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Static and Wind Tunnel Aero-Performance Tests of NASA AST Separate Flow Nozzle Noise Reduction Configurations

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February 2001

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DEFINITION OF SYMBOLS

A	Cross-section area, in^2
AP	(Channel 10) Pitching moment at aft balance bridge, in.-lb_f
A^*	Sonic throat area, in^2
b	Real-gas ideal thrust function correction, dimensionless
B_j	Balance readout, millivolts
c	Real-gas A/A* correction factor, dimensionless
C_D	Discharge coefficient, dimensionless
C_DA	Effective area, in^2
C_T	Thrust coefficient, dimensionless
d	Diameter, inches
f	Exit stream thrust parameter, dimensionless
F	Stream thrust, $(1 + \gamma M^2)$ PA, lb_f
FP	(Channel 10) Pitching moment at forward balance bridge, in.-lb_f
g	Acceleration of gravity, 32.174 ft/sec^2
G	Real gas stream thrust correction factor, dimensionless
H_o	Axial balance force (unpressurized calibration), lb_f
H_2	Axial balance force corrected for seal tare, lb_f
H_r	Resultant thrust, lb_f
H_x	Axial thrust, lb_f
H_y	Vertical thrust, lb_f
K	Real-gas mass flow function, $°R^{1/2}$/sec
K_{ij}	Balance force calibration factors, lb_f/millivolt
L_{bal}	Axial distance between vertical bridges V1 and V3, inches
L_{ref}	(Channel 14) Axial distance from the balance center to the model reference plane at exit of fan nozzle : 2078-001 (for Ch14 L_{ref} = 68.625 inches)
L_{ref}	(Channel 10) Axial distance from the balance downstream pitching moment bridge (AP) to the model reference plane at exit of fan nozzle : 2078-001 (for Ch10 L_{ref}=34.77 inches)

L_x	Axial distance to the intersection of the resultant thrust vector with the model centerline, measured from the model reference plane, positive downstream of the reference plane (also referred to as "Station Ly" on the Channel 14 output sheet), inches
L_y	(Channel 14): Axial distance from the balance center to the intersection of the resultant thrust vector with the facility lower centerline, inches
L_y	(Channel 10): Vertical displacement of resultant thrust vector at the reference plane, measured from nozzle centerline to the intersection of the thrust vector and the reference plane, positive upward, inches
m	Mass flow rate, slugs/second
M	Mach number, dimensionless
Mo	(Channel 14) Pitching moment about the intersection of the balance center and the model centerline, positive clockwise with flow left to right, $(=L_yH_y)$, in.-lb_f
Mo	(Channel 10) Pitching moment about the intersection of the reference plane and the model centerline, positive clockwise with flow left to right, $(=L_xH_y)$, in.-lb_f
P	Pressure, static unless otherwise specified by subscript, psia
ΔP	Static pressure difference across seal, psid
r	Radius from centerline, inches
Δr	(Channel 14) Vertical displacement of resultant thrust vector at the reference plane, measured from nozzle centerline to the intersection of the thrust vector and the reference plane (equivalent centerline for dual-flow ASME nozzles) positive above centerline, inches
R	Gas constant, 1716.32 $ft^2/sec^{2}{}^\circ R$
R_N	Reynolds number, dimensionless
T	Temperature, °R (unless stated as °F)
V_1,V_3	(Channel 14) Vertical balance forces, lb_f
v	Velocity, ft/sec

W	Mass flow rate, lb_m/sec
W_x, W_y	Dead-weight calibration loads, lb_f
y	Distance from wall
α	Thrust vector angle, degrees
γ	Ratio of specific heats, dimensionless
δ	Boundary layer thickness
θ	Meridian angle measured clockwise from top looking upstream, degrees
λ	Pressure ratio, P_t/P_a, dimensionless
ρ	Density, $slugs/ft^3$
Σ	Summation
Δ	Incremental quantity
τ	Temperature ratio, T_{t8}/T_{t7}, dimensionless
η	Temperature difference ratio, $(T - T_{t7})/(T_{t8} - T_{t7})$, dimensionless

Subscripts

a	Ambient
e	Exit
i	Ideal
i,j	Counter for summations
mp	Mixing plane
r	Resultant
t	Total conditions
w	Wall
x	Axial component
y	Vertical component
∞	Freestream
1,2,...	See Figures 7-10

Superscript

*	Sonic condition, $M = 1$

1.0 INTRODUCTION

This cold-flow model study investigated the static and simulated in-flight performance of several NASA Advanced Subsonic Technology (AST) separate flow nozzle noise reduction configurations. The tests were conducted at ASE's FluiDyne Laboratory located in Plymouth, Minnesota. Tests were conducted in the Channel 14 static thrust stand, the Channel 6 wind tunnel sting checkout facility, and the Channel 10 transonic wind tunnel. In Channels 14 and 6 the model exhausts directly to atmosphere. Channel 6 is used to check-out the wind tunnel sting, force balance, and model prior to transporting the sting system into the 66x66 inch transonic wind tunnel.

The test program was defined by NASA test specifications with some changes as the test progressed. Technical liaison for NASA LeRC was performed by Mr. Naseem Saiyed. The model was designed and fabricated by ASE-FluiDyne using aerodynamic lines furnished by customers on prior jobs (Jobs 2078 & 2087) and tested previously at NASA LeRC for acoustics. Some new model-to-facility adapter hardware were fabricated for the present job. Existing adapters were used where possible to minimize the cost. Consequently, the charging station contours are different between the static and wind tunnel tests.

This report describes the test facility, test model, data acquisition and analysis procedures, and presents the test results. Test conditions and major test results are tabulated in Figure 17. Detailed data and calculations are contained in a separate Appendix. Detailed part drawings are included at the end of this report.

2.0 FACILITY DESCRIPTION

The tests were performed at the FluiDyne Laboratory in the Channel 14 static thrust stand, the Channel 6 static stand for wind tunnel sting checkout, and the Channel 10 transonic wind tunnel.

2.1 Channel 14 Static Thrust Stand

Channel 14 is a dual passage hot-cold flow static stand used to determine performance of exhaust nozzle models. Nozzle thrust is determined from force measurement with a strain-gage force balance. Model air is metered and ducted to the model through two separate passages; see Figure 1a. The general arrangement of Channel 14 is shown in Figures 1 and 9. While the current tests were with cold flow only, the general description of the facility below includes its hot flow capability.

The airflows for both the cold and hot passages of a test nozzle are obtained from the facility 500 psi dry air storage system. Air for the cold passage is throttled, metered through a long-radius ASME nozzle, ducted to the cold passage of the test nozzle, and finally exhausted to atmosphere. Air for the hot passage is throttled, passed through a regenerative storage heater, mixed with unheated bypass flow to achieve a desired temperature, metered through a long-radius ASME nozzle, ducted to the hot passage of the test nozzle, and finally exhausted to atmosphere.

The air heater used for the hot flow contains alumina pebbles which are preheated to approximately 1250°F with a combustion heater. The Channel 14 heater capacity is nominally 30 lbs/sec at 1400°F (1600°F if heater liner is changed to Inconel).

The model assembly is supported by a 3-component strain-gage force balance and is isolated from the facility piping by two elastic seals; see schematic in Figures 1 and 9. Calibration of the balance and seals is described in Section 4.8.

The ASME meter at Station 1 is water-cooled to protect the elastic seal from thermal effects. Since the cooling water is confined to the upstream (i.e., non-metric) hardware only, no tare forces are introduced by the water supply lines.

Facility instrumentation is provided to calculate mass flow rates at Stations 1 and 4, and to calculate the exit thrust produced by the test nozzle; details are described in Section 4.

2.2 Wind Tunnel Checkout Facility, Channel 6

Channel 6 is the static (M=0) wind tunnel setup and checkout facility used prior to the Channel 10 wind tunnel. Figure 4 shows the arrangement of Channel 6. Channel 6 consists of piping which supplies dried, heated air from the 2500 psi air storage system to the sting mounted flow-through force balance. This facility allows checkout of the model (exhausting to atmosphere), balance, instrumentation and data acquisition systems before the sting is installed in the wind tunnel(Channel 10). Proper performance of this facility was demonstrated by testing a standard 5.7 inch diameter ASME nozzle. In addition, the baseline model configuration 1 (3BB) was tested statically in both Channels 6 and 14 to confirm agreement. Channel 14 is the more accurate facility for measuring static performance.

2.3 Transonic Wind Tunnel, Channel 10

Channel 10 is a transonic wind tunnel having a 66 inch x 66 inch test section with slotted upper and lower walls. Figures 2a and 2b show overall views of the tunnel and Figure 3 shows a model installation for exhaust nozzle tests. This is an induction-type tunnel in which atmospheric air is drawn through the test section using air ejectors to reduce the downstream pressure. The required test section Mach number is obtained by controlling the mass flow to the ejectors. Tunnel Mach number for the present tests was controlled to M= 0.28 and 0.80. At Mach .8, water condensation in the test section is avoided by burning propane upstream of the inlet.

The exhaust nozzle model and the force balance system are supported in the test cell by a cantilevered tube (or sting) that projects through the contraction into the test section. This 10 inch diameter sting flares to 14.5 inch diameter to match the model diameter at the beginning of the slotted wall test section. The model support tube consists of two concentric pipes with the model air (obtained from the 2500 psi storage system) being supplied to the model through the inner pipe. Thinning of the boundary layer on the support tube was achieved by using the facility vacuum system(33500 ft^3) to remove the low energy air adjacent to the tube through a perforated section upstream of the test model. This air is removed through the outer pipe in the sting. Figure 10 shows a schematic of this boundary layer removal system.

The boundary layer thickness on the support tube was measured with a total pressure rake located 1 inch upstream of the metric break at theta = 0 degrees (top). Boundary layer thicknesses are discussed in Section 3.3.

The performance data taken in Channel 10 were obtained by force measurement using a dual passage flow through strain gage force balance system. This system consists of two choked ASME metering nozzles, two flexible seals, and a five component force balance.

2.4 Operational Procedures

Flow conditions for the Channel 14 static tests were set by independently regulating the airflow to the fan and core meters to obtain the desired P_{t7}/P_a and P_{t8}/P_a. The model air was preheated to room temperature for these tests.

Flow conditions in Channels 6 and 10 were set by regulating the total air flow to obtain the desired Pt_7/Pa, while adjusting a motorized flow splitter to obtain the desired Pt_7/Pt_8. The motorized flow splitter utilizes a sliding choke plate arrangement to vary area and divide flow between the fan and core passages. (Splitter 6051-8115-2, Choke plates: C1= 6070-6158-4, F1=6070-6158-2) External flow Mach number in Channel 10 was set using the tunnel air ejectors. Model support tube boundary layer suction was adjusted with sting vacuum control to reduce the boundary layer thickness to better simulate freestream conditions. Upstream tunnel propane burners were ignited to produce a freestream air temperature rise to prevent test section water vapor condensation at higher Mach numbers. The test section freestream flow was monitored with a video camera to confirm there was no cloud of water vapor condensation in the test section. Test section total temperature was typically 120 F at M=0.8.

3.0 MODEL DESCRIPTION

3.1 Model Adapters

The test model was attached to common adapting hardware in Channel 14 (Figures 1a-b) which supplied separately-metered flows to the fan and core nozzles. The fan and core air flow was nominally at 70°F temperature for all tests.

Figures 1b (6051-0160) and 5 (2212-001) illustrate major adapters for Channel 14 tests. Adapters for the core passage included an insulated duct, a choke plate, four screens, a centerbody with three struts, and a primary duct to which interchangeable mixers attached. The tailcone or plug was common to all configurations. Adapters for the annular fan passage included a choke plate, two screens, a bellmouth contraction, and a common outer bypass duct. Spacers were fabricated to position the hardware in axial locations corresponding to the cold aero-design lines per NASA specification. These design lines were defined to ASE-FluiDyne for fabrication Jobs 2078 and 2087 and are depicted on the drawings.

Figures 6a and 6b (2212-005, -006) illustrate major adapters for Channels 6 and 10 tests. Adapters for the core passage included two choke plates, four screens, a charging station, a centerbody with three struts, and a primary duct to which interchangeable mixers attached. Adapters for the annular fan passage included two choke plates, four screens, a charging station, and a common outer bypass duct to which interchangeable fan nozzles were attached. The hardware were positioned in axial locations corresponding to the cold aero-design lines per NASA specification.

3.2 Model Components

The test model hardware adapters were designed and fabricated by the ASE FluiDyne Laboratory. The nozzle models were fabricated by ASE under previous jobs using aerodynamic lines and instrumentation locations specified by the customer. Aero-lines correspond to the cold aero-design lines from Jobs 2078 and 2087 per NASA specification. Figures 5, 6a, and 6b show assembly drawings of the test model. Detail drawings of the model hardware are contained in the last section of this report. Photographs of model assemblies and components are shown in Figure 15. Model configuration definitions are documented in Figure 16. The major interchangeable components were the core nozzle and the fan nozzle. The plug was common to all configurations.

The plug was designed with a vent hole. This was left open during all tests including wind tunnel tests with sub-barometric pressure in the test section. The plug tip was modified on a previous test program, and a screw was installed in the aft tip. This screw remained in the plug for the present test.

3.3 Model Instrumentation

In Channel 14 charging station instrumentation for the fan passage consisted of four 12-probe area-weighted rakes (P_{t7}) and three 5-probe thermocouple rakes (T_{t7}). Associated with each total pressure rake was an inner and outer wall static pressure tap (P_{s7}). Core nozzle charging instrumentation consisted of four 5-probe total pressure rakes (P_{t8}), two 4-probe, and two 2-probe total temperature rakes (T_{t8}). Also associated with each total pressure rake was an outer wall static pressure tap (P_{s8}). An inner wall static pressure tap was not available.

In Channels 6 and 10 charging station instrumentation for the fan passage consisted of four 12-probe area-weighted rakes (P_{t7}). Associated with each total pressure rake was an inner and outer wall static pressure tap (P_{s7}). Core nozzle charging instrumentation consisted of four 5-probe total pressure rakes (P_{t8}). Also associated with each total pressure rake was an inner and outer wall static pressure tap (P_{s8}).

For the wind tunnel test, ten external static pressure taps were installed on the baseline fan nozzle (2078-001). These pressure taps were installed to provide information for the calculation of boat-tail drag of the fan nacelle.

The model support sting boundary layer total pressure profile was measured with an 11 probe boundary layer rake (6051-4281-1) located 1 inch upstream of the metric break. The boundary layer thicknesses were larger than usual because of the larger size model in combination with a fixed vacuum system capability. The model size was a result of previous test programs. In the tunnel, a sting boundary layer profile generated by vacuum suction is superimposed onto a larger boundary layer profile approaching the perforated section. Near the sting surface the vacuum dominates, and the velocity gradients are large. Farther from the sting surface the original velocity profile remains, and a small velocity gradient persists. Boundary layer thicknesses were calculated using two methods and are documented in the Data Appendix.

The first method calculates overall thicknesses from the combined vacuum-plus-original-profile and results in the following:

Data Point 58.02, δ_1 [99%(V/Vinf)]= 0.92 inches (M= 0.8)

Data Point 55.03, δ_1 [99%(V/Vinf)]= 0.24 inches (M= 0.28)

The second method considers only the boundary layer shape created by the vacuum which is superimposed onto the larger shape. Since the largest velocity gradients are in this section of the profile, this definition may be useful. Thicknesses calculated using this method are listed below.

Data Point 58.02, δ_2 [99%(V/Vinf)]= 0.63 inches (M=0.8).

Data Point 55.03, δ_2 [99%(V/Vinf)]= 0.21 inches (M= 0.28)

During the program, experiments at M=0.8 demonstrated that the boundary layer thickness could be decreased by about 45% by reducing the length of the perforated section of the covers by 1/3rd (eliminating the first third of the bleed section length). However, this bleed configuration was never employed for the actual test data.

4.0 DATA ANALYSIS PROCEDURES

The following subsections describe the data analysis procedures used for the present tests. Station notations are defined in Figures 7-10. Computerized data reduction programs written in BASIC language are included in the Data Appendix.

4.1 P_t Definitions

In Channel 14, charging station instrumentation for the fan passage consisted of four 12-probe area-weighted rakes (P_{t7}) Each total pressure rake was associated with an inner and outer wall static pressure tap (P_{s7}). Core nozzle charging station instrumentation consisted of four 5-probe total pressure rakes (P_{t8}). Each total pressure rake was associated with an outer wall static pressure tap (P_{s8}). For the core duct, the inner wall static pressure was assumed equal to the outer wall static pressure (part 0946-001-2 was used).

In Channels 6 and 10 charging station instrumentation for the fan passage consisted of four 12-probe area-weighted rakes (P_{t7}). Each total pressure rake was associated with an inner and outer wall static pressure tap (P_{s7}). Core nozzle charging instrumentation consisted of four 5-probe total pressure rakes (P_{t8}). Each total pressure rake was associated with an inner and outer wall static pressure tap (P_{s8}).

The mass-momentum method was used to determine total pressures in the ducts. A summary of the mass-momentum method is given below.

Mass-momentum average model charging station total pressures were determined as follows. For flows with nearly-uniform total pressure profiles, the average total pressure may be obtained by simply area-weighting individual probe measurements. For flows with non-uniform total pressure profiles, however, a more accurate measure of the average total pressure is obtained from the mass-momentum method (Reference 5). This method represents a non-uniform flow by average properties that simultaneously satisfy both the mass flow and the momentum of the real flow.

From continuity:

$$PAM \sqrt{\frac{\gamma}{RT}\left(1 + \frac{\gamma - 1}{2} M^2\right)} = \Sigma P_j A_j M_j \sqrt{\frac{\gamma}{RT_j}\left(1 + \frac{\gamma - 1}{2} M_j^2\right)}$$

and from momentum:

$$PA\,(1 + \gamma\ M^2) = \Sigma P_j A_j\,(1 + \gamma\ M_j^2)$$

where the individual A_j were determined from the flow path and rake geometry, P_j is assumed to vary linearly between the inner and outer wall, P_{tj} is measured directly, and

$$M_j = \sqrt{\frac{2}{\gamma - 1}\left[\left(\frac{P_t}{P}\right)^{\frac{\gamma - 1}{\gamma}} - 1\right]}$$

If total temperature is assumed constant in the passage, then:

$$\frac{M\sqrt{1 + \frac{\gamma - 1}{2} M^2}}{1 + \gamma M^2} = \frac{\Sigma P_j A_j M_j \sqrt{1 + \frac{\gamma - 1}{2} M_j^2}}{\Sigma P_j A_j\ (1 + \gamma M_j^2)}$$

The right side of the above equation is calculated by summation from the measured quantities. Squaring the above equation results in a quadratic (with variable M^2), which is readily solved for a unique value of the effective Mach number, M, satisfying the stated requirements. Knowing the effective Mach number, the effective static pressure, P, is determined from the preceding continuity equation, and finally, the effective total pressure is calculated from:

$$P_t = P\left(1 + \frac{\gamma - 1}{2} M^2\right)^{\frac{\gamma}{\gamma - 1}}$$

For the present test the total pressure profile at each of the charging station rakes was integrated using the mass-momentum technique. The average charging station total pressure was then defined as the average from the separate rake integrations.

4.2 T_t Definitions

T_{t1} and T_{t4} were measured with facility thermocouples. For all model and ASME checkout nozzle tests, T_{t7} and T_{t8} were calculated from T_{t4} and T_{t1}, respectively, by subtracting the temperature drop due to adiabatic throttling of flow between the meter station and the nozzle charging station. The temperature drop was calculated from Joule-Thomson throttling values (Reference 4) and typically varied between 1° and 6°F . Measured values of T_{t7} were acquired but not used in the data reduction. Measured values of T_{t8} were acquired in Channel 14 only and were not used in the data reduction.

4.3 Flow Rates

The mass flow rates through the test nozzles were determined using choked ASME long-radius metering nozzles. The core nozzle flow rate was calculated at

Station 1 and the fan nozzle flow rate was calculated at Station 4 using the following equations.

$$W_1 = W_8 = \frac{K_1 C_{D_1} A_1 P_{t_1}}{\sqrt{T_{t_1}}}$$

$$W_4 = W_7 = \frac{K_4 C_{D_4} A_4 P_{t_4}}{\sqrt{T_{t_4}}}$$

The critical flow factor, K, was calculated as a function of total pressure and total temperature.

Channel 14:

$$K = 0.52820 + a\,T_t + b\,T_t^2 + c\,T_t^3 + 0.186 \times 10^{-4}\ P_t e^{-.0067(T_t - 500)}$$

where

$a = 0.1654 \times 10^{-4}$

$b = -0.2119 \times 10^{-7}$

$c = 0.6008 \times 10^{-11}$

T_t is in °R and P_t is in psia.

This equation was obtained by curve-fitting tabulated values in References 1 and 4; the curve-fit is accurate to within ± 0.03% for $0 < P_t < 30$ atmospheres and $460 < T_t < 700$°R, and is accurate to within ± 0.1% for $0 < P_t < 40$ atmospheres and $460 < T_t < 1800$°R.

In Channels 6 and 10, K was calculated using a different equation. K was calculated as a function of total pressure and temperature from a different curve fit of Reference 1 data.

Channel 6 & 10:

$$K=0.776615\,[\,(0.68166+1.36243E\text{-}5\ T_t-1.43545E\text{-}8\ T_t^2)$$
$$+(2.14835E\text{-}4-6.06496E\text{-}7\ T_t+4.49456E\text{-}10\ T_t^2)\ P_t$$
$$+(5.4424E\text{-}8-1.90568E\text{-}10\ T_t+1.64438E\text{-}13\ T_t^2)\ P_t^2]$$

where Pt (psia) = 0 to 1100 psia

Tt(R) = 460 to 600 R

Throat Reynolds numbers at Stations 1 and 4 were calculated using the following equation from Reference 3.

$$R_N = 1.50994 \times 10^7 \, \frac{P_t\, M\, d \left[T_t \left(1 + .2\, M^2\right)^{-1} + 198.6 \right]}{T_t^2 \left(1 + .2\, M^2\right)^{1.5}}$$

where all parameters pertain to the desired station.

C_{D4} was calculated using a semi-empirical equation

$$C_{D_4} = 1 - 0.184\ R_{N_4}^{-0.2}\ .$$

For cold flow, C_{D1} can be calculated with an equation of the same form as above. For hot flow, the C_{D1} equation is modified to account for a thermal boundary layer. This thermal boundary layer results from water-cooling of the Station 1 meter.

$$C_{D_1} = 1 - \left(0.184\ R_{N_1}^{-0.2}\right)\left(1.574 - 0.574\ T_{t_1} / T_w\right)$$

For some hot tests at low flow rates, the above equation (for turbulent flow) can be modified slightly (corresponding to transitional boundary layer flow). The above equation was derived assuming: constant static pressure in the boundary layer, a 1/7th power velocity profile, thermal boundary layer thickness equal to velocity boundary layer thickness, and a density distribution in the boundary layer defined by

$$\frac{\rho}{\rho_\infty} = \frac{T_\infty}{T_w} - \left(\frac{T_\infty}{T_w} - 1\right)\left(\frac{y}{\delta}\right)^{1/7} .$$

T_w, the wall temperature at the nozzle throat, is estimated for hot flow tests from heat-balance calculations of heat transfer from the air stream to the cooling water. T_w values calculated are typically 95° to 165°F. R_{N_1} is calculated using a mean temperature, $(T_w + T_{t_1})/2$. Given sufficient wall cooling, C_{D_1} may exceed unity (Reference 2).

The above equation for "hot" C_{D_1} is believed to be correct within ±0.0025, on the basis of results from facility demonstration tests. These demonstration tests included test series with either a 2.5-inch or a 4-inch diameter ASME nozzle located downstream of the water-cooled Station 1 meter. The downstream nozzle was essentially at adiabatic conditions (thin-wall construction, backside insulated). Flow rates calculated at Station 1 (using the above C_{D_1} equation) agreed within ±0.25% with flow rates calculated at the downstream nozzle (using adiabatic wall C_D).

In Channel 14, A_4, the geometric throat area of the Station 4 meter, was 4.9029 in^2. The geometric throat area of the Station 1 meter was 1.3507 in^2. For hot core flow tests, A_1 is calculated assuming thermal expansion from 70°F to T_w. In Channels 6 and 10, A_1=1.3283 in^2 and A_4=1.3304 in^2.

In Channel 14, core meter pressure, P_{t_1}, was measured using total pressure probes. Fan meter total pressure, P_{t_4}, was calculated using the measured static pressure and the isentropic pressure ratio for the A/A* at the meter charging station duct location, i.e. P_{t4}=1.0023 P_{s4}.

In Channels 6 and 10, both core and fan meter pressures were calculated using the measured static pressures and the isentropic pressure ratios for the A/A* at the meter charging station duct locations, i.e. P_{t_1}=1.0262 P_{s_1} and P_{t_4}=1.0262 P_{s_4}.

T_{t_1} and T_{t_4} were measured with shielded thermocouple probes and were recorded on the facility data acquisition system.

Flow rates (lbm/sec) calculated for the present tests were in the ranges:

For Channel 14:	$2.94 < W_8 < 7.18$	$12.88 < W_7 < 20.23$
For Channel 6:	$4.13 < W_8 < 6.05$	$15.49 < W_7 < 18.79$
For Channel 10:	$4.31 < W_8 < 5.94$	$15.0 < W_7 < 18.0$

4.4 Discharge Coefficients

Discharge coefficient is defined as the ratio of the actual flow rate through a nozzle to the ideal isentropic flow rate at the overall nozzle pressure ratio. Overall nozzle pressure ratios are defined as $\lambda_7 = P_{t_7}/P_a$ and $\lambda_8 = P_{t_8}/P_a$. In a static thrust stand, P_a is atmospheric pressure. In the wind tunnel, P_a is the test section static pressure. Fan and core nozzle discharge coefficients are then

$$C_{D_7} = W_7/W_{7_i} \quad \text{and} \quad C_{D_8} = W_8/W_{8_i}$$

where

$$W_{7_i} = P_{t_7} A_7 K_7 (A^* / A) / \sqrt{T_{t_7}}$$

$$W_{8_i} = P_{t_8} A_8 K_8 (A^* / A) / \sqrt{T_{t_8}} \ .$$

P_{t7}, P_{t8}, T_{t7}, and T_{t8} were defined in Sections 4.1 and 4.2. K_7 and K_8 were evaluated using previous equations, as functions of P_{t7}, T_{t7}, P_{t8} and T_{t8}.

Actual reference areas A_7 and A_8 were not defined for noise reduction configurations. Therefore fan and core nozzle discharge coefficients were calculated using the baseline areas. Baseline areas were calculated using design contours adjusted for assembled "tip to tip" inspections defining the relative axial locations of the fan, core, and centerbody parts. Calculated areas are listed in the following table.

NOZZLE	**DRAWING**	**CH14 AREA (in^2)**	**CH10 AREA (in^2)**
Baseline Fan (3BB)	2078-001	30.2491	30.2944
Baseline Core (3BB)	2078-405	10.5553	10.5553

For Channel 14 ASME checkout nozzle tests, the throat area of the 7.1-inch nozzle was A_7 = 39.5897 in^2. The throat area of the 4-inch nozzle was A_8 = 12.5613 in^2 for cold tests. In Channel 6, the throat area of the 5.7 inch ASME checkout nozzle was 25.4994 in^2.

A*/A, the isentropic area ratio, is used to correct the ideal flow rate when the nozzle is unchoked. A*/A for cold flow was calculated using equations valid for γ = 1.4, obtained from Reference 3.

$$A^* / A = 3.86393\ \lambda^{-0.71429} \sqrt{1 - \lambda^{-0.28571}} \text{ for } \lambda < 1.8929$$

and

$$A^* / A = 1 \text{ for } \lambda \geq 1.8929.$$

A*/A for hot core nozzle tests are obtained by correcting the $\gamma = 1.4$ value for "real gas effects," to account for γ_8 being significantly less than 1.4. The correction was derived by curve-fitting tabulated values from Reference 4; no corrections are indicated for T_t < 900°R. First, the critical pressure ratio was expressed as a function of total temperature:

$$1/\lambda^* = 9.667 \times 10^{-6}\, T_t(^\circ R) + 0.5196$$

If $\lambda > \lambda^*$, then A*/A = 1. If $\lambda < \lambda^*$ and $900 < T_t < 1260$°R,

$$c = 1 + \left(\frac{1}{\lambda} - \frac{1}{\lambda^*}\right) 5.728 \times 10^{-5}\ (T_t - 900)$$

If $\lambda < \lambda^*$ and $1260 < T_t \leq 1800$°R,

$$c = 1 + \left(\frac{1}{\lambda} - \frac{1}{\lambda^*}\right) \left[2.615 \times 10^{-5}\ (T_t - 1260) + 0.020621\right].$$

Finally,

$$A^* / A = c \times (A^* / A)_{\gamma=1.4}\ .$$

For the present cold flow tests, c is 1.000.

4.5 Thrust Measurement

Model thrust is measured by a highly accurate force balance system with a control volume approach to account for entering stream thrusts and other pressure-area terms. Forces caused by the elastic seals which separate the balance system from the facility piping are also accounted for. The measurement of thrust is described below for Channels 14 and 10 separately.

4.5.1 Thrust Measurement in Channel 14

The net static axial thrust of an exhaust nozzle is defined as the axial exit momentum of the exhaust flow, plus the excess of exit pressure over ambient pressure times the projected exit area.

$$H_x = mv_{ex} + (P_e - P_a)\,A_{ex}$$

The net static thrust of an exhaust nozzle model was determined in the present test program by applying the momentum equation to the control volume shown in Figures 7 and 9. The analysis of axial forces applied to the control volume includes entering stream thrusts (F_1 and F_4), a balance force (H_2), various pressure-area terms and the axial exit stream thrust, ($H_x + P_aA_{ex}$). The axial balance force, H_2, as used here, includes seal tare forces. Summing axial forces,

$$H_x = F_1 + F_4 + P_2\,(A_2 - A_1) + P_5(A_5 - A_4) - P_a(A_2 + A_5) - H_2\,.$$

The stream thrust at Station 4 is the exit stream thrust of a choked long-radius ASME nozzle, and was calculated as:

$$F_4 = G_4 \left(1 + 1.4 C_{D_4} C_{T_4}\right) .52828 \; P_{t_4} A_4 .$$

Use of $\gamma = 1.4$ and $P^*/P_t = .52828$ in the above equation implies an ideal gas. The factor G, derived from tabulated values in References 1 and 4, corrects the stream thrust from that of an ideal gas to that of a real gas.

$$\text{If } T_t < 560°R, \; G = 1.00012 + 6.8338 \times 10^{-6} \, P_t \, (\text{psia})$$

$$\text{If } T_t > 560°R, \; G = 1.0044 - (4.196 - .0059 \, P_t)(T_t + 460) \times 10^{-6}$$

C_{D_4} has already been discussed; C_{T_4} was calculated in an analogous manner,

$$C_{T_4} = 1 - 0.109 \, R_{N_4}^{-0.2} .$$

This equation is a semi-empirical expression of the thrust coefficient of an ASME nozzle at a pressure ratio of $\lambda = 1.8929$ (corresponding to $P^*/P_t = .52828$). For the present tests, G_1 typically varied from 1.000 to 1.002, G_4 from 1.000 to 1.004, and C_{T_4} from 0.9954 to 0.9962.

The stream thrust at Station 1 was calculated as:

$$F_1 = G_1 \left(1 + 1.4 \, C_{D_1} C_{T_1}\right) .52828 \, P_{t_1} A_1 .$$

Each variable in this equation has been previously described, except C_{T_1}. C_{T_1} was calculated in a similar manner as C_{T_4}, but is modified for hot flow tests to account for the thermal boundary layer described in the discussion of C_{D_1} in Section 4.3:

$$C_{T_1} = 1 - \left(0.109 \ R_{N_1}^{-0.2}\right)\left(0.828 + 0.172 \ T_{t_1} / T_w\right).$$

The above equation was derived using the same assumptions as in the derivation of C_{D_1}. C_{T_1} for the present cold flow tests varied from 0.9946 to 0.9955.

P_2 and P_5 are seal cavity static pressures which act over areas determined by the seal area $(A_2\text{-}A_1)$ or $(A_5\text{-}A_4)$. Static pressures P_2 and P_5, and test area ambient pressure (P_a), were measured with PSI pressure transducers. A_2 and A_5, the geometric reference areas for the seals, were 3.500 and 7.0686 in^2, respectively. The balance force and seal tare calibrations are described in Section 4.8.

The vertical thrust, H_y, was obtained from the vertical force balances:

$$H_y = V_1 + V_3.$$

The resultant thrust, H_r, was calculated as the vector sum of the axial thrust, H_x, and the vertical thrust, H_y. Resultant thrust vector angle, α, was determined as:

$$\alpha = \tan^{-1}(H_y/H_x).$$

The sign convention for positive values of thrust components and vector angle is defined in Figures 8 and 10. **At ASE-FluiDyne, positive vertical thrust is defined as pointing downward as a result of historical balance calibration procedures.** The location of the resultant thrust vector was determined by summation of moments and is described by the axial distance between the intersection of the thrust vector and the facility centerline to the intersection of the reference plane and the facility centerline (L_x). The reference plane for all configurations is the baseline fan nozzle exit plane.

Lref = distance from balance center to model reference plane (fan exit)

$L_x = L_y - L_{ref}$ (see above, positive downstream from ref. plane)

$L_y = -(V_1 - V_3)(L_{bal}/2) / H_y$ (distance from balance center to vector intersection with model centerline)

$Mo = L_y H_y$ (moment about balance center)

$\Delta r = (L_{ref} - L_y) \tan \alpha$ (vertical distance from model centerline to intersection of vector with ref. plane, positive upward)

4.5.2 Thrust Measurement in Channel 10

The thrust coefficient (in-flight) of an exhaust nozzle is defined as the ratio of the measured nozzle thrust-minus -drag, to the ideal thrust of the actual mass flow expanded to ambient pressure. The actual thrust-minus-drag of an exhaust nozzle can be determined indirectly by applying the momentum equation to the control volume shown in Figure 10. The analysis of forces applied to the boundaries of the control volume includes entering and exit stream thrust, the balance force (H_2) and various pressure area terms. Thus, the actual thrust equation can be written from the summation of forces as:

$$H_x = F_1 + F_4 + P_2 (A_2 - A_1) + P_5 (A_5 - A_4) + P_3 (A_3 - A_2 - A_5) - P_a A_3 - H_2$$

where P_3 is the pressure inside the cavity surrounding the seal and load cell, and A_3 is the sting support tube cross sectional area ($A_3 = 164.675$ in^2 or 14.48 inch diameter). The 10 inch diameter upstream tube has a cross sectional area of 78.54

in^2 . The nozzle exit thrust term, H_x, includes form and friction drags due to the external flow.

F_1 and F_4 were calculated as described in Section 4.4, except that the real-gas correction G was calculated from

$$G=1.00011+AP_t+BP_t^2-C(T_t-560)P_t^{1.9477}$$

where $A=0.601347E-5$

$B=1.50556E-9$

$C=2.2751E-11$

This equation was obtained by curve fitting tabulated data from Reference 1, and applies for $460<T_t<560$ R and $0<P_t<1000$ psia.

P_2 and P_5 are seal cavity static pressures which act over the seal areas A_2 and A_5. A_2 and A_5 (each 1.9956 in^2) are the geometric areas of the seals. P_a is the ambient pressure surrounding the model. P_2, P_5 and P_3 were measured on the PSI System.

The vertical thrust, H_y, was obtained from the sting balance pitching moments.

$$H_y = (FP - AP)/ L_{bal}$$

where L_{bal} is the distance between the two balance bridges (5.962 inches). FP and AP are the moments at the forward and aft pitching moment bridges (referred to in the computer program as V1 and V3 for convenience).

The resultant thrust, H_r, was calculated as the vector sum of the axial thrust, H_x, and the vertical thrust, H_y. Resultant thrust vector angle, α, was determined as:

$$\alpha = \tan^{-1} (H_y/H_x) .$$

Referring to Figure 10, the axial location of the thrust vector is defined by L_x, the axial distance from the reference plane (fan cowl exit for all configurations) to the intersection of the resultant thrust vector with the model centerline. L_x is defined as positive downstream of the reference plane. L_x is found by a moment equation at the balance center.

$$L_x = (FP+AP)/(2H_y) - (L_{bal}/2+L_{ref})$$

where Lref is the distance from the downstream bridge (AP) to the model reference plane. L_y is the vertical distance to the intersection of the resultant thrust vector with the reference plane, measured positive upward from the model centerline, and is calculated from Lx and α.

$$L_y = - L_x \tan \alpha$$

$$Mo= H_y L_x \quad \text{(moment about intersection of ref. plane and model centerline)}$$

Static pressure measurements were made for the baseline fan nozzle external surface (2078-001). These pressure measurements can be used to calculate the boat- tail drag of the fan nacelle external flow. The instrumentation locations are defined on the drawing.

4.6 Thrust Coefficient

Thrust coefficient calculations are described below for the static and wind tunnel tests.

4.6.1 Channel 14 Static Thrust Coefficient

Thrust coefficient is defined as the ratio of the measured nozzle thrust, to the ideal thrust of the actual fan flow (expanded isentropically from P_{t_7} to P_a) plus the ideal thrust of the core flow (expanded isentropically from P_{t8} to P_a). For the present tests, thrust coefficients were calculated for the axial and vertical thrust components, and for the resultant (in vertical plane) thrust vector:

$$C_{T_x} = \frac{H_x}{\sum mv_i}$$

$$C_{T_y} = \frac{H_y}{\sum mv_i}$$

$$C_{T_r} = \sqrt{C_{T_x}^2 + C_{T_y}^2}$$

where $\Sigma mv_i = m_7 v_{i_7} + m_8 v_{i_8}$.

Ideal thrust was calculated using a dimensionless ideal thrust function, $m_i v_i / P_t A^*$, which is a function of both λ and γ.

$$m_7 v_{i_7} = (A^*/A)_7 C_{D_7} A_7 P_{t_7} (m_i v_i / P_t A^*)_7$$

$$m_8 v_{i_8} = (A^*/A)_8 C_{D_8} A_8 P_{t_8} (m_i v_i / P_t A^*)_8$$

where

$$(m_i v_i / P_t A^*) = \gamma \left[\frac{2}{\gamma + 1}\right]^{\frac{\gamma}{\gamma - 1}} \sqrt{\frac{\gamma + 1}{\gamma - 1}} \sqrt{1 - \lambda^{\frac{1 - \gamma}{\gamma}}}$$

$$= 1.81162 \sqrt{1 - \lambda^{-0.28571}} \quad \text{for } \gamma = 1.4$$

For the present test, γ_7 and γ_8 were taken to be 1.4. However, $\gamma_8 \neq 1.4$ for hot tests, and therefore, $(m_i v_i / P_t A^*)_8$ obtained from the above equation can be corrected to account for "real gas effects" by multiplying by the ratio

$$b = \frac{\left(m_i v_i / P_t A^*\right) \text{ for real gas}}{\left(m_i v_i / P_t A^*\right) \text{ for } \gamma = 1.4} .$$

This ratio is calculated from tabulated values in Reference 4; this factor can be obtained by interpolating between the following equations:

$$b = .99707 + .00228 \log \lambda, \text{ at } T_{t8} = 440°F$$

$$b = .99393 + .00377 \log \lambda, \text{ at } T_{t8} = 800°F.$$

b typically varies between 0.994 and 1.000 for hot tests.

4.6.2 Channel 10 Wind Tunnel Thrust Coefficient

Thrust coefficient, C_{Tr}, is identical to that defined in Section 4.6.1. For in-flight tests, however, the measured net thrust includes form and friction drag on the external model surfaces and thus may also be referred to as "thrust-minus-drag". Similarly, the thrust coefficient for in-flight tests may be referred to as "thrust-minus drag coefficient".

The wind tunnel sting was tested statically (M=0) in Channel 6 and compared to Channel 14 static results. In Channels 6 and 10 the shorter distance between the model charging station and the nozzle exit could result in a slightly higher C_{Tr} in Channels 6 and 10 than Channel 14. Calculations of lower frictional losses were estimated to increase C_{Tr} in Channels 6 and 10 by roughly 0.1% above Channel 14 results (M=0). This difference is within the data scatter band for Channel 10.

Static pressure data were measured on the baseline fan nozzle external nacelle (2078-001) such that one could perform a calculation of boat-tail drag. The reported C_{Tr} has not been adjusted or increased in any way to remove boat-tail or nacelle friction drag.

4.7 Pressure and Temperature Data

Pressure instrumentation for facility pressures and charging station pressures were described previously. All other pressures in the model were measured using a Pressure Systems Incorporated Model 780B pressure scanning unit. In the wind tunnel, all of the model pressures were measured with Pressure Systems Incorporated ESP remote modules mounted on the model under the sting tube covers. This reduced the amount of tubing crossing the force balance to the support sting and increased force measurement accuracy. Miscellaneous other pressures were measured with the standard PSI system and transducers outside the tunnel (wind tunnel plenum, wall pressures and other facility pressures). The model pressure data were reduced to absolute pressures (psia) and dimensionless ratios (P/P_{t7}, P/P_{t8}, P/P_a).

Temperature measurements were obtained using chromel/alumel or iron/constantan thermocouples. Temperatures were expressed in °F and °R. Temperatures from hot model tests are often normalized using a dimensionless temperature difference ratio,

$$\eta = (T - T_{t7}) / (T_{t8} - T_{t7}) .$$

4.8 Force Balance Calibration

The Channel 14 force balance calibration determined the output characteristics of the three force balance flexures and the two elastic seals between the metric model assembly and the non-metric facility structure. The elastic seals produce a small tare force, largely due to radial seal deflections necessary to support the static pressure differential across the seal. The seal and balance assembly are calibrated under simulated operating conditions of loads and seal differential pressures.

The balance assembly was first calibrated with the internal seals unpressurized. Known loads were applied in the axial and vertical directions to obtain a matrix of balance equations, including force interactions, of the form:

$$V_1 = K_{11}B_1 + K_{12}B_2 + K_{13}B_3$$

$$H_o = K_{21}B_1 + K_{22}B_2 + K_{23}B_3$$

$$V_3 = K_{31}B_1 + K_{32}B_2 + K_{33}B_3$$

In the above equations, B_j is the balance output in millivolts for the axial and vertical bridges. K_{ij} terms are the calibration coefficients obtained during the calibration process, where the off-diagonal terms ($i \neq j$) are the interaction correction terms, which numerically have the effect of canceling any interactive load along one axis of the system due to an applied load along an orthogonal axis. The reference coordinate system is defined along the facility centerline and all forces and moments are defined with respect to this coordinate system.

Calibration of the elastic seals was accomplished as follows. Blank-off plates were installed downstream of the seals, and the seals were pressurized (independently) to selected values of pressure differentials, ΔP. This pressure loading produces a downstream force on the balance. Additional axial loads, W_x, were then applied to increase or decrease the net load to simulate test conditions of axial load and ΔP. The balance force calculated from the balance output and unpressurized calibration is greater than the apparent applied load ($W_x + \Delta P_2 A_2 + \Delta P_5 A_5$), due to the seal tare force. The ratio of applied to calculated loads is then curve-fit as a function of ΔP and H_2 and included as a correction term in the balance force calculation. The Channel 14 vertical balance force calculations also include similar corrections to adjust for a seal ΔP effect on the balance vertical bridge outputs.

In Channels 6 and 10 the procedures are the same except the seal calibrations are simplified by applying the average of the differential pressures (ΔP_2 and ΔP_5) to simulate a condition. Not simulating exact individual seal pressures is desirable because of the difficult access for installing internal blank off plates in the wind tunnel balance system. Also, the meter-diffusers are designed to create similar seal pressures. Another difference is that the vertical balance force correction determined from seal calibrations was not employed for the wind tunnel balance.

5.0 PRESENTATION OF RESULTS

5.1 ASME Checkout Nozzle Tests

Standard ASME long-radius flow nozzles were tested before this test program to demonstrate proper facility operation and accuracy in determining C_D and C_T of static test nozzles. The test results were compared with predicted (target) values. The target-value curves are based on semi-empirical equations consistent with those described for the ASME meter in Sections 4.3 and 4.5.

In Channel 14, a 7.1-inch diameter nozzle was tested to simulate the fan nozzle, and a 4.0-inch diameter nozzle was tested to simulate the core nozzle, as shown in Figure 7. The two nozzles were tested simultaneously, both with room temperature air flow ($T_{t8}/T_{t7} = 1$). Major results are tabulated in Figure 11 and plotted in Figure 12. Detailed data are contained in the Data Appendix.

In Channel 6, a single 5.7-inch diameter nozzle was tested statically as shown in Figure 8. The air flow was at room temperature. Both fan and core facility meters were flowing and the fan to core mass flow split was roughly 3 to 1. The two flows were mixed and exhausted through a single 5.7 inch diameter ASME nozzle. Major results are tabulated in Figure 11 and plotted in Figure 13. Detailed data are contained in the Data Appendix.

The test results were statistically analyzed for bias (average difference between actual and predicted values) and scatter (standard deviation of the individual differences from their average). Standard procedure is to peform the analysis for the nozzle pressure ratio range from 1.6 and greater. This analysis is summarized in the following table.

Static Checkout Results with ASME Nozzles

			Bias			Standard Deviation (±):		
Static Test Series	**λ Range**	**N**	**C_T**	**C_{D_7}**	**C_{D_8}**	**C_T**	**C_{D_7}**	**C_{D_8}**
Channel 14 4 " ASME Core 7.1 " ASME Fan								
Pretest, cold	1.6-2.4	10	.0005	-.0001	-.0002	.0007	.0003	.0003
Channel 6 5.7 " ASME Nozzle								
Pretest, cold	1.6-2.6	10	.0007	n/a	-.0010	.0003	n/a	.0013

5.2 Model Tests

The test matrix and model configuration definition are provided in Figure 16. Test conditions and major test results are tabulated in Figure 17. The tabulation includes: facility, configuration, noise reduction device, data point number, actual values of independent test variables (λ_7 and λ_8), pressure ratio split (λ_7/λ_8), mass flow split (W_7/W_8), and major test results (C_{D_7}, C_{D_8}, C_{T_r}, and α).

Channel 14 static thrust rig results are plotted in Figures 18, 19, and 20. The wind tunnel sting is checked out statically in Channel 6 prior to actual wind tunnel tests. Channels 6 and 14 static results are compared for the baseline configuration #1 (3BB) in Figures 21, 22, and 23. In this comparison, Channel 14 results are the most accurate. The comparison is very good demonstrating the correct operation of the wind tunnel sting balance system. Different charging station locations between the two sets of adapter hardware are expected to result in about 0.1% greater static C_{T_r} in

Channel 6 above Channel 14. This level of difference is within the scatter band of the Channel 6 data.

Results from the Channel 10 wind tunnel are shown in Figures 24, 25, and 26. Since all the data could not be fit on a single plot, the data are plotted in several groups. The first group presents all configurations that were tested at Mach=0.28 and 0.8. The second group presents all configurations with the baseline fan nozzle at the M=0.8 cruise point "A". The third group presents all configurations with the chevron or T48 fan nozzle at the M=0.8 cruise point "A". The next 3 groups present data at M=0.8 with an expanded cruise pressure ratio matrix for the baseline (3BB) and 2 other selected configurations (3T24C and 3AC).

Detailed data and calculations are contained in a separate Data Appendix and include: computer programs, instrumentation lists, inspections, thrust calculations, tabulations of pressures, charging station pressure plots, and boat-tail pressure distribution plots.

6.0 REFERENCES

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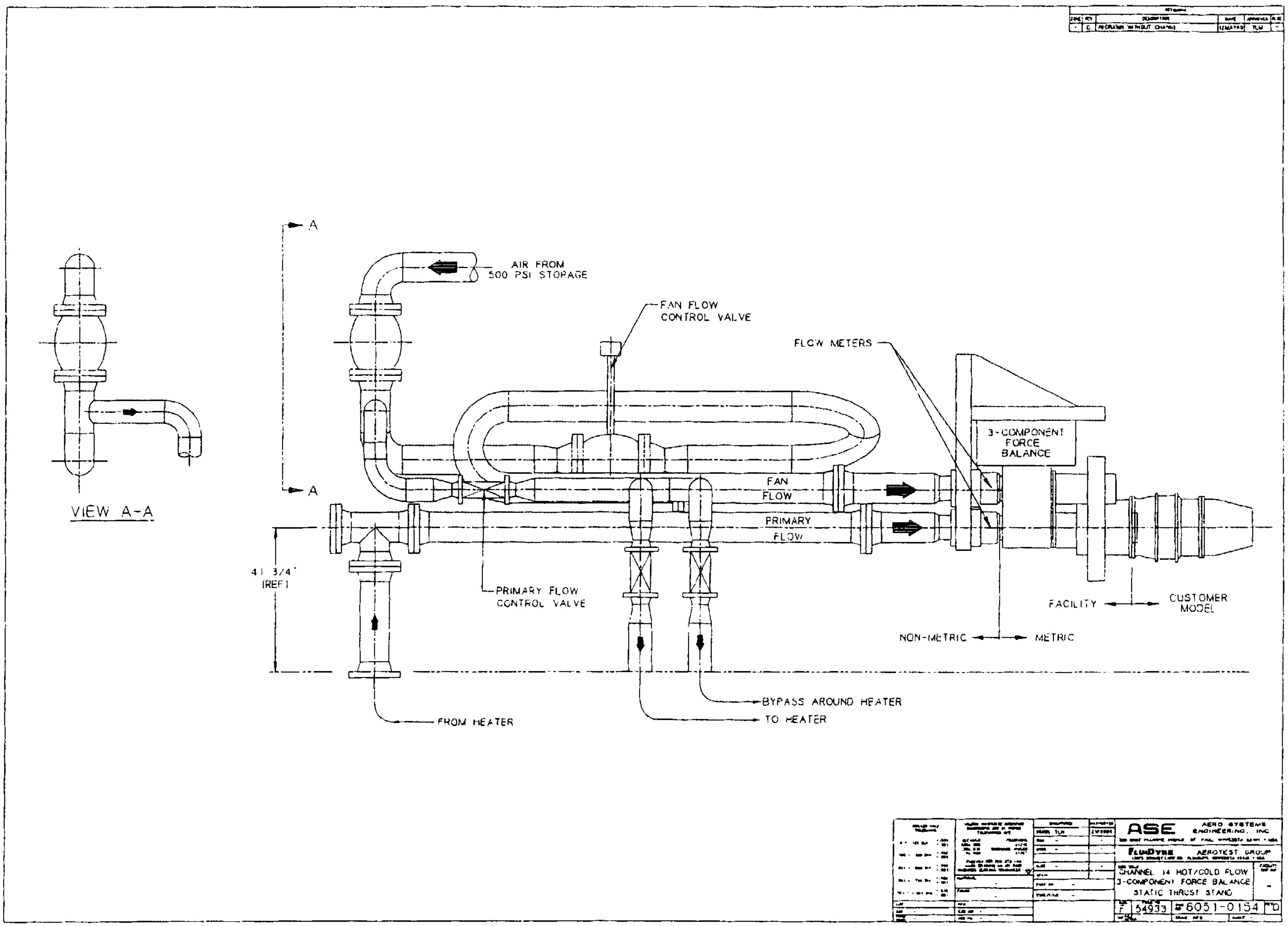
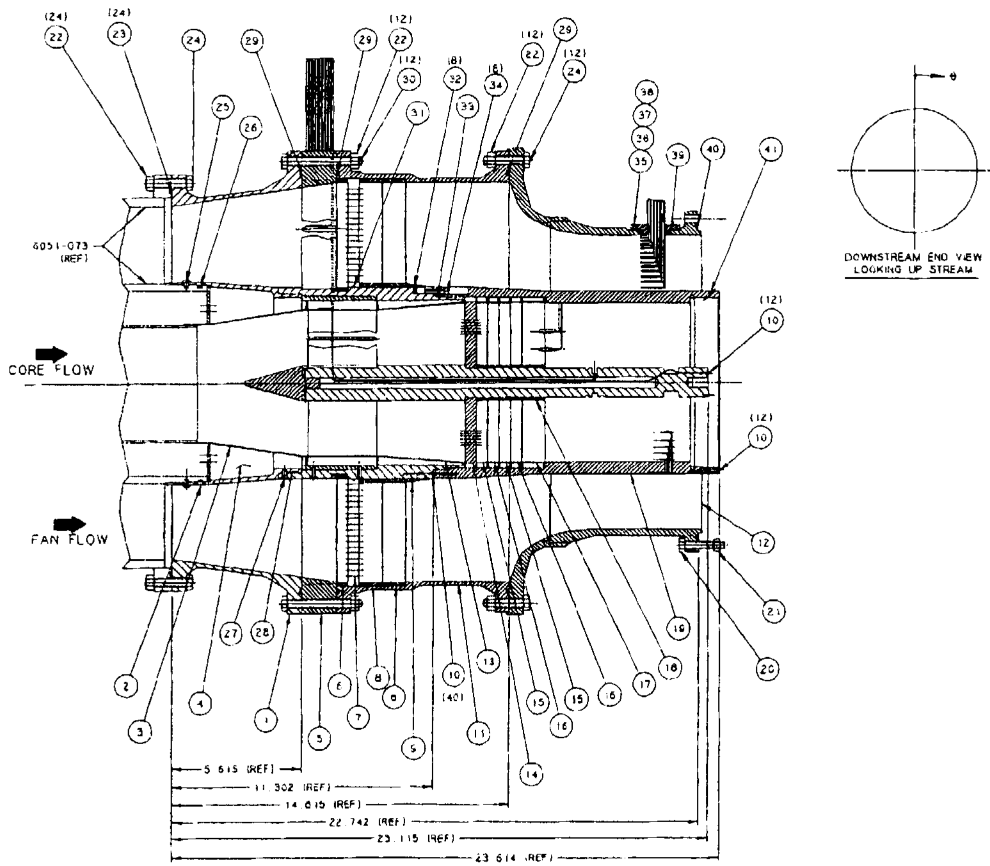


FIGURE 1a. CHANNEL 14 STATIC THRUST STAND



8	41	-	#8-32 UNC x 1/2 LONG HEX SOC SET SCR - CUP POINT
1	40	-	O-RING - FAB FROM 1/8 DIA CROSS SECTION MAT'L
6	39	-	O-RING - PARKER #026
12	38	-	#8-32 UNC x3/8 LONG SOC HD CAP SCR
1	37	0946-409	INSTRUMENTATION PLUG - LOC AT THETA = 90°
2	36	0946-408	INSTRUMENTATION PLUG - LOC AT THETA = 150° AND 330°
3	35	0946-407	INSTRUMENTATION PLUG - LOC AT THETA = 0°, 180°, 270°
8	34	-	#5-32 UNC x 7/8 LONG SOC HD CAP SCR
1	33	-	O-RING - PARKER #168 - SILICONE
-	-	-	-
1	31	-	O-RING - PARKER #172
12	30	-	3/8-16 UNC x 3 1/4 LG HEX HD CAP SCR
3	29	-	O-RING - PARKER #284
1	28	-	O-RING - PARKER #169 - SILICONE
16	27	-	#10-32 UNF x 3/8 LG FL HD SOC SCR
1	26	-	O-RING PARKER #267 - SILICONE
24	25	-	#10-32 UNF x 1/4 LONG HEX SOC BUTTON HD CAP SCR
36	24	-	3/8-16 UNC x 1 3/4 LONG HEX HD CAP SCR
1	23	-	O-RING PARKER #262
48	22	-	3/8-16 UNC HEX NUT
8	21	-	5/16-18 UNC HEX NUT
8	20	-	5/16-18 UNC x 1 3/4 LG HEX HD CAP SCR
1	19	0946-901	CORE SHROUD ADAPTER
1	18	0946-602-Z	SPACER
1	17	0946-607-3	SPACER - LINER
2	16	0946-602-2	CORE SCREEN
2	15	0946-602-1	CORE SCREEN
1	14	0946-603	CORE CHOKE PLATE
1	13	0946-601	TAPERED LINER - DOWNSTREWAM
1	12	0946-410	FAN BELLMOUTH
1	11	0946-405	SPOOL
64	10	-	O-RING - PARKER #2-003 SILICONE
1	9	0946-605	RETAINER - FAN SCREEN
2	8	0946-401	FAN SCREEN
1	7	0946-402	FAN CHOKE PLATE
1	6	0945-606	SPACER - CHOKE PLATE
1	5	0946-902	SPIDER
A/R	4	-	INSULATION - FIBERFRAX LOW CON FELT
1	3	0946-604	TAPERED LINER - UPSTREAM
1	2	0946-403	SPIDER ADAPTER - INNER
1	1	0946-404	TAPERED SPOOL

LIST OF MATERIALS

ASE AERO SYSTEMS ENGINEERING, INC.

FLUIDYNE AEROTEST GROUP

ASSEMBLY - MODEL ADAPTERS

MIXER NOZZLE TEST

F 54933 6051-0160 B

B REDRAWN WITHOUT CHANGE 13MAY93 TLN

FIGURE 1b. CHANNEL 14 ADAPTER ASSEMBLY

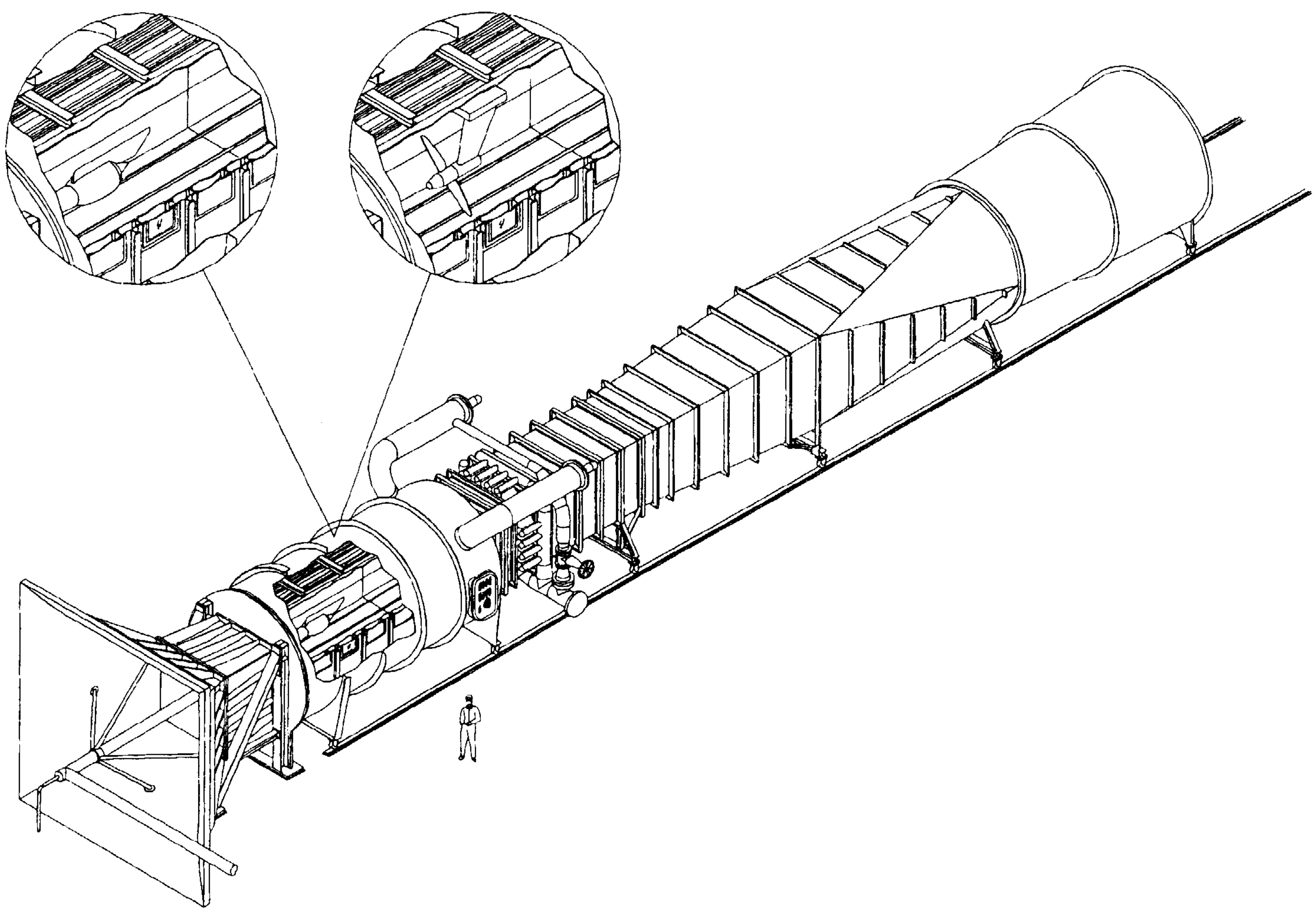


FIGURE 2a. CHANNEL 10 TRANSONIC WIND TUNNEL.

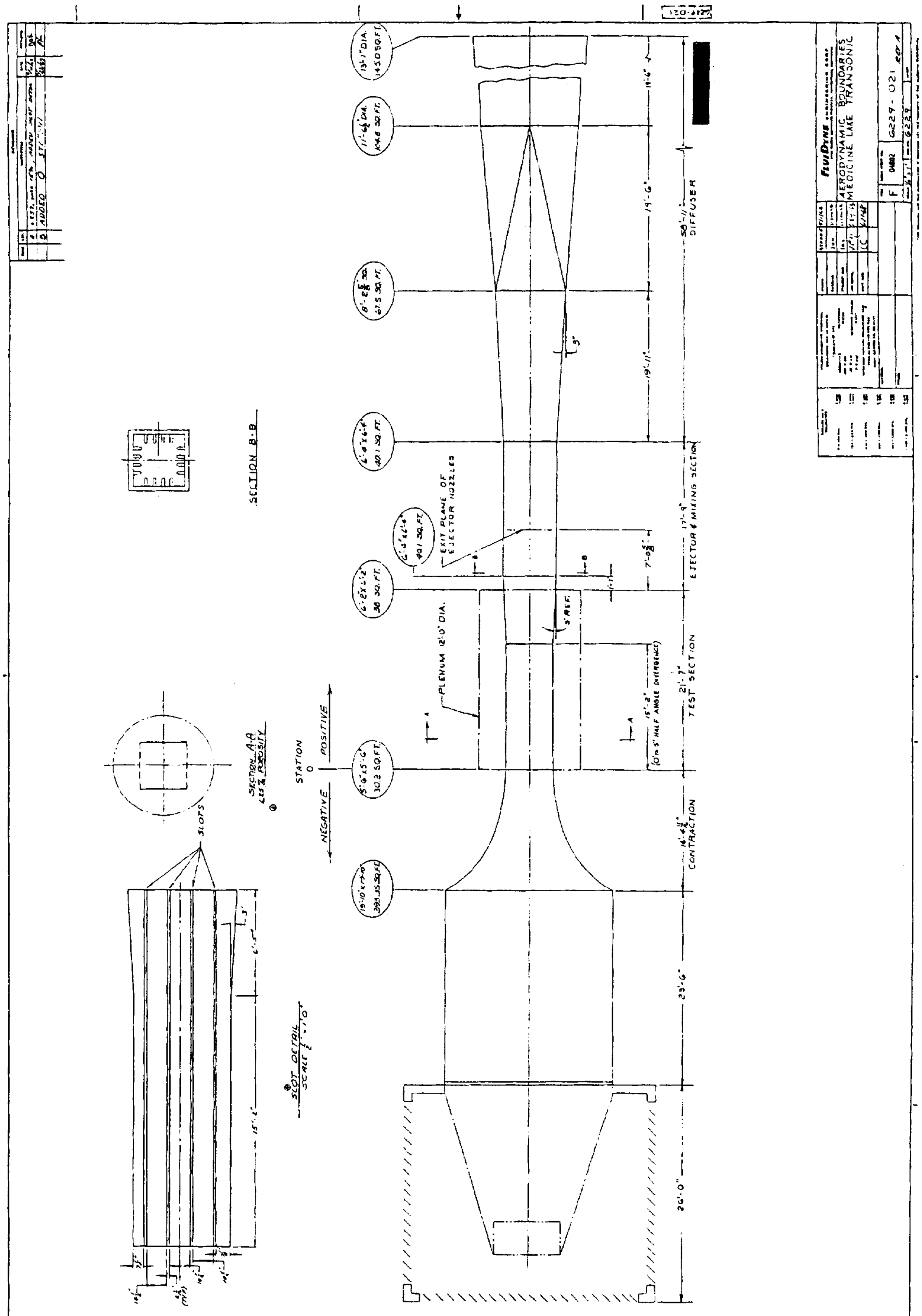


FIGURE 2b. CHANNEL 10 AERO-LINES

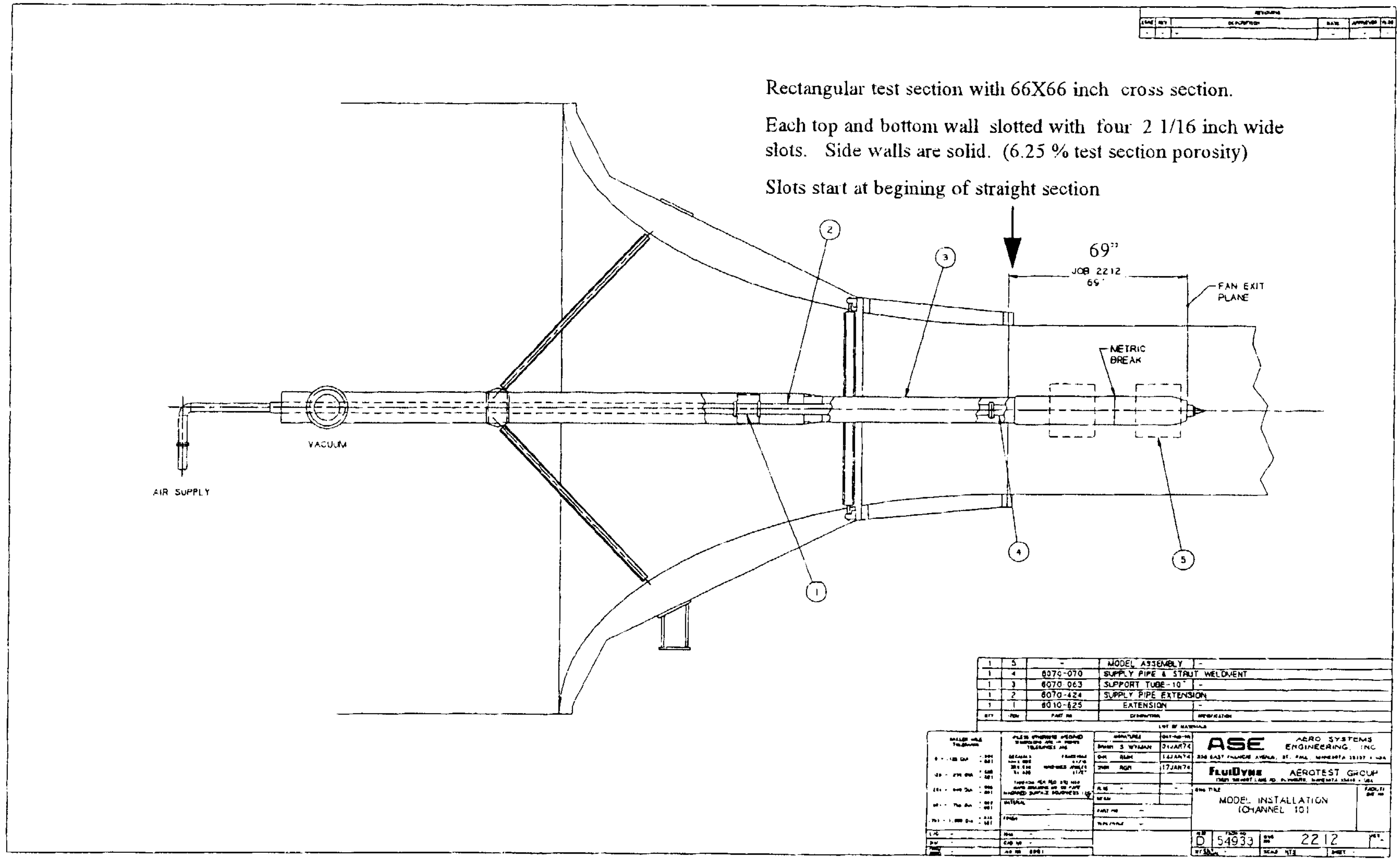


FIGURE 3. CHANNEL 10 MODEL INSTALLATION

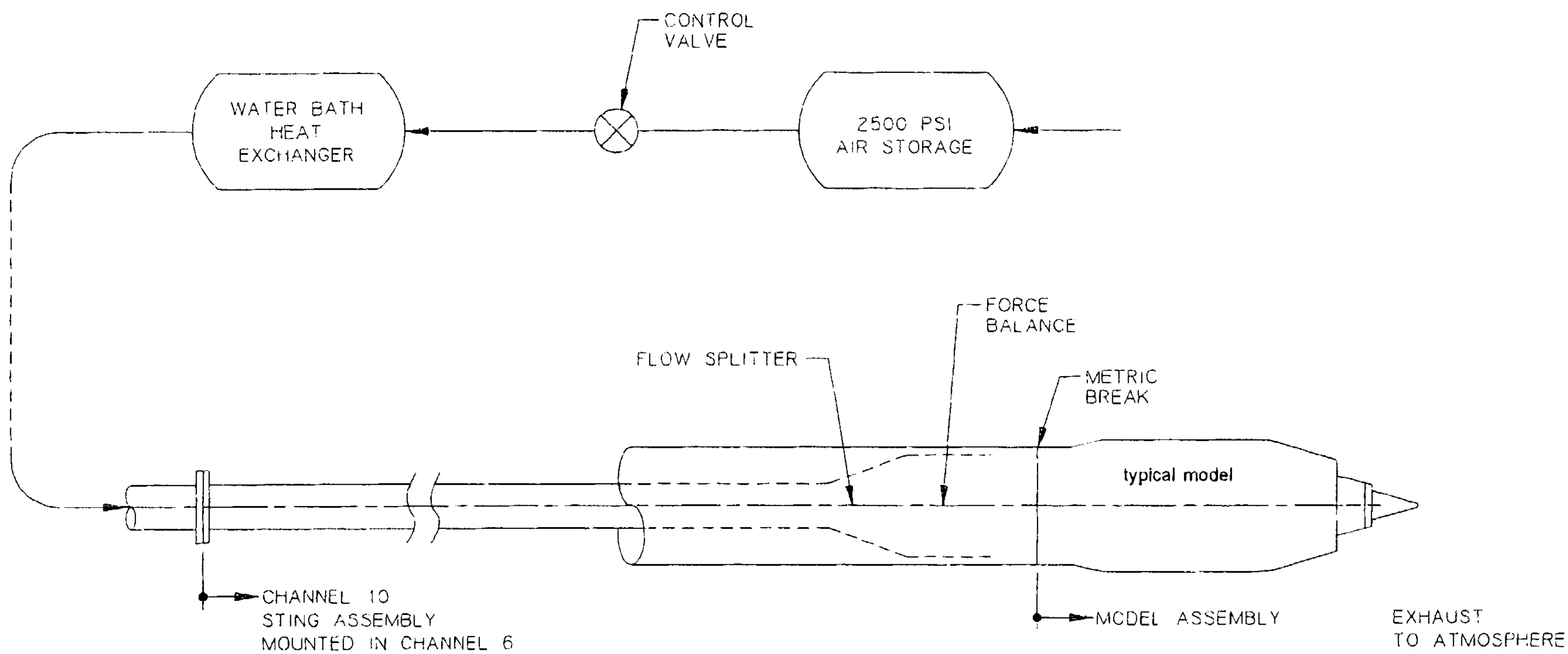


FIGURE 4. CHANNEL 6 STATIC THRUST STAND

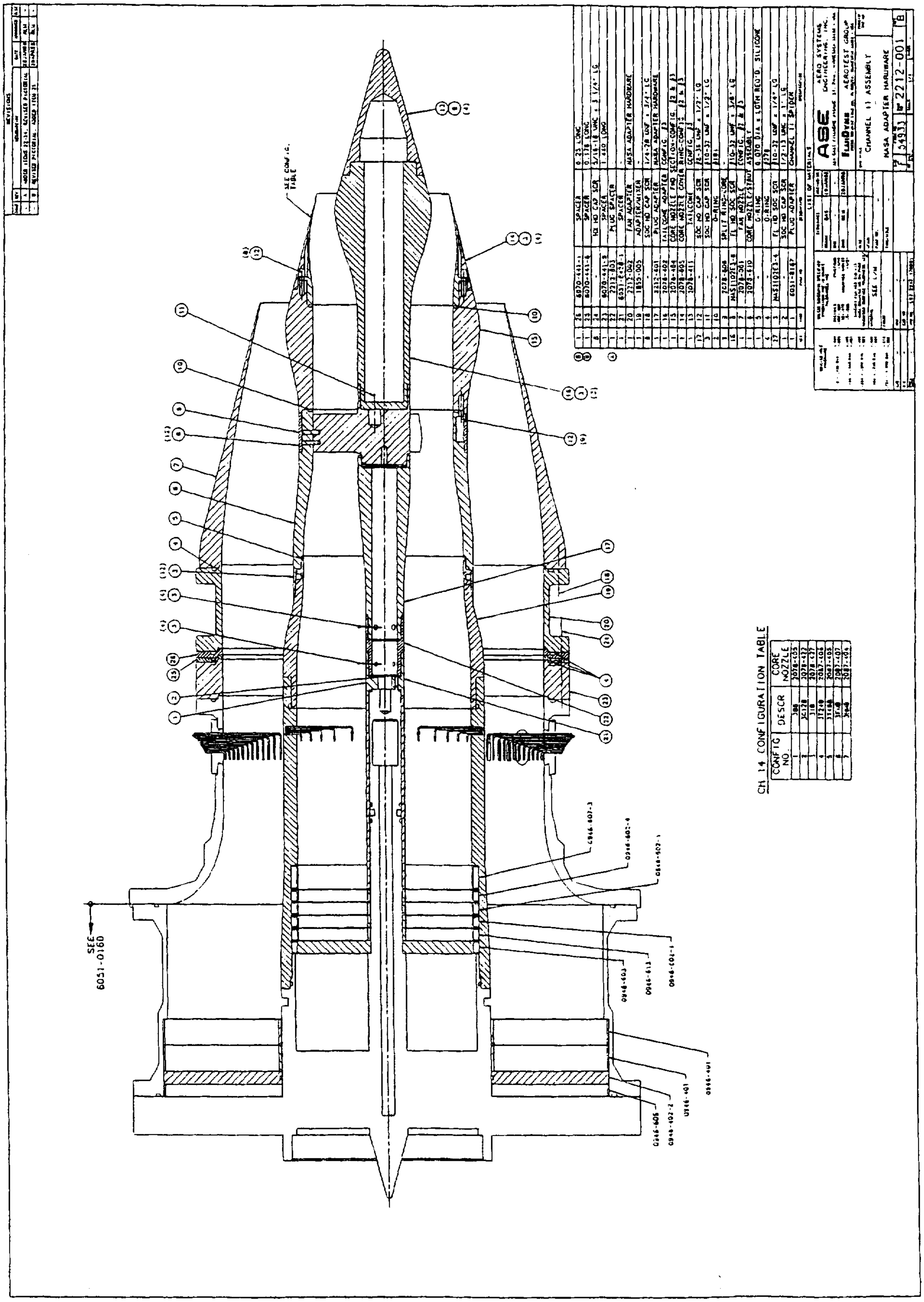


FIGURE 5. CHANNEL 14 MODEL ASSEMBLY

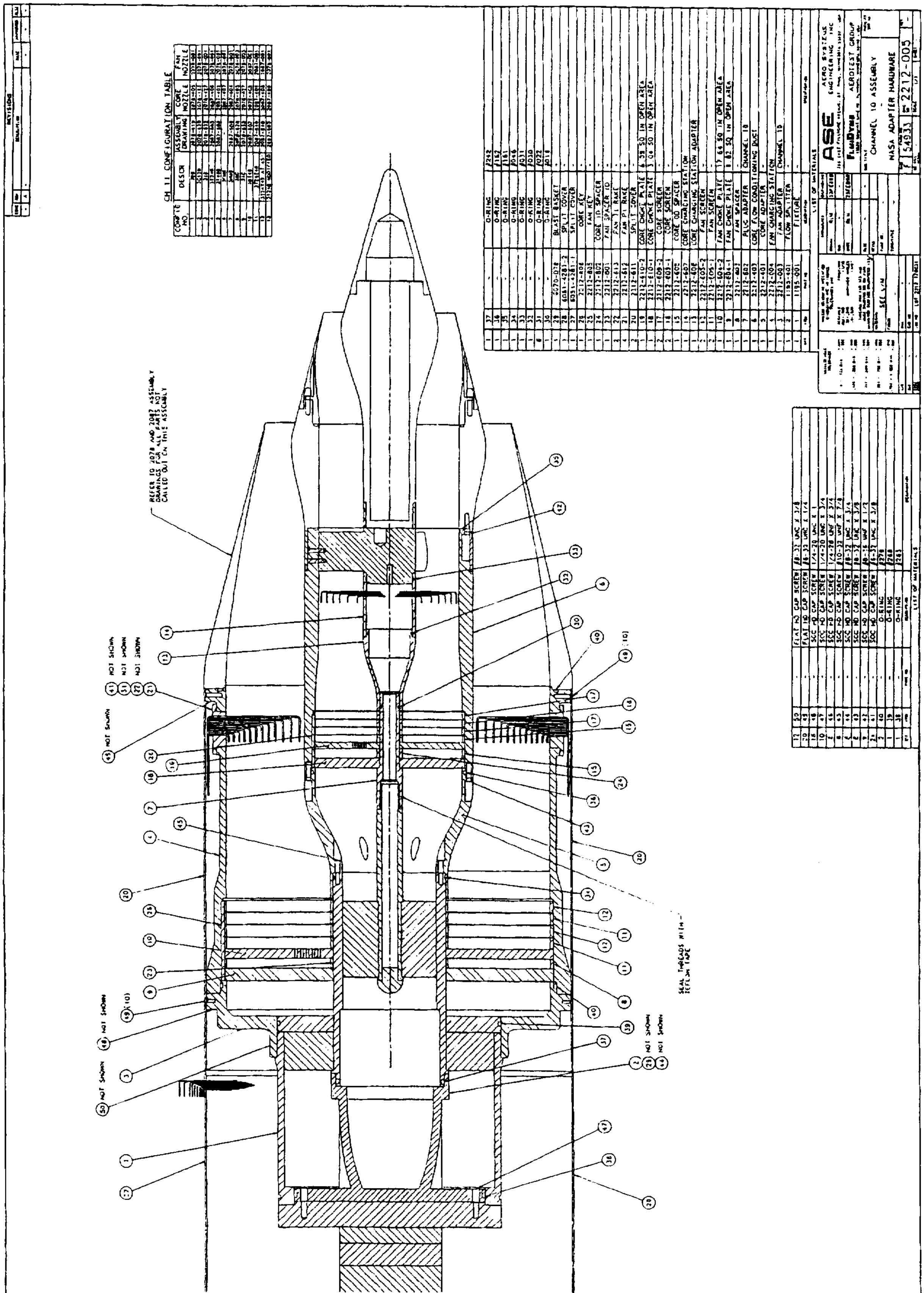
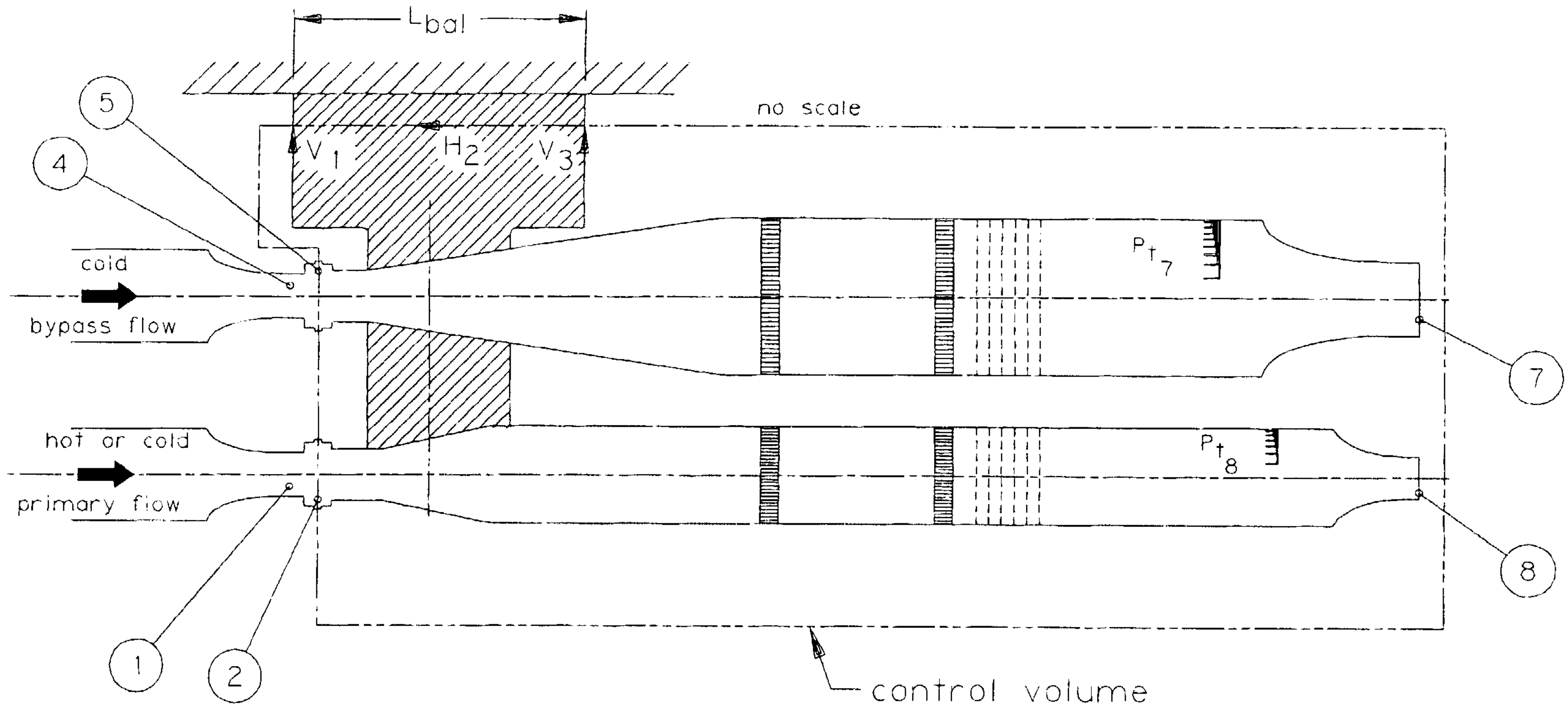
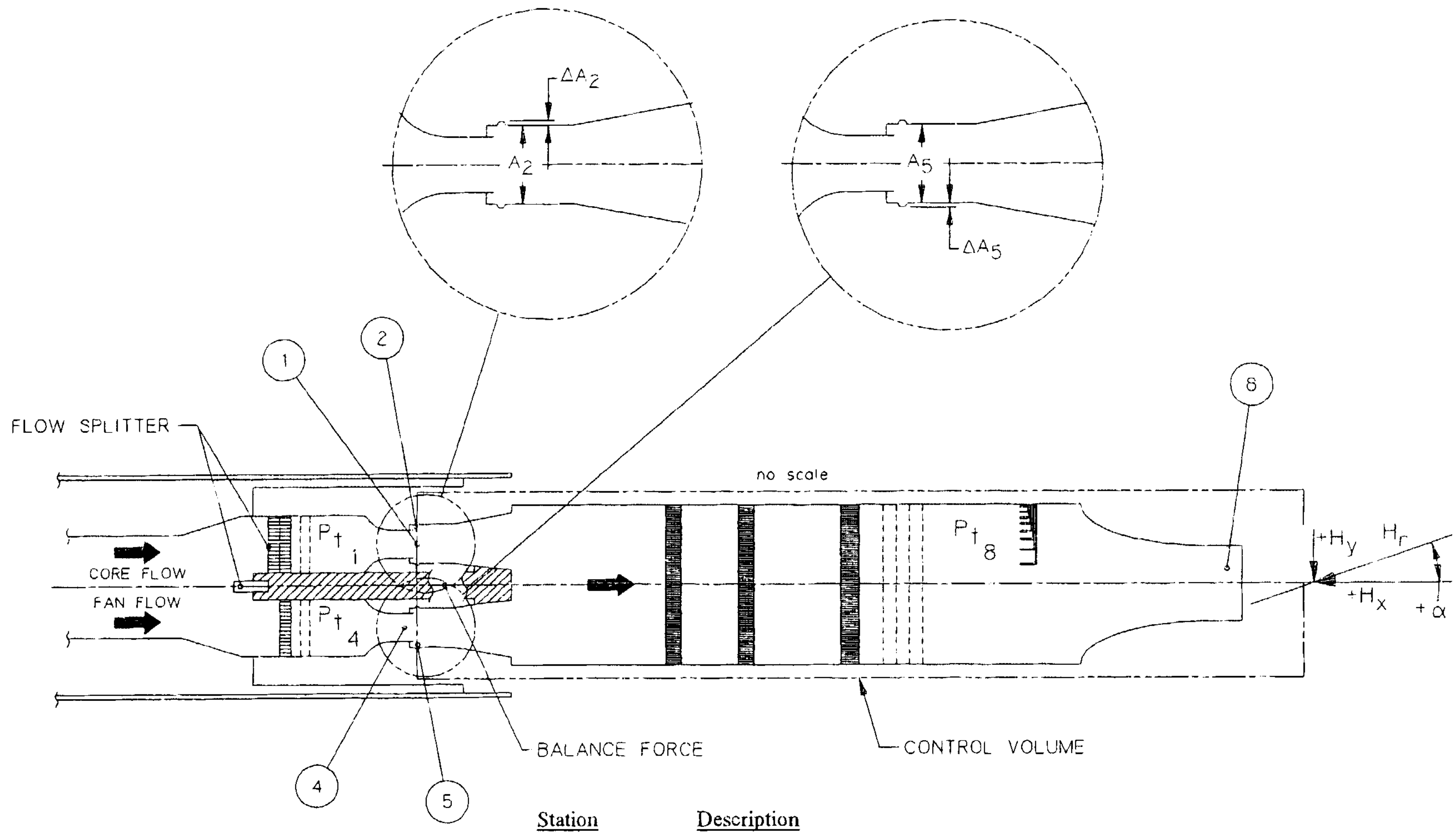


FIGURE 6a. CHANNELS 6 AND 10 MODEL ASSEMBLY



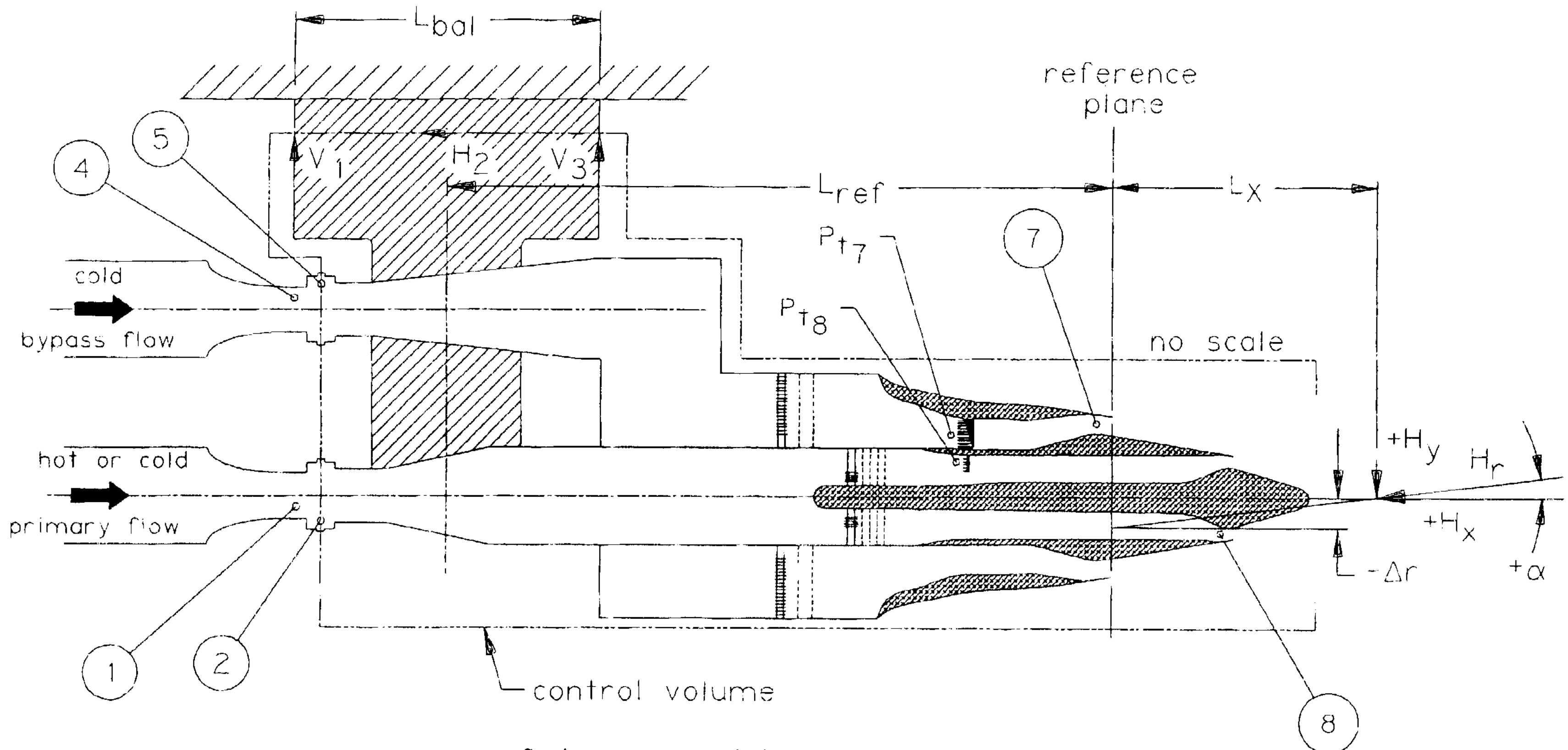
Station	Description
1	ASME meter throat (core flow)
2	Flexible seal (core flow)
4	ASME meter throat (fan flow)
5	Flexible seal (fan flow)
7	Fan nozzle
8	Core nozzle

FIGURE 7. STATION NOTATION, ASME CHECKOUT NOZZLE TESTS, CHANNEL 14



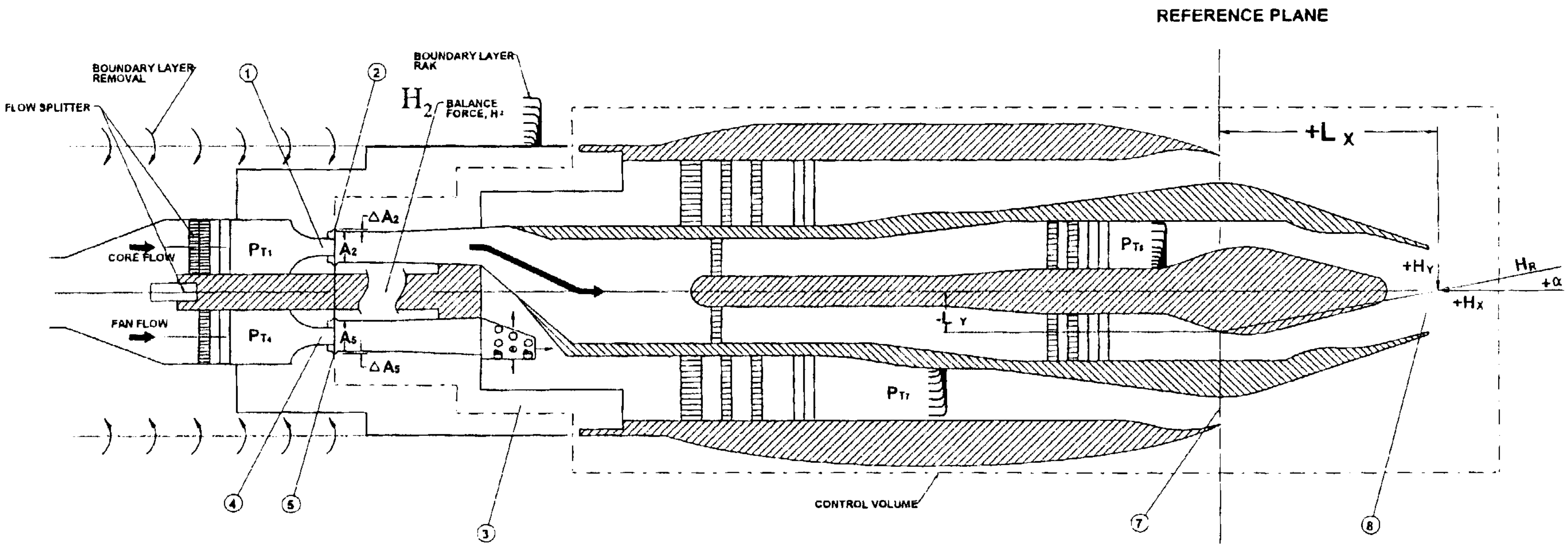
Station	Description
1	ASME Meter Throat (core flow)
2	Flexible Seal
4	ASME Meter Throat (fan flow)
5	Flexible Seal
8	Nozzle Throat

FIGURE 8. STATION NOTATION, ASME CHECKOUT NOZZLE, CHANNEL 6



Station	Description
1	ASME meter throat (core flow)
2	Flexible seal (core flow)
4	ASME meter throat (fan flow)
5	Flexible seal (fan flow)
7	Fan nozzle throat
8	Core nozzle throat

FIGURE 9. STATION NOTATION, CHANNEL 14 MODEL TESTS



Station	Description
1	ASME Meter Throat (core flow)
2	Flexible Seal
3	Balance Cavity
4	ASME Meter Throat (fan flow)
5	Flexible Seal
7	Fan Nozzle Throat
8	Core Nozzle Throat

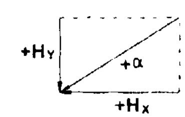


FIGURE 10. STATION NOTATION, CHANNEL 6 AND 10 MODEL TESTS

JOB 2212, NASA AST

Data Point	λ_7	λ_8	T_{t8}/T_{t7}	C_{D7}	C_{D8}	C_{Tr}	α (deg.)
Channel 14, Pretest, Cold							
7.1 inch Diameter ASME Fan Nozzle, 4.0 inch Diameter ASME Core Nozzle							
701.01	2.400	2.393	0.985	0.9922	0.9906	0.9971	0.00
701.02	2.405	2.401	0.980	0.9923	0.9905	0.9964	-0.04
701.03	2.406	2.396	0.994	0.9921	0.9903	0.9967	-0.13
702.01	2.203	2.199	0.985	0.9919	0.9903	0.9974	-0.04
702.02	2.204	2.196	0.986	0.9922	0.9903	0.9971	-0.01
702.03	2.205	2.198	0.989	0.9922	0.9906	0.9970	-0.13
703.01	1.998	1.997	0.988	0.9916	0.9905	0.9961	0.00
703.02	2.002	2.003	0.984	0.9917	0.9904	0.9957	-0.03
703.03	2.003	1.998	0.995	0.9915	0.9903	0.9956	-0.11
704.02	1.801	1.806	0.989	0.9912	0.9907	0.9952	0.04
704.03	1.801	1.795	0.990	0.9912	0.9905	0.9948	0.03
704.04	1.804	1.799	0.990	0.9915	0.9906	0.9949	-0.09
705.01	1.595	1.602	0.990	0.9906	0.9903	0.9937	0.06
705.03	1.601	1.600	1.000	0.9907	0.9902	0.9935	-0.06
705.04	1.601	1.598	0.992	0.9909	0.9905	0.9934	-0.05
706.01	1.391	1.399	0.989	0.9902	0.9895	0.9934	0.08
706.02	1.400	1.399	0.990	0.9901	0.9897	0.9924	0.14
706.03	1.401	1.397	0.994	0.9902	0.9898	0.9925	-0.02
707.01	1.294	1.300	0.991	0.9892	0.9894	0.9909	0.19
707.02	1.297	1.300	0.984	0.9899	0.9895	0.9911	0.15
707.03	1.300	1.297	1.004	0.9899	0.9894	0.9908	0.01
Channel 6, Pretest, Cold							
Single 5.7 Inch Diameter ASME Nozzle for Combined Fan and Core Flow							
610.01		1.598			0.9922	0.9950	-0.05
610.02		1.600			0.9915	0.9946	-0.07
611.01		1.799			0.9910	0.9951	-0.07
611.02		1.799			0.9909	0.9953	-0.07
612.01		1.999			0.9903	0.9962	-0.01
612.02		2.000			0.9897	0.9958	-0.02
613.01		2.202			0.9904	0.9966	-0.01
613.02		2.207			0.9893	0.9960	-0.01
614.01		2.403			0.9897	0.9962	0.04
614.03		2.408			0.9894	0.9960	-0.01
615.01		2.612			0.9892	0.9956	-0.02
615.02		2.609			0.9901	0.9960	-0.01

FIGURE 11. TABULATION OF ASME NOZZLE TEST RESULTS

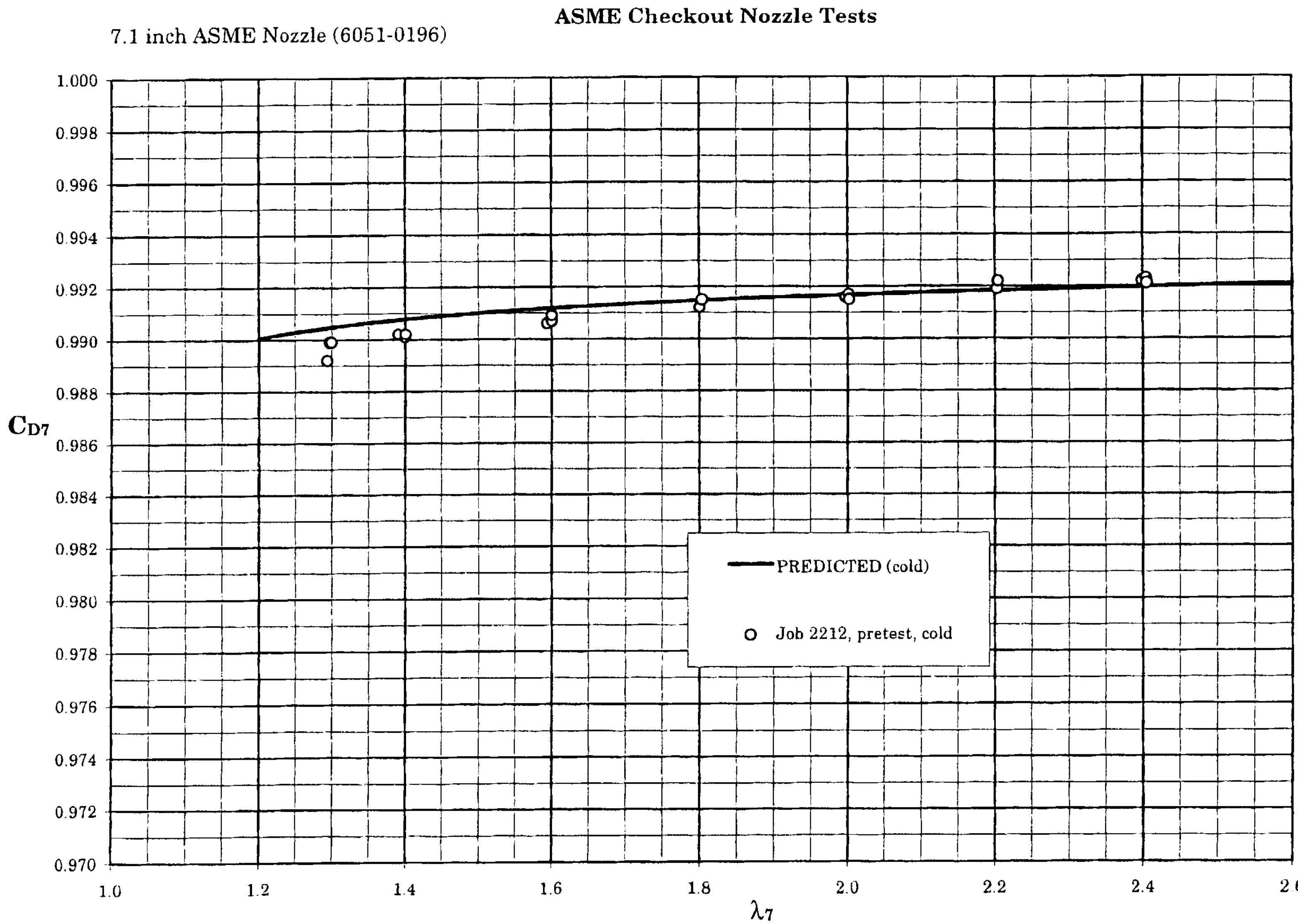


FIGURE 12a. CHANNEL 14 FAN DISCHARGE COEFFICIENTS, 7.1 INCH ASME NOZZLE, T_{t8}/T_{t7}=1.0

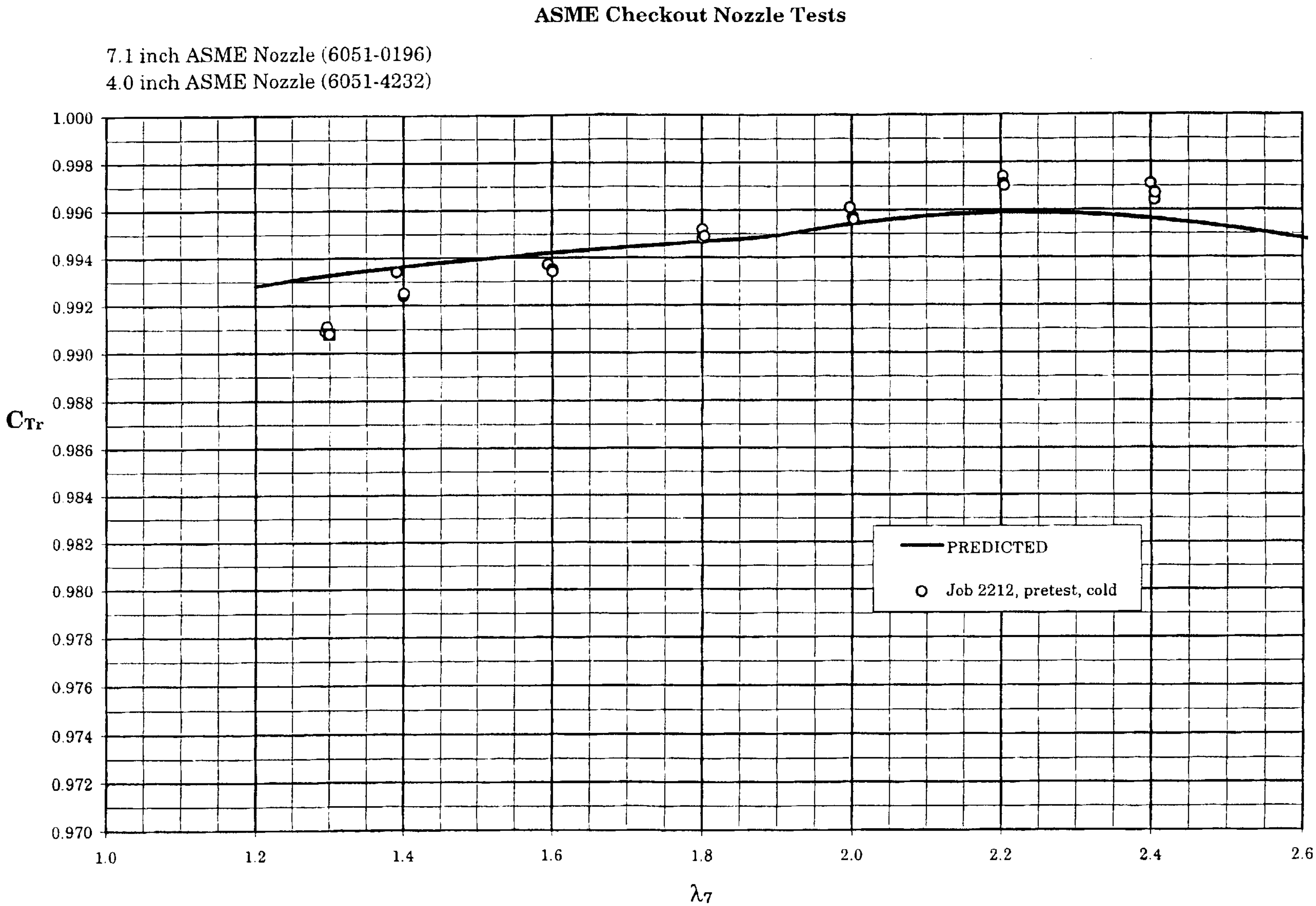


FIGURE 12c. CHANNEL 14 THRUST COEFFICIENTS, 7.1 AND 4.0 INCH ASME NOZZLES, T_{t8}/T_{t7}=1.0

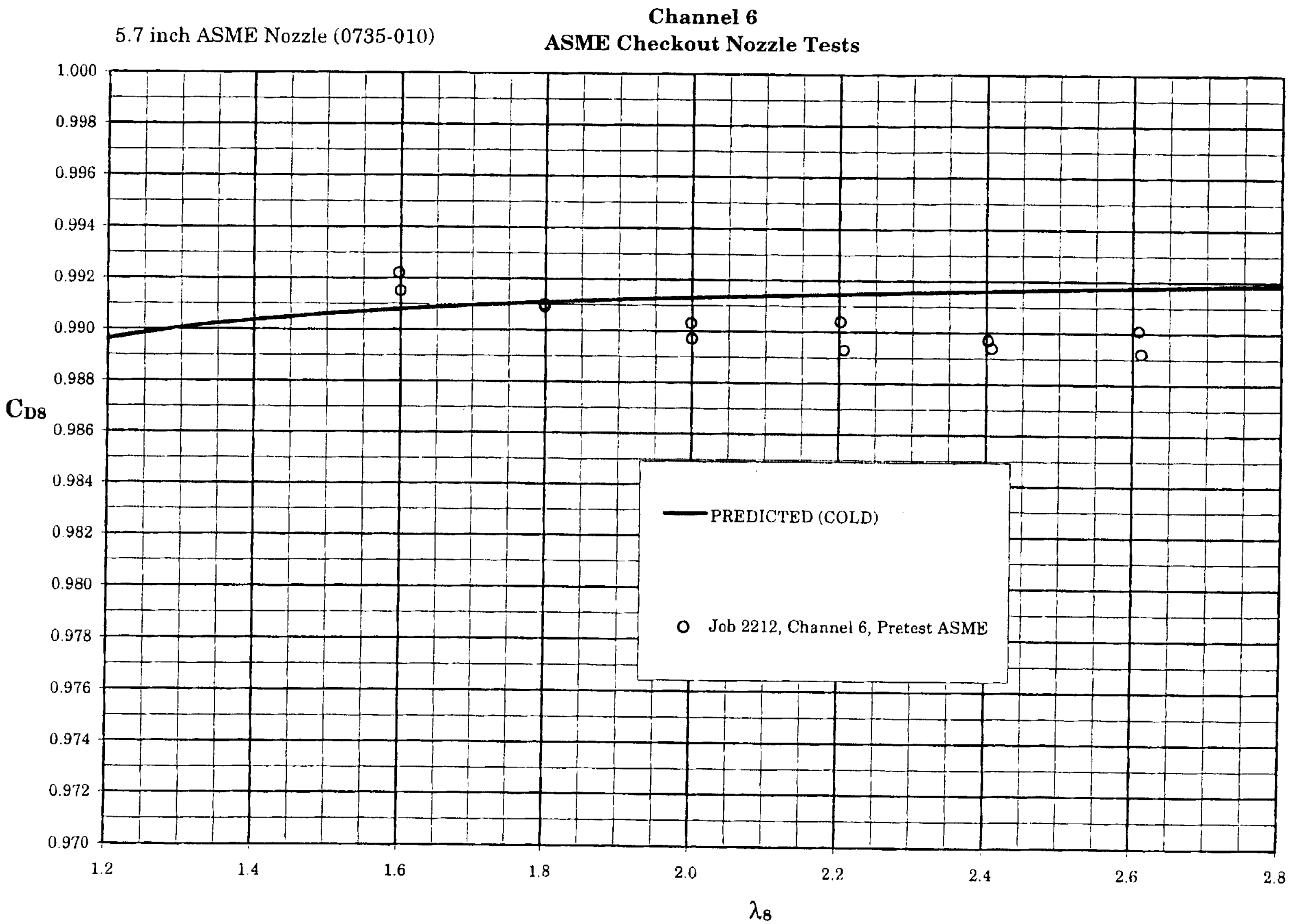


FIGURE 13a. CHANNEL 6 DISCHARGE COEFFICIENTS, 5.7 INCH ASME NOZZLE, $T_{t8}/T_{t7}=1.0$

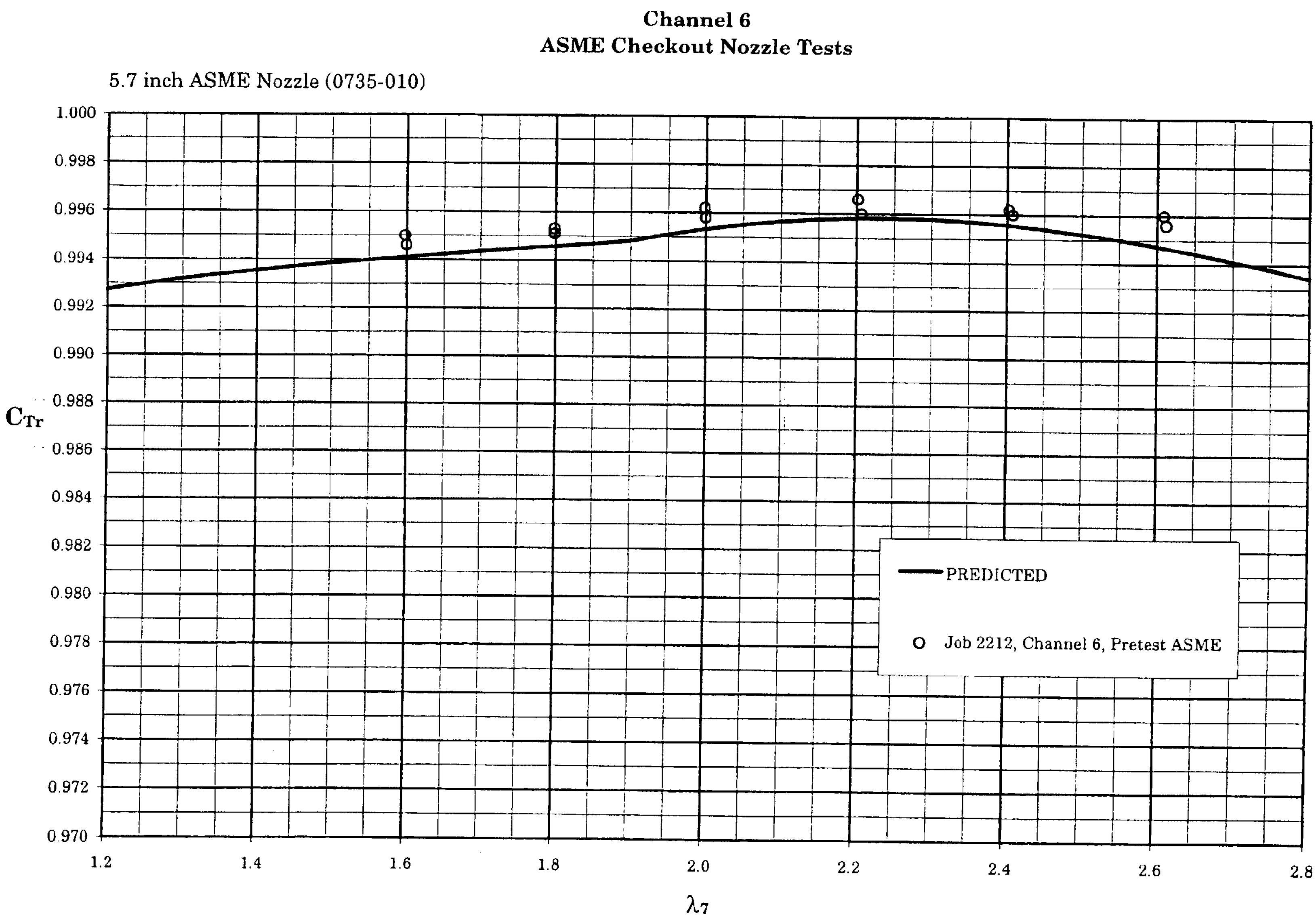
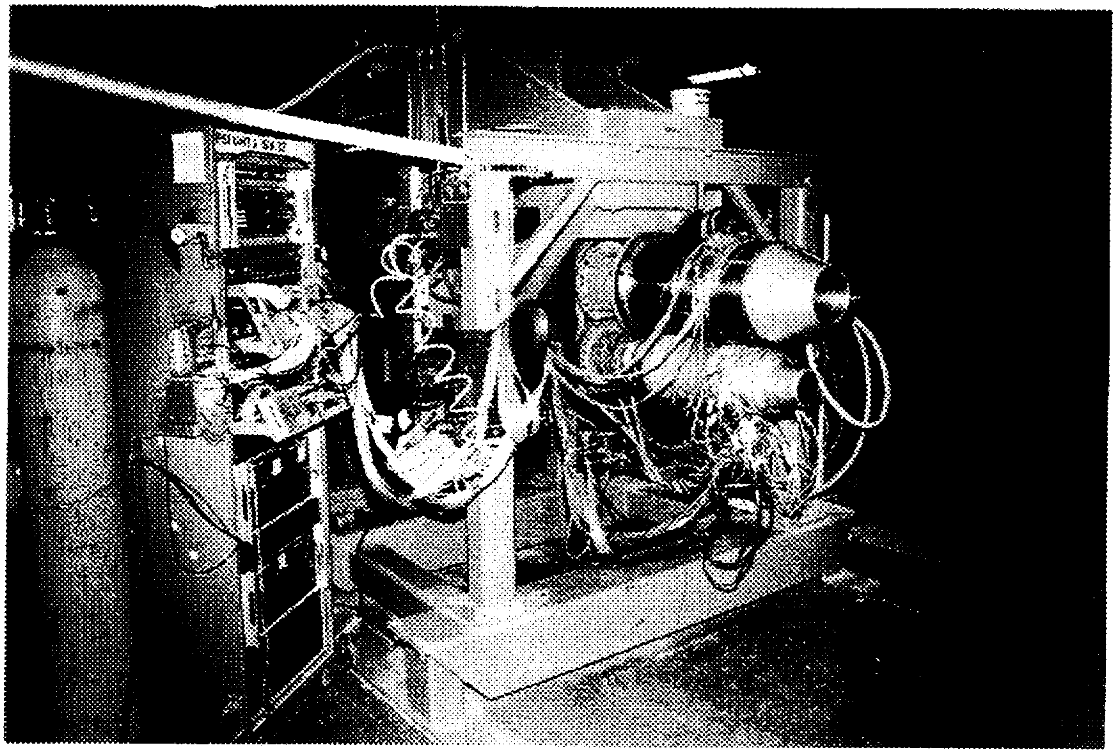
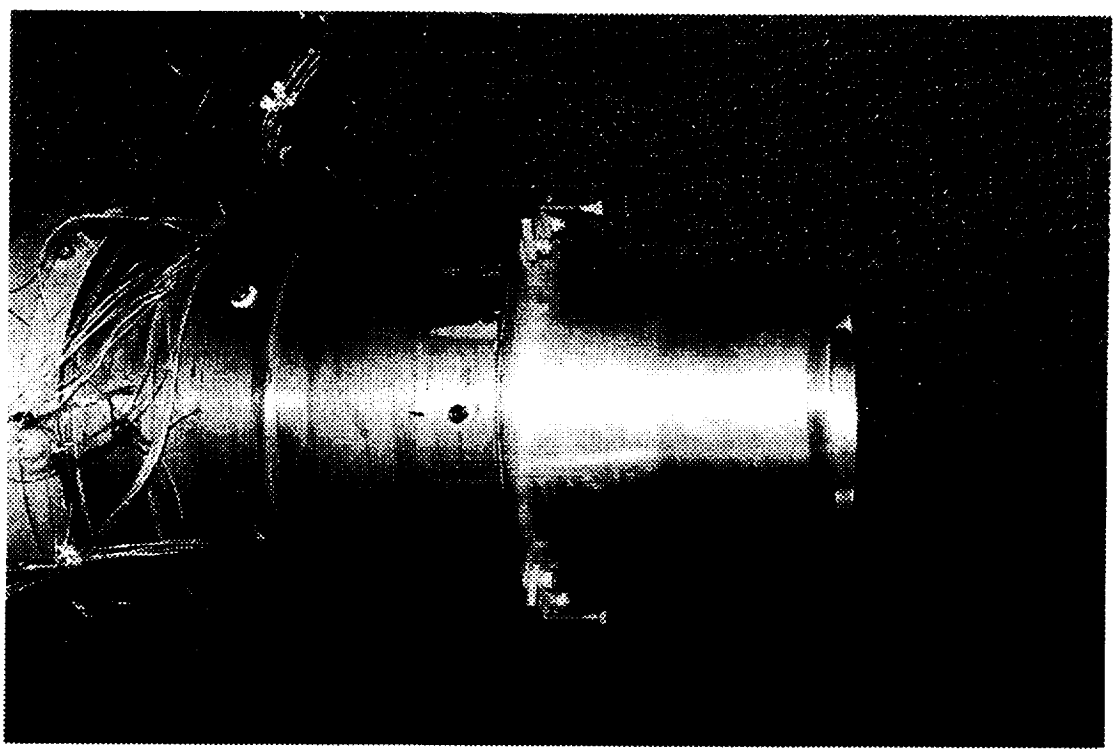


FIGURE 13b. CHANNEL 6 THRUST COEFFICIENTS, 5.7 INCH ASME NOZZLE, T_{t8}/T_{t7}=1.0

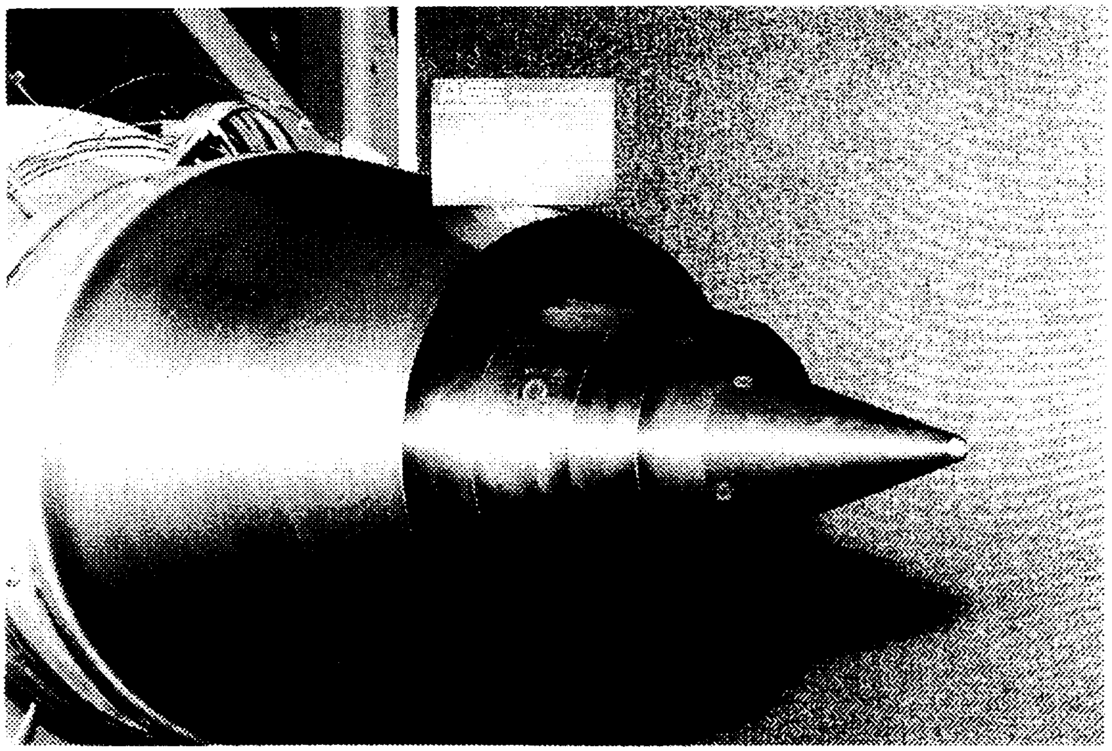


Channel 14 ASME Checkout Nozzle Tests (7.1 " Dia. Fan, 4.0" Dia. Core)

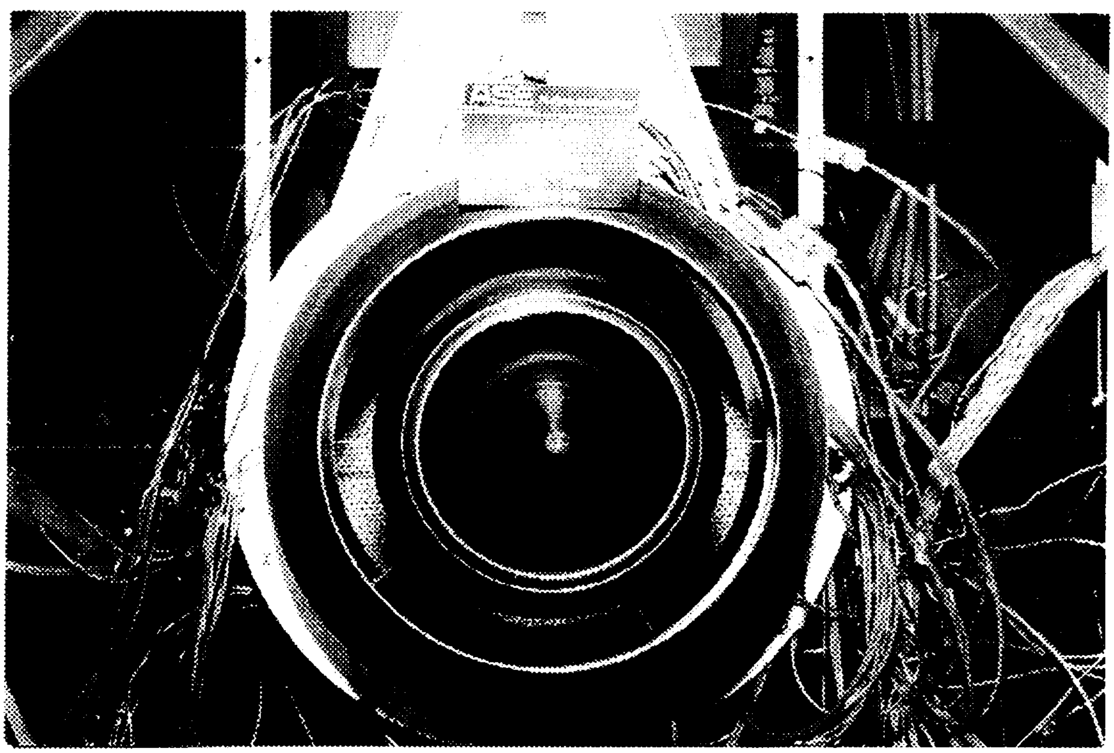


Channel 6 ASME Checkout Nozzle (5.7" Diameter, Mixed Fan and Core Flow)

FIGURE 14. ASME CHECKOUT NOZZLE PHOTOGRAPHS

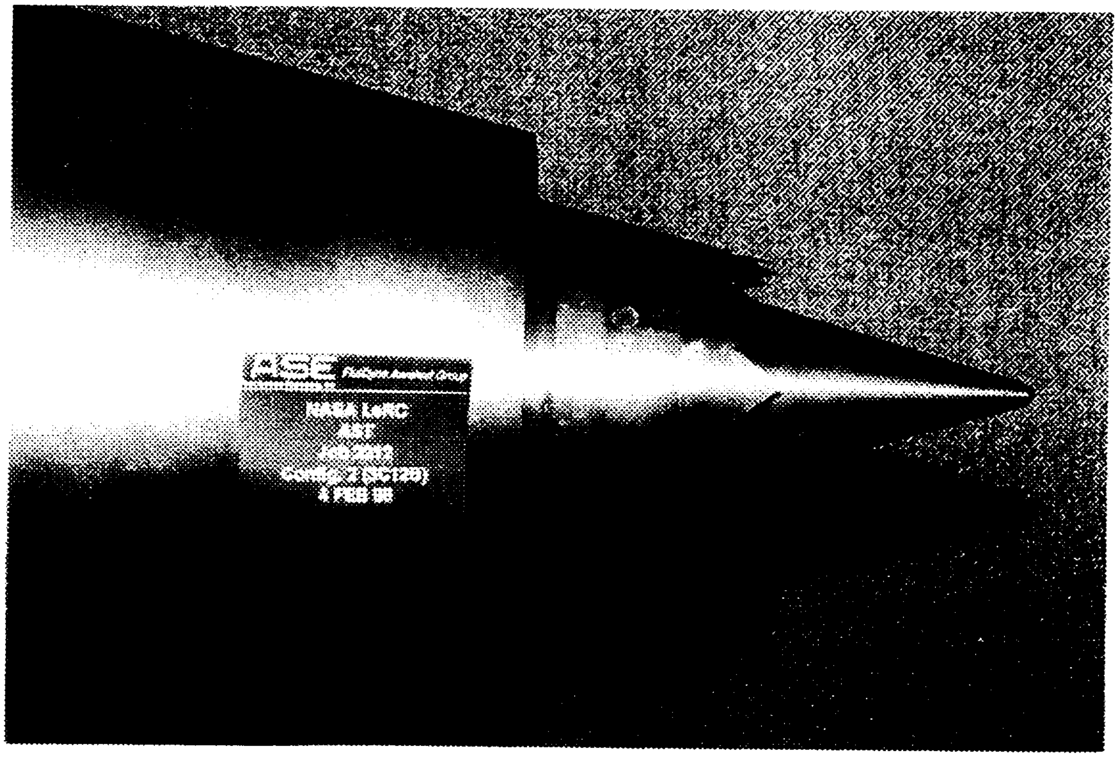


Configuration 1 (3BB) in Channel 14



Configuration 1 (3BB) in Channel 14

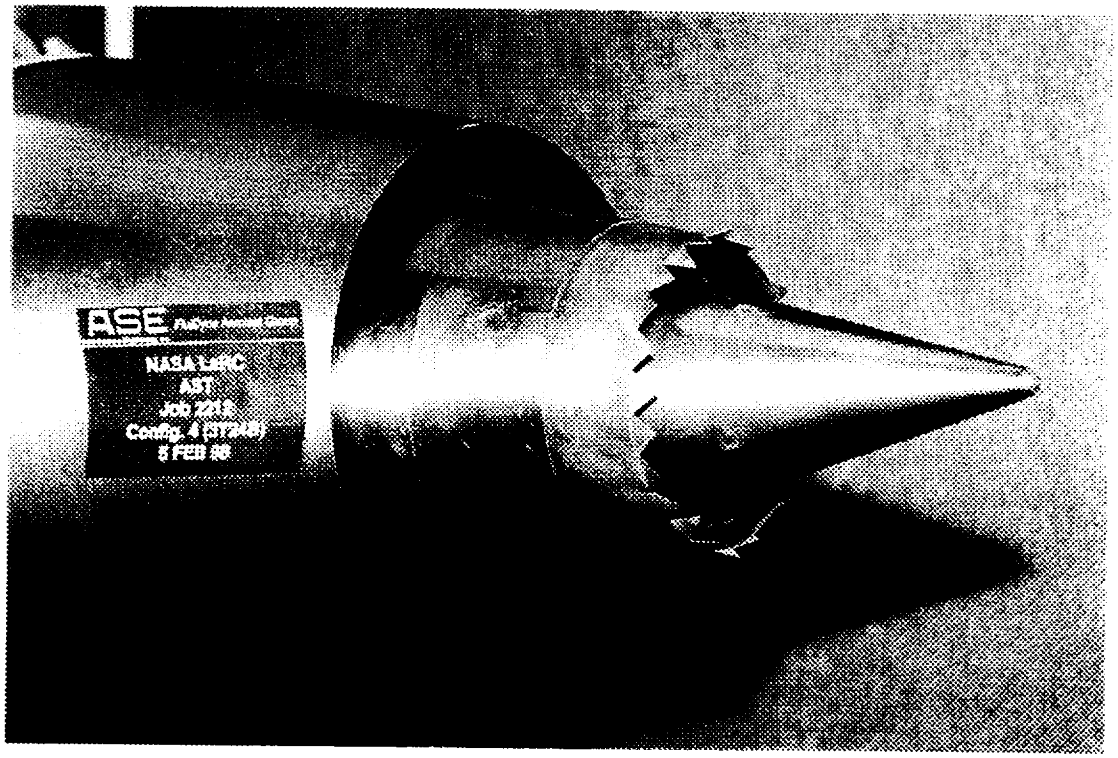
FIGURE 15a. MODEL PHOTOGRAPHS



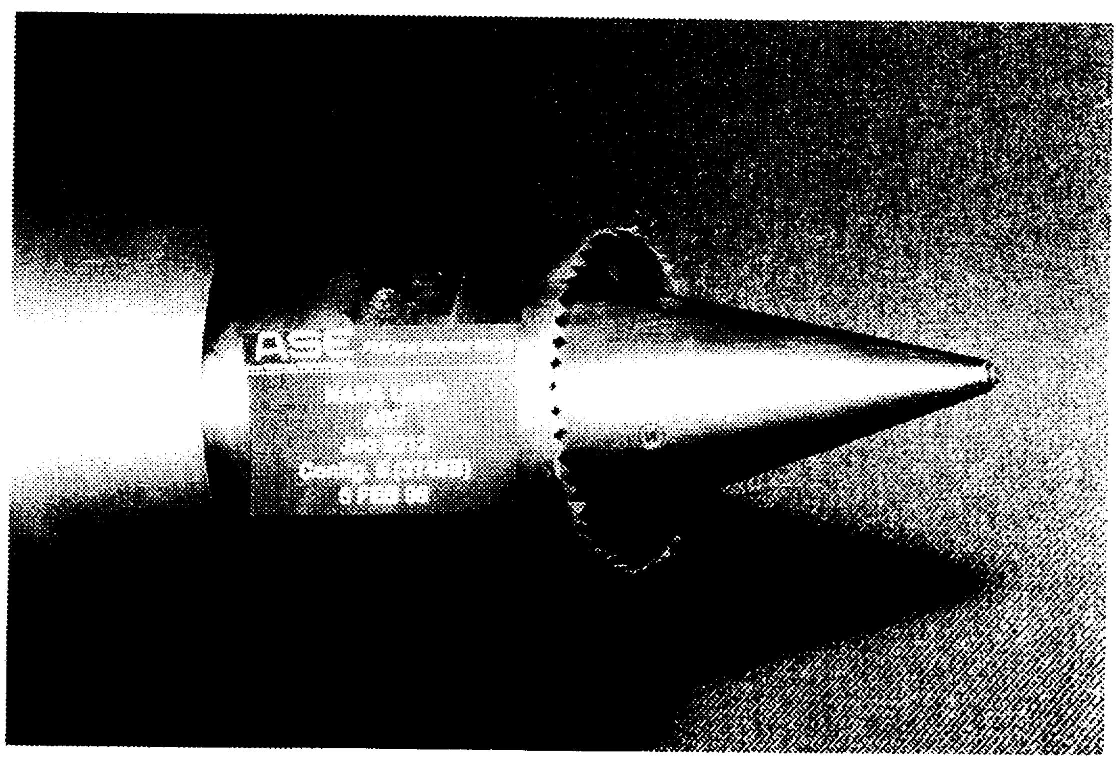
Configuration 2 (3C12B) in Channel 14

Configuration 3 (3IB) in Channel 14

FIGURE 15b. MODEL PHOTOGRAPHS

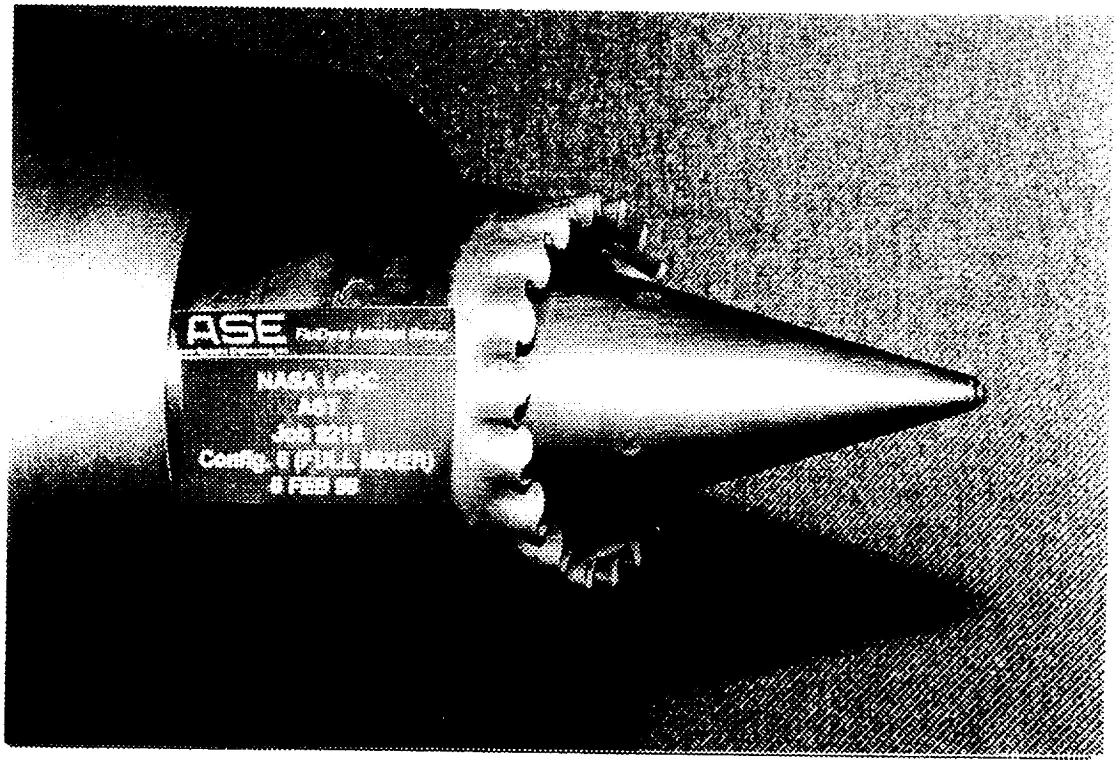


Configuration 4 (3T24B) in Channel 14



Configuration 5 (3T48B) in Channel 14

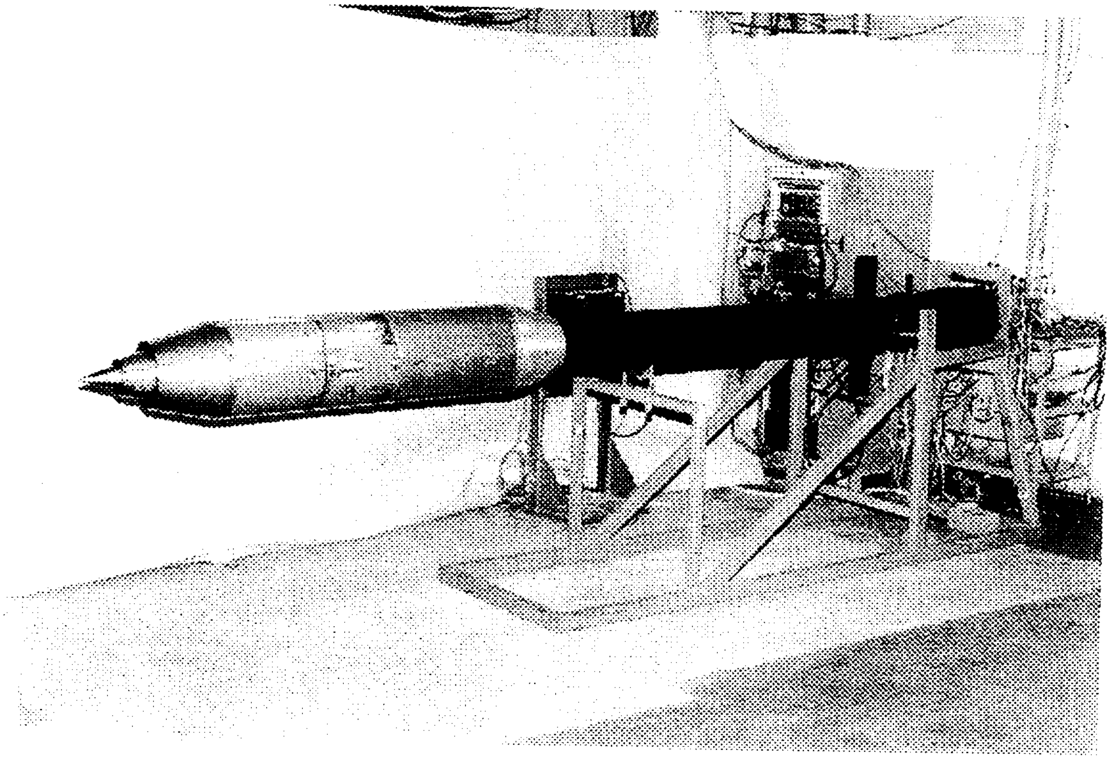
FIGURE 15c. MODEL PHOTOGRAPHS



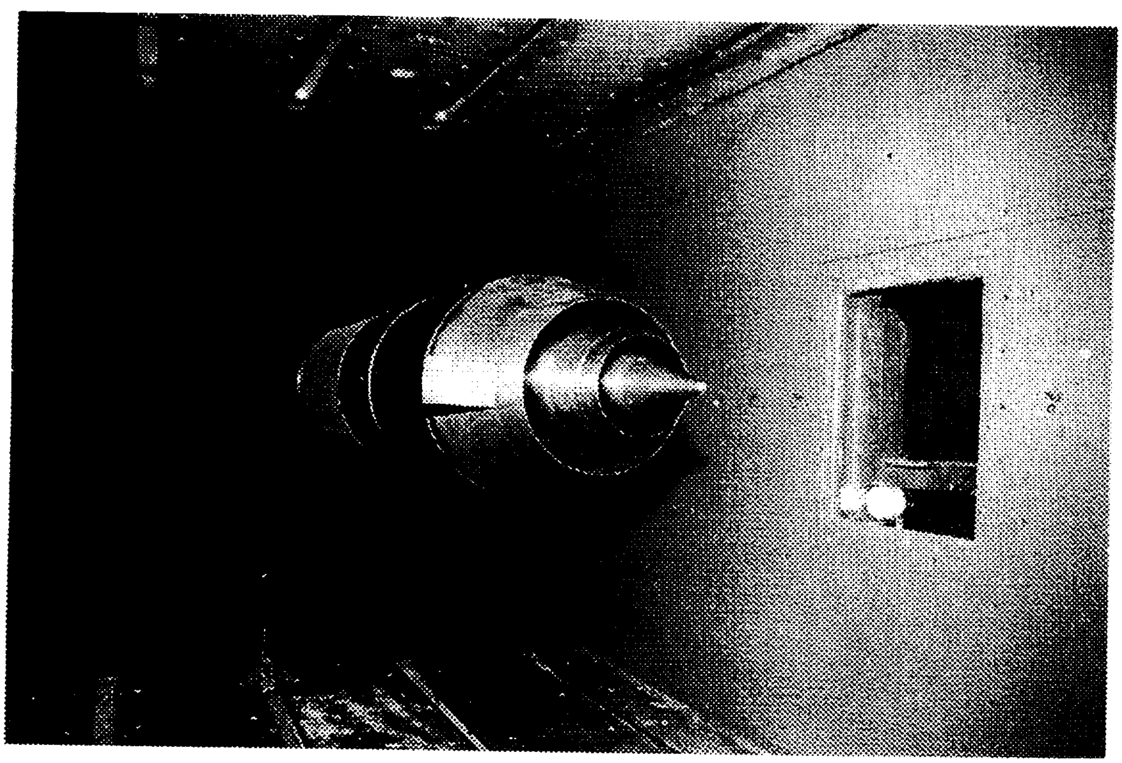
Configuration 6 (3FmB) in Channel 14

Configuration 7 (3HmB) in Channel 14

FIGURE 15d. MODEL PHOTOGRAPHS

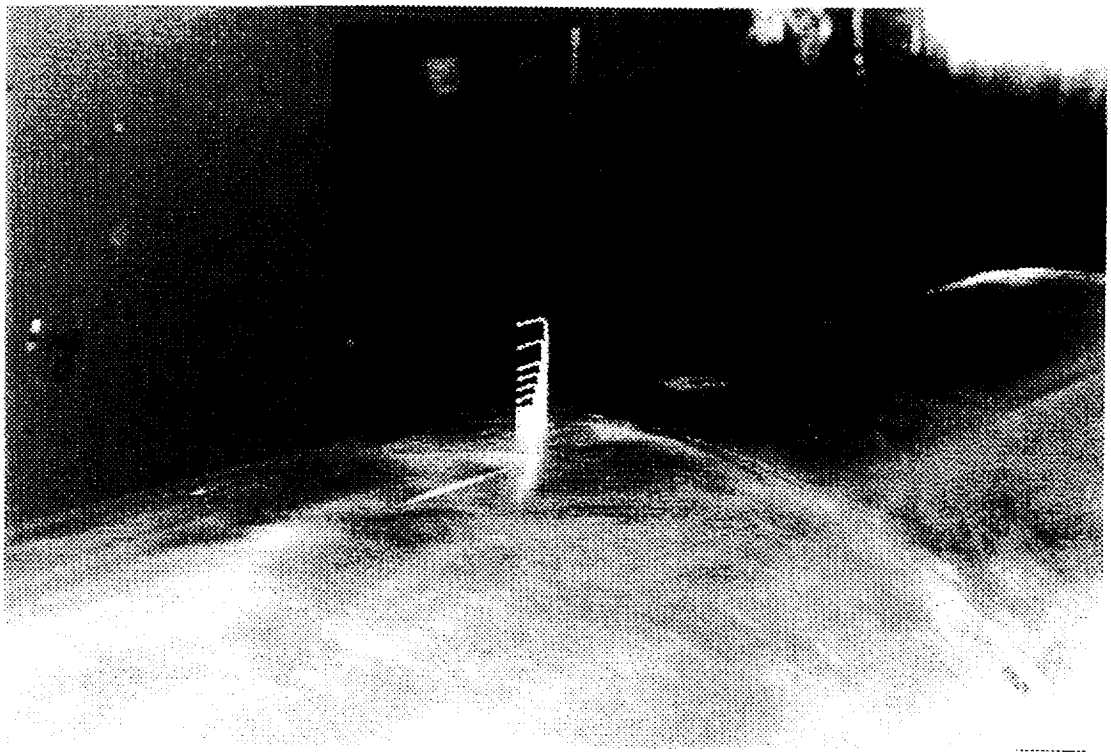


Wind Tunnel Sting Checkout in Channel 6 Facility, Configuration 1 (3BB)

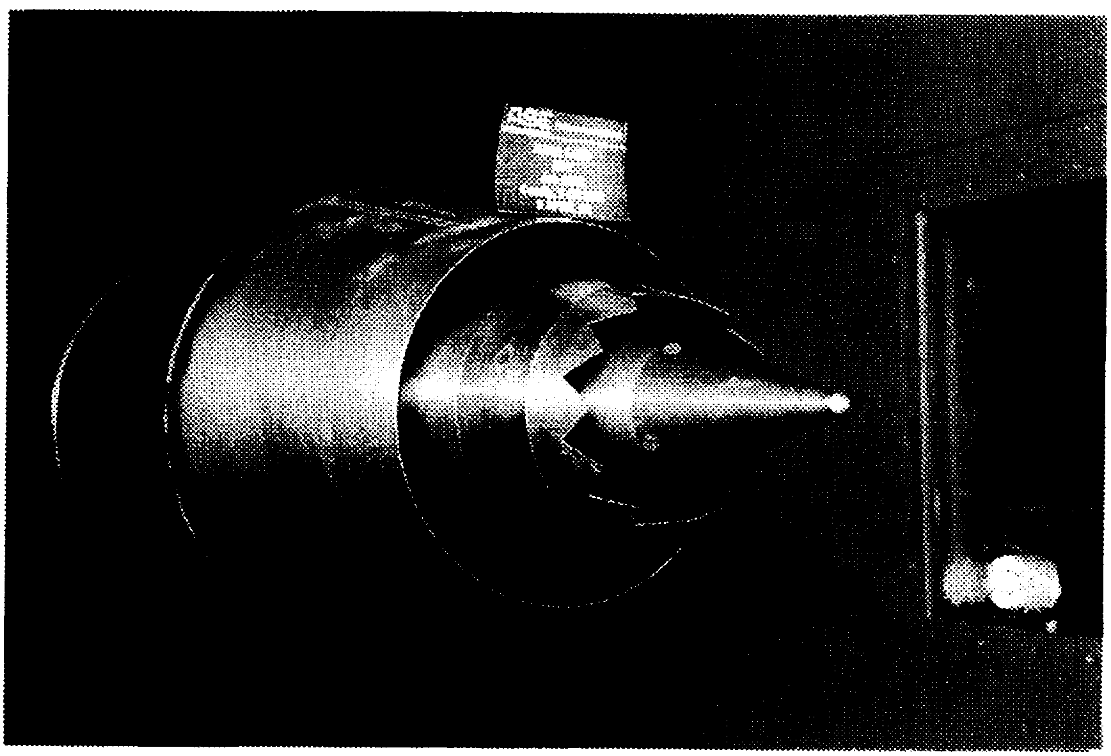


Configuration 1 (3BB) in Channel 10 Wind Tunnel

FIGURE 15e. MODEL PHOTOGRAPHS

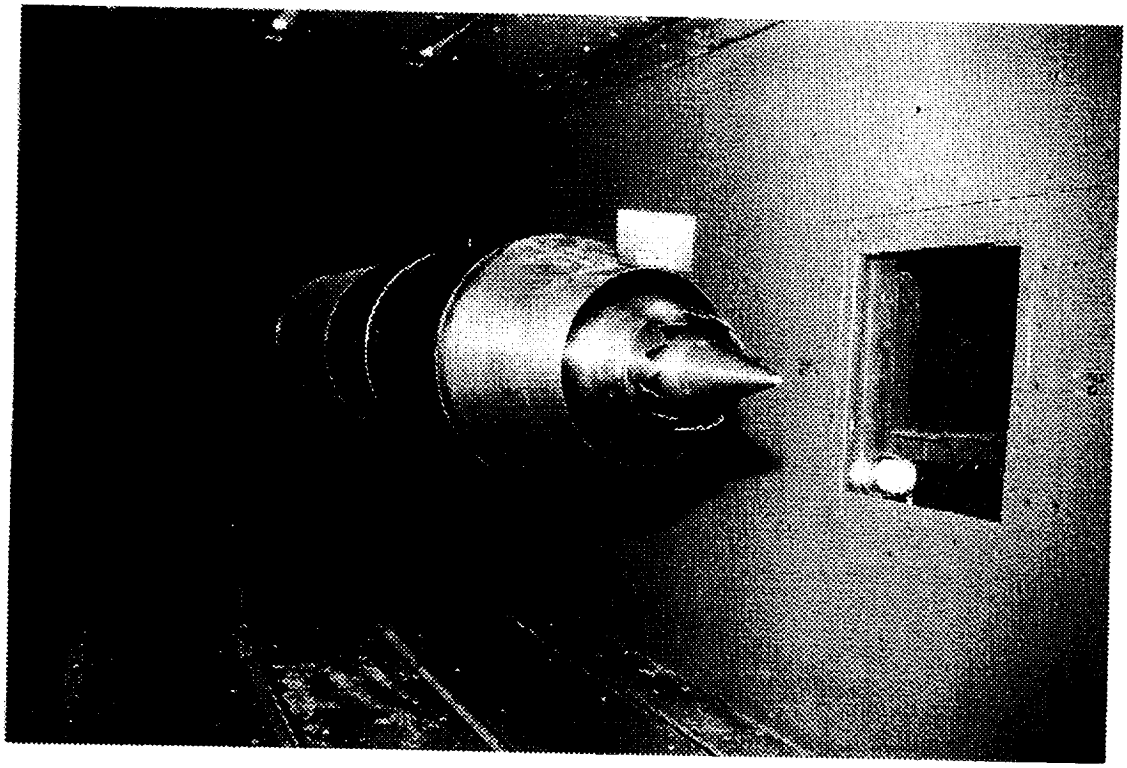


Wind Tunnel Sting Boundary Layer Probe

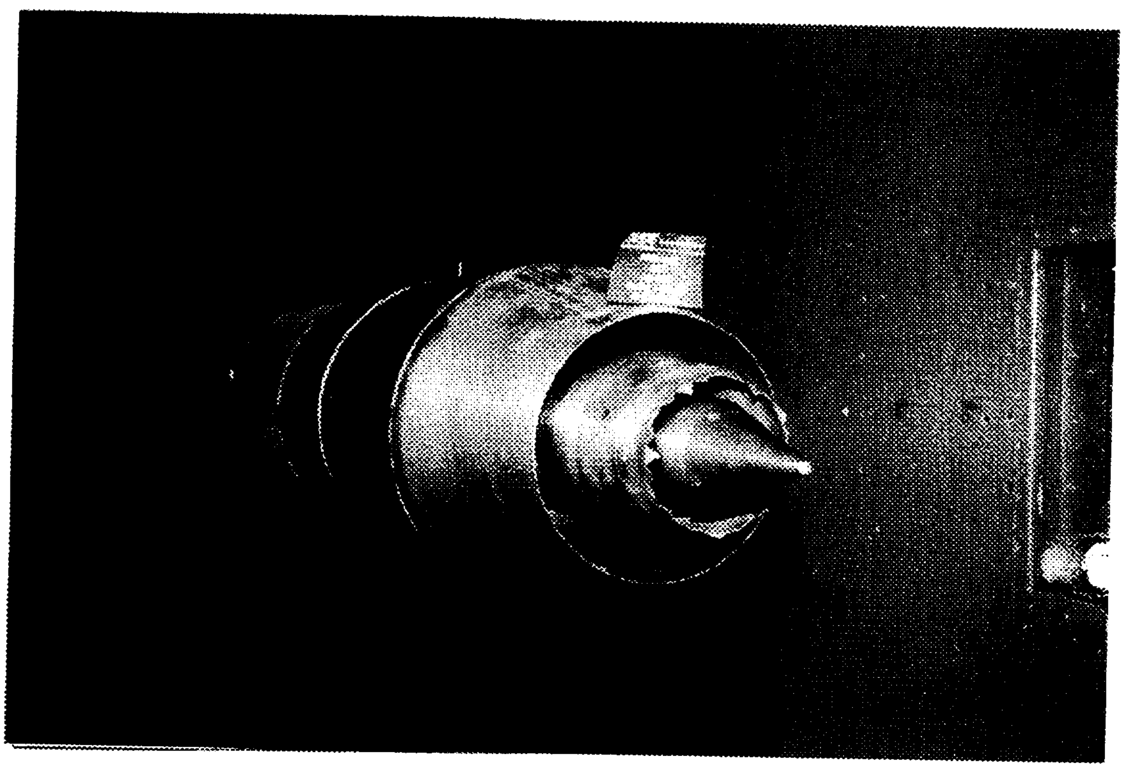


Configuration 2 (3C12B)

FIGURE 15f. MODEL PHOTOGRAPHS

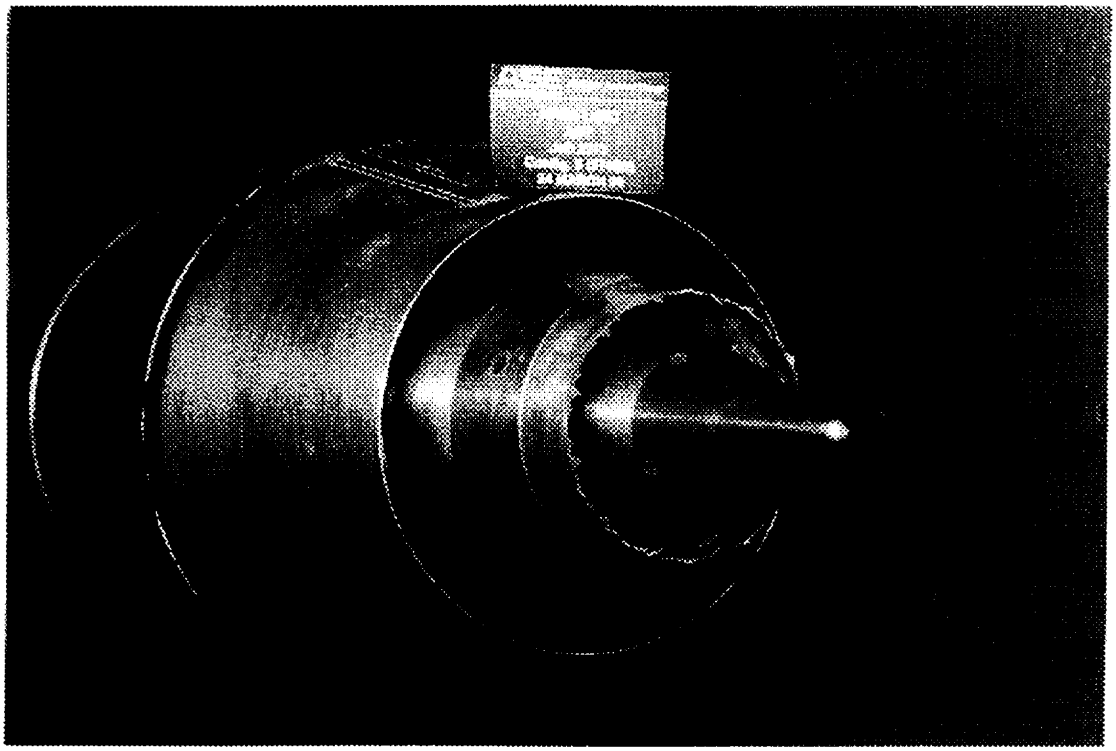


Configuration 3 (3IB)

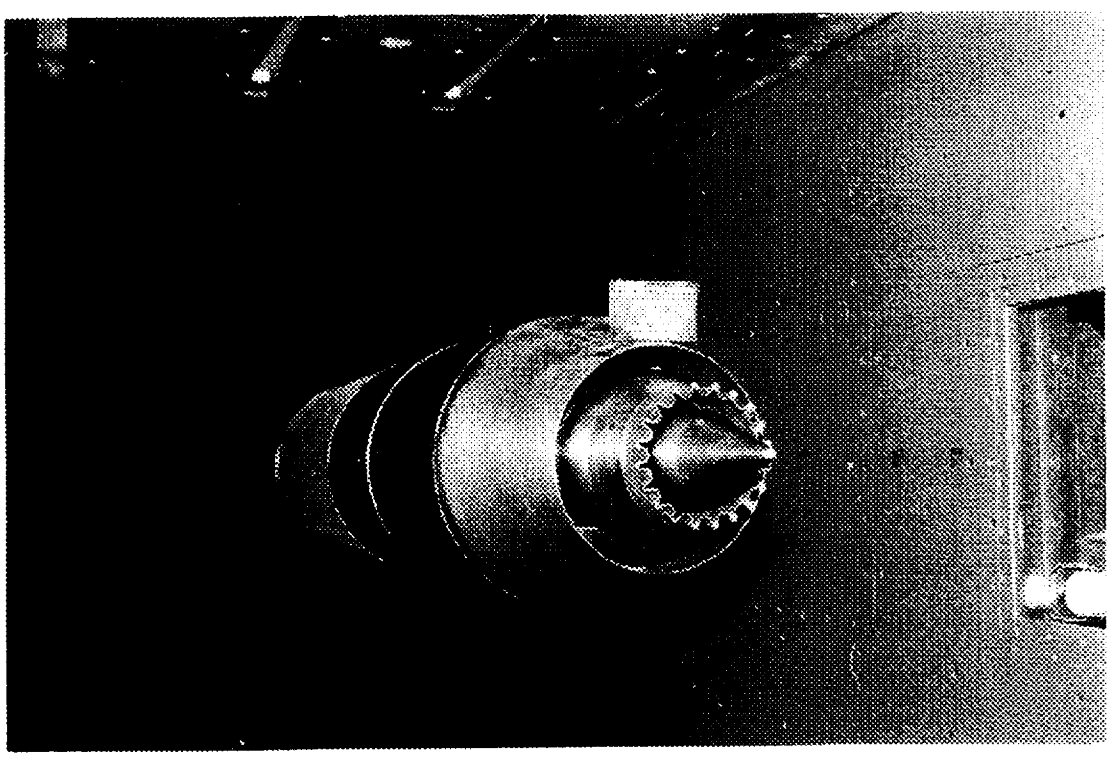


Configuration 4 (3T24B)

FIGURE 15g. MODEL PHOTOGRAPHS

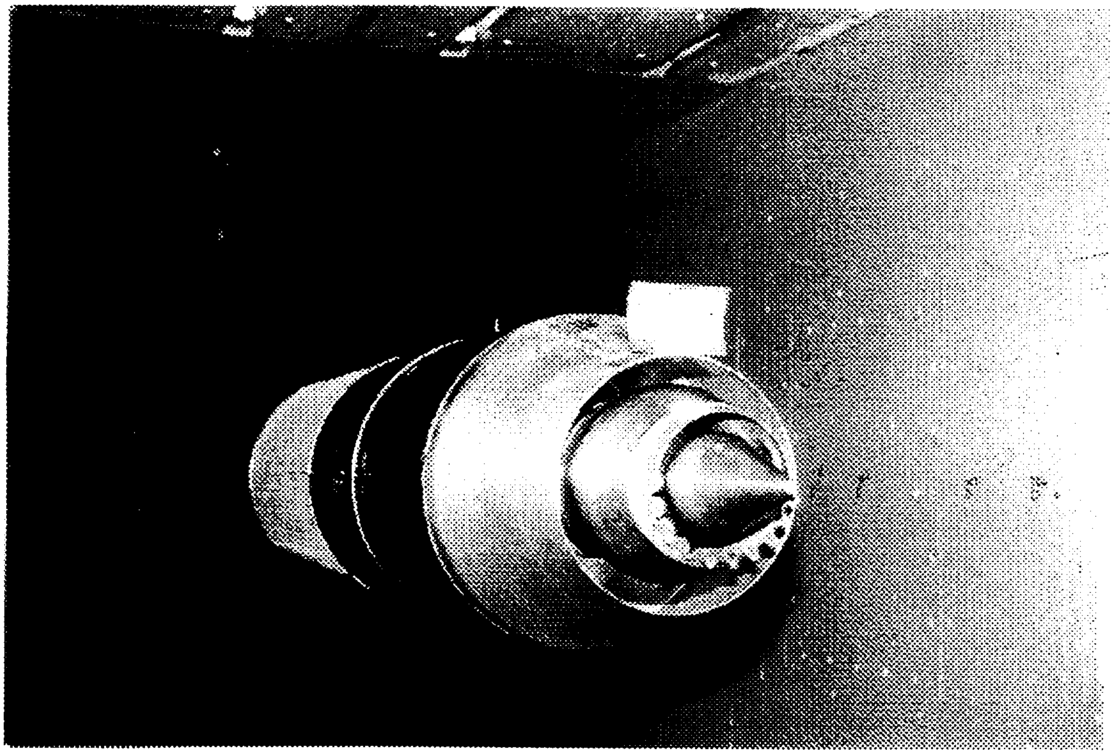


Configuration 5 (3T48B)

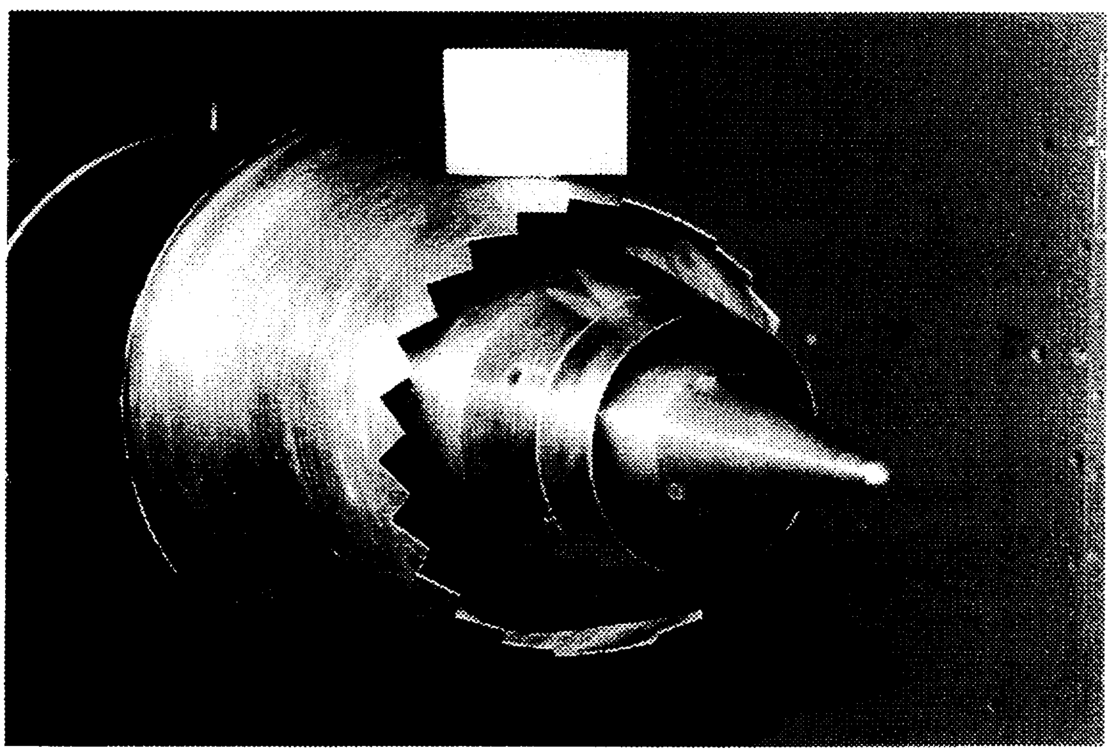


Configuration 6 (3FmB)

FIGURE 15h. MODEL PHOTOGRAPHS

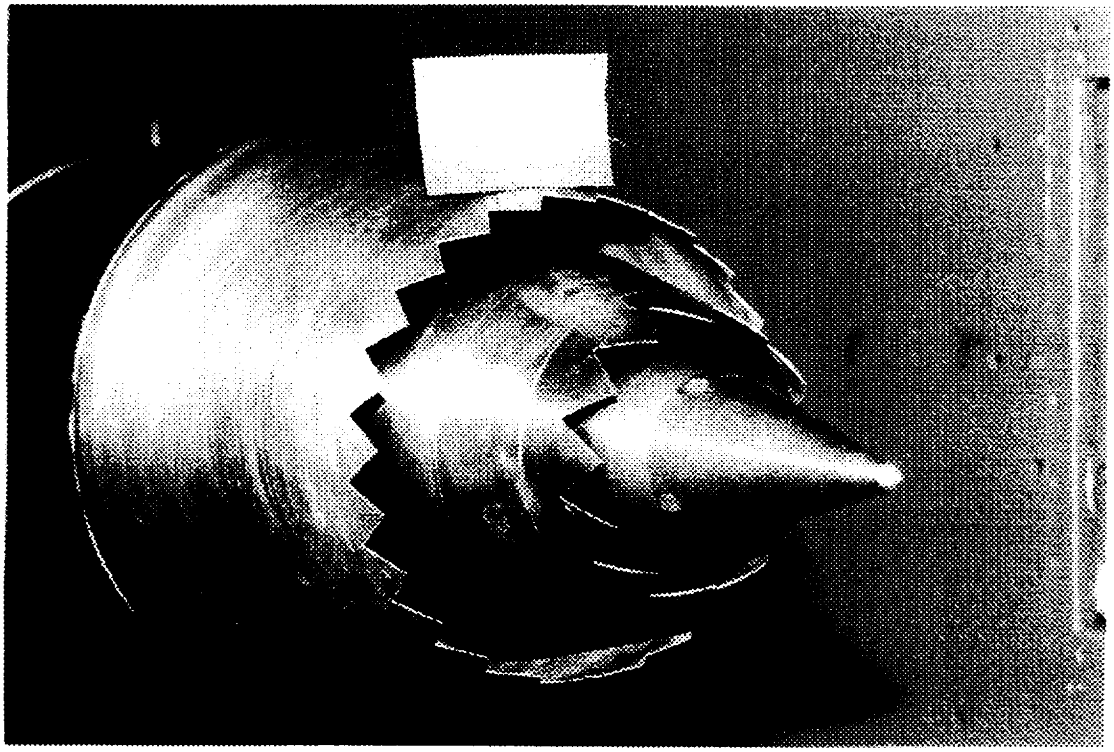


Configuration 7 (3HmB)

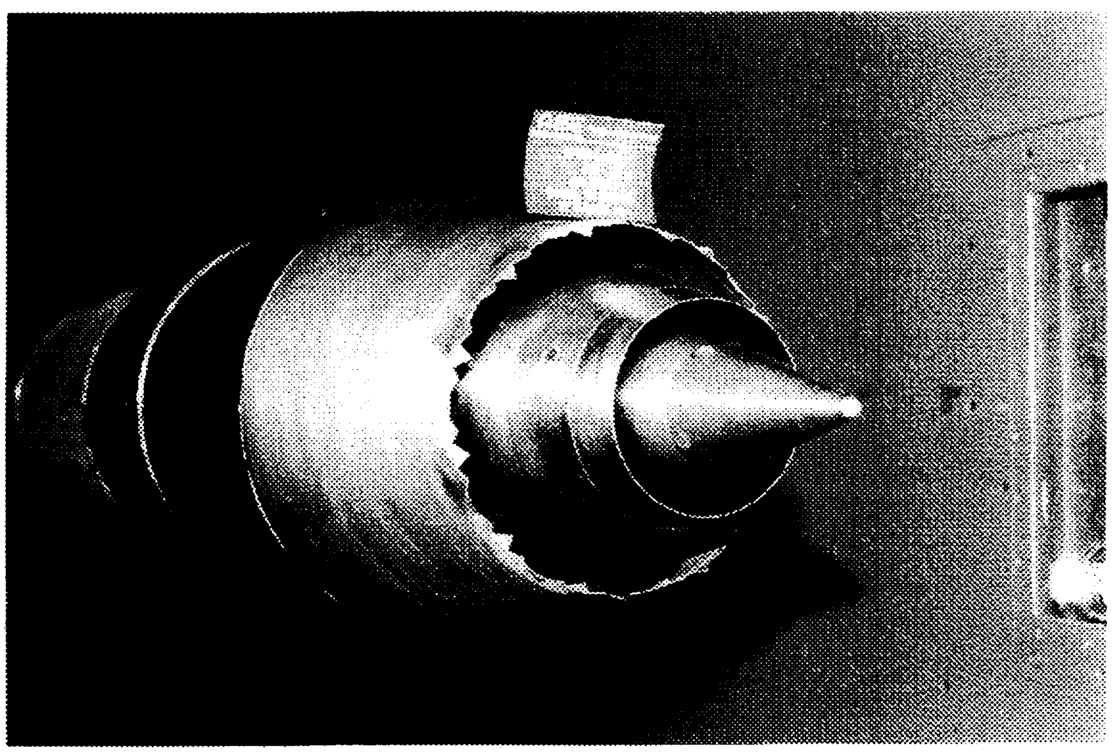


Configuration 8 (3BC)

FIGURE 15i. MODEL PHOTOGRAPHS

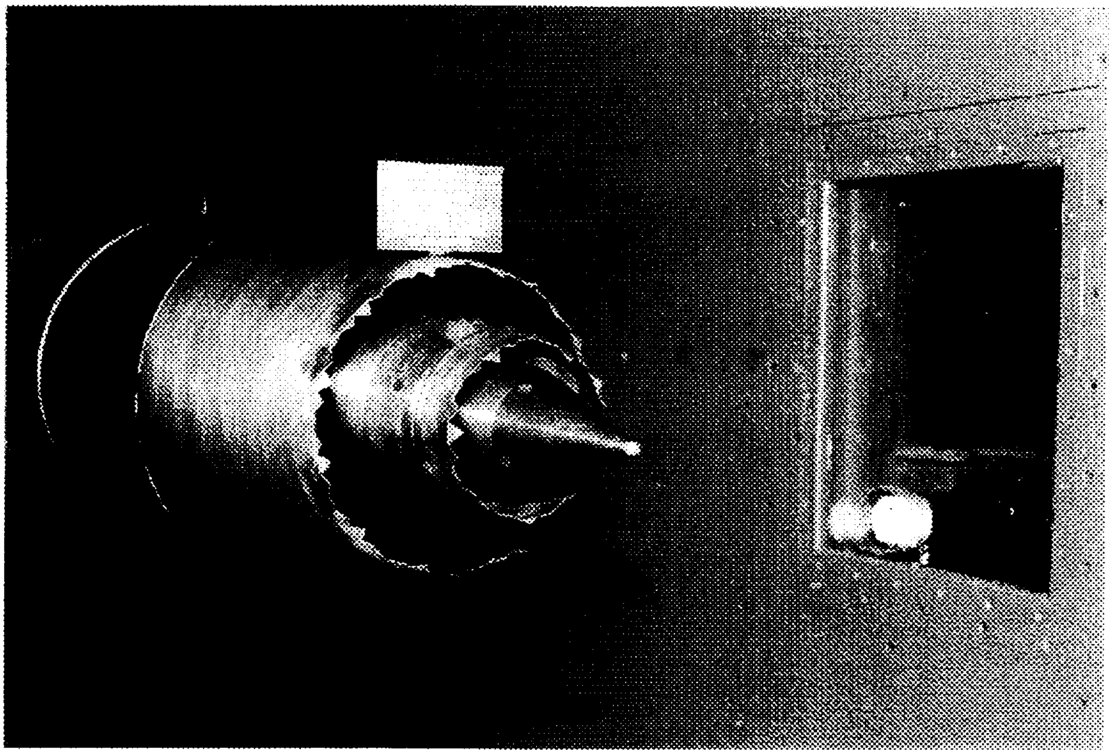


Configuration 9 (3IC)

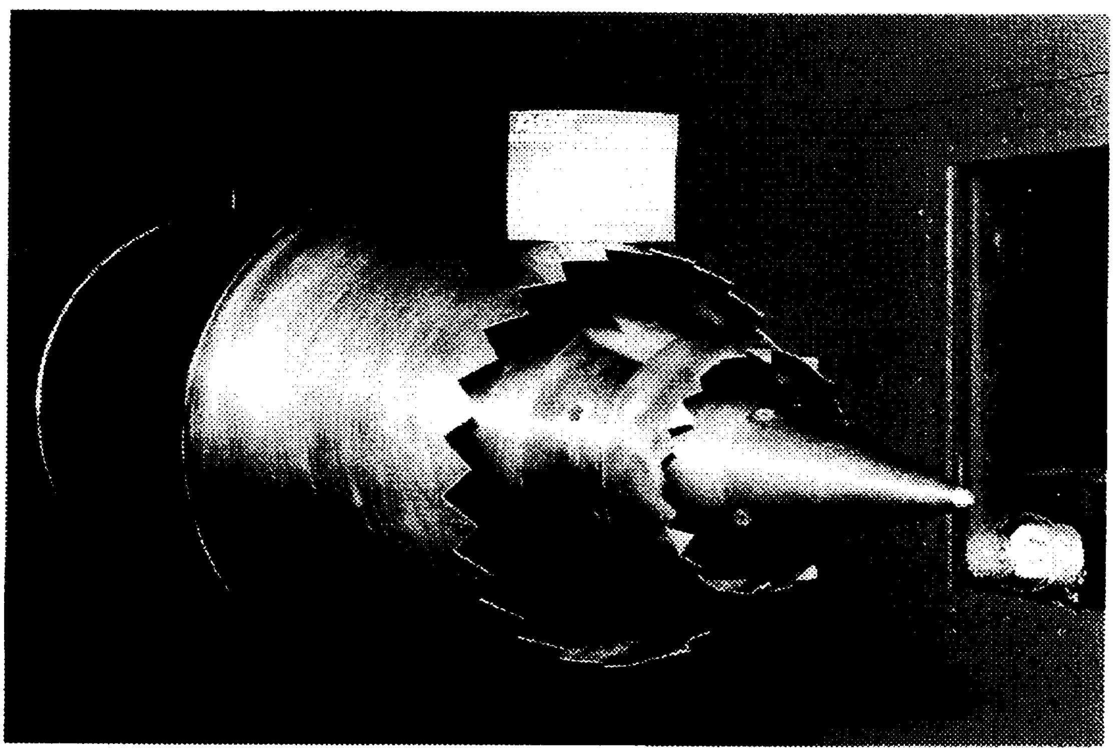


Configuration 10 (3BT48)

FIGURE 15j. MODEL PHOTOGRAPHS

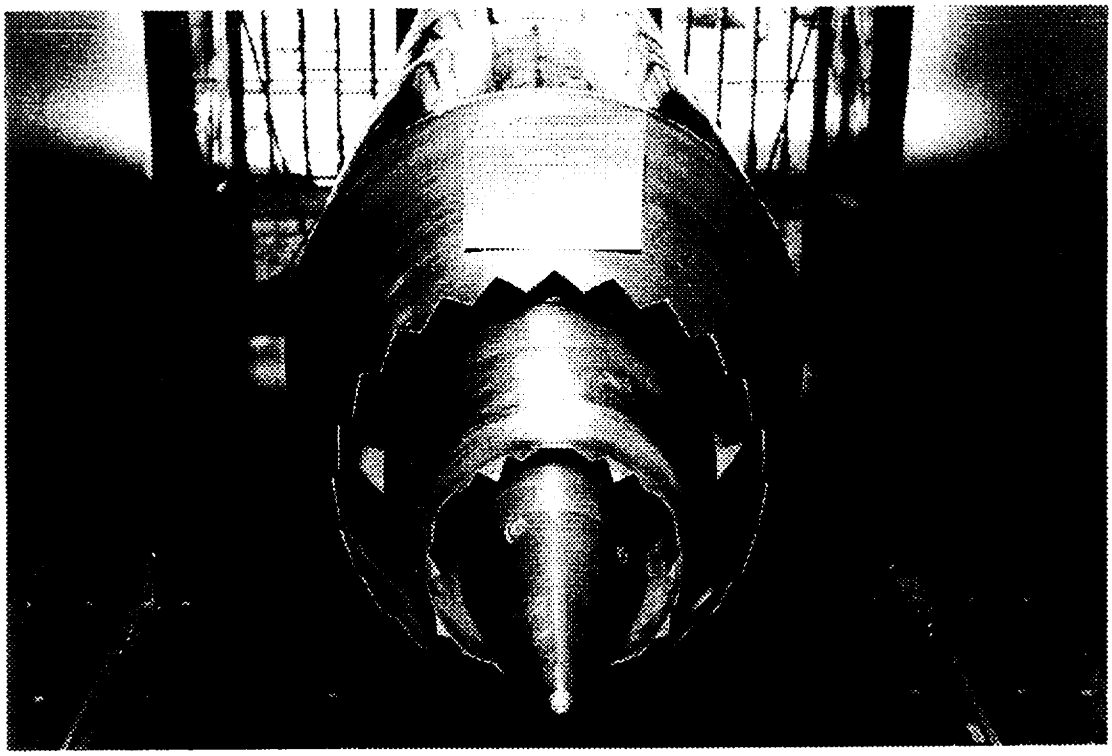


Configuration 11 (3T24T48)

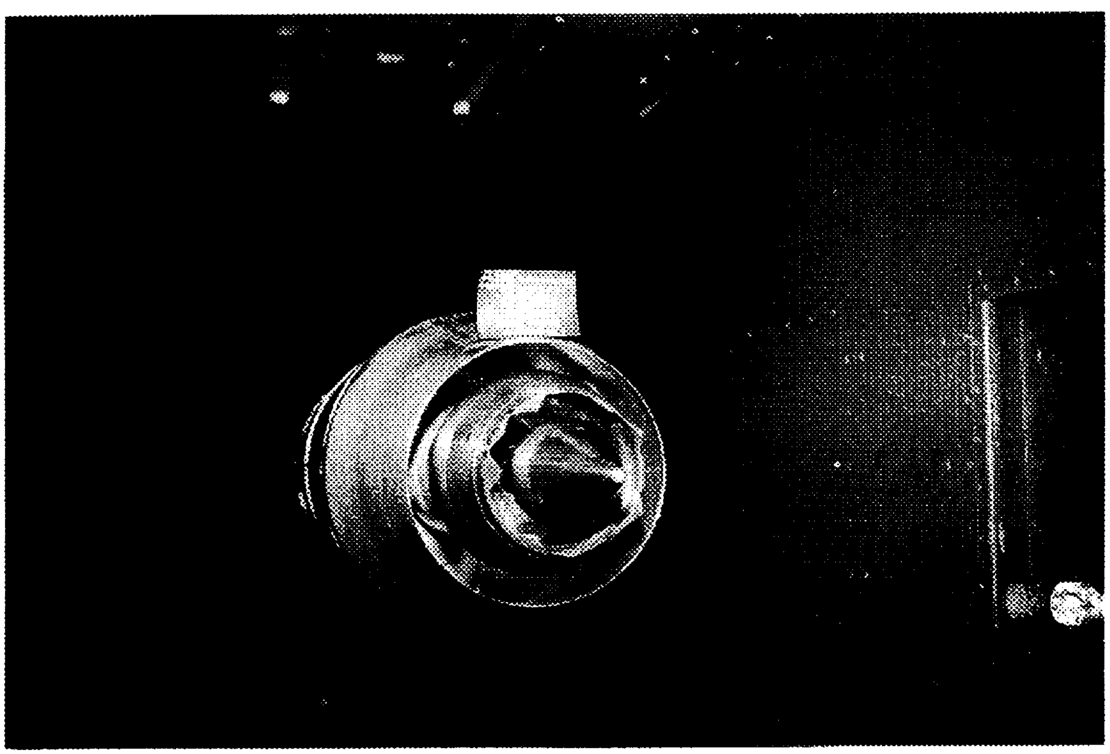


Configuration 12 (3T24C with core clocked 90 degrees clockwise looking upstream)

FIGURE 15k. MODEL PHOTOGRAPHS

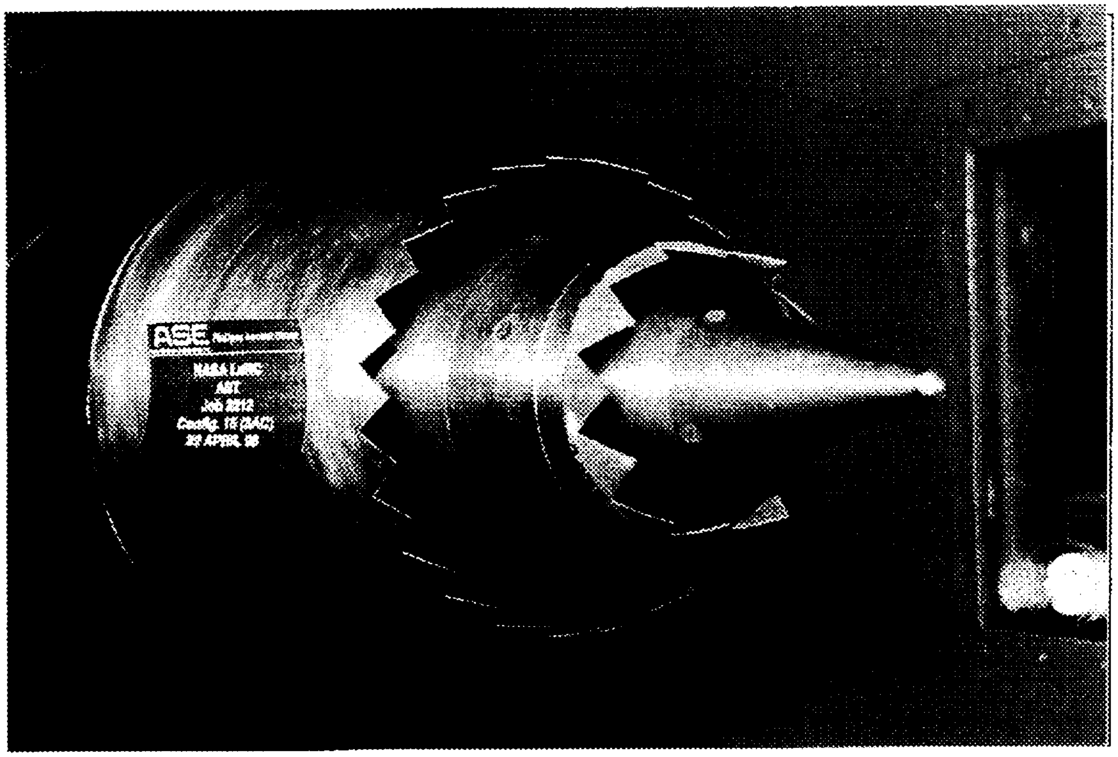


Configuration 13 (3T24C with fan clocked 22.5 degrees clockwise looking upstream)

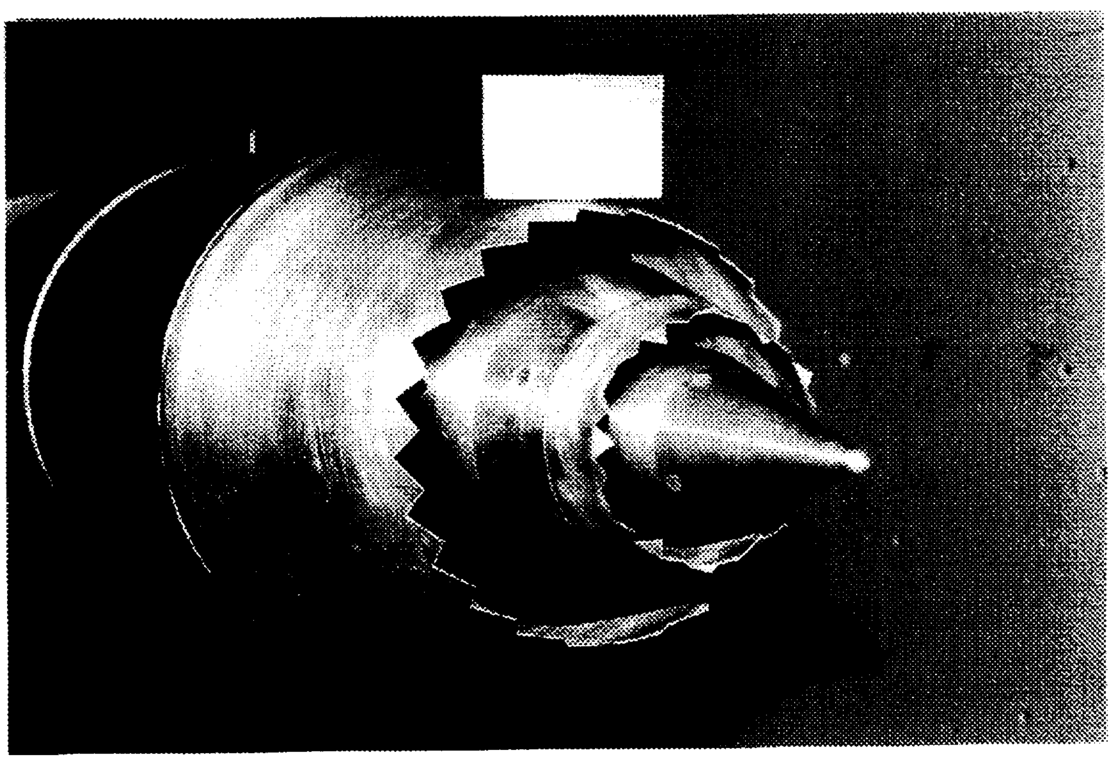


Configuration 14 (3AB)

FIGURE 151. MODEL PHOTOGRAPHS

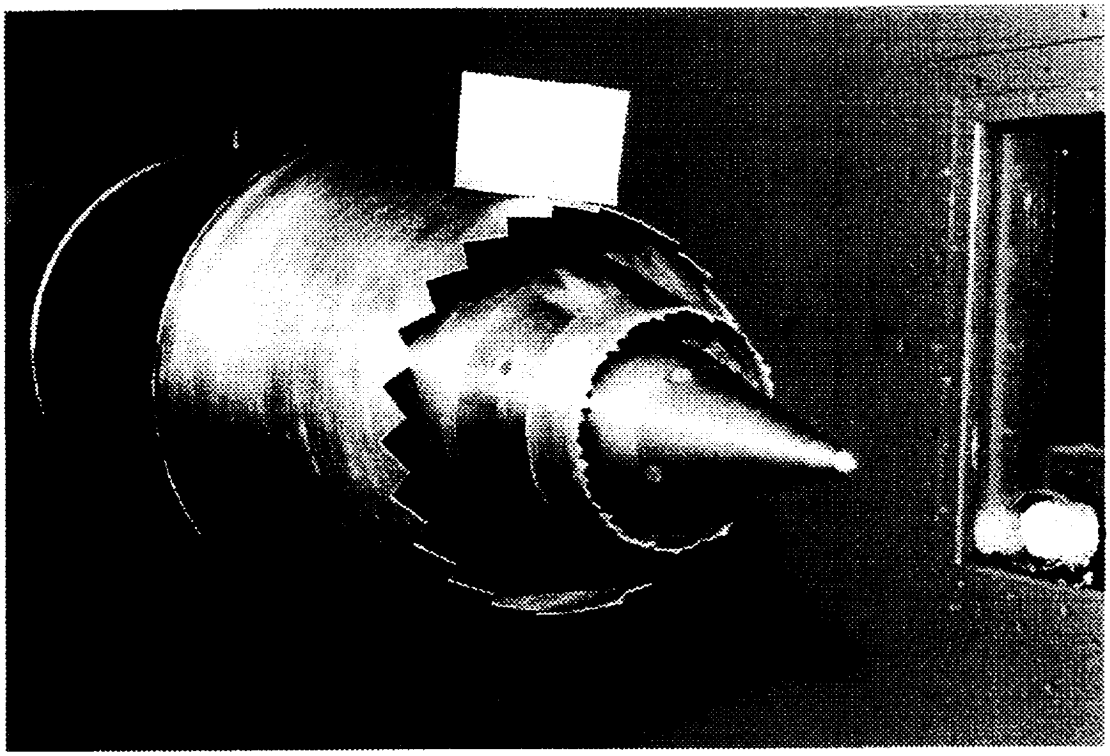


Configuration 15 (3AC)

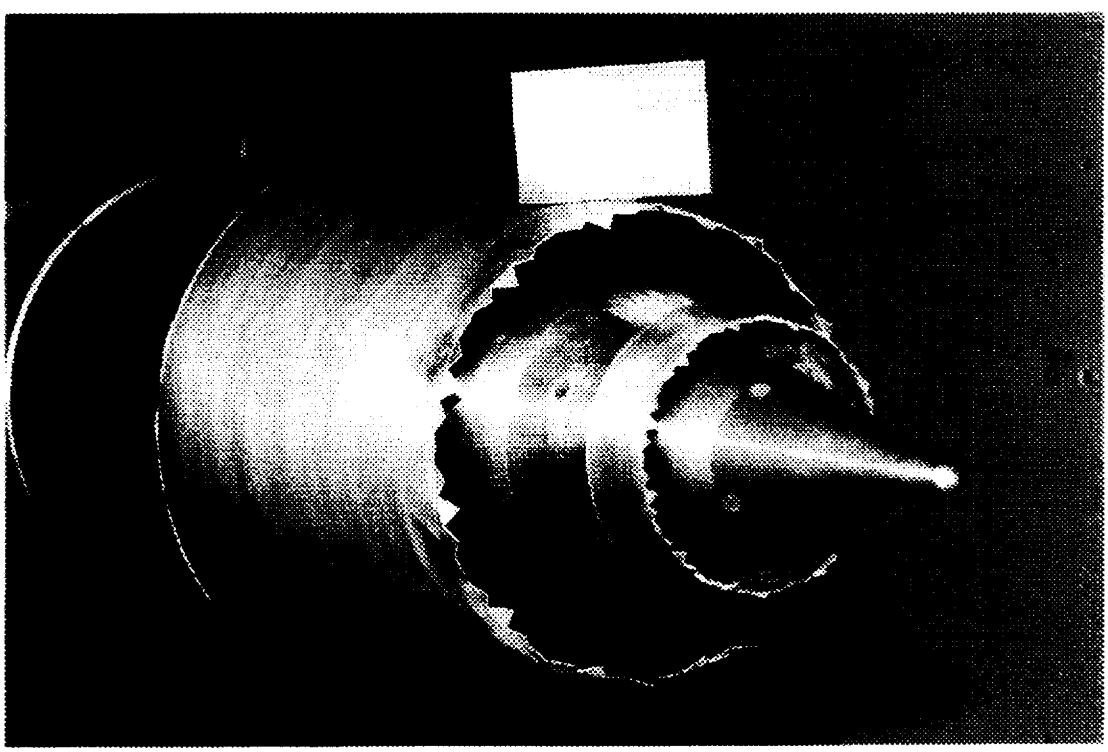


Configuration 16 (3T24C)

FIGURE 15m. MODEL PHOTOGRAPHS



Configuration 17 (3T48C)



Configuration 18 (3T48T48)

FIGURE 15n. MODEL PHOTOGRAPHS

		TEST MATRIX AND MODEL CONFIGURATIONS						
		Data Points:						
				Point A	Best 2 Configurations,			
		Static	M = 0.28	M= 0.8	4-Point Cruise		Core Nozzle	Fan Nozzle
Configuration	Device	5-pt cycle	3-pt cycle	Cruise	Matrix M=0.8		Part	Part
1	3BB(baseline)	5	3	1	4		2078-405	2078-001
2	3C12B	5		1			2078-422	2078-001
3	3IB	5		1			2078-427	2078-001
4	3T24B	5		1			2087-406	2078-001
5	3T48B	5		1			2087-405	2078-001
6	3FmB	5		1			2087-407	2078-001
7	3HmB	5		1			2087-404	2078-001
8	3BC		3	1			2078-405	2078-003
9	3IC		3	1			2078-427	2078-003
10	3BT48		3	1			2078-405	2087-001
11	3T24T48		3	1			2087-406	2087-001
12	clock config. 16 core 90 deg.			1			2087-406	2078-003
13	clock config. 16 fan 22.5 deg.			1			2087-406	2078-003
14	3AB			1			2078-429	2078-001
15	3AC			1	4		2078-429	2078-003
16	3T24C			1	4		2087-406	2078-003
17	3T48C			1			2087-405	2078-003
18	3T48T48			1			2087-405	2087-001

	Definition of Conditions:					
	Pt7/Pa	Pt8/Pa	Pt7/Pt8	M		Common Parts:
	5 Point Static Matrix					Forward core nozzle: 2078-404
1	1.89	1.79	1.056	0		Forward plug: 2078-402
2	1.83	1.68	1.089	0		Aft plug: 2078-411
3	1.73	1.51	1.146	0		Core nozzle cover: 2078-605
4	1.60	1.35	1.185	0		
5	1.51	1.27	1.189	0		
	3 Point Takeoff Matrix					
1	1.89	1.79	1.056	0.28		
2	1.83	1.68	1.089	0.28		
3	1.73	1.51	1.146	0.28		
	Cruise Point A					
A	2.60	2.40	1.083	0.8		
	4 Point Cruise Matrix					
1	2.80	2.40	1.167	0.8		
2	2.60	2.60	1.000	0.8		
3	2.60	2.20	1.182	0.8		
4	2.40	2.40	1.000	0.8		

FIGURE 16. TEST MATRIX AND MODEL CONFIGURATION DEFINITION.

Facility	Config.	Device	Run #	Mach #	λ_7	λ_8	λ_7/λ_8	W_7/W_8	C_{D7}	C_{D8}	C_{Tr}	α (deg.)
Ch. 14	1	3BB	*1.01	0	2.004	1.996	1.004	2.892	0.9923	0.9855	0.9908	0.05
			2.01	0	1.892	1.785	1.060	3.093	0.9919	0.9745	0.9903	0.06
			*2.02	0	1.892	1.787	1.058	3.087	0.9918	0.9750	0.9901	0.02
			*2.03	0	1.891	1.786	1.059	3.089	0.9919	0.9750	0.9900	0.04
			3.01	0	1.831	1.676	1.093	3.232	0.9913	0.9675	0.9901	0.08
			4.01	0	1.733	1.503	1.153	3.562	0.9902	0.9512	0.9893	0.07
			*4.02	0	1.732	1.504	1.151	3.556	0.9900	0.9517	0.9890	0.05
			5.01	0	1.599	1.346	1.189	3.951	0.9897	0.9333	0.9891	0.13
			6.01	0	1.507	1.265	1.192	4.206	0.9886	0.9208	0.9882	0.12
			*6.02	0	1.511	1.266	1.194	4.212	0.9887	0.9208	0.9877	0.10
			*7.01	0	1.399	1.196	1.169	4.380	0.9881	0.9110	0.9875	0.20
	2	3C12B	*8.03	0	2.001	2.000	1.000	2.799	0.9924	1.0136	0.9902	0.03
			9.02	0	1.888	1.788	1.056	2.978	0.9918	1.0067	0.9896	0.04
			10.01	0	1.829	1.679	1.090	3.117	0.9911	0.9998	0.9898	0.13
			11.01	0	1.728	1.507	1.147	3.419	0.9899	0.9845	0.9889	0.18
			12.01	0	1.595	1.344	1.187	3.813	0.9895	0.9658	0.9888	0.22
			13.01	0	1.506	1.266	1.190	4.050	0.9887	0.9536	0.9878	0.28
	3	3IB	*14.01	0	1.998	2.001	0.998	2.857	0.9921	0.9907	0.9888	0.06
			15.01	0	1.893	1.788	1.059	3.082	0.9917	0.9751	0.9884	0.08
			16.01	0	1.831	1.675	1.093	3.243	0.9911	0.9639	0.9883	0.10
			17.01	0	1.730	1.509	1.146	3.555	0.9901	0.9453	0.9876	0.12
			18.01	0	1.600	1.345	1.190	4.005	0.9897	0.9224	0.9873	0.15
			19.01	0	1.512	1.268	1.193	4.258	0.9886	0.9094	0.9866	0.19
	4	3T24B	*20.02	0	2.004	2.005	1.000	2.966	0.9922	0.9545	0.9854	0.02
			21.01	0	1.888	1.791	1.055	3.161	0.9917	0.9470	0.9849	0.05
			22.01	0	1.830	1.679	1.090	3.306	0.9911	0.9417	0.9846	0.05
			23.01	0	1.728	1.507	1.147	3.601	0.9899	0.9328	0.9838	0.07
			24.01	0	1.597	1.343	1.189	3.998	0.9892	0.9227	0.9832	0.11
			25.01	0	1.508	1.266	1.191	4.212	0.9884	0.9171	0.9826	0.10

* no charge

FIGURE 17. TEST CONDITIONS AND MAJOR TEST RESULTS, (Sheet 1 of 4)

Facility	Config.	Device	Run #	Mach #	λ_7	λ_e	λ_7/λ_8	W_7/W_8	C_{D7}	C_{D8}	C_{Tr}	α (deg.)
Ch. 14	5	3T48B	*26.01	0	2.005	2.004	1.001	2.931	0.9919	0.9674	0.9875	0.05
			27.01	0	1.888	1.790	1.055	3.128	0.9916	0.9573	0.9871	0.08
			28.01	0	1.830	1.679	1.090	3.276	0.9912	0.9509	0.9867	0.08
			29.01	0	1.729	1.510	1.145	3.570	0.9903	0.9400	0.9864	0.09
			30.01	0	1.598	1.346	1.187	3.967	0.9895	0.9272	0.9859	0.15
			31.01	0	1.508	1.270	1.187	4.170	0.9888	0.9198	0.9850	0.17
	6	3FmB	*32.01	0	2.003	2.002	1.000	2.924	0.9925	0.9663	0.9759	-0.02
			*32.02	0	2.002	2.004	0.999	2.929	0.9924	0.9668	0.9763	0.01
			33.01	0	1.891	1.791	1.056	3.109	0.9919	0.9637	0.9757	0.06
			34.01	0	1.828	1.678	1.089	3.243	0.9911	0.9595	0.9765	0.06
			35.01	0	1.729	1.511	1.144	3.530	0.9903	0.9495	0.9776	0.06
			36.01	0	1.598	1.350	1.184	3.898	0.9896	0.9395	0.9786	0.11
			37.01	0	1.509	1.271	1.187	4.111	0.9886	0.9329	0.9783	0.14
	7	3HmB	*38.01	0	2.002	2.006	0.999	2.911	0.9919	0.9724	0.9825	-0.06
			*38.03	0	2.001	2.002	1.000	2.919	0.9921	0.9722	0.9823	-0.08
			39.01	0	1.889	1.793	1.054	3.099	0.9918	0.9653	0.9820	-0.02
			40.01	0	1.829	1.681	1.088	3.240	0.9908	0.9595	0.9823	-0.01
			41.01	0	1.730	1.512	1.144	3.539	0.9901	0.9473	0.9826	0.06
			42.01	0	1.596	1.353	1.179	3.902	0.9887	0.9336	0.9827	0.06
			*42.03	0	1.599	1.350	1.184	3.920	0.9895	0.9337	0.9831	0.05
			43.03	0	1.510	1.272	1.187	4.150	0.9886	0.9248	0.9825	0.04
	1	3BB	*44.01	0	2.019	2.005	1.007	2.896	0.9927	0.9858	0.9904	0.01
		Post Test	*44.03	0	2.000	2.003	0.999	2.876	0.9924	0.9858	0.9904	0.05
		Repeat	*45.01	0	1.894	1.795	1.055	3.069	0.9921	0.9762	0.9897	0.05
			*46.01	0	1.828	1.682	1.087	3.207	0.9912	0.9684	0.9895	0.06
			*47.01	0	1.731	1.512	1.144	3.521	0.9899	0.9532	0.9891	0.07
			*48.01	0	1.595	1.354	1.178	3.889	0.9886	0.9359	0.9888	0.10
			*49.03	0	1.509	1.270	1.188	4.154	0.9886	0.9234	0.9882	0.13

* no charge

FIGURE 17. TEST CONDITIONS AND MAJOR TEST RESULTS, (Sheet 2 of 4)

Facility	Config.	Device	Run #	Mach #	λ_7	λ_8	λ_7/λ_8	W_7/W_8	C_{D7}	C_{D8}	C_{Tr}	α (deg.)
Ch. 6	1	3BB	++50.01	0	1.891	1.792	1.055	3.086	0.9927	0.9755	0.9903	-0.13
		sting	++50.02	0	1.887	1.782	1.059	3.104	0.9922	0.9740	0.9910	-0.12
		checkout	++51.01	0	1.829	1.687	1.084	3.209	0.9898	0.9678	0.9896	-0.13
			++51.02	0	1.837	1.696	1.083	3.204	0.9903	0.9682	0.9893	-0.13
			++51.04	0	1.838	1.694	1.086	3.210	0.9910	0.9687	0.9891	-0.15
			++52.02	0	1.731	1.503	1.152	3.575	0.9917	0.9522	0.9899	-0.16
			++53.01	0	1.601	1.383	1.158	3.749	0.9898	0.9420	0.9888	-0.14
Ch. 10	1	3BB	55.03	0.277	1.889	1.804	1.047	3.062	0.9908	0.9731	0.9792	-0.01
			56.02	0.295	1.846	1.681	1.098	3.265	0.9908	0.9639	0.9787	-0.04
			57.01	0.273	1.730	1.509	1.147	3.556	0.9886	0.9474	0.9774	-0.05
	1	3BB	58.02	0.795	2.604	2.392	1.089	3.150	0.9936	0.9846	0.9374	0.59
	3	3IB	60.01	0.797	2.606	2.397	1.087	3.102	0.9938	0.9985	0.9342	0.62
	4	3T24B	61.01	0.803	2.630	2.434	1.081	3.229	0.9938	0.9538	0.9275	0.50
	5	3T48B	62.01	0.799	2.592	2.407	1.077	3.172	0.9934	0.9666	0.9297	0.68
		3BB	+63.01	0.8	1.1		Background noise acquired by NASA.					
		3BB	+64.01	0.8	2.600	2.400	Baseline noise acquired by NASA.					
	14	3AB	65.04	0.801	2.603	2.444	1.065	2.942	0.9929	1.0311	0.9340	0.63
	7	3HmB	66.01	0.803	2.620	2.412	1.086	3.183	0.9933	0.9719	0.9280	0.39
	6	3FmB	67.02	0.804	2.616	2.419	1.082	3.190	0.9931	0.9651	0.9210	0.47
	10	3BT48	68.01	0.792	2.595	2.392	1.085	3.057	0.9670	0.9839	0.9317	0.40
	10	3BT48	69.01	0.281	1.899	1.777	1.069	3.016	0.9550	0.9735	0.9760	-0.11
			70.01	0.282	1.837	1.669	1.101	3.141	0.9518	0.9662	0.9750	-0.10
			71.01	0.280	1.733	1.501	1.155	3.420	0.9463	0.9514	0.9718	-0.07
	11	3T24T48	72.01	0.795	2.608	2.391	1.091	3.166	0.9663	0.9542	0.9260	0.33
	11	3T24T48	73.02	0.282	1.896	1.789	1.060	3.072	0.9546	0.9462	0.9721	-0.13
			74.01	0.274	1.827	1.675	1.091	3.194	0.9512	0.9409	0.9684	-0.16
			75.01	0.280	1.732	1.494	1.159	3.511	0.9460	0.9318	0.9670	-0.08
	18	3T48T48	76.05	0.800	2.614	2.434	1.074	3.078	0.9661	0.9664	0.9264	0.44

+ Runs 63.01 and 64.01 for NASA acoustic data and charged together as one run.
++ Sting Checkout runs considered part of setup charge.

FIGURE 17. TEST CONDITIONS AND MAJOR TEST RESULTS, (Sheet 3 of 4)

Facility	Config.	Device	Run #	Mach #	λ_7	λ_8	λ_7/λ_8	W_7/W_8	C_{D7}	C_{D8}	C_{Tr}	α (deg.)
Ch10	8	3BC	77.01	0.801	2.629	2.407	1.092	3.195	1.0039	0.9843	0.9356	0.23
	8	3BC	78.01	0.285	1.900	1.804	1.053	3.104	0.9991	0.9736	0.9785	-0.02
			79.01	0.279	1.835	1.681	1.091	3.271	0.9991	0.9645	0.9776	-0.01
			80.01	0.284	1.732	1.506	1.150	3.608	0.9977	0.9462	0.9767	0.01
	16	3T24C	81.01	0.793	2.594	2.400	1.081	3.266	1.0034	0.9523	0.9331	0.35
	12	3T24C core@90deg.	82.01	0.791	2.588	2.391	1.083	3.274	1.0032	0.9516	0.9331	0.33
	15	3AC	83.02	0.786	2.565	2.385	1.076	3.008	1.0030	1.0284	0.9325	0.22
	17	3T48C	84.02	0.796	2.609	2.391	1.091	3.256	1.0025	0.9633	0.9323	0.43
	9	3IC	85.01	0.790	2.586	2.387	1.083	3.138	1.0036	0.9941	0.9368	0.29
	9	3IC	86.01	0.279	1.891	1.794	1.054	3.110	0.9989	0.9725	0.9780	0.00
			87.02	0.290	1.843	1.697	1.087	3.258	0.9982	0.9620	0.9761	0.01
			88.01	0.282	1.733	1.510	1.148	3.627	0.9971	0.9384	0.9767	-0.02
	1	3BB	89.02	0.798	2.811	2.390	1.176	3.400	0.9925	0.9845	0.9394	0.36
		expanded	90.01	0.797	2.608	2.639	0.988	2.863	0.9946	0.9847	0.9415	0.37
		cruise matrix	91.02	0.798	2.607	2.192	1.189	3.444	0.9934	0.9838	0.9317	0.47
			92.01	0.793	2.397	2.379	1.008	2.918	0.9938	0.9844	0.9395	0.50
	2	3C12B	95.02	0.804	2.615	2.394	1.092	3.055	0.9932	1.0186	0.9319	0.24
	16	3T24C	96.020	0.799	2.612	2.589	1.009	3.041	1.0026	0.9537	0.9338	0.40
		expanded	98.020	0.786	2.379	2.368	1.005	3.024	1.0023	0.9549	0.9280	0.43
		cruise matrix	99.010	0.788	2.795	2.415	1.157	3.493	1.0041	0.9544	0.9364	0.40
			97.010	0.794	2.600	2.169	1.198	3.645	1.0027	0.9455	0.9320	0.38
	15	3AC	103.010	0.797	2.406	2.366	1.017	2.841	1.0026	1.0291	0.9251	0.58
		expanded	101.010	0.790	2.593	2.581	1.005	2.799	1.0035	1.0326	0.9351	0.51
		cruise matrix	100.020	0.799	2.821	2.406	1.173	3.272	1.0041	1.0322	0.9347	0.32
			102.010	0.796	2.595	2.184	1.188	3.342	1.0031	1.0233	0.9234	0.50
	13	3T24C fan rotated 22.5 degrees	104.030	0.799	2.612	2.430	1.075	3.247	1.0032	0.9524	0.9290	0.38

FIGURE 17. TEST CONDITIONS AND MAJOR TEST RESULTS, (Sheet 4 of 4)

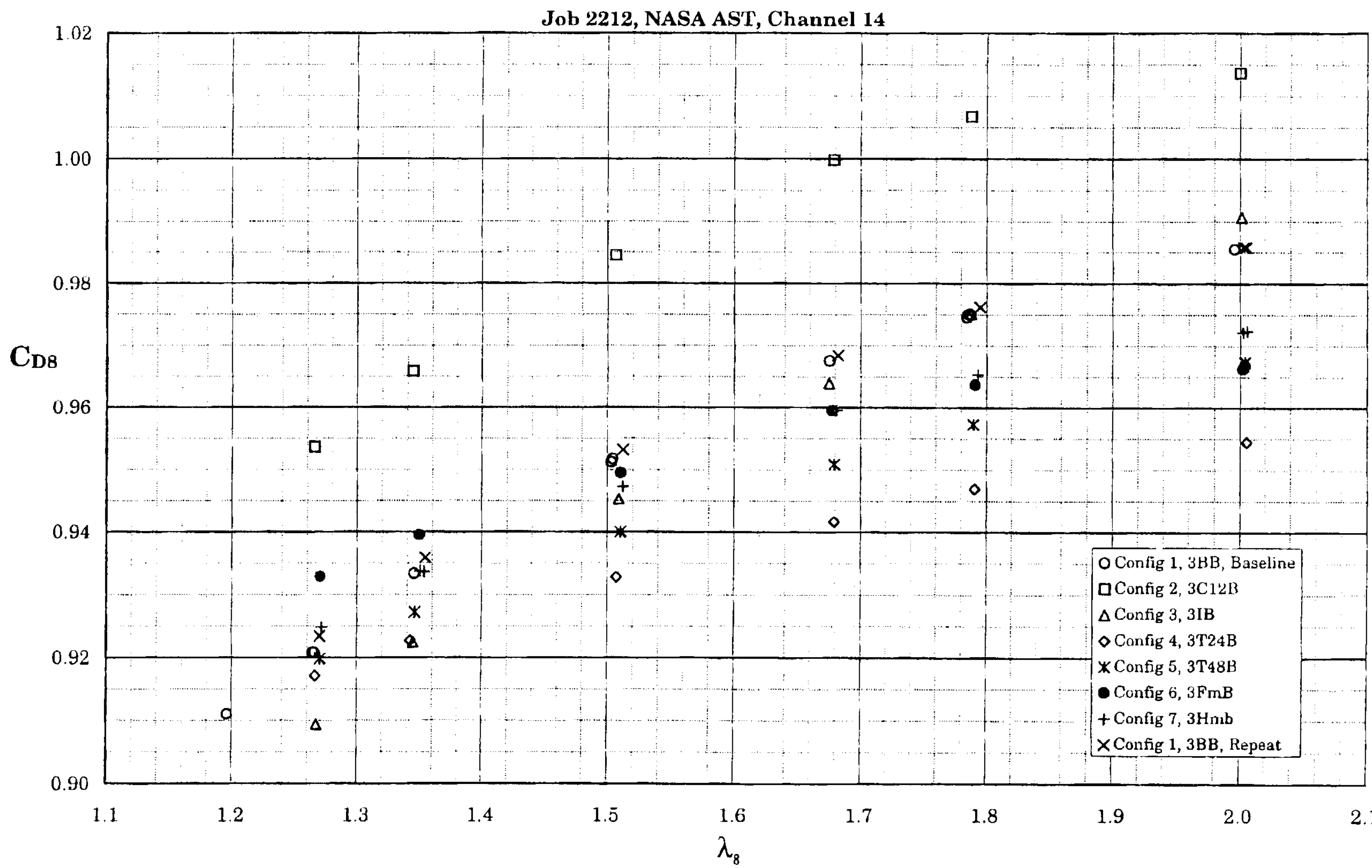


FIGURE 18. CHANNEL 14 STATIC TEST, CORE NOZZLE DISCHARGE COEFFICIENTS

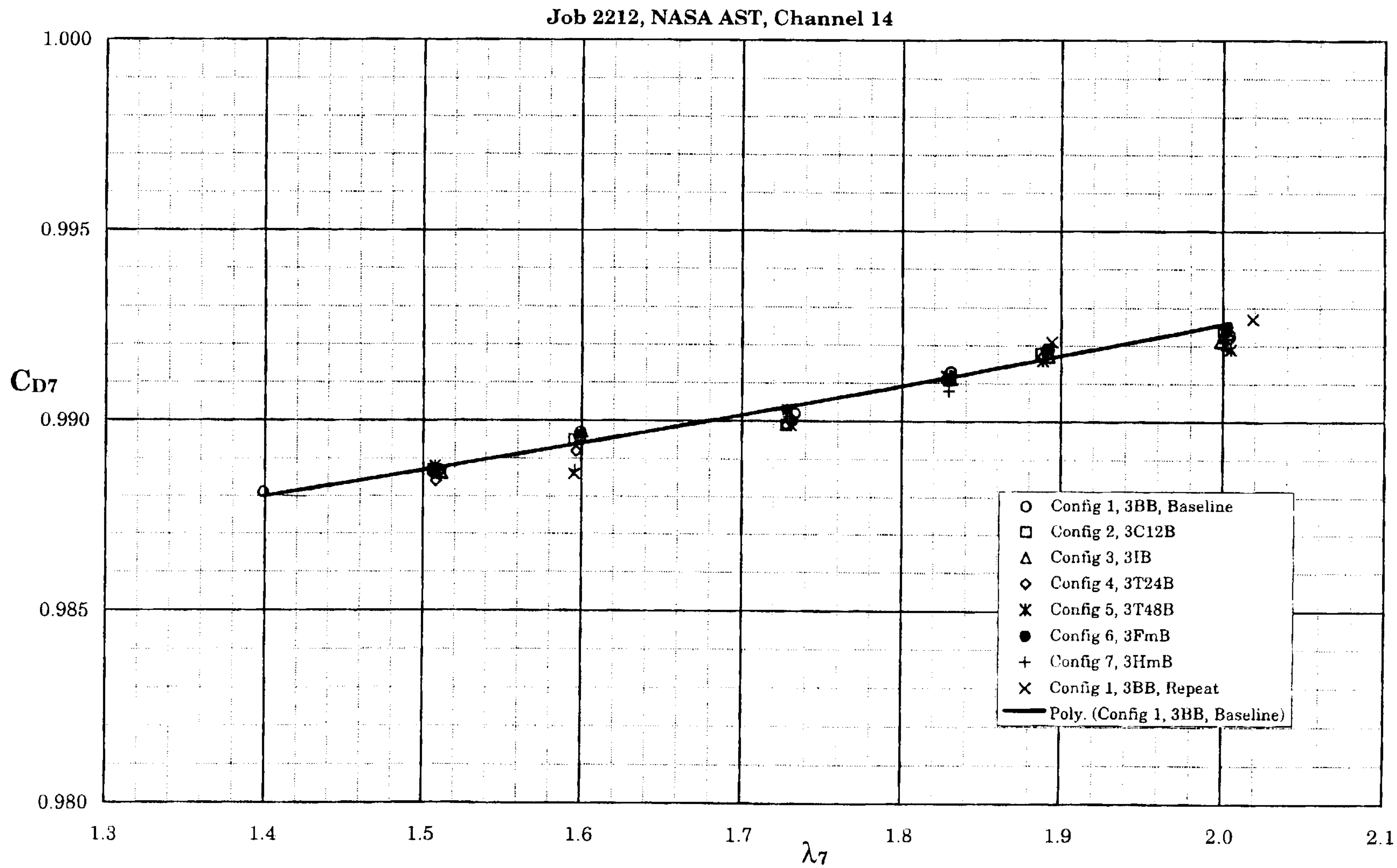


FIGURE 19. CHANNEL 14 STATIC TEST, FAN NOZZLE DISCHARGE COEFFICIENTS

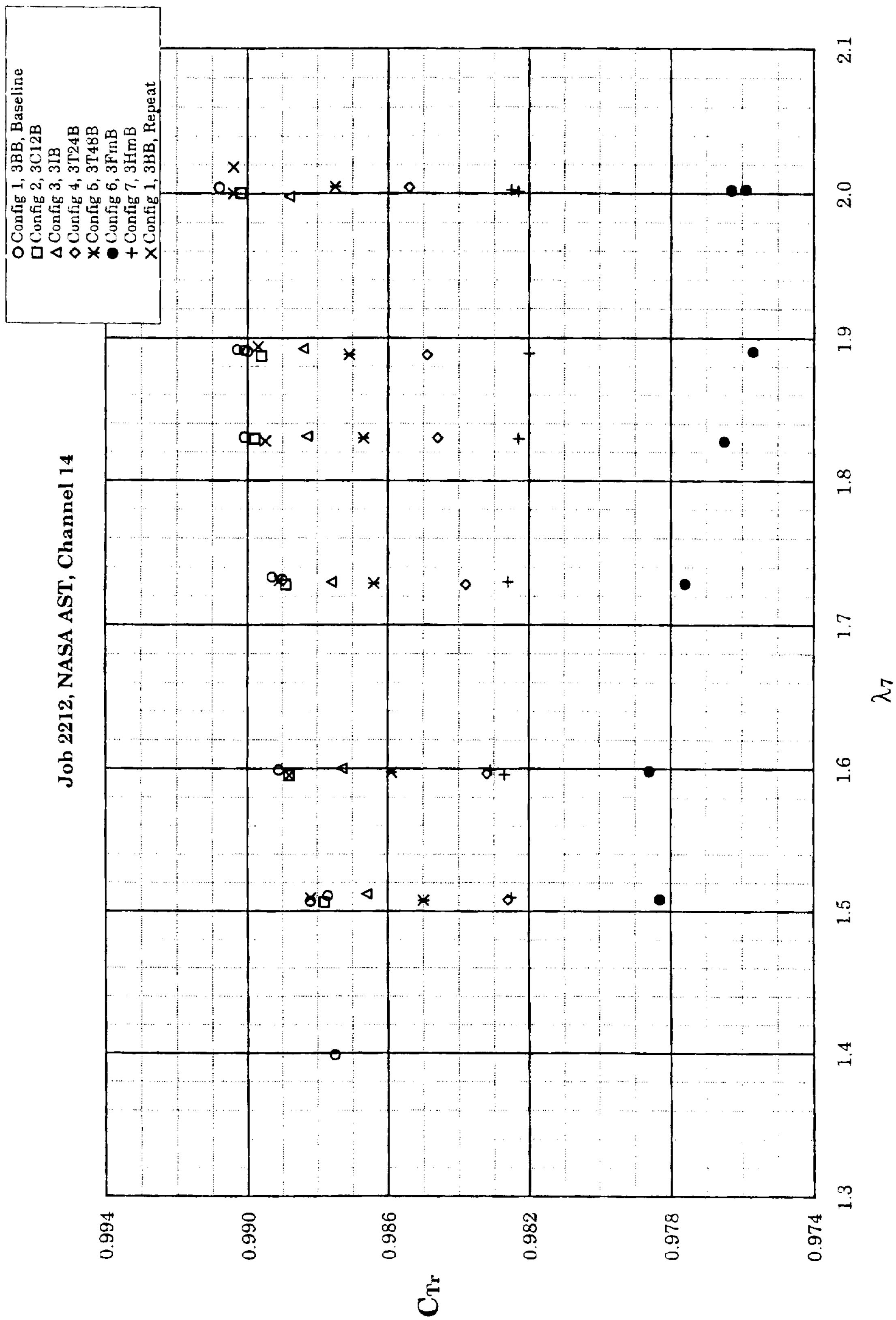


FIGURE 20. CHANNEL 14 STATIC TEST, THRUST COEFFICIENTS

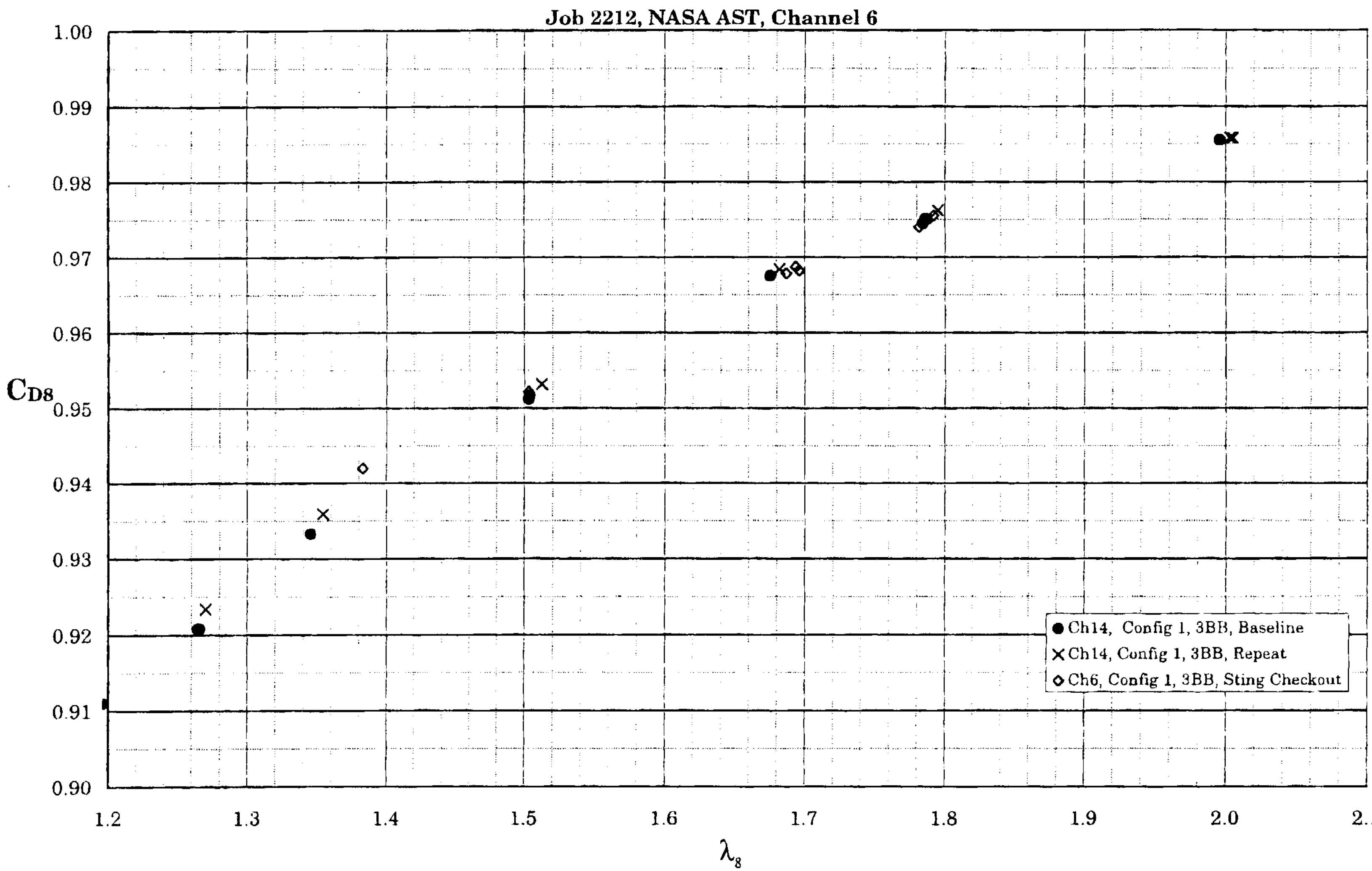


FIGURE 21. CHANNEL 6 STING CHECKOUT, CORE NOZZLE DISCHARGE COEFFICIENTS

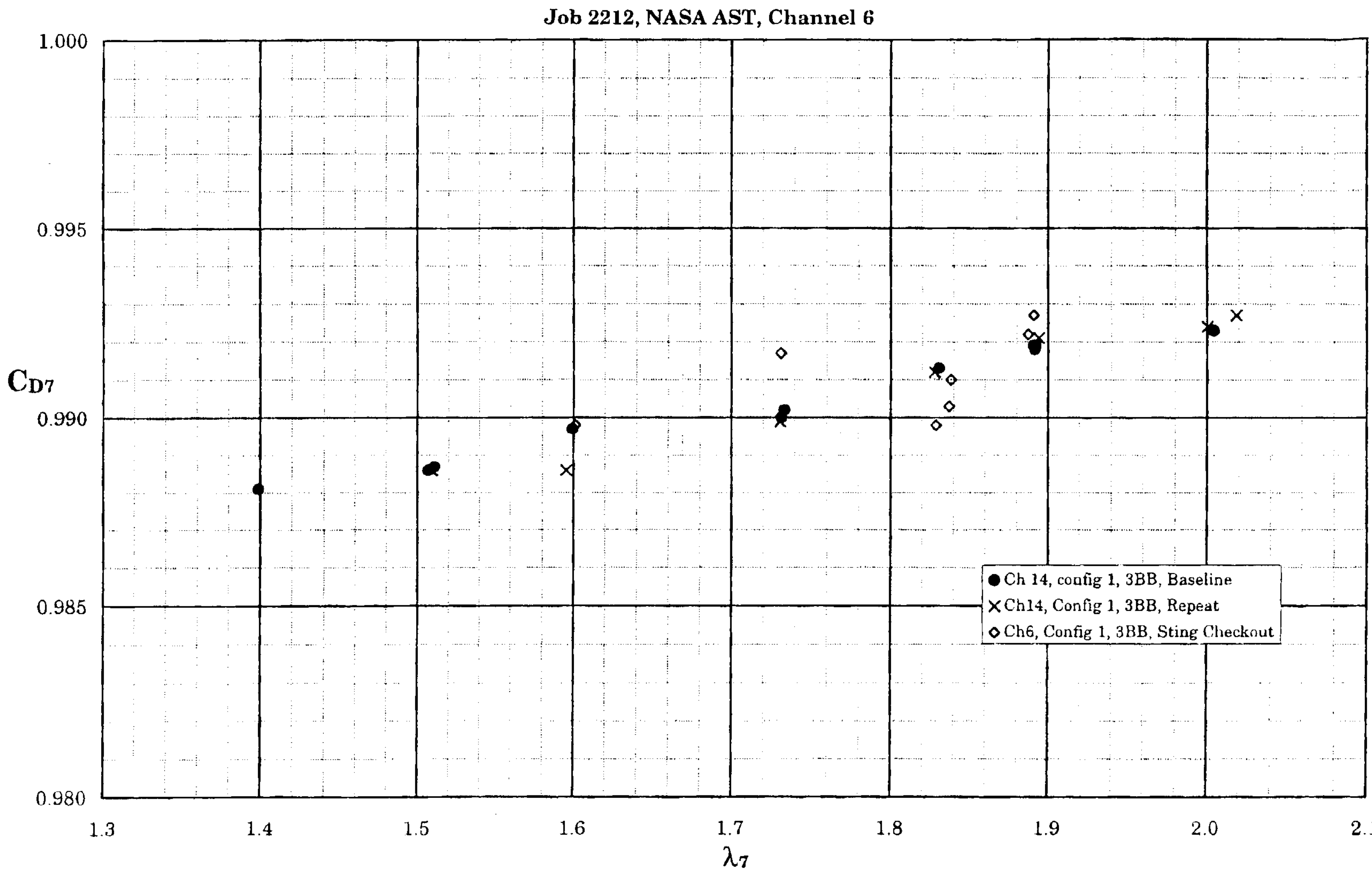


FIGURE 22. CHANNEL 6 STING CHECKOUT, FAN NOZZLE DISCHARGE COEFFICIENTS

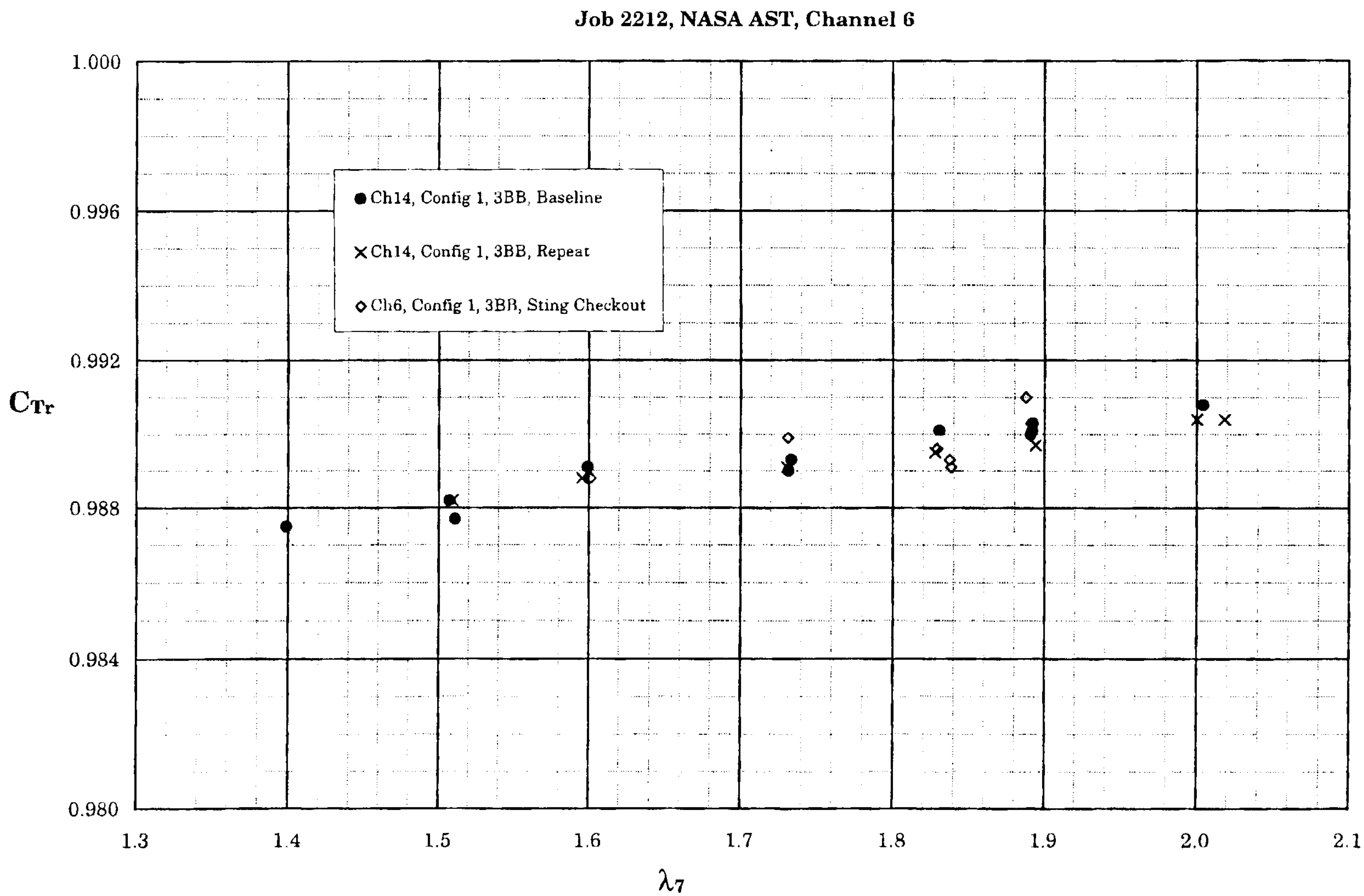


FIGURE 23. CHANNEL 6 STING CHECKOUT, THRUST COEFFICIENTS

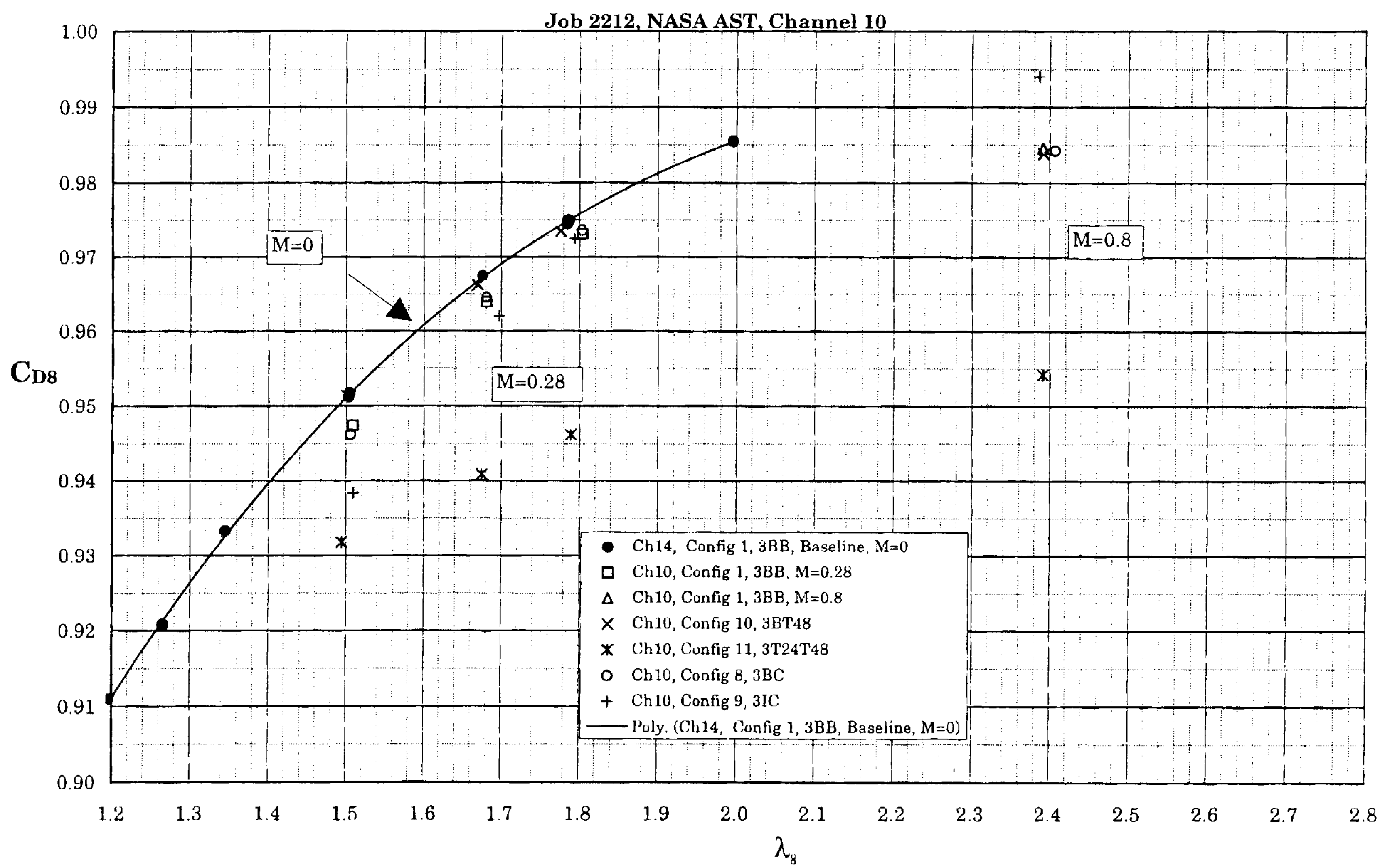


FIGURE 24a. CHANNEL 10 WIND TUNNEL, CORE NOZZLE DISCHARGE COEFFICIENTS

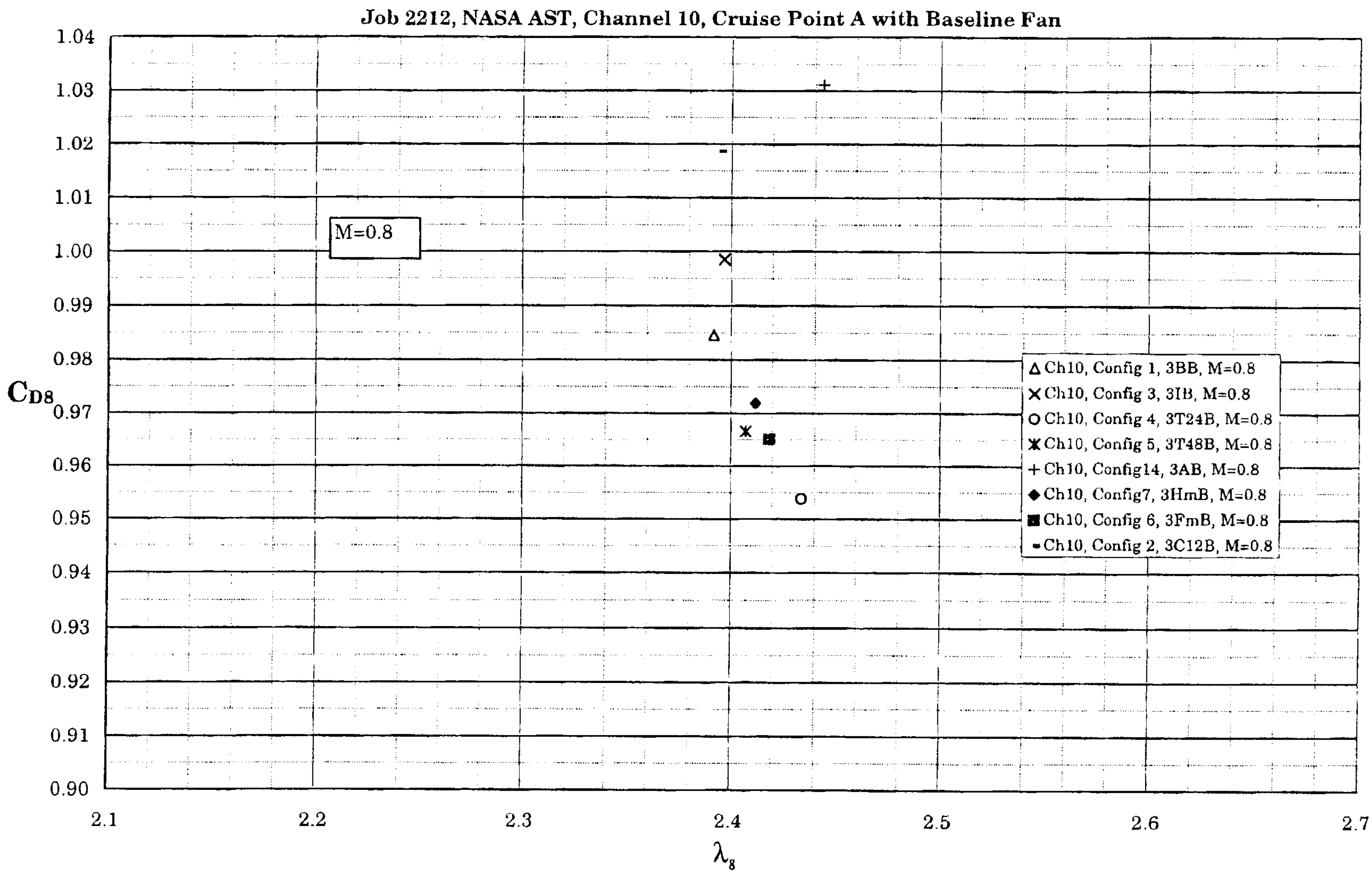


FIGURE 24b. CHANNEL 10 WIND TUNNEL, CORE NOZZLE DISCHARGE COEFFICIENTS, CRUISE POINT A WITH BASELINE FAN

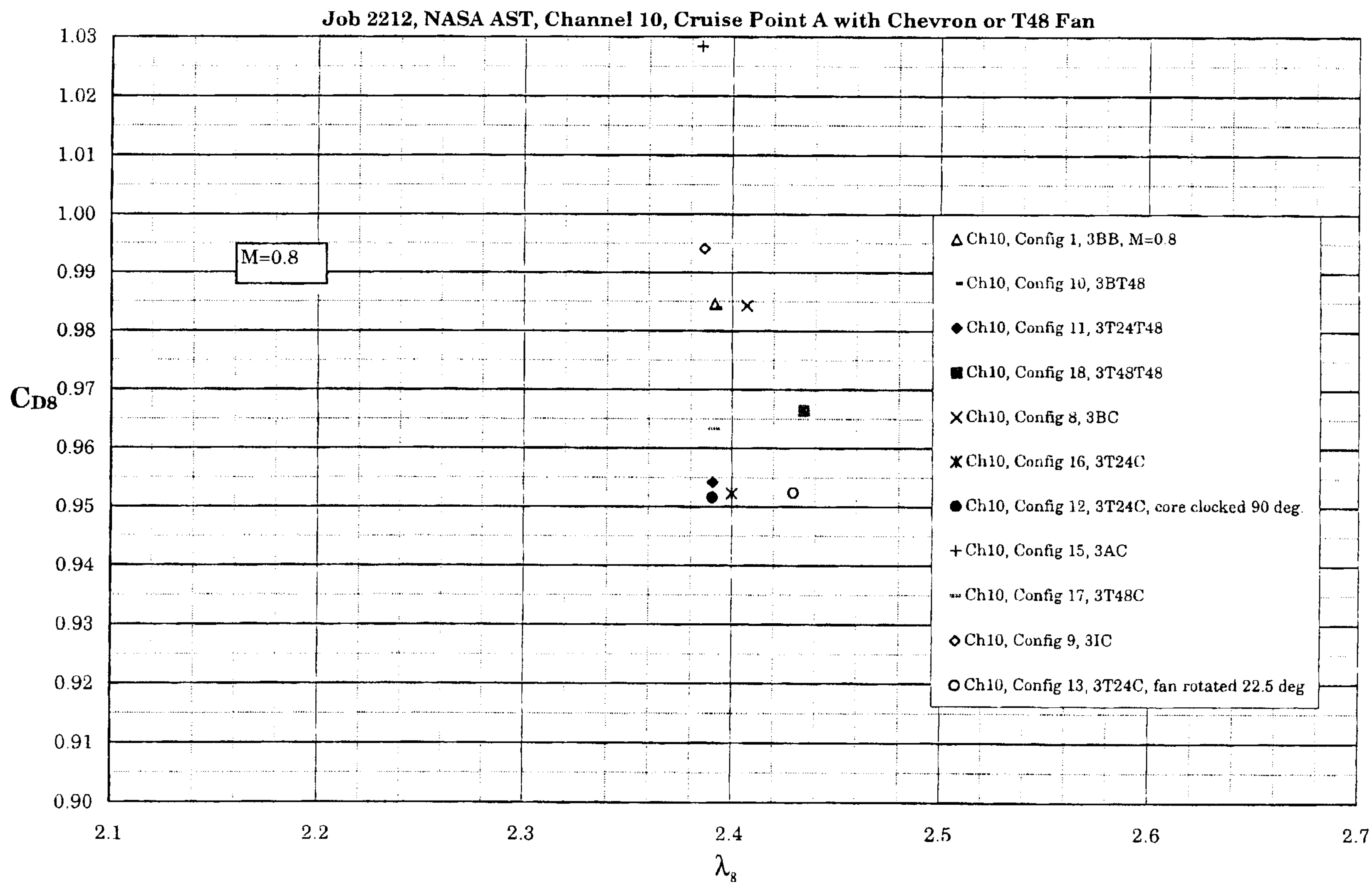


FIGURE 24c. CHANNEL 10 WIND TUNNEL, CORE NOZZLE DISCHARGE COEFFICIENTS, CRUISE POINT A WITH CHEVRON OR T48 FAN

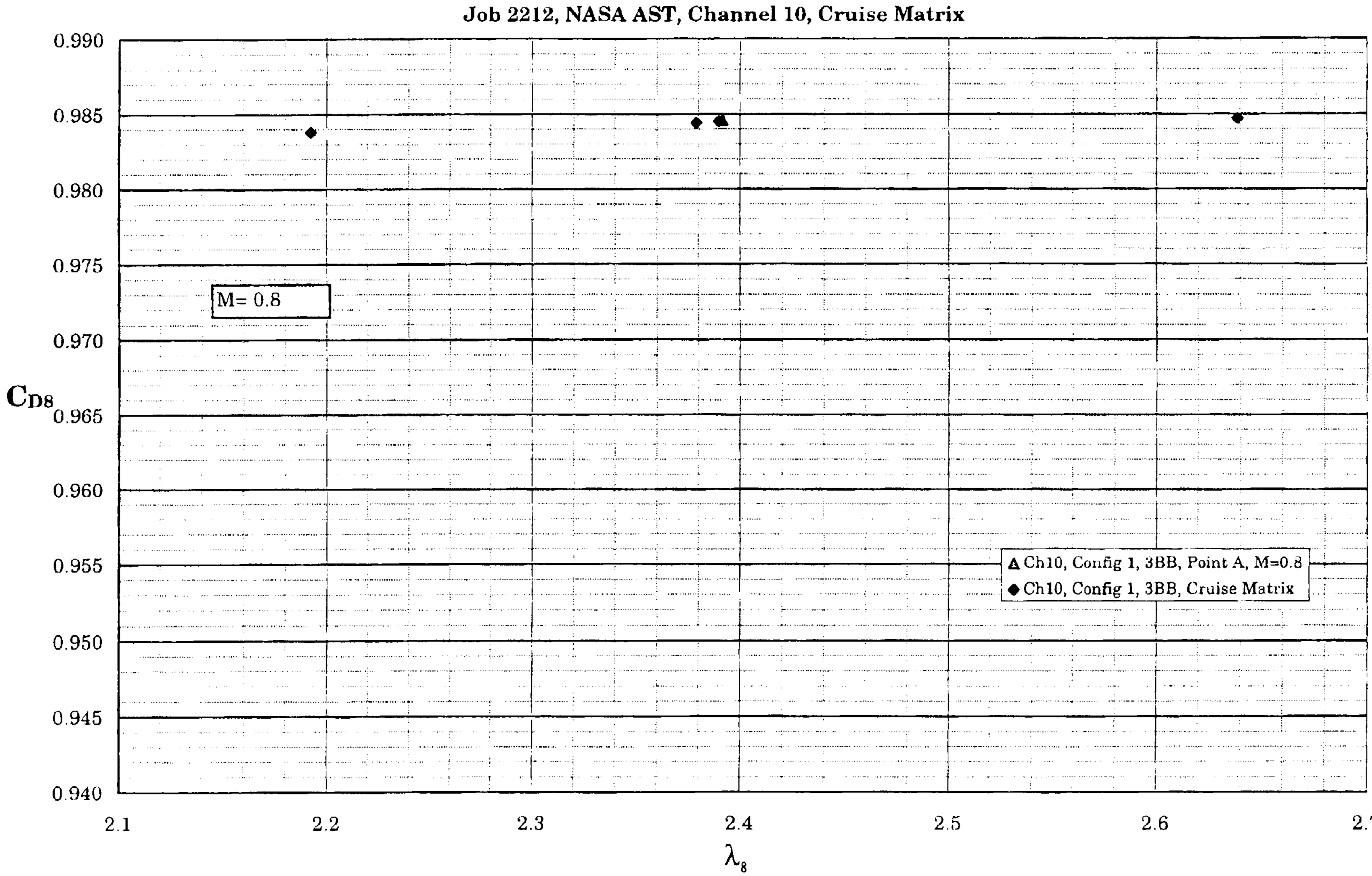


FIGURE 24d. CHANNEL 10 WIND TUNNEL, CORE NOZZLE DISCHARGE COEFFICIENTS, CRUISE MATRIX FOR CONFIGURATION 1 (3BB)

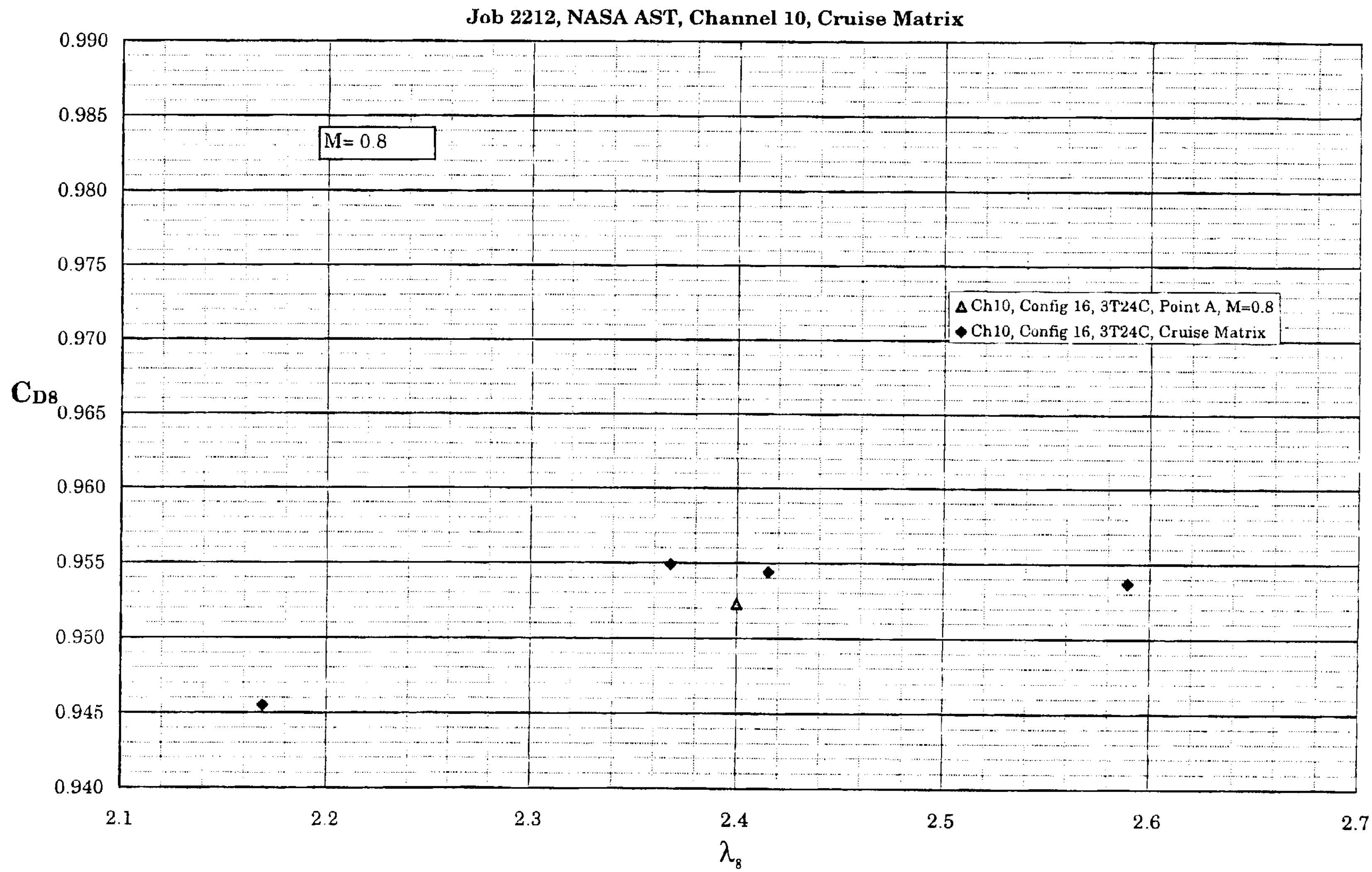


FIGURE 24e. CHANNEL 10 WIND TUNNEL, CORE NOZZLE DISCHARGE COEFFICIENTS, CRUISE MATRIX FOR CONFIGURATION 16 (3T24C)

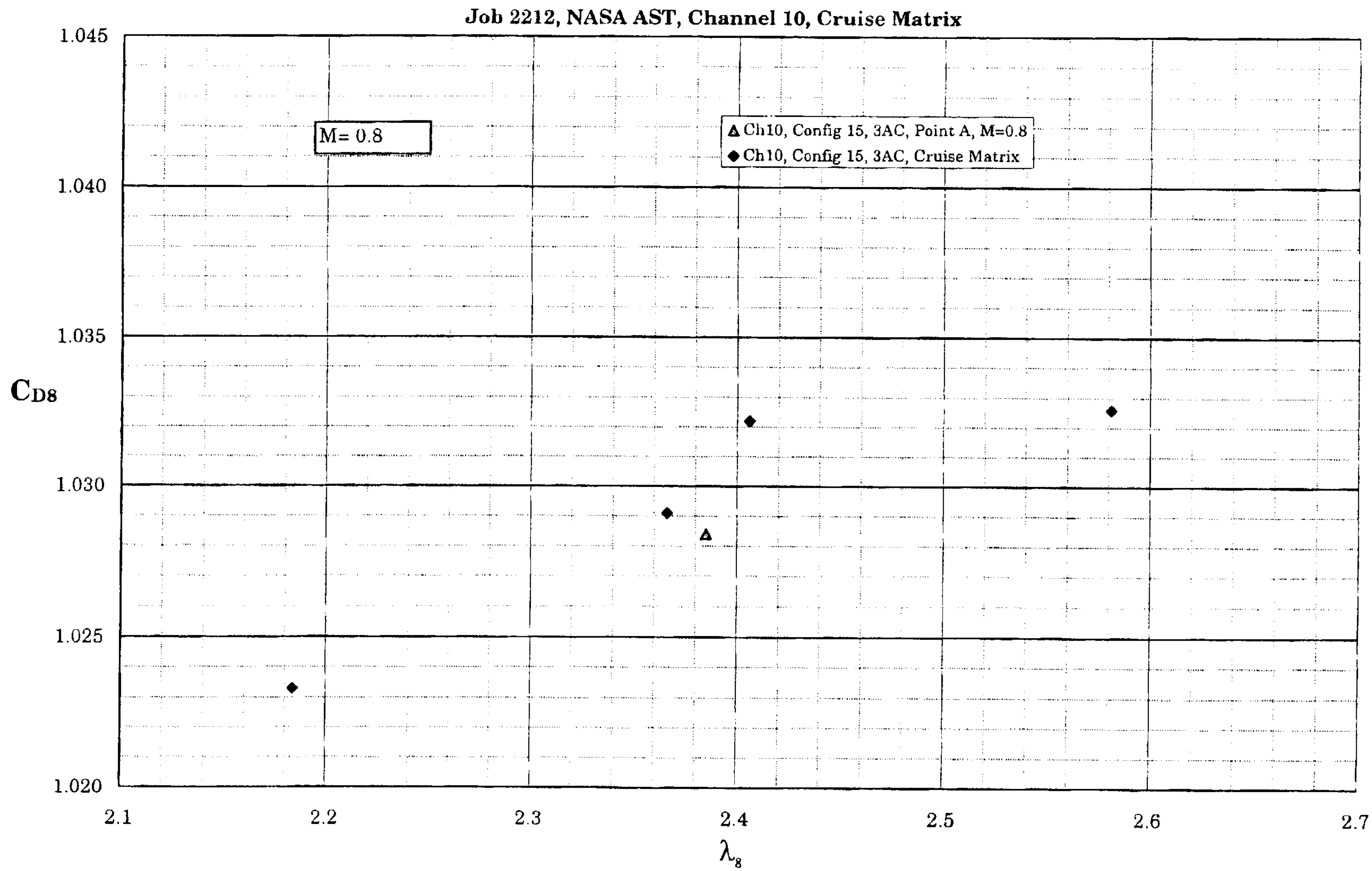


FIGURE 24f. CHANNEL 10 WIND TUNNEL, CORE NOZZLE DISCHARGE COEFFICIENTS, CRUISE MATRIX FOR CONFIGURATION 15 (3AC)

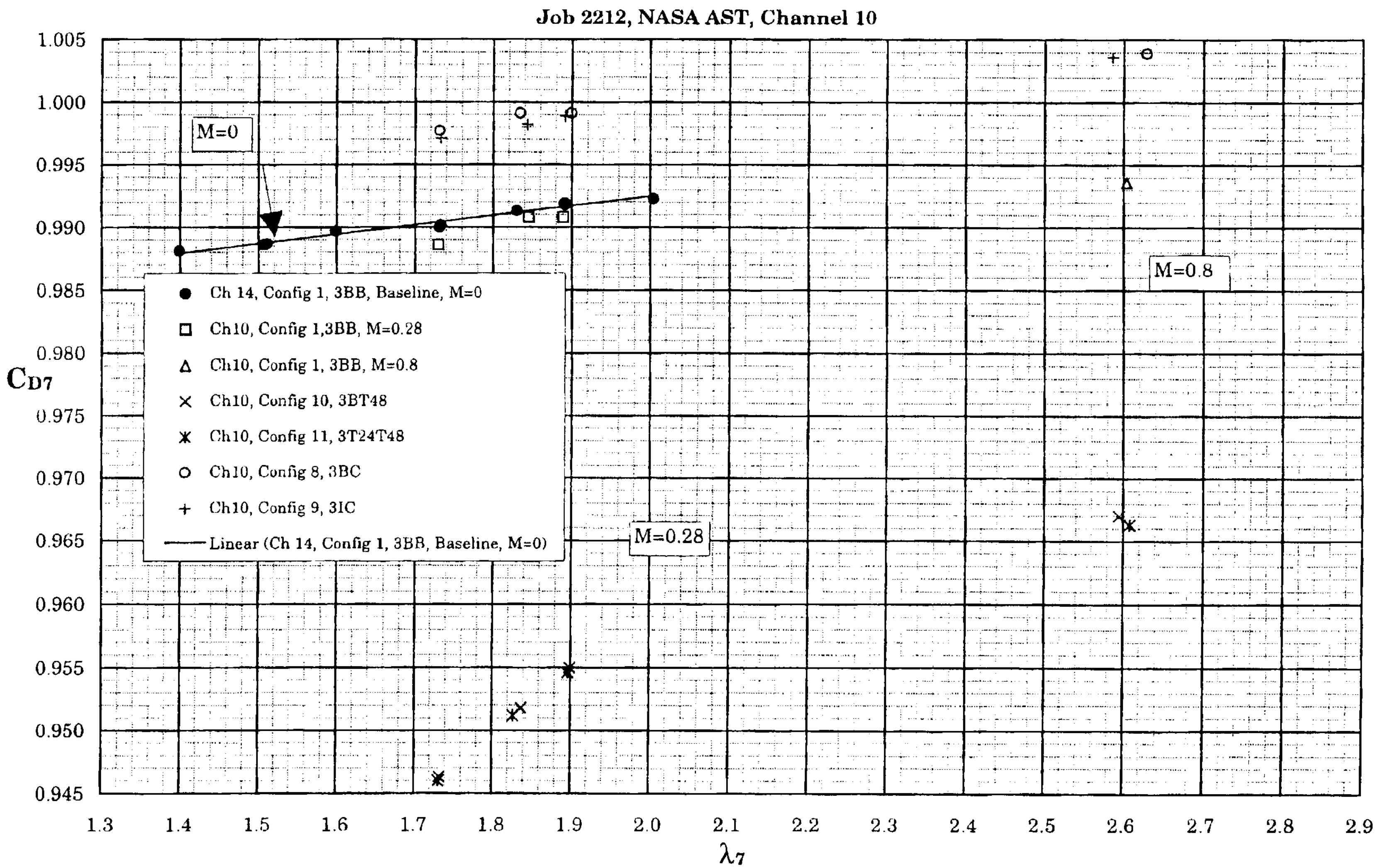


FIGURE 25a. CHANNEL 10 WIND TUNNEL, FAN NOZZLE DISCHARGE COEFFICIENTS

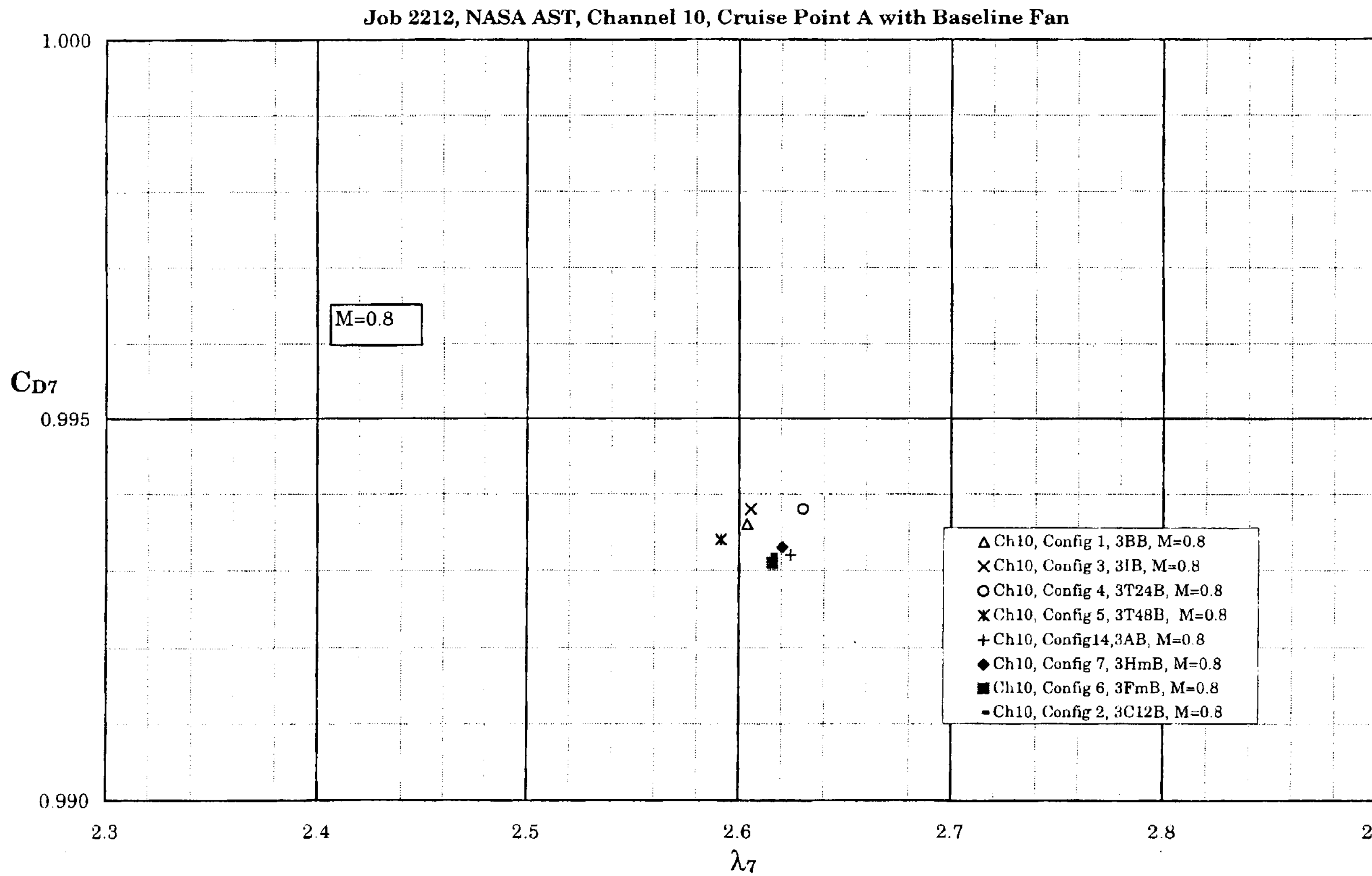


FIGURE 25b. CHANNEL 10 WIND TUNNEL, FAN NOZZLE DISCHARGE COEFFICIENTS, CRUISE POINT A WITH BASELINE FAN

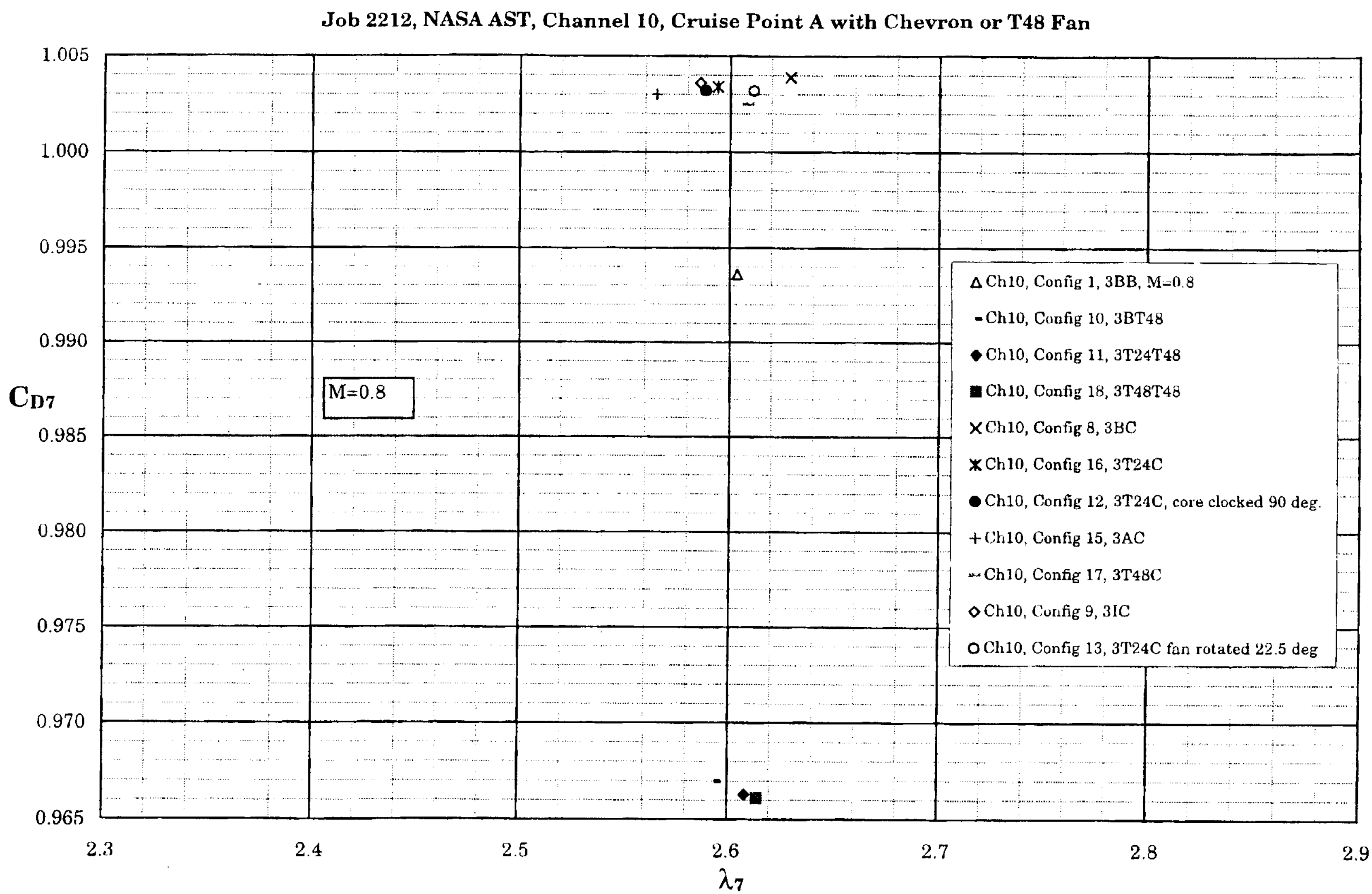


FIGURE 25c. CHANNEL 10 WIND TUNNEL, FAN NOZZLE DISCHARGE COEFFICIENTS, CRUISE POINT A WITH CHEVRON OR T48 FAN

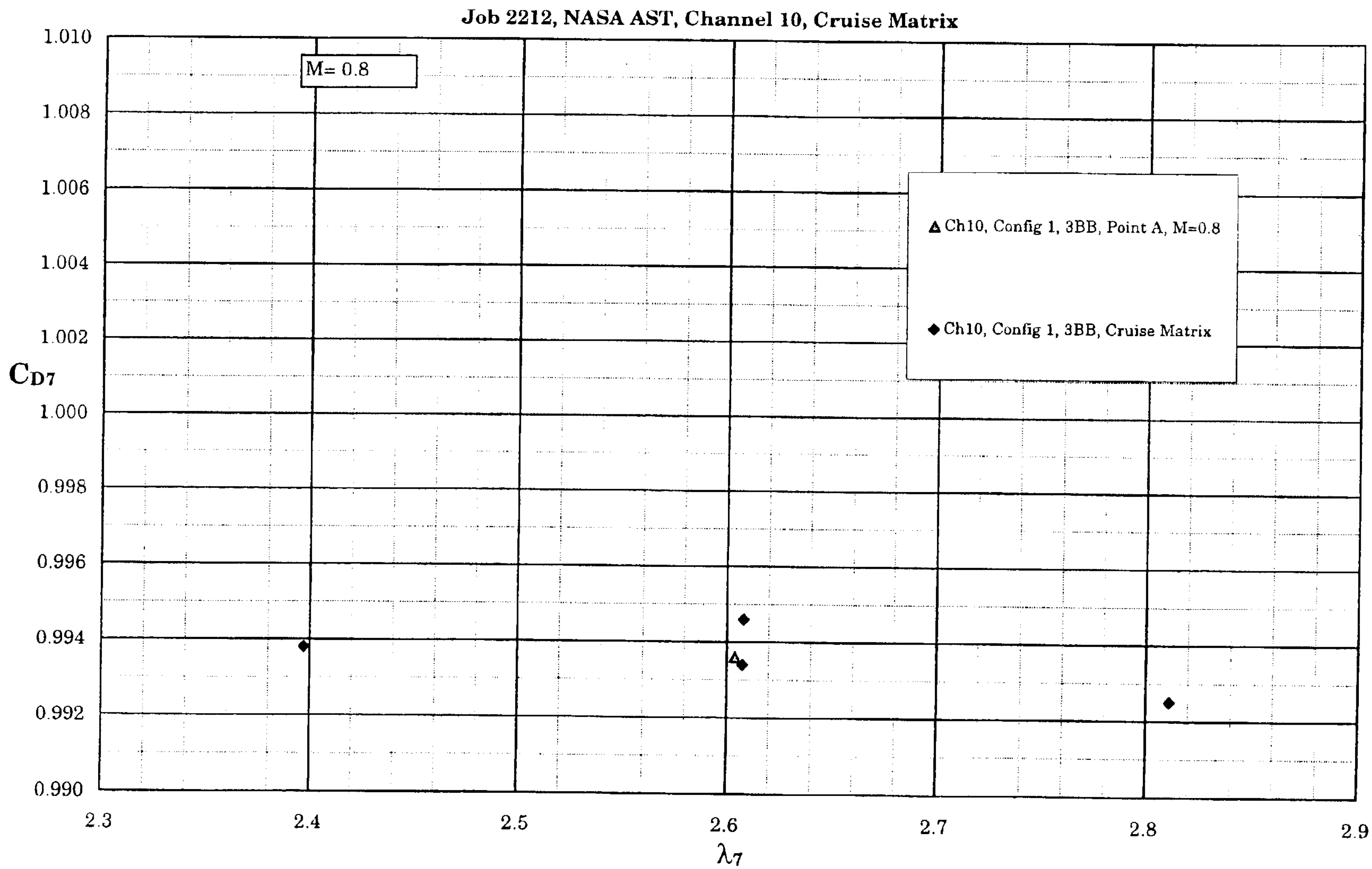


FIGURE 25d. CHANNEL 10 WIND TUNNEL, FAN NOZZLE DISCHARGE COEFFICIENTS, CRUISE MATRIX FOR CONFIGURATION 1 (3BB)

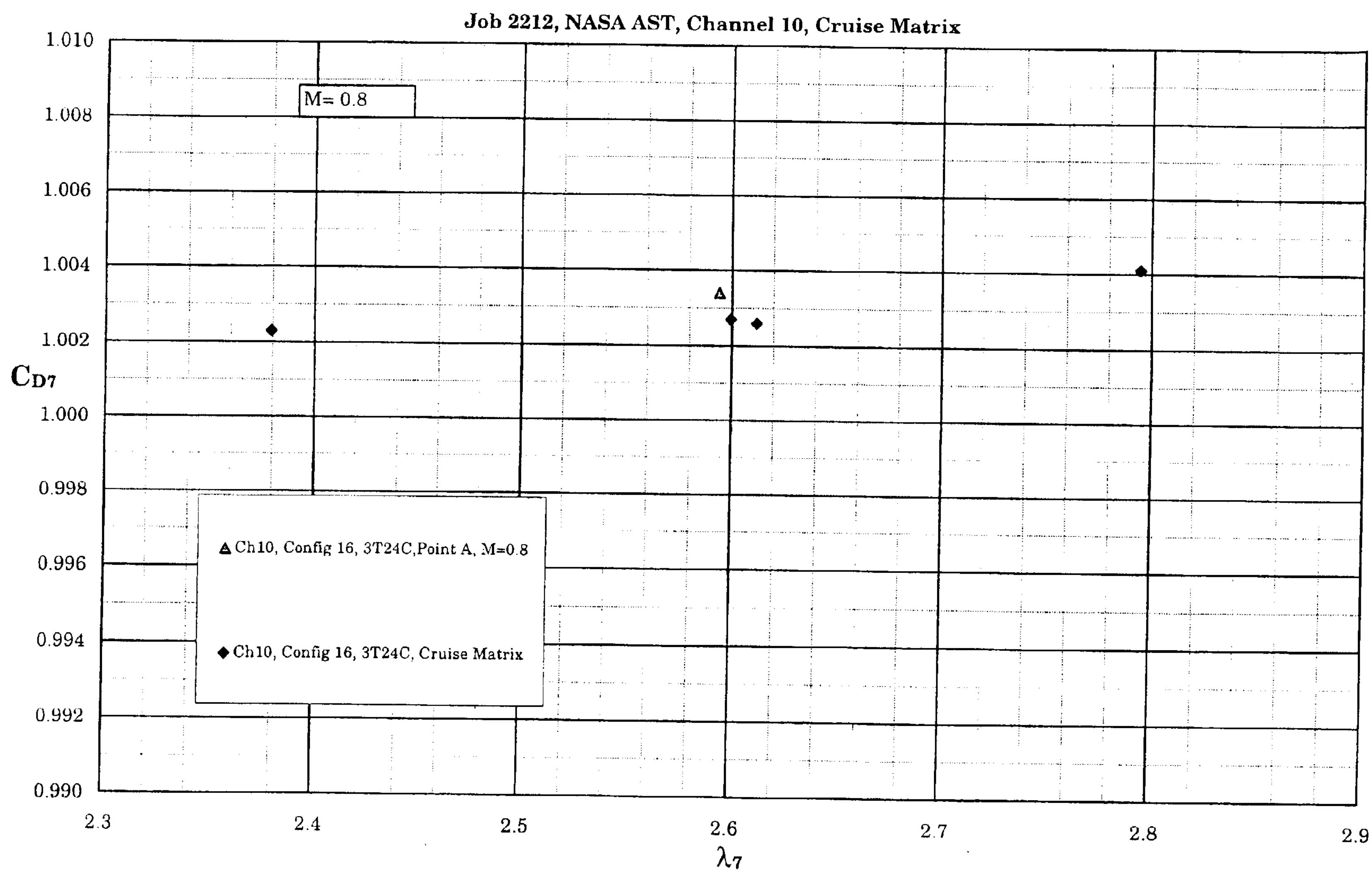


FIGURE 25e. CHANNEL 10 WIND TUNNEL, FAN NOZZLE DISCHARGE COEFFICIENTS, CONFIGURATION 16 (3T24C)

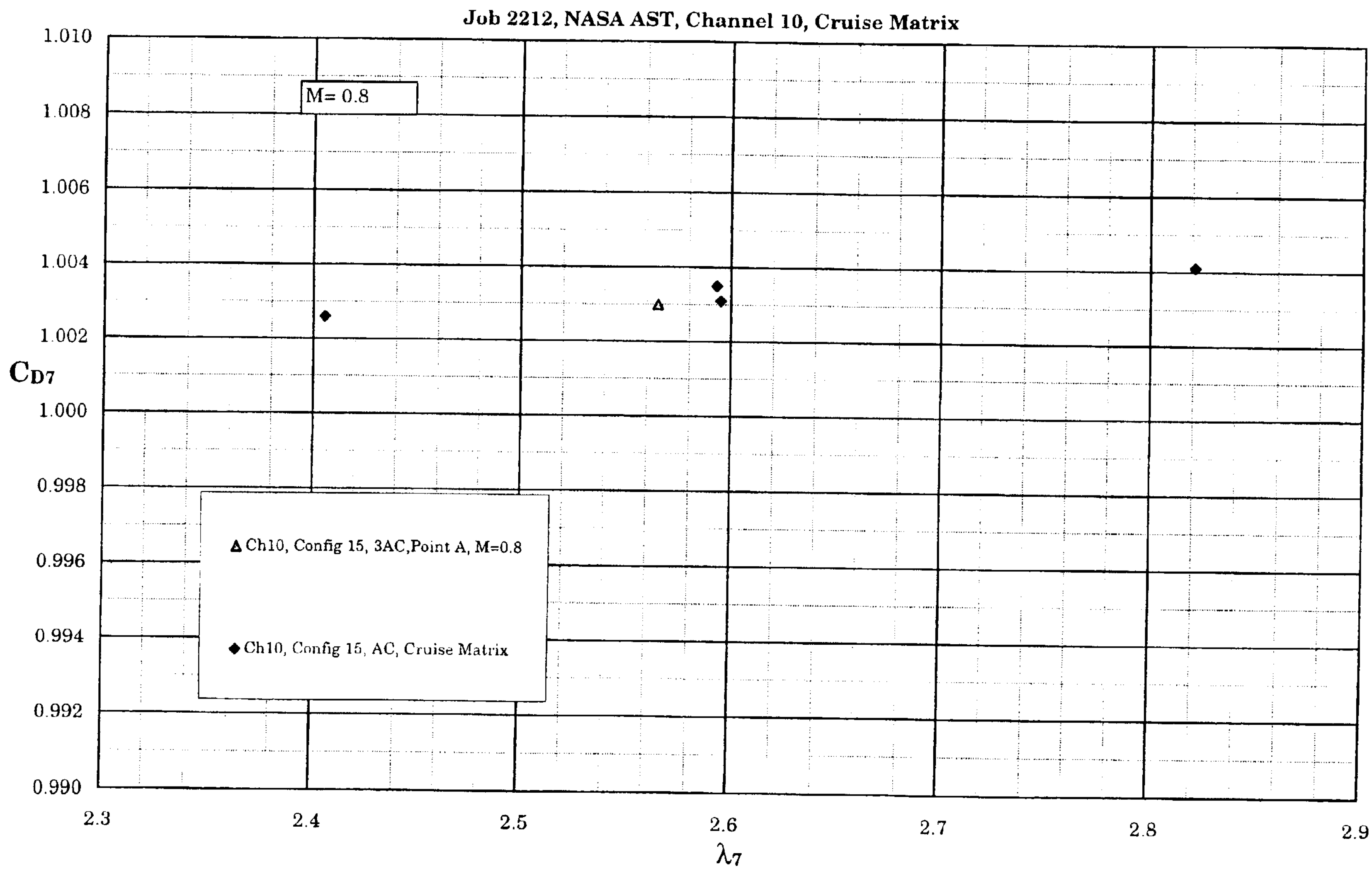


FIGURE 25f. CHANNEL 10 WIND TUNNEL, FAN NOZZLE DISCHARGE COEFFICIENTS, CRUISE MATRIX FOR CONFIGURATION 15 (3AC)

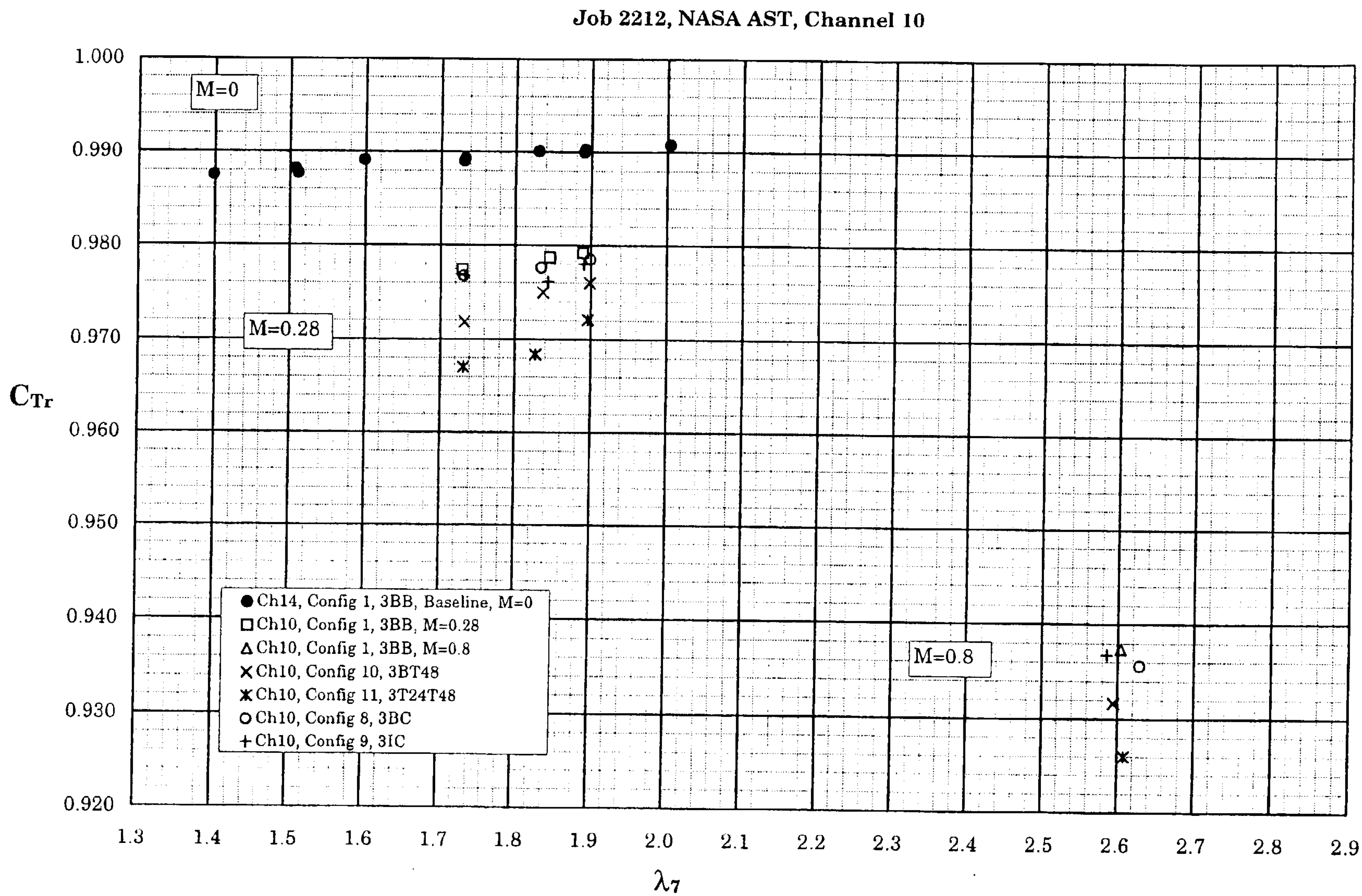


FIGURE 26a. CHANNEL 10 WIND TUNNEL, THRUST COEFFICIENTS

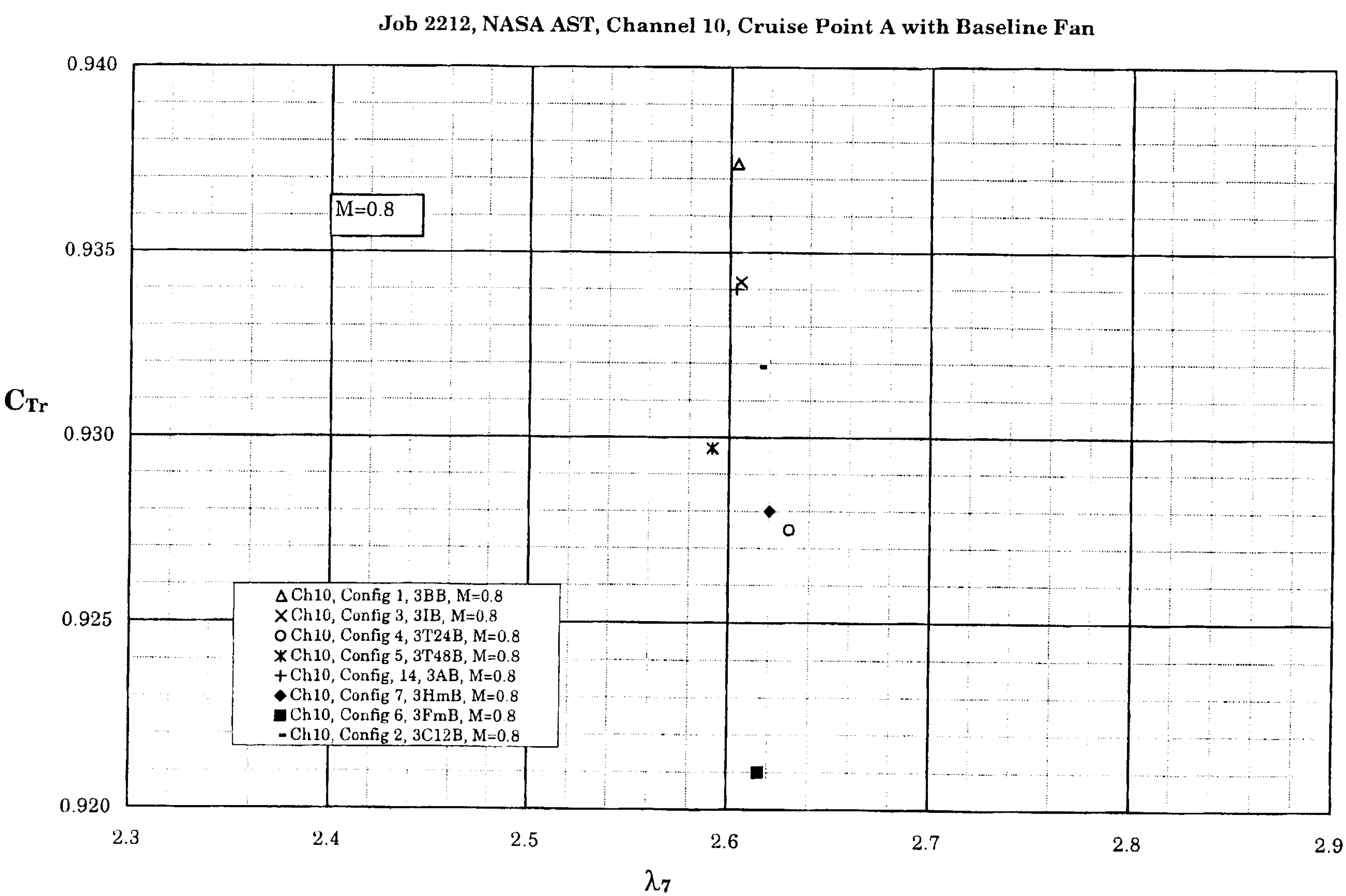


FIGURE 26b. CHANNEL 10 WIND TUNNEL, THRUST COEFFICIENTS, CRUISE POINT A WITH BASELINE FAN

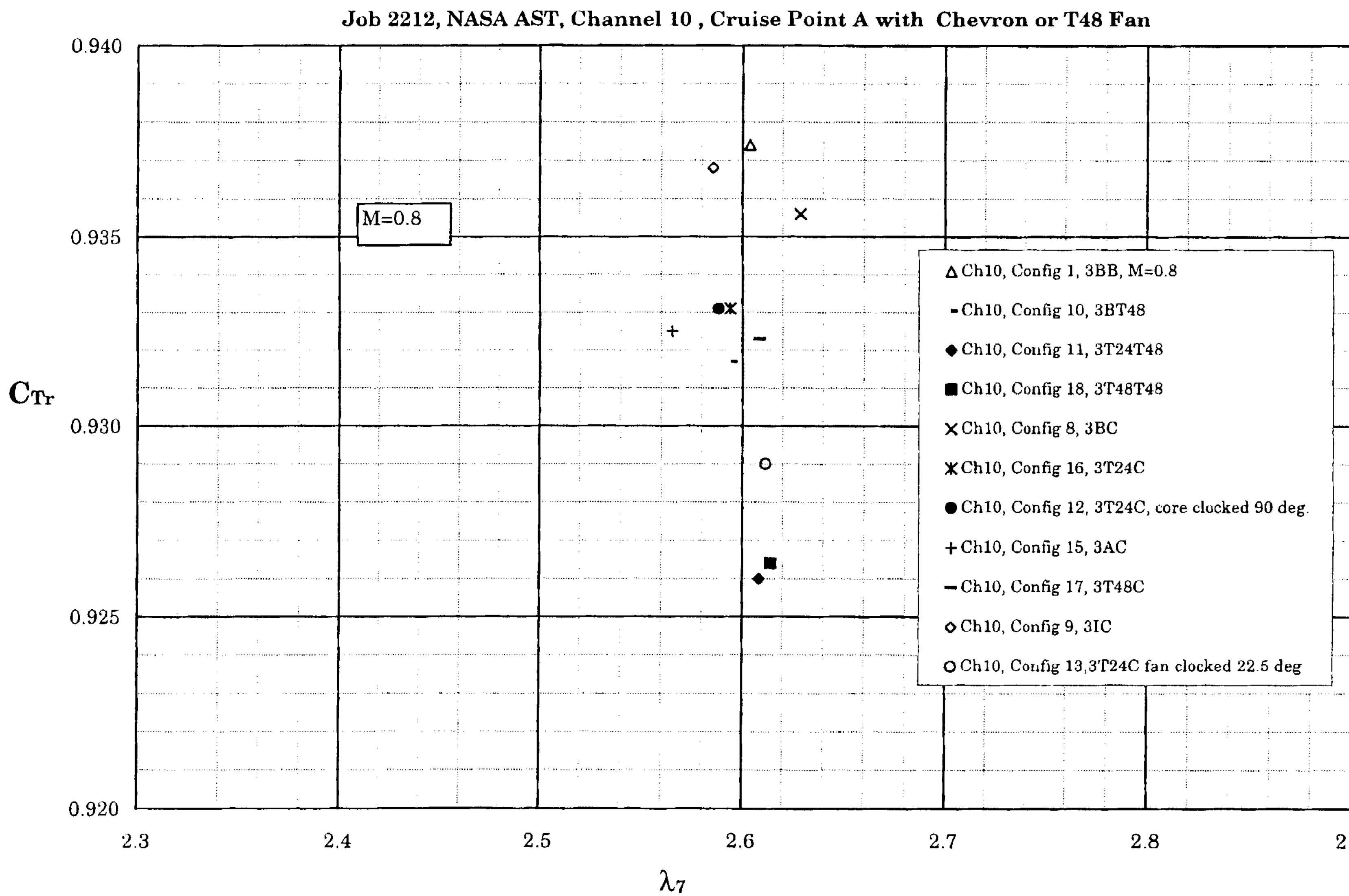


FIGURE 26c. CHANNEL 10 WIND TUNNEL, THRUST COEFFICIENTS, CRUISE POINT A WITH CHEVRON OR T48 FAN

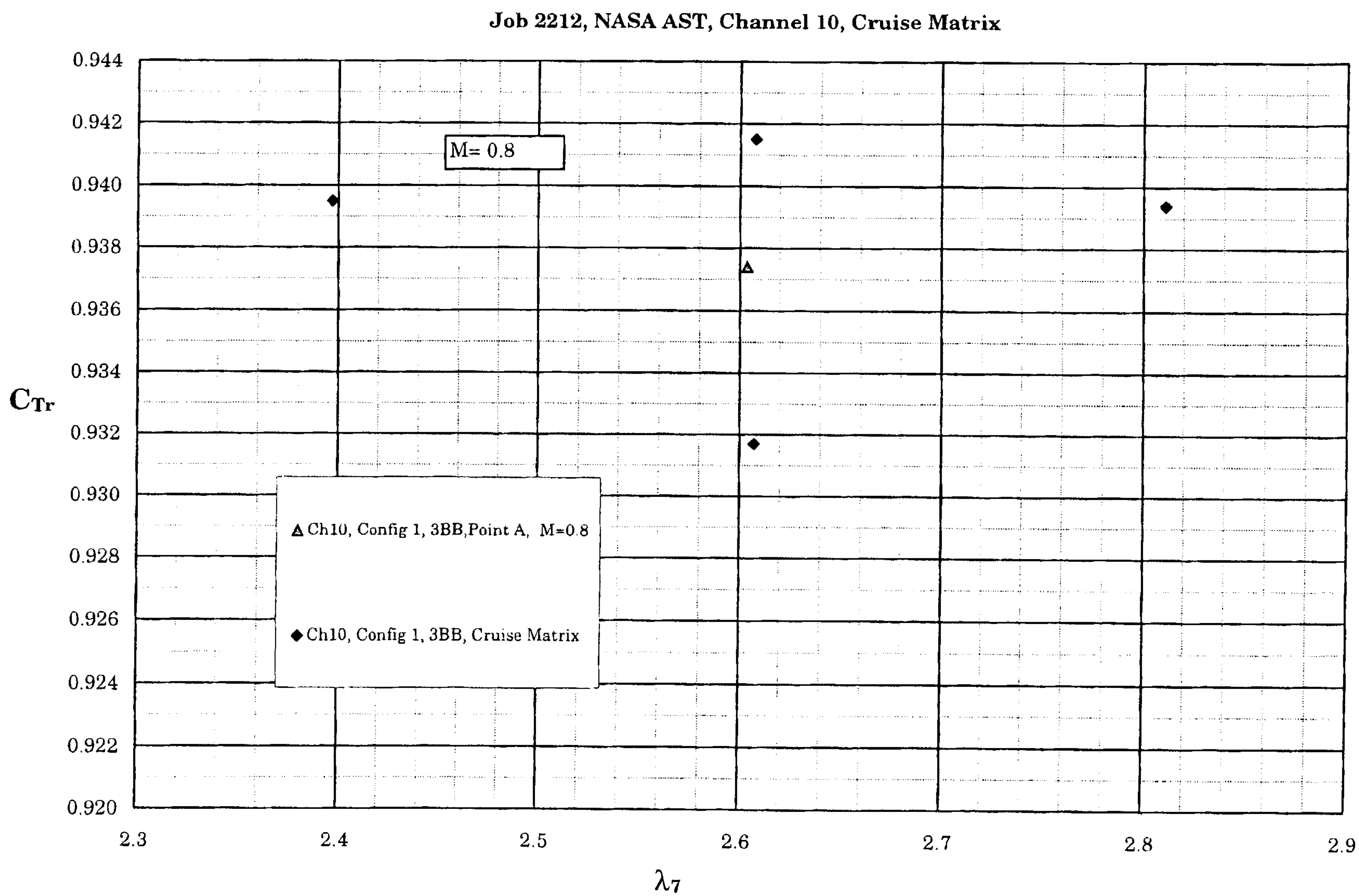


FIGURE 26d. CHANNEL 10 WIND TUNNEL, THRUST COEFFICIENTS, CRUISE MATRIX FOR CONFIGURATION 1 (3BB)

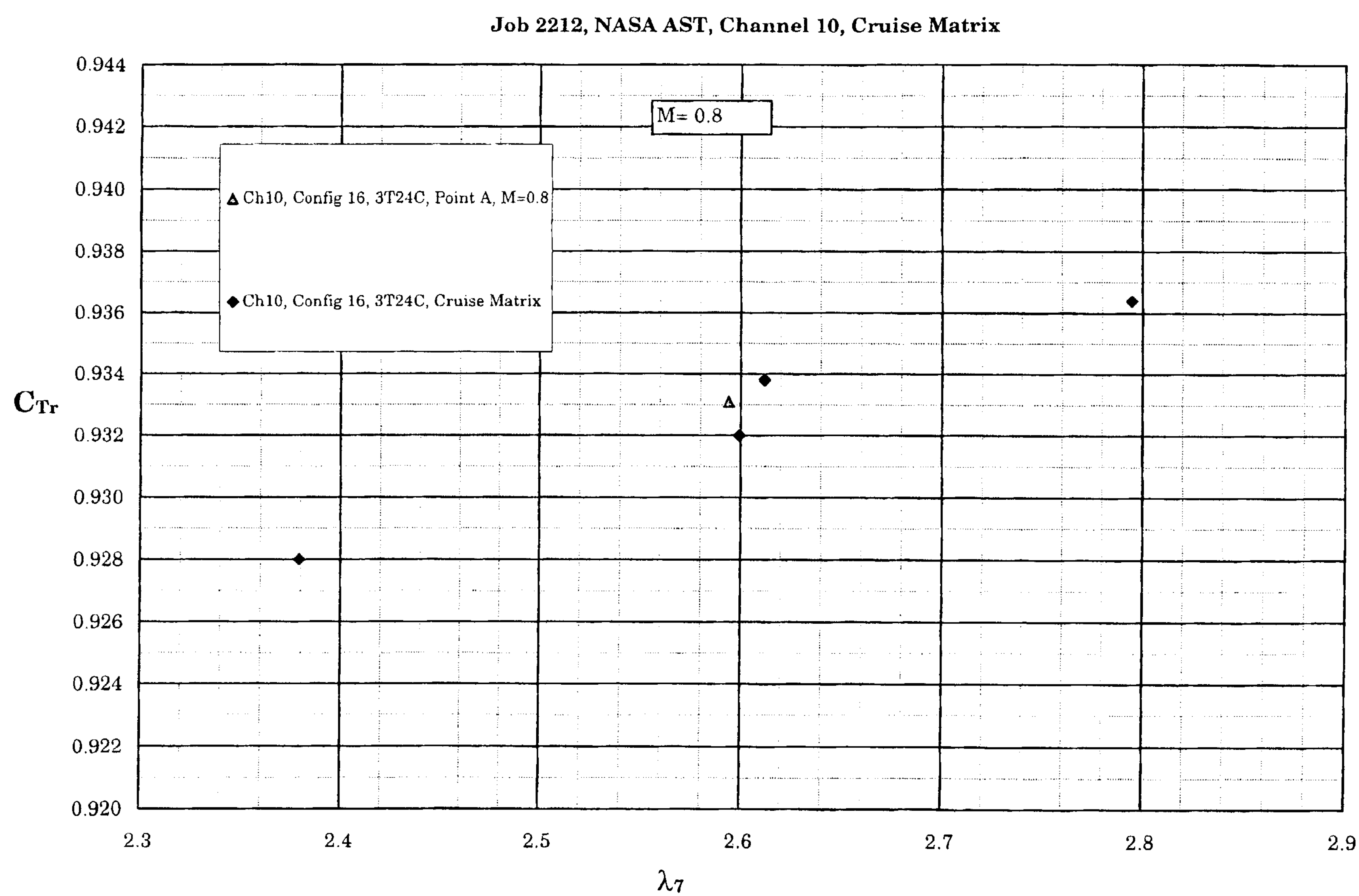


FIGURE 26e. CHANNEL 10 WIND TUNNEL, THRUST COEFFICIENTS, CRUISE MATRIX FOR CONFIGURATION 16 (3T24C)

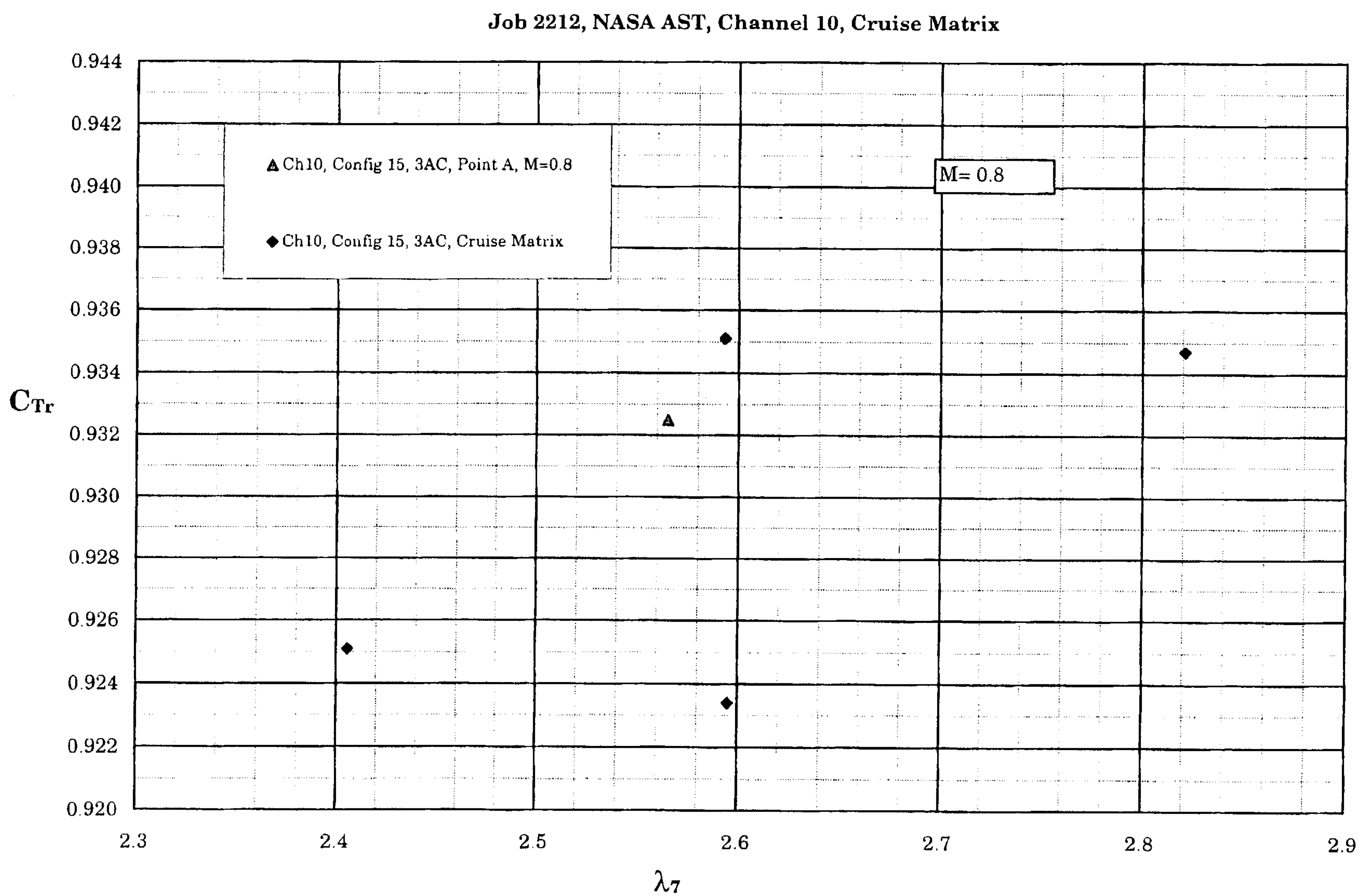
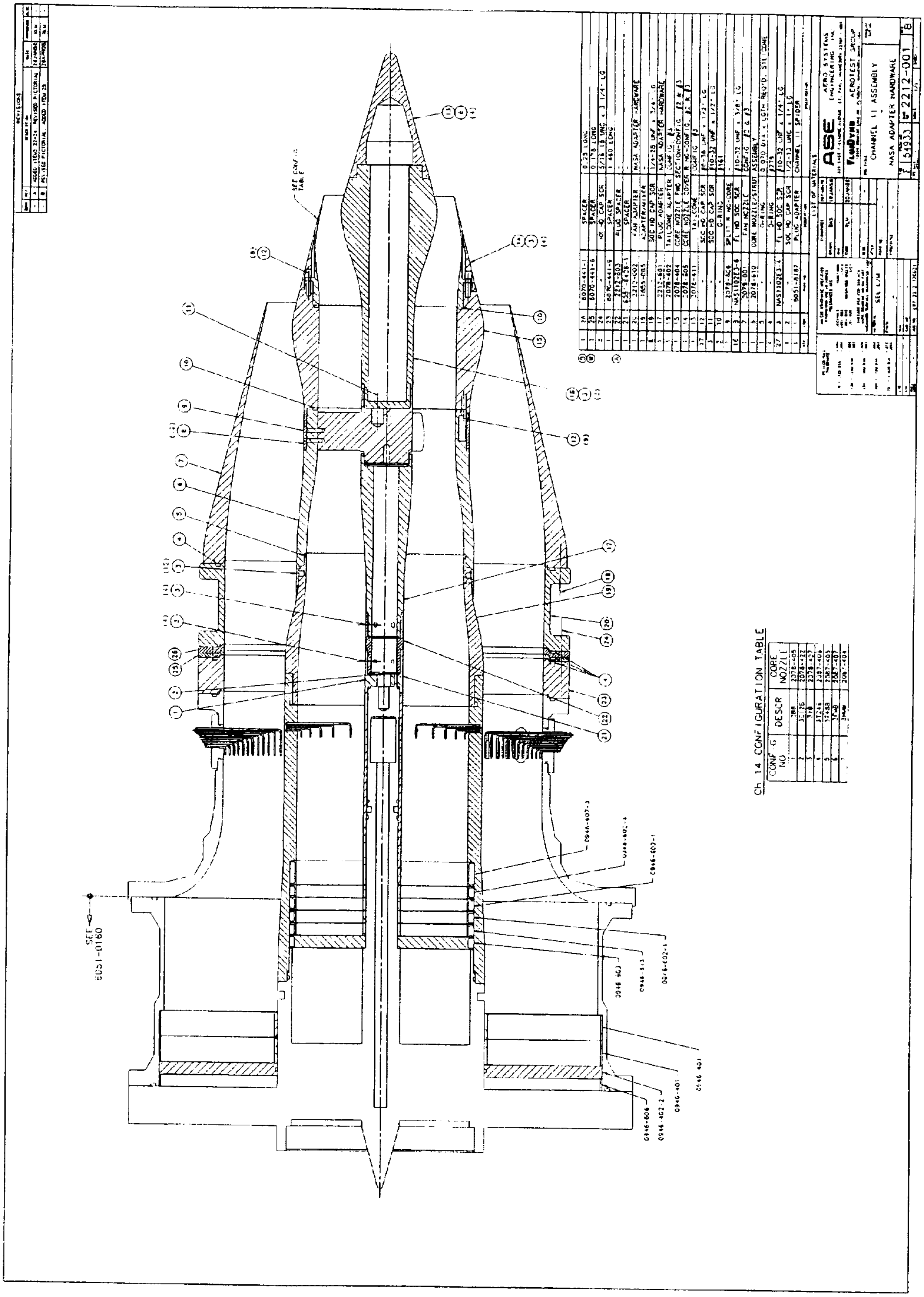
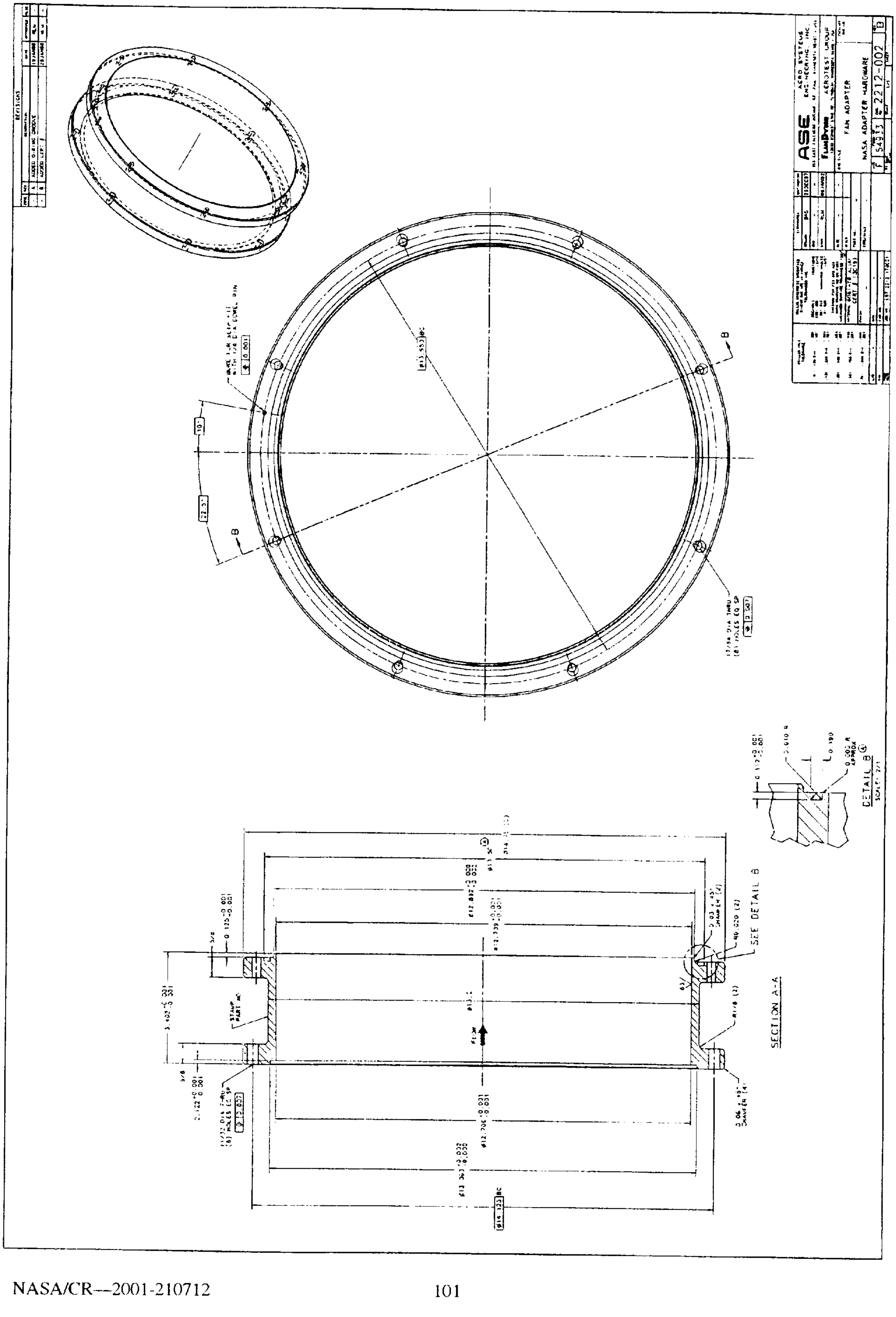
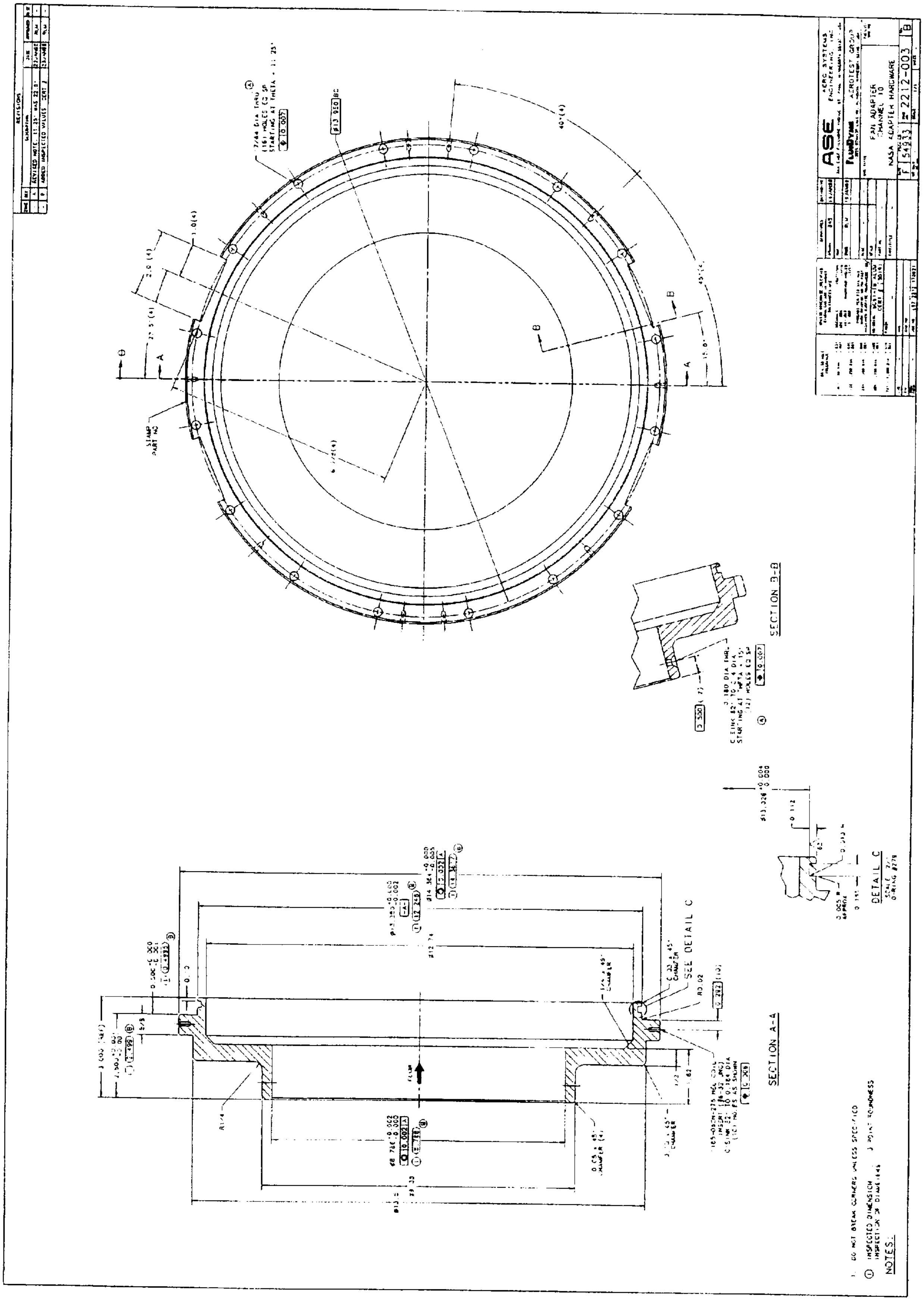


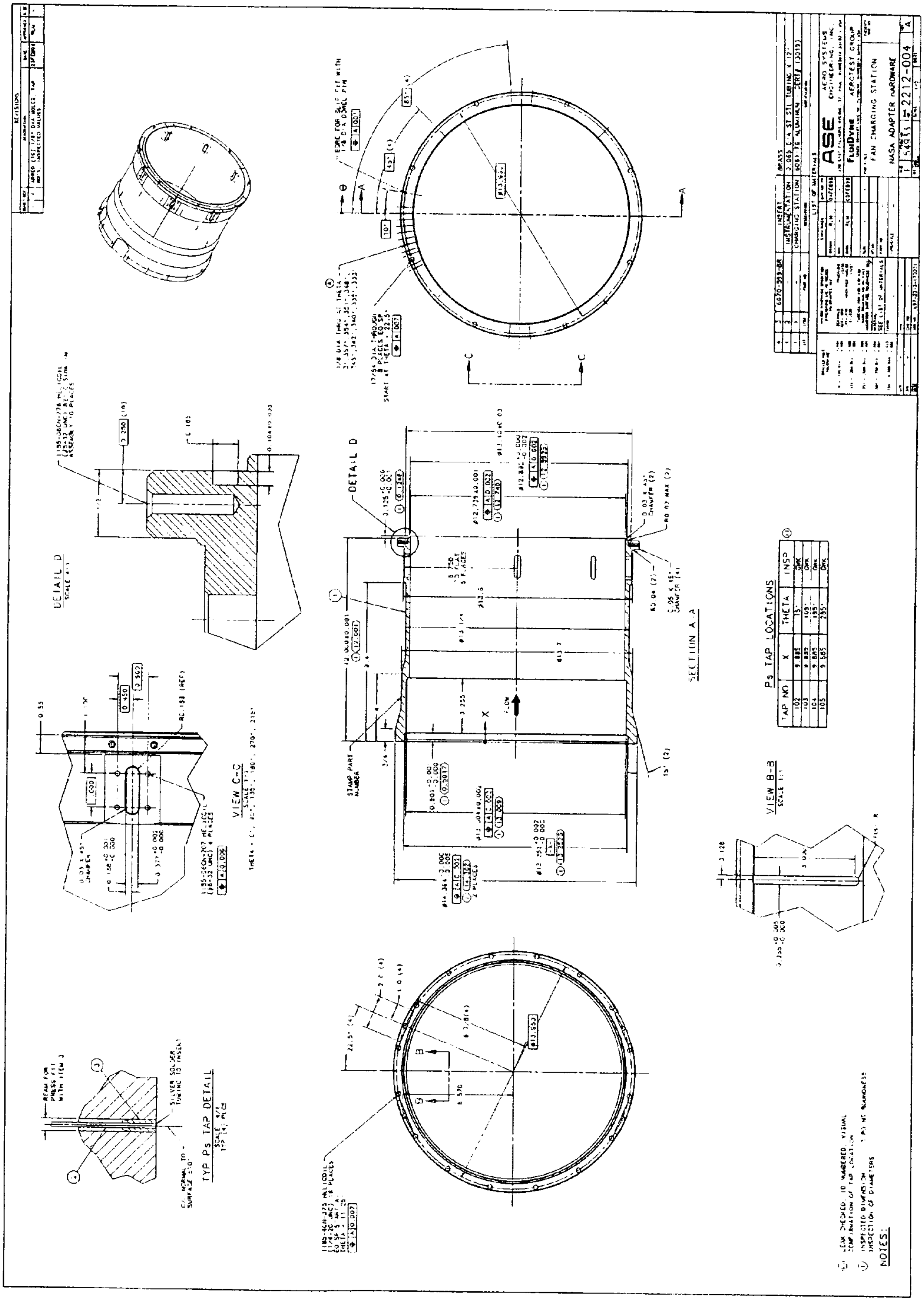
FIGURE 26f. CHANNEL 10 WIND TUNNEL, THRUST COEFFICIENTS, CRUISE MATRIX FOR CONFIGURATION 15 (3AC)

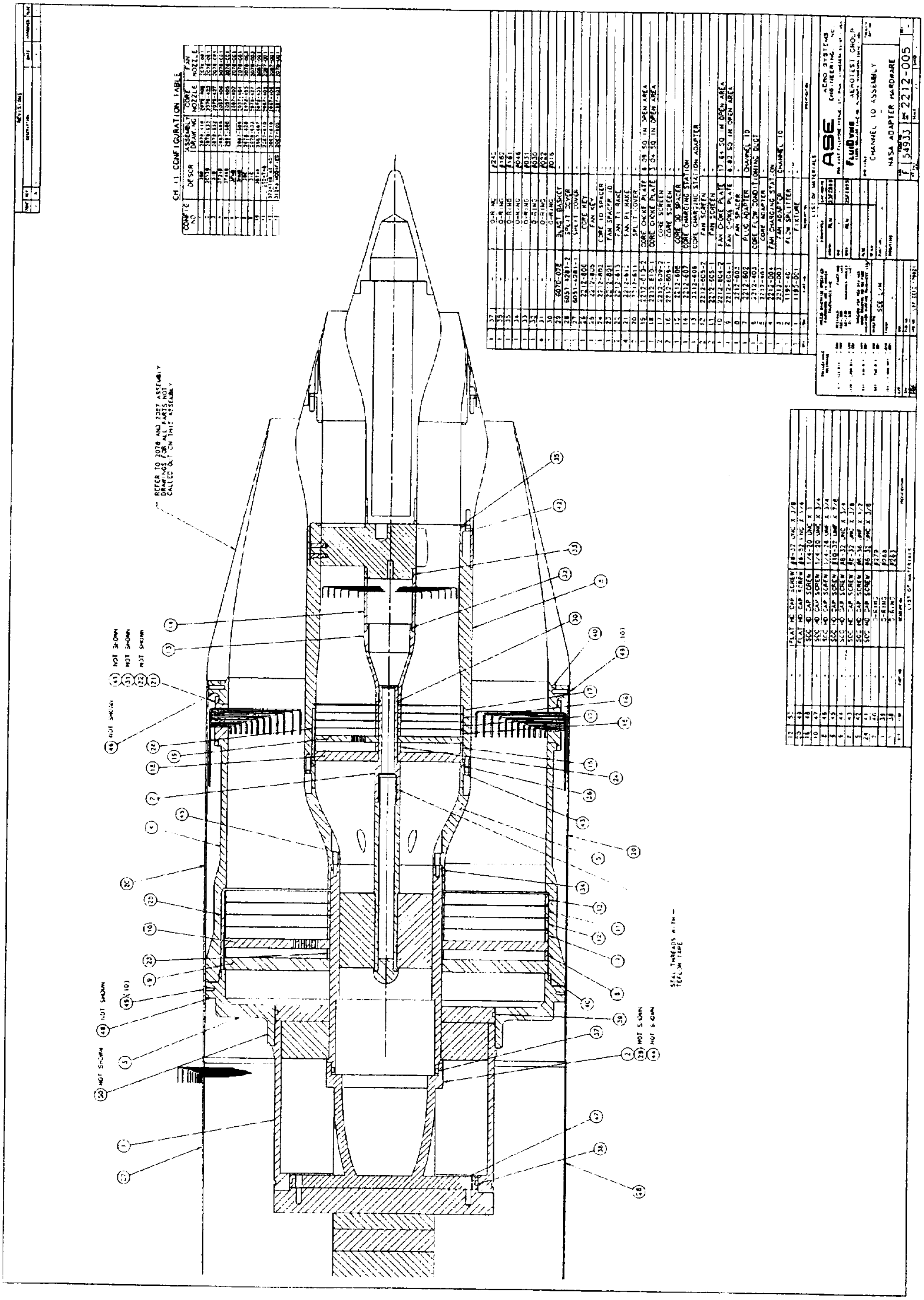
		ASE FluiDyne Laboratory	
		Detail Drawings	
Part Number	**Rev**	**Description**	
2212-001	B	Channel 11 Assembly	
2212-002	B	Fan Adapter	
2212-003	B	Fan Adapter - Channel 10	
2212-004	A	Fan Charging Station	
2212-005	-	Channel 10 Assembly	
2212-006	-	Sting Assembly	
2212-401	C	Core Adapter	
2212-403	D	Core Flow Conditioning Duct	
2212-601	B	Plug Adapter	
2212-602	A	Plug Adapter	
2212-603		Fan Spacer	
2212-604	A	Fan Choke Plate	
2212-605	A	Fan Screen	
2212-606	A	Core Charging Station Adapter	
2212-607	B	Core Charging Station	
2212-608	A	Core OD Spacer	
2212-609	A	Core Screen	
2212-610	A	Core Choke Plate	
2212-611	-	Split Cover	
2212-612	B	Fan Pt Rake	
2212-613	A	Fan Tt Rake	
2212-801	A	Fan Spacer ID	
2212-802	A	Core ID Spacer	
2212-803	A	Plug Spacer	
2212-804	A	Fan Duct Plug	
2212-805	-	Fan Key	
2212-806	-	Core Key	
Other Drawings Provided:			
2078-001	D	Fan Nozzle - Configurations #2 Through #5	
2078.003	B	Chevron Fan Nozzle, Configuration 7A	
2078.402	B	Tail Cone Adapter Configuration 3	
2078.404	C	Core Nozzle Forward Section, Configuration 2 and 3	
2078.405	A	Core Nozzle, Configuration #3	
2078.411	A	Tail Cone, Configuration #3	
2078.422	A	Core Nozzle 9a, Configuration #3	
2078.427	A	Core Nozzle 9c, Configuration #3	
2078-429	B	Core Nozzle 9d, Configuration #3	
2078.605	A	Core Nozzle Cover Ring, Configurations 2 and 3	
2078.606	-	Split Ring -Core	
2078.610	B	Core Nozzle/Strut Assembly	
2087.001	A	48 Flipper Tab, Fan Nozzle Model #3	
2087.404	A	Half Mixer	
2087.405	A	Core Nozzle Config #3, 48 Alternating Tabs	
2087.406	A	Core Nozzle Config #3, 24 Alternating Tabs	
2087.407	A	20 Lobe Mixer	
946.001	J	Core Shroud Adapter(see also 0946-416)	
946.407	C	Instrumentation Plug Pt (Ch14 Fan)	
946.410	C	Fan Bellmouth (Ch14)	
946.415	C	Instrumentaion Plug - Tt	
946.416	B	Total Temperature & Total Pressure Rake Locations for 946-001	
946.603.1	B	Core Choke Plate	
946.606	-	Spacer -Choke Plate	
1195.001		Not available on CAD	
1195.401		Not available on CAD	
1855-005	D	Adapter/Mixer	
6051.0160	B	Assembly Model Adapters	
6051-0209	C	14.5 Diameter Sting Adapter	
6051 4280	-	Perforated Split Cover	
6051-4281	D	Split Cover- Boundary Layer Rake	
6051-4282	A	Support Ring	
6051.6428.1	A	Spacer	
6051-8115	A	Variable Choke Plate	
6051.8167	C	Plug adapter Channel 11 & 14	
6051-8172	-	Split Cover Block	
6070-441	G	Fan Spacers-Outer	
6070-6158	B	Choke Plate - C1 and F1	

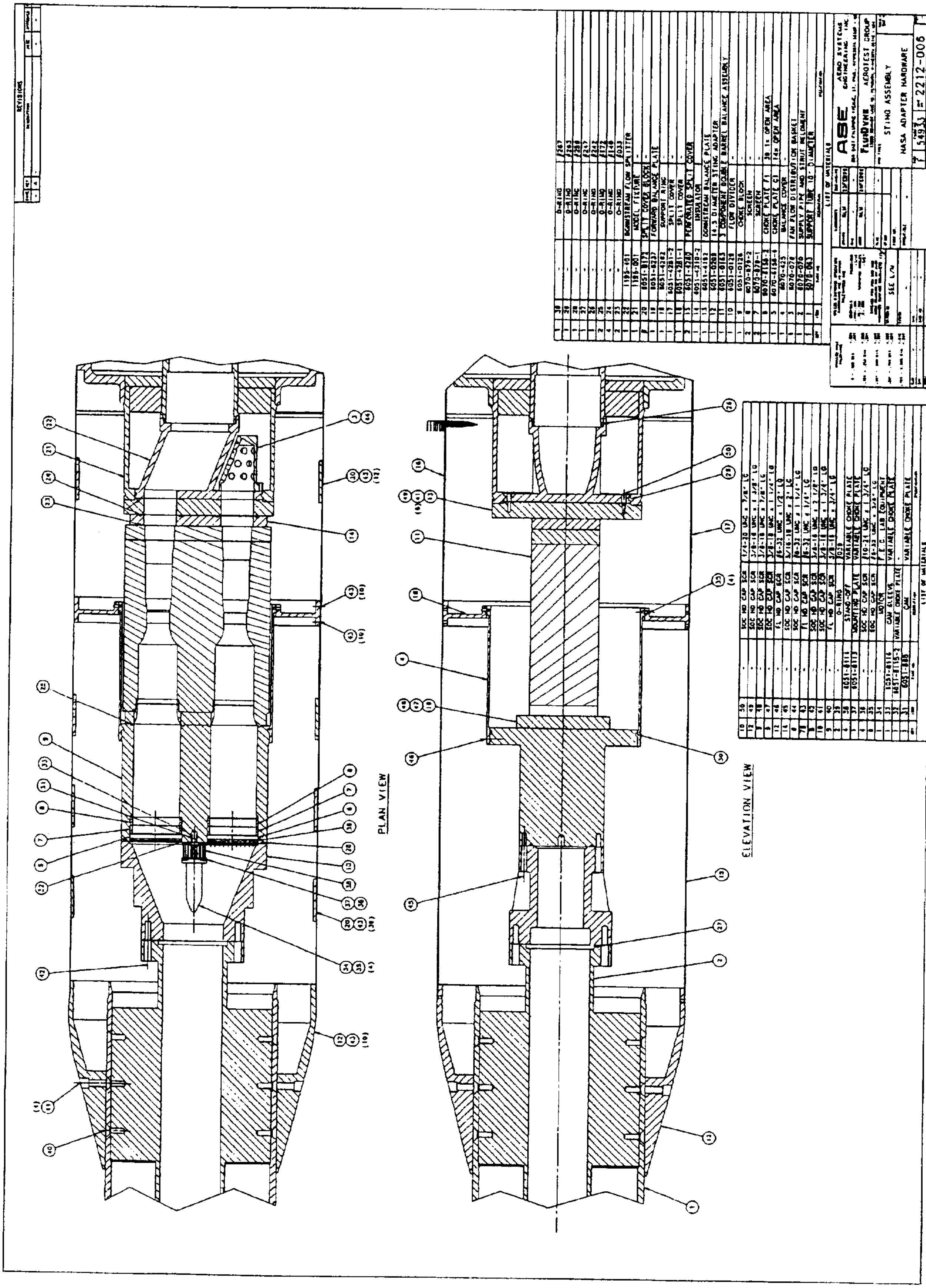

CH. 14 CONFIGURATION TABLE
ASE
CHANNEL 11 ASSEMBLY
NASA ADAPTER HARDWARE
2212-001
SEE 6051-0160

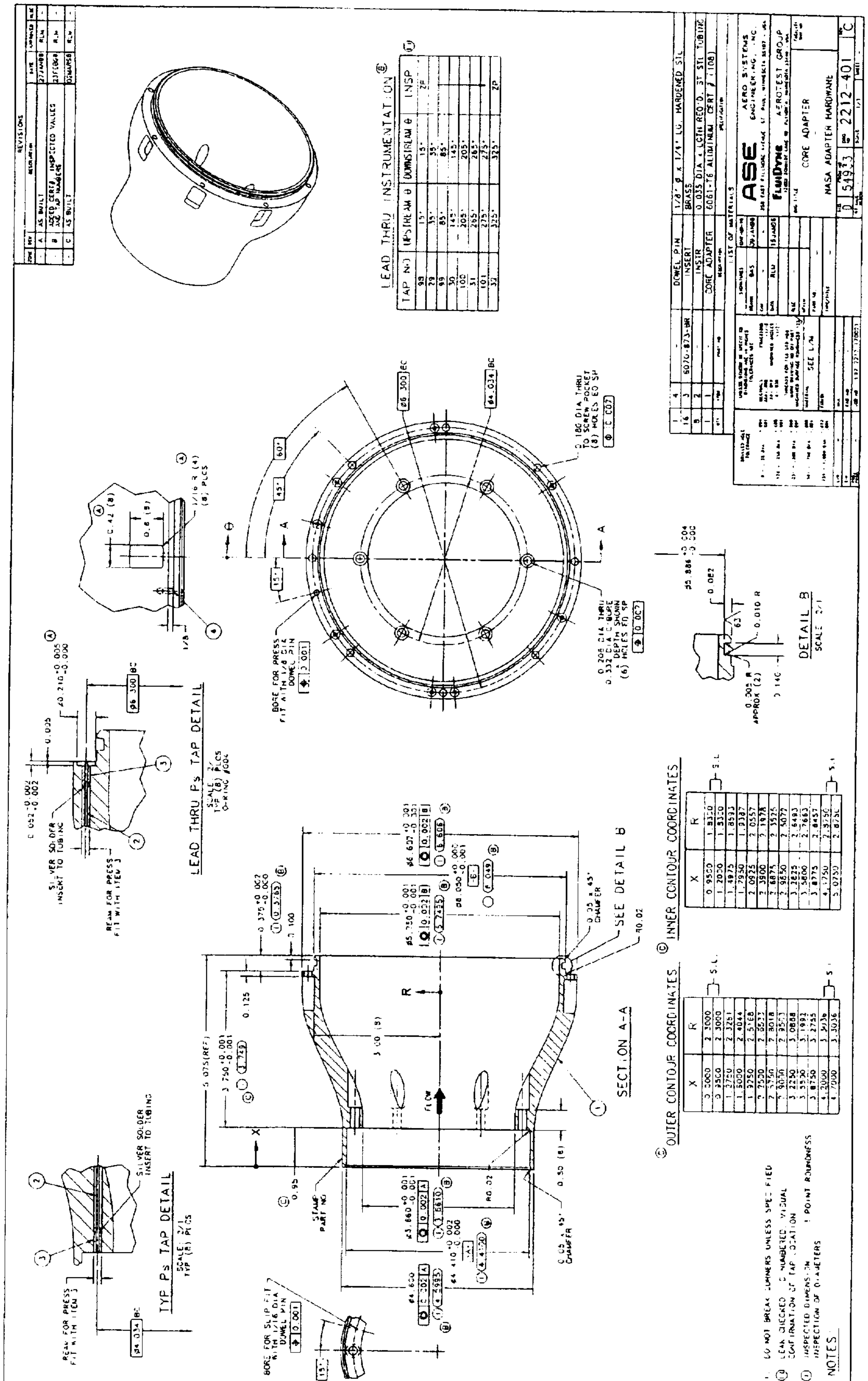

ASE
AERO SYSTEMS ENGINEERING, INC.
AEROTEST GROUP
FAN ADAPTER
NASA ADAPTER HARDWARE
2212-002
SECTION A-A
SEE DETAIL B
DETAIL B
REVISIONS


SECTION A-A
SECTION B-B
DETAIL C
SEE DETAIL C
NOTES:
FAN ADAPTER
CHANNEL 10
NASA ADAPTER HARDWARE
2212-003

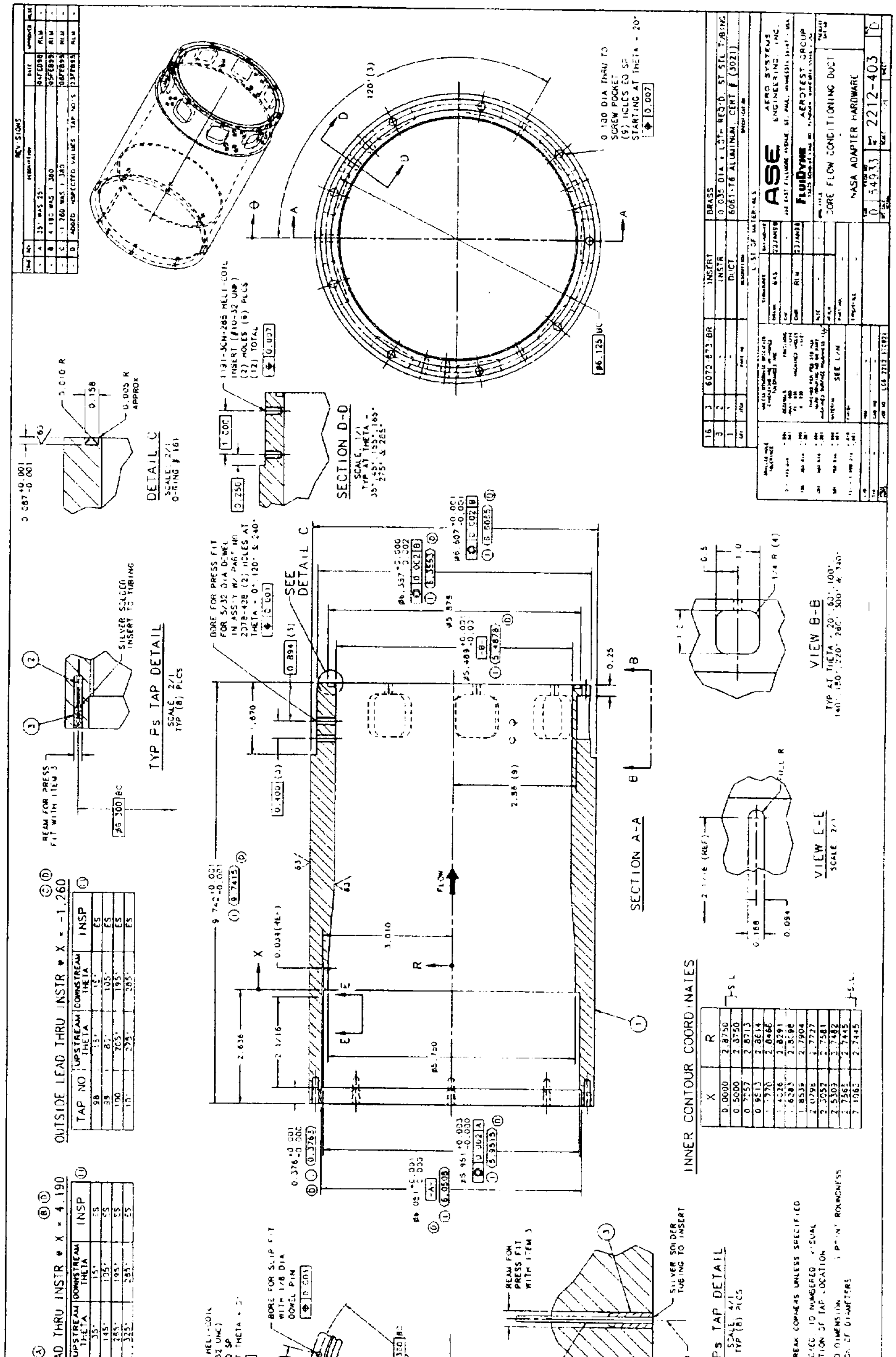

DETAIL D
VIEW C-C
SECTION A-A
Ps TAP LOCATIONS
VIEW B-B
TYP Ps TAP DETAIL
NOTES:
FAN CHARGING STATION
NASA ADAPTER HARDWARE

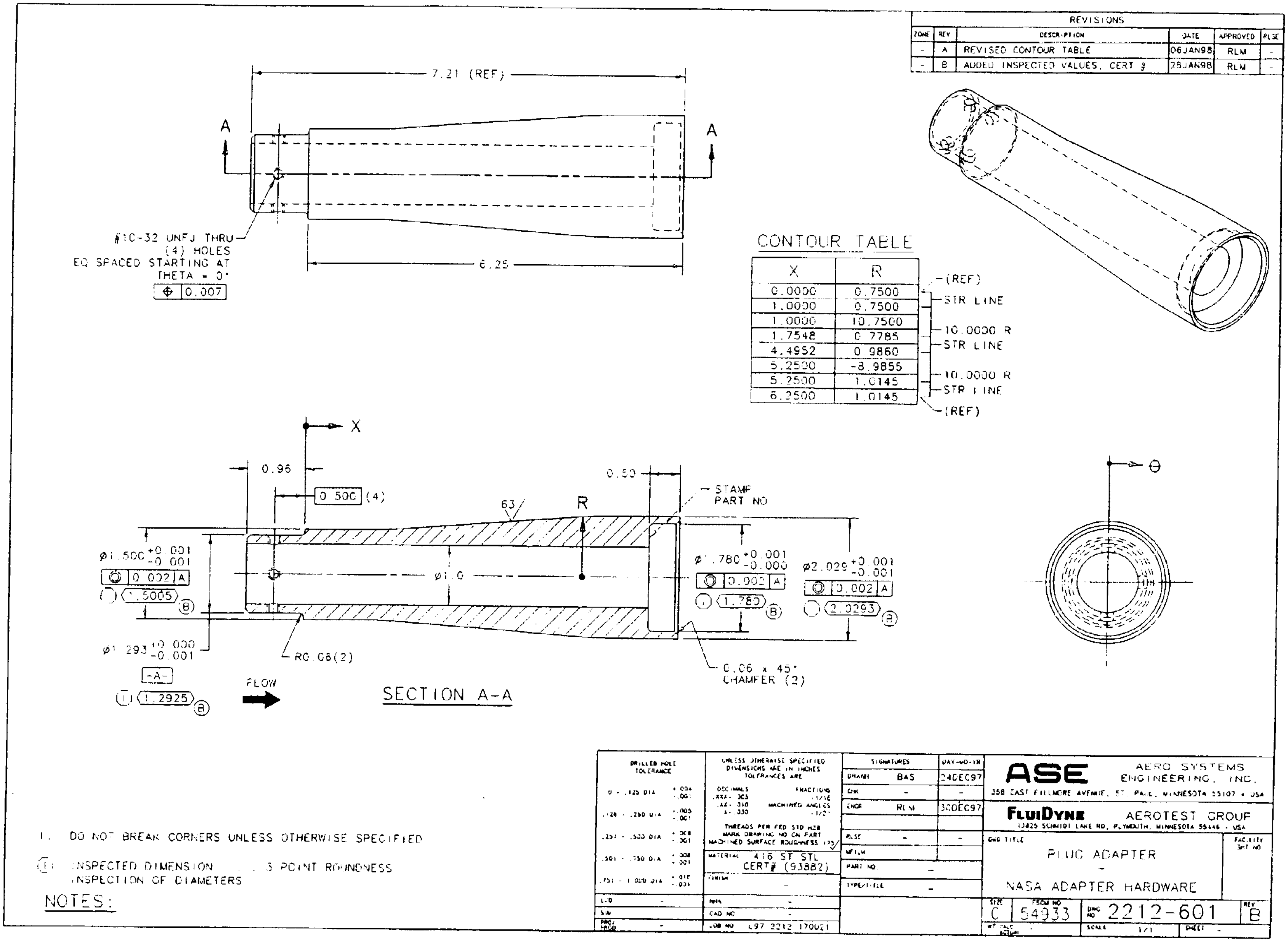






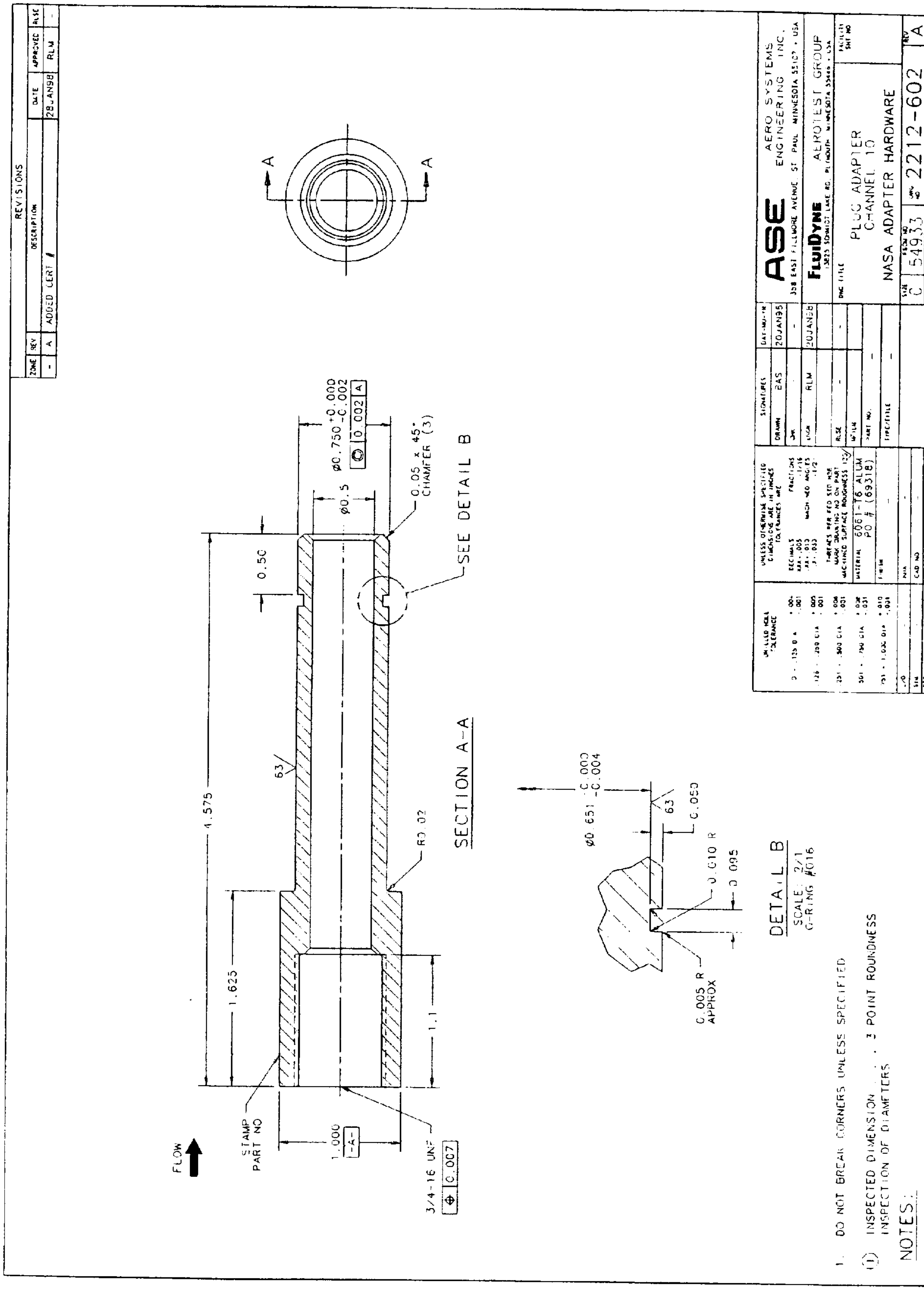
TYP Ps TAP DETAIL
LEAD THRU Ps TAP DETAIL
SECTION A-A
SEE DETAIL B
DETAIL B
OUTER CONTOUR COORDINATES
INNER CONTOUR COORDINATES
LEAD THRU INSTRUMENTATION
NOTES
ASE
CORE ADAPTER
NASA ADAPTER HARDWARE
2212-401

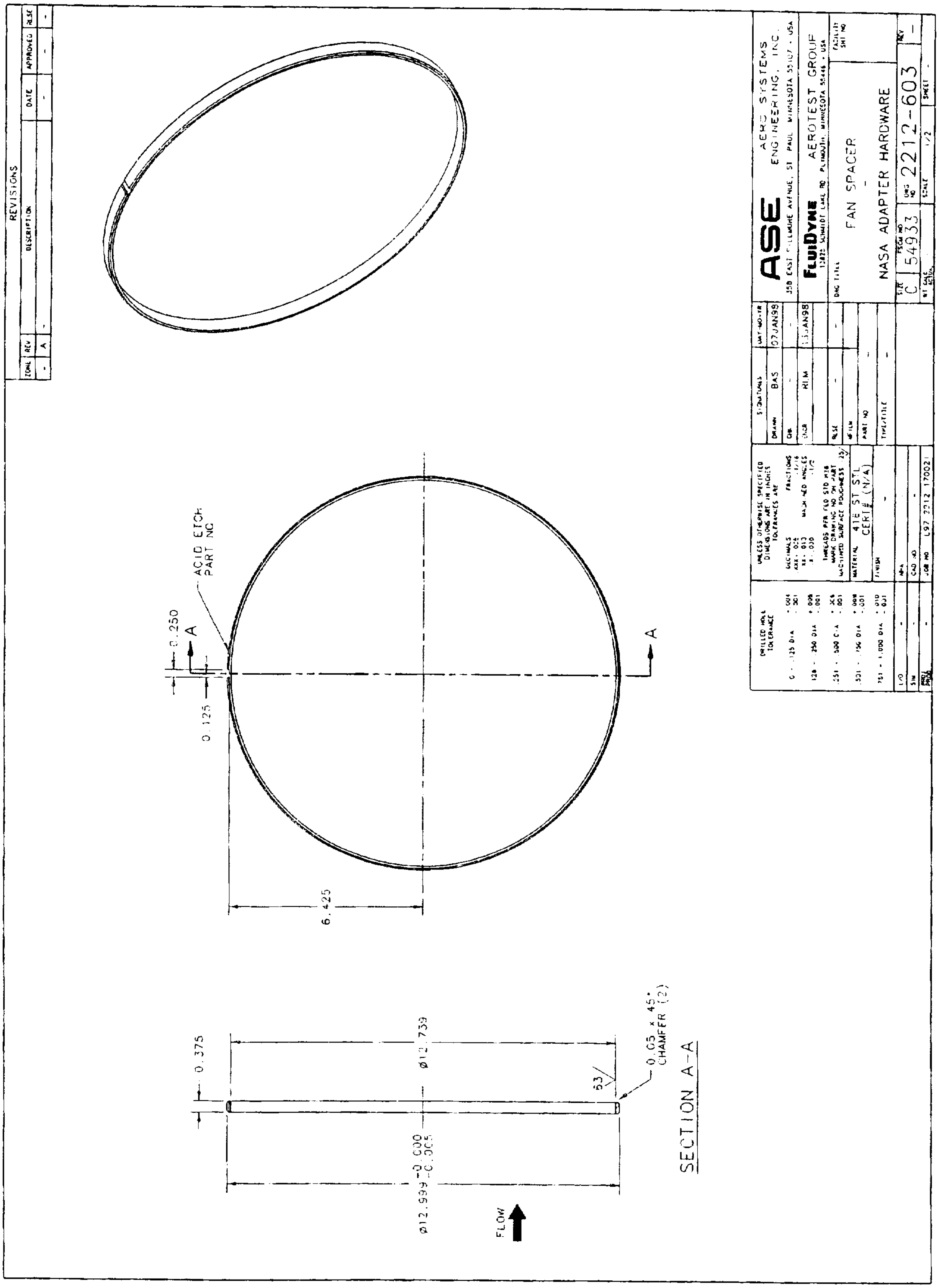

SECTION A-A
VIEW B-B
VIEW E-E
SECTION D-D
DETAIL C
TYP Ps TAP DETAIL
INNER CONTOUR COORDINATES
NOTES:
CORE FLOW CONDITIONING DUCT
NASA ADAPTER HARDWARE
2212-403



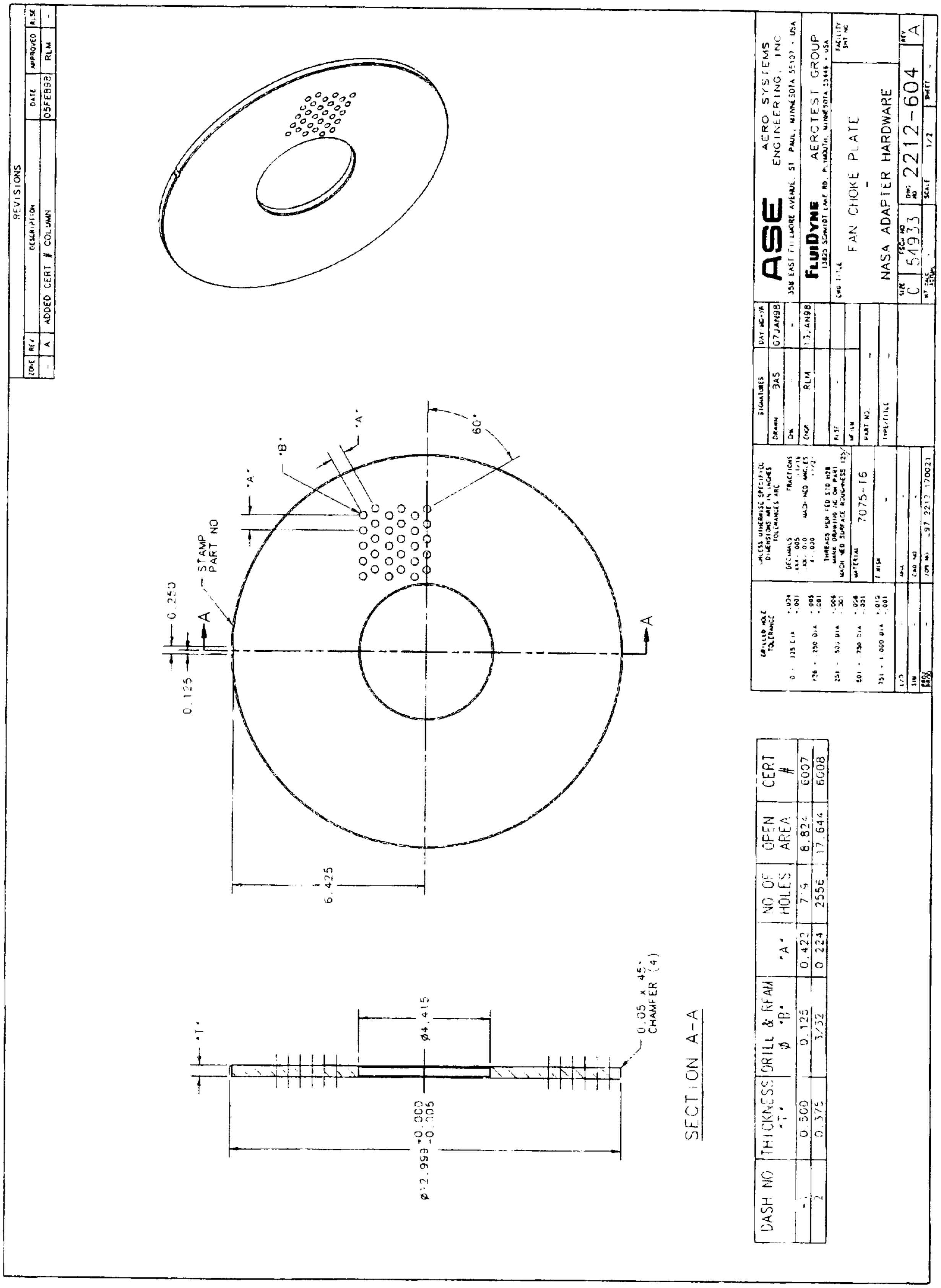
CONTOUR TABLE

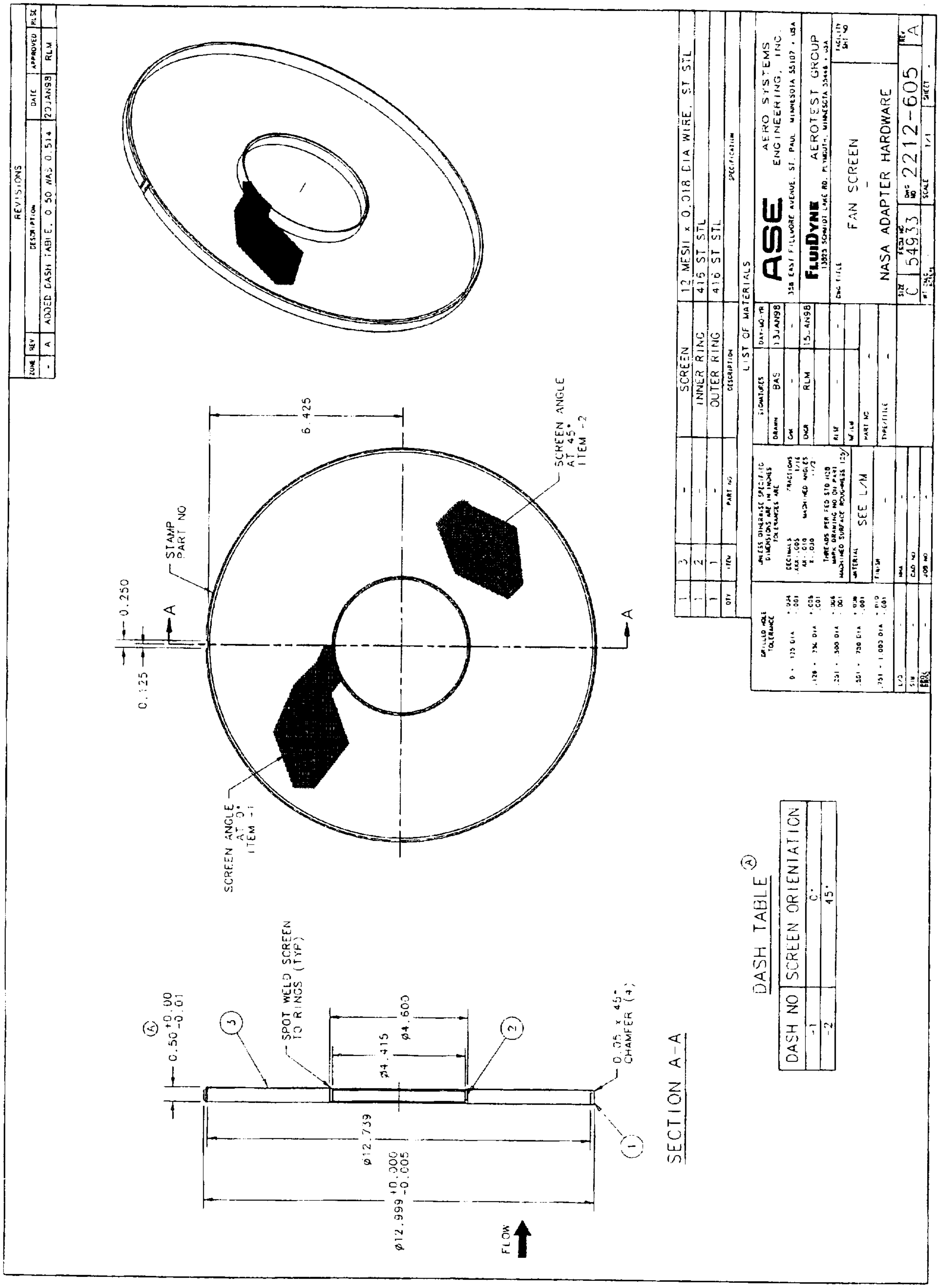
X	R
0.0000	0.7500
1.0000	0.7500
1.0000	10.7500
1.7548	0.7785
4.4952	0.9860
5.2500	-8.9855
5.2500	1.0145
6.2500	1.0145

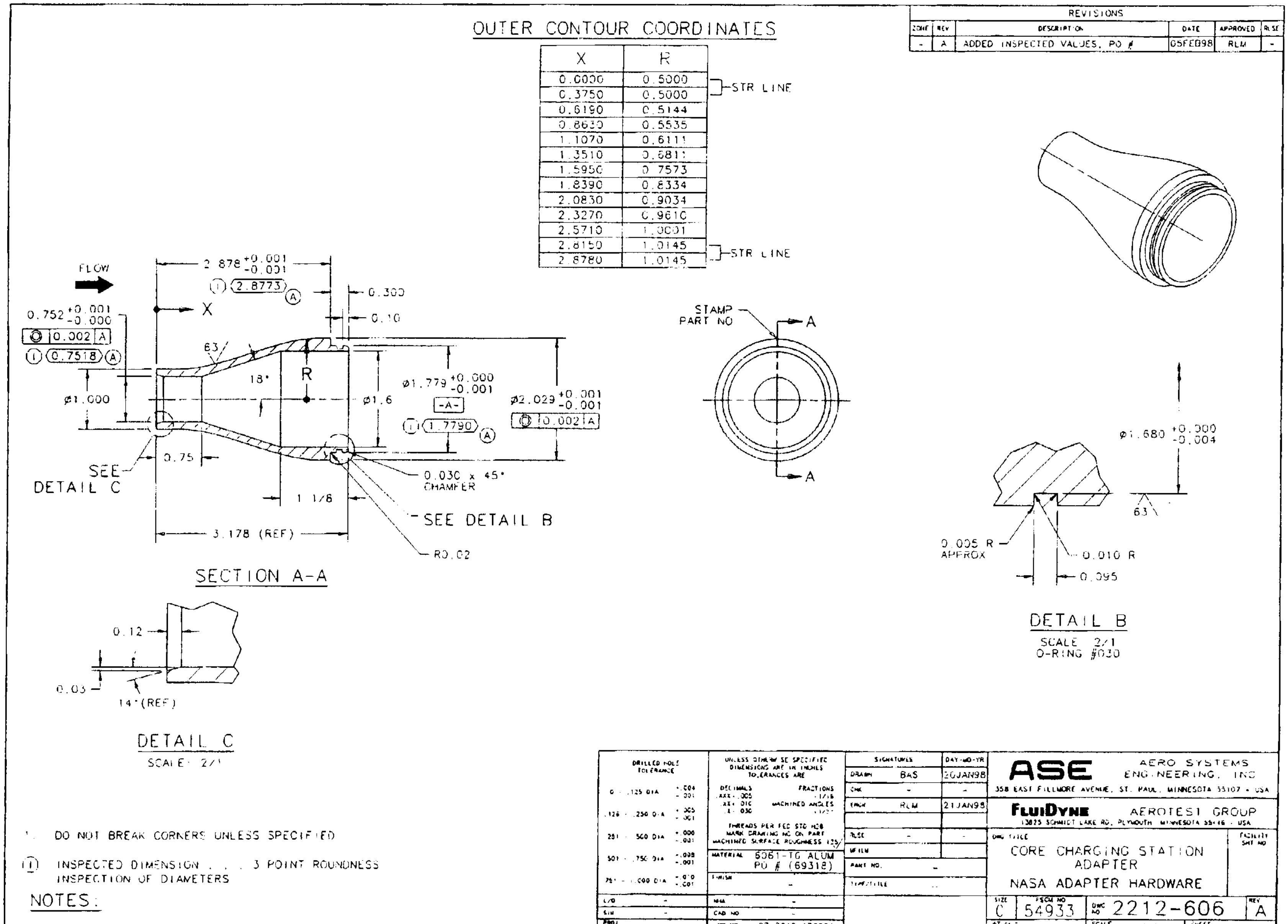

REVISIONS
ZONE REV DESCRIPTION DATE APPROVED
- A ADDED CERT # 28JAN98 RLM
SECTION A-A
SEE DETAIL B
Ø0.750 +0.000 -0.002
0.002 A
Ø0.5
0.05 x 45° CHAMFER (3)
0.50
4.575
1.625
1.1
63
R0.02
1.000
-A-
3/4-16 UNF
0.007
STAMP PART NO
FLOW
DETAIL B
SCALE 2/1
O-RING #016
Ø0.651 +0.000 -0.004
0.050
0.010 R
0.095
0.005 R APPROX
NOTES:
(1) INSPECTED DIMENSION ... 3 POINT ROUNDNESS INSPECTION OF DIAMETERS
1. DO NOT BREAK CORNERS UNLESS SPECIFIED
MATERIAL 6061-T6 ALUM PO # (69318)
ASE AERO SYSTEMS ENGINEERING INC.
FLUIDYNE AEROTEST GROUP
PLUG ADAPTER CHANNEL 10
NASA ADAPTER HARDWARE
C 54933 2212-602 A
SCALE 1/1



REVISIONS
ZONE | REV | DESCRIPTION | DATE | APPROVED | RLSE
ASE
AERO SYSTEMS ENGINEERING, INC.
FLUIDYNE
AEROTEST GROUP
FAN SPACER
NASA ADAPTER HARDWARE
C
54933
2212-603
DRAWN BAS 07JAN99
ENGR RLM 13JAN98
MATERIAL 416 ST STL
CERT# (N/A)
JOB NO L97 2212 17002
SCALE 1/2
ACID ETCH PART NO
0.250
0.125
6.425
A
A
0.375
Ø12.739
63
0.03 x 45° CHAMFER (2)
Ø12.999 -0.000 -0.005
SECTION A-A
FLOW

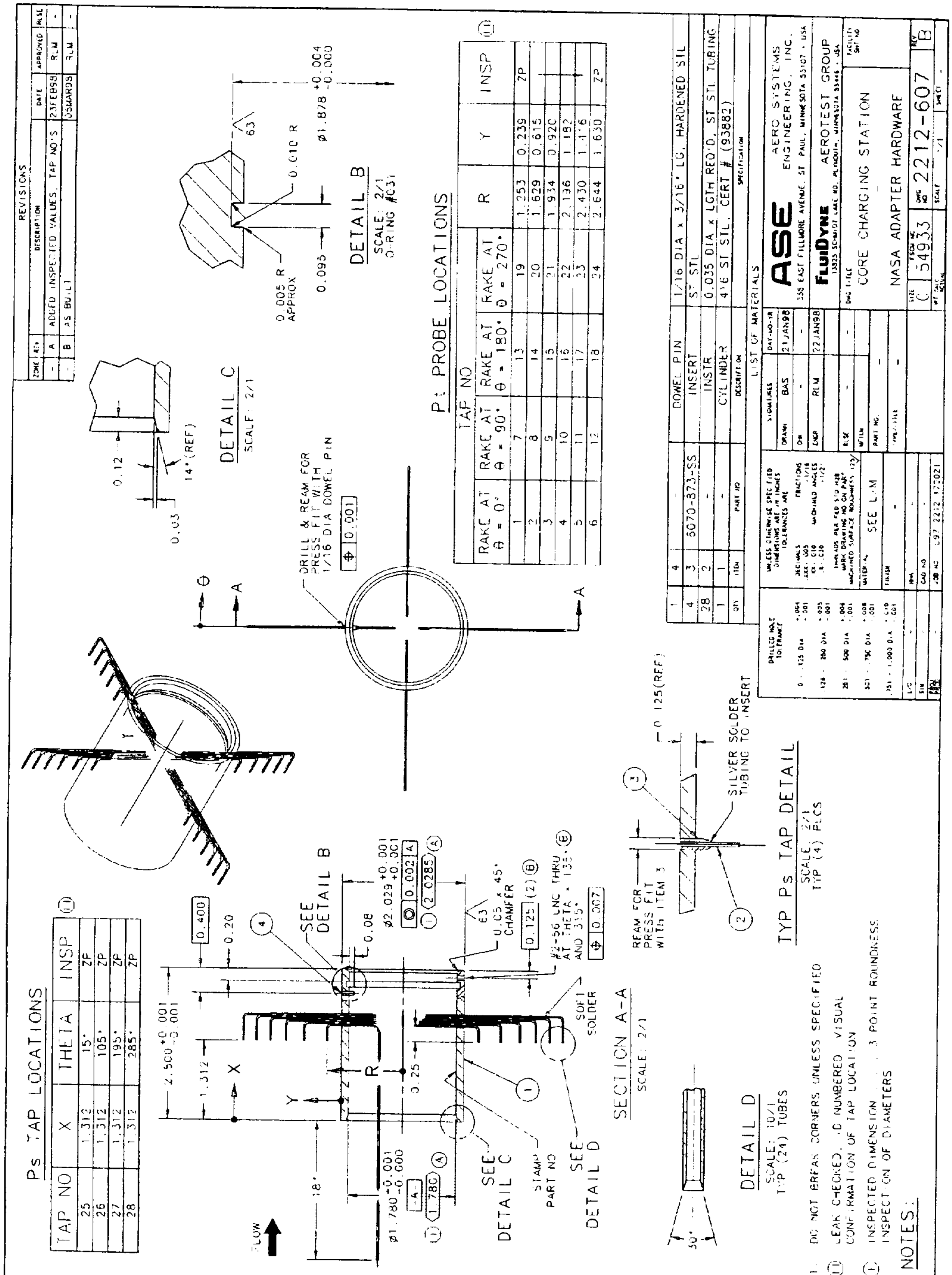

REVISIONS
ZONE REV DESCRIPTION DATE APPROVED
- A ADDED CERT # COLUMN 05FEB98 RLM
STAMP PART NO
SECTION A-A
0.05 x 45° CHAMFER (4)
DASH NO | THICKNESS 'T' | DRILL & REAM ø 'B' | 'A' | NO OF HOLES | OPEN AREA | CERT #
-1 | 0.500 | 0.125 | 0.422 | 719 | 8.824 | 6007
-2 | 0.375 | 3/32 | 0.224 | 2556 | 17.644 | 6008
MATERIAL 7075-T6
ASE AERO SYSTEMS ENGINEERING, INC
FLUIDYNE AEROTEST GROUP
FAN CHOKE PLATE
NASA ADAPTER HARDWARE
51933
2212-604
A


REVISIONS
ADDED DASH TABLE, 0.50 WAS 0.514
22JAN98
RLM
SECTION A-A
DASH TABLE
DASH NO | SCREEN ORIENTATION
-1 | 0°
-2 | 45°
SCREEN ANGLE AT 0° ITEM -1
SCREEN ANGLE AT 45° ITEM -2
STAMP PART NO
6.425
0.250
0.125
SPOT WELD SCREEN TO RINGS (TYP)
0.05 x 45° CHAMFER (4)
ø4.415
ø4.600
ø12.739
ø12.999 +0.000 -0.005
0.50 +0.00 -0.01
FLOW
SCREEN | 12 MESH x 0.018 DIA WIRE, ST STL
INNER RING | 416 ST STL
OUTER RING | 416 ST STL
LIST OF MATERIALS
ASE AERO SYSTEMS ENGINEERING, INC.
FLUIDYNE AEROTEST GROUP
FAN SCREEN
NASA ADAPTER HARDWARE
C 54933 2212-605 A
SEE L/M

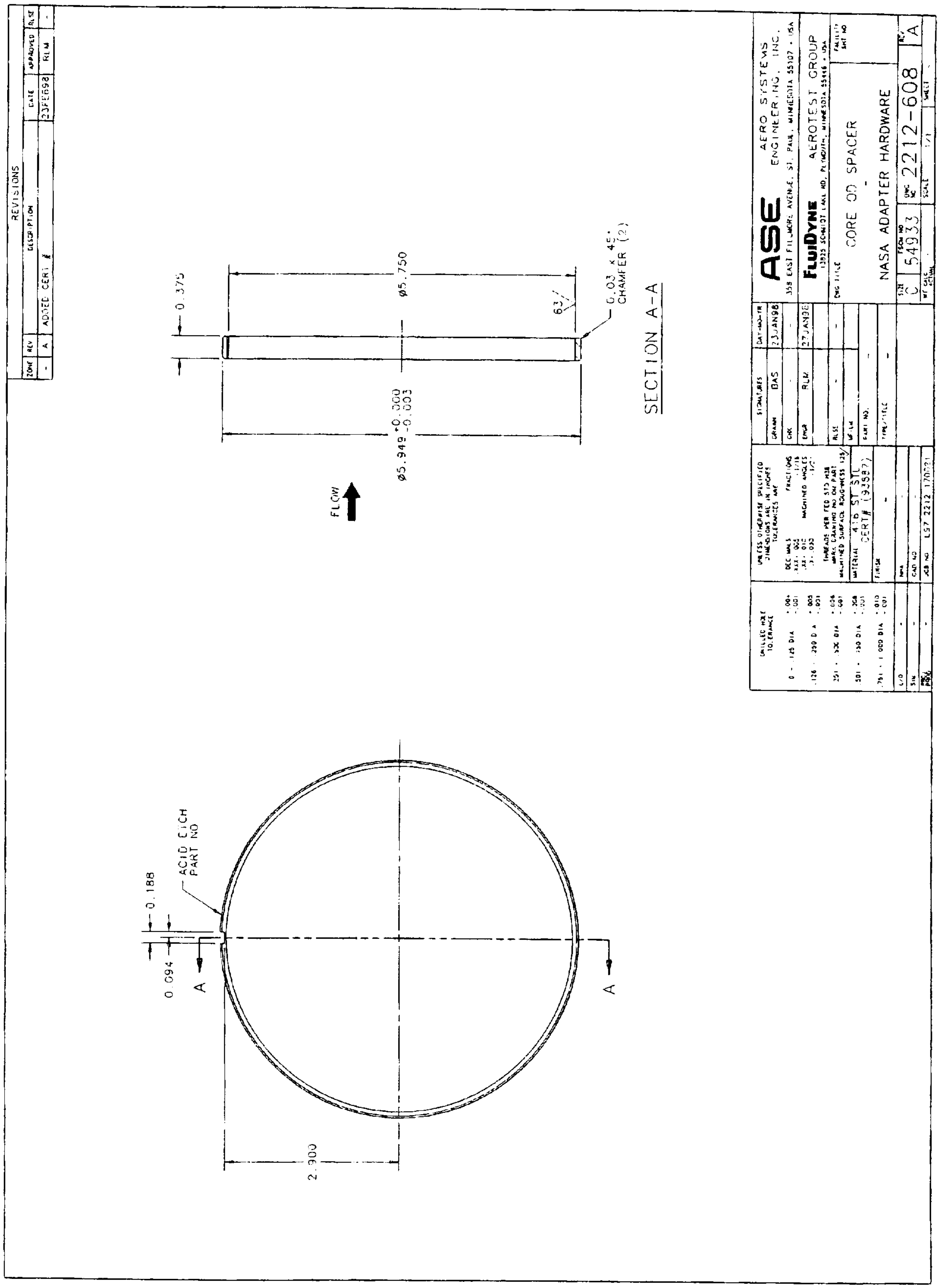


OUTER CONTOUR COORDINATES

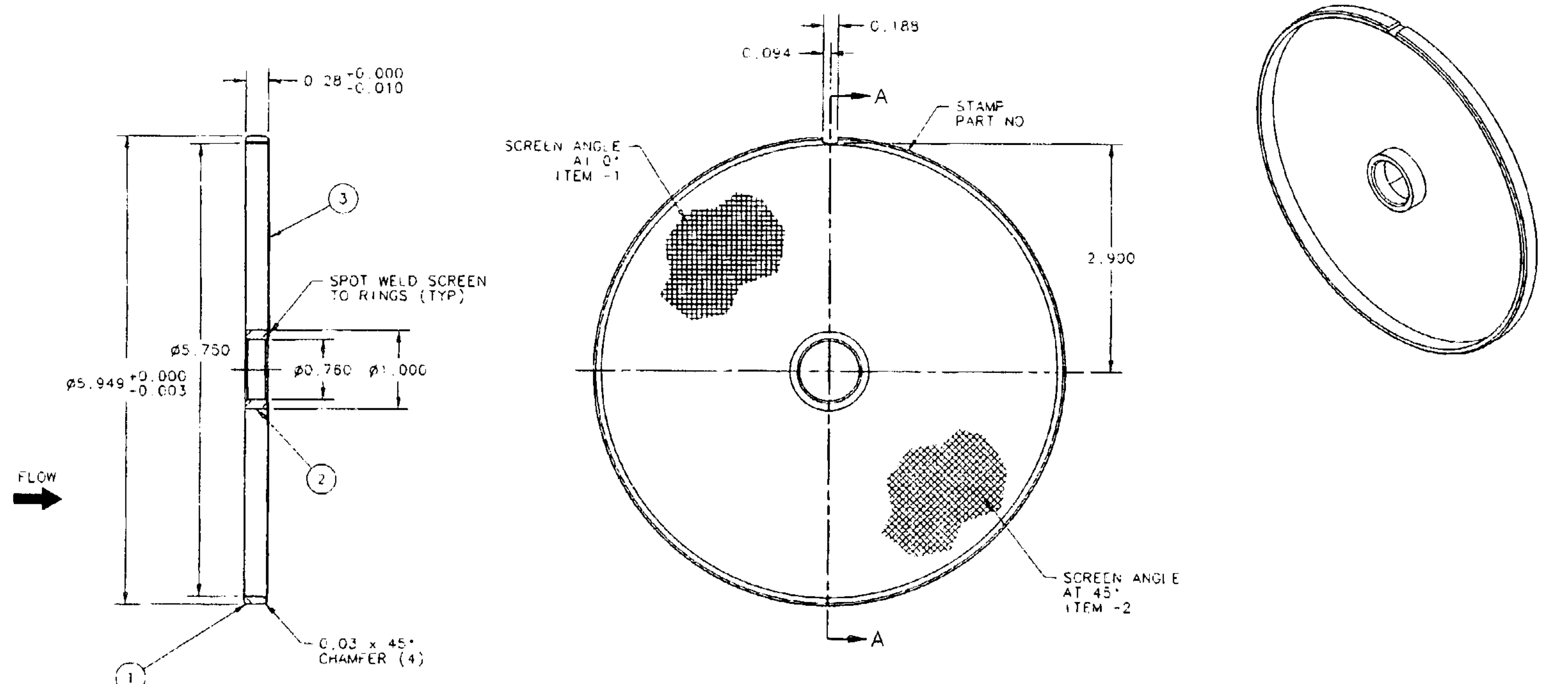
X	R
0.0000	0.5000
0.3750	0.5000
0.6190	0.5144
0.8630	0.5535
1.1070	0.6111
1.3510	0.6811
1.5950	0.7573
1.8390	0.8334
2.0830	0.9034
2.3270	0.9610
2.5710	1.0001
2.8150	1.0145
2.8780	1.0145



REVISIONS
A ADDED INSPECTED VALUES, TAP NO'S 23FEB99 RLM
B AS BUILT 05MAR99 RLM
Ps TAP LOCATIONS
TAP NO X THETA INSP
25 1.312 15° ZP
26 1.312 105° ZP
27 1.312 195° ZP
28 1.312 285° ZP
SECTION A-A
SCALE: 2/1
DETAIL B
SCALE: 2/1
O-RING #031
DETAIL C
SCALE: 2/1
DETAIL D
SCALE: 10/1
TYP (24) TUBES
TYP Ps TAP DETAIL
SCALE: 2/1
TYP (4) PLCS
Pt PROBE LOCATIONS
TAP NO
RAKE AT θ = 0° RAKE AT θ = 90° RAKE AT θ = 180° RAKE AT θ = 270° R Y INSP
1 7 13 19 1.253 0.239 ZP
2 8 14 20 1.629 0.615
3 9 15 21 1.934 0.920
4 10 16 22 2.136 1.182
5 11 17 23 2.430 1.416
6 12 18 24 2.644 1.630 ZP
DRILL & REAM FOR PRESS FIT WITH 1/16 DIA DOWEL PIN
SILVER SOLDER TUBING TO INSERT
REAM FOR PRESS FIT WITH ITEM 3
SOFT SOLDER
STAMP PART NO
FLOW
1/16 DIA x 3/16" LG. HARDENED STL
ST STL
0.035 DIA x LGTH REQ'D. ST STL TUBING
416 ST STL. CERT # (93882)
DOWEL PIN
INSERT
INSTR
CYLINDER
5070-373-SS
LIST OF MATERIALS
ASE
AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE ST. PAUL, MINNESOTA 55107 USA
FLUIDYNE AEROTEST GROUP
CORE CHARGING STATION
NASA ADAPTER HARDWARE
C 54933 2212-607 B
NOTES:
1. DO NOT BREAK CORNERS UNLESS SPECIFIED
LEAK CHECKED. ID NUMBERED VISUAL CONFIRMATION OF TAP LOCATION
INSPECTED DIMENSION. 3 POINT ROUNDNESS INSPECTION OF DIAMETERS


REVISIONS
ADDED CERT #
23FEB98
RLM
ACID ETCH PART NO
0.188
0.094
2.900
FLOW
0.375
Ø5.750
Ø5.949 +0.000 -0.003
0.03 x 45° CHAMFER (2)
SECTION A-A
ASE AERO SYSTEMS ENGINEERING, INC.
FLUIDYNE AEROTEST GROUP
CORE OD SPACER
NASA ADAPTER HARDWARE
416 SS STL CERT# (93582)
54933
2212-608
A

ZONE	REV	DESCRIPTION	DATE	APPROVED	RLSE
REVISIONS					
-	A	ADDED PO #'S	23FEB98	RLM	-



SECTION A-A

DASH TABLE

DASH NO	SCREEN ORIENTATION
-1	0°
-2	45°

QTY	ITEM	PART NO	DESCRIPTION	SPECIFICATION
1	3	-	SCREEN	12 MESH x 0.018 DIA WIRE, ST STL
1	2	-	INNER RING	416 ST STL, PO # (93882)
1	1	-	OUTER RING	416 ST STL, PO # (93882)

LIST OF MATERIALS

DRILLED HOLE TOLERANCE	
0 - .125 DIA	+.004 -.001
.126 - .250 DIA	+.005 -.001
.251 - .500 DIA	+.006 -.001
.501 - .750 DIA	+.008 -.001
.751 - 1.000 DIA	+.010 -.001
I/O	-
SIM	-
REFER	-

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
DECIMALS .XXX ±.005 .XX ±.010 .X ±.020 FRACTIONS ±1/16 MACHINED ANGLES ±1/2°
THREADS PER FED STD H28 MARK DRAWING NO ON PART MACHINED SURFACE ROUGHNESS 125
MATERIAL SEE L/M
FINISH -
NHA -
CAD NO -
JOB NO L97 2212 175021

SIGNATURES		DAY-MO-YR
DRAWN	BAS	26JAN98
CHK	-	-
ENGR	RLM	27JAN98
RLSE	-	-
MFILM		
PART NO	-	
TYPE/TITLE	-	

ASE AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE, ST. PAUL, MINNESOTA 55107 - USA

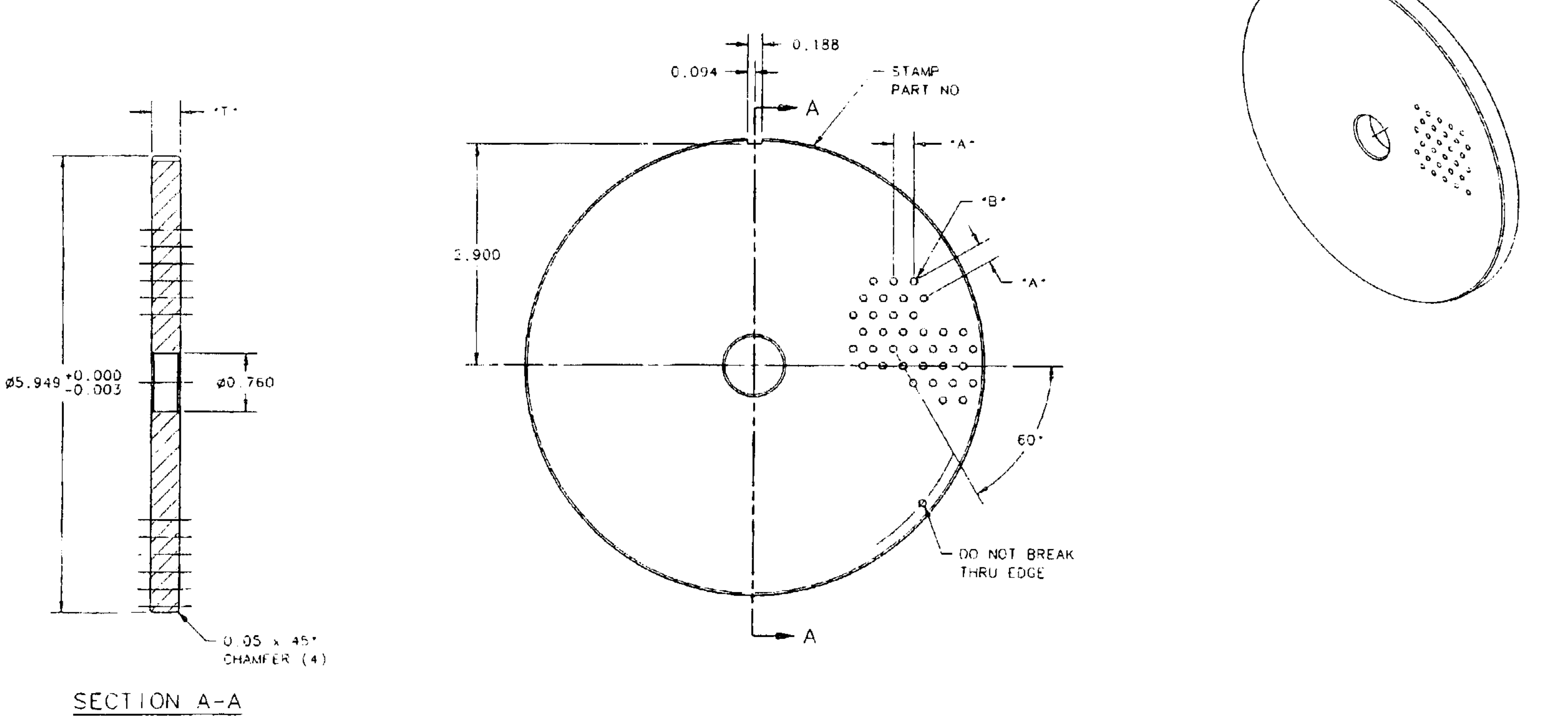
FLUIDYNE AEROTEST GROUP
13825 SCHMIDT LAKE RD. PLYMOUTH, MINNESOTA 55446 - USA

DWG TITLE CORE SCREEN - NASA ADAPTER HARDWARE

FACILITY SHT NO

SIZE C FSCM NO 54933 DWG NO 2212-609 REV A
WT CALC ACTUAL - SCALE 1/1 SHEET -

ZONE	REV	DESCRIPTION	DATE	APPROVED	RLSE
REVISIONS					
-	A	ADDED CERT #'S	23FEB98	RLM	-



(A)

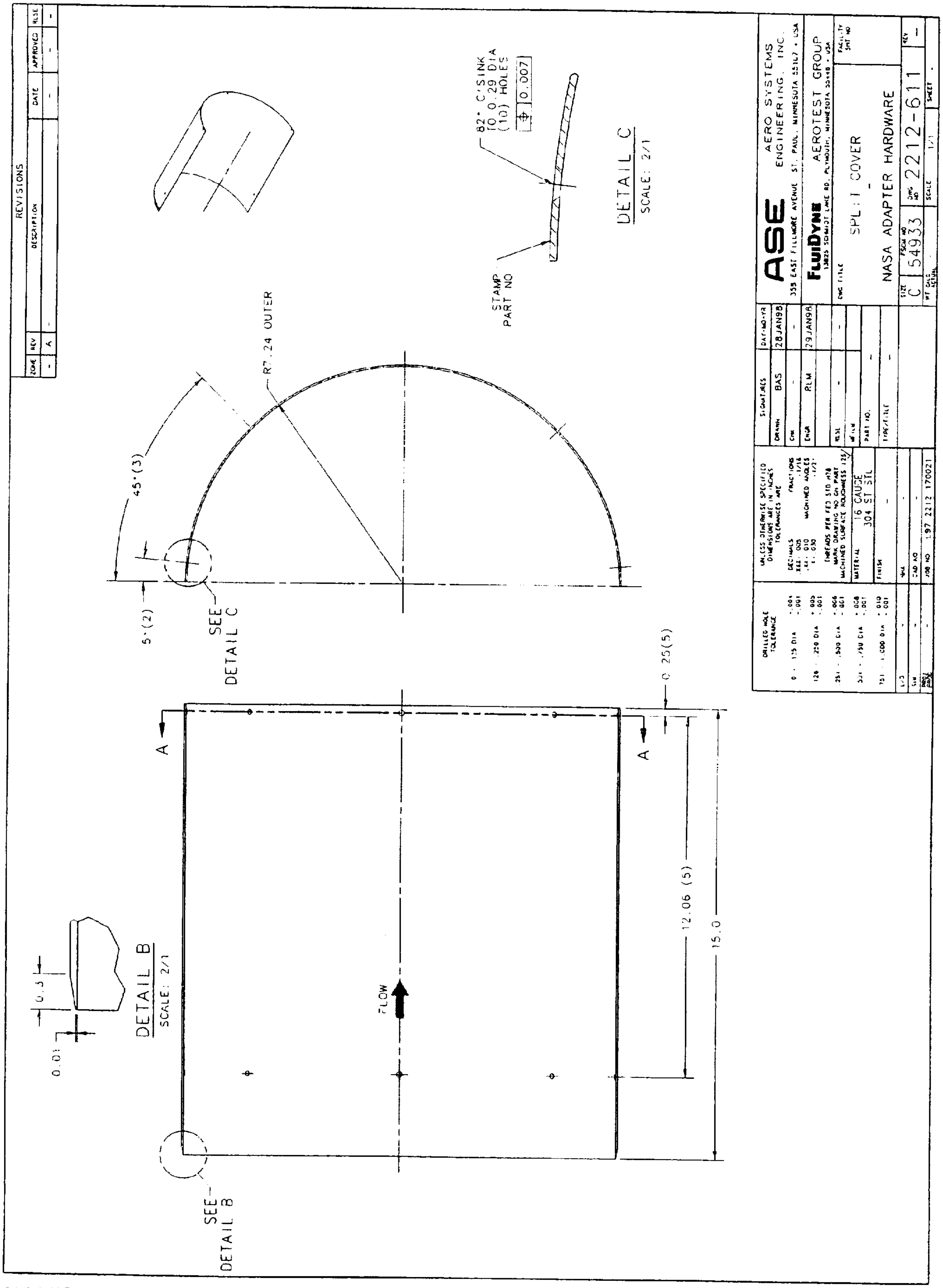
DASH NO	THICKNESS 'T'	DRILL & REAM Ø 'B'	'A'	NO OF HOLES	OPEN AREA	CERT NO
-	3/8	3/32	0.257	441	3.044	3022
-2	1/4	1/16	0.121	1,985	6.09	3023

DRILLED HOLE TOLERANCE
0 - .125 DIA +.004 -.001
.126 - .250 DIA +.005 -.001
.251 - .500 DIA +.006 -.00
.501 - .750 DIA +.008 -.001
.751 - 1.000 DIA +.010 -.001

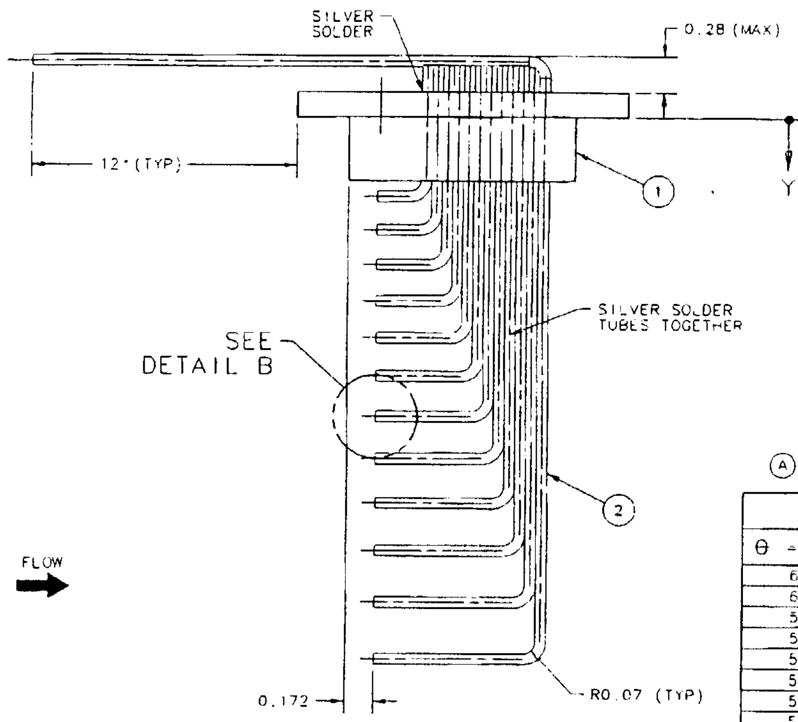
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
DECIMALS .XXX ±.005 .XX ±.010 .X ±.030
FRACTIONS ±1/16 MACHINED ANGLES ±1/2°
THREADS PER FED STD H28
MARK DRAWING NO ON PART
MACHINED SURFACE ROUGHNESS 125
MATERIAL 7075-T6 ALUM
FINISH -

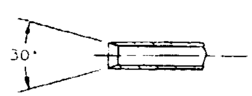
SIGNATURES		DAY-MO-YR
DRAWN	BAS	27JAN98
CHK		-
ENGR	RLM	27JAN98
RLSE	-	
MFG		
PART NO		-
TYPE/TITLE		-

ASE AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE, ST. PAUL, MINNESOTA 55107 - USA
FLUIDYNE AEROTEST GROUP
13825 SCHMIDT LAKE RD, PLYMOUTH, MINNESOTA 55446 - USA
DWG TITLE
CORE CHOKE PLATE
-
NASA ADAPTER HARDWARE
SIZE C FSCM NO 54933 DWG NO 2212-610 REV A
SCALE 1/1 SHEET -
JOB NO 97 2212 170021


REVISIONS
ZONE REV DESCRIPTION DATE APPROVED RLSE
- A - - - -
82° C'SINK
TO 0.29 DIA
(10) HOLES
0.007
STAMP
PART NO
DETAIL C
SCALE: 2/1
R7.24 OUTER
45°(3)
5°(2)
SEE
DETAIL C
0.25(5)
A
A
FLOW
12.06 (5)
15.0
0.3
0.03
DETAIL B
SCALE: 2/1
SEE
DETAIL B
ASE
AERO SYSTEMS
ENGINEERING, INC.
355 EAST FILLMORE AVENUE ST. PAUL, MINNESOTA 55107 • USA
FLUIDYNE
AEROTEST GROUP
SPLIT COVER
NASA ADAPTER HARDWARE
C 54933 2212-611
DRAWN BAS 28JAN98
ENGR RLM 29JAN98
MATERIAL 16 GAUGE
304 ST STL
97 2212 170021

REV SIONS					
ZONE	REV	DESCRIPTION	DATE	APPROVED	RLSE
-	A	TAP NUMBERS	23FEB98	RLM	-
-	B	ADDED INSPECTED VALUES	04MAR98	RLM	-





DETAIL B
SCALE: 5/1

Pt PROBE LOCATIONS

(A) (B)

TAP NO						
θ = 0°	θ = 90°	θ = 180°	θ = 270°	R	Y	INSP (1)
61	73	85	97	6.272	0.478	RH
60	72	84	96	6.072	0.678	
59	71	83	95	5.864	0.886	
58	70	82	94	5.650	1.100	
57	69	81	93	5.427	1.323	
56	68	80	92	5.194	1.556	
55	67	79	91	4.950	1.800	
54	66	78	90	4.694	2.056	
53	65	77	89	4.423	2.327	
52	64	76	88	4.134	2.616	
51	63	75	87	3.824	2.926	
50	62	74	86	3.486	3.264	RH

QTY	ITEM	PART NO	DESCRIPTION	SPECIFICATION
12	2	-	INSTR	0.065 DIA x LGTH REQ'D, ST STL TUBING
1	1	2212-804-1	FAN DUCT PLUG	-

LIST OF MATERIALS

DRILLED HOLE TOLERANCE	
0 - .125 DIA	+.004 -.001
.126 - .250 DIA	+.005 -.001
.251 - .500 DIA	+.006 -.001
.501 - .750 DIA	+.008 -.001
.751 - 1.000 DIA	+.010 -.001

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
DECIMALS .XXX ±.005 .XX ±.010 .X ±.030
FRACTIONS ±1/16
MACHINED ANGLES ±1/2°
THREADS PER FED STD H28
MARK DRAWING NO ON PART
MACHINED SURFACE ROUGHNESS 125

MATERIAL: SEE L/M
FINISH: -
L/O: - | MHA: -
S/M: - | CAD NO: -
PROG PROD: - | JOB NO: L97 2212 170021

SIGNATURES		DAY-MO-YR
DRAWN	BAS	29JAN98
CHK		-
ENGR	RLM	02FEB98
RLSE	-	-
MFG		
PART NO.	-	
TYPE/TITLE	-	

ASE AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE · ST. PAUL, MINNESOTA 55107 · USA

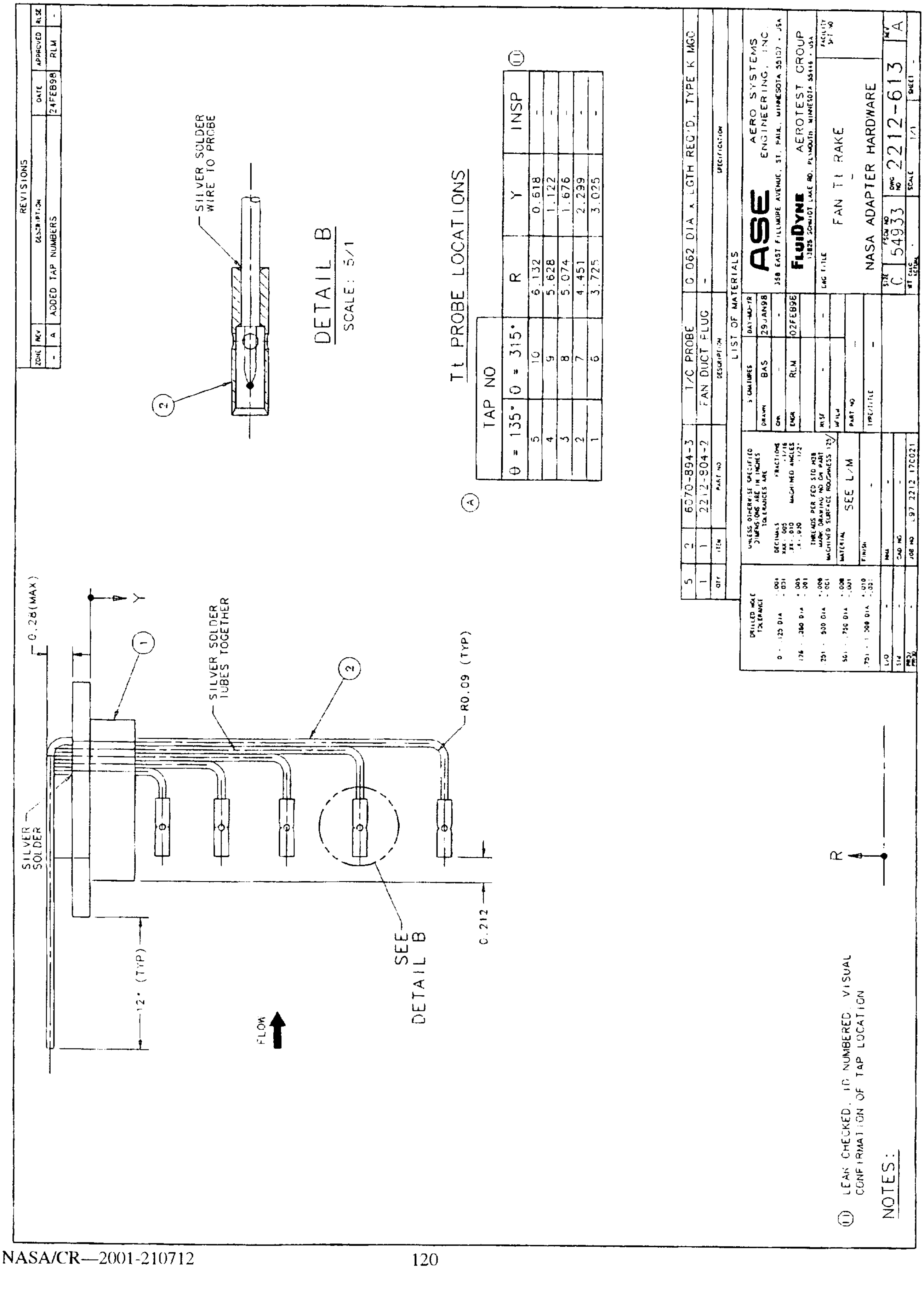
FLUIDYNE AEROTEST GROUP
13825 SCHMIDT LAKE RD., PLYMOUTH, MINNESOTA 55446 · USA

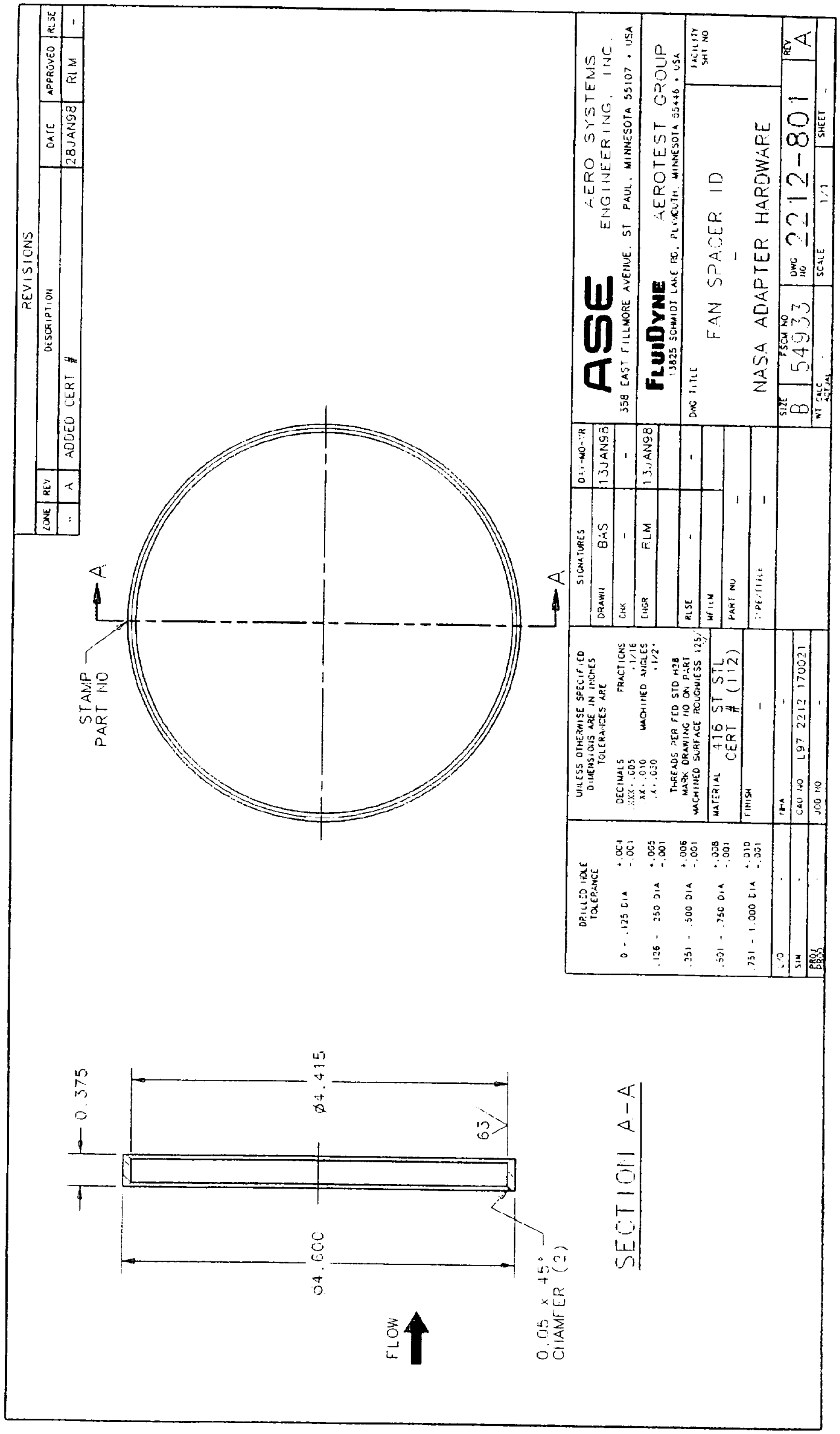
DWG TITLE: FAN Pt RAKE
-
NASA ADAPTER HARDWARE

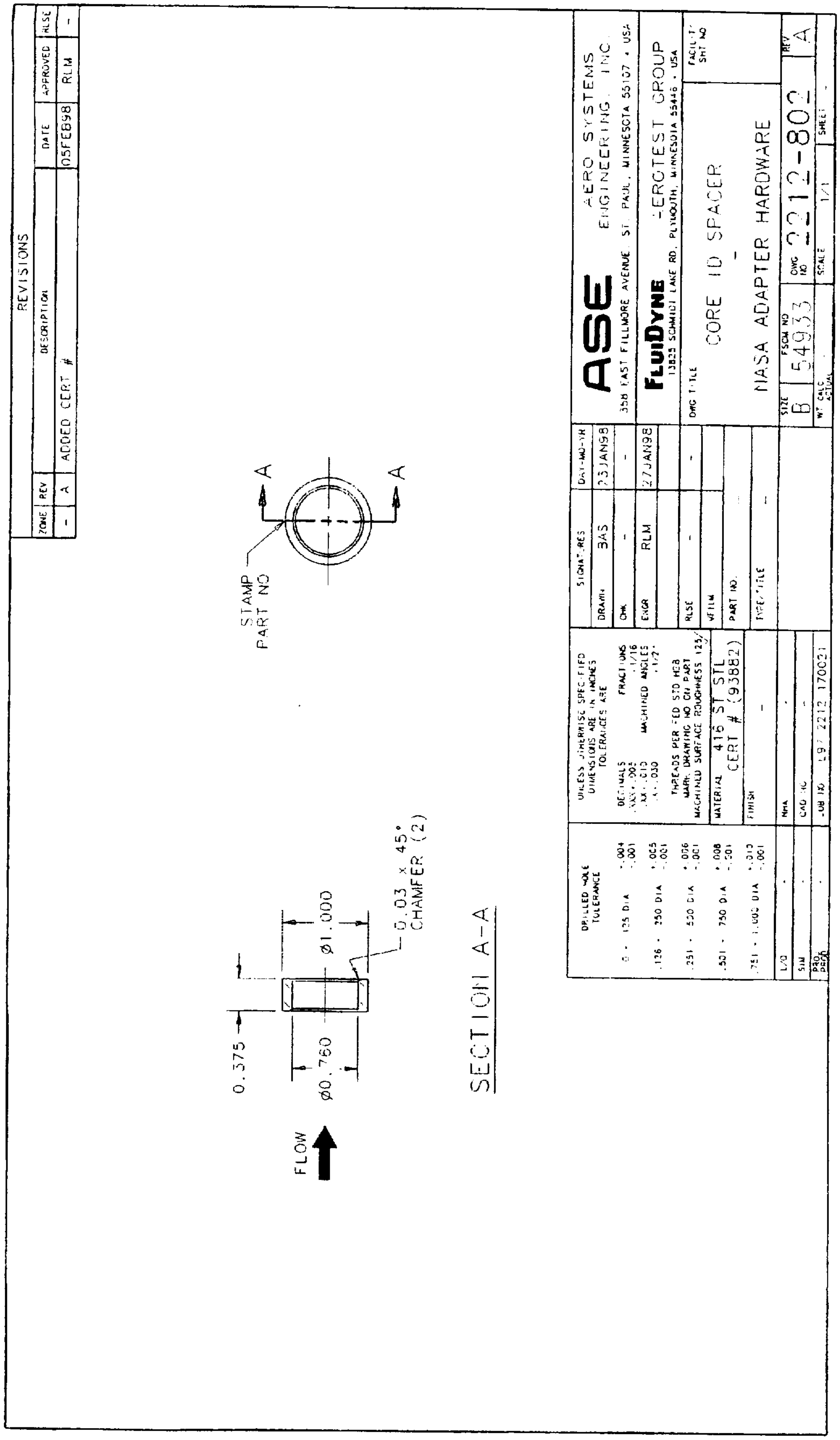
SIZE: C | FSCM NO: 54933 | DWG NO: 2212-612 | REV: B
WT CALC ACTUAL: - | SCALE: 2/1 | SHEET: -

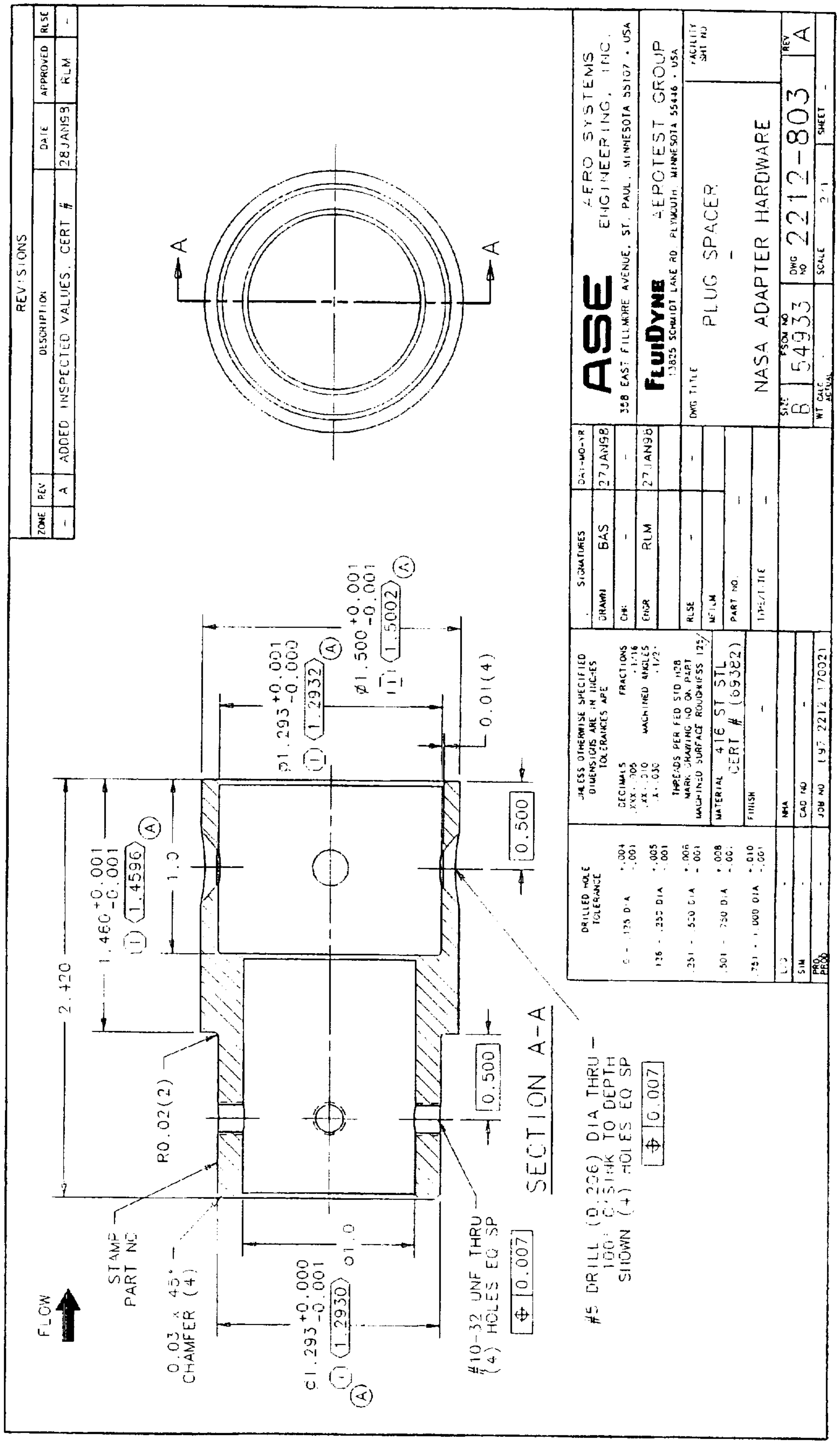
NOTES:

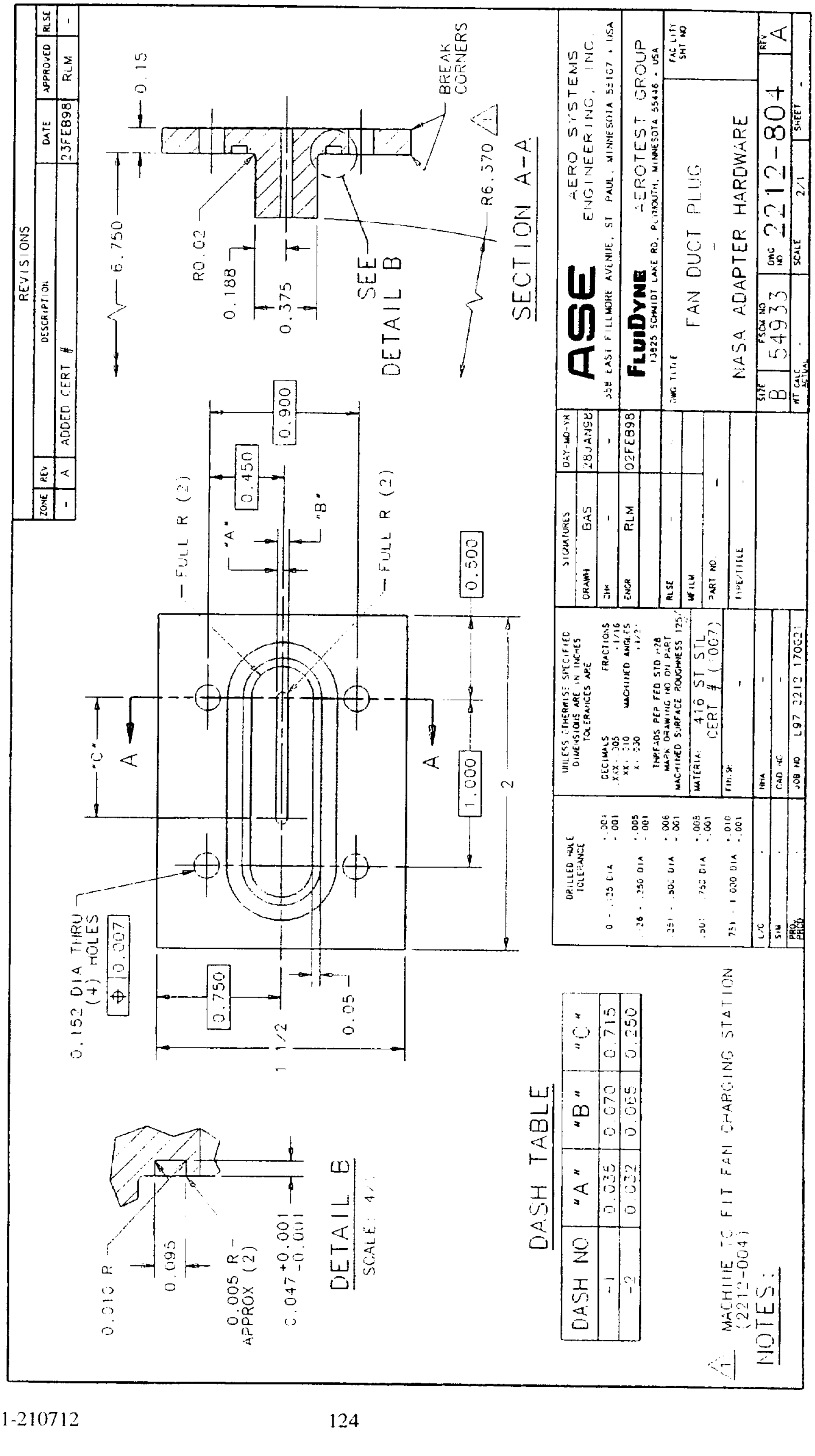
(1) LEAK CHECKED, ID NUMBERED, VISUAL CONFIRMATION OF TAP LOCATION

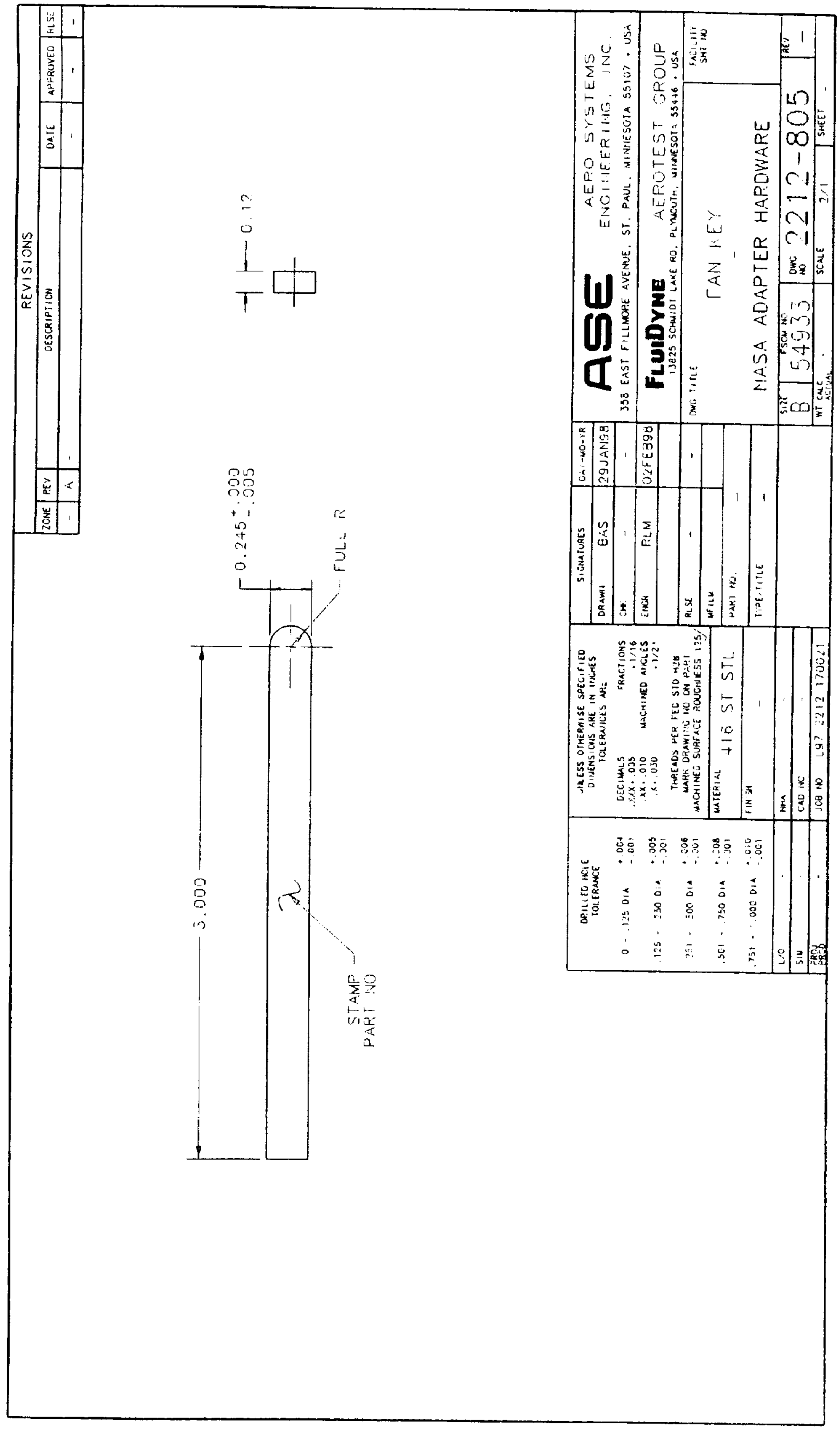

REVISIONS
ZONE REV DESCRIPTION DATE APPROVED RLSE
- A ADDED TAP NUMBERS 24FEB98 RLM -
SILVER SOLDER WIRE TO PROBE
DETAIL B
SCALE: 5/1
Tt PROBE LOCATIONS
TAP NO
θ = 135° θ = 315° R Y INSP
5 10 6.132 0.618 -
4 9 5.628 1.122 -
3 8 5.074 1.676 -
2 7 4.451 2.239 -
1 6 3.725 3.025 -
5 2 6070-894-3 T/C PROBE 0.062 DIA x LGTH REQ'D, TYPE K MGO
1 1 2212-904-2 FAN DUCT PLUG -
QTY ITEM PART NO DESCRIPTION SPECIFICATION
LIST OF MATERIALS
DRAWN BAS 29JAN98
ENGR RLM 02FEB98
MATERIAL SEE L/M
ASE
AERO SYSTEMS ENGINEERING, INC
358 EAST FILLMORE AVENUE, ST. PAUL, MINNESOTA 55107 - USA
FLUIDYNE
AEROTEST GROUP
FAN Tt RAKE
NASA ADAPTER HARDWARE
C 54933 2212-613 A
SCALE 1/1
JOB NO .97 2212 170021
SILVER SOLDER
0.28 (MAX)
Y
SILVER SOLDER TUBES TOGETHER
R0.09 (TYP)
12" (TYP)
0.212
SEE DETAIL B
FLOW
R
NOTES:
1 LEAK CHECKED, ID NUMBERED, VISUAL CONFIRMATION OF TAP LOCATION

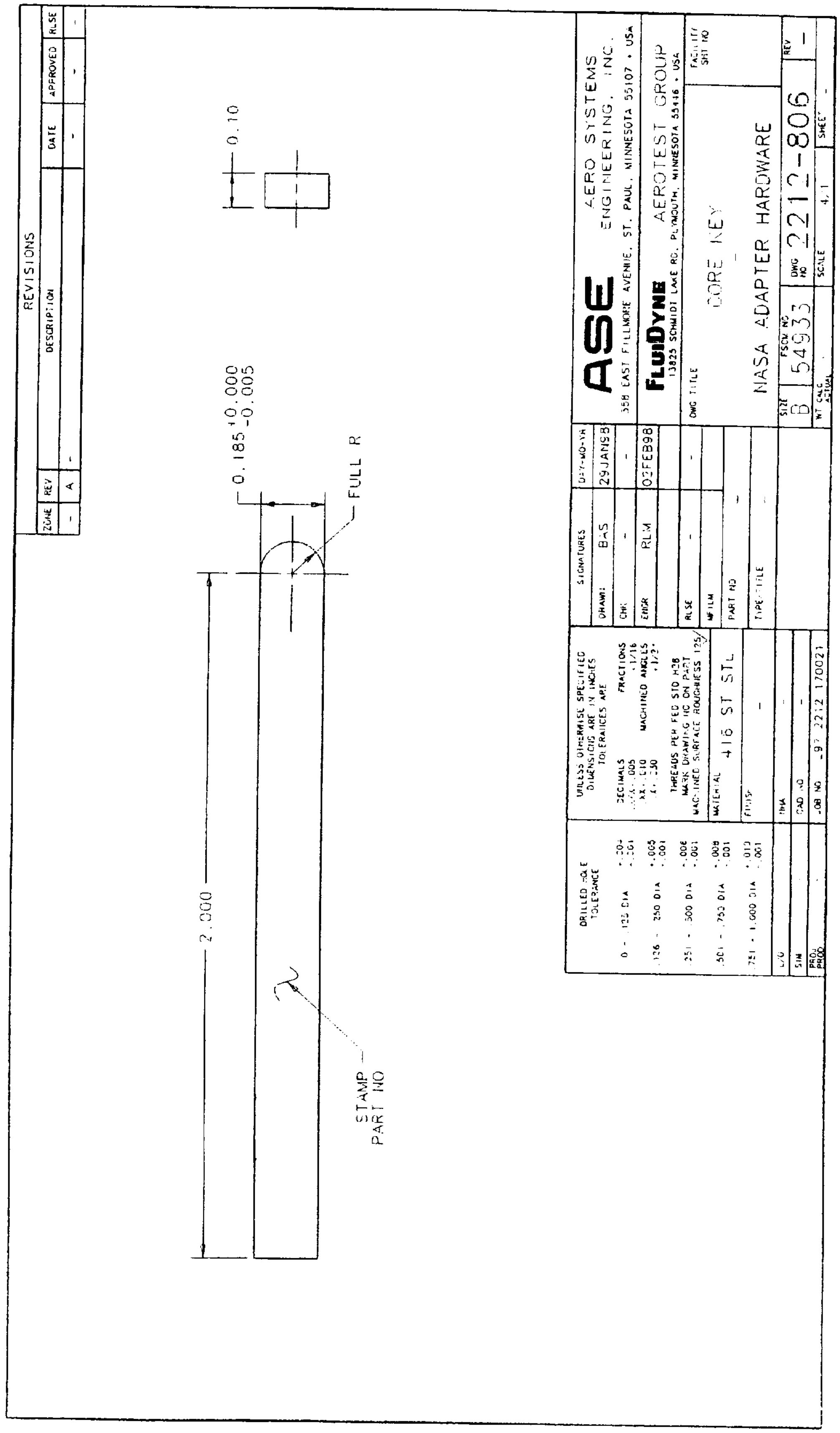

REVISIONS
ZONE | REV | DESCRIPTION | DATE | APPROVED | RLSE
- | A | ADDED CERT # | 28JAN98 | RLM | -
STAMP PART NO
A
A
SECTION A-A
0.375
Ø4.415
Ø4.600
63
0.05 x 45° CHAMFER (2)
FLOW
DRILLED HOLE TOLERANCE
0 - .125 DIA +.004 -.001
.126 - .250 DIA +.005 -.001
.251 - .500 DIA +.006 -.001
.501 - .750 DIA +.008 -.001
.751 - 1.000 DIA +.010 -.001
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
DECIMALS .XXX ±.005 .XX ±.010 .X ±.030
FRACTIONS ±1/16
MACHINED ANGLES ±1/2°
THREADS PER FED STD H28
MARK DRAWING NO ON PART
MACHINED SURFACE ROUGHNESS 125
MATERIAL 416 ST STL CERT # (112)
FINISH -
CAD NO L97 2212 170021
SIGNATURES | DAY-MO-YR
DRAWN BAS 13JAN98
CHK -
ENGR RLM 13JAN98
ASE
AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE, ST PAUL, MINNESOTA 55107 • USA
FLUIDYNE
AEROTEST GROUP
13825 SCHMIDT LAKE RD, PLYMOUTH, MINNESOTA 55446 • USA
DWG TITLE
FAN SPACER ID
NASA ADAPTER HARDWARE
SIZE B
FSCM NO 54933
DWG NO 2212-801
REV A
SCALE 1/1
SHEET -

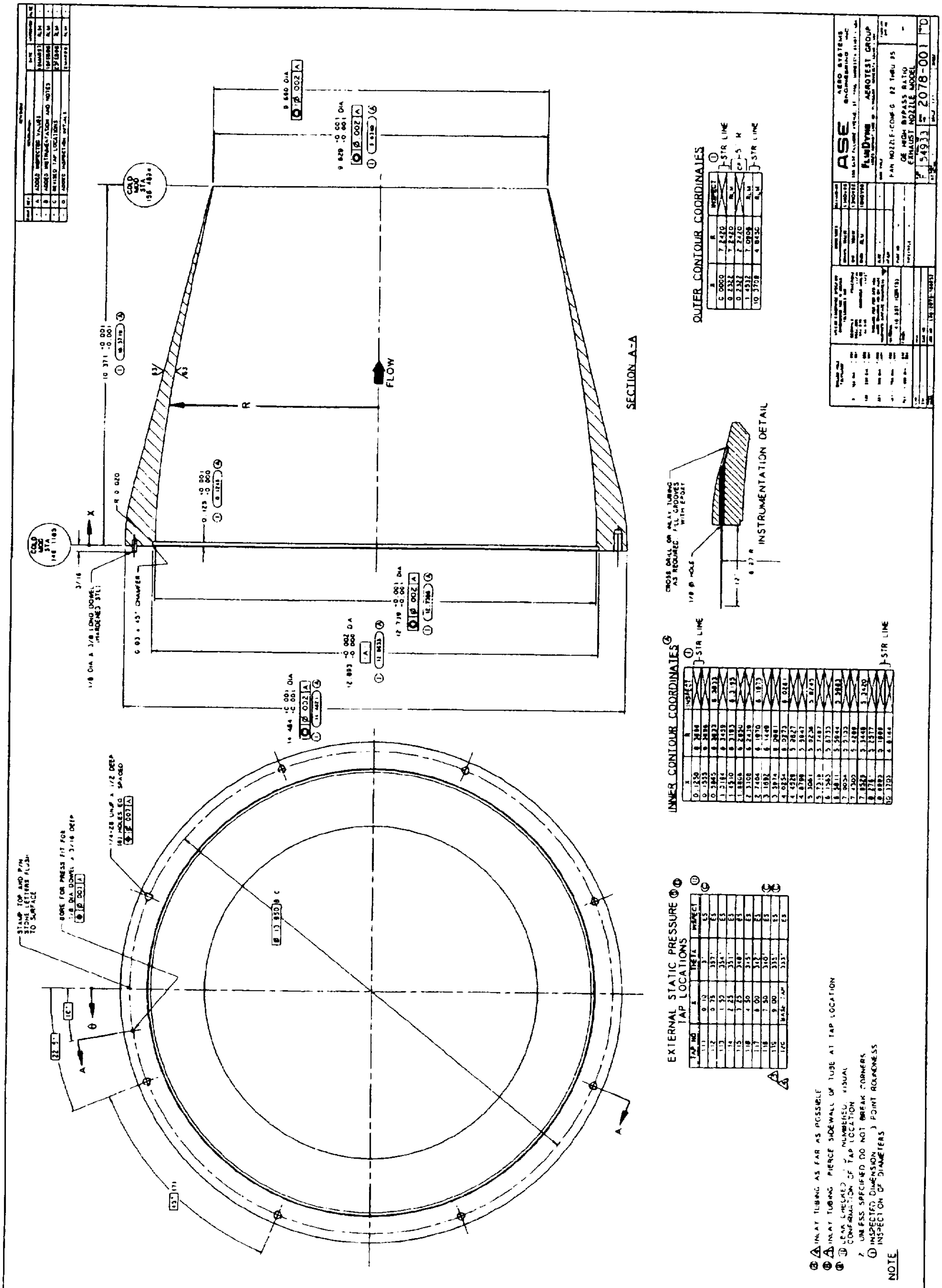

REVISIONS
ZONE REV DESCRIPTION DATE APPROVED RLSE
- A ADDED CERT # 05FEB98 RLM -
STAMP PART NO
A
A
FLOW
0.375
Ø0.760
Ø1.000
0.03 x 45° CHAMFER (2)
SECTION A-A
DRILLED HOLE TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
THREADS PER FED STD H28
MARK DRAWING NO ON PART
MATERIAL 416 ST STL CERT # (93882)
SIGNATURES
DRAWN BAS 23JAN98
ENGR RLM 27JAN98
ASE AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE ST. PAUL, MINNESOTA 55107 • USA
FLUIDYNE AEROTEST GROUP
13825 SCHMIDT LAKE RD. PLYMOUTH, MINNESOTA 55446 • USA
DWG TITLE
CORE ID SPACER
NASA ADAPTER HARDWARE
SIZE B
FSCM NO 54933
DWG NO 2212-802
REV A
SCALE 1/1

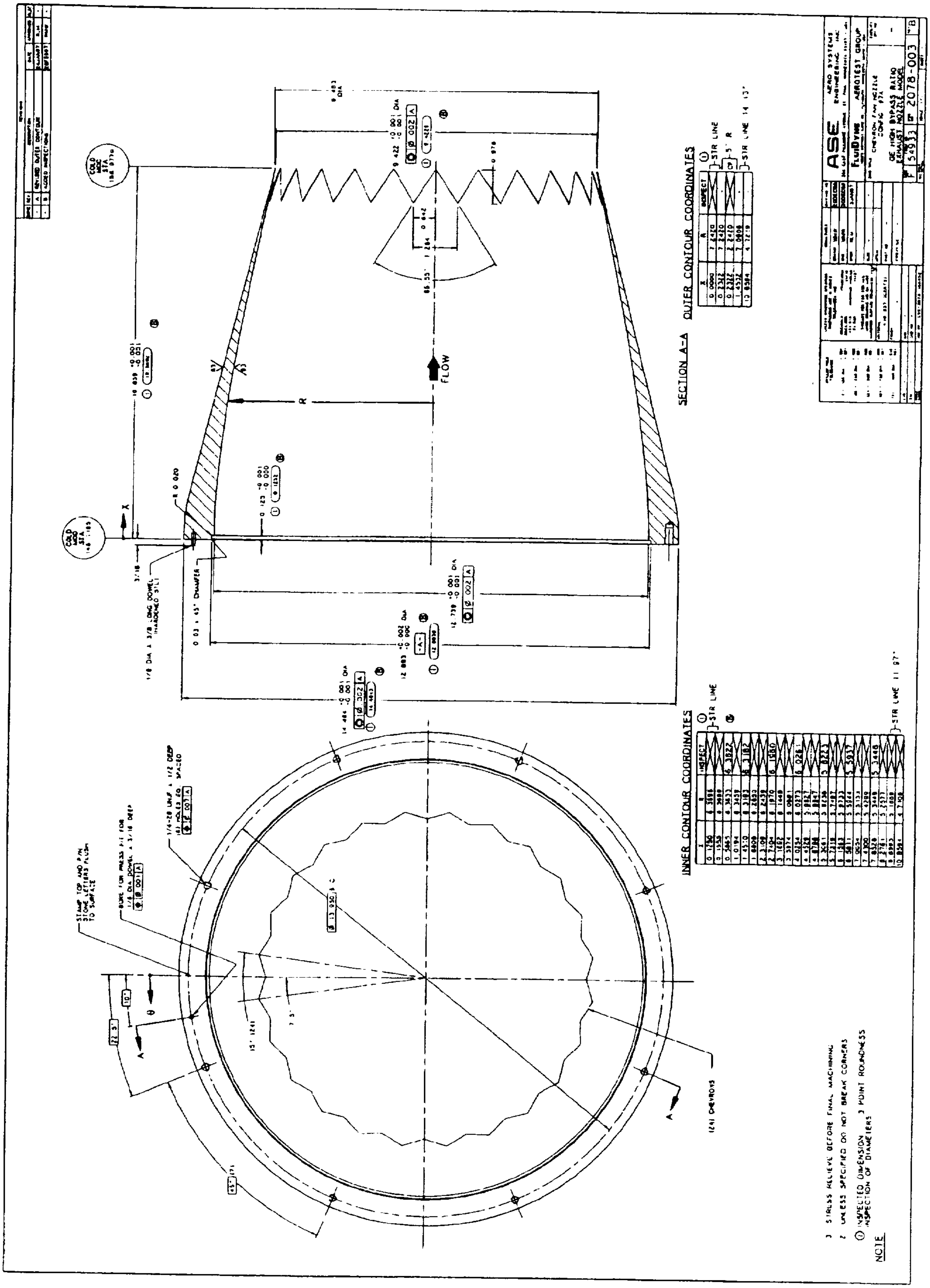

REVISIONS
ZONE REV DESCRIPTION DATE APPROVED RLSE
- A ADDED INSPECTED VALUES, CERT # 28JAN98 RLM -
FLOW
SECTION A-A
R0.02(2)
STAMP PART NO
0.03 x 45° CHAMFER (4)
#10-32 UNF THRU (4) HOLES EQ SP
#5 DRILL (0.206) DIA THRU - 100° C'SINK TO DEPTH SHOWN (4) HOLES EQ SP
ø1.0
ø1.293 +0.000 -0.001
ø1.293 +0.001 -0.000
ø1.500 +0.001 -0.001
1.460 +0.001 -0.001
2.420
1.0
0.500
0.01(4)
MATERIAL 416 ST STL CERT # (69382)
ASE AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE, ST. PAUL, MINNESOTA 55107 • USA
FLUIDYNE AEROTEST GROUP
13825 SCHMIDT LAKE RD PLYMOUTH, MINNESOTA 55446 • USA
PLUG SPACER
NASA ADAPTER HARDWARE
B 54933 2212-803 A
DRAWN BAS 27JAN98
ENGR RLM 27JAN98

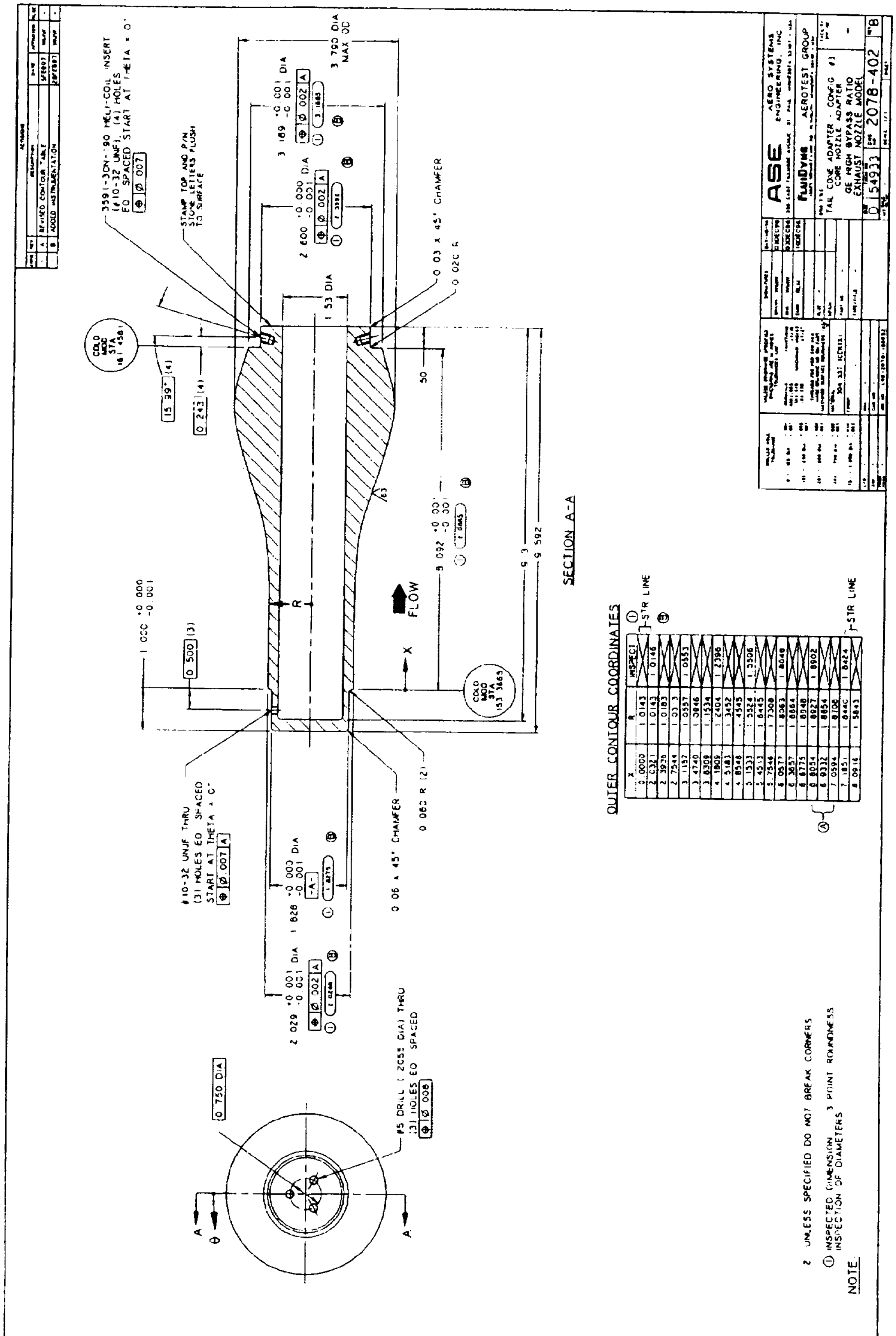

REVISIONS
ZONE | REV | DESCRIPTION | DATE | APPROVED | RLSE
- | A | ADDED CERT # | 23FEB98 | RLM | -
0.15
6.750
R0.02
0.188
0.375
SEE DETAIL B
BREAK CORNERS
R6.370
SECTION A-A
0.900
0.450
FULL R (2)
"A"
"B"
0.500
"C"
A
1.000
2
0.152 DIA THRU (4) HOLES
0.007
0.750
1 1/2
0.05
0.010 R
0.095
0.005 R - APPROX (2)
0.047 +0.001 -0.001
DETAIL B
SCALE: 4/1
DASH TABLE
DASH NO | "A" | "B" | "C"
-1 | 0.035 | 0.070 | 0.715
-2 | 0.032 | 0.065 | 0.250
NOTES:
1 MACHINE TO FIT FAN CHARGING STATION (2212-004)
DRILLED HOLE TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
MATERIAL 416 ST STL CERT # (-0067)
SIGNATURES
DRAWN GAS 28JAN98
ENGR RLM 02FEB98
ASE AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE, ST. PAUL, MINNESOTA 55107 • USA
FLUIDYNE AEROTEST GROUP
13925 SCHMIDT LAKE RD, PLYMOUTH, MINNESOTA 55446 • USA
FAN DUCT PLUG
NASA ADAPTER HARDWARE
SIZE B
FSCM NO 54933
DWG NO 2212-804
REV A
SCALE 2/1
JOB NO L97 2212 170021


REVISIONS
ZONE
REV
DESCRIPTION
DATE
APPROVED
RLSE
A
3.000
0.245 +.000 -.005
0.12
FULL R
STAMP PART NO
DRILLED HOLE TOLERANCE
0 - .125 DIA +.004 -.001
.125 - .250 DIA +.005 -.001
.251 - .500 DIA +.006 -.001
.501 - .750 DIA +.008 -.001
.751 - 1.000 DIA +.010 -.001
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
DECIMALS .XXX ±.005 .XX ±.010 .X ±.030
FRACTIONS ±1/16
MACHINED ANGLES ±1/2°
THREADS PER FED STD H28
MARK DRAWING NO ON PART
MACHINED SURFACE ROUGHNESS 125
MATERIAL 416 ST STL
FINISH
NHA
CAD INC
JOB NO L97 2212 170021
SIGNATURES
DAY-MO-YR
DRAWN BAS 29JAN98
CHK
ENGR RLM 02FEB98
RLSE
MFILM
PART NO.
TYPE/TITLE
ASE AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE, ST. PAUL, MINNESOTA 55107 • USA
FLUIDYNE AEROTEST GROUP
13825 SCHMIDT LAKE RD, PLYMOUTH, MINNESOTA 55446 • USA
DWG TITLE
FAN KEY
NASA ADAPTER HARDWARE
FACILITY SHT NO
SIZE B
FSCM NO 54933
DWG NO 2212-805
REV
WT CALC ACTUAL
SCALE 2/1
SHEET


REVISIONS
ZONE
REV
DESCRIPTION
DATE
APPROVED
RLSE
A
0.10
0.185 +0.000 -0.005
FULL R
2.000
STAMP PART NO
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
MATERIAL 416 ST STL
SIGNATURES
DRAWN BAS 29JAN98
ENGR RLM 02FEB98
ASE AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE, ST. PAUL, MINNESOTA 55107 • USA
FLUIDYNE AEROTEST GROUP
13825 SCHMIDT LAKE RD. PLYMOUTH, MINNESOTA 55446 • USA
DWG TITLE
CORE KEY
NASA ADAPTER HARDWARE
SIZE B
FSCM NO 54933
DWG NO 2212-806
REV
SCALE 4:1

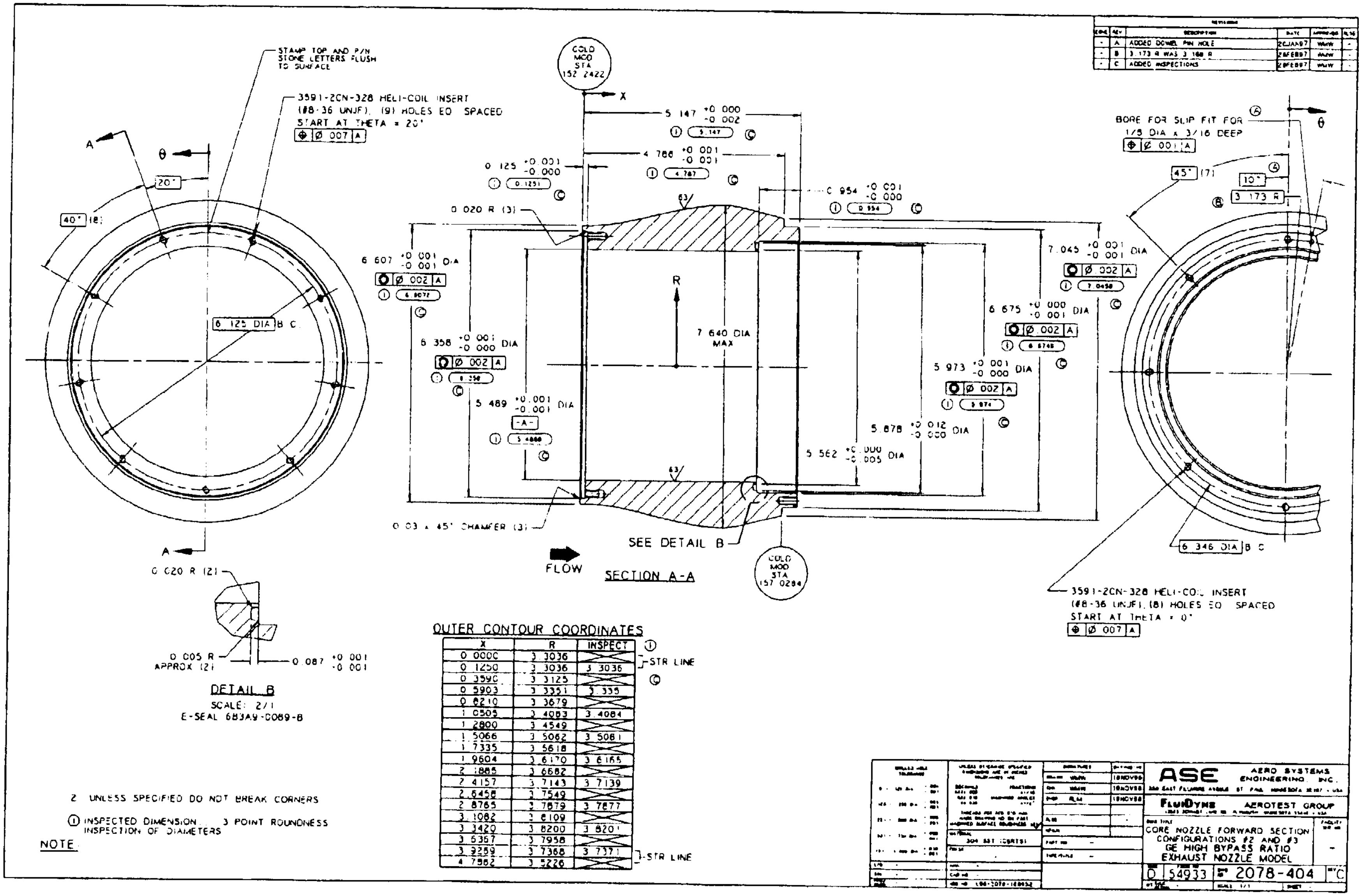

SECTION A-A
FLOW
OUTER CONTOUR COORDINATES
INNER CONTOUR COORDINATES
INSTRUMENTATION DETAIL
EXTERNAL STATIC PRESSURE TAP LOCATIONS
NOTE
ASE
AEROTEST GROUP
2078-001


SECTION A-A
OUTER CONTOUR COORDINATES
INNER CONTOUR COORDINATES
FLOW
1241 CHEVRONS
NOTE
ASE
AEROTEST GROUP
GE HIGH BYPASS RATIO EXHAUST NOZZLE MODEL
2078-003


SECTION A-A
OUTER CONTOUR COORDINATES

X	R	INSPECT
0 0000	1 0143	
2 0321	1 0143	1 0146
2 3936	1 0183	
2 7544	[illegible]	
3 1157	1 0557	1 0553
3 4740	1 0846	
3 8309	1 1534	
4 1909	1 2404	1 2396
4 5183	1 3452	
4 8548	1 4545	
5 1533	1 5524	1 5506
5 4513	1 6445	
5 7546	1 7308	
6 0577	1 8063	1 8048
6 3657	1 8664	
6 6775	1 8940	
6 8054	1 8927	1 8902
6 9332	1 8854	
7 0594	1 8706	
7 1851	1 844C	1 8424
8 0916	1 5843	

STR LINE
FLOW
NOTE
2 UNLESS SPECIFIED DO NOT BREAK CORNERS
1 INSPECTED DIMENSION 3 POINT ROUNDNESS INSPECTION OF DIAMETERS
ASE AERO SYSTEMS ENGINEERING, INC
FLUIDYNE AEROTEST GROUP
TAIL CONE ADAPTER - CONFIG #1 CORE NOZZLE ADAPTER
GE HIGH BYPASS RATIO EXHAUST NOZZLE MODEL
D 54933 2078-402 B



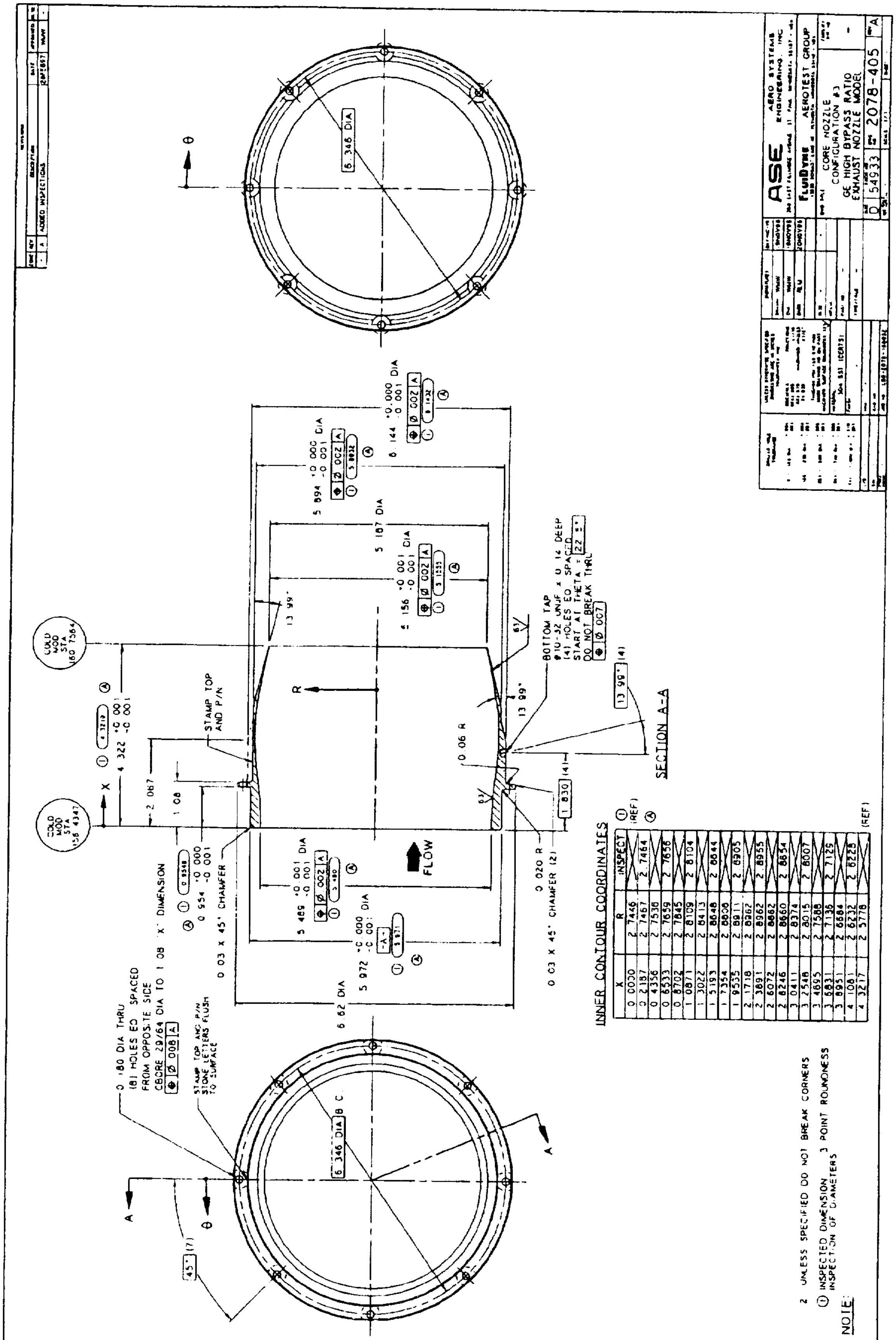
OUTER CONTOUR COORDINATES

X	R	INSPECT
0.0000	3.3036	
0.1250	3.3036	3.3036
0.3590	3.3125	
0.5903	3.3351	3.335
0.8210	3.3679	
1.0505	3.4083	3.4084
1.2800	3.4549	
1.5066	3.5062	3.5061
1.7335	3.5618	
1.9604	3.6170	3.6165
2.1885	3.6682	
2.4157	3.7143	3.7139
2.6458	3.7549	
2.8765	3.7879	3.7877
3.1082	3.8109	
3.3420	3.8200	3.8201
3.6367	3.7958	
3.9259	3.7368	3.7371
4.7982	3.5226	

NOTE

① INSPECTED DIMENSION. 3 POINT ROUNDNESS INSPECTION OF DIAMETERS

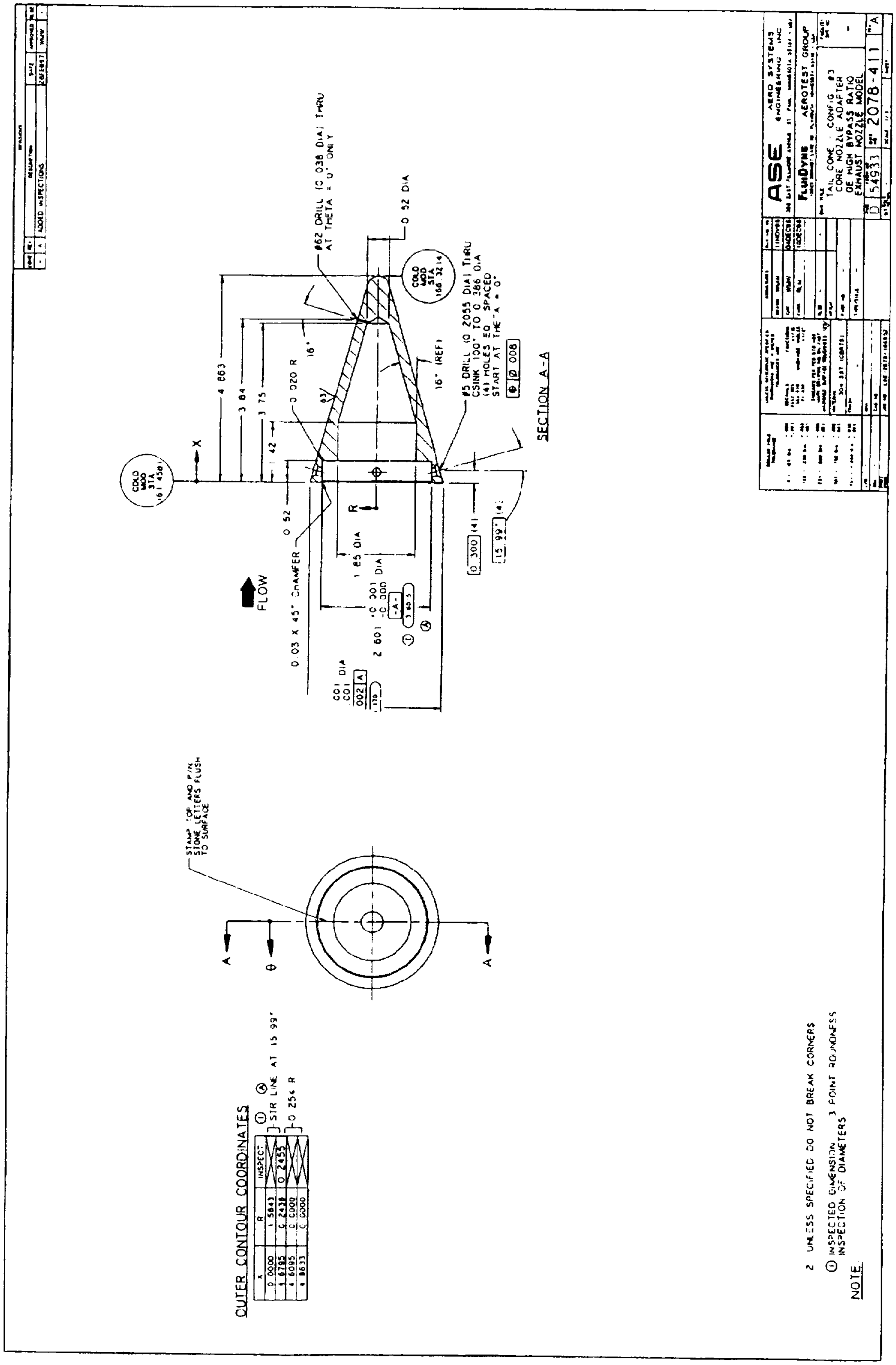
2. UNLESS SPECIFIED DO NOT BREAK CORNERS

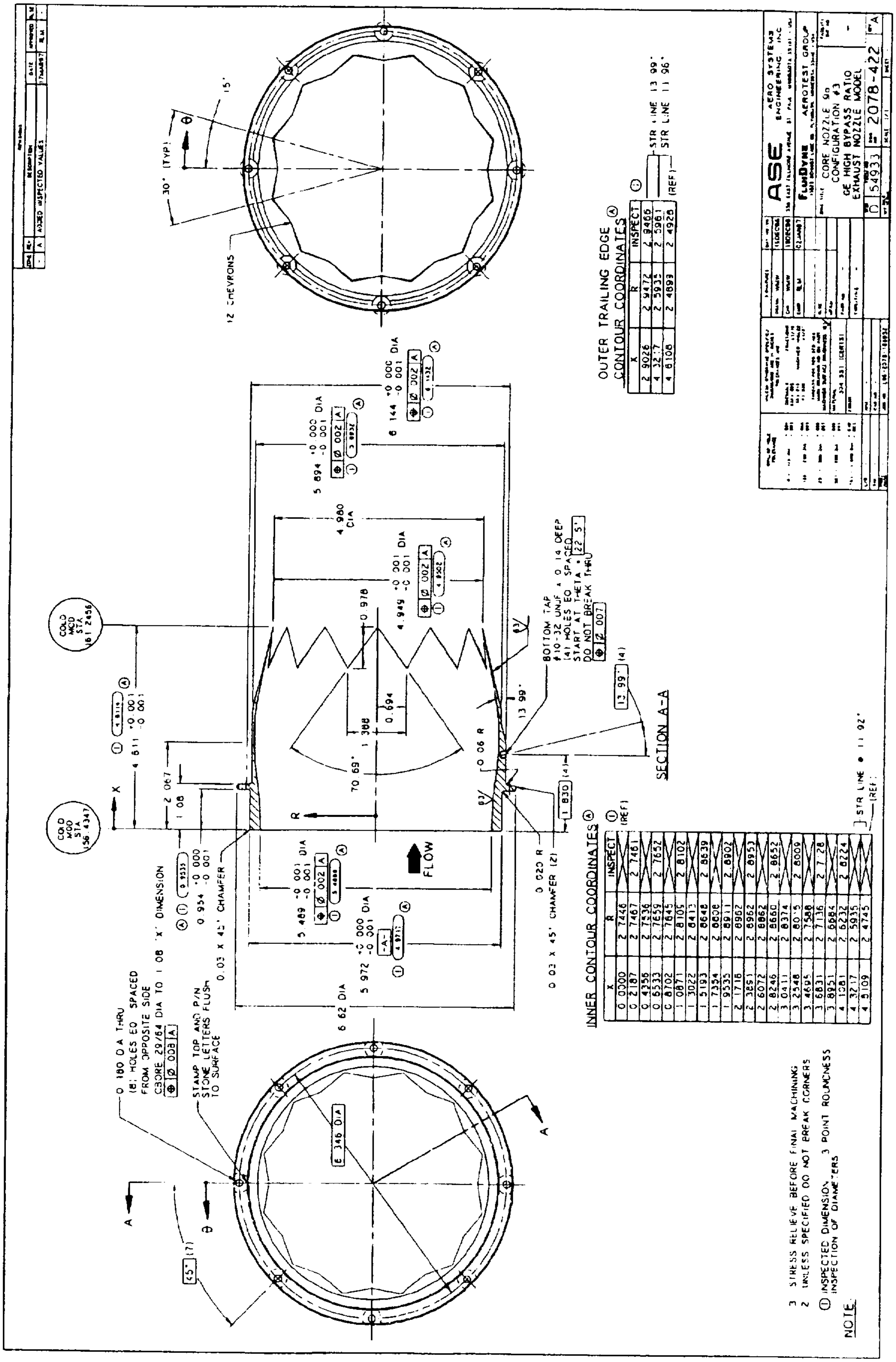


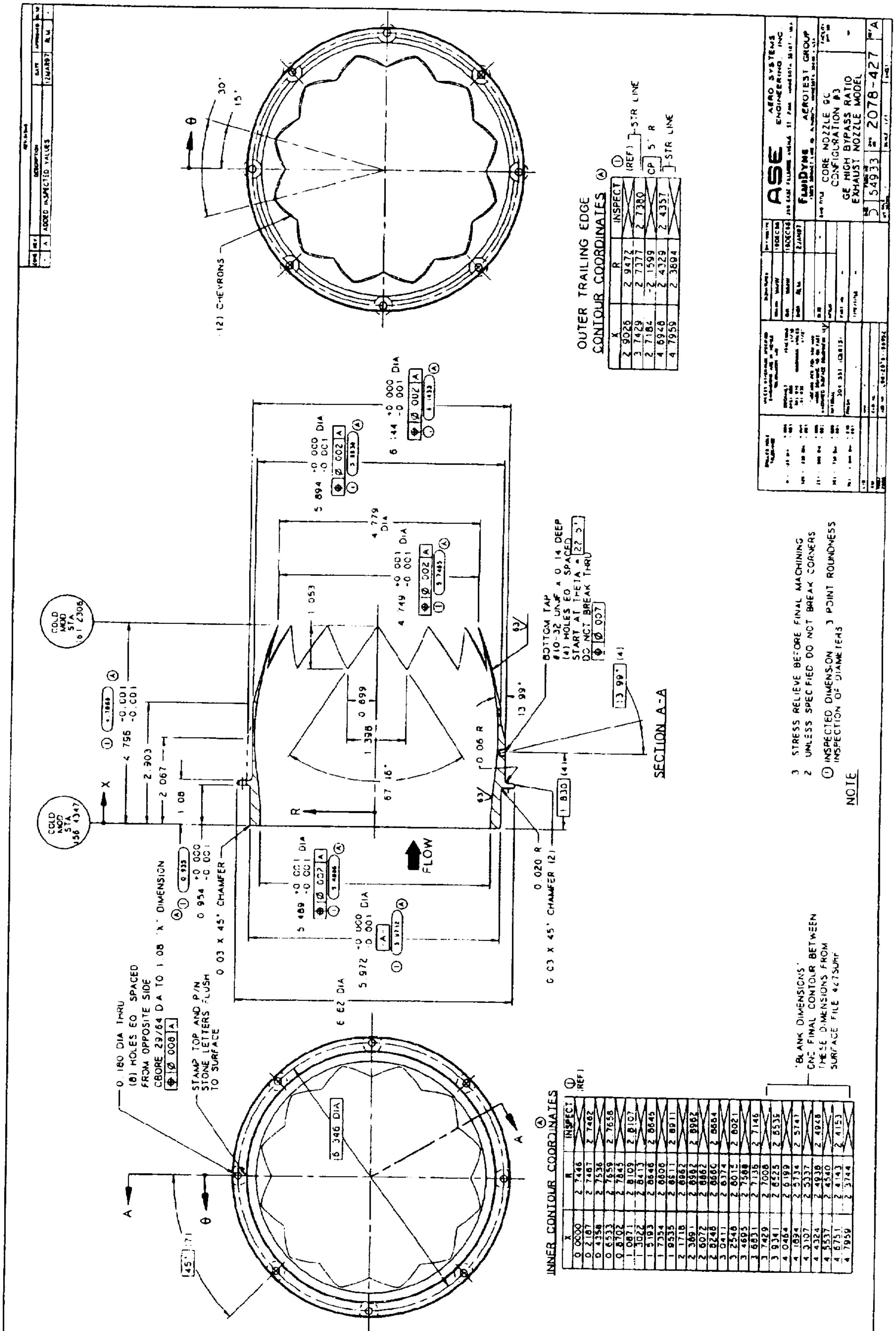
INNER CONTOUR COORDINATES

X	R	INSPECT
0 0000	2 7446	
0 2187	2 7467	2 7464
0 4356	2 7536	
0 6533	2 7659	2 7656
0 8702	2 7845	
1 0871	2 8109	2 8104
1 3022	2 8413	
1 5193	2 8648	2 8644
1 7354	2 8806	
1 9535	2 8911	2 8905
2 1718	2 8962	
2 3891	2 8962	2 8955
2 6072	2 8862	
2 8246	2 8660	2 8654
3 0411	2 8374	
3 2548	2 8015	2 8007
3 4695	2 7588	
3 6831	2 7136	2 7129
3 8951	2 6584	
4 1081	2 6232	2 6228
4 3217	2 5778	

(REF)


OUTER CONTOUR COORDINATES
SECTION A-A
FLOW
NOTE
2 UNLESS SPECIFIED DO NOT BREAK CORNERS
1 INSPECTED DIMENSION 3 POINT ROUNDNESS INSPECTION OF DIAMETERS
STAMP TOP AND P/N STONE LETTERS FLUSH TO SURFACE
ASE AERO SYSTEMS ENGINEERING INC
FLUIDYNE AEROTEST GROUP
TAIL CONE - CONFIG #3 CORE NOZZLE ADAPTER OF HIGH BYPASS RATIO EXHAUST NOZZLE MODEL
54933
2078-411
A



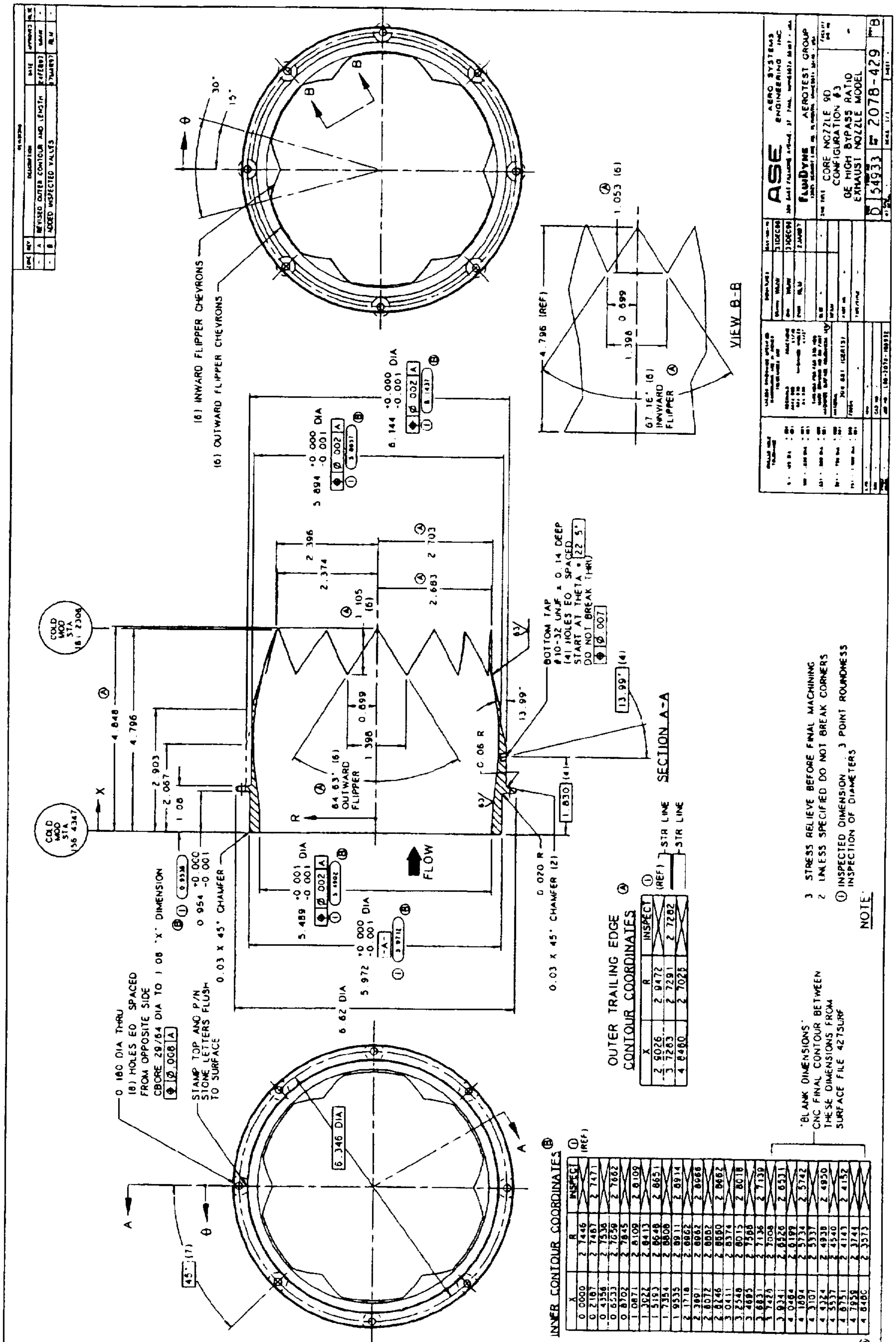


INNER CONTOUR COORDINATES (A)

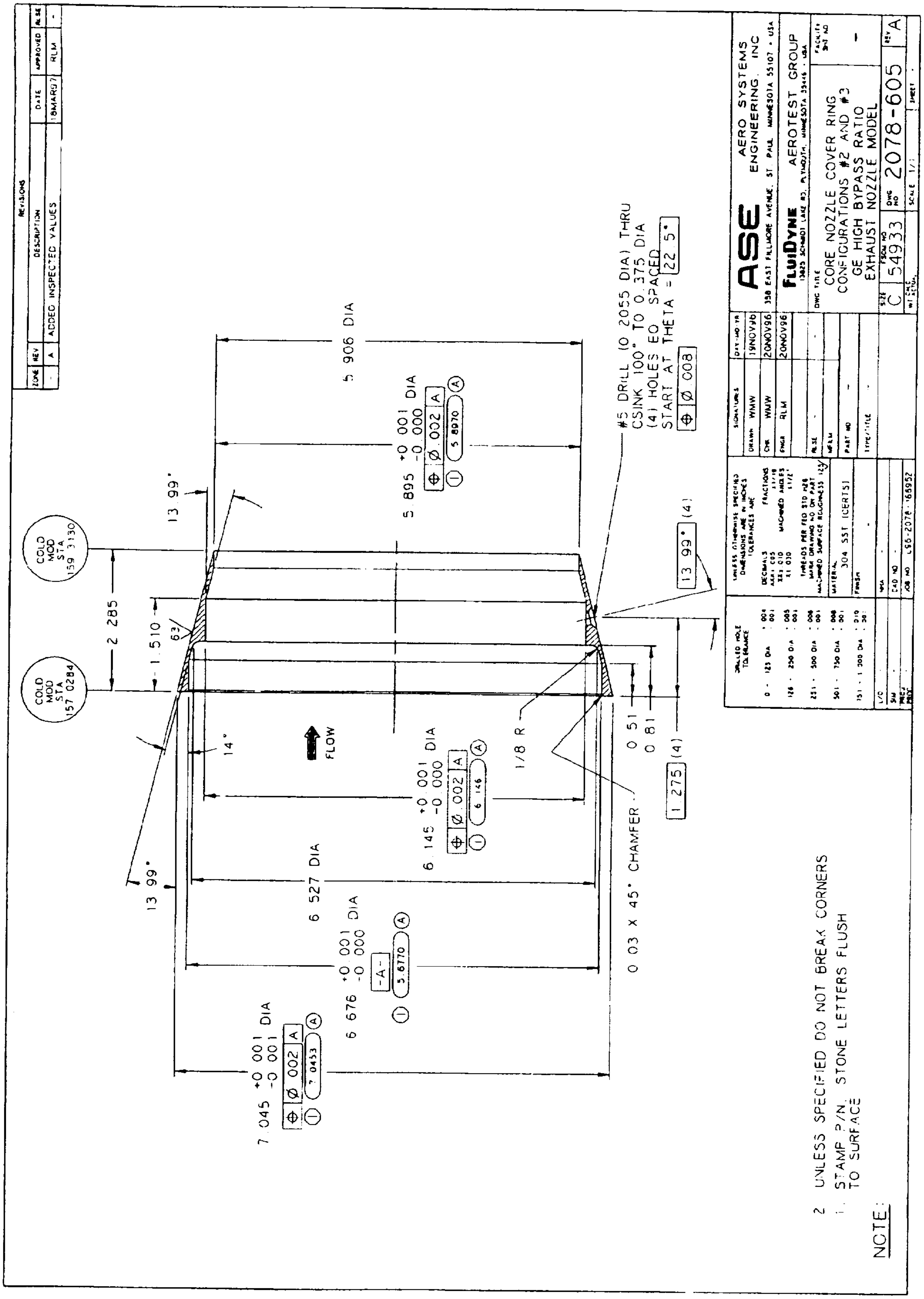
X	R	INSPECT (1) (REF)
0.0000	2.7446	
0.2187	2.7467	2.7462
0.4358	2.7536	
0.6533	2.7659	2.7658
0.8702	2.7845	
1.0871	2.8109	2.8107
1.3022	2.8413	
1.5193	2.8646	2.8645
1.7354	2.8806	
1.9535	2.8911	2.8911
2.1718	2.8962	
2.3891	2.8962	2.8962
2.6072	2.8862	
2.8248	2.8660	2.8664
3.0411	2.8374	
3.2548	2.8015	2.8021
3.4695	2.7588	
3.6831	2.7136	2.7146
3.7429	2.7008	
3.9341	2.6525	2.6535
4.0464	2.6199	
4.1694	2.5734	2.5741
4.3107	2.5337	
4.4324	2.4938	2.4948
4.5537	2.4540	
4.6751	2.4143	2.4153
4.7959	2.3744	

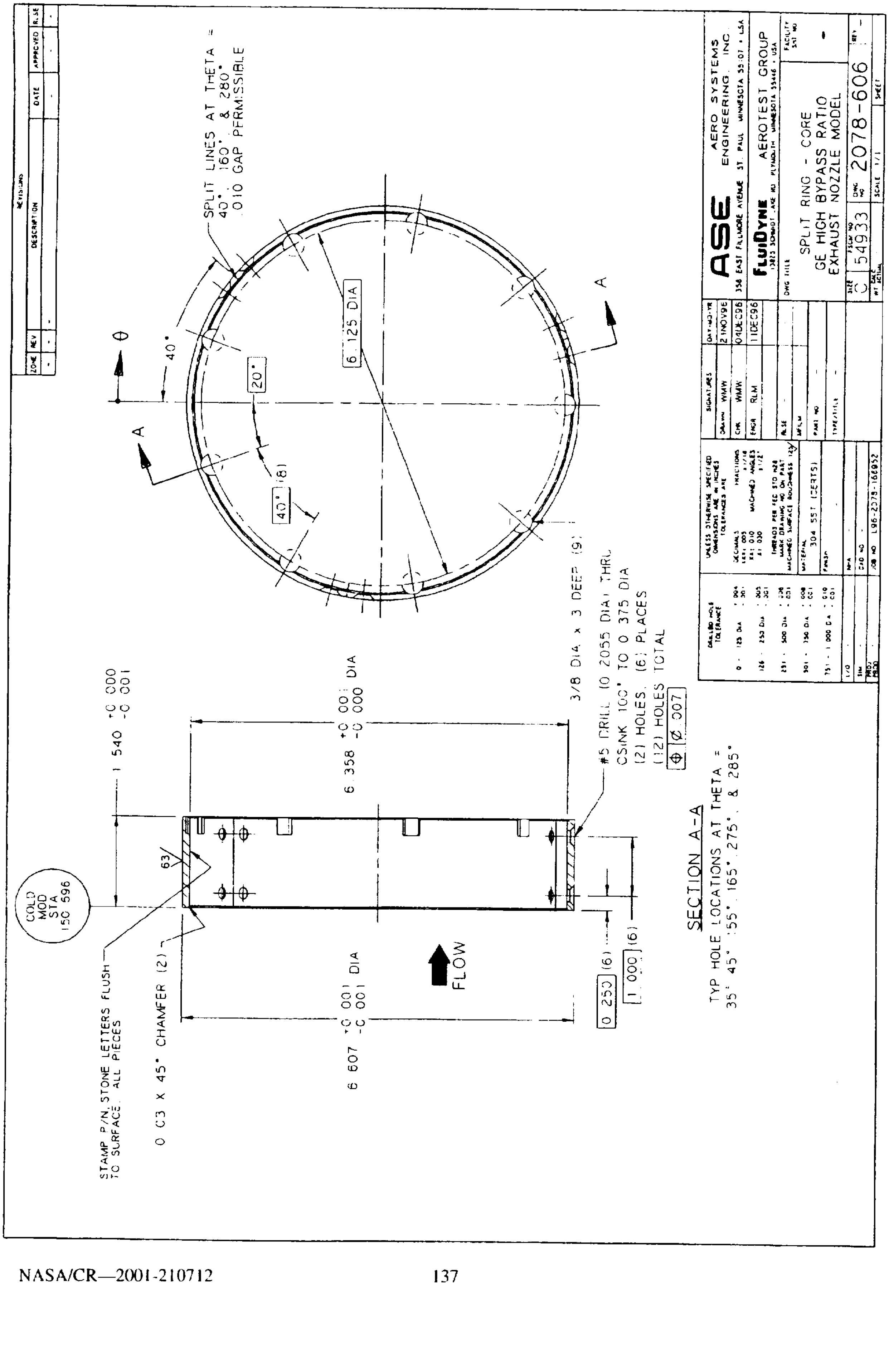
OUTER TRAILING EDGE CONTOUR COORDINATES (A)

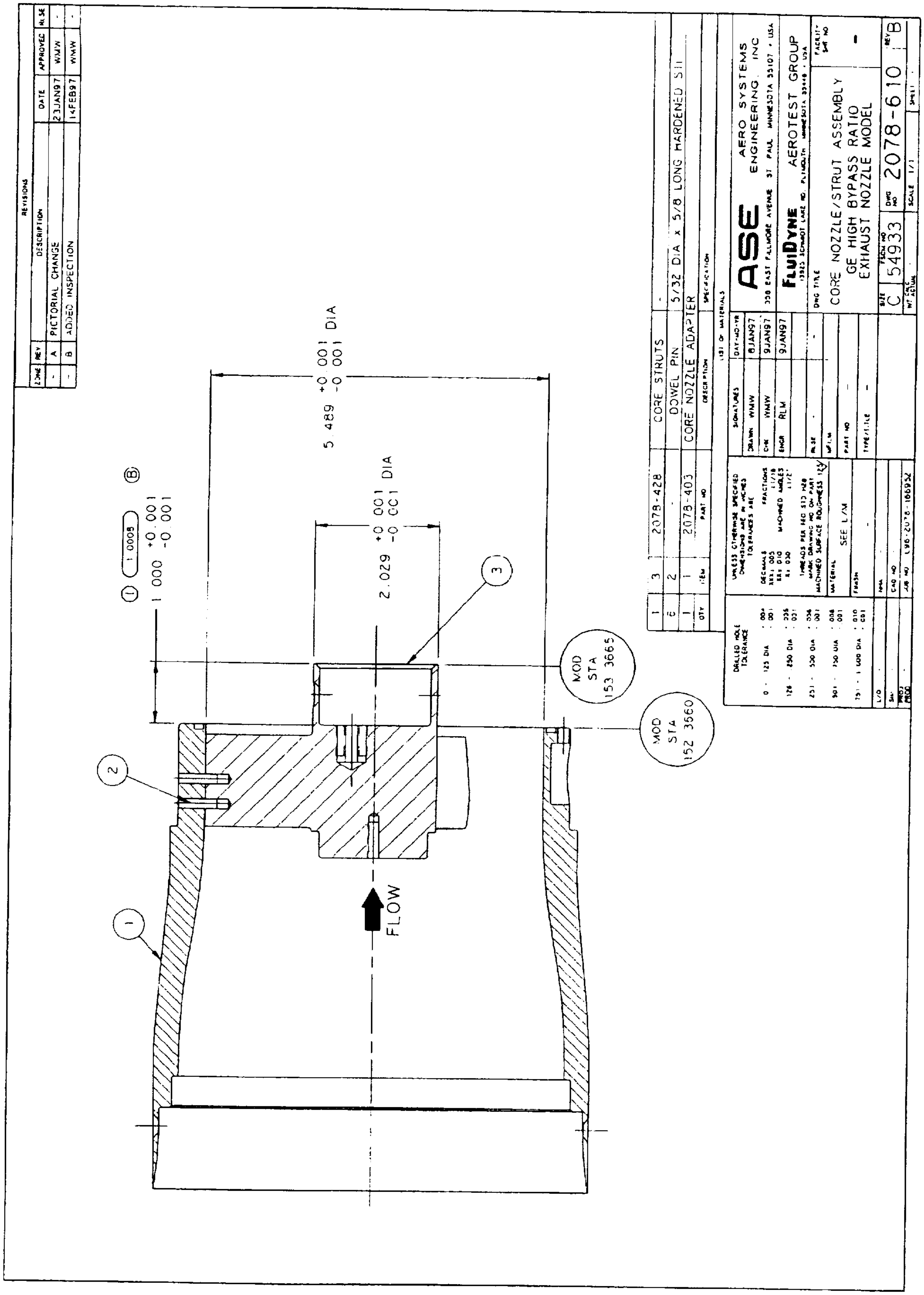
X	R	INSPECT (1) (REF)
2.9026	2.9472	
3.7429	2.7377	2.7380
2.7184	2.1599	
4.6948	2.4329	2.4357
4.7959	2.3894	

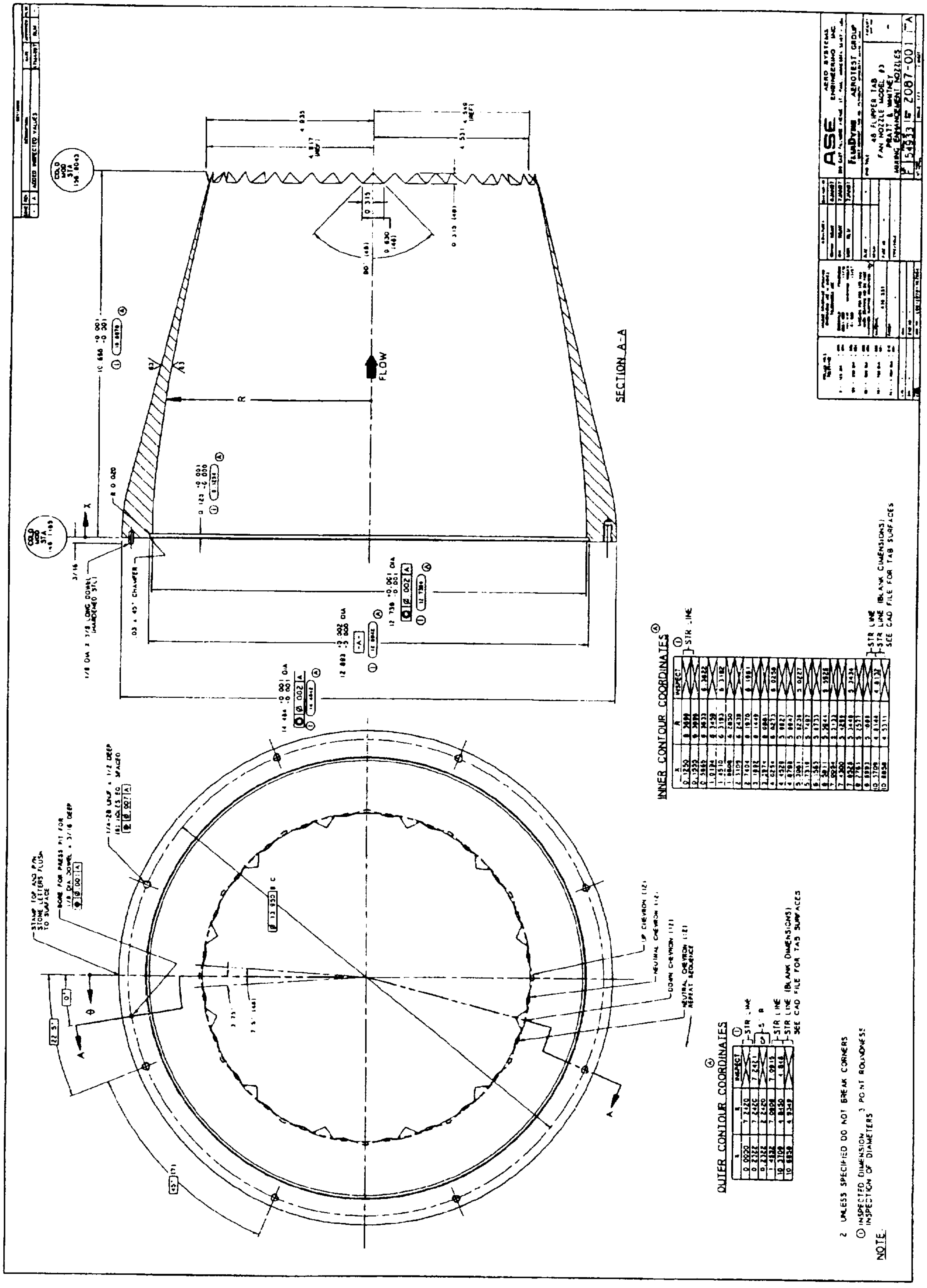


INNER CONTOUR COORDINATES
OUTER TRAILING EDGE CONTOUR COORDINATES
SECTION A-A
VIEW B-B
FLOW
(6) INWARD FLIPPER CHEVRONS
(6) OUTWARD FLIPPER CHEVRONS
COLD MOD STA 56.4347
COLD MOD STA 61.2306
0.180 DIA THRU (8) HOLES EQ SPACED FROM OPPOSITE SIDE CBORE 29/64 DIA TO 1.08 'X' DIMENSION
STAMP TOP AND P/N STONE LETTERS FLUSH TO SURFACE
6.62 DIA
6.346 DIA
BOTTOM TAP #10-32 UNJF x 0.14 DEEP (4) HOLES EQ SPACED START AT THETA = 22.5° DO NOT BREAK THRU
64.63° (6) OUTWARD FLIPPER
67.16° (6) INWARD FLIPPER
'BLANK DIMENSIONS' CNC FINAL CONTOUR BETWEEN THESE DIMENSIONS FROM SURFACE FILE 4273URF
NOTE:
3 STRESS RELIEVE BEFORE FINAL MACHINING
2 UNLESS SPECIFIED DO NOT BREAK CORNERS
① INSPECTED DIMENSION, 3 POINT ROUNDNESS INSPECTION OF DIAMETERS
ASE AERO SYSTEMS ENGINEERING INC
FluiDyne AEROTEST GROUP
CORE NOZZLE 9D CONFIGURATION #3 GE HIGH BYPASS RATIO EXHAUST NOZZLE MODEL
D 54933 2078-429 B
REVISED OUTER CONTOUR AND LENGTH
ADDED INSPECTED VALUES


NOTE:
1. STAMP P/N, STONE LETTERS FLUSH TO SURFACE
2. UNLESS SPECIFIED DO NOT BREAK CORNERS
ASE AERO SYSTEMS ENGINEERING, INC
358 EAST FILLMORE AVENUE, ST. PAUL, MINNESOTA 55107 • USA
FLUIDYNE AEROTEST GROUP
CORE NOZZLE COVER RING
CONFIGURATIONS #2 AND #3
GE HIGH BYPASS RATIO
EXHAUST NOZZLE MODEL
C 54933 2078-605 A
REVISIONS
A ADDED INSPECTED VALUES 18MAR97 RLM
304 SST (CERTS)
#5 DRILL (0.2055 DIA) THRU
CSINK 100° TO 0.375 DIA
(4) HOLES EQ. SPACED
START AT THETA = 22.5°
COLD MOD STA 157.0284
COLD MOD STA 159.3130
5.906 DIA
5.895 +0.001 -0.000 DIA
6.145 +0.001 -0.000 DIA
6.527 DIA
6.676 +0.001 -0.000 DIA
7.045 +0.001 -0.001 DIA
2.285
1.510
13.99°
14°
1/8 R
0.51
0.81
1.275 (4)
0.03 X 45° CHAMFER
FLOW


SPLIT LINES AT THETA = 40°, 160° & 280°
.010 GAP PERMISSIBLE
6.125 DIA
20°
40°
40° (8)
A
θ
COLD MOD STA 150.596
1.540 +0.000 -0.001
6.358 +0.001 -0.000 DIA
6.607 +0.001 -0.001 DIA
STAMP P/N, STONE LETTERS FLUSH TO SURFACE. ALL PIECES
0.03 X 45° CHAMFER (2)
63
FLOW
3/8 DIA x .3 DEEP (9)
#5 DRILL (0.2055 DIA) THRU
CSINK 100° TO 0.375 DIA
(2) HOLES. (6) PLACES
(12) HOLES TOTAL
⌖ Ø .007
0.250 (6)
1.000 (6)
SECTION A-A
TYP HOLE LOCATIONS AT THETA =
35°, 45°, 155°, 165°, 275°, & 285°
ASE AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE ST. PAUL MINNESOTA 55107 USA
FLUIDYNE AEROTEST GROUP
SPLIT RING - CORE
GE HIGH BYPASS RATIO
EXHAUST NOZZLE MODEL
DRAWN WMW 21NOV96
CHK WMW 04DEC96
ENGR RLM 11DEC96
304 SST (CERTS)
JOB NO L96-2378-16E952
SIZE C
FSCM NO 54933
DWG NO 2078-606
SCALE 1/1


REVISIONS
ZONE REV DESCRIPTION DATE APPROVED RLSE
A PICTORIAL CHANGE 23JAN97 WMW
B ADDED INSPECTION 14FEB97 WMW
1.000 +0.001 -0.001
1.0005
5.489 +0.001 -0.001 DIA
2.029 +0.001 -0.001 DIA
MOD STA 153.3665
MOD STA 152.3560
FLOW
1 3 2078-428 CORE STRUTS
6 2 DOWEL PIN 5/32 DIA x 5/8 LONG HARDENED STL
1 1 2078-403 CORE NOZZLE ADAPTER
QTY ITEM PART NO DESCRIPTION SPECIFICATION
LIST OF MATERIALS
DRAWN WMW 8JAN97
CHK WMW 9JAN97
ENGR RLM 9JAN97
MATERIAL SEE L/M
ASE AERO SYSTEMS ENGINEERING, INC
358 EAST FILLMORE AVENUE ST PAUL MINNESOTA 55107 USA
FLUIDYNE AEROTEST GROUP
DWG TITLE
CORE NOZZLE/STRUT ASSEMBLY
GE HIGH BYPASS RATIO
EXHAUST NOZZLE MODEL
SIZE C FSCM NO 54933 DWG NO 2078-610 REV B
SCALE 1/1
JOB NO L96-2078-166952


SECTION A-A
FLOW
INNER CONTOUR COORDINATES
OUTER CONTOUR COORDINATES
ASE
NOTE

ZONE	REV	DESCRIPTION	DATE	APPROVED
-	A	ADDED INSPECTED VALUES	18MAR97	RLM

3 POINT ROUNDNESS INNER CONTOUR COORDINATES

X	R	INSPECT
0.0000	2.7446	2.7442
0.2187	2.7467	
0.4356	2.7536	2.7544
0.6533	2.7659	
0.8702	2.7845	2.7859
1.0871	2.8109	
1.3022	2.8413	2.8437
1.5193	2.8648	
1.7354	2.8808	2.8825
1.9535	2.8911	
2.1718	2.8962	2.8973
2.3891	2.8982	
2.6072	2.8862	2.8853
2.8246	2.8660	
3.0411	2.8374	2.8342
3.2548	2.8015	
3.4613	2.7606	2.7616

INNER CONTOUR INSPECTION

X	R	INSPECT @ THETA = 0°
3.4613	2.7606	2.6832
4.3232	2.5774	2.575

OUTER CONTOUR INSPECTION

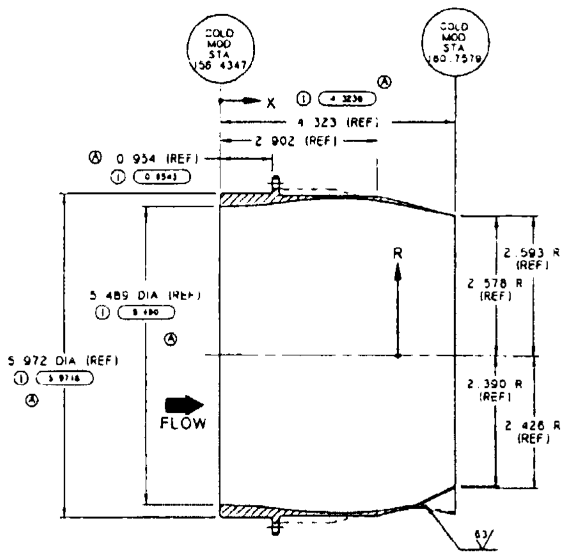
X	R	INSPECT @ THETA = 0°
2.9023	2.9472	2.9421
4.3232	2.5930	2.5915

INNER CONTOUR INSPECTION

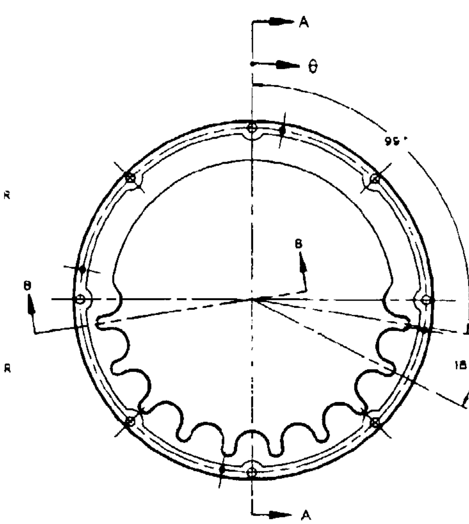
X	R	INSPECT @ THETA = 180°
3.7172	2.6823	2.6832
3.9600	2.5653	2.5642
4.3232	2.3900	2.3915

OUTER CONTOUR INSPECTION

X	R	INSPECT @ THETA = 180°
2.9023	2.9472	2.942
4.3232	2.4290	2.429



SECTION A-A

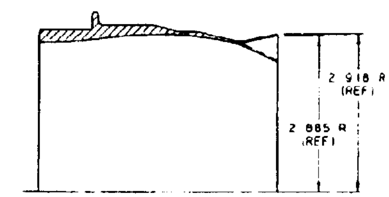


CORE EXPANSION LOBE INNER CONTOUR INSPECTION

X	R	INSPECT @ THETA = 99°	INSPECT @ THETA = 171°	INSPECT @ THETA = 261°
3.8349	2.7452	2.7475	2.7449	2.7463
3.9809	2.8112	2.8116	2.8069	2.8069
4.1517	2.8479	2.8496	2.8456	2.8462

CORE EXPANSION LOBE OUTER CONTOUR INSPECTION

X	R	INSPECT @ THETA = 99°	INSPECT @ THETA = 171°	INSPECT @ THETA = 261°
2.9023	2.9472	2.9463	2.9435	2.9456
3.5853	2.7834	2.7885	2.7881	2.7880
3.8320	2.8120	2.8167	2.8149	2.8145
3.9546	2.8383	2.8423	2.8404	2.8413
4.2014	2.8913	2.8954	2.8945	2.8958



SECTION B-B

NOTE:

① INSPECTED DIMENSION. 3 POINT ROUNDNESS INSPECTION OF DIAMETERS

2. UNLESS SPECIFIED DO NOT BREAK CORNERS

3. FINAL MACHINE PER CAD FILE

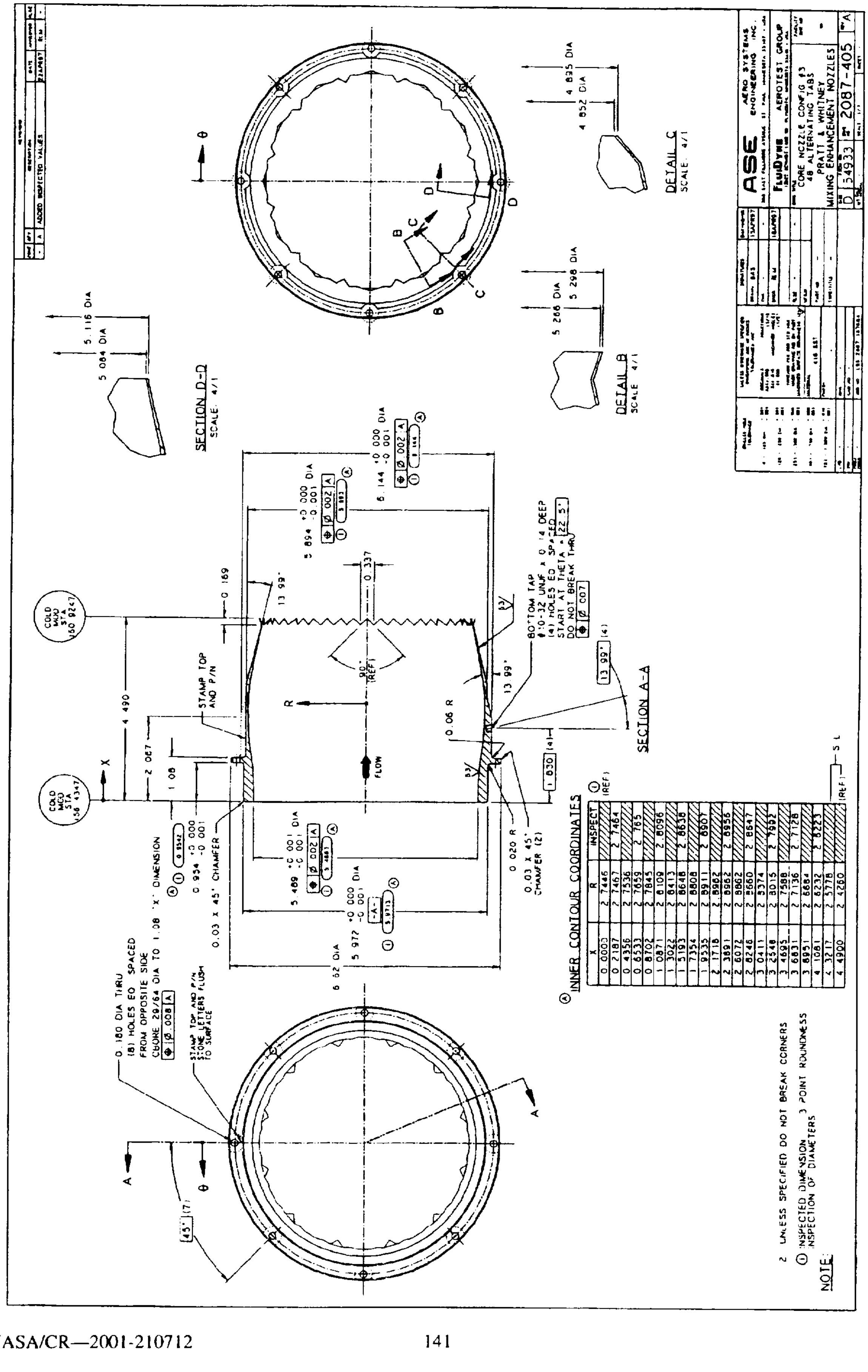
ASE AERO SYSTEMS ENGINEERING, INC.

FLUIDYNE AEROTEST GROUP

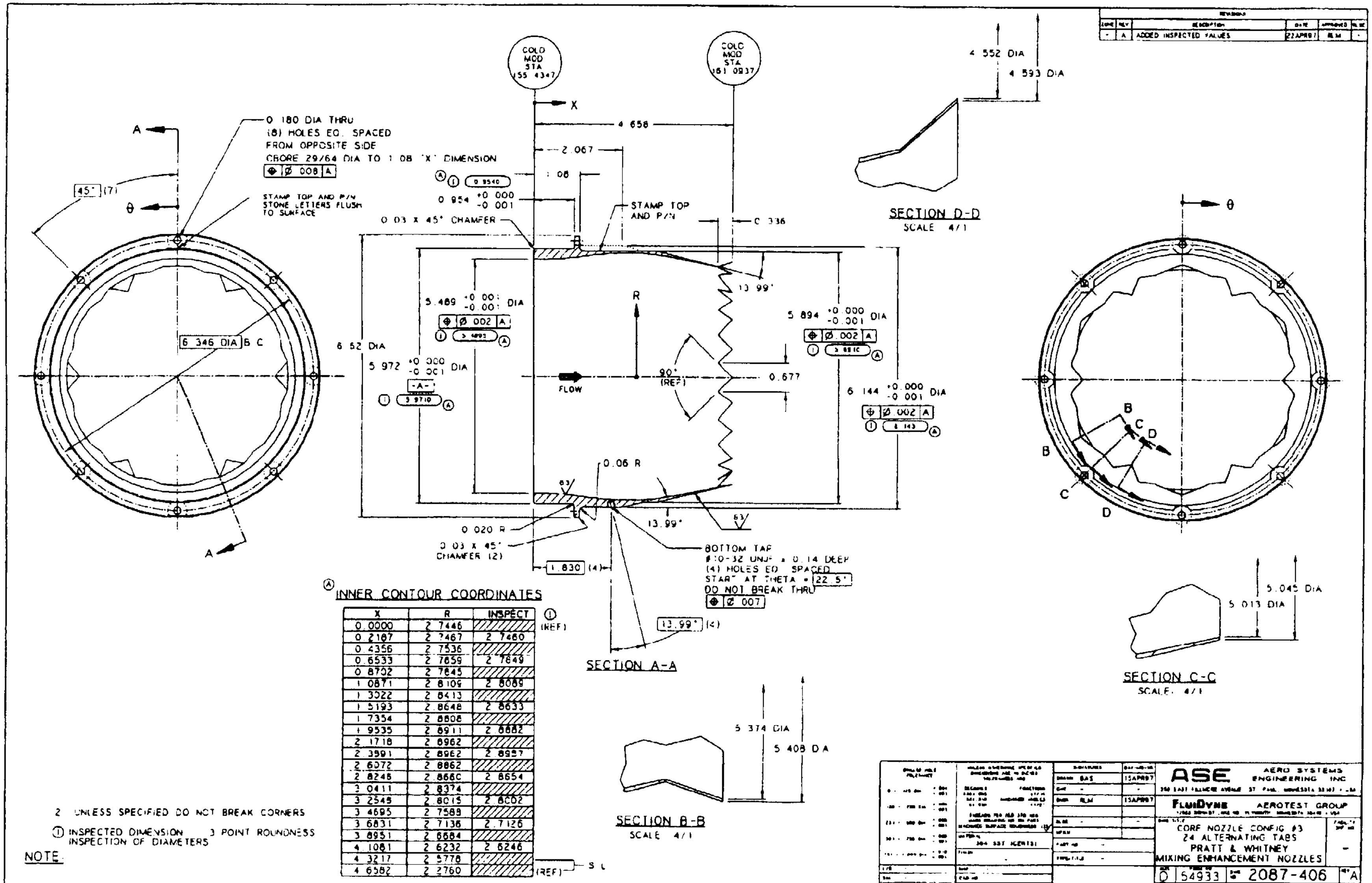
HALF MIXER

PRATT & WHITNEY MIXING ENHANCEMENT NOZZLES

D 54933 2087-404 A



INNER CONTOUR COORDINATES
X	R	INSPECT
0.0003	2.7446	
0.2187	2.7467	2.7464
0.4356	2.7536	
0.6533	2.7659	2.765
0.8702	2.7845	
1.0871	2.8109	2.8096
1.3022	2.8413	
1.5193	2.8648	2.8638
1.7354	2.8808	
1.9535	2.8911	2.8907
2.1718	2.8962	
2.3891	2.8962	2.8956
2.6072	2.8862	
2.8246	2.8660	2.8647
3.0411	2.8374	
3.2548	2.8015	2.7992
3.4695	2.7588	
3.6831	2.7136	2.7128
3.8951	2.6684	
4.1081	2.6232	2.6223
4.3217	2.5776	
4.4900	2.4260	
SECTION A-A
SECTION D-D
SCALE: 4/1
DETAIL B
SCALE: 4/1
DETAIL C
SCALE: 4/1
COLD MOD STA 56.4347
COLD MOD STA 60.9247
0.180 DIA THRU
(8) HOLES EQ. SPACED
FROM OPPOSITE SIDE
CBORE 29/64 DIA TO 1.08 "X" DIMENSION
STAMP TOP AND P/N
STONE LETTERS FLUSH TO SURFACE
0.03 X 45° CHAMFER
STAMP TOP AND P/N
FLOW
BOTTOM TAP
#10-32 UNJF x 0.14 DEEP
(4) HOLES EQ. SPACED
START AT THETA = 22.5°
DO NOT BREAK THRU
0.03 X 45° CHAMFER (2)
5.116 DIA
5.084 DIA
5.268 DIA
5.298 DIA
4.895 DIA
4.852 DIA
6.62 DIA
NOTE:
1 INSPECTED DIMENSION. 3 POINT ROUNDNESS INSPECTION OF DIAMETERS
2 UNLESS SPECIFIED DO NOT BREAK CORNERS
ADDED INSPECTED VALUES
ASE AERO SYSTEMS ENGINEERING INC.
FLUIDYNE AEROTEST GROUP
CORE NOZZLE CONFIG #3
48 ALTERNATING TABS
PRATT & WHITNEY
MIXING ENHANCEMENT NOZZLES
D 54933 2087-405 A



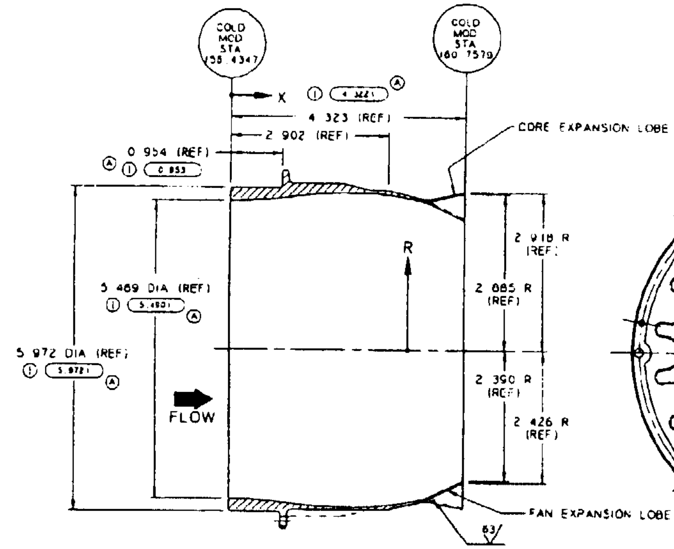
INNER CONTOUR COORDINATES

X	R	INSPECT (1)
0.0000	2.7446	
0.2187	2.7467	2.7460
0.4356	2.7536	
0.6533	2.7659	2.7649
0.8702	2.7645	
1.0871	2.8109	2.8089
1.3022	2.8413	
1.5193	2.8648	2.8633
1.7354	2.8808	
1.9535	2.8911	2.8882
2.1718	2.8962	
2.3991	2.8962	2.8957
2.6072	2.8862	
2.8246	2.8660	2.8654
3.0411	2.8374	
3.2545	2.8015	2.8002
3.4695	2.7589	
3.6831	2.7136	2.7126
3.8951	2.6684	
4.1081	2.6232	2.6246
4.3217	2.5778	
4.6582	2.2760	

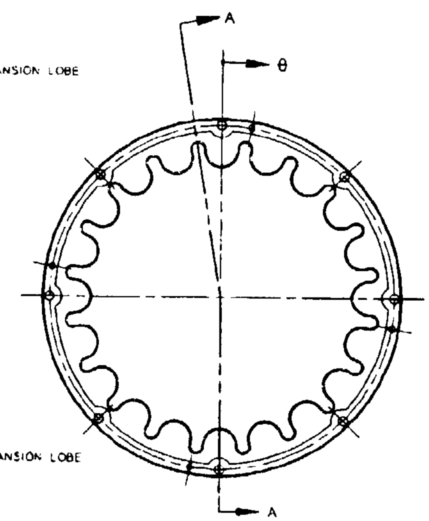
3 POINT ROUNDNESS (A)
INNER CONTOUR COORDINATES

X	R	INSPECT (1)
0.0000	2.7446	2.7450
0.2187	2.7467	
0.4356	2.7536	2.7524
0.6533	2.7659	
0.8702	2.7845	2.7832
1.0871	2.8109	
1.3022	2.8413	2.8401
1.5193	2.8648	
1.7354	2.8808	2.880
1.9535	2.8911	
2.1718	2.8962	2.8960
2.3891	2.8962	
2.6072	2.8862	2.8849
2.8246	2.8660	
3.0411	2.8374	2.8363
3.2548	2.8015	
3.4613	2.7606	2.7594

STR LINE



SECTION A-A



FAN EXPANSION LOBE (A)
INNER CONTOUR INSPECTION

X	R	INSPECT @ THETA = 0°	INSPECT @ THETA = 108°	INSPECT @ THETA = 234° (1)
3.4613	2.7606	2.7589	2.7599	2.7615
3.7172	2.6823	2.6799	2.6811	2.6816
3.9600	2.5653	2.5624	2.5629	2.5643
4.2014	2.4488	2.4454	2.4475	2.4497
4.3232	2.3900	2.3913	2.3921	2.3920

FAN EXPANSION LOBE (A)
OUTER CONTOUR INSPECTION

		INSPECT @ THETA = 0°	INSPECT @ THETA = 108°	INSPECT @ THETA = 234° (1)
3.4613	2.8078	2.8047	2.8057	2.8055
3.7090	2.7219	2.7208	2.7212	2.7225
3.9137	2.6231	2.6218	2.6224	2.6243
4.1185	2.5243	2.5226	2.5241	2.5244
4.3232	2.4255	2.4205	2.4233	2.4233

CORE EXPANSION LOBE (A)
INNER CONTOUR INSPECTION

X	R	INSPECT @ THETA = 0°	INSPECT @ THETA = 180°	INSPECT @ THETA = 270° (1)
3.6349	2.7452	2.7435	2.7455	2.749
3.8079	2.7741	2.7718	2.7720	2.7756
3.9809	2.8112	2.8089	2.809	2.8135
4.1517	2.8479	2.8458	2.8485	2.850
4.3232	2.8848	2.8824	2.8865	2.8871

CORE EXPANSION LOBE (A)
OUTER CONTOUR INSPECTION

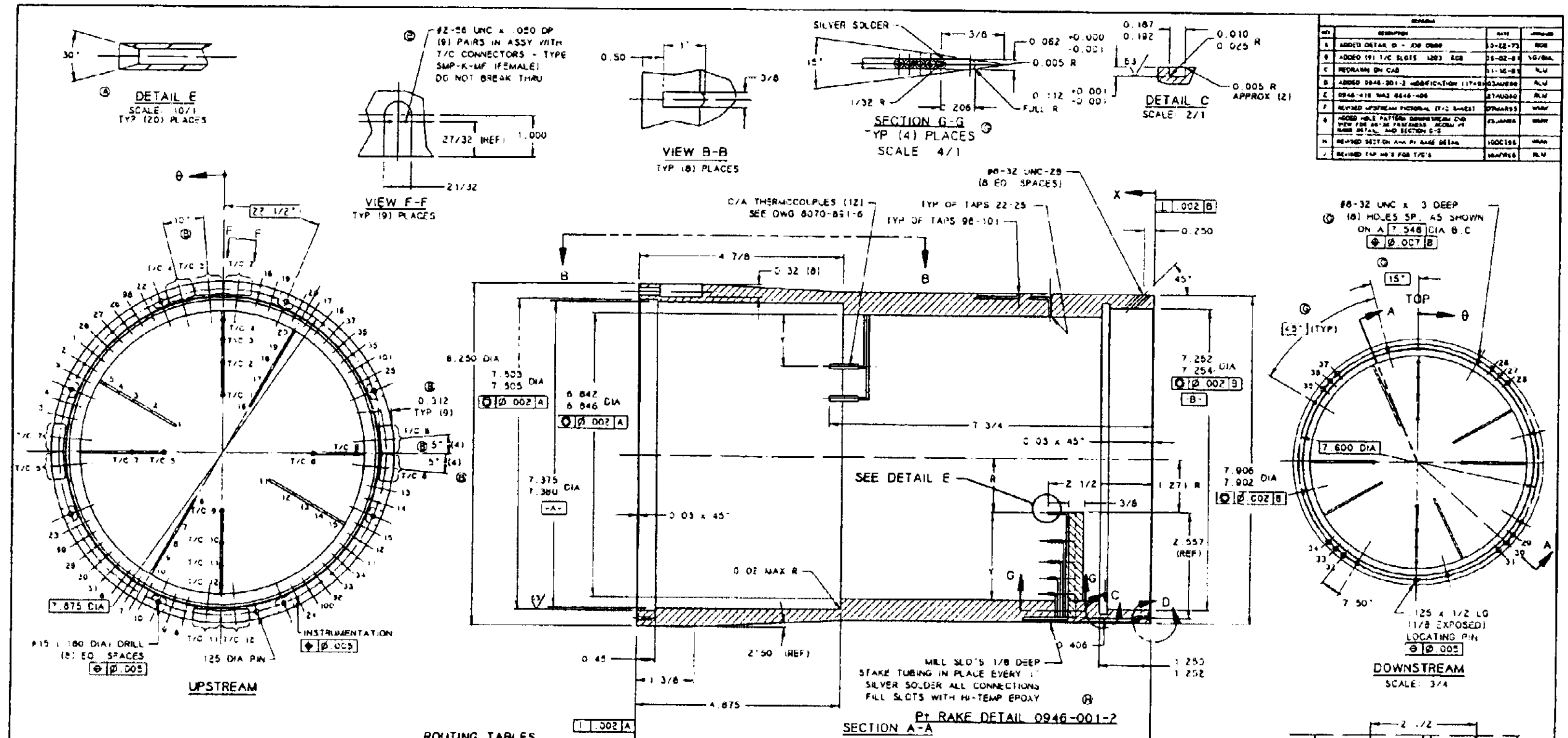
X	R	INSPECT @ THETA = 5°	INSPECT @ THETA = 117°	INSPECT @ THETA = 243° (1)
3.4613	2.8078	2.8053	2.8062	2.8081
3.7087	2.7870	2.7835	2.7847	2.7877
3.8693	2.8200	2.8180	2.8192	2.8211
4.0780	2.8648	2.8647	2.8632	2.8658
4.3232	2.9175	2.9182	2.9158	2.9171

NOTE:

(1) INSPECTED DIMENSION   3 POINT ROUNDNESS INSPECTION OF DIAMETERS
2 UNLESS SPECIFIED DO NOT BREAK CORNERS
3 FINAL MACHINE PER CAD FILE

REV	DESCRIPTION	DATE	APPROVED
A	ADDED INSPECTED VALUES	26MAY97	BLM

ASE AERO SYSTEMS ENGINEERING INC
FLUIDYNE AEROTEST GROUP
20 LOBE MIXER
PRATT & WHITNEY
MIXING ENHANCEMENT NOZZLES
D 54933 2087-407 A

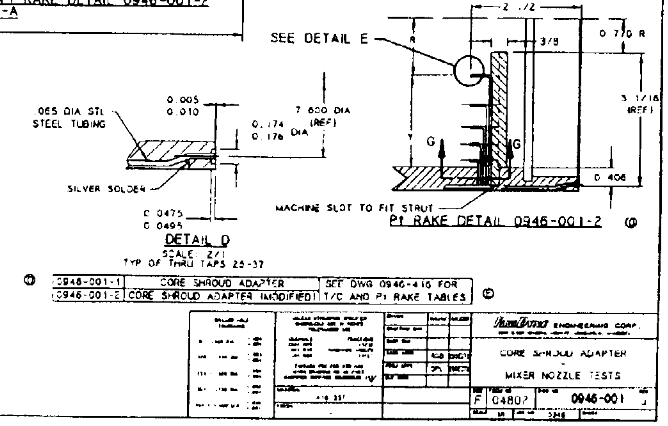


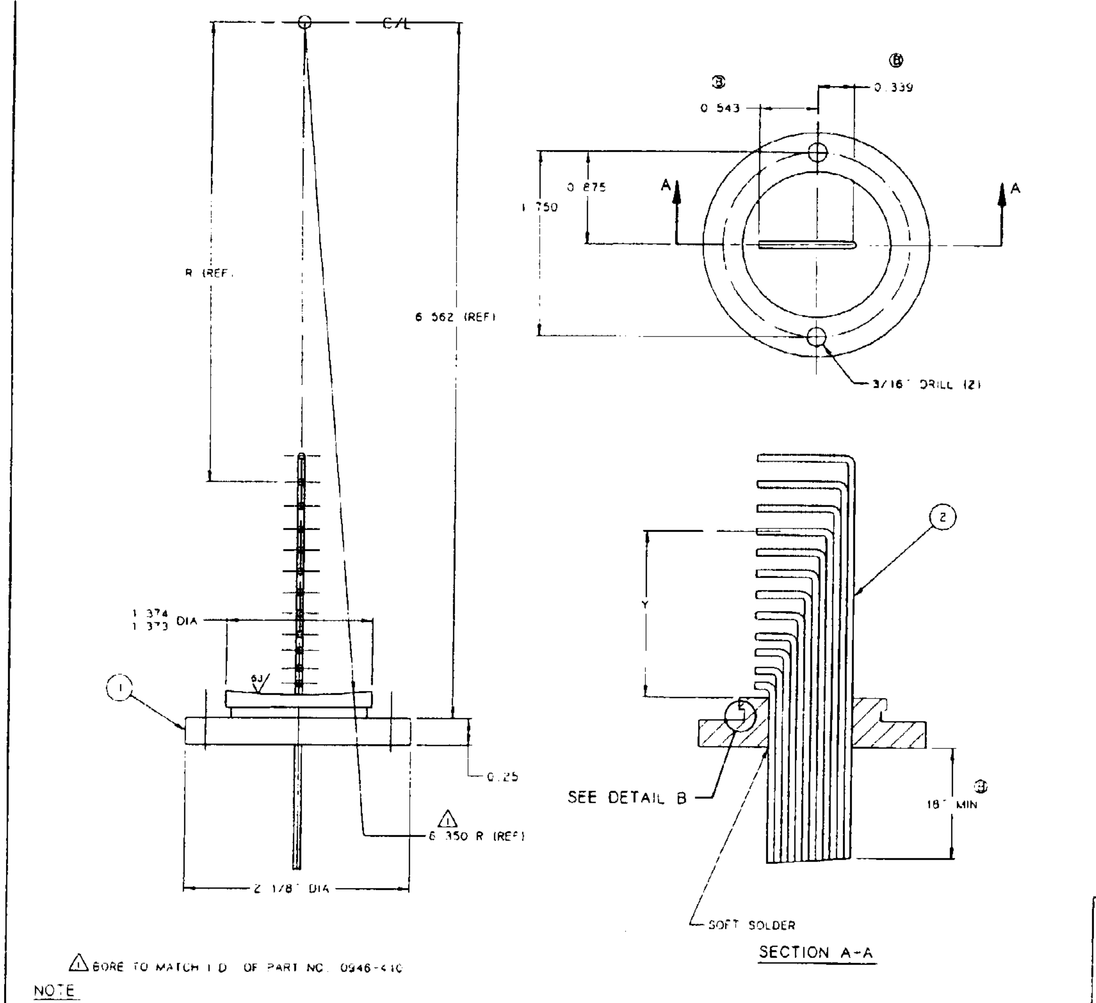
ROUTING TABLES

TAP NO	UPSTREAM THETA	DOWNSTREAM THETA	X
T/C 3	2 1/2		T/C RAKE
T/C 3	7 1/2		T/C RAKE
T/C 4	12 1/2		T/C RAKE
T/C 4	17 1/2		T/C RAKE
	22 1/2		SCREW
22	27 1/2	30°	2 1/2 (INT)
98	32 1/2	30°	3 1/4 (EXT)
26	37 1/2	40°	THRU
27	42 1/2	45°	THRU
28	47 1/2	50°	THRU
1	52 1/2		RAKE
2	57 1/2		RAKE
5	62 1/2		RAKE
	67 1/2		SCREW
4	72 1/2		RAKE
3	77 1/2		RAKE
T/C 7	82 1/2		T/C RAKE
T/C 7	87 1/2		T/C RAKE
T/C 5	92 1/2		T/C RAKE
T/C 5	97 1/2		T/C RAKE
	102 1/2		
	107 1/2		
	112 1/2		SCREW
23	117 1/2	120°	2 1/2 (INT)

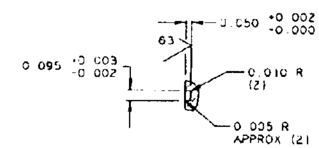
TAP NO	UPSTREAM THETA	DOWNSTREAM THETA	X
99	122 1/2	120°	3 1/4 (EXT)
29	127 1/2	130°	THRU
30	132 1/2	135°	THRU
31	137 1/2	140°	THRU
6	142 1/2		RAKE
7	147 1/2		RAKE
10	152 1/2		RAKE
	157 1/2		SCREW
9	162 1/2		RAKE
8	167 1/2		RAKE
T/C 11	172 1/2		T/C RAKE
T/C 11	177 1/2		T/C RAKE
T/C 12	182 1/2		T/C RAKE
T/C 12	187 1/2		T/C RAKE
PIN	192 1/2	190°	PIN
	197 1/2		
	202 1/2		SCREW
24	207 1/2	210°	2 1/2 (INT)
100	212 1/2	210°	3 1/4 (EXT)
32	217 1/2	220°	THRU
33	222 1/2	225°	THRU
34	227 1/2	230°	THRU
11	232 1/2		RAKE
12	237 1/2		RAKE

TAP NO	UPSTREAM THETA	DOWNSTREAM THETA	X
15	242 1/2		RAKE
	247 1/2		SCREW
14	252 1/2		RAKE
13	257 1/2		RAKE
T/C 6	262 1/2		T/C RAKE
T/C 6	267 1/2		T/C RAKE
T/C 8	272 1/2		T/C RAKE
T/C 8	277 1/2		T/C RAKE
	282 1/2		
	287 1/2		
	292 1/2		SCREW
25	297 1/2	300°	2 1/2 (INT)
101	302 1/2	300°	3 1/4 (EXT)
35	307 1/2	310°	THRU
36	312 1/2	315°	THRU
37	317 1/2	320°	THRU
16	322 1/2		RAKE
17	327 1/2		RAKE
20	332 1/2		RAKE
	337 1/2		SCREW
19	342 1/2		RAKE
18	347 1/2		RAKE
T/C 2	352 1/2		T/C RAKE
T/C 2	357 1/2		T/C RAKE





Pt RAKE THETA=0°	Pt RAKE THETA=90°	Pt RAKE THETA=180°	Pt RAKE THETA=270°	PROBE LOCATIONS	
TAP NO	TAP NO	TAP NO	TAP NO	Y	R REF
50	62	74	86	2.270	4.080
51	63	75	87	2.025	4.325
52	64	76	88	1.793	4.557
53	65	77	89	1.573	4.777
54	66	78	90	1.362	4.988
55	67	79	91	1.160	5.190
56	68	80	92	0.965	5.385
57	69	81	93	0.777	5.573
58	70	82	94	0.595	5.755
59	71	83	95	0.419	5.931
60	72	84	96	0.248	6.102
61	73	85	97	0.082	6.268



DETAIL B
SCALE: 2/1

REV	DESCRIPTION	DATE	APPROVED
A	REDRAWN ON CAD, NO CHANGE		RLM
B	18" WAS 2', ADDED 0.543 & 0.339 DIM'S	23AUG93	RLM
C	REDRAWN ON PERSONAL DESIGNER NO CHANGE	09JAN95	WMW

QTY	ITEM	PART NO	DESCRIPTION	SPECIFICATION
A/R	2	-	INSTRUMENTATION	0.065 DIA. ST STL TUBING
1	1	-	PLUG	416 ST STL

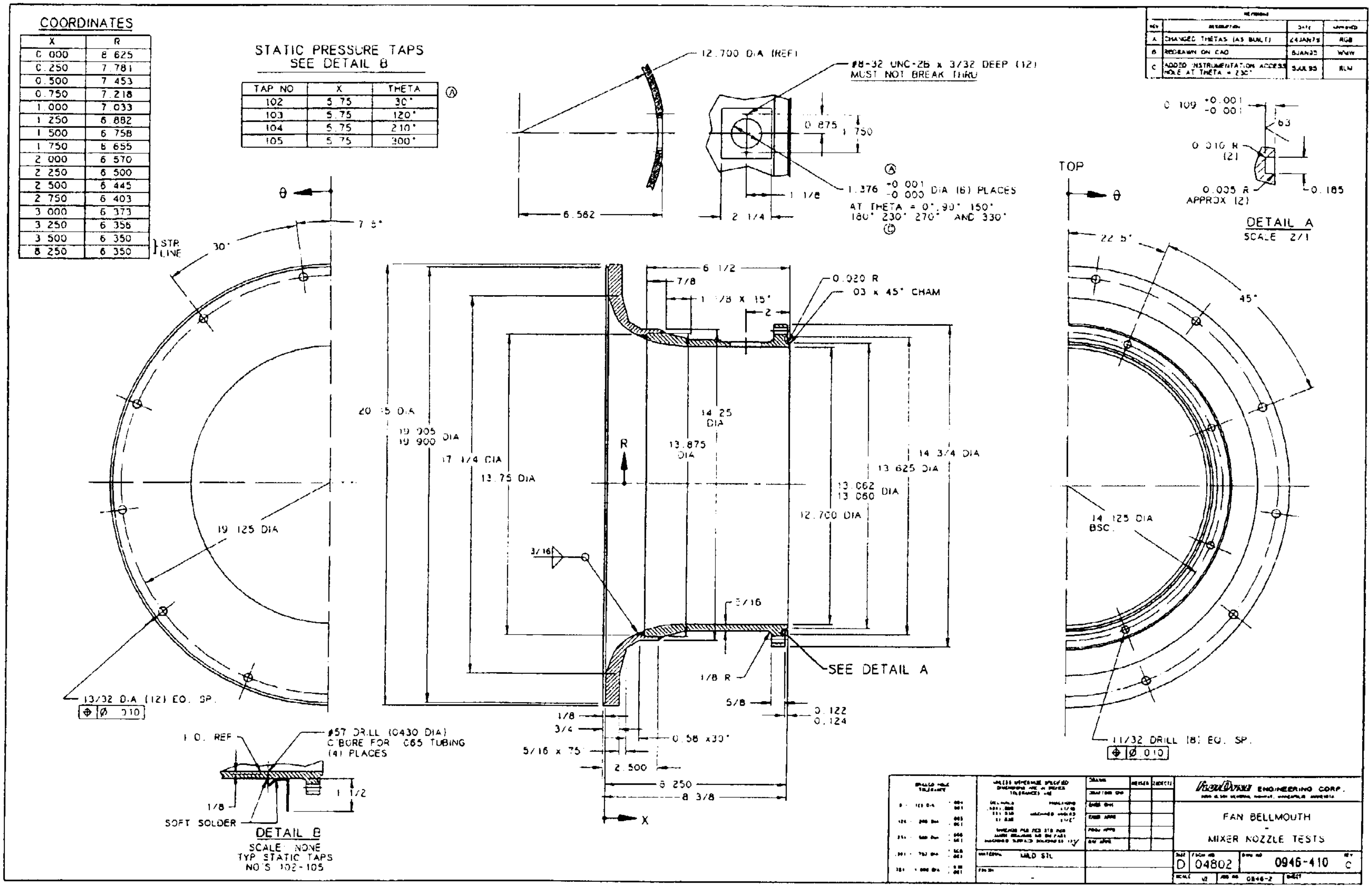
ASE AERO SYSTEMS ENGINEERING, INC.

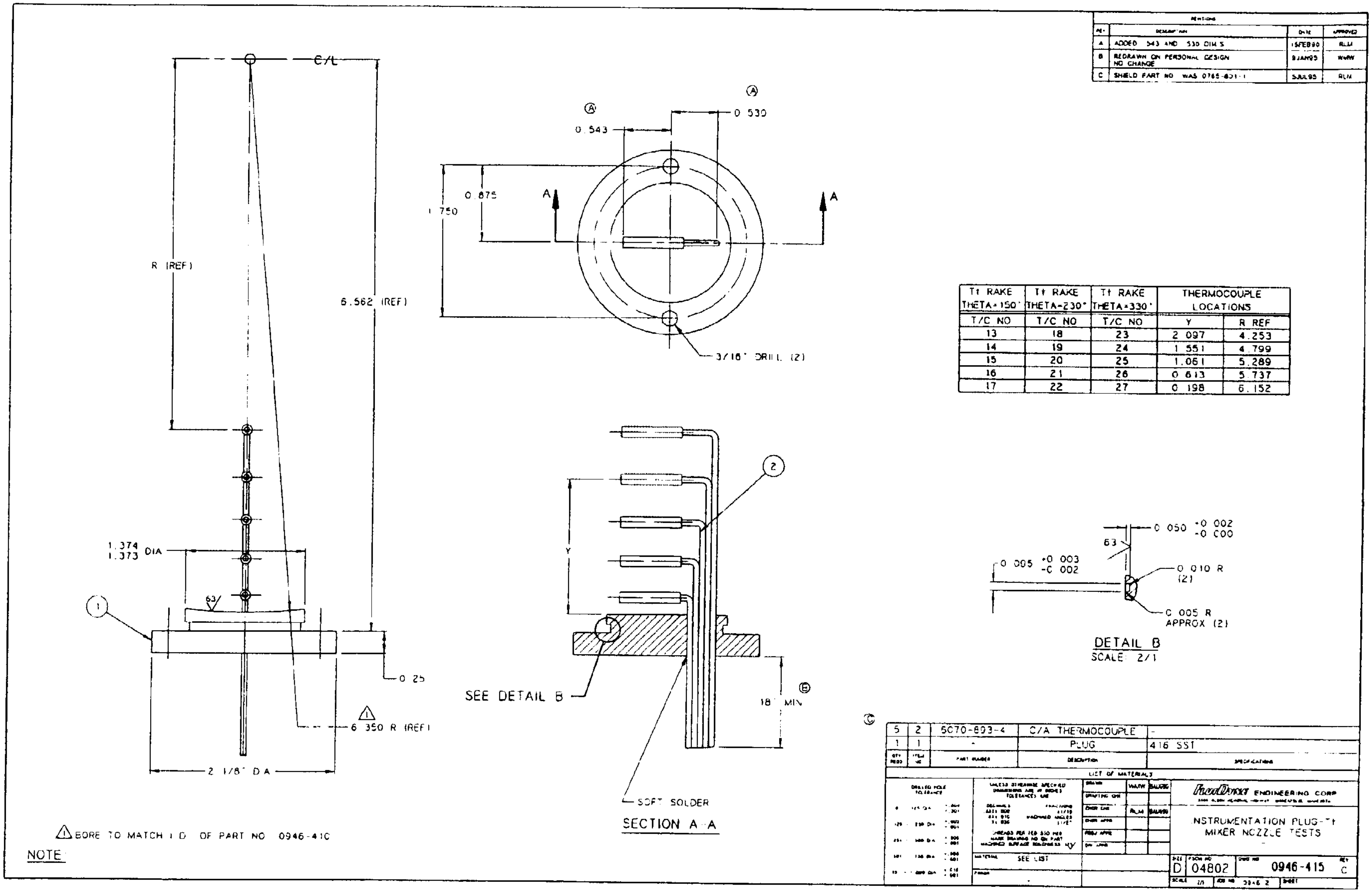
FLUIDYNE AEROTEST GROUP

INSTRUMENTATION PLUG-Pt MIXER NOZZLE TESTS

D 54933 0946-407 C

SCALE 2/1


COORDINATES
X R
0.000 8.625
0.250 7.781
0.500 7.453
0.750 7.218
1.000 7.033
1.250 6.882
1.500 6.758
1.750 6.655
2.000 6.570
2.250 6.500
2.500 6.445
2.750 6.403
3.000 6.373
3.250 6.356
3.500 6.350
8.250 6.350
STR LINE
STATIC PRESSURE TAPS
SEE DETAIL B
TAP NO X THETA
102 5.75 30°
103 5.75 120°
104 5.75 210°
105 5.75 300°
12.700 DIA (REF)
#8-32 UNC-2B x 3/32 DEEP (12)
MUST NOT BREAK THRU
1.376 +0.001 -0.000 DIA (6) PLACES
AT THETA = 0°, 90°, 150°, 180°, 230°, 270° AND 330°
DETAIL A
SCALE 2/1
SEE DETAIL A
19.125 DIA
14.125 DIA BSC.
13/32 DIA (12) EQ. SP.
11/32 DRILL (8) EQ. SP.
#57 DRILL (0430 DIA)
C'BORE FOR .065 TUBING
(4) PLACES
SOFT SOLDER
DETAIL B
SCALE: NONE
TYP STATIC TAPS
NO'S 102-105
FAN BELLMOUTH
MIXER NOZZLE TESTS
0946-410
MILD STL



Tt RAKE THETA=150°	Tt RAKE THETA=230°	Tt RAKE THETA=330°	THERMOCOUPLE LOCATIONS	
T/C NO	T/C NO	T/C NO	Y	R REF
13	18	23	2.097	4.253
14	19	24	1.551	4.799
15	20	25	1.061	5.289
16	21	26	0.613	5.737
17	22	27	0.198	6.152

ZONE	REV	DESCRIPTION	DATE	APPROVED
-	A	REVISED TABLES AND REDRAWN	27MAY94	
	B	REVISED NOTE	18APR98	RLM

RAKE LOCATIONS FOR 0946-001-1

Pt PRESSURE RAKES (X= 2 1/2)			
TAP NO	THETA	Y	R (REF)
1	60°	1.27	2.15
2	60°	.93	2.49
3	60°	.63	2.79
4	60°	.36	3.06
5	60°	.11	3.31
6	150°	1.27	2.15
7	150°	.93	2.49
8	150°	.63	2.79
9	150°	.36	3.06
10	150°	.11	3.31
11	240°	1.27	2.15
12	240°	.93	2.49
13	240°	.63	2.79
14	240°	.36	3.06
15	240°	.11	3.31
16	330°	1.27	2.15
17	330°	.93	2.49
18	330°	.63	2.79
19	330°	.36	3.06
20	330°	.11	3.31

THERMOCOUPLE Tt RAKES FOR 0946-001-1

T/C NO	THETA	Y	R	T/C NO	THETA	Y	R
1	0°	2.02	1.40	6	270°	1.24	2.18
2	0°	1.24	2.18	8	270°	0.21	3.21
3	0°	0.68	2.74	9	180°	2.02	1.40
4	0°	0.21	3.21	10	180°	1.24	2.18
5	90°	2.02	1.40	11	180°	0.68	2.74
7	90°	0.68	2.74	12	180°	0.21	3.21

Pt PRESSURE RAKES FOR 0946-001-2

TAP NO	THETA	Y	R	TAP NO	THETA	Y	R
1	60°	2.12	1.30	11	240°	2.12	1.30
2	60°	1.44	1.98	12	240°	1.44	1.98
3	60°	0.94	2.48	13	240°	0.94	2.48
4	60°	0.53	2.89	14	240°	0.53	2.89
5	60°	0.16	3.26	15	240°	0.16	3.26
6	150°	2.12	1.30	16	330°	2.12	1.30
7	150°	1.44	1.98	17	330°	1.44	1.98
8	150°	0.94	2.48	18	330°	0.94	2.48
9	150°	0.53	2.89	19	330°	0.53	2.89
10	150°	0.16	3.26	20	330°	0.16	3.26

THERMOCOUPLE Tt RAKES FOR 0946-001-2

T/C NO	THETA	Y	R	T/C NO	THETA	Y	R
1	0°	2.02	1.40	6	270°	1.24	2.18
2	0°	1.24	2.18	8	270°	0.21	3.21
3	0°	0.68	2.74	9	180°	2.02	1.40
4	0°	0.21	3.21	10	180°	1.24	2.18
5	90°	2.02	1.40	11	180°	0.68	2.74
7	90°	0.68	2.74	12	180°	0.21	3.21

NOTE:

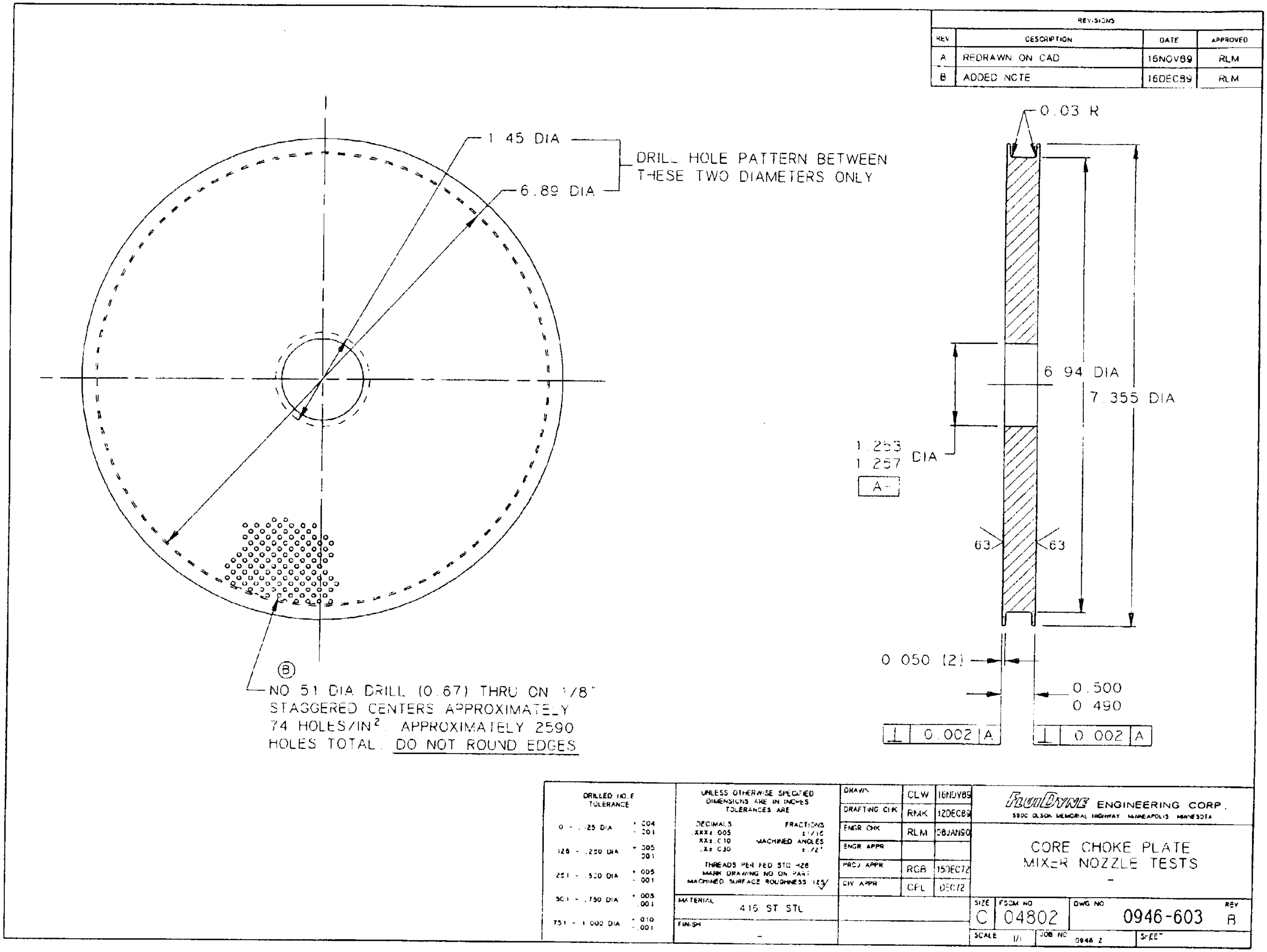
1. STRAP TO EXTERNAL SURFACE THERMOCOUPLES TO EXTEND 24" FROM UPSTREAM END OF PART

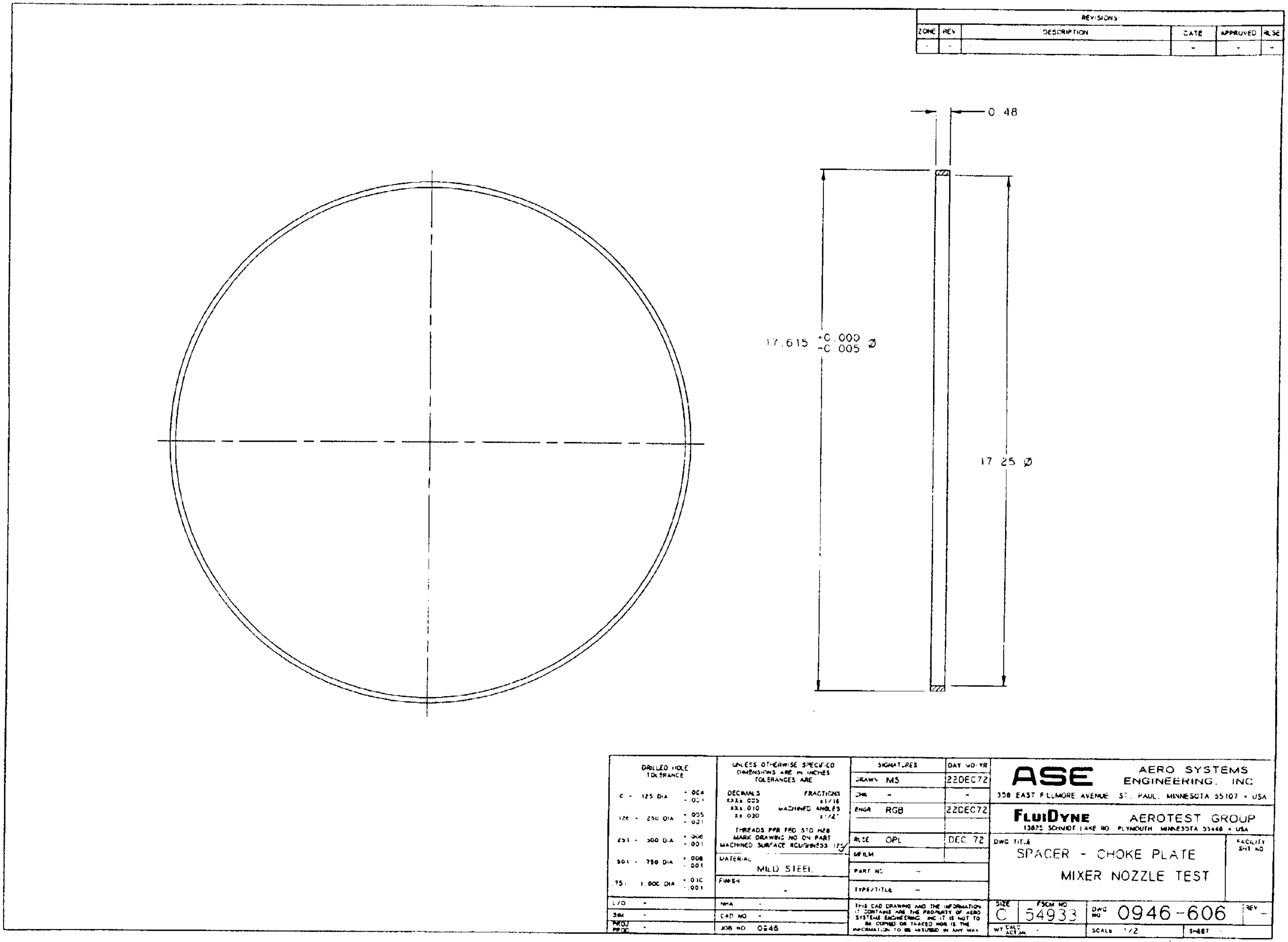
ASE AERO SYSTEMS ENGINEERING INC

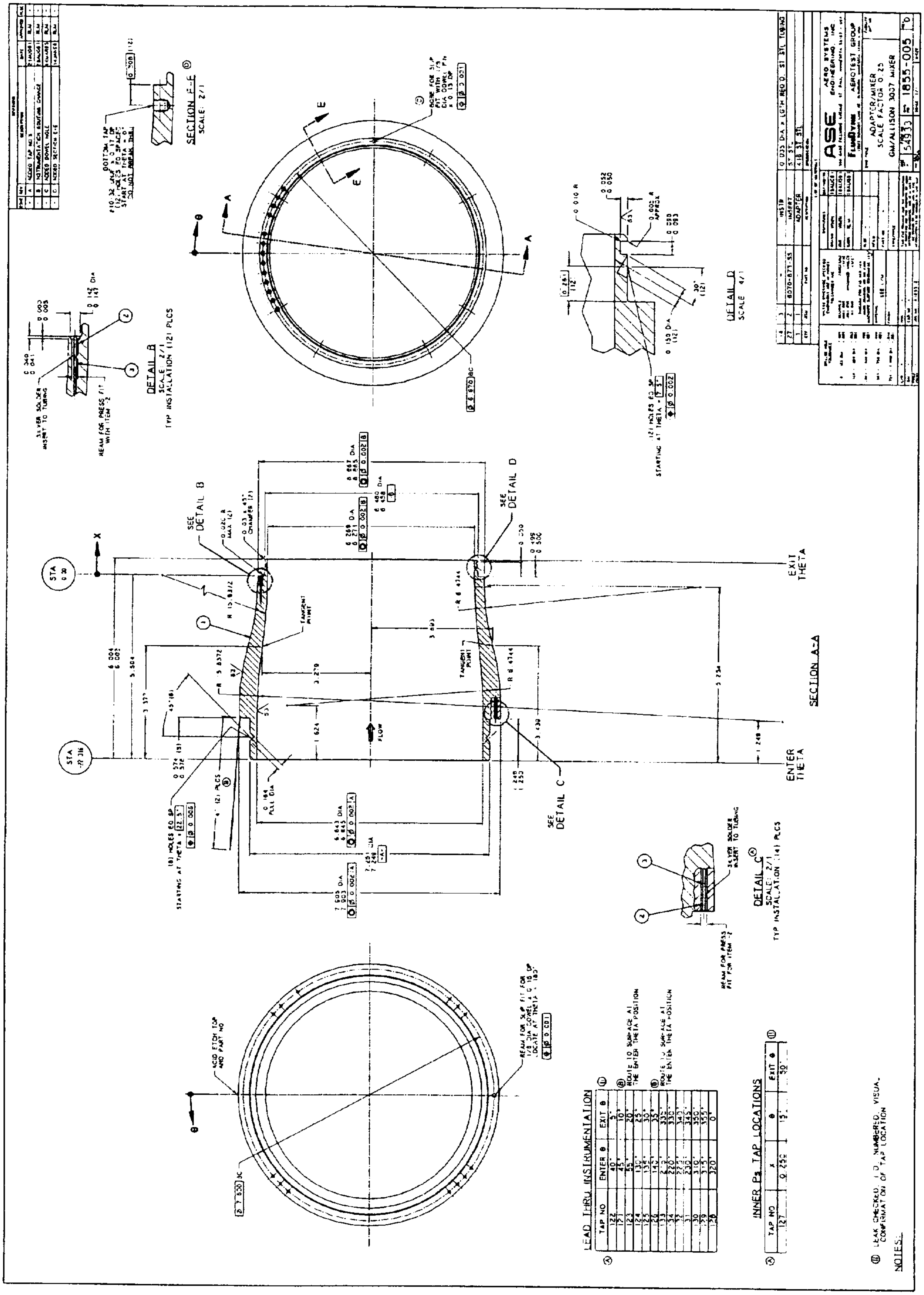
FLUIDYNE AEROTEST GROUP

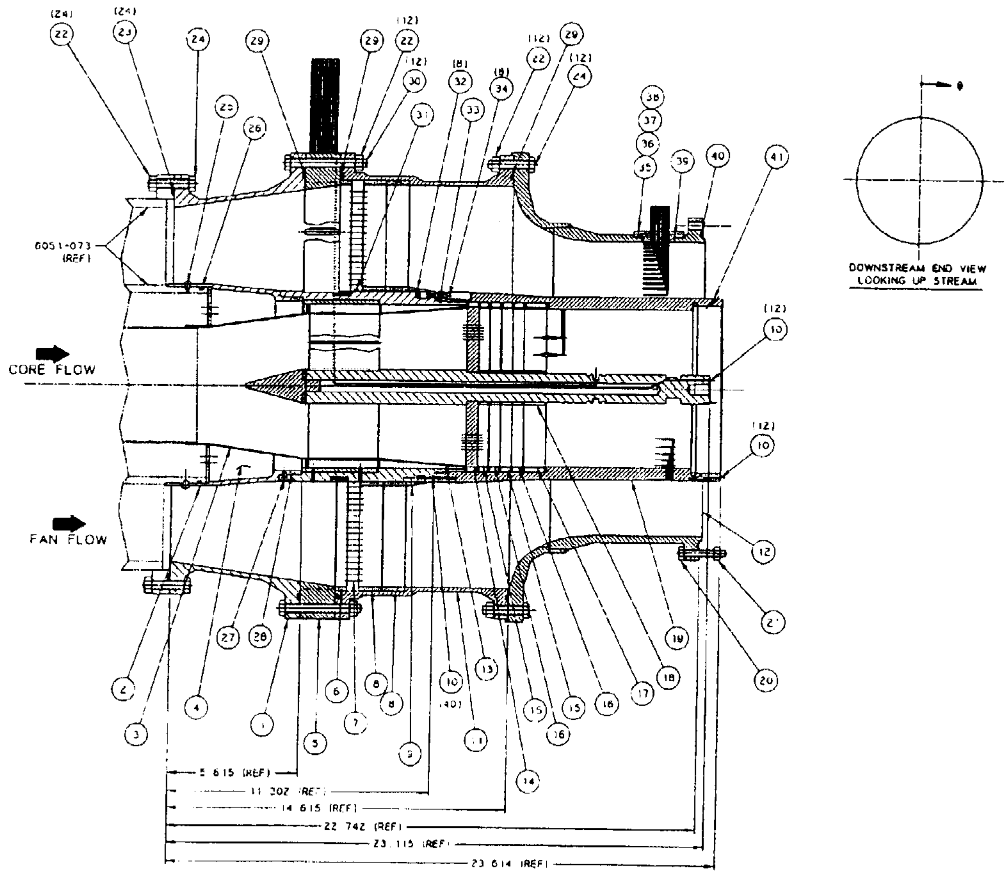
TOTAL TEMPERATURE & TOTAL PRESSURE RAKE LOCATIONS

D 54933 0946-416 B


REVISIONS
REV | DESCRIPTION | DATE | APPROVED
A | REDRAWN ON CAD | 16NOV89 | RLM
B | ADDED NOTE | 16DEC89 | RLM
1.45 DIA
6.89 DIA
DRILL HOLE PATTERN BETWEEN THESE TWO DIAMETERS ONLY
B
NO 51 DIA DRILL (0.67) THRU ON 1/8" STAGGERED CENTERS APPROXIMATELY 74 HOLES/IN². APPROXIMATELY 2590 HOLES TOTAL. DO NOT ROUND EDGES
0.03 R
6.94 DIA
7.355 DIA
1.253
1.257 DIA
A
63
63
0.050 (2)
0.500
0.490
⊥ 0.002 A
⊥ 0.002 A
DRILLED HOLE TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
MATERIAL 416 ST STL
FINISH
DRAWN CLW 16NOV89
DRAFTING CHK RMK 12DEC89
ENGR CHK RLM 08JAN90
ENGR APPR
PROJ APPR RGB 15DEC72
DIV APPR CPL
FLUIDYNE ENGINEERING CORP.
CORE CHOKE PLATE
MIXER NOZZLE TESTS
SIZE C
FSCM NO 04802
DWG NO 0946-603
REV B
SCALE 1/1
SHEET


REVISIONS
ZONE REV DESCRIPTION DATE APPROVED RLSE
0.48
17.615 +0.000 -0.005 Ø
17.25 Ø
DRILLED HOLE TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
MATERIAL MILD STEEL
FINISH
SIGNATURES DAY MO YR
DRAWN MS 22DEC72
ENGR RGB 22DEC72
RLSE OPL DEC 72
JOB NO 0946
ASE AERO SYSTEMS ENGINEERING, INC
358 EAST FILLMORE AVENUE ST. PAUL, MINNESOTA 55107 • USA
FLUIDYNE AEROTEST GROUP
DWG TITLE
SPACER - CHOKE PLATE
MIXER NOZZLE TEST
SIZE C
FSCM NO 54933
DWG NO 0946-606
SCALE 1/2


SECTION A-A
DETAIL B
DETAIL C
DETAIL D
SECTION E-E
LEAD THRU INSTRUMENTATION
INNER Ps TAP LOCATIONS
NOTES:
ENTER THETA
EXIT THETA
FLOW
ASE
AERO SYSTEMS ENGINEERING
AEROTEST GROUP
ADAPTER/MIXER
SCALE FACTOR 0.25
GM/ALLISON 3007 MIXER
1855-005



8	41	-	#8-32 UNC x 1/2 LONG HEX SOC SET SCR - CUP POINT
1	40	-	O-RING - FAB FROM 1/8 DIA CROSS SECTION MAT'L
8	39	-	O-RING - PARKER #026
12	38	-	#8-32 UNC x3/8 LONG SOC HD CAP SCR
1	37	0946-409	INSTRUMENTATION PLUG - LOC AT THETA = 90°
2	36	0946-408	INSTRUMENTATION PLUG - LOC AT THETA = 150° AND 330°
3	35	0946-407	INSTRUMENTATION PLUG - LOC AT THETA = 0°, 150°, 270°
9	34	-	#8-32 UNC x 7/8 LONG SOC HD CAP SCR
1	33	-	O-RING - PARKER #168 - SILICONE
-	-	-	-
1	31	-	O-RING - PARKER #172
12	30	-	3/8-16 UNC x 3 1/4 LG HEX HD CAP SCR
3	29	-	O-RING - PARKER #284
1	28	-	O-RING - PARKER #169 - SILICONE
16	27	-	#10-32 UNF x 3/8 LG FL HD SOC SCR
1	26	-	O-RING PARKER #267 - SILICONE
24	25	-	#10-32 UNF x 1/4 LONG HEX SOC BUTTON HD CAP SCR
36	24	-	3/8-16 UNC x 1 3/4 LONG HEX HD CAP SCR
1	23	-	O-RING PARKER #282
48	22	-	3/8-16 UNC HEX NUT
8	21	-	5/16-18 UNC HEX NUT
8	20	-	5/16-18 UNC x 1 3/4 LG HEX HD CAP SCR
1	19	0946-001	CORE SHROUD ADAPTER
1	18	0946-802-2	SPACER
1	17	0946-807-3	SPACER - LINER
2	16	0946-602-2	CORE SCREEN
2	15	0946-602-1	CORE SCREEN
1	14	0946-603	CORE CHOKE PLATE
1	13	0946-601	TAPERED LINER - DOWNSTREWAM
1	12	0946-410	FAN BELLMOUTH
1	11	0946-405	SPOOL
64	10	-	O-RING - PARKER #2-003 SILICONE
1	9	0946-605	RETAINER - FAN SCREEN
2	8	0946-401	FAN SCREEN
1	7	0946-402	FAN CHOKE PLATE
1	6	0946-606	SPACER - CHOKE PLATE
1	5	0946-902	SPIDER
A/R	4		INSULATION - FIBERFRAX LOW CON FELT
1	3	0946-604	TAPERED LINER - UPSTREAM
1	2	0946-403	SPIDER ADAPTER - INNER
1	1	0946-404	TAPERED SPOOL

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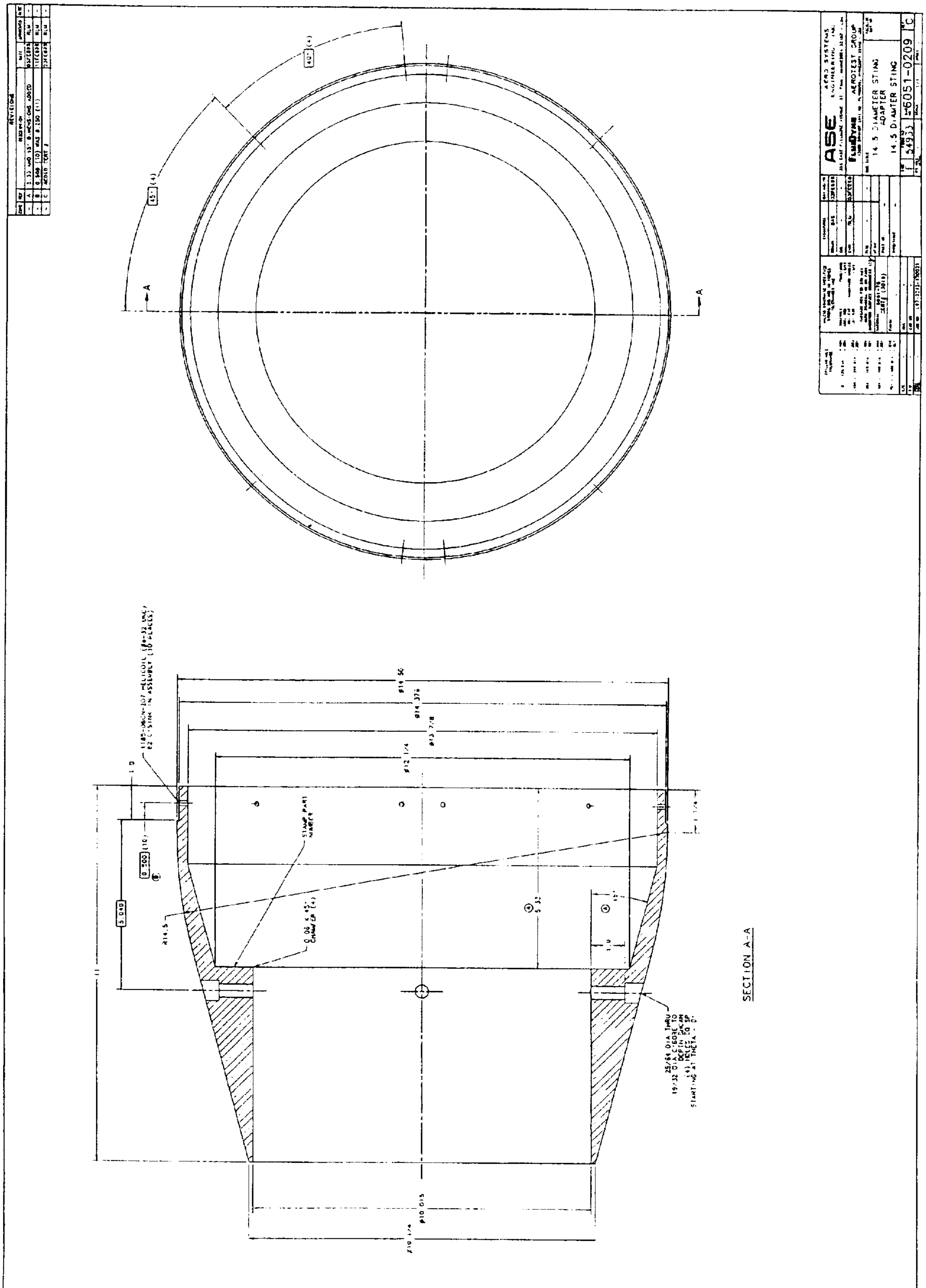
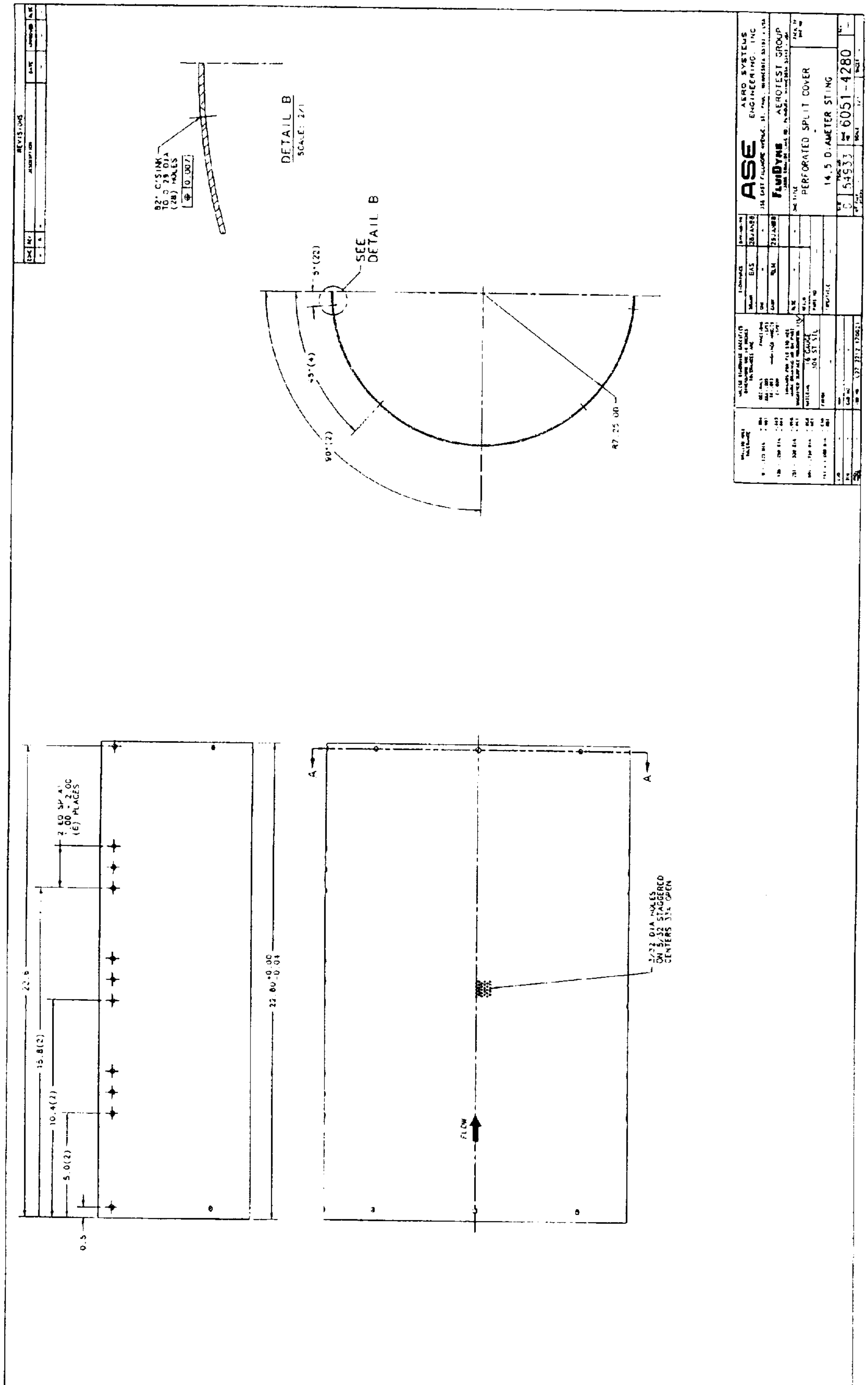
FLUIDYNE AEROTEST GROUP

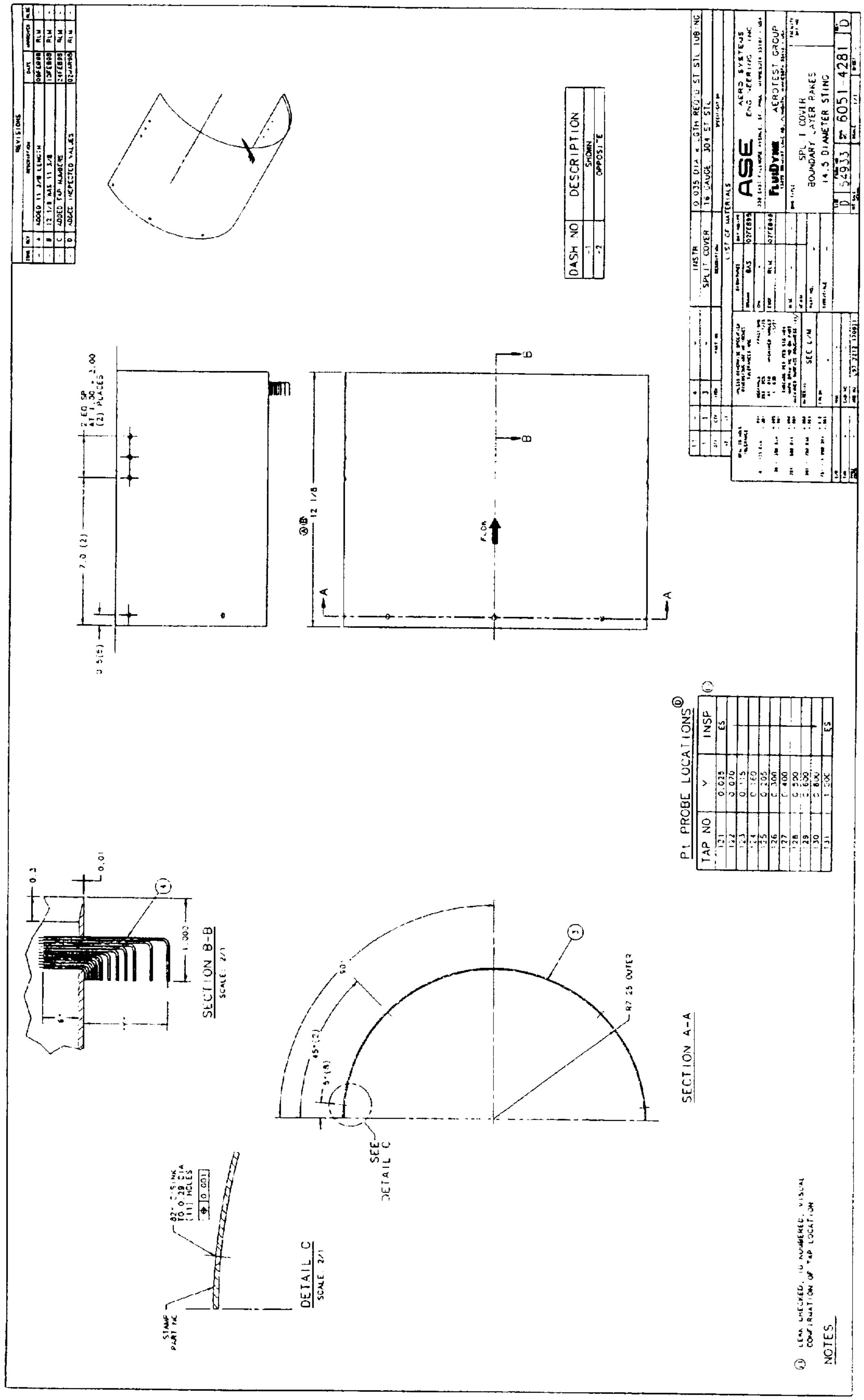
ASSEMBLY - MODEL ADAPTERS

MIXER NOZZLE TEST

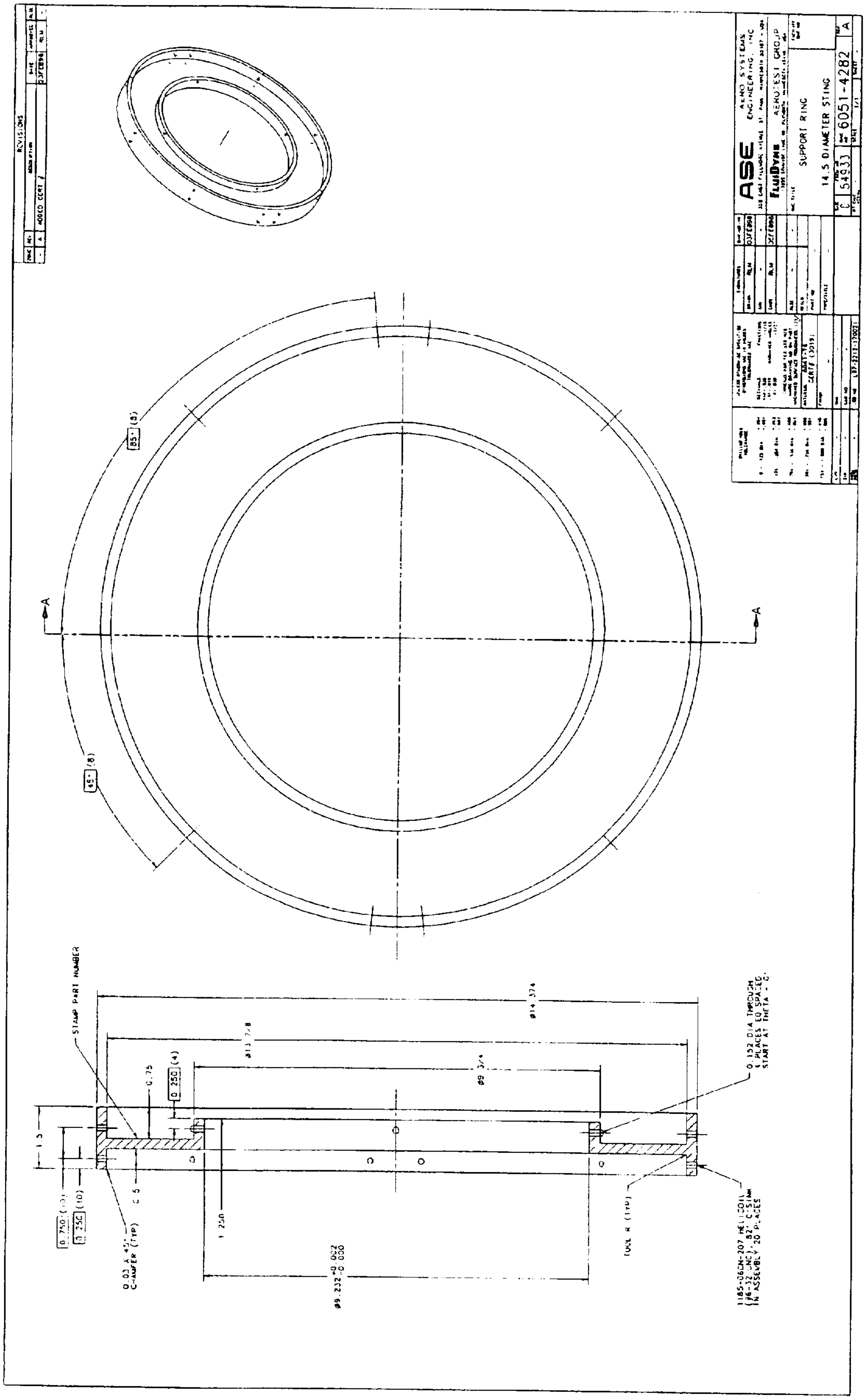
F 54933 6051-0160 B


SECTION A-A
ASE
AEROTEST GROUP
14.5 DIAMETER STING ADAPTER
6051-0209


DETAIL B
SCALE: 2/1
SEE DETAIL B
FLOW
ASE
AERO SYSTEMS ENGINEERING, INC
AEROTEST GROUP
PERFORATED SPLIT COVER
14.5 DIAMETER STING
54933
6051-4280



REVISIONS
DASH NO
DESCRIPTION
SHOWN
OPPOSITE
SECTION B-B
SECTION A-A
SEE DETAIL C
DETAIL C
Pt PROBE LOCATIONS
TAP NO
INSP
FLOW
12 1/8
7.0 (2)
R7.25 OUTER
NOTES
SPLIT COVER
LIST OF MATERIALS
ASE
AERO SYSTEMS ENGINEERING INC
FLUIDYNE
AEROTEST GROUP
SPLIT COVER
BOUNDARY LAYER RAKES
14.5 DIAMETER STING
6051-4281



SUPPORT RING
14.5 DIAMETER STING
6051-4282

REVISIONS					
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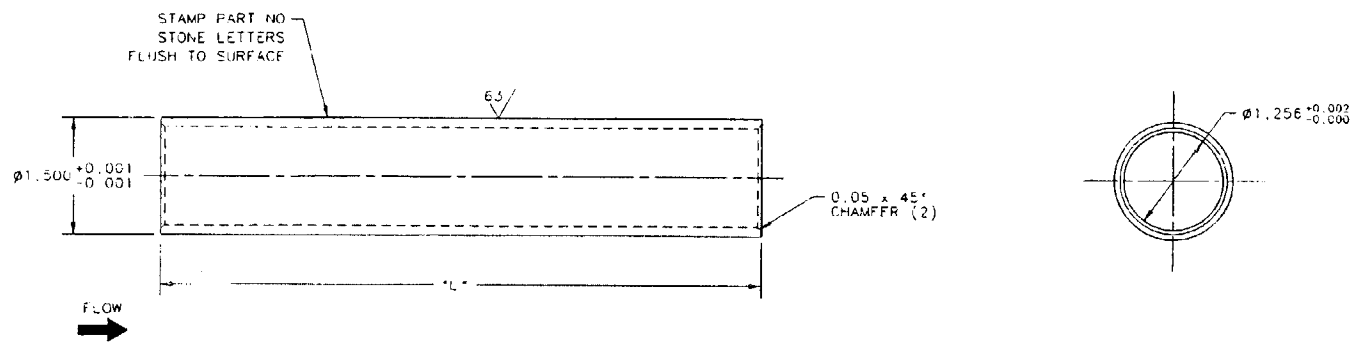
-	A	ADDED CERT # FOR DASH -1	28JAN98	RLM	-



DASH NO	"L"	QTY	DATE	CERT #
	7.52"	[illegible]	JAN98	69382
		-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
	-	-	-	-

DRILLED HOLE TOLERANCE	
0 - .125 DIA	+.004 -.001
.126 - .250 DIA	+.005 -.001
.251 - .500 DIA	+.006 -.001
.501 - .750 DIA	+.008 -.001
.751 - 1.000 DIA	+.010 -.001

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
DECIMALS .XXX ±.005 .XX ±.010 .X ±.030 FRACTIONS ±1/16 MACHINED ANGLES ±1/2°
THREADS PER FED STD H28
MARK DRAWING NO ON PART
MACHINED SURFACE ROUGHNESS 125

MATERIAL	416 ST STL
FINISH	-
NHA	-
CAD NO	-
JOB NO	L97 2212 170021
L/C	
SIM	-
PROJ ENGR	-

SIGNATURES		DAY-MO-YR
DRAWN	BAS	24DEC97
CHK	-	
ENGR	RLM	13JAN98
RLSE	-	-
MFG		
PART NO	-	
TYPE/TITLE	-	

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FLUIDYNE AEROTEST GROUP
13825 SCHMIDT LAKE RD. PLYMOUTH, MINNESOTA 55446 - USA

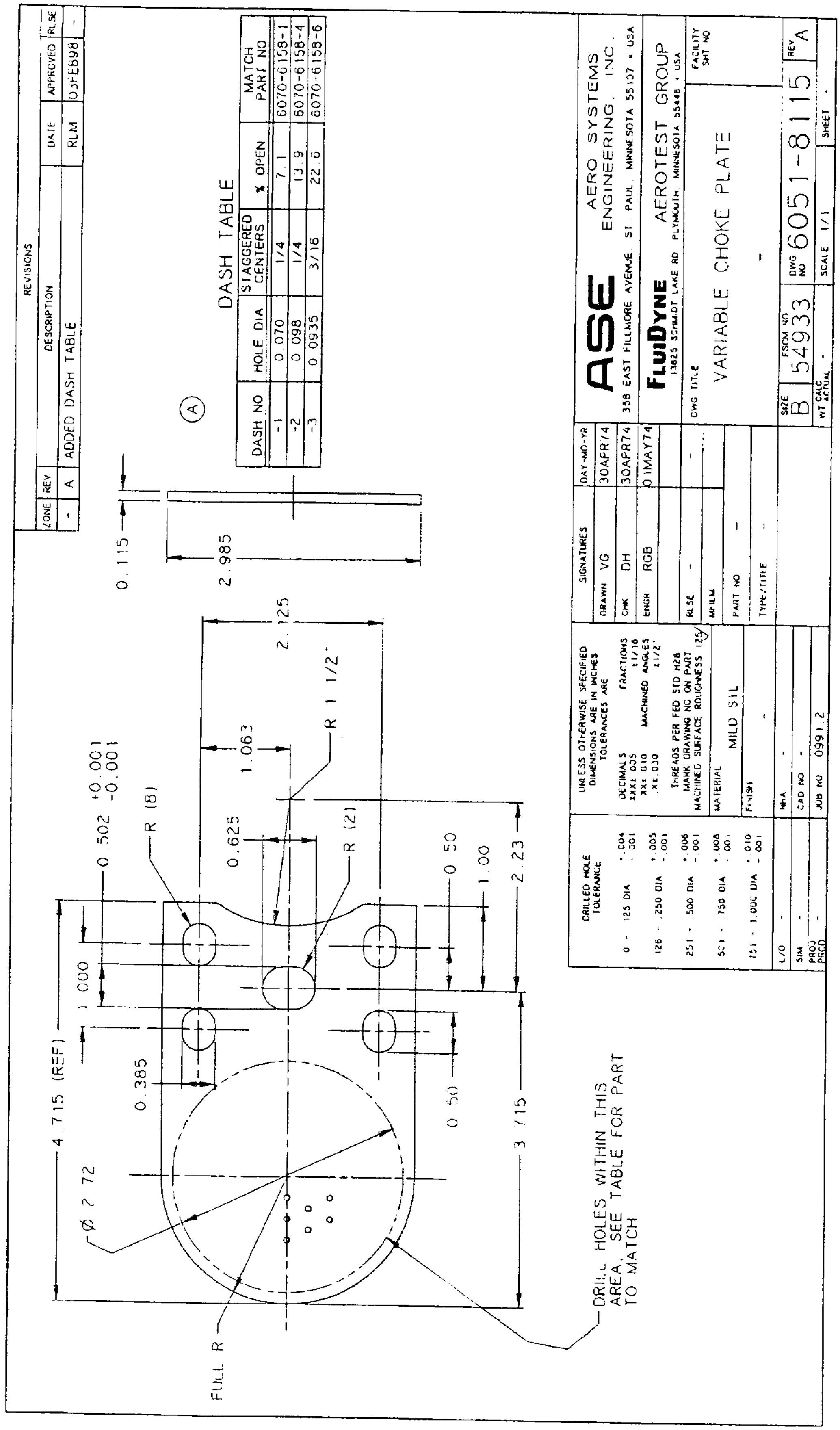
DWG TITLE
SPACER
-
NASA ADAPTER HARDWARE

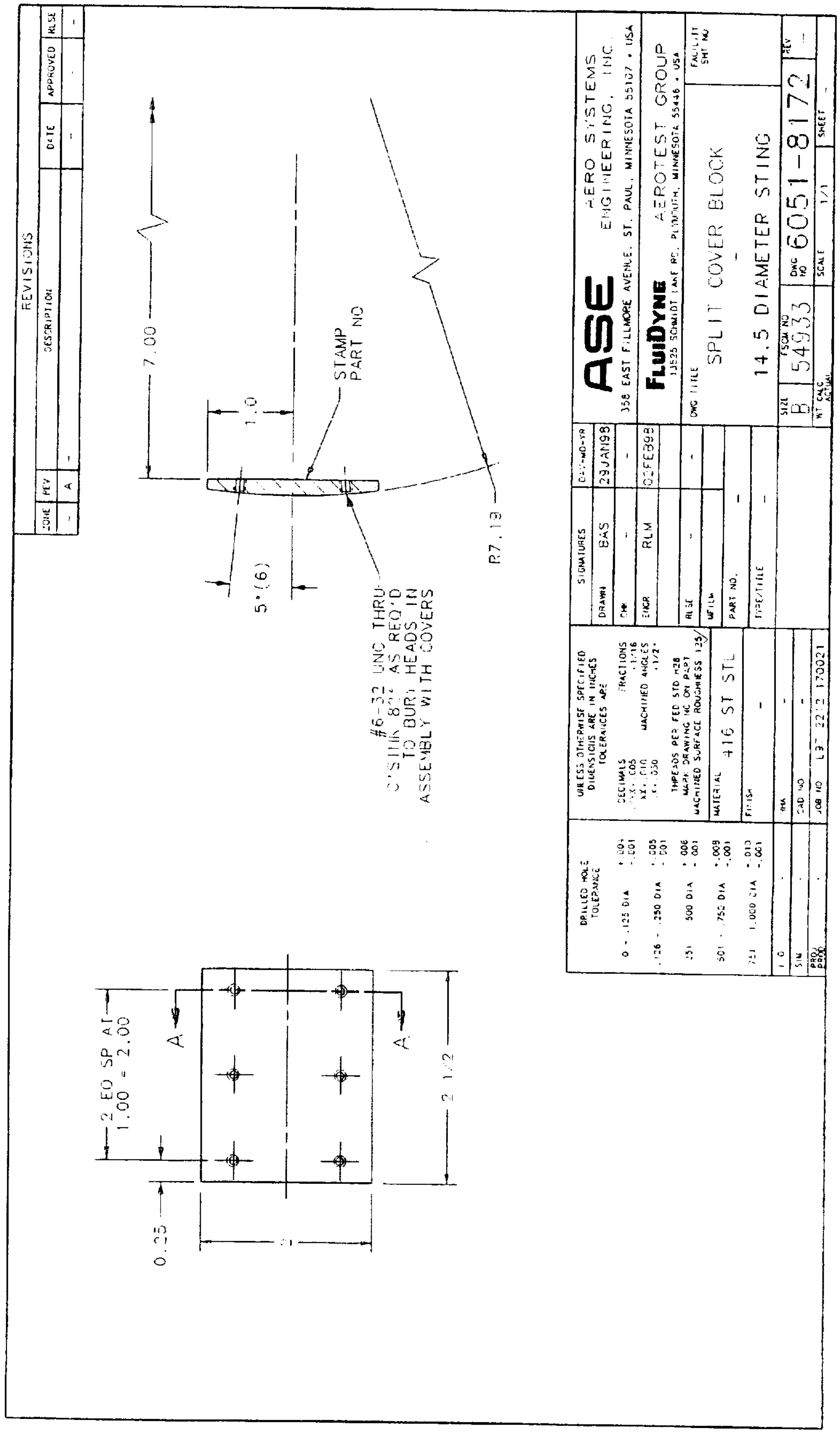
FACILITY SHT NO

SIZE	FSCM NO	DWG NO	REV
C	54933	6051-6428	A
WT CALC ACTUAL -		SCALE 1/1	SHEET

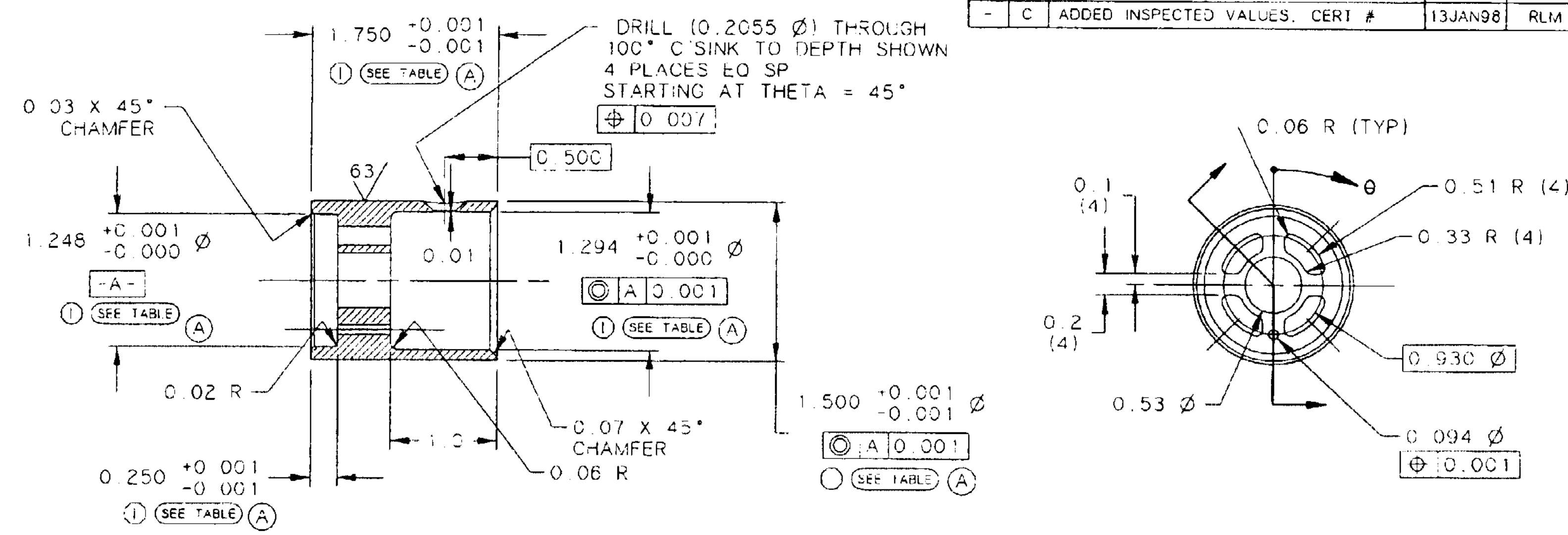
1 DO NOT BREAK CORNERS UNLESS OTHERWISE SPECIFIED

NOTES:


REVISIONS
ZONE REV DESCRIPTION DATE APPROVED RLSE
- A ADDED DASH TABLE RLM 03FEB98 -
DASH TABLE
DASH NO | HOLE DIA | STAGGERED CENTERS | % OPEN | MATCH PART NO
-1 | 0.070 | 1/4 | 7.1 | 6070-6158-1
-2 | 0.098 | 1/4 | 13.9 | 6070-6158-4
-3 | 0.0935 | 3/16 | 22.6 | 6070-6158-6
0.115
2.985
2.125
R 1 1/2"
1.063
0.502 +0.001 -0.001
R (8)
0.625
R (2)
0.50
1.00
2.23
4.715 (REF)
1.000
0.385
Ø 2.72
0.50
3.715
FULL R
DRILL HOLES WITHIN THIS AREA. SEE TABLE FOR PART TO MATCH
DRILLED HOLE TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
MATERIAL MILD STL
FINISH -
JOB NO 0991.2
SIGNATURES DAY-MO-YR
DRAWN VG 30APR74
CHK DH 30APR74
ENGR RGB 01MAY74
ASE AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE ST. PAUL, MINNESOTA 55107 • USA
FLUIDYNE AEROTEST GROUP
13825 SCHMIDT LAKE RD PLYMOUTH, MINNESOTA 55446 • USA
DWG TITLE
VARIABLE CHOKE PLATE
SIZE B
FSCM NO 54933
DWG NO 6051-8115
REV A
SCALE 1/1
SHEET -


REVISIONS
ZONE REV DESCRIPTION DATE APPROVED RLSE
2 EQ SP AT
1.00 = 2.00
0.25
A
A
2 1/2
7.00
1.0
5°(6)
STAMP
PART NO
#6-32 UNC THRU
C'SINK 82° AS REQ'D
TO BURY HEADS IN
ASSEMBLY WITH COVERS
R7.19
DRILLED HOLE TOLERANCE
0 - .125 DIA +.004 -.001
.126 - .250 DIA +.005 -.001
.251 - .500 DIA +.006 -.001
.501 - .750 DIA +.008 -.001
.751 - 1.000 DIA +.010 -.001
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
DECIMALS .XXX ±.005 .XX ±.010 .X ±.030
FRACTIONS ±1/16
MACHINED ANGLES ±1/2°
THREADS PER FED STD H28
MARK DRAWING NO ON PART
MACHINED SURFACE ROUGHNESS 125
MATERIAL 416 ST STL
FINISH -
SIGNATURES
DRAWN BAS 29JAN98
ENGR RLM 02FEB98
ASE
AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE, ST. PAUL, MINNESOTA 55107 • USA
FLUIDYNE AEROTEST GROUP
13525 SCHMIDT LAKE RD, PLYMOUTH, MINNESOTA 55446 • USA
DWG TITLE
SPLIT COVER BLOCK
-
14.5 DIAMETER STING
SIZE B
FSCM NO 54933
DWG NO 6051-8172
SCALE 1/1
JOB NO L97 2212 170021

REVISIONS					
ZONE	REV	DESCRIPTION	DATE	APPROVED	RLSE
-	A	ADDED INSPECTED VALUES	14FEB97	RLM	-
-	B	ADDED ITEM -2 AND INSPECTION TABLE	07JAN98	RLM	-
-	C	ADDED INSPECTED VALUES. CERT #	13JAN98	RLM	-



Ⓑ Ⓒ
INSPECTION TABLE

DIMENSION	INSPECTED VALUES -1	INSPECTED VALUES -2
DATE	14FEB97	08JAN98
1.750	1.7498	1.750
1.248	1.2485	1.2485
0.250	0.2500	0.250
1.294	1.2945	1.294
1.500	1.5003	1.5002

DRILLED HOLE TOLERANCE	
0 - .125 DIA	+.004 -.001
.126 - .250 DIA	+.005 -.001
.251 - .500 DIA	+.006 -.001
.501 - .750 DIA	+.008 -.001
.751 - 1.000 DIA	+.010 -.001

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
DECIMALS .XXX± .005 .XX± .010 X± .030
FRACTIONS ±1/16
MACHINED ANGLES ±1/2°
THREADS PER FED STD H28
MARK DRAWING NO ON PART
MACHINED SURFACE ROUGHNESS 125

MATERIAL 416 ST STL CERT #93882
FINISH -

SIGNATURES		DAY-MO-YR
DRAWN	RLM	15OCT95
CHK	-	-
ENGR	RLM	15OCT96
RLSE	-	-
MFILM		
PART NO	-	
TYPE/TITLE	-	

L/O	-
SIM	-
PROJ PROD	-
NHA	
CAD NO	-
JOB NO	L96-2090-167732

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358 EAST FILLMORE AVENUE ST. PAUL, MINNESOTA 55107 • USA

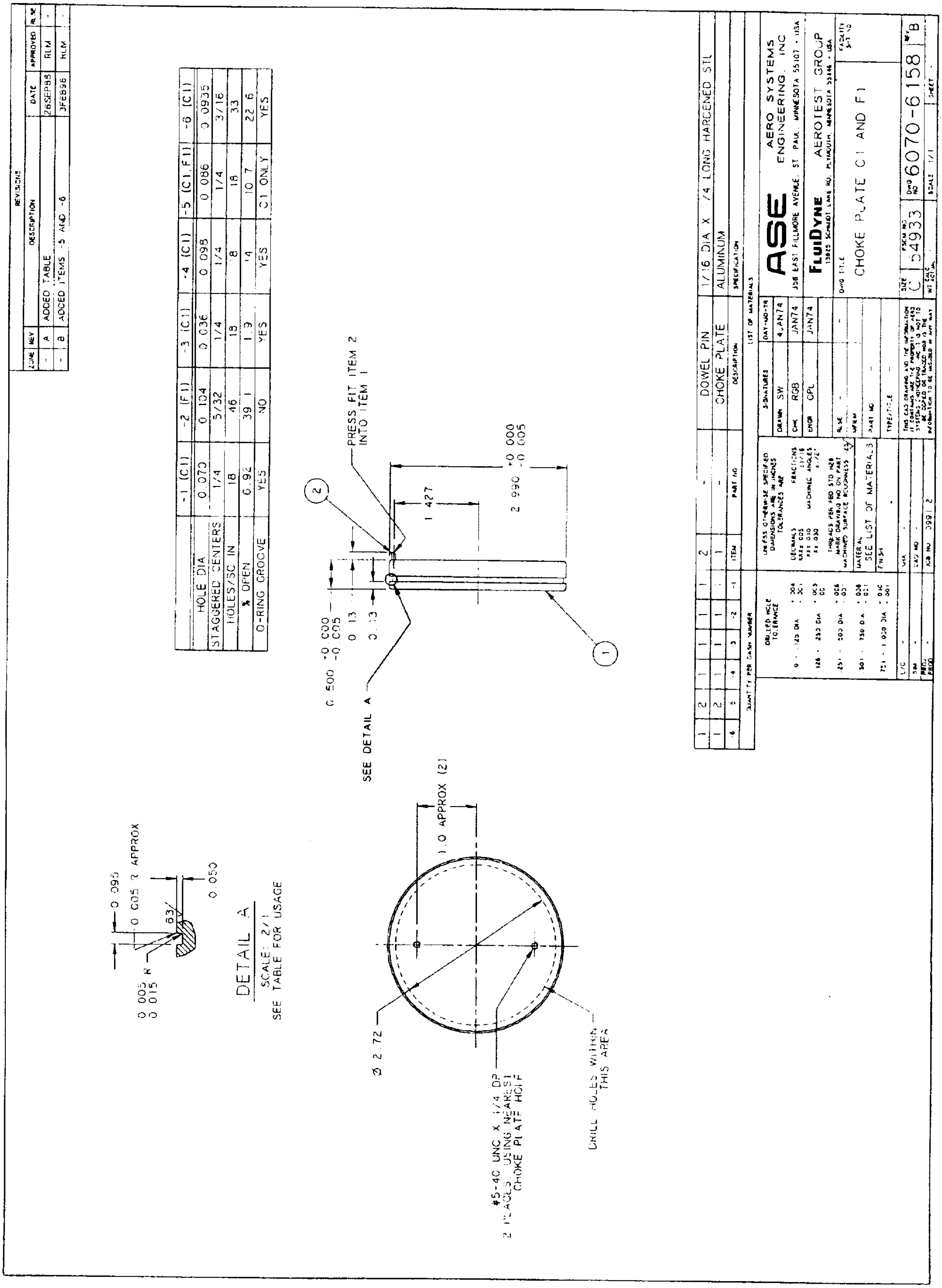
FLUIDYNE AEROTEST GROUP
13825 SCHMIDT LAKE RD. PLYMOUTH, MINNESOTA 55446 • USA

DWG TITLE
PLUG ADAPTER
CHANNEL 11 SPIDER

FACILITY SHT NO -

SIZE B | FSCM NO 54933 | DWG NO 60518167 | REV C

WT CALC ACTUAL - | SCALE 1/1 | SHEET -



ZONE	REV	DESCRIPTION	DATE	APPROVED	RLSE
-	A	ADDED TABLE	26SEP95	RLM	-
-	B	ADDED ITEMS -5 AND -6	3FEB96	RLM	-

	-1 (C1)	-2 (F1)	-3 (C1)	-4 (C1)	-5 (C1,F1)	-6 (C1)
HOLE DIA	0.070	0.104	0.036	0.098	0.086	0.0935
STAGGERED CENTERS	1/4	5/32	1/4	1/4	1/4	3/16
HOLES/SQ IN	18	46	18	18	18	33
% OPEN	6.92	39.1	1.9	14	10.7	22.6
O-RING GROOVE	YES	NO	YES	YES	C1 ONLY	YES

ID. #	NAME	FLUIDYNE THRUST PARAMETERS
1	CTR -	Resultant thrust coefficient dimensionless
2	HR -	Resultant thrust lbf
3	CTX -	Axial thrust coefficient dimensionless
4	HX -	Axial thrust lbf
5	CTY -	Normal thrust coefficient dimensionless
6	HY -	Normal thrust lbf
7	ALPHA	Angle of the resultant thrust
8	MACH -	"Tunnel mach number, dimensionless"
9	Q -	"Tunnel freestream dynamic pressure, psi"
10	LAM7 -	"Pressure ratio, Pt/Pa, dimensionless (Fan)"
11	LAM8 -	"Pressure ratio, Pt/Pa, dimensionless (Core)"
12	LAM9 -	"Pressure ratio, Pt/Pa, dimensionless (Final nozzle)"
13	W1 -	"Mass flow rate, lbm/sec (Core meter)"
14	W1COR	W1 corrected to std. pressure and temp.
15	W4 -	"Mass flow rate, lbm/sec (Fan meter)"
16	W4COR	W4 corrected to std. pressure and temp.
17	W7 -	"Mass flow rate, lbm/sec (Fan)"
18	W8 -	"Mass flow rate, lbm/sec (Core)"
19	MAVI7 -	Ideal thrust (Fan)
20	MAVI8 -	Ideal thrust (Core)
21	CD1 -	Meter discharge coefficient (Core)
22	CD4 -	Meter discharge coefficient (Fan)
23	CD6 -	Discharge coefficient (Venturi)
24	CD7 -	Discharge coefficient (Fan)
25	CD8 -	Discharge coefficient (Core)
26	CD9 -	Discharge coefficient (Final nozzle)
27	CT1 -	Meter thrust coefficient (Core)
28	CT4 -	Meter thrust coefficient (Fan)
29	PRATIO	Pt7/Pt8
30	TRATIO	Nozzle temperature ratio (TT8/TT7)
31	WRATIO	W7/W8
32	CWRATIO	SQR(Tt7/Tt8)*W7/W8
33	WCRATIO	W7/W8 corrected
34	CSTAR -	Real gas A/A* correction factor
35	MSTAR	Gamma correction factor
36	ASTARA8	A* for core duct
37	F9 -	Exit stream thrust parameter dimensionless
38	F9X -	Exit stream thrust parameter dimensionless X-plane
39	F9Y -	Exit stream thrust parameter dimensionless Y-plane
40	K1 -	Real gas critical mass flow function (Meter)
41	K4 -	Real gas critical mass flow function (Meter)
42	K6 -	Real gas critical mass flow function (Venturi)
43	K7 -	Real gas critical mass flow function (Fan)
44	K8 -	Real gas critical mass flow function (Core)
45	RN1/1000	Reynolds number dimensionless
46	RN4/1000	Reynolds number dimensionless (Fan)
47	RN6/1000	Reynolds number dimensionless (Venturi)
48	RNWT/1000	Reynolds number dimensionless (Tunnel)
49	F1 -	Stream thrust (Core)
50	F4 -	Stream thrust (Fan)
51	G1 -	Real gas stream thrust correction factor (Core)
52	G4 -	Real gas stream thrust correction factor (Fan)

53	P2PT1 -	Pseal/Pmeter (Core)
54	P5PT4 -	Pseal/Pmeter (Fan)
55	PSPT6 -	Ps(venturi)/Pt(venturi)
56	A1 -	"Cross-section area, in^2 (Meter)"
57	A1COLD	"Cross-section area, in^2 (Meter @ room temp
58	A2 -	"Cross-section area, in^2 (Seal)"
59	A3 -	"Cross-section area, in^2 (Sting cavity)"
60	A4 -	"Meter cross-section area, in^2 (Fan)"
61	A5 -	"Seal cross-section area, in^2 (Fan)"
62	A6 -	"Cross-section area, in^2 (Venturi)"
63	A7 -	"Cross-section area, in^2 (Fan)"
64	A8 -	"Cross-section area, in^2 (Core)"
65	A8COLD	"Cross-section area, in^2 (Core @ room temp.)"
66	A9 -	"Cross-section area, in^2 (Final nozzle)"
67	A9X -	"Cross-section area, in^2 (Final nozzle X-plane)"
68	A9Y -	"Cross-section area, in^2 (Final nozzle Y-plane)"
69	P2-PA -	"Static pressure difference across core seal, (Psid)"
70	P3-PA -	"Static pressure in sting cavity, psi"
71	P5-PA -	"Static pressure difference across fan seal, (Psid)"
72	PBAR -	Barometric pressure (Psia)
73	P -	Measured tunnel static pressure (Psia)
74	PT0 -	Measured tunnel total pressure (Psia)
75	PA -	Ambient pressure model sees (Psia)
76	PT1 -	Meter total pressure (Psia)
77	P2 -	Seal static pressure (Psia)
78	P3 -	Cavity static pressure (Psia)
79	PT4 -	Fan meter total pressure (Psia)
80	P5 -	Fan seal static pressure (Psia)
81	PT6 -	Venturi total pressure (Psia)
82	PSV -	Venturi throat static (Psia)
83	PT7 -	Fan charging station total pressure (Psia)
84	PT8 -	Core charging station total pressure (Psia)
85	TT0 -	Tunnel total temperature (Deg. F.)
86	TT1 -	Meter total temperature (Deg. F.)
87	T1WALL	Meter wall temp. (Deg. F.)
88	T1BAR -	Average temp. between meter wall and TT1 (Deg. F.)
89	TT4 -	Fan meter total temperature (Deg. F.)
90	TT6 -	Venturi total temperature (Deg. F.)
91	TT7 -	Fan charging station total temperature (Deg. F.)
92	TT8 -	Core charging station total temperature (Deg. F.)
93	TT8RATIO	Tt8/Twall
94	TTW -	Hot asme exit wall temp.
95	DELTAT	Tt1-Tt8
96	H0 -	"Iterated axial balance force, lbf"
97	V1 -	"Vertical balance force (upstream strap), lbs"
98	V3 -	"Vertical balance force (downstream strap), lbs"
99	H2 -	"Axial balance force corrected for seal tare, lbs"
100	H0I -	"Axial balance force @ 26.983, lbf"
101	K0P -	Correction for vertical location of thrust
102	B9 -	Vertical location of axial thrust vector
103	LBAL -	Length of balance from V1 to V3 (Inches)
104	LREF -	Length: bal. center(ch11,14)orV3(ch12) to ref. point (Inch)
105	LX -	Axial distance of pitching moment
106	LY -	Vertical distance of pitching moment

107	L3	-	Vertical location of thrust vector
108	WTLO	-	Weight balance sees @ 26.983
109	WTUP	-	Weight balance sees @ 6.783
110	M0	-	Pitching moment
111	DA2	-	Seal delta area (Core)
112	DA5	-	Seal delta area (Fan)
113	DELCTI		Ct ideal with 100% mix on channel 11 hot runs
114	DELR	-	Vertical displacement of vector @ model ref. point

ADDENDUM

PRESSURE DISTRIBUTION TEST FOR NASA AST SEPARATE FLOW NOZZLE NOISE REDUCTION CONFIGURATIONS

INTRODUCTION

PRESSURE DISTRIBUTION TEST FOR
NASA AST
SEPARATE FLOW NOZZLE
NOISE REDUCTION CONFIGURATIONS

ADDENDUM TO REPORT 2212 DATA APPENDIX

29 Oct 98

Introduction:

This is an addendum to the Report 2212 Data Appendix to document pressure distribution tests for selected NASA AST separate flow nozzle noise reduction configurations. These tests were added to the contract after the final report was completed for the performance tests. This Appendix Addendum contains drawing revisions, tables of run conditions, model photographs, tables of pressure measurements, and plots of charging station profiles and model pressure distributions.

New Instrumentation

Instrumentation was added to the model for measuring static pressure distributions on the core cowl outer flow surface downstream of the fan throat. The purpose was to measure the pressure distributions and interactions between the base, chevron, and tab nozzle trailing edge devices. Three axial rows of 10 pressure taps each were added at circumferential angles of 300, 330, and 345 degrees. Model stations for these pressure taps are documented on the following pages and on the detail drawings.

This instrumentation was not present in the original model design. Therefore the tubing was routed out of the core hardware and onto the inner fan duct air flow surface in a low Mach number region. It was covered with metallic tape. The tubing crossed the fan duct flow at 315 degrees. A sheet metal shield was used to form a strut for the 30 instrumentation tubes in an inline fashion. A total temperature rake/plug was modified by removing the temperature rake and slotting the plug to route the instrumentation out of the model. The sheet metal strut and tubes were all soldered to this plug. Existing PSI system ESP modules mounted in the sting were reconfigured to measure the new instrumentation.

One new T24 core nozzle was fabricated with static pressure instrumentation (2212-404). Tests were first done with the core tabs in place. Then half the tabs were cut off to locally simulate a baseline core nozzle. The tabs were cut off by hand with a Dremel tool parting disk.

Test Matrix and Conditions

The table below presents the test matrix. The chevron fan nozzle was first tested at the normal position with part top at top dead center(3T24Co). This positioned the fan chevron sharp point tip in line with a core tab protruding into the fan flow at the top dead center position. Next the fan chevron nozzle was rotated 22.5 degrees to position the fan chevron valley directly in line with the core tab at top dead center(3T24C$_{22.5}$). Target test conditions were cruise point "A" (Pt7/Pa=2.6, Pt7/Pt8=1.083, Mach # =0.8).

Test Sequence	Description 3 (core)(fan)	Data Point	Core Drawing #	Fan Drawing #	Pt7/Pa	Pt7/Pt8	Mach
1	3T24B	201.02	2212-404RevB	2078-001	2.598	1.094	.796
2		201.03	2212-404RevB	2078-001	2.601	1.064	.794
3	3T24C$_0$	202.02	2212-404RevB	2078-003 (@ 0 deg.)	2.607	1.087	.800
4	3T24C$_{22.5}$	203.01	2212-404RevB	2078-003 (@ 22.5 deg.)	2.581	1.082	.787
5	3B'C$_{22.5}$	204.01	2212-404RevC	2078-003 (@ 22.5 deg.)	2.591	1.085	.789
6	3B'C$_0$	205.01	2212-404RevC	2078-003 (@ 0 deg.)	2.626	1.091	.803
7	3B'B	206.01	2212-404RevC	2078-001	2.621	1.080	.801

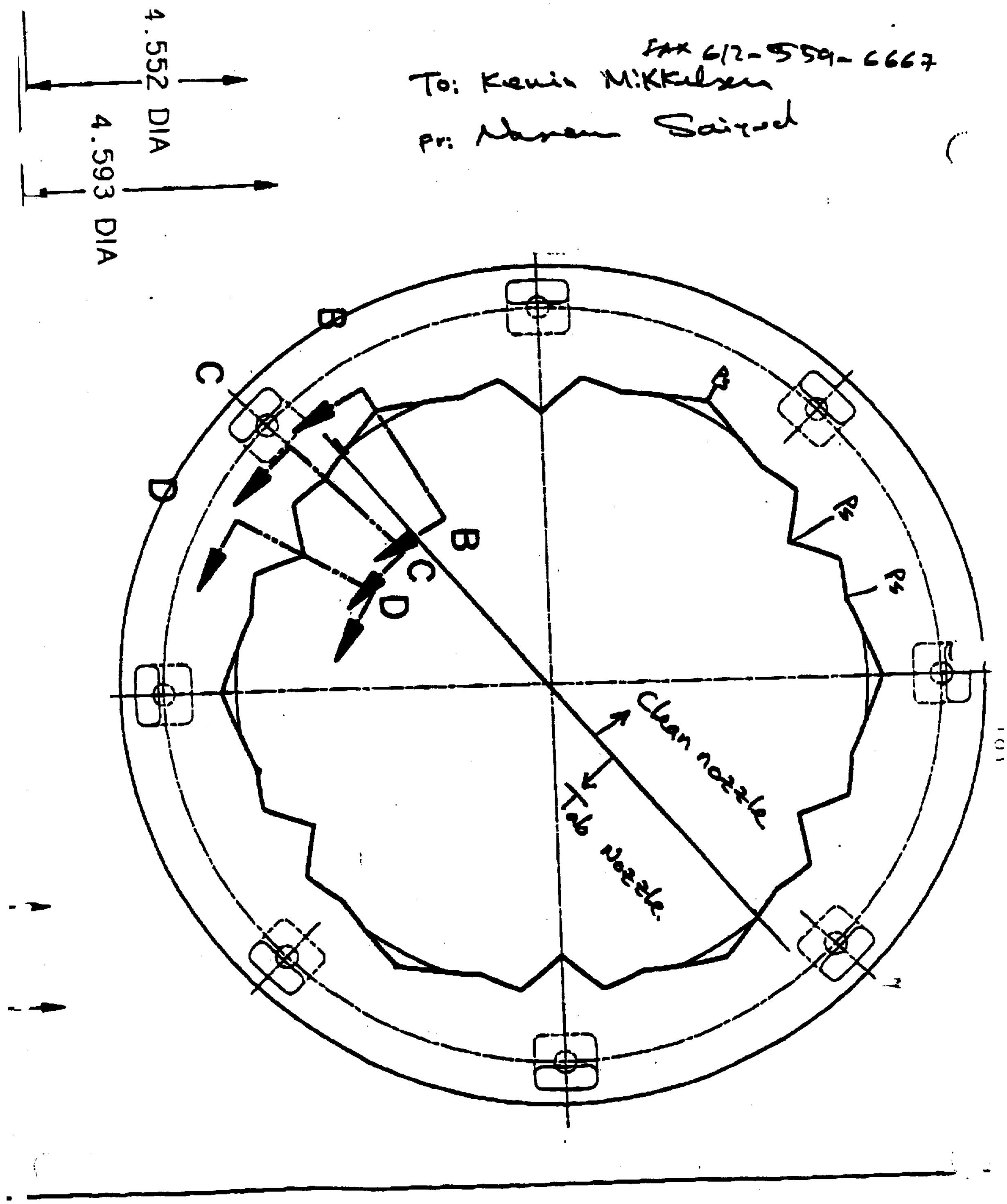
Job 2212: NASA AST NOZZLE TESTS									
Instrumentation Locations									
Channel 6&10 Core Charging Station									
	Pressure Tap no.	theta	R	(R-Ri)/(Ro-Ri)		**T/C Probe no.**	theta	R	(R-Ri)/(Ro-Ri)
Pt8	1	0	1.253	0.1376	Tt8				
Pt8	2	0	1.629	0.3549	Tt8				
Pt8	3	0	1.934	0.5312	Tt8				
Pt8	4	0	2.196	0.6827	Tt8				
Pt8	5	0	2.43	0.8179	Tt8	(none provided, use J.T. temp drop)			
Pt8	6	0	2.644	0.9416	Tt8				
Pt8	7	90	1.253	0.1376	Tt8				
Pt8	8	90	1.629	0.3549	Tt8				
Pt8	9	90	1.934	0.5312	Tt8				
Pt8	10	90	2.196	0.6827	Tt8				
Pt8	11	90	2.43	0.8179	Tt8				
Pt8	12	90	2.644	0.9416	Tt8				
Pt8	13	180	1.253	0.1376					
Pt8	14	180	1.629	0.3549					
Pt8	15	180	1.934	0.5312					
Pt8	16	180	2.196	0.6827					
Pt8	17	180	2.43	0.8179		Core Charging Station Du		drawing	
Pt8	18	180	2.644	0.9416		Ri=. inch	1.015	2212-607	
Pt8	19	270	1.253	0.1376		Ro= inch	2.745	2212-403	
Pt8	20	270	1.629	0.3549					
Pt8	21	270	1.934	0.5312					
Pt8	22	270	2.196	0.6827					
Pt8	23	270	2.43	0.8179					
Pt8	24	270	2.644	0.9416					
	Tap	theta (deg)							
Ps8_inner	25	15							
Ps8_inner	26	105							
Ps8_inner	27	195							
Ps8_inner	28	285							
Ps8_outer	29	15							
Ps8_outer	30	105							
Ps8_outer	31	195							
Ps8_outer	32	285							

Channel 6&10 Fan Charging Station									
	Pressure Tap no.	theta	R	(R-Ri)/(Ro-Ri)		T/C Probe no.	theta	R	(R-Ri)/(Ro-Ri)
Pt7	50	0	3.486	0.0594	Tt7	1	135	3.725	0.1373
Pt7	51	0	3.824	0.1696	Tt7	2	135	4.451	0.3741
Pt7	52	0	4.134	0.2707	Tt7	3	135	5.074	0.5773
Pt7	53	0	4.423	0.3650	Tt7	4	135	5.628	0.7580
Pt7	54	0	4.694	0.4534	Tt7	5	135	6.132	0.9224
Pt7	55	0	4.950	0.5369	Tt7	6	315	3.725	0.1373
Pt7	56	0	5.194	0.6164	Tt7	7	315	4.451	0.3741
Pt7	57	0	5.427	0.6924	Tt7	8	315	5.074	0.5773
Pt7	58	0	5.650	0.7652	Tt7	9	315	5.628	0.7580
Pt7	59	0	5.864	0.8350	Tt7	10	315	6.132	0.9224
Pt7	60	0	6.072	0.9028					
Pt7	61	0	6.272	0.9680					
Pt7	62	90	3.486	0.0594					
Pt7	63	90	3.824	0.1696					
Pt7	64	90	4.134	0.2707					
Pt7	65	90	4.423	0.3650					
Pt7	66	90	4.694	0.4534					
Pt7	67	90	4.95	0.5369		Fan Charging Station Duc		drawings	
Pt7	68	90	5.194	0.6164		Ri= inch	3.304	2212-403	
Pt7	69	90	5.427	0.6924		Ro= inch	6.370	2212-004	
Pt7	70	90	5.65	0.7652					
Pt7	71	90	5.864	0.8350		Pt rake		2212-612	
Pt7	72	90	6.072	0.9028		Tt rake		2212-613	
Pt7	73	90	6.272	0.9680					
Pt7	74	180	3.486	0.0594					
Pt7	75	180	3.824	0.1696					
Pt7	76	180	4.134	0.2707					
Pt7	77	180	4.423	0.3650					
Pt7	78	180	4.694	0.4534					
Pt7	79	180	4.95	0.5369					
Pt7	80	180	5.194	0.6164					
Pt7	81	180	5.427	0.6924					
Pt7	82	180	5.65	0.7652					
Pt7	83	180	5.864	0.8350					
Pt7	84	180	6.072	0.9028					
Pt7	85	180	6.272	0.9680					
Pt7	86	270	3.486	0.0594					
Pt7	87	270	3.824	0.1696					
Pt7	88	270	4.134	0.2707					
Pt7	89	270	4.423	0.3650					
Pt7	90	270	4.694	0.4534					
Pt7	91	270	4.95	0.5369					
Pt7	92	270	5.194	0.6164					
Pt7	93	270	5.427	0.6924					
Pt7	94	270	5.65	0.7652					
Pt7	95	270	5.864	0.8350					
Pt7	96	270	6.072	0.9028					
Pt7	97	270	6.272	0.9680					
	Tap	Theta (deg)							
Ps7_in	98	15		2212-403					
Ps7_in	99	85							
Ps7_in	100	205							
Ps7_in	101	275							
Ps7_out	102	15		2212-004					
Ps7_out	103	85							
Ps7_out	104	205							
Ps7_out	105	275							

Channel 10 Sting Boundary Layer Rake					
	Tap		Y(inch)	theta , deg	
PtBL	121		0.025	0	
	122		0.070		
	123		0.115		
	124		0.160		
	125		0.205		
	126		0.300		
	127		0.400		
	128		0.500		
	129		0.600		
	130		0.800		
	131		1.000		
Channel 6&10 Fan External Nacelle					
	Tap		X1, inches	theta, deg	X =0 is upstream face of part 2078-001
	111		0.1	3	
	112		0.75	357	
	113		1.5	354	
	114		2.25	351	
	115		3.25	348	
	116		4.5	345	
	117		6	342	
	118		7.5	340	
	119		9	335	
	120	base tap	10.371	333	
Channel 10 Phase 2 Additional Pressures for Core Cowl Outer Surface Downstream of Fan Throat					
	Tap		Model Station (inches)	Theta (deg)	
Phase 2	151		156.489	300	
	152		156.989		
	153		157.489		
	154		157.739		
	155		157.989		
	156		158.239		
	157		158.489		
	158		158.989		
	159		159.489		
	160		159.989		
	161		156.489	330	
	162		156.989		
	163		157.489		
	164		157.739		
	165		157.989		
	166		158.239		
	167		158.489		
	168		158.989		
	169		159.489		
	170		159.989		
	171		156.489	345	
	172		156.989		
	173		157.489		
	174		157.739		
	175		157.989		
	176		158.239		
	177		158.489		
	178		158.989		
	179		159.489		
	180		159.989		

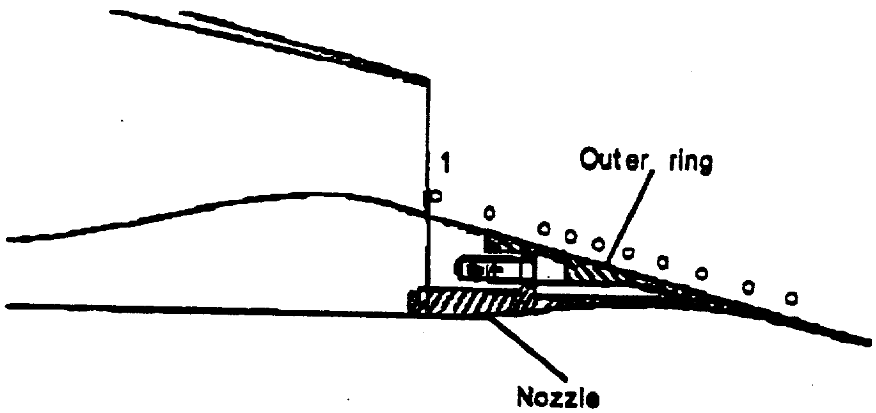
Channel 10 Wall Static Pressures			
	Tap	X2(inches) from beginning of wall slots	
Floor	701	2.5	
	702	9.5	
	703	16.5	
	704	23.5	
	705	30.5	
	706	37.5	
	707	44.5	
	708	51.5	
	709	58.5	
	710	62.5	
	711	65	Baseline fan exit plane is 64.5 inches downstream of beginning of wall slots.
	712	69	
	713	72.5	
	714	79.5	
	715	86.5	
Ceiling	720	2.25	
	721	9.25	
	722	16.25	
	723	23.25	
	724	30.25	
	725	37.25	
	726	44.25	
	727	51.25	
	728	58.25	
	729	65.25	
	730	72.25	
	731	79.25	
	732	86.25	
West Wall	760	2.25	
	761	9.25	
	762	16.25	
	763	30.25	
	764	37.25	
	765	65.25	
	766	72.25	
East Wall	790	2.25	
	791	30.25	
	792	37.25	
	793	65.25	
	794	72.25	
Plenum	5 on plenum side of East wall, spread from upstream to downstream over entire length		
	5 on plenum side of West wall, spread from upstream to downstream over entire length		
Pa	is plenum pressure corrected to centerline pressure based on original tunnel calibration		
Pto	measured barometer with screen loss correction		

FAX 612-559-6667
To: Kevin Mikkelsen
fr: Naseem Saiyed

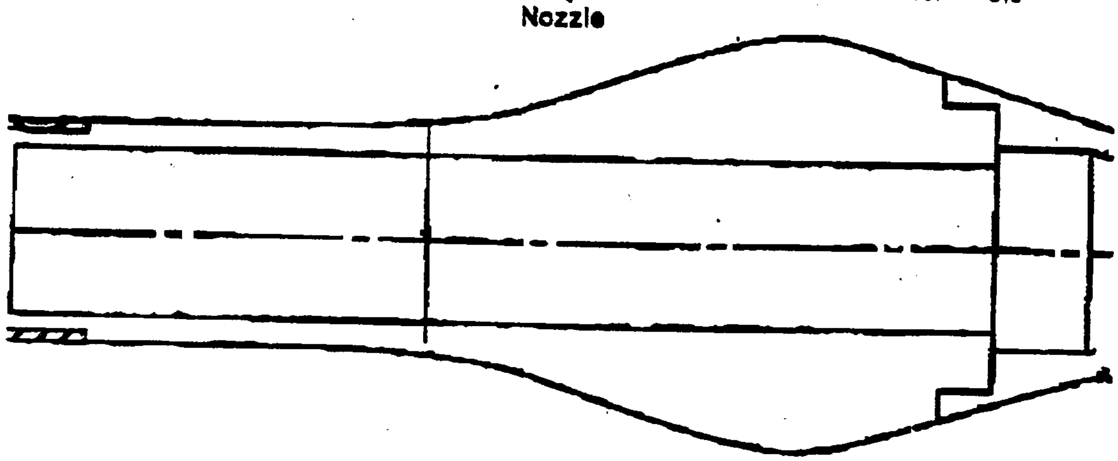


10-19-1998 17:47 216 433 3918 NASA/BLDG 77.RM 137 P.01

Full Scale



#	x(in)
1.	0
2.	0.5
3.	1.0
4.	1.25
5.	1.5
6.	1.75
7.	2.0
8.	2.5
9.	3.0
10.	3.5

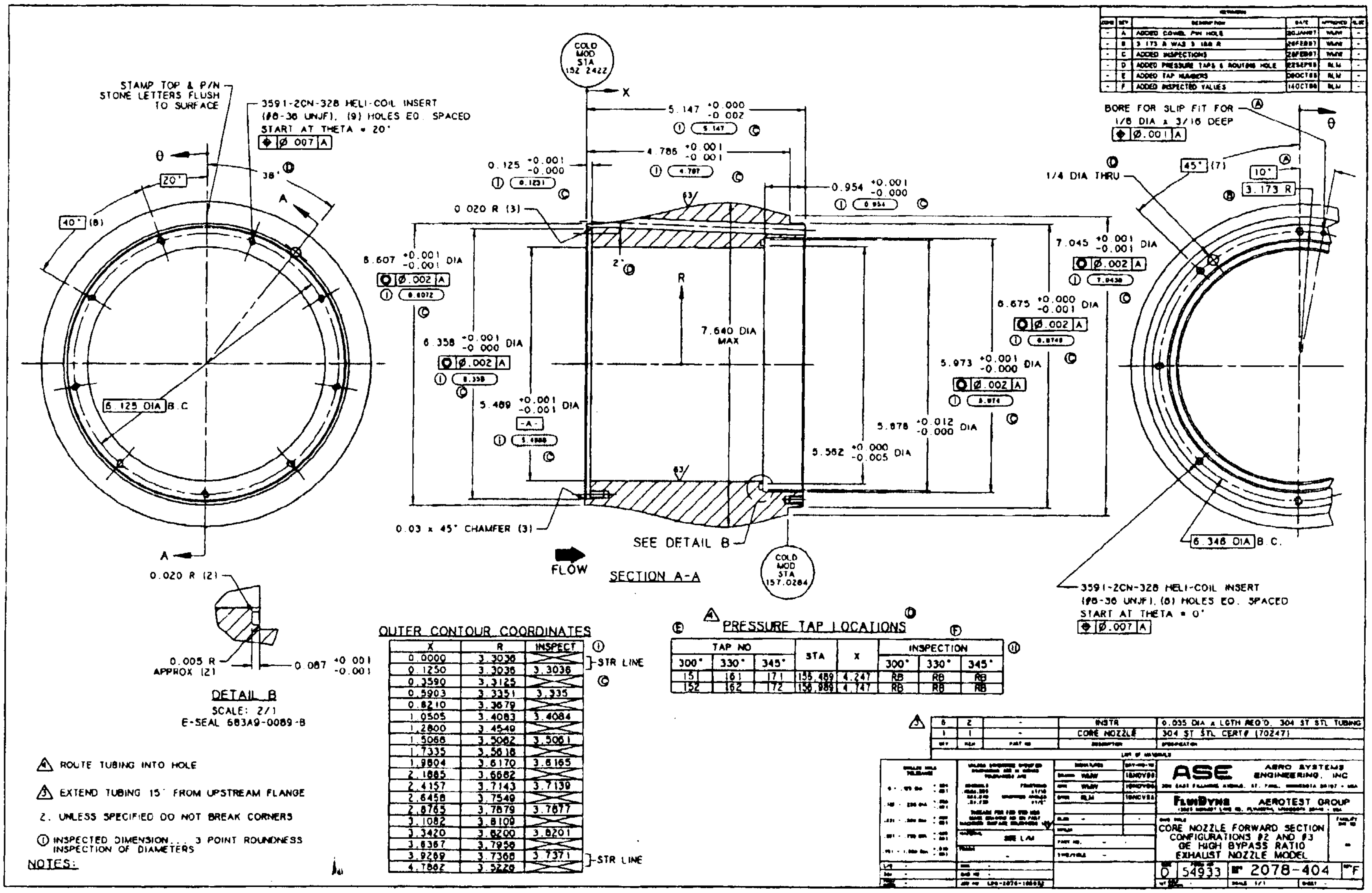


REVISED DRAWINGS

REVISED DRAWINGS

This section contains drawing revisions for the Phase 2 Pressure Distribution Test. For all other drawings refer to the Report for Job 2212 Phase 1 Test. The revised drawings are:

2078-404 Core Nozzle Forward Section
2212-404 Instrumented Core Nozzle
2212-613 Fan Tt Rake (modified for Ps instrumentation lead through)

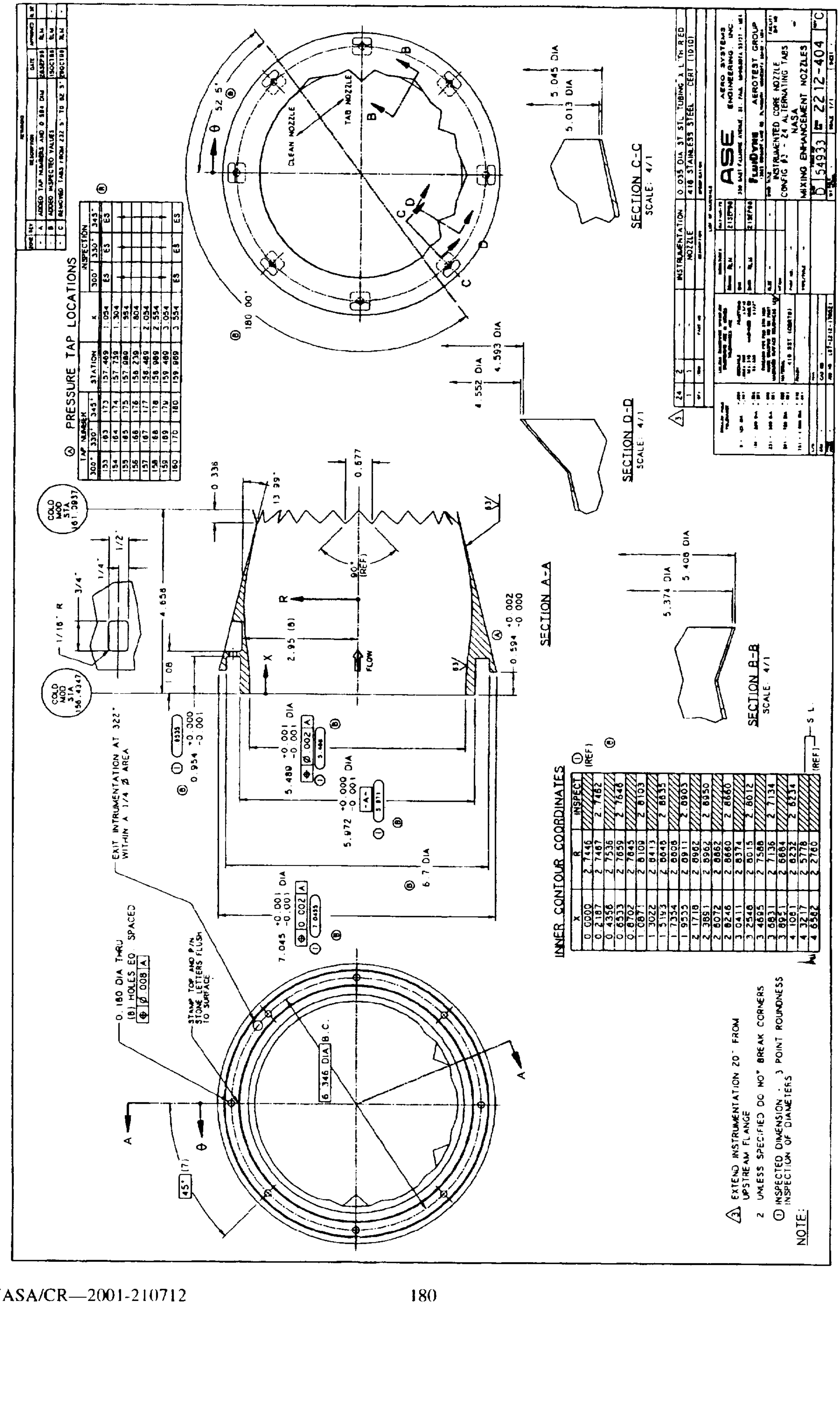


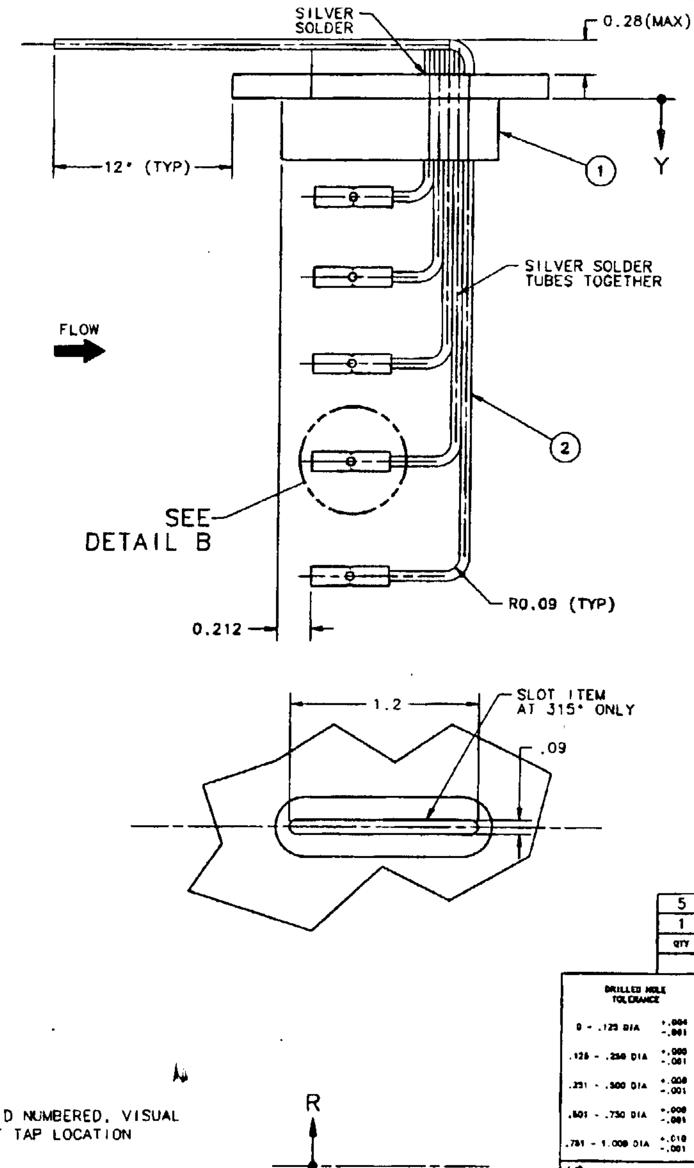
OUTER CONTOUR COORDINATES

X	R	INSPECT
0.0000	3.3036	
0.1250	3.3036	3.3036
0.3590	3.3125	
0.5903	3.3351	3.335
0.8210	3.3679	
1.0505	3.4083	3.4084
1.2800	3.4549	
1.5066	3.5062	3.5061
1.7335	3.5618	
1.9804	3.6170	3.6165
2.1885	3.6682	
2.4157	3.7143	3.7139
2.6458	3.7549	
2.8765	3.7879	3.7877
3.1082	3.8109	
3.3420	3.8200	3.8201
3.6367	3.7958	
3.9269	3.7368	3.7371
4.7862	3.5229	

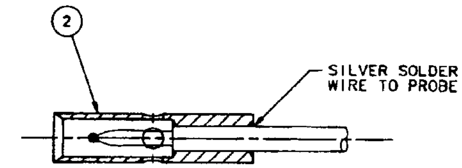
PRESSURE TAP LOCATIONS

TAP NO			STA	X	INSPECTION		
300°	330°	345°			300°	330°	345°
151	161	171	155.489	4.247	RB	RB	RB
152	162	172	156.989	4.747	RB	RB	RB


PRESSURE TAP LOCATIONS
INNER CONTOUR COORDINATES
SECTION A-A
SECTION B-B
SCALE: 4/1
SECTION C-C
SCALE: 4/1
SECTION D-D
SCALE: 4/1
CLEAN NOZZLE
TAB NOZZLE
FLOW
NOTE:
EXTEND INSTRUMENTATION 20" FROM UPSTREAM FLANGE
UNLESS SPECIFIED DO NOT BREAK CORNERS
INSPECTED DIMENSION - 3 POINT ROUNDNESS INSPECTION OF DIAMETERS
EXIT INSTRUMENTATION AT 322° WITHIN A 1/4 Ø AREA
0.180 DIA THRU (8) HOLES EQ. SPACED
STAMP TOP AND P/N STONE LETTERS FLUSH TO SURFACE
6.346 DIA B.C.
6.7 DIA
5.374 DIA
5.408 DIA
5.045 DIA
5.013 DIA
4.552 DIA
4.593 DIA
ASE
AEROTEST GROUP
INSTRUMENTED CORE NOZZLE
CONFIG #3 - 24 ALTERNATING TABS
NASA
MIXING ENHANCEMENT NOZZLES
D 54933 2212-404



REVISIONS					
ZONE	REV	DESCRIPTION	DATE	APPROVED	RLSE
-	A	ADDED TAP NUMBERS	24FEB98	RLM	-
-	B	REMOVED THERMOCOUPLES FROM ITEM AT 315°, ADDED SLOT FOR PRESSURE TUBING	23SEP98	RLM	-



DETAIL B
SCALE: 5/1

Ⓐ Ⓑ Tt PROBE LOCATIONS

TAP NO				
θ = 135°	θ = 315°	R	Y	INSP ⑪
5	-	6.132	0.818	-
4	-	5.628	1.122	-
3	-	5.074	1.676	-
2	-	4.451	2.299	-
1	-	3.725	3.025	-

QTY	ITEM	PART NO	DESCRIPTION	SPECIFICATION
5	2	6070-894-3	T/C PROBE	0.062 DIA x LGTH REQ'D, TYPE K MGO
1	1	2212-804-2	FAN DUCT PLUG	-

LIST OF MATERIALS

DRILLED HOLE TOLERANCE	
0 - .125 DIA	+.004 -.001
.126 - .250 DIA	+.005 -.001
.251 - .500 DIA	+.008 -.001
.501 - .750 DIA	+.008 -.001
.751 - 1.000 DIA	+.010 -.001

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
DECIMALS .XXX ±.005 .XX ±.010 .X ±.030 FRACTIONS ±1/16 MACHINED ANGLES ±1/2°
THREADS PER FED STD H28
MARK DRAWING NO ON PART
MACHINED SURFACE ROUGHNESS 125
MATERIAL SEE L/M
FINISH -

SIGNATURES		DAY-MO-YR
DRAWN	BAS	29JAN98
CHK	-	-
ENGR	RLM	02FEB98
RLSE	-	-

PART NO. -
TYPE/TITLE -
JOB NO L97 2212 170021

ASE AERO SYSTEMS ENGINEERING, INC.
358 EAST FILLMORE AVENUE, ST. PAUL, MINNESOTA 55107 • USA
FluiDyne AEROTEST GROUP
13825 SCHMIDT LAKE RD, PLYMOUTH, MINNESOTA 55446 • USA

DWG TITLE: FAN Tt RAKE - NASA ADAPTER HARDWARE
SIZE C FSCM NO 54933 DWG NO 2212-613 REV B
SCALE 1/1

⑪ LEAK CHECKED, ID NUMBERED, VISUAL CONFIRMATION OF TAP LOCATION

NOTES:

3T24B

Data Point =	201.02
Nozzle Description =	3T24B
Pt7/Pa =	2.598
Pt7/Pt8 =	1.094
Mach Number =	0.796

FLUIDYNE AEROTEST LABORATORY 3T24B

Run Day/Time=	20-OCT-98 10:37:43	Run Number=	201.02
Job Number=	2212	File Id=	06293103743
PtO=	14.341	Bar. (Psia)=	14.379
Mach number=	0.796	Ptunnel (Psia)=	9.444
Tunnel Rn=	3.599E+06	Tunnel Q=	4.1903

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
TUNNEL FLOOR STATICS						
701	9.448				0.0010	0.7957
702	9.451				0.0017	0.7954
703	9.578				0.0321	0.7818
704	9.428				-0.0037	0.7978
705	9.406				-0.0090	0.8002
706	9.404				-0.0095	0.8004
707	9.466				0.0053	0.7938
708	9.343				-0.0240	0.8069
709	9.271				-0.0412	0.8147
710	9.163				-0.0670	0.8262
711	9.283				-0.0383	0.8134
712	9.380				-0.0152	0.8030
713	9.424				-0.0047	0.7983
714	9.466				0.0053	0.7938
715	9.427				-0.0040	0.7980
TUNNEL CEILING STATICS						
720	9.458				0.0034	0.7946
721	9.430				-0.0033	0.7976
722	9.428				-0.0037	0.7978
723	9.452				0.0020	0.7953
724	9.375				-0.0164	0.8035
725	9.342				-0.0243	0.8071
726	9.329				-0.0274	0.8084
727	9.252				-0.0457	0.8167
728	9.248				-0.0467	0.8171
729	9.392				-0.0123	0.8017
730	9.451				0.0017	0.7954
731	9.489				0.0108	0.7913
732	9.494				0.0120	0.7908
TUNNEL WEST WALL STATICS						
760	9.519				0.0180	0.7881
761	9.405				-0.0092	0.8003
762	9.428				-0.0037	0.7978
763	9.288				-0.0372	0.8128
764	9.360				-0.0200	0.8051
765	9.454				0.0025	0.7951
766	9.595				0.0361	0.7800
TUNNEL EAST WALL STATICS						
790	9.549				0.0251	0.7849

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 20-OCT-98 10:37:43
Job Number= 2212
PtO= 14.341
Mach number= 0.796
Tunnel Rn= 3.599E+06

Run Number= 201.02
File Id= 06293103743
Bar. (Psia)= 14.379
Ptunnel (Psia)= 9.444
Tunnel Q= 4.1903

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
TUNNEL EAST WALL STATICS						
791	9.430				-0.0033	0.7976
792	9.338				-0.0252	0.8075
793	9.258				-0.0443	0.8160
794	9.415				-0.0068	0.7992
PT8 - RAKE @60 DEGREES						
1	22.442	1.0010				
2	22.455	1.0016				
3	22.436	1.0007				
4	22.407	0.9994				
5	22.365	0.9975				
6	22.311	0.9951				
AVERAGE=	22.403	Distortion .0064				
PS8 - STATICS						
25	21.165	0.9440				
29	21.017	0.9374				
AVERAGE=	21.091	Distortion .0070				
PT8 - RAKE @150 DEGREES						
7	22.431	1.0005				
8	22.390	0.9987				
9	22.398	0.9990				
10	22.420	1.0000				
11	22.452	1.0014				
12	22.407	0.9994				
AVERAGE=	22.416	Distortion .0028				
PS8 - STATICS						
26	21.041	0.9385				
30	21.007	0.9370				
AVERAGE=	21.024	Distortion .0016				
PT8 - RAKE @240 DEGREES						
Fixed 13	22.444	1.0010				
14	22.391	0.9987				
15	22.438	1.0008				
16	22.431	1.0005				
17	22.483	1.0028				
18	22.428	1.0004				
AVERAGE=	22.436	Distortion .0041				
PS8 - STATICS						
27	21.033	0.9381				
31	20.994	0.9364				
AVERAGE=	21.013	Distortion .0019				

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 20-OCT-98 10:37:43
Job Number= 2212
PtO= 14.341
Mach number= 0.796
Tunnel Rn= 3.599E+06

Run Number= 201.02
File Id= 06293103743
Bar. (Psia)= 14.379
Ptunnel (Psia)= 9.444
Tunnel Q= 4.1903

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PT8 -	RAKE @330 DEGREES					
19	22.458	1.0017				
20	22.442	1.0010				
Fixed 21	22.424	1.0002				
22	22.433	1.0006				
23	22.486	1.0029				
24	22.308	0.9950				
AVERAGE=	22.425	Distortion .0079				
PS8 -	STATICS					
28	20.971	0.9354				
32	20.901	0.9322				
AVERAGE=	20.936	Distortion .0033				
PT7 -	RAKE @0 DEGREES					
50	24.506		0.9988			
51	24.494		0.9983			
52	24.504		0.9987			
53	24.501		0.9986			
54	24.500		0.9985			
55	24.496		0.9984			
56	24.528		0.9997			
57	24.554		1.0007			
58	24.589		1.0022			
59	24.598		1.0025			
60	24.541		1.0002			
61	24.407		0.9948			
AVERAGE=	24.518	Distortion .0078				
PS7 -	STATICS @30 DEGREES					
98	23.842		0.9717			
102	23.915		0.9747			
AVERAGE=	23.878	Distortion .0031				
PT7 -	RAKE @90 DEGREES					
62	24.489		0.9981			
63	24.587		1.0021			
64	24.601		1.0027			
65	24.597		1.0025			
66	24.594		1.0024			
67	24.569		1.0014			
68	24.536		1.0000			
69	24.529		0.9997			
70	24.513		0.9991			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time=	20-OCT-98 10:37:43	Run Number=	201.02
Job Number=	2212	File Id=	06293103743
PtO=	14.341	Bar. (Psia)=	14.379
Mach number=	0.796	Ptunnel (Psia)=	9.444
Tunnel Rn=	3.599E+06	Tunnel Q=	4.1903

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PT8 -	RAKE @330 DEGREES					
19	22.458	1.0017				
20	22.442	1.0010				
Fixed 21	22.424	1.0002				
22	22.433	1.0006				
23	22.486	1.0029				
24	22.308	0.9950				
AVERAGE=	22.425	Distortion	.0079			
PS8 -	STATICS					
28	20.971	0.9354				
32	20.901	0.9322				
AVERAGE=	20.936	Distortion	.0033			
PT7 -	RAKE @0 DEGREES					
50	24.506		0.9988			
51	24.494		0.9983			
52	24.504		0.9987			
53	24.501		0.9986			
54	24.500		0.9985			
55	24.496		0.9984			
56	24.528		0.9997			
57	24.554		1.0007			
58	24.589		1.0022			
59	24.598		1.0025			
60	24.541		1.0002			
61	24.407		0.9948			
AVERAGE=	24.518	Distortion	.0078			
PS7 -	STATICS @30 DEGREES					
98	23.842		0.9717			
102	23.915		0.9747			
AVERAGE=	23.878	Distortion	.0031			
PT7 -	RAKE @90 DEGREES					
62	24.489		0.9981			
63	24.587		1.0021			
64	24.601		1.0027			
65	24.597		1.0025			
66	24.594		1.0024			
67	24.569		1.0014			
68	24.536		1.0000			
69	24.529		0.9997			
70	24.513		0.9991			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time=	20-OCT-98 10:37:43	Run Number=	201.02
Job Number=	2212	File Id=	06293103743
PtO=	14.341	Bar. (Psia)=	14.379
Mach number=	0.796	Ptunnel (Psia)=	9.444
Tunnel Rn=	3.599E+06	Tunnel Q=	4.1903

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PT7 - RAKE @90 DEGREES						
71	24.514		0.9991			
72	24.510		0.9990			
73	24.540		1.0002			
AVERAGE=	24.548	Distortion	.0046			
PS7 - STATICS @120 DEGREES						
99	23.874		0.9730			
103	23.920		0.9749			
AVERAGE=	23.897	Distortion	.0019			
PT7 - RAKE @180 DEGREES						
74	24.518		0.9993			
75	24.513		0.9991			
76	24.526		0.9996			
77	24.498		0.9985			
78	24.451		0.9966			
79	24.442		0.9962			
80	24.456		0.9968			
81	24.509		0.9989			
82	24.538		1.0001			
83	24.550		1.0006			
84	24.552		1.0007			
85	24.555		1.0008			
AVERAGE=	24.509	Distortion	.0046			
PS7 - STATICS @210 DEGREES						
100	23.860		0.9725			
104	23.919		0.9749			
AVERAGE=	23.889	Distortion	.0025			
PT7 - RAKE @270 DEGREES						
86	24.534		0.9999			
87	24.651		1.0047			
88	24.649		1.0046			
89	24.636		1.0041			
90	24.603		1.0027			
91	24.554		1.0007			
92	24.529		0.9997			
Fixed 93	24.531		0.9998			
94	24.525		0.9996			
95	24.514		0.9991			
96	24.524		0.9995			
97	24.511		0.9990			
AVERAGE=	24.563	Distortion	.0057			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 20-OCT-98 10:37:43
Job Number= 2212
PtO= 14.341
Mach number= 0.796
Tunnel Rn= 3.599E+06

Run Number= 201.02
File Id= 06293103743
Bar. (Psia)= 14.379
Ptunnel (Psia)= 9.444
Tunnel Q= 4.1903

	TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
	PS7 - STATICS @300 DEGREES						
Fixed	101	23.859		0.9724			
	105	23.915		0.9747			
	AVERAGE=	23.887	Distortion	.0024			
	EXTERNAL FAN NACELLE						
	111	7.611				-0.4374	0.9960
	112	5.843				-0.8593	1.2092
	115	8.804				-0.1527	0.8648
	120	9.863				0.1001	0.7513
	B.L. PT RAKE						
	122	12.202			1.2921		
	125	13.000			1.3766		
	PHASE 2 FAN INNER SURFACE PS @ 300 DEG						
	151	12.563		0.5120			
	152	9.628		0.3924			
	153	8.901		0.3628			
	154	8.919		0.3635			
	155	9.066		0.3695			
	156	9.400		0.3831			
	157	10.701		0.4361			
	158	12.238		0.4988			
	159	11.347		0.4625			
	160	9.645		0.3931			
	PHASE 2 FAN INNER SURFACE PS @ 330 DEG						
	161	12.585		0.5129			
	162	9.598		0.3912			
	163	8.876		0.3618			
	164	8.936		0.3642			
	165	8.980		0.3660			
	166	9.143		0.3726			
	167	10.482		0.4272			
	168	12.320		0.5021			
	169	11.447		0.4665			
	170	9.674		0.3943			
	PHASE 2 FAN INNER SURFACE PS @ 345 DEG						
	171	12.672		0.5165			
	172	9.683		0.3946			
	173	8.951		0.3648			
	174	8.889		0.3622			
	175	9.083		0.3702			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time=	20-OCT-98 10:37:43	Run Number=	201.02
Job Number=	2212	File Id=	06293103743
PtO=	14.341	Bar. (Psia)=	14.379
Mach number=	0.796	Ptunnel (Psia)=	9.444
Tunnel Rn=	3.599E+06	Tunnel Q=	4.1903

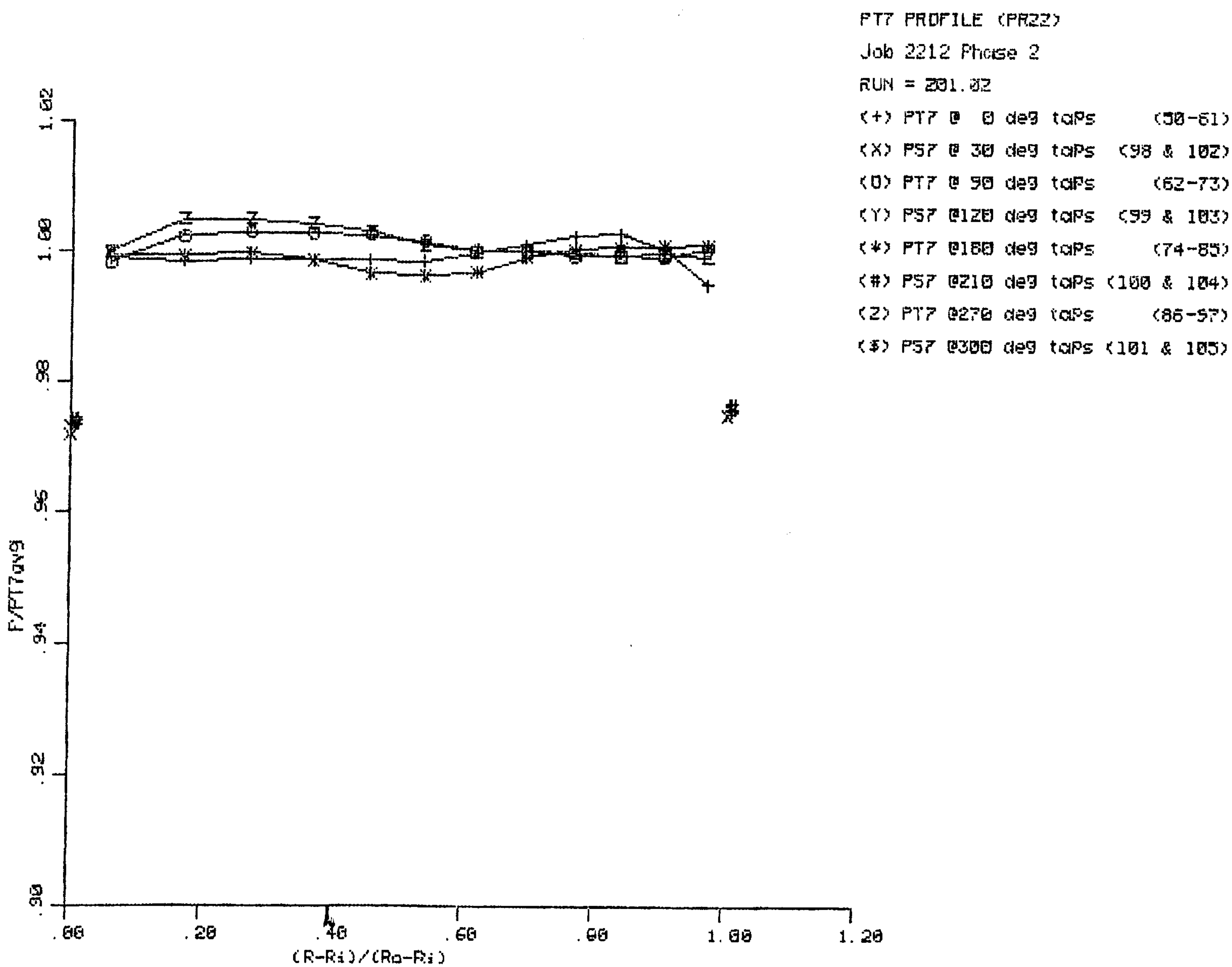
PHASE 2 FAN INNER SURFACE PS @ 345 DEG

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
176	9.200		0.3750			
177	10.441		0.4255			
178	12.300		0.5013			
179	11.493		0.4684			
180	9.723		0.3963			

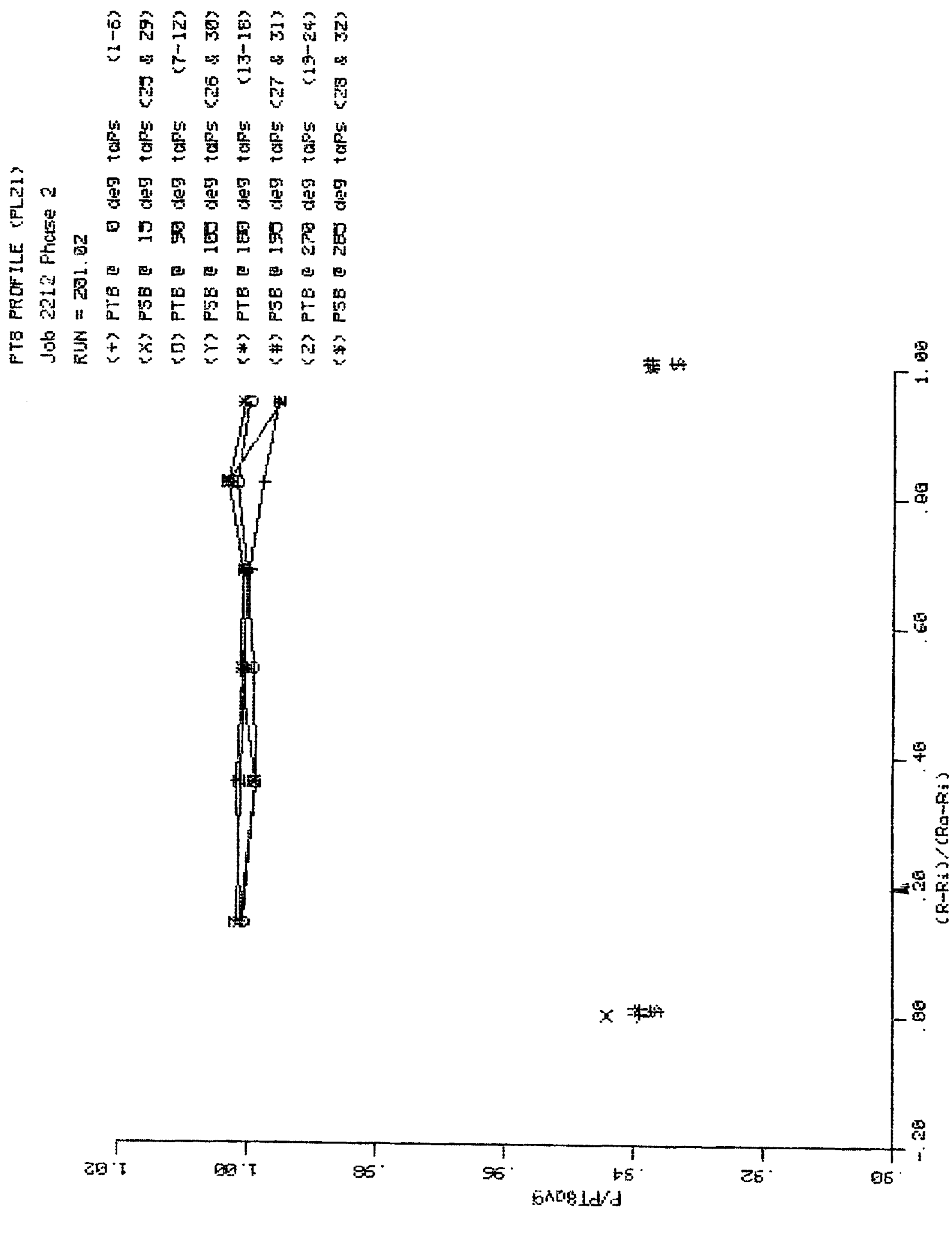
	PT	PS	MACH
STA8			
	22.403	21.080	0.2962
	22.416	21.021	0.3043
	22.436	21.011	0.3076
	22.425	20.931	0.3154
STA7			
	24.519	23.884	0.1939
	24.549	23.901	0.1959
	24.509	23.894	0.1910
	24.565	23.893	0.1994

		AVERAGE		Pt Dist	Ps Dist
STA8	22.420	21.011	0.3059	0.0079	0.0126
STA7	24.536	23.893	0.1951	0.0099	0.0033

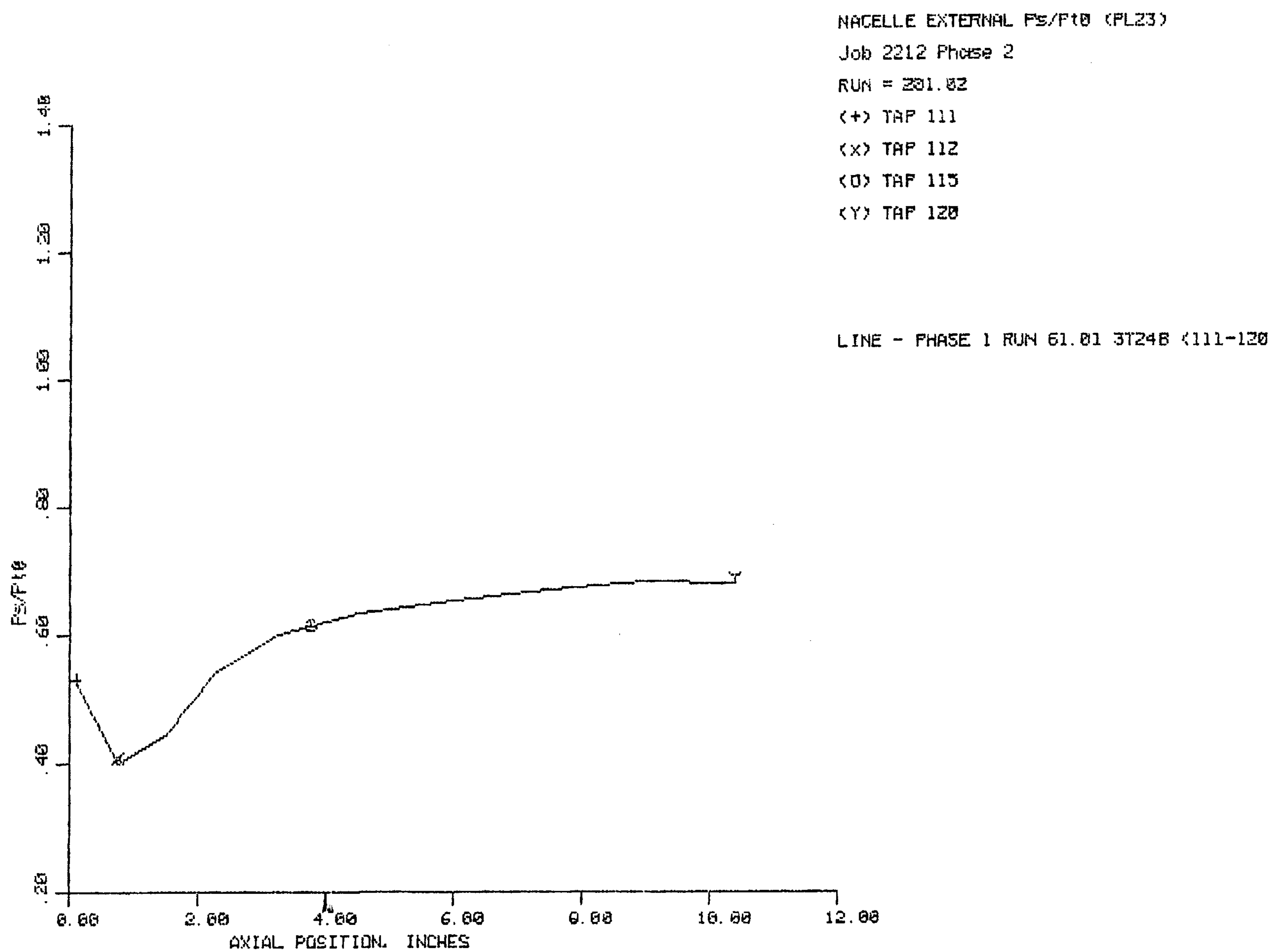
USR1:[CH06.SET]PRCONF11.SET;7
USR1:[CH06.SET]PZCONF12.SET;2
USR1:[CH06.SET]PFCONF12.SET;2
USR1:[CH06.SET]PBCONF11.SET;4
DATA REDUCED WITH A DELTA FILE



PT7 PROFILE (PR22)
Job 2212 Phase 2
RUN = 201.02
(+) PT7 @ 0 deg taps (50-61)
(X) PS7 @ 30 deg taps (98 & 102)
(O) PT7 @ 90 deg taps (62-73)
(Y) PS7 @120 deg taps (99 & 103)
(*) PT7 @180 deg taps (74-85)
(#) PS7 @210 deg taps (100 & 104)
(Z) PT7 @270 deg taps (86-97)
($) PS7 @300 deg taps (101 & 105)
P/PT7avg
1.02
1.00
.98
.96
.94
.92
.90
.00
.20
.40
.60
.80
1.00
1.20
(R-Ri)/(Ro-Ri)



PTB PROFILE (PL21)
Job 2212 Phase 2
RUN = 201.02
(+) PTB @ 0 deg tdPs (1-6)
(X) PSB @ 15 deg tdPs (25 & 29)
(O) PTB @ 90 deg tdPs (7-12)
(Y) PSB @ 105 deg tdPs (26 & 30)
(*) PTB @ 180 deg tdPs (13-18)
(#) PSB @ 195 deg tdPs (27 & 31)
(Z) PTB @ 270 deg tdPs (19-24)
($) PSB @ 285 deg tdPs (28 & 32)
P/PTBavg
(R-Ri)/(Ro-Ri)


NACELLE EXTERNAL Ps/Pt0 (PL23)
Job 2212 Phase 2
RUN = 201.02
(+) TAP 111
(x) TAP 112
(O) TAP 115
(Y) TAP 120
LINE - PHASE 1 RUN 61.01 3T24B (111-120)
Ps/Pt0
.20
.40
.60
.80
1.00
1.20
1.40
0.00
2.00
4.00
6.00
0.00
10.00
12.00
AXIAL POSITION, INCHES

FAN STATIC PRESSURE DISTRIBUTION (PL24)

Job 2212 Phase 2

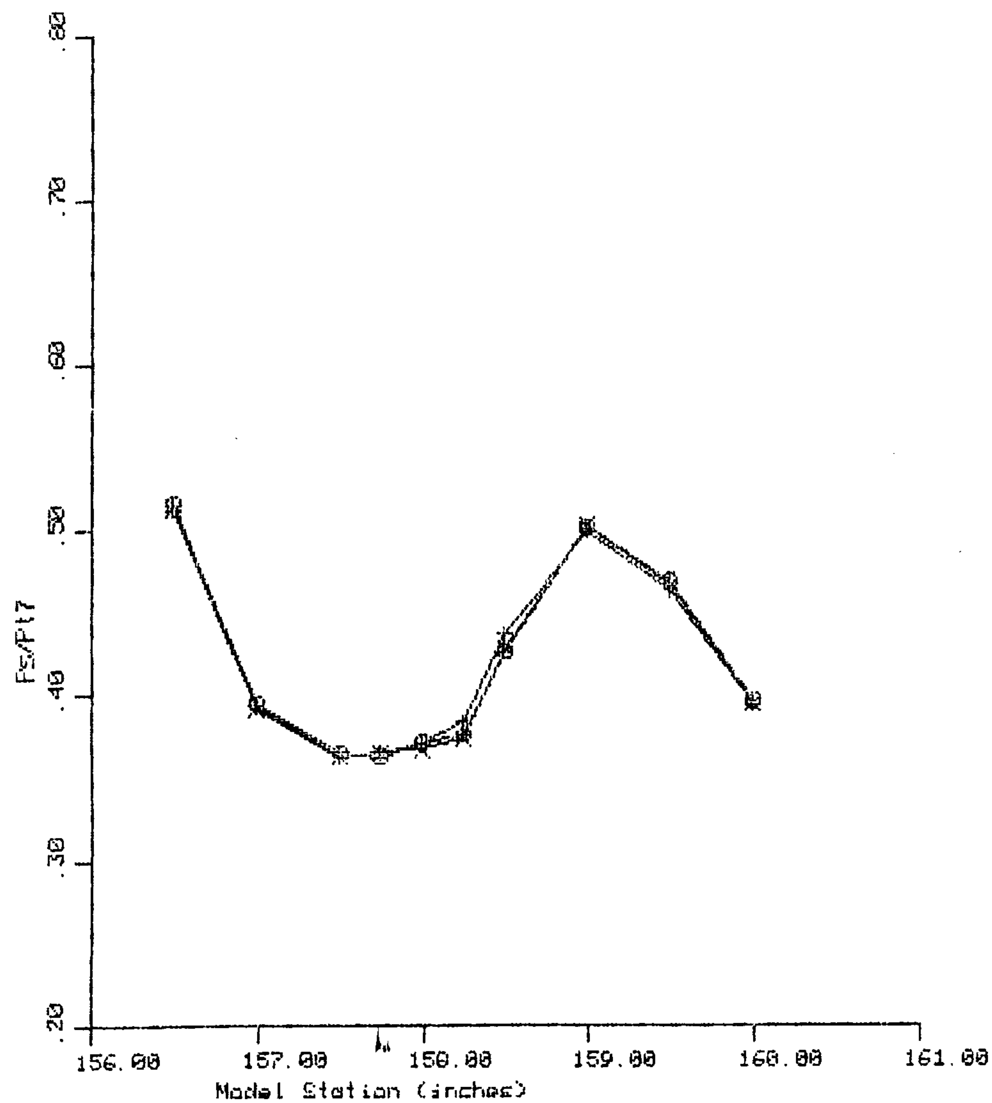
RUN = 201.02

(+) Ps/Pt7 @300deg (taps 151-160)

(X) Ps/Pt7 @330deg (taps 161-170)

(O) Ps/Pt7 @345deg (taps 171-180)

3T24B



Data Point =	201.03
Nozzle Description =	3T24B
Pt7/Pa =	2.601
Pt7/Pt8 =	1.064
Mach Number =	0.794

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 20-OCT-98 14:58:21
Job Number= 2212
PtO= 14.309
Mach number= 0.794
Tunnel Rn= 3.845E+06

Run Number= 201.03
File Id= 06293145821
Bar. (Psia)= 14.347
Ptunnel (Psia)= 9.443
Tunnel Q= 4.1665

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
TUNNEL FLOOR STATICS						
701	9.459				0.0039	0.7922
702	9.446				0.0007	0.7936
703	9.568				0.0300	0.7805
704	9.423				-0.0048	0.7961
705	9.402				-0.0098	0.7983
706	9.399				-0.0105	0.7986
707	9.462				0.0046	0.7919
708	9.332				-0.0266	0.8058
709	9.264				-0.0429	0.8131
710	9.157				-0.0686	0.8246
711	9.279				-0.0393	0.8115
712	9.387				-0.0134	0.7999
713	9.428				-0.0036	0.7955
714	9.465				0.0053	0.7916
715	9.420				-0.0055	0.7964
TUNNEL CEILING STATICS						
720	9.447				0.0010	0.7935
721	9.425				-0.0043	0.7958
722	9.415				-0.0067	0.7969
723	9.444				0.0003	0.7938
724	9.370				-0.0175	0.8017
725	9.338				-0.0252	0.8052
726	9.329				-0.0273	0.8061
727	9.255				-0.0451	0.8141
728	9.251				-0.0461	0.8145
729	9.388				-0.0132	0.7998
730	9.447				0.0010	0.7935
731	9.490				0.0113	0.7889
732	9.496				0.0127	0.7882
TUNNEL WEST WALL STATICS						
760	9.512				0.0166	0.7865
761	9.402				-0.0098	0.7983
762	9.427				-0.0038	0.7956
763	9.289				-0.0369	0.8104
764	9.359				-0.0201	0.8029
765	9.446				0.0007	0.7936
766	9.589				0.0351	0.7782
TUNNEL EAST WALL STATICS						
790	9.540				0.0233	0.7835

FLUIDYNE AEROTEST LABORATORY

Run Day/Time=	20-OCT-98 14:58:21	Run Number=	201.03
Job Number=	2212	File Id=	06293145821
Pt0=	14.309	Bar. (Psia)=	14.347
Mach number=	0.794	Ptunnel (Psia)=	9.443
Tunnel Rn=	3.845E+06	Tunnel Q=	4.1665

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
TUNNEL EAST WALL STATICS						
791	9.427				-0.0038	0.7956
792	9.335				-0.0259	0.8055
793	9.257				-0.0446	0.8139
794	9.411				-0.0077	0.7973
PT8 - RAKE @60 DEGREES						
1	23.108	1.0009				
2	23.118	1.0013				
3	23.108	1.0009				
4	23.073	0.9993				
5	23.028	0.9974				
6	22.977	0.9952				
AVERAGE=	23.069	Distortion .0061				
PS8 - STATICS						
25	21.789	0.9437				
29	21.640	0.9373				
AVERAGE=	21.715	Distortion .0069				
PT8 - RAKE @150 DEGREES						
7	23.108	1.0009				
8	23.065	0.9990				
9	23.064	0.9989				
10	23.088	1.0000				
11	23.122	1.0015				
12	23.074	0.9994				
AVERAGE=	23.087	Distortion .0025				
PS8 - STATICS						
26	21.665	0.9384				
30	21.628	0.9368				
AVERAGE=	21.647	Distortion .0017				
PT8 - RAKE @240 DEGREES						
Fixed 13	23.115	1.0012				
14	23.057	0.9986				
15	23.103	1.0006				
16	23.100	1.0005				
17	23.153	1.0028				
18	23.102	1.0006				
AVERAGE=	23.105	Distortion .0042				
PS8 - STATICS						
27	21.658	0.9381				
31	21.612	0.9361				
AVERAGE=	21.635	Distortion .0021				

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 20-OCT-98 14:58:21
Job Number= 2212
PtO= 14.309
Mach number= 0.794
Tunnel Rn= 3.845E+06

Run Number= 201.03
File Id= 06293145821
Bar. (Psia)= 14.347
Ptunnel (Psia)= 9.443
Tunnel Q= 4.1665

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PT8 -	RAKE @330 DEGREES					
19	23.129	1.0018				
20	23.109	1.0009				
Fixed 21	23.092	1.0001				
22	23.095	1.0003				
23	23.161	1.0032				
24	22.965	0.9947				
AVERAGE=	23.092	Distortion	.0085			
PS8 -	STATICS					
28	21.580	0.9347				
32	21.529	0.9325				
AVERAGE=	21.555	Distortion	.0024			
PT7 -	RAKE @0 DEGREES					
50	24.536		0.9989			
51	24.522		0.9983			
52	24.532		0.9987			
53	24.524		0.9984			
54	24.530		0.9986			
55	24.527		0.9985			
56	24.556		0.9997			
57	24.580		1.0007			
58	24.613		1.0020			
59	24.621		1.0023			
60	24.562		0.9999			
61	24.443		0.9951			
AVERAGE=	24.546	Distortion	.0073			
PS7 -	STATICS @30 DEGREES					
98	23.868		0.9717			
102	23.950		0.9750			
AVERAGE=	23.909	Distortion	.0034			
PT7 -	RAKE @90 DEGREES					
62	24.530		0.9986			
63	24.615		1.0021			
64	24.634		1.0029			
65	24.631		1.0028			
66	24.622		1.0024			
67	24.600		1.0015			
68	24.558		0.9998			
69	24.553		0.9996			
70	24.537		0.9989			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 20-OCT-98 14:58:21
Job Number= 2212
PtO= 14.309
Mach number= 0.794
Tunnel Rn= 3.845E+06

Run Number= 201.03
File Id= 06293145821
Bar. (Psia)= 14.347
Ptunnel (Psia)= 9.443
Tunnel Q= 4.1665

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PT7 - RAKE @90 DEGREES						
71	24.535		0.9988			
72	24.538		0.9990			
73	24.570		1.0003			
AVERAGE=	24.577	Distortion	.0042			
PS7 - STATICS @120 DEGREES						
99	23.901		0.9730			
103	23.944		0.9748			
AVERAGE=	23.923	Distortion	.0018			
PT7 - RAKE @180 DEGREES						
74	24.551		0.9995			
75	24.539		0.9990			
76	24.556		0.9997			
77	24.523		0.9984			
78	24.481		0.9966			
79	24.469		0.9962			
80	24.494		0.9968			
81	24.527		0.9985			
82	24.567		1.0001			
83	24.585		1.0009			
84	24.585		1.0009			
85	24.583		1.0008			
AVERAGE=	24.538	Distortion	.0047			
PS7 - STATICS @210 DEGREES						
100	23.899		0.9730			
104	23.945		0.9748			
AVERAGE=	23.922	Distortion	.0019			
PT7 - RAKE @270 DEGREES						
86	24.559		0.9998			
87	24.676		1.0046			
88	24.687		1.0050			
89	24.665		1.0041			
90	24.629		1.0027			
91	24.585		1.0009			
92	24.556		0.9997			
Fixed 93	24.554		0.9996			
94	24.548		0.9994			
95	24.542		0.9991			
96	24.547		0.9993			
97	24.533		0.9988			
AVERAGE=	24.590	Distortion	.0063			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 20-OCT-98 14:58:21
Job Number= 2212
PtO= 14.309
Mach number= 0.794
Tunnel Rn= 3.845E+06

Run Number= 201.03
File Id= 06293145821
Bar. (Psia)= 14.347
Ptunnel (Psia)= 9.443
Tunnel Q= 4.1665

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PS7 - STATICS @300 DEGREES						
Fixed 101	23.890		0.9726			
105	23.939		0.9746			
AVERAGE=	23.915	Distortion	.0021			
EXTERNAL FAN NACELLE						
111	7.602				-0.4418	0.9951
112	5.837				-0.8654	1.2082
115	8.781				-0.1589	0.8651
120	9.847				0.0970	0.7505
B.L. PT RAKE						
122	12.176			1.2894		
125	12.915			1.3677		
PHASE 2 FAN INNER SURFACE PS @ 300 DEG						
151	12.615		0.5136			
152	9.641		0.3925			
153	8.862		0.3608			
154	8.876		0.3614			
155	9.029		0.3676			
156	9.350		0.3807			
157	10.585		0.4309			
158	12.276		0.4998			
159	11.417		0.4648			
160	9.670		0.3937			
PHASE 2 FAN INNER SURFACE PS @ 330 DEG						
161	12.640		0.5146			
162	9.603		0.3910			
163	8.833		0.3596			
164	8.900		0.3623			
165	8.955		0.3646			
166	9.094		0.3702			
167	10.395		0.4232			
168	12.339		0.5023			
169	11.515		0.4688			
170	9.704		0.3951			
PHASE 2 FAN INNER SURFACE PS @ 345 DEG						
171	12.694		0.5168			
172	9.712		0.3954			
173	8.905		0.3625			
174	8.849		0.3603			
175	9.042		0.3681			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 20-OCT-98 14:58:21
Job Number= 2212
PtO= 14.309
Mach number= 0.794
Tunnel Rn= 3.845E+06

Run Number= 201.03
File Id= 06293145821
Bar. (Psia)= 14.347
Ptunnel (Psia)= 9.443
Tunnel Q= 4.1665

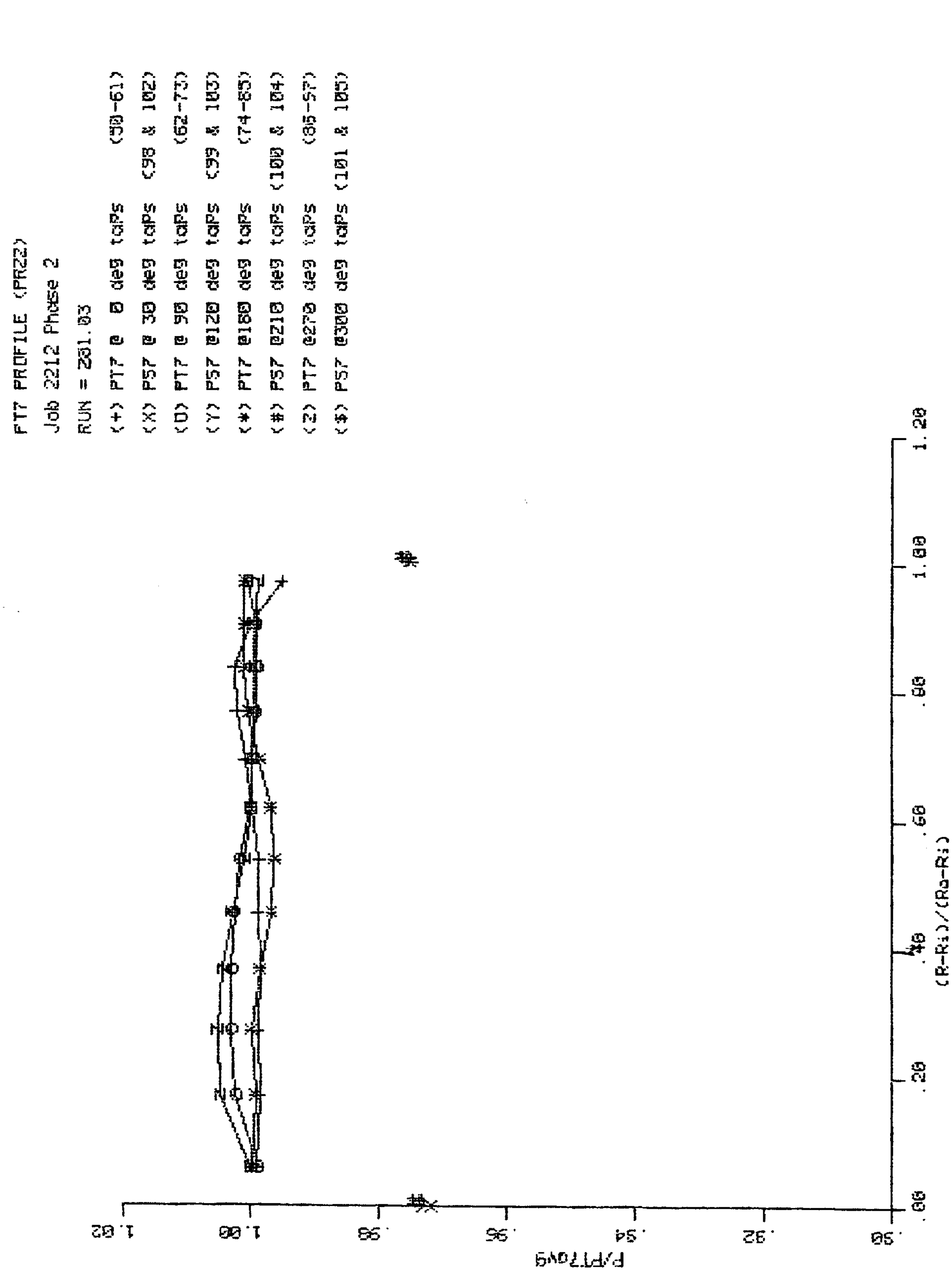
TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PHASE 2 FAN INNER SURFACE PS @ 345 DEG						
176	9.170		0.3733			
177	10.342		0.4210			
178	12.316		0.5014			
179	11.550		0.4702			
180	9.747		0.3968			

	PT	PS	MACH
STA8			
	23.069	21.703	0.2965
	23.087	21.644	0.3051
	23.106	21.632	0.3083
	23.093	21.552	0.3156
STA7			
	24.547	23.916	0.1933
	24.578	23.927	0.1962
	24.538	23.926	0.1904
	24.592	23.920	0.1993

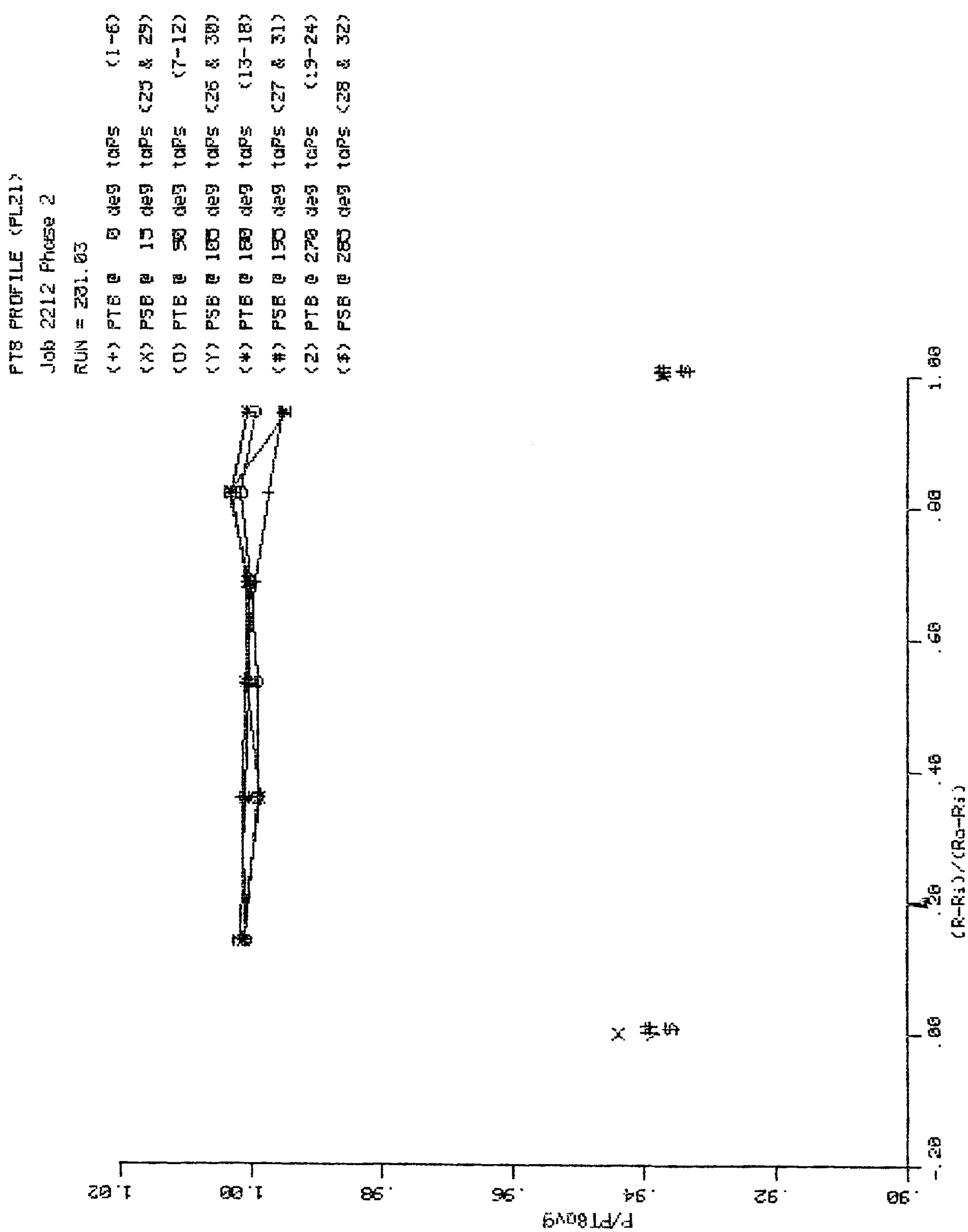
		AVERAGE		Pt Dist	Ps Dist
STA8	23.089	21.633	0.3064	0.0085	0.0120
STA7	24.564	23.922	0.1948	0.0099	0.0034

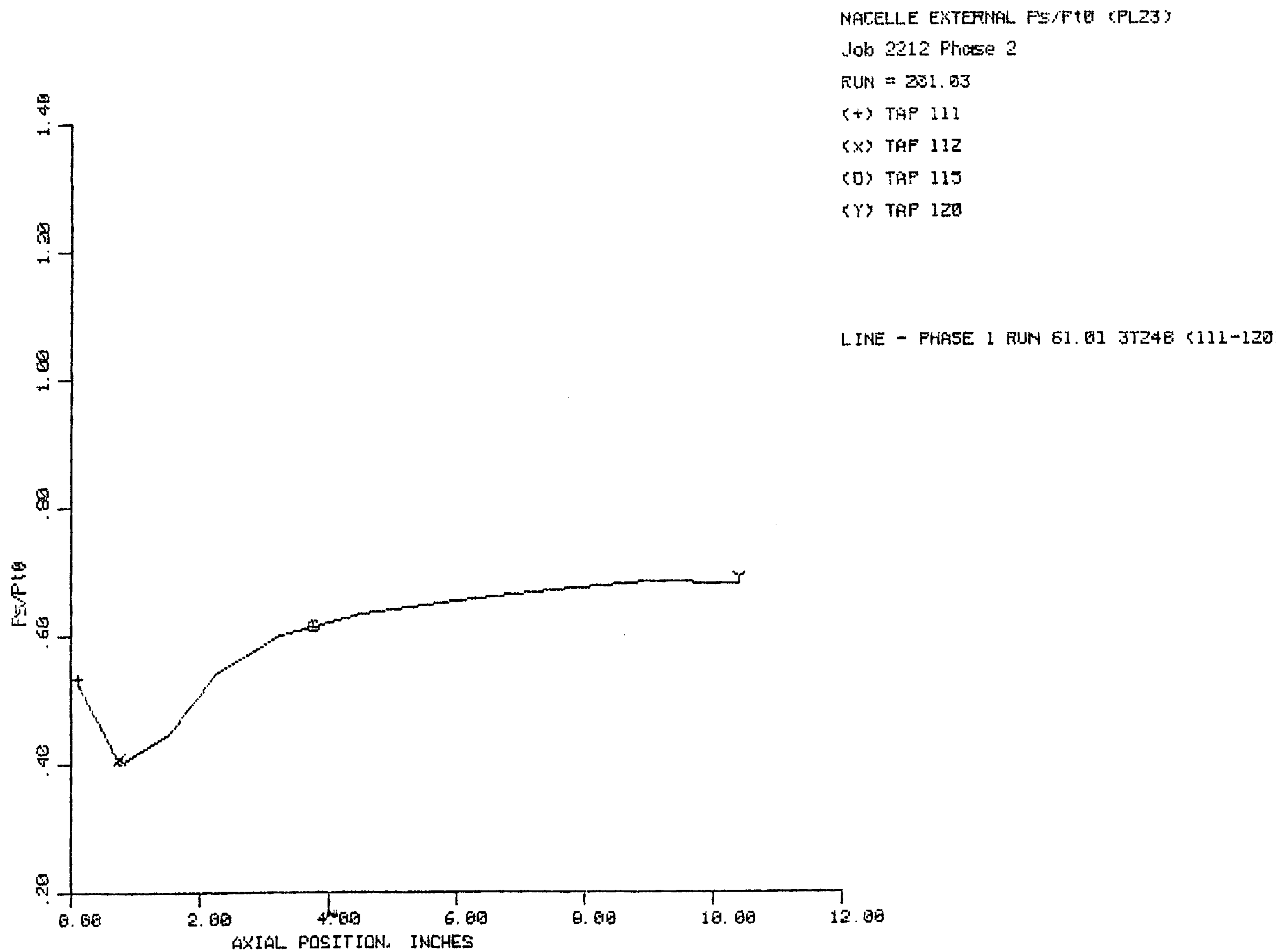
USR1:[CH06.SET]PRCONF11.SET;7
USR1:[CH06.SET]PZCONF12.SET;2
USR1:[CH06.SET]PFCONF12.SET;2

USR1:[CH06.SET]PBCONF11.SET;4
DATA REDUCED WITH A DELTA FILE



FT7 PROFILE (PRZ2)
Job 2212 Phase 2
RUN = 281.03
(+) PT7 @ 0 deg taps (50-61)
(X) P57 @ 30 deg taps (98 & 102)
(O) PT7 @ 90 deg taps (62-73)
(Y) P57 @120 deg taps (99 & 103)
(*) PT7 @180 deg taps (74-85)
(#) P57 @210 deg taps (100 & 104)
(Z) PT7 @270 deg taps (86-97)
($) P57 @300 deg taps (101 & 105)
P/PT7avg
1.02
1.00
.98
.96
.94
.92
.90
.00
.20
.40
.60
.80
1.00
1.20
(R-Ri)/(Ro-Ri)


PT8 PROFILE (PL21)
Job 2212 Phase 2
RUN = 201.03
(+) PT8 @ 0 deg taps (1-6)
(X) PS8 @ 15 deg taps (25 & 29)
(O) PT8 @ 90 deg taps (7-12)
(Y) PS8 @ 105 deg taps (26 & 30)
(*) PT8 @ 180 deg taps (13-18)
(#) PS8 @ 195 deg taps (27 & 31)
(Z) PT8 @ 270 deg taps (19-24)
($) PS8 @ 285 deg taps (28 & 32)
P/PT8avg
.90
.92
.94
.96
.98
1.00
1.02
-.20
.00
.20
.40
.60
.80
1.00
(R-Ri)/(Ro-Ri)


NACELLE EXTERNAL Ps/P10 (PL23)
Job 2212 Phase 2
RUN = 201.03
(+) TAP 111
(x) TAP 112
(D) TAP 115
(Y) TAP 120
LINE - PHASE 1 RUN 61.01 3T248 (111-120)
Ps/P10
1.40
1.20
1.00
.80
.60
.40
.20
0.00
2.00
4.00
6.00
8.00
10.00
12.00
AXIAL POSITION, INCHES

FAN STATIC PRESSURE DISTRIBUTION (FL24)

Job 2212 Phase 2

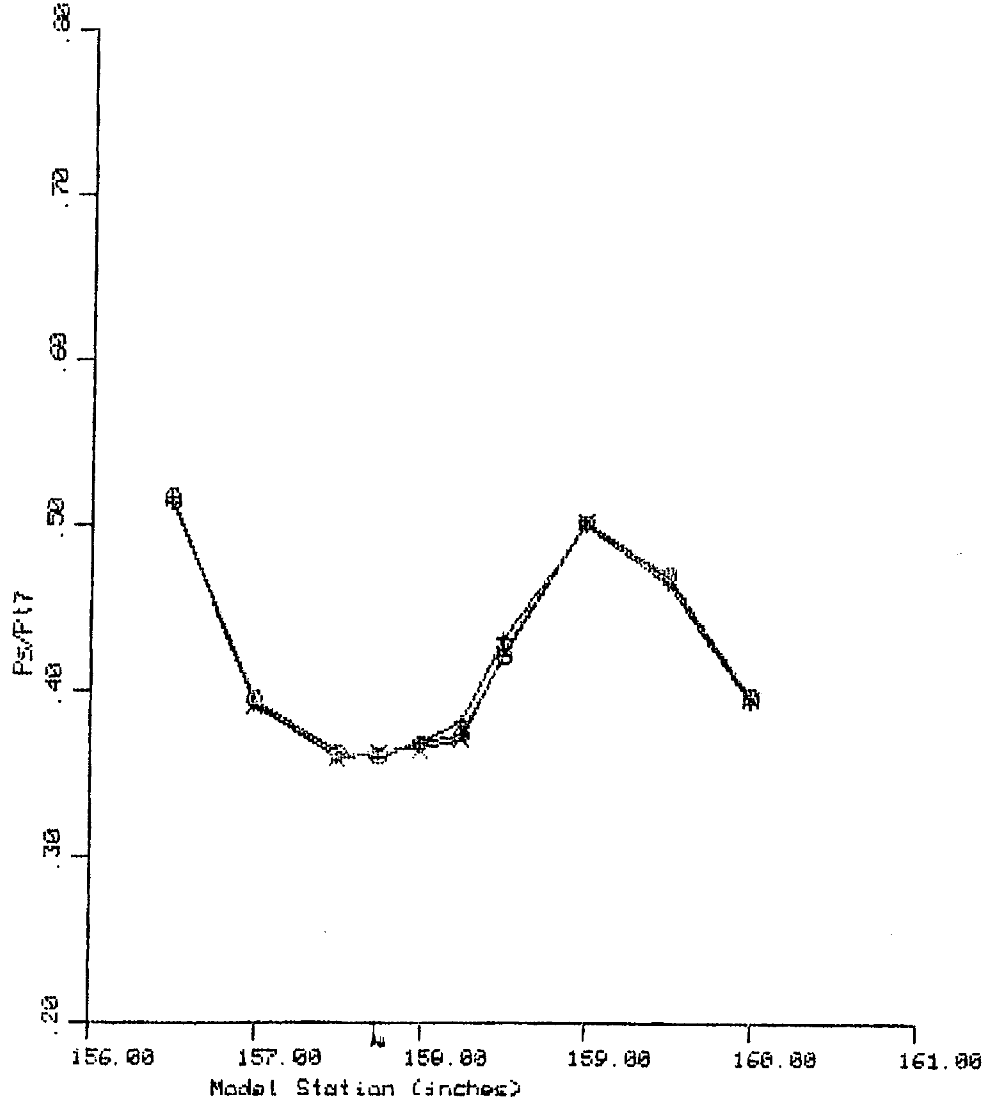
RUN = 201.03

(+) Ps/Pt17 @300deg (taps 151-160)

(X) Ps/Pt17 @330deg (taps 161-170)

(O) Ps/Pt17 @345deg (taps 171-180)

3T24B



$3T24C_0^0$

Data Point =	202.02
Nozzle Description =	$3T24C_0$
Pt7/Pa =	2.607
Pt7/Pt8 =	1.087
Mach Number =	0.800

FLUIDYNE AEROTEST LABORATORY 3T24 C'o

Run Day/Time= 21-OCT-98 10:59:25
Job Number= 2212
PtO= 14.371
Mach number= 0.800
Tunnel Rn= 3.726E+06

Run Number= 202.02
File Id= 06294105925
Bar. (Psia)= 14.410
Ptunnel (Psia)= 9.427
Tunnel Q= 4.2242

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
TUNNEL FLOOR STATICS						
701	9.433				0.0016	0.7994
702	9.416				-0.0024	0.8012
703	9.540				0.0269	0.7879
704	9.397				-0.0069	0.8032
705	9.371				-0.0131	0.8060
706	9.368				-0.0138	0.8063
707	9.429				0.0007	0.7998
708	9.295				-0.0311	0.8141
709	9.240				-0.0441	0.8200
710	9.135				-0.0689	0.8312
711	9.259				-0.0396	0.8180
712	9.379				-0.0112	0.8051
713	9.403				-0.0055	0.8026
714	9.442				0.0037	0.7984
715	9.404				-0.0052	0.8025
TUNNEL CEILING STATICS						
720	9.428				0.0004	0.7999
721	9.400				-0.0062	0.8029
722	9.395				-0.0074	0.8034
723	9.408				-0.0043	0.8020
724	9.341				-0.0202	0.8092
725	9.309				-0.0277	0.8126
726	9.299				-0.0301	0.8137
727	9.226				-0.0474	0.8215
728	9.224				-0.0479	0.8217
729	9.365				-0.0145	0.8066
730	9.424				-0.0005	0.8003
731	9.468				0.0099	0.7956
732	9.474				0.0113	0.7950
TUNNEL WEST WALL STATICS						
760	9.495				0.0163	0.7928
761	9.380				-0.0109	0.8050
762	9.404				-0.0052	0.8025
763	9.264				-0.0384	0.8174
764	9.335				-0.0216	0.8098
765	9.428				0.0004	0.7999
766	9.574				0.0350	0.7843
TUNNEL EAST WALL STATICS						
790	9.517				0.0215	0.7904

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 21-OCT-98 10:59:25
Job Number= 2212
PtO= 14.371
Mach number= 0.800
Tunnel Rn= 3.726E+06

Run Number= 202.02
File Id= 06294105925
Bar. (Psia)= 14.410
Ptunnel (Psia)= 9.427
Tunnel Q= 4.2242

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
TUNNEL EAST WALL STATICS						
791	9.403				-0.0055	0.8026
792	9.308				-0.0280	0.8127
793	9.238				-0.0445	0.8202
794	9.393				-0.0079	0.8036
PT8 - RAKE @60 DEGREES						
1	22.624	1.0009				
2	22.637	1.0014				
3	22.617	1.0006				
4	22.582	0.9990				
5	22.547	0.9975				
6	22.492	0.9950				
AVERAGE=	22.584	Distortion .0064				
PS8 - STATICS						
25	21.330	0.9436				
29	21.196	0.9377				
AVERAGE=	21.263	Distortion .0063				
PT8 - RAKE @150 DEGREES						
7	22.618	1.0006				
8	22.577	0.9988				
9	22.581	0.9990				
10	22.608	1.0002				
11	22.640	1.0016				
12	22.592	0.9994				
AVERAGE=	22.603	Distortion .0028				
PS8 - STATICS						
26	21.215	0.9385				
30	21.179	0.9369				
AVERAGE=	21.197	Distortion .0017				
PT8 - RAKE @240 DEGREES						
Fixed 13	22.630	1.0011				
14	22.576	0.9987				
15	22.624	1.0009				
16	22.617	1.0006				
17	22.667	1.0028				
18	22.612	1.0003				
AVERAGE=	22.621	Distortion .0040				
PS8 - STATICS						
27	21.202	0.9380				
31	21.160	0.9361				
AVERAGE=	21.181	Distortion .0020				

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 21-OCT-98 10:59:25
Job Number= 2212
PtO= 14.371
Mach number= 0.800
Tunnel Rn= 3.726E+06

Run Number= 202.02
File Id= 06294105925
Bar. (Psia)= 14.410
Ptunnel (Psia)= 9.427
Tunnel Q= 4.2242

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PT8 - RAKE @330 DEGREES						
19	22.647	1.0019				
20	22.620	1.0007				
Fixed 21	22.608	1.0001				
22	22.613	1.0004				
23	22.679	1.0033				
24	22.497	0.9952				
AVERAGE=	22.611	Distortion .0080				
PS8 - STATICS						
28	21.160	0.9361				
32	21.080	0.9326				
AVERAGE=	21.120	Distortion .0038				
PT7 - RAKE @0 DEGREES						
50	24.540		0.9987			
51	24.527		0.9982			
Fixed 52	24.532		0.9984			
53	24.537		0.9986			
54	24.532		0.9984			
55	24.537		0.9986			
56	24.563		0.9996			
57	24.592		1.0008			
58	24.629		1.0023			
59	24.636		1.0026			
60	24.582		1.0004			
61	24.455		0.9952			
AVERAGE=	24.556	Distortion .0074				
PS7 - STATICS @30 DEGREES						
98	23.870		0.9714			
102	23.942		0.9743			
AVERAGE=	23.906	Distortion .0030				
PT7 - RAKE @90 DEGREES						
62	24.538		0.9986			
63	24.627		1.0022			
64	24.644		1.0029			
65	24.639		1.0027			
66	24.636		1.0026			
67	24.613		1.0017			
68	24.573		1.0000			
69	24.570		0.9999			
70	24.548		0.9990			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 21-OCT-98 10:59:25
Job Number= 2212
PtO= 14.371
Mach number= 0.800
Tunnel Rn= 3.726E+06

Run Number= 202.02
File Id= 06294105925
Bar. (Psia)= 14.410
Ptunnel (Psia)= 9.427
Tunnel Q= 4.2242

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PT7 - RAKE @90 DEGREES						
71	24.543		0.9988			
72	24.547		0.9990			
73	24.577		1.0002			
AVERAGE=	24.588	Distortion	.0043			
PS7 - STATICS @120 DEGREES						
99	23.909		0.9730			
103	23.938		0.9742			
AVERAGE=	23.924	Distortion	.0012			
PT7 - RAKE @180 DEGREES						
74	24.558		0.9994			
75	24.547		0.9990			
76	24.558		0.9994			
77	24.525		0.9981			
78	24.484		0.9964			
79	24.476		0.9961			
80	24.490		0.9966			
81	24.543		0.9988			
82	24.574		1.0001			
83	24.595		1.0009			
84	24.590		1.0007			
85	24.587		1.0006			
AVERAGE=	24.544	Distortion	.0048			
PS7 - STATICS @210 DEGREES						
100	23.910		0.9730			
104	23.939		0.9742			
AVERAGE=	23.925	Distortion	.0012			
PT7 - RAKE @270 DEGREES						
86	24.600		1.0011			
87	24.687		1.0047			
88	24.692		1.0049			
89	24.667		1.0038			
90	24.636		1.0026			
91	24.582		1.0004			
92	24.557		0.9994			
Fixed 93	24.569		0.9998			
94	24.555		0.9993			
95	24.544		0.9988			
96	24.555		0.9993			
97	24.545		0.9989			
AVERAGE=	24.599	Distortion	.0060			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 21-OCT-98 10:59:25
Job Number= 2212
PtO= 14.371
Mach number= 0.800
Tunnel Rn= 3.726E+06

Run Number= 202.02
File Id= 06294105925
Bar. (Psia)= 14.410
Ptunnel (Psia)= 9.427
Tunnel Q= 4.2242

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PS7 - STATICS @300 DEGREES						
Fixed 101	23.897		0.9725			
105	23.935		0.9741			
AVERAGE=	23.916	Distortion	.0016			
EXTERNAL FAN NACELLE						
111						
112						
115						
120						
B.L. PT RAKE						
122	12.311			1.3060		
125	13.191			1.3994		
PHASE 2 FAN INNER SURFACE PS @ 300 DEG						
151	10.977		0.4467			
152	9.440		0.3842			
153	8.697		0.3539			
154	10.067		0.4097			
155	9.742		0.3965			
156	10.529		0.4285			
157	11.590		0.4717			
158	11.222		0.4567			
159	10.280		0.4184			
160	9.182		0.3737			
PHASE 2 FAN INNER SURFACE PS @ 330 DEG						
161	10.946		0.4455			
162	9.446		0.3844			
163	8.591		0.3496			
164	10.185		0.4145			
165	9.719		0.3955			
166	10.396		0.4231			
167	11.343		0.4616			
168	11.296		0.4597			
169	10.352		0.4213			
170	9.180		0.3736			
PHASE 2 FAN INNER SURFACE PS @ 345 DEG						
171	11.008		0.4480			
172	9.503		0.3867			
173	8.938		0.3638			
174	10.140		0.4127			
175	9.685		0.3942			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 21-OCT-98 10:59:25
Job Number= 2212
PtO= 14.371
Mach number= 0.800
Tunnel Rn= 3.726E+06

Run Number= 202.02
File Id= 06294105925
Bar. (Psia)= 14.410
Ptunnel (Psia)= 9.427
Tunnel Q= 4.2242

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PHASE 2 FAN INNER SURFACE PS @ 345 DEG						
176	10.436		0.4247			
177	11.263		0.4584			
178	11.179		0.4550			
179	10.495		0.4271			
180	9.246		0.3763			

	PT	PS	MACH
STA8			
	22.584	21.253	0.2958
	22.603	21.195	0.3046
	22.622	21.179	0.3083
	22.611	21.115	0.3143
STA7			
	24.556	23.912	0.1953
	24.589	23.927	0.1979
	24.545	23.928	0.1911
	24.601	23.921	0.2005

		AVERAGE		Pt Dist	Ps Dist
STA8	22.605	21.185	0.3057	0.0083	0.0118
STA7	24.573	23.922	0.1962	0.0096	0.0030

USR1:[CH06.SET]PRCONF11.SET;7
USR1:[CH06.SET]PZCONF12.SET;2
USR1:[CH06.SET]PFCONF15.SET;2
USR1:[CH06.SET]PBCONF12.SET;1
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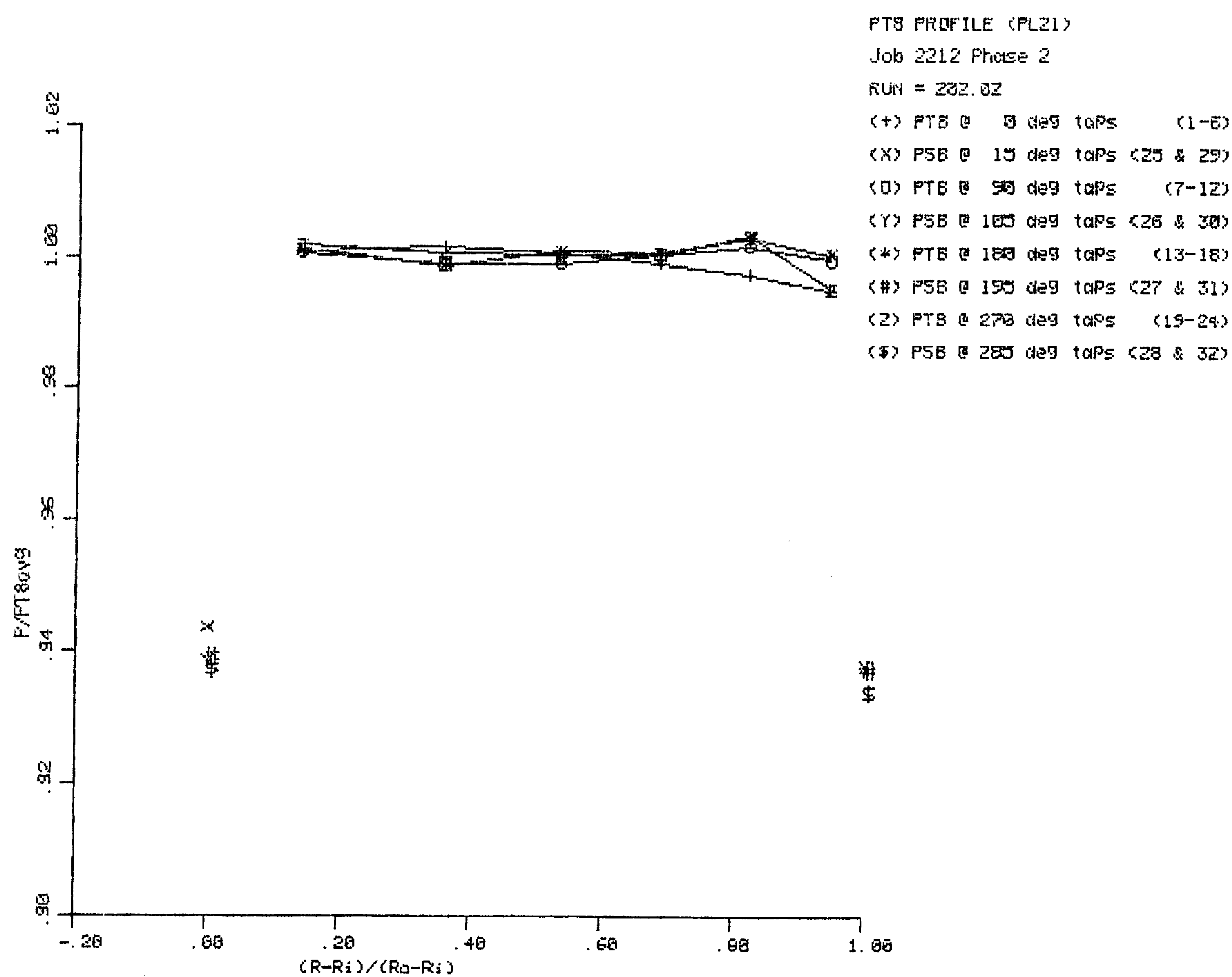
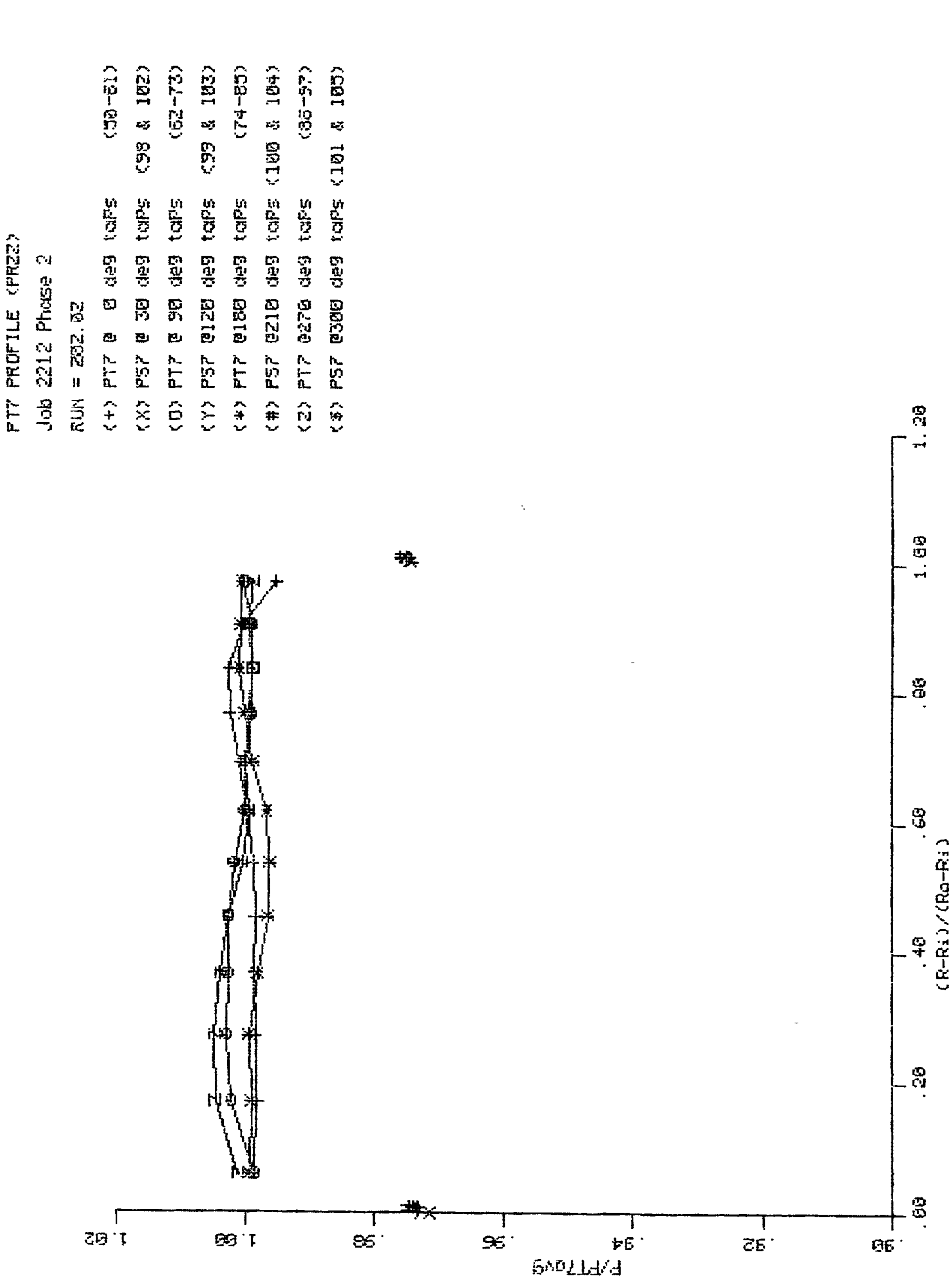


PT8 PROFILE (PL21)
Job 2212 Phase 2
RUN = 202.02
(+) PT8 @ 0 deg taps (1-6)
(X) PSB @ 15 deg taps (25 & 29)
(O) PT8 @ 90 deg taps (7-12)
(Y) PSB @ 105 deg taps (26 & 30)
(*) PT8 @ 180 deg taps (13-18)
(#) PSB @ 195 deg taps (27 & 31)
(Z) PT8 @ 270 deg taps (19-24)
($) PSB @ 285 deg taps (28 & 32)
1.02
1.00
.98
.96
.94
.92
.90
P/PT8avg
-.20
.00
.20
.40
.60
.80
1.00
(R-Ri)/(Ro-Ri)



PT7 PROFILE (PR22)
Job 2212 Phase 2
RUN = 202.02
(+) PT7 @ 0 deg taps (50-61)
(X) PS7 @ 30 deg taps (98 & 102)
(O) PT7 @ 90 deg taps (62-73)
(Y) PS7 @120 deg taps (99 & 103)
(*) PT7 @180 deg taps (74-85)
(#) PS7 @210 deg taps (100 & 104)
(Z) PT7 @270 deg taps (86-97)
($) PS7 @300 deg taps (101 & 105)
P/PT7avg
1.02
1.00
.98
.96
.94
.92
.90
.00
.20
.40
.60
.80
1.00
1.20
(R-Ri)/(Ro-Ri)

FAN STATIC PRESSURE DISTRIBUTION (PL24)

Job 2212 Phase 2

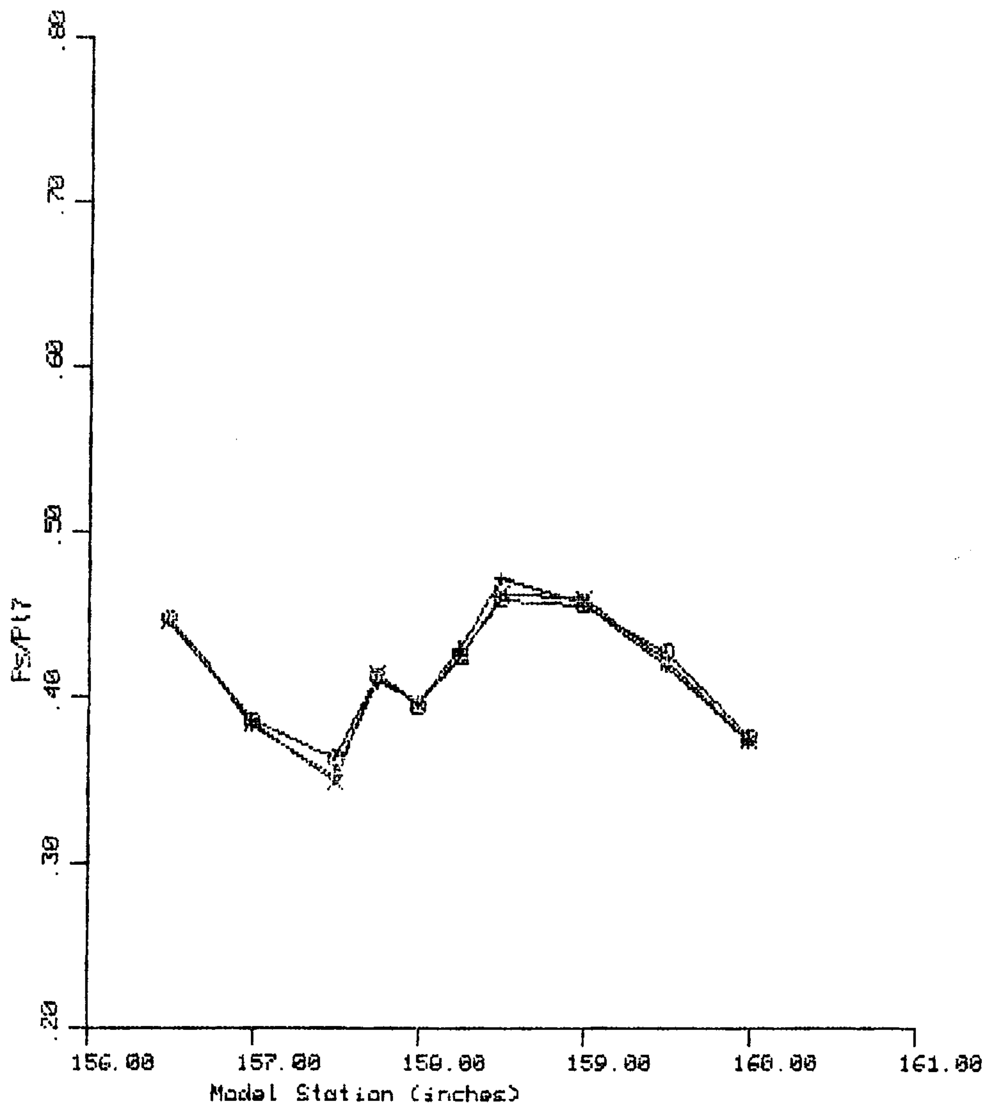
RUN = 202.02

(+) Ps/Pt7 @300deg (taPs 151-160)

(X) Ps/Pt7 @330deg (taPs 161-170)

(O) Ps/Pt7 @345deg (taPs 171-180)

3T24C₀



$3T24C_{22.5}{}^{0}$

Data Point =	203.01
Nozzle Description =	$3T24C_{22.5}$
Pt7/Pa =	2.581
Pt7/Pt8 =	1.082
Mach Number =	0.787

FLUIDYNE AEROTEST LABORATORY

3T24 C 22.5

Run Day/Time=	21-OCT-98 14:07:33	Run Number=	203.01
Job Number=	2212	File Id=	06294140733
PtO=	14.379	Bar. (Psia)=	14.417
Mach number=	0.787	Ptunnel (Psia)=	9.558
Tunnel Rn=	3.995E+06	Tunnel Q=	4.1401

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
TUNNEL FLOOR STATICS						
701	9.573				0.0035	0.7851
702	9.560				0.0004	0.7865
703	9.678				0.0289	0.7739
704	9.535				-0.0056	0.7891
705	9.515				-0.0105	0.7913
706	9.510				-0.0117	0.7918
707	9.569				0.0026	0.7855
708	9.458				-0.0242	0.7973
709	9.391				-0.0404	0.8045
710	9.298				-0.0629	0.8144
711	9.410				-0.0358	0.8025
712	9.512				-0.0112	0.7916
713	9.540				-0.0044	0.7886
714	9.590				0.0076	0.7833
715	9.547				-0.0027	0.7878
TUNNEL CEILING STATICS						
720	9.567				0.0021	0.7857
721	9.545				-0.0032	0.7881
722	9.541				-0.0042	0.7885
723	9.560				0.0004	0.7865
724	9.490				-0.0165	0.7939
725	9.454				-0.0252	0.7978
726	9.448				-0.0267	0.7984
727	9.386				-0.0416	0.8050
728	9.378				-0.0436	0.8059
729	9.510				-0.0117	0.7918
730	9.569				0.0026	0.7855
731	9.612				0.0130	0.7809
732	9.614				0.0134	0.7807
TUNNEL WEST WALL STATICS						
760	9.631				0.0175	0.7789
761	9.530				-0.0069	0.7897
762	9.543				-0.0037	0.7883
763	9.404				-0.0373	0.8031
764	9.468				-0.0218	0.7963
765	9.558				-0.0001	0.7867
766	9.711				0.0369	0.7703
TUNNEL EAST WALL STATICS						
790	9.649				0.0219	0.7770

FLUIDYNE AEROTEST LABORATORY

Run Day/Time=	21-OCT-98 14:07:33	Run Number=	203.01
Job Number=	2212	File Id=	06294140733
Pt0=	14.379	Bar. (Psia)=	14.417
Mach number=	0.787	Ptunnel (Psia)=	9.558
Tunnel Rn=	3.995E+06	Tunnel Q=	4.1401

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
TUNNEL EAST WALL STATICS						
791	9.536				-0.0054	0.7890
792	9.453				-0.0255	0.7979
793	9.389				-0.0409	0.8047
794	9.534				-0.0059	0.7892
PT8 - RAKE @60 DEGREES						
1	22.833	1.0010				
2	22.847	1.0016				
3	22.823	1.0006				
4	22.792	0.9992				
5	22.752	0.9975				
6	22.698	0.9951				
AVERAGE=	22.791	Distortion .0065				
PS8 - STATICS						
25	21.534	0.9441				
29	21.387	0.9376				
AVERAGE=	21.460	Distortion .0068				
PT8 - RAKE @150 DEGREES						
7	22.825	1.0007				
8	22.780	0.9987				
9	22.785	0.9989				
10	22.808	0.9999				
11	22.843	1.0015				
12	22.794	0.9993				
AVERAGE=	22.806	Distortion .0028				
PS8 - STATICS						
26	21.409	0.9386				
30	21.372	0.9370				
AVERAGE=	21.390	Distortion .0017				
PT8 - RAKE @240 DEGREES						
Fixed 13	22.836	1.0012				
14	22.778	0.9986				
15	22.826	1.0007				
16	22.823	1.0006				
17	22.872	1.0027				
18	22.820	1.0005				
AVERAGE=	22.826	Distortion .0041				
PS8 - STATICS						
27	21.401	0.9382				
31	21.353	0.9361				
AVERAGE=	21.377	Distortion .0022				

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 21-OCT-98 14:07:33
Job Number= 2212
PtO= 14.379
Mach number= 0.787
Tunnel Rn= 3.995E+06

Run Number= 203.01
File Id= 06294140733
Bar. (Psia)= 14.417
Ptunnel (Psia)= 9.558
Tunnel Q= 4.1401

	TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
	PT8 -	RAKE @330	DEGREES				
	19	22.851	1.0018				
	20	22.826	1.0007				
Fixed	21	22.811	1.0001				
	22	22.816	1.0003				
	23	22.881	1.0031				
	24	22.705	0.9954				
AVERAGE=		22.815	Distortion	.0077			
	PS8 -	STATICS					
	28	21.353	0.9361				
	32	21.267	0.9324				
AVERAGE=		21.310	Distortion	.0040			
	PT7 -	RAKE @0 DEGREES					
	50	24.636		0.9987			
	51	24.632		0.9985			
Fixed	52	24.634		0.9986			
	53	24.637		0.9987			
	54	24.635		0.9986			
	55	24.635		0.9986			
	56	24.665		0.9999			
	57	24.687		1.0007			
	58	24.723		1.0022			
	59	24.730		1.0025			
	60	24.671		1.0001			
	61	24.547		0.9951			
AVERAGE=		24.652	Distortion	.0074			
	PS7 -	STATICS @30 DEGREES					
	98	23.962		0.9714			
	102	24.039		0.9745			
AVERAGE=		24.000	Distortion	.0032			
	PT7 -	RAKE @90 DEGREES					
	62	24.623		0.9982			
	63	24.719		1.0020			
	64	24.738		1.0028			
	65	24.735		1.0027			
	66	24.732		1.0026			
	67	24.708		1.0016			
	68	24.666		0.9999			
	69	24.664		0.9998			
	70	24.641		0.9989			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 21-OCT-98 14:07:33
Job Number= 2212
PtO= 14.379
Mach number= 0.787
Tunnel Rn= 3.995E+06

Run Number= 203.01
File Id= 06294140733
Bar. (Psia)= 14.417
Ptunnel (Psia)= 9.558
Tunnel Q= 4.1401

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PT7 - RAKE @90 DEGREES						
71	24.638		0.9988			
72	24.638		0.9988			
73	24.669		1.0000			
AVERAGE=	24.681	Distortion	.0047			
PS7 - STATICS @120 DEGREES						
99	24.017		0.9736			
103	24.031		0.9742			
AVERAGE=	24.024	Distortion	.0006			
PT7 - RAKE @180 DEGREES						
74	24.650		0.9992			
75	24.648		0.9992			
76	24.662		0.9997			
77	24.626		0.9983			
78	24.586		0.9967			
79	24.571		0.9960			
80	24.586		0.9967			
81	24.631		0.9985			
82	24.671		1.0001			
83	24.691		1.0009			
84	24.688		1.0008			
85	24.687		1.0007			
AVERAGE=	24.641	Distortion	.0049			
PS7 - STATICS @210 DEGREES						
100	24.011		0.9733			
104	24.033		0.9742			
AVERAGE=	24.022	Distortion	.0009			
PT7 - RAKE @270 DEGREES						
86	24.673		1.0004			
87	24.781		1.0046			
88	24.795		1.0051			
89	24.768		1.0040			
90	24.734		1.0027			
91	24.688		1.0008			
92	24.658		0.9996			
Fixed 93	24.660		0.9997			
94	24.651		0.9993			
95	24.644		0.9990			
96	24.649		0.9992			
97	24.643		0.9990			
AVERAGE=	24.696	Distortion	.0062			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time=	21-OCT-98 14:07:33	Run Number=	203.01
Job Number=	2212	File Id=	06294140733
Pt0=	14.379	Bar. (Psia)=	14.417
Mach number=	0.787	Ptunnel (Psia)=	9.558
Tunnel Rn=	3.995E+06	Tunnel Q=	4.1401

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PS7 - STATICS @300 DEGREES						
Fixed 101	23.996		0.9728			
105	24.034		0.9743			
AVERAGE=	24.015	Distortion	.0016			
EXTERNAL FAN NACELLE						
111						
112						
115						
120						
B.L. PT RAKE						
122	12.269			1.2836		
125	13.007			1.3608		
PHASE 2 FAN INNER SURFACE PS @ 300 DEG						
151	11.034		0.4473			
152	9.510		0.3855			
153	8.737		0.3542			
154	9.837		0.3988			
155	10.276		0.4166			
156	10.628		0.4308			
157	11.914		0.4830			
158	11.105		0.4502			
159	10.202		0.4136			
160	9.383		0.3804			
PHASE 2 FAN INNER SURFACE PS @ 330 DEG						
161	10.992		0.4456			
162	9.503		0.3852			
163	8.747		0.3546			
164	9.917		0.4020			
165	10.201		0.4135			
166	10.416		0.4222			
167	11.673		0.4732			
168	11.189		0.4536			
169	10.244		0.4153			
170	9.264		0.3755			
PHASE 2 FAN INNER SURFACE PS @ 345 DEG						
171	11.069		0.4487			
172	9.585		0.3885			
173	8.826		0.3578			
174	9.826		0.3983			
175	10.269		0.4163			

FLUIDYNE AEROTEST LABORATORY

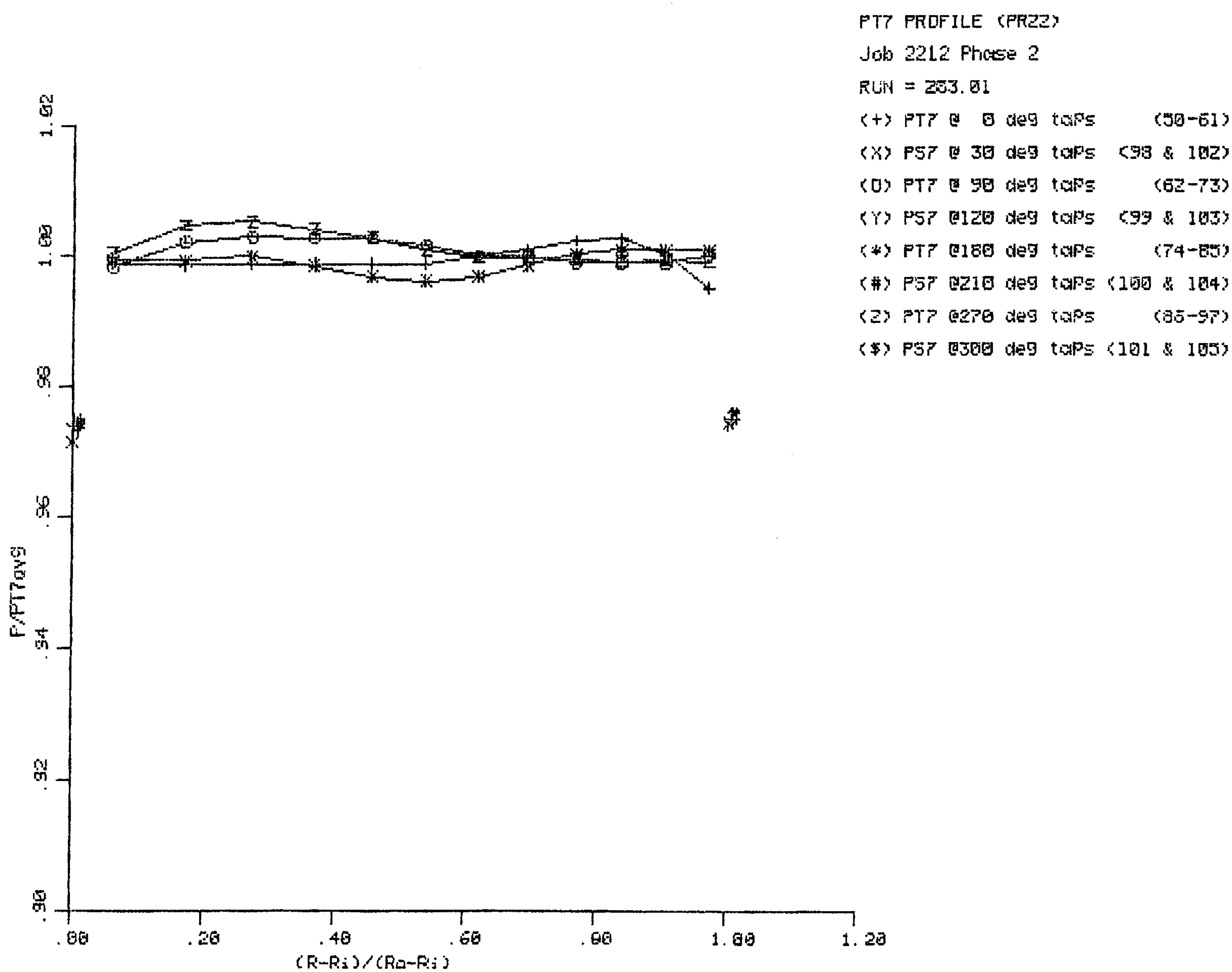
Run Day/Time=	21-OCT-98 14:07:33	Run Number=	203.01
Job Number=	2212	File Id=	06294140733
Pt0=	14.379	Bar. (Psia)=	14.417
Mach number=	0.787	Ptunnel (Psia)=	9.558
Tunnel Rn=	3.995E+06	Tunnel Q=	4.1401

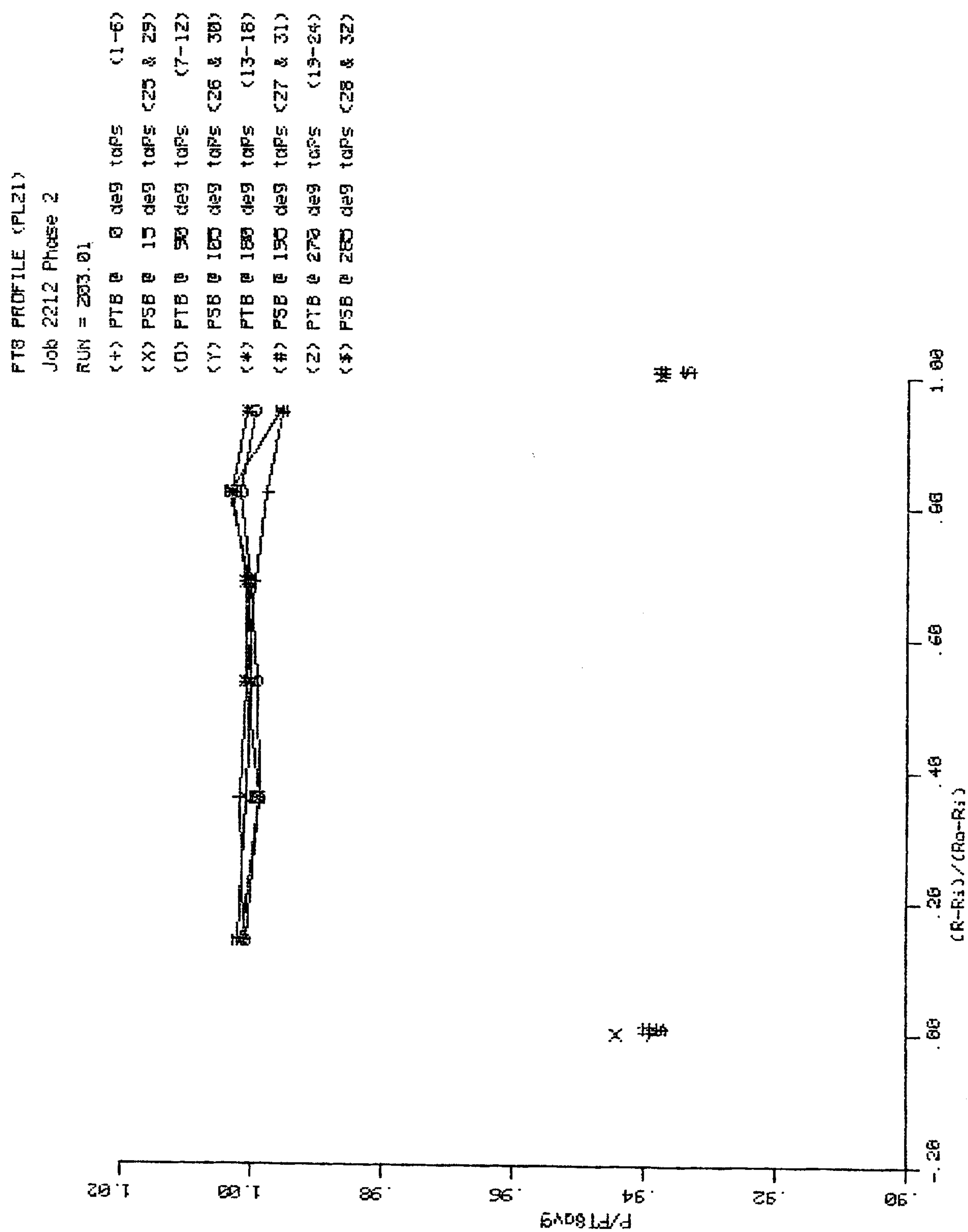
TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PHASE 2 FAN INNER SURFACE PS @ 345 DEG						
176	10.516		0.4263			
177	11.553		0.4683			
178	11.075		0.4489			
179	10.339		0.4191			
180	9.378		0.3802			

	PT	PS	MACH
STA8			
	22.791	21.449	0.2957
	22.806	21.388	0.3042
	22.826	21.373	0.3079
	22.815	21.304	0.3144
STA7			
	24.653	24.006	0.1953
	24.681	24.026	0.1965
	24.642	24.024	0.1908
	24.697	24.020	0.1997

		AVERAGE		Pt Dist	Ps Dist
STA8	22.809	21.378	0.3056	0.0080	0.0125
STA7	24.668	24.019	0.1955	0.0101	0.0032

USR1:[CH06.SET]PRCONF11.SET;7
USR1:[CH06.SET]PZCONF12.SET;2
USR1:[CH06.SET]PFCONF15.SET;2
USR1:[CH06.SET]PBCONF12.SET;1
DATA REDUCED WITH A DELTA FILE


PT7 PROFILE (PR22)
Job 2212 Phase 2
RUN = 253.01
(+) PT7 @ 0 deg taps (50-61)
(X) PS7 @ 30 deg taps (98 & 102)
(O) PT7 @ 90 deg taps (62-73)
(Y) PS7 @120 deg taps (99 & 103)
(*) PT7 @180 deg taps (74-85)
(#) PS7 @210 deg taps (100 & 104)
(Z) PT7 @270 deg taps (86-97)
($) PS7 @300 deg taps (101 & 105)
P/PT7avg
(R-Ri)/(Ro-Ri)
1.02
1.00
.98
.96
.94
.92
.90
.00
.20
.40
.60
.80
1.00
1.20


PTB PROFILE (PL21)
Job 2212 Phase 2
RUN = 203.01
(+) PTB @ 0 deg taPs (1-6)
(X) PSB @ 15 deg taPs (25 & 29)
(O) PTB @ 90 deg taPs (7-12)
(Y) PSB @ 105 deg taPs (26 & 30)
(*) PTB @ 180 deg taPs (13-18)
(#) PSB @ 195 deg taPs (27 & 31)
(Z) PTB @ 270 deg taPs (19-24)
($) PSB @ 285 deg taPs (28 & 32)
P/PTBavg
1.02
1.00
.98
.96
.94
.92
.90
-.20
.00
.20
.40
.60
.80
1.00
(R-Ri)/(Ro-Ri)

FAN STATIC PRESSURE DISTRIBUTION (PL24)

Job 2212 Phase 2

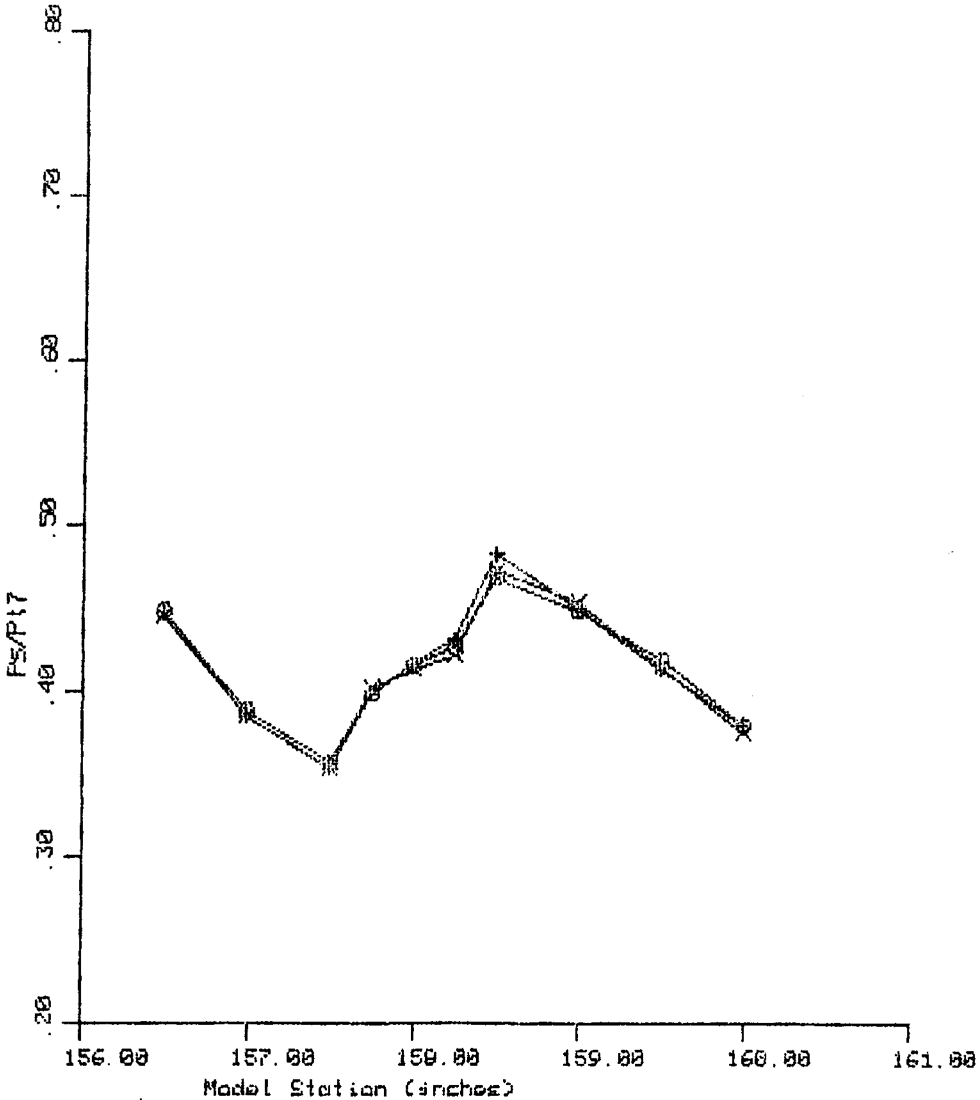
RUN = 203.01

(+) Ps/Pt7 @300deg (taPs 151-160)

(X) Ps/Pt7 @330deg (taPs 161-170)

(O) Ps/Pt7 @345deg (taPs 171-180)

3T24C$_{22.5°}$



$3B'C_{22.5}{}^{0}$

Data Point =	204.01
Nozzle Description =	3B'C22.5
Pt7/Pa =	2.591
Pt7/Pt8 =	1.085
Mach Number =	0.789

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 22-OCT-98 13:46:05
Job Number= 2212
PtO= 14.385
Mach number= 0.789
Tunnel Rn= 3.746E+06

Run Number= 204.01
File Id= 06295134605
Bar. (Psia)= 14.423
Ptunnel (Psia)= 9.536
Tunnel Q= 4.1593

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
TUNNEL FLOOR STATICS						
701	9.540				0.0008	0.7890
702	9.521				-0.0038	0.7910
703	9.642				0.0253	0.7781
704	9.501				-0.0086	0.7932
705	9.478				-0.0141	0.7956
706	9.477				-0.0144	0.7957
707	9.531				-0.0014	0.7900
708	9.417				-0.0288	0.8021
709	9.358				-0.0430	0.8084
710	9.273				-0.0634	0.8175
711	9.386				-0.0362	0.8054
712	9.491				-0.0110	0.7942
713	9.512				-0.0060	0.7920
714	9.547				0.0025	0.7883
715	9.510				-0.0064	0.7922
TUNNEL CEILING STATICS						
720	9.539				0.0005	0.7891
721	9.511				-0.0062	0.7921
722	9.504				-0.0079	0.7928
723	9.535				-0.0004	0.7895
724	9.462				-0.0180	0.7973
725	9.427				-0.0264	0.8011
726	9.421				-0.0278	0.8017
727	9.345				-0.0461	0.8098
728	9.344				-0.0463	0.8099
729	9.478				-0.0141	0.7956
730	9.544				0.0017	0.7886
731	9.583				0.0111	0.7844
732	9.588				0.0123	0.7839
TUNNEL WEST WALL STATICS						
760	9.605				0.0164	0.7821
761	9.493				-0.0105	0.7940
762	9.518				-0.0045	0.7914
763	9.382				-0.0372	0.8059
764	9.448				-0.0213	0.7988
765	9.539				0.0005	0.7891
766	9.679				0.0342	0.7742
TUNNEL EAST WALL STATICS						
790	9.620				0.0200	0.7805

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 22-OCT-98 13:46:05
Job Number= 2212
PtO= 14.385
Mach number= 0.789
Tunnel Rn= 3.746E+06

Run Number= 204.01
File Id= 06295134605
Bar. (Psia)= 14.423
Ptunnel (Psia)= 9.536
Tunnel Q= 4.1593

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
TUNNEL EAST WALL STATICS						
791	9.511				-0.0062	0.7921
792	9.422				-0.0276	0.8016
793	9.353				-0.0442	0.8090
794	9.504				-0.0079	0.7928
PT8 - RAKE @60 DEGREES						
1	22.803	1.0010				
2	22.817	1.0016				
3	22.797	1.0007				
4	22.764	0.9993				
5	22.721	0.9974				
6	22.667	0.9950				
AVERAGE=	22.761	Distortion .0066				
PS8 - STATICS						
25	21.455	0.9418				
29	21.315	0.9357				
AVERAGE=	21.385	Distortion .0065				
PT8 - RAKE @150 DEGREES						
7	22.799	1.0008				
8	22.748	0.9986				
9	22.755	0.9989				
10	22.777	0.9999				
11	22.820	1.0018				
12	22.768	0.9995				
AVERAGE=	22.777	Distortion .0032				
PS8 - STATICS						
26	21.331	0.9364				
30	21.297	0.9349				
AVERAGE=	21.314	Distortion .0016				
PT8 - RAKE @240 DEGREES						
Fixed 13	22.808	1.0012				
14	22.748	0.9986				
15	22.794	1.0006				
16	22.791	1.0005				
17	22.845	1.0029				
18	22.785	1.0002				
AVERAGE=	22.795	Distortion .0043				
PS8 - STATICS						
27	21.321	0.9360				
31	21.277	0.9340				
AVERAGE=	21.299	Distortion .0021				

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 22-OCT-98 13:46:05
Job Number= 2212
PtO= 14.395
Mach number= 0.789
Tunnel Rn= 3.746E+06

Run Number= 204.01
File Id= 06295134605
Bar. (Psia)= 14.423
Ptunnel (Psia)= 9.536
Tunnel Q= 4.1593

	TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
	PT8 -	RAKE @330 DEGREES					
	19	22.823	1.0019				
	20	22.796	1.0007				
Fixed	21	22.782	1.0001				
	22	22.788	1.0004				
	23	22.854	1.0032				
	24	22.666	0.9950				
AVERAGE=		22.784	Distortion	.0083			
	PS8 -	STATICS					
	28	21.262	0.9334				
	32	21.199	0.9306				
AVERAGE=		21.230	Distortion	.0030			
	PT7 -	RAKE @0 DEGREES					
	50	24.686		0.9989			
	51	24.669		0.9982			
Fixed	52	24.674		0.9984			
	53	24.680		0.9986			
	54	24.674		0.9984			
	55	24.680		0.9986			
	56	24.707		0.9997			
	57	24.732		1.0007			
	58	24.762		1.0020			
	59	24.780		1.0027			
	60	24.711		0.9999			
	61	24.587		0.9949			
AVERAGE=		24.695	Distortion	.0078			
	PS7 -	STATICS @30 DEGREES					
	98	24.009		0.9715			
	102	24.084		0.9745			
AVERAGE=		24.046	Distortion	.0031			
	PT7 -	RAKE @90 DEGREES					
	62	24.673		0.9984			
	63	24.770		1.0023			
	64	24.782		1.0028			
	65	24.782		1.0028			
	66	24.773		1.0024			
	67	24.759		1.0018			
	68	24.707		0.9997			
	69	24.708		0.9998			
	70	24.693		0.9992			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 22-OCT-98 13:46:05
Job Number= 2212
PtO= 14.385
Mach number= 0.789
Tunnel Rn= 3.746E+06

Run Number= 204.01
File Id= 06295134605
Bar. (Psia)= 14.423
Ptunnel (Psia)= 9.536
Tunnel Q= 4.1593

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PT7 - RAKE @90 DEGREES						
71	24.684		0.9988			
72	24.686		0.9989			
73	24.714		1.0000			
AVERAGE=	24.727	Distortion	.0044			
PS7 - STATICS @120 DEGREES						
99	24.045		0.9729			
103	24.082		0.9744			
AVERAGE=	24.063	Distortion	.0015			
PT7 - RAKE @180 DEGREES						
74	24.693		0.9992			
75	24.685		0.9988			
76	24.702		0.9995			
77	24.673		0.9984			
78	24.626		0.9965			
79	24.614		0.9960			
80	24.635		0.9968			
81	24.681		0.9987			
82	24.721		1.0003			
83	24.735		1.0009			
84	24.736		1.0009			
85	24.737		1.0009			
AVERAGE=	24.686	Distortion	.0050			
PS7 - STATICS @210 DEGREES						
100	24.115		0.9758			
104	24.080		0.9744			
AVERAGE=	24.097	Distortion	.0015			
PT7 - RAKE @270 DEGREES						
86	24.707		0.9997			
87	24.828		1.0046			
88	24.837		1.0050			
89	24.814		1.0041			
90	24.790		1.0031			
91	24.727		1.0005			
92	24.704		0.9996			
Fixed 93	24.707		0.9997			
94	24.700		0.9994			
95	24.695		0.9992			
96	24.702		0.9995			
97	24.691		0.9991			
AVERAGE=	24.741	Distortion	.0059			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 22-OCT-98 13:46:05
Job Number= 2212
PtO= 14.385
Mach number= 0.789
Tunnel Rn= 3.746E+06

Run Number= 204.01
File Id= 06295134605
Bar. (Psia)= 14.423
Ptunnel (Psia)= 9.536
Tunnel Q= 4.1593

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PS7 - STATICS @300 DEGREES						
Fixed 101	24.056		0.9734			
105	24.084		0.9745			
AVERAGE=	24.070	Distortion	.0011			
EXTERNAL FAN NACELLE						
111						
112						
115						
120						
B.L. PT RAKE						
122	12.327			1.2926		
125	13.113			1.3750		
PHASE 2 FAN INNER SURFACE PS @ 300 DEG						
151	11.049		0.4471			
152	9.505		0.3846			
153	8.576		0.3470			
154	9.807		0.3968			
155	10.207		0.4130			
156	10.438		0.4223			
157	11.772		0.4763			
158	11.235		0.4546			
159	10.377		0.4199			
160	9.234		0.3736			
PHASE 2 FAN INNER SURFACE PS @ 330 DEG						
161	11.003		0.4452			
162	9.506		0.3846			
163	8.605		0.3482			
164	9.879		0.3997			
165	10.154		0.4109			
166	10.226		0.4138			
167	11.501		0.4654			
168	11.304		0.4574			
169	10.404		0.4210			
170	9.190		0.3718			
PHASE 2 FAN INNER SURFACE PS @ 345 DEG						
171	11.078		0.4482			
172	9.580		0.3876			
173	8.679		0.3512			
174	9.802		0.3966			
175	10.176		0.4117			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 22-OCT-98 13:46:05
Job Number= 2212
PtO= 14.385
Mach number= 0.789
Tunnel Rn= 3.746E+06

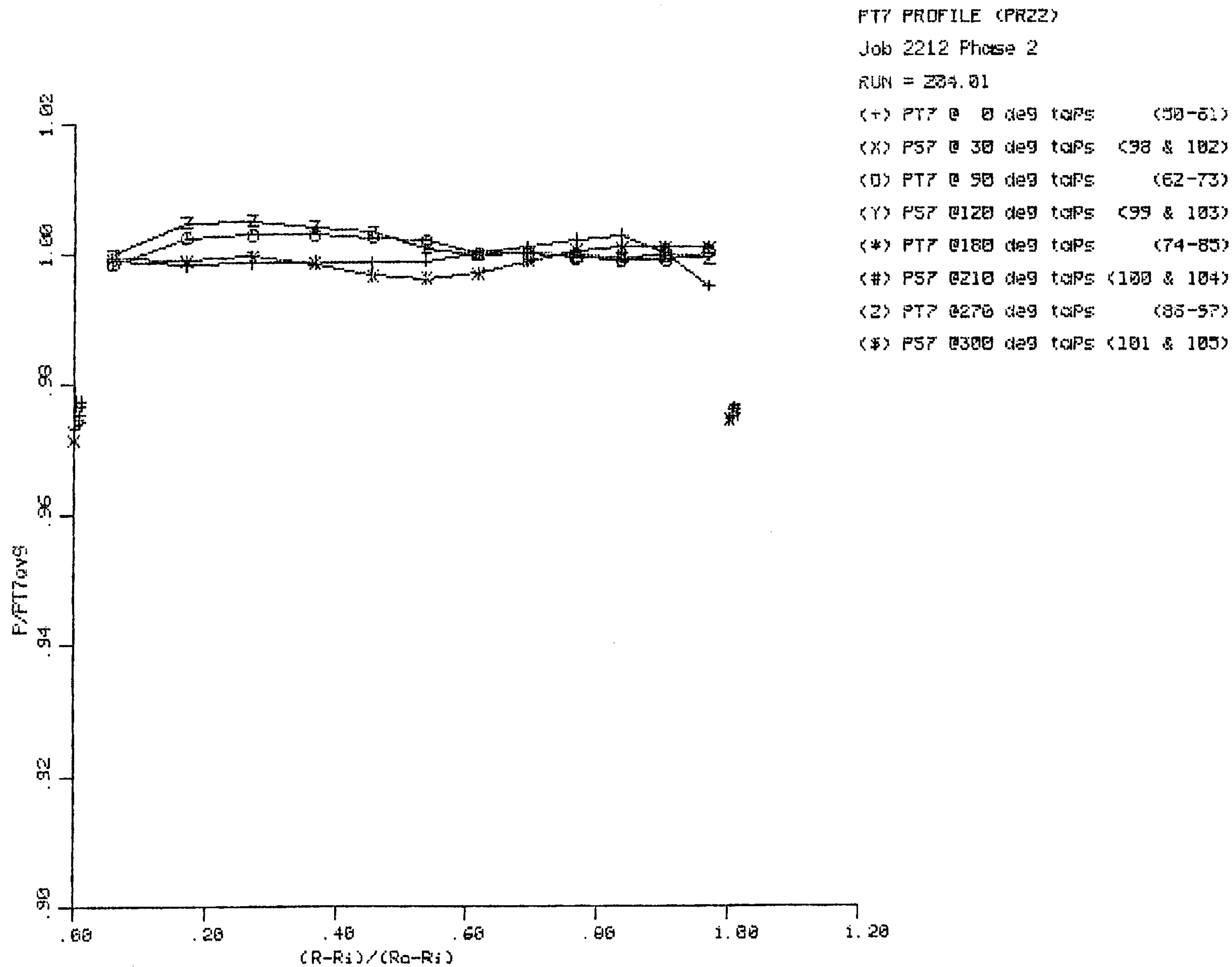
Run Number= 204.01
File Id= 06295134605
Bar. (Psia)= 14.423
Ptunnel (Psia)= 9.536
Tunnel Q= 4.1593

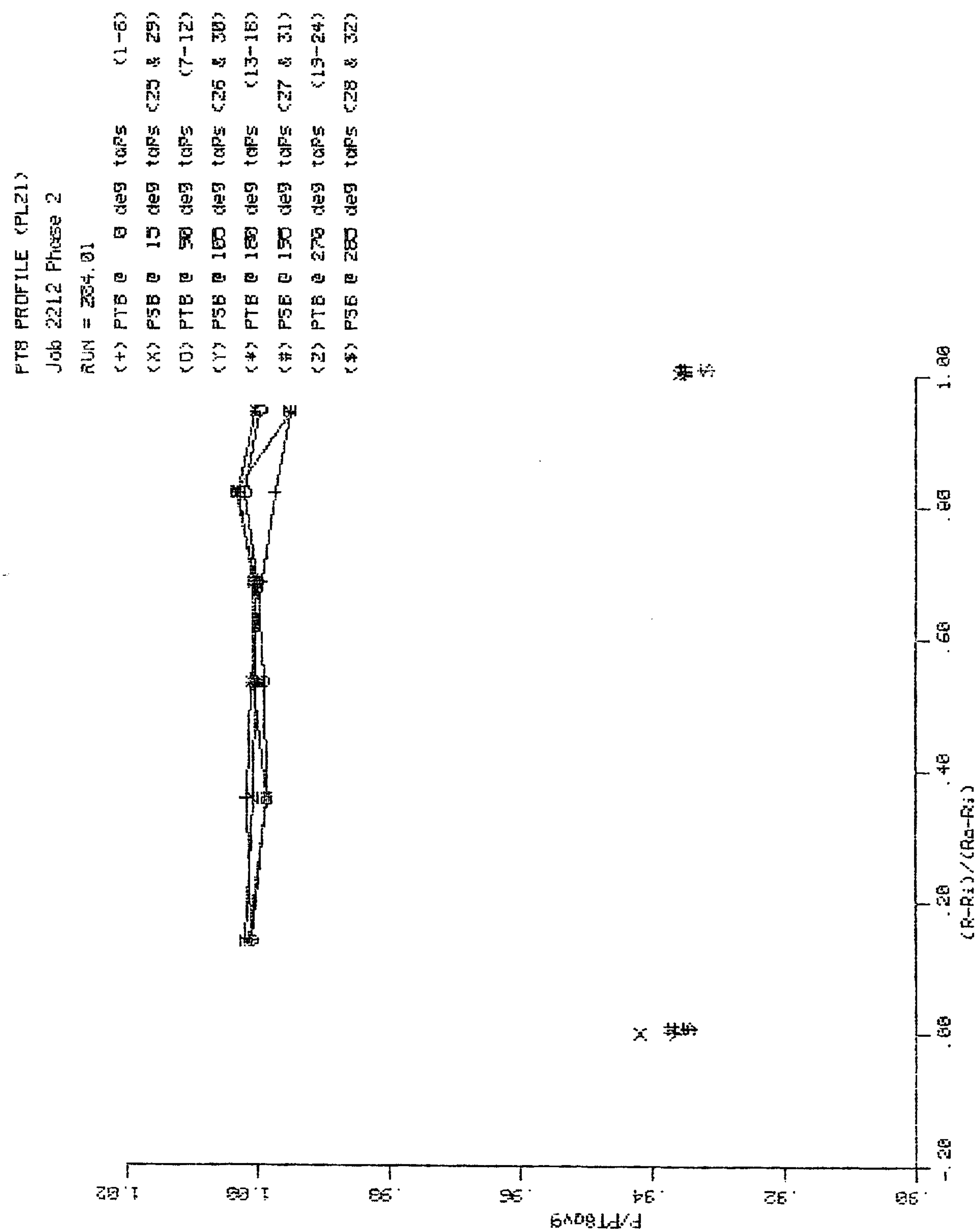
TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PHASE 2 FAN INNER SURFACE PS @ 345 DEG						
176	10.318		0.4175			
177	11.415		0.4619			
178	11.209		0.4535			
179	10.496		0.4247			
180	9.365		0.3789			

	PT	PS	MACH
STA8			
	22.761	21.374	0.3011
	22.778	21.311	0.3098
	22.795	21.296	0.3133
	22.785	21.226	0.3198
STA7			
	24.696	24.052	0.1946
	24.728	24.067	0.1972
	24.687	24.097	0.1862
	24.743	24.074	0.1982

		AVERAGE		Pt Dist	Ps Dist
STA8	22.780	21.302	0.3110	0.0083	0.0120
STA7	24.713	24.072	0.1940	0.0101	0.0044

USR1:[CH06.SET]PRCONF11.SET;7
USR1:[CH06.SET]PZCONF12.SET;2
USR1:[CH06.SET]PFCONF15.SET;2
USR1:[CH06.SET]PBCONF12.SET;1
DATA REDUCED WITH A DELTA FILE


PT7 PROFILE (PR22)
Job 2212 Phase 2
RUN = 284.01
(+) PT7 @ 0 deg taps (50-61)
(X) P57 @ 30 deg taps (98 & 102)
(O) PT7 @ 90 deg taps (62-73)
(Y) P57 @120 deg taps (99 & 103)
(*) PT7 @180 deg taps (74-85)
(#) P57 @210 deg taps (100 & 104)
(2) PT7 @270 deg taps (86-97)
($) P57 @300 deg taps (101 & 105)
1.02
1.00
.98
.96
.94
.92
.90
P/PT7avg
.00
.20
.40
.60
.80
1.00
1.20
(R-Ri)/(Ro-Ri)



PTB PROFILE (PL21)
Job 2212 Phase 2
RUN = 234.01
(+) PTB @ 0 deg taps (1-6)
(X) P5B @ 15 deg taps (25 & 29)
(O) PTB @ 90 deg taps (7-12)
(Y) P5B @ 165 deg taps (26 & 30)
(*) PTB @ 180 deg taps (13-18)
(#) P5B @ 195 deg taps (27 & 31)
(Z) PTB @ 270 deg taps (19-24)
($) P5B @ 285 deg taps (28 & 32)
F/FTBavg
(R-Ri)/(Ro-Ri)

FAN STATIC PRESSURE DISTRIBUTION (PL24)

Job 2212 Phase 2

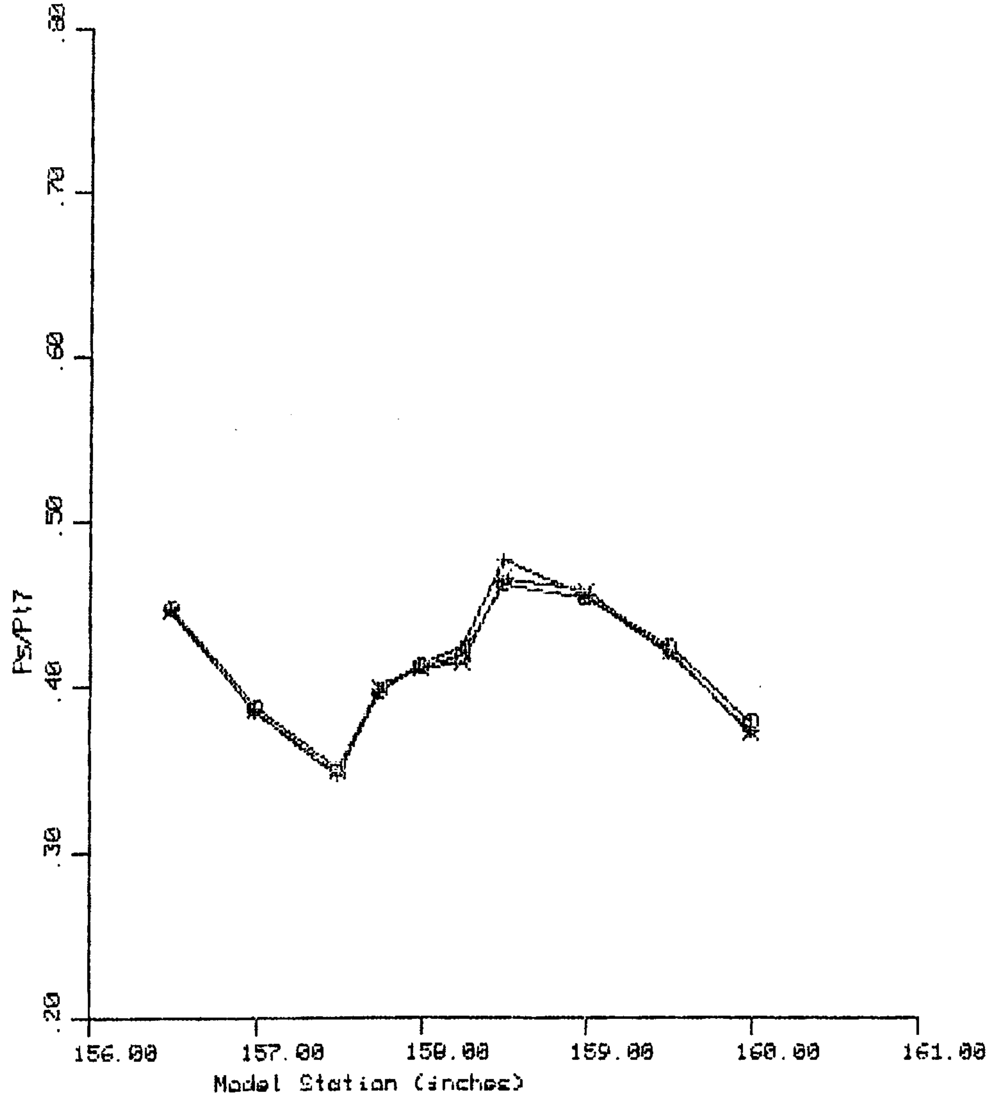
RUN = 234.01

(+) Ps/Pt7 @300deg (taps 151-160)

(X) Ps/Pt7 @330deg (taps 161-170)

(O) Ps/Pt7 @345deg (taps 171-180)

3 B' $C_{22.5°}$



$3B'C_0^0$

$3B'C_0^0$

Data Point =	205.01
Nozzle Description =	3B'C_0
Pt7/Pa =	2.626
Pt7/Pt8 =	1.091
Mach Number =	0.803

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 22-OCT-98 15:39:11
Job Number= 2212
PtO= 14.366
Mach number= 0.803
Tunnel Rn= 3.596E+06

Run Number= 205.01
File Id= 06295153911
Bar. (Psia)= 14.405
Ptunnel (Psia)= 9.393
Tunnel Q= 4.2435

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
TUNNEL FLOOR STATICS						
701	9.410				0.0041	0.8015
702	9.393				0.0000	0.8034
703	9.522				0.0304	0.7896
704	9.374				-0.0044	0.8054
705	9.347				-0.0108	0.8083
706	9.344				-0.0115	0.8086
707	9.410				0.0041	0.8015
708	9.276				-0.0275	0.8159
709	9.213				-0.0424	0.8226
710	9.107				-0.0674	0.8339
711	9.234				-0.0374	0.8204
712	9.340				-0.0124	0.8090
713	9.372				-0.0049	0.8056
714	9.410				0.0041	0.8015
715	9.373				-0.0047	0.8055
TUNNEL CEILING STATICS						
720	9.393				0.0000	0.8034
721	9.372				-0.0049	0.8056
722	9.367				-0.0061	0.8061
723	9.395				0.0005	0.8031
724	9.320				-0.0172	0.8112
725	9.280				-0.0266	0.8154
726	9.277				-0.0273	0.8158
727	9.193				-0.0471	0.8247
728	9.188				-0.0483	0.8253
729	9.334				-0.0139	0.8097
730	9.400				0.0017	0.8026
731	9.444				0.0121	0.7979
732	9.451				0.0137	0.7972
TUNNEL WEST WALL STATICS						
760	9.463				0.0165	0.7959
761	9.346				-0.0110	0.8084
762	9.374				-0.0044	0.8054
763	9.233				-0.0377	0.8205
764	9.303				-0.0212	0.8130
765	9.393				0.0000	0.8034
766	9.543				0.0354	0.7873
TUNNEL EAST WALL STATICS						
790	9.489				0.0227	0.7931

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 22-OCT-98 15:39:11
Job Number= 2212
Pt0= 14.366
Mach number= 0.803
Tunnel Rn= 3.596E+06

Run Number= 205.01
File Id= 06295153911
Bar. (Psia)= 14.405
Ptunnel (Psia)= 9.393
Tunnel Q= 4.2435

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
TUNNEL EAST WALL STATICS						
791	9.375				-0.0042	0.8053
792	9.284				-0.0256	0.8150
793	9.205				-0.0443	0.8235
794	9.363				-0.0070	0.8066
PT8 - RAKE @60 DEGREES						
1	22.624	1.0011				
2	22.641	1.0018				
3	22.610	1.0004				
4	22.584	0.9993				
5	22.535	0.9971				
6	22.480	0.9947				
AVERAGE=	22.579	Distortion .0071				
PS8 - STATICS						
25	21.292	0.9421				
29	21.144	0.9356				
AVERAGE=	21.218	Distortion .0070				
PT8 - RAKE @150 DEGREES						
7	22.618	1.0008				
8	22.569	0.9986				
9	22.576	0.9989				
10	22.601	1.0000				
11	22.639	1.0017				
12	22.591	0.9996				
AVERAGE=	22.599	Distortion .0031				
PS8 - STATICS						
26	21.161	0.9363				
30	21.129	0.9349				
AVERAGE=	21.145	Distortion .0015				
PT8 - RAKE @240 DEGREES						
Fixed 13	22.627	1.0012				
14	22.570	0.9987				
15	22.617	1.0008				
16	22.615	1.0007				
17	22.665	1.0029				
18	22.604	1.0002				
AVERAGE=	22.616	Distortion .0042				
PS8 - STATICS						
27	21.154	0.9360				
31	21.114	0.9343				
AVERAGE=	21.134	Distortion .0019				

FLUIDYNE AEROTEST LABORATORY

Run Day/Time=	22-OCT-98 15:39:11	Run Number=	205.01
Job Number=	2212	File Id=	06295153911
Pt0=	14.366	Bar. (Psia)=	14.405
Mach number=	0.803	Ptunnel (Psia)=	9.393
Tunnel Rn=	3.596E+06	Tunnel Q=	4.2435

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PT8 -	RAKE @330 DEGREES					
19	22.639	1.0017				
20	22.616	1.0007				
Fixed 21	22.601	1.0000				
22	22.607	1.0003				
23	22.673	1.0032				
24	22.491	0.9952				
AVERAGE=	22.604	Distortion .0081				
PS8 -	STATICS					
28	21.089	0.9331				
32	21.026	0.9304				
AVERAGE=	21.057	Distortion .0030				
PT7 -	RAKE @0 DEGREES					
50	24.640		0.9990			
51	24.628		0.9986			
Fixed 52	24.631		0.9987			
53	24.635		0.9988			
54	24.628		0.9986			
55	24.638		0.9990			
56	24.664		1.0000			
57	24.681		1.0007			
58	24.716		1.0021			
59	24.728		1.0026			
60	24.672		1.0003			
61	24.529		0.9945			
AVERAGE=	24.649	Distortion .0081				
PS7 -	STATICS @30 DEGREES					
98	23.962		0.9715			
102	24.033		0.9744			
AVERAGE=	23.997	Distortion .0030				
PT7 -	RAKE @90 DEGREES					
62	24.619		0.9982			
63	24.715		1.0021			
64	24.729		1.0026			
65	24.725		1.0025			
66	24.723		1.0024			
67	24.695		1.0013			
68	24.655		0.9996			
69	24.653		0.9996			
70	24.637		0.9989			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 22-OCT-98 15:39:11
Job Number= 2212
PtO= 14.366
Mach number= 0.803
Tunnel Rn= 3.596E+06

Run Number= 205.01
File Id= 06295153911
Bar. (Psia)= 14.405
Ptunnel (Psia)= 9.393
Tunnel Q= 4.2435

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PT7 - RAKE @90 DEGREES						
71	24.631		0.9987			
72	24.636		0.9989			
73	24.667		1.0001			
AVERAGE=	24.674	Distortion	.0045			
PS7 - STATICS @120 DEGREES						
99	24.001		0.9731			
103	24.030		0.9743			
AVERAGE=	24.015	Distortion	.0012			
PT7 - RAKE @180 DEGREES						
74	24.645		0.9992			
75	24.638		0.9990			
76	24.648		0.9994			
77	24.617		0.9981			
78	24.573		0.9963			
79	24.564		0.9960			
80	24.581		0.9966			
81	24.630		0.9986			
82	24.664		1.0000			
83	24.683		1.0008			
84	24.686		1.0009			
85	24.681		1.0007			
AVERAGE=	24.634	Distortion	.0050			
PS7 - STATICS @210 DEGREES						
100	24.010		0.9735			
104	24.031		0.9743			
AVERAGE=	24.020	Distortion	.0009			
PT7 - RAKE @270 DEGREES						
86	24.680		1.0007			
87	24.781		1.0048			
88	24.785		1.0049			
89	24.767		1.0042			
90	24.732		1.0028			
91	24.686		1.0009			
92	24.656		0.9997			
Fixed 93	24.655		0.9996			
94	24.653		0.9996			
95	24.645		0.9992			
96	24.651		0.9995			
97	24.639		0.9990			
AVERAGE=	24.694	Distortion	.0059			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time=	22-OCT-98 15:39:11	Run Number=	205.01
Job Number=	2212	File Id=	06295153911
PtO=	14.366	Bar. (Psia)=	14.405
Mach number=	0.803	Ptunnel (Psia)=	9.393
Tunnel Rn=	3.596E+06	Tunnel Q=	4.2435

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PS7 - STATICS @300 DEGREES						
Fixed 101	23.991		0.9727			
105	24.030		0.9743			
AVERAGE=	24.010	Distortion	.0016			
EXTERNAL FAN NACELLE						
111						
112						
115						
120						
B.L. PT RAKE						
122	12.198			1.2987		
125	12.976			1.3815		
PHASE 2 FAN INNER SURFACE PS @ 300 DEG						
151	10.999		0.4460			
152	9.418		0.3819			
153	8.550		0.3467			
154	9.882		0.4007			
155	9.692		0.3930			
156	10.357		0.4199			
157	11.387		0.4617			
158	11.351		0.4602			
159	10.509		0.4261			
160	9.187		0.3725			
PHASE 2 FAN INNER SURFACE PS @ 330 DEG						
161	10.964		0.4445			
162	9.418		0.3819			
163	8.477		0.3437			
164	10.003		0.4056			
165	9.699		0.3932			
166	10.234		0.4149			
167	11.149		0.4520			
168	11.385		0.4616			
169	10.564		0.4283			
170	9.206		0.3733			
PHASE 2 FAN INNER SURFACE PS @ 345 DEG						
171	11.025		0.4470			
172	9.497		0.3847			
173	8.680		0.3519			
174	9.969		0.4042			
175	9.650		0.3913			

FLUIDYNE AEROTEST LABORATORY

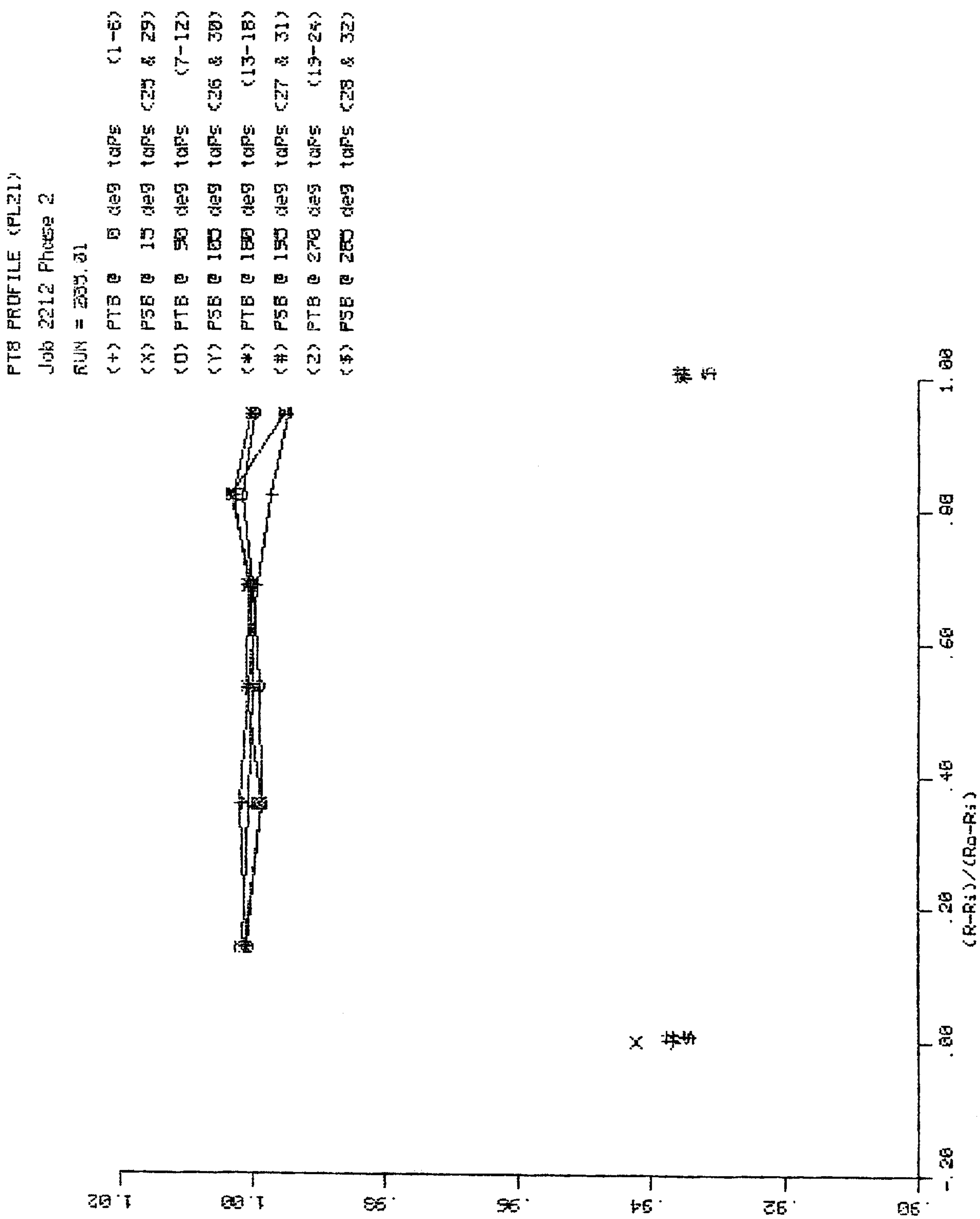
Run Day/Time=	22-OCT-98 15:39:11	Run Number=	205.01
Job Number=	2212	File Id=	06295153911
PtO=	14.366	Bar. (Psia)=	14.405
Mach number=	0.803	Ptunnel (Psia)=	9.393
Tunnel Rn=	3.596E+06	Tunnel Q=	4.2435

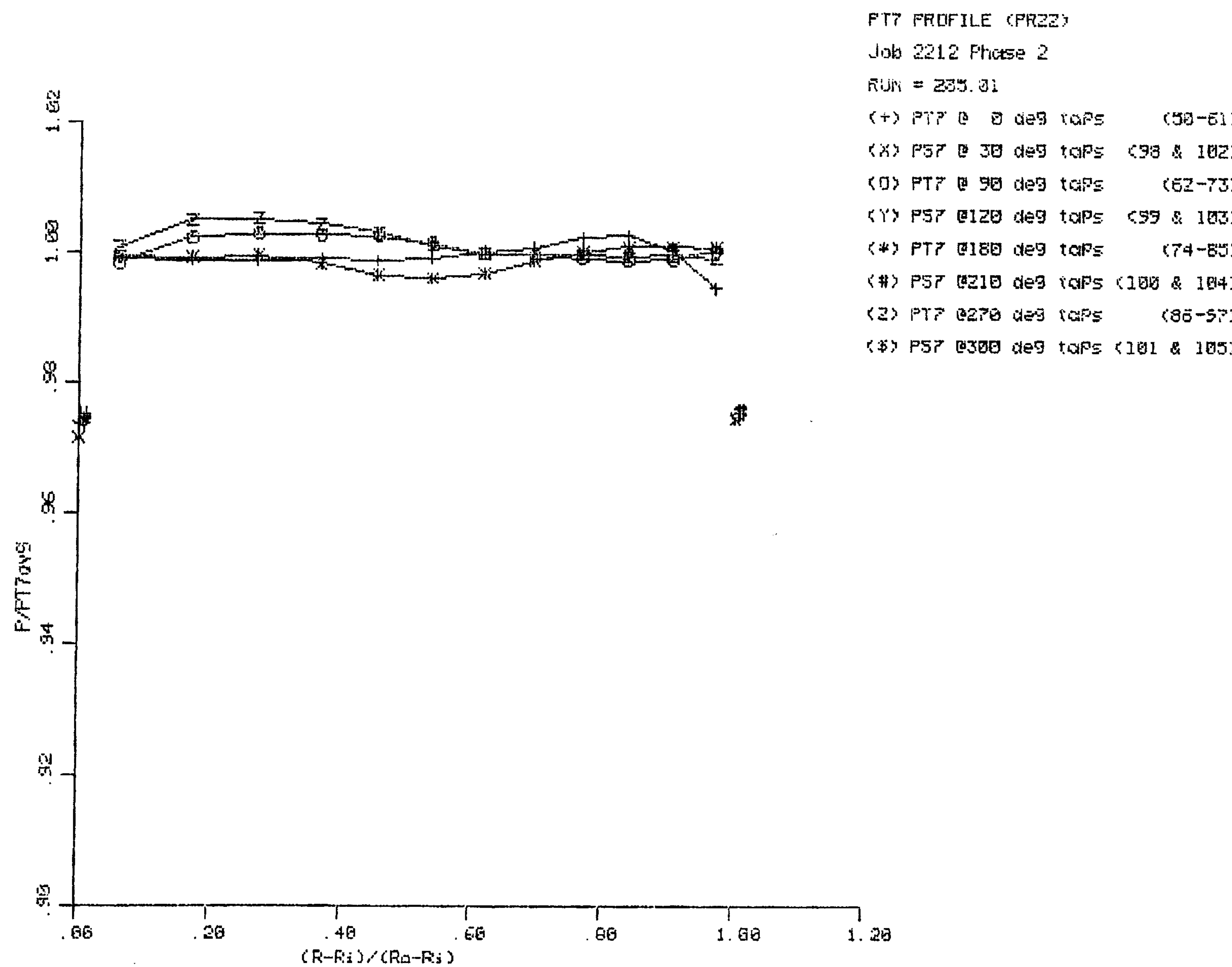
TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PHASE 2 FAN INNER SURFACE PS @ 345 DEG						
176	10.277		0.4167			
177	11.101		0.4501			
178	11.253		0.4563			
179	10.677		0.4329			
180	9.272		0.3759			

	PT	PS	MACH
STA8			
	22.579	21.207	0.3006
	22.599	21.143	0.3100
	22.616	21.131	0.3130
	22.605	21.053	0.3203
STA7			
	24.650	24.003	0.1953
	24.674	24.018	0.1966
	24.635	24.023	0.1899
	24.695	24.015	0.2001

		AVERAGE		Pt Dist	Ps Dist
STA8	22.600	21.133	0.3110	0.0085	0.0126
STA7	24.664	24.015	0.1955	0.0104	0.0030

USR1:[CH06.SET]PRCONF11.SET;7
USR1:[CH06.SET]PZCONF12.SET;2
USR1:[CH06.SET]PFCONF15.SET;2
USR1:[CH06.SET]PBCONF12.SET;1
DATA REDUCED WITH A DELTA FILE


PT8 PROFILE (PL21)
Job 2212 Phase 2
(+) PTB @ 0 deg taPs (1-6)
(X) PSB @ 15 deg taPs (25 & 29)
(O) PTB @ 90 deg taPs (7-12)
(Y) PSB @ 105 deg taPs (26 & 30)
(*) PTB @ 180 deg taPs (13-18)
(#) PSB @ 195 deg taPs (27 & 31)
(2) PTB @ 270 deg taPs (19-24)
($) PSB @ 285 deg taPs (28 & 32)
P/PT8avg
(R-Ri)/(Ro-Ri)


PT7 PROFILE (PR22)
Job 2212 Phase 2
RUN = 235.01
(+) PT7 @ 0 deg taps (50-61)
(X) PS7 @ 30 deg taps (98 & 102)
(O) PT7 @ 90 deg taps (62-73)
(Y) PS7 @120 deg taps (99 & 103)
(*) PT7 @180 deg taps (74-85)
(#) PS7 @210 deg taps (100 & 104)
(Z) PT7 @270 deg taps (86-97)
($) PS7 @300 deg taps (101 & 105)
P/PT7avg
1.02
1.00
.98
.96
.94
.92
.90
.00
.20
.40
.60
.80
1.00
1.20
(R-Ri)/(Ro-Ri)

FAN STATIC PRESSURE DISTRIBUTION (PL24)

Job 2212 Phase 2

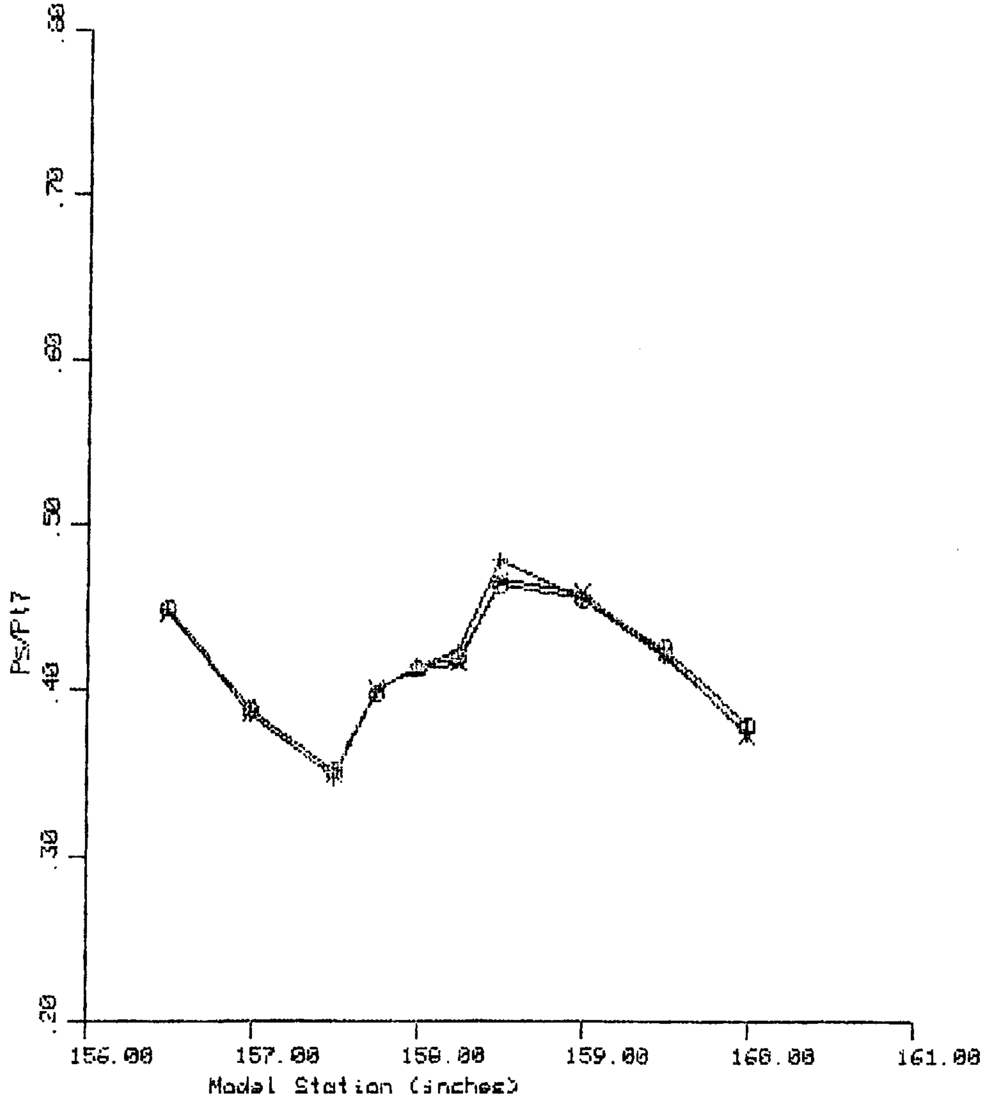
RUN = 235.01

(+) Ps/Pt7 @300deg (taps 151-160)

(X) Ps/Pt7 @330deg (taps 161-170)

(O) Ps/Pt7 @345deg (taps 171-180)

3 B' C°



3B'B

Data Point =	206.01
Nozzle Description =	3B'B
Pt7/Pa =	2.621
Pt7/Pt8 =	1.080
Mach Number =	0.801

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 26-OCT-98 09:46:10
Job Number= 2212
PtO= 14.243
Mach number= 0.801
Tunnel Rn= 3.557E+06

Run Number= 206.01
File Id= 06299084610
Bar. (Psia)= 14.281
Ptunnel (Psia)= 9.332
Tunnel Q= 4.1934

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
TUNNEL FLOOR STATICS						
701	9.339				0.0016	0.8005
702	9.321				-0.0027	0.8024
703	9.448				0.0276	0.7888
704	9.299				-0.0080	0.8048
705	9.277				-0.0132	0.8072
706	9.272				-0.0144	0.8077
707	9.337				0.0011	0.8007
708	9.208				-0.0297	0.8146
709	9.139				-0.0461	0.8221
710	9.050				-0.0674	0.8317
711	9.169				-0.0390	0.8188
712	9.285				-0.0113	0.8063
713	9.302				-0.0073	0.8045
714	9.340				0.0018	0.8004
715	9.305				-0.0065	0.8042
TUNNEL CEILING STATICS						
720	9.327				-0.0013	0.8018
721	9.300				-0.0077	0.8047
722	9.298				-0.0082	0.8049
723	9.324				-0.0020	0.8021
724	9.249				-0.0199	0.8102
725	9.213				-0.0285	0.8141
726	9.203				-0.0309	0.8152
727	9.125				-0.0495	0.8236
728	9.125				-0.0495	0.8236
729	9.264				-0.0163	0.8086
730	9.331				-0.0003	0.8014
731	9.366				0.0080	0.7976
732	9.373				0.0097	0.7968
TUNNEL WEST WALL STATICS						
760	9.396				0.0152	0.7944
761	9.280				-0.0125	0.8069
762	9.307				-0.0061	0.8040
763	9.170				-0.0387	0.8187
764	9.236				-0.0230	0.8116
765	9.323				-0.0023	0.8022
766	9.471				0.0330	0.7863
TUNNEL EAST WALL STATICS						
790	9.415				0.0197	0.7923

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 26-OCT-98 08:46:10
Job Number= 2212
PtO= 14.243
Mach number= 0.801
Tunnel Rn= 3.557E+06

Run Number= 206.01
File Id= 06299084610
Bar. (Psia)= 14.281
Ptunnel (Psia)= 9.332
Tunnel Q= 4.1934

	TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
	TUNNEL EAST WALL STATICS						
	791	9.304				-0.0068	0.8043
	792	9.212				-0.0287	0.8142
	793	9.140				-0.0459	0.8220
	794	9.297				-0.0085	0.8050
	PT8 - RAKE @60 DEGREES						
	1	22.687	1.0012				
	2	22.699	1.0017				
	3	22.675	1.0007				
	4	22.643	0.9993				
	5	22.600	0.9974				
	6	22.551	0.9952				
AVERAGE=		22.642	Distortion .0065				
	PS8 - STATICS						
	25	21.351	0.9422				
	29	21.192	0.9352				
AVERAGE=		21.271	Distortion .0075				
	PT8 - RAKE @150 DEGREES						
	7	22.658	0.9999				
	8	22.631	0.9987				
	9	22.637	0.9990				
	10	22.660	1.0000				
	11	22.693	1.0015				
	12	22.647	0.9994				
AVERAGE=		22.654	Distortion .0027				
	PS8 - STATICS						
	26	21.216	0.9363				
	30	21.176	0.9345				
AVERAGE=		21.196	Distortion .0019				
	PT8 - RAKE @240 DEGREES						
Fixed	13	22.681	1.0009				
	14	22.634	0.9989				
	15	22.677	1.0008				
	16	22.675	1.0007				
	17	22.728	1.0030				
	18	22.669	1.0004				
AVERAGE=		22.677	Distortion .0041				
	PS8 - STATICS						
	27	21.207	0.9359				
	31	21.171	0.9343				
AVERAGE=		21.189	Distortion .0017				

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 26-OCT-98 08:46:10
Job Number= 2212
PtO= 14.243
Mach number= 0.801
Tunnel Rn= 3.557E+06

Run Number= 206.01
File Id= 06299084610
Bar. (Psia)= 14.281
Ptunnel (Psia)= 9.332
Tunnel Q= 4.1934

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PT8 - RAKE @330 DEGREES						
19	22.698	1.0017				
20	22.681	1.0009				
Fixed 21	22.663	1.0001				
22	22.662	1.0001				
23	22.733	1.0032				
24	22.548	0.9951				
AVERAGE=	22.664	Distortion .0082				
PS8 - STATICS						
28	21.168	0.9342				
32	21.076	0.9301				
AVERAGE=	21.122	Distortion .0044				
PT7 - RAKE @0 DEGREES						
50	24.430		0.9987			
51	24.421		0.9983			
Fixed 52	24.424		0.9985			
53	24.428		0.9986			
54	24.427		0.9986			
55	24.433		0.9988			
56	24.457		0.9998			
57	24.481		1.0008			
58	24.511		1.0020			
59	24.518		1.0023			
60	24.455		0.9997			
61	24.325		0.9944			
AVERAGE=	24.442	Distortion .0079				
PS7 - STATICS @30 DEGREES						
98	23.768		0.9716			
102	23.845		0.9748			
AVERAGE=	23.806	Distortion .0032				
PT7 - RAKE @90 DEGREES						
62	24.424		0.9984			
63	24.512		1.0020			
64	24.529		1.0027			
65	24.527		1.0027			
66	24.522		1.0024			
67	24.504		1.0017			
68	24.462		1.0000			
69	24.451		0.9995			
70	24.439		0.9991			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 26-OCT-98 08:46:10
Job Number= 2212
PtO= 14.243
Mach number= 0.801
Tunnel Rn= 3.557E+06

Run Number= 206.01
File Id= 06299084610
Bar. (Psia)= 14.281
Ptunnel (Psia)= 9.332
Tunnel Q= 4.1934

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PT7 - RAKE @90 DEGREES						
71	24.430		0.9987			
72	24.438		0.9990			
73	24.475		1.0005			
AVERAGE=	24.476	Distortion	.0043			
PS7 - STATICS @120 DEGREES						
99	23.927		0.9781			
103	23.847		0.9749			
AVERAGE=	23.887	Distortion	.0033			
PT7 - RAKE @180 DEGREES						
74	24.449		0.9995			
75	24.435		0.9989			
76	24.451		0.9995			
77	24.424		0.9984			
78	24.384		0.9968			
79	24.375		0.9964			
80	24.383		0.9968			
81	24.432		0.9988			
82	24.466		1.0002			
83	24.482		1.0008			
84	24.481		1.0008			
85	24.484		1.0009			
AVERAGE=	24.437	Distortion	.0045			
PS7 - STATICS @210 DEGREES						
100	23.807		0.9732			
104	23.847		0.9749			
AVERAGE=	23.827	Distortion	.0017			
PT7 - RAKE @270 DEGREES						
86	24.493		1.0013			
87	24.576		1.0047			
88	24.579		1.0048			
89	24.556		1.0038			
90	24.522		1.0024			
91	24.481		1.0008			
92	24.456		0.9998			
Fixed 93	24.454		0.9997			
94	24.444		0.9993			
95	24.442		0.9992			
96	24.440		0.9991			
97	24.430		0.9987			
AVERAGE=	24.489	Distortion	.0061			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time= 26-OCT-98 08:46:10
Job Number= 2212
PtO= 14.243
Mach number= 0.801
Tunnel Rn= 3.557E+06

Run Number= 206.01
File Id= 06299084610
Bar. (Psia)= 14.281
Ptunnel (Psia)= 9.332
Tunnel Q= 4.1934

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
PS7 - STATICS @300 DEGREES						
Fixed 101	23.834		0.9743			
105	23.846		0.9748			
AVERAGE=	23.840	Distortion	.0005			
EXTERNAL FAN NACELLE						
111	7.547				-0.4258	0.9974
112	5.732				-0.8586	1.2186
115	8.614				-0.1713	0.8790
120	9.737				0.0965	0.7576
B.L. PT RAKE						
122	12.155			1.3025		
125	12.930			1.3855		
PHASE 2 FAN INNER SURFACE PS @ 300 DEG						
151	12.509		0.5114			
152	9.612		0.3929			
153	8.663		0.3541			
154	8.698		0.3556			
155	8.885		0.3632			
156	9.143		0.3738			
157	10.069		0.4116			
158	12.216		0.4994			
159	11.566		0.4728			
160	9.732		0.3978			
PHASE 2 FAN INNER SURFACE PS @ 330 DEG						
161	12.562		0.5135			
162	9.567		0.3911			
163	8.663		0.3541			
164	8.733		0.3570			
165	8.822		0.3606			
166	8.926		0.3649			
167	9.891		0.4043			
168	12.277		0.5019			
169	11.642		0.4759			
170	9.799		0.4006			
PHASE 2 FAN INNER SURFACE PS @ 345 DEG						
171	12.701		0.5192			
172	9.712		0.3970			
173	8.739		0.3572			
174	8.684		0.3550			
175	8.826		0.3608			

FLUIDYNE AEROTEST LABORATORY

Run Day/Time=	26-OCT-98 08:46:10	Run Number=	206.01
Job Number=	2212	File Id=	06299084610
PtO=	14.243	Bar. (Psia)=	14.281
Mach number=	0.801	Ptunnel (Psia)=	9.332
Tunnel Rn=	3.557E+06	Tunnel Q=	4.1934

PHASE 2 FAN INNER SURFACE PS @ 345 DEG

TAP	P(PSIA)	P/Pt8	P/Pt7	P/Pa	Cp	Mach #
176	8.985		0.3673			
177	9.933		0.4060			
178	12.253		0.5009			
179	11.710		0.4787			
180	9.853		0.4028			

	PT	PS	MACH
STA8			
	22.642	21.259	0.3014
	22.654	21.193	0.3101
	22.677	21.186	0.3132
	22.664	21.115	0.3196
STA7			
	24.443	23.812	0.1936
	24.476	23.884	0.1875
	24.437	23.830	0.1900
	24.490	23.843	0.1960

		AVERAGE		Pt Dist	Ps Dist
STA8	22.659	21.188	0.3111	0.0082	0.0130
STA7	24.462	23.842	0.1918	0.0104	0.0067

USR1:[CH06.SET]PRCONF11.SET;7
USR1:[CH06.SET]PZCONF12.SET;2
USR1:[CH06.SET]PFCONF15.SET;2
USR1:[CH06.SET]PBCONF13.SET;1
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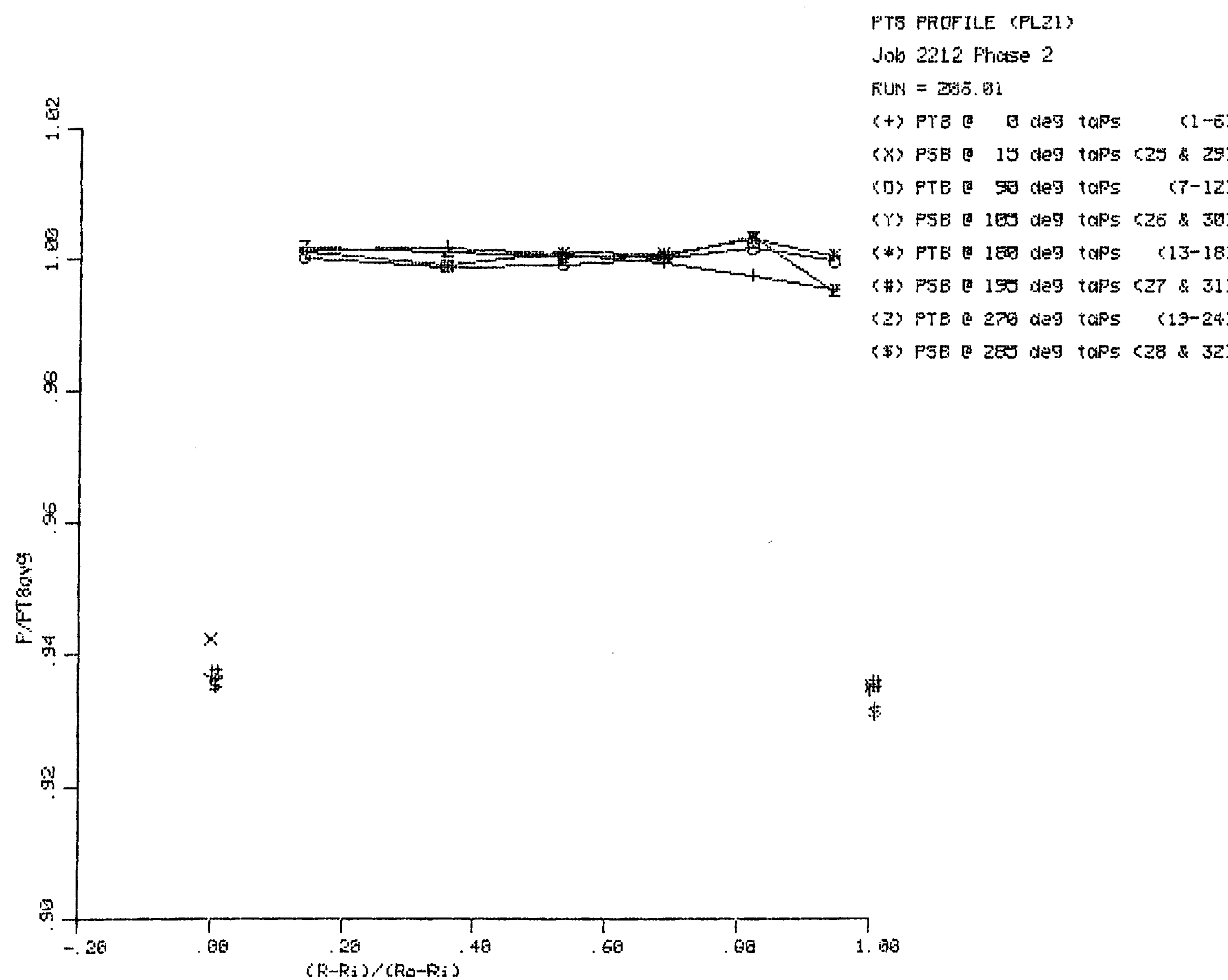
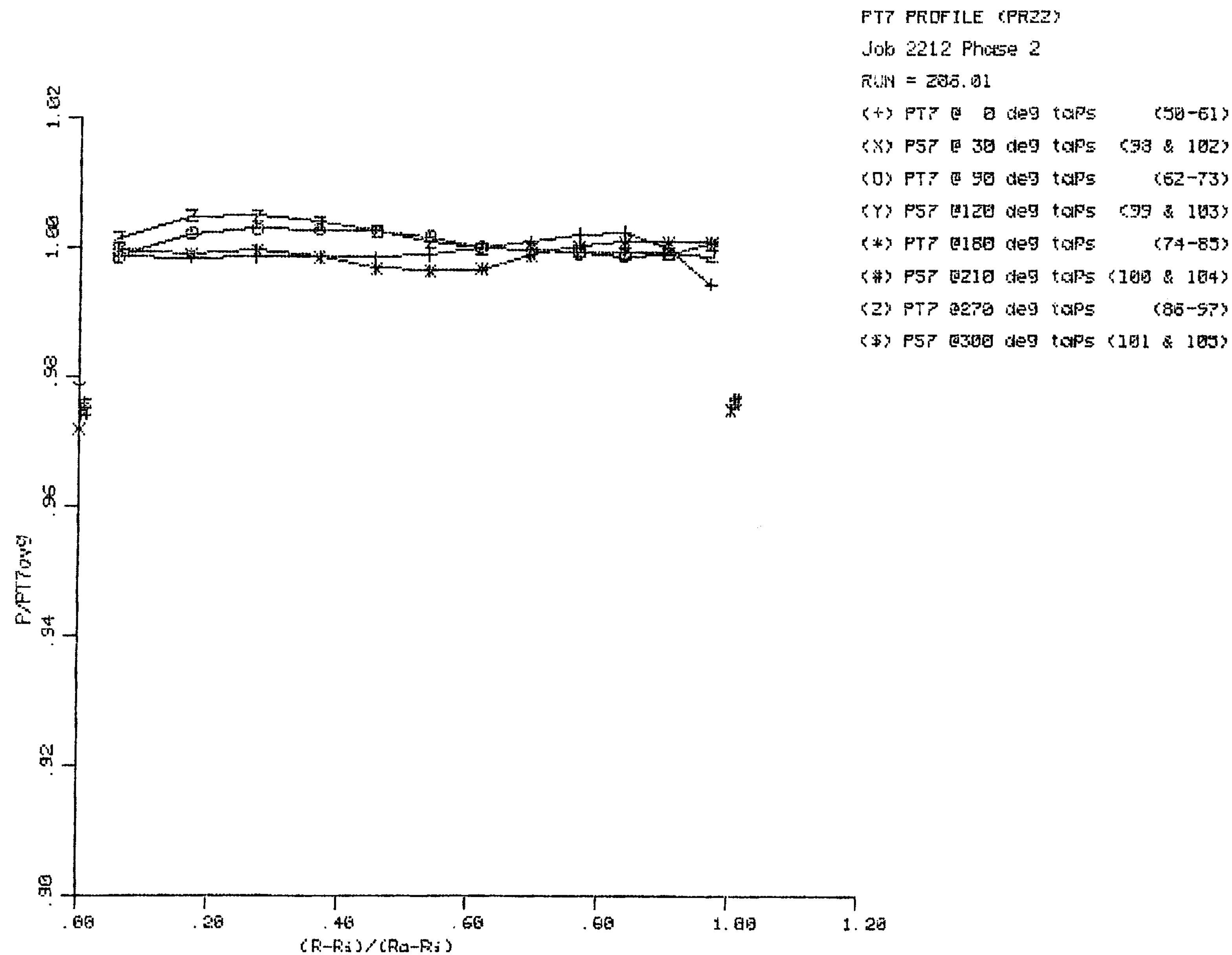
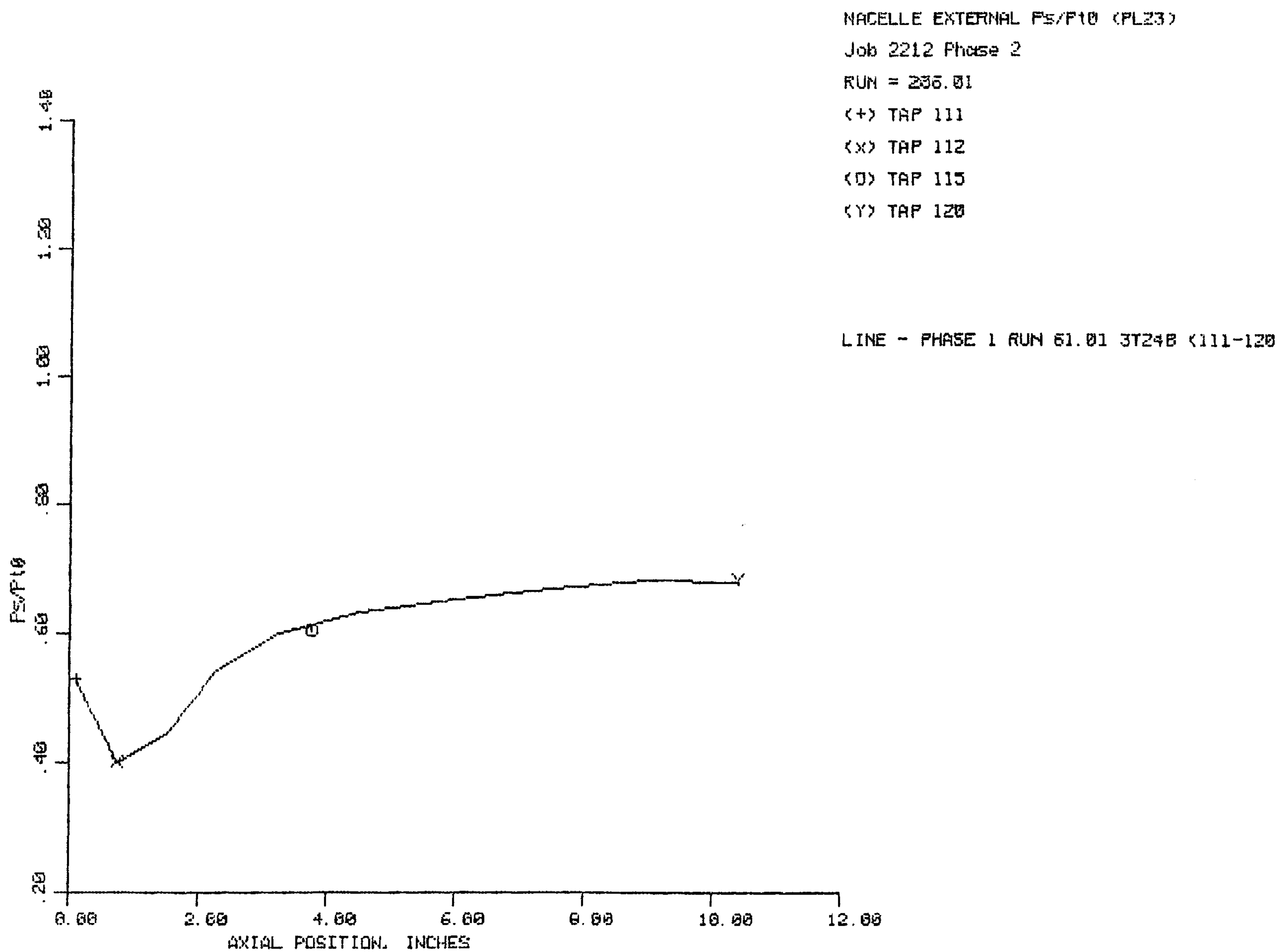

PTS PROFILE (PL21)
Job 2212 Phase 2
RUN = 285.01
(+) PTB @ 0 deg taps (1-6)
(X) PSB @ 15 deg taps (25 & 29)
(O) PTB @ 90 deg taps (7-12)
(Y) PSB @ 105 deg taps (26 & 30)
(*) PTB @ 180 deg taps (13-18)
(#) PSB @ 195 deg taps (27 & 31)
(Z) PTB @ 270 deg taps (19-24)
($) PSB @ 285 deg taps (28 & 32)
P/PTBavg
1.02
1.00
.98
.96
.94
.92
.90
-.20
.00
.20
.40
.60
.80
1.00
(R-Ri)/(Ro-Ri)


PT7 PROFILE (PRZ2)
Job 2212 Phase 2
RUN = 206.01
(+) PT7 @ 0 deg taps (50-61)
(X) P57 @ 30 deg taps (98 & 102)
(O) PT7 @ 90 deg taps (62-73)
(Y) P57 @120 deg taps (99 & 103)
(*) PT7 @180 deg taps (74-85)
(#) P57 @210 deg taps (100 & 104)
(Z) PT7 @270 deg taps (86-97)
($) P57 @300 deg taps (101 & 105)
P/PT7avg
1.02
1.00
.98
.96
.94
.92
.90
.00
.20
.40
.60
.80
1.00
1.20
(R-Ri)/(Ro-Ri)


NACELLE EXTERNAL Ps/P10 (PL23)
Job 2212 Phase 2
RUN = 236.01
(+) TAP 111
(x) TAP 112
(O) TAP 115
(Y) TAP 120
LINE - PHASE 1 RUN 61.01 3T24B (111-120)
Ps/P10
1.40
1.20
1.00
.80
.60
.40
.20
0.00
2.00
4.00
6.00
8.00
10.00
12.00
AXIAL POSITION, INCHES

FAN STATIC PRESSURE DISTRIBUTION (PL24)

Job 2212 Phase 2

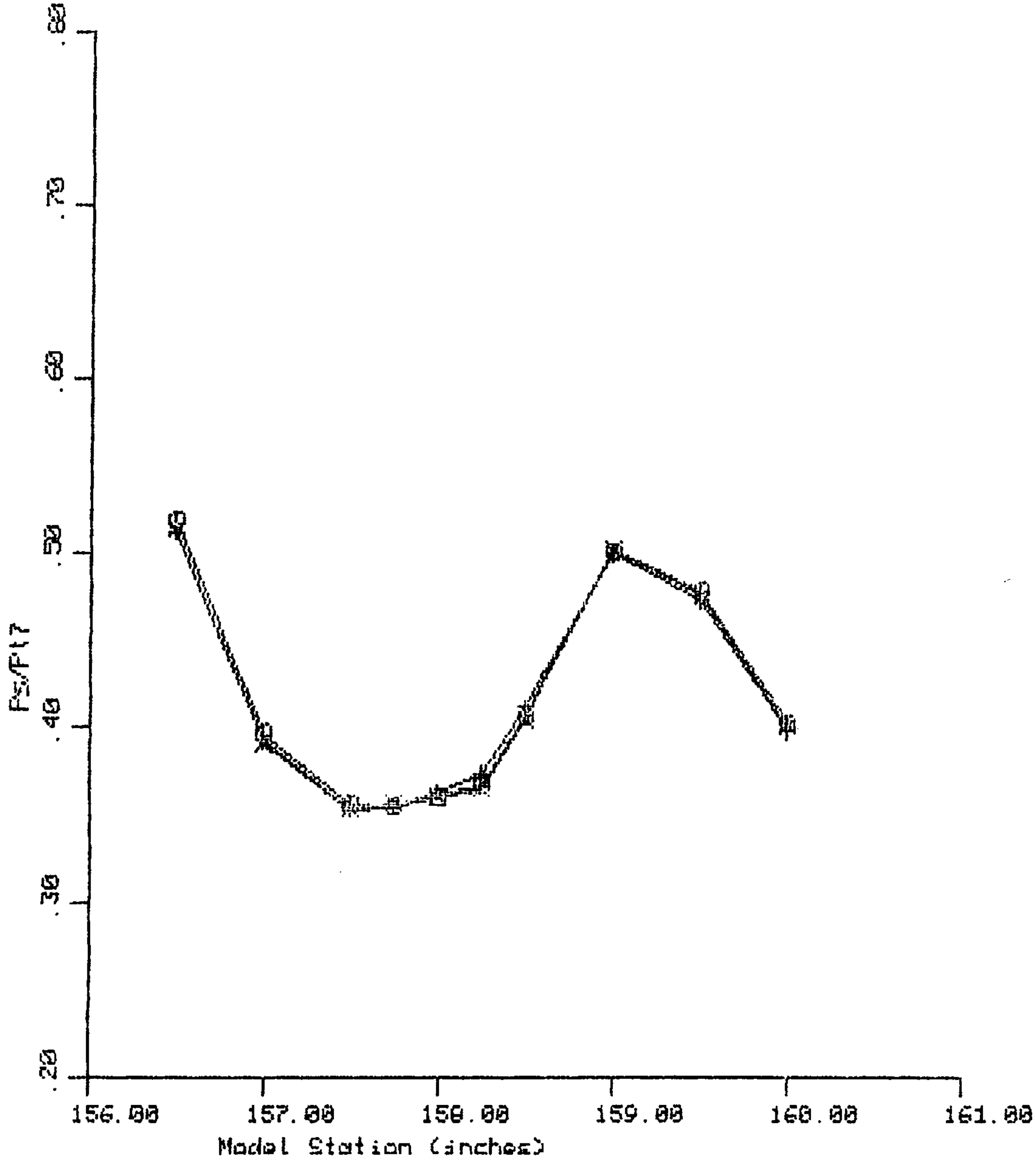
RUN = 236.01

(+) Ps/Pt7 @300deg (taps 151-160)

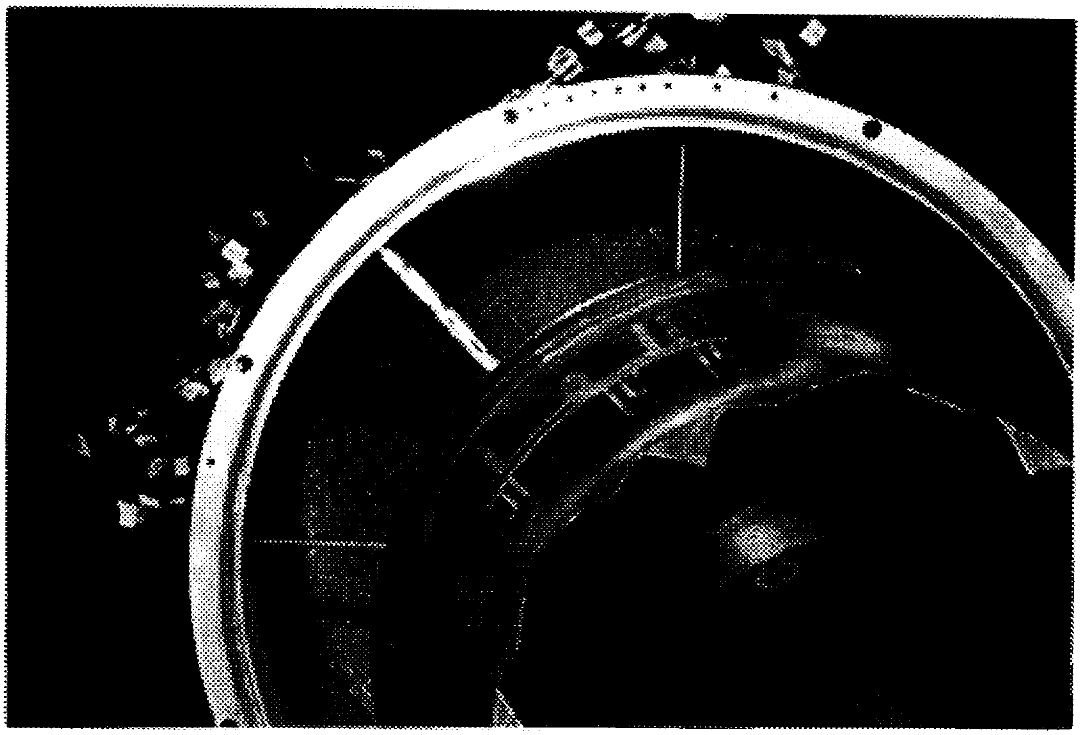
(X) Ps/Pt7 @330deg (taps 161-170)

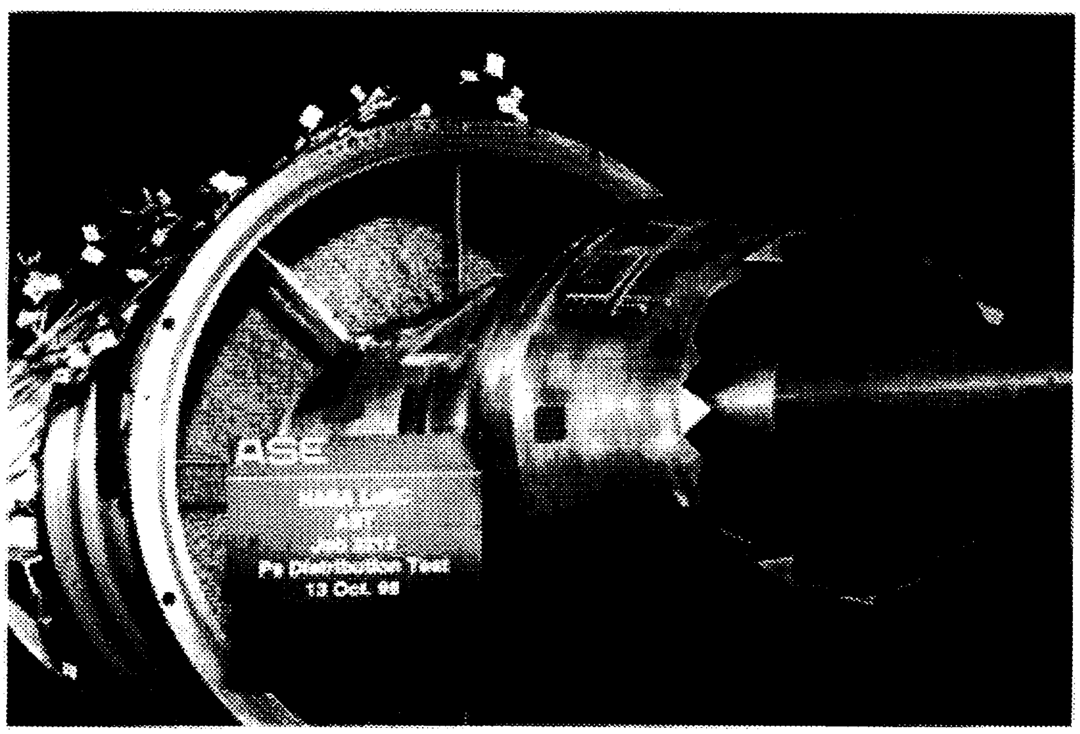
(O) Ps/Pt7 @345deg (taps 171-180)

3B'B



PHOTOGRAPHS

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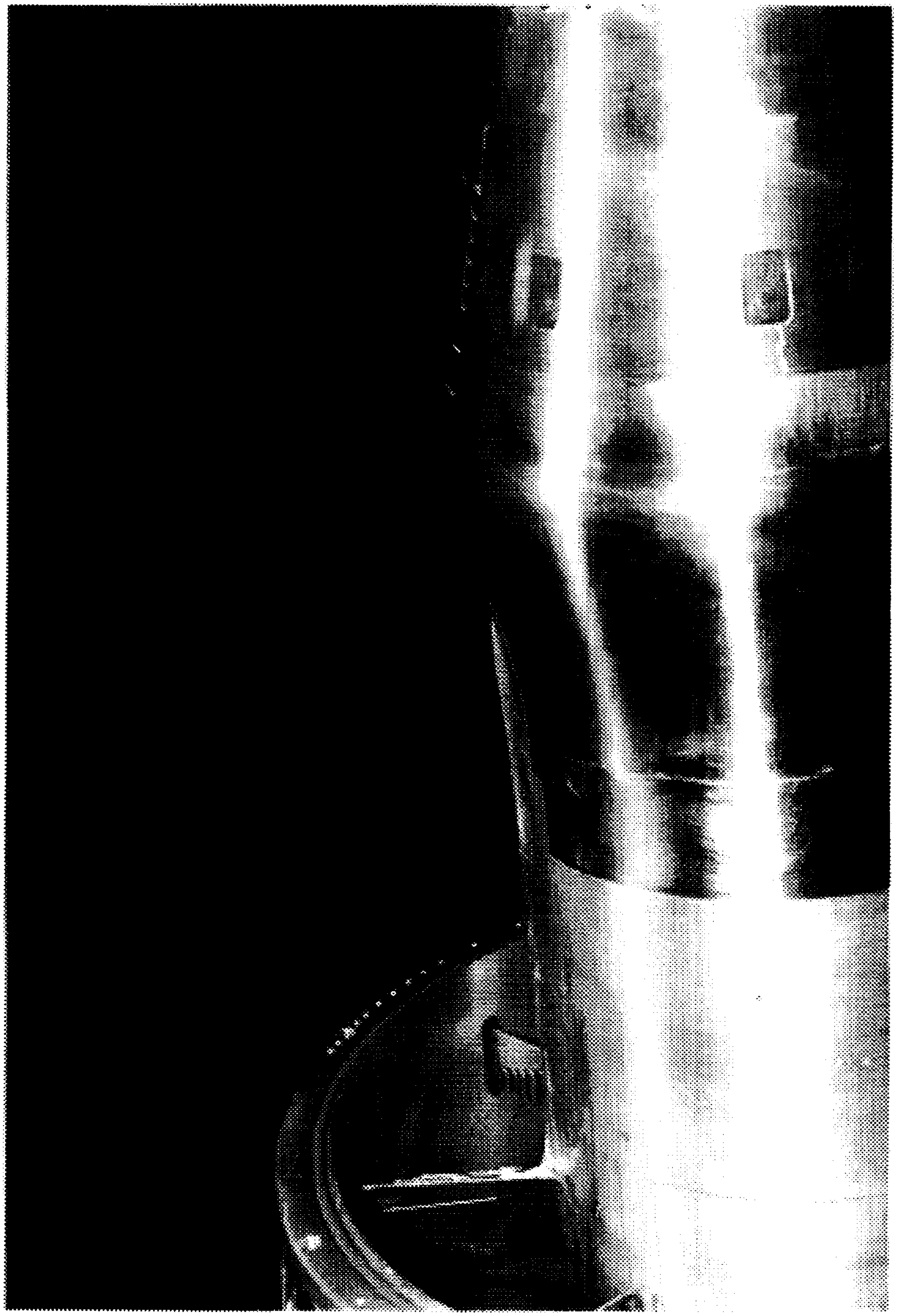
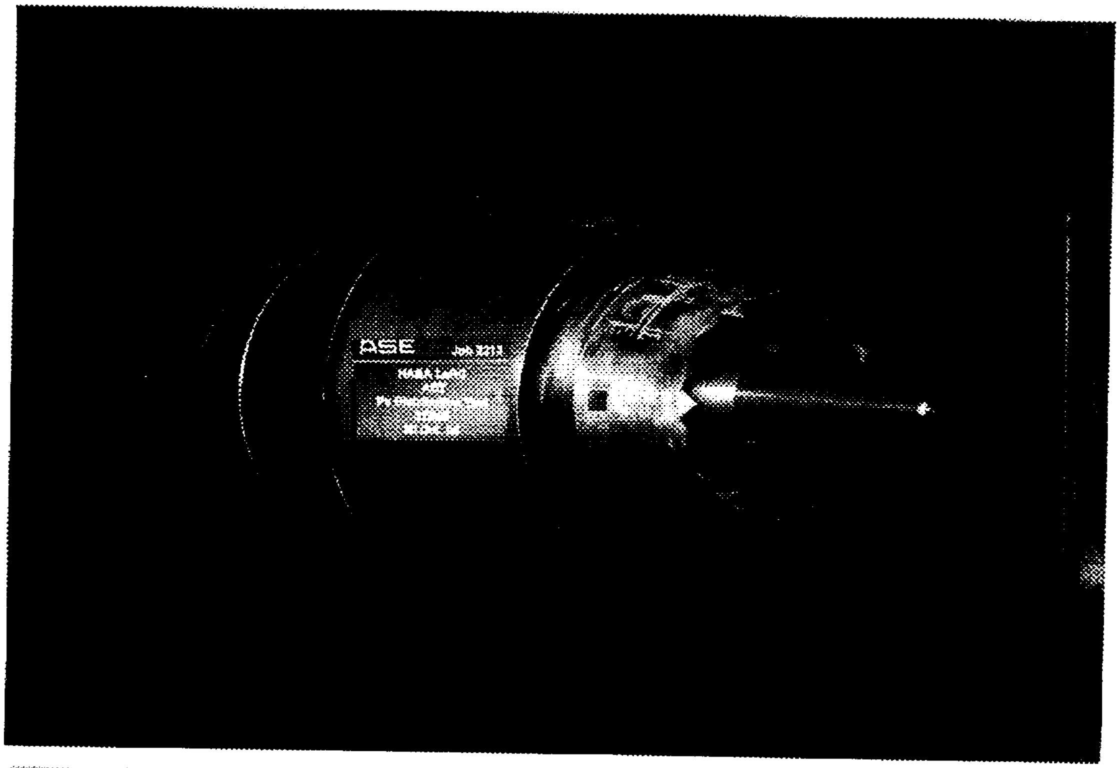
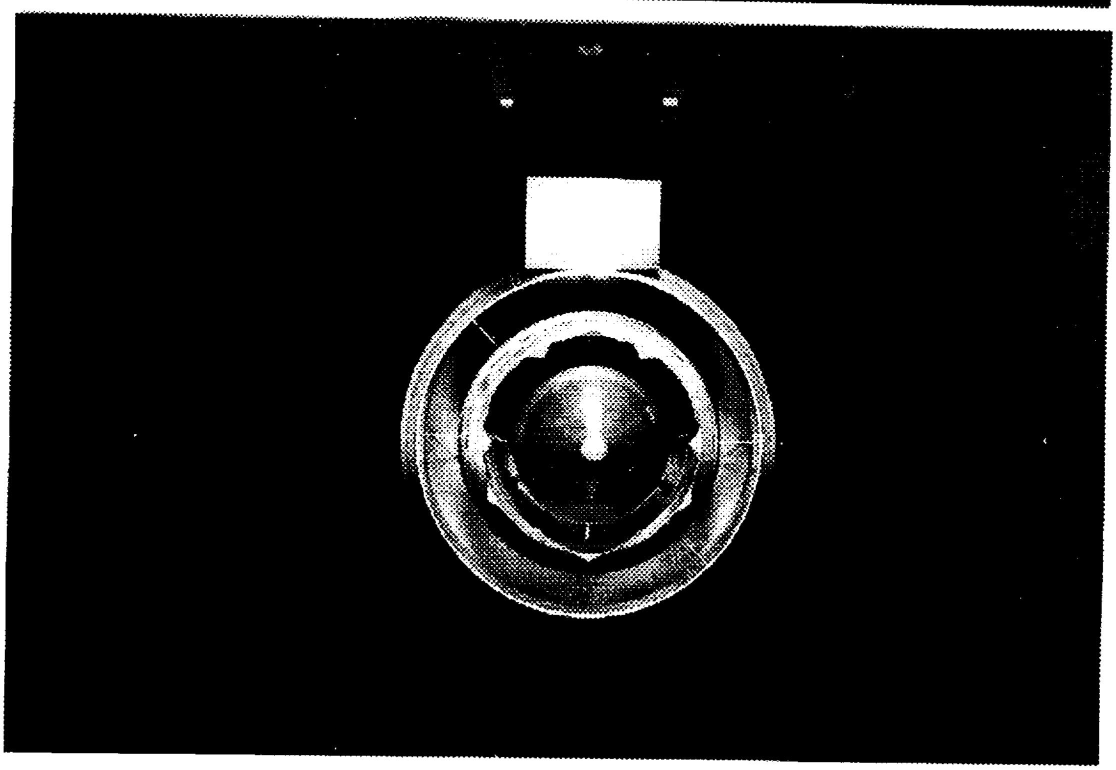


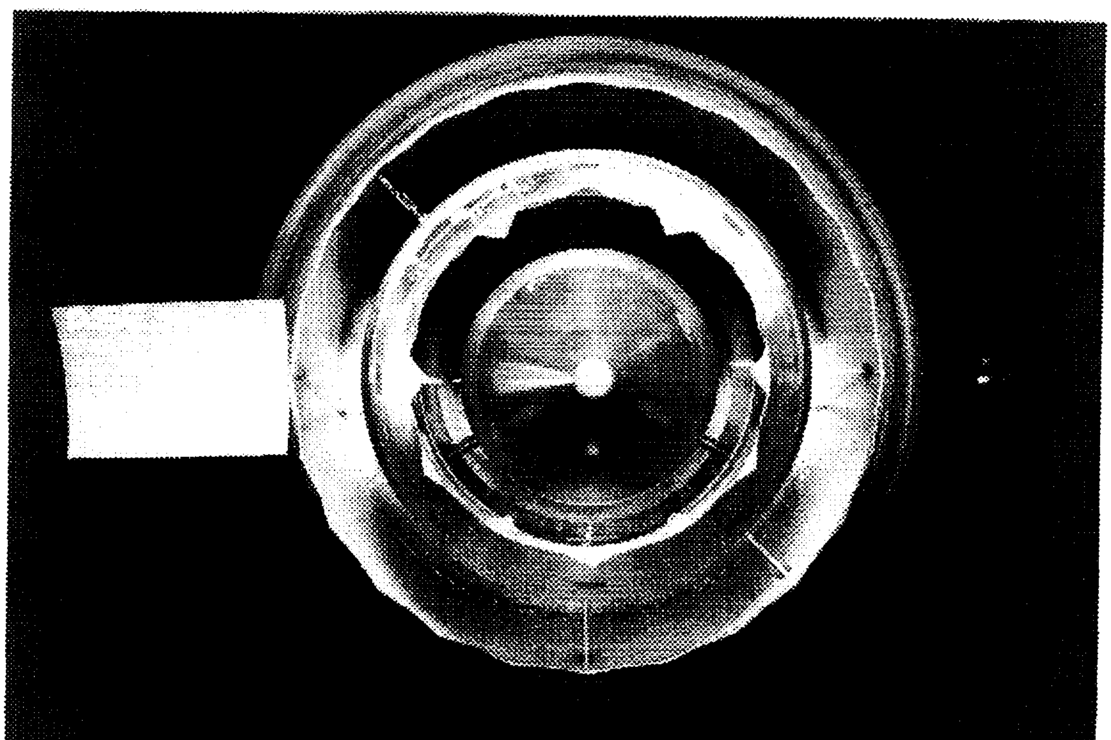

ASE
Job 2212
NASA LeRC
AST
Ps Distribution Test
3T24C
21 Oct. 98

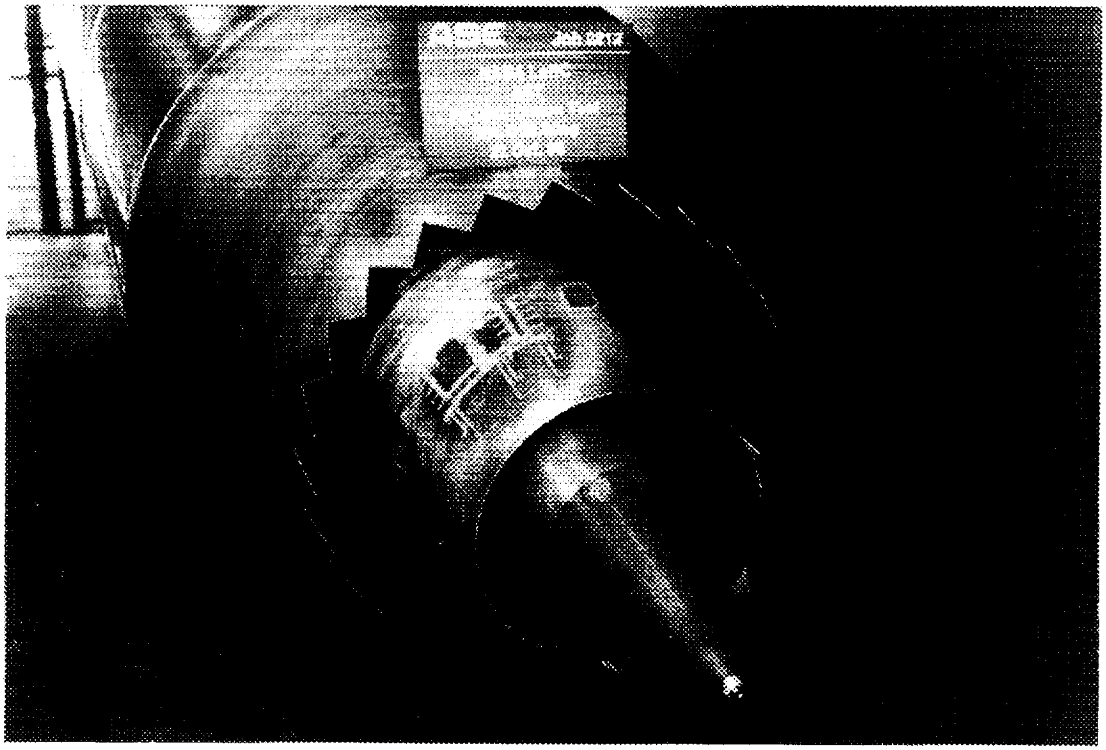

ASE
Job 2212
NASA LeRC
AST
Ps Distribution Test
3T24C
21 Oct. 98

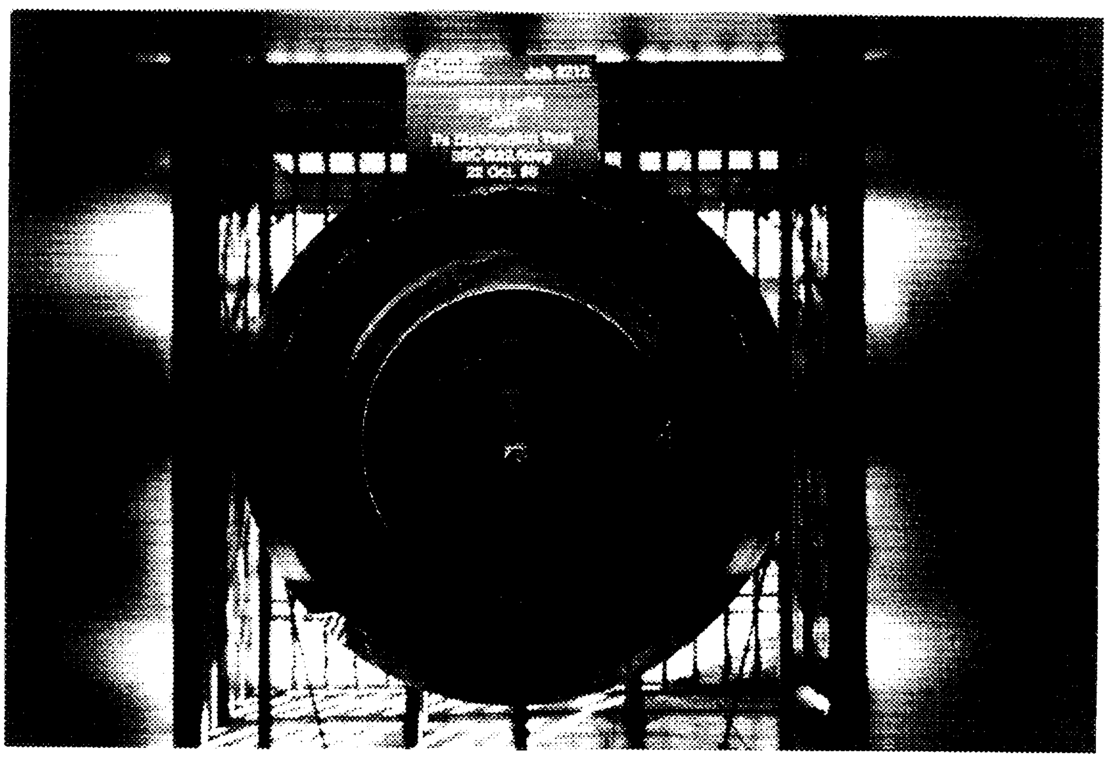


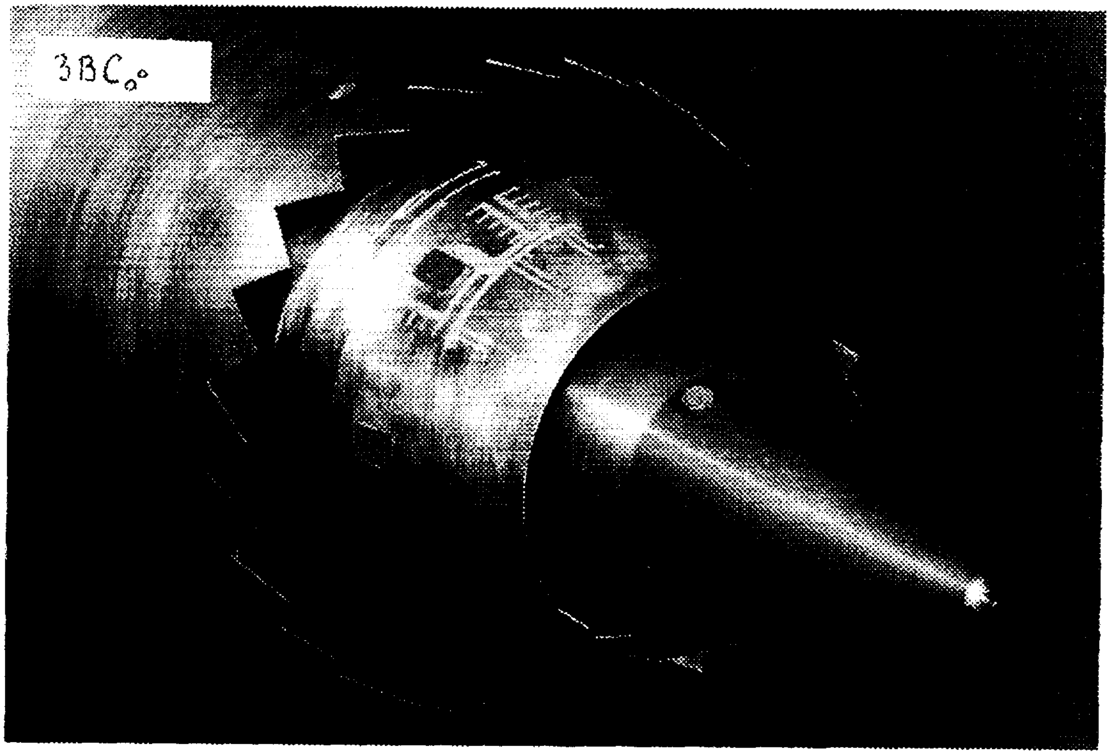


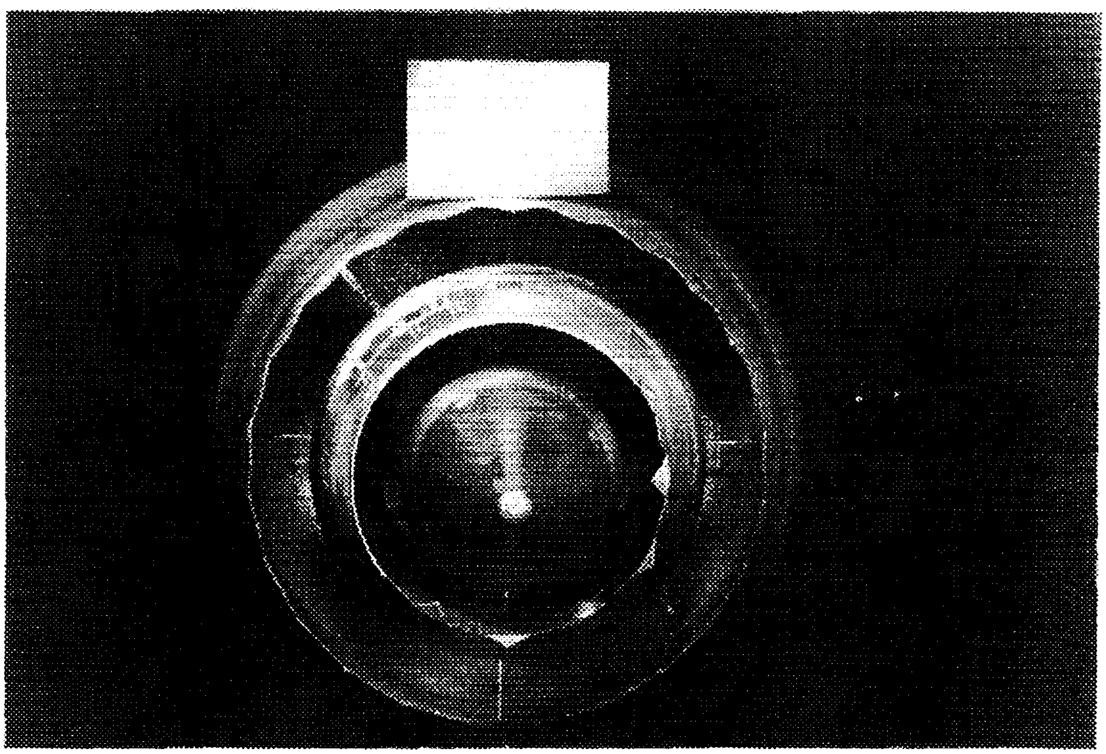

ASE
Job 2212
NASA LeRC
AST
Ps Distribution Test
3T24C@22.5deg

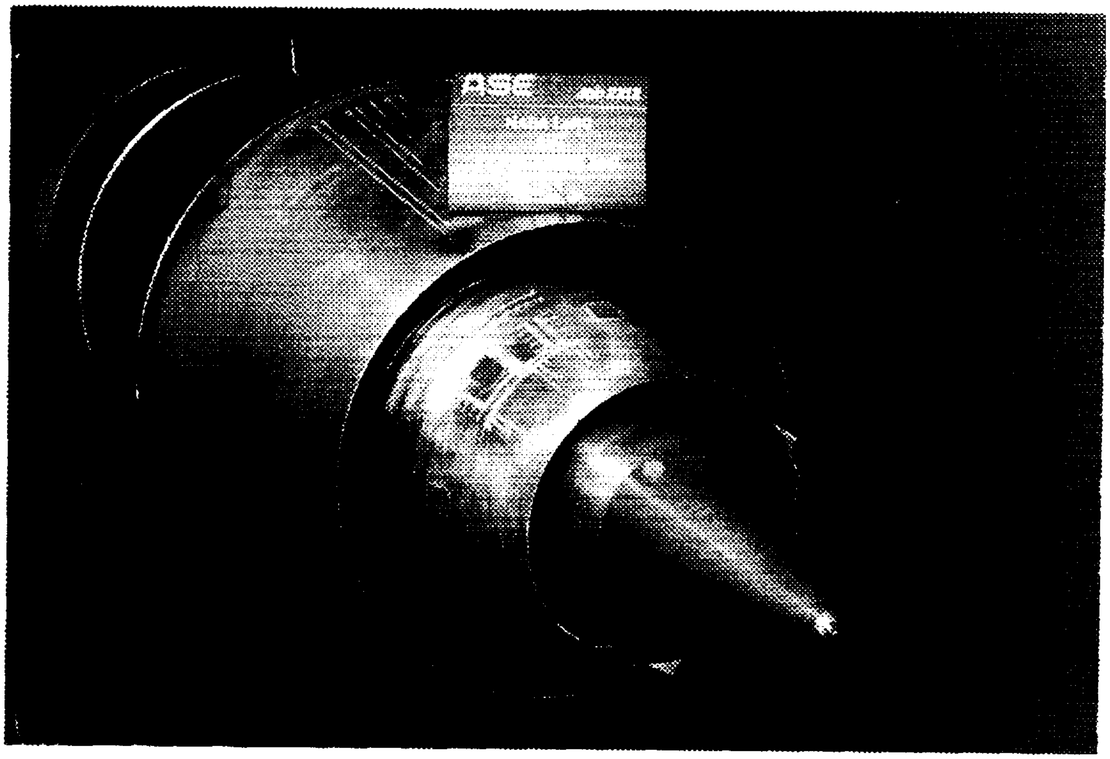


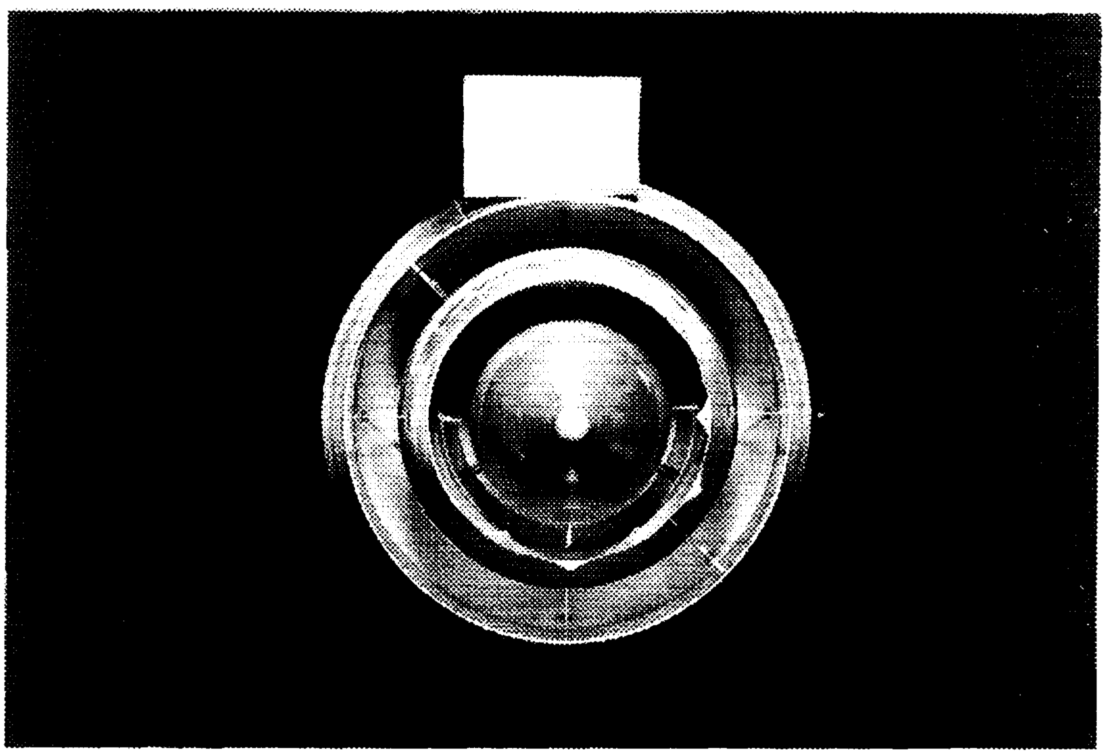





3BC$_{0°}$







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12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*
This report presents the results of cold flow model tests to determine the static and wind tunnel performance of several NASA AST separate flow nozzle noise reduction configurations. The tests were conducted by Aero Systems Engineering, Inc., for NASA Glenn Research Center. The tests were performed in the Channels 14 and 6 static thrust stands and the Channel 10 transonic wind tunnel at the FluiDyne Aerodynamics Laboratory in Plymouth, Minnesota. Facility checkout tests were made using standard ASME long-radius metering nozzles. These tests demonstrated facility data accuracy at flow conditions similar to the model tests. Channel 14 static tests reported here consisted of 21 ASME nozzle facility checkout tests and 57 static model performance tests (including 22 at no charge). Fan nozzle pressure ratio varied from 1.4 to 2.0, and fan to core total pressure ratio varied from 1.0 to 1.19. Core to fan total temperature ratio was 1.0. Channel 10 wind tunnel tests consisted of 15 tests at Mach number 0.28 and 31 tests at Mach 0.8. The sting was checked out statically in Channel 6 before the wind tunnel tests. In the Channel 6 facility, 12 ASME nozzle data points were taken and 7 model data points were taken. In the wind tunnel, fan nozzle pressure ratio varied from 1.73 to 2.8, and fan to core total pressure ratio varied from 1.0 to 1.19. Core to fan total temperature ratio was 1.0 . Test results include thrust coefficients, thrust vector angle, core and fan nozzle discharge coefficients, total pressure and temperature charging station profiles, and boat-tail static pressure distributions in the wind tunnel (in Data Appendix).

14. SUBJECT TERMS
Acoustic nozzles; Discharge coefficient; Exhaust nozzles; Jet thrust; Mixers; Nozzle flow; Nozzle efficiency; Nozzle thrust coefficient; Power efficiency; Propulsive coefficient

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