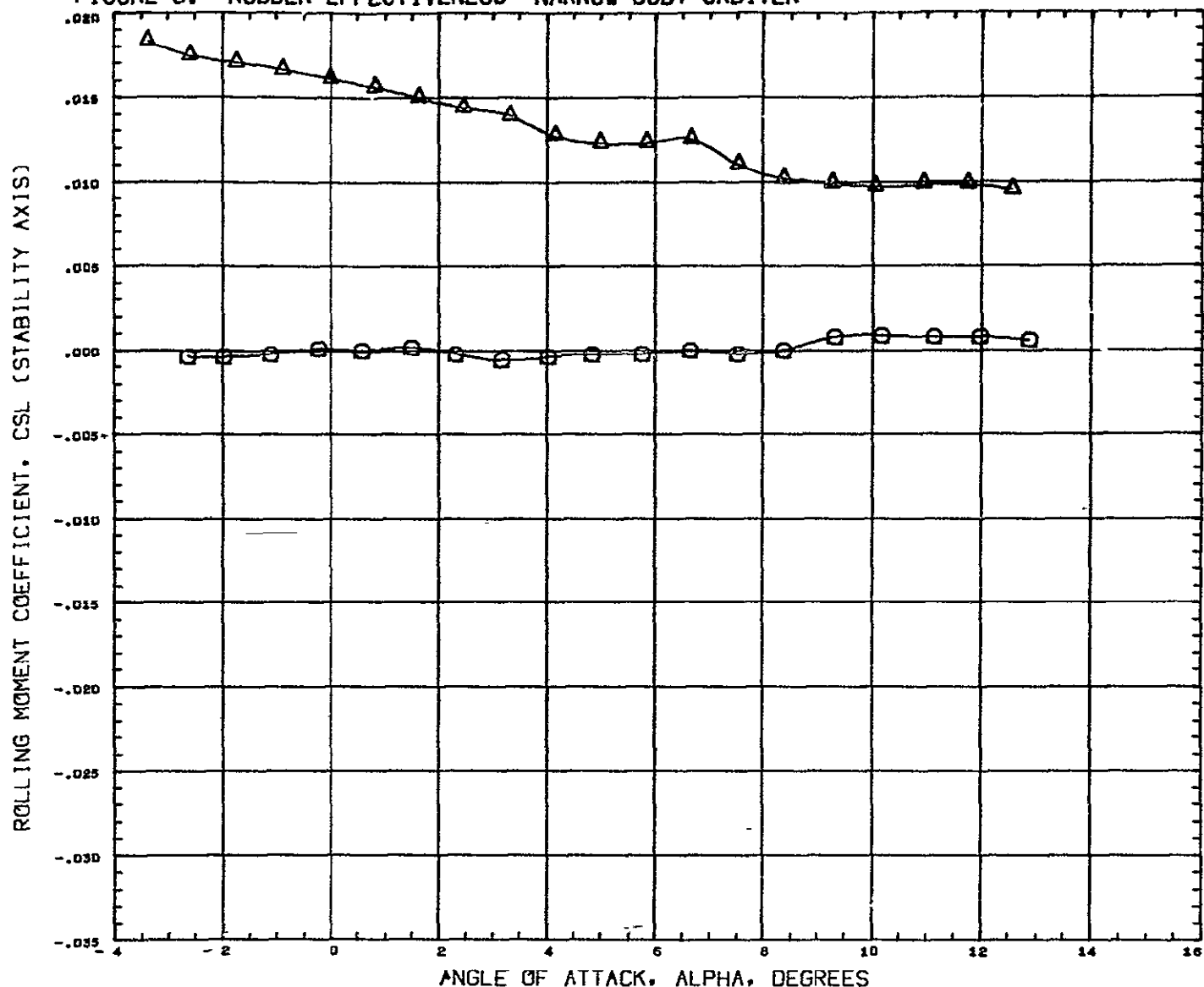
DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (ACR021) GFTT-035 CONF ROS-NB1 B1W1V1
 (RCRD42) GFTT-035 CONF ROS-NB1 B1W1V1 (1D)

BETA ELEVNS RUDDER
 0.000 0.000 0.000
 0.000 0.000 10.000

REFERENCE INFORMATION
 SREF 20.6900 SQ.IN.
 LREF 9.6500 IN.
 BREF 5.0380 IN.
 XMRP 1495.0040 IN.
 YMRP 0.0000 IN.
 ZMRP 377.0004 IN.
 SCALE 0.0050

MACH 1.160

FIGURE 3. RUDDER EFFECTIVENESS- NARROW BODY ORBITER



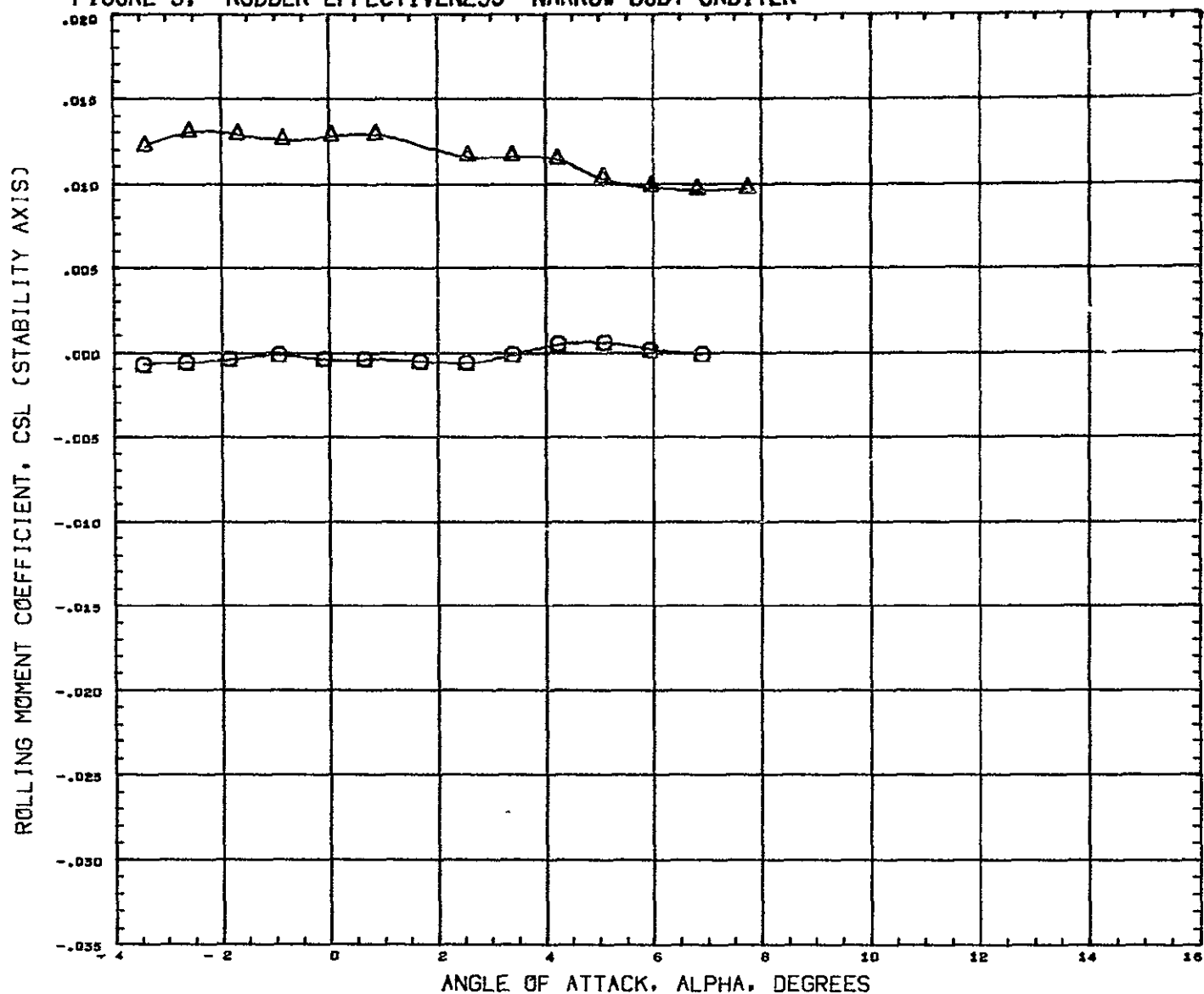
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(ACR021)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR042)	GFTT-035 CONF ROS-NB1 B1W1V1 (10)

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	10.000

REFERENCE INFORMATION	
SREF	20.6900 SQ. IN.
LREF	9.6500 IN.
BREF	5.8380 IN.
XMRP	1485.0040 IN.
YMRP	0.0000 IN.
ZMRP	377.0004 IN.
SCALE	0.0050

MACH 0.700

FIGURE 3. RUDDER EFFECTIVENESS- NARROW BODY ORBITER



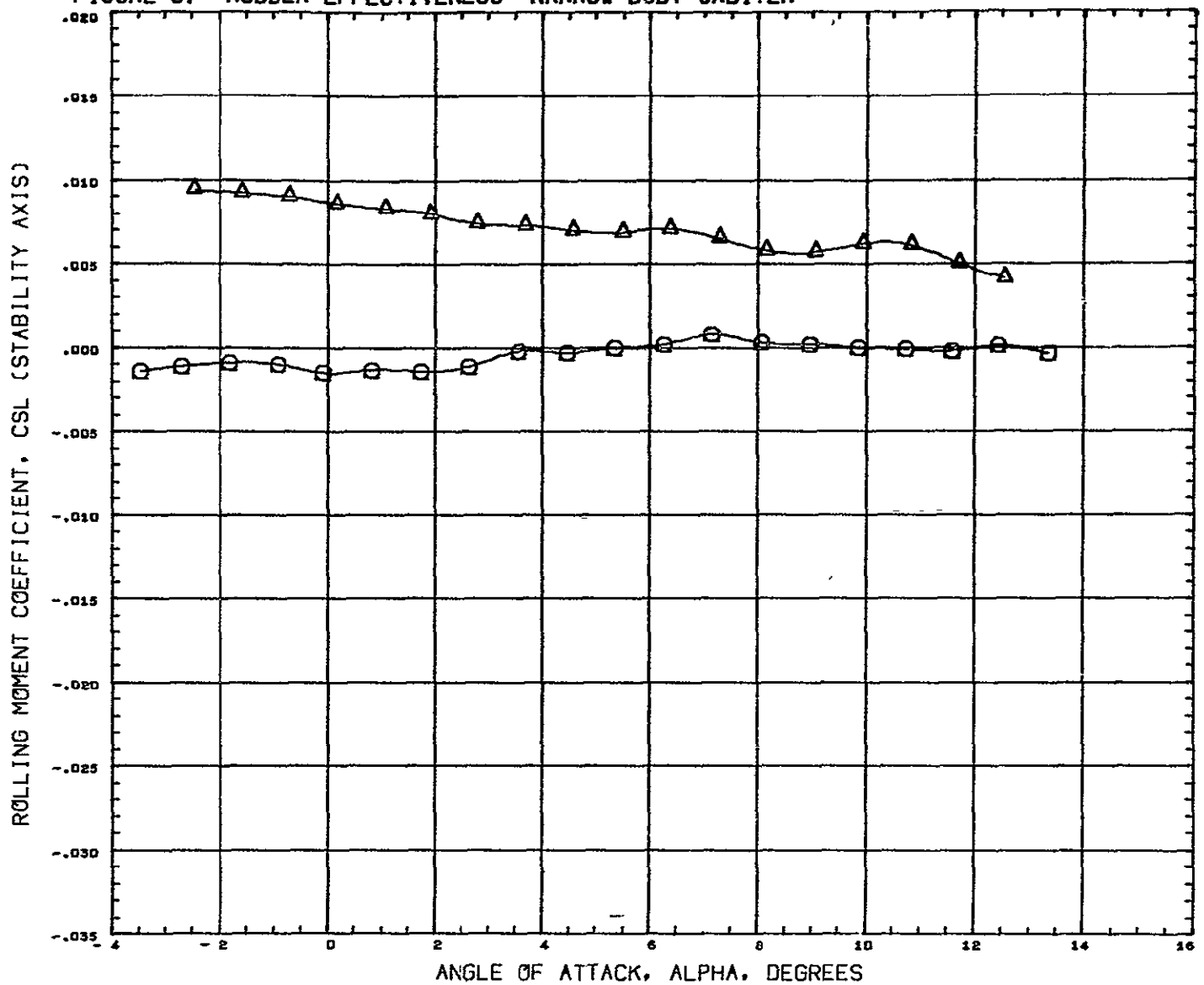
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(ACR021)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR042)	GFTT-035 CONF ROS-NB1 B1W1V1 (10)

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	10.000

REFERENCE INFORMATION		
SREF	20.6900	90.IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.890

FIGURE 3. RUDDER EFFECTIVENESS- NARROW BODY ORBITER



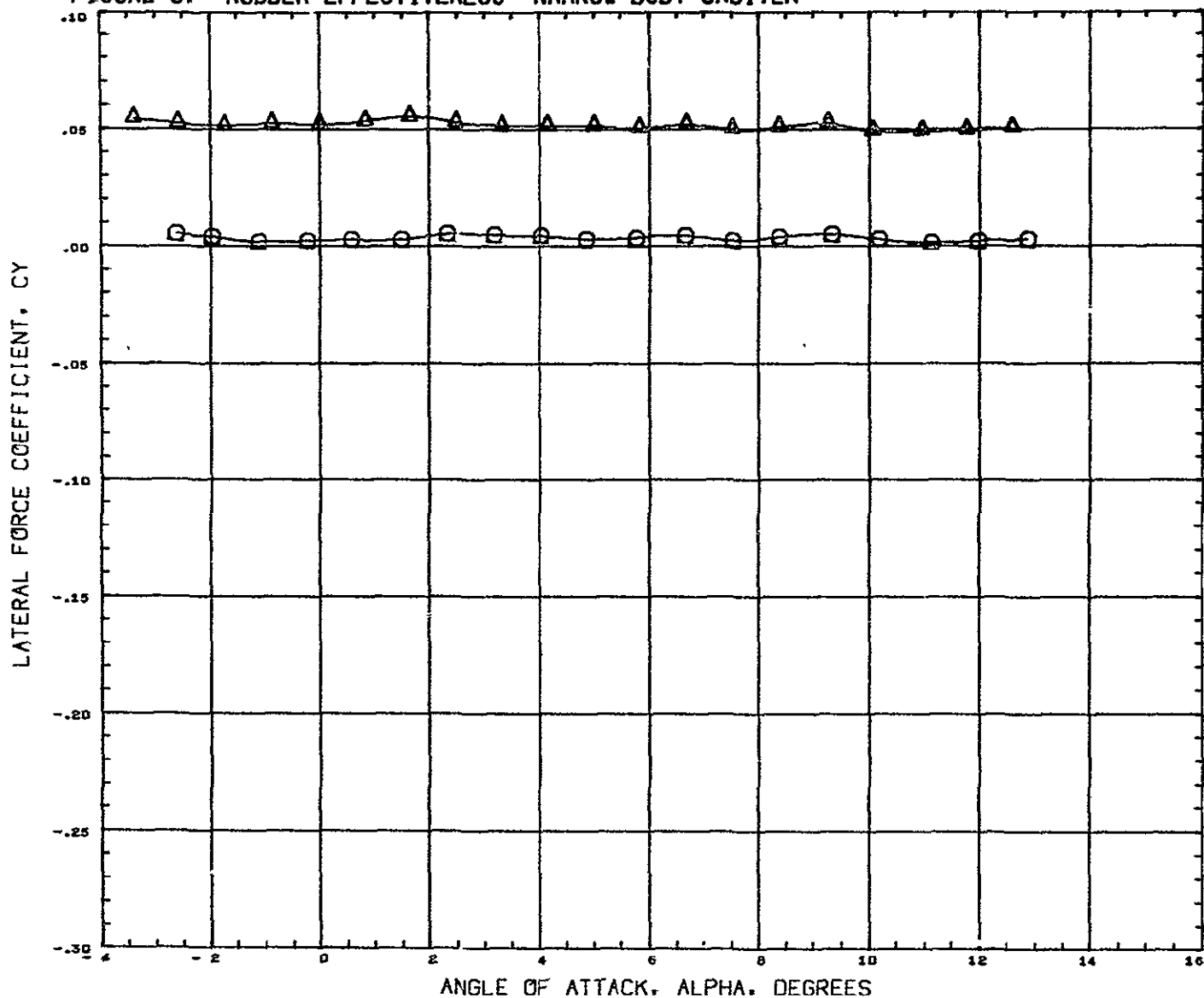
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(ACR021)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR042)	GFTT-035 CONF ROS-NB1 B1W1V1(10)

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	10.000

REFERENCE INFORMATION		
SREF	20.6900	SQ.IN.
LREF	9.6500	IN.
BRCF	5.6360	IN.
XMRP	1485.0040	IN.
YMRP	0.0006	IN.
ZMRP	377.0004	IN.
SCALE	0.0650	

MACH 1.160

FIGURE 3. RUDDER EFFECTIVENESS- NARROW BODY ORBITER



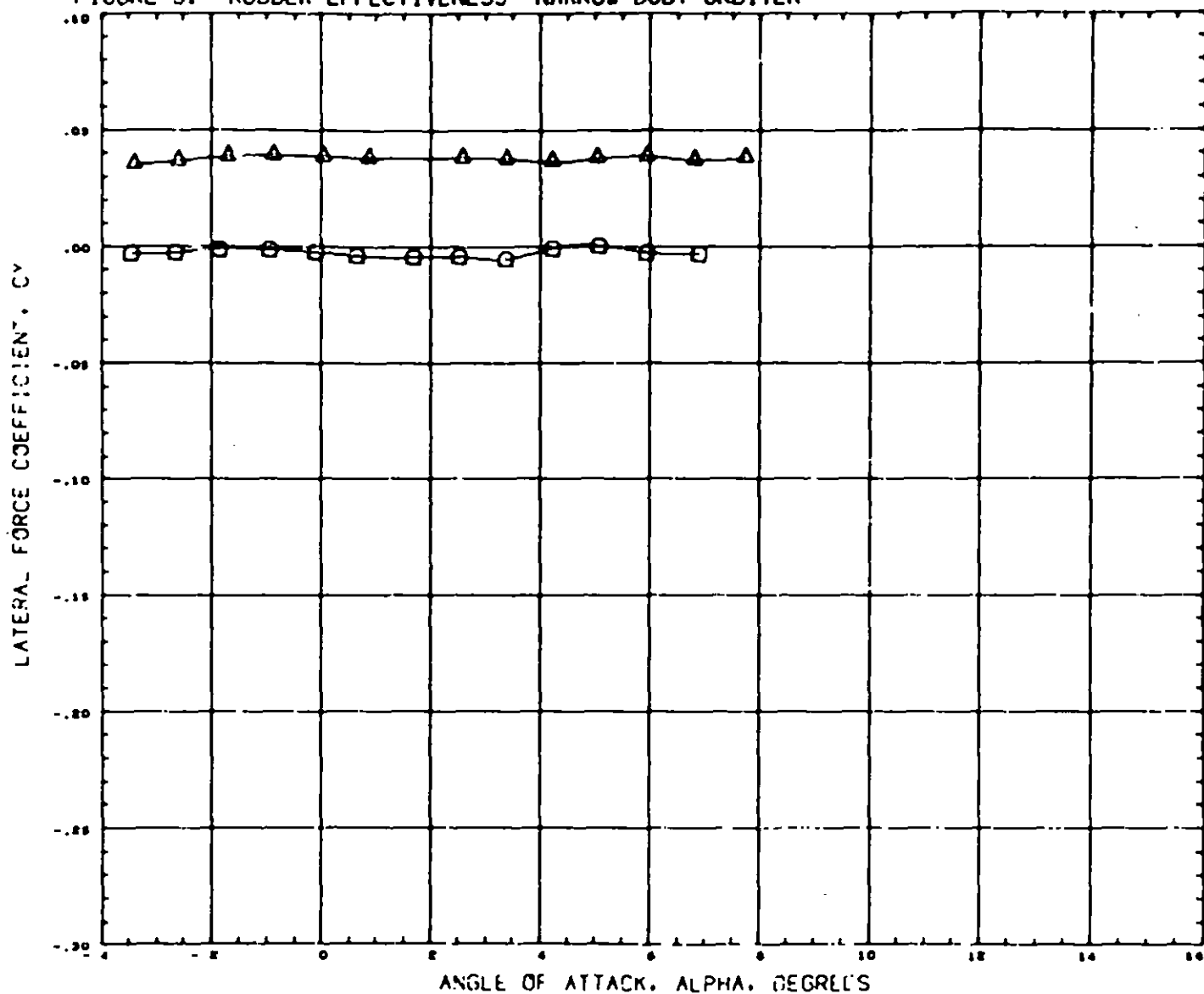
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(ACR021)	Q GFTT-D35 CONF ROS-NB1 BIWIV1
(RCR042)	A GFTT-D35 CONF ROS-NB1 BIWIV1 (10)

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	10.000

REFERENCE INFORMATION		
SREF	20.6900	90.IN.
LREF	9.6500	IN.
BREF	5.0380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.700

FIGURE 3. RUDDER EFFECTIVENESS- NARROW BODY ORBITER



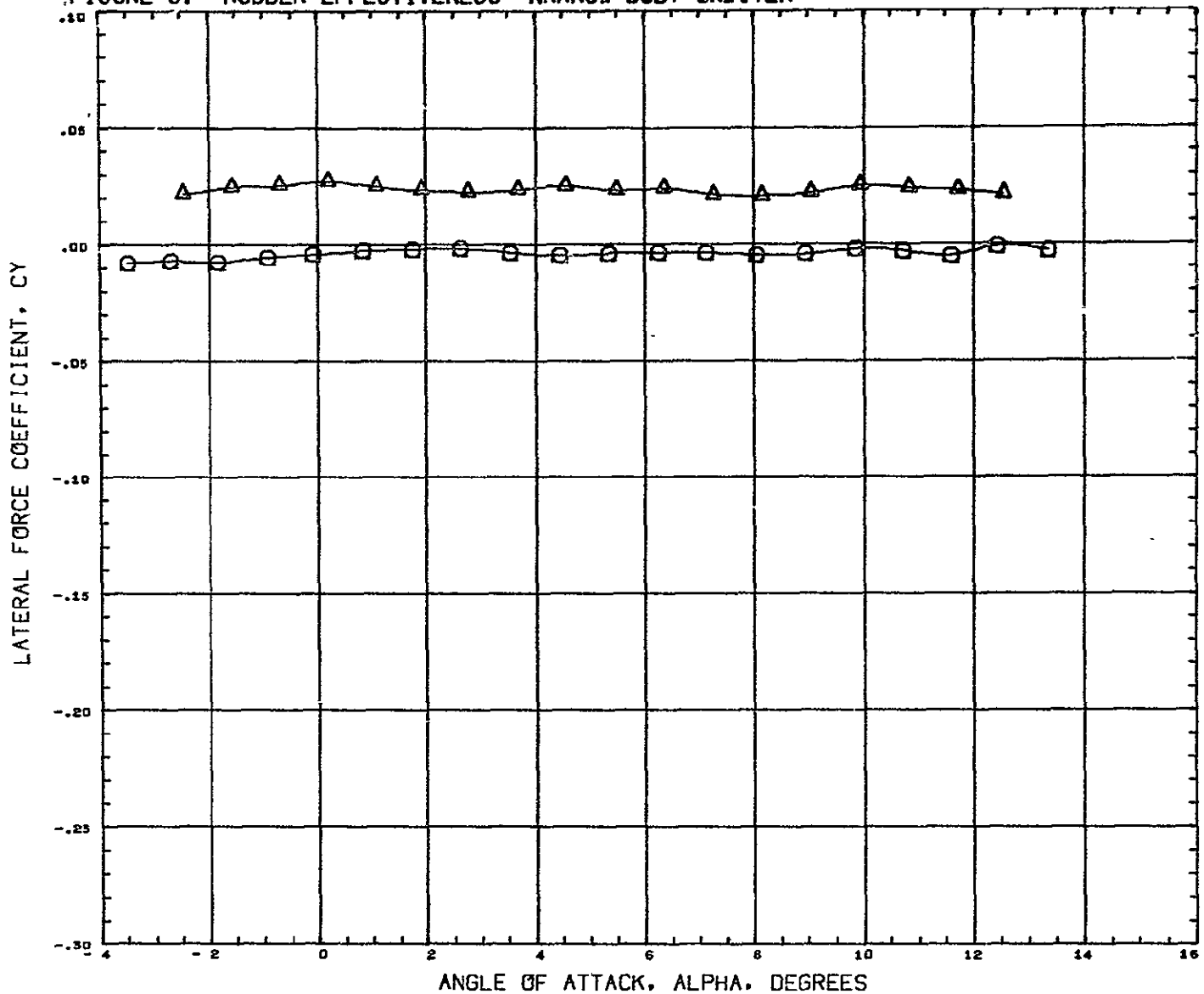
DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (ACROSS) 6FTT-035 CONF ROS-NBI BEMVLS
 (RCROSS) 6FTT-035 CONF ROS-NBI BEMVLS (10)

BETA ELEVNS RUDDER
 0.000 0.000 0.000
 0.000 0.000 10.000

REFERENCE INFORMATION
 SREF 20.6900 66.1N.
 LREF 9.4500 1N.
 BREF 5.6380 1N.
 XMRP 1405.0040 1N.
 YMRP 0.0000 1N.
 ZMRP 377.0004 1N.
 SCALE 0.0030

MACH 0.890

FIGURE 3. RUDDER EFFECTIVENESS- NARROW BODY ORBITER



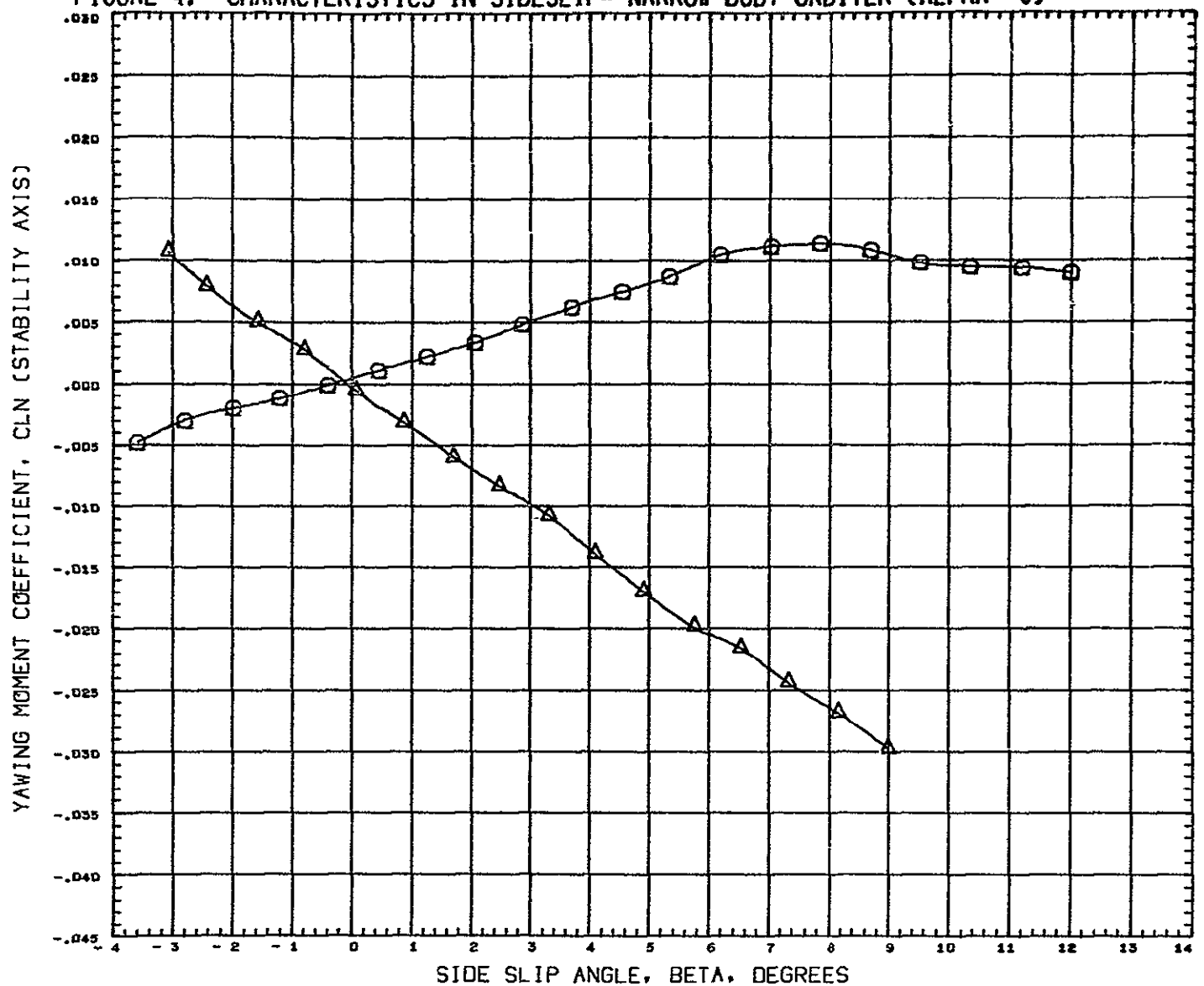
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(ACR021)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR042)	GFTT-035 CONF ROS-NB1 B1W1V1 (10)

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	10.000

REFERENCE INFORMATION		
SREF	20.6900	Sq. IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0000	IN.
SCALE	0.0950	

MACH 1.160

FIGURE 4. CHARACTERISTICS IN SIDESLIP- NARROW BODY ORBITER (ALPHA= 0)



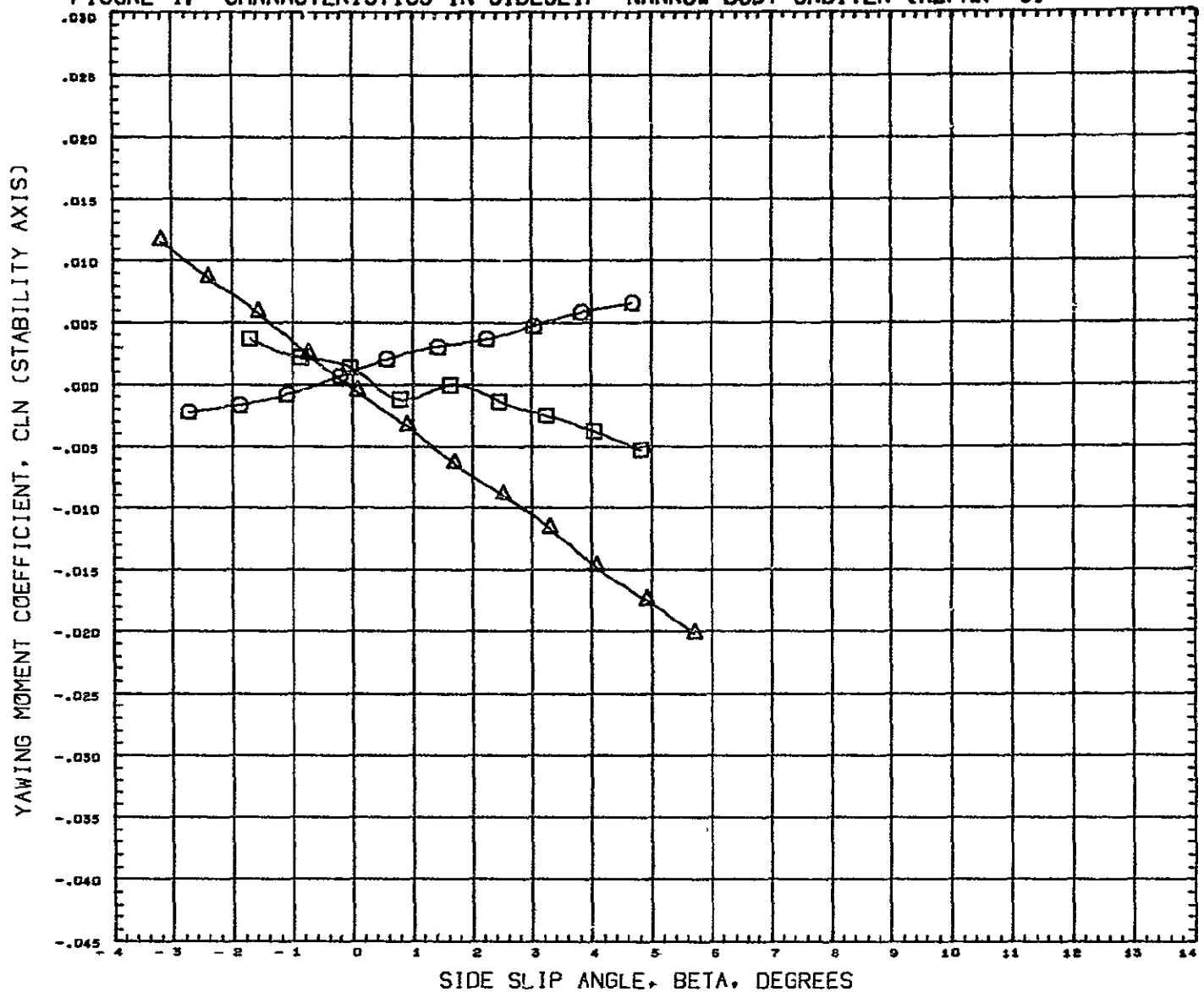
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR028)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR046)	GFTT-035 CONF ROS-NB1 B1W1
(RCR045)	DATA NOT AVAILABLE FOR ALL CONDITIONS
(RCR049)	DATA NOT AVAILABLE FOR ALL CONDITIONS

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	sq. in.
LREF	9.6500	in.
BREF	5.8380	in.
XMRP	1485.0040	in.
YMRP	0.0000	in.
ZMRP	377.0004	in.
SCALE	0.0050	

MACH 0.710

FIGURE 4. CHARACTERISTICS IN SIDESLIP- NARROW BODY ORBITER (ALPHA= 0)



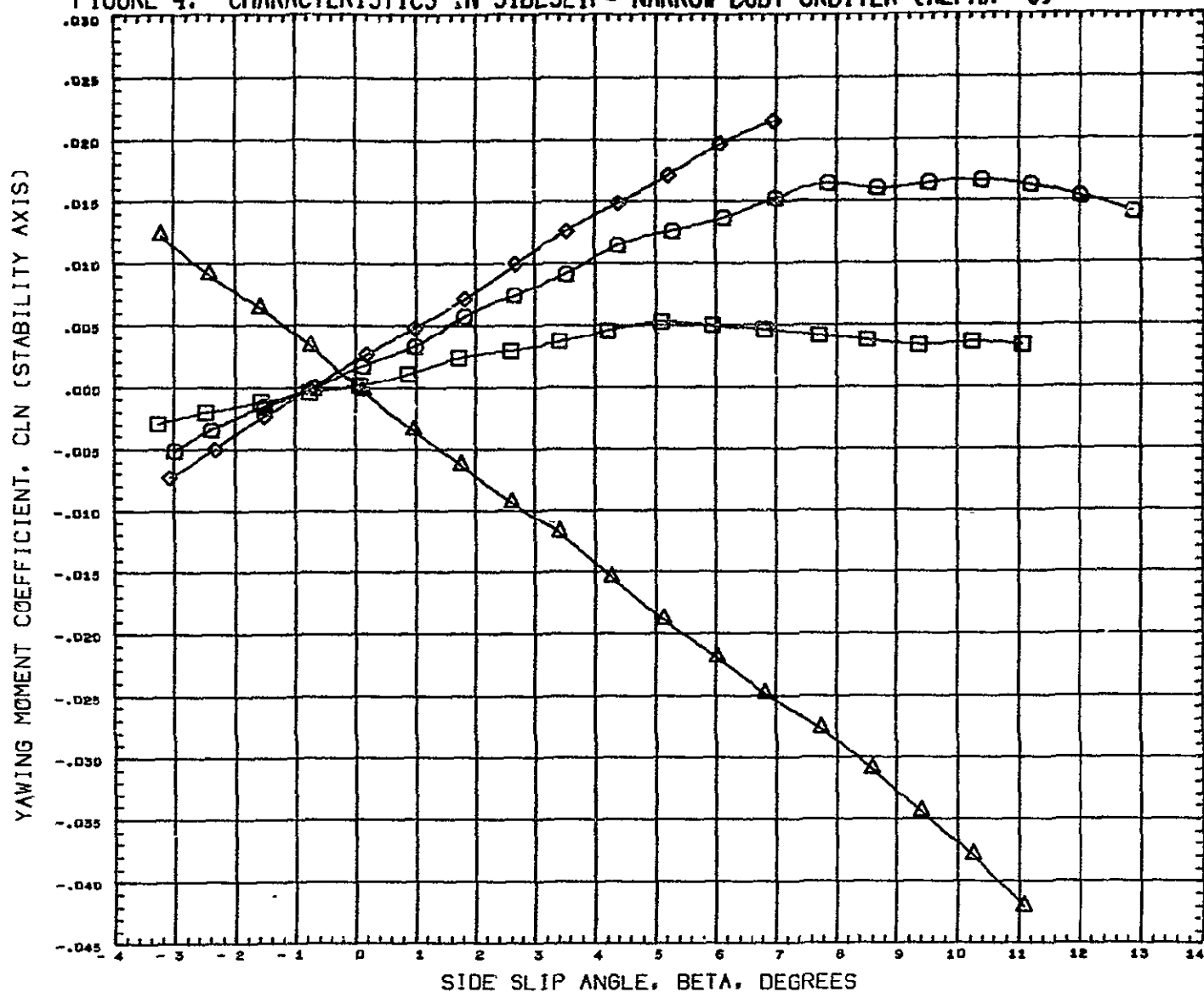
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR028)	6FTT-035 CONF ROS-NB1 B1W1V1
(RCR046)	6FTT-035 CONF ROS-NB1 B1W1
(RCR045)	DATA NOT AVAILABLE FOR ALL CONDITIONS
(RCR049)	6FTT-035 CONF ROS-NB1 B1W2V3

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	50.IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

NACH 0.900

FIGURE 4. CHARACTERISTICS IN SIDESLIP- NARROW BODY ORBITER (ALPHA= 0)



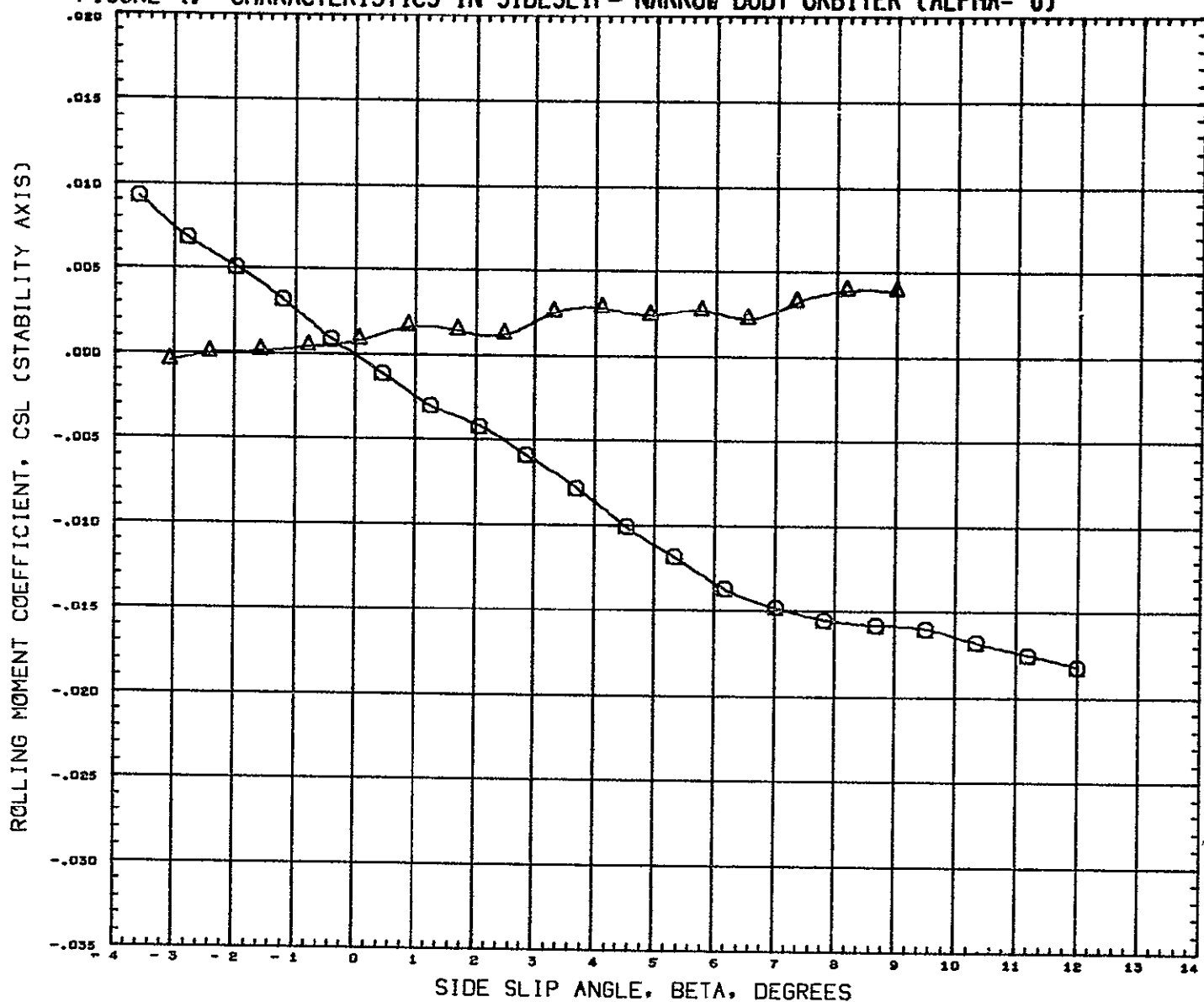
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR020) Δ	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR046) $\circ$	GFTT-035 CONF ROS-NB1 B1W1
(RCR045) $\diamond$	GFTT-035 CONF ROS-NB1 B1W1V1U1
(RCR049) $\square$	GFTT-035 CONF ROS-NB1 B1W2V3

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.003	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	SQ. IN.
LREF	9.6500	IN.
BREF	5.8360	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 1.160

FIGURE 4. CHARACTERISTICS IN SIDESLIP- NARROW BODY ORBITER (ALPHA= 0)



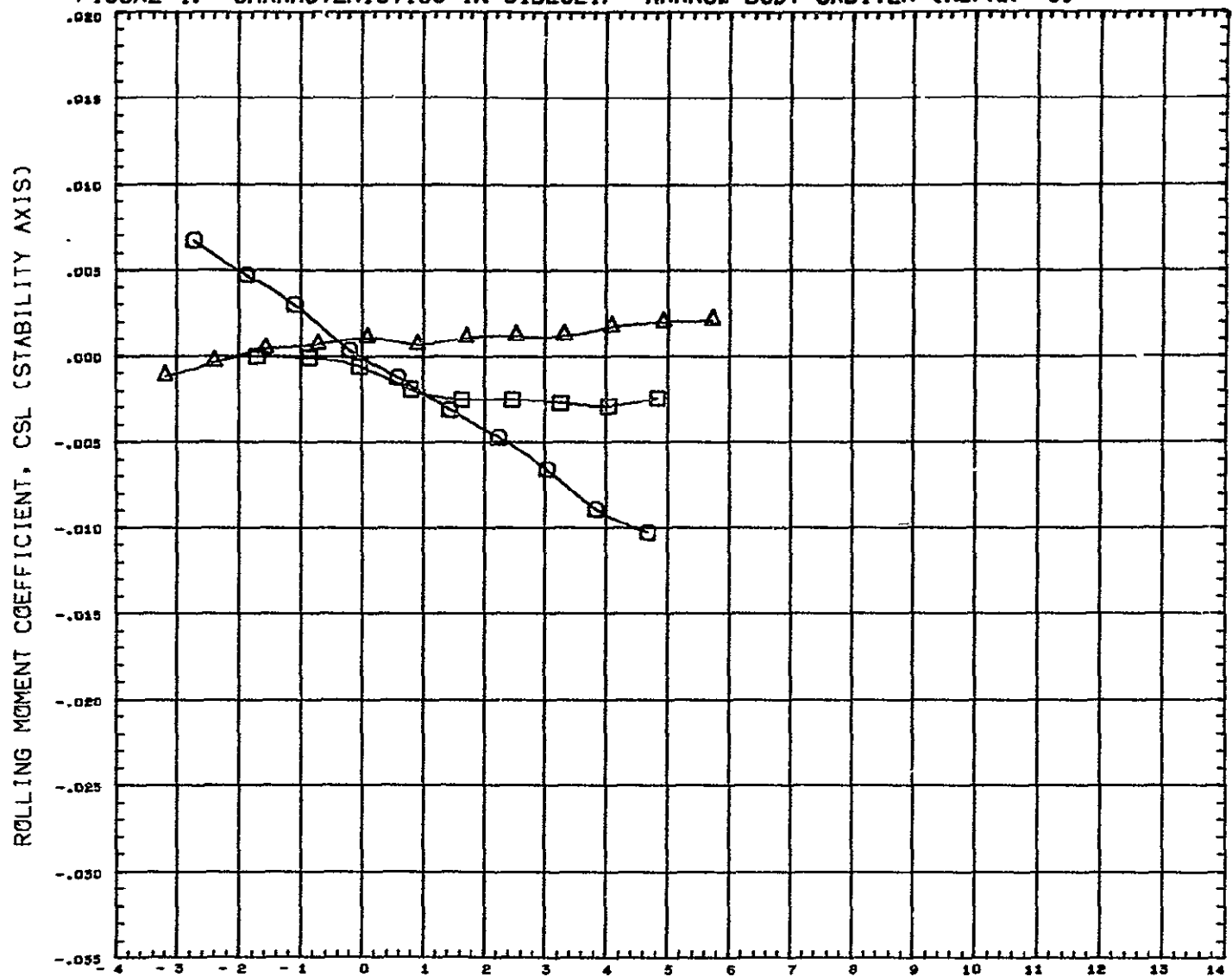
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RCR028) ○ GFTT-035 CONF ROS-NB1 B1W1V1
(RCR046) △ GFTT-035 CONF ROS-NR1 B1W1
(RCR045) □ DATA NOT AVAILABLE FOR ALL CONDITIONS
(RCR049) □ DATA NOT AVAILABLE FOR ALL CONDITIONS

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	Sq. IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.710

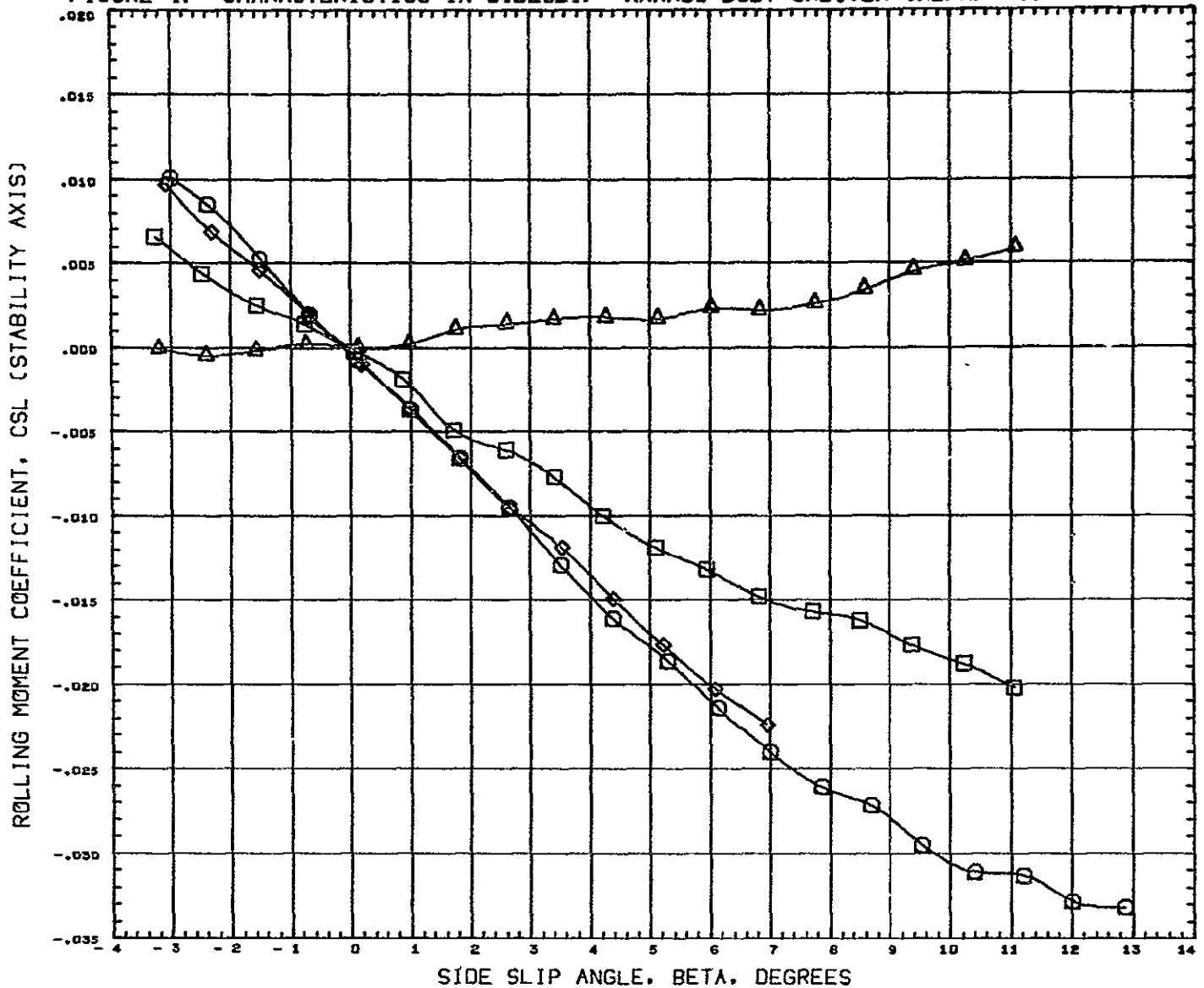
FIGURE 4. CHARACTERISTICS IN SIDESLIP- NARROW BODY ORBITER (ALPHA= 0)



DATA SET SYMBOL	CONFIGURATION DESCRIPTION	ALPHA	ELEVNS	RUDDER	REFERENCE INFORMATION	
(RCR028)	GFTT-035 CONF ROS-NB1 B1W1V1	0.000	0.000	0.000	SREF	20.6900 SQ. IN.
(RCR046)	GFTT-035 CONF ROS-NB1 B1W1	0.000	0.000	0.000	LREF	9.6500 IN.
(RCR045)	DATA NOT AVAILABLE FOR ALL CONDITIONS	0.000	0.000	0.000	BREF	5.6360 IN.
(RCR049)	GFTT-035 CONF ROS-NB1 B1W2V3	0.000	0.000	0.000	XMRP	1485.0040 IN.
					YMRP	0.0000 IN.
					ZMRP	377.0004 IN.
					SCALE	0.0050

MACH 0.900

FIGURE 4. CHARACTERISTICS IN SIDESLIP- NARROW BODY ORBITER (ALPHA= 0)



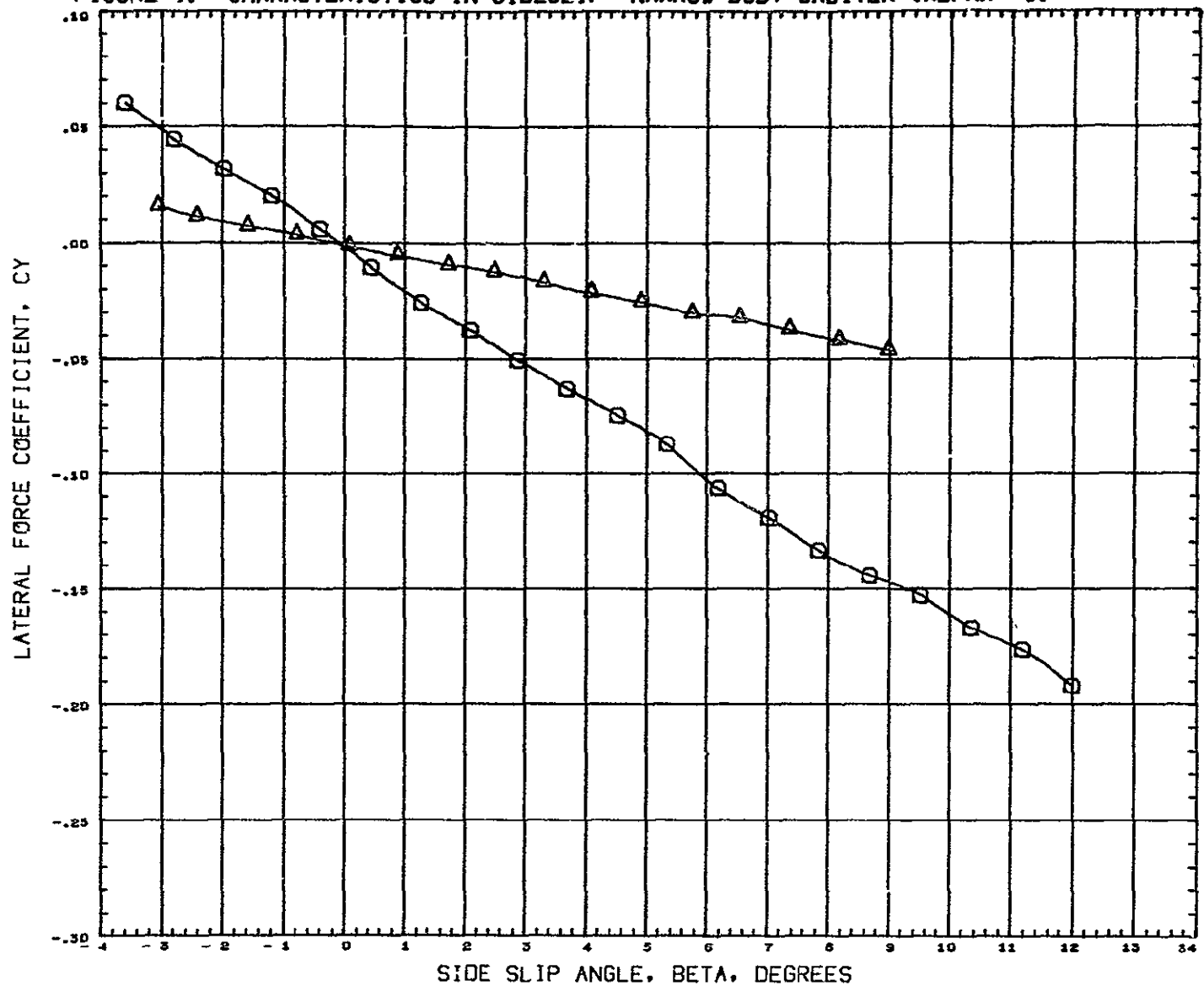
DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(RCR028)	○	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR046)	◇	GFTT-035 CONF ROS-NB1 B1W1
(RCR045)	□	GFTT-035 CONF ROS-NB1 B1W1V1U1
(RCR049)	△	GFTT-035 CONF ROS-NB1 B1W2V3

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.006	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	sq.in.
LREF	9.6500	in.
BREF	5.8300	in.
XMRP	1485.0040	in.
YMRP	0.0000	in.
ZMRP	377.0004	in.
SCALE	0.0050	

MACH 1.160

FIGURE 4. CHARACTERISTICS IN SIDESLIP- NARROW BODY ORBITER (ALPHA= 0)



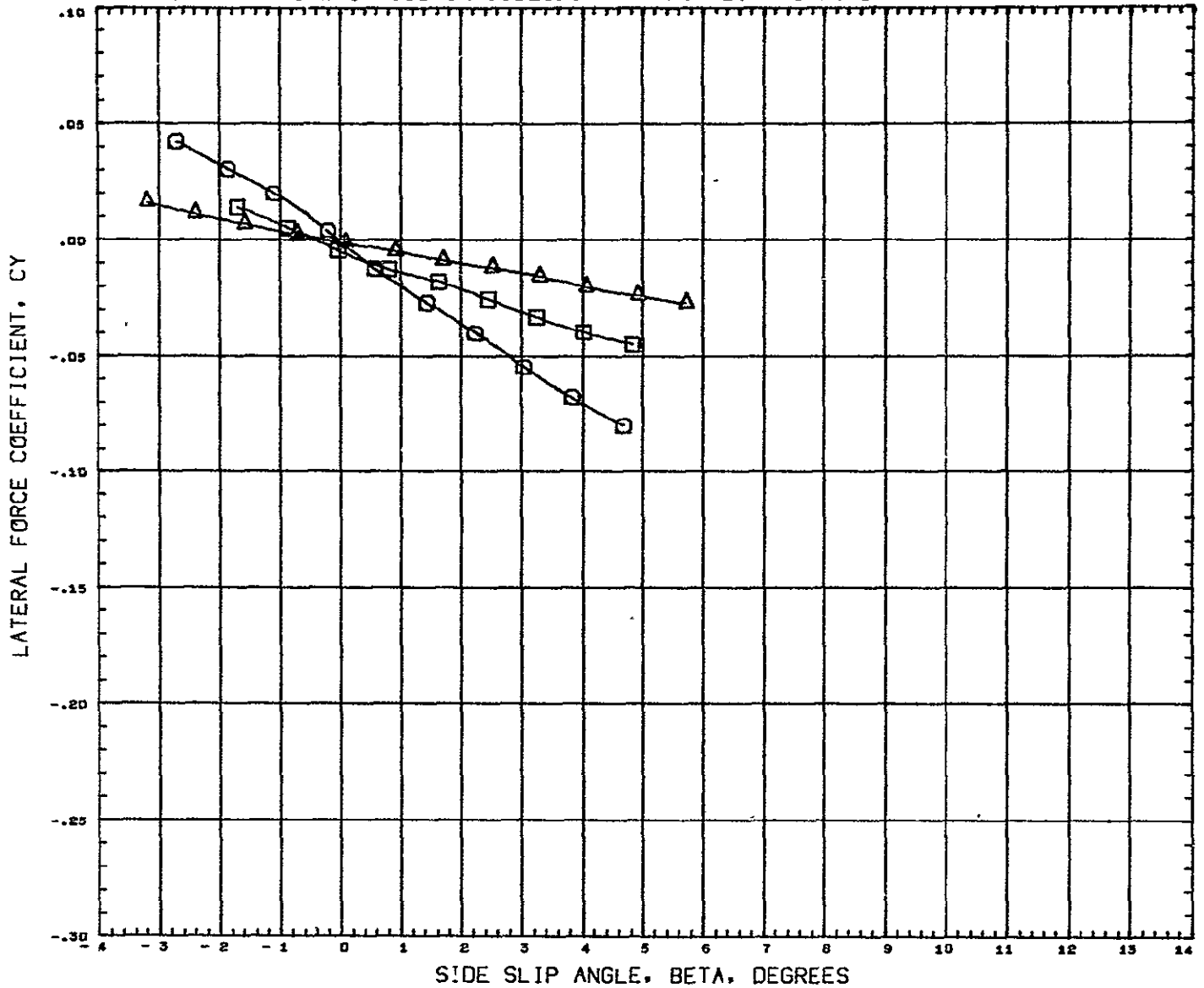
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCRD28)	6FTT-035 CONF ROS-NB1 B1W1V1
(RCRD46)	6FTT-035 CONF ROS-NB1 B1W1
(RCRD45)	DATA NOT AVAILABLE FOR ALL CONDITIONS
(RCRD49)	DATA NOT AVAILABLE FOR ALL CONDITIONS

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	SQ.IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.710

FIGURE 4. CHARACTERISTICS IN SIDESLIP- NARROW BODY ORBITER (ALPHA= 0)



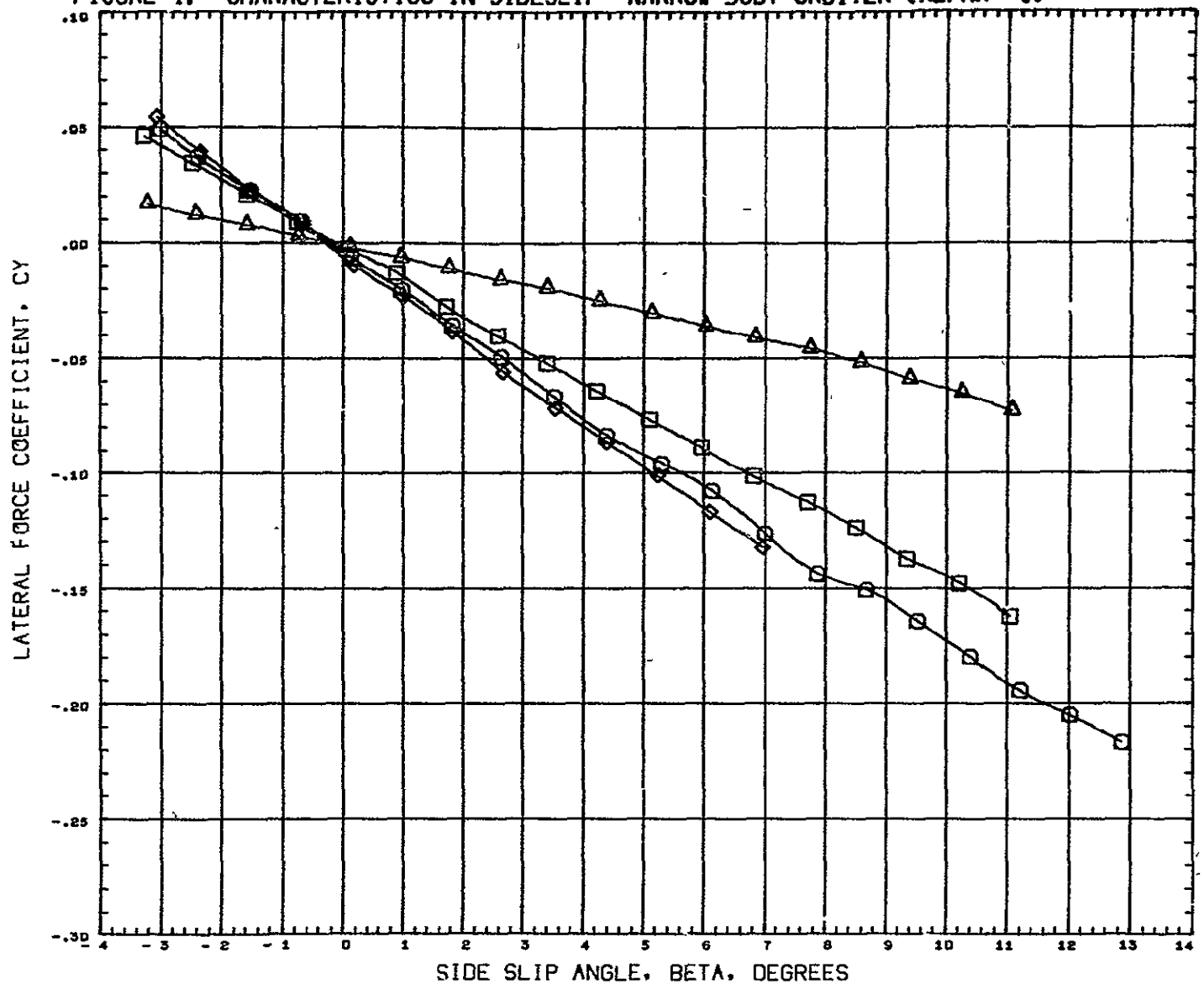
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR020)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR046)	GFTT-035 CONF ROS-NB1 B1W1
(RCR045)	DATA NOT AVAILABLE FOR ALL CONDITIONS
(RCR049)	GFTT-035 CONF ROS-NB1 B1W2V3

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	Sq. IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.900

FIGURE 4. CHARACTERISTICS IN SIDESLIP- NARROW BODY ORBITER (ALPHA= 0)



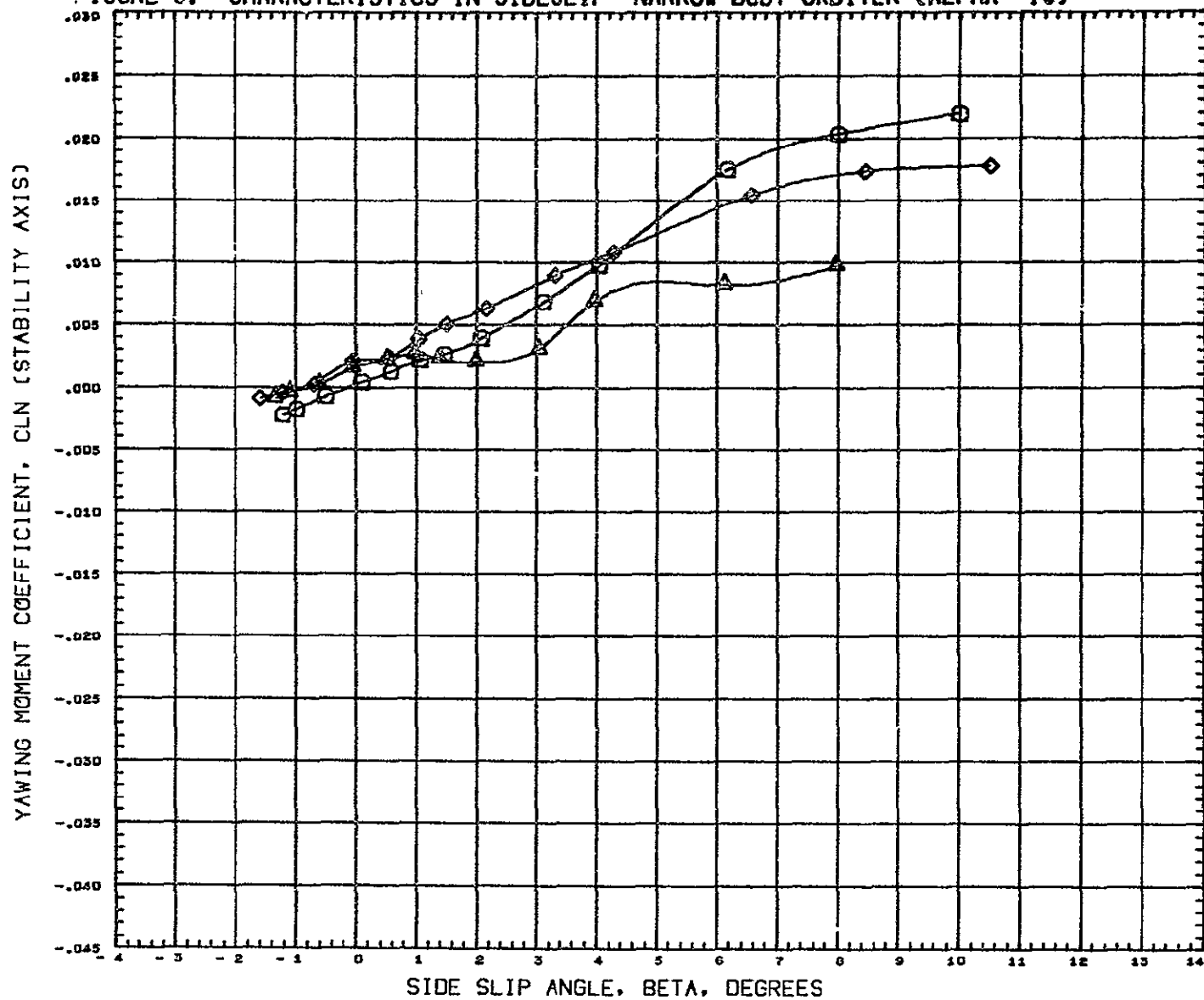
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCRD28)	6FTT-035 CONF ROS-NB1 B1W1V1
(RCRD46)	6FTT-035 CONF ROS-NB1 B1W1
(RCRD45)	6FTT-035 CONF ROS-NB1 B1W1V1U1
(RCRD49)	6FTT-035 CONF ROS-NB1 B1W2V3

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.070	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	sq. in.
LREF	9.6500	in.
BREF	5.0380	in.
XMRP	1485.0040	in.
YMRP	0.0000	in.
ZMRP	377.0604	in.
SCALE	0.0050	

MACH 1.160

FIGURE 5. CHARACTERISTICS IN SIDESLIP- NARROW BODY ORBITER (ALPHA= 10)



SYMBOL	MACH	ALPHA	PARAMETRIC VALUES	
○	0.720	10.000	ELEVNS	0.000
△	0.950	RUDDER	0.000	
◇	1.160			

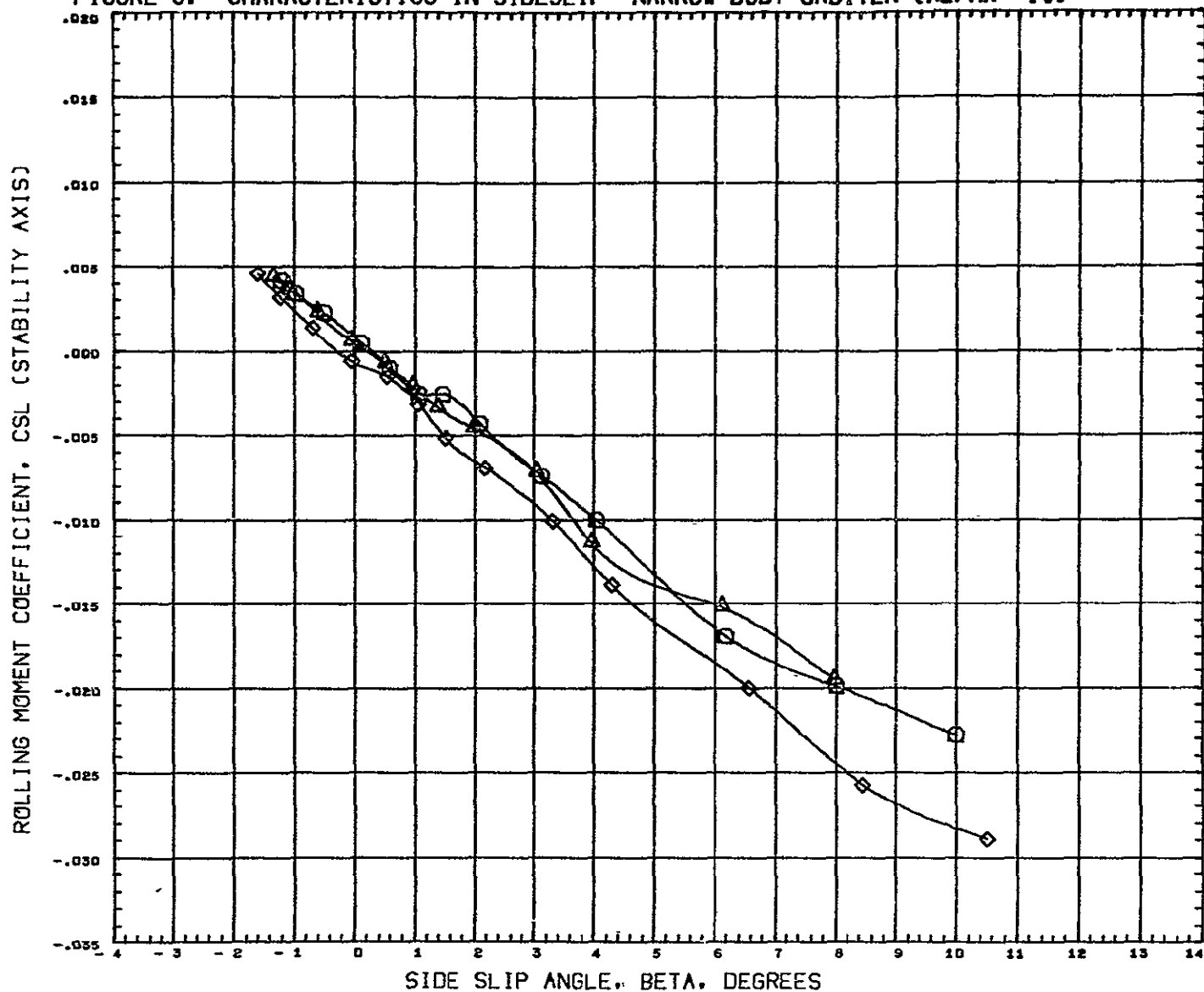
REFERENCE INFORMATION		
SREF	20.6900	SQ. IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XHRP	1485.0040	IN.
YHRP	0.0000	IN.
ZHRP	377.0004	IN.
SCALE	0.005J	

REFERENCE FILE

GFTT-035 CONF ROS-NB1 B1W1V1

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FIGURE 5. CHARACTERISTICS IN SIDESLIP- NARROW BODY ORBITER (ALPHA= 10)



SYMBOL	MACH	ALPHA	PARAMETRIC VALUES	
○	0.720	10.000	ELEVNS	0.000
△	0.950	RUDDER	0.000	
◇	1.160			

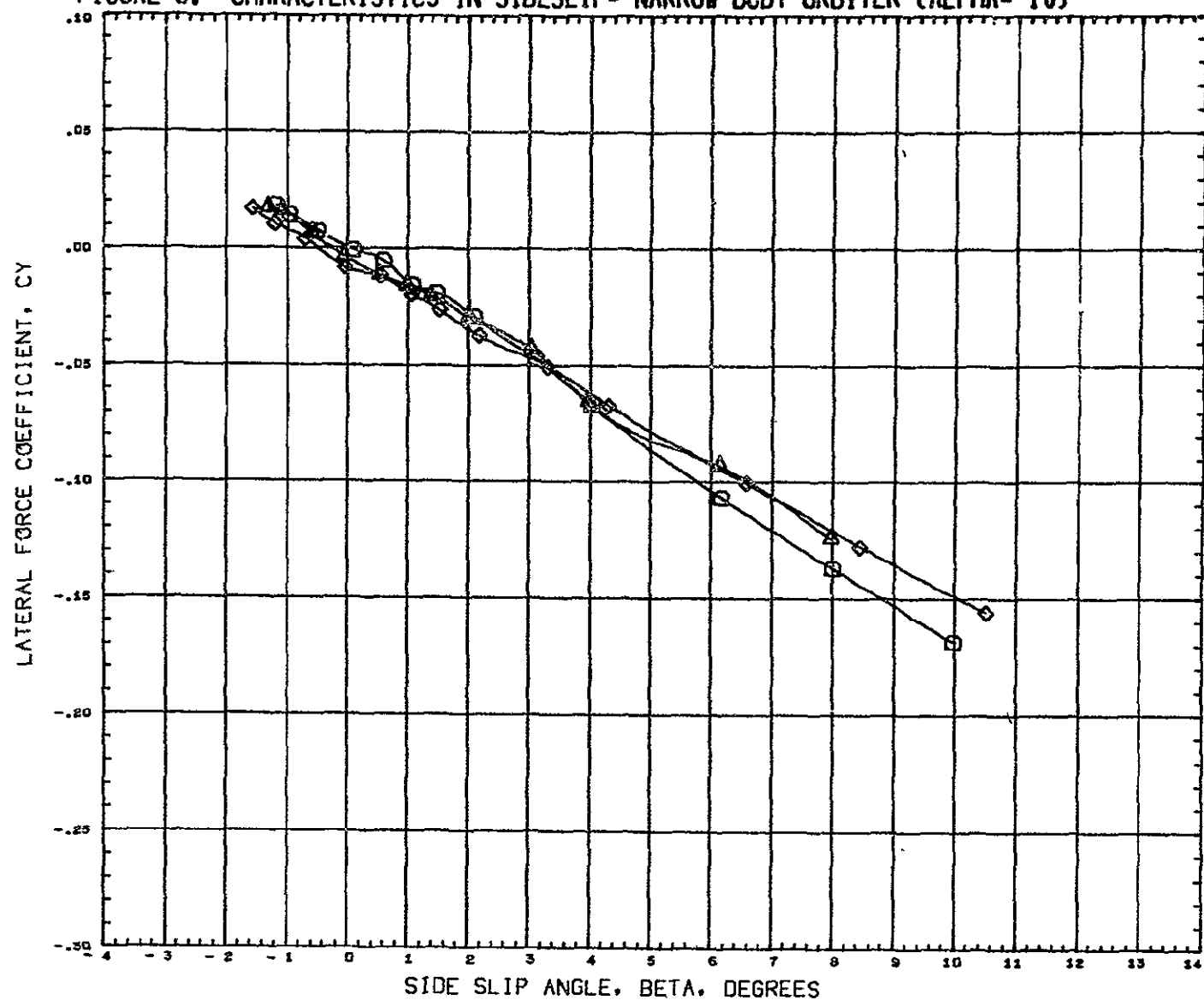
REFERENCE INFORMATION		
SREF	20.6900	S2.IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

REFERENCE FILE

GFTT-035 CONF R0S-NB1 B1W1V1

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FIGURE 5. CHARACTERISTICS IN SIDESLIP- NARROW BODY ORBITER (ALPHA= 10)



SYMBOL	MACH	ALPHA	PARAMETRIC VALUES	
$\square$	0.720	10.000	ELEVNS	0.000
$\triangle$	0.950	RUDDER	0.000	
$\diamond$	1.160			

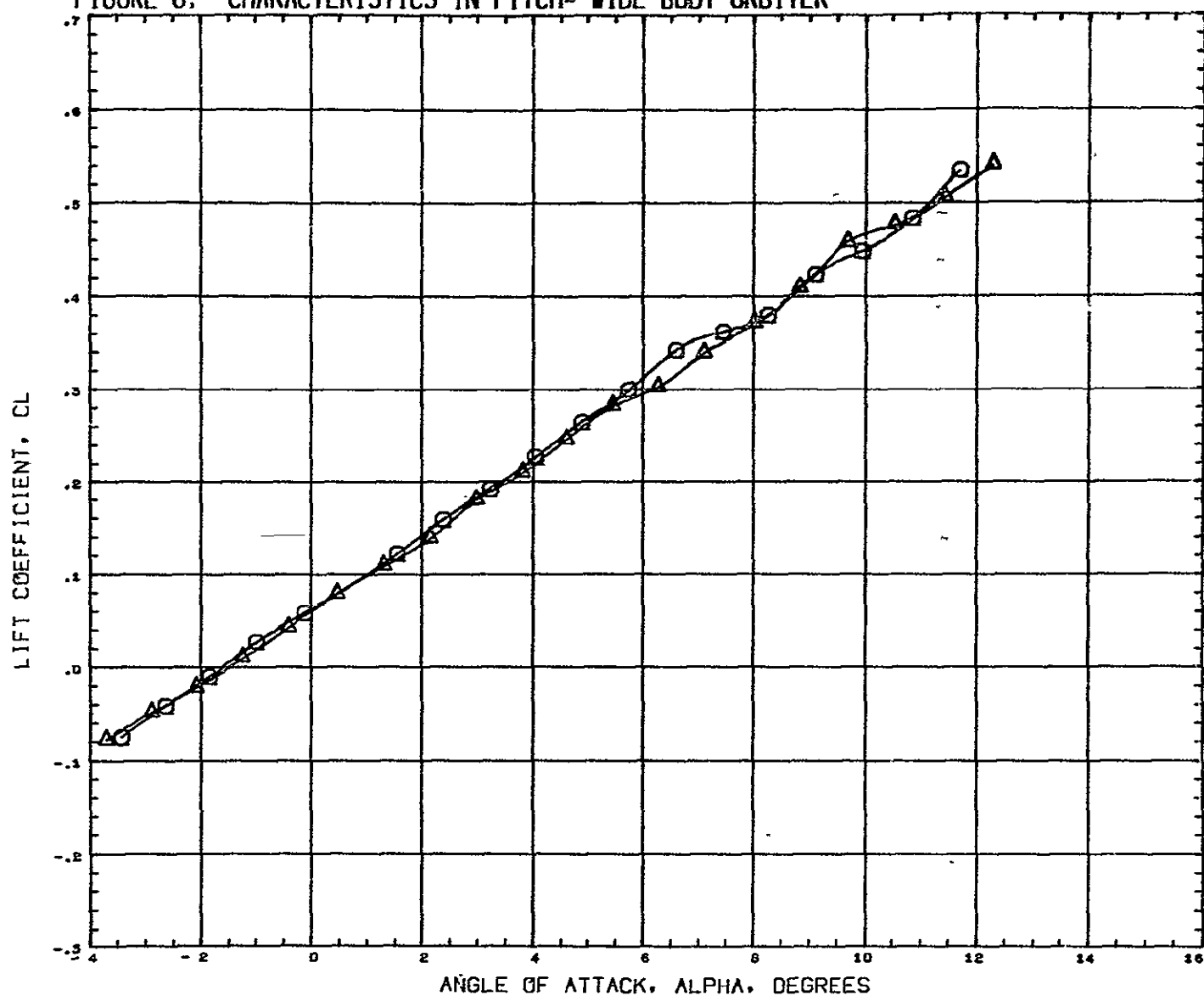
REFERENCE FILE

REFERENCE INFORMATION		
SREF	20.6900	80. IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

GFTT-035 CONF ROS-NB1 B1W1V1

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FIGURE 6. CHARACTERISTICS IN PITCH- WIDE BODY ORBITER



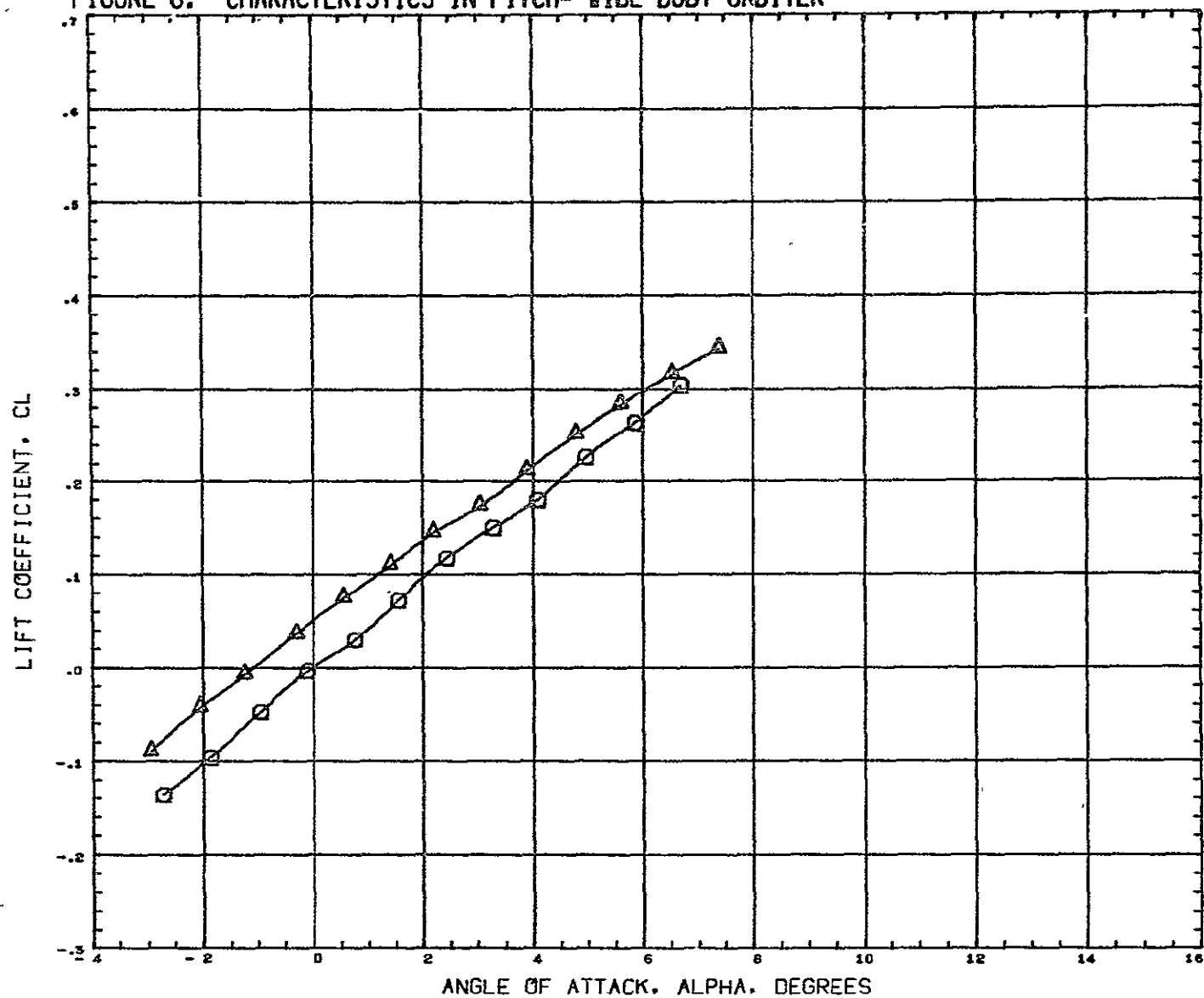
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR055)	GFTT-035 CONF ROS-WB1 B2W1V2
(RCR064)	GFTT-035 CONF ROS-WB1 B2W1

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	sq. IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XHRP	1485.0040	IN.
YHRP	0.0000	IN.
ZHRP	377.0004	IN.
SCALE	0.0050	

MACH 0.710

FIGURE 6. CHARACTERISTICS IN PITCH- WIDE BODY ORBITER



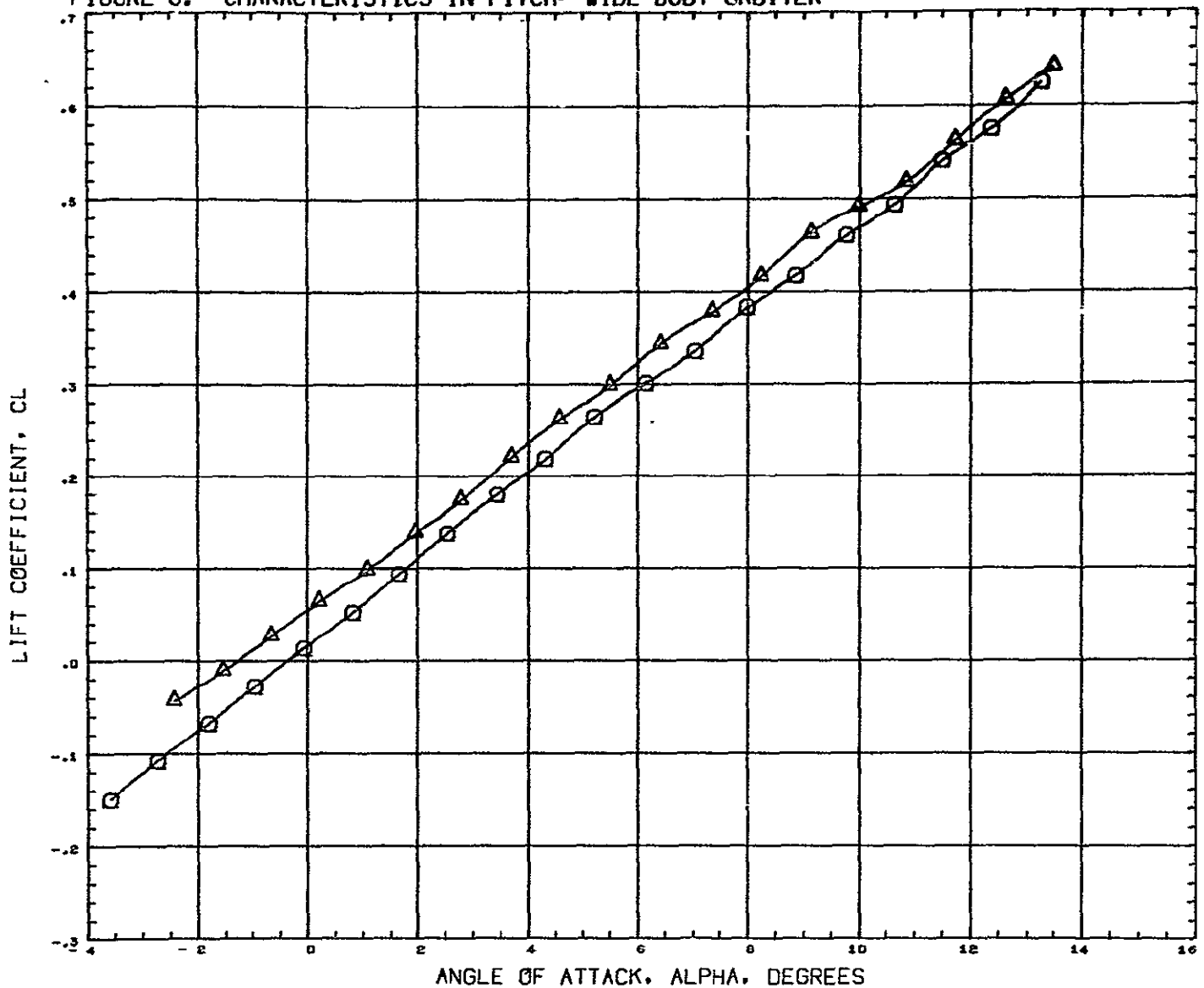
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCRD55) ○	GFTT-035 CONF ROS-WB1 B2W1V2
(RCRD64) △	GFTT-035 CONF ROS-WB1 B2W1

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION	
SREF	20.6900 SQ. IN.
LREF	9.6500 IN.
BREF	5.8380 IN.
XMRP	1485.0040 IN.
YMRP	0.0000 IN.
ZMRP	377.0024 IN.
SCALE	0.0050

MACH 0.900

FIGURE 6. CHARACTERISTICS IN PITCH- WIDE BODY ORBITER



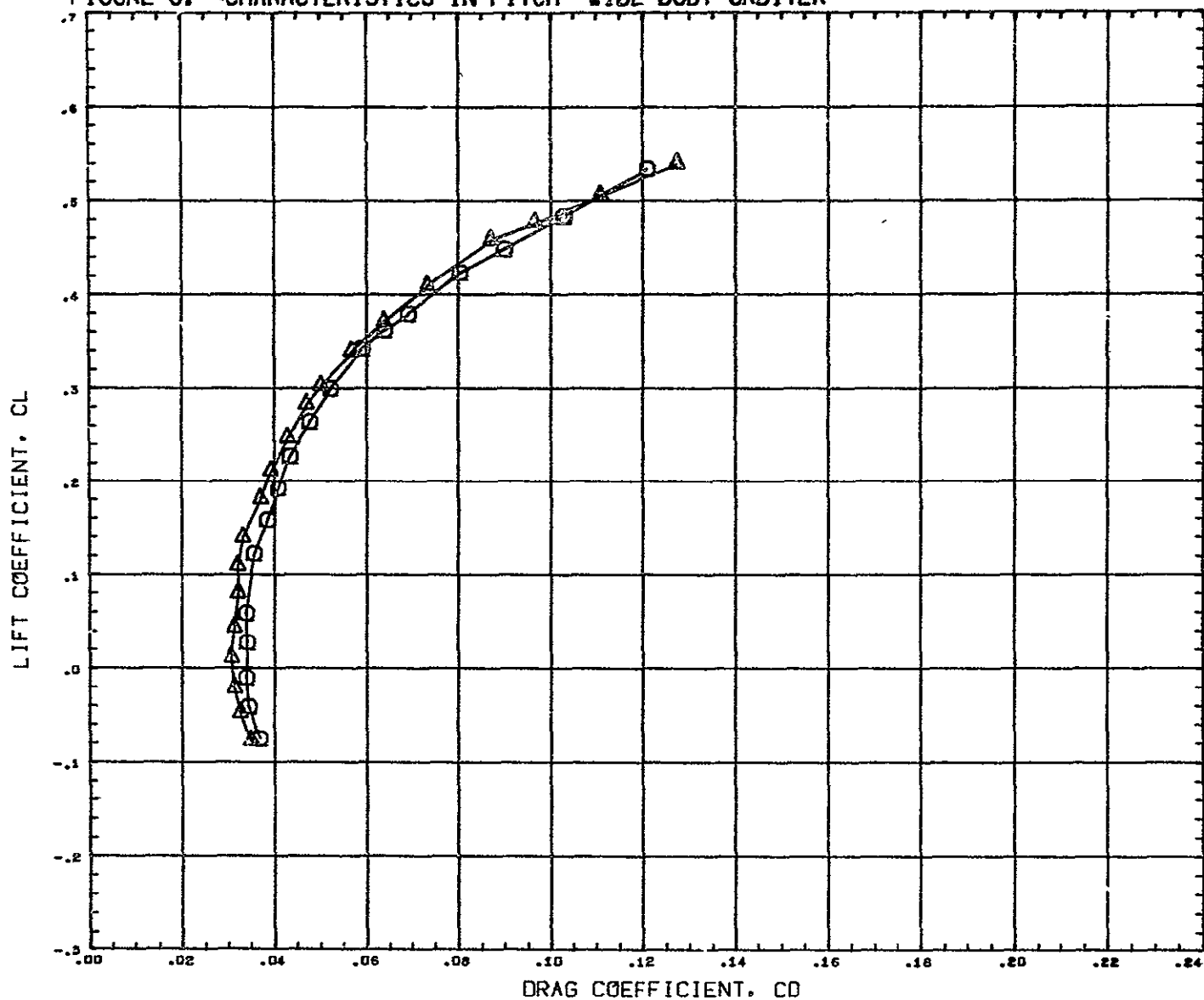
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCRD55) ○	GFTT-035 CONF ROS-WB1 B2W1V2
(RCRD64) △	GFTT-035 CONF ROS-WB1 B2W1

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	SQ. IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0064	IN.
SCALE	0.0050	

MACH 1.160

FIGURE 6. CHARACTERISTICS IN PITCH- WIDE BODY ORBITER



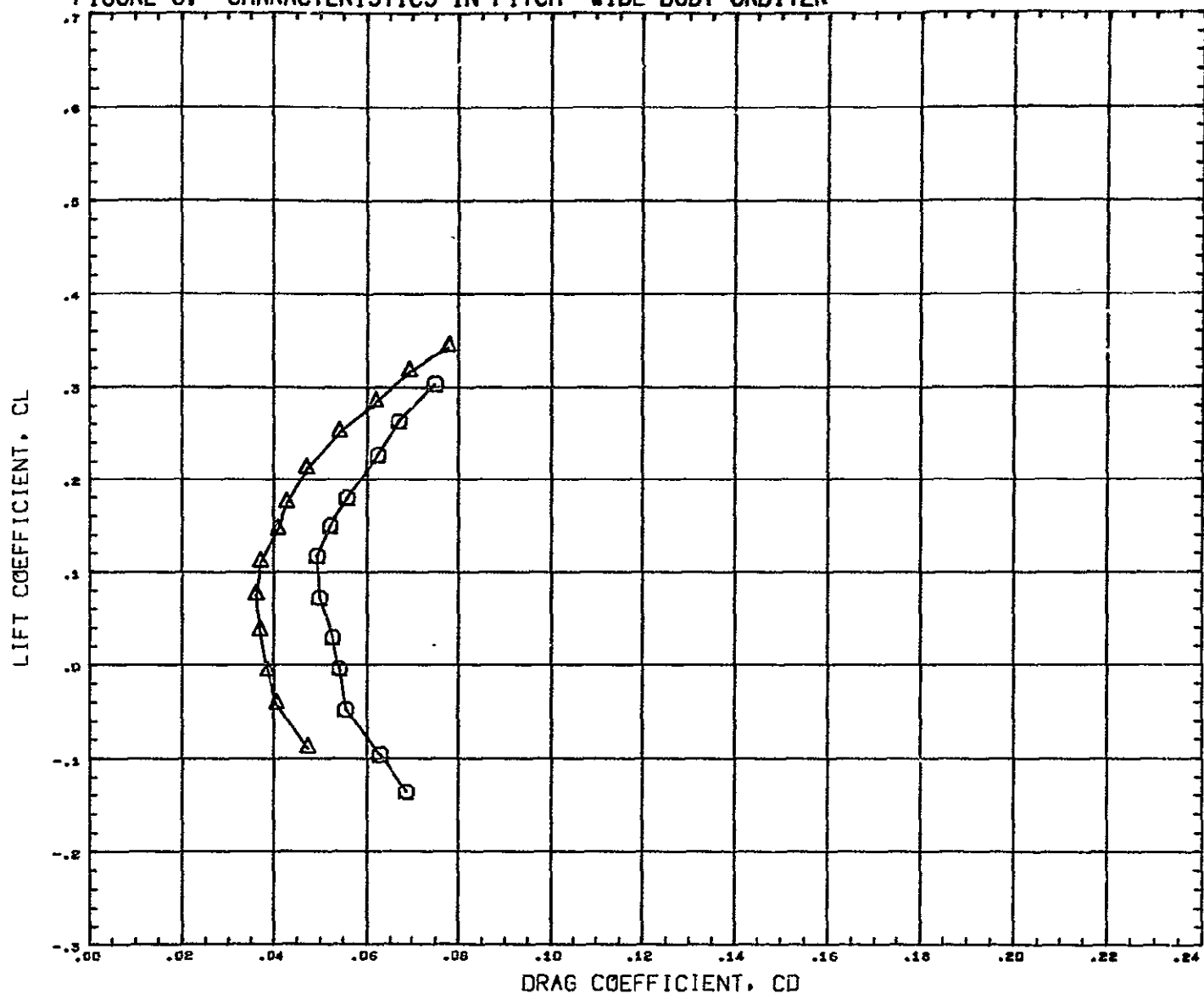
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR055)	GFTT-035 CONF ROS-WB1 82W1V2
(RCR064)	GFTT-035 CONF ROS-WB1 82W1

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	98.IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.710

FIGURE 6. CHARACTERISTICS IN PITCH- WIDE BODY ORBITER



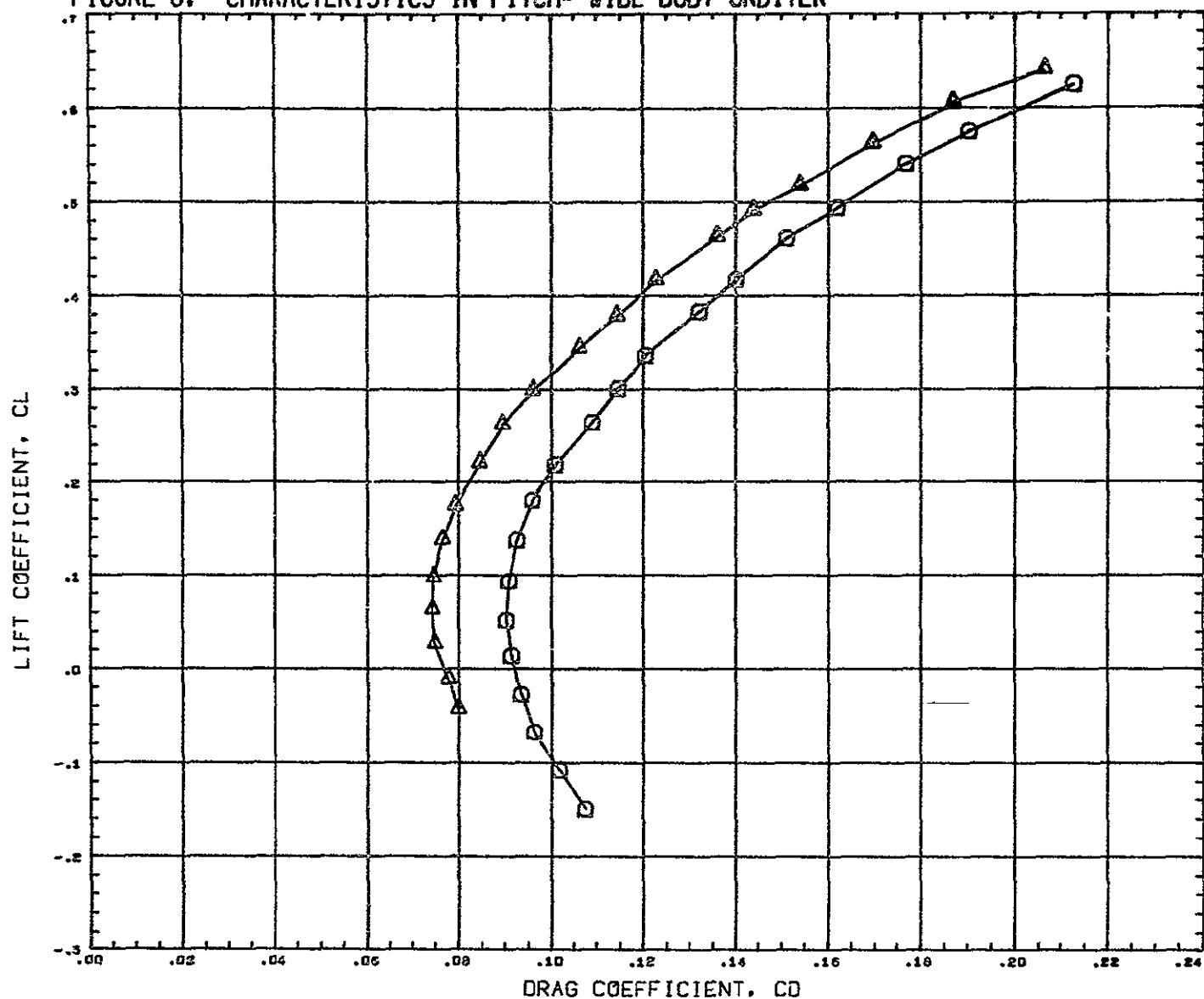
DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (RCRD55) $\square$ GFTT-035 CONF ROS-WB1 B2W1V2
 (RCRD64) $\triangle$ GFTT-035 CONF ROS-WB1 B2W1

BETA ELEVNS RUDDER
 0.000 0.000 0.000
 0.000 0.000 0.000

REFERENCE INFORMATION
 SREF 20.6900 50.1N.
 LREF 9.6500 IN.
 BREF 5.8380 IN.
 XHRP 1485.0040 IN.
 YHRP 0.0000 IN.
 ZHRP 377.0004 IN.
 SCALE 0.0050

MACH 0.900

FIGURE 6. CHARACTERISTICS IN PITCH- WIDE BODY ORBITER



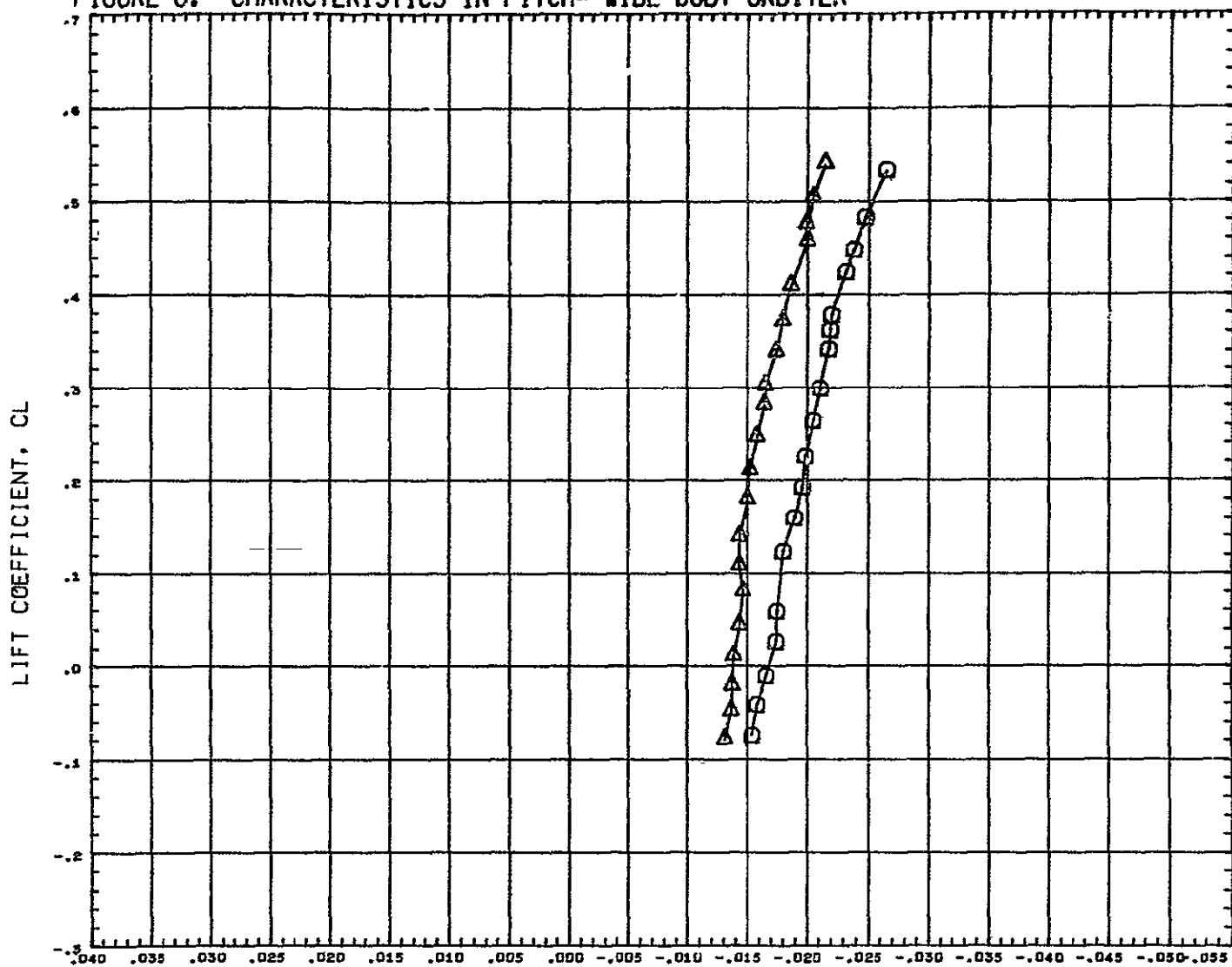
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR055)	GFTT-035 CONF ROS-WB1 B2W1V2
(RCR054)	GFTT-035 CONF ROS-WB1 B2W1

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	SQ. IN.
LREF	9.6500	IN.
BREF	5.8360	IN.
XMRP	1485.0040	IN.
YMRP	0.0006	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 1.160

FIGURE 6. CHARACTERISTICS IN PITCH- WIDE BODY ORBITER



PITCHING MOMENT COEFFICIENT, CLM

DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (RCR055) GFTT-035 CONF ROS-WB1 B2W1V2
 (RCR064) GFTT-035 CONF ROS-WB1 B2W1

BETA ELEVNS RUDDER
 0.000 0.000 0.000
 0.000 0.000 0.000

REFERENCE INFORMATION
 SREF 20.6900 SQ. IN.
 LREF 9.6500 IN.
 BREF 5.8386 IN.
 XHRF 1485.0040 IN.
 YHRF 0.0003 IN.
 ZHRF 377.0004 IN.
 SCALE 0.0050

MACH 0.710

FIGURE 6. CHARACTERISTICS IN PITCH- WIDE BODY ORBITER

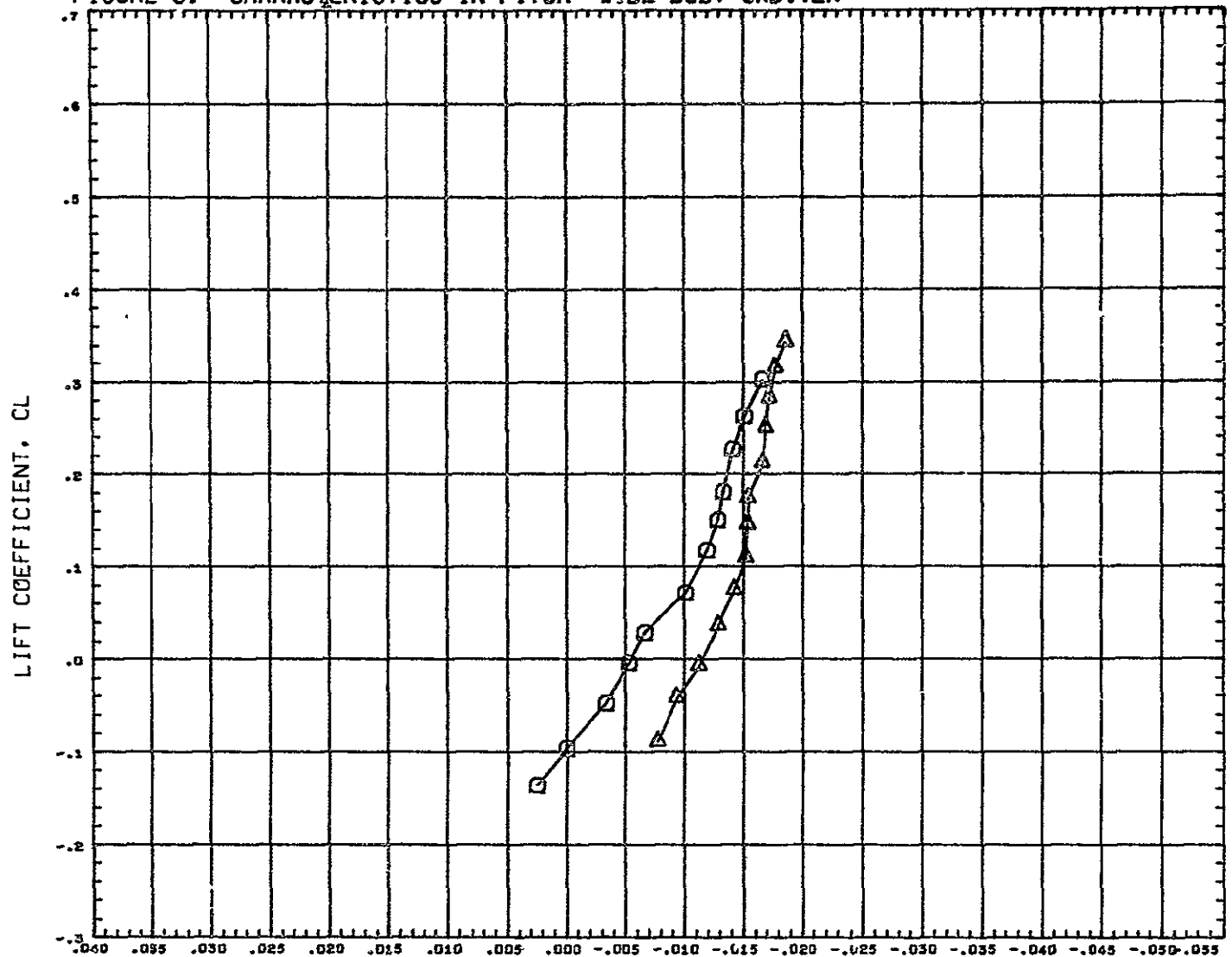
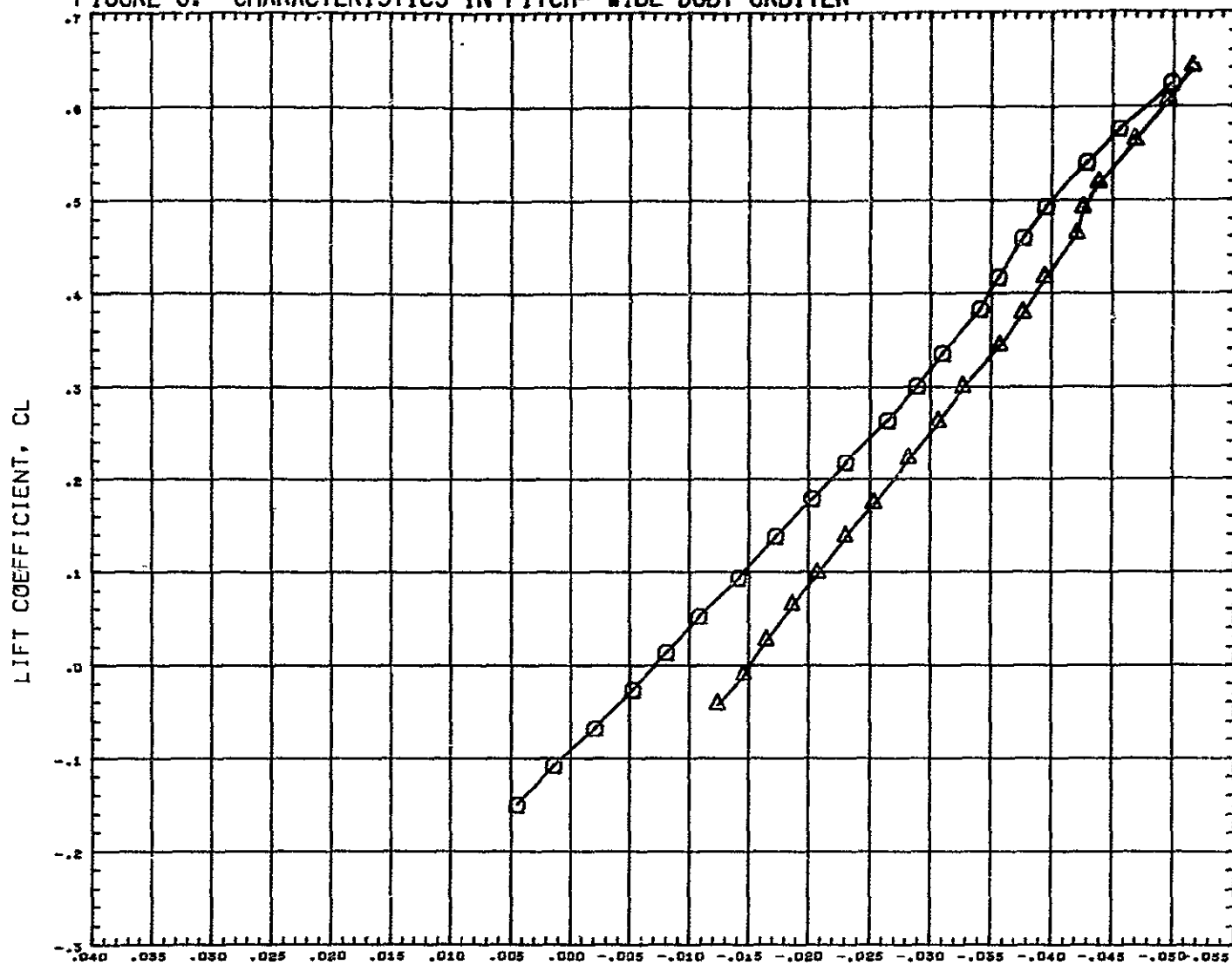


FIGURE 6. CHARACTERISTICS IN PITCH- WIDE BODY ORBITER



PITCHING MOMENT COEFFICIENT, CLM

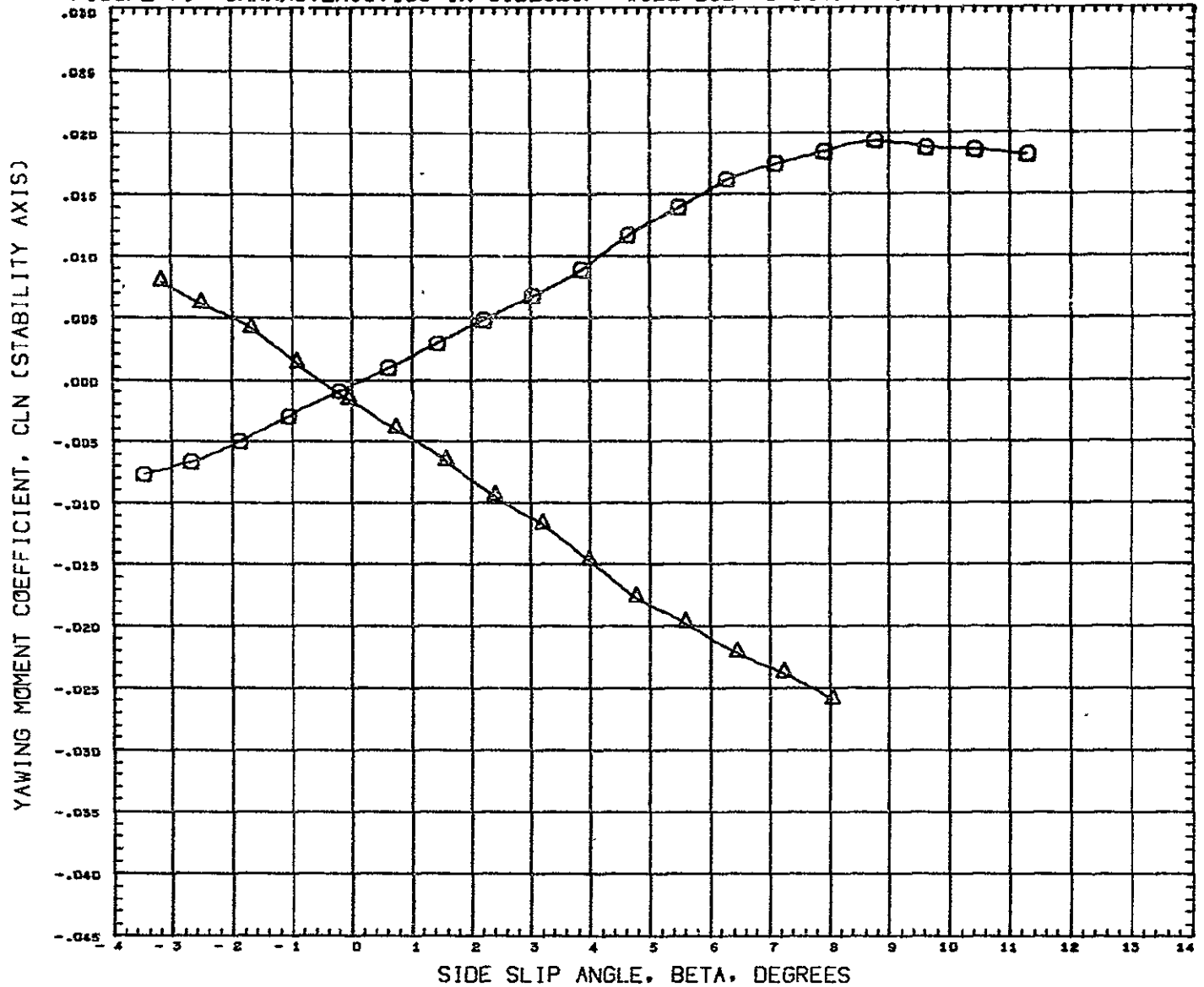
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR055) ○	GFTT-035 CONF ROS-WB1 B2W1V2
(RCR064) △	GFTT-035 CONF ROS-WB1 B2W1

BETA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	sq. in.
LREF	9.6500	in.
BREF	5.8300	in.
XMRP	1485.0040	in.
YMRP	0.0000	in.
ZMRP	377.0004	in.
SCALE	0.0050	

MACH 1.160

FIGURE 7. CHARACTERISTICS IN SIDESLIP- WIDE BODY ORBITER (ALPHA=0)



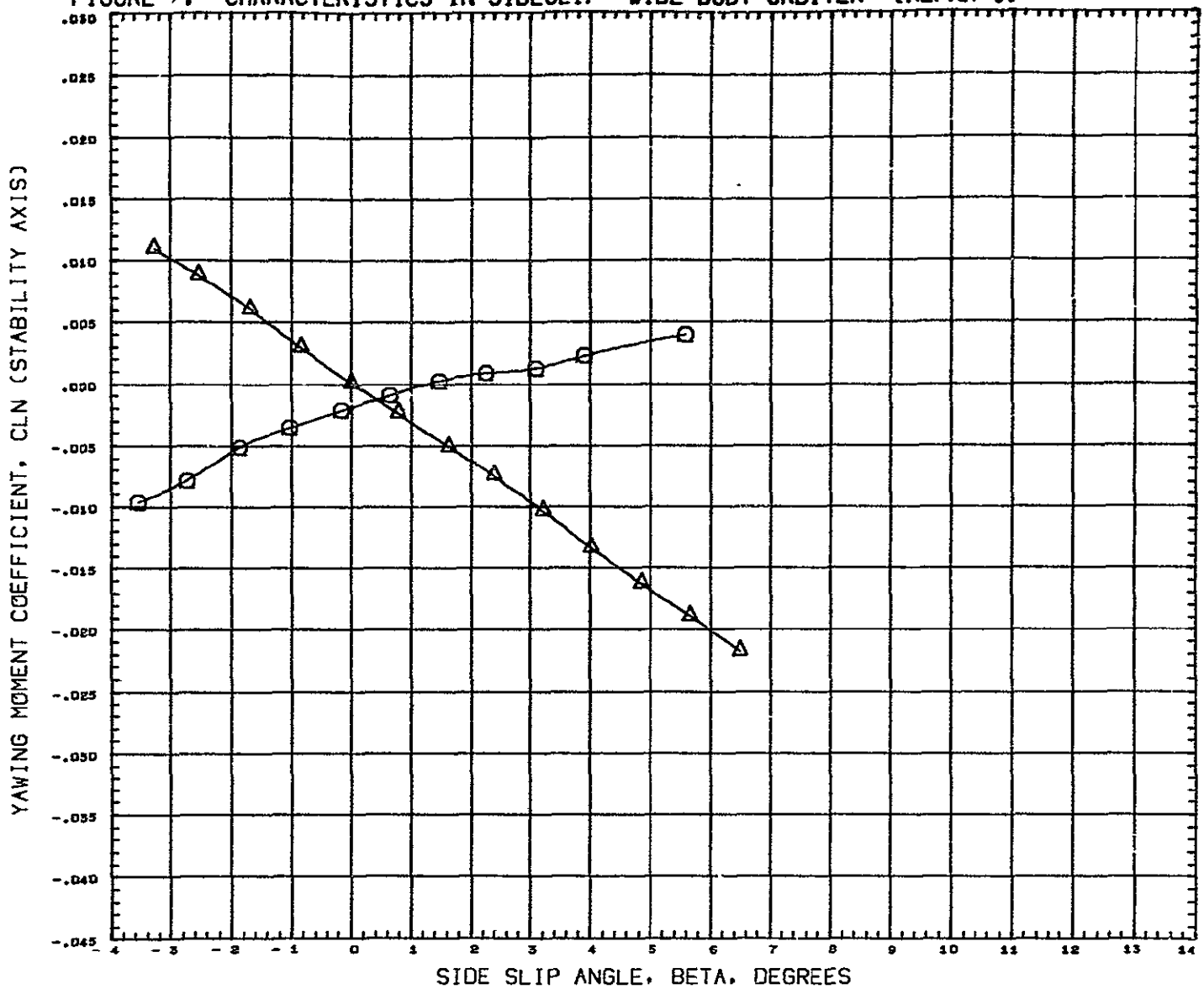
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCRD58) ○	GFTT-035 CONF ROS-WB1 B2W1V2
(RCRD67) △	GFTT-035 CONF ROS-WB1 B2W1

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	Sq. IN.
LREF	9.6500	IN.
BREF	5.6380	IN.
XMRP	1405.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.710

FIGURE 7. CHARACTERISTICS IN SIDESLIP- WIDE BODY ORBITER (ALPHA=0)



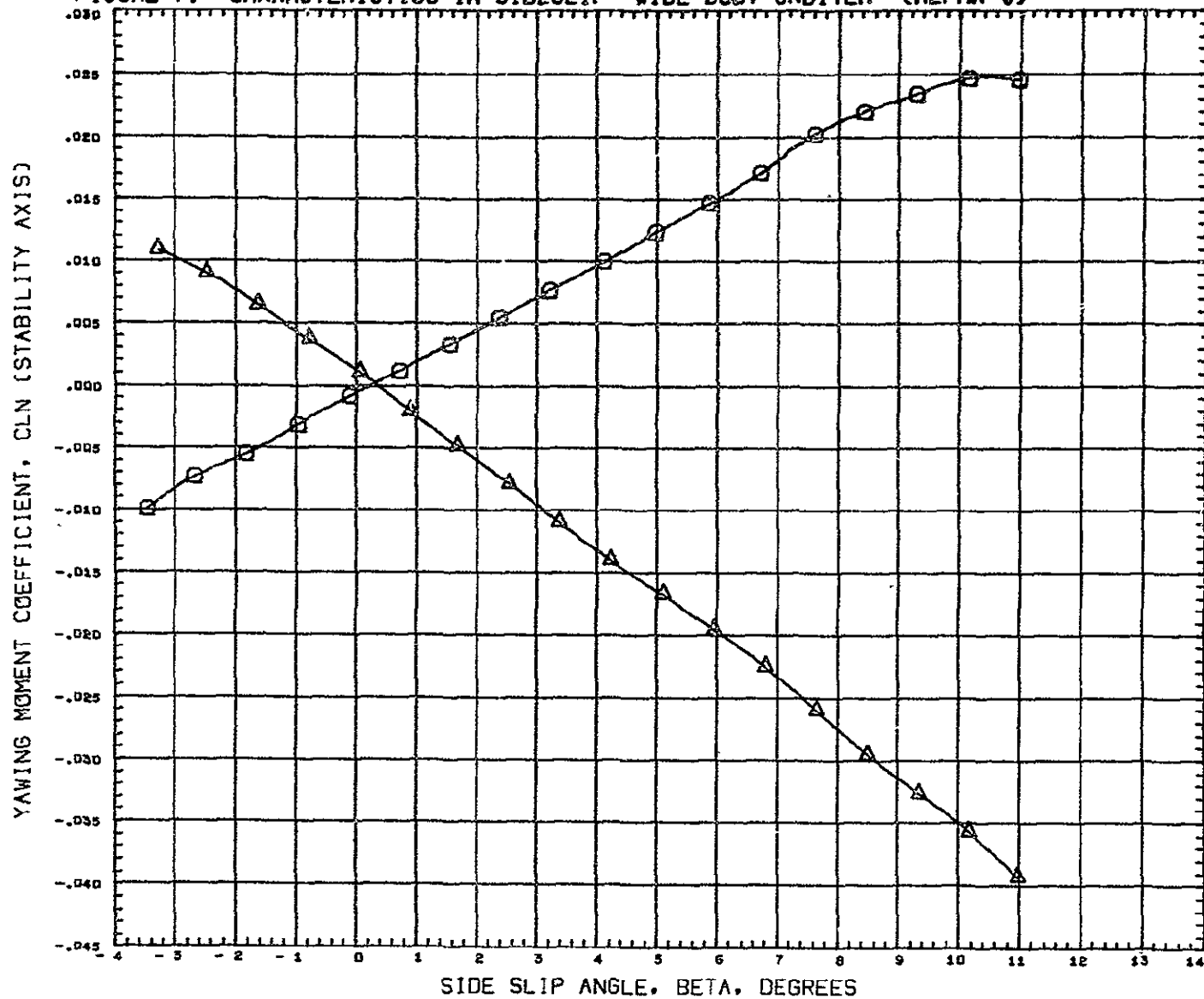
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR058)	GFTT-035 CONF ROS-WB1 B2W1V2
(RCR067)	GFTT-035 CONF ROS-WB1 B2W1

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	SQ.IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.900

FIGURE 7. CHARACTERISTICS IN SIDESLIP- WIDE BODY ORBITER (ALPHA=0)



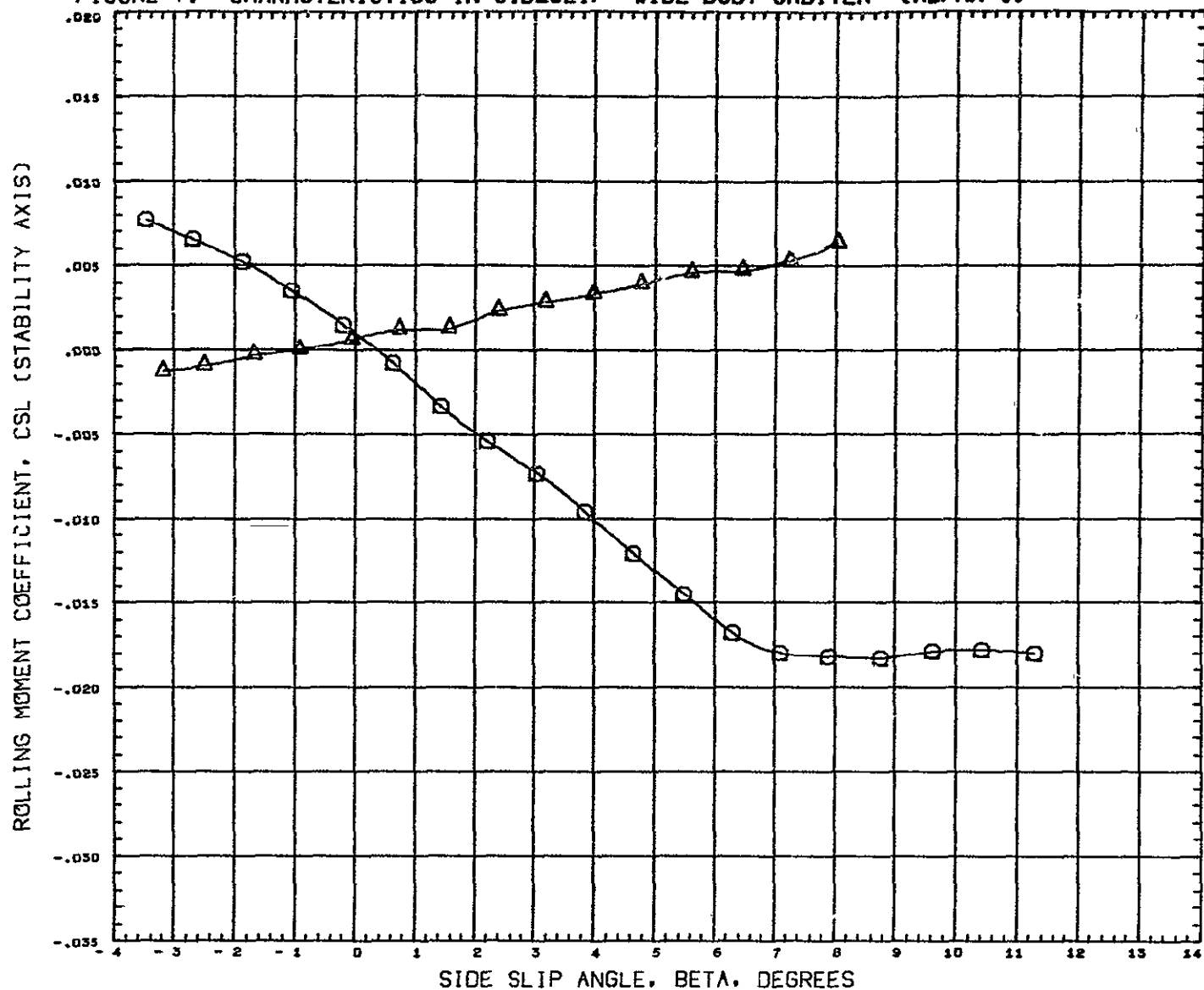
DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (RCR055) $\square$ 6FTT-035 CONF R05-WB1 B2W1V2
 (RCR067) $\triangle$ 6FTT-035 CONF R05-WB1 B2W1

ALPHA ELEVNS RUDDER
 0.000 0.000 0.000
 0.000 0.000 0.000

REFERENCE INFORMATION
 SREF 20.6900 SQ. IN.
 LREF 9.6500 IN.
 BREF 5.8380 IN.
 XMRP 1485.0040 IN.
 YMRP 0.0000 IN.
 ZMRP 377.0004 IN.
 SCALE 0.0050

MACH 1.160

FIGURE 7. CHARACTERISTICS IN SIDESLIP- WIDE BODY ORBITER (ALPHA=0)



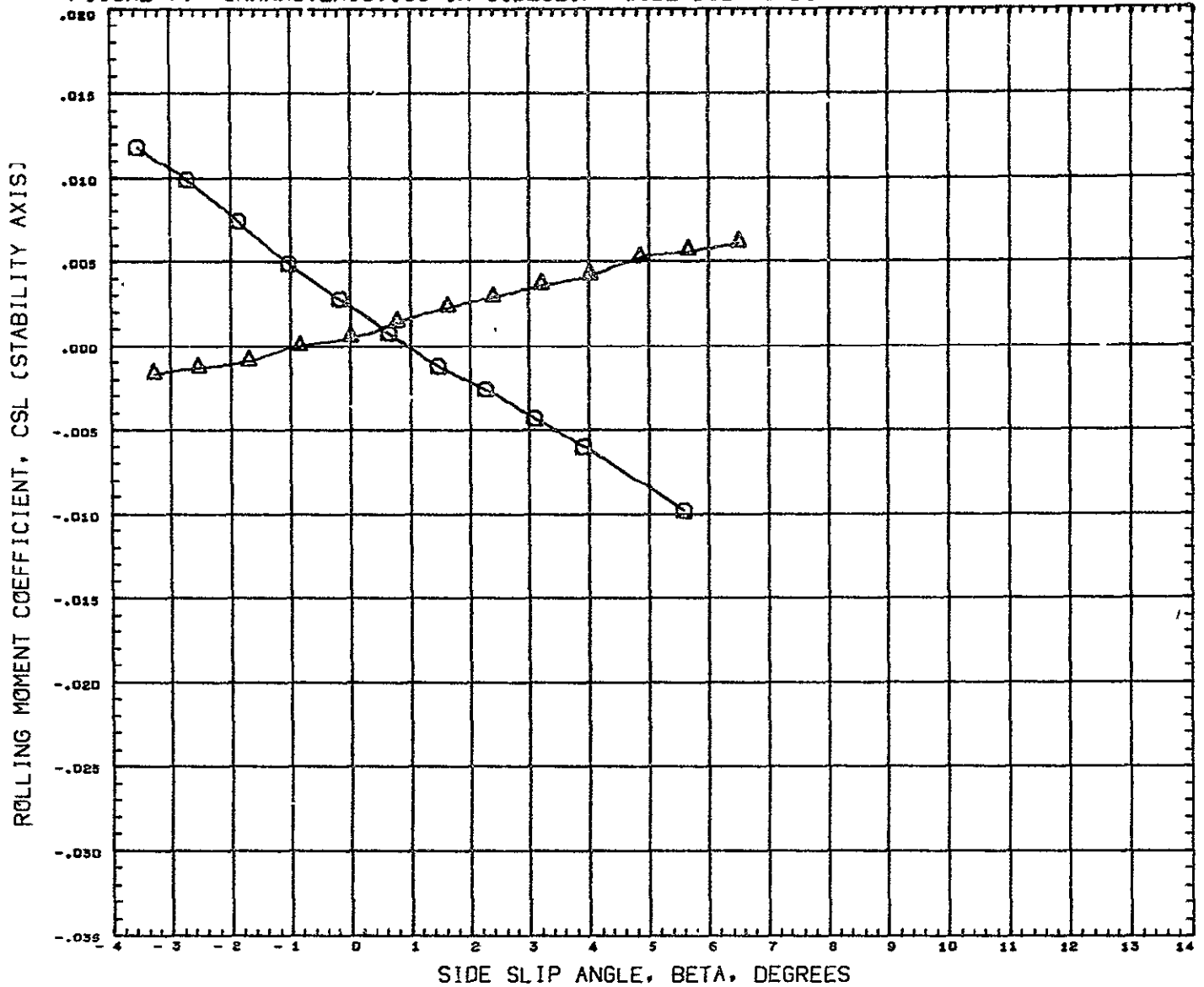
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR058)	GFTT-035 CONF ROS-WB1 B2W1V2
(RCR067)	GFTT-035 CONF ROS-WB1 B2W1

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	SQ. IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1465.0049	IN.
YMRP	0.0010	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

MACH 0.710

FIGURE 7. CHARACTERISTICS IN SIDESLIP- WIDE BODY ORBITER (ALPHA=0)



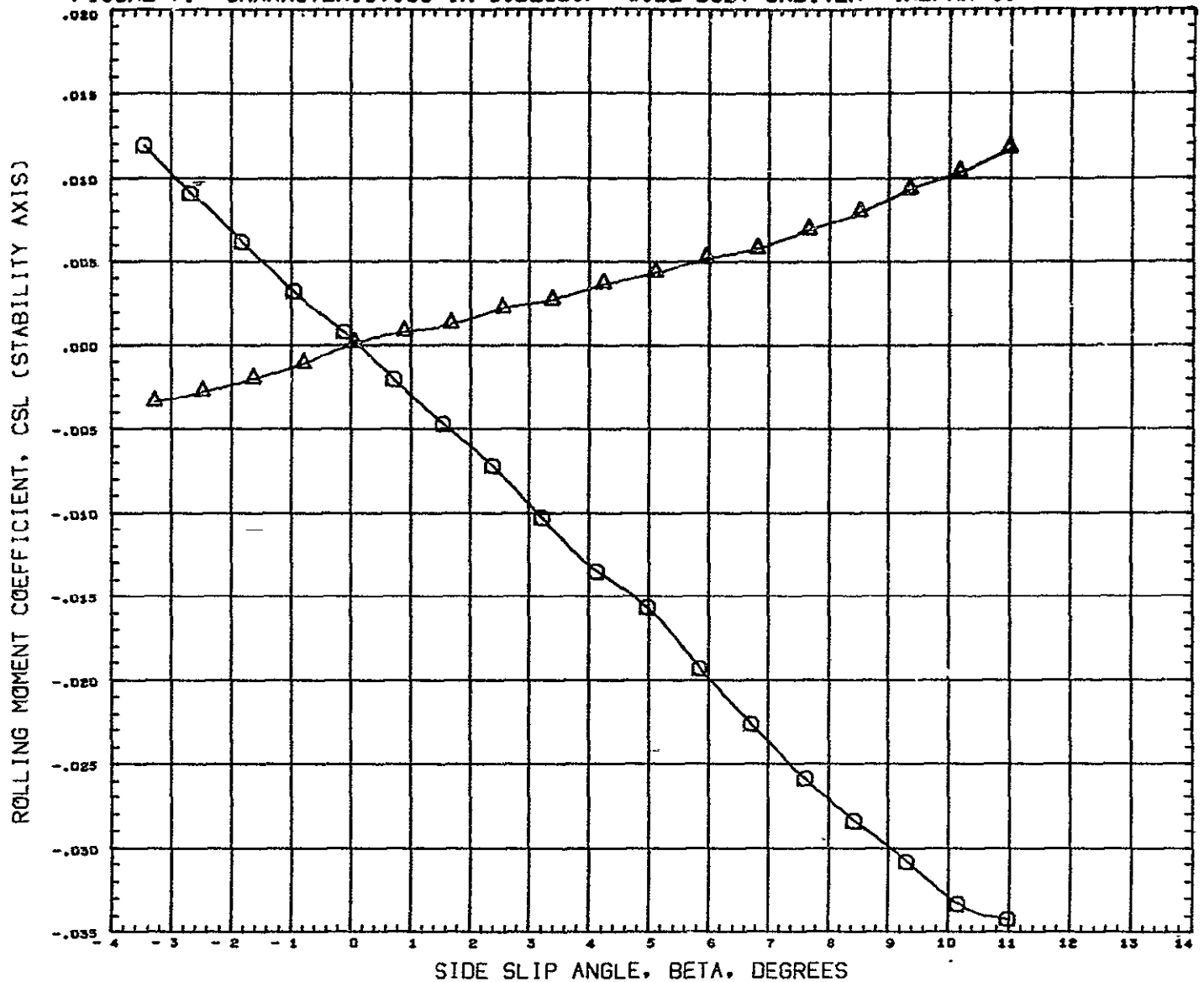
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(R058)	GFTT-035 CONF ROS-WB1 B2W1V2
(R067)	GFTT-035 CONF ROS-WB1 B2W1

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION		
SREF	20.6900	sq.in.
LREF	9.6500	in.
BREF	5.8380	in.
XMRP	1485.0040	in.
YMRP	0.0000	in.
ZMRP	377.0004	in.
SCALE	0.0350	

MACH 0.900

FIGURE 7. CHARACTERISTICS IN SIDESLIP- WIDE BODY ORBITER (ALPHA=0)



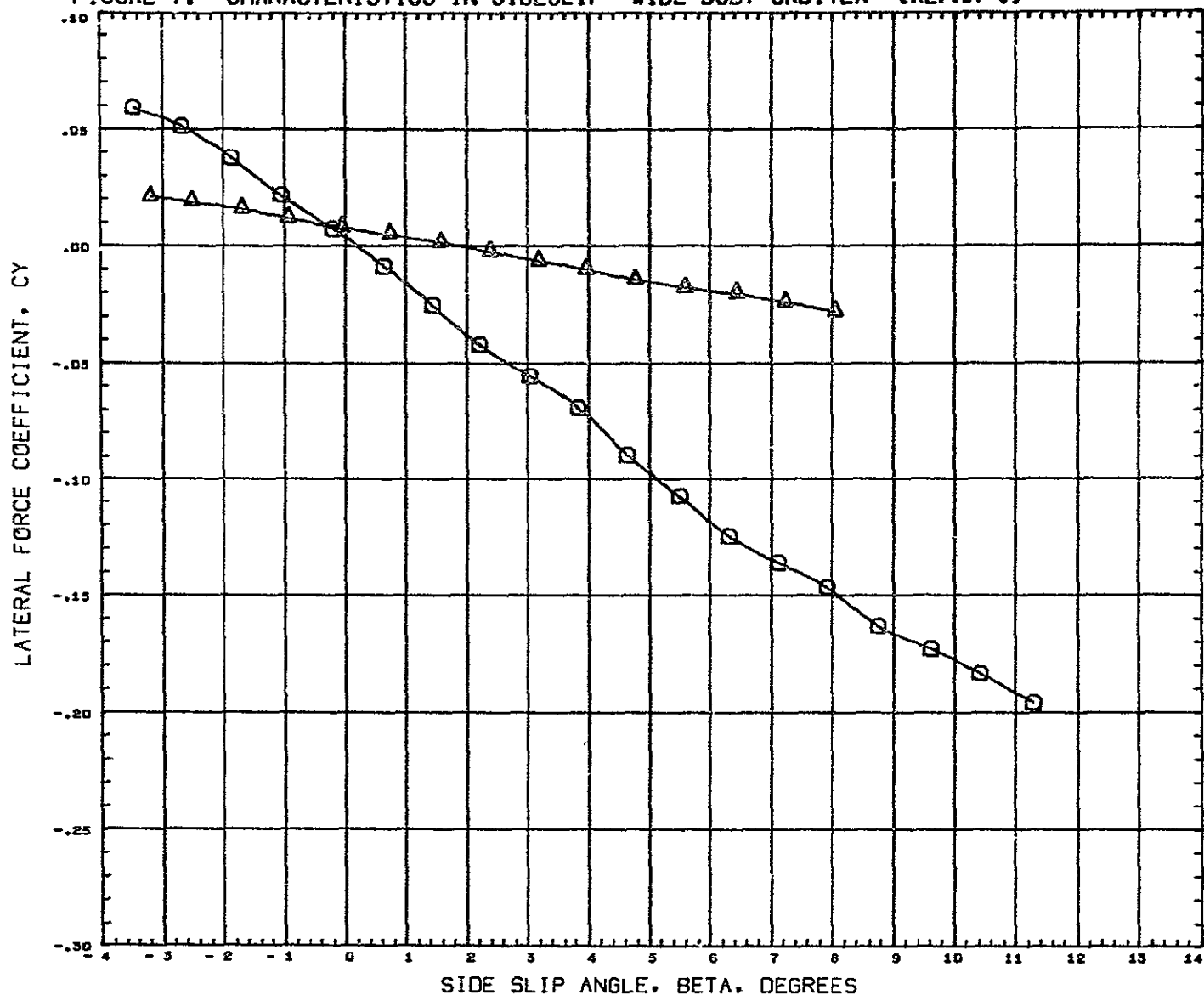
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR058) □	GFTT-035 CONF ROS-WB1 B2W1V2
(RCR067) △	GFTT-035 CONF ROS-WB1 B2W1

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION	
SREF	20.6900 SQ.IN.
LREF	9.6500 IN.
BREF	5.8380 IN.
XNRP	1485.0040 IN.
YNRP	0.0009 IN.
ZNRP	37.0004 IN.
SCALE	0.0050

MACH 1.160

FIGURE 7. CHARACTERISTICS IN SIDESLIP- WIDE BODY ORBITER (ALPHA=0)



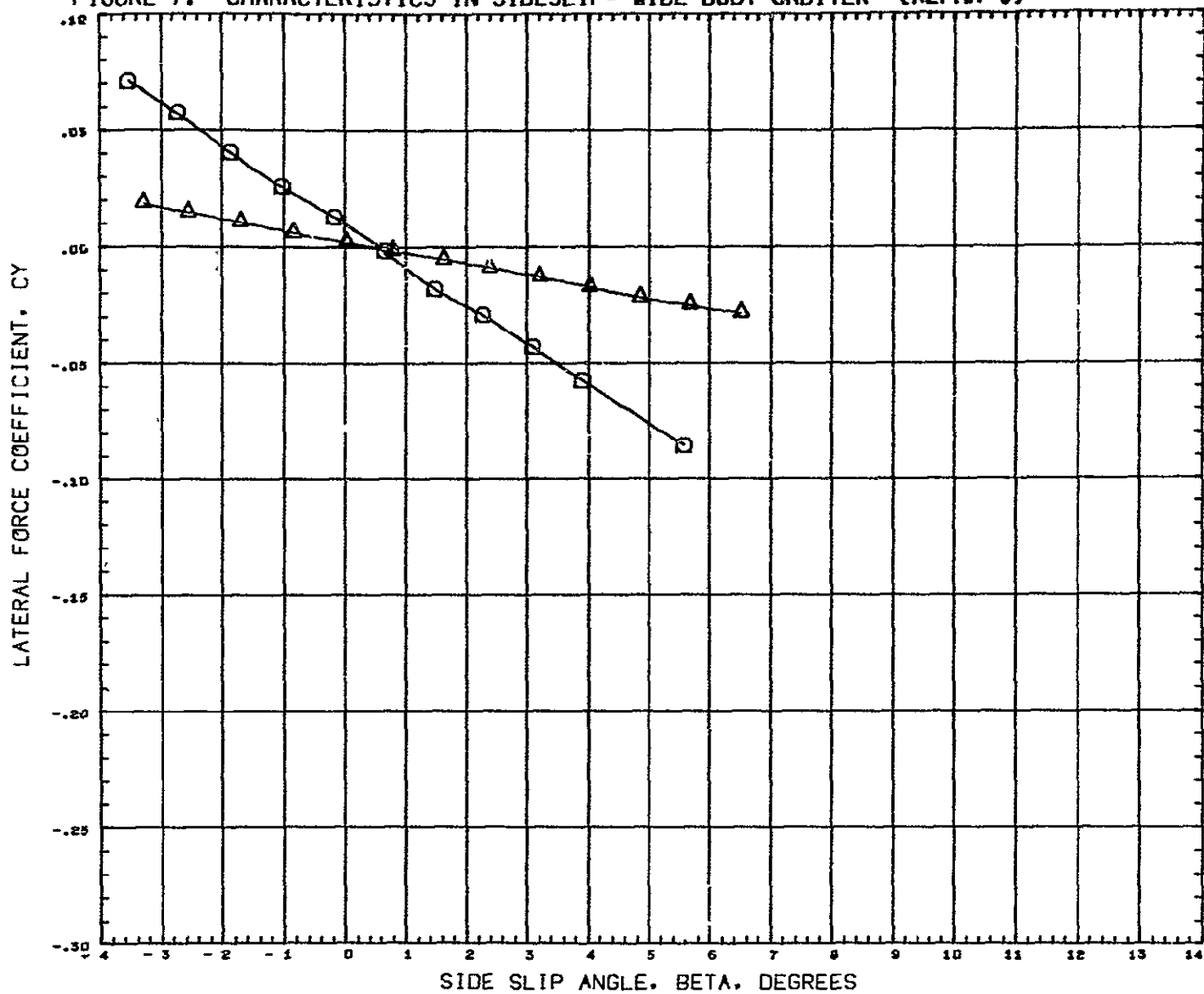
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR050) □	6FTT-035 CONF ROS-WB1 B2W1V2
(RCR067) △	6FTT-035 CONF ROS-WB1 B2W1

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	0.000

REFERENCE INFORMATION	
SREF	20.6900 SQ. IN.
LREF	9.6500 IN.
BREF	5.8380 IN.
XMRP	1485.0040 IN.
YMRP	0.0001 IN.
ZMRP	377.0004 IN.
SCALE	0.0050

MACH 0.710

FIGURE 7. CHARACTERISTICS IN SIDESLIP- WIDE BODY ORBITER (ALPHA=0)



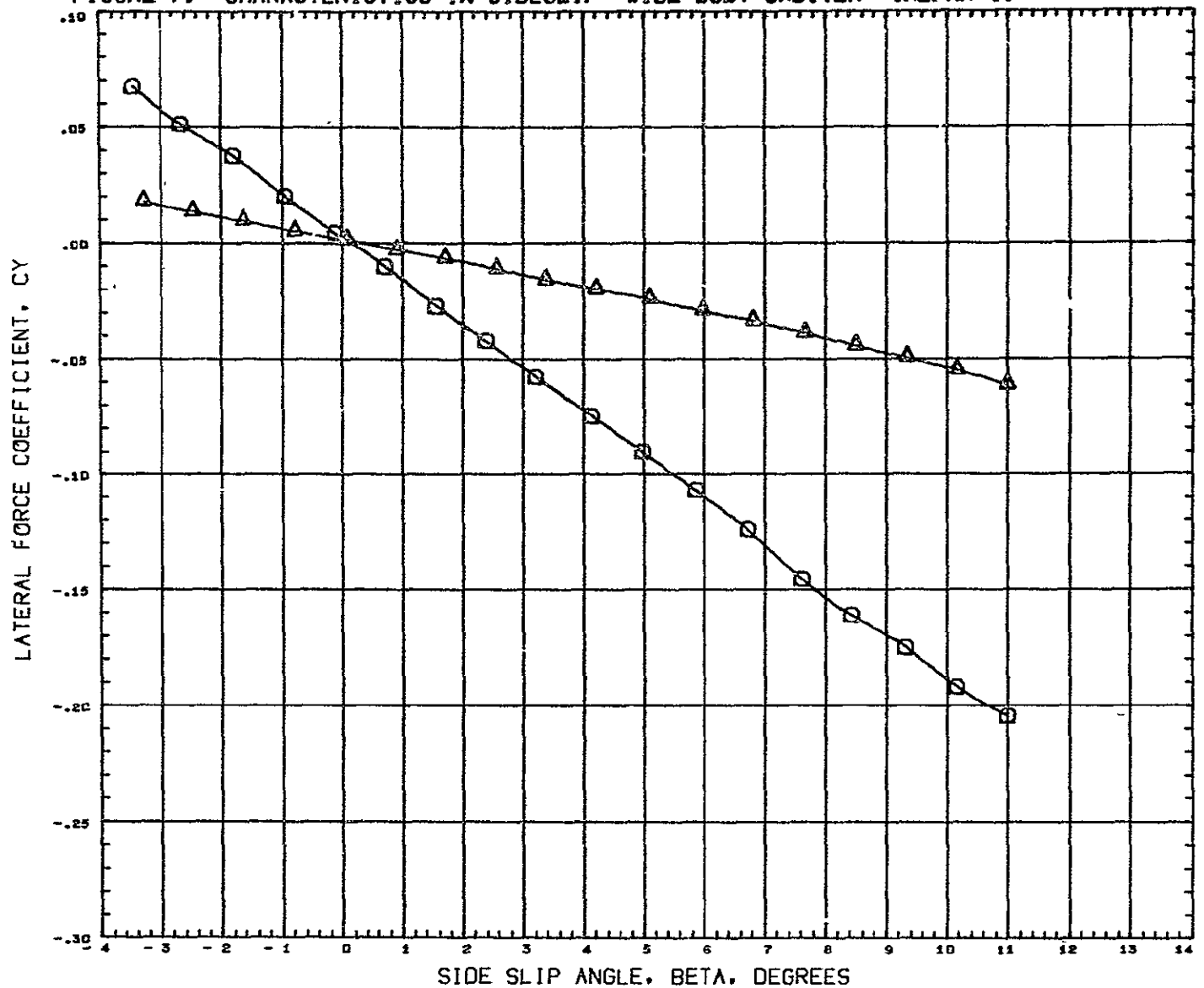
DATA SET SYMBOL CONFIGURATION DESCRIPTION
(RCR058) 6FIT-035 CONF ROS-WB1 B2W1V2
(RCR067) 6FIT-035 CONF ROS-WB1 B2W1

ALPHA ELEVNS RUDDER
0.000 0.000 0.000
0.000 0.000 0.000

REFERENCE INFORMATION
SREF 20.6900 SQ.IN.
LREF 9.8500 IN.
BREF 5.8580 IN.
XMRP 1485.0040 IN.
YMRP 0.0000 IN.
ZMRP 377.0004 IN.
SCALE 0.0050

MACH 0.900

FIGURE 7. CHARACTERISTICS IN SIDESLIP- WIDE BODY ORBITER (ALPHA=0)



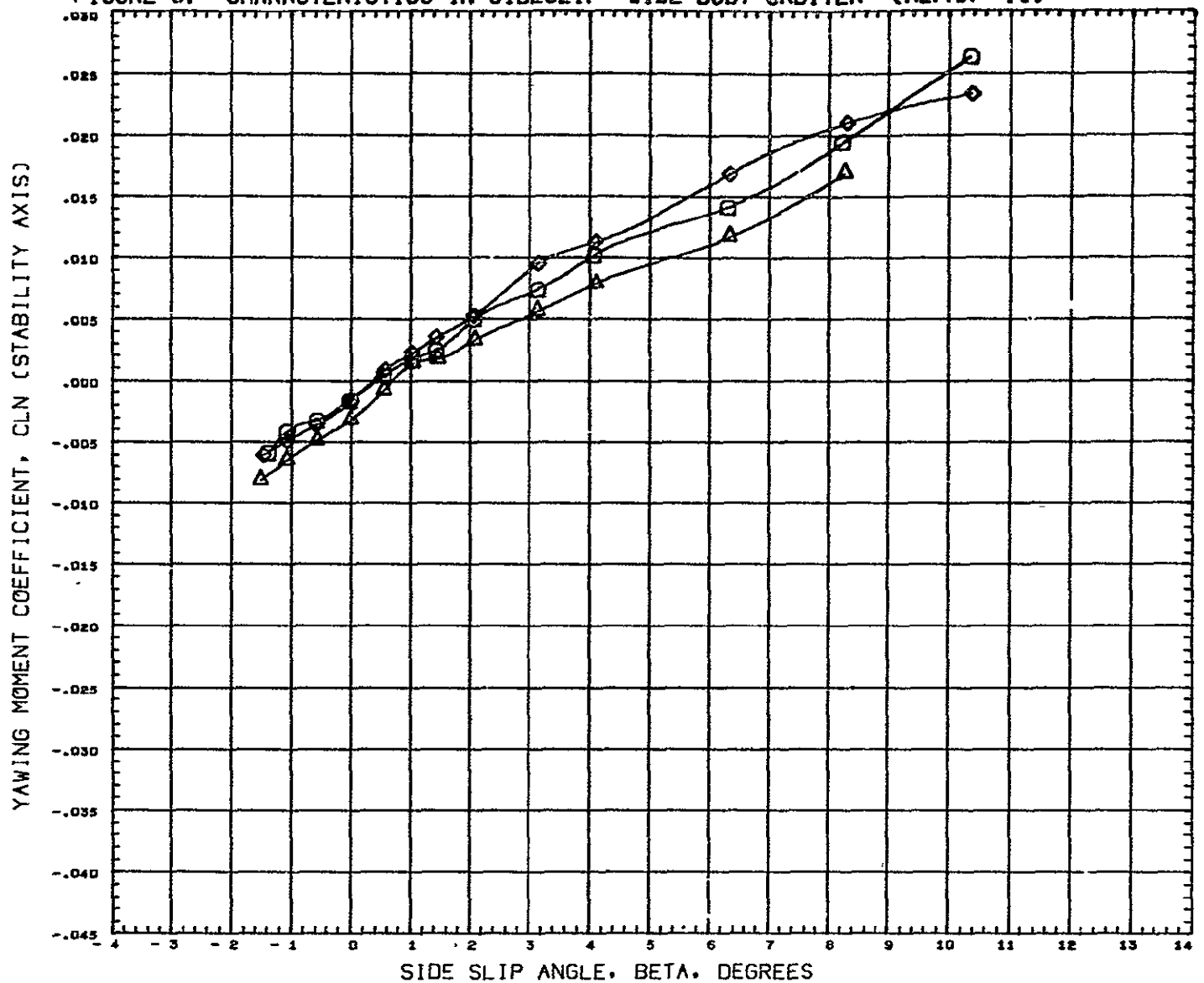
DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCRD58) 	GFTT-035 CONF ROS-WB1 B2W1V2
(RCRD67) 	GFTT-035 CONF ROS-WB1 B2W1

ALPHA	ELEVNS	RUDDER
0.000	0.000	0.000
0.000	0.000	

REFERENCE INFORMATION		
SREF	20.6900	sq. IN.
LREF	9.6500	IN.
BREF	5.8360	IN.
XMRP	1485.0040	IN.
YMRP	0.0010	IN.
ZMRP	377.0004	IN.
SCALE	0.3050	

MACH 2.160

FIGURE 8. CHARACTERISTICS IN SIDESLIP- WIDE BODY ORBITER (ALPHA= 10)

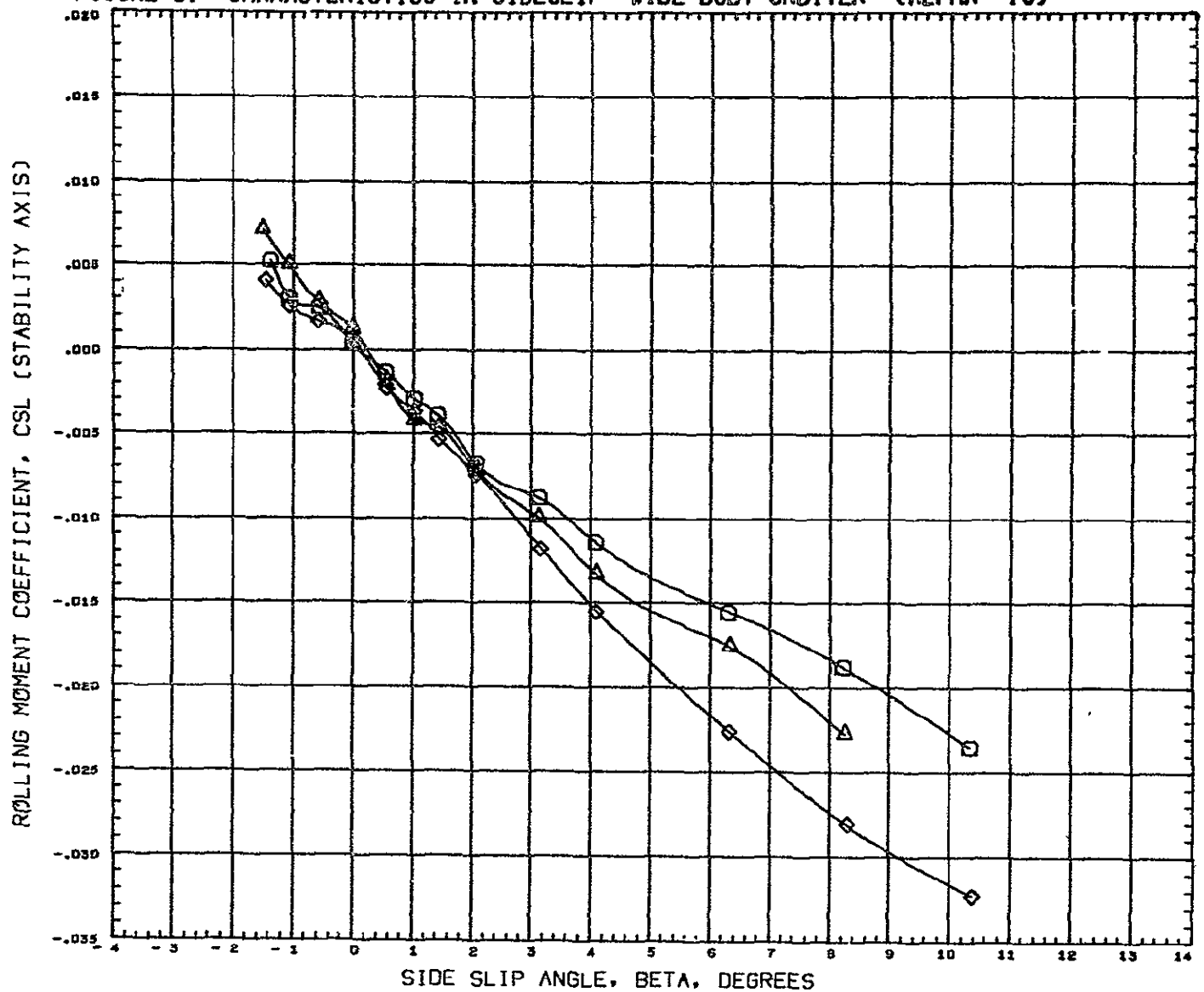


SYMBOL	MACH	ALPHA	PARAMETRIC VALUES	
○	0.720	10.000	ELEVNS	0.000
□	0.950	RUDDER	0.000	
△	1.160			

REFERENCE INFORMATION		
SREF	20.6900	SQ. IN.
LREF	9.6500	IN.
BREF	5.8360	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

REFERENCE FILE

FIGURE 8. CHARACTERISTICS IN SIDESLIP- WIDE BODY ORBITER (ALPHA= 10)



SYMBOL	MACH	ALPHA	PARAMETRIC VALUES	ELEVNS	
○	0.720	10.000	0.000	0.000	
△	0.950	RUDDER	0.000		
◇	1.160				

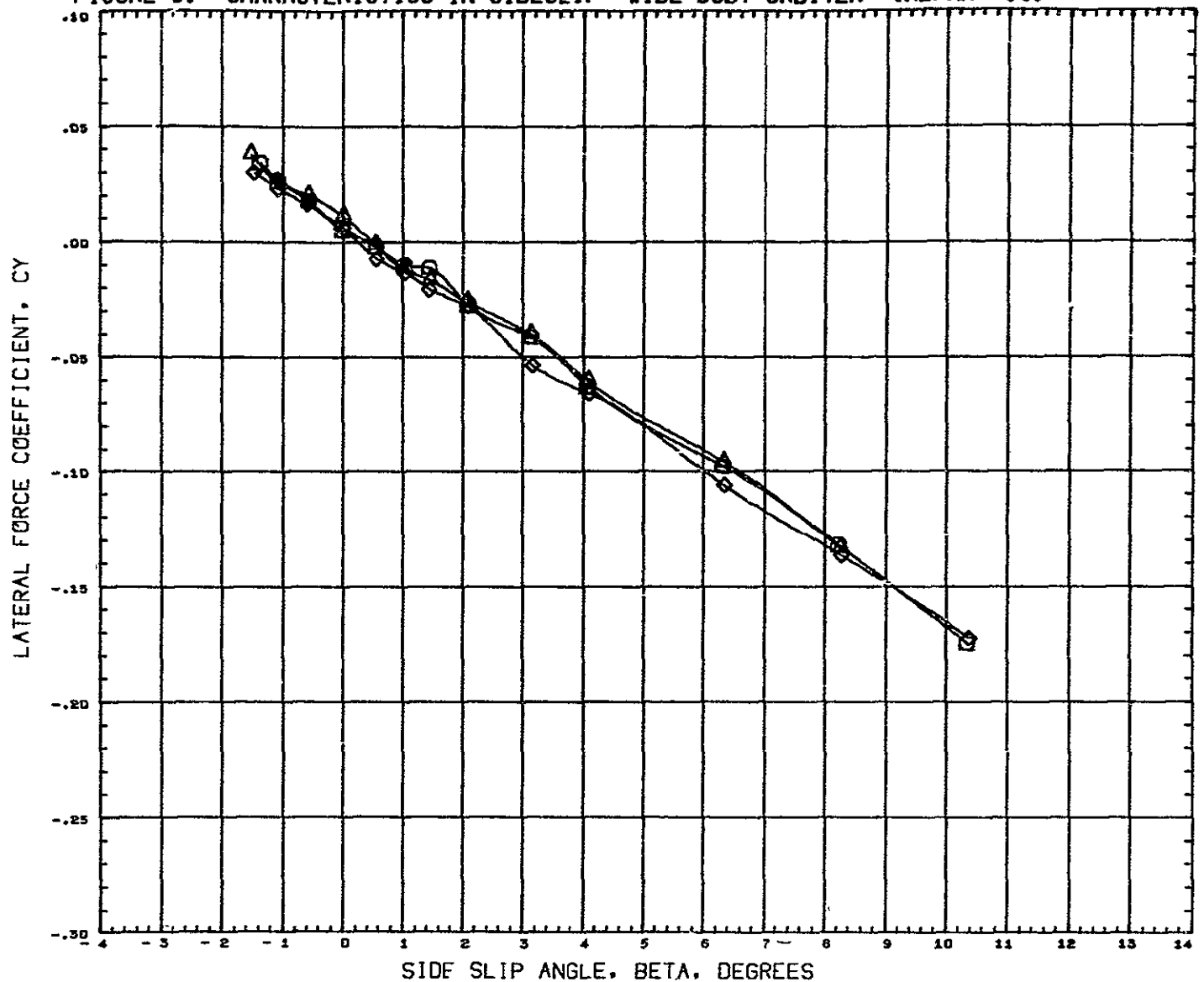
REFERENCE INFORMATION		
SREF	20.6900	58. IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0056	

REFERENCE FILE

GFTT-035 CONF R0S-WB1 B2W1V2

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FIGURE 8. CHARACTERISTICS IN SIDESLIP- WIDE BODY ORBITER (ALPHA= 10)



SYMBOL	MACH	PARAMETRIC VALUES		
○	0.720	ALPHA	10.000	ELEVNS 0.000
△	0.950	RUDDER	0.000	
◇	1.160			

REFERENCE INFORMATION		
SREF	20.6900	SG.IN.
LREF	9.6500	IN.
BREF	5.8360	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

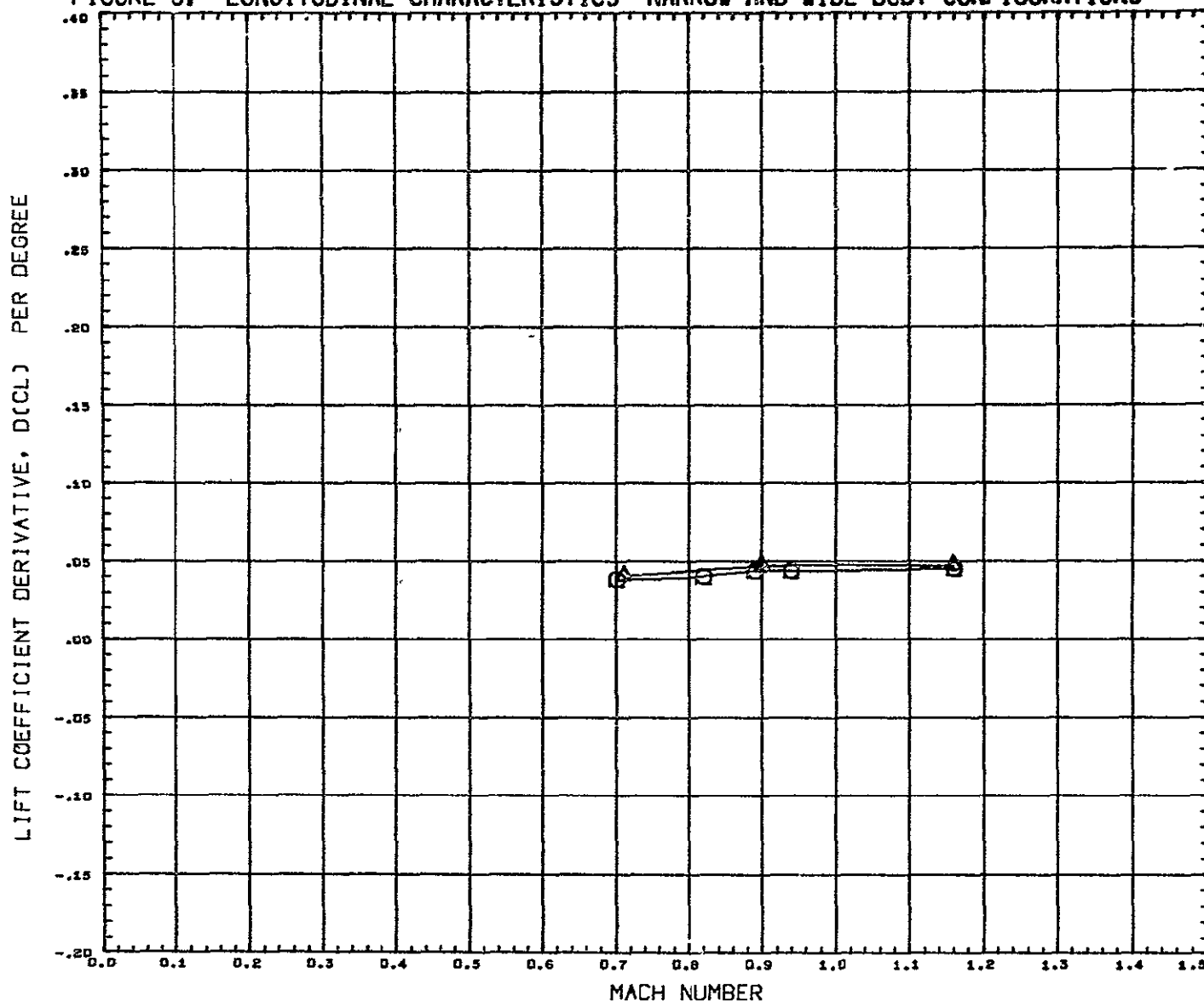
REFERENCE FILE

GFTT-035 CONF R0S-WB1 B2W1V2

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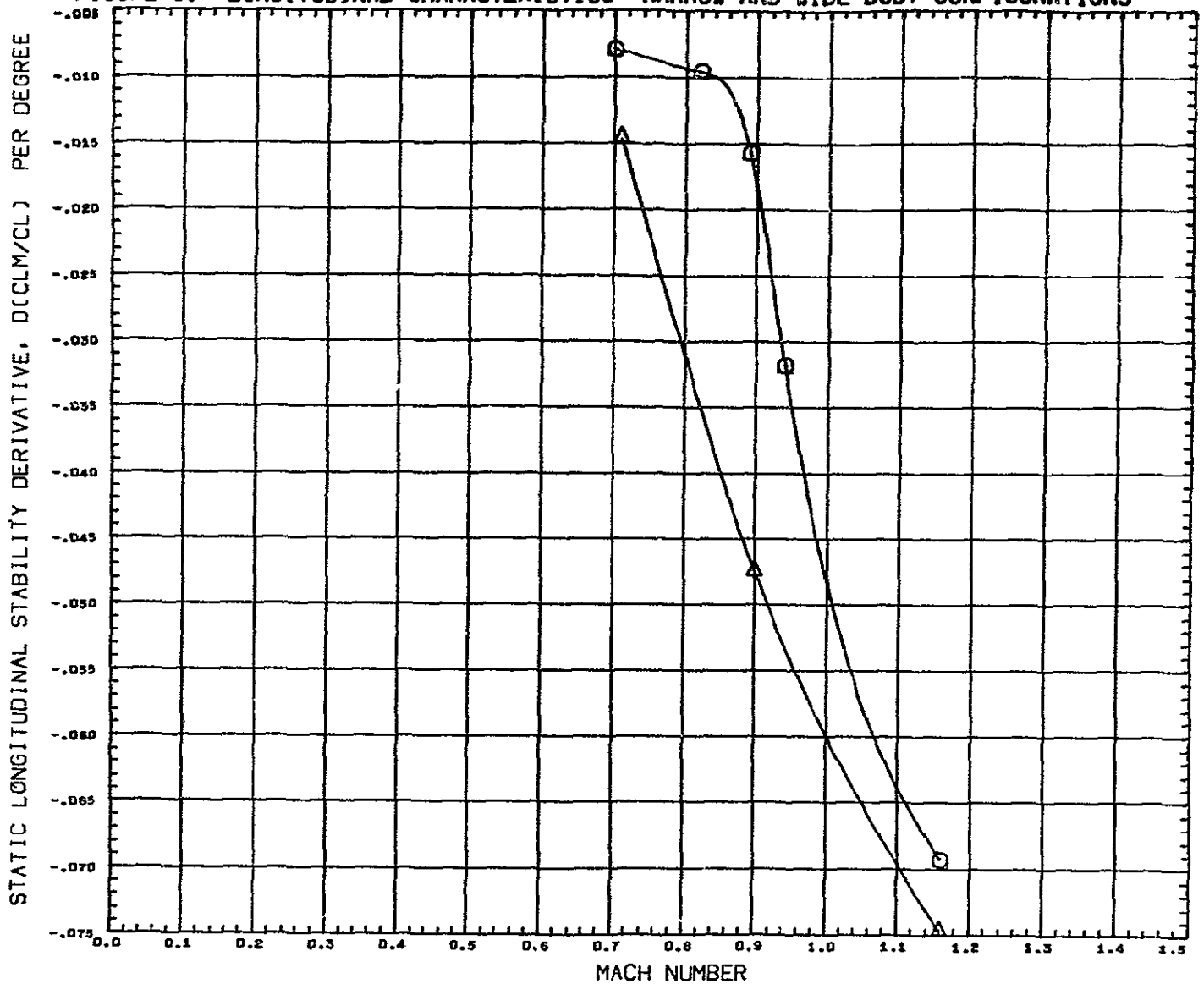
FIGURE 9. LONGITUDINAL CHARACTERISTICS- NARROW AND WIDE BODY CONFIGURATIONS



DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(ZCRO21)	GFTT-035 CONF ROS-NB1 B1W1V1
(ZCRO55)	GFTT-035 CONF ROS-WB1 B2W1V2

REFERENCE INFORMATION		
SREF	20.6900	Sq. IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0003	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

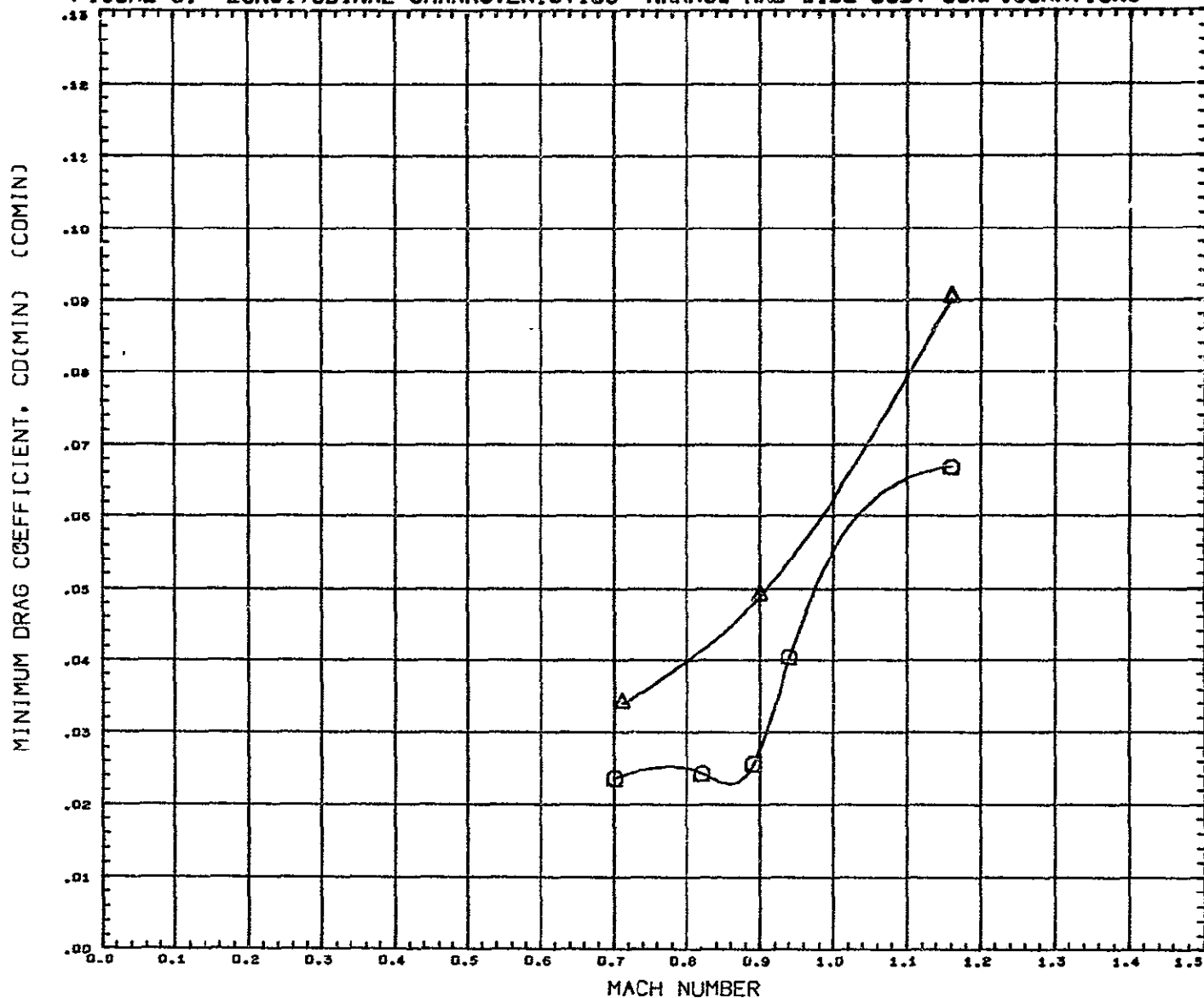
FIGURE 9. LONGITUDINAL CHARACTERISTICS- NARROW AND WIDE BODY CONFIGURATIONS



DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (ZCR021) $\bigcirc$ GFTT-035 CONF ROS-NB1 B1W1V1
 (ZCR055) $\triangle$ GFTT-035 CONF ROS-WB1 B2W1V2

REFERENCE INFORMATION
 SREF 20.6900 SQ. IN.
 LREF 9.6500 IN.
 BREF 5.8380 IN.
 XMRP 1485.0000 IN.
 YMRP 0.0000 IN.
 ZMRP 377.0004 IN.
 SCALE 0.0050

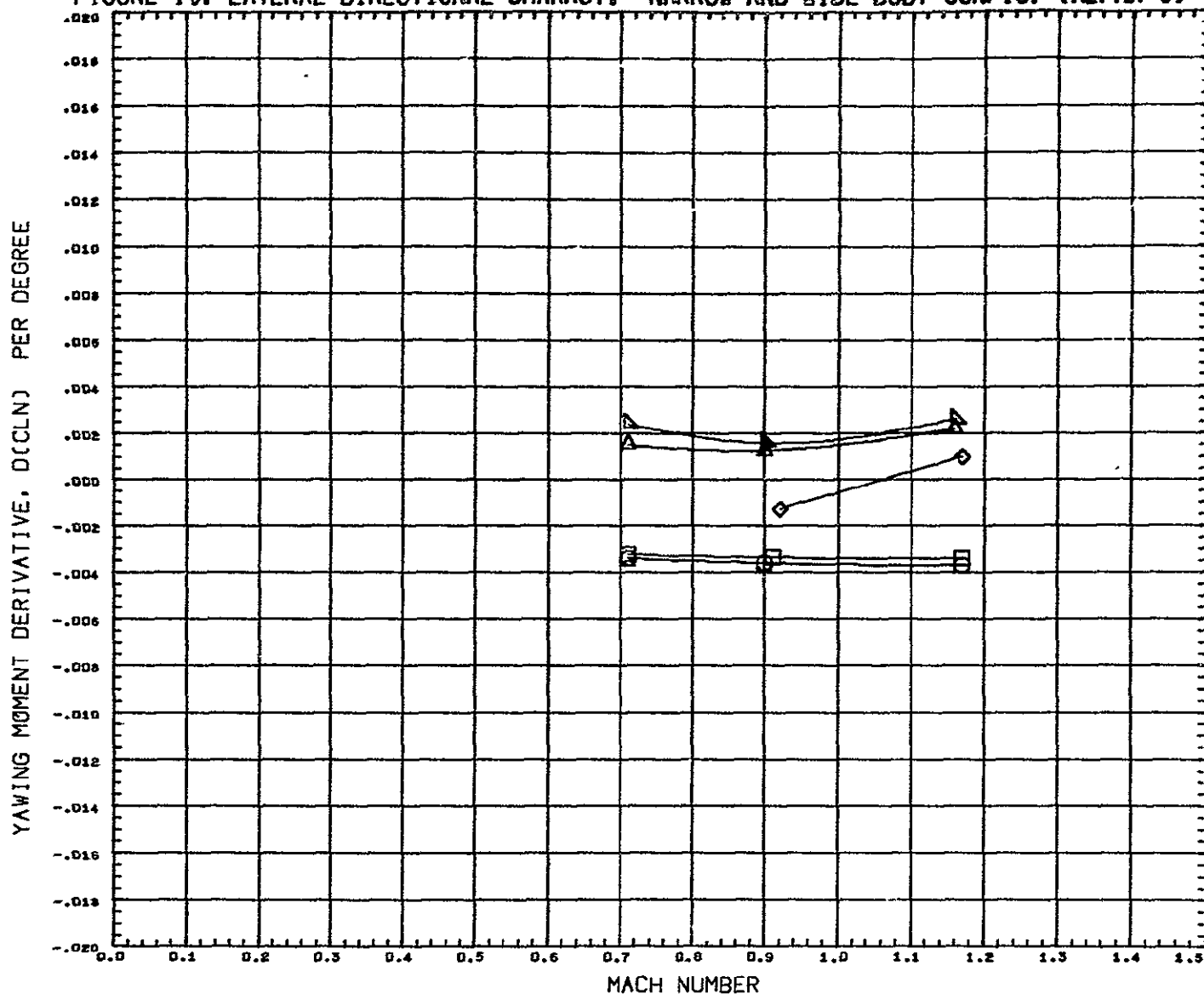
FIGURE 9. LONGITUDINAL CHARACTERISTICS- NARROW AND WIDE BODY CONFIGURATIONS



DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(DCR021) $\bigcirc$	GFTT-035 CONF ROS-NB1 B1W1V1
(DCR055) $\triangle$	GFTT-035 CONF ROS-WB1 B2W1V2

REFERENCE INFORMATION		
SREF	20.6900	SQ. IN.
LREF	9.6500	IN.
BREF	5.8360	IN.
XWRP	1485.0040	IN.
YWRP	0.0001	IN.
ZWRP	377.0004	IN.
SCALE	0.0050	

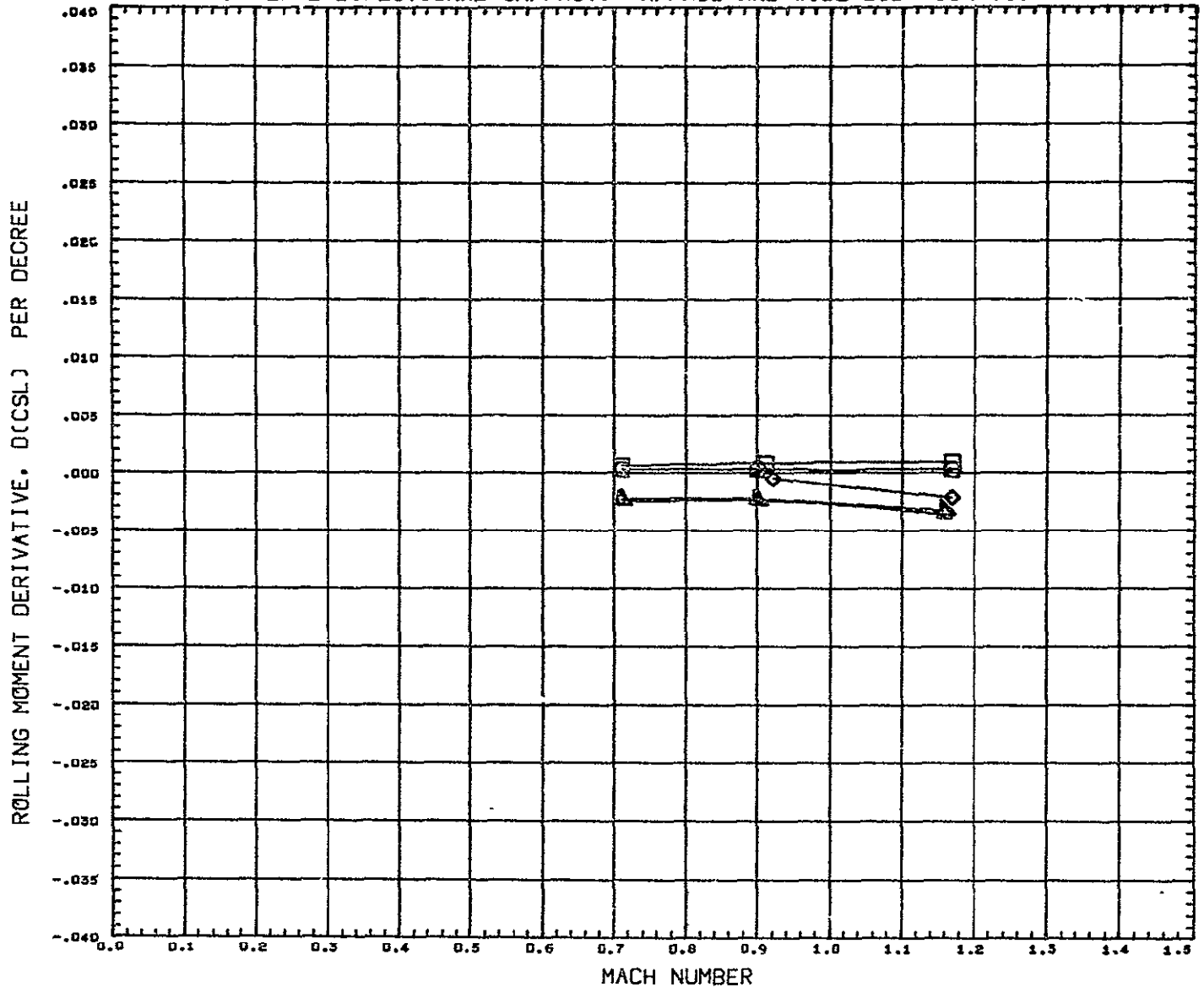
FIGURE 10. LATERAL-DIRECTIONAL CHARACT.- NARROW AND WIDE BODY CONFIG. (ALPHA=0)



DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR046)	GFTT-035 CONF ROS-NB1 B1W1
(RCR029)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR049)	GFTT-035 CONF ROS-NB1 B1W2V3
(RCR067)	GFTT-035 CONF ROS-NB1 B2W1
(RCR058)	GFTT-035 CONF ROS-NB1 B2W1V2

REFERENCE INFORMATION		
SREF	20.6900	sq. in.
LREF	9.6500	in.
BREF	5.8380	in.
XNRP	1485.0040	in.
YNRP	0.0000	in.
ZNRP	377.0004	in.
SCALE	0.0050	

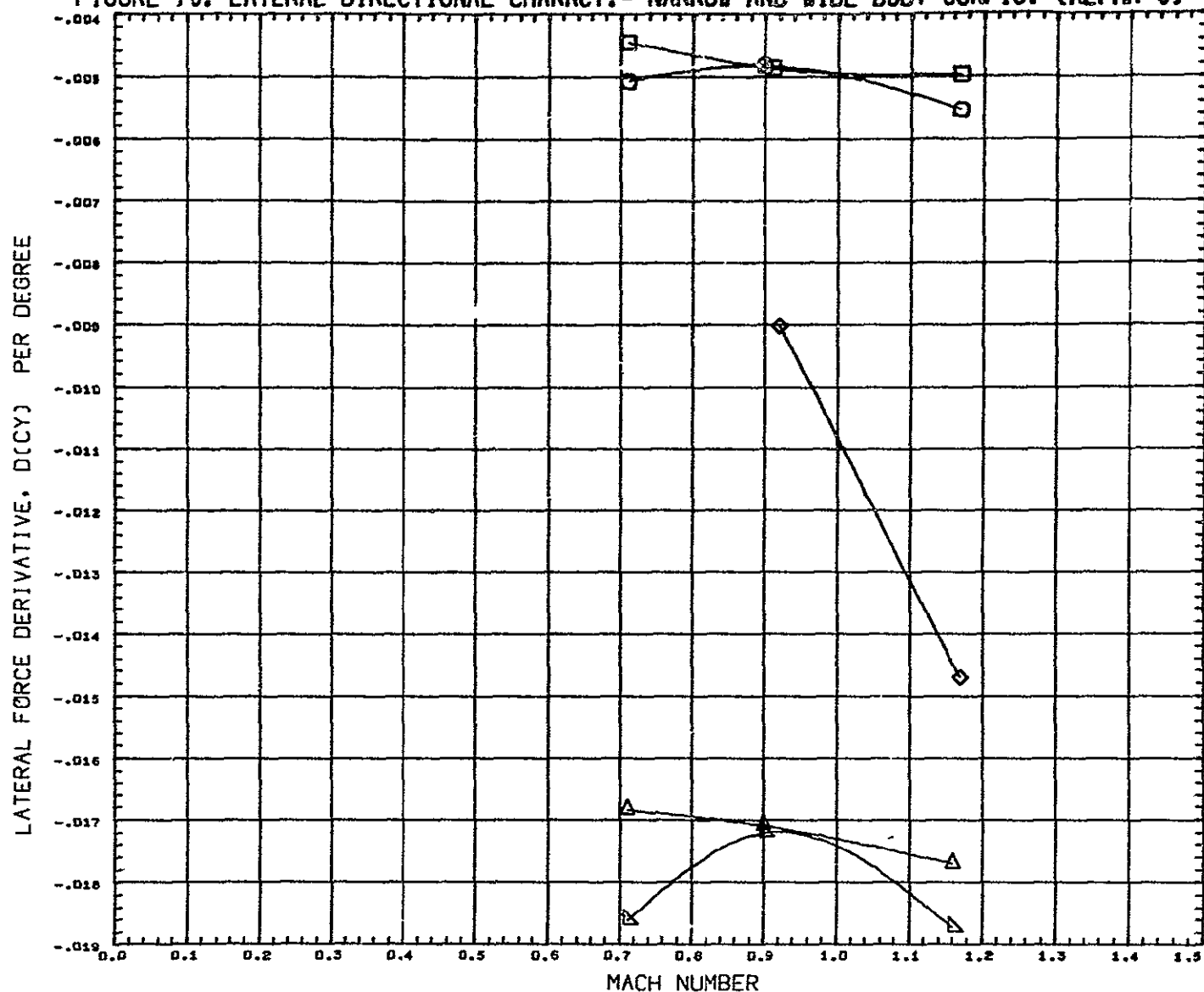
FIGURE 10. LATERAL-DIRECTIONAL CHARACT.- NARROW AND WIDE BODY CONFIG. (ALPHA=0)



DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR046)	GFTT-035 CONF ROS-NB1 B1W1
(RCR028)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR049)	GFTT-035 CONF ROS-NB1 B1W2V3
(RCR067)	GFTT-035 CONF ROS-WB1 B2W1
(RCR058)	GFTT-035 CONF ROS-WB1 B2W1V2

REFERENCE INFORMATION		
SREF	20.6900	SQ.IN.
LREF	9.6500	IN.
BREF	5.8380	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

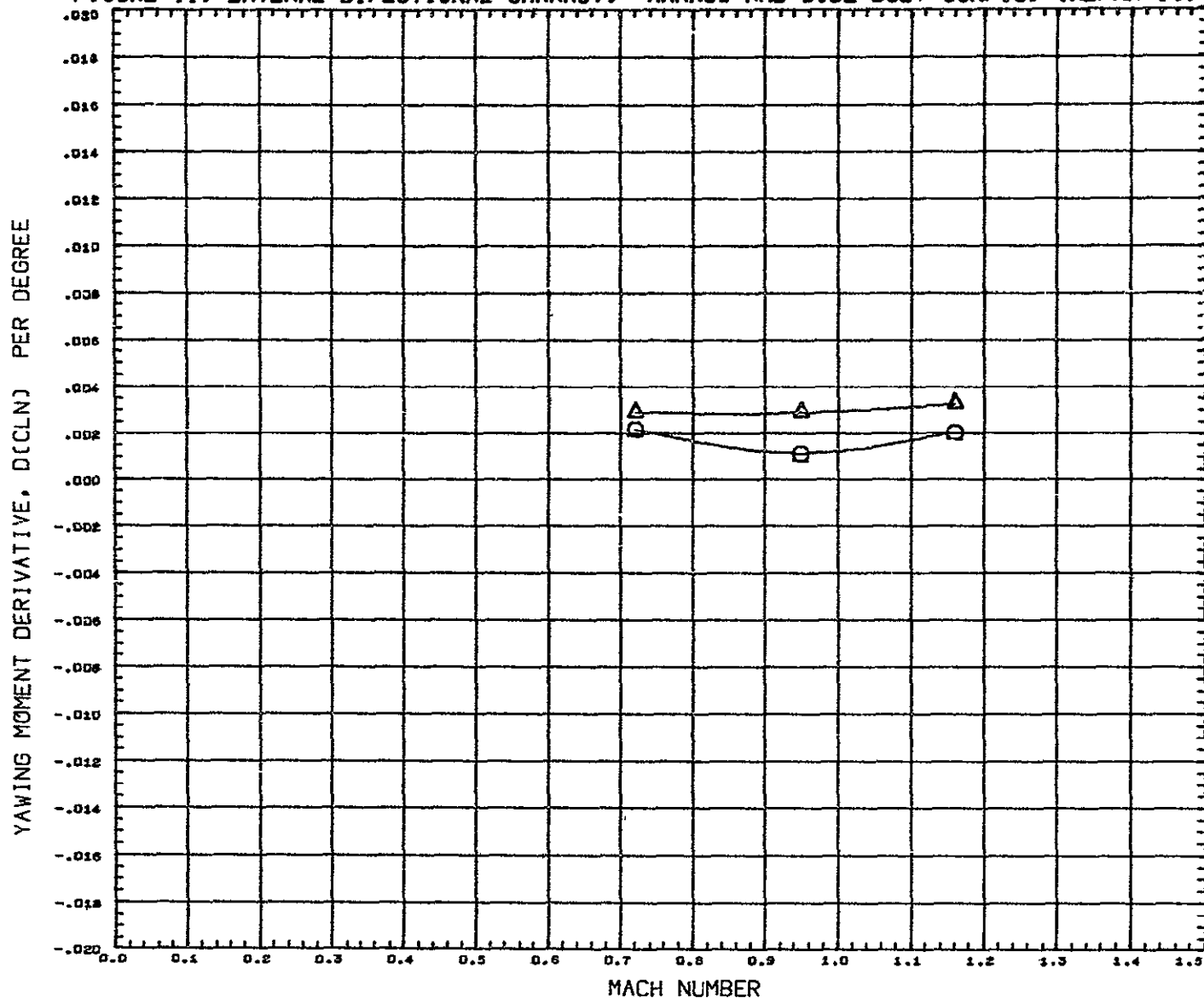
FIGURE 10. LATERAL-DIRECTIONAL CHARACT.- NARROW AND WIDE BODY CONFIG. (ALPHA=0)



DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCRD46)	GFTT-035 CONF ROS-NB1 B1W1
(RCRD28)	GFTT-035 CONF ROS-NB1 B1W1V1
(RCRD49)	GFTT-035 CONF ROS-NB1 B1W2V3
(RCRD67)	GFTT-035 CONF ROS-WB1 B2W1
(RCRD58)	GFTT-035 CONF ROS-WB1 B2W1V2

REFERENCE INFORMATION		
SREF	20.6900	98. IN.
LREF	9.6500	IN.
BREF	5.8360	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

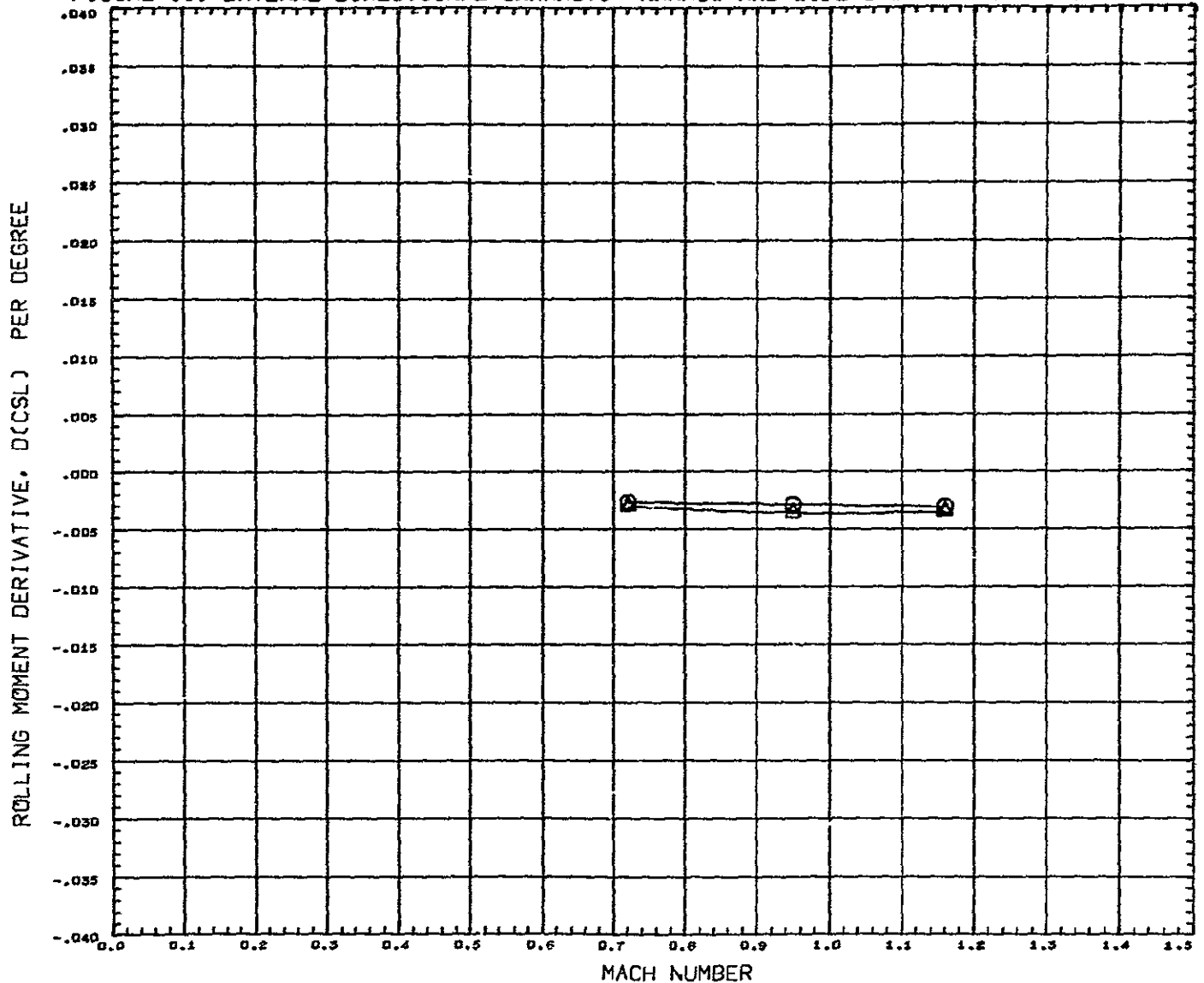
FIGURE 11. LATERAL-DIRECTIONAL CHARACT.- NARROW AND WIDE BODY CONFIG. (ALPHA=10)



DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (RCRD31) Q GFTT-035 CONF ROS-NB1 B1W1V1
 (RCRD61) A GFTT-035 CONF ROS-WB1 B2W1V2

REFERENCE INFORMATION
 SREF 20.6900 SQ. IN.
 LREF 9.6500 IN.
 BREF 5.8361 IN.
 XHRP 1485.0040 IN.
 YHRP 0.0000 IN.
 ZHRP 377.0004 IN.
 SCALE 0.0050

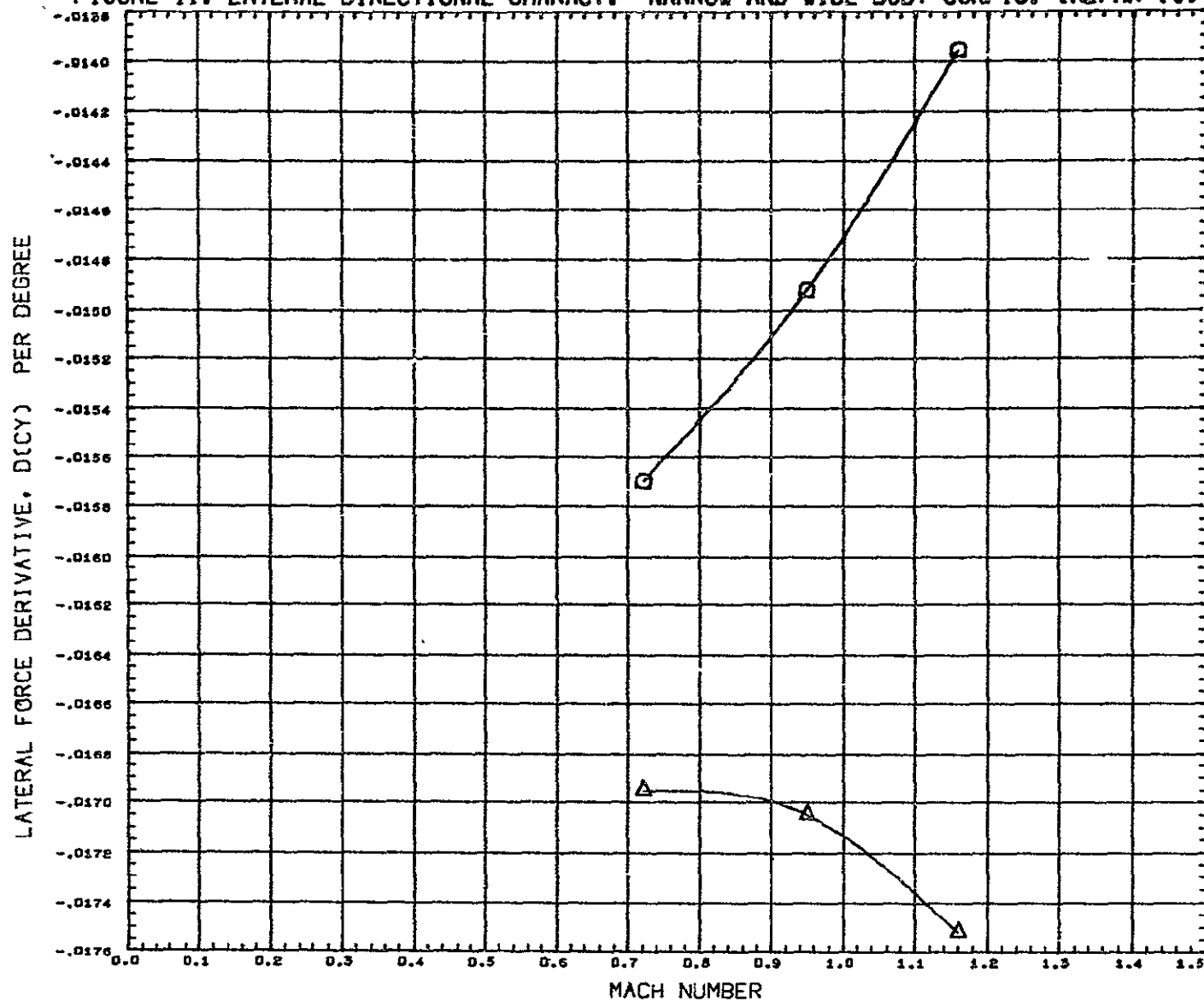
FIGURE 11. LATERAL-DIRECTIONAL CHARACT.- NARROW AND WIDE BODY CONFIG. (ALPHA=10)



DATA SET SYMBOL	CONFIGURATION DESCRIPTION
(RCR031) 	GFTT-035 CONF ROS-NB1 B1W1V1
(RCR061) 	GFTT-035 CONF ROS-WB1 B2W1V2

REFERENCE INFORMATION		
SREF	20.6900	SQ. IN.
LREF	9.6500	IN.
BREF	5.6360	IN.
XMRP	1485.0040	IN.
YMRP	0.0000	IN.
ZMRP	377.0004	IN.
SCALE	0.0050	

FIGURE 11. LATERAL-DIRECTIONAL CHARACT.- NARROW AND WIDE BODY CONF 16. (ALPHA=10)



DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (RCRD31) $\circ$ GFTT-035 CONF ROS-NB1 B1W1V1
 (RCRD61) $\triangle$ GFTT-035 CONF ROS-WB1 B2W1V2

REFERENCE INFORMATION
 SREF 20.6900 SQ.IN.
 LREF 9.6542 IN.
 BREF 5.8300 IN.
 XMRP 1485.0040 IN.
 YMRP 0.0000 IN.
 ZMRP 377.0004 IN.
 SCALE 0.0050