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# MUTUAL INTERFERENCE OF MULTIPLE BODIES IN THE FLOW FIELD OF THE F-4C AIRCRAFT IN THE TRANSONIC SPEED RANGE


A. A. Hesketh
ARO, Inc.



December 1979

Final Report for Period 12 - 21 November 1979






**ARNOLD ENGINEERING DEVELOPMENT CENTER**
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| captive loads | |
| aerodynamic loads | |
| flow field | |

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A wind tunnel test was conducted to study the mutual interference of multiple bodies in the flow field of the F-4C aircraft. The test utilized 1/20-scale models of the F-4C aircraft, the MK-83 bomb (with and without fins) and the triple ejector rack (TER) to obtain aerodynamic loads on the MK-83 at, and near, the carriage position on the wing inboard pylon. Flow field data in the vicinity of the TER were also obtained. Test variables included aircraft angle of attack from -3 to 17 deg, freestream Mach number from 0.60 to 0.95, and aircraft configuration. Freestream aerodynamic loads data were also obtained on the MK-83 bomb model.

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*ILLUSTRATIONS*

## TABLES

## NOMENCLATURE

| | |
|---|---|
| AE | Engine exhaust choke exit area, 7.4662 X $10^{-3}$ $ft^2$, model scale |
| AI | Engine duct inlet area, 1.7050 X $10^{-2}$ $ft^2$, model scale |
| ALPHA | Aircraft model angle of attack relative to the free-stream velocity vector, deg |
| ALPHAS | Store model angle of attack, deg |
| APPE | Average measured total pressure at the engine exhaust choke exit plane, psfa |
| APPE1 | Calculated average total pressure at the engine exhaust choke exit plane for supersonic flow, psfa |
| APSE | Average measured static pressure at the engine exhaust choke exit plane, psfa |
| BL | Aircraft buttock line from plane of symmetry, in., model scale |
| CAT | Store model total axial-force coefficient, total axial force/(Q·AM) |
| CLL | Store model rolling-moment coefficient, rolling moment/Q·AM·L3M |
| CLM | Store model pitching-moment coefficient, pitching moment/Q·AM·L1M |
| CLN | Store model yawing-moment coefficient, yawing moment/Q·AM·L2M |
| CN | Store model normal-force coefficient, normal force/Q·AM |
| CONFIG | Aircraft model configuration designation |
| CPE | Difference in pressure coefficient between probe orifices 1 and 3, positive for positive EPS, (PS1 - PS3)/QL |
| CPS | Difference in pressure coefficient between probe orifices 2 and 4, positive for positive SIG, (PS4 - PS2)/QL |

| | |
|---|---|
| CR | Capture ratio, mass flow rate divided by the theoretical inlet mass flow rate, (see page 12) |
| CY | Store model side-force coefficient, side force/Q·AM |
| D | Store model reference diameter, 0.70 in |
| DPHI | Angle between the store lateral ($Y_B$) axis and the intersection of the $Y_B$-$Z_B$ and $X_P$-$Y_P$ planes, positive for clockwise rotation when looking upstream, deg |
| EPS | Indicated angle (in pitch and calculated using CPE) between the projection of the local flow velocity vector onto the probe $X_B$-$Z_B$ plane and the probe $X_B$-axis, positive for a velocity-vector component in the negative $Z_B$ direction, deg |
| FS | Aircraft fuselage station, in., model scale |
| IP,IY | Pitch and yaw incidence angles of the store longitudinal axis at carriage with respect to the aircraft longitudinal axis, positive nose up and nose to the right, respectively, as seen by pilot, deg |
| L1M | Reference length for pitching-moment coefficient, 0.70 in. model scale |
| L2M | Reference length for yawing-moment coefficient, 0.70 in model scale |
| L3M | Reference length for rolling-moment coefficient, 0.70 in model scale |
| M | Wind tunnel free-stream Mach number |
| MDOTN | Engine duct mass flow rate, lbm/sec, (see page 12) |
| MNE | Engine duct exit Mach number, (see page 12) |
| PS1-PS4,PP5 | Measured pressures for probe orifices 1 through 5, respectively, psfa |
| PT | Wind tunnel total pressure, psfa |
| Q | Wind tunnel free-stream dynamic pressure, psf |
| QL | Local dynamic pressure, psf |
| RE | Wind tunnel free-stream unit Reynolds number, millions per foot |

RUN Data set identification number

SIG Indicated angle (in yaw and calculated using CPS) between the projection of the local flow velocity vector onto the probe $X_B$-$Y_B$ plane and the probe $X_B$-axis, positive for a velocity-vector component in the positive $Y_B$ direction, deg

TT Wind tunnel total temperature, °F

VR Velocity ratio, exhaust choke exit velocity divided by freestream velocity, (see page 12)

WL Aircraft waterline from reference horizontal plane, in., model scale

XCG Axial distance from the store nose to its center of gravity, 4.2083 ft full scale

Grid Aerodynamic Loads

XP Separation distance of the store nose with respect to the pylon-axis system origin in the $X_P$ direction, in, model scale

YP Separation distance of the store nose with respect to the pylon-axis system origin in the $Y_P$ direction, in, model scale

ZP Separation distance of the store nose with respect to the pylon axis system origin in the $Z_P$ direction, in, model scale

Flow-field Probe

XP Position of the probe reference point with respect to the probe-axis system origin in the $X_P$ direction, in, model scale

YP Position of the probe reference point with respect to the probe-axis system origin in the $Y_P$ direction, in, model scale

ZP Position of the probe reference point with respect to the probe-axis system origin in the $Z_P$ direction, in, model scale

## STORE BODY-AXIS SYSTEM DEFINITIONS

Coordinate Directions

$X_B$ Parallel to the store longitudinal axis, positive direction is upstream at store release

$Y_B$ Perpendicular to $X_B$ and $Z_B$ directions, positive to the right looking upstream when the store is at zero yaw and roll angles

$Z_B$ Perpendicular to the $X_B$ direction and parallel to the aircraft plane of symmetry when the store and aircraft are at zero yaw and roll angles, positive downward as seen by the pilot when the store is at zero pitch and roll angles

Origin

The store body-axis system origin is coincident with the store cg at all times. The $X_B$, $Y_B$, and $Z_B$ coordinate axes rotate with the store in pitch, yaw, and roll so that mass moments of inertia about the three axes are not time-varying quantities.

## PYLON-AXIS SYSTEM DEFINITIONS (GRID)

Coordinate Directions

$X_P$ Parallel to the store longitudinal axis at carriage, positive forward as seen by the pilot

$Y_P$ Perpendicular to the $X_P$ direction and parallel to the $X_F$-$Y_F$ plane, positive to the right as seen by the pilot

$Z_P$ Perpendicular to the $X_P$ and $Y_P$ directions, positive downward as seen by the pilot

## FLIGHT-AXIS SYSTEM DEFINITIONS (GRID)

Coordinate Directions

$X_F$ Parallel to the aircraft flight path direction, positive forward as seen by the pilot

$Y_F$ Perpendicular to the $X_F$ and $Z_F$ directions, positive to the right as seen by the pilot

$Z_F$ Parallel to the aircraft plane of symmetry and perpendicular to the aircraft flight path direction, positive downward as seen by the pilot

Origin

The origin of the pylon-axis and flight-axis coordinate systems was defined for this test as being the location of the MK-83 store nose tip (station 0.0) at the carriage position.

PROBE BODY-AXIS SYSTEM DEFINITIONS (FLOW FIELD)

Coordinate Directions

$X_B$ Parallel to the probe longitudinal axis, positive forward as seen by the pilot

$Y_B$ Perpendicular to the $X_B$ and $Z_B$ directions, positive to the right as seen by the pilot when the probe is at zero yaw and roll angles

$Z_B$ Perpendicular to the $X_B$ direction and parallel to the aircraft plane of symmetry when the probe and aircraft are at zero yaw and roll angles, positive downward as seen by the pilot when the probe is at zero pitch and roll angles

Origin

The probe reference point is the intersection of the plane containing the four static orifices and the probe centerline. The probe body-axis system origin is coincident with the probe reference point and is fixed with respect to the probe for the duration of the grid set. The $X_B$, $Y_B$ and $Z_B$ coordinate axes rotate with the probe in pitch, yaw and roll.

PROBE-AXIS SYSTEM DEFINITIONS (FLOW FIELD)

Coordinate Directions

$X_P$ Parallel to the probe longitudinal axis at the initialization of the grid set and rotated through pitch and yaw angles of IP and IY, respectively, with respect to the aircraft longitudinal axes positive forward as seen by the pilot

$Y_P$ Perpendicular to the $X_P$ direction and parallel to the $X_F$-$Y_F$ plane, positive to the right as seen by the pilot

$Z_P$ Perpendicular to the $X_P$ and $Y_P$ directions, positive downward as seen by the pilot

FLIGHT-AXIS SYSTEM DEFINITIONS (FLOW FIELD)

Coordinate Directions

| | |
|---|---|
| $X_F$ | Parallel to the aircraft flight path direction, positive forward as seen by the pilot |
| $Y_F$ | Perpendicular to the $X_F$ and $Z_F$ directions, positive to the right as seen by the pilot |
| $Z_F$ | Parallel to the aircraft plane of symmetry and perpendicular to the aircraft flight path direction, positive downward as seen by the pilot |

Origin

The origin of the probe-axis and flight-axis coordinate systems was defined for this test as being the location of the MK-83 store nose tip (station 0.0) at the carriage position.

## 1.0 INTRODUCTION

The work reported herein was conducted by the Arnold Engineering Development Center (AEDC), Air Force Systems Command (AFSC), at the request of the Air Force Flight Dynamics Laboratory (AFFDL/FGC), Wright-Patterson AFB, Ohio, for Nielsen Engineering and Research, Inc., Mountain View, California, under Program Element 62201F. The project monitor was Mr. Calvin L. Dyer (AFFDL/FGC). The results of the test were obtained by ARO, Inc., AEDC Division (a Sverdrup Corporation Company), operating contractor for AEDC, AFSC, Arnold Air Force Station, Tennessee, under ARO Project Number P41C-F0 (Test TC-623). The test was conducted from November 12 through 21, 1979, in the Aerodynamic Wind Tunnel (4T).

The objective of this test was to provide aerodynamic data for use in determining the mutual interference of multiple bodies in the flowfield of the F-4C aircraft in the transonic speed range. This information will be used to improve analytic procedures for calculating aerodynamic loads on stores. The test utilized 1/20-scale models of the F-4C aircraft, the MK-83 bomb (with and without fins), and a triple ejector rack (TER) to obtain aerodynamic loads, using the captive loads and CTS grid techniques. Also, during the captive loads phase, a total pressure rake was mounted just aft of the right hand engine exhaust choke of the F-4C aircraft model to determine the mass flow rate through the simulated engine ducting.

The purpose of this report is to document the test and to describe the test parameters. The report provides information to permit the use of the data but does not include any data analysis, which is beyond the scope of this report.

The final data from this test have been transmitted to Nielsen Engineering and Research, Inc., Mountain View, California, and the Air Force Flight Dynamics Laboratory (AFFDL/FGC). Requests for the data should be addressed to AFFDL/FGC, Wright-Patterson AFB, Ohio 45433. A copy of the final data is on file on microfilm at AEDC.

## 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. The nominal range of 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. A more complete description of the test facility may be found in Ref. 1.

For this test, two separate and independent support systems were used. The aircraft model was installed inverted in the test section and was supported by an offset sting attached to the main pitch sector. For captive loads testing, the store model was mounted on a balance fastened to the bottom station of the TER on the aircraft model. For grid aerodynamic loads and flow-field testing the store model or the flow-field probe was mounted on the captive trajectory support (CTS). The aircraft model was removed when obtaining free-stream data, and the CTS was moved upward (and downstream) in the tunnel during the captive loads phase to minimize interference. Isometric drawings of typical captive loads, grid survey, and flow-field testing are shown in Fig. 1, along with block diagrams of the computer control loops. Schematics showing the test section details and the location of the models in the tunnel are shown in Fig. 2. Further description of the CTS rig can be found in Ref. 1.

## 2.2 TEST ARTICLES

The basic details of the 1/20-scale F-4C model are presented in Fig. 3. The model is geometrically similar to the full-scale aircraft except that the tail section was removed to minimize interference with the CTS movement. The F-4 model has flow-through engine inlets and interchangeable nose sections. All testing was accomplished with the F-4C nose configuration. Details and dimensions of the F-4C pylons are given in Fig. 4. The triple ejector rack (TER) model was made with ventilation passages and sway braces to more closely simulate the full scale version. Details and dimensions of the TER model are given in Fig. 5. A total pressure rake, containing 13 total pressure orifices, was mounted just aft of the right hand engine exhaust choke of the F-4C aircraft model. The interior surface of the exhaust choke contained six static pressure orifices. Details and dimensions of the total pressure rake and exhaust choke are given in Fig. 6. Details and dimensions of the MK-83 bomb models are given in Fig. 7. The afterbody of the MK-83 bomb model was modified to allow for sting mounting on the CTS. The modified and the actual afterbody were tested during the captive loads phase. The MK-83 model was also tested with and without tail fins during the captive loads and grid survey phases.

The pressure probe which was used to obtain the flow-field measurements consisted of a single cone-cylinder with a 40-deg included angle tip. There were four equally spaced static pressure orifices on the surface of the cone and a total pressure orifice at the apex of the cone. Details of the probe are shown in Fig. 8.

Tunnel installation of typical test configurations is shown in Fig. 9.

## 2.3 INSTRUMENTATION

A six-component, internal strain-gage balance was used to measure the aerodynamic forces and moments acting on the MK-83 bomb model. For the captive loads testing, the balance was supported by a bracket attached to the TER. A sketch of the store, balance, and TER assembly is shown in Fig. 10. For grid survey testing the balance was sting mounted to the CTS.

All pressures were measured using ±15-psid transducers. Translational and angular positions of the store or pressure probe were obtained from the CTS analog outputs. The aircraft model angle of attack was set using an internal gravimetric angular position indicator. The TER contained a mechanical touch wire to provide accurate setting of the store or pressure probe at the reference position for each survey. The system was also electrically connected to automatically stop the CTS movement if the probe or CTS contacted the model, sting support, or test section walls.

# 3.0 TEST DESCRIPTION

## 3.1 TEST CONDITIONS

Data were obtained at Mach numbers from 0.60 to 0.95 at a constant Reynolds number of 3.5 million per foot. The aircraft model angle of attack was varied from -3 to 17 deg during the captive loads testing and from 1 to 17 deg during the grid aerodynamic loads and flow-field survey testing. The nominal wind tunnel test conditions are presented in Table 1. Tunnel conditions were held constant at the desired settings while data for each captive aerodynamic loads sweep, grid aerodynamic loads survey, and flow-field survey were obtained.

## 3.2 DATA ACQUISITION AND REDUCTION

### 3.2.1 Captive Aerodynamic Loads Data

The carriage aerodynamic loads data were obtained at aircraft model angles of attack from -3 to 17 deg at 0 deg sideslip angle. The CTS was moved upward (and downstream) in the test section to minimize its influence on the aircraft flow field. All pitch polars were run automatically utilizing online computer facilities to calculate the control commands to set the aircraft model attitude. The force and moment data for the store were reduced to coefficient form in the body axis system and the moment data were referenced to the MK-83 center-of-gravity location (XCG). Exit Mach number, mass flow rate, captive area ratio, and a velocity ratio for the right hand engine duct were calculated from the following equations using the measured total pressures from the total pressure rake, the static pressure located in the exhaust choke, and the tunnel freestream conditions.

$$\mathrm{MNE} = \{5[(\mathrm{APPE}/\mathrm{APSE})^{2/7}-1]\}^{1/2} \tag{1}$$

$$\mathrm{MDOTN} = \mathrm{APPE}\cdot\mathrm{MNE}\cdot\mathrm{AE}\cdot[1+0.2(\mathrm{MNE})^2]^{-3}\cdot[0.8843/(\mathrm{TT}+459.6)]^{1/2} \tag{2}$$

$$\mathrm{CR} = \mathrm{MDOTN}/\{\mathrm{PT}\cdot\mathrm{M}\cdot\mathrm{AI}\cdot[1+0.2(\mathrm{MNE})^2]^{-3}\cdot[0.8843/(\mathrm{TT}+459.6)]^{1/2}\} \tag{3}$$

$$\mathrm{VR} = (\mathrm{MNE}/\mathrm{M})\cdot[(1+0.2(\mathrm{M})^2)/(1+0.2(\mathrm{MNE})^2)]^{1/2} \tag{4}$$

If the static-to-total pressure ratio (APSE/APPE) was less than 0.5283, indicating that the exit flow was supersonic, the exit Mach number (MNE) was determined by iteration of the Rayliegh-Pitot Formula (Eq. 5 below). The total pressure upstream of the rake shock wave was then calculated by Eq. 6, and this value was used instead of the measured total pressure value (APPE) in Eq. 2.

$$(\mathrm{APPE}/\mathrm{APSE}) = [(6/5)\cdot\mathrm{MNE}^2]^{7/2}\cdot[6/(7\cdot(\mathrm{MNE})^2-1)]^{5/2} \tag{5}$$

$$\mathrm{APPE1} = \mathrm{APSE}\cdot[1+0.2(\mathrm{MNE})^2]^{7/2} \tag{6}$$

The rake and choke pressures were processed through an automatic pressure settling routine and were recorded and tabulated only after a prescribed convergence criterion (pressure change less than 2 psf/sec) was met.

### 3.2.2 Grid Aerodynamic Loads Data

To obtain store aerodynamic loads data, test conditions were first established in the tunnel. Operational control of the model support systems was then switched to the digital computer. For free-stream data, the computer would initially position the store at ALPHAS = 0 through commands to the CTS (see block diagram, Fig. 1). For data in the aircraft flow field, the computer would position the aircraft model at the desired angle of attack and then position the store at a known location and orientation with respect to the aircraft model. After initial-point data were recorded, the digital computer then positioned the store at preselected orientations and positions programmed into the computer. At each set position, the wind tunnel operating conditions and the store model forces and moments were measured and recorded. The model aerodynamic loads were then reduced to coefficient form and tabulated by the digital computer. The aerodynamic moments were reduced about the XCG location of the store. Grid aerodynamic loads in the aircraft flow field were measured along vertical traverses as shown in Table 2. Freestream aerodynamic loads data were measured at store angles of attack from -4 to 16 deg. The Mach number was varied from 0.60 to 0.95.

### 3.2.3 Flow-field Survey Data

During the test, flow-field probe data were obtained in the following manner. After tunnel conditions and aircraft model angle of attack were set, operational control of the CTS was switched to the digital computer. The computer then positioned the probe at a known location and orientation with respect to the aircraft model through commands to the CTS. After initial point data were recorded, the probe was automatically positioned at preselected positions and orientations programmed into the computer. The probe pressures were processed through an automatic pressure settling routine and were recorded and tabulated only after a prescribed convergence criterion (pressure change less than 2 psf/sec) was met. Flow-field survey data in the aircraft flow field were measured along XP traverses at constant YP and ZP values as shown in Table 3.

## 3.3 CORRECTIONS

Balance, sting, and support deflections caused by the aerodynamic loads on the store models during the captive and grid aerodynamic loads testing were accounted for in the data reduction program to calculate the true store-model angles and positions. Corrections were also made for model weight tares to calculate the net aerodynamic forces on the store model.

## 3.4 UNCERTAINTY/PRECISION OF MEASUREMENTS

Uncertainties in the basic tunnel parameters, PT, TT and M, were estimated from repeat calibrations of the instrumentation and from repeatability and uniformity of the test section flow during tunnel calibration. These uncertainties were then used to estimate the uncertainties in other free-stream properties, using the Taylor series method of error propagation (Ref. 2). The balance uncertainties, based on a 95-percent confidence level, were combined with the uncertainties in the tunnel parameters, assuming a Taylor series error propagation, to estimate the precision of the aerodynamic coefficients. The maximum estimated uncertainties are given in Table 4. The uncertainties in the flow field data were calculated considering probable inaccuracies in the pressure measurements and tunnel conditions. These estimated uncertainties are also shown in Table 4.

The estimated uncertainties in store model and pressure probe positioning from the ability of the CTS to set on a specified value were ±0.050 in model scale in X, Y, and Z, ±0.15 deg in pitch and yaw, and ±1.0 deg in roll settings. Estimated uncertainty in aircraft model angle of attack is ±0.15 deg. The Mach number was held constant within ±0.005 of the quoted Mach number with an estimated uncertainty of ±0.003.

Examples of data repeatability are shown in the plots of Fig. 11.

## 4.0 DATA PRESENTATION

The data package consists of tabulated summary data, microfilm of the summary data, model installation photographs, and computer-generated plots of the flow field data.

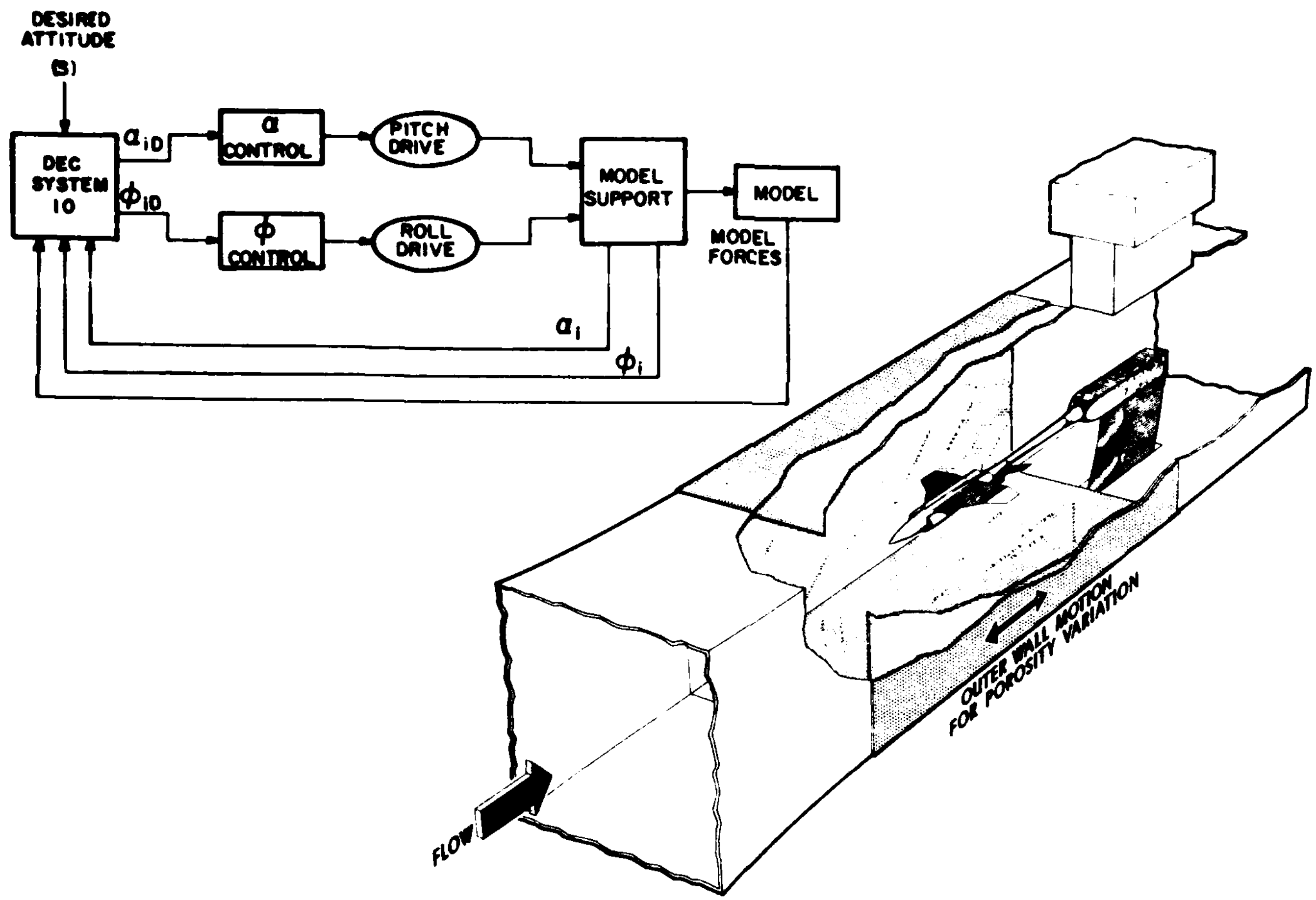
A test run number summary is presented in Table 5 correlating the model configurations and the test conditions with the test data run number. Configuration identifications are shown in Table 6.

Data tabulation formats for the captive aerodynamic loads phase and nomenclature for these data are presented in Tables 7 and 8, respectively. The data tabulation format for the grid aerodynamic loads phase and nomenclature for these data are presented in Tables 9 and 10, respectively. The data tabulation format for the flow-field survey phase and nomenclature are presented in Tables 11 and 12, respectively. Online plotting capability was also available through an interactive graphics system, and some examples are shown in Figure 12.

## REFERENCES

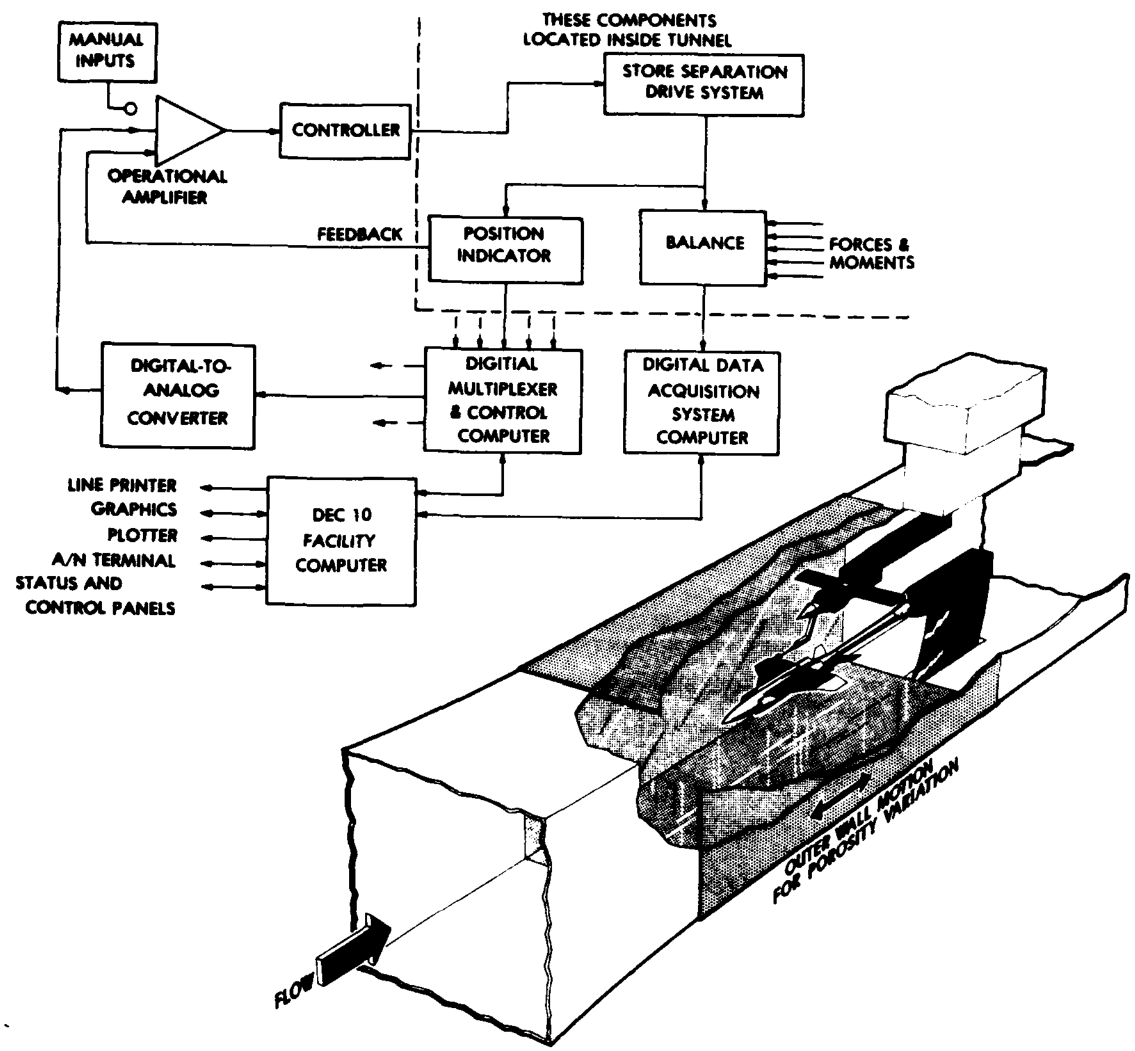
1. Test Facilities Handbook (Eleventh Edition). "Propulsion Wind Tunnel Facility, Vol. 4." Arnold Engineering Development Center, June 1979.

2. Beers, Yardley. Introduction to the Theory of Error. Addison Wesley Publishing Company, Inc., Reading, MA, 1957, pp. 26-36.



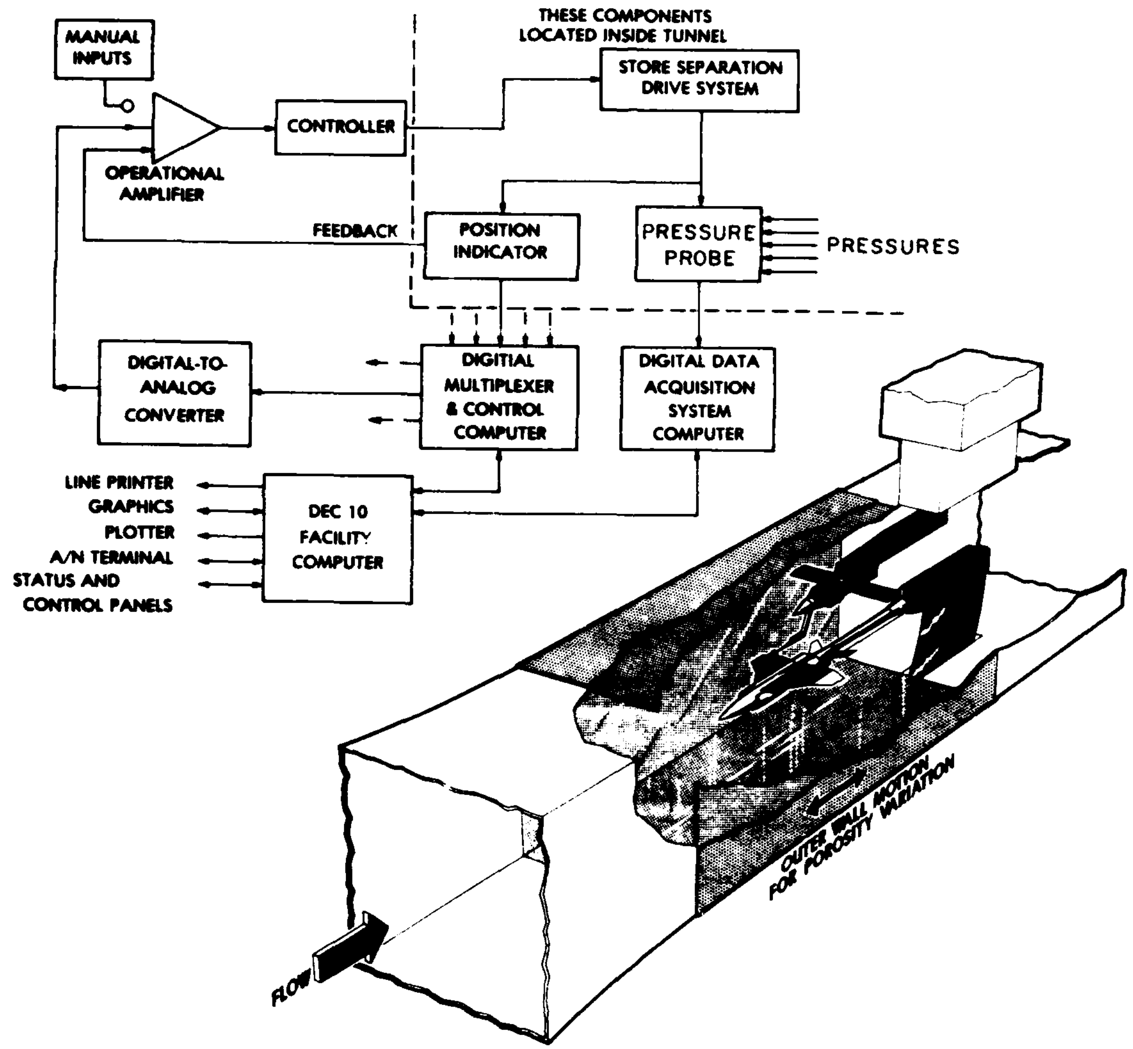

a. Captive Loads Phase

Figure 1. Isometric Drawings of Typical Installations and Block Diagrams of the Computer Control Loops




b. Grid Phase

Figure 1. Continued




c. Flow-Field Phase

Figure 1. Concluded

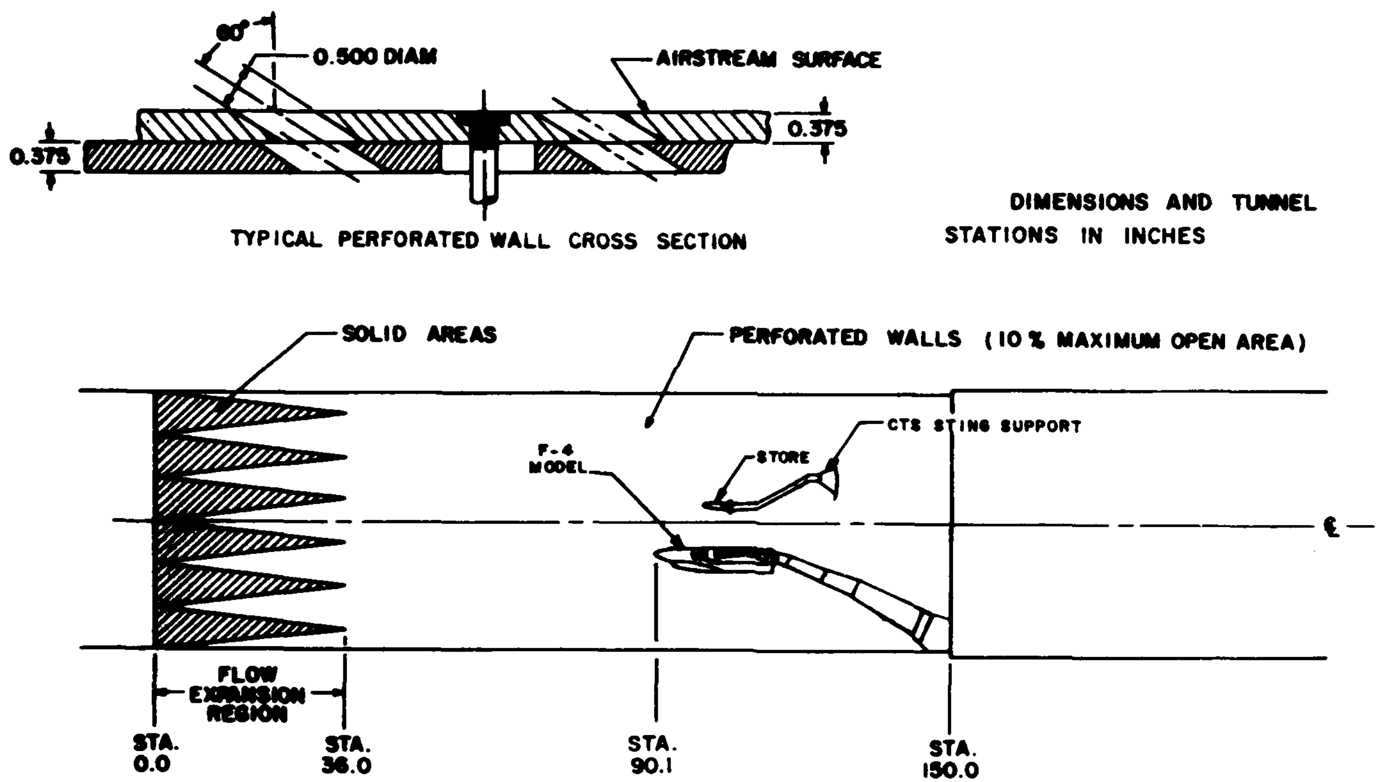



Figure 2. Schematic of the Test Installation

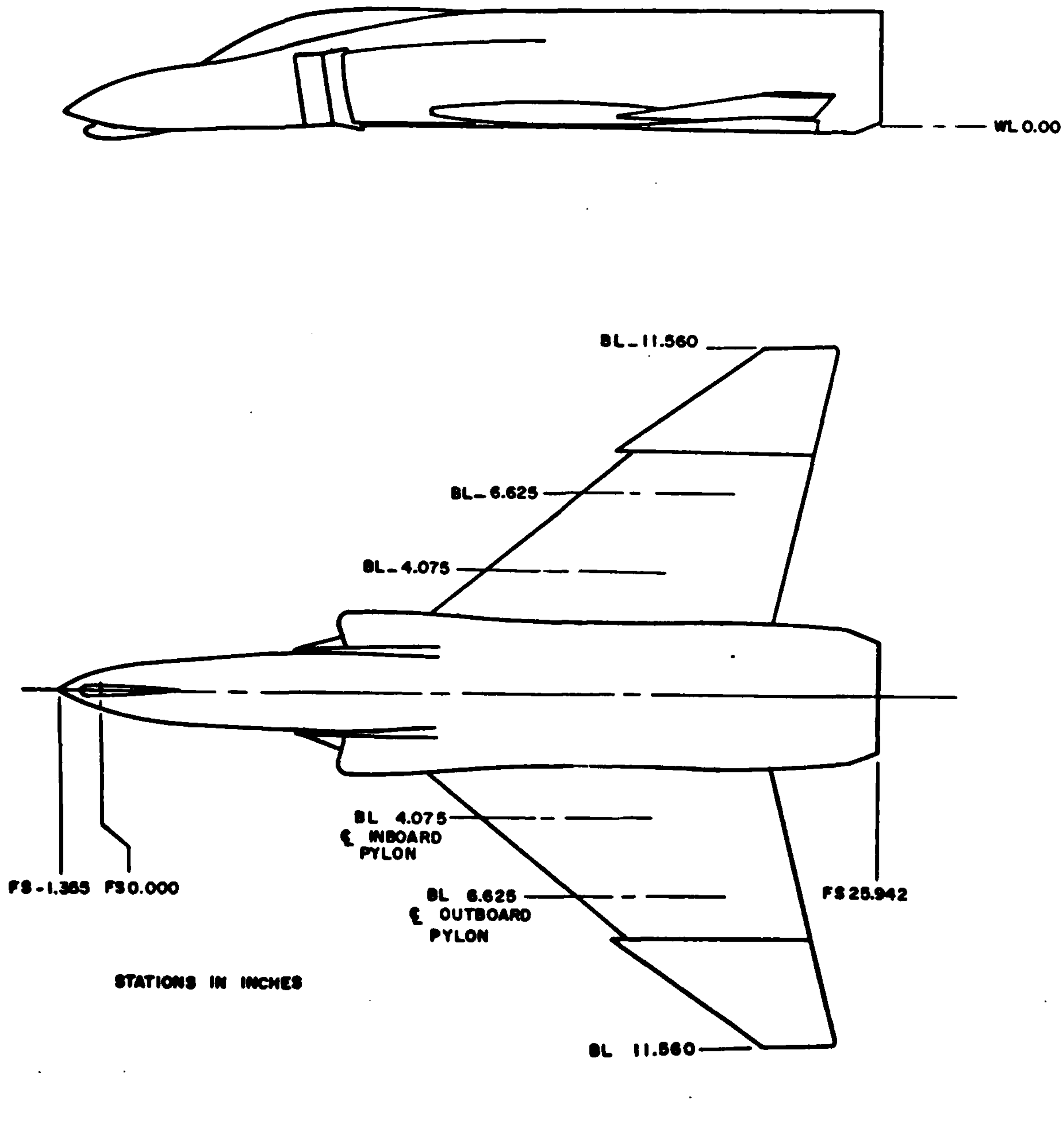



Figure 3. F-4C Aircraft Model

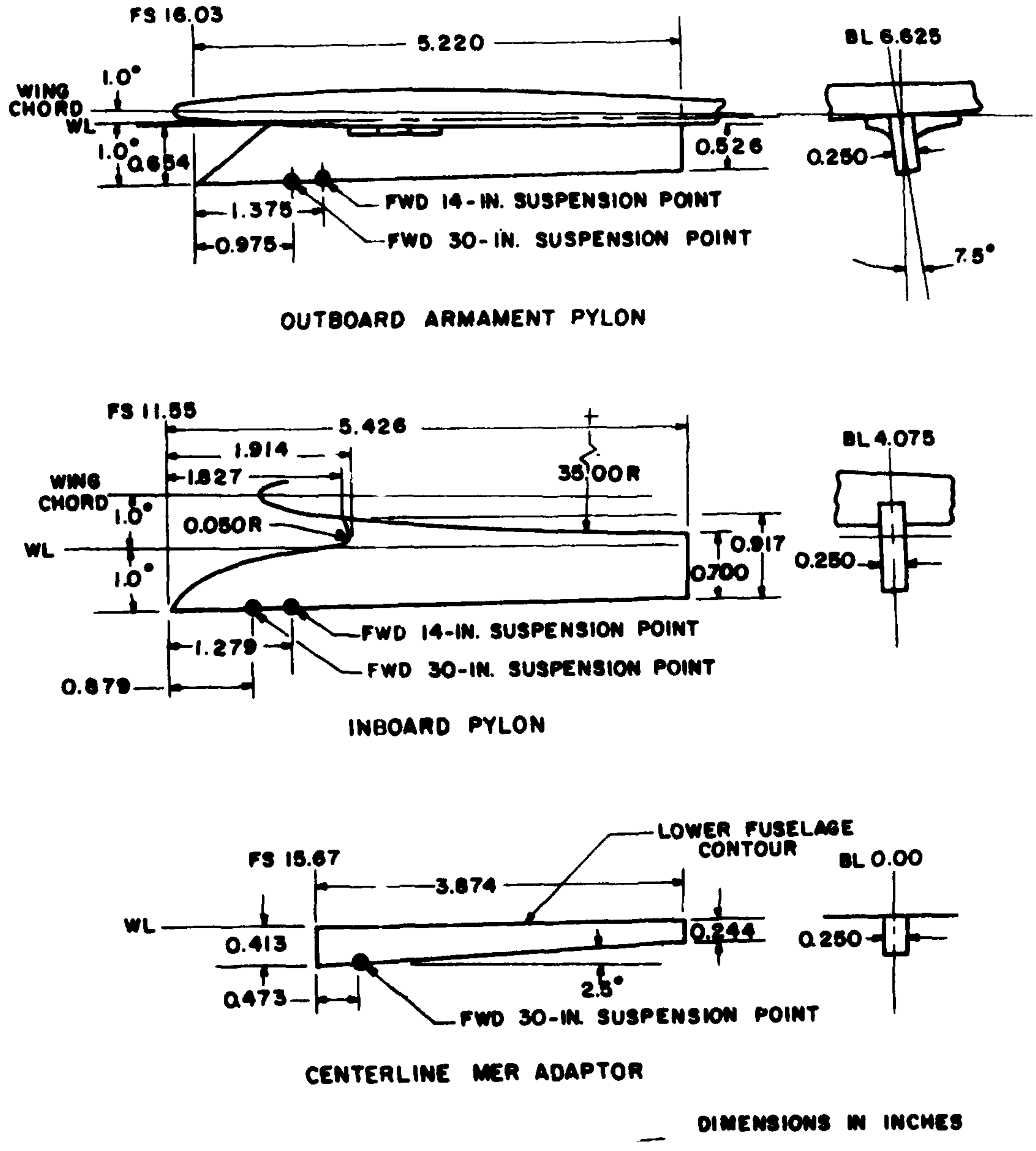



Figure 4. F-4C Pylon Models

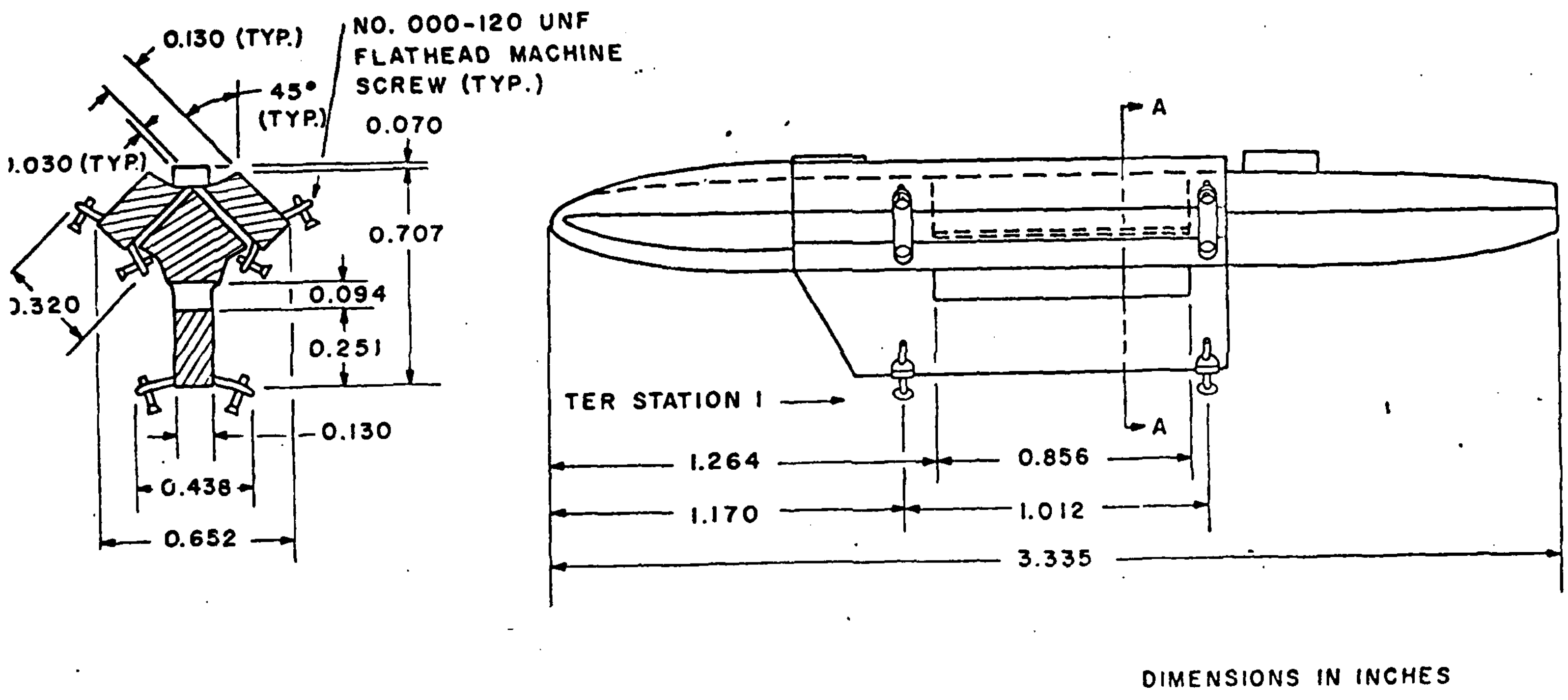
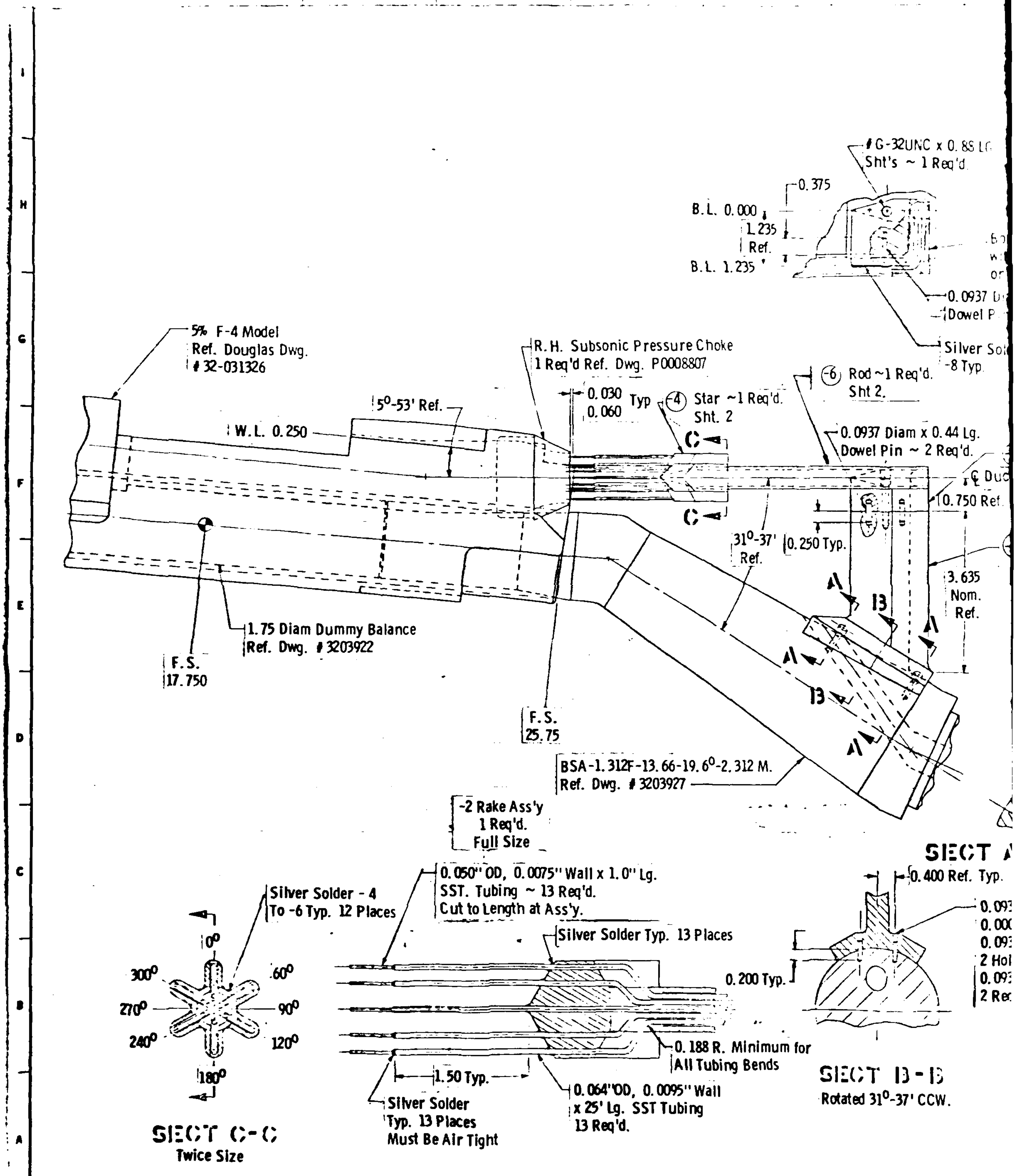



Figure 5. Modified Triple Ejector Rack Model



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Ref. Douglas Dwg.
# 32-031326
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1 Req'd Ref. Dwg. P0008807
0.030
0.060
Typ
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Sht. 2
6 Rod ~1 Req'd.
Sht 2.
5°-53' Ref.
W.L. 0.250
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C
0.0937 Diam x 0.44 Lg.
Dowel Pin ~ 2 Req'd.
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A
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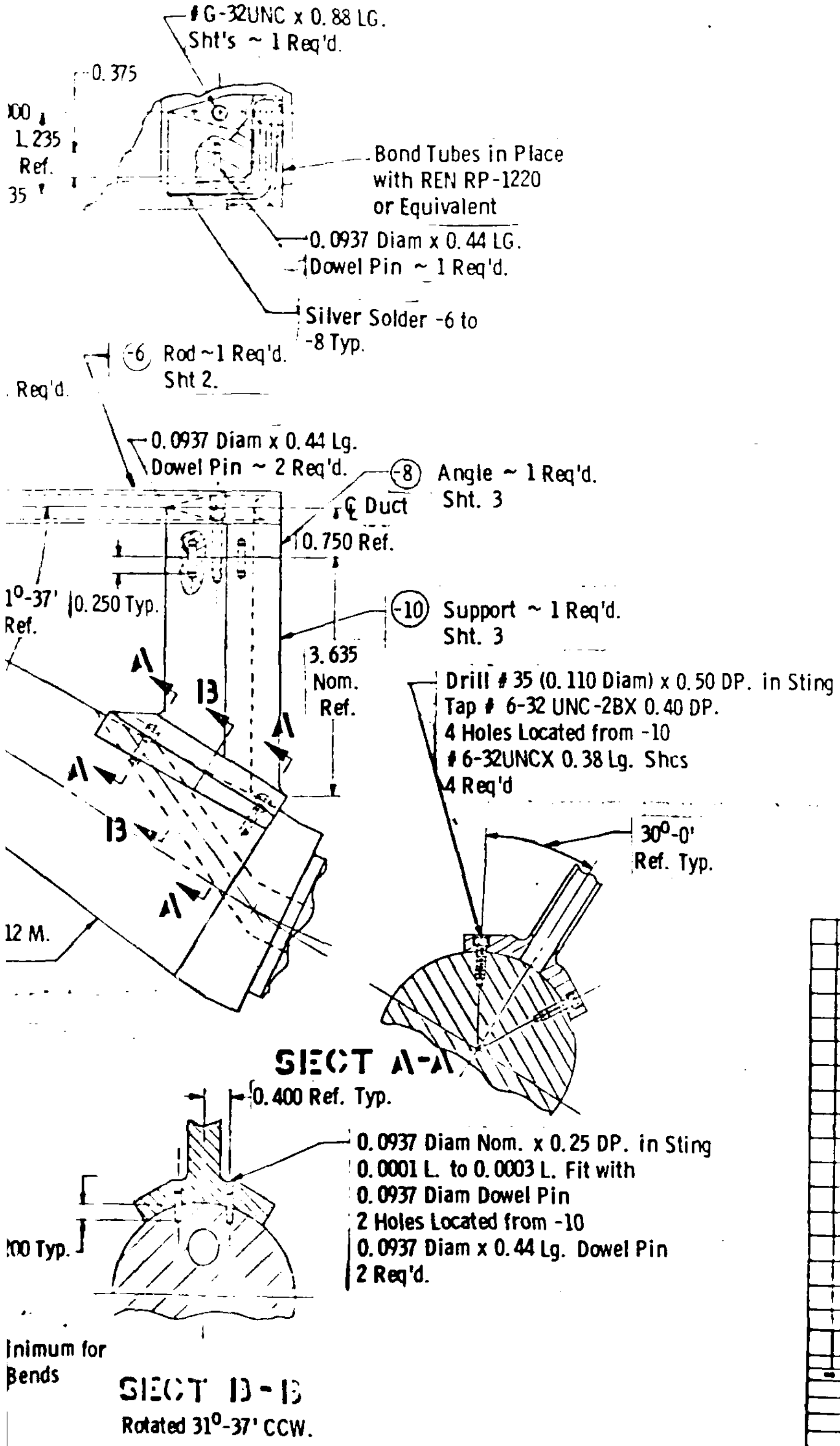
F.S.
25.75
BSA-1.312F-13.66-19.6°-2.312 M.
Ref. Dwg. # 3203927
-2 Rake Ass'y
1 Req'd.
Full Size
SECT A
0.400 Ref. Typ.
Silver Solder - 4
To -6 Typ. 12 Places
0.050" OD, 0.0075" Wall x 1.0" Lg.
SST. Tubing ~ 13 Req'd.
Cut to Length at Ass'y.
Silver Solder Typ. 13 Places
0°
300°
60°
270°
90°
240°
120°
180°
0.200 Typ.
0.188 R. Minimum for
All Tubing Bends
1.50 Typ.
Silver Solder
Typ. 13 Places
Must Be Air Tight
0.064" OD, 0.0095" Wall
x 25' Lg. SST Tubing
13 Req'd.
SECT C-C
Twice Size
SECT B-B
Rotated 31°-37' CCW.
I
H
G
F
E
D
C
B
A
13
12
11
10
9
8
7

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FROM COPY FURNISHED TO DDC

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 4 | | | # 6-32 UNC x .38 | LG SHCS | | |
| | | | 1 | | | # 6-32 UNC X .88 | LG SHCS | | |
| | | | 5 | | | .0937 DIA x .44 | LG. DOWEL PIN | | |
| | | | 13 | | | .050" OD, .0075" | WALL X 1.0" LG SST | TUB NG | |
| | | | 13 | | | .064" OD, .0095" | WALL X 2.5" LG. SST | TUB NG | |
| | | | 1 | | -10 | SUPPORT | | | |
| | | | 1 | | -8 | ANGLE | | | |
| | | | 1 | | -6 | ROD | | | |
| | | | 1 | | -4 | STRA | | | |
| | | | | 1 | -2 | RAKE ASSY | | | |
| | | | -2 | BASIC | PART NO. | PART NAME | MATERIAL DESCRIPTION | STOCK SIZE | MATERIAL PROCUREMENT SPEC OR PROCESS DATA |

PC006798

ARNOLD ENGINEERING DEVELOPMENT CENTER

PRESSURE RAKE
5% F-4

ARNOLD AIR FORCE STATION, TENN.

TOLERANCES UNLESS OTHERWISE SPECIFIED

| | |
|---|---|
| FRACTIONS | ± 1/64" |
| TENTHS | ± .1 |
| HUNDREDTHS | ± .03 |
| THOUSANDTHS | ± .010 |
| ANGULAR | ± 0°-30' |
| SHOP STDS. | ☐ |
| SURFACE FINISH | ✓ |

NEXT ASSY

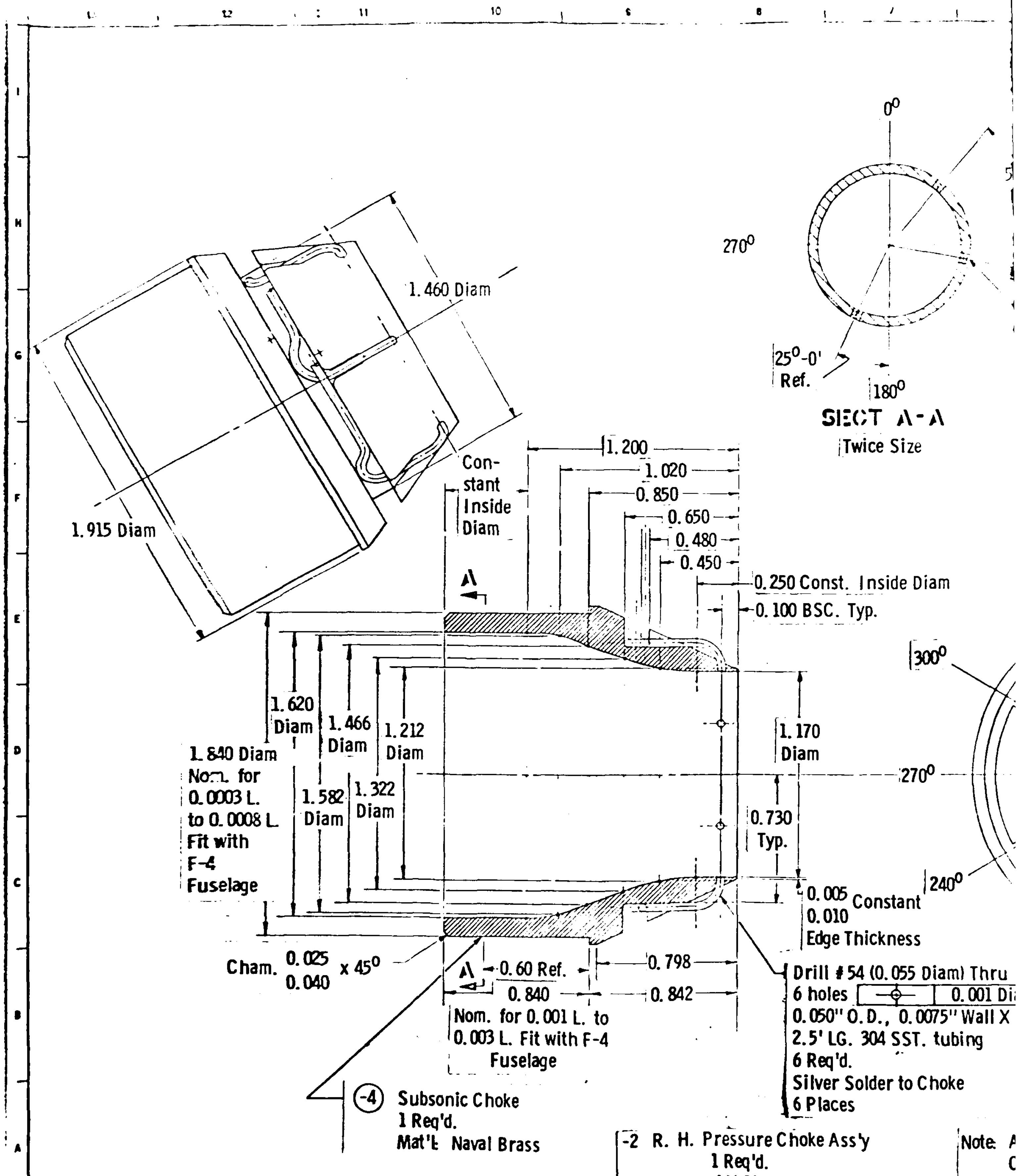
SCALE

DWG NO.

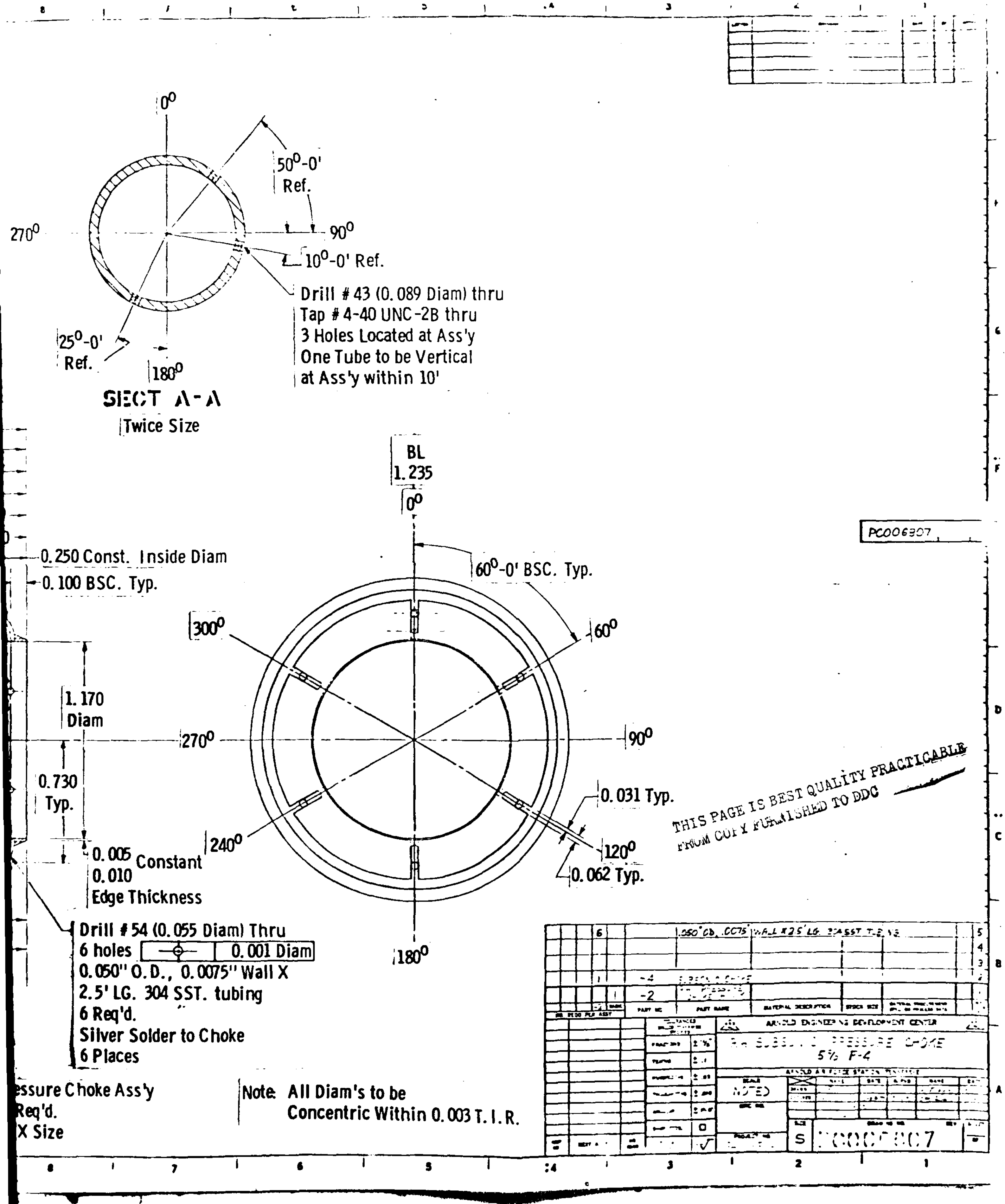
PROJECT NO

SIZE S

PC006798

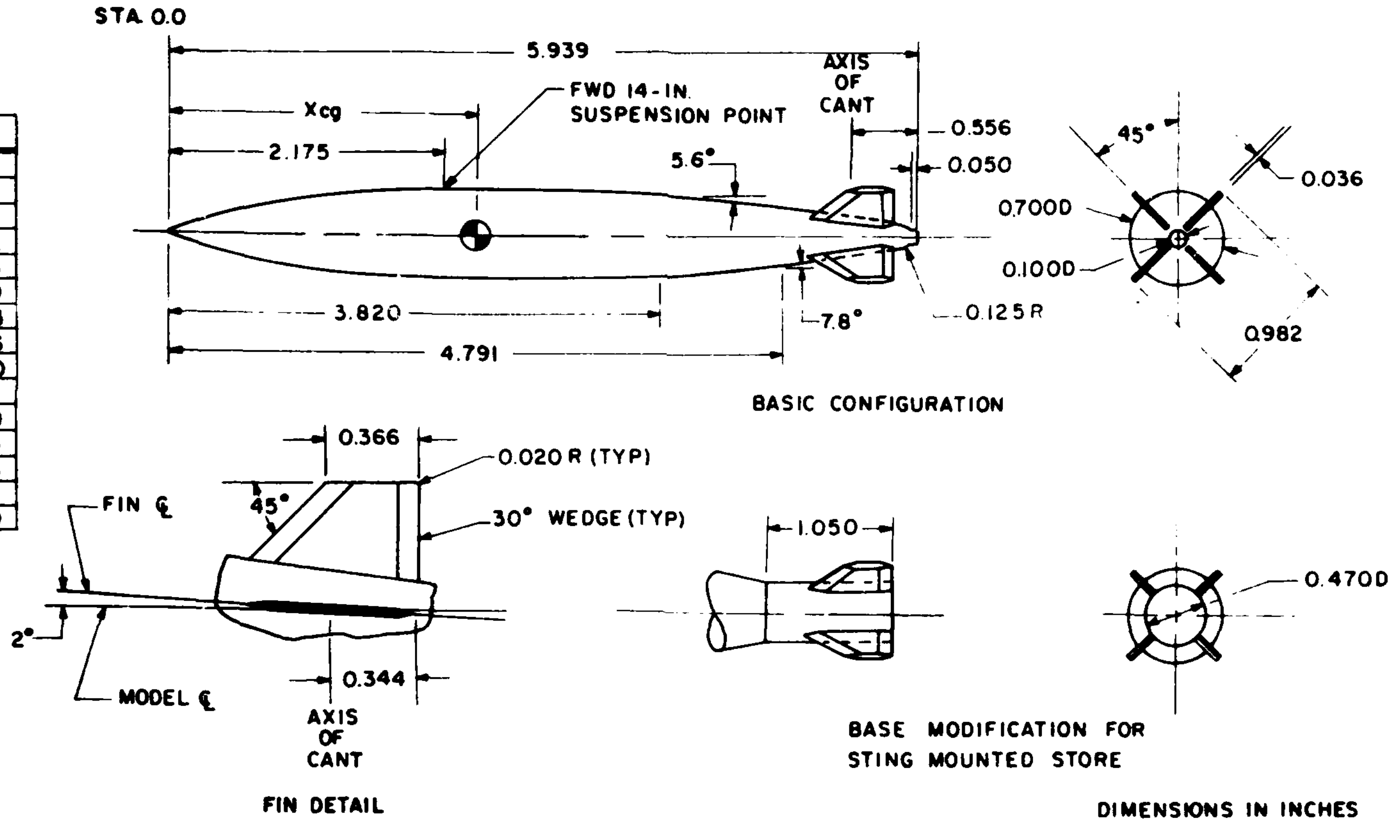


1.460 Diam
1.915 Diam
0°
270°
25°-0' Ref.
180°
SECT A-A
Twice Size
1.200
1.020
0.850
0.650
0.480
0.450
Con-stant Inside Diam
0.250 Const. Inside Diam
0.100 BSC. Typ.
A
1.620 Diam
1.466 Diam
1.212 Diam
1.840 Diam Nom. for 0.0003 L. to 0.0008 L. Fit with F-4 Fuselage
1.582 Diam
1.322 Diam
1.170 Diam
0.730 Typ.
270°
300°
240°
0.005 0.010 Constant Edge Thickness
Cham. 0.025 0.040 x 45°
0.60 Ref.
0.798
0.840
0.842
Nom. for 0.001 L. to 0.003 L. Fit with F-4 Fuselage
Drill #54 (0.055 Diam) Thru 6 holes 0.001 Di
0.050" O.D., 0.0075" Wall X 2.5' LG. 304 SST. tubing 6 Req'd.
Silver Solder to Choke 6 Places
-4 Subsonic Choke 1 Req'd. Mat'l. Naval Brass
-2 R. H. Pressure Choke Ass'y 1 Req'd. 4 X Size
Note



0°
50°-0' Ref.
270°
90°
10°-0' Ref.
Drill # 43 (0.089 Diam) thru
Tap # 4-40 UNC-2B thru
3 Holes Located at Ass'y
One Tube to be Vertical
at Ass'y within 10'
25°-0' Ref.
180°
SECT A-A
Twice Size
BL
1.235
0°
PC006807
0.250 Const. Inside Diam
0.100 BSC. Typ.
60°-0' BSC. Typ.
300°
60°
1.170
Diam
270°
90°
0.730
Typ.
0.031 Typ.
240°
120°
0.005
0.010
Constant
Edge Thickness
0.062 Typ.
Drill # 54 (0.055 Diam) Thru
6 holes
0.001 Diam
0.050" O.D., 0.0075" Wall X
2.5' LG. 304 SST. tubing
6 Req'd.
Silver Solder to Choke
6 Places
180°
essure Choke Ass'y
Req'd.
X Size
Note: All Diam's to be
Concentric Within 0.003 T.I.R.
ARNOLD ENGINEERING DEVELOPMENT CENTER
5% F-4
ARNOLD AIR FORCE STATION, TENNESSEE
NOTED
-4
-2
S

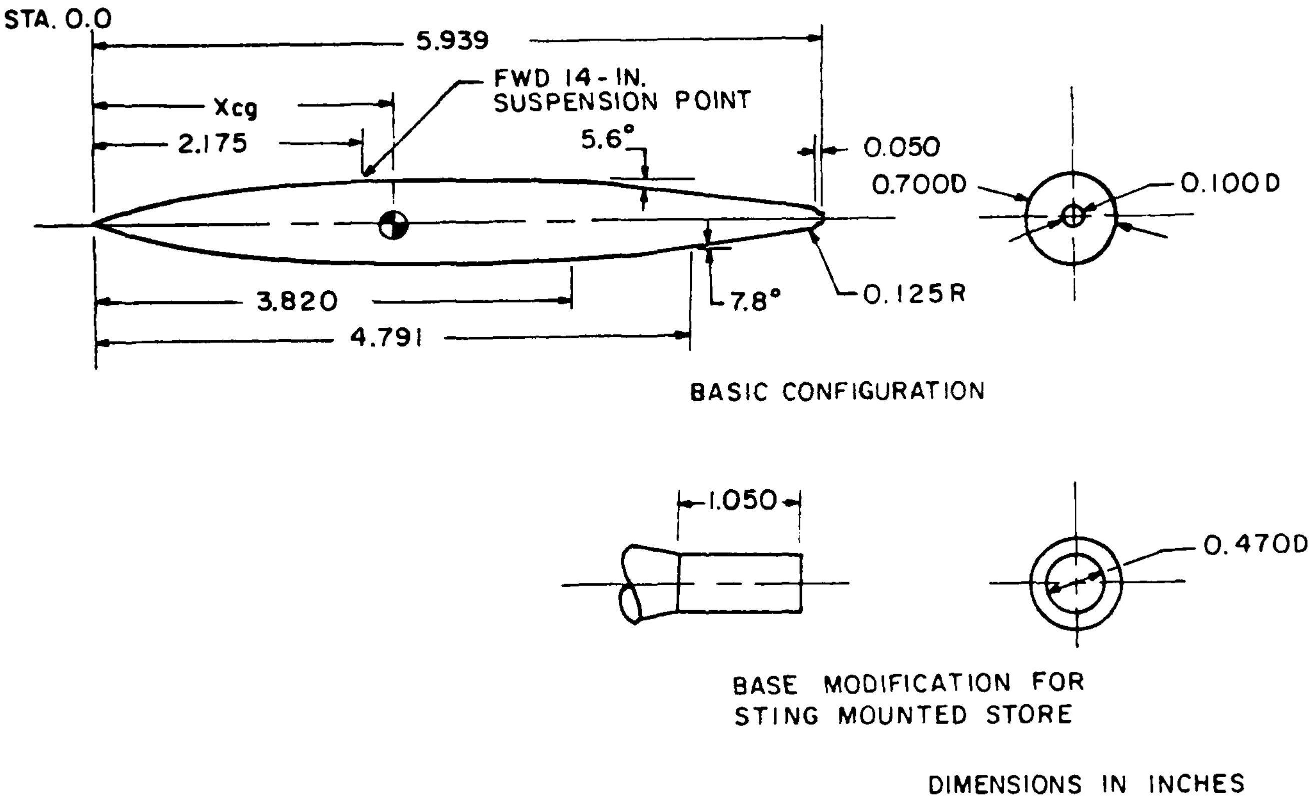
| STA | DIAM |
|---|---|
| 0 | 0 |
| 0.267 | 0.231 |
| 0.517 | 0.378 |
| 0.783 | 0.482 |
| 1.050 | 0.554 |
| 1.317 | 0.609 |
| 1.583 | 0.653 |
| 1.850 | 0.686 |
| 2.117 | 0.700 |
| CONST | DIAM |
| 2.983 | 0.700 |
| 3.250 | 0.693 |
| 3.383 | 0.686 |
| 3.650 | 0.661 |
| 3.820 | 0.639 |




a. Finned

Figure 7. Mk-83 Bomb Model

| STA | DIAM |
|---|---|
| 0 | 0 |
| 0.267 | 0.231 |
| 0.517 | 0.378 |
| 0.783 | 0.482 |
| 1.050 | 0.554 |
| 1.317 | 0.609 |
| 1.583 | 0.653 |
| 1.850 | 0.686 |
| 2.117 | 0.700 |
| CONST | DIAM |
| 2.983 | 0.700 |
| 3.250 | 0.693 |
| 3.383 | 0.686 |
| 3.650 | 0.661 |
| 3.820 | 0.639 |




b. Unfinned

Figure 7. Concluded

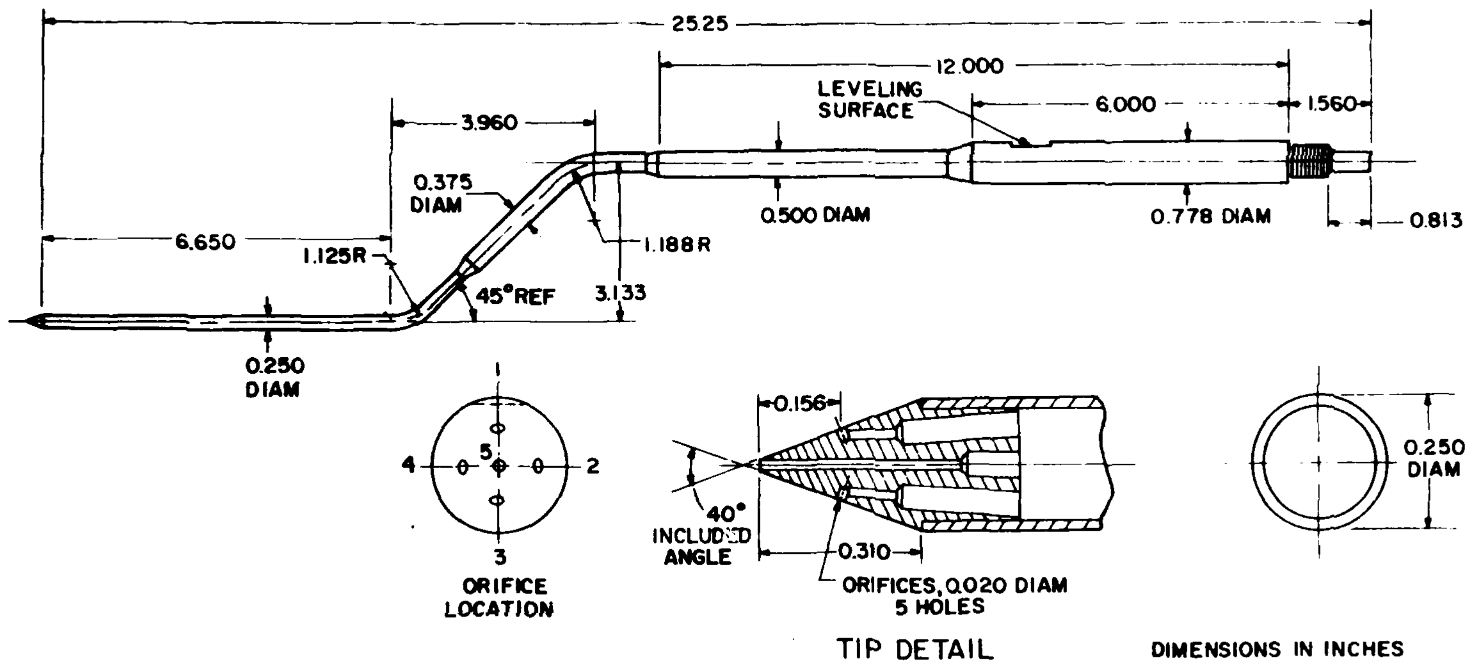
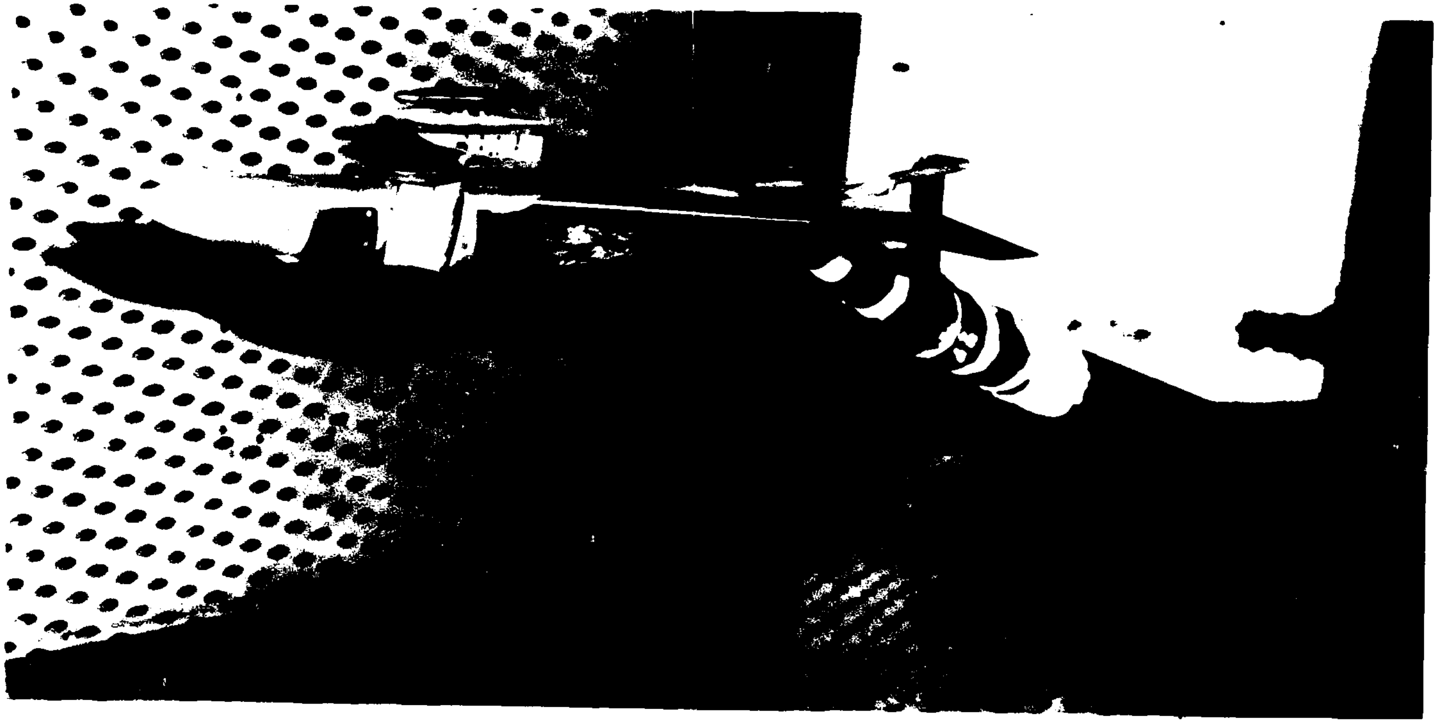
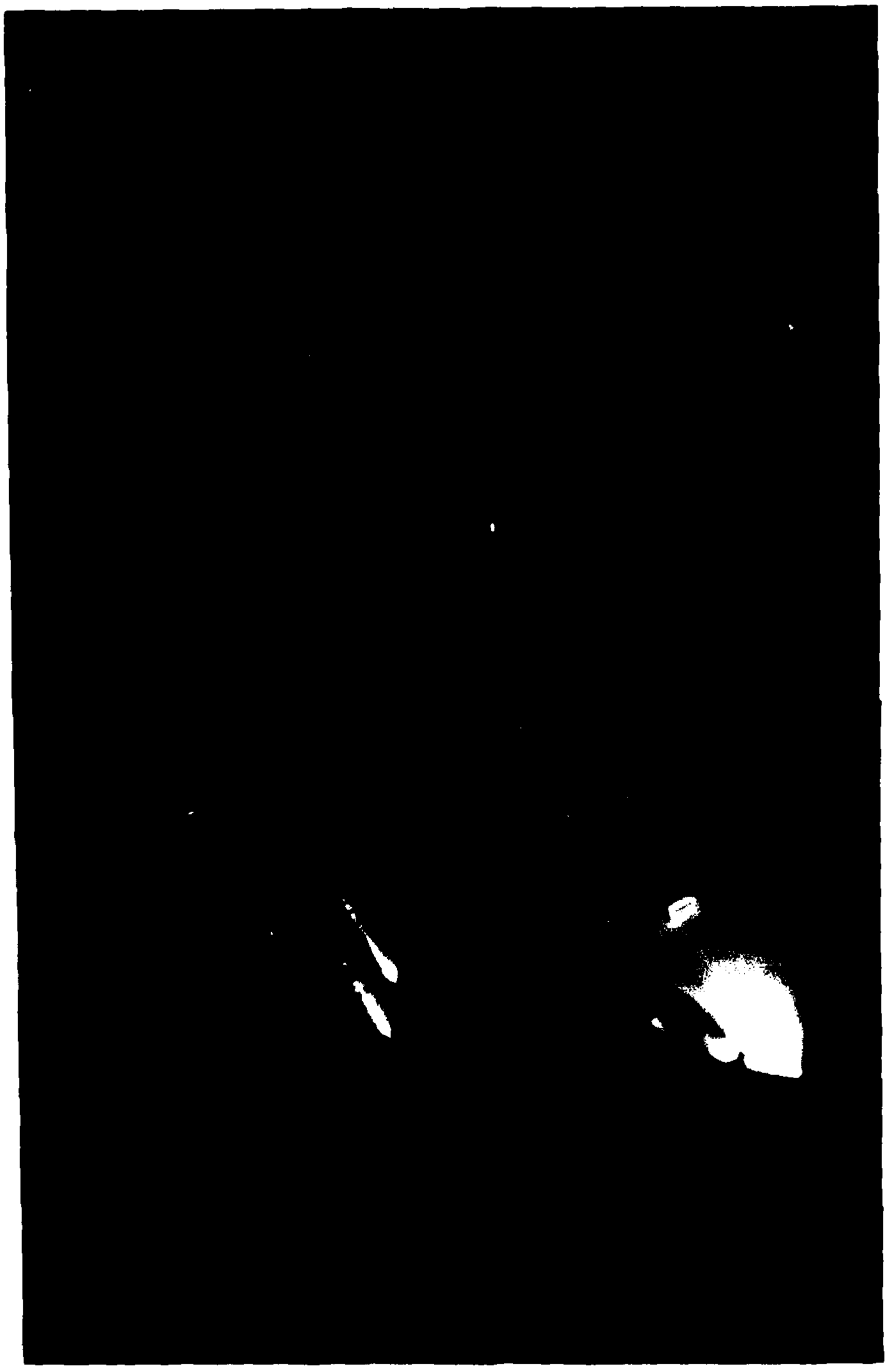



Figure 8. Details of Flow-Field Probe



a. Captive Loads Phase

Figure 9. Typical Tunnel Installation Photograph



b. Grid Phase

Figure 9. Concluded

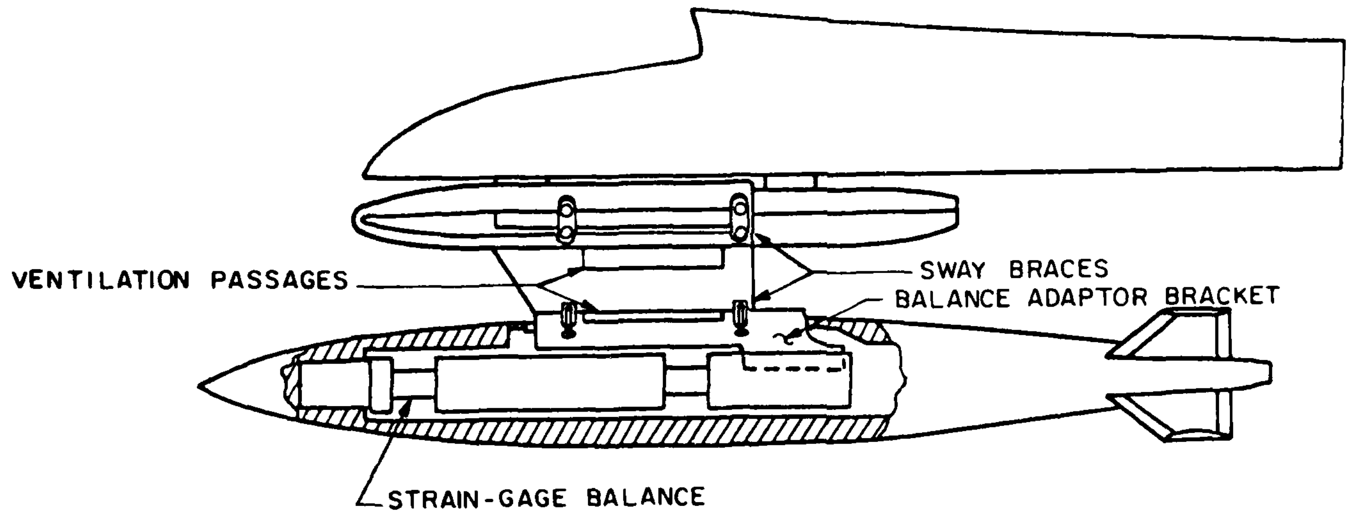
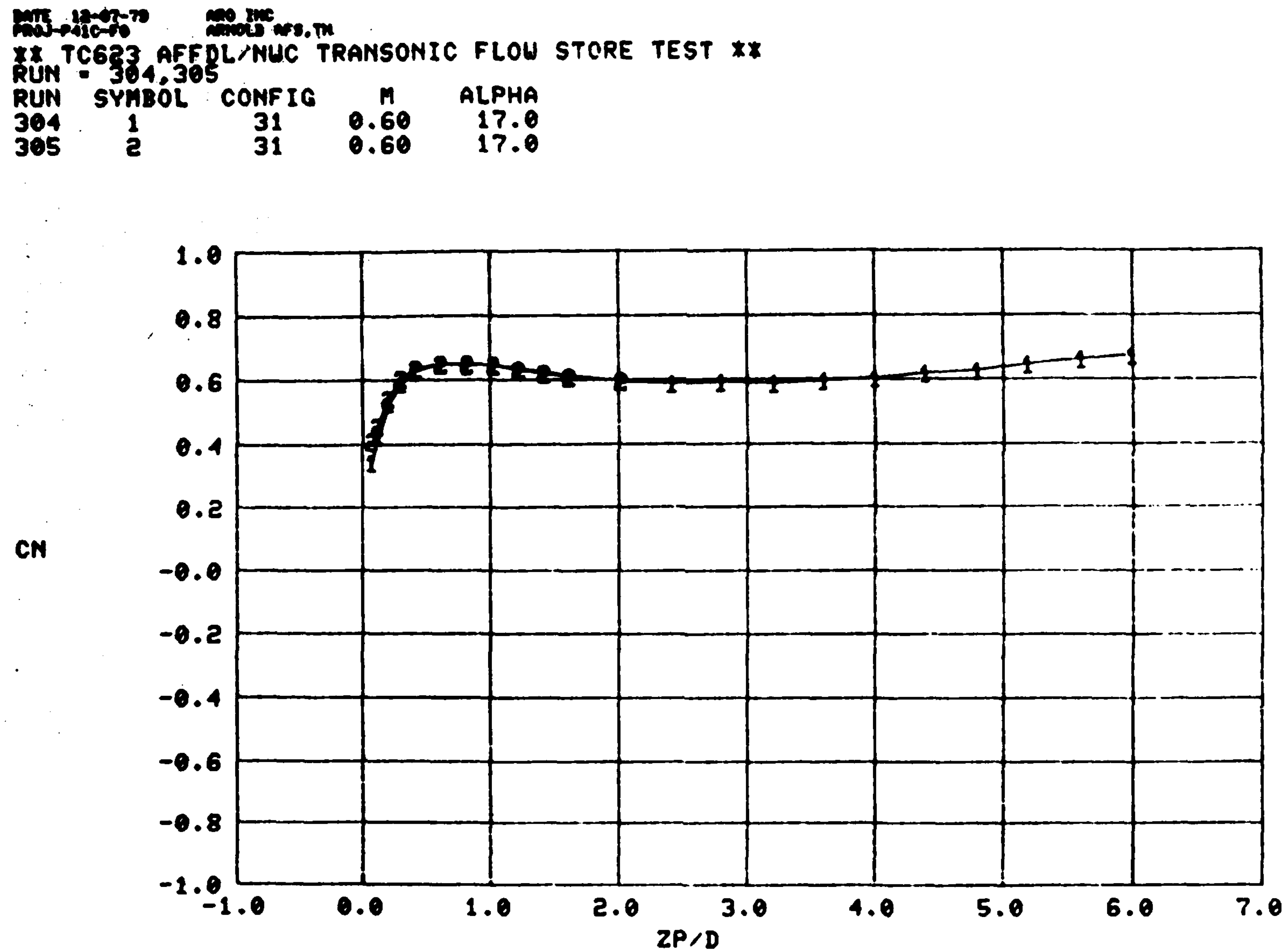



Figure 10. Captive Loads Store, Balance and TER Assembly

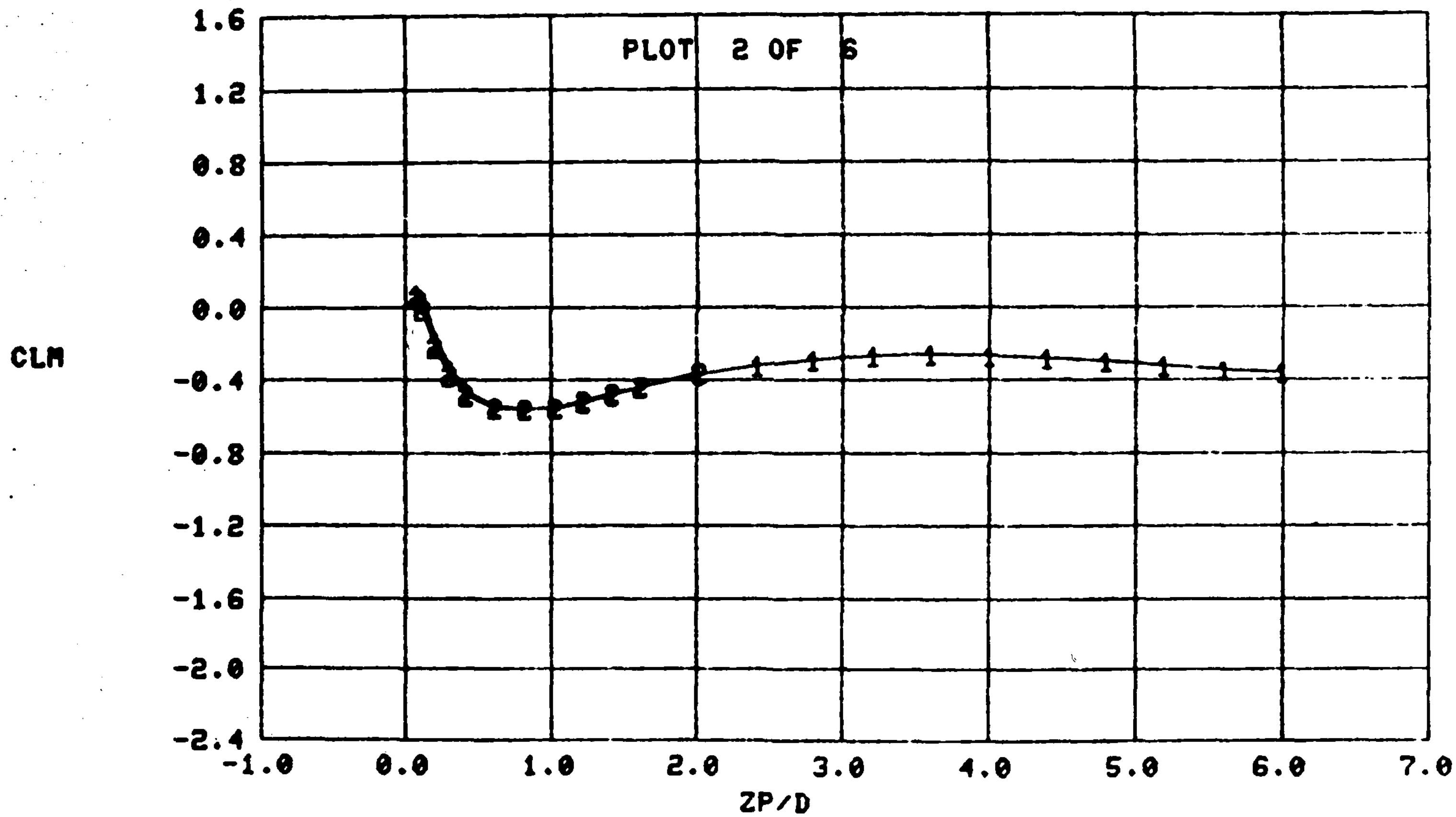



a. CN vs ZP/D

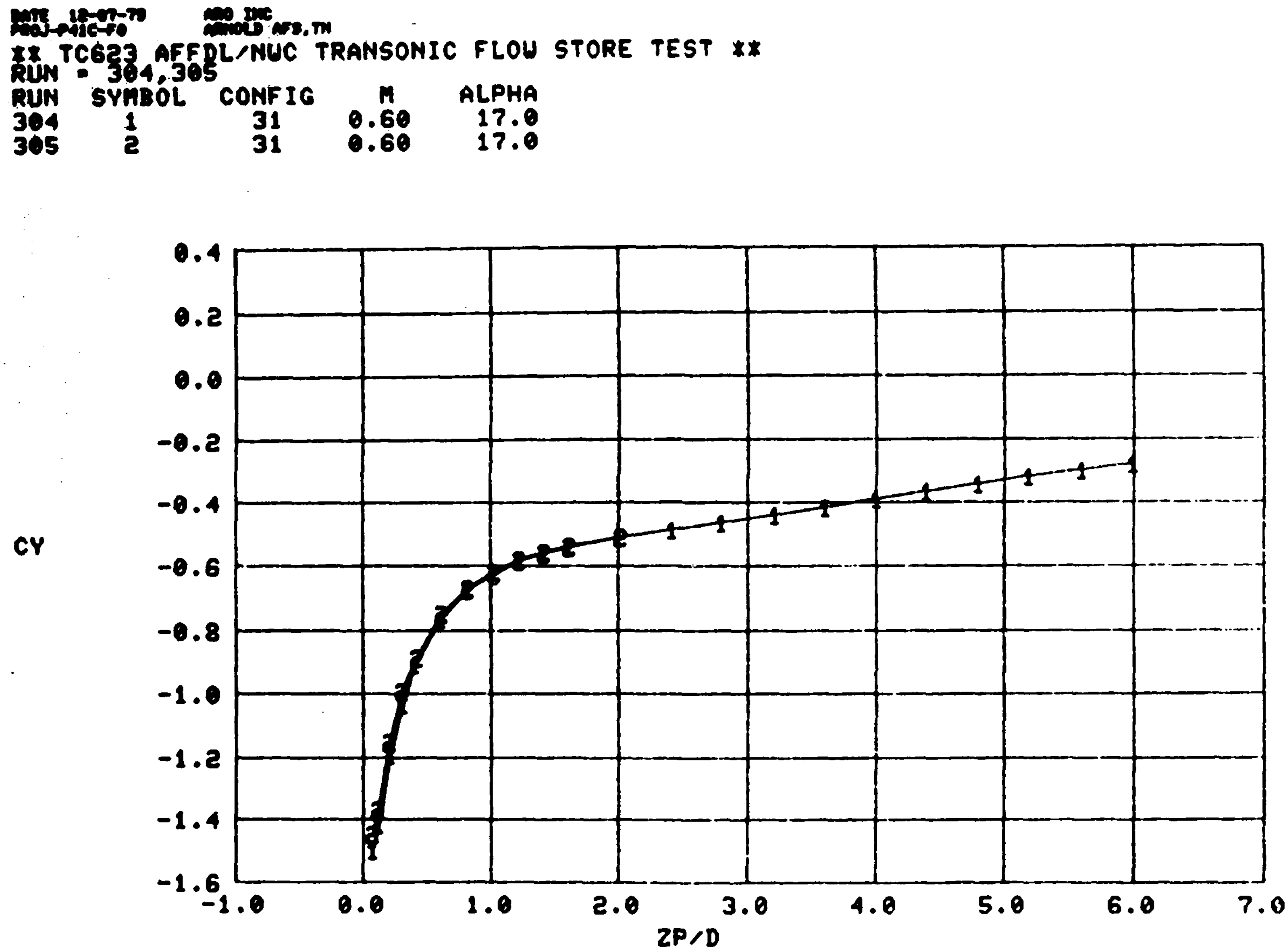
Figure 11. Example of Data Repeatability

DATE 12-07-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN
** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **
RUN = 304,305

| RUN | SYMBOL | CONFIG | M | ALPHA |
|---|---|---|---|---|
| 304 | 1 | 31 | 0.60 | 17.0 |
| 305 | 2 | 31 | 0.60 | 17.0 |

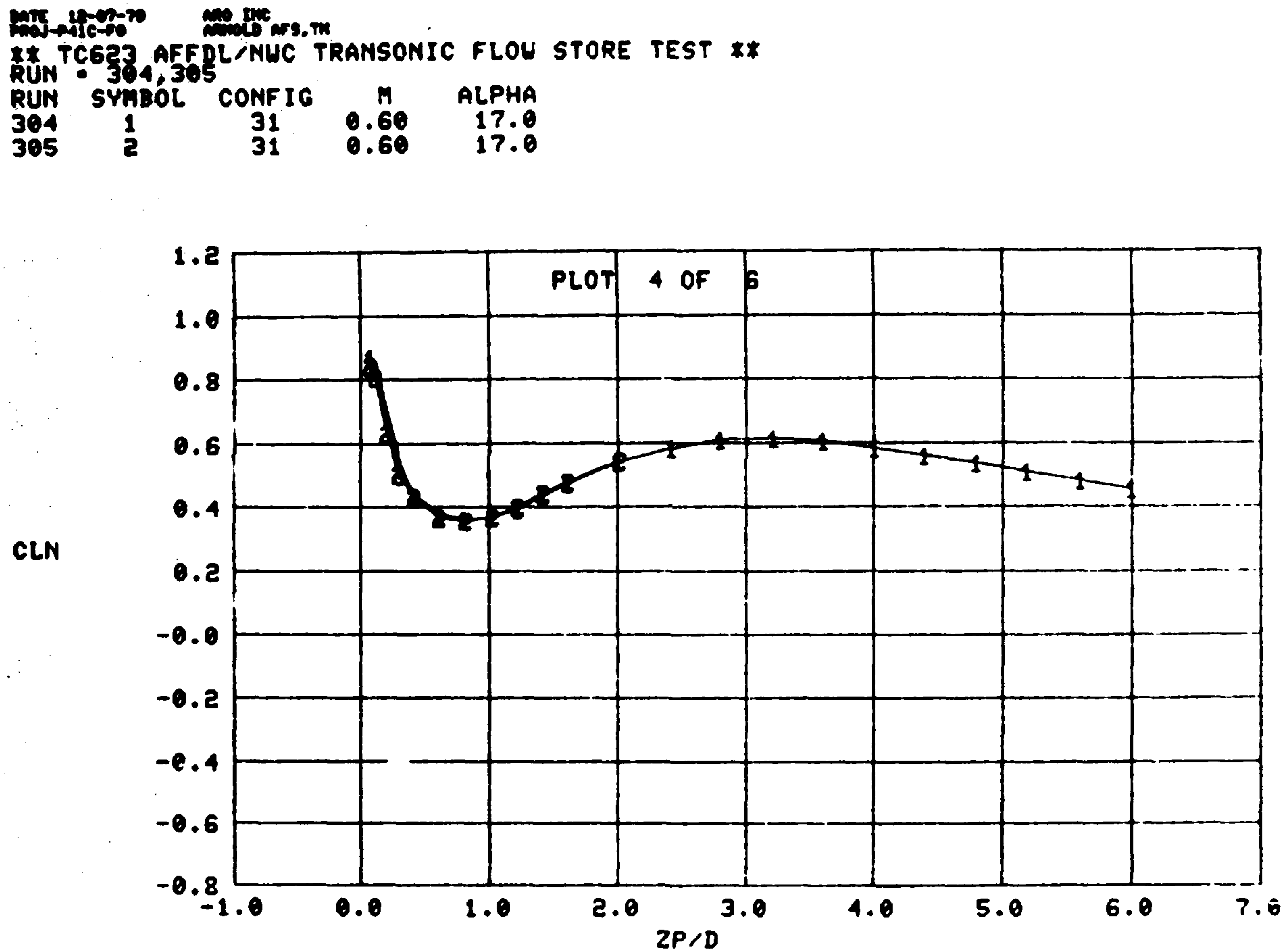



b. CLM vs ZP/D
Figure 11. Continued




c. CY vs ZP/D

Figure 11. Continued

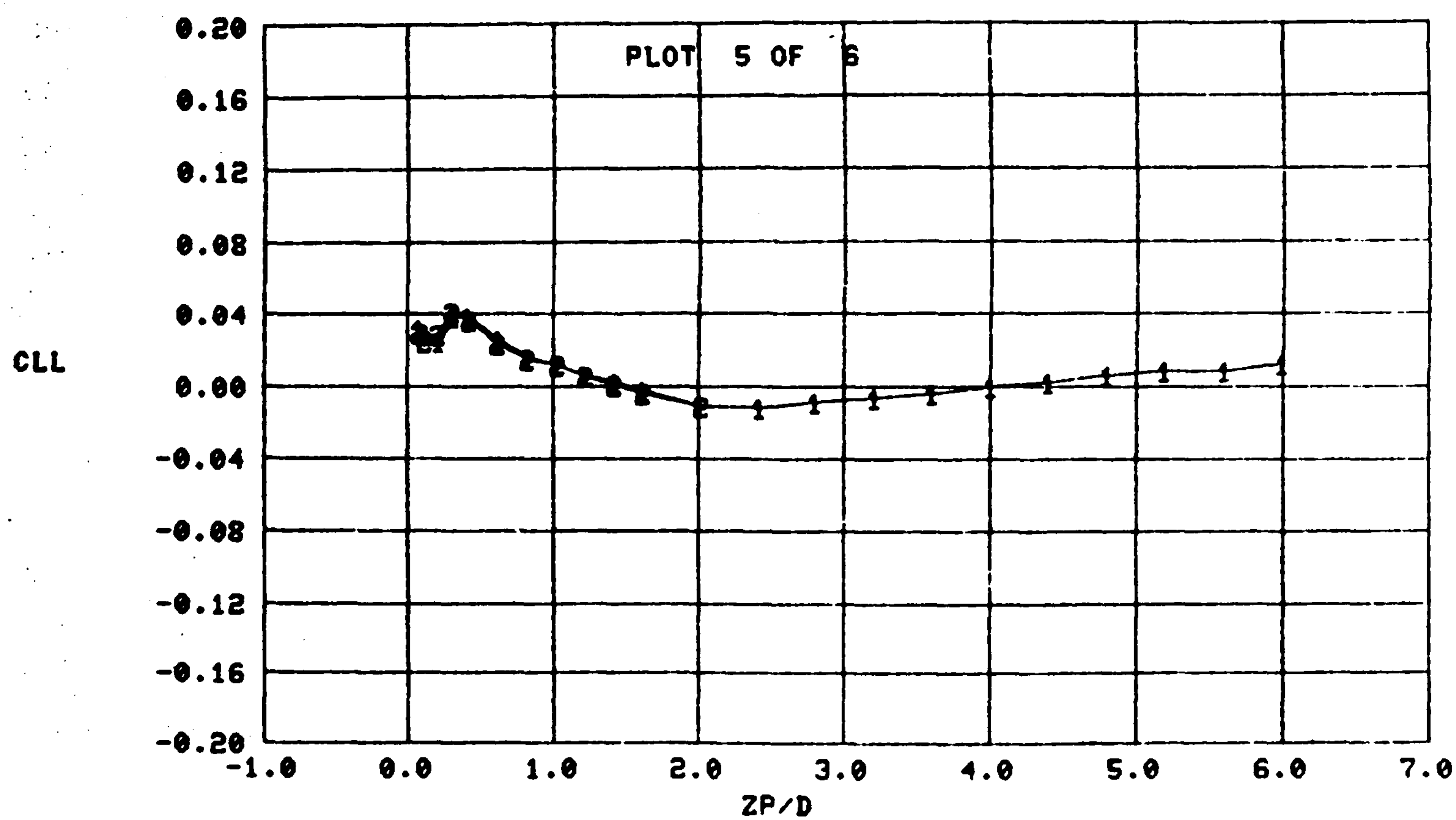



d. CLN vs ZP/D

Figure 11. Continued

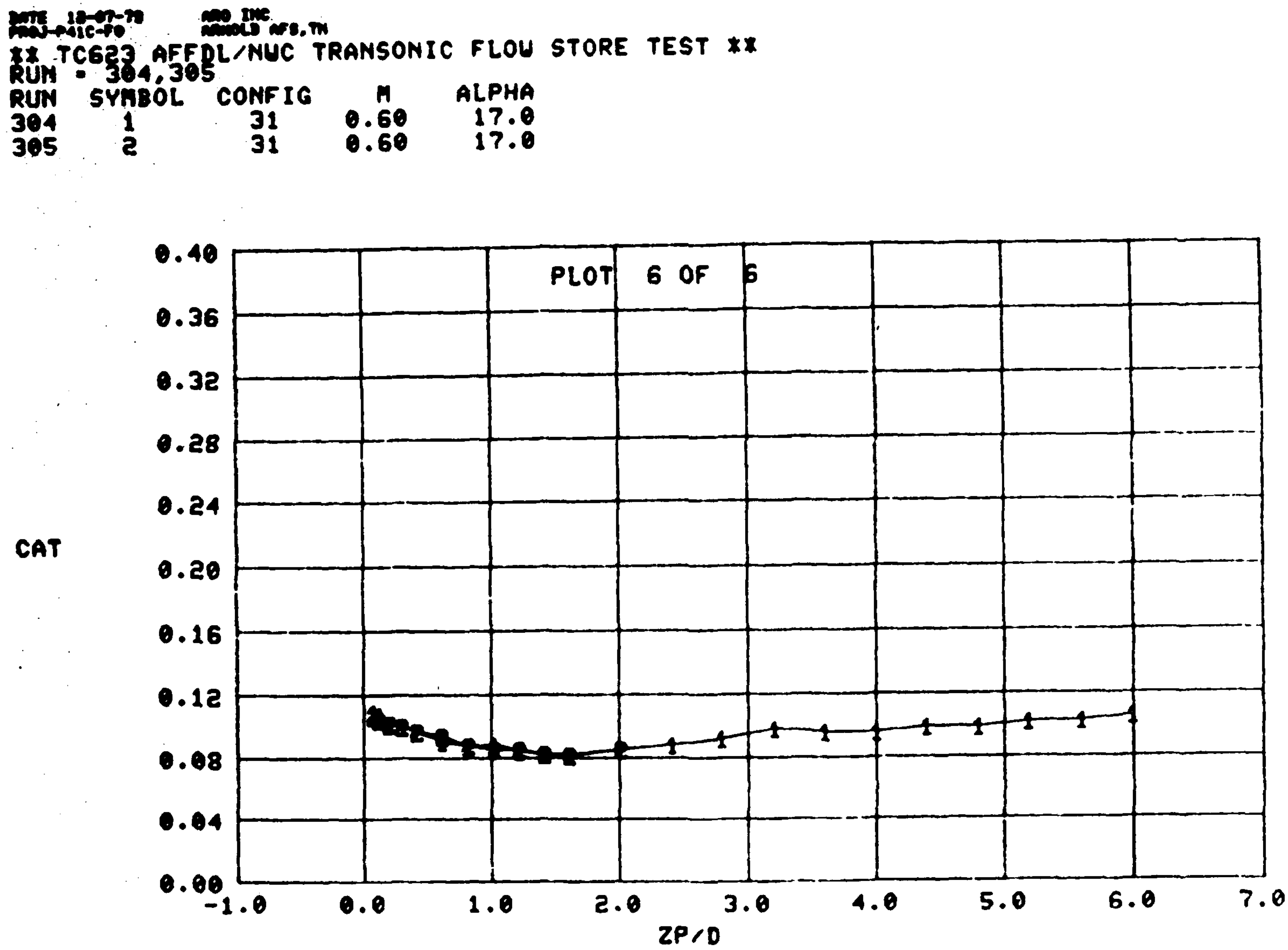
DATE 12-07-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN
** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **
RUN = 304,305

| RUN | SYMBOL | CONFIG | M | ALPHA |
|---|---|---|---|---|
| 304 | 1 | 31 | 0.60 | 17.0 |
| 305 | 2 | 31 | 0.60 | 17.0 |



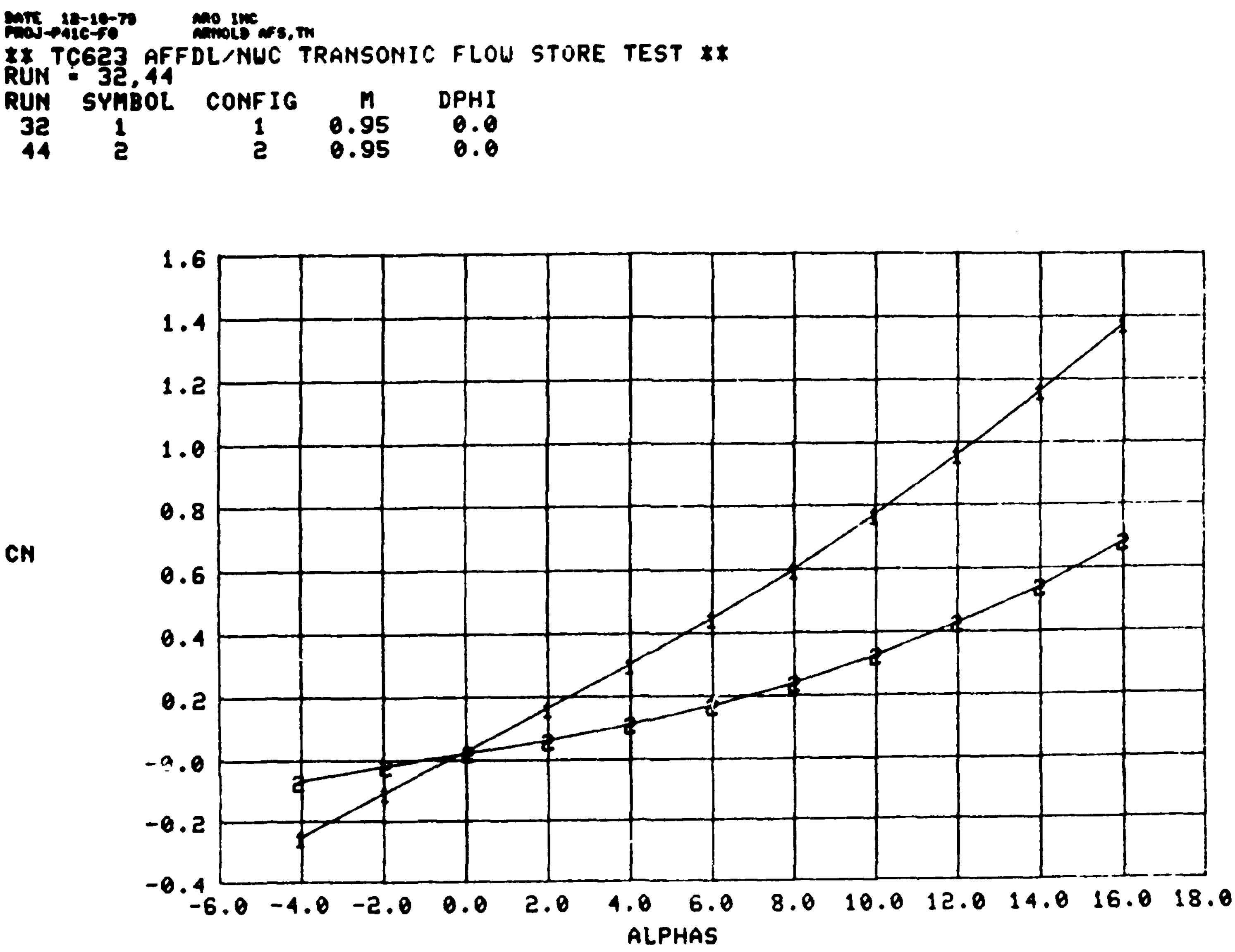

e. CLL vs ZP/D

Figure 11. Continued




f. CAT vs ZP/D

Figure 11. Concluded

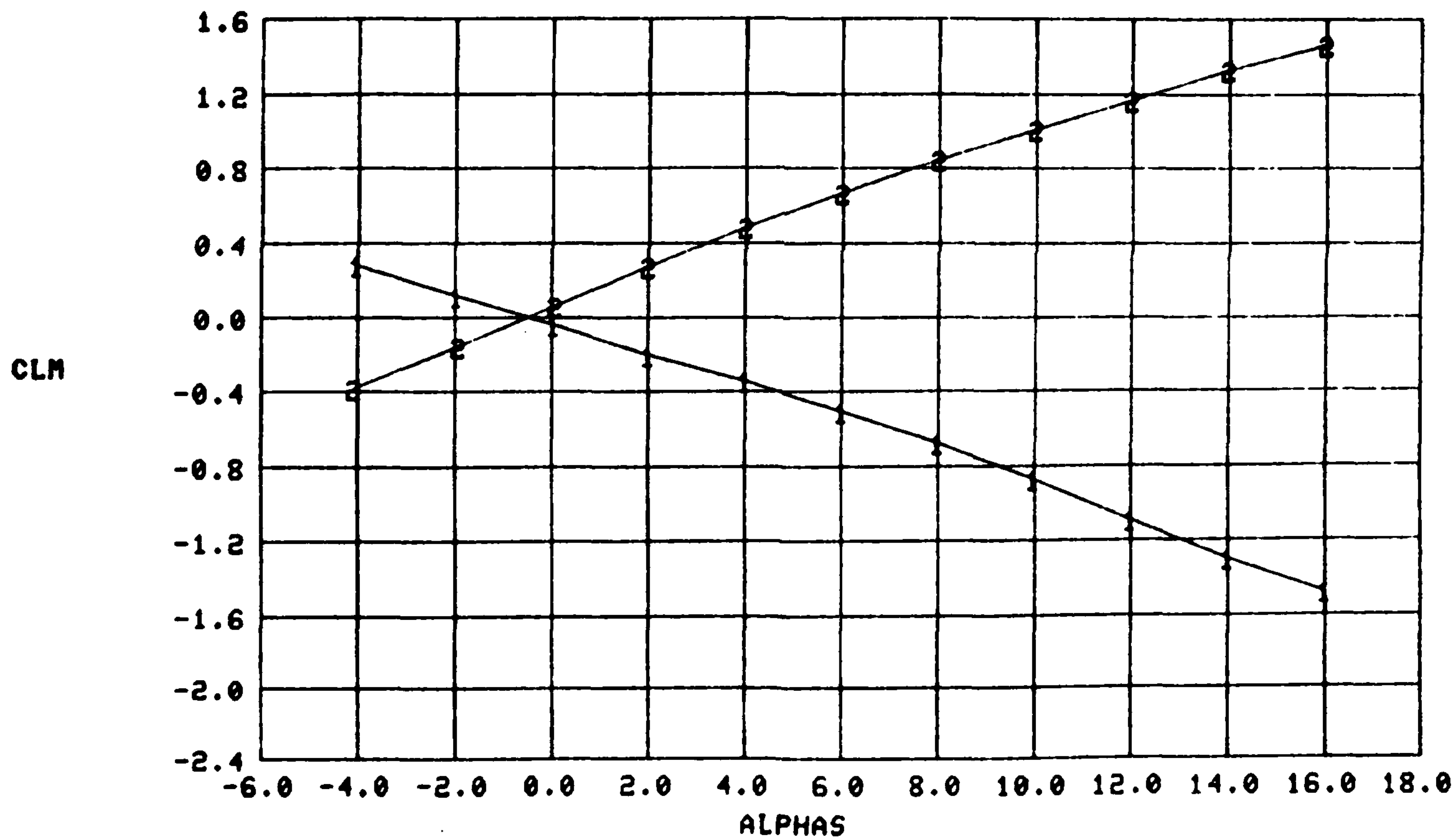



a. CN vs ALPHAS, Freestream

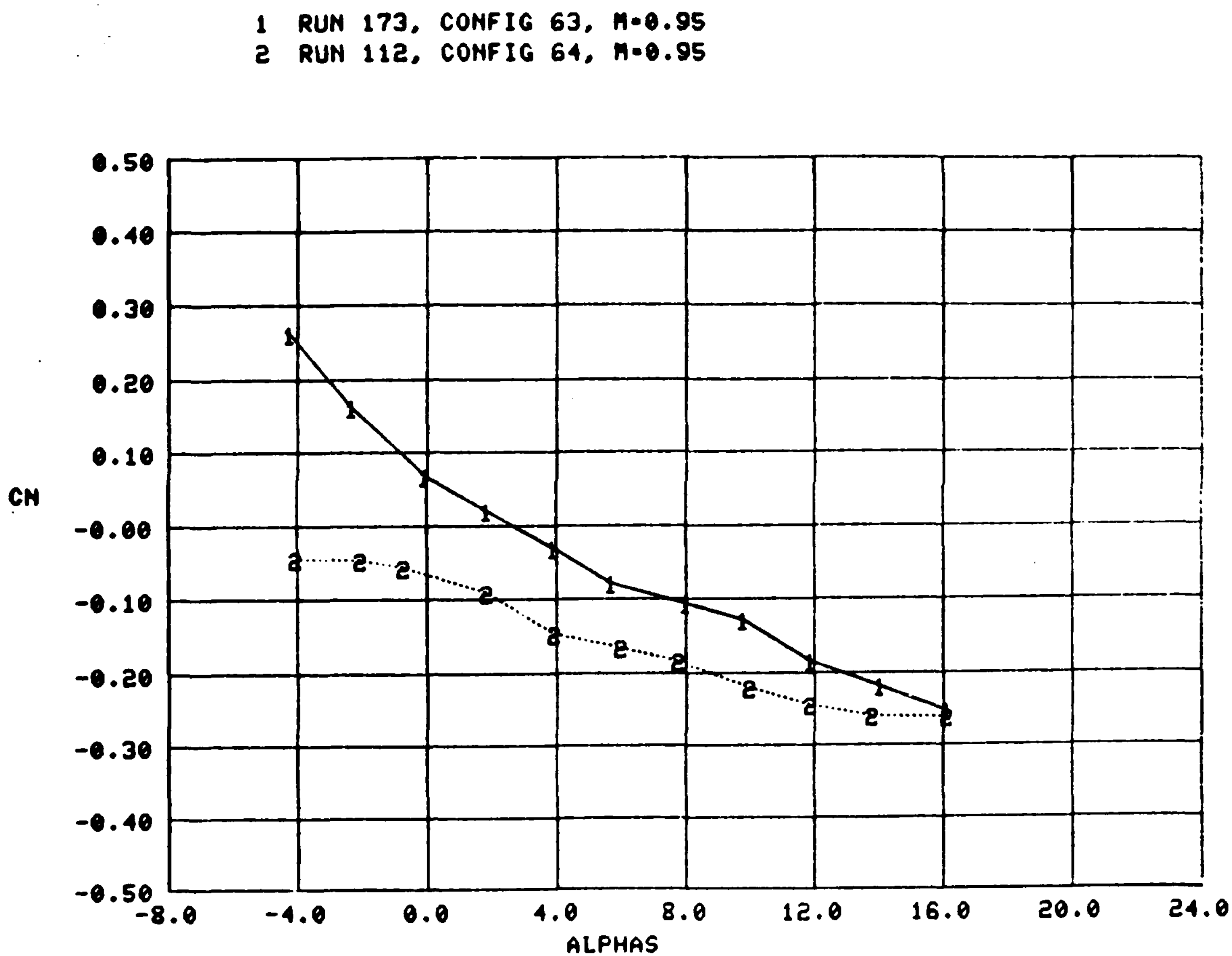
Figure 12. Typical On Line Plots

DATE 12-10-78 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN
** TC623 AFFDL/NUC TRANSONIC FLOW STORE TEST **
RUN = 32,44

| RUN | SYMBOL | CONFIG | M | DPHI |
| --- | --- | --- | --- | --- |
| 32 | 1 | 1 | 0.5 | 0.0 |
| 44 | 2 | 2 | 0.95 | 0.0 |

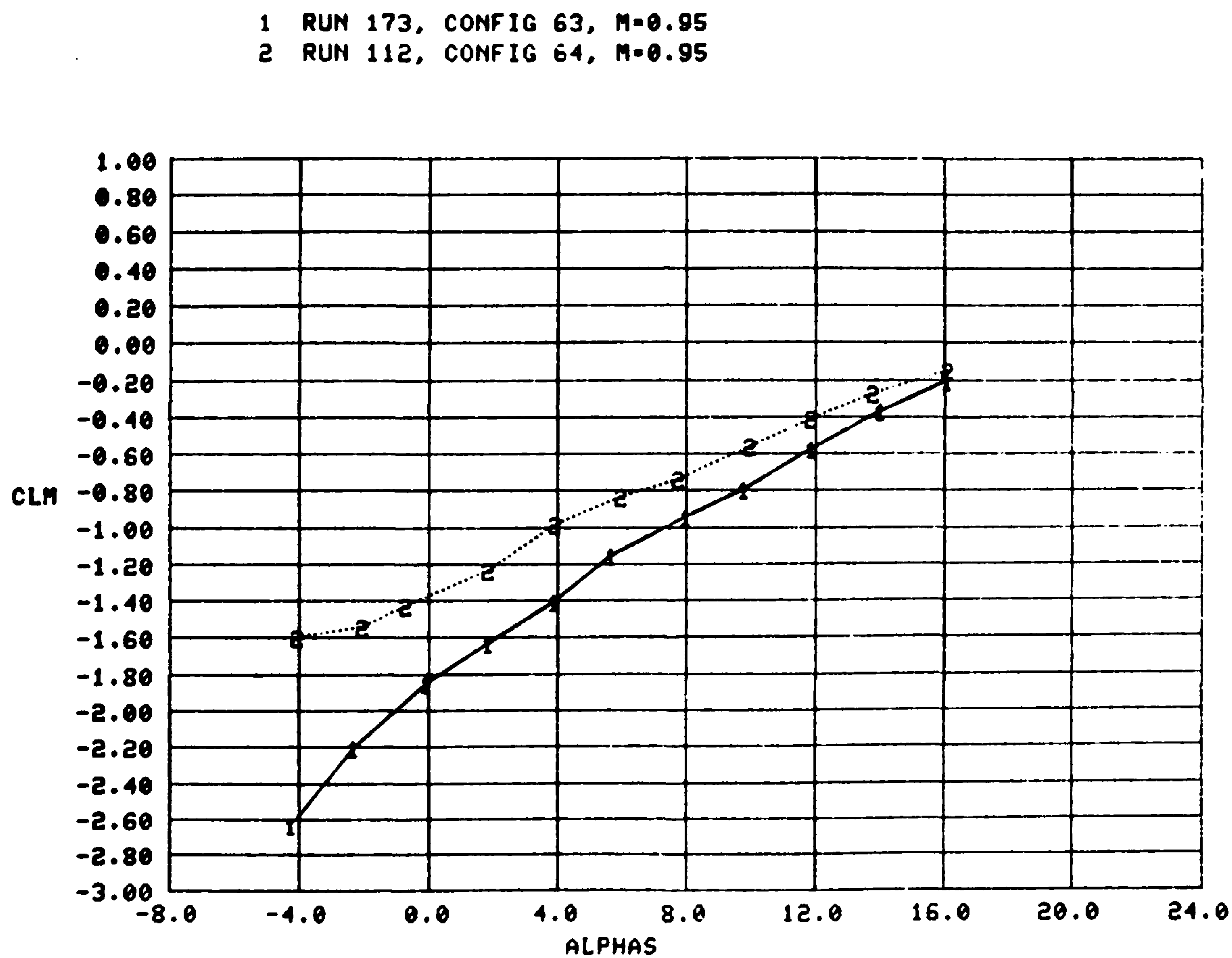



b. CLM vs ALPHAS, Freestream
Figure 12. Continued




c. CN vs ALPHAS, Captive Loads

Figure 12. Continued



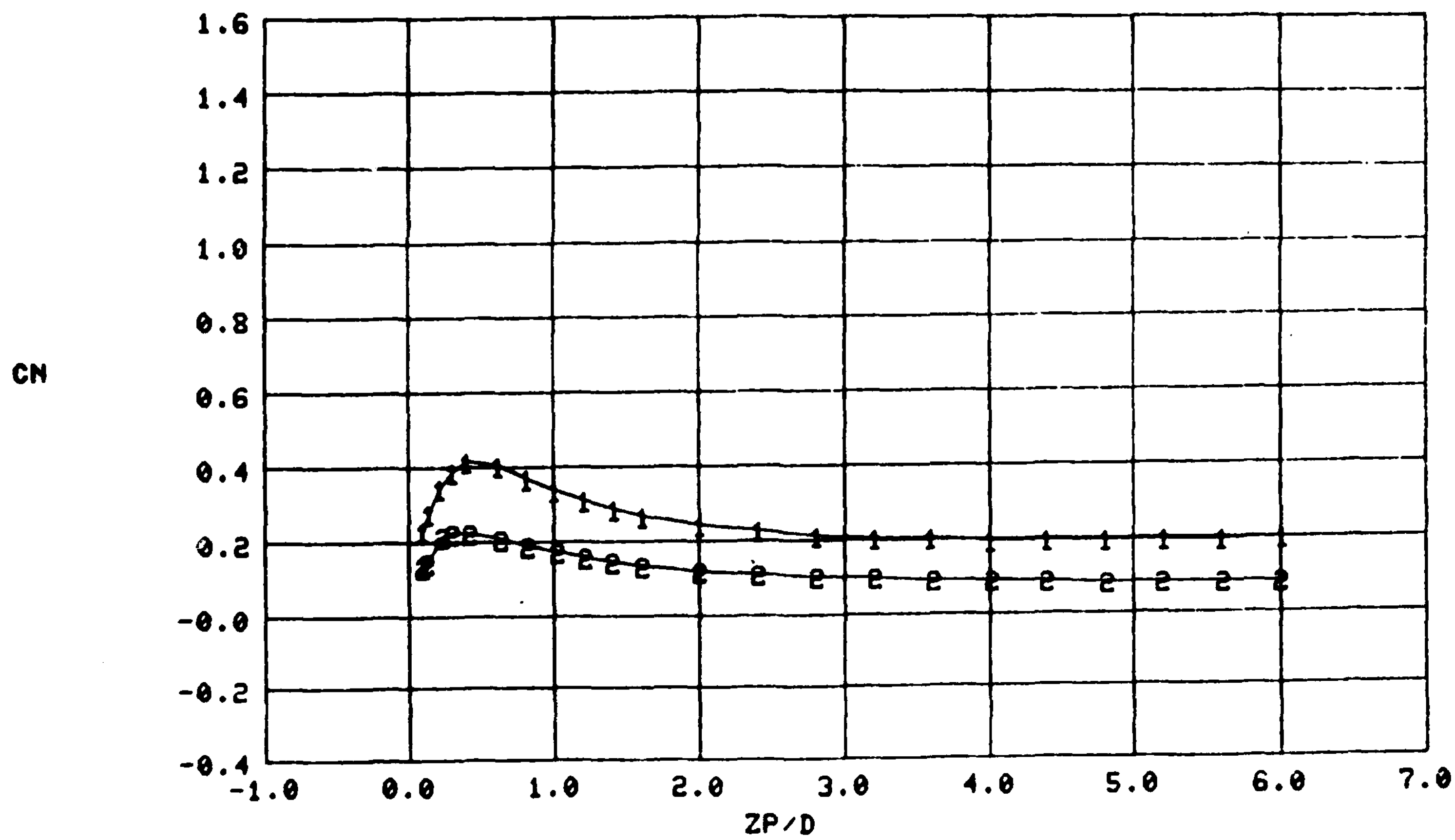

d. CLM vs ALPHAS, Captive Loads
Figure 12. Continued

DATE 12-10-79 ARO INC
PROJ-P51C-F0 ARNOLD AFS,TN

** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **

RUN = 275,244

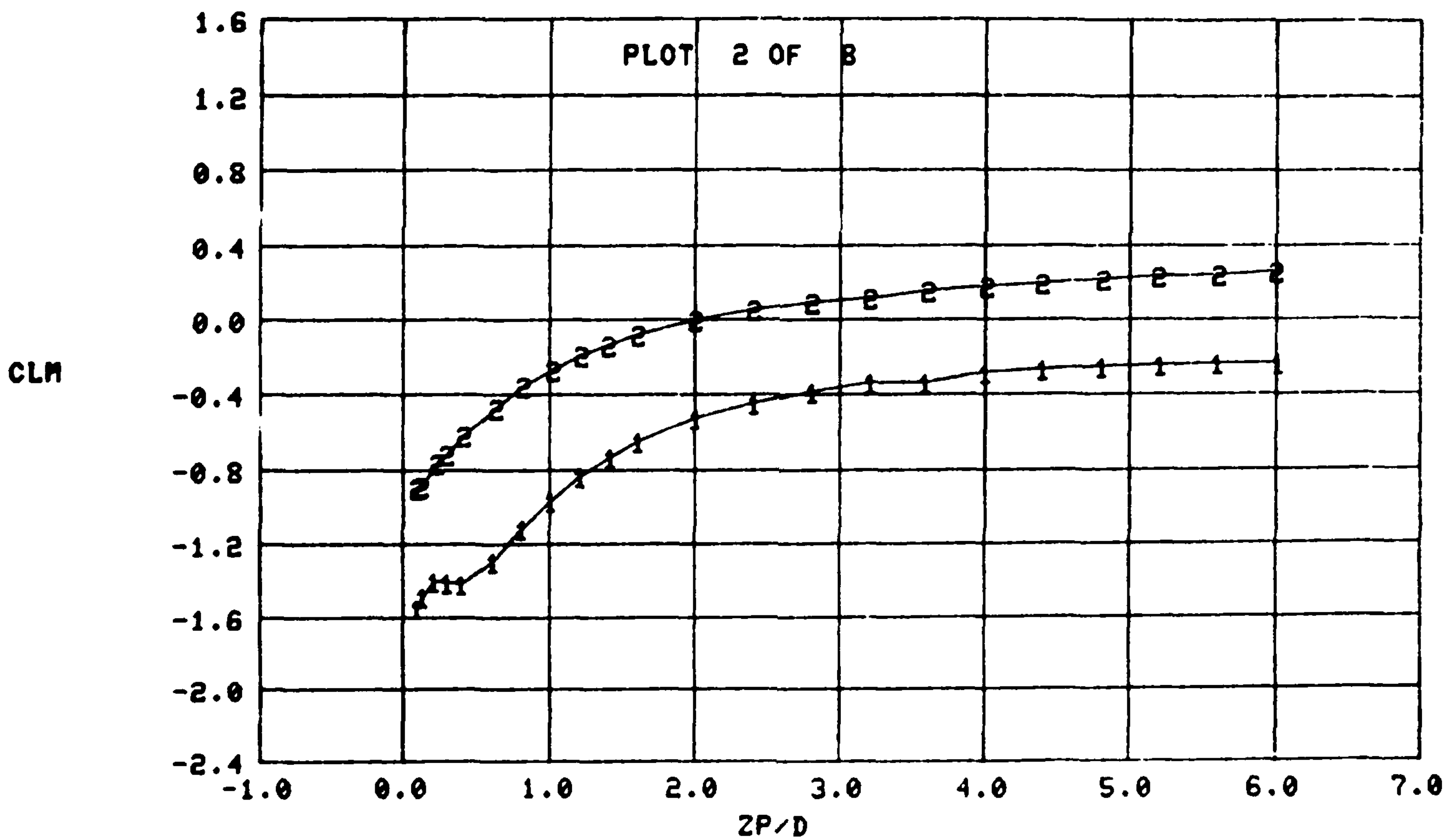
| RUN | SYMBOL | CONFIG | M | ALPHA |
|---|---|---|---|---|
| 275 | 1 | 61 | 0.95 | 5.0 |
| 244 | 2 | 62 | 0.95 | 5.0 |




e. CN vs ZP/D, Grid Phase
Figure 12. Continued

DATE 10-30-78 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN
** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **
RUN = 275,244

| RUN | SYMBOL | CONFIG | M | ALPHA |
|---|---|---|---|---|
| 275 | 1 | 61 | 0.95 | 5.0 |
| 244 | 2 | 62 | 0.95 | 5.0 |




f. CLM vs ZP/D, Grid Phase

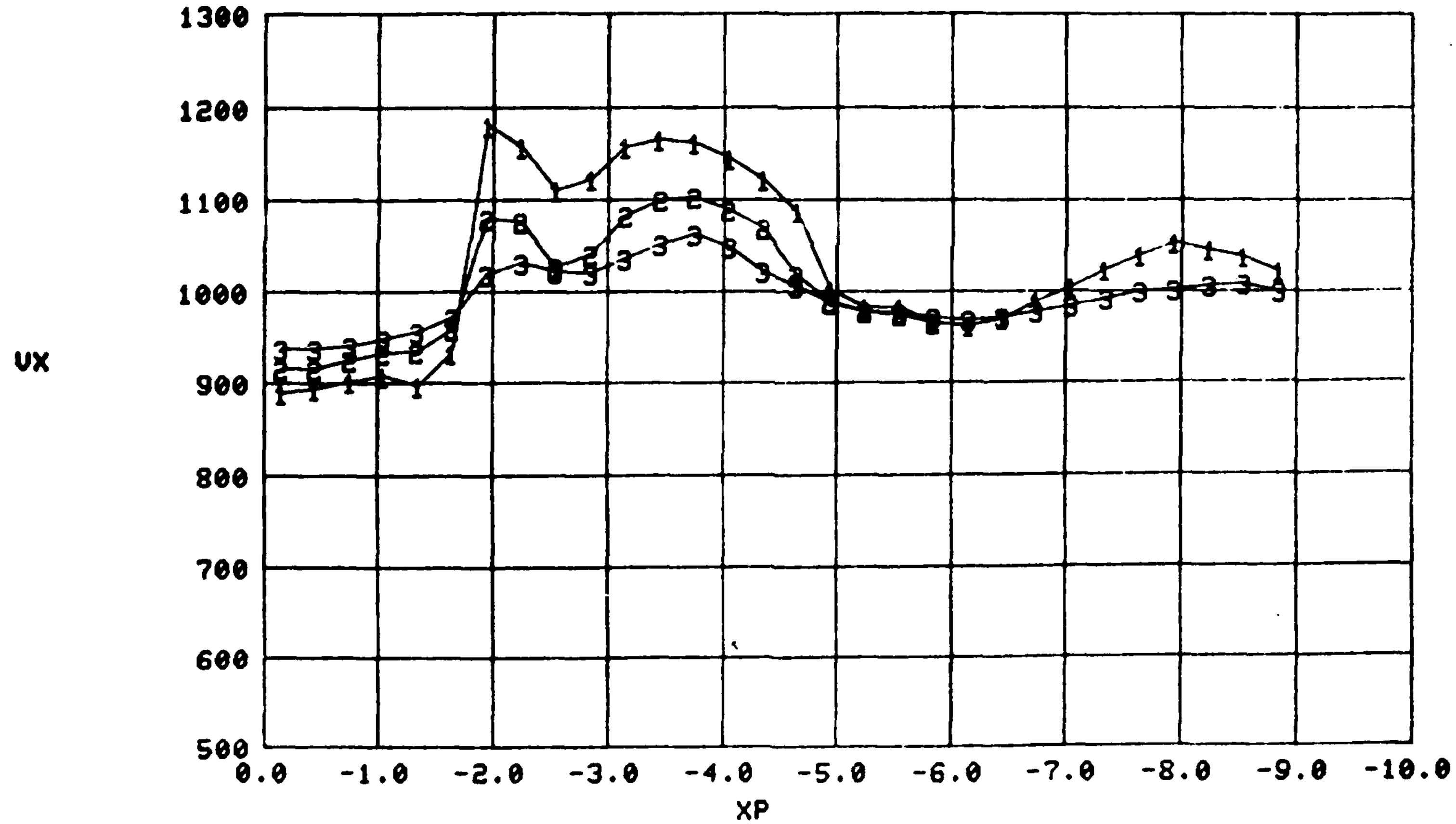
Figure 12. Continued

DATE 18-10-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN

XX TC623 AFFDL/NUC TRANSONIC FLOW STORE TEST XX

RUN = 713,714,715

| RUN | SYMBOL | CONFIG | MACH | ALPHA | YP | ZP |
|---|---|---|---|---|---|---|
| 713 | 1 | 65 | 0.95 | 5.0 | 0.00 | 0.00 |
| 714 | 2 | 65 | 0.95 | 5.0 | 0.00 | 0.35 |
| 715 | 3 | 65 | 0.95 | 5.0 | 0.00 | 0.70 |



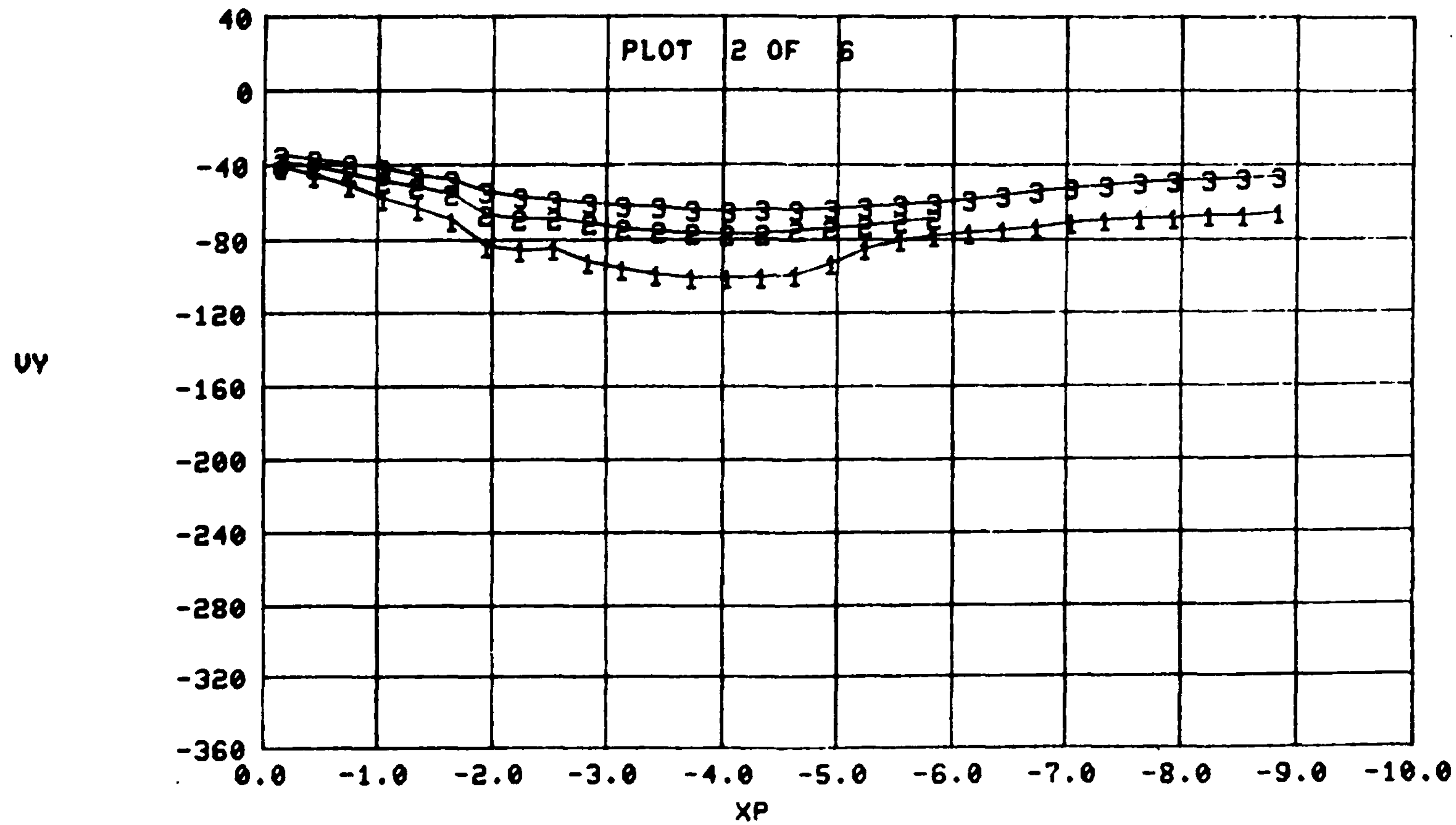

g. VX vs XP, Flow-Field Phase
Figure 12. Continued.

DATE 12-10-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN

** TC623 AFFDL/NUC TRANSONIC FLOW STORE TEST **

RUN = 713,714,715

| RUN | SYMBOL | CONFIG | MACH | ALPHA | YP | ZP |
|---|---|---|---|---|---|---|
| 713 | 1 | 65 | 0.95 | 5.0 | 0.00 | 0.00 |
| 714 | 2 | 65 | 0.95 | 5.0 | 0.00 | 0.35 |
| 715 | 3 | 65 | 0.95 | 5.0 | 0.00 | 0.70 |

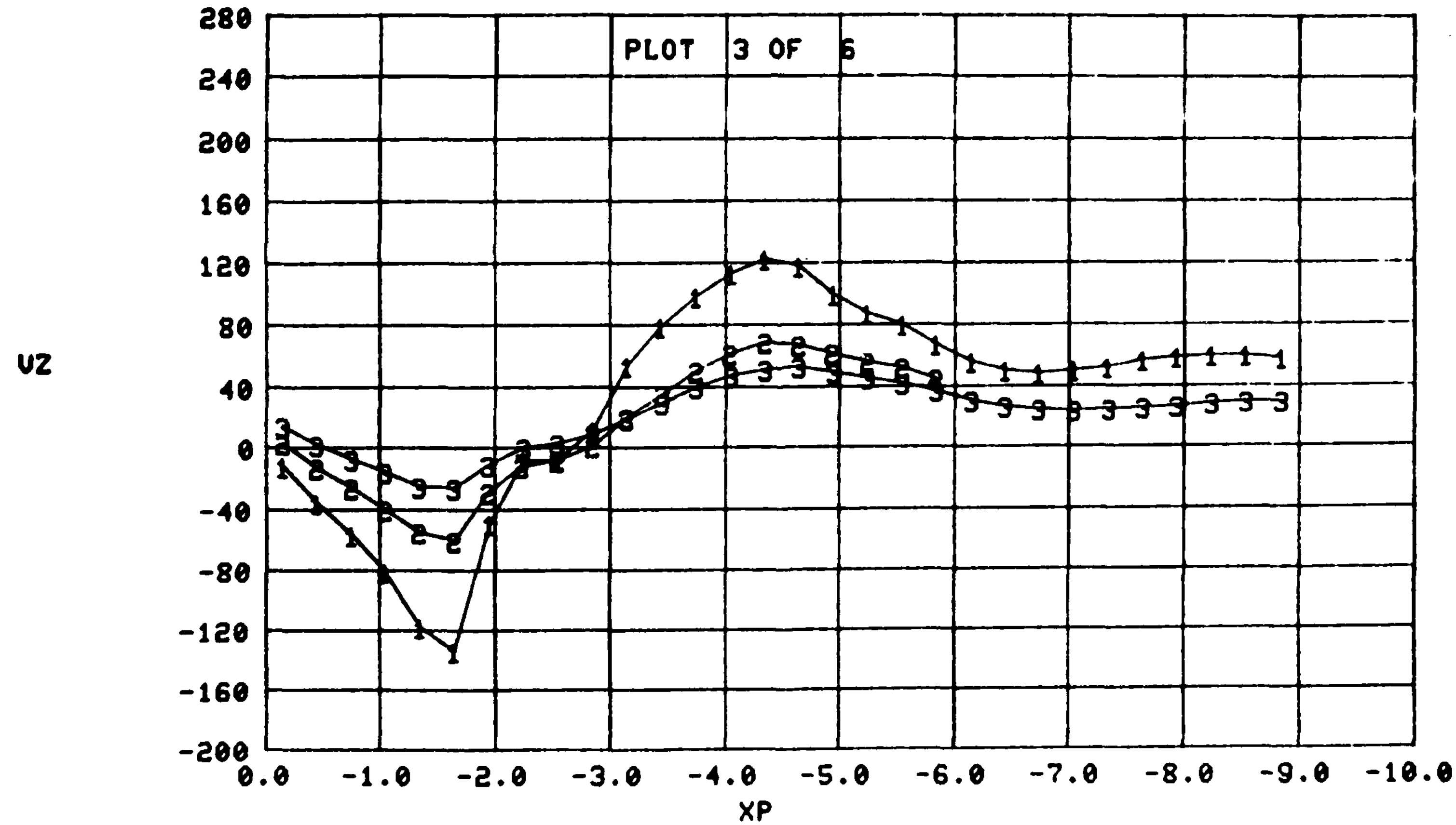



h. VY vs XP, Flow-Field Phase

Figure 12. Continued

DATE 12-10-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN
** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **
RUN = 713,714,715

| RUN | SYMBOL | CONFIG | MACH | ALPHA | YP | ZP |
|---|---|---|---|---|---|---|
| 713 | 1 | 65 | 0.95 | 5.0 | 0.00 | 0.00 |
| 714 | 2 | 65 | 0.95 | 5.0 | 0.00 | 0.35 |
| 715 | 3 | 65 | 0.95 | 5.0 | 0.00 | 0.70 |




i. VZ vs XP, Flow-Field Phase

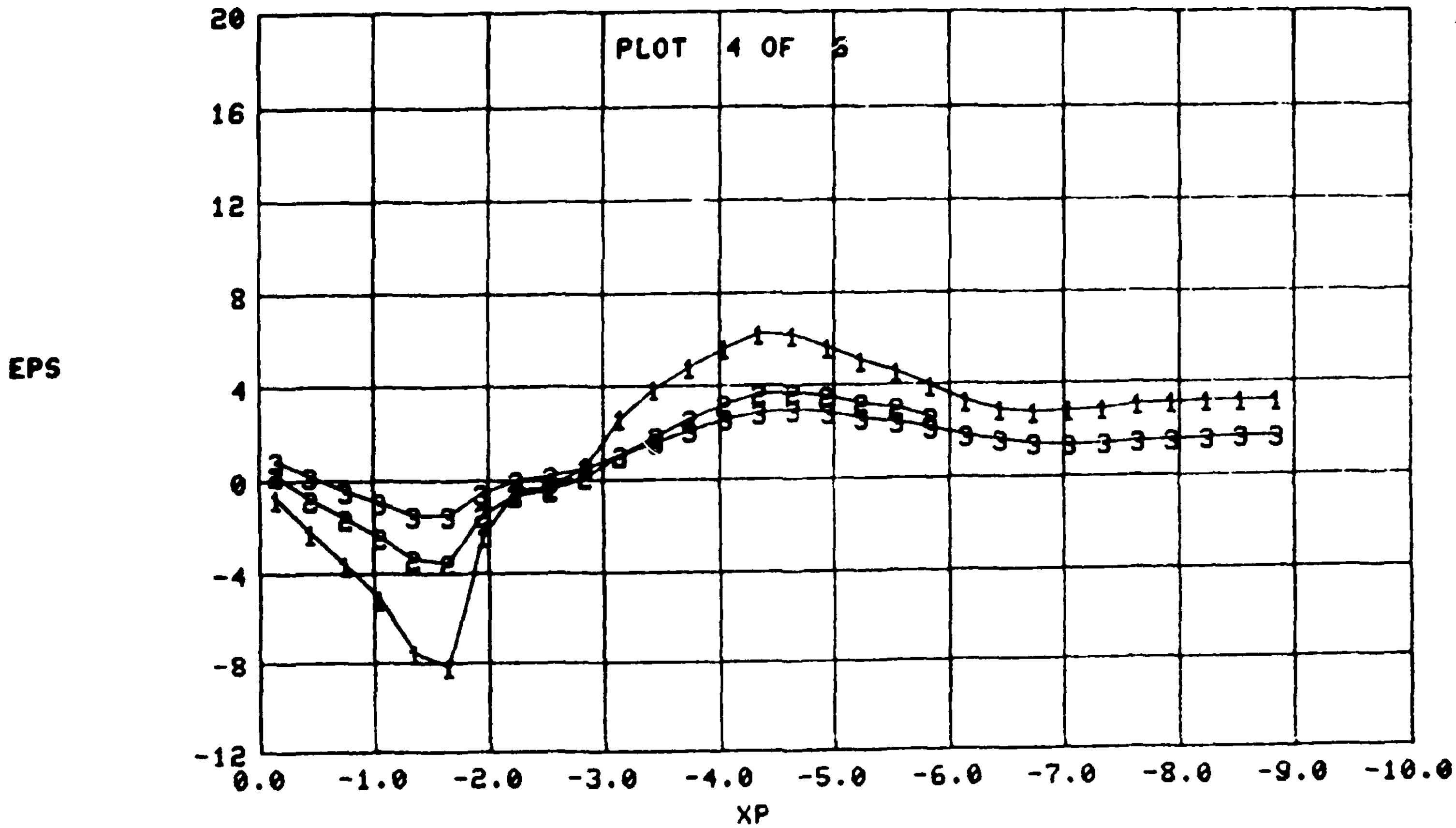
Figure 12. Continued

DATE 12-10-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN

** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **

RUN = 713,714,715

| RUN | SYMBOL | CONFIG | MACH | ALPHA | YP | ZP |
|---|---|---|---|---|---|---|
| 713 | 1 | 65 | 0.95 | 5.0 | 0.00 | 0.00 |
| 714 | 2 | 65 | 0.95 | 5.0 | 0.00 | 0.35 |
| 715 | 3 | 65 | 0.95 | 5.0 | 0.00 | 0.70 |

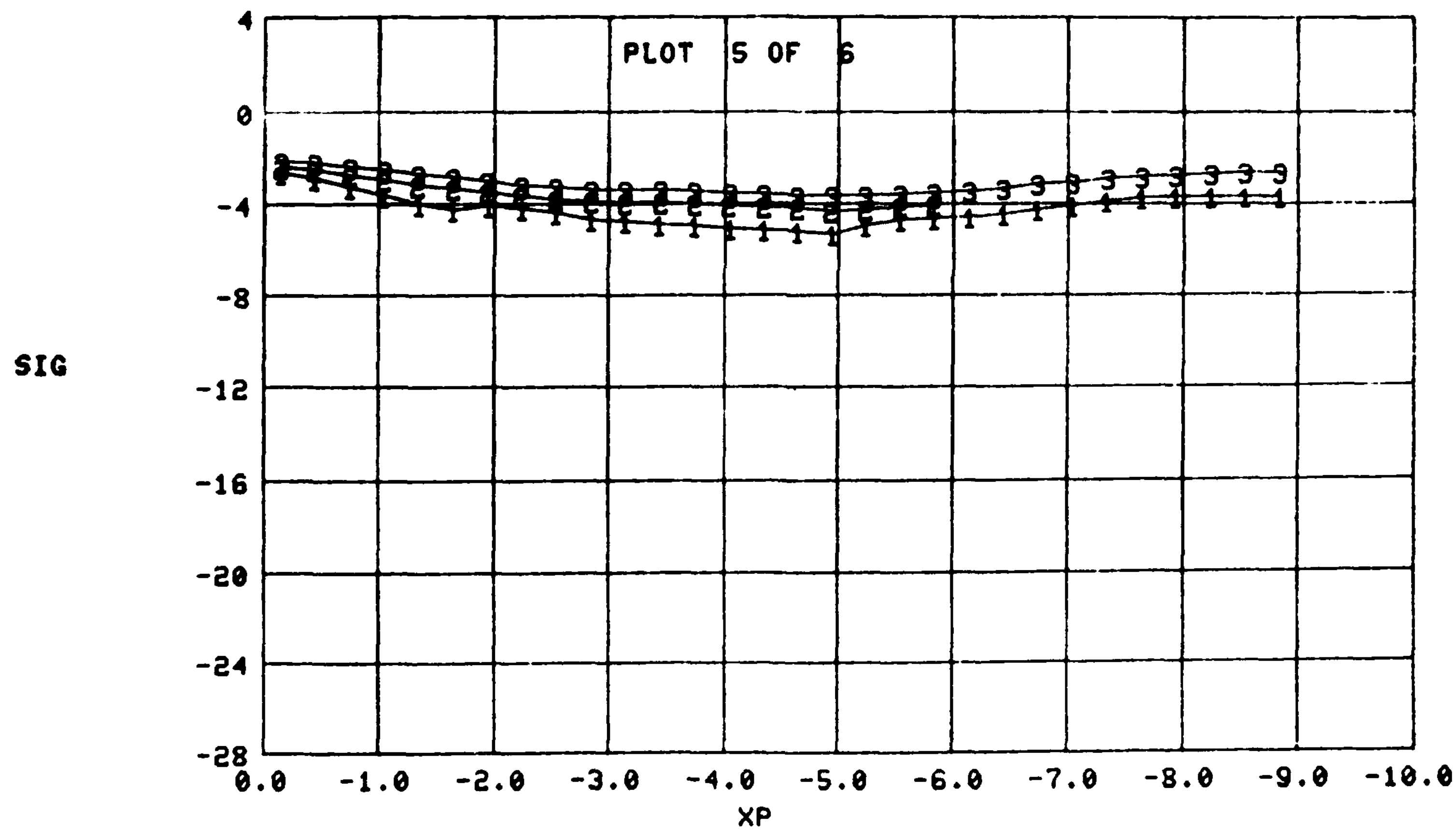



j. EPS vs XP, Flow-Field Phase

Figure 12. Continued

DATE 12-10-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN
** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **
RUN = 713,714,715

| RUN | SYMBOL | CONFIG | MACH | ALPHA | YP | ZP |
|---|---|---|---|---|---|---|
| 713 | 1 | 65 | 0.95 | 5.0 | 0.00 | 0.00 |
| 714 | 2 | 65 | 0.95 | 5.0 | 0.00 | 0.35 |
| 715 | 3 | 65 | 0.95 | 5.0 | 0.00 | 0.70 |




k. SIG vs XP, Flow-Field Phase

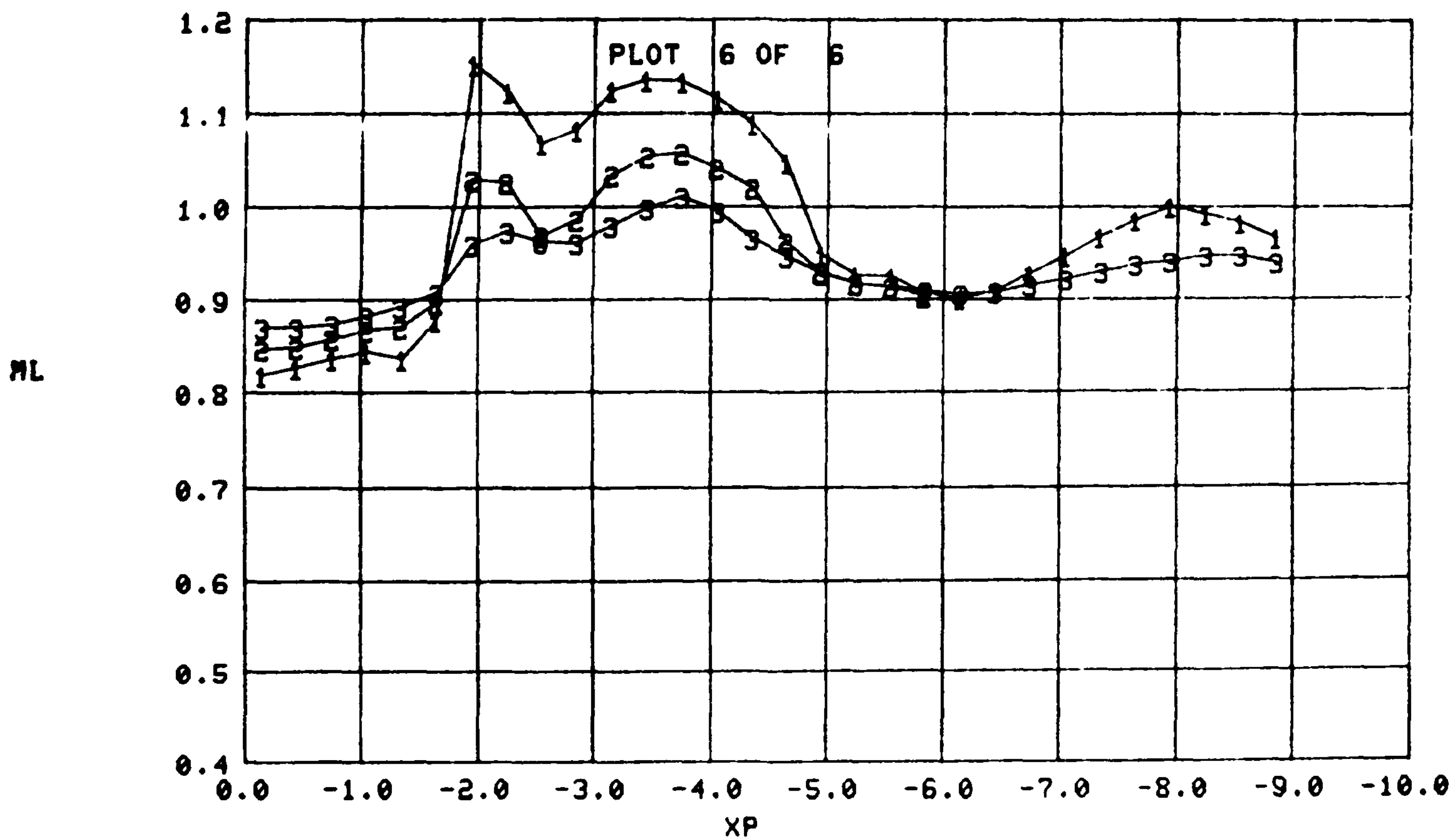
Figure 12. Continued

DATE 12-10-79 ARO INC
PROJ-P41C-F8 ARNOLD AFS,TN

** TC623 AFFDL/NUC TRANSONIC FLOW STORE TEST **

RUN = 713,714,715

| RUN | SYMBOL | CONFIG | MACH | ALPHA | YP | ZP |
|---|---|---|---|---|---|---|
| 713 | 1 | 65 | 0.95 | 5.0 | 0.00 | 0.00 |
| 714 | 2 | 65 | 0.95 | 5.0 | 0.00 | 0.35 |
| 715 | 3 | 65 | 0.95 | 5.0 | 0.00 | 0.70 |




1. ML vs XP, Flow-Field Phase

Figure 12. Concluded

Table 1.  Wind Tunnel Nominal Test Conditions

| M | PT | Q | TT | RE |
|---|---|---|---|---|
| 0.60 | 2186 | 432 | 90 | 3.5 |
| 0.70 | 1975 | 489 | | |
| 0.80 | 1835 | 539 | | |
| 0.90 | 1741 | 584 | | |
| 0.95 | 1708 | 604 | | |

Table 2. Grid Aerodynamic Loads Survey Locations

| | | ZP/D | |
|---|---|---|---|
| XP | YP | Grid Type A | Grid Type B |
| 0.0 | 0.0 | 0.0 | 0.0 |
| | | 0.4 | 0.1 |
| | | 0.8 | 0.2 |
| | | 1.2 | 0.3 |
| | | 1.6 | 0.4 |
| | | 2.0 | 0.6 |
| | | 2.4 | 0.8 |
| | | 2.8 | 1.0 |
| | | 3.2 | 1.2 |
| | | 3.6 | 1.4 |
| | | 4.0 | 1.6 |
| | | 4.4 | 2.0 |
| | | 4.8 | 2.4 |
| | | 5.2 | 2.8 |
| | | 5.6 | 3.2 |
| | | 6.0 | 3.6 |
| | | | 4.0 |
| | | | 4.4 |
| | | | 4.8 |
| | | | 5.2 |
| | | | 5.6 |
| | | | 6.0 |

Table 3. Flow Field Survey Locations

| SURVEY TYPE | INITIAL XP | FINAL XP | INCREMENT IN XP | YP | ZP |
|---|---|---|---|---|---|
| A | -0.15 | -8.85 | -0.30 | 0.00 | 0.00 |
| ↓ | ↓ | ↓ | ↓ | ↓ | 0.35 |
| | | | | | 0.70 |
| B | -0.15 | -5.85 | -0.30 | ±0.35 | 0.00 |
| ↓ | ↓ | ↓ | ↓ | ↓ | 0.35 |

Table 4. Data Uncertainties

a. Aerodynamic Coefficient Uncertainties

| M | ΔCN | ΔCY | ΔCAT | ΔCLM | ΔCLN | ΔCLL |
|---|---|---|---|---|---|---|
| 0.60 | ±0.03 | ±0.03 | ±0.04 | ±0.04 | ±0.03 | ±0.01 |
| 0.70 | ±0.02 | ±0.02 | ±0.04 | ±0.04 | ±0.02 | ±0.01 |
| 0.80 | ±0.02 | ±0.02 | ±0.03 | ±0.03 | ±0.02 | ±0.01 |
| 0.90 | ±0.02 | ±0.02 | ±0.03 | ±0.03 | ±0.02 | ±0.01 |
| 0.95 | ±0.02 | ±0.02 | ±0.03 | ±0.03 | ±0.02 | ±0.01 |

b. Flow Field Angle Uncertainties

| | ΔEPS | ΔSIG |
|---|---|---|
| All Mach No. | ±0.25 | ±0.25 |

TABLE 5. RUN NUMBER SUMMARY

a. CAPTIVE LOADS RUN NUMBER SUMMARY

| CONFIG | ALPHA* | RUN | | | | |
|---|---|---|---|---|---|---|
| | | M= 0.60 | M = 0.70 | M = 0.80 | M = 0.90 | M = 0.95 |
| 33 | A | 86 | | 87 | | 88 |
| 34 | | 121 | | | | 122 |
| | | 126 | | | | 125 |
| 36 | | 141 | | 142 | | 143 |
| 37 | | 160 | | | | 161 |
| 43 | | 81 | | 82 | | 83 |
| 53 | | 77 | | | | 78 |
| 54 | | 129 | | | | 130 |
| 56 | | 136 | | | | 137 |
| 57 | | 164 | | | | 165 |
| 63 | | 97 | 98 | 99 | 100 | 101 |
| | | 104 | 105 | 106 | 107 | 108 |
| | | 174 | 170 | 171 | 172 | 173 |
| 64 | | 111 | | | | 112 |
| 66 | | 146 | | 147 | | 148 |
| 67 | | 153 | | | | 154 |
| 83 | | 91 | | 92 | | 93 |

***A: ALPHA = -3, -1, 1, 3, 5, 7, 9, 11, 13, 15, 17**

TABLE 5. CONTINUED

b. GRID RUN NUMBER SUMMARY

| CONFIG | M | ZP/D* | RUN ALPHA=1 | ALPHA=5 | ALPHA=9 | ALPHA=13 | ALPHA=17 |
|---|---|---|---|---|---|---|---|
| 11 | 0.60 | A | 343 | 344 | 345 | 346 | 347 |
| | 0.95 | | 352 | 351 | 350 | 349 | 348 |
| 21 | 0.60 | | 338 | 339 | 340 | | |
| 31 | | B | 300 | 301 | 302 | 303 | 304 |
| | 0.80 | | 310 | 309 | 308 | 307 | 306 |
| | 0.95 | | 311 | 312 | 313 | 314 | 315 |
| 32 | 0.60 | | 232 | 233 | 234 | | |
| | 0.95 | | 237 | 236 | 235 | | |
| 51 | 0.60 | | 319 | 320 | 321 | | |
| | 0.95 | | 324 | 323 | 322 | | |
| 52 | 0.60 | | 219 | 220 | 221 | | |
| | 0.95 | | 229 | 225 | 224 | | |
| 61 | 0.60 | | 249 | 250 | 251 | 254 | 255 |
| | 0.70 | | 258 | 257 | 256 | | |
| | 0.80 | | 260 | 261 | 262 | 263 | 264 |
| | 0.90 | | 279 | 274 | 265 | | |
| | 0.95 | | 280 | 275 | 276 | 277 | 278 |
| 610 | 0.60 | | 327 | | | | |
| | 0.70 | | 328 | | | | |
| | 0.80 | | 329 | | | | |
| | 0.90 | | 331 | | | | |
| | 0.95 | | 334 | | | | |
| 62 | 0.60 | | 240 | 241 | 242 | | |
| | 0.95 | | 245 | 244 | 243 | | |
| 81 | 0.60 | | 283 | 284 | 285 | | |
| | 0.80 | | 292 | 287 | 286 | | |
| | 0.95 | | 294 | 295 | 296 | | |

*ZP/D SCHEDULES

A: ZP/D = 0, 0.4, 0.8, 1.2, 1.6, 2.0, 2.4, 2 8, 3.2, 3.6, 4.0, 4.4, 4.8, 5.2, 5.6, 6.0

B: ZP/D = 0, 0.1, 0.2, 0.3, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 2.0, 2.4, 2.8, 3.2, 3.6, 4.0, 4.4, 4.8, 5.2, 5.6, 6.0,

TABLE 5. CONTINUED

c. FREESTREAM RUN NUMBER SUMMARY

| CONFIG | M | ALPHAS* | RUN DPHI=0.0 | DPHI=22.5 | DPHI=45.0 | DPHI=67.5 | DPHI=90.0 |
|---|---|---|---|---|---|---|---|
| 1 | 0.60 | A | 12 | 13 | 14 | 15 | 16 |
| | 0.70 | | 17 | 18 | 19 | 20 | 2 |
| | 0.80 | | 22 | 23 | 24 | 25 | 26 |
| | 0.90 | | 27 | 28 | 29 | 30 | 31 |
| | 0.95 | | 32 | 33 | 34 | 35 | 36 |
| 2 | 0.60 | | 40 | | | | |
| | 0.70 | | 41 | | | | |
| | 0.80 | | 42 | | | | |
| | 0.90 | | 43 | | | | |
| | 0.95 | | 44 | | | | |

***A: ALPHAS = -4, -2, 0, 2, 4, 6, 8, 10, 12, 14, 16**

TABLE 5. Continued

d. FLOWFIELD RUN NUMBER SUMMARY

| CONFIG | M | ALPHA | XP* | RUN YP = 0.0 ZP=0.0 | YP = 0.0 ZP=0.35 | YP = 0.0 ZP=0.70 | YP = 0.35 ZP=0.0 | YP = 0.35 ZP=0.35 | YP = -0.35 ZP=0.0 | YP = -0.35 ZP=0.35 |
|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 0.60 | 1.0 | A | 956 | | 958 | | | | |
| | | ↓ | B | | 957 | | | | | |
| | | 5.0 | A | 959 | | 961 | | | | |
| | | ↓ | B | | 960 | | | | | |
| | | 9.0 | A | 962 | | 964 | | | | |
| | | ↓ | B | | 963 | | | | | |
| | | 13.0 | A | 965 | | 967 | | | | |
| | | ↓ | B | | 966 | | | | | |
| | | 17.0 | A | 968 | | 970 | | | | |
| | | ↓ | B | | 969 | | | | | |
| | 0.95 | 1.0 | A | 985 | | 987 | | | | |
| | | ↓ | B | | 986 | | | | | |
| | | 5.0 | A | 973 | | 975 | | | | |
| | | ↓ | B | | 974 | | | | | |
| | | 9.0 | A | 976 | | 978 | | | | |
| | | ↓ | B | | 977 | | | | | |
| | | 13.0 | A | 979 | | 981 | | | | |
| | | ↓ | B | | 980 | | | | | |
| | | 17.0 | A | 982 | | 984 | | | | |
| | | ↓ | B | | 983 | | | | | |
| 25 | 0.60 | 1.0 | A | 939 | | 941 | | | | |
| | | ↓ | B | | 940 | | 942 | | 943 | |
| | | 5.0 | A | 944 | | 946 | | | | |
| | | ↓ | B | | 945 | | 947 | | 948 | |
| | | 9.0 | A | 949 | | 951 | | | | |
| | | ↓ | B | | 950 | | 952 | | 953 | |

*** XP SCHEDULES**

| | INITIAL XP | FINAL XP | INCREMENT IN XP |
|---|---|---|---|
| A | -0.15 | -8.85 | -0.30 |
| B | -0.15 | -5.85 | -0.30 |

TABLE 5. CONTINUED

e. FLOWFIELD RUN NUMBER SUMMARY

| CONFIG | M | ALPHA | XP* | RUN YP = 0.0 ZP=0.0 | RUN YP = 0.0 ZP=0.35 | RUN YP = 0.0 ZP=0.70 | RUN YP = 0.35 ZP=0.0 | RUN YP = 0.35 ZP=0.35 | RUN YP = -0.35 ZP=0.0 | RUN YP = -0.35 ZP=0.35 |
|---|---|---|---|---|---|---|---|---|---|---|
| 35 | 0.60 | 1.0 | A | 771 | | 773 | | | | |
| | | | B | | 772 | | 774 | 775 | 776 | 777 |
| | | 5.0 | A | 778 | | 780 | | | | |
| | | | B | | 779 | | 781 | 782 | 783 | 784 |
| | | 9.0 | A | 785 | | 787 | | | | |
| | | | B | | 786 | | 788 | 789 | 790 | 791 |
| | | 13.0 | A | 792 | | 794 | | | | |
| | | | B | | 793 | | 795 | 796 | 797 | 798 |
| | | 17.0 | A | 799 | | 801 | | | | |
| | | | B | | 800 | | 802 | 803 | 804 | 805 |
| | 0.80 | 1.0 | A | 806 | | 808 | | | | |
| | | | B | | 807 | | 809 | 810 | 811 | 812 |
| | | 5.0 | A | 820 | | 822 | | | | |
| | | | B | | 821 | | 823 | 824 | 825 | 826 |
| | | 9.0 | A | 827 | | 829 | | | | |
| | | | B | | 828 | | 830 | 831 | 832 | 833 |
| | | 13.0 | A | 835 | | 837 | | | | |
| | | | B | | 836 | | 838 | 839 | 840 | 841 |
| | | 17.0 | A | 842 | | 844 | | | | |
| | | | B | | 843 | | 845 | 846 | 847 | 848 |
| | 0.95 | 1.0 | A | 849 | | 851 | | | | |
| | | | B | | 850 | | 852 | 853 | 854 | 855 |
| | | 5.0 | A | 856 | | 858 | | | | |
| | | | B | | 857 | | 859 | 860 | 861 | 862 |
| | | 9.0 | A | 863 | | 865 | | | | |
| | | | B | | 864 | | 866 | 867 | 868 | 869 |

* **XP SCHEDULES**

| | INITIAL XP | FINAL XP | INCREMENT IN XP |
|---|---|---|---|
| A | -0.15 | -8.85 | -0.30 |
| B | -0.15 | -5.85 | -0.30 |

TABLE 5. CONTINUED

f. FLOWFIELD RUN NUMBER SUMMARY

| CONFIG | M | ALPHA | XP* | RUN YP = 0.0 ZP=0.0 | RUN YP = 0.0 ZP=0.35 | RUN YP = 0.0 ZP=0.70 | RUN YP = 0.35 ZP=0.0 | RUN YP = 0.35 ZP=0.35 | RUN YP = -0.35 ZP=0.0 | RUN YP = -0.35 ZP=0.35 |
|---|---|---|---|---|---|---|---|---|---|---|
| 35 | 0.95 | 13.0 | A | 870 | | 872 | | | | |
| | | | B | | 871 | | 873 | 874 | 875 | 876 |
| | | 17.0 | A | 877 | | 879 | | | | |
| | | | B | | 878 | | 880 | 881 | 882 | 883 |
| 45 | 0.60 | 1.0 | A | 886 | | 888 | | | | |
| | | | B | | 887 | | 889 | 890 | 891 | 892 |
| | | 5.0 | A | 893 | | 895 | | | | |
| | | | B | | 894 | | 896 | 897 | 898 | 899 |
| | | 9.0 | A | 900 | | 902 | | | | |
| | | | B | | 901 | | 903 | 904 | 905 | 906 |
| 55 | | 1.0 | A | 913 | | 915 | | | | |
| | | | B | | 914 | | 916 | 917 | 918 | 919 |
| | | 5.0 | A | 920 | | 923 | | | | |
| | | | B | | 921/922 | | 924 | 925 | 926 | 927 |
| | | 9.0 | A | 928 | | 930 | | | | |
| | | | B | | 929 | | 931 | 932 | 933 | 934 |
| 65 | | 1.0 | A | 597 | | 599 | | | | |
| | | | B | | 598 | | 600 | 601 | 602 | 603 |
| | | 5.0 | A | 604 | | 606 | | | | |
| | | | B | | 605 | | 607 | 608 | 610 | 611 |
| | | 9.0 | A | 612 | | 615 | | | | |
| | | | B | | 614 | | 616 | 617 | 619 | 620 |
| | | 13.0 | A | 621 | | 623 | | | | |
| | | | B | | 622 | | 624 | 625 | 626 | 627 |
| | | 17.0 | A | 663 | | 665 | | | | |
| | | | B | | 664 | | 666 | 667 | 668 | 669 |

* **XP SCHEDULES**

| | INITIAL XP | FINAL XP | INCREMENT IN XP |
|---|---|---|---|
| A | -0.15 | -8.85 | -0.30 |
| B | -0.15 | -5.85 | -0.30 |

TABLE 5. CONTINUED

g. FLOWFIELD RUN NUMBER SUMMARY

| CONFIG | M | ALPHA | XP* | RUN | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | YP = 0.0 | | | YP = 0.35 | | YP = -0.35 | |
| | | | | ZP=0.0 | ZP=0.35 | ZP=0.70 | ZP=0.0 | ZP=0.35 | ZP=0.0 | ZP=0.35 |
| 65 | 0.60 | 1.0 | A | 670 | | 672 | | | | |
| | | | B | | 671 | | 673 | 674 | 675 | 676 |
| | | 5.0 | A | 677 | | 679 | | | | |
| | | | B | | 678 | | 680 | 681 | 682 | 683 |
| | | 9.0 | A | 684 | | 686 | | | | |
| | | | B | | 685 | | 687 | 688 | 689 | 690 |
| | | 13.0 | A | 691 | | 693 | | | | |
| | | | B | | 692 | | 694 | 695 | 696 | 697 |
| | | 17.0 | A | 698 | | 700 | | | | |
| | | | B | | 699 | | 701 | 702 | 703 | 704 |
| | 0.95 | 1.0 | A | 706 | | 708 | | | | |
| | | | B | | 707 | | 709 | 710 | 711 | 712 |
| | | 5.0 | A | 713 | | 715 | | | | |
| | | | B | | 714 | | 716 | 717 | 718 | 719 |
| | | 9.0 | A | 720 | | 724 | | | | |
| | | | B | | 721/723 | | 725 | 726 | 727 | 728 |
| | | 13.0 | A | 729 | | 731 | | | | |
| | | | B | | 730 | | 732 | 733 | 734 | 735 |
| | | 17.0 | A | 736 | | 738 | | | | |
| | | | B | | 737 | | 739 | 740 | 741 | 742 |
| 75 | 0.60 | 1.0 | A | 569 | | 571 | | | | |
| | | | B | | 570 | | 572 | 573 | 574 | 575 |
| | | 5.0 | A | 576 | | 578 | | | | |
| | | | B | | 577 | | 579 | 580 | 582 | 583 |
| | | 9.0 | A | 584 | | 587 | | | | |
| | | | B | | 586 | | 588 | 589 | 591 | 593 |

* **XP SCHEDULES**

| | INITIAL XP | FINAL XP | INCREMENT IN XP |
|---|---|---|---|
| A | -0.15 | -8.85 | -0.30 |
| B | -0.15 | -5.85 | -0.30 |

TABLE 5. CONCLUDED

h. FLOWFIELD RUN NUMBER SUMMARY

| CONFIG | M | ALPHA | XP* | RUN | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | YP = 0.0 | | | YP = 0.35 | | YP = -0.35 | |
| | | | | ZP=0.0 | ZP=0.35 | ZP=0.70 | ZP=0.0 | ZP=0.35 | ZP=0.0 | ZP=0.35 |
| B5 | 0.60 | 1.0 | A | 745 | | 747 | | | | |
| | | | B | | 746 | | 748 | 749 | 750 | 751 |
| | | 5.0 | A | 752 | | 754 | | | | |
| | | | B | | 753 | | 755 | 756 | 757/758 | 759 |
| | | 9.0 | A | 760 | | 762 | | | | |
| | | | B | | 761 | | 763 | 764 | 765/766 | 767 |

* XP SCHEDULES

| | INITIAL XP | FINAL XP | INCREMENT IN XP |
|---|---|---|---|
| A | -0.15 | -8.85 | -0.30 |
| B | -0.15 | -5.85 | -0.30 |

Table 6. Configuration Identification

| CONFIG NO | REMARKS |
|---|---|
| 1 | MK-83 with fins, freestream |
| 2 | MK-83 without fins, freestream |

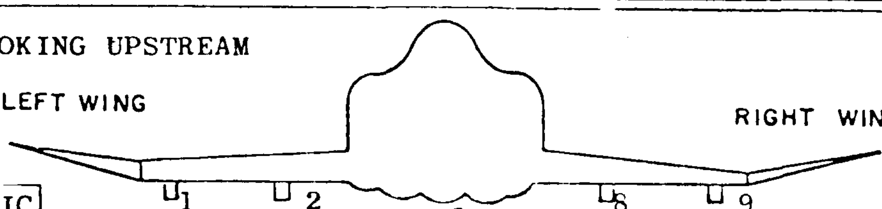
NOTE: On the Tabulated Summary Data under the heading "STORE", the following Nomenclature was used for all the configurations tested:

MK-83 F - MK-83 store metric model with fins

MK-83 UF - MK-83 store metric model without fins

TABLE 6. CONTINUED

LOOKING UPSTREAM




| CONFIG. NO. | METRIC STORE / FINS | PYLONS OUTB'D (1) | PYLONS INB'D (2) | 5 ℄ | PYLONS INB'D (8) | PYLONS OUTB'D (9) |
|---|---|---|---|---|---|---|
| 11 | MK-83 CTS / ON | CLEAN | ● CLEAN | CLEAN | CLEAN | CLEAN |
| 15 | PRESSURE PROBE | | (P.P.) CLEAN | | | |
| 21 | MK-83 CTS / ON | | ● EMPTY | | | |
| 25 | PRESSURE PROBE | | (P.P.) EMPTY | | | |

○ DENOTES DUMMY STORE

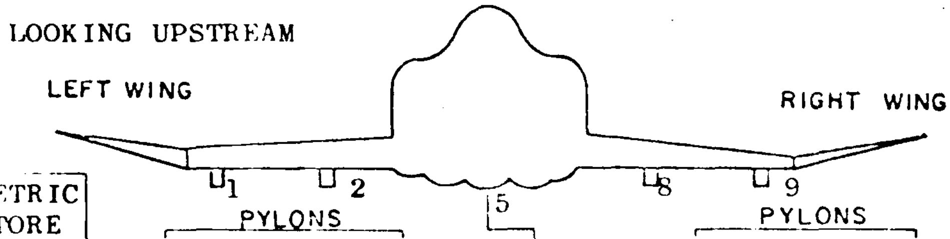
▽ - DENOTES TER

● DENOTES STING MOUNTED STORE

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

TABLE 6. CONTINUED




| CONFIG. NO. | METRIC STORE / FINS | OUTB'D | INB'D | ℄ | INB'D | OUTB'D |
|---|---|---|---|---|---|---|
| 31 | MK-83 CTS / ON | CLEAN | ▽ ● | CLEAN | CLEAN | CLEAN |
| 32 | MK-83 CTS / OFF | | ▽ ● | | | |
| 33 | MK-83 CAPTIVE LOADS / ON (ACTUAL AFTERBODY) | | ▽ ● | | | |
| 34 | MK-83 CAPTIVE LOADS / OFF (ACTUAL AFTERBODY) | | ▽ ● | | | |

○ DENOTES DUMMY STORE

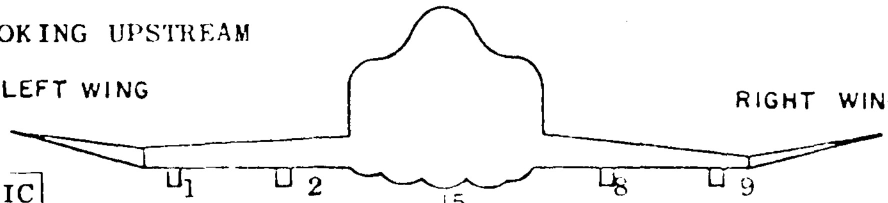
● DENOTES STING MOUNTED STORE

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

▽ - DENOTES TER

TABLE 6. CONTINUED




| CONFIG. NO. | METRIC STORE FINS | OUTB'D | INB'D | ℄ | INB'D | OUTB'D |
|---|---|---|---|---|---|---|
| 35 | PRESSURE PROBE | CLEAN | ▽ (P.P.) | CLEAN | CLEAN | CLEAN |
| 36 | MK-83 CAPTIVE LOADS ON (MODIFIED AFTERBODY) | | ▽ ● | | | |
| 37 | MK-83 CAPTIVE LOADS OFF (MODIFIED AFTERBODY) | | ▽ ● | | | |
| 43 | MK-83 CAPTIVE LOADS ON (ACTUAL AFTERBODY) | | ○ ▽ ● | | | |

○ DENOTES DUMMY STORE

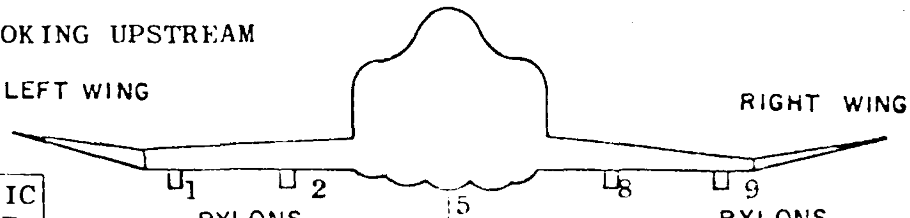
▽ - DENOTES TER

● DENOTES STING MOUNTED STORE

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

TABLE 6. CONTINUED




| CONFIG. NO. | METRIC STORE / FINS | OUTB'D | INB'D | ℄ | INB'D | OUTB'D |
|---|---|---|---|---|---|---|
| 45 | PRESSURE PROBE | CLEAN | ○▽ (P.P.) | CLEAN | CLEAN | CLEAN |
| 51 | MK-83 CTS / ON | ↓ | ○▽○ ● | ↓ | ↓ | ↓ |
| 52 | MK-83 CTS / OFF | ↓ | ○▽○ ● | ↓ | ↓ | ↓ |
| 53 | MK-83 CAPTIVE LOADS / ON (ACTIVE AFTERBODY) | ↓ | ○▽○ ● | ↓ | ↓ | ↓ |

○ DENOTES DUMMY STORE

● DENOTES STING MOUNTED STORE

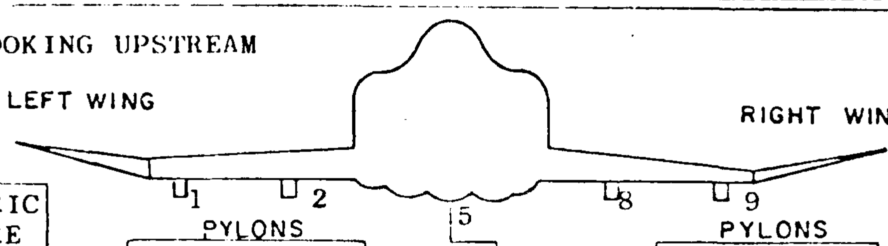
CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

▽ - DENOTES TER

TABLE 6. CONTINUED

LOOKING UPSTREAM




| CONFIG. NO. | METRIC STORE FINS | OUTB'D (PYLON 1) | INB'D (PYLON 2) | ℄ (5) | INB'D (PYLON 8) | OUTB'D (PYLON 9) |
|---|---|---|---|---|---|---|
| 54 | MK-83 CAPTIVE LOADS<br>OFF (ACTUAL AFTERBODY) | CLEAN | ○▽○<br>● | CLEAN | CLEAN | CLEAN |
| 55 | PRESSURE PROBE | | ○▽○<br>(P.P.) | | | |
| 56 | MK-83 CAPTIVE LOADS<br>ON (MODIFIED AFTERBODY) | | ○▽○<br>● | | | |
| 57 | MK-83 CAPTIVE LOADS<br>OFF (MODIFIED AFTERBODY) | | ○▽○<br>● | | | |

○ DENOTES DUMMY STORE

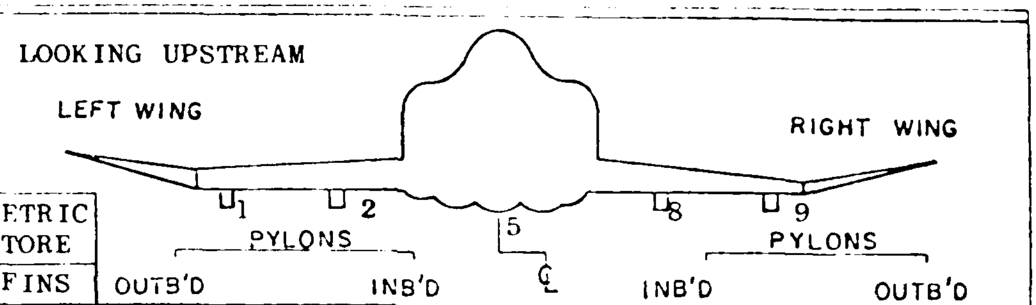
▽ - DENOTES TER

● DENOTES STING MOUNTED STORE

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

TABLE 6. CONTINUED




| CONFIG. NO. | METRIC STORE | FINS | OUTB'D | INB'D | ℄ | INB'D | OUTB'D |
|---|---|---|---|---|---|---|---|
| 61 | MK-83 CTS | ON | CLEAN | | CLEAN | CLEAN | CLEAN |
| 62 | MK-83 CTS | OFF | | | | | |
| 63 | MK-83 CAPTIVE LOADS | ON (ACTUAL AFTERBODY) | | | | | |
| 64 | MK-83 CAPTIVE LOADS | OFF (ACTUAL AFTERBODY) | | | | | |

○ DENOTES DUMMY STORE

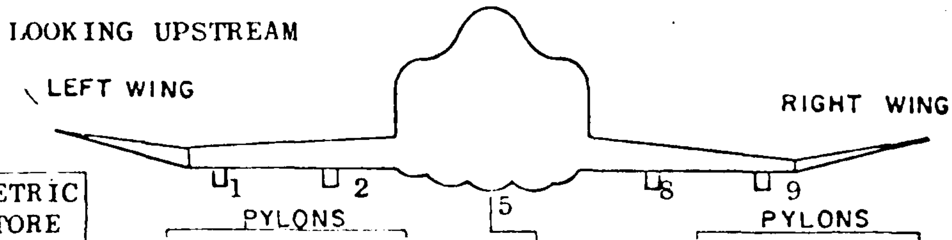
● DENOTES STING MOUNTED STORE

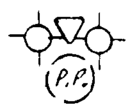
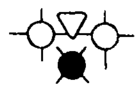
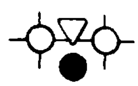
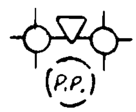
▽ - DENOTES TER

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

TABLE 6. CONTINUED




| CONFIG. NO. | METRIC STORE | FINS | OUTB'D | INB'D | ℄ | INB'D | OUTB'D |
|---|---|---|---|---|---|---|---|
| 65 | PRESSURE PROBE | | CLEAN |  | CLEAN | CLEAN | CLEAN |
| 66 | MK-83 CAPTIVE LOADS | ON (MODIFIED AFTERBODY) | |  | | | |
| 67 | MK-83 CAPTIVE LOADS | OFF (MODIFIED AFTERBODY) | |  | | | |
| 75 | PRESSURE PROBE | | EMPTY |  | EMPTY | | |

○ DENOTES DUMMY STORE

● DENOTES STING MOUNTED STORE

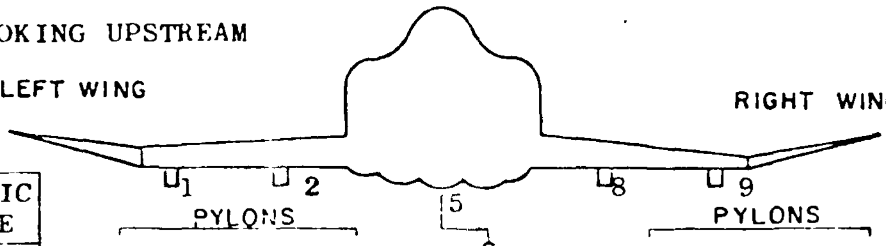
▽ - DENOTES TER

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

TABLE 6. CONCLUDED

LOOKING UPSTREAM




| CONFIG. NO. | METRIC STORE / FINS | OUTB'D | INB'D | ℄ | INB'D | OUTB'D |
|---|---|---|---|---|---|---|
| 81 | MK-83 CTS / ON | CLEAN | | CLEAN | CLEHN | CLEHN |
| 83 | MK-83 CAPTIVE LOADS / ON (ACTIVE AFTERBODY) | | | | | |
| 85 | PRESSURE PANEL | | (P.P.) | | | |
| | | | | | | |

○ DENOTES DUMMY STORE

● DENOTES STING MOUNTED STORE

▽ - DENOTES TER

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

TABLE 7. Captive Aerodynamic Loads Data Tabulation Format

```
DATE  5-DEC-79   PROJECT NO  P41C-FD        ********************
ARO, INC.                                   *                  *
AEDC DIVISION                               *   UNCLASSIFIED   *
A SVERDRUP CORPORATION COMPANY              *                  *
PROPULSION WIND TUNNEL                      ********************
ARNOLD AIR FORCE STATION, TENNESSEE

TEST TC-623  SUMMARY  1             AFFDL/NWC TRANSONIC FLOW STORE TEST              TRANSONIC 4T

RUN   M     PT     TT     Q      P      T      V    RE   TDP   SH       CONSET  ZERO SET
 77 0.599 2147.6  82.7 423.6 1684.6  506.0  660.9 3.5  34.6 0.0009      12     74/  1

A/C   CONFIG    STORE
F-4C    53      MK-83 F
```

| PN | ALPHAS | BETAS | CN | CY | CAT | CLM | CLN | CLL | NCP | YCP | ALPHA | BETA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | -4.23 | 0.04 | 0.634 | 0.277 | 0.282 | -2.280 | -0.323 | -0.005 | -3.597 | -1.165 | -2.98 | 0.00 |
| 11 | -2.11 | 0.00 | 0.490 | 0.032 | 0.297 | -1.937 | 0.007 | 0.024 | -3.951 | 0.206 | -0.89 | 0.00 |
| 14 | -0.40 | -0.02 | 0.386 | -0.132 | 0.305 | -1.673 | 0.182 | 0.046 | -4.338 | -1.382 | 0.79 | 0.00 |
| 18 | 1.92 | -0.05 | 0.234 | -0.332 | 0.297 | -1.233 | 0.396 | 0.074 | -5.269 | -1.193 | 3.06 | 0.00 |
| 22 | 3.95 | -0.06 | 0.100 | -0.476 | 0.294 | -0.934 | 0.453 | 0.083 | -9.356 | -0.951 | 5.06 | 0.00 |
| 26 | 5.98 | -0.07 | -0.037 | -0.649 | 0.283 | -0.522 | 0.550 | 0.088 | 14.130 | -0.848 | 7.05 | 0.00 |
| 30 | 8.06 | -0.10 | -0.166 | -0.822 | 0.281 | -0.181 | 0.708 | 0.086 | 1.095 | -0.862 | 9.09 | 0.00 |
| 34 | 10.07 | -0.12 | -0.210 | -0.993 | 0.284 | -0.046 | 0.958 | 0.079 | 0.220 | -0.964 | 11.09 | 0.00 |
| 37 | 11.86 | -0.14 | -0.232 | -1.112 | 0.279 | 0.049 | 1.080 | 0.077 | -0.210 | -0.971 | 12.87 | 0.00 |
| 40 | 13.85 | -0.15 | -0.246 | -1.249 | 0.282 | 0.125 | 1.220 | 0.072 | -0.509 | -0.977 | 14.85 | 0.00 |
| 44 | 16.09 | -0.17 | -0.231 | -1.398 | 0.279 | 0.134 | 1.376 | 0.066 | -0.578 | -0.985 | 17.09 | 0.00 |

```
********************
*                  *
*   UNCLASSIFIED   *
*                  *
********************
```

TABLE 7. CONCLUDED

DATE 5-DEC-79 PROJECT NO P41C-FO
ARO, INC.
AEDC DIVISION
A SVERDRUP CORPORATION COMPANY
PROPULSION WIND TUNNEL
ARNOLD AIR FORCE STATION, TENNESSEE

UNCLASSIFIED

TEST TC-623 SUMMARY 2 AFFDL/NWC TRANSONIC FLOW STORE TEST TRANSONIC 4T

| RUN | M | PT | TT | Q | P | T | V | RE | TDP | SH | CONSET | ZERO SET |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 77 | 0.599 | 2147.6 | 82.7 | 423.6 | 1684.6 | 506.0 | 660.9 | 3.5 | 34.6 | 0.0009 | 12 | 74/ 1 |

| A/C | CONFIG | STORE |
|---|---|---|
| F-4C | 53 | MK-83 F |

| PN | ALPHA | BETA | APSE | APPE | APPE1 | MNE | MDOTN | CR | VR |
|---|---|---|---|---|---|---|---|---|---|
| 7 | -2.98 | 0.00 | 1690.3 | 2119.6 | 2119.6 | 0.578 | 0.297 | 0.423 | 0.967 |
| 11 | -0.89 | 0.00 | 1690.8 | 2120.6 | 2120.6 | 0.578 | 0.297 | 0.423 | 0.968 |
| 14 | 0.79 | 0.00 | 1691.1 | 2121.0 | 2121.0 | 0.578 | 0.297 | 0.423 | 0.967 |
| 18 | 3.06 | 0.00 | 1691.8 | 2121.2 | 2121.2 | 0.578 | 0.297 | 0.422 | 0.965 |
| 22 | 5.06 | 0.00 | 1692.2 | 2116.2 | 2116.2 | 0.574 | 0.295 | 0.420 | 0.960 |
| 26 | 7.05 | 0.00 | 1692.9 | 2112.3 | 2112.3 | 0.571 | 0.294 | 0.418 | 0.956 |
| 30 | 9.09 | 0.00 | 1694.3 | 2114.5 | 2114.5 | 0.572 | 0.294 | 0.417 | 0.954 |
| 34 | 11.09 | 0.00 | 1694.4 | 2119.7 | 2119.7 | 0.575 | 0.296 | 0.420 | 0.960 |
| 37 | 12.87 | 0.00 | 1692.2 | 2120.7 | 2120.7 | 0.577 | 0.297 | 0.421 | 0.965 |
| 40 | 14.85 | 0.00 | 1689.8 | 2120.9 | 2120.9 | 0.579 | 0.297 | 0.423 | 0.970 |
| 44 | 17.09 | 0.00 | 1686.5 | 2120.0 | 2120.0 | 0.581 | 0.298 | 0.423 | 0.972 |

UNCLASSIFIED

Table 8. Nomenclature for Captive Aerodynamic Loads Tabulated Summary Data

PAGE HEADING (COMMON TO ALL SUMMARIES)

COMPANY HEADING

| | |
|---|---|
| DATE | Calendar time at which the data were printed |
| PROJECT | Alpha-numeric notation for referencing a specific test project |
| TEST | Alpha-numeric notation for referencing a specific test program in a specific test unit |

LINE 1

| | |
|---|---|
| RUN | Sequential indexing number for referencing data. A constant throughout specified (or all) points of a survey. |
| M | Wind tunnel free-stream Mach number |
| PT | Wind tunnel free-stream total pressure, psfa |
| TT | Wind tunnel free-stream total temperature, °F |
| Q | Wind tunnel free-stream dynamic pressure, psf |
| P | Wind tunnel free-stream static pressure, psfa |
| T | Wind tunnel free-stream static temperature, °R |
| V | Wind tunnel free-stream velocity, ft/sec |
| RE | Wind tunnel free-stream unit Reynolds number, millions per foot |
| TDP | Hygrometer dew point temperature, °F |
| SH | Wind tunnel specific humidity, lbm $H_2O$ per lbm air |
| CON SET | Constant set used in data reduction |
| ZERO SET | Run/point number of the air off set of instrument readings used in data reduction |

Table 8. Continued

<u>LINE 2</u>

| | |
|---|---|
| A/C | Aircraft designation |
| CONFIG | Aircraft store loading designation |
| STORE | Store model designation |

COLUMNAR HEADINGS

<u>SUMMARY PAGE 1</u>

| | |
|---|---|
| PN | Sequential indexing number for referencing data obtained during one run. Indexes each time a new set of data inputs is obtained. |
| ALPHAS, BETAS | Store model angle of attack and sideslip angle, respectively, deg. |
| CN | Normal-force coefficient |
| CY | Side-force coefficient |
| CAT | Total axial-force coefficient |
| CLM | Pitching-moment coefficient |
| CLN | Yawing-moment coefficient |
| CLL | Rolling-moment coefficient |
| NCP | Normal force center-of-pressure location, CLM/CN |
| YCP | Side force center-of-pressure location, CLN/CY |
| ALPHA,BETA | Aircraft-model angle of attack and sideslip angle, respectively, deg |

<u>SUMMARY PAGE 2</u>

| | |
|---|---|
| PN | Sequential indexing number for referencing data obtained during one run. Indexes each time a new set of data inputs is obtained. |
| ALPHA,BETA | Aircraft-model angle of attack and sideslip angle, respectively, deg |
| APSE | Average measured static pressure at the engine exhaust choke exit plane, psfa |

Table 8. Concluded

SUMMARY PAGE 2 (Continued)

| | |
|---|---|
| APPE | Average measured total pressure at the engine exhaust choke exit plane, psfa |
| APPE1 | Calculated average total pressure at the engine exhaust choke exit plane, psfa |
| MNE | Duct exit Mach number |
| MDOTN | Engine duct mass flow rate, lbm/sec. |
| CR | Capture ratio, engine duct mass flow rate divided by the theoretical inlet mass flow rate |
| VR | Velocity ratio duct exit velocity divided by freestream velocity |

## TABLE 9. Grid Aerodynamic Loads Tabulation Format

DATE 4-DEC-79 PROJECT NO P41C-P0
ARO, INC.
AEDC DIVISION
A SVERDRUP CORPORATION COMPANY
PROPULSION WIND TUNNEL
ARNOLD AIR FORCE STATION, TENNESSEE

| RUN | SURVEY | M | PT | TT | Q | P | T | V | RE | TDP | SH | SCALE | DATE | TIME | CON SET | ZERO SET | TRANSONIC 4T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 229 | 16 | 0.950 | 1686.6 | 83.4 | 595.9 | 943.9 | 460.1 | 998.5 | 3.5 | 20.5 | 0.0027 | 0.050 | 11/17/79 | 1/13/47 | 229/ 15 | 228/ 1 | TEST TC-623 |

| A/C | ALPHA | BETA | IP | IY | IR | CONFIG | WING | STORE | A | L1 | L2,L3 | XCG | YCG | ZCG | PHIS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F-4C | 1.00 | 0.00 | -1.00 | 0.00 | 0.0 | 52 | LEFT | MK-83 UF | 1.069 | 1.167 | 1.167 | 4.208 | 0.000 | 0.000 | 0.0 |

SUMMARY 2

PYLON AXIS / BODY AXIS COEFFICIENTS

| PN | XP | YP | ZP/D | DPSI | DTHA | DPHI | ALPHAS | BETAS | NCP | YCP | CN | CLM | CY | CLN | CLL | CAT | NDX | RUN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | 0.00 | -0.02 | 0.09 | -0.04 | -0.04 | -0.0 | -0.04 | 0.04 | -4.833 | 3.306 | 0.335 | -1.621 | -0.149 | -0.494 | 0.011 | 0.342 | 1 | 229 |
| 20 | 0.00 | -0.03 | 0.14 | -0.04 | -0.03 | -0.0 | -0.03 | 0.04 | -4.444 | 3.069 | 0.357 | -1.585 | -0.146 | -0.447 | 0.011 | 0.343 | 2 | 229 |
| 21 | 0.00 | -0.02 | 0.22 | -0.01 | -0.00 | -0.0 | -0.00 | 0.01 | -3.872 | 2.746 | 0.366 | -1.417 | -0.129 | -0.353 | 0.009 | 0.332 | 3 | 229 |
| 22 | -0.00 | -0.02 | 0.33 | -0.01 | -0.01 | -0.1 | -0.01 | 0.01 | -3.491 | 3.079 | 0.349 | -1.217 | -0.093 | -0.286 | 0.009 | 0.318 | 4 | 229 |
| 23 | -0.00 | -0.02 | 0.41 | -0.01 | -0.00 | -0.1 | -0.00 | 0.01 | -3.411 | 3.383 | 0.325 | -1.108 | -0.082 | -0.277 | 0.008 | 0.313 | 5 | 229 |
| 24 | -0.00 | -0.02 | 0.61 | -0.02 | -0.00 | -0.1 | -0.00 | 0.02 | -3.295 | 4.249 | 0.267 | -0.881 | -0.063 | -0.266 | 0.007 | 0.293 | 6 | 229 |
| 25 | -0.00 | -0.02 | 0.81 | -0.02 | -0.00 | -0.1 | -0.00 | 0.02 | -3.327 | 5.115 | 0.227 | -0.754 | -0.051 | -0.259 | 0.006 | 0.276 | 7 | 229 |
| 26 | -0.00 | -0.02 | 1.00 | -0.02 | 0.00 | -0.1 | 0.00 | 0.02 | -3.294 | 5.314 | 0.201 | -0.662 | -0.046 | -0.247 | 0.006 | 0.272 | 8 | 229 |
| 27 | -0.00 | -0.02 | 1.20 | -0.01 | 0.02 | -0.1 | 0.02 | 0.01 | -3.338 | 5.464 | 0.177 | -0.591 | -0.043 | -0.236 | 0.006 | 0.260 | 9 | 229 |
| 28 | -0.00 | -0.02 | 1.41 | -0.02 | -0.00 | -0.1 | -0.00 | 0.02 | -3.408 | 5.552 | 0.157 | -0.535 | -0.041 | -0.228 | 0.006 | 0.253 | 10 | 229 |
| 29 | -0.00 | -0.02 | 1.61 | -0.02 | -0.00 | -0.1 | -0.00 | 0.02 | -3.497 | 5.411 | 0.141 | -0.493 | -0.040 | -0.216 | 0.006 | 0.246 | 11 | 229 |
| 30 | 0.00 | -0.01 | 1.99 | -0.02 | -0.00 | -0.1 | -0.00 | 0.02 | -3.576 | 5.375 | 0.118 | -0.422 | -0.037 | -0.197 | 0.006 | 0.232 | 12 | 229 |
| 31 | 0.00 | -0.01 | 2.39 | -0.02 | 0.00 | -0.1 | 0.00 | 0.02 | -3.629 | 5.050 | 0.102 | -0.369 | -0.036 | -0.180 | 0.006 | 0.220 | 13 | 229 |
| 32 | -0.01 | -0.02 | 2.79 | -0.01 | 0.01 | -0.1 | 0.01 | 0.01 | -3.681 | 4.870 | 0.088 | -0.324 | -0.034 | -0.167 | 0.006 | 0.211 | 14 | 229 |
| 33 | -0.01 | -0.02 | 3.19 | -0.03 | -0.00 | -0.1 | -0.00 | 0.03 | -3.684 | 4.669 | 0.078 | -0.289 | -0.033 | -0.155 | 0.006 | 0.204 | 15 | 229 |
| 34 | -0.01 | -0.01 | 3.59 | -0.01 | 0.01 | -0.1 | 0.01 | 0.01 | -3.662 | 4.640 | 0.070 | -0.256 | -0.031 | -0.145 | 0.006 | 0.197 | 16 | 229 |
| 35 | -0.00 | -0.02 | 3.98 | -0.02 | 0.00 | -0.1 | 0.00 | 0.02 | -3.614 | 4.340 | 0.064 | -0.232 | -0.031 | -0.135 | 0.006 | 0.190 | 17 | 229 |
| 36 | -0.01 | -0.02 | 4.39 | -0.02 | 0.01 | -0.1 | 0.01 | 0.02 | -3.619 | 4.549 | 0.057 | -0.209 | -0.029 | -0.128 | 0.006 | 0.185 | 18 | 229 |
| 37 | -0.01 | -0.01 | 4.79 | -0.02 | 0.01 | -0.1 | 0.01 | 0.02 | -3.489 | 4.158 | 0.053 | -0.186 | -0.029 | -0.120 | 0.006 | 0.180 | 19 | 229 |
| 38 | -0.00 | -0.01 | 5.19 | -0.01 | 0.00 | -0.1 | 0.00 | 0.01 | -3.350 | 4.432 | 0.050 | -0.169 | -0.026 | -0.116 | 0.006 | 0.173 | 20 | 229 |
| 39 | -0.01 | -0.01 | 5.58 | -0.01 | 0.01 | -0.1 | 0.01 | 0.01 | -3.207 | 4.216 | 0.049 | -0.156 | -0.026 | -0.110 | 0.006 | 0.173 | 21 | 229 |
| 40 | -0.00 | -0.02 | 5.99 | -0.02 | -0.00 | -0.1 | -0.00 | 0.02 | -3.122 | 4.366 | 0.046 | -0.142 | -0.024 | -0.105 | 0.005 | 0.169 | 22 | 229 |

Table 10. Nomenclature for Grid Aerodynamic Loads Tabulated Summary Data

PAGE HEADING (COMMON TO ALL SUMMARIES)

COMPANY HEADING

| | |
|---|---|
| DATE | Calendar time at which the data were printed |
| PROJECT | Alpha-numeric notation for referencing a specific test project |

LINE 1

| | |
|---|---|
| RUN | Sequential indexing number for referencing data. A constant throughout specified (or all) points of a survey. |
| SURVEY | Configuration indexing number used to correlate data with the test log. Survey may be used to identify all or portion of a grid set. |
| M | Wind tunnel free-stream Mach number |
| PT | Wind tunnel free-stream total pressure, psfa |
| TT | Wind tunnel free-stream total temperature, °F |
| Q | Wind tunnel free-stream dynamic pressure, psf |
| P | Wind tunnel free-stream static pressure, psfa |
| T | Wind tunnel free-stream static temperature, °R |
| V | Wind tunnel free-stream velocity, ft/sec |
| RE | Wind tunnel free-stream unit Reynolds number, millions per foot |
| TDP | Hygrometer dew point temperature, °F |
| SH | Wind tunnel specific humidity, lbm $H_2O$ per lbm air |
| SCALE | Aircraft model scale factor |
| DATE | Calendar time at which data were recorded |
| TIME | Time at which data were recorded (hr/min/sec) |
| CON SET | Run/point number of constants set used in data reduction |
| ZERO SET | Run/point number of the air off set of instrument readings used in data reduction |

Table 10. Continued

| | |
|---|---|
| TEST | Alpha-numeric notation for referencing a specific test program in a specific test unit |
| LINE 2 | |
| A/C | Aircraft designation |
| ALPHA,BETA | Aircraft-model angle of attack and sideslip angle, respectively, deg |
| IP,IY | Pitch and yaw incidence angles of the store longitudinal axis at carriage with respect to the aircraft longitudinal axis, positive nose up and nose to the right, respectively, as seen by pilot, deg |
| IR | Roll incidence of the store $Z_B$ axis at carriage with respect to the aircraft plane of symmetry, positive for clockwise roll looking upstream, deg |
| CONFIG | Aircraft store loading designation |
| WING | Location of store launch position |
| STORE | Store model designation |
| A | Store reference area, $ft^2$, full scale |
| L1,L2,L3 | Store reference lengths for pitching-moment, yawing-moment, and rolling-moment coefficients, respectively, ft, full scale |
| XCG | Axial distance from the store nose to the center of gravity location, ft, full scale |
| YCG,ZCG | Lateral and vertical distances from the store reference (balance) axis to the center of gravity location, positive in the positive $Y_B$ and $Z_B$ directions, respectively, ft, full scale |
| PHIS | Roll angle of the store Number 1 fin with respect to the $-Z_B$ axis, positive clockwise looking upstream, deg |

Table 10. Continued

COLUMNAR HEADINGS

SUMMARY PAGE 2

| | |
|---|---|
| PN | Sequential indexing number for referencing data obtained during one run. Indexes each time a new set of data inputs is obtained. |
| XP,YP | Separation distance of the store nose with respect to the pylon-axis system origin in the $X_P$ and $Y_P$ directions, respectively, in, model scale |
| ZP/D | Separation distance of the store nose with respect to the pylon-axis system origin in the $Z_P$ direction, calibres |
| DPSI | Angle between the projection of the store longitudinal axis in the $X_P$-$Y_P$ plane and the $X_P$-axis, positive for store nose to the right as seen by the pilot, deg |
| DTHA | Angle between the store longitudinal axis and its projection in the $X_P$-$Y_P$ plane, positive when the store nose is raised as seen by the pilot, deg |
| DPHI | Angle between the store lateral ($Y_B$) axis and the intersection of the $Y_B$-$Z_B$ and $X_P$-$Y_P$ planes, positive for clockwise rotation when looking upstream, deg |
| ALPHAS, BETAS | Store model angle of attack and sideslip angle, respectively, deg |
| NCP | Normal force center-of-pressure location, CLM/CN |
| YCP | Side force center-of-pressure location, CLN/CY |
| CAT,CN,CY | Store measured aerodynamic axial-force, normal-force, and side-force coefficients, positive in the negative $X_B$, negative $Z_B$, and positive $Y_B$ direction, respectively |
| CLL,CLM,CLN | Store measured aerodynamic rolling-moment, pitching-moment, and yawing-moment coefficients. The positive vectors are coincident with the positive $X_B$, $Y_B$, and $Z_B$ axes, respectively. |
| Q | Wind tunnel free-stream dynamic pressure, psf |
| NDX | Sequential indexing number for referencing data obtained during a grid set. Indexes for each position in the set |

Table 10. Continued

SUMMARY PAGE 2 (Continued)

| | |
|---|---|
| RUN | Sequential indexing number for referencing data. A constant throughout specified (or all) points of a survey. |

STORE BODY-AXIS SYSTEM DEFINITIONS

Coordinate Directions

| | |
|---|---|
| $X_B$ | Parallel to the store longitudinal axis, positive direction is upstream at store release |
| $Y_B$ | Perpendicular to $X_B$ and $Z_B$ directions, positive to the right looking upstream when the store is at zero yaw and roll angles |
| $Z_B$ | Perpendicular to the $X_B$ direction and parallel to the aircraft plane of symmetry when the store and aircraft are at zero yaw and roll angles, positive downward as seen by the pilot when the store is at zero pitch and roll angles |

Origin

The store body-axis system origin is coincident with the store cg at all time. The $X_B$, $Y_B$, and $Z_B$ coordinate axes rotate with the store in pitch, yaw, and roll so that mass moments of inertia about the three axes are not time-varying quantities.

PYLON-AXIS SYSTEM DEFINITIONS (GRID)

Coordinate Directions

| | |
|---|---|
| $X_P$ | Parallel to the store longitudinal axis at carriage, positive forward as seen by the pilot |
| $Y_P$ | Perpendicular to the $X_P$ direction and parallel to the $X_F$-$Y_F$ plane, positive to the right as seen by the pilot |
| $Z_P$ | Perpendicular to the $X_P$ and $Y_P$ directions, positive downward as seen by the pilot |

Table 10. Concluded

FLIGHT-AXIS SYSTEM DEFINITIONS (GRID)

Coordinate Directions

| | |
|---|---|
| $X_F$ | Parallel to the aircraft flight path direction, positive forward as seen by the pilot |
| $Y_F$ | Perpendicular to the $X_F$ and $Z_F$ directions, positive to the right as seen by the pilot |
| $Z_F$ | Parallel to the aircraft plane of symmetry and perpendicular to the aircraft flight path direction, positive downward as seen by the pilot |

Origin

The origin of the pylon-axis and flight-axis coordinate systems was defined for this test as being the location of the MK-83 store nose tip (station 0.0) at the carriage position.

TABLE 11. Flow-Field Data Tabulation Format.

DATE 5-DEC-79 PROJECT NO P41C-F0
ARO, INC.
AEDC DIVISION
A SVERDRUP CORPORATION COMPANY
PROPULSION WIND TUNNEL
ARNOLD AIR FORCE STATION, TENNESSEE

| RUN | SURVEY | M | PT | TT | Q | P | T | V | RE | TDP | SH | SCALE | DATE | TIME | CON SET | ZERO SET | TRANSONIC 4T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 900 | 134 | 0.599 | 2214.8 | 96.8 | 436.4 | 1737.8 | 519.2 | 669.0 | 3.5 | 22.6 | 0.0023 | 0.050 | 11/21/79 | 17/45/14 | 900/ 3 | 885/ 1 | TEST TC-623 |

| A/C | ALPHA | BETA | IP | IY | IR | CONFIG | WING |
|---|---|---|---|---|---|---|---|
| F-4C | 9.00 | 0.00 | -1.00 | 0.00 | 0.0 | 45 | LEFT |

SUMMARY 2

PYLON AXIS — BODY AXIS FLOW ANGLES AND VELOCITIES

| PN | XP | YP | ZP | ALFXY | ALFXZ | ALFYZ | VX | VXY | VXZ | VY | VYZ | VZ | PTP | QL | VL | THAT | ML | NDX | RUN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | -8.85 | -0.01 | 0.01 | 1.2 | -5.0 | 283.4 | 647.0 | 649.4 | 647.1 | -56.2 | 57.8 | 13.4 | 2213.4 | 415.3 | 649.5 | 5.1 | 0.58 | 1 | 900 |
| 8 | -8.55 | -0.01 | 0.01 | 1.1 | -5.0 | 282.4 | 646.0 | 648.4 | 646.1 | -56.7 | 58.1 | 12.5 | 2215.6 | 414.7 | 648.5 | 5.1 | 0.58 | 2 | 900 |
| 9 | -8.25 | -0.02 | 0.00 | 1.0 | -5.1 | 281.2 | 645.8 | 648.4 | 645.9 | -57.6 | 58.7 | 11.4 | 2218.3 | 415.1 | 648.4 | 5.1 | 0.58 | 3 | 900 |
| 10 | -7.95 | -0.01 | 0.00 | 0.9 | -5.2 | 280.0 | 643.5 | 646.1 | 643.6 | -58.6 | 59.5 | 10.4 | 2217.0 | 412.4 | 646.2 | 5.2 | 0.58 | 4 | 900 |
| 11 | -7.64 | -0.01 | 0.01 | 0.8 | -5.4 | 278.6 | 644.4 | 647.2 | 644.5 | -60.5 | 61.2 | 9.1 | 2218.9 | 413.8 | 647.2 | 5.4 | 0.58 | 5 | 900 |
| 13 | -7.35 | -0.01 | 0.00 | 0.7 | -5.5 | 276.9 | 639.9 | 642.9 | 640.0 | -62.0 | 62.5 | 7.6 | 2220.5 | 409.5 | 642.9 | 5.5 | 0.57 | 6 | 900 |
| 14 | -7.05 | -0.01 | 0.00 | 0.6 | -5.8 | 275.5 | 636.5 | 639.7 | 636.5 | -64.2 | 64.5 | 6.2 | 2215.9 | 405.2 | 639.7 | 5.7 | 0.57 | 7 | 900 |
| 15 | -6.75 | -0.01 | 0.01 | 0.5 | -6.0 | 275.1 | 636.1 | 639.6 | 636.1 | -67.3 | 67.5 | 6.0 | 2217.3 | 405.4 | 639.6 | 6.0 | 0.57 | 8 | 900 |
| 16 | -6.45 | -0.01 | 0.00 | 0.6 | -6.3 | 275.0 | 628.8 | 632.6 | 628.8 | -69.6 | 69.9 | 6.1 | 2217.9 | 398.1 | 632.5 | 6.3 | 0.56 | 9 | 900 |
| 17 | -6.15 | -0.01 | -0.00 | 0.7 | -6.7 | 276.3 | 626.3 | 630.6 | 626.4 | -73.1 | 73.6 | 8.0 | 2216.6 | 395.9 | 630.6 | 6.7 | 0.56 | 10 | 900 |
| 18 | -5.85 | -0.01 | 0.00 | 1.0 | -7.0 | 278.2 | 624.1 | 628.9 | 624.2 | -77.1 | 77.9 | 11.1 | 2217.6 | 394.2 | 629.0 | 7.1 | 0.56 | 11 | 900 |
| 19 | -5.55 | -0.01 | -0.00 | 1.4 | -7.4 | 280.5 | 622.6 | 627.8 | 622.8 | -80.9 | 82.3 | 15.1 | 2217.7 | 393.3 | 628.0 | 7.5 | 0.56 | 12 | 900 |
| 22 | -5.25 | -0.01 | 0.00 | 1.8 | -7.7 | 283.1 | 617.6 | 623.3 | 618.0 | -83.8 | 86.0 | 19.6 | 2218.4 | 388.8 | 623.6 | 7.9 | 0.56 | 13 | 900 |
| 23 | -4.95 | -0.01 | 0.00 | 2.2 | -8.0 | 285.5 | 624.9 | 631.0 | 625.3 | -88.0 | 91.3 | 24.4 | 2217.5 | 396.9 | 631.5 | 8.3 | 0.56 | 14 | 900 |
| 24 | -4.65 | -0.01 | 0.00 | 2.6 | -8.2 | 287.5 | 622.2 | 628.5 | 622.8 | -89.2 | 93.6 | 28.2 | 2211.6 | 393.4 | 629.1 | 8.5 | 0.56 | 15 | 900 |
| 25 | -4.35 | -0.01 | 0.00 | 2.8 | -8.2 | 289.0 | 625.9 | 632.4 | 626.7 | -90.3 | 95.5 | 31.1 | 2212.8 | 397.8 | 633.1 | 8.7 | 0.56 | 16 | 900 |
| 26 | -4.05 | -0.01 | 0.00 | 3.0 | -8.2 | 289.8 | 633.5 | 640.1 | 634.4 | -91.5 | 97.3 | 32.9 | 2214.6 | 406.5 | 640.9 | 8.7 | 0.57 | 17 | 900 |
| 27 | -3.75 | -0.01 | 0.00 | 2.8 | -8.0 | 289.3 | 637.3 | 643.5 | 638.0 | -89.7 | 95.0 | 31.4 | 2216.9 | 410.4 | 644.3 | 8.5 | 0.58 | 18 | 900 |
| 28 | -3.45 | -0.01 | 0.01 | 2.5 | -7.7 | 287.9 | 642.5 | 648.4 | 643.1 | -87.0 | 91.5 | 28.0 | 2216.0 | 415.2 | 649.0 | 8.1 | 0.58 | 19 | 900 |
| 29 | -3.15 | -0.01 | 0.00 | 2.2 | -7.3 | 286.6 | 648.1 | 653.4 | 648.6 | -83.2 | 86.8 | 24.8 | 2216.0 | 420.5 | 653.9 | 7.6 | 0.58 | 20 | 900 |
| 30 | -2.85 | -0.01 | 0.00 | 0.6 | -7.1 | 275.1 | 636.7 | 641.7 | 636.8 | -79.4 | 79.7 | 7.1 | 2215.1 | 407.4 | 641.7 | 7.1 | 0.57 | 21 | 900 |
| 31 | -2.55 | -0.01 | 0.00 | 0.3 | -6.8 | 272.8 | 636.8 | 641.3 | 636.8 | -75.8 | 75.9 | 3.8 | 2218.0 | 407.5 | 641.3 | 6.8 | 0.57 | 22 | 900 |
| 32 | -2.26 | -0.01 | 0.00 | 0.5 | -6.4 | 274.7 | 637.8 | 641.8 | 637.8 | -71.4 | 71.6 | 5.9 | 2218.4 | 407.9 | 641.7 | 6.3 | 0.57 | 23 | 900 |
| 35 | -1.95 | -0.01 | -0.00 | -0.2 | -5.9 | 268.0 | 632.7 | 636.1 | 632.7 | -65.8 | 65.8 | -2.2 | 2219.7 | 402.2 | 636.0 | 5.9 | 0.57 | 24 | 900 |
| 36 | -1.65 | -0.01 | 0.01 | -1.6 | -5.6 | 254.6 | 611.3 | 614.3 | 611.5 | -60.5 | 62.7 | -16.6 | 2219.4 | 379.3 | 614.4 | 5.8 | 0.55 | 25 | 900 |
| 37 | -1.35 | -0.01 | 0.00 | -0.4 | -5.0 | 265.6 | 599.9 | 602.2 | 599.9 | -53.0 | 53.1 | -4.1 | 2221.5 | 366.8 | 602.2 | 5.0 | 0.54 | 26 | 900 |
| 40 | -1.05 | -0.01 | 0.00 | 1.3 | -4.4 | 285.7 | 602.2 | 604.0 | 602.3 | -46.7 | 48.5 | 13.1 | 2218.7 | 368.3 | 604.1 | 4.6 | 0.54 | 27 | 900 |
| 41 | -0.75 | -0.01 | 0.00 | 2.8 | -3.9 | 305.1 | 603.8 | 605.2 | 604.5 | -41.4 | 50.6 | 29.1 | 2221.9 | 370.7 | 605.9 | 4.8 | 0.54 | 28 | 900 |
| 42 | -0.45 | -0.01 | 0.00 | 4.3 | -3.6 | 319.9 | 604.1 | 605.3 | 605.7 | -38.0 | 58.9 | 45.1 | 2219.8 | 371.4 | 606.9 | 5.5 | 0.54 | 29 | 900 |
| 43 | -0.15 | -0.01 | 0.01 | 5.6 | -3.6 | 327.0 | 605.6 | 606.8 | 608.4 | -38.5 | 70.6 | 59.2 | 2221.9 | 374.6 | 609.6 | 6.6 | 0.54 | 30 | 900 |

Table 12. Nomenclature for Flow Field Tabulated Summary Data

PAGE HEADING (COMMON TO ALL SUMMARIES)

COMPANY HEADING

| | |
|---|---|
| DATE | Calendar Time at which data were printed |
| PROJECT | Alpha-numeric notation for referencing a specific test project |

LINE 1

| | |
|---|---|
| RUN | Sequential indexing number for referencing data. A constant throughout specified (or all) points of a survey. |
| SURVEY | Configuration indexing number used to correlate data with the test log. Survey may be used to identify all or portion of a grid set. |
| M | Wind tunnel free-stream Mach number |
| PT | Wind tunnel free-stream total pressure, psfa |
| TT | Wind tunnel free-stream total temperature, °F |
| Q | Wind tunnel free-stream dynamic pressure, psf |
| P | Wind tunnel free-stream static pressure, psfa |
| T | Wind tunnel free-stream static temperature, °R |
| V | Wind tunnel free-stream velocity, ft/sec |
| RE | Wind tunnel free-stream unit Reynolds number, millions per foot |
| TDP | Hygrometer dew point temperature, °F |
| SH | Wind tunnel specific humidity, lbm $H_2O$ per lbm air |
| SCALE | Aircraft model scale factor |
| DATE | Calendar time at which data were recorded |
| TIME | Time at which data were recorded (hr/min/sec) |
| CON SET | Run/point number of constants set used in data reduction |

Table 12. Continued

LINE 1 (Continued)

| | |
|---|---|
| ZERO SET | Run/point number of the air off set of instrument readings used in data reduction |
| TEST | Alpha-numeric notation for referencing a specific test program in a specific test unit. |

LINE 2

| | |
|---|---|
| A/C | Aircraft designation |
| ALPHA,BETA | Aircraft-model angle of attack and sideslip angle, respectively, deg |
| IP,IY | Pitch and yaw incidence angles of the probe longitudinal axis at the initialization of the grid set with respect to the aircraft longitudinal axis, positive tip up and tip to the right, respectively, as seen by pilot, deg |
| IR | Roll incidence of the probe $Z_B$ axis at the initialization of the grid set with respect to the aircraft plane of symmetry, positive for clockwise roll looking upstream, deg |
| CONFIG | Aircraft store loading designation |
| WING | Location of probe survey |

COLUMNAR HEADINGS

SUMMARY PAGE 2

| | |
|---|---|
| PN | Sequential indexing number for referencing data obtained during one run. Indexes each time a new set of data inputs is obtained. |
| XP | Position of the probe reference point with respect to the probe-axis system origin in the $X_P$ direction, in, model scale |
| YP | Position of the probe reference point with respect to the probe-axis system origin in the $Y_P$ direction, in, model scale |

Table 12. Continued

SUMMARY PAGE 2 (Continued)

| | |
|---|---|
| ZP | Position of the probe reference point with respect to the probe-axis system origin in the $Z_P$ direction, in, model scale |
| ALFXY | Indicated angle between VXY and VX, positive for positive VY, same as SIG, deg |
| ALFXZ | Indicated angle between VXZ and VX, positive for positive VZ, same as EPS, deg |
| ALFYZ | Indicated angle between VYZ and $-Z_B$-axis, positive clockwise looking upstream, deg |
| VX,VY,VZ | Velocity components parallel to the probe $X_B$, $Y_B$, and $Z_B$ axes, positive in the $-X_B$, $Y_B$, and $-Z_B$ directions, respectively, ft/sec |
| VXY,VXZ,VYZ | Velocity components in the probe body-axis $X_B$-$Y_B$, $X_B$-$Z_B$, and $Y_B$-$Z_B$ planes, respectively, ft/sec |
| PTP | Probe measured free-stream total pressure corrected for local Mach number |
| QL | Local dynamic pressure, psf |
| VL | Local velocity, ft/sec |
| THAT | Angle between the local flow velocity vector and the negative $X_B$-axis, deg |
| ML | Local Mach number calculated from the ratio of the average of the four static pressures and the probe total pressure, (PS1 + PS2 + PS3 + PS4)/4(PP5) |
| NDX | Sequential indexing number for referencing data obtained during a grid set. Indexes for each position in the set |
| RUN | Sequential indexing number for referencing data. A constant throughout specified (or all) points of a survey. |

Table 12. Continued

PROBE BODY-AXIS SYSTEM DEFINITIONS (FLOW FIELD)

Coordinate Directions

| | |
|---|---|
| $X_B$ | Parallel to the probe longitudinal axis, positive forward as seen by the pilot |
| $Y_B$ | Perpendicular to the $X_B$ anc $Z_B$ directions, positive to the right as seen by the pilot when the probe is at zero yaw and roll angles |
| $Z_B$ | Perpendicular to the $X_B$ direction and parallel to the aircraft plane of symmetry when the probe and aircraft are at zero yaw and roll angles, positive downward as seen by the pilot when the probe is at zero pitch and roll angles |

Origin

The probe reference point is the intersection of the plane containing the four static orifices and the probe centerline. The probe body-axis system origin is coincident with the probe reference point and is fixed with respect to the probe for the duration of the grid set. The $X_B$, $Y_B$ and $Z_B$ coordinate axes rotate with the probe in pitch, yaw and roll.

PROBE-AXIS SYSTEM DEFINITIONS (FLOW FIELD)

Coordinate Directions

| | |
|---|---|
| $X_P$ | Parallel to the probe longitudinal axis at the initialization of the grid set and rotated through pitch and yaw angles of IP and IY, respectively, with respect to the aircraft longitudinal axes positive forward as seen by the pilot |
| $Y_P$ | Perpendicular to the $X_P$ direction and parallel to the $X_F$-$Y_F$ plane, positive to the right as seen by the pilot |
| $Z_P$ | Perpendicular to the $X_P$ and $Y_P$ directions, positive downward as seen by the pilot |

Table 12. Concluded

FLIGHT-AXIS SYSTEM DEFINITIONS (FLOW FIELD)

Coordinate Directions

| | |
|---|---|
| $X_F$ | Parallel to the aircraft flight path direction, positive forward as seen by the pilot |
| $Y_F$ | Perpendicular to the $X_F$ and $Z_F$ directions, positive to the right as seen by the pilot |
| $Z_F$ | Parallel to the aircraft plane of symmetry and perpendicular to the aircraft flight path direction, positive downward as seen by the pilot |

Origin

The origin of the probe-axis and flight-axis coordinate systems was defined for this test as being the location of the MK-83 store nose tip (station 0.0) at the carriage position.