[redacted]

DATE 12 October 1962

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Declassified
per DD 254
on F101
dated 8 May 1961

MODEL F-101B

AERODYNAMIC SUMMARY OF

FLIGHT TEST DATA

REPORT ASR-33 SERIAL NO.

McDONNELL Aircraft Corporation

SUBMITTED UNDER

PREPARED BY W. D. Morrison, Jr. APPROVED BY

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DOWNGRADED AT 3 YEAR INTERVALS
DECLASSIFIED AFTER 12 YEARS
DOD DIR 5200.10

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DATE _____

REVISED _____

REVISED _____

McDONNELL Aircraft Corporation

ST. LOUIS 3, MISSOURI

PAGE 1

REPORT [illegible]-33

MODEL F-101

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DATE	PAGES AFFECTED			REMARKS	REVISED BY	APPROVED
	REVISED	ADDED	REMOVED			

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1.0 SUMMARY

This report presents a summary of the existing flight test data obtained on the F-101B airplane. Where applicable and available, estimates of the flight test parameters are presented with the actual data for comparison. The flight test data presented was taken from both Air Force Evaluation and MAC Flight Tests. On an overall basis it can be concluded that the estimated flight parameters and the existing data show reasonably good agreement and that the F-101B airplane does meet the requirements of the Military Specifications.

Page 1.2 presents a condensed version of the Aerodynamic and Physical data presented in this report.

The section of this report entitled Extrapolated Mach Capabilities is a summary of a study made of the aerodynamic changes due to the incorporation of an external compression variable ramp, variable bypass inlet and a revised nose on the present F-101B. The conclusion reached was that if the recommended changes were incorporated in an advanced F-101 airplane it would extend the operational capability of the airplane to Mach = 2.1.

PHYSICAL DATA SUMMARY

WING

TOTAL AREA (THEO)/(ACTUAL OUTBOARD OF B.L. 79.5)	367.99/206.42 FT.^{2}
SPAN	39.69 FT.
THEO. ROOT CHORD (B.L.O.O.)	173.25 IN.
THEO. TIP CHORD (B.L. 238.125)	49.285 IN.
M.A.C. (THEO.)(B.L. 96.63)	122.918 IN.
ASPECT RATIO	4.28
TAPER RATIO	.2845
INCIDENCE ANGLE (WITH RESPECT TO W.L.)	1°
GEOMETRIC TWIST	0°
AERODYNAMIC TWIST	0°
DIHEDRAL ANGLE	0°
SWEEPBACK ANGLE (25.218% CHORD LINE)	35°
SWEEPBACK ANGLE (L.E.)/(T.E.)	41.124°/19.421°
ROOT AIRFOIL SECTION (PARALLEL TO C)(THEO.)	NACA 65A007 MOD.
TIP AIRFOIL SECTION (PARALLEL TO C)	NACA 65A008 MOD.
ROOT THICKNESS RATIO (THEO.)	6.67%
TIP THICKNESS RATIO	5.71%
WETTED AREA (OUTBOARD OF B.L. 79.5)	416.70 FT.^{2}
FRONTAL AREA (OUTBOARD OF B.L. 79.5)	13.02 FT.^{2}

TRAILING EDGE FLAP

TYPE: ZAP	
AREA (ONE SIDE)	21.00 FT.^{2}
SPAN (ONE SIDE)	5.76 FT.
ROOT CHORD (B.L. 51.00)	51.17 IN.
TIP CHORD (B.L. 129.19)	29.00 IN.
FLAP DEFLECTION (UP)/(DOWN)	0°/50°
WING AREA AFFECTED BY T.E. FLAP (ONE-SIDE)(THEO. WING)	87.79 FT.^{2}

AILERON

TYPE: PLAIN (PIANO HINGE, UNSEALED)	
AREA AFT OF HINGE LINE (ONE SIDE)(THEO.)	14.74 FT.^{2}
SPAN (ONE SIDE)	7.48 FT.
ROOT CHORD (B.L. 120, 50)	30.00 IN.
TIP CHORD (B.L. 220.125)	17.32 IN.
HINGE LINE LOCATION (% WING CHORD PARALLEL ℄)	72.86%
SWEEPBACK OF HINGE LINE	26°17'
TWICE MOMENT AREA (ONE SIDE)	26.69 FT.^{3}
AILERON DEFLECTION (ONE SIDE) (UP)/(DOWN)	25°/25°
STICK TRAVEL FOR FULL AILERON DEFLECTION (LEFT)/(RIGHT)	10°52'/10°52'
STICK LENGTH (ROTATIONAL AXIS TO PILOT'S HAND)	26.50 IN.
STICK FORCE FOR FULL AILERON DEFLECTION (ARTIFICIAL FEEL)	15 LBS.
RATE OF AILERON TRAVEL-NO LOAD (EACH)	78°/SEC.
DESIGN HINGE MOMENT (LIMIT)	146,940 IN.-LBS.
RATE OF AILERON TRAVEL-70% DESIGN LOAD (EACH)	52°/SEC.
TRAILING EDGE ANGLE (PARALLEL TO C)	SEE PLOT
WING AREA AFFECTED BY AILERON (ONE SIDE)	54.31 FT.^{2}

FUSELAGE

LENGTH	804.11 IN.
WIDTH (MAXIMUM)	89.80 IN.
HEIGTH (MAXIMUM)(INCLUDING CANOPY)	84.25 IN.
FRONTAL AREA (EXCLUDING CANOPY)	40.12 FT.^{2}
FRONTAL AREA (INCLUDING CANOPY)	42.79 FT.^{2}
MAXIMUM CROSS SECTIONAL AREA	40.12 FT.^{2}
LENGTH FROM NOSE TO MAXIMUM CROSS SECTIONAL AREA	391.11 IN.
MAXIMUM CANOPY CROSS SECTIONAL AREA (F.S. PLANE)	5.42 FT.^{2}
CANOPY WETTED AREA	79.70 FT.^{2}
FUSELAGE WETTED AREA (EXCLUDING COMMON AREA BETWEEN FUSELAGE AND AFTERBURNER)	888.50 FT.^{2}

AIRPLANE

TOTAL WETTED AREA	2028.93 FT.^{2}

ENGINE DUCT (ONE SIDE)

CAPTURE AREA	5.582 FT.^{2}
INLET AREA	4.67 FT.^{2}
DUCT AREA AT COMPRESSOR FACE (EXCLUDING 2.48 SQ. FT. BLOCKED BY ACCESSORY HOUSING)	4.83 FT.^{2}
BOUNDRY LAYER BLEED INLET AREA	.649 FT.^{2}
BOUNDRY LAYER BLEED WIDTH	2.487 IN.
WETTED AREA (OUTBOARD TO B.L. 79.5)*	297.50 FT.^{2}
FRONTAL AREA (INCLUDING INLET AREA)*	12.33 FT.^{2}

*BOTH SIDES

SPEED BRAKE (ONE SIDE)

PROJECTED AREA	8.54 FT.^{2}
MAXIMUM DEFLECTION	50°
DESIGN HINGE MOMENT	525,000 IN.-LBS.

HORIZONTAL TAIL

TOTAL AREA (THEO.)/(ACTUAL)	75.08/74.47 FT.^{2}
SPAN	15.75 FT.
THEO. ROOT CHORD (HORIZ. STAB. STA. 0.0)	78.50 IN.
THEO. TIP CHORD (HORIZ. STAB. STA. 94.50)	35.91 IN.
M.A.C. (THEO.)(B.L. 40.77)	59.85 IN.
ASPECT RATIO	3.30
TAPER RATIO	.457
DIHEDRAL ANGLE	10°
SWEEPBACK ANGLE (29.34% CHORD LINE)	35°
SWEEPBACK ANGLE (L.E.)/(T.E.)	39.798°/20.929°
HINGE LINE LOCATION (% M.A.C.)/(F.S.)/(W.L.)	26.5/838.90/156.88
TOTAL MOVABLE AREA (ACTUAL)	69.07 FT.^{2}
MOVABLE SPAN (ONE SPAN)	7.45 FT.^{2}
HORIZONTAL STABILIZER MOVEMENT (WITH RESPECT TO W.L.) LEADING EDGE UP	10°
LEADING EDGE DOWN	20°
STICK TRAVEL FOR FULL STABILIZER DEFLECTION (FWD.)/(AFT)	12°31'15"/20°59'22"
STICK LENGTH (ROTATIONAL AXIS TO PILOT'S HAND)	19.75 IN.
BOBWEIGHT (LBS. / "g" AT PILOT'S GRIP)	5
RATE OF STABILIZER TRAVEL-NO LOAD	30°/SEC.
DESIGN HINGE MOMENT (LIMIT)	234,000 IN.-LBS.
RATE OF STABILIZER TRAVEL-70% DESIGN LOAD	169°/SEC.
TAIL LENGTH (25% TAIL M.A.C.)	354.164 IN.
TAIL VOLUME (TO 25% M.A.C.)	.58787
ROOT AIRFOIL SECTION (PARALLEL TO ℄)	NACA 65A007 MOD.
TIP AIRFOIL SECTION (PARALLEL TO ℄)	NACA 65A006 MOD.
TRAILING EDGE ANGLE (AT M.A.C.)	9°12'
WETTED AREA (EXPOSED)	141.52 FT.^{2}

VERTICAL TAIL

AREA (THEO)(ABOVE W.L. 80.00)	100.38 FT.^{2}
AREA ABOVE FUSELAGE (DORSAL EXCLUDED)	75.29 FT.^{2}
AREA OF DORSAL	1.27 FT.^{2}
SPAN	102.00 IN.
THEO. ROOT CHORD (W.L. 80.00)	191.78 IN.
THEO. TIP CHORD (W.L. 182.00)	91.54 IN.
M.A.C. (THEO.)(W.L. 124.993)	147.61 IN.
ASPECT RATIO (THEO.)	.720
TAPER RATIO (THEO.)	.478
SWEEPBACK ANGLE (L.E.)/(T.E.)	52.002°/16.604°
25% CHORD M.A.C.	F.S. 763.53
TAIL LENGTH (25% WING M.A.C. TO 25% TAIL M.A.C.)	280.502 IN.
TAIL VOLUME (TO 25% THEO. M.A.C.)	.62270
ROOT AIRFOIL SECTION	NACA 65A007
TIP AIRFOIL SECTION	NACA 65A007
WETTED AREA EXPOSED (ABOVE W.L. 117.0)	110.06 FT.^{2}

RUDDER

TYPE: PLAIN (UNSEALED)	
AREA AFT OF HINGE LINE	12.20 FT.^{2}
SPAN	5.95 FT.
ROOT CHORD (W.L. 100.33)	30.93 IN.
TIP CHORD (W.L. 171.70)	18.32 IN.
HINGE LINE LOCATION (% TAIL CHORD PARALLEL TO ℄)	82.00
SWEEPBACK OF HINGE LINE	25°24'13"
TWICE MOMENT AREA	23.10 FT.^{3}
RUDDER DEFLECTION (IN PLANE NORMAL TO HINGE LINE)	±25°
PEDAL TRAVEL (FWD.)/(AFT)	3.37/3.25 IN.
PEDAL MOMENT ARM	11.42 IN.
PEDAL FORCE GRADIENT (ABOVE 290 KNOTS)	18.4 LBS./DEG.
PEDAL FORCE GRADIENT (BELOW 290 KNOTS)	5.26 LBS./DEG.
DESIGN HINGE MOMENT (POWER CYL. ALONE)	10,540 IN.-LBS.
TRAILING EDGE ANGLE (PARALLEL TO ℄)	9°37'
RUDDER RATE OF TRAVEL-NO LOAD	92°/SEC.
RUDDER RATE OF TRAVEL-70% LOAD	47°/SEC.

POWER PLANT

TWO PRATT AND WHITNEY J-57-P-55, SPEC. A-ITISA
AXIAL FLOW TURBO-JET ENGINES

LENGTH (INCLUDING AFTERBURNER)	251.34 IN.
NORMAL DIAMETER	40.50 IN.
STATIC THRUST AT SEA LEVEL (ONE ENGINE)(INSTALLED) MILITARY + AFTERBURNING	13,300 LBS.
MILITARY	8,450 LBS.
NORMAL	7,150 LBS.
IDLE	505 LBS.
A/B WETTED AREA	104.95 FT.^{2}

EXTERNAL TANKS

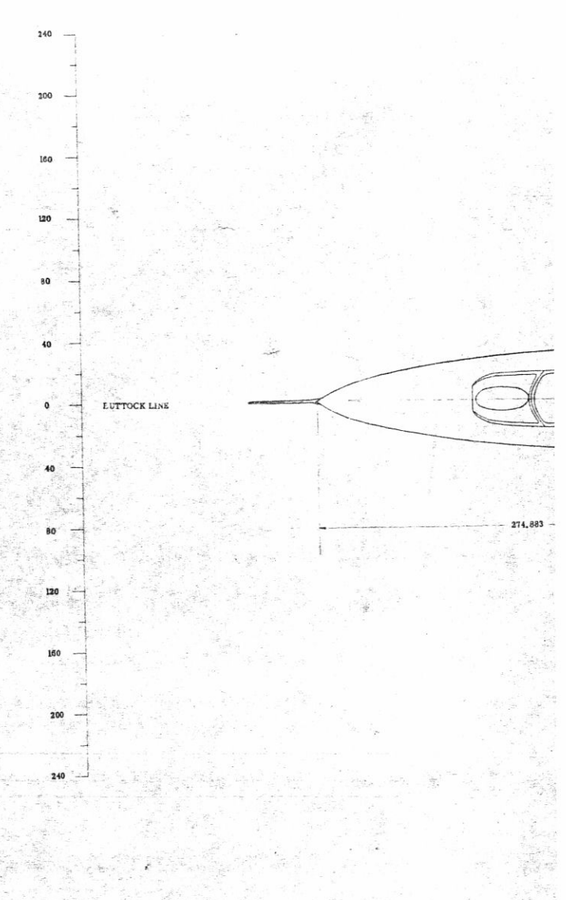
NAME AND TYPE: TWO-AIR FORCE STANDARD	
CAPACITY (EACH)	450 GAL.
MAXIMUM DIAMETER	29.00 IN.
LENGTH	223.35 IN.
LENGTH TO MAXIMUM DIAMETER	58.00 IN.
LOCATION (NOSE OF TANK)(F.S.)/(W.L.)/(B.L.)	371.00/-5.556/37.53
LOCATION (C.G. OF TANK)(F.S.)/(W.L.)/(B.L.)	465.27/-5.556/37.53
TANK INCIDENCE ANGLE (WITH RESPECT TO W.L.)	0°
EMPTY WEIGHT (EACH)	206.47 LBS.
WETTED AREA (EACH)	112.33 FT.^{2}

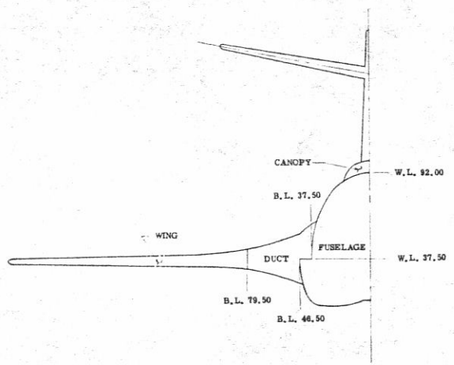
TAIL CHUTE (PARA-BRAKE)

TYPE: RING SLOT MAIN CHUTE WITH SPRING RELEASED PILOT CHUTE	
MAIN CANOPY DIAMETER (FLAT)/(INFLATED)	15.60/10.00 FT.
NUMBER OF MAIN SHROUD LINES	20
LENGTH OF MAIN SHROUD LINES	16.00 FT.
LENGTH OF TOW LINE	19.00 FT.
PILOT CHUTE CANOPY DIAMETER (FLAT)	2.50 FT.
C_{D_0} (STEADY STATE)(BASED ON WING AREA)	.270

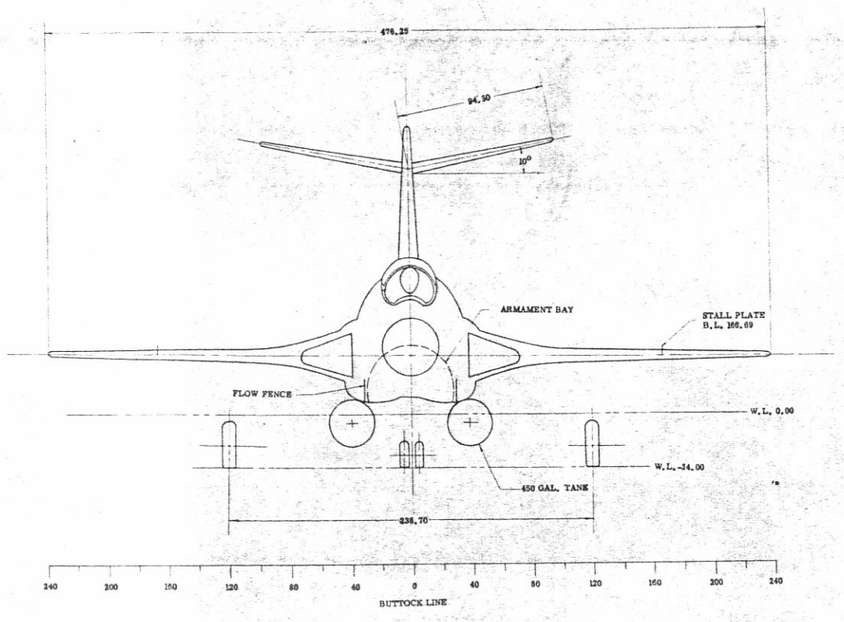
ARMAMENT DOOR (ROTO-DOOR)

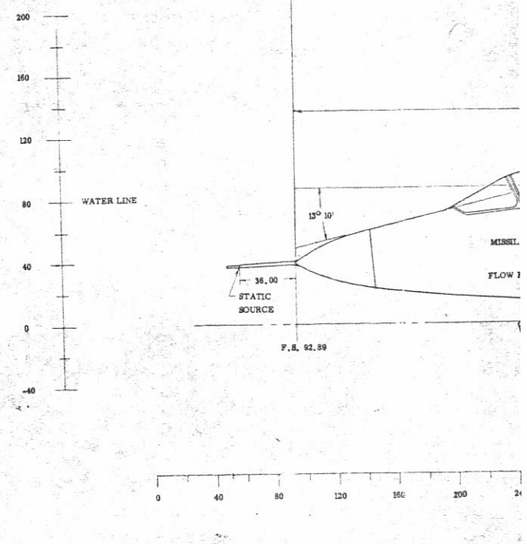
CAPACITY	PRIMARY	2 MB-1, 2 GAR-ID, -2A
	ALTERNATE	6 GAR-ID, -2A
TIME TO ROTATE	0 TO 180°	1.00 ± SEC.
	180° TO 0°	3.00 SEC.
POWER CYLINDER CAPACITY NORMAL TO INVERTED		7890 LBS.
INVERTED TO NORMAL		21,200 LBS.





FRONTAL AREA-
COMPONENT BREAKDOWN





SUMMARY

	5.582 FT.^{2}
	4.87 FT.^{2}
2. FT.	4.83 FT.^{2}
	.849 FT.^{2}
	2.487 IN.
	287.50 FT.^{2}
	12.33 FT.^{2}
	8.54 FT.^{2}
	50^0
	525,000 IN.-LBS.
	75.08/74.47 FT.^{2}
	15.75 FT.
	78.50 IN.
	35.91 IN.
	59.85 IN.
	3.30
	.457
	10^0
	30^0
	39.796^0/20.929^0
	26.5/838.90/156.88
	69.07 FT.^{3}
T TO W.L.)	7.45 FT.^{3}
	10^0
WN	20^0
FWD.)/(AFT)	12°31'15"/20°59'22"
	19.75 IN.
	5
	30^0/SEC.
	234,000 IN.-LBS.
	16^0/SEC.
	354.164 IN.
	.58787
	NACA 65A007 MOD.
	NACA 65A006 MOD.
	9°32'
	141.52 FT.^{2}
	100.38 FT.^{2}
	75.39 FT.^{2}
	1.27 FT.^{2}
	102.00 IN.
	191.78 IN.
	91.64 IN.
	147.81 IN.
	.720
	.478
	52.902^0/16.604^0
C.)	F.S. 763.53
	280.602 IN.
	.62270
	NACA 65A007
	NACA 65A007
	110.06 FT.^{2}

RUDDER

TYPE: PLAIN (UNSEALED)	
AREA AFT OF HINGE LINE	12.20 FT.^{2}
SPAN	5.95 FT.
ROOT CHORD (W.L. 100.33)	30.93 IN.
TIP CHORD (W.L. 171.70)	18.32 IN.
HINGE LINE LOCATION (% TAIL CHORD PARALLEL TO ℄)	82.00
SWEEPBACK OF HINGE LINE	25°24'13"
TWICE MOMENT AREA	22.10 FT.^{3}
RUDDER DEFLECTION (IN PLANE NORMAL TO HINGE LINE)	.299
PEDAL TRAVEL (FWD.)/(AFT)	3.27/3.25 IN.
PEDAL MOMENT ARM	11.42 IN.
PEDAL FORCE GRADIENT (ABOVE 290 KNOTS)	19.4 LBS./DEG.
PEDAL FORCE GRADIENT (BELOW 290 KNOTS)	5.26 LBS./DEG.
DESIGN HINGE MOMENT (POWER CYL. ALONE)	10,540 IN.-LBS.
TRAILING EDGE ANGLE (PARALLEL TO ℄)	9°27'
RUDDER RATE OF TRAVEL-NO LOAD	92^0/SEC.
RUDDER RATE OF TRAVEL-70% LOAD	47^0/SEC.

POWER PLANT

TWO PRATT AND WHITNEY J-57-P-55, SPEC. A-171BA

AXIAL FLOW TURBO-JET ENGINES	
LENGTH (INCLUDING AFTERBURNER)	251.34 IN.
NORMAL DIAMETER	40.50 IN.
STATIC THRUST AT SEA LEVEL (ONE ENGINE)(INSTALLED)	
MILITARY + AFTERBURNING	13,300 LBS.
MILITARY	8,450 LBS.
NORMAL	7,150 LBS.
IDLE	505 LBS.
A/B WETTED AREA	104.95 FT.^{2}

EXTERNAL TANKS

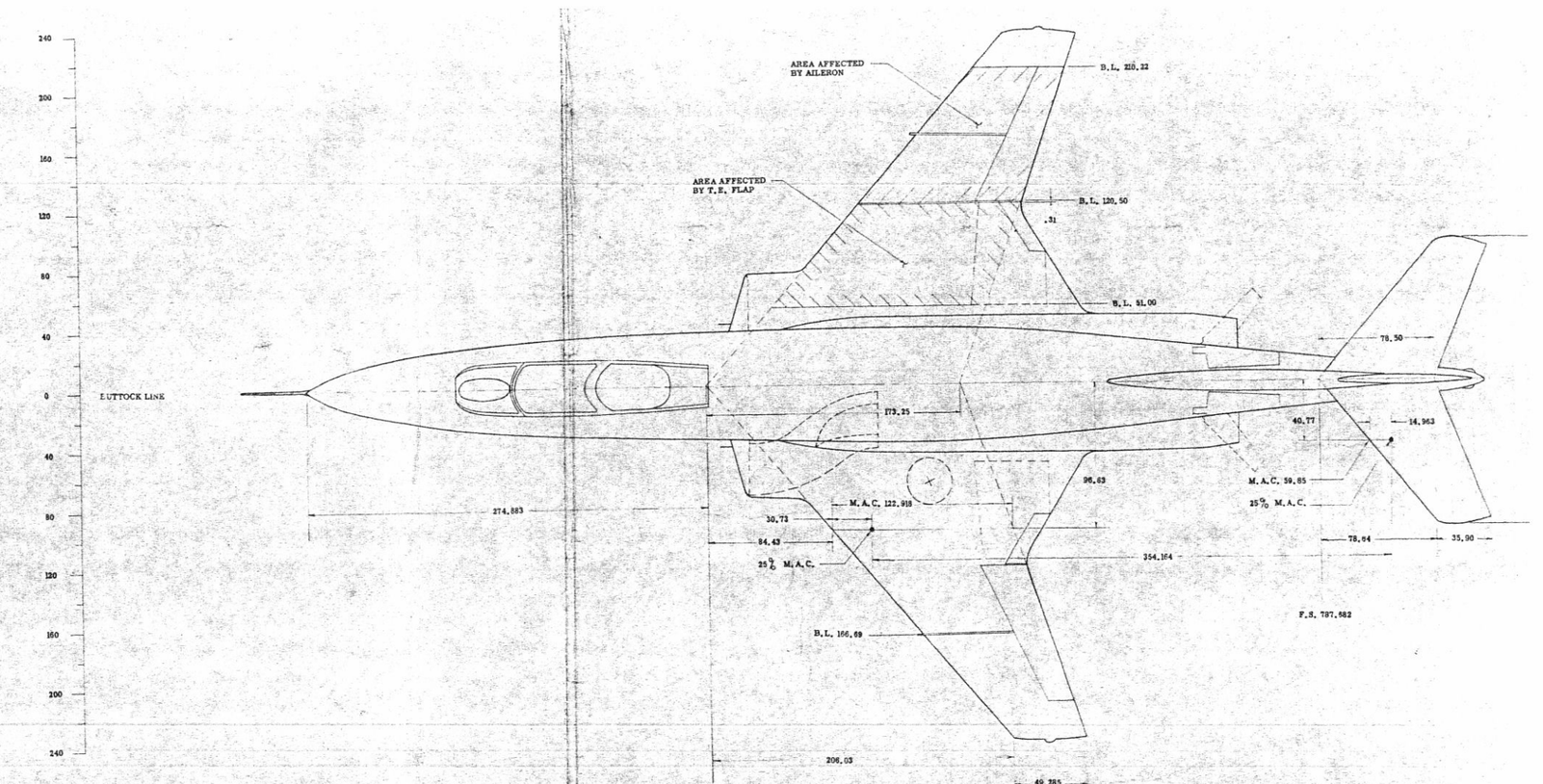
NAME AND TYPE: TWO-AIR FORCE STANDARD	
CAPACITY (EACH)	450 GAL.
MAXIMUM DIAMETER	29.00 IN.
LENGTH	223.35 IN.
LENGTH TO MAXIMUM DIAMETER	58.00 IN.
LOCATION (NOSE OF TANK(F.S.)/(W.L.)/(B.L.)	371.00/-5.556/37.63
LOCATION (C.G. OF TANK(F.S.)/(W.L.)/(B.L.)	465.27/-5.556/37.63
TANK INCIDENCE ANGLE (WITH RESPECT TO W.L.)	0^0
EMPTY WEIGHT (EACH)	206.47 LBS.
WETTED AREA (EACH)	112.33 FT.^{2}

TAIL CHUTE (PARA-BRAKE)

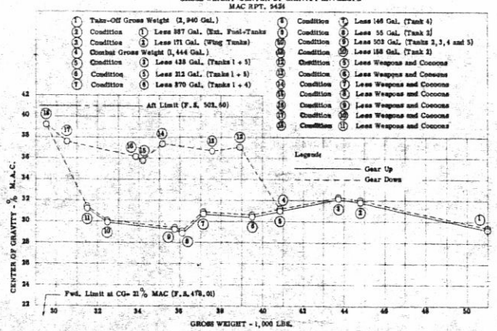
TYPE: RING SLOT MAIN CHUTE WITH SPRING RELEASED PILOT CHUTE	
MAIN CANOPY DIAMETER (FLAT)/(INFLATED)	15.60/10.00 FT.
NUMBER OF MAIN SHROUD LINES	20
LENGTH OF MAIN SHROUD LINES	16.00 FT.
LENGTH OF TOW LINE	19.00 FT.
PILOT CHUTE CANOPY DIAMETER (FLAT)	2.50 FT.
C_{D_0} (STEADY STATE)(BASED ON WING AREA)	.270

ARMAMENT DOOR (ROTO-DOOR)

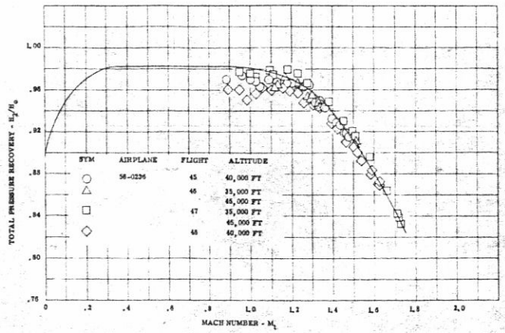
CAPACITY	PRIMARY	2 ME-1, 2 GAR-ID, -2A
	ALTERNATE	6 GAR-ID, -2A
TIME TO ROTATE	0 TO 180^0	1.00 ± .3 SEC.
	180^0 TO 0^0	3.00 SEC.
POWER CYLINDER CAPACITY NORMAL TO INVERTED		7890 LBS.
INVERTED TO NORMAL		21,200 LBS.



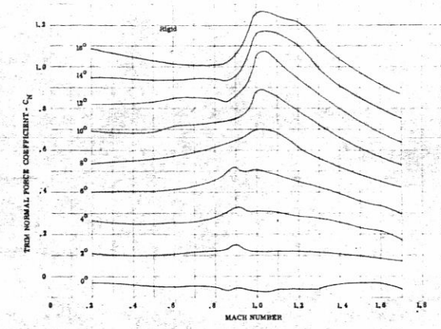
GROSS WEIGHT-CENTER OF GRAVITY ENVELOPE
MAC RPT. 3436



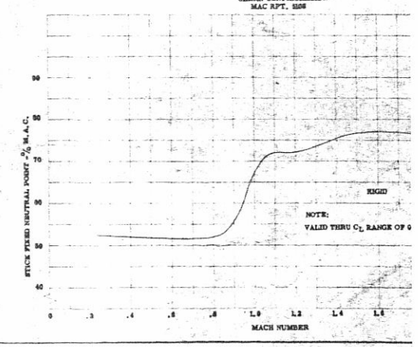
TOTAL PRESSURE RECOVERY
DUCT TYPE III$_c$



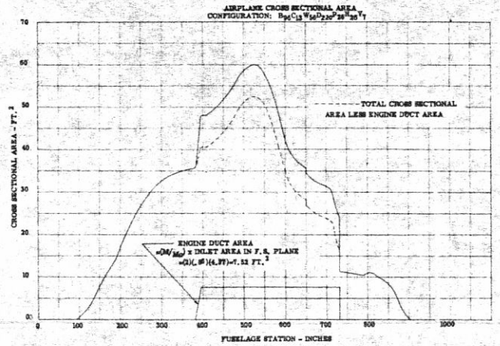
TRIM NORMAL FORCE COEFFICIENT
C.G. @ 36.6 %



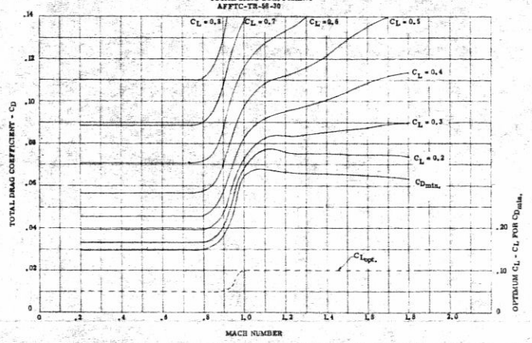
STICK FIXED NEUTRAL POINT
CLEAN CONFIGURATION
MAC RPT. 3105



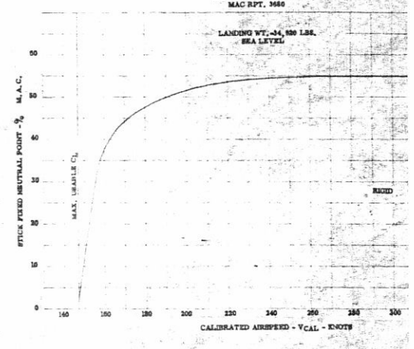
AIRPLANE CROSS SECTIONAL AREA
CONFIGURATION: $B_{94}C_{13}W_{10}D_{20}P_{20}^{-20}T_7$



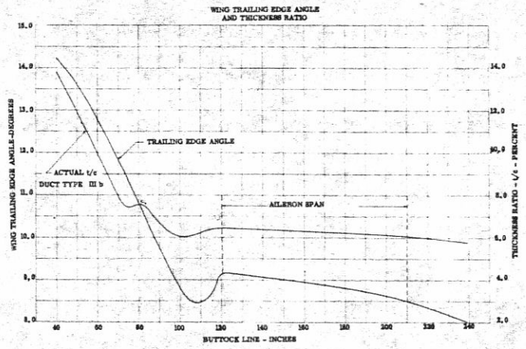
TOTAL DRAG COEFFICIENT
AFFTC-TR-56-30



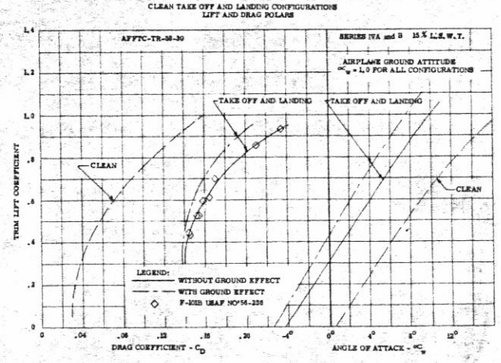
STICK FIXED NEUTRAL POINT
LANDING CONFIGURATIONS
MAC RPT. 3686



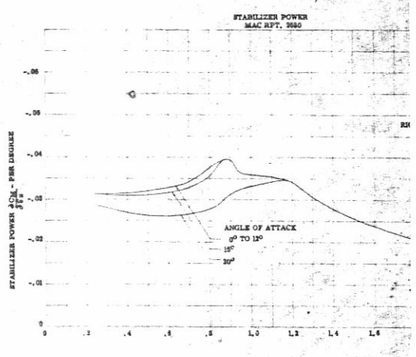
WING TRAILING EDGE ANGLE
AND THICKNESS RATIO



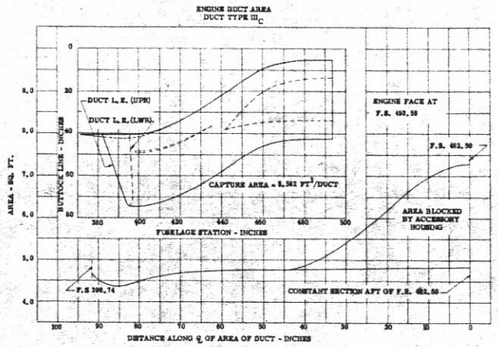
CLEAN TAKE OFF AND LANDING CONFIGURATIONS
LIFT AND DRAG POLARS



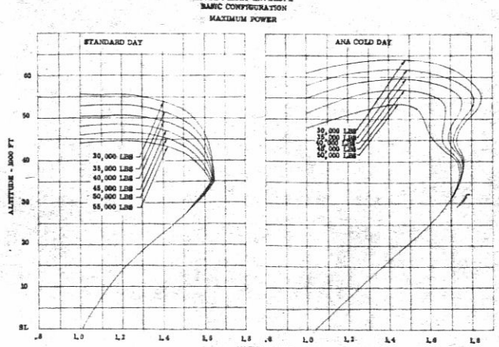
STABILIZER POWER
MAC RPT. 3020



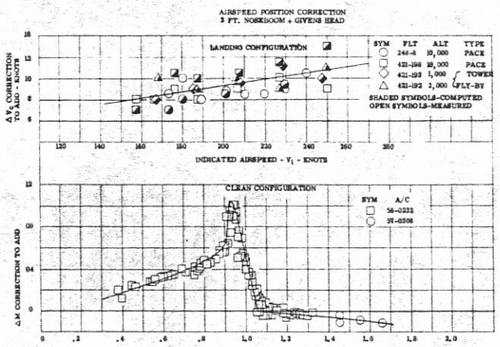
ENGINE DUCT AREA
DUCT TYPE III$_c$



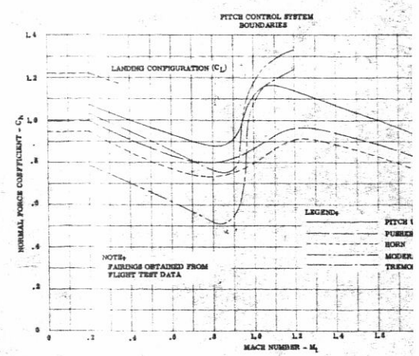
LEVEL FLIGHT ENVELOPE
BASIC CONFIGURATION
MAXIMUM POWER



AIRSPEED POSITION CORRECTION
3 FT. NOSEBOOM + GIVENS HEAD

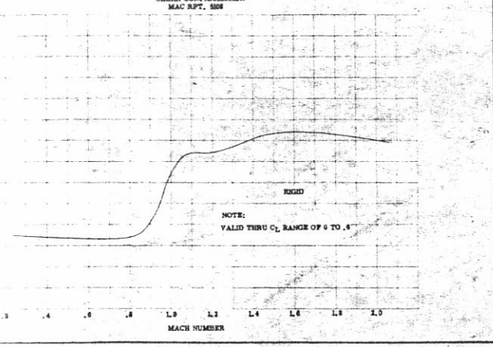


PITCH CONTROL SYSTEM
BOUNDARIES

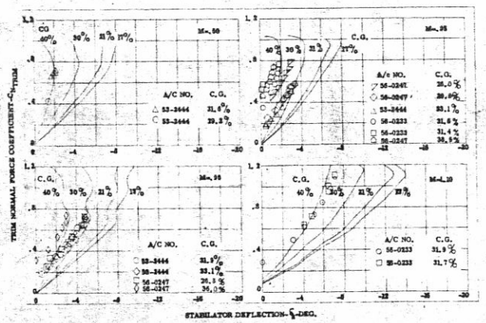


LONGITUDINAL STABILITY AND CONTROL

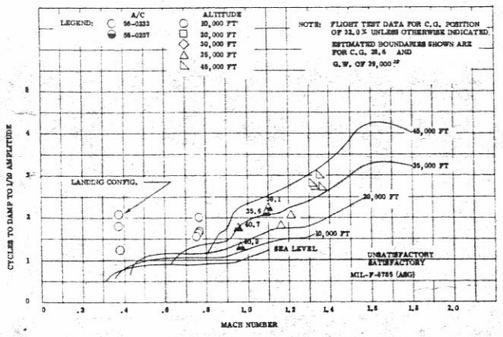
STICK FIXED NEUTRAL POINT
CLEAN CONFIGURATION
MAC RPT. 5208



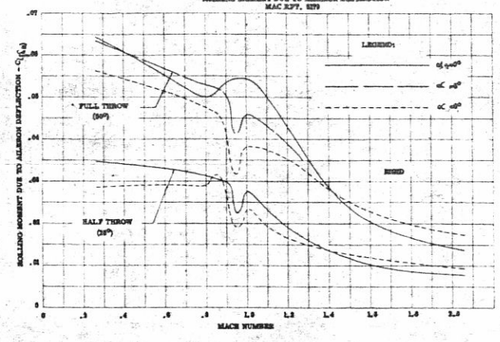
STABILATOR DEFLECTION REQUIRED FOR TRIM
CLEAN CONFIGURATION

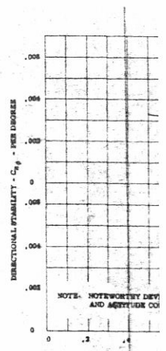


LONGITUDINAL DYNAMIC STABILITY
FLIGHT TEST RESULTS

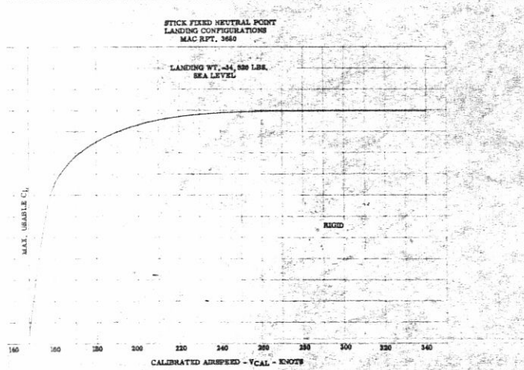


ROLLING MOMENT DUE TO AILERON DEFLECTION
MAC RPT. 5279

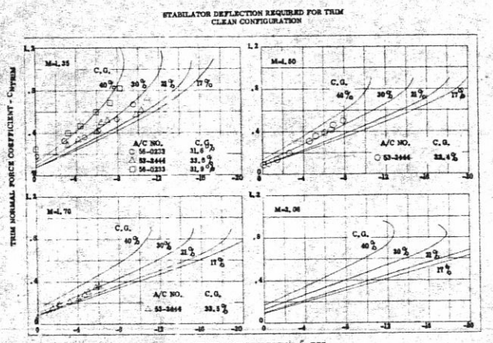




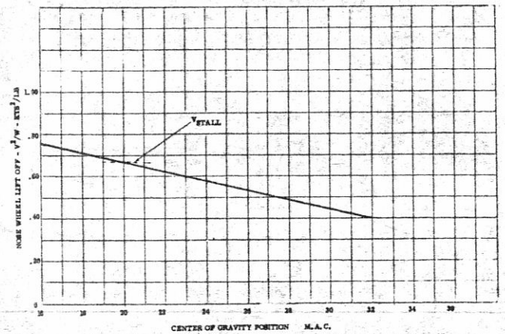
STICK FIXED NEUTRAL POINT
LANDING CONFIGURATIONS
MAC RPT. 3650



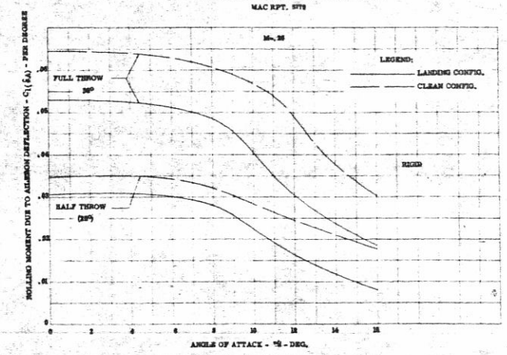
STABILATOR DEFLECTION REQUIRED FOR TRIM
CLEAN CONFIGURATION

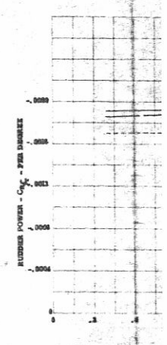


ESTIMATED NOSE WHEEL LIFT OFF CHARACTERISTICS
TAKE-OFF CONFIGURATION - MOST EXTREME FORWARD LOADINGS



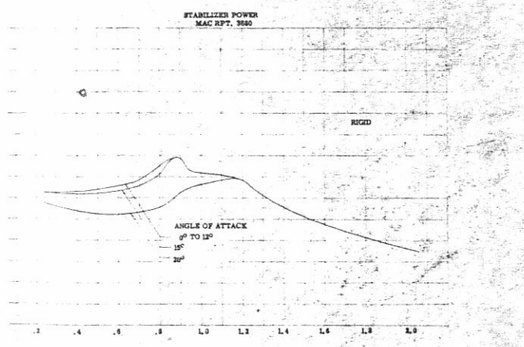
ROLLING MOMENT DUE TO AILERON DEFLECTION
MAC RPT. 5278



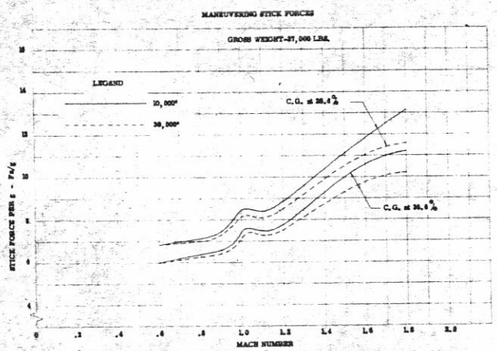


LATERAL-DIRECTIONAL STABILITY AND CONTROL

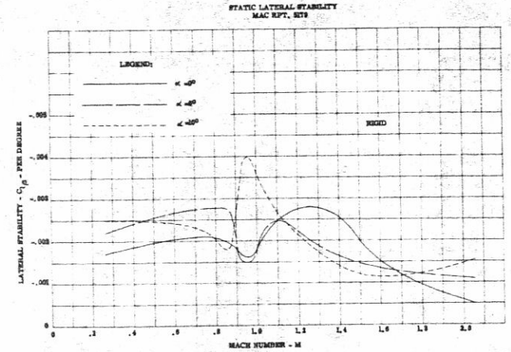
STABILIZER POWER
MAC RPT. 3650



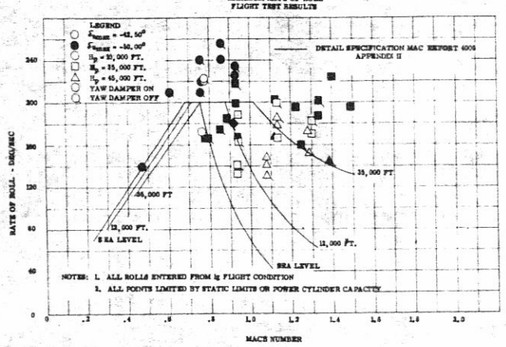
MANEUVERING STICK FORCES

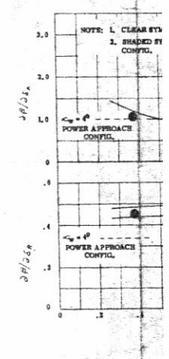


STATIC LATERAL STABILITY
MAC RPT. 5278

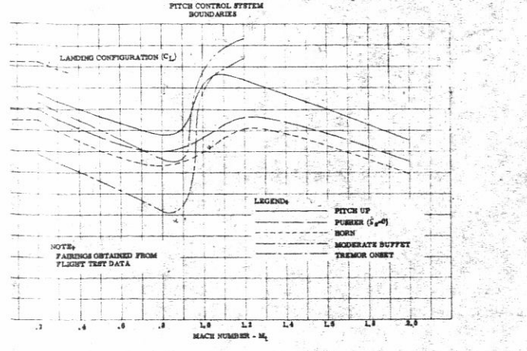


MAXIMUM RATE OF ROLL
FLIGHT TEST RESULTS

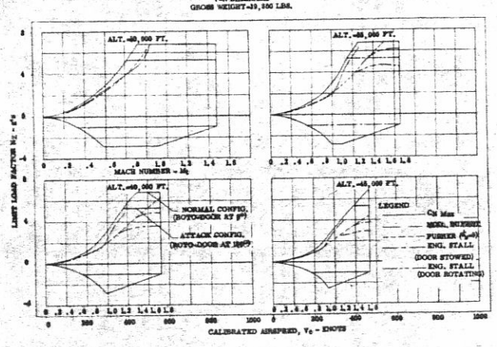




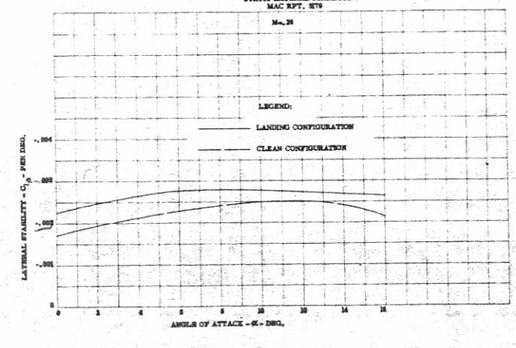
PITCH CONTROL SYSTEM
BOUNDARIES



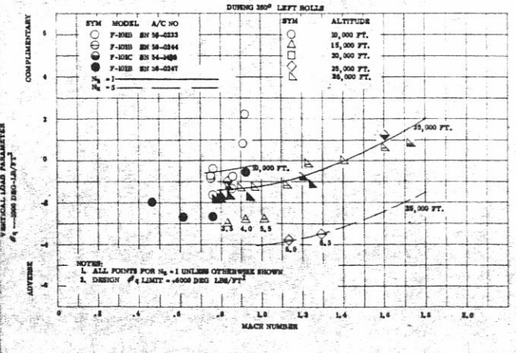
V-N DIAGRAMS
GROSS WEIGHT-39,500 LBS.

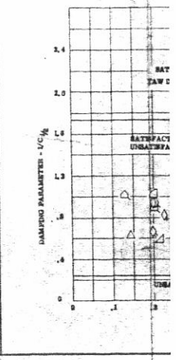


STATIC LATERAL STABILITY
MAC RPT. 5278



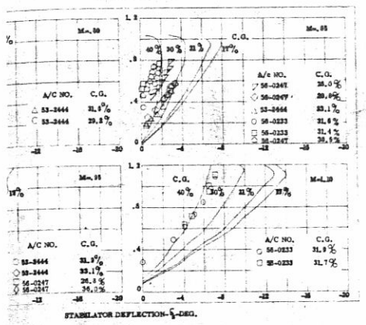
VERTICAL TAIL LOAD PARAMETER
DURING 360° LEFT ROLLS





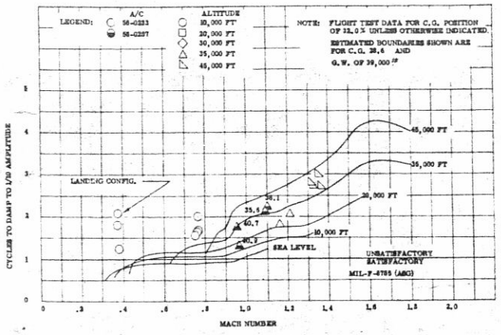
CONFIDENTIAL

STABILATOR DEFLECTION REQUIRED FOR TRIM
CLEAN CONFIGURATION

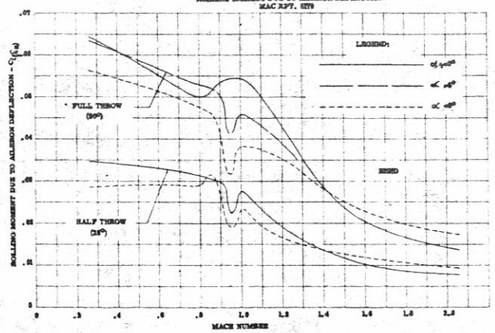


STABILATOR DEFLECTION- δ_s-DEG.

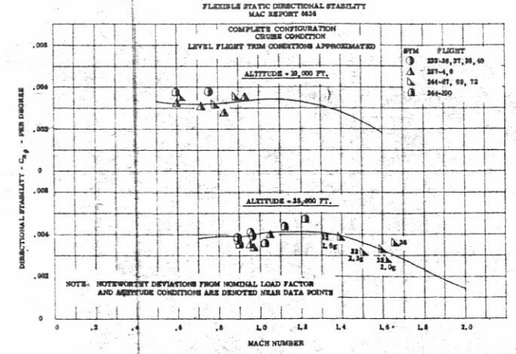
LONGITUDINAL DYNAMIC STABILITY
FLIGHT TEST RESULTS



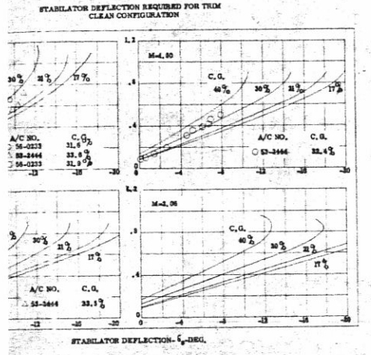
ROLLING MOMENT DUE TO AILERON DEFLECTION
MAC RPT. 5278



FLEXIBLE STATIC DIRECTIONAL STABILITY
MAC REPORT 5626

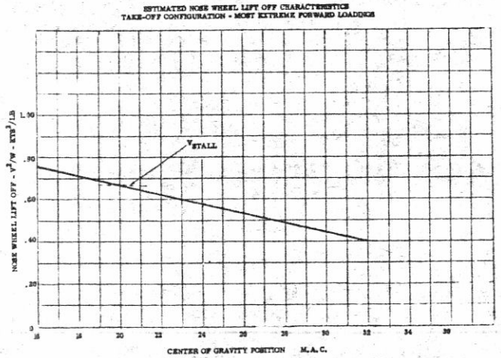


STABILATOR DEFLECTION REQUIRED FOR TRIM
CLEAN CONFIGURATION

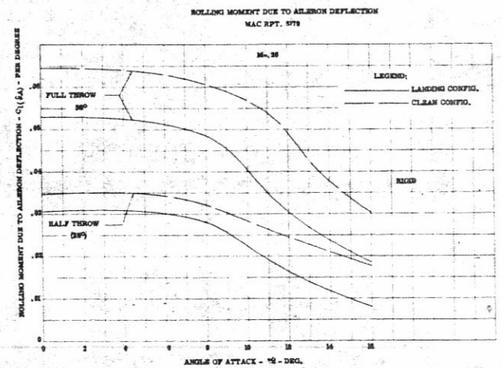


STABILATOR DEFLECTION- δ_s-DEG.

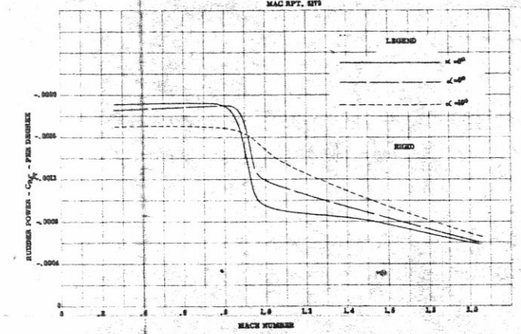
ESTIMATED NOSE WHEEL LIFT OFF CHARACTERISTICS
TAKE-OFF CONFIGURATION - MOST EXTREME FORWARD LOADINGS



ROLLING MOMENT DUE TO AILERON DEFLECTION
MAC RPT. 5278

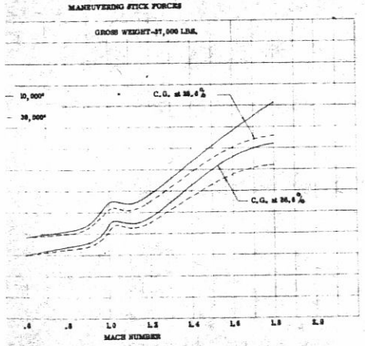


RUDDER POWER
CLEAN AND LANDING CONFIGURATION
MAC RPT. 5279

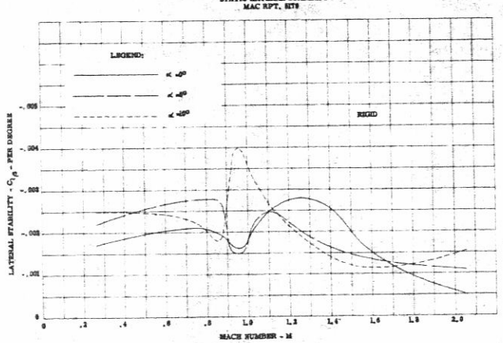


LATERAL-DIRECTIONAL STABILITY AND CONTROL

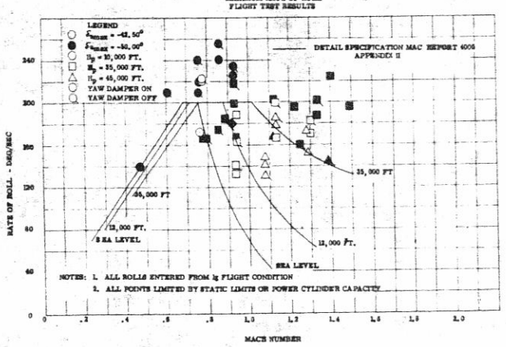
MANEUVERING STICK FORCES
GROSS WEIGHT-37,000 LBS.



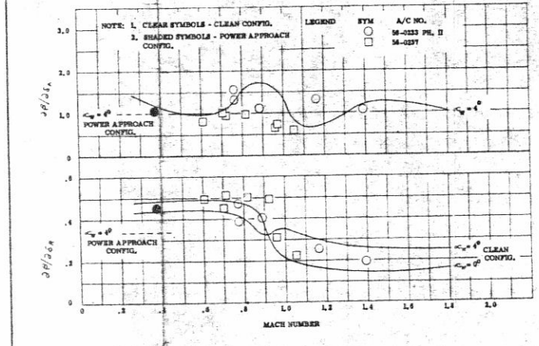
STATIC LATERAL STABILITY
MAC RPT. 5279



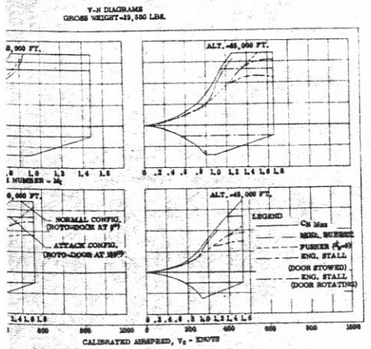
MAXIMUM RATE OF ROLL
FLIGHT TEST RESULTS



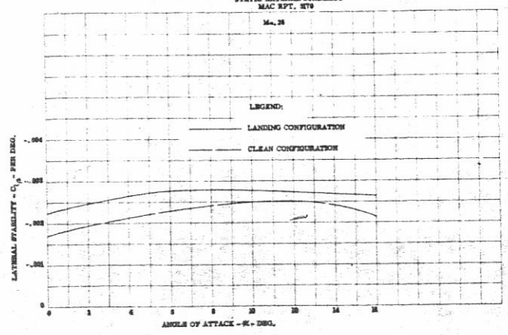
VARIATION OF SIDESLIP WITH AILERON AND RUDDER DEFLECTIONS
FLIGHT TEST RESULTS



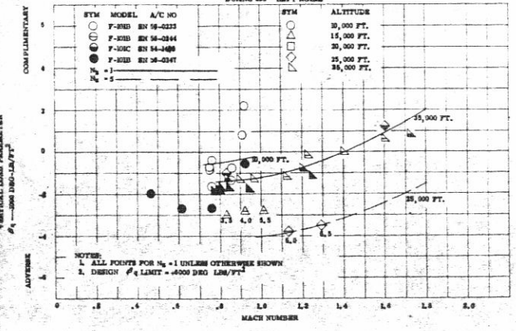
V-N DIAGRAMS
GROSS WEIGHT-39,500 LBS.



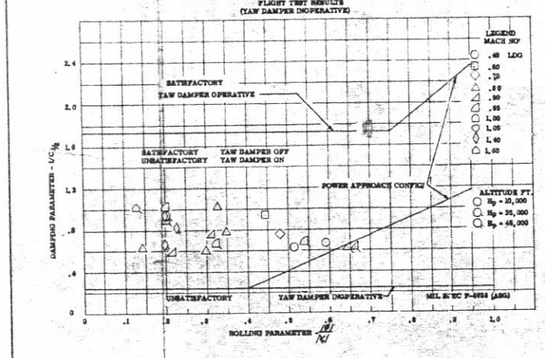
STATIC LATERAL STABILITY
MAC RPT. 5279



VERTICAL TAIL LOAD PARAMETER
DURING 360° LEFT ROLLS



LATERAL DIRECTIONAL DYNAMIC STABILITY
FLIGHT TEST RESULTS
(YAW DAMPER INOPERATIVE)



AERODYNAMIC DATA SUMMARY
F-101B
Report ASR-33
Page 1.2

CONFIDENTIAL

2.0 INTRODUCTION

It is the desire and intent of the Aerodynamics department to summarize in one report the existing flight test data obtained on the F-101B airplane. However the task of compiling, assimilating, and analyzing all these data would be so time consuming, it is justifiably felt that a nucleus report should be edited immediately and as more data are analyzed or become available these would be incorporated in this report.

The basic structure of this report, Airplane Description, Operatinnal Boundaries, Longitudinal, Lateral-Directional, Performance, Internal Flow Systems, Airspeed System, Armament System, Spins, Extrapolated Mach Capabilities and Miscellaneous, will remain fixed, however the contents of each section will be fluid in that they will be revised as more data become available or as configuration changes are made.

As an aid in evaluating the available methods for estimating the various flight parameters, an appropriate estimate will be included with the corresponding flight test data.

3.0 SYMBOLS AND NOMENCLATURE

3.1 General Symbols

b	span, no subscripts denotes wing span	ft.
c.g.	center of gravity	
$\bar{c}$, M.A.C.	Mean Aerodynamic Chord, no subscript denotes wing M.A.C.	ft.
D	Drag	lb.
Δ , δ	increment or pressure ratio P/P_o	
F	stick, pedal force or thrust	lb.
H	total pressure	lbs/ft^2
I	moment of inertia	$slug\text{-}ft^2$
L	Lift or Load	lb.
l	tail length measured from C.G. to tail a.c.	ft.
M	Mach number	
M_a	Moment area	ft^3
N	Load Factor	g's
p	roll rate (see page 3.5.1)	deg/sec
q	Dynamic Pressure - Incompressible	lbs/ft^2
	or Angular Pitching Velocity (see page 3.5.1)	deg/sec
σ	Atmospheric density ratio	
r	yaw rate (see page 3.5.1)	degs/sec
S	area, no subscript denotes wing area	ft^2
T	Temperature	degrees
V	Airspeed	kts.

W, G.W.	Gross Weight	lbs.
X	Longitudinal Axis	
Y	Lateral axis or side force	
Z	Vertical Axis	

3.2 Subscripts - Subscripts may indicate partial differentiation, i.e.; $\partial(\ )/\ \partial$ (subscript); where the subscript can be angular measurement or an aerodynamic coefficient.

Subscript	Pertains To:
( ) a	Aileron or Speed of Sound
( ) C	Calibrated
( ) f	Fuel
( ) G	Glide Power Off
( ) H	High speed, level flight, normal rated power
( ) max	maximum value
( ) min	minimum value
( ) M-T	Model minus tail
( ) n	net value
( ) NB	Nose Boom
( ) o	free stream, zero lift, zero deflection or initial condition
( ) R/C	Max Rate of Climb
( ) r	rudder
( ) S	Stalling speed
( ) s	stabilator
( ) Sensor	Angle of Attack Transmitter
( ) t	tail
( ) T	True Value
( ) Vt	Vertical tail
( ) w	wing
( ) 2	compressor

3.3 Angular Measurements

α	angle of attack - sensor referenced to waterline, nose boom to wing chord plane
$\dot{\alpha}$	rate of change of angle of attack
β	sideslip angle
δ	surface deflection angle measured from primary surface chord (see page 3.5.1)
$\dot{\delta}$	rate of change of surface deflection
i	incidence setting measured from a waterline
θ	inclination of principle axes from a waterline

3.4 Aerodynamic Coefficients

$C_D = \frac{\text{Drag}}{q\ S_w}$ drag coefficient

$C_L = \frac{\text{Lift}}{q\ S_w}$ lift coefficient

$C_m = \frac{\text{Pitching Moment}}{q\ S_w\ \bar{c}}$ Pitching Moment Coefficient

$C_{m_q} = \frac{\partial\ C_m}{\partial\left(\frac{q_c}{2V}\right)}$ damping in pitch

$C_{m_{\dot{\alpha}}} = \frac{\partial\ C_m}{\partial\left(\frac{\dot{\alpha}\ \bar{c}}{2V}\right)}$ damping in pitch due to rate of change of α

$C_{h_s} = \frac{\text{Stabilator Hinge Moment}}{q\ S_t\ \bar{c}_t}$ stabilator hinge moment coefficient

$C_{h_a} = \frac{\text{Aileron Hinge Moment}}{q\ 2\ Ma_a}$ aileron hinge moment

$C_{h_r} = \frac{\text{Rudder Hinge Moment}}{q\ 2\ Ma_r}$ rudder hinge moment

$C_l = \frac{\text{Rolling Moment}}{q\ S_w b}$ rolling moment coefficient

$C_{l_p} = \frac{\partial\ C_l}{\partial\left(\frac{Pb}{2V}\right)}$ damping in roll

$C_n = \frac{\text{Yawing Moment}}{q\ S_w b}$ yawing moment coefficient

$C_{n_r} = \frac{\partial\ C_n}{\partial\left(\frac{rb}{2V}\right)}$ damping in yaw

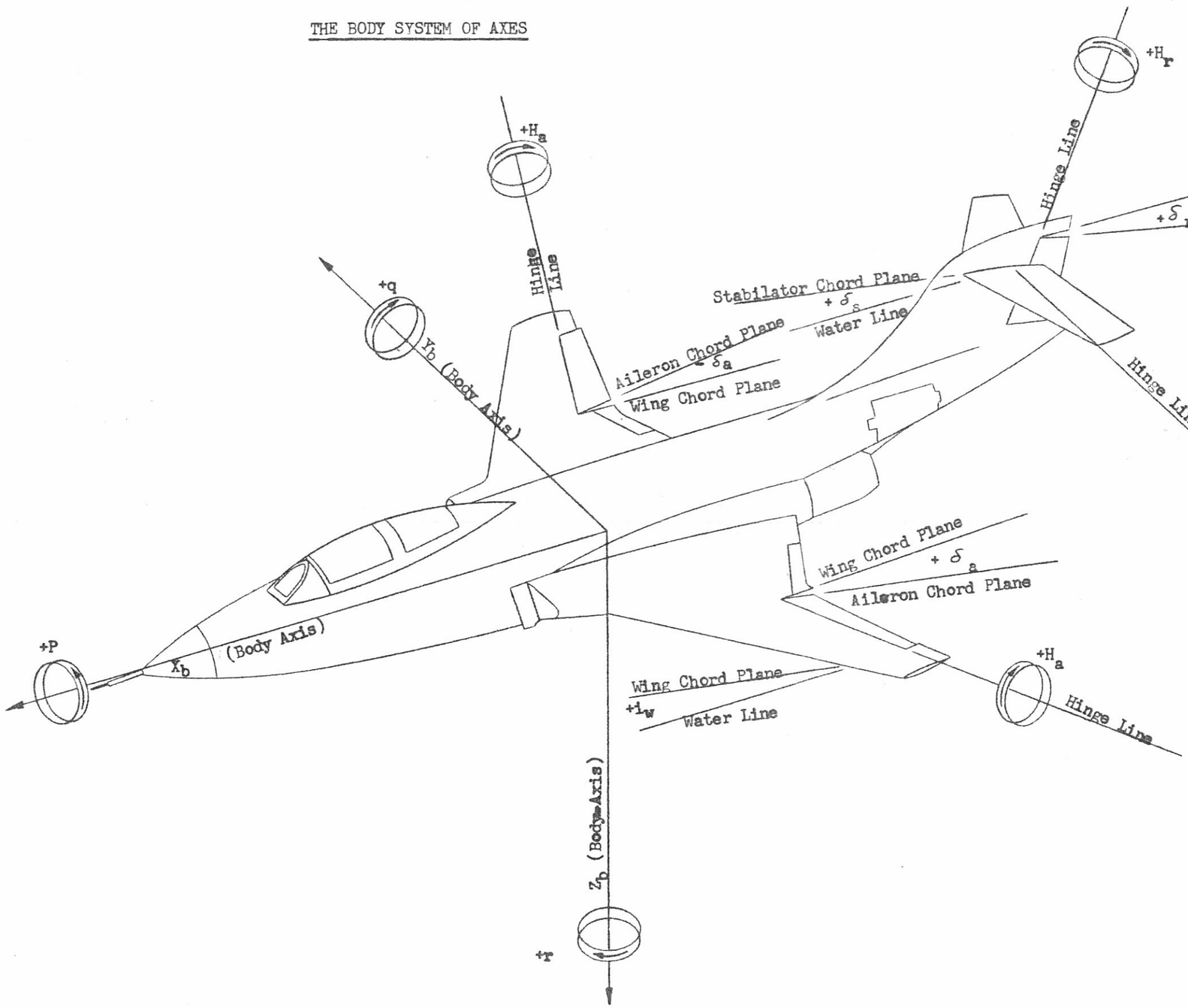
$C_N = \frac{\text{Normal Force}}{q\ S_w} = \frac{n\ G.W.}{q\ S_w}$ normal force coefficient

$C_y = \frac{\text{Side Force}}{q\ S}$ side force coefficient

$\frac{F_n}{qS}$ = thrust coefficient

$\frac{V_T}{W_f}$ = specific range - $\frac{\text{nautical miles}}{\text{lb.}}$

THE BODY SYSTEM OF AXES



NOTES:

1) The Body System of Axes is an imaginary system of axes fixed in the airplane. In general the body X axis will be along the water line plane of symmetry. The Z body axis will be in the plane of symmetry perpendicular to the X axis. The Y body axis will be perpendicular to the X-Z body axis plane. The origin of these axes will be common to all. In special study cases the origin of this system of axes may be the center of gravity and the X body axis will be the principal axis. Positive directions of these axes and rates about these axes are indicated by arrows.

2) Control Deflections are considered positive as follows; positive rudder produces positive side force, positive stabilator and positive aileron produce positive lift (negative Z_b force). Total aileron deflection is defined as $\delta_{a_{total}} = \delta_{a_{left}} - \delta_{a_{right}}$.

3) Hinge Moments are considered positive if the reaction after deflection tends to rotate the control in a clockwise direction looking down hinge line from left of airplane for stabilator or aileron, and looking down the hinge line from the top in the case of the rudder.

4) Symbols

X_b	X Body Axis
Y_b	Y Body Axis
Z_b	Z Body Axis
p	Roll Rate
q	Pitch Rate
r	Yaw Rate
i_w	Wing Incidence
δs	Stabilator Deflection
δa	Aileron Deflection
δr	Rudder Deflection
H_s	Stabilator Hinge Moment
H_a	Aileron Hinge Moment
H_r	Rudder Hinge Moment

4.0 AIRPLANE DESCRIPTION

4.1 Physical Characteristics - The model F-101B is a long range, all-weather, two place, tandem-cockpit, twin engine, swept-wing airplane designed specifically to effect interception and kill of enemy bombardment type vehicles. The rear cockpit is provided for a radar observer. The production airplane will be powered by two J57-P-55 engines, which feature long afterburner and increased performance, in place of the J57-P-13 engines used in the F-101A. Major component differences from the F-101A include a MG-13 fire control unit, an MB-5 autopilot, an autopilot coupler and an armament arrangement which includes a rotary door. The F-101B will use GAR-1, GAR-2 and GAR-2A missiles and MB-1 rockets as armament. A three-view drawing of the airplane and a tabulated summary of the physical data is shown on page 4.2.2.

4.2 Dimensional Data - The overall dimensions of the aircraft are similar to the F-101A except that the fuselage forward of station 417 has been redesigned to provide for the tandem cockpit and new fire control and armament systems. The dimensional data for the aircraft is shown on the three view drawing and in the table shown on page 4.2.2.

4.3 Weight, Balance and Inertia Characteristics - Pages 4.3.2 and 4.3.3 present a typical analysis of weight, balance and moment of inertia data for an F-101B flight test airplane.

This data is representative of that used in estimating the various flight parameters presented in this report.

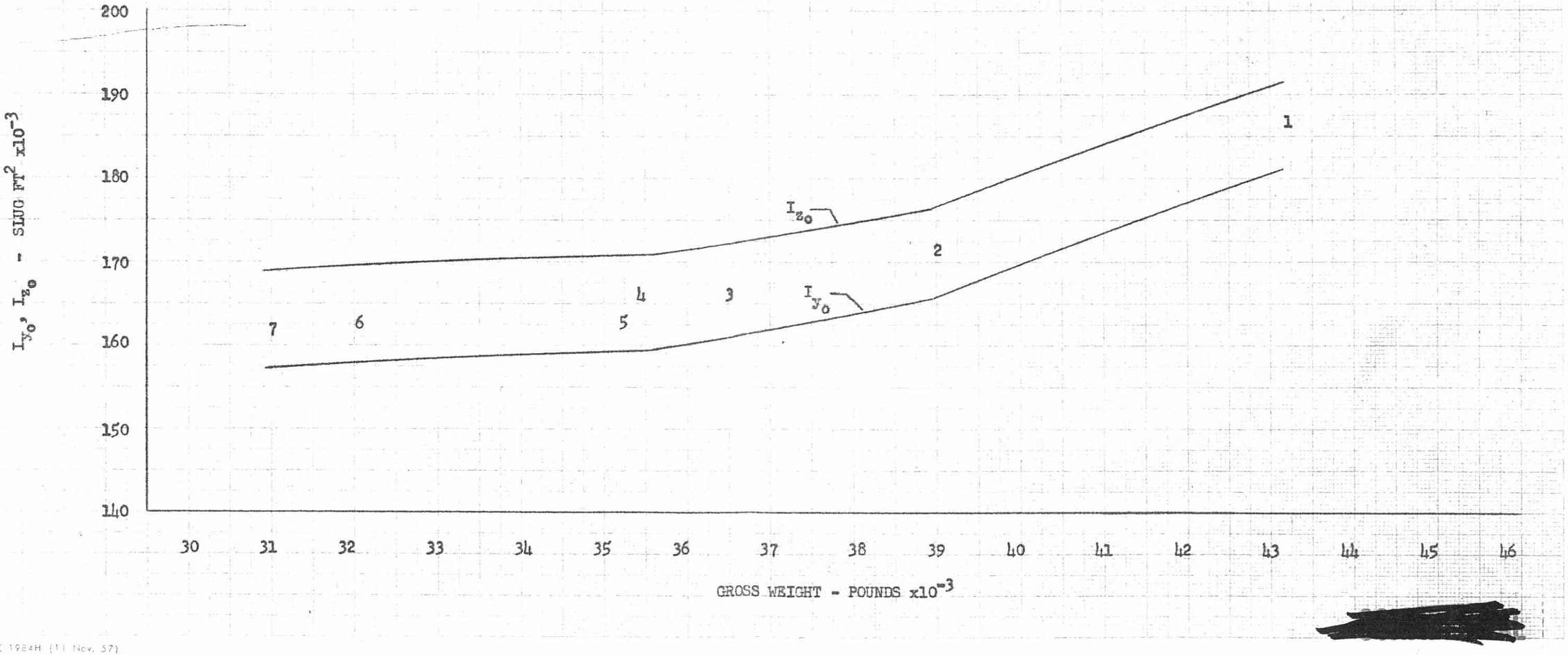
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MODEL F-101B

WEIGHT, BALANCE & MOMENT OF INERTIA

S/N 56-244 #13B

	Condition	Weight	X	Z	I_{x_o}	I_{y_o}	I_{z_o}	I_{xz_o}	Θ
1	Full Fuselage Fuel 1882 Gal.	43,165	493.4	49.7	21,893	181,015	191,559	9,076	3°3'
2	1292 Gal. Remaining	38,940	491.6	47.8	21,480	165,531	176,457	8,319	3°4'
3	862	36,535	492.1	47.2	21,167	161,074	172,247	7,433	2°49'
4	716	35,586	489.9	46.7	21,087	169,631	170,890	7,165	2°45'
5	661	35,229	490.3	46.4	21,015	159,415	170,738	7,257	2°46'
6	158	31,959	491.3	44.1	20,607	157,965	169,677	7,443	2°21'
7	No Fuel	30,932	493.0	46.4	20,571	157,293	168,985	7,366	2°20'



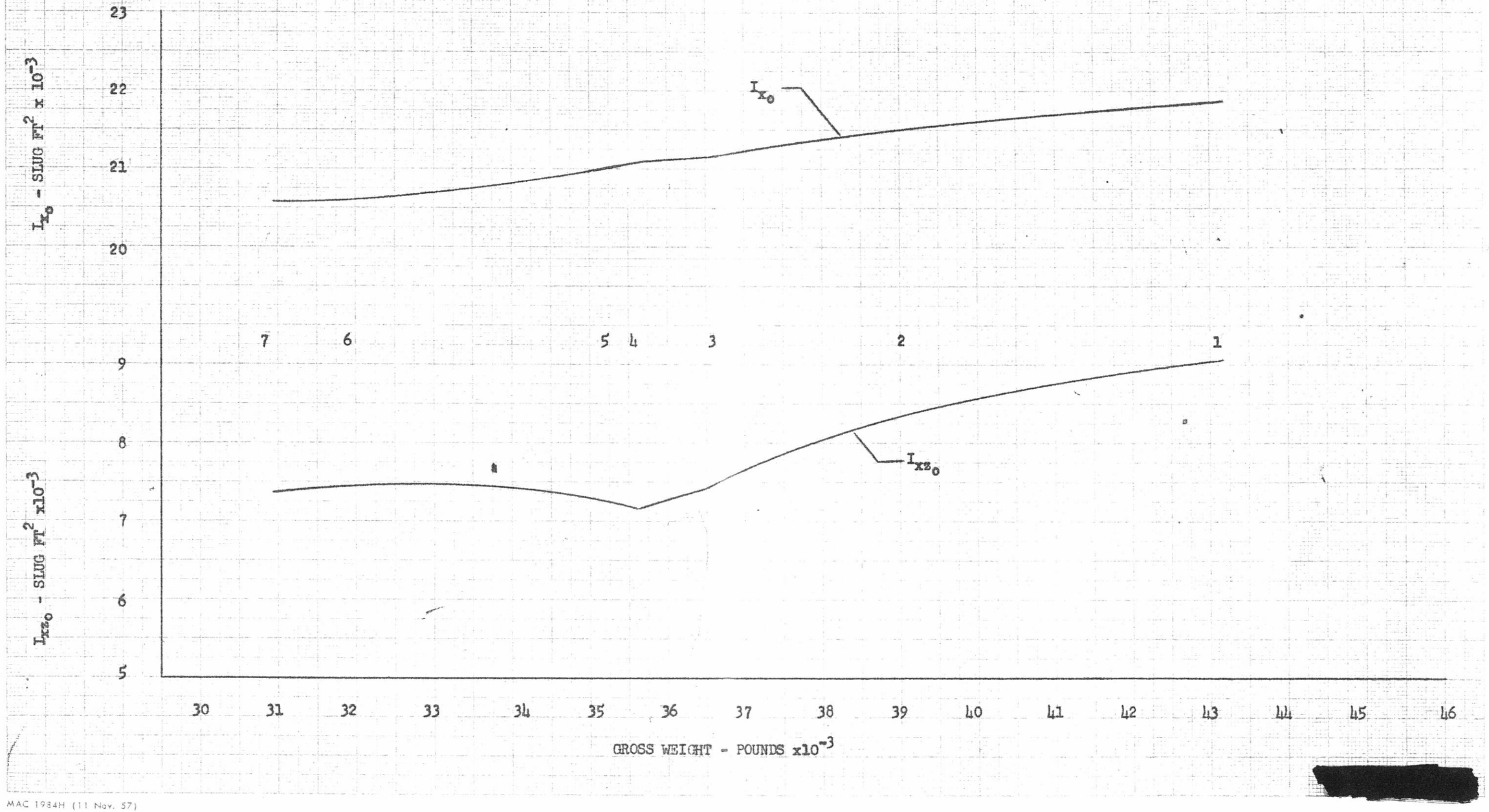
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MODEL F-101B

WEIGHT, BALANCE & MOMENT OF INERTIA

S/N 56-244 #13B



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