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A SIMULATOR INVESTIGATION OF THE INFLUENCE OF ENGINE RESPONSE CHARACTERISTICS ON THE APPROACH AND LANDING FOR AN EXTERNALLY BLOWN FLAP AIRCRAFT

Part 2: Aerodynamic Model

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The following is a description of the aerodynamic model of the aircraft used in the simulation study discussed in Part 1 of this report. The model was based on an externally blown flap aircraft with engines mounted at 0.22 and 0.42 semispan.

The wing incorporated blown leading edge flaps, which were deflected 60 degrees, and 0.62 semispan triple-slotted trailing edge flaps. The trailing-edge flaps were divided into two spanwise segments on each wing semispan. The outer third of each semispan consisted of a 30 degree drooped aileron with 60 degree maximum deflection. Wing spoilers of 0.57 semispan (located directly in front of the ailerons and outboard half of the flaps) with maximum deflection of 60 degrees were also used for roll control. The aft segment of the inboard flap could be deflected symmetrically as a drag control device. The aft segment of the outboard flap could be deflected asymmetrically for roll control.

The horizontal stabilizer was used for longitudinal control. It incorporated a leading edge Kruger flap and a geared elevator such that at maximum stabilizer deflections of $\pm$10 degrees, the elevator was deflected +10 and -50 degrees respectively. The vertical stabilizer employed a 0.57 chord double hinger rudder for directional control.

Aerodynamic characteristics as a function of angle of attack, thrust coefficient, and flap deflection are presented in Tables AI through AXV and Figures A1 through A50. Static longitudinal data are referred to the stability-axis system. The dynamic longitudinal and lateral-directional data and static lateral data are referred to the body-axis system. A listing of the individual tables and figures rollows. Only data for flap deflections of 35 and 60 degrees are included herein. Data for the flaps up and 40 degree flap configurations were used in addition to the 35 and 60 degree flap data in the complete aerodynamic model for the simulation.

In conclusion, the authors wish to express their appreciation to Messrs. D. A. Kier and B. G. Powers of the Flight Research Center and W. D. Grantham of the Langley Research Center for making available the aerodynamic data in their individual simulations as anaid in the compilation of the simulation model reported herein.

LIST OF TABLES

Table	Remarks		
AI	List of Figures		
Table	δ_{f_3} deg	C_j	Effect of Angle of Attack on The Coefficient of:
AII	35, 70	0., 1.74, 3.48	Rate of change of normal force with pitch (includes $C_{n_{\dot{\alpha}}}$)
AIII	35, 60	0., 1.94, 3.50	Rate of change of lift with spoiler deflection
AIV	35, 60	0., 1.94, 3.50	Rate of change of drag with spoiler deflection
AV	35, 60	0., 1.94, 3.50	Rate of change of side force with spoiler deflection
AVI	35, 70	0., 1.74, 3.48	Side force due to rolling
AVII	35, 70	0., 1.74, 3.48	Side force due to yaw
AVIII	35, 60	0., 1.94, 3.50	Rate of change of yawing moment with spoiler deflection
AIX	35, 60	0., 1.59, 3.18	Rate of change of yawing moment with aileron deflection
AX	35, 60	0., 1.94, 3.50	Rate of change of rolling moment with spoiler deflection
AXI	35, 60	0., 1.59, 3.18	Rate of change of rolling moment with aileron deflection
Table	δ_{f_3} deg	C_j	Effect of height above ground on:
AXII	35, 70	0., 1.89, 3.78	Ratio of lift in ground effect to lift in free air
AXIII	35, 70	0., 1.89, 3.78	Drag coefficient increment due to ground effect
AXIV	35, 70	0., 1.89, 3.78	Pitching moment increment due to ground effect
Table	δ_{f_3} deg	C_j	
AXV	35, 60	0., .97, 1.93, 2.9, 3.85	Engine out max lift coefficient

TABLE AI - LIST OF FIGURES

Figure	δ_{f_3} deg	Effect of Thrust Coefficient (C_j = 0., .97, 1.93, 2.9, 3.85) and Angle of Attack on The Coefficient of:
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A5, A6		Rate of change of lift with deflection of aft element of inboard segment of trailing edge flap (Δf_3)
A7, A8		Drag
A9, A10		Rate of change of drag with stabilizer deflection (includes δ_e)
A11, A12		Rate of change of drag with deflection of aft element of inboard segment of trailing edge flap (Δf_3)
A13, A14		Pitching moment
A15, A16		Rate of change of pitching moment with stabilizer deflection (includes δ_e)
A17, A18		Rate of change of pitching moment with deflection of aft element of inboard segment of trailing edge flap (Δf_3)
A19, A20		Damping in pitch (includes $C_{m\dot{\alpha}}$)
A21, A22		Rate of change of side force with side slip angle
A23, A24		Rate of change of side force with rudder deflection
A25, A26		Rate of change of side force with differential deflection of aft element of outboard segment of trailing edge flap (Δf_3)
A27, A28		Rate of change of yawing moment with rudder deflection
A29, A30		Rate of change of yawing moment with side slip angle
A31, A32		Rate of change of yawing moment with differential deflection of aft element of outboard segment of trailing edge flap (Δf_3)
A33, A34		Yawing moment due to roll
A35, A36		Damping in yaw
A37, A38		Yawing moment increment due to outboard engine out
A39, A40		Rate of change of rolling moment with rudder deflection
A41, A42		Rate of change of rolling moment with side slip angle
A43, A44		Rate of change of rolling moment with differential deflection of aft element of outboard segment of trailing edge flap (Δf_3)
A45, A46		Damping in roll
A47, A48		Rolling moment due to yaw
A49, A50		Rolling moment increment due to outboard engine out

	C_{N_Q}					
δ_{F_3}	35°			70°		
α \ C_j	0.	1.74	3.48	0.	1.74	3.48
−10°	−10.	+25.	30.	8.	25.	25.
−2	+12.	32.	37.	14.	33.	35.
+6	28.	37.	43.	27.	40.	40.
12	41.	42.	46.	40.	37.	40.
18	48.	63.	48.	43.	85.	41.
24	41.	79.	63.	35.	105.	125.
28	37.	75.	80.	31.	92.	135.

Table AII

	$C_{L_{\delta_{SP}}}$					
δ_{F_3}	35°			60°		
C_j / α	0.	1.94	3.50	0.	1.94	3.50
-10°	-.0087	-.0065	-.0058	0.	-.01	-.0017
-2	-.0087	-.0065	-.0058	-.0042	-.0067	-.0033
+6	-.0087	-.0088	-.005	-.0067	-.0083	-.005
12	-.0078	-.0075	-.0038	-.0083	-.0133	-.0067
18	-.0027	-.0045	-.0030	-.0017	-.0133	-.0092
24	-.0003	-.0010	-.0020	-.0017	-.0133	-.0150
28	+.0005	+.0017	-.0007	-.0008	-.0017	-.020

Table AIII

	$C_{D_{S_{SP}}}$					
δ_{F_3}	35°			60°		
C_j / α	0.	1.94	3.50	0.	1.94	3.50
-10°	.0023	.0025	.0032	0.	0.	0.
-2	.0023	.0025	.0032	0.	0.	0.
+6	.0012	.0017	.0025	0.	-.0008	-.0008
12	.0005	.0013	.0019	0.	-.0017	-.0017
18	0.	.0008	.0013	0.	-.0042	-.0017
24	-.0003	-.0005	+.0006	0.	-.0042	-.0067
28	-.0002	-.0003	+.0006	0.	-.0017	-.0075

Table AIV

	$C_{y_{\delta_{SP}}}$					
δ_{F_3}	35°			60°		
C_j / α	0.	1.94	3.50	0.	1.94	3.50
-10°	-.0017	-.0003	+.0021	-.0007	-.0013	-.0023
-2	-.0017	-.0002	+.0012	-.0017	-.0022	-.0026
+6	-.0022	-.0003	+.0005	-.0015	-.0033	-.0033
12	-.0020	-.0007	+.0003	-.0010	-.0045	-.0043
18	-.0015	-.0007	+.0003	-.0003	-.0053	-.0050
24	-.0015	-.0005	+.0004	+.0002	-.0070	-.0065
28	-.0012	-.0003	+.0004	.0002	+.0002	-.0095

Table AV

	C_{y_p}					
δ_{F_3}	35°			70°		
α \ C_j	0.	1.74	3.48	0.	1.74	3.48
-10°	-0.20	-0.50	-0.27	-0.20	+0.05	-0.30
-2	-0.14	-0.09	-0.02	-0.16	0.	-0.18
+6	+0.04	+0.17	+1.70	0.	+0.18	+0.20
12	0.10	0.37	0.41	0.07	0.40	0.56
18	0.11	0.41	0.59	0.10	0.55	0.92
24	0.02	0.50	0.62	0.08	0.15	1.11
28	0.02	0.55	0.72	0.02	0.40	0.38

Table AVI

	C_{y_R}					
δ_{F_3}	35°			70°		
α \ C_j	0.	1.74	3.48	0.	1.74	3.48
-10°	0.75	0.	0.40	1.26	0.70	1.32
-2	0.61	0.55	0.81	0.80	0.80	0.90
+6	0.76	0.59	0.91	0.79	1.01	1.30
12	0.75	0.75	0.95	0.82	0.97	1.41
18	0.61	1.04	1.15	0.70	0.94	1.11
24	0.40	1.23	1.45	0.49	0.84	1.37
28	0.10	1.55	1.55	0.015	0.50	1.47

Table AVII

	$C_{n_{\delta_{SP}}}$					
δ_{F_3}	35°			60°		
α \ C_j	0.	1.94	3.50	0.	1.94	3.50
-10°	.0005	.0006	.0006	.0003	0.	.0003
-2	.0006	.0007	.0008	.0003	0.	.0003
+6	.0006	.0008	.0009	.0003	.0001	.0003
12	.0006	.0008	.0005	.0002	.0002	.0002
18	.0006	.0007	.0008	.0001	.0003	.0003
24	.0005	.0003	.0006	0.	.0008	.0004
28	.0005	0.	.0003	0.	0.	.0010

Table AVIII

	$C_{n_{\delta A}}$					
δ_{F_3}	35°			60°		
α \ C_j	0.	1.59	3.18	0.	1.59	3.18
-10°	0.	.0001	.0001	0.	.0005	.0002
-2	-.0001	-.0001	0.	0.	-.0001	-.0002
+6	-.0003	-.0002	0.	-.0002	-.0002	-.0001
12	-.0003	-.0001	0.	-.0002	-.0001	0.
18	-.0005	-.0001	0.	-.0002	0.	0.
24	-.0004	-.0001	0.	-.0002	-.0001	-.0001
28	-.0005	-.0001	0.	-.0003	0.	-.0002

Table AIX

	$C_{l_{\delta_{SP}}}$					
δ_{F_3}	35°			60°		
C_j / α	0.	1.94	3.50	0.	1.94	3.50
-10°	-.0011	+.0015	.0017	.0006	.0013	.0012
-2	-.0018	+.0020	.0020	.0009	.0016	.0013
+6	-.0021	+.0023	.0023	.0010	.0020	.0017
12	-.0018	+.0019	.0019	.0008	.0025	.0020
18	-.0013	+.0014	.0015	.0003	.0032	.0027
24	-.0007	+.0008	.0012	-.0001	+.0038	.0037
28	-.0004	+.0005	.0006	-.0002	+.0008	.0052

Table AX

	$C_{l_{\delta_A}}$					
δ_{F_3}	35°			60°		
α \ C_j	0.	1.59	3.18	0.	1.59	3.18
-10°	-.0002	+.0017	.0029	.0008	.0011	.0023
-2	+.0001	.0023	.0033	.0002	.0018	.0025
+6	.0008	.0024	.0034	.0007	.0016	.0027
12	.0005	.0028	.0038	.0003	.0017	.0025
18	.0006	.0010	.0029	.0004	.0018	.0023
24	.0008	.0010	.0008	.0006	.0001	.0005
28	.0002	.0001	-.0002	+.0004	0.	.0006

Table AXI

	$C_{L_{GE}} / C_L$					
δ_{F_3}	35°			70°		
C_j / h/b	0.	1.89	3.78	0.	1.89	3.78
.1	1.19	1.08	1.04	1.21	.91	.79
.2	1.125	1.05	1.03	1.11	.96	.975
.3	1.06	1.03	1.02	1.05	1.01	1.03
.4	1.01	1.01	1.01	1.025	1.025	1.03
.5	1.005	1.005	1.005	1.010	1.015	1.015
.6	1.0	1.0	1.0	1.0	1.0	1.0

Table AXII

	$\Delta C_{D_{GE}}$					
δ_{F_3}	35°			70°		
h/b \ C_j	0.	1.89	3.78	0.	1.89	3.78
.1	-.02	-.05	-.10	-.04	-.35	-.60
.2	-.01	-.03	-.04	-.02	-.21	-.28
.3	0.	-.01	-.01	-.01	-.09	-.13
.4	0.	0.	0.	0.	-.03	-.06
.5	0.	0.	0.	0.	-.01	-.02
.6	0.	0.	0.	0.	0.	0.

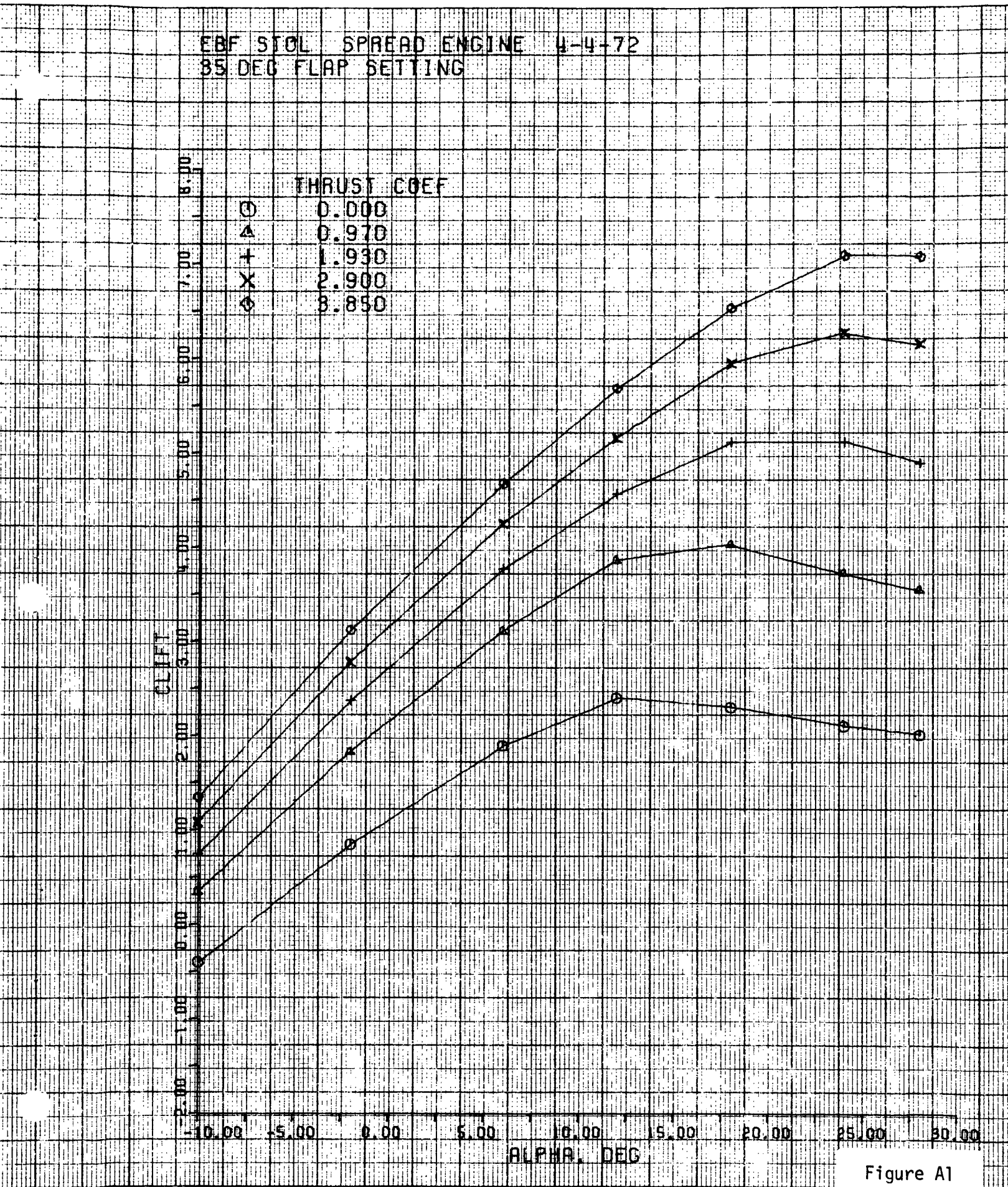
Table AXIII

	$\Delta C_{m.4c_{GE}}$					
δ_{F_3}	35°			70°		
C_j / h/b	0.	1.89	3.78	0.	1.89	3.78
.1	-.09	-.29	-.39	-.12	-.42	-.38
.2	-.08	-.13	-.18	-.07	-.28	-.36
.3	-.03	-.03	-.06	-.04	-.16	-.22
.4	0.	-.01	-.02	-.02	-.08	-.08
.5	0.	0.	-.01	-.01	-.02	-.01
.6	0.	0.	0.	0.	0.	0.

Table AIV

	$C_{L_{max_{3E}}}$	
C_j \ δ_{F_3}	35°	60°
0.	2.4	2.2
0.97	4.03	4.35
1.93	4.92	5.58
2.90	5.87	7.05
3.85	6.29	8.15

Table AXV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2.00
1.00
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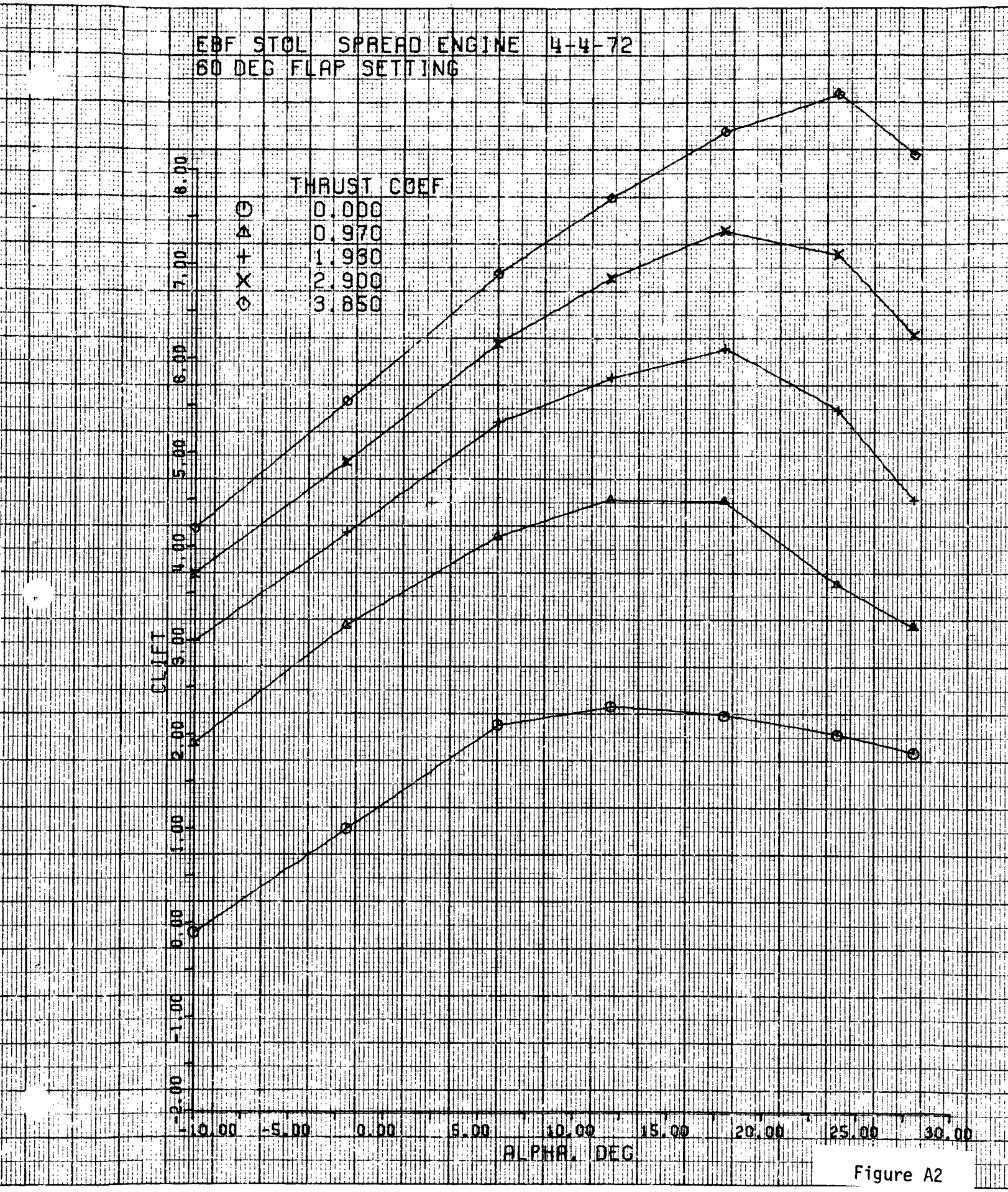
Figure A1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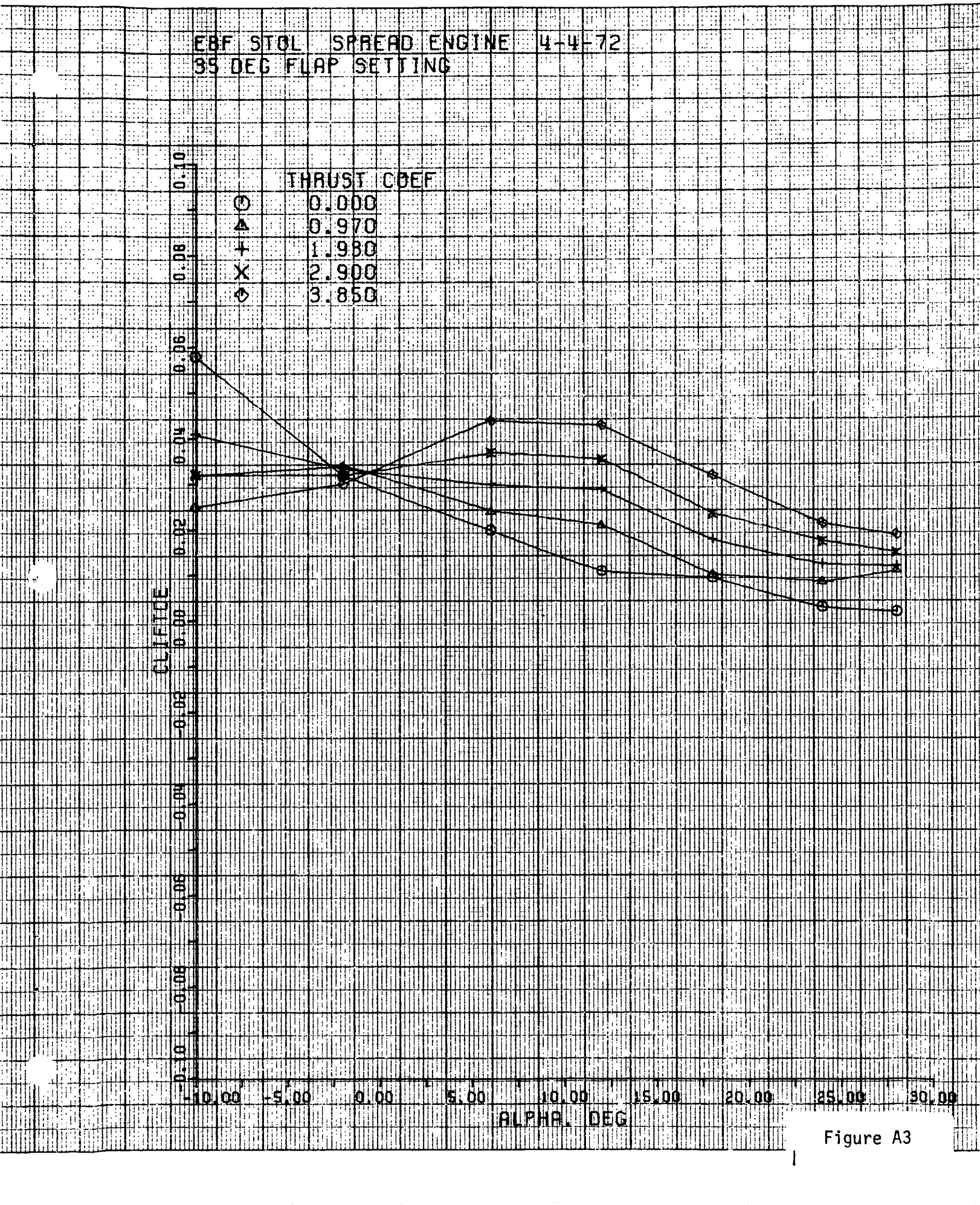
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0.02
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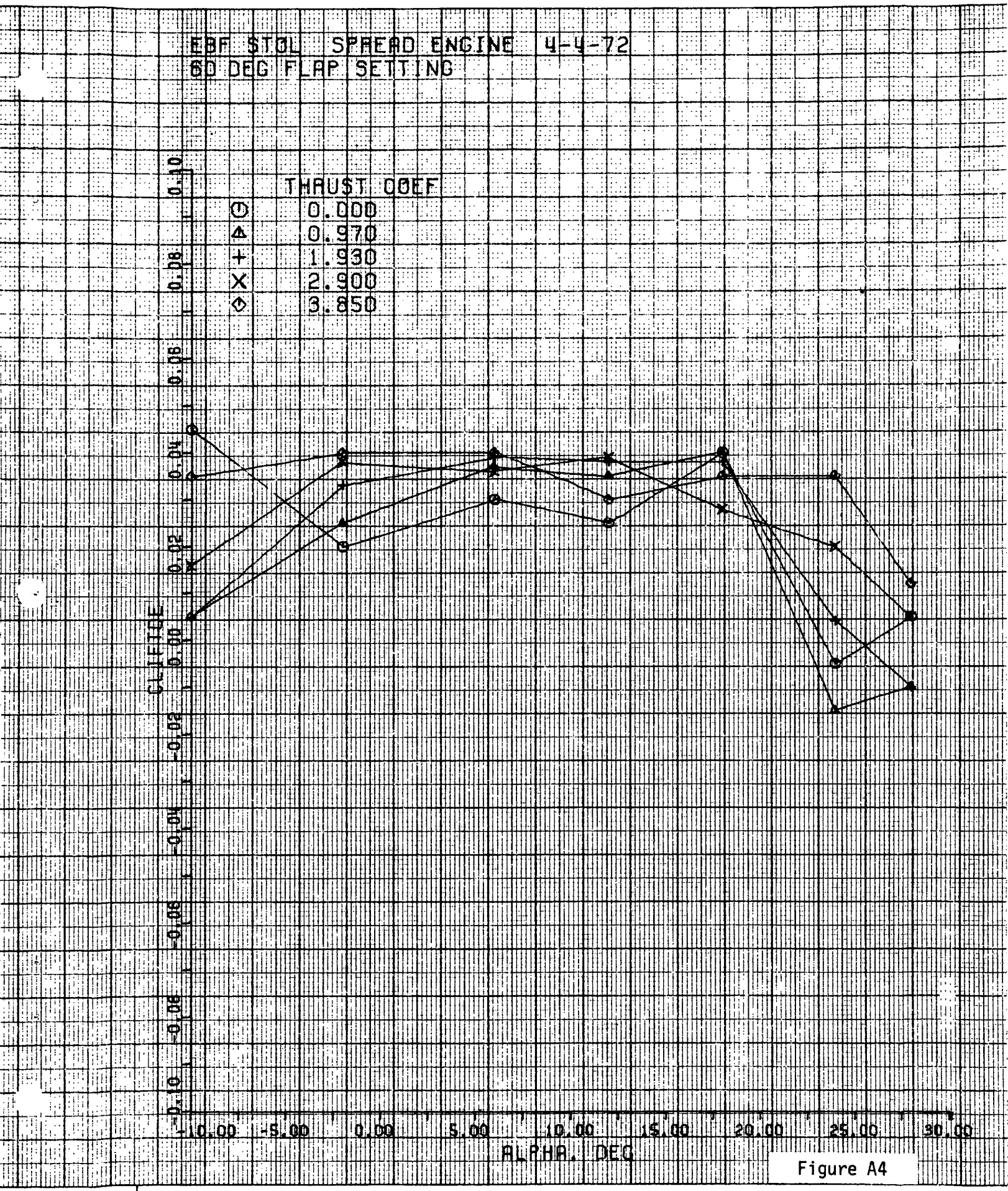
Figure A3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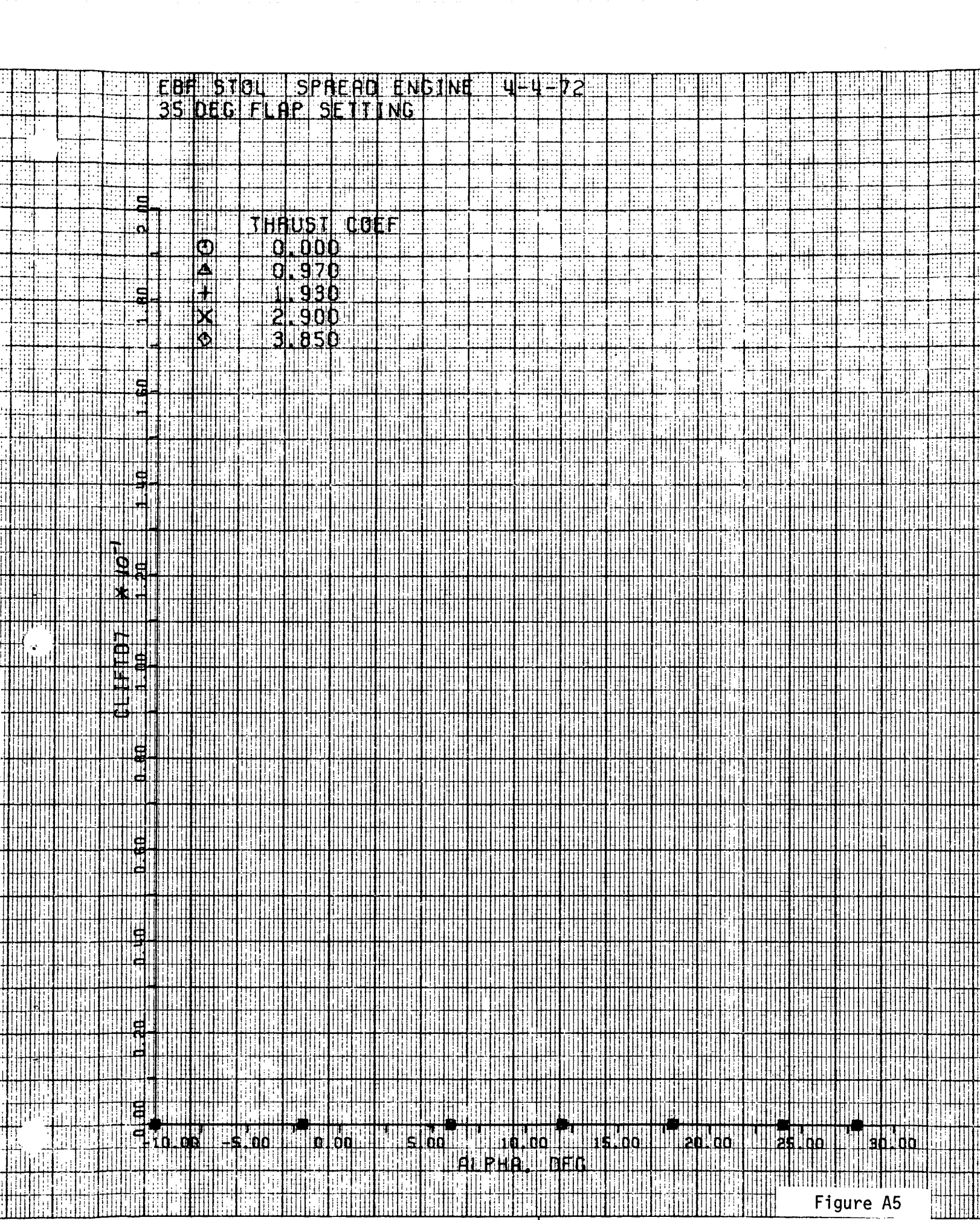
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X 2.900
◇ 3.850
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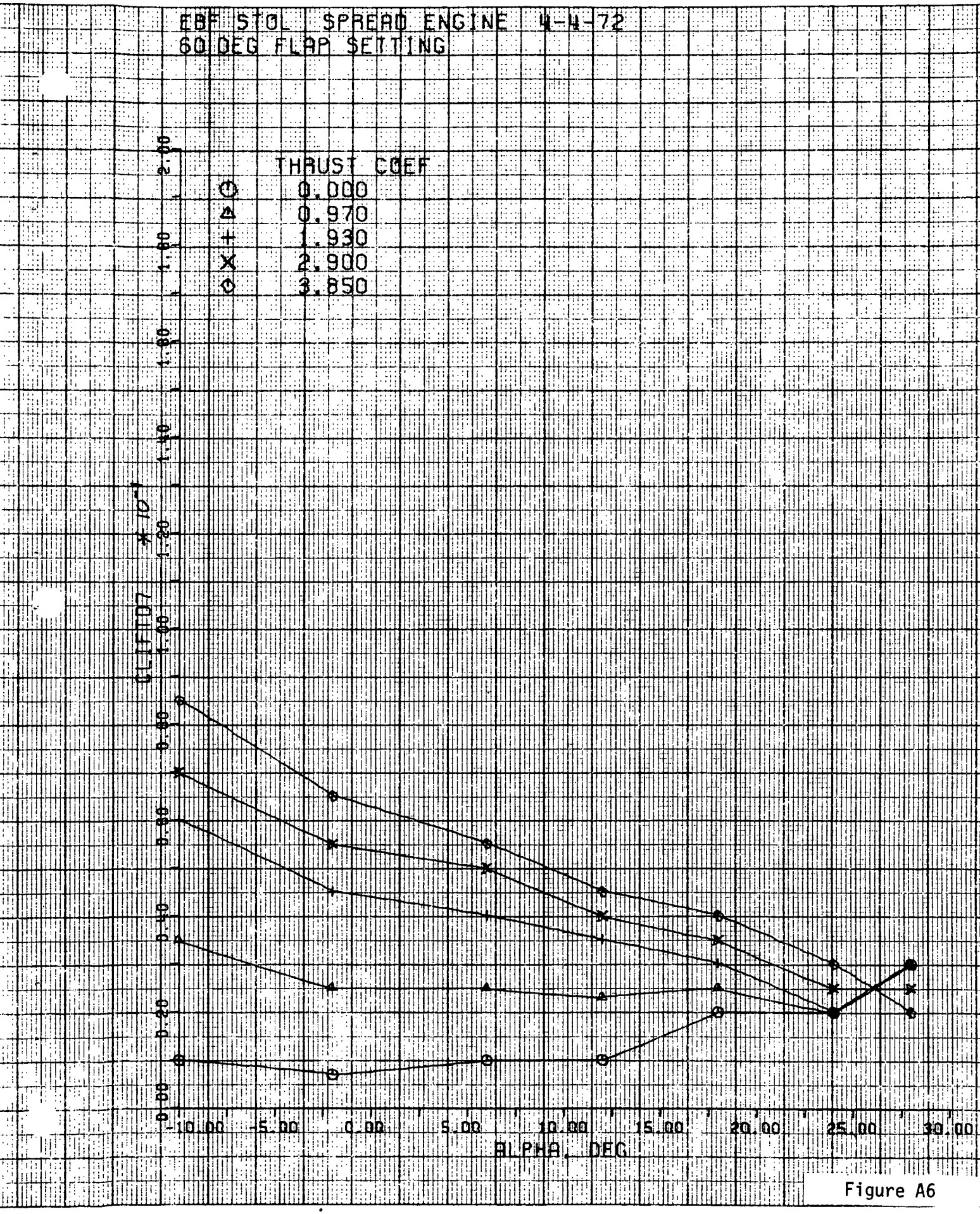
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1.20
1.00
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.40
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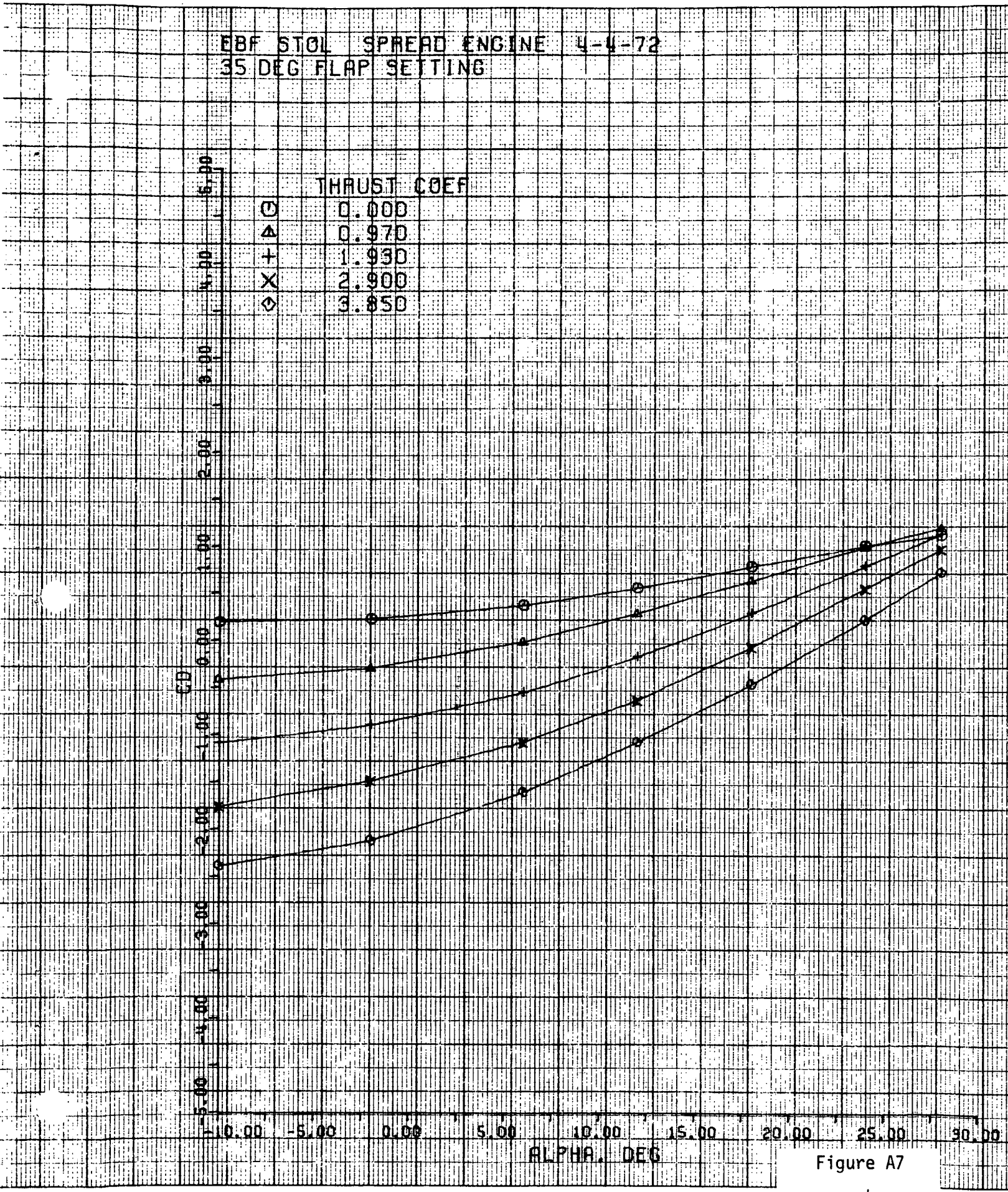
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ALPHA, DEG

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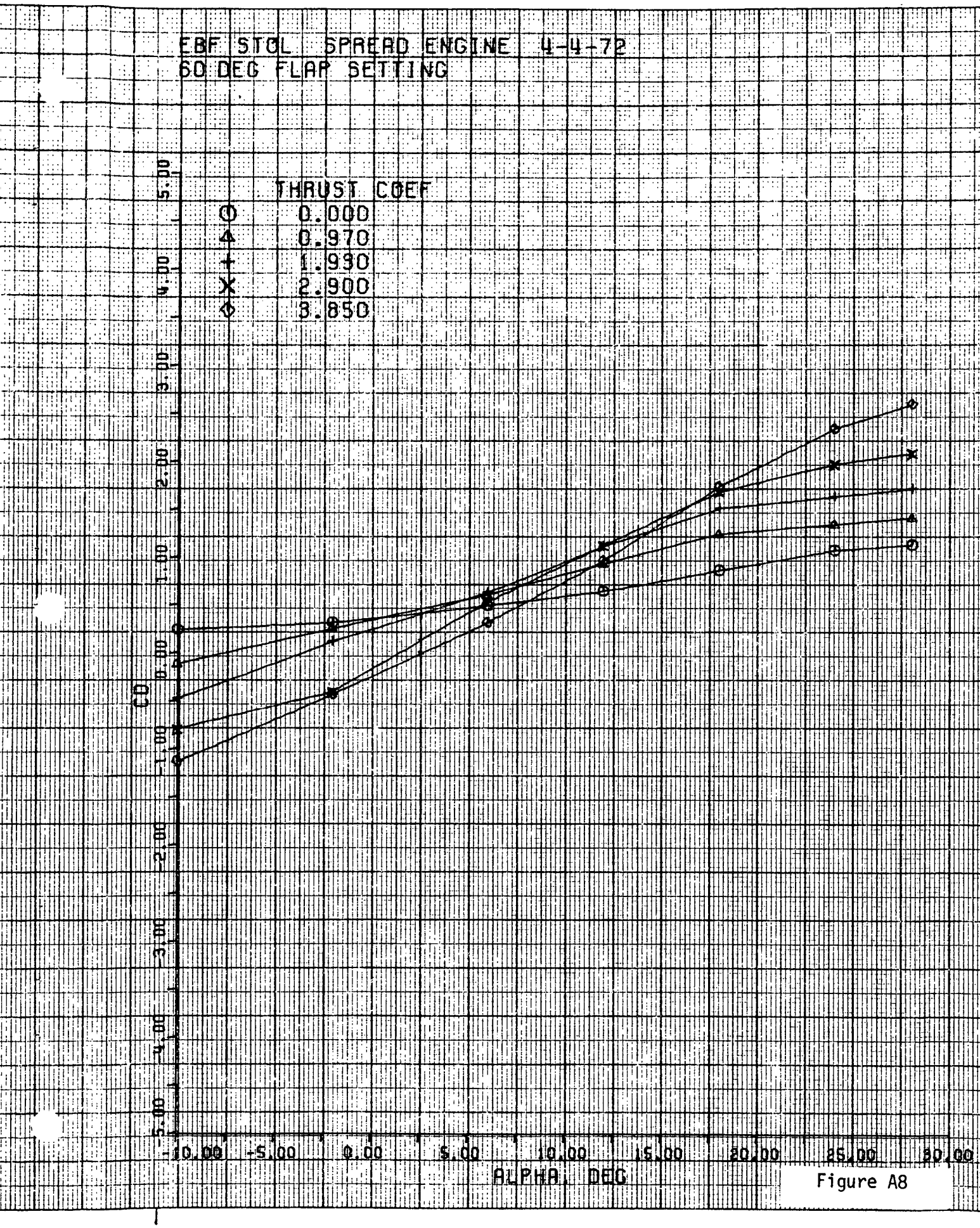
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+ 1.930
X 2.900
◇ 3.850
CL
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
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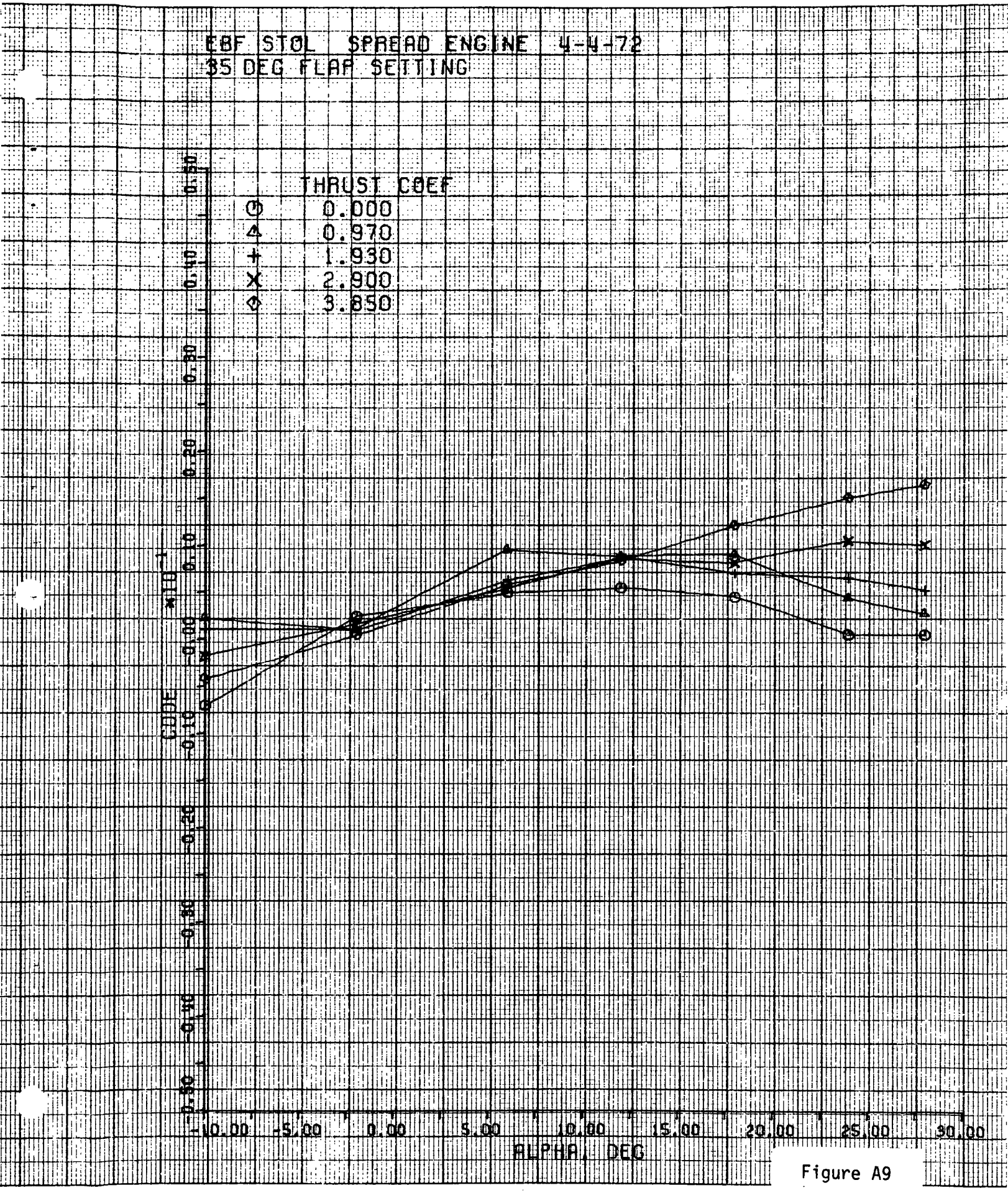
Figure A8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2.900
3.850
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0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
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25.00
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ALPHA, DEG

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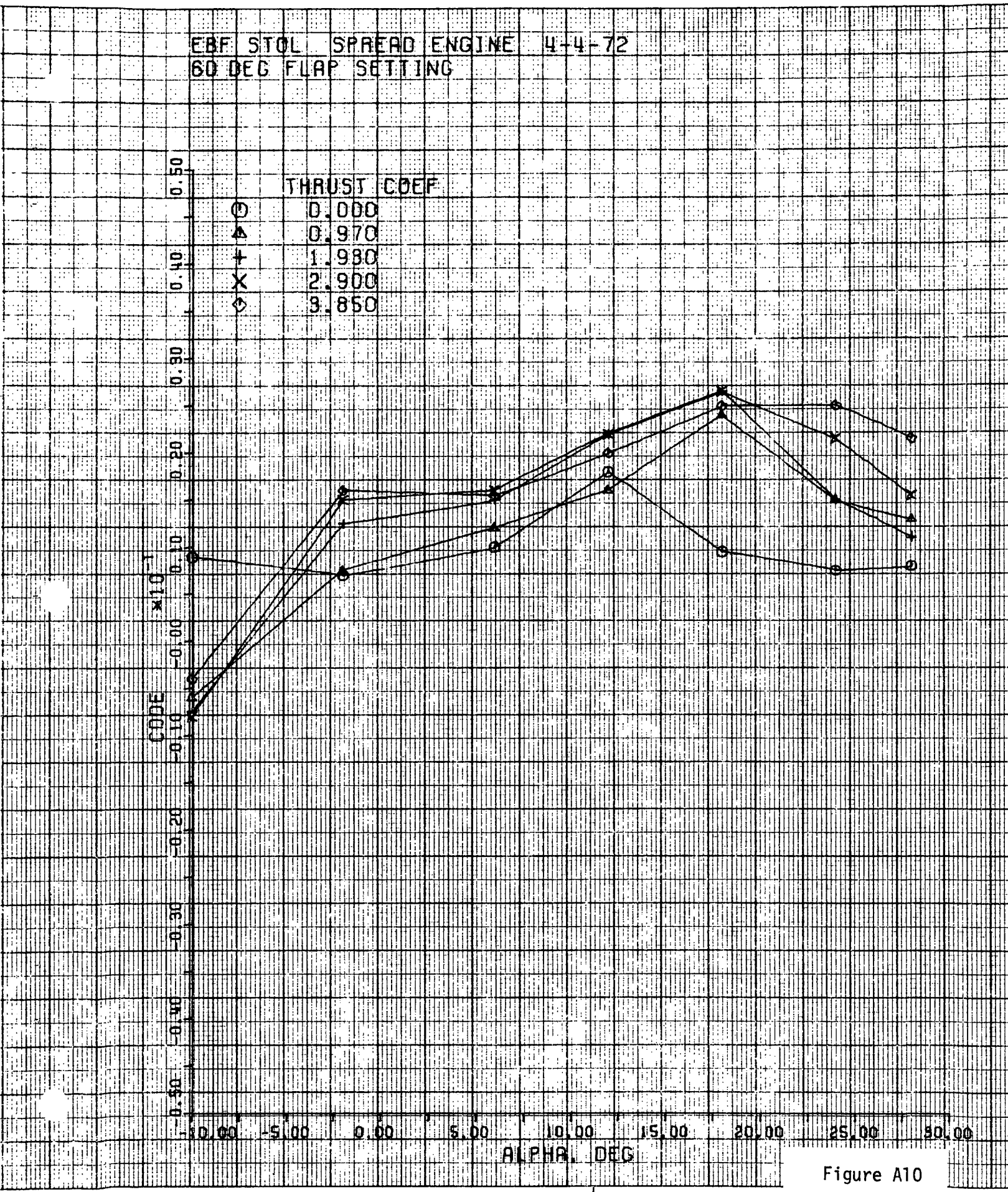
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ALPHA, DEG

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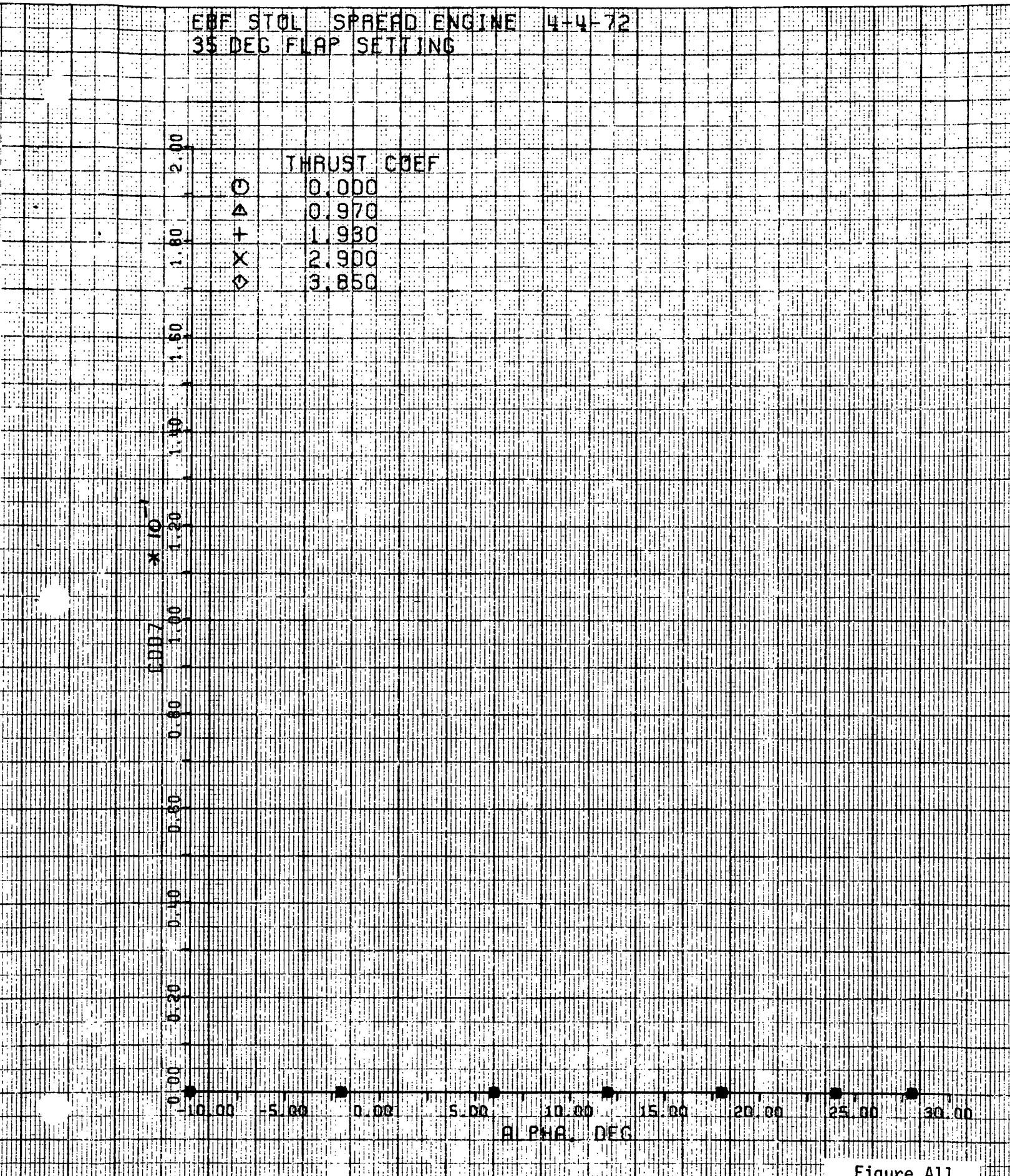
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+ 1.930
X 2.900
◇ 3.850
CDT * 10
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1.60
1.40
1.20
1.00
0.80
0.60
0.40
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0.00
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-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A11

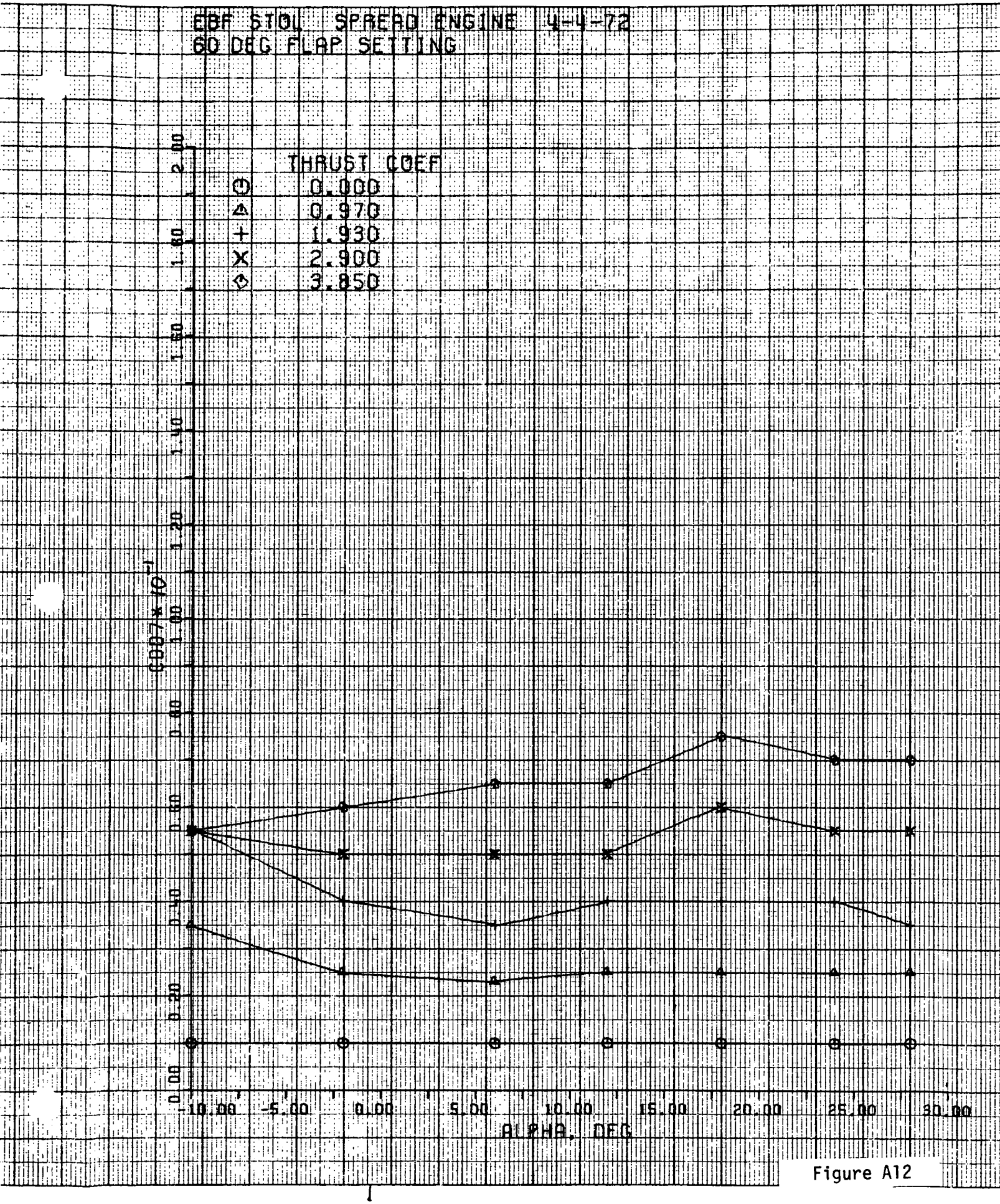
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CD7*AR
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A12

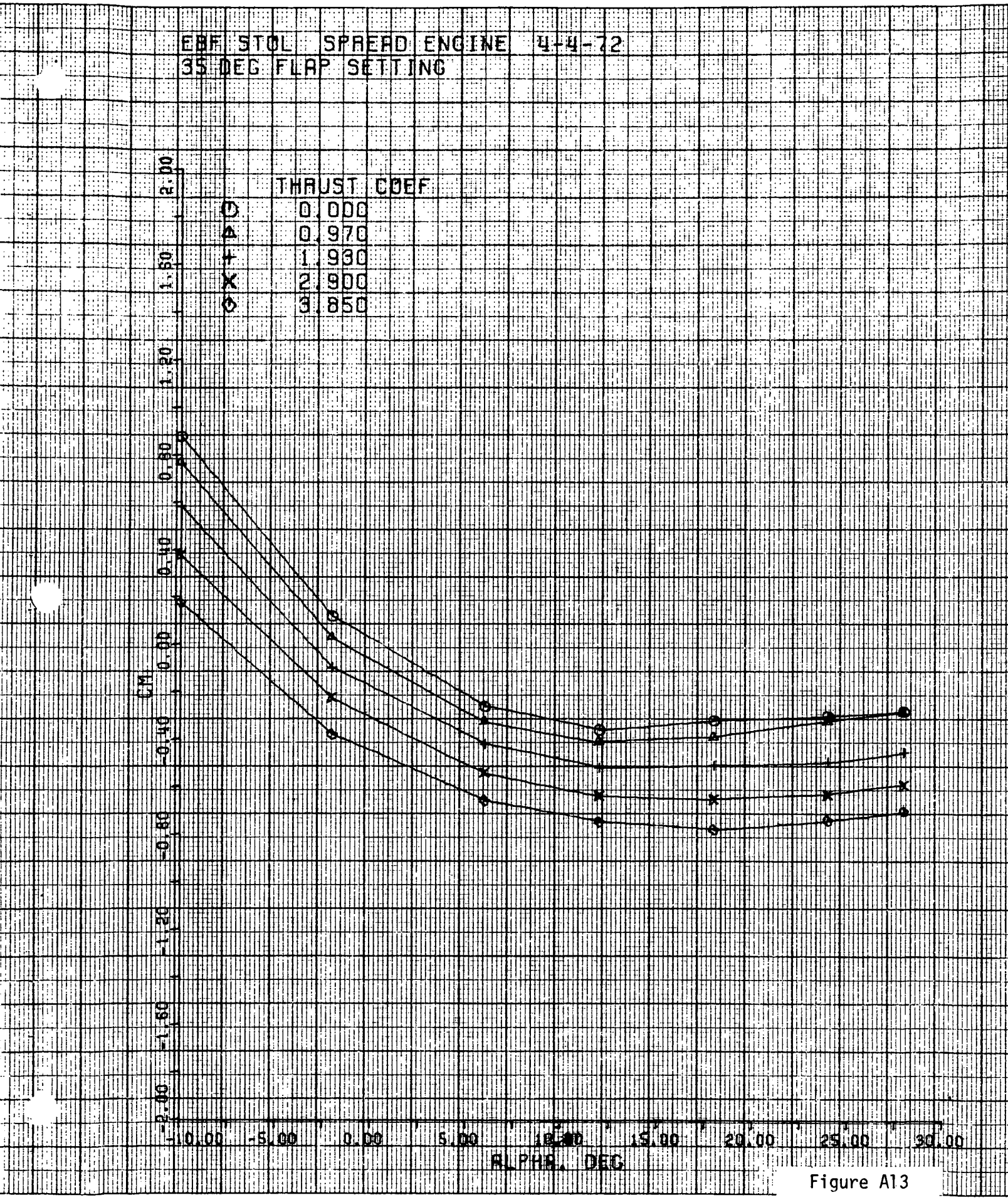
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0 0.000
Δ 0.970
+ 1.930
X 2.900
◇ 3.850
CM
2.00
1.60
1.20
0.80
0.40
0.00
-0.40
-0.80
-1.20
-1.60
-2.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A13

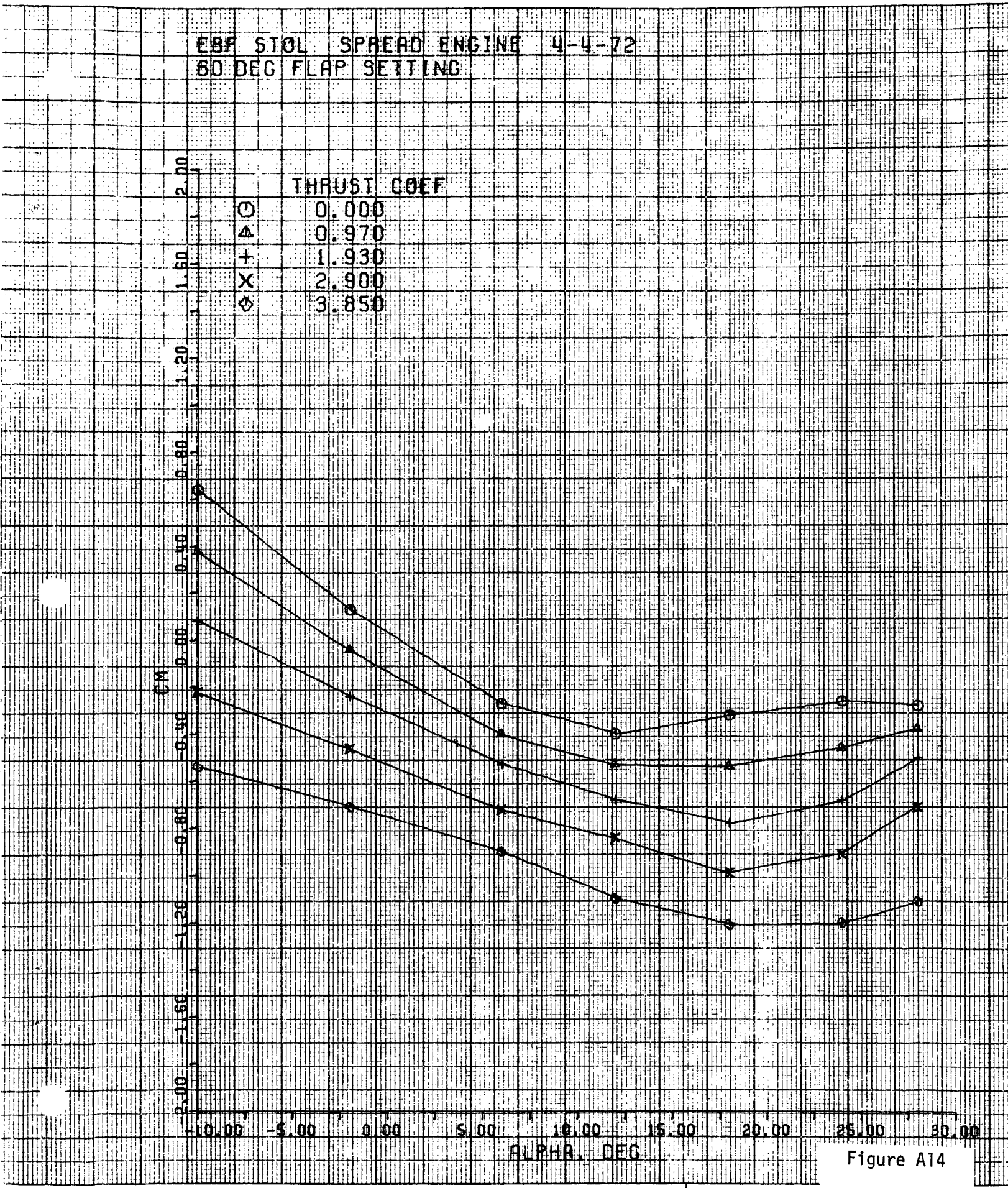
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CM
2.00
1.60
1.20
0.80
0.40
0.00
-0.40
-0.80
-1.20
-1.60
-2.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A14

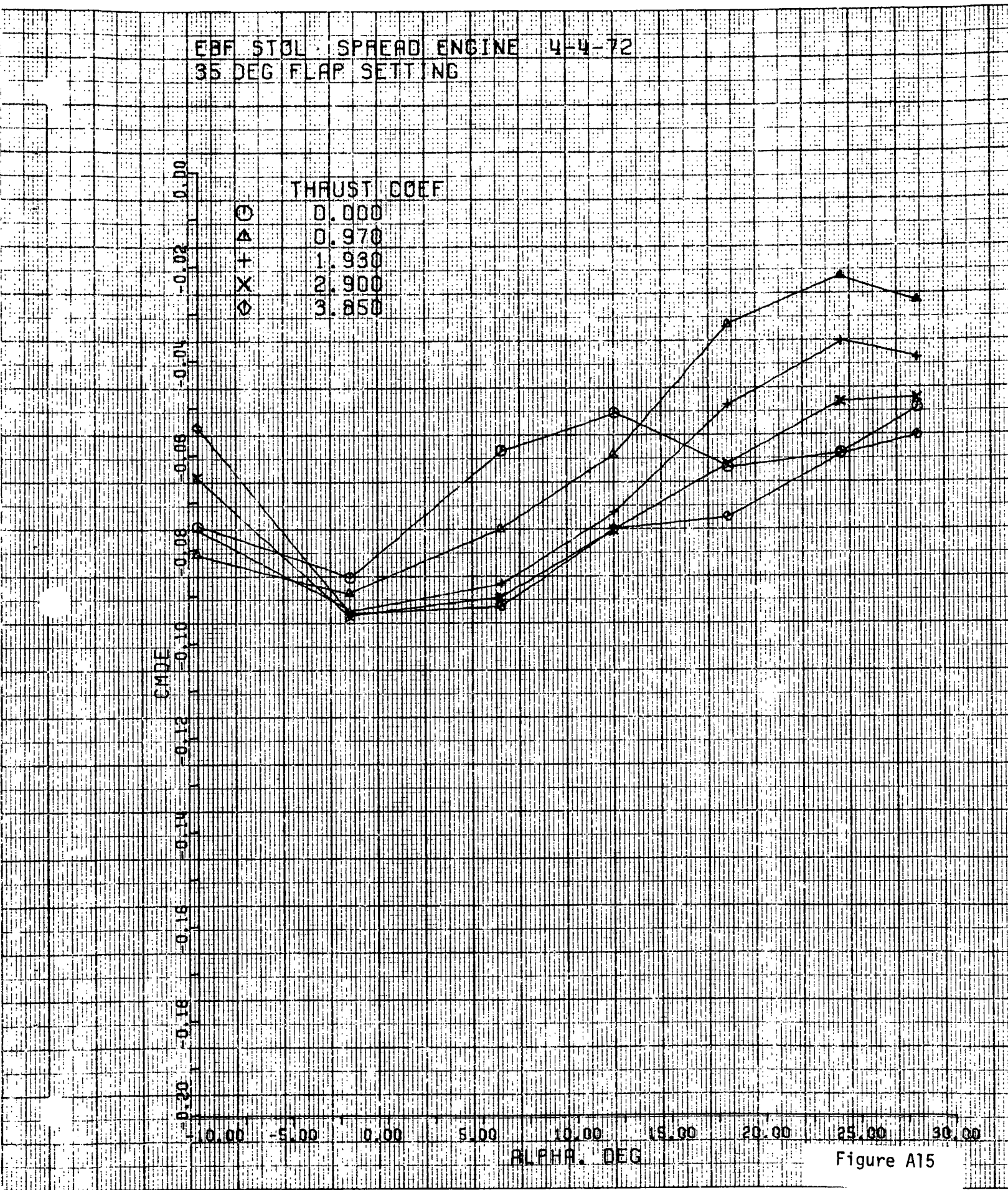
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CMDE
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
-0.18
-0.20
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A15

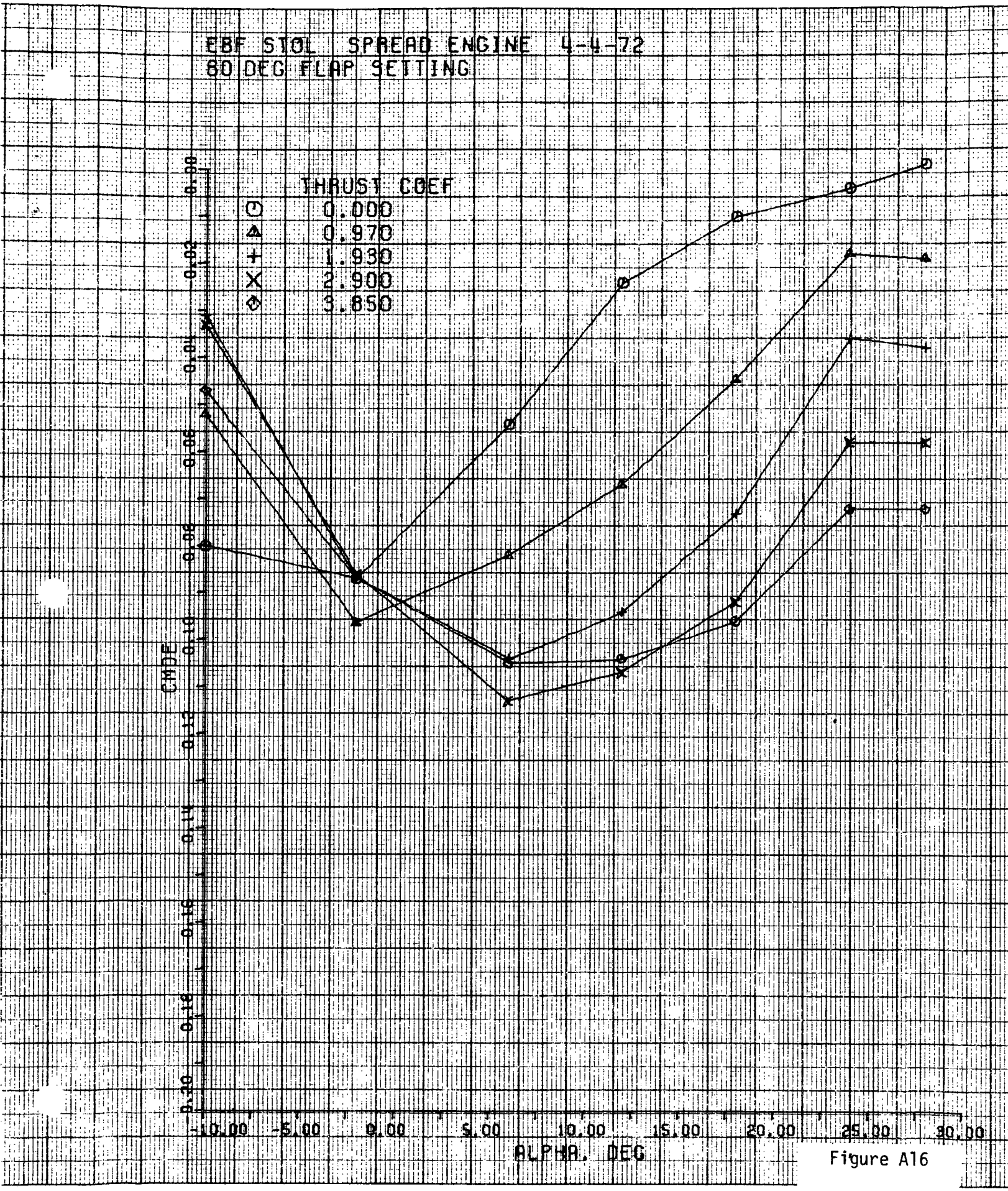
EBF STOL SPREAD ENGINE 4-4-72
80 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CMDE
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
-0.18
-0.20
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A16

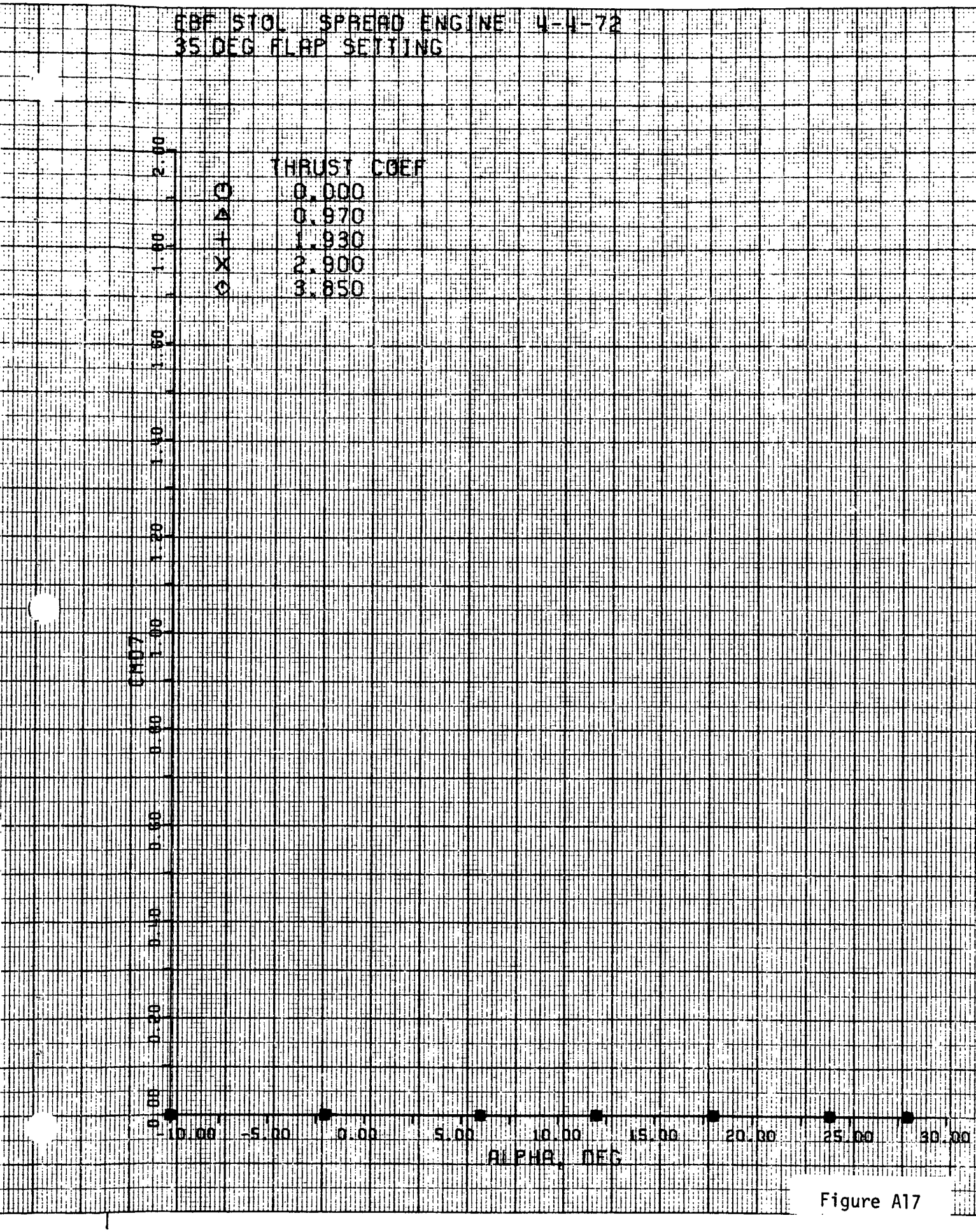
CBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0 0.000
Δ 0.970
+ 1.930
X 2.900
◇ 3.850
CMOT
2.80
2.40
2.00
1.60
1.20
0.80
0.40
0.00
-0.40
-0.80
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A17

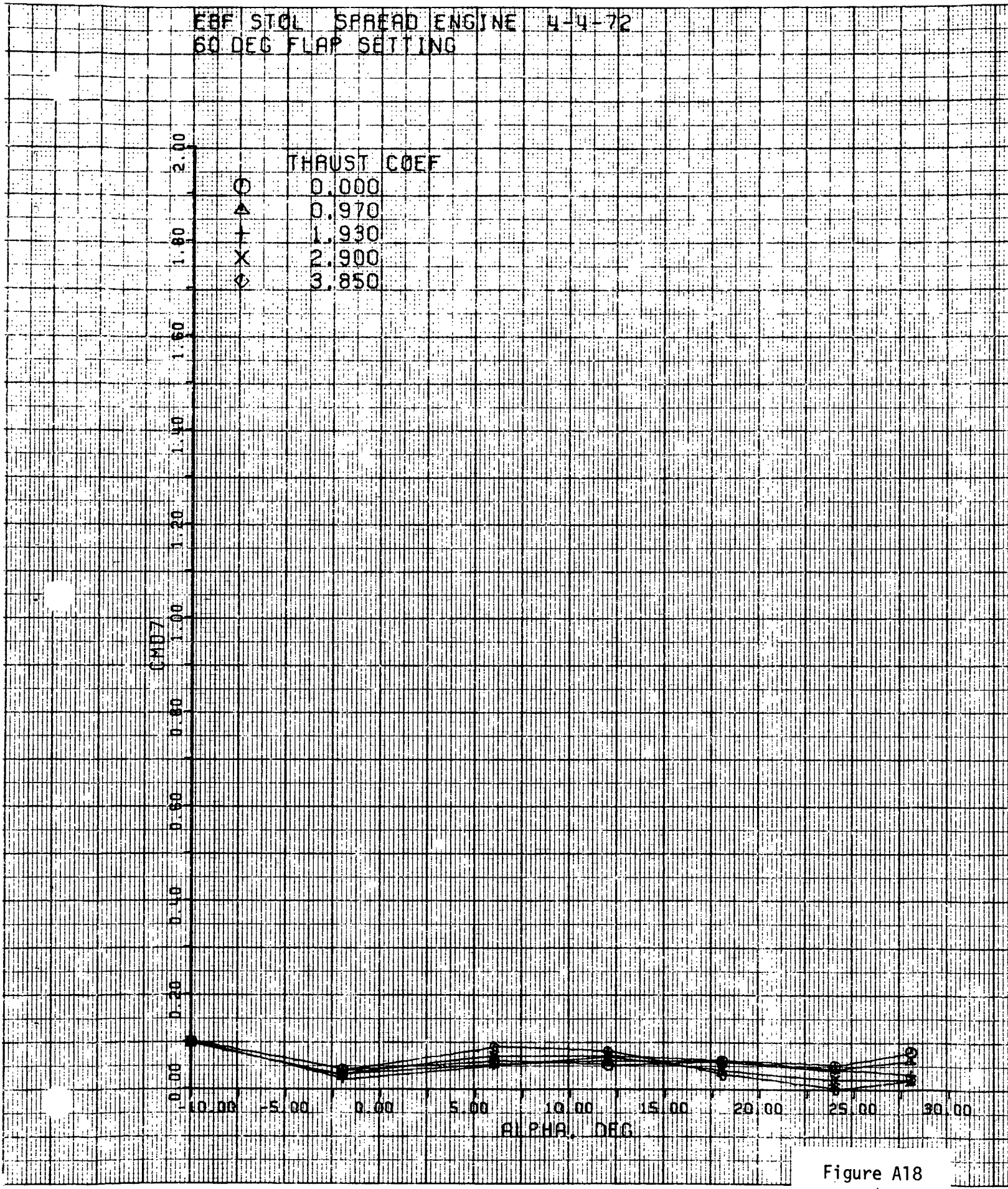
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CMDZ
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A18

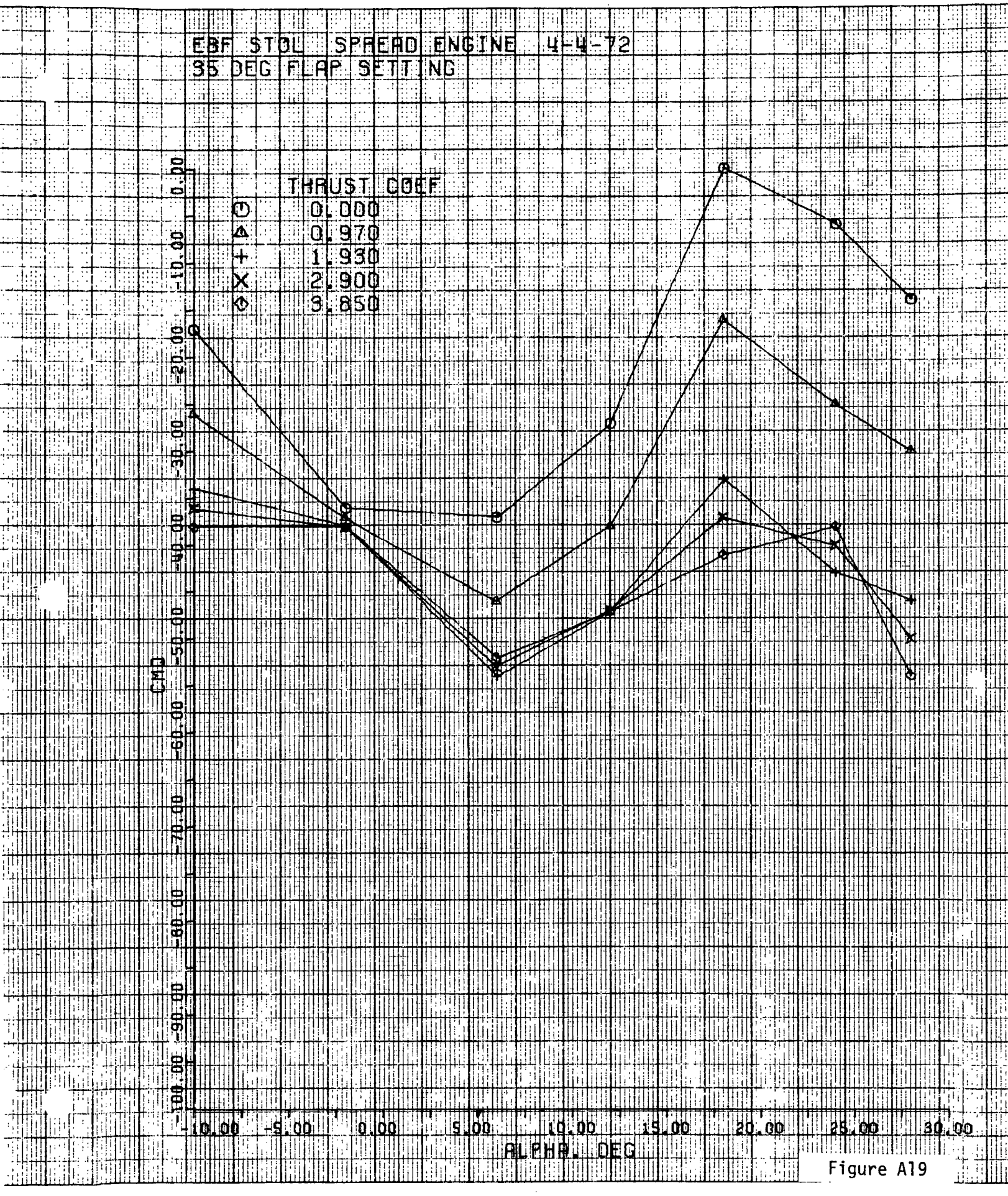
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CMD
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-80.00
-90.00
-100.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A19

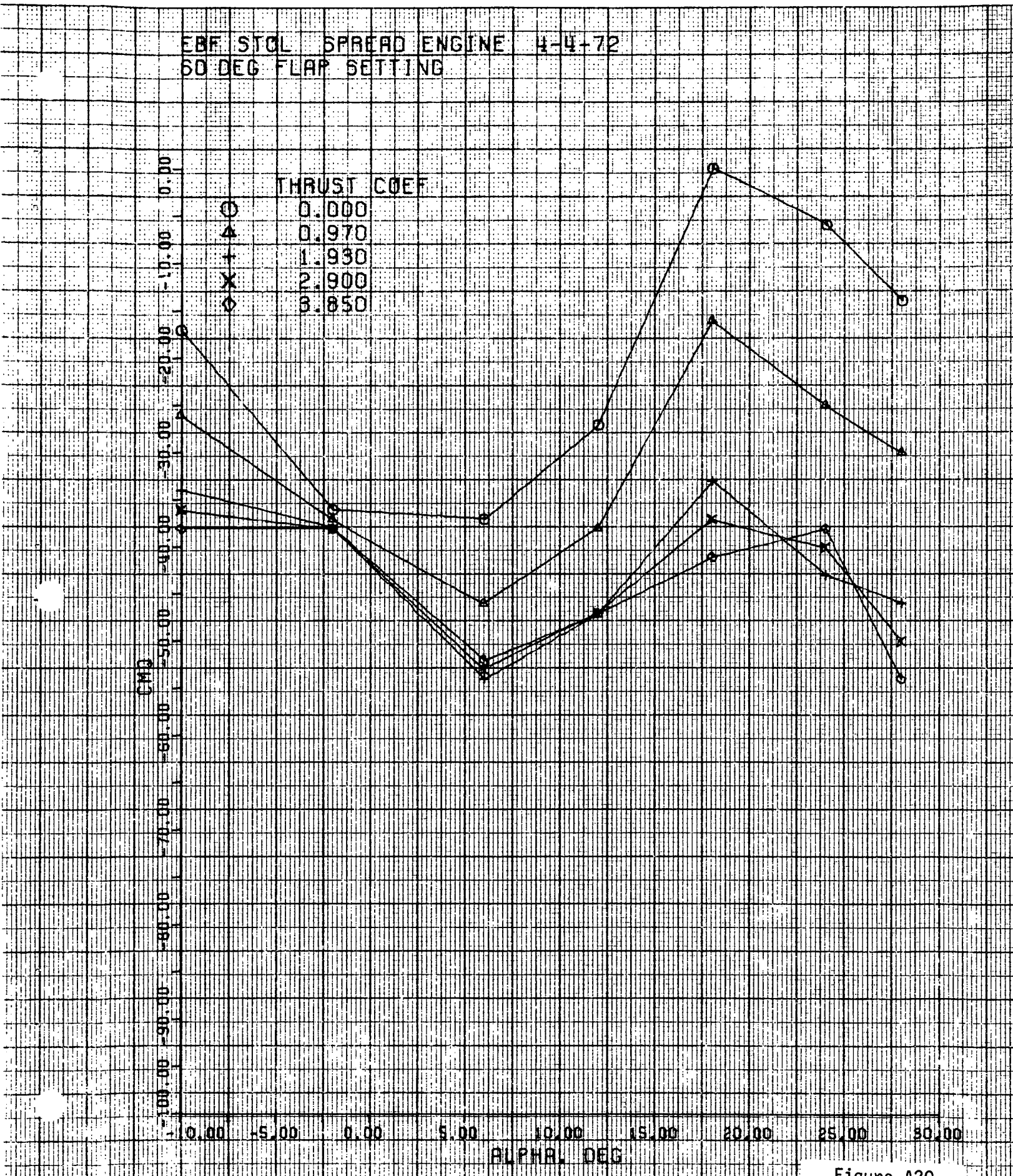
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CMQ
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-80.00
-90.00
-100.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A20

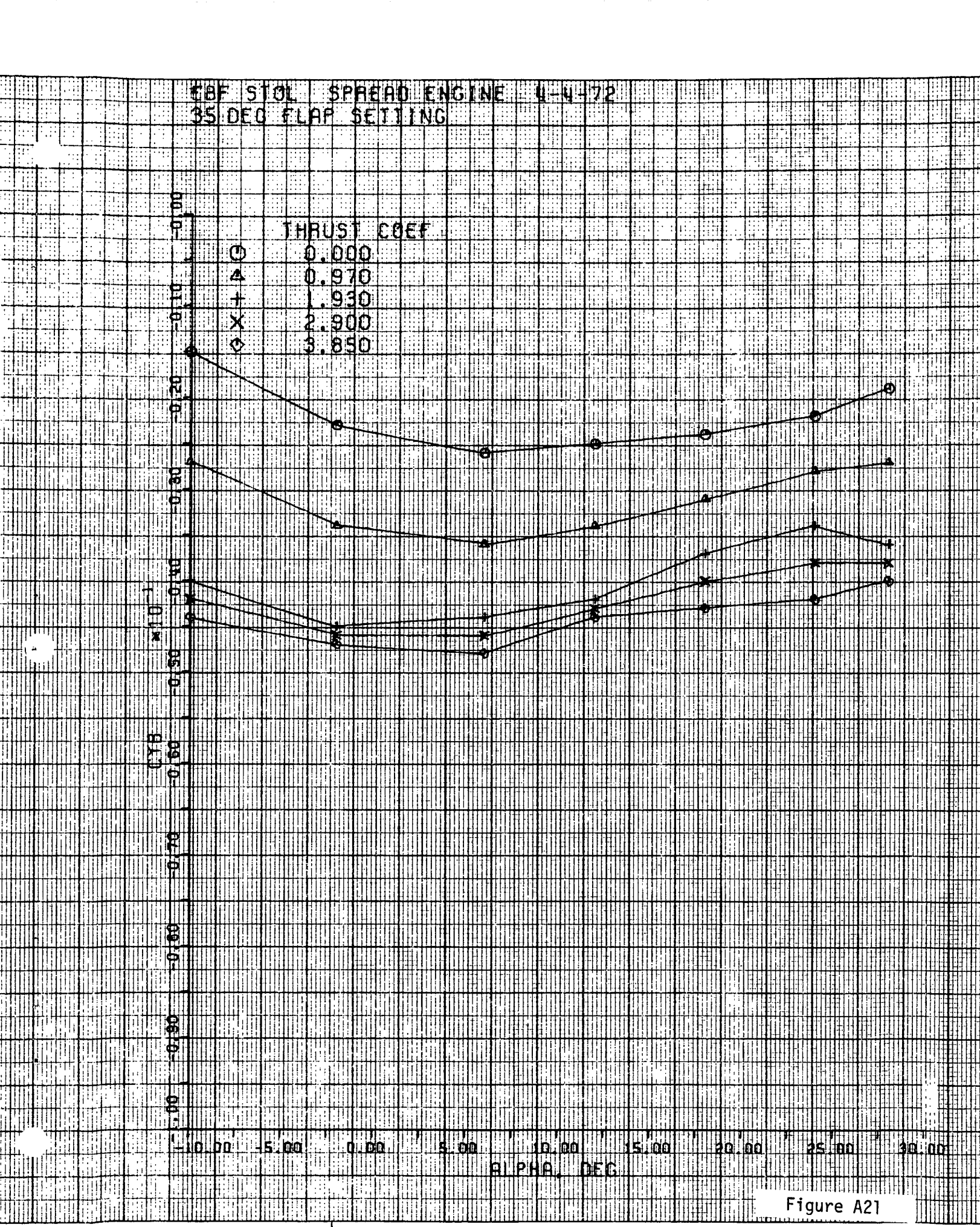
CBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CYB (1/D)
-0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A21

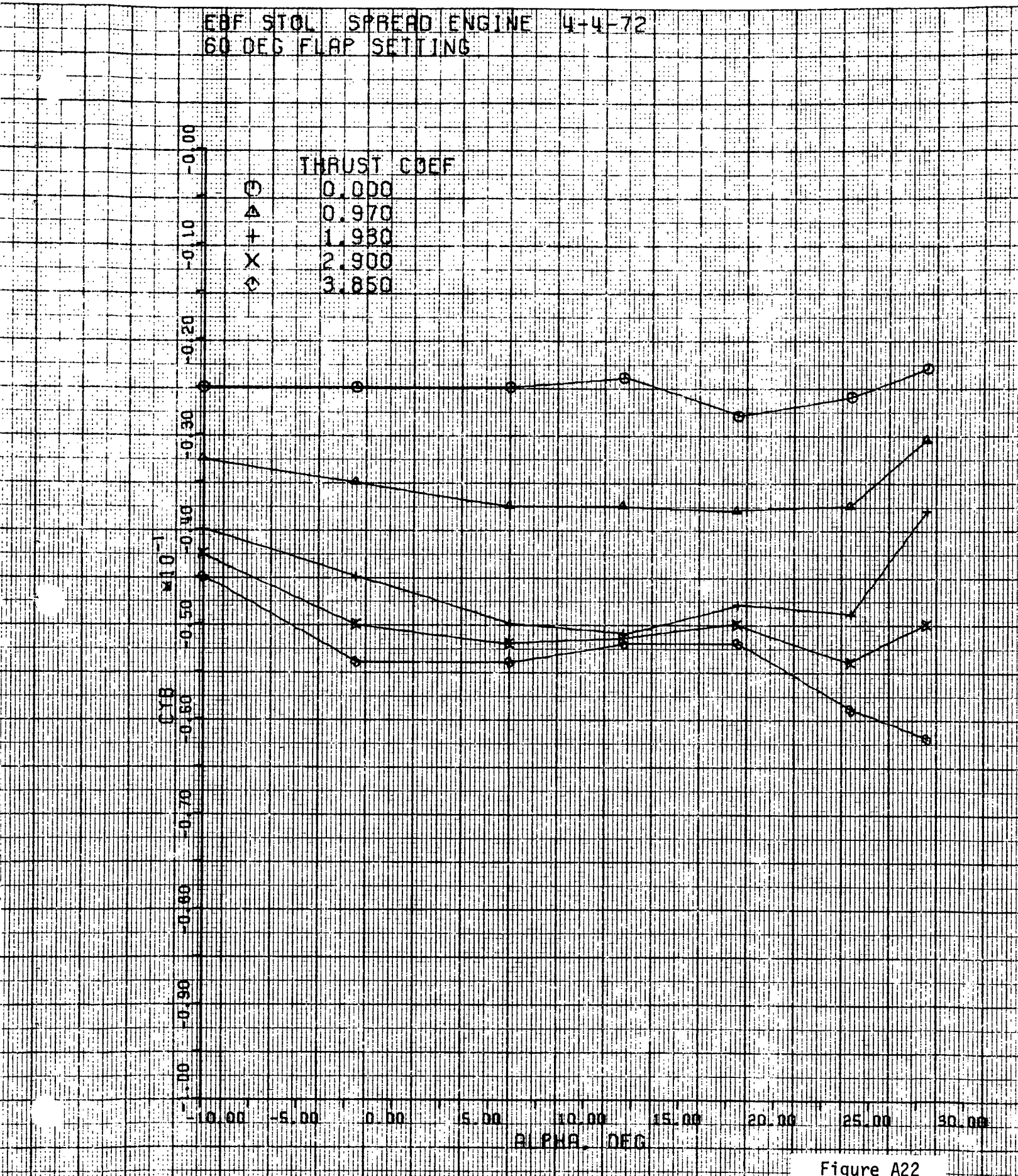
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CYB
-0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A22

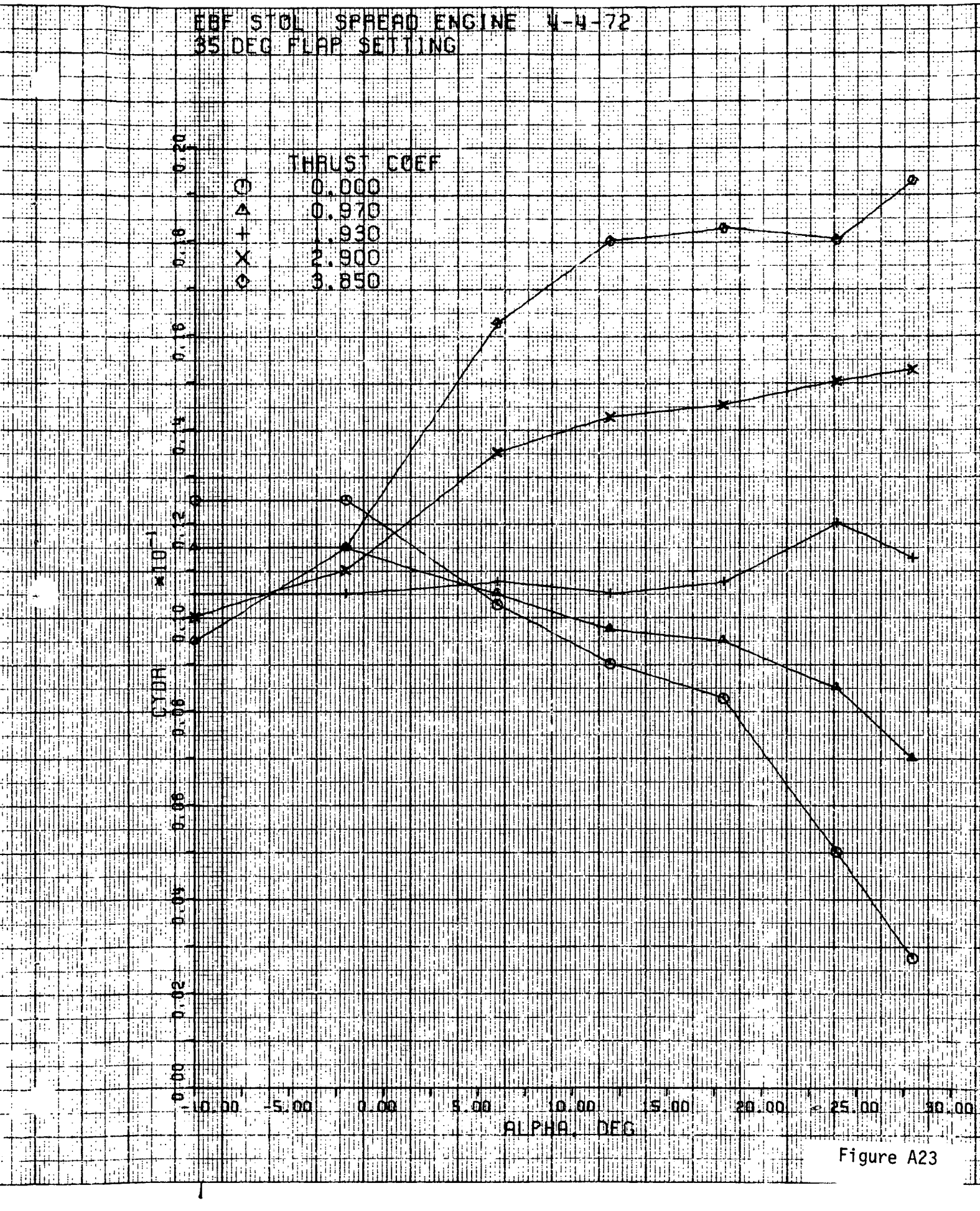
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CYDR *10⁻¹
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A23

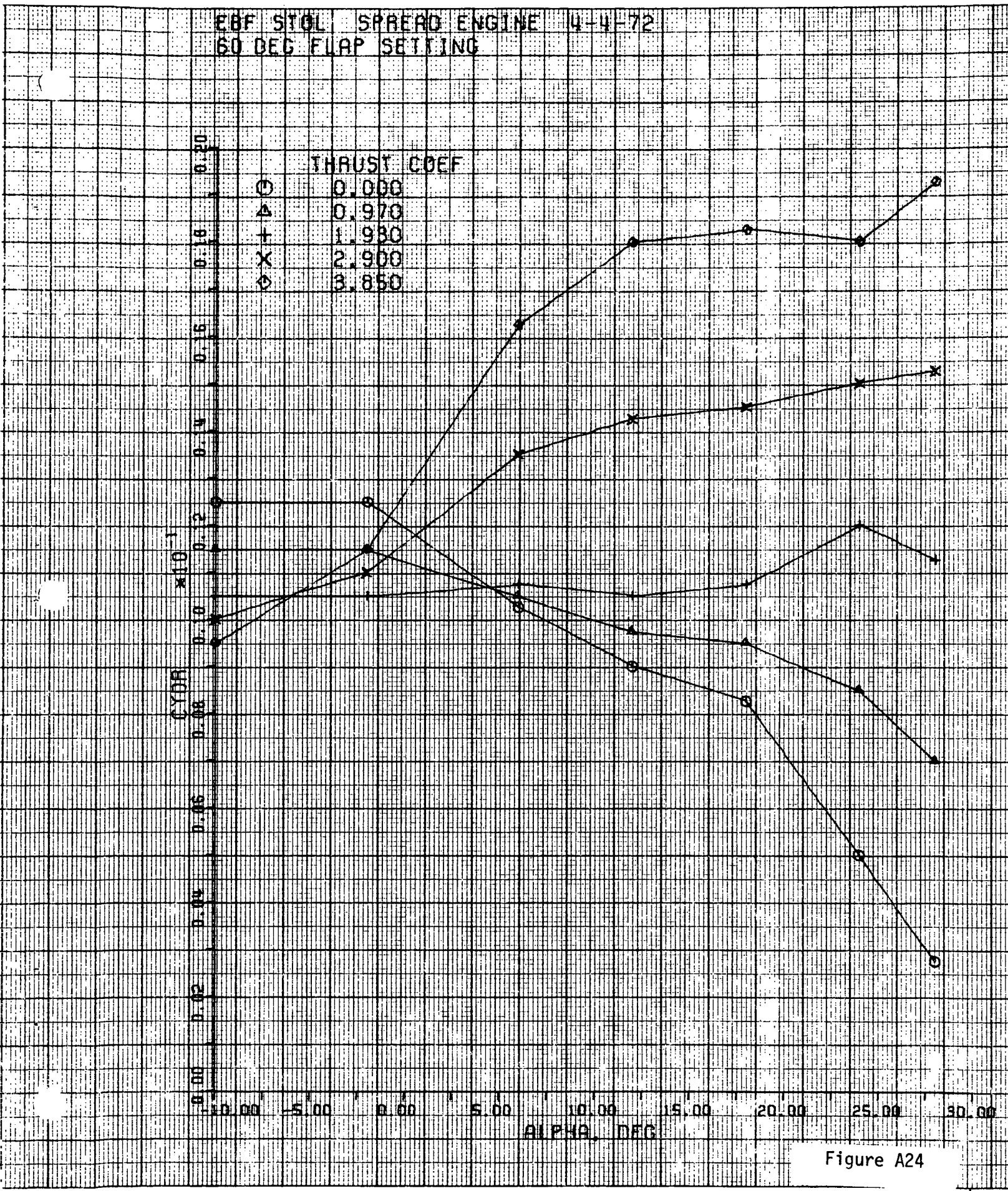
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0 0.000
Δ 0.970
+ 1.930
X 2.900
◇ 3.850
CYDR *10-1
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
0.20
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A24

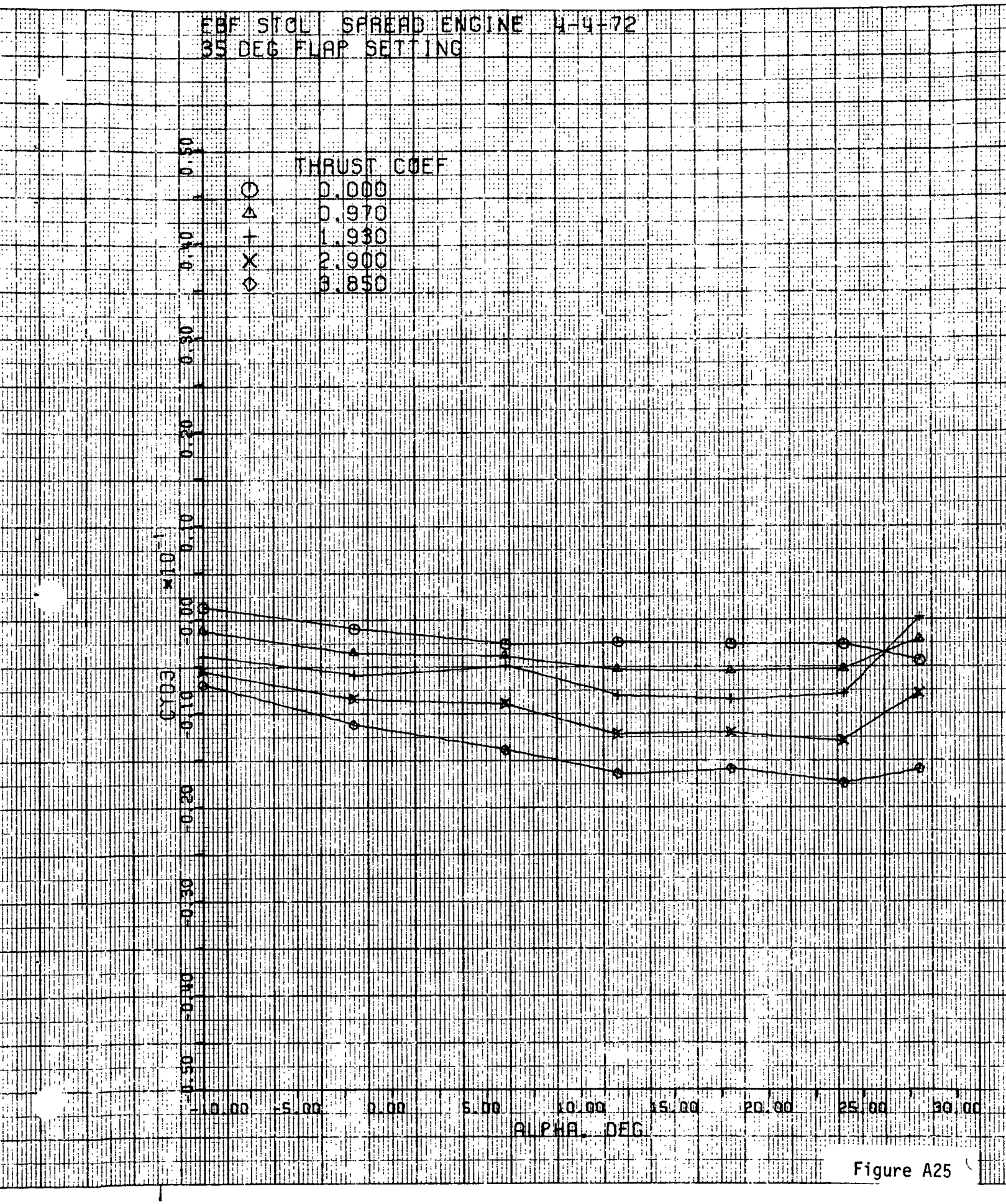
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CD
CL
CM
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A25

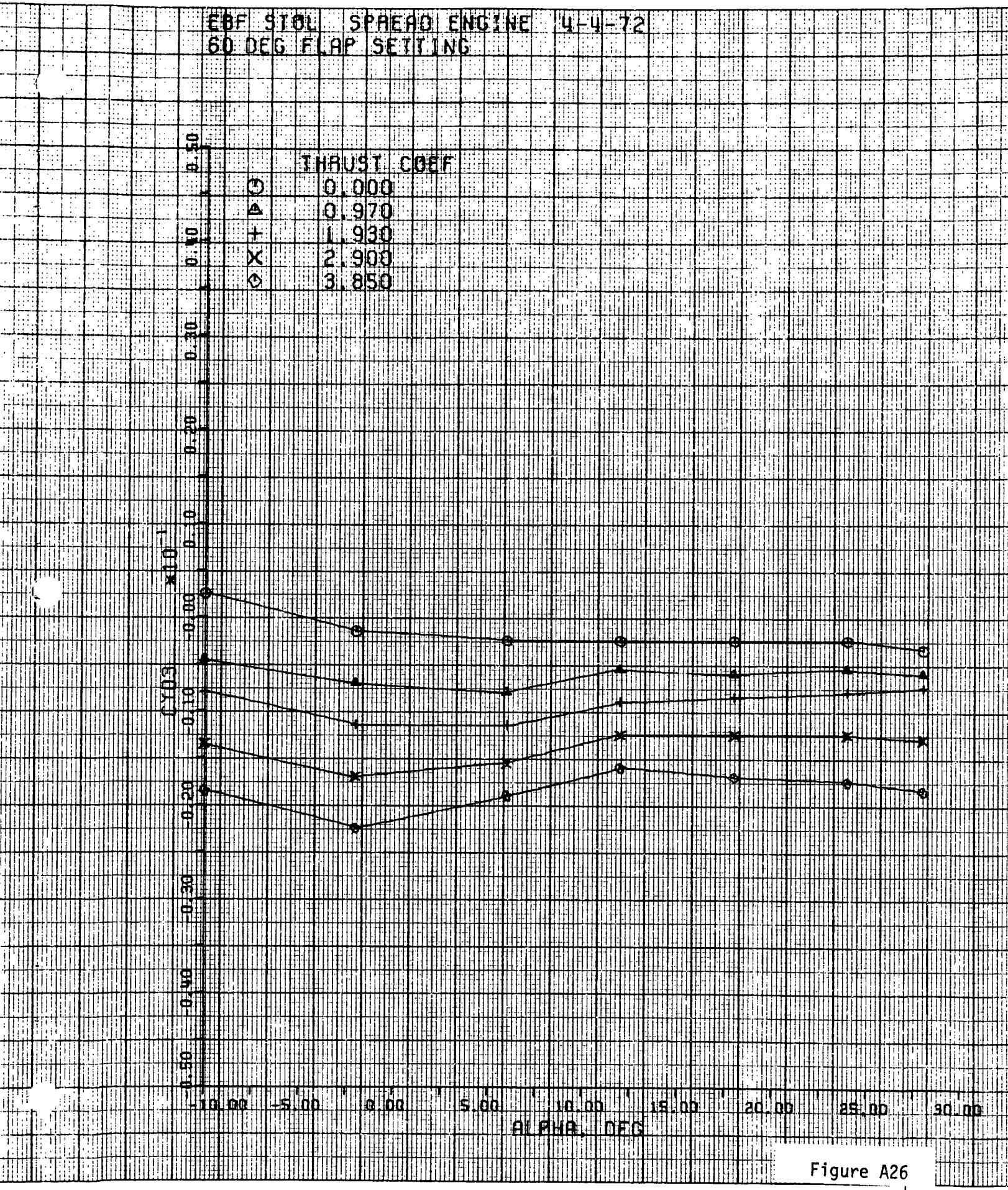
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CY03 x10⁻¹
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A26

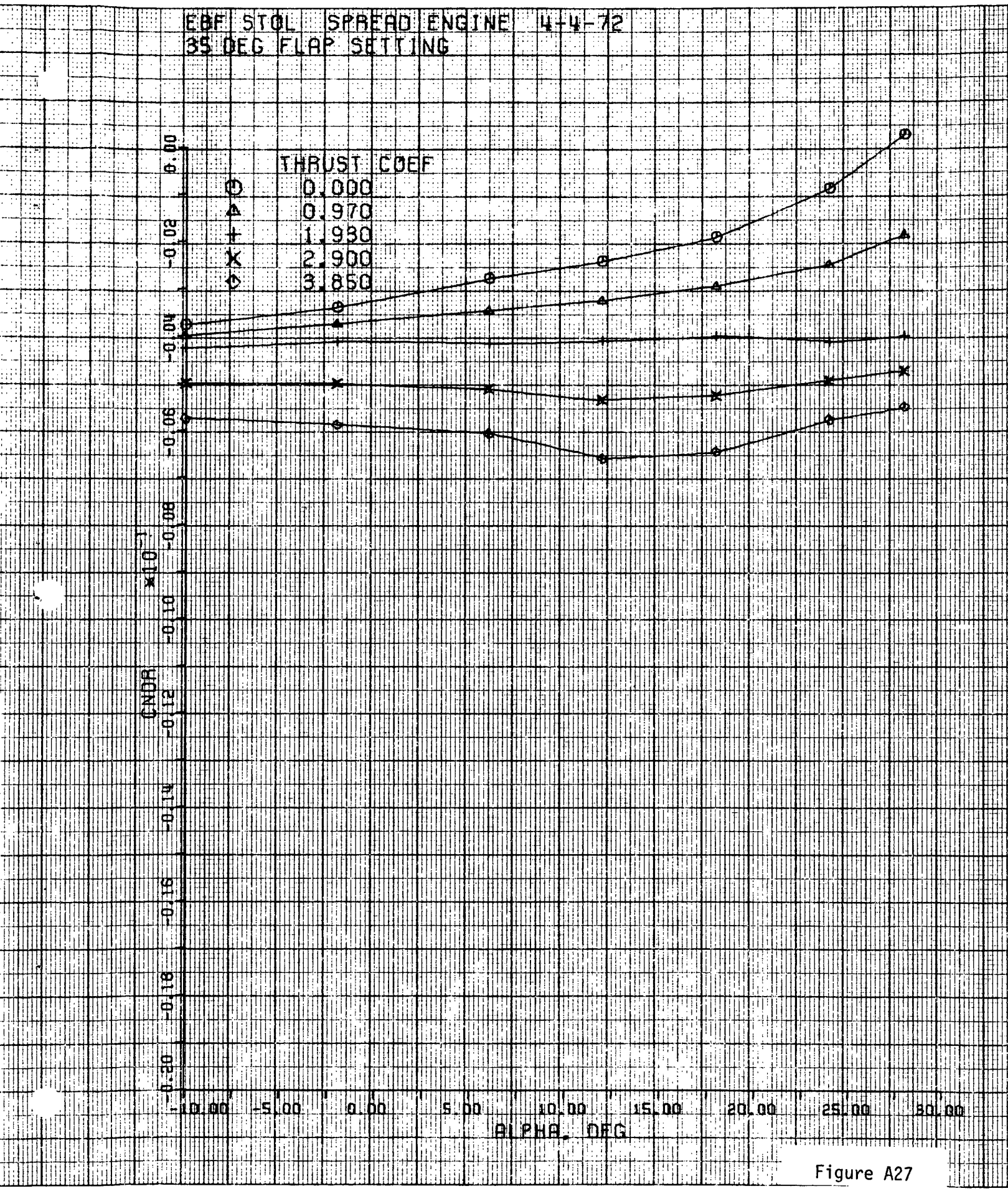
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CNBA *10**-1
.60
.40
.20
.00
-.20
-.40
-.60
-.80
-1.00
-1.21
-1.41
-1.61
-1.81
-2.02
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A27

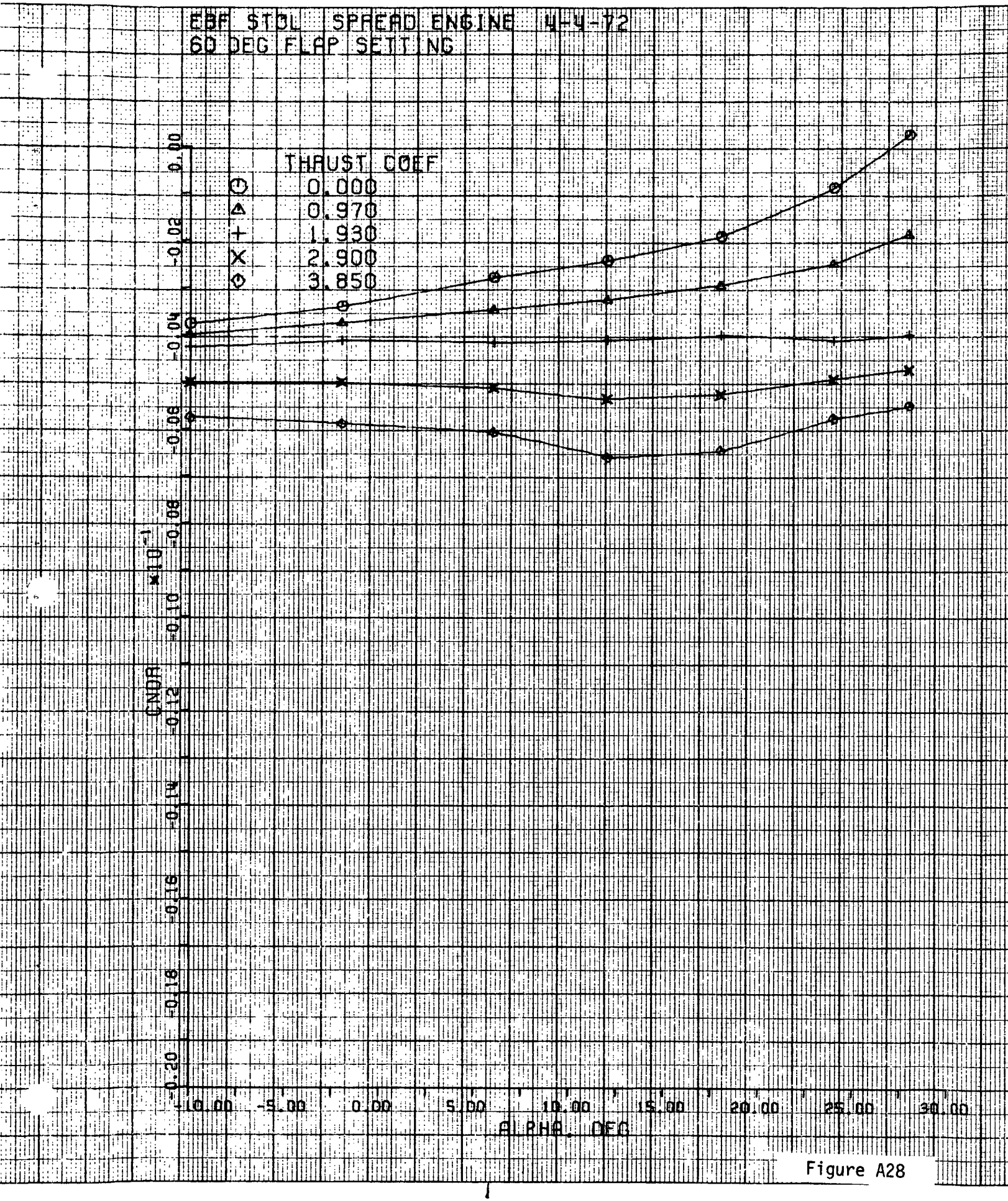
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CNDR
×10⁻¹
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
-0.18
-0.20
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A28

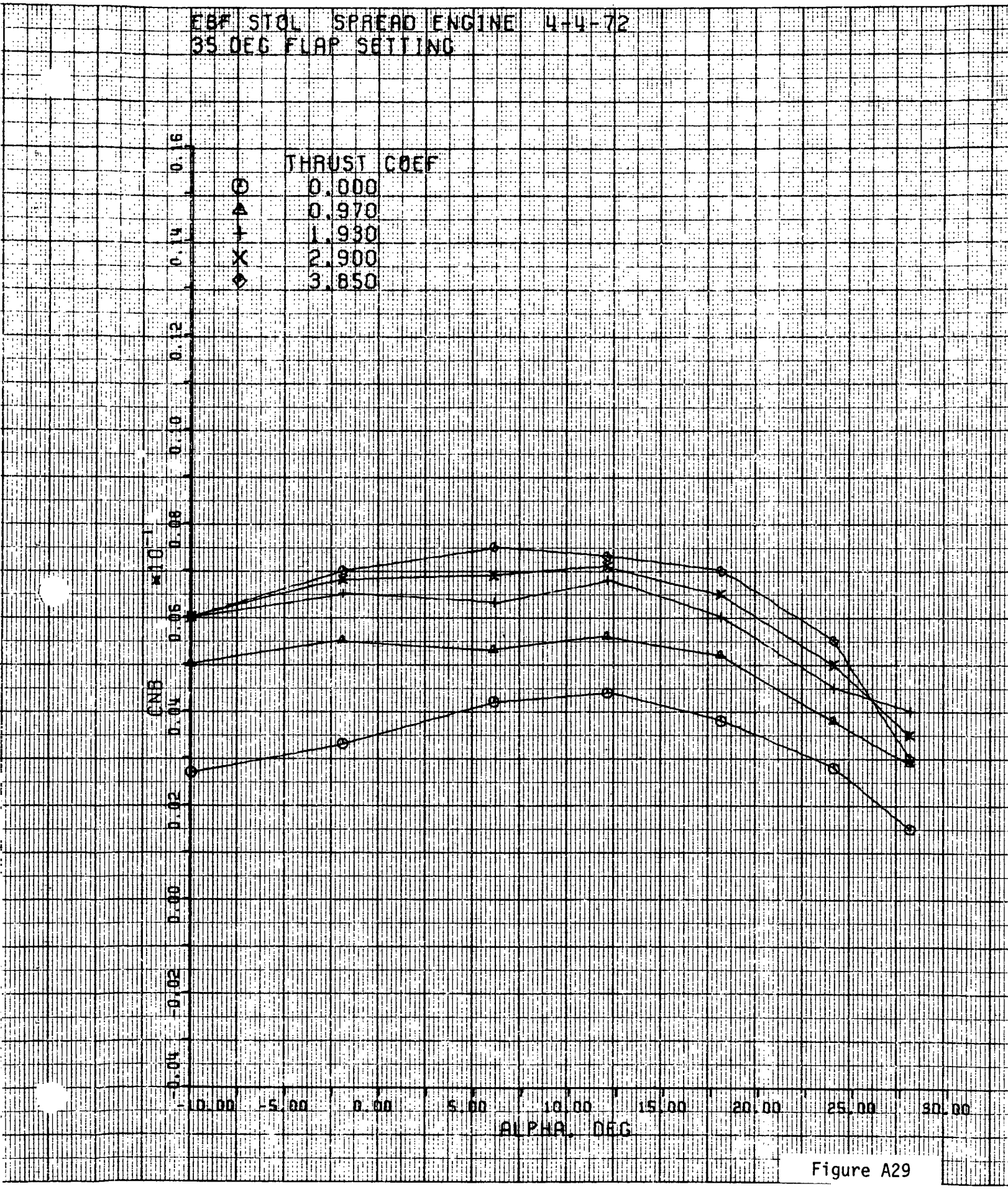
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CNB
×10⁻¹
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A29

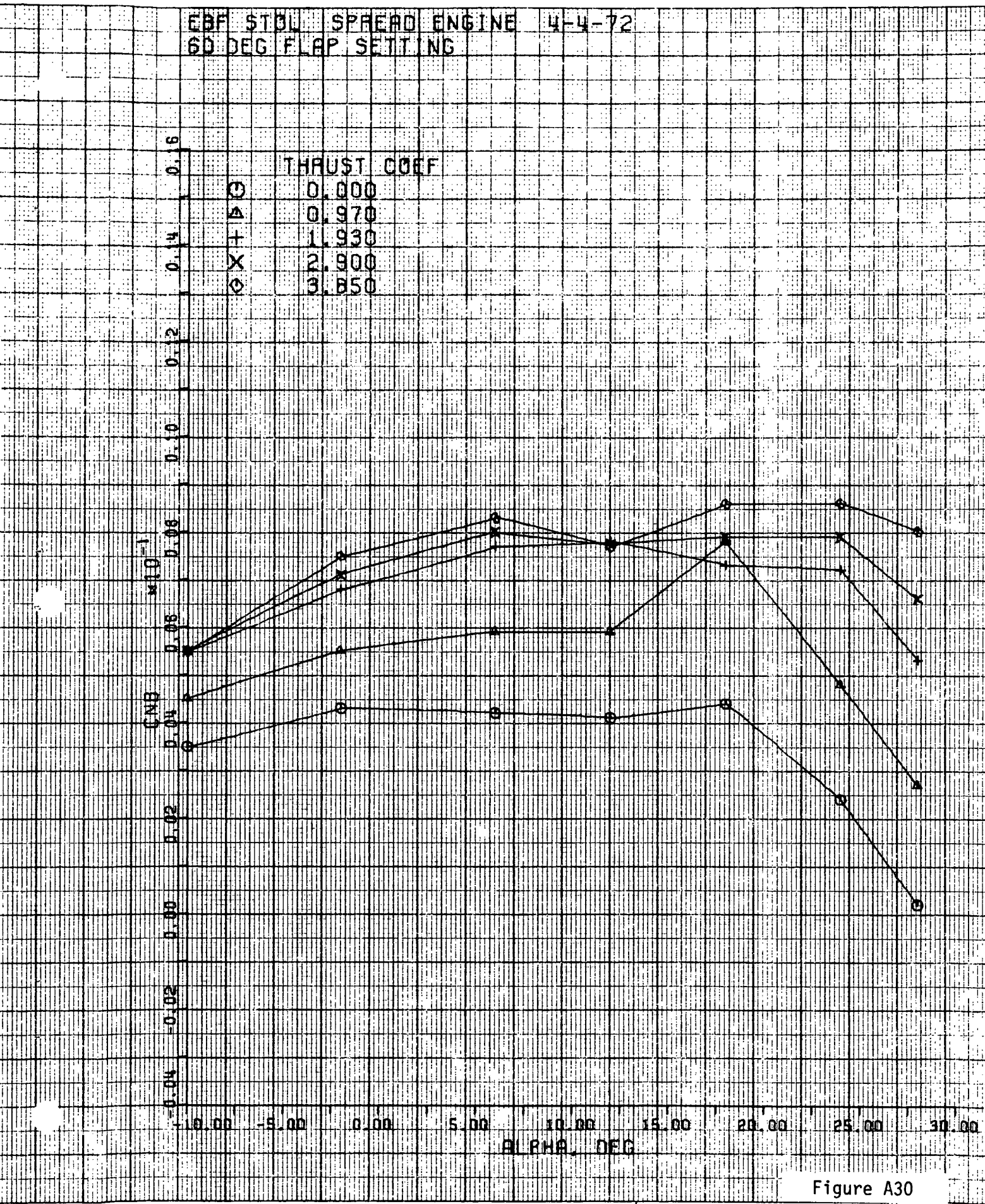
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CNB
x(10-1)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A30

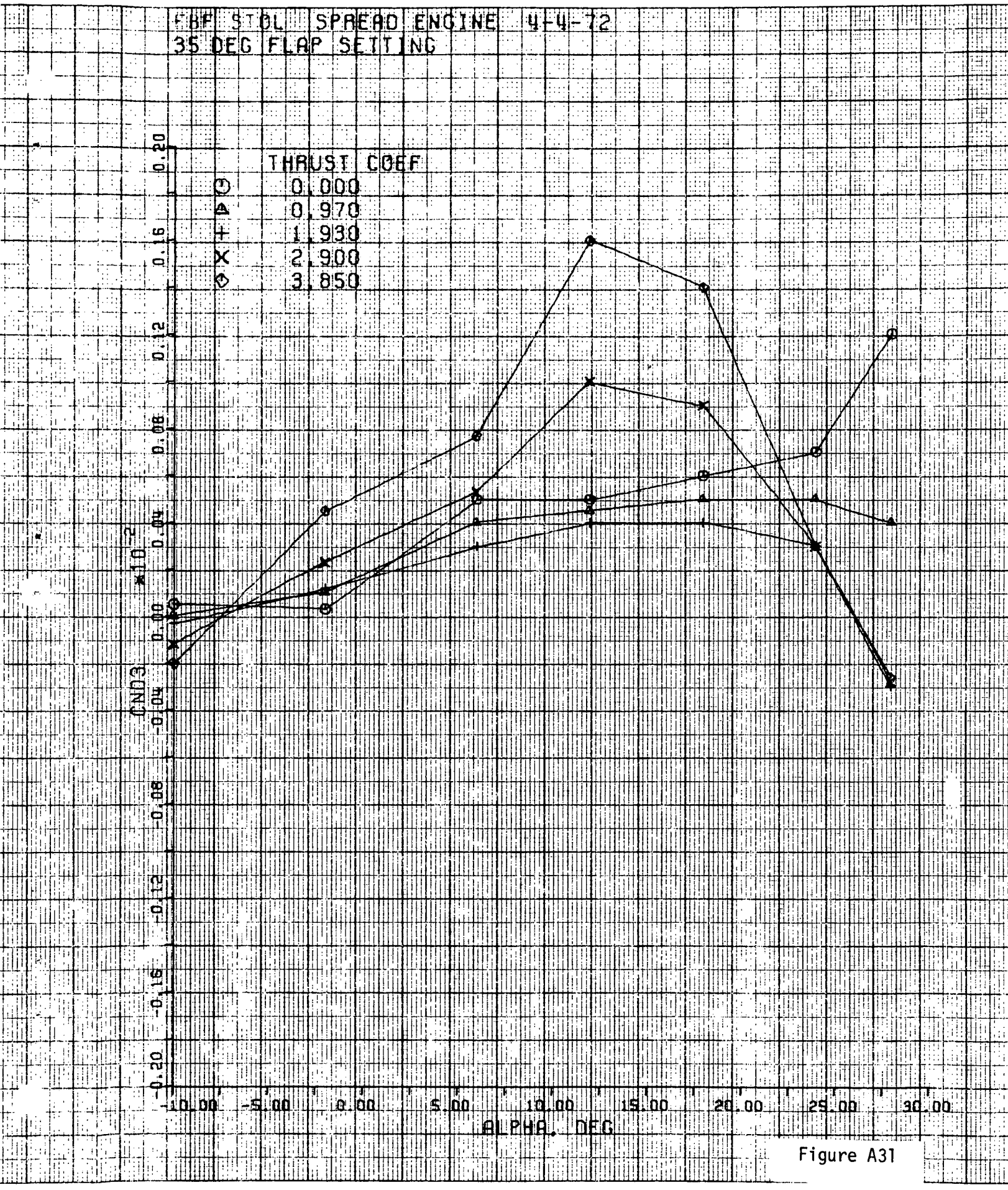
FBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CND3 *10 -2
0.20
0.16
0.12
0.08
0.04
0.00
-0.04
-0.08
-0.12
-0.16
-0.20
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A31

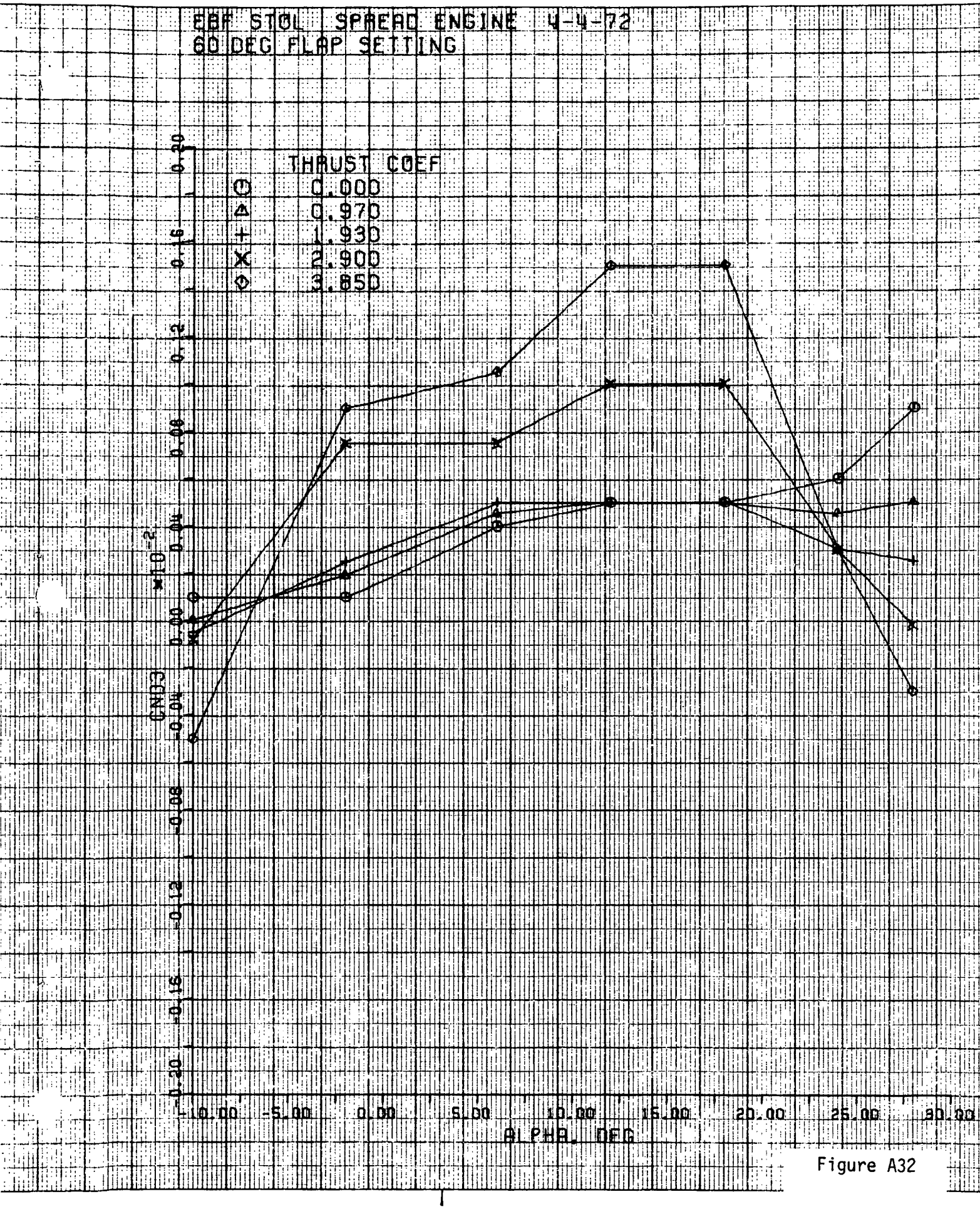
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
○ 0.000
△ 0.970
+ 1.930
X 2.900
◇ 3.850
CNDJ
×10⁻²
0.20
0.16
0.12
0.08
0.04
0.00
-0.04
-0.08
-0.12
-0.16
-0.20
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A32

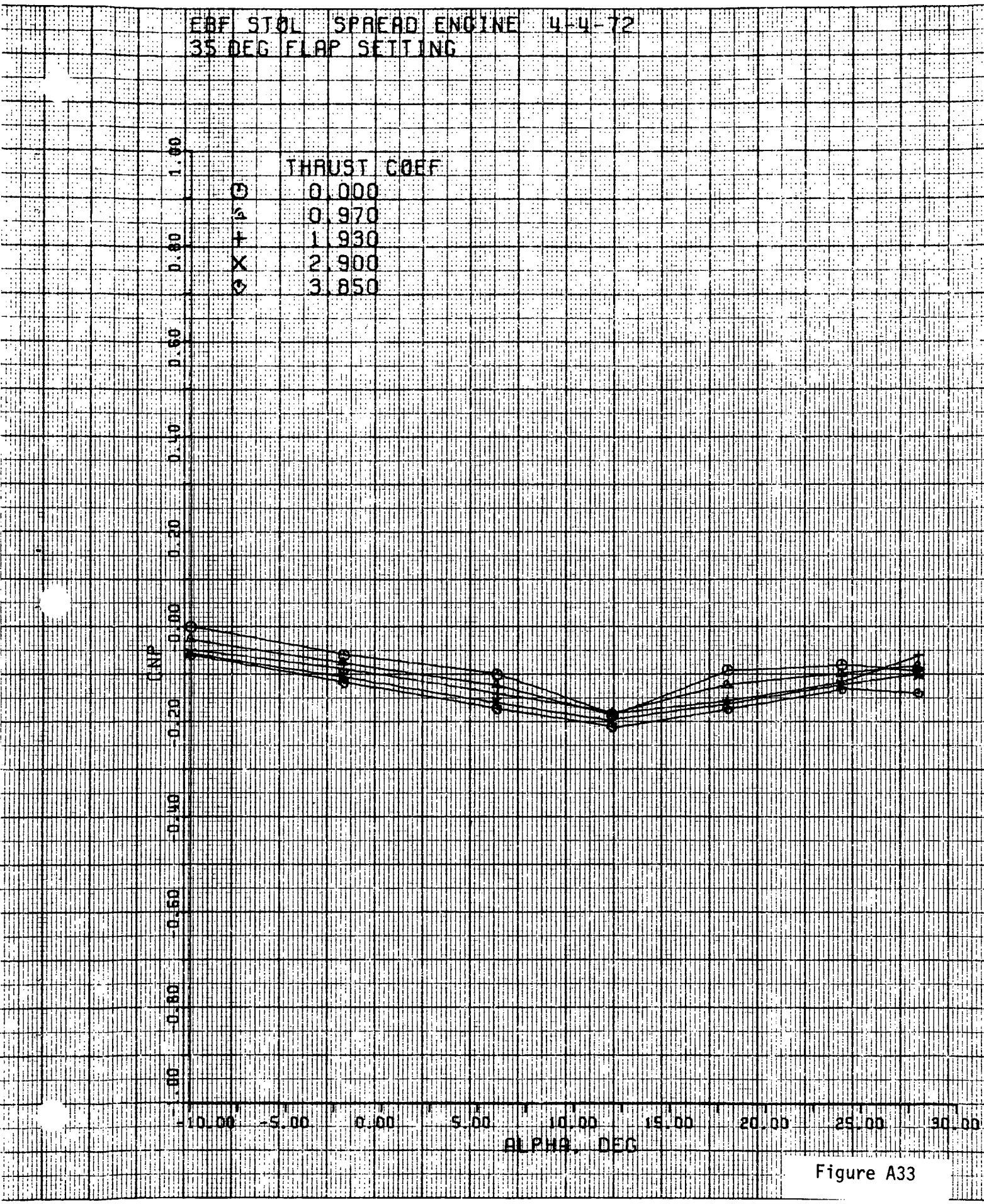
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0 0.000
◇ 0.970
+ 1.930
X 2.900
◇ 3.850
C.NP
1.00
0.80
0.60
0.40
0.20
-0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A33

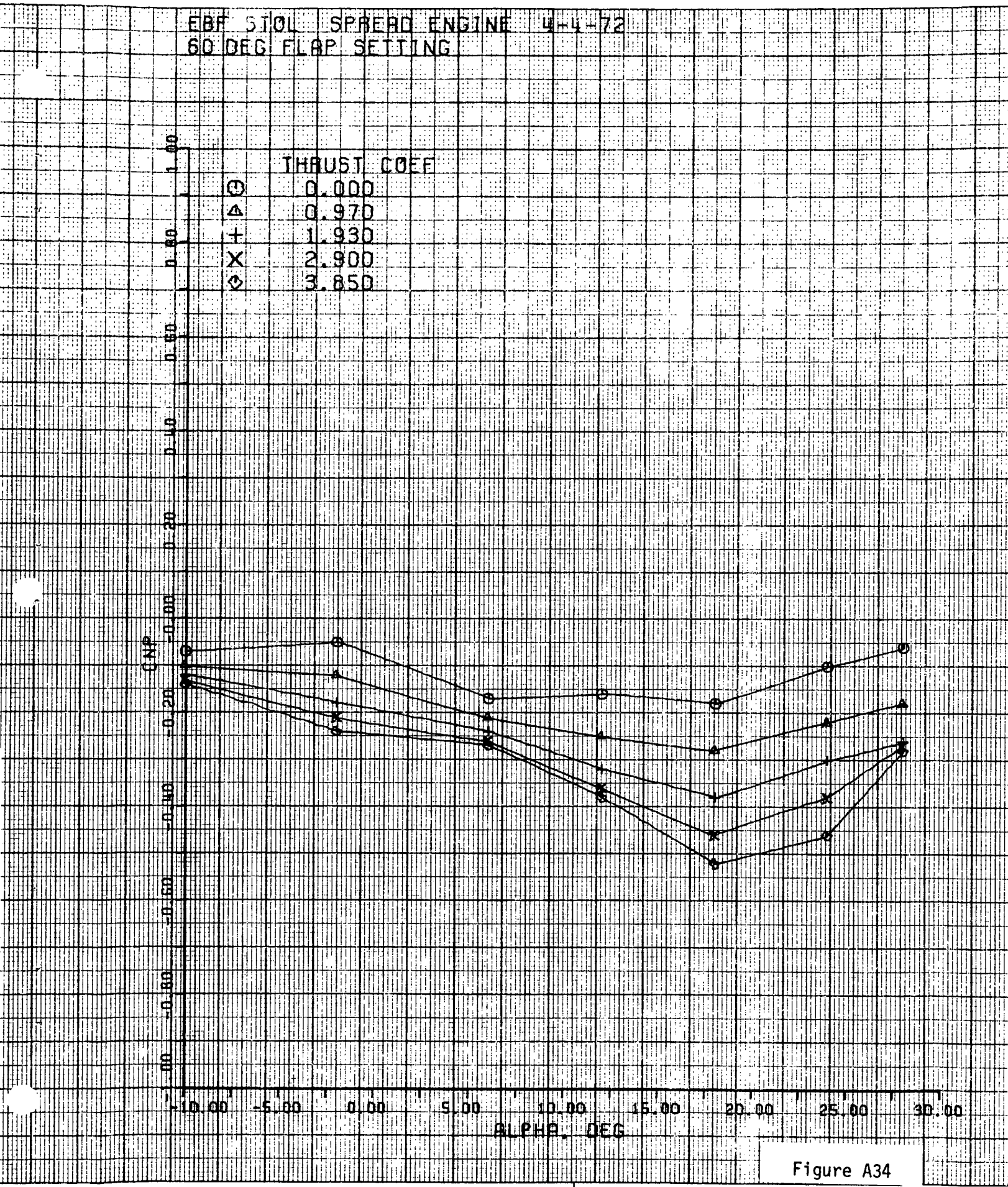
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CNP
1.00
0.80
0.60
0.40
0.20
-0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A34

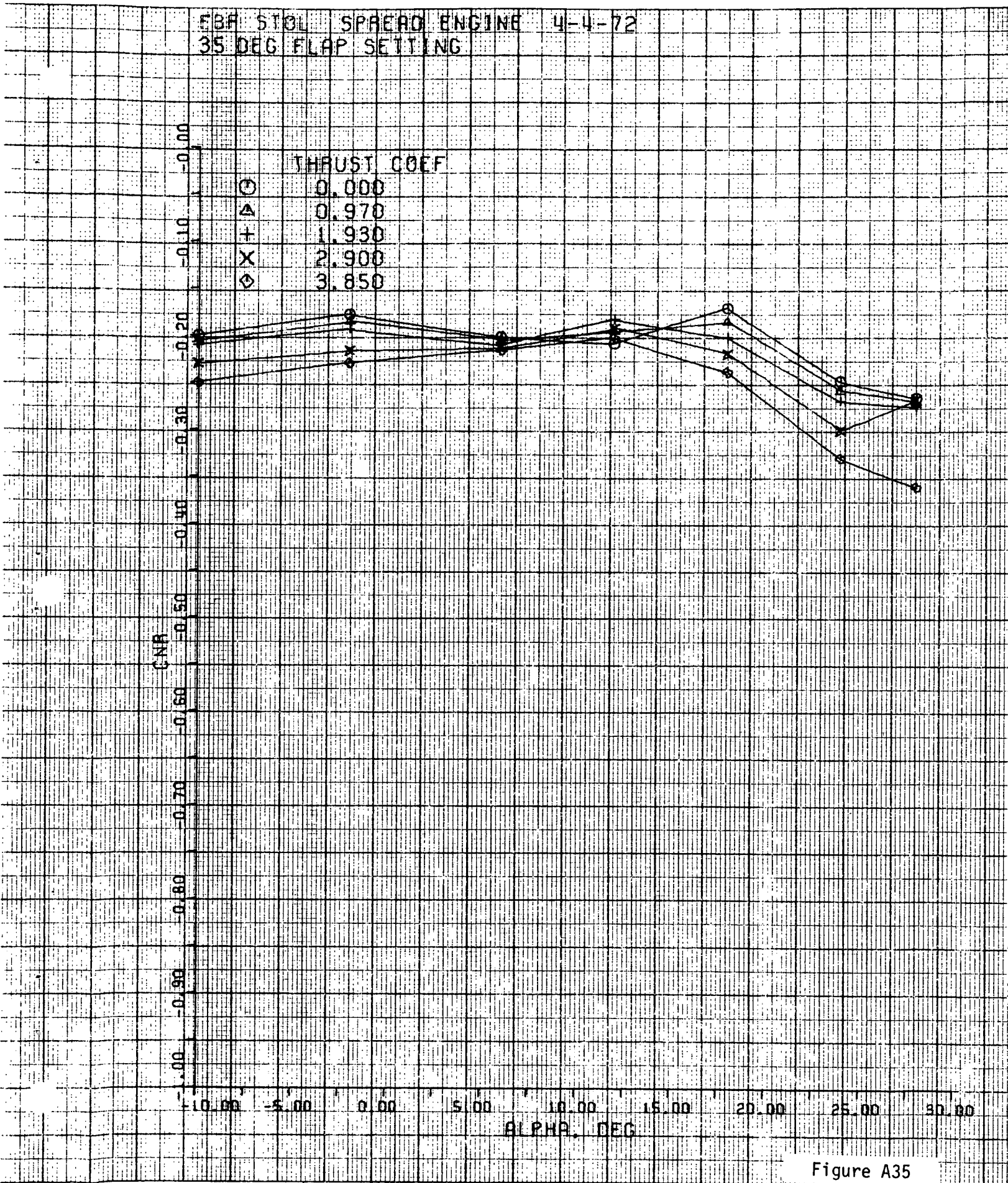
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CNR
-0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A35

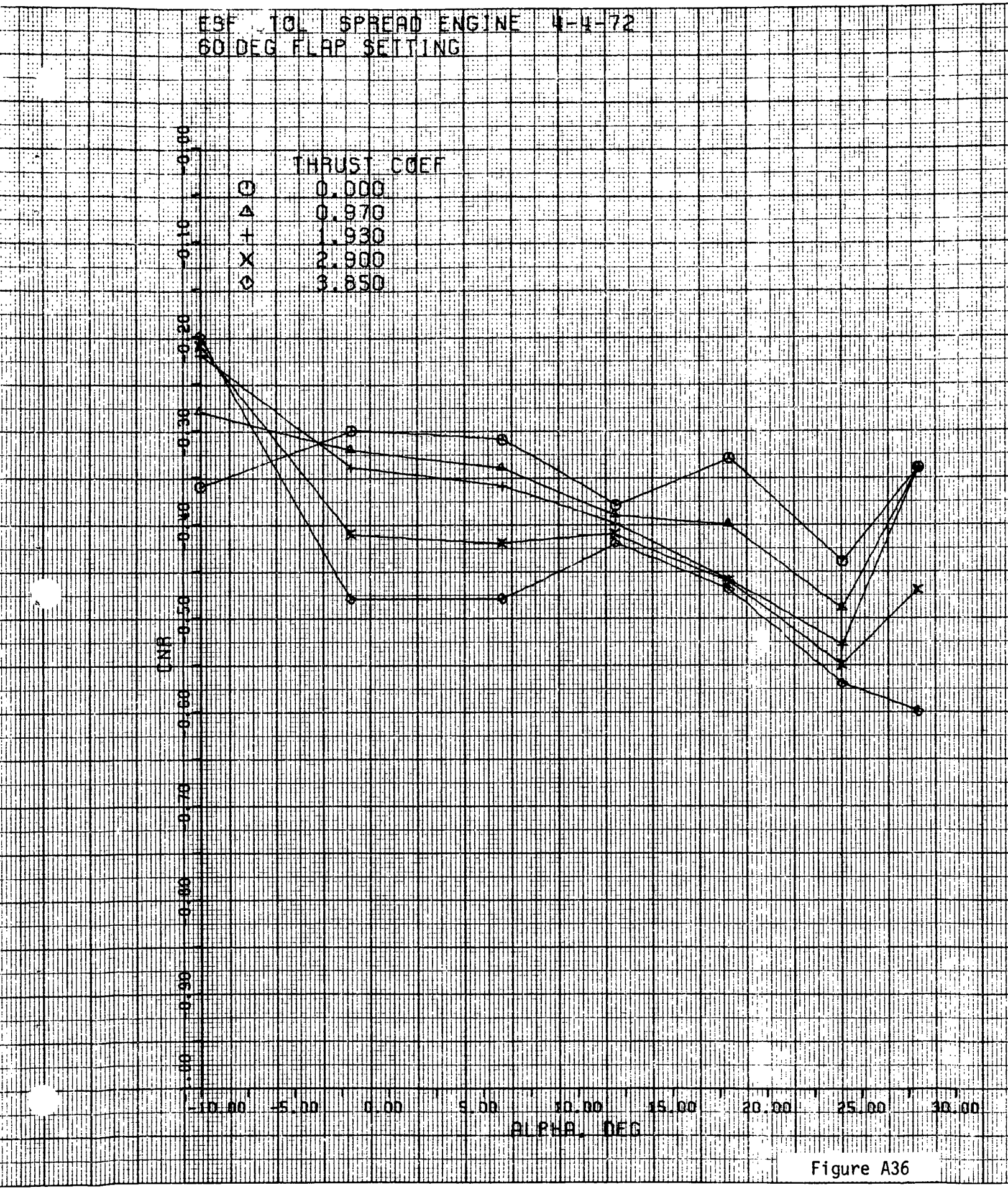
ESF TOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CNR
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A36

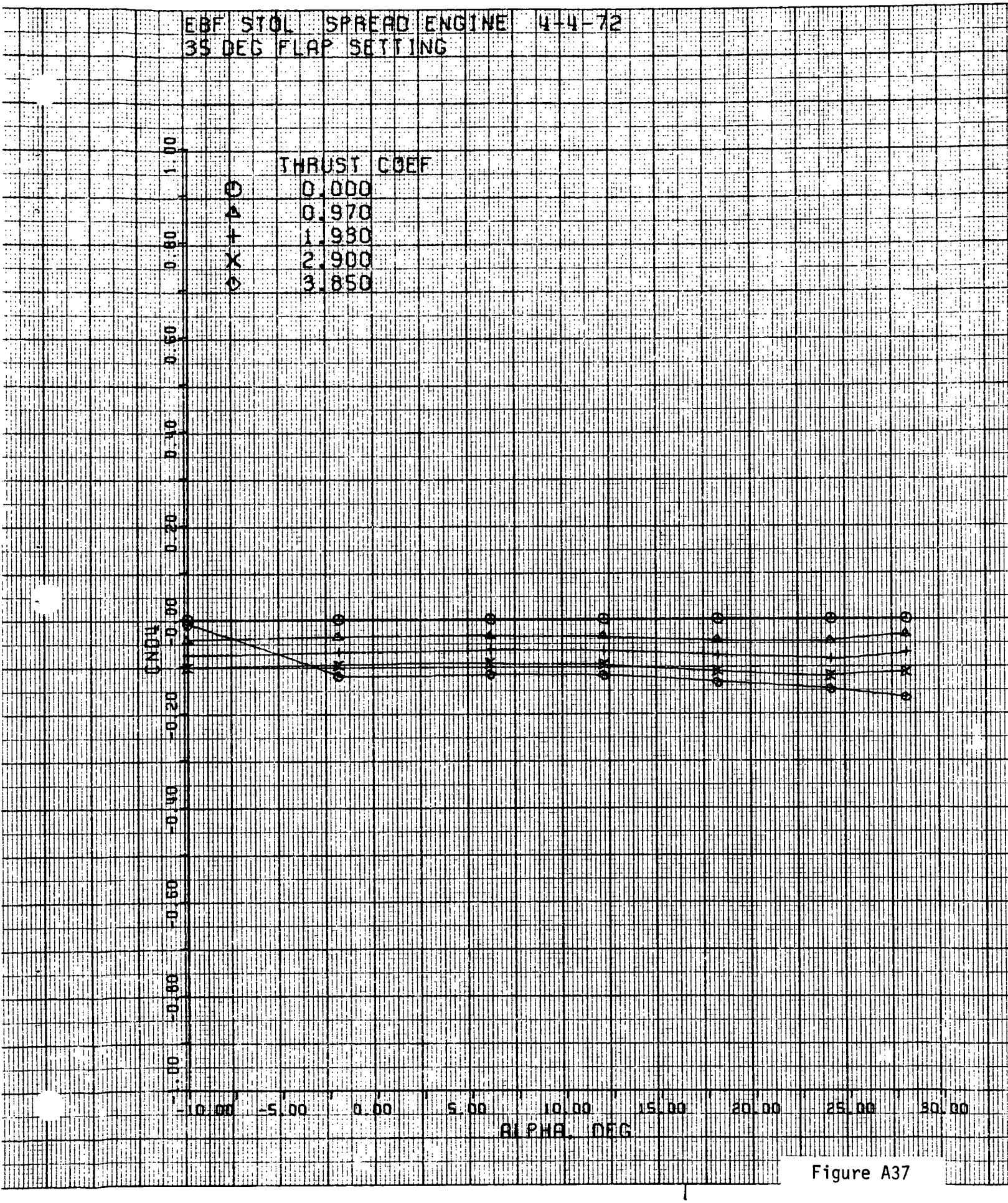
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0 0.000
Δ 0.970
+ 1.930
X 2.900
◇ 3.850
CNOL
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A37

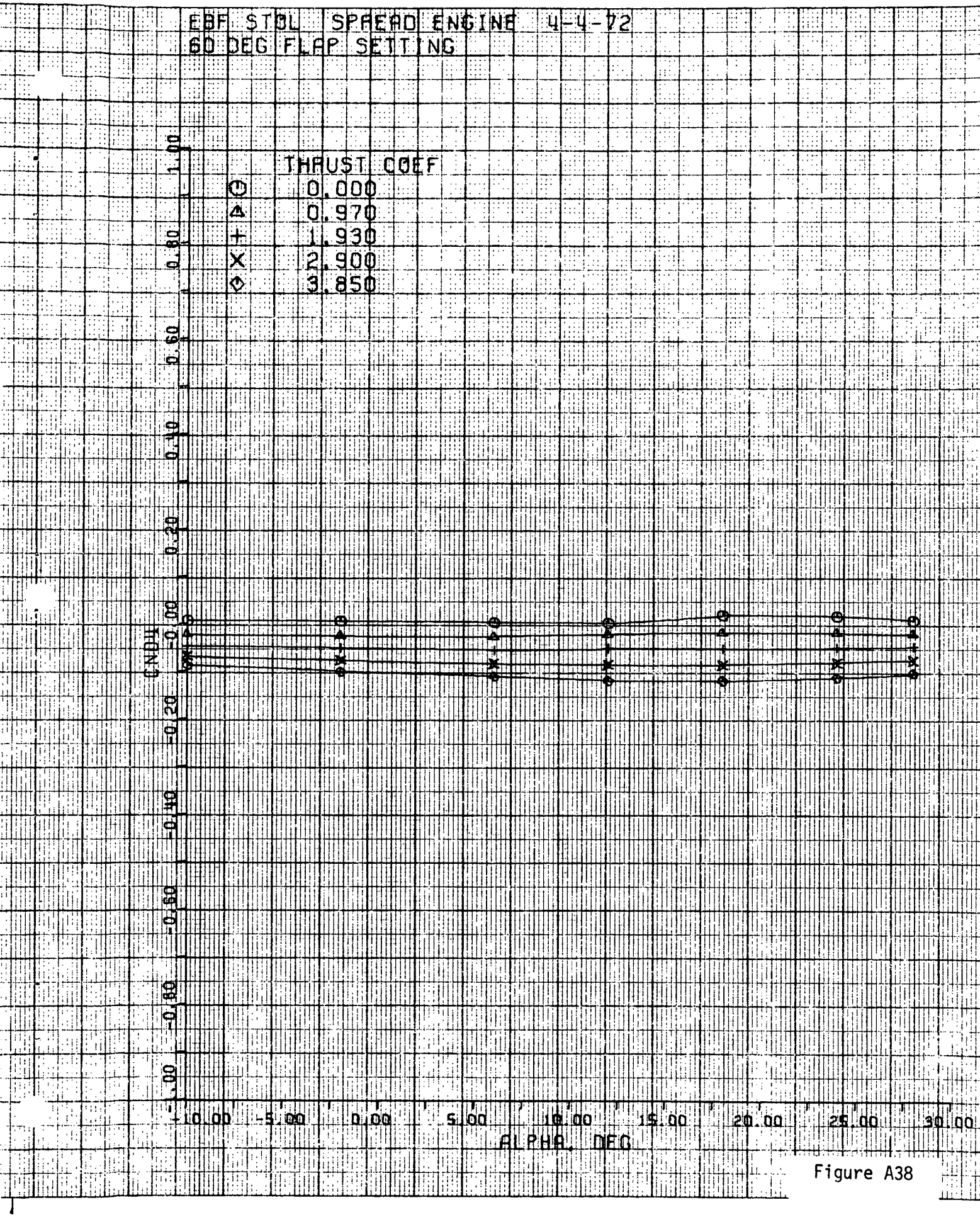
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0 0.000
Δ 0.970
+ 1.930
X 2.900
◇ 3.850
CN,DU
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A38

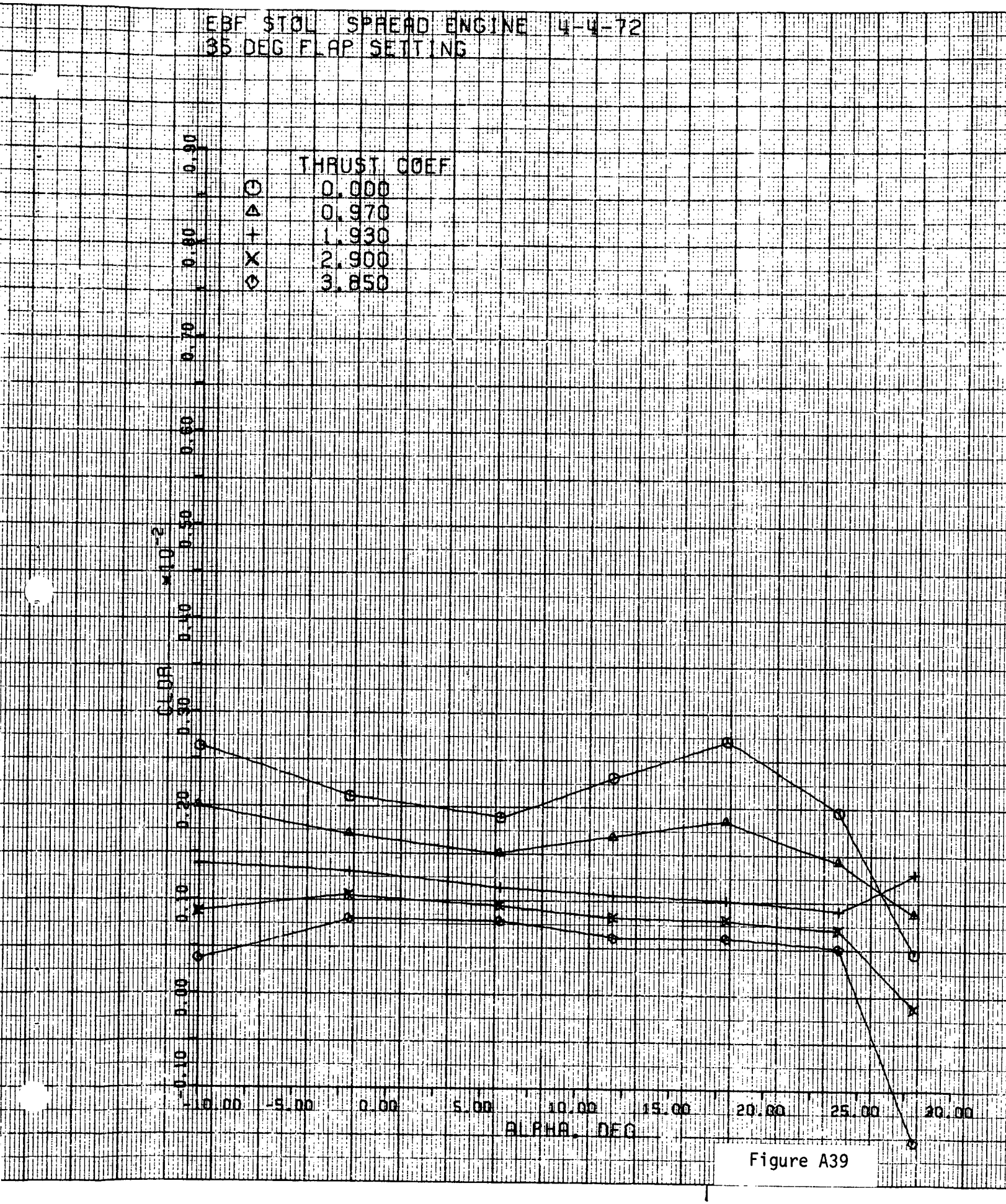
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CLDR
*10**-2
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A39

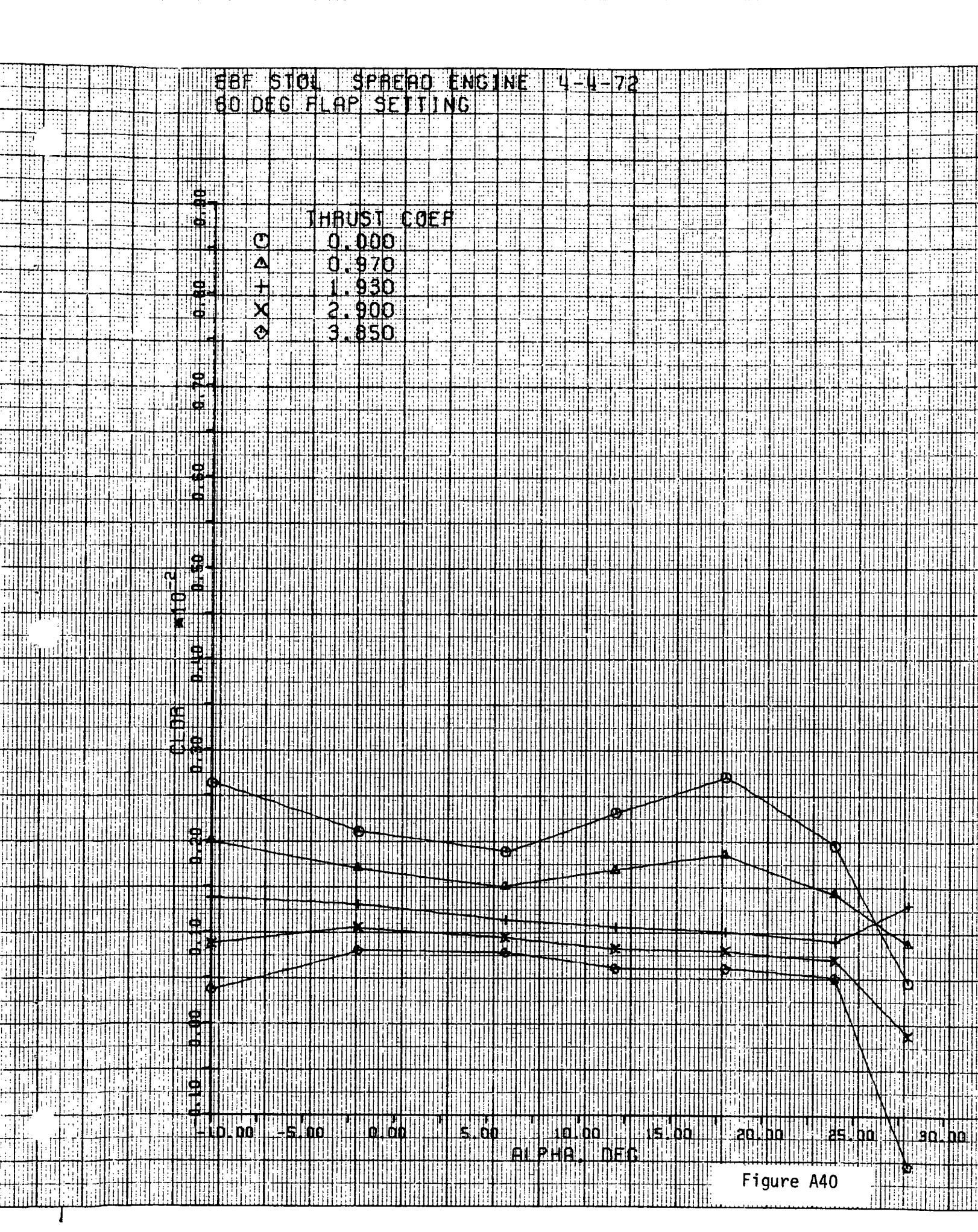
6BF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CLBA
*10-2
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A40

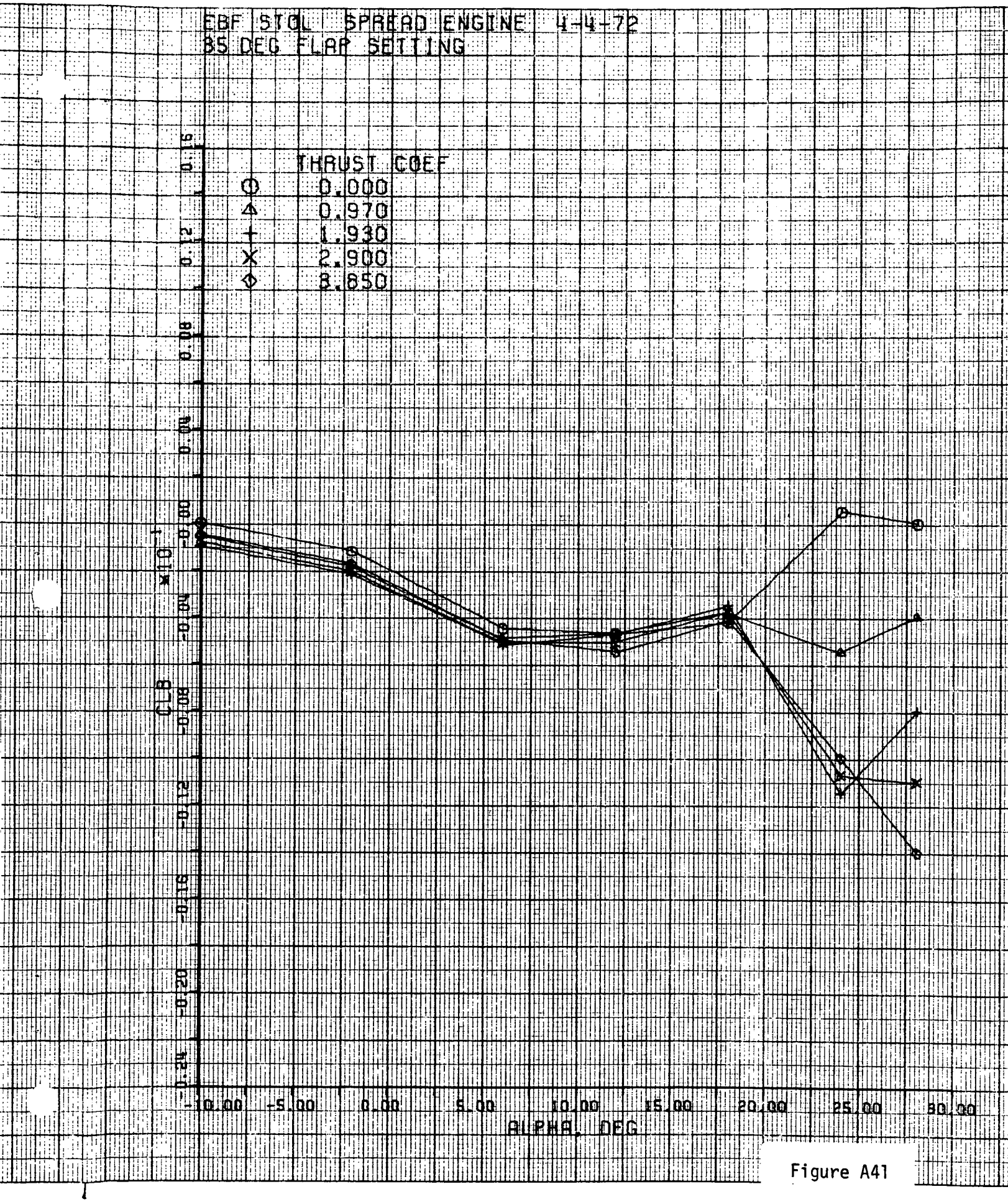
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CLB
ALPHA, DEG
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00

Figure A41

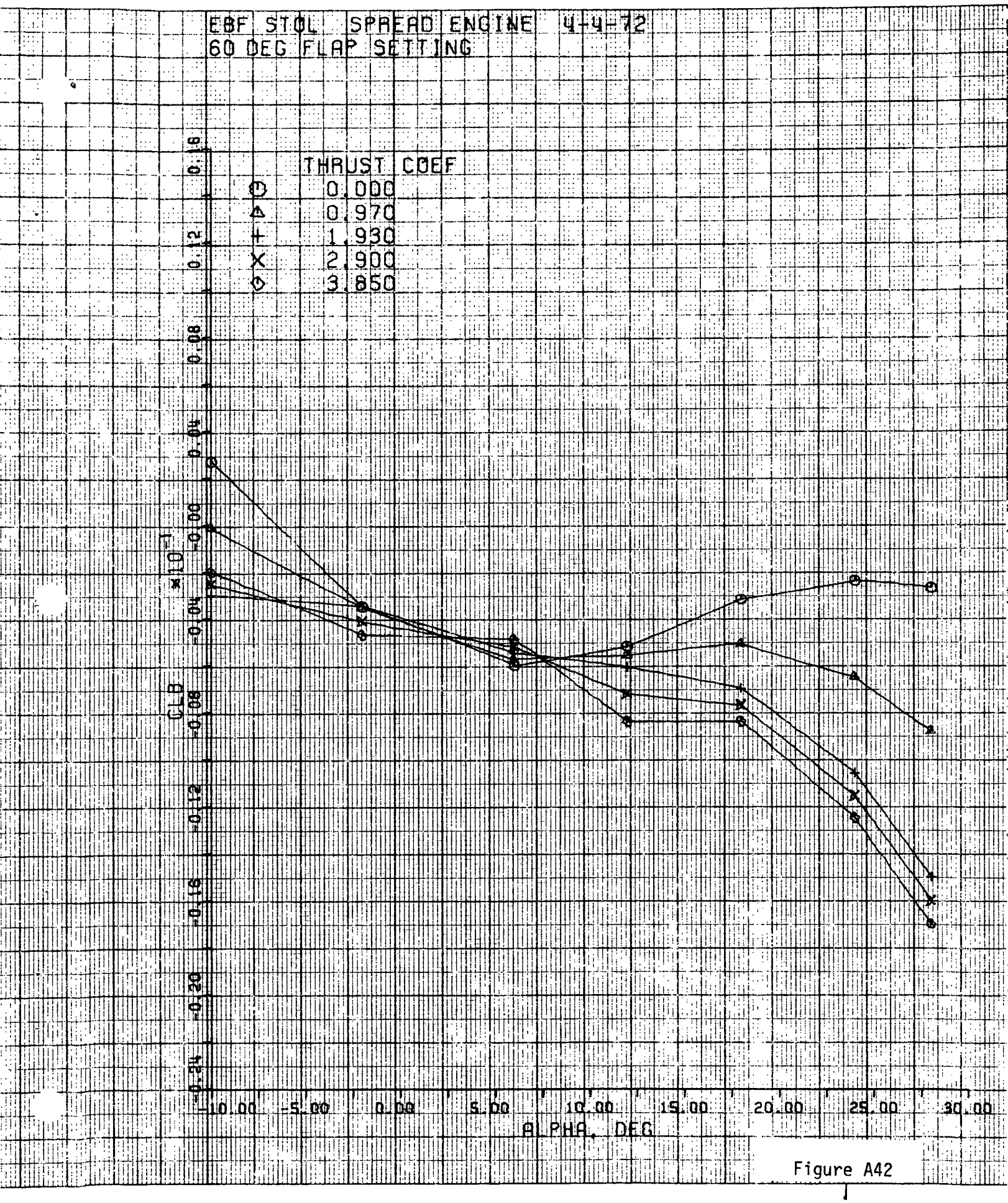
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CLD
*10-1
0.16
0.12
0.08
0.04
-0.00
-0.04
-0.08
-0.12
-0.16
-0.20
-0.24
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A42

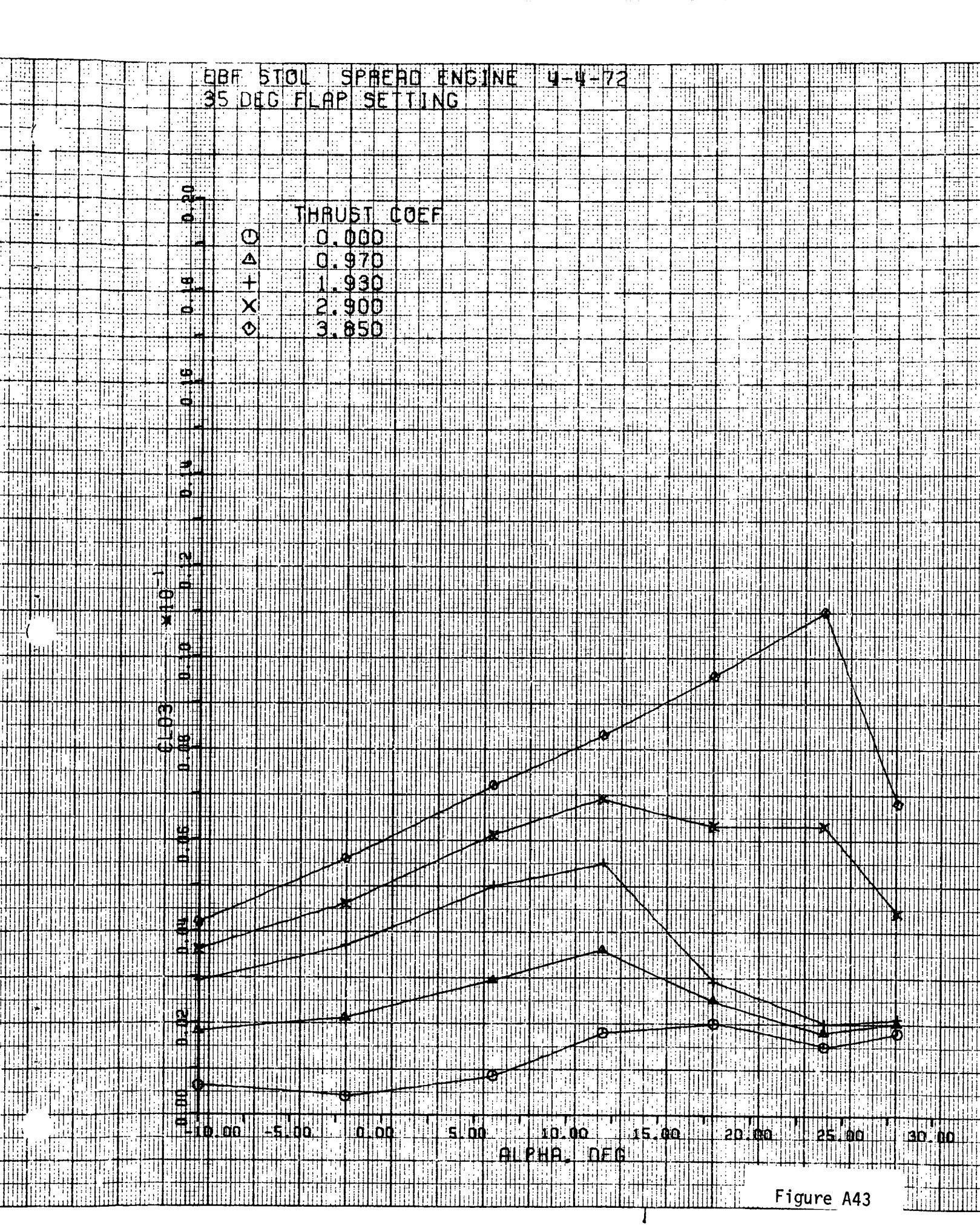
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CL
0.00
0.04
0.08
0.12
0.16
0.20
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A43

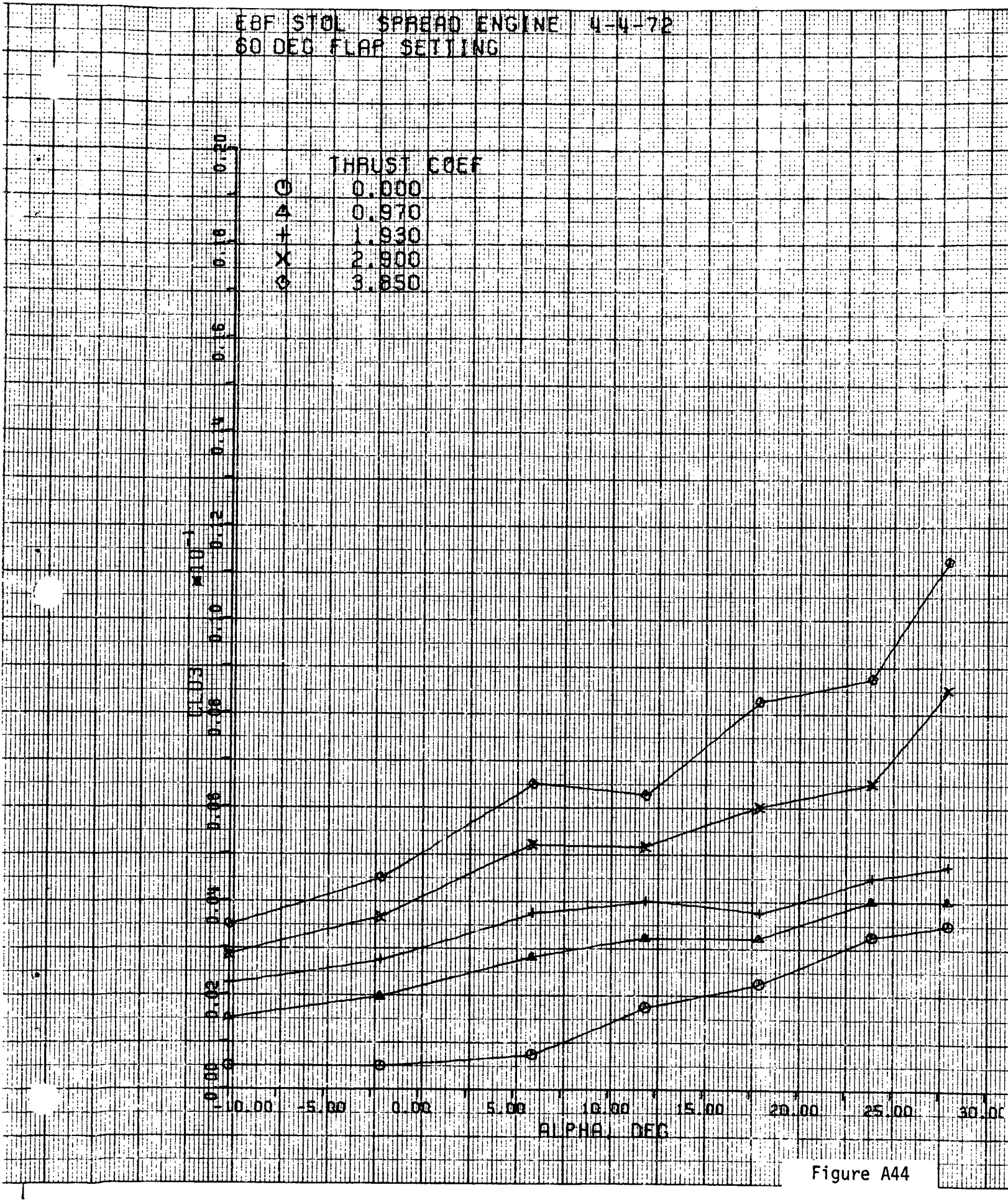
E8F STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CL
CD
ALPHA, DEG
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
0.00
0.02
0.04
0.06
0.08
0.10
0.2
0.4
0.6
0.8
1.0
1.20

Figure A44

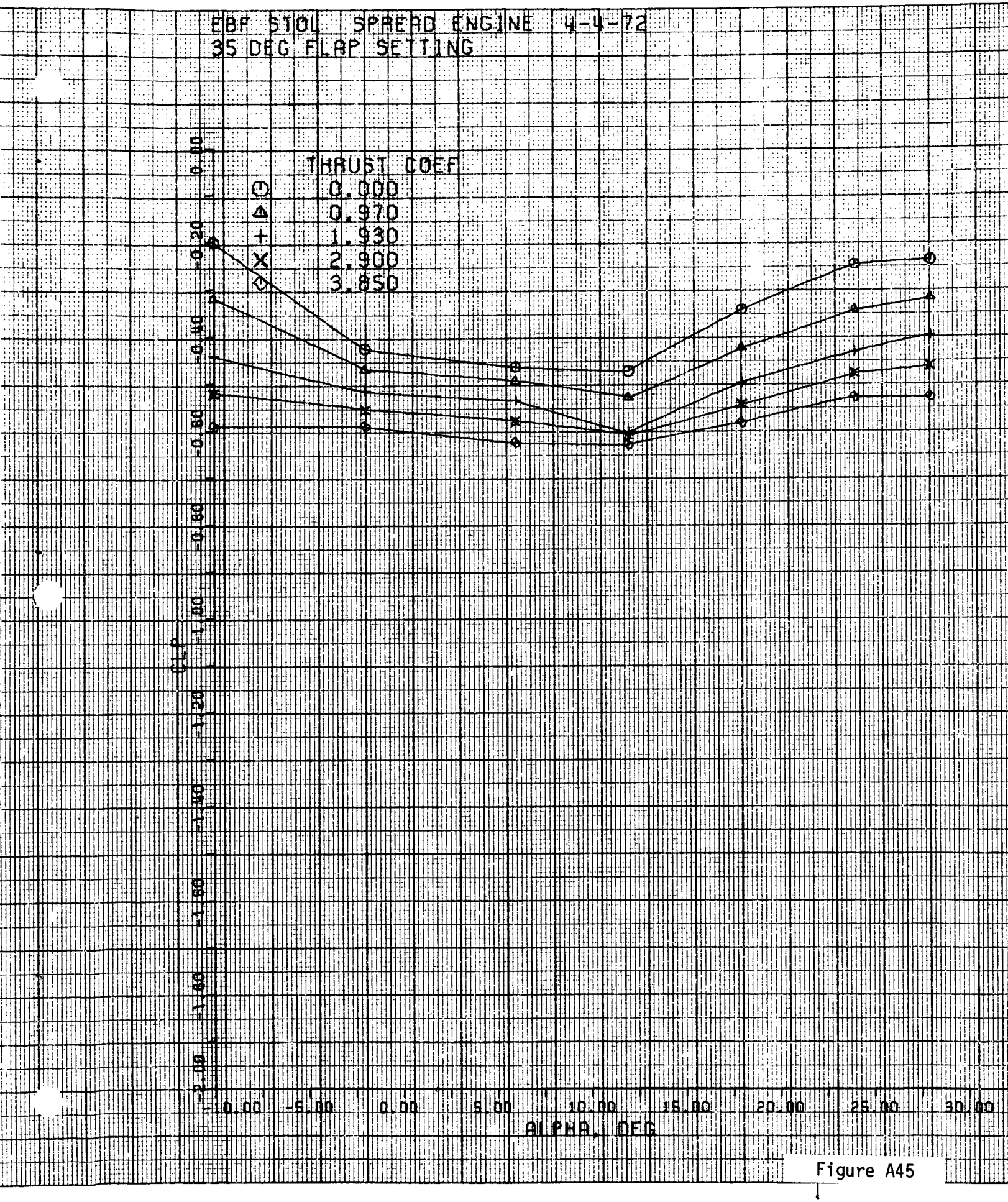
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CLP
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
-1.40
-1.60
-1.80
-2.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A45

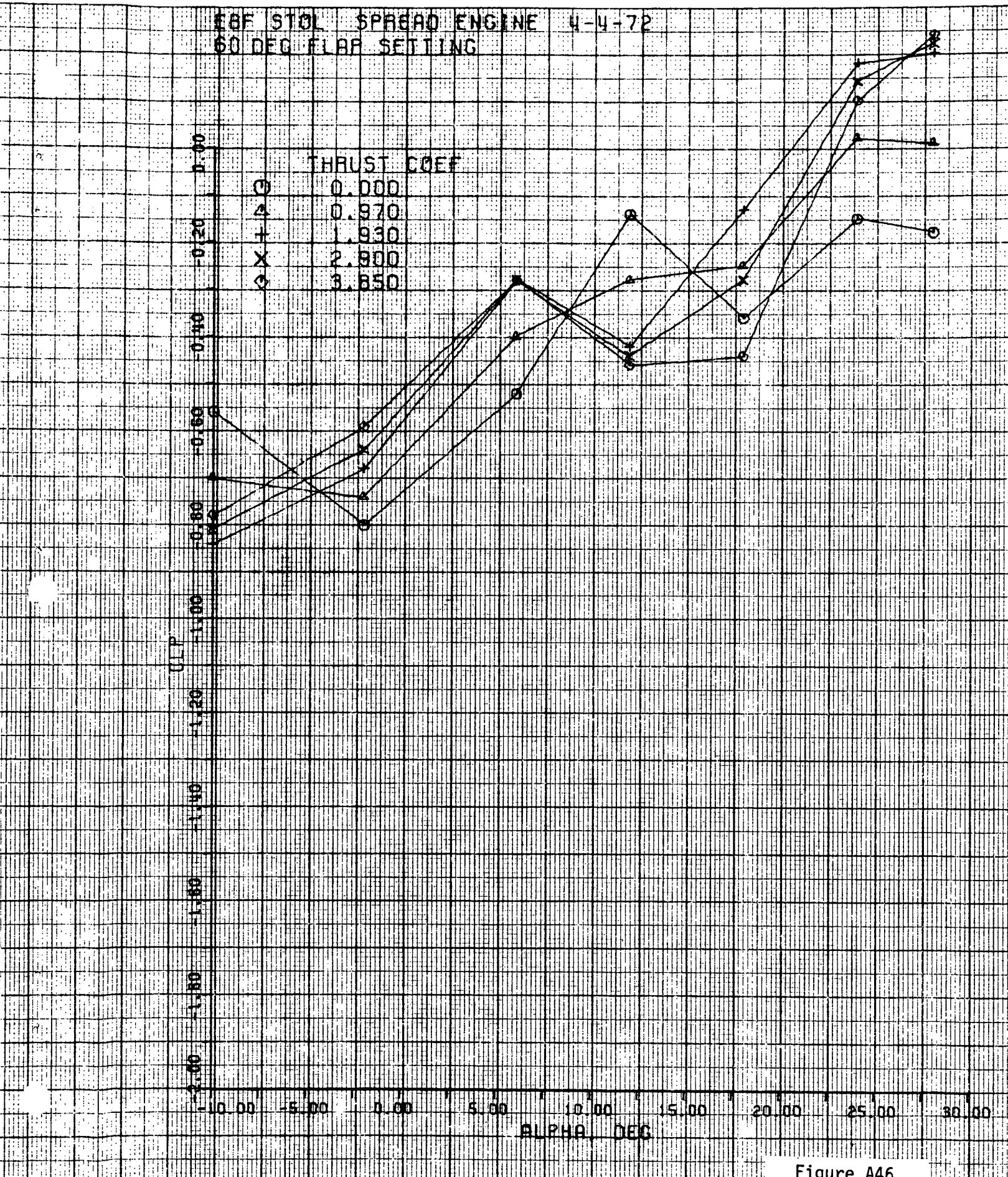
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CLP
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
-1.40
-1.60
-1.80
-2.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A46

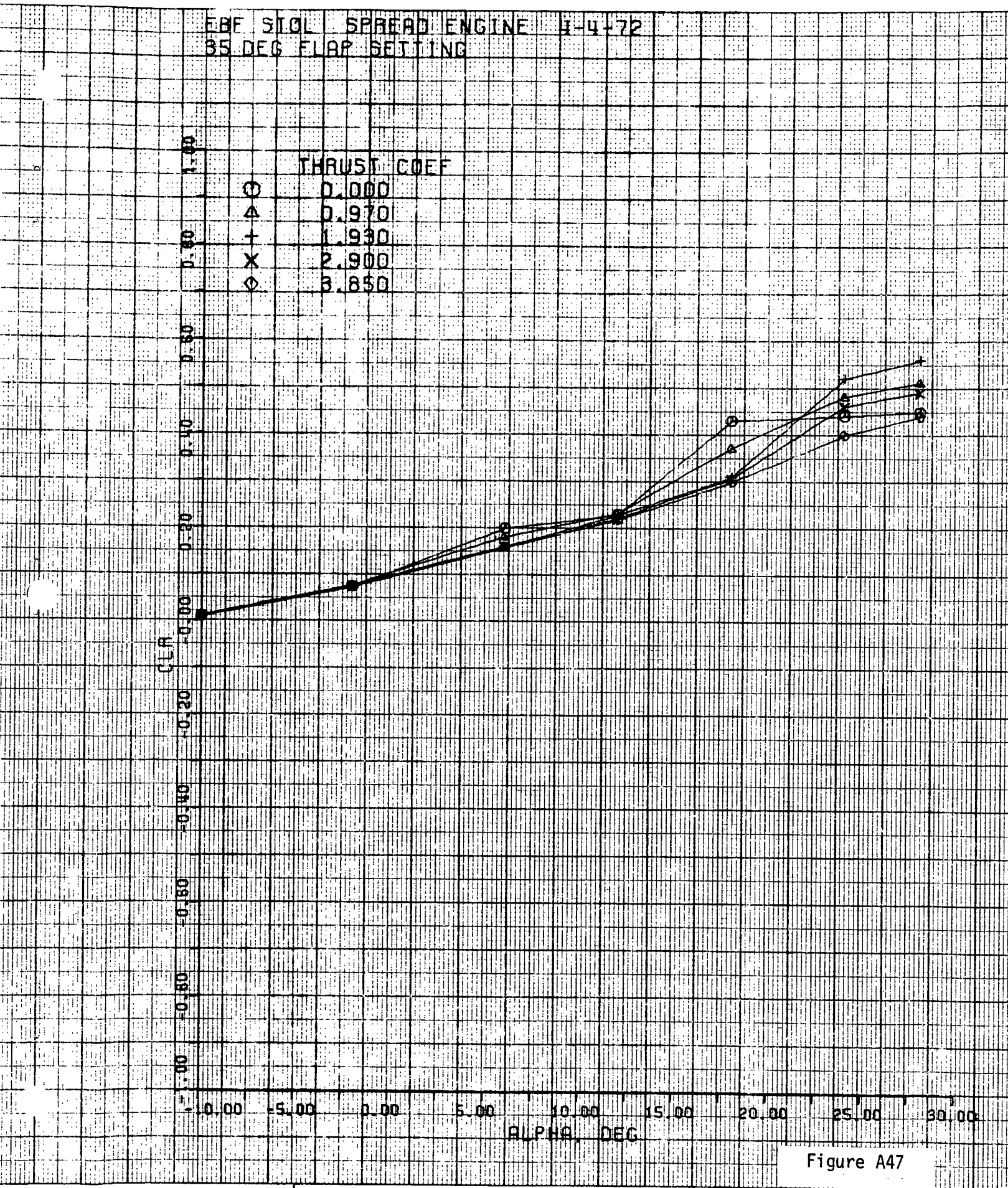
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CLA
1.00
0.80
0.60
0.40
0.20
-0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A47

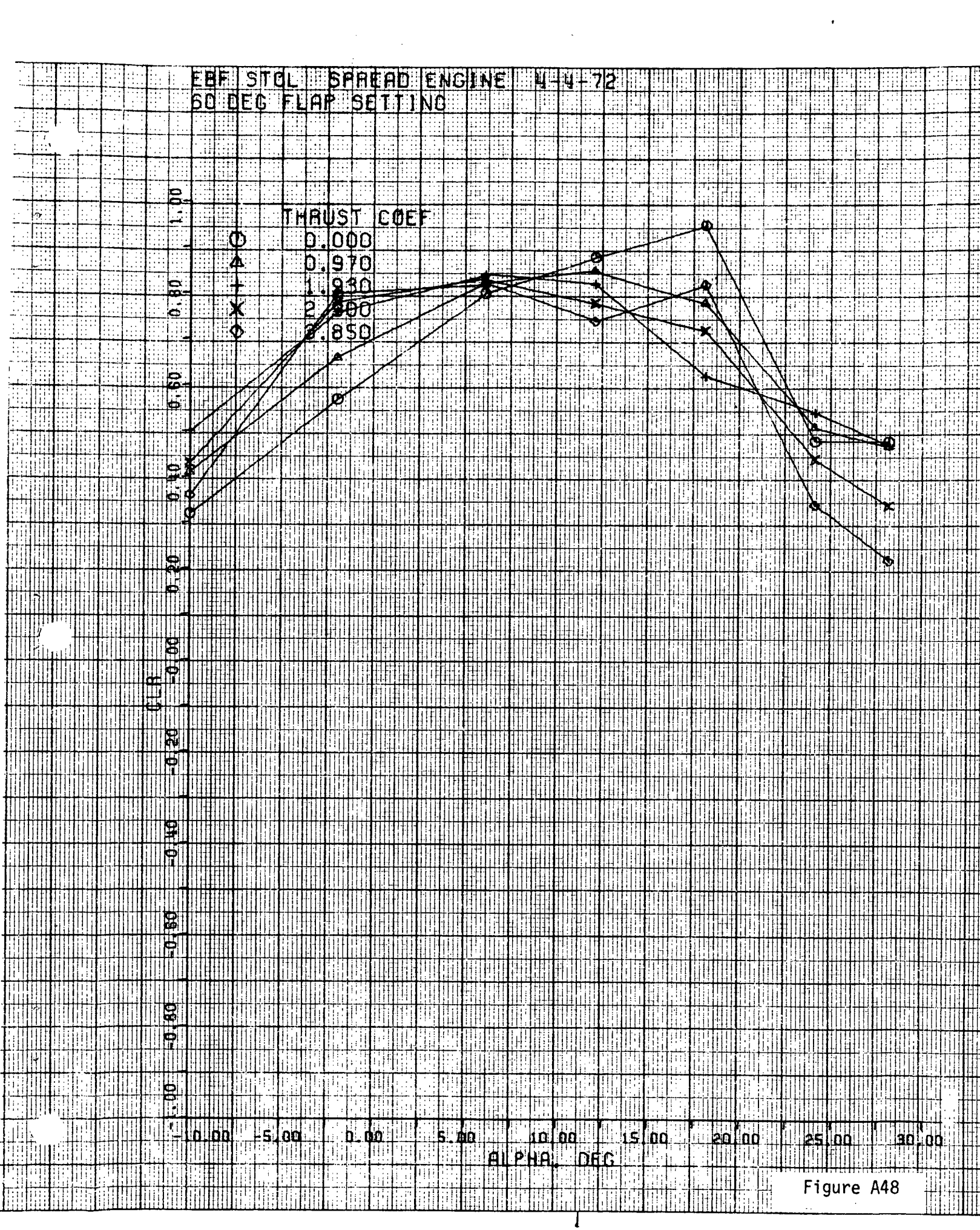
EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
2.850
CLR
1.00
0.80
0.60
0.40
0.20
-0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A48

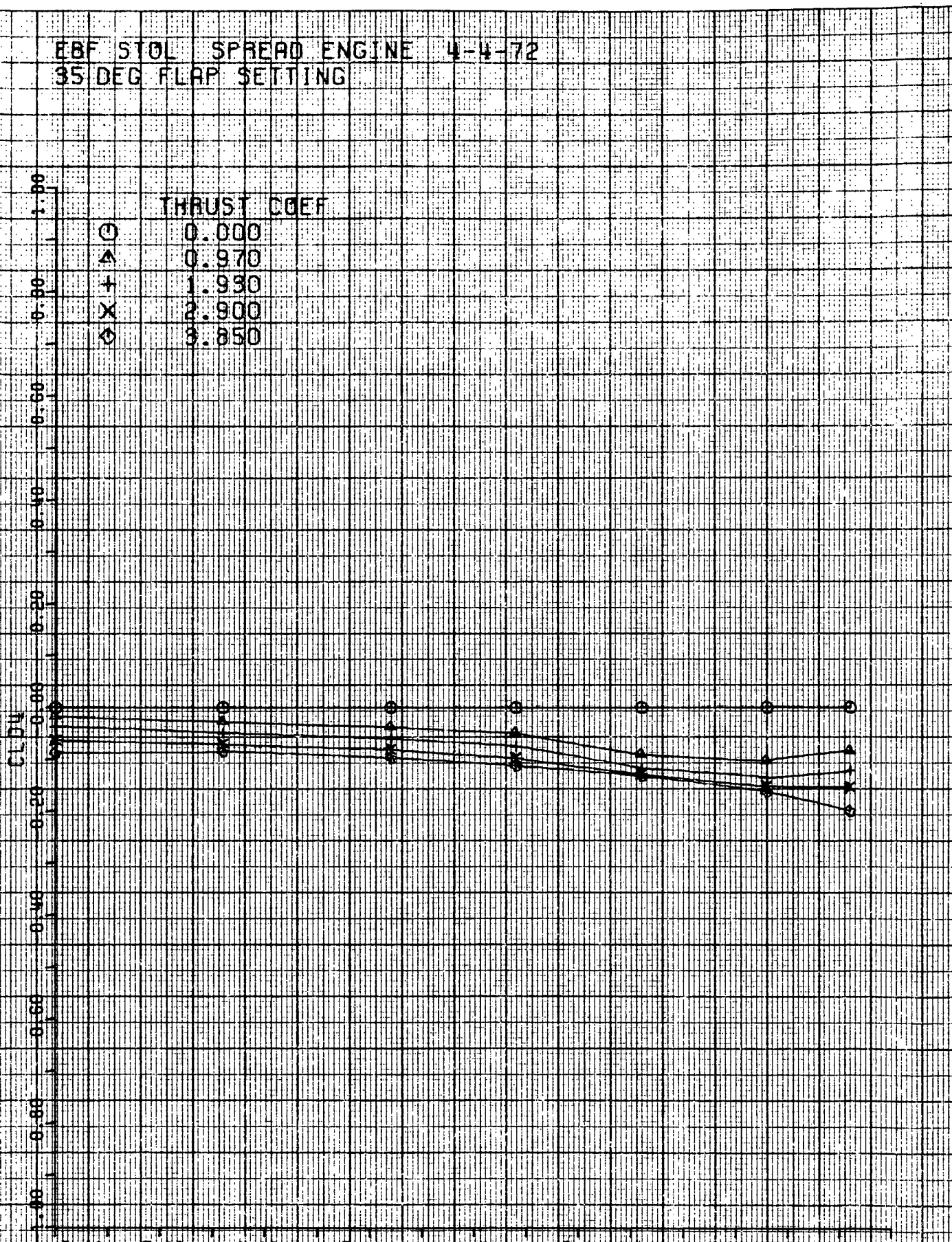
EBF STOL SPREAD ENGINE 4-4-72
35 DEG FLAP SETTING
THRUST COEF
0.000
0.970
1.930
2.900
3.850
CLDU
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ALPHA, DEG

Figure A49

EBF STOL SPREAD ENGINE 4-4-72
60 DEG FLAP SETTING

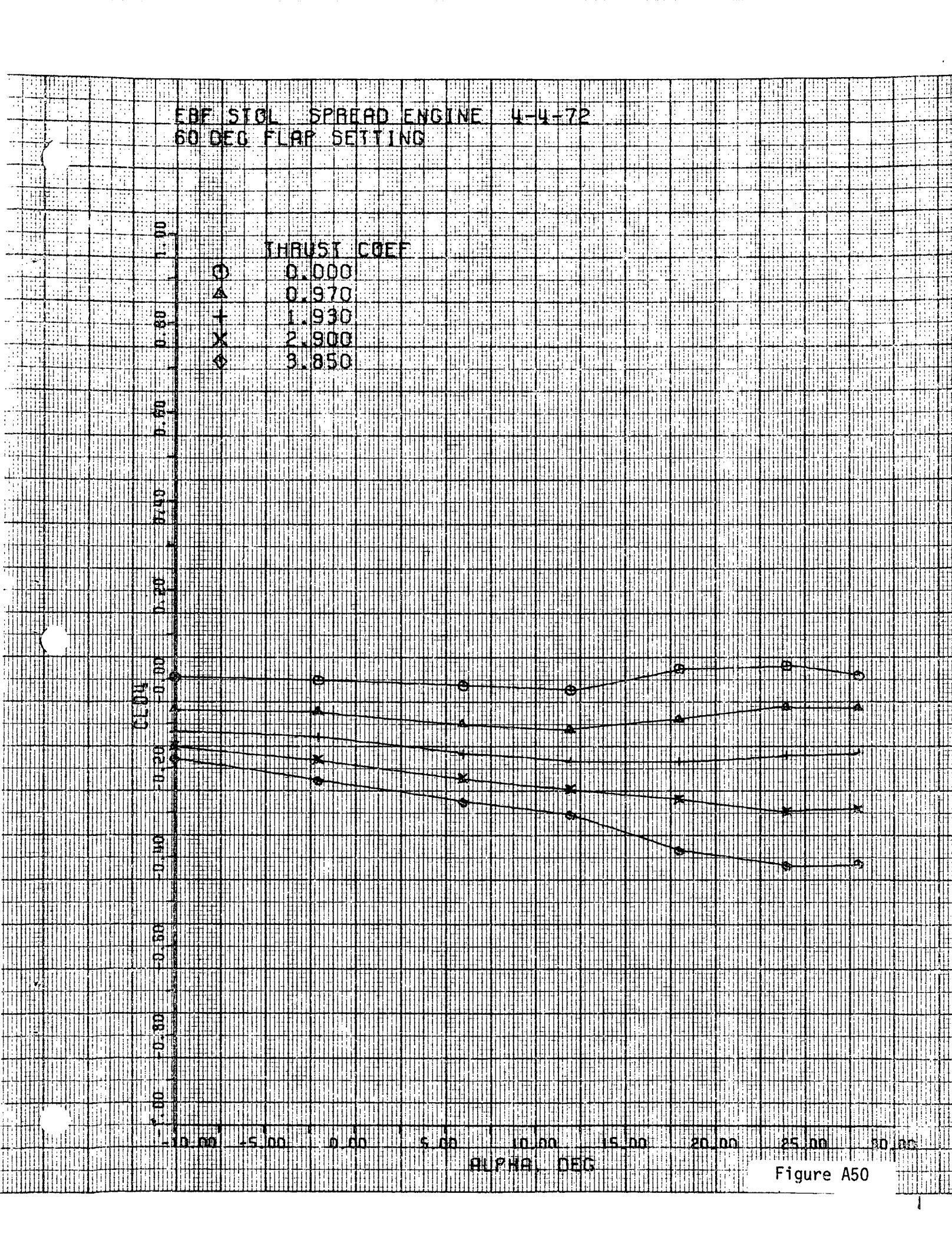

Figure A50