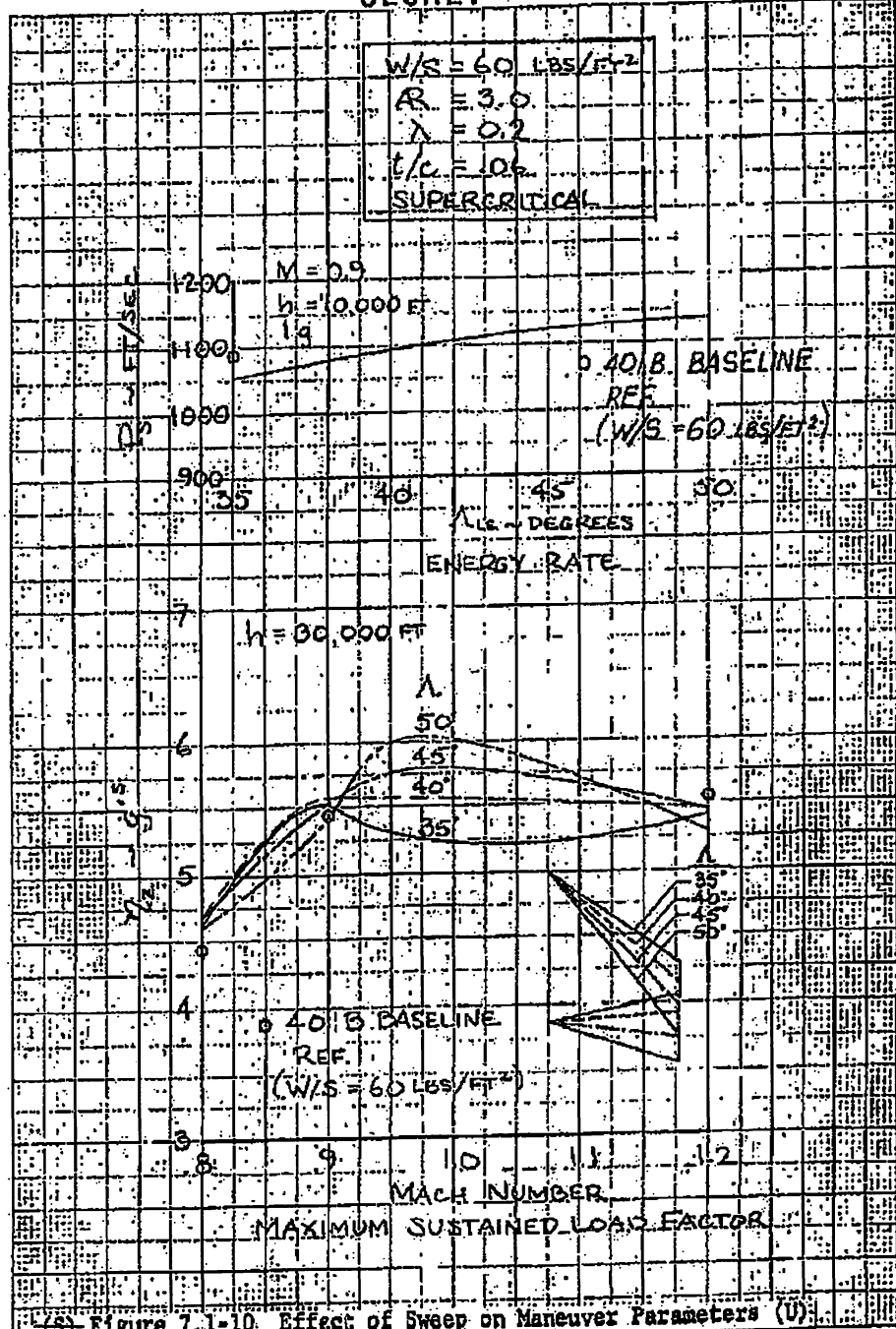


88H ABWIP
 FOIA(b)(7)(C) / (D)
 E.O. 13526 (SEC. 3.3(b)(4))
 E.O. 13526 (SEC. 3.3(b)(4))
 SEC. 1.4(a)(2)

~~SECRET~~



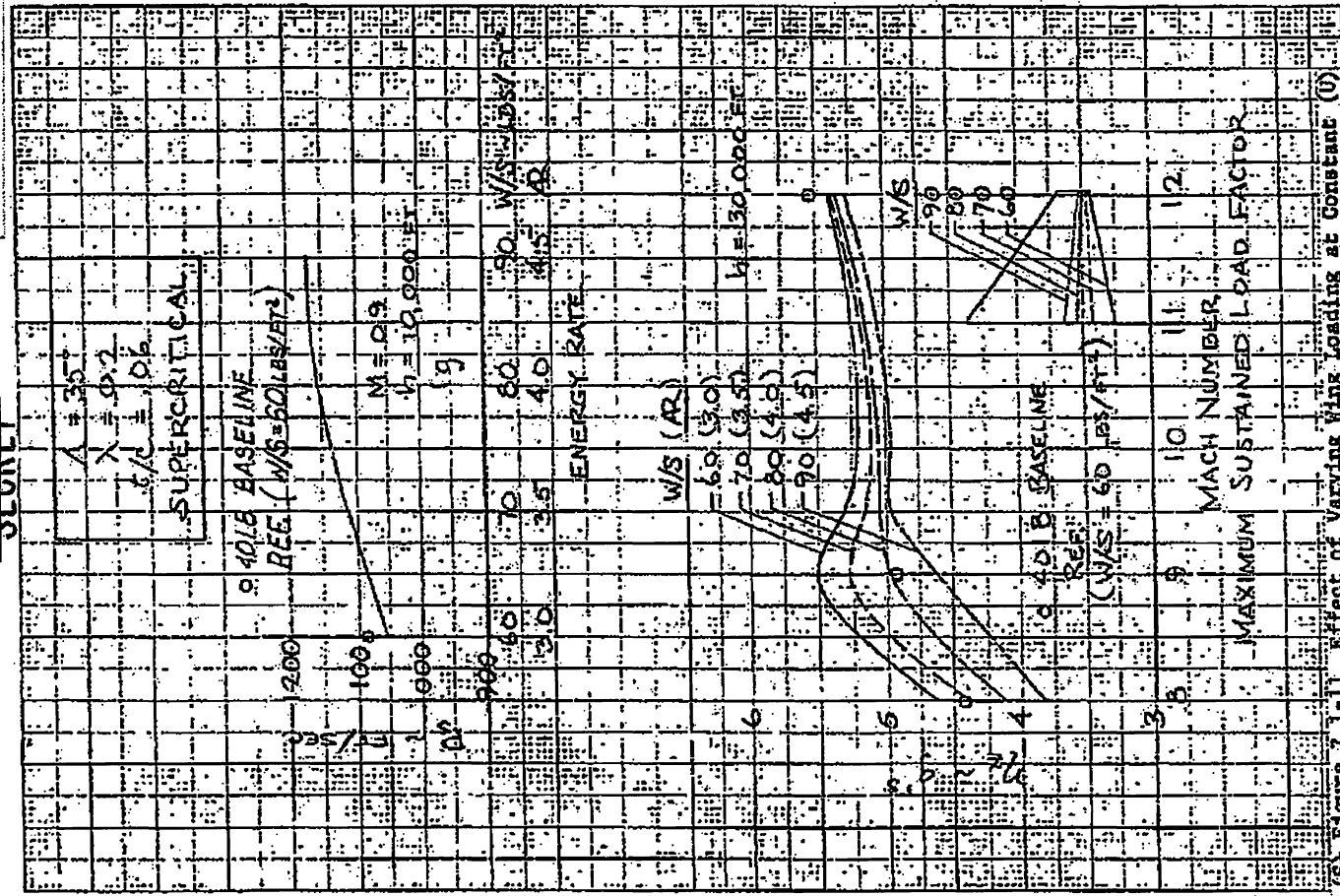
K-E
 ANALYSIS & DESIGN CO.
 6527 BR. ROAD
 FORT WORTH, TEXAS 76116
 TEL. 817-343-1111

(S) Figure 7.1-10 Effect of Sweep on Maneuver Parameters (U)

400
~~SECRET~~

FOIA (b)(1) / 707
E.O. 13526 (S) SEC. 3.3 (b)(4)
EO (a)(9) 26 Sec 3.3 (d)(xv)
Sec 1.4 (a)(9)

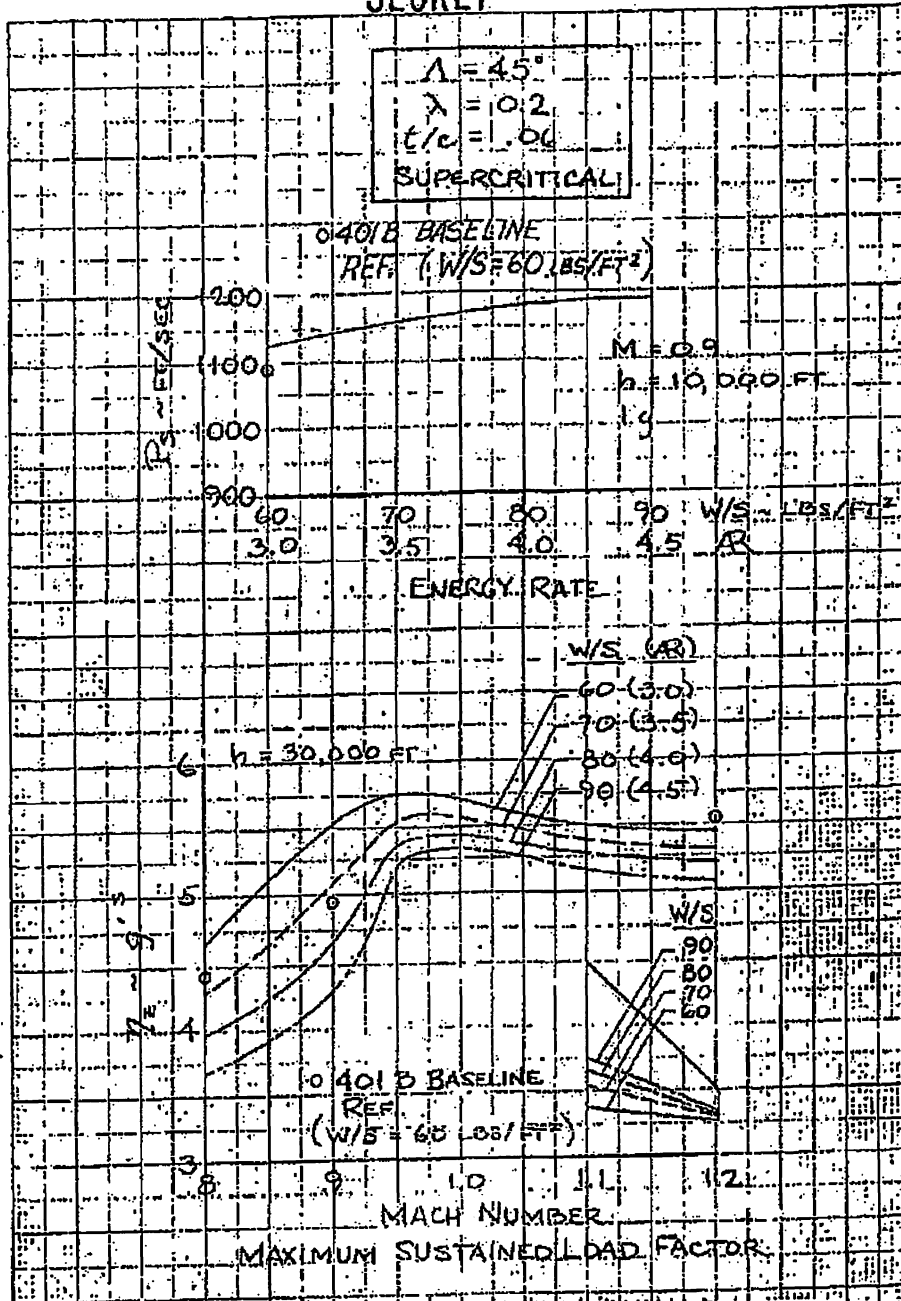
SECRET



(e) Figure 7.1-11 Effect of Varying Wing Loading at Constant (0)

SECRET

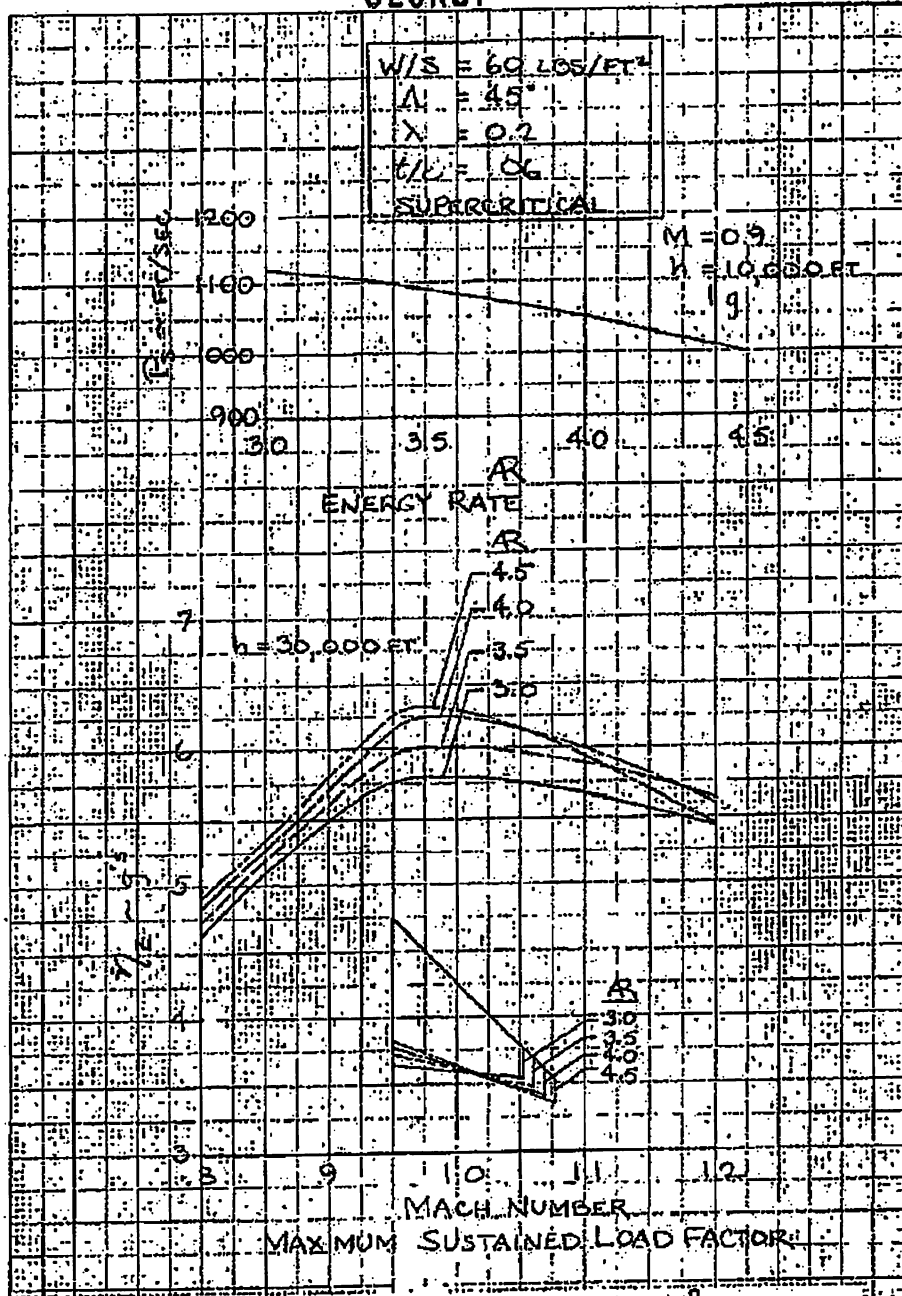
~~SECRET~~



(6) Figure 7.1-12 Span on Maneuver Parameters, $\Lambda = 35^\circ$
 Effect of Varying Wing Loading at Constant (U)

402
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AIR FORCE RESEARCH AND DEVELOPMENT
 REPORT 7-1-13
 1955

(8) Figure 7.1-13 Span on Maneuver Parameters, $\lambda = 45^\circ$
 Effect of Aspect Ratio on Maneuver Parameters (U)

~~SECRET~~

~~SECRET~~

7.2 VEHICLE DESIGN

(S) Layouts for the two selected supercritical wing configurations were developed for a detailed analysis. The selected design points were for wing aspect ratios of 3.00 and 3.75 and an airplane mission weight of 16,800 lb. These aspect ratios are based on a theoretical trapezoidal planform. The true aspect ratios, based on wings with curved tips, are 3.2 and 4.0, respectively. Each configuration is essentially the same as the basic 401B arrangement except for the wing planform and the associated tail size changes. Each point design was reconfigured to provide appropriate balance characteristics, and both horizontal and vertical tail sizes were adjusted so that the tail volume remained the same.

88th ABW/PI
FOIA (b)(1) (b)(7) (C)
E.O. 13526 SEC. 3.3
(b)(4) 3.1.26
SEC 1.4 (a) (g)

(U) The lines layout of the large single-engine airplane (401B) with a supercritical wing is presented in Figure 7.2-1 for an aspect ratio of 3.00. The basic description data and friction drag data are summarized in Figures 7.2-2 and -3, respectively, for the AR = 3.00 design. The normal area distribution for the AR = 3.00 arrangement is shown in Figure 7.2-4.

(U) The lines layout of the large single-engine aircraft with a supercritical wing is presented in Figure 7.2-5 for an aspect ratio of 3.75. The basic description data and friction drag data are summarized in Figures 7.2-6 and -7, respectively, for the AR = 3.75 design. The normal area distribution for the AR = 3.75 arrangement is shown in Figure 7.2-8.

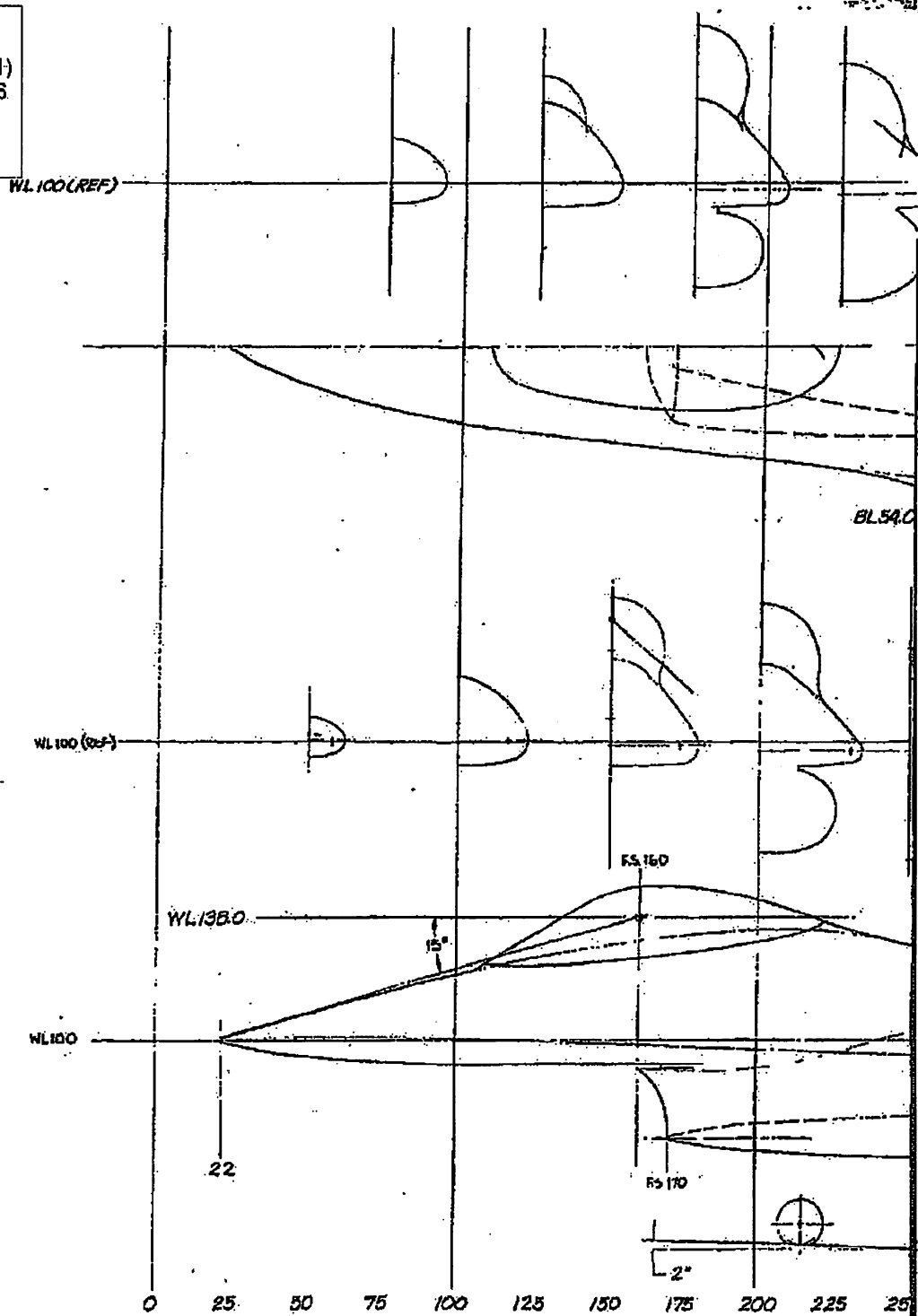
88th ABW/PI
FOIA (b)(1) (b)(7) (C)
E.O. 13526 SEC. 3.3 (b)
(b)(4) 3.1.26
SEC 1.4 (a) (g)

(S) The performance evaluation (Section 7.4) resulted in a mission weight of 16,640 lb for the aspect-ratio 3.0 design and a mission weight of 17,115 lb for the aspect-ratio 3.75 design. A general arrangement drawing of the airplane with a wing aspect ratio of 3.75 at a mission weight of 17,115 lb is shown in Figure 7.2-9. The general arrangement of the airplane with a wing aspect ratio of 3.0 is basically the same as shown in Section 3.1 (Figure 3.1-4). The small difference in size (mission weight of 16,640 lb compared to 17,115 lb) does not warrant a new layout.

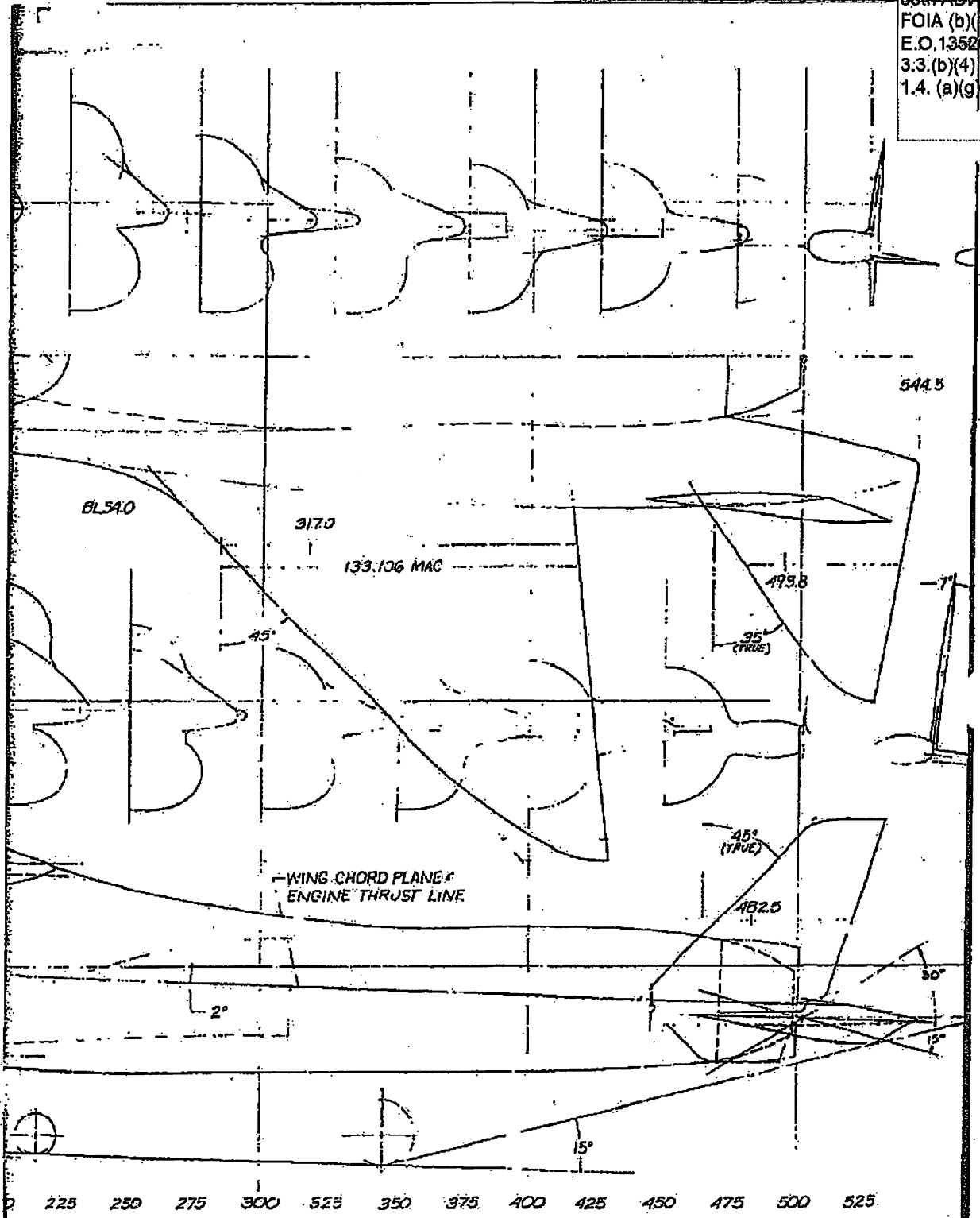
88th ABW/PI
FOIA (b)(1) (b)(7) (C)
E.O. 13526 SEC. 3.3 (b)
(b)(4) 3.1.26
SEC 1.4 (a) (g)

~~SECRET~~

88th
ABW/PI
FOIA (b)(1)
E.O. 13526
SEC. 3.3.
(b)(4)
1.4. (a)(g)



88th ADW/IPI
FOIA (b)(1)
E.O. 13526 SEC.
3.3.(b)(4)
1.4. (a)(g)



225 250 275 300 325 350 375 400 425 450 475 500 525

2

(g) Figure 7.2-1 Configuration 401B

88th ABW/PI

FOIA (b)(1)

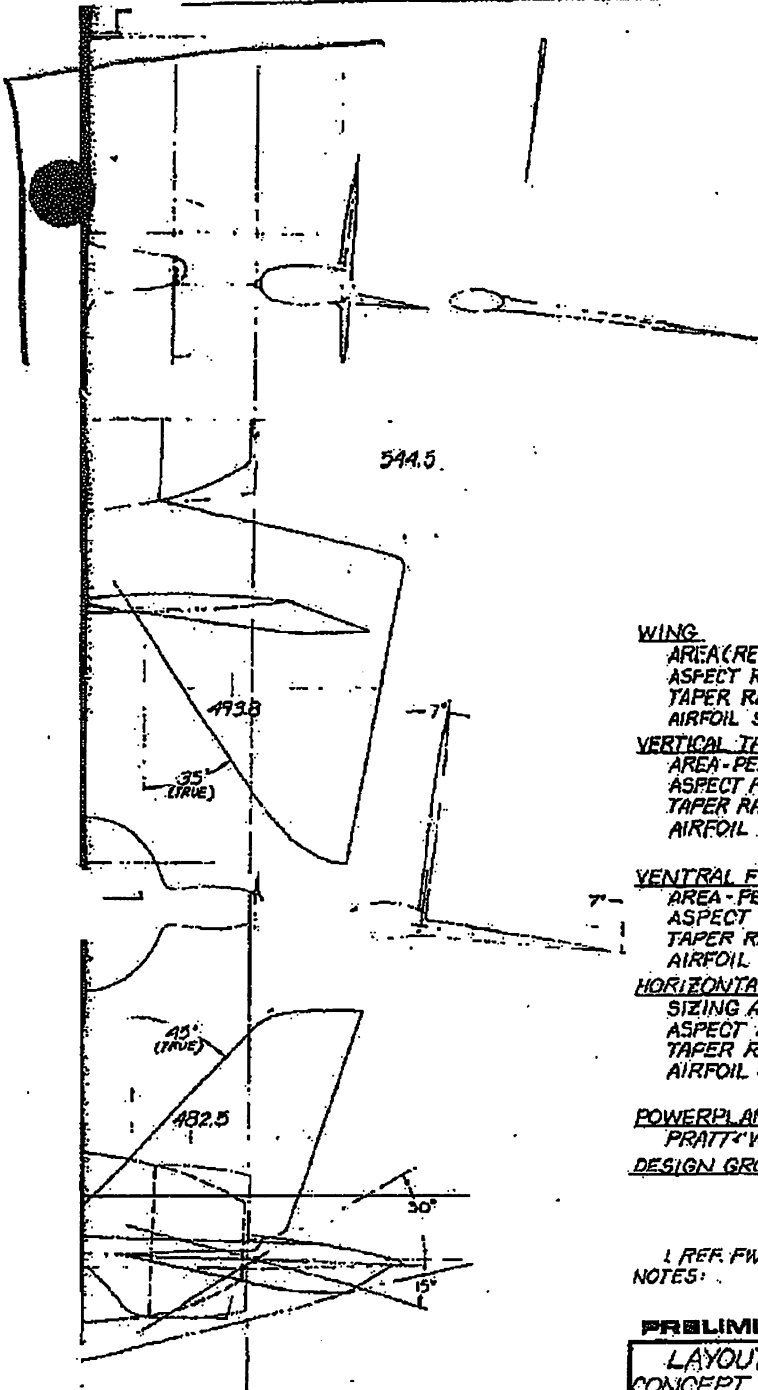
E.O. 13526 (S) 50. A (b)(4)

1.4 (a)(9) (b)(1)

EO 13526 SEC. 5.3 (b)(4)

SEC. 1.4 (a)(9)

~~SECRET~~ P95 405-408



BASIC DATA

<u>WING</u>	
AREA (REF)	280 SQ.F.
ASPECT RATIO	3.0
TAPER RATIO	0.2
AIRFOIL SECTION	6% SUPERCritical
<u>VERTICAL TAIL</u>	
AREA - PER TAIL	21.383 SQ.FT
ASPECT RATIO	1.3265
TAPER RATIO	0.4
AIRFOIL SECTION	ROOT 6% BI-CONVEX
	TIP 4% BI-CONVEX
<u>VENTRAL FIN</u>	
AREA - PER FIN	3.525 SQ.FT
ASPECT RATIO	0.3739
TAPER RATIO	0.5957
AIRFOIL SECTION	6% BI-CONVEX
<u>HORIZONTAL TAIL</u>	
SIZING AREA	54.80 SQ.FT
ASPECT RATIO	3.0
TAPER RATIO	0.2
AIRFOIL SECTION	ROOT 6% BI-CONVEX
	TIP 4% BI-CONVEX

POWERPLANT

PRATT & WHITNEY F102-PW-100 ENGINE

DESIGN GROSS WEIGHT

16,800 LBS

~~SECRET~~

1 REF. FW 710406 FOR BASIC CONFIG 401B LINES
NOTES:

PRELIMINARY DESIGN DRAWING

LAYOUT - LARGE CONSISTING ENGINE
CONCEPT WITH SUPERCritical WING
AR = 3.0 CONFIG 401B AFFIX PROGRAM

DR J CASZAK (REVISED)	SCALE 1/2" = 1'-0" (A, B, C, D)
GENERAL DYNAMICS Convair Aerospace Division <small>For Work Orders</small>	FY 7104119 LIMIT 02

0 475 500 525

e 7.2-1 Configuration 401B with Supercritical Wing of Aspect Ratio = 3.00 (U)

405/406

3

88th ABW/IPI
 FOIA (b)(1)
 E.O. 13526 SEC.
 3.3.(b)(4)
 1.4. (a)(g)

~~SECRET~~
 BASIC DESCRIPTIONS

PROJECT: AVFFX PROGRAM

G.W. - 16,800 lbs.
 WIS - 60 lbs./sq.
 T/W - 1.397 (unmodified)
 Eng. - PWA JTF 224-27
 CRF - skulpt (in. x 100 x 100)

CONFIGURATION: 401B WITH
SUPERCritical WING R=3.0
 DATE: 23 AUG 71
 Ref. Desg - W7104119

BODIES				
	LENGTH (IN.)	X (IN.)	Y (IN.)	Z (IN.)
FUSELAGE CENTERBODY	478	0	0	0
FUSELAGE OUTERBODY	420.5	102	± 40.0	0
CHNOPIY	188.5	85	0	± 38

WING REF AREA (IN ²)					SURFACES			
* Includes Nozzle Length Open + For K-35 Program Only					2% THICK LEADING EDGE	2% THICK LEADING EDGE	2% THICK LEADING EDGE	2% THICK LEADING EDGE
					HORIZONTAL	HORIZONTAL	VERTICAL	VERTICAL
AREA (FT ²)	WING (MINIMAL)	HORIZ. TAIL	VERT. TAIL	VENTRICAL WING				
AR - ASPECT RATIO	3.0	3.4215	1.32653	0.37523				
λ - TAPER RATIO	0.2	0.13615	0.4	0.59079				
LE (°)	E ₁	+4.5°	55°	+4.5°	+4.5°			
	E ₂	-6.5°	+10° 41'	-19° 22'	+12° 22'			
Q - CUTOFF = $\frac{C_{Lmax}}{C_{Lmax} - C_{Lmin}}$								
c _r - ROOT CHORD (IN.)	193.22	125.57	68.827	46.212				
c _t - TIP CHORD (IN.)	38.61	17.096	27.531	27.531				
b - SPAN (IN.)	347.79	244.067	63.911	13.765				
AIRFOIL	6% Supercritical 5% Area in. 0.25 in. Tu	6% Supercritical 5% Area in. 0.25 in. Tu	6% Supercritical 5% Area in. 0.25 in. Tu	6% Supercritical 5% Area in. 0.25 in. Tu				
d (IN.)	59	51.5	0	0				
x (IN.)	298	439	420	55				
y (IN.)	0	0	± 51.7	± 51.5				
z (IN.)	0	0	0	-13				

d = Average buried span
 x = Distance aft from fuselage nose to body nose or surface fuselage intersection point.
 y = Distance outbd from fuselage ref. line to body ref. line or vertical surface chord line.
 z = Distance up (+) or down (-) from fuselage ref. line to body or surface ref line.

(8) Figure 7.2-2 Basic Description Data Sheet - Configuration 401B with Supercritical Wing of Aspect Ratio = 3.00 (U)

88th ABW/PI
 FOIA (b)(1)
 E.O. 13526 SEC. 3.3.(b)(4)
 1.4. (a)(g)

FRICION DRAG DATA

G.W. = 16,800 LBS
 W/S = 60 LBS/FT²
 T/W = 1.397 (uninstalled)
 Eng. = PW-VA JTF 22A-27
 BODIES (AF Designation: F100-PW-100)

SECRET PROJECT AVFFX PROGRAM 82
 CONFIGURATION 401B WITH
SUPERCritical WING, R=3.0
 DATE 20 Aug 71
 R.S. Desg. FW7104119

BODY	WETTED AREA (FT ²)	LENGTH (IN)	MAX WIDTH (IN)	MAX HEIGHT (IN)
Fuselage (Including)	405.5	476.6	52.0	71.0
Fuselage (Diller body)	266.1	422.5	28.0	18.0
Composit (Including)	50.7	113.0	10.0	27.0
Nozzle (Closed)	20.8	27.2	43.5 Dia	
Nozzle (Open)	26.7	28.6	43.5 Dia	

BODY TOTAL 759.1 * Length Includes Nozzle Closed - A unit for Nozzle Shown Separately

SURFACES

SURFACE	WETTED AREA (FT ²)	EXPOSED MAC LENGTH (IN)	MAX. THICKNESS SWEEP (DEG.)	AIRFOIL
Wing	306.2	102.23	54.5	6% Supercritical
Horizontal Tail	98	56.09	14° 30'	2% 1500
Vertical Tail (2)	88.5	52.00	54° 15'	4% 1500
Vertical Fin (2)	14.6	22.30	17° 15'	6% 1500

SURFACE TOTAL 507.8

AIRPLANE TOTAL 1295.4

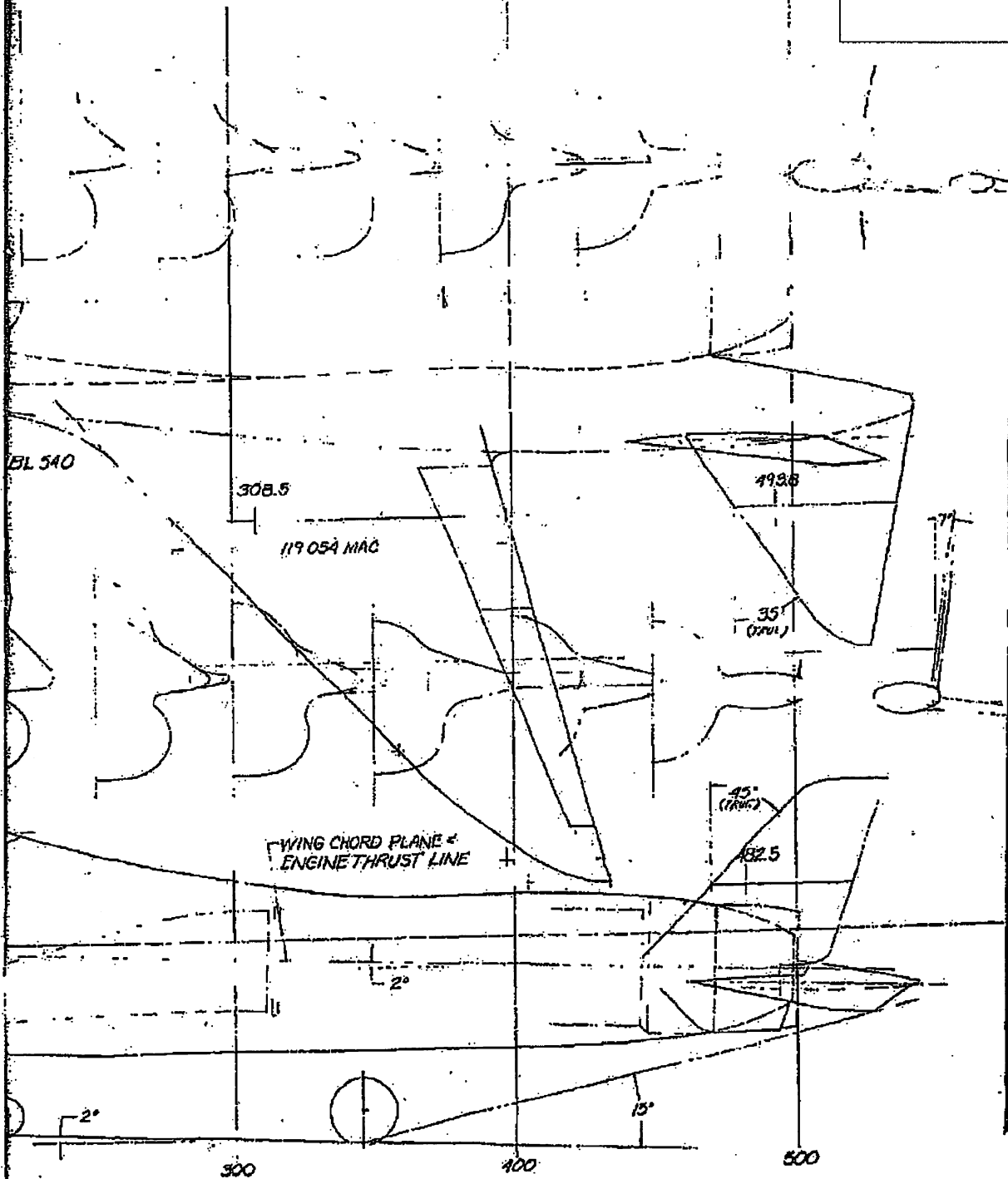
BASIC WING GEOMETRY:

	TRAPEZOID SHAPE FOR CURVED TIP BASIC REF. WING	TRAPEZOID SHAPE FOR CURVED TIP REF. WING
AREA (FT ²)	280	289.358
ASPECT RATIO	3.0	3.2
TAPER RATIO	0.2	0.16889
LEADING EDGE SWEEP (DEG.)	45°	45°

(S) Figure 7.2-3 Friction Drag Data Sheet - Configuration 401B with Supercritical Wing of Aspect Ratio = 3.00 (U)

88th ABW/IPI
FOIA (b)(1)
E.O. 13526 SEC.
3.3.(b)(4)
1.4. (a)(g)

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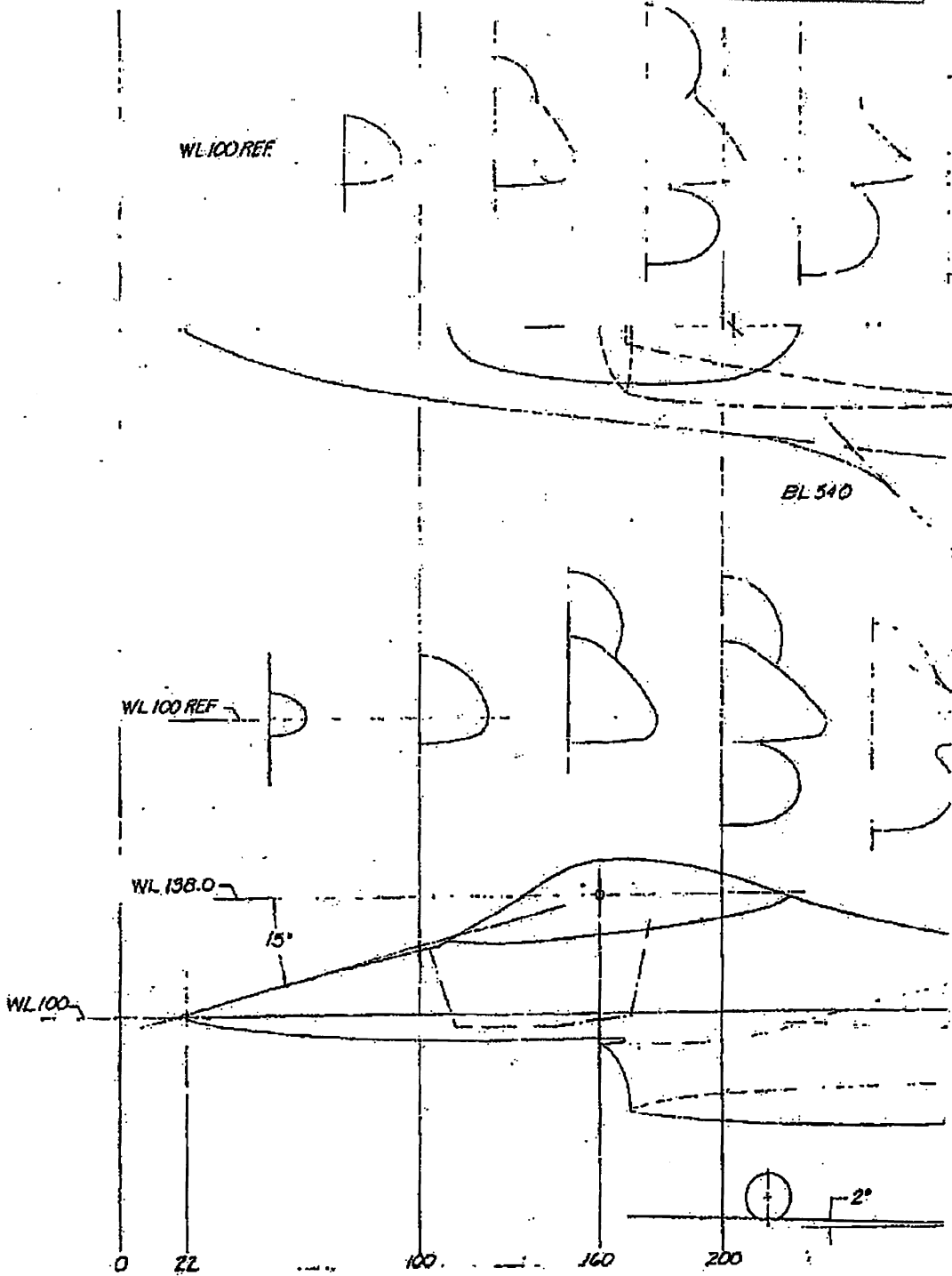


(S) Figure 7.2-5 Configuration 401B with

88th ABW/PI
FOIA (b)(1)
E.O. 13526 SEC. 3.3.(b)
(4)
1.4. (a)(g)

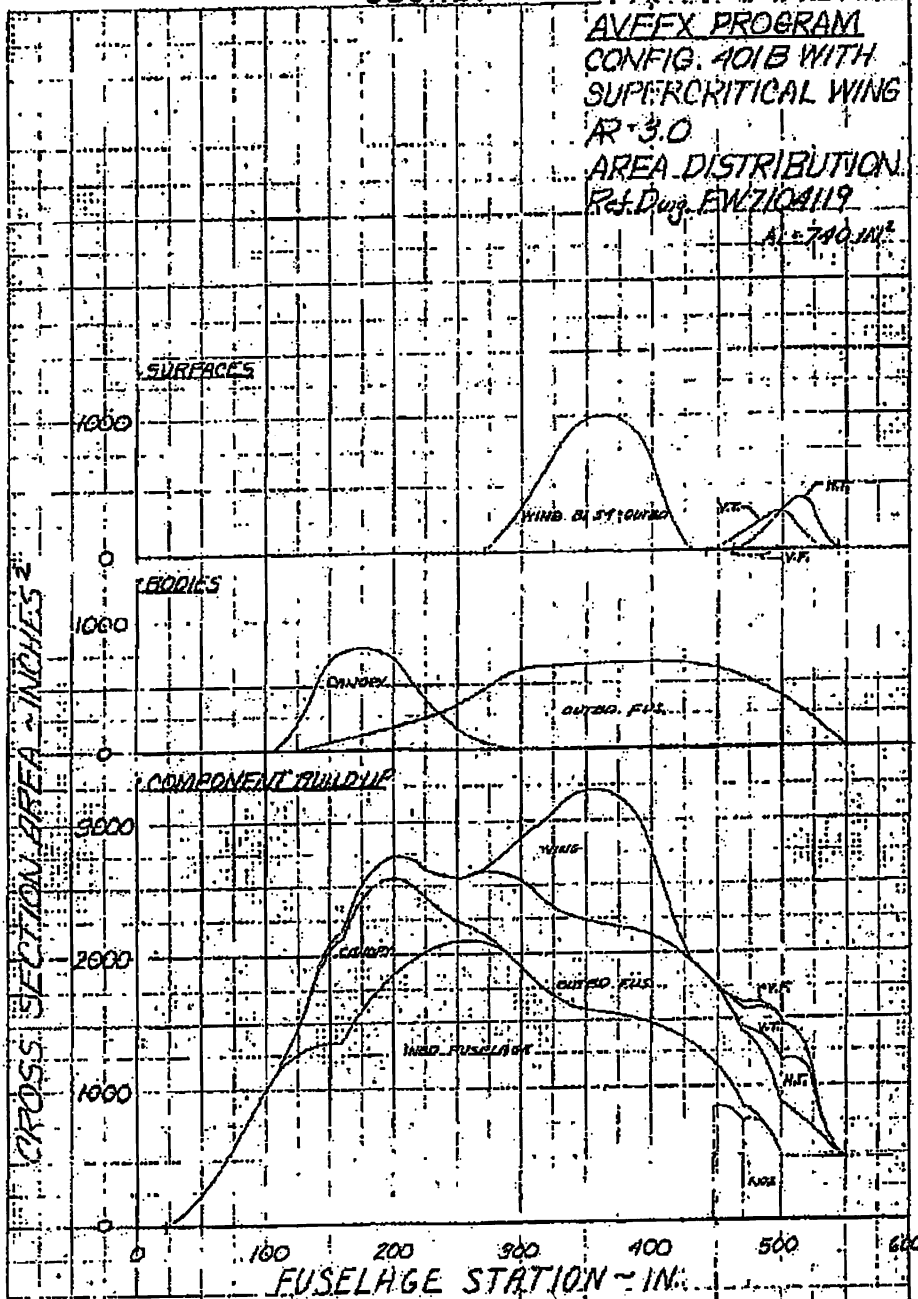
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123



88th ABW/PI
 FOIA (b) (5) ABL/DP
 E.O. 13526 SEC. 1.4 (b) (4)
 14-00000 26 SEC 33 (b) (4)
 SEC 26 (a) (9)

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K&E ENGINEERING CO.
 1000 W. 10th St.
 WICHITA, KS 67202
 TEL: 316-261-1111
 FAX: 316-261-1112

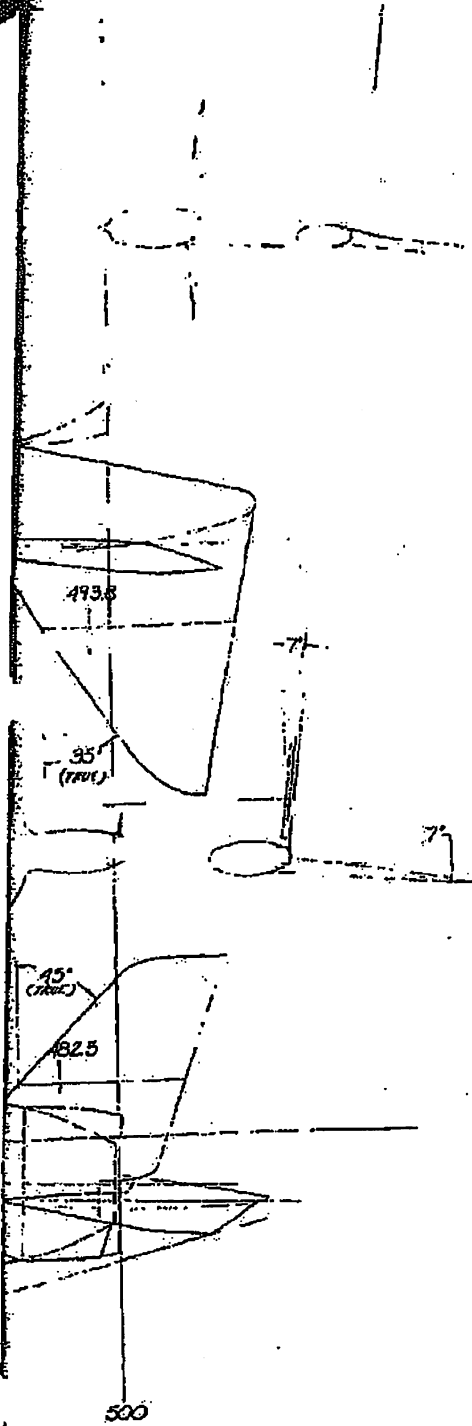
(S) Figure 7.2-4 Area Distribution Curve - Configuration 401B with Supercritical Wing of Aspect Ratio = 3.00 (U)

409
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88th ABW/PI
 FOIA (b)(1)
 E.O. 13526 SEC.
 3.3.(b)(4)
 1.4. (a)(g)

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BASIC DATA

<u>WING</u>		280 SQ.FT
REF AREA		3.75
ASPECT RATIO		0.2
TAPER RATIO		
AIRFOIL SECTION	6% SUPERCRITICAL	
<u>VERTICAL TAIL</u>		20.398 SQ.FT
AREA-PER TAIL		1.9265
ASPECT RATIO		0.4
TAPER RATIO		
AIRFOIL SECTION	ROOT 6% BICONVEX TIP 4% BICONVEX	
<u>VENTRAL FIN</u>		3.352 SQ.FT
AREA-PER FIN		0.9739
ASPECT RATIO		0.5937
TAPER RATIO		
AIRFOIL SECTION	6% BICONVEX	
<u>HORIZONTAL TAIL</u>		52.287 SQ.FT
SIZEING AREA		3.0
ASPECT RATIO		0.2
TAPER RATIO		
AIRFOIL SECTION	BL 51.5 6% BICONVEX TIP 4% BI-CONVEX	
<u>POWERPLANT</u>		
PRATT & WHITNEY F100-PW100 ENGINE		
DESIGN GROSS WEIGHT		16,800 LBS

1 REF FW7104066 FOR BASIC CONFIG 401B LINES
 NOTES:

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PRELIMINARY DESIGN DRAWING

LAYOUT-LARGE SINGLE ENGINE
 CONCEPT WITH SUPERCRITICAL WING,
 AR=3.75, CONFIG 401B AVFTX PROGRAM

REV	DATE	BY	CHKD	DATE
GENERAL DYNAMICS Convair Aerospace Division Fort Worth Operation			FW7104103	
			SECRET	

2-5 Configuration 401B with Supercritical Wing of Aspect Ratio = 3.75 (0)

411/412

3

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BASIC DESCRIPTION

PROJECT: AVFEX PROGRAM

G.W. = 16,800 LBS
W/S = 60 lbs./ft.²
T/W = 1.397 (unstalled)
Eng = PWYA JTF 22A-27
(AF Designation: F100PW-100)


CONFIGURATION: 401B WITH SUPERCRITICAL WING
DATE: 30 July 71 K-3.15
Rev. Eng. FW 7104103

BODIES

	LENGTH (IN.)	X (IN.)	Y (IN.)	Z (IN.)
FUSELAGE CENTERBODY	478	0	0	0
FUSELAGE OUTERBODY	120	102	+10	0
CANOPY*	183.5	85	0	+38

88th ABW/PI
FOIA (b)(1) / (b)(7)
E.O. 13526, SEC.
3.8 (b) (1), (2), (7)
1.5 (b) (1), (2), (6), (7)
3.8 (b) (1), (2), (6), (7)
Sec. 1.4 (a) (2)

* Includes Nacelle Length (qv) + For K-35 Program Only

WING REF. AREA (IN ²)	SURFACES			
	* INCIDENCE WING (NOMINAL)	* INCIDENCE WING NOM. HORIZ. TAIL	VERT. TAIL	REF. SURF. VERTICAL FIN
AREA (ft ²)	280	117.401	20.338	3.352
R - ASPECT RATIO	3.75	3.42967	1.92659	0.37333
λ - TAPER RATIO	0.2	0.13498	0.4	0.59574
 E ₁ +45° E ₂ -16°	+45°	+55°	+45°	+45°
	-16°	+10° 41'	-1° 22'	+1° 22'
Q - CUTOUT = $\frac{E_1 - E_2}{2 \sin(\theta)}$				
R - ROOT CHORD (IN.)	172.820	123.718	67.126	45.070
T - TIP CHORD (IN.)	94.564	16.699	26.850	26.850
b - SPAN (IN.)	388.514	240.793	62.330	13.425
AIRFOIL	6% Supercritical (See data for Details)	6% Supercritical (See data for Details)	Root 6% Biconvex Tip 4% Biconvex	6% Biconvex
d (IN.)	54	51.5	0	0
x (IN.)	235	441	421.3	431.2
y (IN.)	0	0	154.9 WING	1.0
z (IN.)	0	0	-3	-1.5

- d = Average buried surface depth
- x = Distance aft from fuselage nose to body nose or surface fuselage intersection point.
- y = Distance outbd from fuselage ref. line to body ref. line or vertical surface chord line.
- z = Distance up (+) or down (-) from fuselage ref. line to body or surface ref line.

(9) Figure 7.2-6 Basic Description Data Sheet - Configuration 401B with Supercritical Wing of Aspect Ratio = 3.75 (U)

FRICION DRAG DATA

G.W. * 16,800 LBS
 W/S * 60 lbs/ft²
 T/W * 1.397 (uninstalled)
 Eng * PrWA JTF 22A-27
 BODIES (AF Designation - F100-PW-100)

~~SECRET~~ PROJECT AVFFX PROGRAM

CONFIGURATION 401B WITH
SUPERCRITICAL WING
 DATE 12 Aug 71 R-375
 Ref. Desg. FW7104103

BODY	WETTED AREA (FT ²)	MAX LENGTH (IN)	MAX WIDTH (IN)	MAX HEIGHT (IN)
Fuselage (Centerbody)	405.5	476.6	52.0	71
Fuselage (Outerbody)	268.0	420	28.0	18.0
Canopy (Total Faring)	50.7	143.0	40.0	27.0
Nozzle (Closed)	20.8	27.2	43.5 Dia.	
Nozzle (Open)	26.7	28.6	43.5 Dia.	
BODY TOTAL	745.0	* Length Includes Nozzle Closed - A wet. for Nozzle Shown Separately		

88th ABW/PI
 FOIA (b)(1) (2)
 E.O. 13526 SEC. 3.3.
 (b)(4) (b)(7)
 9/1/97 (14)
 SEC 3.3 (5) (14)
 SEC 1.4 (a) (9)

SURFACE	WETTED AREA (FT ²)	EXPOSED MAC LENGTH (IN)	MAX. THICKNESS SWEEP (DEG.)	AIRFOIL
Wing	329.6	94.38	37°	Supercritical
Horiz Tail	90.6	58.92	14°30'	6% Biconvex
Vert. Tail (2)	81.4	49.86	34°15'	17% Biconvex
Ventral Fin (2)	13.4	36.73	17°45'	6% Biconvex
SURFACE TOTAL	515.0			

AIRPLANE TOTAL 1260

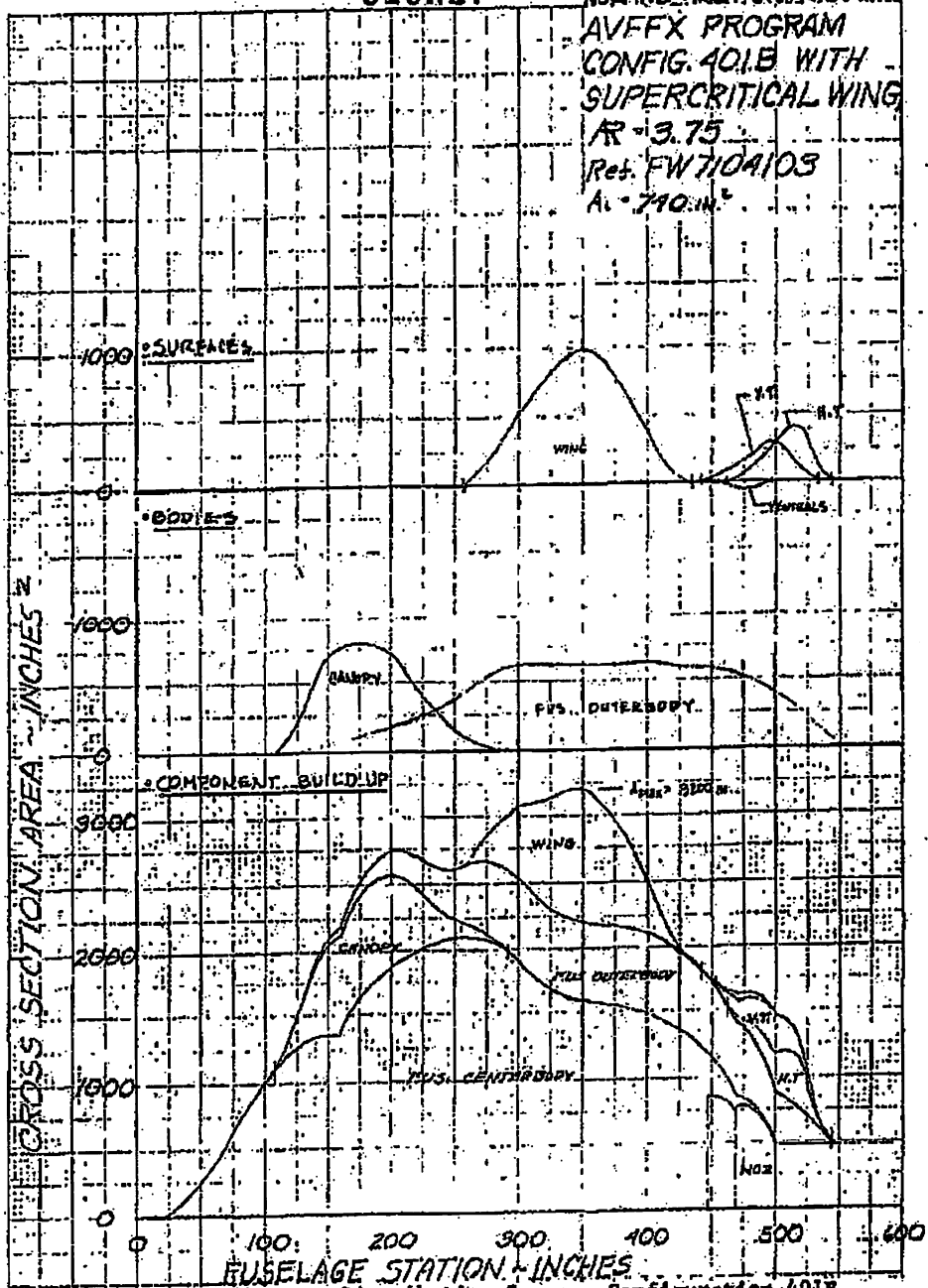
BASIC WING GEOMETRY:	TAPERED SHAPE	TAPERED SHAPE
	BASIC REF WING	FOR CURVED TIP REF WING
AREA (FT ²)	280	289.359
ASPECT RATIO	3.75	4.00
TAPER RATIO	0.2	0.1688
LEADING EDGE SWEEP (DEG.)	45°	45°

(6) Figure 7.2-7 Friction Drag Data Sheet - Configuration 401B with Supercritical Wing of Aspect Ratio = 3.75 (U)

88th ABW/IPI
 FOIA (b)(1) / (b)(7) / (b)(1) / (b)(1)
 E.O. 13526, SEC. 3.3 (b)(4)
 TCM 440 (1) / (1) / (1) / (1)
 E.O. 13526, SEC. 3.3 (b)(4) / (4) / (4) / (4)
 SEC 14 (a)(9)

~~SECRET~~

NORMAL AREA DISTRIBUTION
 AVFFX PROGRAM
 CONFIG. 401B WITH
 SUPERCRITICAL WING
 $R = 3.75$
 Ref. FW7104103
 $A_i = 790 \text{ in}^2$



K&E
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(S) Figure 7.2-3 Area Distribution Curve - Configuration 401B
 with Supercritical Wing of Aspect Ratio = 3.75 (1)

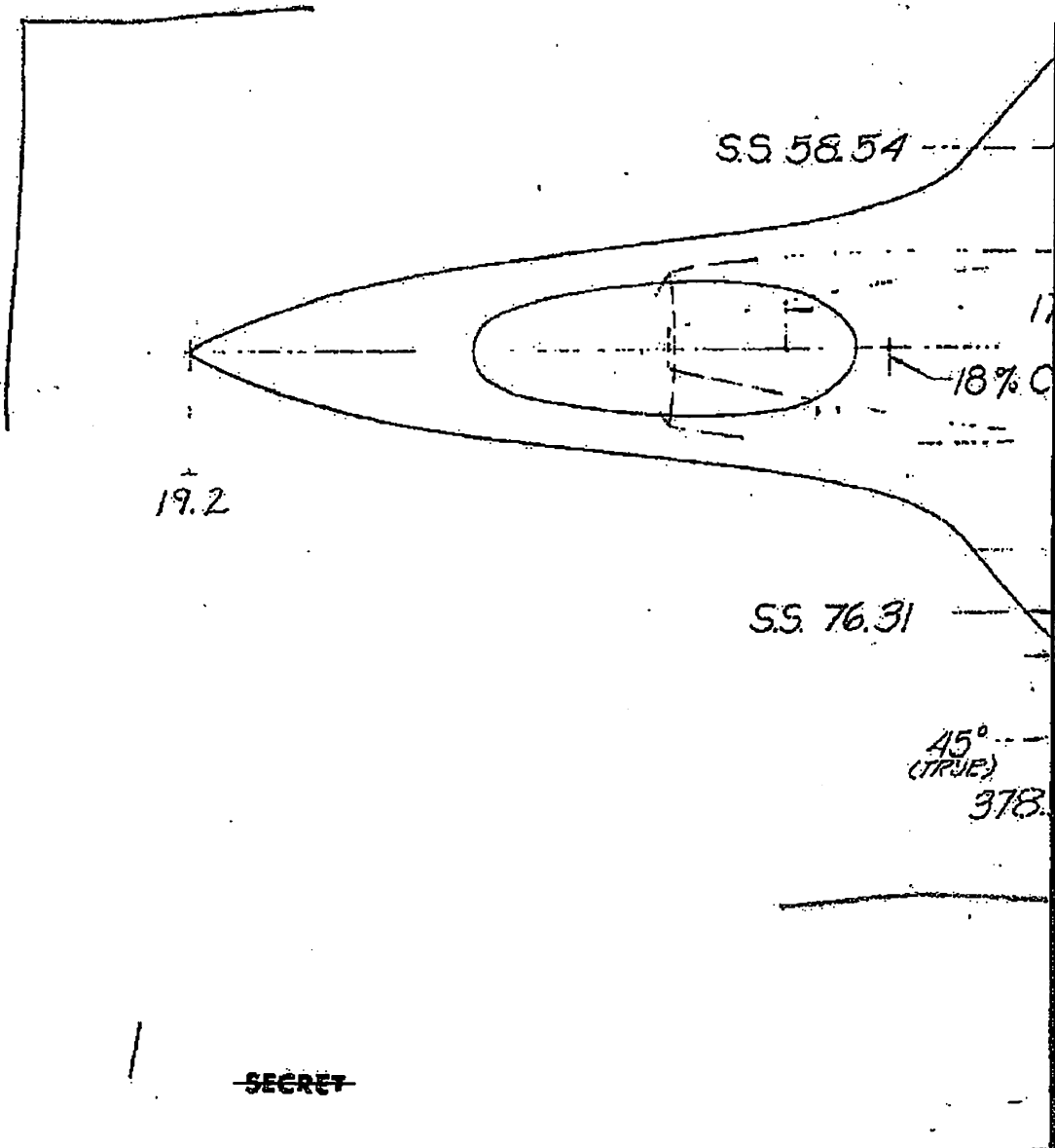
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88th ABW/IPI
FOIA (b)(1)
88 ABW/IPI
FOIA (b)(1)

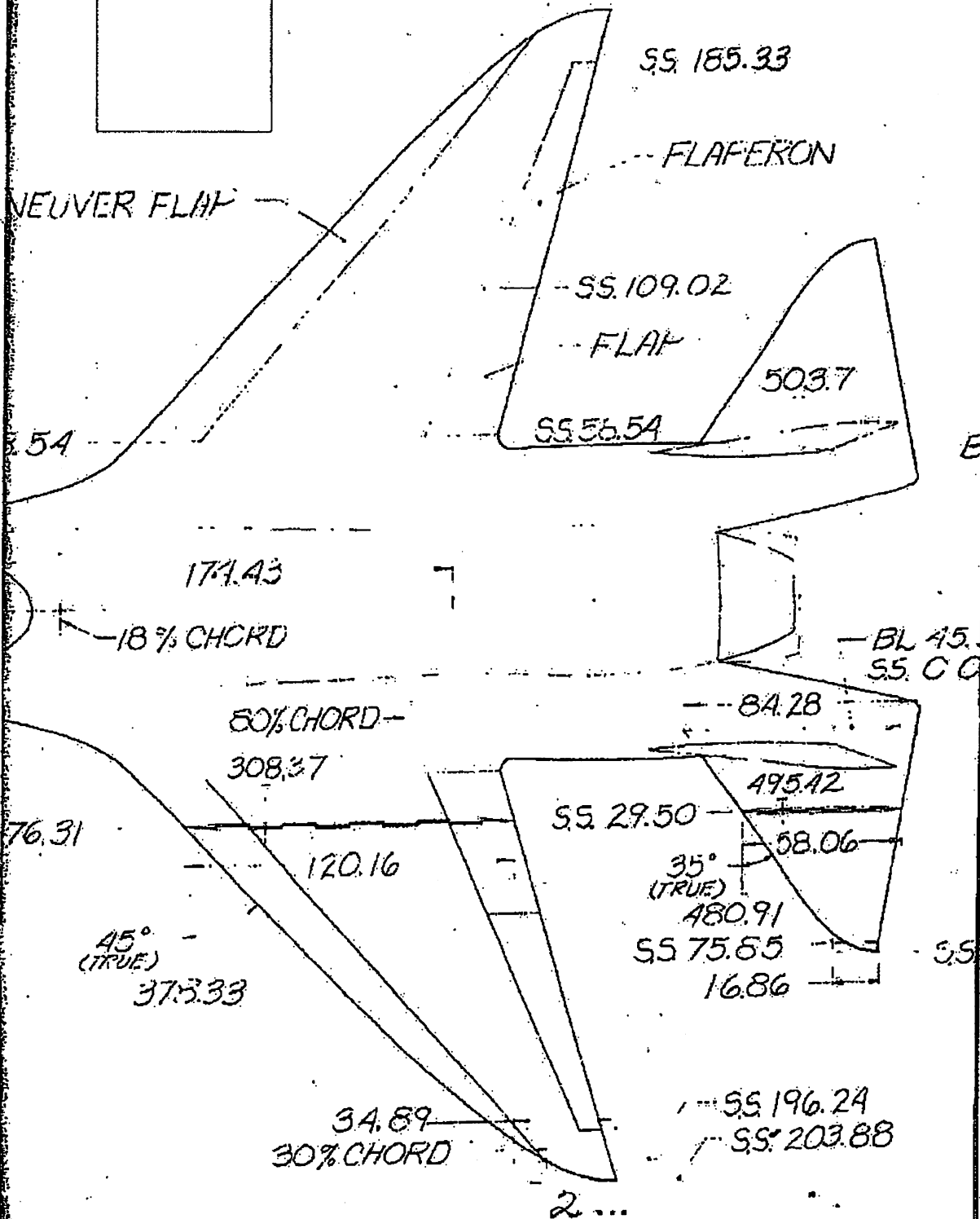
MANEUVER FLA



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88th ABW/IPI
FOIA (b)(1)

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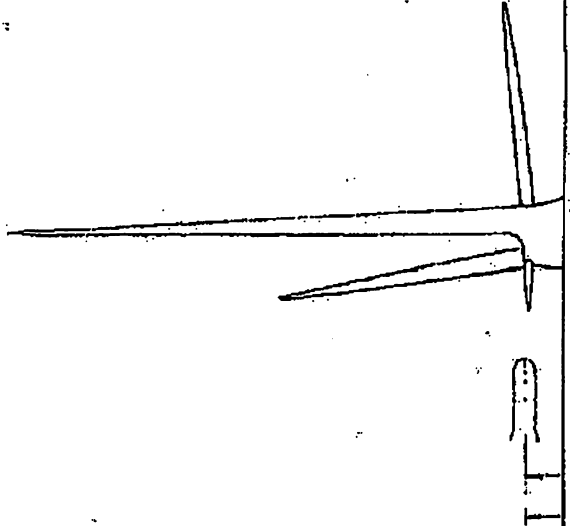
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88th ABW/PI
FOIA (b)(1)

OV
3



EL 51.33



OVERALL
43F

BL 45.52
SS. CO



HORIZ. VISION LINE

15°

WL 100

2° INC.

55.78.80

19.2

2°

157.2

3

6

COM

STATIC GROUND LINE

212.2

EXT

4
88

0

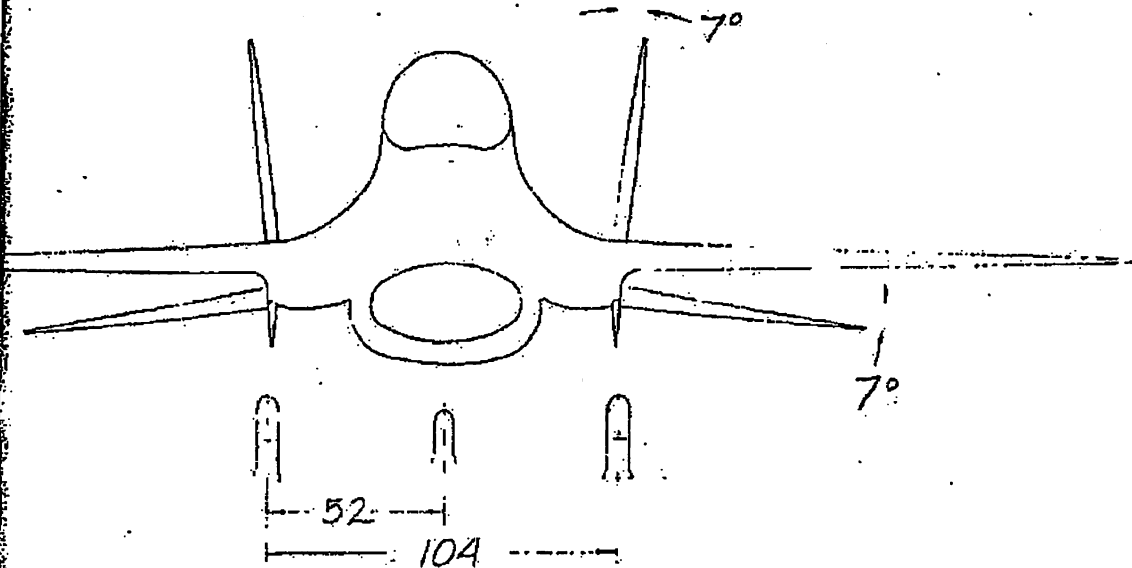
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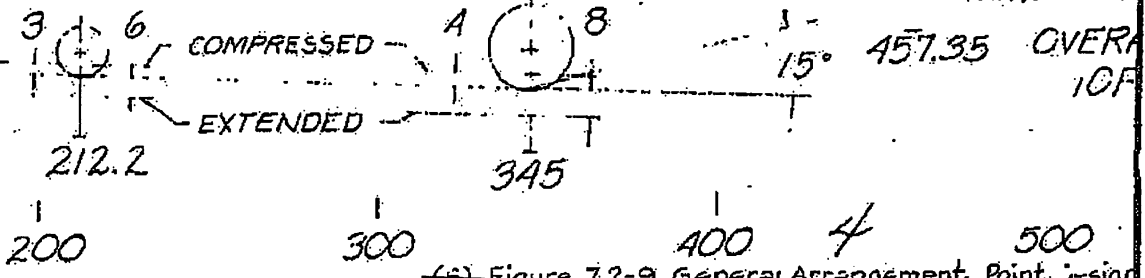
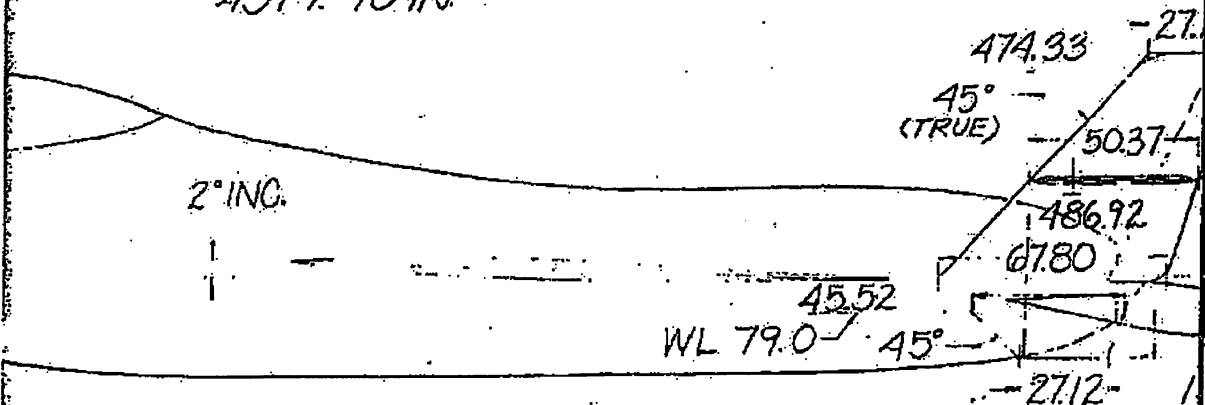
88th ABW/PI
FOIA (b)(1)

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OVERALL SPAN
33 FT 11.8 IN.



OVERALL LENGTH
43 FT 10 IN.



(s) Figure 7.2-9. General Arrangement, Point Design

88th ABW/IPI

FOIA(b)(7)(C) / (D)
E.O. 13526 SEC 3.3 (b)(4)
1.4 (a)(1) (2) (3) (4)
E.O. 13526 SEC 3.3 (b)(4) (7)(4)
SEC 1.4 (a)(1) (2)

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Aircraft Mission Weight = 17,115 lb

WING (REFERENCE)

AREA	183.71 SQ. FT
ASPECT RATIO	3.75
TAPER RATIO	0.3
SPAN	32.71 FT
SWEEP-LEADING EDGE	43°
ROOT CHORD	16.43 IN
TIP CHORD	16.89 IN
M.A.C.	120.16 IN
AIRFOIL SECTION	43 BICOINVER
INCIDENCE	20°
DIRECTIONAL	0°

MANEUVER FLAP

TYPE	PLAIN
TOTAL AREA	12.15 SQ. FT
SPAN-PCA SIDE	13.1 IN
ROOT CHORD	25.1 IN
TIP CHORD	18.3 IN
DEFLECTION	25°
HINGE LINE	
NOSE	101
TIP	304

FLAP

TYPE	PLAIN
TOTAL AREA - INCLUDING FLAPBAND	10.92 SQ. FT
ROOT CHORD	26.26 IN
TIP CHORD	19.6 IN
FLAPBAND	
TOTAL AREA	14.29 SQ. FT
SPAN-PCA SIDE	76.31 IN
ROOT CHORD	19.6 IN
TIP CHORD	8.3 IN
DEFLECTION	20° - 30°
FLAP DEFLECTION - MAX	30°
TAIL HINGE	402

VERTICAL TAIL

AREA - TOTAL	41.30 SQ. FT
ASPECT RATIO	1.3189
TAPER RATIO	0.6
SPAN	62.96 IN
SWEEP-LEADING EDGE	43°
ROOT CHORD	67.80 IN
TIP CHORD	27.12 IN
AIRFOIL SECTION	65 ROOT, 43 TIP BICOINVER

BUDGET

AREA-TOTAL	10.20 SQ. FT
SPAN	62.96 IN
ROOT CHORD	18.93 IN
TIP CHORD	6.75 IN
DEFLECTION	20°

VERTICAL FIN

AREA-TOTAL	5.46 SQ. FT
ASPECT RATIO	0.3233
TAPER RATIO	0.3937
SPAN	13.16 IN
SWEEP-LEADING EDGE	43°
ROOT CHORD	65.17 IN
TIP CHORD	22.12 IN
AIRFOIL SECTION	65 BICOINVER

HORIZONTAL TAIL (ALL MOVABLE)

AREA	13.27 SQ. FT
ASPECT RATIO	3.0
TAPER RATIO	0.3
SPAN-EXTENDED	154.78 IN
SWEEP-LEADING EDGE	39°
ROOT CHORD	64.28 IN
TIP CHORD	19.66 IN
M.A.C.	58.06 IN
INCIDENCE	20°
AIRFOIL SECTION	65 AT 91, 51.67, 43 TIP BICOINVER
DIRECTIONAL	0°
DEFLECTION	L.E. UP 15°, DOWN 30°

POWERPLANT
PWA J722A-27 TURBOFAN ENGINE

LANDING GEAR

WING GEAR TYPE	26 x 6.5
NOSE GEAR TYPE	15 x 6.5

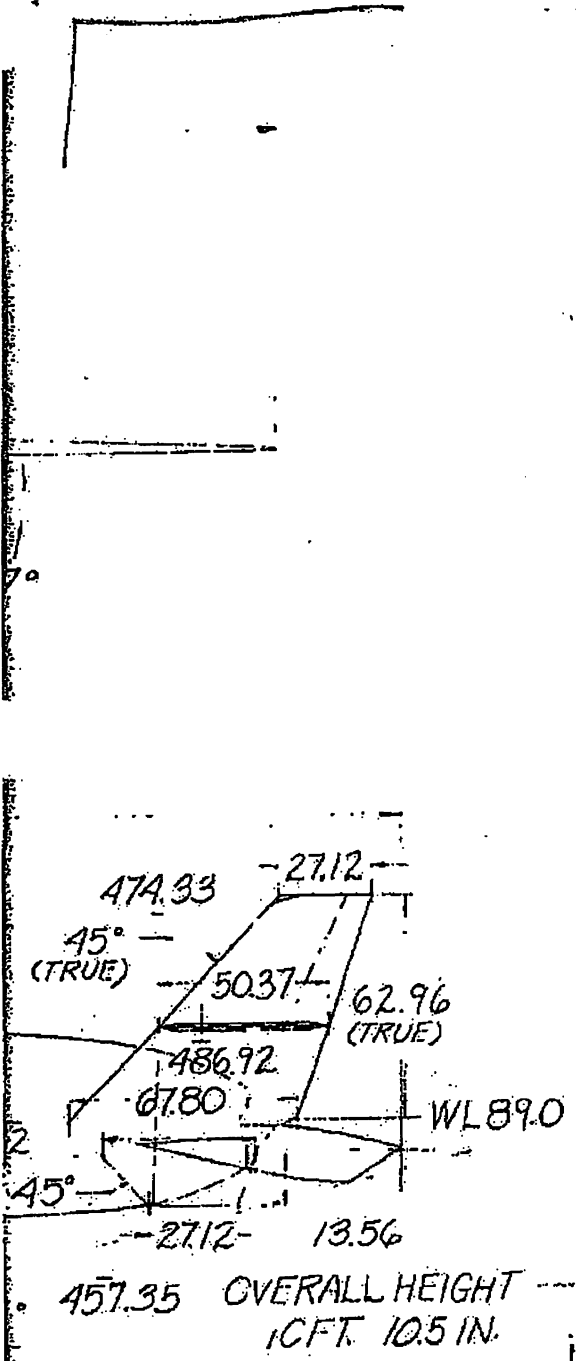
TAIL LENGTH

C/L WING TO C/L VERTICAL TAIL	14 FT. 10.6 IN
C/L WING TO C/L HORIZONTAL TAIL	15 FT. 7.1 IN

PRELIMINARY DESIGN DRAWING

GENERAL ARRANGEMENT-POINT DESIGN
CONFIG 401B TYPE WITH SUPERCRITICAL
WING AR=3.75, AVFFX PROGRAM

BY: J. CSISZVAR (274810)	SCALE: 1/40 (DATE: SEPT 71)
GENERAL DYNAMICS	FW 7104146
Convair Aerospace Division	SHEET 51
Fort Worth Operation	



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Arrangement, Point Design 401B Type, with AR 3.75 Supercritical Wing (U) **SECRET**

7.3 AERODYNAMICS

- (U) The derivation of the aerodynamic characteristics in this section are based on the true aspect ratios of 3.2 and 4.0 for the two supercritical wings with curved wing tips. However, for consistency with the preceding sections, these will be referred to as 3.0 and 3.75, respectively, throughout this section.

7.3.1 Minimum Drag

- (U) The minimum drags for the two supercritical wing aircraft are defined in Figures 7.3-1a and -1b. The drag buildup is the same as is defined in Section 3.3.1, and the additional drag components (canopy, diverter, etc.) are the same as shown in Figure 3.3-2.
- (U) The supersonic wave drag was computed by the supersonic area-rule procedure (K35). This calculation does not include camber drag, which is included in the drag due to lift discussed in the following subsection.

7.3.2 Drag Due to Lift

- (U) The drag due to lift is shown in Figures 7.3-2a through -4b. The camber drag is presented in Figure 7.3-5. At subsonic speeds, the increment was calculated by an analytical prediction; at supersonic speeds, the increment was derived from wind tunnel test of an AR = 3.0 supercritical wing.

7.3.3 Trim Drag

- (U) As for the parametric study, it is presumed that design refinements to the supercritical wing configuration will remove the trim penalty associated with the airfoil, and the levels of trim drag will be comparable to the basic 401B configuration. For a consistent comparison; therefore, the trim drag increments used for the basic configuration were used for the supercritical wing configurations. (See Figure 3.3-13).

7.3.4 Trimmed-Drag Polars

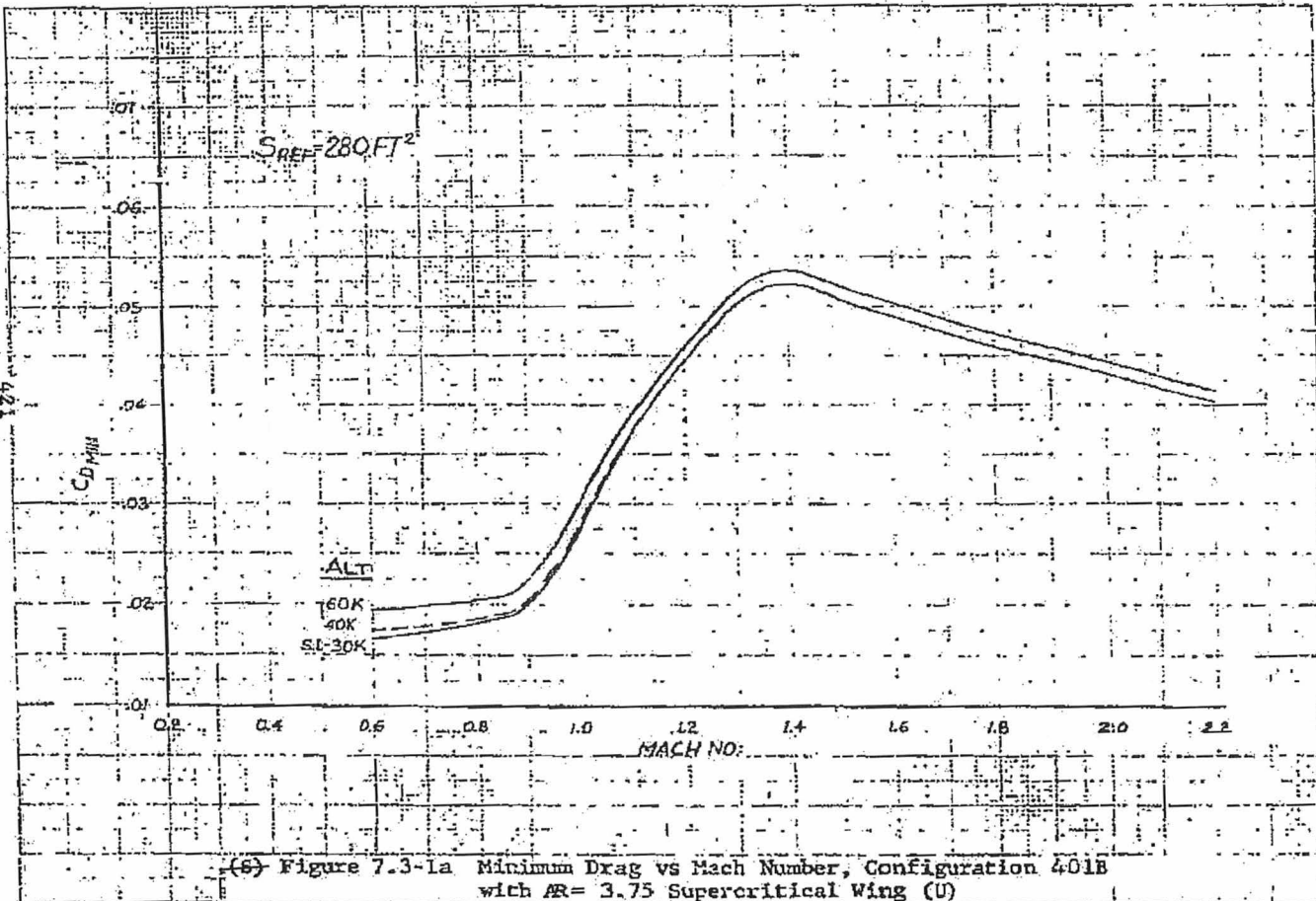
- (U) The trimmed drag polars used in mission performance for the supercritical-wing aircraft are presented in Figures 7.3-6a through -8b. The trimmed configuration polars are presented in Figures 7.3-9a through -11b.
- (U) Trimmed $(L/D)_{\max}$ is shown in Figure 7.3-12 along with values for the 4018 configuration. The aspect-ratio 3.0 and 3.75 supercritical wing configuration show higher $(L/D)_{\max}$ levels at subsonic speeds as compared to the basic 4018 configuration (biconvex wing with leading-edge flap), but the inverse is indicated at supersonic speeds, due primarily to supercritical airfoil thickness and camber drag effects.

7.3.5 Lift and Buffet Data

- (U) The predicted untrimmed C_L -vs- α curves are shown in Figures 7.3-13a and -13b. Analytical estimates of the trimmed C_L -vs- α data were not made.
- (U) The supercritical wing is expected to have superior buffet characteristics at transonic speeds. This is shown by the data of Figure 7.2-14 in which the buffet onset C_L 's of the F-111A are compared with those of the F-111/TACT.

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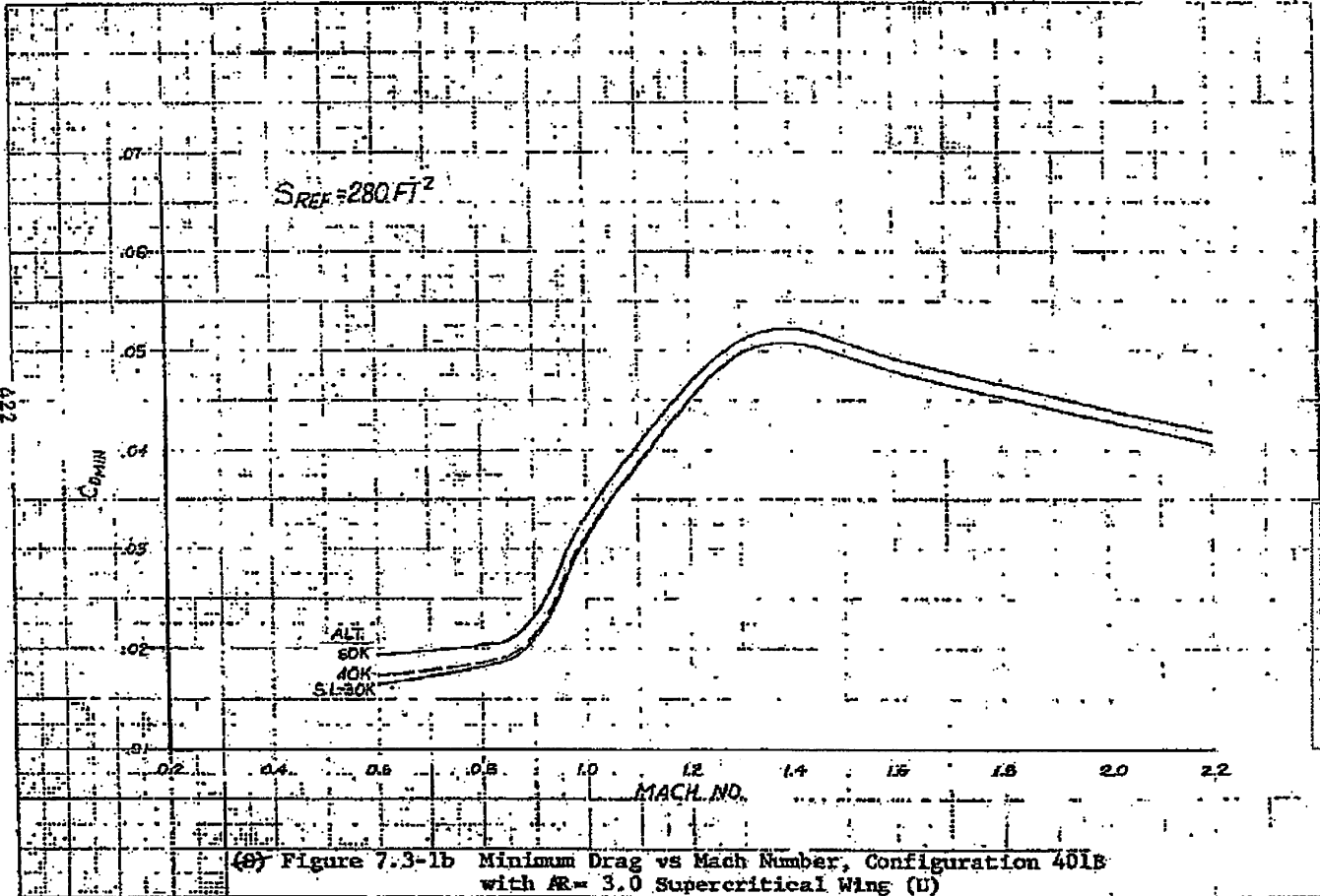


(S) Figure 7.3-1a Minimum Drag vs Mach Number, Configuration 401B with AR= 3.75 Supercritical Wing (U)

88th ARW/BI
 FOIA (b)(1) (c) AS/W/EPZ
 E.O. 13526 SEC. 3.3 (D)(4)
 1.4 (b)(1) (c) (b)(1) (c)
 E.O. 13526 SEC. 3.3 (D)(4)
 SEC. 1.4 (a)(9)

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NO. 1019



(8) Figure 7.3-1b Minimum Drag vs Mach Number, Configuration 401B with $AR = 3.0$ Supercritical Wing (U)

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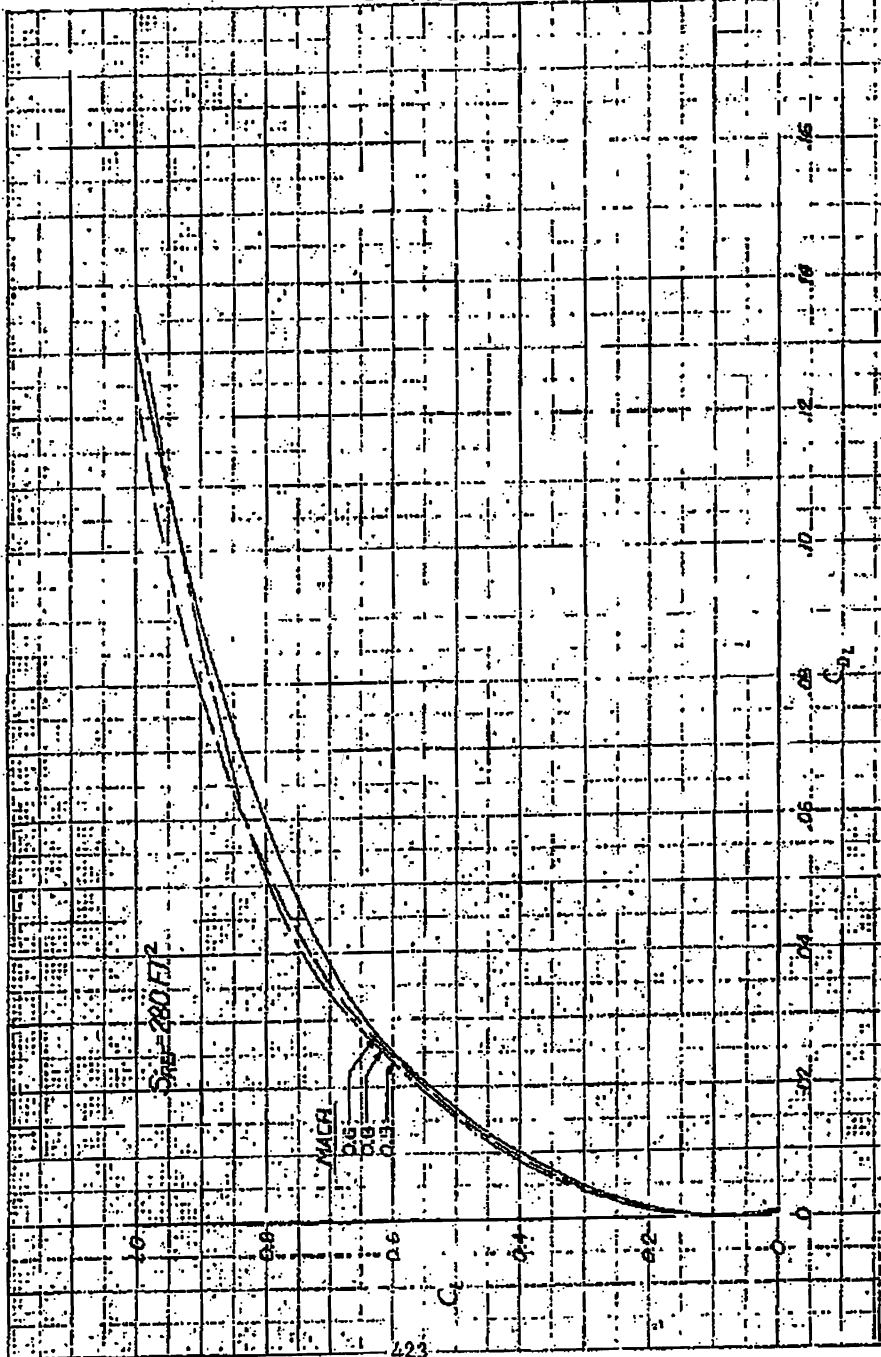
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88th ABW/BI
FOIA (b)(1)
E.O. 13526 SEC. 3.3
(b)(4)
1.4 (a)(9)

88th ABW/PI
FOIA (b)(1)
E.O. 13526 SEC. 3.3.(b)
(4)
1.4. (a)(g)

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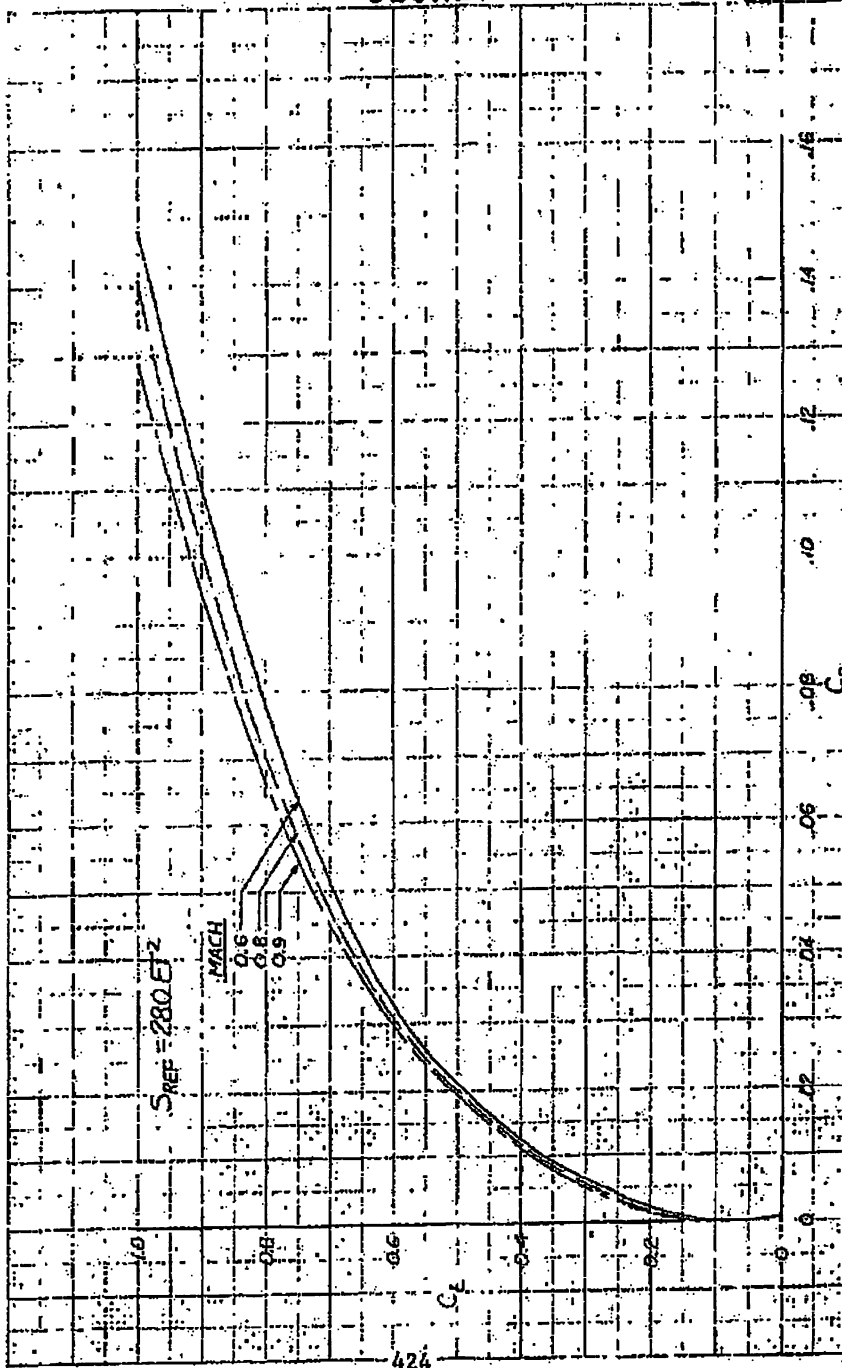
(S) Figure 7.3-2a Subsonic Drag Due to Lift, Configuration 401B with AR=3.75 Supercritical Wing (U)

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88th ABW/PI
 EOIA (b)(1)
 E.O. 13526 SEC. 3.3.
 (b)(4)
 1.4. (a)(g)

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CSCL 8A - MEMORANDUM FOR THE DIRECTOR
 SECURITY INFORMATION
 (S) (U)

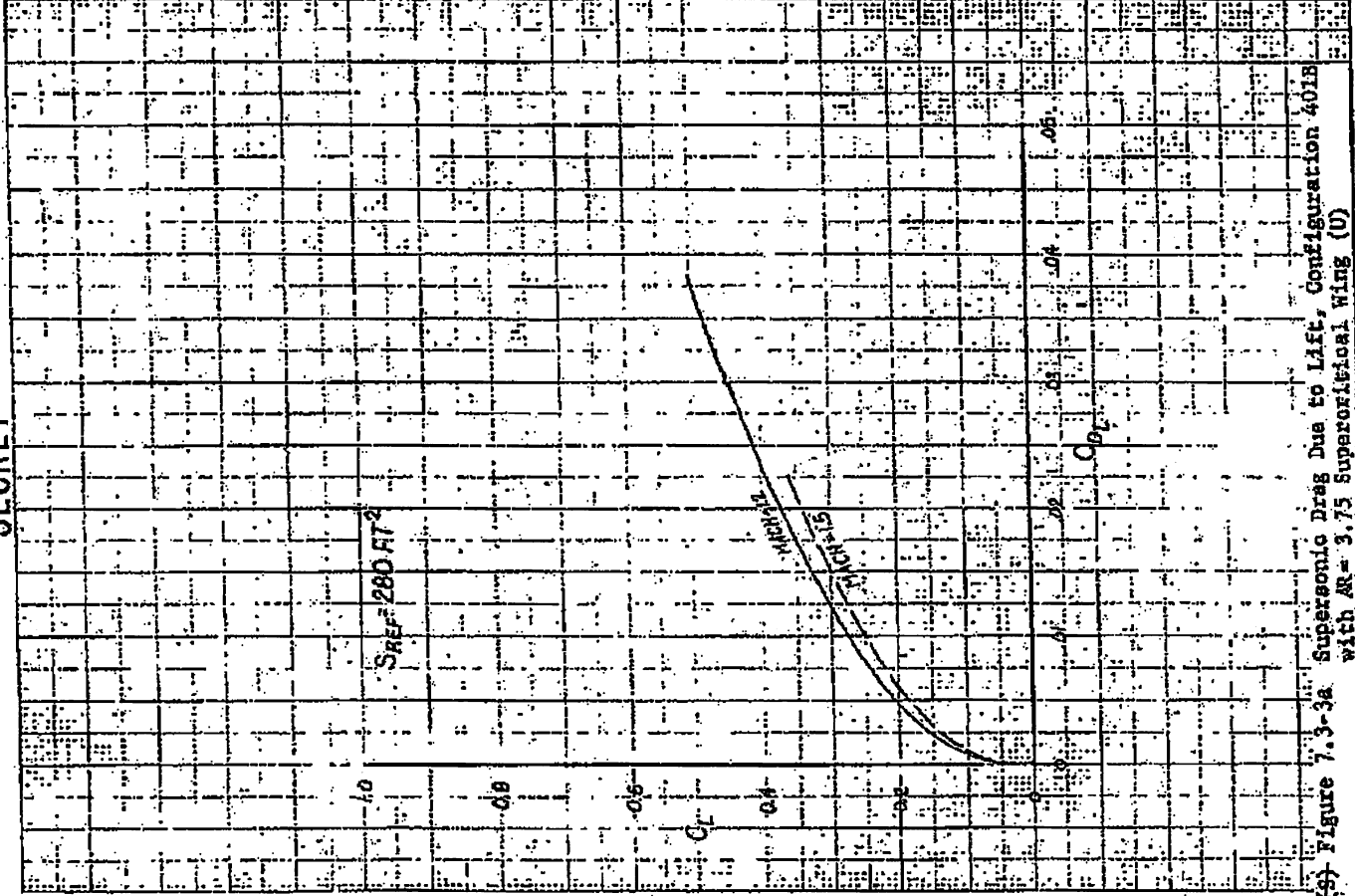


(S) Figure 7.3-2b Subsonic Drag Due to Lift, Configuration 401B with $R=3.0$ Supercritical Wing (U)

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88th ABW/PI
FOIA (b)(1)
E.O. 13526 SEC. 3.3.
(b)(4)
1.4. (e)(g)

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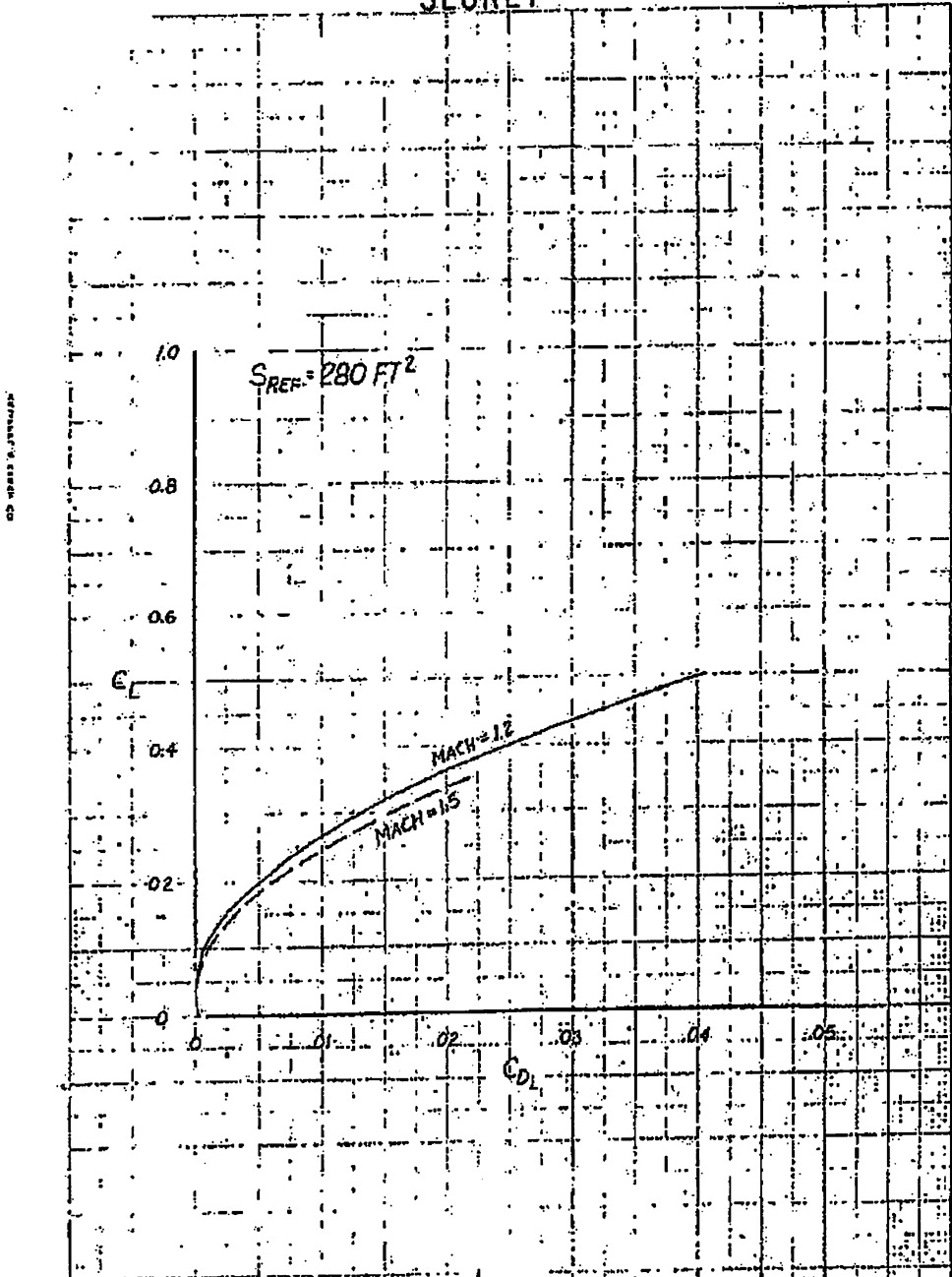


(S) Figure 7.3-3a Superornical Drag Due to Lift, Configuration 401B with AR = 3.75 Superornical Wing (U)

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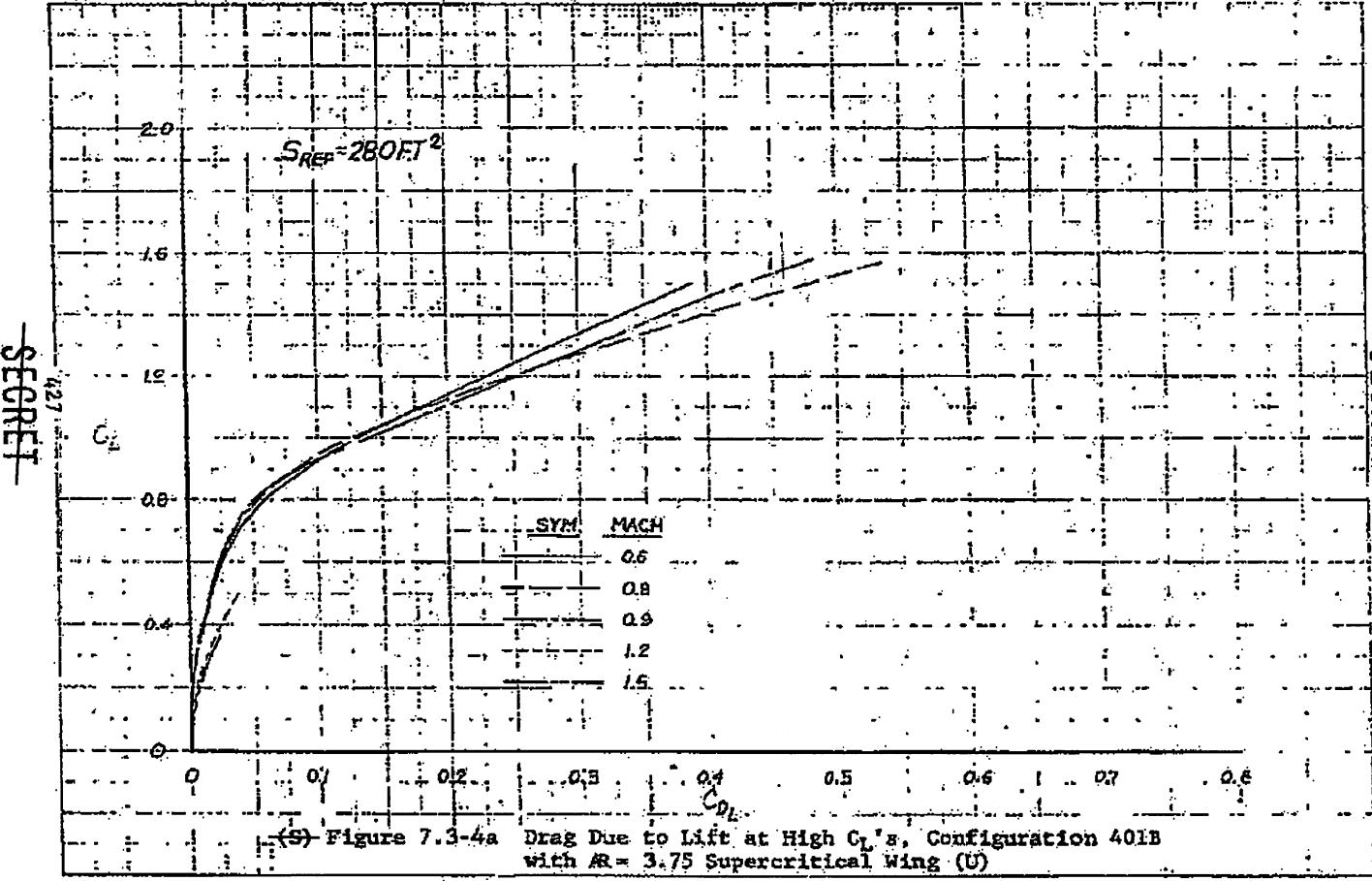
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3 1/2" X 5" X 1/8" INCH
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(S) Figure 7.3-3b Supersonic Drag Due to Lift, Configuration 401B with AR= 3.0 Supercritical Wing (U)

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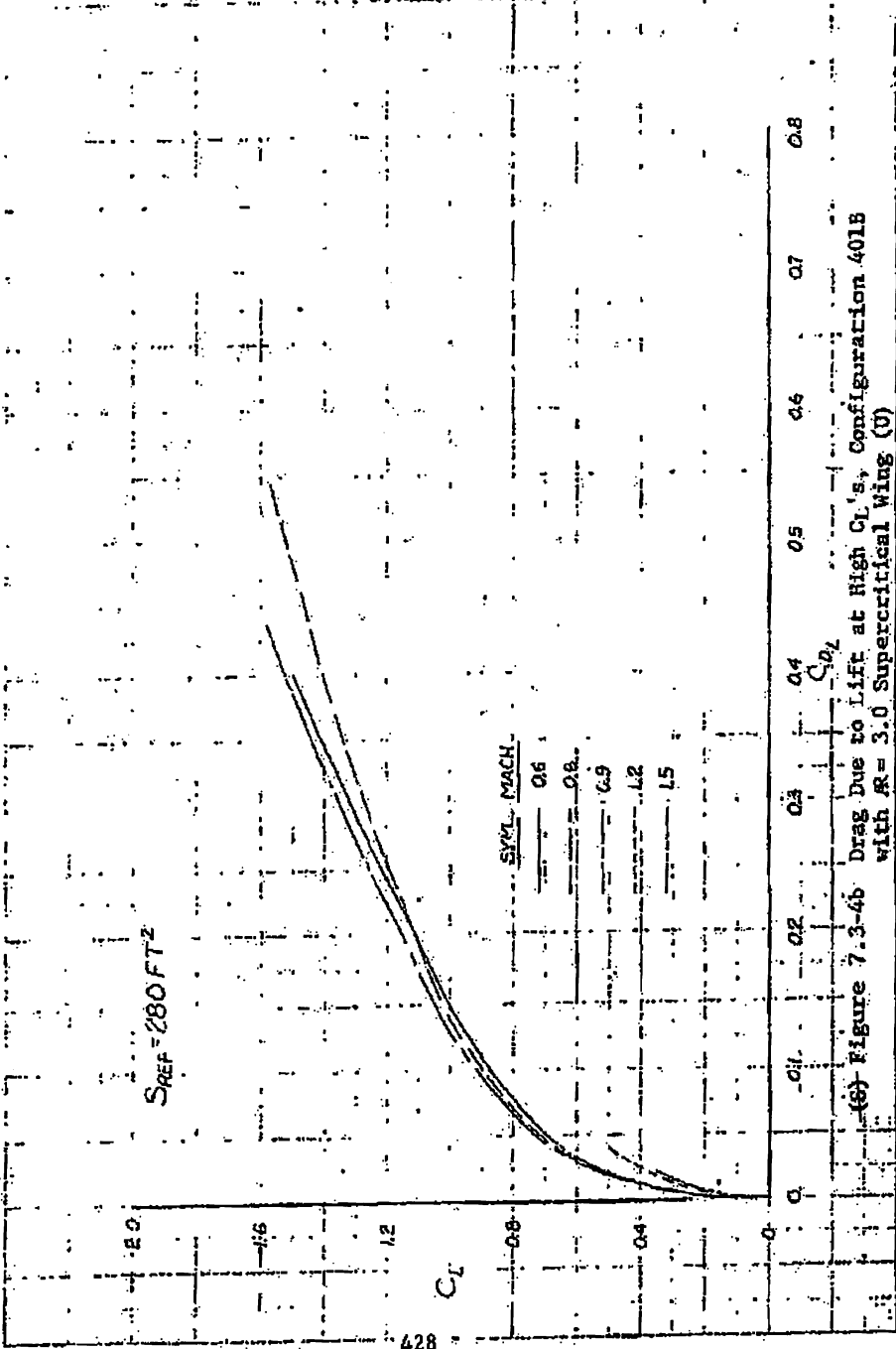
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88th ABW/PI
 FOIA (b)(1)
 E.O. 13526
 SEC. 3.3 (b)(4)
 1.4 (a)(g)

88th ABW/PI
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 E.O. 13526 SEC.
 3.3.(b)(4)
 1.4. (a)(g)

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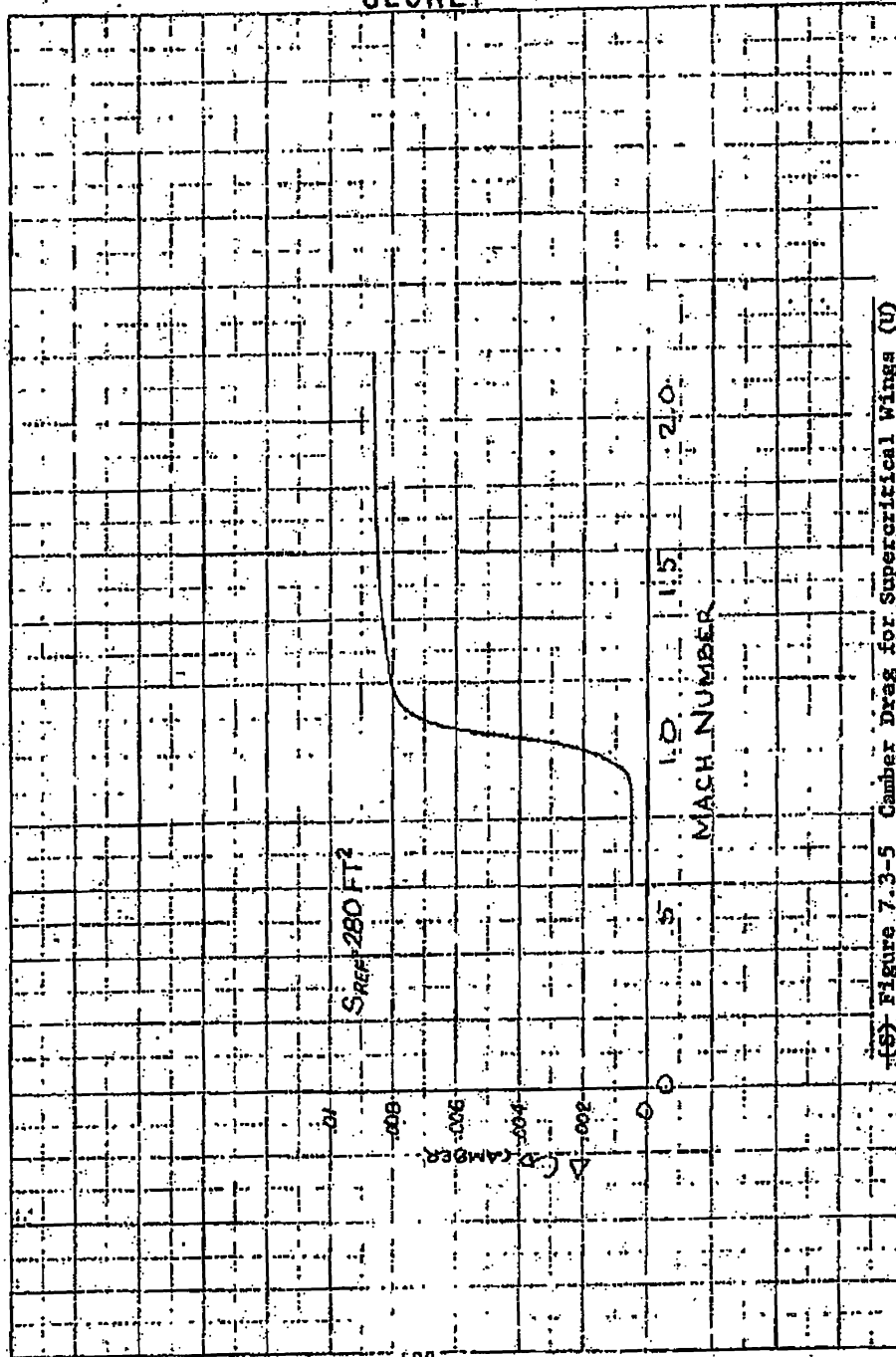
(e) Figure 7.3-6b Drag Due to Lift at High C_L 's, Configuration 401B with $R_e = 3.0$ Supercritical Wing (U)

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FOIA (b)(1)
E.O. 13526 SEC.
3.3.(b)(4)
1.4. (a)(g)

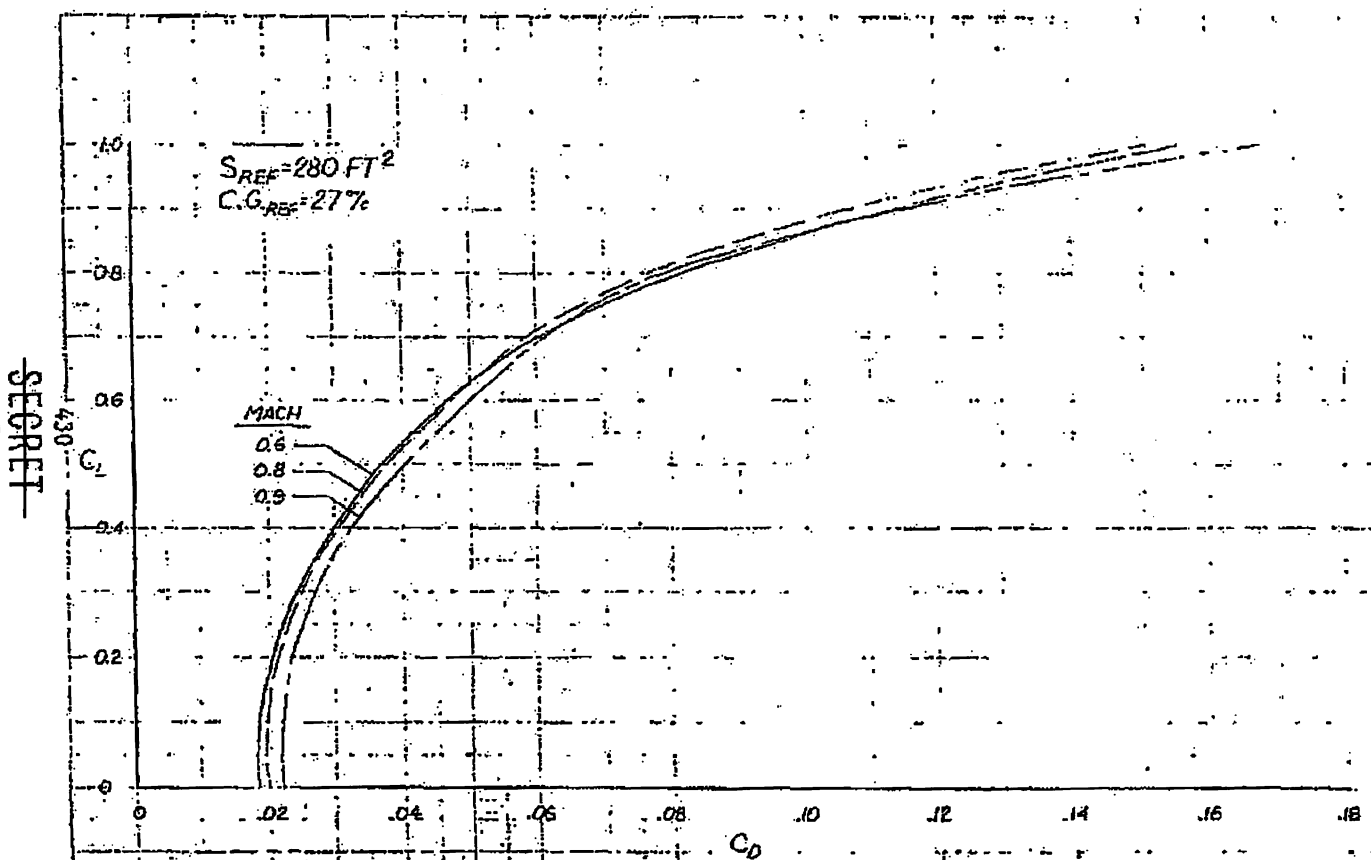
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(S) Figure 7.3-5 Camber Drag for Supercritical Wings (U)

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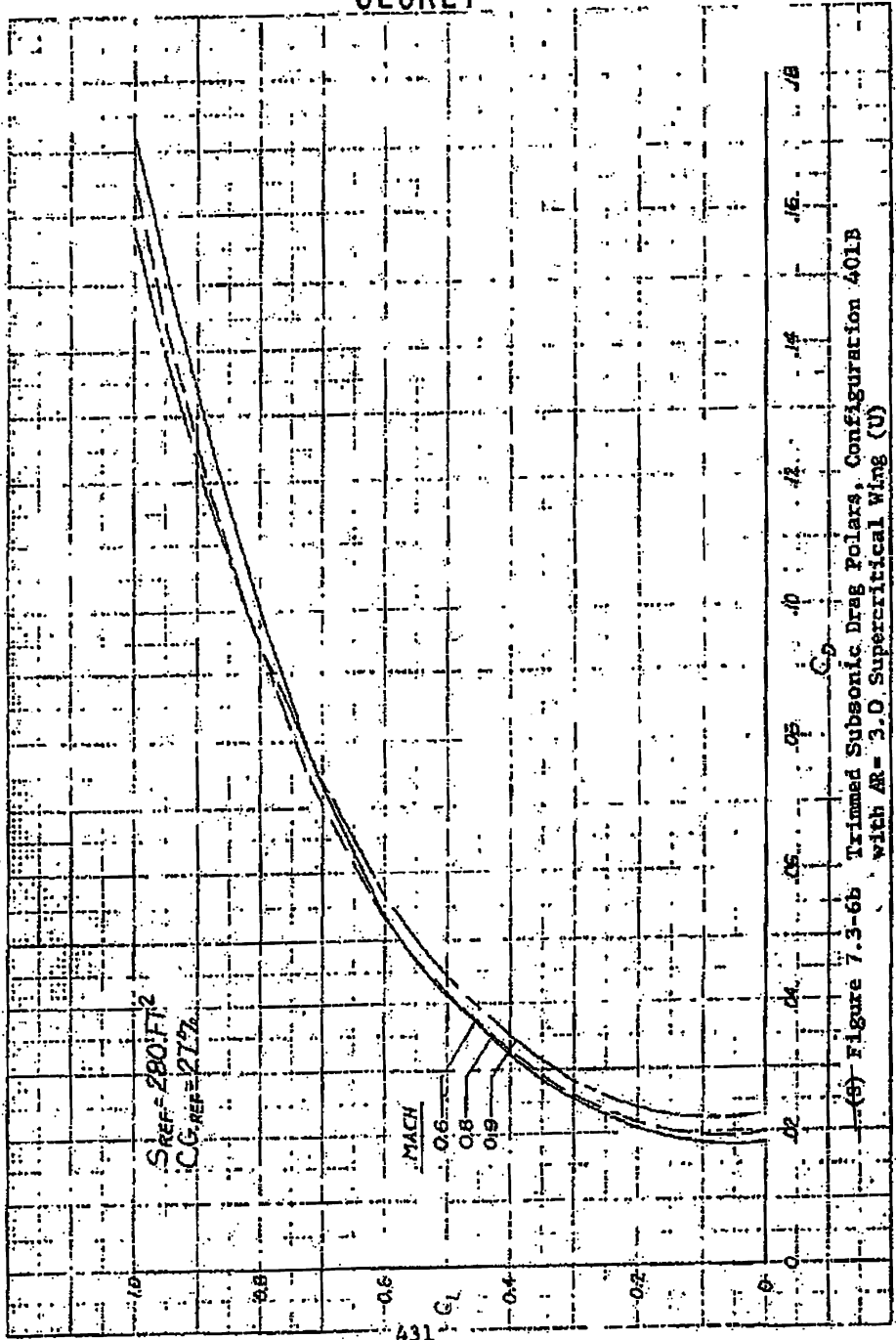
(S) Figure 7.3-6a Trimmed Subsonic Drag Polars, Configuration 401B with $AR = 3.75$ Supercritical Wing (U)

88th ABW/PI
FOIA (b)(1)
E.O. 13526 SEC. 3.3
(b)(4)
1.A.(a)(9)

88th ABW/1P1
FOIA (b)(1)
E.O. 13526 SEC.
3.3.(b)(4)
1.4.(a)(g)

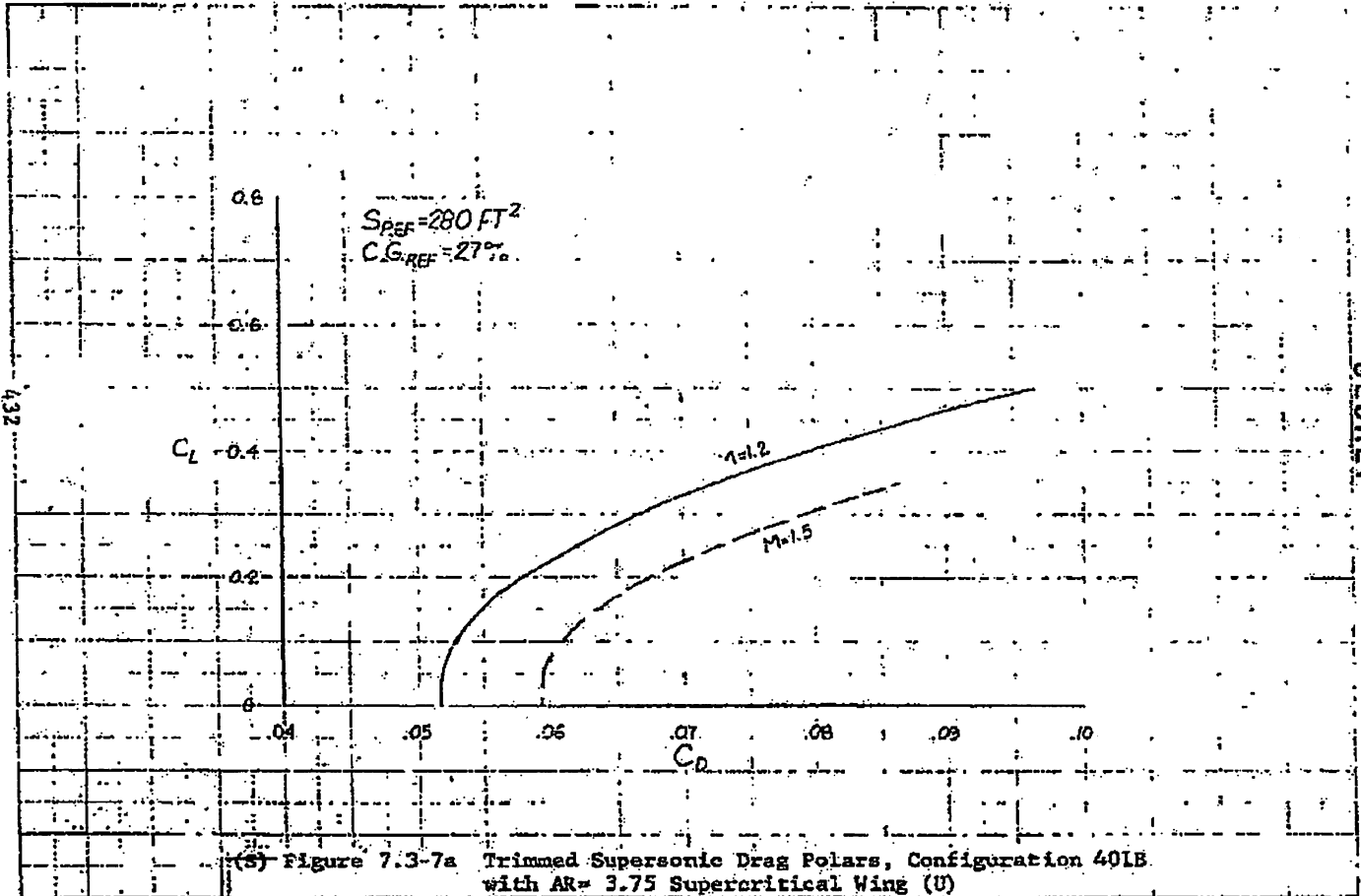
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(6) Figure 7.3-6b Trimmed Subsonic Drag Polars, Configuration 401B with AR = 3.0 Supercritical Wing (U)

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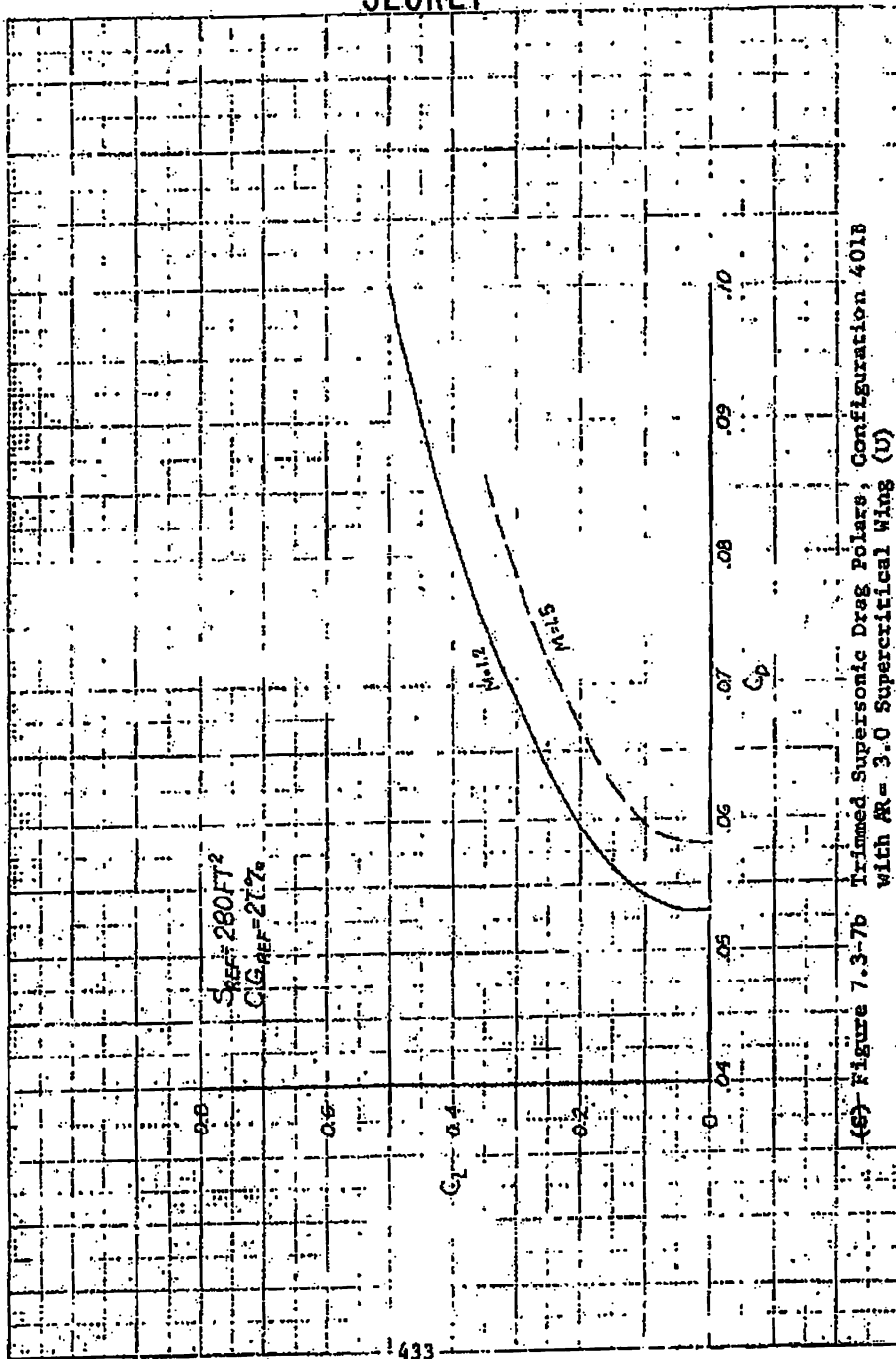
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88th ABW/PI
FOIA (b)(1)
E.O. 13526 SEC.
3.3.(b)(4)
1.4.(a)(9)

(S) Figure 7.3-7a Trimmed Supersonic Drag Polars, Configuration 401B with AR= 3.75 Supercritical Wing (U)

88th ABW/IPI
FOIA (b)(1)
E.O. 13526 SEC.
3.3.(b)(4)
1.4. (a)(g)

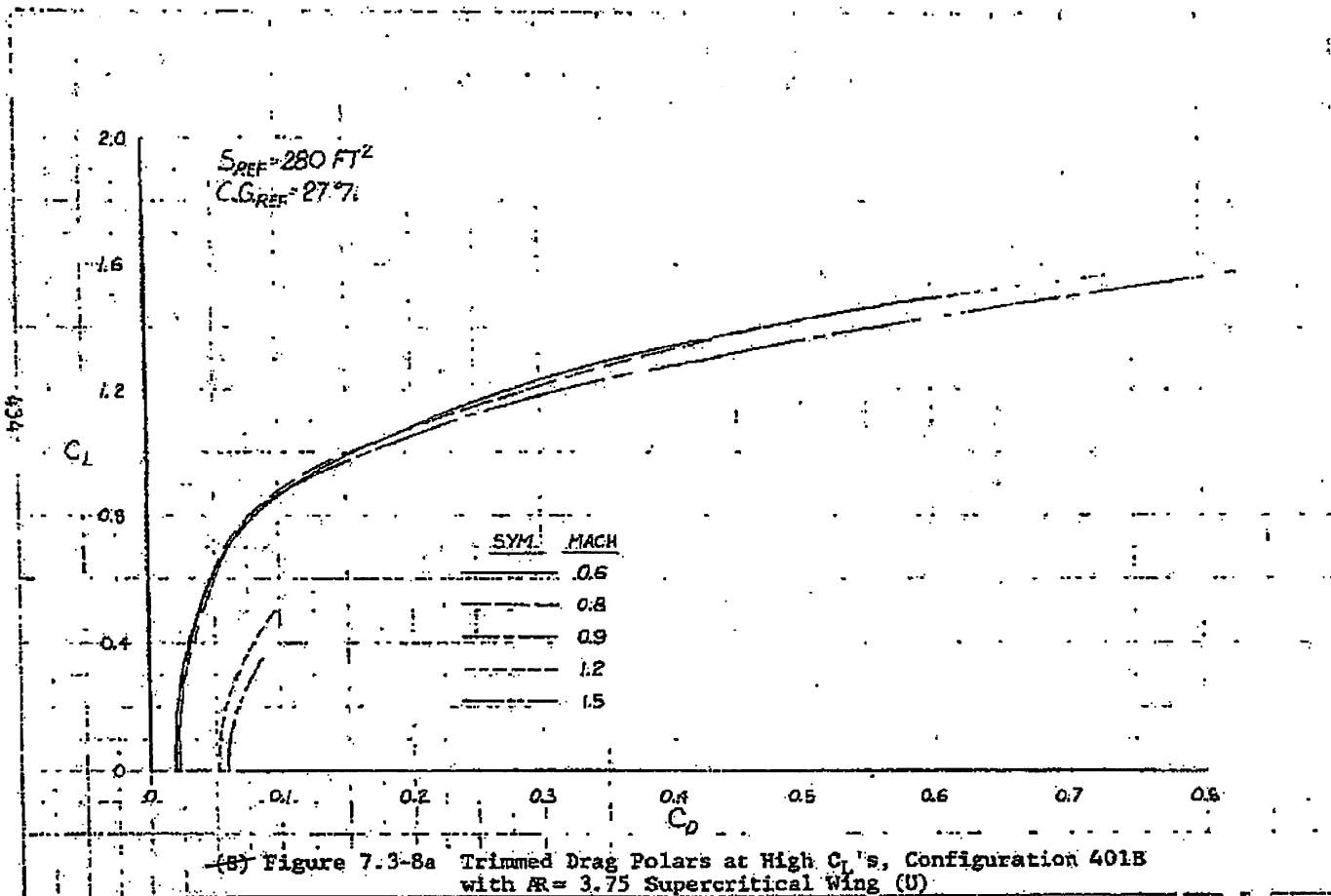
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(6) Figure 7.3-7b Trimmed Supersonic Drag Polars, Configuration 401B with AR = 3.0 Supercritical Wing (U)

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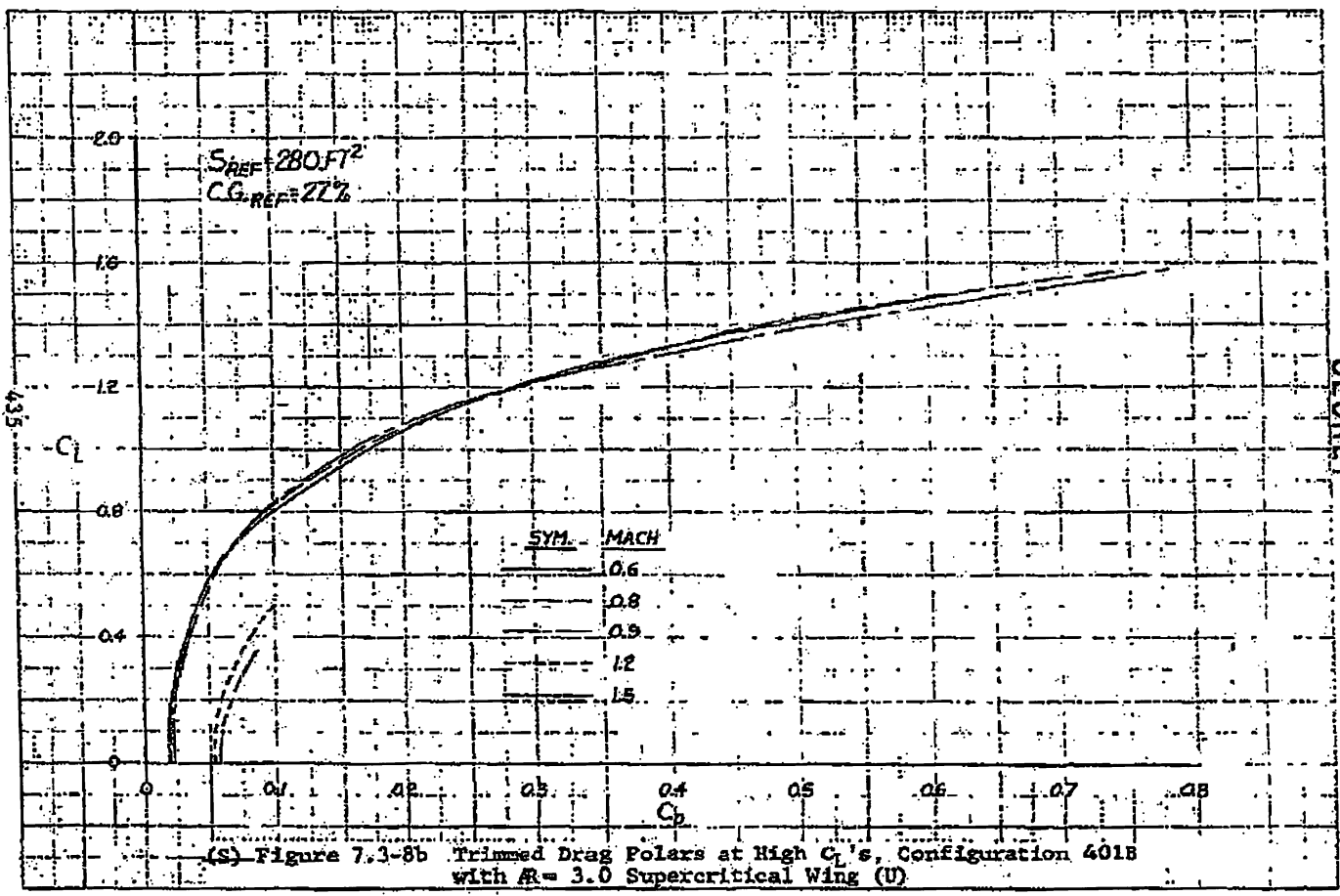


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 E.O. 13526 SEC. 3.3.
 (b)(4)
 1.4. (a)(9)

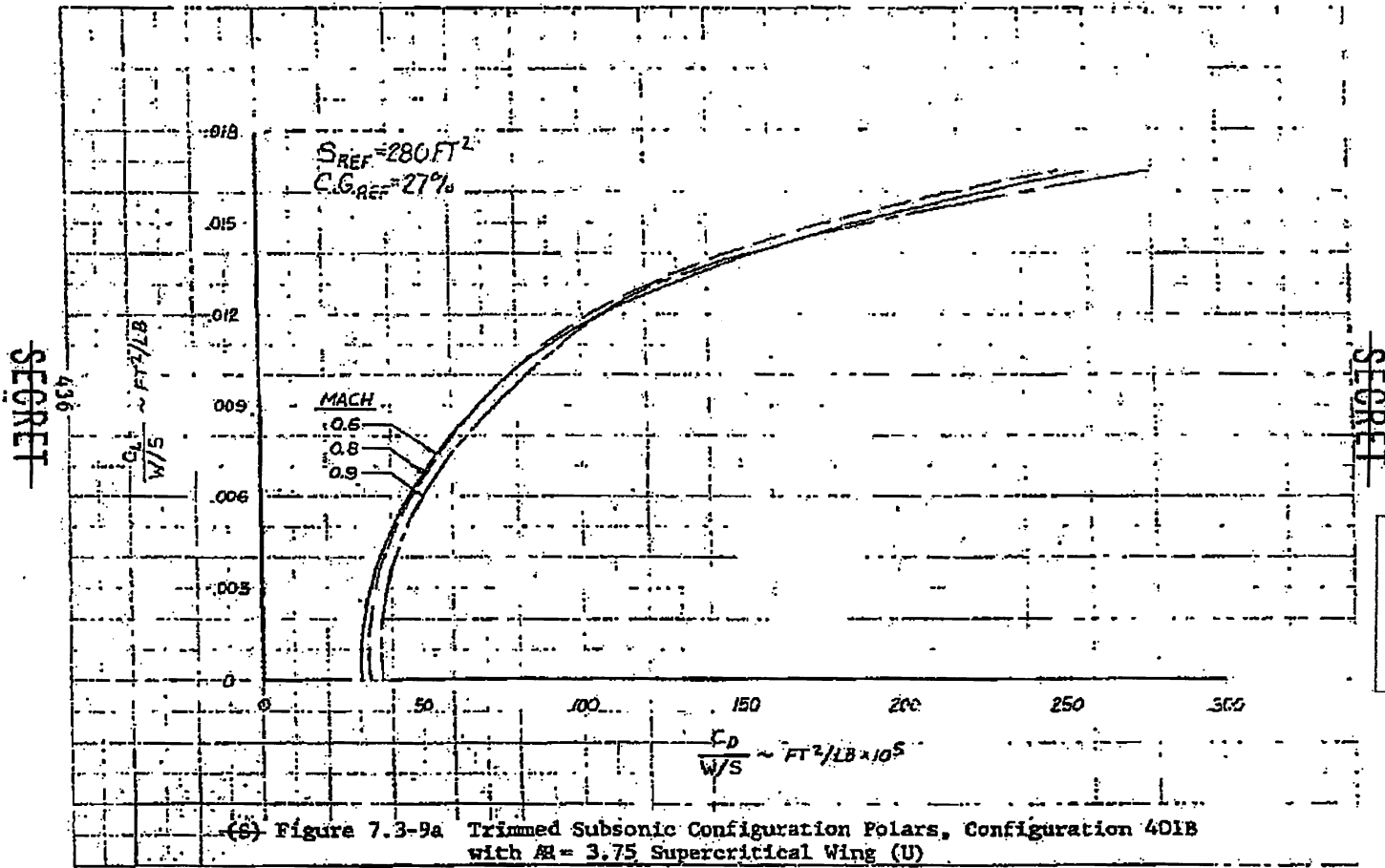
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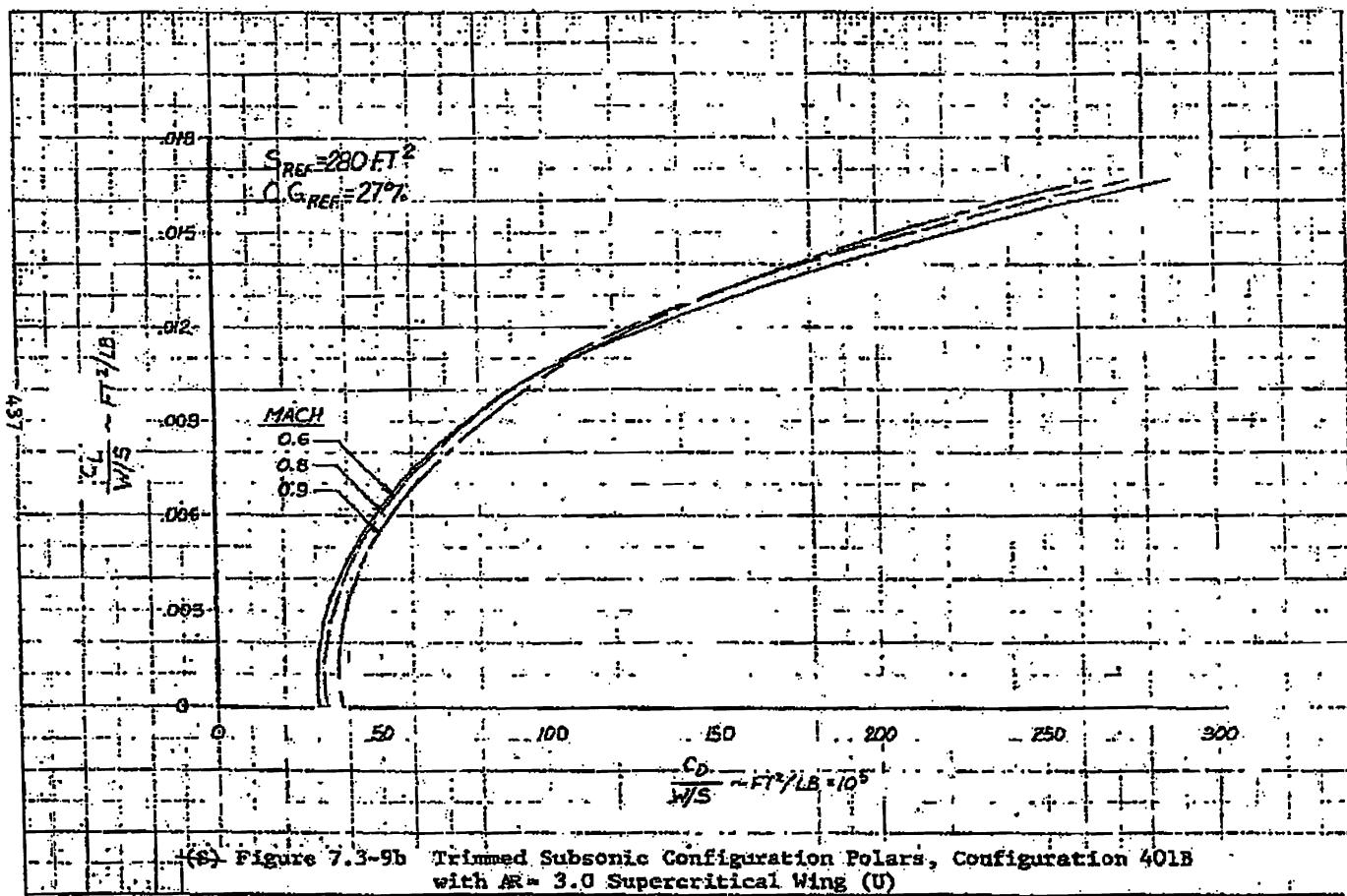
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88th ABW/PI
FOIA(b)(7)
E.O. 13526
SEC. 3.3.(b)
(4)
1.4 (a)(9)



88th ABW/PI
FOIA (b)(4)
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SEC. 3.3 (b)(4)
1.4 (a)(9)

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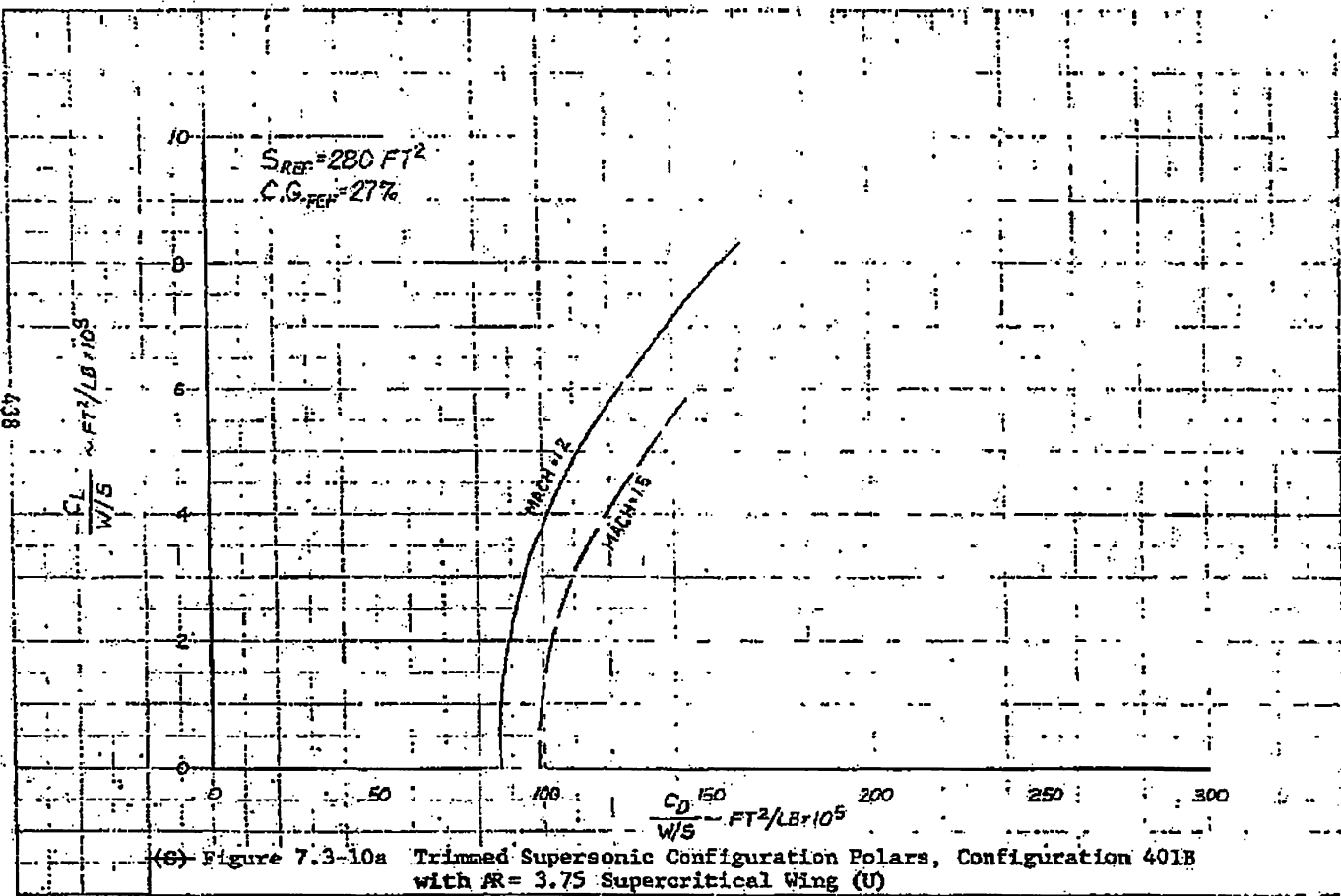


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FOIA (b) (7)
E.O. 13526 SEC.
3.3 (b) (4)
1.4 (a) (i)

(S) Figure 7.3-9b Trimmed Subsonic Configuration Polars, Configuration 401B with $A_c = 3.0$ Supercritical Wing (U)



(e) Figure 7.3-10a Trimmed Supersonic Configuration Polars, Configuration 401B with $M = 3.75$ Supercritical Wing (U)

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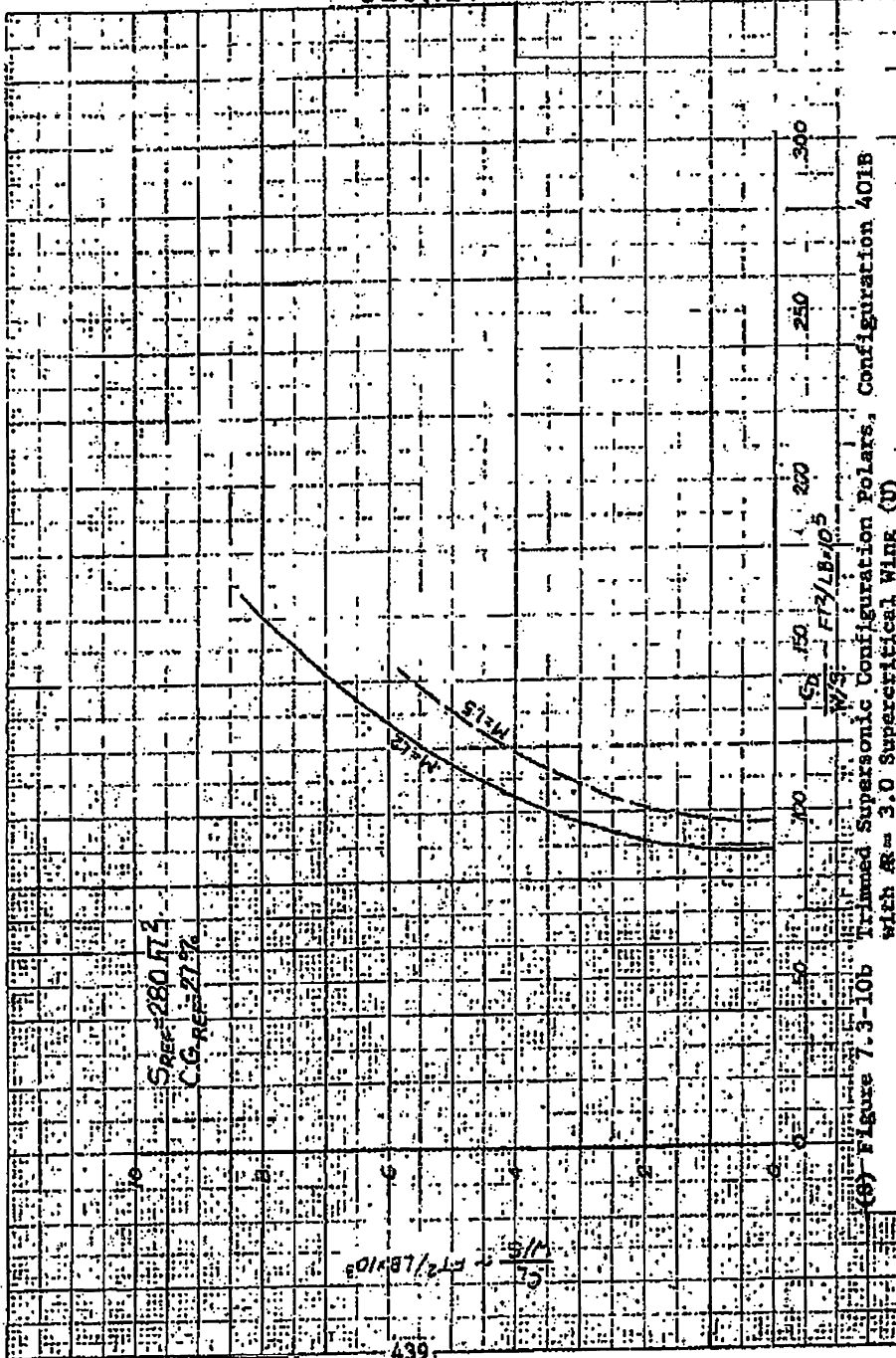
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FOIA (b)(7)
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(b)(4)
1.4. (a)(g)

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FOIA (b)(1)
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1.4. (a)(g)

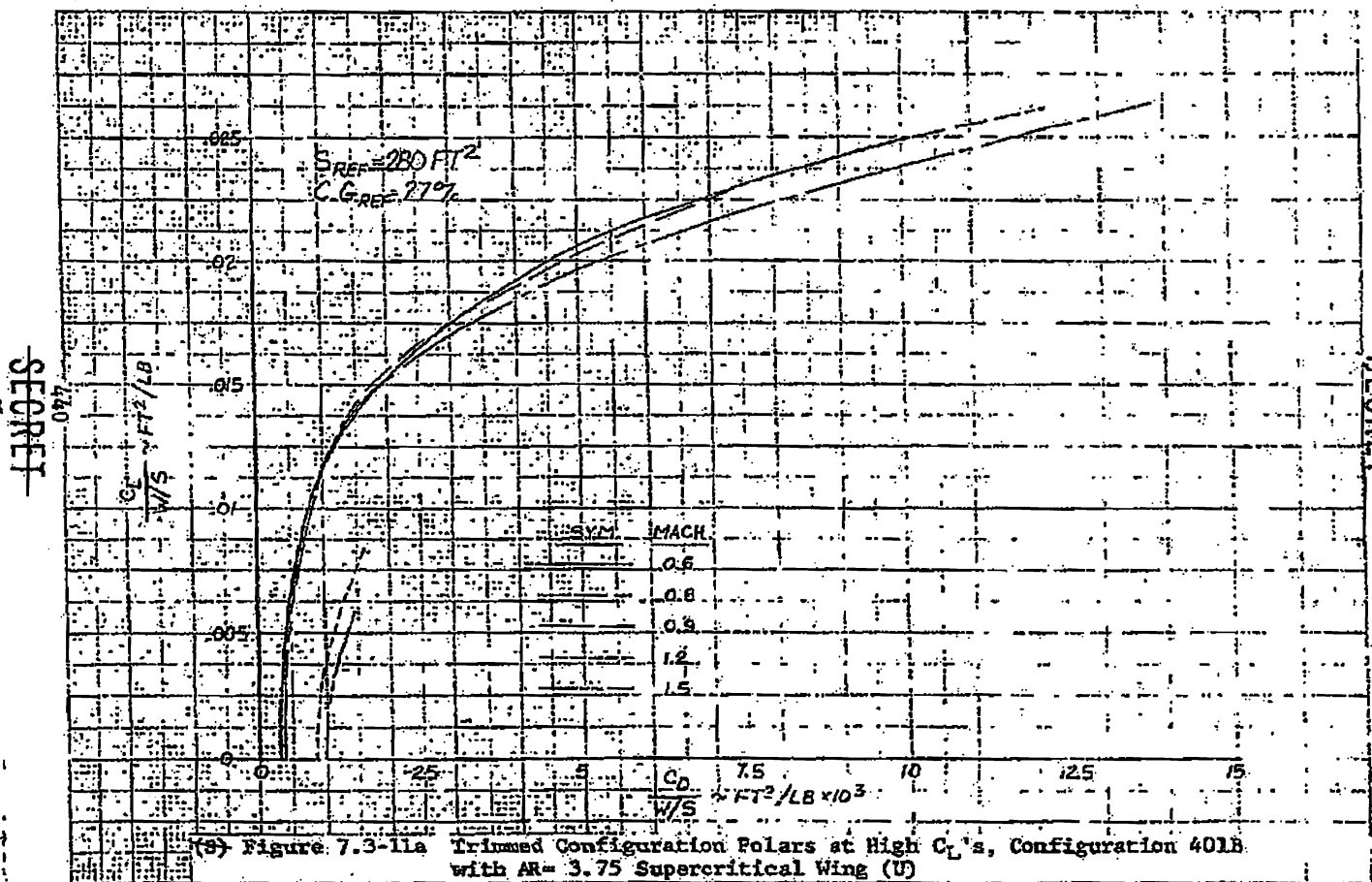
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(8) Figure 7.3-10b Trimmed Supersonic Configuration Polars, Configuration 401B with AR = 3.0 Supercritical Wing (U)

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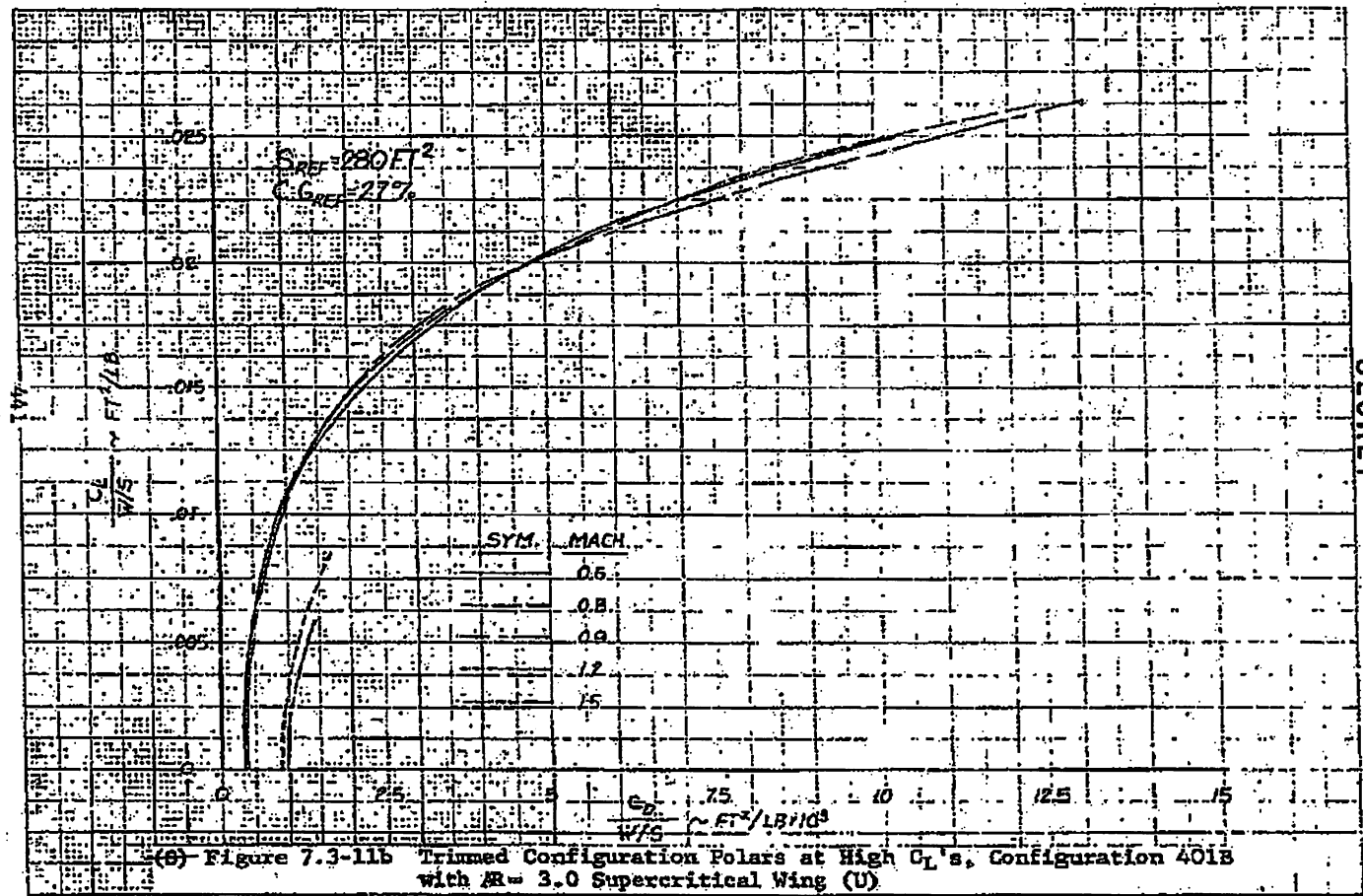
(S) Figure 7.3-11a Trimmed Configuration Polars at High C_L 's, Configuration 40LB with AR= 3.75 Supercritical Wing (U)

88th ABW/PI
 FOIA (b)(1)
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 3.3.(b)(4)
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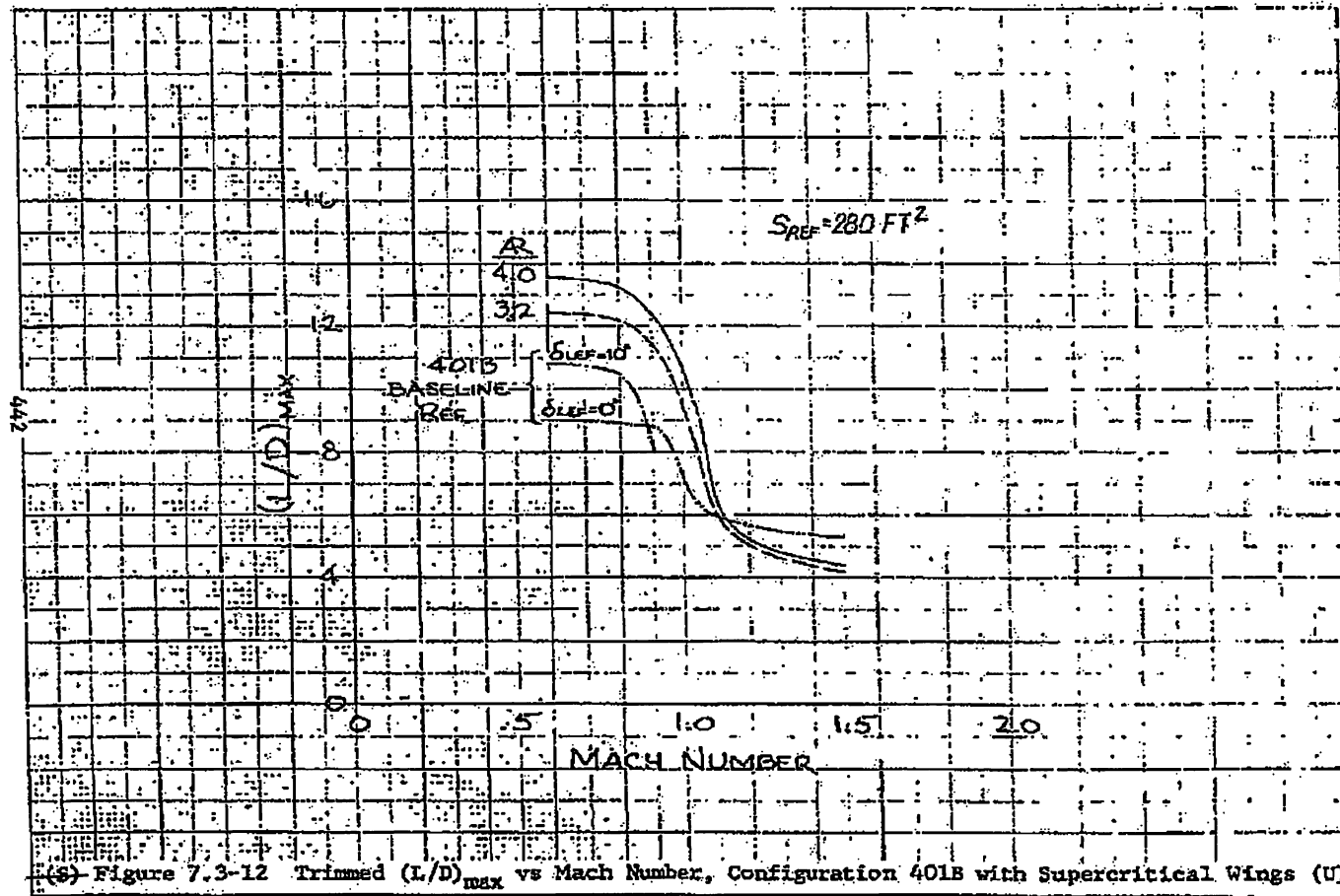
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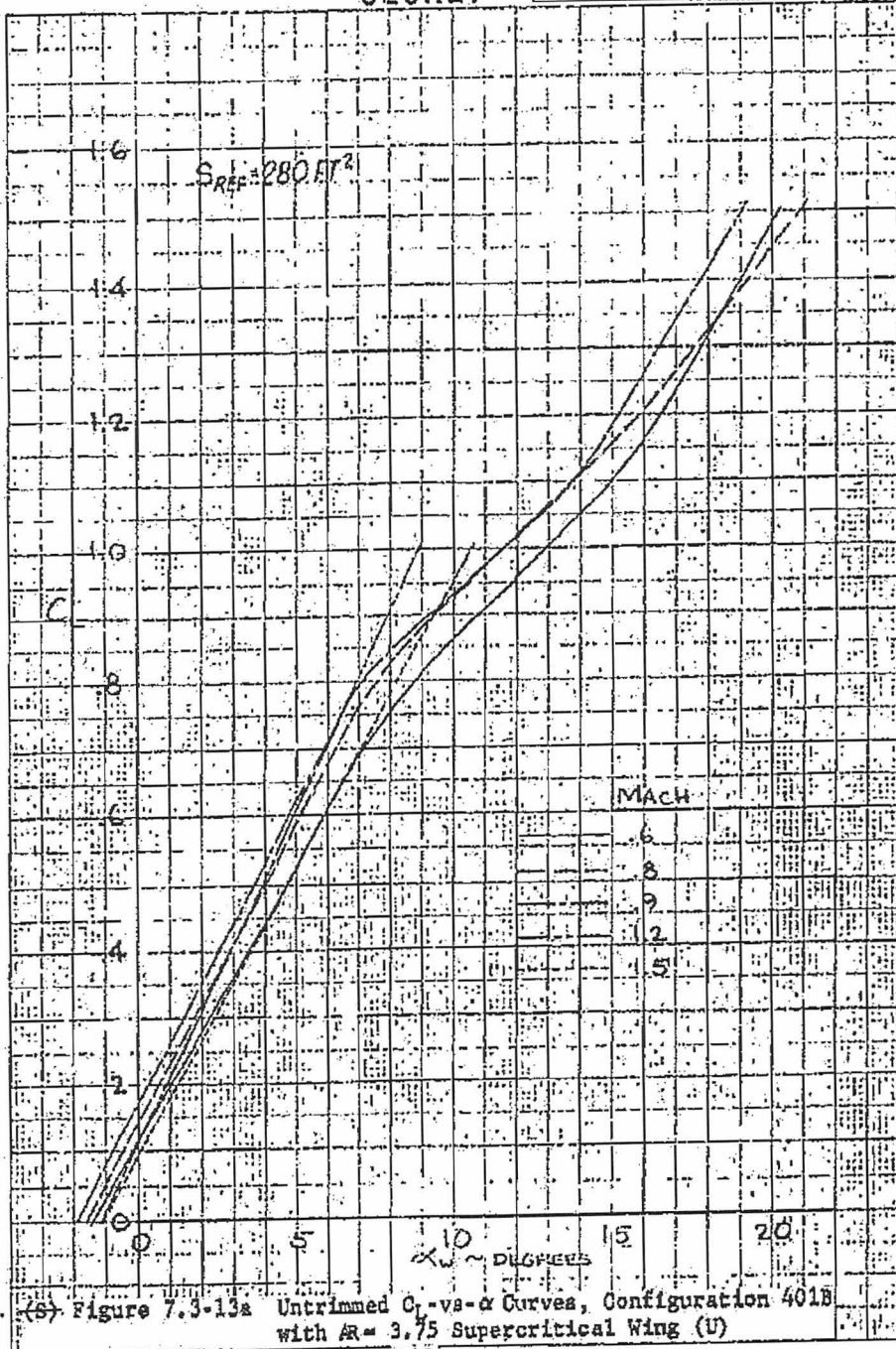


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EO 1.3526 SEC.
3.3 (b)(4)
1.4 (a)(9)

88th ABW/IPI
 FOIA (b)(1)
 E.O. 13526-SEC. 3.3
 (b)(4)
 1.4. (a)(g)

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(S) Figure 7.3-13a Untrimmed C_L -vs- α Curves, Configuration 401B with $AR = 3.75$ Supercritical Wing (U)

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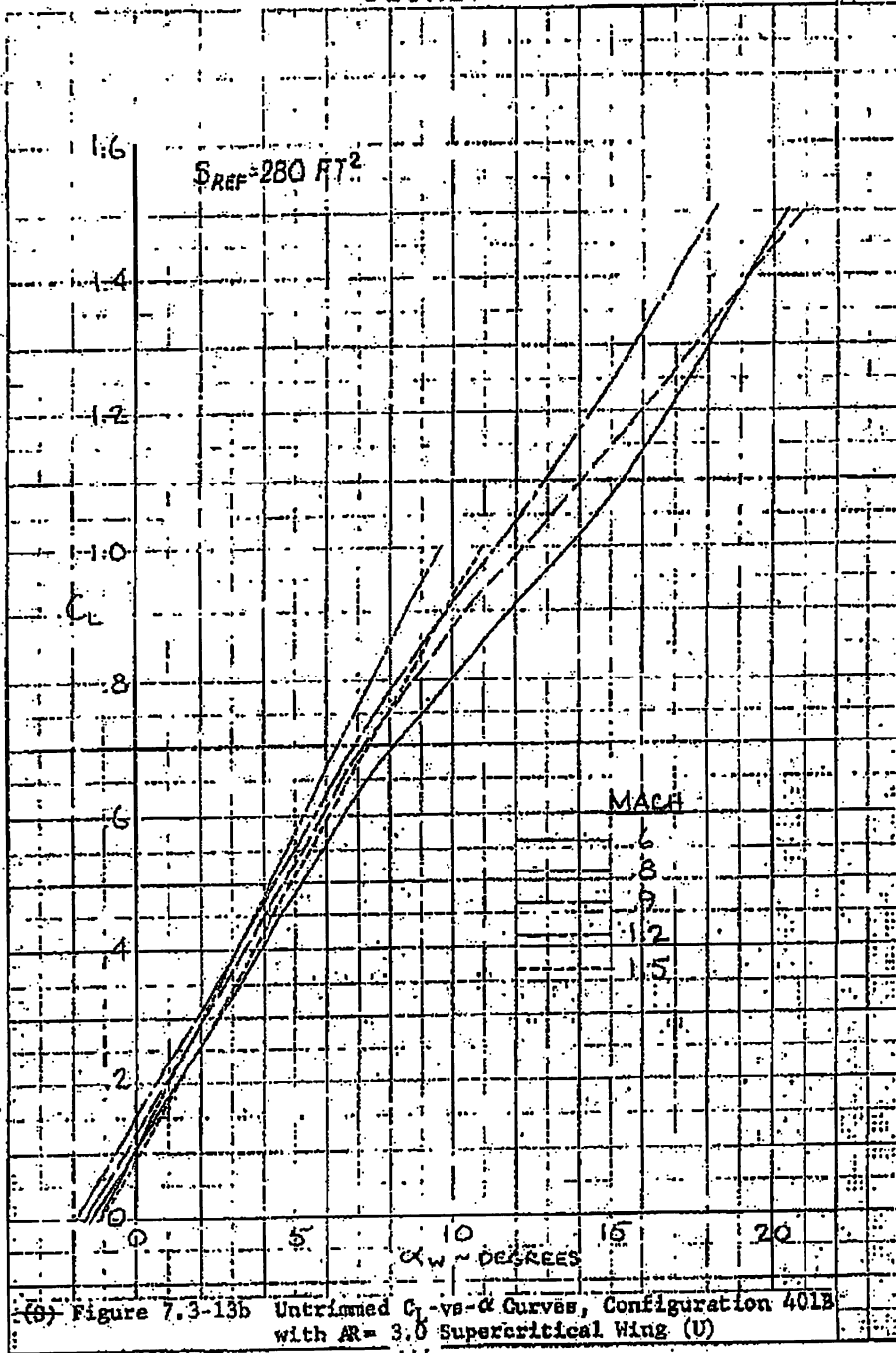
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88th ABW/IPI
 FOIA (b)(1)
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 (b)(4)
 1.4. (a)(g)

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(b) Figure 7.3-13b Untrimmed C_L -vs- α Curves, Configuration 401B with $AR = 3.0$ Supercritical Wing (U)

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