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STATIC AERODYNAMIC CHARACTERISTICS OF A 0.035-SCALE MODEL OF A MODIFIED NKC-135 AIRPLANE AT A MACH NUMBER OF 0.28

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16. Abstract

A 0.035-scale model of a modified NKC-135 airplane was tested in the Ames 12-Foot Pressure Wind Tunnel to determine the effects on the static aerodynamic characteristics of modifications to the basic aircraft. Modifications investigated included: nose, lower fuselage, and upper fuselage radomes; wing pylons and pods; overwing probe; and air-conditioning inlets. The investigation was performed at a Mach number of 0.28 over a Reynolds number range from 6.6 to 26.2 million per meter (2.0 to 8.0 million per foot). Angles of attack and sideslip varied from -8° to 20° and from -18° to 8°, respectively, for various combinations of flap, aileron, and rudder deflections.

Indications, based on limited analysis of the test results, are that the addition of the radomes reduces lateral-directional stability and control effectiveness of the basic aircraft. Presented herein are results from the investigation with minimal analysis.

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CONTENTS

NOMENCLATURE

The axis systems and sign convention are presented in figure 1. Because the data were computer plotted, the corresponding plot symbol, where used, is given together with the conventional symbol.

Symbol	Plot Symbol	Definition
b	BREF	wing span
c	CREF	wing mean aerodynamic chord
C_A	CA	body axis axial-force coefficient, axial force/$q_\infty S$
C_{A_C}	CAC	body axis cavity axial-force coefficient, cavity axial force/$q_\infty S$
C_D	CD	stability axis drag coefficient, drag/$q_\infty S$
C_L	CL	stability axis lift coefficient, lift/$q_\infty S$
C_{ℓ_b}	CBL	body axis rolling-moment coefficient, rolling moment/$q_\infty Sb$
C_{ℓ_s}	C_l(STAB)	stability axis rolling-moment coefficient, rolling moment/$q_\infty S$
C_N	CN	body axis normal-force coefficient, normal force/q_∞
C_m	C_m	body and stability axis pitching-moment coefficient pitching moment/$q_\infty Sc$
C_{p_i}	C_p	pressure coefficient; $(p_i - p_\infty)/q_\infty$, i = 102 through 112 and 202 through 212
C_Y	C_Y	body and stability axis side-force coefficient, side force/$q_\infty S$
C_{n_b}	CLNB	body axis yawing-moment coefficient; yawing moment/ $q_\infty Sb$
C_{n_s}	C_n(STAB)	stability axis yawing-moment/$q_\infty SB$
M_∞	MACH	free-stream Mach number

Symbol	Plot Symbol	Definition
p_∞		free-stream static pressure
P_{t_∞}		free-stream total pressure
q_∞		free-stream dynamic pressure
RN	RN/L	unit Reynolds number, 1×10^6/m
S	SREF	wing reference area
T_∞		free-stream static temperature
T_{T_∞}		free-stream total temperature
WBL	WBL	wing butt line, cm
α	ALPHA	angle of attack of fuselage reference line, deg
β	BETA	angle of sideslip of fuselage reference line, deg
δA	AIL	inboard and outboard aileron deflection angle, positive producing positive rolling moment
δF	FLAP	flap deflection angle, positive trailing edge down
δR	RUDDER	rudder deflection angle, positive trailing edge right
η	ETA	percent semispan 2WBL/b

Configuration Code

B	body
C	nose radome
E	electronic pods
G	landing gear
H0	horizontal tail, 0° incidence
H6	horizontal tail, 6° incidence (trailing edge up)
I	air-conditioning inlets
L	lower fuselage radome
LL	laser lab on upper fuselage radome

N	nacelles
O	overwing probe
P	wing pylons
U	upper fuselage radome
V	vertical tail
W	wing

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Ames Research Center

SUMMARY

A 0.035-scale model of a modified NKC-135 Airplane was tested in the Ames 12-Foot Pressure Wind Tunnel to determine the effects on the static aerodynamic characteristics of modifications to the basic aircraft. Modifications investigated included: nose, lower fuselage, and upper fuselage radomes; wing pylons and pods; overwing probe; and air conditioning inlets. The investigation was performed at a Mach number of 0.28 over a Reynolds number range from 6.6 to 26.2 million per meter (2.0 to 8.0 million per foot). Angles of attack and sideslip varied from -8° to 20° and from -18° to 8°, respectively, for various combinations of flap, aileron, and rudder deflections.

Indications, based on limited analysis of the test results, are that the addition of the radomes reduces lateral-directional stability and control effectiveness of the basic aircraft.

INTRODUCTION

During flight tests of an extensively modified NKC-135 aircraft, an earlier than anticipated stall occurred at low speed with the aircraft in the landing configuration. Subsequently, the aircraft departed in a spin and was recovered through the application of normal spin-recovery controls. This event prompted the investigation in the Ames 12-Foot Pressure Wind tunnel of the effects on the static aerodynamic characteristics of adding the various domes and protuberances comprising the modifications to the basic NKC-135 aircraft. Presented herein are results from the investigation with minimal analysis.

*Project Engineer, ARO, Inc., Moffett Field, Calif. 94035

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TEST FACILITY

The Ames 12-Foot Pressure Wind Tunnel is a variable-density, low-turbulence wind tunnel which operates in the Mach number range of 0.1 to 0.94. The wind tunnel is powered by a two-stage, axial-flow fan driven by electric motors totaling 8,950 kw (12,000 hp). Airspeed in the test section is controlled by variation of the fan's rotative speed. Eight fine-mesh screens in the settling chamber, together with a contraction ratio of 25 to 1, provide an airstream of exceptionally low turbulence.

MODEL DESCRIPTION

The model was a 0.035-scale NKC-135 aircraft configuration, modified with various external protuberances. The geometry of the model is given in table 1, drawings of the model are presented in figure 2, and photographs of the model installed in the Ames 12-Foot Pressure Wind Tunnel are presented in figure 3.

The basic NKC-135 aircraft is a four-engine, low-wing transport configuration with 37.55° leading-edge sweep and a single conventional vertical and horizontal tail assembly.

External modification to the NKC-135 aircraft and model, shown in figure 2, included a nose radome, upper and lower fuselage radomes, underwing pylons and pods, an over-wing probe, and air conditioning inlets. Details of these modifications are presented in figures 2d through 2j.

Aileron, rudder, and flap deflections were positioned with the use of brackets. Aileron deflections could be set at 0°, ±10°, and ±20°. Similarly, rudder deflections could be set at 0°, ±10°, and ±27°. In addition to the retracted position, the flap deflections could be set to 30°, 40°, and 50°. The model aft-end lines were modified to accept the model-support sting and balance. A pressure transducer, located in the model-support sting body, was used to sense model cavity pressure.

Boundary-layer transition to turbulent conditions was induced on the model through the use of 0.254 cm (0.10 in.) wide transition strips using glass beads for roughness. Trip size and location were conservatively selected on the basis of experience; hence, effectiveness was not verified through flow-visualization techniques.

On the wings and horizontal tails, strips of 0.0227 cm (0.009 in.) diameter beads were located (streamwise) 1.095 cm (0.431 in.) aft of the leading edge. Elsewhere (nacelles, nose, radomes, and pods), strips of 0.020 cm (0.008 in.) diameter beads were located 1.27 cm (0.50 in.) aft of all leading edges.

The basic NKC-135 configuration was designated as WBNH6V. Model configuration changes consisted of the addition of various combinations of radomes, pylons and pods, over-wing probes, and air conditioning inlets, all at various combinations of flap and control-surface deflection positions.

TESTING AND PROCEDURE

The investigation was conducted at a Mach number of 0.28 and Reynolds numbers of 6.6 to 26.2 million per meter (2.0 to 8.0 million per foot). Data were obtained at angles of attack from -8° to 20° for sideslip angles of 0°, -6°, and -12° and at angles of attack of 0° and 6° for sideslip angles from -18° to 8°.

Aerodynamic force and moment data were obtained using a six-component strain-gage balance. A sting-mounted pendulous angle transducer was used to measure angle of attack or angle of sideslip during the respective pitch or side-slip polar runs (side-slip polars were conducted with wings vertical in the tunnel).

In addition, from orifices equally distributed spanwise across the upper surface of the right wing (identified in table 2), 22 static pressures were measured with a multipressure sensing-valve assembly mounted in the model nose.

DATA REDUCTION

The six-component force and moment data were reduced about the model moment-reference center in the stability and body-axis systems. The axis systems are defined in figure 1, and the moment-reference center is located at M.S.=75.27 cm and W.L.=17.98 cm. Model pressure data were reduced to coefficient form. Model cavity pressure was used to correct the data for balance cavity axial force to a reference condition of free-stream static pressure in the cavity. Tunnel blockage corrections were applied according to a combination of the methods presented in references 1 and 2.

Angle of attack and the appropriate aerodynamic coefficients were corrected for tunnel wall interference effects (ref. 3). The wall correction values varied with configuration. The values for a typical case, flaps at 50° for the fully modified configuration, were as follows:

$$\Delta\alpha = 0.233378\ (K_a C_L)$$

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$$\Delta C_D = 0.00383134\ (K_a C_L)^2$$

$$\Delta C_m \text{ (tail off)} = 0.00957003\ (K_a C_L)$$

$$\Delta C_m \text{ (tail on)} = 0.0111992\ (K_a C_L)$$

where

$$K_a = 1.0 \text{ (tail off)}$$

$$K_a = 0.85 \text{ (tail on, flaps at 50°)}$$

No stream angle corrections were applied to the data. Data repeatability was estimated by reviewing repeat points and was as follows:

C_N	= ±0.025	C_ℓ	= ±0.003
C_A	= ±0.002	α	= ±0.04°
C_Y	= ±0.014	β	= ±0.04°
C_m	= ±0.010	RN/L	= ±0.07 x 10^6/m
C_n	= ±0.003	M_∞	= ±0.001

RESULTS AND DISCUSSION

Computer-plotted data, all for a Mach number of 0.28, are presented in figures 4 through 19. An index to the plotted data is given as table 3.

Figures 4 through 14 present the aerodynamic characteristics of the model at several stages of component addition for various combinations of attitude and control deflection. Angles of attack ranged from -8° to 20°, and side-slip angles ranged from -18° to 8°. Flap deflections were set at 0°, 30°, and 50°. Aileron deflections were 0°, -10°, and -20°, and rudder deflections were 0°, -10°, and -27°.

At 0° rudder and aileron deflection and 50° flap deflection, the clean or unmodified configuration is laterally-directionally stable at all side-slip angles tested, while the totally modified configuration with all its electronic protuberances added, and at the same conditions, shows instability at side-slip angles greater than -14° (for example, see figs. 6, 7, 13, and 14). The rudder deflection is changed to -10° when instability occurs at approximately -11° side-slip. The results show that instability may be attributed to the presence of the upper radome of the modified model.

In figures 15 and 16, effects of Reynolds number on the lateral-directional and longitudinal coefficients are shown for both the clean (WBNHOV) and fully modified (WBNH6VULCPEOIG) configurations. In general there were no appreciable Reynolds number effects until the model was pitched beyond 12° angle of attack.

In figure 17, the static stability margin of the fully modified configuration is shown at various control settings. In figure 18, the lateral-directional rate derivatives are plotted as a function of lift coefficient for the fully modified configuration at various control settings.

Pressure coefficients from 22 orifices on the right wing (identified as to spanwise location in table 2) are presented in figure 19. Coefficients for both the clean and fully modified model at various control settings are plotted against spanwise location.

These test data, with further analysis, can be useful in the development of a safe flying envelope for the totally modified airplane. Due to the airplane's various electronic protuberances, this flight envelope will be different from the envelope for the clean NKC-135 airplane.

CONCLUSION

Indications, based on limited analysis of the test results, are that the addition of the radomes reduces lateral-directional stability and control effectiveness of the basic aircraft.

Ames Research Center
National Aeronautics and Space Administration
Moffett Field, California 94035 April 4, 1977

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2. Maskell, E. C.: A Theory of the Blockage Effects on Bluff Bodies and Stalled Wings in a Closed Wind Tunnel. Ministry of Aviation Reports and Memoranda No. 3400, 1963.

3. Sivells, James C.; and Salmi, Rachel M.: Jet-Boundary Corrections for Complete and Semispan Swept Wings in Closed Circular Wind Tunnels. NACA TN 2454, 1951.

TABLE 1. - Model Geometry

Fuselage		
Length, cm (ft)	138.96	(4.559)
Max. width, cm (ft)	12.80	(0.42)
Max. depth, cm (ft)	14.75	(0.484)
Fineness ratio	10.854	
Area, cm^2 (ft^2)		
Max cross-sectional	1188.87	(1.280)

TABLE 1. - Continued

Wing		
Area, cm^2 (ft^2)		
Planform	2768.91	(2.98)
Wetted	4930.36	(5.307)
Span (equivalent), cm (ft)	139.569	(4.579)
Aspect ratio	7.035	
Taper ratio	0.33	
Dihedral angle, deg	7	
Incidence angle, deg	2	
Aerodynamic twist, deg	0	
Sweep back angles, deg		
Leading Edge	37.55	
Trailing edge	25.21 and 26.31	
0.25 element line	35	
Chords, cm (in.)		
Root (wing sta. 0.0)	30.02	(11.82)
Tip (equivalent)	9.96	(3.92)
MAC	21.51	(8.47)
Fuselage station of 0.25 MAC	75.26	(29.63)
Water plane of 0.25 MAC	17.98	(7.08)
Butt line of 0.25 MAC	28.42	(11.19)
Airfoil section		
Root	BAC 310	
Tip	BAC 313	

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TABLE 1. - Continued

Vertical Tail		
Area, cm^2 (ft^2)		
Planform	383.68	(0.413)
Wetted	778.50	(0.838)
Span (equivalent), cm (ft)	26.37	(0.865)
Aspect ratio	1.80	
Rate of taper		
Taper ratio	0.36	
Dihedral angle, deg		
Incidence angle, deg	0	
Aerodynamic twist, deg		
Toe-in angle		
Cant angle		
Sweep back angles, deg		
Leading edge	36.15	
Trailing edge	11.92	
0.25 Element line	31	
Chords, cm (in.)		
Root (wing sta. 0.0)	21.51	(8.47)
Tip (equivalent)	7.72	(3.04)
MAC	15.52	(6.11)
Fuselage Station of 0.25 MAC	136.12	(53.59)
Water plane	37.49	(14.76)
Butt line	0.0	(0.0)
Airfoil section		
Root	BAC 277	
Tip	BAC 279	

TABLE 1. - Continued.

Ailerons: model ailerons have 0, ±10°, and ±20° deflection capability.

Area, cm^2 (ft^2)........................	68.75	(0.074)	per side
Span (equivalent), cm (ft)............	36.27	(1.190)	per side
Inboard equivalent chord, cm (ft).....	3.39	(0.111)	
Outboard equivalent chord, cm (ft)....	3.22	(0.106)	
Sweep back angles, deg			
Leading edge......................	28		
Trailing edge.....................	26		
Hingeline.........................	28		

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TABLE 1. - Continued

Rudder: model rudder has 0, ±10°, and ±27° deflection capability

Area aft of hingeline, cm^2(ft^2)	117.0	(0.126)
Span (equivalent), cm (ft)	21.51	(0.706)
Inboard equivalent chord (bare),cm(ft)	6.45	(0.212)
Outboard equivalent chord(tip),cm(ft)	4.0	(0.131)
Sweep back angles, deg		
Leading edge	20	
Tailing edge	13	
Hingeline	20	

TABLE 1. - Continued.

Horizontal tail		
Area, cm^2 (ft^2)		
Planform........................	569.48	(0.613)
Wetted..........................	995.89	(1.072)
Span (equivalent), cm (ft)........	42.34	(1.389)
Aspect ratio......................	3.2	
Rate of taper		
Taper ratio.......................	0.447	
Dihedral angle, deg...............	7	
Incidence angle...................	+0.5 - 14	
Aerodynamic twist, deg............	0	
Toe-in angle		
Cant angle		
Sweep back angles, deg		
Leading edge..................	39.35	
Trailing edge.................	18.82	
0.25 Element line.............	35	
Chords, cm (in.)		
Root (wing sta. 0.0)..........	18.49	(7.28)
Tip (equivalent)..............	8.46	(3.33)
MAC...........................	14.02	(5.52)
Fuselage station of 0.25 MAC..	140.77	(55.42)
Water plane of 0.25 MAC.......	24.28	(9.56)
Butt line of 0.25 MAC........	9.40	(3.70)
Airfoil section		
Root..........................	BAC 319	
Tip...........................	BAC 317	

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TABLE 1. - Concluded.

Flaps: model flaps have 0°, 30°, 40°, and 50° deflection capability

Area, cm^2 (ft^2)	411.52	(0.44)
Span (equivalent), cm (ft)	31.70	(1.04)
Inboard equivalent chord,cm (ft)	5.76	(0.189)
Outboard equivalent chord, cm (ft)	5.76	(0.189)
Sweep back angles, deg		
Leading edge	29	
Tailing edge	26	
Hingeline	29	

TABLE 2. - STATIC PRESSURE ORIFICE LOCATIONS[a]

Percent chord line	n
95.0	.127
85.5	.182
83.1	.217
82.5	.255
81.9	.293
81.3	.331
80.6	.369
95.0	.369
95.0	.408
95.0	.444
78.1	.478
77.4	.513
76.5	.552
75.5	.590
74.5	.627
73.3	.665
95.0	.665
95.0	.741
95.0	.818
95.0	.894
95.0	.932
95.0	.972

[a]Top/right wing only.

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TABLE 3. - INDEX OF DATA FIGURES

Notes:

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

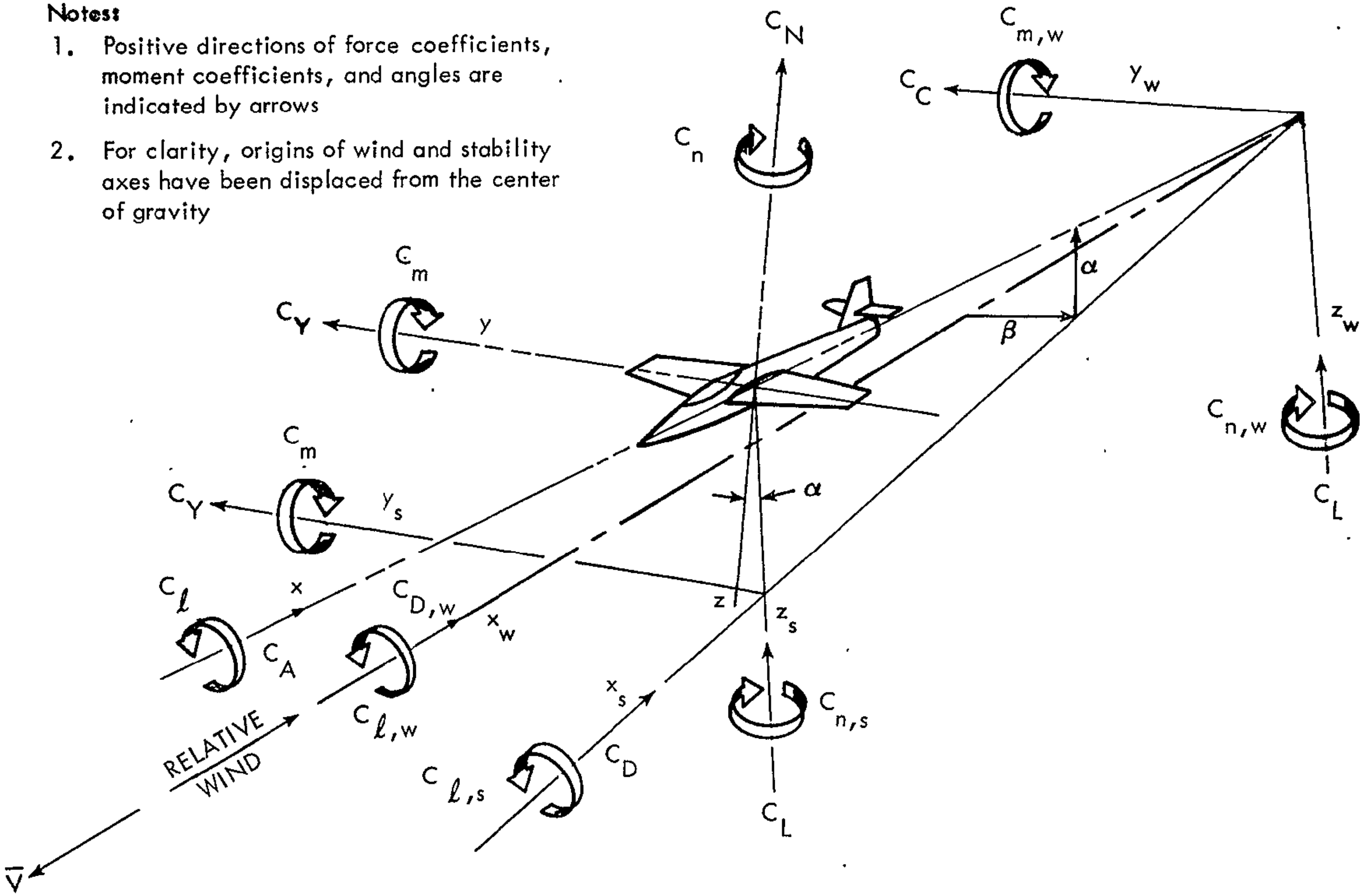

Figure 1. - Axis System Definition

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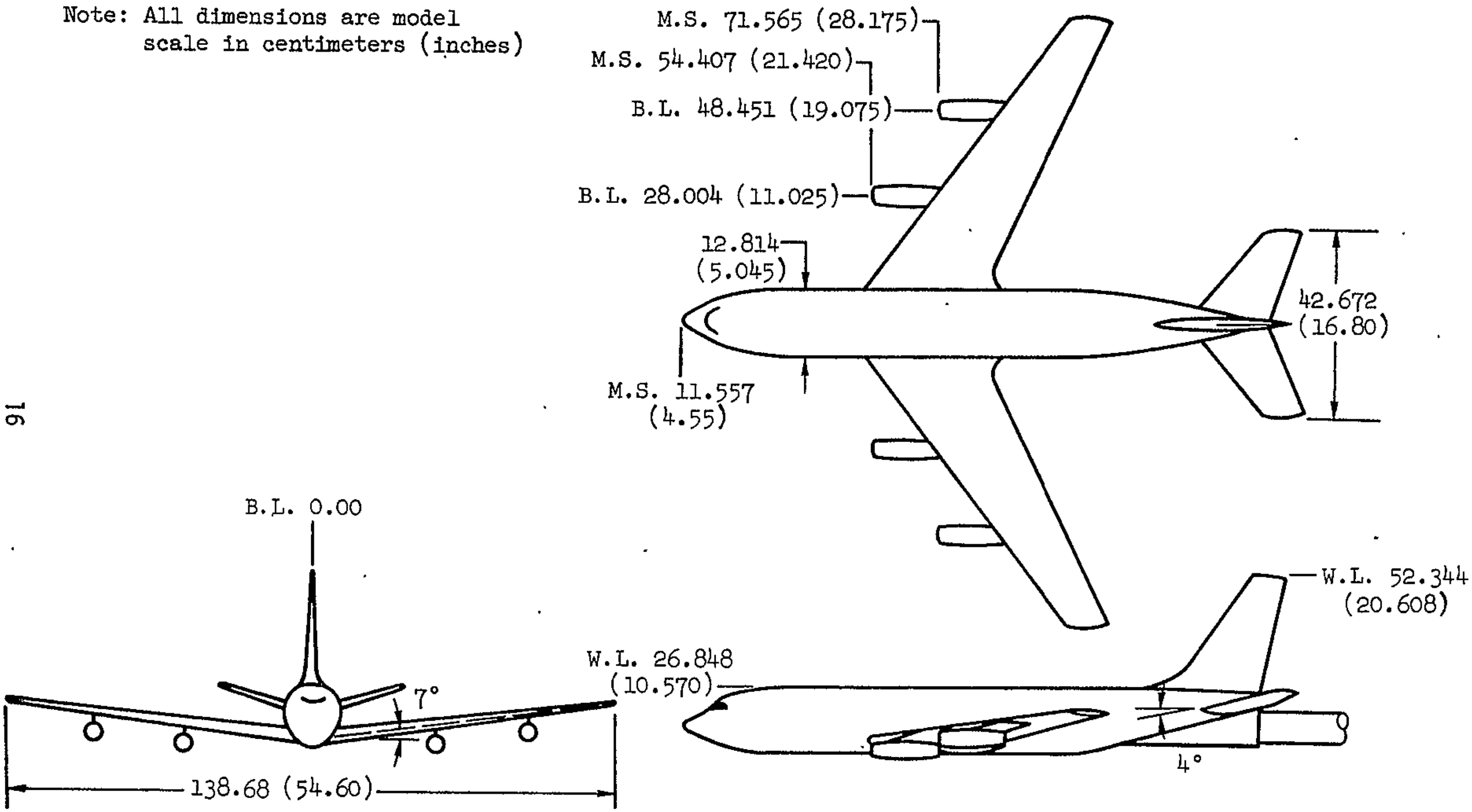
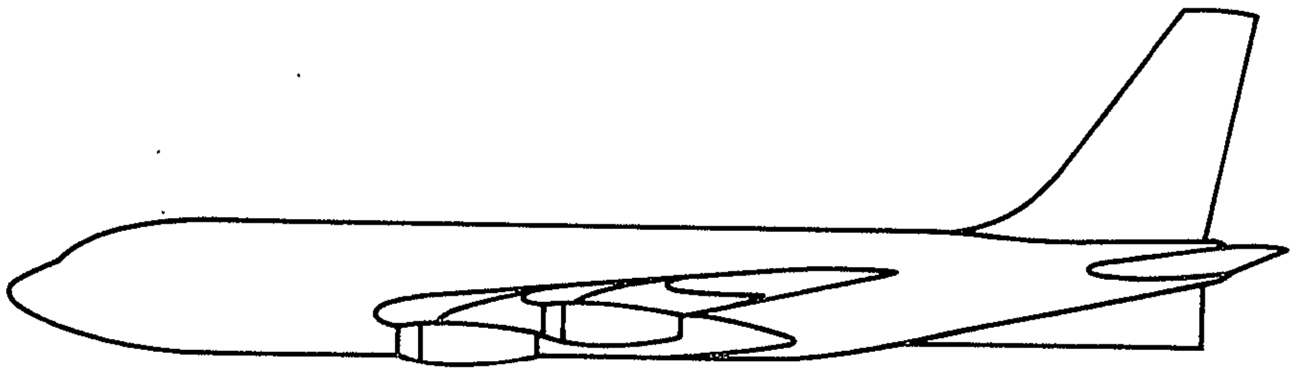
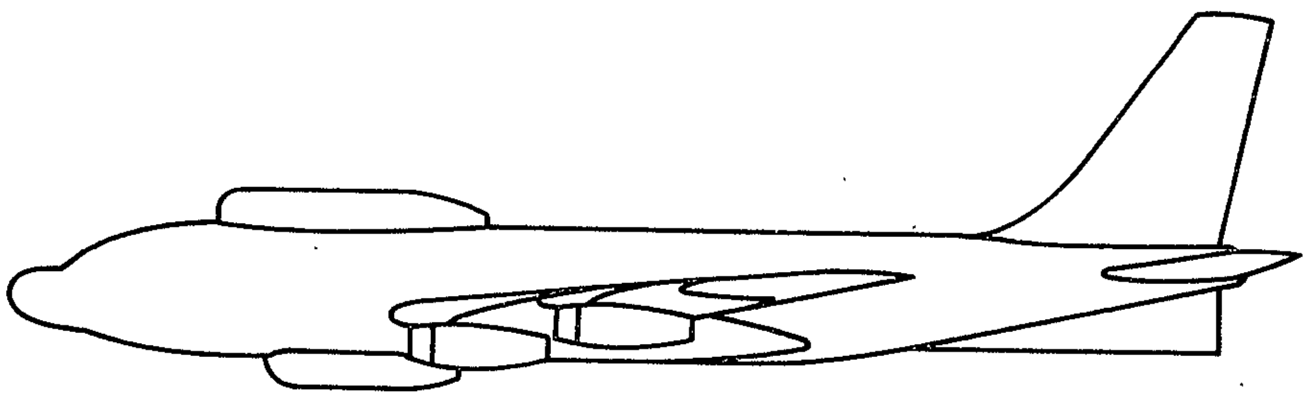


(a) Three-view drawing

Figure 2. - Model Geometry.



KC-135A Model



Modified model with radomes

(b) Basic model and model with radomes.

Figure 2. - Continued.

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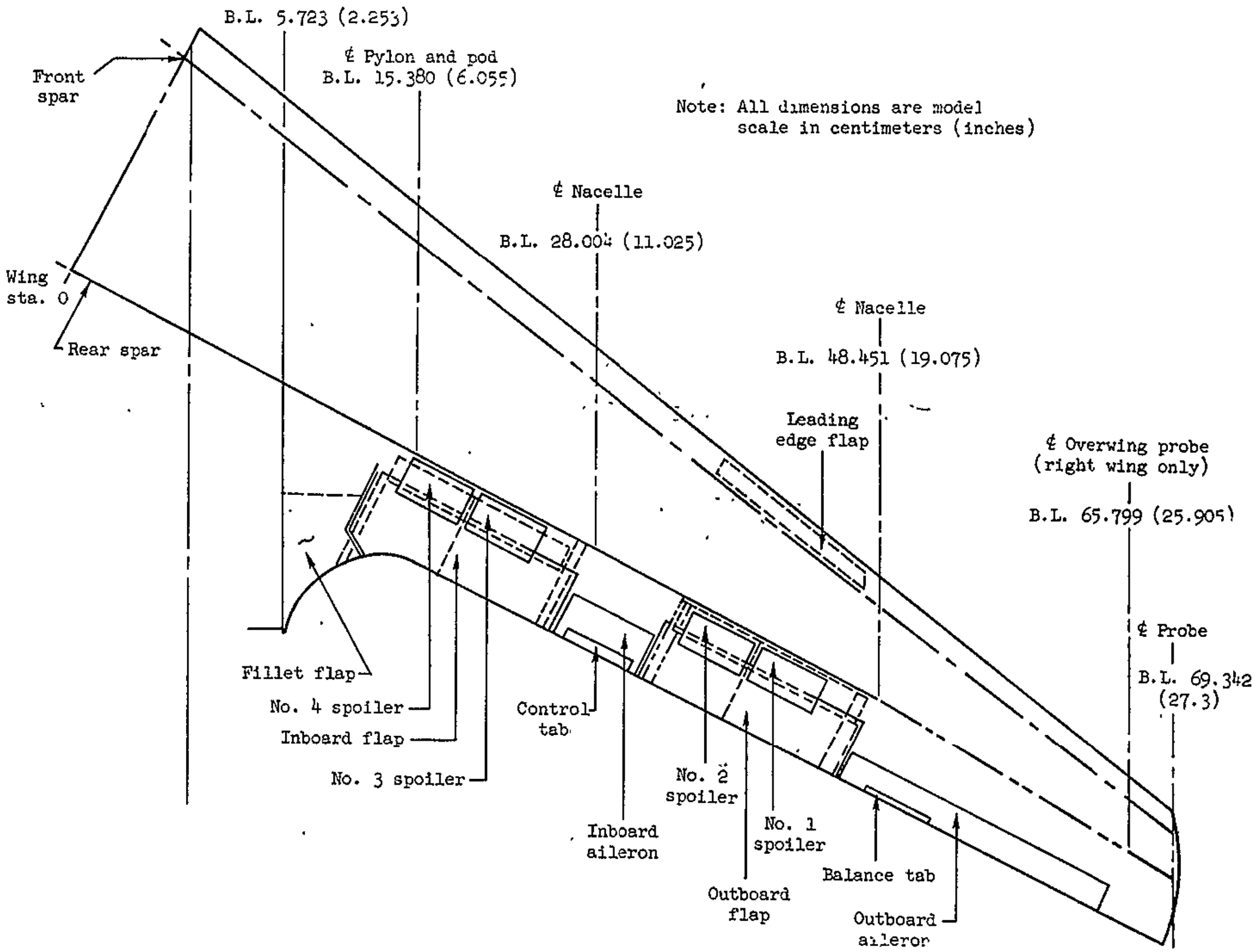

(c) Model wing

Figure 2. - Continued.

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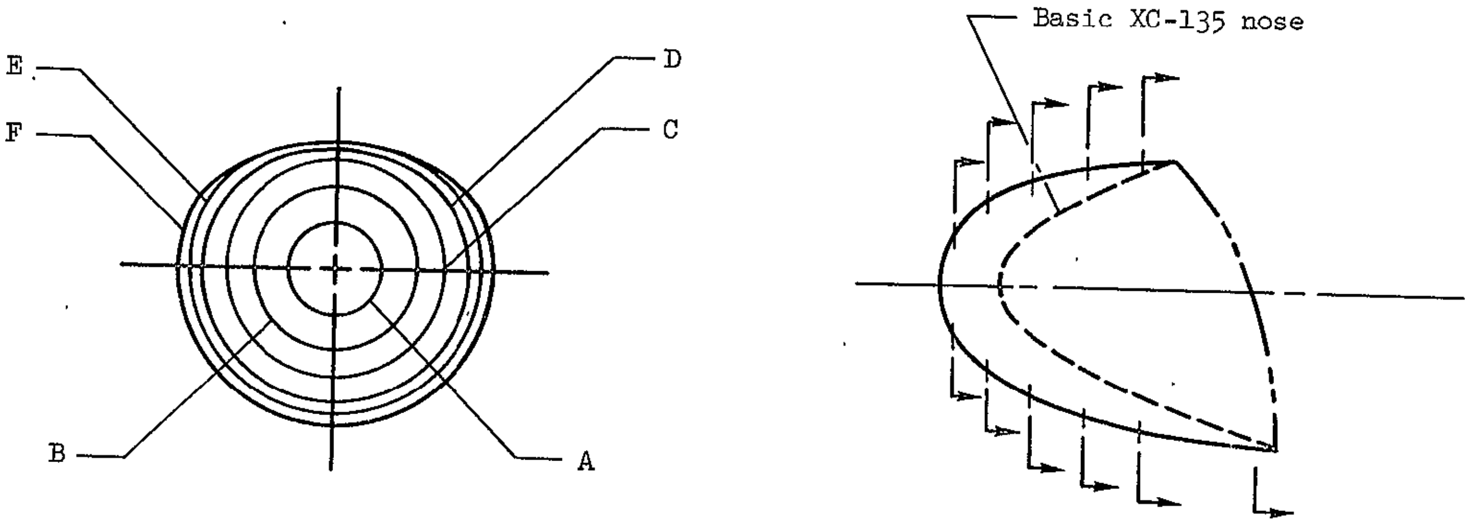
Note: All dimensions are model
scale in centimeters (inches)

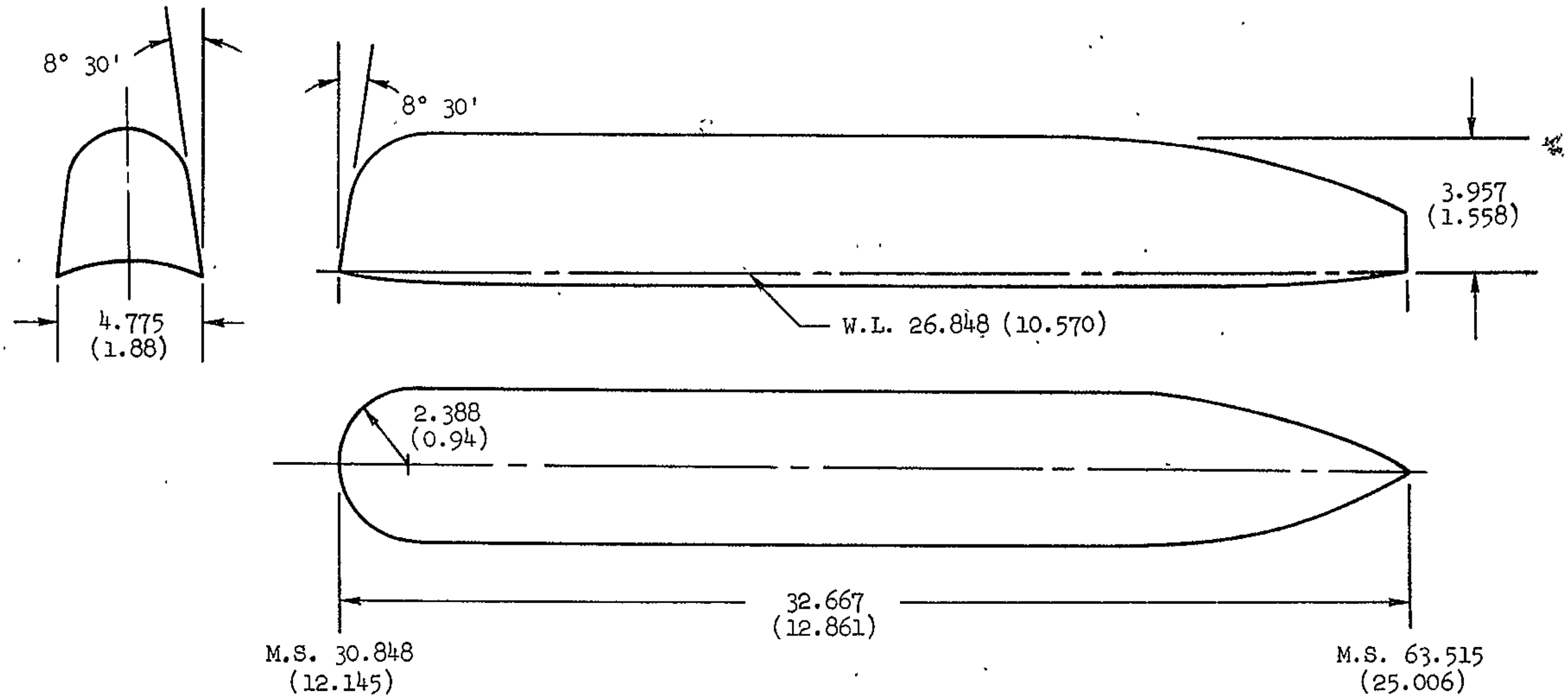


	Model station	Radius
A	10.224 (4.025)	1.270 (0.500)
B	11.113 (4.375)	2.154 (0.848)
C	12.268 (4.830)	2.819 (1.110)
D	13.691 (5.390)	3.353 (1.320)
E	15.113 (5.950)	3.688 (1.452)
F	18.098 (7.125)	3.950 (1.555)

(d) Model nose radome.

Figure 2. - Continued.

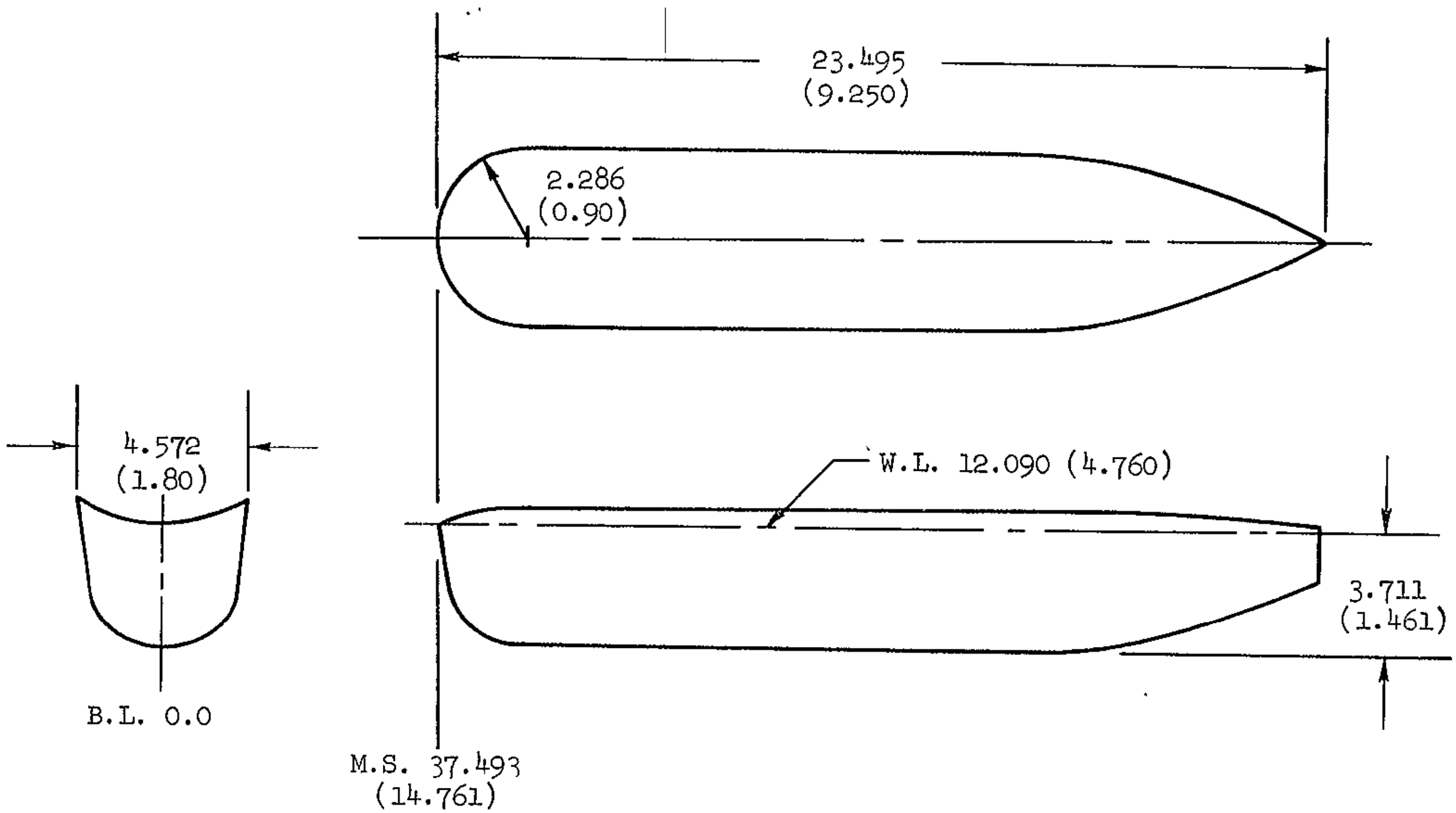
Note: All dimensions are model
scale in centimeters (inches)



(e) Model upper radome

Figure 2. - Continued.

Note: All dimensions are model
scale in centimeters (inches)



(f) Model lower radome

Figure 2. - Continued.

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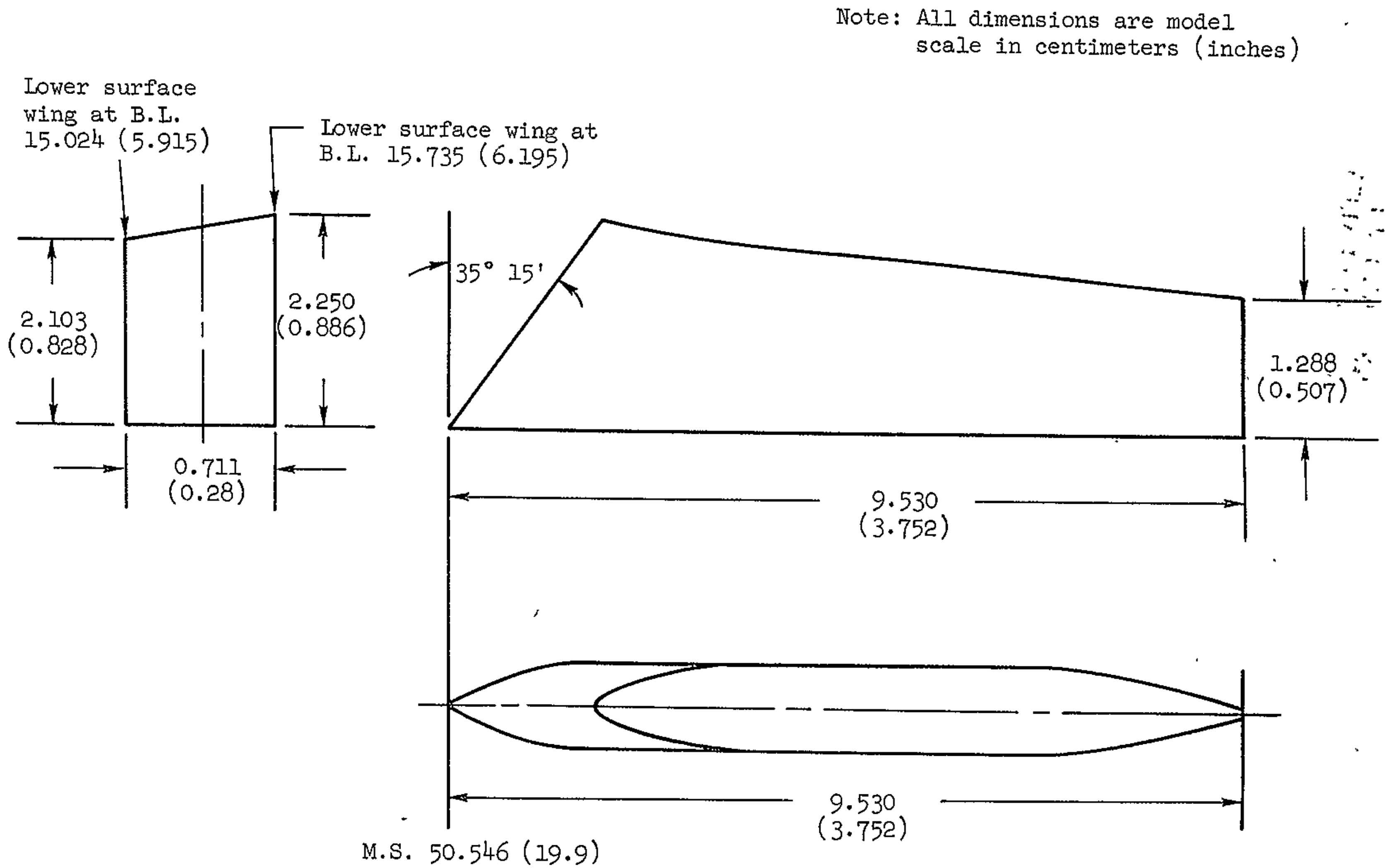
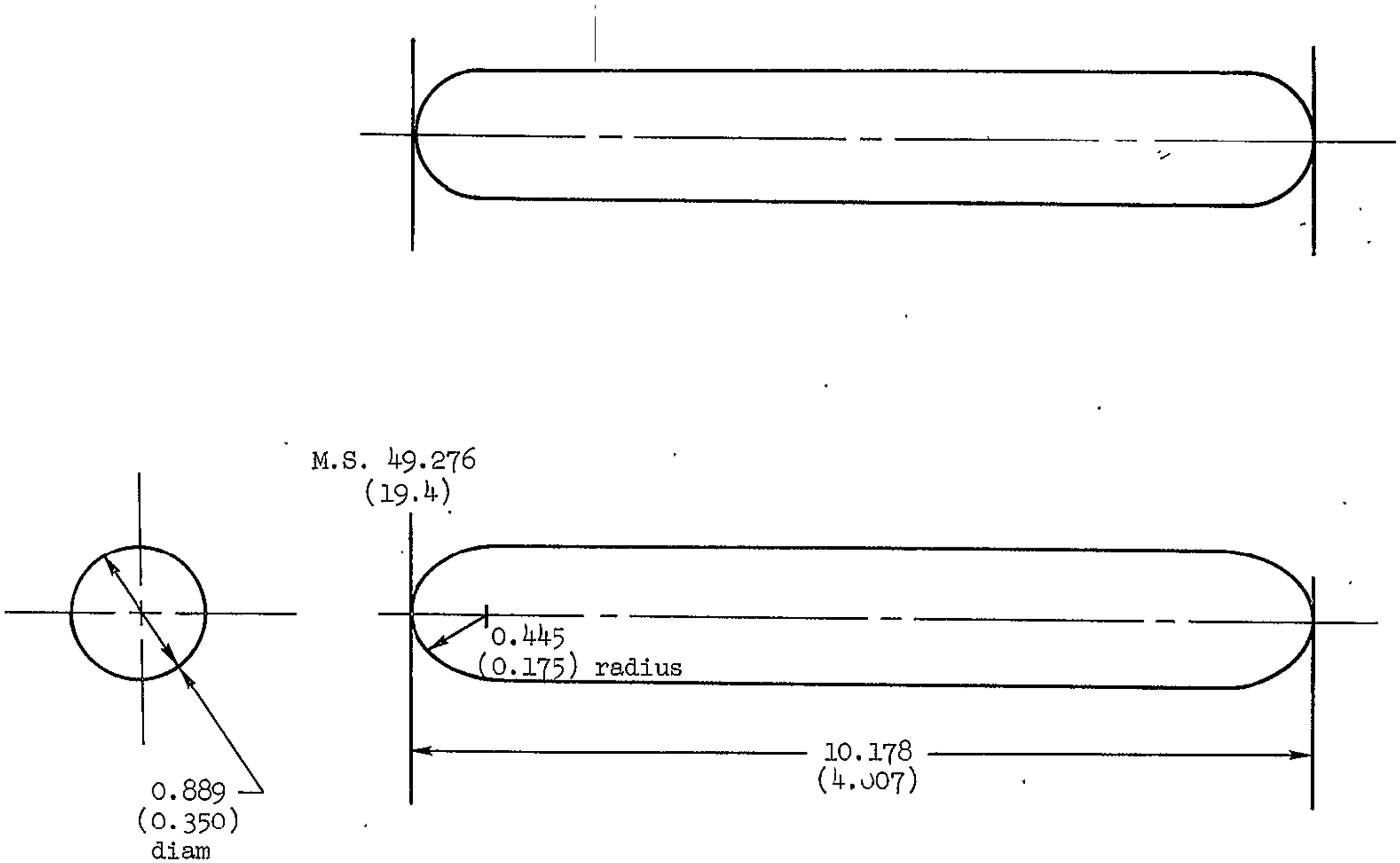


(g) Model wing pylons

Figure 2. - Continued.

Note: All dimensions are model
scale in centimeters (inches)



(h) Model electronic pods

Figure 2. - Continued.

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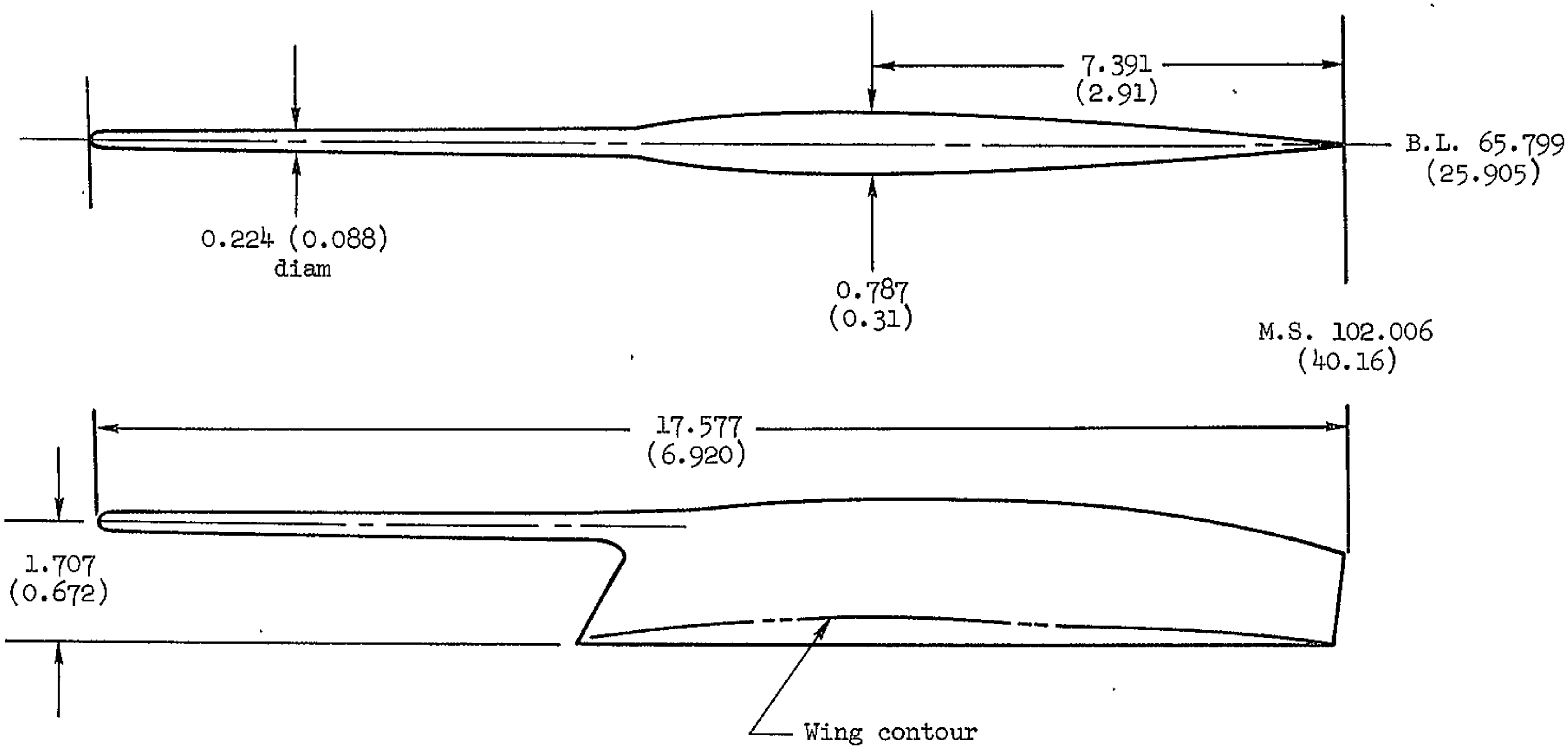
Note: All dimensions are model
scale in centimeters (inches)



(i) Model overwing probe.

Figure 2. - Continued.

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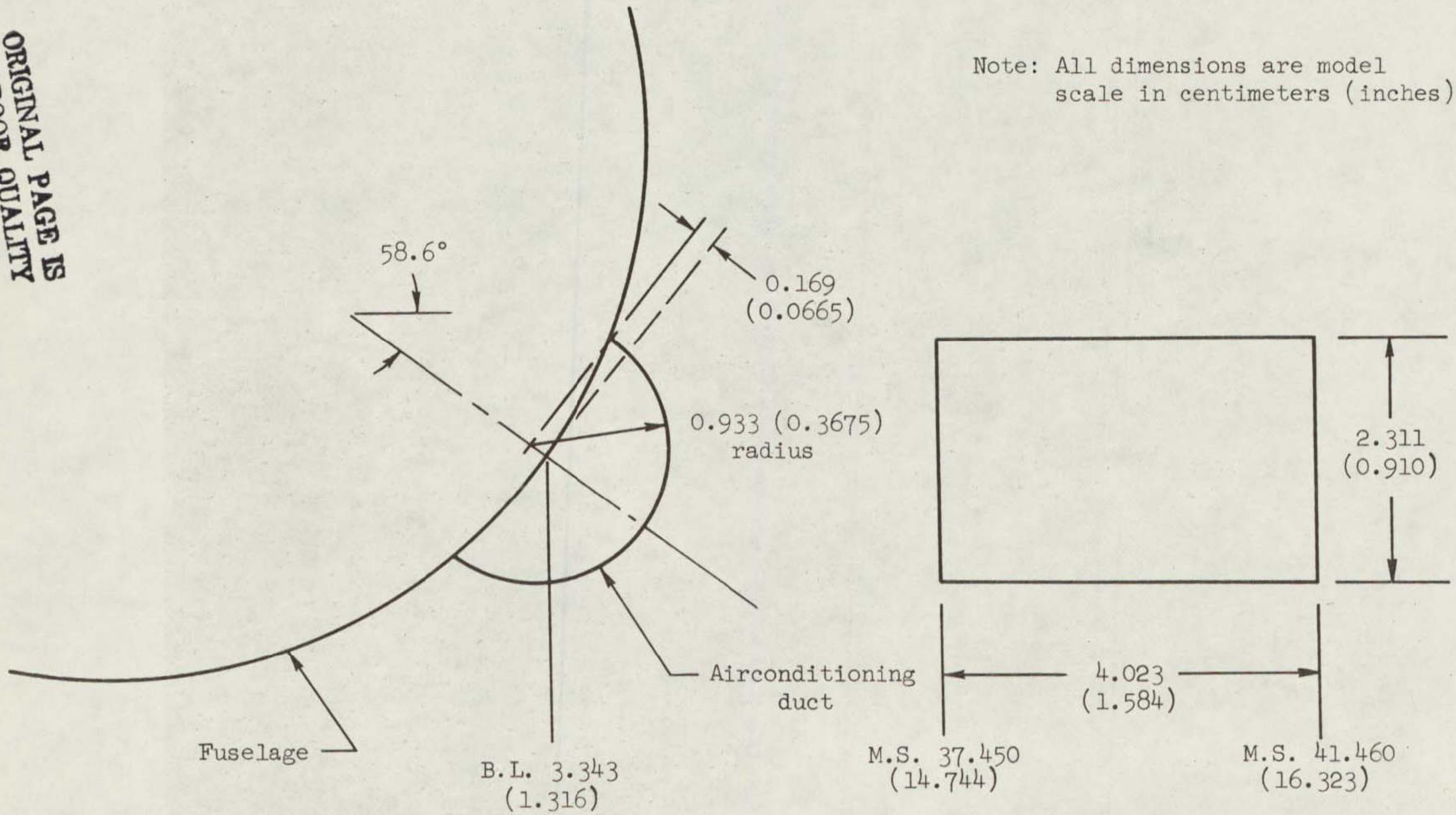
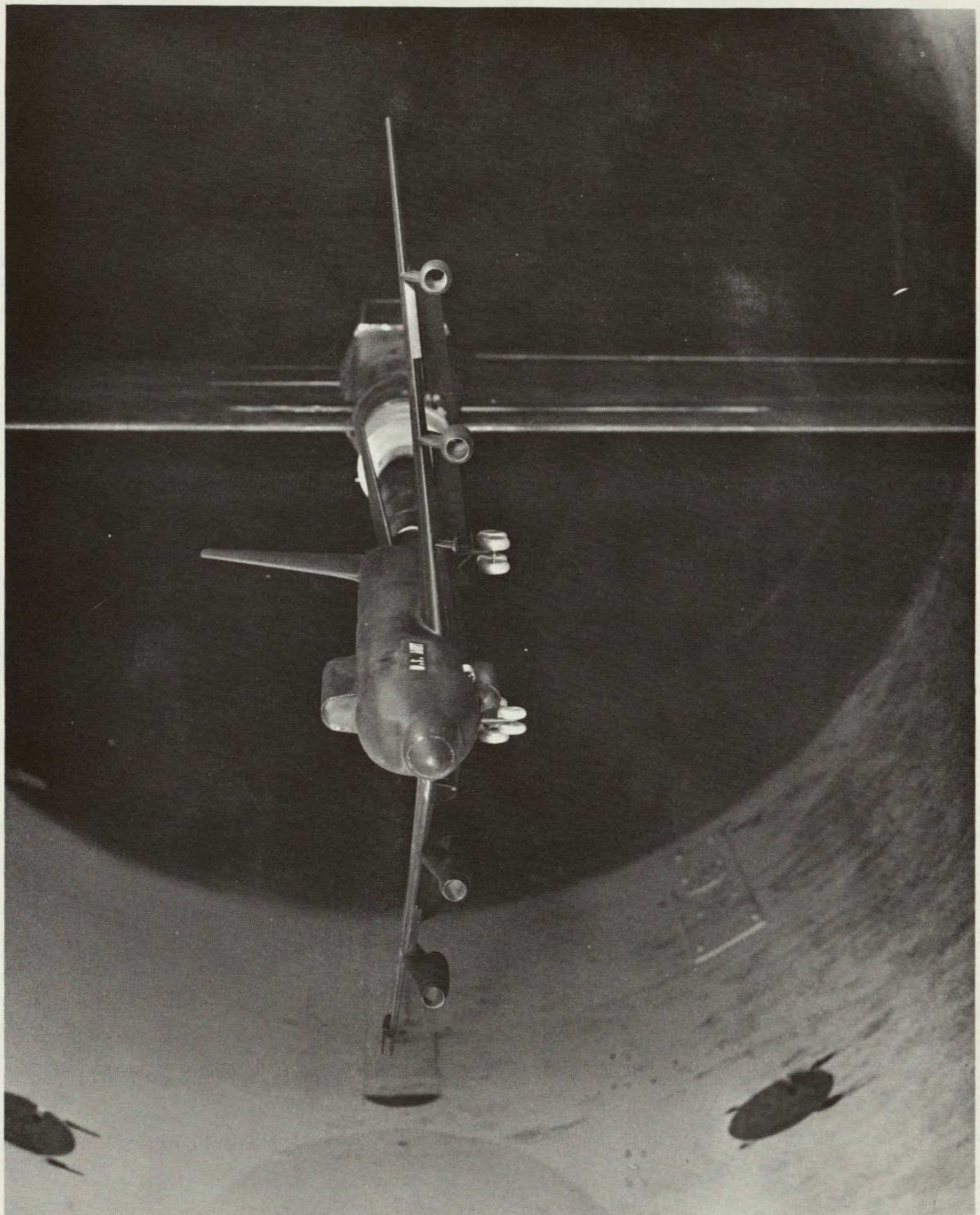


(j) Model air conditioning ducts

Figure 2. - Concluded.

a. Installation aft view

Figure 3. - Model photographs.



b. Installation front view

Figure 3.- Concluded.

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Data Figures

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DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG004	○	W B N H6 V	.280	.000	.000	.000	.000
ZHG001	□	W B N H0 V	.280	.000	.000	.000	.000
ZHG002	◇	W B N H0 V U L C P E O I	.280	.000	.000	.000	.000
ZHG003	△	W B N H6 V U L C P E O I	.280	.000	.000	.000	.000

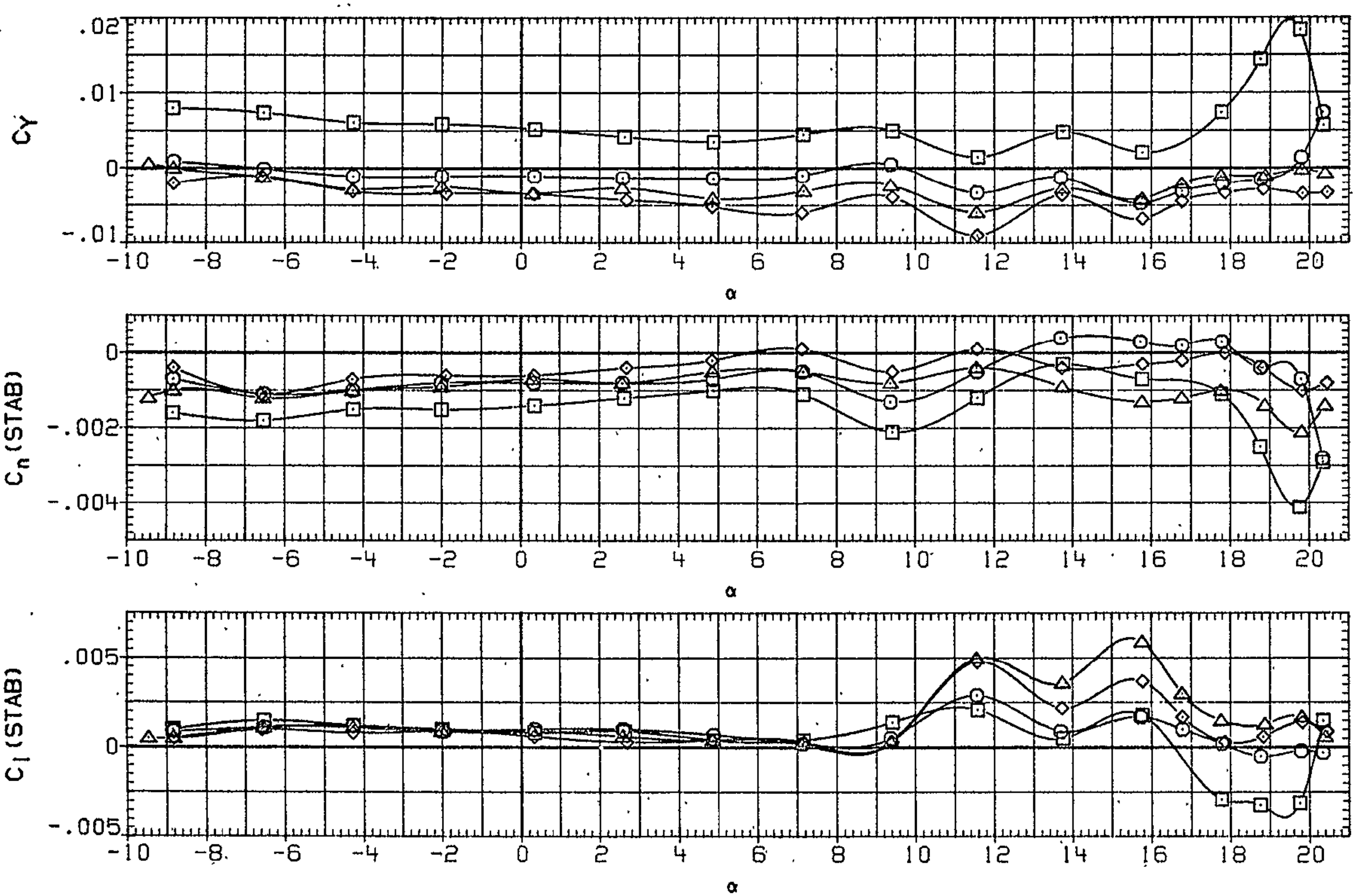

FIG. 4 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

(A)RN/L = 19.69

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG005	○	W B N H6 V	.280	.000	30.000	.000	.000
ZHG008	□	W B N H6 V U L C P E O I	.280	.000	30.000	.000	.000
ZHG009	◇	W B N H6 V L C P E O I	.280	.000	30.000	.000	.000
ZHG012	△	W B N H6 V L C O I	.280	.000	30.000	.000	.000

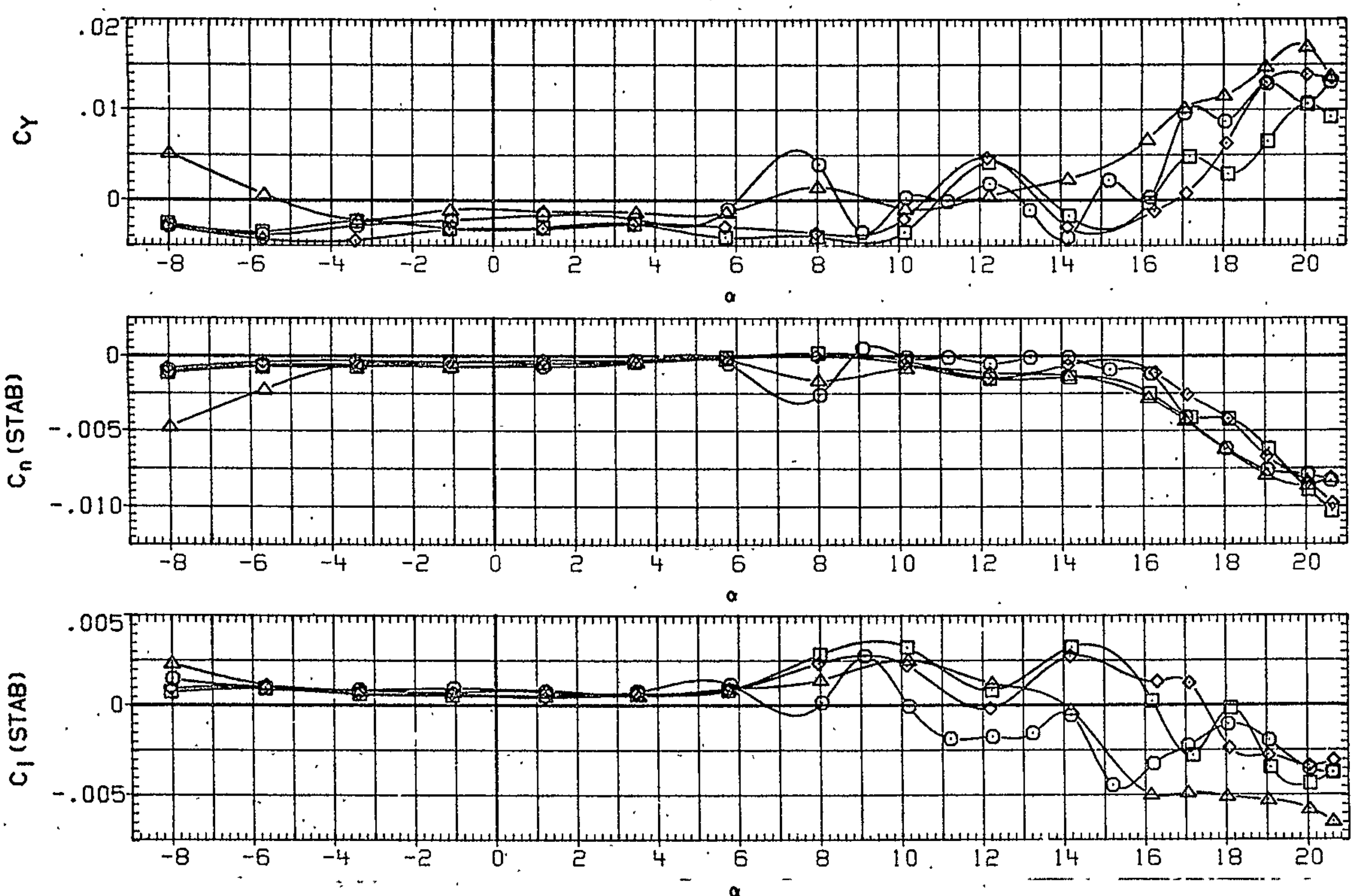

FIG. 4 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

(A)RN/L = 19.69

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG030	○	W B N H6 V	.280	.000	50.000	.000	.000
ZHG017	□	W B N H6 V U L C P E O I	.280	.000	50.000	.000	.000
ZHG020	◇	W B N H6 V L C P E O I	.280	.000	50.000	.000	.000
ZHG021	△	W B N H6 V L C O I	.280	.000	50.000	.000	.000
ZHG018	◺	W B N H6 V U L C P E I	.280	.000	50.000	.000	.000
ZHG019	D	W B N H6 V U L C P O I	.280	.000	50.000	.000	.000

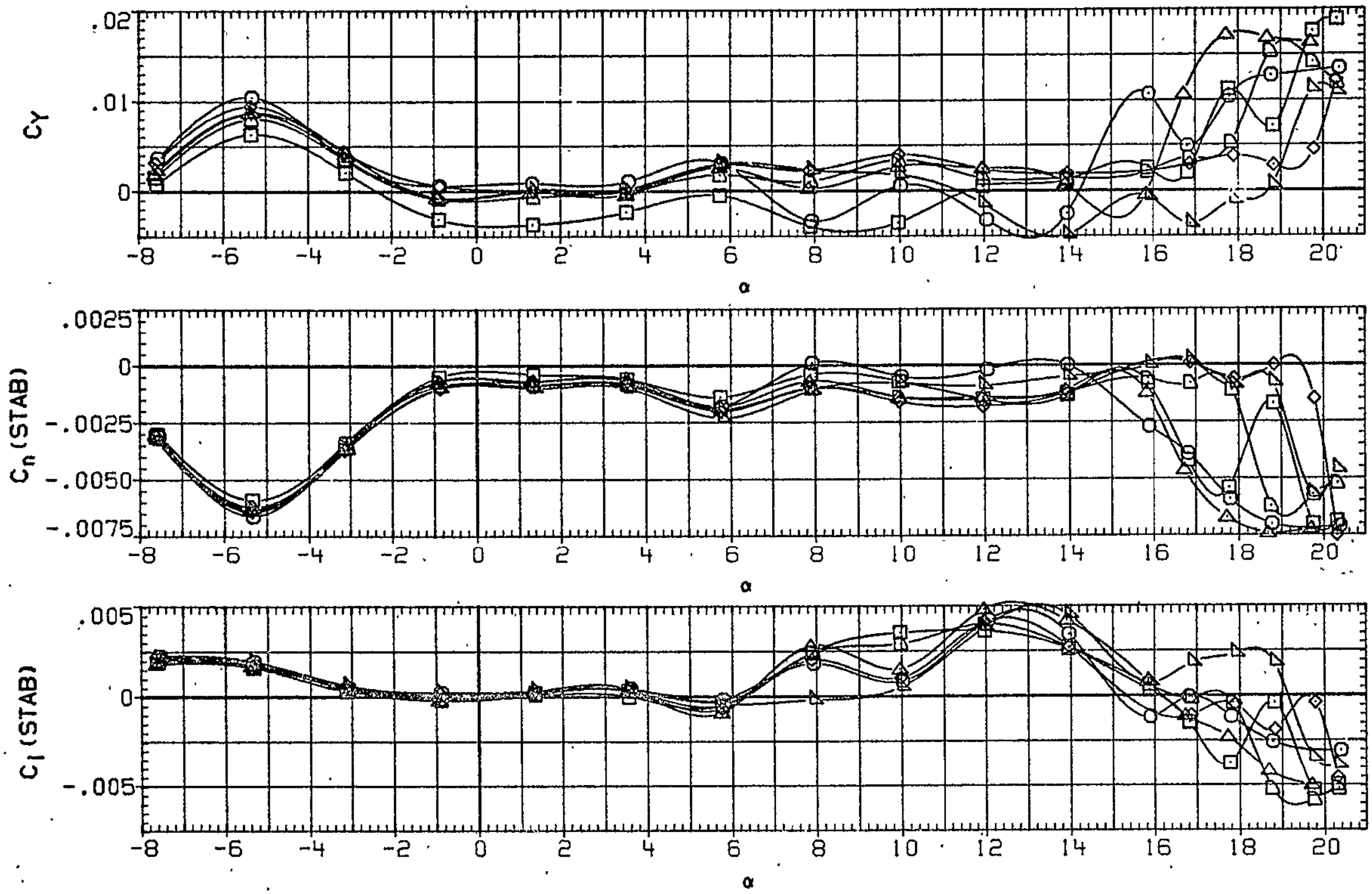

FIG. 4 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

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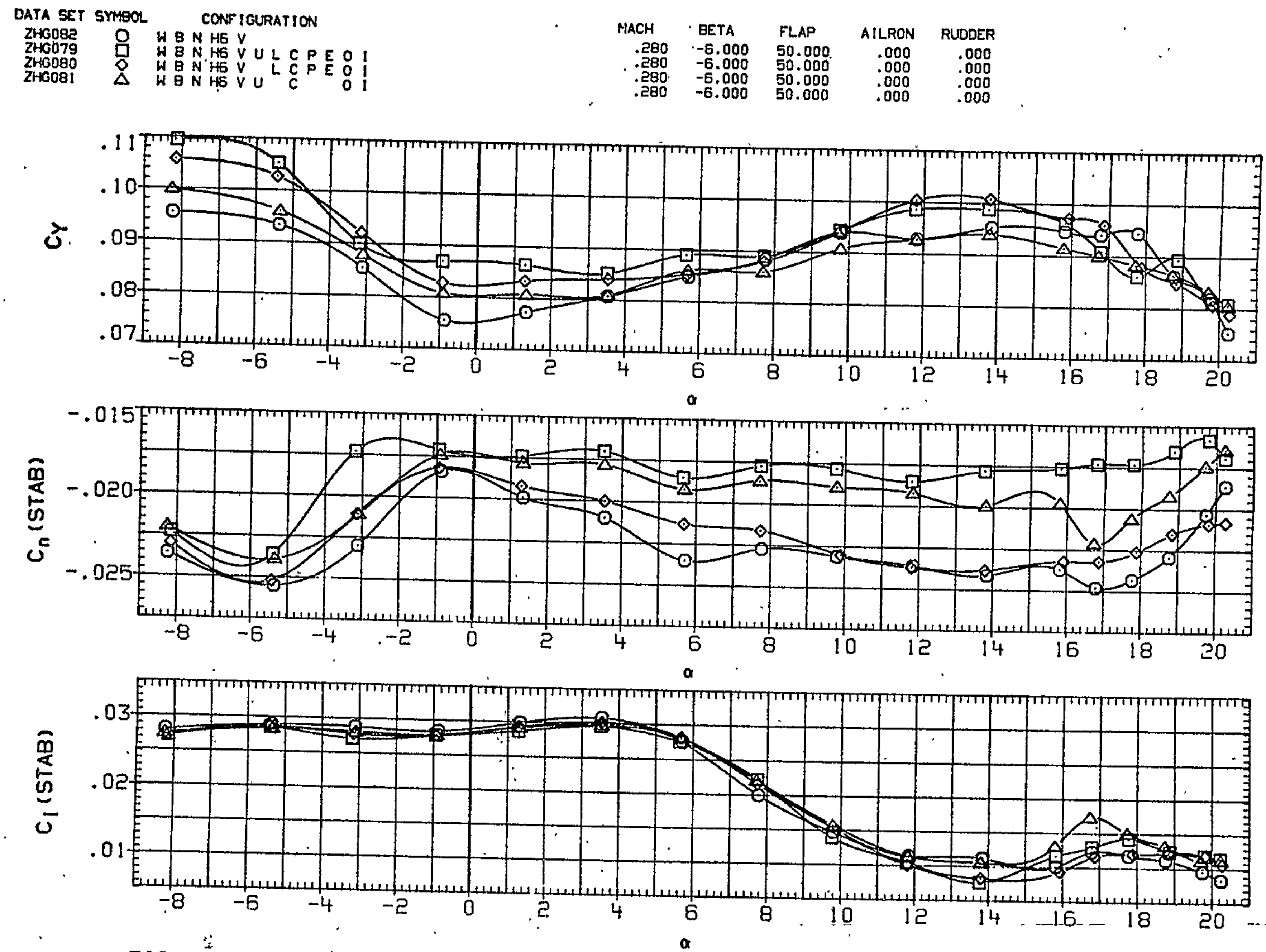

FIG. 4 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

(A)RN/L = 14.75

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG083	○	W B N H6 V	.280	-6.000	50.000	-20.000	-10.000
ZHG086	□	W B N H6 V U L C P E O I	.280	-6.000	50.000	-20.000	-10.000
ZHG085	◇	W B N H6 V L C P E O I	.280	-6.000	50.000	-20.000	-10.000
ZHG084	△	W B N H6 V U C O I	.280	-6.000	50.000	-20.000	-10.000

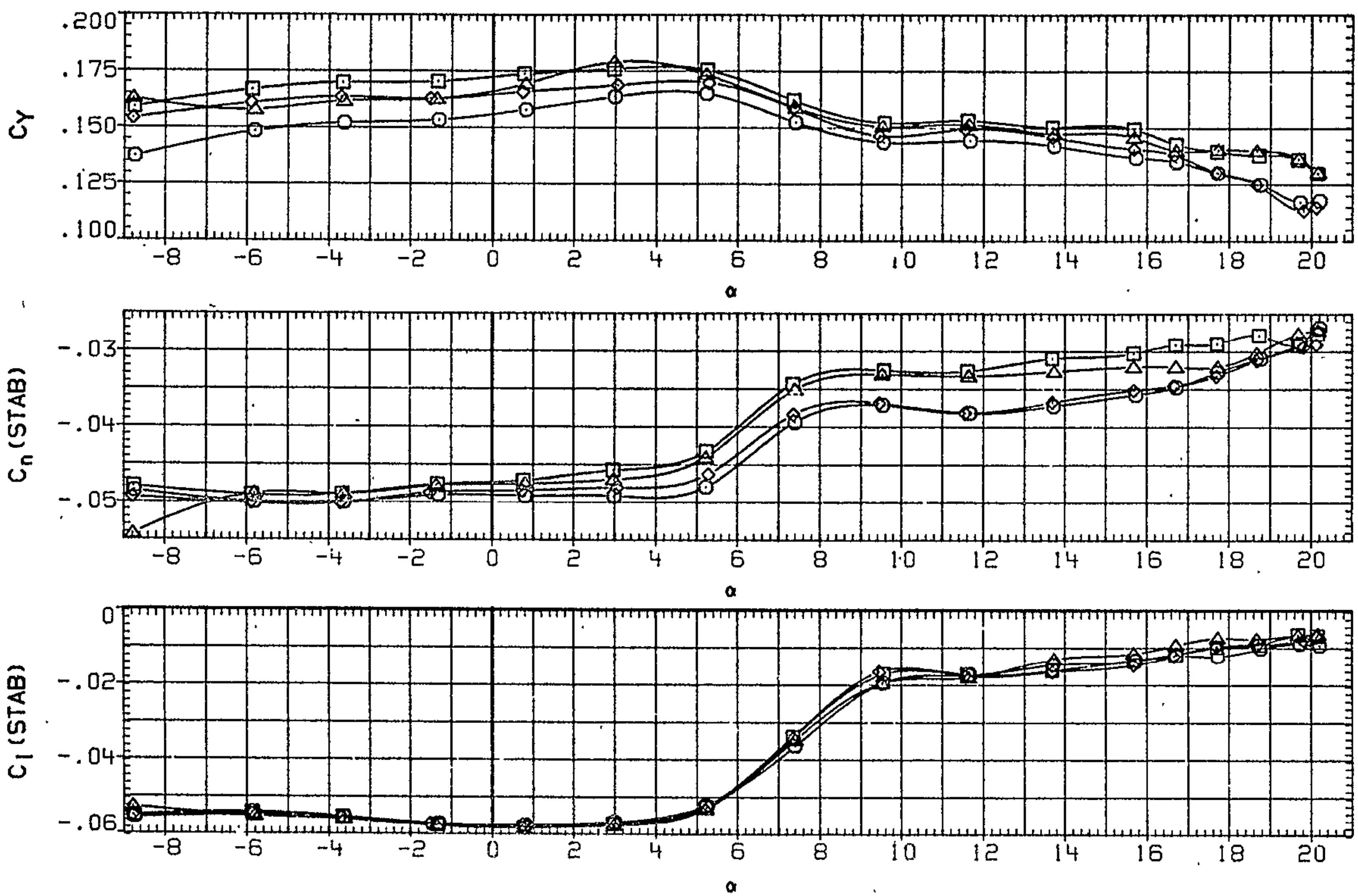

FIG. 4 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

(A)RN/L = 14.78

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DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG090	○	W B N H6 V	.280	-12.000	50.000	-20.000	-10.000
ZHG087	□	W B N H6 V U L C P E O I	.280	-12.000	50.000	-20.000	-10.000
ZHG088	◇	W B N H6 V L C P E O I	.280	-12.000	50.000	-20.000	-10.000
ZHG089	△	W B N H6 V U C O I	.280	-12.000	50.000	-20.000	-10.000

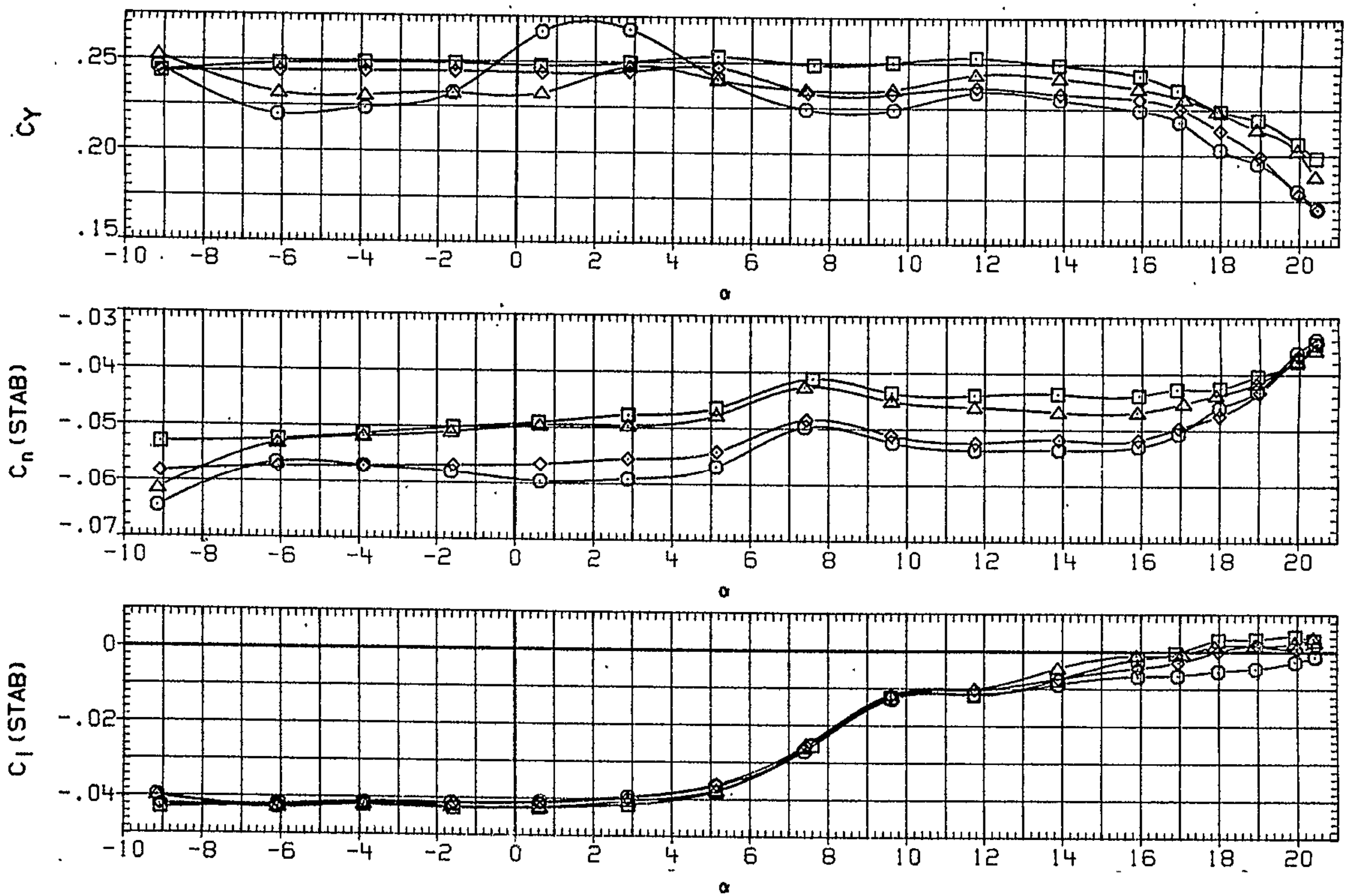

FIG. 4 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

(A)RN/L = 14.78

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG091	○	W B N H6 V	.280	-12.000	50.000	.000	.000
ZHG094	□	W B N H6 V U L C P E O I	.280	-12.000	50.000	.000	.000
ZHG093	◇	W B N H6 V L C P E O I	.280	-12.000	50.000	.000	.000
ZHG092	△	W B N H6 V U C O I	.280	-12.000	50.000	.000	.000
ZHG100	⊿	W B N H6 V LL	.280	-12.000	50.000	.000	.000

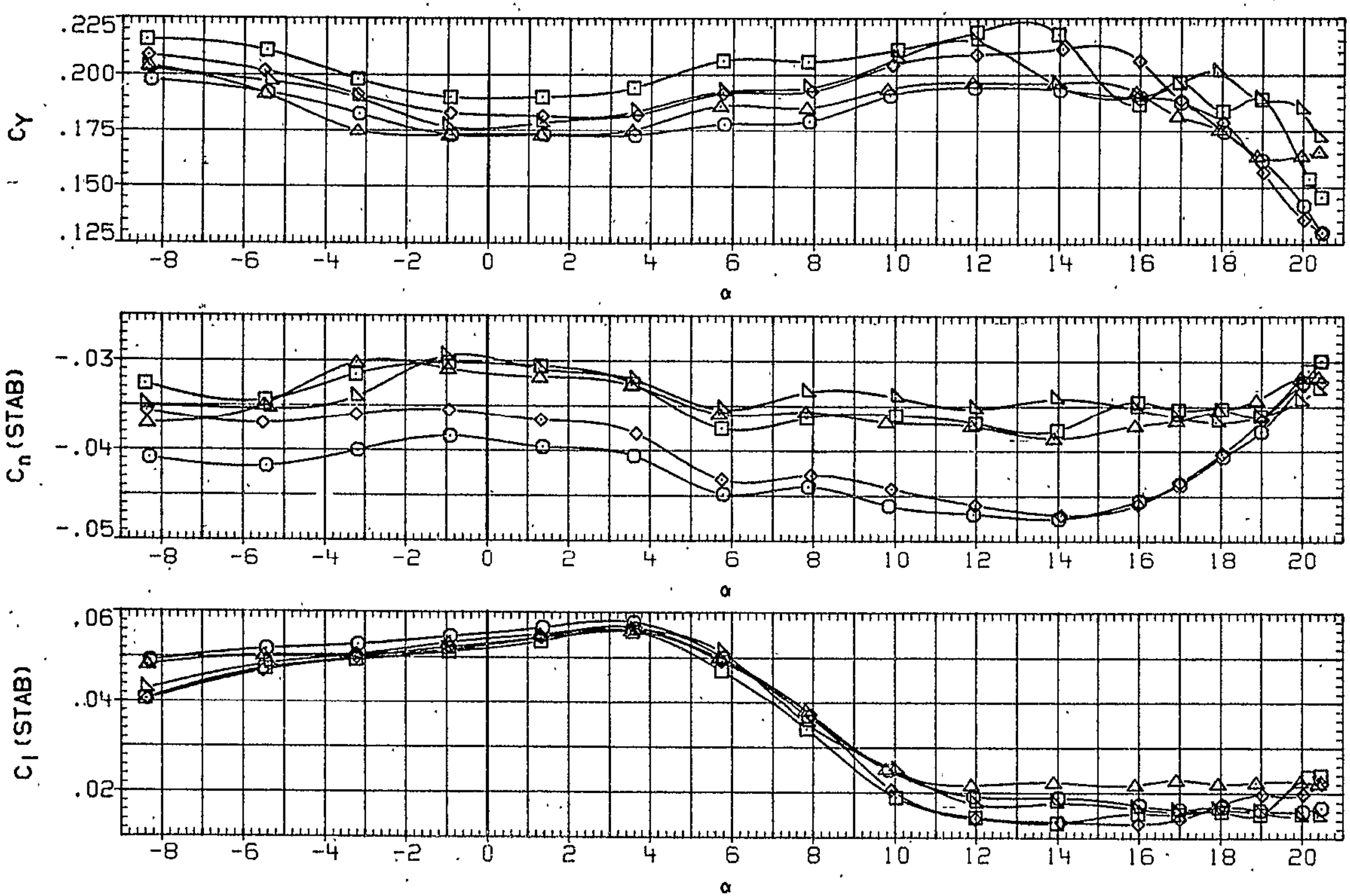

FIG. 4 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

(A)RN/L = 14.78

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DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG006	○	W B N H6 V G	.280	.000	30.000	.000	.000
ZHG007	□	W B N H6 V U L C P E O I G	.280	.000	30.000	.000	.000
ZHG010	◇	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000
ZHG011	△	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000
ZHG013	◺	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000
ZHG014	◻	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000

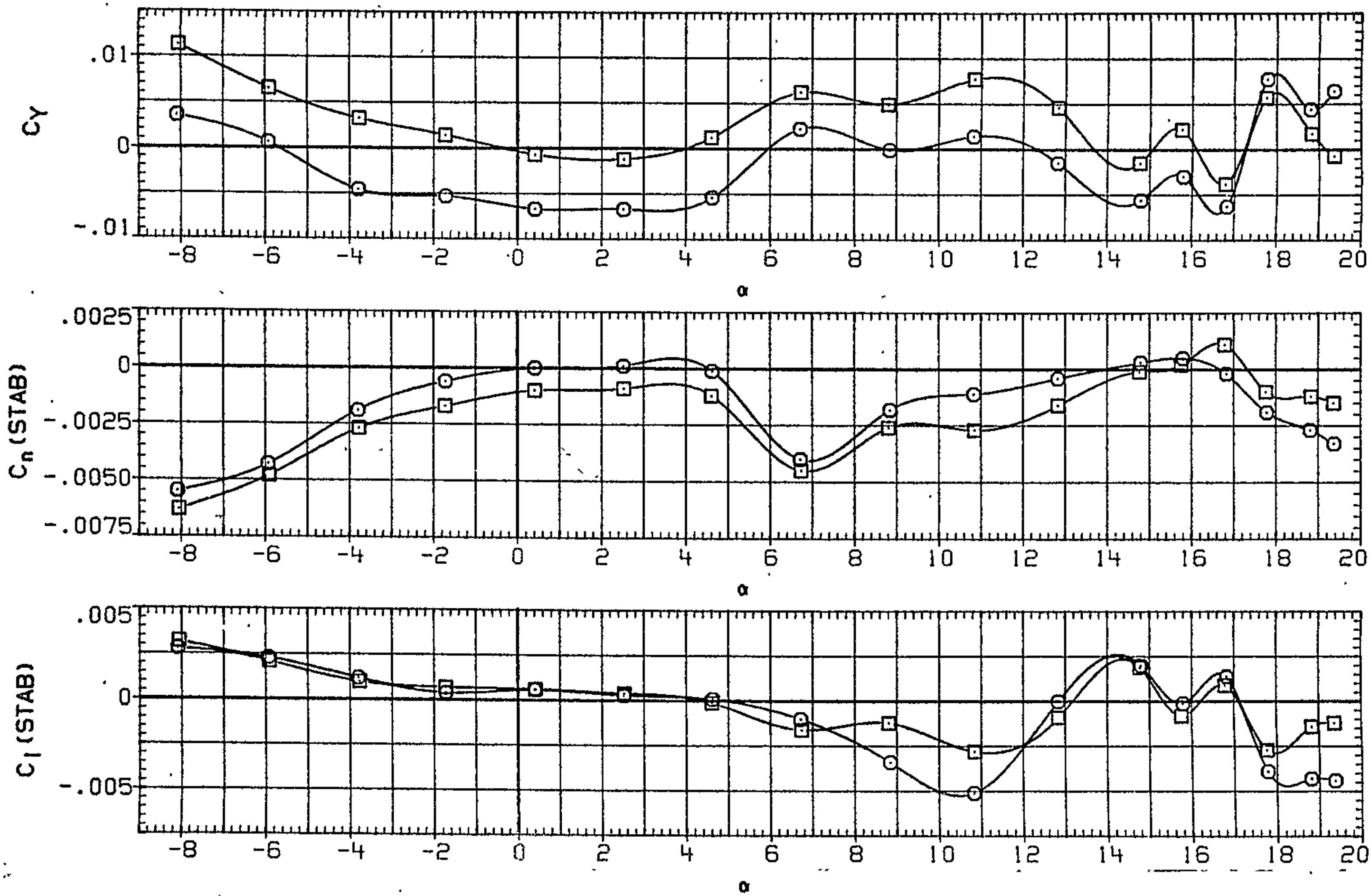

FIG. 5 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(A)RN/L = 6.53

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG006	○	W B N H6 V G	.280	.000	30.000	.000	.000
ZHG007	□	W B N H6 V U L C P E O I G	.280	.000	30.000	.000	.000
ZHG010	◇	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000
ZHG011	△	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000
ZHG013	◺	W B N H6 V U L C O I G	.280	.000	30.000	.000	.000
ZHG014	◻	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000

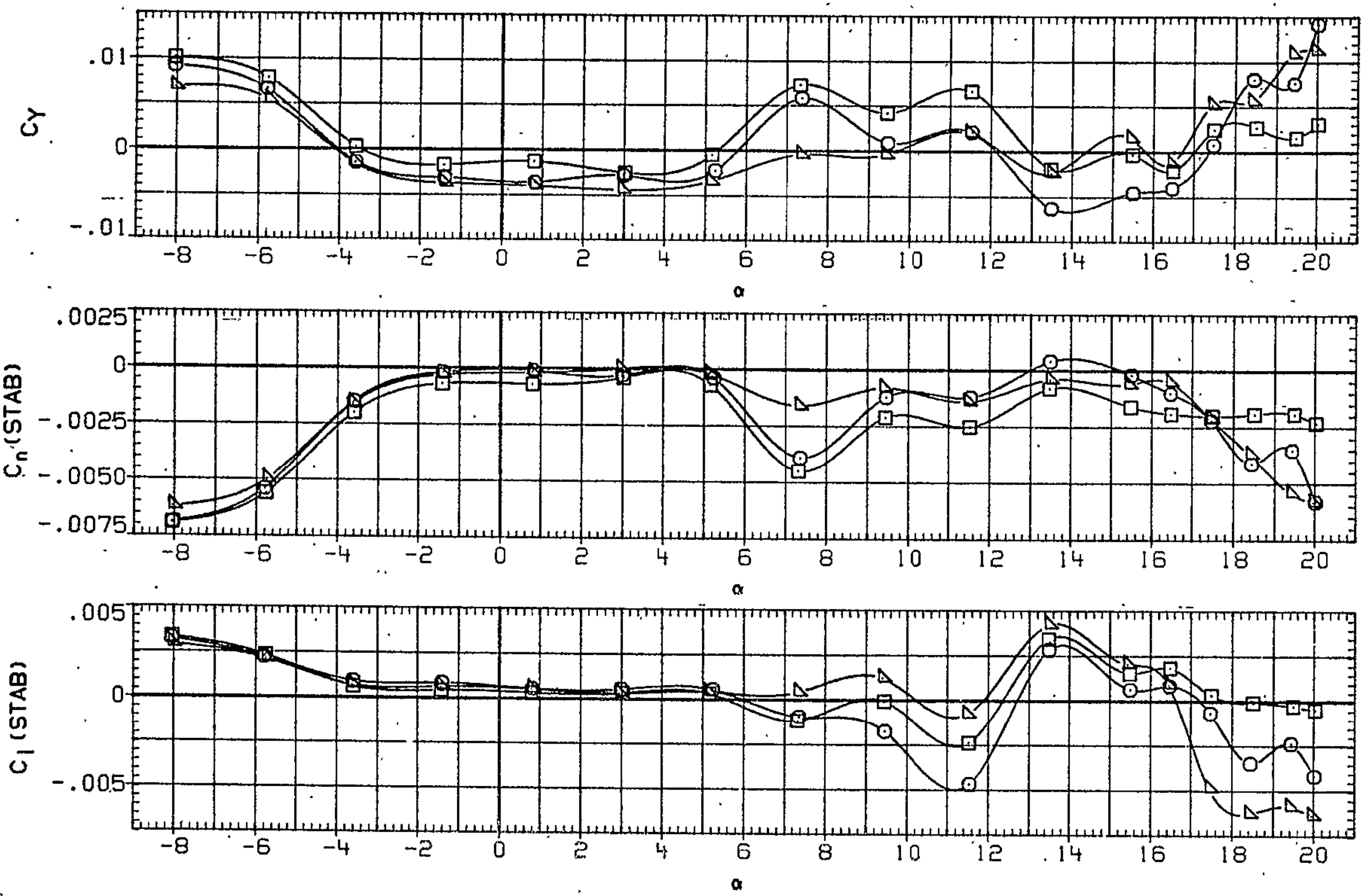

FIG. 5 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(B)RN/L = 12.98

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DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG006	○	W B N H6 V G	.280	.000	30.000	.000	.000
ZHG007	□	W B N H6 V U L C P E O I G	.280	.000	30.000	.000	.000
ZHG010	◇	W B N H6 V L C P E O I G	.280	.000	30.000	.000	.000
ZHG011	△	W B N H6 V L C O I G	.280	.000	30.000	.000	.000
ZHG013	◺	W B N H6 V U L C O I G	.280	.000	30.000	.000	.000
ZHG014	D	W B N H6 V U C O I G	.280	.000	30.000	.000	.000

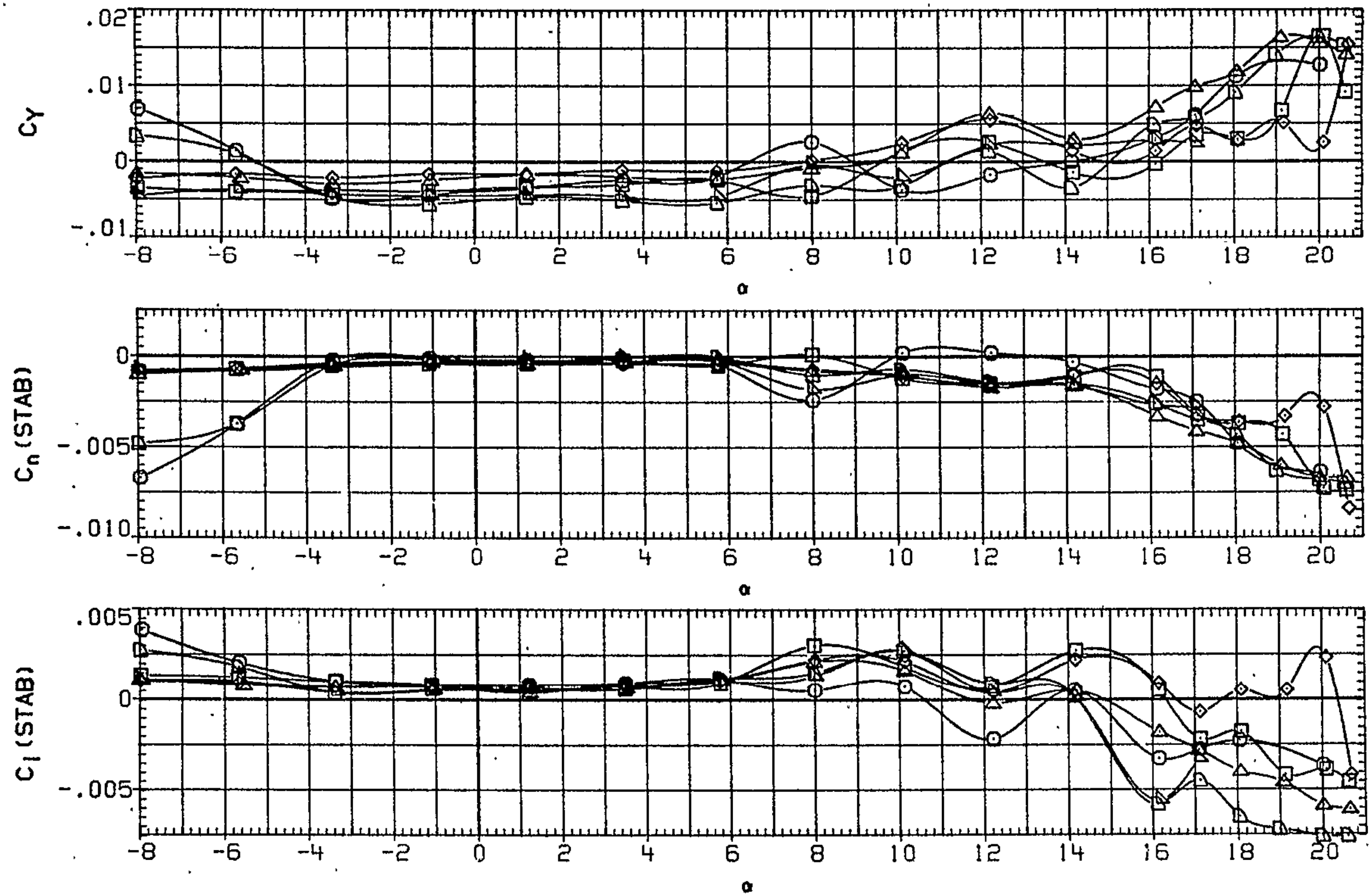

FIG. 5 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(C)RN/L = 19.54

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG028	○	W B N H6 V G	.280	.000	50.000	.000	.000
ZHG015	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG023	◇	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG022	△	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG024	◺	W B N H6 V U L C O I G	.280	.000	50.000	.000	.000

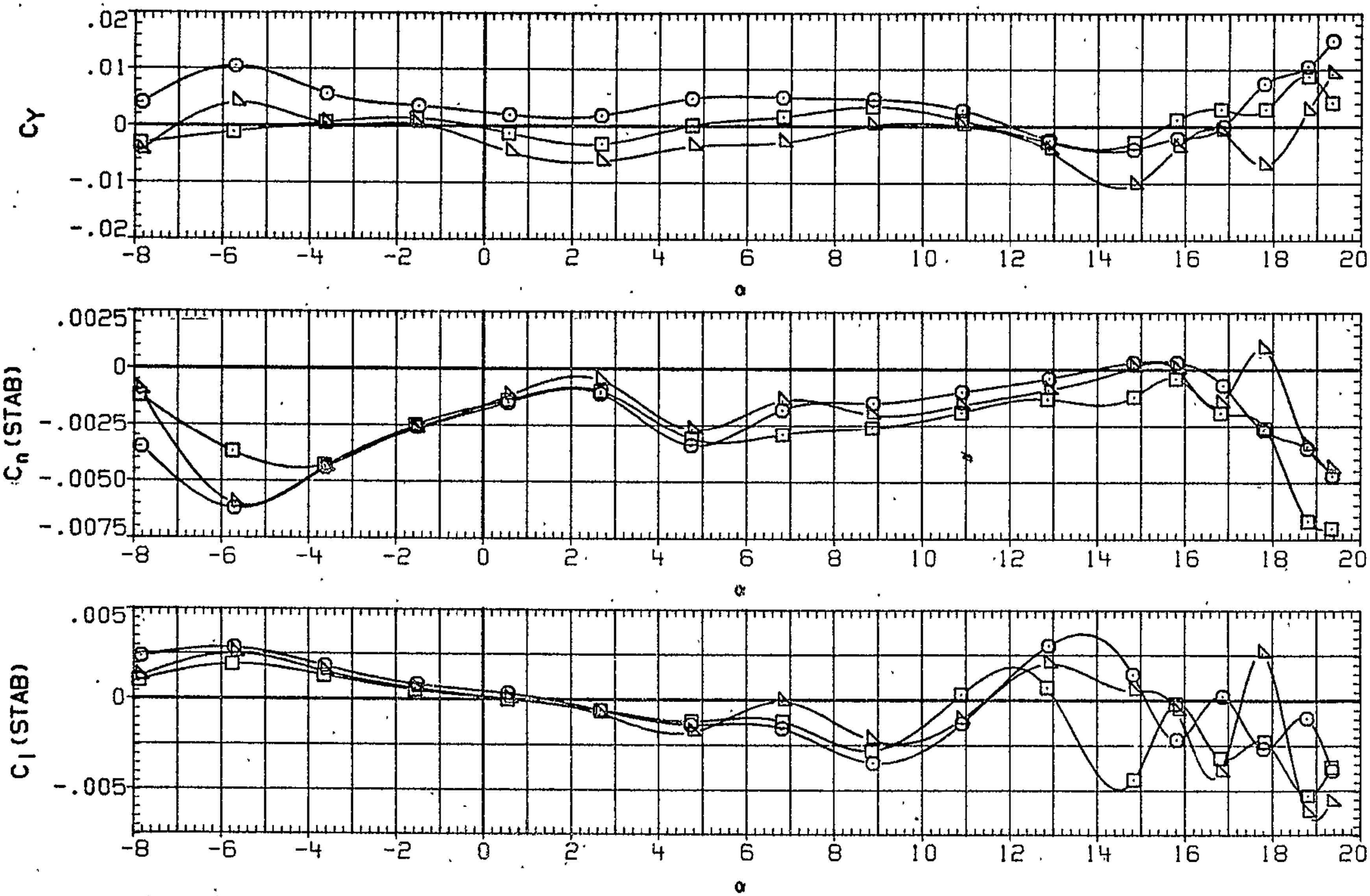

FIG. 5 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(A)RN/L = 6.37

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DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG028	○	W B N H6 V G	.280	.000	50.000	.000	.000
ZHG015	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG023	◇	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG022	△	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG024	◺	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000

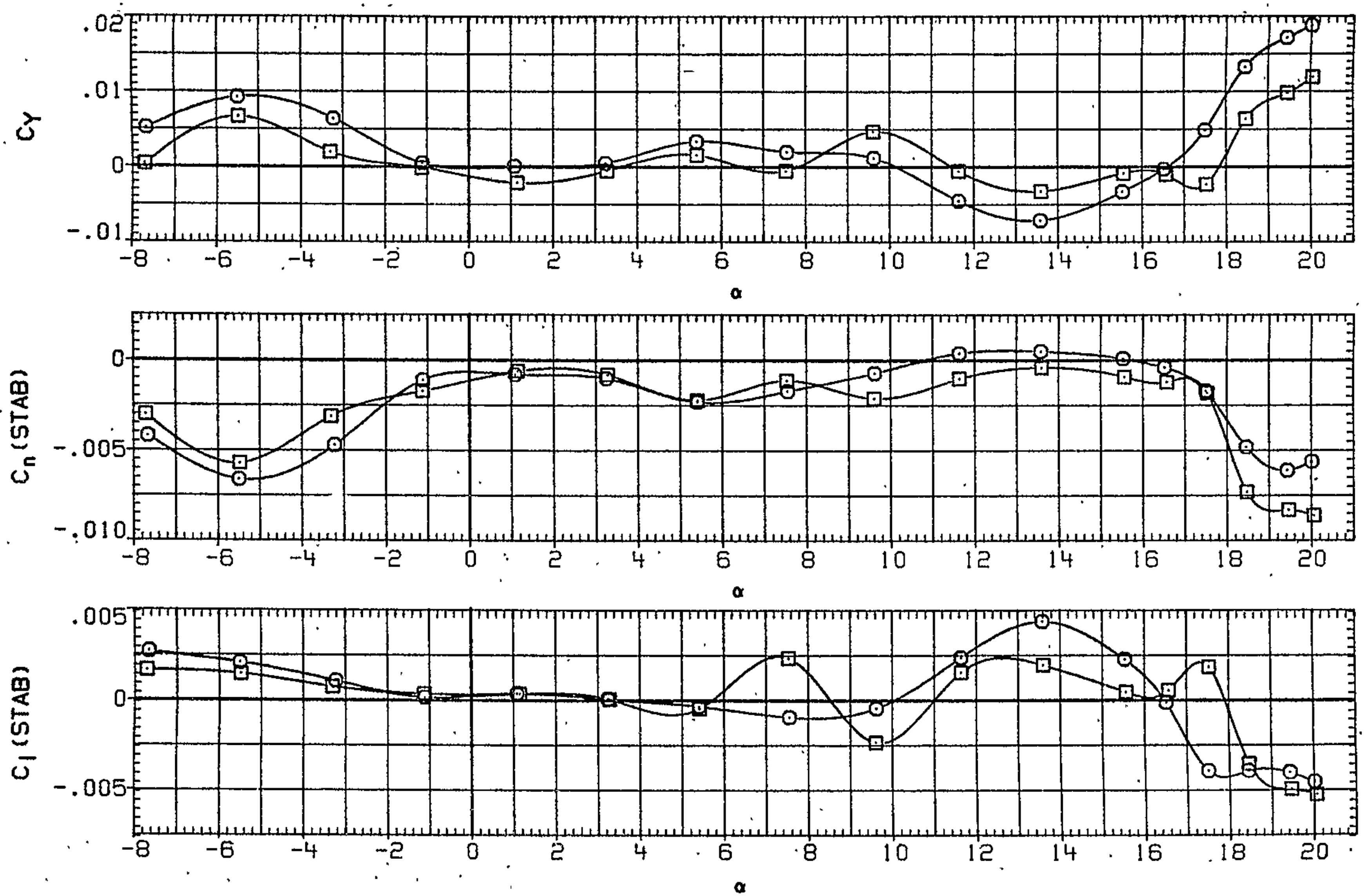

FIG. 5 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(B)RN/L = 12.95

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG028	○	W B N H6 V G	.280	.000	50.000	.000	.000
ZHG015	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG023	◇	W B N H6 V L C P E O I G	.280	.000	50.000	.000	.000
ZHG022	△	W B N H6 V L C O I G	.280	.000	50.000	.000	.000
ZHG024	◺	W B N H6 V U L C O I G	.280	.000	50.000	.000	.000

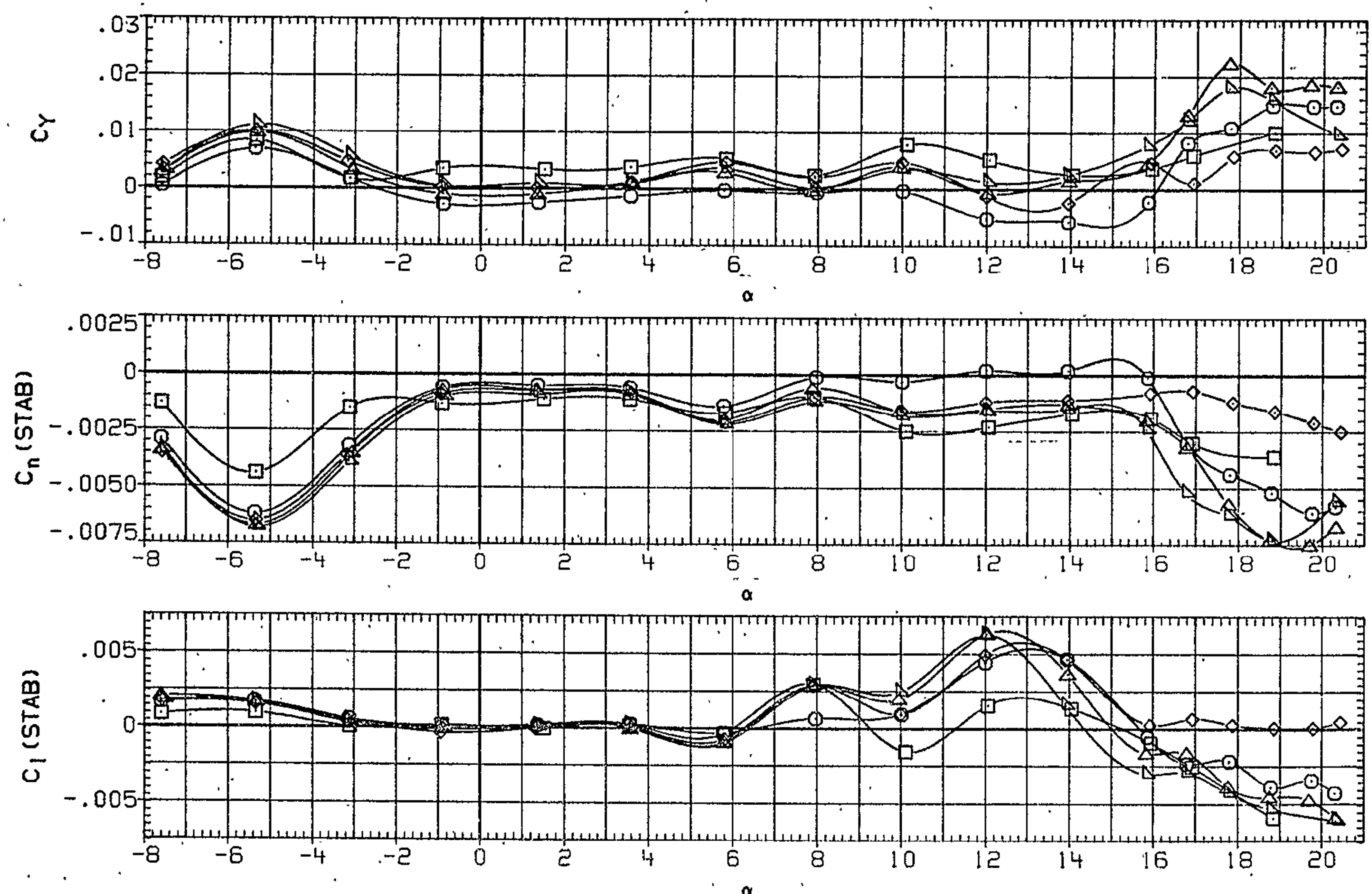

FIG. 5 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(C)RN/L = 16.42

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DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG028	○	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG015	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG023	◇	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG022	△	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG024	◺	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000

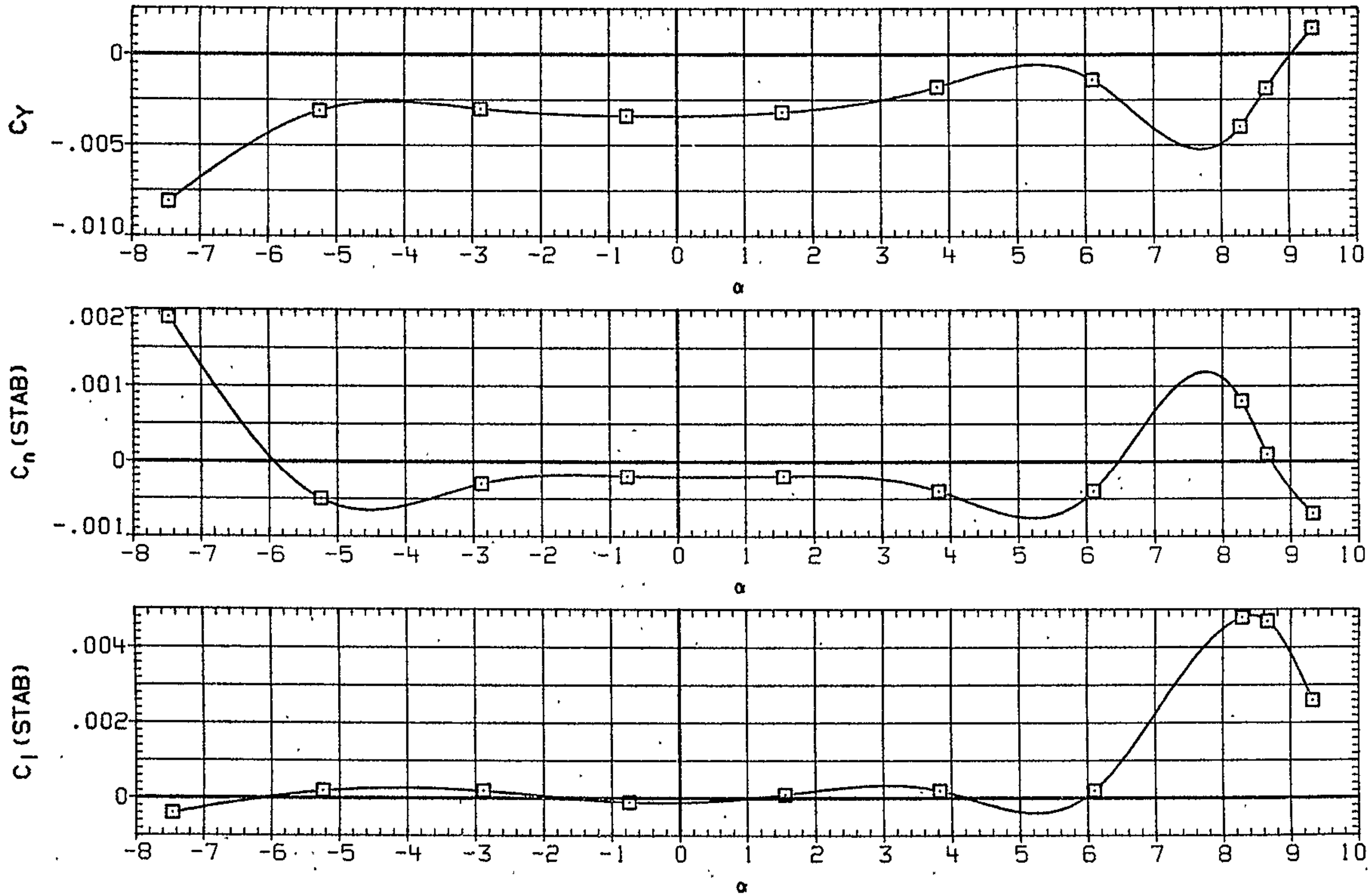

FIG. 5 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(D)RN/L = 19.54

DATA SET	SYMBOL	CONFIGURATION		MACH	BETA	FLAP	AILRON	RUDDER
ZHG028	○	W B N H6 V	G	.280	.000	50.000	.000	.000
ZHG026	□	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000
ZHG025	◇	W B N H6 V U L C	I G	.280	.000	50.000	.000	.000
ZHG027	△	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000
ZHG029	◺	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000

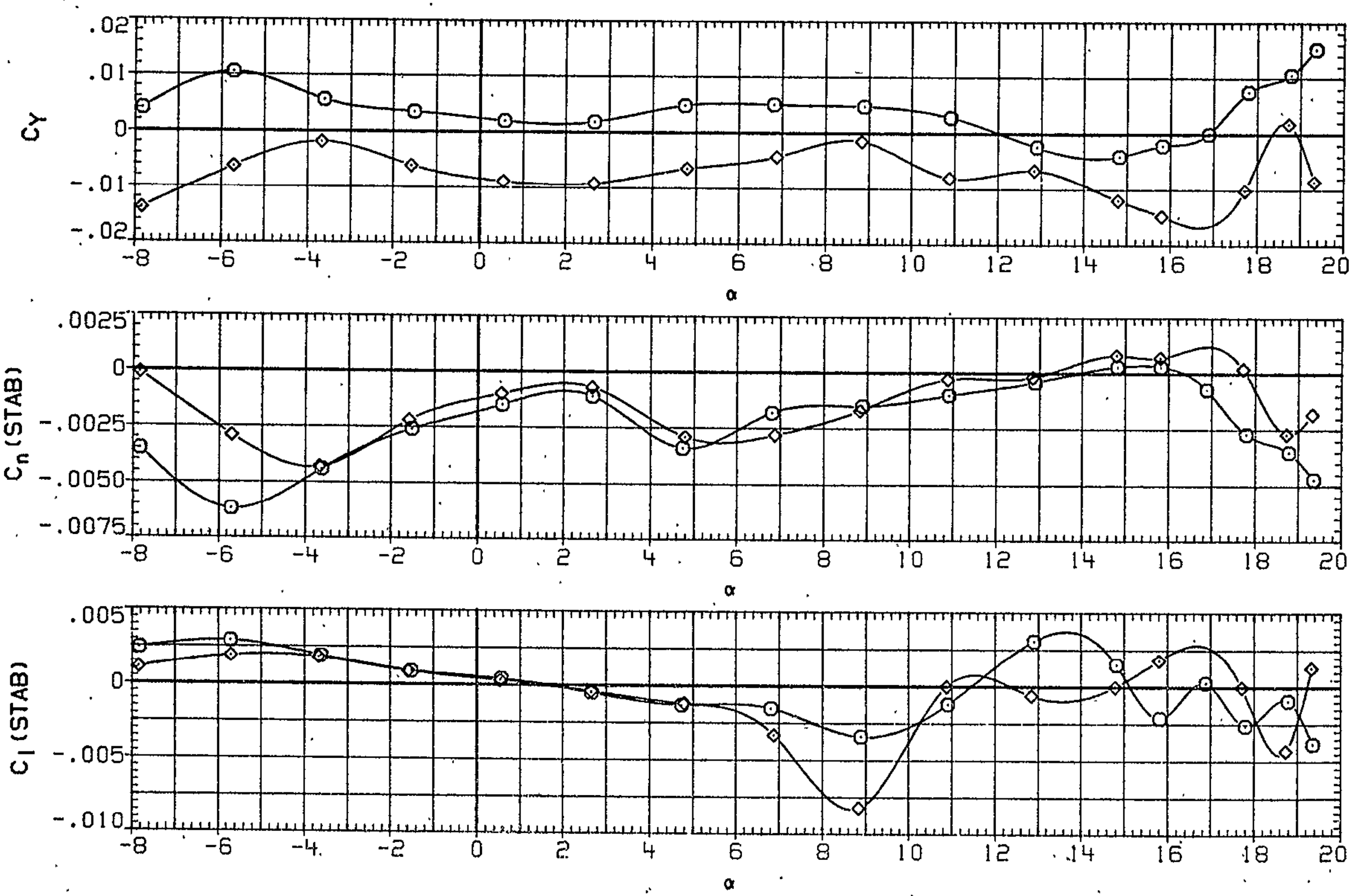

FIG. 5 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(A)RN/L = 6.37

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DATA SET	SYMBOL	CONFIGURATION		MACH	BETA	FLAP	AILRON	RUDDER
ZHG028	○	W B N H6 V	G	.280	.000	50.000	.000	.000
ZHG026	□	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000
ZHG025	◇	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000
ZHG027	△	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000
ZHG029	⊿	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000

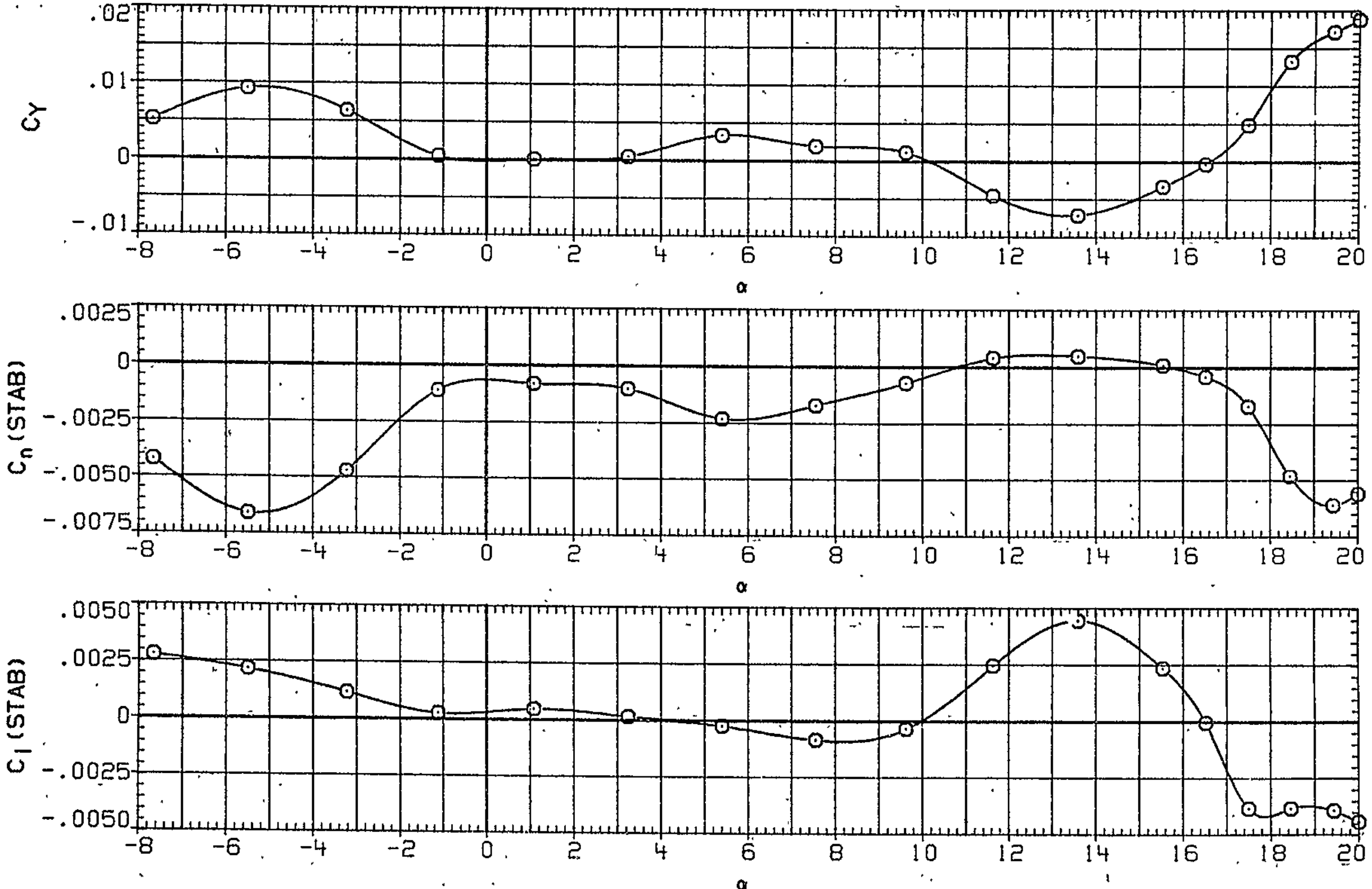

FIG. 5 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(B)RN/L = 12.95

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG028	○	W B N H6 V G	.280	.000	50.000	.000	.000
ZHG026	□	W B N H6 V U C O I G	.280	.000	50.000	.000	.000
ZHG025	◇	W B N H6 V U L C I G	.280	.000	50.000	.000	.000
ZHG027	△	W B N H6 V C O I G	.280	.000	50.000	.000	.000
ZHG029	◺	W B N H6 V O G	.280	.000	50.000	.000	.000

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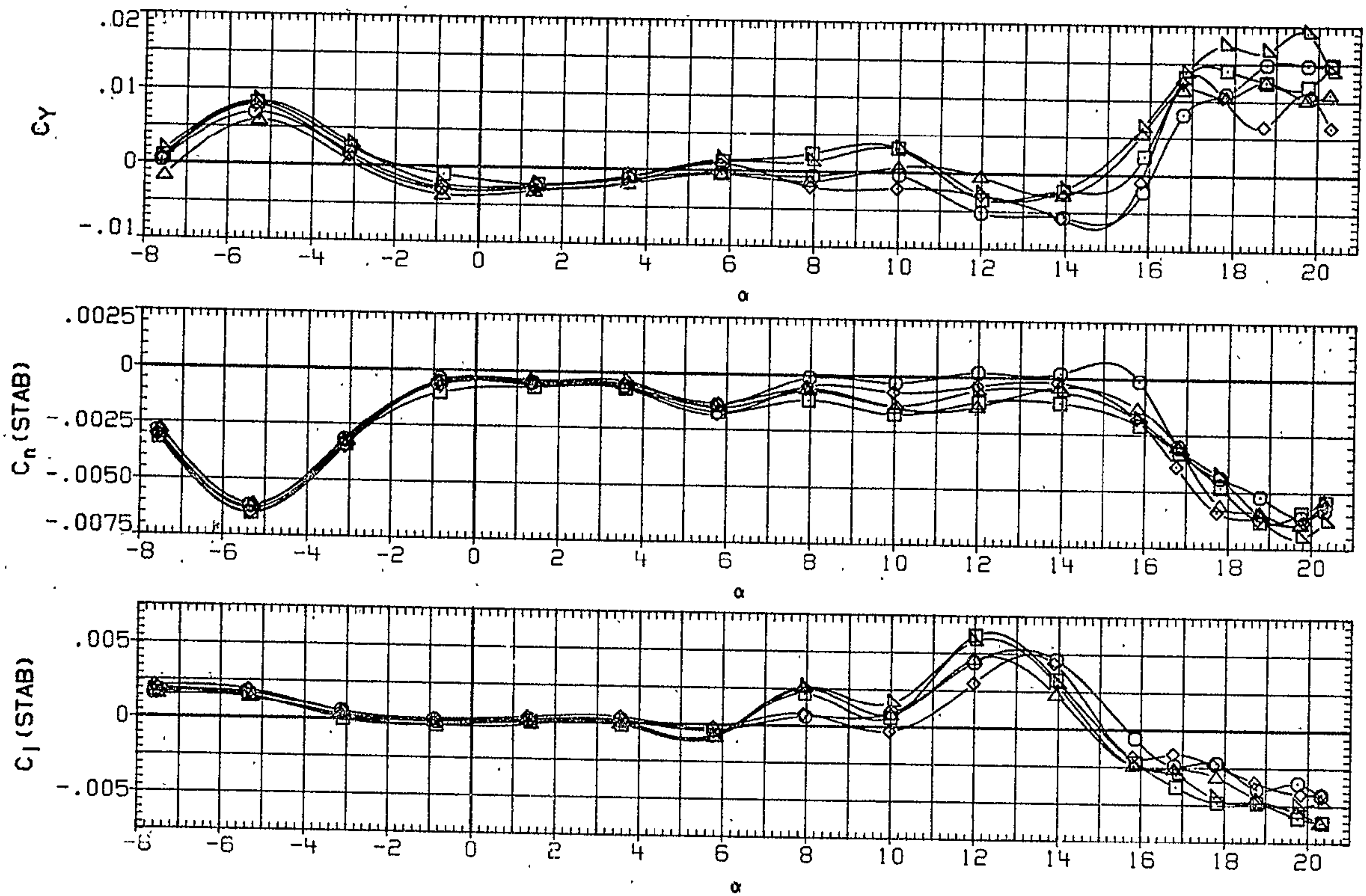

FIG. 5 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(C)RN/L = 16.42

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG099	○	W B N H6 V G	.280	-12.000	30.000	.000	.000
ZHG098	□	W B N H6 V U L C P E O I G	.280	-12.000	30.000	.000	.000

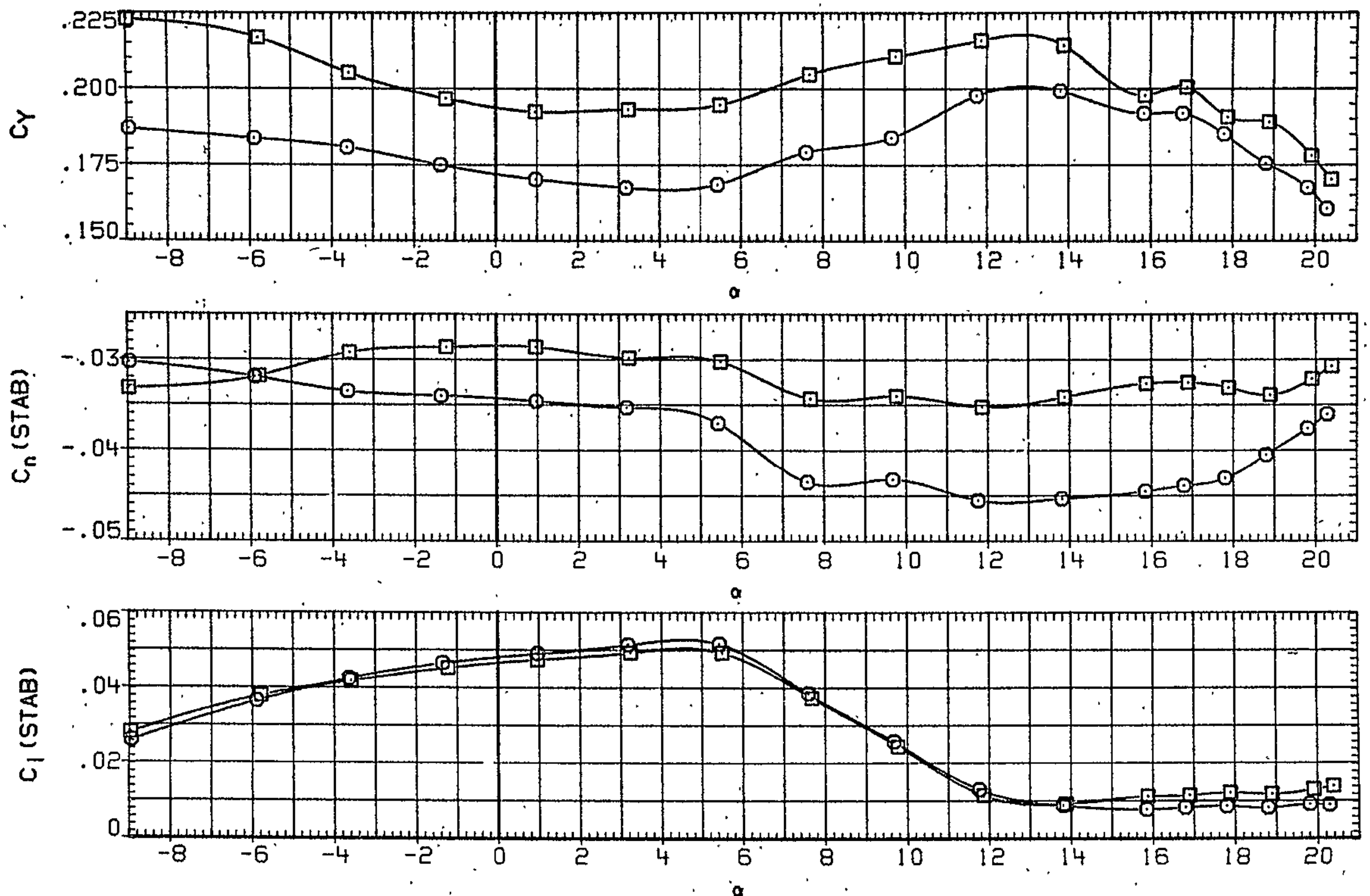

FIG. 5 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(A)RN/L = 14.62

DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG076	○	W B N H6 V	.280	6.000	.000	.000	.000
ZHG078	□	W B N H6 V U L C P E O I	.280	6.000	.000	.000	.000
ZHG077	◇	W B N H6 V L C P E O I	.280	6.000	.000	.000	.000

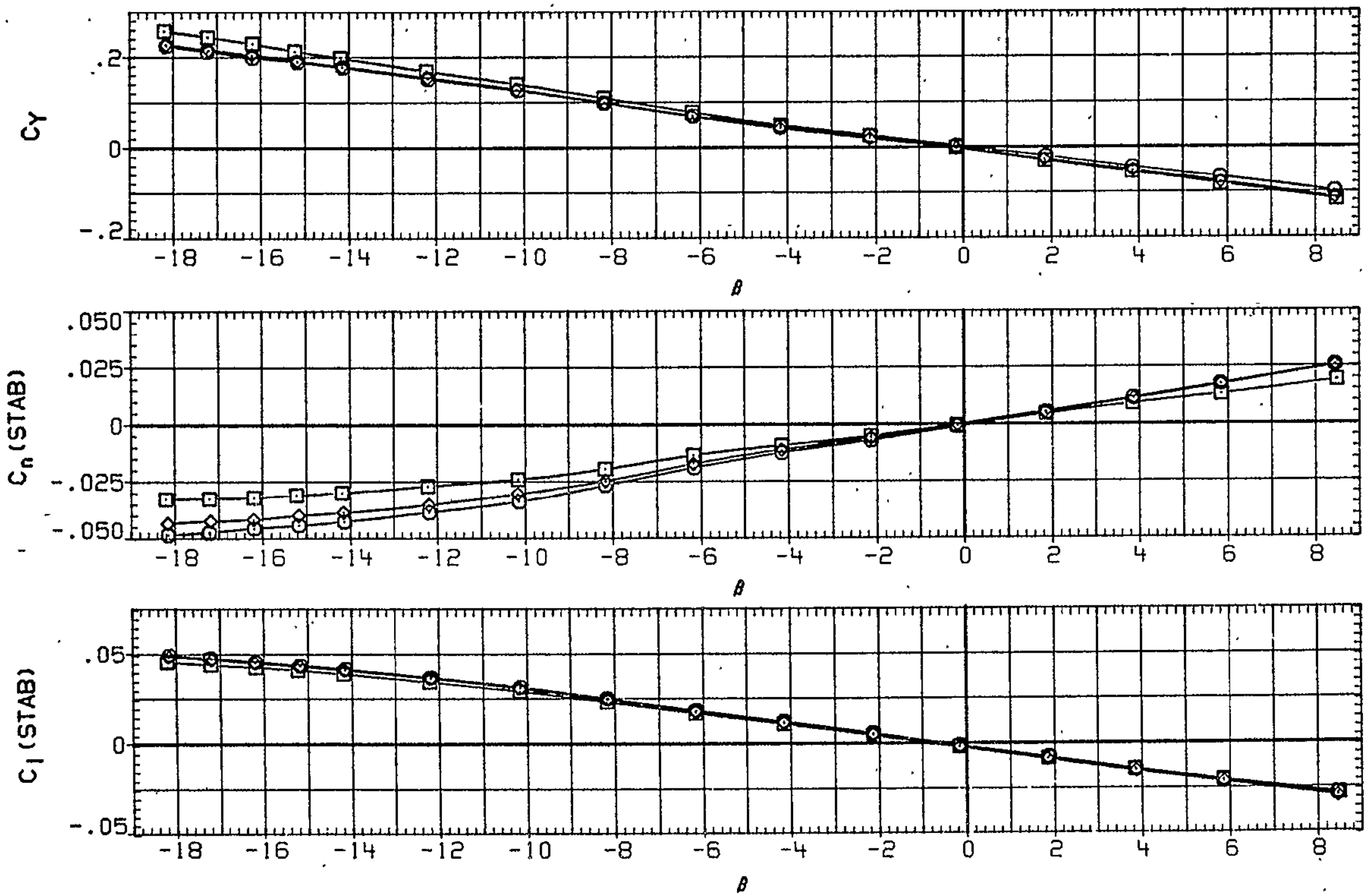

FIG. 6 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR UP

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(A)RN/L = 6.18

DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG046	○	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG035	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG038	◇	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG039	△	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG042	◺	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000

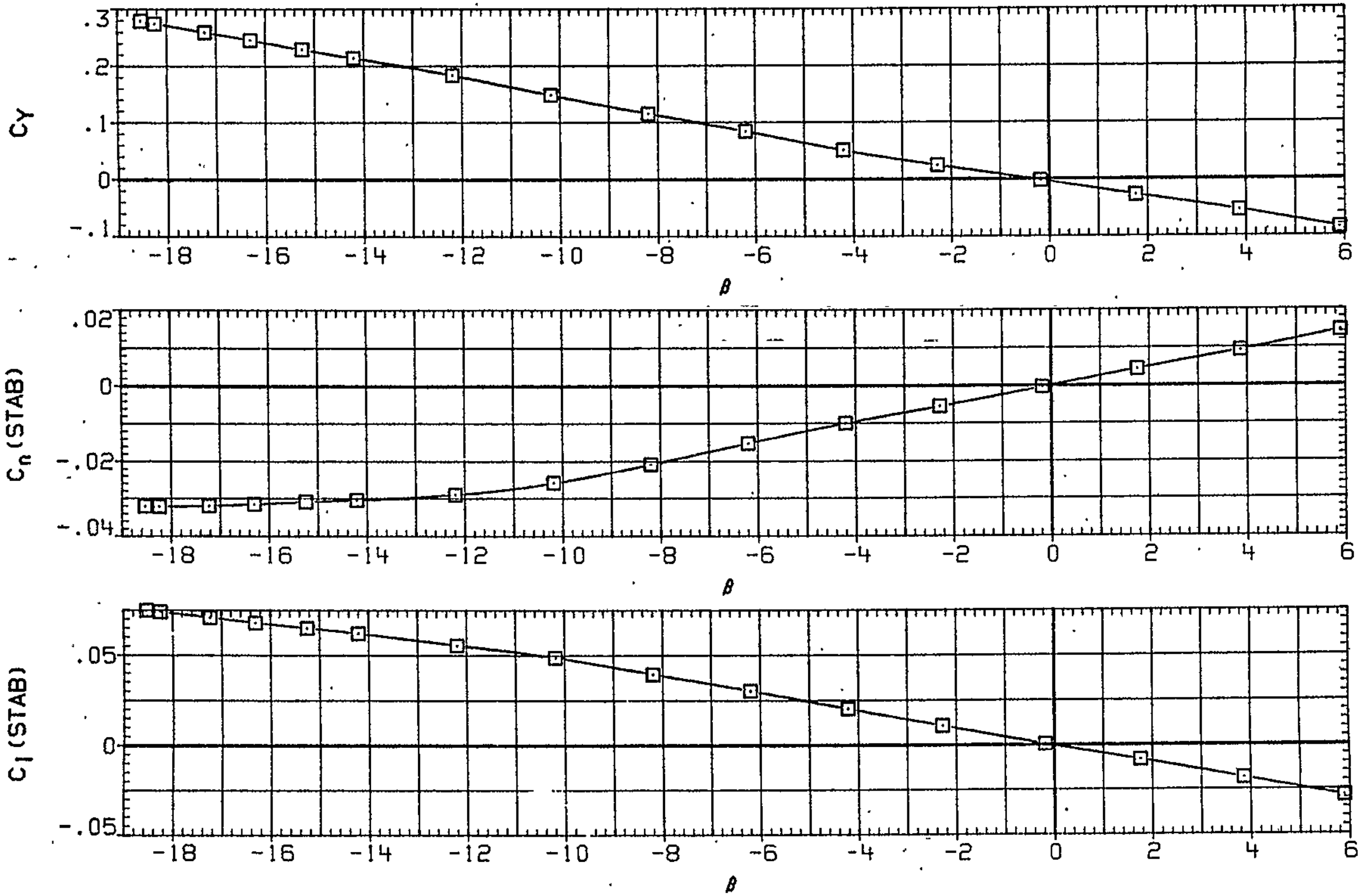

FIG. 7 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

(A)RN/L = 6.31

DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG046	○	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG035	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG038	◇	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG039	△	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG042	◺	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000

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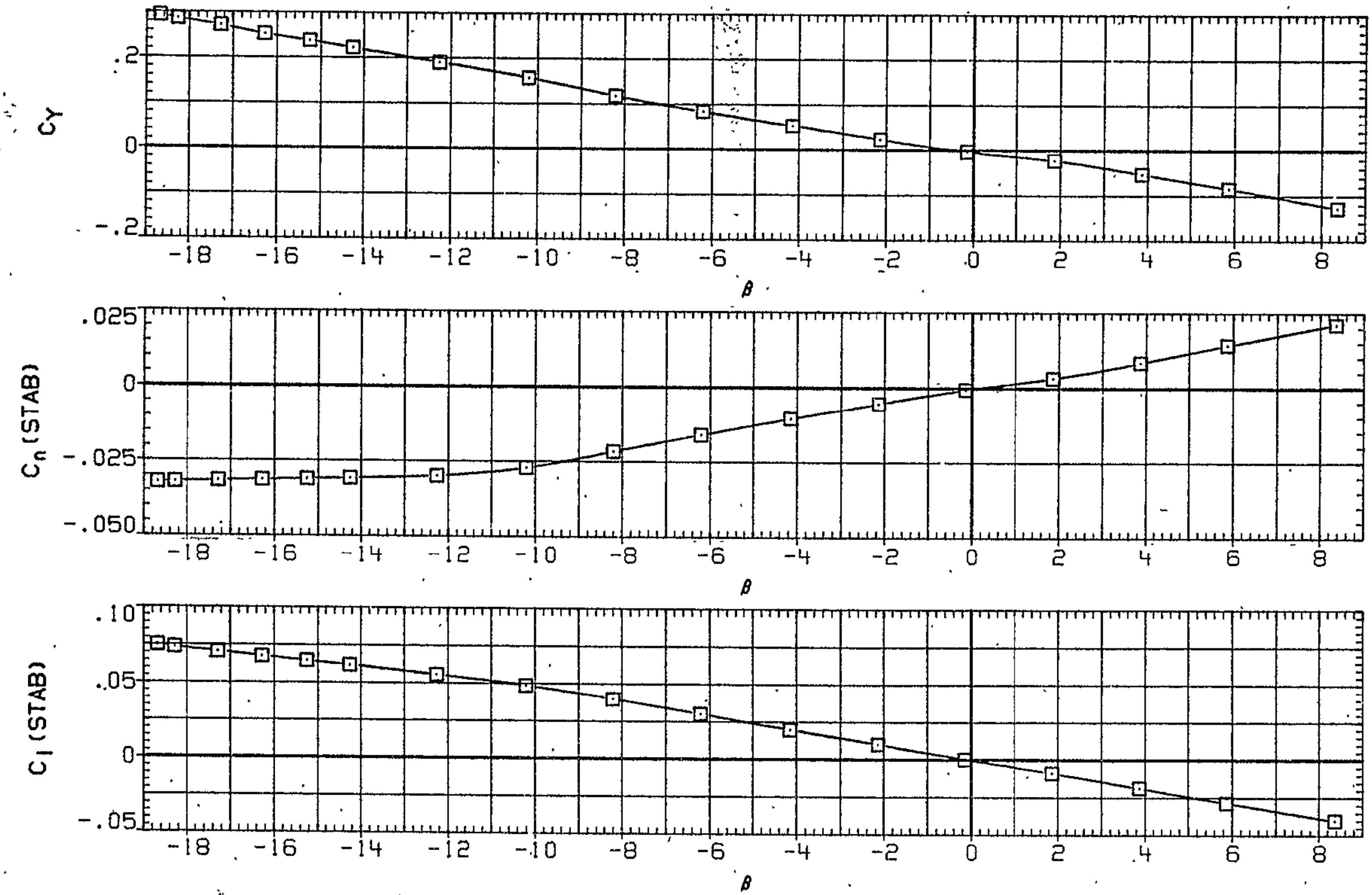

FIG. 7 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

(B)RN/L = 9.74

DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG046	○	W B N H6 V G	.280	.000	50.000	.000	.000
ZHG035	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG038	◇	W B N H6 V L C P E O I G	.280	.000	50.000	.000	.000
ZHG039	△	W B N H6 V L C O I G	.280	.000	50.000	.000	.000
ZHG042	◺	W B N H6 V U L C O I G	.280	.000	50.000	.000	.000

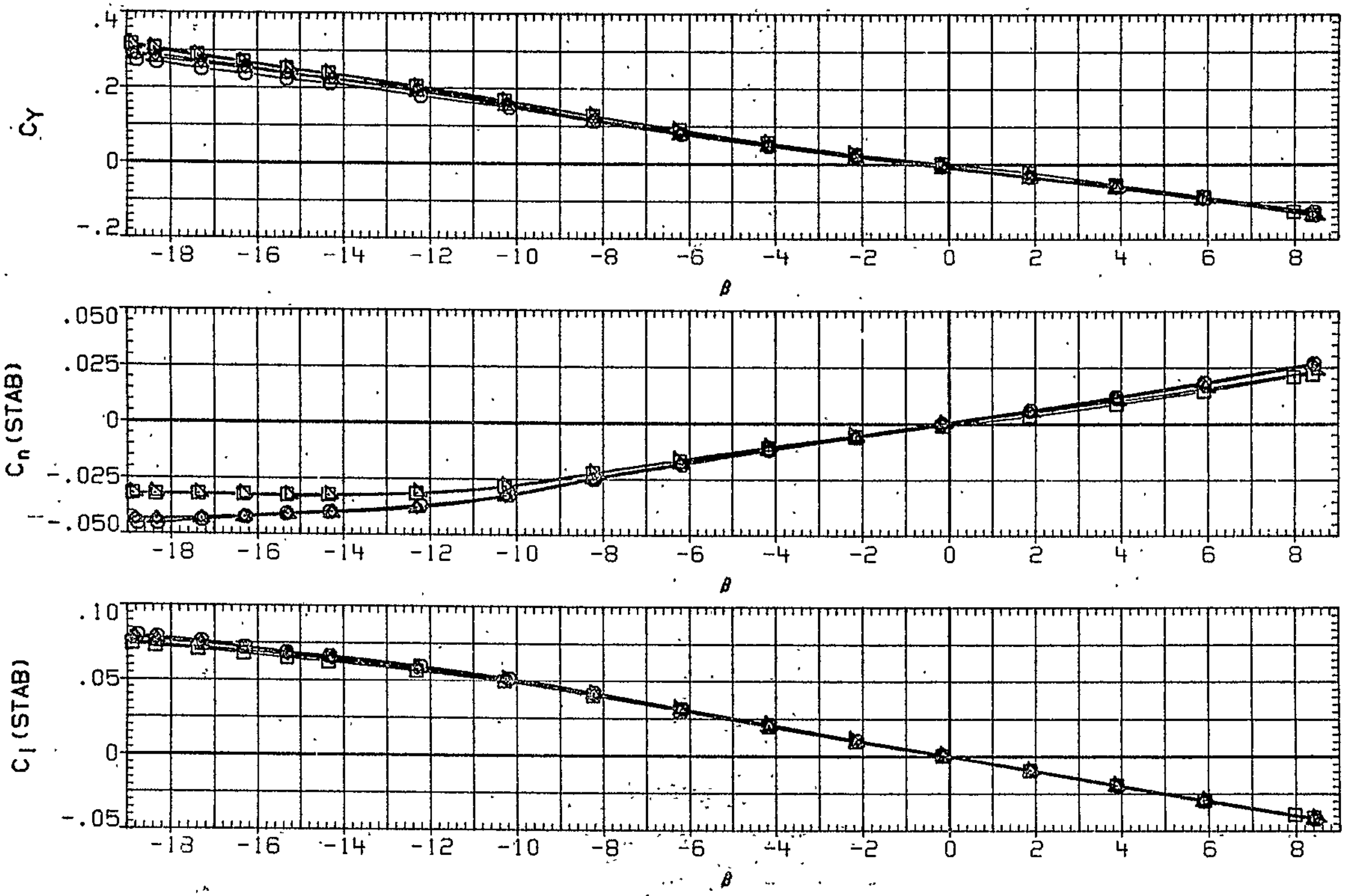

FIG. 7 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

(C)RN/L = 14.51

DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG046	○	W B N H6 V G	.280	.000	50.000	.000	.000
ZHG043	□	W B N H6 V U C O I G	.280	.000	50.000	.000	.000
ZHG057	◇	W B N H6 V C O I G	.280	.000	50.000	.000	.000
ZHG058	△	W B N H6 V O G	.280	.000	50.000	.000	.000
ZHG036	◺	W B N H6 U L C P E O I G	.280	.000	50.000	.000	.000

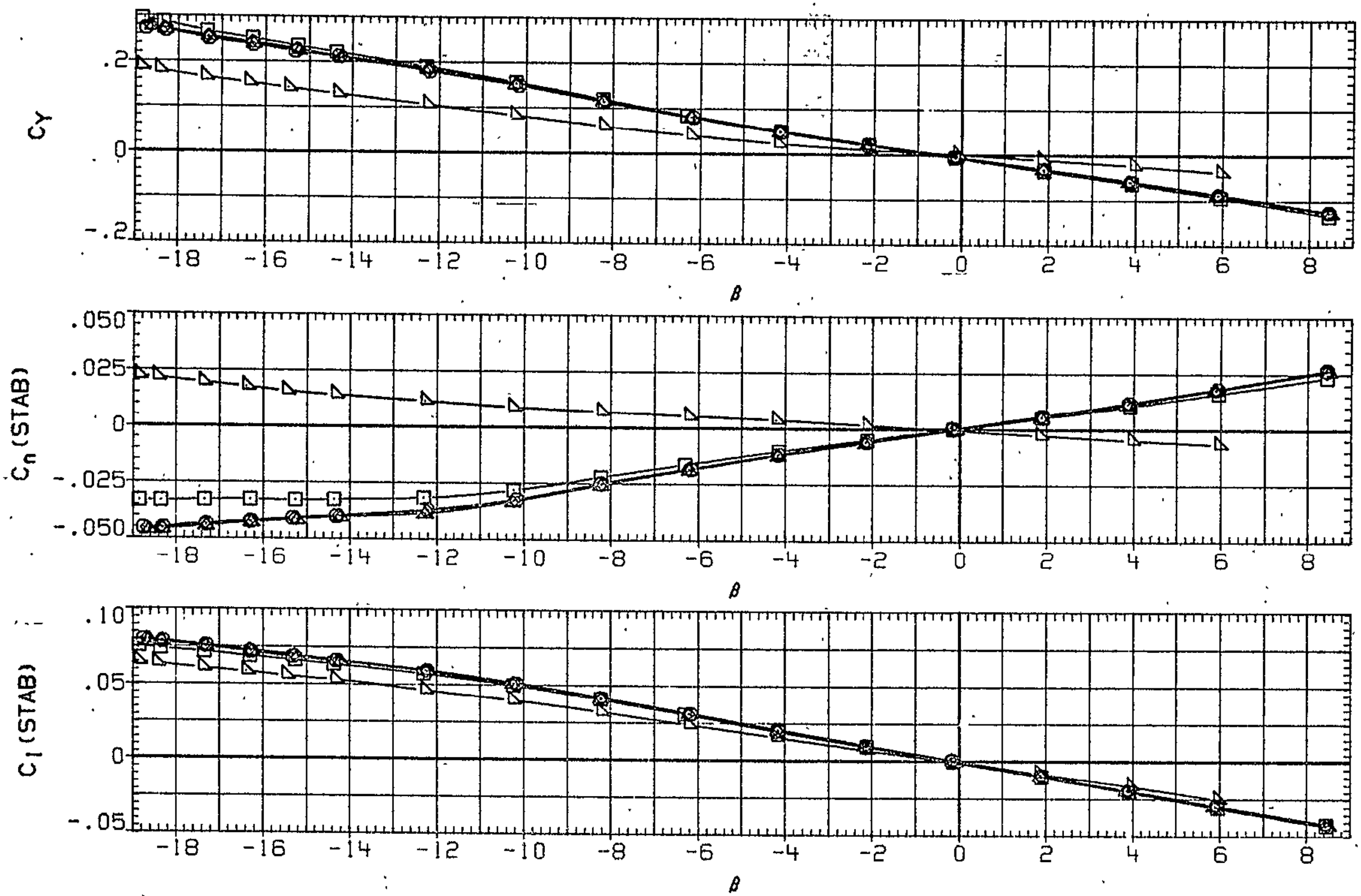

FIG. 7 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

(A)RN/L = 14.51

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DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG046	⊙	W B N H6 V G	.280	.000	50.000	.000	.000
ZHG040	□	W B N H6 L C O I G	.280	.000	50.000	.000	.000
ZHG041	◇	W B N H6 U L C O I G	.280	.000	50.000	.000	.000
ZHG044	△	W B N H6 U C O I G	.280	.000	50.000	.000	.000
ZHG045	◺	W B N H6 G	.280	.000	50.000	.000	.000

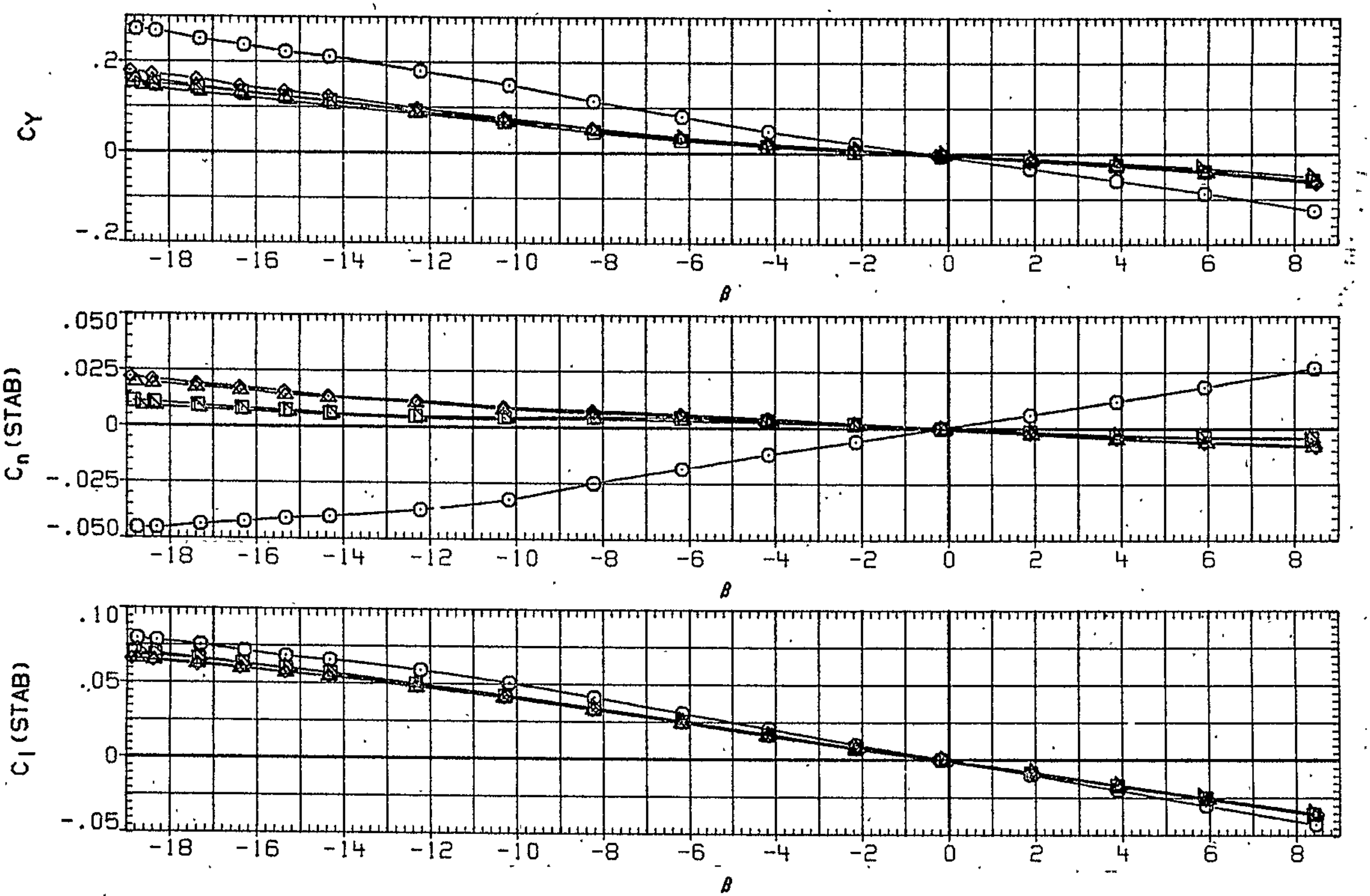

FIG. 7 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

(A)RN/L = 14.51

DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG067	○	W B N H6 V G	.280	.000	30.000	.000	.000
ZHG066	□	W B N H6 V U L C P E O I G	.280	.000	30.000	.000	.000
ZHG065	◇	W B N H6 V L C P E O I G	.280	.000	30.000	.000	.000
ZHG064	△	W B N H6 V L C O I G	.280	.000	30.000	.000	.000
ZHG063	◺	W B N H6 V U L C O I G	.280	.000	30.000	.000	.000
ZHG062	D	W B N H6 V U C O I G	.280	.000	30.000	.000	.000

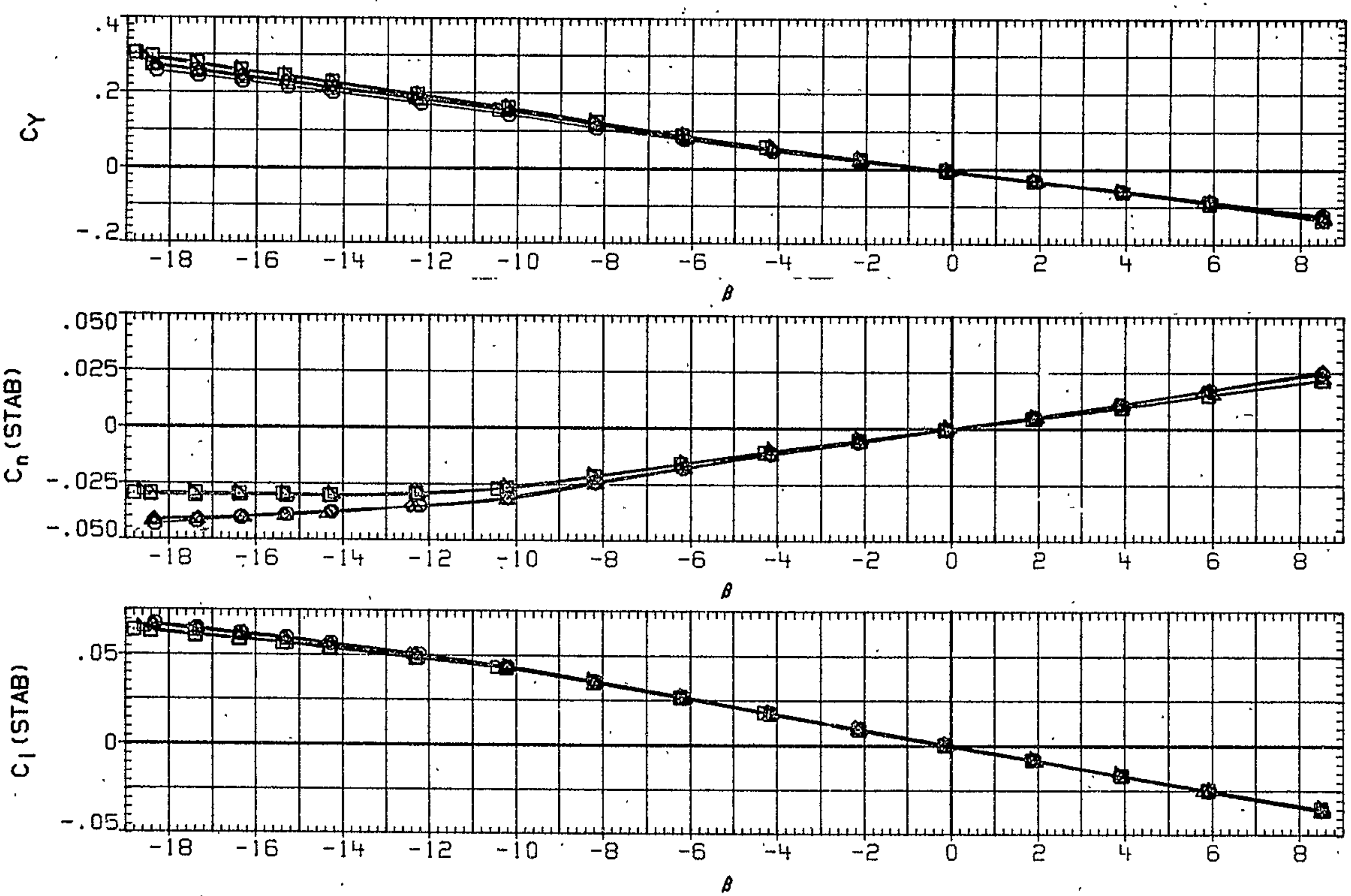

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FIG. 7 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

(A)RN/L = 14.68

DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG068	○	W B N H6 V G	.280	6.000	30.000	.000	.000
ZHG069	□	W B N H6 V U L C P E O I G	.280	6.000	30.000	.000	.000
ZHG070	◇	W B N H6 V L C P E O I G	.280	6.000	30.000	.000	.000

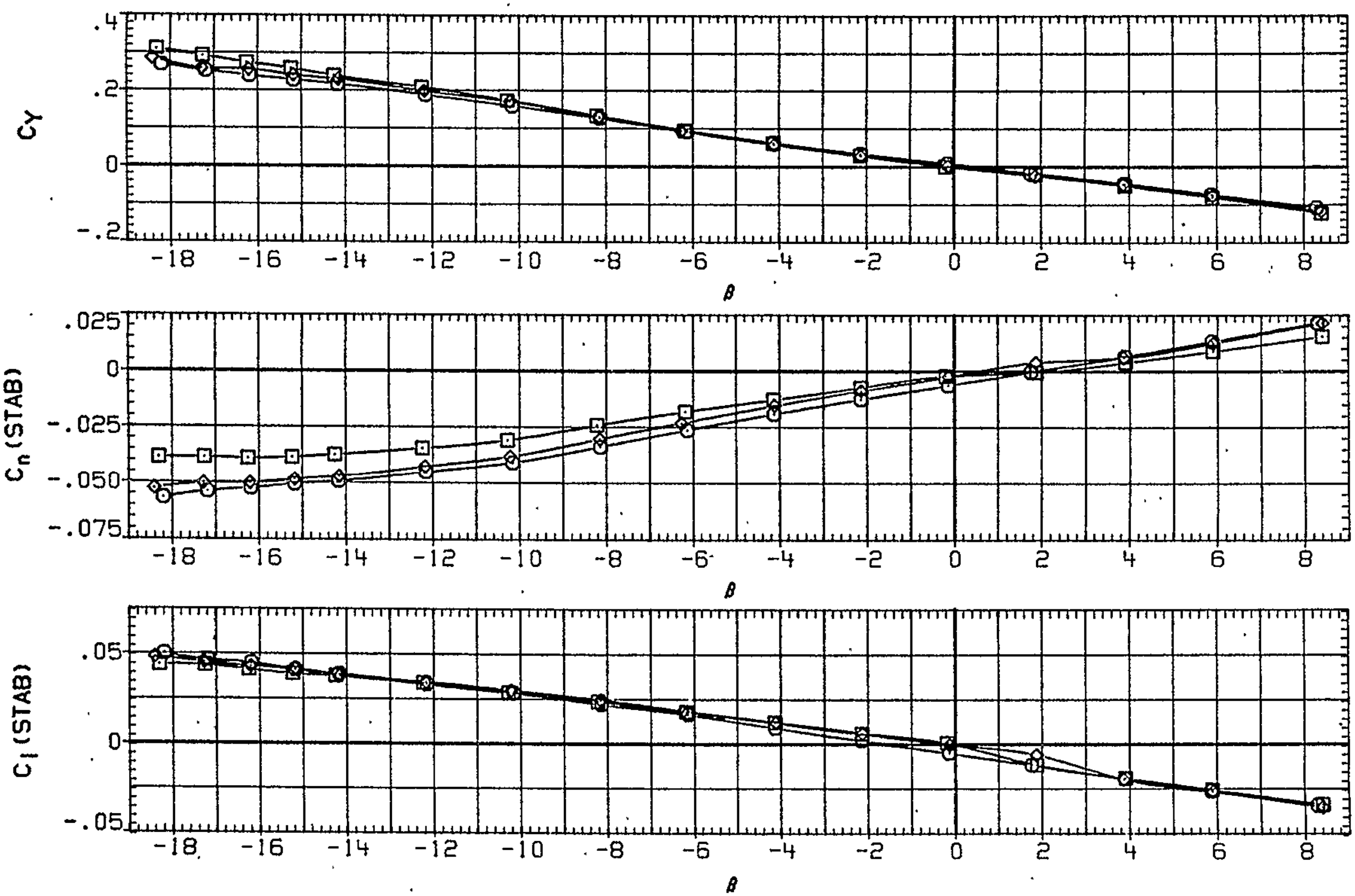

FIG. 7 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

(A)RN/L = 13.04

DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG075	○	W B N H6 V G	.280	6.000	50.000	.000	.000
ZHG072	□	W B N H6 V U L C P E O I G	.280	6.000	50.000	.000	.000
ZHG071	◇	W B N H6 V L C P E O I G	.280	6.000	50.000	.000	.000
ZHG073	△	W B N H6 U L C P E O I G	.280	6.000	50.000	.000	.000
ZHG074	◺	W B N H6 G	.280	6.000	50.000	.000	.000

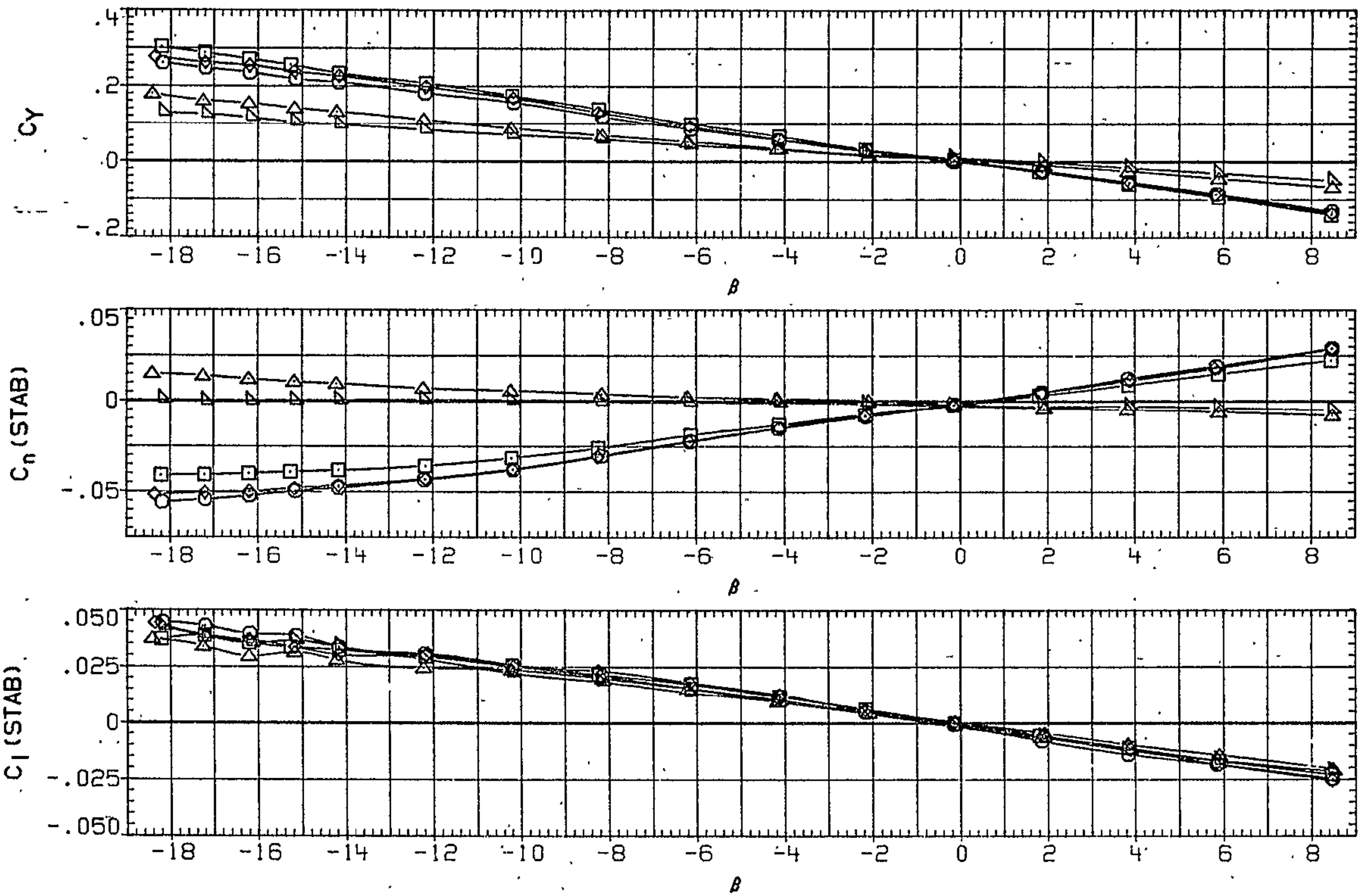

FIG. 7 LATERAL-DIRECTIONAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

(A)RN/L = 6.11

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DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG004	○	W B N H6 V	.280	.000	.000	.000	.000
ZHG001	□	W B N H0 V	.280	.000	.000	.000	.000
ZHG002	◇	W B N H0 V U L C P E O I	.280	.000	.000	.000	.000
ZHG003	△	W B N H6 V U L C P E O I	.280	.000	.000	.000	.000

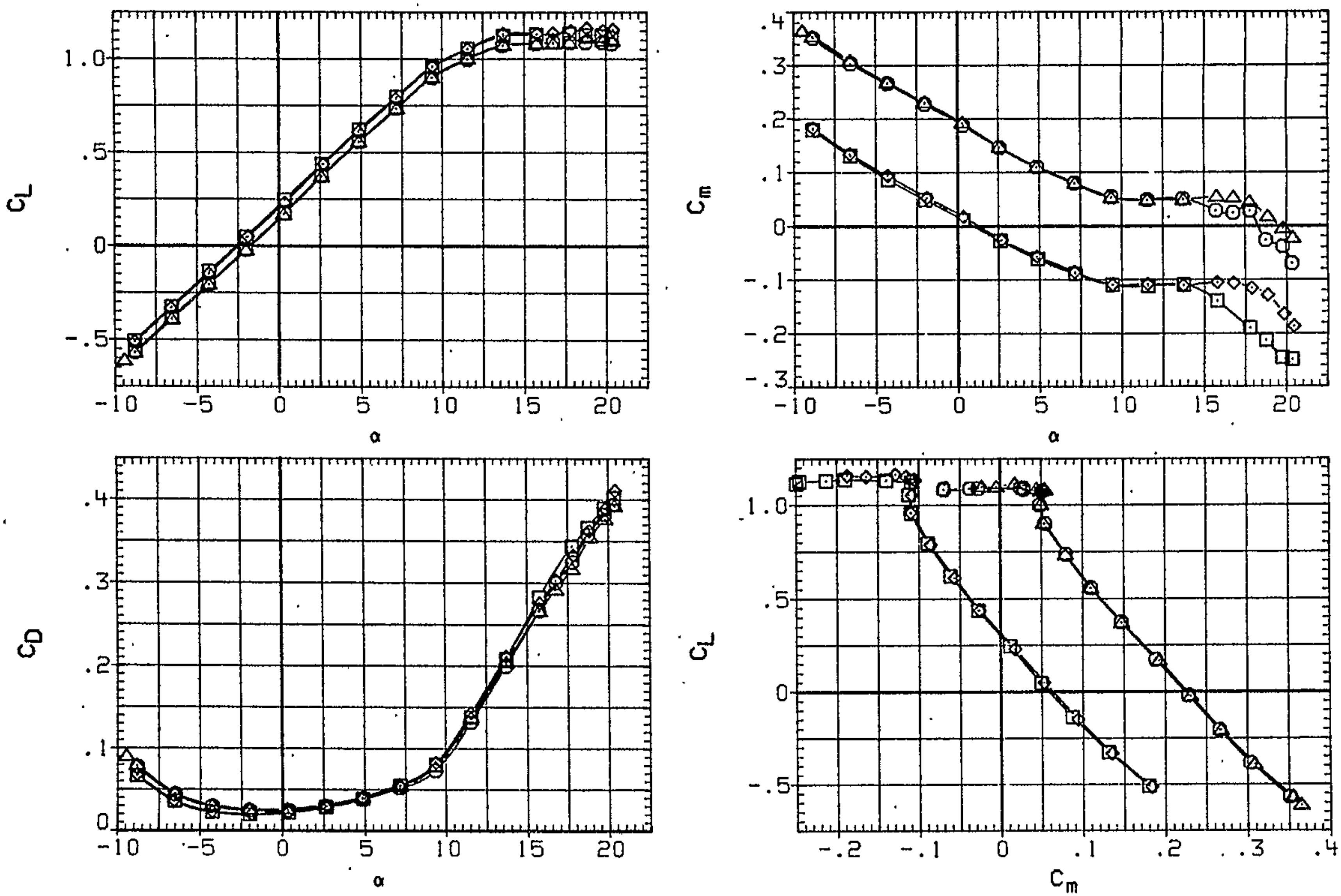

FIG. 8 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

(A)RN/L = 19.69

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG005	○	W B N H6 V	.280	.000	30.000	.000	.000
ZHG008	□	W B N H6 V U L C P E O I	.280	.000	30.000	.000	.000
ZHG009	◇	W B N H6 V L C P E O I	.280	.000	30.000	.000	.000
ZHG012	△	W B N H6 V L C O I	.280	.000	30.000	.000	.000

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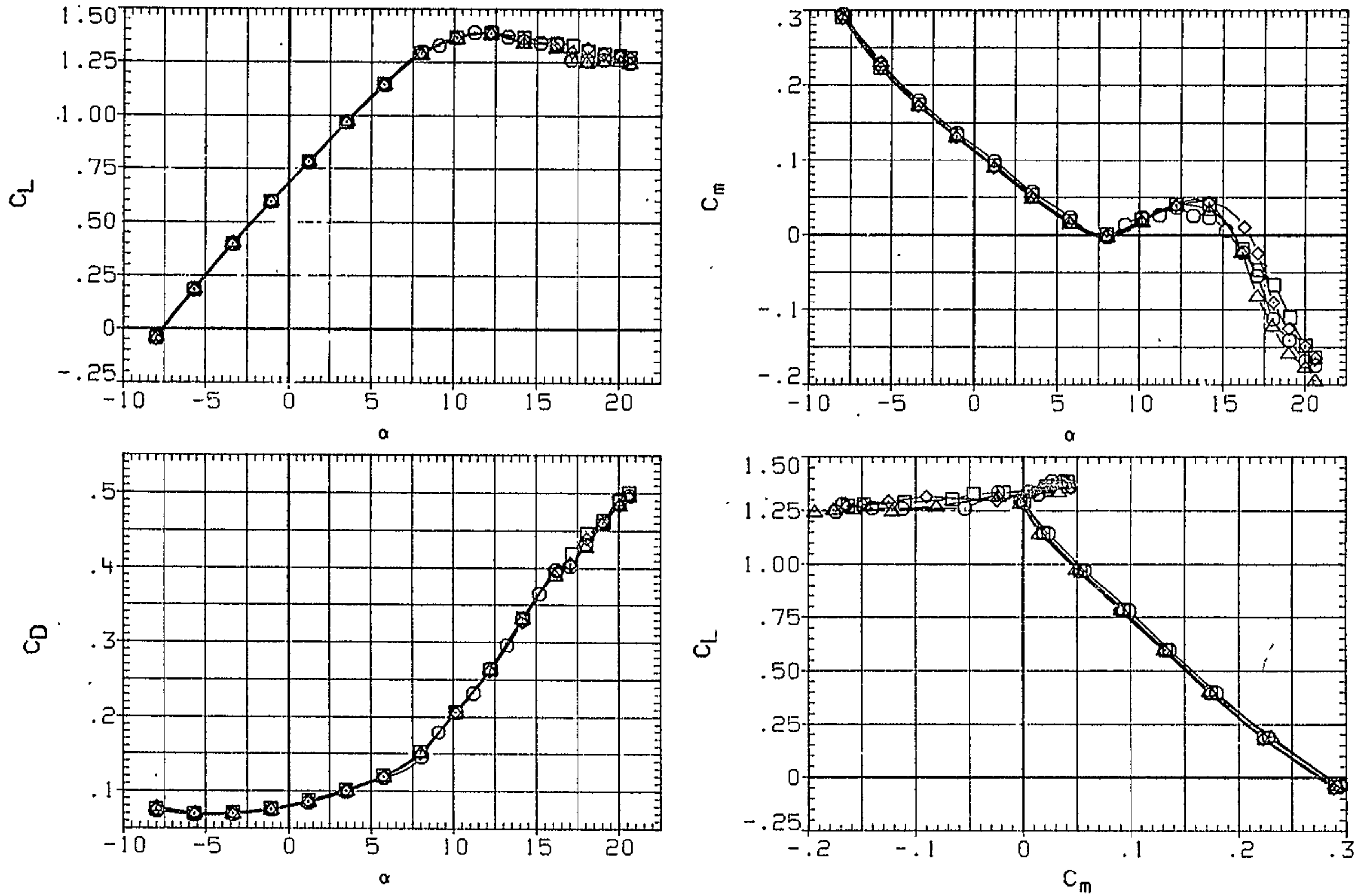

FIG. 8 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

(A)RN/L = 19.69

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG030	○	W B N H6 V	.280	.000	50.000	.000	.000
ZHG017	□	W B N H6 V U L C P E O I	.280	.000	50.000	.000	.000
ZHG020	◇	W B N H6 V L C P E O I	.280	.000	50.000	.000	.000
ZHG021	△	W B N H6 V L C O I	.280	.000	50.000	.000	.000
ZHG018	◺	W B N H6 V U L C P E I	.280	.000	50.000	.000	.000
ZHG019	D	W B N H6 V U L C P O I	.280	.000	50.000	.000	.000

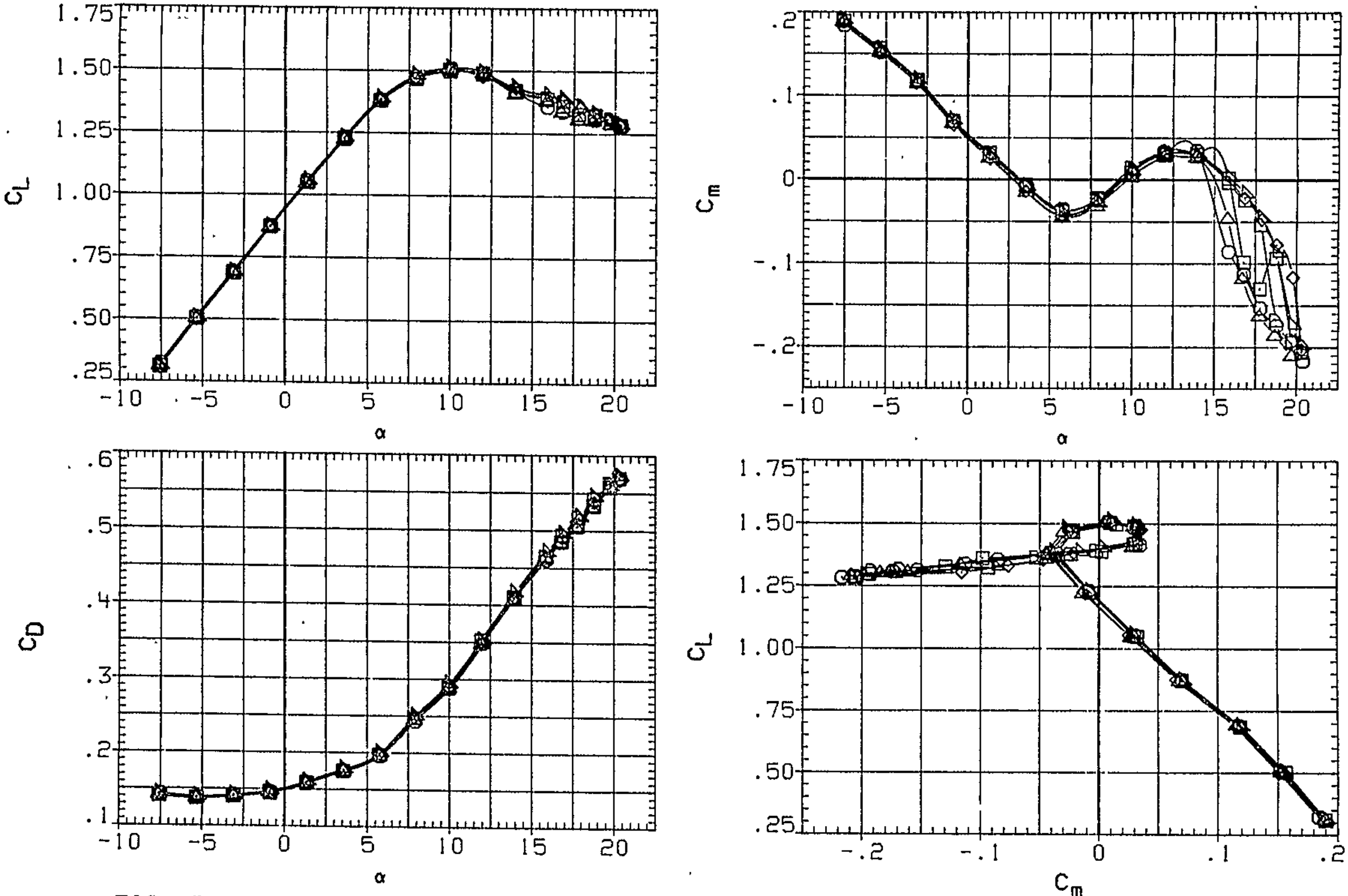

FIG. 8 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

(A)RN/L = 16.40

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG082	○	W B N H6 V	.280	-6.000	50.000	.000	.000
ZHG079	□	W B N H6 V U L C P E O I	.280	-6.000	50.000	.000	.000
ZHG080	◇	W B N H6 V L C P E O I	.280	-6.000	50.000	.000	.000
ZHG081	△	W B N H6 V U C O I	.280	-6.000	50.000	.000	.000

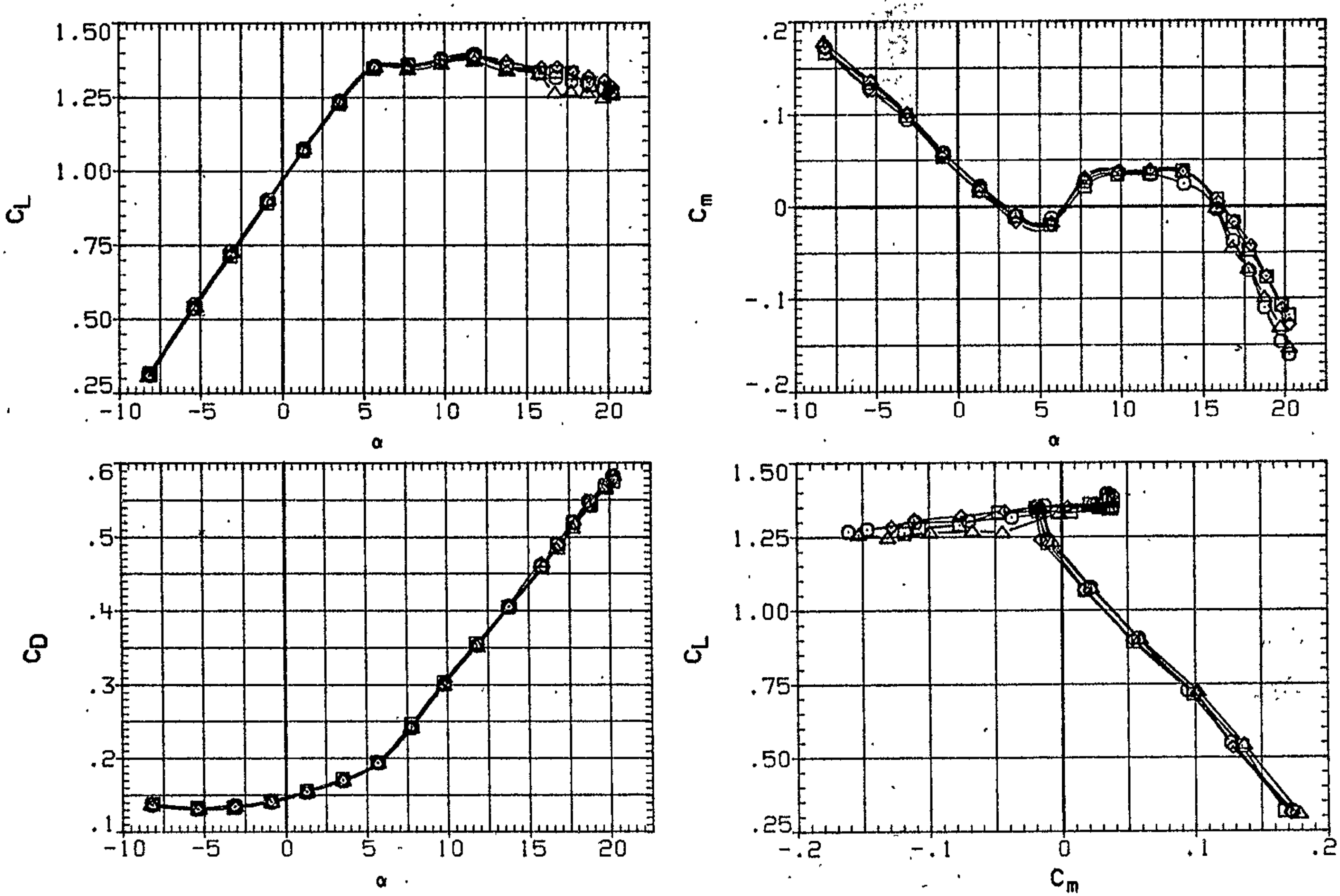

FIG. 8 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

(A)RN/L = 14.75

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DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG083	○	W B N H6 V	.280	-6.000	50.000	-20.000	-10.000
ZHG086	□	W B N H6 V U L C P E O I	.280	-6.000	50.000	-20.000	-10.000
ZHG085	◇	W B N H6 V L C P E O I	.280	-6.000	50.000	-20.000	-10.000
ZHG084	△	W B N H6 V U C O I	.280	-6.000	50.000	-20.000	-10.000

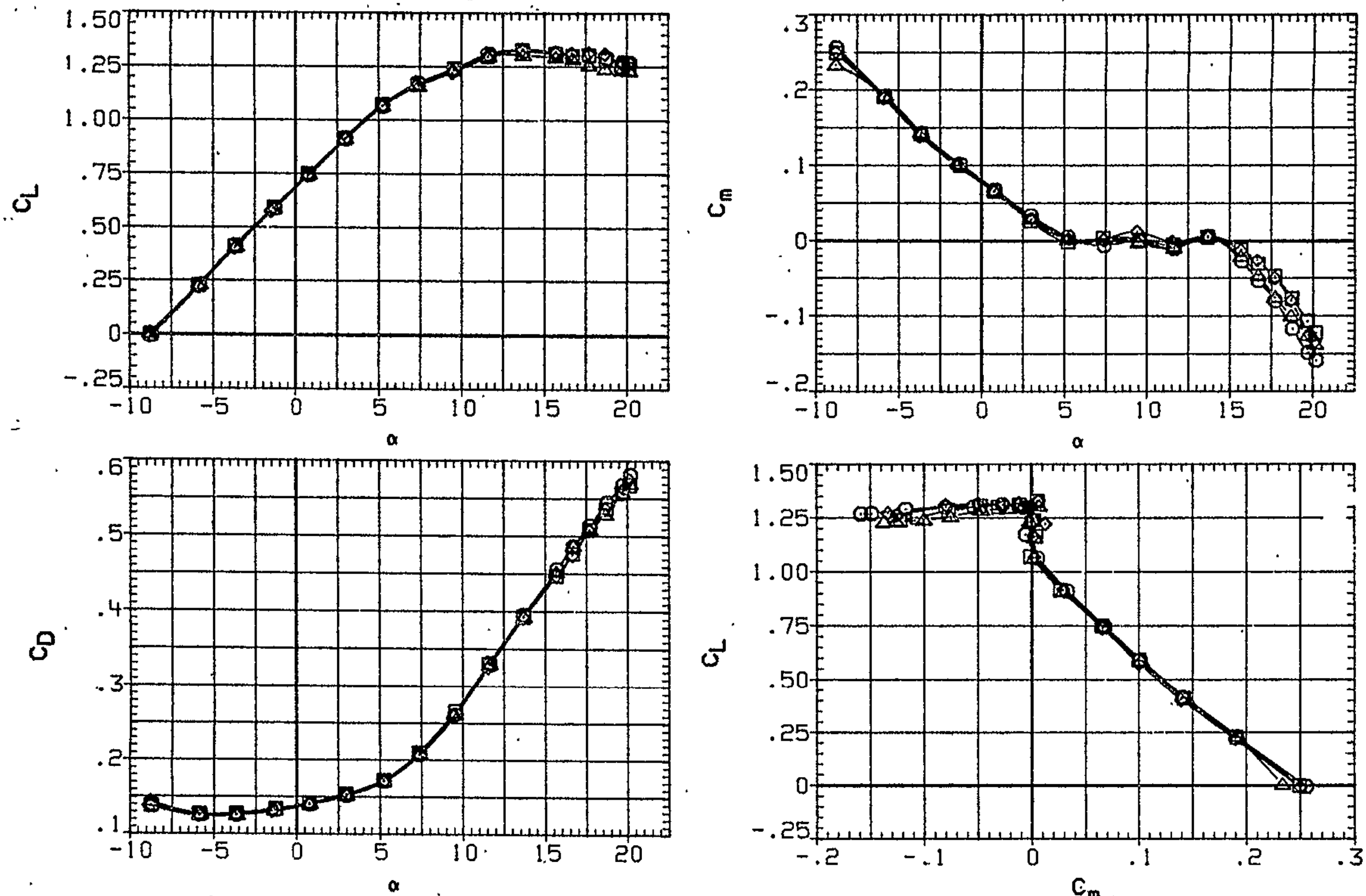

FIG. 8 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

(A)RN/L = 14.78

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG090	○	W B N H6 V	.280	-12.000	50.000	-20.000	-10.000
ZHG087	□	W B N H6 V U L C P E O I	.280	-12.000	50.000	-20.000	-10.000
ZHG088	◇	W B N H6 V L C P E O I	.280	-12.000	50.000	-20.000	-10.000
ZHG089	△	W B N H6 V U C O I	.280	-12.000	50.000	-20.000	-10.000

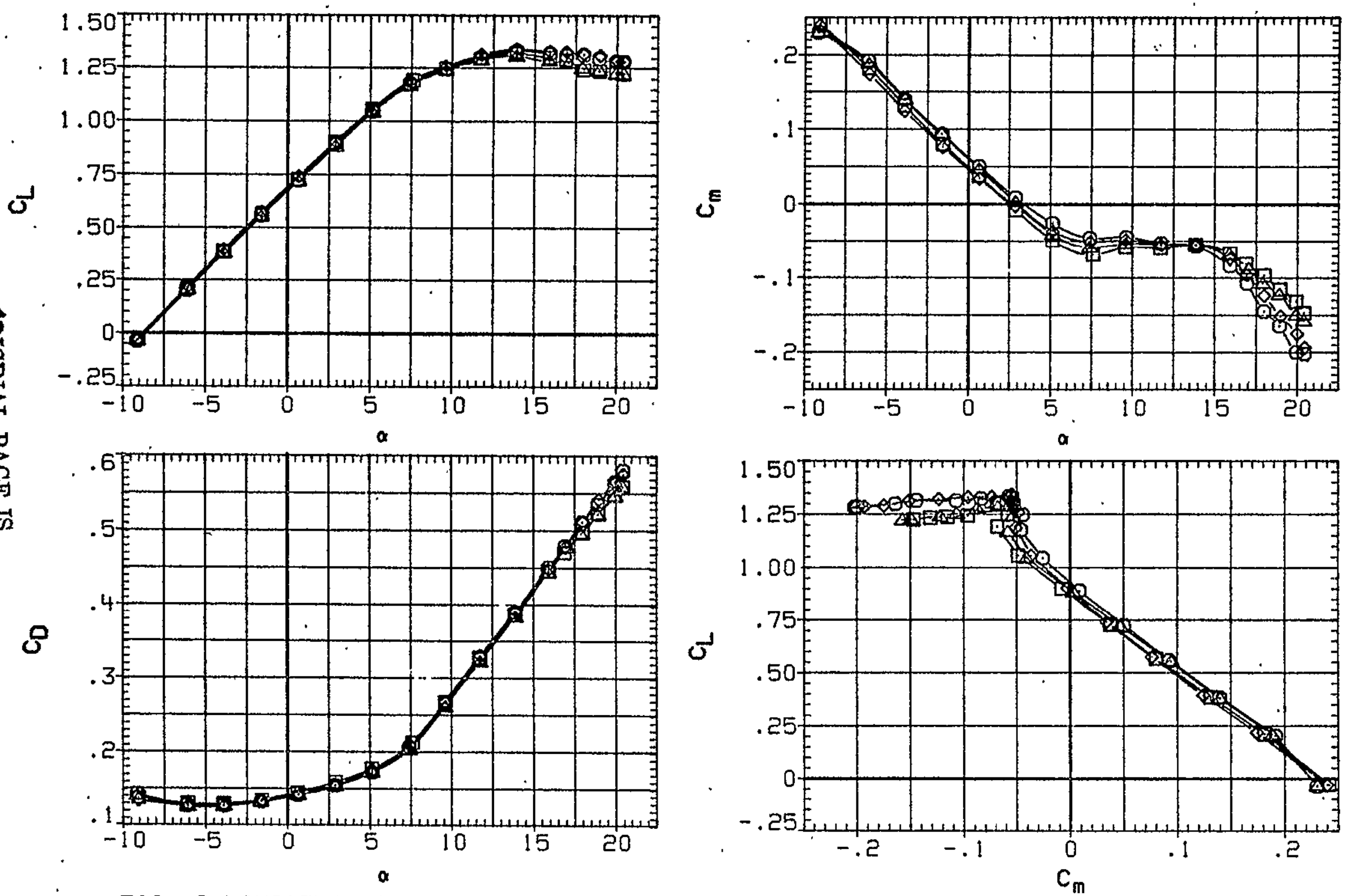

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FIG. 8 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

(A)RN/L = 14.78

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG091	○	W B N H6 V	.280	-12.000	50.000	.000	.000
ZHG094	□	W B N H6 V U L C P E O I	.280	-12.000	50.000	.000	.000
ZHG093	◇	W B N H6 V L C P E O I	.280	-12.000	50.000	.000	.000
ZHG092	△	W B N H6 V U C O I	.280	-12.000	50.000	.000	.000
ZHG100	◺	W B N H6 V LL	.280	-12.000	50.000	.000	.000

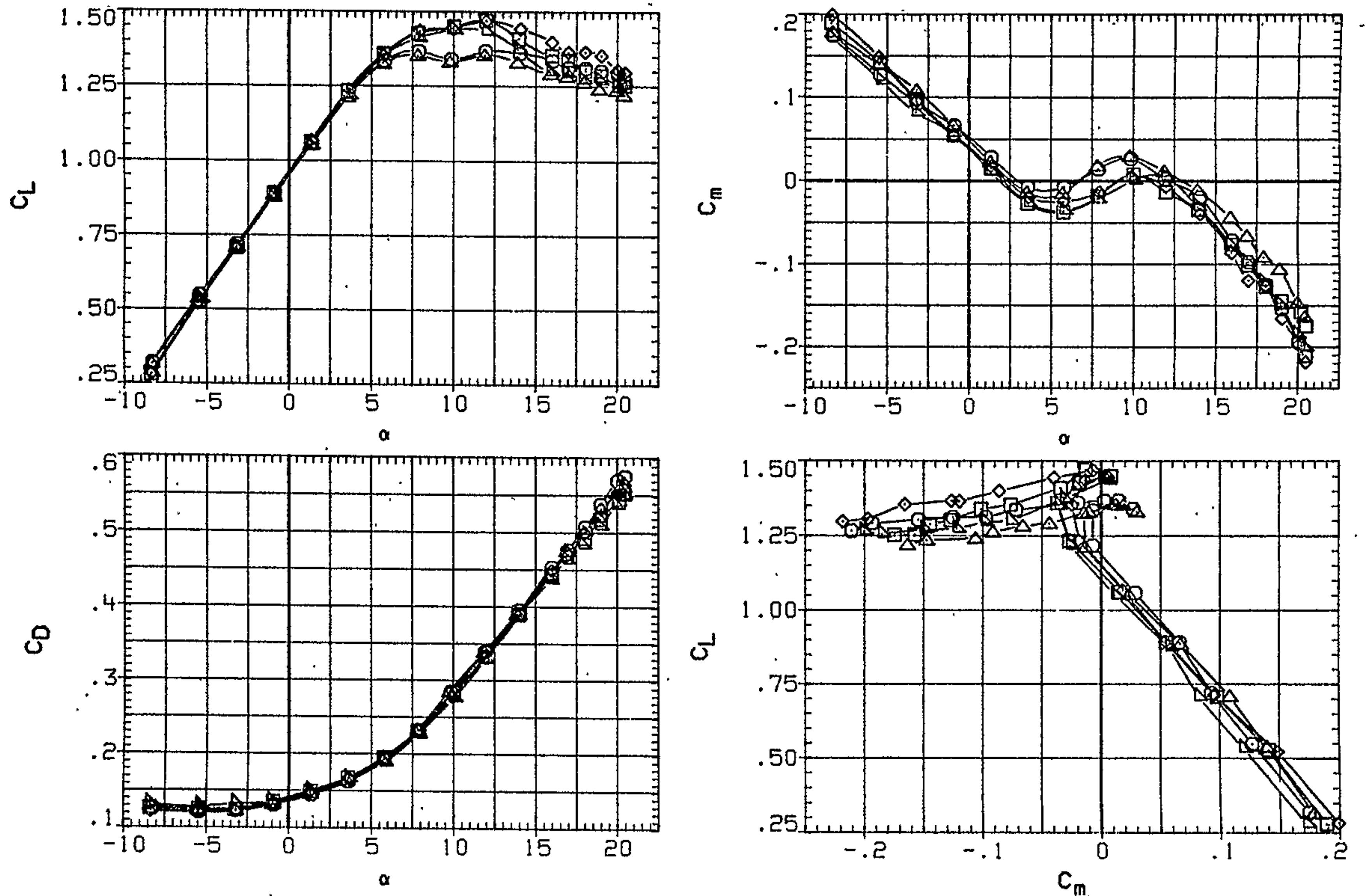

FIG. 8 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR UP

(A)RN/L = 14.78

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG006	○	W B N H6 V G	.280	.000	30.000	.000	.000
ZHG007	□	W B N H6 V U L C P E O I G	.280	.000	30.000	.000	.000
ZHG010	◇	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000
ZHG011	△	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000
ZHG013	◺	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000
ZHG014	D	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000

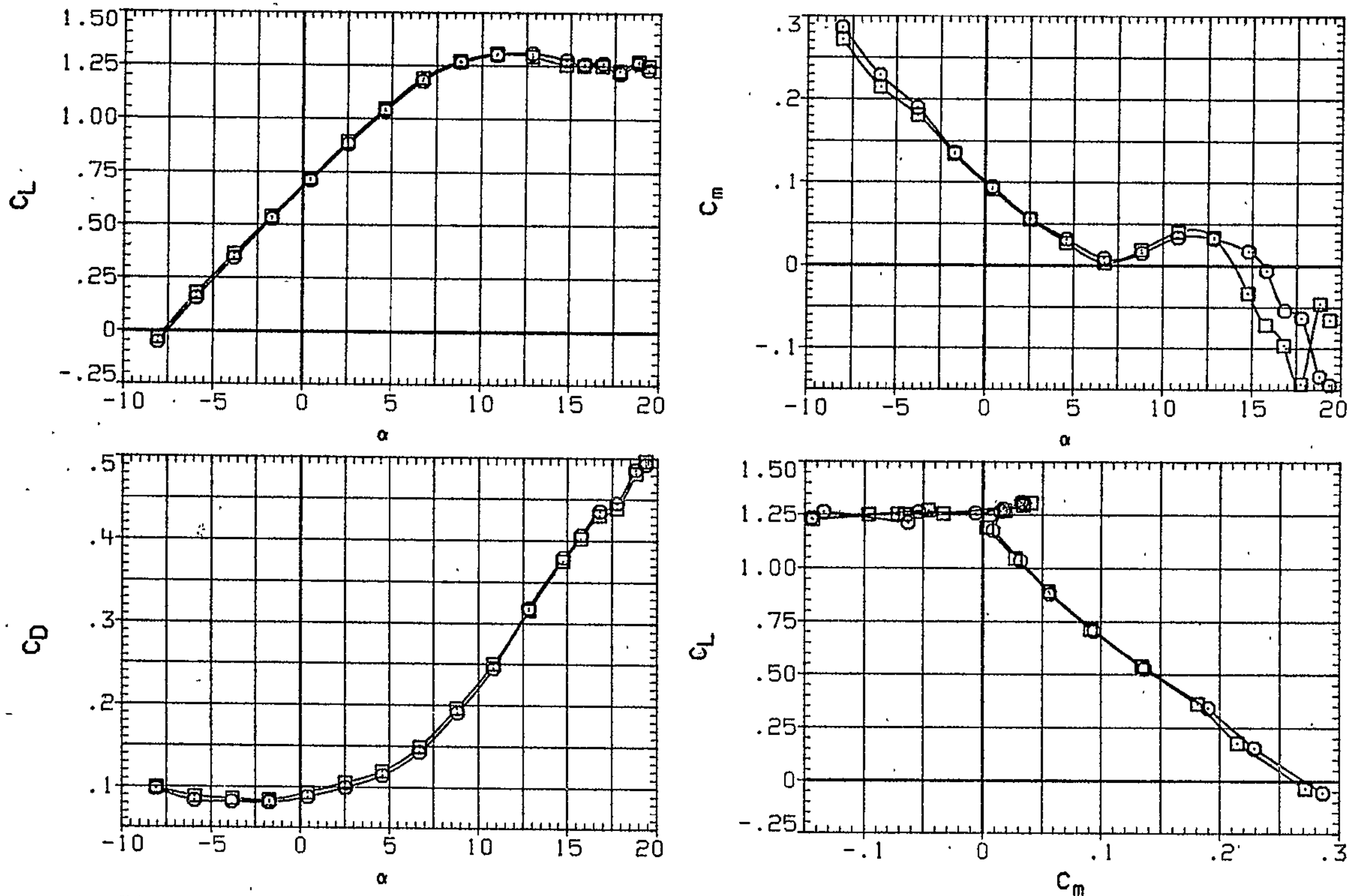

FIG. 9 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(A)RN/L = 6.53

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DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG006	○	W B N H6 V G	.280	.000	30.000	.000	.000
ZHG007	□	W B N H6 V U L C P E O I G	.280	.000	30.000	.000	.000
ZHG010	◇	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000
ZHG011	△	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000
ZHG013	◺	W B N H6 V U L C O I G	.280	.000	30.000	.000	.000
ZHG014	D	DATA NOT AVAILABLE	.280	.000	30.000	.000	.000

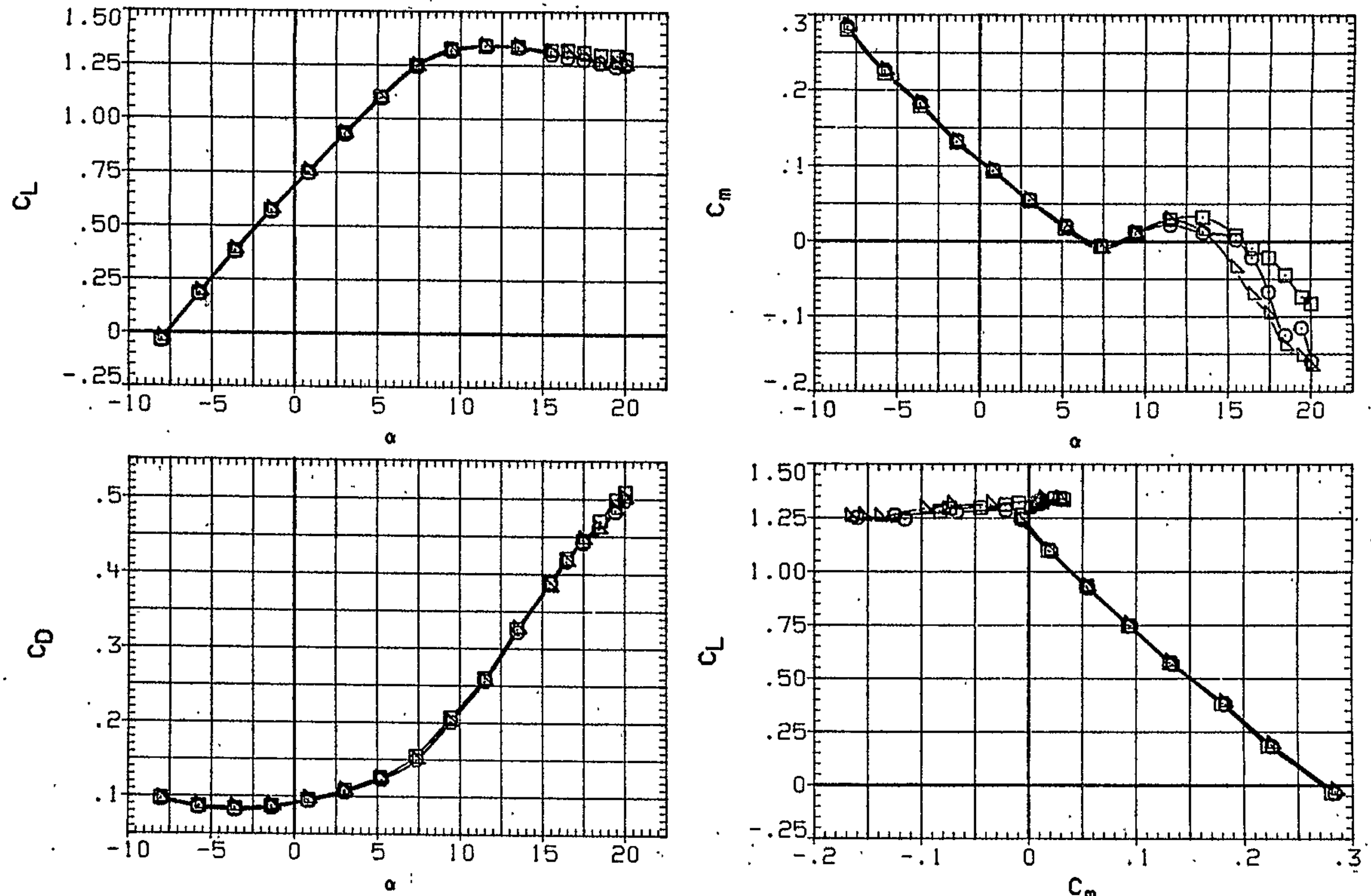

FIG. 9 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(B)RN/L = 12.98

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG006	○	W B N H6 V G	.280	.000	30.000	.000	.000
ZHG007	□	W B N H6 V U L C P E O I G	.280	.000	30.000	.000	.000
ZHG010	◇	W B N H6 V L C P E O I G	.280	.000	30.000	.000	.000
ZHG011	△	W B N H6 V L C O I G	.280	.000	30.000	.000	.000
ZHG013	◁	W B N H6 V U L C O I G	.280	.000	30.000	.000	.000
ZHG014	D	W B N H6 V U C O I G	.280	.000	30.000	.000	.000

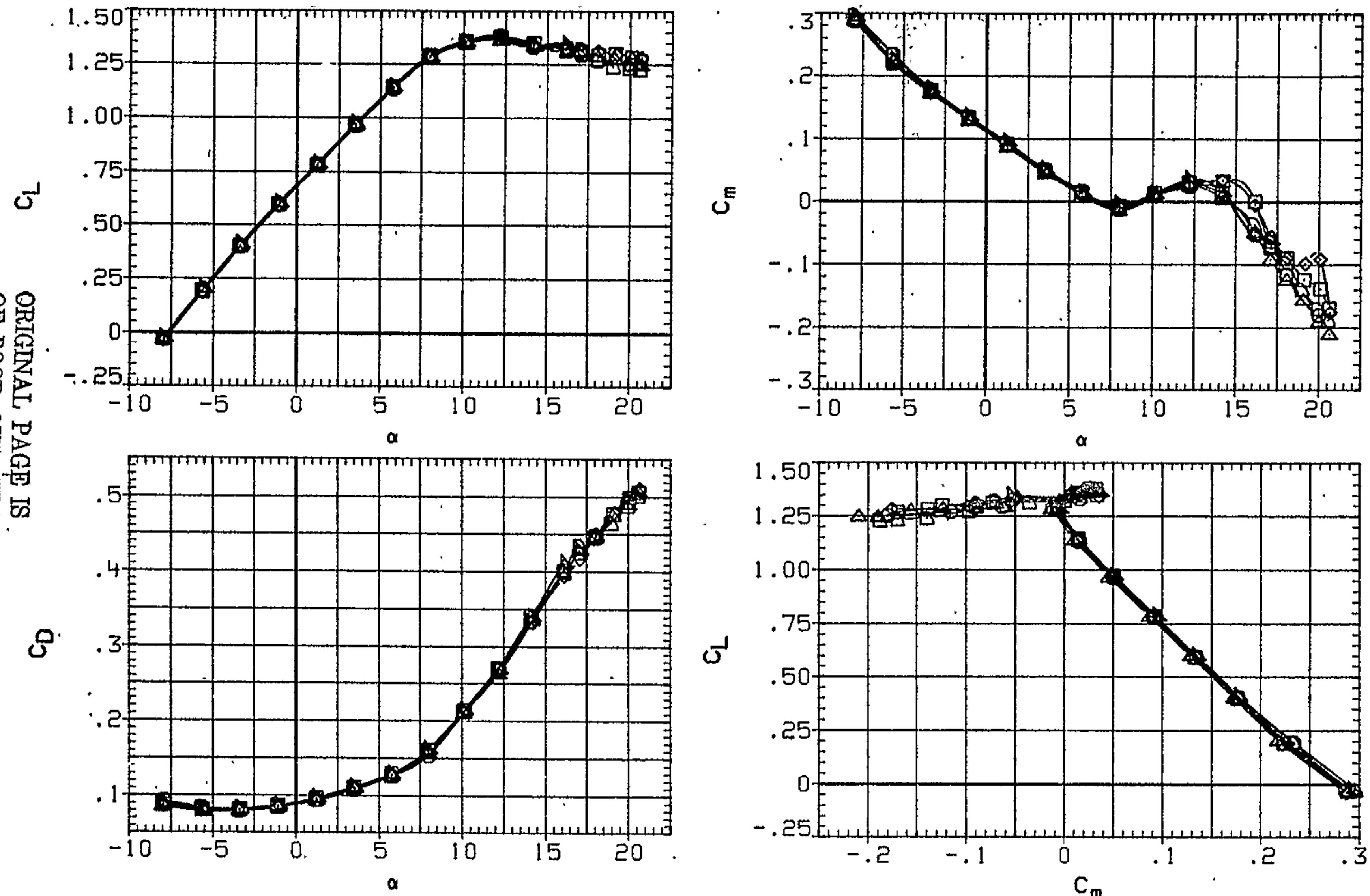

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FIG. 9 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(C)RN/L = 19.54

TA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
HG028	○	W B N H6 V G	.280	.000	50.000	.000	.000
HG015	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
HG023	◇	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
HG022	△	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
HG024	◺	W B N H6 V U L C O I G	.280	.000	50.000	.000	.000

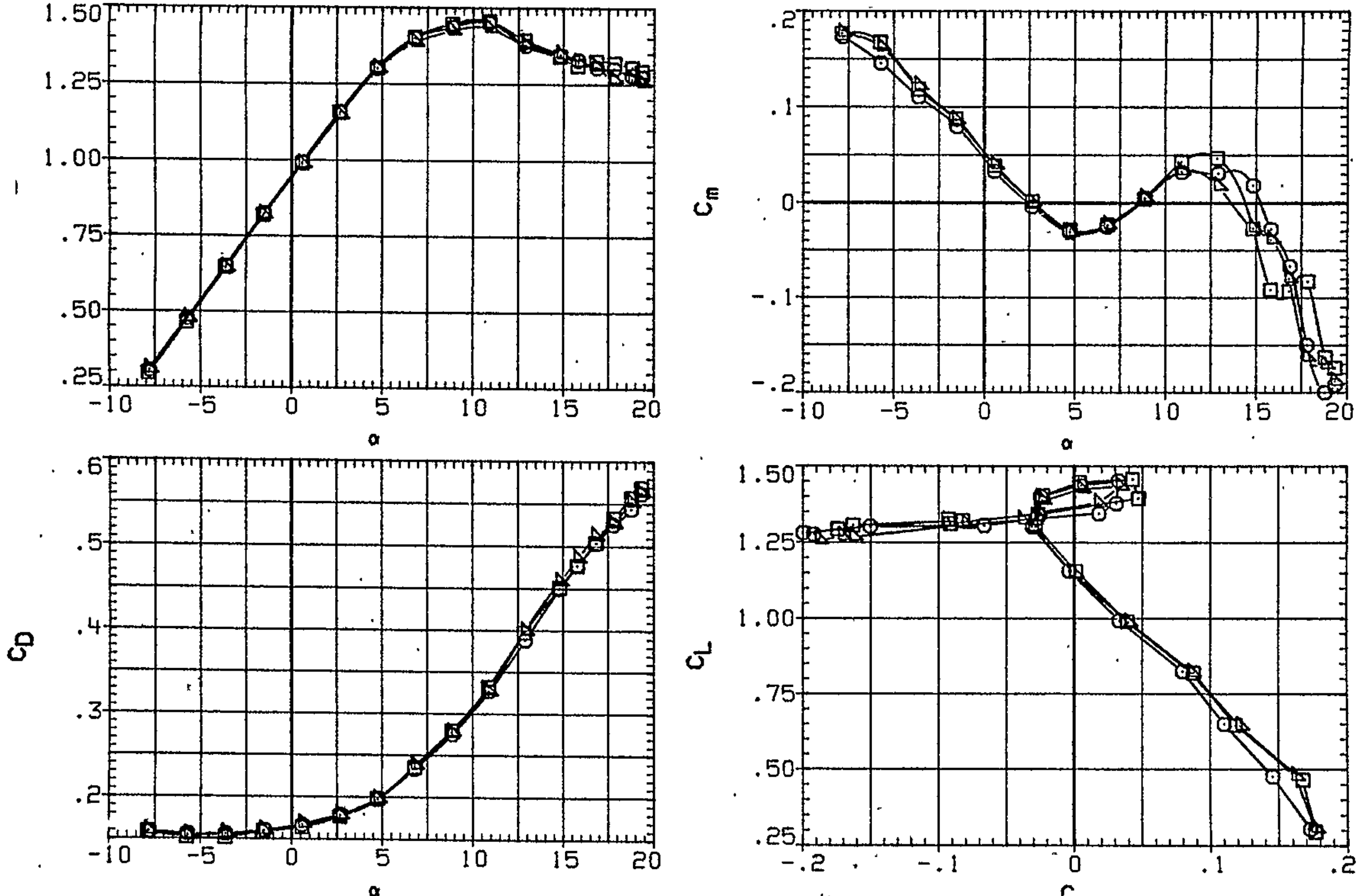

FIG. 9 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

A)RN/L = 6.37

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG028	○	W B N H6 V G	.280	.000	50.000	.000	.000
ZHG015	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG023	◇	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG022	△	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG024	◺	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000

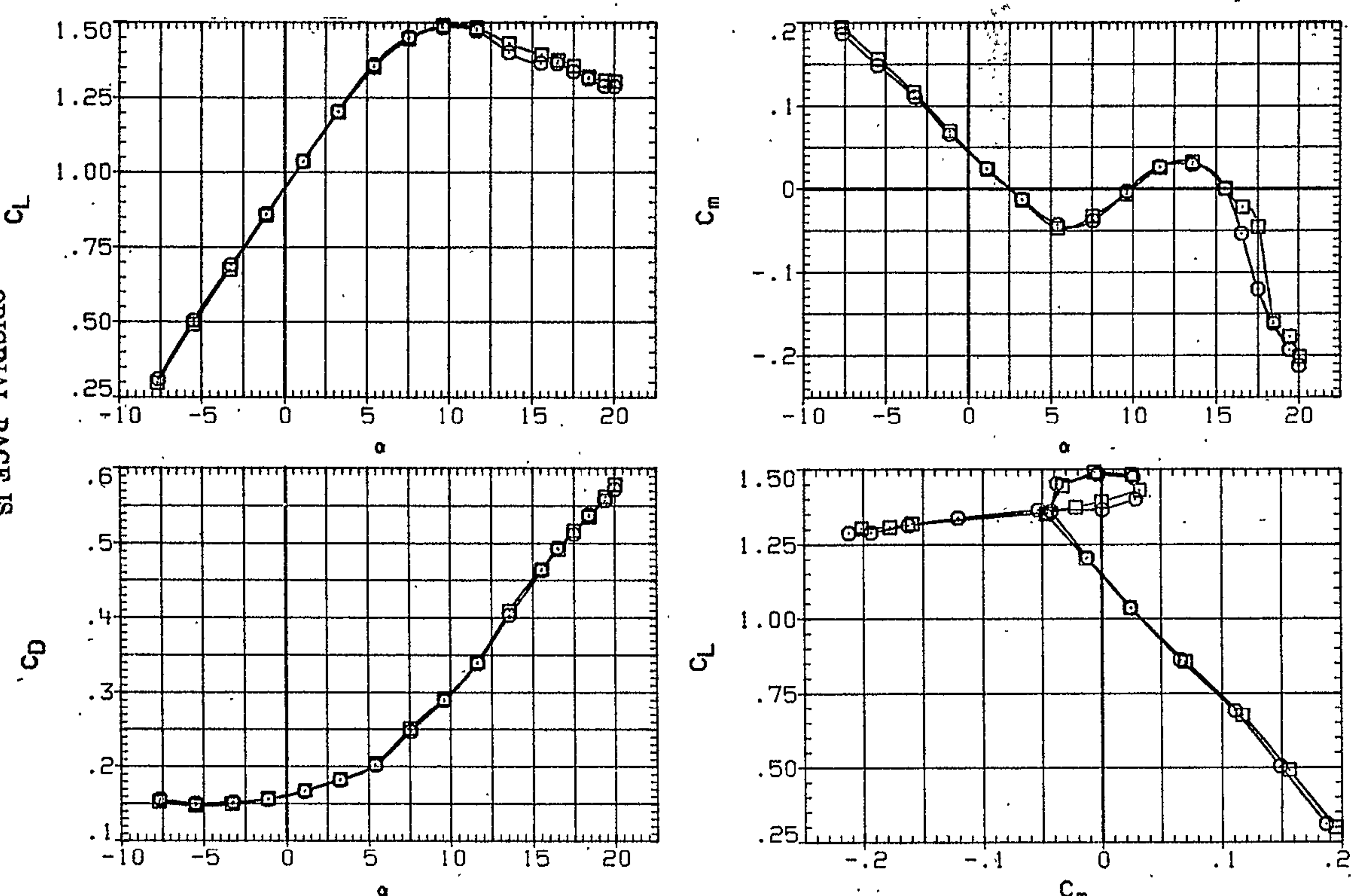

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FIG. 9 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(B)RN/L = 12.95

TA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
HG028	○	W B N H6 V G	.280	.000	50.000	.000	.000
HG015	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
HG023	◇	W B N H6 V L C P E O I G	.280	.000	50.000	.000	.000
HG022	△	W B N H6 V L C O I G	.280	.000	50.000	.000	.000
HG024	◺	W B N H6 V U L C O I G	.280	.000	50.000	.000	.000

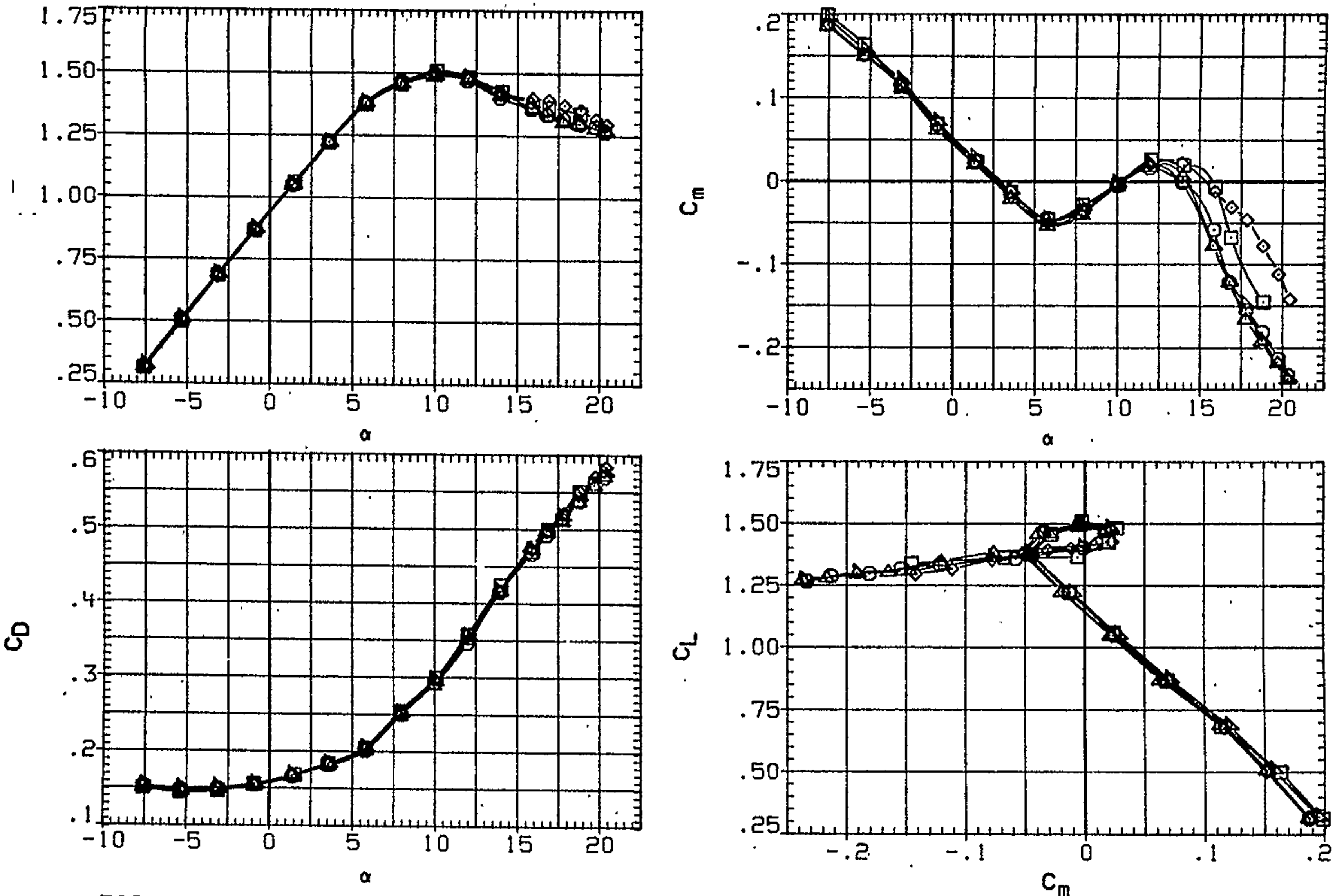

FIG. 9 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

C)RN/L = 16.42

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG028	○	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG015	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG023	◇	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG022	△	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG024	◺	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000

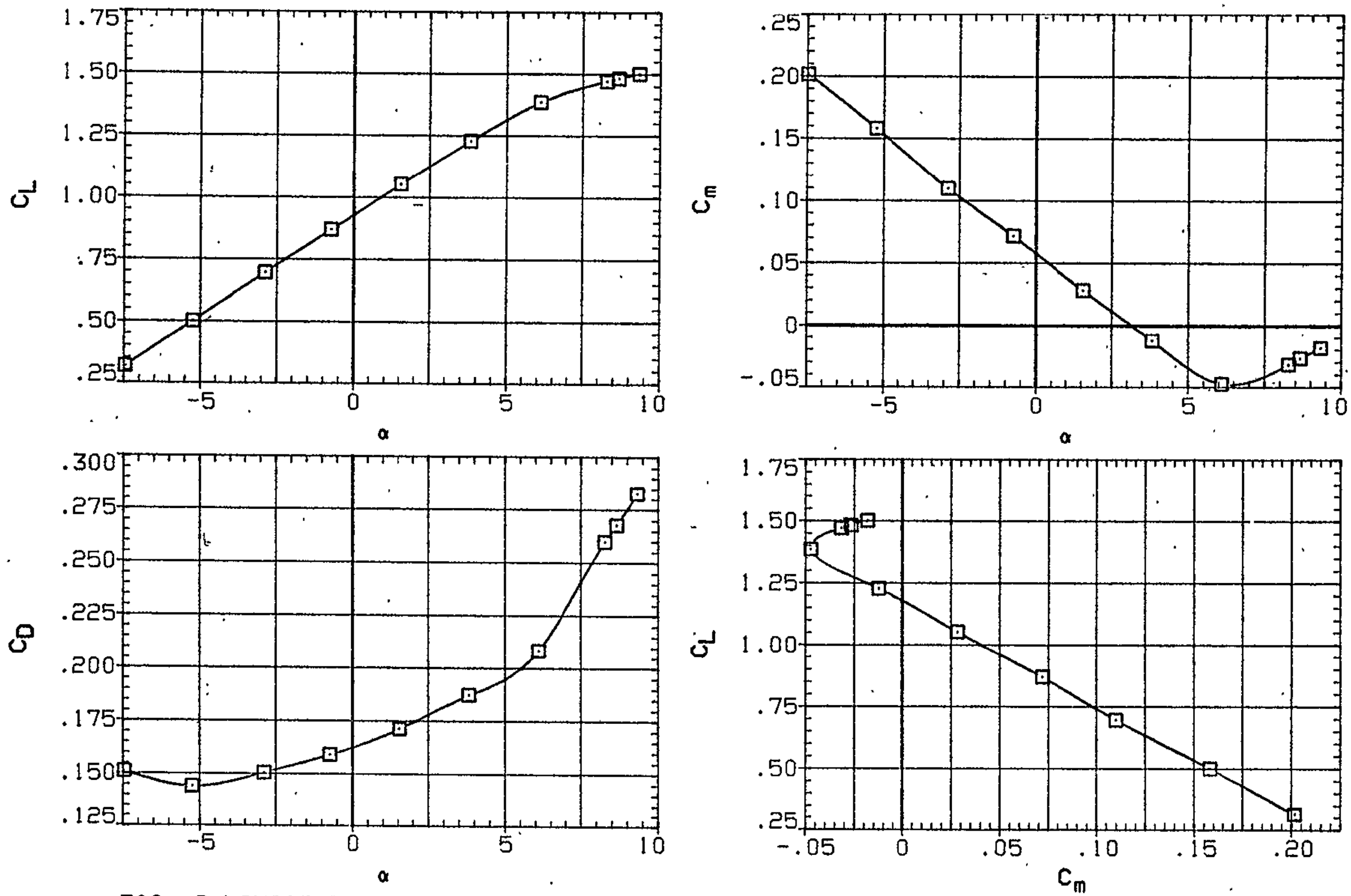

FIG. 9 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

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(D)RN/L = 19.54

SET	SYMBOL	CONFIGURATION		MACH	BETA	FLAP	AILRON	RUDDER
3028	○	W B N H6 V	G	.280	.000	50.000	.000	.000
3026	□	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000
3025	◇	W B N H6 V U L C	1 G	.280	.000	50.000	.000	.000
3027	△	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000
3029	⊾	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000

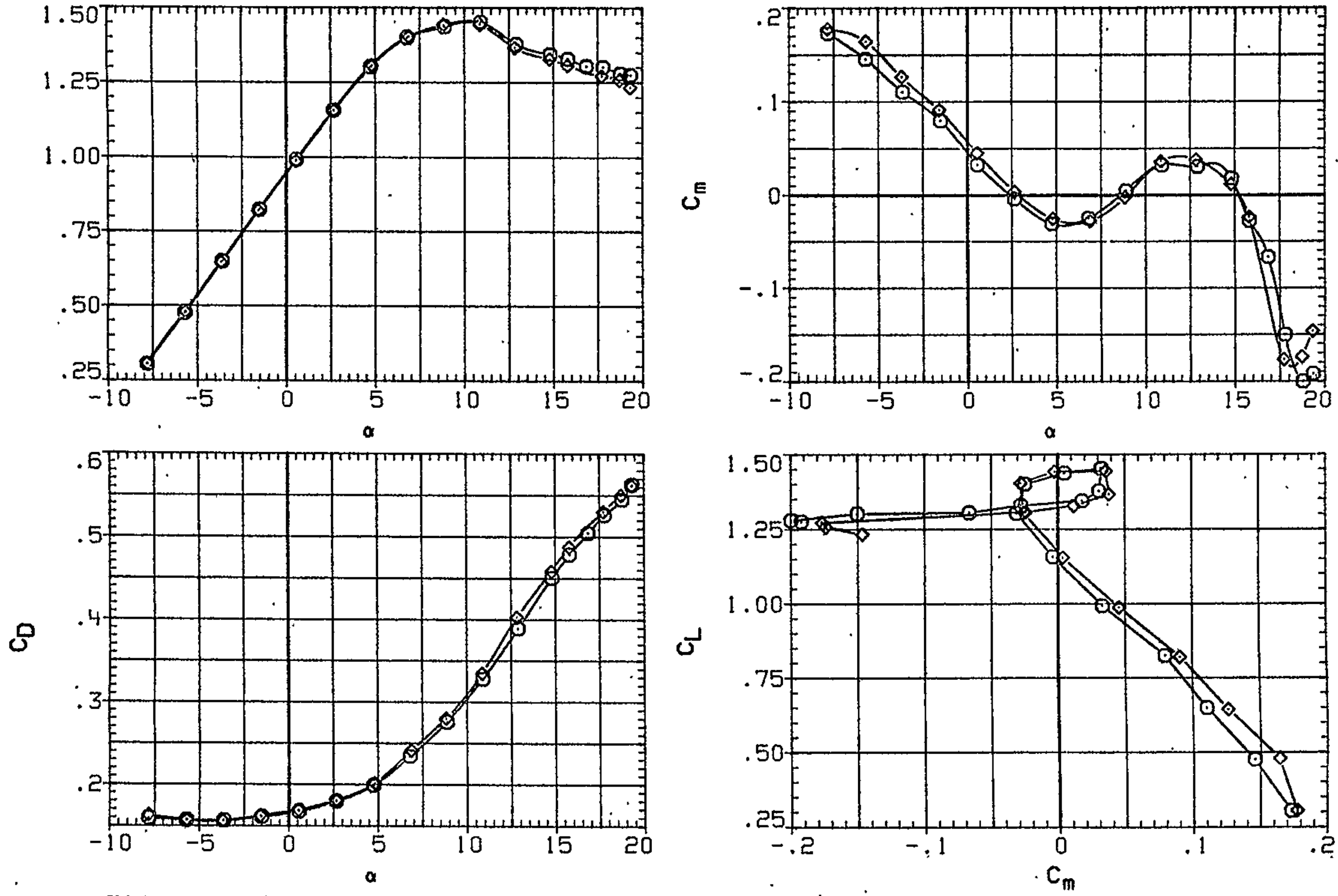

FIG. 9 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

A)RN/L = 6.37

DATA SET	SYMBOL	CONFIGURATION		MACH	BETA	FLAP	AILRON	RUDDER
ZHG028	○	W B N HS V	G	.280	.000	50.000	.000	.000
ZHG026	□	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000
ZHG025	◇	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000
ZHG027	△	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000
ZHG029	◺	DATA NOT AVAILABLE		.280	.000	50.000	.000	.000

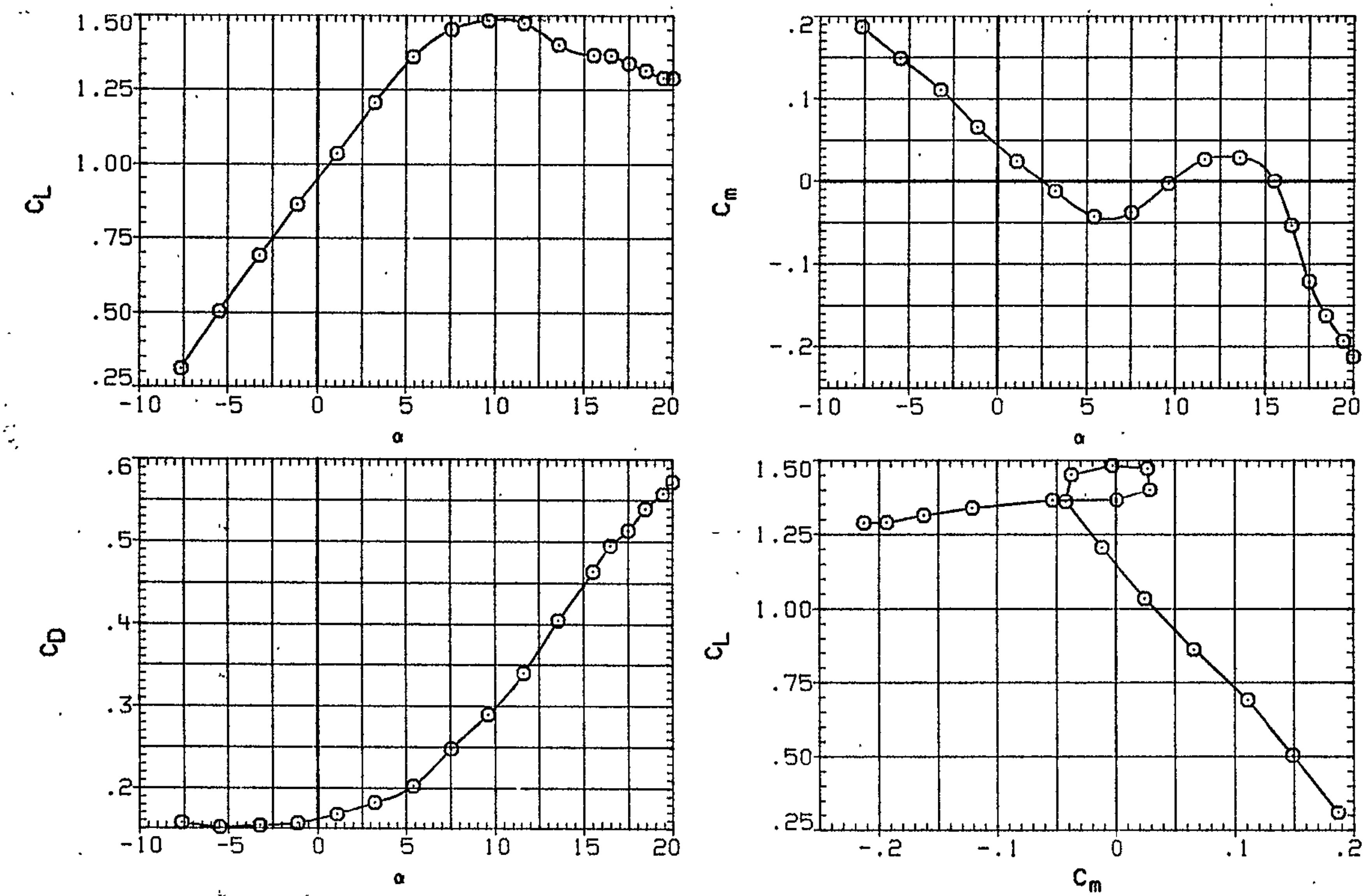

FIG. 9 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(B)RN/L = 12.95

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A SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
G028	○	W B N H6 V G	.280	.000	50.000	.000	.000
G026	□	W B N H6 V U C O I G	.280	.000	50.000	.000	.000
G025	◇	W B N H6 V U L C I G	.280	.000	50.000	.000	.000
G027	△	W B N H6 V C O I G	.280	.000	50.000	.000	.000
G029	◺	W B N H6 V O G	.280	.000	50.000	.000	.000

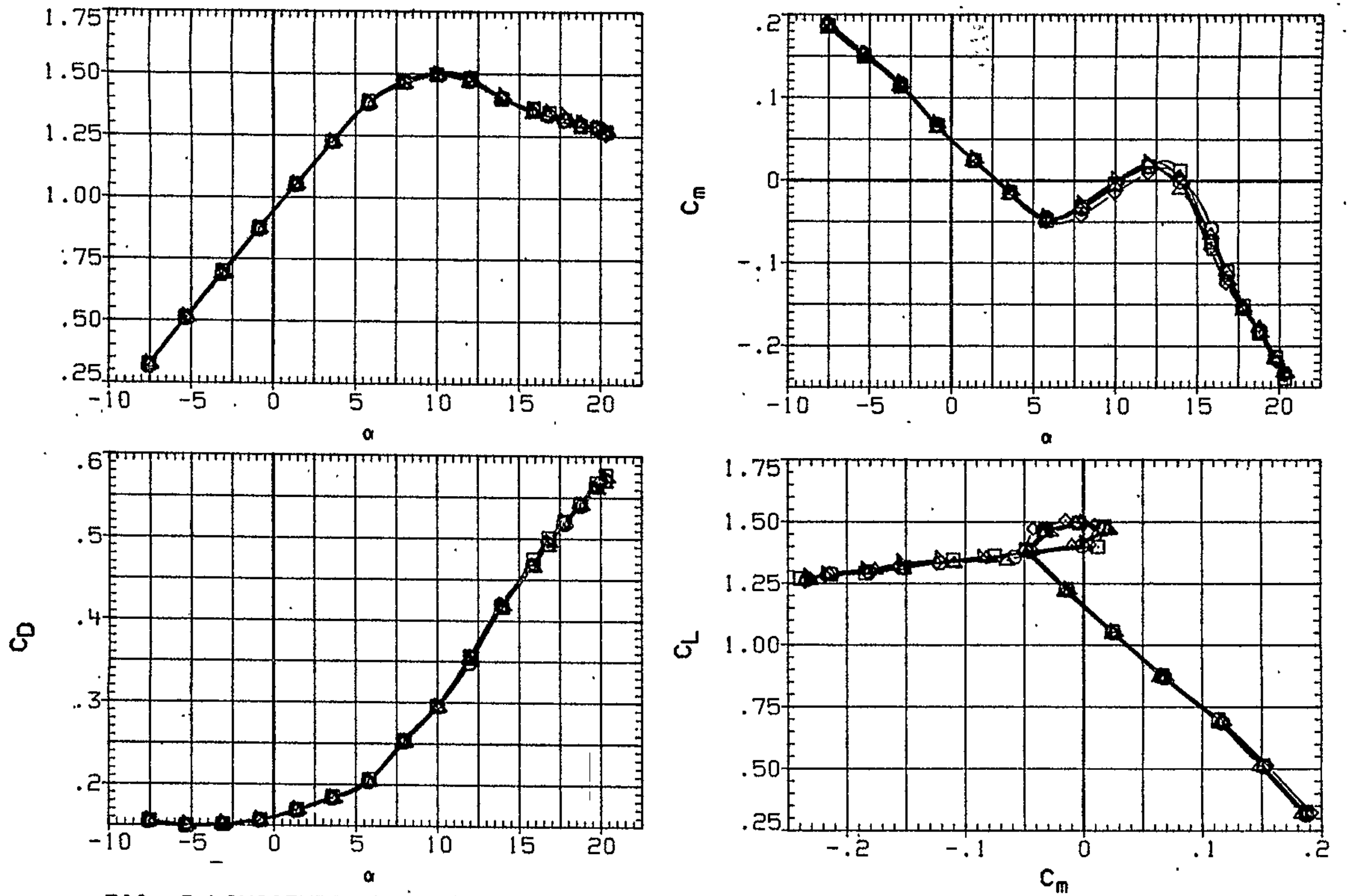

FIG. 9 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

C)RN/L = 16.42

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG099	○	W B N H6 V G	.280	-12.000	30.000	.000	.000
ZHG098	□	W B N H6 V U L C P E O I G	.280	-12.000	30.000	.000	.000

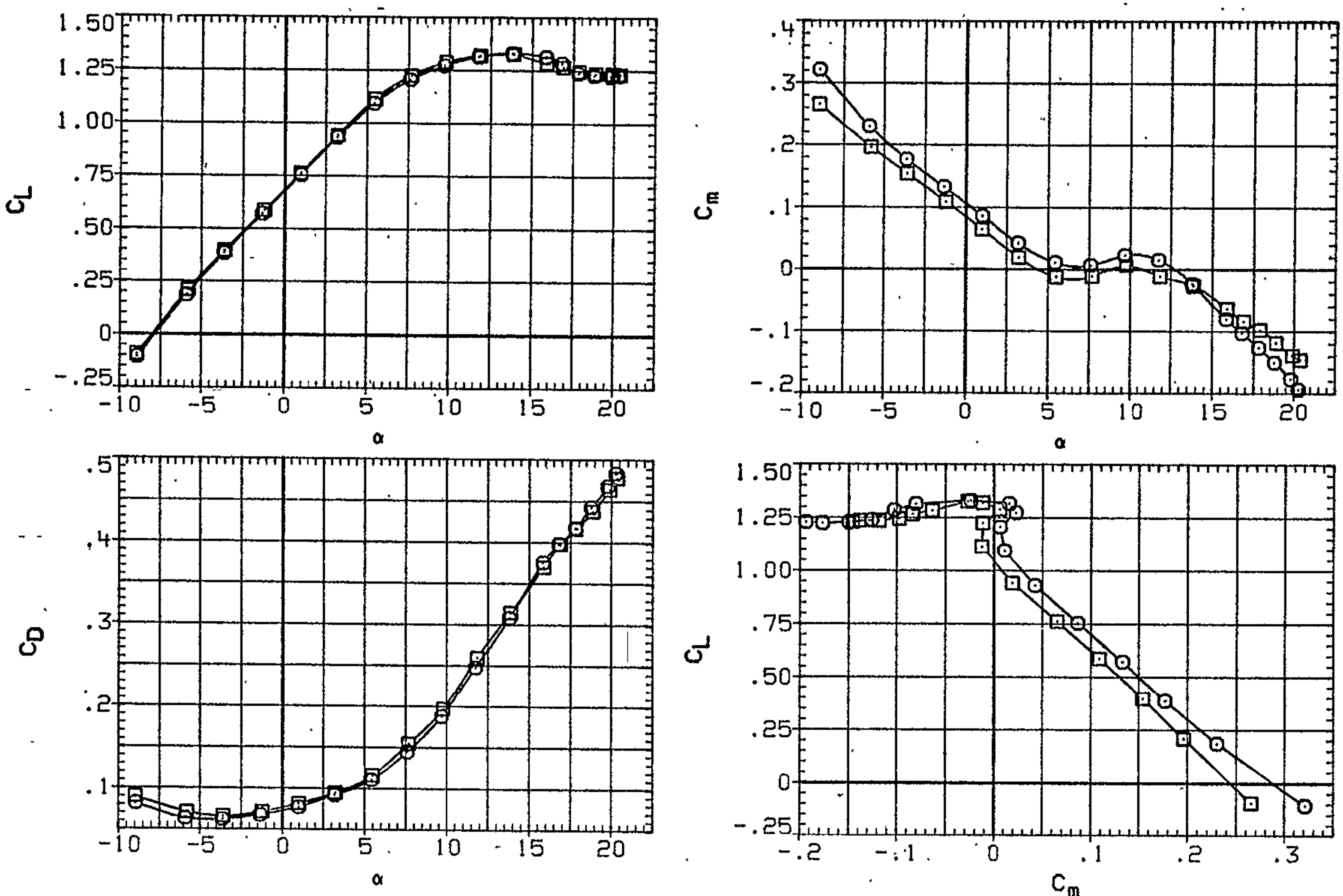

FIG. 9 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN PITCH, GEAR DOWN

(A)RN/L = 14.62

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A SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
G076	○	W B N H6 V	.280	6.000	.000	.000	.000
G078	□	W B N H6 V U L C P E O I	.280	6.000	.000	.000	.000
G077	◇	W B N H6 V L C P E O I	.280	6.000	.000	.000	.000

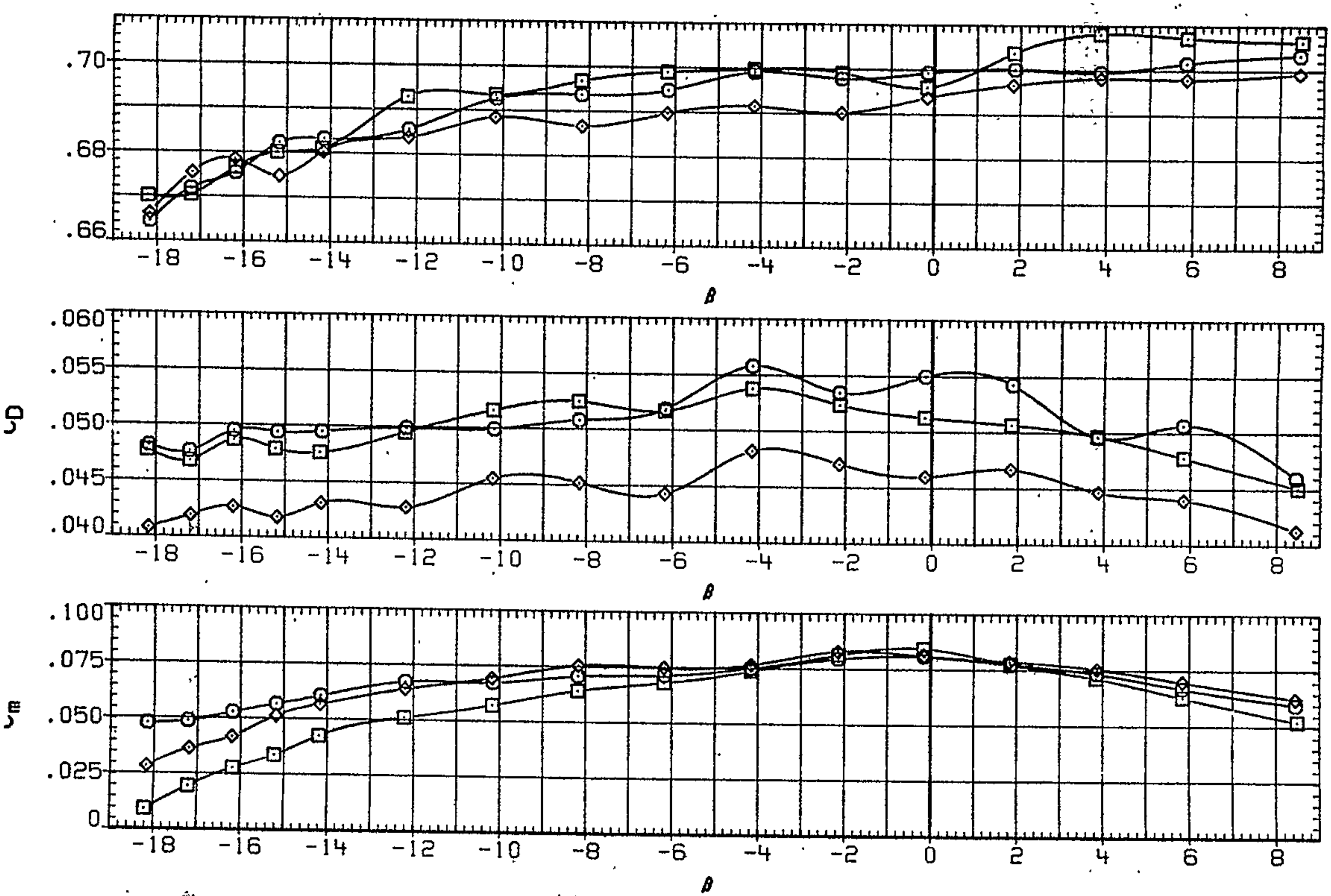

FIG.10 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR UP

)RN/L = 6.18

DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG046	○	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG035	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG038	◇	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG039	△	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
ZHG042	◺	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000

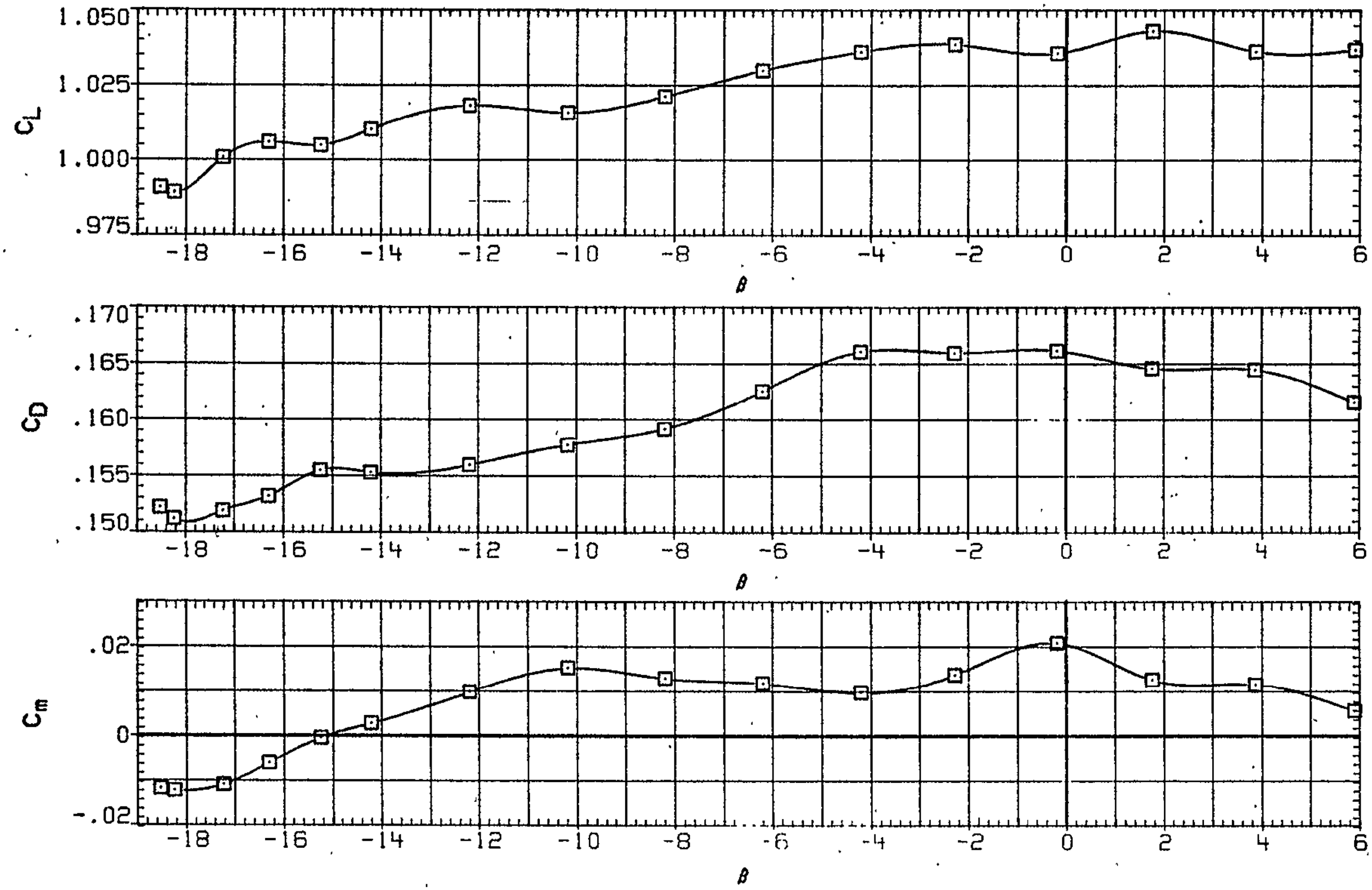

FIG.11 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

(A)RN/L = 6.31

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A SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
IG046	○	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
IG035	□	W B N H6 V U L C P E O 1 G	.280	.000	50.000	.000	.000
IG038	◇	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
IG039	△	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000
IG042	◺	DATA NOT AVAILABLE	.280	.000	50.000	.000	.000

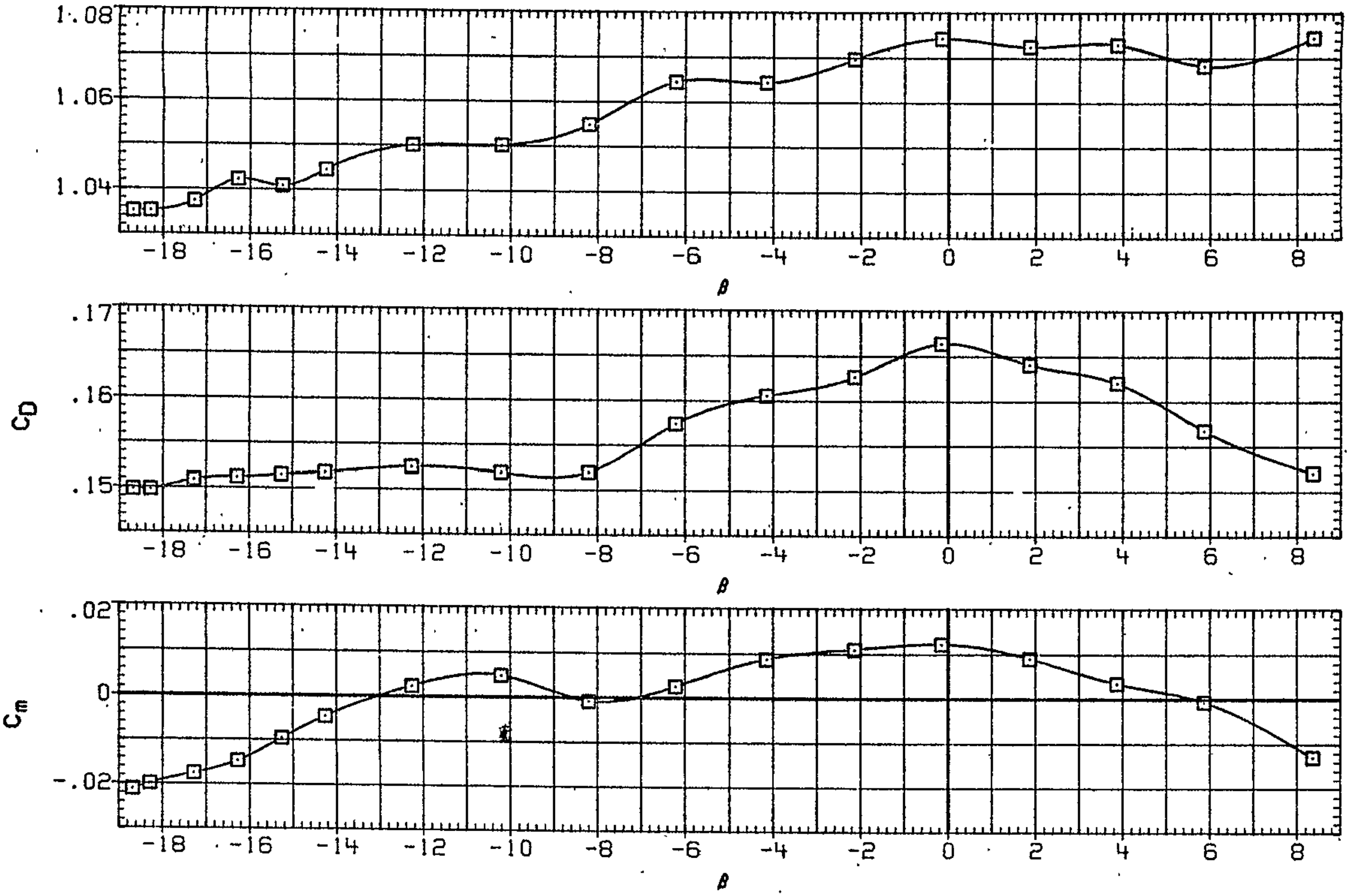

FIG.11 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

B)RN/L = 9.74

DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG046	○	W B N H6 V G	.280	.000	50.000	.000	.000
ZHG035	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG038	◇	W B N H6 V L C P E O I G	.280	.000	50.000	.000	.000
ZHG039	△	W B N H6 V L C O I G	.280	.000	50.000	.000	.000
ZHG042	◺	W B N H6 V U L C O I G	.280	.000	50.000	.000	.000

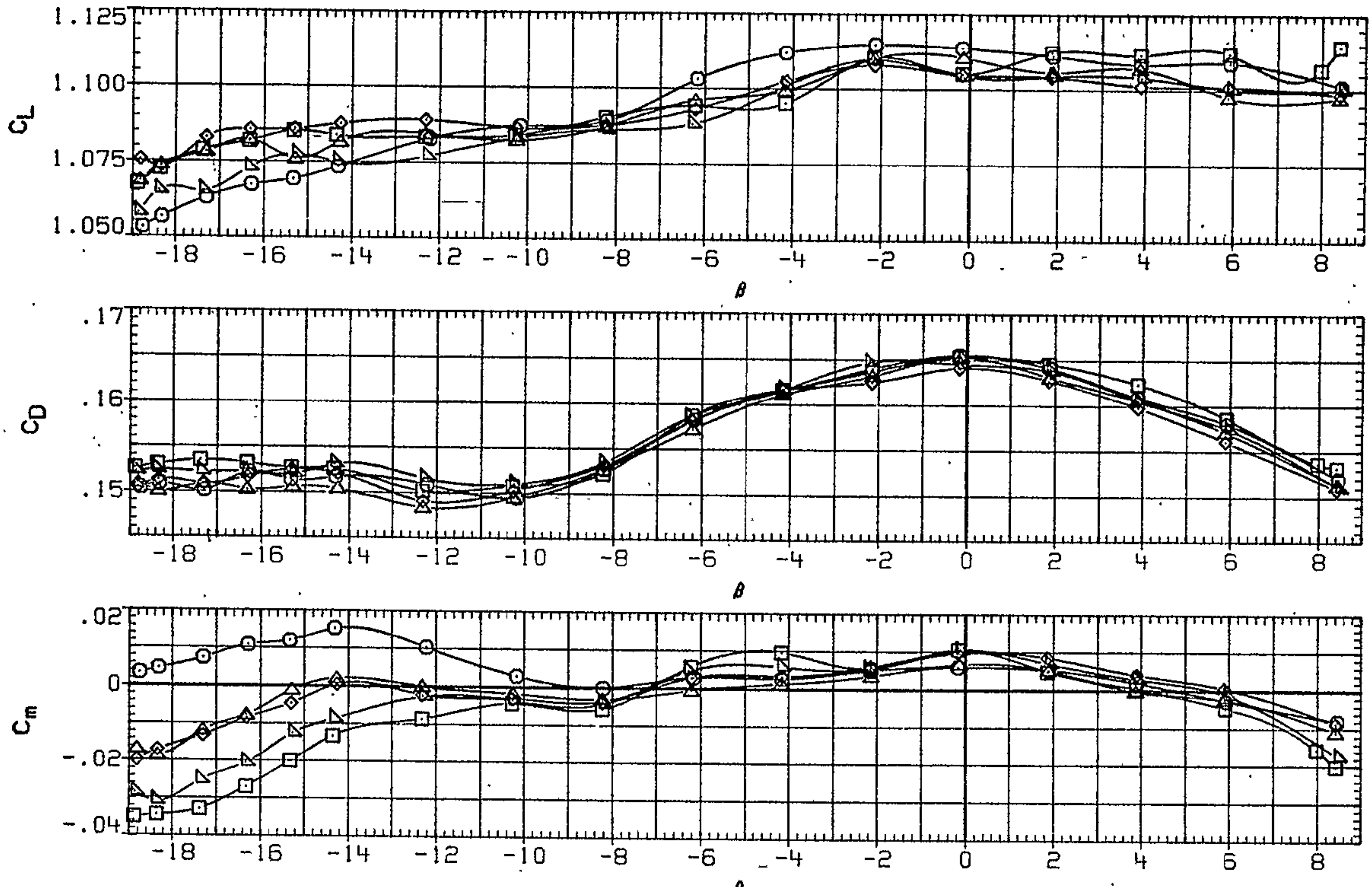

FIG.11 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

(C)RN/L = 14.51

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SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
046	○	W B N H6 V G	.280	.000	50.000	.000	.000
043	□	W B N H6 V U C O I G	.280	.000	50.000	.000	.000
057	◇	W B N H6 V C O I G	.280	.000	50.000	.000	.000
058	△	W B N H6 V O G	.280	.000	50.000	.000	.000
036	◺	W B N H6 U L C P E O I G	.280	.000	50.000	.000	.000

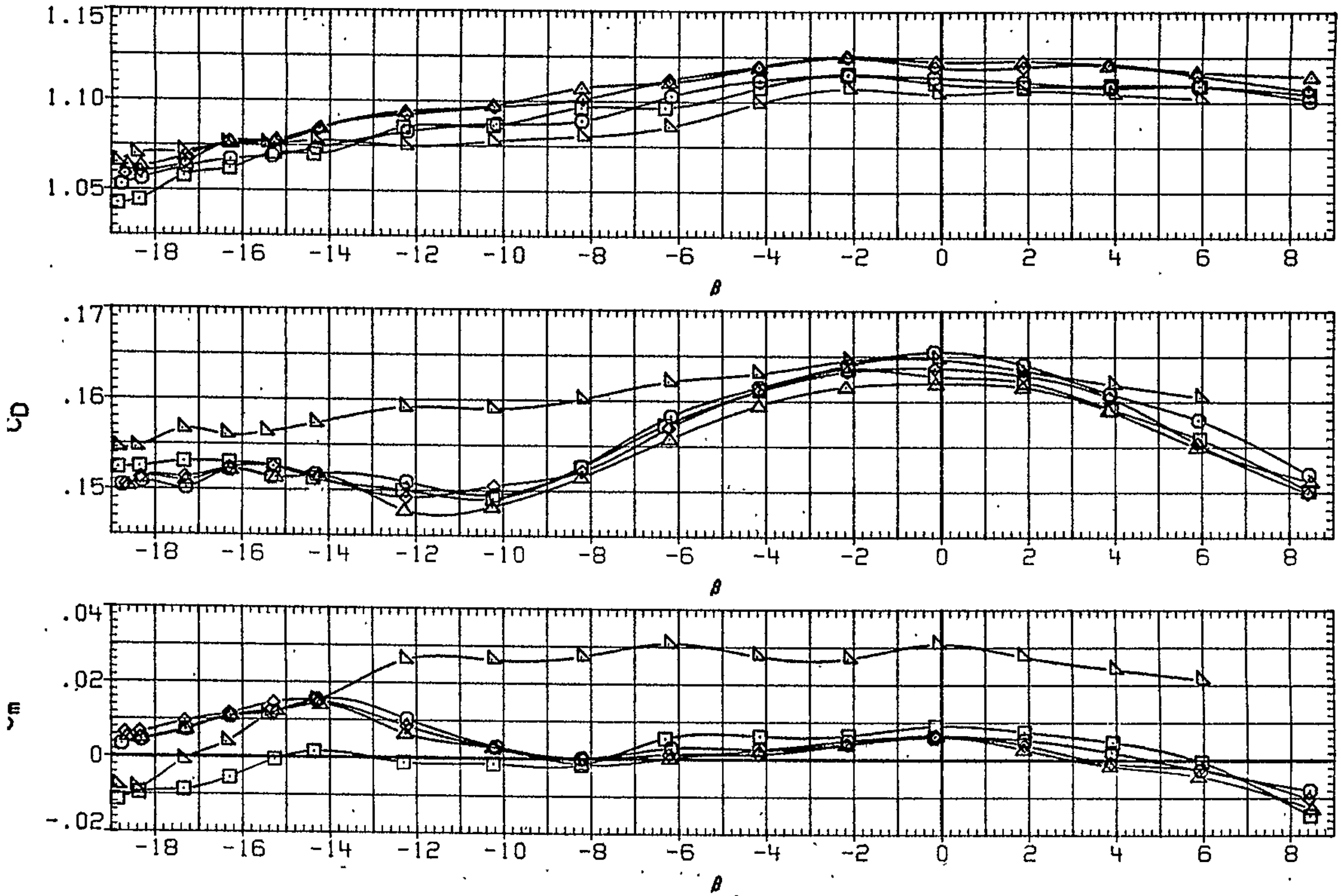

FIG.11 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

)RN/L = 14.51

DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG046	○	W B N H6 V G	.280	.000	50.000	.000	.000
ZHG040	□	W B N H6 L C O I G	.280	.000	50.000	.000	.000
ZHG041	◇	W B N H6 U L C O I G	.280	.000	50.000	.000	.000
ZHG044	△	W B N H6 U C O I G	.280	.000	50.000	.000	.000
ZHG045	◺	W B N H6 G	.280	.000	50.000	.000	.000

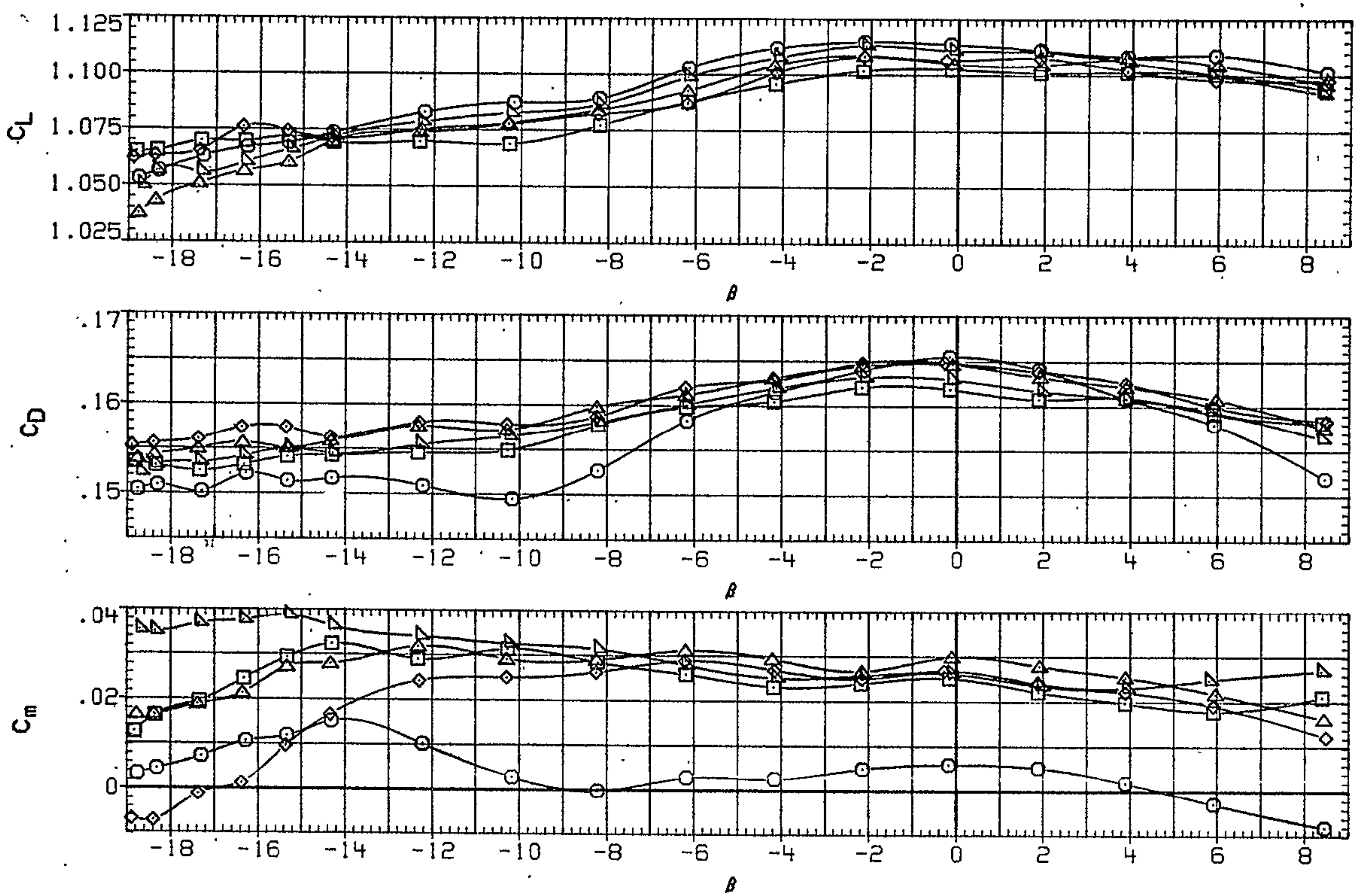

FIG.11 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

(A)RN/L = 14.51

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SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
067	○	W B N H6 V G	.280	.000	30.000	.000	.000
066	□	W B N H6 V U L C P E O I G	.280	.000	30.000	.000	.000
065	◇	W B N H6 V L C P E O I G	.280	.000	30.000	.000	.000
064	△	W B N H6 V L C O I G	.280	.000	30.000	.000	.000
063	◺	W B N H6 V U L C O I G	.280	.000	30.000	.000	.000
062	D	W B N H6 V U C O I G	.280	.000	30.000	.000	.000

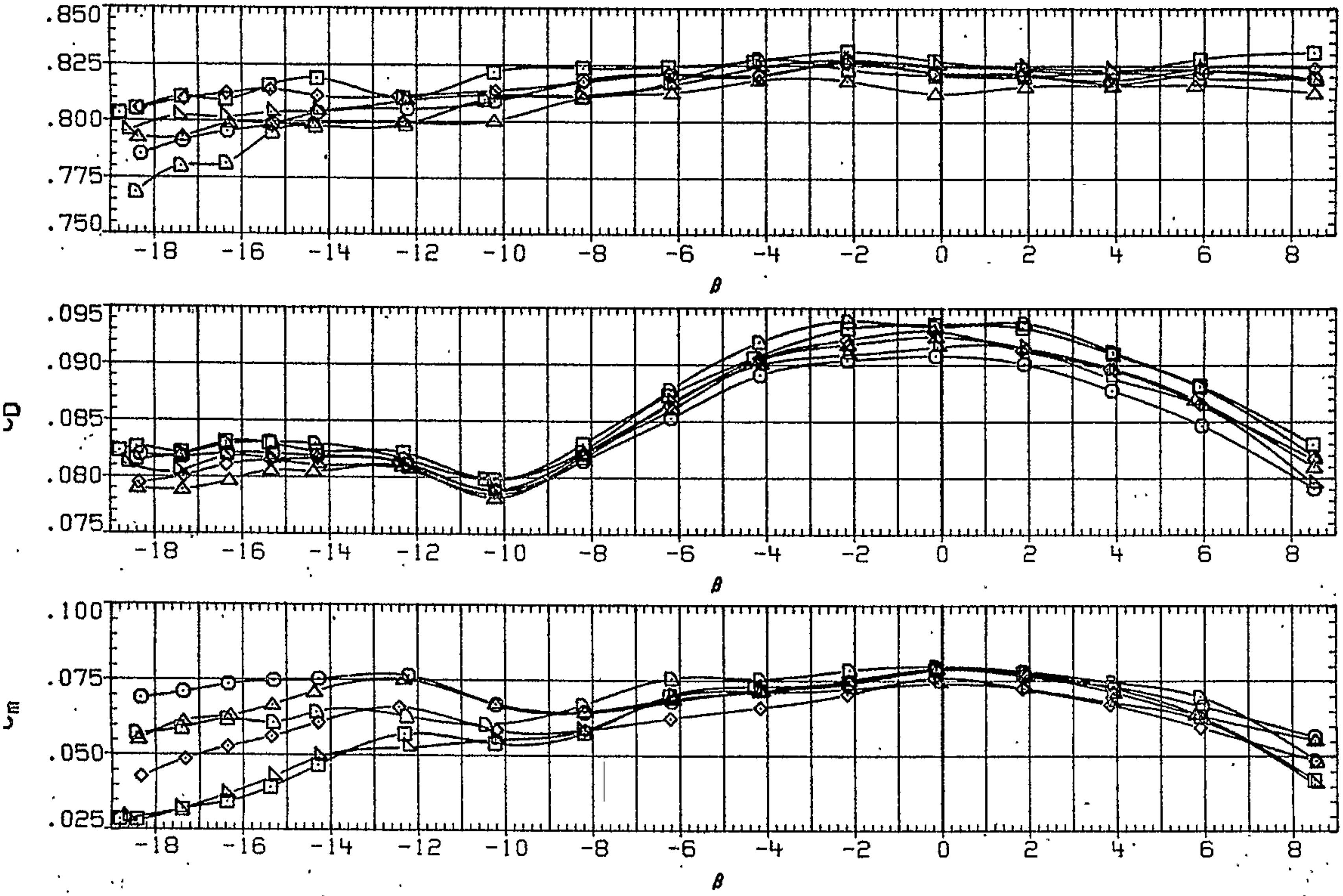

FIG.11 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

()RN/L = 14.68

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DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG068	○	W B N H6 V G	.280	6.000	30.000	.000	.000
ZHG069	□	W B N H6 V U L C P E O I G	.280	6.000	30.000	.000	.000
ZHG070	◇	W B N H6 V L C P E O I G	.280	6.000	30.000	.000	.000

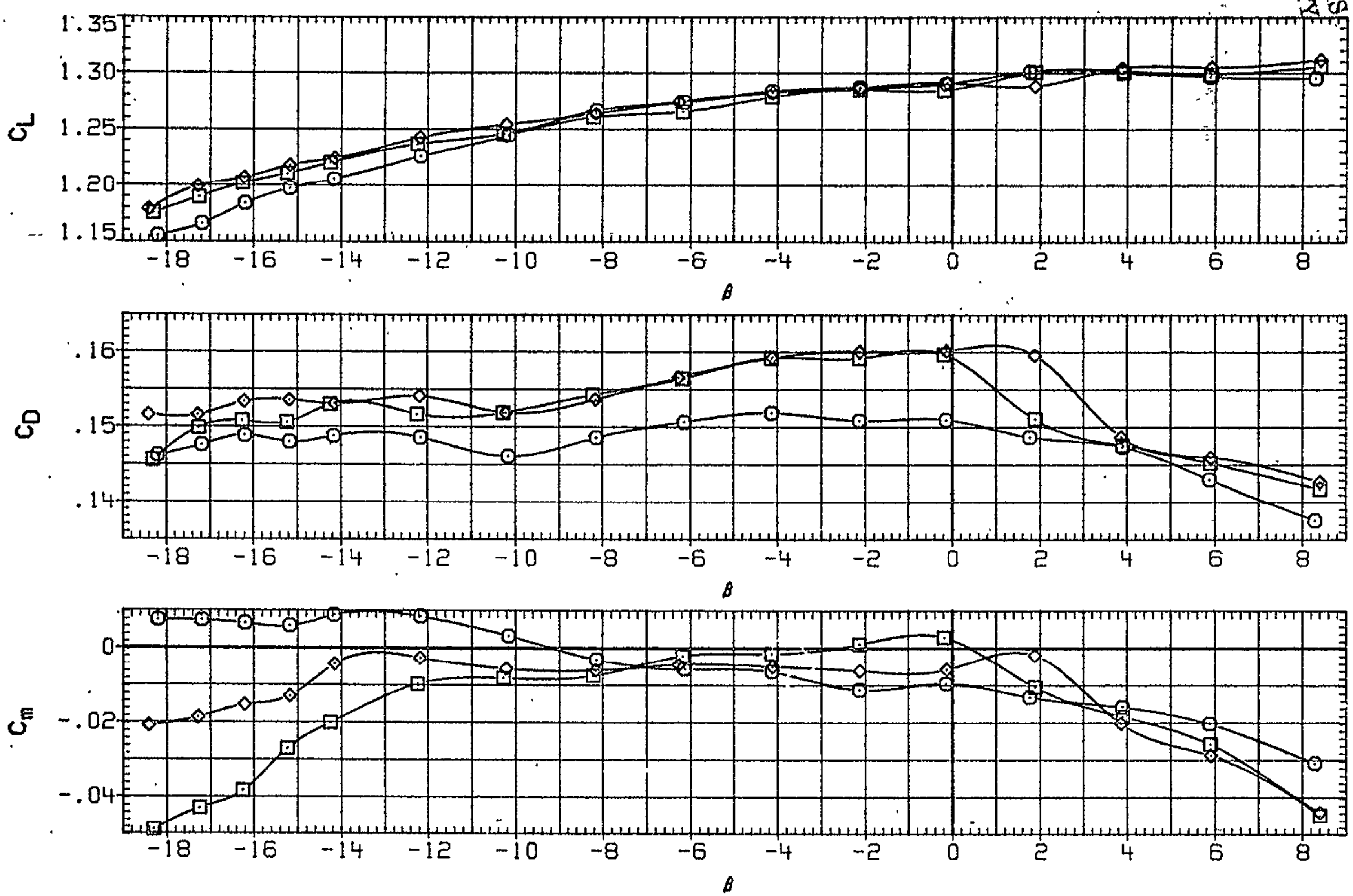

FIG.11 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

(A)RN/L = 13.04

SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
075	○	W B N H6 V G	.280	6.000	50.000	.000	.000
072	□	W B N H6 V U L C P E O I G	.280	6.000	50.000	.000	.000
071	◇	W B N H6 V L C P E O I G	.280	6.000	50.000	.000	.000
073	△	W B N H6 U L C P E O I G	.280	6.000	50.000	.000	.000
074	◺	W B N H6 G	.280	6.000	50.000	.000	.000

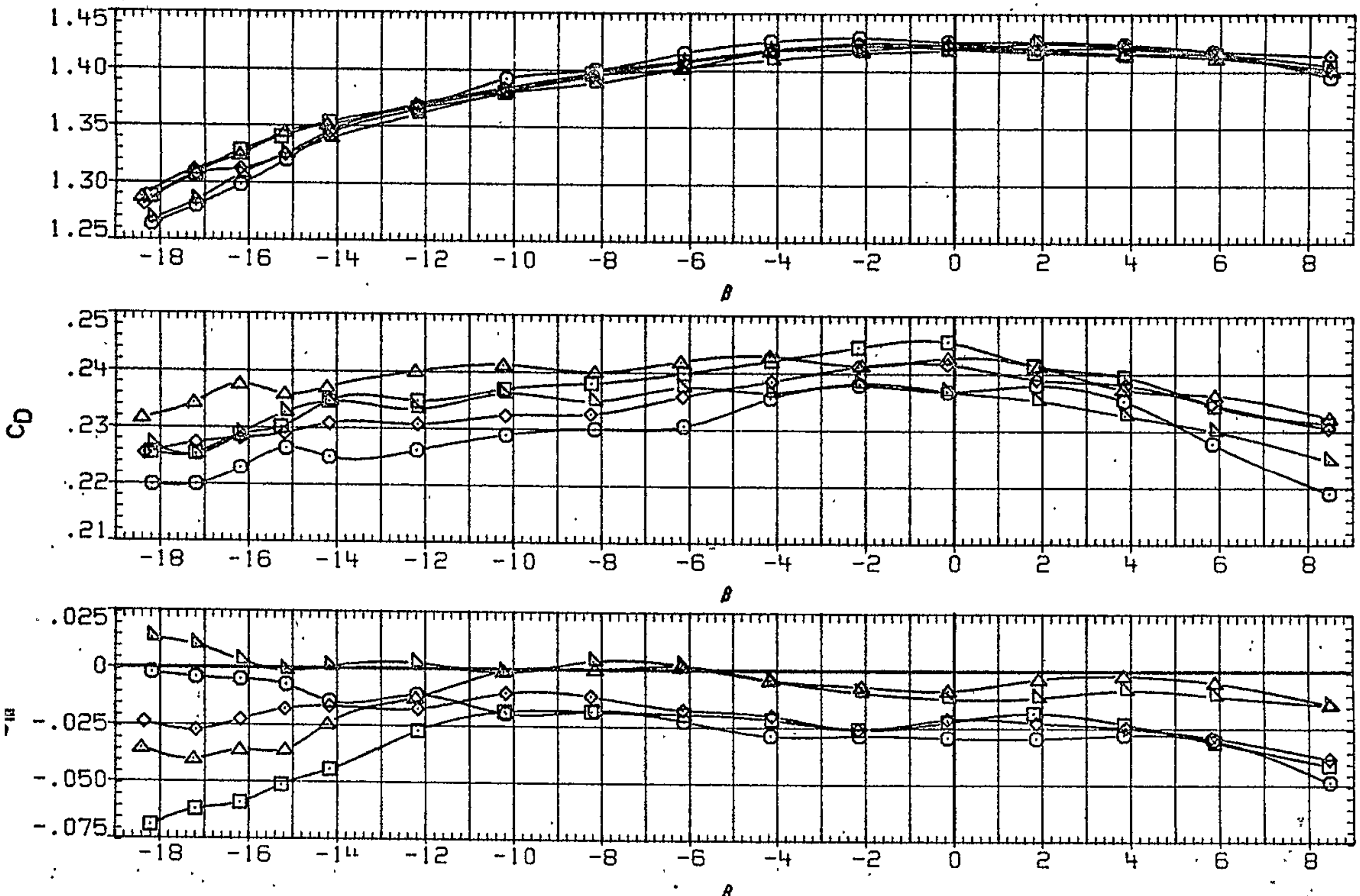

FIG.11 LONGITUDINAL AERODYNAMIC CHARACTERISTICS IN YAW, GEAR DOWN

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG015	○	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG031	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	10.000
ZHG032	◇	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	27.000
ZHG034	△	W B N H6 V U L C P E O I G	.280	.000	50.000	10.000	.000
ZHG033	◺	W B N H6 V U L C P E O I G	.280	.000	50.000	20.000	.000

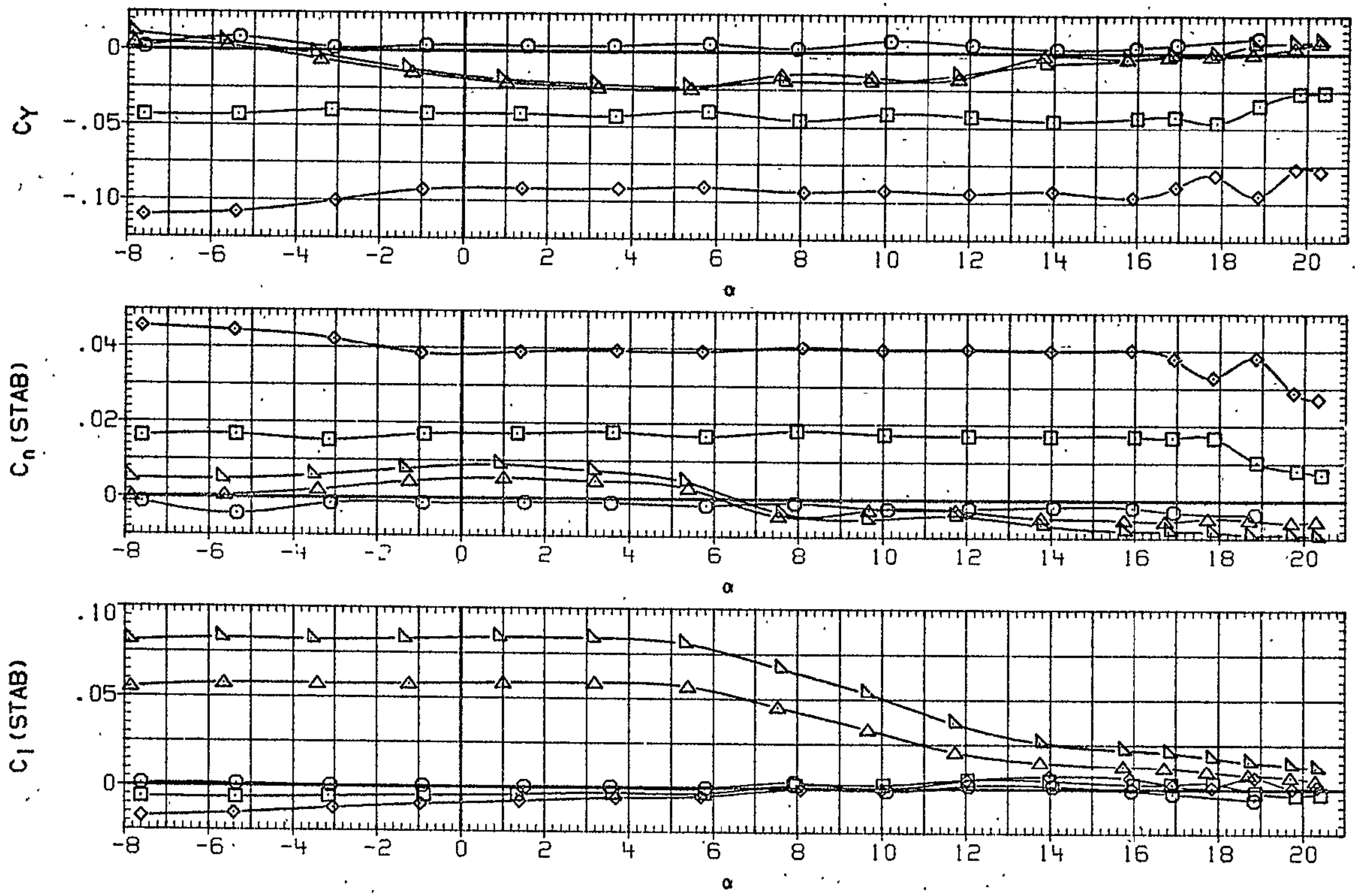

FIG.12 RUDDER AND AILERON EFFECTS IN PITCH, ALL PROTUBERANCES ON, GEAR DOWN

(A) RN/L = 16.40

ATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
ZHG015	○	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG031	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	10.000
ZHG032	◇	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	27.000
ZHG034	△	W B N H6 V U L C P E O I G	.280	.000	50.000	10.000	.000
ZHG033	◺	W B N H6 V U L C P E O I G	.280	.000	50.000	20.000	.000

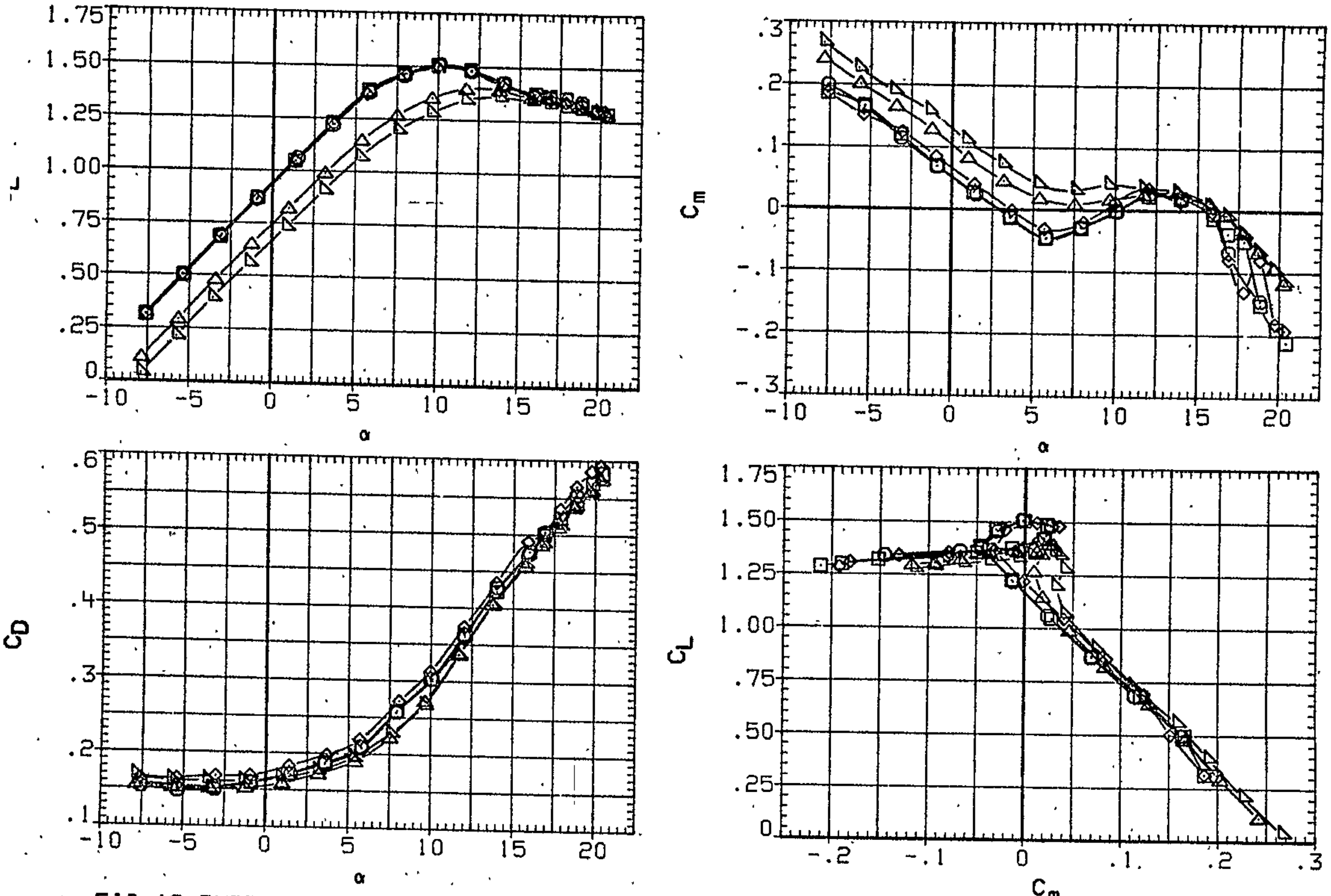

FIG.12 RUDDER AND AILERON EFFECTS IN PITCH, ALL PROTUBERANCES ON, GEAR DOWN

A) RN/L = 16.40

DATA SET	SYMBOL	CONFIGURATION		MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG046	○	W B N H6 V	G	.280	.000	50.000	.000	.000
ZHG050	□	W B N H6 V	G	.280	.000	50.000	-10.000	.000
ZHG049	◇	W B N H6 V	G	.280	.000	50.000	-20.000	.000
ZHG059	△	W B N H6 V	G	.280	.000	50.000	.000	-10.000
ZHG060	◺	W B N H6 V	G	.280	.000	50.000	.000	-27.000

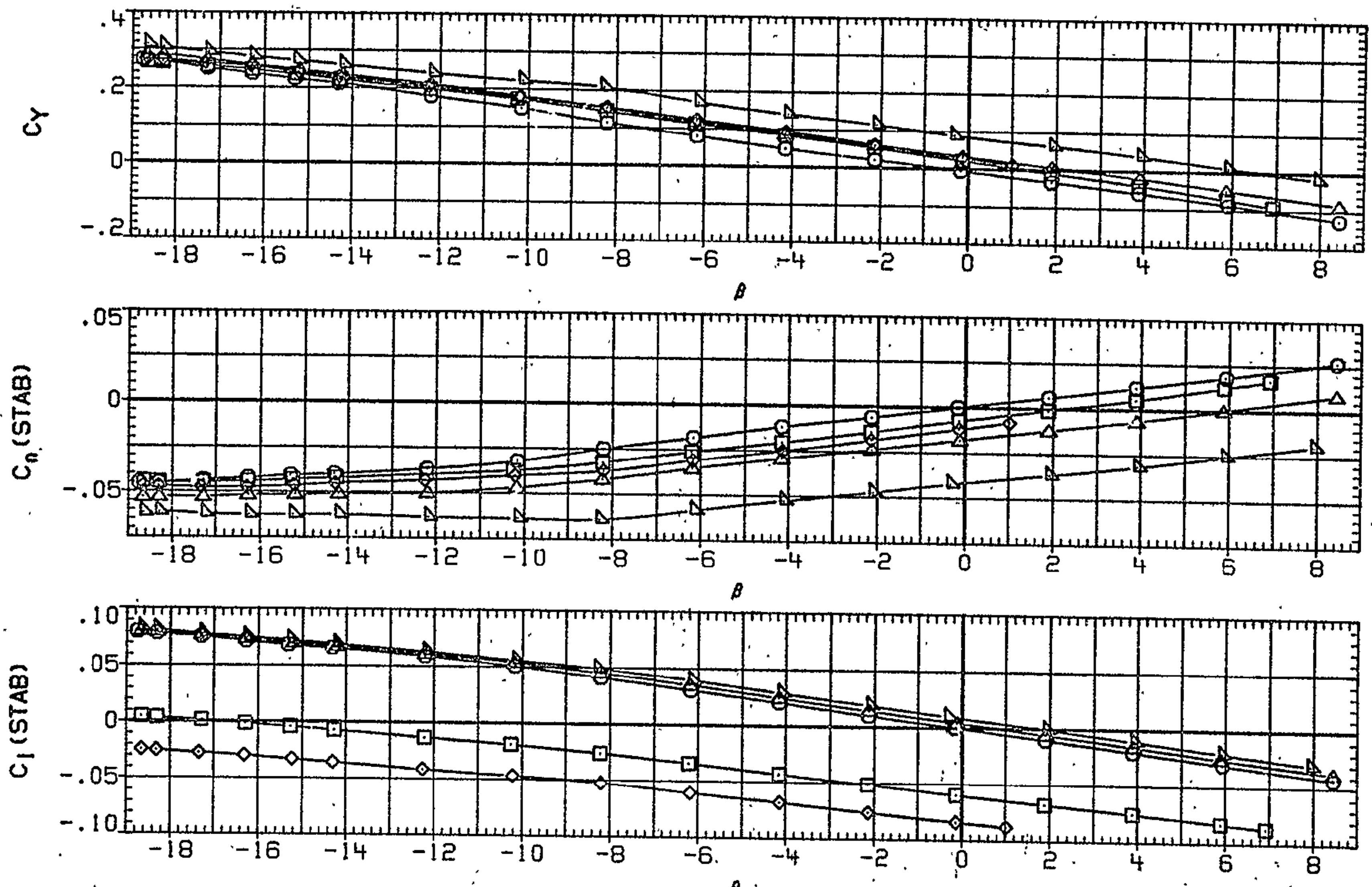

FIG. 13 RUDDER AND AILERON EFFECTS IN YAW, BASIC CONFIGURATION, GEAR DOWN

(A)RN/L = 16.40

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DATA SET	SYMBOL	CONFIGURATION		MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG046	○	W B N H6 V	G	.280	.000	50.000	.000	.000
ZHG050	□	W B N H6 V	G	.280	.000	50.000	-10.000	.000
ZHG049	◇	W B N H6 V	G	.280	.000	50.000	-20.000	.000
ZHG059	△	W B N H6 V	G	.280	.000	50.000	.000	-10.000
ZHG060	◺	W B N H6 V	G	.280	.000	50.000	.000	-27.000

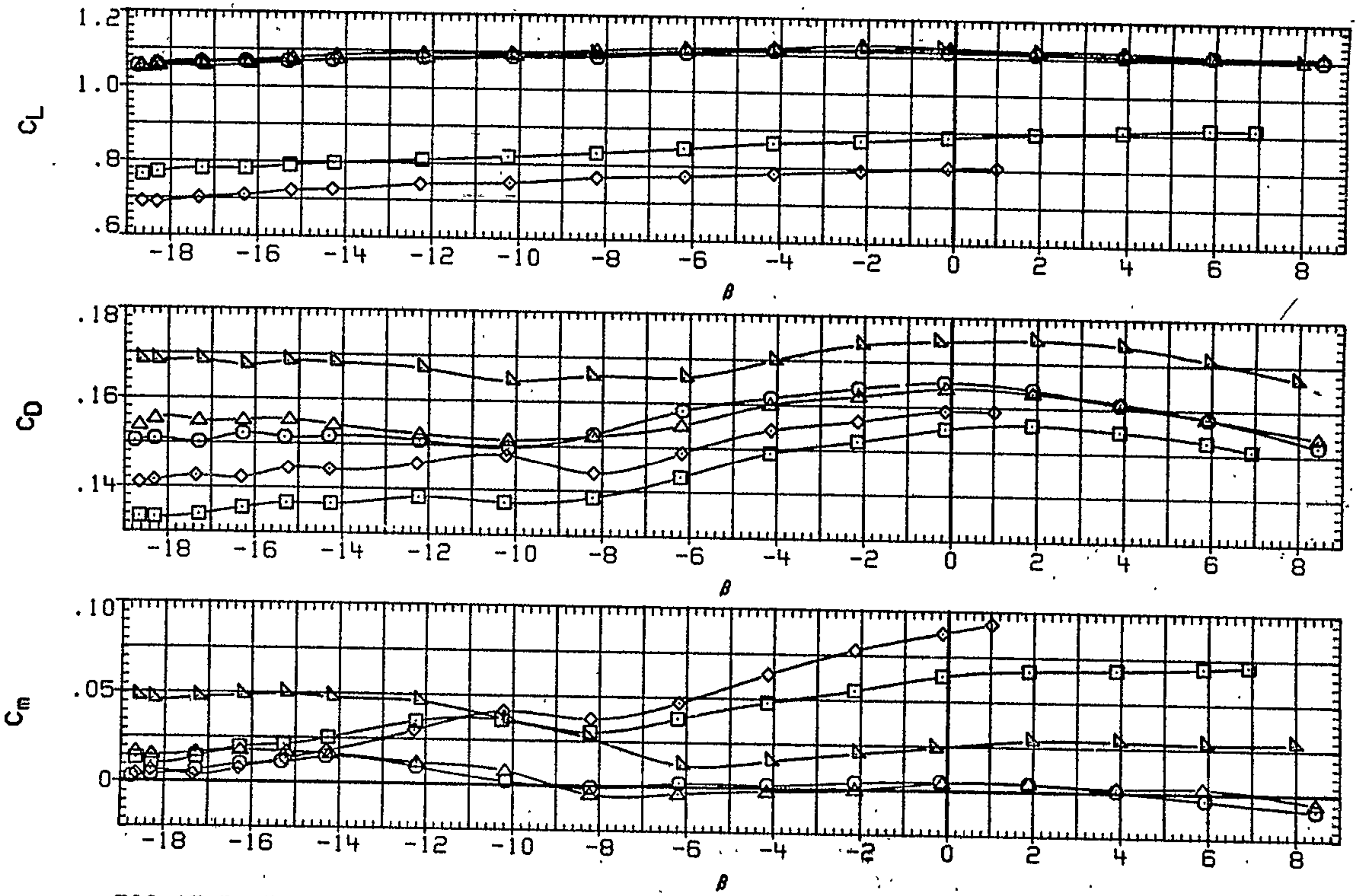

FIG.13 RUDDER AND AILERON EFFECTS IN YAW, BASIC CONFIGURATION, GEAR DOWN

(A)RN/L = 16.40

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DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG035	○	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG051	□	W B N H6 V U L C P E O I G	.280	.000	50.000	-10.000	.000
ZHG052	◇	W B N H6 V U L C P E O I G	.280	.000	50.000	-20.000	.000
ZHG056	△	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	-10.000
ZHG055	◺	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	-27.000

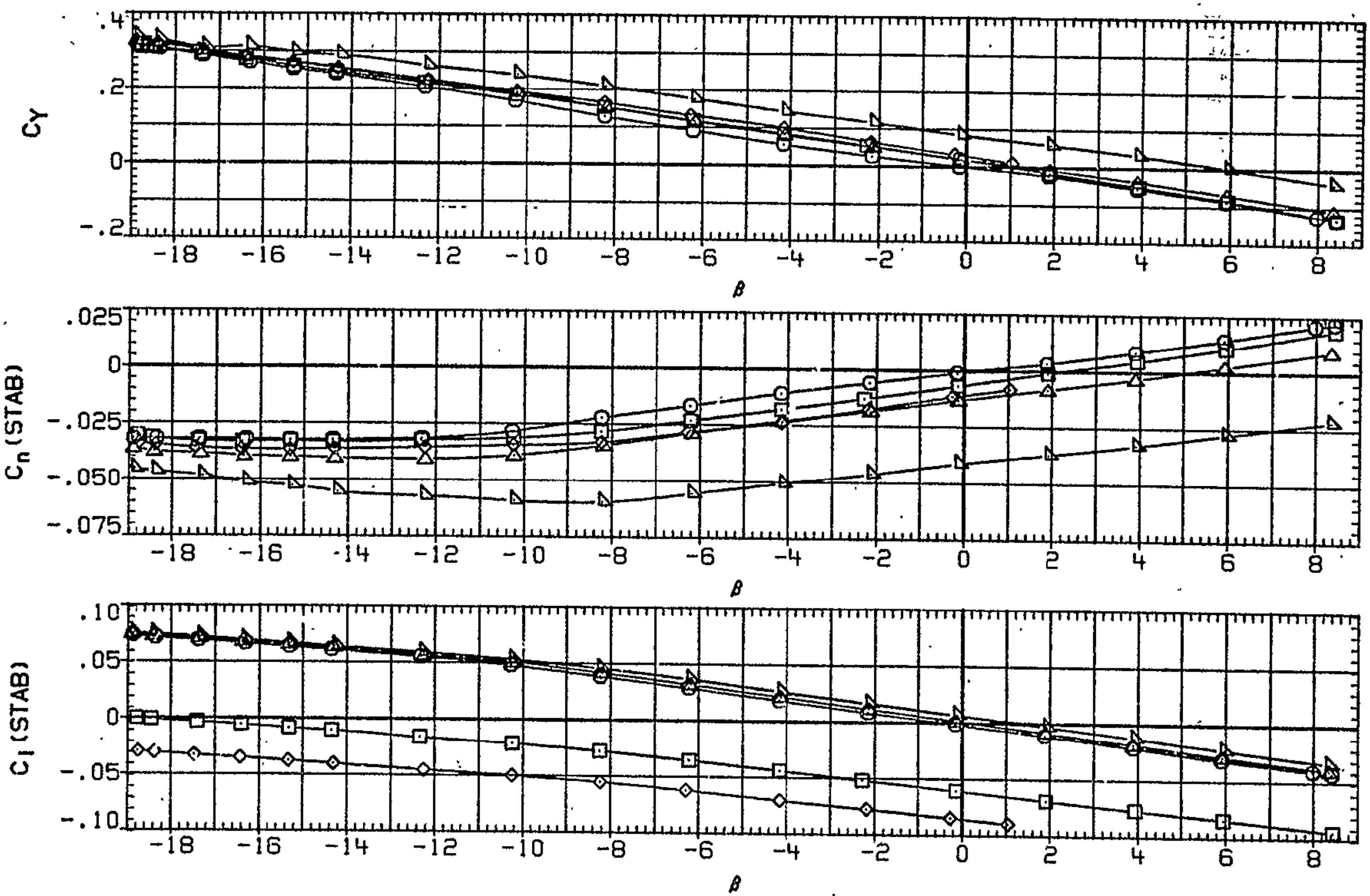

FIG. 14 RUDDER AND AILERON EFFECTS IN YAW, ALL PROTUBERANCES ON, GEAR DOWN

(A) RN/L = 15.40

DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
ZHG035	○	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
ZHG051	□	W B N H6 V U L C P E O I G	.280	.000	50.000	-10.000	.000
ZHG052	◇	W B N H6 V U L C P E O I G	.280	.000	50.000	-20.000	.000
ZHG056	△	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	-10.000
ZHG055	◺	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	-27.000

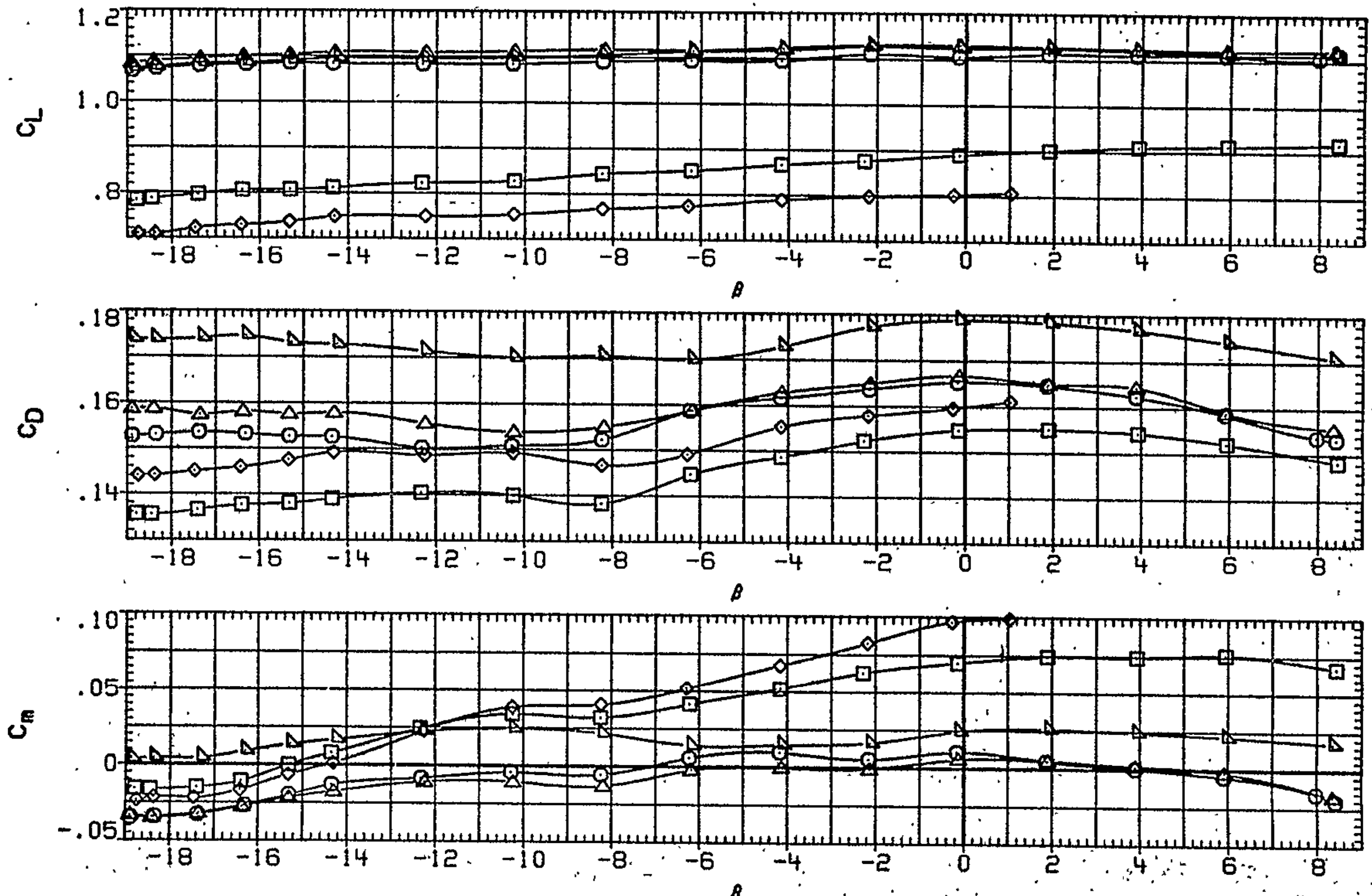

FIG. 14 RUDDER AND AILERON EFFECTS IN YAW, ALL PROTUBERANCES ON, GEAR DOWN

(A) RN/L = 16.40

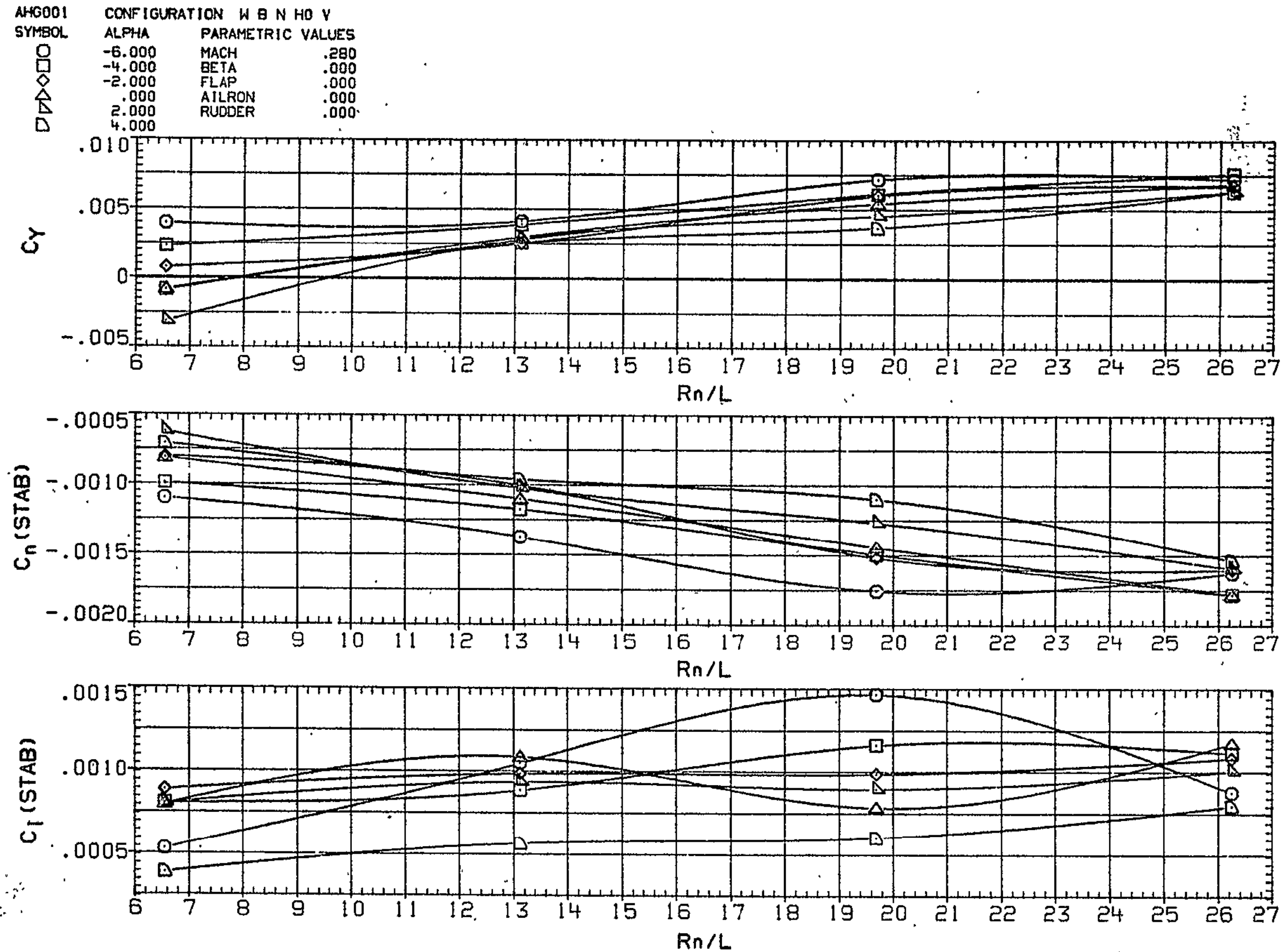

FIG.15 EFFECT OF UNIT REYNOLDS NUMBER , BASIC CONFIGURATION

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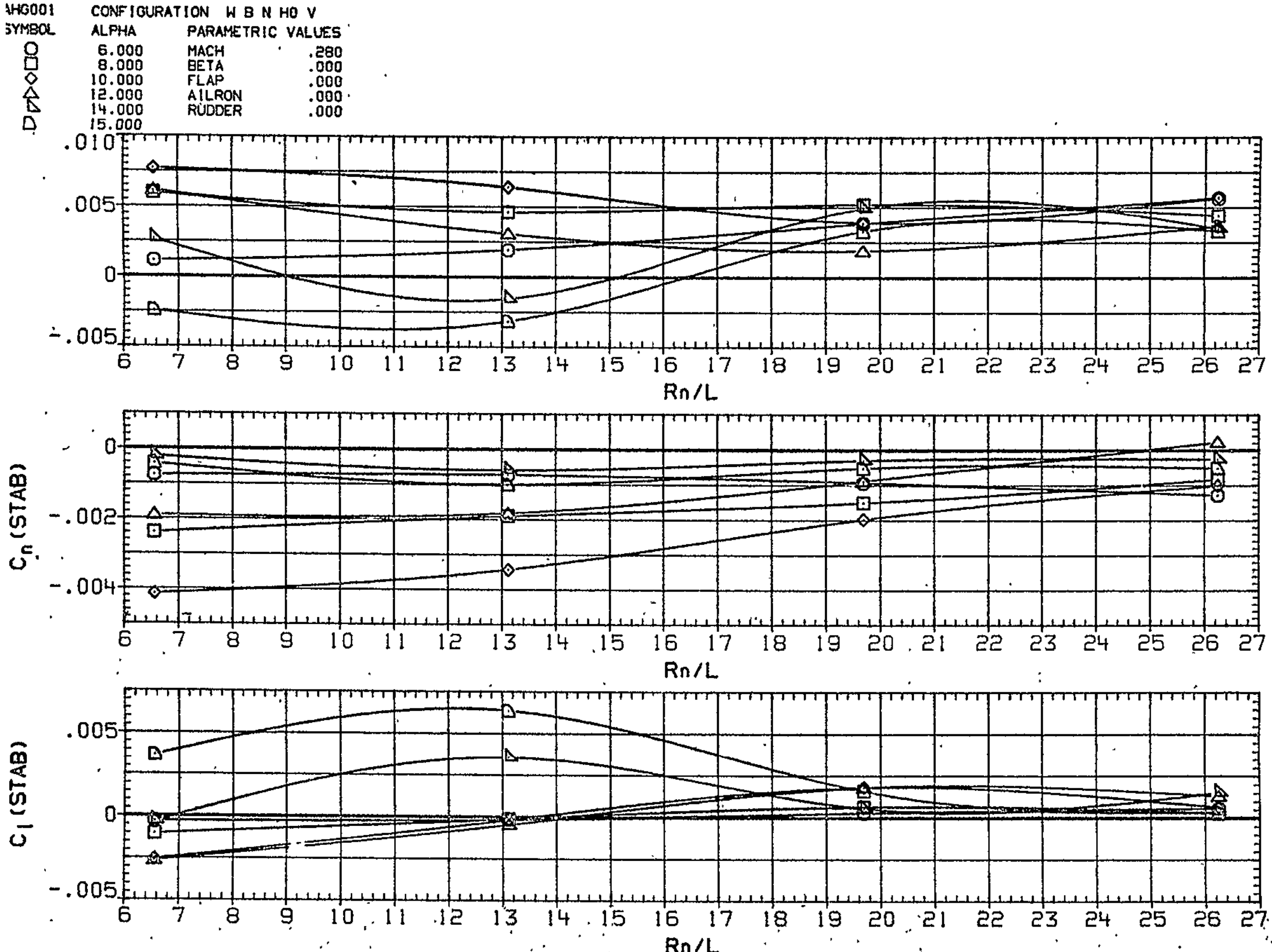

FIG.15 EFFECT OF UNIT REYNOLDS NUMBER , BASIC CONFIGURATION

AHG001 CONFIGURATION W B N HO V

SYMBOL	ALPHA	PARAMETRIC VALUES	
○	16.000	MACH	.280
□	17.000	BETA	.000
◇	18.000	FLAP	.000
		AILRON	.000
		RUDDER	.000

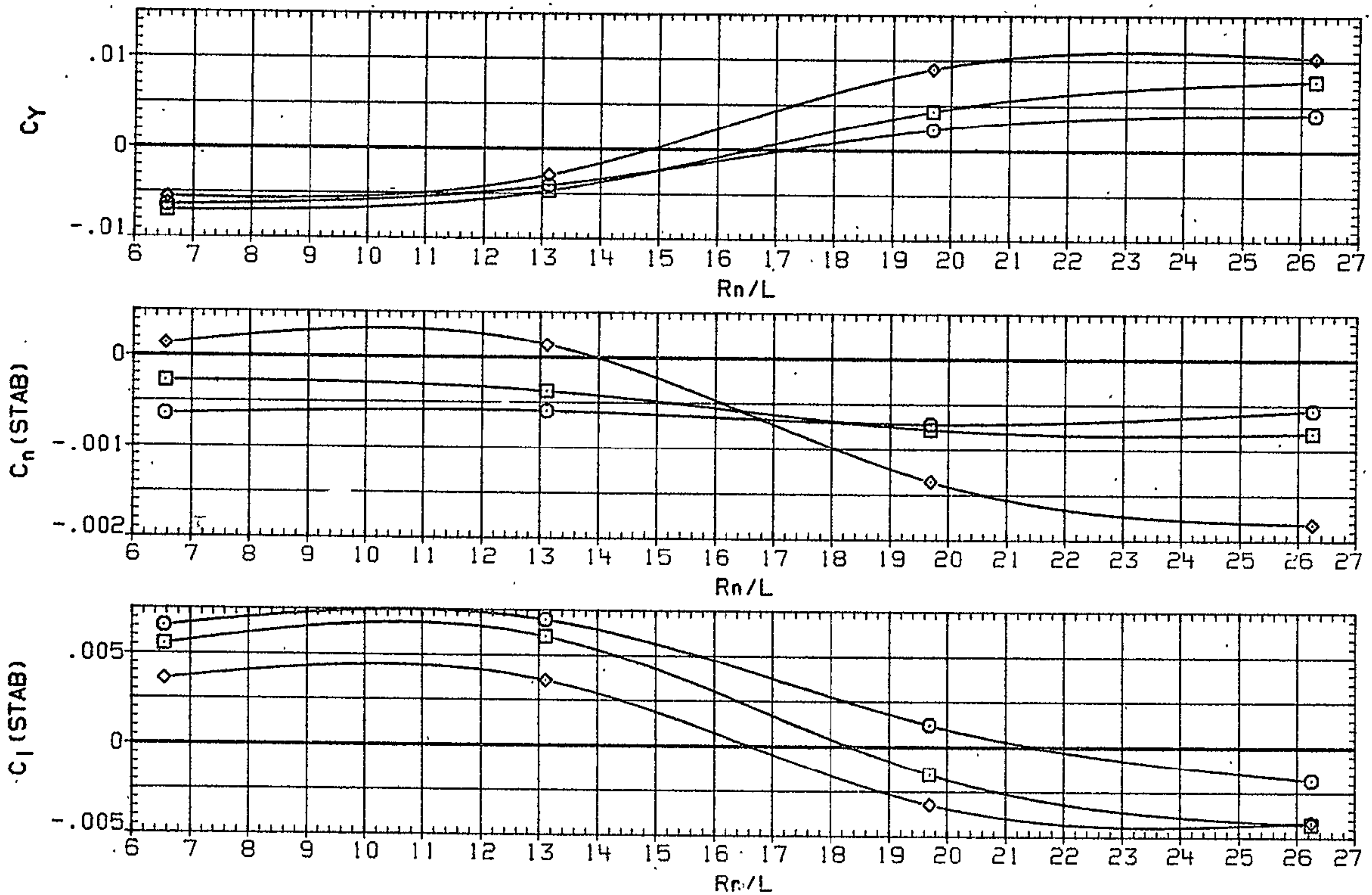

FIG.15 EFFECT OF UNIT REYNOLDS NUMBER , BASIC CONFIGURATION

WHG001 CONFIGURATION W B N HO V

SYMBOL	ALPHA	PARAMETRIC VALUES	
○	-6.000	MACH	.280
□	-4.000	BETA	.000
◇	-2.000	FLAP	.000
△	.000	AILRON	.000
◺	2.000	RUDDER	.000
D	4.000		

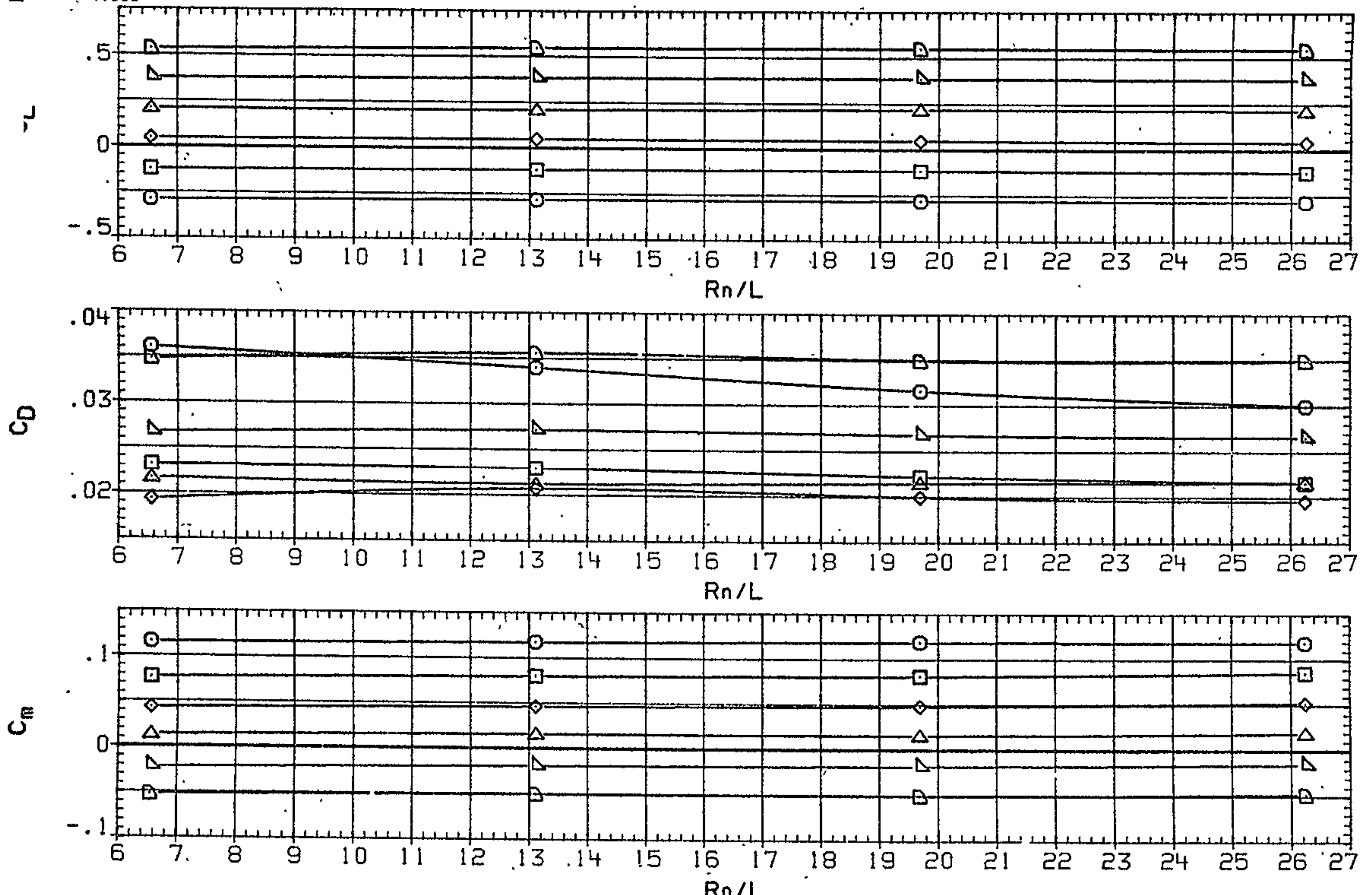

FIG. 15 EFFECT OF UNIT REYNOLDS NUMBER , BASIC CONFIGURATION

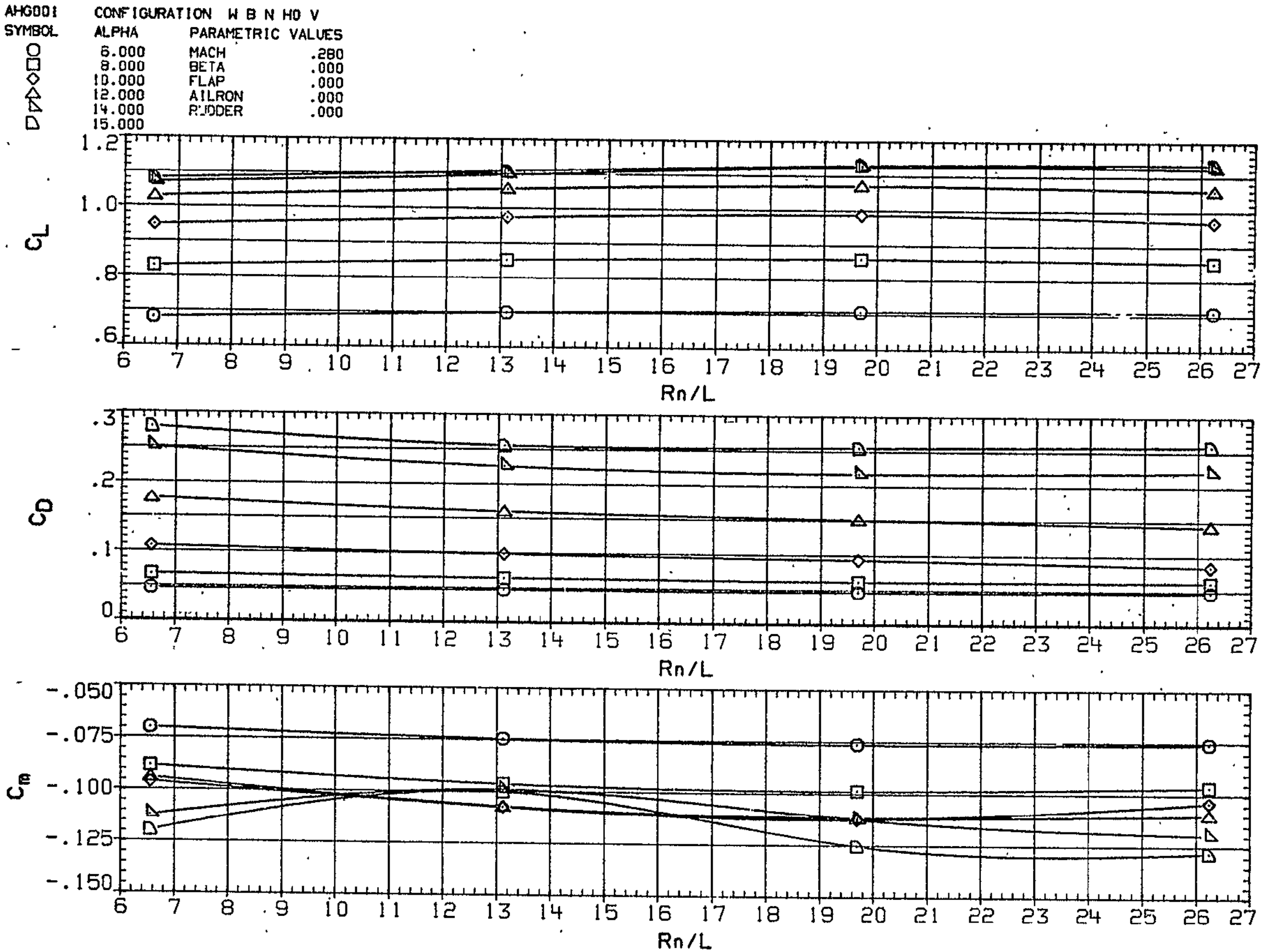

FIG.15 EFFECT OF UNIT REYNOLDS NUMBER , BASIC CONFIGURATION

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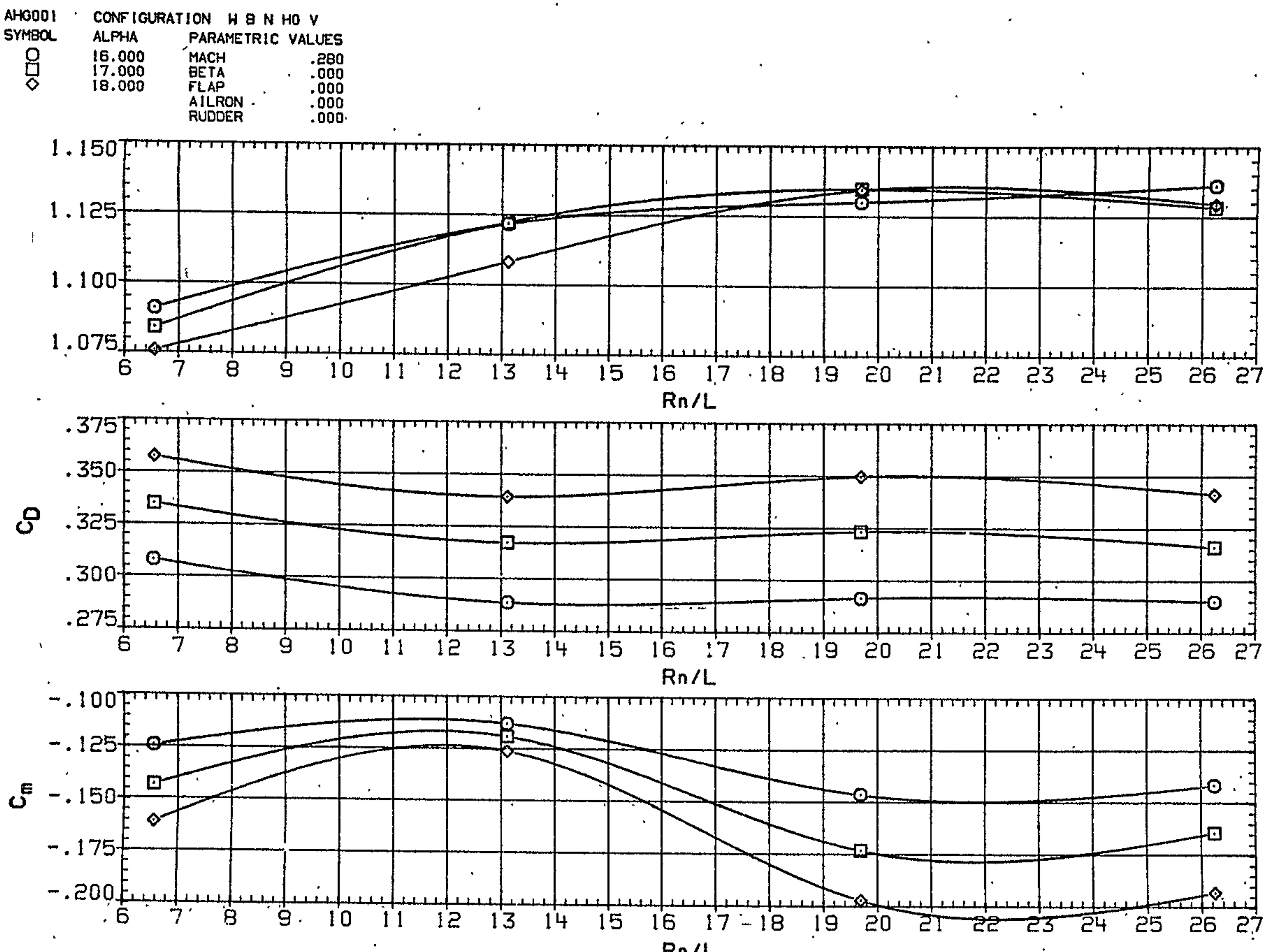

FIG.15 EFFECT OF UNIT REYNOLDS NUMBER , BASIC CONFIGURATION

AHG015 CONFIGURATION W B N H6 V U L C P E O I G

SYMBOL	ALPHA	PARAMETRIC VALUES	
○	-6.000	MACH	.280
□	-4.000	BETA	.000
◇	-2.000	FLAP	50.000
△	.000	AILRON	.000
◺	2.000	RUDDER	.000
D	4.000		

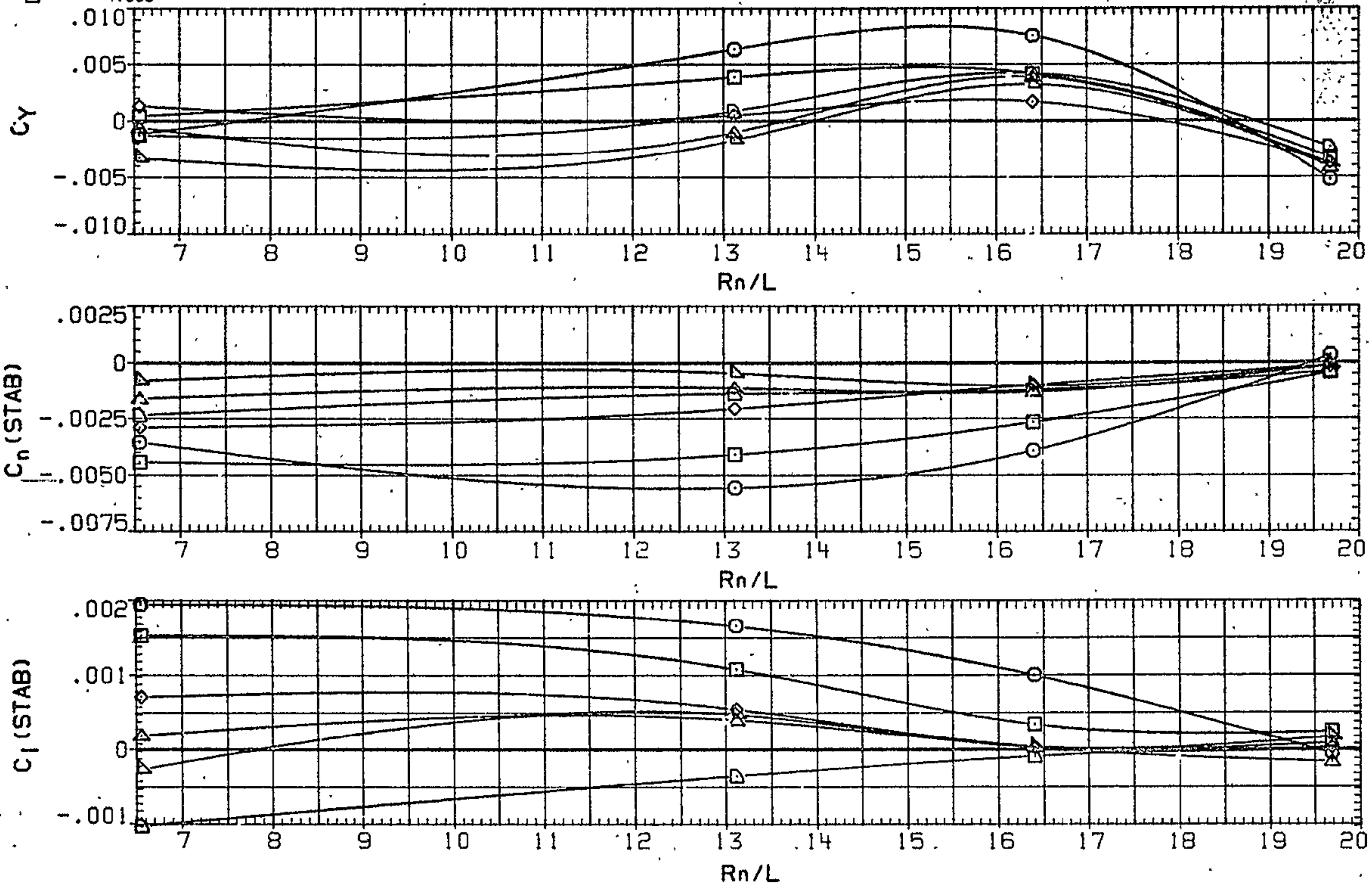

FIG.16 EFFECT OF UNIT REYNOLDS NUMBER , ALL PROTUBERANCES ON

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AHG015 CONFIGURATION W B N H6 V U L C P E O I G

SYMBOL	ALPHA	PARAMETRIC VALUES	
○	6.000	MACH	.280
□	8.000	BETA	.000
◇	10.000	FLAP	50.000
△	12.000	AILRON	.000
◁	14.000	RUDDER	.000
▷	15.000		

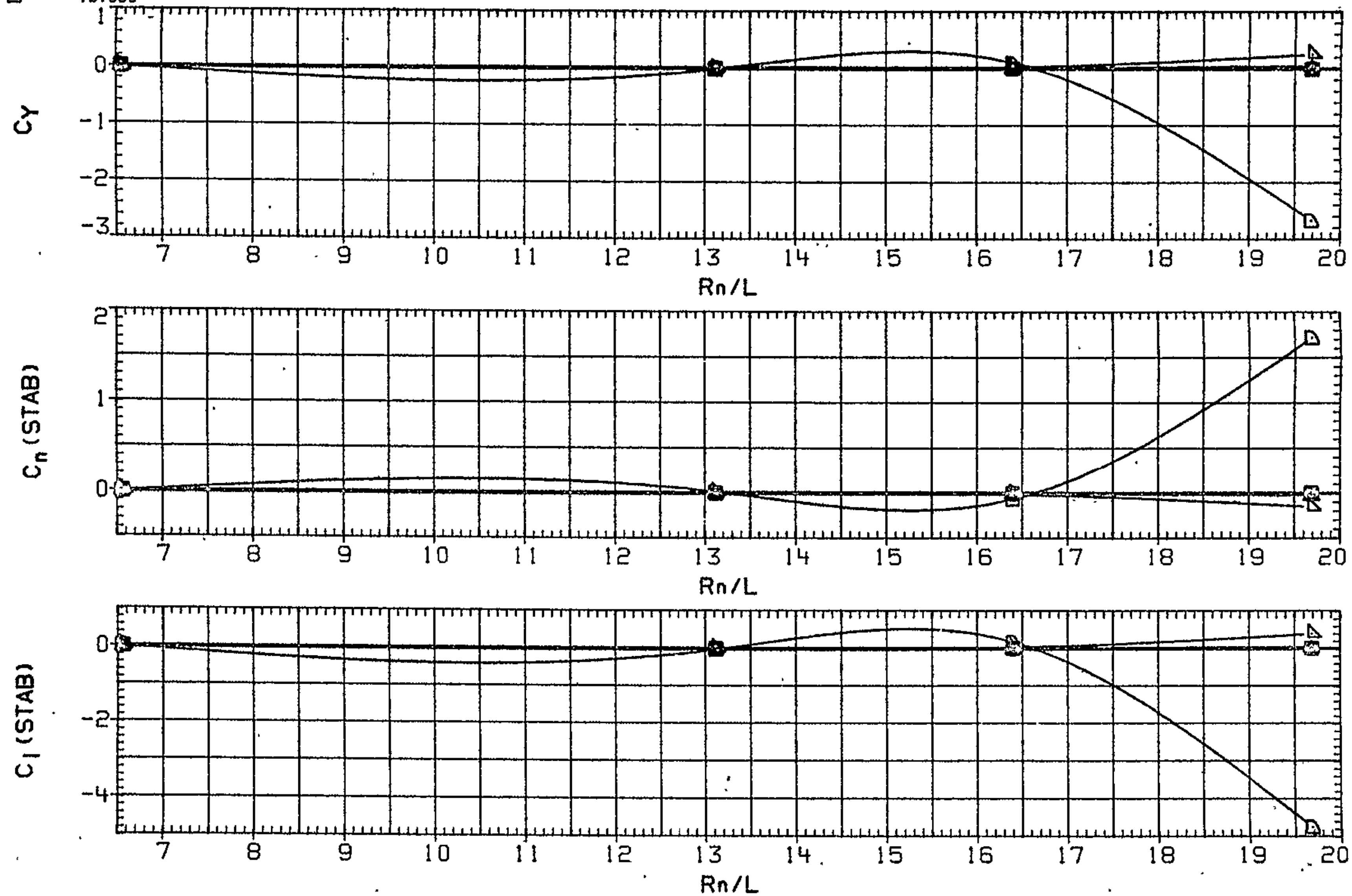

FIG.16 EFFECT OF UNIT REYNOLDS NUMBER , ALL PROTUBERANCES ON

AHG015 CONFIGURATION W B N H6 V U L C P E 0 1 G

SYMBOL	ALPHA	PARAMETRIC VALUES	
○	16.000	MACH	.280
□	17.000	BETA	.000
◇	18.000	FLAP	50.000
		AILRON	.000
		RUDDER	.000

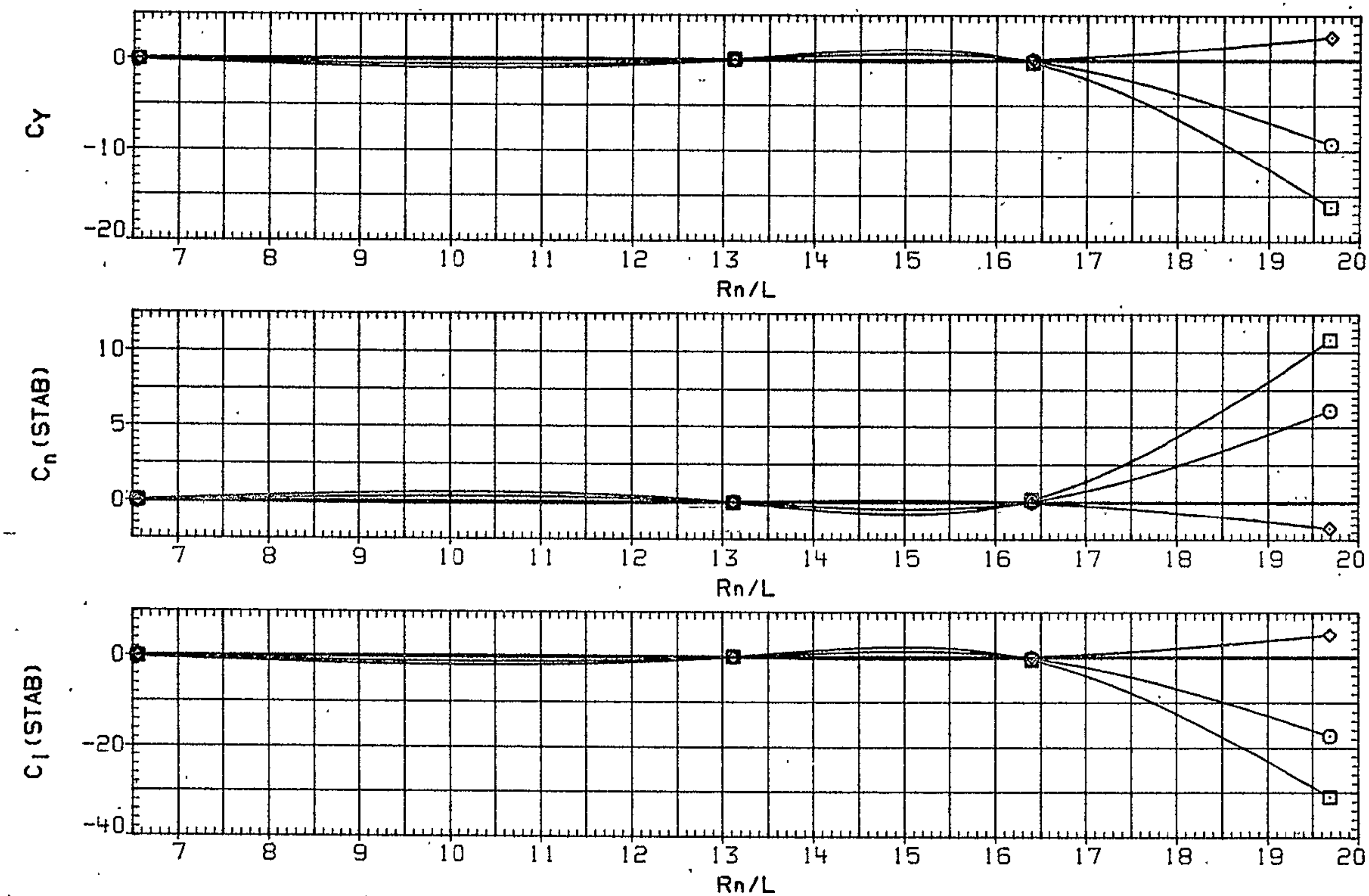

FIG. 16 EFFECT OF UNIT REYNOLDS NUMBER , ALL PROTUBERANCES ON

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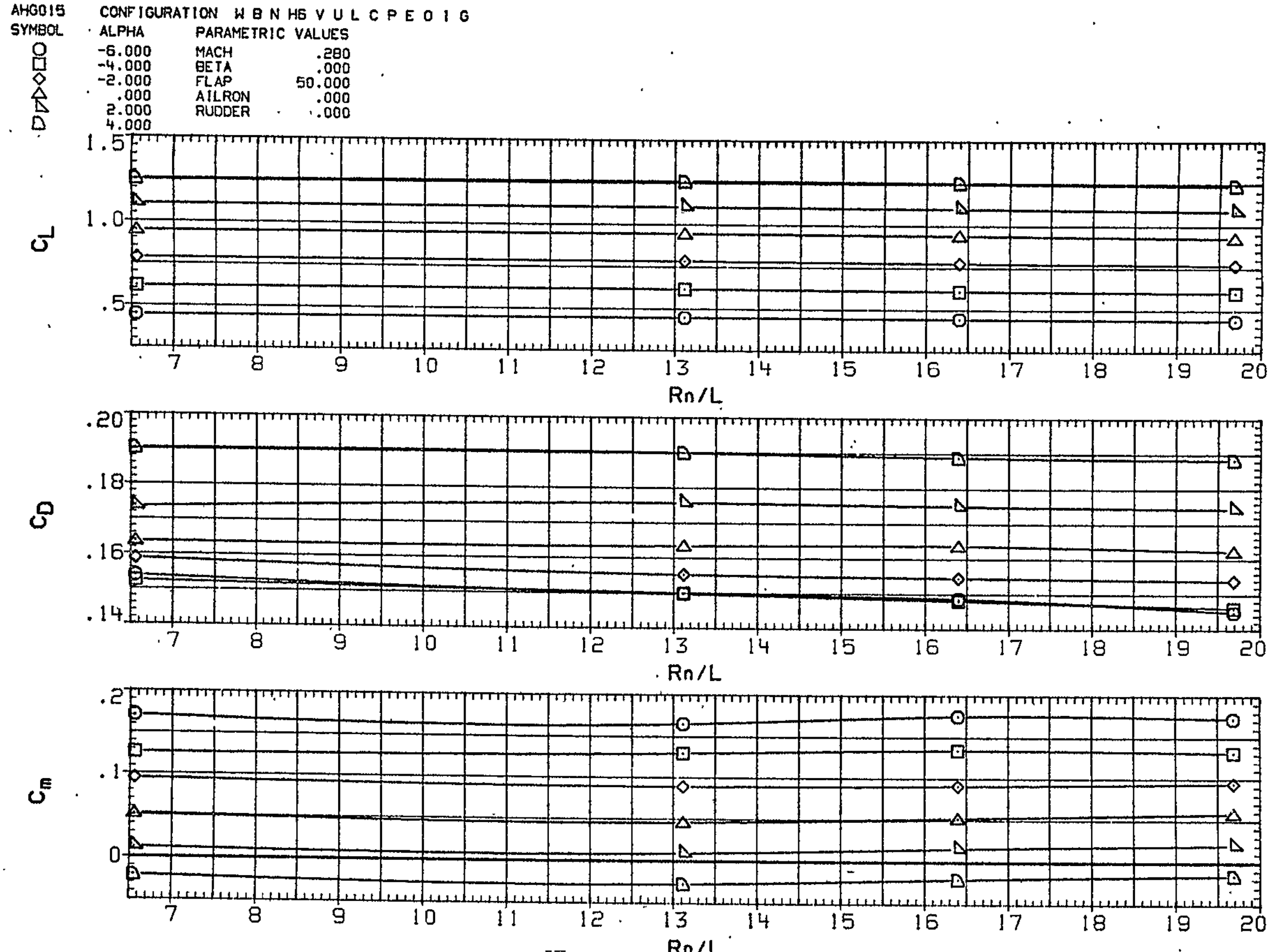

FIG. 16 EFFECT OF UNIT REYNOLDS NUMBER , ALL PROTUBERANCES ON

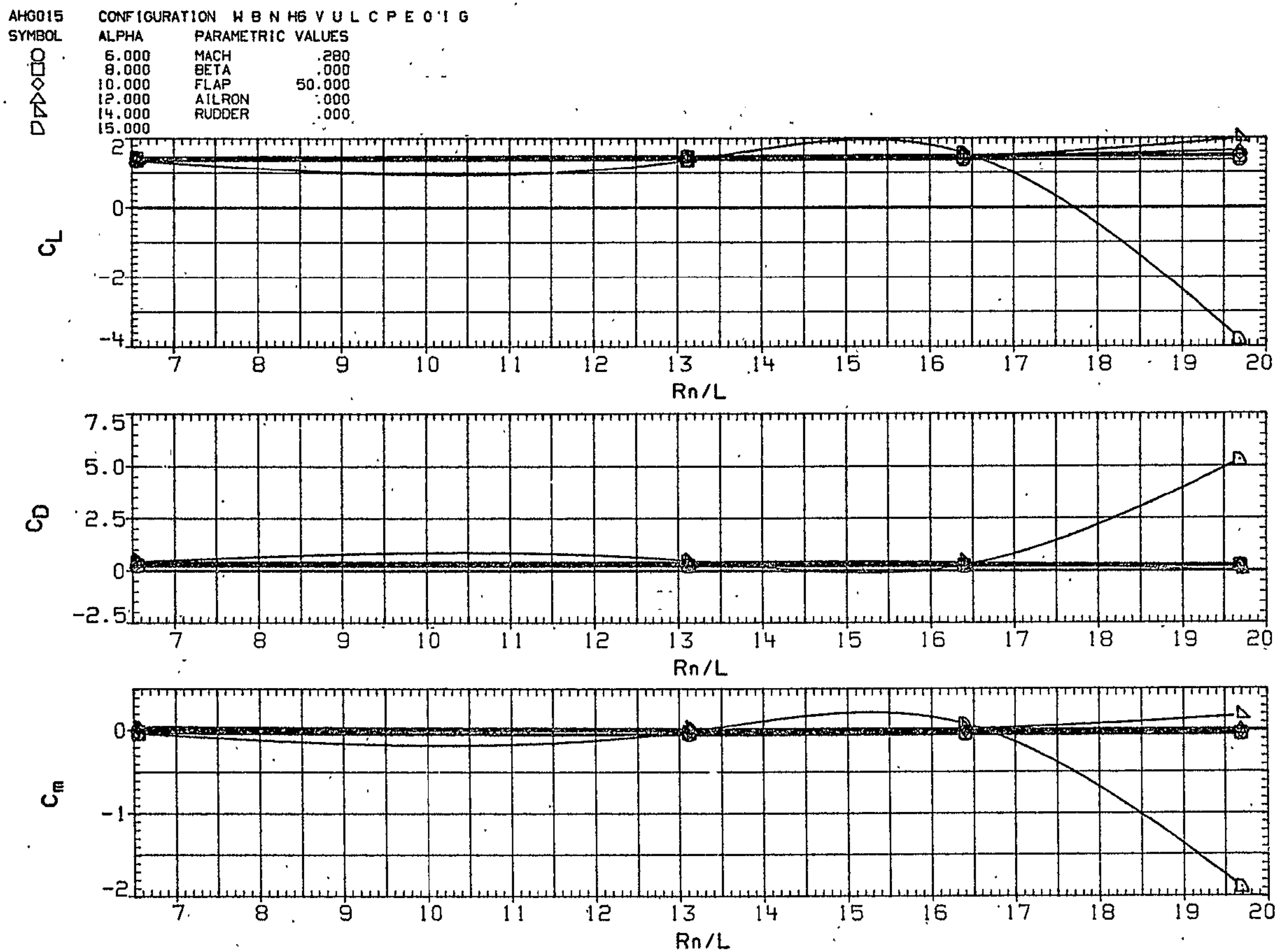

FIG.16 EFFECT OF UNIT REYNOLDS NUMBER , ALL PROTUBERANCES ON

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AHG015 CONFIGURATION W B N H6 V U L C P E O I G

SYMBOL	ALPHA	PARAMETRIC VALUES	
○	16.000	MACH	.280
□	17.000	BETA	.000
◇	18.000	FLAP	50.000
		AILRON	.000
		RUDDER	.000

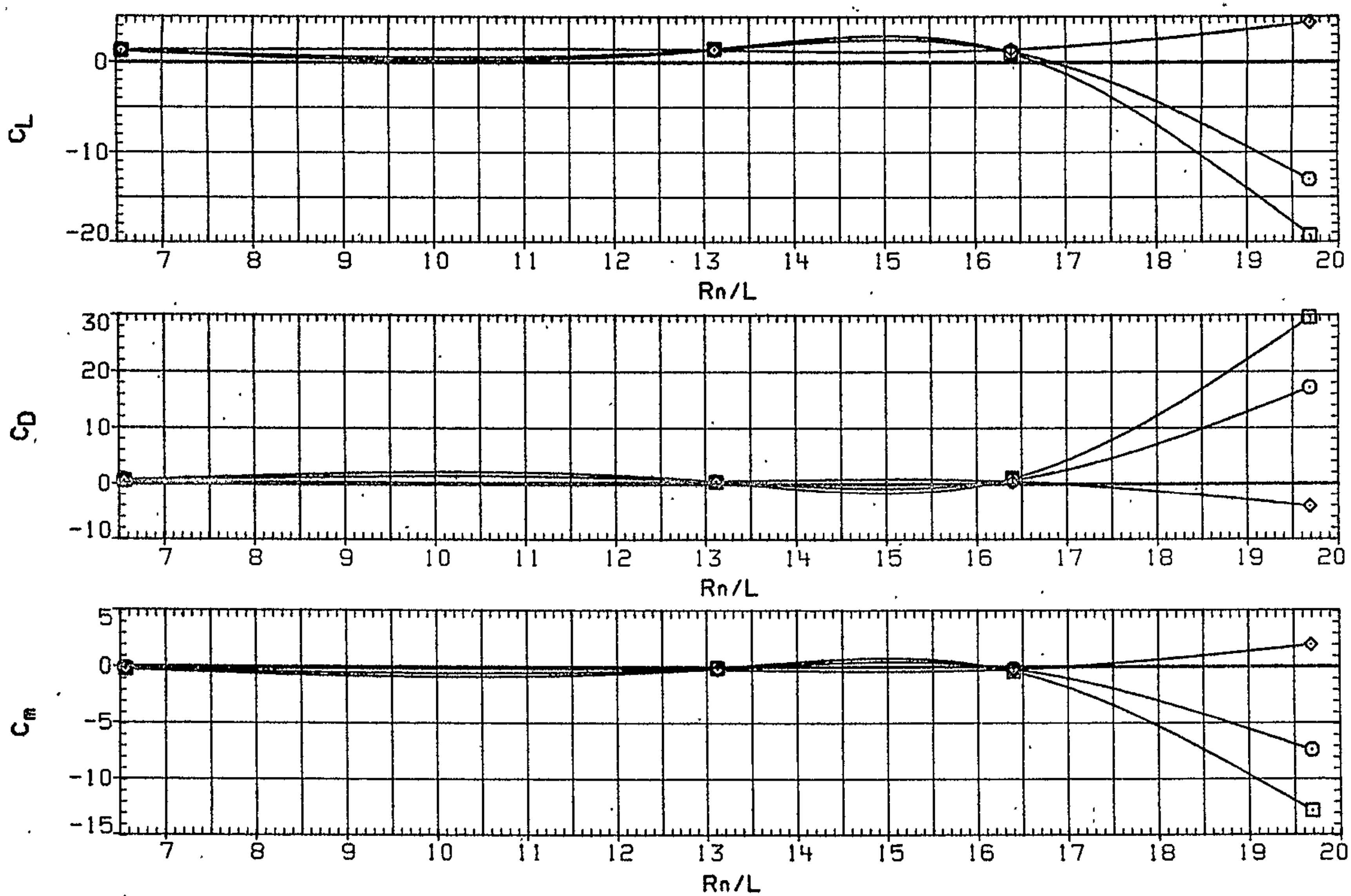

FIG. 16 EFFECT OF UNIT REYNOLDS NUMBER , ALL PROTUBERANCES ON

DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
DHG007	○	W B N H6 V U L C P E O I G	.280	.000	30.000	.000	.000
DHG015	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000

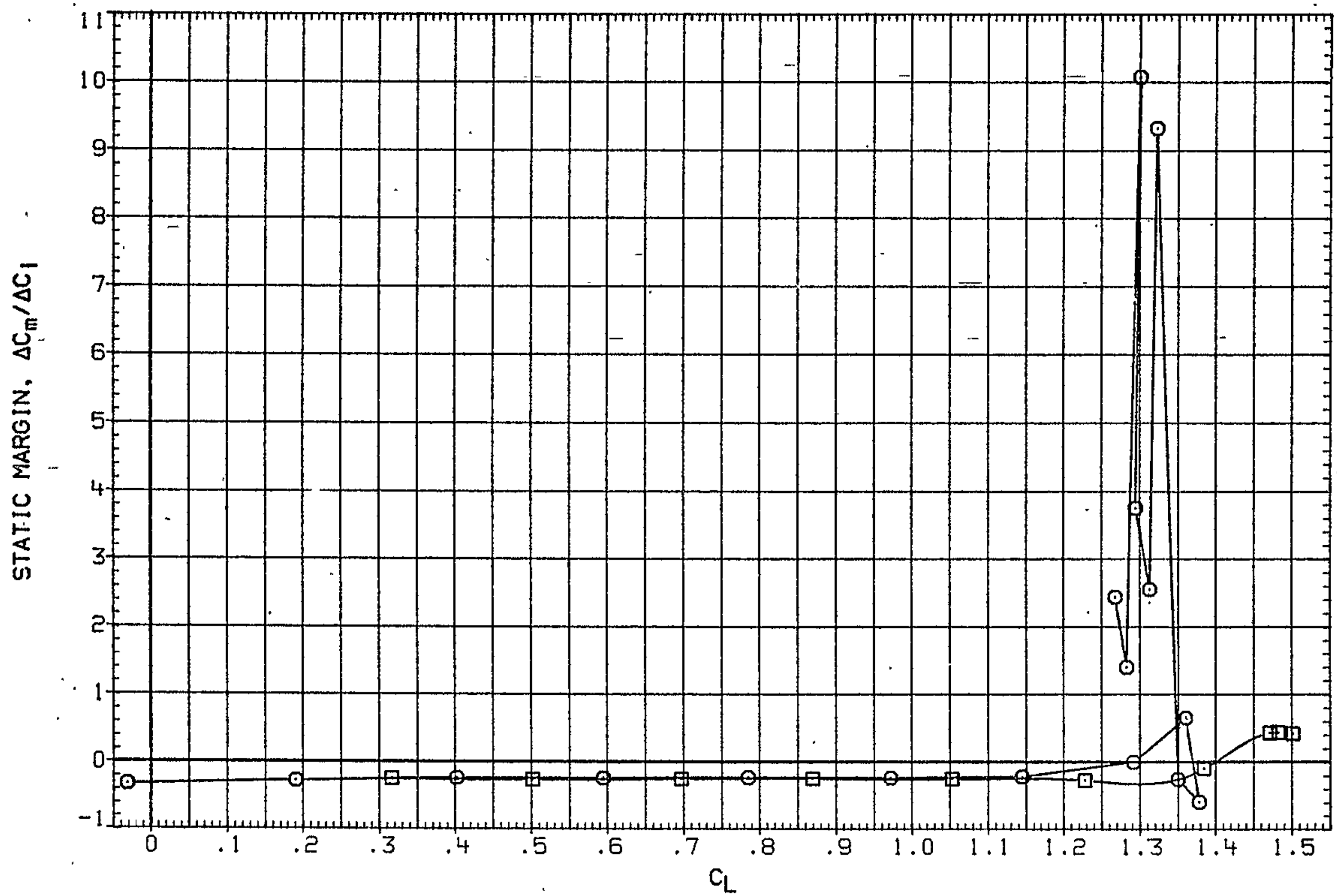

FIG.17 STATIC STABILITY MARGIN

(A)RN/L = 19.69

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DATA SET	SYMBOL	CONFIGURATION	MACH	BETA	FLAP	AILRON	RUDDER
DHG031	○	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	10.000
DHG032	□	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	27.000
DHG033	◇	W B N H6 V U L C P E O I G	.280	.000	50.000	20.000	.000
DHG034	△	W B N H6 V U L C P E O I G	.280	.000	50.000	10.000	.000
DHG098	◺	W B N H6 V U L C P E O I G	.280	-12.000	30.000	.000	.000

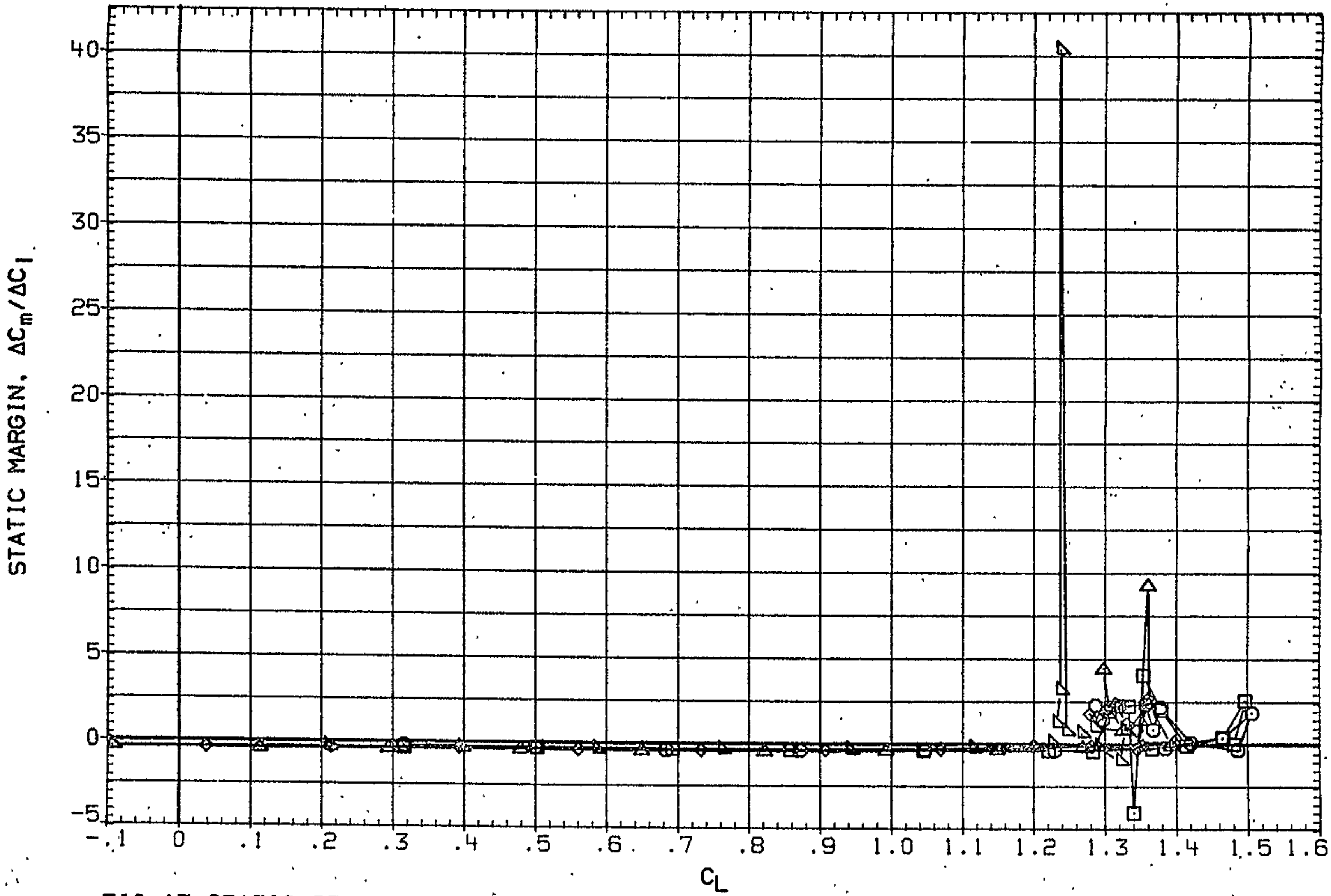

FIG. 17 STATIC STABILITY MARGIN

(A)RN/L = 16.40

DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
BHG035	○	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000
BHG051	□	W B N H6 V U L C P E O I G	.280	.000	50.000	-10.000	.000
BHG052	◇	W B N H6 V U L C P E O I G	.280	.000	50.000	-20.000	.000
BHG055	△	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	-27.000
BHG066	◺	W B N H6 V U L C P E O I G	.280	.000	30.000	.000	.000
BHG069	D	W B N H6 V.U L C P E O I G	.280	6.000	30.000	.000	.000

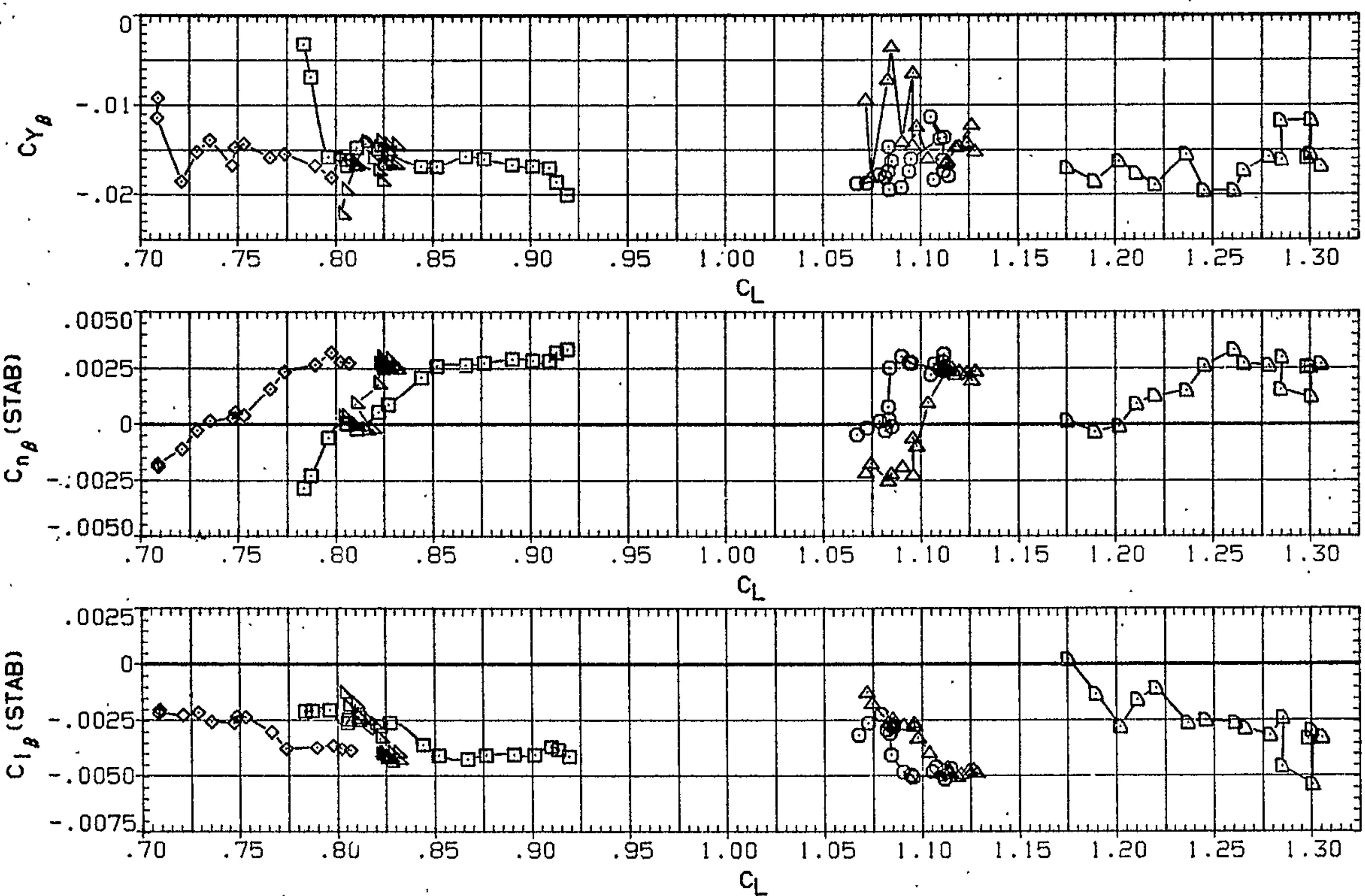

FIG.18 LATERAL-DIRECTIONAL DERIVATIVES

(A)RN/L = 14.76

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DATA SET	SYMBOL	CONFIGURATION	MACH	ALPHA	FLAP	AILRON	RUDDER
BHG053	○	W B N H6 V U L C P E O I G	.280	.000	50.000	20.000	.000
BHG054	□	W B N H6 V U L C P E O I G	.280	.000	50.000	10.000	.000
BHG072	◇	W B N H6 V U L C P E O I G	.280	6.000	50.000	.000	.000
BHG105	△	W B N H6 V U L C P E O I G	.280	.000	50.000	.000	.000

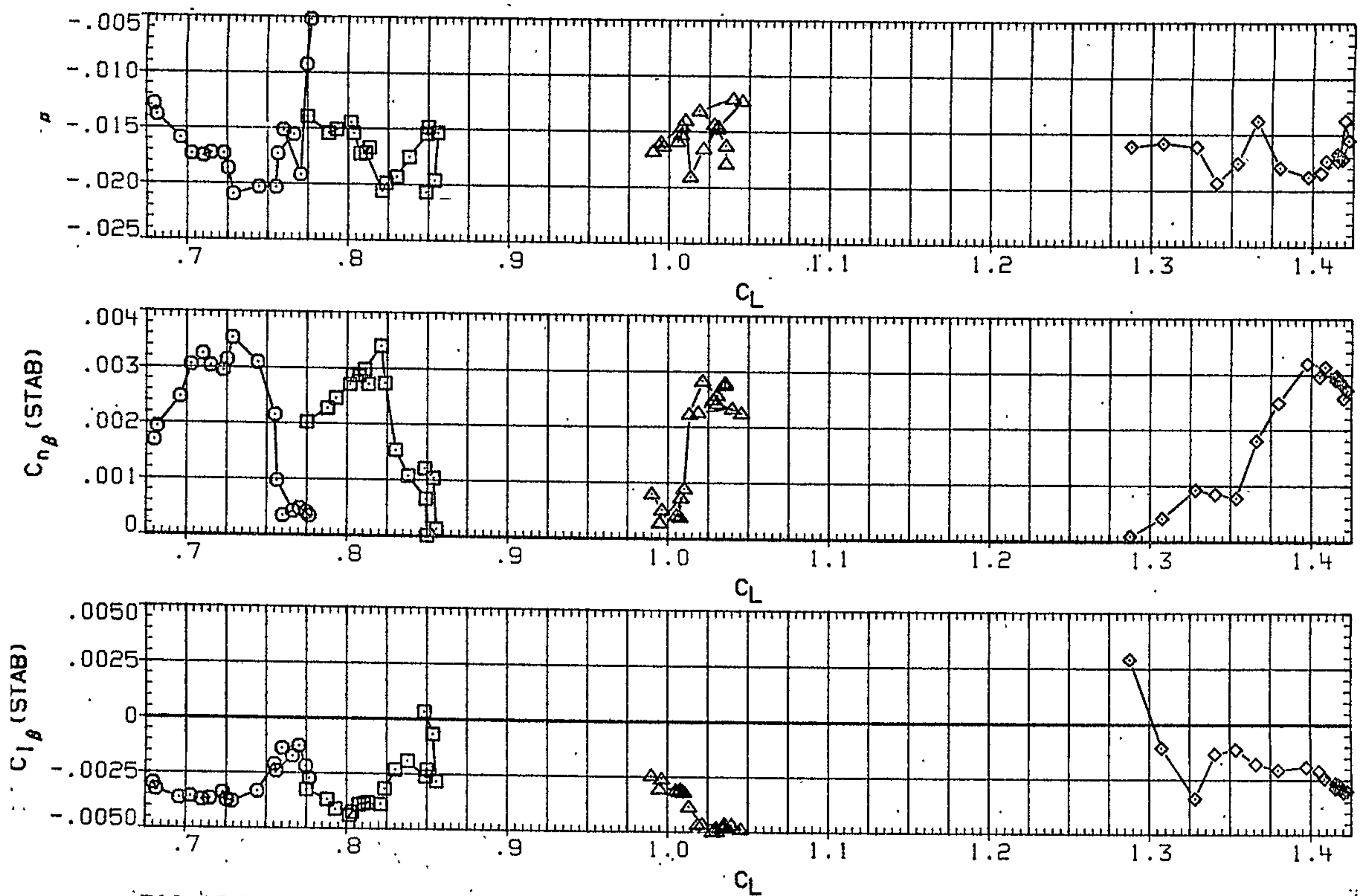

FIG. 18 LATERAL-DIRECTIONAL DERIVATIVES

(A)RN/L = 6.56

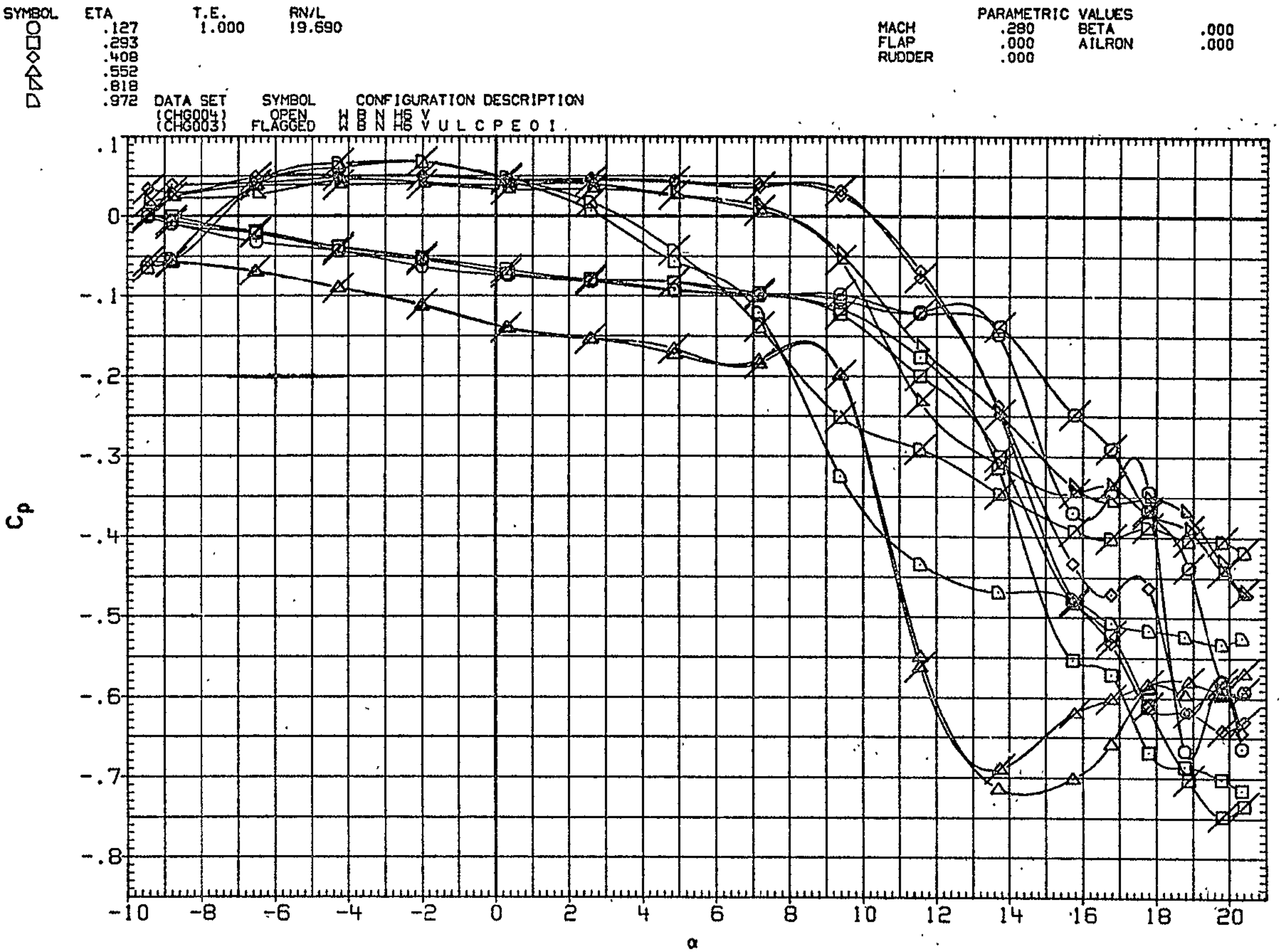

FIG. 19 TRAILING EDGE PRESSURE COEFFICIENTS

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SYMBOL	ETA	T.E.	RN/L
○	.127	1.000	19.690
□	.293		
◇	.408		
△	.552		
◁	.818		
D	.972		

PARAMETRIC VALUES

MACH	.280	BETA	.000
FLAP	30.000	AILRON	.000
RUDDER	.000		

DATA SET	SYMBOL	CONFIGURATION DESCRIPTION
(CHG005)	OPEN	W B N H6 V
(CHG008)	FLAGGED	W B N H6 V U L C P E O I

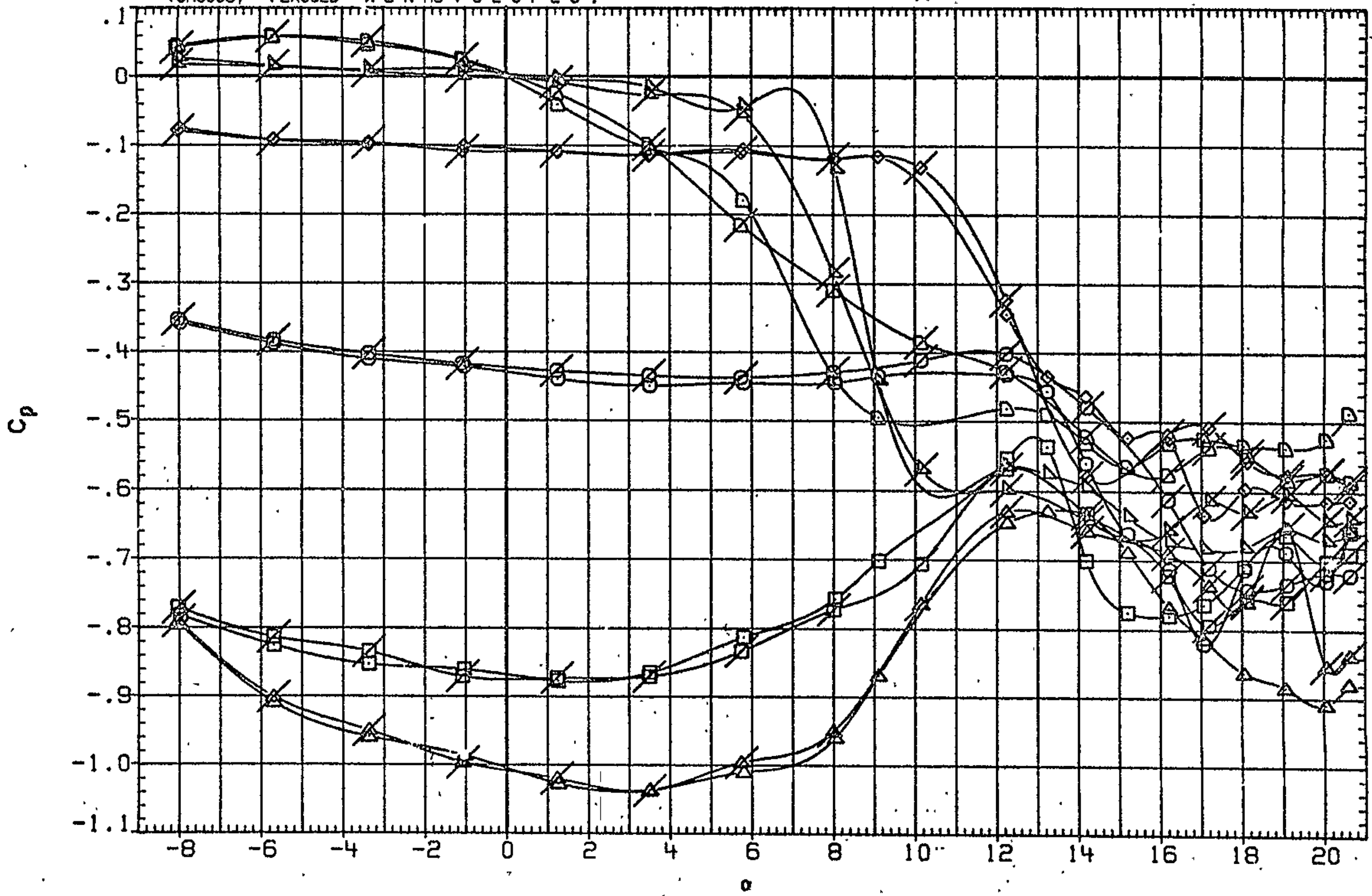

FIG. 19 TRAILING EDGE PRESSURE COEFFICIENTS

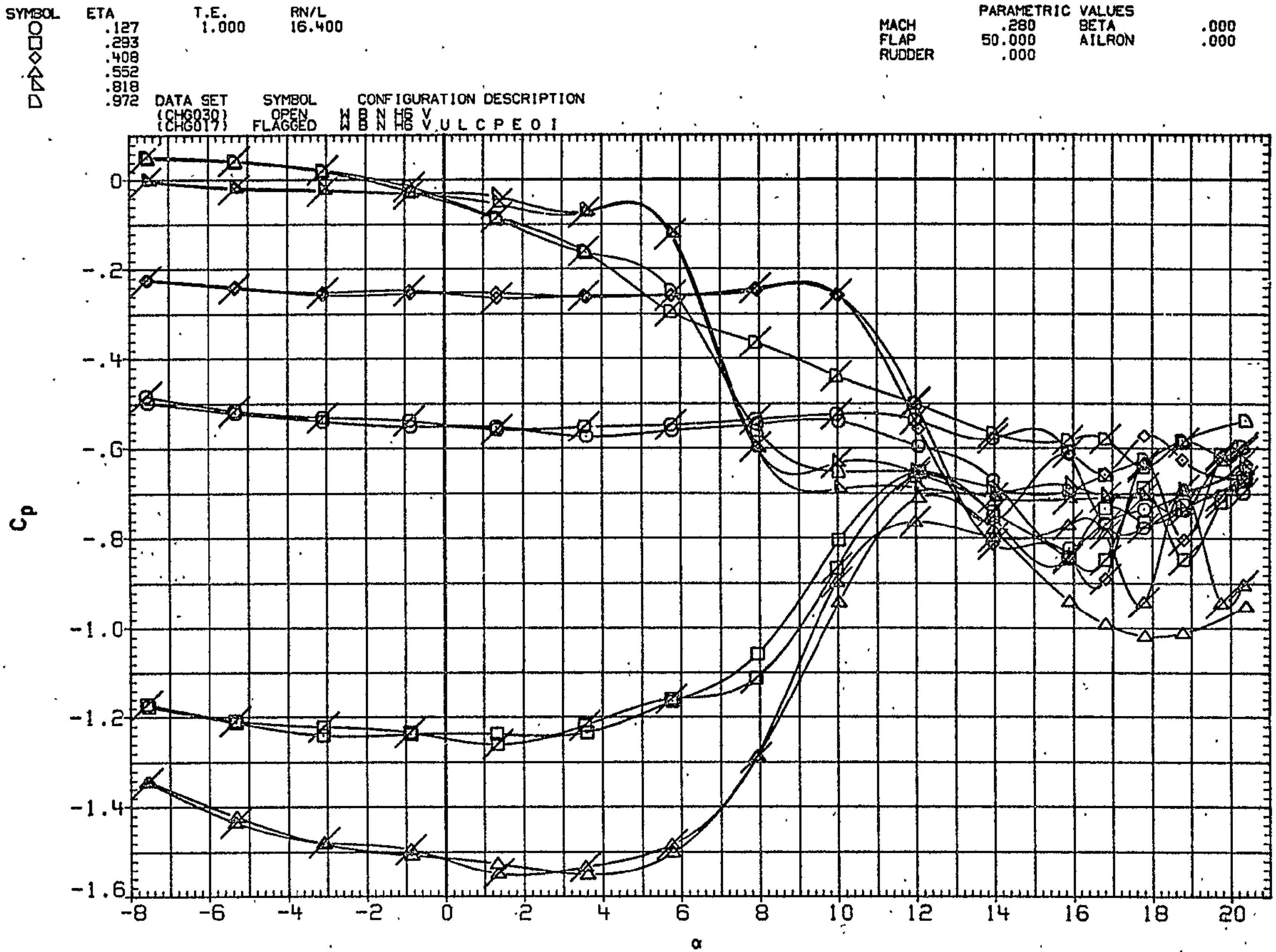

FIG. 19 TRAILING EDGE PRESSURE COEFFICIENTS

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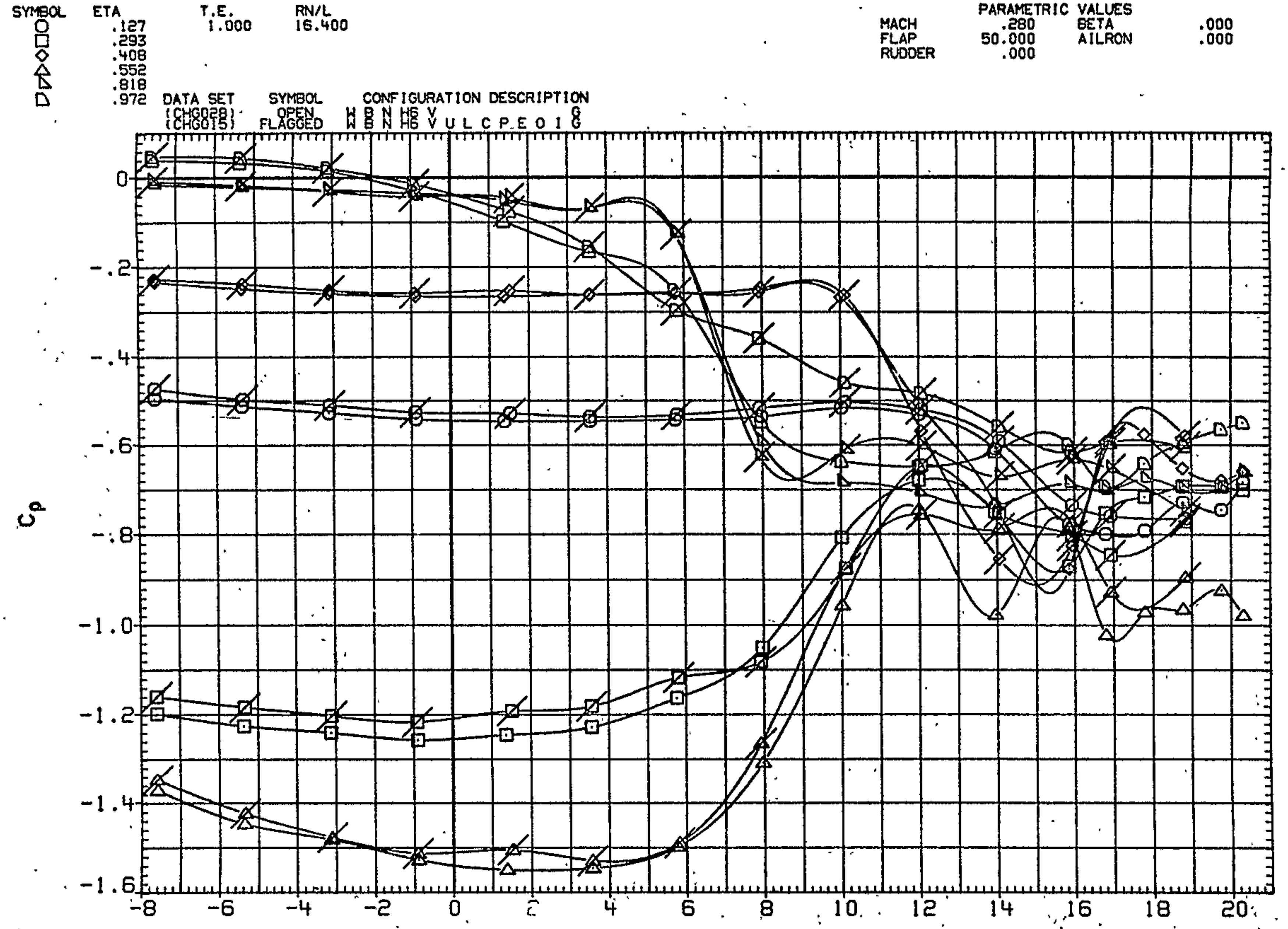

FIG. 19 TRAILING EDGE PRESSURE COEFFICIENTS

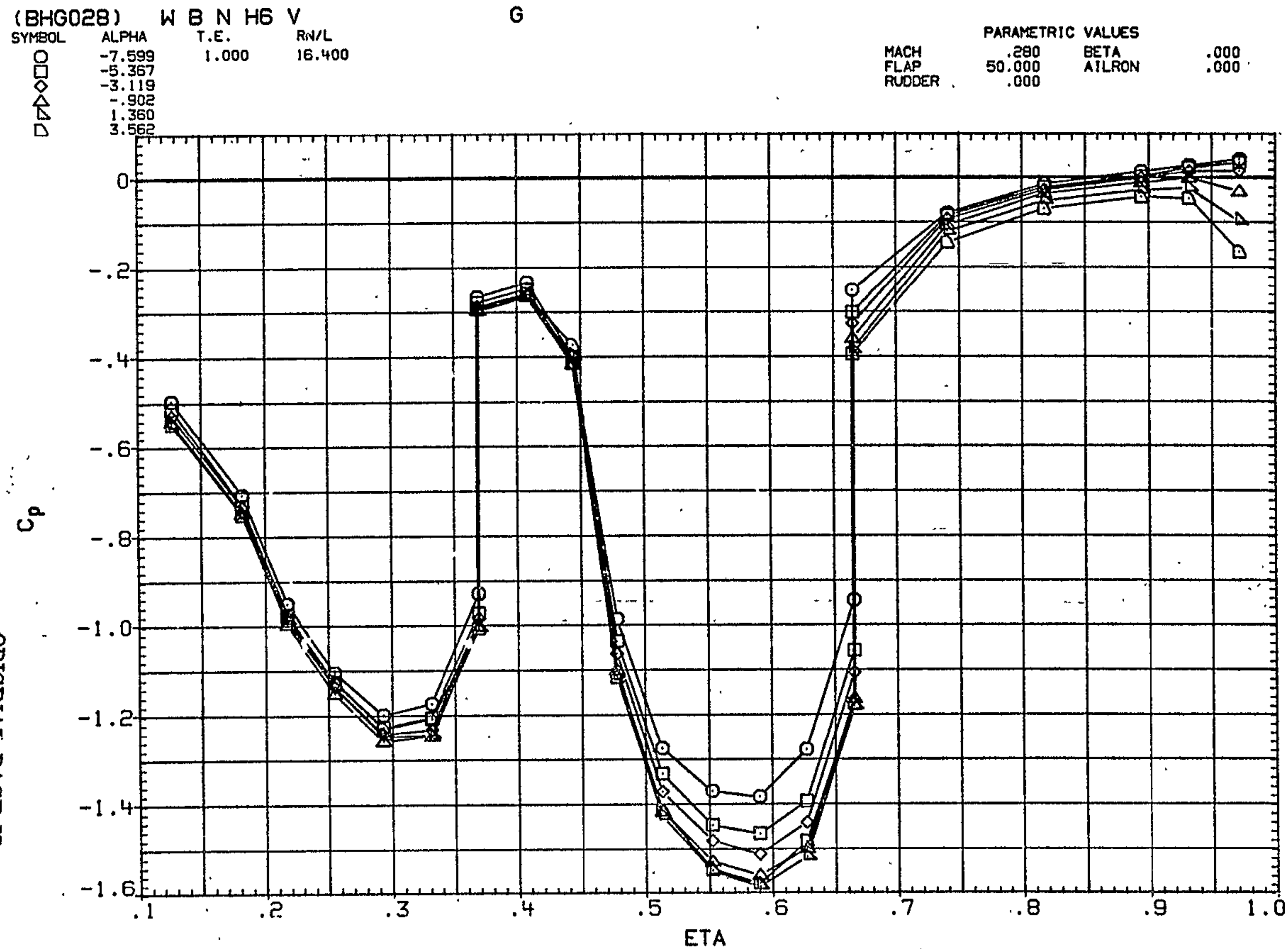

FIG. 19 TRAILING EDGE PRESSURE COEFFICIENTS

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(BHG028) W B N H6 V G

SYMBOL	ALPHA	T.E.	RN/L
○	5.769	1.000	16.400
□	7.964		
◇	10.009		
△	11.991		
◺	13.945		
D	15.856		

PARAMETRIC VALUES

MACH	.280	BETA	.000
FLAP	50.000	AILRON	.000
RUDDER	.000		

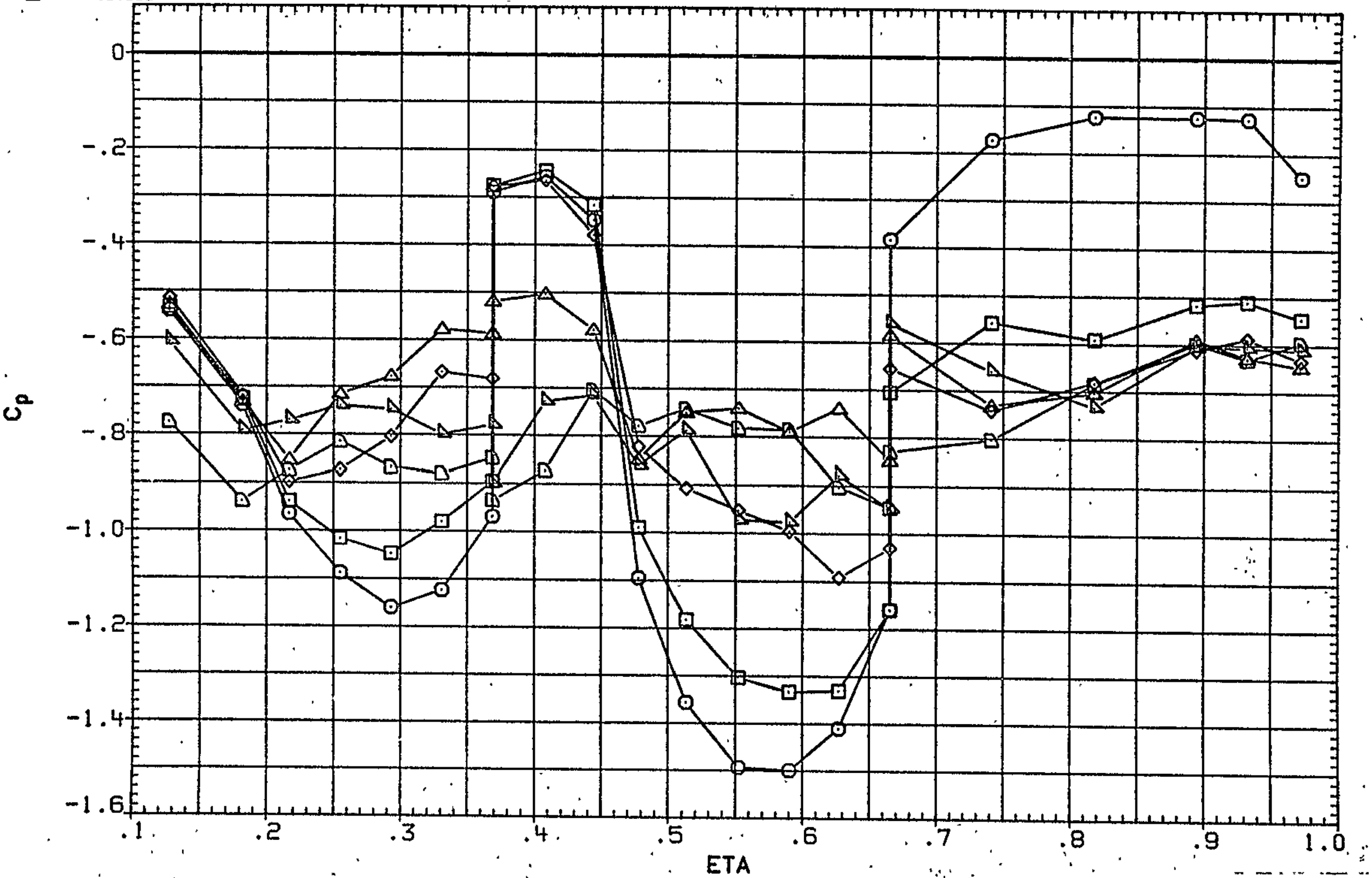

FIG. 19 TRAILING EDGE PRESSURE COEFFICIENTS

(BHG028) W B N H6 V G

SYMBOL	ALPHA	T.E.	RN/L
○	16.798	1.000	16.400
□	17.796		
◇	18.774		
△	19.753		
◺	20.313		

PARAMETRIC VALUES

MACH	.280	BETA	.000
FLAP	50.000	AILRON	.000
RUDDER	.000		

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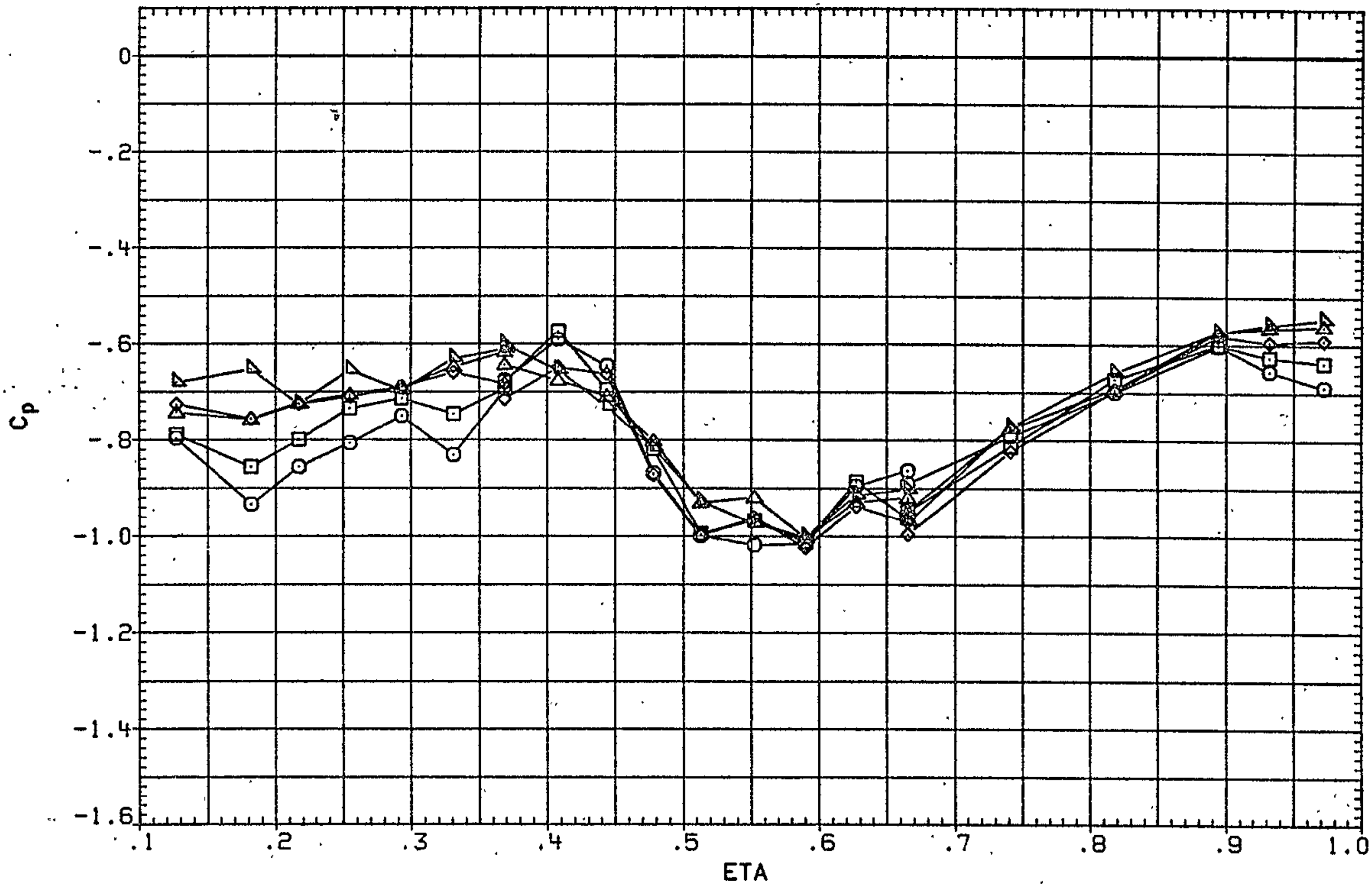

FIG. 19 TRAILING EDGE PRESSURE COEFFICIENTS

(BHG015) W B N H6 V U L C P E O I G

SYMBOL	ALPHA	T.E.	RN/L
○	-7.459	1.000	19.690
□	-5.240		
◇	-2.876		
△	-.741		
◺	1.556		
◻	3.831		

PARAMETRIC VALUES

MACH	.280	BETA	.000
FLAP	50.000	AILRON	.000
RUDDER	.000		

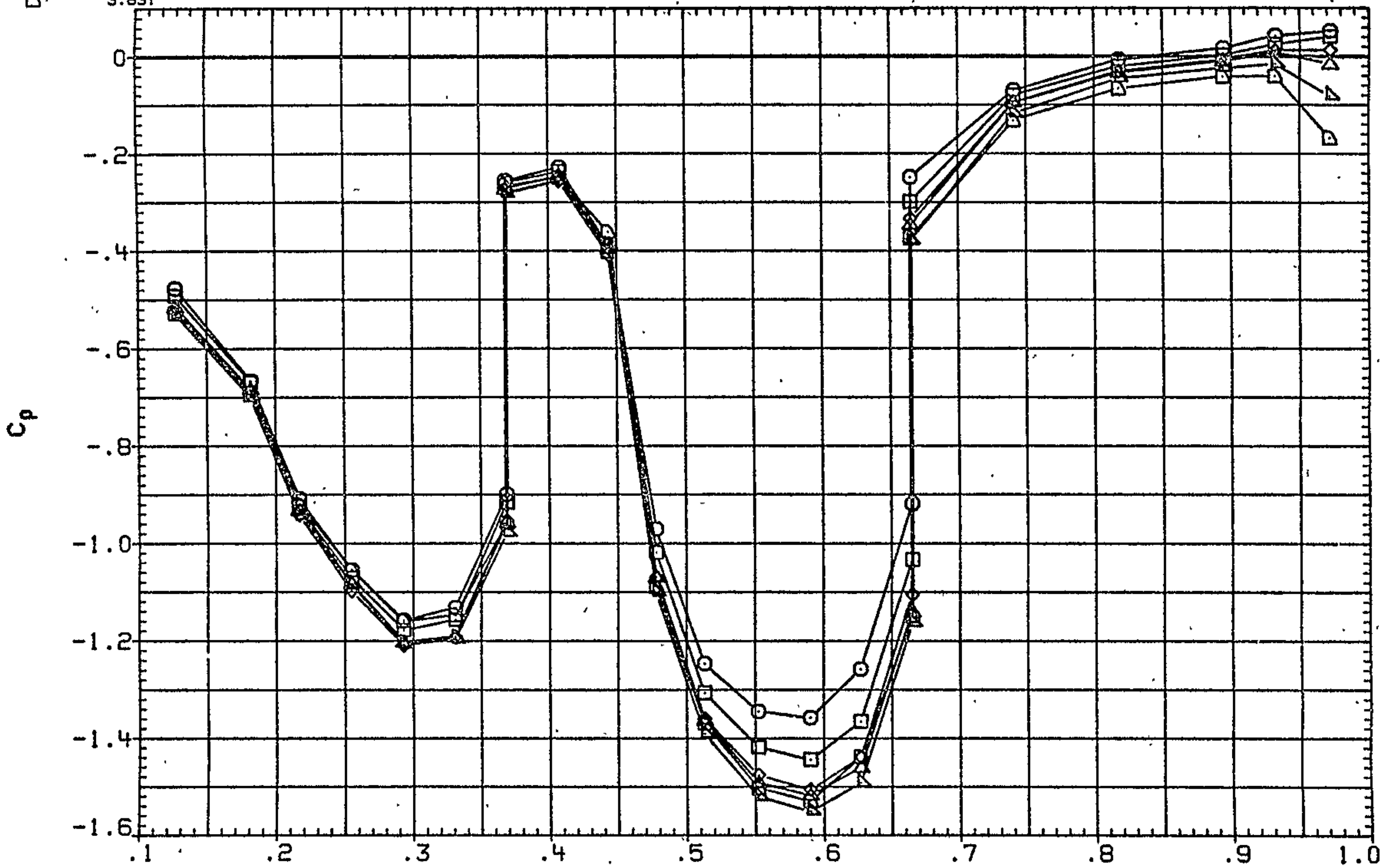

FIG. 19 TRAILING EDGE PRESSURE COEFFICIENTS

(BHG015) W B N H6 V U L C P E O I G

SYMBOL	ALPHA	T.E.	RN/L
○	6.098	1.000	19.690
□	8.281		
◇	8.657		
△	9.323		

PARAMETRIC VALUES

MACH	.280	BETA	.000
FLAP	50.000	AILRON	.000
RUDDER	.000		

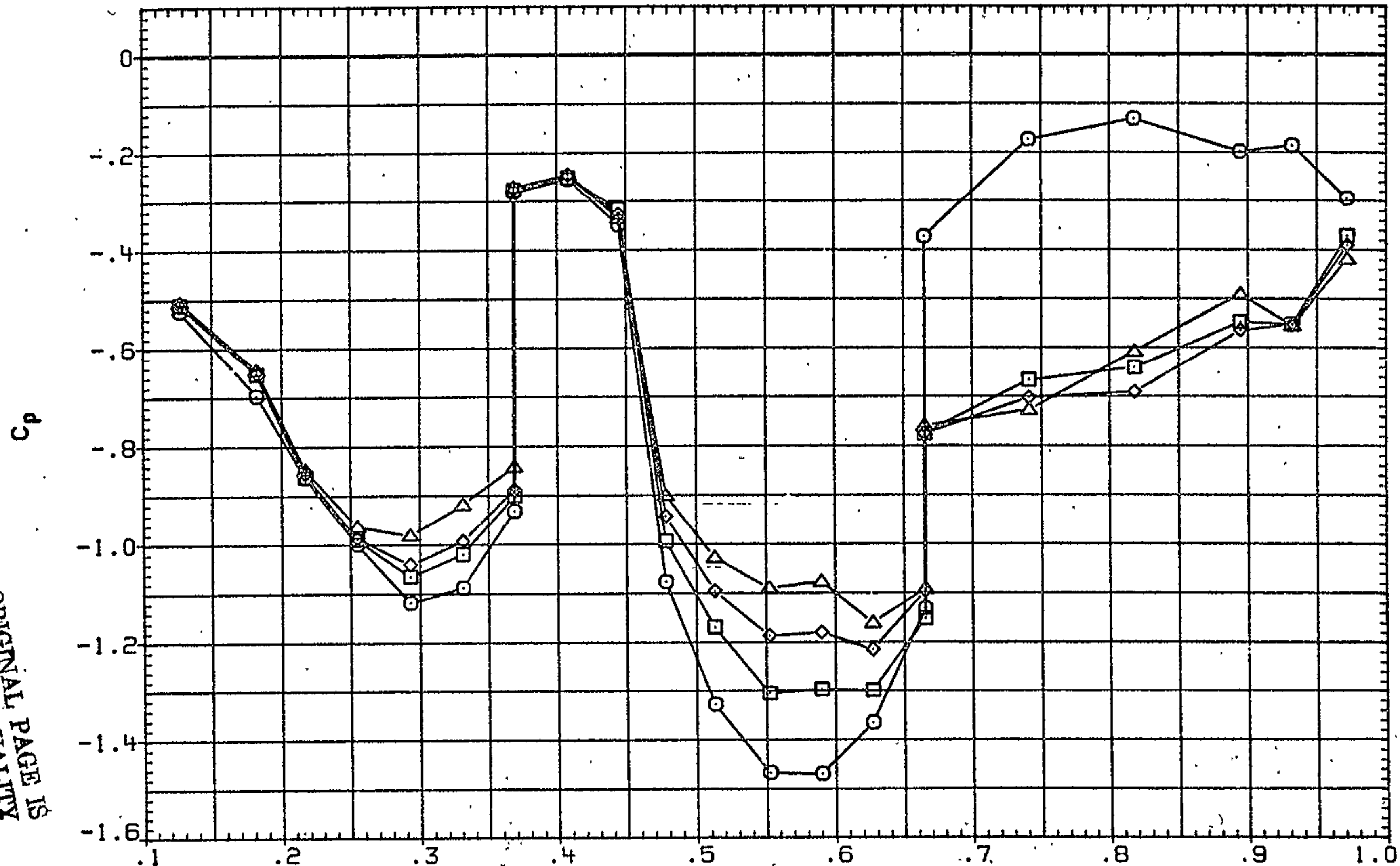

FIG. 19 TRAILING EDGE PRESSURE COEFFICIENTS

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