

AD A 024978



Technical Report RD-76-22

INVESTIGATION OF JET PLUME EFFECTS  
ON THE LONGITUDINAL STABILITY CHARACTERISTICS  
OF A BODY OF REVOLUTION WITH VARIOUS FIN CONFIGURATIONS  
AT MACH NUMBERS FROM 0.2 TO 2.3 (NORMAL JET PLUME SIMULATOR)

James H. Henderson  
Aeroballistics Directorate  
US Army Missile Research, Development and Engineering Laboratory  
US Army Missile Command  
Redstone Arsenal, Alabama 35809

20 February 1976

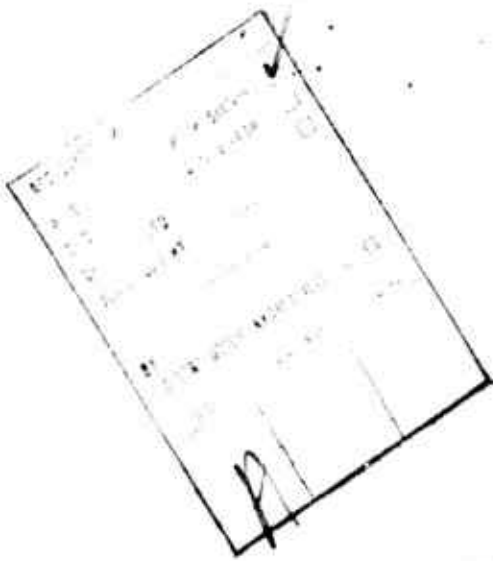
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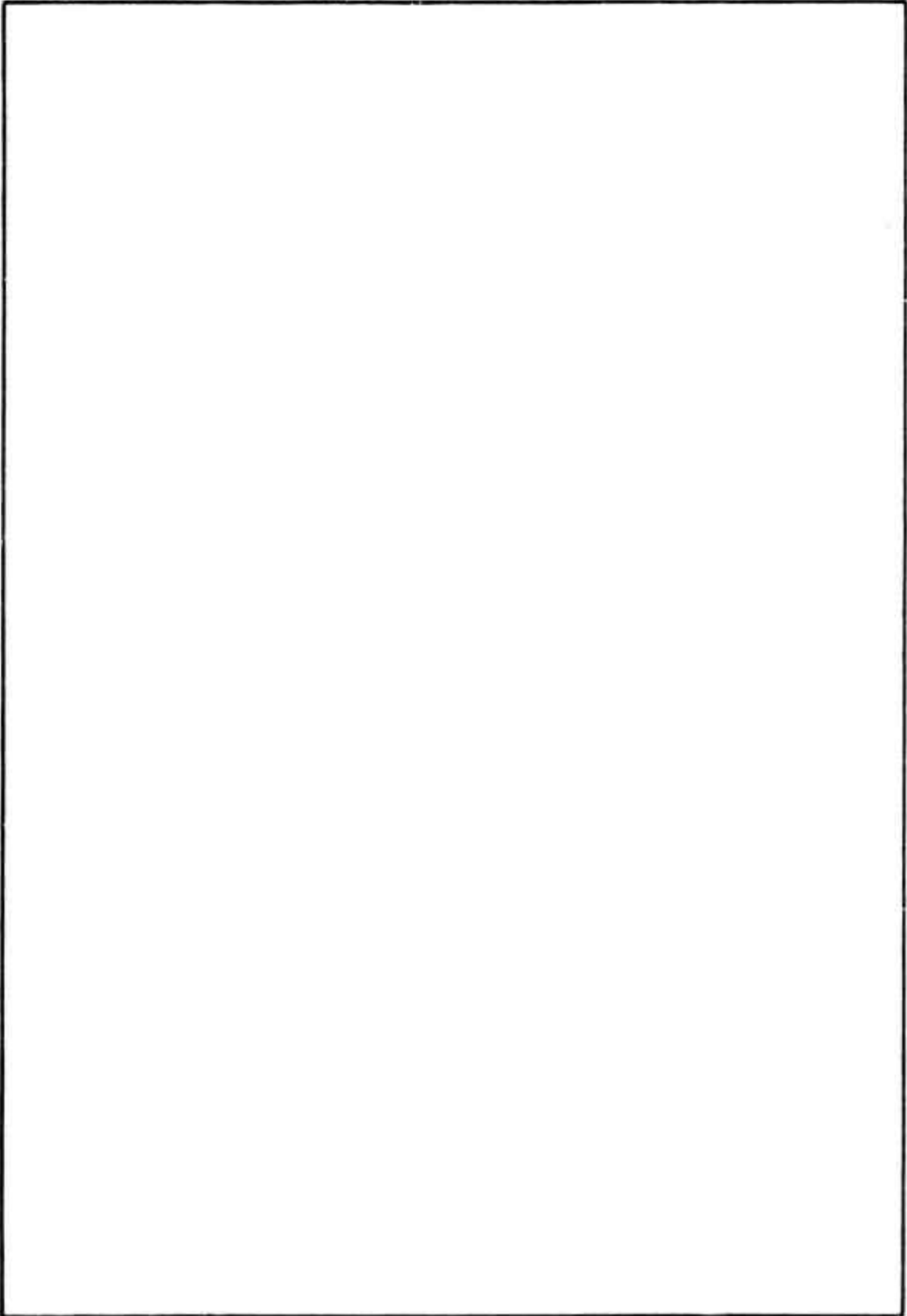
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER RD-76-22	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Investigation of Jet Plume Effects on the Longitudinal Stability Characteristics of a Body of Revolution with Various Fin Configurations at Mach Numbers from 0.2 to 2.3 (Normal Jet Plume Simulator)		5. TYPE OF REPORT & PERIOD COVERED Technical Report
7. AUTHOR(s) James H. Henderson		6. PERFORMING ORG. REPORT NUMBER AMSAR-1026
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Missile Command Attn: AMSMI-RDK Redstone Arsenal, Alabama 35809		8. CONTRACT OR GRANT NUMBER(s) <del>DAAG01-76-C-0901</del>
11. CONTROLLING OFFICE NAME AND ADDRESS Commander US Army Missile Command Attn: AMSMI-RPR Redstone Arsenal, Alabama 35809		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS DA Project No. 1W362303A214 AMC MS Code 632303.11.21400
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) DA-1-W-362303-A-214		12. REPORT DATE 28 February 1976
		13. NUMBER OF PAGES 89
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES This report was prepared from data plotted by the Chrysler Corporation Space Division.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Thrust Effects                      Jet: Plume Longitudinal Stability Plume Effects Base Pressure		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Transonic wind tunnel tests were conducted on a body of revolution with various fin configurations to investigate jet plume effects on missile longitudinal stability. A series of cold air normal jets located downstream of the base were utilized to simulate the jet plume. Fins of various planform geometry were tested at a forward longitudinal location only. The angle of attack range was -4 to 11 degrees at Mach numbers of from 0.2 to 2.3. The test was run at the Arnold Engineering Development Center Transonic (16T) and Supersonic (16S) wind tunnels and was designated AEDC SF172/TF360.		

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PLOT SCHEDULE:

- (A) CN and CLM vs. ALPHA
- (B) CNF1, CNF2, CNF3, and CNF4 vs. ALPHA
- (C) CLMH1, CLMH2, CLMH3, and CLMH4 vs. ALPHA
- (D) CLMR1, CLMR2, CLMR3, and CLMR4 vs. ALPHA
- (E) CNALFA and CLMALF vs. CRT
- (F) CNF2ALFA vs. CRT
- (G) CNF4ALFA vs. CRT

## INTRODUCTION

During the past few years the Army Missile Command has been interested in the adverse effects of the propulsive jet plume on missile aerodynamics. Of particular importance are the effects on missile longitudinal stability. A research program has been established as a means of obtaining the understanding necessary for proper design of future missiles susceptible to this problem (see Reference 1).

It was previously shown that plume induced instability could be avoided by moving the fins forward from the base and using fins of sufficient size. Results also indicated that stability margin might be controlled to a precision where plume effects could be used to advantage as a means of reducing missile wind sensitivity. Later test results appear to substantiate this judgement. Fins can be located in a position to retain most of their effectiveness, while the plume still has a significant destabilizing influence on the missile body. Thus, based on available data, the desired unstable transonic-stable supersonic stability characteristics can be attained.

Previous tests at the CALSPAN transonic tunnel were made at Mach numbers up to 1.25. The present test extended the results up to a Mach number of 2.3. Also, tests were made at Mach numbers of 0.2 and 0.4 and at angles of attack up to 11 degrees to determine launch crosswind effects.



## APPARATUS AND TESTS

The model is a sting mounted body of revolution, 5 inches in diameter and 52-inches long with a 30 caliber tangent ogive nose. The model was tested in combination with two different sets of cruciform rectangular fins set at zero degrees roll. For the present test the fins were tested in the forward location only (Fin trailing edge 1.5 calibers ahead of the model base). The fin geometry is shown in figure 4.

The geometry of the fins tested is as follows:

<u>Fin</u>	<u>Chord (in)</u>	<u>Semi span (in)</u>
F1	5.0	2.5
F2	3.0	2.5

The plume simulator consisted of 24 sonic jets normal to the sting centerline and arranged circumferentially in two rows with a common air chamber (see figure 3). The simulator was located 0.5 caliber aft of the model base. The combined exit area of the 24 jets represented 6 per cent of the model base (reference) area. The level of plume simulation was established by setting various pressures in the simulator chamber.

Tunnels 16T and 16S are closed-circuit, continuous-flow tunnels that can be currently operated at Mach numbers from 0.20 to 1.6 and 1.5 to 2.4, respectively. The test sections are 16 by 16 ft in cross-section and 40 ft long. Details of each tunnel's capabilities and supporting equipment can be found in reference 5. Photographs of the model installed in the test sections are shown in figures 6 and 7 and sketches of the location of the models in the tunnels are shown in figure 5.

Total model force and moments were measured using a 2.0-inch, 6-component balance, with normal and side force capacities of 1800 pounds and 900 pounds, respectively. The balance was mounted in the model, such that the balance 900-pound capacity side-force gages measured model normal forces, in order to achieve better data resolution in the model pitch plane. Fin forces and moments were measured using 5-component (no axial force) balances, with a nominal normal force capacity of 60 pounds.

A static pressure measurement was made in the balance cavity and was used to calculate the balance cavity axial force. Two static pressure measurements were made at the base of the model and were used to calculate base pressure.

Model angle of attack was measured using a pendulum-type angle sensor, with a backup measurement determined from balance-sting deflections.

Steady-state data were obtained at free-stream Mach numbers from 0.2 to 2.3. The tunnel test conditions were held constant at each Mach number. Plume effects were obtained by setting and maintaining a specific value of chamber pressure while angle of attack was varied.

Model aerodynamic coefficients were tabulated in the body-axes system and referenced to model station 26.5 inches. No correction was made to the data for tunnel flow angularity. Fin moment coefficients were referenced to the fin hinge-line and fin root bending moment coefficients were referenced to the fin-body intersection. The positive orientation of the model and fin forces and moments are shown in figure 2.

## TEST CONDITIONS

The test was conducted in the AEDC Propulsion Wind Tunnels, Supersonic (16S) and Transonic (16T), respectively. Tunnels 16T and 16S are closed-circuit, continuous-flow tunnels that can be currently operated at Mach numbers from 0.20 to 1.6 and 1.5 to 2.4, respectively. The purpose of the test was to determine the Mach number range of adverse jet plume effects on missile longitudinal stability. Similar data were previously obtained at the Calspan Corporation 8-Foot Transonic Wind Tunnel. Three configurations were tested (body with Fins F1, body with Fins F2, and body alone) at various simulated plume shapes, at model angles of attack from -4 to 11 degrees at zero degrees yaw, zero degrees roll, and at free-stream Mach numbers from 0.2 to 2.3. Steady-state data were obtained at these free-stream Mach numbers. The tunnel test conditions were held constant at each Mach number, and the plume shape was generated by setting a specific value of high-pressure air in the plume simulator chamber and discharging the air radially. The Radial Thrust Coefficient (CRT) is a measure of the plume shape and is a function of the free-stream Mach number and the simulator pressure. At specified levels of CRT and Mach number, the model angle of attack was varied from -4 to 11 degrees at the free-stream Mach numbers of 0.2 and 0.4. At all other Mach numbers, the angle-of-attack range was -4 to 4 degrees.

## PLUME SIMULATION

In the past, the Army Missile Command has used base pressure ratio  $p_b/p_\infty$  as an indication of the onset and the severity of plume effects on missile aerodynamics (see reference 1). One of the parameters that can be conveniently used to correlate base pressure is thrust coefficient  $CT$ , where  $CT$  is axial thrust non-dimensionalized by dynamic pressure and body cross-sectional area, ( $S_{ref}$ ). For the normal jet simulator a similar parameter is radial thrust coefficient,  $CRT$ , where

$$CRT = \frac{\text{Radial Thrust}}{qA}$$

Radial thrust is the summation of the thrust of the 24 individual nozzles. For an axial jet, base pressure appears to be primarily influenced by the portion of the jet plume in the vicinity of the jet boundary where it interacts with the freestream flow. Where  $CT$  can be considered to represent the axial component of the effective jet, it can be assumed that  $CRT$  represents the normal component.

For the plume size of interest in the present investigation a value of  $CT$  several times the value of  $CRT$  is required for matching base pressures. The exact  $CT/CRT$  ratio will depend on a comparison of flight base pressures with base pressure values for the normal jet simulator. Where flight base pressures are unavailable, methods exist which allow simulation of flight rockets with cold air axial jets (see, for example reference 6). An estimate of the  $CT/CRT$  ratio (although crude) is valuable for use in preliminary design and insuring that the range of  $CRT$  values planned for wind tunnel tests are sufficient.

## RESULTS

Data presented in the plots show radial thrust effects on stability characteristics, fin normal force, fin hinge moment, and fin root bending moment. Radial thrust effect on longitudinal derivatives and hysteresis effects are also plotted.

The transonic portion of the test was run 24-25 January 1975 and was designated Tf360. Several runs were made to determine plume effects at high angles of attack and at low Mach numbers. These conditions approximate exit from the launcher for a free rocket configuration. Typical results at these conditions are shown for the body alone (B) configuration on page 2 of the data figures. Significant plume effects are apparent when the thrust level is increased to a CRT value of 12. With a further increase of CRT to 37.5, plume effects are more severe--but only at angles of attack between  $\pm 1.5$  degrees. At higher angles of attack stability characteristics tend to approach the jet-off case. These results suggest that the plume effects at a CRT of 37.5 reach forward to the ogive portion of the body or possibly the nose tip. In this case, the short body tested does not represent the plume effects on a much longer body such as that being considered for the free rocket technology program configuration. Therefore, it is recommended that plume effects on long bodies be investigated for several typical conditions.

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## NOMENCLATURE

<u>SYMBOL</u>	<u>PLOT SYMBOL</u>	<u>DEFINITION</u>
RN/L	RN/L	unit Reynolds number; per ft
V		velocity; ft/sec
$\alpha$	ALPHA	angle of attack, degrees
$\beta$	BETA	angle of sideslip, degrees
$\psi$	PSI	angle of yaw, degrees
$\phi$	PHI	angle of roll, degrees
$\rho$		mass density; slugs/ft <sup>3</sup>
$C_T$	CT	thrust coefficient, axial thrust/qS
$C_{T_r}$	CR <sub>T</sub>	radial thrust coefficient, radial thrust/qS
$P_{bAVG}/P_\infty$	PB/P1	ratio of average base pressure to tunnel freestream static pressure
F.P.	FINPOS	fin position on body: <ol style="list-style-type: none"> <li>1. AFT; Fin Hinge line at M.S. 49.750</li> <li>2. MID; Fin Hinge line at M.S. 46.000</li> <li>3. FWD; Fin Hinge line at M.S. 42.250</li> </ol>
a		speed of sound; ft/sec
$C_p$	CP	pressure coefficient; $(p_1 - p_\infty)/q$
M	MACH	Mach number; V/a
p		pressure; psf
q	Q(NSM) Q(Psf)	dynamic pressure; $1/2\rho V^2$ , psf
$P_b/P_\infty$		base pressure ratio

## NOMENCLATURE (Continued)

### Reference & C.G. Definitions

$A_b$		base area; $m^2, in^2$
$b$	BREF	wing span or reference span; m, in
c.g.		center of gravity
$l_{REF}, \bar{c}$	LREF	reference length or wing mean aerodynamic chord; m, in
$S, S_{ref}$	SREF	reference area based on body diameter, $in^2$
	MRP	moment reference point
	XMRP	moment reference point on X axis
	YMRP	moment reference point on Y axis
	ZMRP	moment reference point on Z axis

### Fin Balances

$C_{NF_x}$	CNFX	fin normal force coefficient, $\frac{\text{fin normal force}}{qS_{ref}}$
$C_{m_{H_x}}$	CLMHX	fin hinge moment coefficient, $\frac{\text{fin hinge moment}}{qS_{ref}l_{ref}}$
$C_{m_{R_x}}$	CLMRX	fin root bending moment coefficient, $\frac{\text{fin root bending moment}}{qS_{ref}l_{ref}}$
$x_{CPF_x}$	XCPFx	chordwise center of pressure location relative to fin hinge line, positive toward the leading edge, inches
$C_{NF_{x\alpha}}$	CNFXALFA	fin normal force coefficient derivative with angle, per degree



## NOMENCLATURE (Concluded)

### Body-Axis System (Main Balance)

C <sub>N</sub>	CN	normal-force coefficient; $\frac{\text{normal force}}{qS}$
C <sub>A</sub>	CA	axial-force coefficient; $\frac{\text{axial force}}{qS}$
C <sub>Y</sub>	CY	side-force coefficient; $\frac{\text{side force}}{qS}$
C <sub>m</sub>	CLM	pitching-moment coefficient; $\frac{\text{pitching moment}}{qS_{\text{REF}}}$
C <sub>n</sub>	CYN	yawing-moment coefficient; $\frac{\text{yawing moment}}{qSb}$
C <sub>l</sub>	CBL	rolling-moment coefficient; $\frac{\text{rolling moment}}{qSb}$
C <sub>mα</sub>	CLMALF	pitching moment coefficient derivative with alpha, per degree
C <sub>Nα</sub>	CNALFA	normal force coefficient derivative with respect to angle of attack, per degree

### SUBSCRIPTS

b	base
l	local
s	static conditions
t	total conditions
∞	free stream



TABLE 1. (Continued)

TEST: AEDC SF172/TF360		DATA SET/RUN NUMBER COLLATION SUMMARY										DATE: 01-20-76						
DATA SET IDENTIFIER	CONFIGURATION	SCHD. PARAMETERS		CRT								OR ALTERNATE INDEPENDENT VARIABLE						
		$\alpha$	$\beta$	$\phi$	F.P.	MACH	0.01	1	2	3	4	6	6.5	12	25	37.5	50	100
RXE1*02	B	A	0	0	-	0.2	128								129		130	100
T 03	T	A	T	T	T	0.4	134							135		136		
04		B	T	T	T	1.0	137				138							
05		T	T	T	T	1.25	139			140	141	142		143				
06		T	T	T	T	1.5	144		145	146	147	148		149				
07		T	T	T	T	1.7	45*		46*	47*	48*	49*						
08		T	T	T	T	2.0	56*		57*		58*	59*						
09	BF1	A	T	T	T	3	0.2	103						104		105	107	
11	T	A	T	T	T	0.4	109						110		111			
12		B	T	T	T	1.0	112				113							
13		T	T	T	T	1.25	114			115	116	117		118				
14		T	T	T	T	1.50	119		120	121	123	122	124	125				
15		T	T	T	T	1.7	18*		19*	22*	20*	21*						
16		T	T	T	T	2.0	30*		31*		32*	33*		34*				
17		A	T	T	T	2.3	36*		37*		38*	39*		40*				
18	BF2	A	T	T	T	0.2	172				173			174	175	176	177	
T 19	BF2	B	T	T	T	0.4	168					169		170	171			
* $\Delta=0$ DATA, CN		CLM	CY	CYN	CBL	CA	PB/PI	CRT	ALPHA	7								
$\Delta=1$ DATA, CNF1		CLM1	CNF2	CNF3	CNF4	XCPF1	XCPF2	XCPF3	XCPF4	CRT	ALPHA	8						
$\Delta=2$ DATA, CLMH1		CLMH2	CLMH3	CLMH4	CLMR1	CLMR2	CLMR3	CLMR4	CRT	ALPHA	8							
TYPE OF DATA		$\alpha$ (A) = -4, -3, -2, -1.5, -1, -0.5, 0, 0.5, 1, 1.5, 2, 3, 4, 5, 7, 9, 11 $\alpha$ (B) = -4, -3, -2, -1.5, -1, -0.5, 0, 0.5, 1, 1.5, 2, 3, 4																
$\alpha$ OR $\beta$ SCHEDULES		*SF172																

TABLE 1. (Concluded)

TEST: AE0C SF172/TF360		DATA SET/RUN NUMBER COLLATION SUMMARY										DATE: 01-20-76												
DATA SET IDENTIFIER	CONFIGURATION	SCHD. PARAMETERS		CRT										TEST RUN NUMBERS										
		$\alpha$	$\beta$	$\phi$	F.P.	MACH	0.01	?	2	3	4	6	6.5		12	25	37.5	50	100					
RXE $\Delta$ *20	BF2	B	0	0	3	1.0	152						153											
21	T					1.25	154	155	156	157	158	159	160											
22	V					1.5	161	162	163	164	165	166	167											
23	A					0.2																131		
24	T																					132		
25	V																					108	106	

TYPE OF DATA  $\alpha$  OR  $\beta$  SCHEDULES

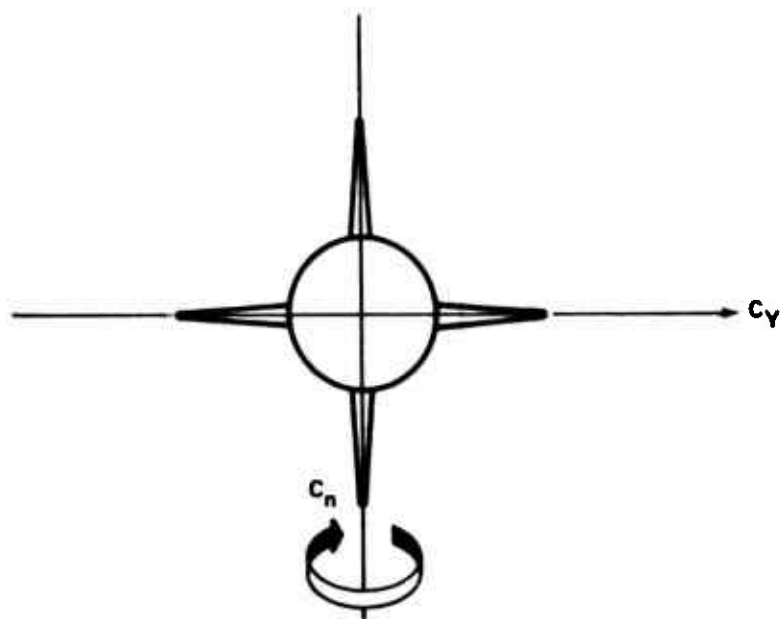
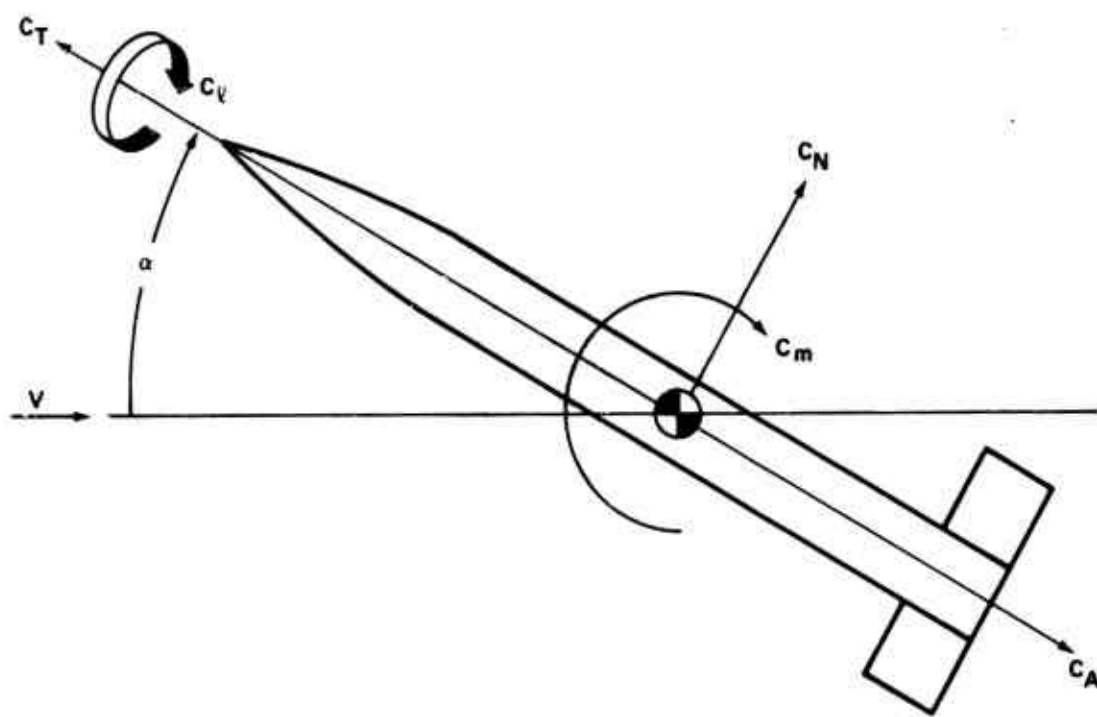
\* $\Delta$ =0 DATA, CH CLM CLM2 CLM3 CLM4 CLM1 CBL CA CB/PI XCPF1 XCPF2 XCPF3 XCPF4

$\Delta$ =1 DATA, CNF1 CNF2 CNF3 CNF4 CNM3 CNM4 CNM1 CBL CA CB/PI XCPF1 XCPF2 XCPF3 XCPF4

$\Delta$ =2 DATA, CIM1 CIM2 CIM3 CIM4 CIM1 CLM2 CLM3 CLM4 CRT IDVAR (1) IDVAR (2) NOV

COEFFICIENT SCHEDULES

$\alpha$  decreasing for runs 106, 108, 131, 132



(VIEW LOOKING FORWARD)

Figure 1 - Axis System Sign Convention for Main Balance

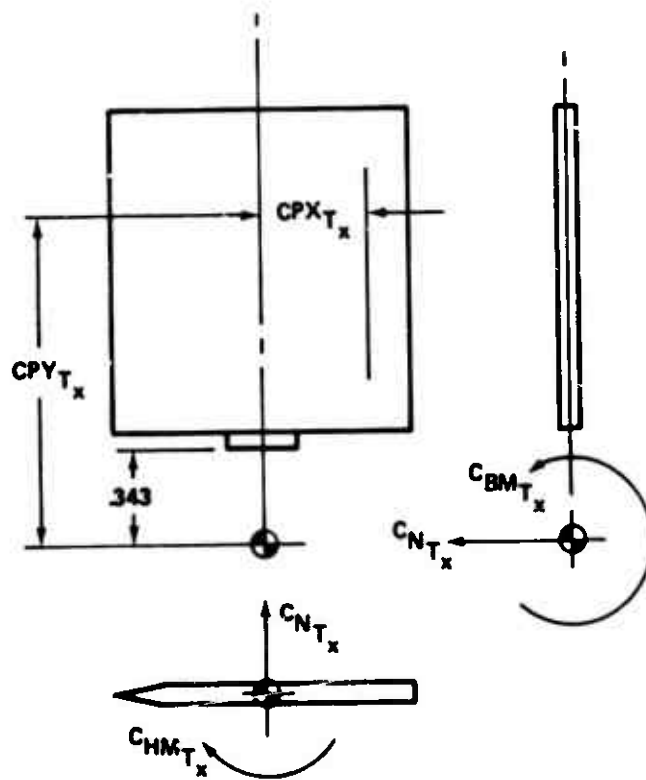
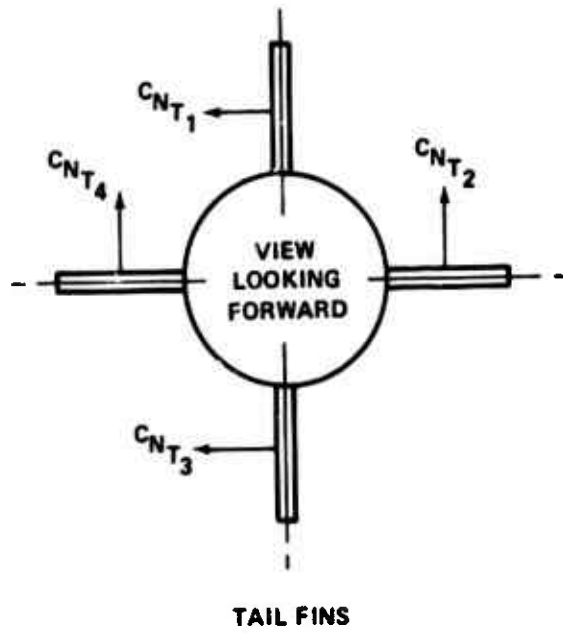


Figure 2 - Axis System and Positive Sign Convention for Fins

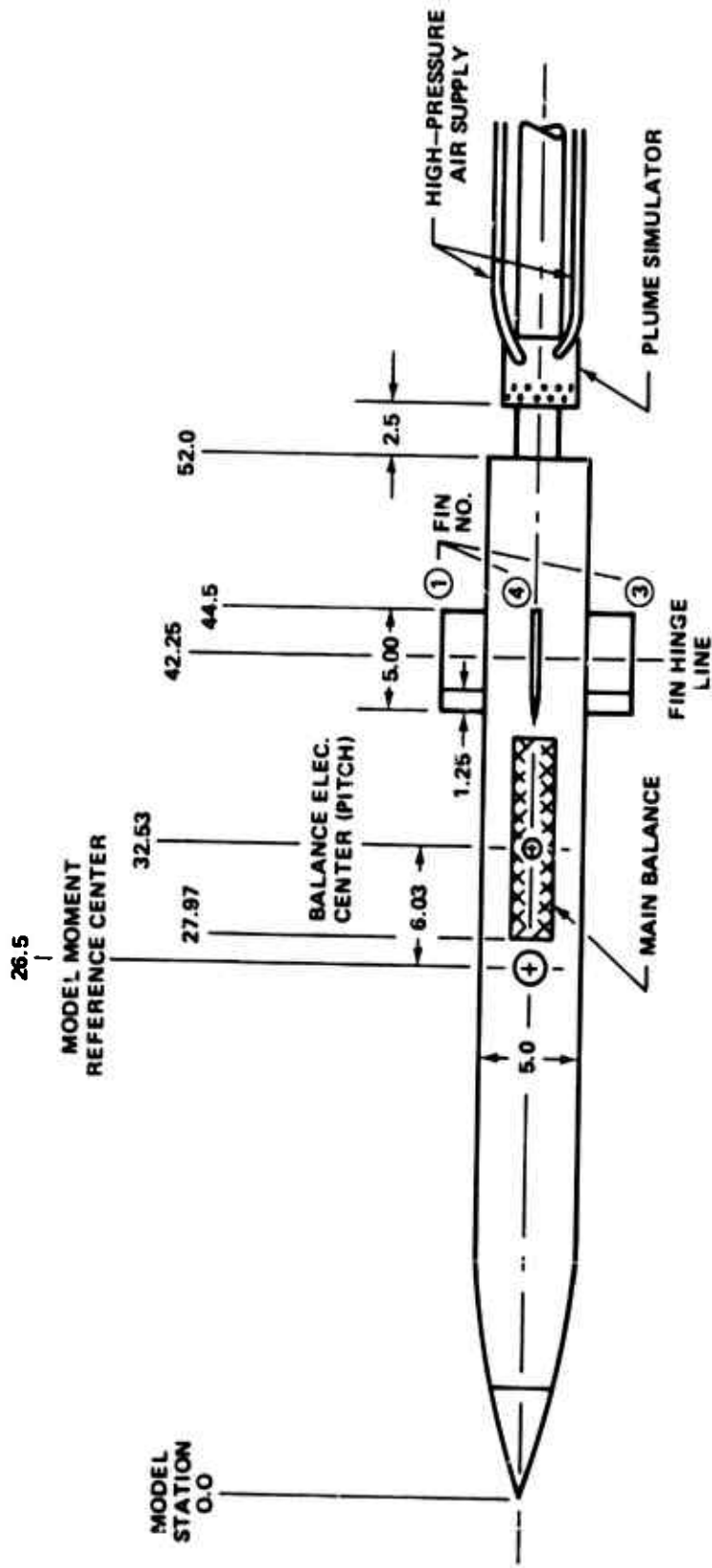


Figure 3 - AMC Model 1 Drawing

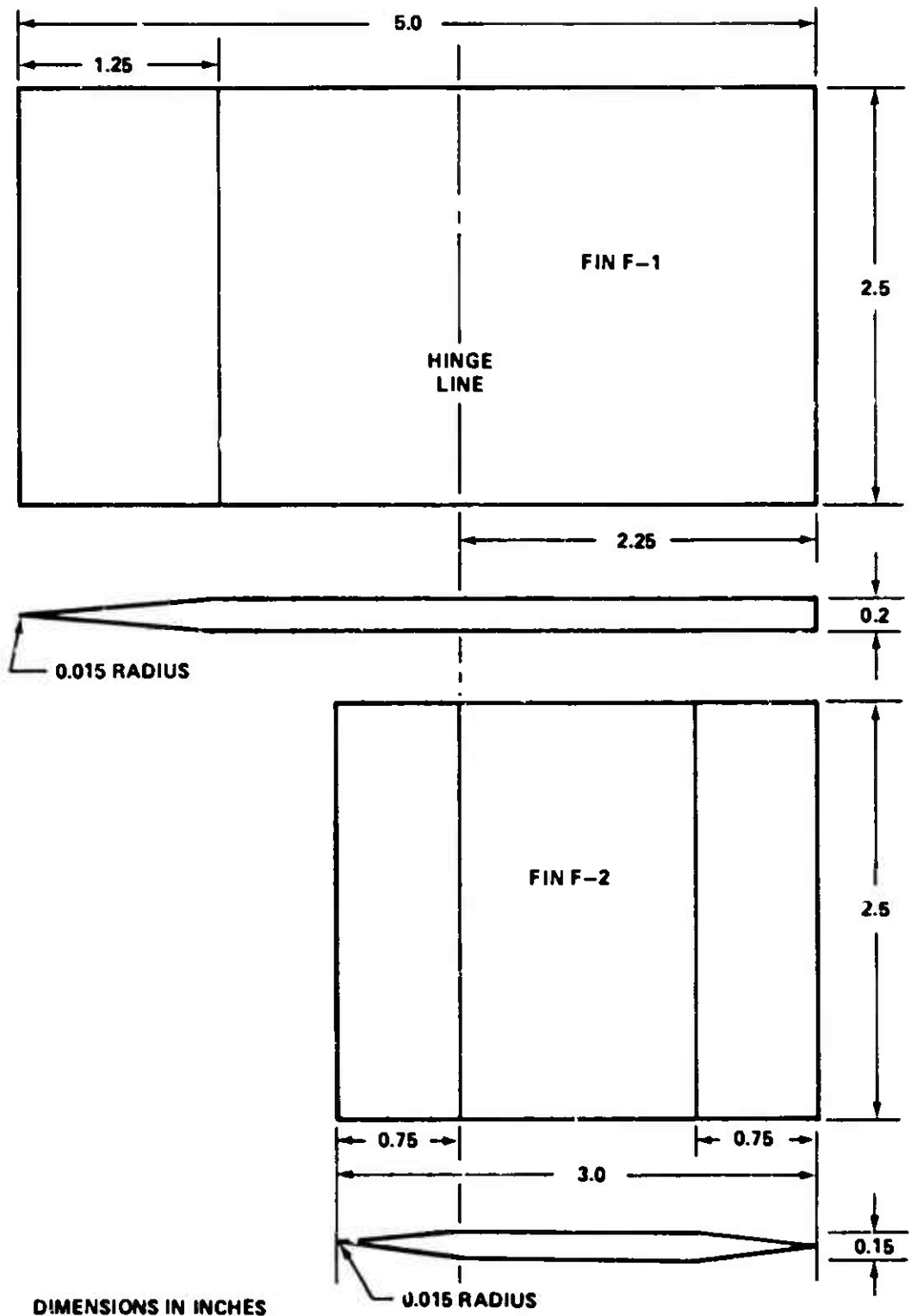
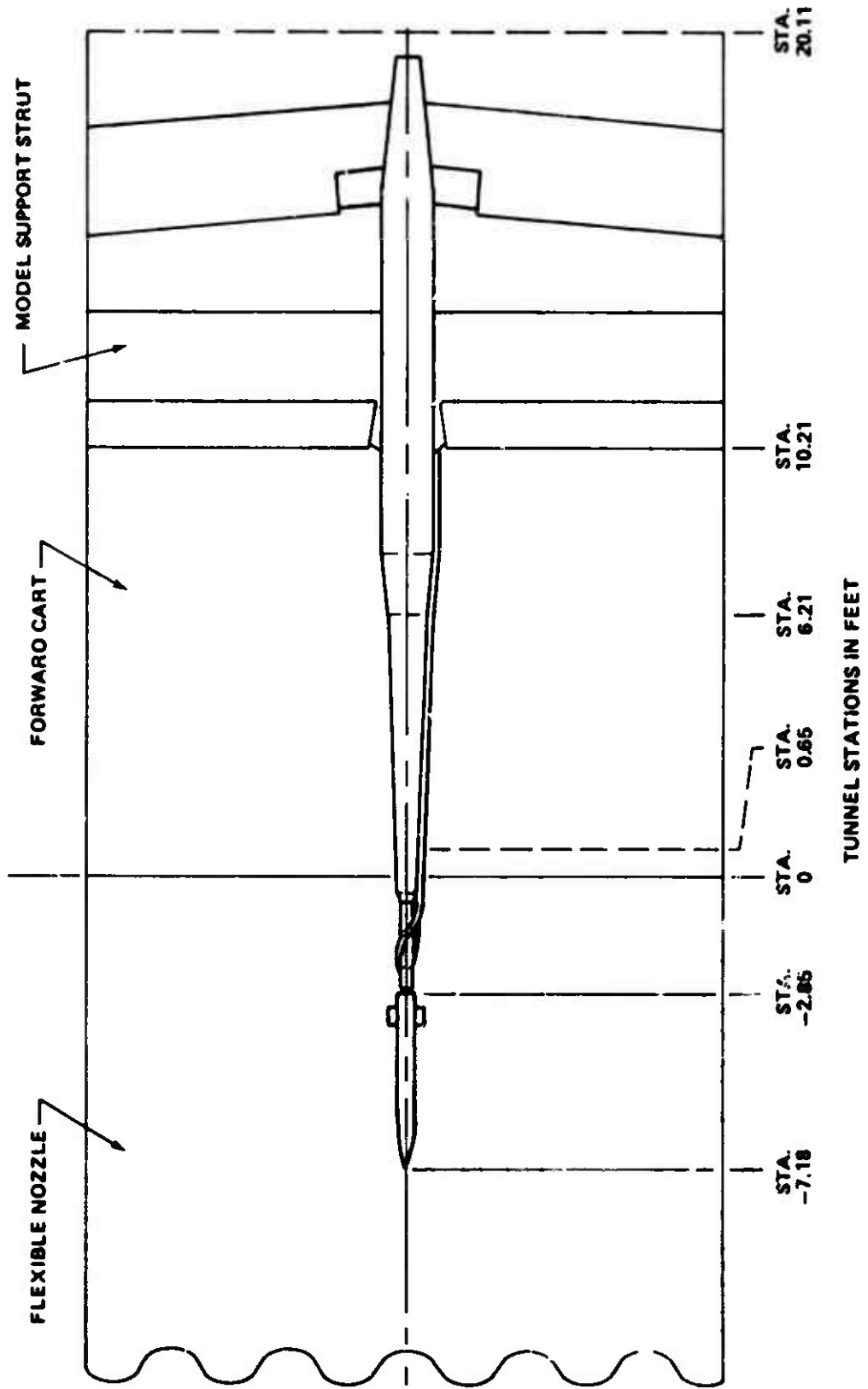


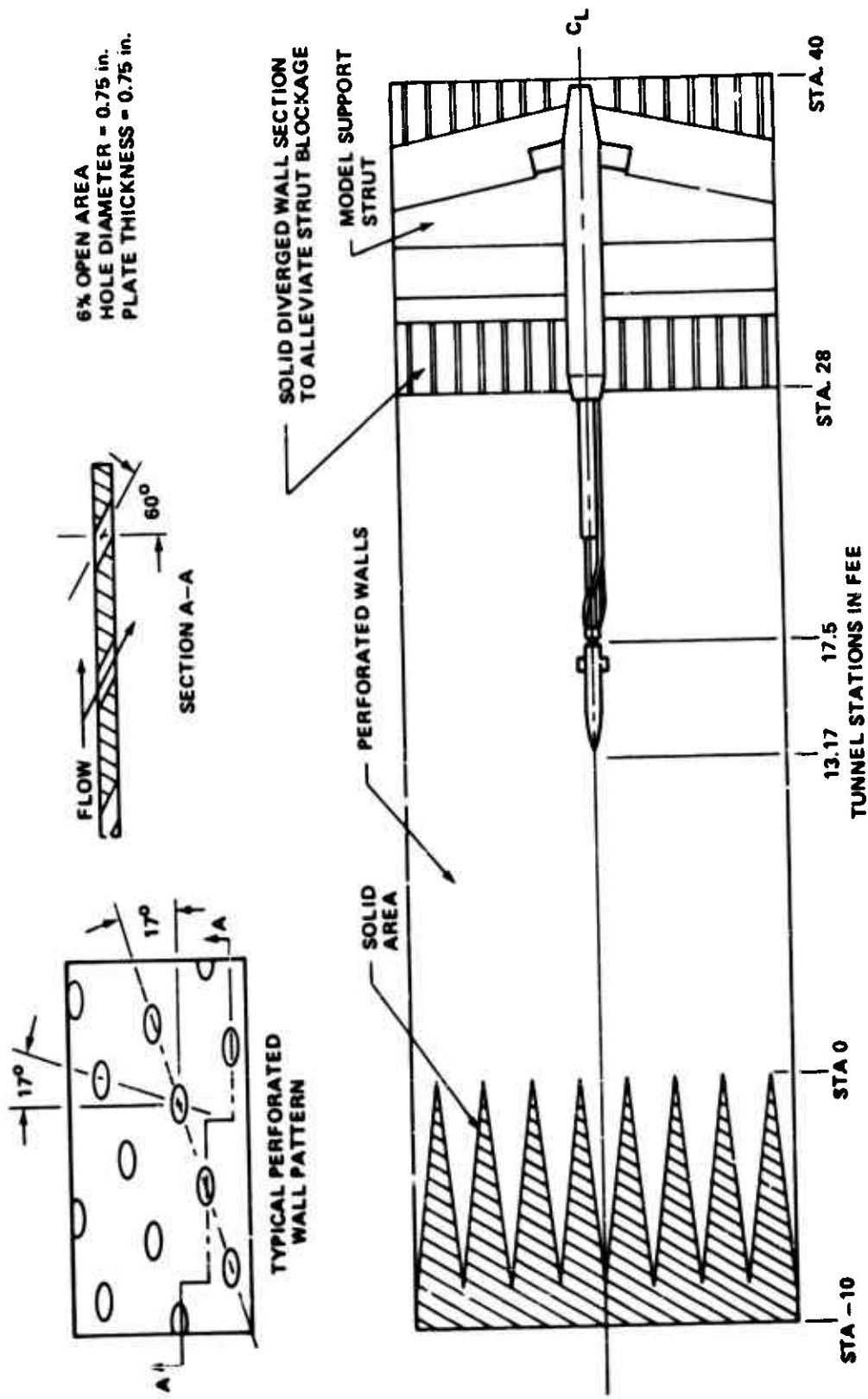
Figure 4 - Sketch of Fins F1 and F4





a. Tunnel 16S

Figure 5 - Sketch of Model Installation



b. Tunnel 16T  
Figure 5. Concluded



Figure 6 - Photograph of Model1 (BF2) in PWT (16T)

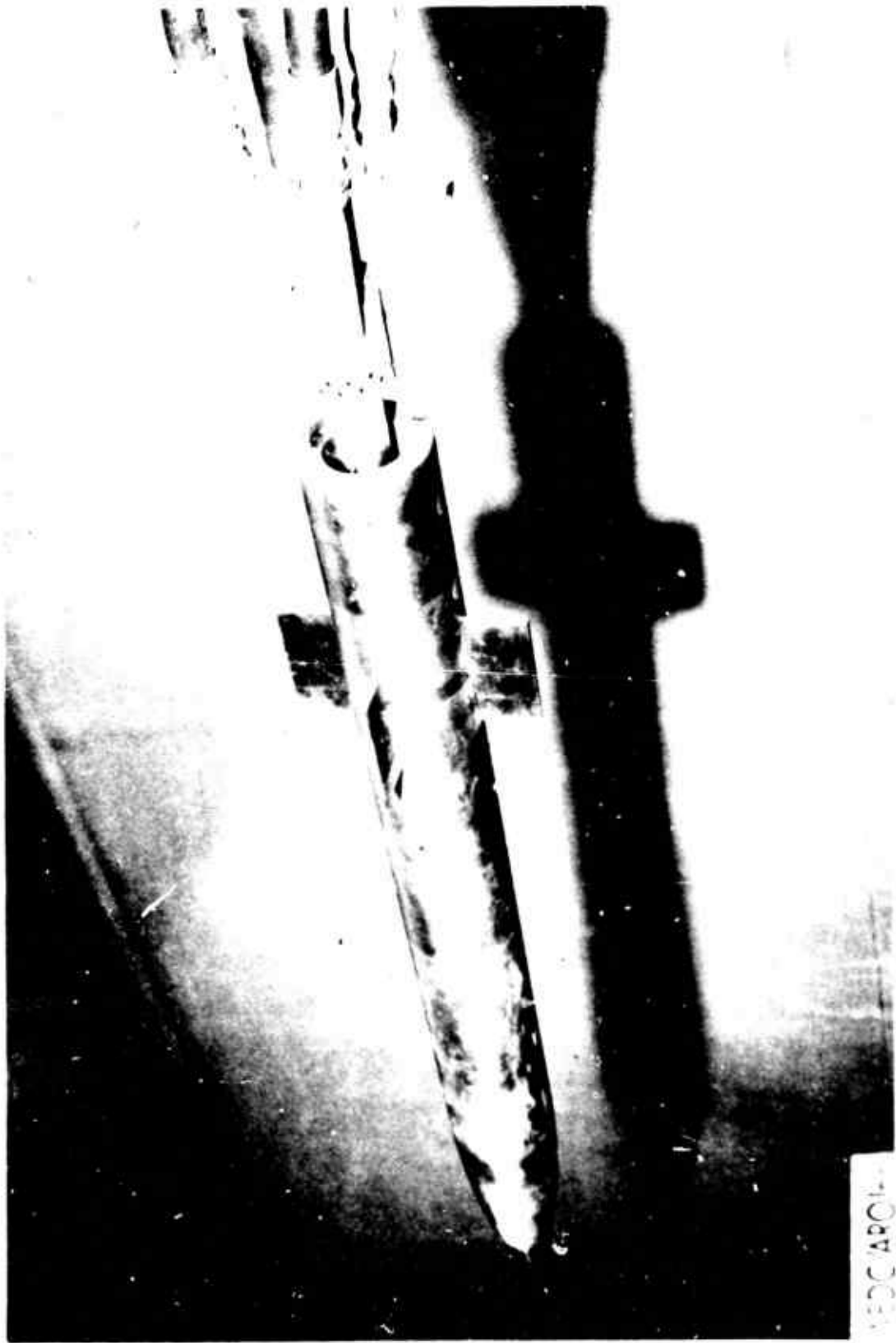


Figure 7. - Photograph of Model (BF1) in PWT (16S)

PLOTTED DATA

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Tabulations of the plotted data and corresponding source data are available from Data Management Services Operations.

(RXE002)

AEDC TF360 BODY ALONE .B

SYMBOL CRT

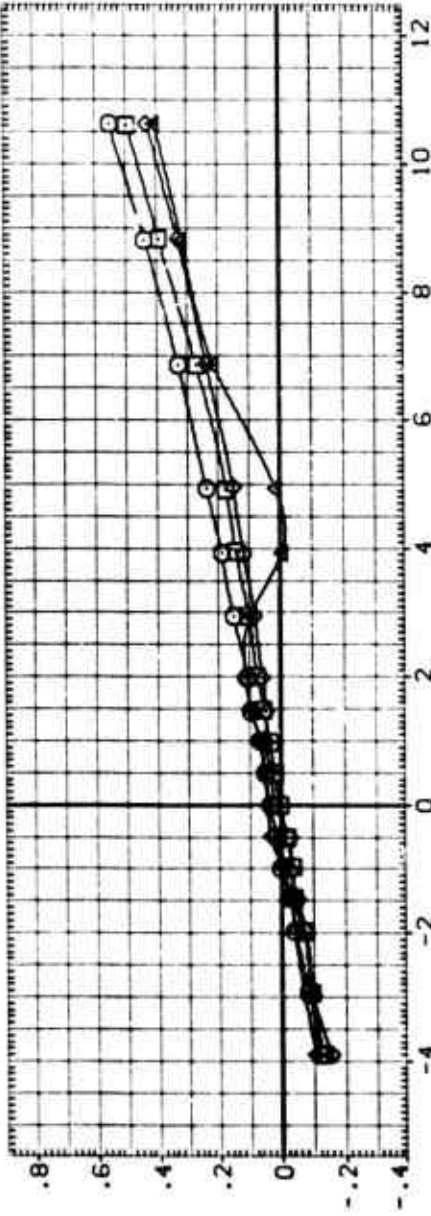
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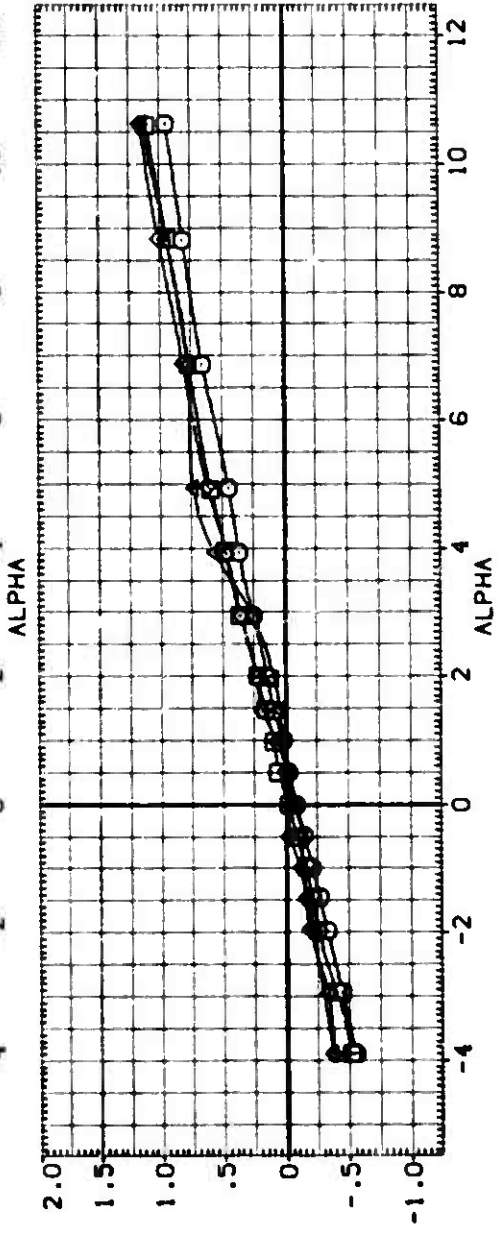
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MACH	.200		

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BREF	5.0000	IN.
XTRP	26.5000	IN.
YTRP	.0000	IN.
ZTRP	.0000	IN.
SCALE	.0000	



33



32

THRUST EFFECTS ON STABILITY CHARACTERISTICS

(RXED03)

AEDC TF360 BODY ALONE .8

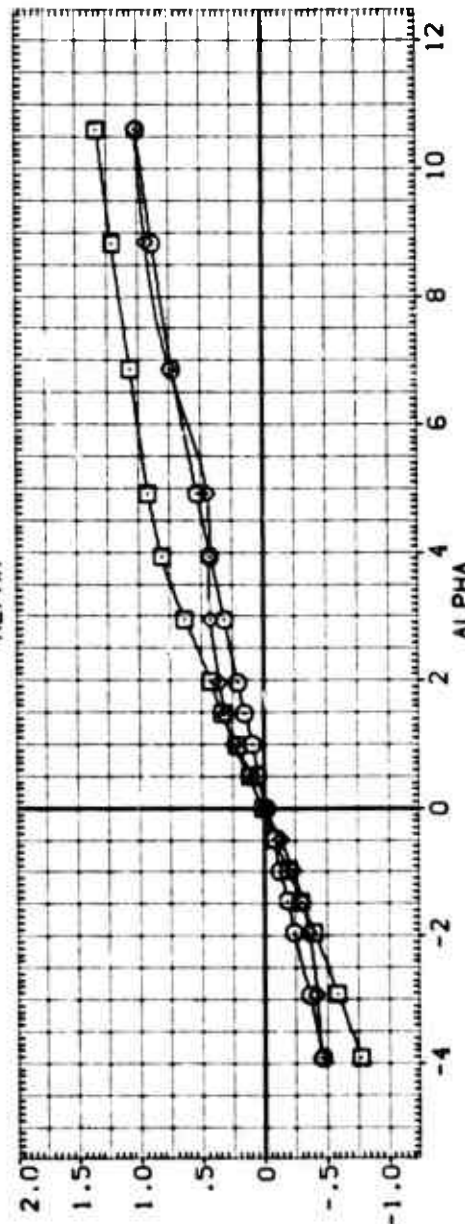
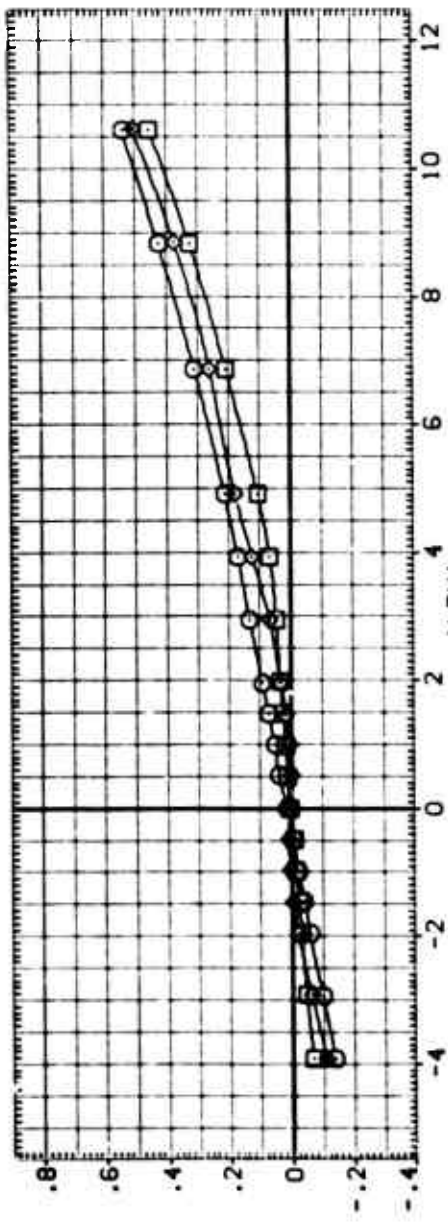
SYMBOL  
□ ○ ◇

ORT .109  
12.013  
37.151

PARAMETRIC VALUES  
.000 PHI .000

REFERENCE INFORMATION

SREF	19.5750	SD, IN.
REF	5.0000	IN.
SREF	5.0000	IN.
WREF	26.5000	IN.
ZREF	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON STABILITY CHARACTERISTICS

(RXE004)

AEDC TF360 BODY ALONE - B

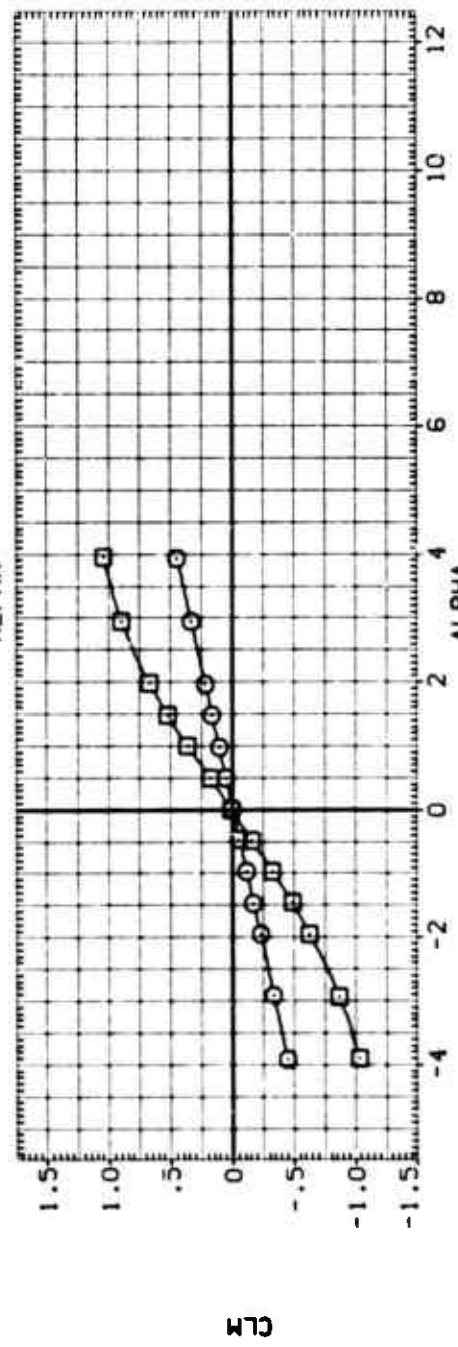
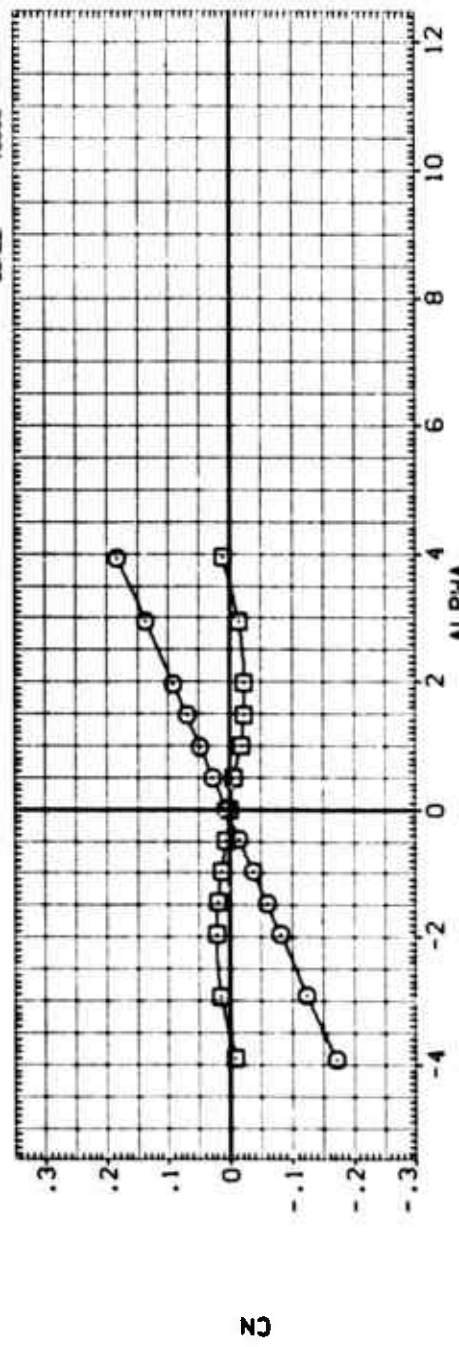
SYMBOL  $\square$   $\circ$

CNT .023 BETA MACH .000

PARAMETRIC VALUES .000 PHI 1.000

REFERENCE INFORMATION

SOEF	19.6750	SO, IN.
LOEF	5.0000	IN.
BOEF	5.0000	IN.
XTRP	26.5000	IN.
YTRP	.0000	IN.
ZTRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON STABILITY CHARACTERISTICS



(RXE005)

AEDC TF360 BODY ALONE, B

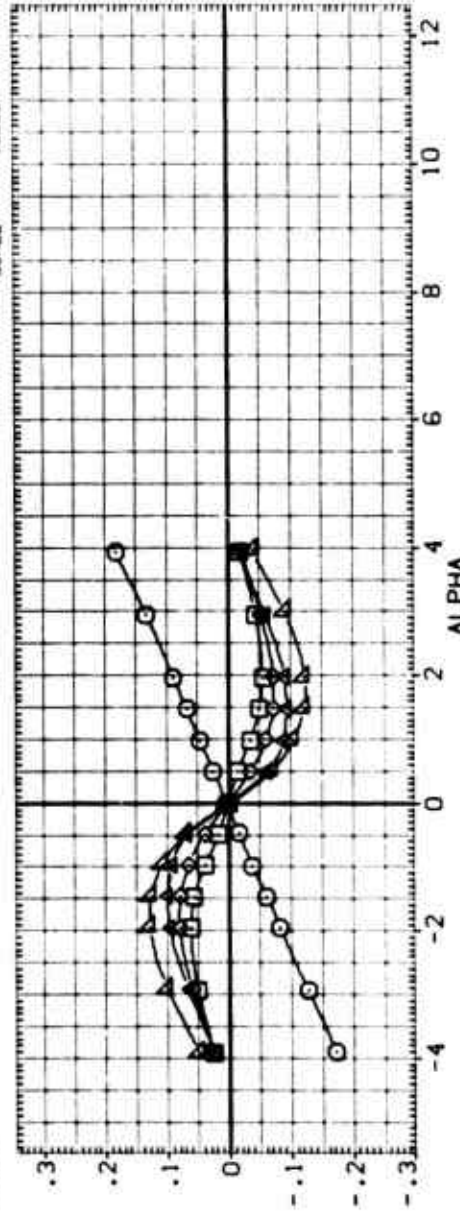
SYMBOL  
P  
□  
◇  
△

ORT  
.010  
3.035  
4.013  
5.976  
11.955

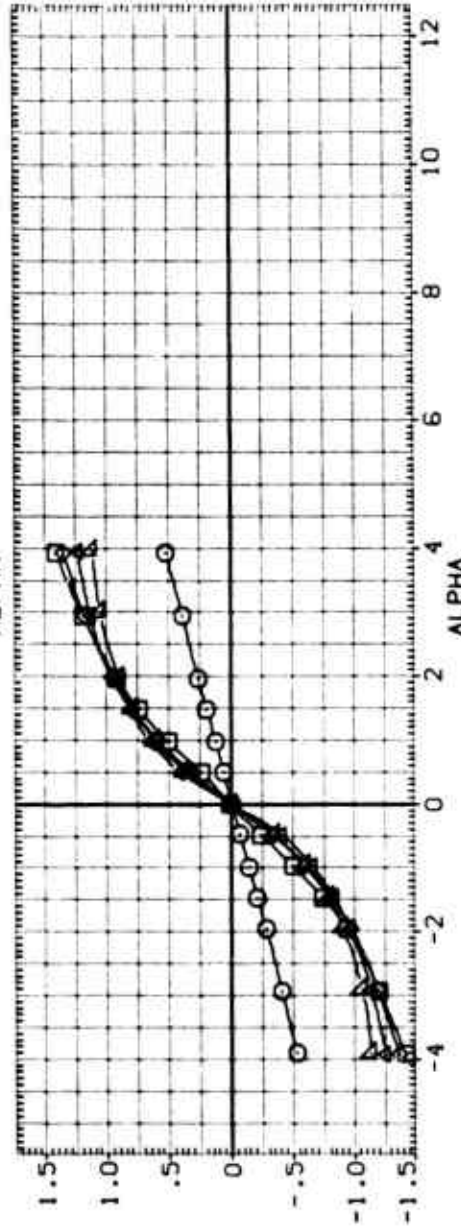
BETA  
MACH

PARAMETRIC VALUES  
.000 PHI  
1.250 .000

REFERENCE INFORMATION  
SREF 19.6750 50. IN  
LREF 5.0000 IN  
BREF 5.0000 IN  
XTRP 26.5000 IN  
YTRP .0000 IN  
ZTRP .0000 IN  
SCALE .0000



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THRUST EFFECTS ON STABILITY CHARACTERISTICS

(RXE006)

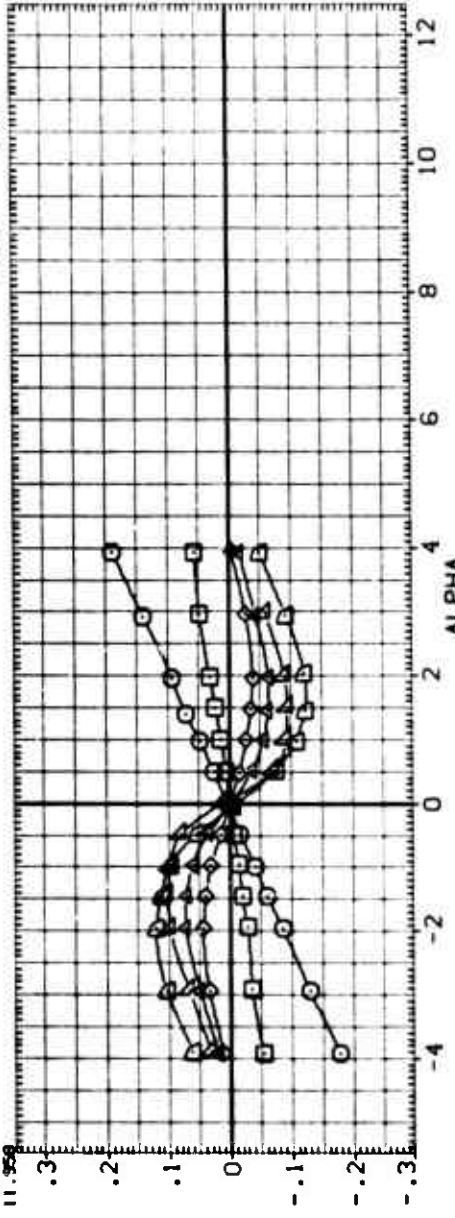
AEDC TF360 BODY ALONE, B

SYMBOL  
□ ○ ◇ △ ▽

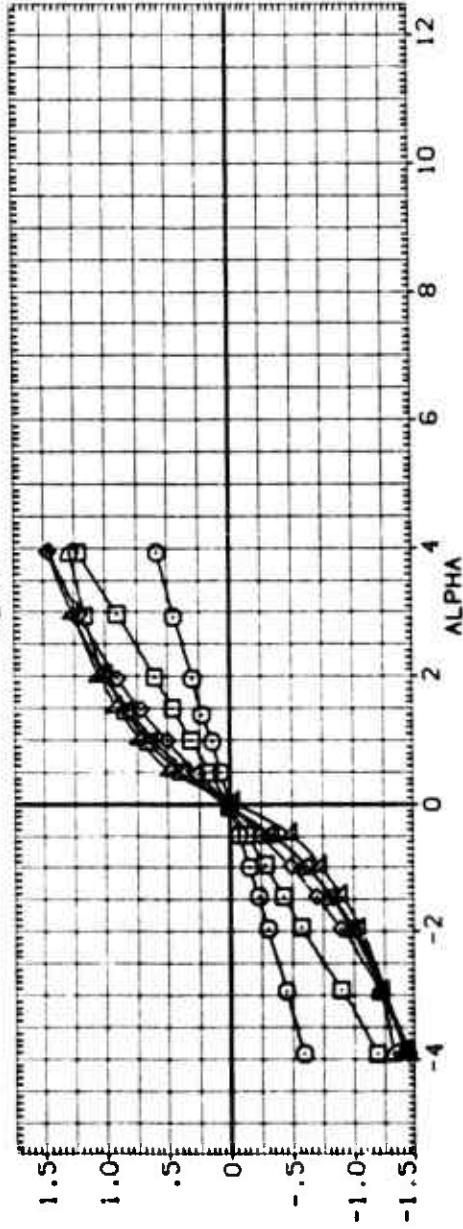
CRT  
.010  
2.005  
3.068  
4.022  
6.035  
11.958

PARAMETRIC VALUES  
BETA MACH .000  
PHI 1.500

REFERENCE INFORMATION  
SREF 19.6350 50. IN.  
LREF 5.0000 IN.  
BREF 5.0000 IN.  
XREF 26.5000 IN.  
YREF .0000 IN.  
ZREF .0000 IN.  
SCALE .0000



$C_x$



$C_z$

THRUST EFFECTS ON STABILITY CHARACTERISTICS

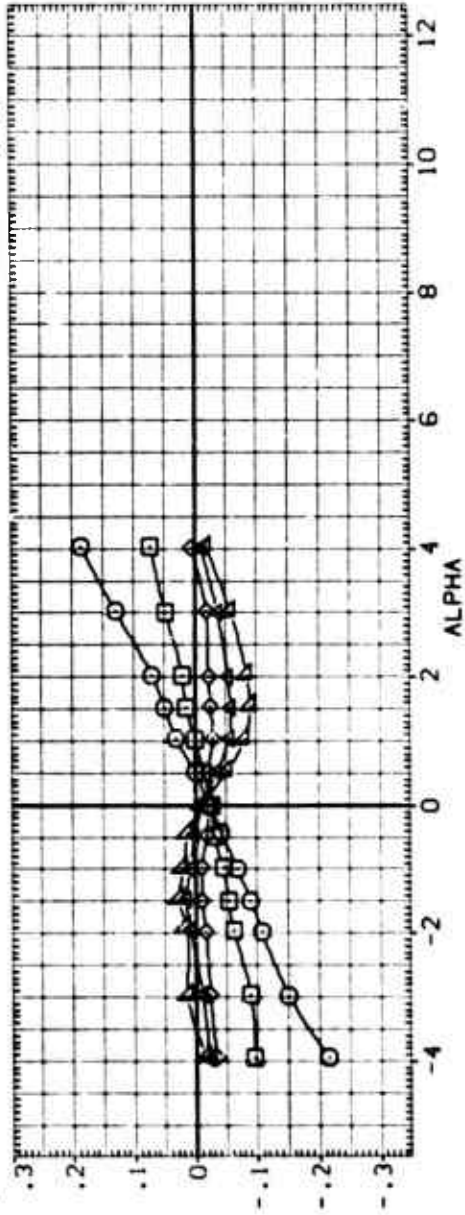
(RXE007)

AEOC SF172 BODY ALONE .8

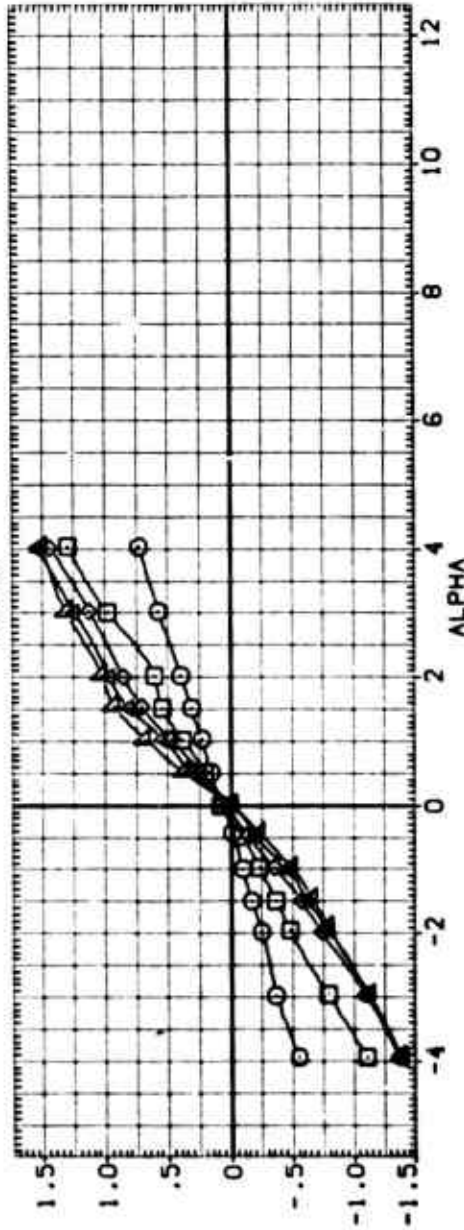
SYMBOL: ○ □ ◇ △

CRT .018 BETA .000 PHI .000  
2.045 MACH 1.700  
3.009  
4.001  
6.030

REFERENCE INFORMATION  
SREF 19.6750 SQ. IN.  
LREF 5.0000 IN.  
BREF 5.0000 IN.  
XREF 26.0000 IN.  
YREF 5.0000 IN.  
ZREF 5.0000 IN.  
SCALE .0000



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THRUST EFFECTS ON STABILITY CHARACTERISTICS

(RXE008)

AE0C SF172 BODY ALONE.B

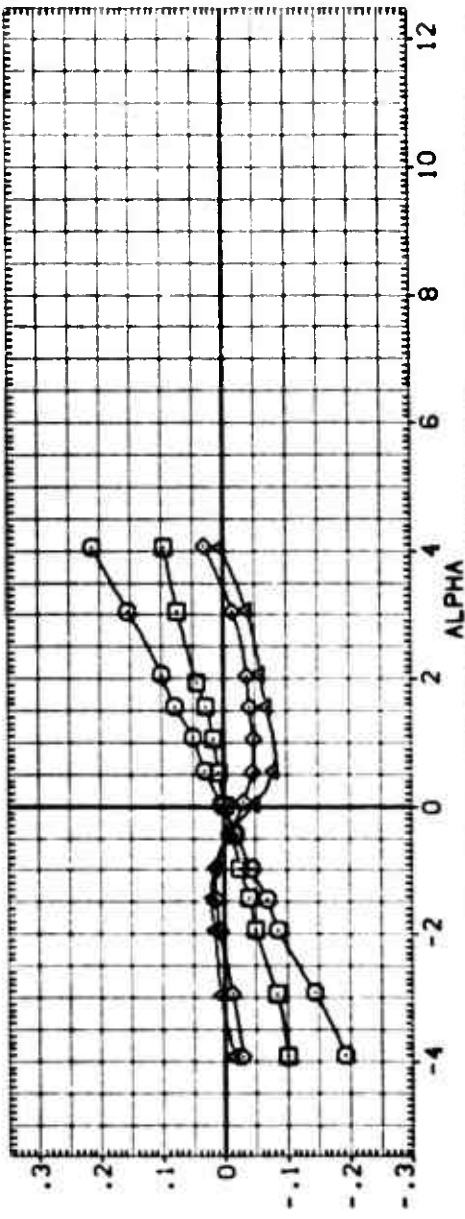
SYMBOL  
○ □ ◇ △

CRT  
.008  
2.004  
3.965  
6.005

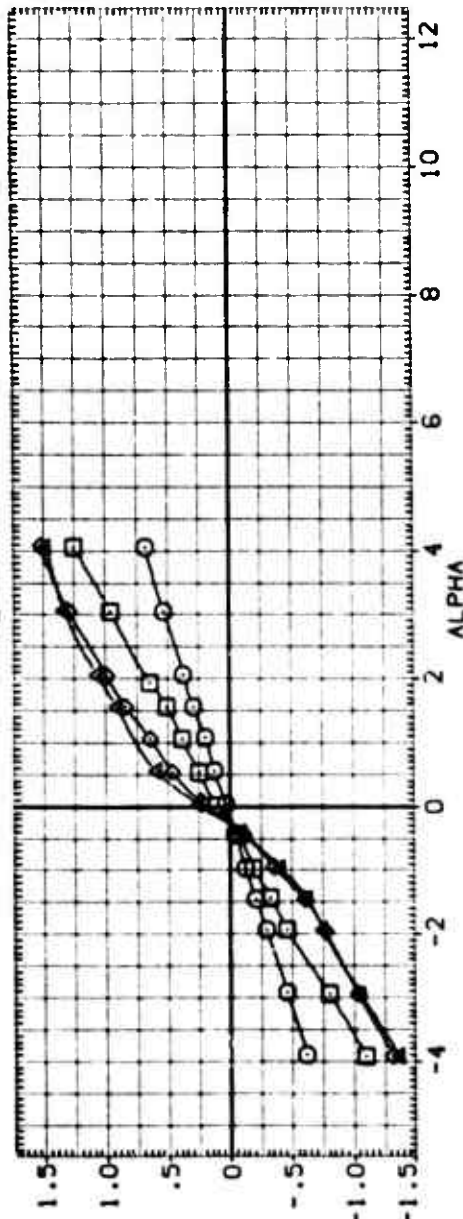
BEVA  
MACH  
2.000  
3.965  
6.005

PARAMETRIC VALUES  
.000  
PHI  
2.000  
3.965  
6.005

REFERENCE INFORMATION  
SREF 19.6750 50. IN.  
LREF 5.0000 IN.  
BREF 5.0000 IN.  
XREF 26.5000 IN.  
YREF .0000 IN.  
ZREF .0000 IN.  
SCALE .0070



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THRUST EFFECTS ON STABILITY CHARACTERISTICS

(RXE009)

AECC TF360 BODY FIN, BF1

SYMBOL

○	◇	△
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REFERENCE INFORMATION

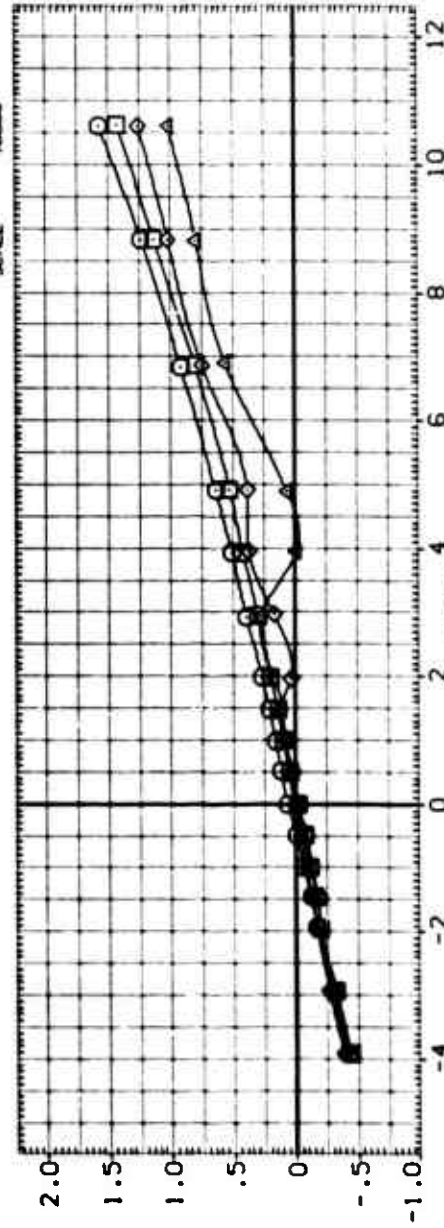
SREF	19.6250	IN.
LREF	3.0000	IN.
BREF	5.0000	IN.
XPRP	26.5000	IN.
YPRP	.0000	IN.
ZPRP	.0000	IN.
SCALE	.0000	

PARAMETRIC VALUES

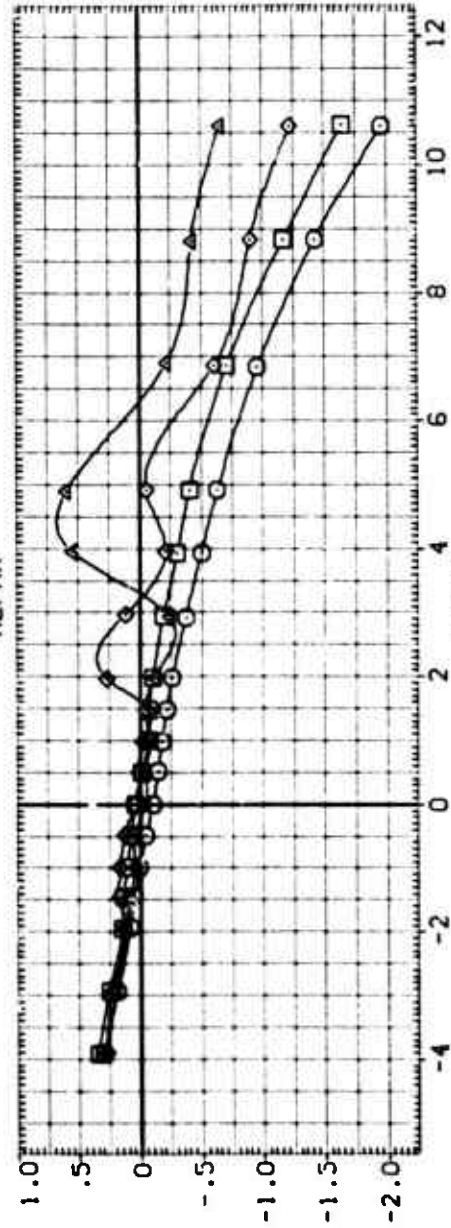
BETA	.000	PHI	.000
FINPOS	3.000	MACH	.200

ORT

.575
26.074
50.139
100.316



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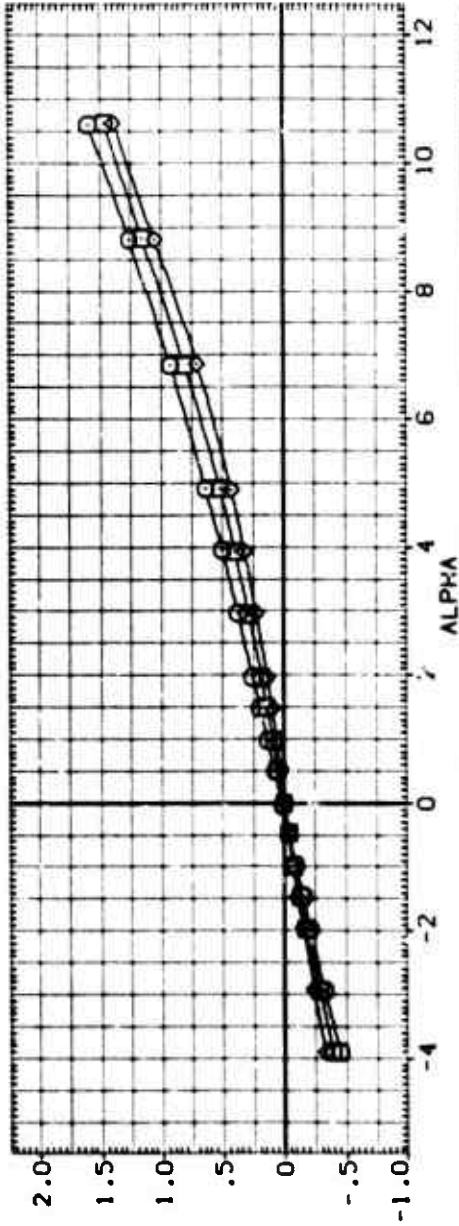
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN. BF1 (RXE011)

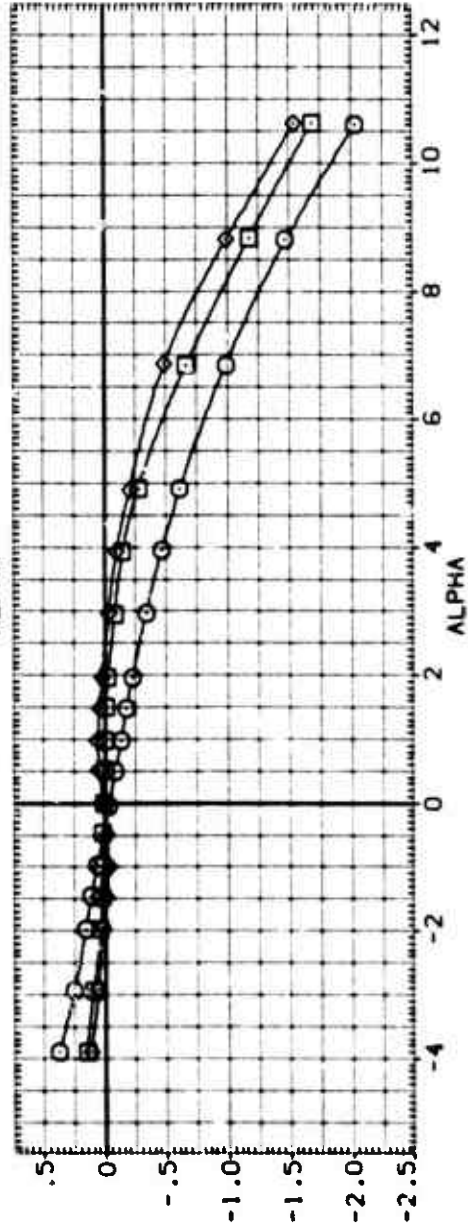
SYMBOL	ORT	BETA	PHI	MACH	PARAMETRIC VALUES
○	.132	.000	.000	.400	
□	11.977	3.000	MACH		
◇	37.530				

REFERENCE INFORMATION	
SREF	19.6250
LREF	5.0000
BREF	5.0000
XREF	26.5000
YREF	5.0000
ZREF	5.0000
SCALE	.0000



Cx



Cz

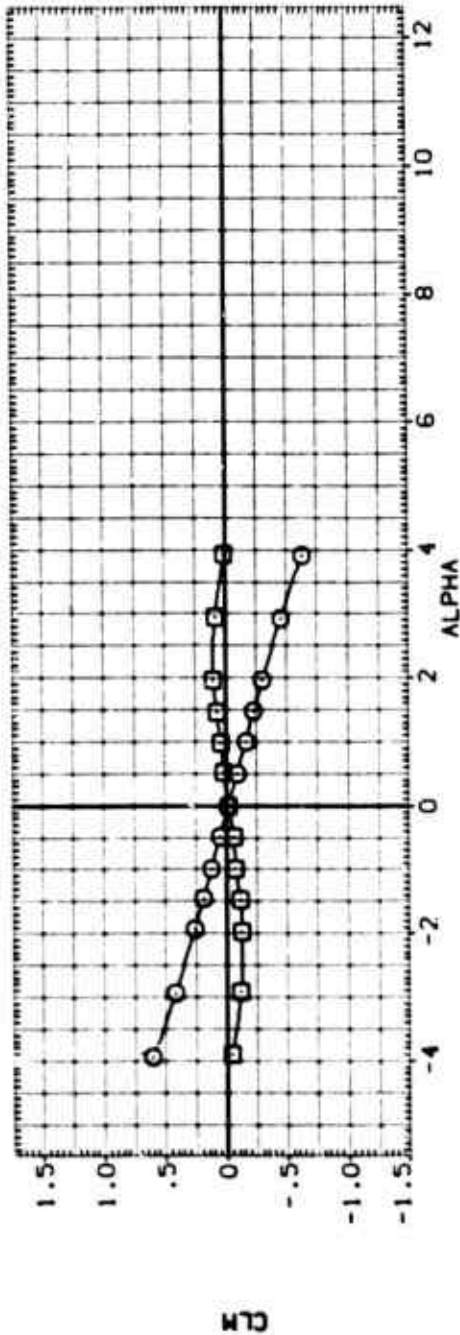
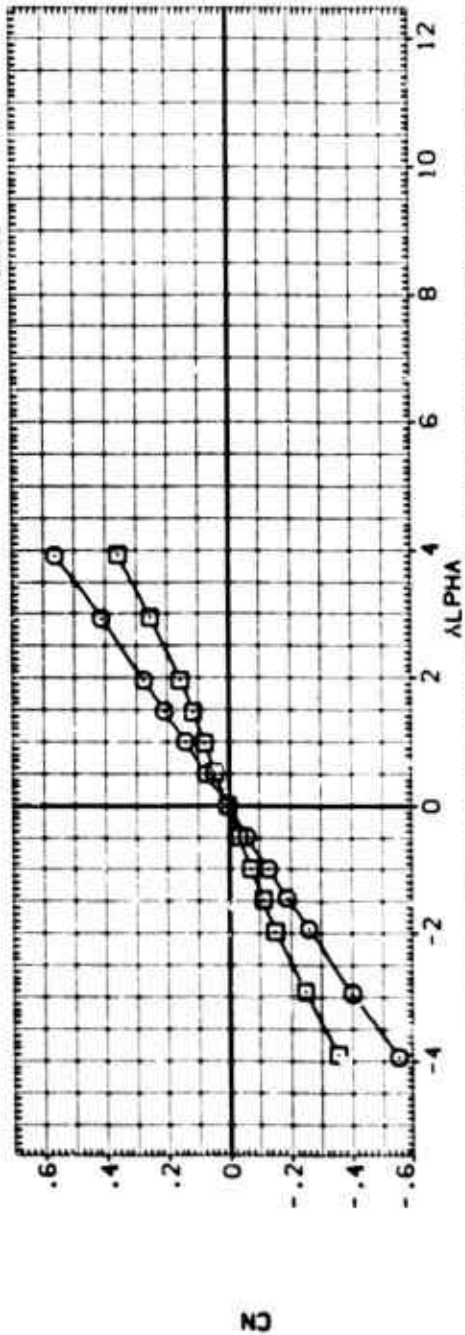
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN, BF1

(RXE012)

SYMBOL    CDT    .012    BETA    .000    PHI    .000  
 □    5.000    FINPOS    3.000    MACH    1.000

REFERENCE INFORMATION  
 SREF 19.6750    SQ. IN.  
 LREF 5.0000    IN.  
 BREF 5.0000    IN.  
 XREF 26.5000    IN.  
 YREF 7.0000    IN.  
 ZREF 7.0000    IN.  
 SCALE .0000



THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN. BF1

(RXED13)

SYMBOL

○	○	○	△
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PARAMETRIC VALUES

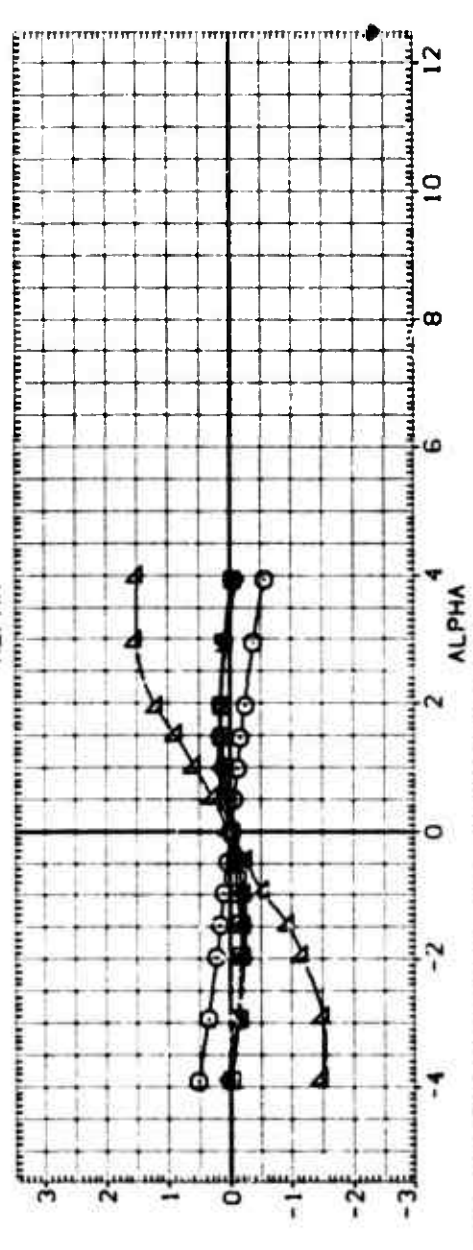
BETA	.010	.000	PHI	.000
F IMPOS	3.000	MACH	1.250	

REFERENCE INFORMATION

SREF	19.6350	50. IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XREF	26.5000	IN.
YREF	.0000	IN.
ZREF	.0000	IN.
SCALE	.0000	



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THRUST EFFECTS ON STABILITY CHARACTERISTICS

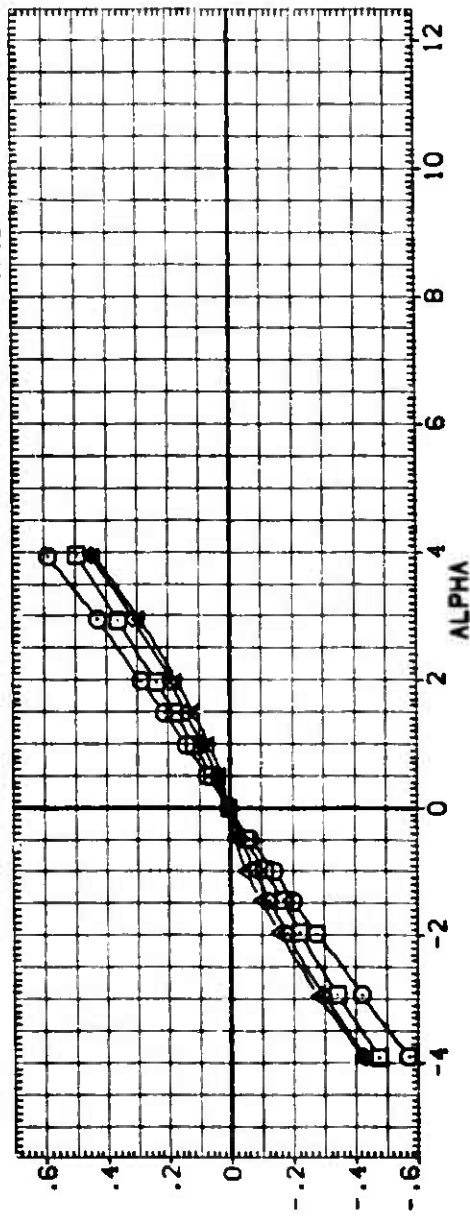


(RXE014)

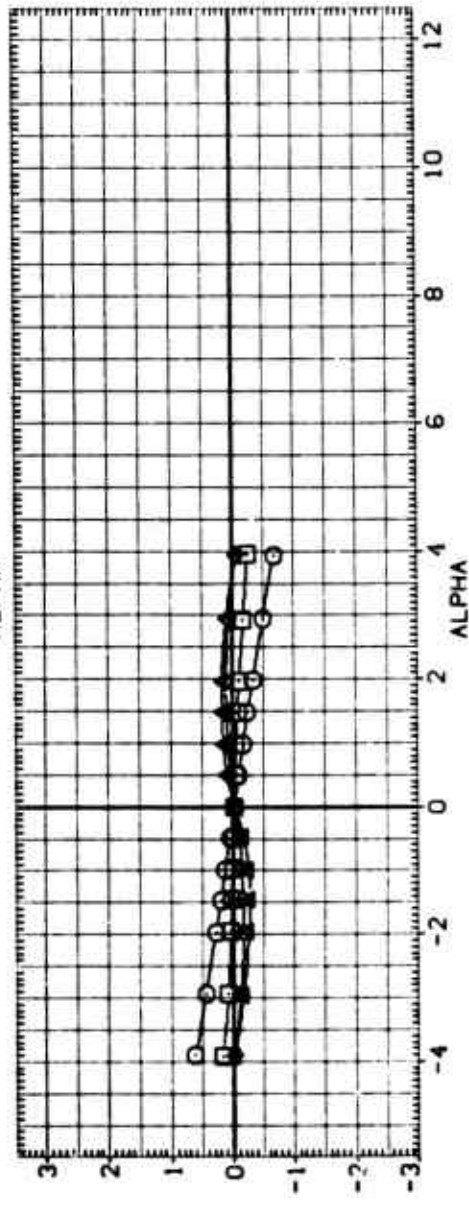
AEDC TF360 BODY FIN. BF1

SYMBOL CRT BETA F1MPOS .000 PHI .000  
 2.011 3.000 MACH 1.500  
 3.012  
 4.017

REFERENCE INFORMATION  
 SREF 19.6750 SQ. IN.  
 LREF 5.0000 IN.  
 BREF 5.0000 IN.  
 XPRP 26.5000 IN.  
 YPRP .0000 IN.  
 ZPRP .0000 IN.  
 SCALE .0000



CLM



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THRUST EFFECTS ON STABILITY CHARACTERISTICS

(RXE014)

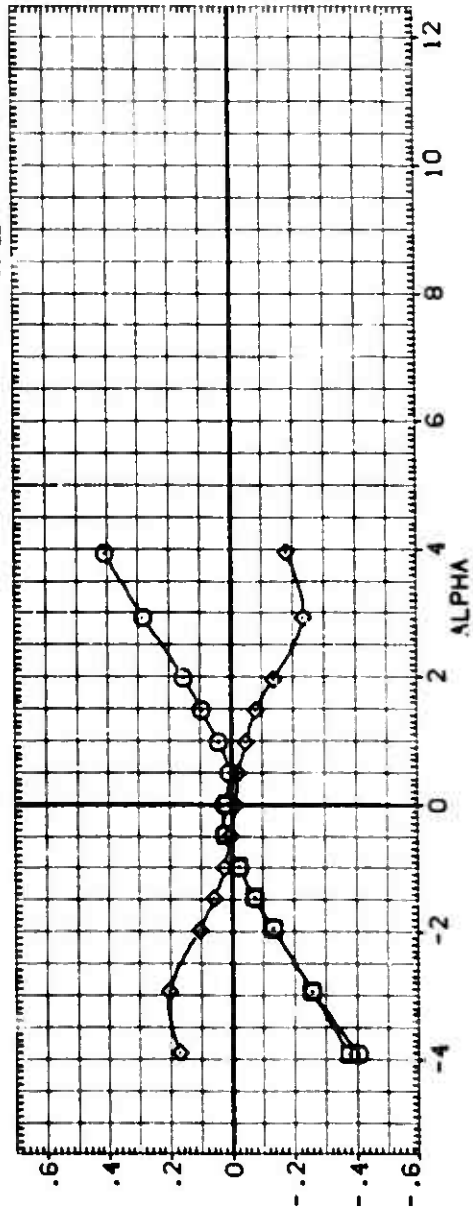
AEDC TF360 BODY FIN, BF1

SYMBOL  
□  
◇

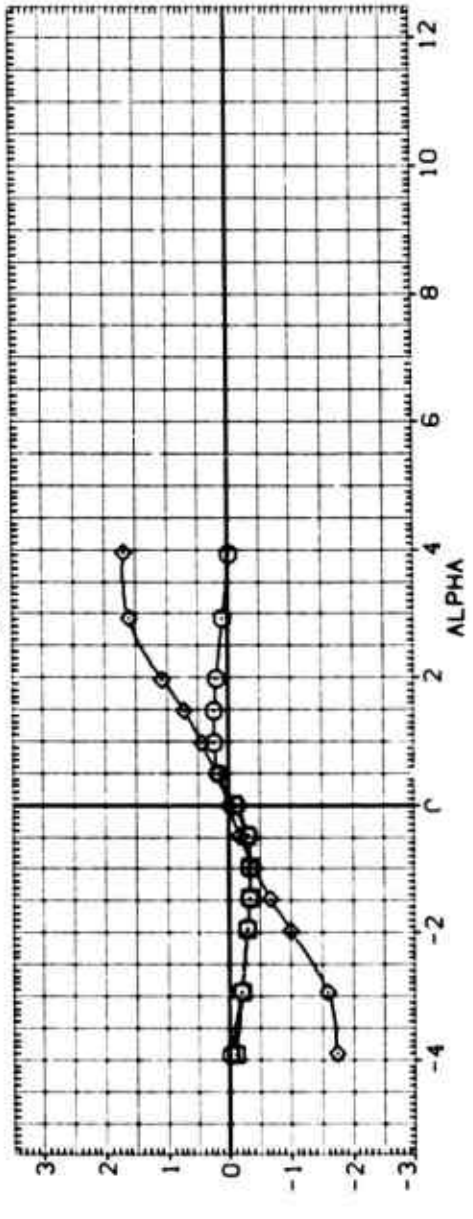
CNT  
5.989  
6.547  
11.952

PARAMETRIC VALUES  
BETA .000 PHI .000  
FINPOS 3.000 MACH 1.500

REFERENCE INFORMATION  
SREF 19.6350 50. IN.  
LREF 5.0000 IN.  
BREF 5.0000 IN.  
XHPRP 26.5000 IN.  
YHPRP .0000 IN.  
ZHPRP .0000 IN.  
SCALE .0000



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THRUST EFFECTS ON STABILITY CHARACTERISTICS

(RXE015)

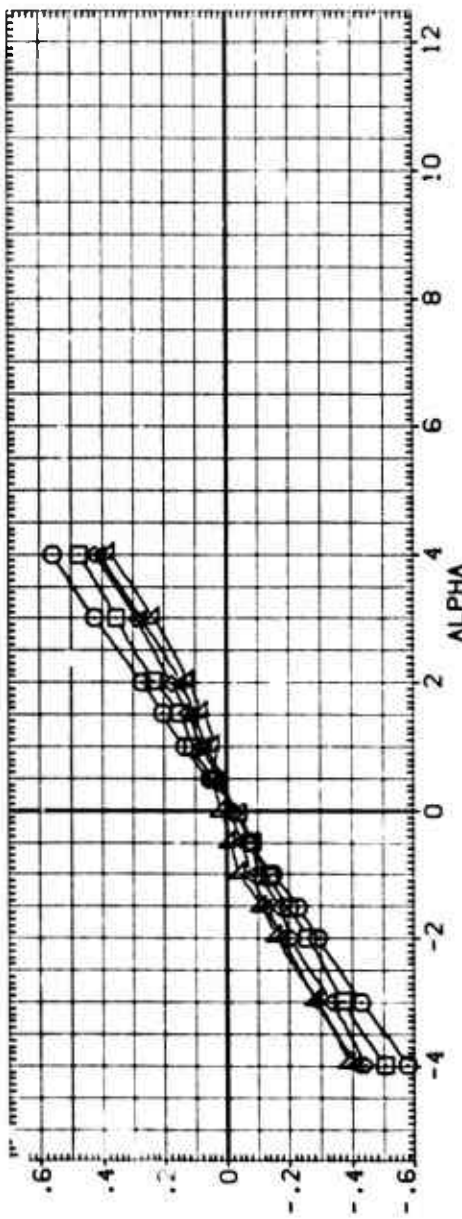
AEDC SF172 BODY FIN. BFI

SYMBOL  
○ □ ◇ △

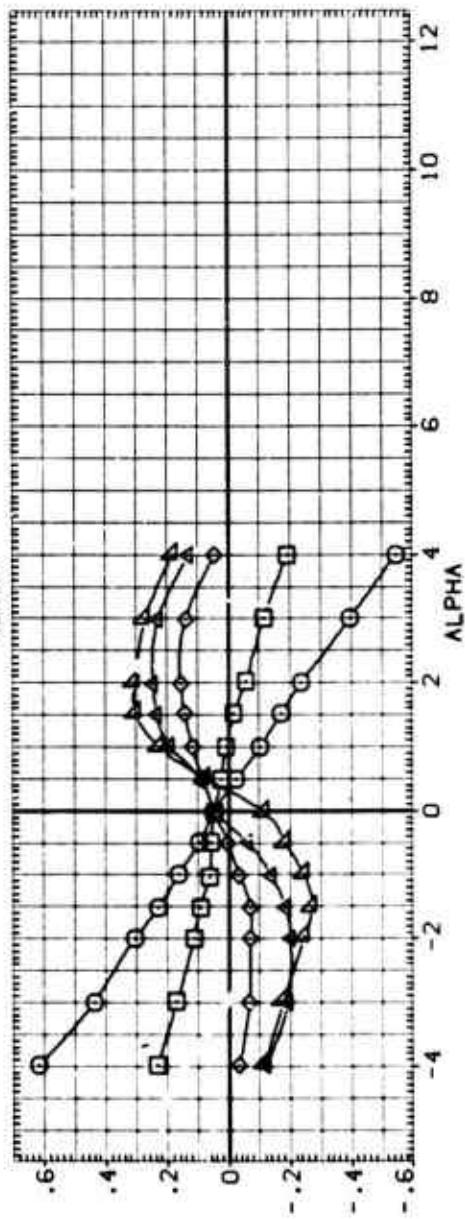
CRT  
.021  
1.954  
3.018  
4.018  
5.959

PARAMETRIC VALUES  
BETA .000 PHI .000  
FINPOS 3.000 MACH 1.700

REFERENCE INFORMATION  
SREF 19.6250 SQ. IN.  
LREF 5.0000 IN.  
BREF 5.0000 IN.  
YREF 2E-5000 IN.  
YMRP .0000 IN.  
ZMRP .0000 IN.  
SCALE .0000



CN

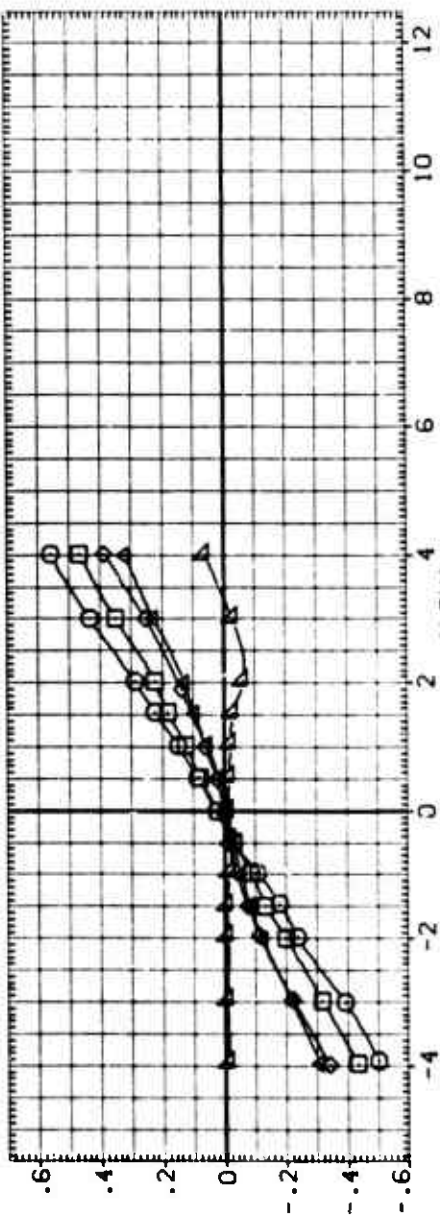


CH

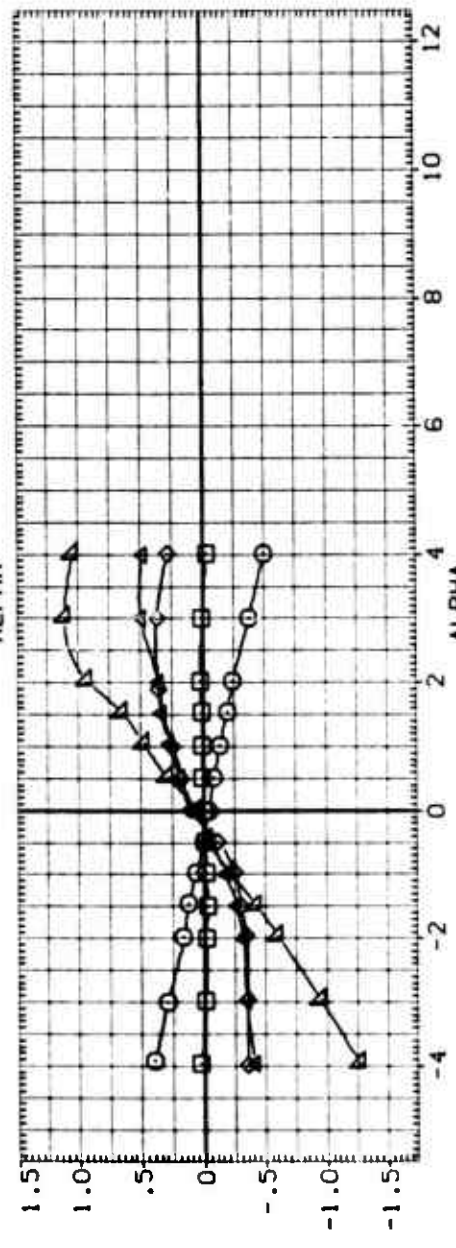
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC SF172 BODY FIN. BF1 (RXE016)

SYMBO		PARAMETRIC VALUES		REFERENCE INFORMATION	
○	□	BETA	PHI	SREF	50 IN.
◇	△	F INPOS	MACH	LREF	IN.
				BREF	IN.
				MREF	IN.
				VREF	IN.
				ZREF	IN.
				SCALE	.0000



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THRUST EFFECTS ON STABILITY CHARACTERISTICS

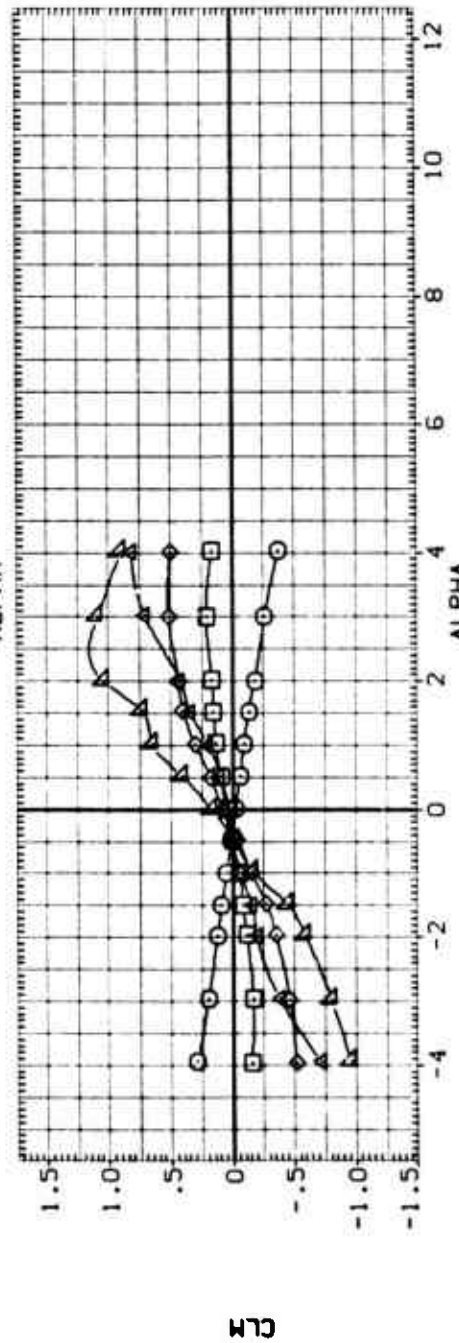
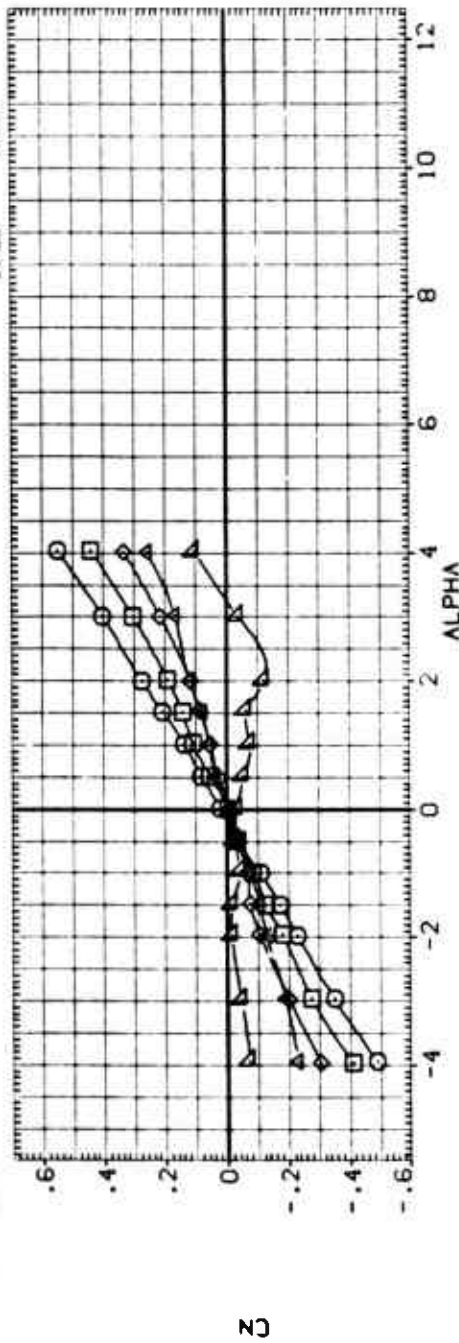
AEDC SF172 BODY FIN. BF1

(RXE017)

SYMBOL  
 ○ □ ◇ △

CRT      BETA      PARAMETRIC VALUES  
 2.024    .000    .000  
 4.021    3.000    MACH    2.300  
 6.052  
 12.011

REFERENCE INFORMATION  
 SREF 19.6750    50. IN.  
 LREF 5.0000    IN.  
 BREF 5.0000    IN.  
 XREF 26.5000    IN.  
 YREF 26.5000    IN.  
 ZREF 26.5000    IN.  
 SCALE .0000



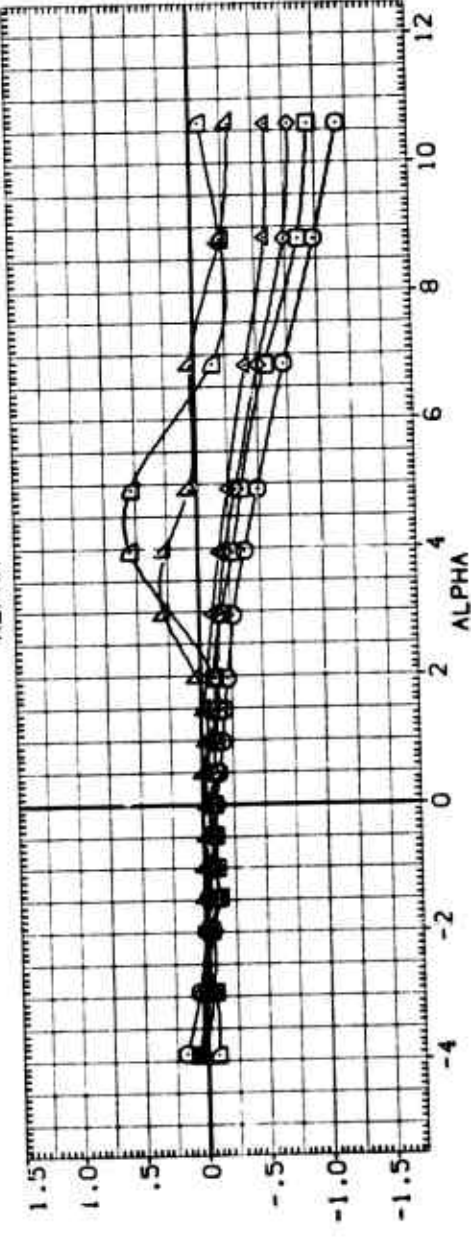
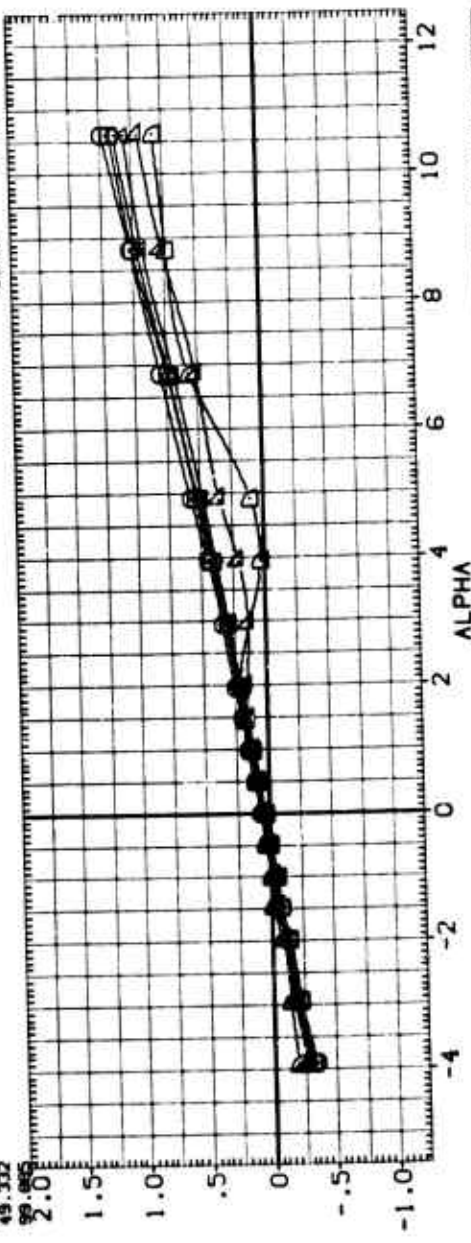
THRUST EFFECTS ON STABILITY CHARACTERISTICS

(RXE018)

AEDC TF360 BODY FIN, BF2

SYMBO	CNT	BETA	FINPOS	PARAMETRIC VALUES	PHI	MACH	SCALE
□	.542				.000		.000
○	5.253				.200		.200
△	12.314						
◇	25.314						
○	49.332						
○	99.665						

REFERENCE INFORMATION		50 IN.
SREF	19.6350	IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON STABILITY CHARACTERISTICS

(RXE019)

AEDC TF360 BODY FIN. BF2

SYMBOL

□	○	◇	△
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PARAMETRIC VALUES

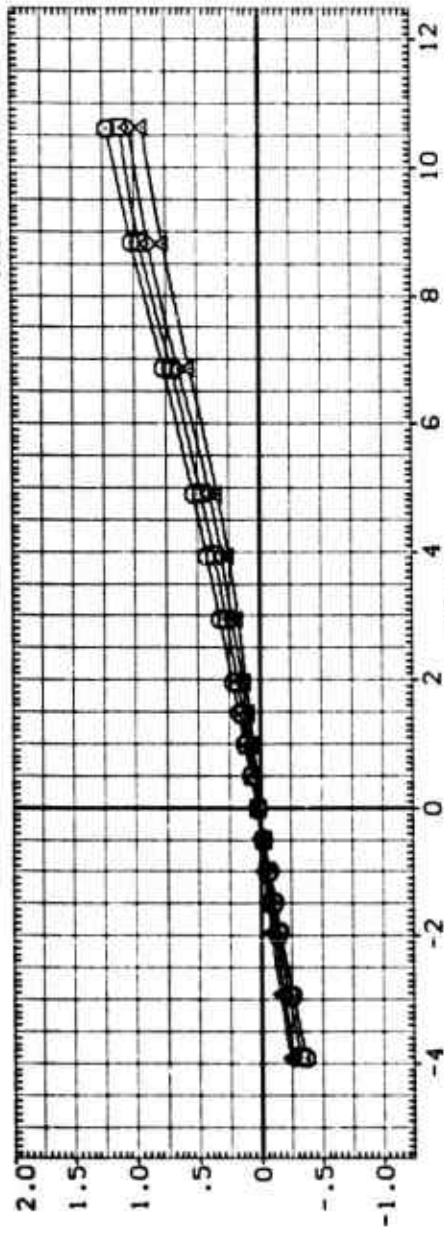
BETA	.000	PHI	.000
FINPOS	3.000	MACH	.400

REFERENCE INFORMATION

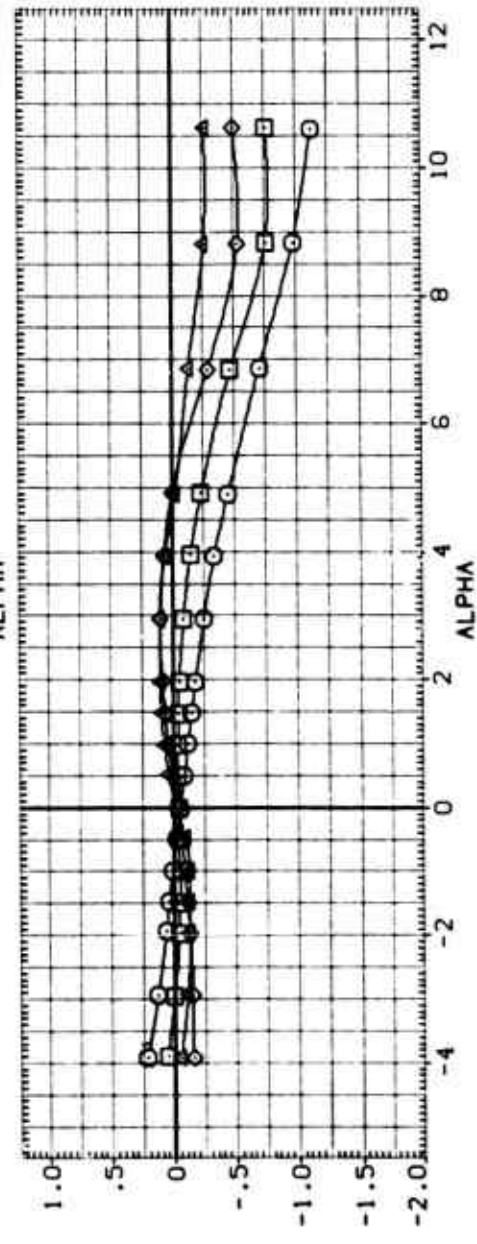
SREF	19.5350	50. IN.
LRREF	5.0000	IN.
BRREF	5.0000	IN.
YREF	26.5000	IN.
ZREF	.0000	IN.
SCALE	.0000	

CRT

.120
5.713
12.135
37.274



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THRUST EFFECTS ON STABILITY CHARACTERISTICS

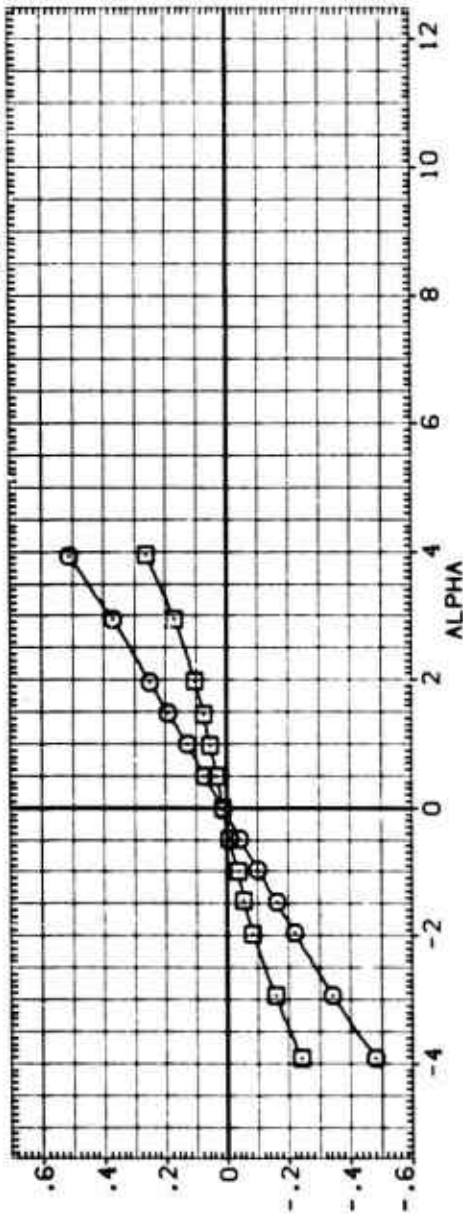
AEDC TF360 BODY FIN, BF2

(RXE020)

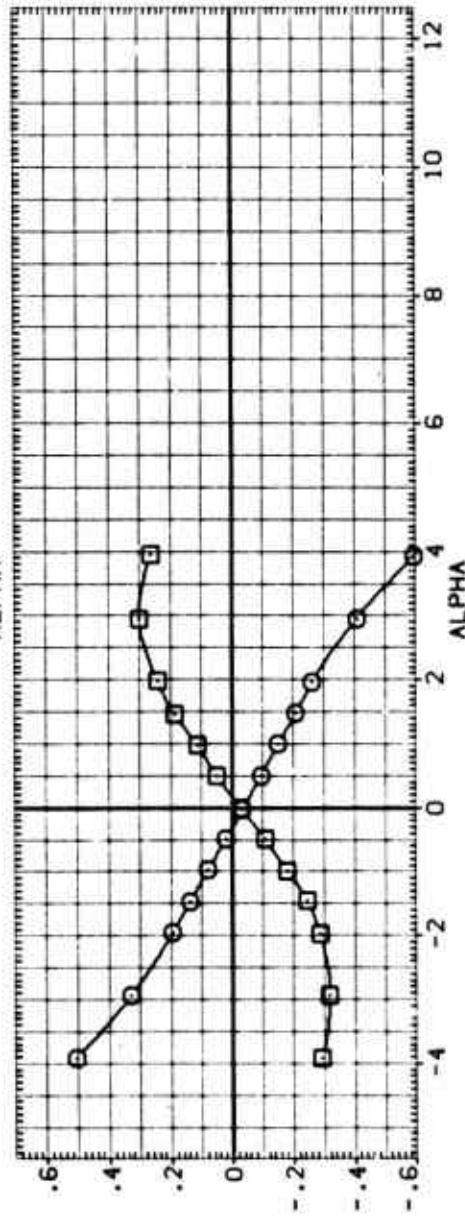
SYMBOL  
 ○ □

CRT .010 BETA .000 PHI .000  
 5.980 FINPOS 3.000 MACH 1.000

REFERENCE INFORMATION  
 SREF 19.6350 SQ. IN.  
 LREF 5.0000 IN.  
 BREF 5.0000 IN.  
 XREF 26.5000 IN.  
 YREF .0000 IN.  
 ZREF .0000 IN.  
 SCALE .0000



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THRUST EFFECTS ON STABILITY CHARACTERISTICS



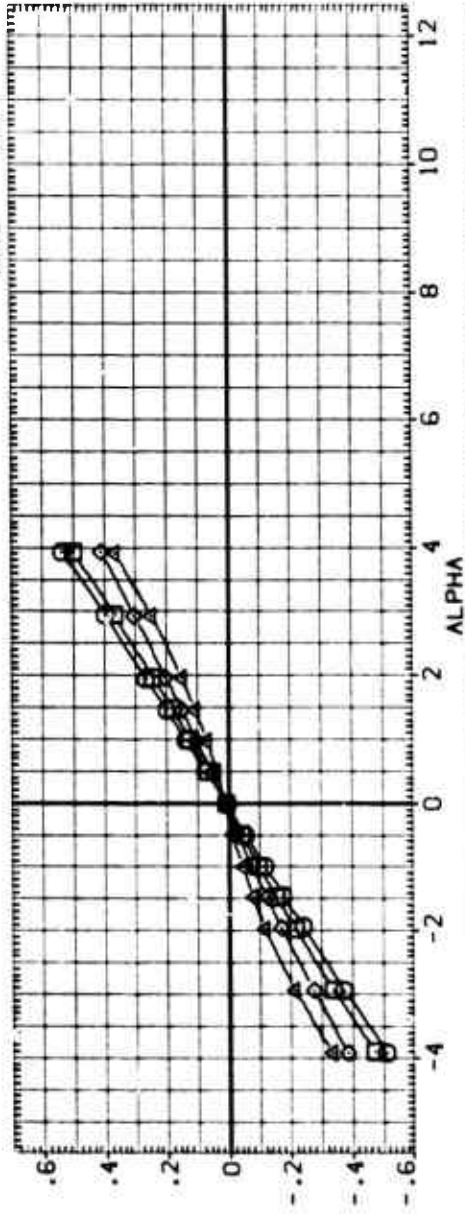
(RXE021)

AEDC TF360 BODY FIN, BF2

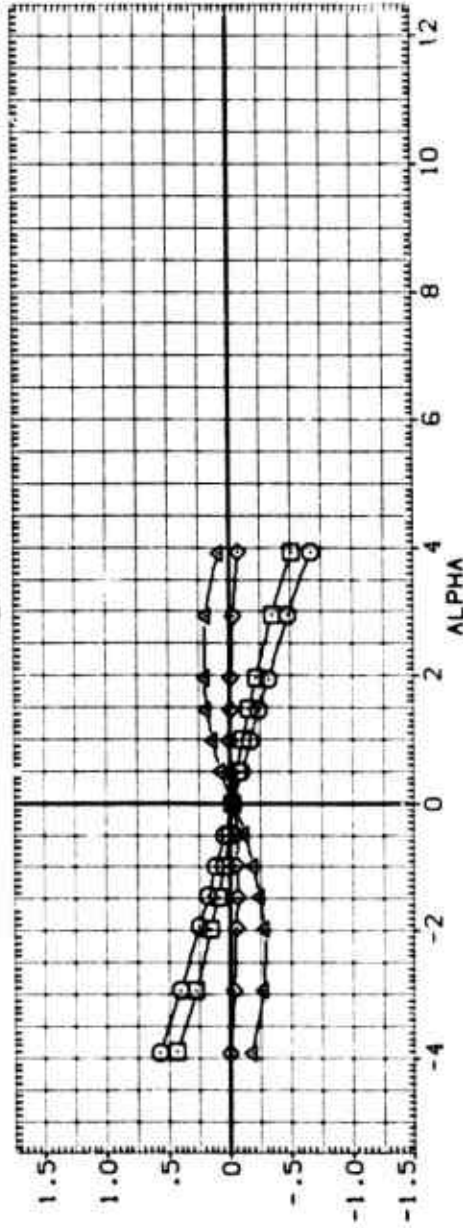
SYMBOL  
□ ○ △

CRIT BETA .010  
FIMPOS 3.000  
PHI .000  
MACH 1.250

REFERENCE INFORMATION  
SREF 19.6350 SO. IN.  
LREF 5.0000 IN.  
BREF 5.0000 IN.  
XTRP 26.5000 IN.  
YTRP .0000 IN.  
ZTRP .0000 IN.  
SCALE .0000



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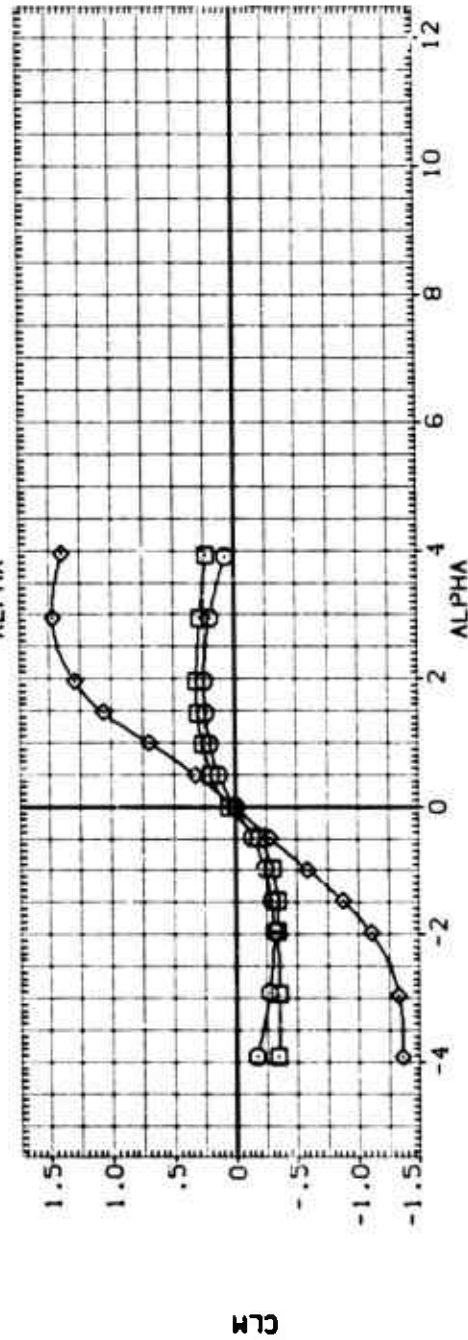
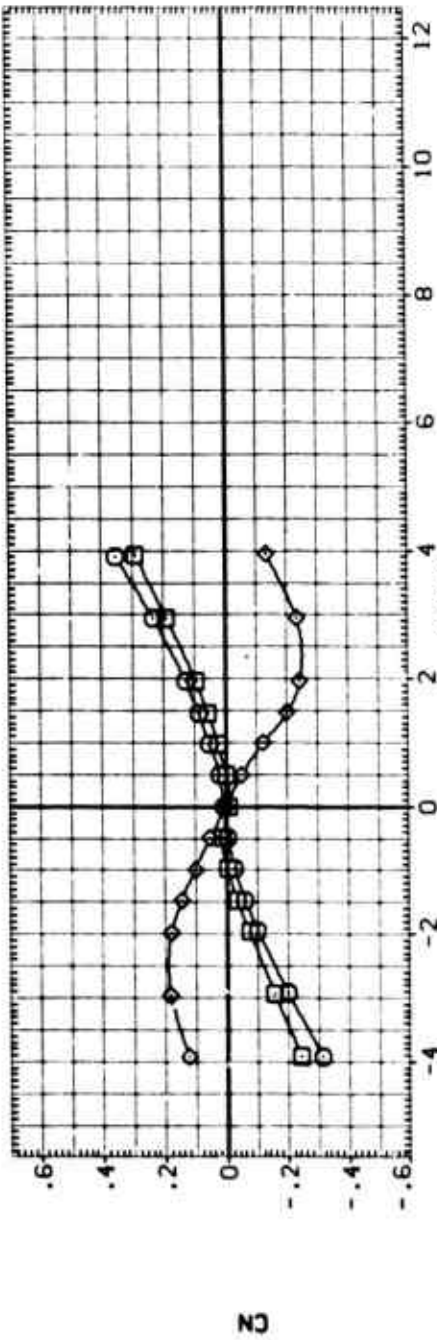
THRUST EFFECTS ON STABILITY CHARACTERISTICS

(RXE021)

AEDC TF360 BODY FIN, BF2

SYMOL	CRT	PARAMETRIC VALUES			
		BETA	PHI	SCALE	IN.
□	4.006	.000	.000	.000	50.000
○	6.010	3.000	MCH	1.250	IN.
◇	11.905				IN.

REFERENCE INFORMATION	
SREF	9.6750
LREF	5.0000
BREF	5.0000
XREF	26.5000
YREF	.0000
ZREF	.0000
SCALE	.0000



THRUST EFFECTS ON STABILITY CHARACTERISTICS

(RXE022)

AEDC TF360 BODY FIN. BF2

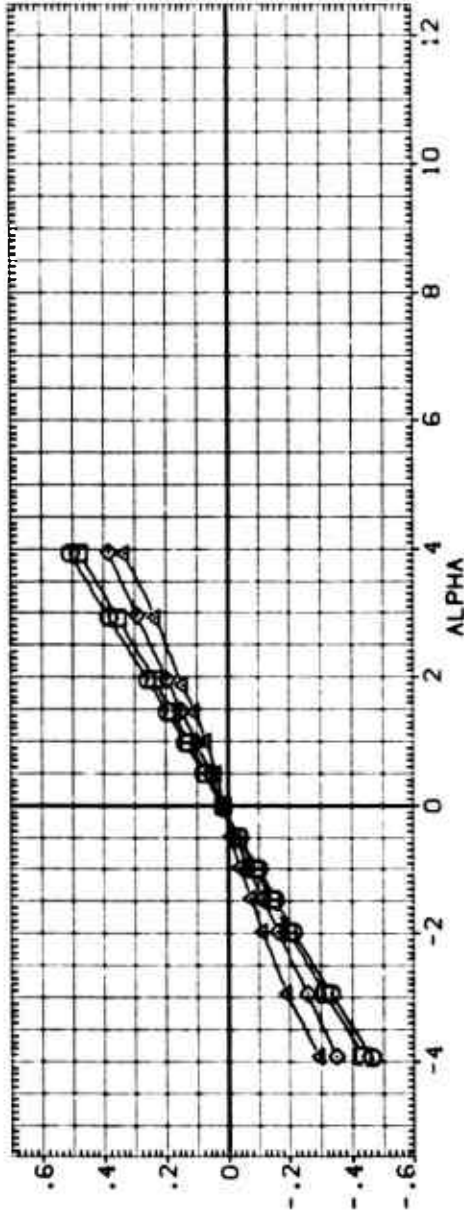
SYMBOL  
○ □ △

ORT  
.010  
.988  
2.008  
3.050

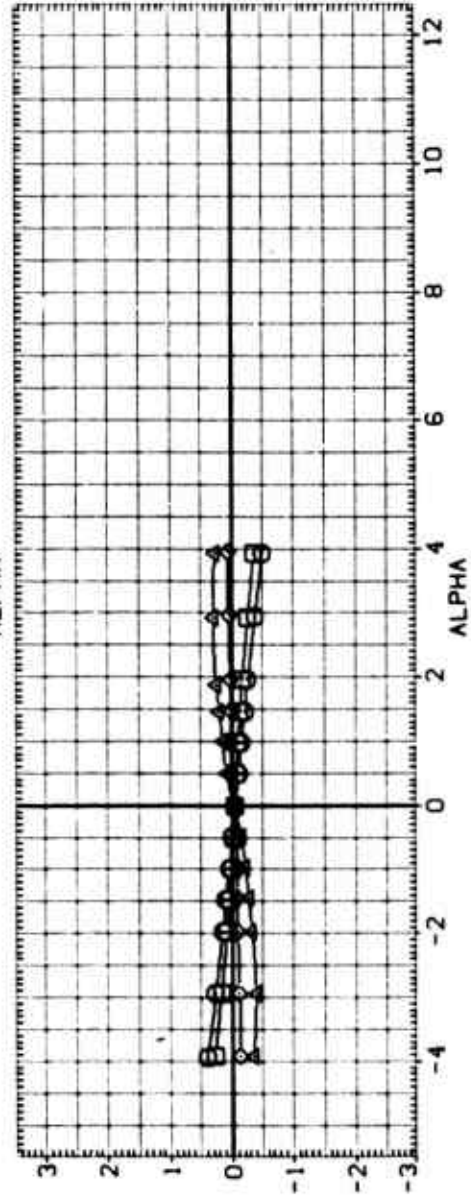
PARAMETRIC VALUES  
.000 PHI  
3.000 MACH  
1.500

BETA  
FIMPOS

REFERENCE INFORMATION  
SREF 19.6360 SQ. IN.  
LREF 5.0000 IN.  
BREF 5.0000 IN.  
XREF 26.5000 IN.  
YREF .0000 IN.  
ZREF .0000 IN.  
SCALE .0000



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THRUST EFFECTS ON STABILITY CHARACTERISTICS

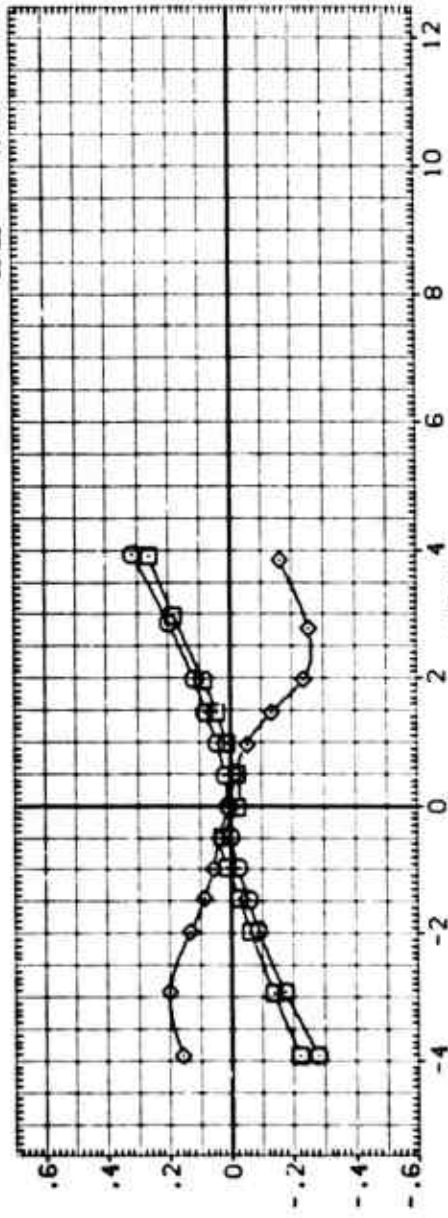
(RXE022)

AEDC TF360 BODY FIN. BF2

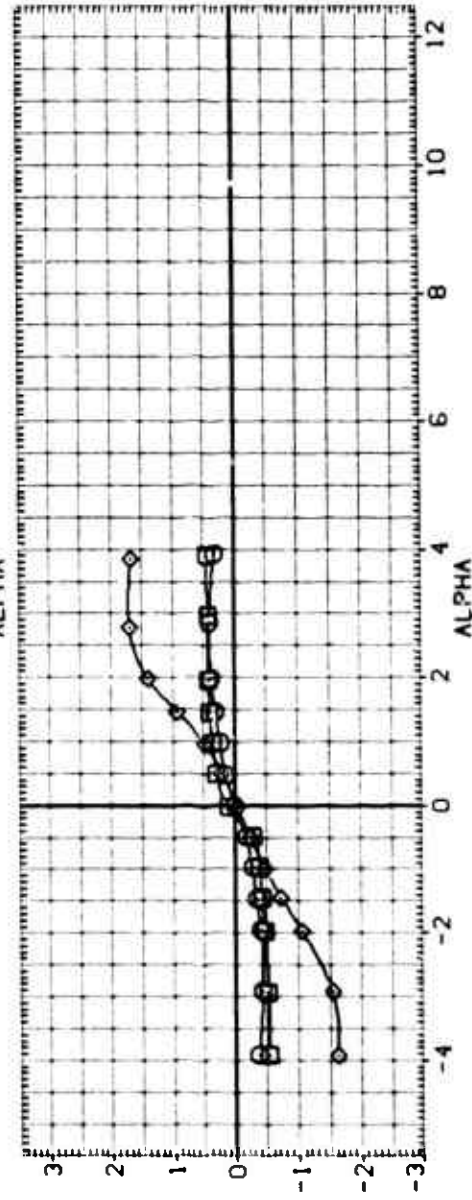
SYMBOL  
□  
◇

CR1 4.008 BETA .000 PHI .000  
5.988 FINPOS 3.000 MACH 1.500  
11.851

REFERENCE INFORMATION  
SREF 19.5250 50. IN.  
LREF 5.0000 IN.  
BREF 5.0000 IN.  
XREF 26.5000 IN.  
YREF 5.0000 IN.  
ZREF 5.0000 IN.  
SCALE .0000



CN



CM

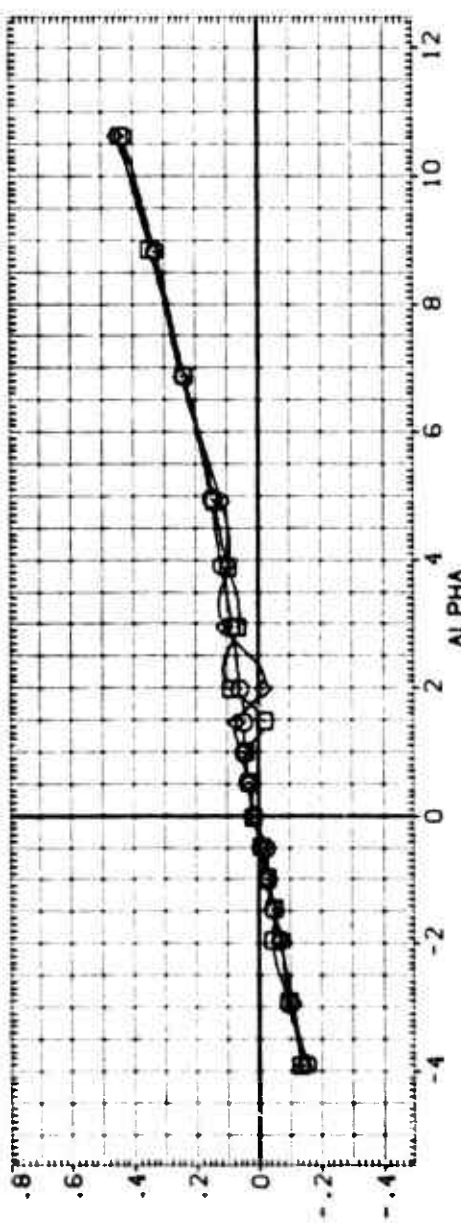
THRUST EFFECTS ON STABILITY CHARACTERISTICS

DATA SET SYMBOL: (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) (AA) (AB) (AC) (AD) (AE) (AF) (AG) (AH) (AI) (AJ) (AK) (AL) (AM) (AN) (AO) (AP) (AQ) (AR) (AS) (AT) (AU) (AV) (AW) (AX) (AY) (AZ) (BA) (BB) (BC) (BD) (BE) (BF) (BG) (BH) (BI) (BJ) (BK) (BL) (BM) (BN) (BO) (BP) (BQ) (BR) (BS) (BT) (BU) (BV) (BW) (BX) (BY) (BZ) (CA) (CB) (CC) (CD) (CE) (CF) (CG) (CH) (CI) (CJ) (CK) (CL) (CM) (CN) (CO) (CP) (CQ) (CR) (CS) (CT) (CU) (CV) (CW) (CX) (CY) (CZ) (DA) (DB) (DC) (DD) (DE) (DF) (DG) (DH) (DI) (DJ) (DK) (DL) (DM) (DN) (DO) (DP) (DQ) (DR) (DS) (DT) (DU) (DV) (DW) (DX) (DY) (DZ) (EA) (EB) (EC) (ED) (EE) (EF) (EG) (EH) (EI) (EJ) (EK) (EL) (EM) (EN) (EO) (EP) (EQ) (ER) (ES) (ET) (EU) (EV) (EW) (EX) (EY) (EZ) (FA) (FB) (FC) (FD) (FE) (FF) (FG) (FH) (FI) (FJ) (FK) (FL) (FM) (FN) (FO) (FP) (FQ) (FR) (FS) (FT) (FU) (FV) (FW) (FX) (FY) (FZ) (GA) (GB) (GC) (GD) (GE) (GF) (GG) (GH) (GI) (GJ) (GK) (GL) (GM) (GN) (GO) (GP) (GQ) (GR) (GS) (GT) (GU) (GV) (GW) (GX) (GY) (GZ) (HA) (HB) (HC) (HD) (HE) (HF) (HG) (HH) (HI) (HJ) (HK) (HL) (HM) (HN) (HO) (HP) (HQ) (HR) (HS) (HT) (HU) (HV) (HW) (HX) (HY) (HZ) (IA) (IB) (IC) (ID) (IE) (IF) (IG) (IH) (II) (IJ) (IK) (IL) (IM) (IN) (IO) (IP) (IQ) (IR) (IS) (IT) (IU) (IV) (IW) (IX) (IY) (IZ) (JA) (JB) (JC) (JD) (JE) (JF) (JG) (JH) (JI) (JJ) (JK) (JL) (JM) (JN) (JO) (JP) (JQ) (JR) (JS) (JT) (JU) (JV) (JW) (JX) (JY) (JZ) (KA) (KB) (KC) (KD) (KE) (KF) (KG) (KH) (KI) (KJ) (KK) (KL) (KM) (KN) (KO) (KP) (KQ) (KR) (KS) (KT) (KU) (KV) (KW) (KX) (KY) (KZ) (LA) (LB) (LC) (LD) (LE) (LF) (LG) (LH) (LI) (LJ) (LK) (LL) (LM) (LN) (LO) (LP) (LQ) (LR) (LS) (LT) (LU) (LV) (LW) (LX) (LY) (LZ) (MA) (MB) (MC) (MD) (ME) (MF) (MG) (MH) (MI) (MJ) (MK) (ML) (MN) (MO) (MP) (MQ) (MR) (MS) (MT) (MU) (MV) (MW) (MX) (MY) (MZ) (NA) (NB) (NC) (ND) (NE) (NF) (NG) (NH) (NI) (NJ) (NK) (NL) (NM) (NO) (NP) (NQ) (NR) (NS) (NT) (NU) (NV) (NW) (NX) (NY) (NZ) (OA) (OB) (OC) (OD) (OE) (OF) (OG) (OH) (OI) (OJ) (OK) (OL) (OM) (ON) (OO) (OP) (OQ) (OR) (OS) (OT) (OU) (OV) (OW) (OX) (OY) (OZ) (PA) (PB) (PC) (PD) (PE) (PF) (PG) (PH) (PI) (PJ) (PK) (PL) (PM) (PN) (PO) (PP) (PQ) (PR) (PS) (PT) (PU) (PV) (PW) (PX) (PY) (PZ) (QA) (QB) (QC) (QD) (QE) (QF) (QG) (QH) (QI) (QJ) (QK) (QL) (QM) (QN) (QO) (QP) (QQ) (QR) (QS) (QT) (QU) (QV) (QW) (QX) (QY) (QZ) (RA) (RB) (RC) (RD) (RE) (RF) (RG) (RH) (RI) (RJ) (RK) (RL) (RM) (RN) (RO) (RP) (RQ) (RR) (RS) (RT) (RU) (RV) (RW) (RX) (RY) (RZ) (SA) (SB) (SC) (SD) (SE) (SF) (SG) (SH) (SI) (SJ) (SK) (SL) (SM) (SN) (SO) (SP) (SQ) (SR) (SS) (ST) (SU) (SV) (SW) (SX) (SY) (SZ) (TA) (TB) (TC) (TD) (TE) (TF) (TG) (TH) (TI) (TJ) (TK) (TL) (TM) (TN) (TO) (TP) (TQ) (TR) (TS) (TT) (TU) (TV) (TW) (TX) (TY) (TZ) (UA) (UB) (UC) (UD) (UE) (UF) (UG) (UH) (UI) (UJ) (UK) (UL) (UM) (UN) (UO) (UP) (UQ) (UR) (US) (UT) (UU) (UV) (UW) (UX) (UY) (UZ) (VA) (VB) (VC) (VD) (VE) (VF) (VG) (VH) (VI) (VJ) (VK) (VL) (VM) (VN) (VO) (VP) (VQ) (VR) (VS) (VT) (VU) (VV) (VW) (VX) (VY) (VZ) (WA) (WB) (WC) (WD) (WE) (WF) (WG) (WH) (WI) (WJ) (WK) (WL) (WM) (WN) (WO) (WP) (WQ) (WR) (WS) (WT) (WU) (WV) (WW) (WX) (WY) (WZ) (XA) (XB) (XC) (XD) (XE) (XF) (XG) (XH) (XI) (XJ) (XK) (XL) (XM) (XN) (XO) (XP) (XQ) (XR) (XS) (XT) (XU) (XV) (XW) (XX) (XY) (XZ) (YA) (YB) (YC) (YD) (YE) (YF) (YG) (YH) (YI) (YJ) (YK) (YL) (YM) (YN) (YO) (YP) (YQ) (YR) (YS) (YT) (YU) (YV) (YW) (YX) (YZ) (ZA) (ZB) (ZC) (ZD) (ZE) (ZF) (ZG) (ZH) (ZI) (ZJ) (ZK) (ZL) (ZM) (ZN) (ZO) (ZP) (ZQ) (ZR) (ZS) (ZT) (ZU) (ZV) (ZW) (ZX) (ZY) (ZZ)

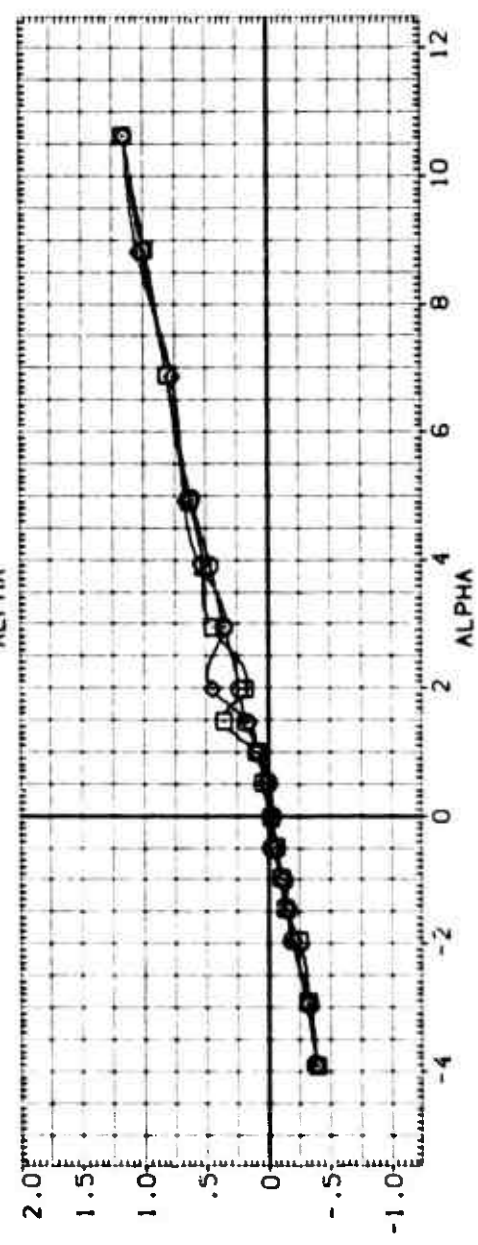
REFERENCE INFORMATION  
 SREF 19.6350 SQ. IN.  
 LREF 5.0000 IN.  
 BREF 5.0000 IN.  
 XREF 26.5000 IN.  
 YREF .0000 IN.  
 ZREF .0000 IN.  
 SCALE .0000

BETA PHI MAD  
 .000 .000 .200  
 .000 .000 .200  
 .000 .000 .200

CONFIGURATION DESCRIPTION  
 AEDC TF 360 BODY ALD-E-BI INCREASING ALPHA  
 AEDC TF 360 BODY ALD-E-BI DECREASING ALPHA  
 AEDC TF 360 BODY ALD-E-BI INCREASING ALPHA



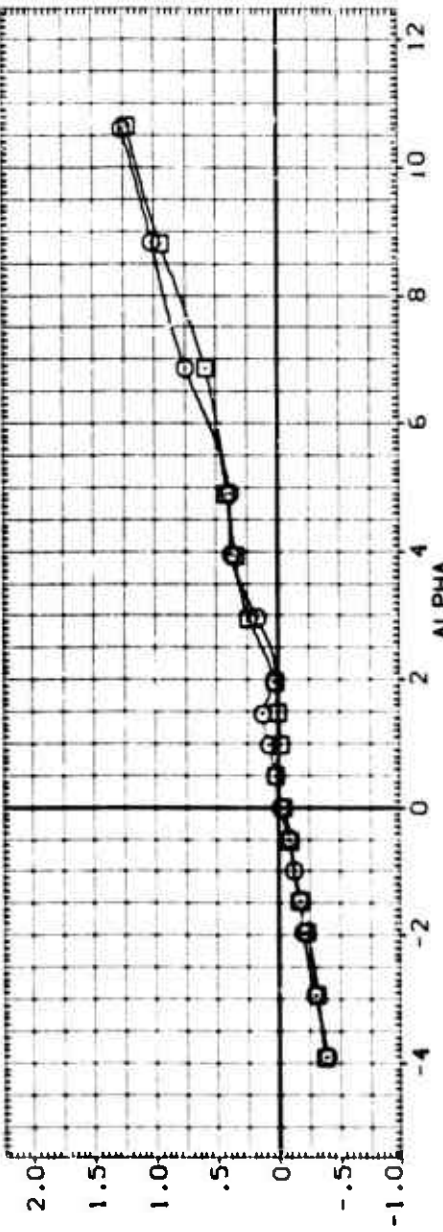
Z



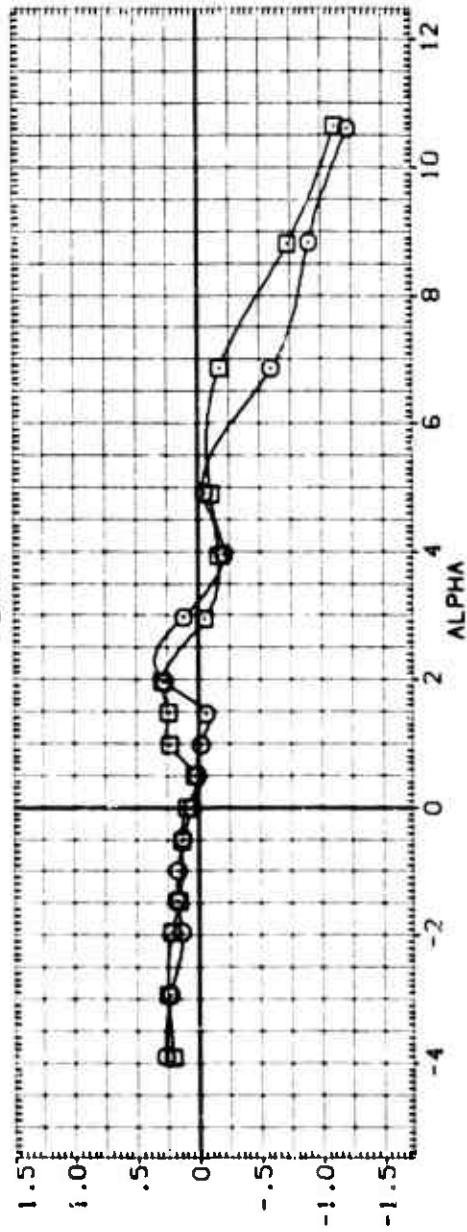
CLM

HYSTERESIS EFFECTS  
 (A) CRT = 50.61

DATA SET SYMBOL: (BME02) (BME02)  
 CONFIGURATION DESCRIPTION: AEDC 1F360 BODY F IN, BF (INCREASING ALPHA) AEDC 1F360 BODY F IN, BF (DECREASING ALPHA)  
 BETA: .000 .000  
 PHI: .000 .000  
 FINOS: 3.000 3.000  
 MACH: .200 .200  
 REFERENCE INFORMATION:  
 SREF: 19.6750 SG. IN.  
 LREF: 5.0000 IN.  
 BREF: 5.0000 IN.  
 XREF: 26.5000 IN.  
 YREF: .0000 IN.  
 ZREF: .0000 IN.  
 SCALE: .0000



Z



Z

HYSTERESIS EFFECTS  
 (A)CRT = 50.14

DATA SET SYMBOL: (B)(E009) (B)(E005)

CONFIGURATION DESCRIPTION: AEDE IF 360 BODY FIN, BF (INCREASING ALPHA) / AEDE IF 360 BODY FIN, BF (DECREASING ALPHA)

BETA: .000 .000

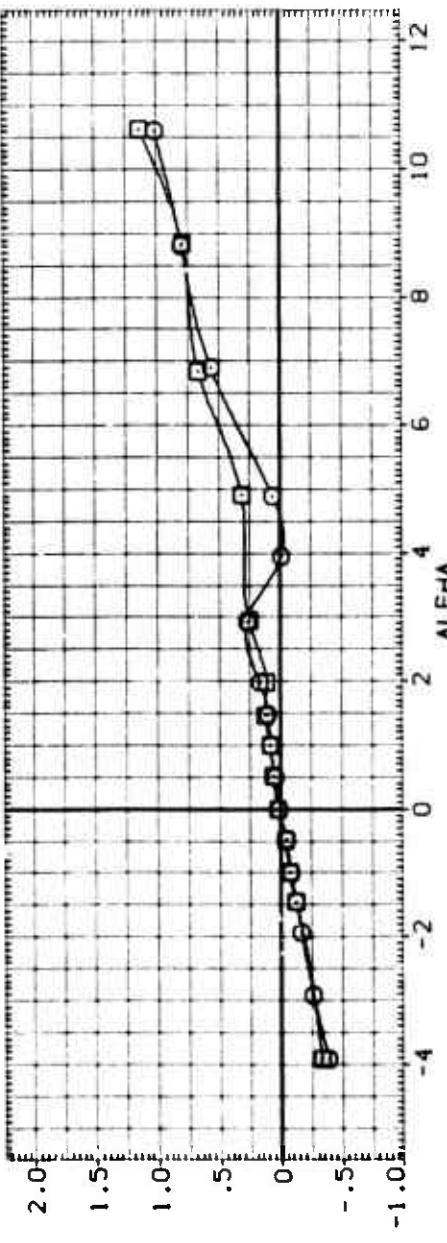
PHI: .000 .000

FINPOS: 3.000 3.000

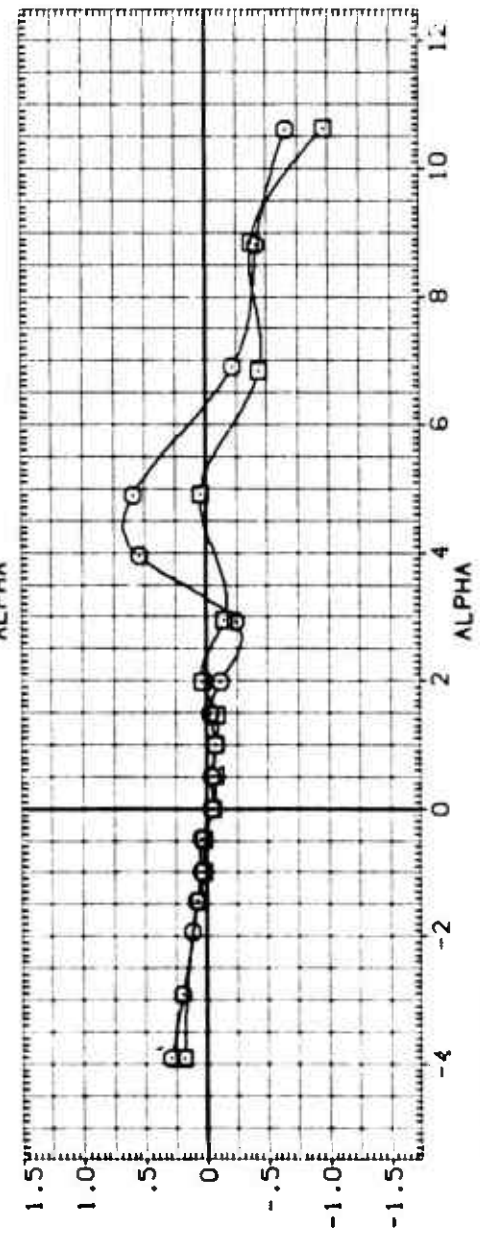
MACH: .200 .200

REFERENCE INFORMATION:

SREF	19.6250	50. IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XTRP	26.5000	IN.
YTRP	.0000	IN.
ZTRP	.0000	IN.
SCALE	.0000	



3



4

HYSTERESIS EFFECTS  
(B)CRT = 100.92

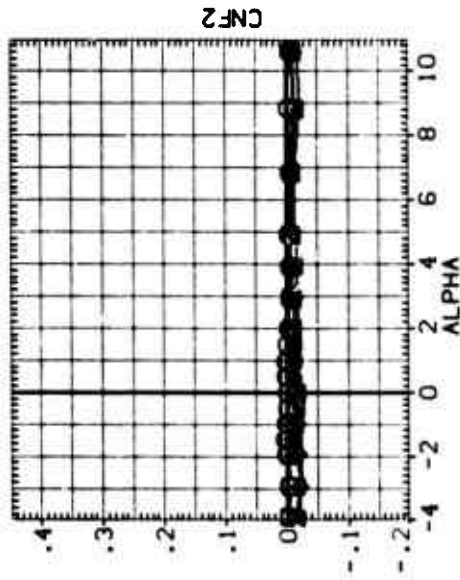
AEDC TF360 BODY FIN, BF1

(RXE109)

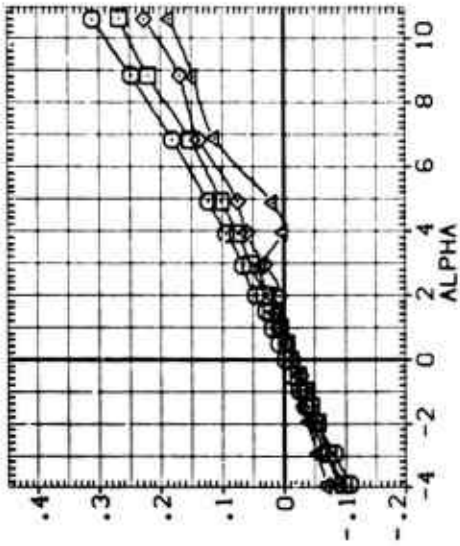
SYMBOL  
 ○  
 □  
 △

CRT      BETA      FIMP35      PH1      MACH      .000      .200  
 26.074      50.136      100.918

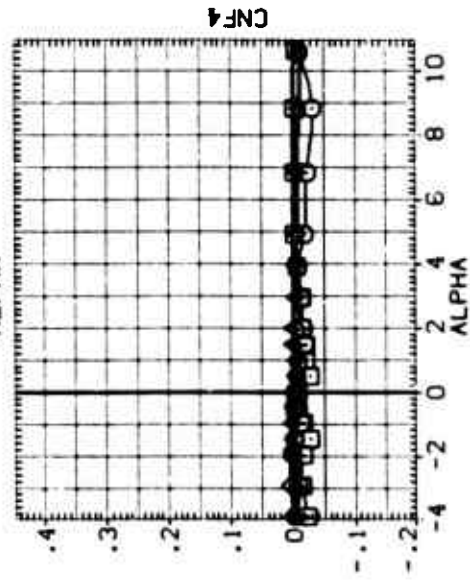
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 BREF      5.0000      IN.  
 YMRP      26.5000      IN.  
 ZMRP      .0000      IN.  
 SCALE      .0000



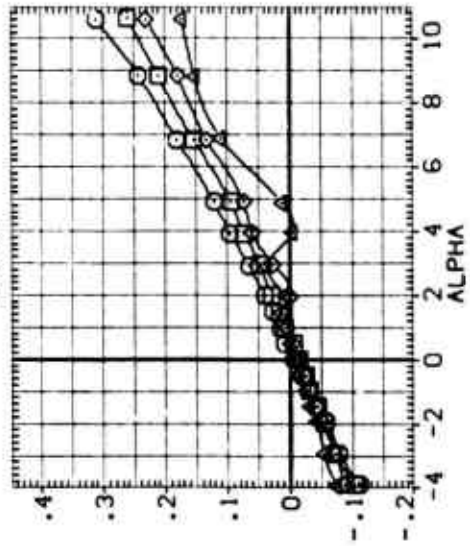
CNF1



CNF2



CNF3



CNF4

THRUST EFFECTS ON FIN NORMAL FORCE



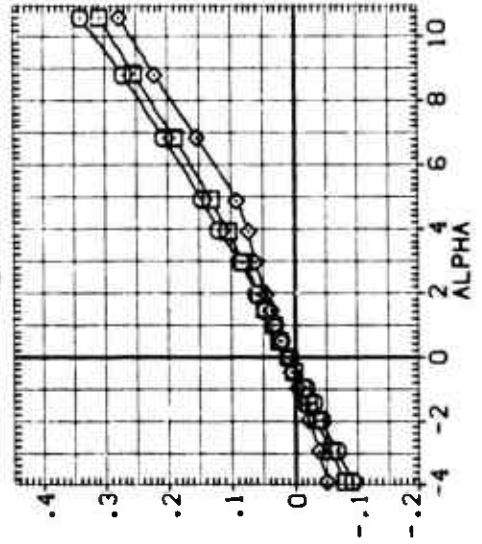
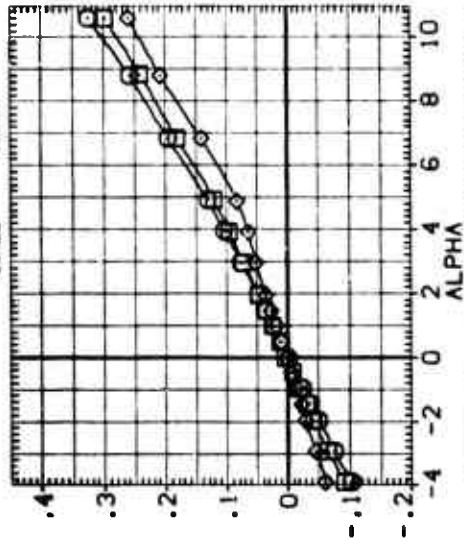
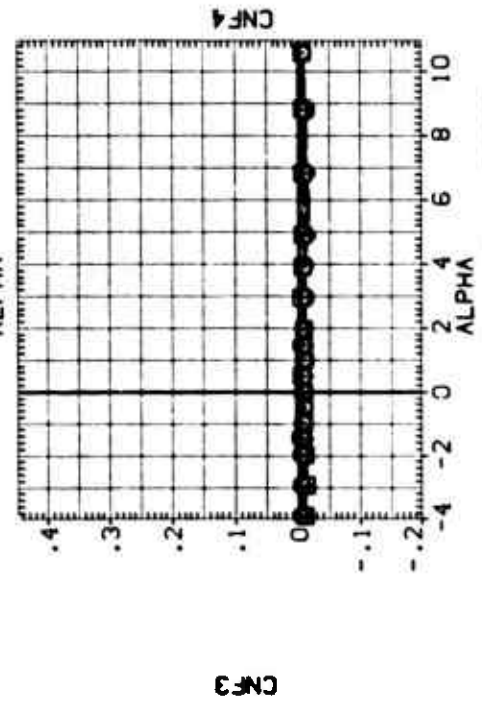
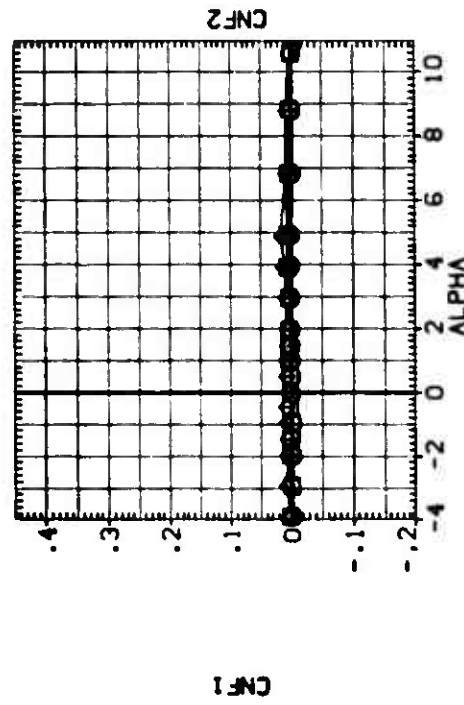
AEDC TF360 BODY FIN, BF1

(RXE111)

SYMBOL  
 ○  
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 ◇

ORT     .132     BETA     .000     PHI     .000  
 11.877     FINPOS     3.000     MACH     .400  
 37.830

REFERENCE INFORMATION  
 SREF     19.6350     SQ. IN.  
 LREF     5.0000     IN.  
 XREF     5.0000     IN.  
 YREF     28.5000     IN.  
 ZREF     .0000     IN.  
 SCALE     .0000



THRUST EFFECTS ON FIN NORMAL FORCE

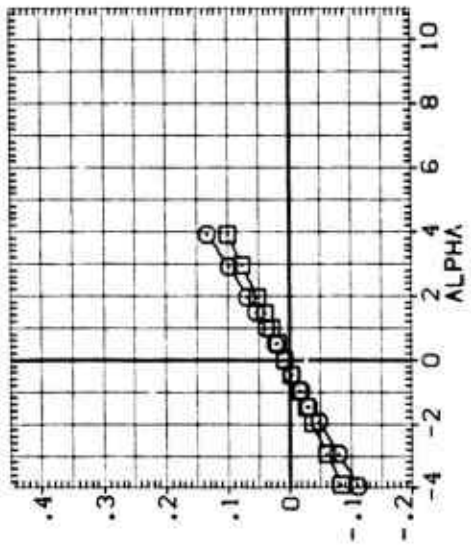
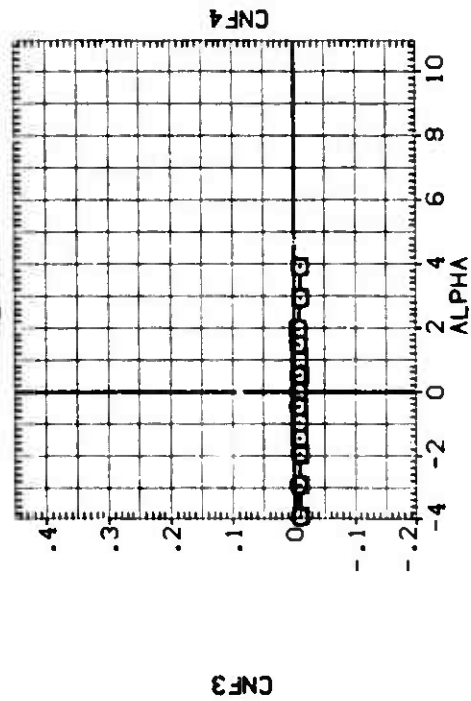
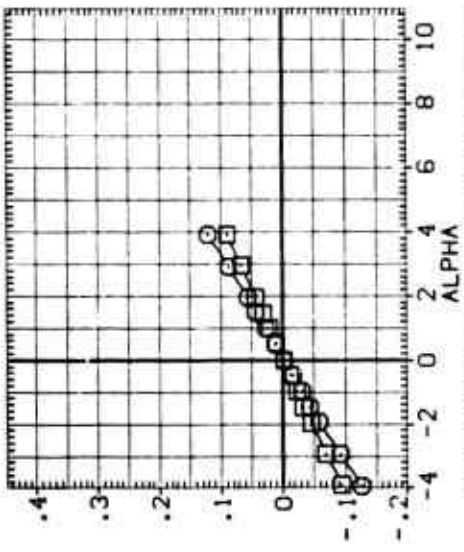
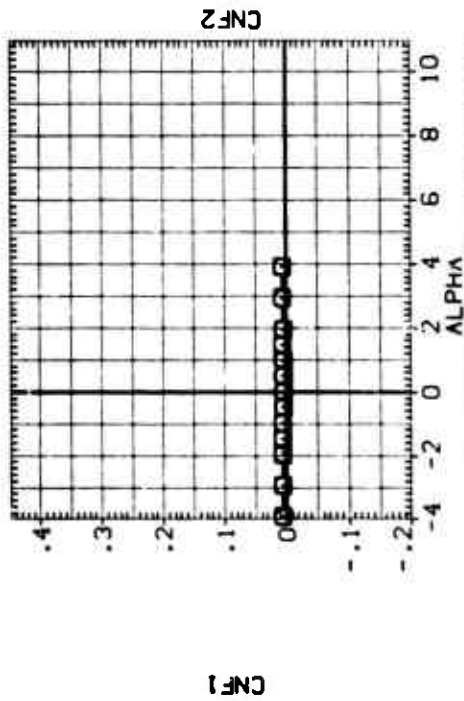
AEDC TF360 BODY FIN, BF1

(RXE112)

SYMBOL	CRT	BETA	FINPOS	PARAMETRIC VALUES	PHI	MACH	SCALE
□	.012	.000	.000	.000	.000	1.000	.000
□	5.885	3.000	3.000	3.000	1.000	1.000	.000

REFERENCE INFORMATION

SYMBOL	UNIT	VALUE
SREF	SQ. IN.	19.6750
LREF	IN.	5.0000
BREF	IN.	5.0000
XPRP	IN.	26.5000
YPRP	IN.	.0000
ZPRP	IN.	.0000
SCALE	IN.	.0000



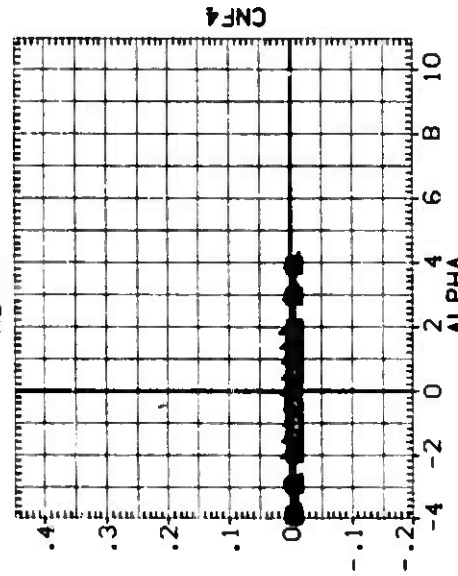
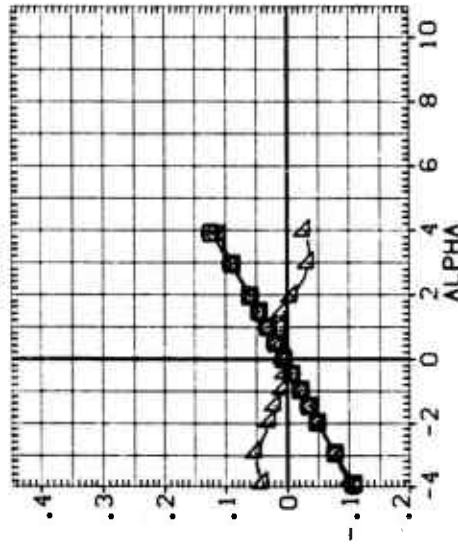
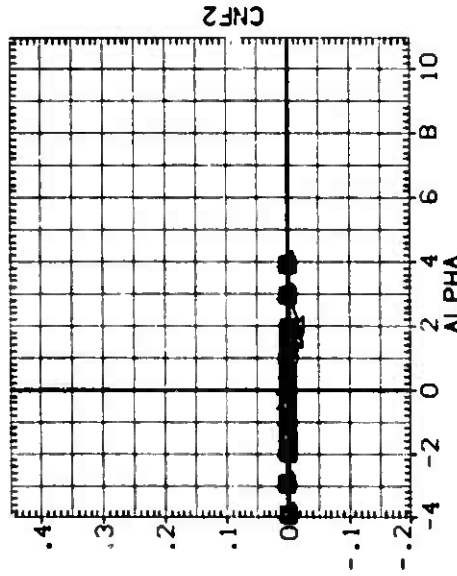
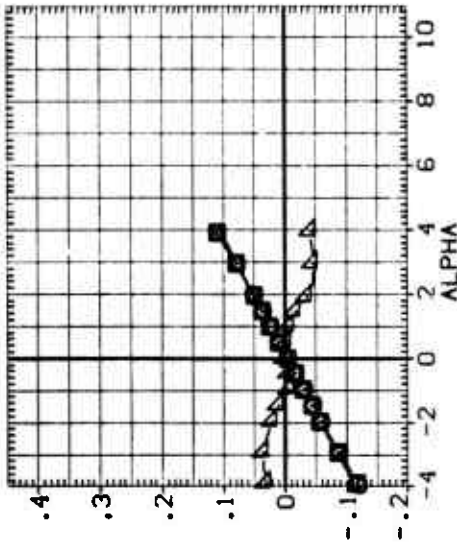
THRUST EFFECTS ON FIN NORMAL FORCE

(RXE113)

AEOC TF360 BODY FIN. BF1

SYMBOL	CRT	BETA	PHI	MACH	PARAMETRIC VALUES
□	.010	.000	.000	.000	
◇	3.042	3.000	3.000	1.250	
△	4.014				
▽	5.006				
▽	11.926				

SYMBOL	REFERENCE INFORMATION	50. IN.
□	SREF	19.6350
◇	LREF	5.0000
△	BREF	5.0000
▽	XTRP	26.5000
▽	YTRP	.0000
▽	ZTRP	.0000
▽	SCALE	.0000



THRUST EFFECTS ON FIN NORMAL FORCE

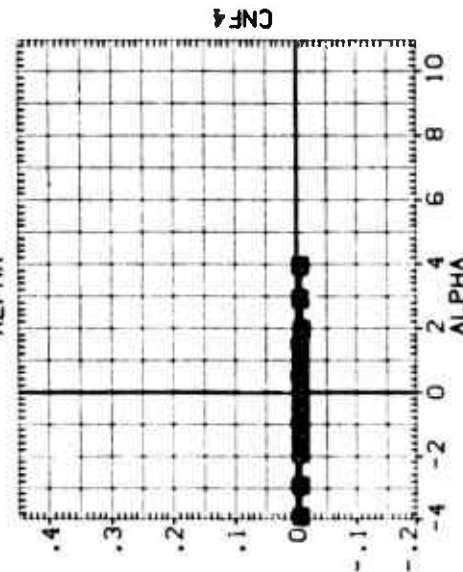
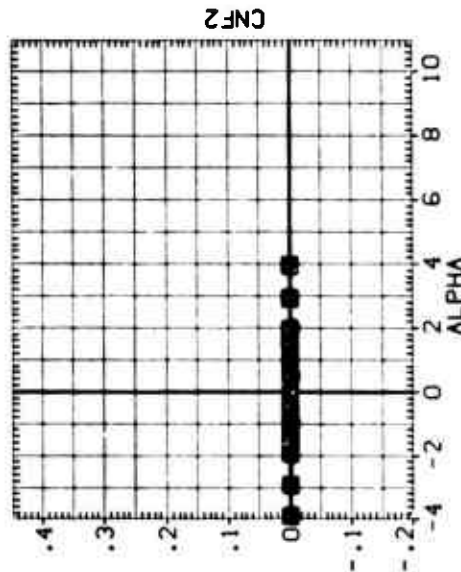
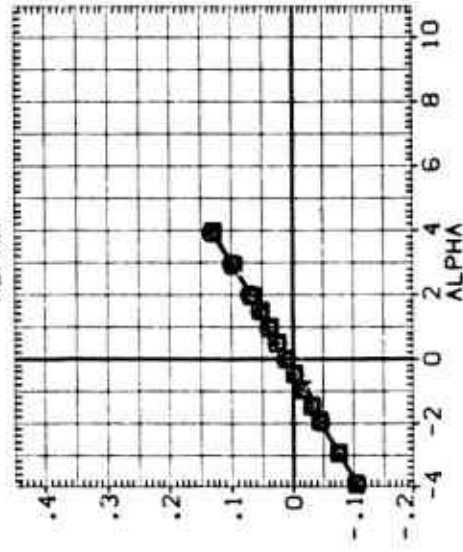
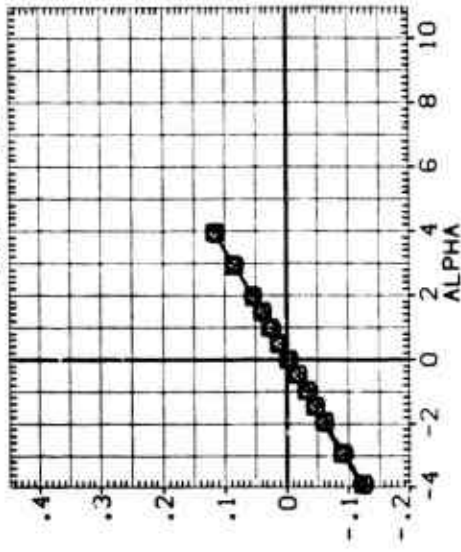
(RXE114)

AEDC TF360 BODY FIN. BF1

SYMBOL	CRT	BETA	PARAMETRIC VALUES
◇	.010	.000	PHI .000
□	2.011	3.000	MACH 1.500
△	3.012		
	4.017		

REFERENCE INFORMATION

SREF	19.6750	50. IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XPRP	26.5000	IN.
YPRP	.0000	IN.
ZPRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON FIN NORMAL FORCE

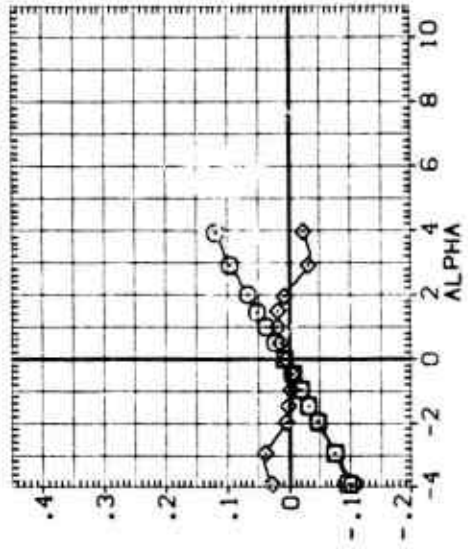
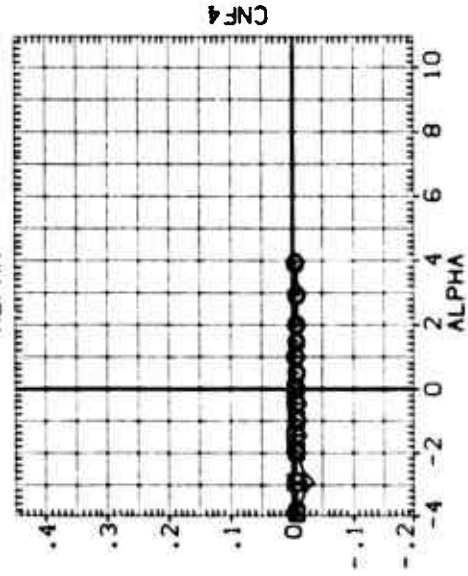
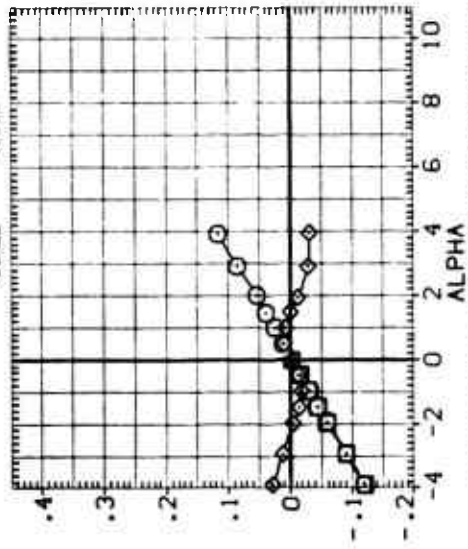
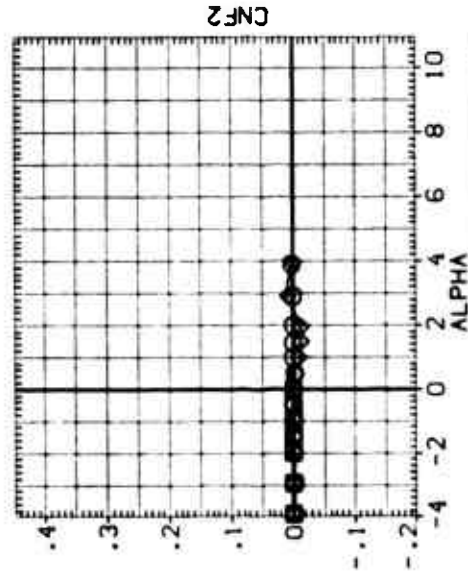
AEDC TF360 BODY FIN, BF1

(RXE114)

SYMBOL  
 □  
 ◇

CRT  
 5.999 BETA .000 PHI .000  
 6.547 FINPOS 3.000 MACH 1.500  
 11.962

REFERENCE INFORMATION  
 SREF 19.6750 SQ. IN.  
 LREF 5.0000 IN.  
 BREF 5.0000 IN.  
 XMRP 26.5000 IN.  
 YMRP .0000 IN.  
 ZMRP .0000 IN.  
 SCALE .0000



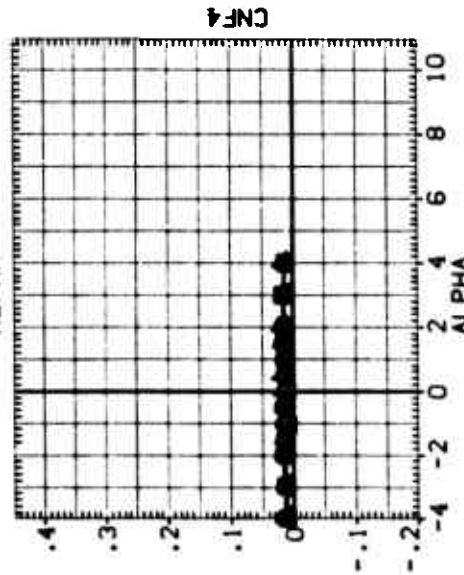
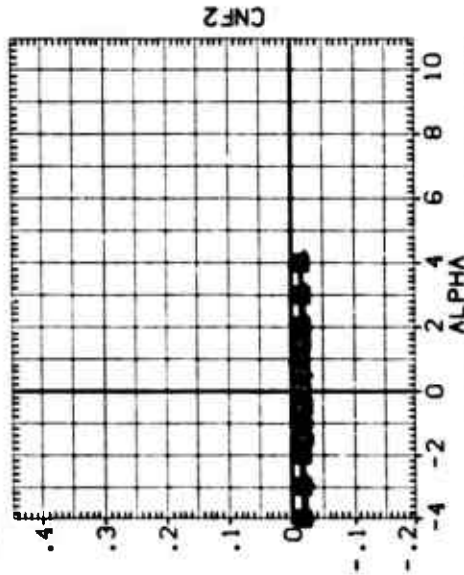
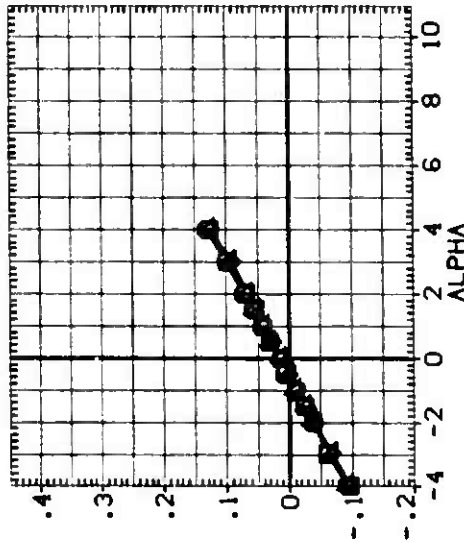
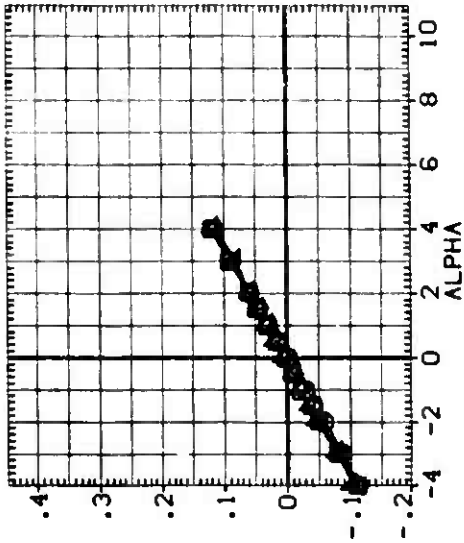
THRUST EFFECTS ON FIN NORMAL FORCE

AEDC SF172 BODY FIN, BF1

SYMBOL	CRT	BETA	PARAMETRIC VALUES	PHI	MACH	SCALE
◇	.021	.000	.000	.000	1.700	.000
◇	1.954	3.000	3.000	1.700		
◇	3.018					
◇	4.018					
◇	5.959					

(RXE115)

REFERENCE INFORMATION	
SREF	19.6350
LREF	5.0000
BREF	5.0000
XPRP	26.5000
YPRP	.0000
ZPRP	.0000
SCALE	.0000



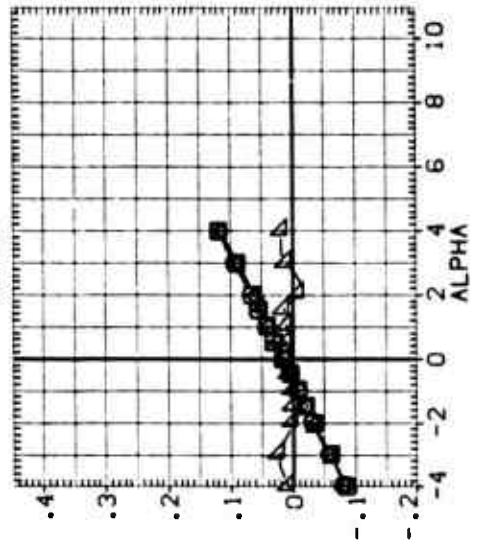
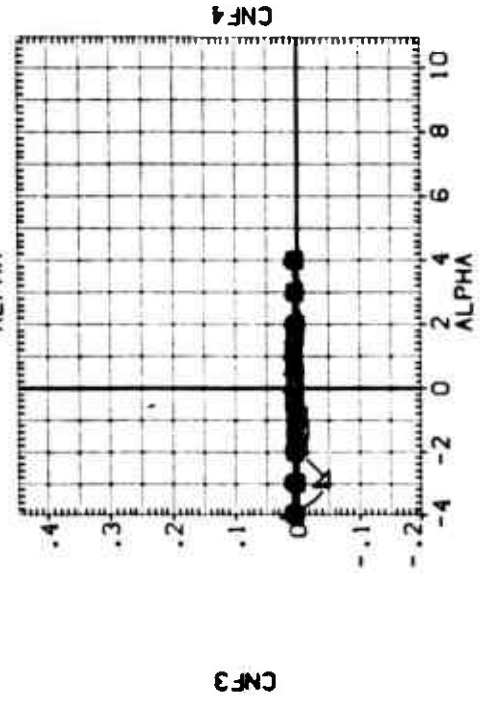
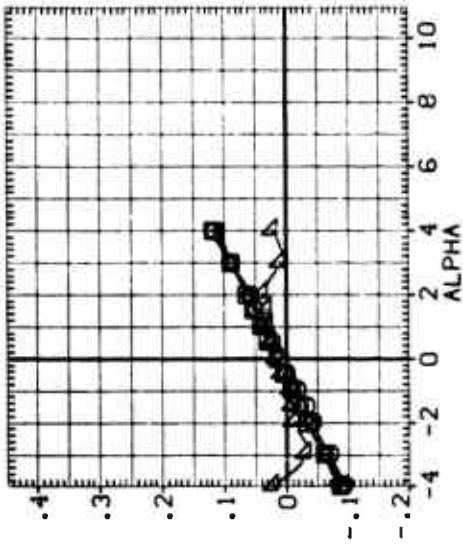
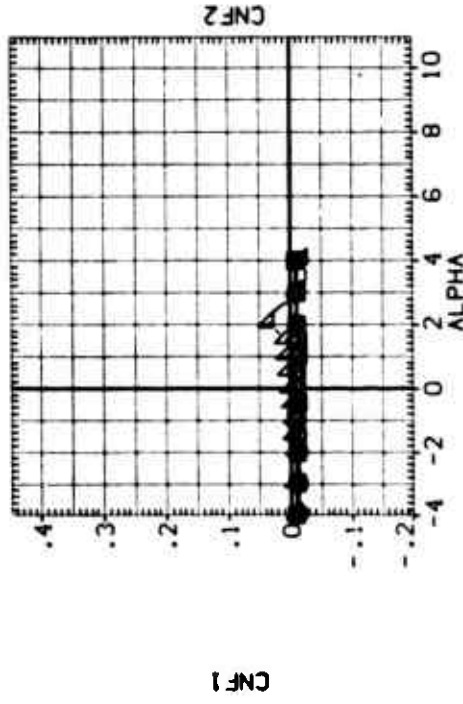
THRUST EFFECTS ON FIN NORMAL FORCE

AEDC SF172 BODY FIN, BF1

(RXE116)

SYMBOL		PARAMETRIC VALUES	
◇	CRT	BETA	PHI
◇		3.000	3.000
◇		FINPOS	MACH
◇		2.011	2.000
◇		3.989	
◇		6.009	
◇		11.932	

REFERENCE INFORMATION	
SREF	19.6750
LRREF	5.0000
BRREF	5.0000
YRREF	26.5000
ZRREF	0.0000
SCALE	0.0000



THRUST EFFECTS ON FIN NORMAL FORCE

AEDC SF172 BODY FIN, BF1

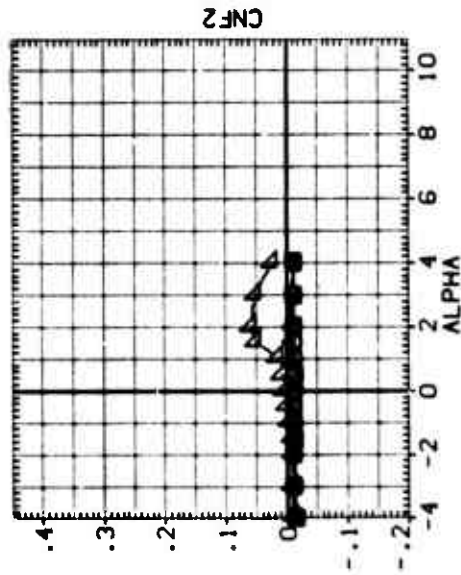
(RXE117)

SYMBOL  
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 ○  
 △  
 ◇

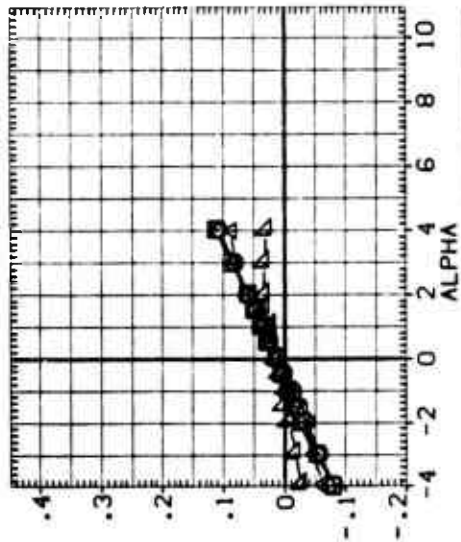
CRT  
 .021  
 2.024  
 4.021  
 6.052  
 12.011

PARAMETRIC VALUES  
 BETA .000 PHI .000  
 F/MPOS 3.000 MACH 2.300

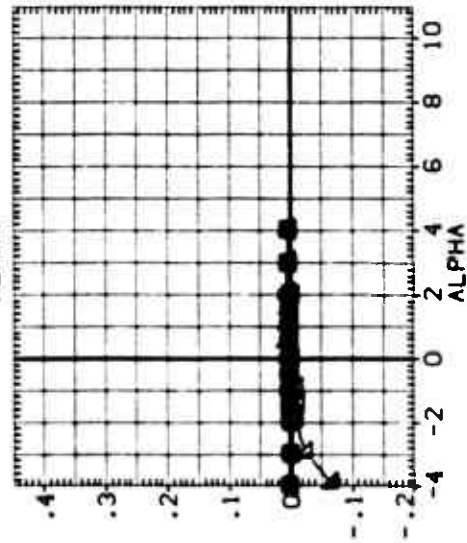
REFERENCE INFORMATION  
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 LREF 5.0000 IN.  
 BREF 5.0000 IN.  
 XREF 26.5000 IN.  
 YREF .0000 IN.  
 ZREF .0000 IN.  
 SCALE .0000



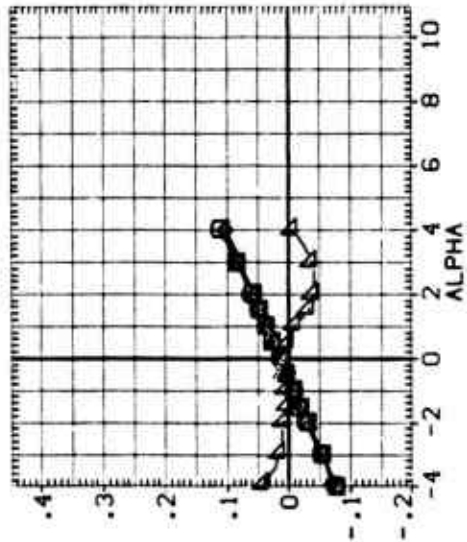
CNF1



CNF2



CNF3



CNF4

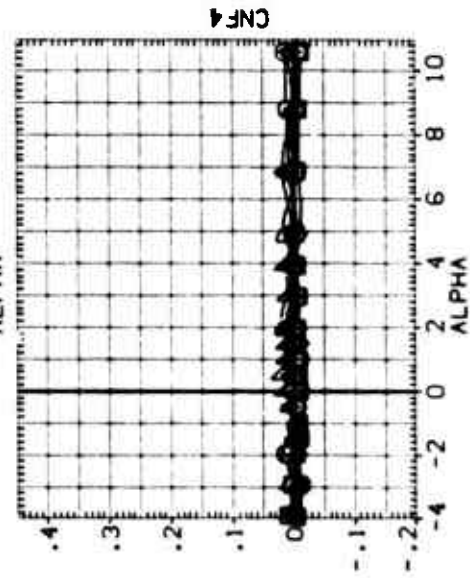
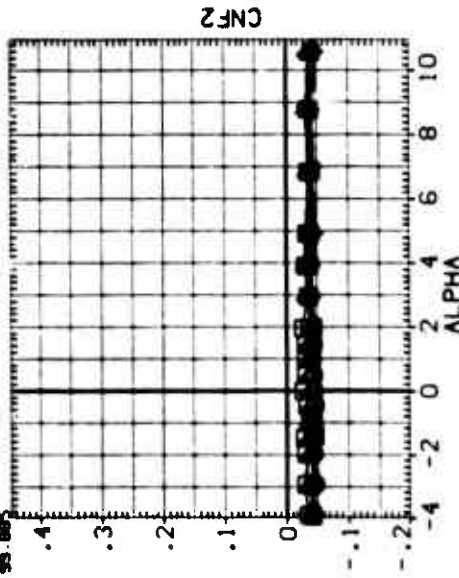
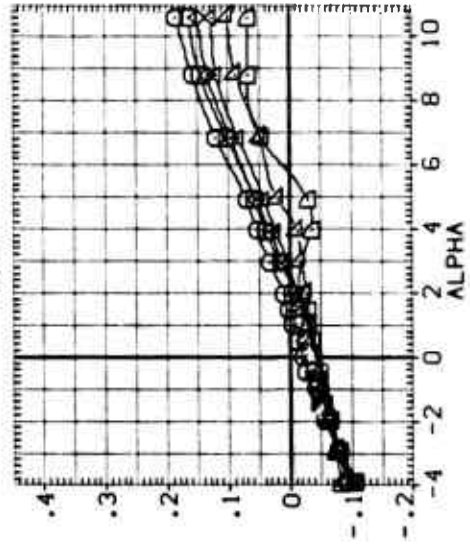
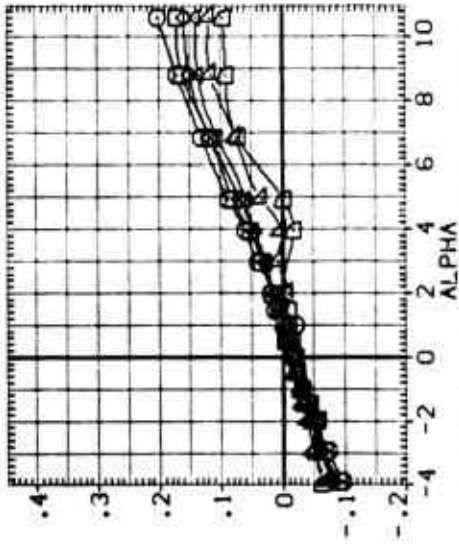
THRUST EFFECTS ON FIN NORMAL FORCE



(RXE11B)  
AEDC TF360 BODY FIN. BF2

SYMOL	CRT	PARAMETRIC VALUES			
		BETA	.000	PHI	.000
□	5.542	3.000	3.000	MACH	.200
◇	5.253				
△	12.314				
▽	25.314				
○	48.332				
◇	95.882				

REFERENCE INFORMATION	
SREF	19.6750
LREF	5.0000
BREF	5.0000
XREF	26.5000
YREF	.0000
ZREF	.0000
SCALE	.0000



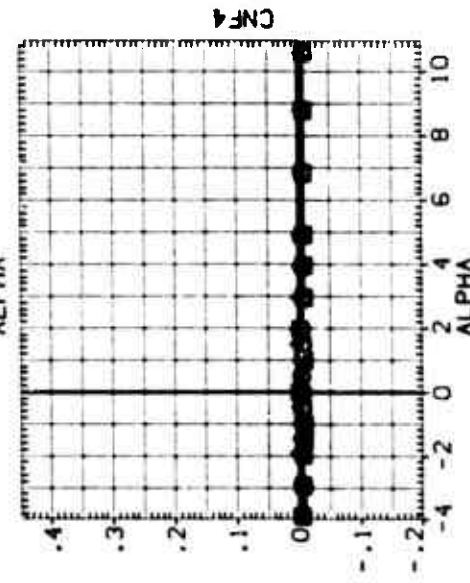
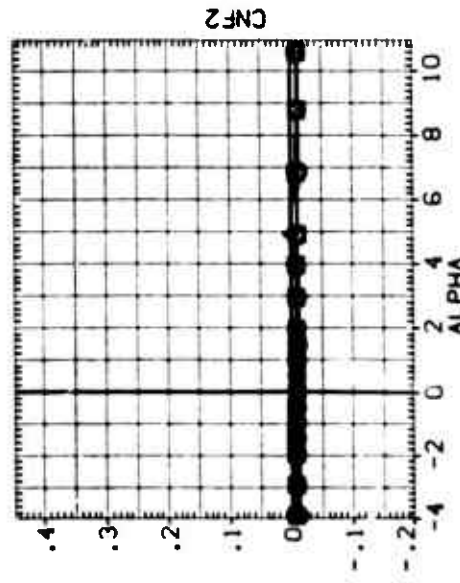
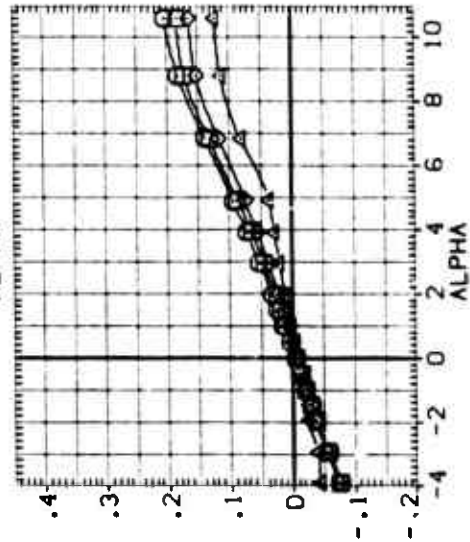
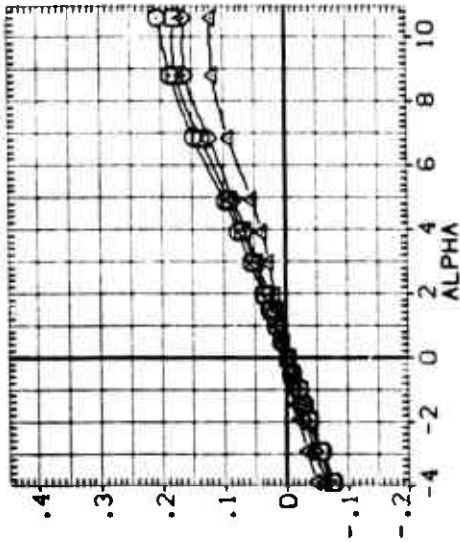
THRUST EFFECTS ON FIN NORMAL FORCE

(CXE119)

AEDC TF360 BODY FIN, BF2

SYMBOL	CRT	BETA	F INPOS	PARAMETRIC VALUES	PHI	MACH	SCALE
○	.120	.000	3.000				.000
□	5.713	.000	3.000				.400
△	12.126	.000	3.000				.400
	37.274	.000	3.000				.400

REFERENCE INFORMATION	
SREF	19.6250
LREF	5.0000
BREF	5.0000
XPRP	26.5000
YPRP	.0000
ZPRP	.0000
SCALE	.0000



THRUST EFFECTS ON FIN NORMAL FORCE

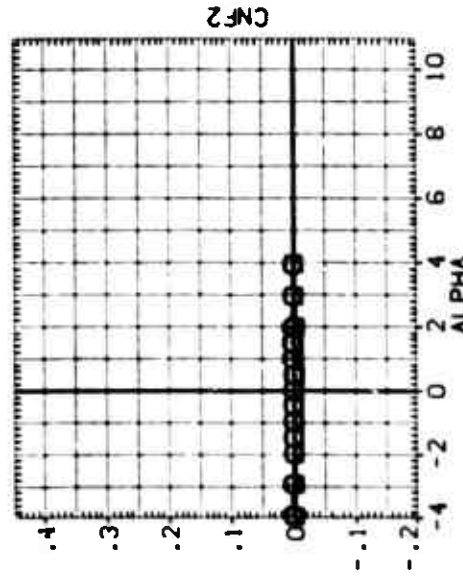
AEDC TF360 BODY FIN. BF2

SYMBOL	CRT	BETA	PARAMETRIC VALUES
○	.010	.000	PHI .000
□	5.980	3.000	MACH 1.000

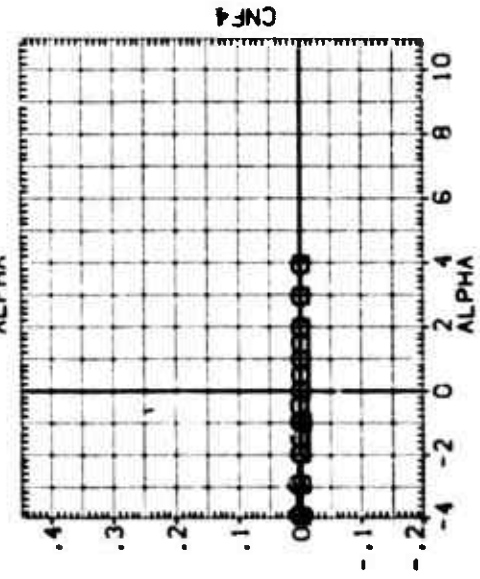
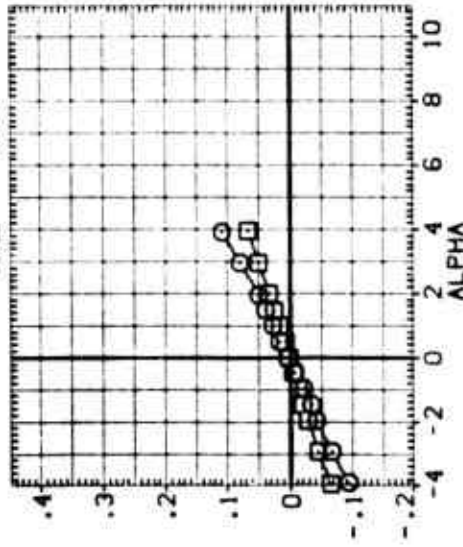
(RXE120)

REFERENCE INFORMATION

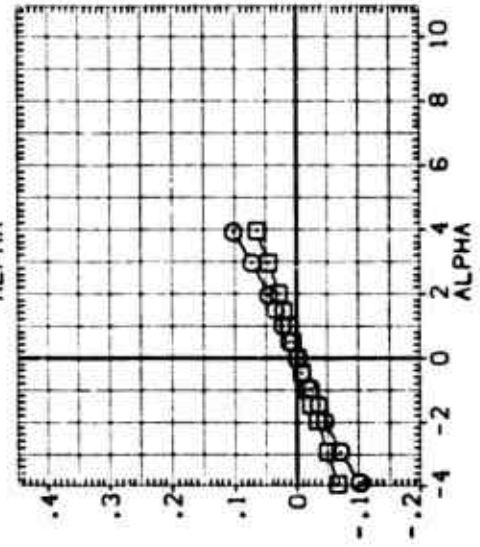
SREF	19.6350	50. IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XREF	26.5000	IN.
YREF	.0000	IN.
ZREF	.0000	IN.
SCALE	.0000	



CNF1



CNF3



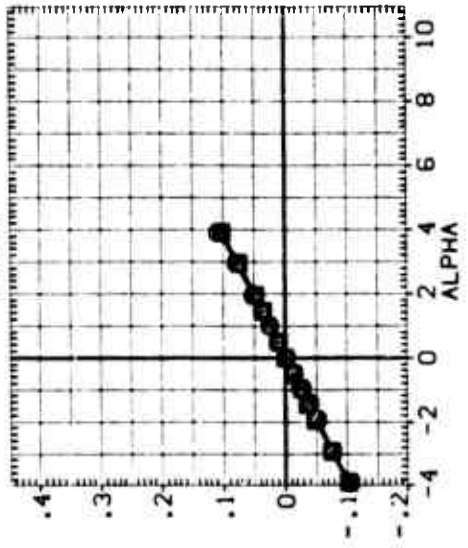
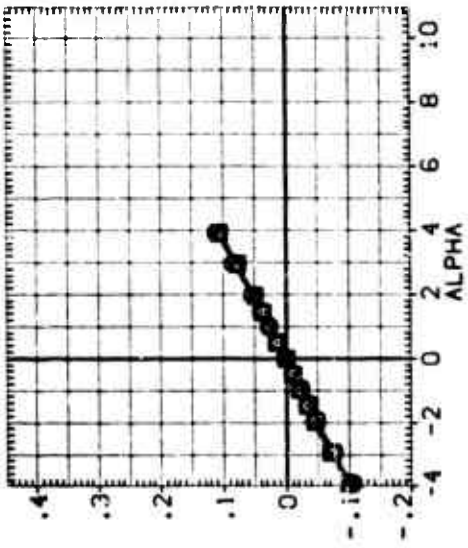
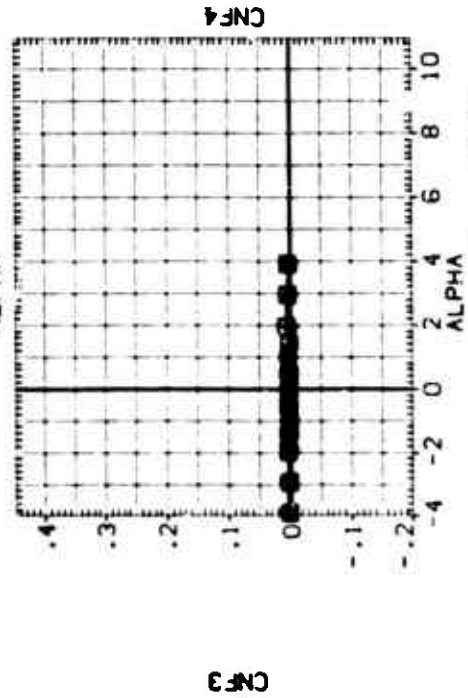
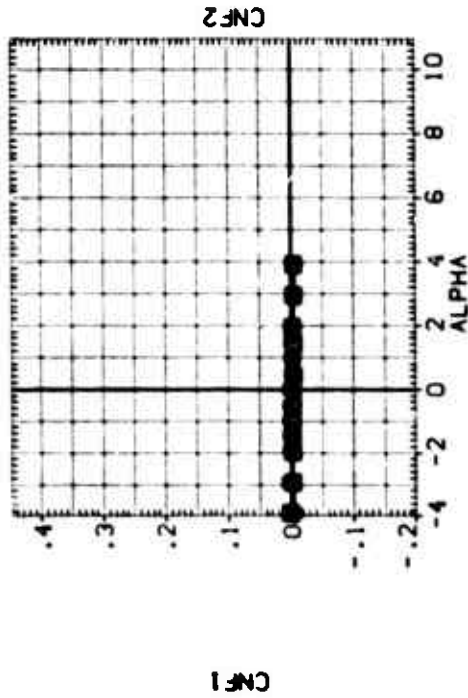
THRUST EFFECTS ON FIN NORMAL FORCE

(CXE121)

AEDC TF360 BODY FIN, BF2

SYMBOL		PARAMETRIC VALUES	
CRT	.010	BETA	.000
	.894	PHI	.000
	2.016	MACH	1.250
	3.015		

REFERENCE INFORMATION	
SREF	19.6350
LRIF	5.0000
BRIF	5.0000
XREF	26.5000
YREF	.0000
ZREF	.0000
SCALE	.0000



THRUST EFFECTS ON FIN NORMAL FORCE

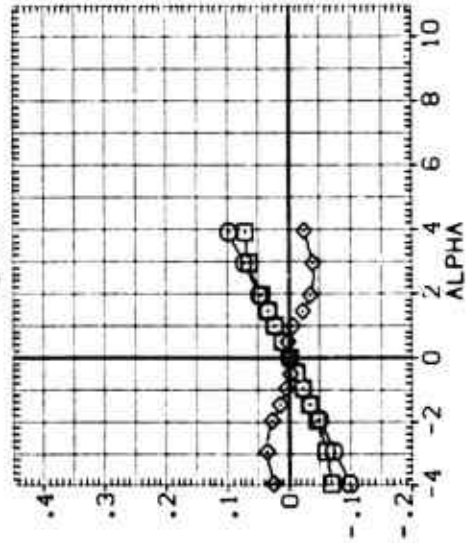
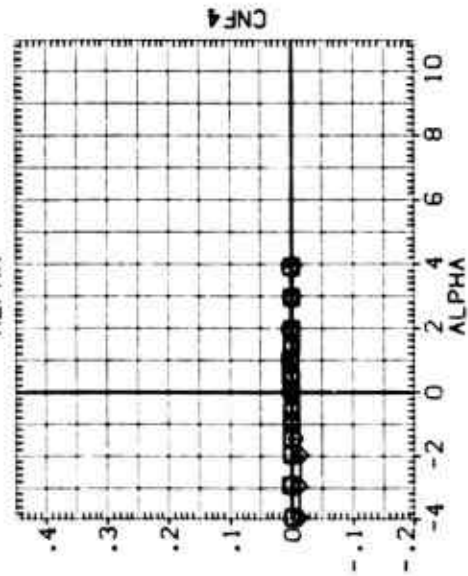
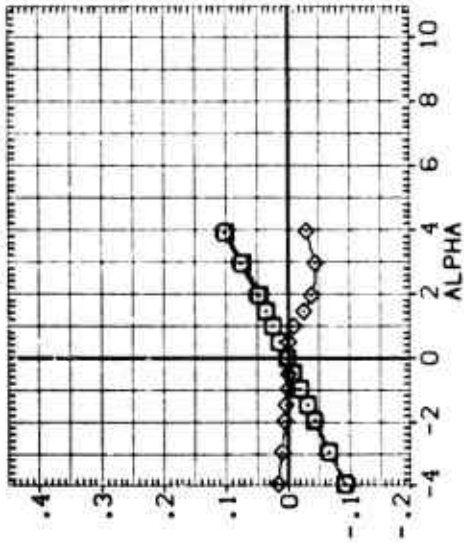
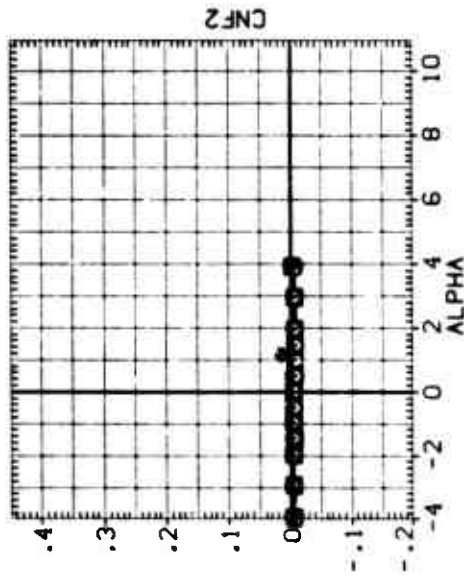
(CXE121)

AEDC TF360 BODY FIN. BF2

SYMBOL  
○ □ ◇

CR1 4.006 BETA .000 PHI .000  
6.010 FINPOS 3.000 MACH 1.250  
11.905

REFERENCE INFORMATION  
SREF 19.6750 SQ. IN.  
URF 5.0000 IN.  
BRF 5.0000 IN.  
VREF 26.5000 IN.  
YREF .0000 IN.  
ZREF .0000 IN.  
SCALE .0000



THRUST EFFECTS ON FIN NORMAL FORCE

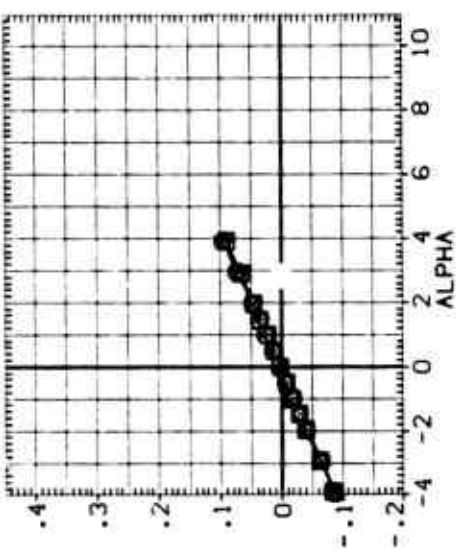
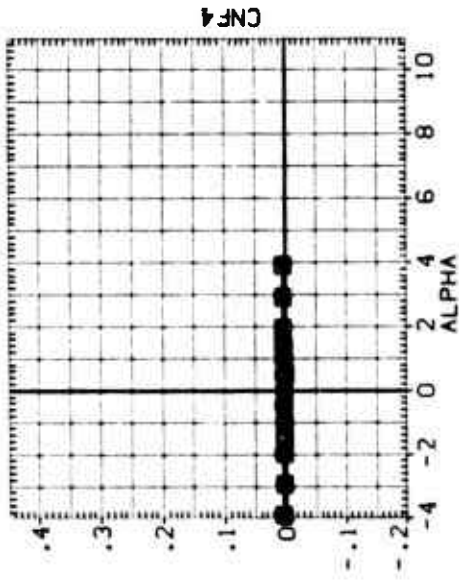
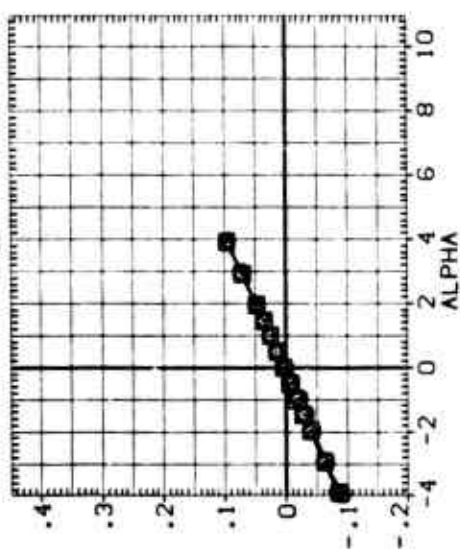
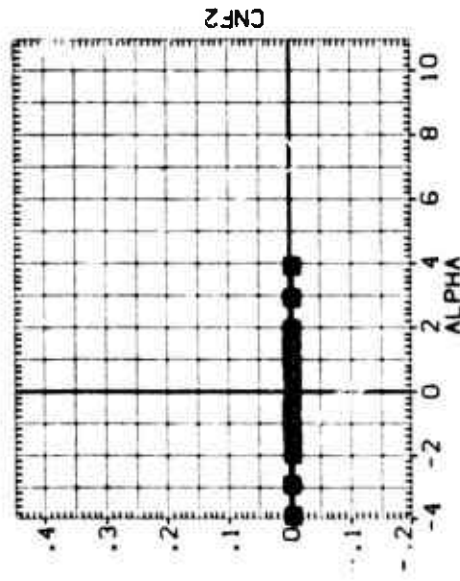
AEDC TF360 BODY FIN, BF2

(RXE122)

SYMBOL  
 ○ □ △

CRT  
 .010 BETA .000 PHI .000  
 .989 F INPOS 3.000 MACH 1.500  
 2.008  
 3.060

REFERENCE INFORMATION  
 SREF 19.6350 SQ. IN.  
 LREF 5.0000 IN.  
 BRREF 5.0000 IN.  
 XHRP 26.5000 IN.  
 YHRP .0000 IN.  
 ZHRP .0000 IN.  
 SCALE .0000



THRUST EFFECTS ON FIN NORMAL FORCE

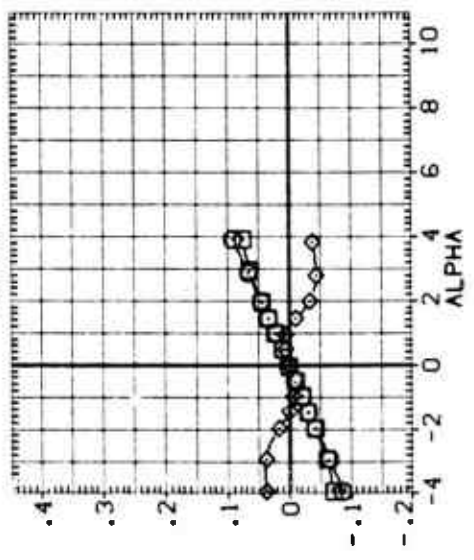
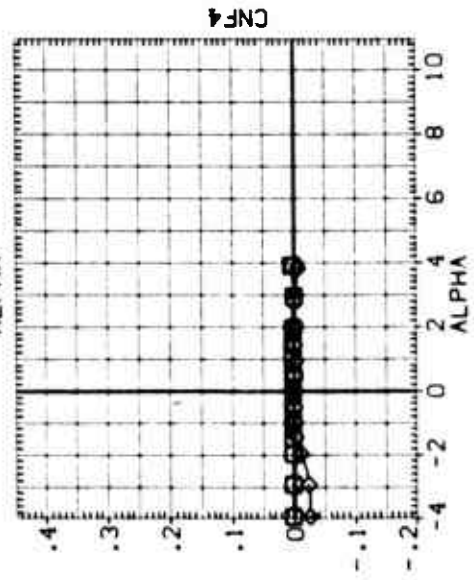
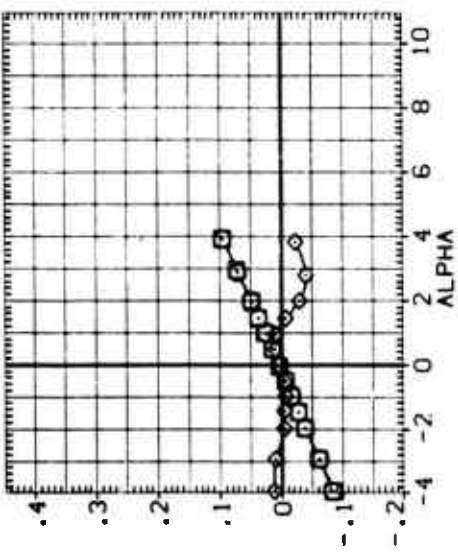
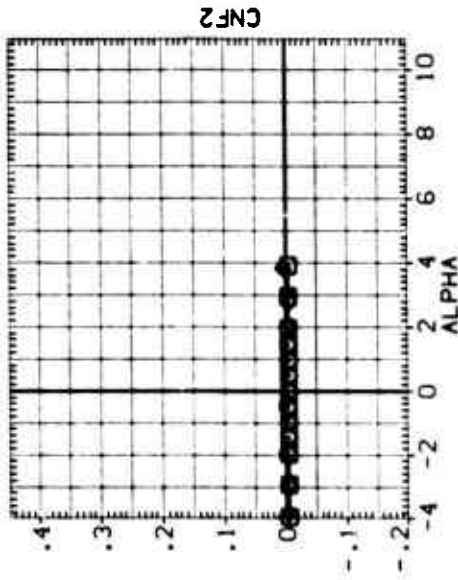
AE0C TF360 BODY FIN, BF2

(RXE122)

SYMBOL	CRT	BETA	FINPOS	PHI	MACH	SCALE
□	4.008	.000	3.000	.000	1.500	.000
◇	5.988	.000	3.000	.000	1.500	.000
◇	11.951	.000	3.000	.000	1.500	.000

REFERENCE INFORMATION

SREF	19.6750	50. IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XRHP	26.5000	IN.
YRHP	.0000	IN.
ZRHP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON FIN NORMAL FORCE

(RXE2D9)

AEDC TF360 BODY FIN, BF1

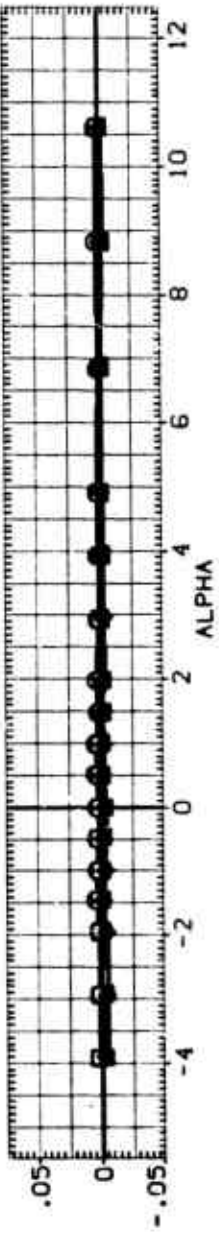
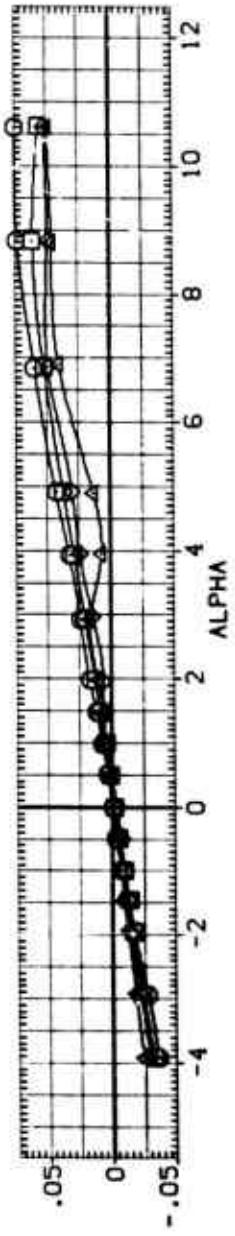
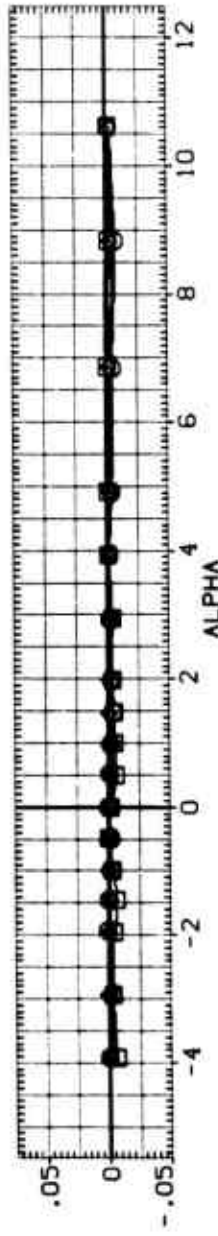
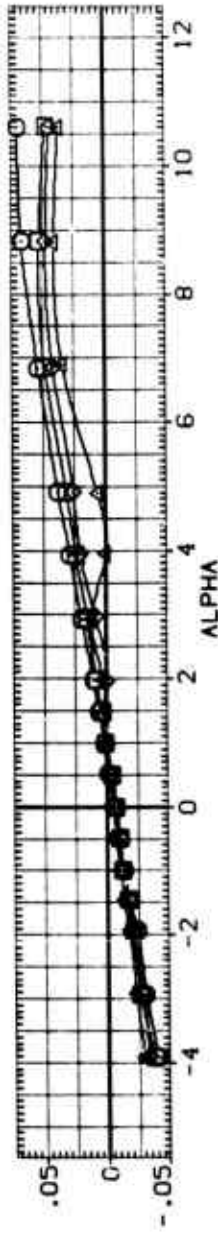
SYMBOL  
◇  
□  
△

CRT .575  
26.074  
50.139  
100.919

BETA .000  
F/MPOS 3.000  
MACH .200

PARAMETRIC VALUES  
.000 PHI  
.200

REFERENCE INFORMATION  
SREF 19.6350  
LREF 5.0000  
BREF 5.0000  
XREF 26.5000  
YREF .0000  
ZREF .0000  
SCALE .0000



TYPICAL THRUST EFFECT ON F/N HINGE MOMENT



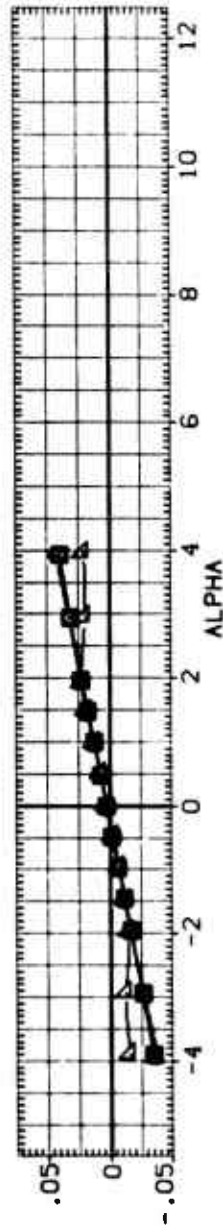
(RXE213)

AEDC TF360 BODY FIN. BF1

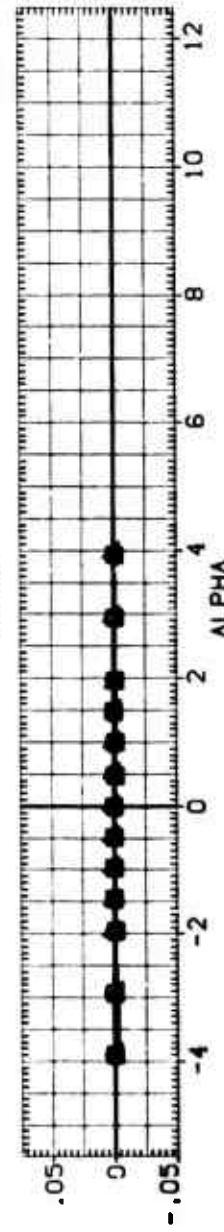
PARAMETRIC VALUES  
 BETA .000 PHI .000  
 F1NPOS 3.000 MACH 1.250

REF. INFORMATION  
 SREF 19.5350 50 IN.  
 LREF 5.0000 IN.  
 BREF 5.0000 IN.  
 XMAP 26 5000 IN.  
 YMAP .0000 IN.  
 ZMAP .0000 IN.  
 SCALE .0000

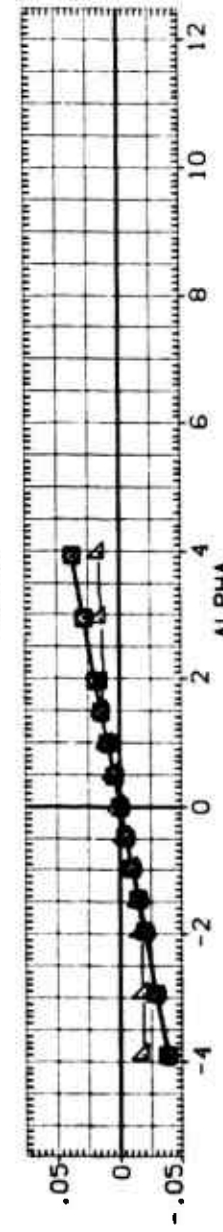
CRT  
 .010  
 3.042  
 4.014  
 6.006  
 11.926



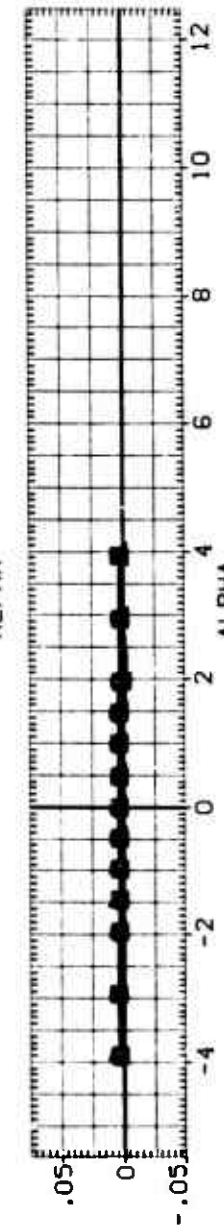
CLM4



CLM3



CLM2



CLM1

TYPICAL THRUST EFFECT ON FIN HINGE MOMENT

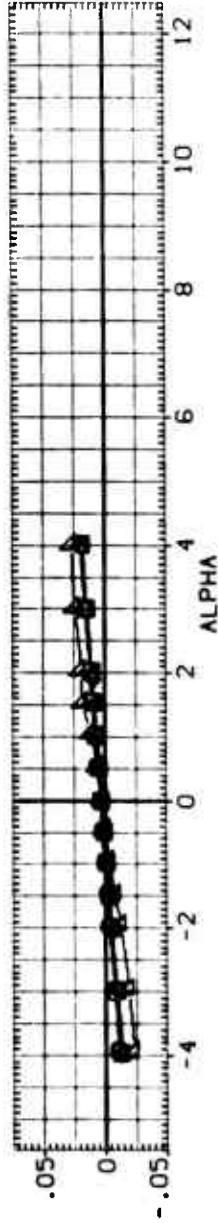
AEDC SF172 BODY FIN. BF1

(RXE216)

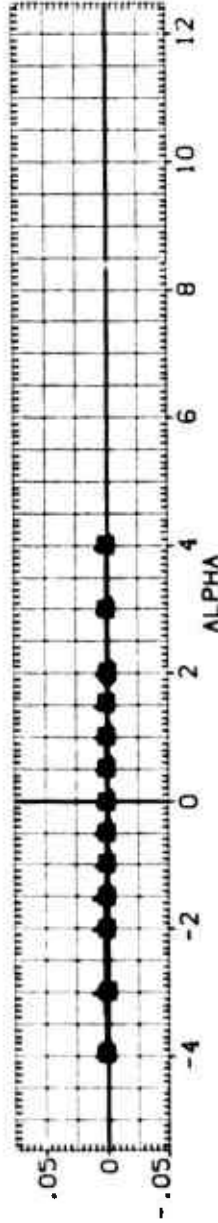
SYMBOL  
 □  
 ○  
 △  
 ▽

CR1 BETA .000 PHI .000  
 2.011 FINPOS 3.000 MACH 2.000  
 3.989  
 6.009  
 11.932

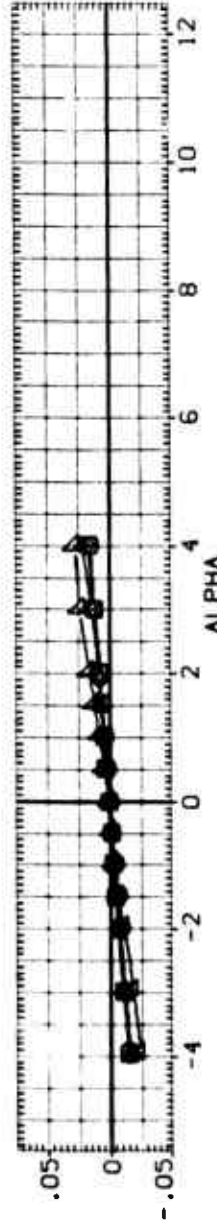
REFERENCE INFORMATION  
 SREF 19.6350 SQ. IN.  
 LREF 5.0000 IN.  
 BREF 5.0000 IN.  
 XPRP 26.5000 IN.  
 YPRP .0000 IN.  
 ZPRP .0000 IN.  
 SCALE .0000



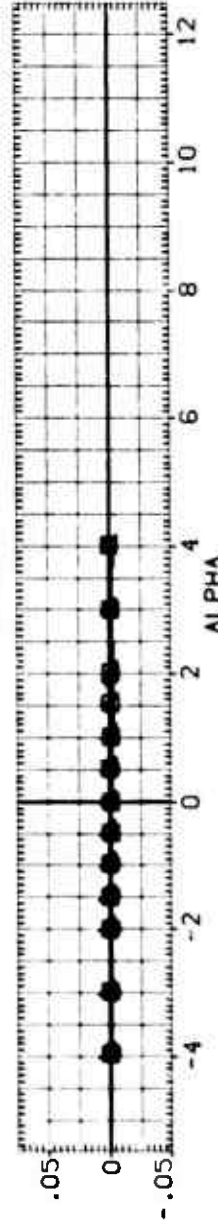
CLM4



CLM3



CLM2



CLM1

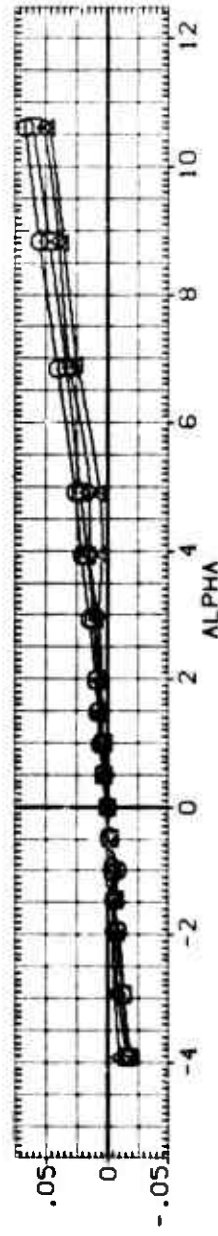
TYPICAL THRUST EFFECT ON FIN HINGE MOMENT

AE0C T1360 BODY FIN, BF1

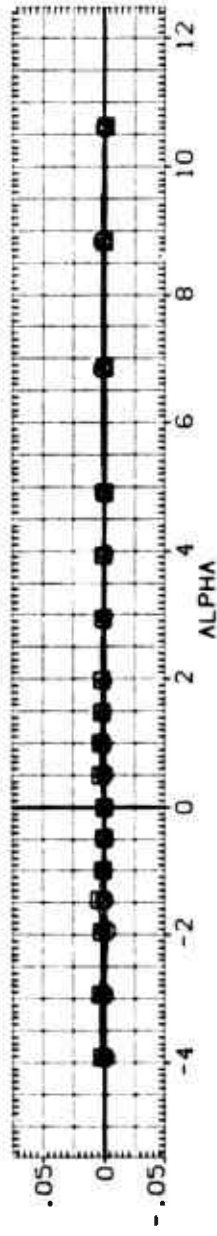
(RXE209)

SYMBOL	CRT	BETA	PARAMETRIC VALUES	
◇	.575	.000	PHI	.000
□	26.074	3.000	MACH	.200
○	50.179			
▽	100.919			

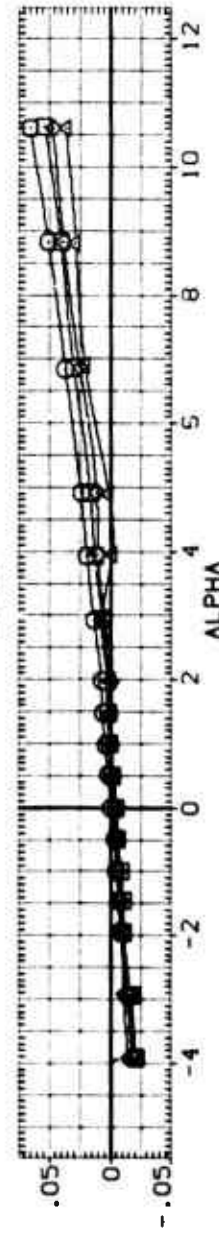
REFERENCE INFORMATION	
SREF	19.6350
LREF	5.0000
XREF	5.0000
YREF	26.5000
ZREF	.0000
SCALE	.0000



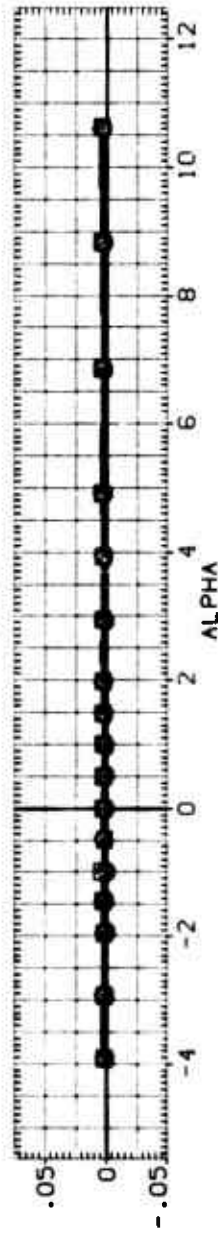
CLMR4



CLMR3



CLMR2



CLMR1

TYPICAL THRUST EFFECT ON FIN ROOT BENDING MOMENT

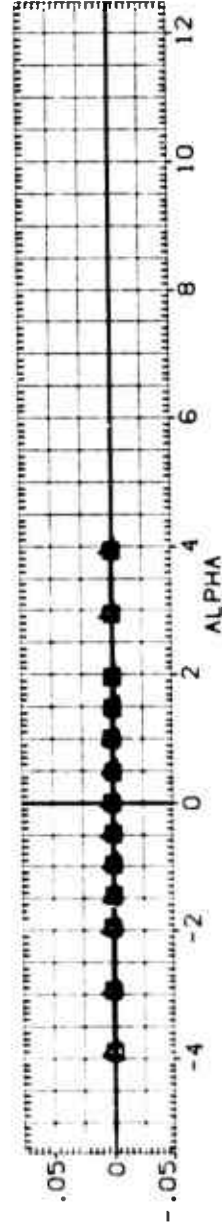
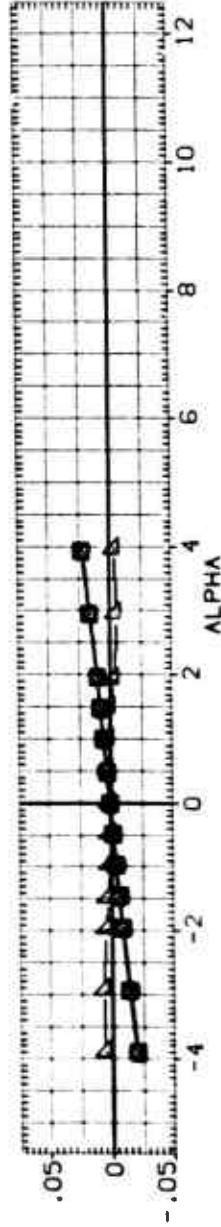
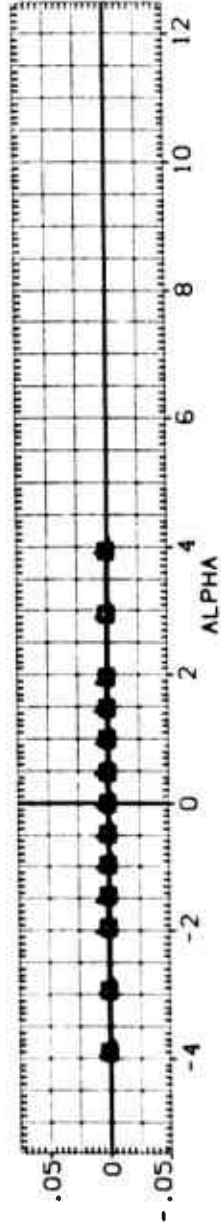
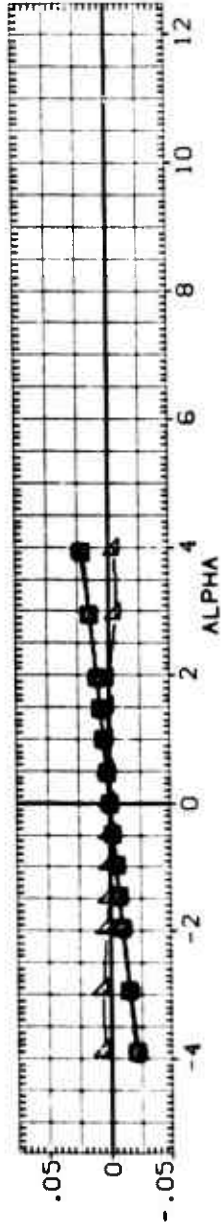
AEDC TF360 BODY FIN. BF1

(RXE213)

SYMBOL  
 ▽ □ ○

ORT  
 .010 BETA .000 PHI .000  
 3.042 FIMPOS 3.000 MACH 1.250  
 4.014  
 6.006  
 11.926

REFERENCE INFORMATION  
 SREF 19.6350 SQ. IN.  
 LREF 5.0000 IN.  
 BREF 5.0000 IN.  
 XMRP 26.5000 IN.  
 YMRP .0000 IN.  
 ZMRP .0000 IN.  
 SCALE .0000



TYPICAL THRUST EFFECT ON FIN ROOT BENDING MOMENT

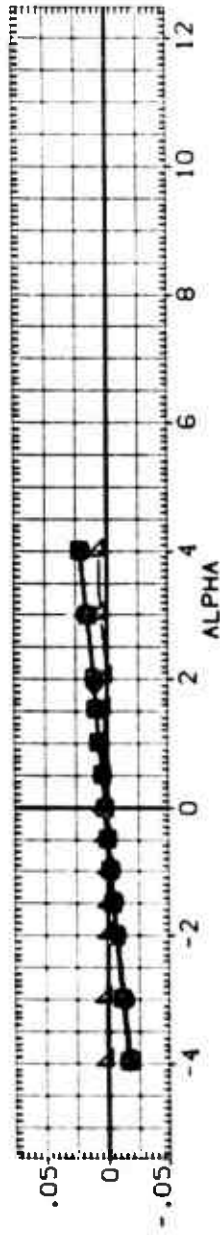
AEDC SF172 BODY FIN, BF1

(RXE216)

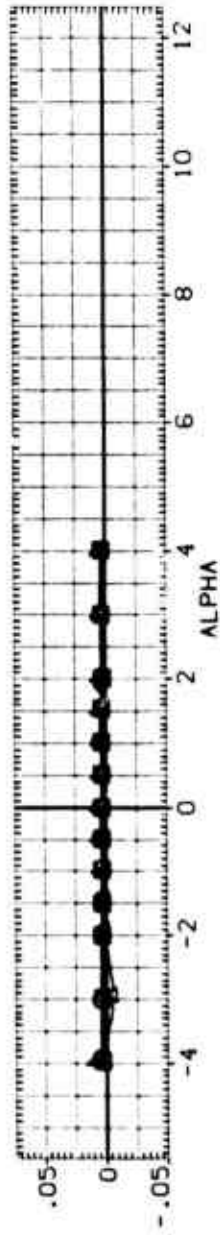
SYMBOL  
 ▽  
 ◊  
 □  
 ○

CPT      BETA      PM1      .000  
 2.011      3.000      MACH      2.000  
 3.969  
 6.009  
 11.932

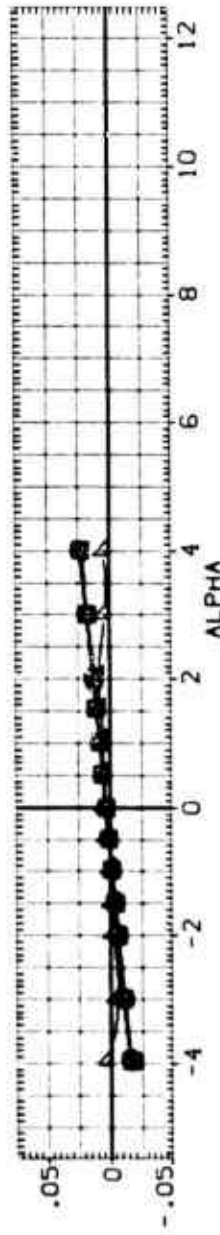
REFERENCE INFORMATION  
 SREF      19.6350      SQ. IN.  
 LREF      3.0000      IN.  
 WREF      26.5000      IN.  
 WREF      .0000      IN.  
 ZREF      .0000      IN.  
 SCALE      .0000



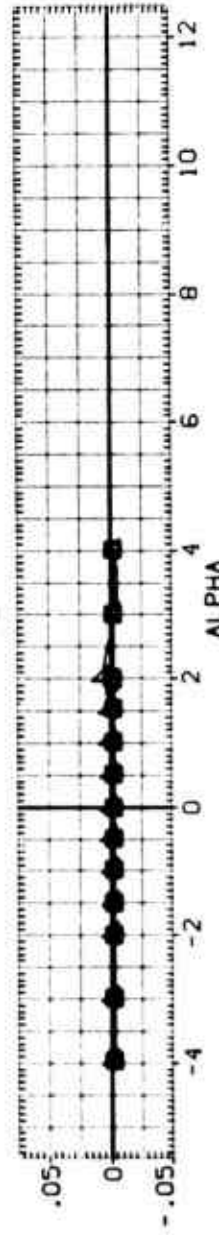
CLMR4



CLMR3



CLMR2



CLMR1

TYPICAL THRUST EFFECT ON FIN ROOT BENDING MOMENT

DATA SET SYMBOL CONFIGURATION DESCRIPTION

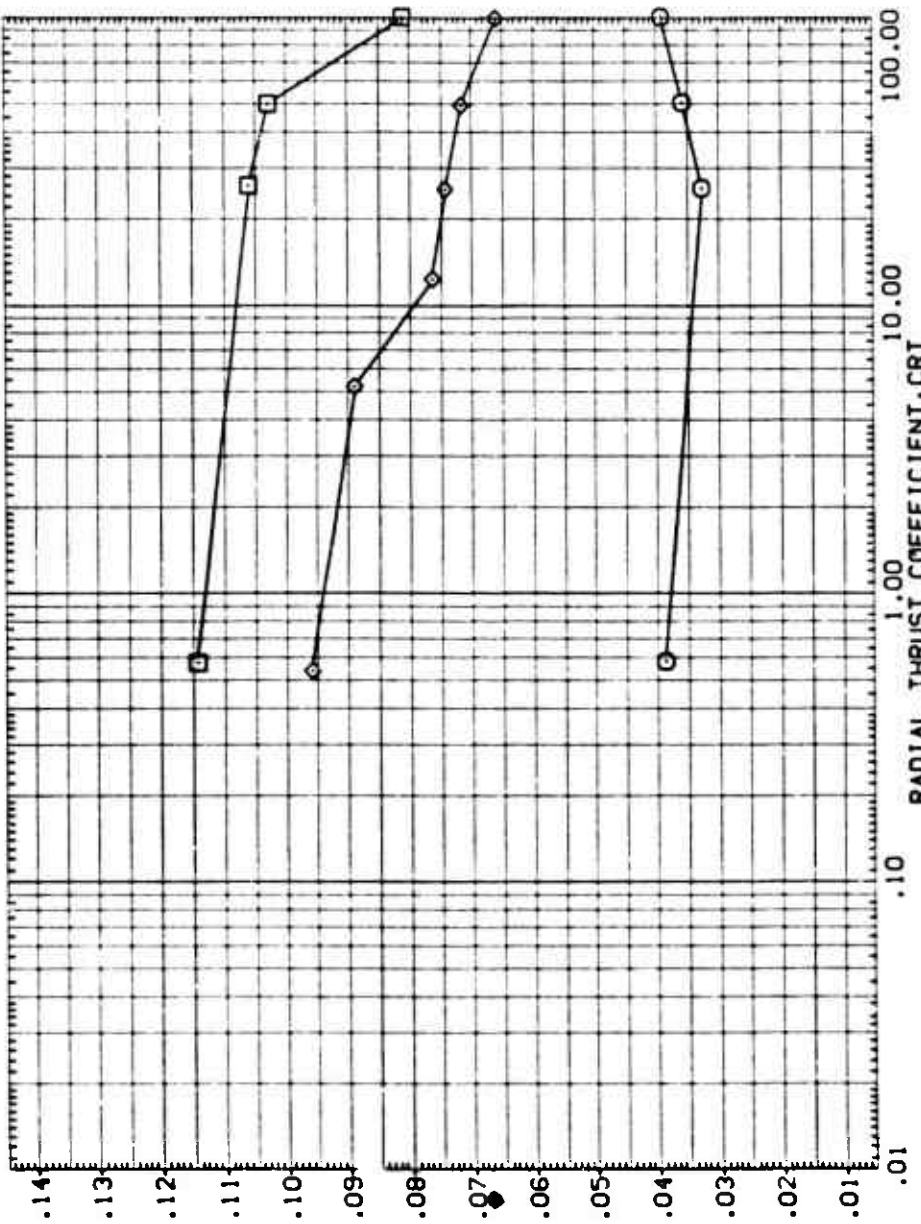
(R06002) AEDD IF 360 BODY ALONE, B

(R06003) AEDD IF 360 BODY FIN, B F1

(R06010) AEDD IF 360 BODY FIN, B F2

BETA .000  
PHI .000  
FINPOS 3.000  
MACH .200  
SREF 19.6750  
LREF 5.0000  
BREF 5.0000  
XREF 26.5000  
YREF .0000  
ZREF .0000  
SCALE .0000

REFERENCE INFORMATION  
SQ. IN.  
IN.  
IN.  
IN.  
IN.  
IN.  
IN.



NORMAL FORCE COEFFICIENT DERIVATIVE WITH ALPHA, CNALFA, PER DEGREE

EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES

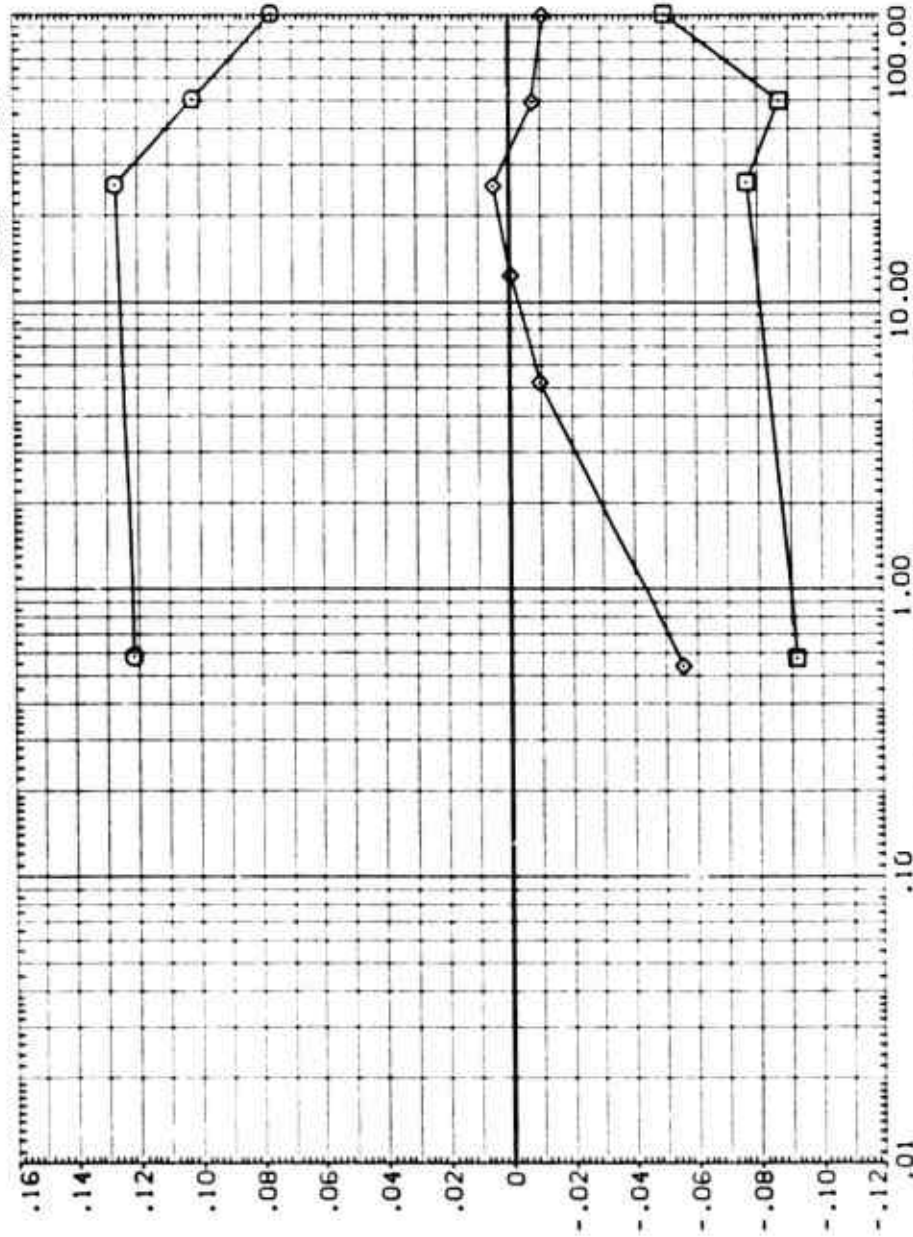
PITCHING MOMENT COEFFICIENT DERIVATIVE WITH ALPHA, CLM/F, PER DEGREE

DATA SET SYMBOL: (R0E002) (R0E009) (R0E018)

CONFIGURATION DESCRIPTION: AECC TF 360 BODY ALONE, B  
AECC TF 360 BODY FIN, B\*1  
AECC TF 360 BODY FIN, B\*2

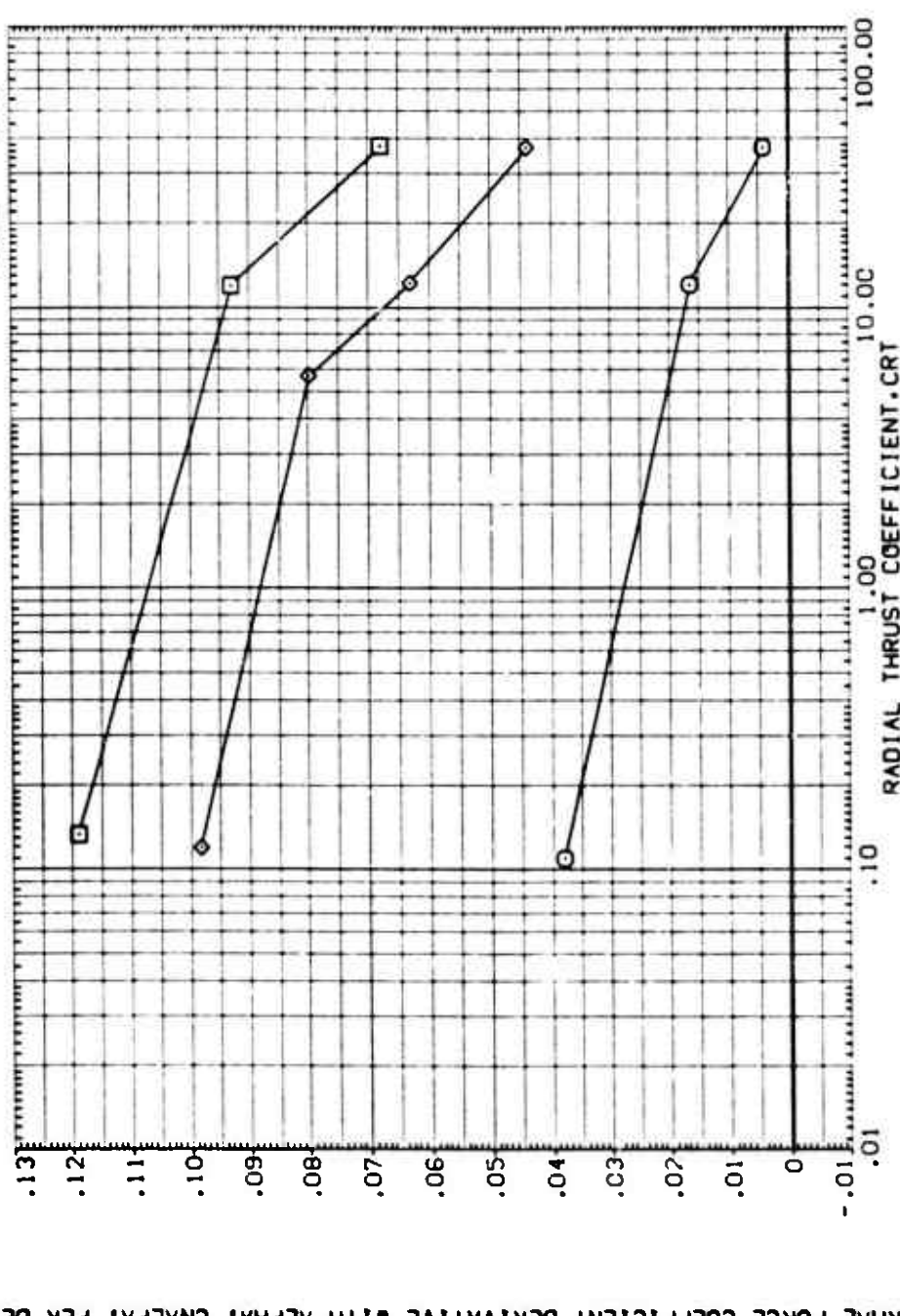
BETA: .000  
PHI: .000  
FINPOS: 3.000  
MACH: .200

REFERENCE INFORMATION: SREF: 19.0350 SQ. IN.  
LREF: 2.0000 IN.  
ASREF: 2.0000 IN.  
ASAPP: 26.0000 IN.  
TSAPP: .0000 IN.  
SCALE: .0000



EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES

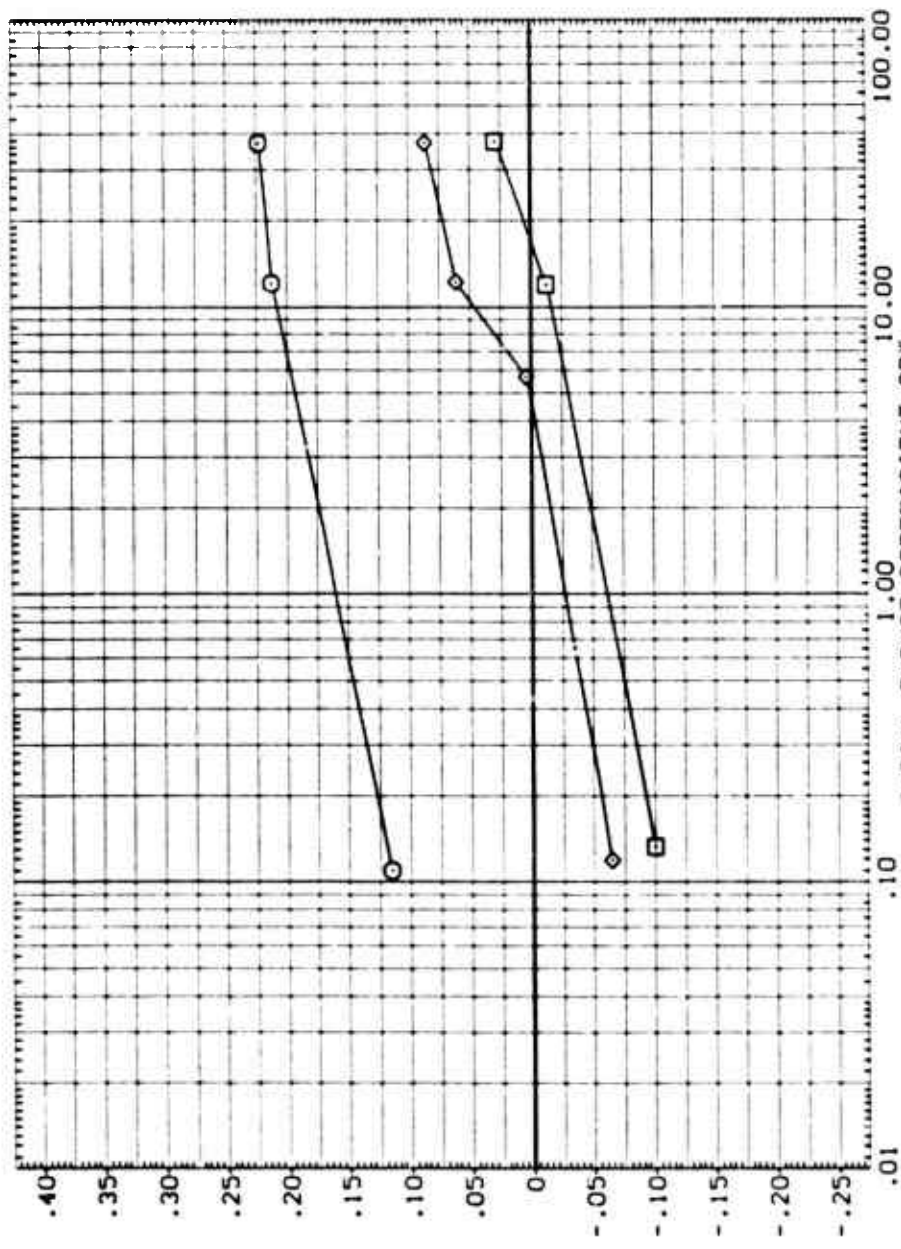
DATA SET SYMBOL: (R0E003) (R0E011) (R0E019)  
 CONFIGURATION DESCRIPTION: AEDE TF 360 BODY ALONE, B; AEDE TF 360 BODY FIN, BF1; AEDE TF 360 BODY FIN, BF2  
 BETA: .000 .000 .000  
 PHI: .000 .000 .000  
 FINPOS: 3.000 3.000 3.000  
 MACH: .400 .400 .400  
 REFERENCE INFORMATION: 19.6350 50. IN.; SREF 5.0000 IN.; LREF 5.0000 IN.; BREF 26.5000 IN.; YPROP .0000 IN.; ZPROP .0000 IN.; SCALE .0000



EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES



DATA SET SYMBOL: (R00E003) (R00E011) (R00E019)  
 CONFIGURATION DESCRIPTION: AEDC TF 360 BODY ALONE, B; AEDC TF 360 BODY FIN, B\*1; AEDC TF 360 BODY FIN, B\*2  
 BETA: .000 .000 .000  
 PHI: .000 .000 .000  
 FINPOS: 3.000 3.000 3.000  
 MACH: .400 .400 .400  
 REFERENCE INFORMATION: SREF: 19.6350 50. IN.; LREF: 3.0000 IN.; UREF: 3.5000 IN.; VREF: .0000 IN.; YREF: .0000 IN.; ZREF: .0000 IN.; SCALE: .0000

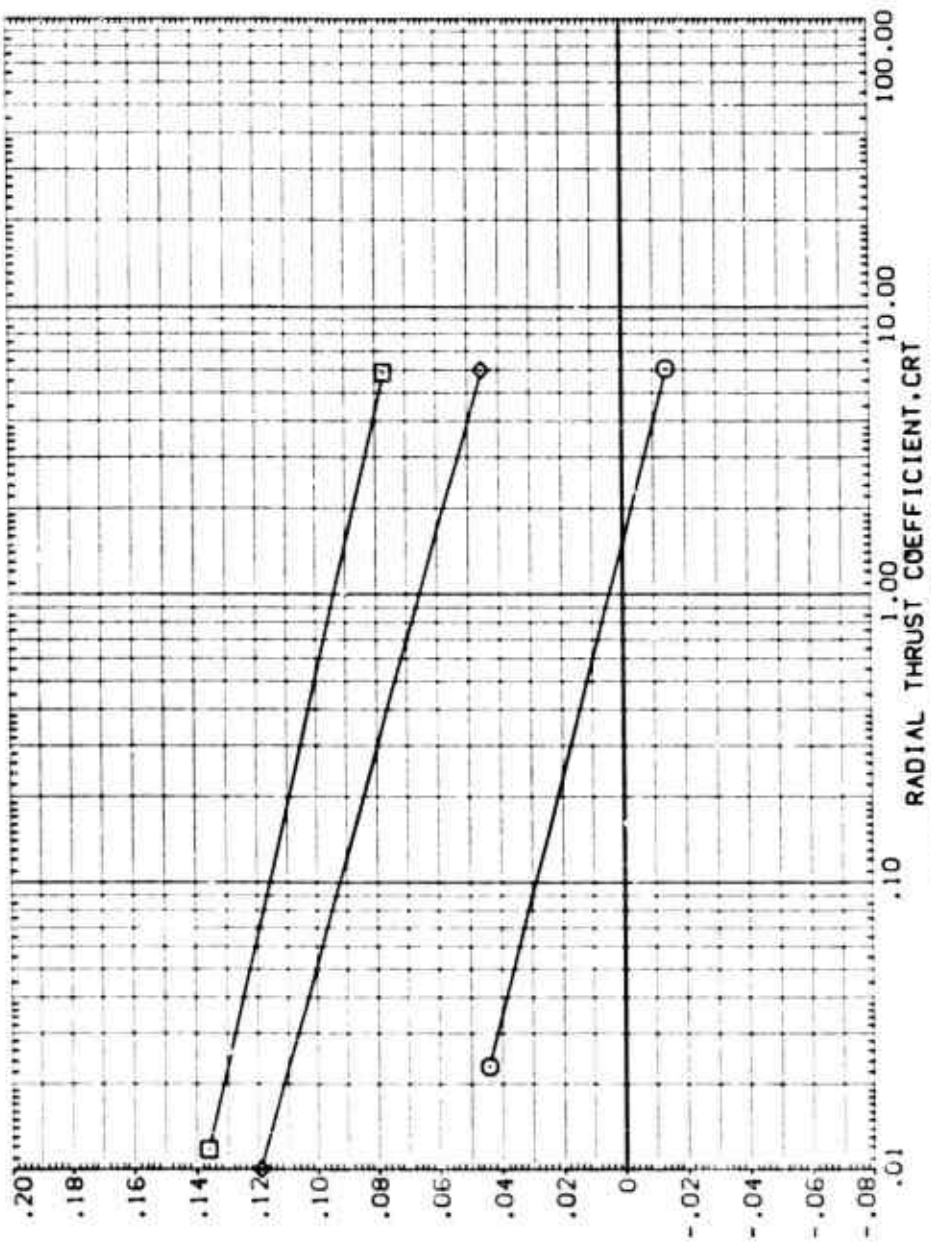


EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES

DATA SET SYMBOL: (RHE004) (RHE012) (RHE000)  
 CONFIGURATION DESCRIPTION:  
 AEZC 1F 360 BODY ALONE, B  
 AEZC 1F 360 BODY FIN, BF1  
 AEZC 1F 360 BODY FIN, BF2

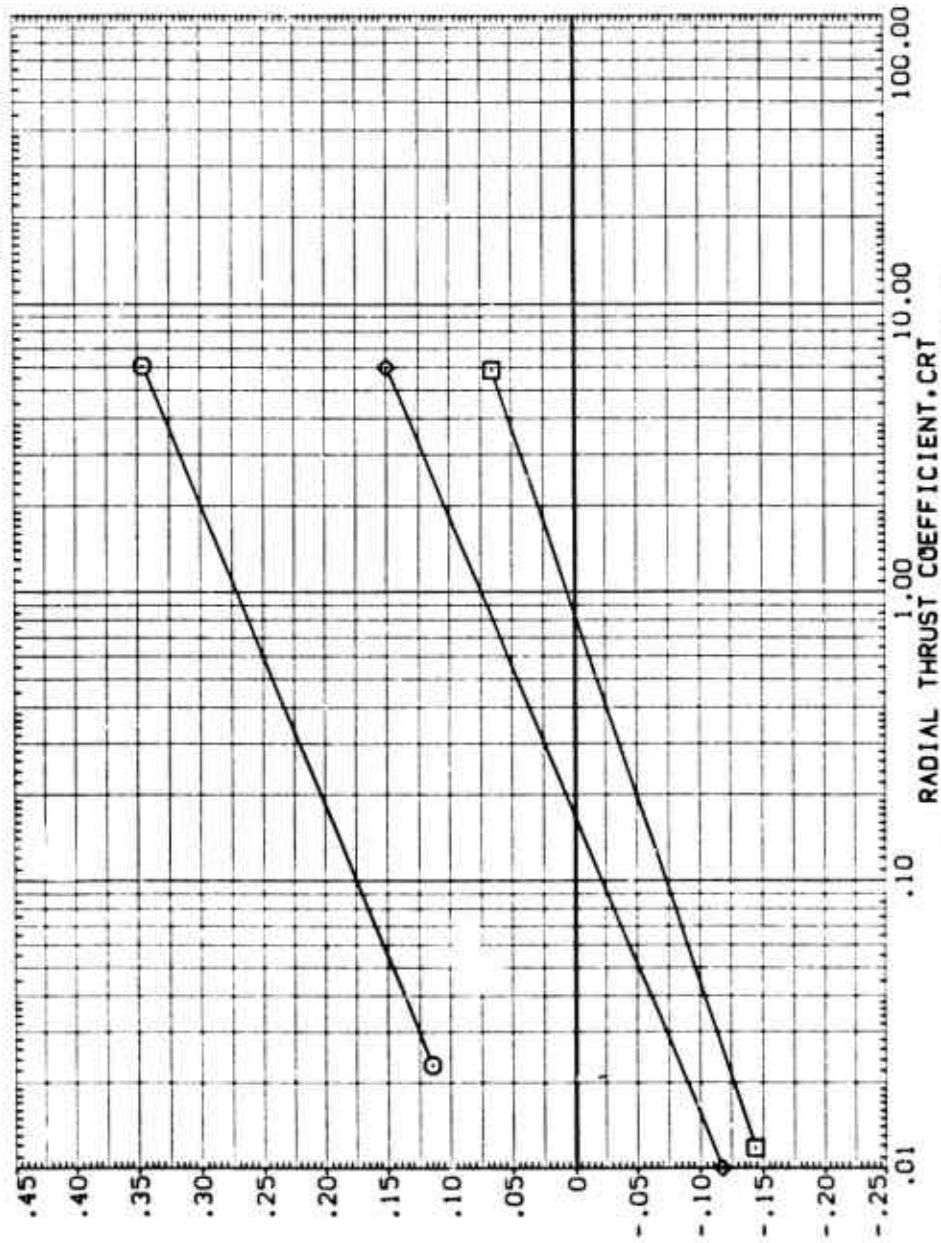
BETA: .000 .000 .000  
 PHI: .000 .000 .000  
 FINPOS: 3.000 3.000 3.000  
 MACH: 1.000 1.000 1.000

REFERENCE INFORMATION:  
 SREF: 19.6750 50. IN.  
 LREF: 5.0000 IN.  
 BREF: 5.0000 IN.  
 XREF: 26.5000 IN.  
 YREF: .0000 IN.  
 ZREF: .0000 IN.  
 SCALE: .0000



EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES

DATA SET SYMBOL CONFIGURATION DESCRIPTION REFERENCE INFORMATION  
 (R0E004) AEZC TF 360 BODY ALONE, B SREF 19.6700 50. IN.  
 (R0E012) AEZC TF 360 BODY FIN, BF1 LREF 3.0000 IN.  
 (R0E020) AEZC TF 360 BODY FIN, BF2 BREF 3.0000 IN.  
 XREF 26.5000 IN.  
 XREF .0000 IN.  
 XREF .0000 IN.  
 XREF .0000 IN.  
 SCALE .0000 IN.



EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES

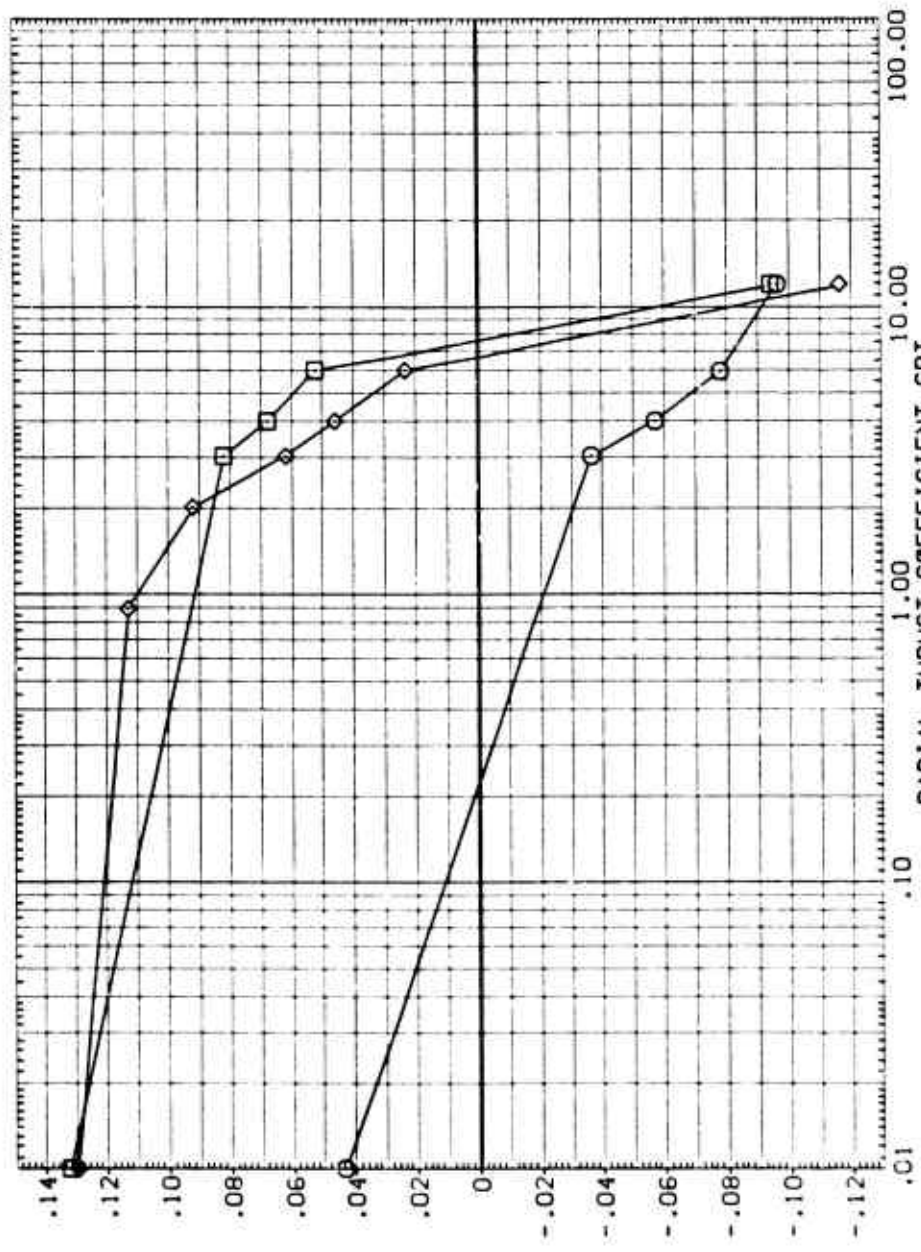
DATA SET SYMBOL: (PRE001) (PRE013) (PRE021)

CONFIGURATION DESCRIPTION:  
 AEDC 1F 360 BODY ALONE-B  
 AEDC 1F 360 BODY FIN: BF1  
 AEDC 1F 360 BODY FIN: BF2

BETA: .000  
 PHI: .000  
 FINPOS: 3.000  
 MACH: 1.250

REFERENCE INFORMATION:  
 SREF: 19.6250 SQ. IN.  
 LREF: 5.0000 IN.  
 BREF: 5.0000 IN.  
 XMRP: 26.0000 IN.  
 YMRP: .0000 IN.  
 ZMRP: .0000 IN.  
 SCALE: .0000

NORMAL FORCE COEFFICIENT DERIVATIVE WITH ALPHA, CNALFA, PER DEGREE

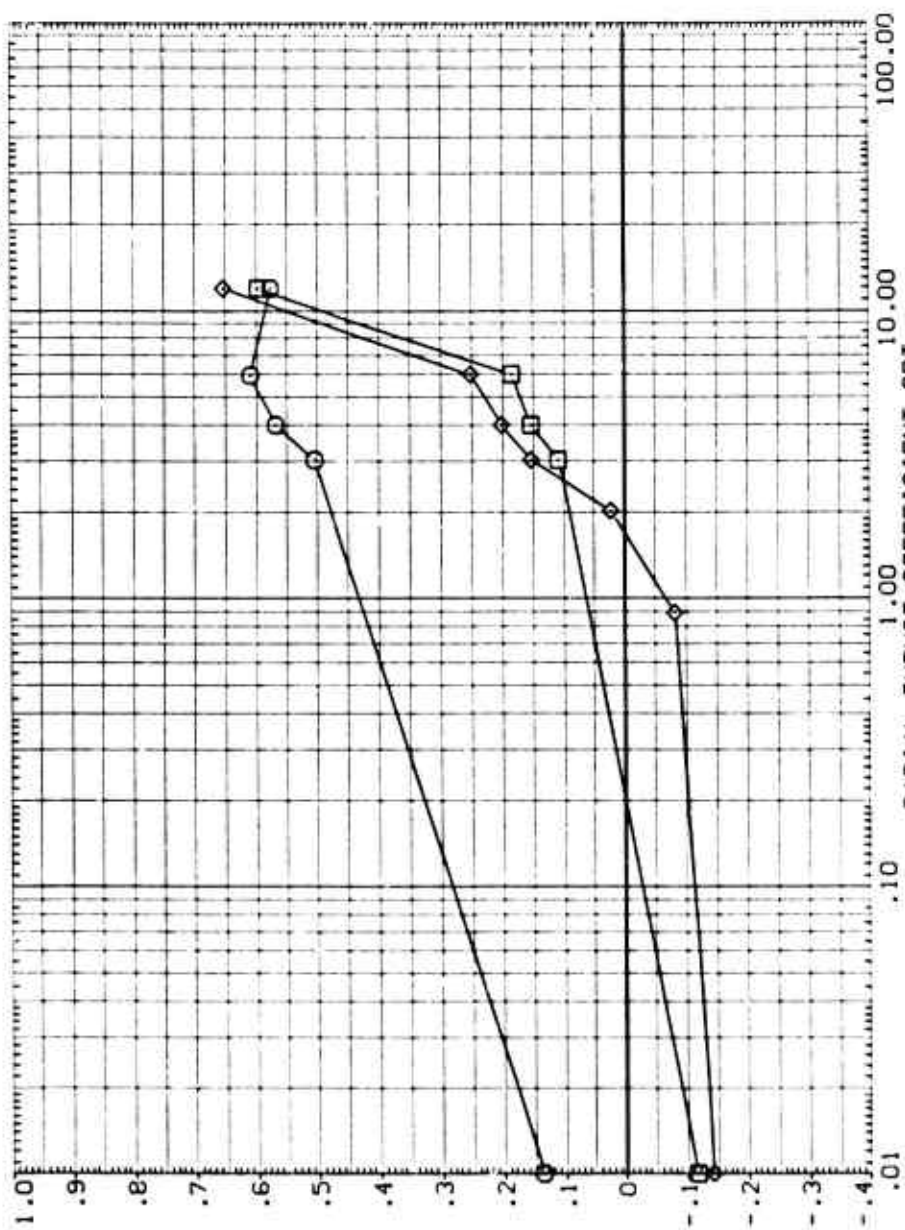


EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES

DATA SET SYMBOL CONFIGURATION DESCRIPTION REFERENCE INFORMATION

(RHE005)	AEDC 1F360 BODY ALONE, B	SREF	19.6750	50. IN.
(RHE013)	AEDC 1F360 BODY F IN. B F1	LREF	5.0000	IN.
(RHE021)	AEDC 1F360 BODY F IN. B F2	BREF	5.0000	IN.
		XMRP	26	50000 IN.
		YMRP		.0000 IN.
		ZMRP		.0000 IN.
		SCALE		.0000

BETA .000 PHI .000 MACH 1.250  
 .000 .000 .000 3.000 1.250  
 .000 .000 .000 3.000 1.250



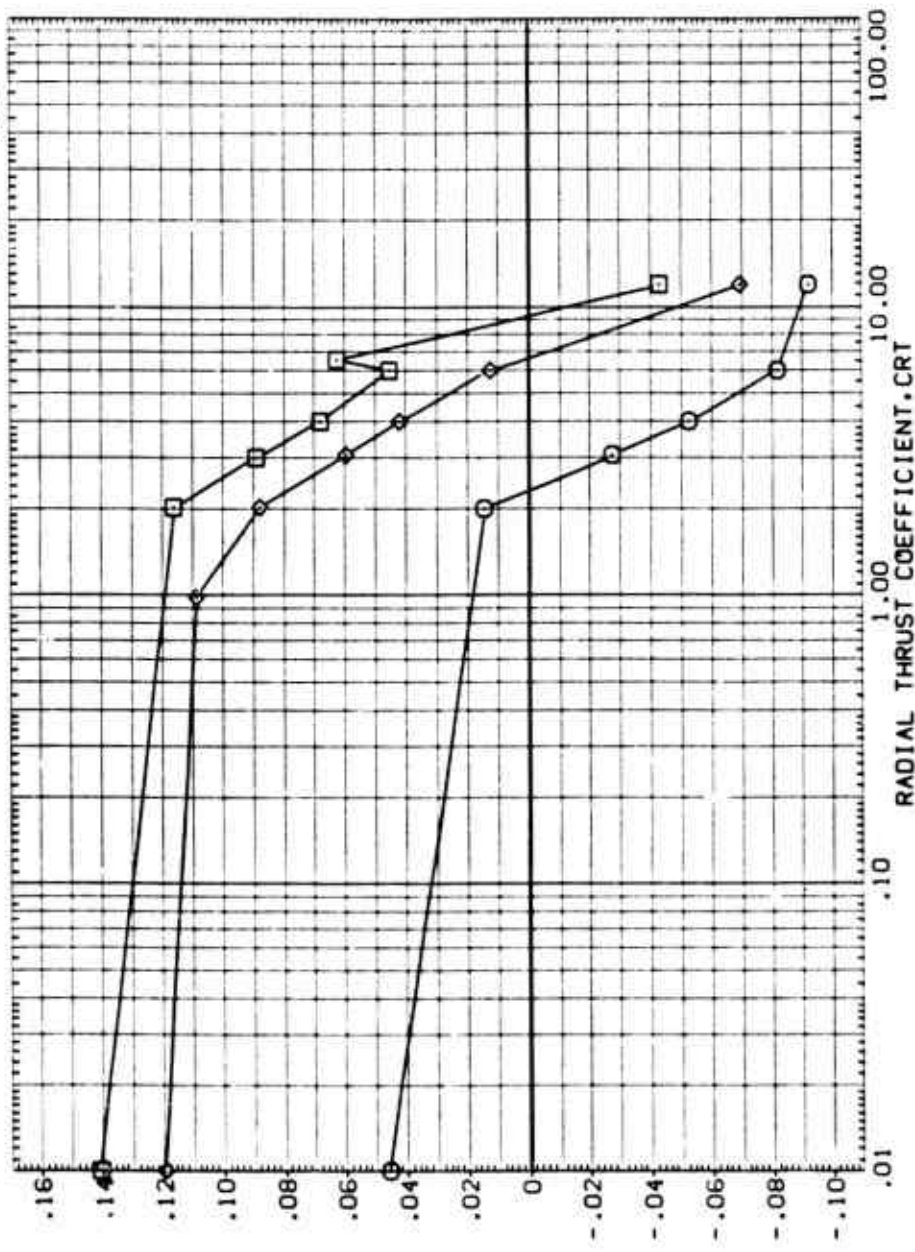
EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES

DATA SET SYMBOL: (RHE006) (RHE014) (RHE022)

CONFIGURATION DESCRIPTION:  
 AEIX TF 360 BODY ALONE, B  
 AEIX TF 360 BODY FIN, BF1  
 AEIX TF 360 BODY FIN, BF2

BETA: .000 .000 .000  
 PHI: .000 .000 .000  
 FINPOS: 3.000 3.000  
 MACH: 1.500 1.500 1.500

REFERENCE INFORMATION:  
 SREF: 19.6350 SQ. IN.  
 LREF: 3.0000 IN.  
 BREF: 3.0000 IN.  
 XREF: 26.5000 IN.  
 YREF: .0000 IN.  
 ZREF: .0000 IN.  
 SCALE: .0000

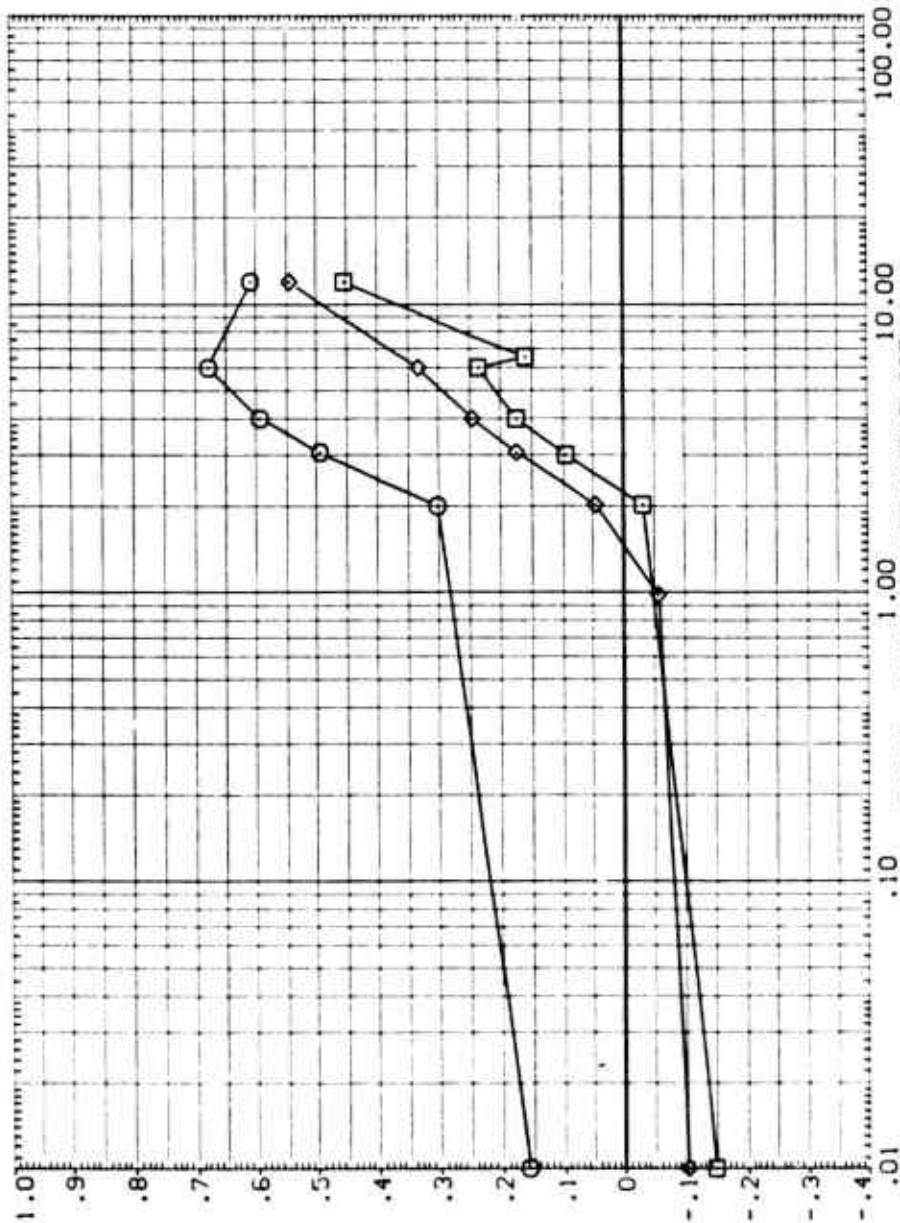


NORMAL FORCE COEFFICIENT DERIVATIVE WITH ALPHA, CNALFA, PER DEGREE

EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES

DATA SET SYMBOL CONFIGURATION DESCRIPTION REFERENCE INFORMATION

Symbol	Symbol	Configuration Description	Beta	Phi	F1MPS	Mach	SRF	50. IN.
(RHE005)	AEDE	IF 360 BODY ALONE-B	.000	.000	3.000	1.500	19.6750	50. IN.
(RHE014)	AEDE	IF 360 BODY F1M, BF 1	.000	.000	3.000	1.500	5.0000	IN.
(RHE022)	AEDE	IF 360 BODY F1M, BF 2	.000	.000	3.000	1.500	5.0000	IN.
							26.5000	IN.
							YPRP	IN.
							ZPRP	IN.
							SCALE	.0000



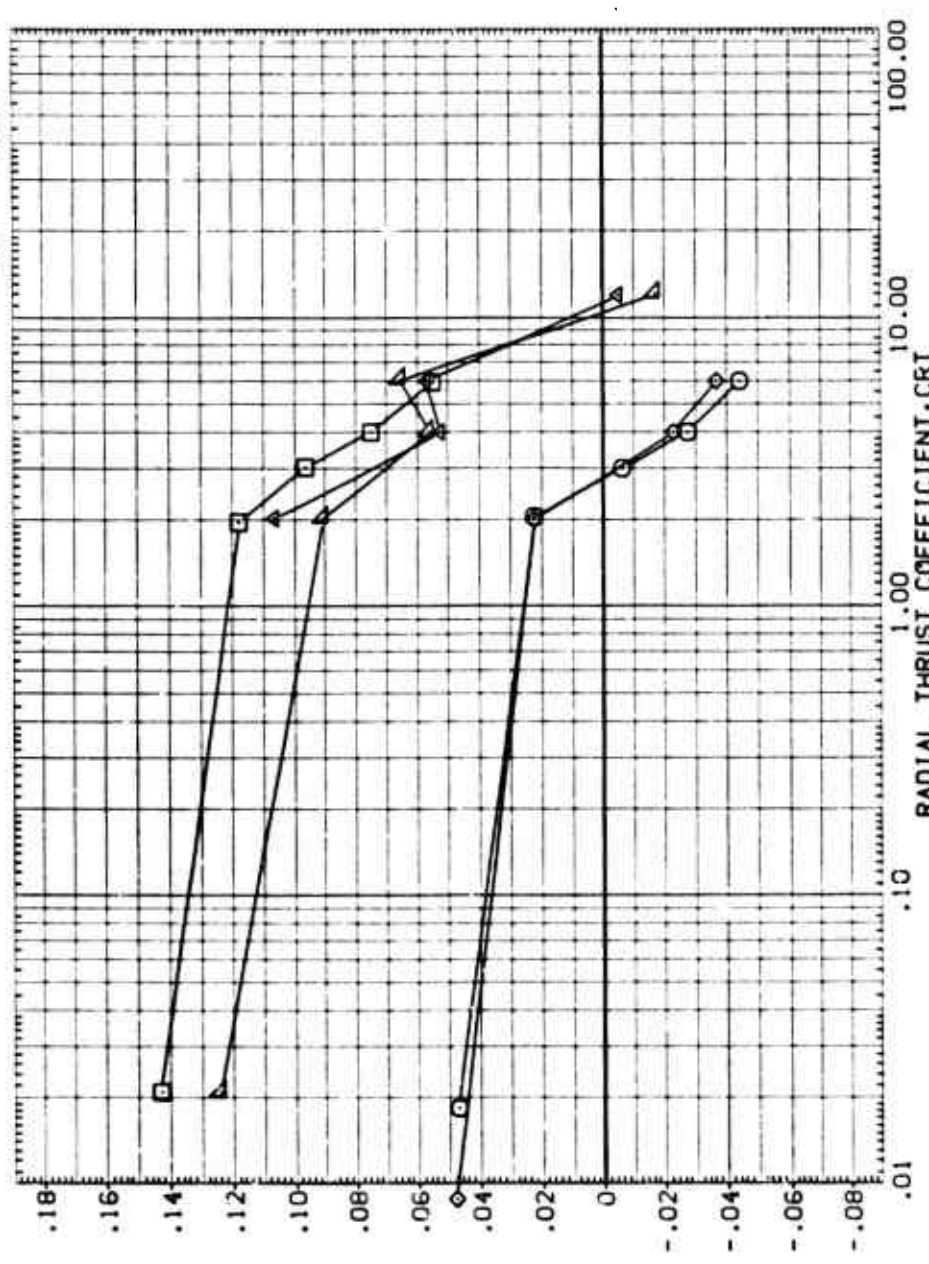
EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES

DATA SET SYMBOL. CONFIGURATION DESCRIPTION

(R0E007)	AEDE SF172 BODY ALONE.B
(R0E015)	AEDE SF172 BODY FIN. BF1
(R0E008)	AEDE SF172 BODY ALONE.B
(R0E016)	AEDE SF172 BODY FIN. BF1
(R0E017)	AEDE SF172 BODY FIN. BF1

BETA PHI FINPOS MACH REFERENCE INFORMATION

BETA	PHI	FINPOS	MACH	SREF	19.6350	50. IN.
.000	.000	3.000	1.700	LREF	5.0000	IN.
.000	.000	3.000	2.000	BREF	5.0000	IN.
.000	.000	3.000	2.500	XPRP	26.5000	IN.
.000	.000	3.000		YPRP	.0000	IN.
.000	.000			ZPRP	.0000	IN.
				SCALE	.0000	

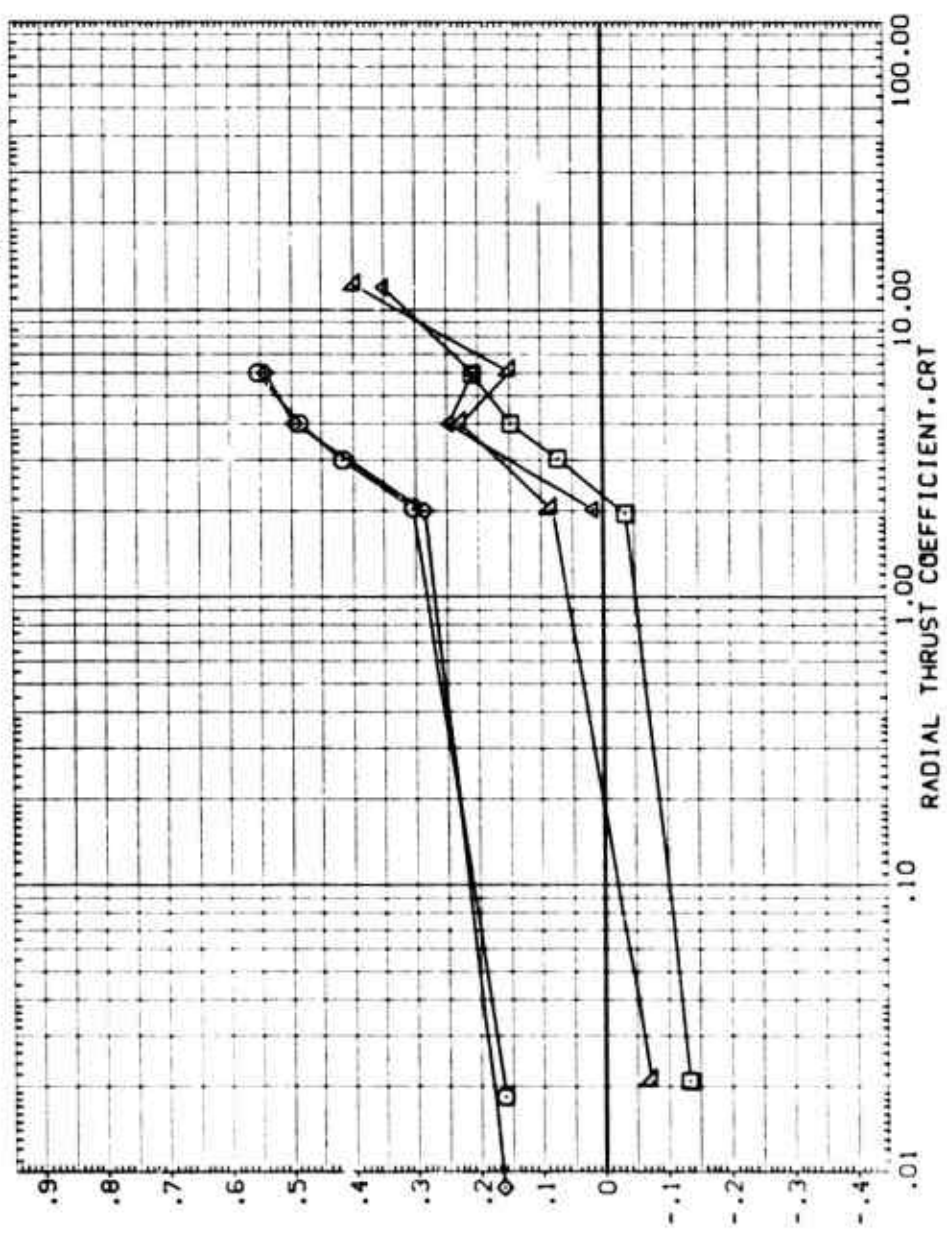


EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES



DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA PHI FIMPOS MACH REFERENCE INFORMATION

DATA SET SYMBOL	CONFIGURATION DESCRIPTION	BETA	PHI	FIMPOS	MACH	REFERENCE INFORMATION
(R)K1007	AECC SF172 BODY ALONE,B	.000	.000	3.000	1.700	SREF 19.6350 50. IN.
(R)K1015	AECC SF172 BODY FIN,BF1	.000	.000	3.000	1.700	LREF 3.0000 IN.
(R)K1008	AECC SF172 BODY ALONE,B	.000	.000	3.000	2.000	BREF 3.0000 IN.
(C)E016	AECC SF172 BODY FIN,BF1	.000	.000	3.000	2.000	MREF 26.0000 IN.
(R)K1017	AECC SF172 BODY FIN,BF1	.000	.000	3.000	2.300	MREF 26.0000 IN.
						SCALE .0000



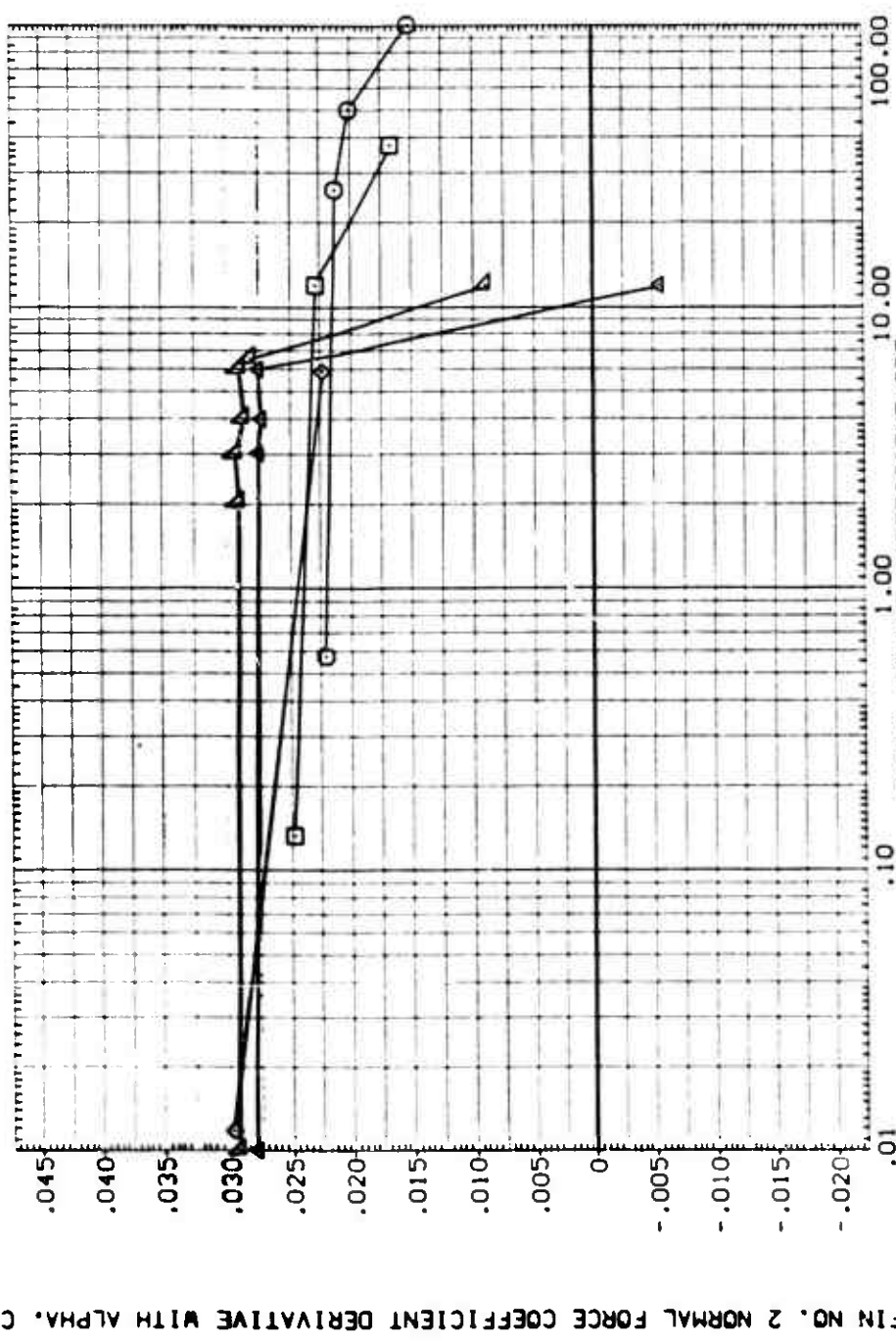
EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES

DATA SET SYMBOL: (RUE) (109) (RUE) (111) (RUE) (112) (RUE) (113) (RUE) (114)

CONFIGURATION DESCRIPTION:  
 AEDC TF 360 BODY FIN. BF  
 AEDC TF 360 BODY FIN. BF  
 AEDC TF 360 BODY FIN. BF  
 AEDC TF 360 BODY FIN. BF

BETA: .000  
 PHI: .000  
 FINPOS: 3.000  
 MACH: .200

REFERENCE INFORMATION:  
 SREF: 19.6350 SQ. IN.  
 LREF: 5.0000 IN.  
 BREF: 5.0000 IN.  
 XPRP: 26.5000 IN.  
 YPRP: .0000 IN.  
 ZPRP: .0000 IN.  
 SCALE: .0000



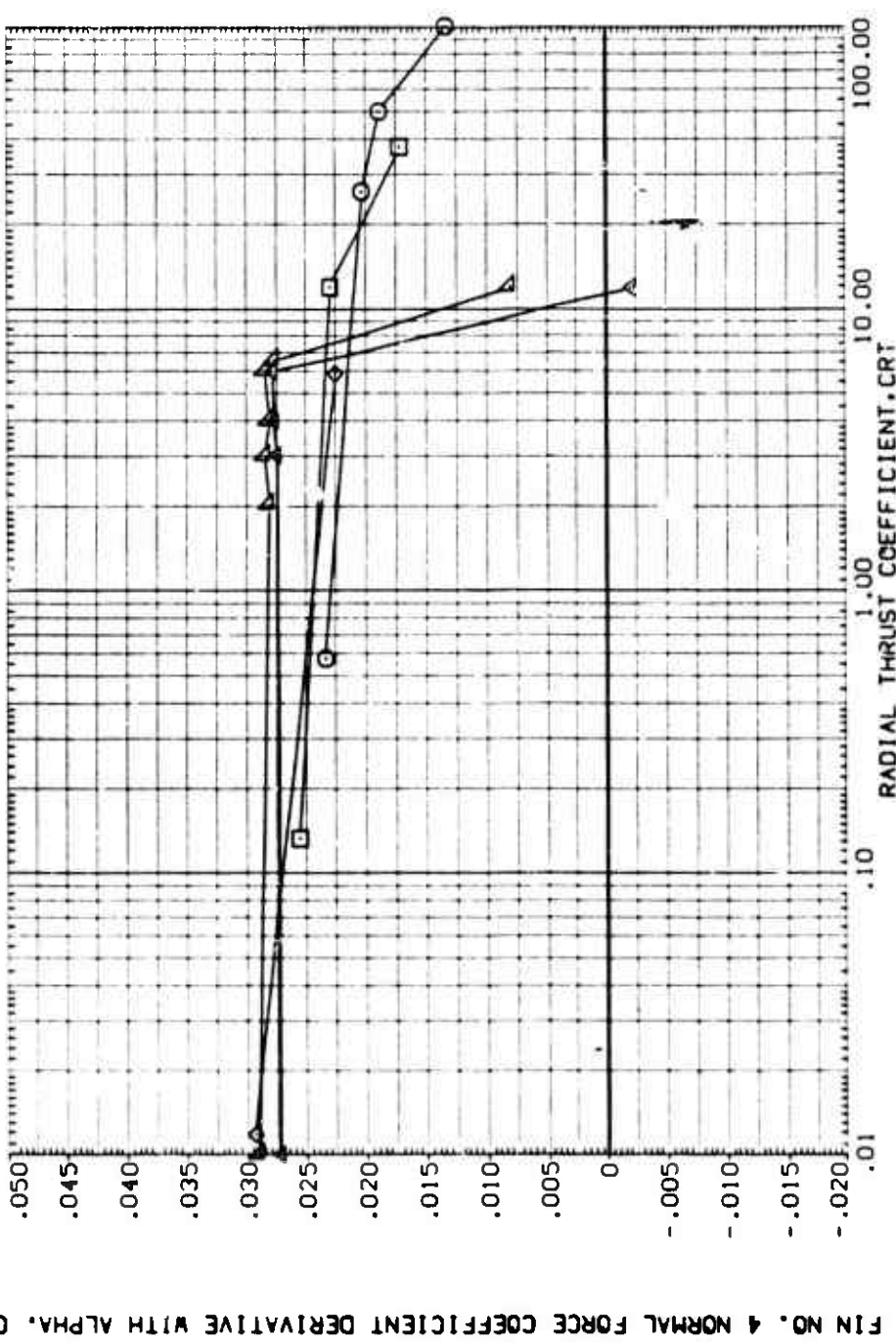
FIN NO. 2 NORMAL FORCE COEFFICIENT DERIVATIVE WITH ALPHA, CN2ALFA

THRUST EFFECTS ON FIN NO. 2 NORMAL FORCE CHARACTERISTICS-FIN IN FORWARD POSITION

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DATA SET SYMBOL CONFIGURATION DESCRIPTION

TRISE109	AEIX TF 360	BOODY F IN BF	BETA	PHI	F INPOS	MACH	REFERENCE INFORMATION
TRISE110	AEIX TF 360	BOODY F IN BF	.000	.000	3.000	.200	SREF 19.63750
TRISE111	AEIX TF 360	BOODY F IN BF	.000	.000	3.000	.400	LREF 5.00000
TRISE112	AEIX TF 360	BOODY F IN BF	.000	.000	3.000	1.000	BREF 5.00000
TRISE113	AEIX TF 360	BOODY F IN BF	.000	.000	3.000	1.250	XHREF 26.50000
TRISE114	AEIX TF 360	BOODY F IN BF	.000	.000	3.000	1.500	ZHREF .00000
							SCALE .00000



FIN NO. 4 NORMAL FORCE COEFFICIENT DERIVATIVE WITH ALPHA, CNFA\_LTA

THRUST EFFECTS ON FIN NO. 4 NORMAL FORCE CHARACTERISTICS-FIN IN FORWARD POSITION

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FIN NO. 2 NORMAL FORCE COEFFICIENT DERIVATIVE WITH ALPHA, CN2ALFA

DATA SET SYMBOL CONFIGURATION DESCRIPTION

(R0E114) ALEX TF 260 BODY FIN, BF1

(R0E115) ALEX SF 172 BODY FIN, BF1

(R0E116) ALEX SF 172 BODY FIN, BF1

(R0E117) ALEX SF 172 BODY FIN, BF1

BETA PHI FINPOS MACH REFERENCE INFORMATION

.000 .000 3.000 1.500 19.6250 SQ. IN.

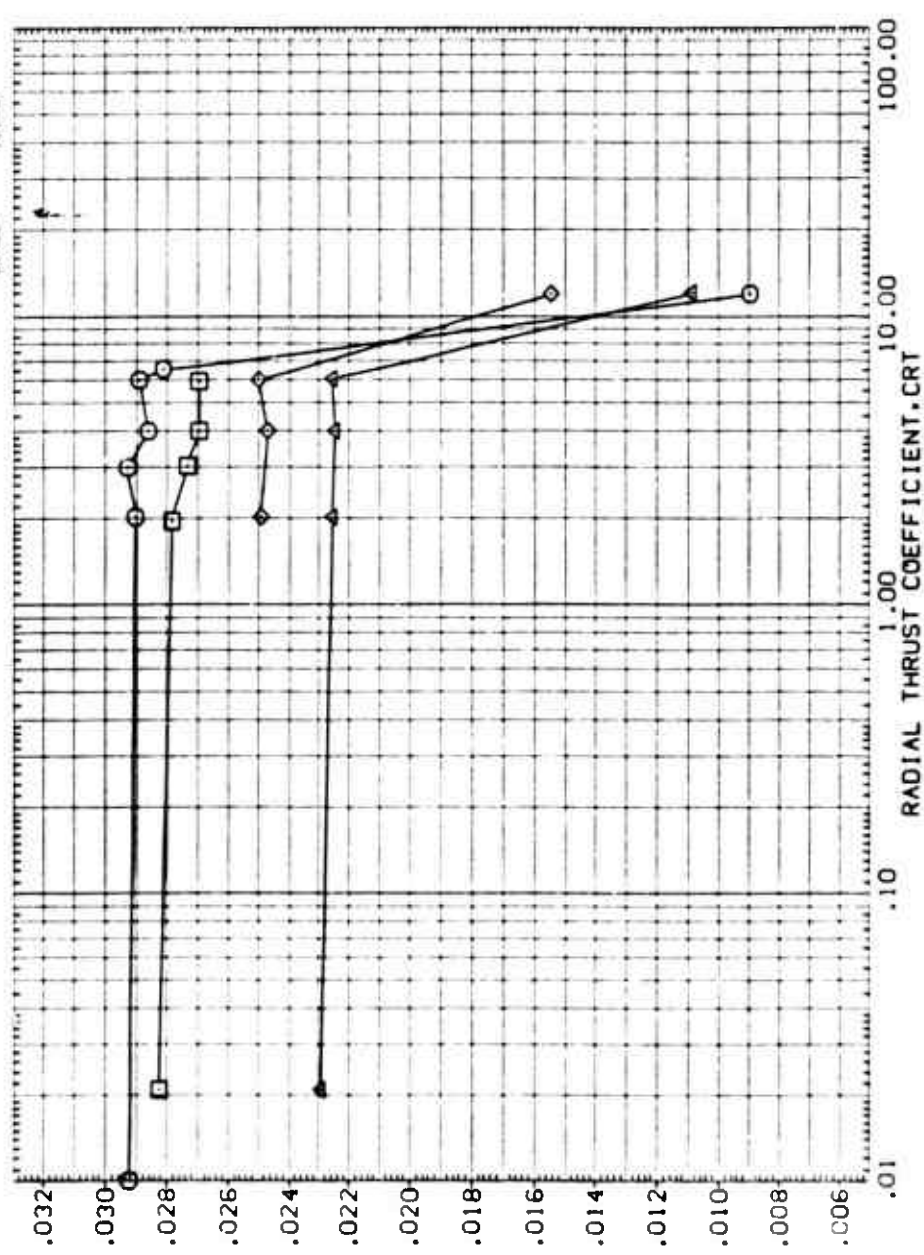
.000 .000 3.000 1.700 5.0000 IN.

.000 .000 3.000 2.000 5.0000 IN.

.000 .000 3.000 2.300 26.5000 IN.

2748P .0000 IN.

SCALE .0000

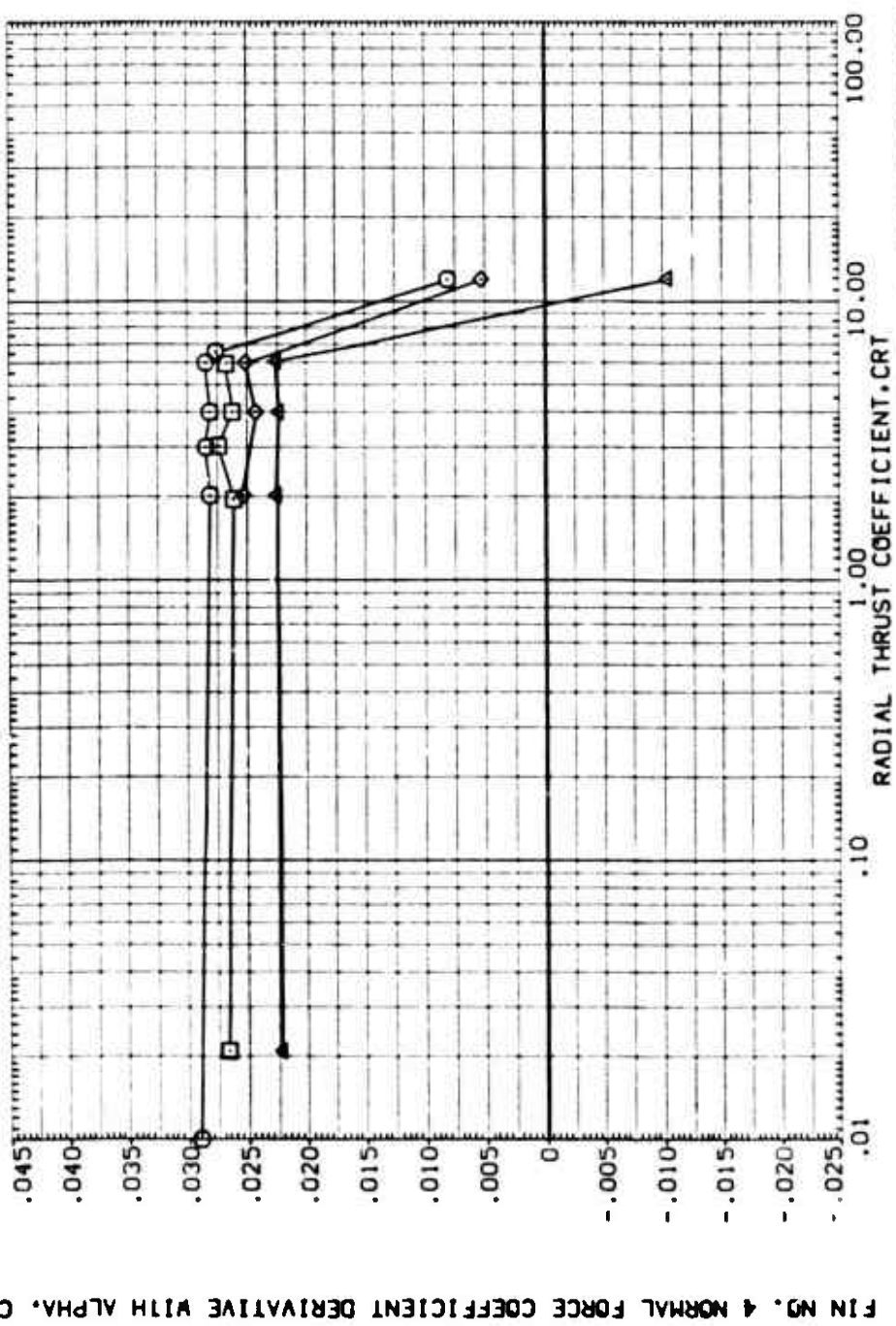


THRUST EFFECTS ON FIN NO. 2 NORMAL FORCE CHARACTERISTICS-FIN IN FORWARD POSITION

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FIN NO. 4 NORMAL FORCE COEFFICIENT DERIVATIVE WITH ALPHA, CN<sub>F</sub>ALFA

DATA SET SYMBOL	CONFIGURATION DESCRIPTION	BETA	PHI	F/VPDS	MACH	REFERENC. INFORMATION
(ROE114)	AEDC TF 260 BODY FIN. BF1	.000	.000	3.000	1.500	SREF 19.5250 SQ. IN.
(ROE115)	AEDC 5F172 BODY FIN. BF1	.000	.000	3.000	1.700	LSREF 5.0000 IN.
(COE116)	AEDC 5F172 BODY FIN. BF1	.000	.000	3.000	2.000	BSREF 5.0000 IN.
(ROE117)	AEDC 5F172 BODY FIN. BF1	.000	.000	3.000	2.300	YREF 26.5000 IN.
						ZREF .0000 IN.
						SCALE .0000



THRUST EFFECTS ON FIN NO. 4 NORMAL FORCE CHARACTERISTICS-FIN IN FORWARD POSITION  
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