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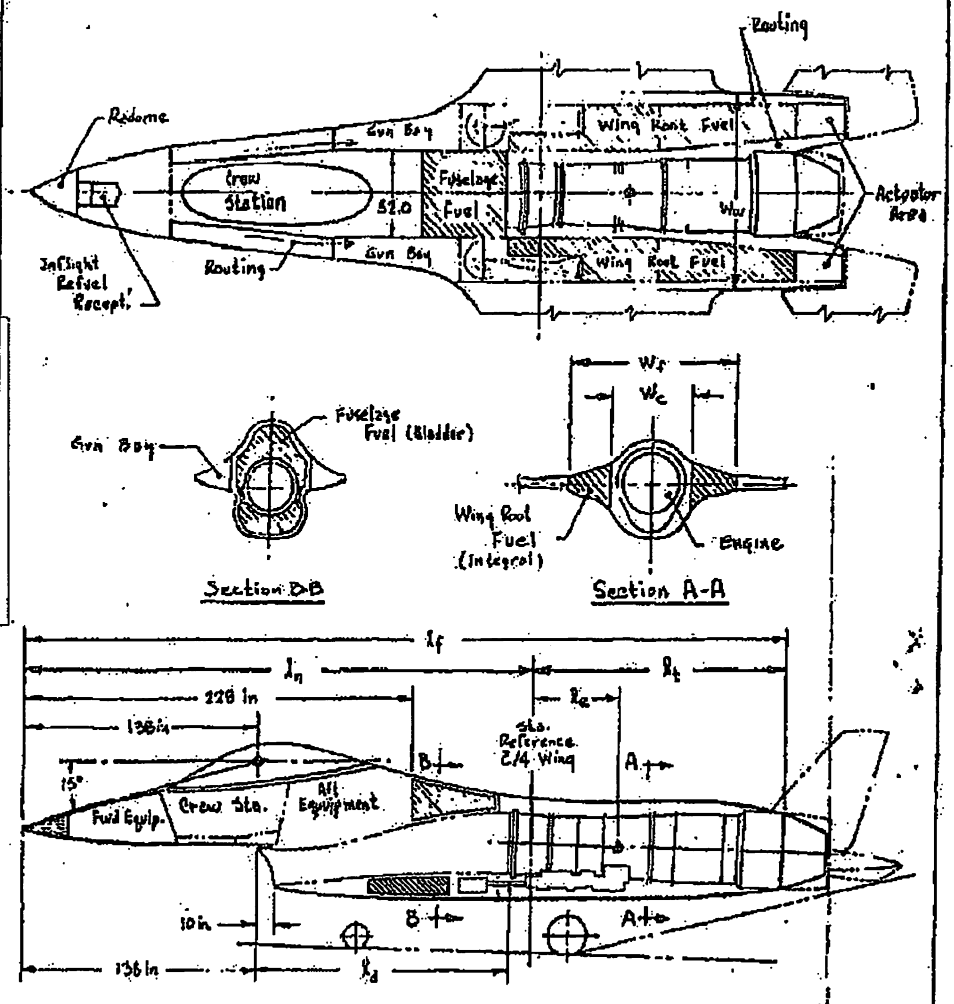

BASIC SCALING GROUND RULES

- Fuselage centerbody length is scaled as G.W. function. ($l_{f_2} = l_{f_1}\sqrt{GW_2/GW_1}$).
- Fuselage outerbody length is a function of Horiz. Tail Location.
- W_f is constant percentage of Reference Wing span (W_f = 28% Span)
- W_w is constant percentage of Reference Wing span (W_w = 31% Span)
- W_c is constant dimension (Function of engine size)

~~(S)~~ Figure 3.1-12 Parametric Configuration Scaling - Fuselage Criteria (U)

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

~~SECRET~~

(U) 3.1.3.2 Growth Data

The configuration design data that were generated in the growth study to support the structure, aerodynamic, and performance analyses are summarized in Figures 3.1-13 through 3.1-24. The variation of airplane wetted area with airplane size (mission weight) and a definition of the major airplane components contributing to the wetted-area total are shown in Figure 3.1-13. The breakout of wetted area versus mission weight for the various major components is shown in Figure 3.1-14. The manner in which selected key characteristic fuselage dimensions vary with airplane size in the growth airplane family are plotted in Figure 3.1-15. Similar variations of selected key characteristic surface dimensions for the growth family are plotted in Figure 3.1-16. In Figures 3.1-17 through 3.1-22, general airplane geometric data are summarized for the data points at the three gross weights used to establish the growth family. A normal area distribution curve and fuel distribution plot are presented for the basic 401B configuration (16,800-lb mission weight) in Figures 3.1-23 and 3.1-24, respectively.

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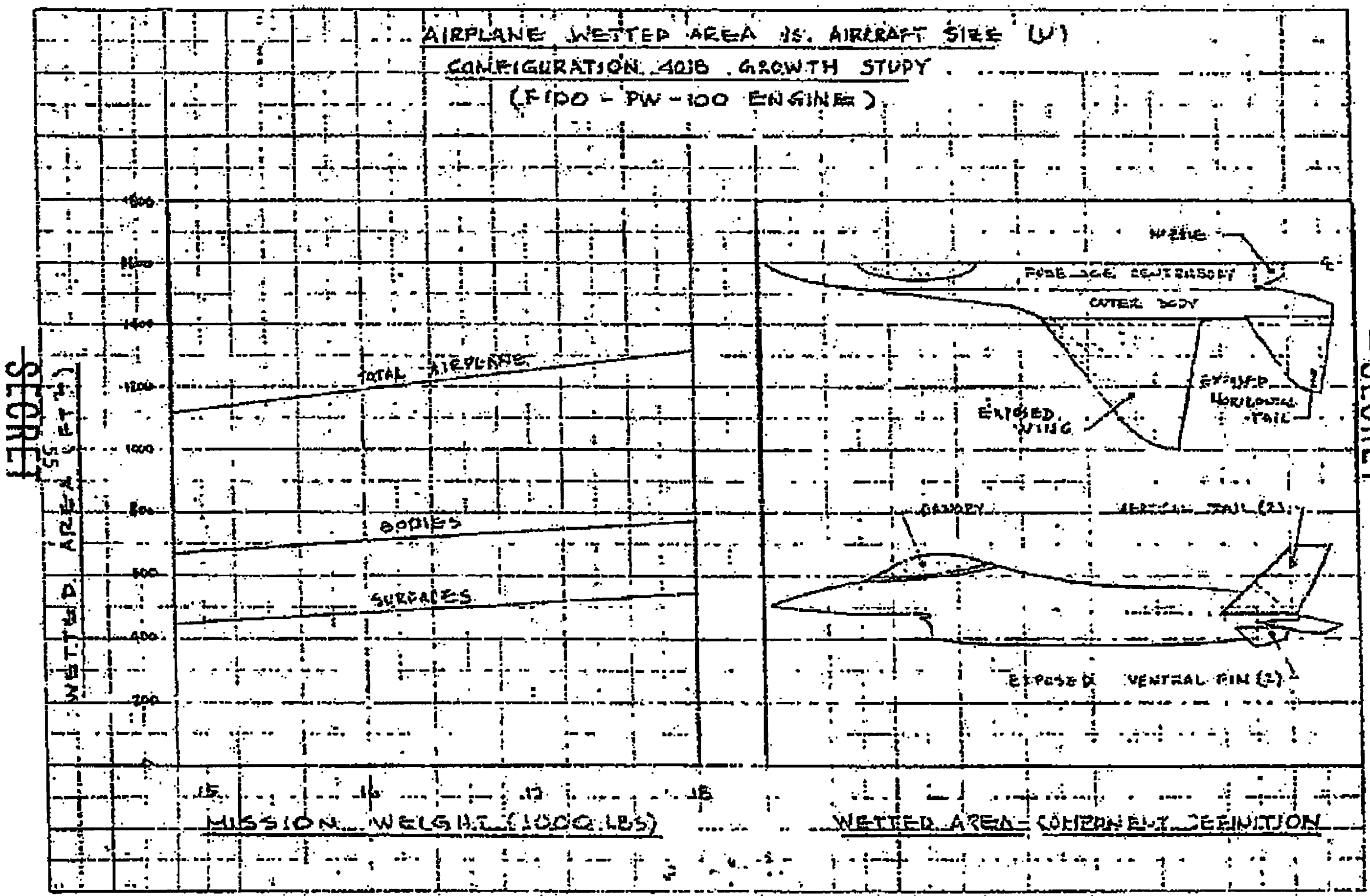

SECRET

~~(S)~~ Figure 3.1-13 Total Aircraft Wetted Area vs. Aircraft Mission Weight (U)

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

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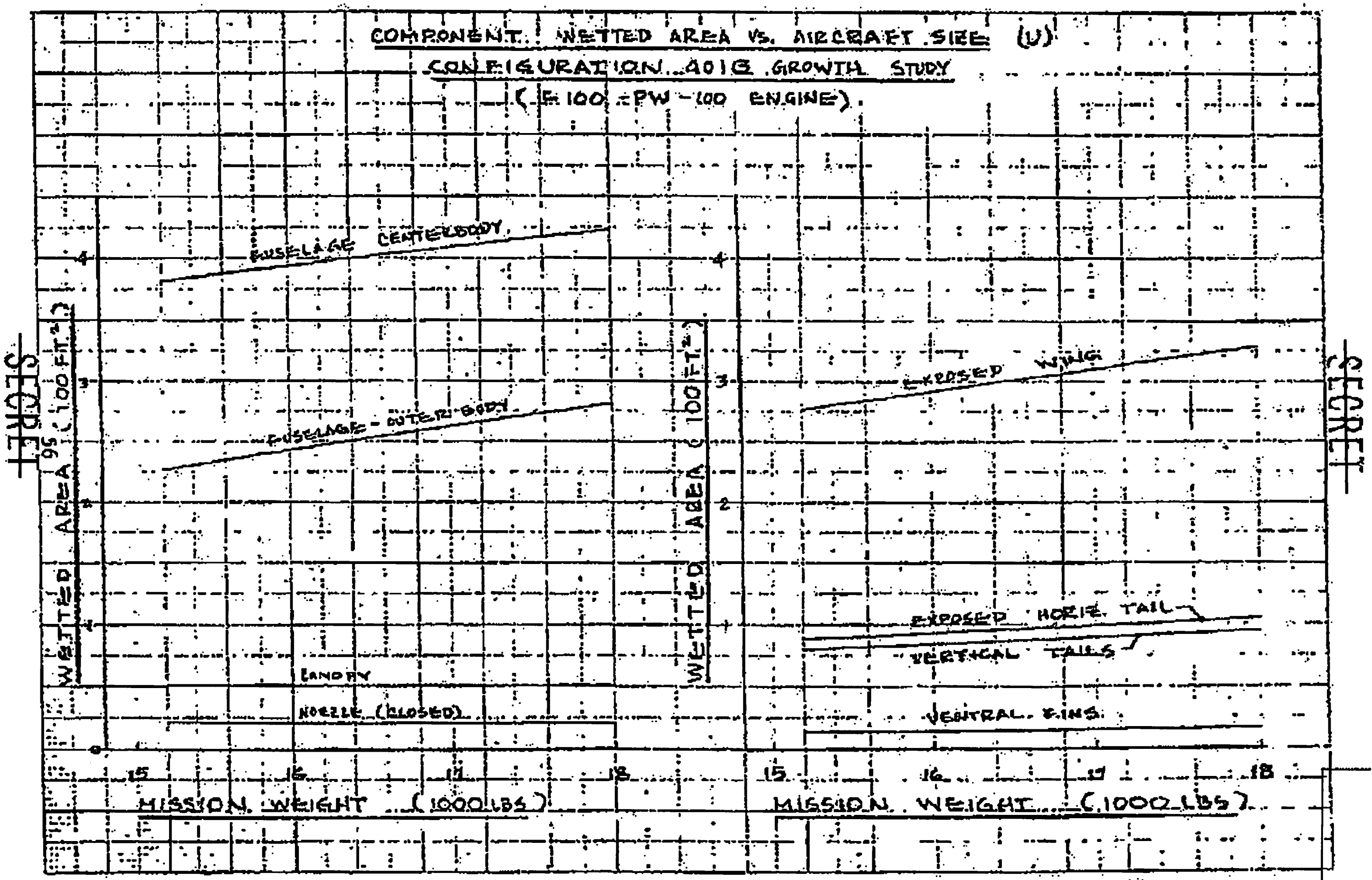

~~(S)~~ Figure 3.1-14 Aircraft Component Wetted Areas vs. Aircraft Mission Weight (U)

SECRET

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

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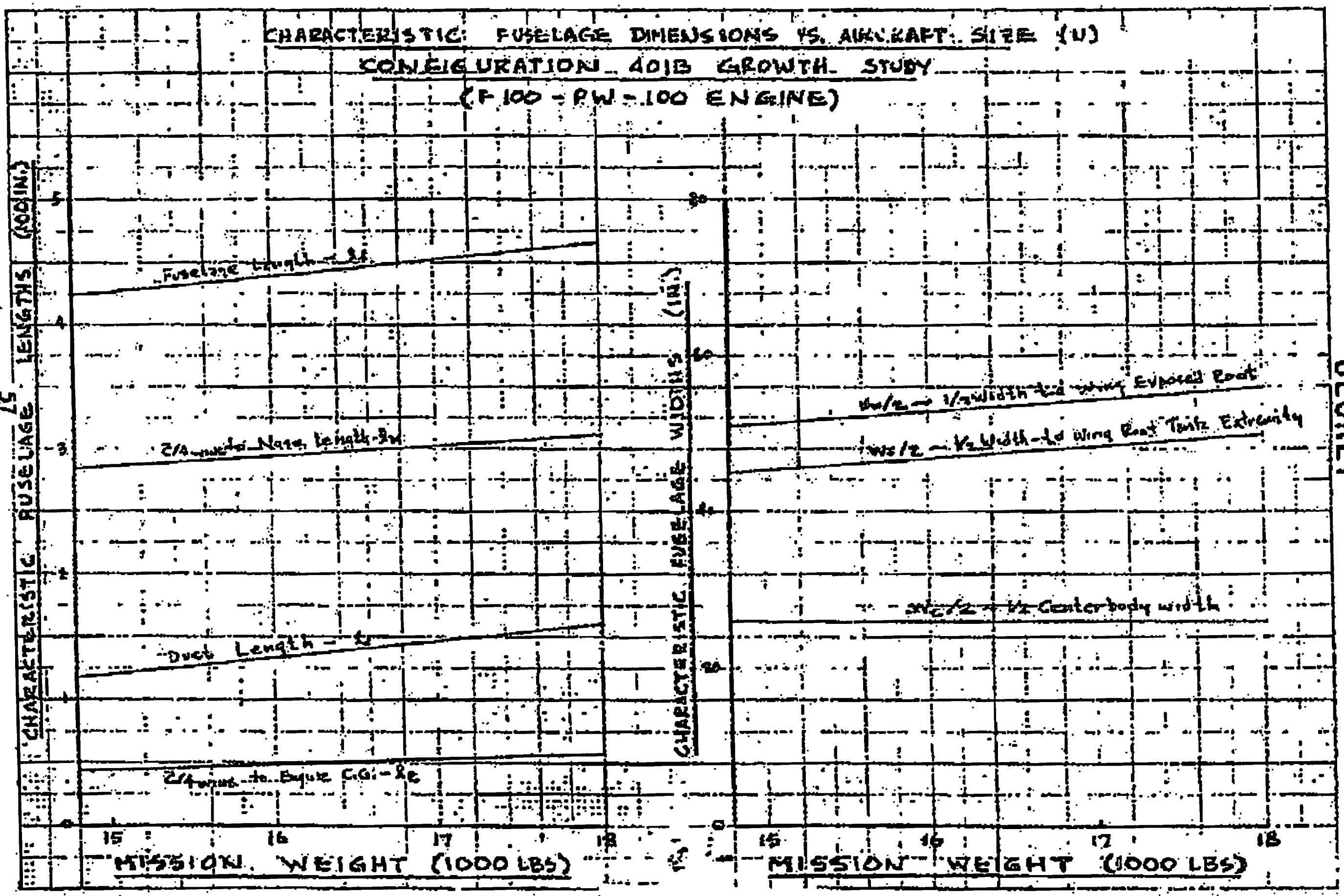

~~(S)~~ Figure 3.1-15 Characteristic Fuselage Dimensions vs. Aircraft Mission Weight (U)

SECRET

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

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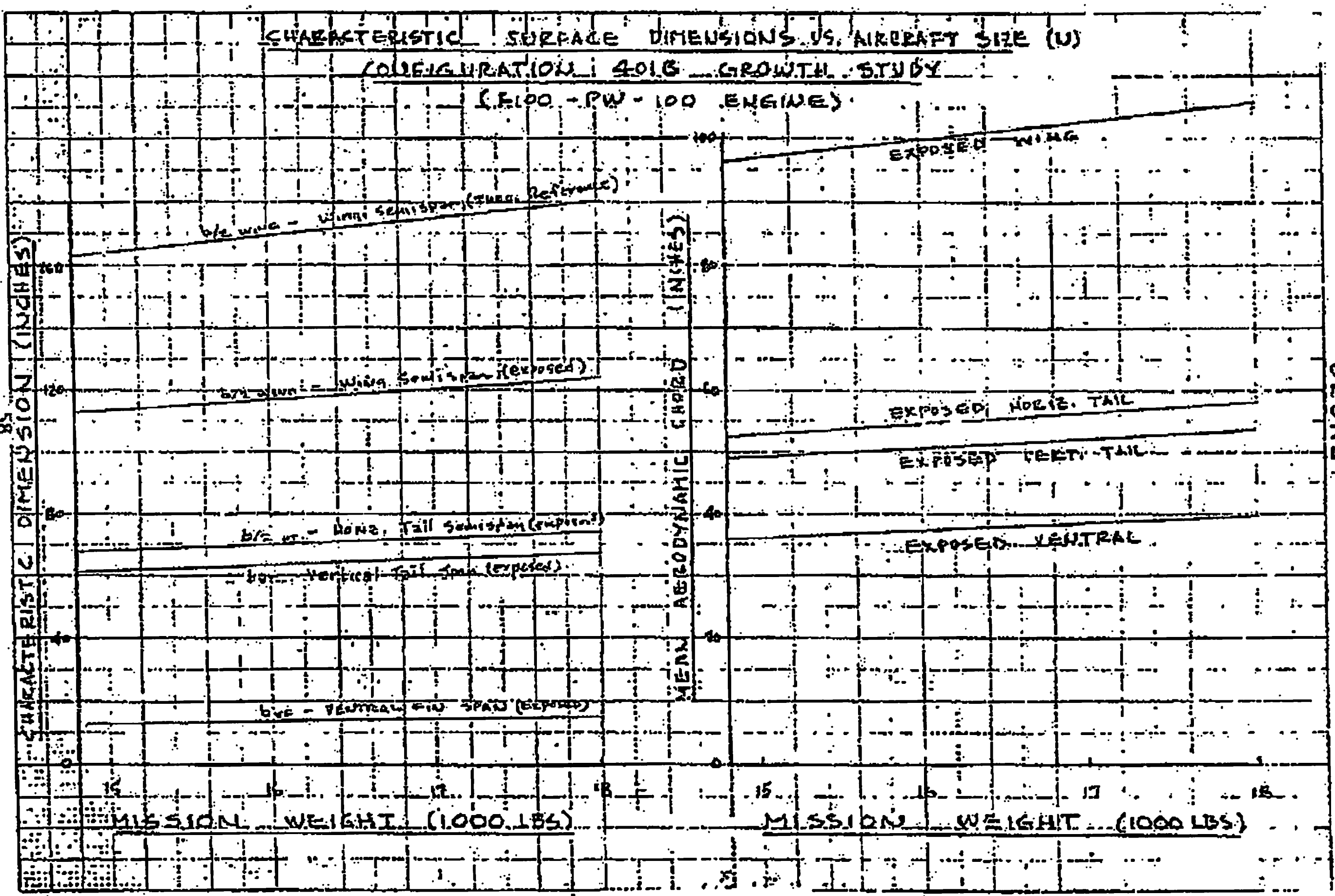


~~(S)~~ Figure 3.1-16 Characteristic Surface Dimensions vs. Aircraft Mission Weight (U)

SECRET

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

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

~~SECRET~~

BASIC DESCRIPTIONS

GW = 15,600 lbs.
W/S = 60 lbs/FT²
T/W = 1.504 (UNINSTALLED)
ENGINE - P&W JTF22A-27
(AF Designation F100-PW-100)

BODIES

	LENGTH (IN.)	X (IN.)	Y (IN.)	Z (IN.)
FUSELAGE CENTERBODY w/o CANOPY	* 462.2	0	0	0
FUSELAGE OUTERBODY	404.0	102.0	±39	0
CANOPY	143.0	95.0	0	+35.0

* INCLUDES NOZZLE LENGTH ([illegible])

WING REF. AREA (IN²)
37,440

SURFACES

		2° INCIDENCE WING NEUTRAL	2° INCIDENCE DOWN HORIZ. TAIL	PER SIDE VERT. TAIL	PER SIDE VENTRAL FIN
AREA (FT²)		260.00	116.25	20.54	3.35
Æ - ASPECT RATIO		3.00	3.423	1.33	0.3733
λ - TAPER RATIO		0.20	0.1359	0.40	0.59574
 L.E. E₁(+) E₂(+)	E₁	+55°	+55°	+45°	+45°
	E₂	+10°41'	+10°41'	-19°22'	+19°22'
a - CUTOUT = $\frac{\tan E_2}{\tan(90-E_1)}$					
C_R - ROOT CHORD (IN.)		196.19	123.13	67.37	45.32
C_T - TIP CHORD (IN.)		37.24	16.74	26.95	27.00
b - SPAN (IN.)		335.14	239.38	62.72	13.50
AIRFOIL		4% BICONVEX	6% @ exp. root 4% @ tip BICONVEX [illegible]	6% @ root 4% @ tip BICONVEX	6% BICONVEX
d (IN.)		52.00	50.627	0	0
x (IN.)		249.00	425.0	129.57	442.57
y (IN.)		0	0	± 53.53	± 50.25
z (IN.)		0	-13.30	0	-13.00

d = Average buried semi-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 WL 72 to body or surface ref. line.

~~(S)~~ Figure 3.1-17 Basic Description Data Sheet - Configuration 401B Type at 15,600-lb Mission Weight (U)

~~SECRET~~

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

~~SECRET~~

BASIC DESCRIPTIONS

GW = 16,800 lbs.
W/S = 60 lbs/ft²
T/W = 1.397 (UNINSTALLED)
ENGINE - P&W JTF22A-27
(AF Designation - F100 PW-100)

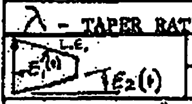
BODIES

	LENGTH (IN.)	X (IN.)	Y (IN.)	Z (IN.)
FUSELAGE CENTERBODY w/o CANOPY	* 478.6	0	0	0
FUSELAGE OUTERBODY	421.0	102.0	±40.0	0
CANOPY	143.0	85.0	0	+39.0

* INCLUDES NOZZLE LENGTH (OPEN)

WING REF. AREA (IN²)
40,320

SURFACES

	2° INCIDENCE WING [illegible]	7° INCIDENCE-LDNG. HORIZ. TAIL	PER SIDE VERT TAIL	PER SIDE VENTRAL FIN
AREA (FT²)	280.00	123.14	22.12	3.65
AR - ASPECT RATIO	3.00	3.415	1.33	0.3733
λ - TAPER RATIO	0.20	0.137	0.40	0.59574
 L.E. $E_1(+)$ $E_2(+)$ — E_1	+55°	+55°	+45°	+45°
E_2	+10°41'	+10°41'	-19°22'	+19°22'
a - CUTOUT = $\frac{\tan E_1}{\tan(90-E_2)}$				
C_R - ROOT CHORD (IN.)	193.22	126.74	69.91	47.03
C_T - TIP CHORD (IN.)	38.64	17.37	27.96	28.02
b. - SPAN (IN.)	347.79	246.09	65.09	14.01
AIRFOIL	4% BICONVEX	6% @ exposed root 4% @ tip BICONVEX exposed @ BL 51.50	1% @ root 4% @ tip BICONVEX	6% BICONVEX
d (IN.)	54.00	51.89	0	0
x (IN.)	357.50	440.0	422.52	435.52
y (IN.)	0	0	±54.9	± 51.50
z (IN.)	0	-13.90	0	-13.00
	0° DIHEDRAL	7° NEG. DIHEDRAL	7° INWD CANT ∡	0° CANT ∡

d = Average buried semi-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 WL92 to body or surface ref line.

~~(S)~~ Figure 3.1-18 Basic Description Data Sheet - Configuration 401B Type at 16,800-lb Mission Weight (U)

~~SECRET~~

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

~~SECRET~~

BASIC DESCRIPTIONS

GW = 18000 lbs
W/S = 60 lbs/ft²
T/W = 1.304 (UNINSTALLED)
ENGINE - P&W JTF 22A-27
(AF Designation - F100-PW-100)

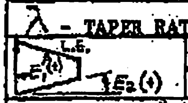
BODIES

	LENGTH (IN.)	X (IN.)	Y (IN.)	Z (IN.)
w/o CANOPY FUSELAGE CENTERBODY	# 494.4	0	0	0
FUSELAGE OUTERBODY	441.0	102.0	± 41.0	0
CANOPY	143.0	85.0	0	+29.0

INCLUDES NOZZLE LENGTH (OPEN)

WING REF. AREA (IN²)
43200

SURFACES

		2° INCIDENCE WING (NOMINAL)	2° INCIDENCE (MIN) HORIZ. TAIL	PER SIDE VERT. TAIL	PER SIDE VENTRAL FIN
AREA (FT²)		300.00	131.91	23.70	3.91
$\mathcal{R}$ - ASPECT RATIO		3.00	3.415	1.33	0.3733
λ - TAPER RATIO		0.20	0.1371	0.40	0.59574
 L.E. $E_1(+)$ $E_2(+)$	E_1	+ 55°	+55°	+45°	+45°
	E_2	+ 10°41'	+10°41'	-19°22'	+19°22'
a - CUTOUT = $\frac{\tan E_2}{\tan(90-E_1)}$					
C_R - ROOT CHORD (IN.)		200.00	131.13	72.37	48.68
C_T - TIP CHORD (IN.)		40.00	17.98	28.95	29.00
b - SPAN (IN.)		360.00	254.57	67.37	14.50
AIRFOIL		4% BICONVEX	6% @ [illegible] 4% @ TIP BICONVEX [illegible] @ BL [illegible]	6% @ ROOT 4% @ TIP BICONVEX	6% BICONVEX
d (IN.)		55.90	53.106	0	0
x (IN.)		268.50	456.5	416.80	479.80
y (IN.)		0	0	± 56.23	± 52.71
z (IN.)		0	- 14.1	0	-13.00
		0° DIHEDRAL	[illegible] DIHEDRAL	[illegible] CANT	0° CANT [illegible]

d = Average buried semi-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 WL 92.0 to body or surface ref line.

~~(S)~~ Figure 3.1-19 Basic Description Data Sheet - Configuration 401B Type at 18,000-lb Mission Weight (U)

~~SECRET~~

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

~~SECRET~~

FRICTION DRAG DATA

GW = 15,600 lbs.
W/S = 60 lbs/ft²
T/W = 1.504 (Uninstalled)
Engine – P&WA JTF22A-27

BODIES (AF Designation – F100-PW-100)

BODY	WETTED AREA (FT²)		LENGTH (IN)	MAX. WIDTH (IN)	MAX. HEIGHT (IN)
Fuselage Centerbody		388.9	* 460.8	52.0	71.0
Fuselage Outerbody		234.7	404.0	26.0	18.0
Canopy (incl Fairing)		50.7	143.0	40.00	27.0
Nozzle - Closed		20.8	27.2	43.5 DIA.	43.3 DIA.
Nozzle - Open	26.7		28.6	43.5 DIA.	43.5 DIA.
BODY TOTAL		695.1			

*Length includes nozzle (Area shown separately above)

SURFACES

SURFACE	WETTED AREA (FT²)		EXPOSED MAC LENGTH (IN)	MAX. THICKNESS SWEEP (DEG.)	AIRFOIL
WING		284.4	98.53	14°30'	4% Biconvex
HORIZ. TAIL		91.0	54.05	14°30'	[illegible] 4% Biconvex @ tip
VERT. TAIL (2)		82.2	50.05	34°15'	[illegible] 4% @ tip} Biconv.
VENTRAL FIN (2)		13.6	36.94	17°45'	6% Biconvex
SURFACE TOTAL		471.2			
AIRPLANE TOTAL		1166.3			

BASIC WING GEOMETRY:

	Trapezoid Shape – Basic Ref Wing	Trapezoid Shape for Curved Tip Wing
AREA (FT²)	260.00	263.114
ASPECT RATIO	3.00	3.20
TAPER RATIO	0.20	0.1659
LEADING EDGE SWEEP (DEG.)	35.0	35.0

~~(S)~~ Figure 3.1-20 Friction Drag Data Sheet - Configuration 401B Type at 15,600-lb Mission Weight (U)

~~SECRET~~

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

~~SECRET~~

FRICTION DRAG DATA

GW = 16,800 LBS
W/S = 60 lb/ft²
T/W = 1.397 (uninstalled)
ENGINE - P&W JTF 22A-27

BODIES

BODY	WETTED AREA (FT²)		LENGTH (IN)	MAX. WIDTH (IN)	MAX. HEIGHT (IN)
FUSELAGE CENTERBODY		405.5	* 476.2	52.0	71.0
FUSELAGE OUTERBODY		259.0	421.0	28.00	18.0
CANOPY (INCL. FAIRING)		50.7	143.0	40.00	27.0
NOZZLE (Closed)		20.8	27.2	43.5 DIA.	43.5 DIA.
NOZZLE (OPEN)	26.7		28.6	43.5 DIA.	43.5 DIA.
BODY TOTAL		736.0			

* Length includes [illegible]

SURFACES

SURFACE	WETTED AREA (FT²)		EXPOSED MAC LENGTH (IN)	MAX. THICKNESS SWEEP (DEG.)	AIRFOIL
WING		306.2	102.23	14° 30'	4% BICONVEX
HORIZ. TAIL		98.0	56.09	14° 30'	6% Biconv - root 4% Biconv - tip
VERT. TAIL (2)		88.5	51.53	34° 15'	[illegible]% Biconv - root [illegible]% Biconv - tip
VENTRAL FIN (2)		14.6	28.33	17° 45'	6% BICONVEX
SURFACE TOTAL		507.3			
AIRPLANE TOTAL		1243.3			

BASIC WING GEOMETRY:

	TRAPEZOID SHAPE - BASIC REF. WING	TRAPEZOID SHAPE FOR CURVED TIP WING
AREA (FT²)	280.00	283.353
ASPECT RATIO	3.00	3.20
TAPER RATIO	0.20	0.1689
LEADING EDGE SWEEP (DEG.)	35.0	35.0

~~(S)~~ Figure 3.1-21 Friction Drag Data Sheet - Configuration 401B Type at 16,800-lb Mission Weight (U)

~~SECRET~~

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

~~SECRET~~

FRICTION DRAG DATA
GW = 18,000 lbs
W/S = 60 lbs/Ft²
T/W = 1.304 (UNINSTALLED)
ENGINE — P&W JTF 22A-27

BODIES (AF Designation - F100-PW-100)

BODY	WETTED AREA (FT²)		LENGTH (IN)	MAX. WIDTH (IN)	MAX. HEIGHT (IN)
Fuselage Center Body		423.6	* 493.0	52.0	71.0
Fuselage Outer Body		280.5	441.0	30.0	18.0
Canopy (incl. fairing)		50.7	143.0	40.0	27.0
Nozzle - Closed		20.8	27.2	43.5 DIA.	43.5 DIA.
Nozzle - Open	26.7		28.6	43.5 DIA.	43.5 DIA.
BODY TOTAL		775.6			

*Length includes nozzle (but shown separately above)

SURFACES

SURFACE	WETTED AREA (FT²)		EXPOSED MAC LENGTH (IN)	MAX. THICKNESS SWEEP (DEG.)	AIRFOIL
WING		328.0	105.81	14° 30'	4% BICONVEX
HORIZ. TAIL		105.0	58.06	14° 30'	6% Biconvex @ root 4% Biconvex @ tip
VERT. TAIL (2)		94.8	53.76	34° 15'	6% @ root 4% @ tip
VENTRAL FIN (2)		15.6	39.67	17° 45'	6% BICONVEX
SURFACE TOTAL		543.4			
AIRPLANE TOTAL		1319.0			

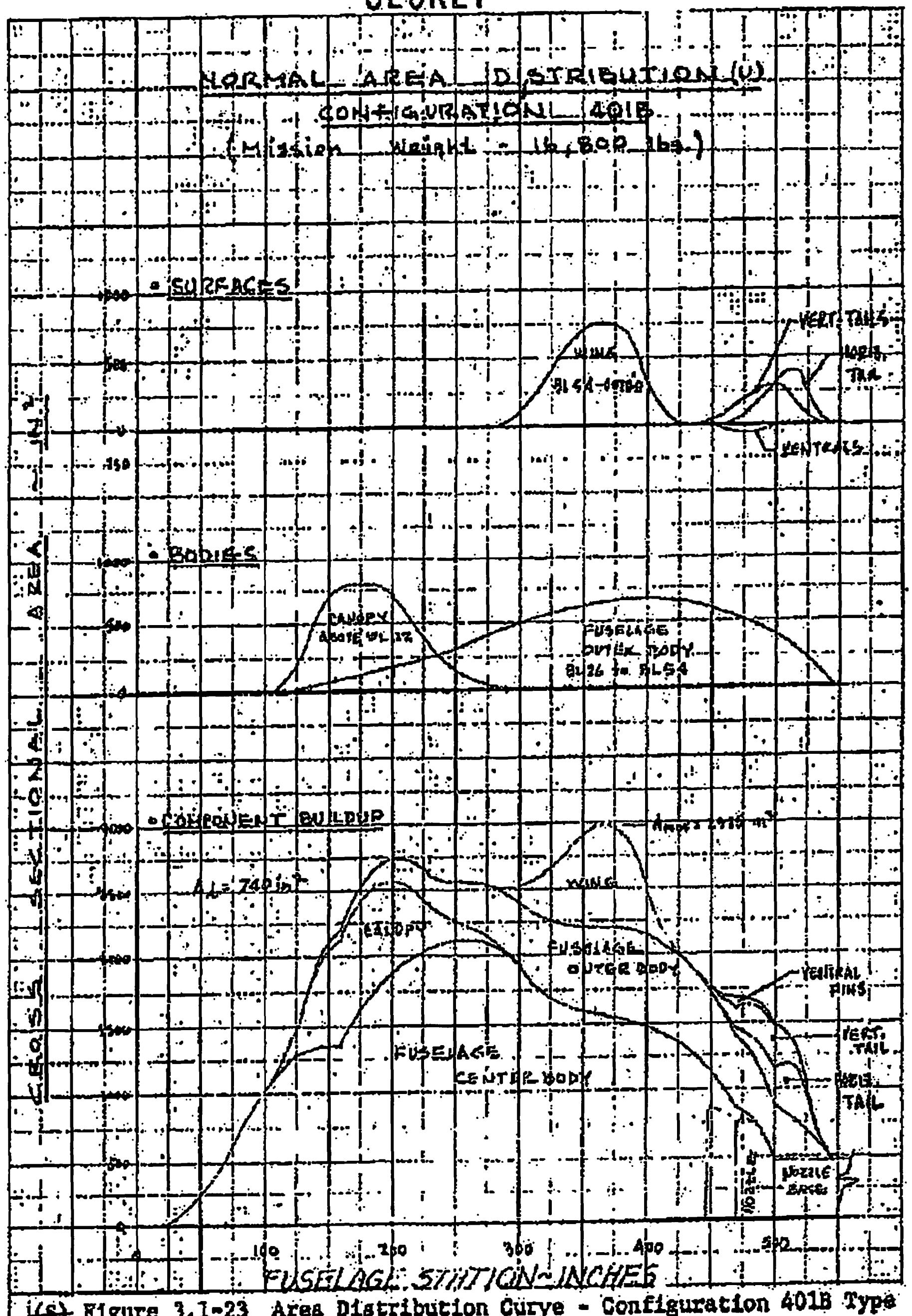
BASIC WING GEOMETRY:

	TRAPEZOID SHAPE BASIC REF WING	TRAPEZOID SHAPE FOR [illegible] WING
AREA (FT²)	300.00	303.593
ASPECT RATIO	3.00	3.20
TAPER RATIO	0.20	0.1689
LEADING EDGE SWEEP (DEG.)	35.0	35.0

~~(S)~~ Figure 3.1-22 Friction Drag Data Sheet - Configuration 401B Type at 18,000-lb Mission Weight (U)

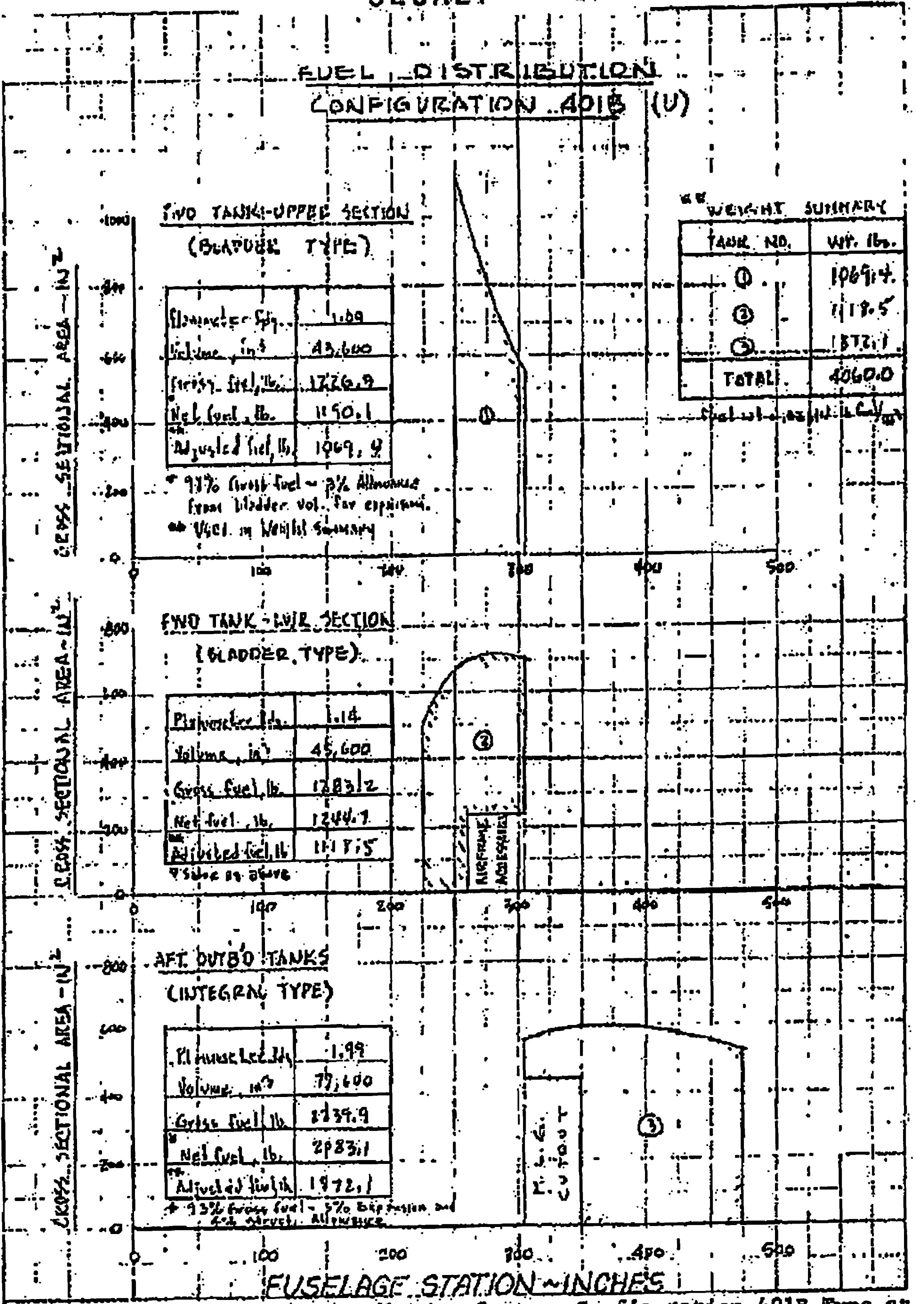
~~SECRET~~

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



(S) Figure 3.1-23 Area Distribution Curve - Configuration 401B Type at 16,800-lb Mission Weight (U)

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



FWD TANK-UPPER SECTION (BLADDER TYPE)

Planimeter Sq.	1.09
Volume, in³	43,600
Gross fuel, lb.	1726.9
*Net fuel, lb.	1150.1
**Adjusted fuel, lb.	1069.4

* 93% Gross fuel – 3% Allowance from bladder vol. for expansion.
** Used in Weight Summary

FWD TANK-LWR. SECTION (BLADDER TYPE)

Planimeter Sq.	1.14
Volume, in³	45,600
Gross fuel, lb.	1283.2
*Net fuel, lb.	1244.7
**Adjusted fuel, lb.	1119.5

* Same as above

AFT OUTB'D TANKS (INTEGRAL TYPE)

Planimeter Sq. In.	1.99
Volume, in³	77,600
Gross fuel, lb.	3139.9
*Net fuel, lb.	2883.1
**Adjusted fuel, lb.	1872.1

* 93% Gross fuel – 5% Expansion and [illegible] Allowance

** WEIGHT SUMMARY

TANK NO.	WT. lb.
①	1069.4
②	1119.5
③	1872.1
TOTAL	4060.0

~~(S)~~ Figure 3.1-24 Fuel Distribution Curve - Configuration 401B Type at 16,800-lb Mission Weight (U)

3.2 PERFORMANCE

(U) Both basic performance and sensitivity data are presented in this section for the large single-engine concept (Configuration 401B). Performance data are presented in the form of maneuver data (i.e., energy rate vs turn rate, persistence plots, and thrust required) for the aircraft with 50 percent fuel and in the form of mission data for the three missions specified in the Statement of Work and described below.

3.2.1 Mission Definitions

~~(S)~~ Three representative air-superiority fighter missions were used for aircraft performance evaluations. These are short- and long-range air-superiority missions and a ferry mission. (The ferry mission is important for deployment considerations.)

1. Short-Range Air-Superiority Mission (SRASM) - This is a radius mission without external tanks. The minimum desired radius is 225 n.mi. The payload is two AIM-9X missiles and 500 rounds of ammunition. The missiles and one half of the ammunition are expended at the end of combat. The mission rules are as follows:

   a. Ground Operation:

   Six minutes at power setting of $T/W = 0.2$

   b. Takeoff and Acceleration:

$$\text{Fuel} = \frac{W_1 V_1}{g(T-D)_1} \quad \frac{\dot{W}_0 + \dot{W}_1}{2}$$

   0 = Sea-Level Static

   1 = Climb Speed ($M = 0.5$)

   W = Takeoff Gross Weight, lb

   $\dot{W}$ = Maximum-Power Fuel Flow, lb/sec

~~(S)~~ T = Thrust, lb

D = Drag, lb

V = Velocity, fps

c. Climb is calculated from sea level at best climb speed to best cruise speed and altitude. Range accumulated is credited to radius.

d. Outbound and return legs are optimum speed and altitude (no dash).

e. Combat fuel allowance is that required to achieve the following maximum power maneuvers at the 30,000-ft altitude at the average combat weight (average combat weight equals weight at start of combat - ½ combat fuel).

(1) Constant altitude acceleration from Mach 0.9 to 1.5.

(2) Three (P_s = 0) turns at Mach 0.8

(3) Two (P_s = 0) turns at Mach 1.2.

(Missiles and one half of ammunition are expended at the end of combat).

f. Descent: No fuel used; no range gained.

g. Landing: 20-minute sea-level endurance.

88th ABW/IPI
FOIA (b)(1)
E.O.13526/SEC 6.3.(b)(4)
1.4 (a)(g)

88 FOIA (b)(1)
EO13526 (b)(4)
SEC 3.3 (b)(4)
SEC 1.4 (a)(g)
SEC

2. Long-Range Air-Superiority Mission (LRASM) - This is a radius mission in which all fuel required prior to combat is external fuel so that combat starts with full internal fuel. Tanks are dropped at start of combat. All other mission rules are the same as specified for the SRASM. The desired radius is 750 n.mi.

3. Ferry Mission - A non-refueled ferry range of 2600 n.mi is desired. External fuel

~~(S)~~ tanks are used and retained and full ammunition (500 rounds) but no missiles are carried. Fuel allowances for takeoff and landing are the same as for the SRASM plus a fuel reserve of 5 percent initial fuel (initial fuel includes external tankage).

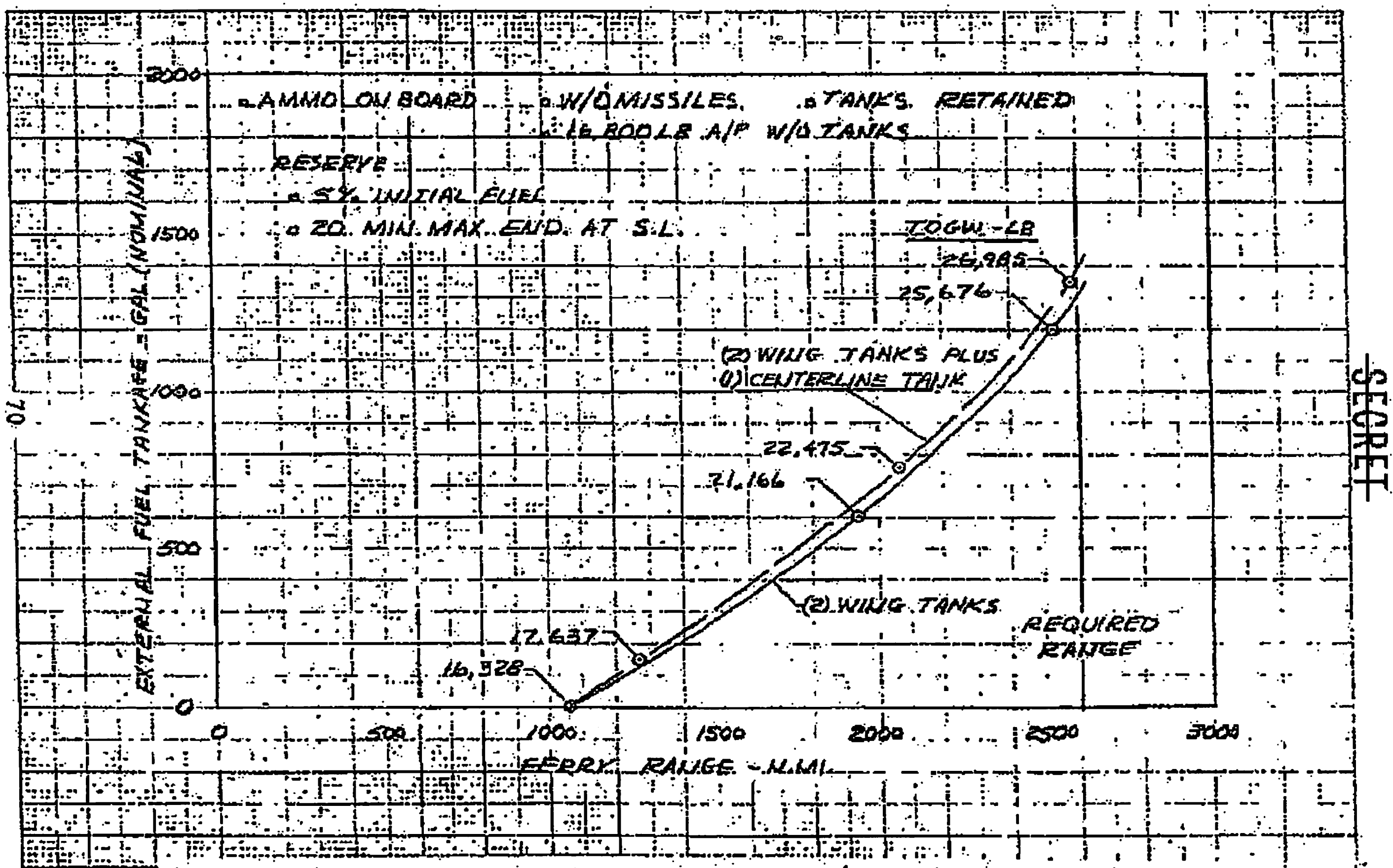
3.2.2 Thrust-Drag Bookkeeping System

(U) In the system of thrust-drag bookkeeping employed, all components of drag that do not vary with power setting are included in the aerodynamic drag data presented in Section 3.3. The aerodynamic data of Section 3.3 are for a capture ratio of 1.0, a reference exhaust nozzle position (40-inch diameter at the exit plane) and a reference nozzle pressure ratio which is defined in Section 3.6. Any effects due to changes in power setting are included in the propulsion data presented in Section 3.6.

3.2.3 Basic Performance Data

~~(S)~~ Configuration 401B performance data are presented for the aircraft sized to meet the LRASM required radius of 750 n.mi. The size aircraft required has a mission weight of 17,115 lb (i.e., full-up weight with mission payload and without external tanks which is the SRASM takeoff gross weight as well as the LRASM initial combat weight). This is an increase of 315 lb over the aircraft size (16,800 lb) used for the initial layout and evaluation. This increase is caused primarily by the ferry-range requirement.

~~(S)~~ The variation of ferry range with external fuel for a 16,800-pound aircraft (Figure 3.2-1) shows that a takeoff gross weight of nearly 27,000 lb is required to obtain the 2600-n.mi desired ferry range with external tanks retained. This is a 60-percent overload above the basic mission weight without tanks (16,800 lb). The initial structural weight evaluation considered an overload capability of 40 percent above the full-up clean airplane weight, which approximately corresponds to the takeoff gross weight for the LRASM (i.e., the maximum overload condition specified in the Statement of Work). The additional 20-percent overload capability for the ferry mission resulted in a 101-lb increase in the dry weight of the 16,800-lb aircraft for larger tires and structural beefup. This 101-lb increase due to increased overload



(S) Figure 3.2-1 Effect of External Fuel on Ferry Range, Configuration 401B (U)

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

FOIA (b)(1)
E013526
SEC 3.3(b)(4)
SEC 1.4(a)(g)

~~(S)~~ [capability together with a 36-lb increase due to revised weight estimates resulted in a 61-n.mi reduction in the LRASM radius. An increase in size to 17,115 lb was required to regain the lost radius.] Thus, while the aircraft was primarily sized for the LRASM, the sizing was also influenced by the ferry-mission requirements.

(U) The performance data presented in this section are for standard-day conditions and are based on the following basic data:

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

1. Aerodynamic data presented in Section 3.3.
2. Stability and Control data presented in Section 3.4.
3. Weight data presented in Section 3.5.
4. Propulsion data presented in Section 3.6.

(U) The following corrections, obtained from the growth data presented in Subsection 3.3.1.3, were added to the basic aerodynamic data of Section 3.3 to account for increased aircraft size and wing area change. [The reference wing area increased from 280 sq ft to 285.2 sq ft to maintain a constant wing loading of 60 psf.

Mach No.	ΔC_D
0.6	-0.00013
0.8	-0.00013
0.9	-0.00015
1.2	-0.00059
1.5	-0.00045

(U) The weight data presented in Section 3.5 were corrected for the change in aircraft size. The growth data presented in Section 3.5 were used to make the corrections. A summary of the corrected weight data is presented in Table 3.2-1.

(U) The engine size was maintained fixed at a scale of 100%, and the propulsion data from Section 3.6 were used without modification.

(U) The summary of the resized Configuration 401B's mission capabilities is presented in Figure 3.2-2. Tabulations of the pertinent data for each segment of the three missions are presented in Tables 3.2-2 through 3.2-4.

(U) General performance data are presented in support of the tabulated data. These include:

1. Takeoff Performance (Figure 3.2-3)
2. Landing Performance (Figure 3.2-4)
3. Initial-Climb Performance (Figure 3.2-5)
4. Climb After Combat (Figure 3.2-6)
5. Cruise Performance (Figure 3.2-7)
6. Combat Fuel Allowance (Figure 3.2-8)
7. Sea-Level Loiter Performance (Figure 3.2-9)

(U) Maneuver performance data in the form of energy rate versus turn rate, persistence plot, and thrust required are presented in Figures 3.2-10 through 3.2-12, respectively.

(U) Sensitivity to weight-empty variations is shown in Figure 3.2-13. Sensitivity is shown for two methods of aircraft growth. One is for the case where engine size, wing area, and fuselage size are fixed. The mission weight (i.e., full-up weight with mission payload and without external tanks) changes by the amount of weight-empty change and the amount of internal fuel change required to maintain the LRASM radius. In the other method, a constant wing loading is maintained while the engine size is held fixed. Mission weight changes by the amount of weight-empty change and the amount of internal fuel and structural weight change associated with the change in aircraft size. The relationship of internal fuel and structural weight change with the change in aircraft size (maintaining constant wing loading) is discussed in Section 3.5.

(U) Performance sensitivities for the case where the engine size is fixed and the wing loading is maintained at 60 psf are shown in Figures 3.2-14 through 3.2-20. The size variations of the fuselage, tails, etc. for this case are as discussed in Section 3.1.

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

Sec 1.4 (a)(g)

~~(S)~~ Table 3.2-1 CONFIGURATION 401B WEIGHT SUMMARY

(17,115-Lb Airplane Without Tanks)

Item	Weight (lb)
1. SRASM and LRASM	
Basic Operating Weight	12,225
Ammunition (500 rounds)	285
Two AIM 9-X Missiles	348
Fuel	4,257
SRASM Takeoff Gross Weight	17,115
Two Full 300-Gallon Tanks & Pylons	4,838
LRASM Takeoff Gross Weight	21,953
Basic Operating Weight	12,225
One Half Ammunition	142
Fuel for 20-Minute Sea-Level Loiter	447
SRASM and LRASM Landing Weight	12,814
2. FERRY MISSION	
Basic Operating Weight	12,225
Missile Pylon (Removed)	- 124
Ammunition (500 Rounds)	285
Zero Fuel Weight	12,386
Internal Fuel	4,257
Two Full 600-Gallon Tanks and Pylons	9,348
One Full 150-Gallon Tank and Pylon	1,309
Takeoff Gross Weight	27,300
Zero Fuel Weight	12,386
Two Empty 600-Gallon Tanks & Pylons	1,506
One Empty 150-Gallon Tank & Pylon	308
Five-Percent Initial Fuel	655
Twenty-Minute Sea-Level Loiter	554
Landing Weight	15,409

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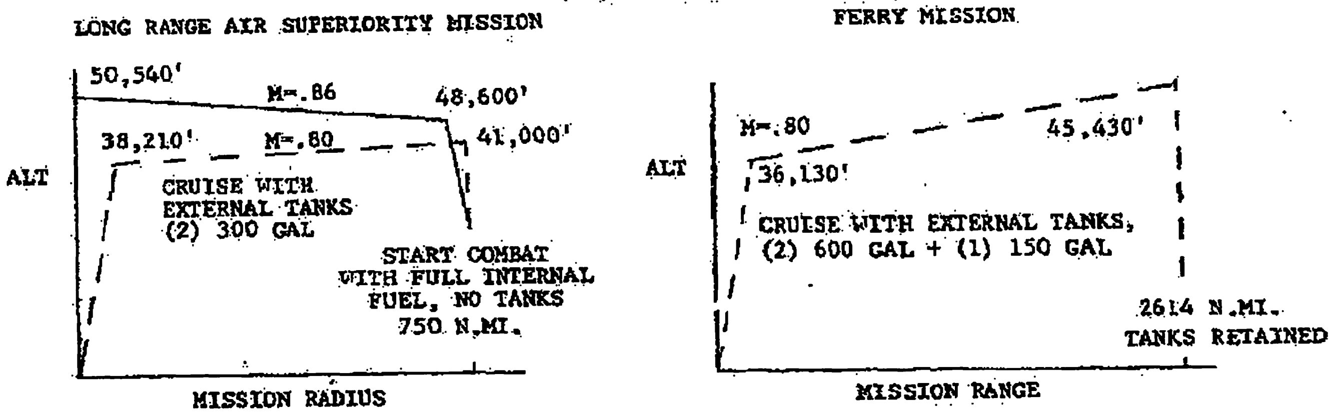
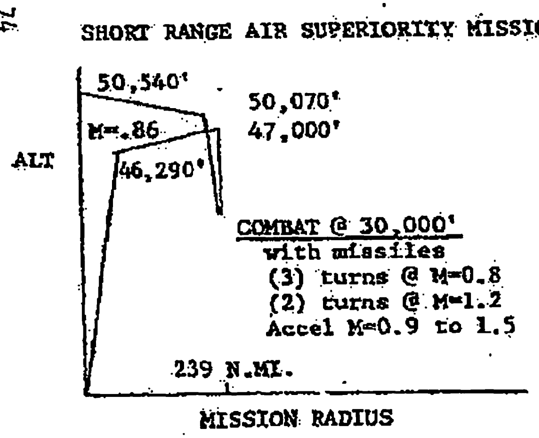
(17,115 LB A/P W/O TANKS)





LONG RANGE AIR SUPERIORITY MISSION

Takeoff Gross Weight	21,953 lb
Takeoff Distance over 50 ft	1,970 ft
Landing Distance over 50 ft	3,330 ft
Accel Time, M=0.9 to 1.5	35.5 sec
Turn Rate @ M=0.8	9.8 deg/sec
Turn Rate @ M=1.2	8.1 deg/sec

SHORT RANGE AIR SUPERIORITY MISSION

Takeoff Gross Weight	17,115 lb
Takeoff Distance over 50 ft	1,330 ft
Landing Distance over 50 ft	3,330 ft
Accel Time, M=0.9 to 1.5	32.4 sec
Turn Rate @ M=20.8	10.9 deg/sec
Turn Rate @ M=1.2	9.1 deg/sec

~~(S)~~ Figure 3.2-2 Configuration 401B Mission Performance Summary (U)

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~~(S)~~ Table 3.2-2 CONFIGURATION 401B LRASM MISSION TABULATION (U)

Mission Phase	Mach No.	Alt. (ft)	Weight (lb)	Weight (lb)	Dist. (n.mi)	Time (hr)	Initial TREQ	Initial TSFC	Initial L/D	Combat CL	Combat g's
Initial Weight	0	0	21953								
Ground Operation				327	0	0					
	0	0	21626								
Accel to Climb Speed				249	0	.11					
	.500	0	21377				2718	.875	7.10		
Climb to Cruise Alt.				506	38	.08					
	.80	38212	20871				2250	.827	9.35		
Outbound Cruise				2711	712	1.54					
	.80	41000	18160								
Drop Tanks				1045	0	0					
(847#Tank+198#Fuel)	.80	4100	17115								
Combat				(1887)		(.066)					
Accel M0.9-M1.5	0.9-1.5	30000		340	0	.010					
(2)M1.2 Turns	1.2	30000		831	0	.025				.490	5.48
(2)M0.8 Turns	0.8	30000		716	0	.031				.880	4.37
	0.86	30000	15228								
Drop Payload				348	0	0					
	0.86	30000	14880								
Drop ½ Ammo				143	0	0					
	0.86	30000	14737				2208	.875	6.40		
Climb to Cruise Alt.				149	26	.054					
	0.86	48605	14588				1490	.863	9.89		
Return Cruise				1774	724	1.46					
	0.86	50539	12814								
Descend				0	0	0					
	0.27	0	12814				1190	1.140	10.79		
Landing Reserves (20-Min.Loiter S.L.)				447	0	.33					
Zero-Fuel Weight			12367								

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

~~SECRET~~

~~(S)~~ Table 3.2-3 CONFIGURATION 401B SRASM MISSION TABULATION (U)

Mission Phase	Mach No.	Alt. (ft)	Weight (lb)	Weight (lb)	Dist. (n.mi)	Time (hr)	Initial TREQ	Initial TSFC	Initial L/D	Combat CL	Combat g's
Initial Weight	0	0	17115								
Ground Operation				238	0	0					
	0	0	16877								
Accel to Climb Speed				190	0	.10					
	.50	0	16687				2254	.875	6.18		
Climb to Cruise Alt.				450	42	.10					
	0.86	46291	16237				1690	.855	9.73		
Outbound Cruise				563	197	.39					
	0.86	47001	15674								
Combat				(1722)		(.06)					
Accel M0.9-M1.5	.9-1.5	30000		309	0	.01					
(2)M1.2 Turns	1.2	30000		754	0	.02				.490	5.98
(3)M0.8 Turns	0.8	30000		659	0	.03				.880	4.77
	0.86	30000	13952								
Drop Payload				348	0	0					
	0.86	30000	13604								
Drop ½ Ammo				143	0	0					
	0.86	30000	13461				2189	.875	5.86		
Climb to Cruise Alt.				145	26	.06					
	0.86	50069	13316				1358	.870	9.85		
Return Cruise				502	213	.43					
	0.86	50539	12814								
Descend				0	0	0					
	.27	0	12814				1190	1.14	10.79		
Landing Reserves (20 Min. Loiter S.L.)				447	0	.33					
Zero-Fuel Weight			12367								

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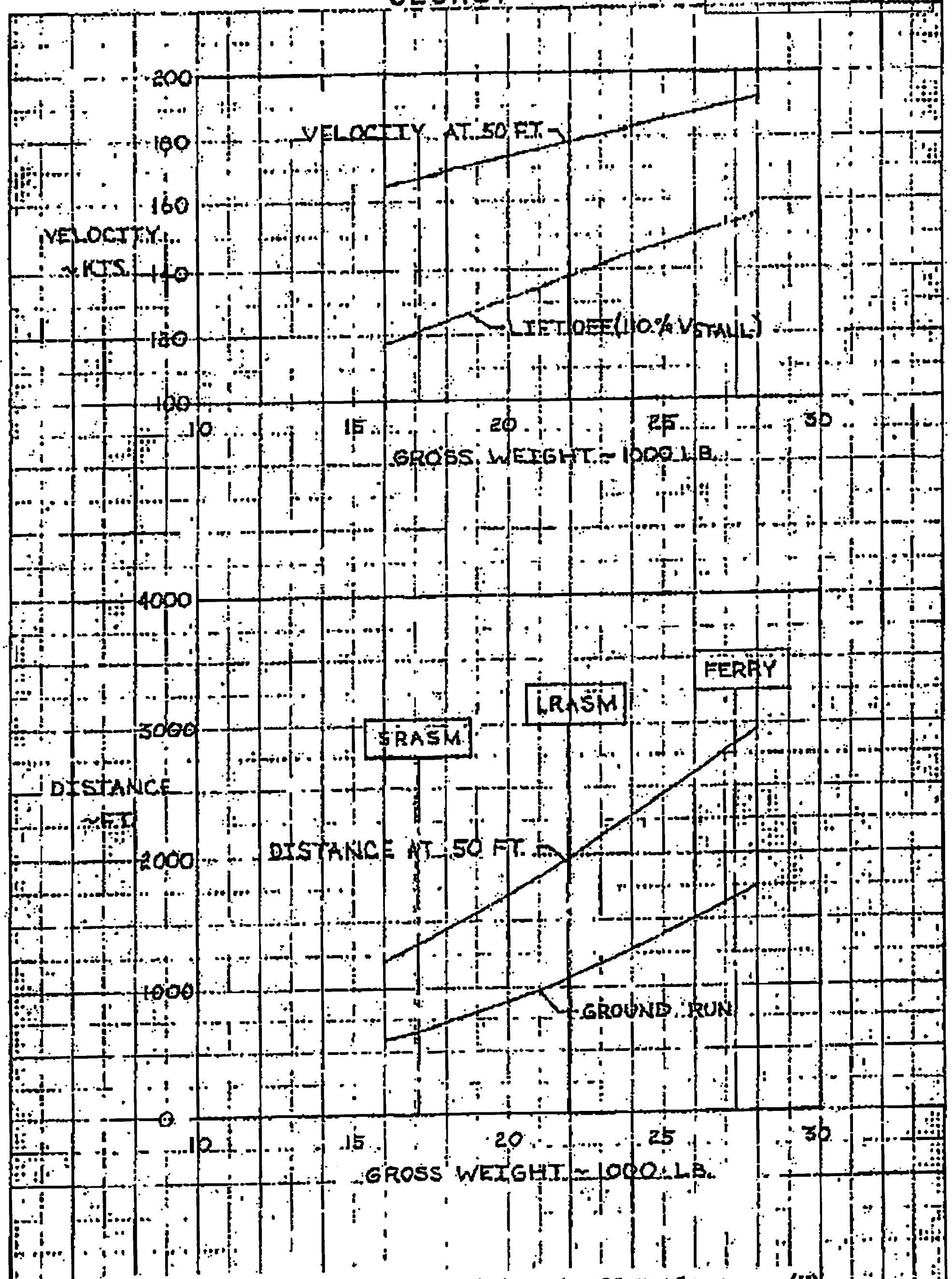
88th ABW/IPI
FOIA (b)(1)
E.O. 13526 SEC. 3.3(b)(4)
1.4. (a)(g)

~~(S)~~ Table 3.2-4 CONFIGURATION 401B FERRY MISSION TABULATION (U)

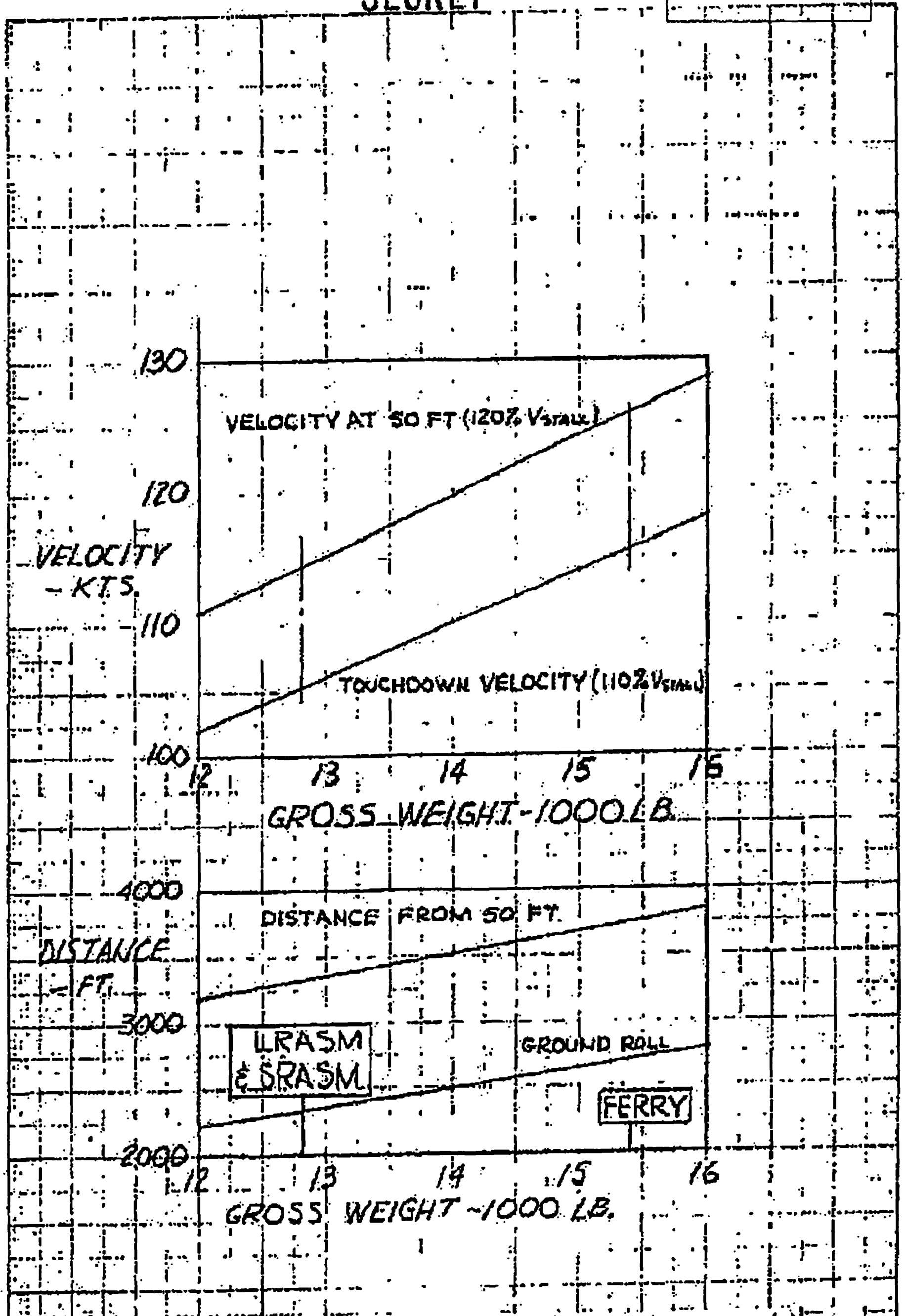
Mission Phase	Mach No.	Alt. (Ft)	Weight (lb)	Weight (lb)	Dist. (n.mi)	Time (hr)	Initial TREQ	Initial TSFC	Initial L/D	Combat C_L	Combat α
Initial Weight	0	0	27300								
Ground Operation				394	0	0					
	0	0	26906								
Accel to Climb Speed				316	0	.11					
	.50	0	26590				3063	0.875	8.11		
Climb to Cruise Alt.				663	48	.11					
	.80	36125	25927				2882	0.820	9.020		
Cruise w/(2)Ext.Tanks				10522	2566	5.59					
	.80	45433	15405								
Descend				0	0	0					
	.28	0	15405				1650	1.015	9.37		
Landing Reserves				(1205)							
(20Min.Loiter S.L.)		0		550		.34					
(5% Initial Fuel)				655							
Zero-Fuel Weight			14200								

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

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

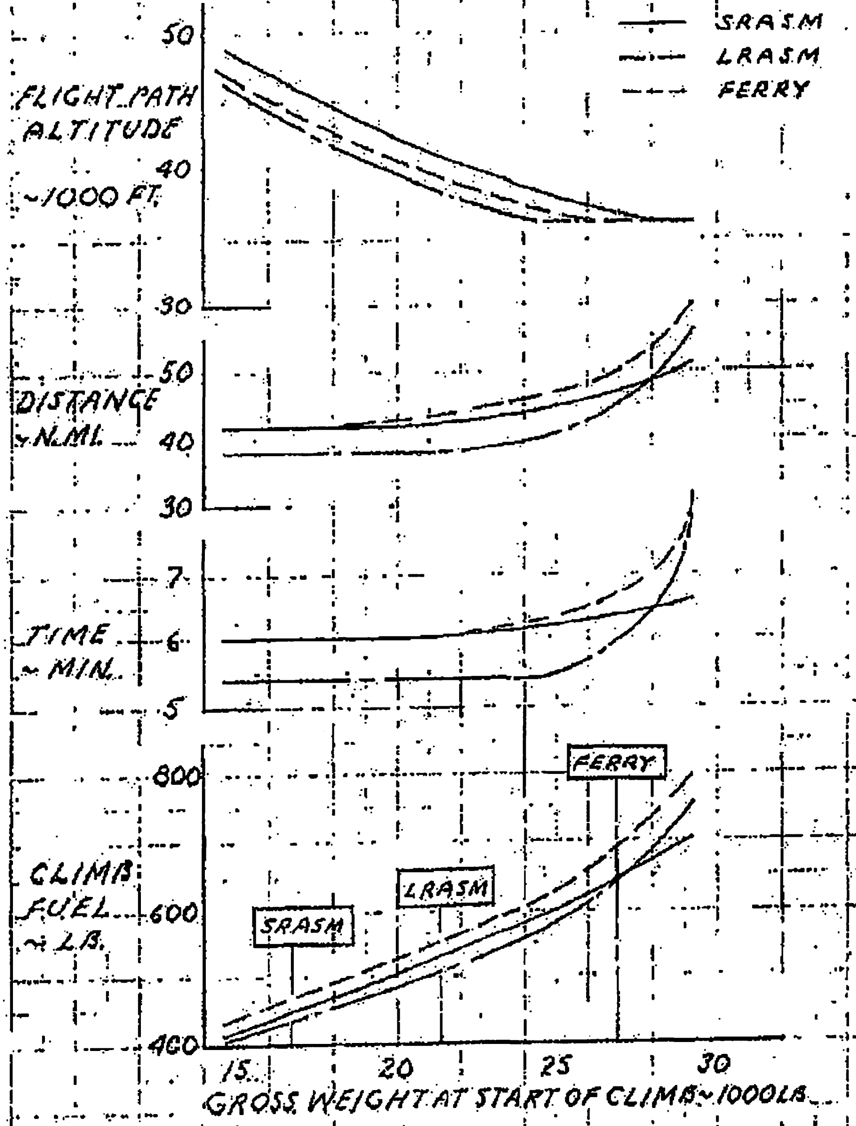


~~(S)~~ Figure 3.2-3 Configuration 401B Takeoff Performance (U)

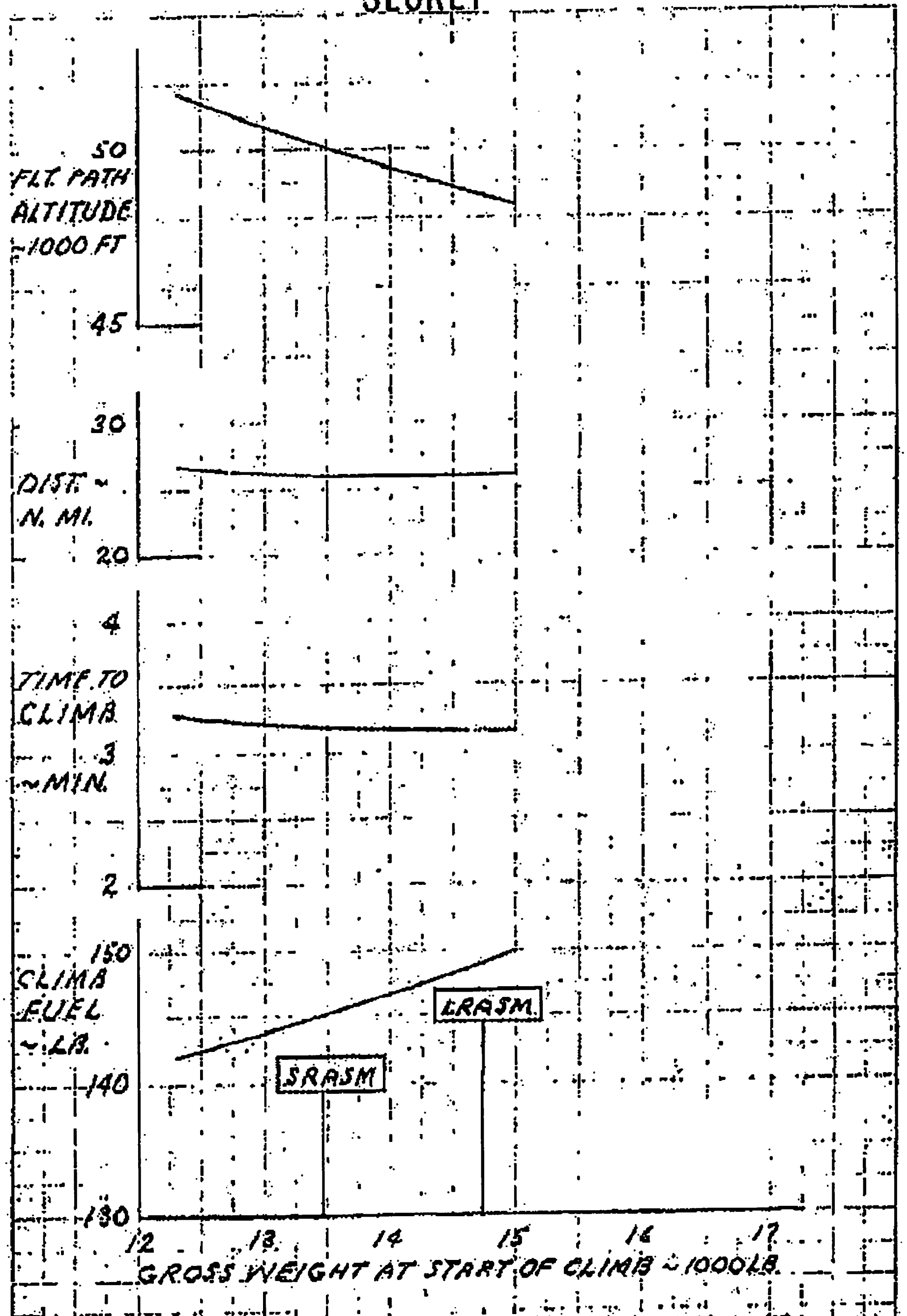


~~(S)~~ Figure 3.2-4 Configuration 401B Landing Performance (U)

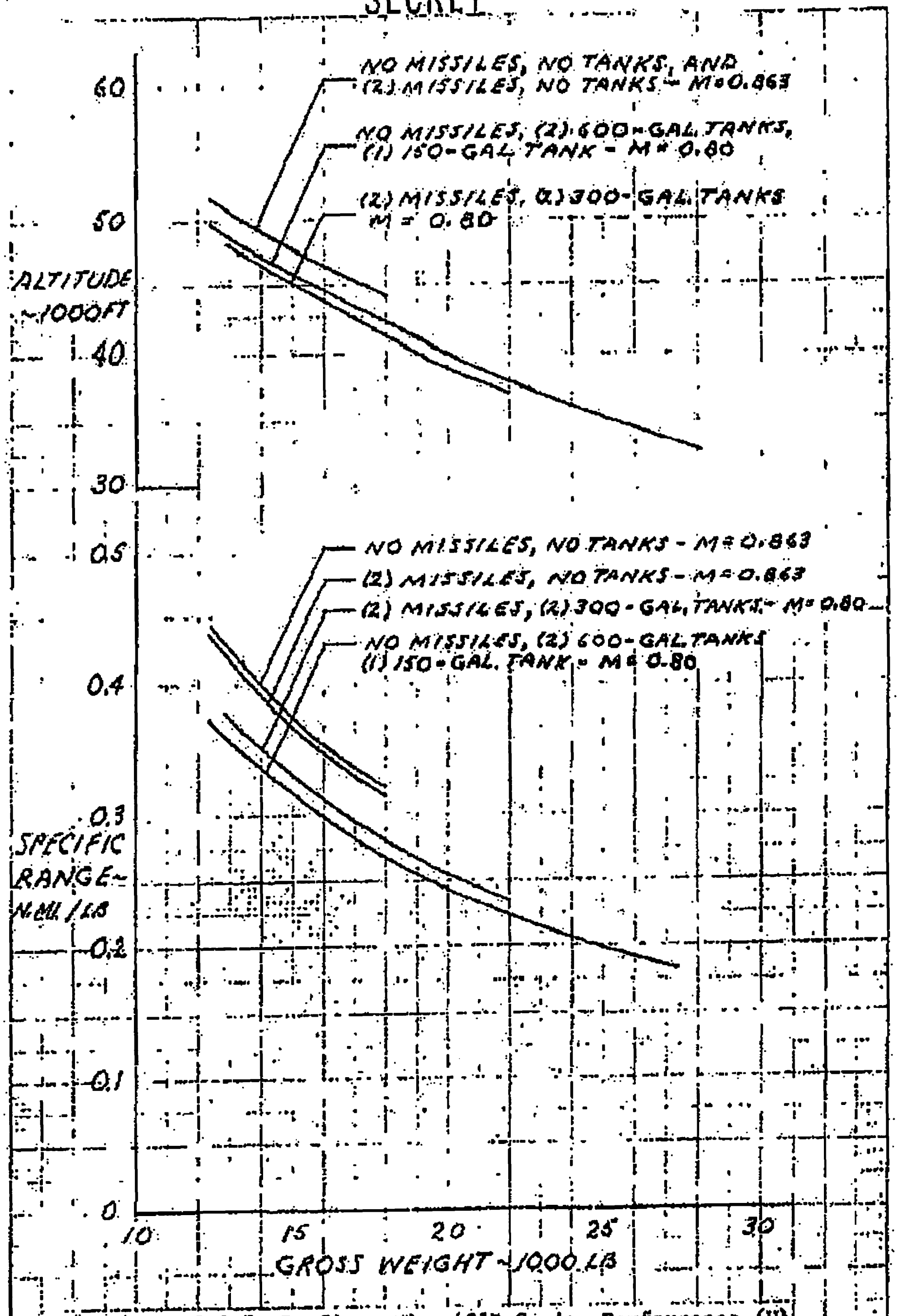
88th ABW/IPI
FOIA (b)(1)
~~E.O.13526 SEC. 3.3.(b)(4)~~
1.4. (a)(g)



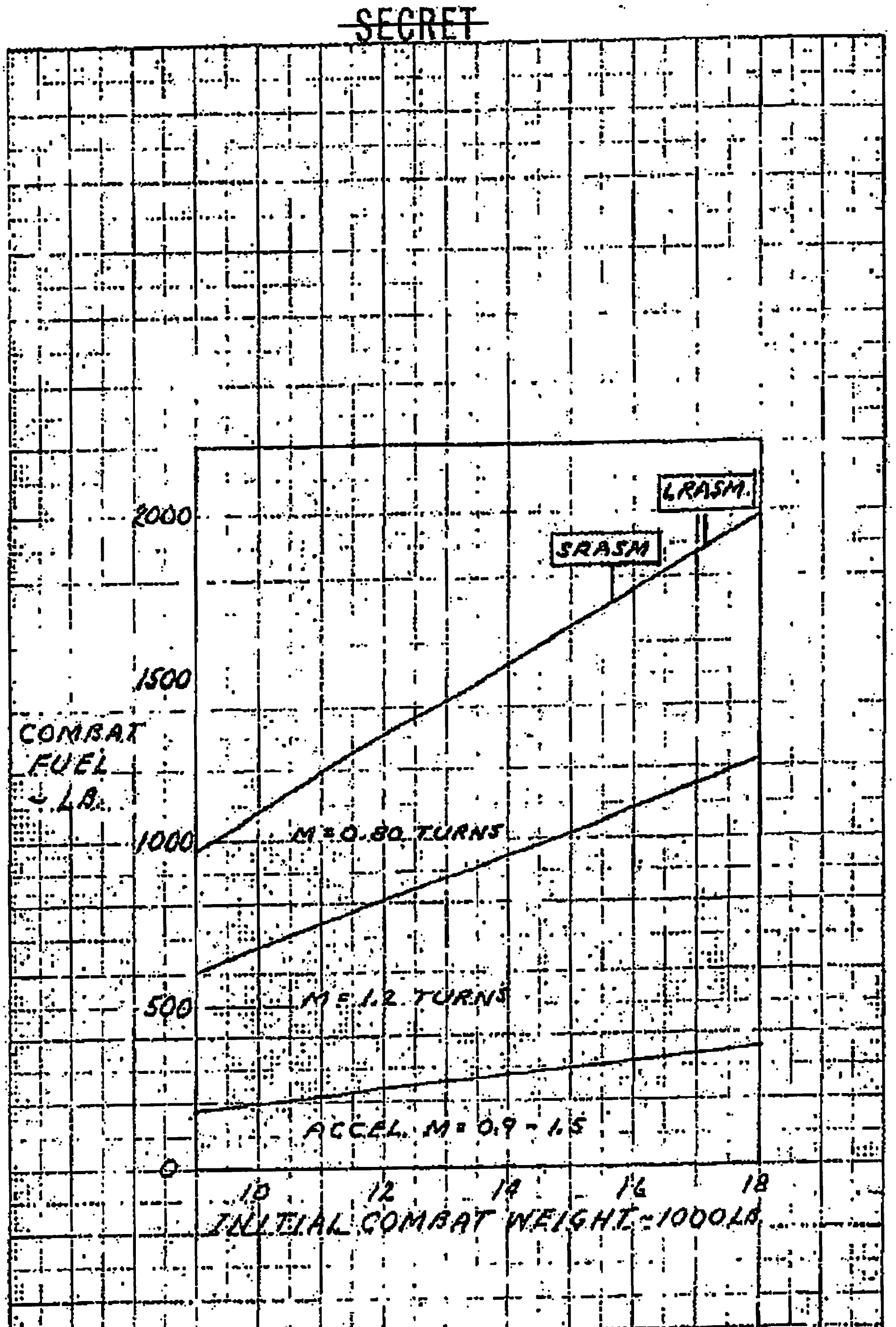
~~(S)~~ Figure 3.2-5 Configuration 401B Initial Climb Performance (U)



~~(S)~~ Figure 3.2-6 Configuration 401B Climb After Combat (U)



~~(S)~~ Figure 3.2-7 Configuration 401B Cruise Performance (U)



~~(S)~~ Figure 3.2-8 Configuration 401B Combat Fuel Allowance (U)

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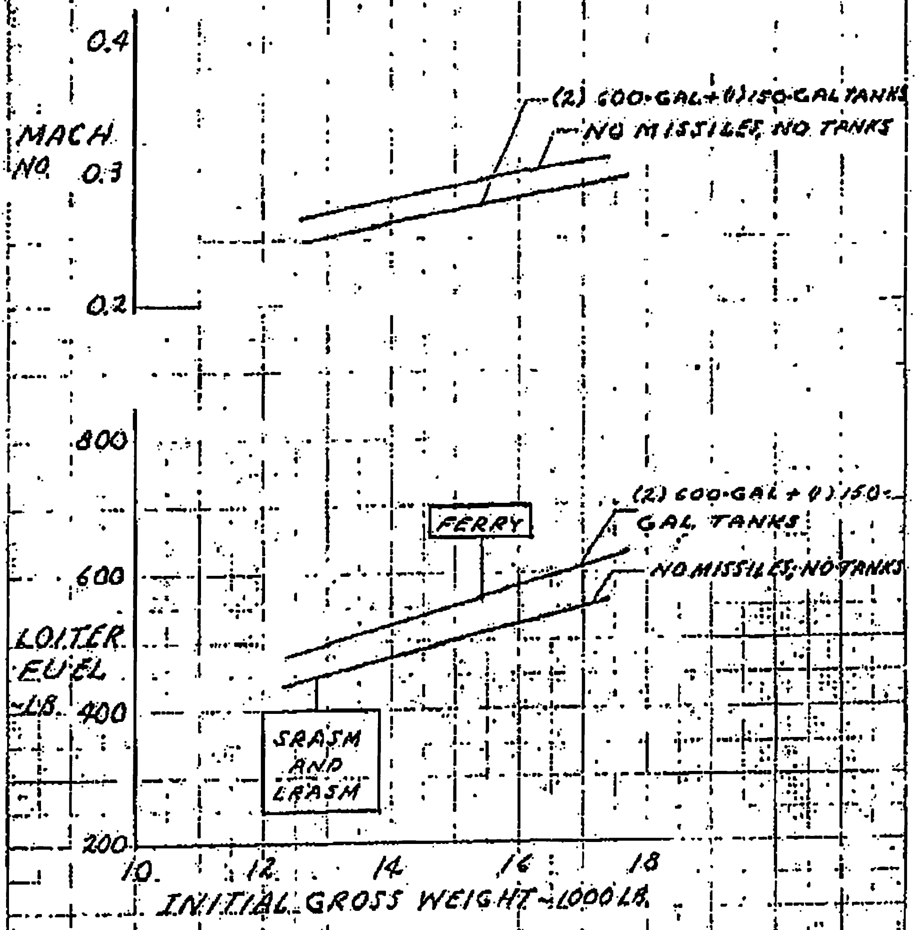

~~(S)~~ Figure 3.2-9 Configuration 401B Sea-Level Loiter Performance (U)

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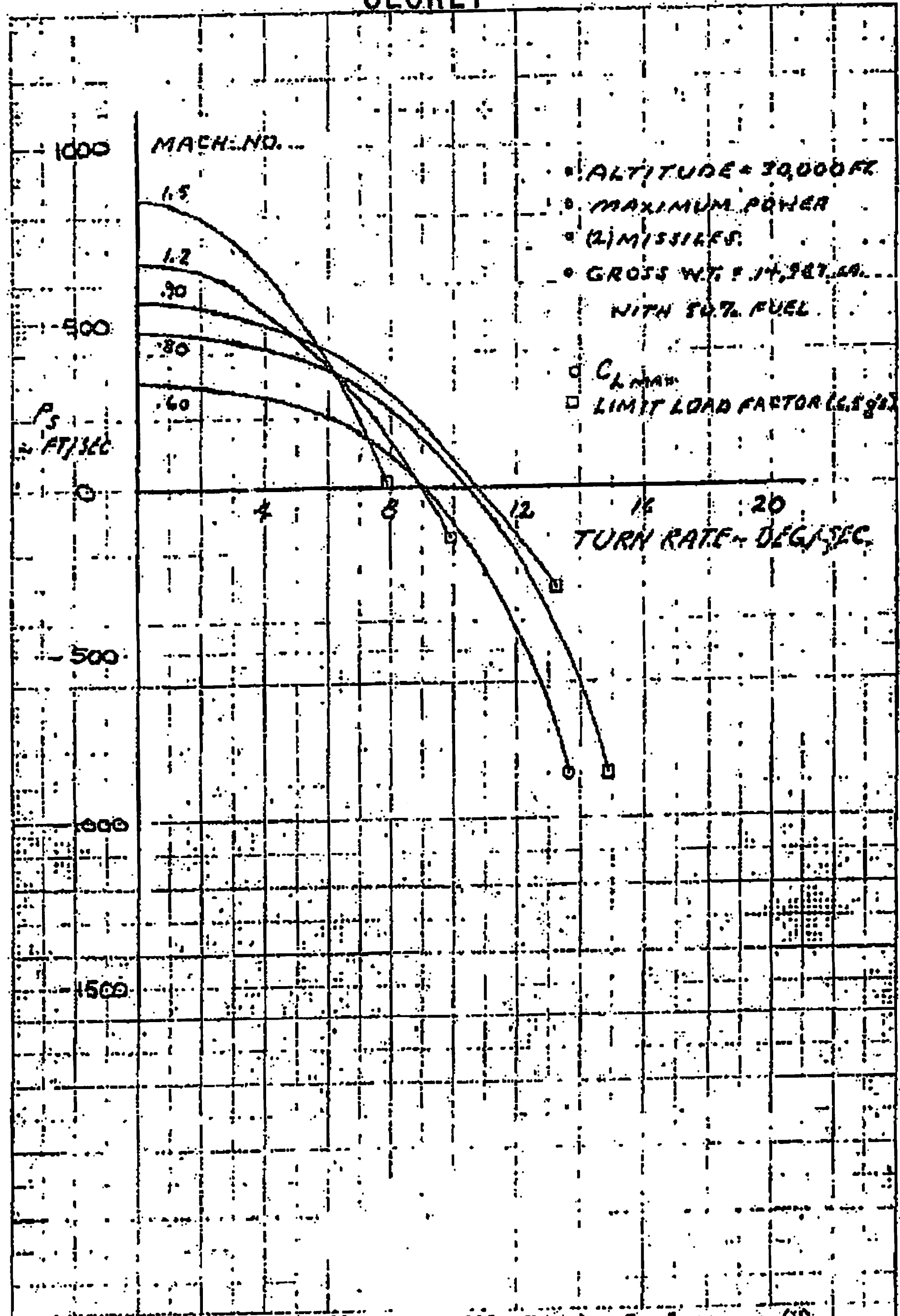
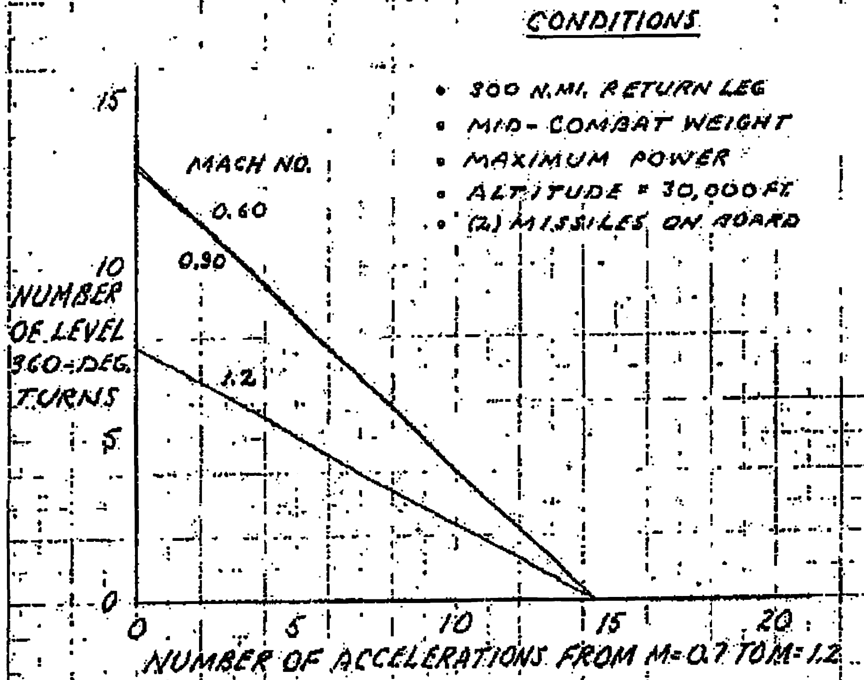
88th ABW/IPI
FOIA (b)(1)
E.O.13526
SEC. 3.3.(b)(4)
1.4. (a)(g)



~~(S)~~ Figure 3.2-10 Configuration 401B Turning Performance (U)

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



~~(S)~~ Figure 3.2-11 Configuration 401B Persistence Plot (U)

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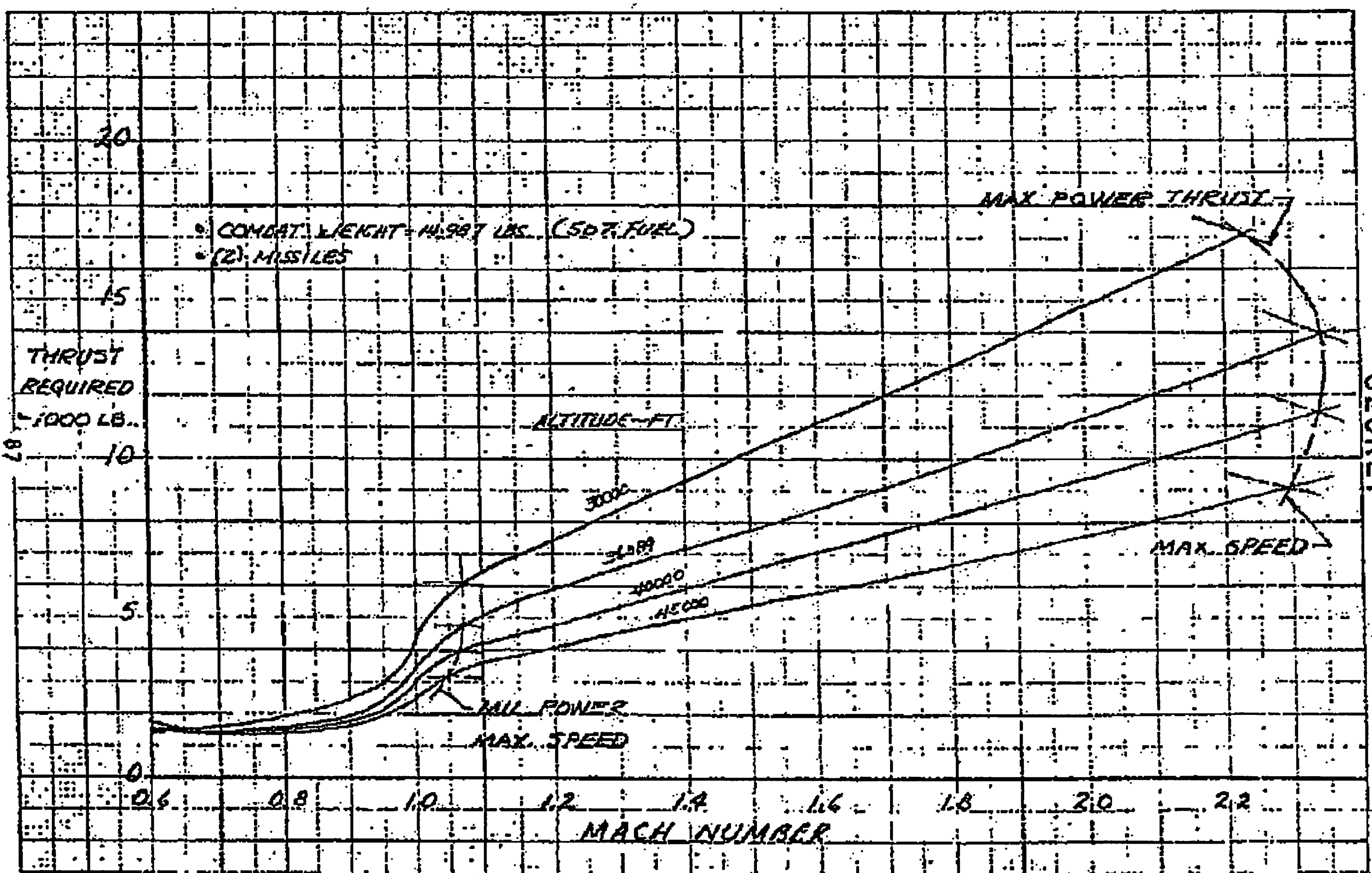

~~(S)~~ Figure 3.2-12 Configuration 401B Thrust Required (U)

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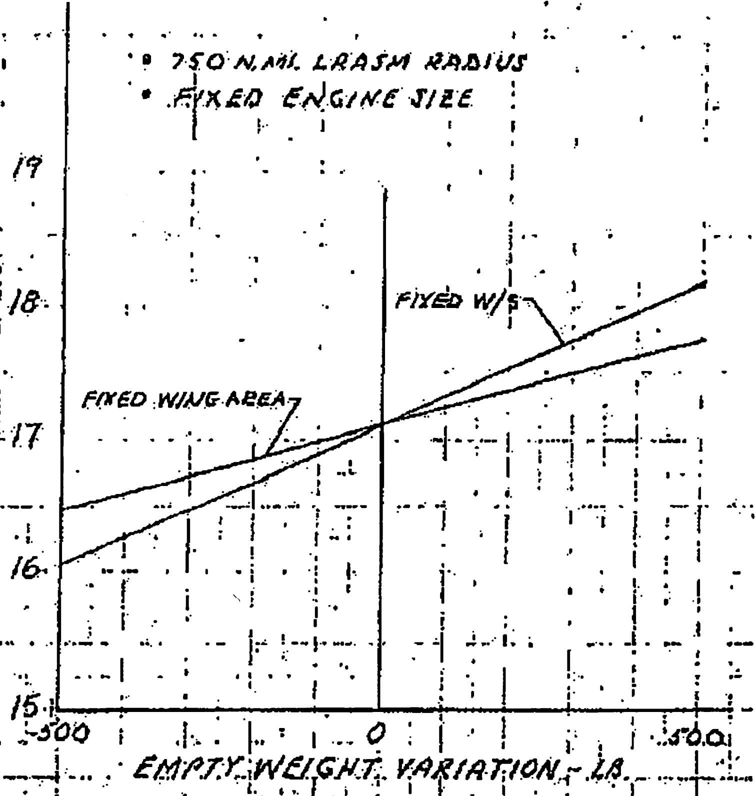
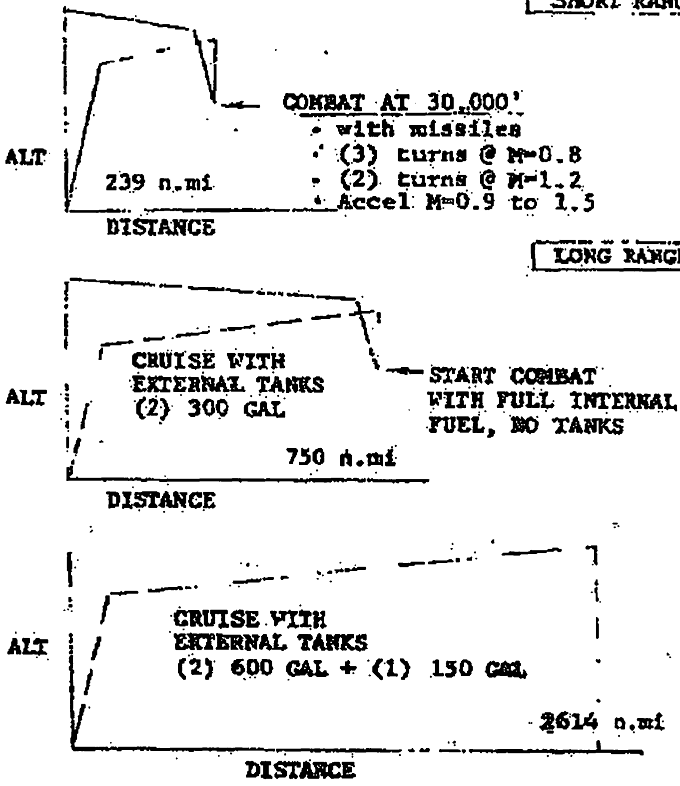
88th ABW/IPI
FOIA (b)(1)
E.O.13526 SEC.
3.3.(b)(4)
1.4. (a)(g)

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



~~(S)~~ Figure 3.2-13 Configuration 401B Sensitivity to Weight-Empty Variation (U)

* 17,115 lb A/P W/0 TANKS



SHORT RANGE AIR SUPERIORITY MISSION

DRAG SENSITIVITY: 1.1 n.mi/ct

WEIGHT SENSITIVITY: 0.21 n.mi/lb

LONG RANGE AIR SUPERIORITY MISSION

DRAG SENSITIVITY: 2.6 n.mi/ct

WEIGHT SENSITIVITY: 0.43 n.mi/lb

FERRY MISSION

DRAG SENSITIVITY: 5.5 n.mi/ct

WEIGHT SENSITIVITY: 0.31 n.mi/lb

~~(S)~~ Figure 3.2-14 Configuration 401B Range Sensitivity (U)

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

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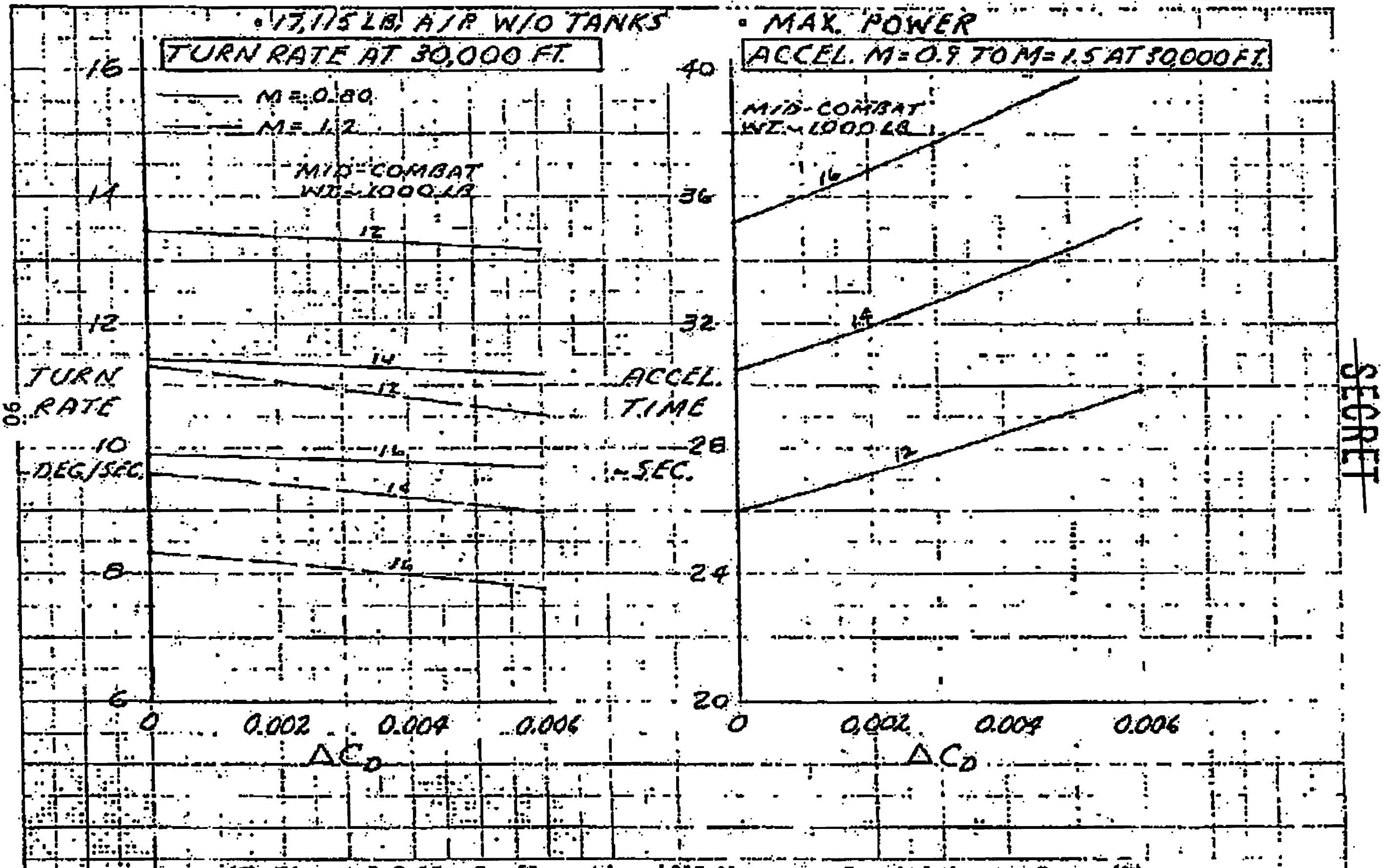

~~(S)~~ Figure 3.2-15 Configuration 401B Maneuver Sensitivity to Drag (U)

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

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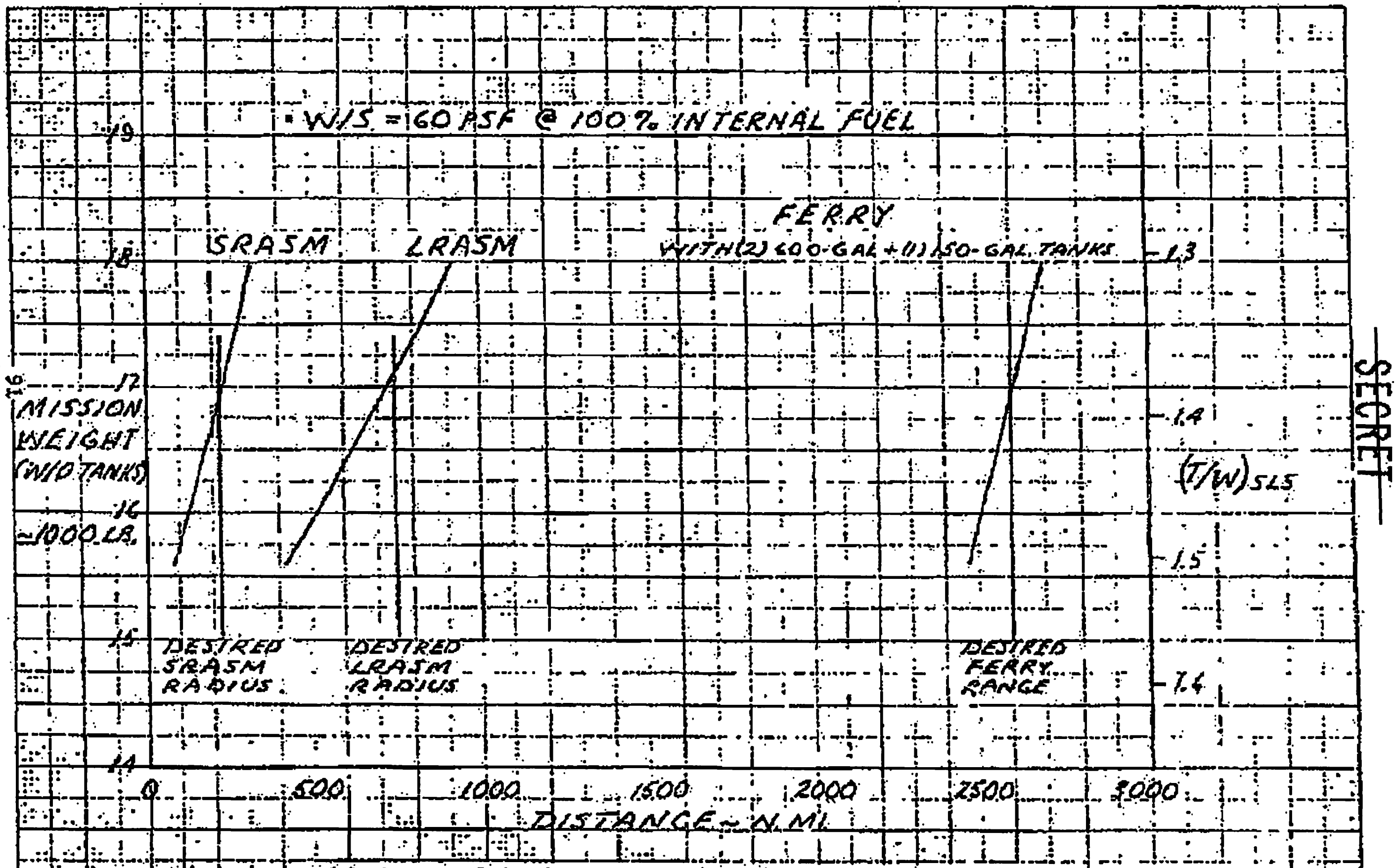

~~(S)~~ Figure 3.2-16 Configuration 401B Growth Curve (U)

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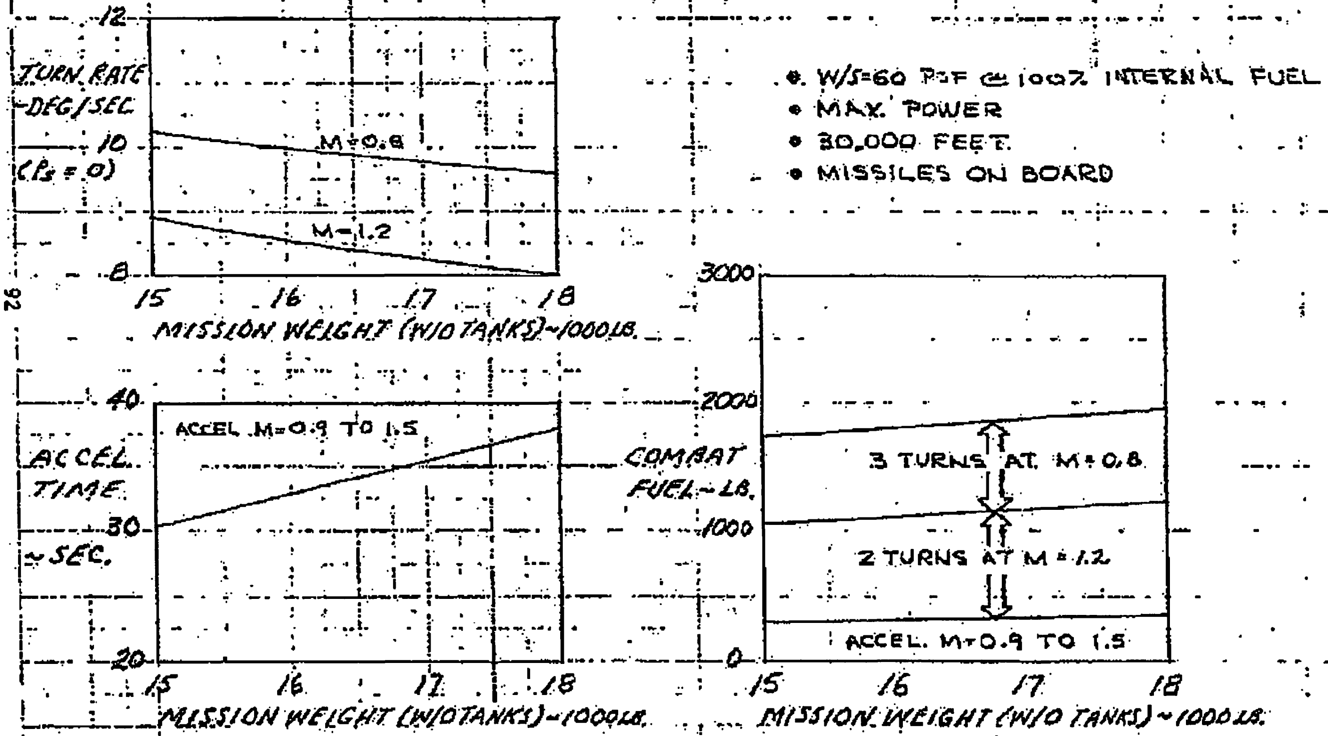
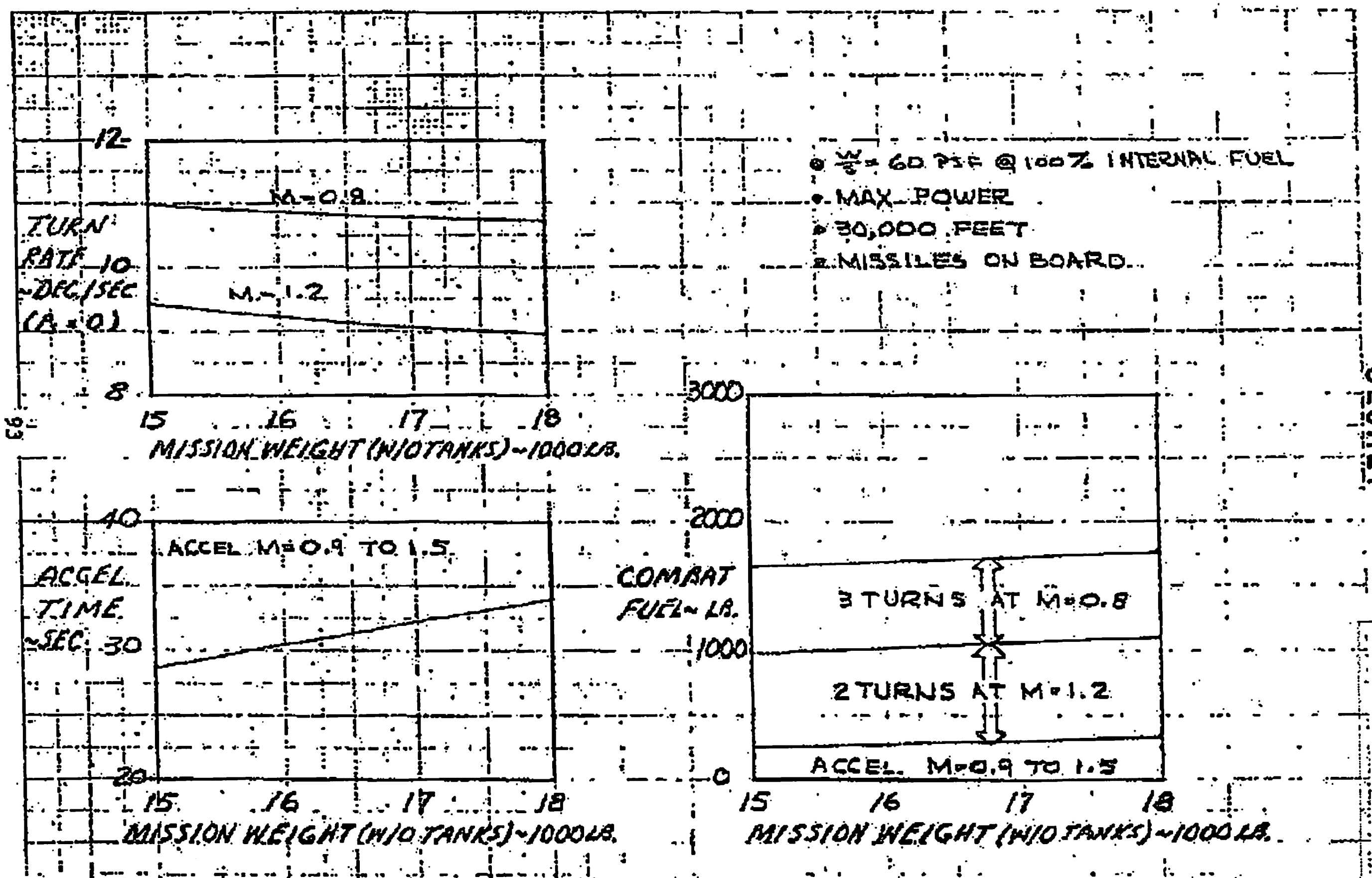


~~(S)~~ Figure 3.2-17 Configuration 401B LRASM Maneuver Sensitivity to Aircraft Size (U)

~~SECRET~~

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



~~(S)~~ Figure 3.2-18 Configuration 401B SRASM Maneuver Sensitivity to Aircraft Size (U)

86th ABW/IPI
FOIA (b)(1)
E.O. 13526 SEC. 3.3(b)
(4)
1.4. (a)(g)

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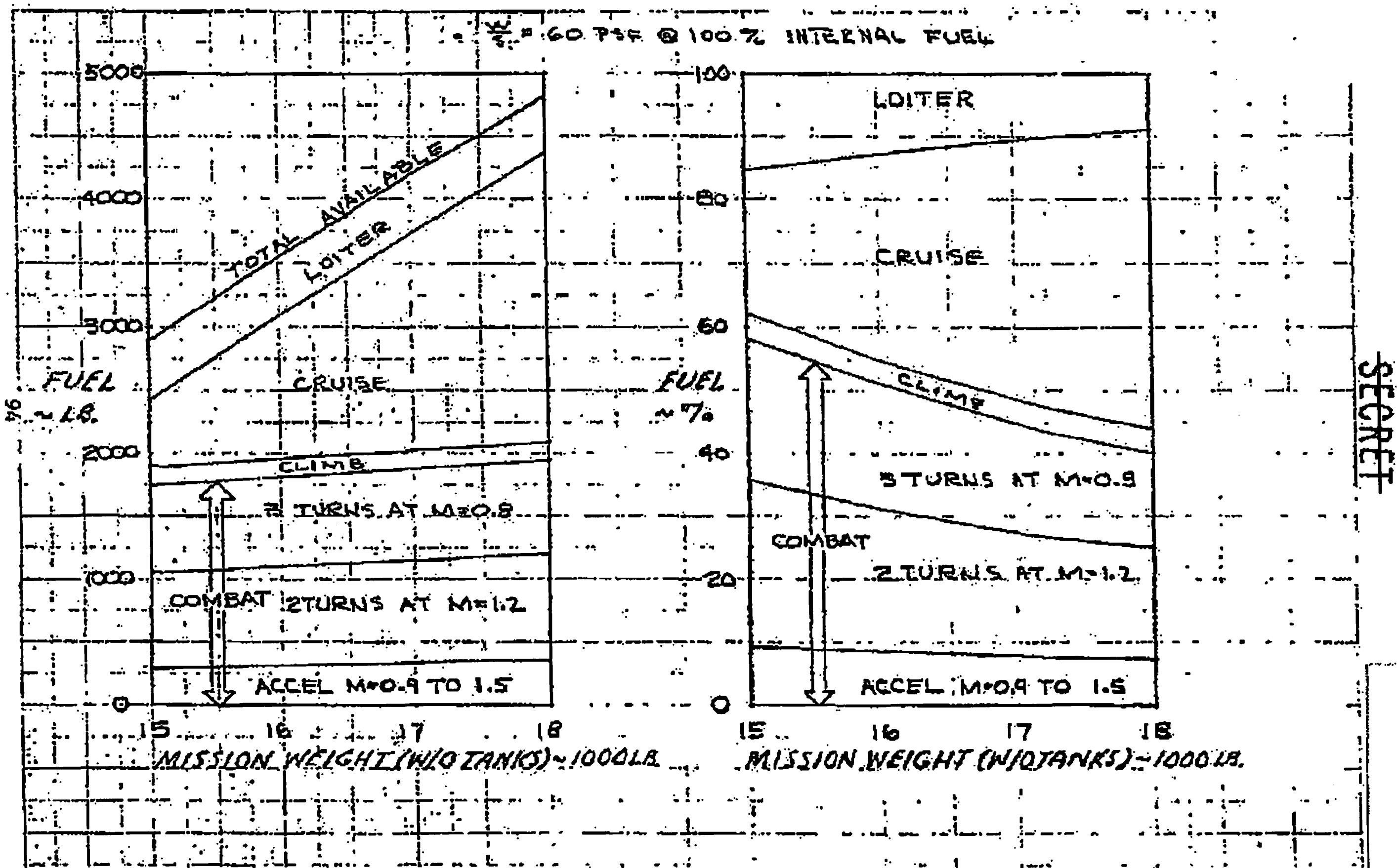

~~(S)~~ Figure 3.2-19 Configuration 401B LRASM Total Fuel Usage vs Aircraft Size (U)

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

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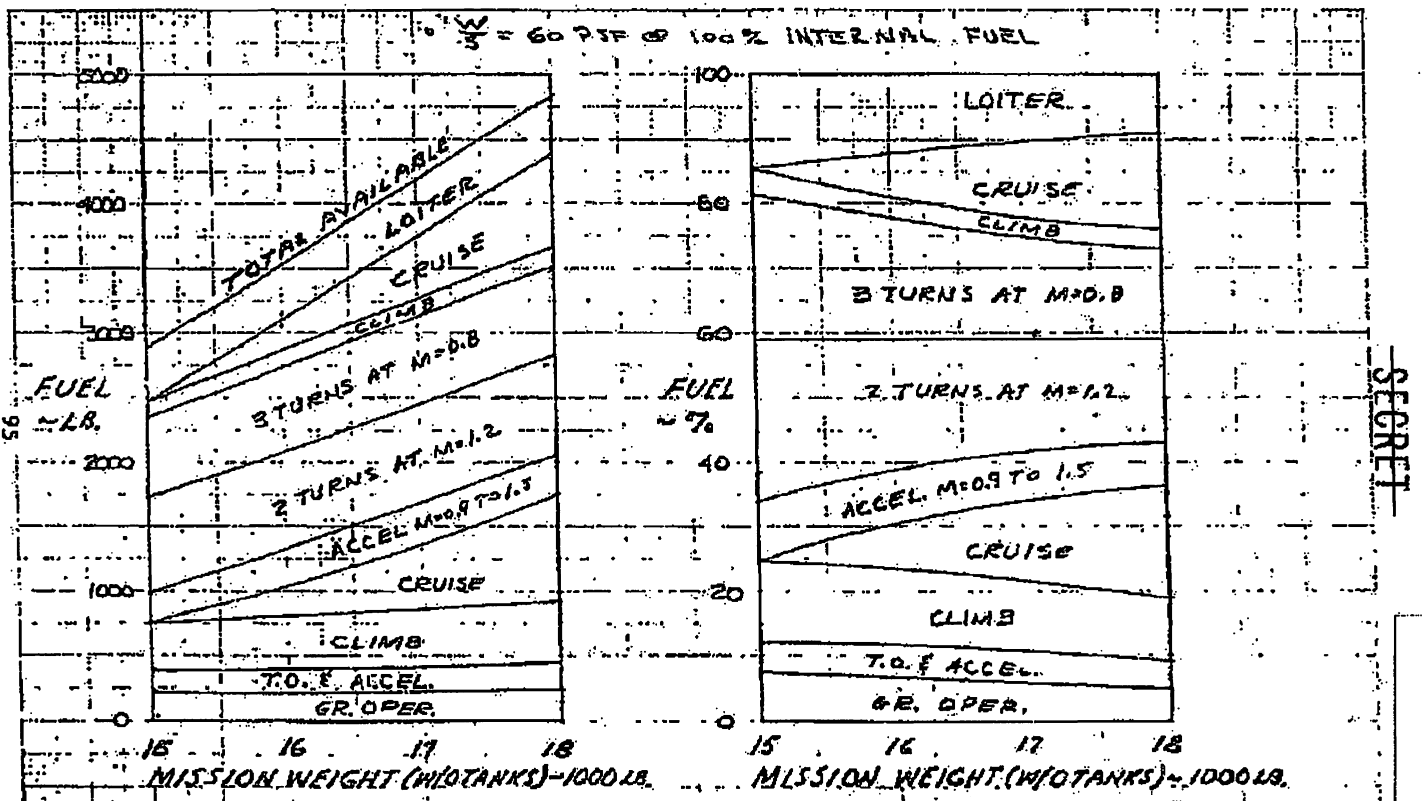


(S) Figure 3.2-20 Configuration 401B SRASM Total Fuel Usage vs Aircraft Size (U)

SECRET

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

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

3.3 AERODYNAMICS

(U) The aerodynamic characteristics of the baseline airplane, Configuration 401B, are presented in this section. The data are derived from theoretical and empirical methods and from wind tunnel data for a similar configuration developed during Convair's FX proposal effort (FX-132).

(U) The total drag of the airplane is defined by

$$C_{D_{total}} = C_{D_{min}} + \Delta C_{D_{stores}} + C_{D_L} + (\Delta C_{D_{min}})_{\delta_{LEF}} + \Delta C_{D_{trim}}$$

Each of the above terms is discussed in the following subsections.

3.3.1 Minimum Drag

3.3.1.1 Basic Minimum Drag

(U) The minimum drag at subsonic speeds is defined by

$$C_{D_{min}} = C_{D_{friction}} + C_{D_{form}} + \Delta C_{D_{canopy}} + \Delta C_{D_{nozzle}}$$

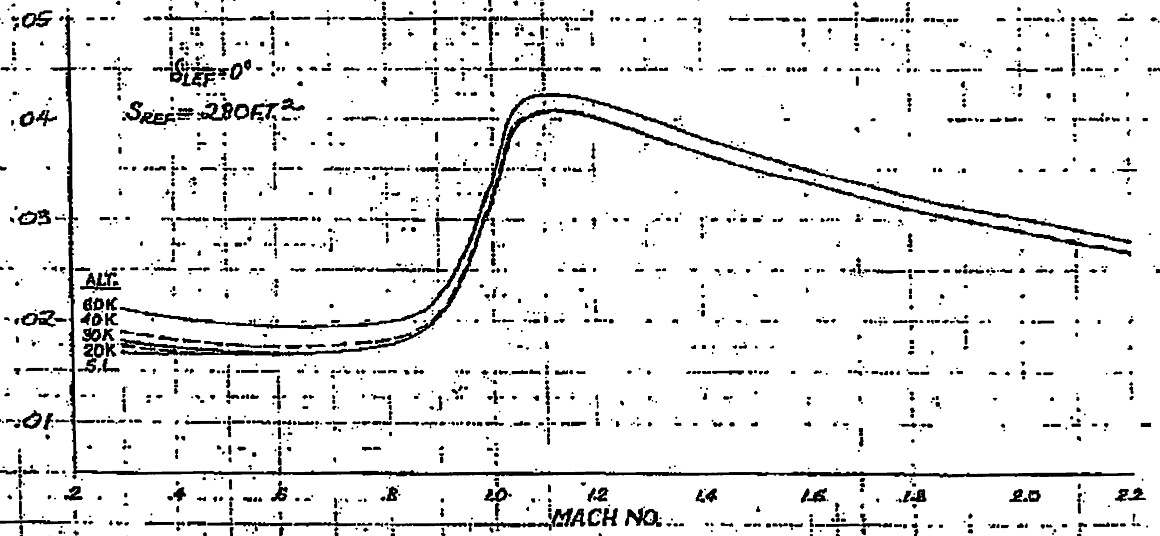
$$+ \Delta C_{D_{diverter}} + \Delta C_{D_{cowl}} + \Delta C_{D_{\substack{secondary \\ systems}}} + \Delta C_{D_{\substack{missile \\ pylons}}}$$

$$+ \Delta C_{D_{protuberances}}$$

The equation is the same for supersonic speeds except that $C_{D_{form}}$ is replaced by $C_{D_{wave}}$.

(U) Configuration 401B total minimum drag (or drag at zero-lift) is plotted in Figure 3.3-1 for various altitudes. The method used to determine the minimum-drag buildup is consistent with Convair's experience in correlating analytical methodology with wind tunnel and flight test data. Use of this method assures that the drag levels are realistic.

(U) The friction and subsonic form drag are computed by the methods documented in Reference 1, and the zero-lift wave drag is obtained from the Convair Aerospace supersonic area-rule method (digital computer procedure K35). The predicted effect of curved wing tips on minimum drag is based



~~(S)~~ Figure 3.3-1 Minimum Drag vs Mach Number, Configuration 401B(U)