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DMS-DR-1227  
FEBRUARY 1972

—SPACE SHUTTLE—

**AERODYNAMIC CHARACTERISTICS  
OF A COMPOSITE BOOSTER/040A  
ORBITER LAUNCH CONFIGURATION  
WITH FIN AND BOOSTER BODY  
CONFIGURATION EFFECT  
CONTRIBUTION**

by

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**MSFC 14-INCH  
TRISONIC WIND TUNNEL**

**Marshall  
Space Flight Center  
NASA**



SADSAC SPACE SHUTTLE  
AEROTHERMODYNAMIC  
DATA MANAGEMENT SYSTEM

CONTRACT NAS8-4016  
MARSHALL SPACE FLIGHT CENTER



This document should be  
referenced as  
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SADSAC/SPACE SHUTTLE  
WIND TUNNEL TEST DATA REPORT

CONFIGURATION: Composite Booster/040A Orbiter Launch Configuration

TEST PURPOSE: To Investigate Forebody and Fin Configuration Effects on  
Longitudinal and Directional Stability of a Booster/Orbiter  
Launch Configuration.

TEST FACILITY: MSFC 14-Inch Trisonic Tunnel

TESTING AGENCY: NASA/MSFC

TEST NO. & DATE: MSFC TWT - 523

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CONTRACT NAS 8-4016

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This report has been prepared by Chrysler Corporation Space Division under a Data Management Contract to the NASA. Chrysler assumes no responsibility for the data presented herein other than its display characteristics.

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## SUMMARY

This was an investigation of the fin configuration and booster body configuration effects on a composite booster/040A orbiter launch configuration. Aerodynamic performance and stability characteristics in pitch and yaw were obtained.

The test was conducted at the MSFC 14-inch trisonic tunnel starting Thursday, January 27, 1972, and continued through Thursday, February 3, 1972, for a total of 64 occupancy hours. Configurations tested included two stepped cylindrical bodies of different lengths with a conical nose, four fin shapes of various sizes and aspect ratios mounted in different positions around the base of the bodies, two base flare angles and three 040A orbiter configurations. The orbiter variations included a tailless configuration and two tail sizes. A tailless booster launch configuration with deflected petals (expanded flare sectors) was also tested. The model scale was 0.003366.

Data were converted to coefficient form in near real time, punched on cards, and tabulated. The cards used in conjunction with a Benson-Lehner plotter were used to provide plotted data. At the end of the test, tabulated input forms were completed for the SADSAC computer program to aid in publishing the final test data report.

## NOMENCLATURE

(General)

<u>SYMBOL</u>	<u>SADSAC SYMBOL</u>	<u>DEFINITION</u>
$\alpha$	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
$\beta$	BETA	sideslip angle, angle between the wind $X_w$ -axis and the projection of this axis on the body X-Z-plane; degrees
$\psi$	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
$\phi$	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
$\rho$		air density; $K_g/m^3$ , slugs/ft <sup>3</sup>
$a$		speed of sound; m/sec, ft/sec
$V$		speed of vehicle relative to surrounding atmosphere; m/sec, ft/sec
$q$	Q(P <sub>SI</sub> ) Q(P <sub>SF</sub> )	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

<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 (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

$\infty$

free stream conditions

t

total conditions

b

base

NOMENCLATURE (Continued)  
Body & Stability Axis System

<u>SYMBOL</u>	<u>SADSAC SYMBOL</u>	<u>DEFINITION</u>
<u>Body Axis System</u>		
$C_N$	CN	normal force coefficient; $F_N/qS$
$C_A$	CA	axial force coefficient; $F_A/qS$
$C_{A_b}$	CAB	base axial force coefficient; $[-1] \left[ \frac{(P_b - P_\infty)}{q} \right] (A_b/S)$
$C_{A_f}$	CAF	forebody axial force coefficient; $C_A - C_{A_b}$
$C_n$	CYN	yawing moment coefficient; $M_Z/qS b_{ref}$
$C_l$	CBL	rolling moment coefficient; $M_X/qS b_{ref}$
<u>Common to Both Axis Systems</u>		
$C_m$	CIM	pitching moment coefficient; $M_Y/qS l_{ref}$
$C_y$	CY	side force coefficient; $F_Y/qS$
<u>Stability Axis System</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; $C_D - C_{D_b}$
$C_n$	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
$\delta$		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
$\delta$		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


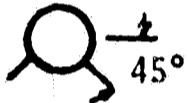

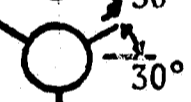
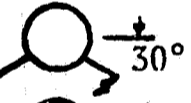

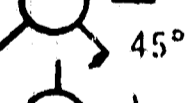
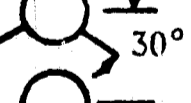
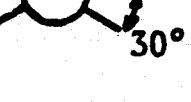
CONFIGURATION INVESTIGATED

BOOSTER BODY: Model 979-160

BODY: Cylindrical Booster and Tank Plus Cone Frustum Nose

	$l$	$d$	$l/d$
B <sub>5</sub>	10.877"	1.333" (Booster)	8.15
B <sub>6</sub>	8.706"	1.333" (Booster)	6.53

FINs:

	CONFIGURATION	EXPOSED AREA PER FIN	AR	SHROUD CONFIG.
V <sub>3.3</sub>		445 sq. ft. (Nominal)	1.14	Small Base Area 38.32 ft. dia. 5° 43' Flare
V <sub>5</sub>		675 sq. ft. (Nominal)	1.746	
V <sub>6</sub>		675 sq. ft.	1.746	Large Base Area 47.53 ft. dia. 12° 54' Flare
V <sub>6.1</sub>		675 sq. ft.	1.746	
V <sub>6.2</sub>		675 sq. ft.	1.746	
V <sub>6.3</sub>		675 sq. ft.	1.746	
V <sub>6.4</sub>		675 sq. ft.	1.746	
V <sub>7</sub>		445 sq. ft.	1.21	
V <sub>7.2</sub>		445 sq. ft.	1.21	



CONFIGURATION INVESTIGATED (Continued)

ORBITER: MSC-040A

	LENGTH	SPAN	INCIDENCE ANGLE	CONFIGURATION
$\phi_1^{-2}$	109.58 ft.	73.5 ft.	-2°	040A $S_V = 380$ sq. ft.
$\phi_2^{-2}$	109.58 ft.	73.5 ft.	-2°	040A $S_V = 485$ sq. ft.
$\phi_3^{-2}$	109.58 ft.	73.5 ft.	-2°	040A Vert. Off

ORBITER LOCATION BEHIND TANK NOSE:

<u>B<sub>5</sub></u>	<u>B<sub>6</sub></u>
23.0 ft.	3.94 ft.

PETALS (BRAKES): Six at 60° on and about the vertical centerline

	LENGTH	$\delta_F$	WIDTH AT BASE EACH
P <sub>1</sub>	26.5 ft.	15°	12.9 ft.

Pertinent geometric dimensions of the model and component parts are presented in Table 3.

## TEST FACILITY DESCRIPTION

The Marshall Space Flight Center 14" x 14" Transonic Wind Tunnel is an intermittent blowdown tunnel which operates by high pressure air flowing from storage to either vacuum or atmospheric conditions. A Mach number range from .2 to 5.85 is covered by utilizing two interchangeable test sections. The transonic section permits testing at Mach 0.20 through 2.50, and the supersonic section permits testing at Mach 2.74 through 5.85. Mach numbers between .2 and .9 are obtained by using a controllable diffuser. The range from .95 to 1.3 is achieved through the use of plenum suction and perforated walls. Mach numbers of 1.44, 1.93 and 2.50 are produced by interchangeable sets of fixed contour nozzle blocks. Above Mach 2.50 a set of fixed contour nozzle blocks are tilted and translated automatically to produce any desired Mach number in .25 increments.

Air is supplied to a 6000 cubic foot storage tank at approximately  $-40^{\circ}\text{F}$  dew point and 500 psi. The compressor is a three-stage reciprocating unit driven by a 1500 hp motor.

The tunnel flow is established and controlled with a servo actuated gate valve. The controlled air flows through the valve diffuser into the stilling chamber and heat exchanger where the air temperature can be controlled from ambient to approximately  $180^{\circ}\text{F}$ . The air then passes through the test section which contains the nozzle blocks and test region.

Downstream of the test section is a hydraulically controlled pitch sector that provides a total angle of attack range of  $20^{\circ}$  ( $\pm 10^{\circ}$ ). Sting offsets are available for obtaining various maximum angles of attack up to  $25^{\circ}$ .

## DATA REDUCTION

Six component aerodynamic force and moment data were recorded using an internal strain gage balance. Base pressures ( $C_{pb\#1}$  and  $C_{pb\#2}$ ) and chamber pressure ( $C_{p_c}$ ) were recorded and utilized to correct the axial force measured data ( $C_{A_T}$ ) to a condition corresponding to free stream pressure acting at the base region.

$$C_{A_T} = C_{A_F} + C_{A_B}$$

$$C_{A_B} = \left( \frac{C_{PB1} + C_{PB2}}{2} \frac{A_B}{S_{ref}} \right) + \left( C_{p_c} \times \frac{A_c}{S_{ref}} \right)$$

$$C_{PB} = \frac{\Delta P_B}{q}$$

$$C_{p_c} = \frac{\Delta P_c}{q}$$

$C_l$  and  $C_D$  were computed based on  $C_{A_F}$ .

DATA REDUCTION DETAILS (Continued)

1. MOMENT REFERENCE CENTER LOCATION

$x = 5.753$  inches from booster base for  $B_5$

$x = 4.353$  inches from booster base for  $B_6$

$y = 0$  inches from centerline of model

$z = 0$  inches from centerline of model

2. MODEL BASE AREAS

$A_B = 2.2868$  square inches       $A_C = .60821$  square inches

3. REFERENCE AREAS

Orbiter Wing = 5.1478 square inches

4. REFERENCE LENGTH

Longitudinal

Lateral

4.426"

2.969"

(Orbiter Length)

(Orbiter Span)

## 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 MSFC	Mr. J. Weaver
NASA AMES	Mr. V. Stevens
TBC	Mr. R. W. Ainsworth

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

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TEST TNT# 523 DATA SET COLLATION SHEET

PRETEST  
 POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD.		PARAMETERS/VALUES	NO. OF RUNS	MACH NUMBERS (OR ALTERNATE INDEPENDENT VARIABLE)										
		2	3			26	27	11	14	274	472					
R5705A	B5 $\phi_1^{-2}$ V6	A	0°	-2°	26	014	017	035	068	069	074	075				
05C	✓	C	C			001	001	003	008	008	003	003				
07C	B5 $\phi_1^{-2}$ V6.2	V	V			004	004	003	004	003	003	003				
07A	✓	A	0°			003	003	003	003	003	003	003				
24A	B5 $\phi_1^{-2}$ P <sub>1</sub>	V	V			005	005	006	006	006	006	006				
06B	B5 $\phi_1^{-2}$ V6.1	0°	B			008	008	008	008	008	008	008				
08B	B5 $\phi_1^{-2}$ V6.3	V	V			008	008	008	008	008	008	008				
08A	✓	A	0°			121	121	121	121	121	121	121				
09A	B5 $\phi_1^{-2}$ V6.4	A	0°			030	030	031	031	031	031	031				
09C	✓	C	C			051	051	051	051	051	051	051				
10C	B5 $\phi_1^{-2}$ V7	V	V			055	055	055	055	055	055	055				
24C	B5 $\phi_1^{-2}$ P <sub>1</sub>	V	C			03B	03B	031	031	031	031	031				
03A	B5 $\phi_1^{-2}$	A	0°			013	013	014	014	014	014	014				
03C	✓	C	C			013	013	014	014	014	014	014				
01A	B5	A	0°			039	039	039	039	039	039	039				
13A	B5V6	V	V			041	041	041	041	041	041	041				
13C	✓	0°	C			017	017	016	016	016	016	016				
14C	B5V6.2	V	V			015	015	015	015	015	015	015				
14A	✓	A	0°			047	047	045	045	045	045	045				

1 CLM 7 FN 13 ICY 19 EEL 25 EYN 31 EAF 37 EAB 43 EPC 49 IC 55 IDP 61 67 7576

COEFFICIENTS:  
 A =  $\phi_1^{-2}$  B =  $\phi_2^{-2}$  C =  $\phi_3^{-2}$  V =  $\phi_4^{-2}$  P =  $\phi_5^{-2}$  0° =  $\phi_6^{-2}$  0° =  $\phi_7^{-2}$  0° =  $\phi_8^{-2}$  0° =  $\phi_9^{-2}$  0° =  $\phi_{10}^{-2}$

SCHEDULES  
 A or B  
 A =  $\phi_1^{-2}$  B =  $\phi_2^{-2}$  C =  $\phi_3^{-2}$  V =  $\phi_4^{-2}$  P =  $\phi_5^{-2}$  0° =  $\phi_6^{-2}$  0° =  $\phi_7^{-2}$  0° =  $\phi_8^{-2}$  0° =  $\phi_9^{-2}$  0° =  $\phi_{10}^{-2}$

IDPVAR(1) IDPVAR(2) NDV



TABLE 1 (Continued)

TEST TWT 523 DATA SET COLLATION SHEET

SHEET 2

PRETEST  
 POSTTEST

DATA SET IDENTIFIER	CONFIGURATION	SCHD.		PARAMETERS/VALUES	NO. of RUNS	MACH NUMBERS (OR ALTERNATE INDEPENDENT VARIABLE)										
		A	B			0.6	0.7	1.1	1.6	2.74	4%					
857153	S-V <sub>2,3</sub>	C	B	-	0.6	0.6	0.7	1.1	1.6	2.74	4%					
16C	B5 V <sub>6.4</sub>	V	C	1		0.6	0.7	1.1	1.6	2.74	4%					
16A	V	A	C	1		0.6	0.7	1.1	1.6	2.74	4%					
18A	B5 V <sub>7.2</sub>	V	C	1		0.6	0.7	1.1	1.6	2.74	4%					
17C	B5 V <sub>7</sub>	C	C	1		0.6	0.7	1.1	1.6	2.74	4%					
19C	B5 Φ <sub>1</sub> <sup>-2</sup> V <sub>7.2</sub>	C	V	-2		0.6	0.7	1.1	1.6	2.74	4%					
19A	V	A	C	1		0.6	0.7	1.1	1.6	2.74	4%					
18C	B5 V <sub>7.2</sub>	C	C	-		0.6	0.7	1.1	1.6	2.74	4%					
19G	B5 Φ <sub>1</sub> <sup>-2</sup> V <sub>7.2</sub>	-C	V	-2		0.6	0.7	1.1	1.6	2.74	4%					
07G	B5 Φ <sub>1</sub> <sup>-2</sup> V <sub>6.2</sub>	V	V	V		0.6	0.7	1.1	1.6	2.74	4%					
20C	B-Φ <sub>2</sub> <sup>-2</sup> V <sub>7.2</sub>	C	V	V		0.6	0.7	1.1	1.6	2.74	4%					
21C	B5 Φ <sub>3</sub> <sup>-2</sup> V <sub>7.2</sub>	V	V	V		0.6	0.7	1.1	1.6	2.74	4%					
12C	B <sub>6</sub> Φ <sub>1</sub> <sup>-2</sup> V <sub>5</sub>	C	C	-2		0.6	0.7	1.1	1.6	2.74	4%					
12A	V	A	C	1		0.6	0.7	1.1	1.6	2.74	4%					
11A	B <sub>6</sub> Φ <sub>1</sub> <sup>-2</sup> V <sub>3.3</sub>	V	V	1		0.6	0.7	1.1	1.6	2.74	4%					
11C	V	C	C	1		0.6	0.7	1.1	1.6	2.74	4%					
22C	B <sub>6</sub> Φ <sub>2</sub> <sup>-2</sup> V <sub>3.3</sub>	V	V	V		0.6	0.7	1.1	1.6	2.74	4%					
23C	B <sub>6</sub> Φ <sub>2</sub> <sup>-2</sup> V <sub>5</sub>	V	V	V		0.6	0.7	1.1	1.6	2.74	4%					

COEFFICIENTS: \_\_\_\_\_  
 n or B \_\_\_\_\_  
 SCHEDULES \_\_\_\_\_  
 SEE SHEET No. 1  
 IDPVAR(1) | IDPVAR(2) | NDV

## TEST CONDITIONS

Table 2 presents the range of test conditions for which data were recorded. The model was mounted on an internal balance and supported on a straight sting. An offset sting was used to obtain fixed angles of  $\alpha$  for some sideslip runs. Pitch runs were made with the model upright, while sideslip runs were made in the pitch plane with the model, balance, and sting rolled  $90^\circ$ . Pitch data were obtained from  $\alpha = -10^\circ$  to  $+10^\circ$  at zero angle of sideslip, and yaw data were obtained from  $\beta = -10^\circ$  to  $+10^\circ$  at zero degrees and  $-6$  degrees angle of attack.

Boundary layer trip strips were located on the model as shown in Figure . No. 180 grit (0.0035") was used for all Mach numbers. Schlieren and shadowgraph photographs were taken for selected Mach numbers.

Base pressures were measured for two positions at the base of the model located approximately 4 o'clock and 10 o'clock when viewing the model from the rear. Whenever possible one tube was placed behind a fin location. Balance chamber pressure was also measured. The orbiter was set at  $-2$  degrees incidence for all launch configurations. MSFC Balance #227 was used throughout the test.



TABLE 2

TEST CONDITIONS  
TEST TWI # 523

MACH NUMBER	REYNOLDS NUMBER per unit length	DYNAMIC PRESSURE (pounds/sq. inch)	STAGNATION TEMPERATURE (degrees Fahrenheit)
0.60	5.0	4.3	100°F (Nominal)
0.90	6.3	7.4	"
1.1	6.7	8.7	"
1.46	7.4	10.8	"
2.74	4.6	6.4	140°F (Nominal)
4.96	5.2	3.2	"

BALANCE UTILIZED: #227

CAPACITY:

- NF 125 lbs (at gages)
- SF 45 lbs
- AF 25 lbs
- PM 500 in.lbs.
- YM 100 in.lbs.
- RM 50 in.lbs.

ACCURACY:

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

COEFFICIENT  
TOLERANCE:

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

COMMENTS:

TABLE 3

MODEL COMPONENT: BODY - B5

GENERAL DESCRIPTION: 0.003366 SCALE BOOSTER BODY

DRAWING NUMBER: \_\_\_\_\_

<u>DIMENSIONS:</u>	<u>THEORETICAL</u>		<u>ACTUAL MEASURED</u>
	<u>FULL-SCALE</u> <u>FT/FT<sup>2</sup></u>	<u>MODEL SCALE</u> <u>IN/IN<sup>2</sup></u>	<u>MODEL SCALE</u> <u>IN/IN<sup>2</sup></u>
Length	<u>269.29</u>	<u>10.877</u>	<u>10.878</u>
Max. Width	<u>47.5</u>	<u>1.919</u>	<u>1.917</u>
Max. Depth	<u>47.5</u>	<u>1.919</u>	<u>1.917</u>
Fineness Ratio (Flare Dia)	<u>5.66</u>	<u>5.66</u>	<u>5.67</u>
Area			
Max. Cross-Sectional	<u>177.14</u>	<u>2.89</u>	<u>2.88</u>
Planform	<u>                    </u>	<u>                    </u>	<u>                    </u>
Wetted	<u>                    </u>	<u>                    </u>	<u>                    </u>
Base	<u>                    </u>	<u>                    </u>	<u>                    </u>

TABLE 3 (Continued)

MODEL COMPONENT: BODY - B6

GENERAL DESCRIPTION: 0.003366 SCALE BOOSTER BODY

DRAWING NUMBER: \_\_\_\_\_

<u>DIMENSIONS:</u>	<u>THEORETICAL</u>		<u>ACTUAL MEASURED</u>
	<u>FULL-SCALE</u> <u>FT/FT<sup>2</sup></u>	<u>MODEL SCALE</u> <u>IN/IN<sup>2</sup></u>	<u>MODEL SCALE</u> <u>IN/IN<sup>2</sup></u>
Length	<u>215.54</u>	<u>8.706</u>	<u>8.709</u>
Max. Width	<u>38.32</u>	<u>1.548</u>	<u>1.543</u>
Max. Depth	<u>38.32</u>	<u>1.548</u>	<u>1.543</u>
Fineness Ratio (Flare Dia)	<u>5.624</u>	<u>5.624</u>	<u>5.642</u>
Area			
Max. Cross-Sectional	<u>115.23</u>	<u>1.88</u>	<u>1.869</u>
Planform	<u>          </u>	<u>          </u>	<u>          </u>
Wetted	<u>          </u>	<u>          </u>	<u>          </u>
Base	<u>          </u>	<u>          </u>	<u>          </u>

TABLE 3 (Continued)

MODEL COMPONENT: ORBITER - O1

GENERAL DESCRIPTION: 0.003366 Scale Model of MSC Orbiter 040A

DRAWING NUMBER: \_\_\_\_\_

<u>DIMENSIONS:</u>	<u>THEORETICAL</u>		<u>ACTUAL MEASURED</u>
	<u>FULL-SCALE</u>	<u>MODEL SCALE</u>	<u>MODEL SCALE</u>
Area	_____	_____	_____
Span (equivalent)	<u>73.5 ft</u>	<u>2.969 in</u>	<u>2.998 in</u>
Inb'd Exposed chord	<u>58.35 ft</u>	<u>2.357 in</u>	<u>2.357 in</u>
Outb'd equivalent chord	_____	_____	_____
Body length	<u>109.58 ft</u>	<u>4.443 in</u>	<u>4.503 in</u>
Body width	<u>16.76 ft.</u>	<u>0.677 in</u>	<u>0.677 in</u>
Sweep Back Angles, degrees			
Leading Edge	<u>60°</u>	<u>60°</u>	<u>60°</u>
Tailing Edge	<u>-10.5°</u>	<u>-10.5°</u>	<u>-10.5°</u>
Incidence angle	<u>+2°</u>	<u>+2°</u>	<u>+2°</u>
Vertical tail area	<u>380 ft<sup>2</sup></u>	<u>0.62 in<sup>2</sup></u>	<u>0.62 in<sup>2</sup></u>

TABLE 3 (Continued)

MODEL COMPONENT: ORBITER - O<sub>2</sub>

GENERAL DESCRIPTION: 0.003366 SCALE MODEL OF MSC ORBITER 040A  
(Modified)

DRAWING NUMBER: \_\_\_\_\_

DIMENSIONS:

	<u>THEORETICAL</u>		<u>ACTUAL MEASURED</u>
	<u>FULL-SCALE</u>	<u>MODEL SCALE</u>	<u>MODEL SCALE</u>
Area	_____	_____	_____
Span (equivalent)	<u>73.5 ft</u>	<u>2.969 in</u>	<u>2.998 in</u>
Inb'd exposed chord	<u>58.35 ft</u>	<u>2.357 in</u>	<u>2.357 in</u>
Outb'd equivalent chord	_____	_____	_____
Body Length	<u>109.58 ft</u>	<u>4.443 in.</u>	<u>4.503 in</u>
Body Width	<u>16.76 ft</u>	<u>0.677 in</u>	<u>0.677 in</u>
Sweep Back Angles, degrees			
Leading Edge	<u>60°</u>	<u>60°</u>	<u>60°</u>
Tailing Edge	<u>0°</u>	<u>0°</u>	<u>0°</u>
Incidence angle	<u>+2°</u>	<u>+2°</u>	<u>+2°</u>
Vertical tail area	<u>485 ft<sup>2</sup></u>	<u>0.7913 in<sup>2</sup></u>	<u>0.776 in<sup>2</sup></u>

TABLE 3 (Continued)

MODEL COMPONENT: ORBITER - O3

GENERAL DESCRIPTION: 0.003366 SCALE MODEL OF MSC ORBITER 040A

(MODIFIED) (Same as Orbiter O2 with Vertical  
Tail Removed)

DRAWING NUMBER:

DIMENSIONS:

	THEORETICAL		ACTUAL MEASURED
	FULL-SCALE	MODEL SCALE	MODEL SCALE
Area	<u>                    </u>	<u>                    </u>	<u>                    </u>
Span (equivalent)	<u>73.5 ft</u>	<u>2.969 in</u>	<u>2.998 in</u>
Inb'd Exposed Chord	<u>58.35 ft</u>	<u>2.357 in</u>	<u>2.357 in</u>
Outb'd equivalent chord	<u>                    </u>	<u>                    </u>	<u>                    </u>
Body length	<u>109.58 ft</u>	<u>4.443 in</u>	<u>4.503 in</u>
Body width	<u>16.76 ft</u>	<u>0.677 in</u>	<u>0.677 in</u>
Sweep Back Angles, degrees			
Leading Edge	<u>60°</u>	<u>60°</u>	<u>60°</u>
Tailing Edge	<u>0°</u>	<u>0°</u>	<u>0°</u>
Incidence angle	<u>+2°</u>	<u>+2°</u>	<u>+2°</u>
Vertical tail area	<u>0</u>	<u>0</u>	<u>0</u>

TABLE 3 (Continued)

MODEL COMPONENT: FIN V3.3  
 GENERAL DESCRIPTION: Three Trapezoidal Fins, Conical Leading Edge, Flat Constant t/c Section Tapered to Tip, 120° Apart, One Fin Up

DRAWING NUMBER: AX 1233-5, -8

DIMENSIONS:	THEORETICAL		ACTUAL MEASURED
	TOTAL DATA	FULL-SCALE	MODEL SCALE
Area			
Planform			
Wetted			
Span (equivalent)			
Aspect Ratio			
Rate of Taper			
Taper Ratio			
Diehedral Angle, degrees			
Incidence Angle, degrees			
Aerodynamic Twist, degrees			
Toe-In Angle			
Cant Angle			
Sweep Back Angles, degrees			
Leading Edge	37°30'	37°30'	37°30'
Trailing Edge	0°	0°	0°
0.25 Element Line			
Chords:			
Root (Wing Sta. 0.0)			
Tip, (equivalent)			
MAC			
Fus. Sta. of .25 MAC			
W.P. of .25 MAC			
B.L. of .25 MAC			
Airfoil Section			
Root			
Tip			
<u>EXPOSED DATA (Each)</u>			
Area sq. ft./sq. in.	418	0.6826	0.686
Span, (equivalent)	23.99	0.969	0.976
Aspect Ratio		1.14	
Taper Ratio			
Chords			
Root	28.12	1.136	1.142
Tip	9.73	0.393	0.385
MAC			
Fus. Sta. of .25 MAC			
W.P. of .25 MAC			
B.L. of .25 MAC			

NOTE: Fin Trailing Edge Aligned with Body Base Station

TABLE 3 (Continued)

MODEL COMPONENT: Fin V<sub>5</sub> (V<sub>6</sub> Fin with Small Base Flare)

GENERAL DESCRIPTION: Two Trapezoidal Fins, Conical Leading Edge, Flat  
Constant t/c Section Tapered to Tip, 45° Below the Horizontal on Each  
Side of the Base Flare

DRAWING NUMBER: AX 1233-20-5

DIMENSIONS:	THEORETICAL		ACTUAL MEASURED
	TOTAL DATA	FULL-SCALE	MODEL SCALE
Area			
Planform			
Wetted			
Span (equivalent)			
Aspect Ratio			
Rate of Taper			
Taper Ratio			
Diehedral Angle, degrees			
Incidence Angle, degrees			
Aerodynamic Twist, degrees			
Toe-In Angle			
Cant Angle			
Sweep Back Angles, degrees			
Leading Edge	30°	30°	30°
Trailing Edge	0°	0°	0°
0.25 Element Line			
Chords:			
Root (Wing Sta. 0.0)			
Tip, (equivalent)			
MAC			
Fus. Sta. of .25 MAC			
W.P. of .25 MAC			
B.L. of .25 MAC			
Airfoil Section			
Root			
Tip			
EXPOSED DATA (Each)			
Area sq.ft./sq. in.	750	1.2242	1.235
Span, (equivalent)	37.95	1.533	1.535
Aspect Ratio		1.746	
Taper Ratio			
Chords			
Root	31.66	1.279	1.282
Tip	9.75	0.394	0.403
MAC			
Fus. Sta. of .25 MAC			
W.P. of .25 MAC			
B.L. of .25 MAC			

NOTE: Fin Trailing Edge Aligned with Body Base Station



TABLE 3 (Continued)

MODEL COMPONENT: FIN V<sub>6</sub> (V<sub>6.1</sub>, V<sub>6.2</sub>, V<sub>6.3</sub>, V<sub>6.4</sub>)  
 GENERAL DESCRIPTION: Trapezoidal Fin, Conical Leading Edge, Flat Contoured  
t/c Section Tapered to Tip  
(See Configuration Nomenclature for Fin Arrangements)

DRAWING NUMBER: AX 1233-16, -20

DIMENSIONS:	THEORETICAL		ACTUAL MEASURED
	TOTAL DATA	FULL-SCALE	MODEL SCALE
Area			
Planform			
Wetted			
Span (equivalent)			
Aspect Ratio			
Rate of Taper			
Taper Ratio			
Diehedral Angle, degrees			
Incidence Angle, degrees			
Aerodynamic Twist, degrees			
Toe-In Angle			
Cant Angle			
Sweep Back Angles, degrees			
Leading Edge	30°	30°	30°15'
Trailing Edge	0°	0°	0°
0.25 Element Line			
Chords:			
Root (Wing Sta. 0.0)			
Tip, (equivalent)			
MAC			
Fus. Sta. of .25 MAC			
W.P. of .25 MAC			
B.L. of .25 MAC			
Airfoil Section			
Root			
Tip			
EXPOSED DATA (Each)			
Area sq. ft./sq. in.	668	1.0906	1.105
Span, (equivalent)	37.95	1.533	1.534
Aspect Ratio		1.746	
Taper Ratio			
Chords			
Root	31.66	1.279	1.284
Tip	9.75	0.394	0.402
MAC			
Fus. Sta. of .25 MAC			
W.P. of .25 MAC			
B.L. of .25 MAC			

NOTE: Fin Trailing Edge Aligned with Body Base Station

TABLE 3 (Continued)

MODEL COMPONENT: Fin V7 (V7.2)  
 GENERAL DESCRIPTION: Trapezoidal Fins, Conical Leading Edge, Flat Constant t/c Section Tapered to Tip  
V7 = 3 fins 120° apart one vertical up  
V7 2 = V7 less top vertical fin (2)

DRAWING NUMBER: AX 1233-17, -20

DIMENSIONS:	THEORETICAL		ACTUAL MEASURED
	FULL-SCALE	MODEL SCALE:	MODEL SCALE
<b>TOTAL DATA</b>			
Area			
Planform			
Wetted			
Span (equivalent)			
Aspect Ratio			
Rate of Taper			
Taper Ratio			
Diehedral Angle, degrees			
Incidence Angle, degrees			
Aerodynamic Twist, degrees			
Toe-In Angle			
Cant Angle			
Sweep Back Angles, degrees			
Leading Edge	43°22'	43°22'	44°15'
Trailing Edge	0°	0°	0°
0.25 Element Line			
Chords:			
Root (Wing Sta. 0.0)			
Tip, (equivalent)			
MAC			
Fus. Sta. of .25 MAC			
W.P. of .25 MAC			
B.L. of .25 MAC			
Airfoil Section			
Root			
Tip			
<b>EXPOSED DATA (Each)</b>			
Area sq.ft./sq.in.	363	0.592	0.584
Span, (equivalent)	23.19	0.937	0.932
Aspect Ratio		1.210	
Taper Ratio			
Chords			
Root	31.66	1.279	1.270
Tip	9.75	0.394	0.386
MAC			
Fus. Sta. of .25 MAC			
W.P. of .25 MAC			
B.L. of .25 MAC			

NOTE: Fin Trailing Edge Aligned with Body Base Station

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FIGURE 2	Press Feb Booster/040A Orbiter 0.003366 Scale AX 1233 Model
FIGURE 3	MSC-040A Orbiter 0.003366 Scale Model
FIGURE 4	Body, B <sub>6</sub>
FIGURE 5	Shroud/Fin Details 0.003366 Scale AX 1233I-1 Model
FIGURE 6	Shroud/Fin Details 0.003366 Scale AX 1233I-1 Model
FIGURE 7	Petal Details 0.003366 Scale AX 1233I-1 Model
FIGURE 8	Trip Strip 0.003366 Scale Model AX 1233I-1

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Lateral-Directional Stability	(B501-2V7.2)	72
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- 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.

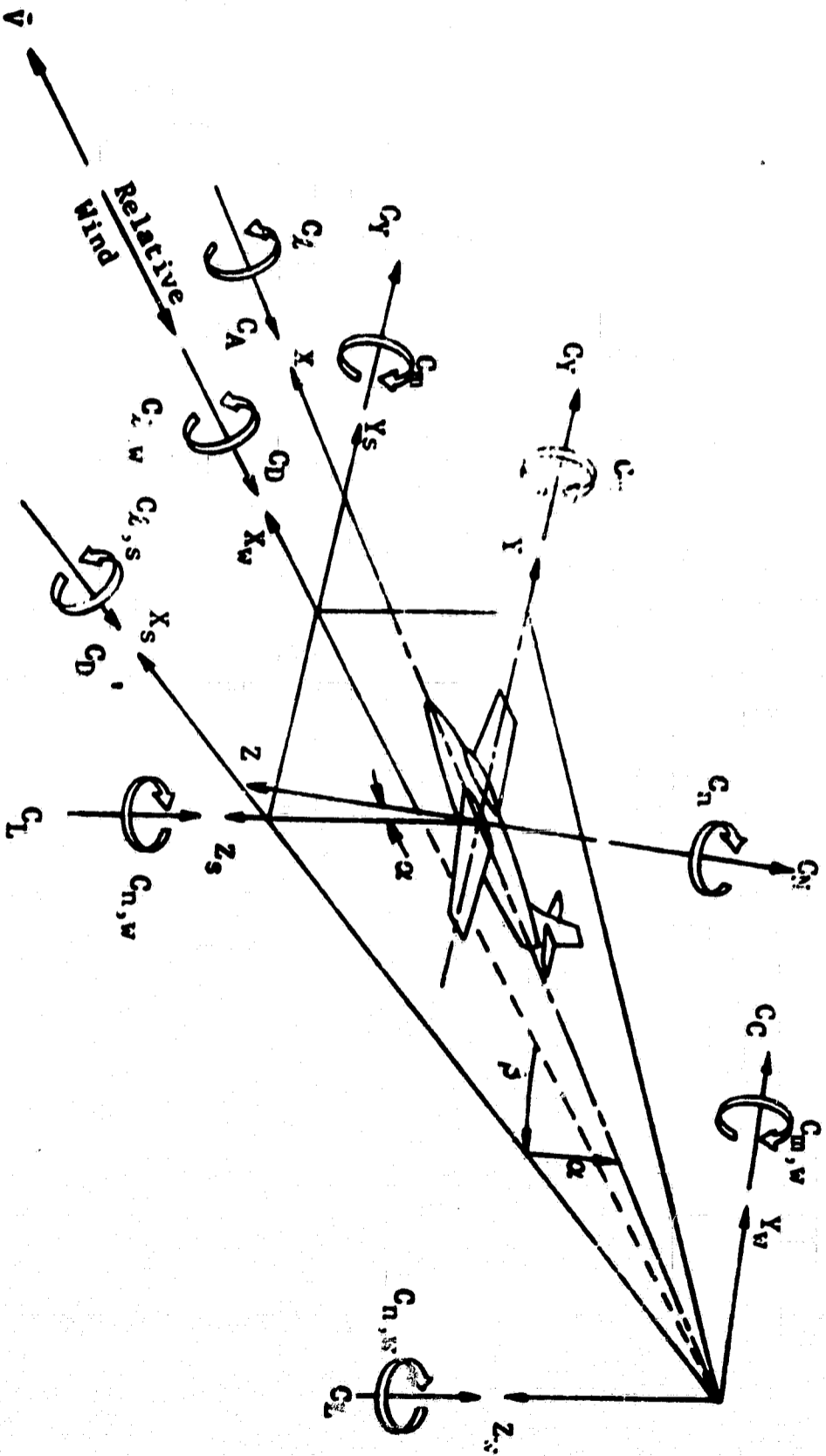


Figure 1. Axis systems, showing direction and sense of force and moment coefficients, angle of attack, and sideslip angle

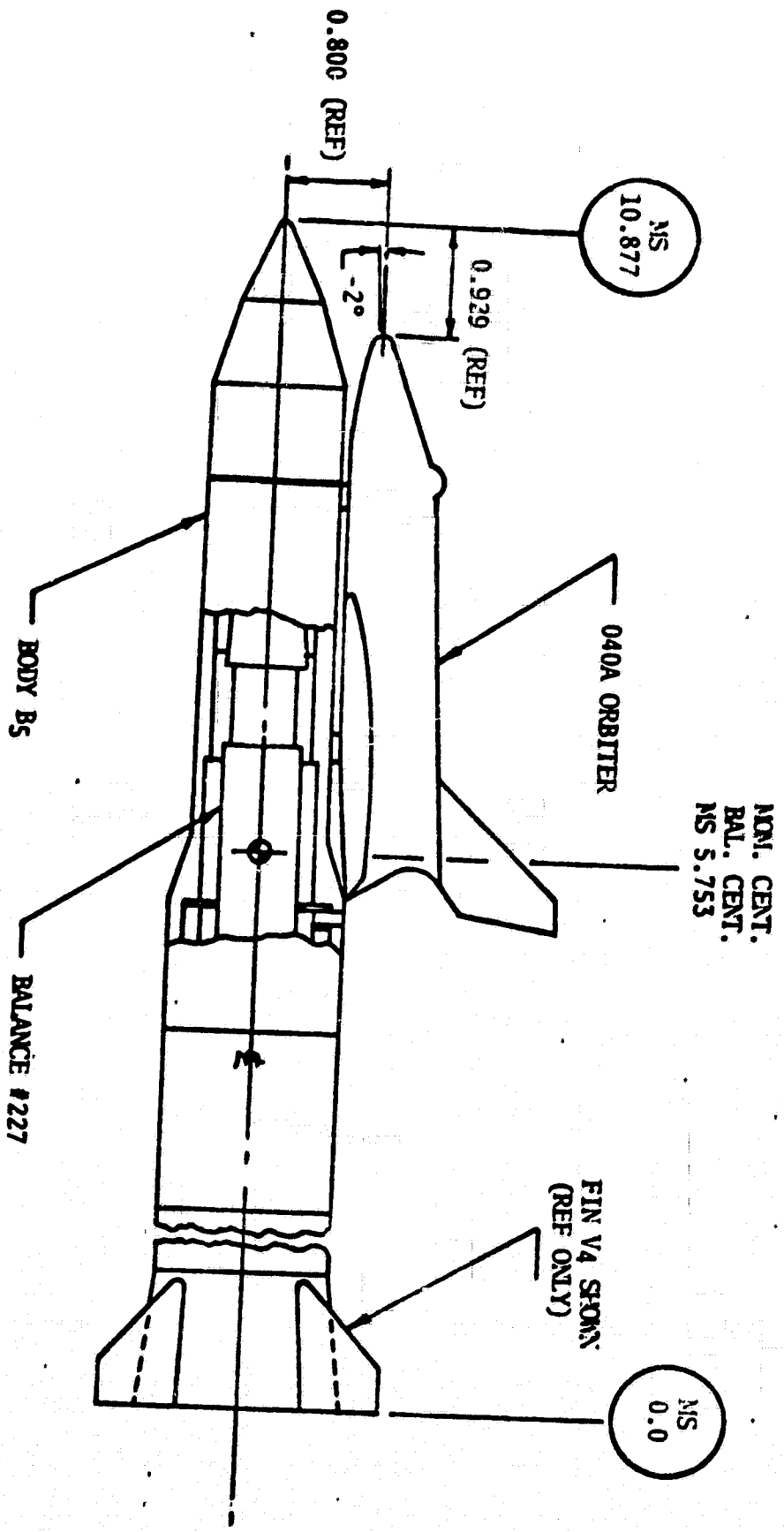


FIGURE 2 - PRESSURE FED BOOSTER/040A ORBITER  
 0.003366 SCALE AX 1233 MODEL

S = 5.1478 sq.in. (3155.3 sq.ft.)  
 4LONG = 4.426 in. (109.58 ft)  
 bLAT = 2.969 in. (73.5 ft)

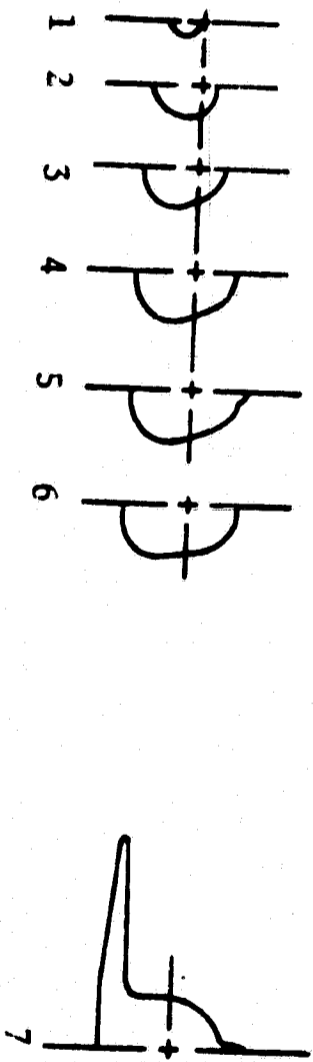
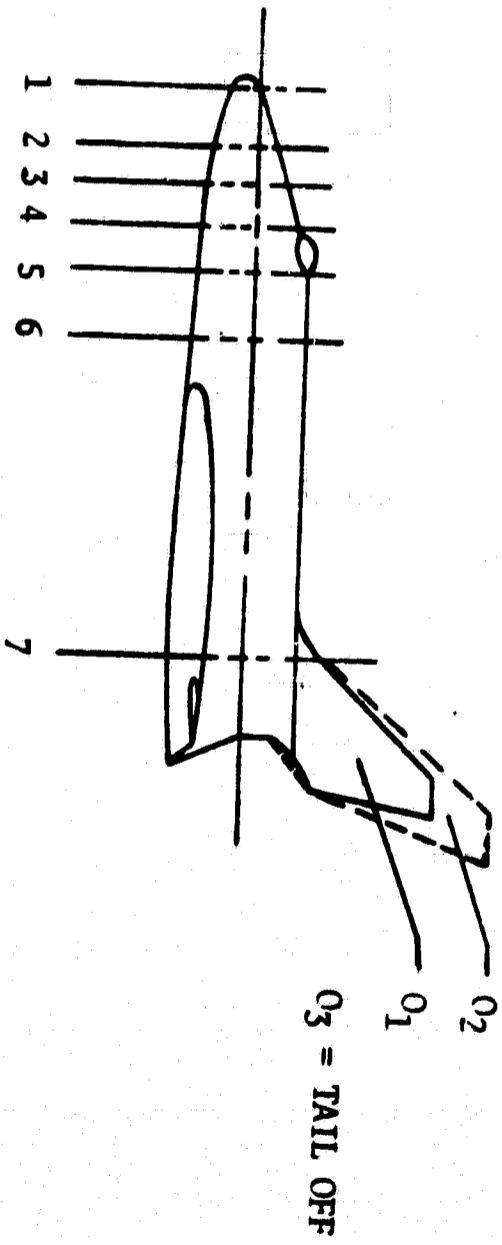
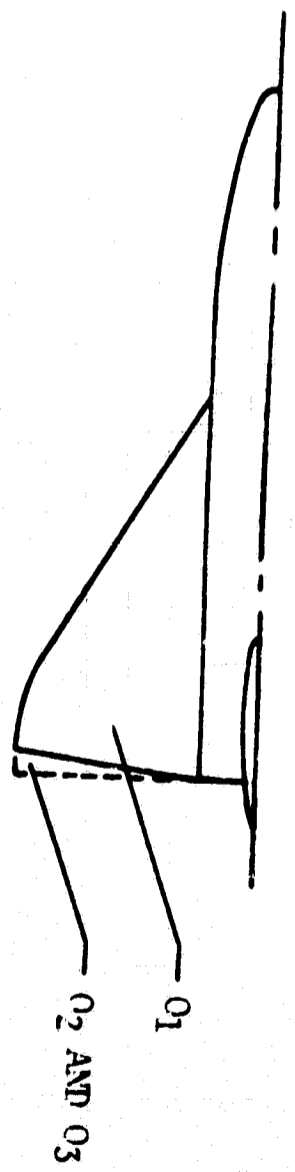


FIGURE 3 - MSC-040A ORBITER  
0.003366 Scale Model



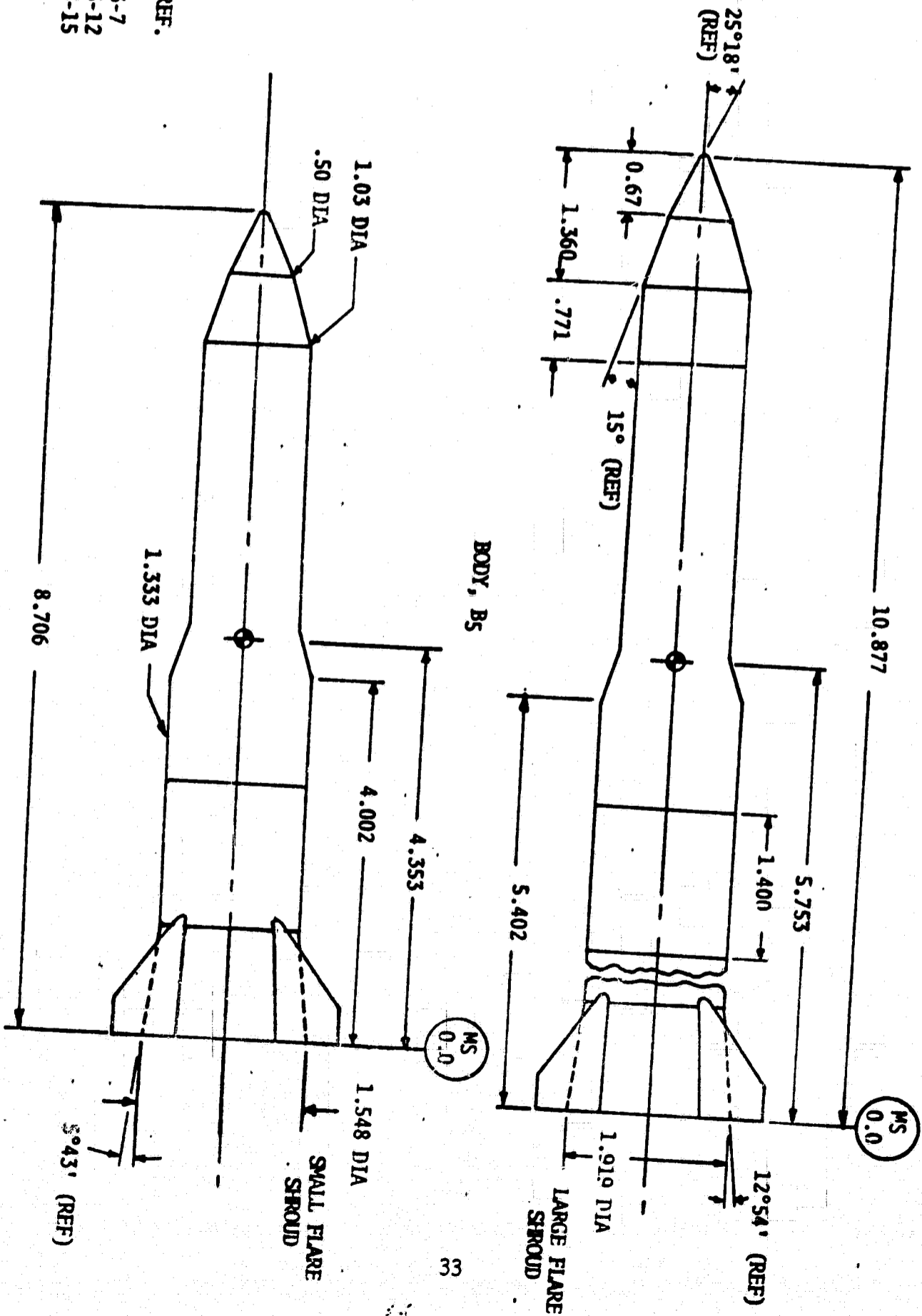


FIGURE 4 - BODY, B<sub>6</sub>

DMC. REF.  
 1233-7  
 1233-12  
 1233-15

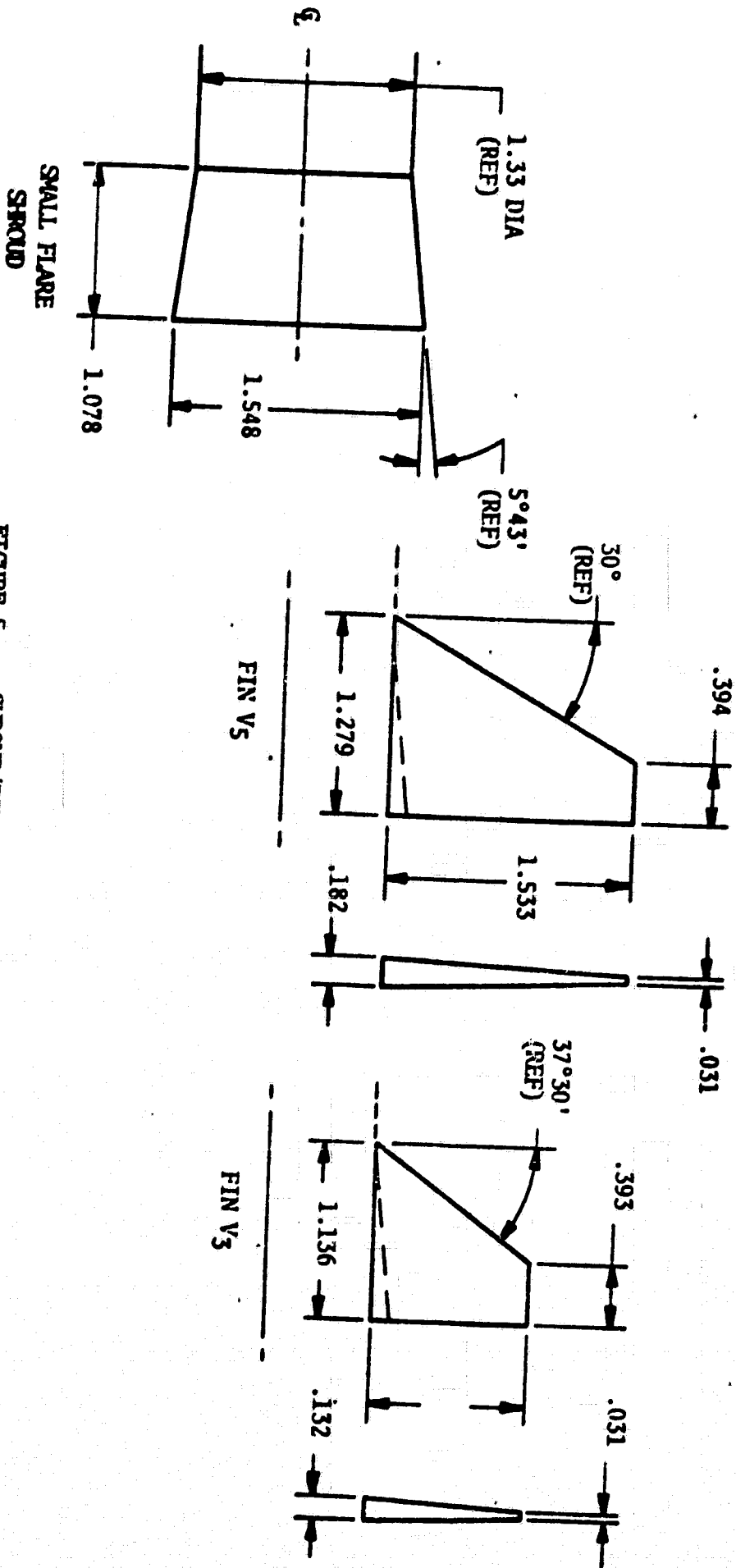


FIGURE 5 - SPROUD/FIN DETAILS  
0.003366 SCALE AX 1235T-1 MODEL

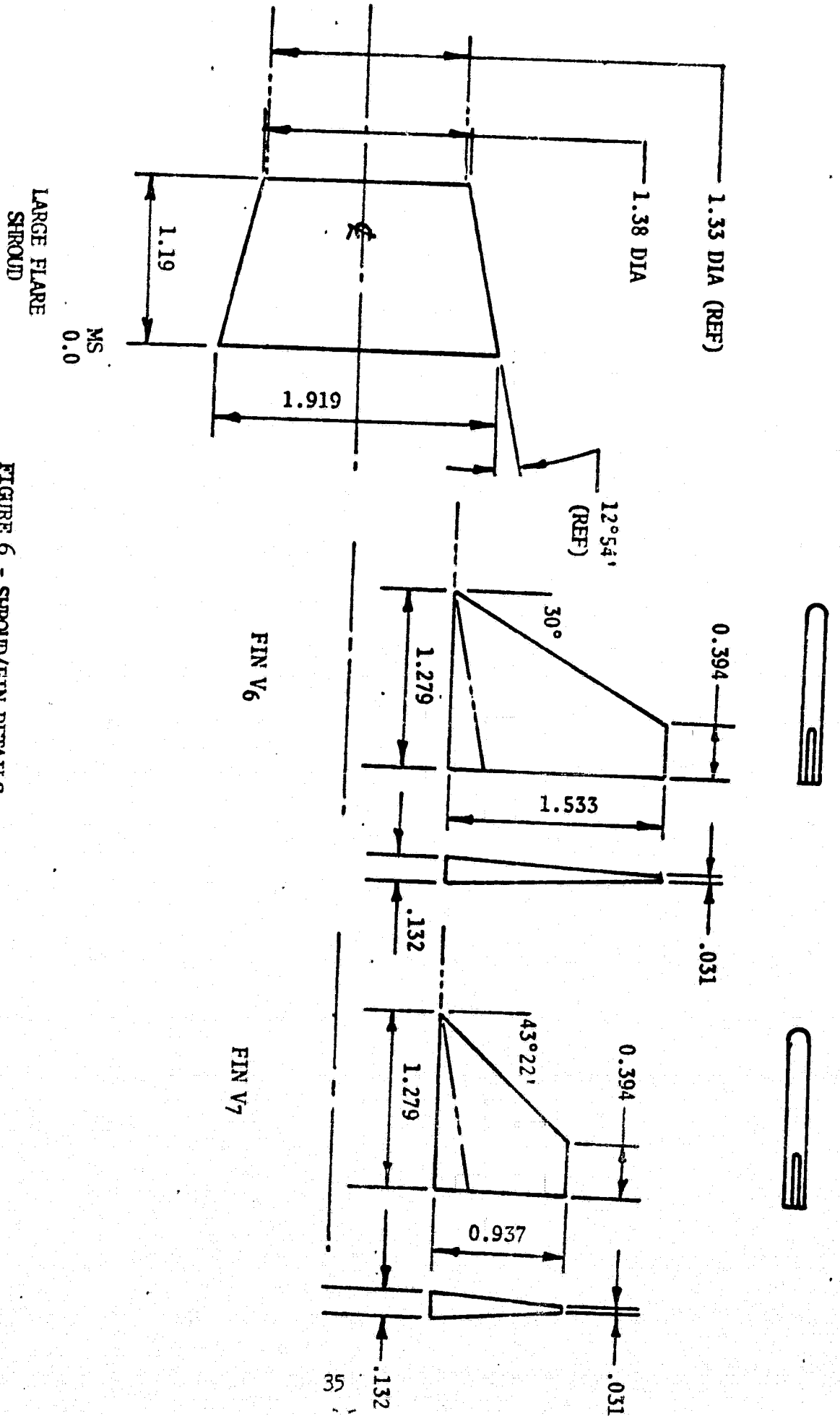


FIGURE 6 - SHROUD/FIN DETAILS  
 0.003366 SCALE AX 1233I-1 MODEL

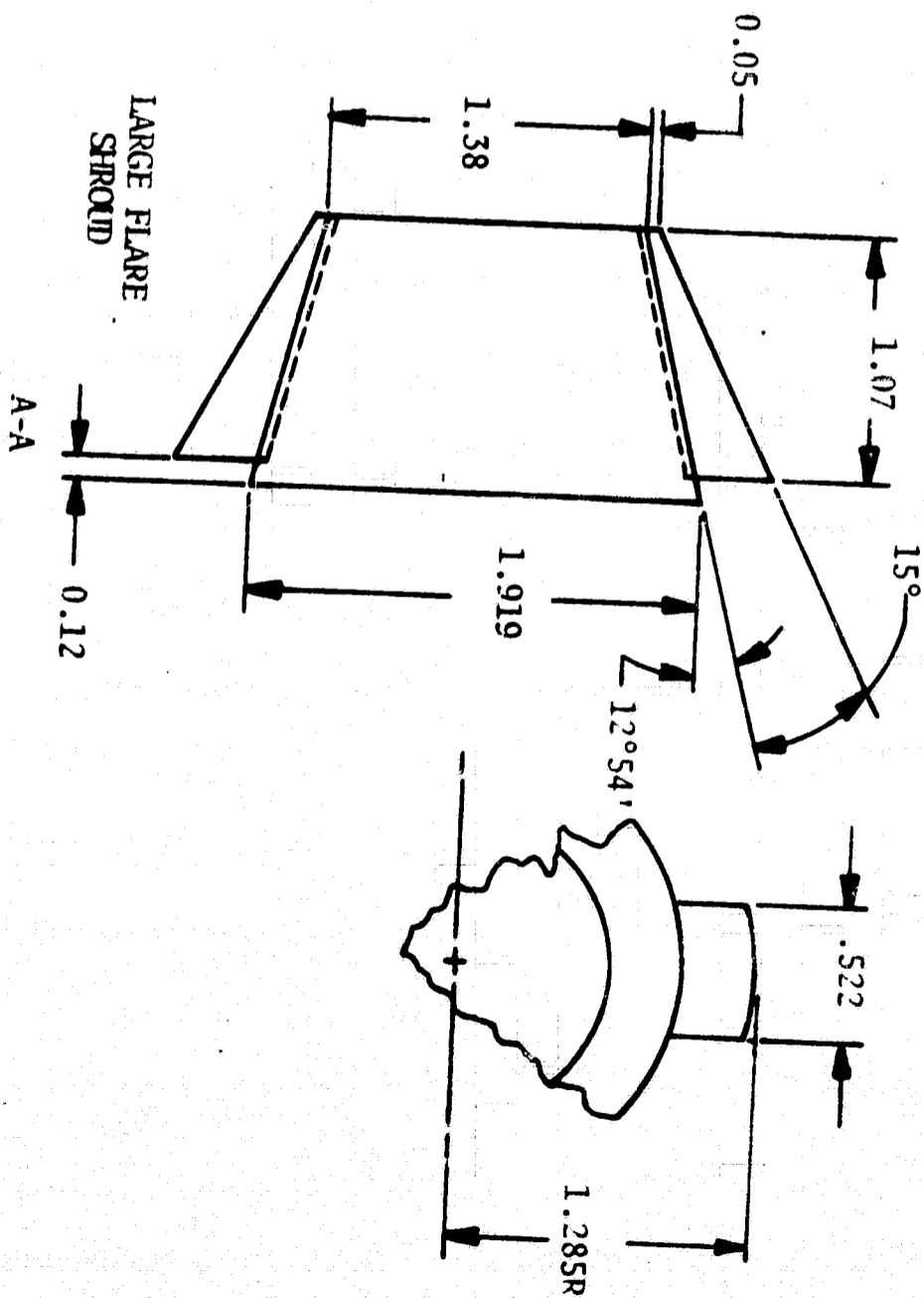
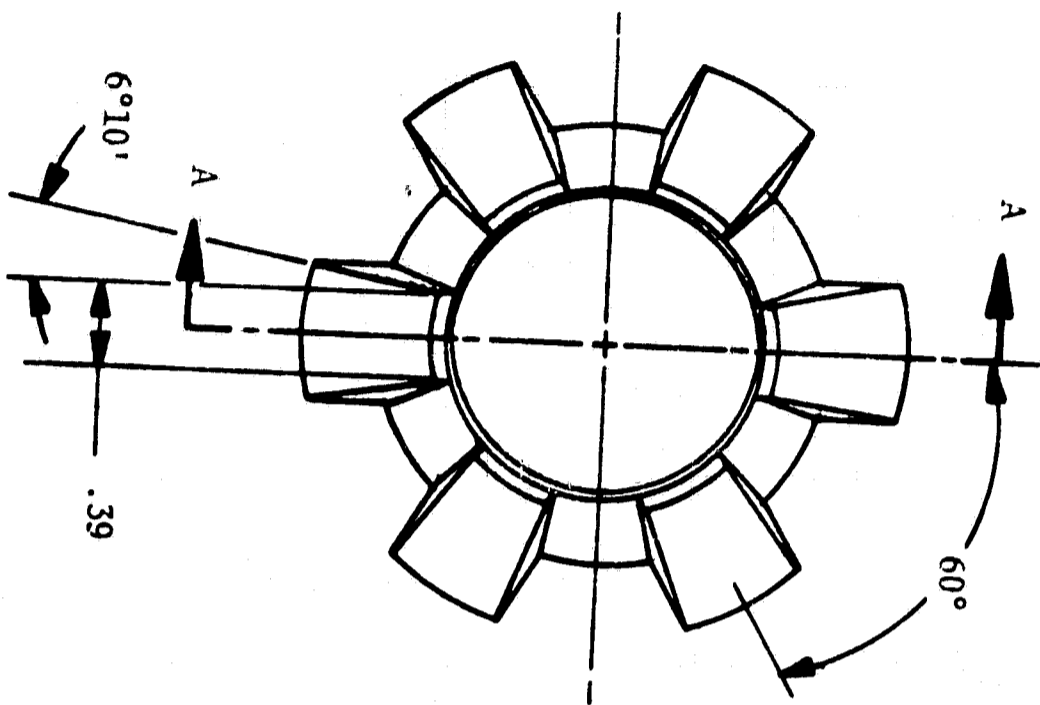
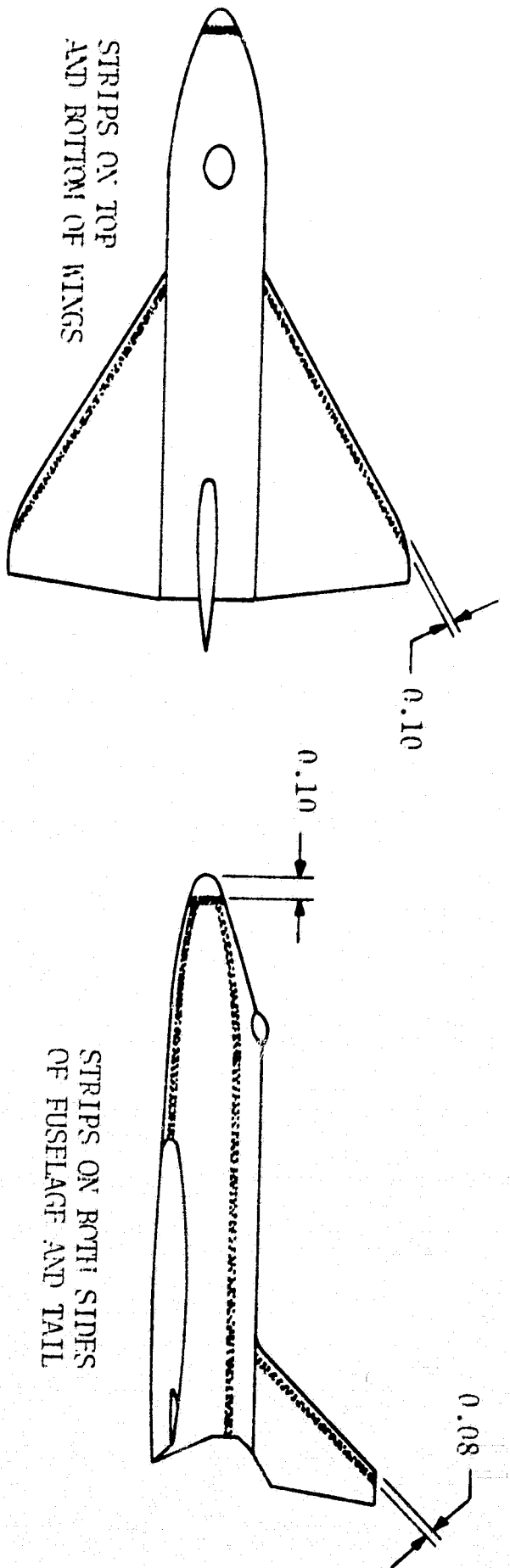


FIGURE 7 - PETAL DETAILS  
 0.003366 SCALE AX 12331-1 MODEL



NO. 180 GRIT USED FOR ALL TRIP STRIPS  
 ALL STRIPS 0.05 TO 0.07 WIDE

CENTRAL  
 VERTICAL

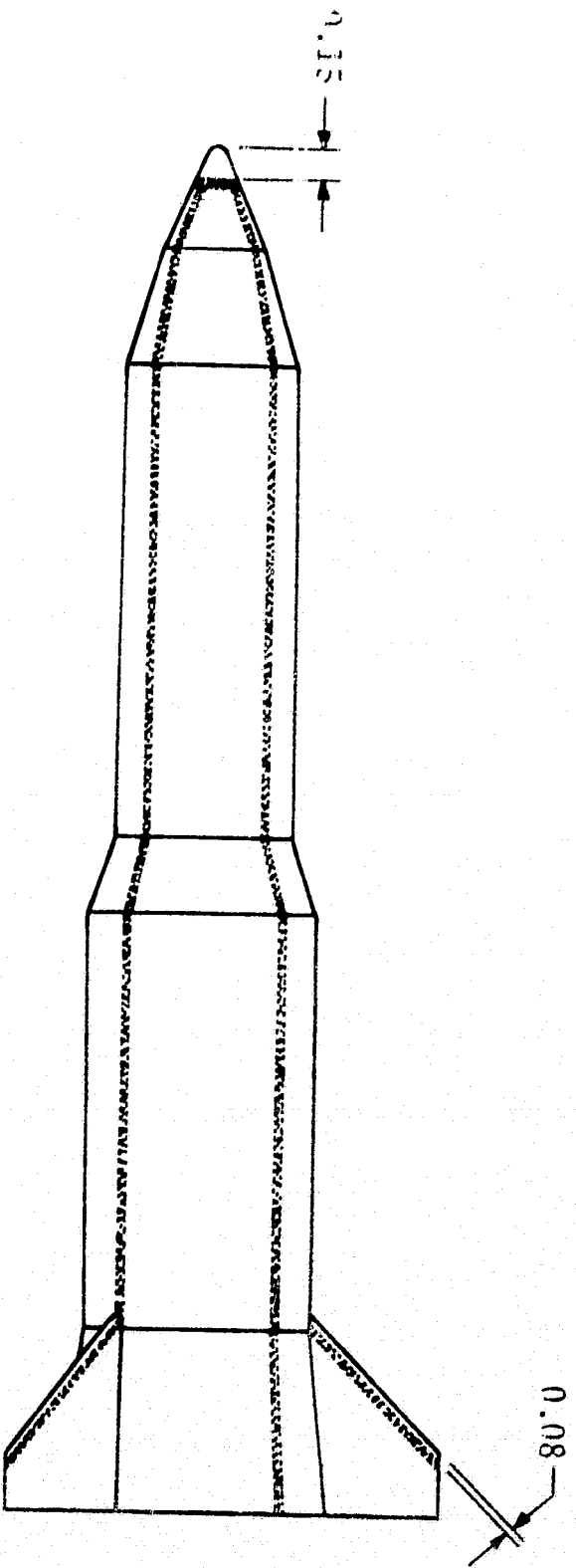
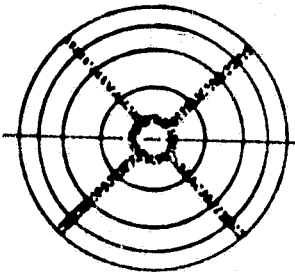
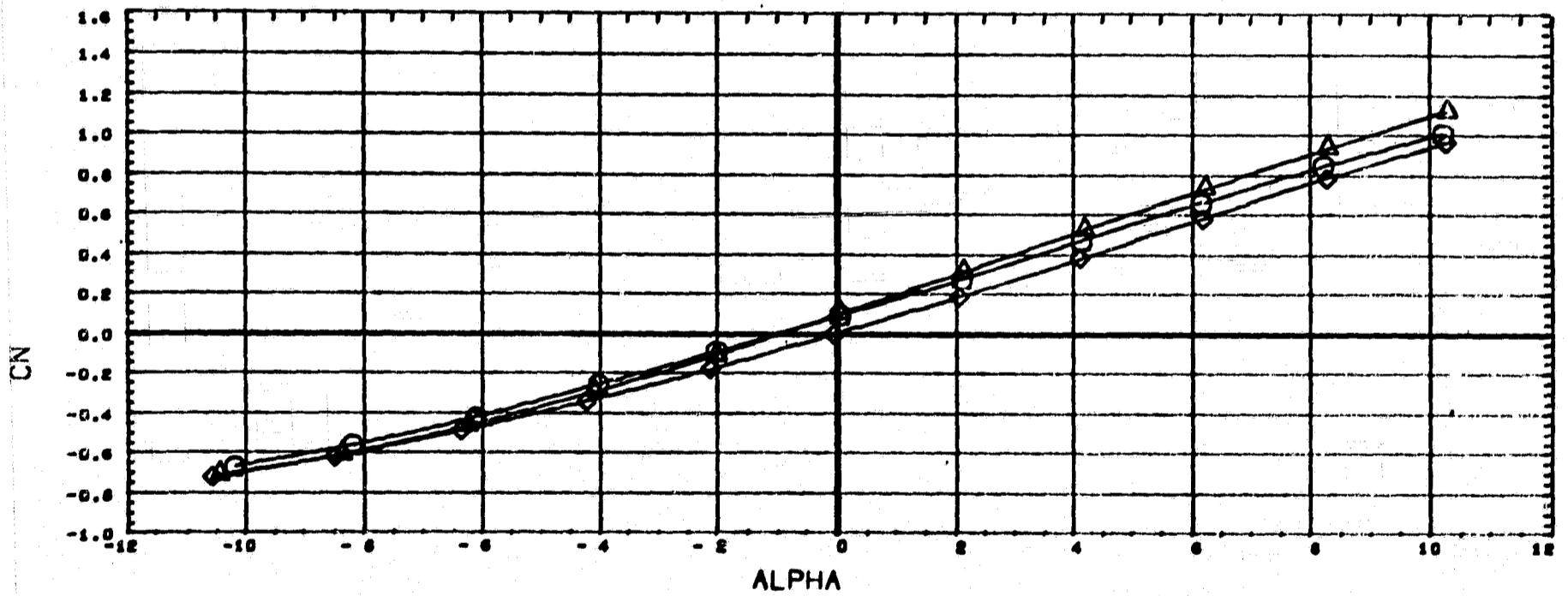
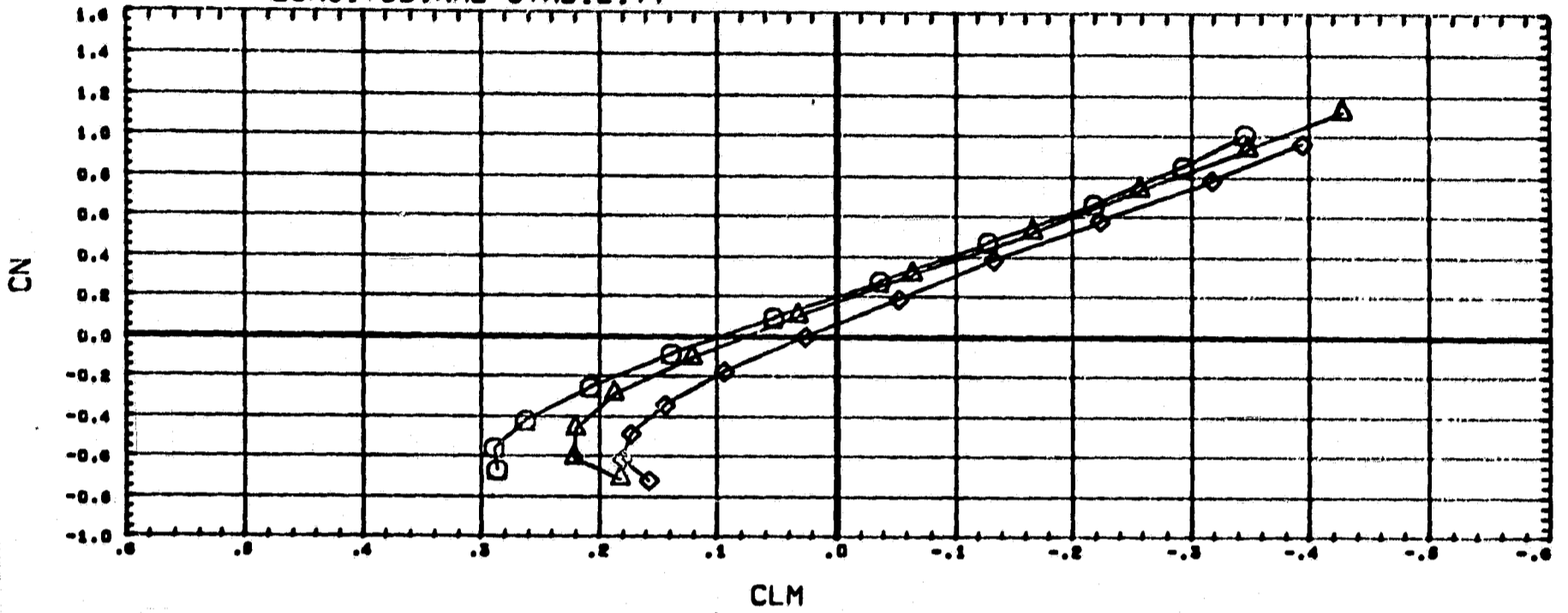


FIGURE 8 - TRIP STRIP CHART  
 0.005366 SCALF MODFL AX 12531-1

DATA FIGURES

# LONGITUDINAL STABILITY

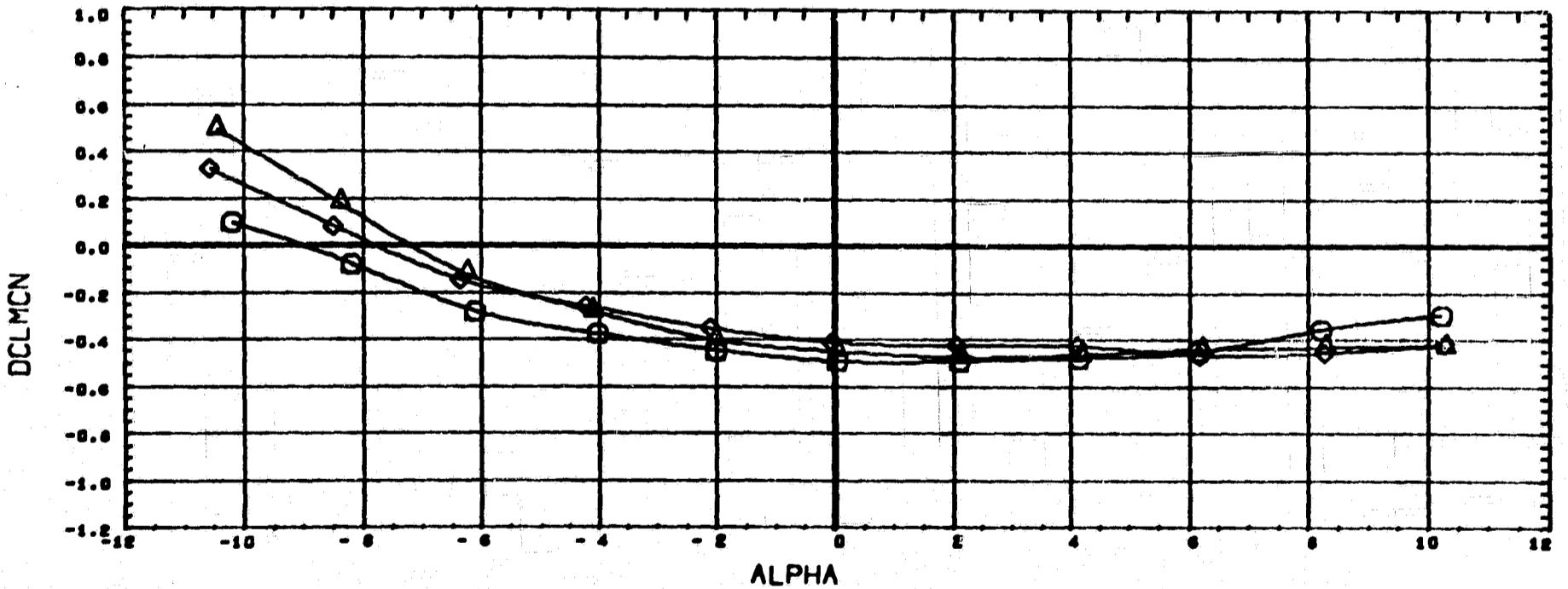
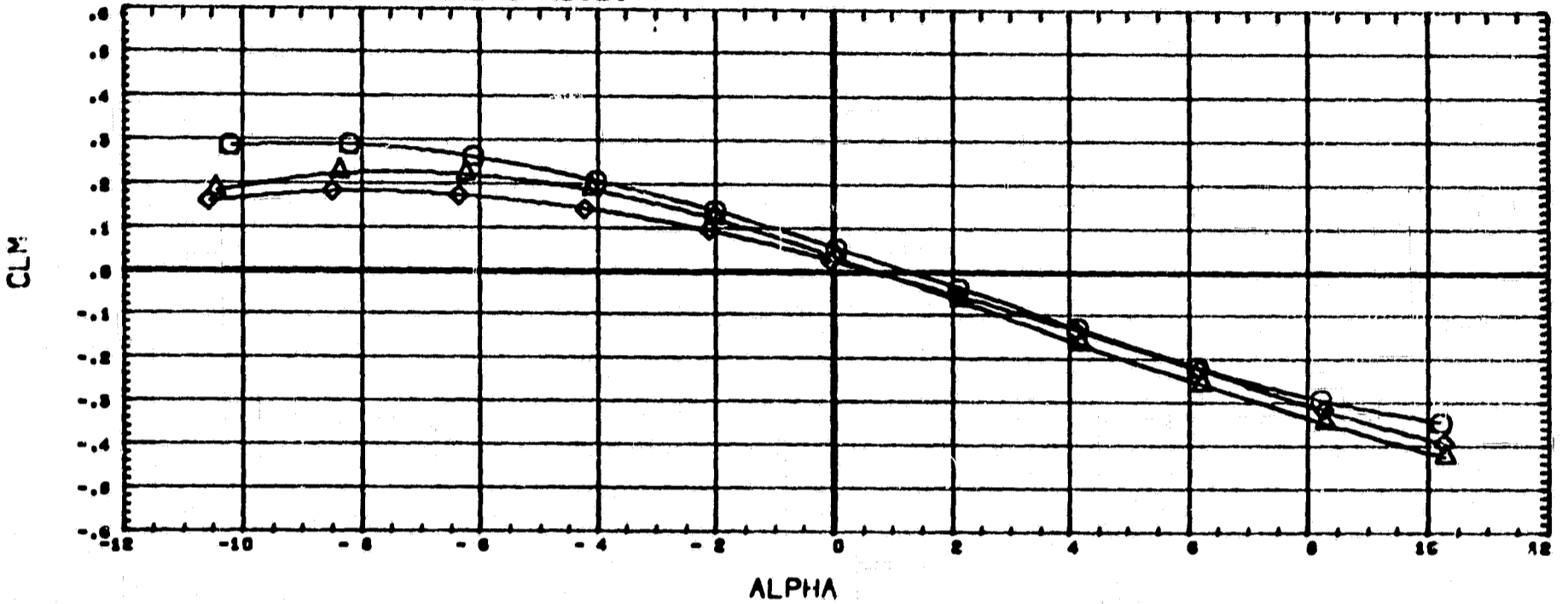


SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.698		0.000 ORBINC - 2.000
△	1.102		
◇	1.462		

REFERENCE INFORMATION		
BREF	5.1478	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE CGR

# LONGITUDINAL STABILITY

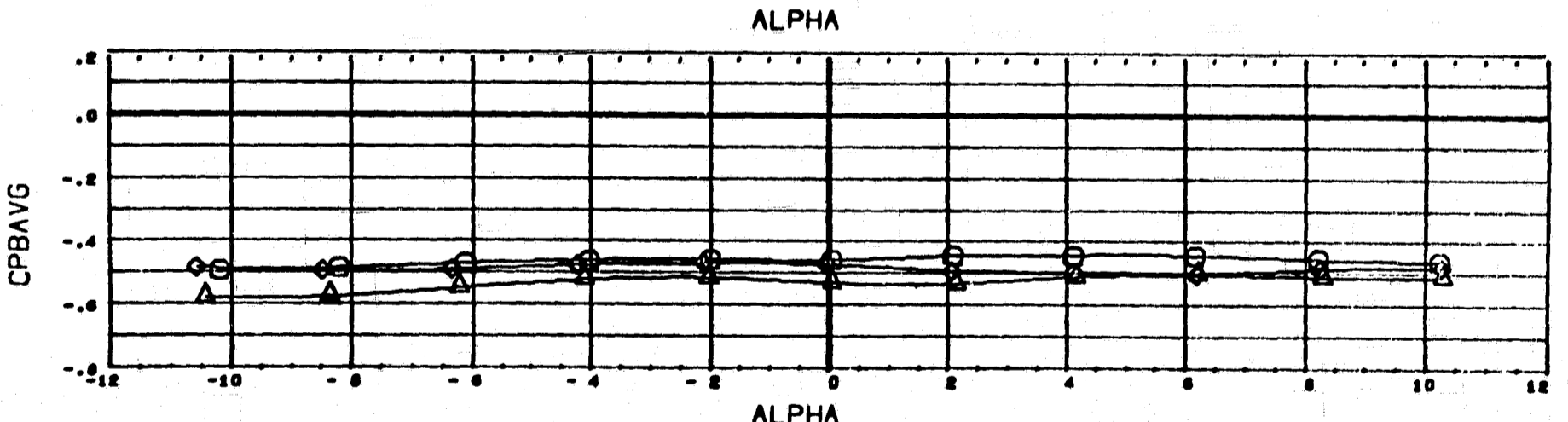
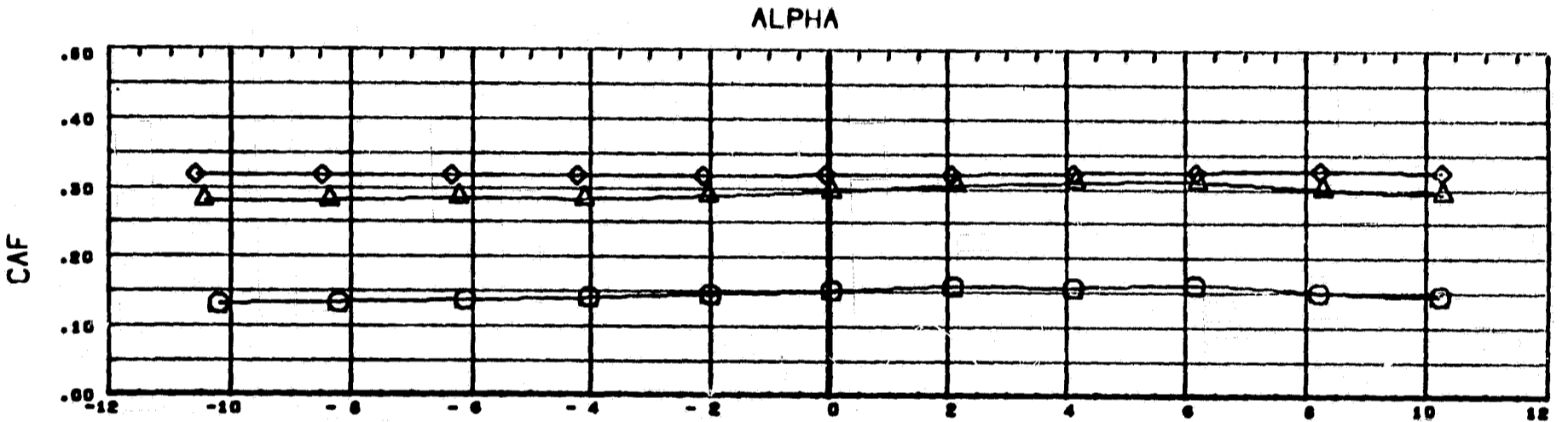
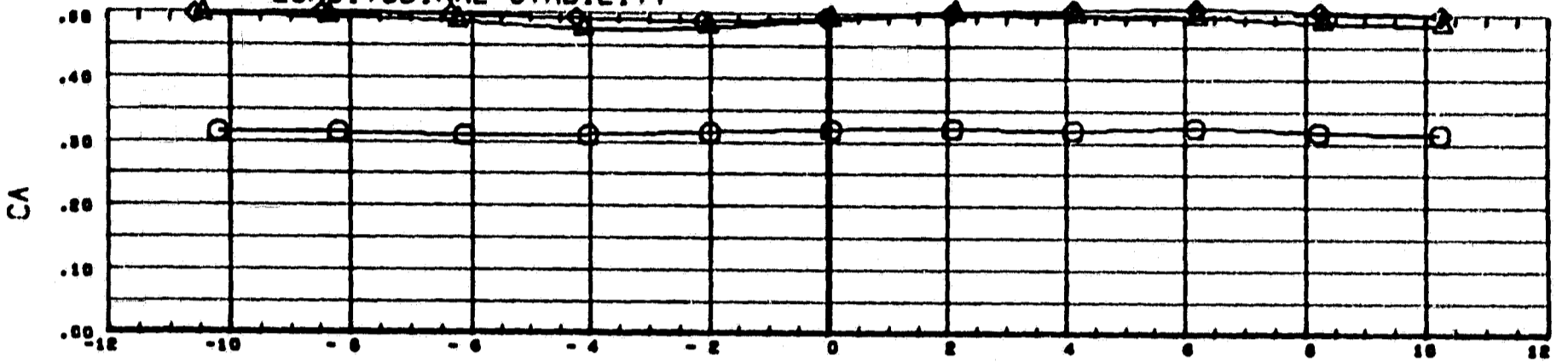


SYMBOL ○ △ ◇	MACH	PARAMETRIC VALUES		REFERENCE INFORMATION				
	0.898	BETA	0.000	ORBINC	- 2.000	SREF	5.1476	88. IN.
	1.102					LREF	4.4260	IN.
1.462						BREF	2.9690	IN.
						XMRP	9.7530	IN.
						YMRP	0.0000	IN.
						ZMRP	0.0000	IN.
						SCALE	0.0034	

DATA HIST. CODE C6R



# LONGITUDINAL STABILITY

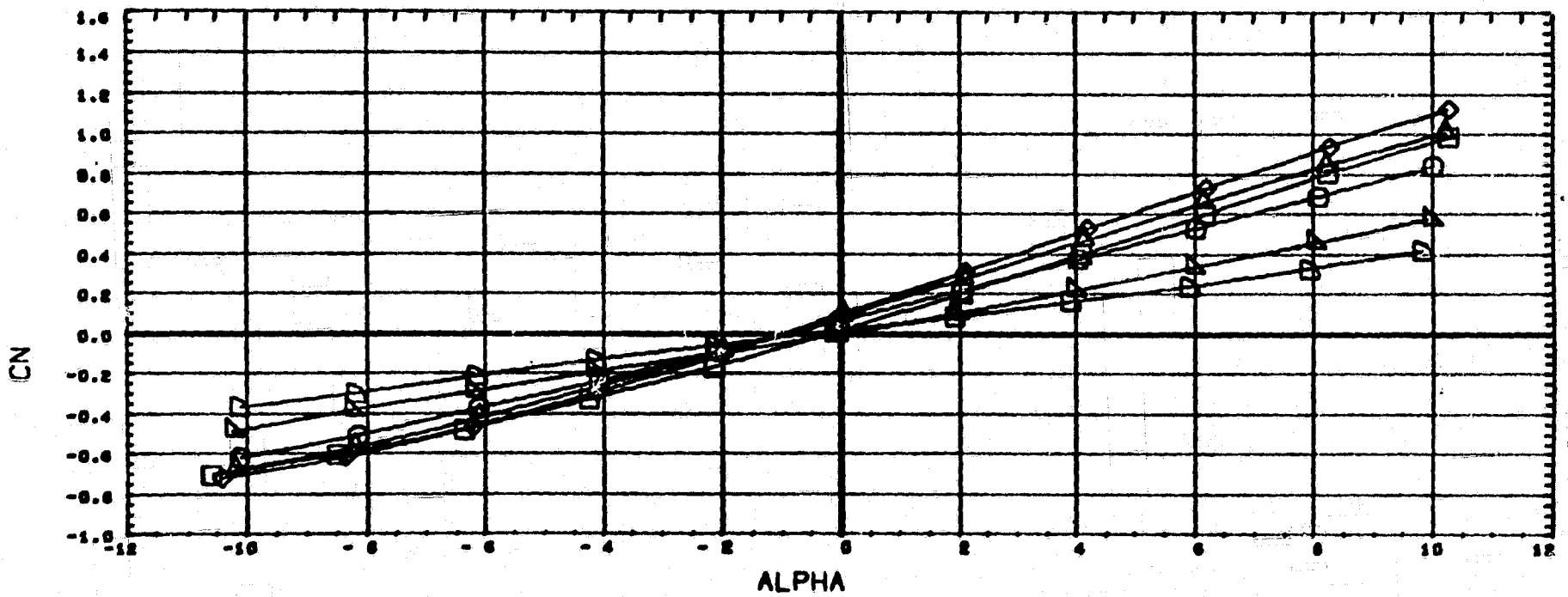
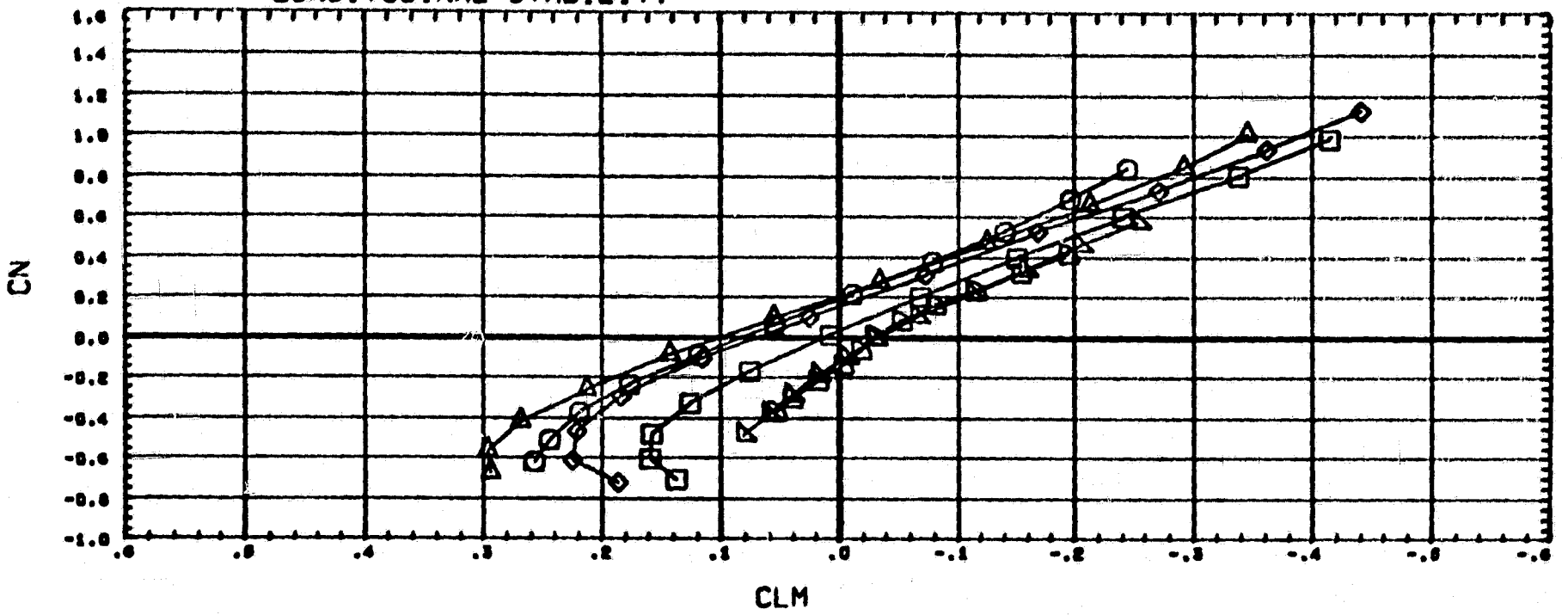


SYMBOL	MACH	BETA	PARAMETRIC VALUES
◇	0.898	0.000	ORBINC - 2.000
△	1.102		
○	1.462		

REFERENCE INFORMATION		
SREF	9.1478	90. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	9.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

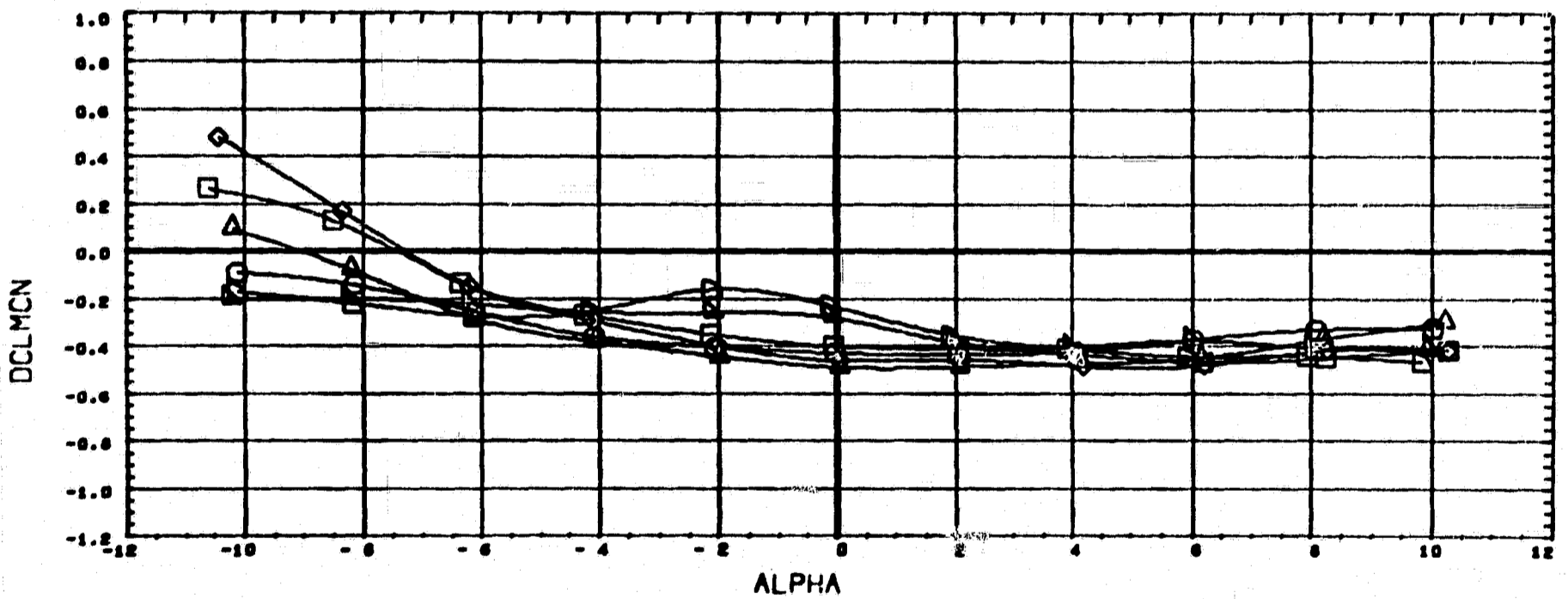
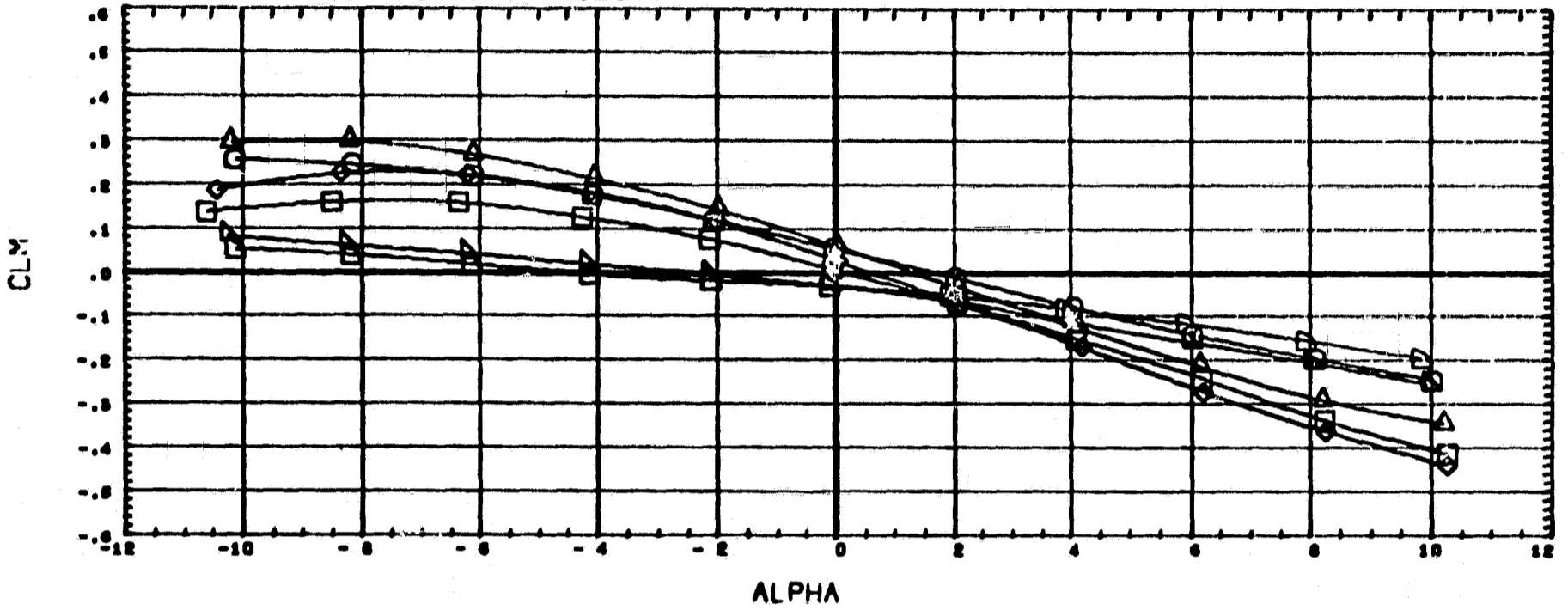
DATA HIST. CODE CGR

# LONGITUDINAL STABILITY



SYMBOL	MACH	PARAMETRIC VALUES		REFERENCE INFORMATION		
		BETA	ORBINC	SREF	LREF	IN.
○	0.600	0.000	- 2.000	9.1478	36. IN.	
□	0.899			4.4260	IN.	
△	1.104			2.9690	IN.	
◇	1.487			8.7930	IN.	
◇	2.740			0.0000	IN.	
◇	4.999			0.0000	IN.	
		DATA HIST. CODE	CGR	SCALE	0.0034	

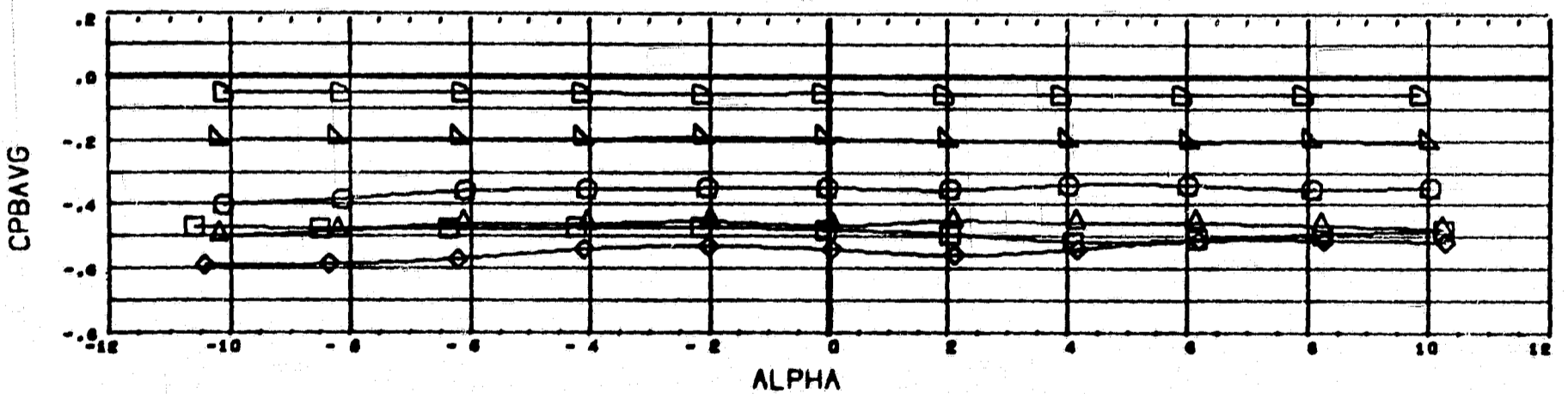
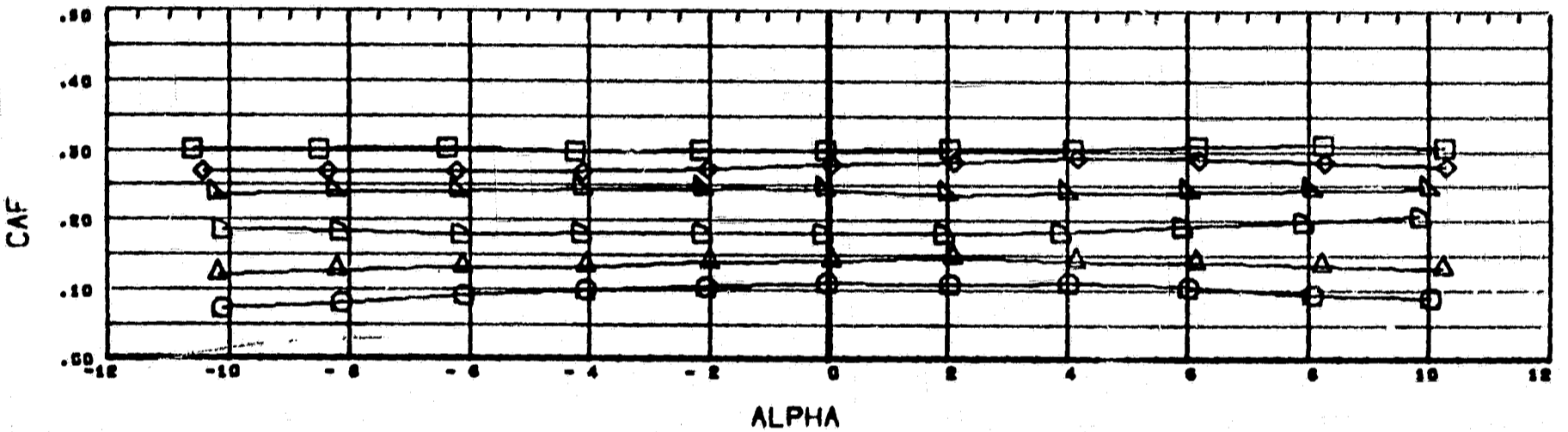
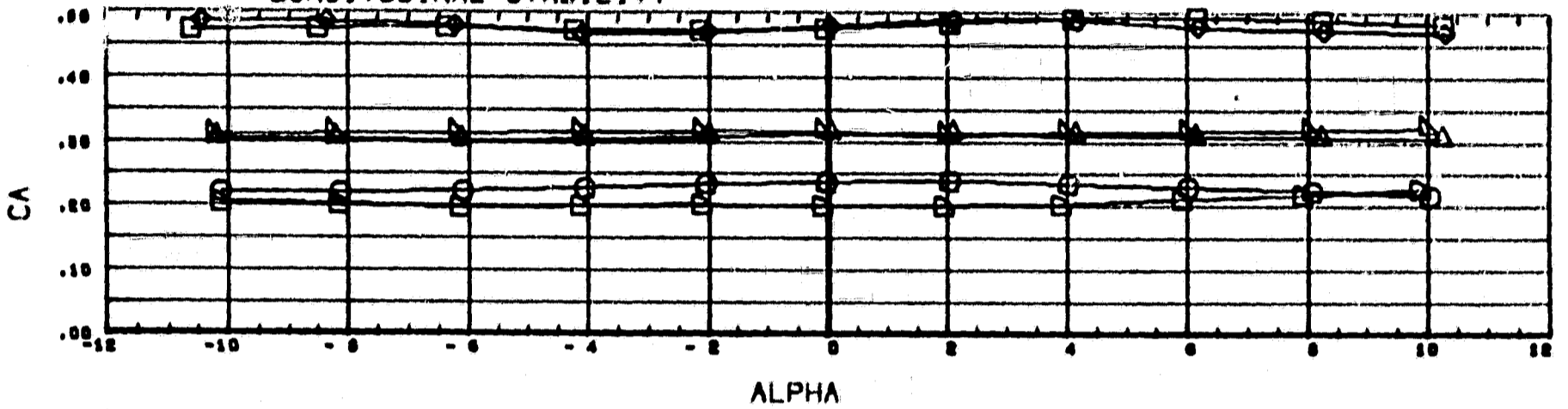
# LONGITUDINAL STABILITY



SYMBOL	MACH	PARAMETRIC VALUES	
		BETA	ORBINC
○	0.600	0.000	2.000
□	0.899		
△	1.104		
◇	1.497		
○	2.740		
□	4.999		
		DATA HIST. CODE	
			CGR

REFERENCE INFORMATION		
OREF	5.1478	80. IN.
LREF	4.4260	IN.
OREF	2.9690	IN.
XMRP	8.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

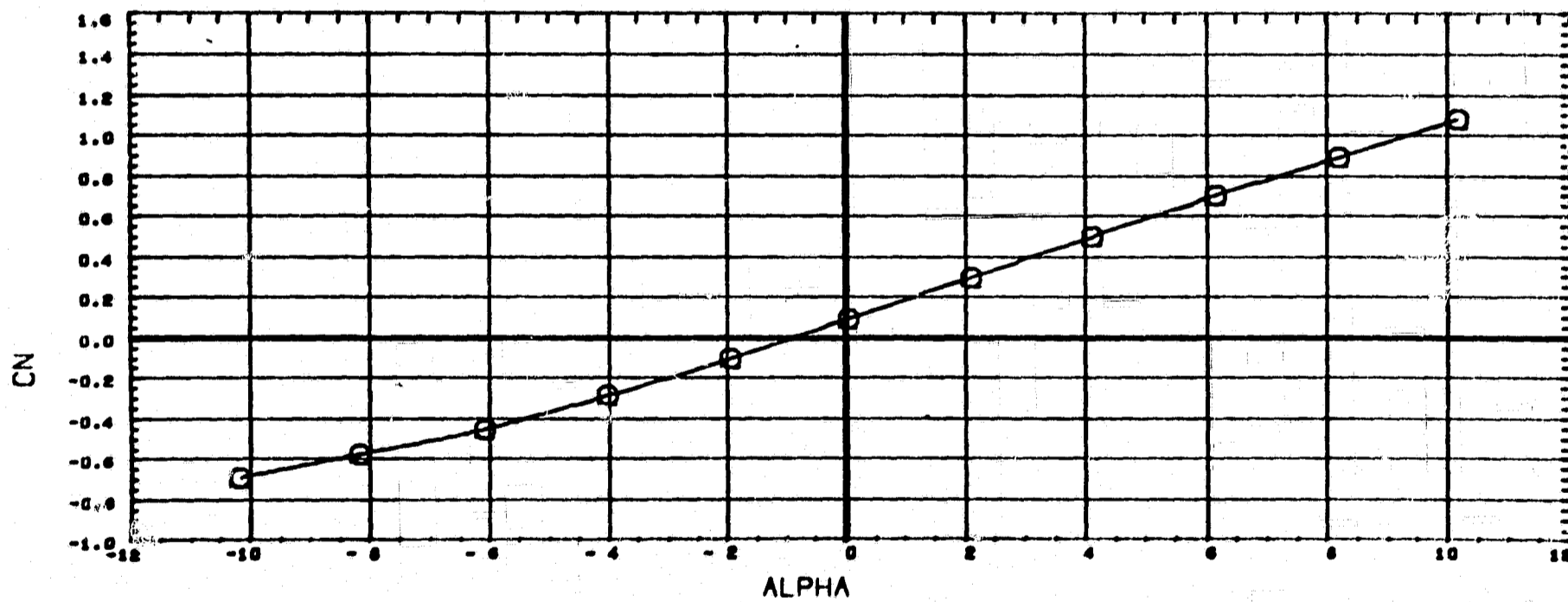
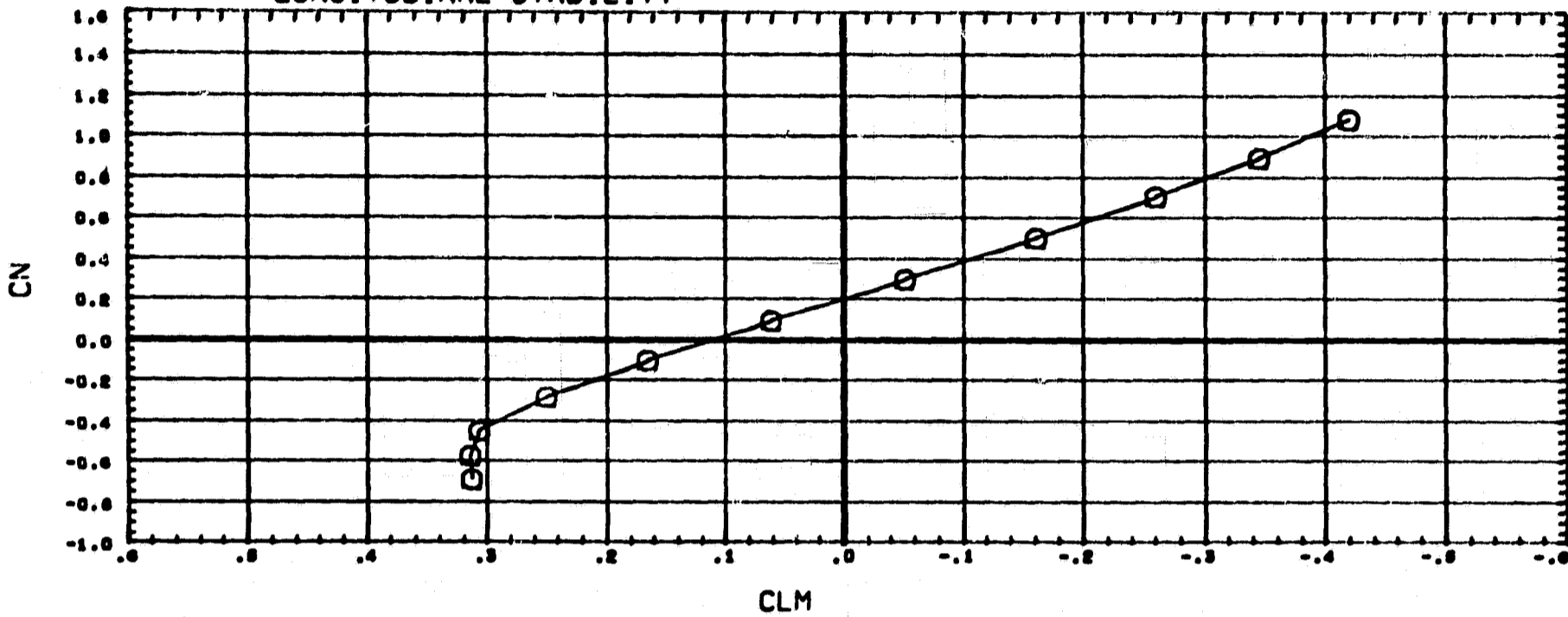
# LONGITUDINAL STABILITY



SYMBOL	MACH	PARAMETRIC VALUES	
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◇	0.899	ORBINC	- 2.000
△	1.104		
○	1.457		
▽	2.740		
◇	4.959	DATA HIST. CODE	C6R

REFERENCE INFORMATION		
SREF	5.1478	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XHRP	5.7530	IN.
YHRP	0.0000	IN.
ZHRP	0.0000	IN.
SCALE	0.0034	

# LONGITUDINAL STABILITY

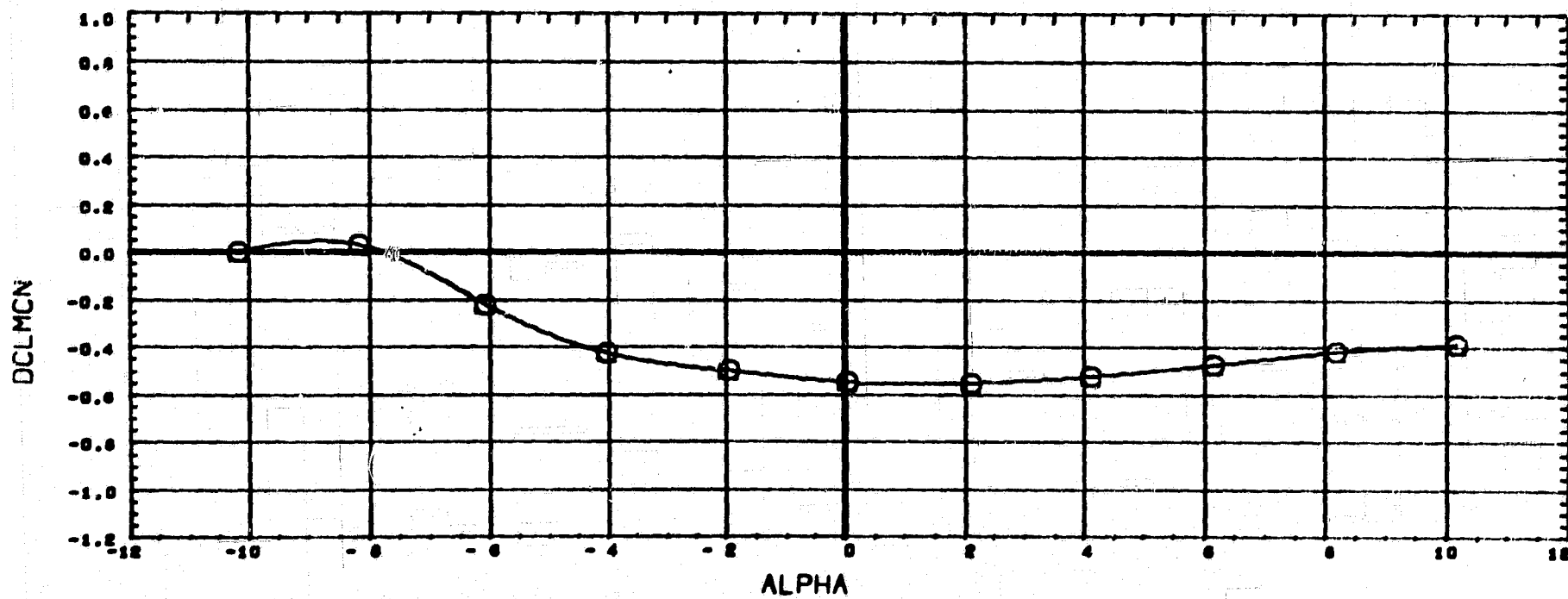
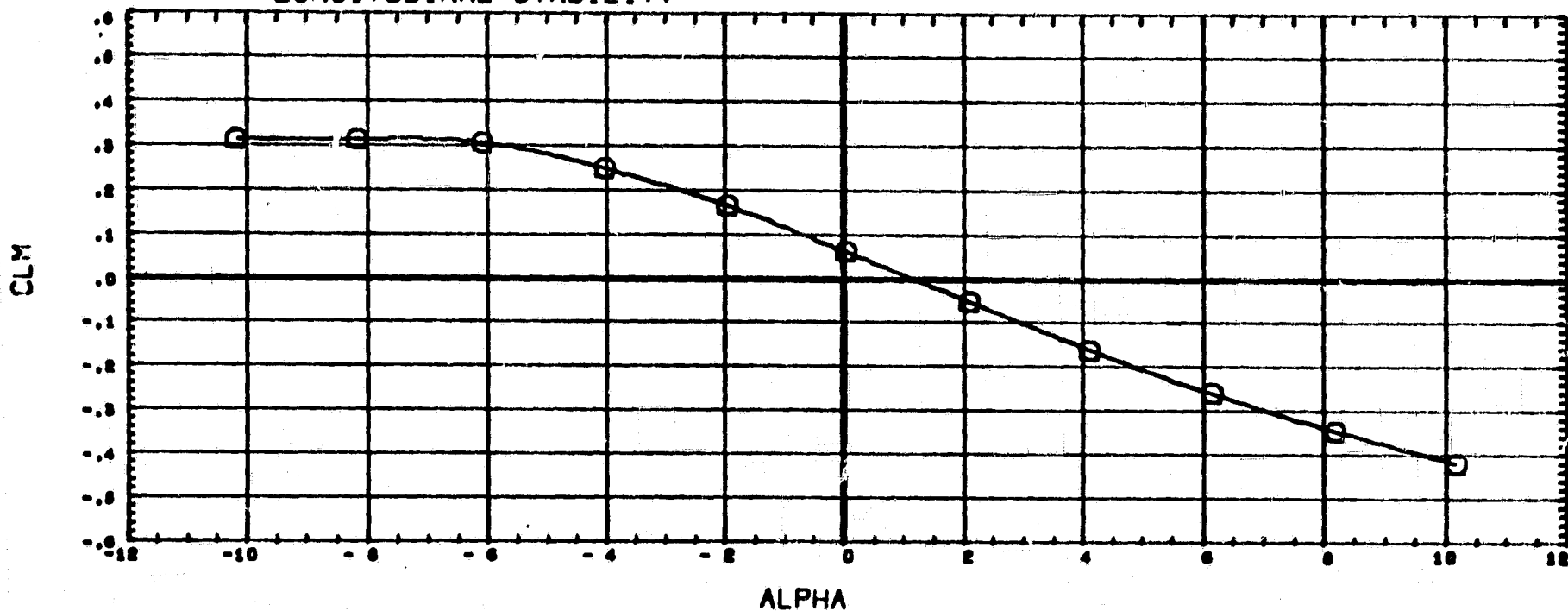


SYMBOL MACH PARAMETRIC VALUES  
 ○ 0.901 BETA 0.000 ORBINC - 2.000

REFERENCE INFORMATION  
 SREF 9.1476 80. IN.  
 LREF 4.4260 IN.  
 BREF 2.9690 IN.  
 XMRP 9.7530 IN.  
 YMRP 0.0000 IN.  
 ZMRP 0.0000 IN.  
 SCALE 0.0034

DATA HIST. CODE CGR

### LONGITUDINAL STABILITY

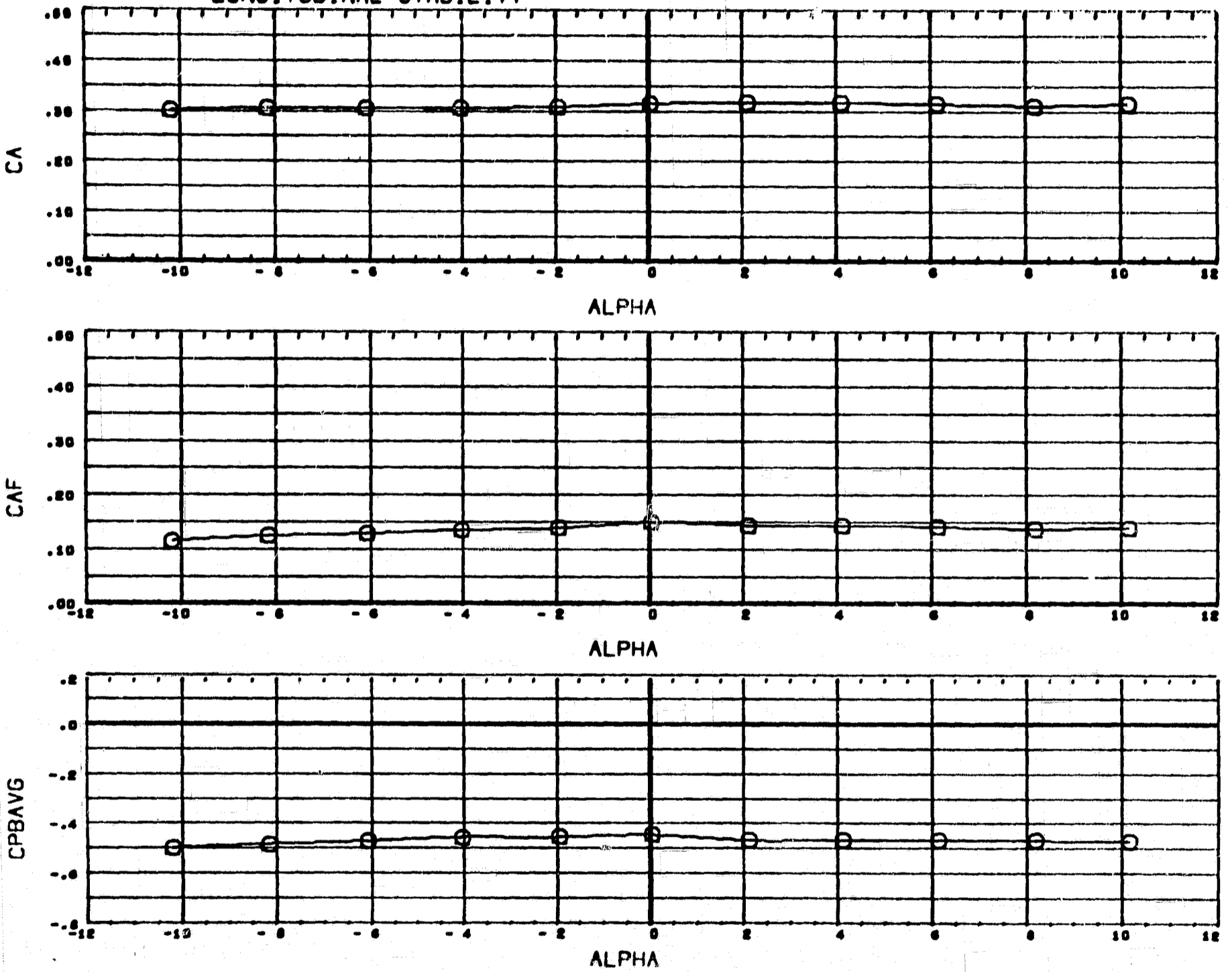


SYMBOL  $\square$  MACH 0.901 BETA 0.000 ORBINC - 2.000

REFERENCE INFORMATION  
 XREF 8.1478 80. IN.  
 LREF 4.4260 IN.  
 OREF 2.9690 IN.  
 XMRP 8.7530 IN.  
 YMRP 0.0000 IN.  
 ZMRP 0.0000 IN.  
 SCALE 0.0034

DATA HIST. CODE C6R

# LONGITUDINAL STABILITY

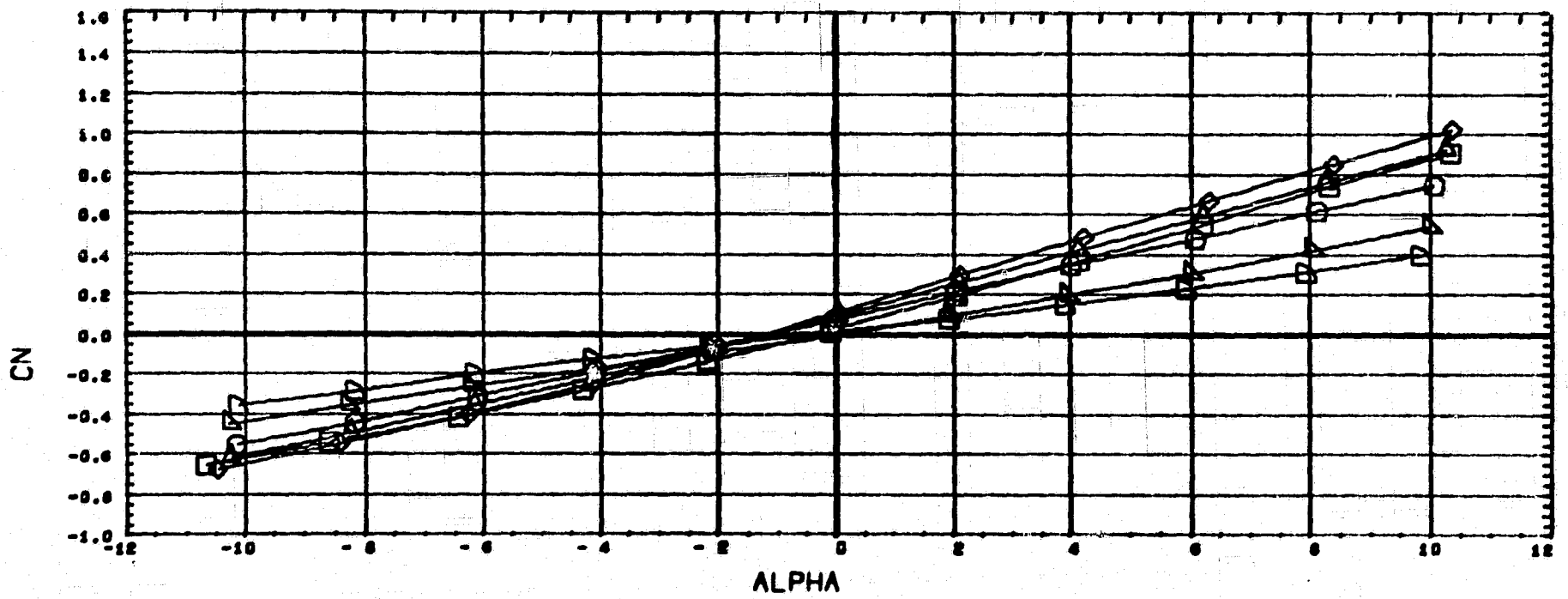
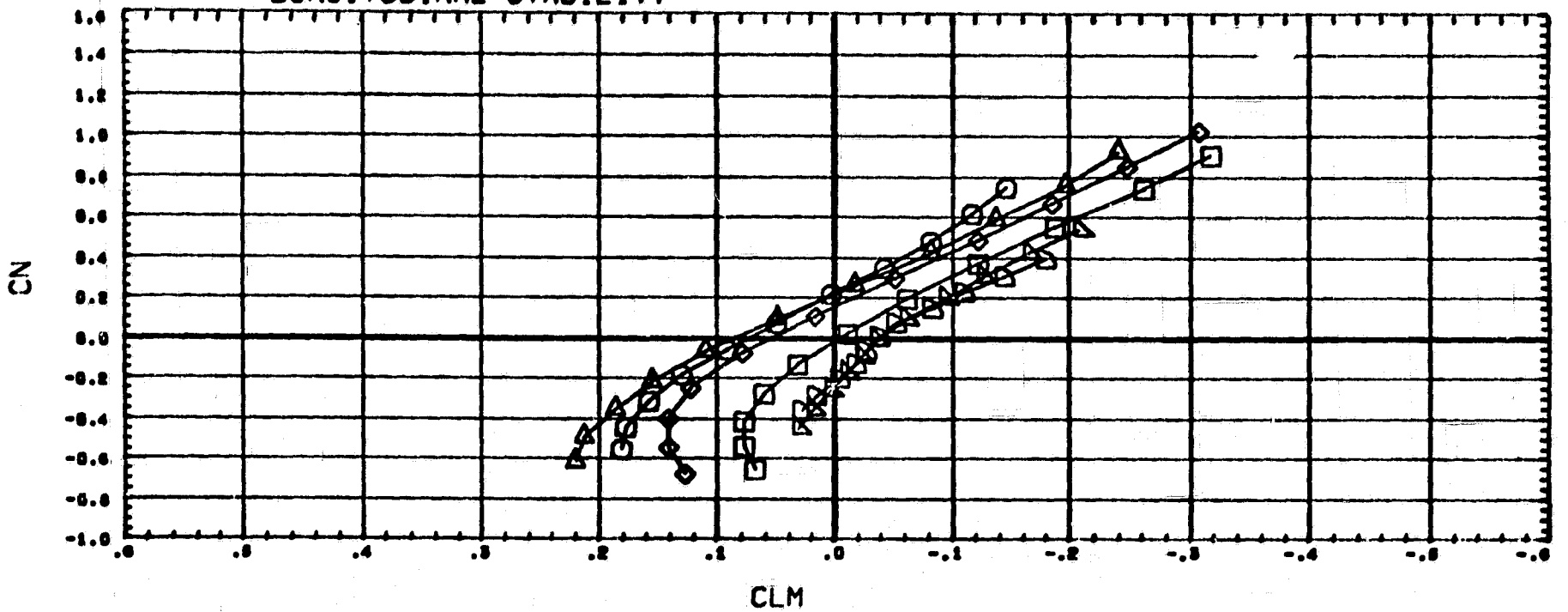


SYMBOL  $\bigcirc$  MACH 0.901 BETA 0.000 ORBINC - 2.000  
 PARAMETRIC VALUES

REFERENCE INFORMATION  
 SREF 5.1476 80. IN.  
 LREF 4.4260 IN.  
 BREF 2.9690 IN.  
 XMRP 5.7530 IN.  
 YMRP 0.0000 IN.  
 ZMRP 0.0000 IN.  
 SCALE 0.0034

DATA HIST. CODE CGR

# LONGITUDINAL STABILITY

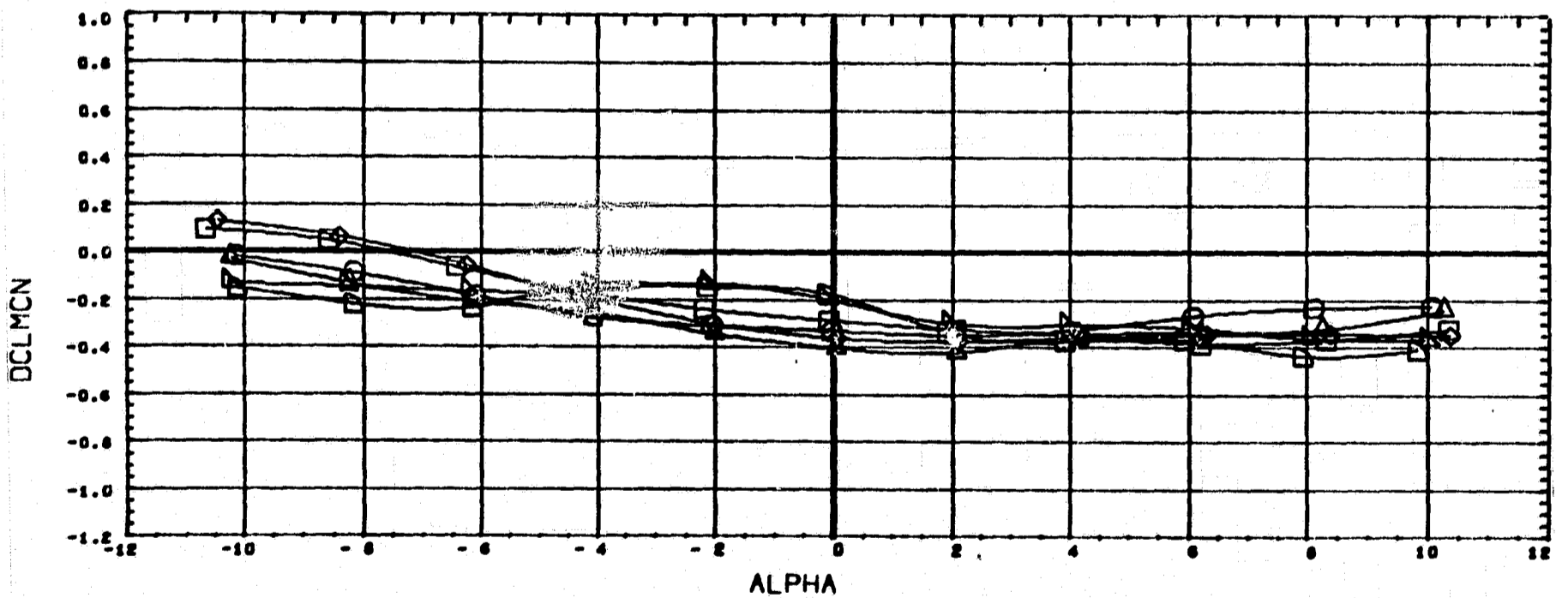
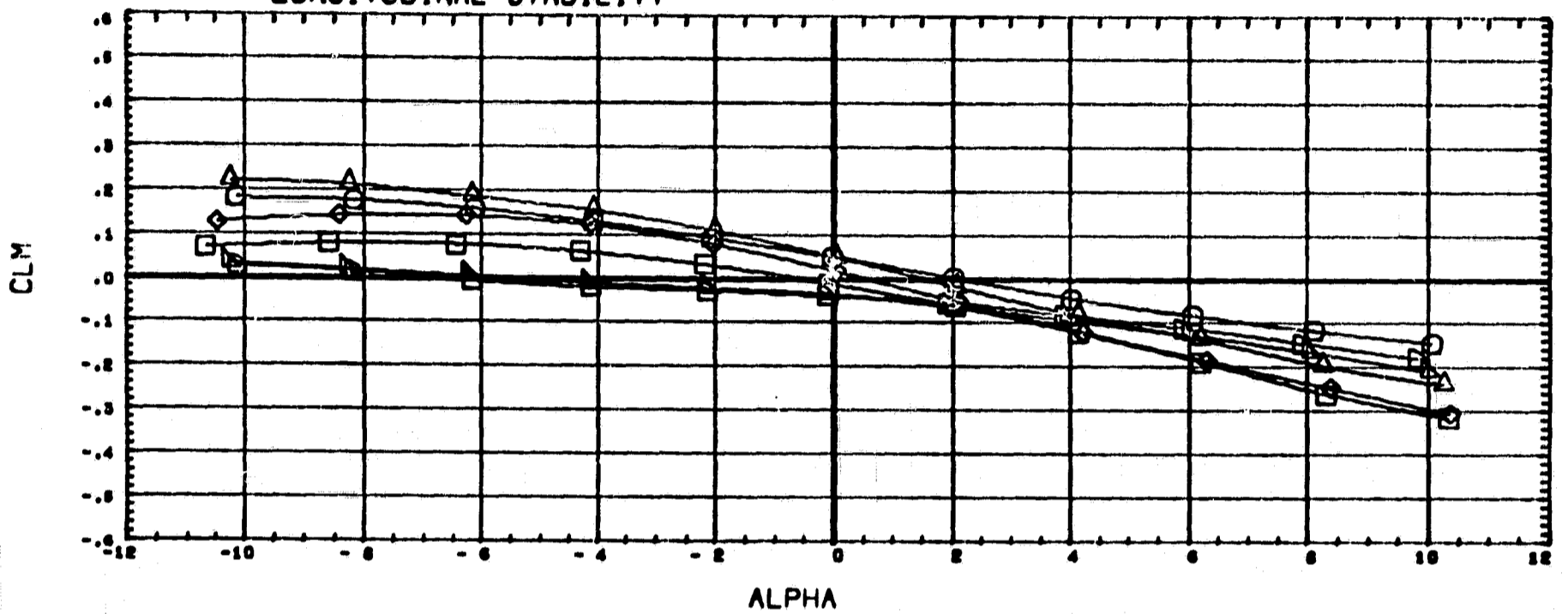


SYMBOL	MACH	PARAMETRIC VALUES	
○	0.599	BETA	0.000 ORBINC - 2.000
◇	0.697		
△	1.100		
□	1.459		
▽	2.740		
◇	4.959	DATA HIST. CODE	C6R

REFERENCE INFORMATION		
SRP	5.1478	80. IN.
LREP	4.4200	IN.
ORP	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

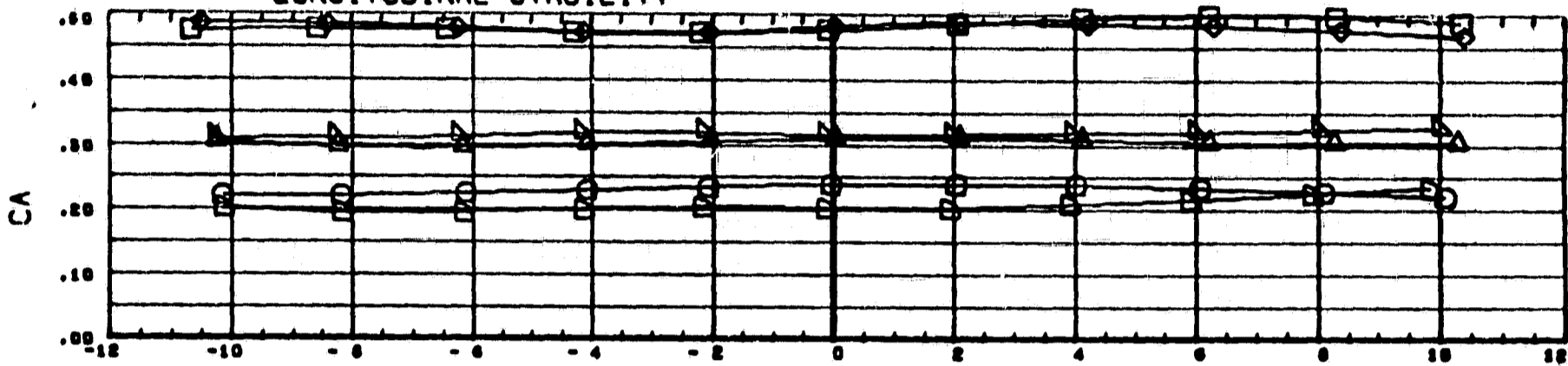


# LONGITUDINAL STABILITY

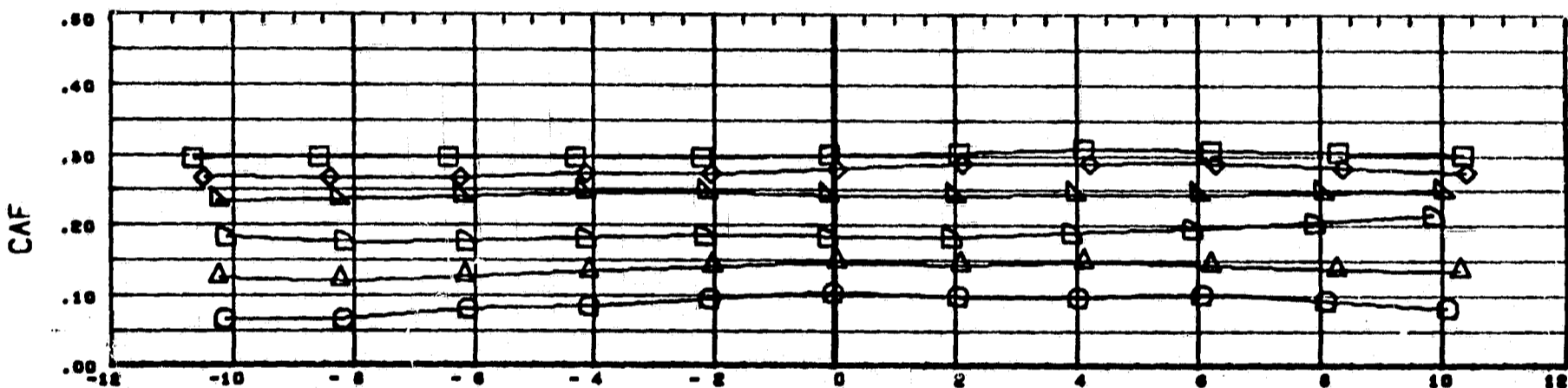


SYMBOL	MACH	BETA	PARAMETRIC VALUES		REFERENCE INFORMATION	
○	0.599	0.000	ORBINC	- 2.000	SREF	5.1476 80. IN.
◇	0.897				LREF	4.4260 IN.
△	1.100				BREF	2.9690 IN.
□	1.459				XHRP	9.7530 IN.
◇	2.740				YHRP	0.0000 IN.
◇	4.959				ZHRP	0.0000 IN.
		DATA MIST. CODE	CGR		SCALE	0.0034

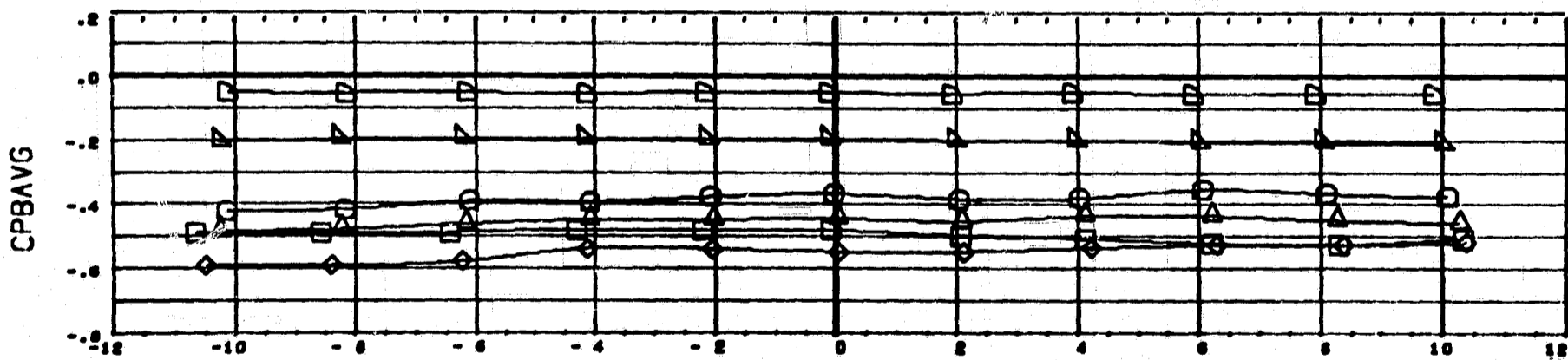
### LONGITUDINAL STABILITY



ALPHA



ALPHA

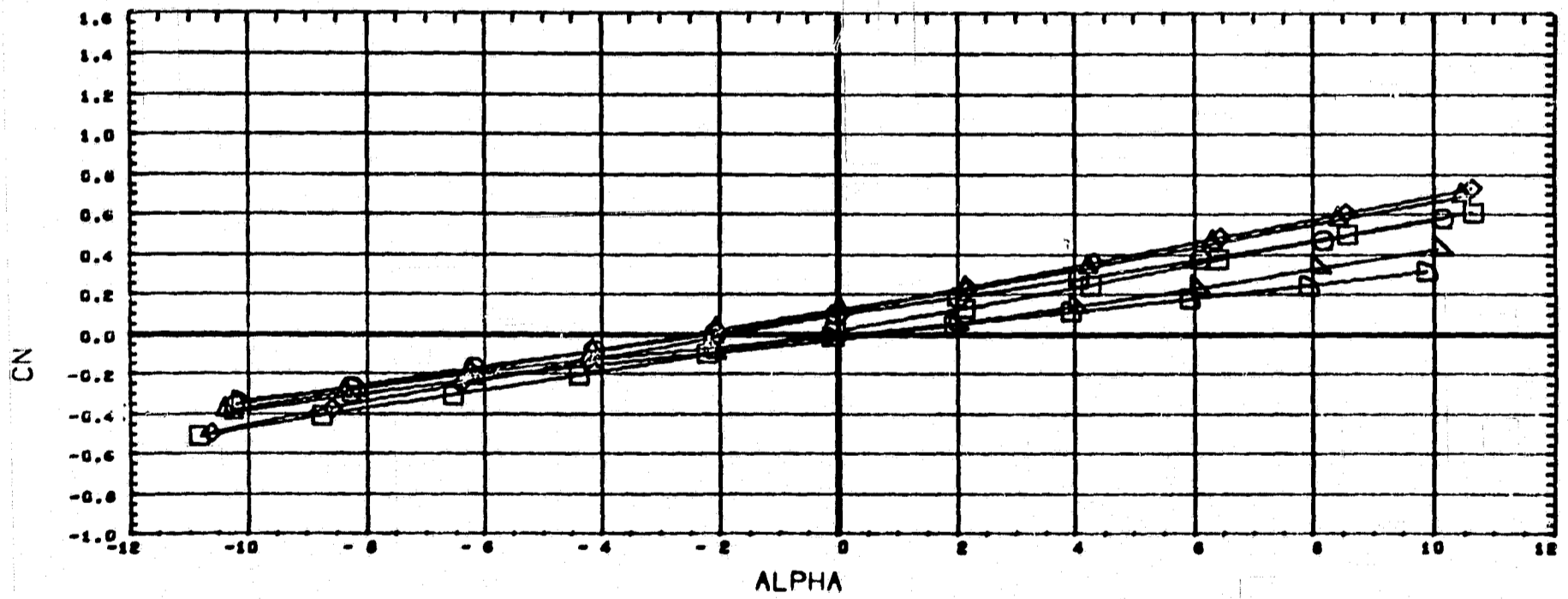
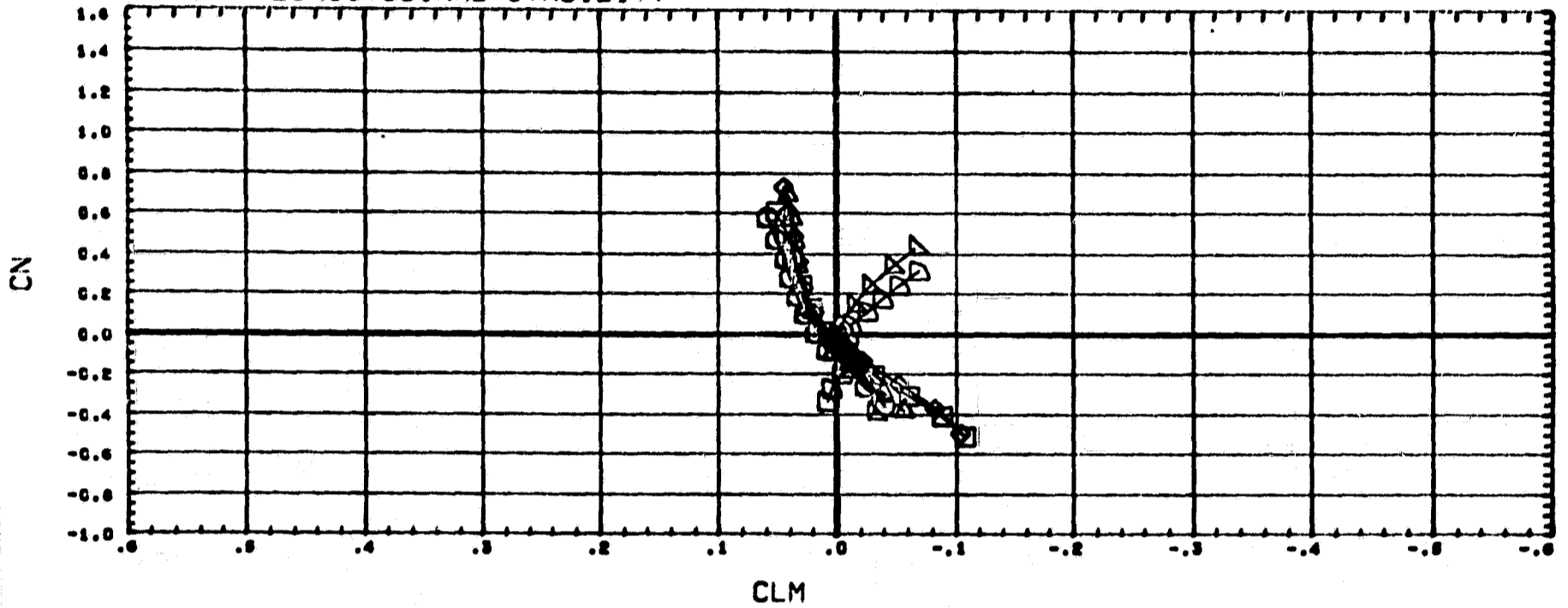


ALPHA

SYMBOL ◻	MACH	PARAMETRIC VALUES	
	0.999	BETA	0.000 ORBINC - 2.000
	0.997		
	1.100		
	1.459		
	2.740		
	4.959	DATA HIST. CODE	CGR

REFERENCE INFORMATION		
SREF	5.1478	80. IN.
LREF	4.4260	IN.
BREF	2.0690	IN.
XMRP	5.7830	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

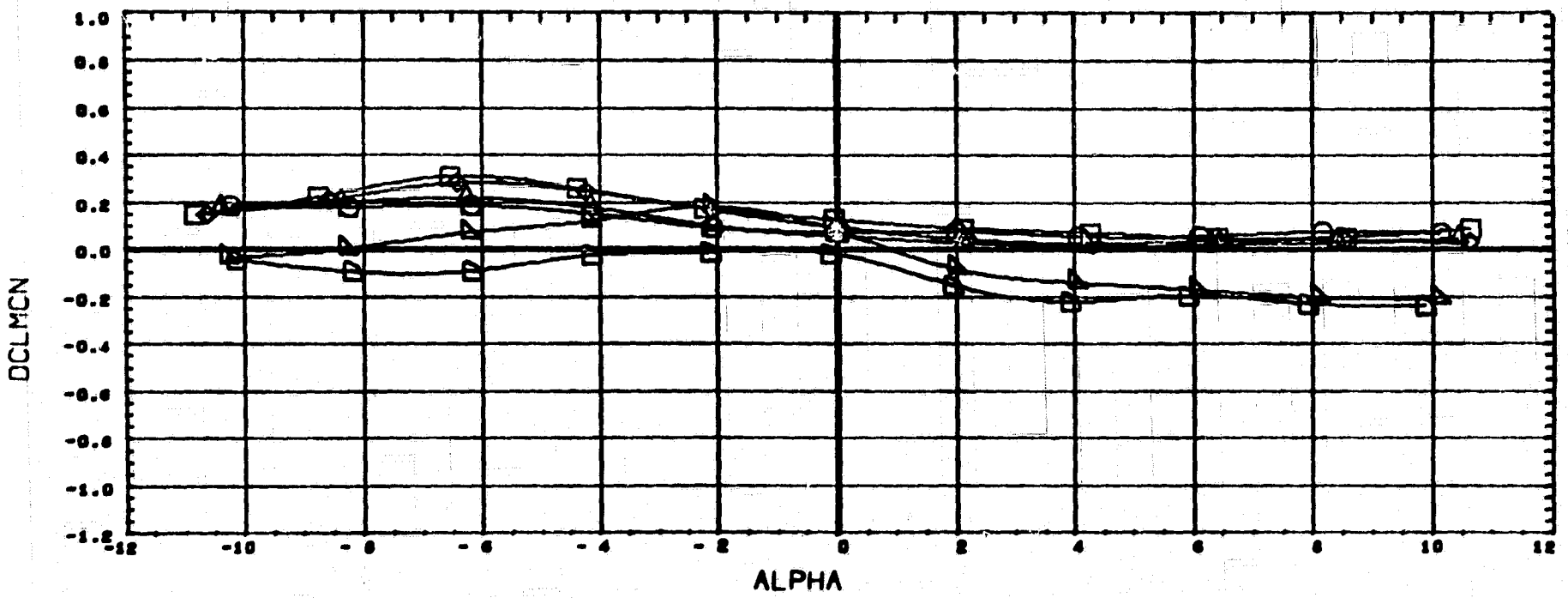
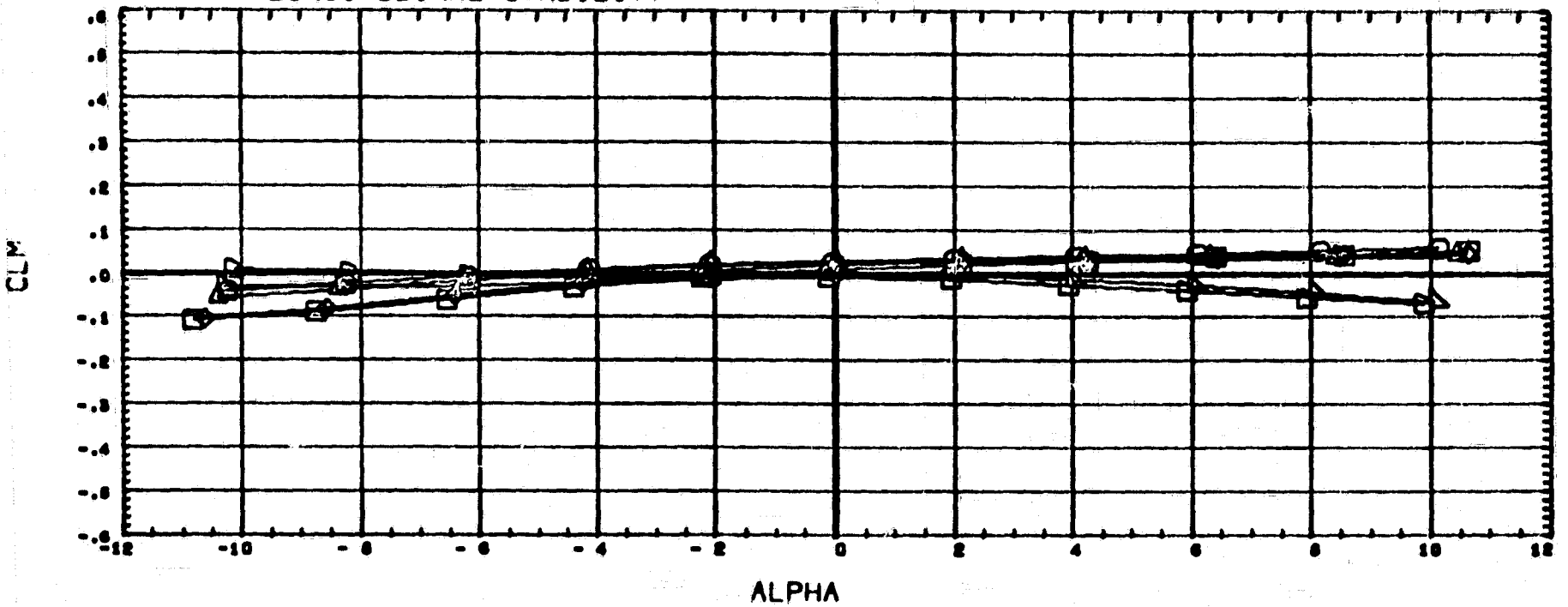
# LONGITUDINAL STABILITY



SYMBOL	MACH	PARAMETRIC VALUES	
		BETA	ORBINC
D Δ □ ○ ◇	0.599	0.000	- 2.000
	0.899		
	1.100		
	1.460		
	2.740		
4.959	DATA HIST. CODE	CGR	

REFERENCE INFORMATION		
BREF	5.1476	36. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	3.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

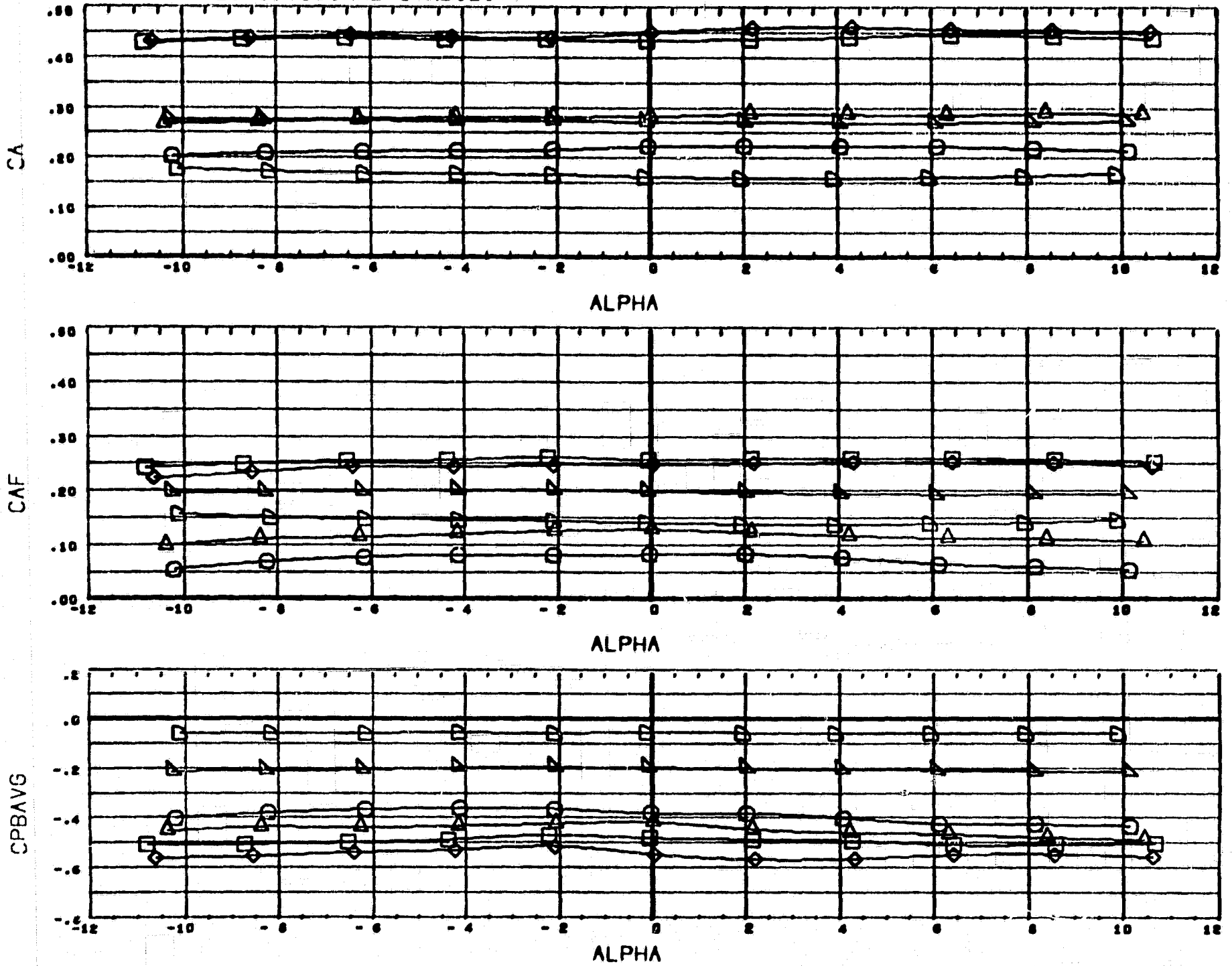
# LONGITUDINAL STABILITY



SYMBOL	MACH	PARAMETRIC VALUES	
○	0.599	BETA	0.000
◇	0.899	ORBINC	- 2.000
△	1.100		
□	1.460		
▽	2.740		
◇	4.999	DATA HIST. CODE	CGR

REFERENCE INFORMATION		
BREF	8.1478	80 IN.
LREF	4.4260	IN.
BREF	2.0690	IN.
XHRP	5.7530	IN.
YHRP	0.0000	IN.
ZHRP	0.0000	IN.
SCALE	0.0034	

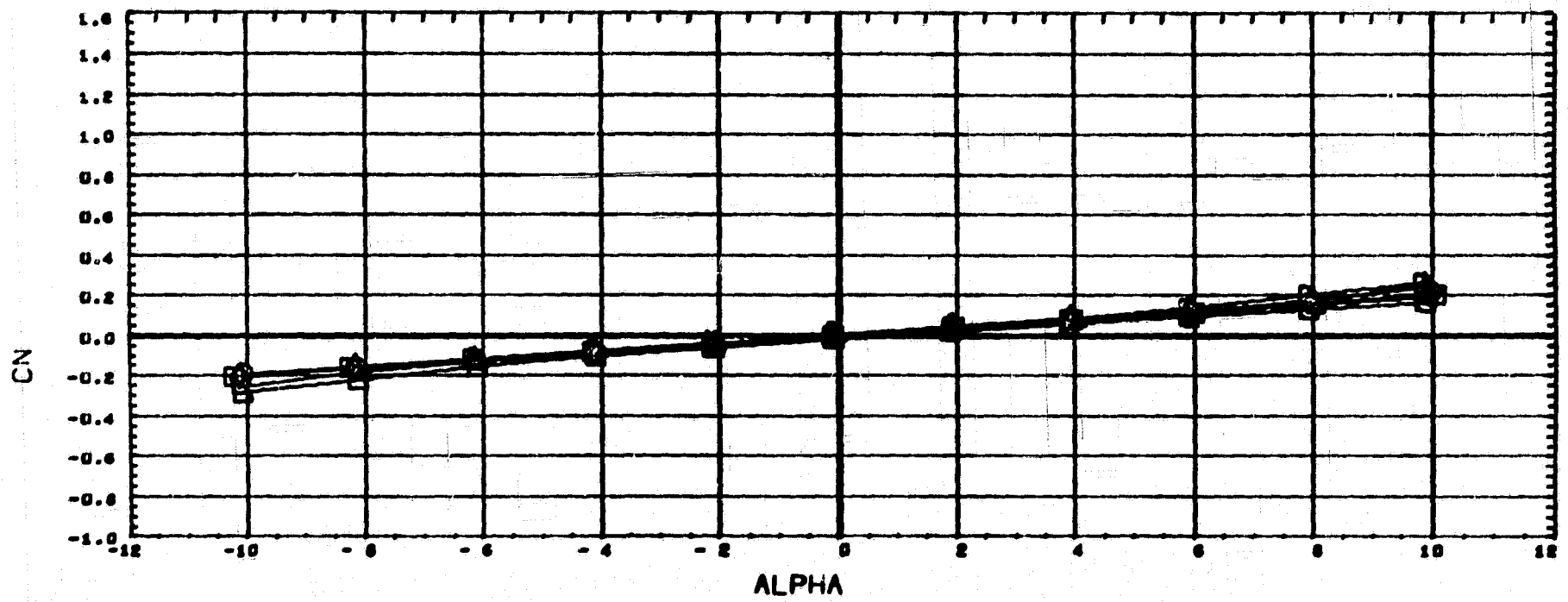
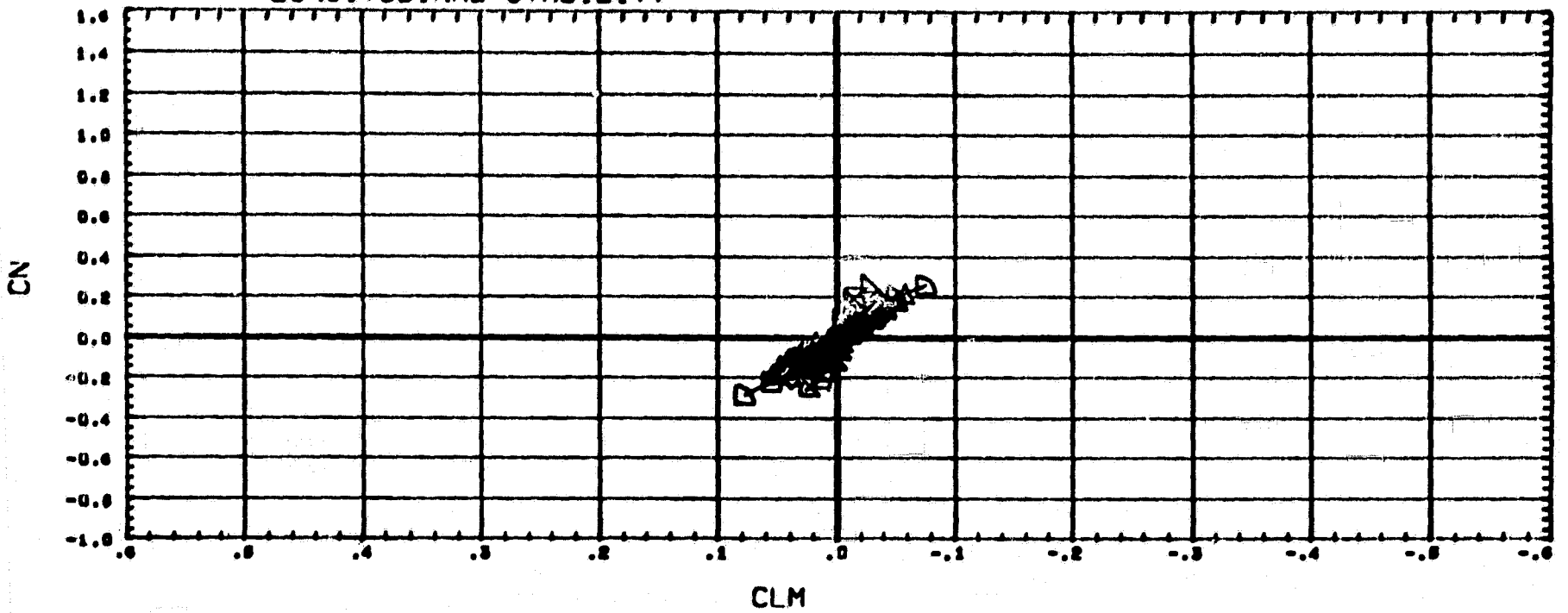
# LONGITUDINAL STABILITY



SYMBOL	MACH	PARAMETRIC VALUES
□	0.599	BETA 0.000 ORBINC - 2.000
△	0.899	
○	1.100	
◇	1.460	
□	2.740	
△	4.999	DATA HIST. CODE CGR

REFERENCE INFORMATION		
SREF	5.1478	88. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	8.7830	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

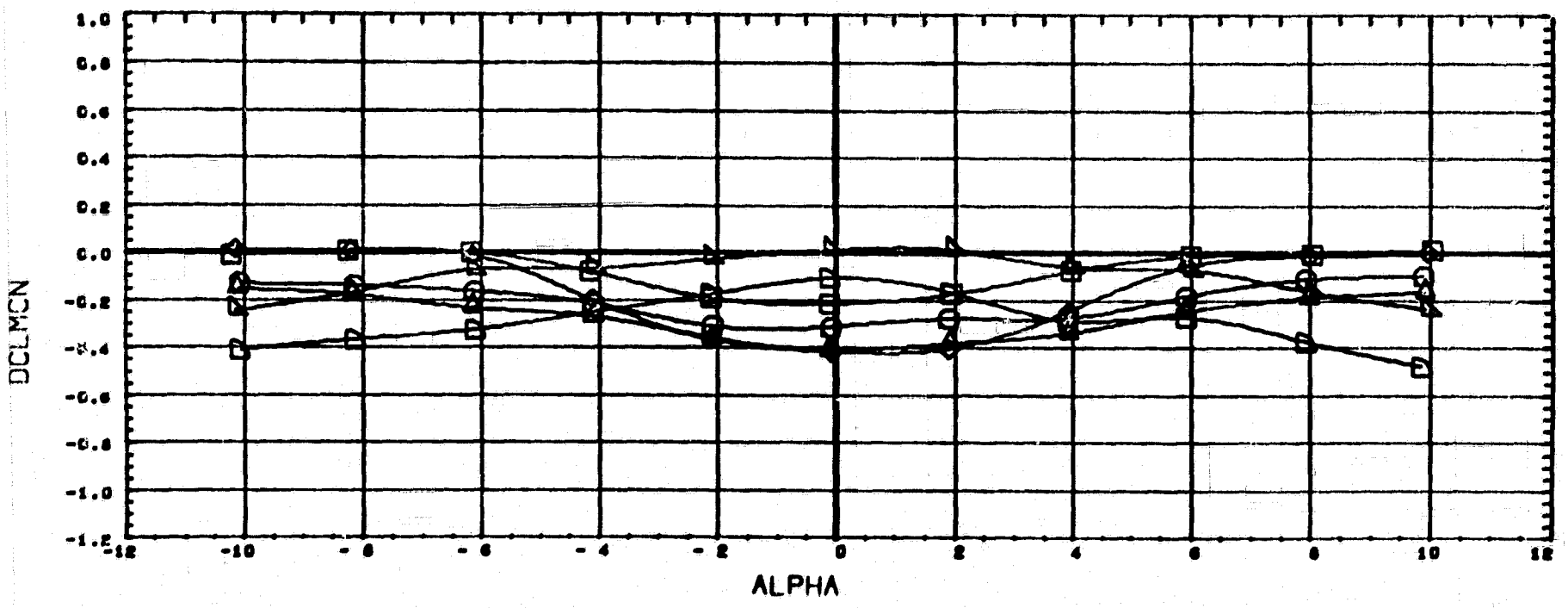
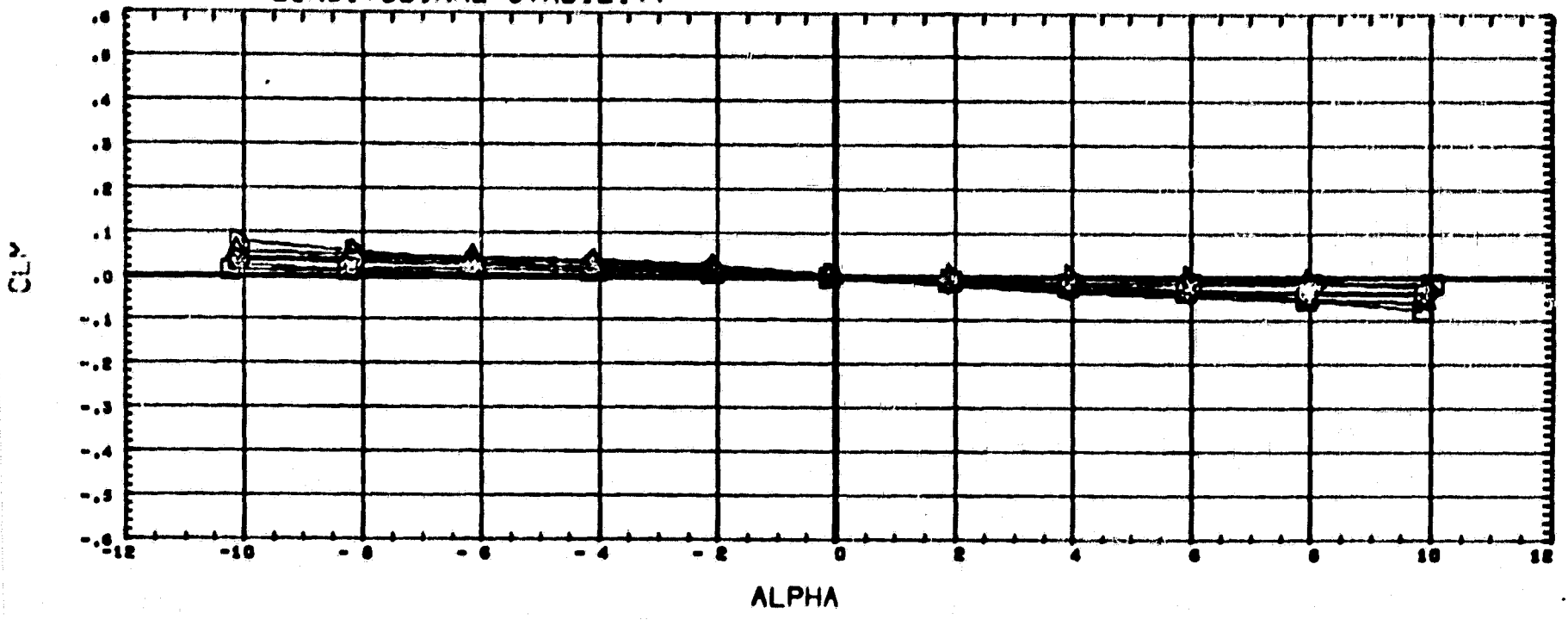
# LONGITUDINAL STABILITY



SYMBOL	MACH	BETA	PARAMETRIC VALUES
◇	0.599	0.000	
◇	0.901		
◇	1.104		
◇	1.439		
◇	2.740		
◇	4.859		
		DATA HIST. CODE	CGR

REFERENCE INFORMATION		
BREF	9.1476	60. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XWRP	9.7930	IN.
YWRP	0.0000	IN.
ZWRP	0.0000	IN.
SCALE	0.0033	

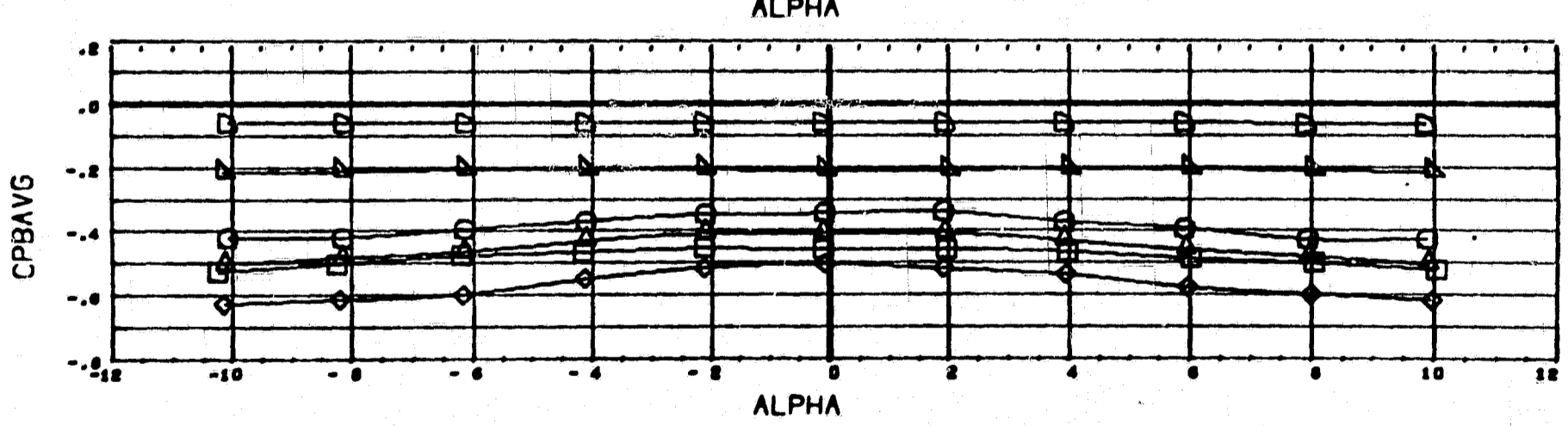
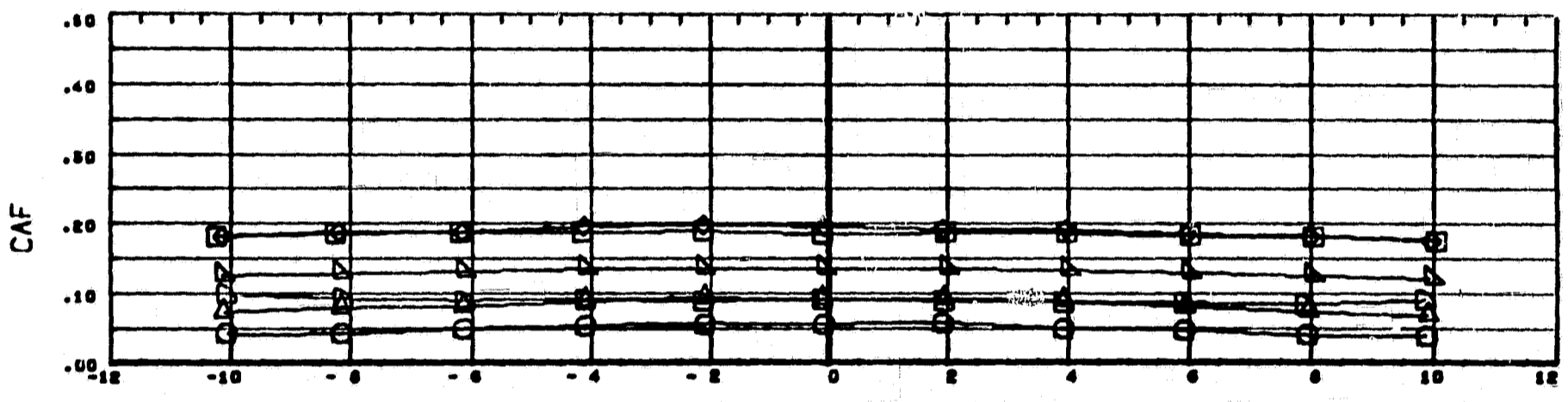
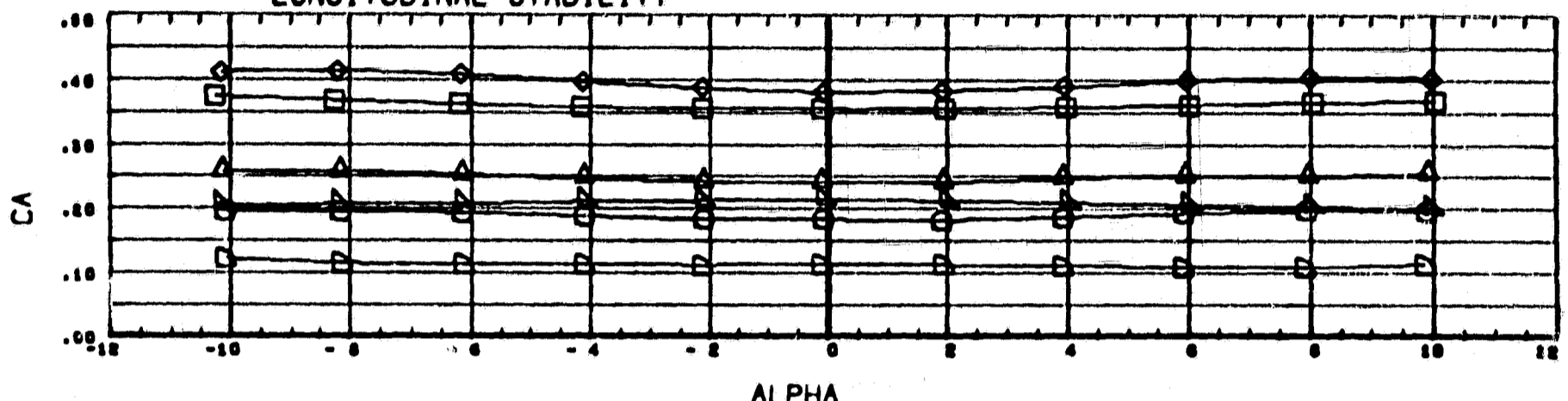
# LONGITUDINAL STABILITY



SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.999	0.000	
□	0.901		
◇	1.104		
△	1.459		
▽	2.740		
◊	4.959		
		DATA HIST. CODE	CGR

REFERENCE INFORMATION		
OREP	9.1478	86. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	9.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0033	

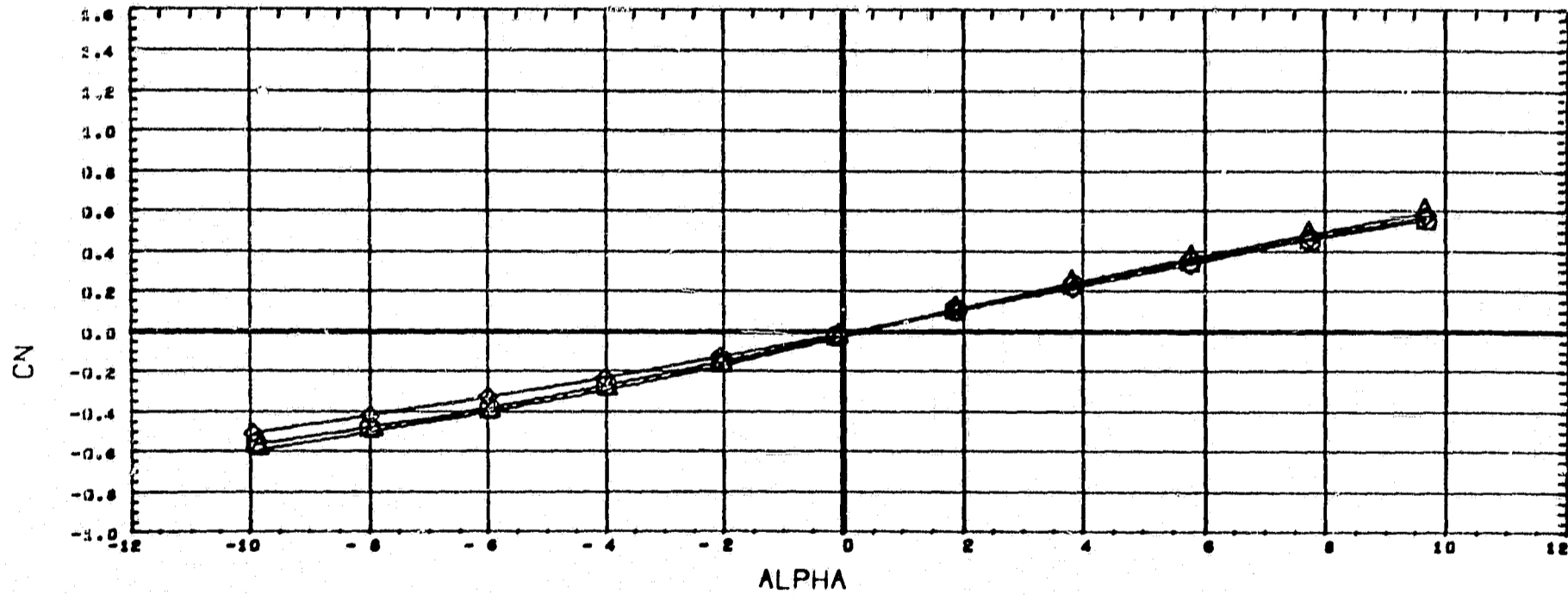
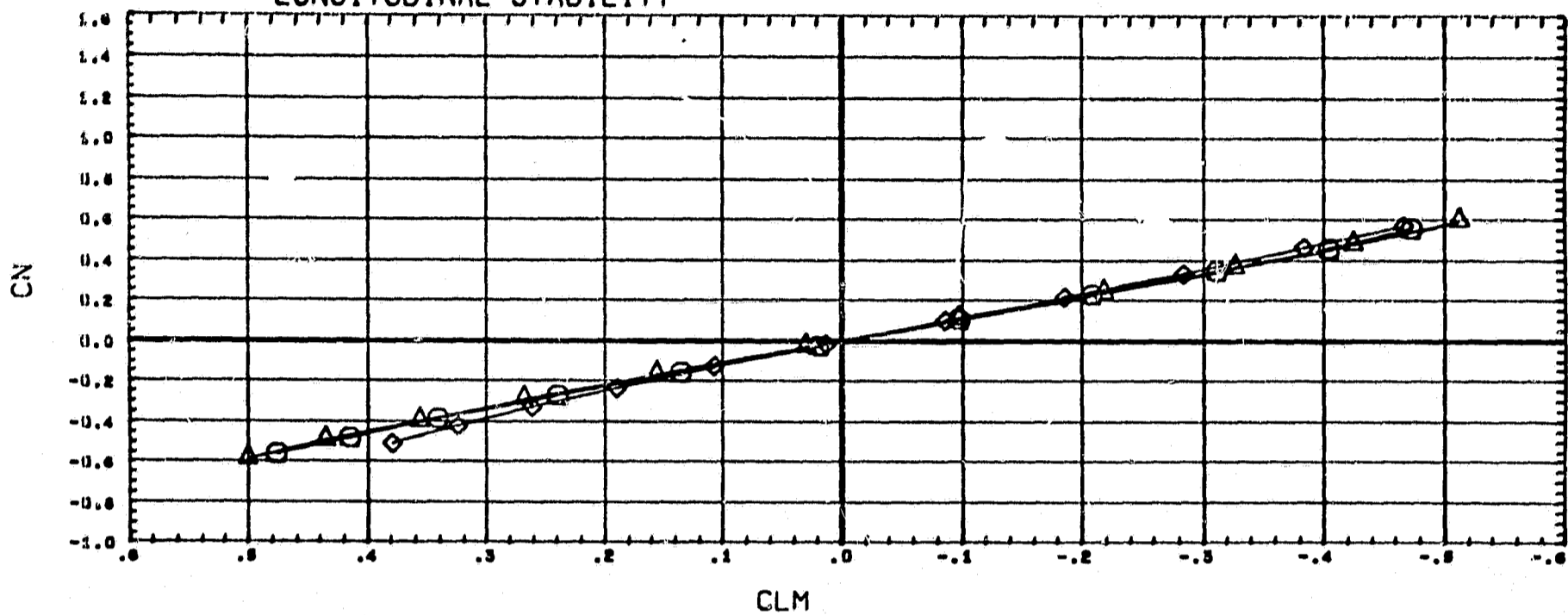
### LONGITUDINAL STABILITY



SYMBOL	MACH	BETA	PARAMETRIC VALUES	REFERENCE INFORMATION	
○	0.999		0.000	SREF	8.1478 80. IN.
◇	0.901			LREF	4.4260 IN.
△	1.104			BREF	2.9690 IN.
□	1.459			XMRP	5.7530 IN.
◇	2.740			YMRP	0.0000 IN.
◇	4.989			ZMRP	0.0000 IN.
		DATA HIST. CODE	CGR	SCALE	0.0033



# LONGITUDINAL STABILITY

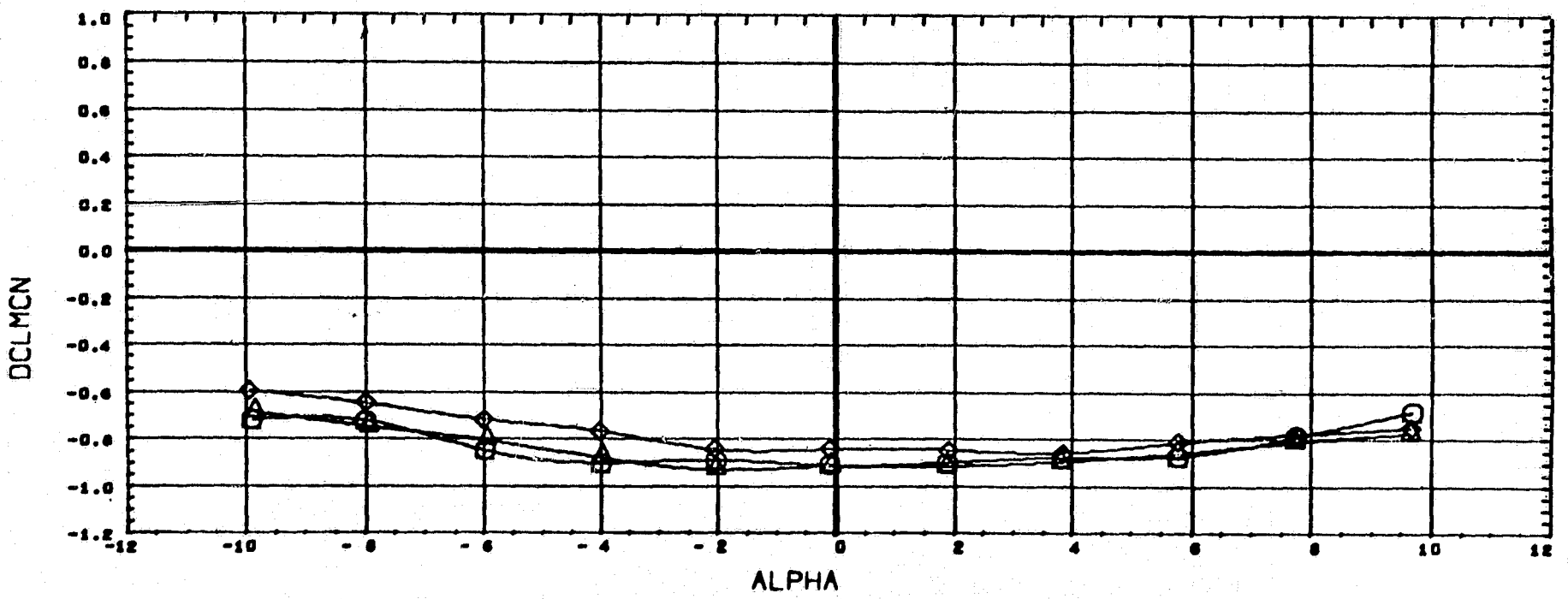
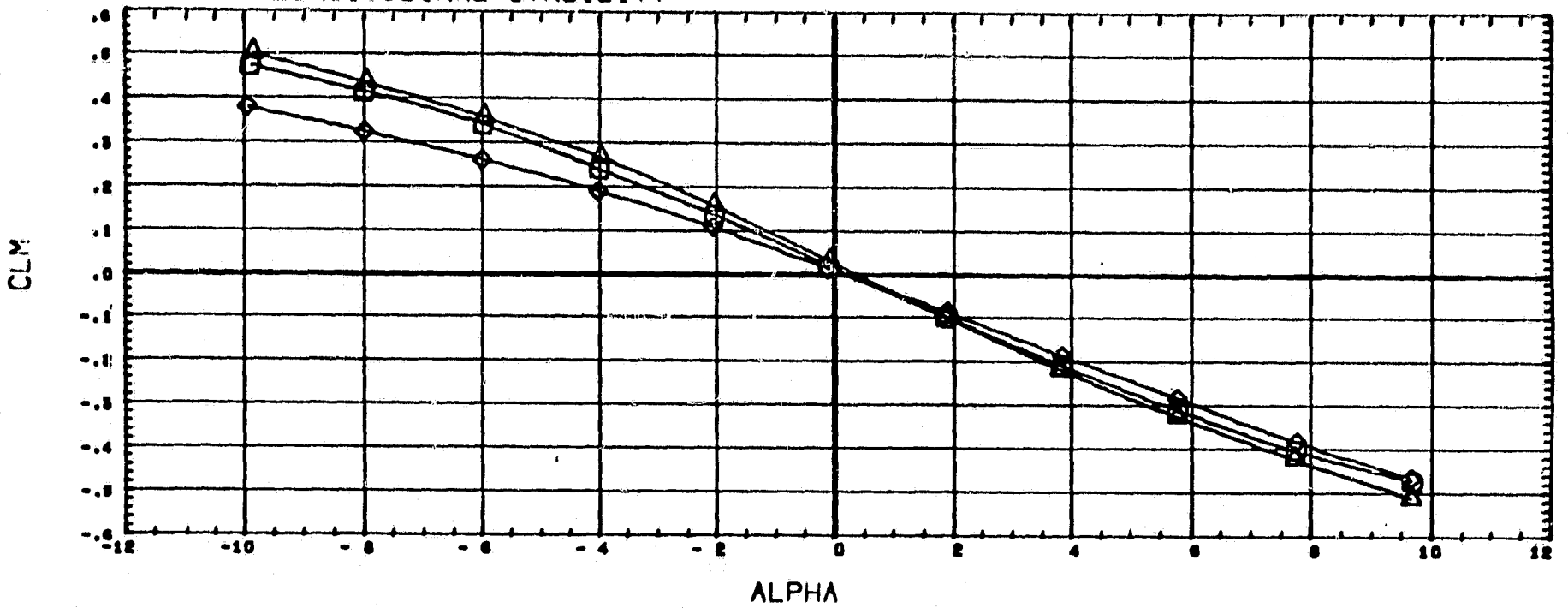


SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.898		0.000
△	1.106		
◇	1.456		

REFERENCE INFORMATION		
SREF	5.1478	88. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7830	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE CGR

# LONGITUDINAL STABILITY

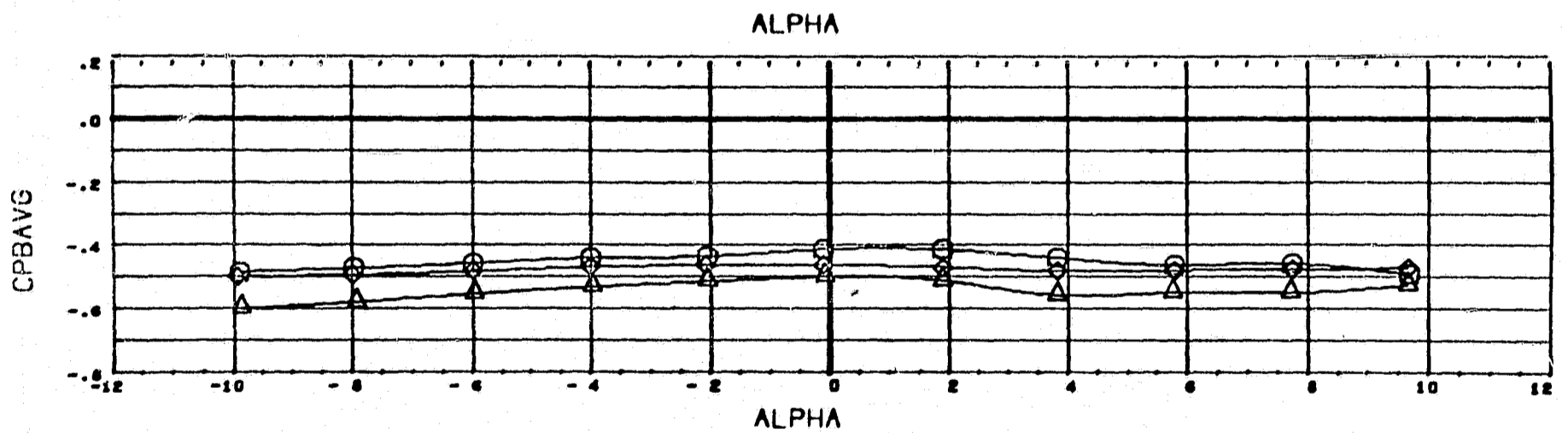
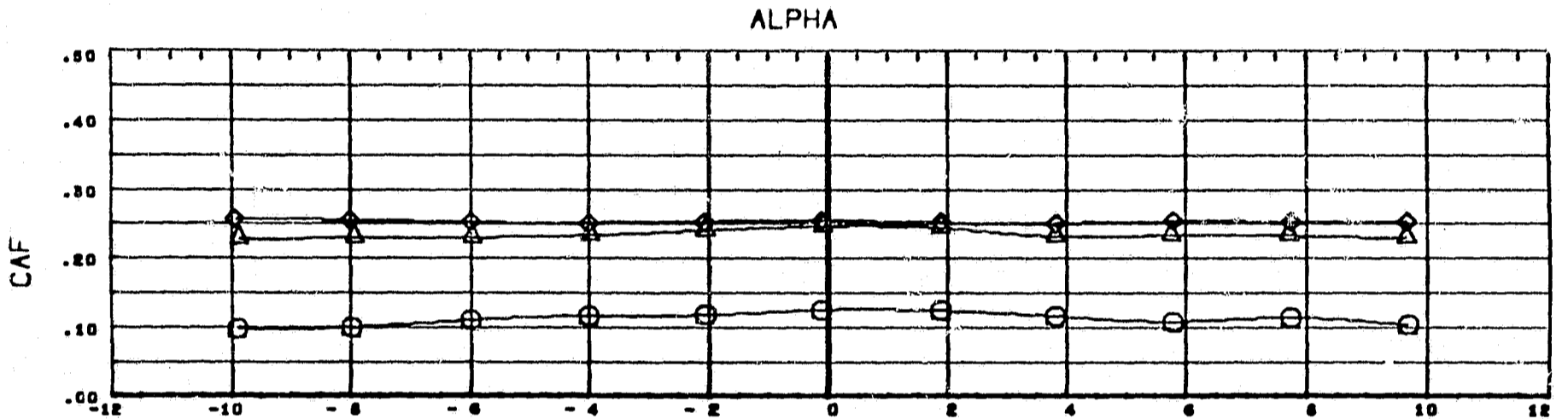
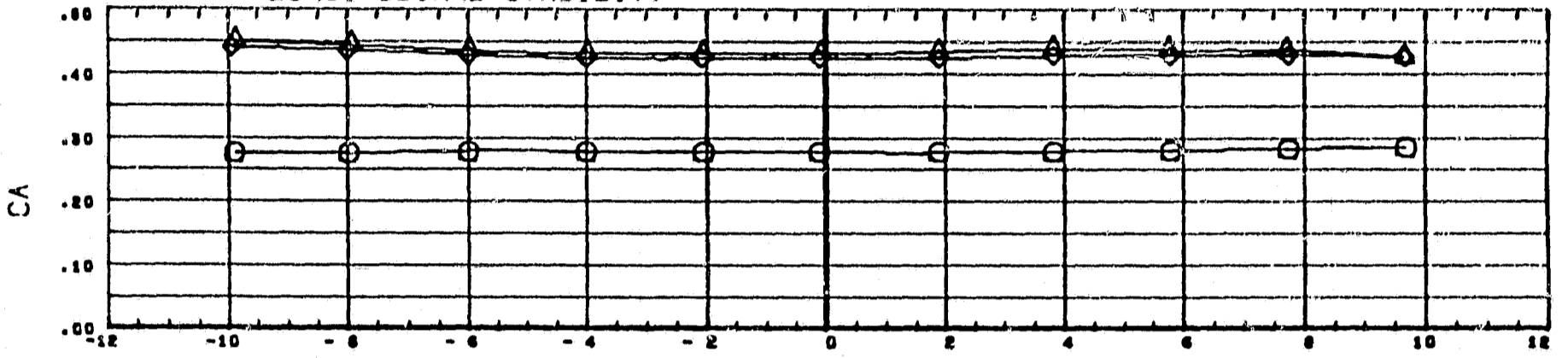


SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.898		0.000
△	1.108		
◇	1.458		

REFERENCE INFORMATION		
SREF	5.1478	80. IN.
LREF	4.4260	IN.
CREF	2.9690	IN.
XMRP	8.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA MIST. CODE CGR

# LONGITUDINAL STABILITY

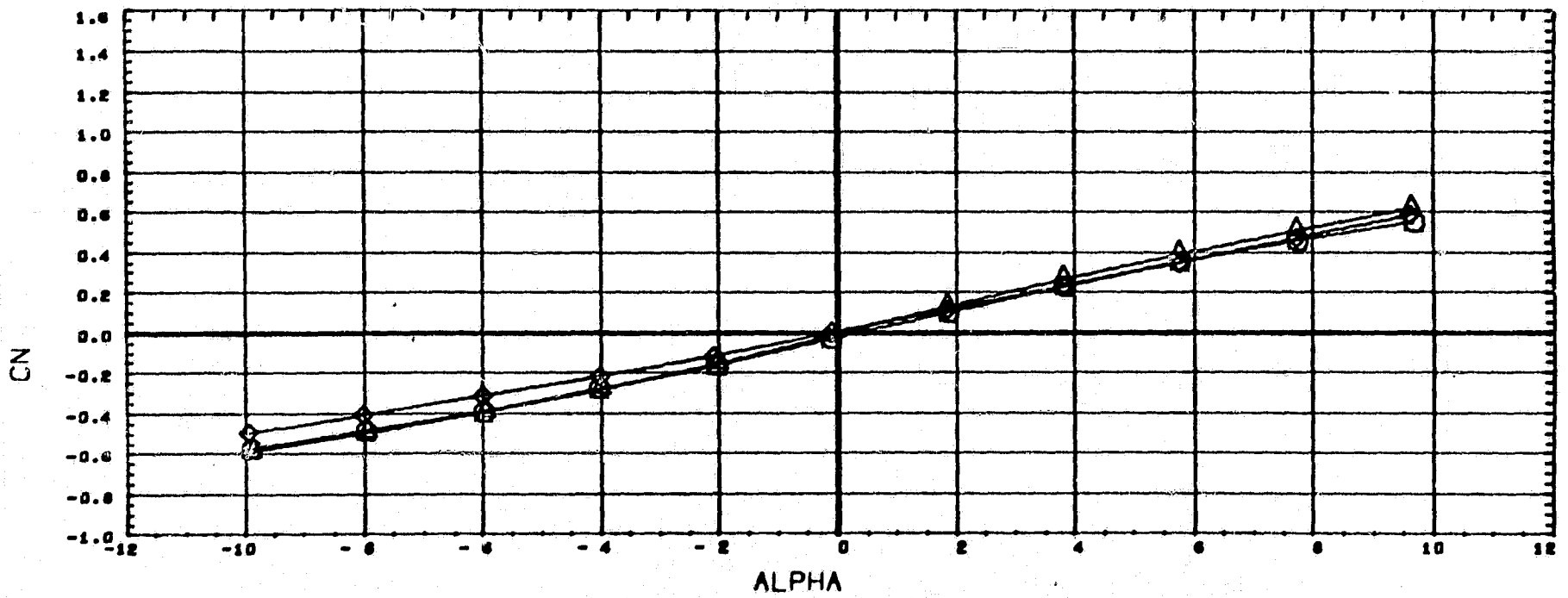
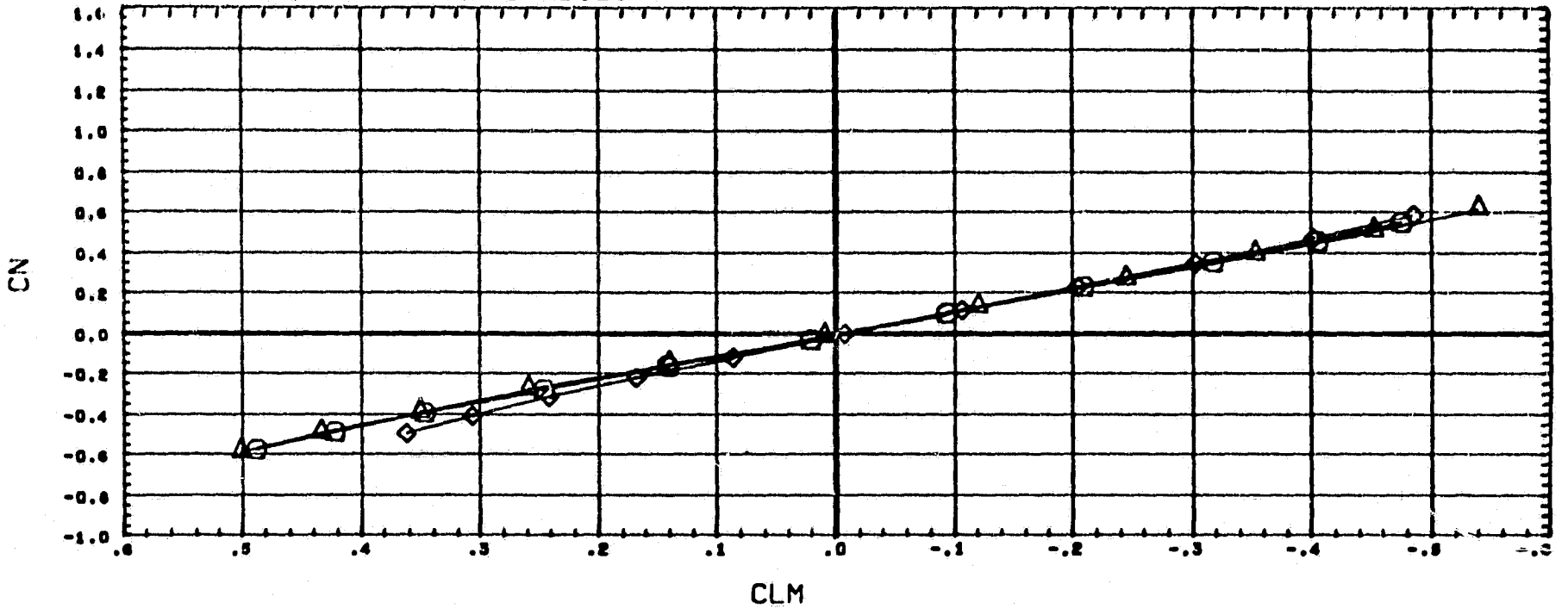


SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.898		0.000
◇	1.106		
△	1.458		

REFERENCE INFORMATION		
\$REF	3.1478	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XHRP	5.7530	IN.
YHRP	0.0000	IN.
ZHRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE CGR

# LONGITUDINAL STABILITY

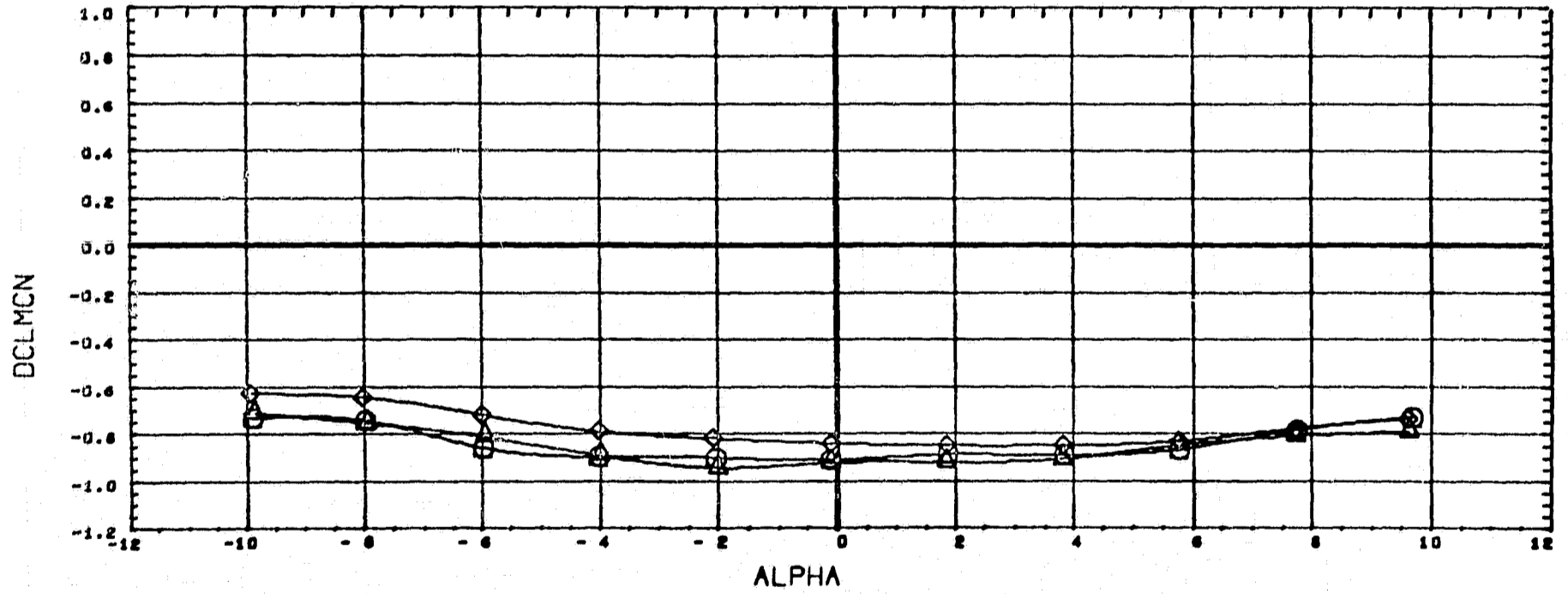
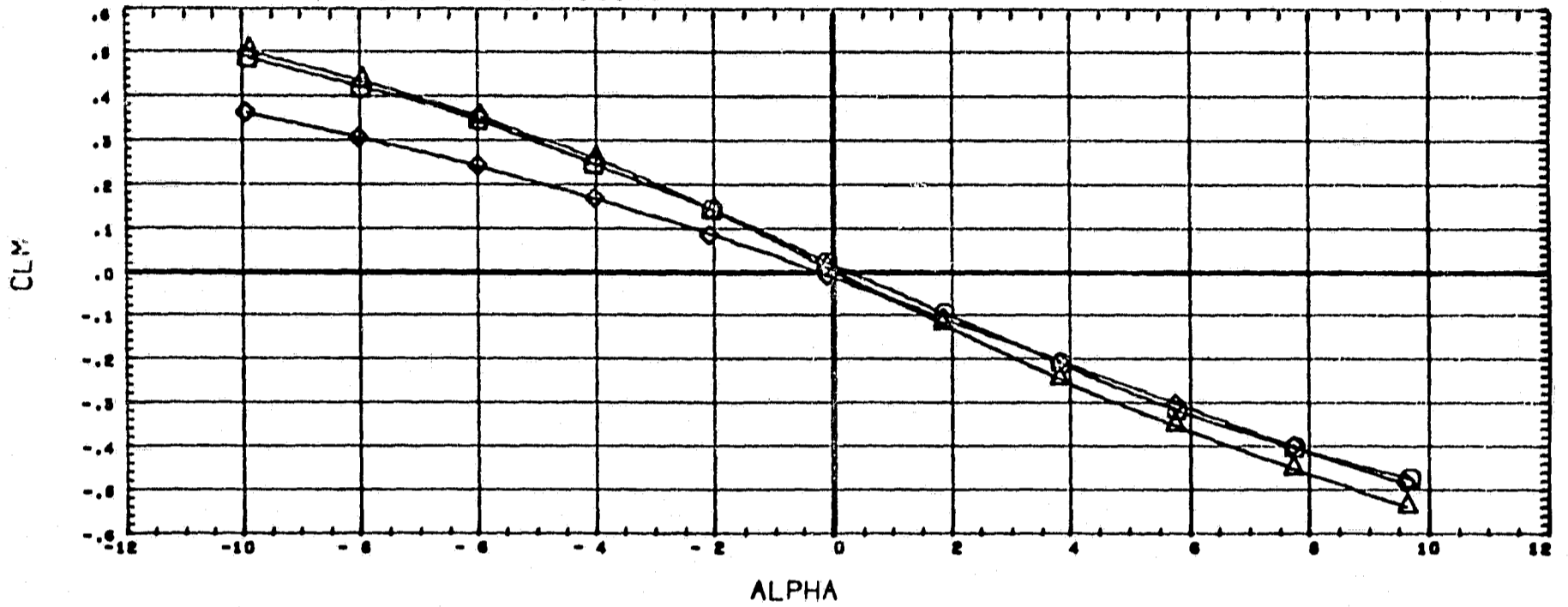


SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.897	0.000	
△	1.104		
◇	1.460		

REFERENCE INFORMATION		
SREF	5.1478	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	8.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

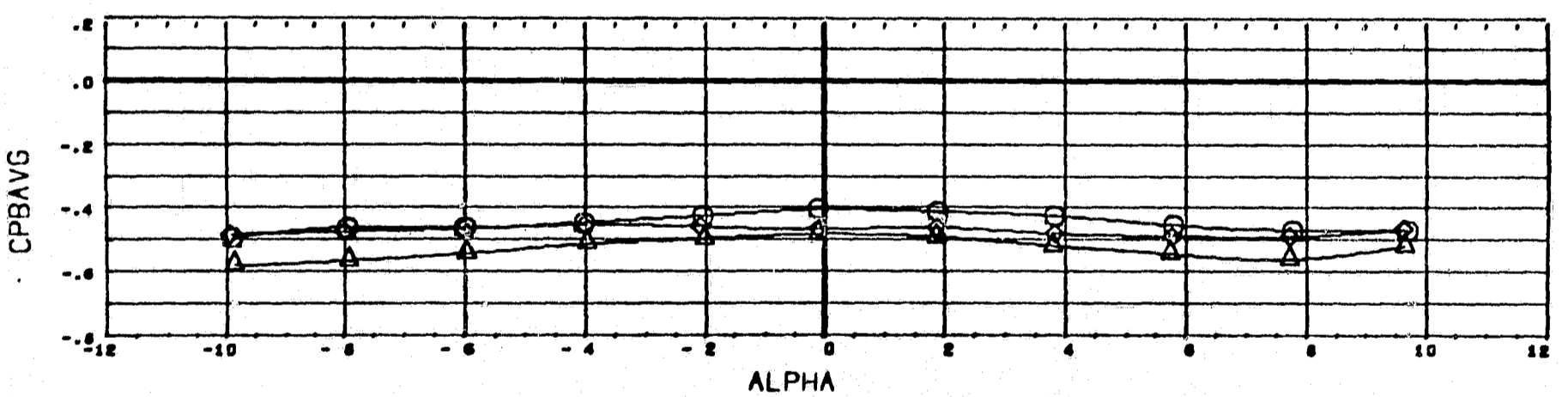
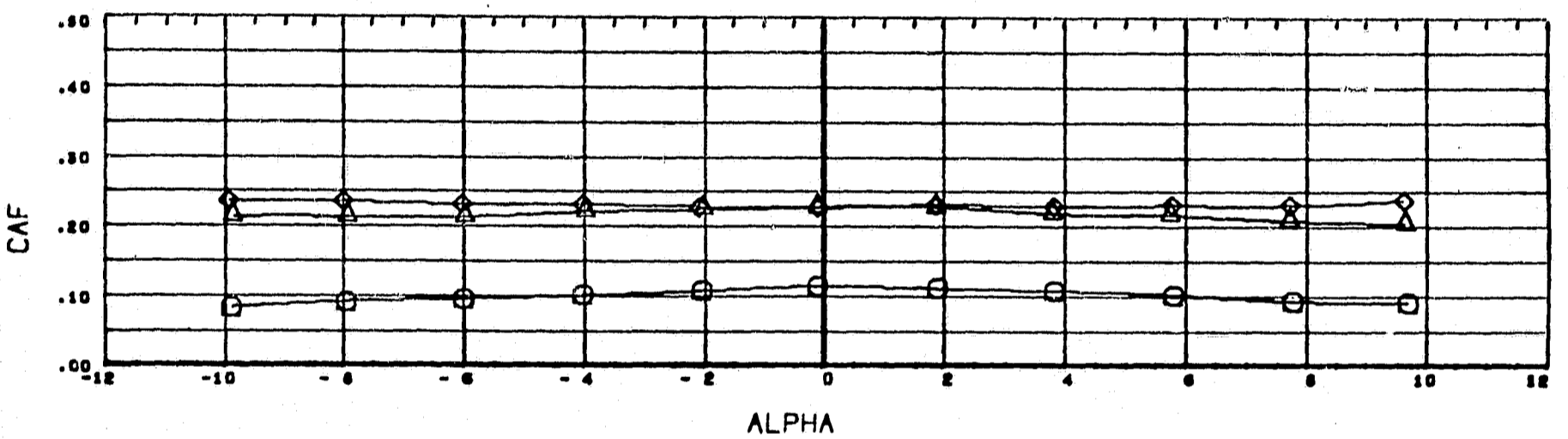
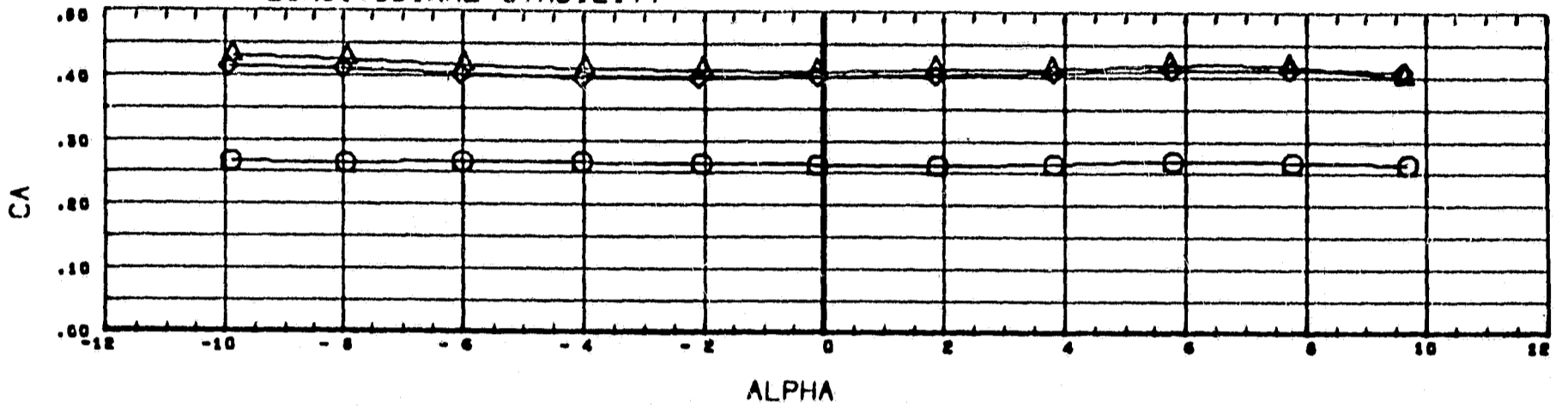
DATA HIST. CODE CGR

# LONGITUDINAL STABILITY



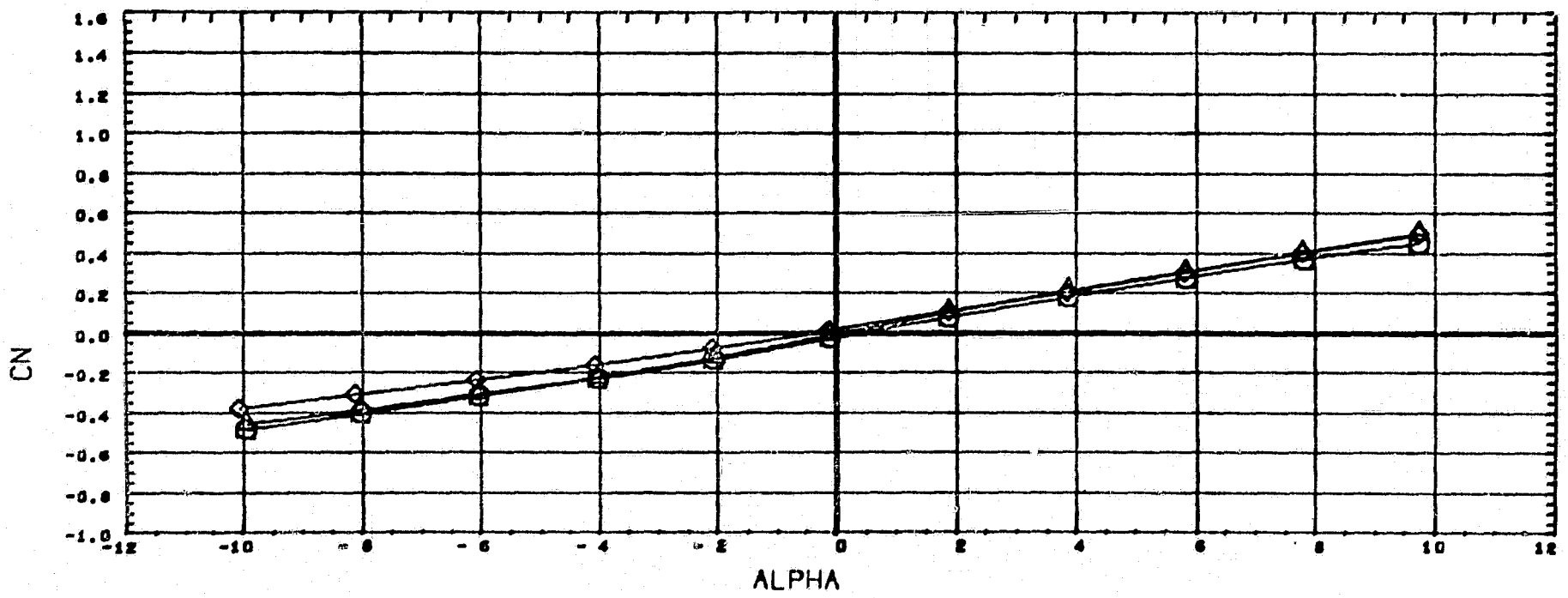
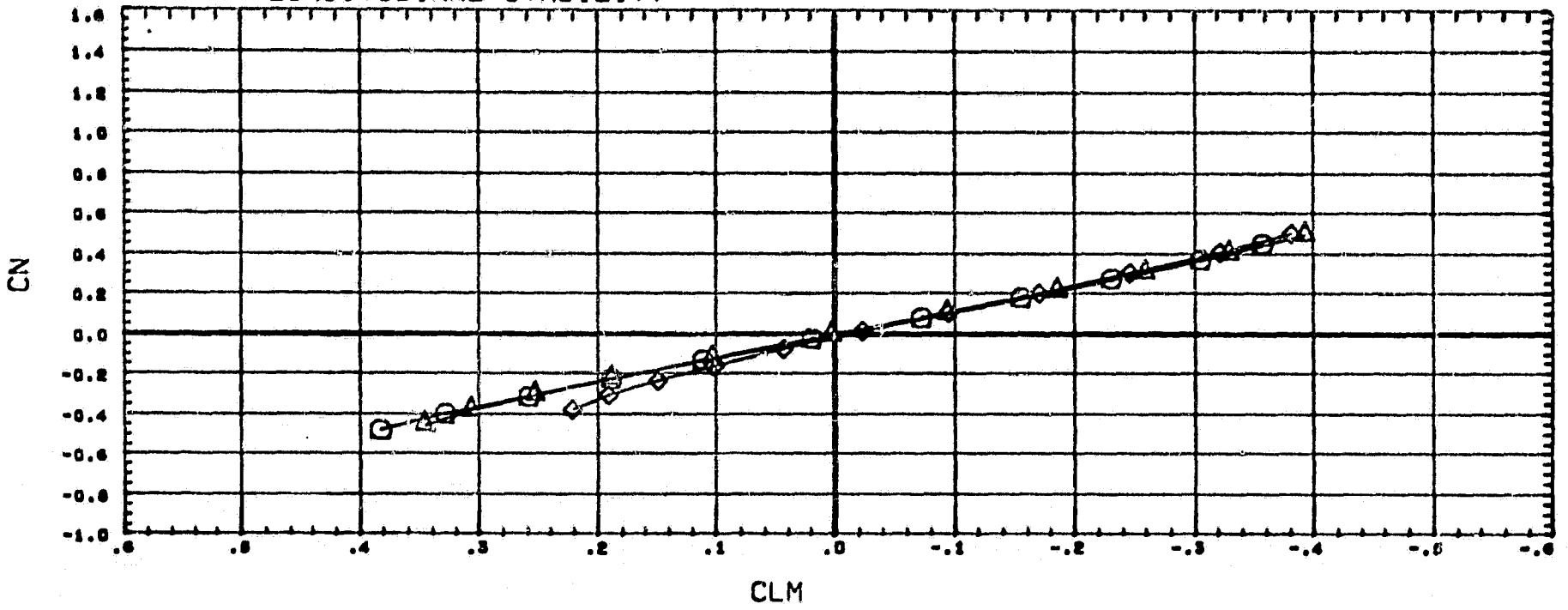
<b>SYMBOL</b>	<b>MACH</b>	<b>PARAMETRIC VALUES</b>	<b>REFERENCE INFORMATION</b>
○	0.897	BETA 0.000	SREF 5.1478 80. IN.
△	1.104		LREF 4.4260 IN.
◇	1.460		BREF 2.9690 IN.
			XMRP 5.7530 IN.
			YMRP 0.0000 IN.
			ZMRP 0.0000 IN.
			SCALE 0.0034

# LONGITUDINAL STABILITY



SYMBOL	MACH	BETA	PARAMETRIC VALUES			REFERENCE INFORMATION
○	0.897		0.000			SREF 5.1478 80. IN.
△	1.104					LREF 4.4260 IN.
◇	1.460					BREF 2.9690 IN.
						XMRP 9.7530 IN.
						YMRP 0.0000 IN.
						ZMRP 0.0000 IN.
						SCALE 0.0034

# LONGITUDINAL STABILITY

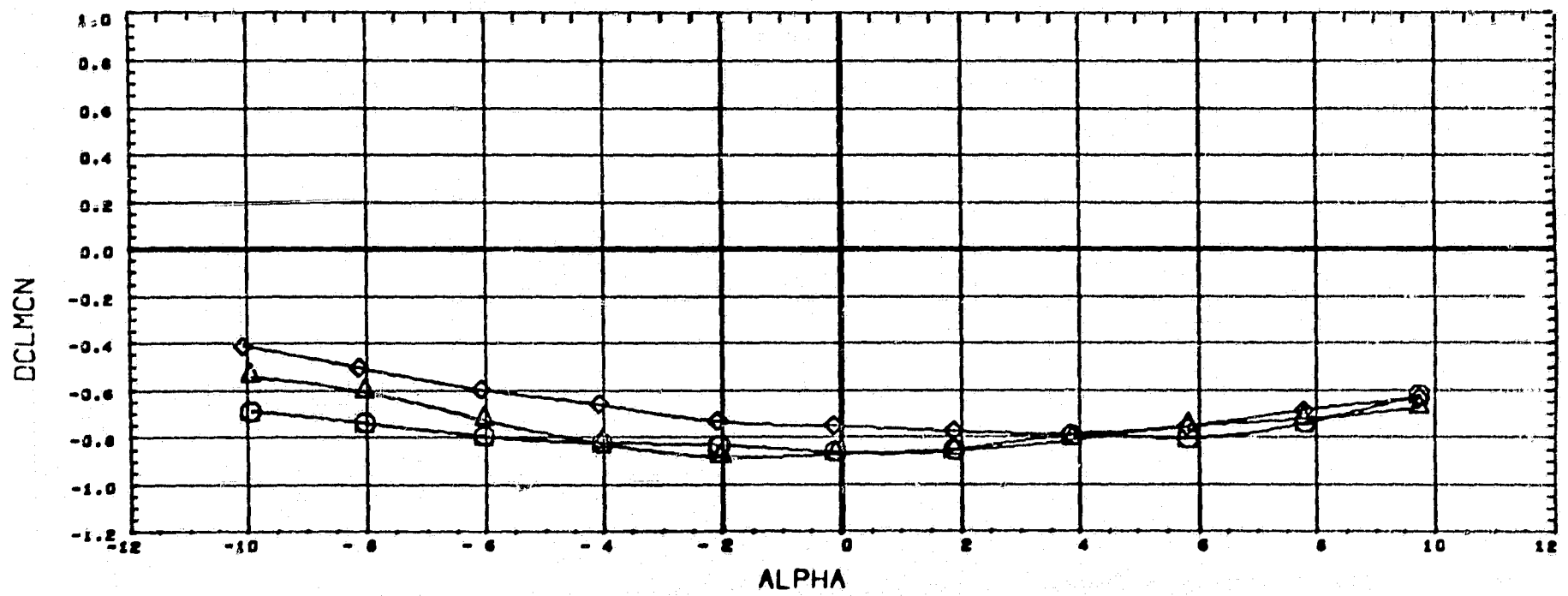
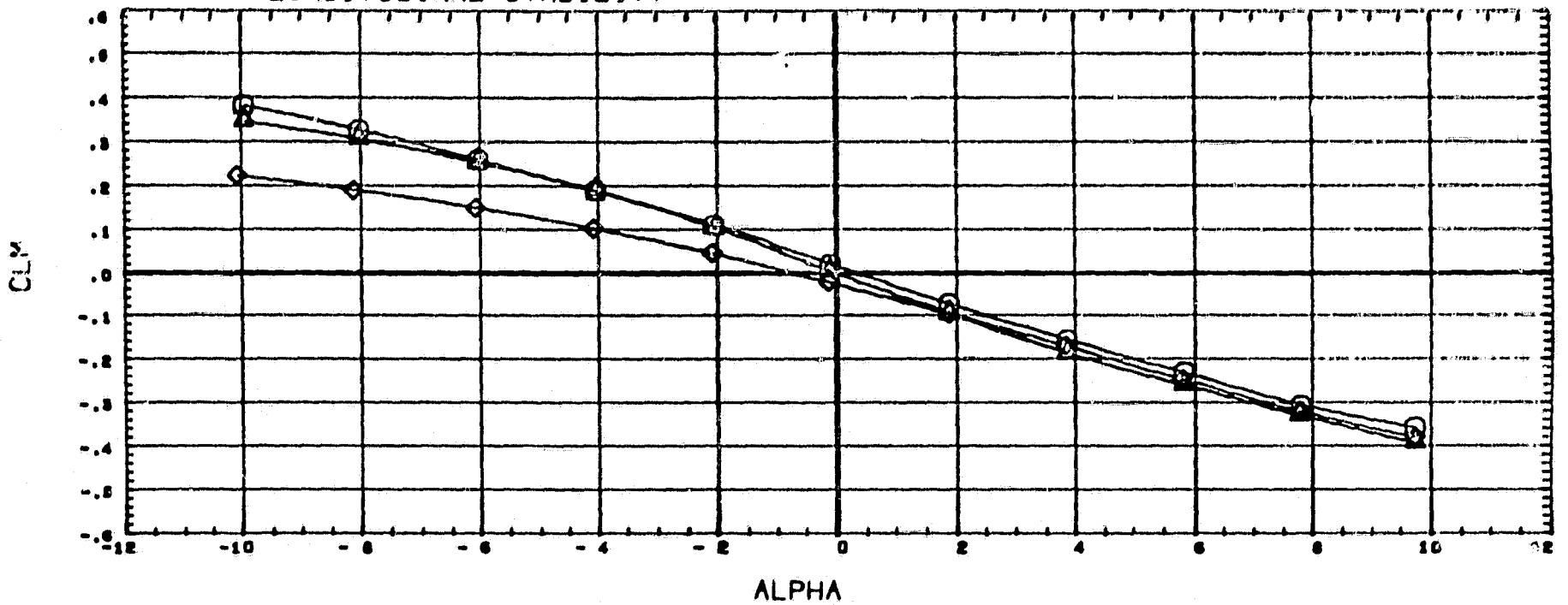


SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.800		0.000
△	1.100		
◇	1.458		

REFERENCE INFORMATION		
SREF	5.1476	86. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE CGR

# LONGITUDINAL STABILITY



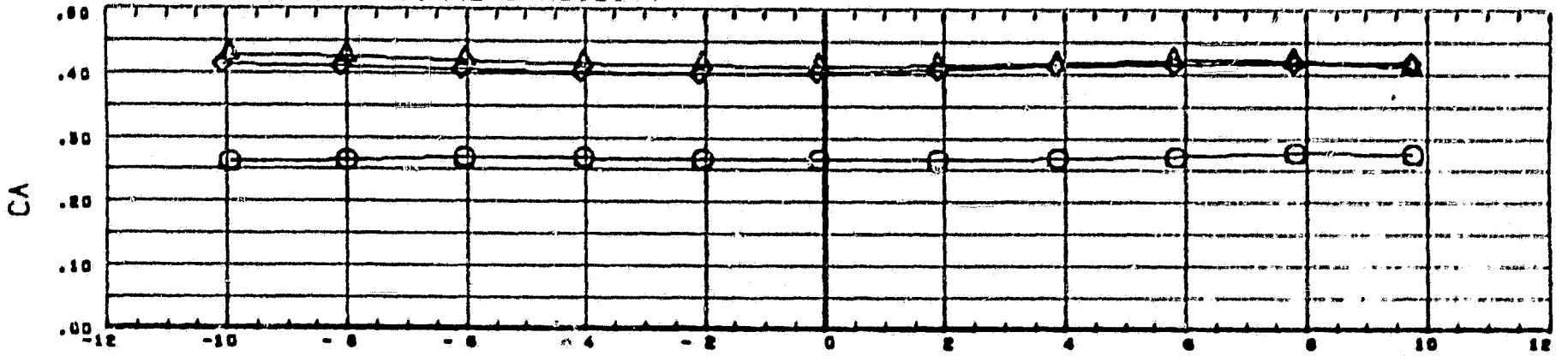
SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.899		0.000
△	1.100		
◇	1.458		

REFERENCE INFORMATION		
SREF	5.1474	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

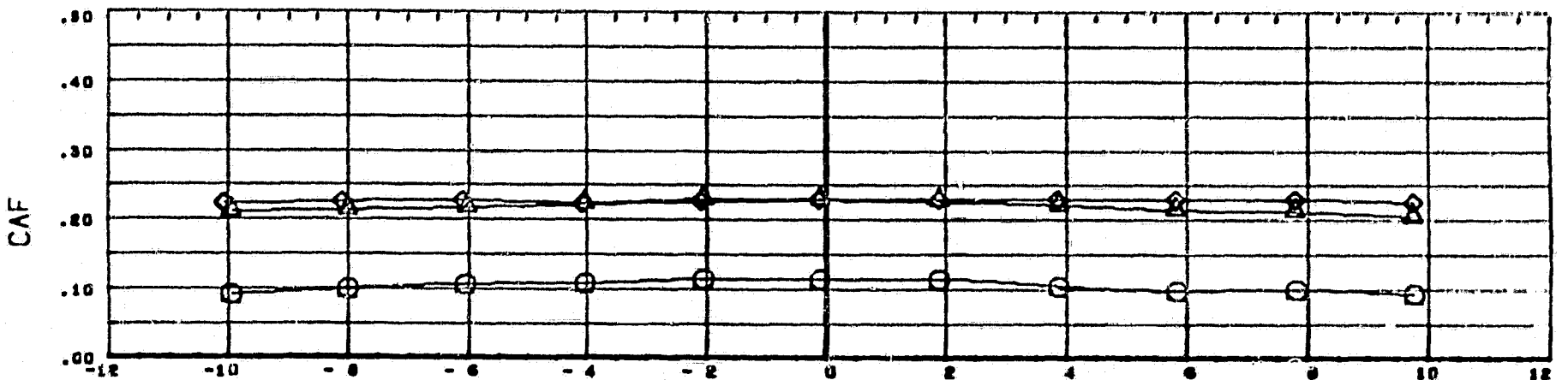
DATA HIST. CODE CGR



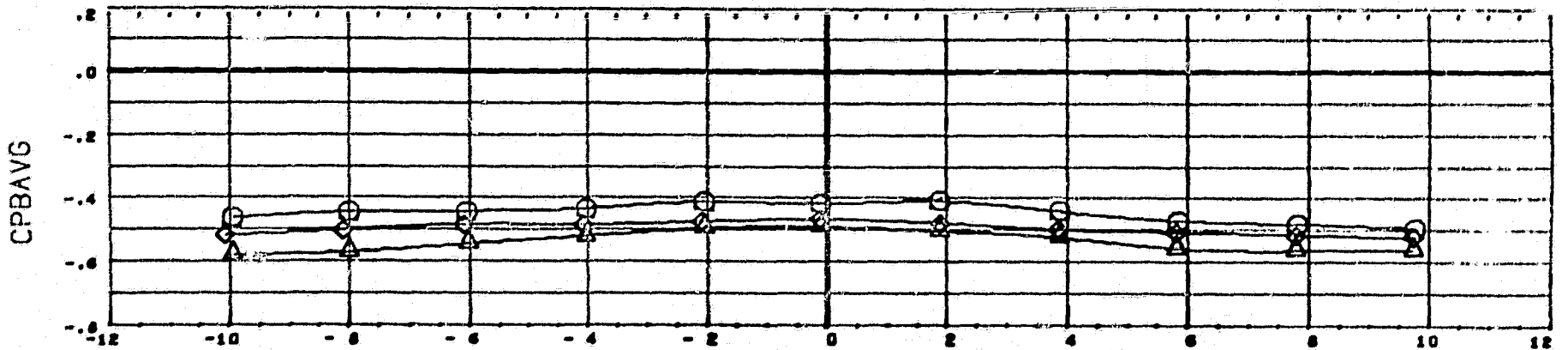
# LONGITUDINAL STABILITY



ALPHA



ALPHA



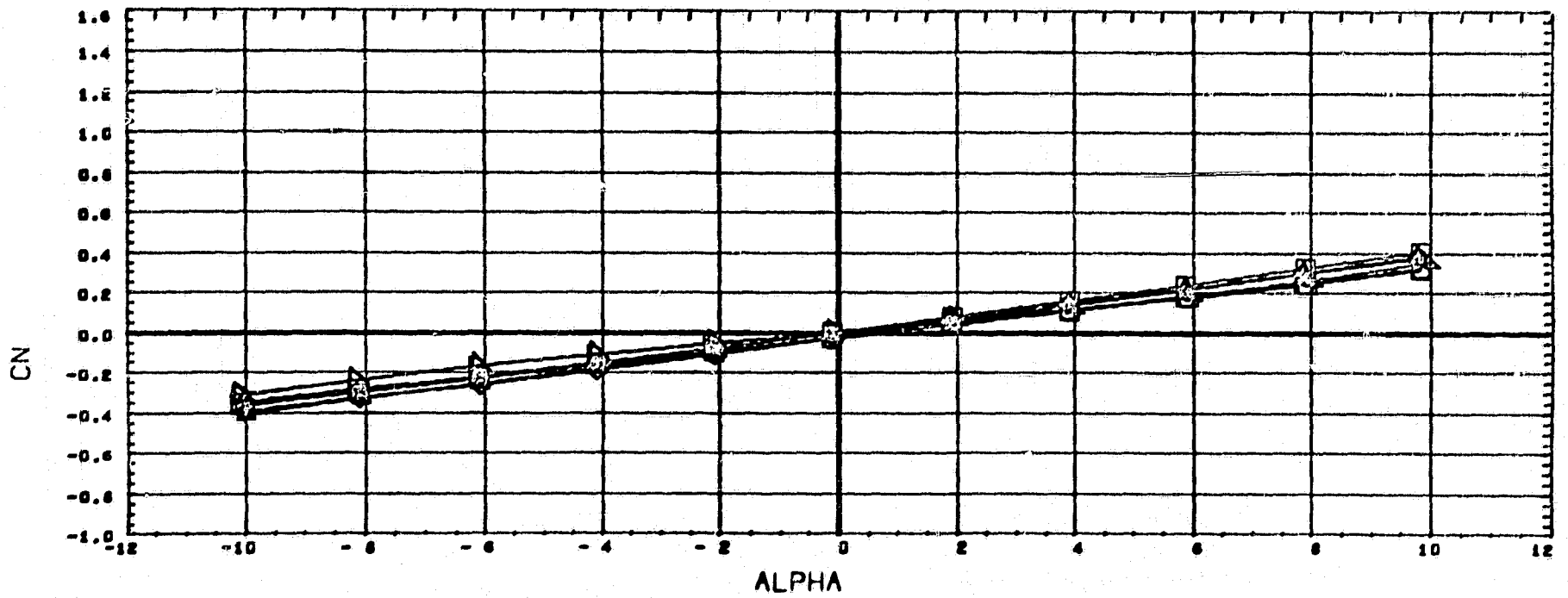
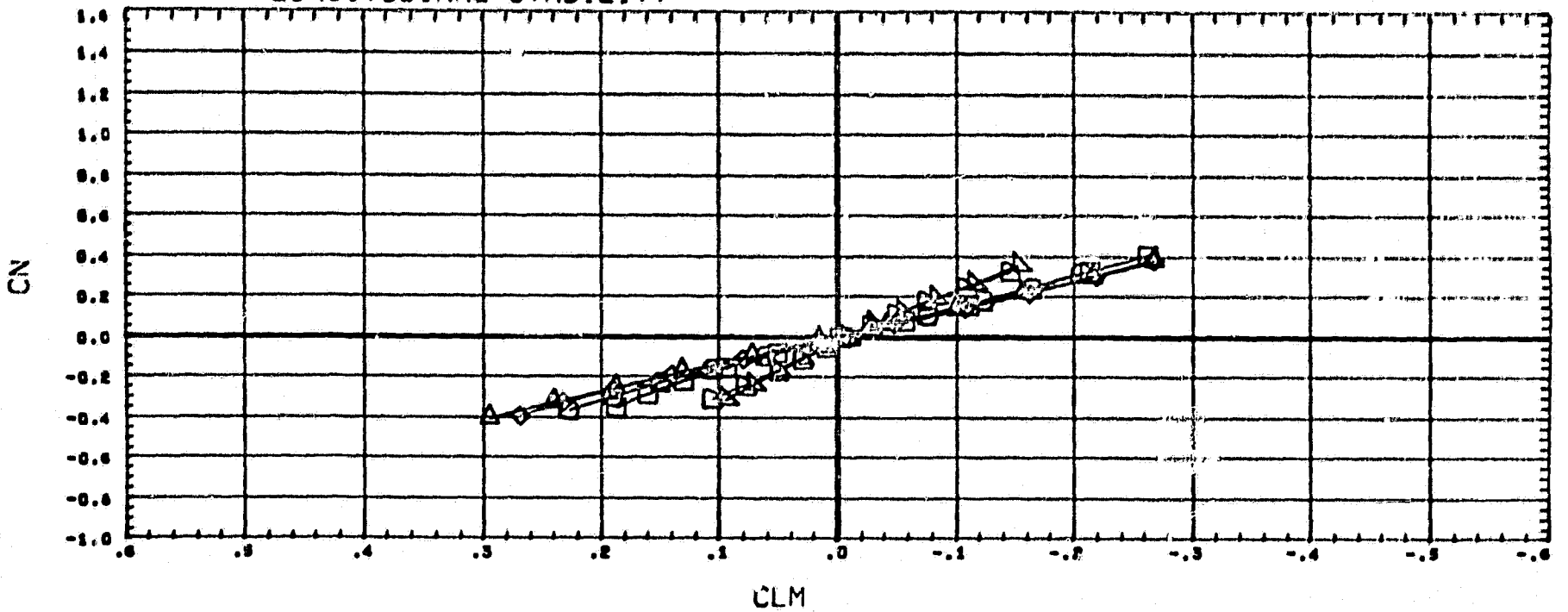
ALPHA

SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.899		0.000
□	1.100		
◇	1.450		

REFERENCE INFORMATION		
SREF	5.1478	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	9.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE CGR

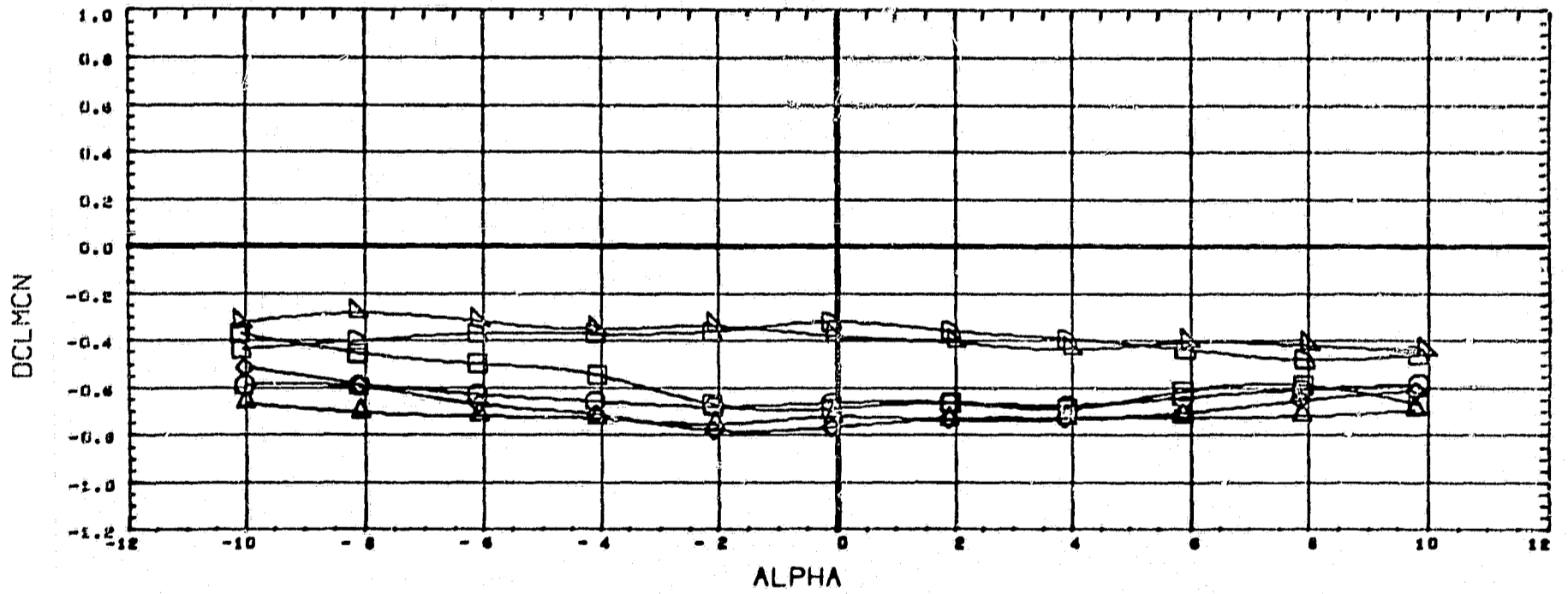
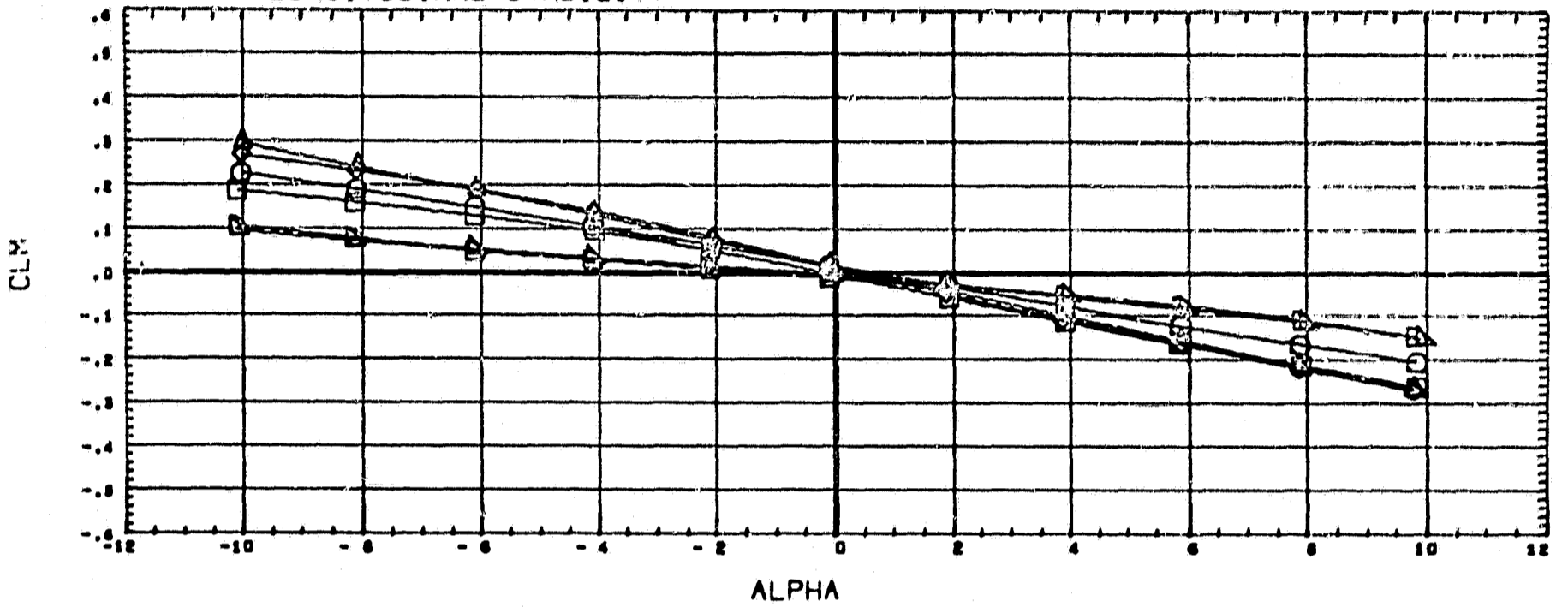
# LONGITUDINAL STABILITY



SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.997		0.000
◇	0.900		
△	1.099		
□	1.460		
◇	2.740		
△	4.959	DATA HIST. CODE	CGR

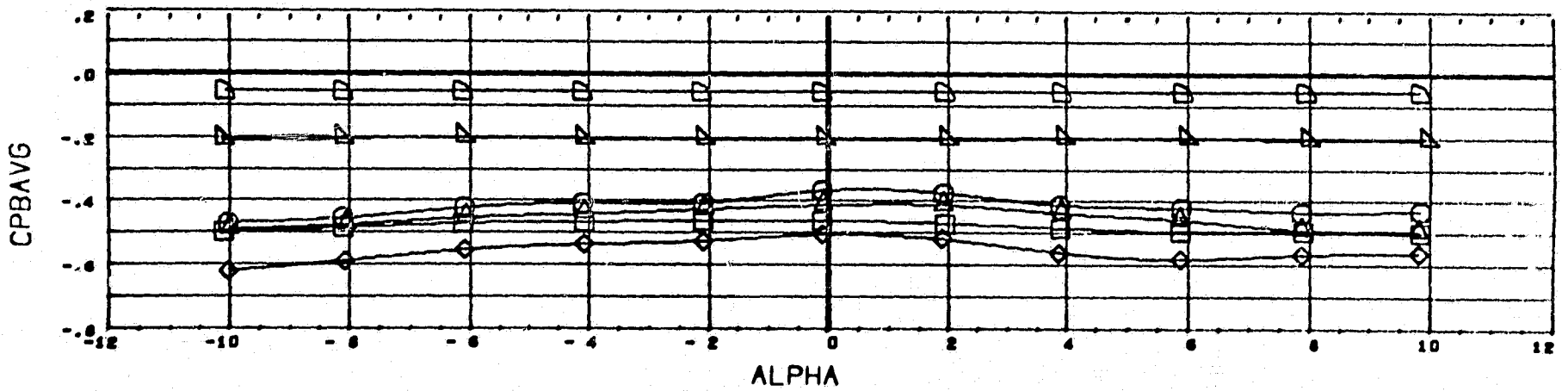
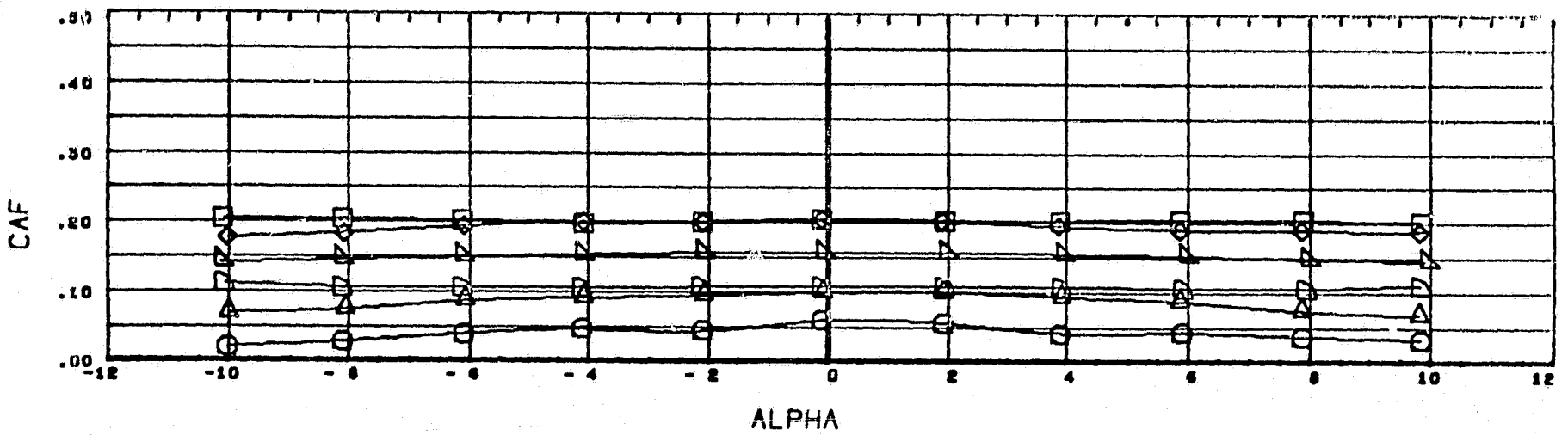
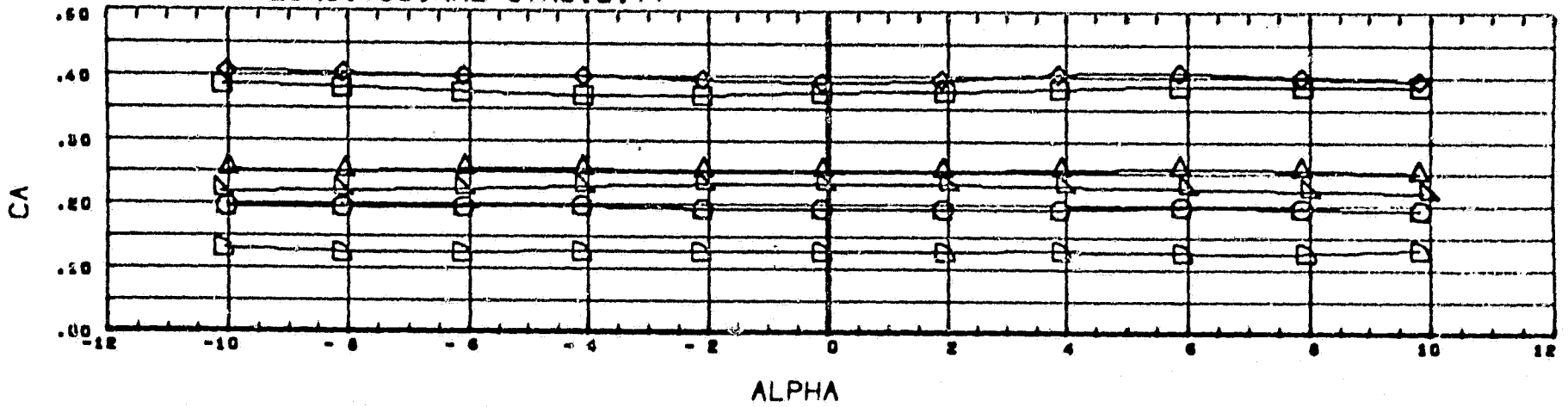
REFERENCE INFORMATION		
SREF	5.1478	sq. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XHRP	5.7550	IN.
YHRP	0.0000	IN.
ZHRP	0.0000	IN.
SCALE	0.0034	

# LONGITUDINAL STABILITY



SYMBOL	MACH	PARAMETRIC VALUES		REFERENCE INFORMATION	
		BETA	0.000	SREF	80. IN.
○	0.597			LREF	4.4260 IN.
◇	0.900			BREF	2.9690 IN.
□	1.099			XMRP	5.7530 IN.
△	1.460			YMRP	0.0000 IN.
○	2.740			ZMRP	0.0000 IN.
○	4.959	DATA HIST. CODE	CGR	SCALE	0.0034

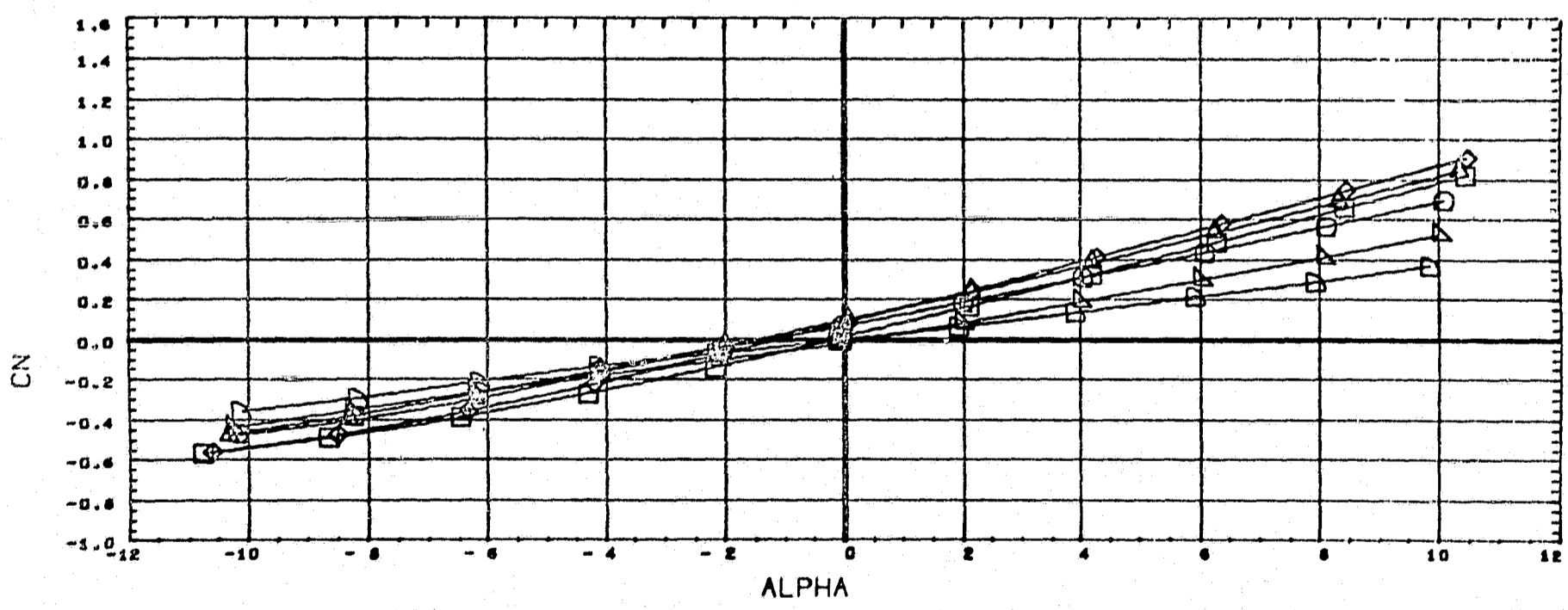
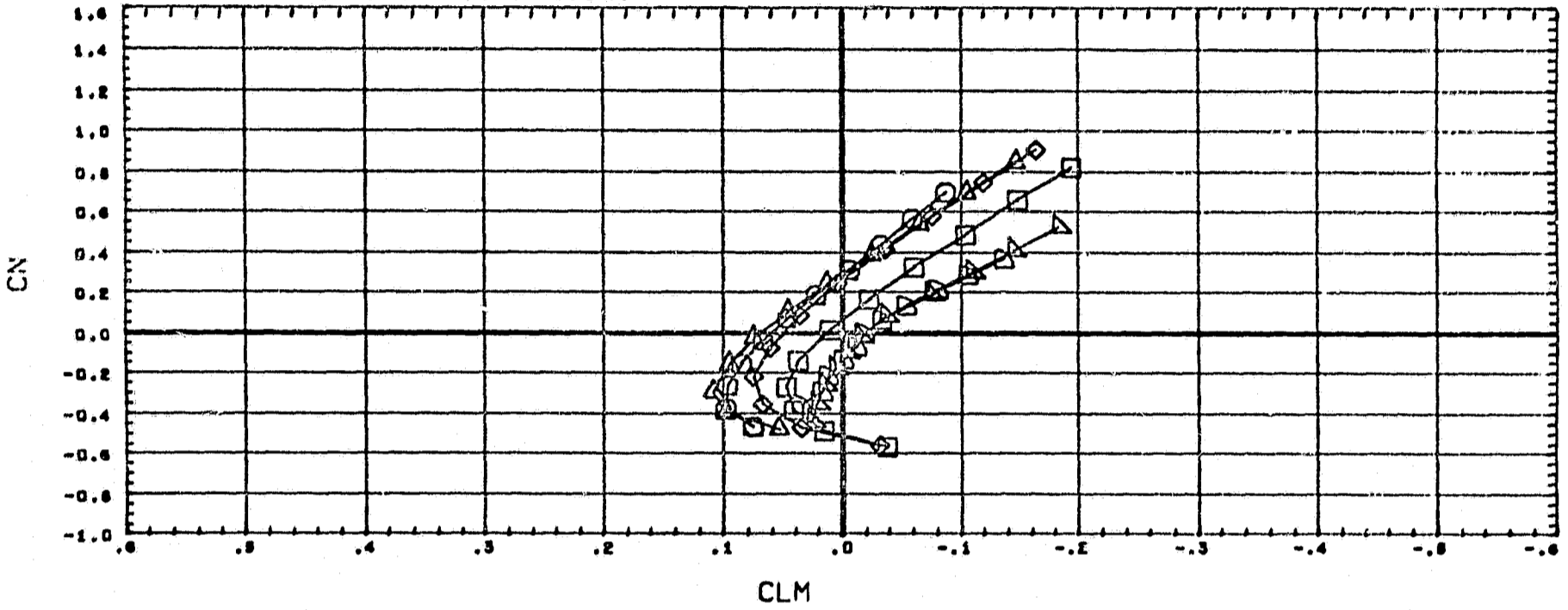
# LONGITUDINAL STABILITY



SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.597	0.000	
◇	0.900		
△	1.099		
□	1.460		
▽	2.740		
◇	4.959		
		DATA HIST. CODE	CGR

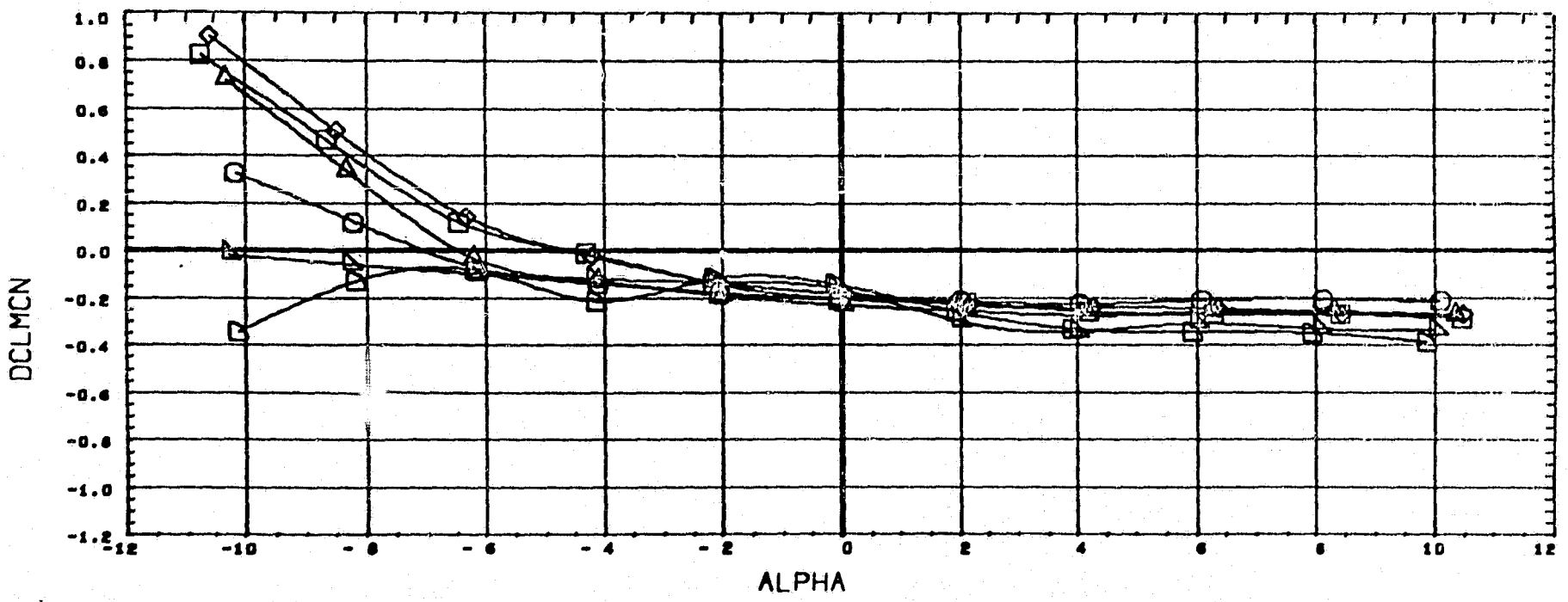
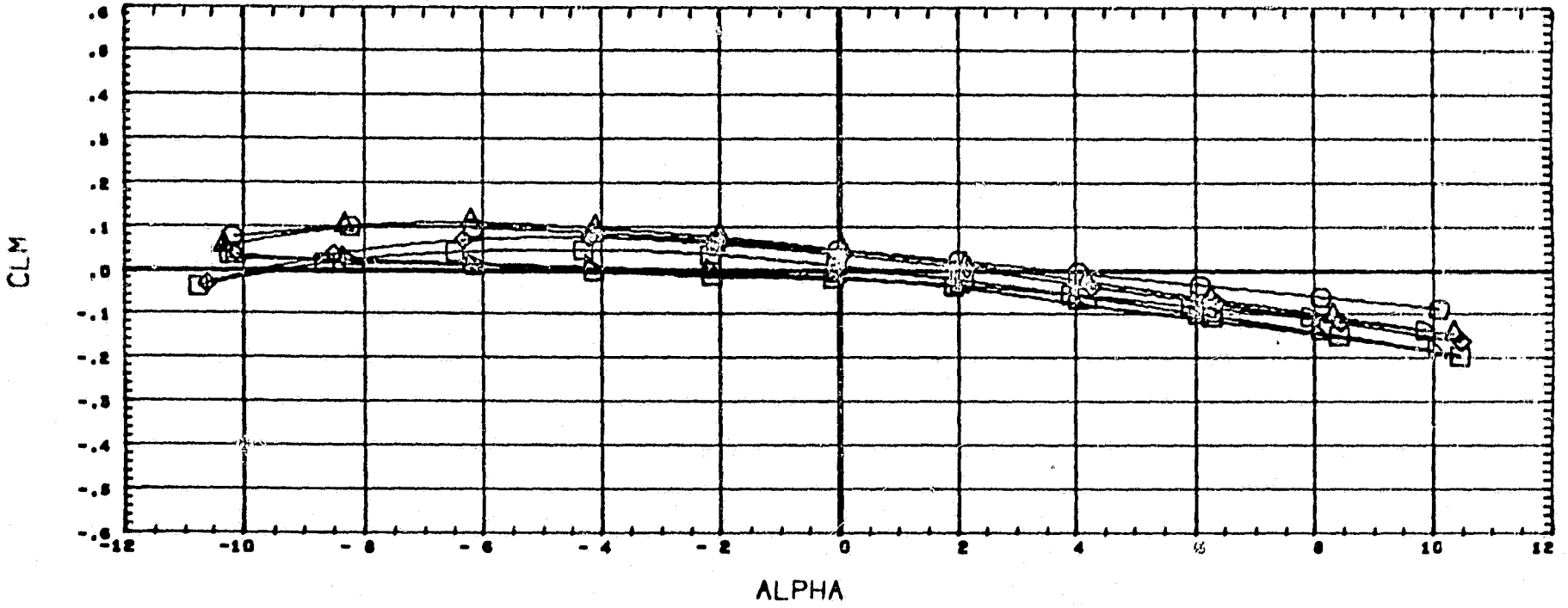
REFERENCE INFORMATION		
SREF	5.1478	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

# LONGITUDINAL STABILITY



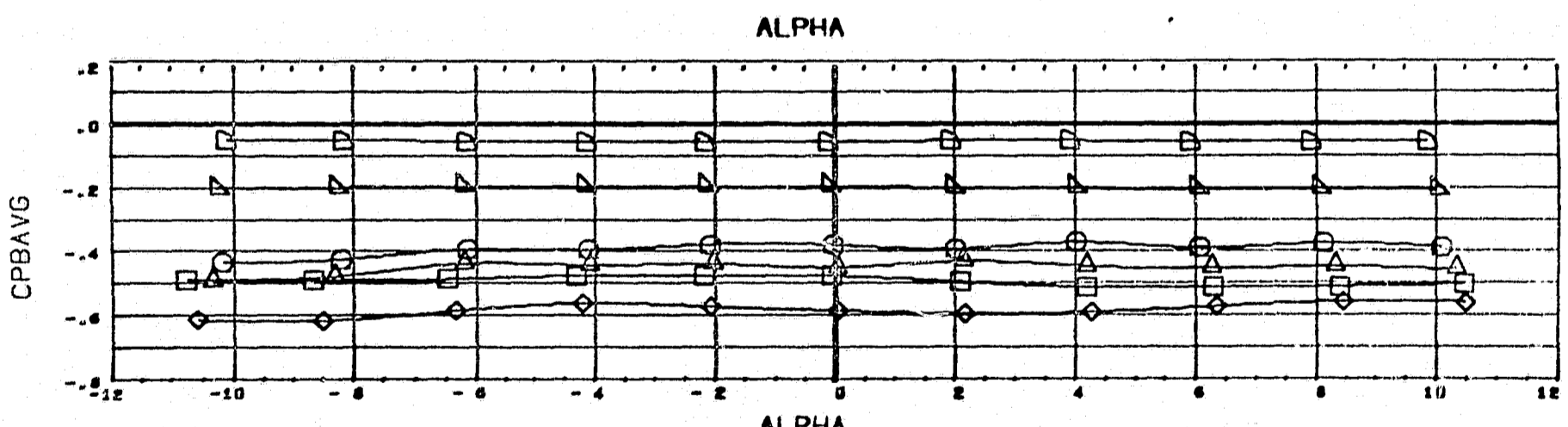
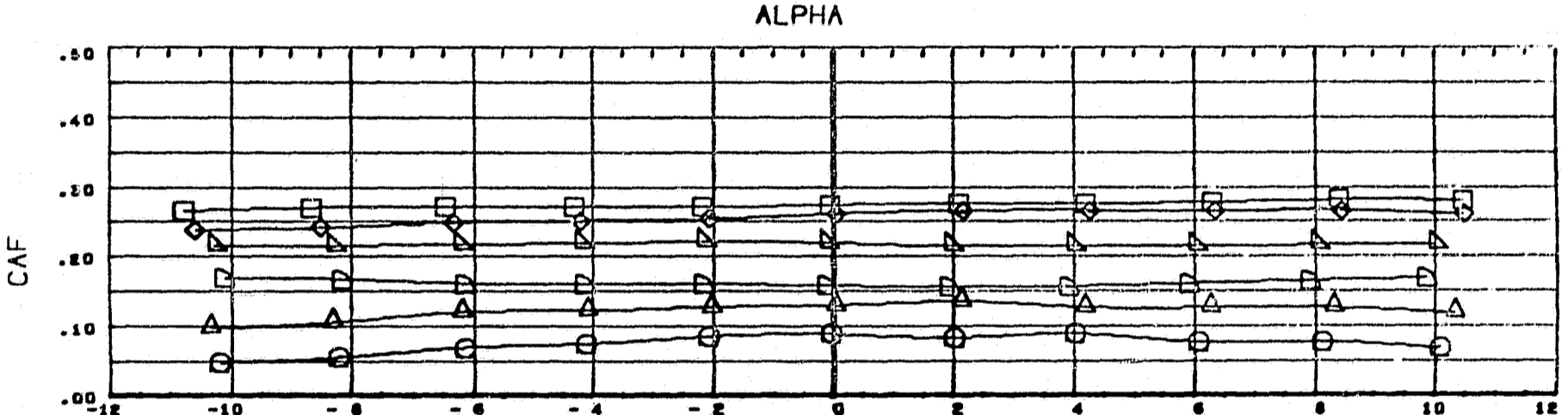
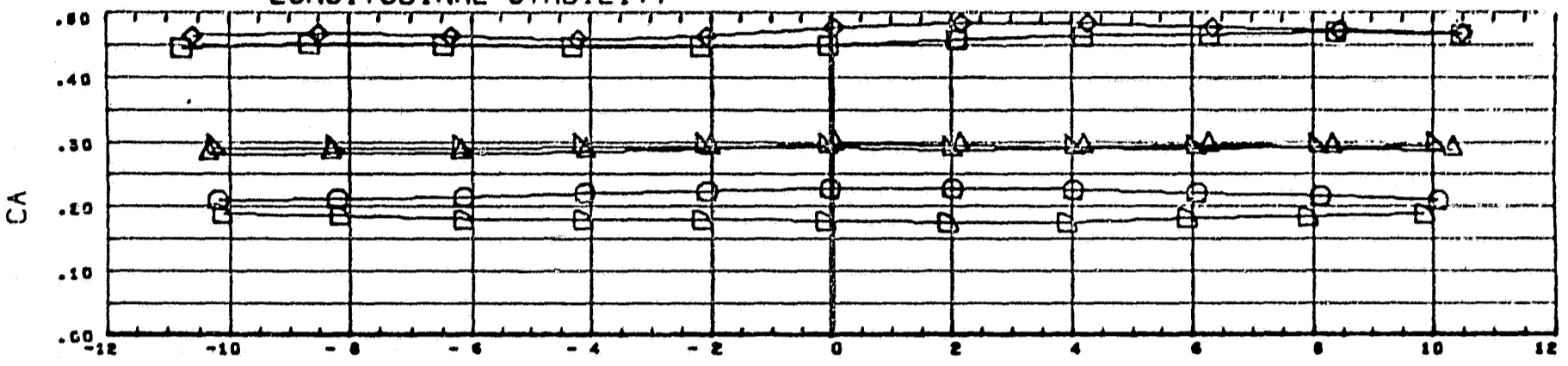
SYMBOL	MACH	PARAMETRIC VALUES		REFERENCE INFORMATION	
		BETA	ORBINC	IN.	IN.
○	0.599	0.000	- 2.000	SREF	5.1478
◇	0.898			LREF	4.4260
△	1.103			BREF	2.9690
□	1.457			XHRP	5.7530
▽	2.740			YHRP	0.0000
◇	4.959			ZHRP	0.0000
		DATA HIST. CODE	CGR	SCALE	0.0034

### LONGITUDINAL STABILITY



SYMBOL	MACH	BETA	PARAMETRIC VALUES		REFERENCE INFORMATION		
○	0.599		0.000	ORBINC	-	2.000	SREF 5.1478 sq. in.
◇	0.898						LREF 4.4260 IN.
△	1.103						BREF 2.9690 IN.
□	1.457						XMRP 5.7550 IN.
◇	2.740						YMRP 0.0000 IN.
□	4.959						ZMRP 0.0000 IN.
		DATA HIST. CODE					SCALE 0.0034
				CGR			

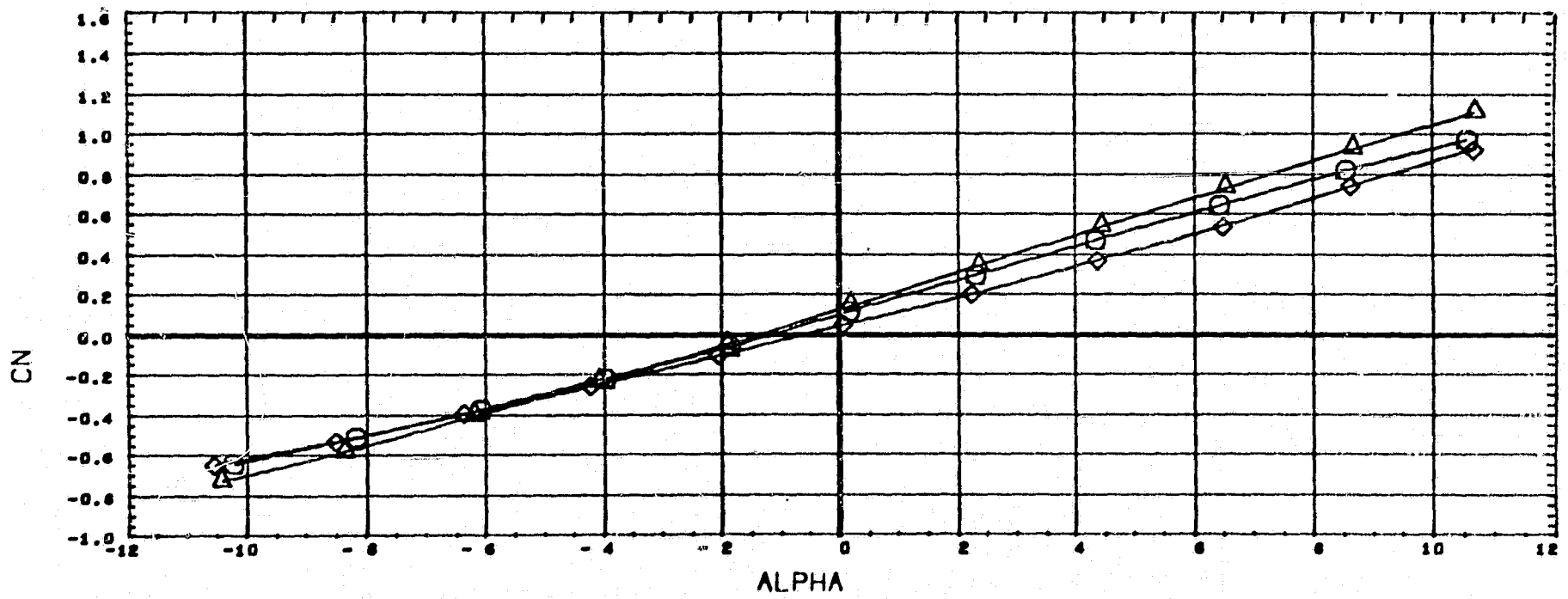
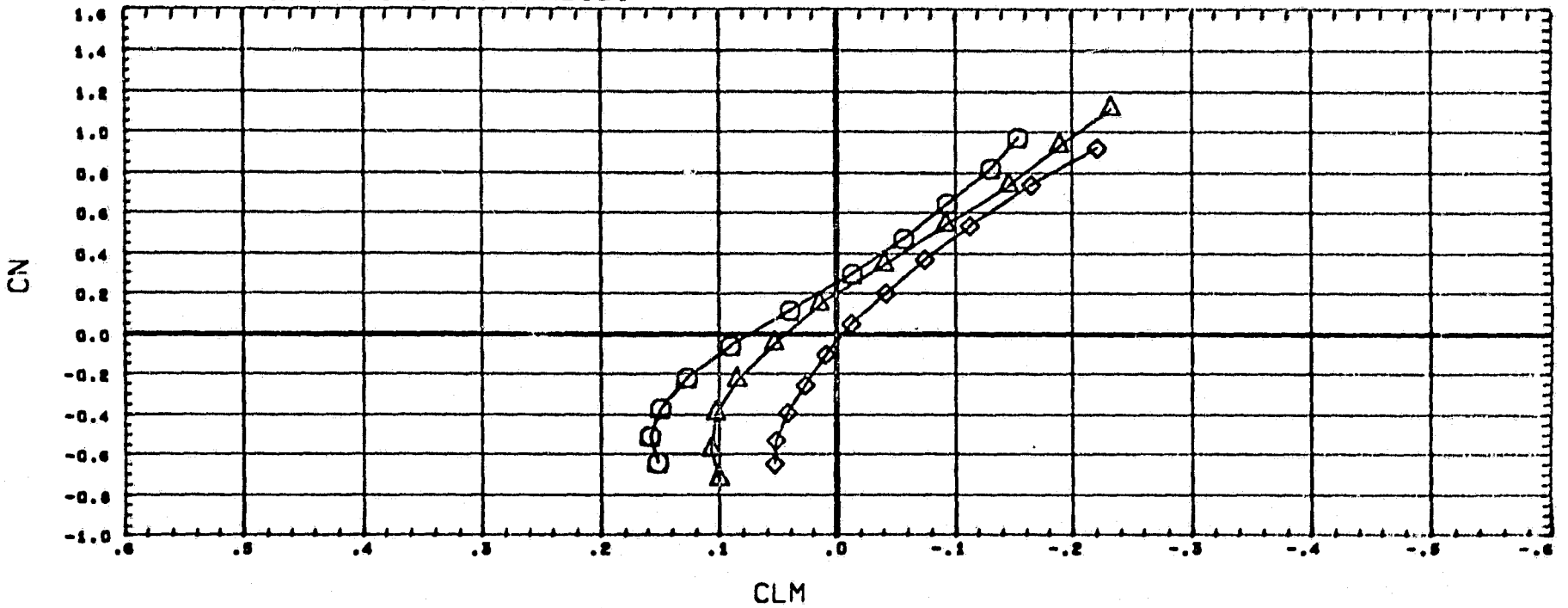
### LONGITUDINAL STABILITY



SYMBOL	MACH	BETA	PARAMETRIC VALUES	
○	0.599		0.000	ORBINC - 2.000
◇	0.898			
△	1.103			
□	1.457			
◇	2.740			
□	4.859			
		DATA HIST. CODE		CGR

REFERENCE INFORMATION		
SREF	5.1478	sq. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

# LONGITUDINAL STABILITY



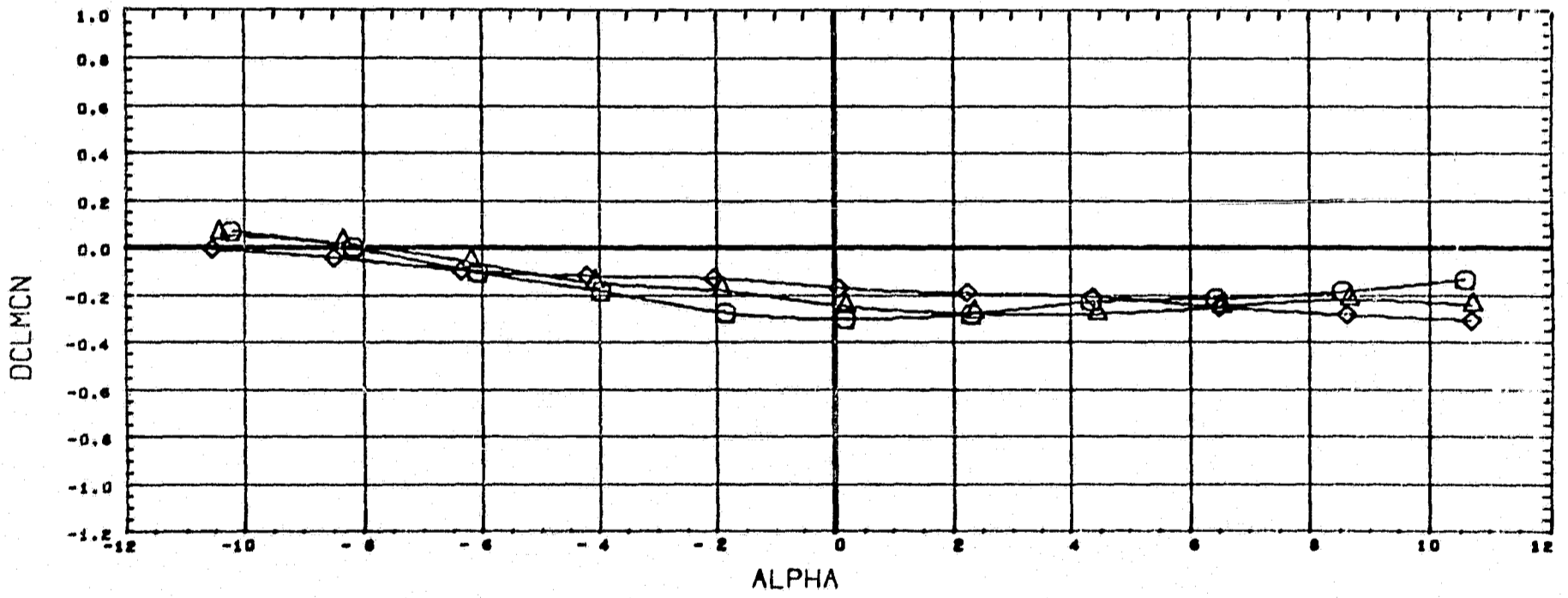
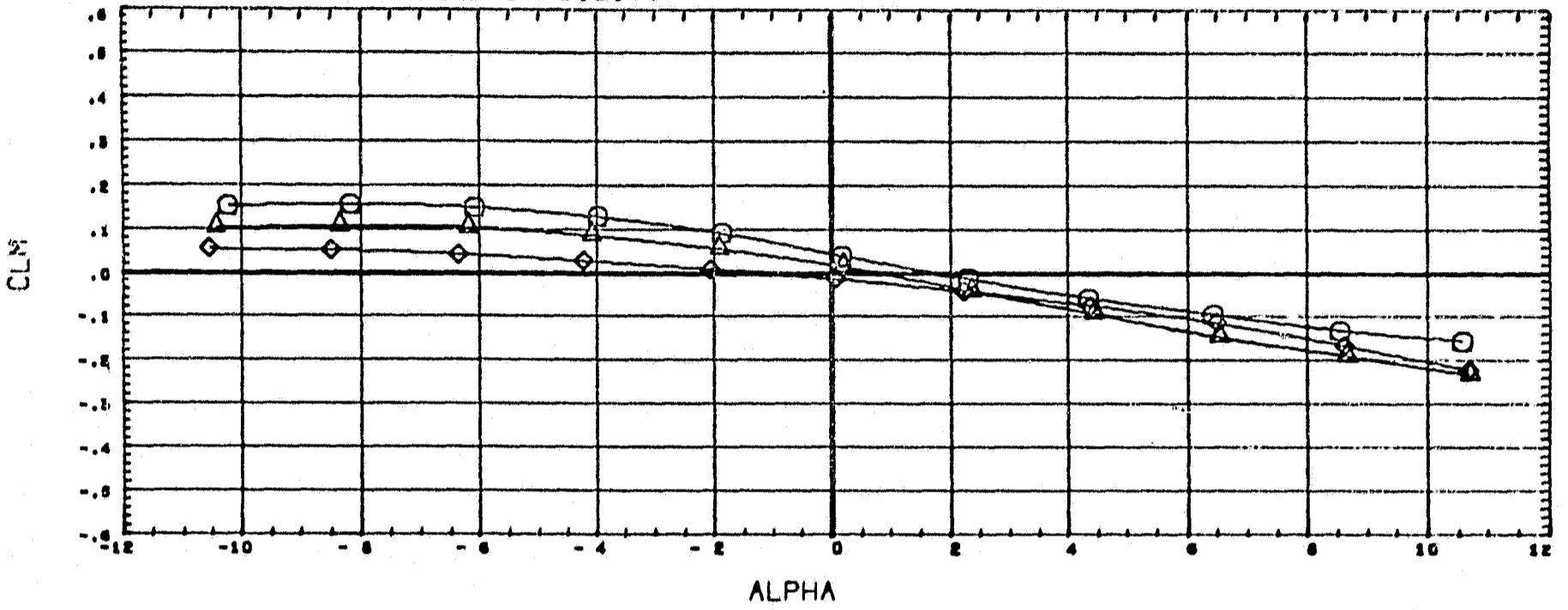
SYMBOL	MACH	PARAMETRIC VALUES	
		BETA	ORBINC
○	0.900	0.000	2.000
△	1.103		
◇	1.460		

REFERENCE INFORMATION		
SREF	5.1476	sq. in.
LREF	4.4260	in.
BREF	2.9690	in.
XHRP	4.3530	in.
YHRP	0.0000	in.
ZHRP	0.0000	in.
SCALE	0.0034	

DATA HIST. CODE CGR



# LONGITUDINAL STABILITY

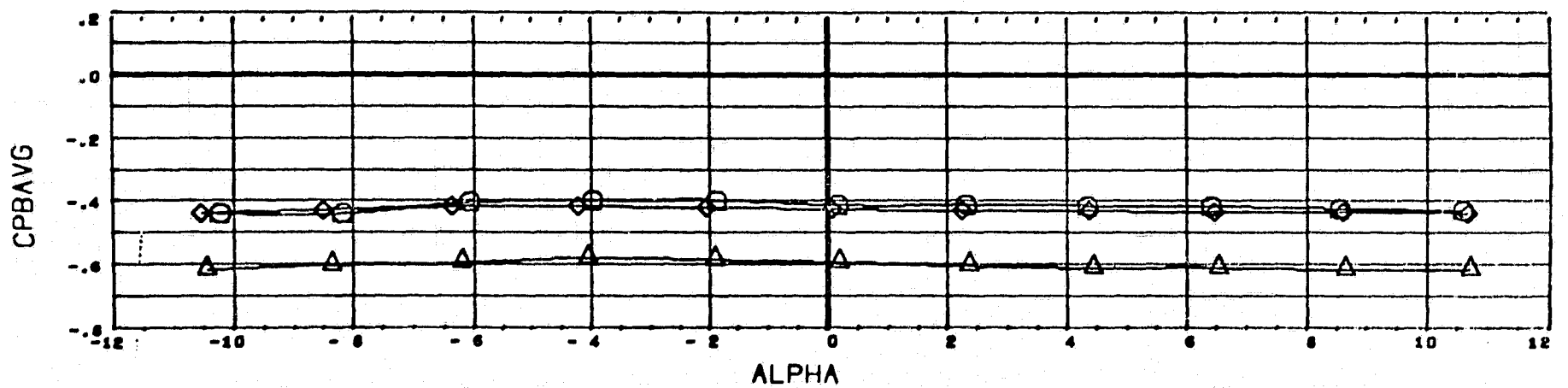
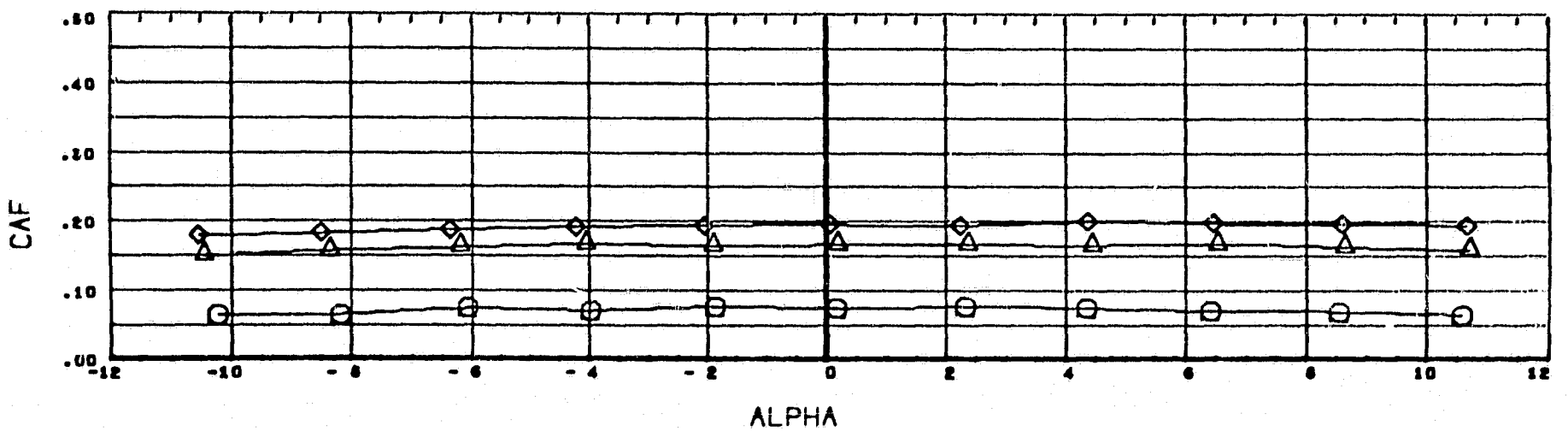
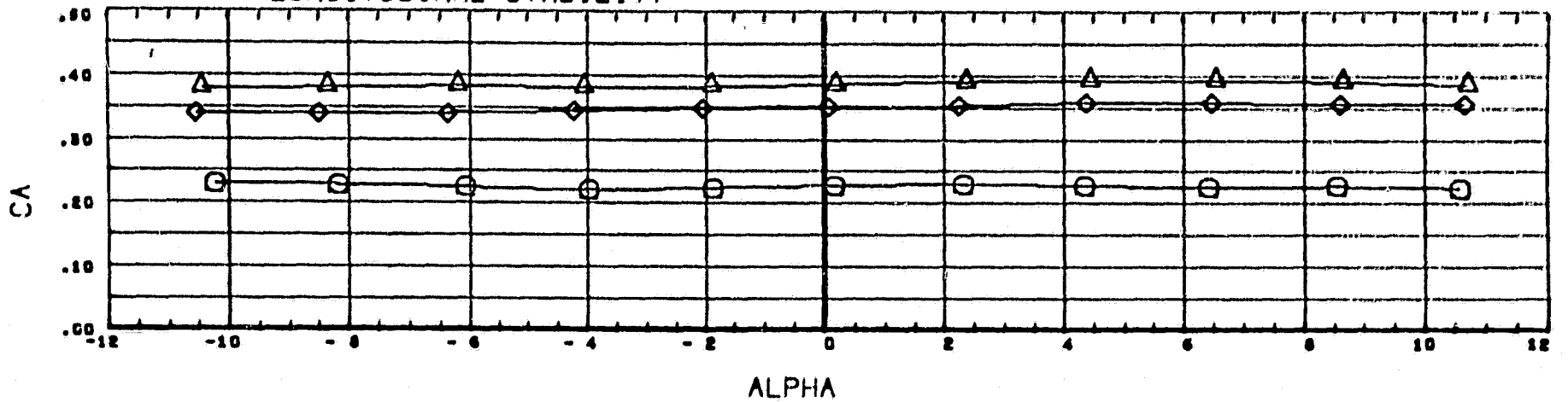


SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.900		0.000 ORBINC - 2.000
△	1.103		
◇	1.460		

REFERENCE INFORMATION		
SREF	5.1478	sq. in.
LREF	4.4260	in.
BREF	2.9690	in.
XMRP	4.3530	in.
YMRP	0.0000	in.
ZMRP	0.0000	in.
SCALE	0.0034	

DATA HIST. CODE CGR

# LONGITUDINAL STABILITY

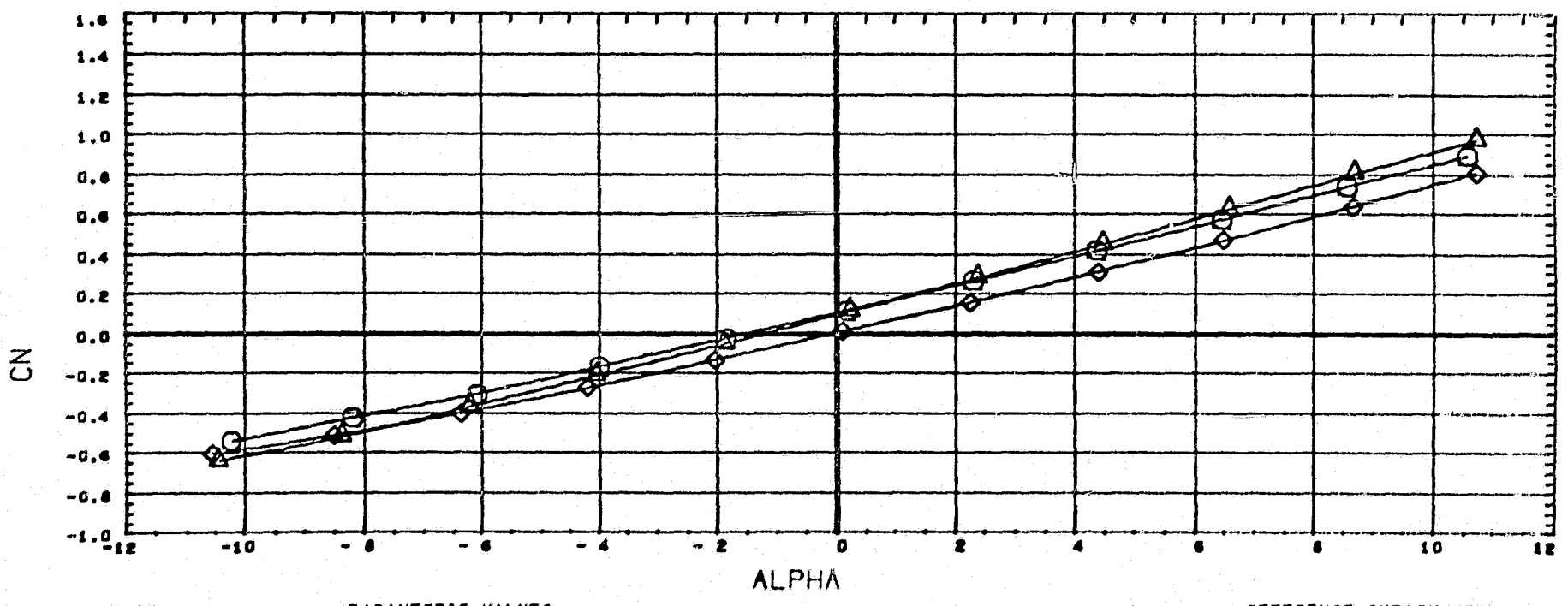
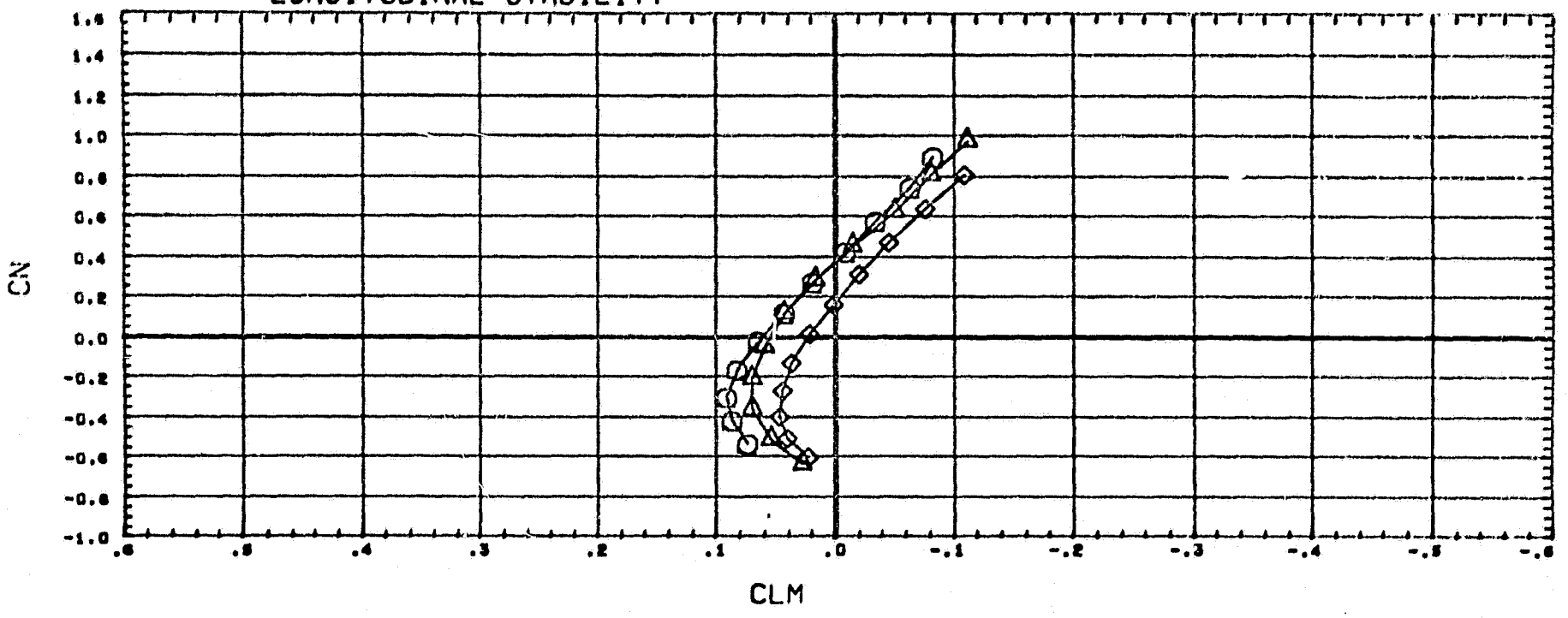


SYMBOL	MACH	BETA	PARAMETRIC VALUES	ORBINC	- 2.000
○	0.900				
△	1.103				
◇	1.460				

REFERENCE INFORMATION		
SREF	5.1478	SQ. IN.
LREF	4.4260	IN.
BREF	2.9590	IN.
XMRP	4.3530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE CGR

# LONGITUDINAL STABILITY

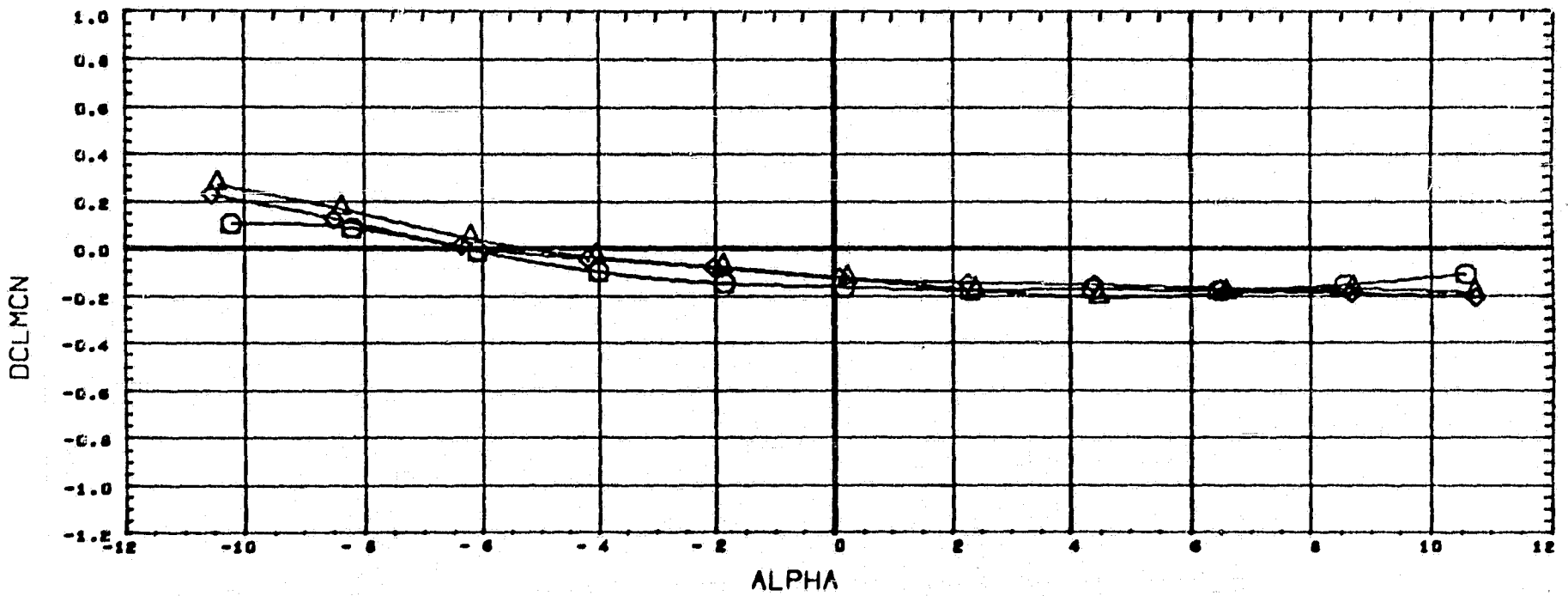
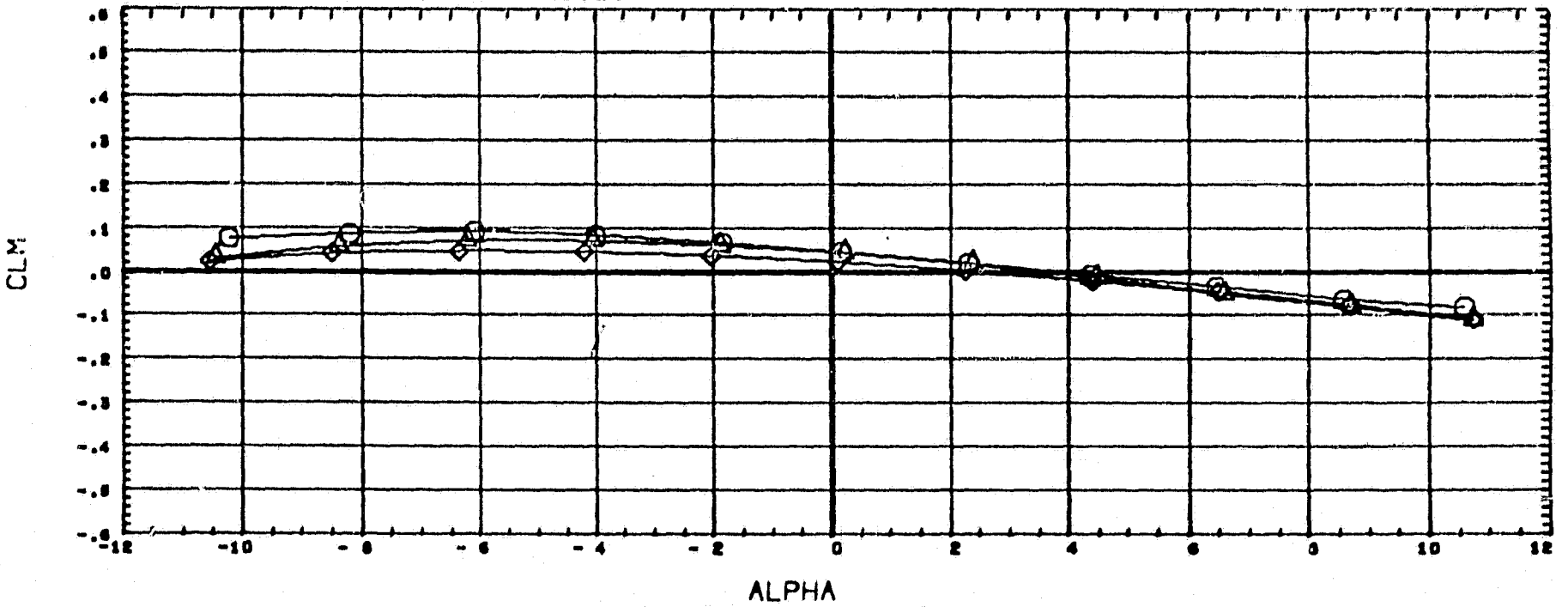


SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.897		0.000 ORBINC - 2.000
△	1.099		
◇	1.460		

REFERENCE INFORMATION		
SREF	5.1478	50. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	4.3530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0033	

DATA HIST. CODE CGR

# LONGITUDINAL STABILITY

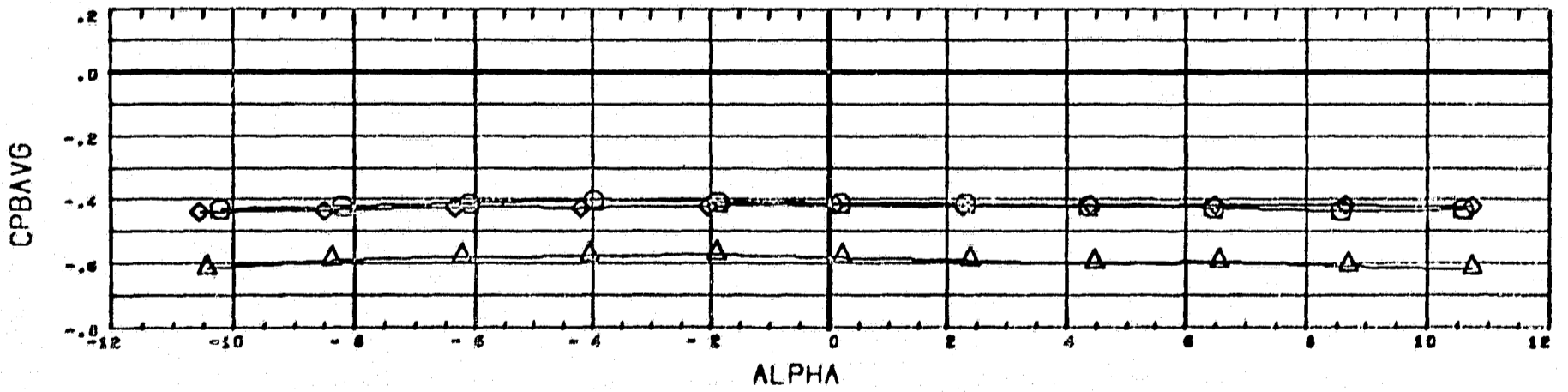
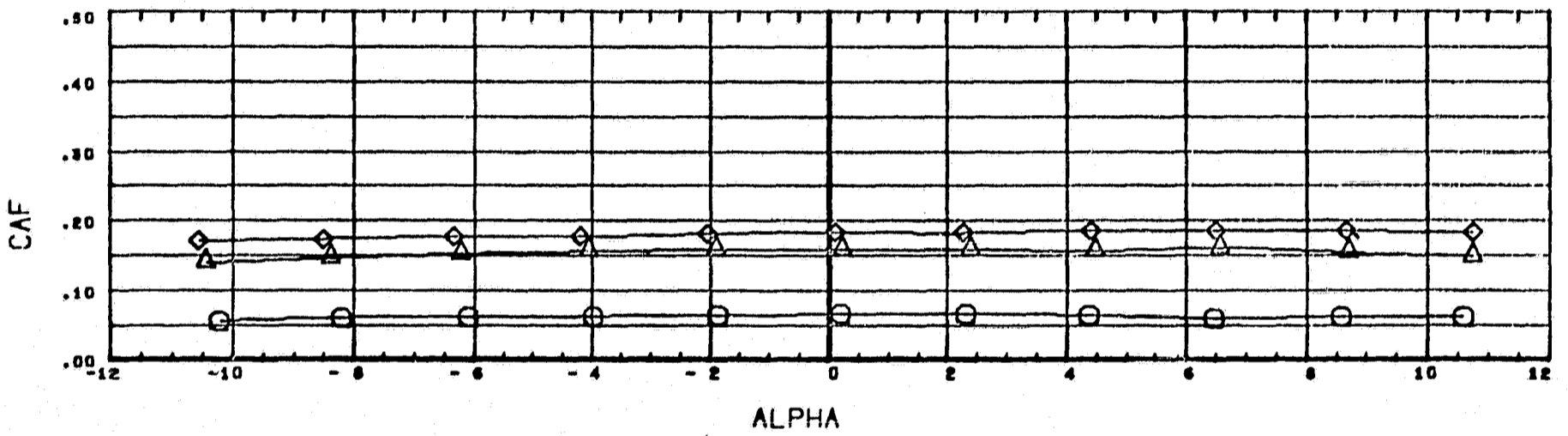
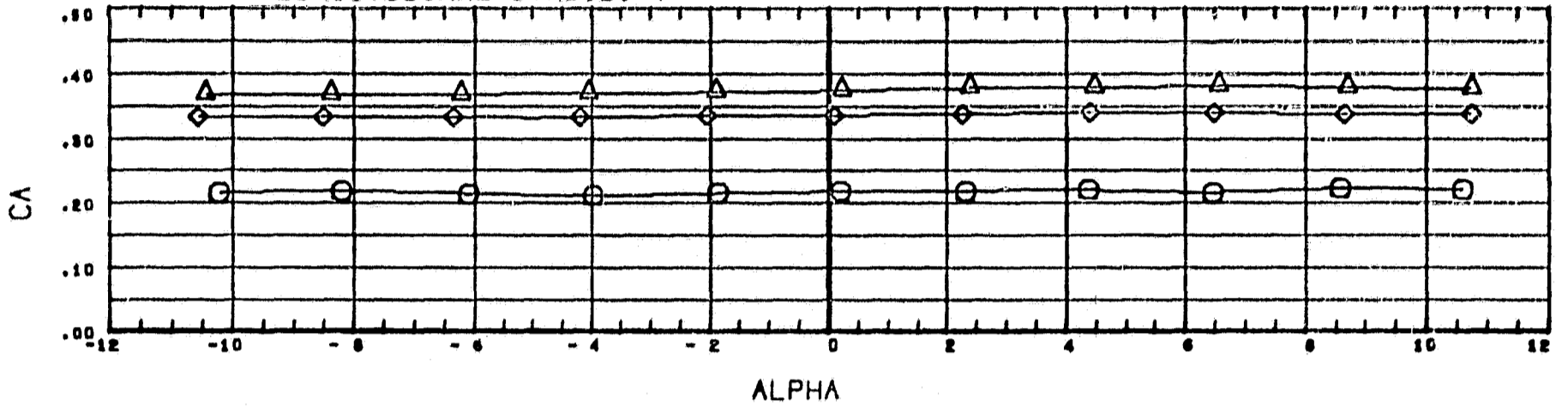


SYMBOL	MACH	BETA	PARAMETRIC VALUES	
○	0.897		0.000	ORBINC - 2.000
△	1.099			
◇	1.460			

REFERENCE INFORMATION		
SREF	5.1476	80. IN.
LREF	4.4260	IN.
GREF	2.9690	IN.
XMRP	4.3530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0033	

DATA HIST. CODE CGR

# LONGITUDINAL STABILITY

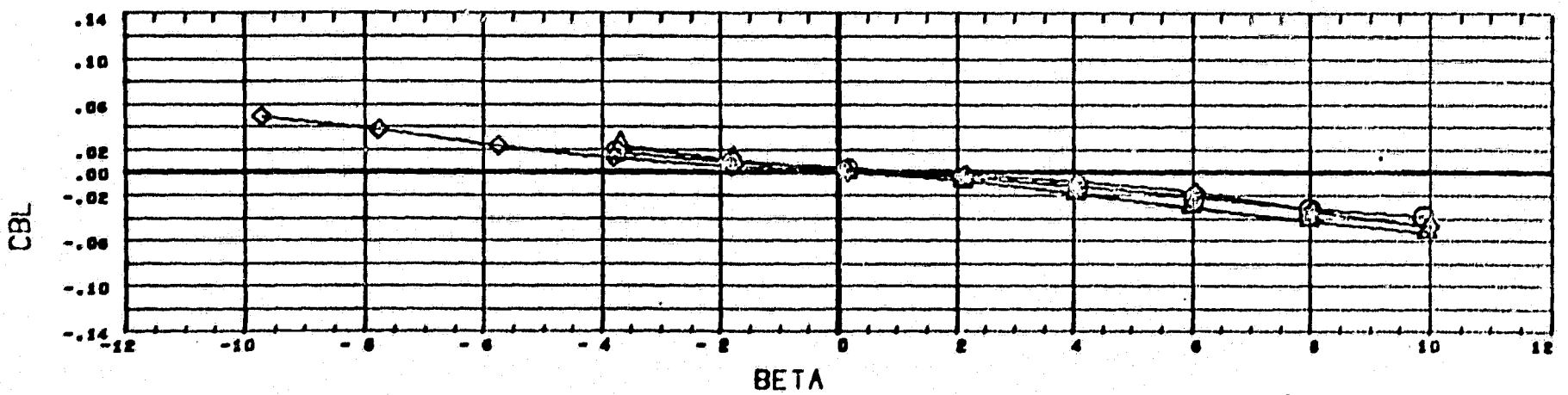
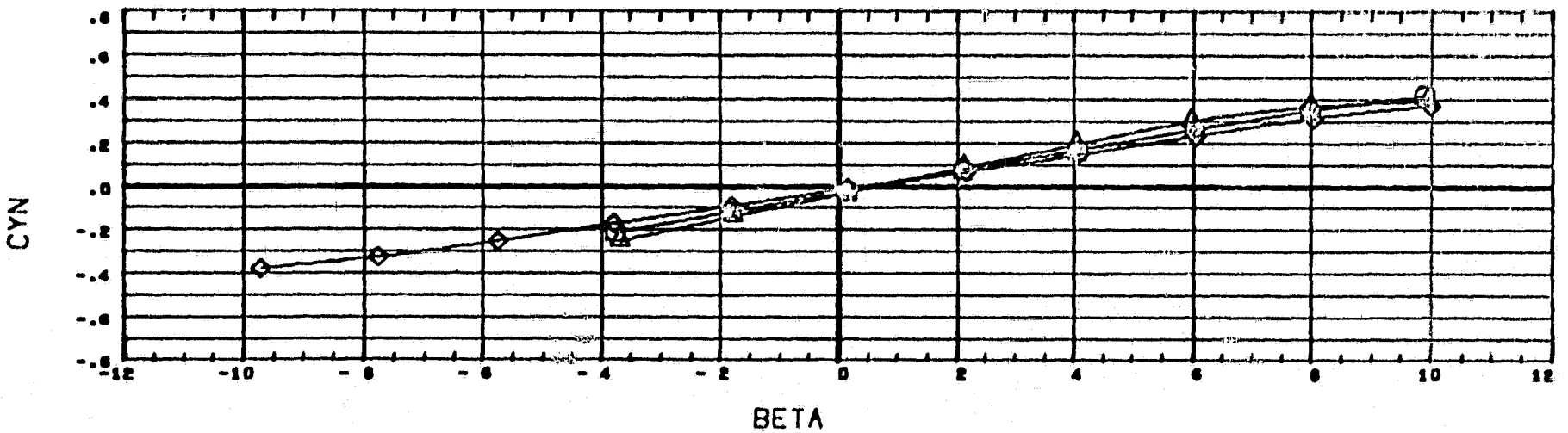
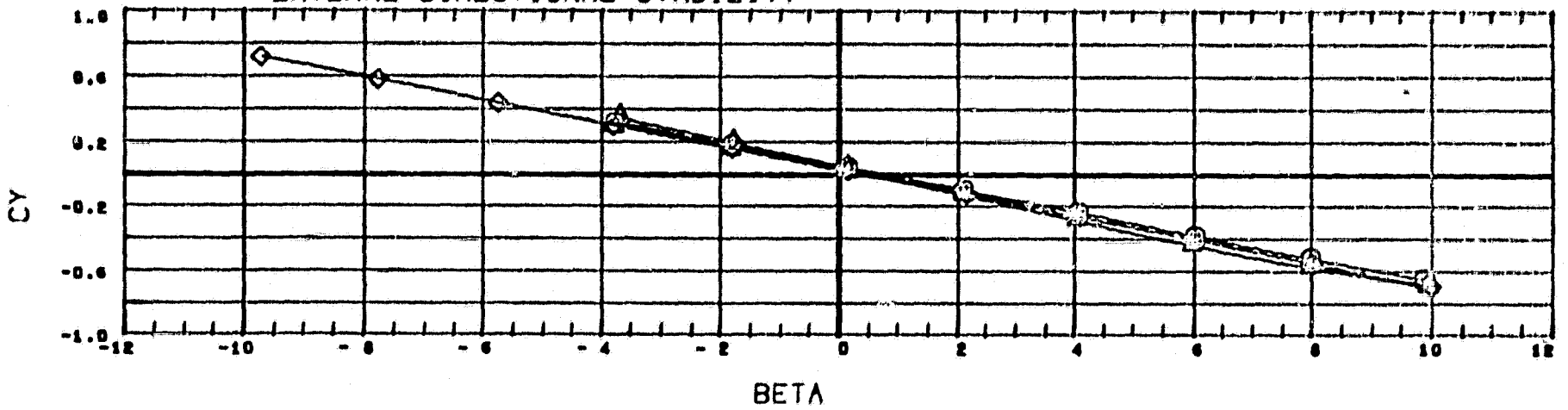


SYMBOL	MACH	BETA	PARAMETRIC VALUES
○	0.897	0.000	ORBINC - 2.000
△	1.099		
◇	1.460		

REFERENCE INFORMATION		
SREF	6.1478	80. IN.
LREF	4.4260	IN.
OREF	2.9690	IN.
XMRP	4.3530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0033	

DATA HIST. CODE CGR

### LATERAL-DIRECTIONAL STABILITY

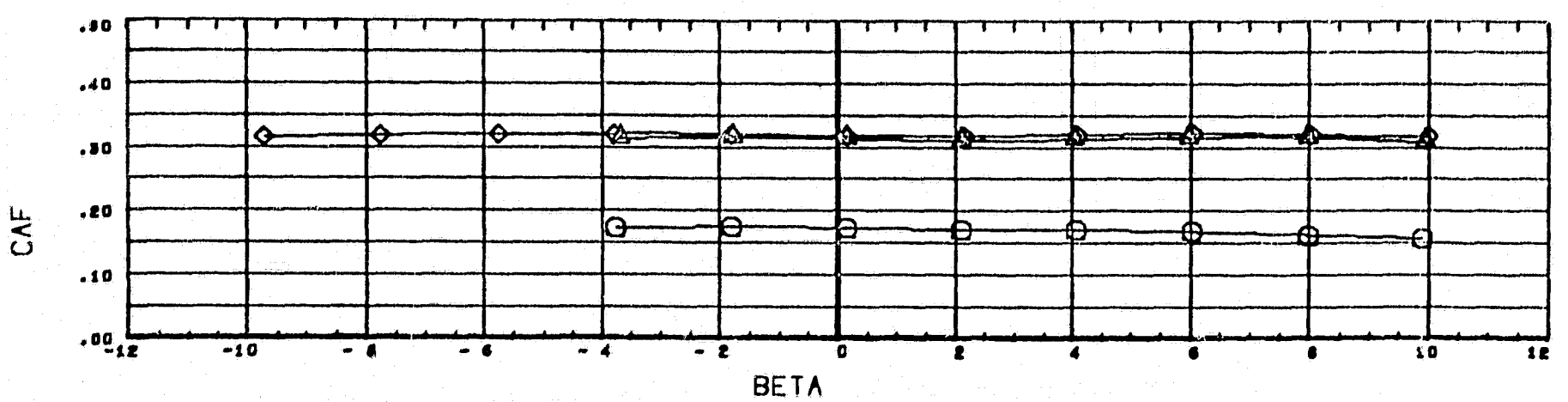
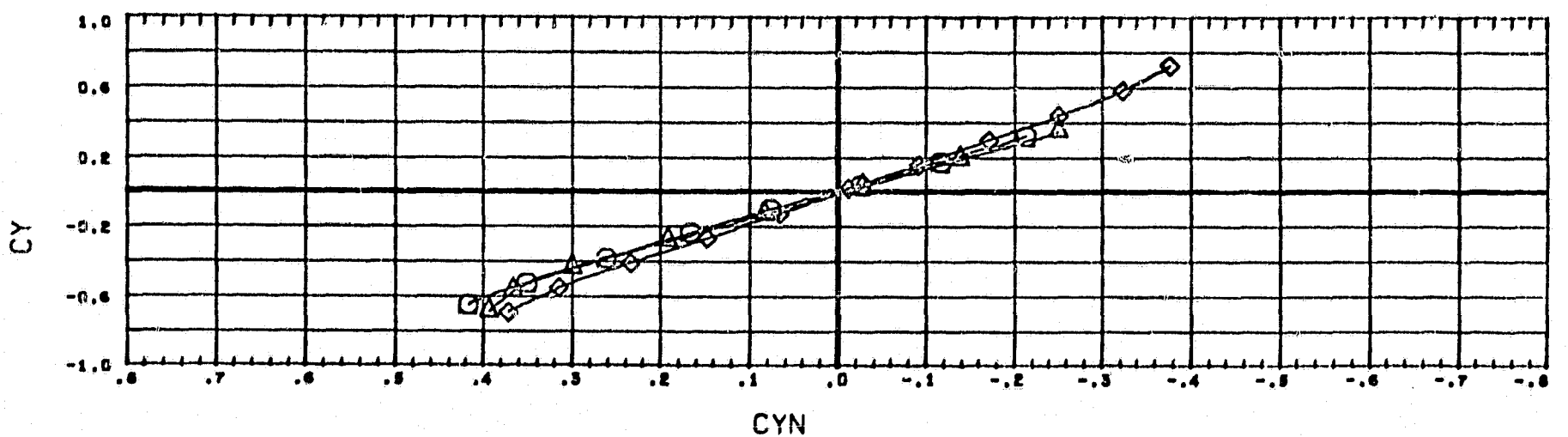
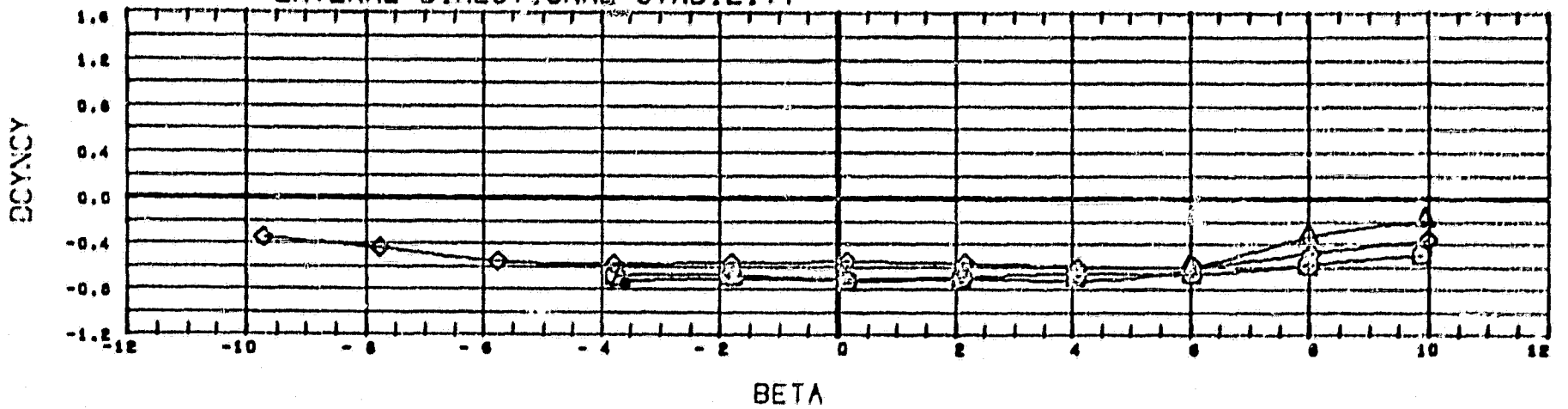


SYMBOL	MACH	PARAMETRIC VALUES
◇	0.899	ALPHA 0.000 ORBINC - 2.000
◇	1.104	
◇	1.465	

REFERENCE INFORMATION		
SREF	5.1478	sq. in.
LREF	4.4260	in.
BREF	2.9690	in.
XMRP	5.7530	in.
YMRP	0.0000	in.
ZMRP	0.0000	in.
SCALE	0.0034	

DATA HIST. CODE GR

# LATERAL-DIRECTIONAL STABILITY

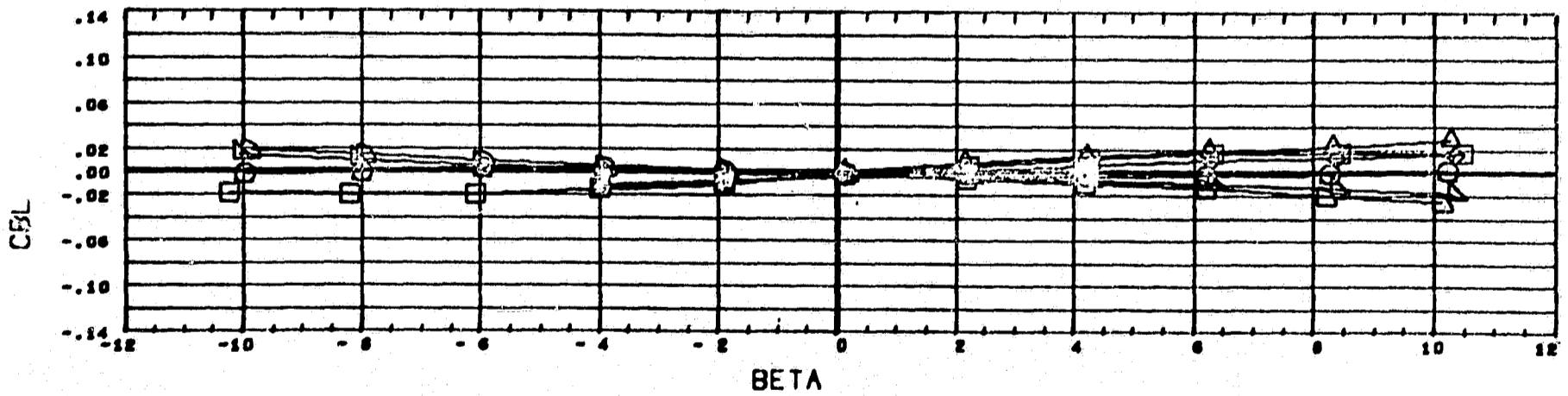
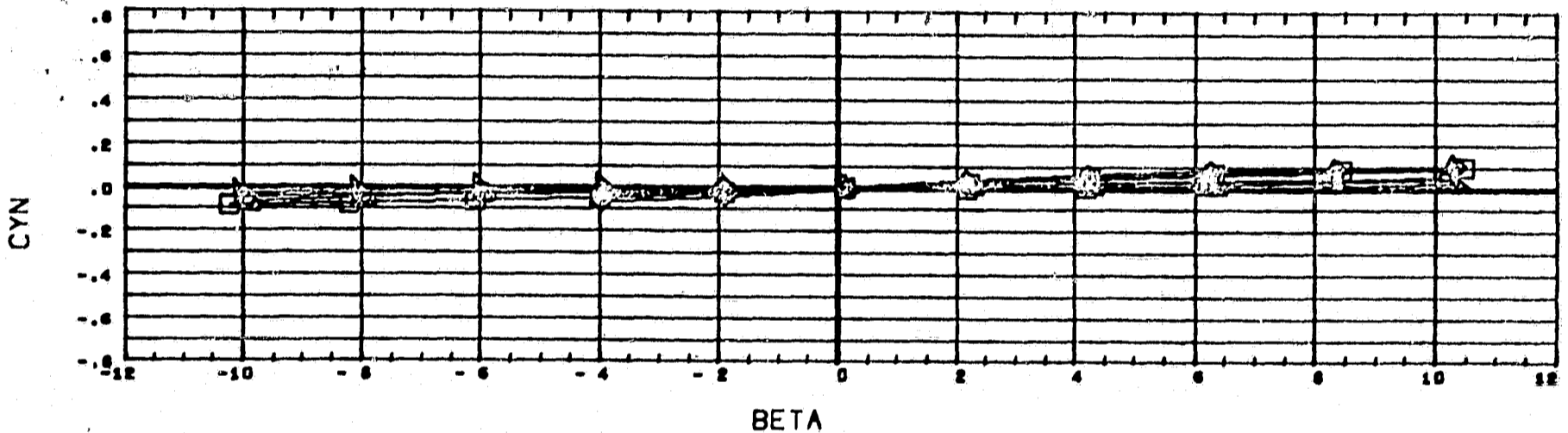
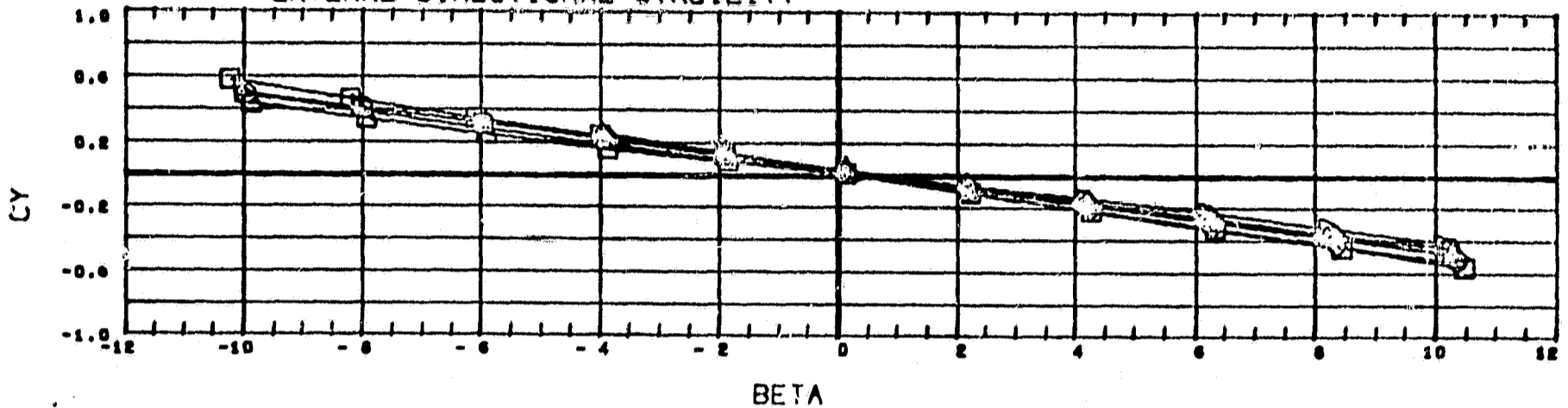


SYMBOL	MACH	PARAMETRIC VALUES
○	0.899	ALPHA 0.000 ORBINC - 2.000
△	1.104	
◇	1.463	

REFERENCE INFORMATION		
SREF	5.1478	80. IN.
LREF	4.4260	IN.
BREF	2.8690	IN.
XHRP	5.7530	IN.
YHRP	0.0000	IN.
ZHRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE GR

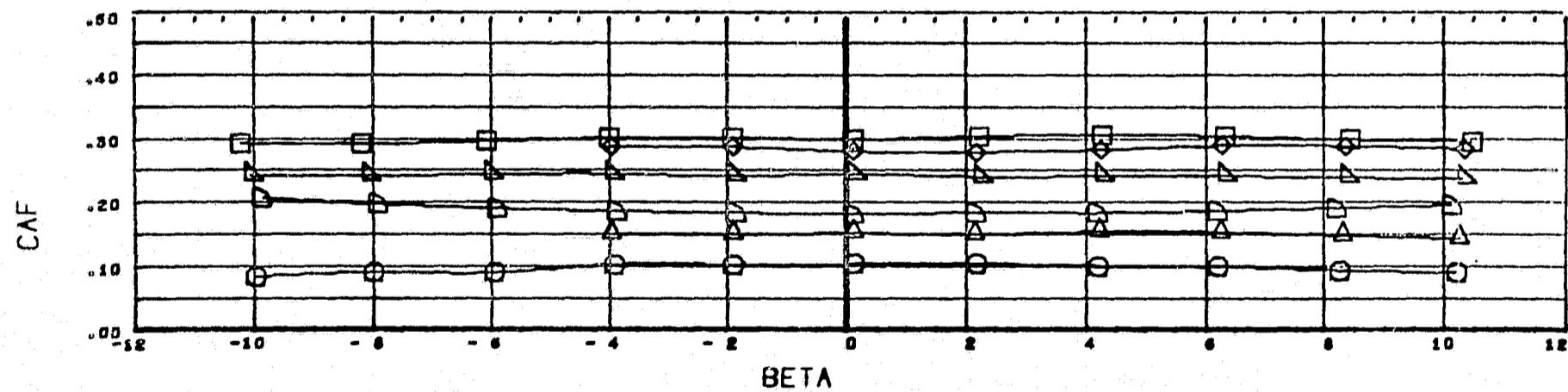
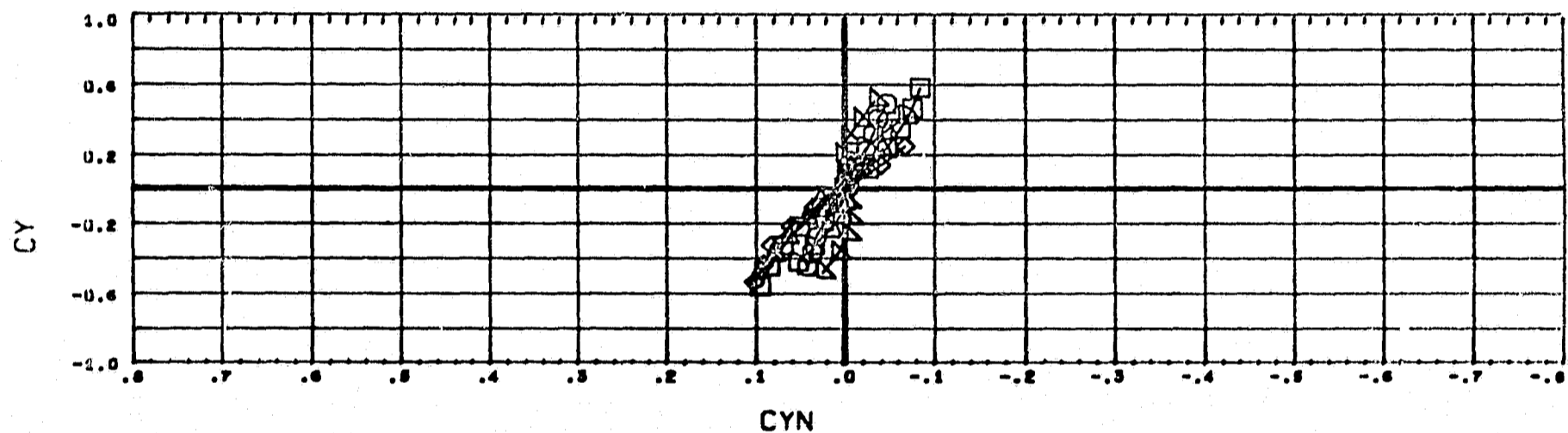
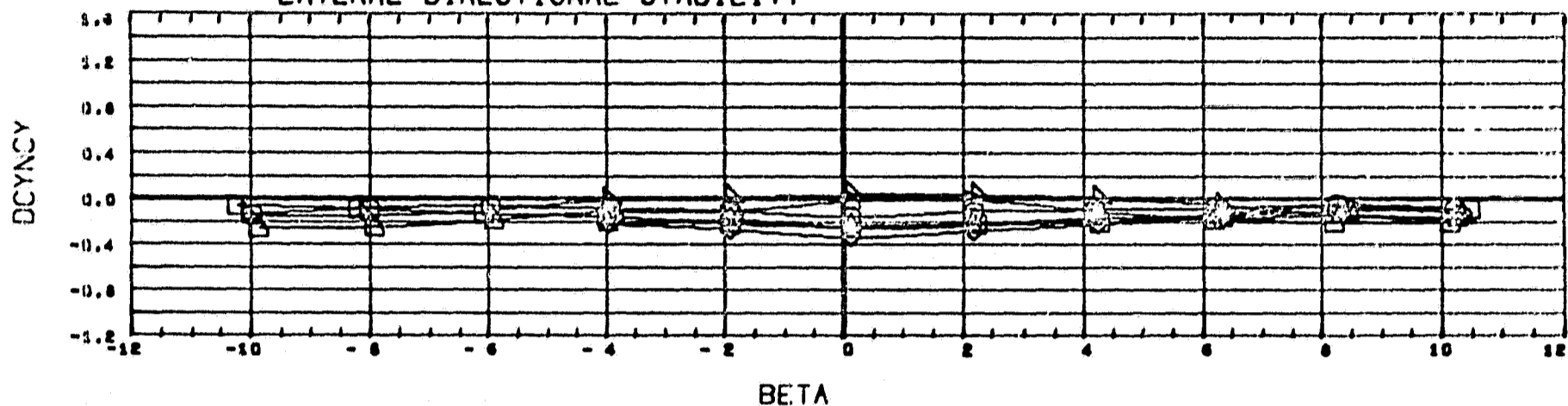
### LATERAL-DIRECTIONAL STABILITY



SYMBOL ○ □ △ ◇ ○	MACH	PARAMETRIC VALUES		REFERENCE INFORMATION				
	0.999	ALPHA	0.000	ORBINC	- 2.000	BREF	5.1478	88. IN.
	0.903					LREF	4.4260	IN.
	1.097					BREF	2.9690	IN.
	1.459					XMRP	5.7530	IN.
2.740					YMRP	0.0000	IN.	
4.999	DATA HIST. CODE	6R			ZMRP	0.0000	IN.	
					SCALE	0.0034		



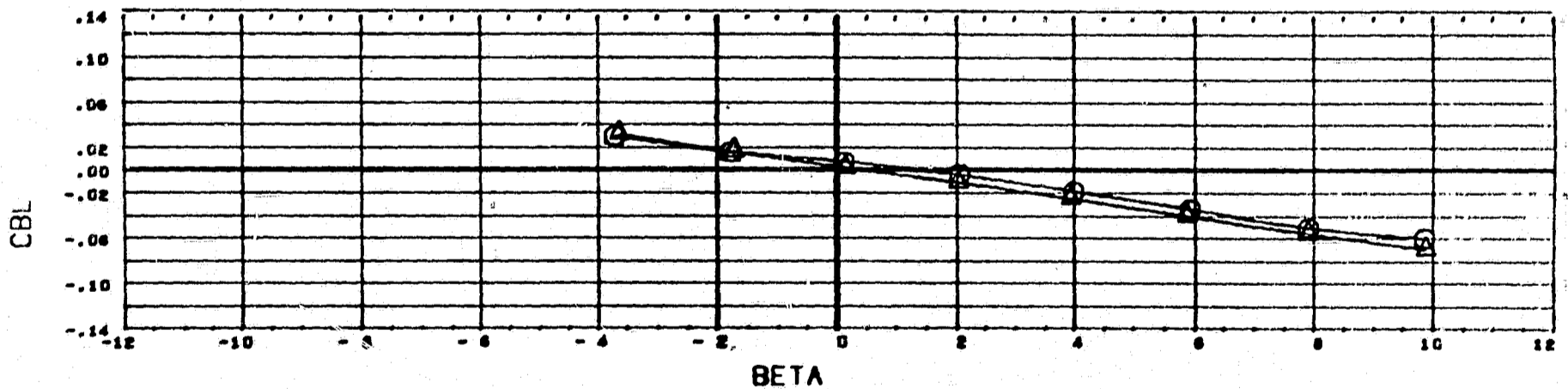
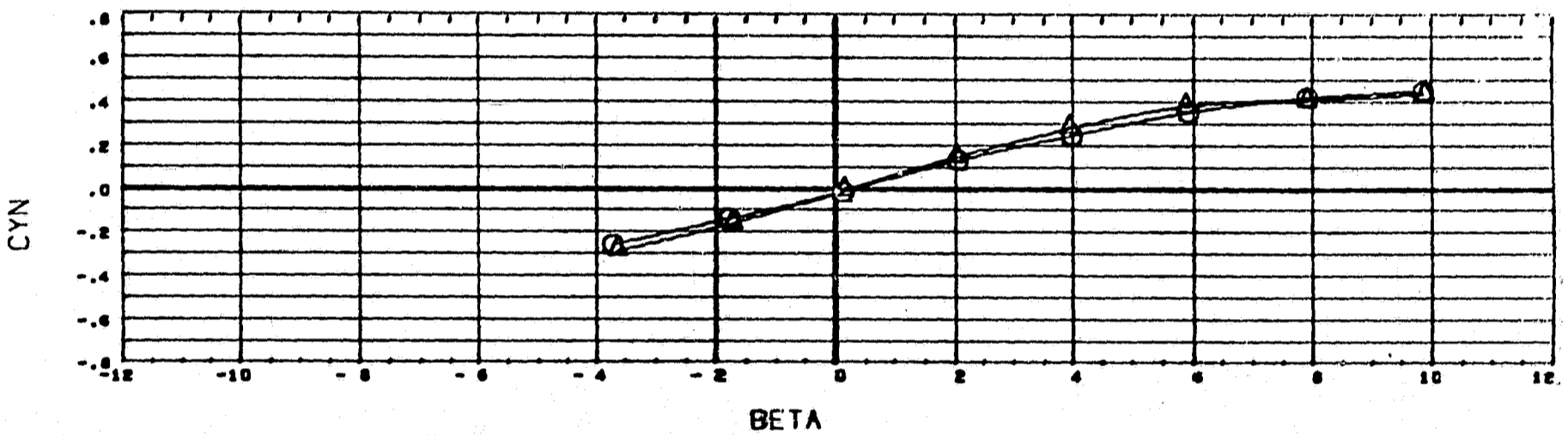
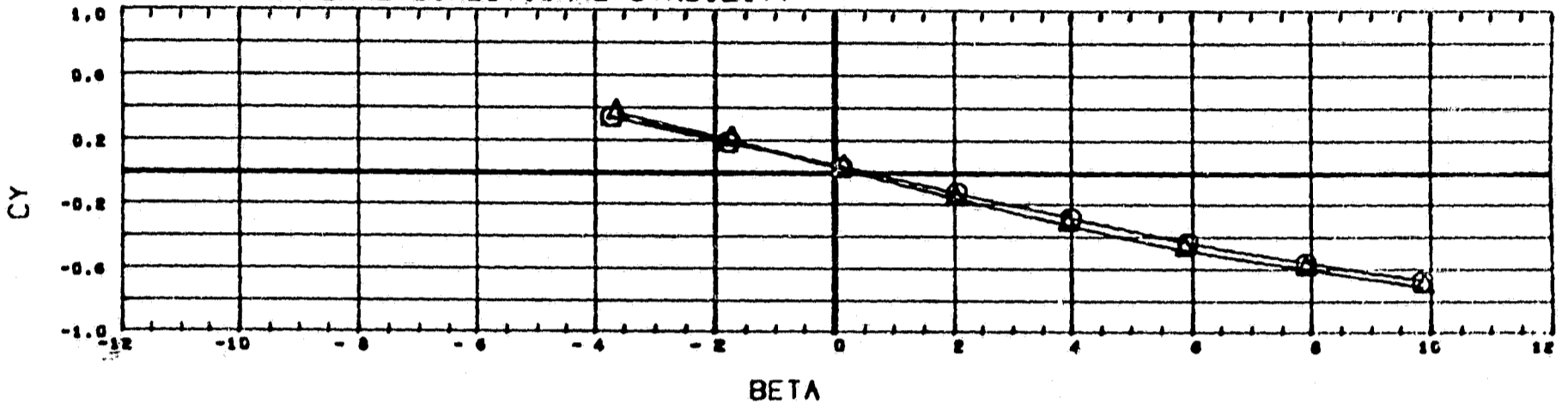
# LATERAL-DIRECTIONAL STABILITY



SYMBOL	MACH	PARAMETRIC VALUES
○	0.599	ALPHA 0.000 ORBINC - 2.000
◇	0.903	
△	1.097	
□	1.459	
▽	2.740	
◇	4.959	DATA HIST. CODE GR

REFERENCE INFORMATION		
SREF	5.1478	88 IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

### LATERAL-DIRECTIONAL STABILITY

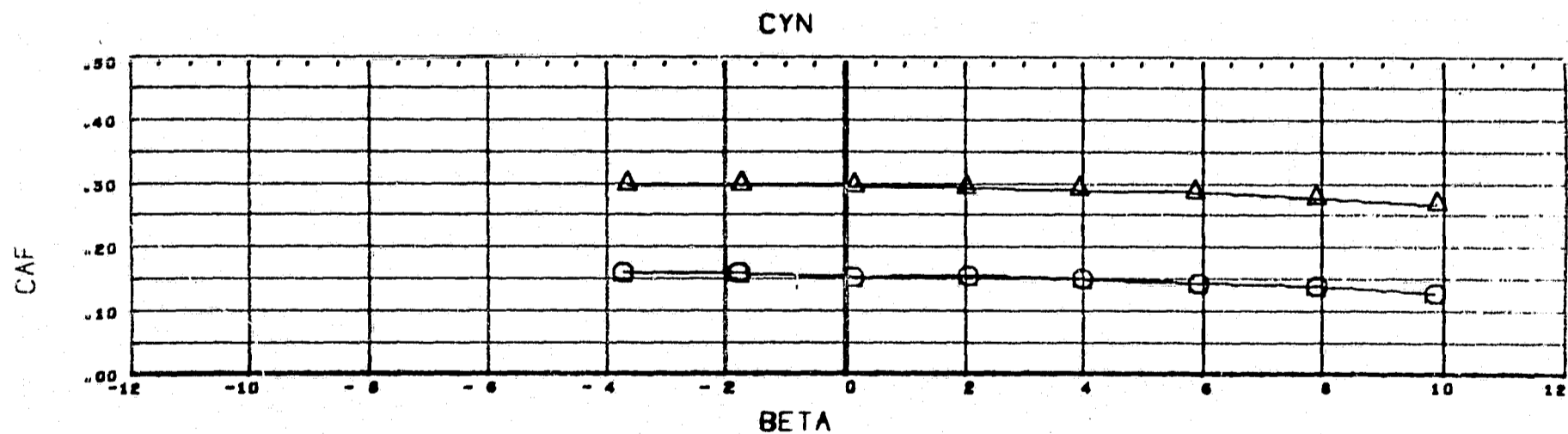
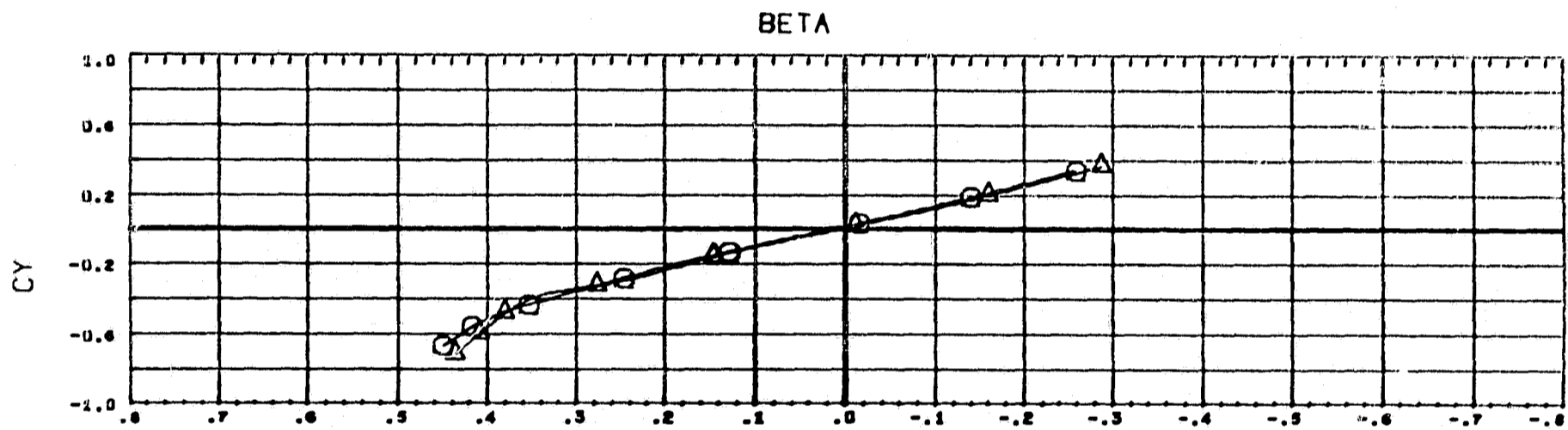
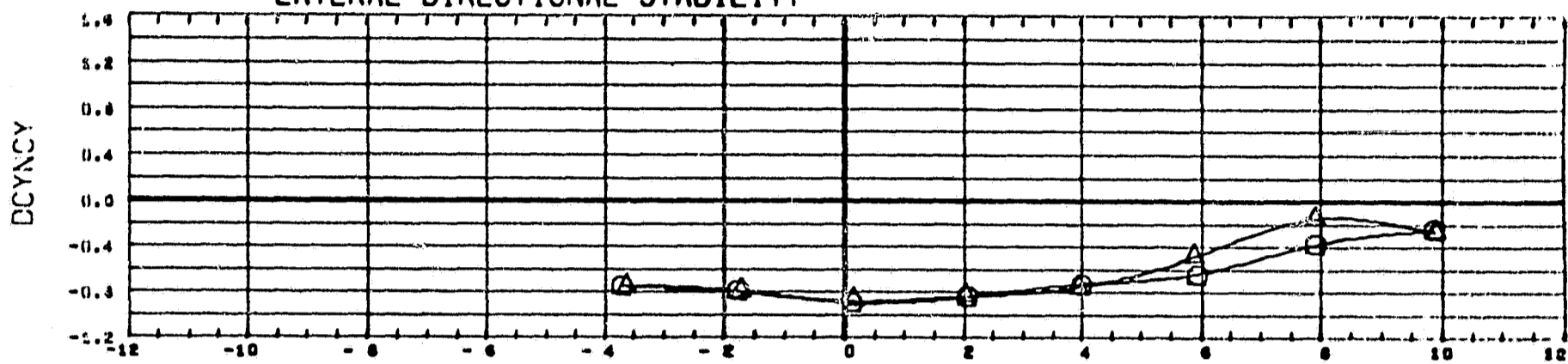


SYMBOL  $\triangle$  MACH 0.900 ALPHA 0.000 ORBINC - 2.000  
 1.102

REFERENCE INFORMATION  
 SREF 5.1476 80. IN.  
 LREF 4.4260 IN.  
 BREF 2.9690 IN.  
 XMRP 5.7530 IN.  
 YMRP 0.0000 IN.  
 ZMRP 0.0000 IN.  
 SCALE 0.0034

DATA MIST. CODE GR

# LATERAL-DIRECTIONAL STABILITY

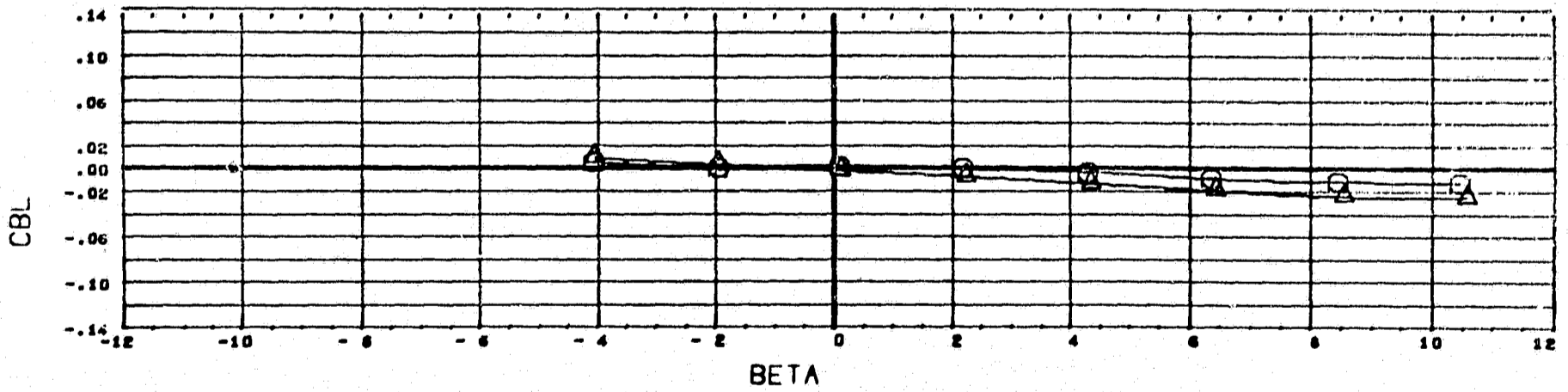
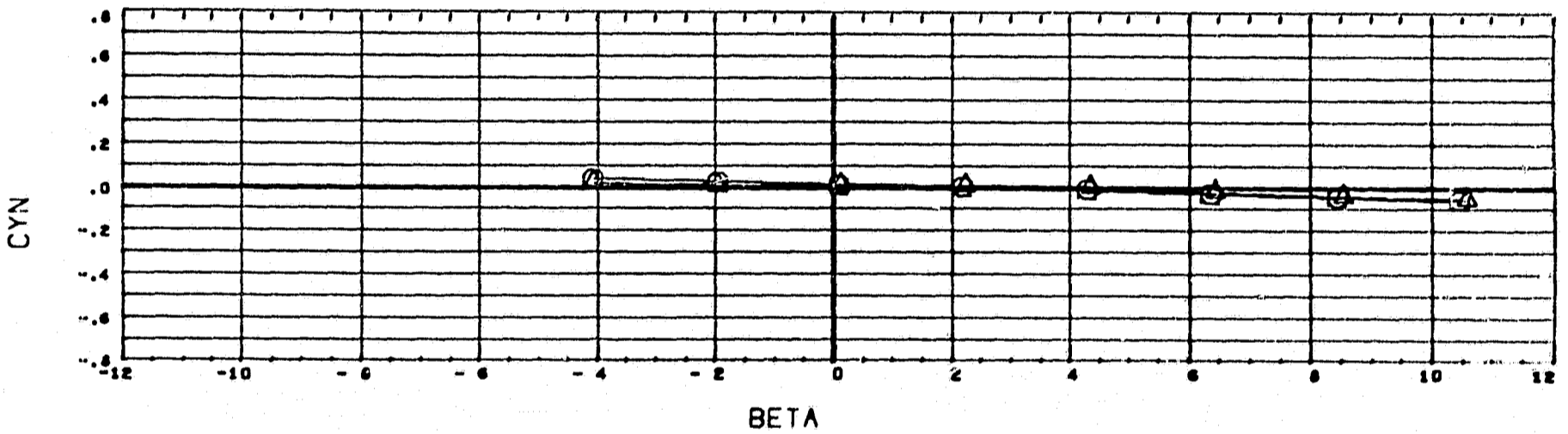
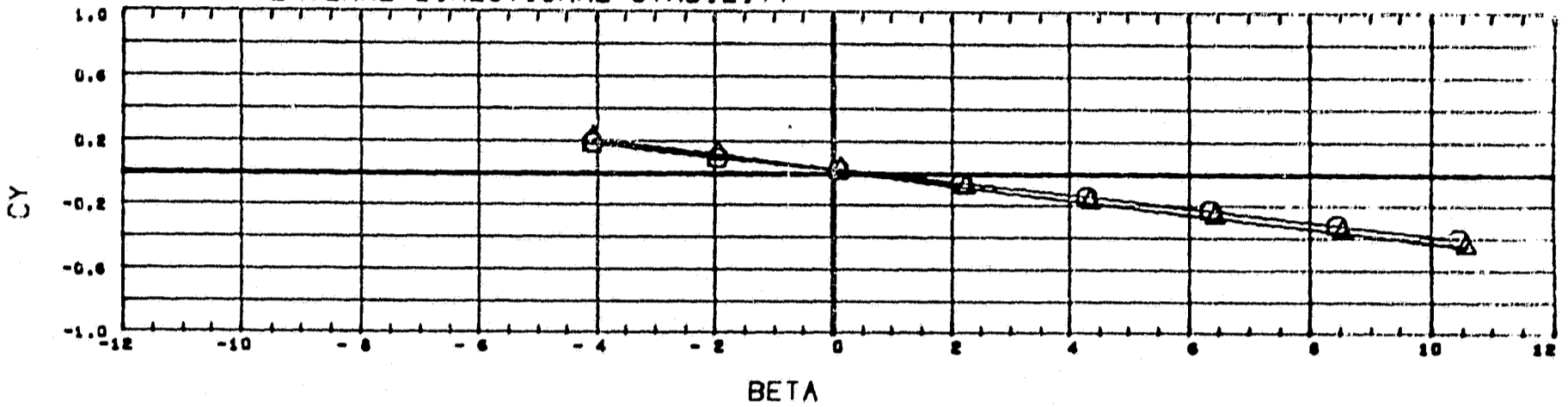


SYMBOL    MACH    PARAMETRIC VALUES  
 ○        0.900    ALPHA    0.000    ORBINC - 2.000  
 △        1.102

REFERENCE INFORMATION  
 SREF      5.1478      SQ. IN.  
 LREF      4.4260      IN.  
 BREF      2.9690      IN.  
 XMRP      5.7530      IN.  
 YMRP      0.0000      IN.  
 ZMRP      0.0000      IN.  
 SCALE     0.0034

DATA HIST. CODE GR

### LATERAL-DIRECTIONAL STABILITY

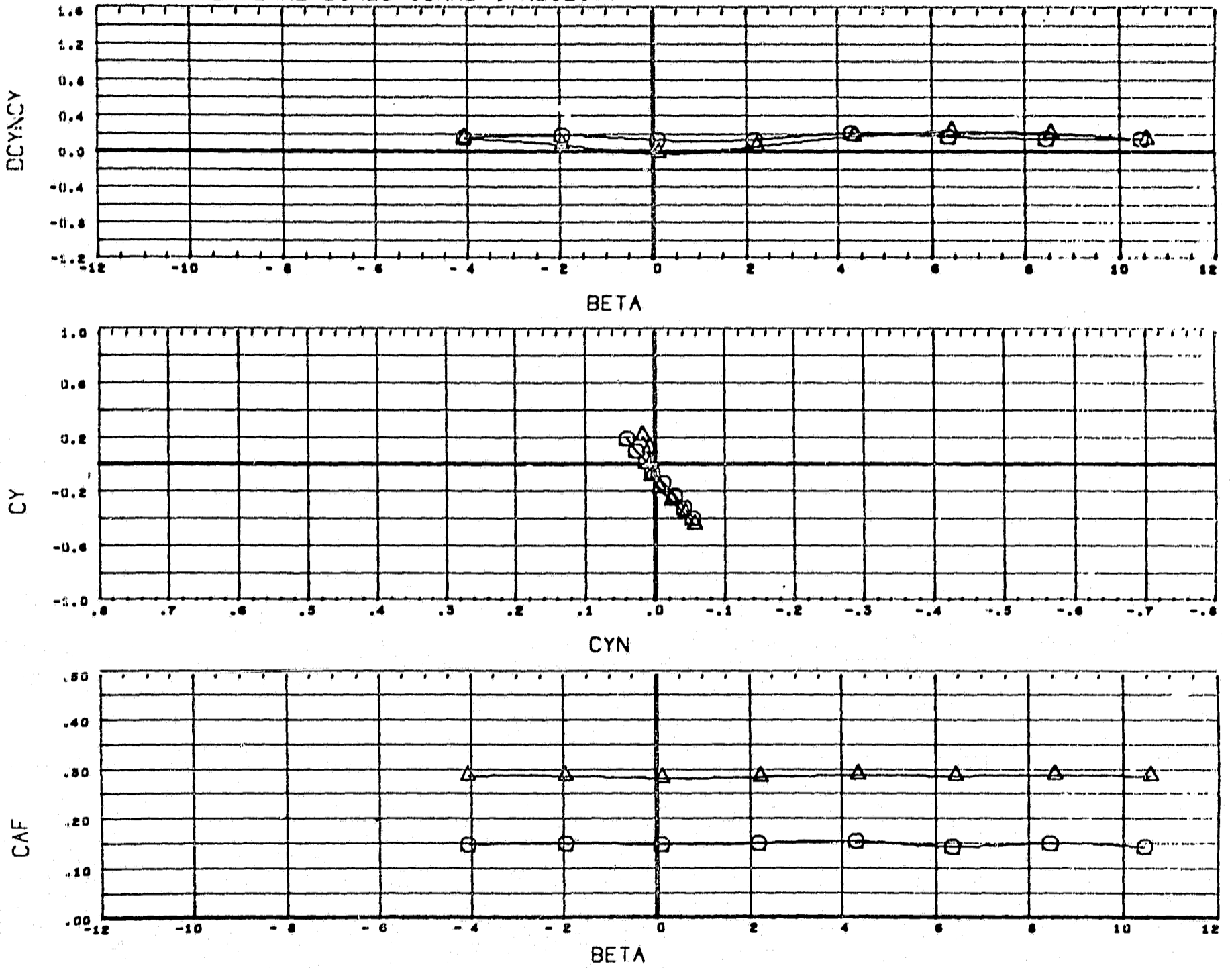


SYMBOL	MACH	PARAMETRIC VALUES	
○	0.903	ALPHA	0.000
△	1.102	ORBINC	- 2.000

REFERENCE INFORMATION		
SREF	5.1478	sq. in.
LREF	4.4260	in.
BREF	2.9690	in.
XMRP	5.7530	in.
YMRP	0.0000	in.
ZMRP	0.0000	in.
SCALE	0.0034	

DATA HIST. CODE GR

# LATERAL-DIRECTIONAL STABILITY



SYMBOL    MACH    PARAMETRIC VALUES  
 ○        0.903    ALPHA    0.000    ORBINC - 2.000  
 △        1.102

REFERENCE INFORMATION  
 SREF    5.1478    SQ. IN.  
 LREF    4.4260    IN.  
 ØREF    2.9690    IN.  
 XMRP    5.7530    IN.  
 YMRP    0.0000    IN.  
 ZMRP    0.0000    IN.  
 SCALE    0.0034

DATA HIST. CODE    GR

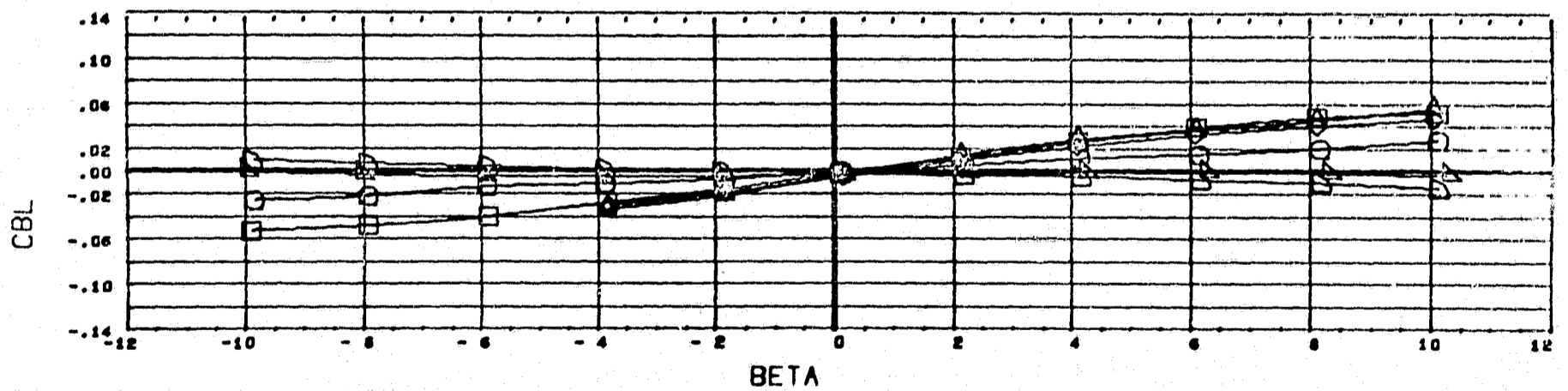
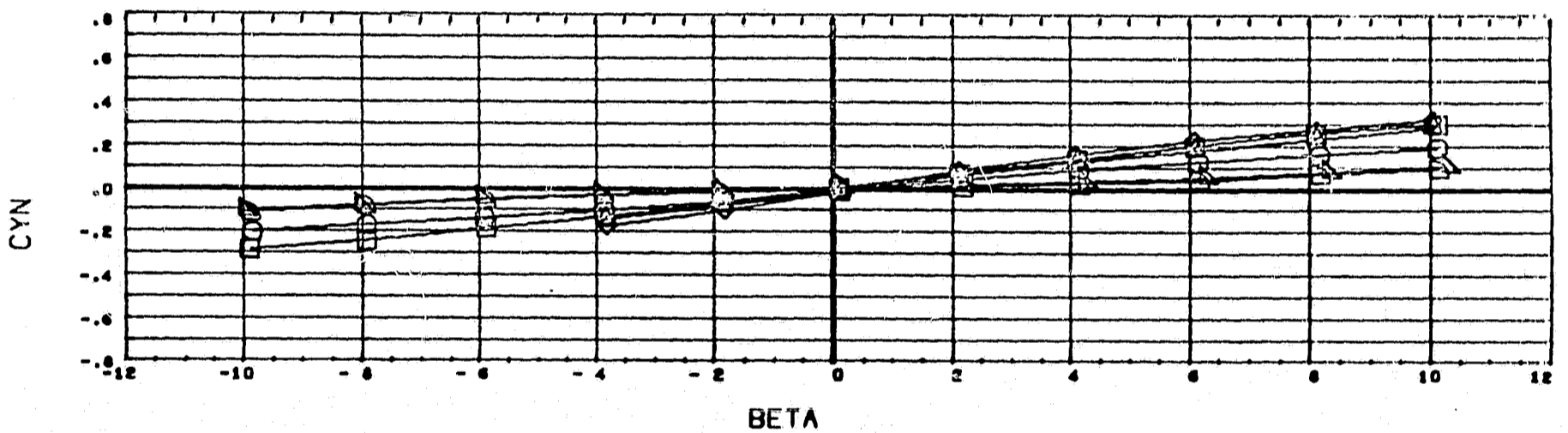
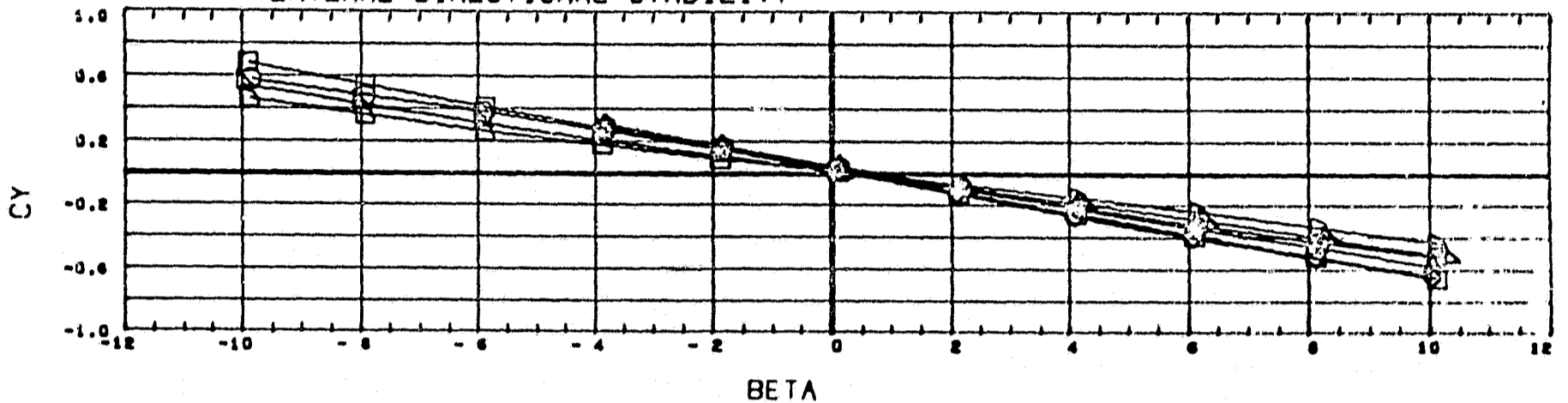
M523-MSFC MODELAX12331-1

B501-2V6.3

(D5708B) 10 FEB 72

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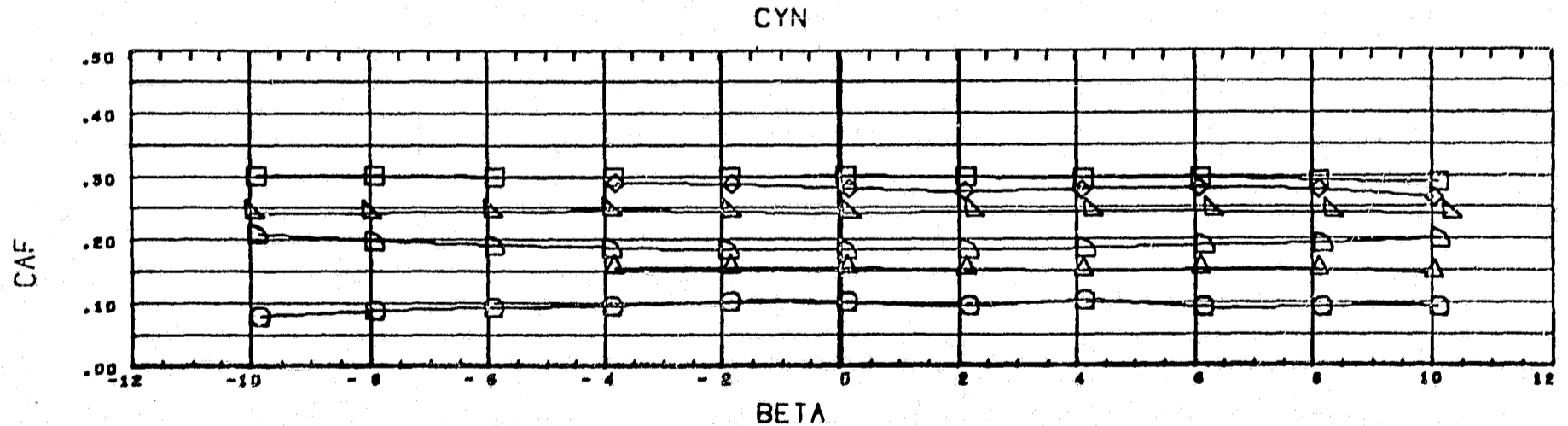
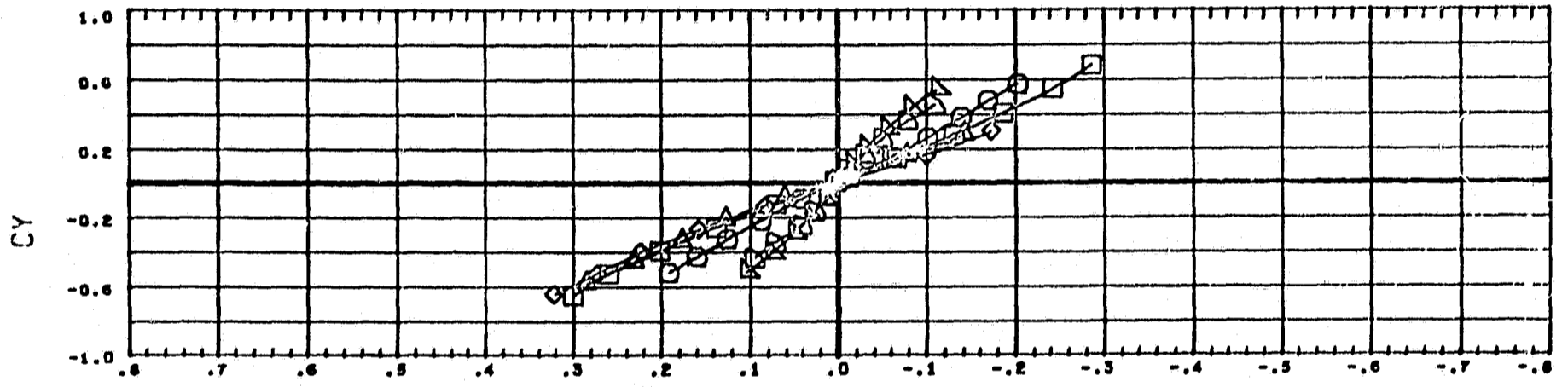
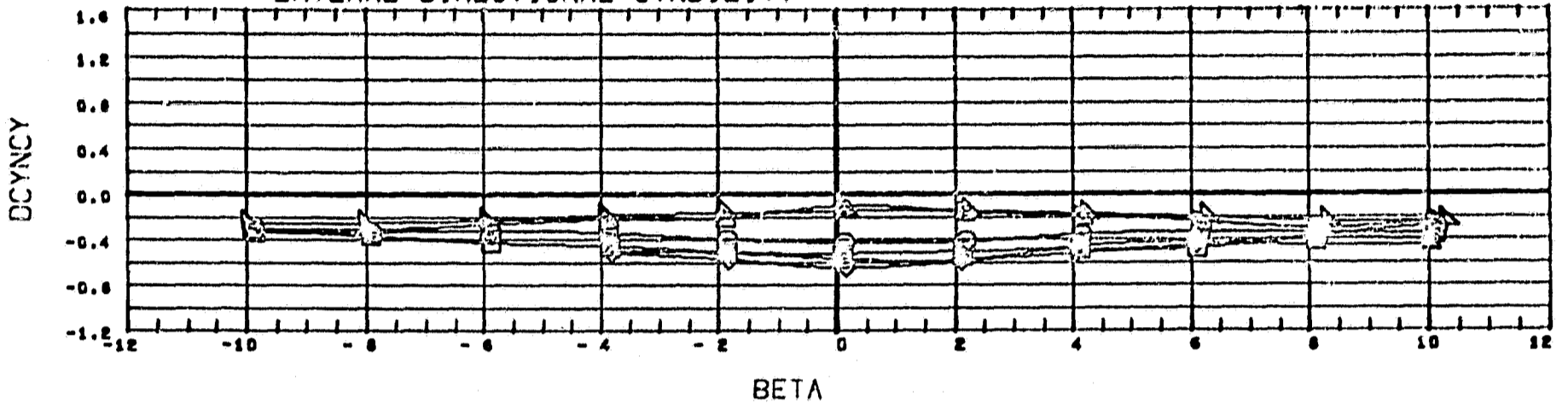
### LATERAL-DIRECTIONAL STABILITY



SYMBOL	MACH	PARAMETRIC VALUES	
		ALPHA	ORBINC
○	0.598	0.000	- 2.000
□	0.950		
◇	1.103		
△	1.461		
▽	2.740		
◻	4.959	DATA HIST. CODE	GR

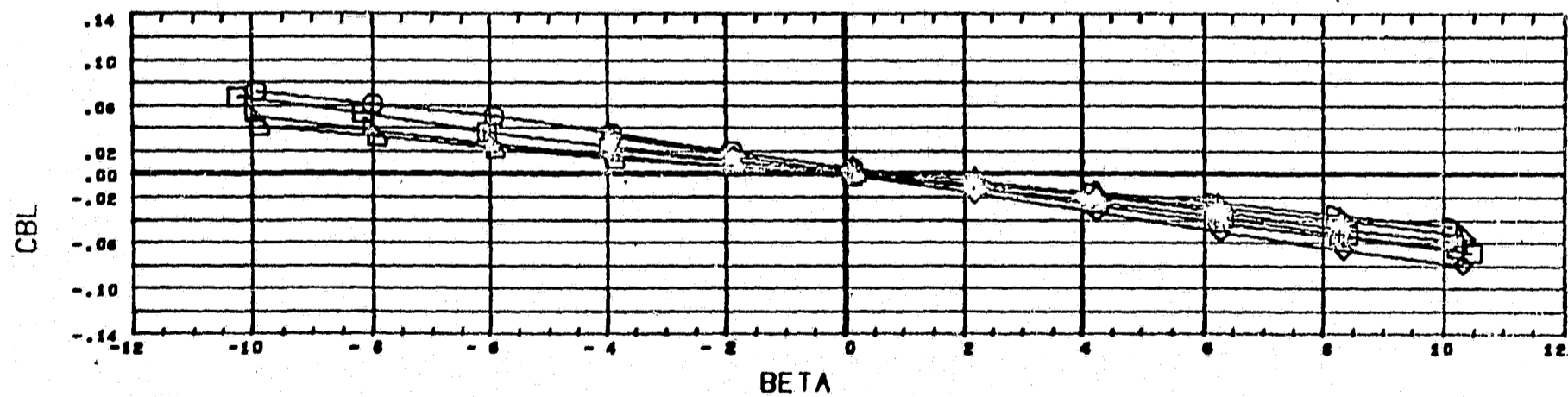
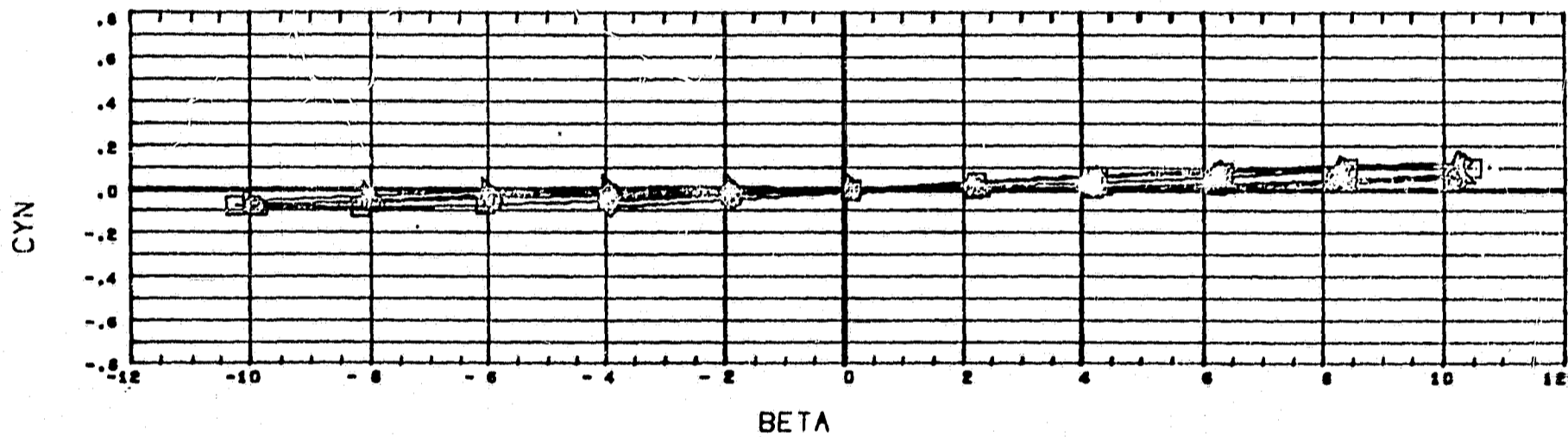
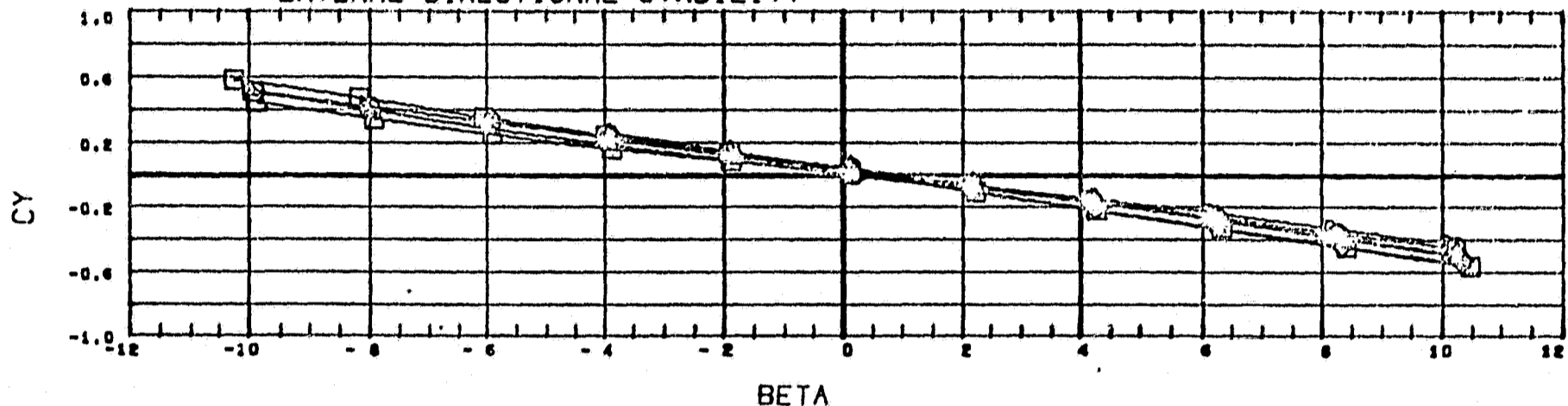
REFERENCE INFORMATION		
SREF	5.1478	sq. in.
LREF	4.4260	in.
BREF	2.9690	in.
XMRP	5.7530	in.
YMRP	0.0000	in.
ZMRP	0.0000	in.
SCALE	0.0034	

# LATERAL-DIRECTIONAL STABILITY



SYMBOL	MACH	PARAMETRIC VALUES		REFERENCE INFORMATION	
		ALPHA	ORBINC	SRF	IN.
○	0.598	0.000	- 2.000	5.1478	80. IN.
◇	0.900			4.4260	IN.
◇	1.103			2.9690	IN.
◇	1.461			5.7530	IN.
◇	2.740			0.0000	IN.
◇	4.959			ZMRP	0.0000
		DATA HIST. CODE	GR	SCALE	0.0034

### LATERAL-DIRECTIONAL STABILITY



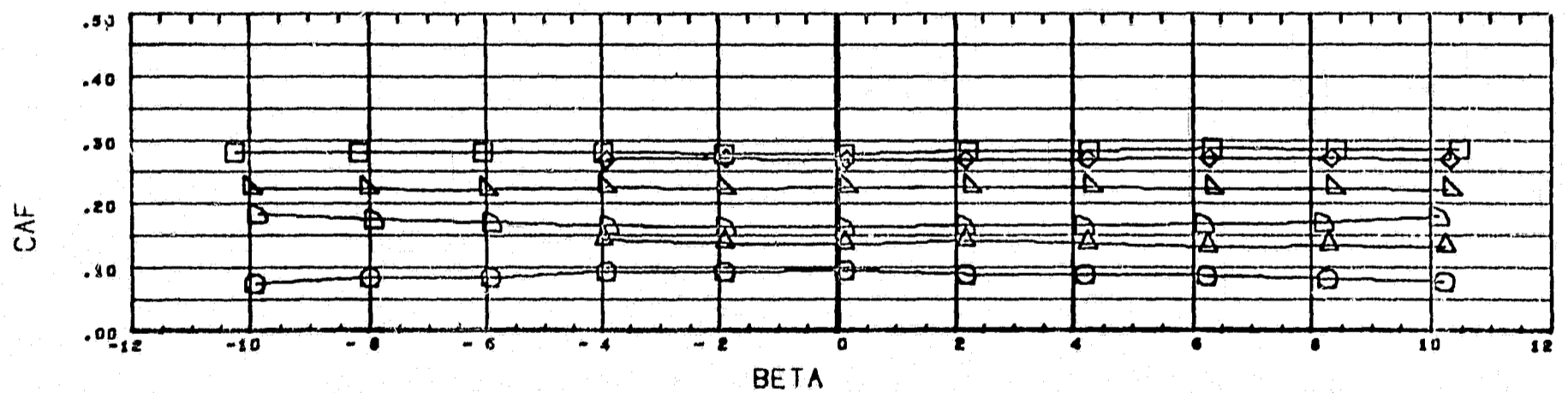
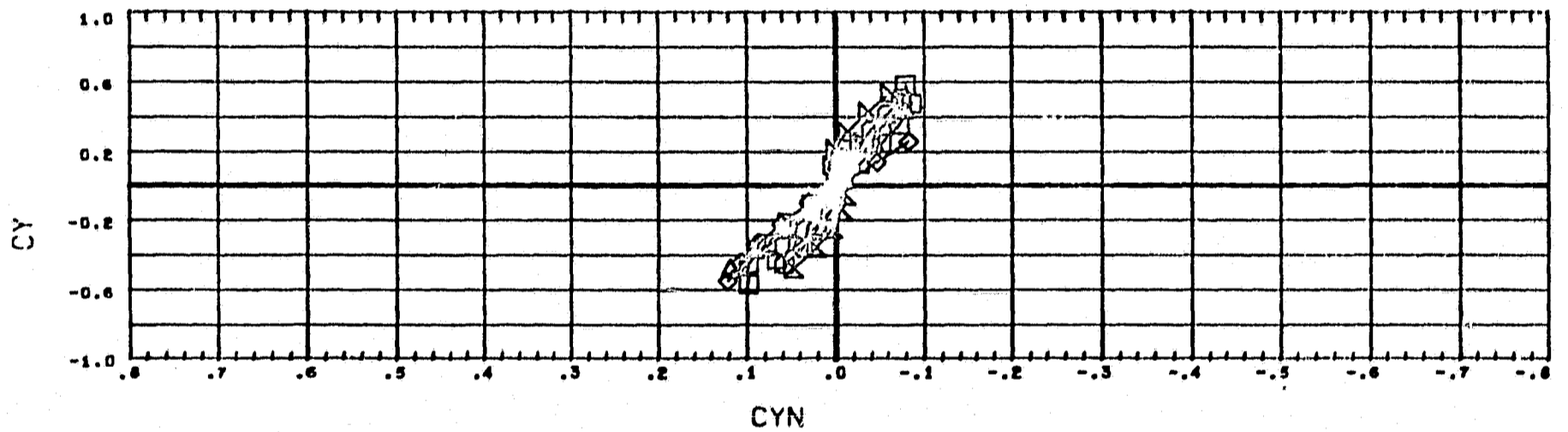
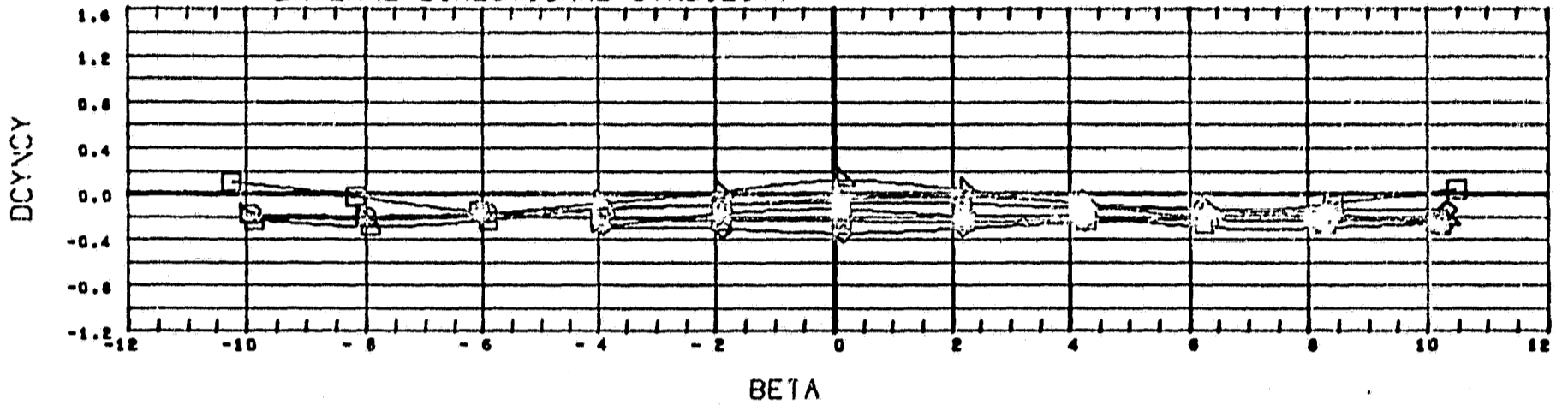
SYMBOL	MACH	PARAMETRIC VALUES	
		ALPHA	ORBINC
○	0.599	0.000	- 2.000
◇	0.903		
□	1.097		
△	1.463		
▽	2.740		
◇	4.959		

DATA HIST. CODE GR

REFERENCE INFORMATION		
BREF	8.1478	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	8.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	



# LATERAL-DIRECTIONAL STABILITY

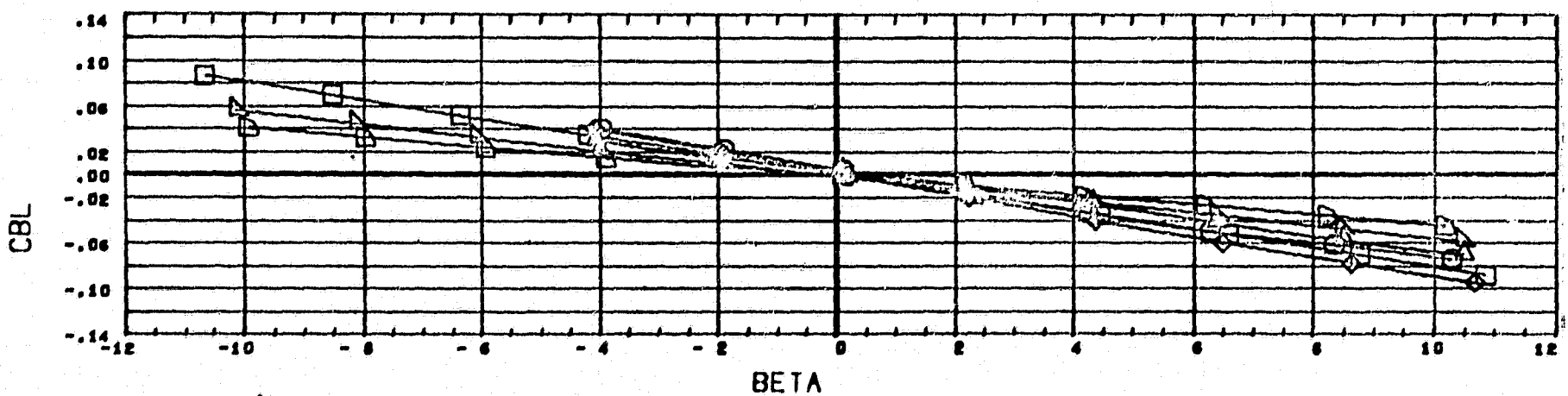
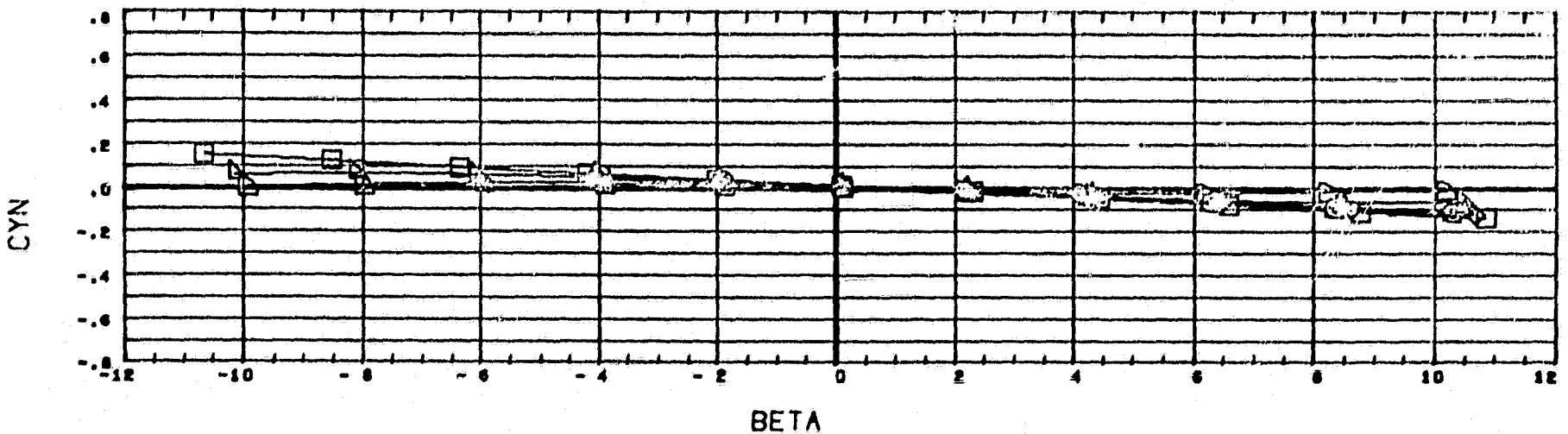
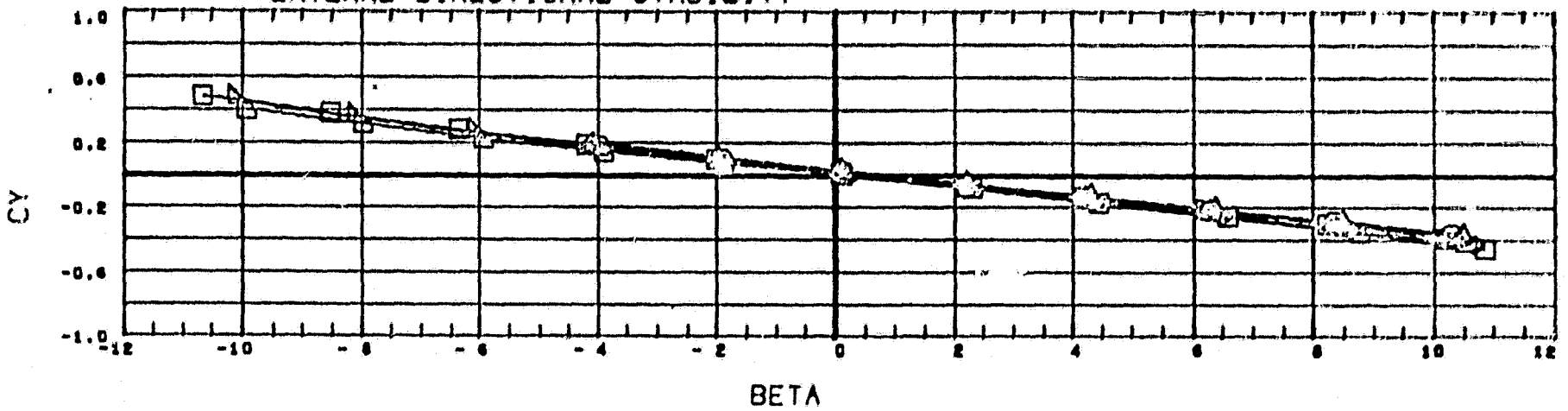


SYMBOL	MACH	PARAMETRIC VALUES	
		ALPHA	ORDINC
○	0.599	0.000	- 2.000
◇	0.903		
△	1.097		
□	1.463		
◇	2.740		
○	4.959		

DATA HIST. CODE 6R

REFERENCE INFORMATION		
SREF	9.1476	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XHRP	9.7530	IN.
YHRP	0.0000	IN.
ZHRP	0.0000	IN.
SCALE	0.0034	

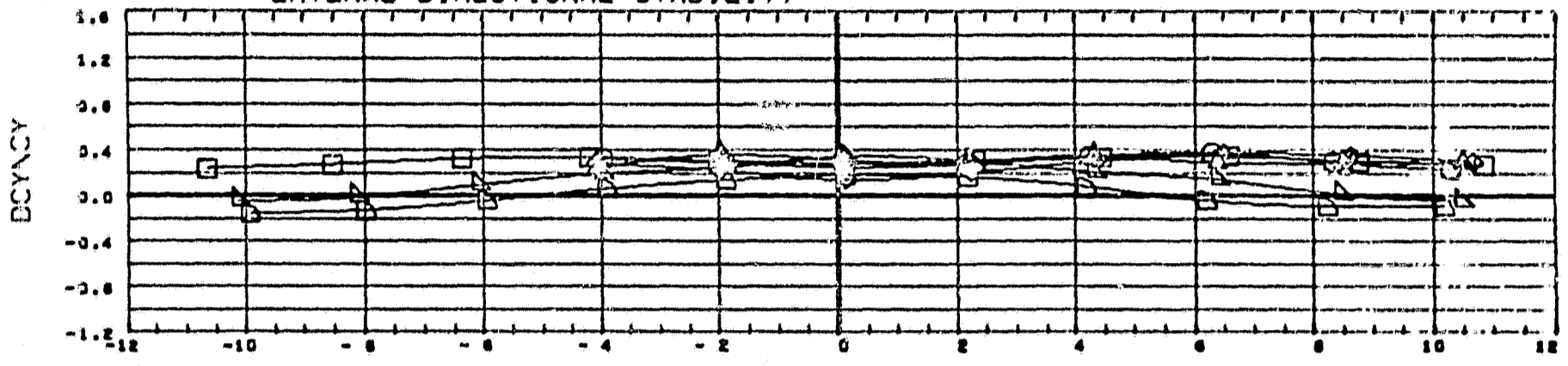
### LATERAL-DIRECTIONAL STABILITY



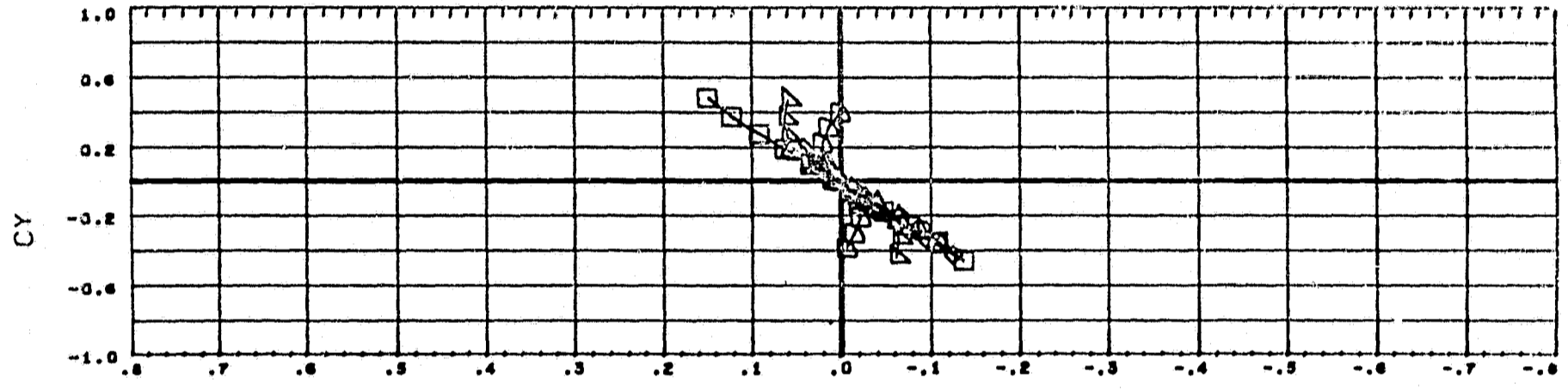
SYMBOL	MACH	ALPHA	PARAMETRIC VALUES
○	0.896	0.000	ORBINC - 2.000
◇	0.900		
△	1.102		
▽	1.460		
□	2.740		
◇	4.959		
		DATA HIST. CODE	GR

REFERENCE INFORMATION		
BREF	5.1478	80. IN.
LREF	4.4260	IN.
ØREF	2.9690	IN.
XHRP	5.7530	IN.
YHRP	0.0000	IN.
ZHRP	0.0000	IN.
SCALE	0.0034	

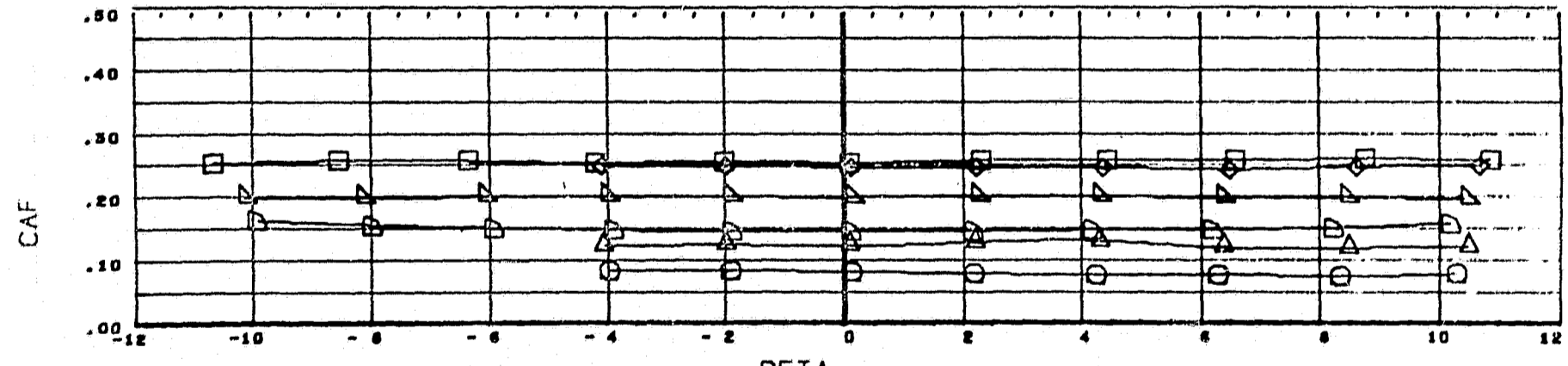
# LATERAL-DIRECTIONAL STABILITY



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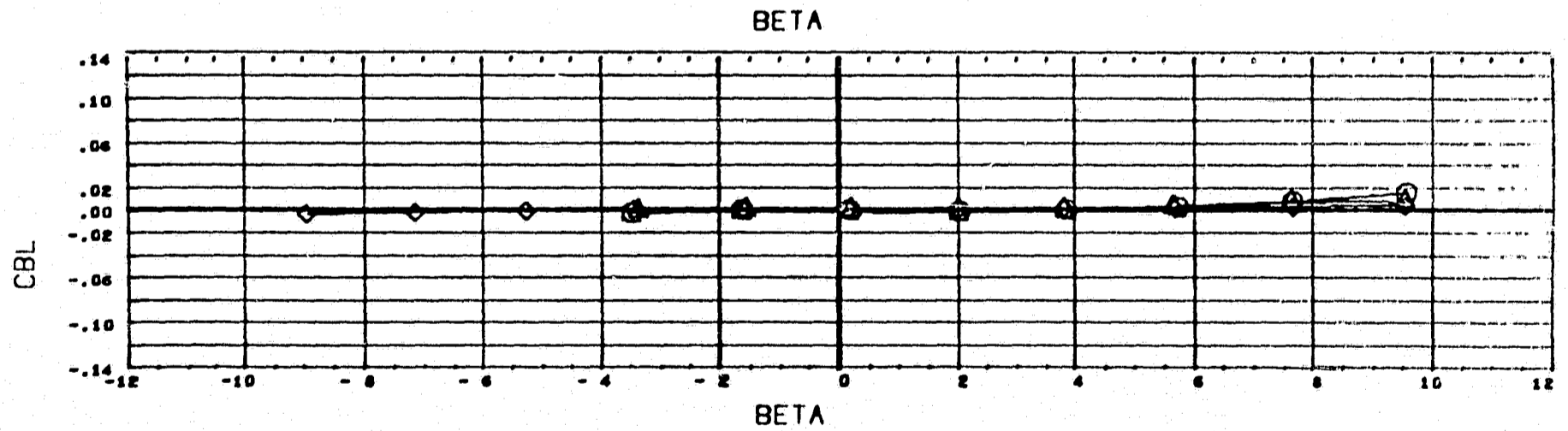
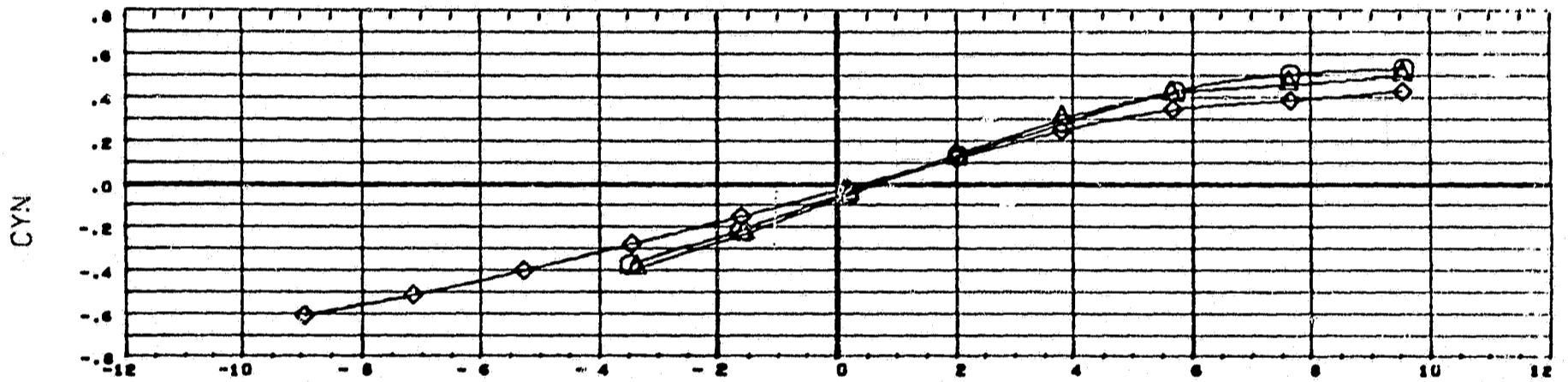
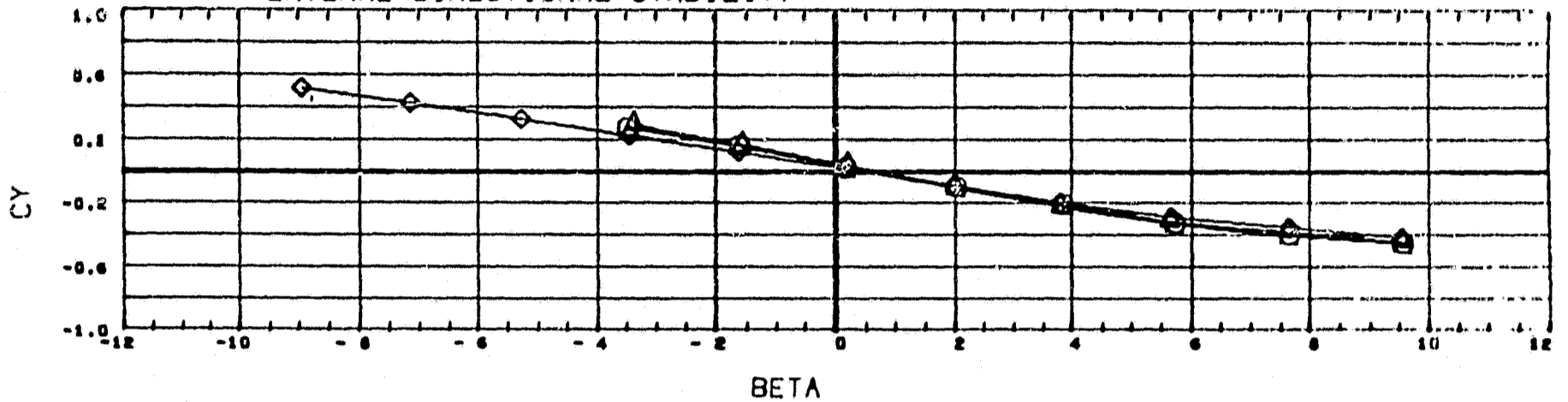


BETA

SYMBOL	MACH	PARAMETRIC VALUES
○	0.596	ALPHA 0.000 ORBINC - 2.000
◇	0.900	
□	1.102	
△	1.460	
▽	2.740	
◇	4.959	DATA HIST. CODE GR

REFERENCE INFORMATION		
SREF	5.1478	sq. in.
LREF	4.4260	in.
BREF	2.9690	in.
XMRP	5.7530	in.
YMRP	0.0000	in.
ZMRP	0.0000	in.
SCALE	0.0034	

### LATERAL-DIRECTIONAL STABILITY

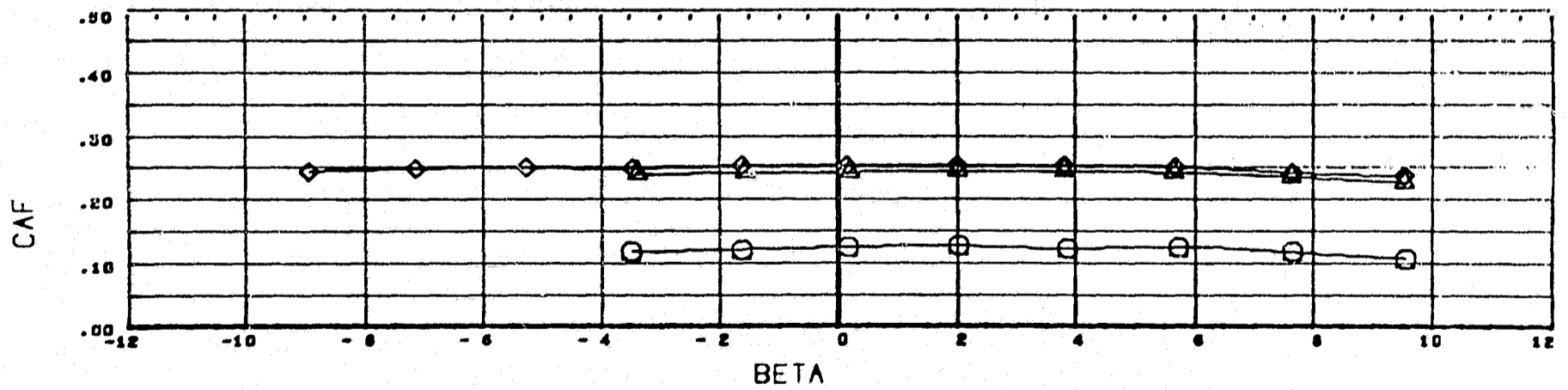
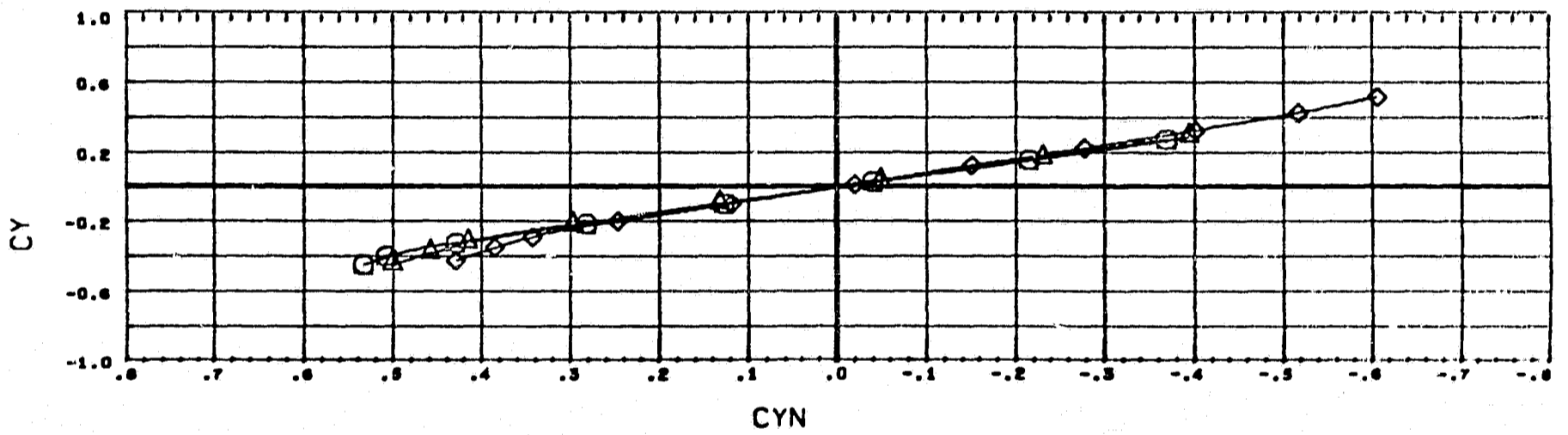
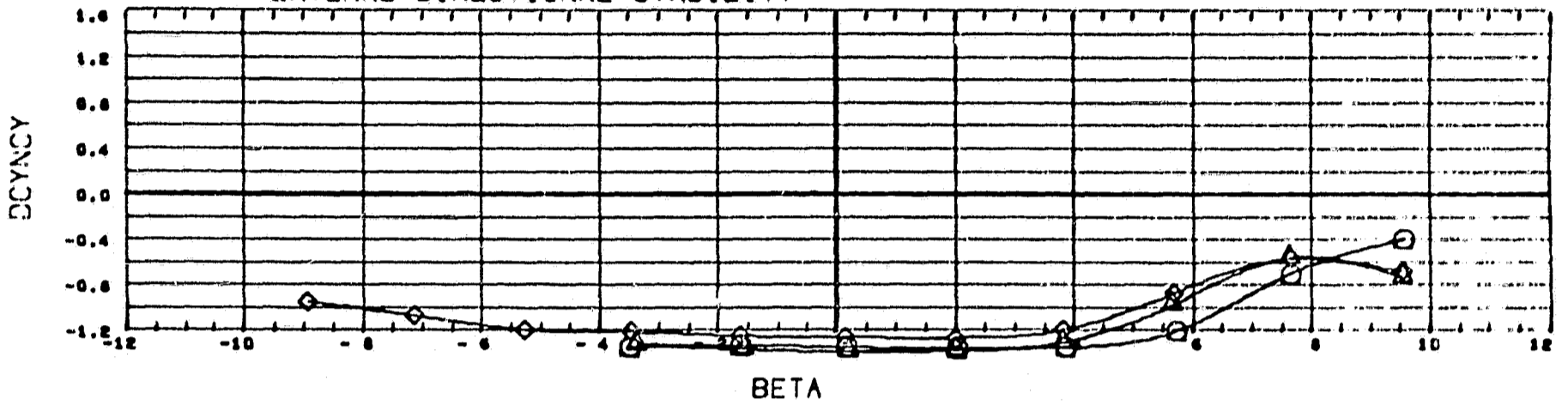


SYMBOL	MACH	PARAMETRIC VALUES
○	0.900	ALPHA 0.000
△	1.103	
◇	1.461	

REFERENCE INFORMATION		
SREF	5.1478	SQ. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE GR

# LATERAL-DIRECTIONAL STABILITY

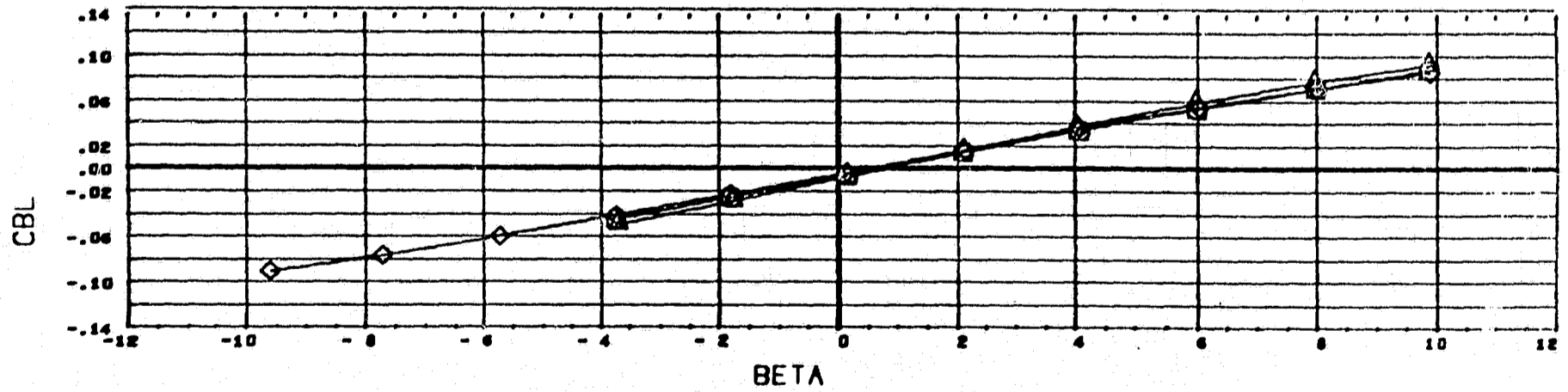
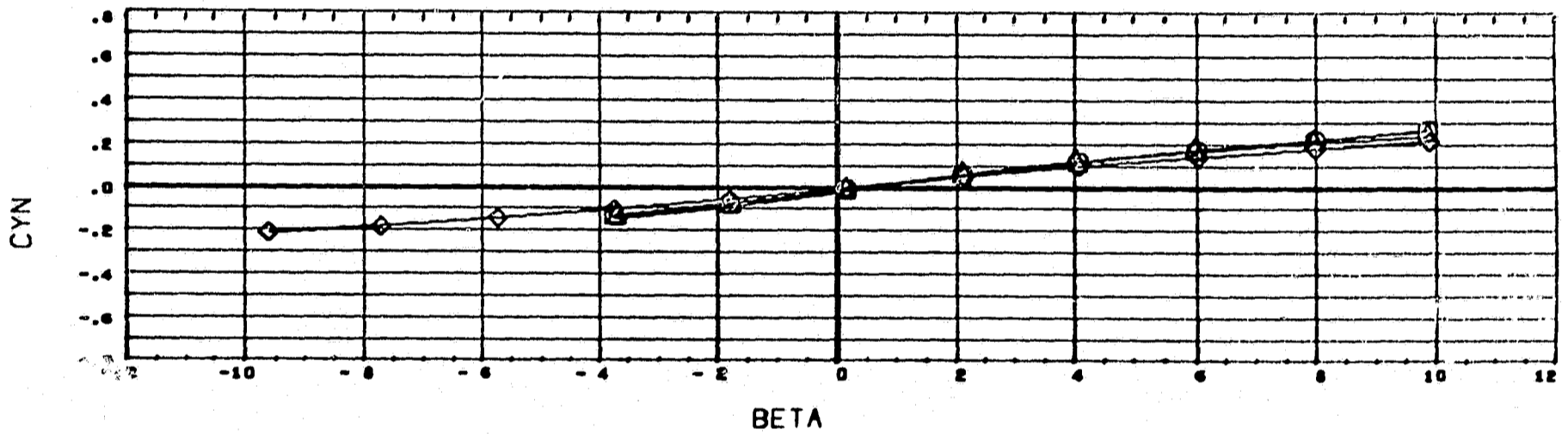
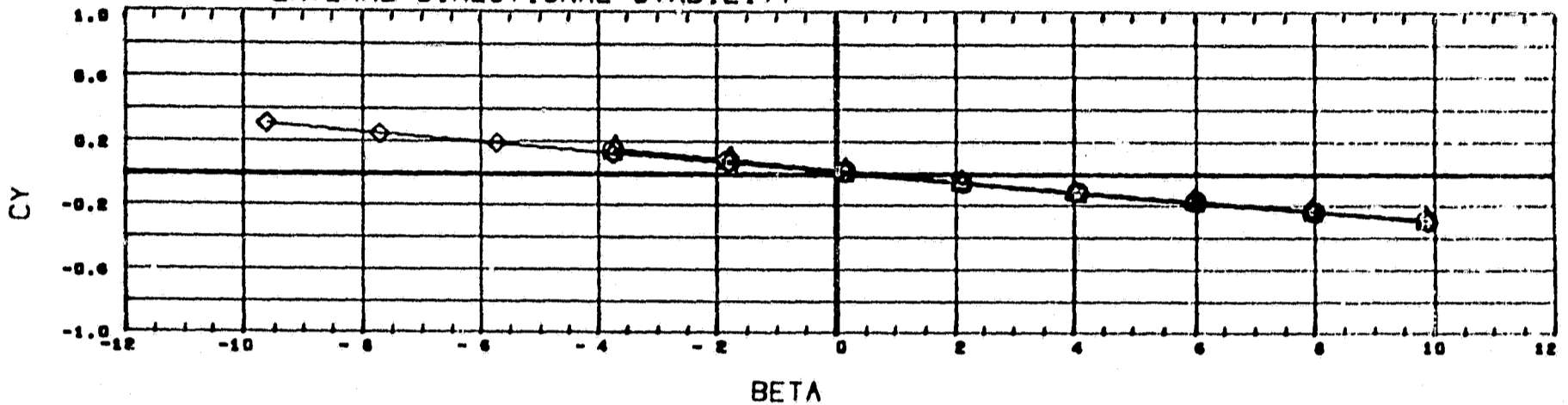


SYMBOL	MACH	PARAMETRIC VALUES
◇	0.900	ALPHA 0.000
◇	1.103	
◇	1.461	

REFERENCE INFORMATION		
SREF	5.1476	SQ. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	9.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE GR

### LATERAL-DIRECTIONAL STABILITY

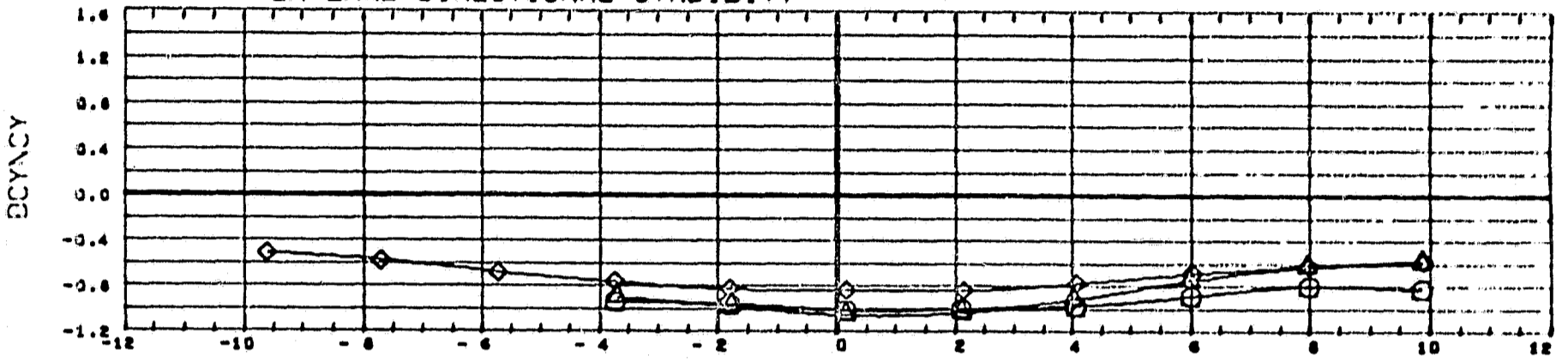


SYMBOL	MACH	ALPHA	PARAMETRIC VALUES
◇	0.899	0.000	
△	1.103		
○	1.456		

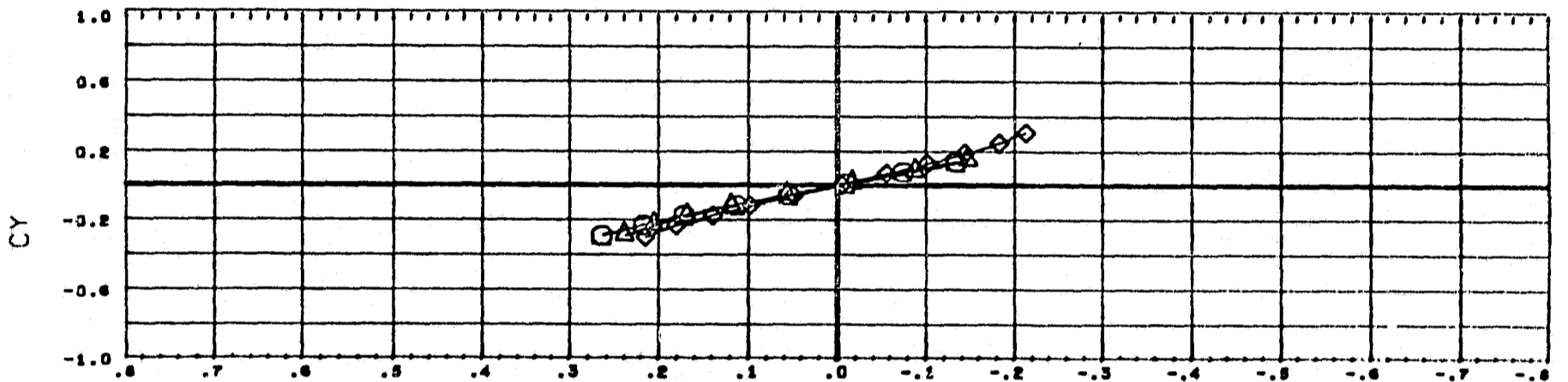
REFERENCE INFORMATION		
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BREF	2.9690	IN.
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YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE GR

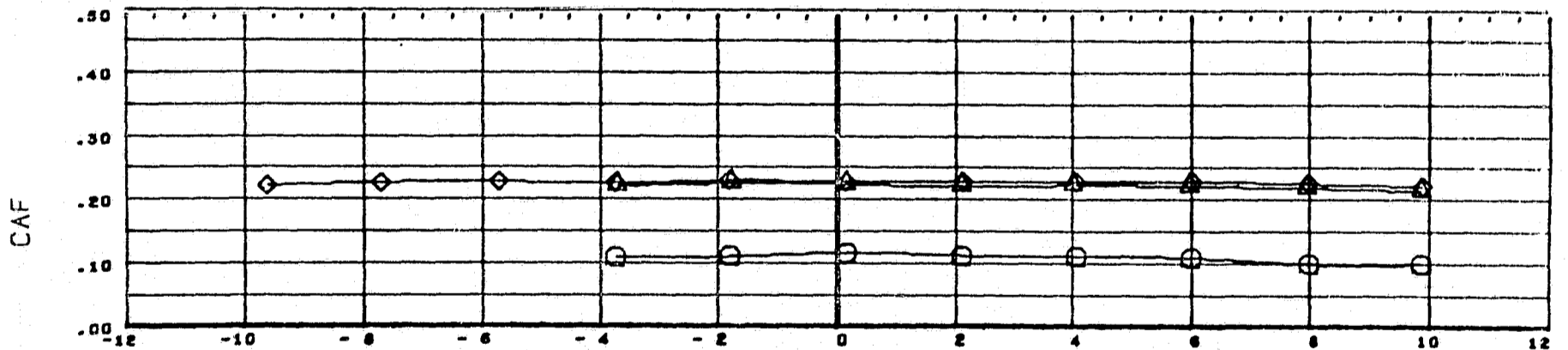
# LATERAL-DIRECTIONAL STABILITY



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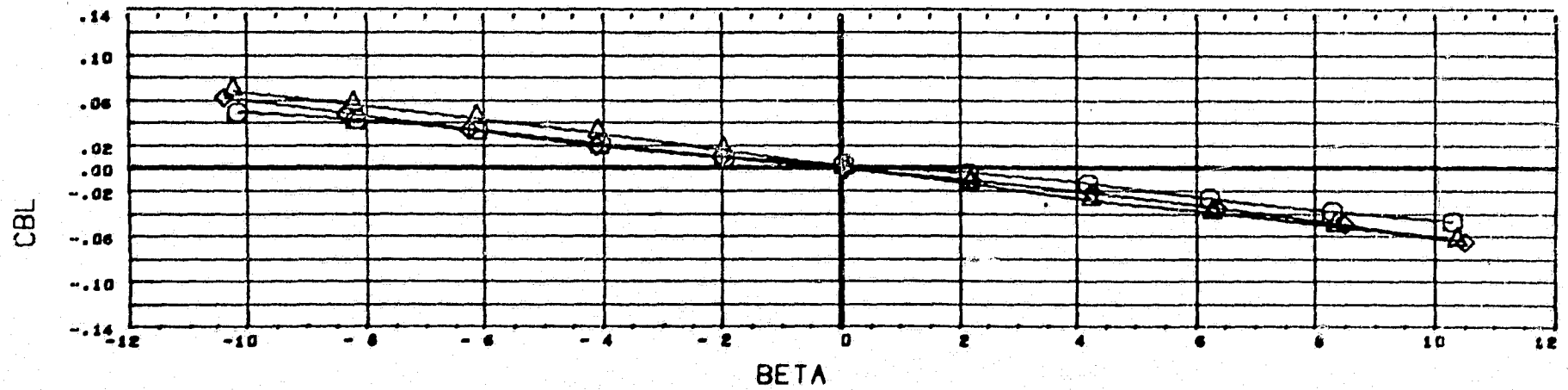
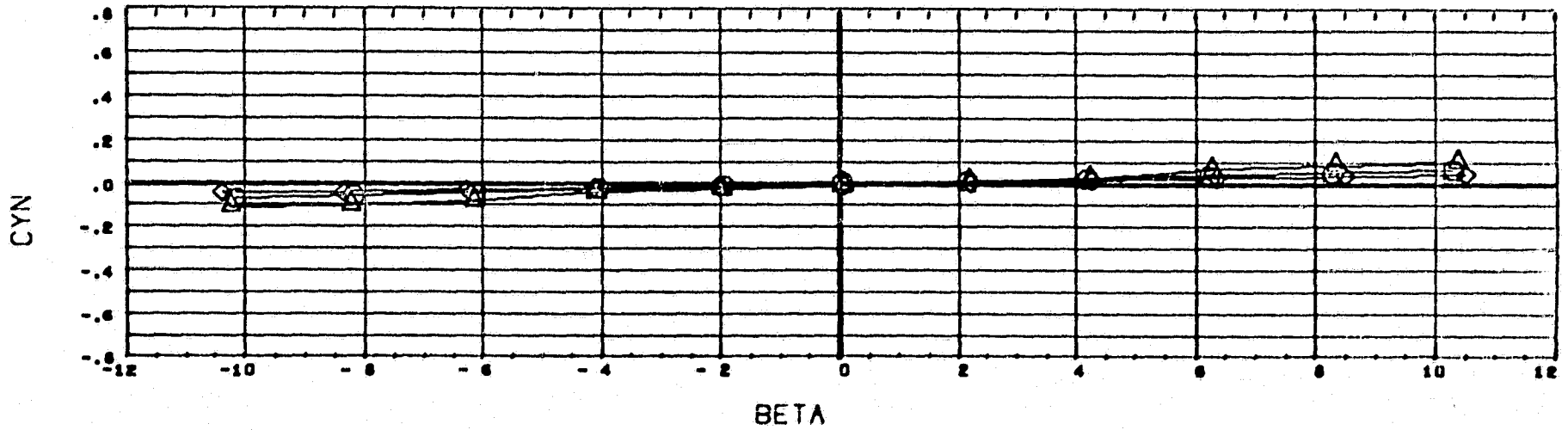
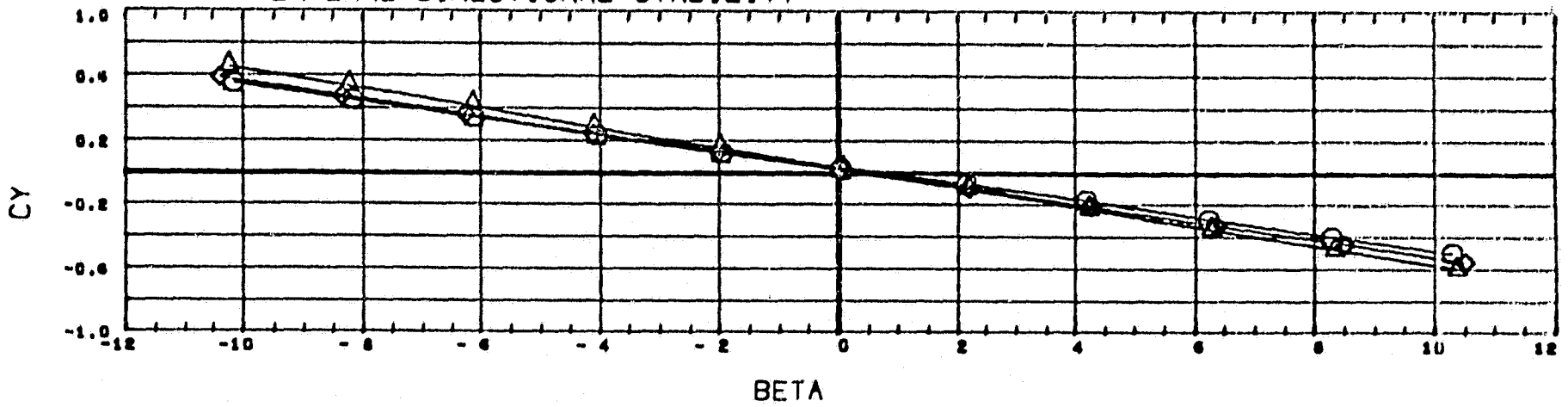
BETA

SYMBOL	MACH	ALPHA	PARAMETRIC VALUES
○	0.899	0.000	
◇	1.103		
◇	1.458		

REFERENCE INFORMATION		
SREF	5.1478	89. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE GR

### LATERAL-DIRECTIONAL STABILITY



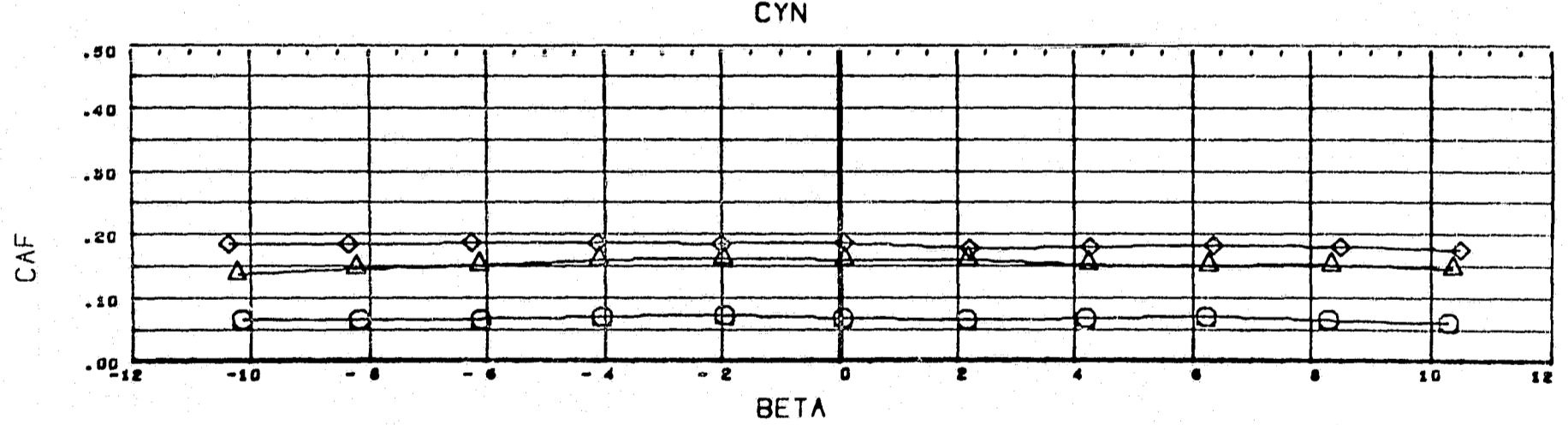
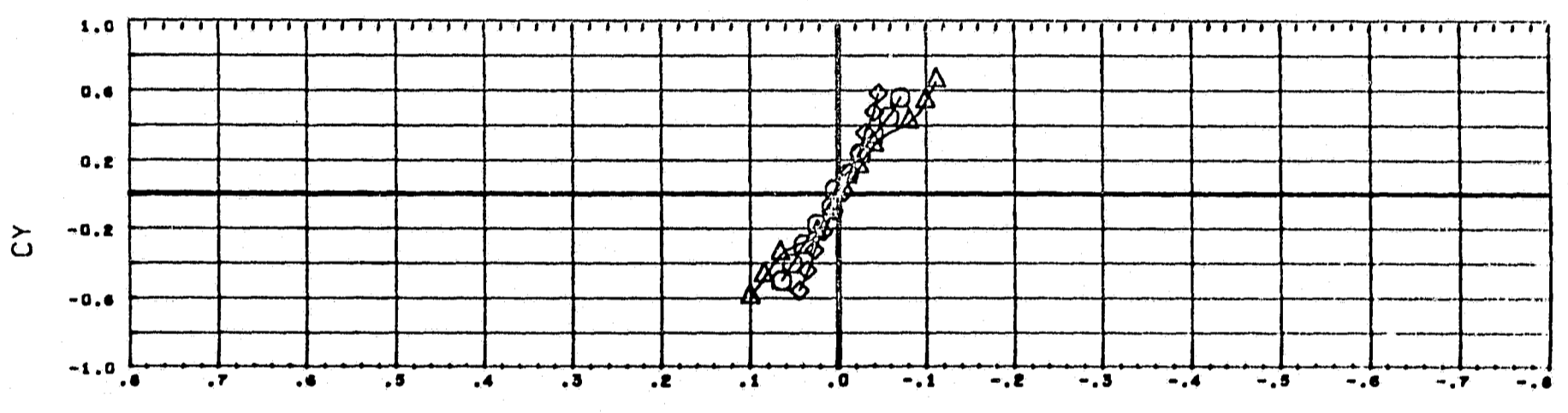
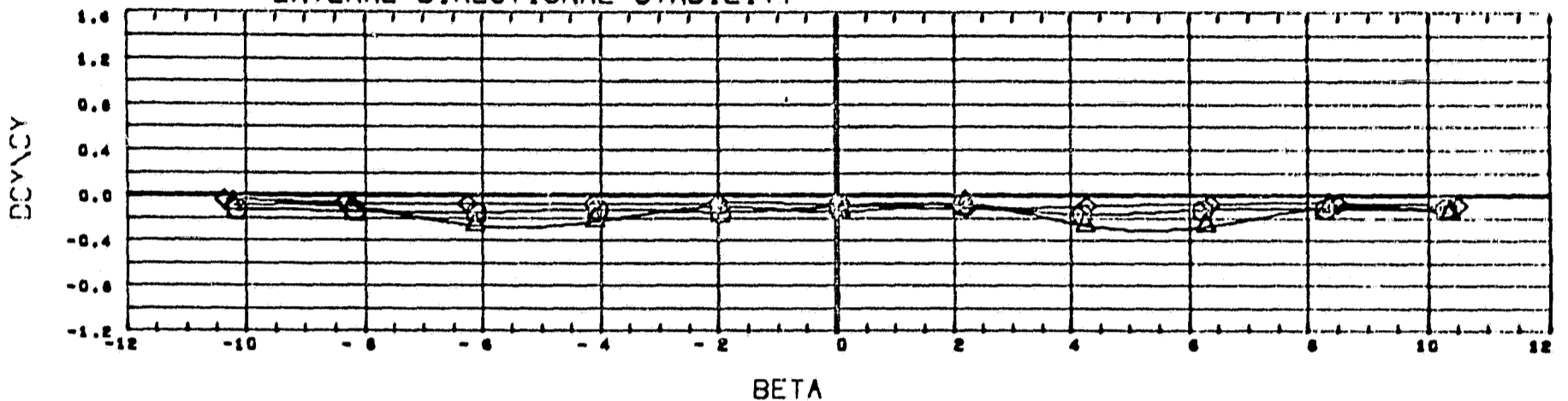
SYMBOL	MACH	ALPHA	PARAMETRIC VALUES
○	0.895		0.000 ORBINC - 2.000
△	1.099		
◇	1.460		

REFERENCE INFORMATION		
SREF	5.1476	sq. in.
LREF	4.4260	in.
BREF	2.9690	in.
XHRP	4.3530	in.
YHRP	0.0000	in.
ZHRP	0.0000	in.
SCALE	0.0034	

DATA HIST. CODE GR



# LATERAL-DIRECTIONAL STABILITY

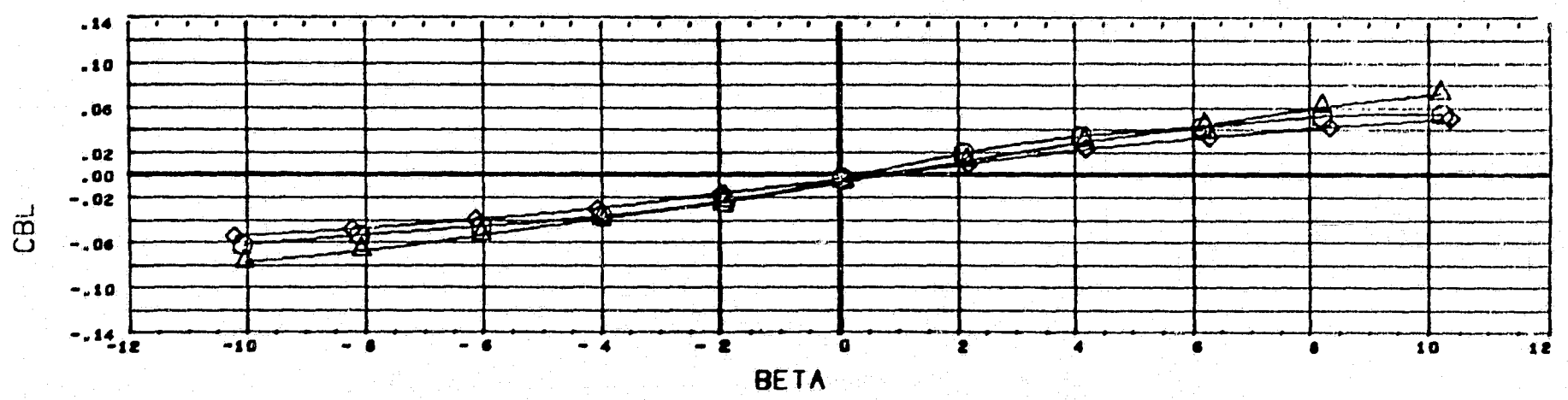
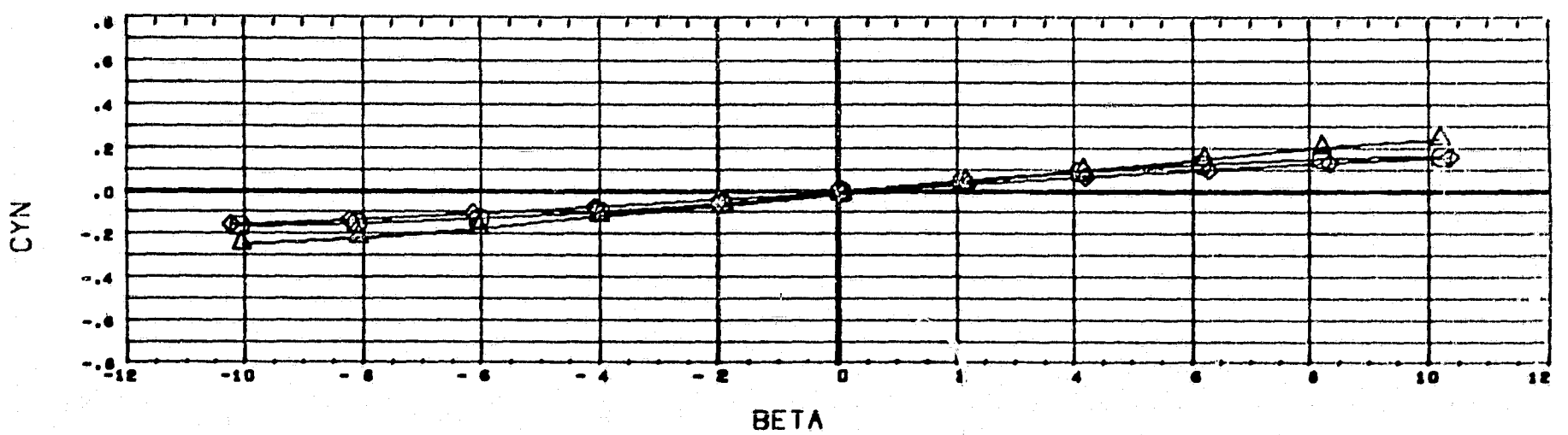
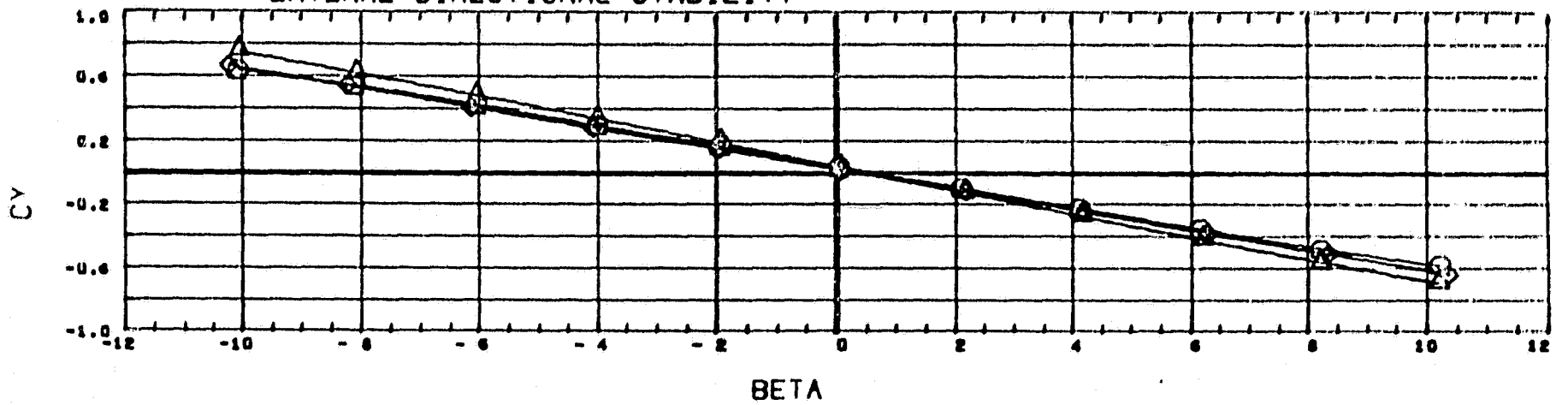


SYMBOL	MACH	ALPHA	PARAMETRIC VALUES	
○	0.895	0.000	ORBINC	- 2.000
△	1.099			
◇	1.460			

REFERENCE INFORMATION		
SREF	5.1476	SQ. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	4.3530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE GR

# LATERAL-DIRECTIONAL STABILITY

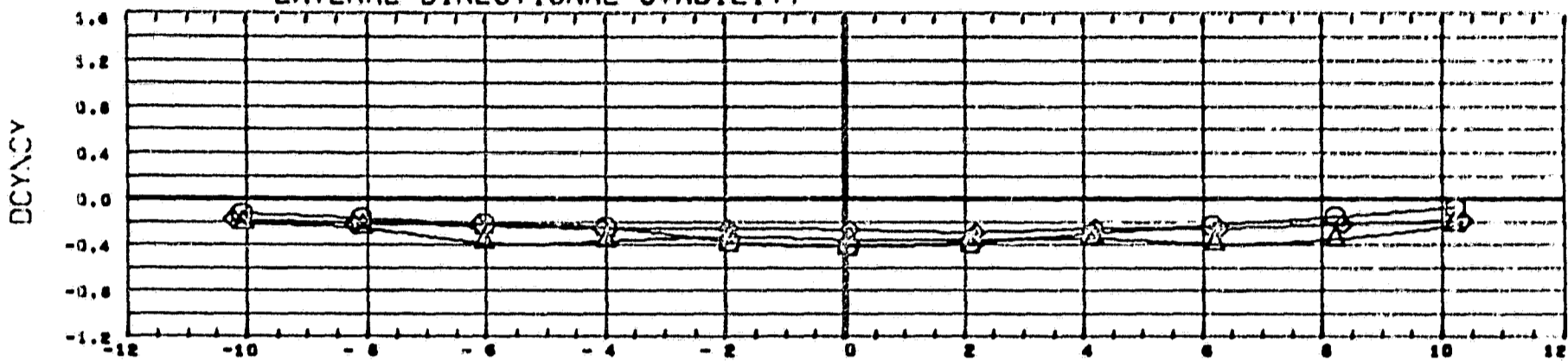


SYMBOL	MACH	ALPHA	PARAMETRIC VALUES	
◇	0.900	0.000	ORBINC	- 2.000
△	1.100			
◇	1.461			

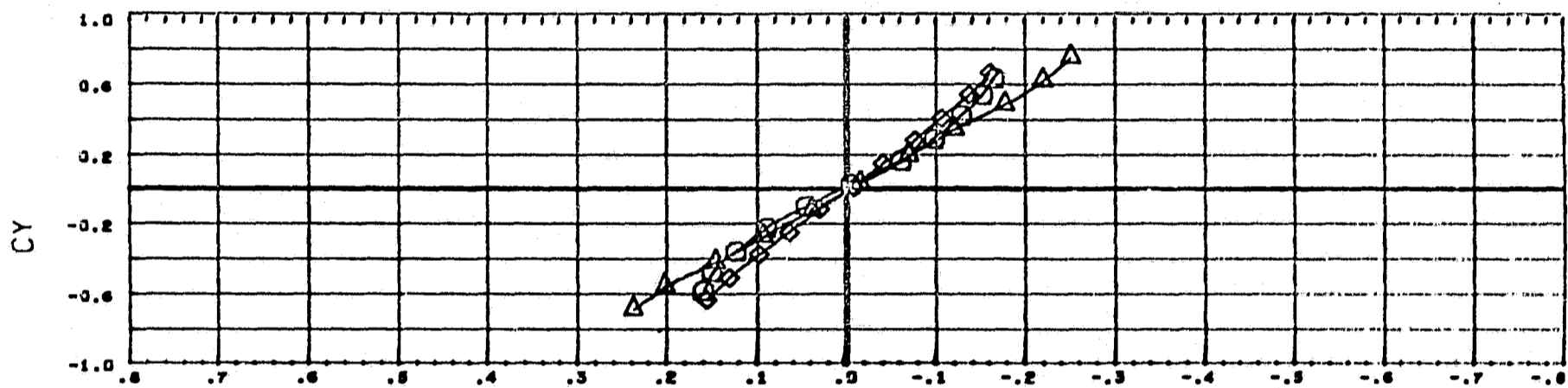
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SCALE	0.0034	

DATA HIST. CODE GR

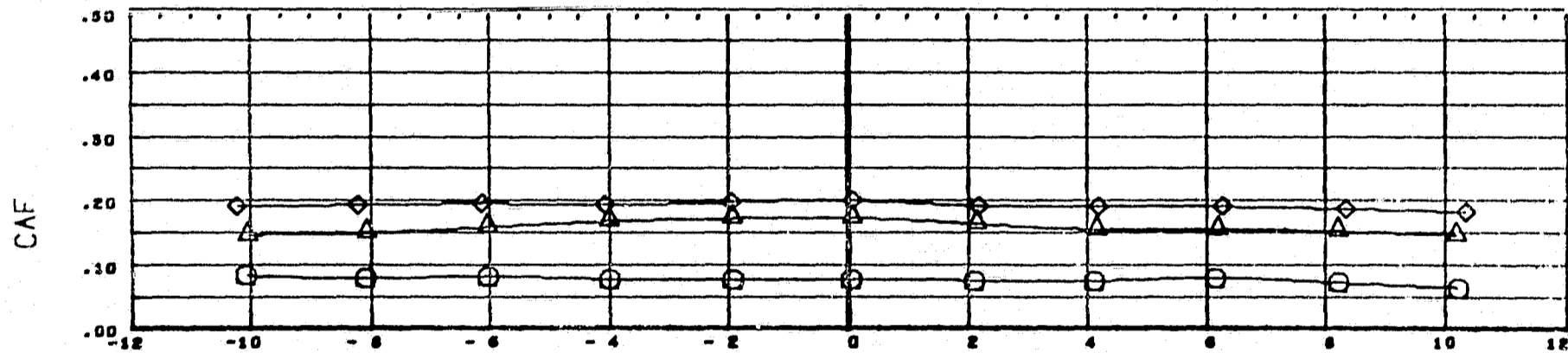
# LATERAL-DIRECTIONAL STABILITY



BETA



CYN



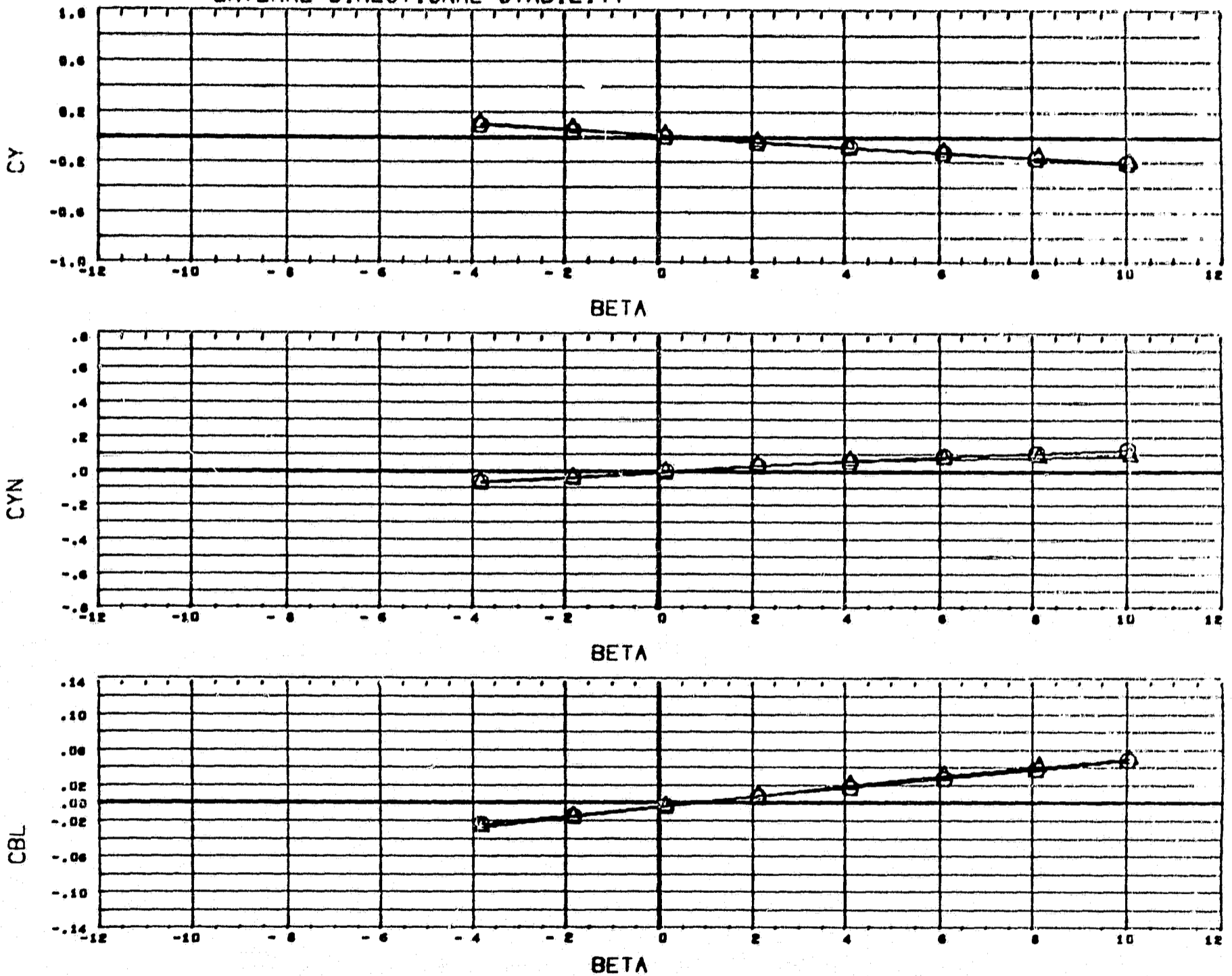
BETA

SYMBOL	MACH	PARAMETRIC VALUES	
○	0.900	ALPHA	0.000
△	1.100	ORBINC	- 2.000
◇	1.461		

REFERENCE INFORMATION		
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LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	4.3530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE GR

# LATERAL-DIRECTIONAL STABILITY



SYMBOL  $\Delta$  MACH 0.899 ALPHA 0.000  
 1.105

REFERENCE INFORMATION  
 SREF 5.1478 90. IN.  
 LREF 4.4260 IN.  
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 XMRP 5.7530 IN.  
 YMRP 0.0000 IN.  
 ZMRP 0.0000 IN.  
 SCALE 0.0034

DATA HIST. CODE GR

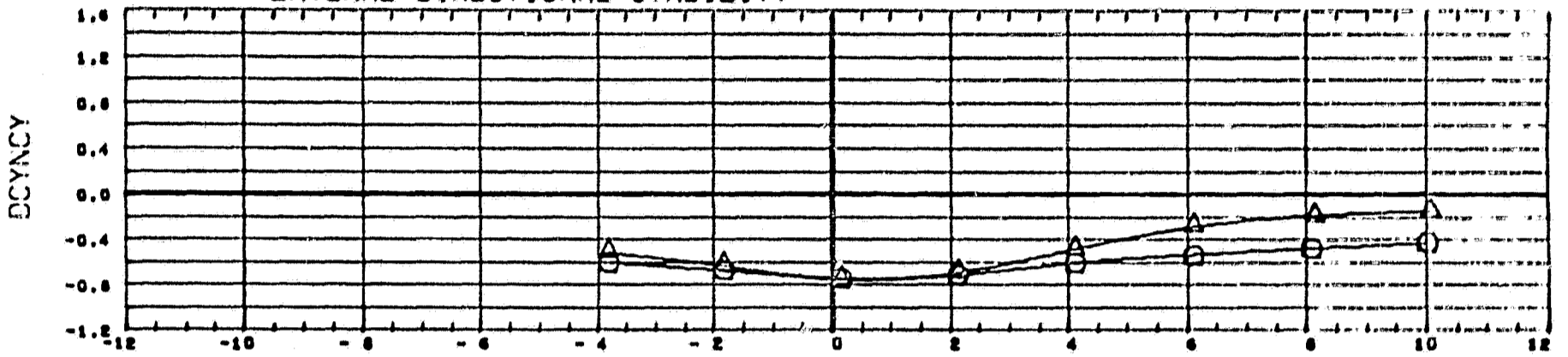
M523-MSFC MODELAX12331-1

B5V6.3

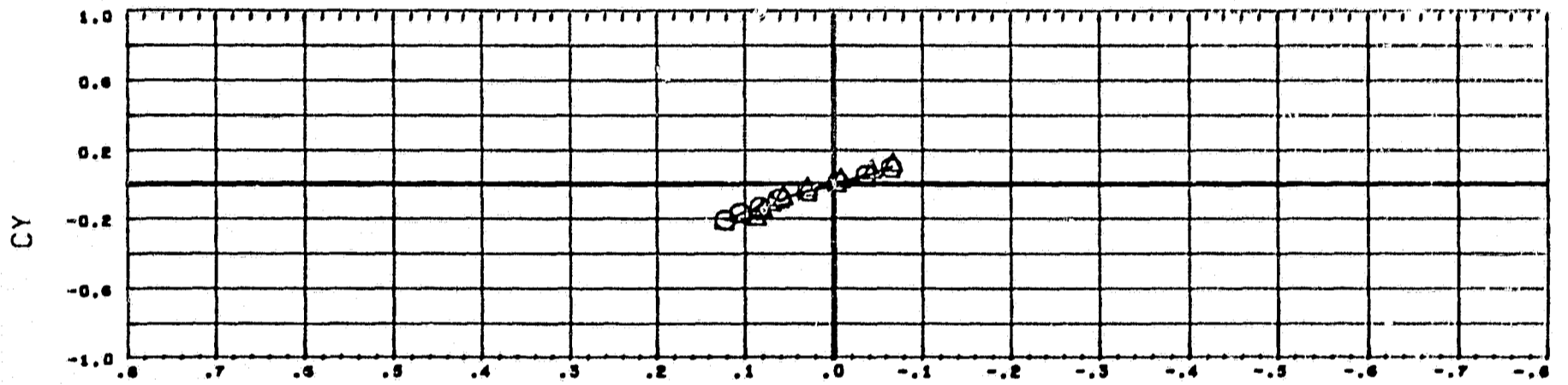
(D5715B) 10 FEB 72

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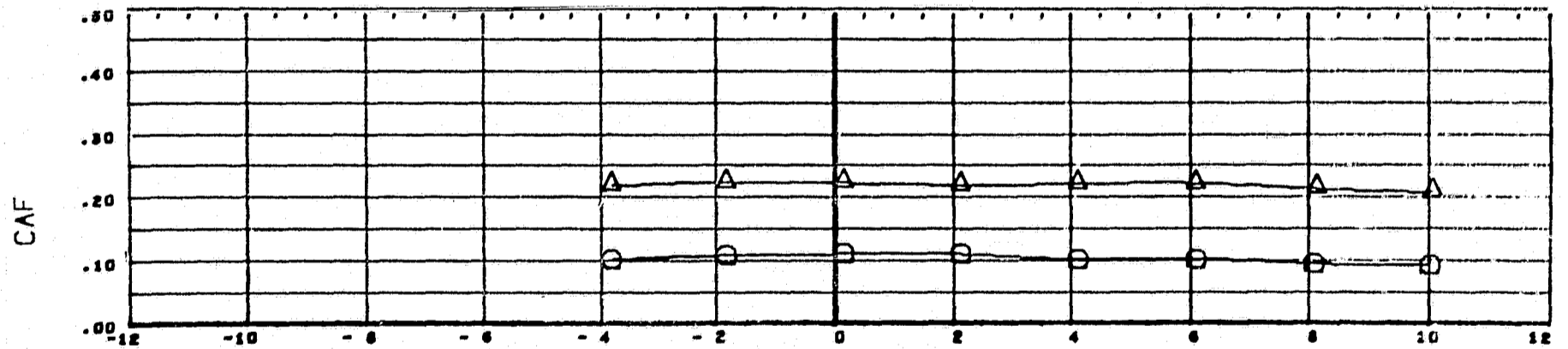
# LATERAL-DIRECTIONAL STABILITY



BETA



CYN



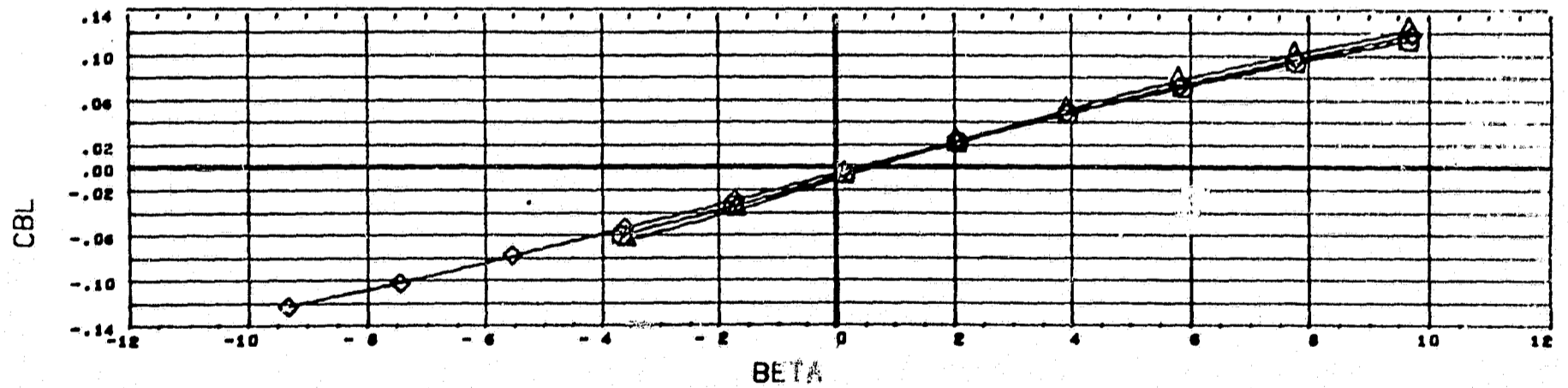
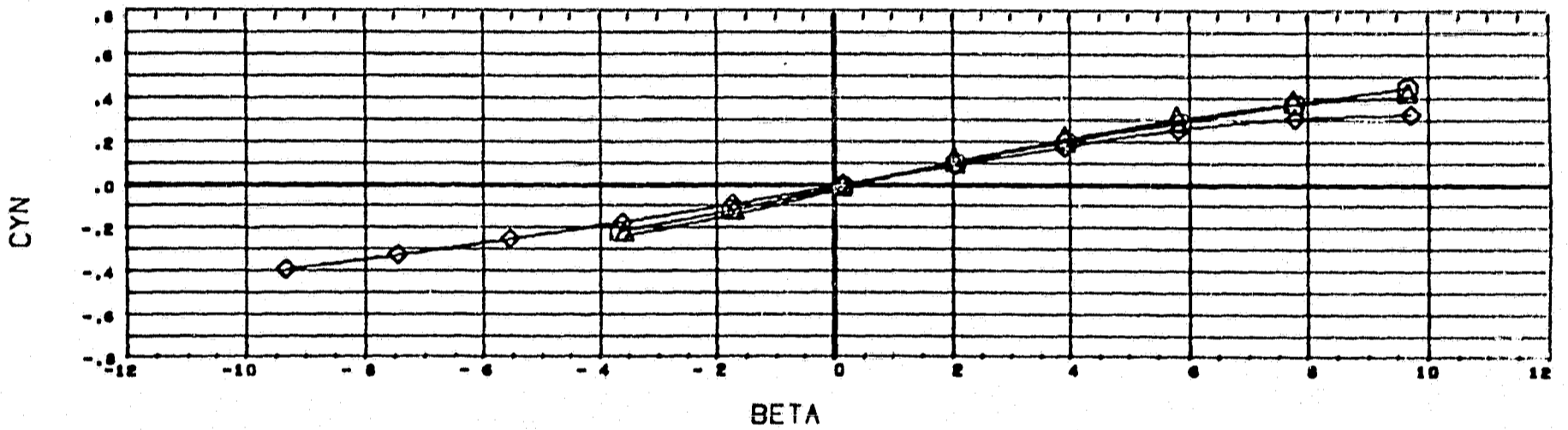
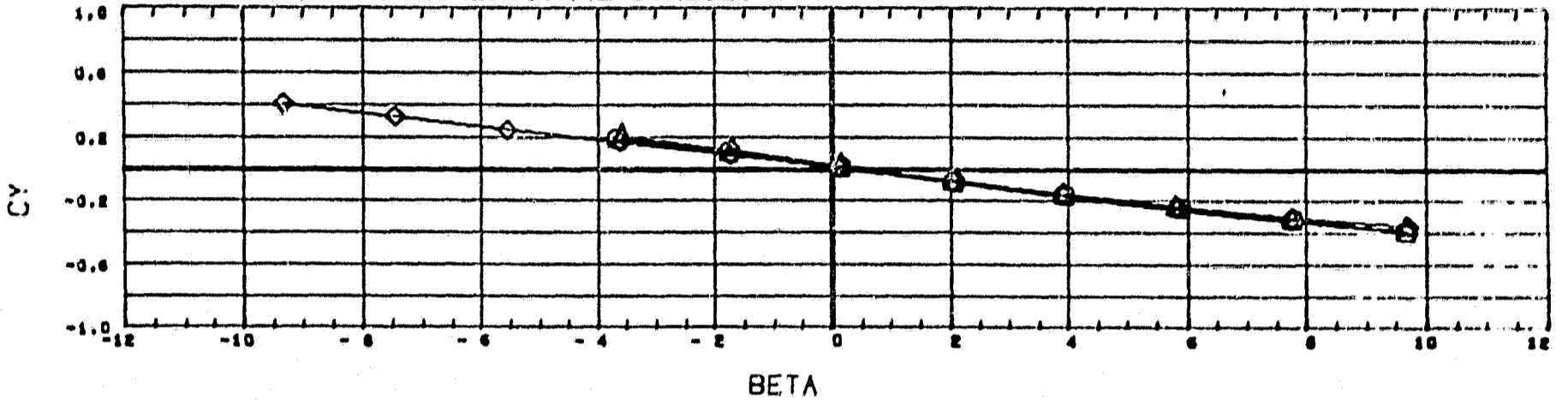
BETA

SYMBOL	MACH	ALPHA	PARAMETRIC VALUES
○	0.899		0.000
△	1.105		

REFERENCE INFORMATION		
SREF	5.1476	30. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE GR

### LATERAL-DIRECTIONAL STABILITY

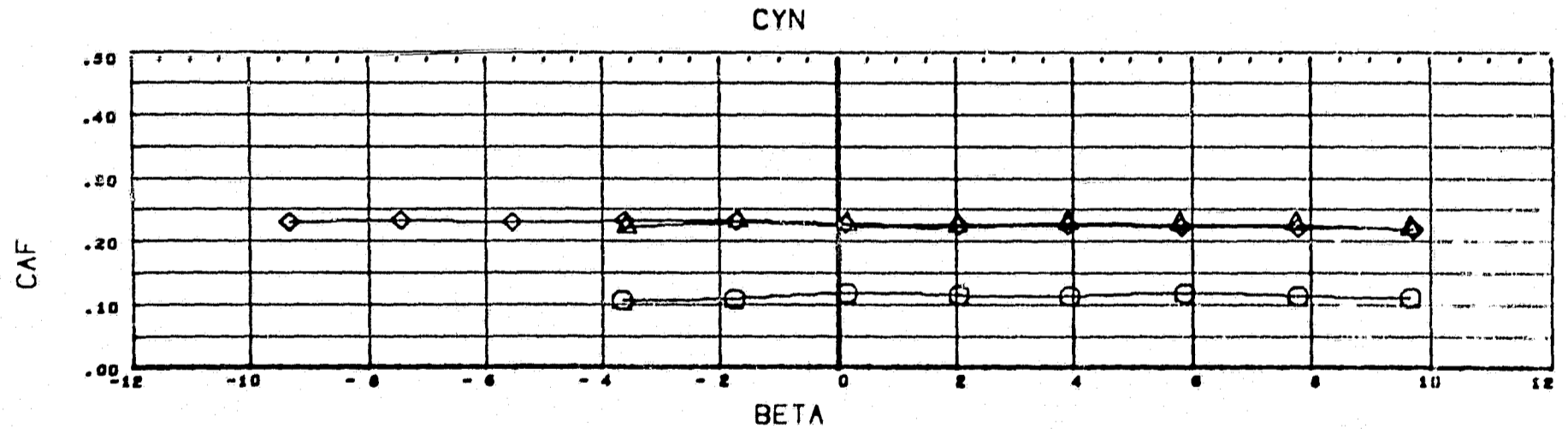
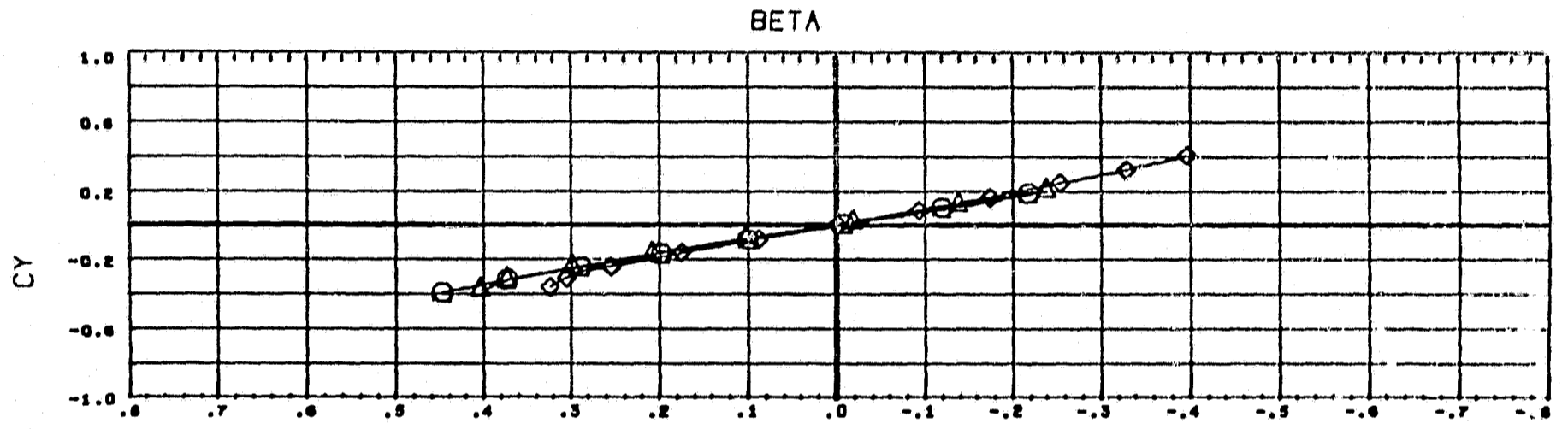
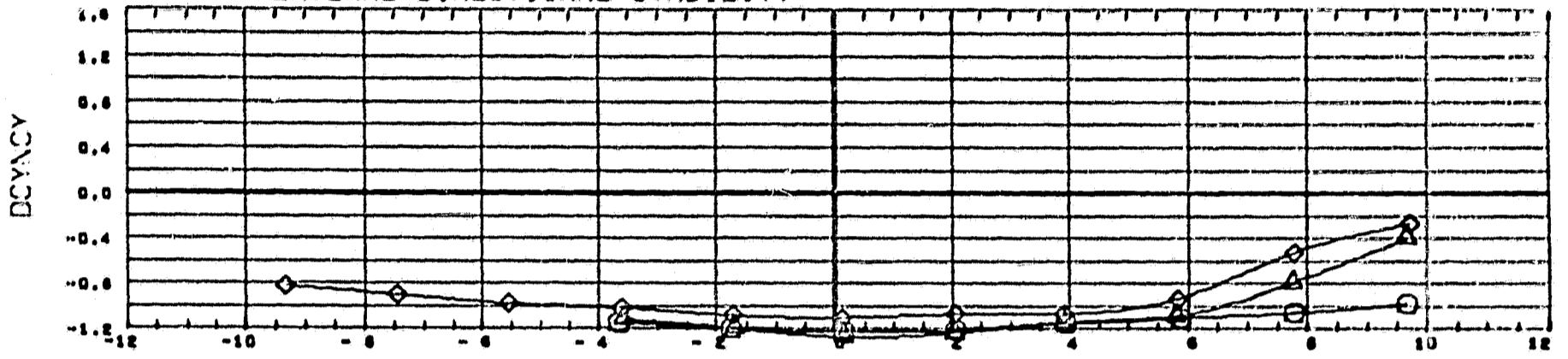


SYMBOL	MACH	ALPHA	PARAMETRIC VALUES
○	0.900		0.000
△	1.103		
◇	1.456		

REFERENCE INFORMATION		
SREF	5.1478	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE GR

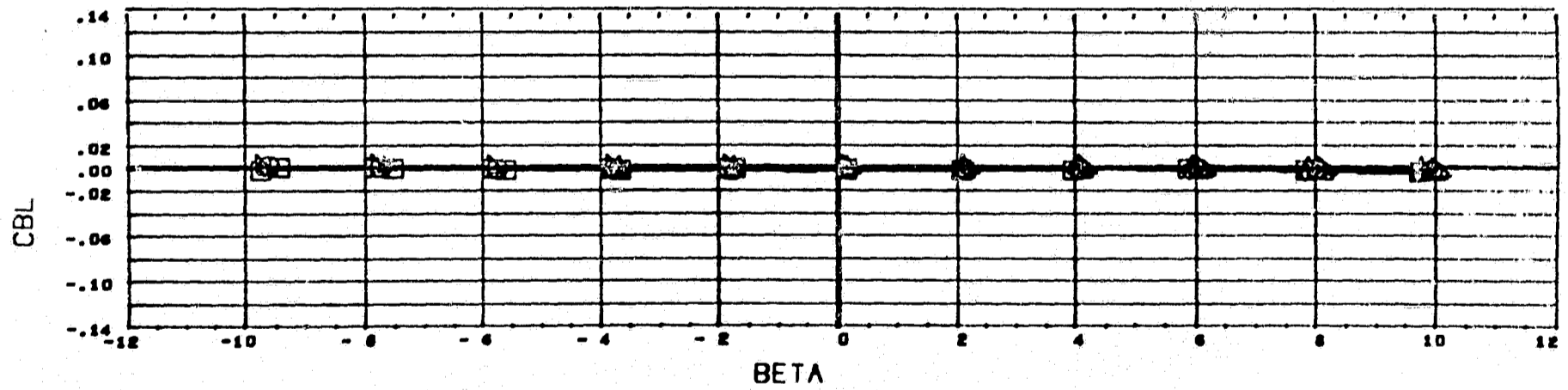
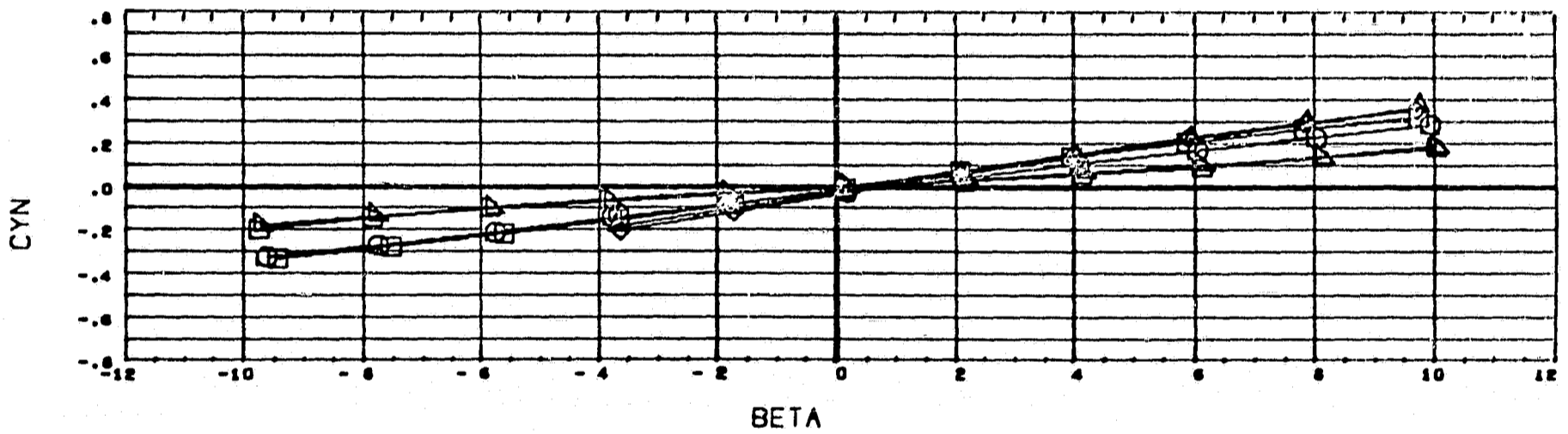
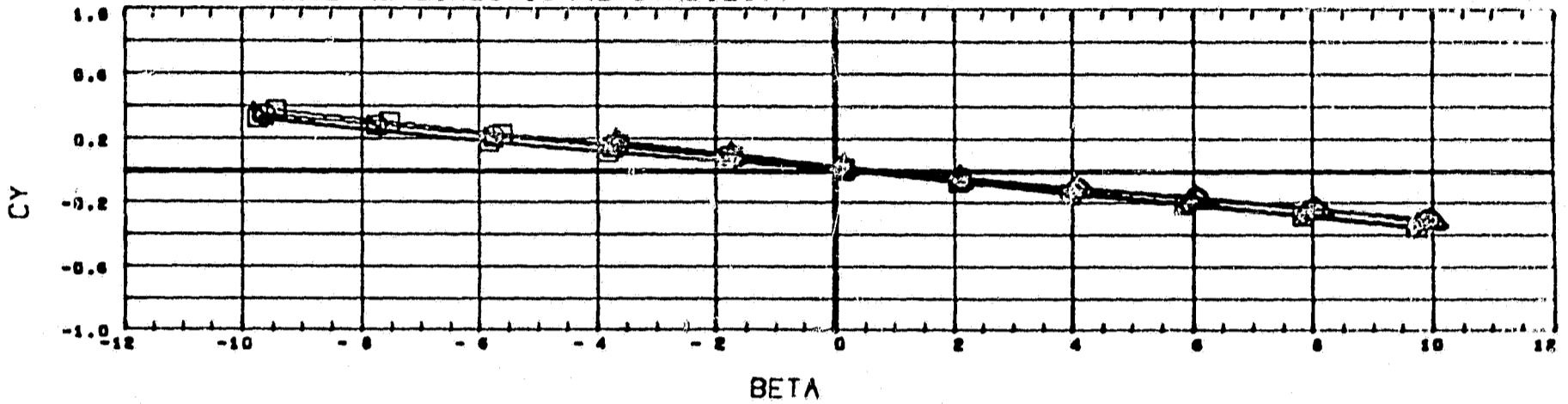
# LATERAL-DIRECTIONAL STABILITY



SYMBOL	MACH	PARAMETRIC VALUES		REFERENCE INFORMATION		
		ALPHA	0.000	SREF	5.1478	80. IN.
○	0.900			LREF	4.4280	IN.
△	1.103			ØREF	2.9690	IN.
◇	1.458			XMRP	5.7530	IN.
				YMRP	0.0000	IN.
				ZMRP	0.0000	IN.
				SCALE	0.0034	

DATA HIST. CODE GR

### LATERAL-DIRECTIONAL STABILITY

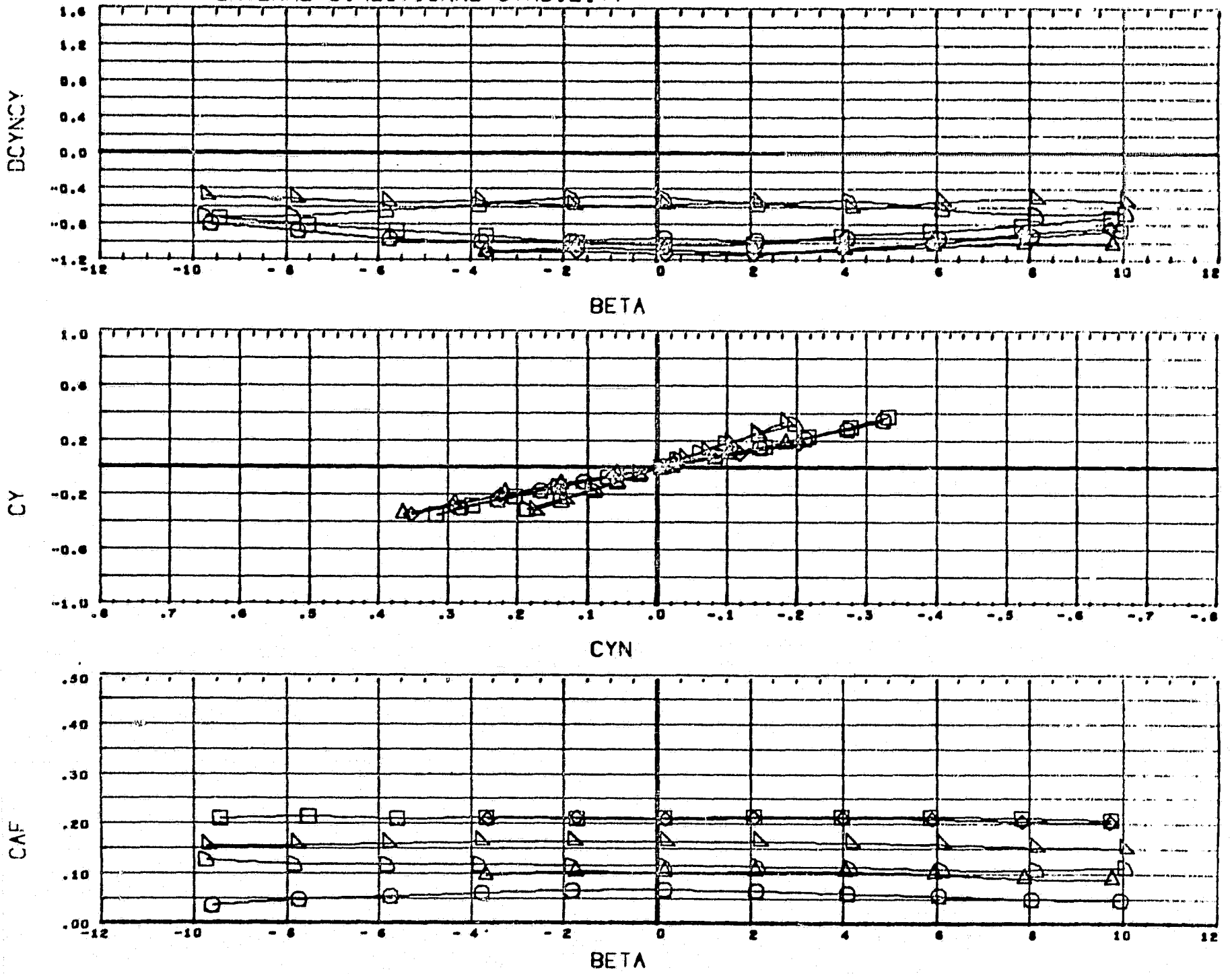


SYMBOL	MACH	ALPHA	PARAMETRIC VALUES
○	0.599	0.000	
◇	0.901		
△	1.102		
□	1.462		
▽	2.740		
◇	4.939		
		DATA MIST. CODE	GR

REFERENCE INFORMATION		
SREF	5.1478	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	



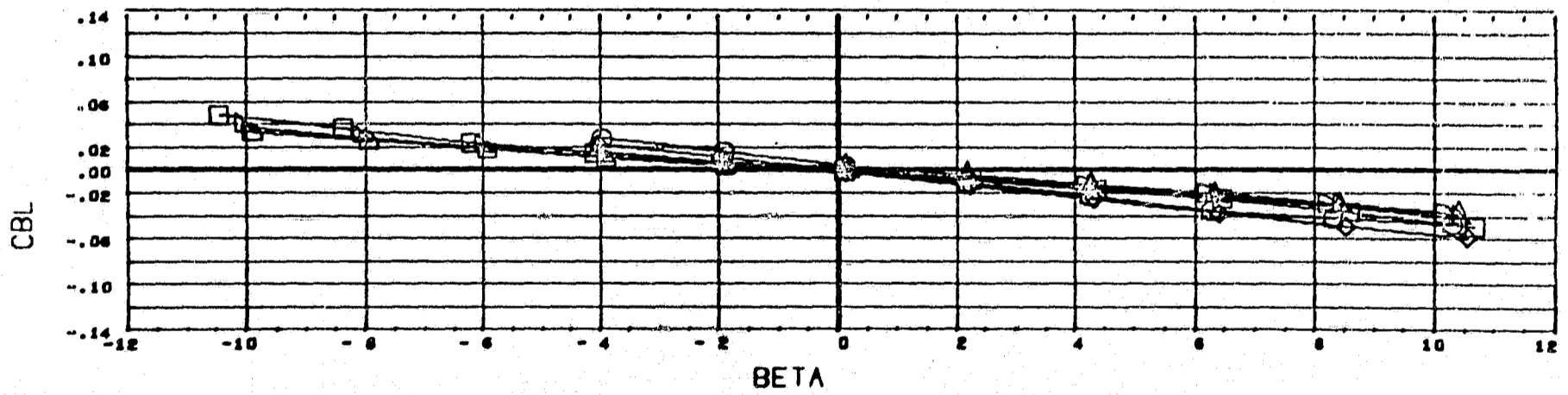
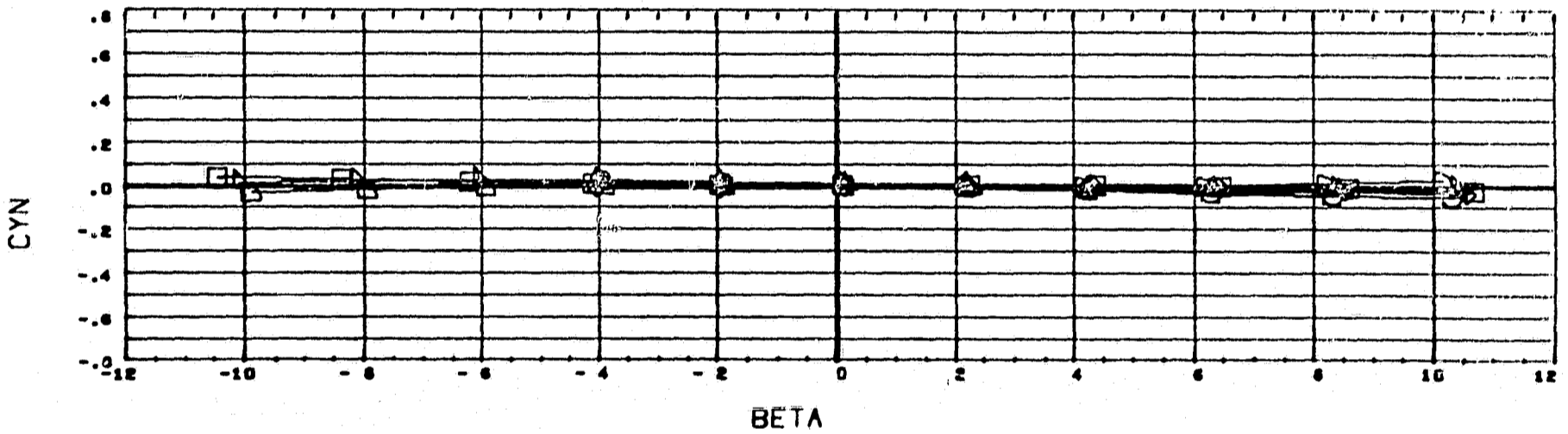
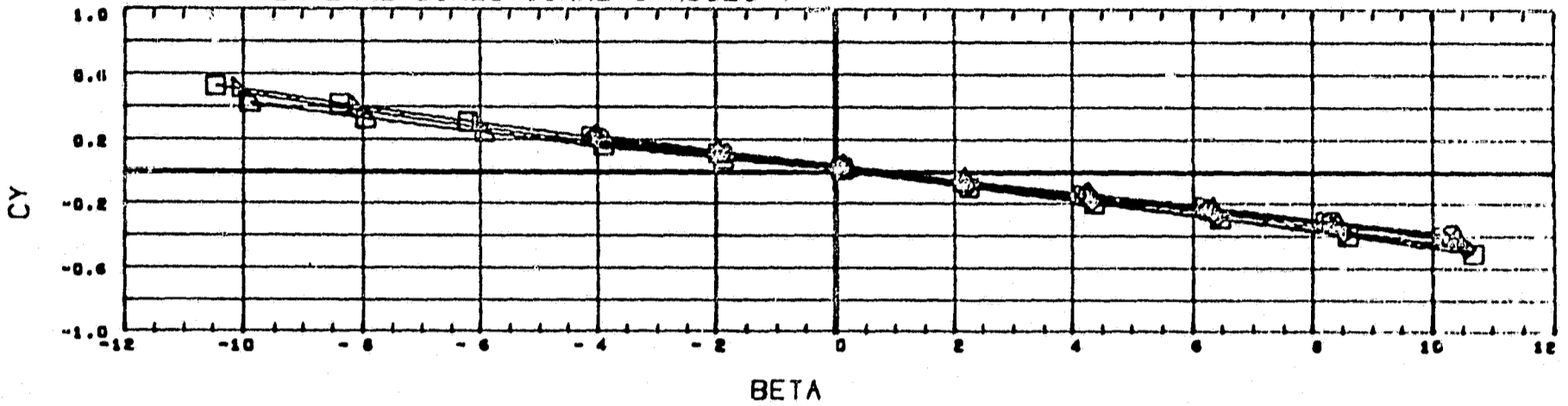
# LATERAL-DIRECTIONAL STABILITY



SYMBOL	MACH	PARAMETRIC VALUES
○	0.599	ALPHA 0.000
◇	0.901	
△	1.102	
□	1.462	
▽	2.740	
◇	4.959	DATA HIST. CODE GR

REFERENCE INFORMATION		
SREF	5.1478	59. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

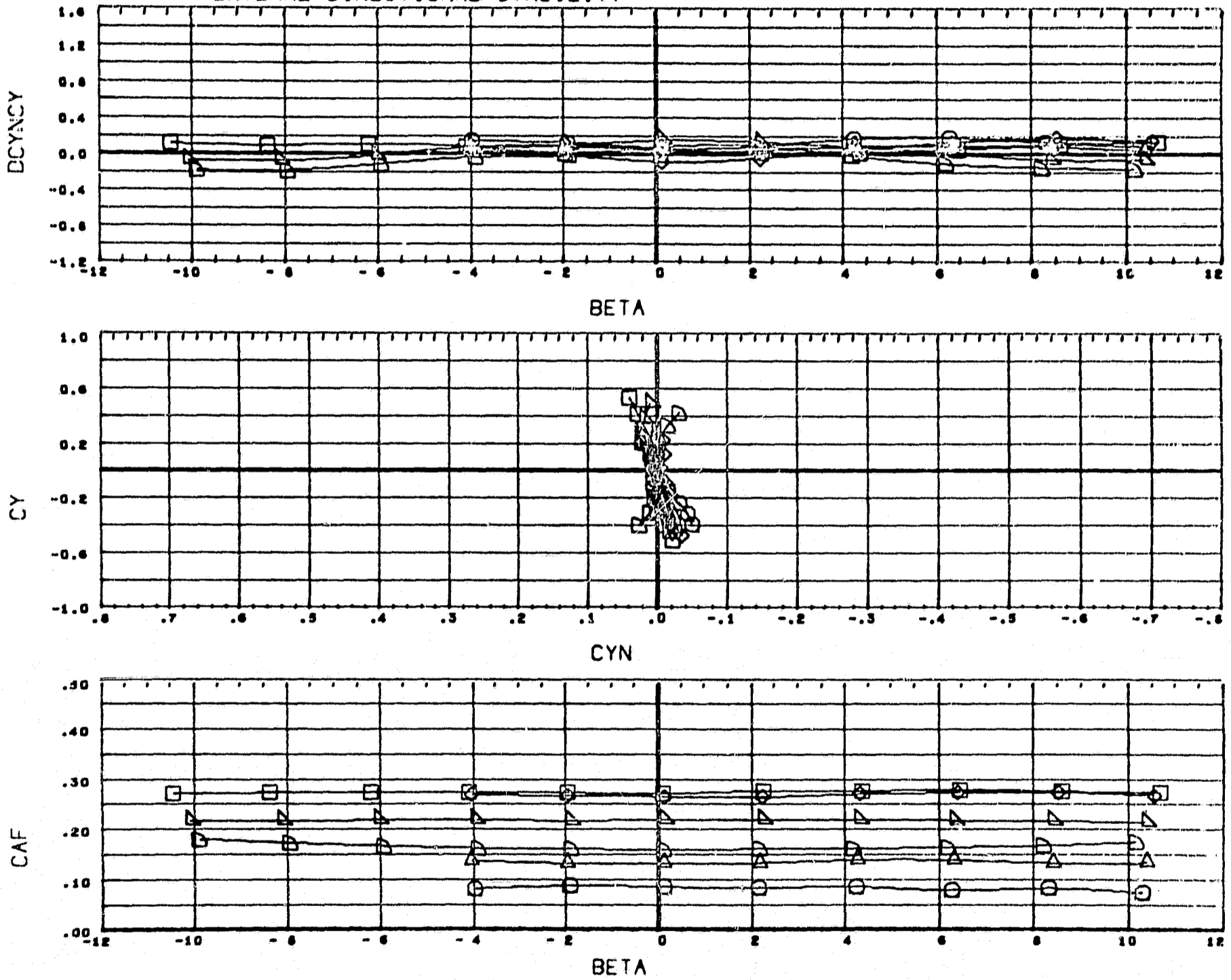
# LATERAL-DIRECTIONAL STABILITY



SYMBOL	MACH	PARAMETRIC VALUES
○	0.600	ALPHA 0.000 ORBITAL - 2.000
◇	0.899	
△	1.102	
□	1.462	
▽	2.740	
◇	4.959	DATA HIST. CODE GR

REFERENCE INFORMATION		
SREF	5.1476	50. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

# LATERAL-DIRECTIONAL STABILITY

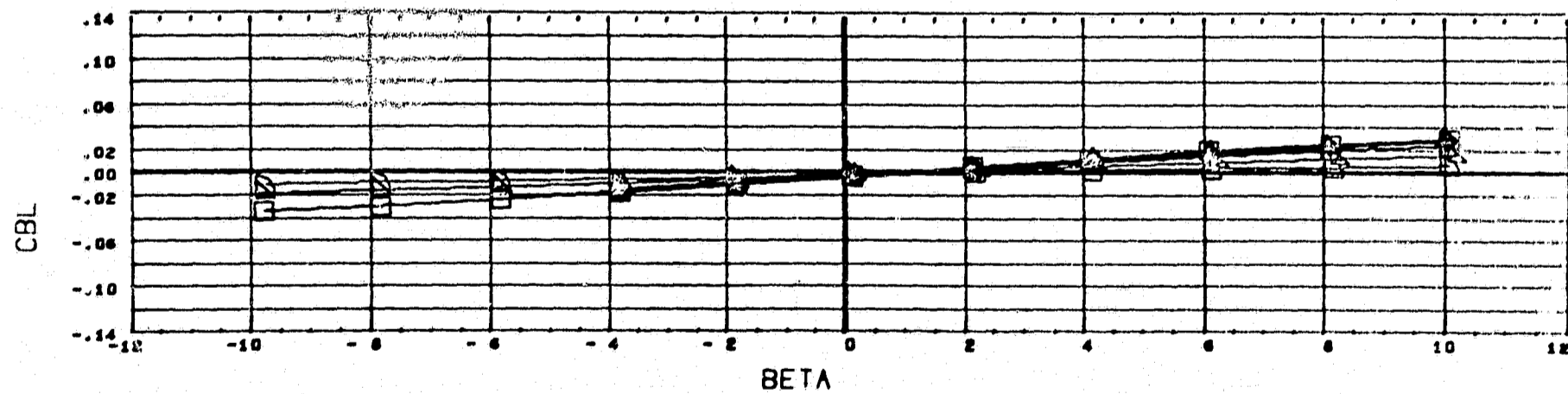
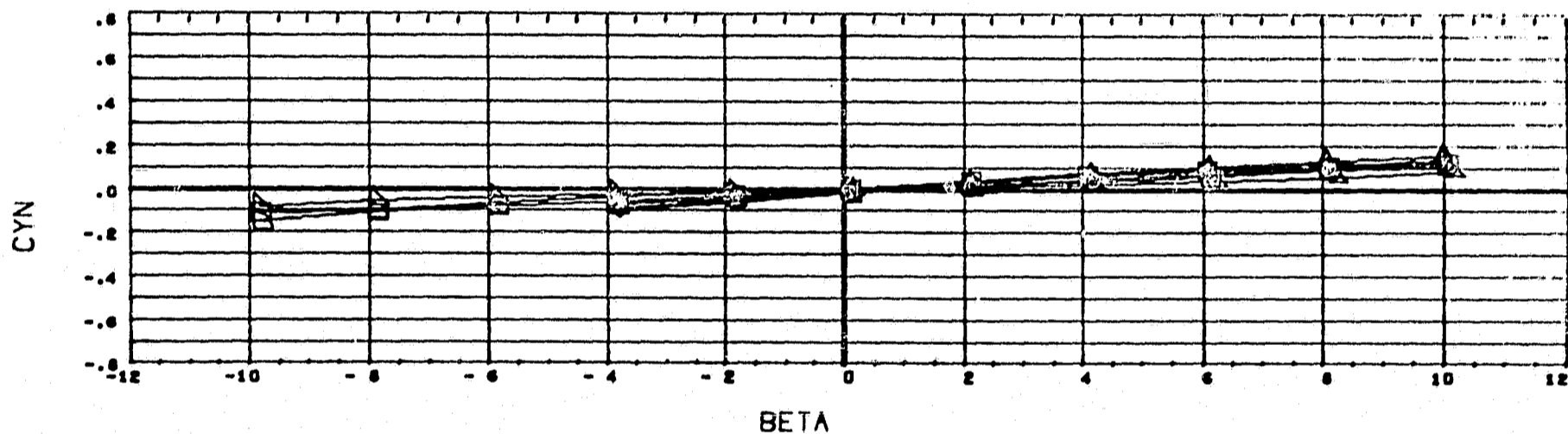
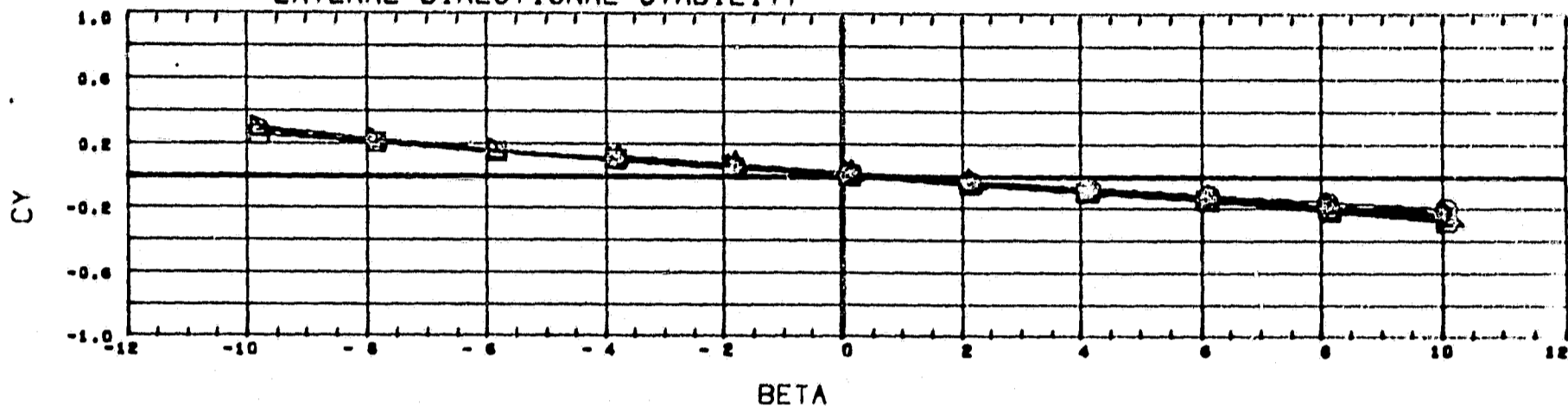


SYMBOL	MACH	PARAMETRIC VALUES	
		ALPHA	ORBINC
○	0.600	0.000	2.000
◇	0.899		
△	1.102		
□	1.462		
◇	2.740		
□	4.959		

DATA HIST. CODE GR

REFERENCE INFORMATION		
SREF	5.1478	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XHRP	9.7530	IN.
YHRP	0.0000	IN.
ZHRP	0.0000	IN.
SCALE	0.0034	

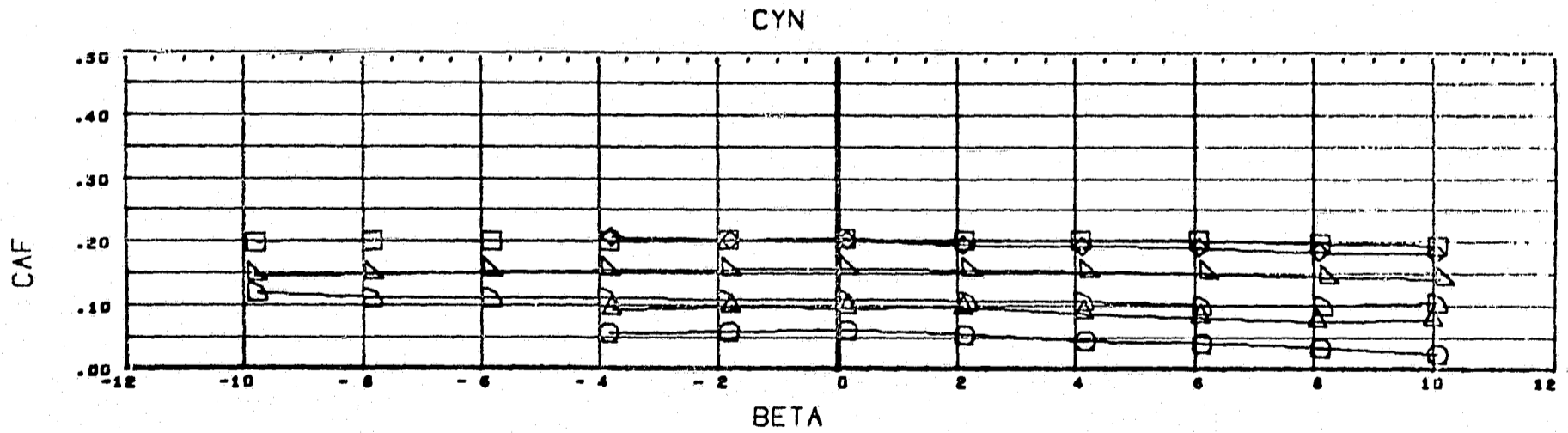
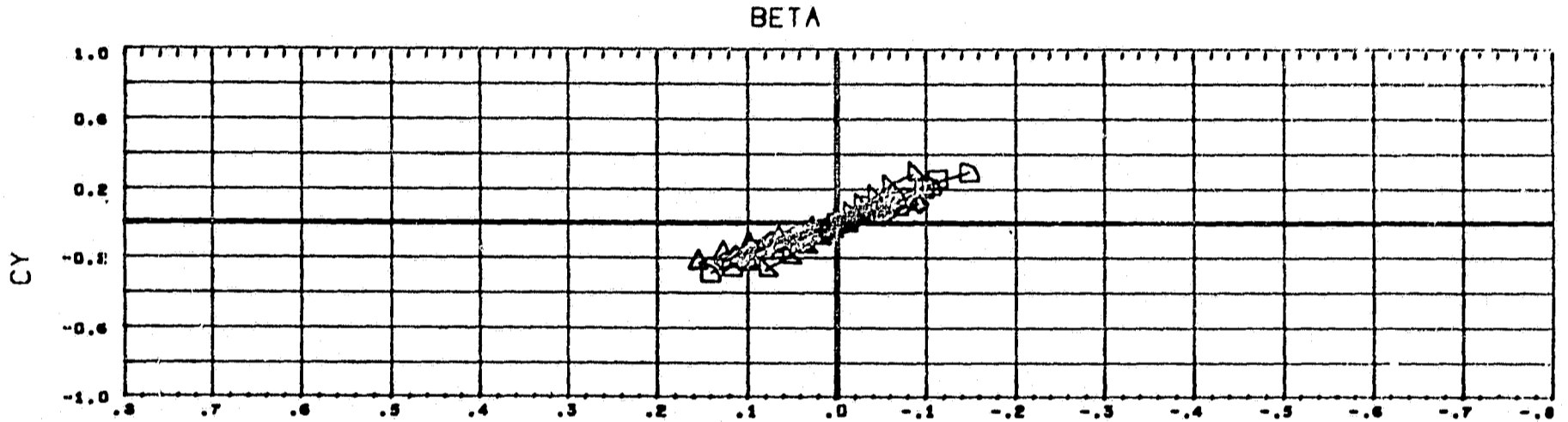
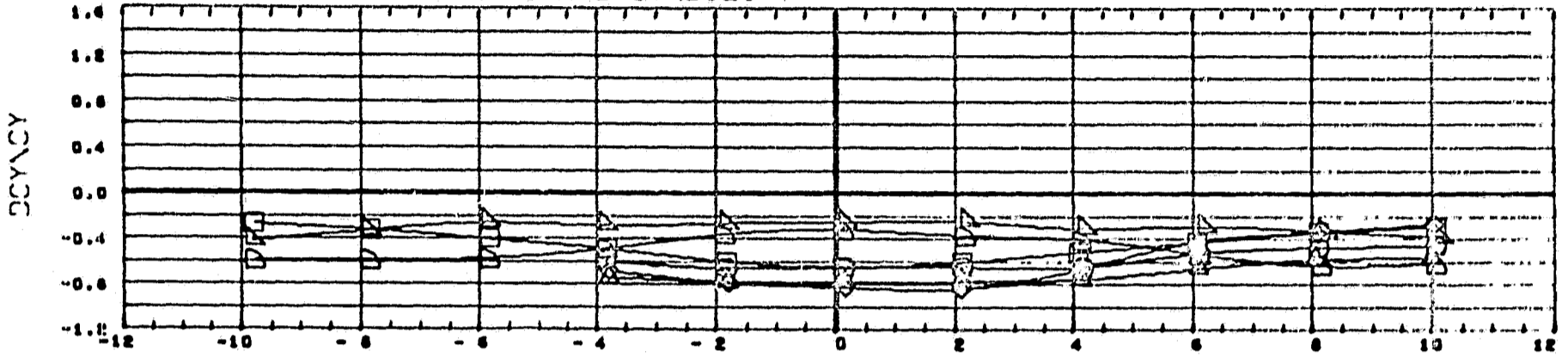
### LATERAL-DIRECTIONAL STABILITY



SYMBOL	MACH	ALPHA	PARAMETRIC VALUES
○	0.598	0.000	
□	0.900		
◇	1.098		
◇	1.461		
◇	2.740		
◇	4.959		
		DATA HIST. CODE	GR

REFERENCE INFORMATION		
SREF	5.1478	sq. in.
LREF	4.4260	in.
BREF	2.9690	in.
XMRP	5.7530	in.
YMRP	0.0000	in.
ZMRP	0.0000	in.
SCALE	0.0034	

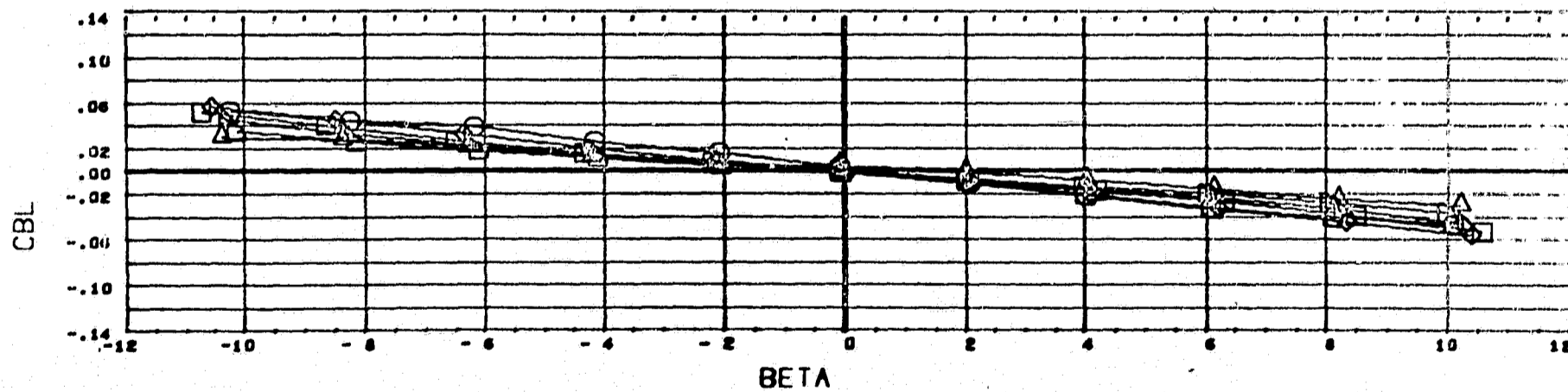
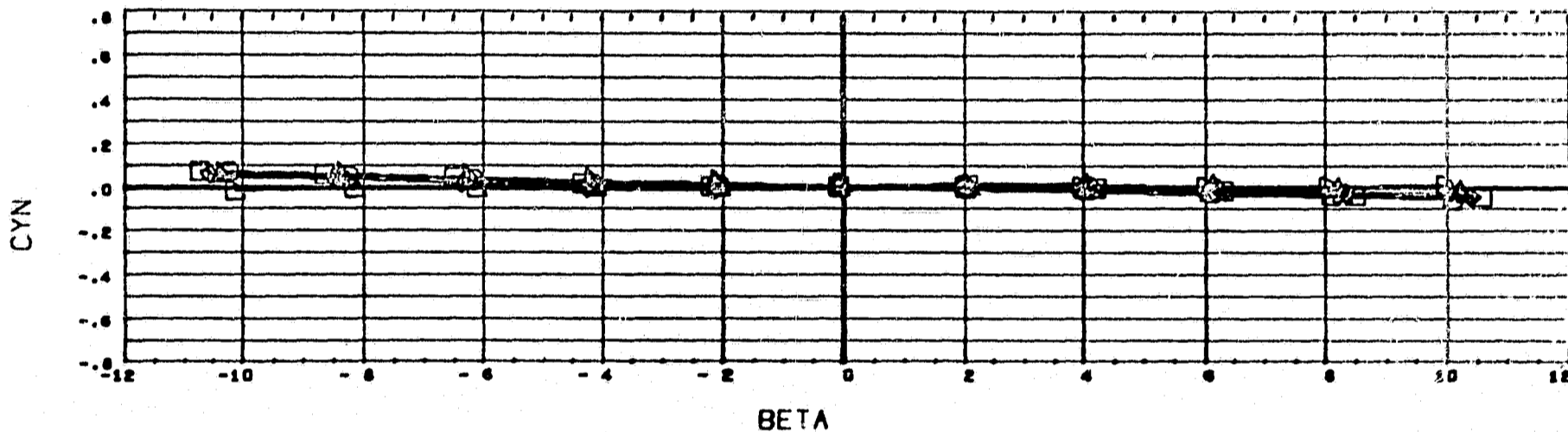
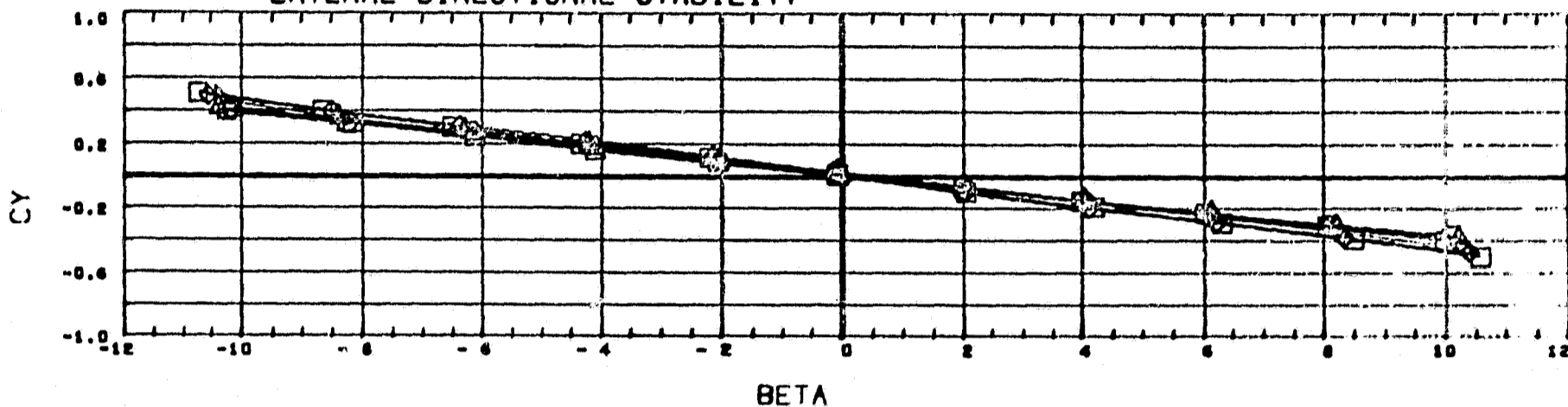
# LATERAL-DIRECTIONAL STABILITY



SYMBOL	MACH	ALPHA	PARAMETRIC VALUES
○	0.598	0.000	
◇	0.900		
□	1.098		
△	1.461		
▽	2.740		
◇	4.958		
		DATA HIST. CODE	GR

REFERENCE INFORMATION		
SREF	5.1478	50. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

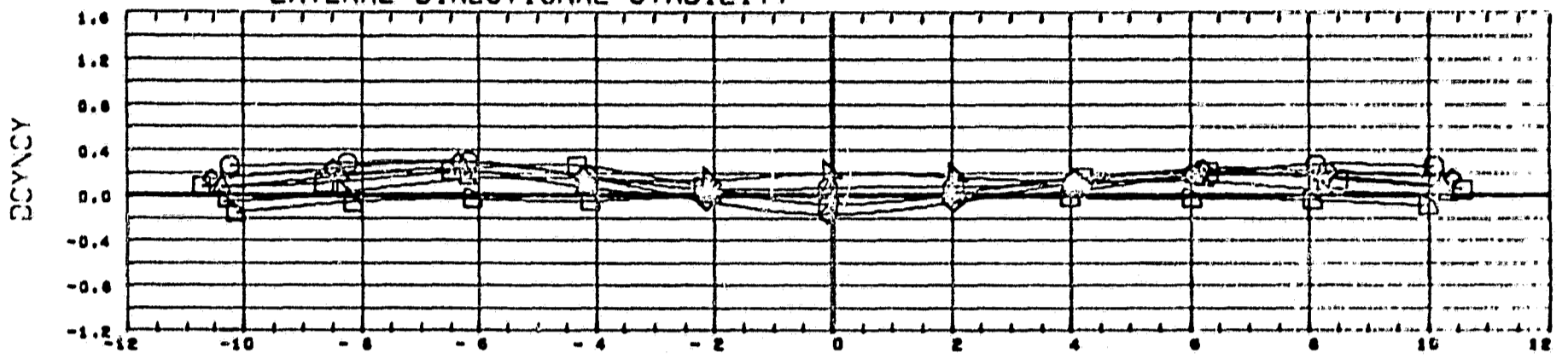
### LATERAL-DIRECTIONAL STABILITY



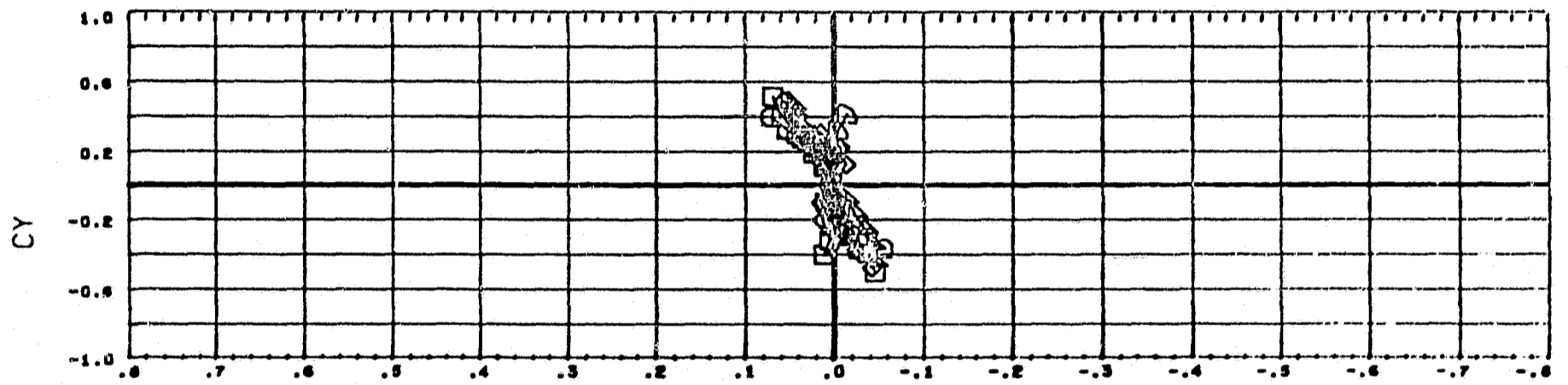
SYMBOL	MACH	PARAMETRIC VALUES	
		ALPHA	ORBINC
○	0.589	- 6.000	2.000
◇	0.897		
△	1.094		
□	1.460		
◇	2.740		
○	4.959		
		DATA HIST. CODE	GR

REFERENCE INFORMATION		
SREF	5.1476	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

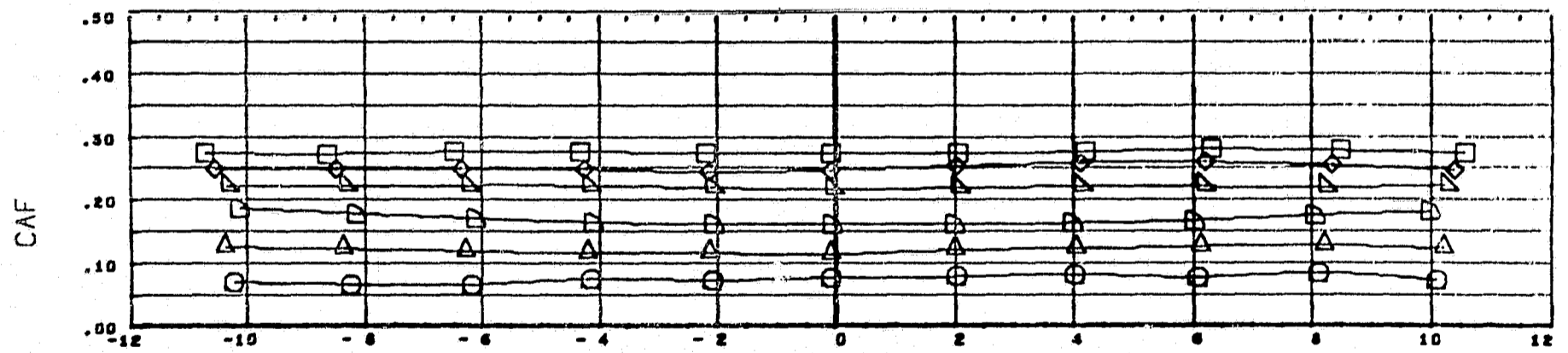
# LATERAL-DIRECTIONAL STABILITY



BETA



CYN

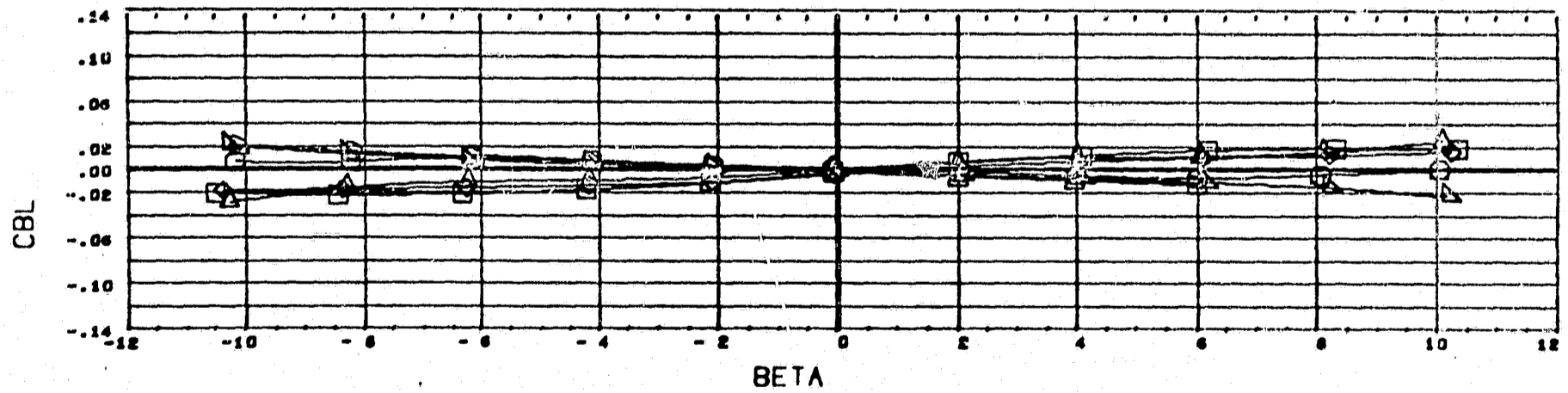
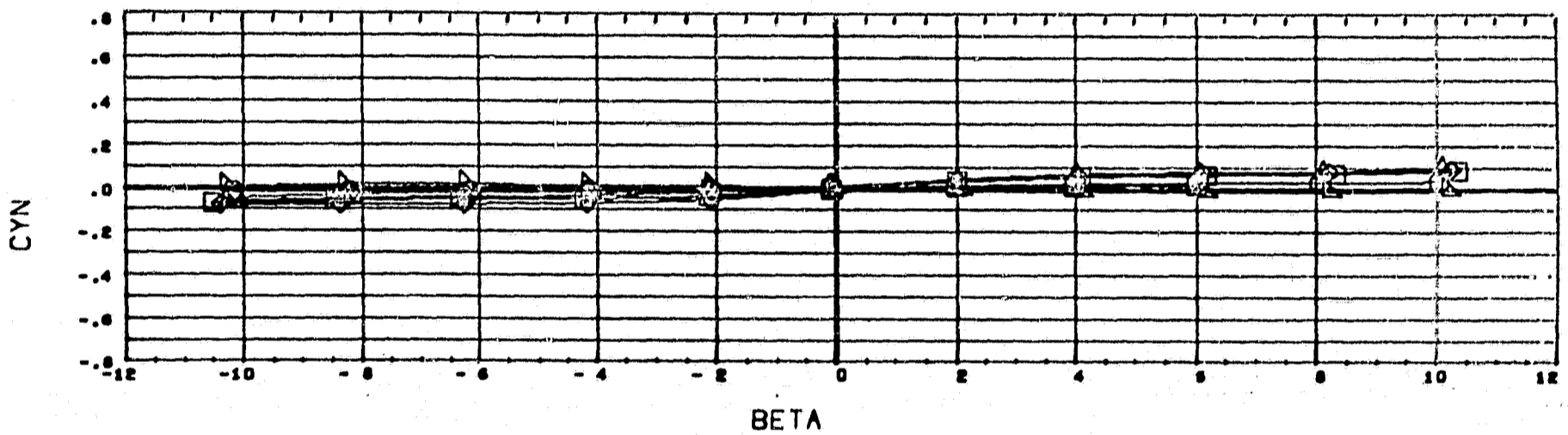
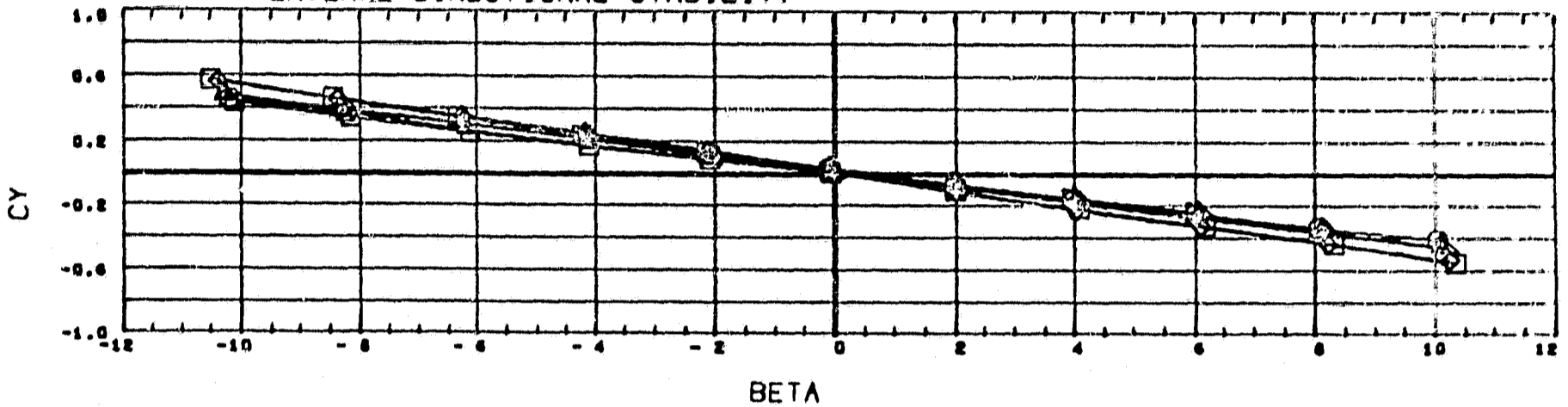


BETA

SYMBOL	MACH	PARAMETRIC VALUES	
○	0.589	ALPHA = 6.000	ORBINC = 2.000
△	0.897		
◇	1.084		
□	1.460		
▽	2.740		
◇	4.959	DATA HIST. CODE	GR

REFERENCE INFORMATION		
SREF	5.1476	sq. in.
LREF	4.4260	in.
BREF	2.9690	in.
XMRP	5.7530	in.
YMRP	0.0000	in.
ZMRP	0.0000	in.
SCALE	0.0034	

### LATERAL-DIRECTIONAL STABILITY



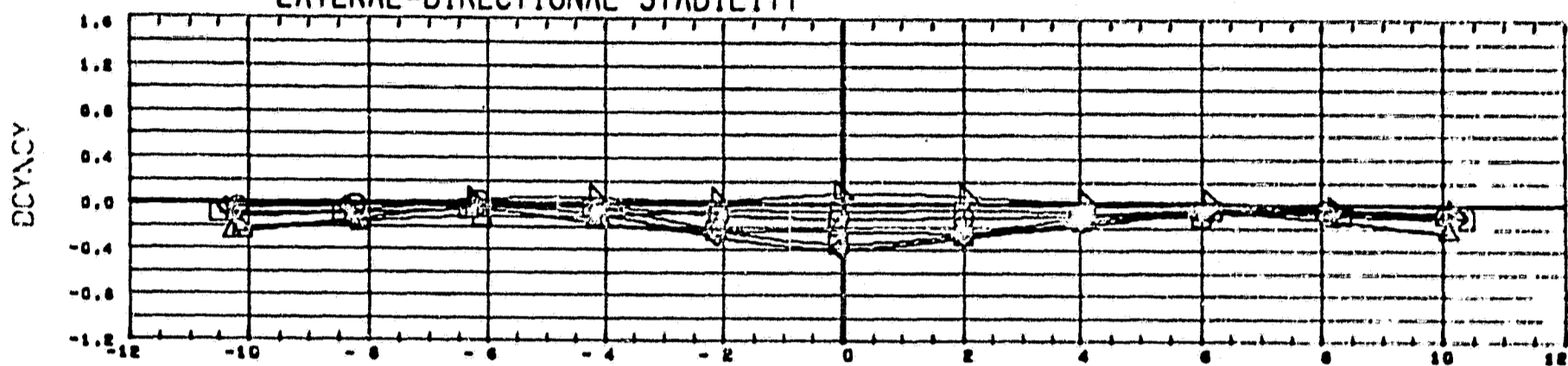
SYMBOL	MACH	PARAMETRIC VALUES	
		ALPHA	ORBINC
○	0.599	-6.000	-2.000
□	0.901		
△	1.102		
◇	1.460		
▽	2.740		
◇	4.960		

DATA HIST. CODE GR

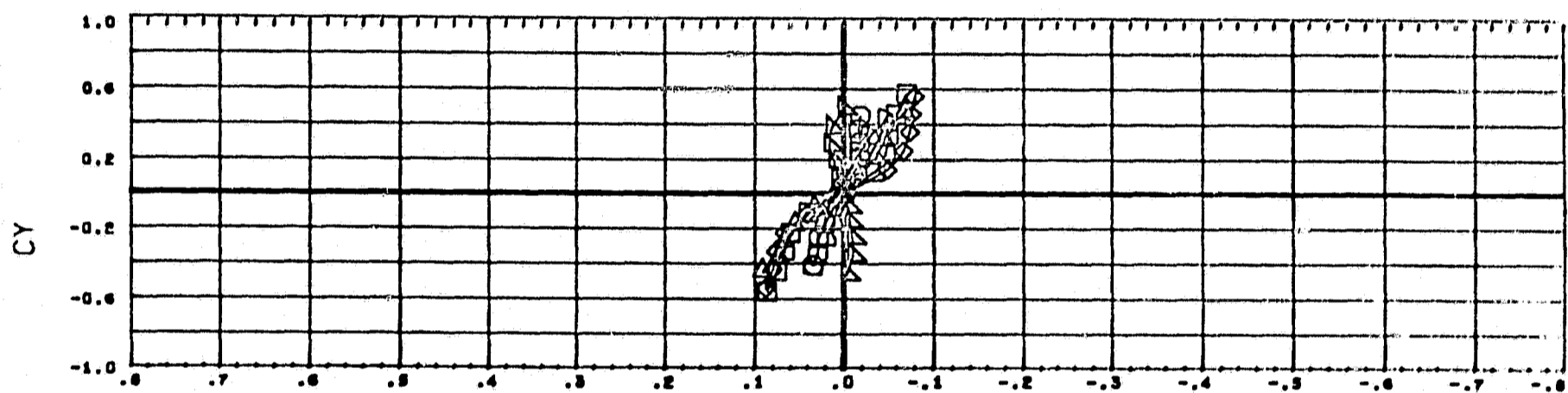
REFERENCE INFORMATION		
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LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	



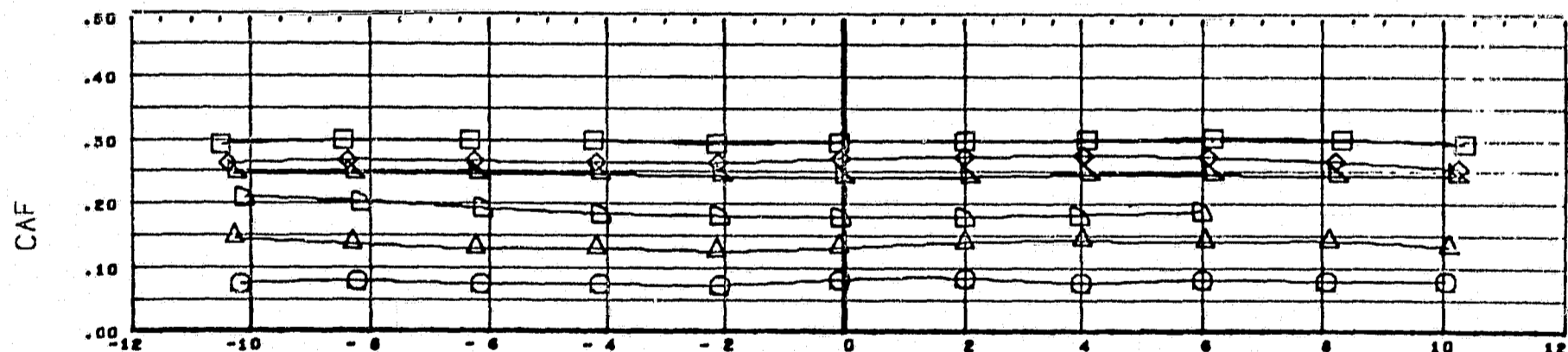
# LATERAL-DIRECTIONAL STABILITY



BETA



CYN

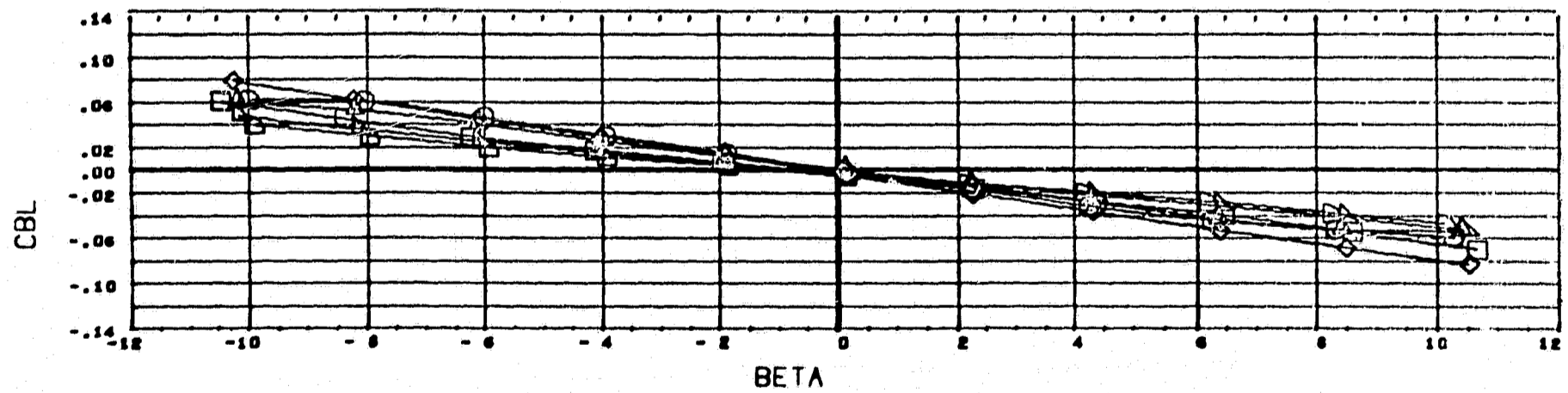
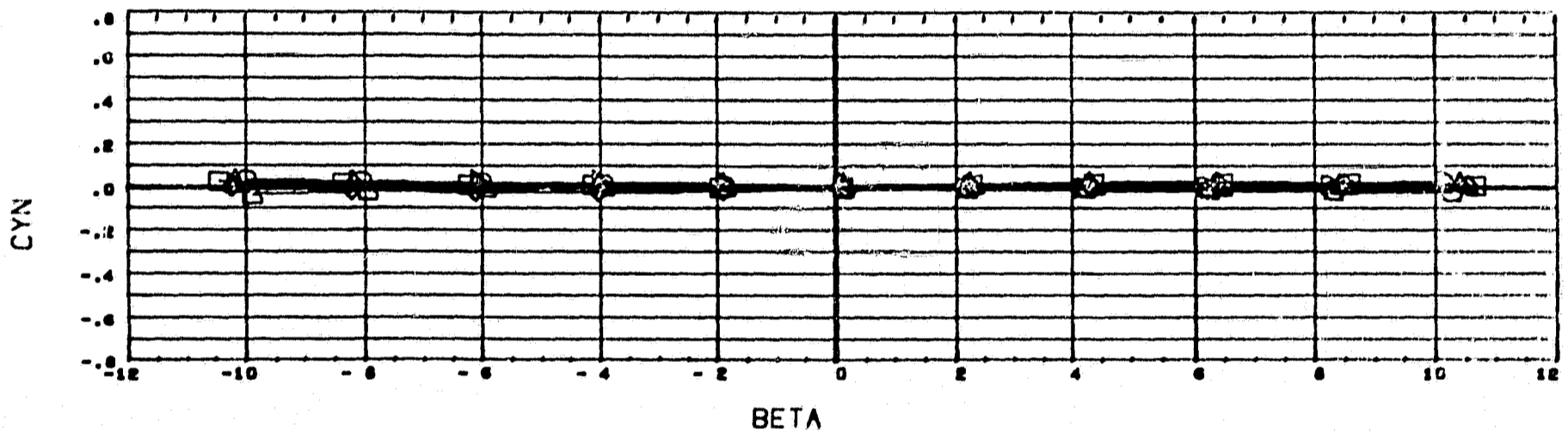
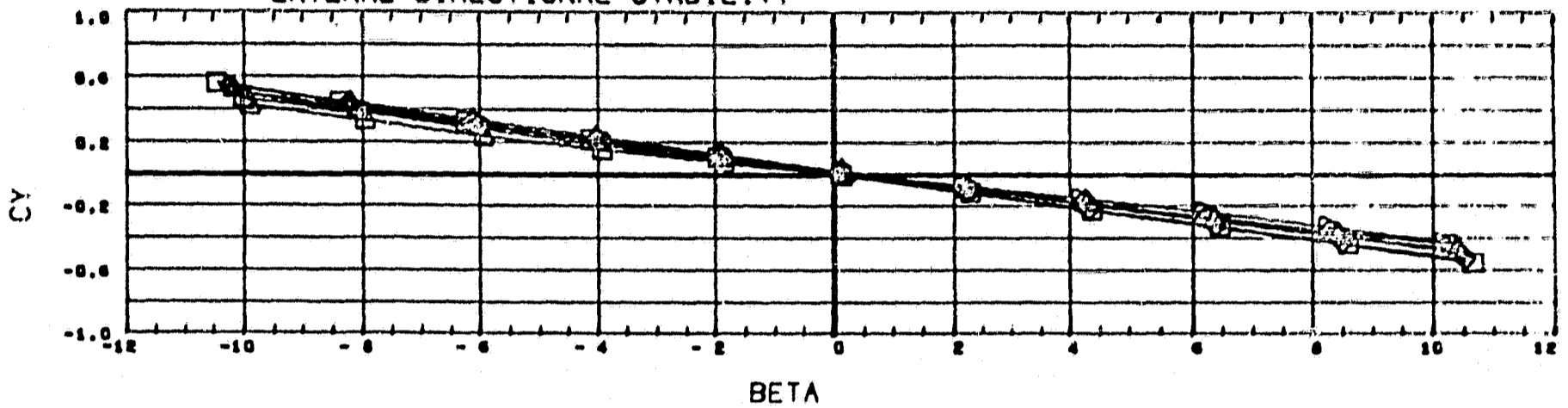


BETA

SYMBOL	MACH	PARAMETRIC VALUES	
○	0.599	ALPHA - 6.000	ORBINC - 2.000
◇	0.801		
△	1.102		
□	1.460		
▽	2.740		
◇	4.960		
		DATA HIST. CODE:	GR

REFERENCE INFORMATION		
SREF	5.1476	90. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

### LATERAL-DIRECTIONAL STABILITY

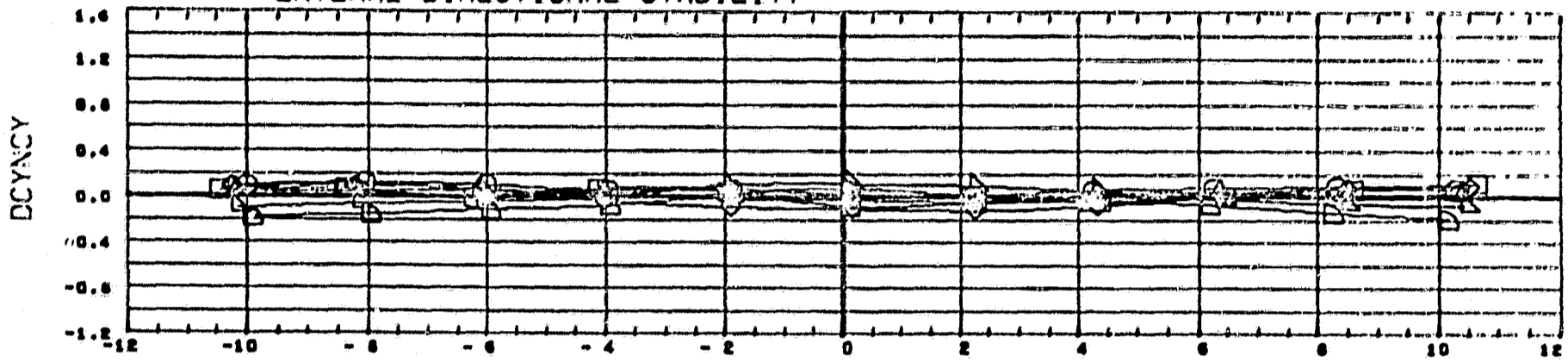


SYMBOL	MACH	PARAMETRIC VALUES	
		ALPHA	ORBINC
○	0.589	0.000	- 2.000
◇	0.901		
△	1.102		
□	1.464		
▽	2.740		
◇	4.959		

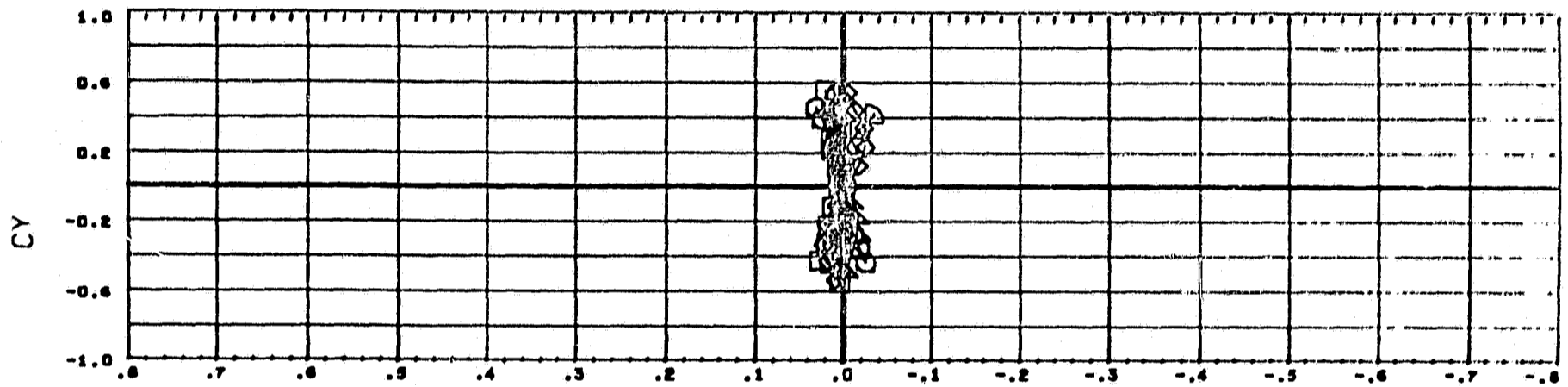
DATA HIST. CODE GR

REFERENCE INFORMATION		
SREF	5.1476	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	0.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

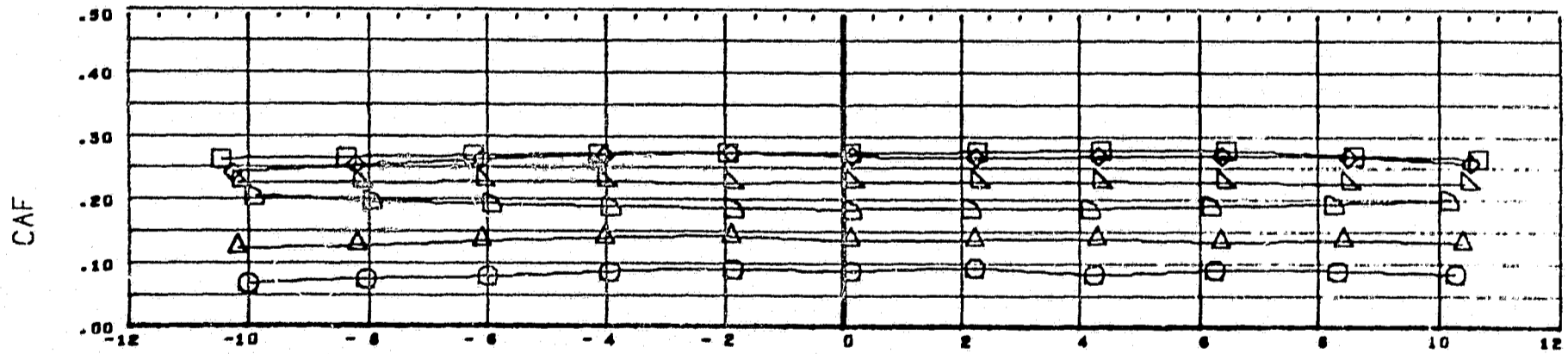
# LATERAL-DIRECTIONAL STABILITY



BETA



CYN



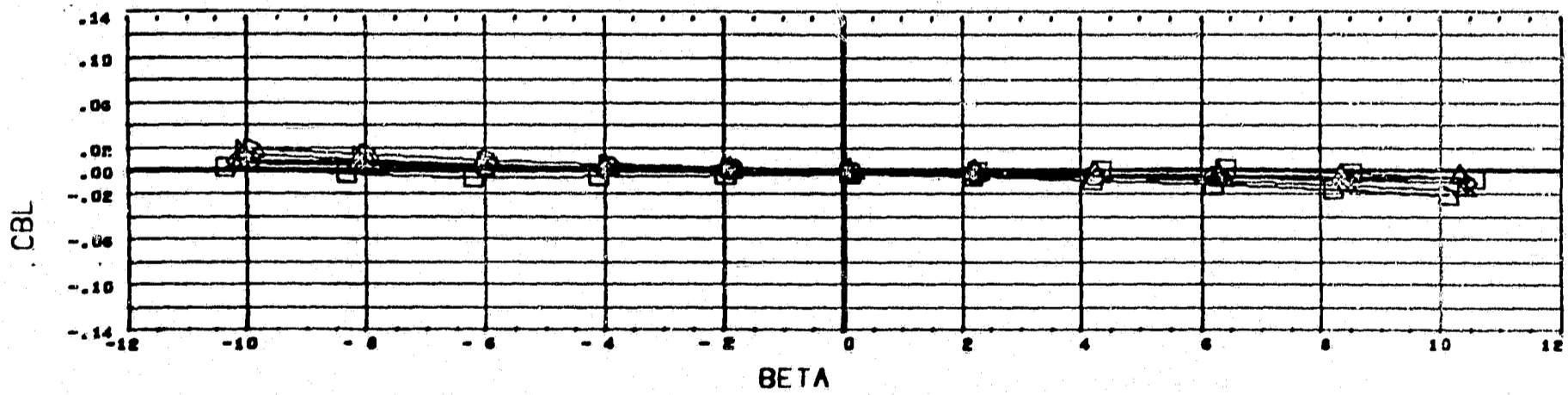
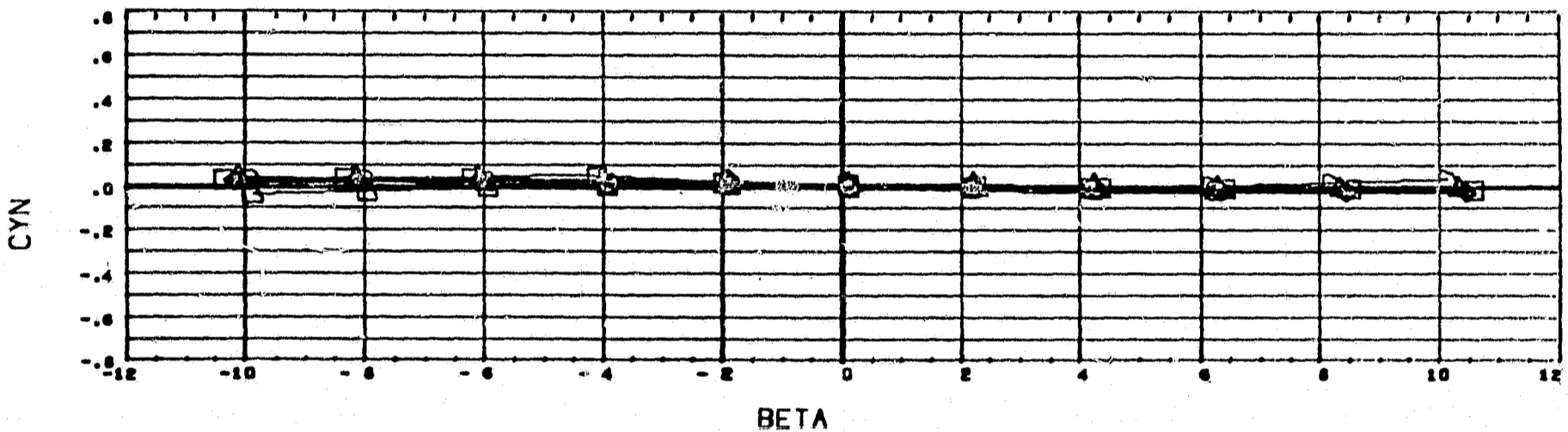
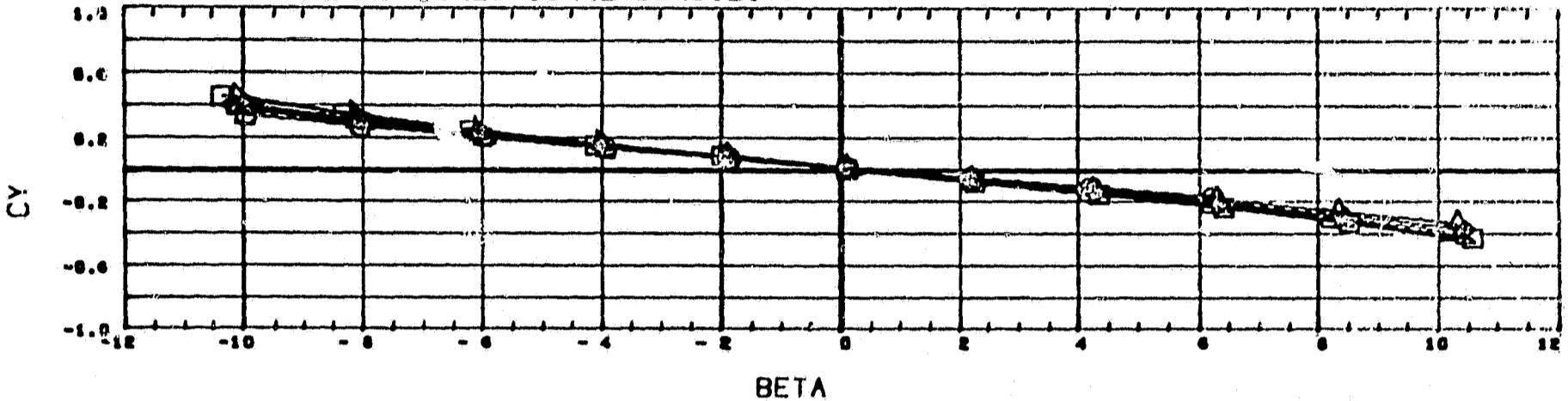
BETA

SYMBOL	MACH	ALPHA	PARAMETRIC VALUES	
○	0.599	0.000	ORBINC	- 2.000
◇	0.901			
□	1.102			
▽	1.494			
△	2.740			
◇	4.959	DATA HIST. CODE	GR	

REFERENCE INFORMATION		
SREF	5.1478	80. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	5.7530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

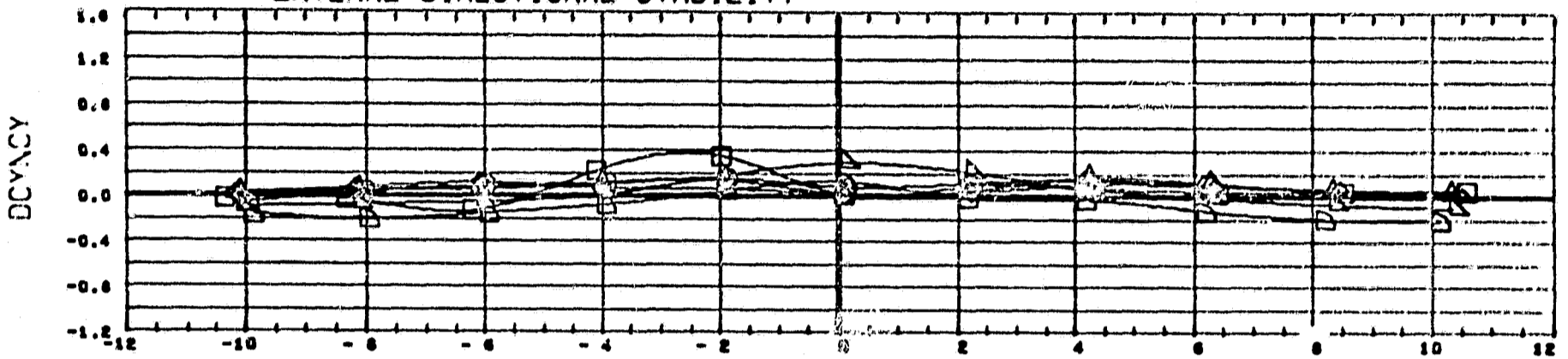
3

### LATERAL-DIRECTIONAL STABILITY

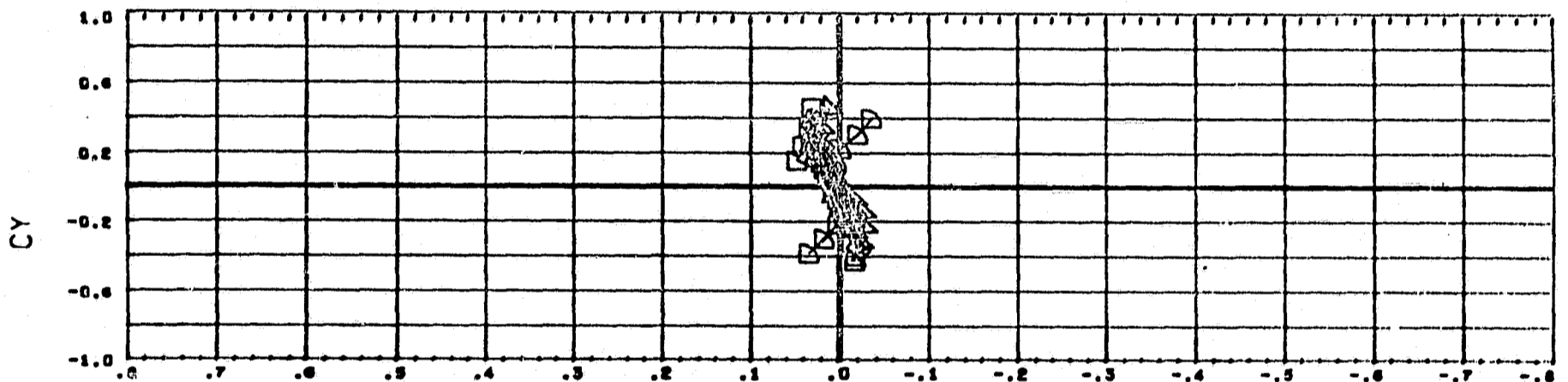


SYMBOL	MACH	PARAMETRIC VALUES		REFERENCE INFORMATION		
		ALPHA	ORBINC			
○	0.599	0.000	- 2.000	SREF	5.1476	50. IN.
◇	0.900			LREF	4.4230	IN.
◊	1.101			BREF	2.9690	IN.
◈	1.458			XHRP	5.7530	IN.
◉	2.740			YHRP	0.0000	IN.
◊	4.959			ZHRP	0.0000	IN.
		DATA HIST. CODE	GR	SCALE	0.0034	

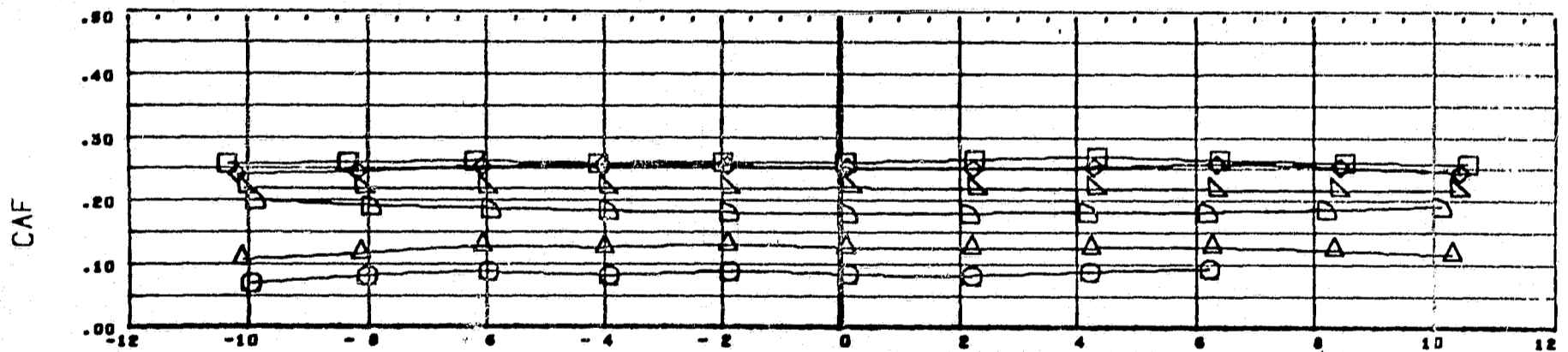
# LATERAL-DIRECTIONAL STABILITY



BETA



CYN



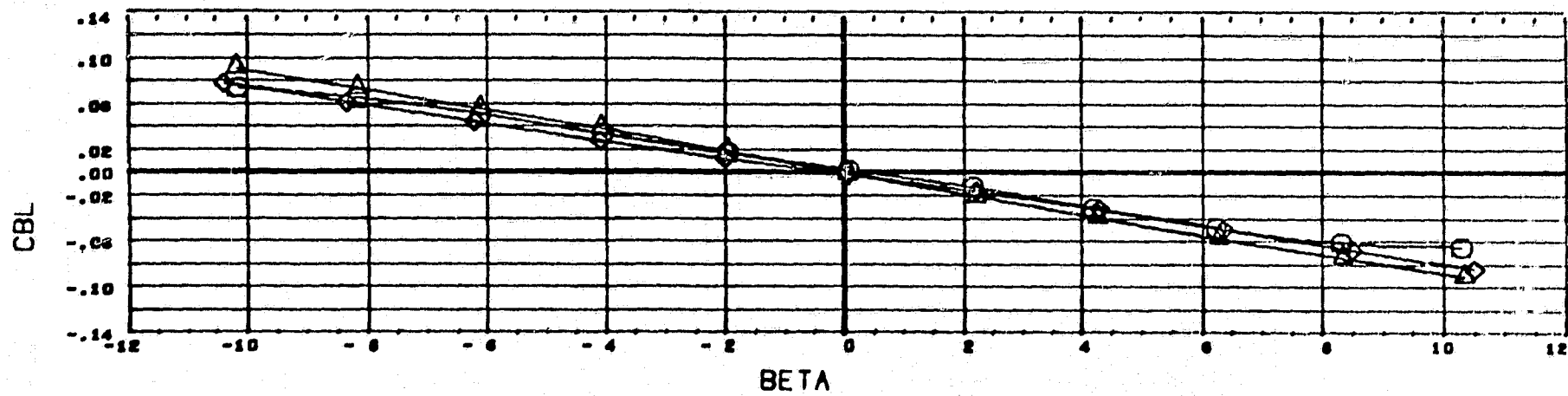
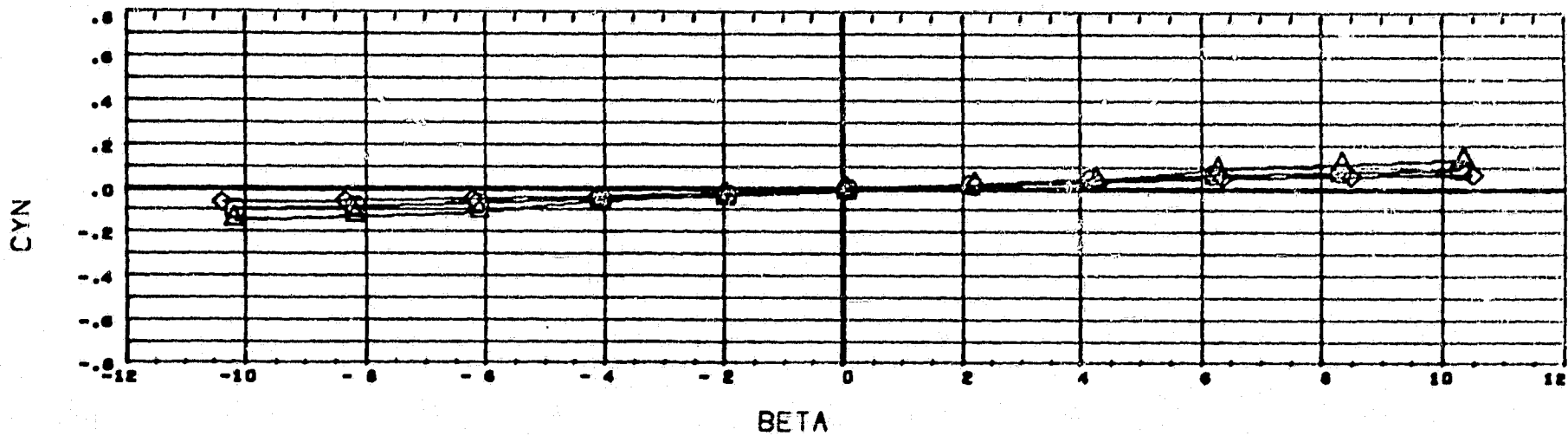
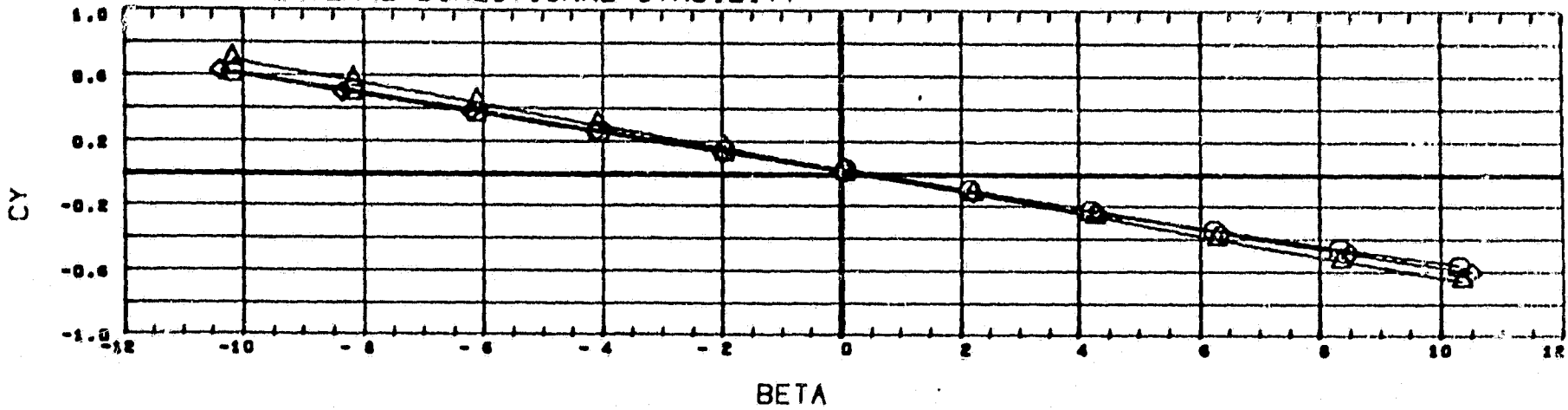
BETA

SYMBOL	MACH	PARAMETRIC VALUES	
		ALPHA	ORBINC
○	0.599	0.000	- 2.000
◇	0.900		
◇	1.101		
◇	1.456		
◇	2.740		
◇	4.899		

DATA HIST. CODE GR

REFERENCE INFORMATION		
SREF	5.1478	50. IN.
LREF	4.4260	IN.
BREF	2.9890	IN.
XMRP	5.7550	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

### LATERAL-DIRECTIONAL STABILITY

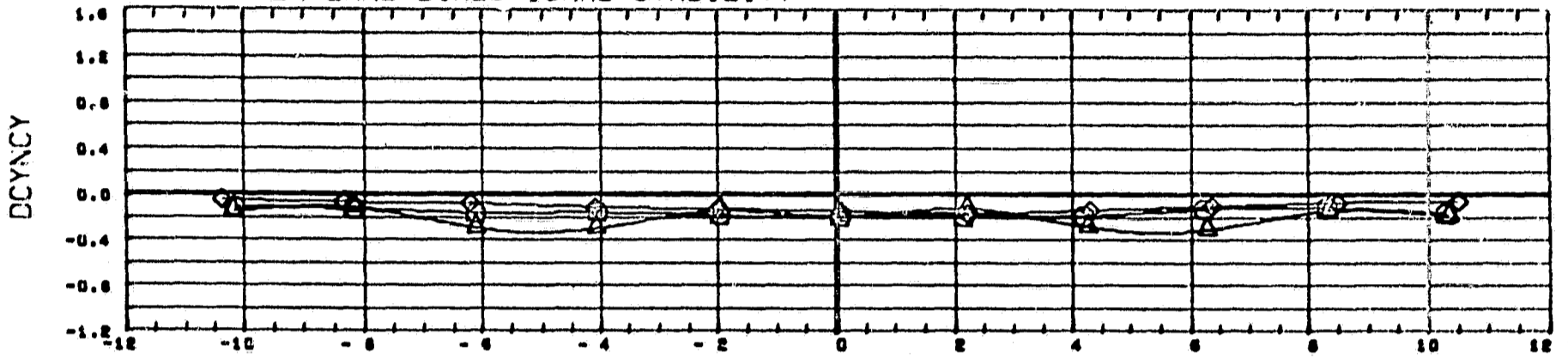


SYMBOL	MACH	PARAMETRIC VALUES	
		ALPHA	ORBINC
○	0.900	0.000	2.000
△	1.101		
◇	1.460		

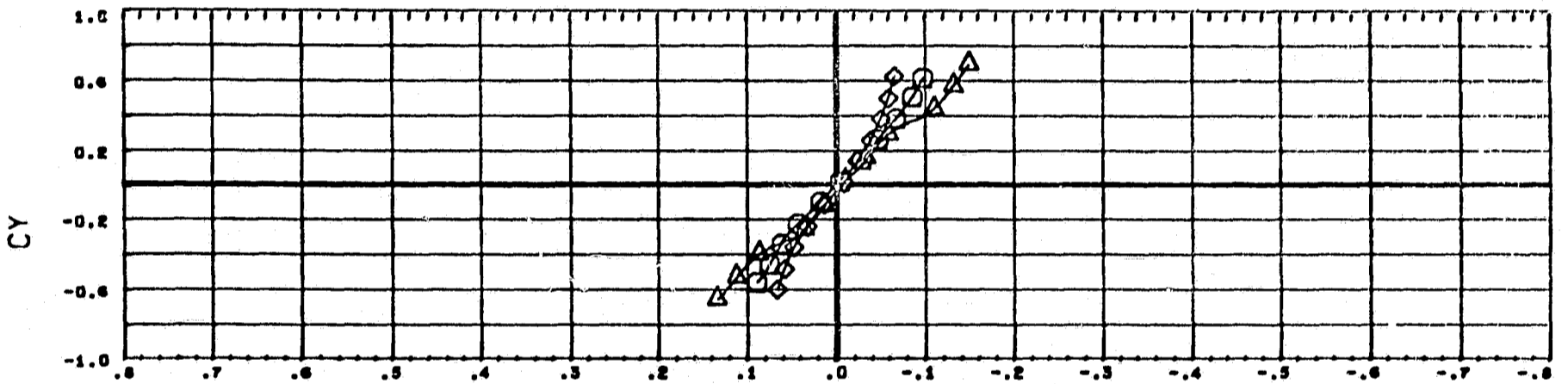
REFERENCE INFORMATION		
BREF	5.1478	SQ. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XHRP	4.3530	IN.
YHRP	0.0000	IN.
ZHRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE GR

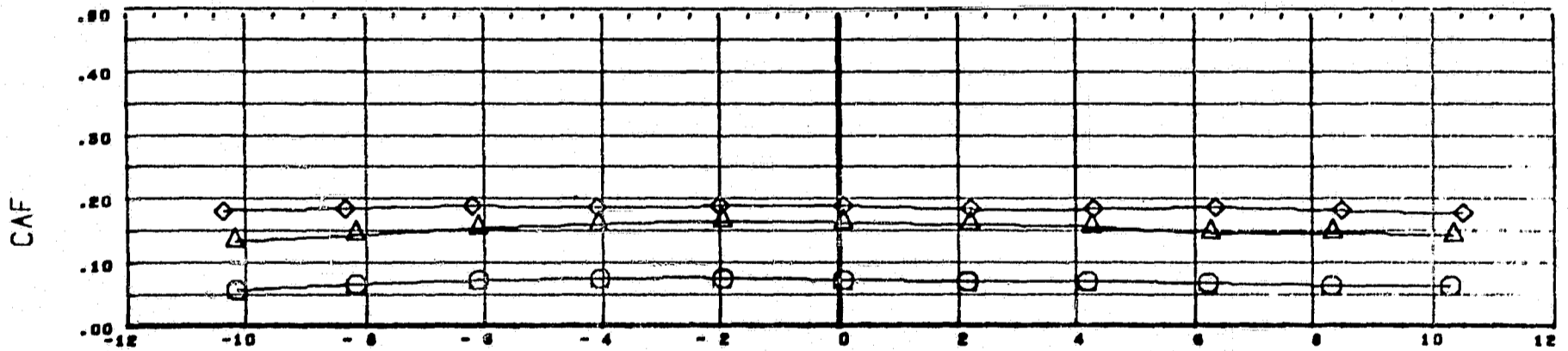
# LATERAL-DIRECTIONAL STABILITY



BETA



CYN



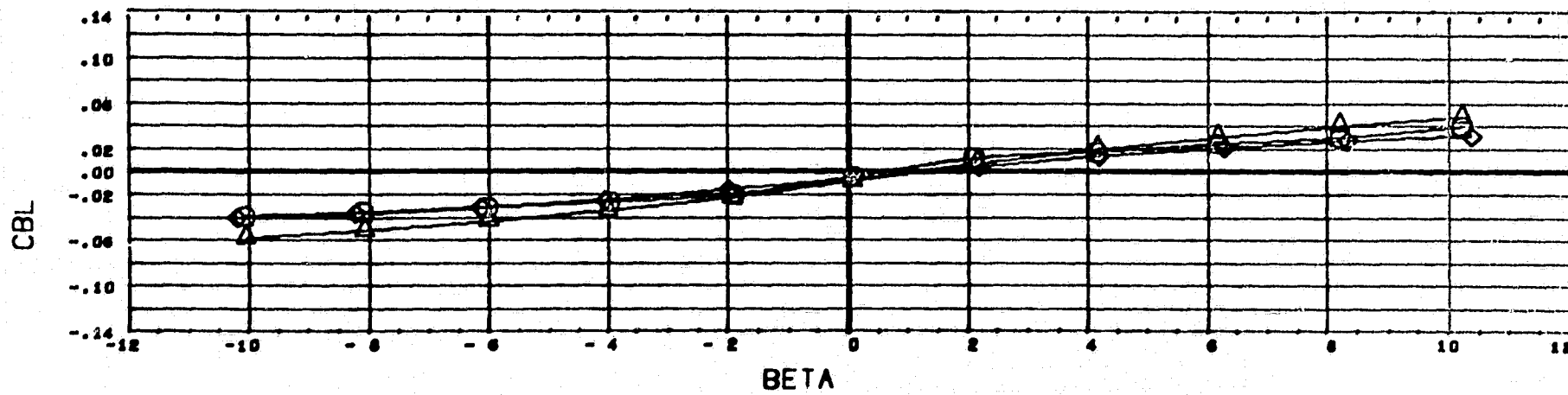
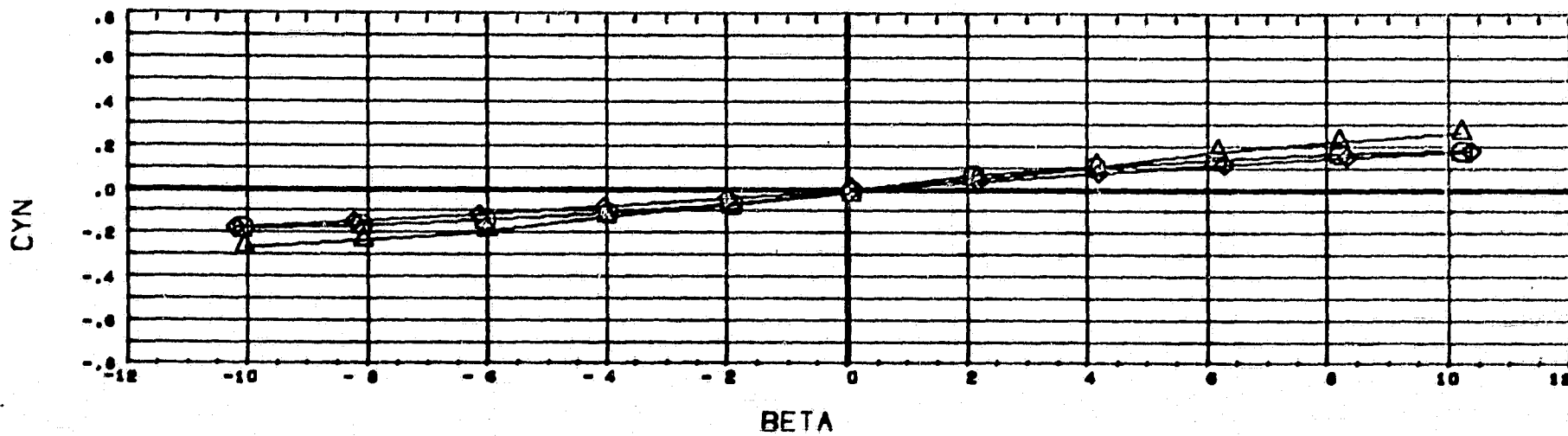
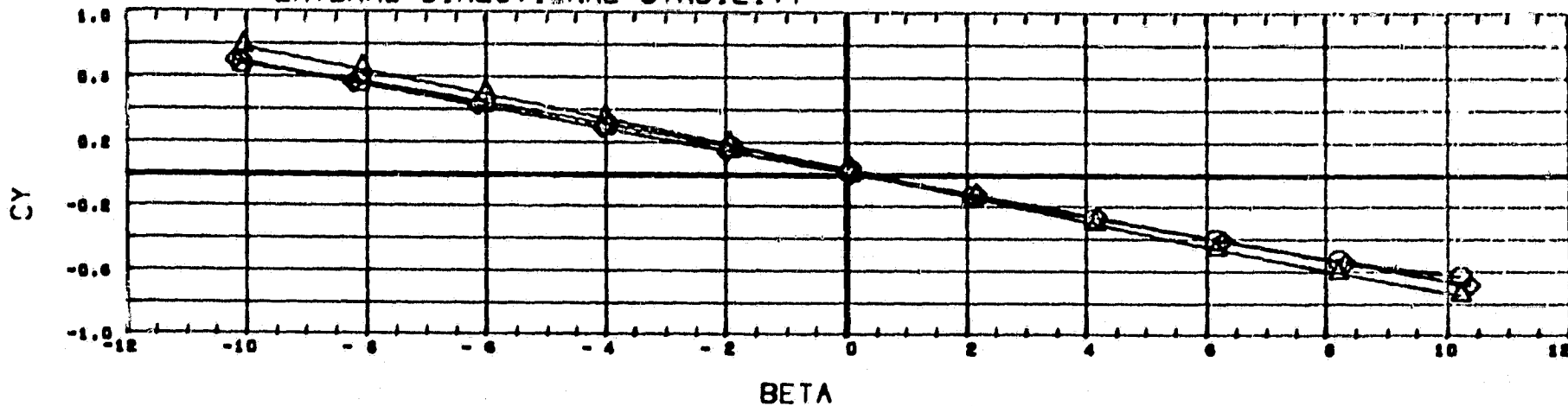
BETA

SYMBOL	MACH	PARAMETRIC VALUES
○	0.900	ALPHA 0.000 ORBINC - 2.000
△	1.101	
◇	1.460	

REFERENCE INFORMATION		
SREF	5.1478	SQ. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	4.3530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA MIST. CODE GR

### LATERAL-DIRECTIONAL STABILITY



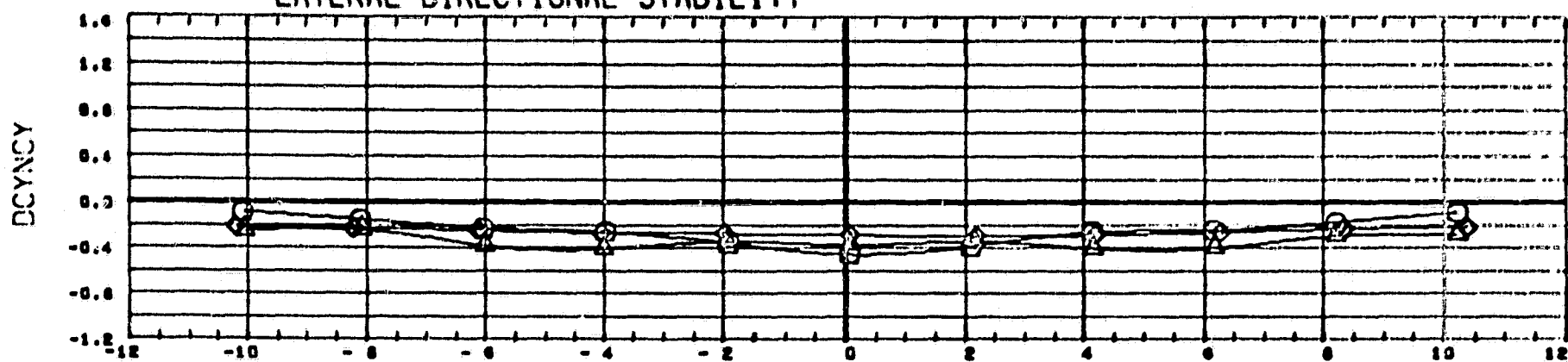
SYMBOL	MACH	PARAMETRIC VALUES
○	0.900	ALPHA 0.000 ORBINC - 2.000
△	1.103	
◇	1.460	

REFERENCE INFORMATION		
SREF	5.1478	SQ. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	4.3530	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

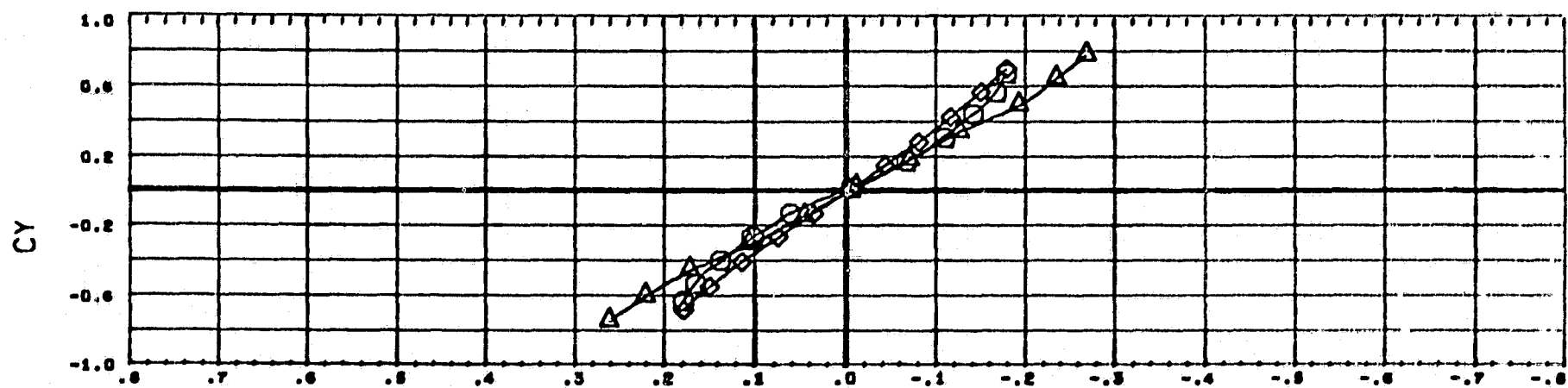
DATA HIST. CODE GR



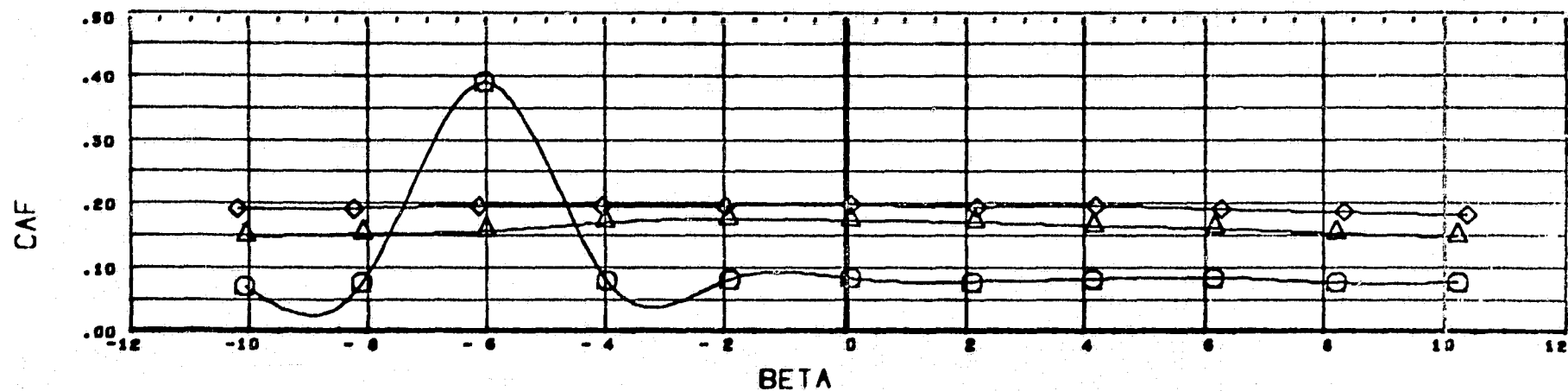
# LATERAL-DIRECTIONAL STABILITY



BETA



CYN



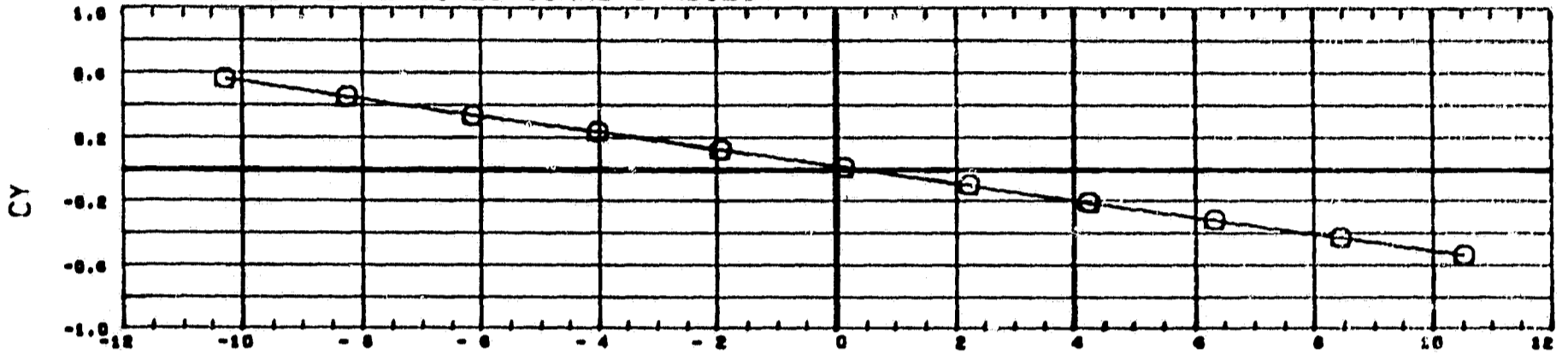
BETA

SYMBOL	MACH	ALPHA	PARAMETRIC VALUES	
○	0.900	0.000	ORBINC	- 2.000
△	1.103			
◇	1.460			

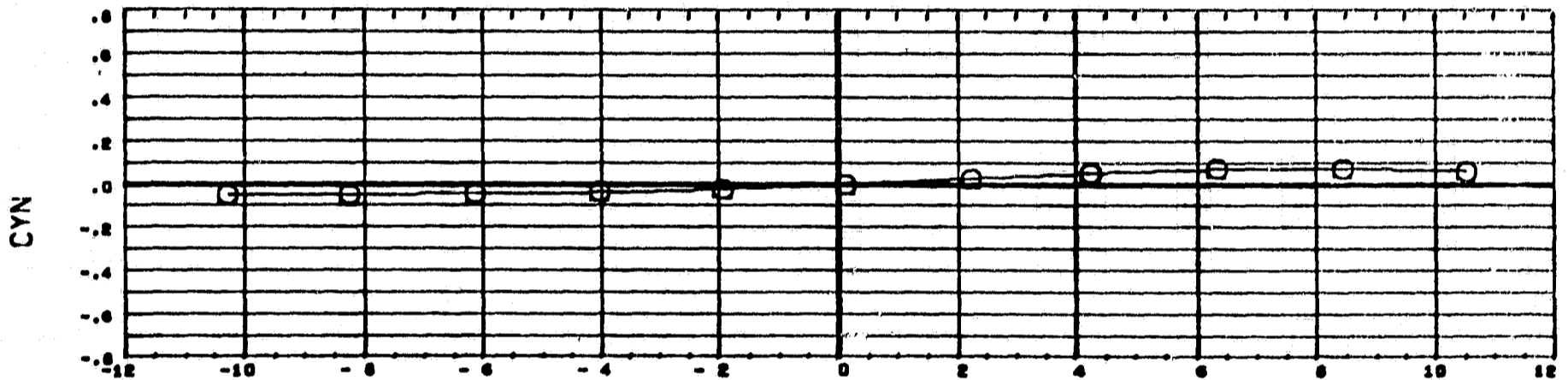
REFERENCE INFORMATION		
SREF	5.1478	SQ. IN.
LREF	4.4260	IN.
BREF	2.9690	IN.
XMRP	4.3550	IN.
YMRP	0.0000	IN.
ZMRP	0.0000	IN.
SCALE	0.0034	

DATA HIST. CODE GR

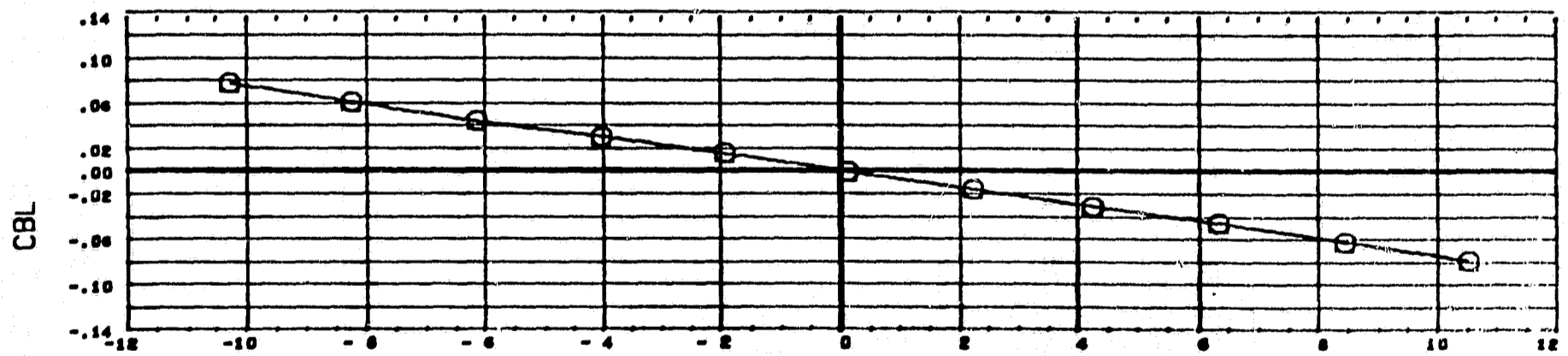
### LATERAL-DIRECTIONAL STABILITY



BETA



BETA



BETA

SYMBOL MACH PARAMETRIC VALUES  
 O 1.461 ALPHA 0.000 ORBINC - 2.000

REFERENCE INFORMATION  
 SREF 5.1478 SQ. IN.  
 LREF 4.4260 IN.  
 BREF 2.9690 IN.  
 XMRP 5.7530 IN.  
 YMRP 0.0000 IN.  
 ZMRP 0.0000 IN.  
 SCALE 9.0034

DATA HIST. CODE GR

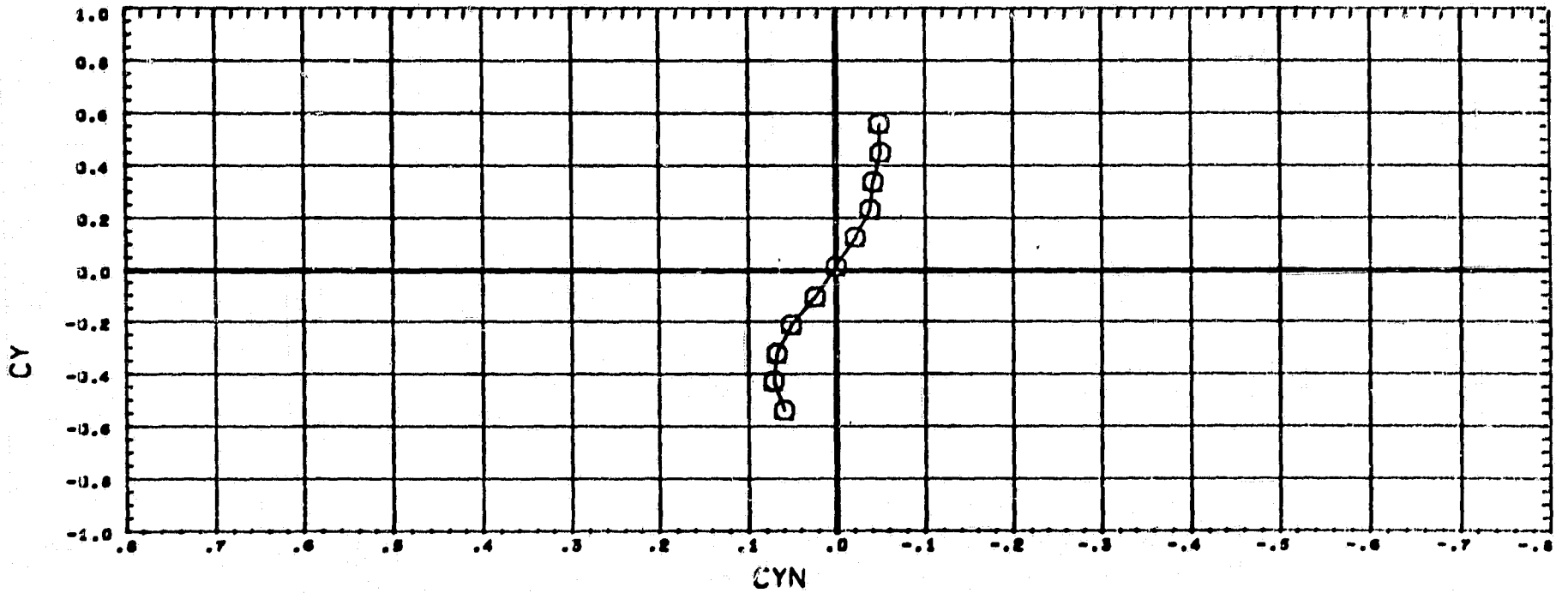
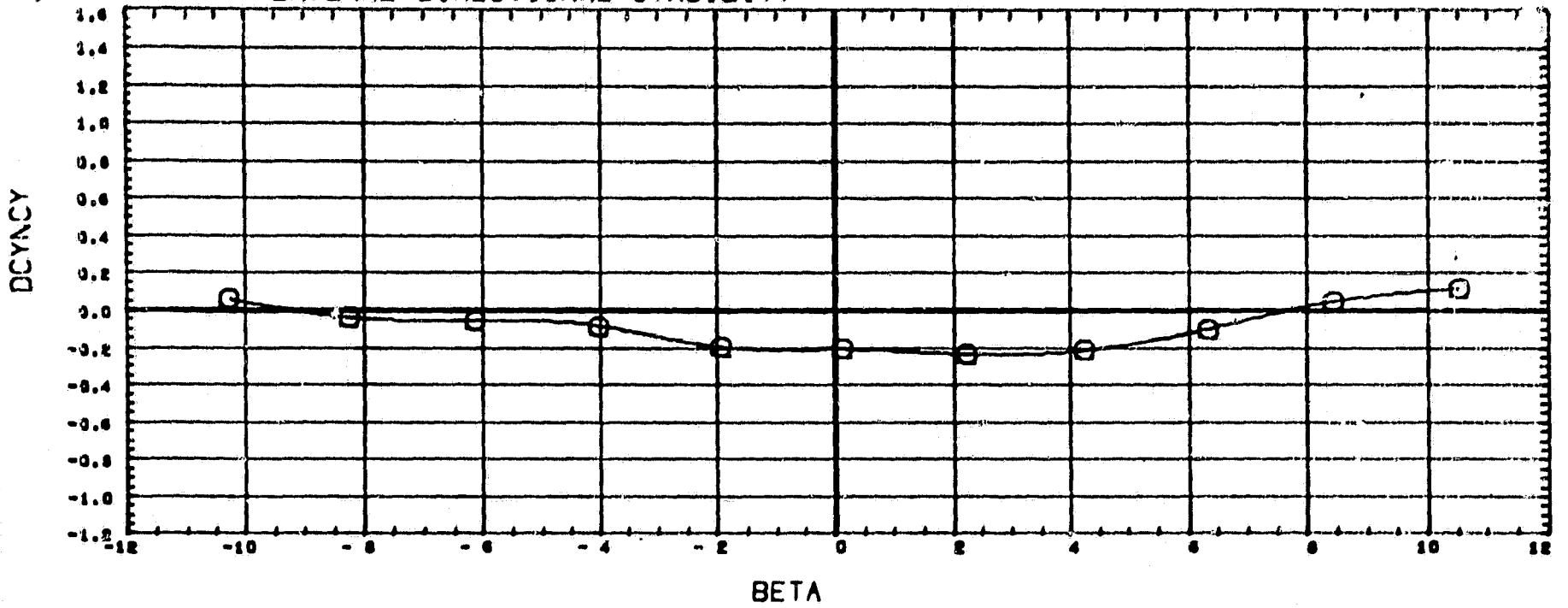
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B501-2P1

(D5724C) 10 FEB 72

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# LATERAL-DIRECTIONAL STABILITY



SYMBOL  $\circ$  MACH 1.461 ALPHA 0.000 ORBINC - 2.000

REFERENCE INFORMATION  
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 ZMRP 0.0000 IN.  
 SCALE 0.0034

DATA HIST. CODE GR