

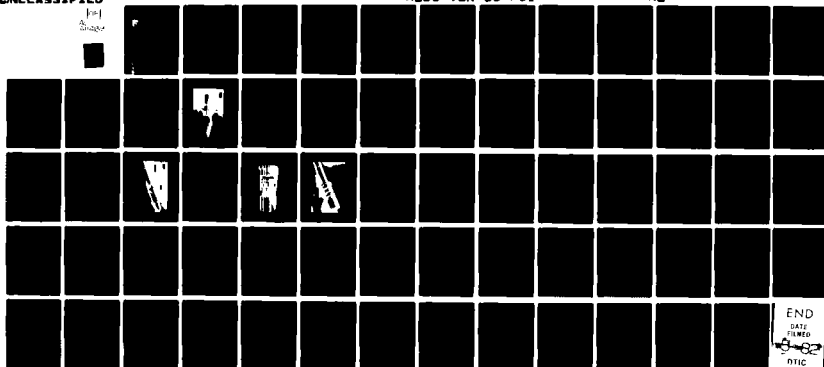
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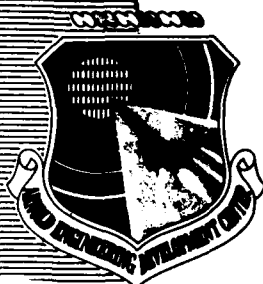
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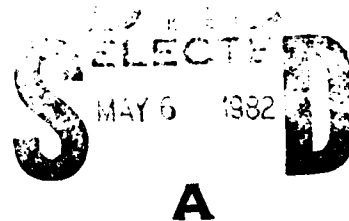
DYNAMIC STABILITY TESTS OF THE
STANDARD DYNAMICS MODEL UTILIZING THE
NEW 1,500-LB BALANCE MECHANISMS

S. M. Coulter and E. J. Marquart
Calspan Field Services, Inc.

February 1981

Final Report for Period December 8, 1980 - February 26, 1981

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This report has been reviewed and approved.



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NOMENCLATURE

AD	Rate of change of angle at attack, rad/sec
ALPHA	Model angle of attack, deg
B	Wing span, 1.65 ft
BD	Rate of change of angle of sideslip, rad/sec
BETA	Sideslip angle in the stability axis system, deg
CBAR	Wing mean aerodynamic chord, 0.62233 ft
CLL	$M_x / (Q \cdot S \cdot B)$
CLL-A	$\partial CLL / \partial ALPHA$, rad^{-1}
CLL-AD	$\partial CLL / \partial (Q \cdot CBAR / 2V) + \partial CLL / \partial (AD \cdot CBAR / 2V)$, rad^{-1}
CLL-B	$[\partial CLL / \partial BETA] \cos ALPHA$ for yaw test phase (measured by can balance) or $[\partial CLL / \partial BETA] \sin ALPHA$ for roll test phase, rad^{-1}
CLL-BD	$\partial CLL / \partial (RB / 2V) - [\partial CLL / \partial (BD \cdot B / 2V)] \cos ALPHA$, rad^{-1}
CLL-PBD	$\partial CLL / \partial (P \cdot B / 2V) + [\partial CLL / \partial (BD \cdot B / 2V)] \sin ALPHA$, rad^{-1}
CLM	$M_m / Q \cdot S \cdot CBAR$
CLM-A	$\partial CLM / \partial ALPHA$, measured by can balance, rad^{-1}
CLM-AD	$\partial CLM / \partial (Q \cdot CBAR / 2V) + \partial CLM / \partial (AD \cdot CBAR / 2V)$, measured by can balance, rad^{-1}
CLM-B	$[\partial CLM / \partial BETA] \cos ALPHA$, rad^{-1}
CLM-BD	$\partial CLM / \partial (R \cdot B / 2V) - [\partial CLM / \partial (BD \cdot B / 2V)] \cos ALPHA$, rad^{-1}
CLN	$M_n / Q \cdot S \cdot B$
CLN-A	$\partial CLN / \partial ALPHA$, rad^{-1}
CLN-AD	$\partial CLN / \partial (Q \cdot CBAR / 2V) + \partial CLN / \partial (AD \cdot CBAR / 2V)$, rad^{-1}
CLN-B	$[\partial CLN / \partial BETA] \cos ALPHA$, measured by can balance, rad^{-1}

CLN-BD	$\partial \text{CLN} / \partial (R \cdot B / 2V) - [\partial \text{CLN} / \partial (BD \cdot B / 2V)] \cos \text{ALPHA}$, measured by can balance, rad^{-1}
CLN-PBD	$\partial \text{CLN} / \partial (P \cdot B / 2V) + [\partial \text{CLN} / \partial (BD \cdot B / 2V)] \sin \text{ALPHA}$, rad^{-1}
CN	$F_N / Q \cdot S$
CN-A	$\partial \text{CN} / \partial \text{ALPHA}$, rad^{-1}
CN-AD	$\partial \text{CN} / \partial (Q \cdot \text{CBAR} / 2V) + \partial \text{CN} / \partial (AD \cdot \text{CBAR} / 2V)$, rad^{-1}
CY	$F_Y / Q \cdot S$
CY-B	$[\partial \text{CY} / \partial \text{BETA}] \cos \text{ALPHA}$
CY-BD	$\partial \text{CY} / \partial (R \cdot B / 2V) - [\partial \text{CY} / \partial (BD \cdot B / 2V)] \cos \text{ALPHA}$, rad^{-1}
CYPBD	$\partial \text{CY} / \partial (P \cdot B / 2V) + [\partial \text{CY} / \partial (BD \cdot B / 2V)] \sin \text{ALPHA}$, rad^{-1}
CONFIG	Model configuration
E	Amplitude of excitation voltage, volts
F.S.	Fuselage Station, inches
F_N	Normal force, lb
F_Y	Side force, lb
M	Free-stream Mach number
M_l	Rolling moment, ft-lb
M_m	Pitching moment, ft-lb
M_n	Yawing moment, ft-lb
MAC	Model mean aerodynamic chord, 0.62233 ft
MØF	Balance restoring spring constant, in-lb/deg
NCP	Center of pressure location, in the normal plane, expressed in terms of the model reference length from the model moment reference point

OMEGA	Wind-on angular frequency, rad/sec
P	Free-stream static pressure, psfa or rolling velocity, rad/sec
POC	Program option code, Pitch = 1 Yaw = 5 Roll = 8
POS	Model oscillation amplitude, deg
PT	Tunnel stilling chamber pressure, psfa
P/Y CLM	$M_n/Q \cdot S \cdot C_{BAR}$, measured by pitch/yaw balance
P/Y CLM-A	$\partial C_{LM}/\partial \alpha$, measured by pitch/yaw balance, rad^{-1}
P/Y CLM-AD	$\partial C_{LM}/\partial (Q \cdot C_{BAR}/2V) + \partial C_{LM}/\partial (AD \cdot C_{BAR}/2V)$, measured by pitch/yaw balance, rad^{-1}
P/Y CLN	$M_n/Q \cdot S \cdot B$, measured by pitch/yaw balance
P/Y CLN-B	$[\partial C_{LN}/\partial \beta] \cos \alpha$, measured by pitch/yaw balance, rad^{-1}
P/Y CLN-BD	$\partial C_{LN}/\partial (R \cdot B/2V) - [\partial C_{LN}/\partial (BD \cdot B/2V)] \cos \alpha$, measured by pitch/yaw balance, rad^{-1}
Q	Free-stream dynamic pressure, psfa or pitching velocity, rad/sec
R	Yawing velocity, rad/sec
RE	Free-stream Reynolds number, ft^{-1}
RFP	Reduced frequency parameter ($OMEGA \cdot C_{BAR}/2V$) for pitch phase, ($OMEGA \cdot B/2V$) for yaw and roll phases
S	Reference model wing area, 0.907 ft^2
TP	Data point number
TT	Tunnel stilling chamber temperature, degrees F or R

W.L.	Water line, inches
V	Free stream velocity, ft/sec
YCP	Center of pressure location, in the side plane, in terms of the model reference length from the model moment reference point
ϕ_B	Roll angle of balance-sting assembly; $\phi_B = 90$ deg for yaw oscillation of balance
θ	Total deflection of cross-flexure, deg
$\bar{\theta}_T$	Static deflection of cross-flexure, deg

1.0 INTRODUCTION

The work reported herein was sponsored by the Arnold Engineering Development Center (AEDC), Air Force Systems Command (AFSC), Arnold Air Force Station, Tennessee, under Program Element 65807F, and Control Number 9T02. The results were obtained by Calspan Field Services, Inc./AEDC Division, operating contractor for the Aerospace Flight Dynamics testing effort at the AEDC, AFSC, Arnold Air Force Station, Tennessee. The tests were conducted in the Propulsion Wind Tunnel Facility (PWT) Aerodynamic Wind Tunnel (4T) under AEDC Project Number C005-PB, December 8 through December 13, 1980. This test was a subtask of the 4T Facility Improvement Program. The project sponsor was Major R. L. Bruce, DOFA, AEDC.

This test was part of a continuing effort to design, fabricate, and verify the performance of forced oscillation dynamic balance systems capable of measuring direct, cross, and cross-coupling derivatives at high angles of attack. The 1,500-lb (normal force) Pitch/Yaw and Roll balance systems were utilized. The objectives of the test were to:

- (1) verify the controllability of the oscillating model over the operating range of the tunnel,
- (2) verify the quantitative measurements of the balance systems by comparing to previous data, and
- (3) further investigate the capabilities and problems associated with measuring cross and cross-coupling derivatives.

Forced oscillation data about the pitch, yaw, and roll axis were obtained on the Standard Dynamics Model (SDM) at angles of attack of -4 to 24 deg at Mach numbers 0.3 to 1.3. The unit Reynolds number ranged from 1.0×10^6 to 2.5×10^6 . The reduced frequency parameter varied from 0.012 to 0.04 for pitch oscillation, from 0.017 to 0.058 for yaw oscillation, and from 0.034 to 0.13 for roll oscillation. The nominal frequencies were 7.35 Hz, 3.65 Hz, and 8.5 Hz for pitch, yaw, and roll, respectively. The model was oscillated at amplitudes of 0.5, 1.0, and 1.5 deg.

A microfilm copy of the final data has been retained in the PWT at AEDC. Inquiries to obtain copies of the test data should be addressed to AEDC/DOS, Arnold Air Force Station, Tennessee 37389.

2.0 APPARATUS

2.1 TEST FACILITY

The Aerodynamic Wind Tunnel (4T) is a closed-loop, continuous flow, variable-density tunnel in which the Mach number can be varied from 0.1 to 1.3 and can be set at discrete Mach numbers of 1.6 and 2.0 by placing nozzle inserts over the permanent sonic nozzle. At all Mach numbers, the

stagnation pressure can be varied from 400 to 3,400 psfa. The test section is 4-ft square and 12.5 ft long with perforated, variable porosity (0.5- to 10-percent open) walls. It is completely enclosed in a plenum chamber from which the air can be evacuated, allowing part of the tunnel airflow to be removed through the perforated walls of the test section. The model support system consists of a sector and boom attachment which has a pitch angle capability of -5 to 24 deg with respect to the tunnel centerline. Guy rod stiffeners were used to strengthen the boom in the yaw plane. The general arrangement of the test section with the test article installed is shown in Fig. 1. A more complete description of the tunnel may be found in Ref. 1.

2.2 TEST ARTICLE

The Standard Dynamics Model (SDM) represents a 1/18-scale fighter type aircraft. Dimensions of the SDM are shown in Fig. 2, and details are shown in Fig. 3. The model has a 19.8 in. wing span and double-taper leading and trailing edges on the wing, stabilators, and vertical tail. The stabilators may be deflected in increments of ± 5 deg. For this test, the stabilator was deflected -5 deg. All external components, that is wings, stabilators, inlet, ventral fins, canopy, etc., may be removed for buildup tests as desired. Table 1 lists the Configuration codes for the test reported herein. The balance pivot center, model center, model center of gravity, and model moment reference point were located at 35 percent MAC. The two configurations tested were (see Table 1)

-B1C1W1V1T05S1F1I1 - full symmetrical aircraft

-B1C1W1V1T05S0F1I1 - full aircraft with left-hand (looking upstream) forebody strake removed.

The heavy wing tips (W2) were installed for the roll phase.

2.3 TEST MECHANISM

The pitch/yaw balance and its external 5-component can balance are shown in Figs. 4 and 5, respectively. A photograph of this arrangement is shown in Fig. 6. For the roll case, the cross-derivative balance was designed as an integral part of the balance system as shown in Fig. 7. These systems were designed, fabricated, and bench checked under various technology and development programs at AEDC.

The P/Y and roll balances use the same principle of operation and control. Each balance consists of a cross-flexure pivot connected to a hydraulic cylinder through a force measuring flexure. The hydraulic cylinder is operated with a servo valve to obtain sinusoidal oscillation motion at a constant oscillation amplitude, up to ± 2 deg, and constant frequency from 2 to about 10 Hz. The cross flexure is instrumented to measure angular displacement and supports the model loads (up to 1,500 lb normal force and 600 lb axial force) and provides the restoring moment to cancel the inertia moment when the system is operating at the natural frequency of the model/balance assembly. The P/Y balance has provisions for changing the restoring moment by installing leaf springs on the sides of the balance; leaf springs were used for these tests. The restoring moment was 348 in-lb/deg for the P/Y balance and 43 in-lb/deg for the roll balance. The P/Y balance was oriented at 0 deg with respect to the model for the pitch tests and at 90 deg for the yaw tests.

The can balance and its load limits are shown in Fig. 5. The balance has five components of load measuring elements: pitching moment and normal force, yawing moment and side force, and rolling moment. Each element is instrumented to resolve the static, in-phase, and out-of-phase (with respect to the model position vector) component of the load as discussed later. The balance is capable, therefore, of measuring the same derivatives as the pitch-yaw balance, as well as the cross and cross-coupling derivatives.

2.4 TEST INSTRUMENTATION

The Forced Oscillation Balance Control and Readout System (FOBCARS) is used for setting the oscillation frequency and amplitude and for nulling the static torque. An electronic position feedback loop is used to maintain a constant oscillation amplitude and frequency under aerodynamic loads and permits testing both dynamically stable and unstable configurations. Data are normally obtained at the natural frequency of the model/flexure spring-mass system. Limit circuits are set prior to the test to provide overload protection for the balance. These limit circuits automatically shut the system down when they are exceeded. The torque-nulling system centers the hydraulic-driven piston so the force-measuring flexure (termed "torque beam") is not subjected to the model static aerodynamic moment. This allows the use of a torque beam suitable to the particular model for increased sensitivity.

Each load measuring element of each balance is instrumented with three sets of strain gages. Two sets of these strain gages are used with the system for each dynamic measurement. A two-phase oscillator provides $E \sin \omega t$ (AC) excitation to one set of strain gages to resolve the in-phase (with respect to a reference signal) component of the dynamic signal while $E \cos \omega t$ (AC) excitation is used to excite the second set of strain gages to resolve the out-of-phase (quadrature) component (where ω is the oscillation rate of the model). The third set of gages is DC excited to provide readings of static deflections, forces, and moments. A LSI-11 minicomputer and filter-amplifier chassis are used to provide analog-to-digital conversion and signal conditioning. The gage signals first pass through a 2-Hz passive filter, then through a 0.2-Hz active filter. A digital filter routine is performed in the minicomputer. The digital filter parameters can be changed easily depending on the noise of the data. The 32 channels of data are then sent to the facility computer for online data reduction.

3.0 TEST DESCRIPTION

3.1 TEST CONDITIONS AND PROCEDURES

3.1.1 General

A summary of the nominal test conditions at each Mach number is listed below.

M	PT, psf	TT, °F	Q, psf	P, psf	RE x 10 ⁻⁶	V ft/sec
0.3	2,870	105	170	2,700	2.5	350
0.6	1,480	68	290	1,160	2.5	655
0.6	585	63	115	460	1.0	650
0.95	1,160	70	410	650	2.5	985
0.95	800	65	280	450	1.7	980
1.05	1,130	67	435	560	2.5	1,071
1.05	890	63	341	445	2.0	1,065
1.3	1,100	67	475	400	2.5	1,265

Definition of the configuration code is given in Table 1. The Test Summary is given in Table 2.

3.1.2 Data Acquisition

After establishing tunnel conditions and model attitude, the model was unlocked and brought to a constant oscillation amplitude by using the FOBCARS. The system was allowed to stabilize at the system resonant frequency before data were recorded. At each angle of attack, generally 3 data points were taken.

3.2 DATA REDUCTION

The digital readouts of the data acquisition instrumentation from the FOBCARS were input to the facility computer for reducing the data to coefficients. The direct damping coefficients were obtained using data reduction equations and procedures given in Ref. 2. The pitch and yaw damping results were corrected for sting motion, as discussed in Ref. 3. The cross and cross-coupling data were reduced using equations derived by methods as discussed in Ref. 4.

3.3 UNCERTAINTY OF MEASUREMENTS

In general, instrumentation calibrations and data uncertainty estimates were made using methods recognized by the National Bureau of Standards (NBS) (Ref. 5). Measurement uncertainty is a combination of bias and precision errors defined as:

$$U = \pm (B + t_{95}S)$$

where B is the bias limit, S is the sample standard deviation, and t_{95} is the 95th percentile point for the two-tailed Student's "t" distribution, which for degrees of freedom greater than 30 equals 2.

Estimates of the measured data uncertainties for this test are given in Table 3a, b, and c. The balance data uncertainties were determined from in-place static and dynamic calibrations through the data recording system and data reduction program. Static load hangings on the balances simulate the range of loads and center-of-pressure locations anticipated during the test, and measurement errors are based on differences between applied loads and corresponding values calculated from the balance

equations used in the data reduction. Load hangings to verify the balance calibrations are made in-place on the assembled model. Static and dynamic calibrations of the dynamic stability balance system allowed the measurement uncertainty to be that which is due to the amount of nonrepeatability of the calibration constants. The sting and parts of the balance not dynamically calibrated were calibrated by static load hangings over the range of anticipated loads. Uncertainties in the measurements of sting effects were included in the error analysis. Structural damping values were obtained near vacuum conditions before the tunnel flow was started to evaluate the still-air damping contribution.

Propagation of the bias and precision errors of measured data through the calculated data was made in accordance with Ref. 5, and the results are given in Table 3d. The uncertainties are for steady-state conditions. Occasionally vibration and noise of the wind tunnel environment caused the scatter in the data to exceed the estimated uncertainty.

4.0 DATA PACKAGE PRESENTATION

The Data Package includes tabulated data, plotted data, and a test summary. Tabulated data includes summary data, point-by-point data, wind-off tare data, zeros data, a listing of constants, and miscellaneous data, such as check loads, etc. Plotted data includes all static, direct dynamic, cross and cross-coupling data as a function of angle of attack, and comparison plots which depict configuration effects. A sample of the tabulated and plotted data is presented in Appendix 3. The data package is comprised of seven volumes, arranged as follows:

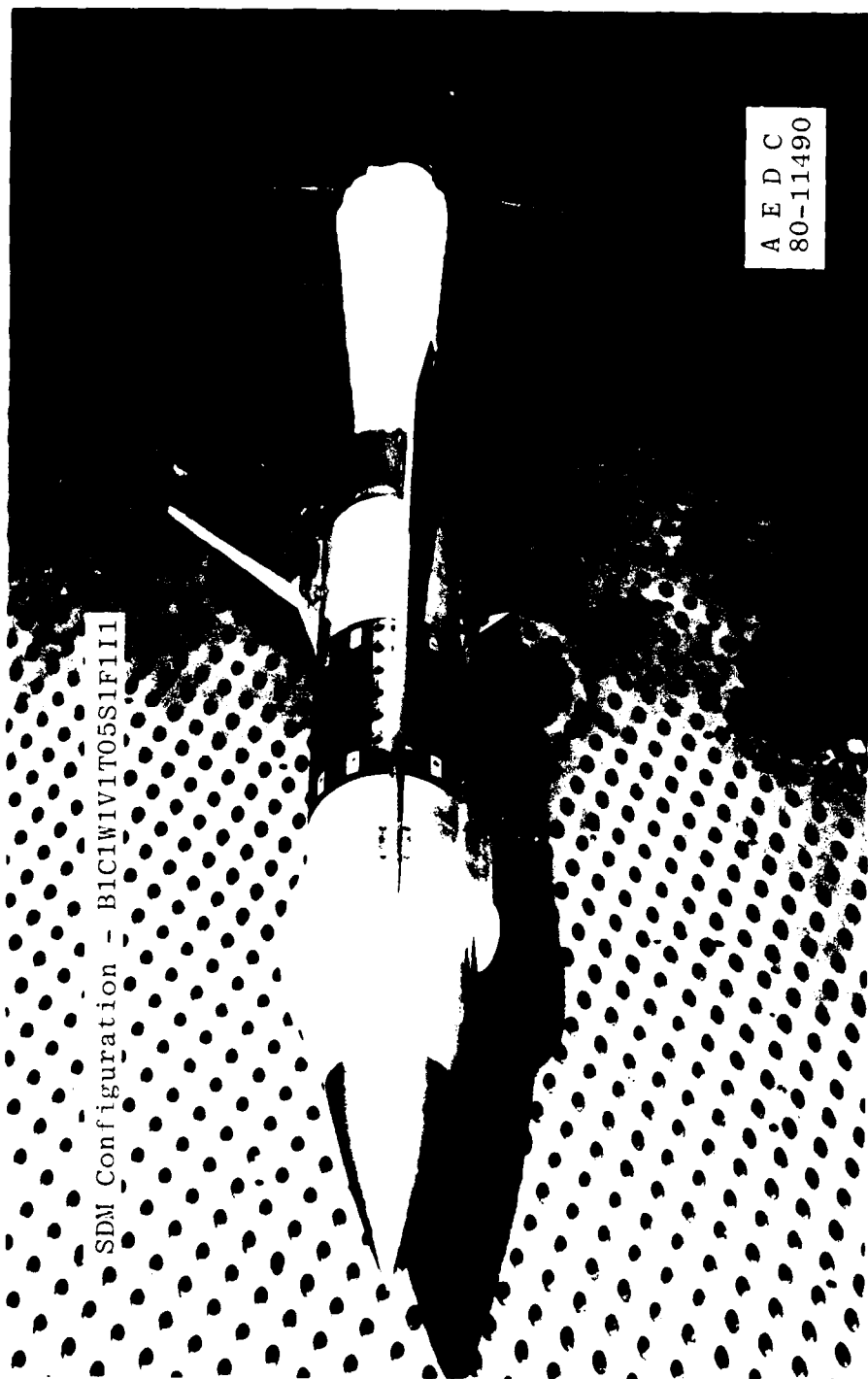
<u>Volume No.</u>	<u>Run Nos.</u>	<u>Description</u>
1	22-61	Pitch phase summary and plotted data
2	76-94	Yaw phase summary and plotted data
3	113-124	Roll phase summary and plotted data
4	22-61	Pitch phase point-by-point data
5	76-94	Yaw phase point-by-point data
6	113-124	Roll phase point-by-point data
7		Zeros, tares, constants, miscellaneous

Plots of some of the coefficient data are shown in Fig. 8. The direct derivatives, P/Y CLM-A, P/Y CLM-AD, P/Y CLN-B, P/Y CLN-BD and P/Y CLM compared favorably with previous SDM data (Refs. 6 and 7).

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6. Cyran, F.B. "An Investigation of Sting Interference Effects on the Static, Dynamic, and Base Pressure Measurements of the SDM Aircraft at Mach Numbers 0.3 through 1.3." AEDC-TR-81-3 (AD-A102612), August 1981.
7. Cyran, F. B. "An Investigation of Sting Interference Effects on the Static, Dynamic, and Base Pressure Measurements of the SDM Aircraft at Mach Numbers 0.3 through 1.3." AEDC-TR-81-3 (AD-A102612), August 1981.

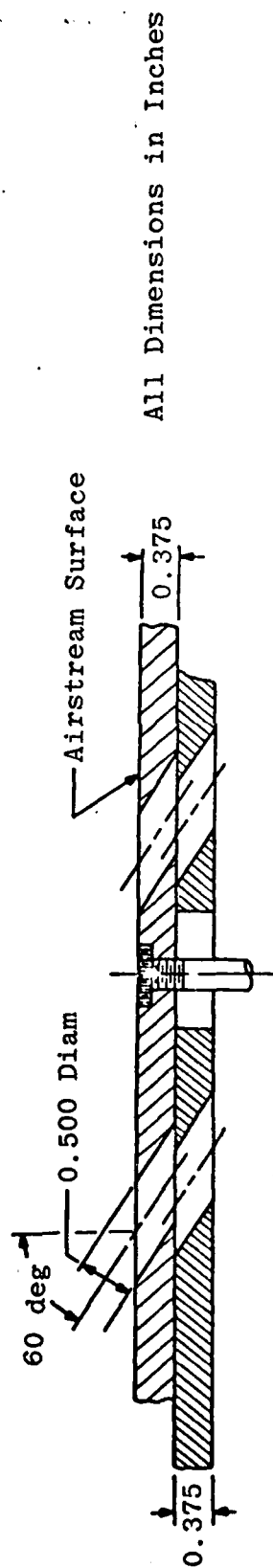
APPENDIX I
ILLUSTRATIONS



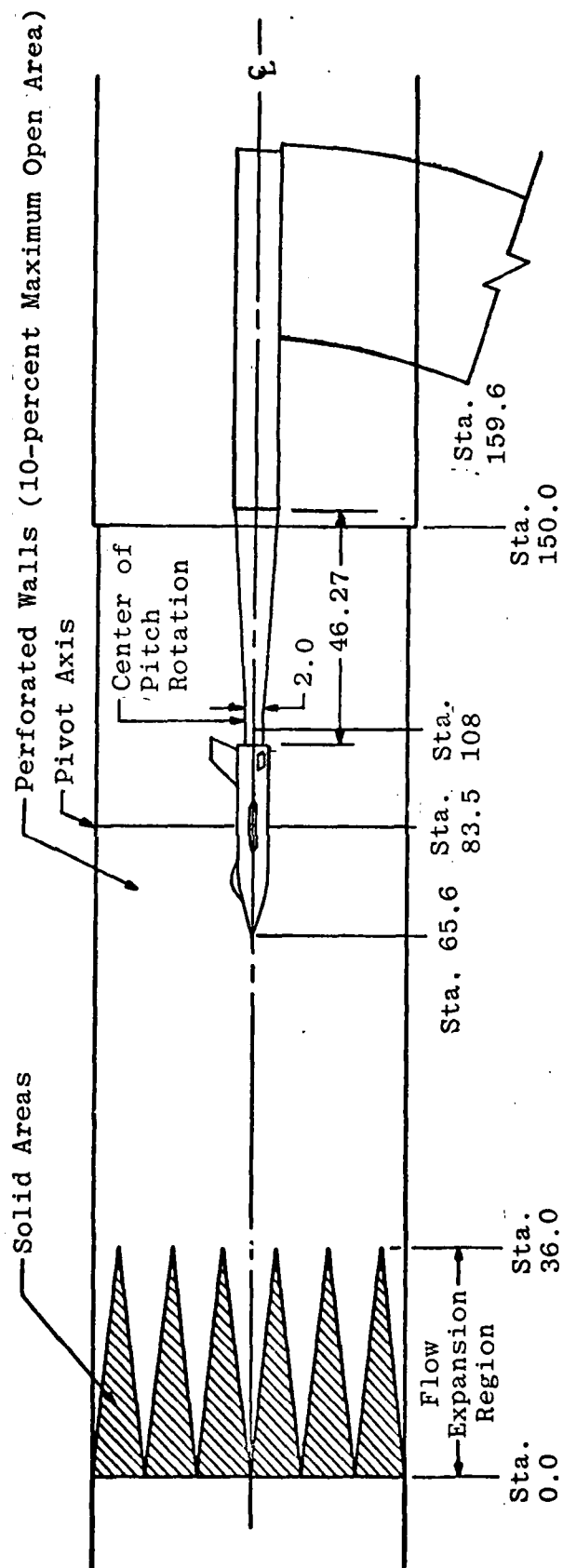
SDM Configuration - BIC1W1V1T05S1F1I1

A E D C
80-11490

a. Installation Photograph
Fig. 1. General Installation Arrangement

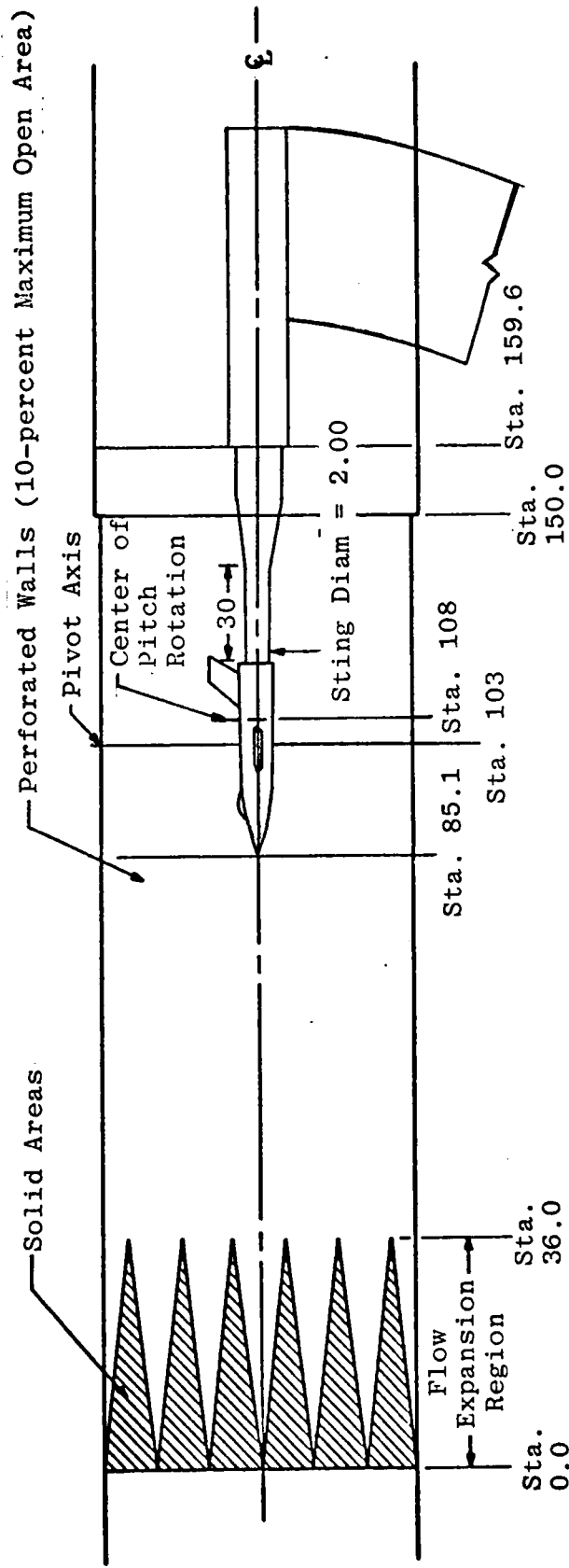
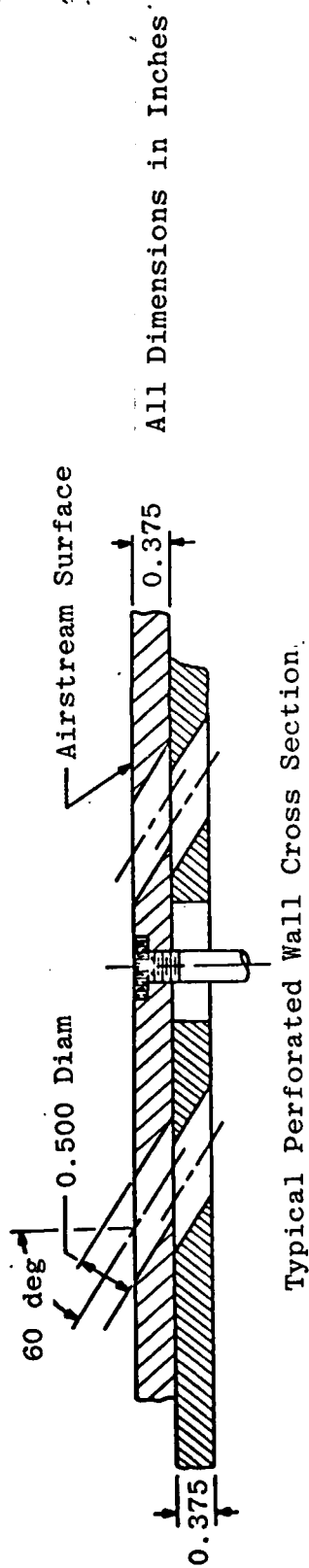


Typical Perforated Wall Cross Section



b. Installation Sketch - Pitch/Yaw Balance

Fig. 1. Continued



Schematic of 4T

c. Installation Sketch - Roll Balance

Fig. 1. Concluded

WING	
Area	0.90702 ft ²
Span	1.6500 ft
MAC	0.62233 ft
Aspect Ratio	3.0
L.E. Sweep	40 deg
Dihedral	0
Incidence	0
Airfoil	Double Wedge 4.5 percent thickness at root.
L.E. Angle	15 (half angle)
T.E. Angle	15 (half angle)
HORIZONTAL TAIL	
Area	0.30707 ft ²
Aspect Ratio	3.0
Taper Ratio	0.213
L.E. Sweep	40 deg
Dihedral	-10 deg
Airfoil	Double Wedge 6.4 percent thickness at root.
L.E. Angle	14 deg (half angle)
T.E. Angle	15 deg (half angle)
VERTICAL TAIL	
Area	0.30846 ft ²
Aspect Ratio	1.093
Taper Ratio	0.362
L.E. Sweep	
Tip	47.5 deg
Root	15.0 deg
Airfoil	Double Wedge 5.6 percent thickness at root.
L.E. Angle	15 deg (half angle)
T.E. Angle	15 deg (half angle)
VENTRAL FIN (Each)	
Area	0.0263 ft ²
Span	0.150 ft
Aspect Ratio	0.86
Taper Ratio	0.70
L.E. Sweep	26.5 deg
Dihedral (cant)	25.2 deg (outboard)
Airfoil	
At Root	Modified Wedge 3.8 percent thick at root.
At Tip	Constant 0.003 r
FUSELAGE	
Length	2.55208 ft
Diameter	0.36458 ft
Center of Gravity	1.49125 ft from Nose @ 35% MAC
	1.36667 ft from Nose @ 15% MAC

Fig. 2. Standard Dynamics Model (SDM) Dimensions

The drawing consists of two views of a missile: a Top View and a Side View.

Top View:

- Overall length: 19.800
- Overall width: 11.701
- Distance from nose to first major section: F.S. 7.150
- Distance from first major section to second: F.S. 13.836
- Distance from second major section to third: F.S. 25.600
- Distance from third major section to fourth: F.S. 28.862
- Distance from fourth major section to tail: F.S. 30.000
- Distance from nose to first major section: 7 deg
- Distance from first major section to second: 17 deg
- Distance from second major section to third: 40 deg
- Distance from third major section to fourth: 3.138
- Distance from fourth major section to tail: 7.468
- Distance from nose to first major section: F.S. 0
- Distance from first major section to second: F.S. 16.280
- Distance from second major section to third: 2.443
- Distance from third major section to fourth: F.S. 31.011
- Distance from fourth major section to tail: 2.612
- Distance from nose to first major section: 40 deg
- Distance from first major section to second: 7 deg
- Distance from second major section to third: 40 deg
- Distance from third major section to fourth: 3.138
- Distance from fourth major section to tail: 7.468
- Distance from nose to first major section: F.S. 0
- Distance from first major section to second: F.S. 16.280
- Distance from second major section to third: 2.443
- Distance from third major section to fourth: F.S. 31.011
- Distance from fourth major section to tail: 2.612

Side View:

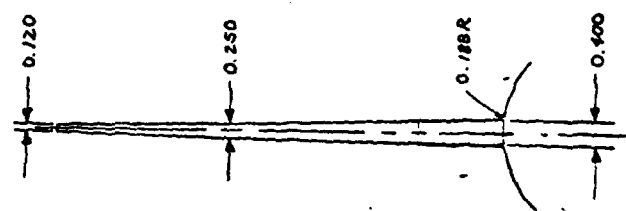
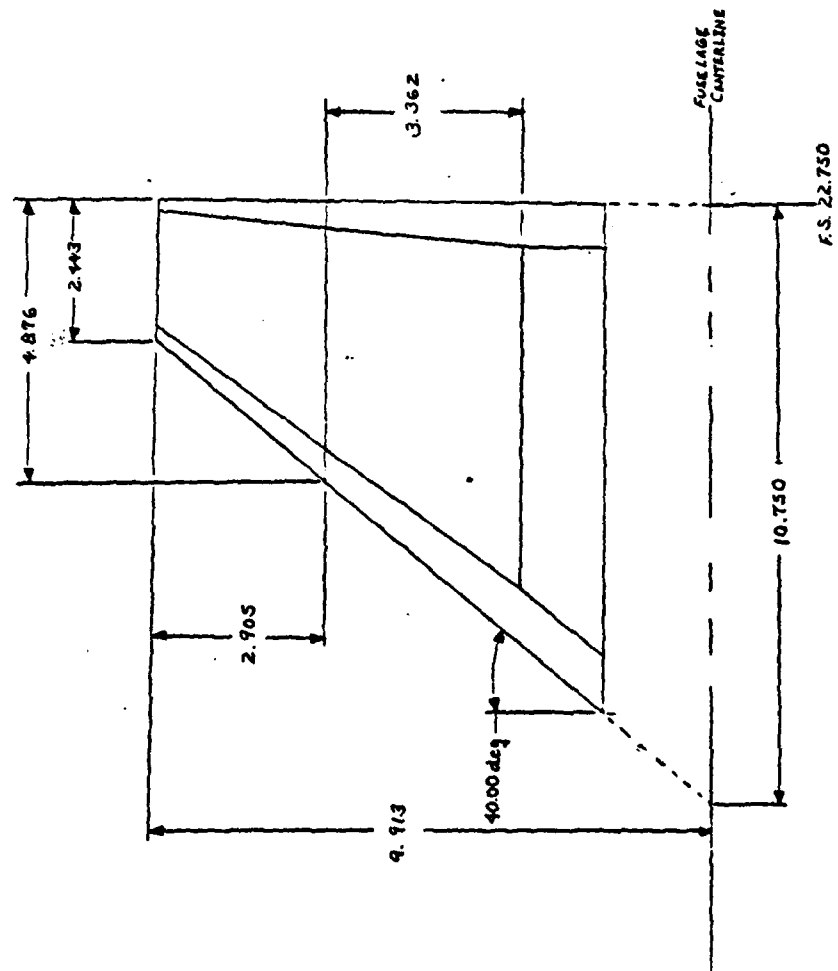
- Overall length: 19.800
- Overall width: 11.701
- Distance from nose to first major section: F.S. 7.150
- Distance from first major section to second: F.S. 13.836
- Distance from second major section to third: F.S. 25.600
- Distance from third major section to fourth: F.S. 28.862
- Distance from fourth major section to tail: F.S. 30.000
- Distance from nose to first major section: 7 deg
- Distance from first major section to second: 17 deg
- Distance from second major section to third: 40 deg
- Distance from third major section to fourth: 3.138
- Distance from fourth major section to tail: 7.468
- Distance from nose to first major section: F.S. 0
- Distance from first major section to second: F.S. 16.280
- Distance from second major section to third: 2.443
- Distance from third major section to fourth: F.S. 31.011
- Distance from fourth major section to tail: 2.612
- Distance from nose to first major section: 40 deg
- Distance from first major section to second: 7 deg
- Distance from second major section to third: 40 deg
- Distance from third major section to fourth: 3.138
- Distance from fourth major section to tail: 7.468
- Distance from nose to first major section: F.S. 0
- Distance from first major section to second: F.S. 16.280
- Distance from second major section to third: 2.443
- Distance from third major section to fourth: F.S. 31.011
- Distance from fourth major section to tail: 2.612

Labels:

- MEAN AERODYNAMIC CHORD
- OGIVE TANGENCY LOCATION
- W.L. 2.875
- W.L. 10.700
- W.L. 6.260
- W.L. 6.968
- W.L. 25.418
- W.L. 31.011
- W.L. 2.612
- W.L. 3.138
- W.L. 7.468
- W.L. 16.280
- W.L. 25.600
- W.L. 28.862
- W.L. 30.000
- W.L. 31.011
- W.L. 32.612
- W.L. 34.138
- W.L. 35.7468
- W.L. 37.468
- W.L. 39.280
- W.L. 41.011
- W.L. 42.612
- W.L. 44.138
- W.L. 45.7468
- W.L. 47.468
- W.L. 49.280
- W.L. 51.011
- W.L. 52.612
- W.L. 54.138
- W.L. 55.7468
- W.L. 57.468
- W.L. 59.280
- W.L. 61.011
- W.L. 62.612
- W.L. 64.138
- W.L. 65.7468
- W.L. 67.468
- W.L. 69.280
- W.L. 71.011
- W.L. 72.612
- W.L. 74.138
- W.L. 75.7468
- W.L. 77.468
- W.L. 79.280
- W.L. 81.011
- W.L. 82.612
- W.L. 84.138
- W.L. 85.7468
- W.L. 87.468
- W.L. 89.280
- W.L. 91.011
- W.L. 92.612
- W.L. 94.138
- W.L. 95.7468
- W.L. 97.468
- W.L. 99.280
- W.L. 101.011
- W.L. 102.612
- W.L. 104.138
- W.L. 105.7468
- W.L. 107.468
- W.L. 109.280
- W.L. 111.011
- W.L. 112.612
- W.L. 114.138
- W.L. 115.7468
- W.L. 117.468
- W.L. 119.280
- W.L. 121.011
- W.L. 122.612
- W.L. 124.138
- W.L. 125.7468
- W.L. 127.468
- W.L. 129.280
- W.L. 131.011
- W.L. 132.612
- W.L. 134.138
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- W.L. 137.468
- W.L. 139.280
- W.L. 141.011
- W.L. 142.612
- W.L. 144.138
- W.L. 145.7468
- W.L. 147.468
- W.L. 149.280
- W.L. 151.011
- W.L. 152.612
- W.L. 154.138
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- W.L. 159.280
- W.L. 161.011
- W.L. 162.612
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- W.L. 165.7468
- W.L. 167.468
- W.L. 169.280
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- W.L. 172.612
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- W.L. 182.612
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- W.L. 191.011
- W.L. 192.612
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- W.L. 197.468
- W.L. 199.280
- W.L. 201.011
- W.L. 202.612
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- W.L. 207.468
- W.L. 209.280
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- W.L. 267.468
- W.L. 269.280
- W.L. 271.011
- W.L. 272.612
- W.L. 274.138
- W.L. 275.7468
- W.L. 277.468
- W.L. 279.280
- W.L. 281.011
- W.L. 282.612
- W.L. 284.138
- W.L. 285.7468
- W.L. 287.468
- W.L. 289.280
- W.L. 291.011
- W.L. 292.612

17

a. Overall Details

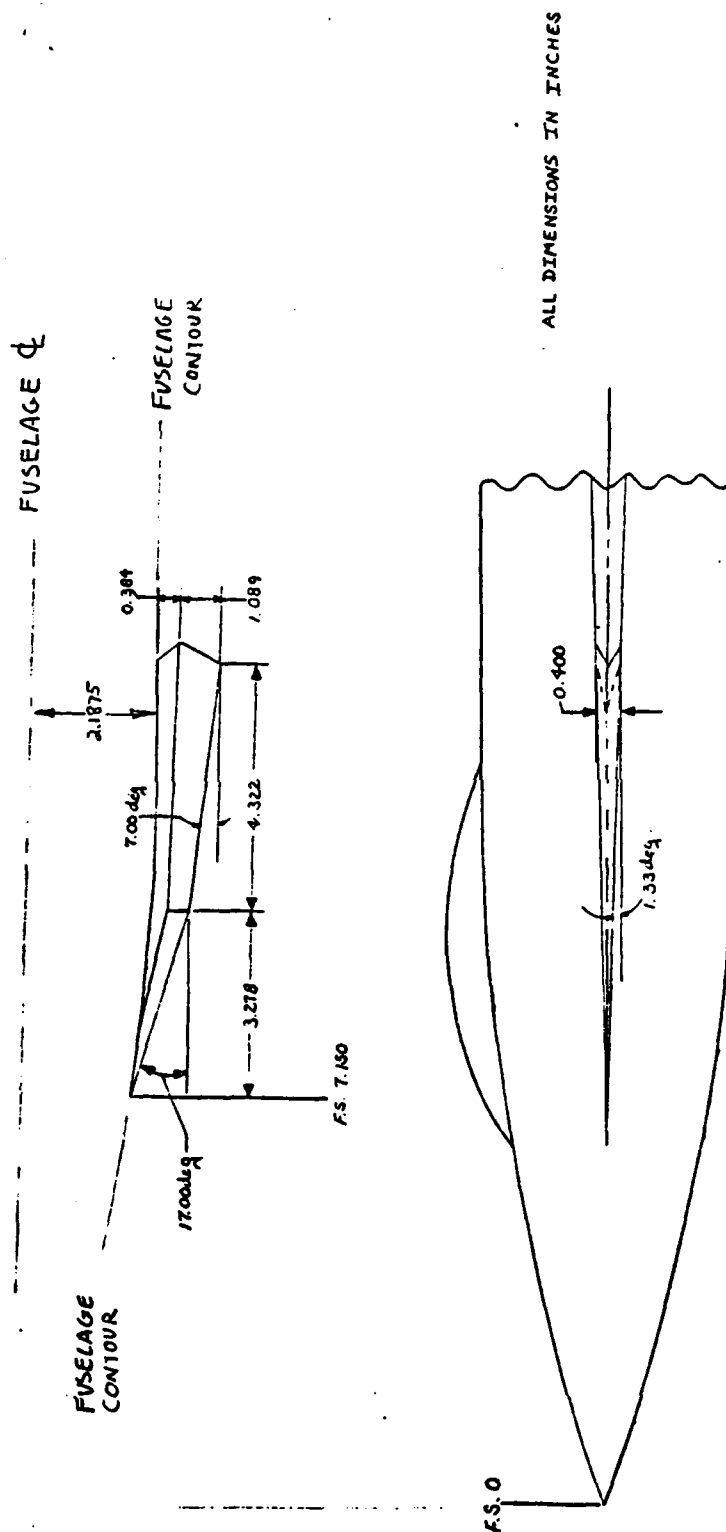


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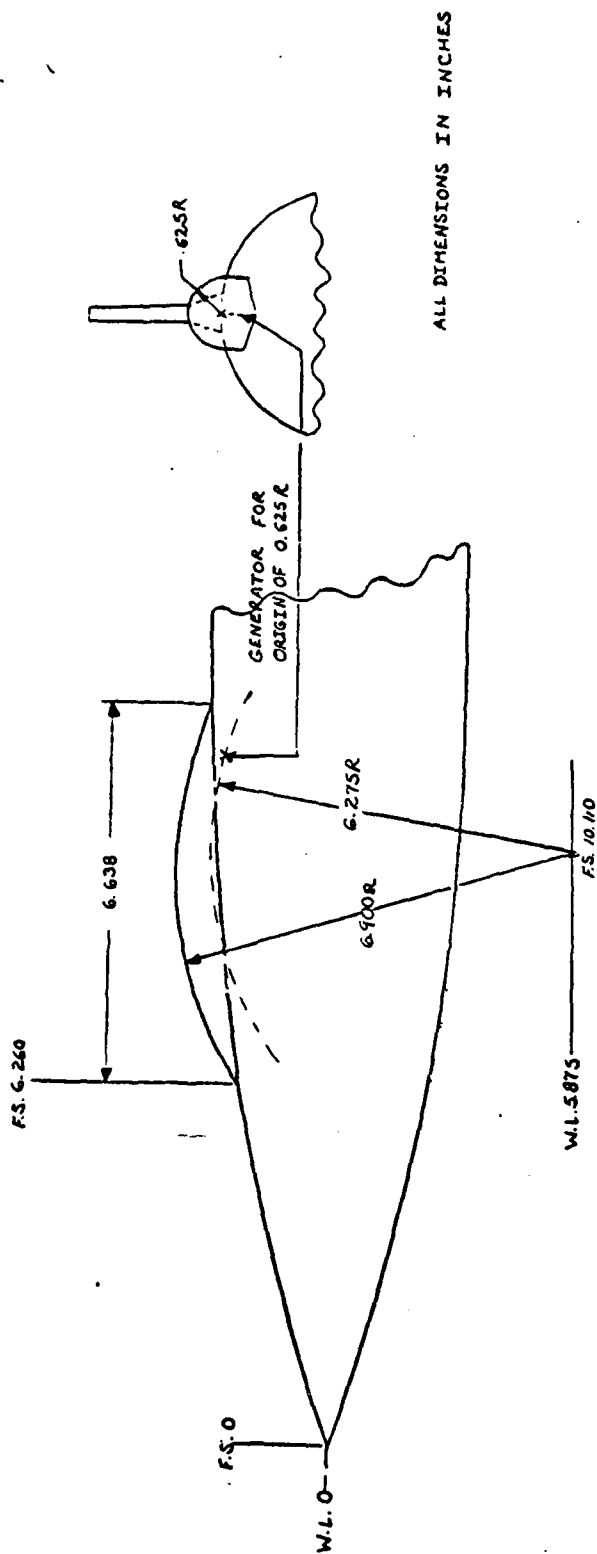
b. Wing and Wing Tip Details

Fig. 3. Continued

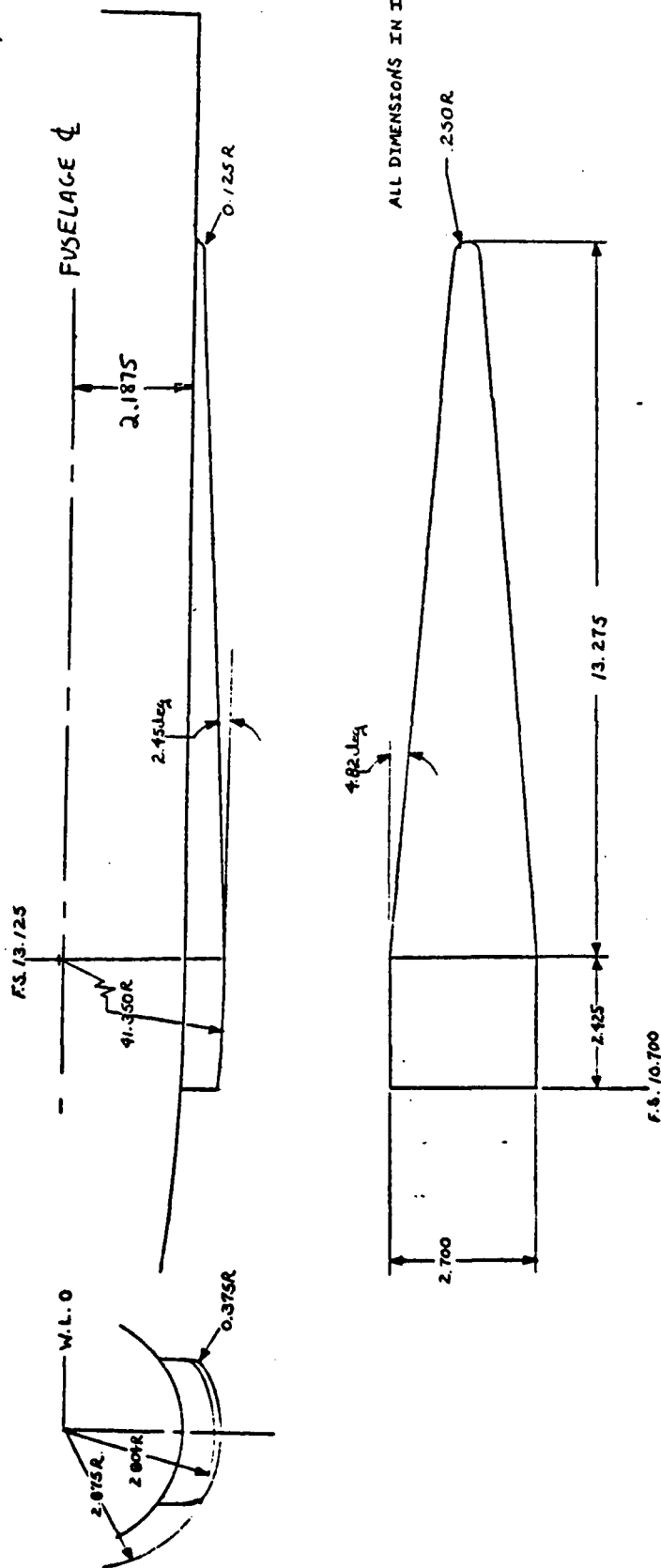
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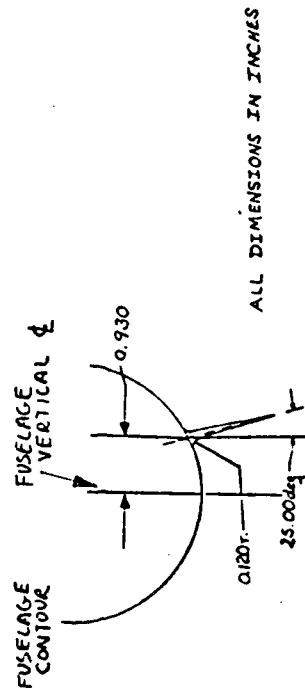
c. Strake Details
Fig. 3. Continued



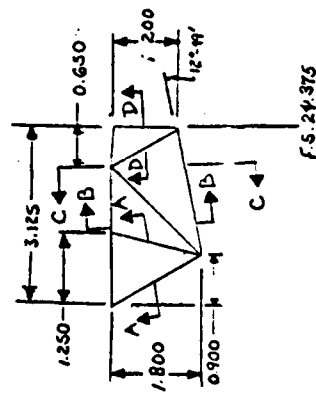
d. Canopy Details
Fig. 3. Continued



e. Inlet Details
Fig. 3. Continued

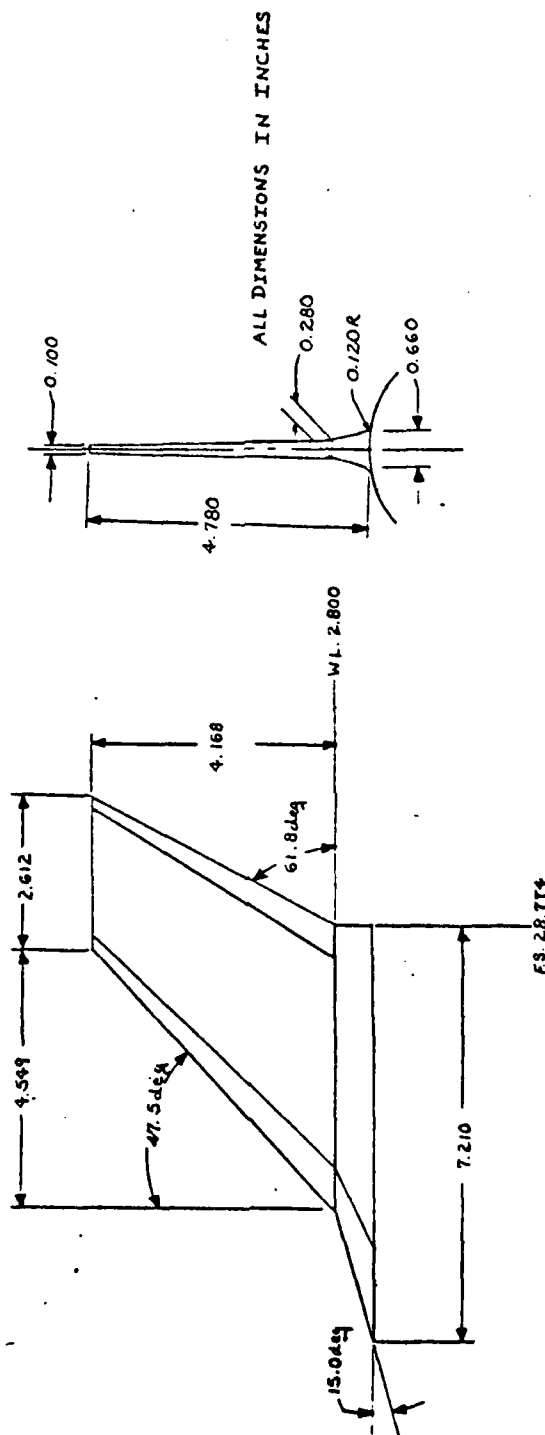


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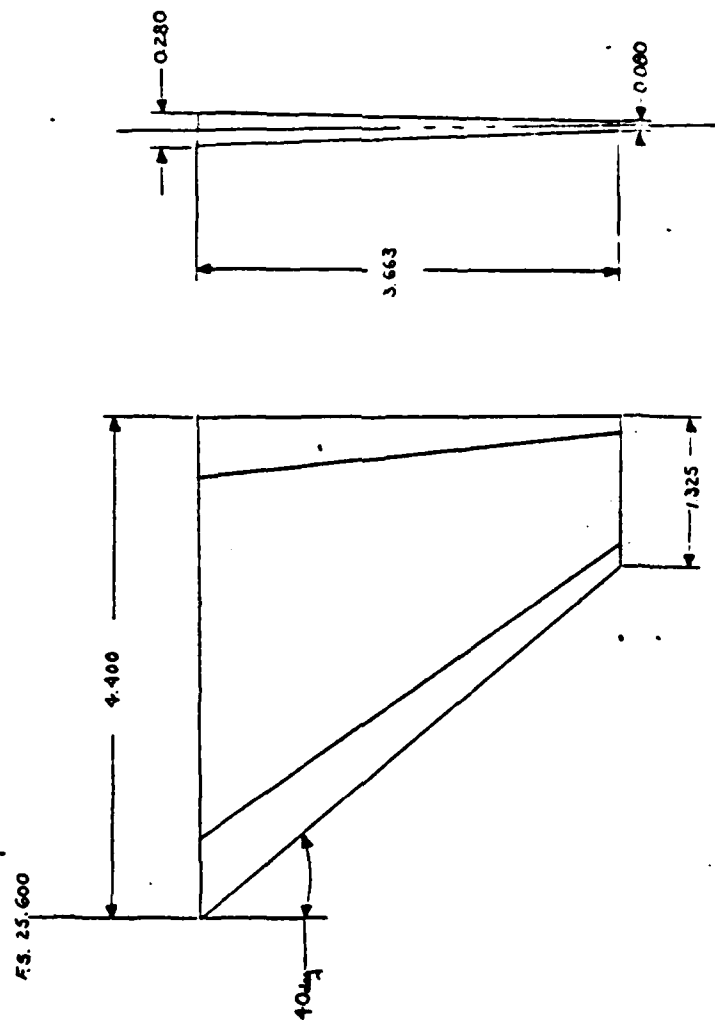


f. Ventral Fin Details

Fig. 3. Continued



G. Vertical Stabilizer Details
Fig. 3. Continued

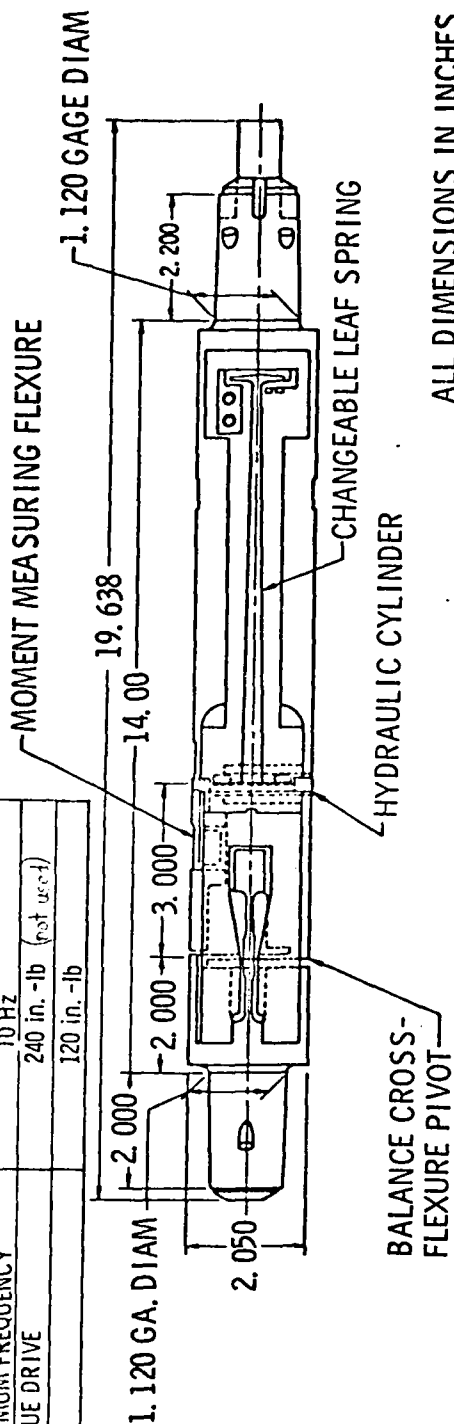


ALL DIMENSIONS IN INCHES

h. Horizontal Stabilizer Details.

Fig. 3. Concluded

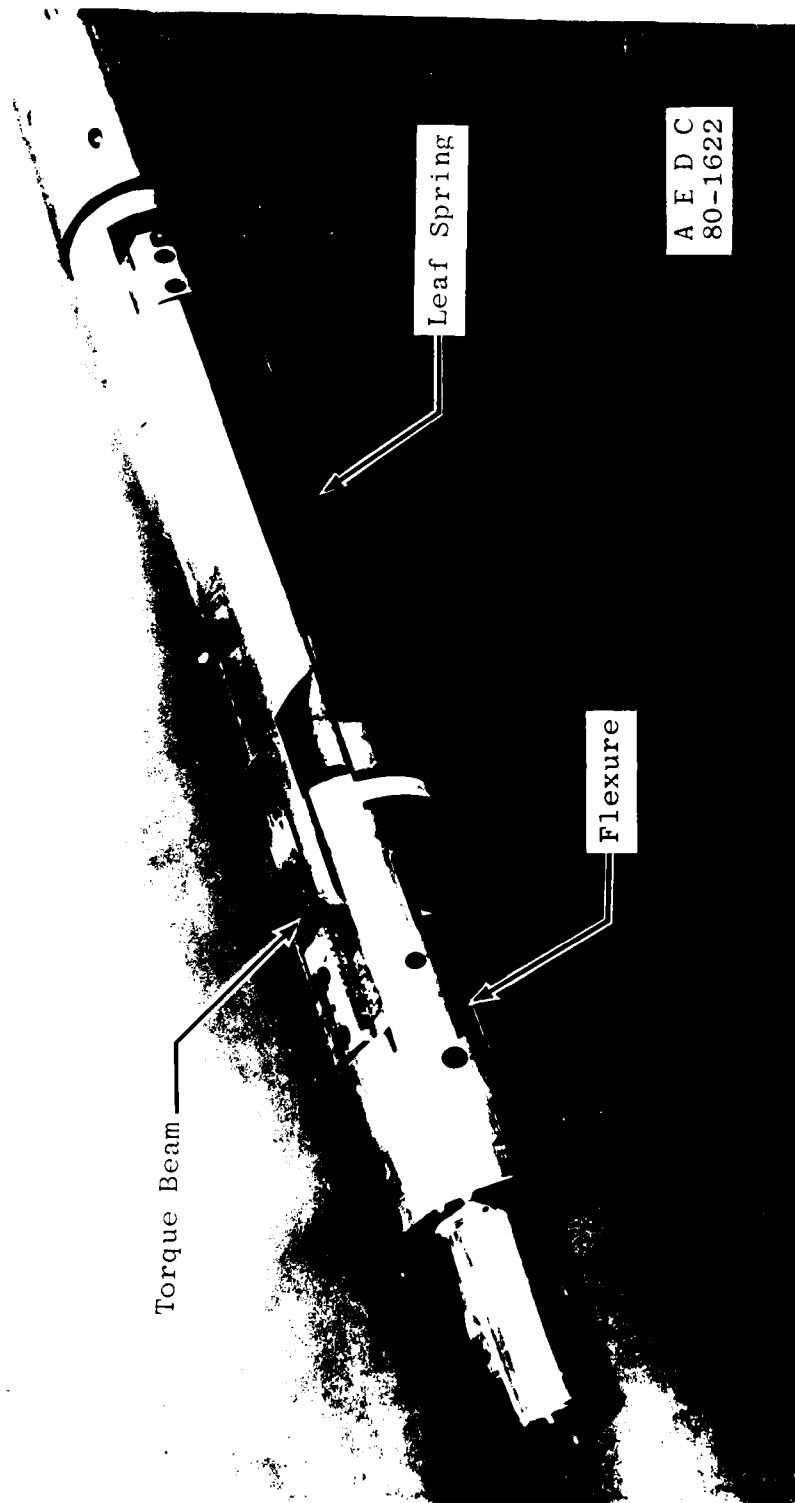
BALANCE LIMITS		
PARAMETER	PITCH DERIVATIVE $\phi_B - 0^\circ$	YAW DERIVATIVE $\phi_B - 90^\circ$
NORMAL FORCE	1500 lb	1500 lb
PITCHING MOMENT	$87 \times M\phi F$	1500 in. -lb
SIDE FORCE	150 lb	150 lb
YAWING MOMENT	150 in. -lb	$87 \times M\phi F$
AXIAL FORCE	600 lb	
ROLLING MOMENT	150 in. -lb	
CROSS-FLEXURE STIFFNESS	87 in. -lb/deg	
CROSS-FLEXURE AND LEAF- SPRING STIFFNESS	600 in-lb/deg or 350 in-lb/deg	
TOTAL OSCILLATING ANGLE	3 deg	1 deg
MAXIMUM FREQUENCY	10 Hz	
TORQUE DRIVE	240 in. -lb (not used)	
	120 in. -lb	



P7986
C811

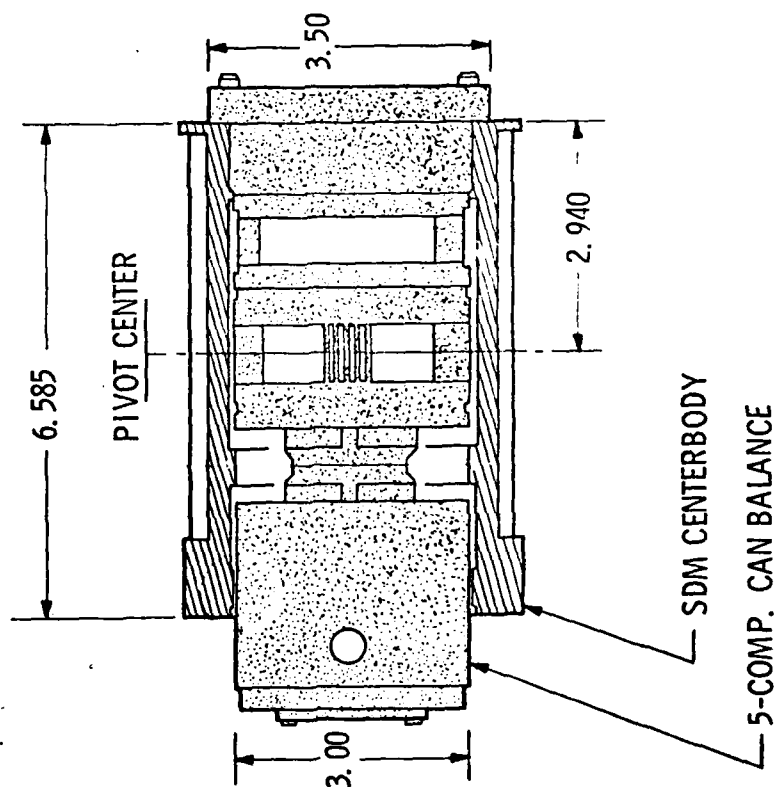
a. Balance Details

Figure 4. 1500 lb Pitch/Yaw Dynamic Balance



b. Balance Photograph
Figure 4. Concluded

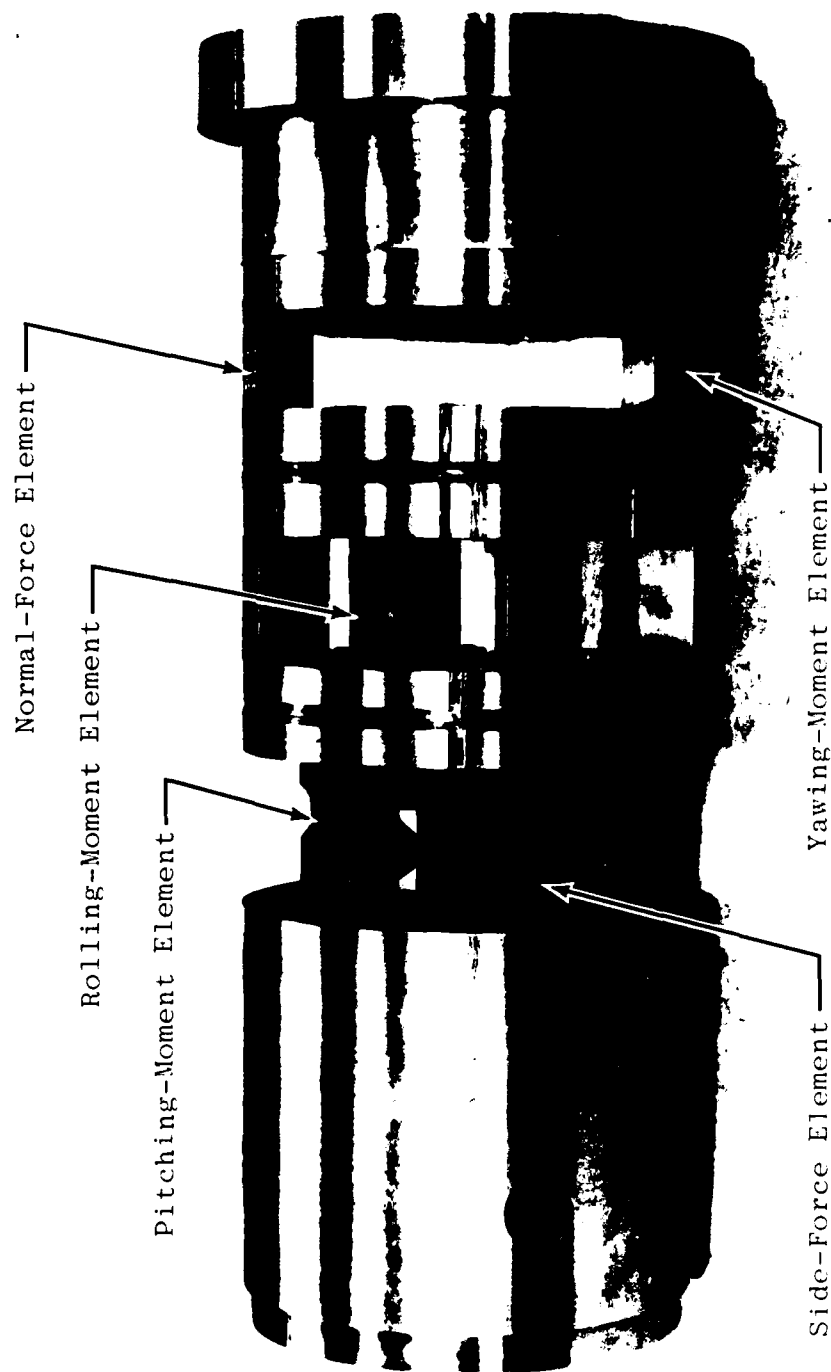
ALL DIMENSIONS IN INCHES



LOAD	BALANCE LIMITS
F_N	1500 LB
F_Y	150 LB
M_m	1050 IN. -LB
M_n	525 IN. -LB
M_ℓ	150 IN. -LB

a. Balance Details

Figure 5. 1500 lb 5-Component Can Balance



A E D C
80-1623

b. Balance Photograph
Figure 5. Concluded

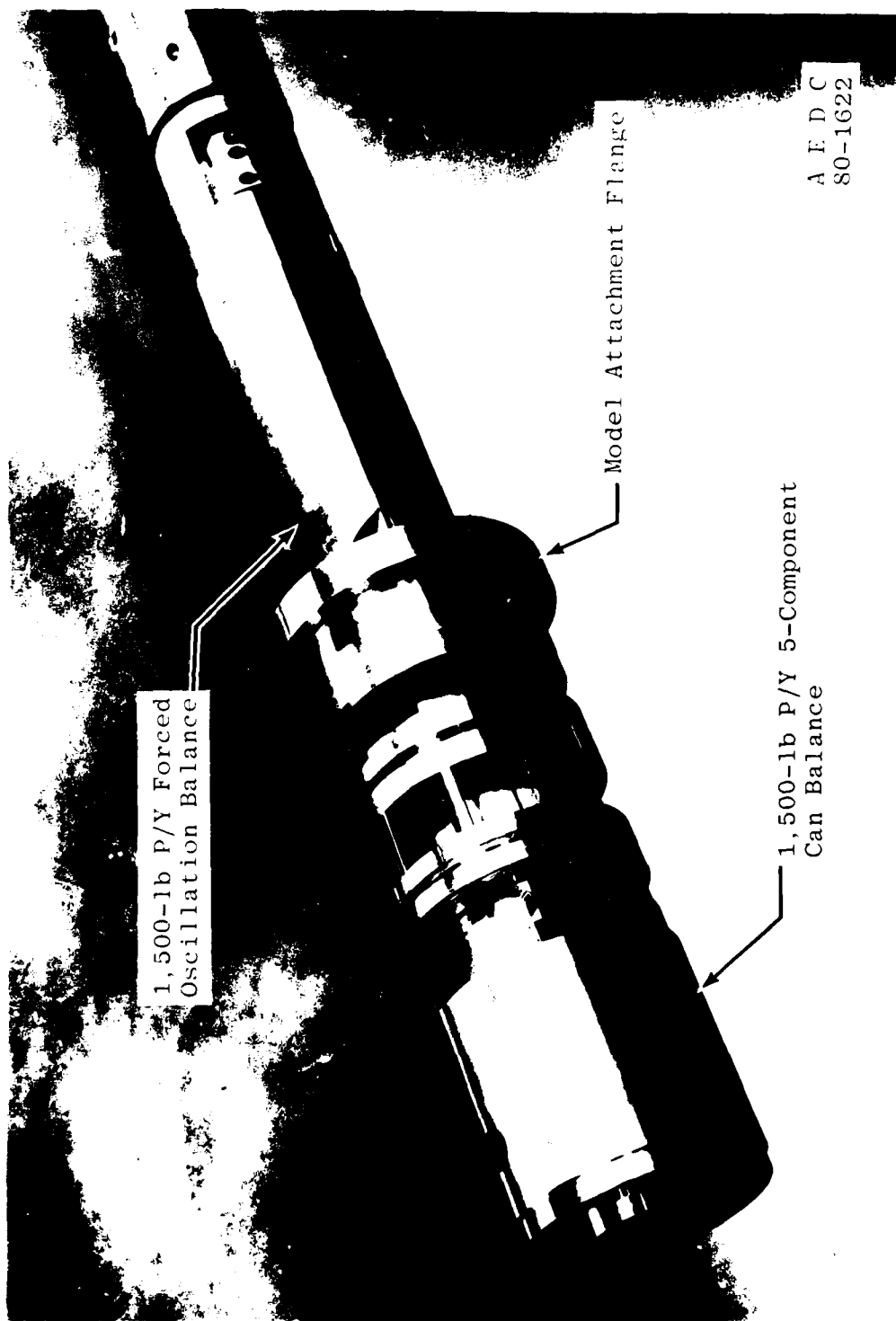
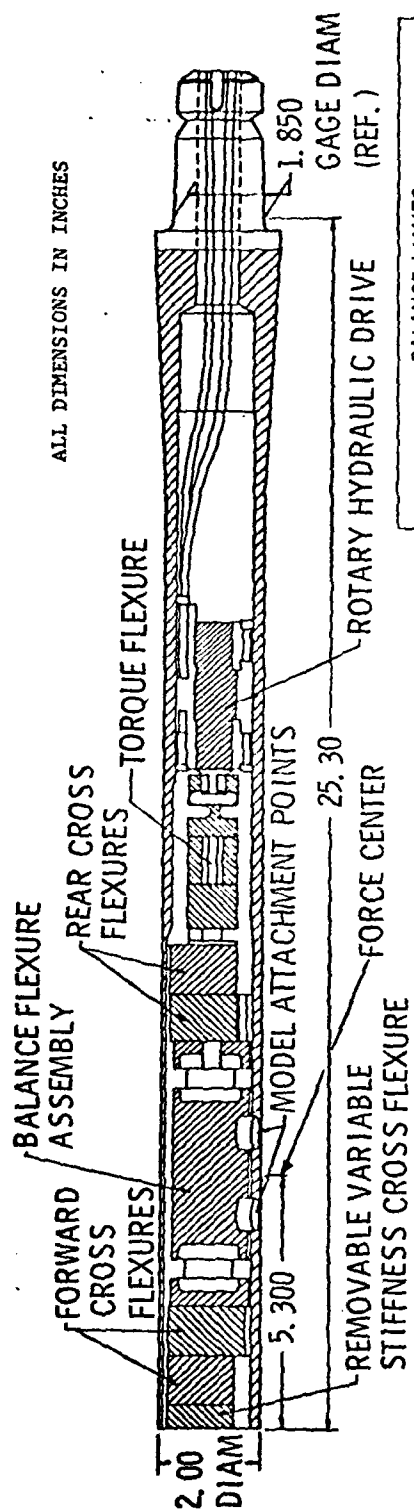


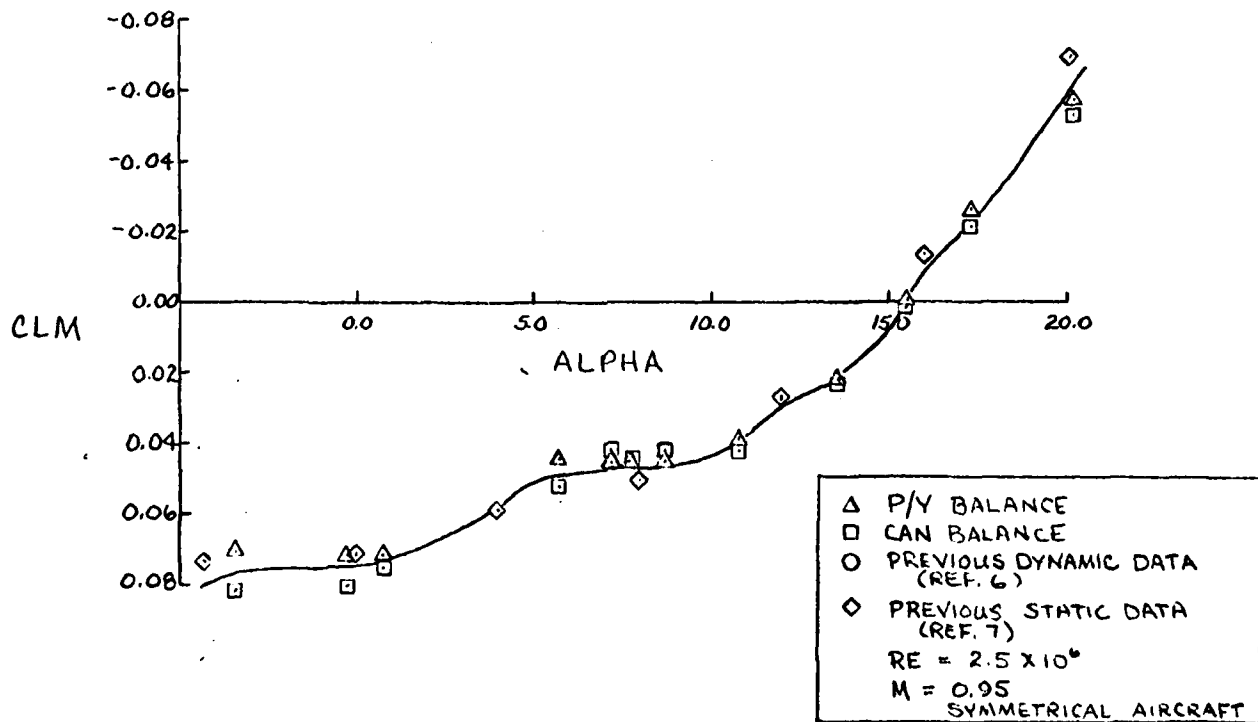
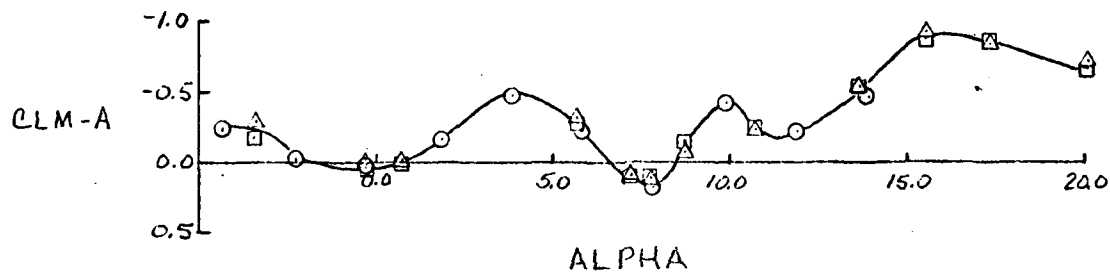
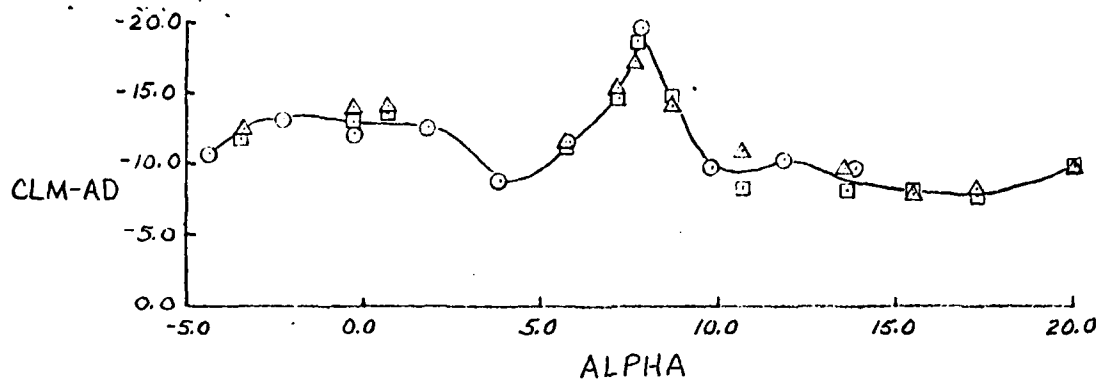
Figure 6. Pitch/Yaw - Can Balance Assembly



BALANCE LIMITS	
PARAMETER	ROLL DERIVATIVE
NORMAL FORCE	1500 LB
PITCHING MOMENT	3000 IN.-LB
SIDE FORCE	200 LB
YAWING MOMENT	400 IN.-LB
AXIAL FORCE	600 LB
ROLLING MOMENT	$\bar{\theta}_T \times \text{MBF}$
CROSS-FLEXURE STIFFNESS	43 IN.-LB/DEG
VARIABLE AND CROSS-FLEXURE STIFFNESS	62 IN.-LB/DEG rest use
TOTAL OSCILLATING ANGLE	± 3 DEG
MAXIMUM FREQUENCY	10 Hz
TORQUE DRIVE rest use	60 IN.-LB
	120 IN.-LB

$\bar{\theta}_T = \theta - 10$ OSCILLATION AMPLITUDE

Figure 7. 1500 lb Roll Dynamic Balance Details



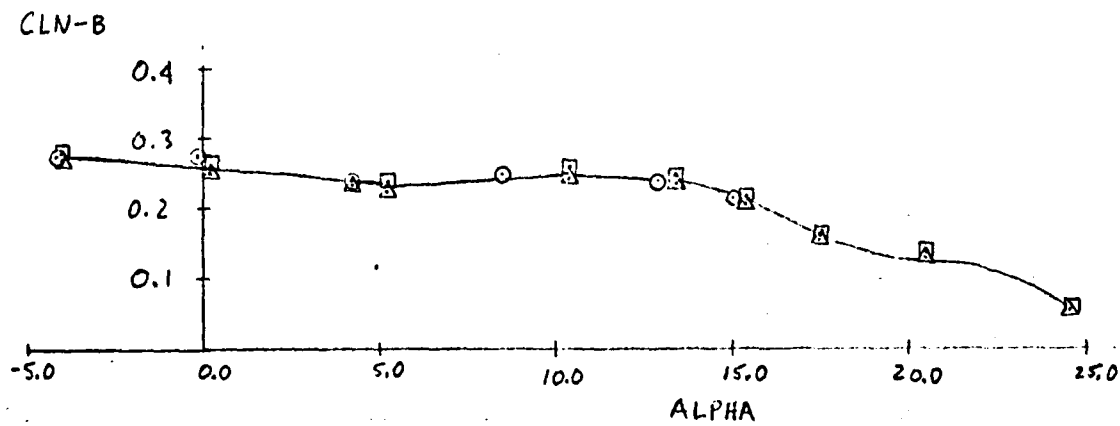
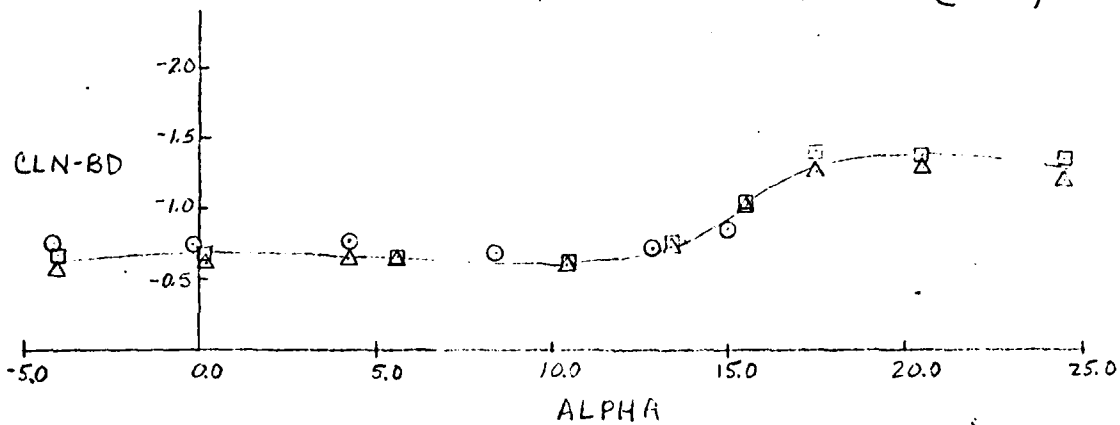
a. Pitch Phase Data
Figure 8. Data Comparisons

Δ P/Y BALANCE

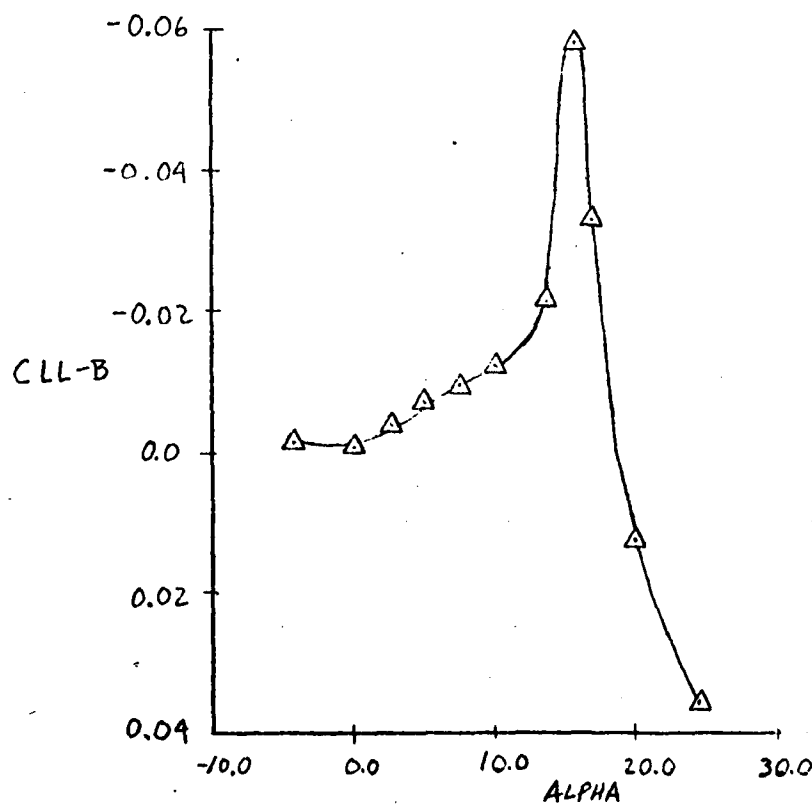
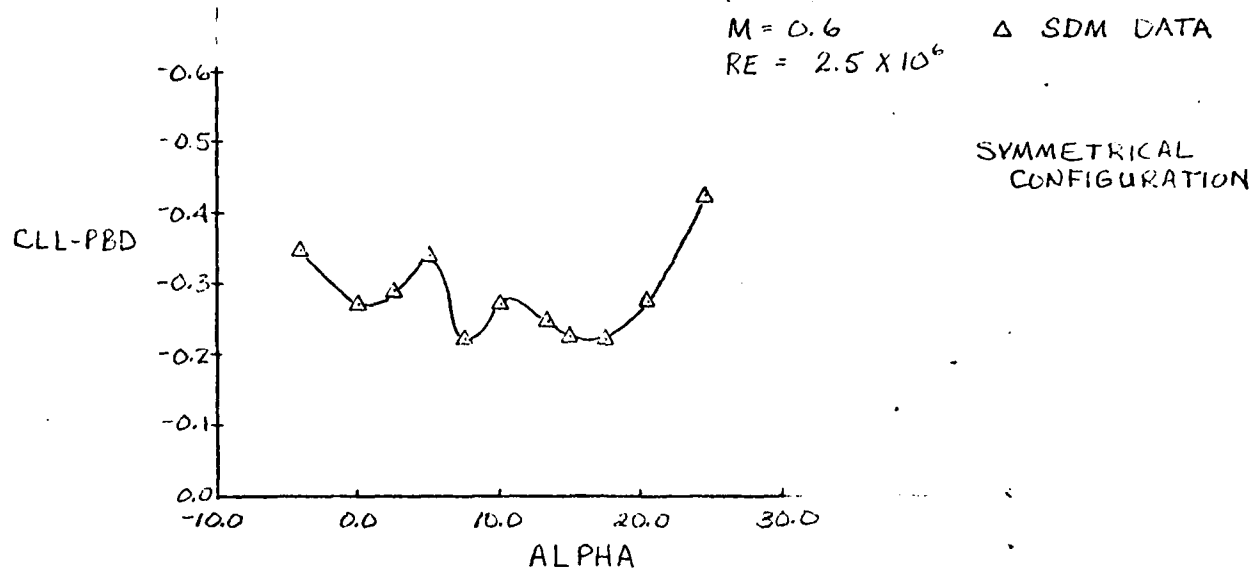
$M = 1.3$ $RE = 2.5 \times 10^6$
SYMMETRICAL AIRCRAFT

$\square$ CAN BALANCE

$\circ$ PREVIOUS DYNAMIC DATA (REF 7)



b. Yaw Phase Data
Figure 8. Continued



c. Roll Phase Data
 Figure 8. Concluded

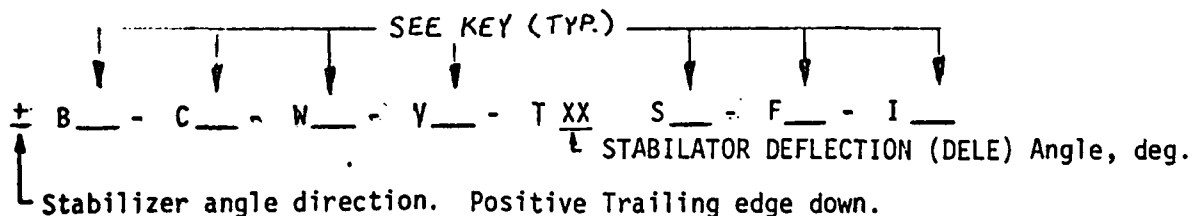
APPENDIX II

TABLES

Table 1

STANDARD DYNAMICS MODEL
CONFIGURATION DESIGNATIONS

<u>EXAMPLE</u>	<u>CONFIGURATION DETAIL</u>
B1COWOVOT99	BASIC FUSELAGE BODY (CG at 35% MAC)
B1C1WOVOT99	BODY + CANOPY
B1C1W1VOT99	BODY + CANOPY + WINGS
B1C2W1V1T99	BODY + CANOPY + WINGS + VERTICAL TAIL
±B1C1W1V1TXX	BODY + CANOPY + WINGS + VERTICAL TAIL + HORIZONTAL STABILIZERS
±B1C1W1V1TXXS1	BODY + CANOPY + WINGS + VERTICAL TAIL + HORIZONTAL STABILIZERS + STRAKES
±B1C1W1V1TXXS1F1	BODY + CANOPY + WINGS + VERTICAL TAIL + HORIZONTAL STABILIZERS + STRAKES + VENTRAL FINS
±B1C1W1V1TXXS1F1I1	BODY + CANOPY + WINGS + VERTICAL TAIL + HORIZONTAL STABILIZERS + STRAKES + VENTRAL FINS + INLET
±B1C1W1V1TXXSOF1I1	BODY + CANOPY + WINGS + VERTICAL TAIL + HORIZONTAL STABILIZER + VENTRAL FINS + INLET (NO STRAKES)



NON-ZERO INDICATES COMPONENT ON EXCEPT FOR
TAIL WHERE 99 WILL SIGNIFY TAIL OFF

Table 1.-Continued

Standard Configuration Key

<u>KEY</u>		<u>MODEL PART</u>
1	B	BASIC FUSELAGE BODY CG @ 35% MAC
2	B	BASIC FUSELAGE BODY CG @ 15% MAC
1	C	CANOPY
1	W	WINGS - LIGHT TIPS
2	W	- HEAVY TIPS
1	V	VERTICAL TAIL
±XX deg	T	HORIZONTAL STABILIZERS - DEFLECTION 99 signifies tail off
1	S	STRAKES
1	F	VENTRAL FINS
1	I	INLET

TABLE 2. Test Summary

<u>RUN</u>	<u>CONFIGURATION</u>	<u>M</u>	<u>REx</u> <u>10⁶</u>	<u>PT</u>	<u>POS</u>	<u>RFP</u>	<u>ALPHA</u> <u>RANGE</u>	<u>TEST</u> <u>PHASE</u>
22	-B1C1W1V1T05S1F1I1	0.3	2.5	2900	0.5, 1.0, 1.5	.04	0	Pitch
23							10	
28					1.5		0	
29					1.0, 1.5		10	
30							20	
31					1.0		0	
32		0.95		1160	1.0, 1.5	.014	0	
34							17-20	
35							15	
36							13	
37							10	
38							5	
39							-4	
40							-1	
41			1.75	800		.015	20-24	
45		1.3	2.5	1110	1.0	.012	-4-20	
*46		0.95		1160		.014	6.5-8	
47		0.6		1480		.021	-4-24	
48		1.05		1130	0.5, 1.0	.013	-4-24	
54	-B1C1W1V1T05S0F1I1	0.6		1480	1.0	.021	-4-13	
55		0.6	1.0	585		.022	0-20	
56		0.95	1.75	800		.015	-4-17	
57		1.05	2.0	890		.013	-4-0	
60							0-12	
61		1.3	2.5	1110	0.5, 1.0	.012	-4-20	
76	-B1C1W1V1T05S1F1I1	0.3		2700	0.5, 1.0	.058	-4-24	Yaw
77		0.95		1160	1.0	.022	0	
78							-4-20	
79		1.3		1110		.017	-4-24	
80		1.05		1130		.02	-4-17	
80.22		1.05	2.0	900			17	
85	-B1C1W1V1T05S0F1I1	0.3	2.5	2760		.058	-4-24	
86		0.95	1.75	800		.02	-4-17	
87		1.3	2.5	1100		.017	-4-10	
93							0-20	
94		1.05	2.0	885		.02	-4-15	
114	-B1C1W2V1T05S1F1I1	0.3	2.5	2730	0.5, 1.0, 1.5	.13	0-20	Roll
115		0.6	2.5	1500	1.0, 1.5	.067	-4-24	
119		0.95	1.7	800	1.5	.044	0-24	
120		1.30	2.5	1100		.034	0-24	
123	-B1C1W2V1T05S0F1I1	0.6	1.0	600		.067	0-15	
124		0.95	1.75	810		.044	0-15	

* Run 46 is additional M = 0.95 data and should be included with Runs 32 → 41

TABLE 3. ESTIMATED UNCERTAINTIES
a. Basic Measurements

Parameter Designation	STEADY-STATE ESTIMATED MEASUREMENT*										Range	Type of Measuring Device	Type of Recording Device	Method of System Calibration
	Precision Index (S)			Bias (B)			Uncertainty $\pm(B + 1.95S)$							
	Percent of Reading	Unit of Measure	Degree of Freedom	Percent of Reading	Unit of Measure	Percent of Reading	Unit of Measure							
Pt, psfa	$\pm(0.04\% + 0.15)$ ± 0.7		30 30	$\pm(0.11\% + 1)$ ± 2.9		$\pm(0.2\% + 1.3)$ ± 4.3				0 to 1500 1500 to 4000	Datametrics Barocel Model 538AX-93 0.4000 PSFA	Datametrics Electronic Manometer C-1018	In-place calibration with a precision pressure standard	
Tt, deg R	± 0.1		6	± 0.55		± 0.77				410 to 610	Dual Chromel [®] Alumel [®] Thermocouples	Newport Model 2600KP Digital Thermometer	Voltage standard substitution using a stirred ice bath thermocouple reference	
ALPHA, deg	$\pm(0.014\% + 0.004)$		7	± 0.029		$\pm(0.03\% + 0.038)$				-8 to 27	Clifton Precision Products Model CG-10-AS-1 SYNCHRO Transmitter	Theta Model C-5280 Digital Indicator	In-place calibration by comparison to an inclinometer	
FREQUENCY, Hz	0.002		2	0		0.00%				0 to 10	Eldorado Freq. Converter Model 1602	FORCARS	Compared with a Frequency Standard	

*Thompson, J. W. and Abernethy, R. B. et al. "Handbook Uncertainty in Gas Turbine Measurements." AEDC-TN-73-5 (AD 755356), February 1973

TABLE 3. Continued
b. Basic Dynamic Measurements - Pitch/Yaw Balance Assembly

Parameter Designation	STEADY-STATE ESTIMATED MEASUREMENT*										Range	Type of Measuring Device	Type of Recording Device	Method of System Calibration
	Precision Index (S)			Bias (B)			Uncertainty $\pm(B + t_{95S})$							
	Percent of Reading	Unit of Measure	Degree of Freedom	Percent of Reading	Unit of Measure	Percent of Reading	Unit of Measure	Percent of Reading	Unit of Measure					
POS, deg	1.06x10 ⁻²		>30				2.37x10 ⁻²				0.4-1.3	Bonded Strain Gage	Forced Oscillation Control and Readout System (FOECARS)	Static Loading
In-Phase Torque, ft-lb	3.00x10 ⁻³		>30				7.00x10 ⁻³				0-10.1			
Out-of-Phase Torque, ft-lb	7.00x10 ⁻³		>30				3.00x10 ⁻³				0-1.5			
In-Phase Sting Moment, ft-lb	1.89		>30				0				0-120			
Out-of-Phase Sting Moment, ft-lb	1.89		>30				0				0-5			
Normal Force, lb (Static) (Dynamic)	5.10x10 ⁻¹		>30				-1.08x10 ⁻¹				0-600 0-130			
Side Force, lb (Static) (Dynamic)	2.30x10 ⁻¹		>30				-6.30x10 ⁻²				0-10 0-15			
Rolling Moment, ft-lb (Static) (Dynamic)	1.92-02		>30				-5.50-03				0-5 0-3			
Pitching Moment, ft-lb (Static) (Dynamic)	1.06x10 ⁻¹		>30				1.375-02				0-50 0-44			
Yawing Moment, ft-lb (Static) (Dynamic)	4.23-02		>30				-2.83-03				0-40.5 0-48			

*Thompson, J. W. and Abernethy, R. B. et al. "Handbook Uncertainty in Gas Turbine Measurements." ASDC-TR-73-5 (AD 755358), February 1973.

TABLE 3. Continued
c. Basic Dynamic Measurements - Roll Balance

Parameter Designation	STEADY-STATE ESTIMATED MEASUREMENT*										Range	Type of Measuring Device	Type of Recording Device	Method of System Calibration
	Precision Index (S)			Bias (B)			Uncertainty $\pm(B + 1.95S)$							
	Percent of Reading	Unit of Measurement	Degree of Freedom	Percent of Reading	Unit of Measurement	Percent of Reading	Unit of Measurement	Percent of Reading	Unit of Measurement					
POS, deg		0.009	>30		0.002	0.020	0.020	0.5-2.0	Bonded Strain Gages	FORCARS		Static Loading		
In Phase Torque, ft-lb	0.04	3.4x10 ⁻⁴	>30	0.02	1.7x10 ⁻³	0.1	2.3x10 ⁻³	0-2.3						
Out-of-Phase Torque, ft-lb	0.04	3.4x10 ⁻⁴	>30	0.02	1.7x10 ⁻³	0.1	2.3x10 ⁻³	2.3-5.0						
Dynamic and Static Forward Normal Force, lb	0.08	7.0x10 ⁻²	>30	0.022	0.35	0.18	0.5	0-300						
Dynamic and Static Aft Normal Force, lb	0.08	7.0x10 ⁻²	>30	0.022	0.35	0.18	0.5	300-1500						
Dynamic and Static Forward Side Force, lb	0.14	1.1x10 ⁻²	>30	0.01	5.5x10 ⁻²	0.28	0.08	0-28						
Dynamic and Static Aft Side Force, lb	0.14	1.1x10 ⁻²	>30	0.01	5.5x10 ⁻²	0.28	0.08	28-200						

*Thompson, J. W. and Abernethy, R. B. et al. "Handbook Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5 (AD 755356), February 1973.

TABLE 3. Continued
d. Calculated Parameters

Parameter Designation	STEADY-STATE ESTIMATED MEASUREMENT ^a										Parameter	M	RE $\times 10^{-6}$
	Precision Index (S)			Bias (B)			Uncertainty $\pm(B + t_{95}S)$						
	Percent of Reading	Unit of Measure	Degree of Freedom	Percent of Reading	Unit of Measure	Percent of Reading	Unit of Measure	Percent of Reading	Unit of Measure				
P, psf	0.71				2.9		4.3	2722	0.3	2.5			
	0.71				2.9		4.3	2594	0.3	2.5			
	0.63				2.3		3.5	1162	0.6	2.5			
	0.36				1.5		2.2	460	0.6	1.0			
	0.43				1.7		2.6	647	0.95	2.5			
	0.36				1.5		2.2	450	0.95	1.8			
	0.40				1.6		2.4	563	1.05	2.5			
	0.36				1.5		2.2	443	1.05	2.0			
M	0.0009				0.004		0.005	0.3	1.30	2.5			
	0.0009				0.004		0.006	0.3		2.5			
	0.0009				0.003		0.003	0.6		2.5			
	0.0013				0.006		0.008	0.6		1.0			
	0.0008				0.003		0.004	0.95		2.5			
	0.0009				0.004		0.005	0.95		1.8			
	0.0007				0.003		0.004	1.05		2.5			
	0.0008				0.003		0.005	1.05		2.0			
V, ft/sec	0.0007				0.003		0.005	1.30		2.5			
	0.98				4.04		6.01	348	0.3	2.5			
	1.01				4.15		6.17	340	0.3	2.5			
	0.96				3.45		5.36	652	0.6	2.5			
	1.32				5.60		8.24	649	0.6	1.0			
	0.67				2.63		3.97	984	0.95	2.5			
	0.77				3.22		4.76	980	0.95	1.8			
	0.62				2.50		3.74	1069	1.05	2.5			
RE $\times 10^{-6}$, ft ²	0.69				2.85		4.23	1066	1.05	2.0			
	0.55				2.31		3.41	1265	1.30	2.5			
	0.007				0.028		0.042	2.5	0.3				
	0.007				0.030		0.044	2.5	0.3				
	0.003				0.012		0.019	2.5	0.6				
	0.002				0.008		0.012	1.0	0.6				
	0.002				0.006		0.009	2.5	0.95				
	0.001				0.005		0.008	1.8	0.95				
	0.001				0.005		0.008	2.5	1.05				
	0.001				0.005		0.007	2.0	1.05				
	0.001				0.005		0.008	2.5	1.30				

^aAbnerthy, R. B. et al. and Thompson, J. W. "Handbook Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5 (AD 755356), February 1973.

TABLE 3. Continued
d. Calculated Parameters

Parameter Designation	STEADY-STATE ESTIMATED MEASUREMENT*								Parameter	M	RE ×10 ⁻⁶
	Precision Index (S)			Bias (B)		Uncertainty ±(B + t ₉₅ S)					
	Percent of Reading	Unit of Measure-	Degree of Freedom	Percent of Reading	Unit of Measure-	Percent of Reading	Unit of Measure				
Q, psi	0.96				3.92		5.83	172	0.3	2.5	
	0.96				3.92		5.83	163	0.3	2.5	
	0.81				2.90		4.52	293	0.6	2.5	
	0.44				1.86		2.74	116	0.6	1.0	
	0.47				1.77		2.71	409	0.95	2.5	
P/Y CLM-A	0.37				1.49		2.23	284	0.95	1.8	
	0.41				1.55		2.36	435	1.05	2.5	
	0.35				1.38		2.07	342	1.05	2.0	
	0.29				1.10		1.68	473	1.30	2.5	
		0.054			0.045		0.153	0.400	0.3	2.5	
P/Y CLM-AD	0.023				0.018		0.064	-0.236	0.95		
	0.020				-0.016		0.024	-0.751	1.30		
	0.098				-0.097		0.099	-5.794	0.3		
	0.157				-0.068		0.246	-10.108	0.95		
	0.149				-0.072		0.226	-7.855	1.30		
P/Y CLM	0.003				0		0.006	0.099	0.3		
	1.200-03				0		2.400-03	0.039	0.95		
	1.100-03				0		2.200-03	-0.075	1.3		
	0.850				0		1.700	3.457	0.3		
	0.347				0		0.693	4.318	0.95		
CN-A	0.299				0		0.599	5.262	1.3		
	20.340				0		40.680	9.977	0.3		
	22.221				0		44.442	10.745	0.95		
	26.477				0		52.954	55.559	1.3		
		0.08				0.04	0.2	0.257	0.3		
CLM-A	0.060				0.032		0.152	-0.251	0.95		
	0.050				0.03		0.13	-0.838	1.3		
	2.737				-2.700		2.770	-2.847	0.3		
	3.820				-3.66		3.980	-5.138	0.95		
	1.416				0.037		2.87	-4.507	1.3		
CLM-AD	4.327-03				9.347-03		0.018	0.027	0.3		
	3.976-03				1.752-03		9.704-03	0.015	0.95		
	3.227-03				1.458-03		7.912-03	8.119-03	1.3		
	0.225				0.106		0.556	-0.027	0.3		
	0.255				0.119		0.629	0.059	0.95		
CLN-A	0.263				0.123		0.649	-0.190	1.3		

*Bernaethy, R. B. et al. and Thompson, J. W. "Handbook Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5 (AD 755356), February 1973.

TABLE 3. Continued
d. Calculated Parameters

Parameter Designation	STEADY-STATE ESTIMATED MEASUREMENT*								M	RE $\times 10^{-4}$
	Precision Index (S)			Bias (B)		Uncertainty $\pm(B + t_{95S})$				
	Percent of Reading	Unit of Measurement	Degree of Freedom	Percent of Reading	Unit of Measurement	Percent of Reading	Unit of Measurement			
CLL-A	4.561-03 2.286-03 1.463-03			1.586-03 6.163-04 4.977-04			1.070-02 5.188-03 3.424-03	0.026 0.016 3.673-03	0.3 0.95 1.3	2.5
CLL-AD	0.112 0.127 0.131			0.036 0.041 0.042			0.260 0.295 0.304	-0.089 -0.352 -0.046	0.3 0.95 1.3	
P/Y CLN-B	5.825-03 2.686-03 2.768-03			5.042-03 1.876-03 1.602-03			0.017 7.248-03 7.138-03	0.105 0.163 0.243	0.3 0.95 1.3	
P/Y CLN-BD	1.446-02 1.634-02 1.680-02			-7.695-03 -5.731-03 -5.957-03			0.021 0.027 0.027	-0.418 -0.669 -0.604	0.3 0.95 1.3	
P/Y CLN	2.800-04 1.141-04 9.847-04			0 0			5.600-04 2.281-04 1.969-04	-6.644-04 2.643-04 -4.488-04	0.3 0.95 1.3	
CY-B	0.080 0.031 0.027			0 0 0			0.160 0.062 0.054	-0.959 -1.251 -1.43	0.3 0.95 1.3	
CY-BD	2.320 2.669 2.957			0 0 0			4.630 5.339 5.913	-1.181 -1.146 -1.391	0.3 0.95 1.3	
CLN-B	0.031 0.012 9.349-03			0.022 4.536-03 8.441-03			0.084 0.029 0.27	0.101 0.176 0.253	0.3 0.95 1.3	
CLN-BD	0.134 0.100 0.067			0.125 0.076 0.042			0.393 0.276 0.176	-0.554 -0.802 -0.633	0.3 0.95 1.3	
CLM-B	0.145 0.057 0.050			0.057 0.011 0.019			0.347 0.125 0.119	-0.036 0.046 0.022	0.3 0.95 1.3	

*Abernathy, R. B. et al. and Thompson, J. W. "Handbook Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5 (AD 755356), February 1973.

TABLE 3. Concluded
b. Calculated Parameters

Parameter Designation	STEADY-STATE ESTIMATED MEASUREMENT*										M	RE $\times 10^{-6}$
	Precision Index (S)			Bias (B)			Uncertainty $\pm(B + t_{95}S)$			Parameter		
	Percent of Reading	Unit of Measure- ment	Degree of Freedom	Percent of Reading	Unit of Measure- ment	Percent of Reading	Unit of Measure- ment					
CLN-BD	2.539 2.680 2.813		30		0.990 0.195 1.097			6.070 5.555 6.723		0.321 -0.341 2.423	0.3 0.95 1.3	2.5
CLL-B (YAW)	8.272-03 5.623-03 2.076-03				2.774-03 9.240-04 6.738-04			0.019 0.012 0.005		-0.063 -0.162 -0.119	0.3 0.95 1.3	
CLL-BD	0.227 0.0913 0.253				0.073 0.029 0.081			0.531 0.211 0.587		0.299 0.319 0.109	0.3 0.95 1.3	
CLL-B (Roll)	3.1x10 ⁻³ 1.8x10 ⁻³ 1.1x10 ⁻³				3.0x10 ⁻³ 1.7x10 ⁻³ 1.0x10 ⁻³			9.2x10 ⁻³ 5.3x10 ⁻³ 3.2x10 ⁻³		-3.212x10 ⁻³ -0.015 -1.503x10 ⁻²	0.3 0.95 1.3	2.5
CLL-PBD	4.6x10 ⁻³ 7.4x10 ⁻³ 6.3x10 ⁻³				6.7x10 ⁻² 1.1x10 ⁻² 8.9x10 ⁻³			1.6x10 ⁻² 2.7x10 ⁻² 2.1x10 ⁻²		-2.590x10 ⁻¹ -3.382x10 ⁻¹ -3.347x10 ⁻¹	0.3 0.95 1.3	2.5
CLN-PBD	7.0x10 ⁻³ 1.2x10 ⁻² 9.7x10 ⁻³				7.1x10 ⁻² 0.12 9.0x10 ⁻²			9.0x10 ⁻² 0.14 0.11		-2.4x10 ⁻² 5.176x10 ⁻² 4.126x10 ⁻²	0.3 0.95 1.3	2.5
CY PBD	0.02 2.1x10 ⁻² 2.2x10 ⁻²				0.28 0.24 0.17			0.32 0.26 0.21		2.658x10 ⁻¹ -5.025x10 ⁻² -1.464x10 ⁻¹	0.3 0.95 1.3	2.5
CN								0.022 6.221-03 3.915-03		0.600 0.758 0.656	0.3 0.95 1.3	
CY	-				-			0.029 1.219-03 1.053-03		4.14-04 5.850-04 2.847-03	0.3 0.95 1.3	
CLL	-				-			9.760-04 4.100-04 3.540-04		-4.650-04 -1.200-05 6.370-04	0.3 0.95 1.3	
CLN	-				-			6.000-03 2.100-03 1.814-03		0.100 0.047 -0.082	0.3 0.95 1.3	
CLN	-				-			4.140-04 1.740-04 1.500-04		5.600-05 1.430-04 -6.550-04	0.3 0.95 1.3	

*Abernethy, R. B. et al. and Thompson, J. W. "Handbook Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5 (AD 755356), February 1973.

APPENDIX III

SAMPLE OF TABULATED AND PLOTTED DATA

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I

JAC INC
 RESEARCH CORPORATION COMPANY
 SUBSIDIARY WIND TUNNEL
 ARRLAND AIR FORCE STATION, TENNESSEE

TEST 49A RUN 57
 SUMMARY 1

AEDC DYNAMIC STABILITY

TRANSONIC 4T

CONFID	PAC	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1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1. DATE 10-DE-80 PROJECT NO 741C-VI

AEC L STON
A SUPERIOR CORPORATION COMPANY

PROPULSION WIND TUNNEL
WALTON AIR FORCE STATION, TENNESSEE

TEST 494 RUN 52
SUMMARY 2

AEDC DYNAMIC STABILITY

TRANSONIC 47

CONFID PAC

9 1

IP	N	REX10-A	ALPHA	PQS	OMEGA	RFP	CLN-A	CLN-AD	CLN-A	CLN-AD	CLN-A	CLN-AD	P/Y	CLM-A	P/Y	CLM-AD
1	1.052	2.00	0.51	0.925	47.18	0.0138	1.7081E+00	-7.2433E-02	-6.3102E-01	-6.6965E+00	1.2046E-02	6.7109E-02	-6.6036E-01	-8.2029E+00		
2	1.052	2.00	0.51	0.924	47.18	0.0138	6.9053E-01	-7.3328E-02	-6.1466E-01	-5.6223E+00	1.3590E-02	-8.7996E-03	-6.7751E-01	-8.4142E+00		
3	1.042	2.00	0.51	0.995	47.19	0.0138	4.6521E-01	-7.3426E-02	-6.2682E-01	-6.0803E+00	1.3397E-02	-2.3586E-02	-6.8213E-01	-8.3726E+00		
5	1.042	2.00	-3.35	0.980	46.69	0.0137	6.2071E-02	-6.6297E-02	-3.7216E-01	-1.3421E+01	6.3311E-03	6.5525E-02	-4.7794E-01	-1.6635E+01		
6	1.042	2.00	-3.35	0.980	46.70	0.0137	1.2928E-01	-6.6147E-02	-3.7637E-01	-1.5122E+01	5.6093E-03	2.0475E-01	-4.7635E-01	-1.6511E+01		
7	1.042	2.00	-3.35	0.979	46.69	0.0136	1.1180E-01	-6.6114E-02	-3.5682E-01	-1.4624E+01	4.9555E-03	1.7313E-01	-4.7428E-01	-1.6837E+01		

b. Dynamic Data

Sample 1. Continued

DATE 10-25-00 PROJECT NO P41C-X1

ABC, INC.

AEDC DIVISION

A. SKEWER CORPORATION COMPANY

PROPELLSION WIND TUNNEL

WALL AIR FORCE STATION, TENNESSEE

TEST 494 RUN 57

SUMMARY 3

AEDC DYNAMIC STABILITY

TRANSONIC 47

CONFIG PNC

9 1

TR	M	DEX	A	ALPHA	POS	OMEGA	REP	CLL-A	CLL-AD	CLN-A	CLN-AD
1	1.050	2.00	0.51	0.995	47.18	0.0138	2.7149E-02	-1.4432E-01	1.2046E-02	6.7109E-02	
2	1.050	2.00	0.51	0.994	47.18	0.0138	2.7314E-02	-1.4528E-01	1.3590E-02	8.7996E-03	
3	1.040	2.00	0.51	0.995	47.19	0.0138	2.6854E-02	-1.4036E-01	1.3397E-02	2.3586E-02	
4	1.040	2.00	-3.35	0.980	46.69	0.0137	3.0545E-03	-7.9749E-02	6.3311E-03	6.5525E-02	
5	1.040	2.00	-3.35	0.980	46.70	0.0137	2.9096E-03	-9.1333E-02	5.6093E-03	2.0475E-01	
6	1.040	2.00	-3.35	0.979	46.69	0.0136	2.9037E-03	-1.1424E-01	4.9555E-03	1.7313E-01	

c. Cross-Coupling Data

Sample 1. Concluded

DATE 11-DEC-80 PROJECT NO P41C-X1

ARC, INC.

AERC DIVISION

A EVERBLP CORPORATION COMPANY

PREFLUTIN WIND TUNNEL

ARACID AIR FORCE STATION, TENNESSEE

TEST 494 RUN 94

SUMMARY 1

AERC DYNAMIC STABILITY

TRANSONIC 4T

CONFIG PNC
9 5

IP	Y	REX10-6	ALPHA	CN	CLM	CY	CLN	CLL	NCP	YCP	P/Y CLN
1	1.052	2.01	0.14	-7.2467E-02	6.7385E-02	-2.6594E-03	8.9387E-04	-5.2893E-05	-9.2986E-01	-3.3607E-01	2.8188E-04
2	1.052	2.01	0.14	-7.2368E-02	6.7224E-02	-2.7014E-03	9.0374E-04	-5.0305E-05	-9.2892E-01	-3.3455E-01	2.8644E-04
3	1.052	2.01	0.14	-7.2662E-02	6.7166E-02	-2.5554E-03	8.9333E-04	-5.0187E-05	-9.2436E-01	-3.4816E-01	2.9138E-04
4	1.045	2.00	-3.97	-4.3309E-01	1.0898E-01	-1.9933E-03	8.5981E-04	-5.0600E-04	-2.5065E-01	-4.3343E-01	2.1680E-04
5	1.044	1.99	-3.98	-4.4936E-01	1.0724E-01	-2.0520E-03	8.7073E-04	-5.2219E-04	-2.3865E-01	-4.2435E-01	2.1988E-04
6	1.042	1.99	-3.98	-4.5265E-01	1.0602E-01	-2.1282E-03	8.7798E-04	-5.2552E-04	-2.3421E-01	-4.1254E-01	2.1002E-04
23	1.042	2.01	5.27	3.7648E-01	1.7814E-02	-3.9383E-03	4.4483E-04	1.3719E-02	4.7319E-02	-1.1153E-01	1.4129E-04
24	1.042	1.98	5.28	3.9320E-01	1.9577E-02	-4.1240E-03	4.7241E-04	1.4025E-03	4.9774E-02	-1.1153E-01	1.4832E-04
25	1.051	1.99	5.28	3.9239E-01	1.7677E-02	-4.1770E-03	4.5881E-04	1.3991E-03	4.5049E-02	-1.0984E-01	1.6211E-04
26	1.048	2.01	10.37	0.1303E-01	5.0613E-02	-1.0991E-02	4.5379E-04	2.3663E-03	-6.1225E-02	4.1286E-02	-1.0528E-03
27	1.049	2.00	10.37	0.1581E-01	5.2644E-02	-1.0967E-02	4.9424E-04	2.3848E-03	-6.4553E-02	4.4798E-02	-1.0947E-03
28	1.051	2.01	10.37	0.1319E-01	5.3677E-02	-1.1222E-02	5.0680E-04	2.3876E-03	-6.6008E-02	4.5145E-02	-1.1086E-03
29	1.047	2.00	13.37	9.9082E-01	-1.1588E-01	-1.2544E-02	5.2337E-04	-5.9167E-03	-1.1693E-01	4.1717E-02	-1.1202E-03
30	1.052	2.00	13.38	9.9450E-01	-1.0334E-01	-1.2624E-02	4.8313E-04	-6.2391E-03	-1.0370E-01	4.8238E-02	-1.1073E-03
31	1.049	1.99	13.38	9.9666E-01	-9.8235E-02	-1.2964E-02	4.6831E-04	-6.4136E-03	-9.8269E-02	3.6123E-02	-1.1038E-03
32	1.042	1.99	15.43	1.2254E+00	-1.1978E-01	-1.3574E-02	2.1783E-03	-7.8376E-03	-9.6931E-02	-1.6347E-01	1.6152E-03
33	1.049	1.99	15.40	1.1629E+00	-1.3136E-01	-1.3033E-02	2.3704E-03	-7.8417E-03	-1.1296E-01	-1.7130E-01	1.7533E-03
34	1.051	1.99	15.39	1.1367E+00	-1.3690E-01	-1.3713E-02	2.3856E-03	-7.8351E-03	-1.2044E-01	-1.7397E-01	1.7627E-03
35	1.052	2.00	14.39	1.0701E+00	-1.1814E-01	-1.3091E-02	8.3069E-04	-7.4662E-03	-1.1040E-01	-6.3454E-02	2.6162E-04
36	1.052	2.00	14.39	1.0708E+00	-1.1554E-01	-1.3404E-02	7.5613E-04	-7.4324E-03	-1.10790E-01	-5.6401E-02	1.7651E-04
37	1.052	2.00	14.39	1.0677E+00	-1.1681E-01	-1.3436E-02	7.5920E-04	-7.4267E-03	-1.0941E-01	-5.6505E-02	1.4916E-04

a. Static Data

Sample 2. Yaw Tabulated Data

DATE 11-DEC-80 PROJECT NO P410-X1

ARC, INC.

AEC DIVISION

A. SVERDRUP CORPORATION COMPANY

PROPOSED WIND TUNNEL

AROLD AIR FORCE STATION, TENNESSEE

TEST 494 RUN 94

AEDC DYNAMIC STABILITY

SUMMARY 2

TRANSONIC 4Y

ENSEMBL 9 PDC 5

TR	P	SEX10-6	ALPHA	POS	OMEGA	RFP	CY-B	CY-BD	CLN-B	CLN-BD	CLM-B	CLM-BD	P/Y	CLN-B	P/Y	CLN-B
1	1.052	2.01	0.14	0.940	26.21	0.0202-9.1623E-01	1.1338E+00	1.7816E-01	6.4282E-01	1.2062E-03	2.0062E-01	2.4928E-01	2.4928E-01	5.1125E-01	2.4928E-01	5.1125E-01
2	1.052	2.01	0.14	0.981	26.21	0.0202-9.0953E-01	1.3861E+00	2.1522E-01	7.2417E-01	1.0724E-03	5.7479E-01	2.5914E-01	2.5914E-01	5.1942E-01	2.5914E-01	5.1942E-01
3	1.052	2.01	0.14	0.903	26.21	0.0202-9.9757E-01	1.1933E+00	2.6563E-01	6.7510E-01	4.5344E-03	4.0159E-01	2.4894E-01	2.4894E-01	5.0601E-01	2.4894E-01	5.0601E-01
4	1.042	2.00	-3.97	0.927	27.32	0.0211-9.7253E-01	1.3300E+00	3.4109E-01	5.3217E-01	3.0799E-03	3.1329E-01	3.3923E-01	3.3923E-01	5.9754E-01	3.3923E-01	5.9754E-01
5	1.042	1.99	-3.98	0.906	27.32	0.0211-9.7642E-01	1.2485E+00	3.5858E-01	5.0505E-01	1.6436E-03	3.8480E-01	3.4958E-01	3.4958E-01	4.0422E-01	3.4958E-01	4.0422E-01
6	1.042	1.99	-3.98	0.907	27.32	0.0212-9.7233E-01	1.2087E+00	3.5628E-01	4.8855E-01	1.4371E-03	5.6581E-01	3.4378E-01	3.4378E-01	4.2167E-01	3.4378E-01	4.2167E-01
23	1.042	2.01	5.27	1.004	25.60	0.0198-8.6084E-01	1.3589E+00	2.1640E-01	8.1173E-01	3.0057E-02	2.9720E-01	2.0435E-01	2.0435E-01	6.2006E-01	2.0435E-01	6.2006E-01
24	1.042	1.98	5.28	1.002	25.53	0.0198-8.6562E-01	1.3475E+00	2.1659E-01	8.2836E-01	2.8708E-02	5.4219E-02	2.0188E-01	2.0188E-01	6.1453E-01	2.0188E-01	6.1453E-01
25	1.051	1.99	5.28	0.909	25.53	0.0197-8.6343E-01	1.5397E+00	2.1679E-01	7.5977E-01	3.2399E-02	2.3489E-01	1.9736E-01	1.9736E-01	6.1561E-01	1.9736E-01	6.1561E-01
26	1.042	2.01	10.37	0.907	25.95	0.0201-8.9707E-01	1.0911E+00	2.4308E-01	6.5379E-01	3.9399E-02	2.1827E-01	2.3182E-01	2.3182E-01	4.7654E-01	2.3182E-01	4.7654E-01
27	1.042	2.00	10.37	0.903	25.95	0.0201-8.9092E-01	1.0668E+00	2.4312E-01	6.9550E-01	3.9399E-02	2.1827E-01	2.3182E-01	2.3182E-01	4.7654E-01	2.3182E-01	4.7654E-01
28	1.051	2.01	10.37	0.909	25.95	0.0200-8.9925E-01	1.0873E+00	2.4910E-01	6.4711E-01	2.5853E-02	1.8669E-01	2.3179E-01	2.3179E-01	4.6230E-01	2.3179E-01	4.6230E-01
29	1.047	2.00	13.37	0.966	25.63	0.0199-8.3207E-01	1.4297E+00	2.1817E-01	8.6363E-01	8.1615E-02	2.3317E-01	2.2806E-01	2.2806E-01	5.4674E-01	2.2806E-01	5.4674E-01
30	1.051	2.00	13.38	0.986	25.63	0.0198-8.3170E-01	1.2097E+00	2.1954E-01	9.2626E-01	8.1969E-02	3.1873E-01	2.0831E-01	2.0831E-01	5.7463E-01	2.0831E-01	5.7463E-01
31	1.042	1.99	13.38	0.986	25.63	0.0198-8.3201E-01	1.3554E+00	2.1393E-01	9.2207E-01	8.6120E-02	3.1046E-01	2.0055E-01	2.0055E-01	5.5639E-01	2.0055E-01	5.5639E-01
32	1.042	1.99	15.43	0.981	25.17	0.0195-8.1534E-01	1.6672E+00	1.6398E-01	1.0969E+00	7.4296E-02	1.5162E-01	1.7114E-01	1.7114E-01	7.6867E-01	1.7114E-01	7.6867E-01
33	1.042	1.99	15.40	0.985	25.17	0.0195-8.0504E-01	1.8325E+00	1.6396E-01	1.0379E+00	7.6792E-02	7.1990E-02	1.7082E-01	1.7082E-01	7.5811E-01	1.7082E-01	7.5811E-01
34	1.051	1.99	15.39	0.903	25.17	0.0195-8.0841E-01	1.8965E+00	1.8568E-01	1.1410E+00	8.1526E-02	5.7890E-02	1.7087E-01	1.7087E-01	8.0655E-01	1.7087E-01	8.0655E-01
35	1.052	2.00	14.39	0.903	25.29	0.0195-7.9283E-01	1.6991E+00	1.8685E-01	1.0415E+00	9.9445E-02	2.4934E-01	1.8130E-01	1.8130E-01	6.7961E-01	1.8130E-01	6.7961E-01
36	1.052	2.00	14.39	0.904	25.29	0.0195-7.9809E-01	1.6296E+00	1.8952E-01	9.5612E-01	9.2348E-02	1.5981E-02	1.8489E-01	1.8489E-01	6.8492E-01	1.8489E-01	6.8492E-01
37	1.052	2.00	14.39	0.993	25.29	0.0195-7.9343E-01	1.5760E+00	1.8716E-01	9.4322E-01	9.0885E-02	7.8425E-02	1.815E-01	1.815E-01	7.0433E-01	1.815E-01	7.0433E-01

b. Dynamic Data

Sample 2. Continued

PAGE 11-7E-80 PROJECT NO P41C-X1

APC, INC.

AEC DIVISION

A SVERDRUP CORPORATION COMPANY

PROPULSION WIND TUNNEL

ARABOLD AIR FORCE STATION, TENNESSEE

TEST 62A RUN 94

SUMMARY 3

AEDC DYNAMIC STABILITY

TRANSONIC 4T

CONFID 9 5

IP	M	REX10-6	ALPHA	PDS	OMEGA	RFP	CLL-B	CLL-BD	CLM-B	CLM-BD
1	1.052	2.01	0.14	0.940	26.21	0.0202-4.2121E-03	1.1437E-01	1.1437E-01	6.2062E-03	2.0062E-01
2	1.052	2.01	0.14	0.981	26.21	0.0202-4.1255E-02	1.0799E-01	1.0724E-02	5.7479E-01	1.0724E-01
3	1.052	2.01	0.14	0.998	26.21	0.0202-4.0721E-03	1.0575E-01	1.0575E-01	4.5344E-03	4.8159E-01
4	1.040	2.00	-3.97	0.997	27.32	0.0211-5.8901E-02	1.1004E-01	1.1004E-01	3.0799E-03	3.1379E-01
5	1.040	1.99	-3.98	0.996	27.32	0.0211-4.0314E-02	1.1319E-01	1.1319E-01	1.6406E-03	3.8480E-01
6	1.047	1.99	-3.98	0.997	27.32	0.0212-4.0113E-02	1.1442E-01	1.1442E-01	1.4371E-03	5.6581E-01
23	1.040	2.01	5.27	1.004	25.60	0.0193-1.0723E-01	1.0954E-01	1.0954E-01	3.0057E-02	2.9720E-01
24	1.040	1.98	5.28	1.022	25.53	0.0198-1.0921E-01	8.0189E-02	8.0189E-02	2.8708E-02	5.4219E-02
25	1.051	1.99	5.28	0.999	25.53	0.0197-1.0913E-01	7.4852E-02	7.4852E-02	3.2899E-02	2.3489E-01
26	1.040	2.01	10.37	0.997	25.95	0.0201-1.6092E-01	4.7255E-02	4.7255E-02	3.9399E-02	2.1827E-01
27	1.040	2.00	10.37	0.993	25.95	0.0201-1.6524E-01	4.8406E-02	4.8406E-02	3.701E-02	1.8669E-01
28	1.051	2.01	10.37	0.998	25.95	0.0200-1.6495E-01	4.2379E-02	4.2379E-02	2.3653E-02	1.9927E-01
29	1.047	2.00	13.37	0.986	25.63	0.0199-2.3191E-01	1.7849E-02	1.7849E-02	8.1616E-02	2.3317E-01
30	1.051	2.00	13.38	0.986	25.63	0.0198-2.3665E-01	2.9037E-02	2.9037E-02	8.1969E-02	3.1873E-01
31	1.047	1.99	13.38	0.986	25.63	0.0198-2.4065E-01	6.7700E-02	6.7700E-02	8.6120E-02	3.1046E-01
32	1.040	1.99	15.43	0.981	25.17	0.0195-2.0712E-01	1.4823E-01	1.4823E-01	7.4296E-02	1.5162E-01
33	1.040	1.99	15.40	0.985	25.17	0.0195-2.1165E-01	1.5795E-01	1.5795E-01	7.6792E-02	7.1990E-02
34	1.051	1.99	15.39	0.983	25.17	0.0195-2.1406E-01	1.6827E-01	1.6827E-01	8.1528E-02	5.7890E-02
35	1.052	2.00	14.39	0.993	25.29	0.0195-2.3400E-01	4.6500E-02	4.6500E-02	9.9445E-02	2.4934E-01
36	1.052	2.00	14.39	0.994	25.29	0.0195-2.3649E-01	2.9533E-02	2.9533E-02	9.2149E-02	1.5981E-02
37	1.052	2.00	14.39	0.993	25.29	0.0195-2.3698E-01	3.4607E-03	3.4607E-03	9.0685E-02	7.8425E-02

DATE 16-DEC-80 PROJECT 80 PAIC-X1

AEC, INC.

AEC Division

A SUBURBAN CORPORATION COMPANY

PRODUCTION AND TUNING

ARMED AIR FORCE STATION, TENNESSEE

TEST 694 RUN 123

SUMMARY 1

AIRC DYNAMIC STABILITY

TRANSONIC 4T

- CONFIG

- BIC1W2V1T05SOF1T1

TP	N	MEXID-N	ALPHA	CN	CLM	CY	CLN	CLT	NCP	YCP
1	0.600	1.02	-0.07	-6.5941E-02	6.5204E-02	-3.4062E-03	1.6037E-04	2.7639E-04	-9.6944E-01	-4.7041E-02
2	0.601	1.02	-0.07	-6.6318E-02	6.5785E-02	-3.6842E-03	1.7565E-04	2.8131E-04	-9.9200E-01	-4.7675E-02
3	0.602	1.02	5.01	2.5805E-01	6.7720E-02	-4.3536E-03	-4.1846E-04	-3.0960E-05	2.6243E-01	4.9615E-02
4	0.599	1.02	5.02	2.6478E-01	6.8907E-02	-4.9848E-03	-4.3436E-04	-7.1528E-05	2.6027E-01	4.6539E-02
5	0.601	1.02	10.07	5.6426E-01	8.2069E-02	-1.5204E-02	-1.8621E-03	-2.5647E-03	1.4545E-01	1.2237E-01
6	0.594	1.02	10.07	5.7709E-01	8.4434E-02	-1.5348E-02	-1.8526E-03	-2.6404E-03	1.4631E-01	1.2010E-01
7	0.601	1.02	15.10	8.2290E-01	8.1454E-02	-3.7423E-02	5.0500E-03	-1.5175E-02	9.4084E-02	-1.3374E-01
8	0.594	1.02	15.10	8.3137E-01	8.1904E-02	-3.8543E-02	5.1541E-03	-1.5200E-02	9.8630E-02	-1.3372E-01
9	0.601	1.03	7.53	4.5238E-01	7.2142E-02	-1.7390E-02	-1.1572E-03	-2.5170E-04	1.5943E-01	6.8513E-02
10	0.594	1.02	7.55	4.6124E-01	7.2990E-02	-1.6453E-02	-1.2190E-03	-2.5107E-04	1.5823E-01	7.4090E-02
11	0.600	1.02	5.02	2.8023E-01	6.8230E-02	-1.2842E-02	-4.3817E-04	-5.9440E-05	2.4344E-01	3.8936E-02
12	0.601	1.03	5.02	2.7036E-01	6.8645E-02	-1.2070E-02	-4.4146E-04	-5.9260E-05	2.5390E-01	3.6577E-02
13	0.601	1.03	2.84	6.1554E-02	7.2974E-02	-9.6505E-03	-1.6230E-04	-3.6494E-05	7.7178E-01	1.8025E-02
14	0.539	1.02	2.47	8.3907E-02	7.2420E-02	-9.4774E-03	-1.9772E-04	-9.1698E-05	8.6889E-01	2.0862E-02
15	0.539	1.02	4.00	1.6760E-01	7.5130E-02	-9.8352E-03	-3.7632E-04	-1.9000E-04	4.1145E-01	3.8275E-02
16	0.600	1.03	4.00	1.8418E-01	7.3764E-02	-9.3437E-03	-2.7029E-04	2.1381E-04	4.0055E-01	2.6928E-02
17	0.500	1.02	6.63	3.3112E-01	6.9054E-02	-1.0067E-02	-5.7019E-04	-2.9740E-06	2.0455E-01	5.6618E-02
18	0.601	1.03	6.03	3.4925E-01	6.5802E-02	-1.1162E-02	-6.5831E-04	-8.8767E-06	1.8841E-01	5.6977E-02
19	0.601	1.03	15.10	8.2955E-01	8.2326E-02	-3.6280E-02	5.1073E-03	-1.5174E-02	9.9247E-02	-1.3077E-01
20	0.601	1.03	15.10	8.3157E-01	8.2540E-02	-3.6905E-02	5.1080E-03	-1.5190E-02	9.9259E-02	-1.3841E-01
21	0.599	1.02	15.10	8.3129E-01	8.4042E-02	-3.6284E-02	5.2155E-03	-1.5307E-02	1.0110E-01	-1.4102E-01
22	0.601	1.03	15.10	8.2911E-01	8.3527E-02	-3.7527E-02	5.1034E-03	-1.5220E-02	1.0074E-01	-1.3599E-01

a. Static Data

Sample 3. Roll Tabulated Data

DATE 16-DEC-80 PROJECT NO P41C-Y1

APOL, INC.

AEC DIVISION

A SUBSIDIARY CORPORATION COMPANY

PROPOSITION: RING TUBE

APOL AIR FORCE STATION, TENNESSEE

TEST 604 RUN 123
SUMMARY 2

AEC DYNAMIC STABILITY

TRANSDUC 47

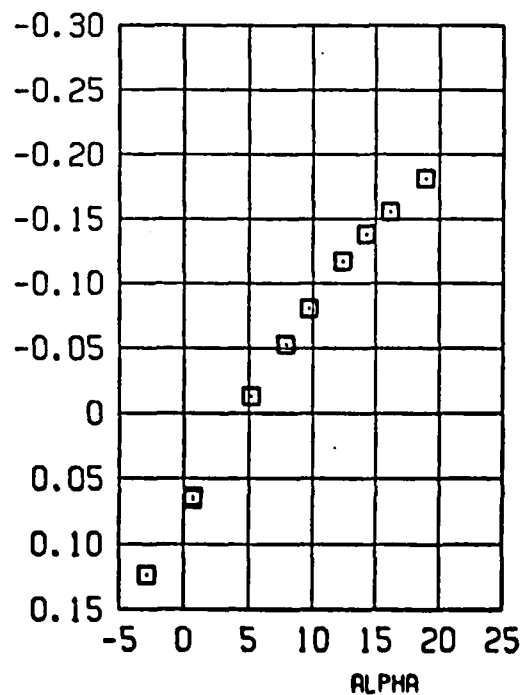
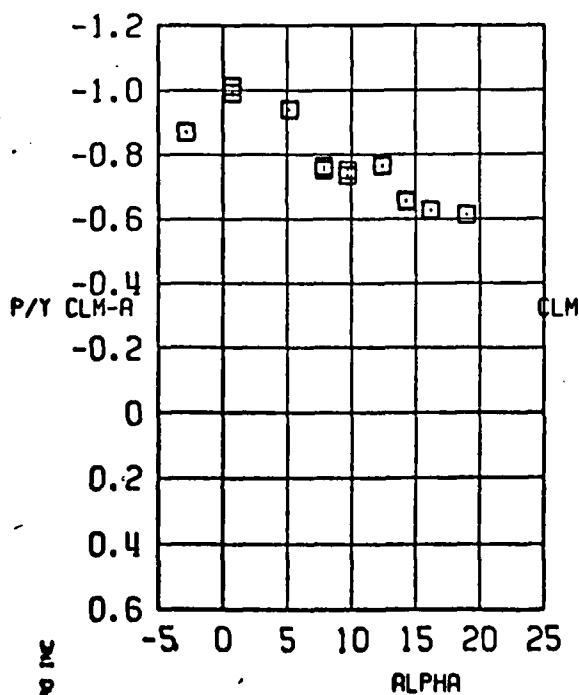
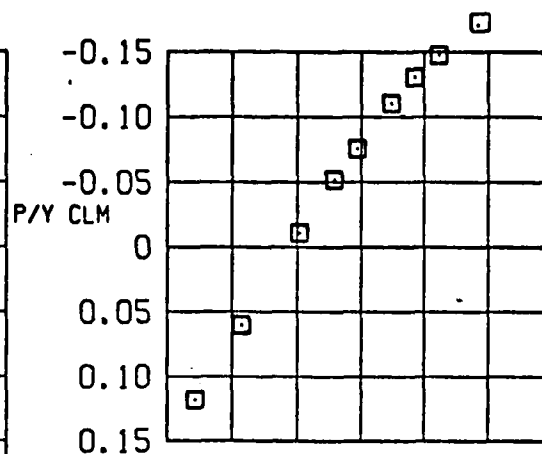
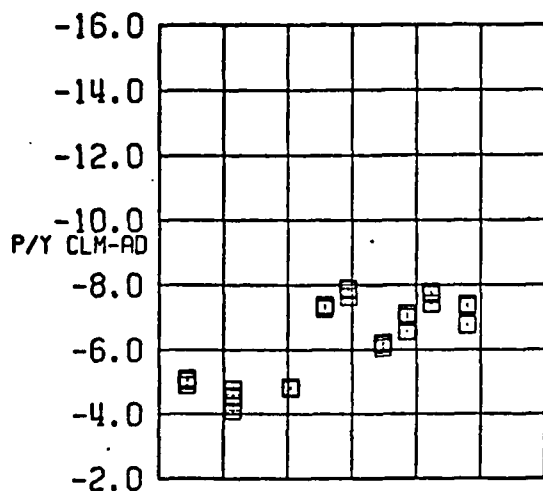
CONFIG

-BIC1W2V170SSOF171

TP	4	REF10-6	ALPHA	POS	OMEGA	REP	CL1-A	CL1-PID	CL1-PID	CYPID
1	0.600	1.02	-0.07	1.504	53.20	0.0670	-1.7703F-03	-2.8233F-01	-0.0195F-02	5.0799F-01
2	0.601	1.02	-0.07	1.504	53.20	0.0673	-1.9197F-03	-2.8609F-01	-3.0416F-02	3.4995F-01
3	0.602	1.02	5.01	1.504	53.34	0.0675	-7.0450F-03	-4.8433F-01	6.0644F-02	-1.5461F-01
4	0.599	1.02	5.02	1.504	53.34	0.0679	-6.8497F-03	-4.8403F-01	7.5551F-02	4.7792F-01
5	0.601	1.02	10.07	1.495	53.45	0.0677	-9.1304F-03	-2.0176F-01	-1.5042F-02	6.2244F-01
6	0.598	1.02	10.07	1.494	53.45	0.0680	-9.1244F-03	-2.0057F-01	2.4265F-05	1.7521F-01
7	0.601	1.02	15.10	1.491	53.45	0.0682	-2.6346F-02	-2.2387F-01	1.0450F-01	-0.0094F-01
8	0.598	1.02	15.10	1.492	53.84	0.0685	-2.4074F-02	-2.1175F-01	3.0005F-02	-1.4896F-01
9	0.601	1.03	7.54	1.494	53.29	0.0676	-5.9554F-03	-2.0410F-01	-2.8202F-02	1.6523F-01
10	0.598	1.02	7.55	1.494	53.29	0.0679	-6.2527F-03	-1.1916F-01	-5.7325F-02	1.5345F-01
11	0.600	1.02	5.02	1.502	53.29	0.0677	-7.7447F-03	-4.7043F-01	-5.5436F-02	-2.0630F-01
12	0.601	1.03	5.02	1.502	53.29	0.0676	-7.6264F-03	-4.7433F-01	-8.6100F-02	1.3850F-01
13	0.601	1.03	2.48	1.507	53.29	0.0676	-4.8167F-03	-3.0052F-01	-8.7401F-02	1.3850F-01
14	0.599	1.02	2.47	1.508	53.29	0.0678	-1.7679F-03	-2.0660F-01	-1.5040F-02	4.4833F-01
15	0.599	1.02	4.00	1.502	53.29	0.0674	-6.3467F-03	-1.4853F-01	-8.7071F-02	3.2730F-01
16	0.600	1.03	4.00	1.501	53.29	0.0677	-6.7516F-03	-1.4545F-01	-2.8141F-02	-5.9221F-03
17	0.606	1.02	6.03	1.506	53.36	0.0678	-7.2537F-03	-3.3414F-01	-4.1743F-02	2.5900F-01
18	0.601	1.03	6.03	1.506	53.36	0.0677	-7.2651F-03	-3.2629F-01	-8.4819F-02	1.5076F-01
19	0.601	1.03	15.10	1.491	53.78	0.0682	-2.6194F-02	-1.9403F-01	1.5026F-02	2.7682F-01
20	0.601	1.03	15.10	1.486	53.78	0.0682	-2.5617F-02	-2.1174F-01	1.5810F-02	1.0574F-01
21	0.599	1.02	15.10	1.490	53.78	0.0682	-2.6422F-02	-2.0746F-01	3.0333F-02	1.9876F-01
22	0.601	1.03	15.10	1.487	53.79	0.0682	-2.8242F-02	-2.0268F-01	-1.3137F-02	9.1185F-02

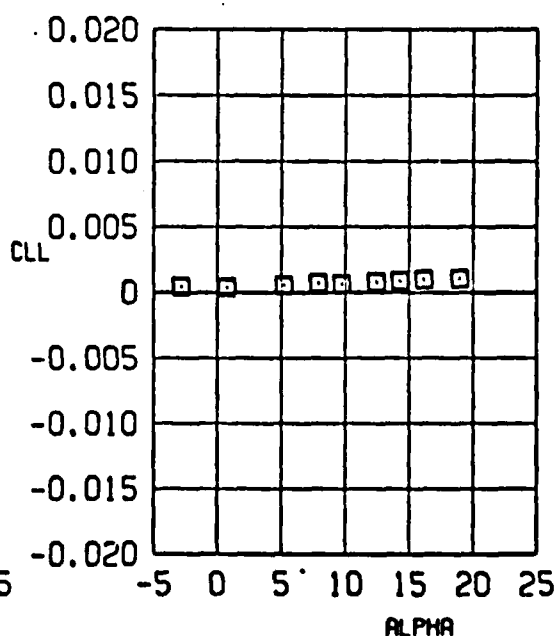
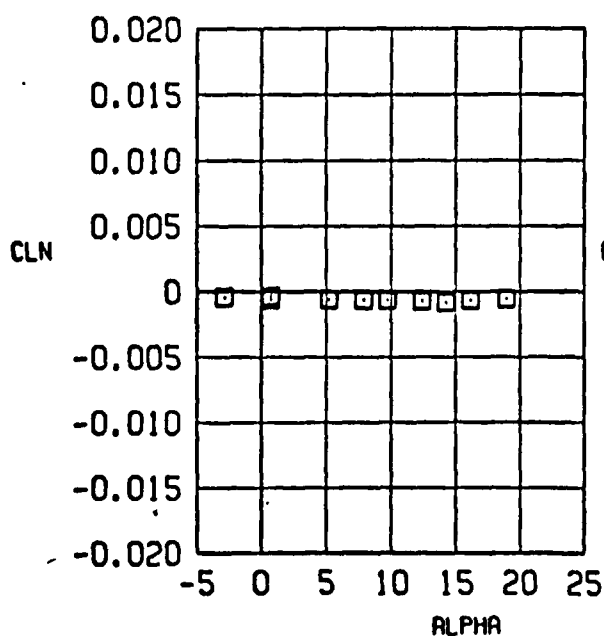
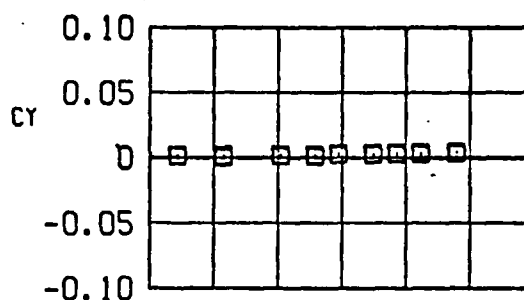
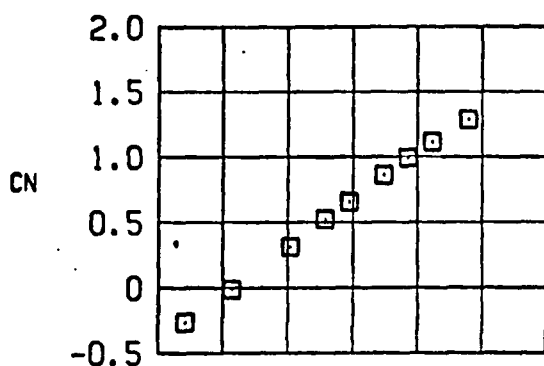
b. Dynamic Data
Sample 3. Concluded

SYM	CONFIGURATION	M	REX10 ⁻⁶	RFP	RUN
□	-B1C1W1V1T05S1F111	1.30	2.50	0.01	45



Sample 4. Pitch Plotted Data

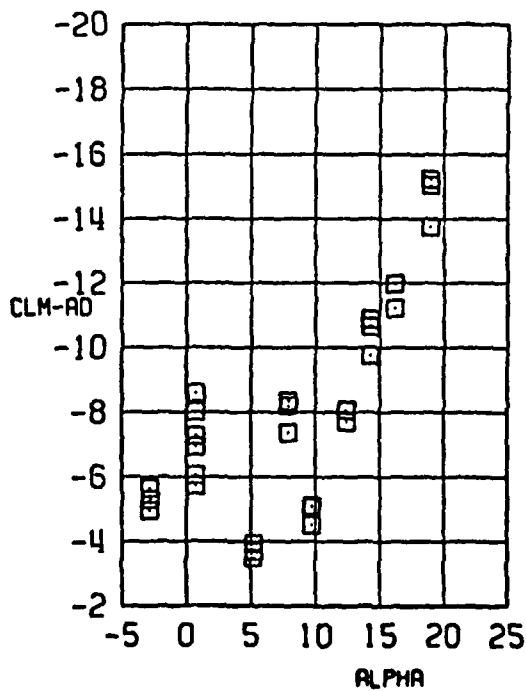
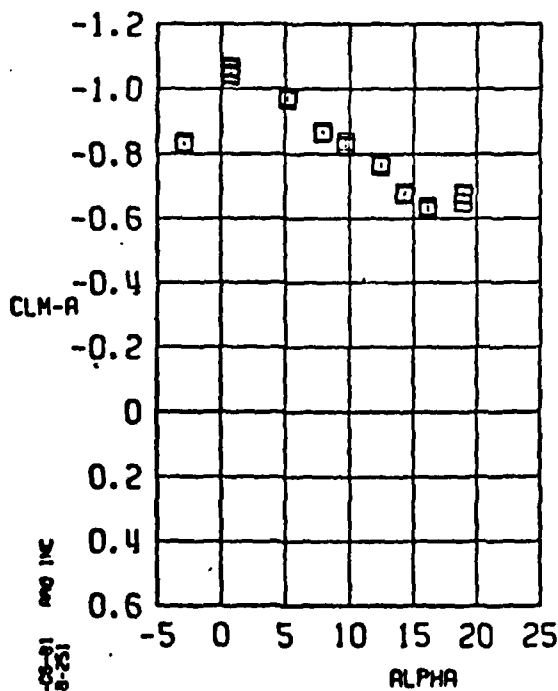
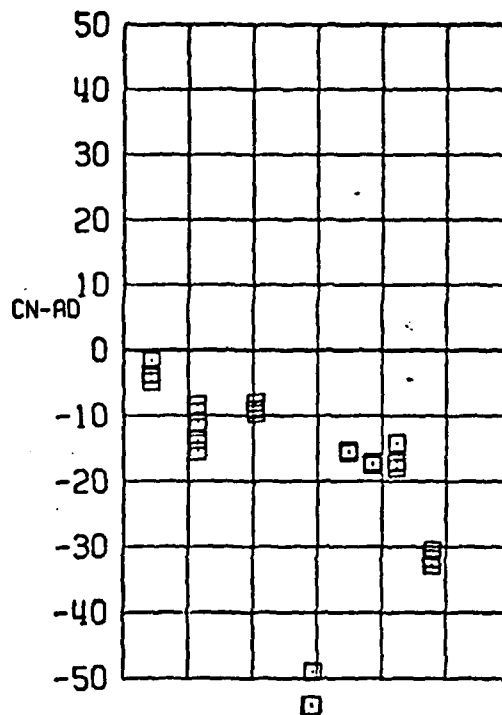
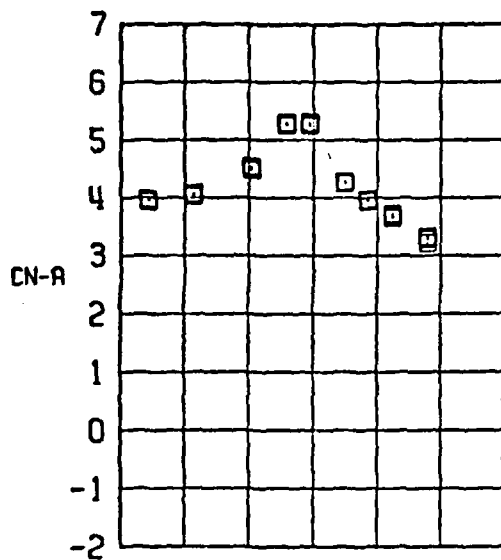
SYM	CONFIGURATION	M	REX10 ⁻⁶	RFP	RUN
□	-B1C1W1V1T05S1F111	1.30	2.50	0.01	45



Sample 4. Continued

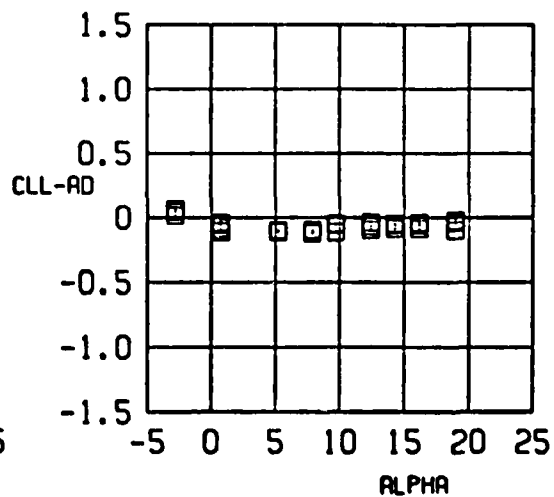
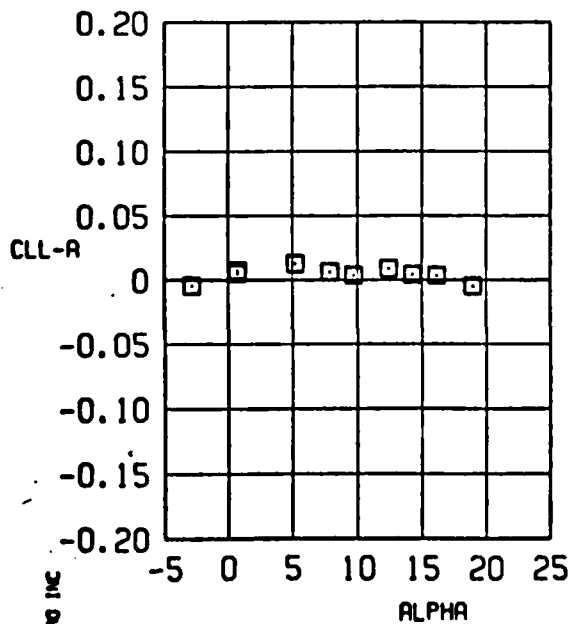
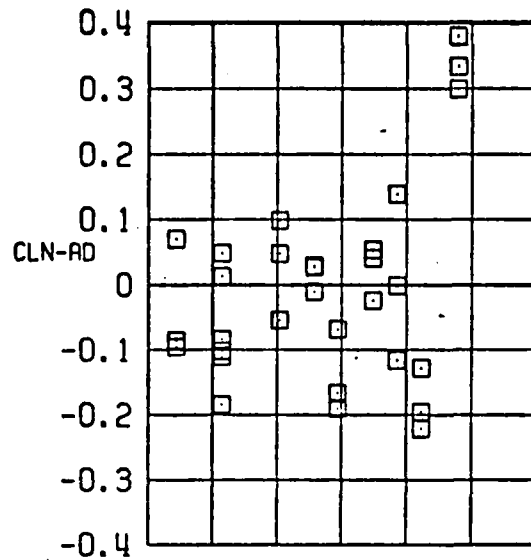
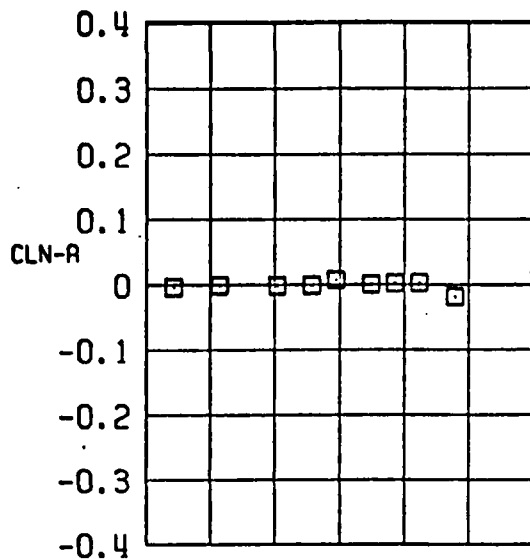
DATE 02-05-81
 PROJ. P-50-201
 AND INC

SYM	CONFIGURATION	M	REX10 ⁻⁶	RFP	RUN
□	-B1C1W1V1T0SS1F111	1.30	2.50	0.01	45



15-08-91
 16-08-91
 17-08-91

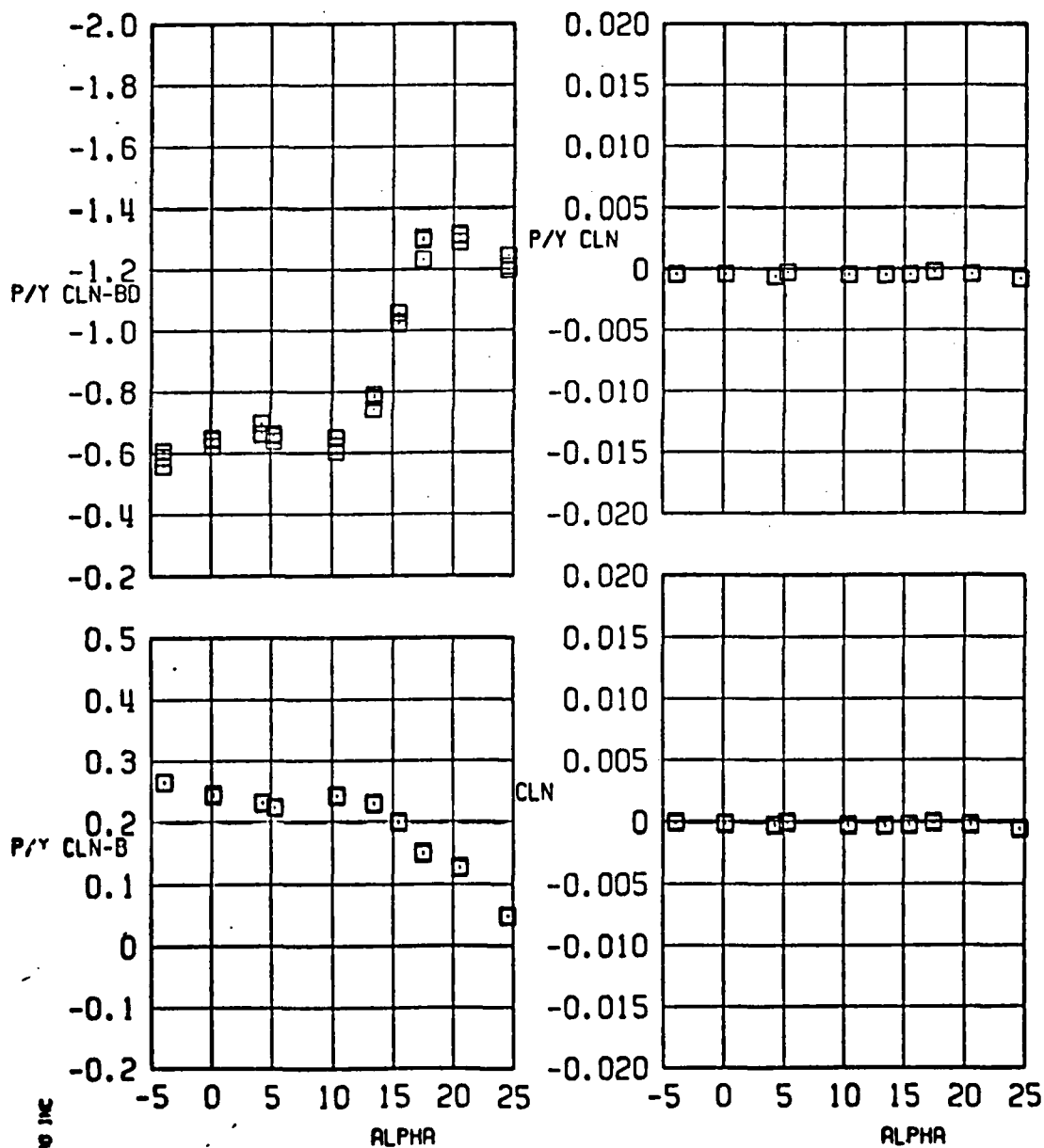
SYM	CONFIGURATION	M	REX10 ⁻⁶	RFP	RUN
□	BIC1WIV1T05SIF111	1.30	2.50	0.01	45



Sample 4. Concluded

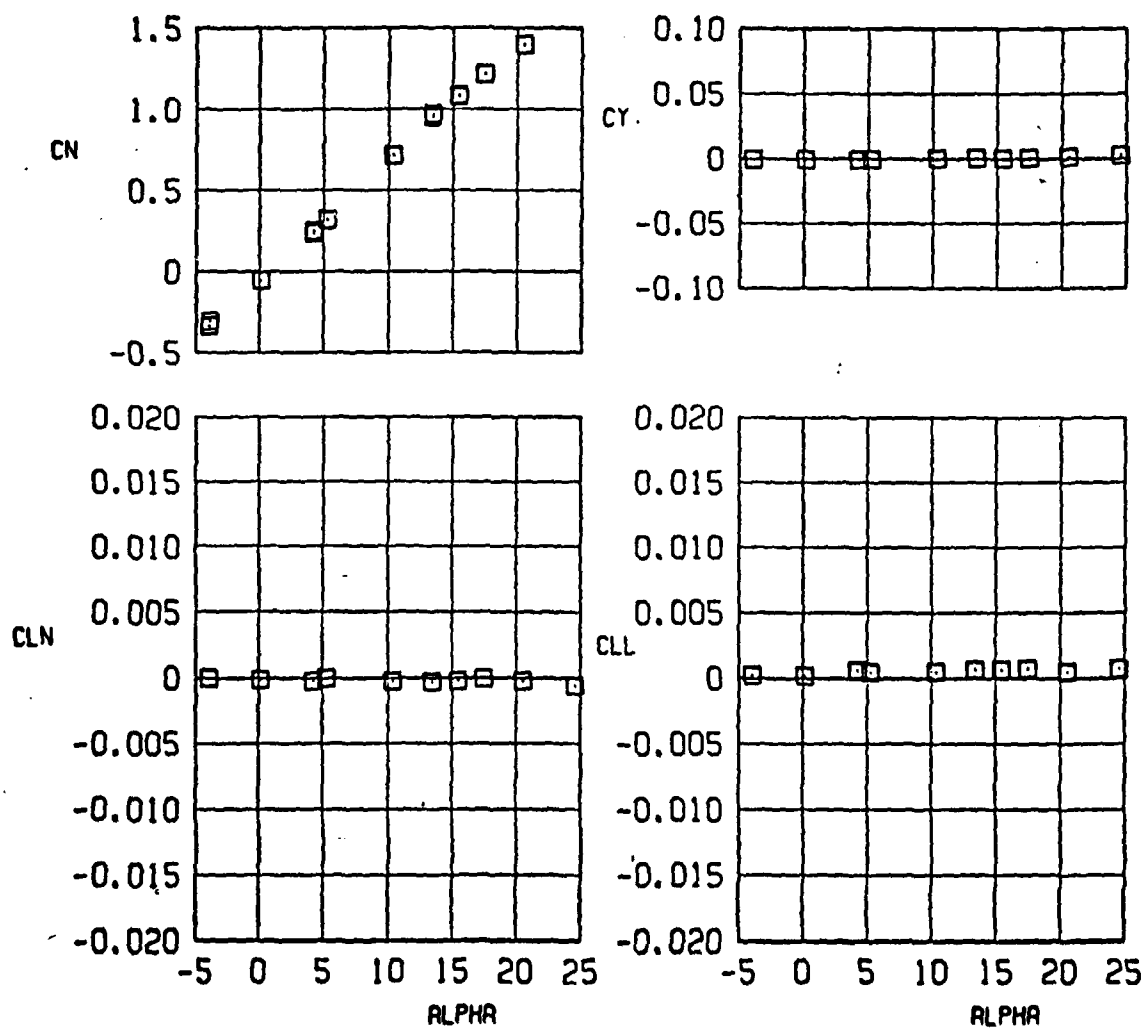
DATE 02-06-81
NOJ-PSB-251

SYM	CONFIGURATION	M	REX10 ⁻⁶	RFP	RUN
□	-B1C1W1V1T05S1F111	1.30	2.50	0.02	79



Sample 5. Yaw Plotted Data

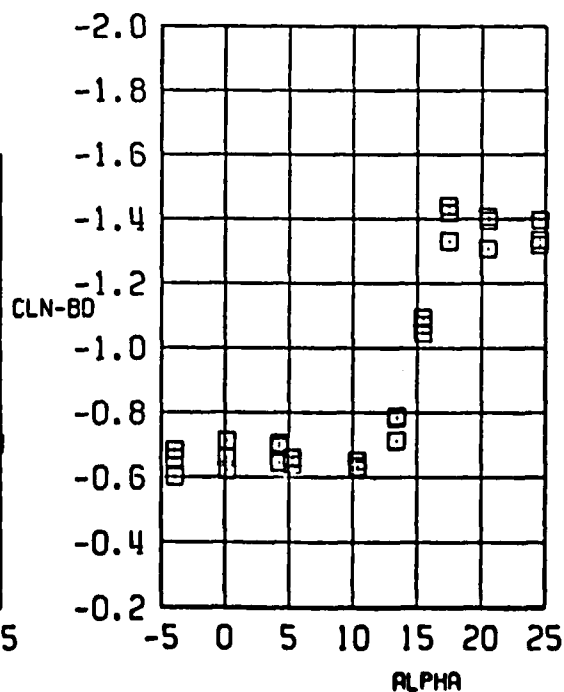
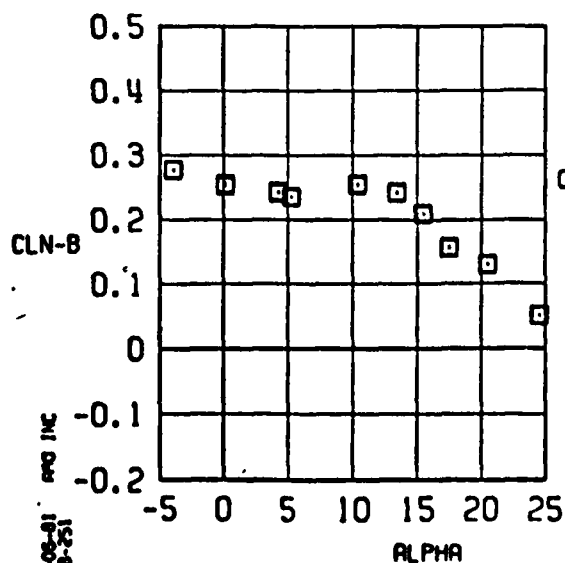
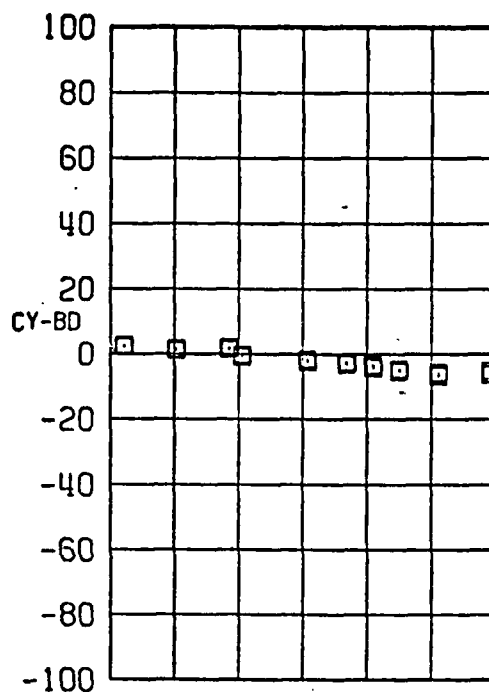
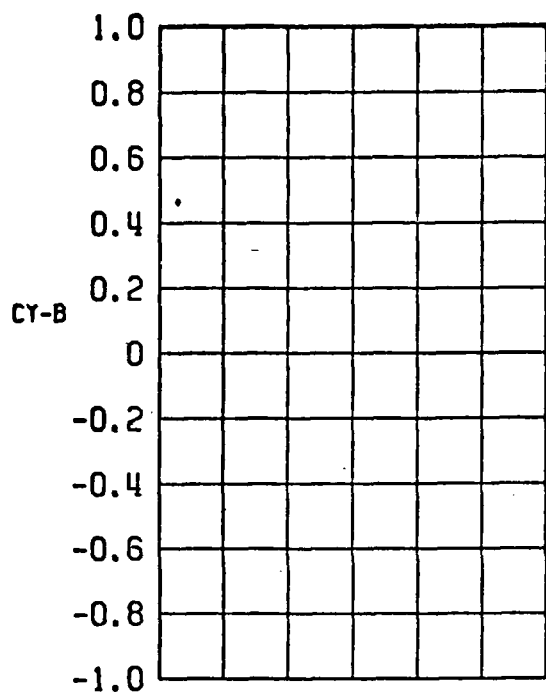
SYM	CONFIGURATION	M	REX10 ⁻⁶	RFP	RUN
□	-BIC1WIVIT05S1F111	1.30	2.50	0.02	79



Sample 5. Continued

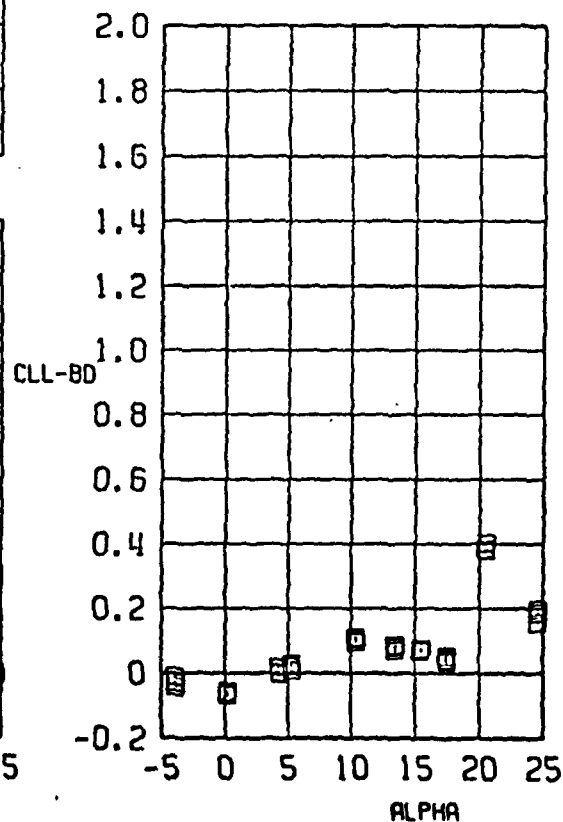
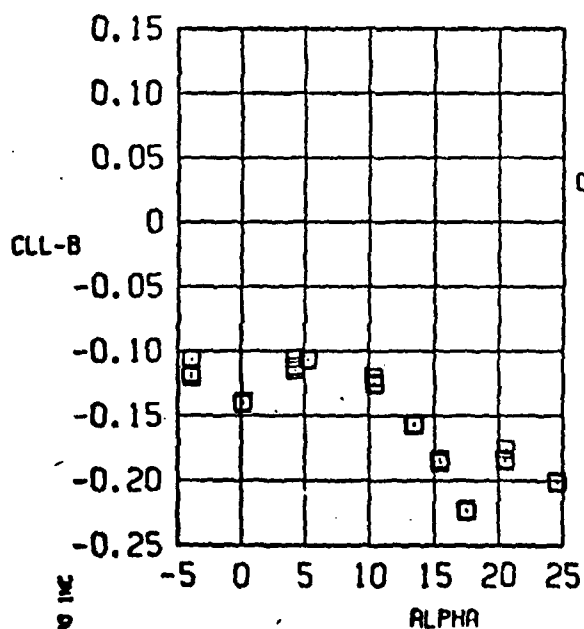
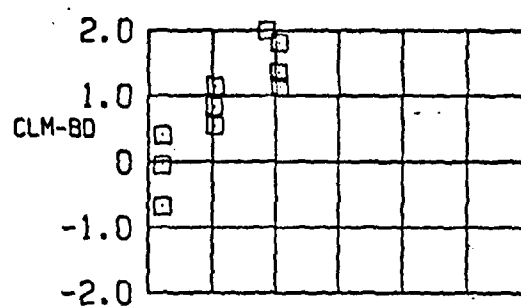
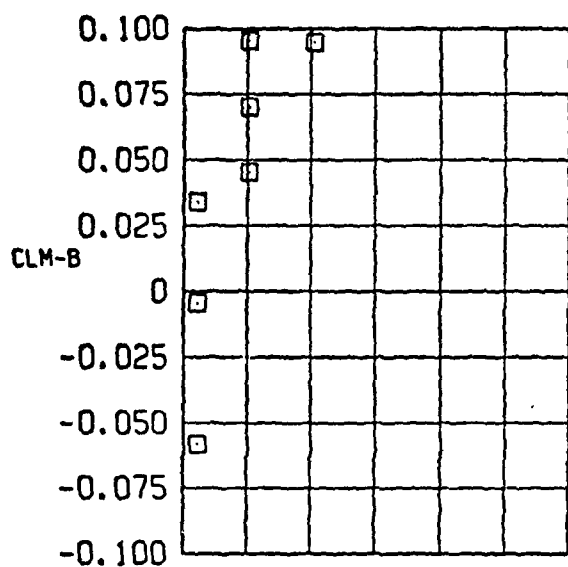
DATE 02-06-81
NOJ-PSS-251

SYM	CONFIGURATION	M	REX10 ⁻⁶	RFP	RUN
□	-BICIWIVIT05SIF111	1.30	2.50	0.02	79



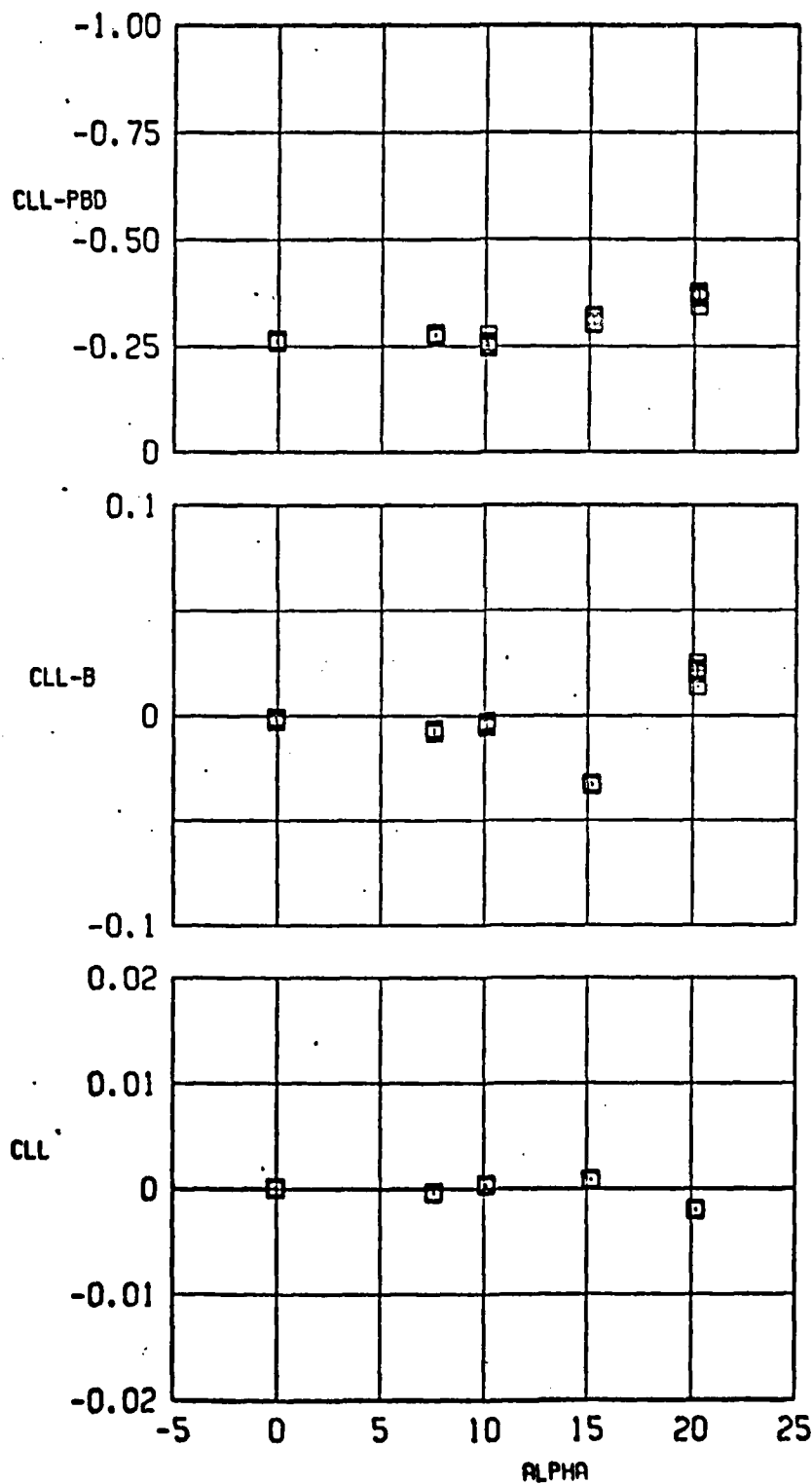
Sample 5. Continued

SYM	CONFIGURATION	M	REX10 ⁻⁶	RFP	RUN
□	-BICIWIVITDSSIF111	1.30	2.50	0.02	79



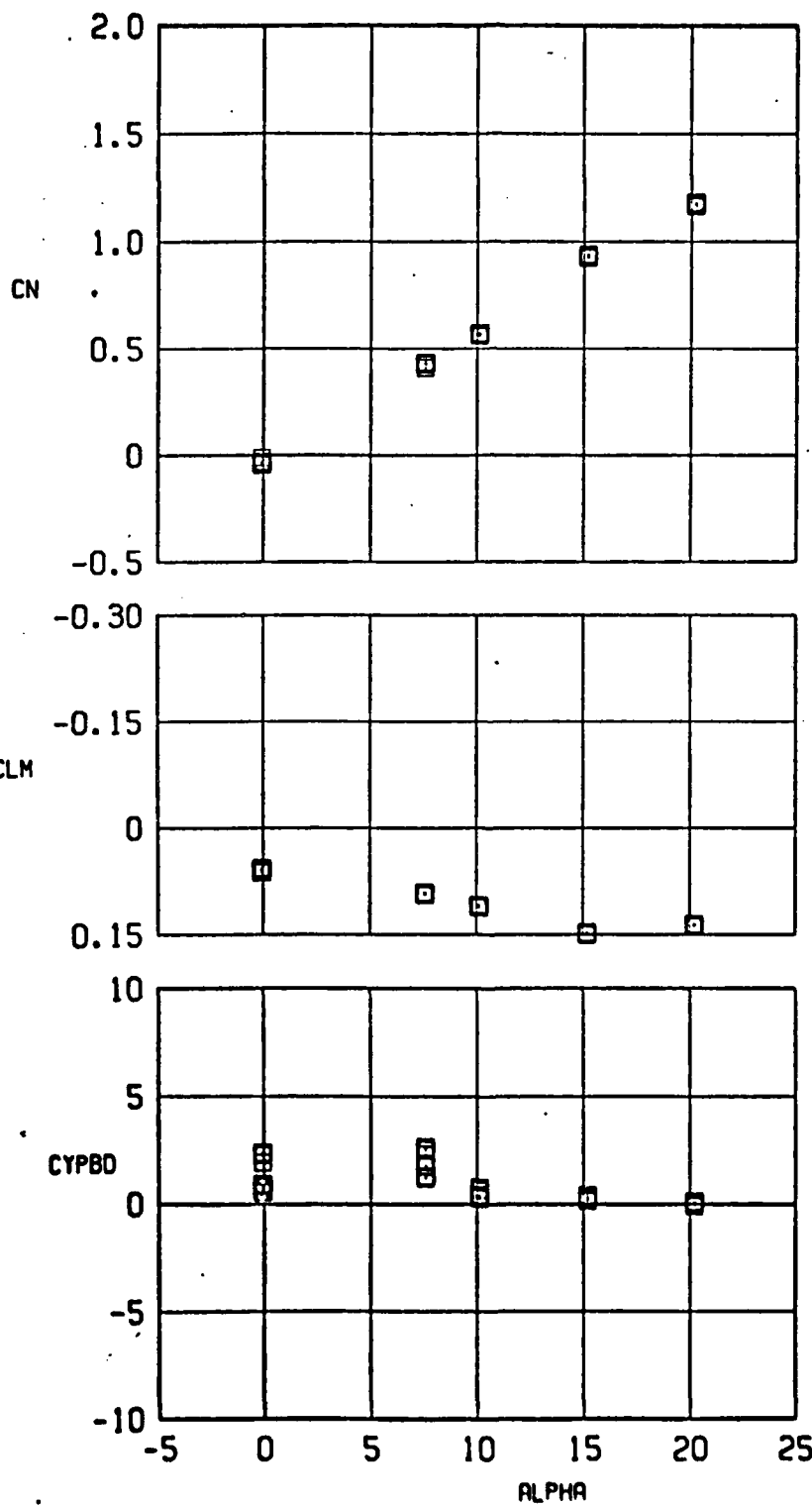
Sample 5. Concluded

SYM	CONFIGURATION	M	REX10 ⁻⁶	RFP	RUN
□	-BIC1W2V1T05S1F111	0.30	2.49	0.13	114

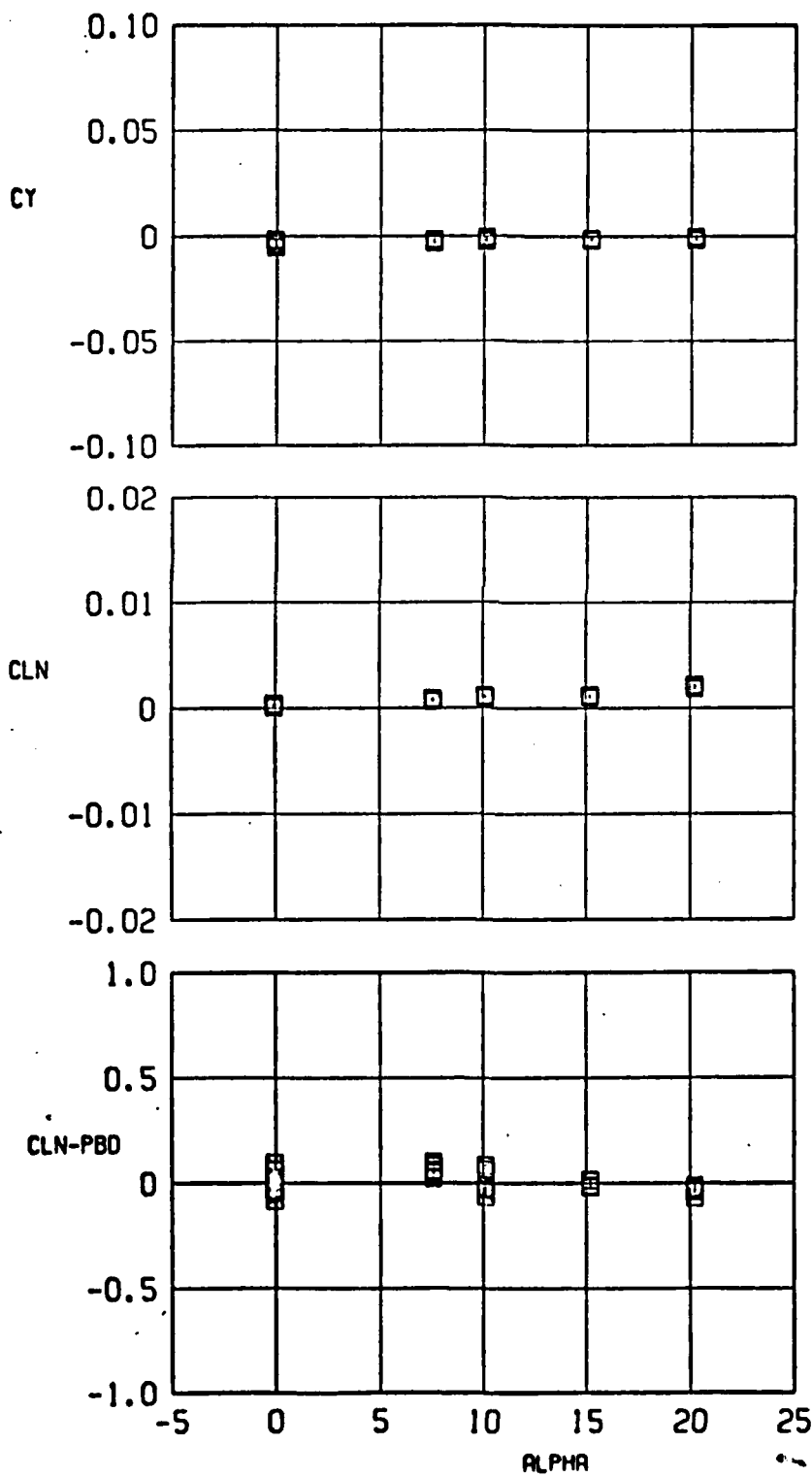


DRG 02-03-81
PACJ-758-751

SYM	CONFIGURATION	M	REX10 ⁻⁶	RFP	RUN
□	-B1C1W2V1T05S1F111	0.30	2.49	0.13	114



SYM	CONFIGURATION	M	REX10 ⁻⁶	RFP	RUN
□	-B1C1W2V1T05SIF111	0.30	2.49	0.13	114



DATE 02-06-81
 PROJ-PS08-251
 AND INC