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(NASA-CR-147636) AN EXPERIMENTAL DETERMINATION IN CALSPAN LUDWIEG TUBE OF THE BASE ENVIRONMENT OF THE INTEGRATED SPACE SHUTTLE VEHICLE AT SIMULATED MACH 4.5 FLIGHT CONDITIONS (TEST IH5 OF MODEL 19-OTS)

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SPACE SHUTTLE

AEROTHERMODYNAMIC DATA REPORT

JOHNSON SPACE CENTER

HOUSTON, TEXAS

DATA MANagement services

SPACE DIVISION CHRYSLER CORPORATION

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AN EXPERIMENTAL DETERMINATION IN THE CALSPAN LUDWIEG TUBE OF THE BASE ENVIRONMENT OF THE INTEGRATED SPACE SHUTTLE VEHICLE AT SIMULATED MACH 4.5 FLIGHT CONDITIONS (TEST IH5 OF MODEL 19-OTS)

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Prepared under NASA Contract Number NAS9-13247

by

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for

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Houston, Texas

WIND TUNNEL SPECIFICS:

Test Number:	Calspan Ludwieg Tube I81
NASA Series Number:	IH5
Model Number:	19-OTS
Test Dates:	January 1974 to July 1974
Occupancy Hours:	1,152

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ABSTRACT

A model test program was conducted to determine heat transfer and pressure distributions in the base region of the Space Shuttle vehicle during simulated launch trajectory conditions of Mach 4.5 and pressure altitudes between 90,000 and 210,000 feet. Model configurations with and without the solid propellant booster rockets were examined to duplicate pre- and post-staging vehicle geometries.

Using short-duration flow techniques, a tube wind tunnel provided supersonic flow over the model. Simultaneously, combustion-generated exhaust products reproduced the gasdynamic and thermochemical structure of the main vehicle engine plumes. The chemical species in the exhaust of the orbiter engines were simulated using 3000 psi gaseous H_2/O_2 propellants and a combustion technique based on short-duration principles. The booster rockets used actual, high aluminum content, solid propellant representative of candidate solid rocket booster fuels.

ABSTRACT (Concluded)

Heat transfer and pressure measurements were made at numerous locations on the base surfaces of the 19-OTS Space Shuttle model with high response instrumentation. In addition, measurements of base recovery temperature were made indirectly by using dual fine wire and resistance thermometers and by extrapolating heat transfer measurements associated with special bases capable of being heated to 1000°F.

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INTRODUCTION

During its launch trajectory, the Space Shuttle will utilize clustered liquid rocket engines for orbiter propulsion in combination with large, solid rocket boosters at lower altitudes. The interacting exhaust plumes from these rockets will recirculate and produce a severe thermal environment in the base region of the shuttle vehicle. Because of the unconventional geometry of the base region with its unusual orbiter/external tank/solid rocket booster arrangement, analytical predictions of the exhaust-plume induced heating are extremely difficult to make, and sub-scale model testing has been employed to provide that information.

A test program (IH5) was conducted at Calspan Corporation to measure heat transfer and pressure distributions about the afterbody surfaces of a 1/45th scale model (19-OTS) of the Space Shuttle vehicle under conditions typical of the early launch trajectory. The early launch trajectory is defined as altitudes up to about 200,000 feet where the external flow field significantly influences the engine exhaust plume spreading, interaction, recirculation, and resultant base environment. Altitudes above and below the SRB staging altitude (nominally 140.000 feet) were simulated.

Over a simulated altitude range of 90,000 to 200,000 feet, data were obtained with heat transfer gauges, radiation gauges, gas temperature probes, and pressure transducers measuring pitot and static pressures. Reduced data from 98 test runs are tabulated in Appendices A and B.

NOMENCLATURE
General

SYMBOL	Computer SYMBOL	DEFINITION
		Tunnel Parameters
M_∞	MACH NO.	freestream MACH number
P_∞	PINF	freestream static pressure, psia
P_{ALT}		pressure at simulated model altitude, psia
P_o	POINF	freestream total pressure, psia
R_N	RE/FT	freestream Reynolds number, 1/ft
T_∞		freestream static temperature, ^oR
T_o	TOINF	freestream total temperature, ^oF
μ		viscosity, lb-sec/ft^2
		Base Heating and Pressure Parameters
DLR		dummy load resistor
K		thin film gauge sensitivity, ohm/^oF
	P	measured model base pressure, psia
	PC123	SSME combustion chamber pressure, psia
	PC4	left SRB combustion chamber pressure, psia
	PC5	right SRB combustion chamber pressure, psia
	PCL	model base centerline pressure: psia PCL = P_{10} on ET base PCL = P_{90} on orbiter base
$\dot{q}$	Q	total heating rate, BTU/ft^2-sec
	Q-R	radiant heating rate, BTU/ft^2-sec

NOMENCLATURE (Continued)

Base Heating and Pressure Parameters

SYMBOL	Computer SYMBOL	DEFINITION
R_G		pre-run thin film gauge resistance, ohms
R_L		thin film gauge line resistance, ohms
R_P		precision resistor used to calibrate thin film gauge signal conditioning system, ohms
R_S		thin film gauge circuit series resistor, ohms
	TOB	orbiter base heat shield temperature, ^oF
	TET	external tank base temperature, ^oF
δ		data trace deflection, cm
Δ		deflection of the square wave calibration signal due to the DLR, cm
		Gas Recovery Temperature Parameters
a		thermal diffusivity $\left(a = \frac{K_w}{\rho c}\right)$, cm^2/sec
a_o		thermal diffusivity at T_o $\left(a_o = \frac{K_{w_o}}{\rho_o C_o}\right)$, cm^2/sec
a_h		accomodation coefficient
a_1, a_2		coefficients that are a function of wire and gas parameters
A		wire cross sectional area, cm^2
c		wire specific heat, $cal/g\text{-}^oK$
c_o		wire specific heat at T_o, $cal/g\text{-}^oK$
D		wire diameter, cm
	Δe	thermocouple voltage output, mv

NOMENCLATURE (Continued)

Gas Recovery Temperature Parameters

SYMBOL	Computer SYMBOL	DEFINITION
R_{20^oC}		wire resistance at 20°C, ohms
	$R_{INITIAL}$	initial measured wire resistance, ohms
	ΔR	measured wire resistance change, ohms
	R_{TOTAL}	total measured wire resistance, ohms
s		dimensionless time parameter ($s=t/\tau$)
S_h		dimensionless gas function
t		time, sec
T		dimensionless temperature ($T = T_w/T_r$)
T_h		gas temperature, °K
T_o		initial wire temperature, °K
T_r		gas recovery temperature, °K
T_w		wire temperature, °K
$\bar{T}_w$		mean wire temperature, °K
X		distance along the wire, cm
α, β		thermal coefficients of resistance, ohm/ohm-°K
γ		ratio of specific heats
ϵ_w		wire surface emissivity
η		dimensionless length parameter ($\eta = X/L$)
π		constant
ρ		wire density, g/cm^3

NOMENCLATURE (Continued)

Gas Recovery Temperature Parameters

SYMBOL	Computer SYMBOL	DEFINITION
$g(s)_h$		dimensionless gas function
h	H	convective heat transfer coefficient, cal/sec-cm^2-^{o}K
I		wire current flow, amperes
K_w		wire thermal conductivity, cal/cm-sec-^{o}K
K_{w_o}		wire thermal conductivity at T_o, cal/cm-sec-^{o}K
L		wire length, cm
M		Mach number
P_h		gas pressure, N/cm^2
q_c		heat input to the wire from the gas, cal/sec
q_j		heat due to current flow, cal/sec
q_k		heat conduction to wire supports, cal/sec
q_{rg}		radiation from the gas, ergs/sec
q_{rw}		heat loss by radiation from the wire, cal/sec
q_s		heat accumulated in the wire, cal/sec
q_{wg}		heat gained by radiation from the gas, cal/sec
R		gas constant, cal/gm-^{o}K
R_a		dimensionless parameter a_o/a
R_o		wire resistance at T_o, ohms
R_w		mean wire resistance, ohms

NOMENCLATURE (Concluded)

Gas Recovery Temperature Parameters

SYMBOL	Computer SYMBOL	DEFINITION
ρ_o		wire density at T_o, g/cm^3
σ_o		wire resistivity at T_o ($\sigma_o = R_o A/L$), ohm-cm
σ_{sb}		Stefan-Boltzmann radiation constant, cal/sec-cm^2-$^oK^4$
σ_{20^oC}		wire resistivity at 20^oC, ohm-cm
τ		$\tau = \frac{\rho o C o L^2}{K_{w_o}} = \frac{L^2}{a_o}$, sec
	ΔT	change in temperature, ^oR
P_o'		stagnation pressure behind a normal shock, PSIA
T_B		base temperature, ^oK
h_B		base convective heat transfer coefficient, CAL/sec-cm^2-^oK
T_c		specific heat at constant pressures, BTU/Lb-^oR
Dex		external diameter
Dt		throat diameter
Din		internal diameter

REMARKS

In December, 1973 Calspan initiated Rockwell test IH5, which involved testing of the 0.0225 scale 19-OTS Space Shuttle vehicle model in the Ludwieg tube blow-down type wind tunnel that was at that time being developed for NASA. Testing, which was interrupted a number of times during the program due to a model fire accident* and other model and facility malfunctions, continued for several months and was finally completed on 3 July 1974 after Run No. 112b. Although not all of the attempted runs produced acceptable data because of various operational problems, the results from 98 runs appear valid and are consequently included in Appendix B. The operating conditions for each run with data reported herein are shown in Table I.

*During Run 2, significant damage was rendered to model hardware, and most of the base instrumentation was destroyed when H_2/O_2 combustion products were diverted behind the orbiter base after the spontaneous failure of the model's igniter adapter seal. The subsequent repair of the model included the installation of somewhat less than the full complement of desired sensors primarily because of the unavailability of sufficient pressure transducers.

In any discussion of the overall conduct of the tests, several points must be kept in mind. The Ludwieg tube facility (Figure 1 (e)), developed by a joint application of NASA and Calspan funds, had not been completely checked out at the start of the test program. Although the hardware had been finished and assembled, it was not operationally proven. Testing on the present program was initiated and pursued vigorously at that time in an attempt to meet data schedule requirements. Furthermore, the overall complexity of the total system being investigated (comprising four independently functioning subsystems: the Ludwieg tube, the orbiter engines, and two SRB engines) combined to make a good run a very difficult goal to realize. At the start of the program, the criteria for a good test run were not clear. As experience was gained in the operation of the model in the facility and in the analysis of the data, evaluation criteria were developed. In support of these criteria, a number of diagnostic runs were made during the program with the specific objective of establishing the validity of the test conditions encountered.

FLOW QUALITY CRITERIA

During the early runs of the test program, the pressure and heating rate data were characterized by unexpectedly high absolute levels and appreciable data scatter. A rigorous analysis of these data, by Mr. Dave Seymour (NASA/MSFC), indicated the existence of flow separation within the Mach 4.5 nozzle. (This was evident from the facility and model data.) Flow separation was related to difficulties in consistently maintaining an adequately low receiver tank pressure (i.e., nozzle back pressure) through the period immediately preceding the test firing. In that interval between the cessation of receiver tank pumping and the test firing (several seconds), leaks into the facility, principally associated with hardware modifications and installations implemented for this test, significantly increased the receiver tank pressure. The resulting high nozzle exit-plane pressures which existed during the initiation of airflow were attributed to the observed flow separation. After implementing repairs to correct the leakage sources, testing continued satisfactorily, and, except for one or two occasions, separated flow within the Mach 4.5 nozzle was not observed.

As a result of the nozzle flow separation experience, two criteria were established to partially assess the air flow quality. These involved the measurements of the static pressure on the internal surface of the nozzle near the exit plane (P_{exit}) as well as the side-wall exit static pressure on the nozzle exterior (P_{NSW}). The latter is, of course, indicative of the ambient pressure surrounding the nozzle exit plane. All test program runs were evaluated relative to the following standards:

$$\frac{P_{NSW}}{P_{EXIT}} \leq 1.7^{*}$$

$$\frac{P_{EXIT}}{P_{\infty}} = 1.2^{**}$$

Test runs which deviated from these criteria were either disqualified or considered highly suspect.

*This expression is a common "rule-of-thumb" ratio used in the rocket industry and states that a nozzle may overexpand to a pressure on the order of 1/1.7 (~ 60%) of the ambient pressure without separating. Various other sources may report the ratio to have an upper limit between 1.5 and 2.0 (probably depending on specific test conditions and rocket configurations).

**The factor of 1.2 is derived from the expected theoretical difference between P_∞ and P_{EXIT} since, because of the foreshortened nozzle, the latter is measured at a location in the flow field where the flow has not fully expanded to the test section conditions.

FLOW DIAGNOSTIC STUDIES

Several times during the test program, diagnostic runs were made to assess the quality of the flow and determine the timing of test section flow breakdown relative to routinely observed model and tunnel sensors. One of the early diagnostic studies involved the use of a pitot pressure survey rake located behind the model to evaluate flow blockage effects with and without firing the SSME engines. Three probes were installed on a support which extended horizontally from the receiver tank wall to the test section centerline. All pitot measurements were made within the free jet test rhombus. At the axial station of the probe tips, this space was calculated to be defined by an approximately 20 inch radius. Five runs (designated D-10 through D-14) were made and the measurements are summarized in Figure 8. Although the free stream total pressure varied somewhat during these runs, depending on the simulated altitude (P_o) and whether or not the SSMEs were firing, the flow was observed to be essentially undisturbed (at approximately Mach 4.5) beyond a radius of about 18 inches from the centerline for all test conditions. This indicates that the OT configuration model does not induce any recognizable tunnel blockage effects. Flow breakdown time, as recognized by high pressure disturbances at the pitot probe locations, agreed within ±3 ms with the observed disturbances at the nozzle exit plane (P_{NSW}, P_{exit}) and at the model bases (P_{10}, P_{90}). Model heat transfer and pressure measurements responded adequately to the external flow and SSME firing, and the model data displayed steady levels of sufficient duration to allow the collection of valid data.

Upon completion of the test program, further investigation was made with more extensive test section diagnostic instrumentation. Although this investigation was performed subsequent to the test program, the relevance of the results to the interpretation of the test data warrants a detailed discussion of the investigation.

The model and tunnel were partially re-instrumented as follows. A pitot pressure probe was mounted on the orbiter's manipulator fairing approximately 13 inches aft of the orbiter nose. In addition, two pressure-instrumented "static-pipe" probes were installed parallel to the flow. One probe was installed 8 inches above the manipulator fairing and extended about 20 inches into the Mach 4.5 nozzle. A slender conical nose was employed on the pipe to minimize bow shock disturbances. The following instrumentation was provided:

REMARKS (Continued)

(1) Static pressure tap at the nozzle exit plane (within the the test rhombus).

(2) Static pressure tap located above the pitot sensor on the manipulator fairing.

(3) Static pressure tap above the orbiter base heat shield.

(4) Rear-facing pitot pressure approximately 4-1/2 feet behind the heat shield (outside the test rhombus).

The second "pipe" was attached to the external tank above the left BSRM and extended downstream into the receiver tank. To minimize bow shock disturbances. it was provided with a blunt nose positioned near the BSRM and orbiter noses. Instrumentation on this second probe included:

(1) Three forward-facing pitot sensors located beneath the left wing of the orbiter (one in line with the manipulator fairing pitot, another approximately 8 inches further downstream, and the third approximately in line with the base heat shield).

(2) Static pressure tap approximately 17 inches downstream of the heat shield.

(3) Static pressure tap approximately 4-1/2 feet behind the heat shield (at the same axial location as the rear-facing pitot on the upper "pipe"-probe).

REMARKS (Continued)

Of the five diagnostic runs (number 4 through 8) made with the Mach 4.5 nozzle, Runs 4 and 6 (140,000 feet nominal simulated model altitude) were useful for discerning the flow quality in the Ludwieg tube. Run 4 was performed to investigate the flow during operation (firing) of the complete OTS configuration in a supersonic airstream. Run 6 was made to observe the effects without any rocket flow. A discussion of these runs is presented in the following paragraphs. During Run 5 (model firing only, no external flow) an early SSME firing filled the receiver tank to the extent that when the steady BSRM flow was established, the test section altitude was altered sufficiently to invalidate direct comparison with Runs 4 and 6. Run 7 flow measurements were affected by significant electrical disturbances which resulted in the loss of most of the data. Run 8, an attempt to repeat the previous run, was at first considered useful; however, more specific analysis of the data disclosed the likelihood that the Mach 4.5 nozzle flow may have been separated at the time of data collection as evidenced by higher than expected nozzle exit plane and test section static pressures. The E/T nose pressure data (i.e., P_o'), on the other hand, was indicative of the expected Mach 4.5 flow.

The data for these diagnostic runs, although not reported herein, remain on file at Calspan.

An analysis of diagnostic Run 4 did not indicate that the flow field about the model had been influenced by facility limitations.

REMARKS (Continued)

Static pressure measurements within the test rhombus were in good agreement with the expected free stream static pressure P_∞.

Pitot pressure measurements under the left wing and above the manipulator fairing as well as both the orbiter and external tank base pressure taps (P_{10} and P_{90}) were observed to indicate similar pressure levels (~ 3X the static pressure in the test section). These measurements support the premise that the rocket plumes induce flow separation at the base of the model since the pressures within such a separated region would not otherwise be expected to be higher than P_∞. Further, the essentially uniform pressure and absence of gradients throughout the base region are indicative of separated flow.

During this run, the manipulator fairing pitot pressure measurement provided a very dramatic history of the development of the flow about the model. During the airflow start transient, the fairing pitot pressure responded in a manner similar to the E/T nose pressure (P_{208}). After an initial starting peak, the fairing pressure steadied to a value of about 80% of the free stream P_o' (as measured by P_{208}), reflecting the stagnation pressure losses across the bow shock. Shortly after the establishment of the BSRM flows, the fairing pressure decreased substantially and rapidly to a stabilized level which was in agreement with the base pressures, as previously discussed. During this period of flow adjustment at the aft end of the model, static pressure measurements within the test rhombus (particularly above the manipulator fairing pitot and above the orbiter base) remained steady, thereby implying that pressure changes in the base regions were not a result of disturbances propagating back into the free jet flow from the receiver tank boundaries.*

*It has been suggested that wave reflections and/or receiver tank filling processes might be responsible for flow field alterations which are not representative of flight conditions.

Another interesting observation was made concerning the static pressure approximately 4-1/2 feet behind the model. The pressure at that location was seen to rise steadily after the BSRM flow was initiated. It is likely that the phenomenon is related to the interaction of the BSRM plumes since the pressure rise was not reflected in the model base measurements or any of the test section pressures and there is no other evidence to support the contention that the rise was associated with a breakdown or alteration of the test section flow.

A review of the pressure records was made to determine the time at which the test section flow did breakdown due to the wave dynamics and "filling" process in the receiver tank. The breakdown phenomenon was identified as an interruption of the established steady pressures by a sudden pressure increase characterized by large oscillations. Since it was desirable to relate any correlation derived from this diagnostic run to the data, it was appropriate to use the routinely recorded nozzle side-wall pressure as a reference. Flow breakdown time in the test section in proximity to the model base was noted to occur approximately 3 ms prior to its detection at the Mach 4.5 nozzle lip. It is concluded, therefore, that the nozzle side-wall or exit plane pressure measurements are good indicators of the breakdown event in the test section.

Inspection of the data from diagnostic Run 6 shows the static pressures above the model as well as the model base pressures to be in good agreement with the expected test section static pressure. Pressures in the test section and around the model base remained relatively constant until the reflected tank filling wave interrupted the external flow. Time from first flow into the receiver tank to flow breakdown was 44 ms for the OT configuration compared to the 32 ms duration noted for the same test conditions but with OTS operation (diagnostic Run 4). The arrival of the flow breakdown wave was detected at the model base approximately 3 ms prior to its arrival at the Mach 4.5 nozzle exit plane. Test section static pressures were, however, seen to degrade approximately 7 ms before the disturbance was noted at the exit plane.

THIN-FILM GAUGE TOTAL HEATING RATE.

Absorptivity of the standard thin-film heat transfer gage varies with the wavelength of the incident radiation. Thus, a knowledge of the spectral character of the incident radiant flux is required to accurately correct the measured heat transfer rate (which consists of both a convective and radiative component) to the absolute heating level. From previous measurements of the radiation from exhaust plumes of scale model rockets, it has been determined that a substantial portion of emitted energy is concentrated in the 1 to 6 μ infrared region (Reference 3). This was verified with measurements of the plume radiance from a single BSRM.

The determination of total incident heating rate (or convective heating rate only) involves the application of correction factors to properly account for (1) the gage and radiative source spectral characteristics and (2) knowledge of the radiative transfer "view factor." The information required to establish a correction factor for the former is provided in Figure 2. On the other hand, the determination of the "view factor" (a function of the sizes, spatial separation and relative orientation of the radiating source and sensor) requires an intimate knowledge of the plume shape, model geometry, the effects of shadowing and the like. Furthermore, because the standard thin-film sensors on the model were much more numerous than the radiation sensors (that is, side-by-side gage pairs were not available), the correction of most of the standard gage data requires estimations of local incident radiation heating levels. Such estimates are often determined from interpolation or extrapolation of radiation gage data from adjacent parts of the model and should be based on a thorough study and interpretation of the data. Since providing a detailed analysis of the base heating data was beyond the scope of the present program, the standard, thin-film, heat-transfer gage data included in this report have not been corrected for such factors and are presented directly as measured.

THIN-FILM GAUGE EROSION

Heat-transfer gage erosion due to impingement of solid particles from the BSRMs was experienced during the test program. When necessary, the indicated model heating rates were corrected for this gage erosion. Early in the test program, gage resistance changes were encountered which were initially attributed to erosion. Subsequently, it was discovered that the resistance changes were due to corrosion of the silver tabs at the ends of the platinum element. Thereafter, the tabs were protected with a thin epoxy coating. All of the early data were recomputed to exclude the initial adjustment for erosion effects.

CONFIGURATIONS INVESTIGATED

The 19-OTS model hardware was developed in accordance with Space Shuttle configuration 2A drawings specified in Reference 1.

The test model consisted of the orbiter vehicle located atop the external propellant tank as illustrated in the tunnel installation photographs, Figures 1(a) and 1(b). The booster solid rocket motors were attached to the sides of the external tank to simulate the pre-staging or launch configuration of the Space Shuttle. This composite configuration was designated OTS (i.e., Orbiter-Tank-Solid Rocket Boosters). Following the same convention, the post-staging configuration, consisting of the orbiter and external tank only, was designated OT.

Important model features and internal composition are illustrated in Figures 1(c) and 1(d). The orbiter consisted of a scaled fuselage, vertical tail, simplified (delta planform) slab wings, a body flap and the Orbital Maneuvering System (OMS) pods. Within the orbiter was an integral, fast-acting bipropellant valve (or autovalve, A/V), flow metering venturis, and an injector/combustion chamber common to the three Space Shuttle Main Engine (SSME) nozzles. In the combustion chamber, gaseous H_2/O_2 propellant was burned to closely duplicate the full scale SSME combustion products at a nominal 1500 psia pressure* and 6000°R temperature. A set of fixed-angle nozzle adapters was provided to simulate gimballing of the SSME nozzles. The simulated OMS nozzles did not fire but were instrumented to determine engine-off heating rates. Instrumentation was also installed at numerous locations on the base heat shield, body flap, OMS pods, and SSME and OMS nozzle outer walls as indicated in Figure 3.

*It should be noted that whereas the full-scale SSMEs operate at a combustor pressure of 3000 psia, the present model design was purposely restricted to only one-half this value for two reasons: (1) heat sink cooling of the ~0.25-inch SSME nozzle throats would have been impractical at any higher pressures and (2) the gaseous oxygen supply pressures in excess of 3000 psia which would have been required were considered too hazardous for the routine testing operations envisioned for this model.

The External Tank (E/T), a heavy walled cylinder approximately seven inches diameter by four feet long, contained the gaseous H_2 and O_2 at 3000 psia in internal, double-pass, spiral charge tubes. The H_2 and O_2 supply tubes were separated by an integral solid section through which instrumentation leads and gas plumbing passed from the strut to the orbiter body. The E/T included a removable base dome in which were placed heating rate and pressure sensors.

The model Booster Solid Rocket Motors (BSRM)* functioned to provide the additional hot gas plume environment typical of the early launch trajectory. Solid propellant (approximately 0.050 inch thick), cemented onto expendible propellant holders, was burned in the motor cases. High aluminum content propellants, with combustion temperature ($\sim 5000^{\circ}F$) and exhaust species similar to candidate Space Shuttle solid fuels, were utilized. An analysis of the exhaust products for the two solid propellants used during this program is presented in Table IV.

Mylar diaphragms located just upstream of the BSRM nozzle throats confined a charge of gaseous ethylene/oxygen which was used to effect rapid, uniform ignition of the solid propellant surface. The ignition gases were introduced into the BSRM cavities through passages in the E/T. A lateral cross-drilled hole through the E/T provided communication between the two BSRMs to encourage pressure balancing between the combustors. Nominal operating pressure was 290 psia.** The motor cases attached to the outer surface of the external tank and were readily removed to simulate the post-staging vehicle configuration.

*Also often referred to as Solid Rocket Boosters (SRBs).

**This value is one-half of the full-scale average steady-state combustion pressure of $\sim$580 psia for consistency with the 50% of full-scale operating pressure of the orbiter SSMEs.

The external lines of the reusable rocket motors duplicated the full scale boosters including the conical nose, aft E/T-BSRM attachment ring, aft nozzle shroud and canted nozzle. Numerous pressure and heat transfer sensors were located on the shrouds. Adapters were provided to effect changes in the nozzle gimbal angle.

The entire model assembly was strut mounted to the receiver tank floor. All model load lines and instrumentation leads were routed through the strut to appropriate bulkheads on the facility walls. Provisions to pitch the model $\pm 10^{\circ}$ were incorporated in the strut/floor bracket hardware, although this feature was not utilized during the test program.

CONFIGURATIONS INVESTIGATED (Concluded)

Table III summarizes dimensional data for the 19-OTS model configuration. The model deviated from true scale in a few instances: namely, (1) the external tank was made approximately six (scale) inches longer than the actual vehicle in order to accommodate the H_2 and O_2 charge tubes, (2) there were solid fairings between the external tank and orbiter and the external tank and BSRMs rather than the open areas which exist on the full scale Shuttle, and (3) the simplified planform wing.

A complete listing of all model instrumentation locations is provided in Figure 3.

INSTRUMENTATION

Heat Transfer Gages

Thin-film heat transfer gages (References 2-4) were employed for the measurement of model surface heating rates. The sensing elements are thin (order of 0.1 micron) platinum resistance thermometers fused onto the surface of pyrex substrates. The thin-film heat-transfer gage operates on the principle that the film thickness is much smaller than the characteristic thermal diffusion depth for the short duration of the test event. Thus, the temperature gradients and heat capacity of the film may be neglected, and the instantaneous film temperature can be said to be equal to the instantaneous substrate surface temperature.

The resistance elements are coated with a dielectric film (i.e., M_gF_2) which provides the following beneficial characteristics: (1) it affords mechanical protection for the element, (2) it improves electrical stability of the element by sealing against the ambient environment, (3) it provides electrical isolation from ionized gas flows, and (4) it provides higher absorptivity to radiant heat flux than can be obtained with uncoated surfaces. Loss of gage response due to the presence of the coating (approximately one micron thick) is negligibly small.

During operation, the temperature induced resistance change of the platinum element is sensed electrically. The electrical signal is fed to an analog network (known as a "Q-meter") which converts the indicated surface temperature in real time to an instantaneous heat-transfer rate by employing the theory of linear heat conduction to an infinite slab (References 2 and 5). This conversion is applicable over a wide range of test conditions, if proper account is taken for gage resistance changes due to erosion, variations in the physical properties of the substrate with temperature, and nonlinear gage sensitivity at elevated temperature (Reference 3).

Three types of heat transfer gages were employed during the test: standard, radiative, and high temperature gages. The physical construction of the first two gage types is similar. The ends of the platinum sensing element are electrically connected to the back of the substrate by silver film deposited on the pyrex. The lead wires are soft soldered to the silver on the back of the gage. A different construction is required for gages used at elevated temperatures. The differences between the three types of gages are described in more detail in the following paragraphs.

Standard Gage

The standard heat transfer gage consists of a platinum film fused onto the surface of the pyrex substrate which, in turn, conforms to the local contour of the model. This gage is sensitive to the entire convective heat flux as well as a portion of the radiative flux. The amount of incident radiation sensed by the gage is a function of its spectral absorptivity as well as the spectral radiance of the energy source. Figure 2 demonstrates the typical absorptivity characteristic in the infrared wavelength region between 1 and 7 μ.

Radiative Gage

The radiative heat transfer gage consists of a standard gage upon which a thin coat of aluminum black has been deposited. The coated gage is mounted within a holder and isolated from convective heating by a sapphire window which has excellent transmittance in the wavelength interval of interest and also protects the relatively fragile black coating. Radiation gages of this type have essentially uniform spectral absorptivity of about 0.85 over the 1 to 6 μ wavelength range (Reference 3, see Figure 2).

High Temperature Gage

In addition to the standard and radiative heat transfer gages used routinely for model measurements, a special gage suitable for the measurement of heat transfer to heated surfaces has been developed by Calspan (Reference 3). This gage overcomes the temperature limitations of the standard variety by eliminating the silver leads and soft-solder connections to the platinum element. Instead, platinum wires were fused into the pyrex substrate and the platinum film is fired directly between the leads whose terminals are made flush with the substrate surface. The electrical characteristics of the high temperature gage are nominally the same as those of the standard gages. Applications are limited to sustained temperatures of no more than 1000°F because of incipient softening of the pyrex substrate.

Pressure Transducers

Model surface and tunnel pressure measurements were made using high frequency response transducers (References 2 and 6). These devices employ lead-zirconium-titanate piezoelectric ceramics as pressure sensitive energy sources and include integral field-effect-transistor (FET) circuits for power amplification and impedance matching. The complete transducers are typically 0.37 inch in diameter by 0.23 inch thick. Units with nominal sensitivities of 2000 mv/psi (0-2.5 psi range) and 50 mv/psi (0-100 psi range) were used. Typically, transducer sensitivities are linear to within ±2% throughout their respective ranges. To provide acceleration compensation, a second integral, but pressure insensitive, diaphragm/piezoelectric crystal unit is wired in opposition to the active unit. This design reduces acceleration sensitivity to nominally 0.00015 psi/g and 0.0004 psi/g, respectively, for the low range and high range transducers. To further reduce acceleration effects, where model locations permit, the transducers were mounted on individual, spring-suspended, seismic masses and connected to the model pressure sensing orifice with soft rubber tubes. In order to minimize temperature induced effects on the transducer diaphragms, copper heat shields were installed to provide line-of-sight shielding from radiant or hot gas sources.

Propellant flow passage and combustion chamber pressures in both the orbiter and the BSRMs were sensed with commercial*, fast-response, piezoelectric pressure transducers. Protection of the transducer from the hot combustion gases was provided by a thin layer of RTV** over the diaphragm, a heat shield, and a devious path orifice arrangement. Appropriate impedance matching of the transducers was provided by external charge amplifiers.

To supplement the available Calspan transducers in fulfilling the model pressure sensor requirements, a number of Calspan-fabricated low pressure transducers utilizing a commercial pressure-sensitive transistor*** as the sensing element were used in the initial tests. These sensors proved inadequate primarily because of their lack of acceleration compensation. After appreciable trial under actual test conditions, attempts to record data from these units were abandoned.

* Kistler Instrument Corporation, Clarence, New York

** Room Temperature Vulcanizing rubber

***"Pitran," manufactured by Stow Laboratories, Inc.

Gas Temperature Probes

Thin wire, resistance thermometer probes, developed by Remtech, Inc., were provided for the measurement of recovery temperature. These probes consisted of two parallel, small diameter platinum-10% rhodium wires of different lengths (1 and 2 mm) supported within the flow field on needle-like prongs. A thermocouple junction and associated leads are integrally built into one of the support needle pairs for each wire. The probe functions on the basis of obtaining sufficient information to evaluate two unknown quantities of the heat balance equation for the wires: namely, the heat transfer coefficient and the recovery temperature. Probes were fabricated in lengths of 3/4-inch, 1-1/4 inches, and 4 inches to provide flexibility and facilitate use in different model locations. A complete description of the probes is provided in Reference 7. Descriptions of gas temperature probes, their use, and the resultant data presented in this report were taken directly from Reference 7.

TEST FACILITY DESCRIPTION

A short-duration tube wind tunnel (Ludwieg tube) (Reference 8) provided aerodynamic flow about the test model to simulate specific regimes of the Space Shuttle launch trajectory. Figure 1 (e) depicts the facility and identifies its main components.

In operation, air is initially loaded into the 42-inch diameter supply tube and contained by a mylar diaphragm located just upstream of the nozzle. To initiate airflow, the diaphragm is cut by mechanical means. A centered expansion wave then propagates upstream in the supply tube and accelerates the test gas to a steady velocity. The gas expands through the nozzle into the initially evacuated receiver tank. Meanwhile, the expansion wave in the supply tube propagates upstream at acoustic speed. The nozzle supply conditions remain constant and flow is steady until that wave, reflected from the upstream end of the supply tube, returns to the nozzle inlet. A schematic diagram of this operation is shown in Figure 1(f). For the 60-foot long supply tube, steady nozzle inlet conditions are maintained for approximately 90 milliseconds (ms) when the test gas is ambient temperature air.

Air expanding through the nozzle into the receiver tank provides the desired ambient test conditions in the free jet test section at the nozzle exit. The test flow of air continues downstream in the receiver tank at high velocity until it is brought to rest when it encounters the receiver tank end wall. The incoming test gas develops a stagnated volume at the end wall, which continues to grow in the unconstrained upstream direction. A shock front (i.e., the interfacial boundary between the incoming high velocity test gas and the stagnated gas) thus propagates upstream until it encounters and (usually) breaks down the test section conditions established by the nozzle flow. Prior to testing, flow breakdown time in the receiver tank was estimated to be approximately equal to the supply-tube wave time for the external flow conditions of this program.

In order to effect a more reasonable simulation of the Shuttle flight trajectory conditions, the supply-tube gas charge was heated during its residence in the charge tube. Strip heaters, covered with high temperature insulation, were distributed uniformly on the outside surface of the tube. The heating system provided the capability of raising the wall temperature to 600°F. Separate "on-off" temperature controllers, with adjustable setpoints, were used to control the longitudinal temperature distribution. One effect of heating the gas in the supply tube was to reduce the time during which steady pressure is available at the nozzle inlet from approximately 90 ms for ambient temperature gas to about 65 ms for gas at 600°F.*

*That is, because of the higher sound speed in the hot air, the expansion wave velocity is greater.

To maintain the pre-run strength and integrity of the mylar diaphragm, a water cooling system consisting of internal and external jacket coils was installed at the diaphragm station. Pre-run air temperature in the portion of the supply tube just upstream of the diaphragm was consequently reduced to 300 to 400°F. Although this environment proved suitable for diaphragm survivability, it also produced an axial temperature gradient in the supply tube air charge. Thus, as the "test slug"* of supply-tube gas passed through the nozzle and expanded into the test section, the test condition total temperature varied accordingly.

*Volume of supply-tube gas exhausted through the nozzle during the period of steady flow.

The Mach 4.5 nozzle, fabricated of glass-reinforced polyester resin, was contoured to provide uniform, parallel test section flow. In order to comply with existing facility length constraints, the final four feet of the theoretical full-expansion length was omitted (see Figure 1(g). The resulting maximum free jet test rhombus diameter was somewhat smaller than the nominal five-foot exit diameter of the nozzle. Ambient temperature airflow tests for an appropriate range of reservoir pressures verified that the flow was repeatable, uniform and symmetrical across the exit plane (Reference 9).

TEST PROCEDURE

INSTRUMENTATION CALIBRATIONS

The calibration methods utilized at Calspan are described in detail in References 2 through 4 and 6 along with the theoretical considerations from which they are derived. Calibration records are maintained at Calspan. However, the following comments are appropriate with respect to their application to the test.

Pressure

Prior to the start of the test program, all Calspan pressure transducers used in the model were pneumatically calibrated with a series of step pressure inputs covering the anticipated range of usage. The voltage output variations of the transducers were typically linear within ±2%.

The Kistler pressure transducers used for combustion-chamber pressure measurements were dynamically calibrated prior to the test program by means of a high pressure pneumatic calibration system. Linearity was again typically well within the nominal ±2% bandwidth.

Heat Transfer

The standard calibration procedure for a thin-film heat transfer gage is explained in detail in Reference 3. First, its resistance is measured at two temperatures in order to obtain the gage's temperature sensitivity $K = \Delta R/\Delta T$. This information along with a corresponding pre-run gage resistance is used to determine the value of a shunt resistor known as the Dummy Load Resistor or DLR. The DLR is used, in turn, to scale the gain of the recording equipment by approximately simulating the expected heating rate.

Recording System

A complete gain calibration of each oscillograph recording channel with its associated conditioning amplifier was performed prior to the start of the test program. Routine checks during the course of the test program disclosed no appreciable variations (i.e., drift or fluctuations). Oscilloscope records were usually calibrated prior to each run using a precision voltage source.

Gas Temperature Probes

Prior to installing a probe on the model, the thin wires were soldered to the probe tips and a resistance temperature calibration was made. It was found that a slight amount of slack was needed in the thin wires to avoid wire breakage during calibration resulting from the thermal induced movement of the probe tips. Taut wires would usually break during calibration. The calibration consisted of heating the probe through a temperature range of approximately 20° to 100° C and recording the corresponding resistances.

Flow Visualization

A double-pass, collimated-light, Schlieren system was used to obtain flow visualization over a 16-inch diameter field of view of the model base. High speed movie and single frame camera equipment were used to record the test events.

Data Acquisition

Both oscillographs and oscilloscopes were used to record test data. Model measurements were recorded on Tektronix 502 dual beam oscilloscopes using trace sweep speeds of 10 ms/cm and span sensitivities individually set to provide adequate trace deflections. However, since the total number of model measurements was too large to record simultaneously, they were divided into groups which were selectively "plugged", in turn, into the available 50 oscilloscope channels. Eight additional channels were allocated permanently to high priority, model measurements that were desired on each run.

Facility and model combustion data were recorded on fourteen channel. direct writing, light-beam oscillographs employing galvanometers having a flat frequency response bandwidth of 0-600 Hz. A chart speed of 32 inches/second provided adequate time resolution and frequency response. Conditioning amplifiers having a variable gain from 1 to 100, adjustable in precision steps of 1, 2, 5, 10, 20, 50, and 100, provided the amplification necessary to drive the galvanometers.

TEST OPERATIONS

The test objectives required simultaneous realization of steady exhaust plumes from three scale SSME rocket nozzles as well as from the two solid propellant BSRM engines during the short duration of steady external flow produced about the 19-OTS model. After initiation of the external flow, model operation was characterized by ignition of BSRM and

SSME propellants sequenced to attain simultaneous, steady state plume flow.

As might be anticipated, proper synchronization of the three flow events (i.e., orbiter SSME rockets, SRB motors, and Ludwieg tube external flow) represented the major development task. For example, it was soon discovered that the 70 msec steady flow period achieved in the free-jet test section with tunnel airflow alone was reduced to only 20-30 msec with the rockets operating due to mass addition effects in the receiver tank and earlier than anticipated arrival of the tank filling wave at the model station. These effects required very careful timing of the rocket plume and Ludwieg tube flows as well as the implementation of some special techniques to provide more rapid rocket thrust buildup.

Event repeatability, adequate synchronization, and some reductions in the initiation time of the various events were achieved by such procedures as the use of high voltage/capacitor discharge activation of solenoid valves, fabrication of special timers, and changes in the BSRM ignition gas mixture ratio and pressure. The repeatability of autovalve operation was enhanced by the intentional "breaking-in" of new seals and the synchronization of opening and closing pressure charges based on the results of an autovalve response optimization study performed during the test program.

As an example of another special technique employed during the program, refer to Figure 4 which shows a composite of several pressure-time histories reproduced from actual data records. It is seen that the "normal" time period required for the SSME combustion pressure to stabilize after ignition is on the order of 30-35 msec. Since this time was too long for the available test period, a method of reducing the response time was required. A procedure was developed equivalent to the use of throat diaphragms in that combustion gases are contained in the chamber until design pressure is reached while avoiding the necessity of nozzle removal after every run for diaphragm replacement. The procedure involved the use of expendable close-fitting plugs which are inserted into the three SSME nozzle throats. The plugs are of a proper weight and length to allow them to accelerate to high velocity during the combustor pressure buildup and then clear the nozzle throat station at, or somewhat above, the design operating pressure. The plug velocity is sufficiently high at this time to assure its complete departure from the model base region during the data acquisition period. The inexpensive plugs used for the present program (illustrated schematically in the upper right corner of Figure 4) consisted of an aluminum rod having a diameter slightly smaller than the nozzle throat inserted into a short section of 3/4-inch wooden dowel. Proper weight was achieved by simply gluing a steel nut to the dowel.

The marked reduction in combustor rise time accompanying the use of plugs is illustrated by the upper ("Improved") pressure trace in Figure 4, which shows the pressure reaching an essentially constant value within approximately 10 msec of the start of pressure rise. The slight pressure overshoot was intentional since this condition was found to provide the minimum time to attain a steady pressure level.

The use of throat plugs was also employed with the BSRMs during the later period of the present test program.

Also shown in Figure 4, to the same time base as the SSME combustor pressures, are records of the fast-acting SSME bipropellant valve position potentiometer and flow metering venturi inlet pressures. The extremely rapid opening characteristic of the valve is evidenced by the near vertical initial slope of the piston displacement record past the point of full port opening. Similarly, the venturi pressures rise to their operating levels within a few milliseconds after valve opening, remaining steady until valve closure terminates flow.

As a final illustration of the overall synchronization required, and ultimately achieved, Figure 5 shows a number of data traces from various events recorded during a single run and combines them in a single composite record having the same time reference. Considering first the rocket parameters, ignition of the two BSRMs is seen to lead the sequential chain of events.* Initiation of propellant burning and

*Although not shown in this record, in actuality the initial event is actuation of the Ludwieg tube diaphragm cutter, which occurs ahead of BSRM ignition.

rise to peak pressure takes approximately 15 msec, at which time the diaphragms rupture and BSRM flow first issues into the test section from the nozzles. Following a rapid decay from the "starting spike," steady ope ating pressures are reached within approximately 10 additional msec. The similarity of behavior between the two rockets is quite apparent from the pressure records.

At about the time the BSRM rockets begin flowing, SSME ignition occurs, followed by throat plug expulsion about 8 msec later and attainment of steady pressure in reasonable synchronization with the SRBs.

Tunnel conditions also stabilize rapidly, with stagnation pressure (P_o) and pitot pressure (as evidenced by the external tank nose pressure record) reaching a nominally steady level within 10 msec after initial rise. Total temperature increases somewhat (375°F to 400°F) during the run time as initially cooler air from near the diaphragm station is replaced by hotter air from farther up the supply tube.

Finally, base pressures on both the orbiter and external tank respond in parallel, first responding to the BSRM rocket flow (as evidenced by the small rise which precedes initiation of external flow) and then to the steady airflow level.

Formal data acquisition occurs over the 20 msec wide interval identified in the figure; it is terminated by test section flow breakdown, which is readily identified by the abrupt increase in model base pressures, followed a short time later by a similar increase in external tank nose pressure. Note that the rocket and Ludwieg tube supply conditions remain steady until well after flow breakdown has occurred, clearly demonstrating the test duration restriction imposed by the receiver tank filling wave.

DATA REDUCTION

PRESSURE

All of the pressure transducers employed during this program operate on a differential basis in that they sense the change between the local pressure applied to the model during the run and the pre-run ambient pressure. Accordingly, the receiver tank pre-run absolute pressure was added to the measured pressure change for all transducers exposed to the tunnel environment. For the BSRMs, however, the initial ignition gas pressure (12 to 18 psia) was added to the transducer output to derive the absolute pressure.

HEAT TRANSFER

The thin-film gage is a resistance thermometer which responds to the local surface temperature of the substrate. The classical theory of heat conduction in a homogeneous body is used to relate the surface temperature history to the rate of heat transfer. Due to the considerable effort required to convert temperature-time records into equivalent heating rate histories, an analog network, referred to as a "q-meter," has been developed to convert the temperature signal directly into a heat flux in real time for presentation on the oscilloscope (Reference 5). All thin-film gage, heat transfer data for this study were obtained directly through the use of q-meters.

The heat transfer data were converted to engineering units using the following formula:

$$\dot{q}\left(\frac{BTU}{ft^2\ sec}\right) = \frac{\delta}{\Delta}\ \frac{R_P}{(DLR + R_P)\ (K)}\ \left(\frac{R_S + R_G + R_L}{R_S + R_P}\right)^2$$

where

δ = Deflection of the data record

DLR = Dummy load resistor used to simulate the expected heating rate for calibration of the data channel

Δ = Deflection of a square wave signal resulting from the insertion of the DLR during data channel calibration

R_P = Precision resistor used to calibrate the conditioning system ($R_P = 100\ \Omega$)

K = Gage Sensitivity = $\Delta R/\Delta T$

R_S = Heat transfer gage circuit series resistor ($R_S = 1000\ \Omega$)

R_G = Pre-run heat transfer gage resistance

R_L = Resistance of gage line extensions between sensing element and constant current network ($R_L = 5$ to $10\ \Omega$)

To account for the absorptivity of the radiation gages, measured radiant heating rates were corrected by the following expression:

$$\dot{q}_{actual} = \dot{q}_{measured}/0.85$$

RECOVERY TEMPERATURE

Heated Base Tests

Estimates of local base recovery temperatures have been made utilizing heated base components on the model. This technique relies on the principle of proportional variation in heat transfer with the temperature differential: recovery temperature (T_R) minus base temperature (T_B). Measured model heating rates were plotted against the various test base temperatures and then extrapolated to zero heating rate (i.e., $T_R = T_B$). The value at that intercept is thus the estimated recovery temperature. An example of this procedure is presented in Figure 6. The data reduction procedure for calculating heat transfer at elevated base temperatures are similar to those of the standard gage but include additional corrections to account for temperature dependent substrate properties and gage sensitivities.

Gas Temperature Probes

Gas temperature probe data reduction procedures are detailed in Reference 7. A brief summary of the procedures is given below.

Gas recovery temperature is obtained from the one dimensional heat balance equation for a thin wire.

$$q_s = q_j + q_c - q_k - q_{rw} + q_{wg}$$

where

q_s = heat accumulated in wire = $A \rho c \dfrac{\partial T_w}{\partial t}$

q_j = heat due to current flow = $I^2 \sigma_o \left[1 + \alpha (T_w - T_o)\right] / A$

q_c = heat input to the wire from gas = $h \pi D (T_r - T_w)$

q_k = heat conduction to wire supports = $-A \dfrac{\partial^2 K_w T_w}{\partial X^2}$

q_{rw} = heat loss by radiation from wire = $\epsilon_w \sigma_{sb} \pi D T_w^4$

q_{wg} = heat gained by radiation from gas = $\epsilon_w q_{rg} \pi D/2$

where

q_{rg} = radiation from gas

All parameters in the heat balance equation are functions of the wire or surrounding gas and are readily known except T_w, T_r, and h. T_w is measured indirectly by the wire.

To obtain a solution, the heat balance equation may be nondimensionalized and quasi-linearized into the form

$$R_a \frac{\partial T}{\partial s} = a_1 + a_2 T + \frac{\partial^2 T}{\partial \eta^2}$$

with boundary conditions

$$\eta = 0,\ T = T_s \text{ and } \eta = 1,\ T = T_s$$

where

R_a, a_1, and a_2 are parameters independent of wire temperature

$T = T_w/T_r$

$\eta = X/L$

$s = t/\tau$

This equation form may be solved numerically by an implicit finite difference relation in η and a backward finite difference relation in s. The numerical methods are too lengthy for this report, but they may be found in Reference 7.

The gas recovery temperature design for Test IH5 was chosen to simplify the data reduction procedures. Specifically, two different length wires mounted on the same probe tip and subjected to the same flow field condition allow simultaneous solution of two independent steady state equations with two unknowns, h and T_r. The nondimensionalized and quasi-linearized equation in the preceding paragraph is now of the form

$$a_1 + a_2 T + \frac{\partial^2 T}{\partial \eta^2} = 0$$

where only the implicit finite difference relation in η is required for numerical solution.

To actually determine gas recovery temperature, an iteration procedure is used as follows:

1. Values of recovery temperature, T_r, and the convective heat transfer coefficient, h, are estimated for input to the data reduction program. The convective heat transfer coefficient is estimated by

$$h = 1.389\, a_h M \frac{g(s)_h}{S_h} P_h \sqrt{\frac{\gamma R}{T_h}}$$

2. Using the estimated h and T_r, mean temperatures are calculated for each wire using the heat balance equation.

3. Mean wire resistances are calculated from the mean wire temperatures by

$$R_w = R_o \left[1 + \alpha (\overline{T}_w - T_o) + \beta (\overline{T}_w - T_o)\right]$$

where

R_o = resistance at initial wire temperature, T_o

α & β = coefficients of resistance

$\overline{T}_w$ = mean wire temperature

4. Calculated mean wire resistances are compared to the steady state resistances measured by the two thin wires; if the sum of the errors between the calculated and measured resistances is greater than 0.5%, new h and T_r estimates are input to the data reduction program for repeated calculations. This procedure is repeated until values of h and T_r are found which satisfy the resistance error parameter.

Individual wire lengths were calculated using the wire resistance at 20°C (68°F) and the manufacturer's stated value of resistivity at 20°C.

$$\sigma_{20^oC} = R_{20^oC}\left(\frac{A}{L}\right) = 1.853\text{x}10^{-5} \text{ ohm-cm}$$

Wire resistance was determined to be steady state at a time coincident with stable model rocket engine flow. This generally occurred between 35-50 milliseconds into the run.

TEST CONDITIONS

Based on airflow calibrations previously performed at ambient temperatures, the Mach 4.5 nozzle was determined to provide satisfactory flow at the design Mach number within ±0.1 Mach number units over a pressure range of 2 to 20 psia. For the purpose of this test program, the test section Mach number was considered constant at $M_\infty = 4.5$.

Thus, test section static pressure and static temperature were computed by:

$$P_{\infty} = 0.003455\ P_o$$

$$T_{\infty} = 0.1980\ T_o$$

where P_o and T_o were the average nozzle inlet stagnation conditions measured on each run during the data acquisition period when model combustor and tunnel pressures were equilibrated (Reference Figure 5). The respective simulated test altitude was determined from a pressure 2X the calculated static pressure, or $P_{ALT} = 2P_{\infty}$.

The test section unit Reynolds number, derived from isentropic flow relations using air as an ideal gas, was calculated by using the expression:

$$\frac{R_e}{ft} = 411\ \frac{P_o}{\mu}\ \sqrt{\frac{1}{T_o + 460}}\ \left[\frac{M_{\infty}}{(1 + 0.2M_{\infty}^2)^3}\right]$$

The viscosity (μ) was based on Sutherland's formula:

$$\mu = 0.350 \times 10^{-6}\ \left(\frac{T_{\infty} + 460}{492}\right)^{3/2}\ \left(\frac{690}{T_{\infty} + 658}\right)$$

DISCUSSION OF RESULTS

The basic results of the Test IH5 program are the pressure and heat transfer data obtained from the tests. In reduced form they are included in Appendix B of this report. Table I provides an index by run number of the nominal test conditions for which the data are reported.

Figure 7 depicts representative data from a flight condition near staging (Mach 4.5 at 140,000 feet altitude) where the model was tested both with and without the SRBs operating. Both heating rate and pressure distributions are shown along the vertical centerline from just beneath the upper SSME nozzle to the body flap. Data repeatability appears reasonable.

The results of the base recovery temperature measurements using the heated base technique were generally unsuccessful because of an early malfuntion of the gages. The malfunctions were attributed to construction features which allowed the platinum element terminal junctions to be susceptible to thermally induced stresses. Although most of the heated gage sensor data could not be resolved, one sensor (Q142) did survive long enough to provide acceptable data. During three consecutive runs, its pre-fire temperature (calculated from its resistance change) was in excellent agreement with model base thermocouple measurements, thus lending credibility to its output response during the run. Furthermore, the data (shown in Figure 6) predict a recovery temperature with a rather small uncertainty bandwidth, namely, $1800^{o}F \pm 3\%$.

Steady State Gas Temperature Probe Results

The definition of the runs which used gas temperature probes is given in Table II. Also included are values of wire lengths and comments concerning the test conditions and validity of the test data.

Typical wire resistance data traces are shown in Figures 9 and 10.

Appendix A lists the wire resistance data which were used to obtain values of gas temperature and convective heating coefficients. Also included in the table are values of the voltage changes observed on the thermocouples on the probe tips. All the recorded thermocouple temperature changes were less than 20°C. A 20° change in probe tip temperature will result in a change in wire temperature of less than 1%. For this reason, the probe tip temperature was assumed to be constant at 300° K for all the data analysis conducted.

Figures 11 through 14 present the values of gas temperature and free molecular convective heat transfer coefficients as a function of test altitude. It is difficult to detect specific trends in the data due to the limited amount of data obtained. However, it is noted that the gas temperature values are lower than expected while the film coefficients are slightly higher than was predicted prior to the test.

Figures 15 and 16 present a comparison of the thin wire probe responses with the response of the pressure transducer and heat transfer gauges located near the probe. These figures illustrate different responses for two runs. Figure 15 illustrates a rapid flow field start-up, and Figure 16 shows a slowly developing flow field buildup. The different flow field buildups are a consequence of the timing and mass flow from the Ludwieg Tube, SSME, and BSRMs. The wire resistance appears to closely follow the flow field processes indicated by the heating and pressure data.

Some simplified calculations were made for the data given in Figures 15 and 16. To qualitatively determine the variation of the gas temperature with time, the free molecular heat transfer coefficient for the wire has the following dependency: $h \propto P/\sqrt{T}$. If one assumes T constant and computes h as a function of time, where the steady state value of h is used for a reference, an h versus time plot will result, which has the same shape as the pressure time plot. If one plots the heating rate versus pressure, it is found that the curve is far from linear where a linear relation would be expected for steady state results. Since $\dot{q} = h_B(T_r - T_w)$ and h_B is primarily a function of pressure, T_r must be changing significantly during the run. Thus, the assumption that the gas temperature is constant during the run is not valid. For example, the peak in heating during the first 8 msec. of Figure 15 must be due to a higher gas temperature than was experienced later in the run. To properly quantify the gas temperature as a function of time before steady flow is achieved, a detailed transient calculation using the heating, pressure, and resistance data would be required. This type of analysis would be time consuming, but could provide additional insight into the type of flow processes which occur during the test.

The results of the base recovery temperature measurements using the gas temperature probes have been reported separately by Remtech, Inc. (Reference 7).

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TABLE I

NOMINAL TEST OPERATING CONDITIONS FOR REPORTED RUN DATA

Run No.	Config.	M	h (K ft.)	P_o (psia)	$P_{c_{SSME}}$ (psia)	$P_{c_{SRM}}$ (psia)	T_B °F
6	OT	4.5	140	4.48	1500	0	70°
14c	"	"	"	"	"	"	"
14d	"	"	"	"	"	"	"
15	"	"	150	3.08	"	"	"
16a	"	"	170	1.49	"	"	"
19	OTS	"	110	15.01	"	290	"
21b	"	"	"	"	"	"	"
21c	"	"	"	"	"	"	"
23b	"	"	120	9.89	"	"	"
32	OT	"	140/2	2.24	750	0	"
33	"	"	"	"	"	"	"
34	"	"	140/4	1.12	375	"	"
35b	"	"	140	4.48	1500	"	"
35c	"	"	"	"	"	"	"
49	"	"	170	1.49	"	"	"
50	"	"	"	"	"	"	"
52	"	"	"	"	"	"	"
53	"	"	"	"	"	"	"
54	"	"	"	"	"	"	"
56	"	"	"	"	"	"	"
57	"	"	140	4.48	"	"	"
58	"	"	150	3.08	"	"	"
59	"	"	160	2.14	"	"	"
60	"	"	130	6.61	"	"	"
61	"	"	120	9.89	"	"	"
62	"	"	160	2.14	"	"	"
63	"	"	150	3.08	"	"	"
64a	"	"	140	4.48	"	"	"
64b	"	"	"	"	"	"	"
65	"	"	170	1.49	"	"	"
66	"	"	150/2	1.54	750	0	"
67b	"	"	150/4	.77	325	"	"
68a	"	"	140	4.48	1500	"	"
68b	"	"	"	"	"	"	"
69	"	"	170	1.49	"	"	"
70	"	"	140	4.48	"	"	"
71	"	"	170	1.49	"	"	"
72a	"	"	170/2	.75	750	"	"
73	"	"	140/4	1.12	375	"	"

TABLE I (Continued)

NOMINAL TEST OPERATING CONDITIONS FOR REPORTED RUN DATA

Run No.	Config.	M	h (K ft.)	P_o (psia)	$P_{c_{SSME}}$ (psia)	$P_{c_{SRM}}$ (psia)	T_B ^oF
74	OT	4.5	140/2	2.24	750	0	70°
75	OTS	"	90	36.5	1500	290	"
76	"	"	140	4.48	"	145	"
77a	"	"	100	23.2	"	290	"
77c	"	"	"	"	"	"	"
78	"	"	"	"	"	"	"
79	"	"	140	4.48	"	145	"
80c	"	"	130	6.61	"	"	"
80d	"	"	"	"	"	"	"
81	"	"	120	9.89	"	"	"
82	"	"	"	"	"	290	"
83	"	"	110	15.01	"	"	"
84	"	"	120/2	4.94	750	145	"
85	"	"	120	9.89	1500	"	"
86	"	"	130	6.61	"	"	"
87	"	"	140	4.48	"	"	"
88	"	"	120/2	4.94	750	"	"
89a	"	"	110	15.01	1500	290	"
89b	"	"	"	"	"	"	"
90	"	"	140	4.48	"	145	"
91a	"	"	120	9.89	"	290	"
91b	"	"	"	"	"	"	"
91c	"	"	"	"	"	"	"
92	"	"	100	23.2	"	"	"
93a	"	"	120	9.89	"	"	"
93b	"	"	"	"	"	"	"
94	"	"	"	"	"	"	"
96	OT	"	160	2.14	"	0	"
97	"	"	150	3.08	"	"	"
98	"	"	140	4.48	"	"	"
99	"	"	170	1.49	"	"	"
100	"	"	140	4.48	"	"	"
101	"	"	170	1.49	"	"	"
102	"	"	160	2.14	"	"	"
103	"	"	140	4.48	"	"	"
104	"	"	150	3.08	"	"	80
105	"	"	"	"	"	"	600
106	"	"	"	"	"	"	1000

TABLE I (Continued)

NOMINAL TEST OPERATING CONDITIONS FOR REPORTED RUN DATA

Run No.	Config.	M	h (k ft.)	P_o (psia)	$P_{c_{SSME}}$ (psia)	$P_{c_{SRM}}$ (psia)	T_B °F
107	OT	4.5	150	3.08	1500	0	300°
108	"	"	"	"	"	"	800
D1	"	"	140	-	"	"	70
D2	"	"	220	-	"	"	"
D3	"	"	200	-	"	"	"
D4	"	"	160	-	"	"	"
D5	"	"	120	-	"	"	"
D6	"	"	"	-	"	"	"
D7	"	"	90	-	"	"	"
D8	"	"	170	1.49	0	"	"
D11	"	"	110	15.01	"	0	70
D12	"	"	170	1.49	"	"	"
D13	"	"	110	15.01	1500	"	"
D14	"	"	170	1.49	"	"	"
D16	"	0	200	-	"	"	"
D17	"	"	160	-	"	"	"
D18	"	"	180	-	"	"	"
D19	"	"	170	-	"	"	"
D20	"	"	220	-	"	"	"
DIAG	OTS	4.5	140	4.48	0	0	70

TABLE II

THIN WIRE GAS TEMPERATURE PROBE RUN DEFINITION

Run No.	Probe No.	Probe Location	Altitude (kft)	Wire Lengths (cm)		Comments
				Short	Long	
77-A	1-1.25	11-ET	100	0.0888	0.1618	BSRMs didn't fire.
78	1-0.75		100	0.088	0.1797	
79	2-1.25		140	0.0768	0.1753	Can't read long wire data
80-A			130			Scopes didn't trigger
80-B						1 BSRM fired
80-C	3-1.25			0.0762	0.1571	No BSRMs fired
80-D						Full Orbiter - 1/2 Booster Chamber Press
81			120			
82	2-0.75		120	0.0926	0.1806	
83	1-1.25		110	0.0806	0.1421	
84	1-1.25		120	0.0806	0.1421	1/2 Reynolds No.
85	1-0.75	101-HS	120	0.0757	0.1681	1/2 Booster Chamber Pressure
86	2-0.75		130	0.0915	0.1361	
87			140			
88			120			Can't read short wire data
89-A			110			Bad pt.- Erratic run
89-B			110			
90			140			1/2 Booster Press.
91-A			120			
91-B			120			
91-C	3-0.75		120	0.0949	0.1683	
92	3-0.75		100	0.0949	0.1683	
93-A	1-0.75	113-HS	120	0.1022	0.1872	
93-B	1-0.75	113-HS	120	0.1022	0.1872	
94	2-0.75	1-ET	120	0.1031	0.1823	

ET - External Tank
HS - Orbiter Heat Shield

TABLE III. - MODEL DIMENSIONAL DATA

MODEL COMPONENT: BODY - B10

GENERAL DESCRIPTION: Fuselage, 2A Configuration, Lightweight Orbiter.
per Rockwell Lines VL70-000089"B"

Scale Model = 0.0225

DRAWING NUMBER: VL70-000089"B", VL70-000092, 93, 94"A"

DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length - In.	1328.3	29.88675
Max. Width - In. (@ X_o=1528.3)	265.0	5.96250
Max. Depth - In. (@ X_o=1480.52)	248.0	5.5800
Fineness Ratio	5.012	5.012
Area - Ft^2		
Max. Cross-Sectional	456.4	0.23105
Planform		
Wetted		
Base		

TABLE III. (Continued)

MODEL COMPONENT: CANOPY - C5

GENERAL DESCRIPTION: 2A Configuration per Lines VL70-000092A

Scale Model = 0.0225

DRAWING NUMBER: VL70-000092A

DIMENSION	FULL SCALE	MODEL SCALE
Length (Sta Fwd Bulkhead)	391.0	8.79750
Max Width (T.E. Bulkhead)	560.0	12.6000
Max Depth (WPZ = 421.922 to Z =500)		
Fineness Ratio		
Area		
Max Cross-Sectional		
Planform		
Wetted		
Base		

TABLE III. (Continued)

MODEL COMPONENT: MANIPULATOR HOUSING - D7

GENERAL DESCRIPTION: 2A Configuration per Rockwell Lines VL70-000093

Scale Model = 0.0225

DRAWING NUMBER VL70-000093

DIMENSION:	FULL SCALE	MODEL SCALE
Length - In.	881.00	19.82250
Max Width - In.	51.00	1.14750
Max Depth - In.	23.00	0.51750
Fineness Ratio		
Area		
Max Cross-Sectional		
Planform		
Wetted		
Base		

℄ Fuselage BP = 0.00
WP = 500.0 INFS
X_o 426.0 to 1307.0 INFS

TABLE III. (Continued)

MODEL COMPONENT: F4 BODY FLAP

GENERAL DESCRIPTION: 2A Configuration per Rockwell Lines VL70-000094A

Scale Model - 0.0225

DRAWING NUMBER: VL70-000094A

DIMENSION:	FULL SCALE	MODEL SCALE
Length	84.70	1.90575
Max Width	265.00	5.96250
Max Depth		
Fineness Ratio		
Area - Ft^2		
Max Cross-Sectional		
Planform	142.64	0.07221
Wetted		
Base	38.65	0.01957

TABLE III. (Continued)

MODEL COMPONENT: OMS POD - M3

GENERAL DESCRIPTION: 2A Lightweight Configuration Per Rockwell Lines VL70-000094A

Scale Model = 0.0225

DRAWING NUMBER: VL70-000094A

DIMENSION:	FULL SCALE	MODEL SCALE
Length	346.0	7.78500
Max Width X_o = 1450.0	108.0	2.4300
Max Depth X_o = 1500.0	113.0	2.54250
Fineness Ratio,		
Area		
Max Cross-Sectional		
Planform		
Wetted		
Base		

℄ OF OMS POD
WP = 463.9 INFS: WP 400 + 63.9 = 463.9
BP = 80.0 INFS
LENGTH 1214.0 to 1560.0 = 346.0 INFS

TABLE III. (Continued)

MODEL COMPONENT: N8 - OMS NOZZLE

GENERAL DESCRIPTION: Basic OMS nozzle of the 2A Configuration per Rockwell Lines VL70-008306 and VL70-000089"B"

Scale Model = 0.0225

DRAWING NO. VL70-008306, VL70-000089"B", SS-A00092

DIMENSIONS:		FULL SCALE	MODEL SCALE
Mach No. -			
Diameter Dex ~ In.		50.00	1.1250
Diameter Dt ~ In.		N/A	N/A
Diameter Din ~ In.		28.00	0.630
On Degrees		N/A	N/A
Area - Ft^2			
Max Cross-Sectional		13.635	0.00690
Gimbal Origin	X_o	Y_o	Z_o
Left Nozzle ~ In.	1518	-88.0	492
Right Nozzle ~ In.	1518	+88.0	492
Null Position		PITCH	YAW
Left Nozzle - Deg		15° 49'	-12° 17'
Right Nozzle - Deg		15° 49'	$+12^\circ$ 17'
Intersection of Nozzle Exit Plane and Nozzle Centerline: - In.		X_o = 1570.75	35.34188
		Y_o = $\pm$ 99.25	2.23312
		Z_o = 507.25	11.41312

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TABLE III. (Continued)

MODEL COMPONENT: NOZZLE - N_{26}

GENERAL DESCRIPTION: MPS Nozzle, Configuration 2A

Model Scale - 0.0225

DRAWING NO: VL70-000089B

DEMENSIONS: (for one nozzle)	FULL SCALE		MODEL SCALE
Mach No.			
Diameter Dex ~ In	92.0		2.070
Diameter Dt ~ In			
Diameter Din ~ In			
On Degrees			
Area - Ft^2			
Max Cross-Sectional	46.16396		0.02337
Gimbal Origin	X_o	Y_o	Z_o
Upper Nozzle ~ In Fs	1445	0	443
Bottom Nozzle ~ In Fs	1468.17	+53	543.36
Null Position	PITCH		YAW
Upper Nozzle - Deg. (Pitch $\pm 11^\circ$, Yaw $\pm 9^\circ$)	16		0
Bottom Nozzle - Deg. (Pitch $\pm 11^\circ$ Yaw $\pm 9^\circ$)	10		3.5 Outb'd

TABLE III. (Continued)

MODEL COMPONENT: VERTICAL - V5 (Lightweight Orbiter Configuration)

GENERAL DESCRIPTION: Centerline Vertical Tail, Doublewedge Airfoil with Rounded Leading Edge

Scale Model = 0.0225

DRAWING NUMBER: VL70-000095

DIMENSIONS:	FULL SCALE	MODEL SCALE
TOTAL DATA		
Area (Theo) Ft^2	413.25	0.20921
Planform		
Span (theo) In	315.72	7.10370
Aspect Ratio	1.675	1.675
Rate of Taper	0.507	0.507
Taper Ratio	0.404	0.404
Sweep Back Angles, degrees		
Leading Edge	45.000	45.000
Trailing Edge	26.249	26.249
0.25 Element Line	41.130	41.130
Chords:		
Root (Theo) WP	268.50	6.04125
Tip (Theo) WP	108.47	2.44058
MAC	199.81	4.49572
Fus. Sta. of .25 MAC	1463.50	32.92875
W. P. of .25 MAC	635.522	14.29924
B. L. of .25 MAC	0.00	0.00
Airfoil Section		
Leading Wedge Angle Deg	10.000	10.000
Trailing Wedge Angle Deg	14.920	14.920
Leading Edge Radius	2.00	0.04500
Void Area	13.17	0.00667
Blanketed Area	12.67	0.00641

TABLE III. (Continued)

MODEL COMPONENT: WING-W 87 NEW LIGHTWEIGHT ORBITER

GENERAL DESCRIPTION: Orbiter Configuration per Lines VL70-000093

(NOTE: Dihedral angle is defined at the lower surface of the wing at the 75.33% element line projected into a plane perpendicular to the FRL)

Scale Model = 0.0225

TEST NO.

DWG. NO. VL70-000093

DIMENSIONS:	FULL SCALE	MODEL SCALE
TOTAL DATA		
Area (Theo.) Ft^2		
Planform	2690.00	1.36181
Span (Theo.) In.	936.68	21.07530
Aspect Ratio	2.265	2.265
Rate of Taper	1.177	1.177
Taper Ratio	0.200	0.200
Dihedral Angle, Degrees	3.500	3.500
Incidence Angle, Degrees	3.000	3.000
Aerodynamic Twist, Degrees	+3.000	+3.000
Sweep Back Angles, Degrees		
Leading Edge	45.000	45.000
Trailing Edge	-10.24	-10.24
0.25 Element Line	35.209	35.209
Chords:		
Root (Theo) B.P. = zero	689.24	15.50790
Tip, (Theo) B.P. 468.341	137.85	3.10162
MAC	474.81	10.68322
Fus. Sta. of .25 MAC	1136.89	25.58002
W.P. of .25 MAC	299.20	6.73200
B.L. of .25 MAC	182.13	4.09792
EXPOSED DATA		
Area (Theo) Ft^2	1752.29	0.88710
Span, (Theo) In. BP108 to 468.341	720.68	16.21530
Aspect Ratio	2.058	2.058
Taper Ratio	0.2451	0.2451
Chords		
Root BP108	562.40	12.6540
Tip 1.00 b/2	137.85	3.10162
MAC	393.03	8.84318
Fus. Sta. of .25 MAC	1185.31	26.66948
W.P. of .25 MAC	300.20	6.75450
B.L. of .25 MAC	251.76	5.66460
Airfoil Section (Rockwell Mod NASA) XXXX-64		
Root b/2 = .425	0.10	0.10
Tip b/2 = 1.00	0.12	0.12
Data for (1) of (2) Sides		
Leading Edge Cuff		
Planform Area Ft^2	120.33	0.06092
Leading Edge Intersects Fus M.L.@ Sta	560.0	12.60000
Leading Edge Intersects Wing @ Sta	1035.0	23.28750

TABLE III. (Continued)

MODEL COMPONENT: T8 - EXTERNAL TANK

GENERAL DESCRIPTION: 2A Configuration per Rockewell Lines:

VL78-000018 and VL72-000061"A" Body of Revolution

Scale Model = 0.0225

DRAWING NO: VL78-000018

DIMENSION:	FULL SCALE	MODEL SCALE
Length - In.	1989.0	44.75250
Max Width (Dia.) - In.	324.0	7.2900
Max Depth		
Fineness Ratio L/D	6.1389	6.1389
Area - Ft^2		
Max Cross-Sectional	572.56	0.28986
Planform		
Wetted		
Base		

REF:
FS (Orbiter) = 0.00 = Tank Station 752.2 IN. FS
WP (ET) = WP 400 (Orbiter) - 344.4 IN. FS = 55.6 IN. FS
BP (Orbiter) = 0.00 = 0.00 ET

TABLE III. (Continued)

MODEL COMPONENT: BOOSTER SOLID ROCKET MOTOR - S_{17}

GENERAL DESCRIPTION: 2A Configuration per Rockwell Lines VL77-000012 and VL72-000061A, but with an MCR 200 (Configuration 3A) Skirt per Rockwell Lines VL77-000036A.

Body of Revolution: Data for (1) of (2) sides.

DRAWING NUMBER:

DIMENSION:	FULL SCALE	MODEL SCALE
Length in.	1932.00	43.470
Max Width (Dia) - in. BSRM Tank	142.00	3.1950
Max Depth (Dia) Aft Skirt	192.0	4.320
Fineness Ratio L/D	7.459	7.459
Area Ft^2		
Max Cross-Sectional	109.978	0.05568
Planform		
Wetted		
Base		

REF:
FS (Orbiter) = 0.00 = 747.99 in. ET = 200.0 BSRM
WP (BSRM) = 400 - 344.413 = 55.587 in. FS
BP (Orbiter) = 0.00 = 0.00 = 243.0 BSRM

TABLE III. (Concluded)

MODEL COMPONENT: NOZZLE - N65

GENERAL DESCRIPTION: MCR 0200, Configuration 3A, 7:1 Expansion Ratio BSRM Nozzle Attached to a Configuration 2A BSRM.

Model Scale = 0.0225

DRAWING No: VL77-000036A

DIMENSIONS: (For one nozzle)	FULL SCALE	MODEL SCALE
Mach No.		
Diameter Dex ~ In (One Nozzle)	141.3	3.179
Diameter Dt ~ In		
Diameter Din ~ In		
On Degrees		
Area - Ft^2		
Max Cross-Sectional	108.896	0.055

Gimbal Origin	*X_s	Y_o	Z_o
Left Nozzle ~ In. F.S.	1796.15	-243	400
Right Nozzle ~ In. FS	1796.15	+243	400

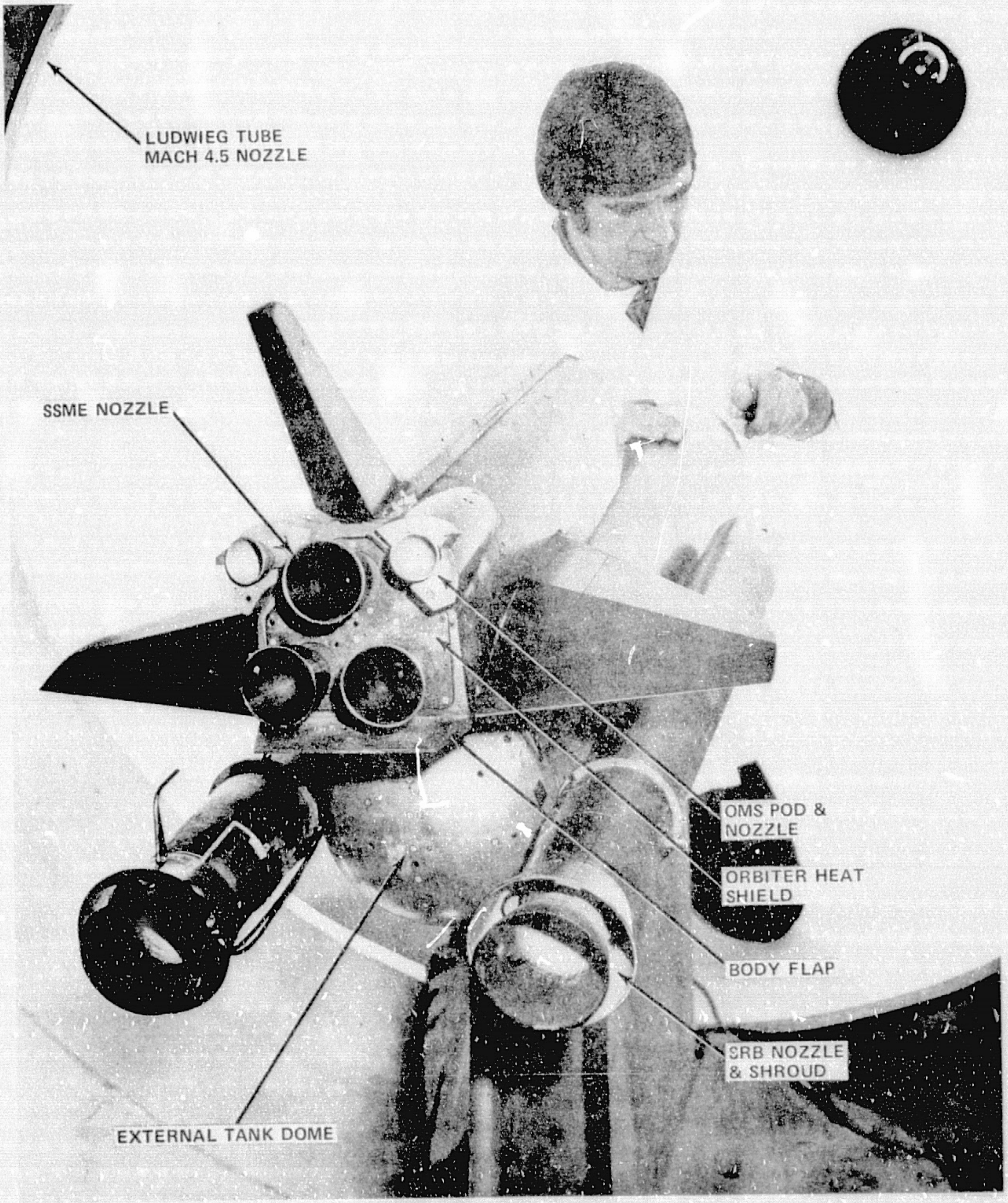
Null Position - Deg.	PITCH	YAW
Left Nozzle (Pitch $\pm 5^{\circ}$, Yaw $\pm 5^{\circ}$)	0	0
Right Nozzle (Pitch $\pm 5^{\circ}$, Yaw $\pm 5^{\circ}$)	0	0

*Gimbal origin shown is for the flight vehicle; for the model, the origin is at X_s = 1764.5 due to interface with the 2A Configuration BSRM.

TABLE IV

COMPARISON OF UTP-3001 AND LPC-580C PROPELLANT COMBUSTION PRODUCTS

	UTP-3001	LPC-580C
Combustion Temp., T_c (^oR)	100	6330
Specific heat, C_p (Btu/lb-^oR)	-	0.435
Molecular Weight, M (lbs/mole)	27.3	26.8
γ effective	1.18	1.17
<u>Combustion Products (Mole %)</u>		
CO_2	1	2
H_2	28	28
H_2O	12	12
N_2	8	8
CO	25	22
HCl	13	12
Al_2O_3	7	8
Other (H, Cl, OH, $AlCl_2$, etc.)	6	8
	100%	100%



a. 2.25% Scale Space Shuttle Base Heating Model installed in Calspan Ludwieg Tube MACH 4.5 Nozzle

Figure 1. Model Sketches and Photographs.

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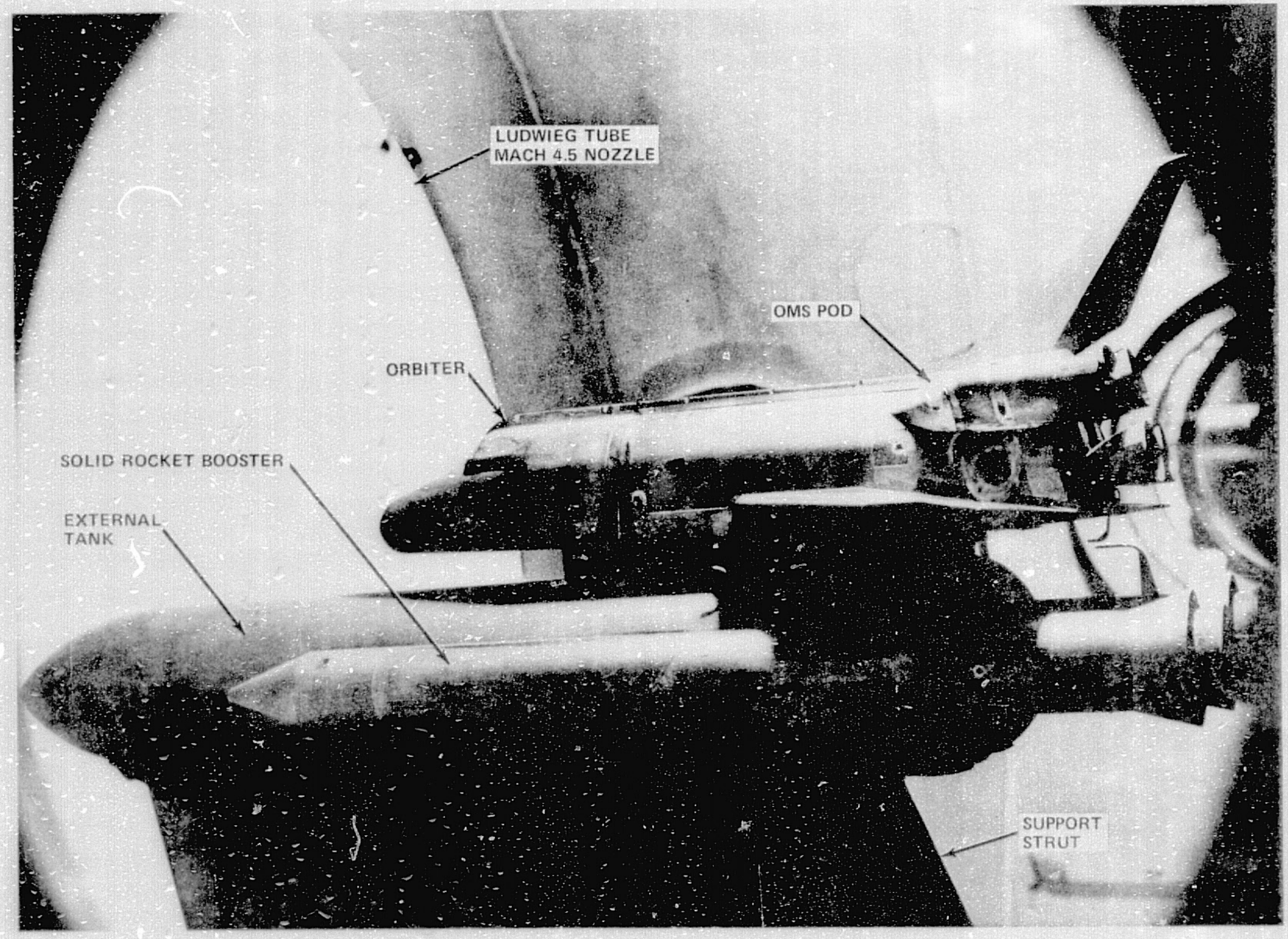
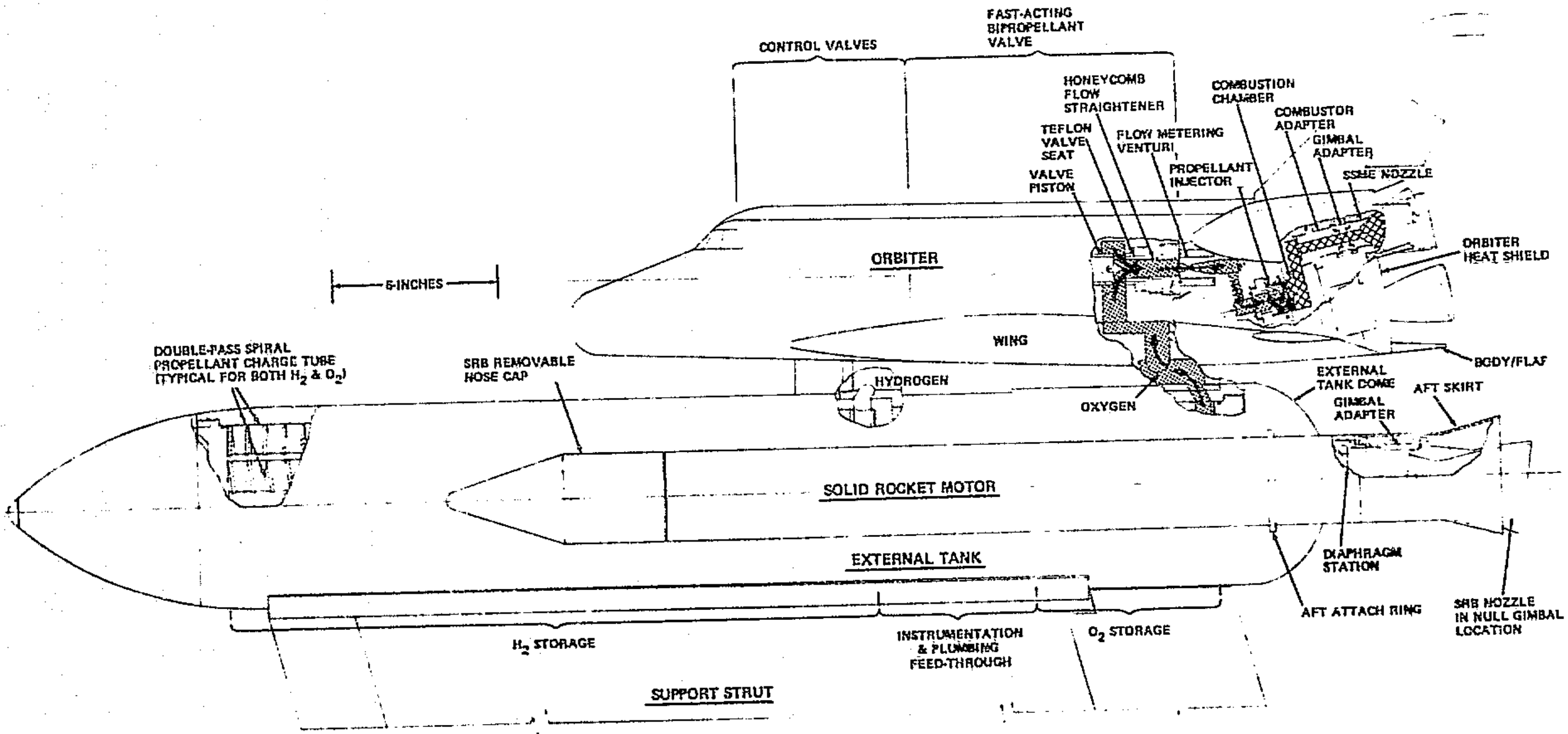
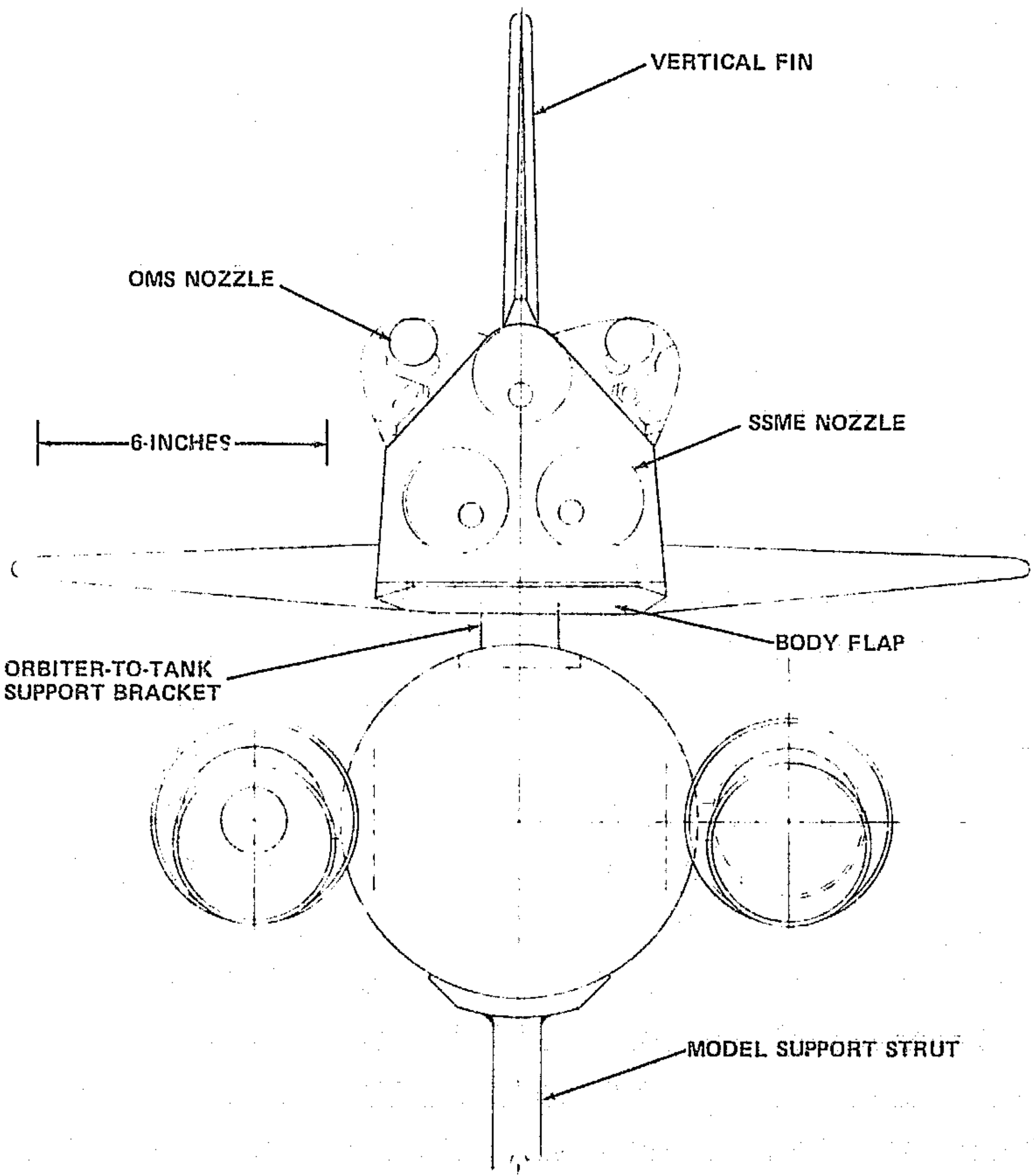


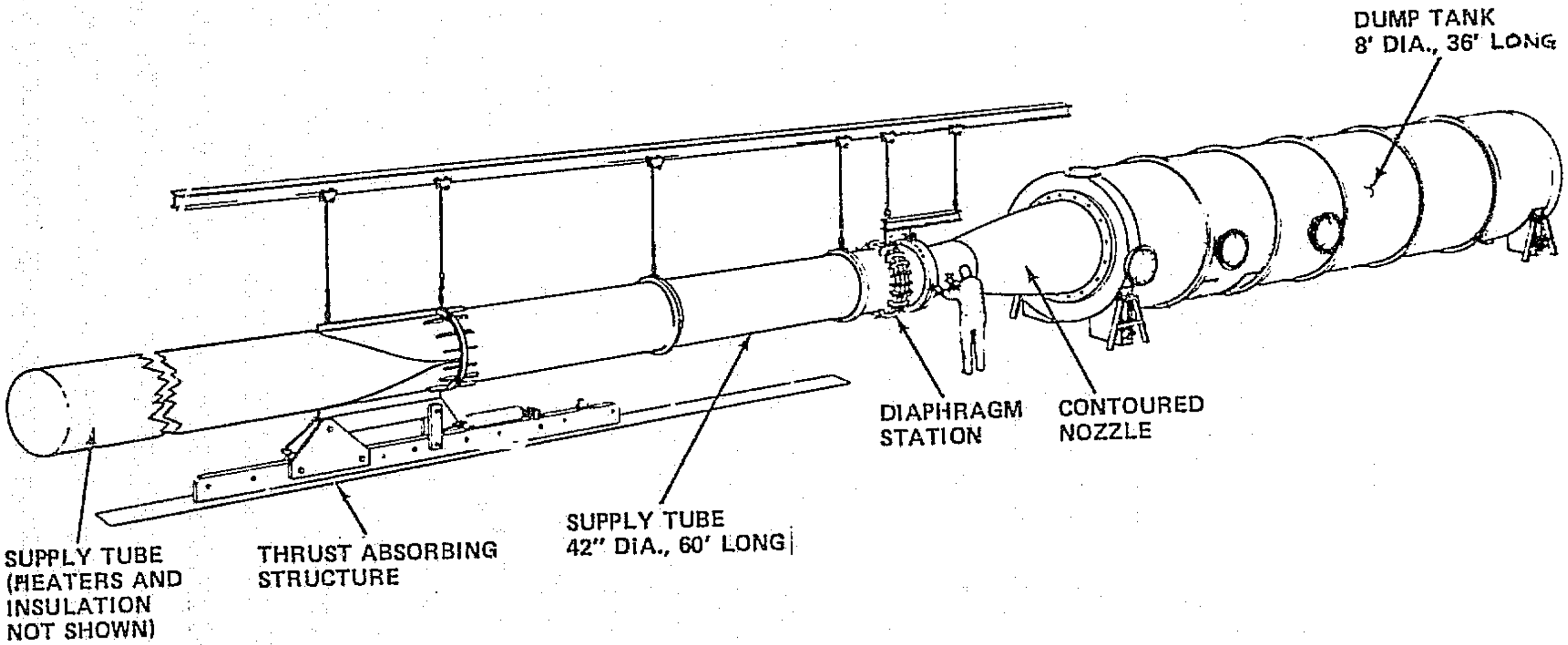
b. 2.25% Scale Space Shuttle Base Heating Model
Figure 1. Continued.



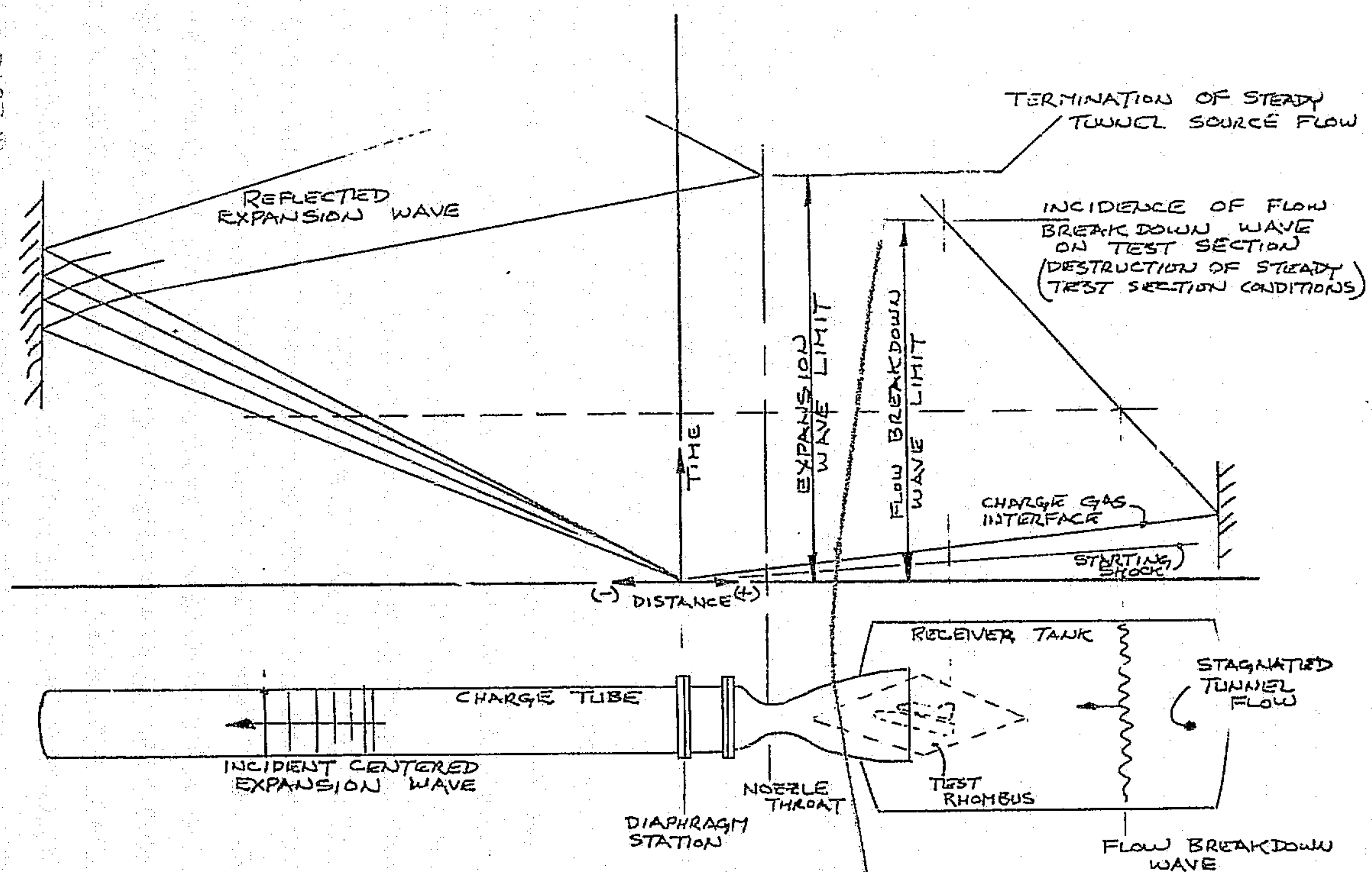
c. 2.25% Scale Shuttle Base Heating Model - Outline and Cross-Sectional Views
Figure 1. Continued.



d. 2.25% Scale Space Shuttle Base Heating Model - End View
Figure 1. Continued.



e. Short-Duration Ludwieg Tube Wind Tunnel
Figure 1. Continued.



f. Wave Diagram for Tube Wind Tunnel

Figure 1. Continued.

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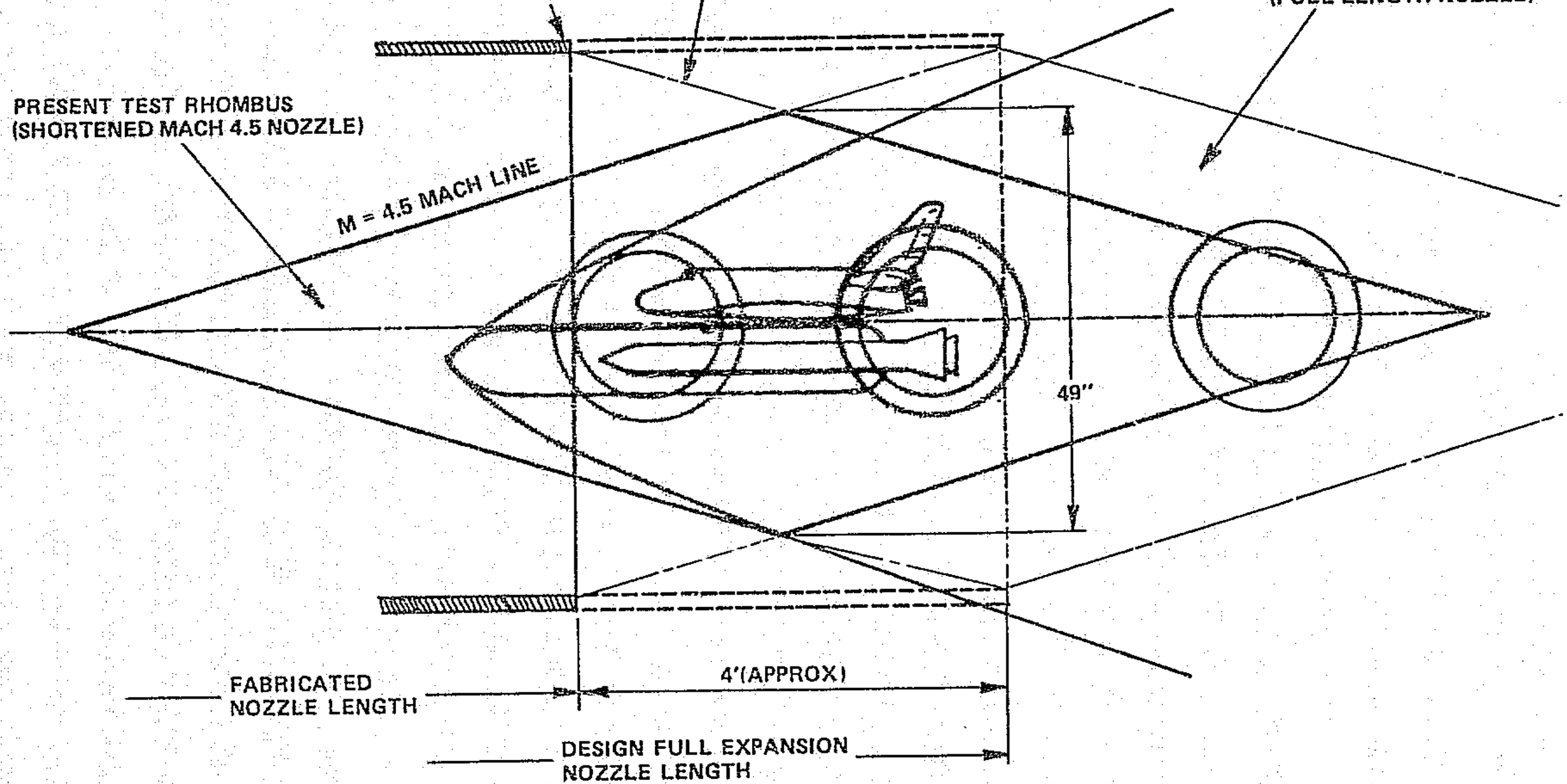

g. Ludwieg Tube Free Jet Test Rhombus for MACH 4.5 Nozzle
Figure 1. Continued.

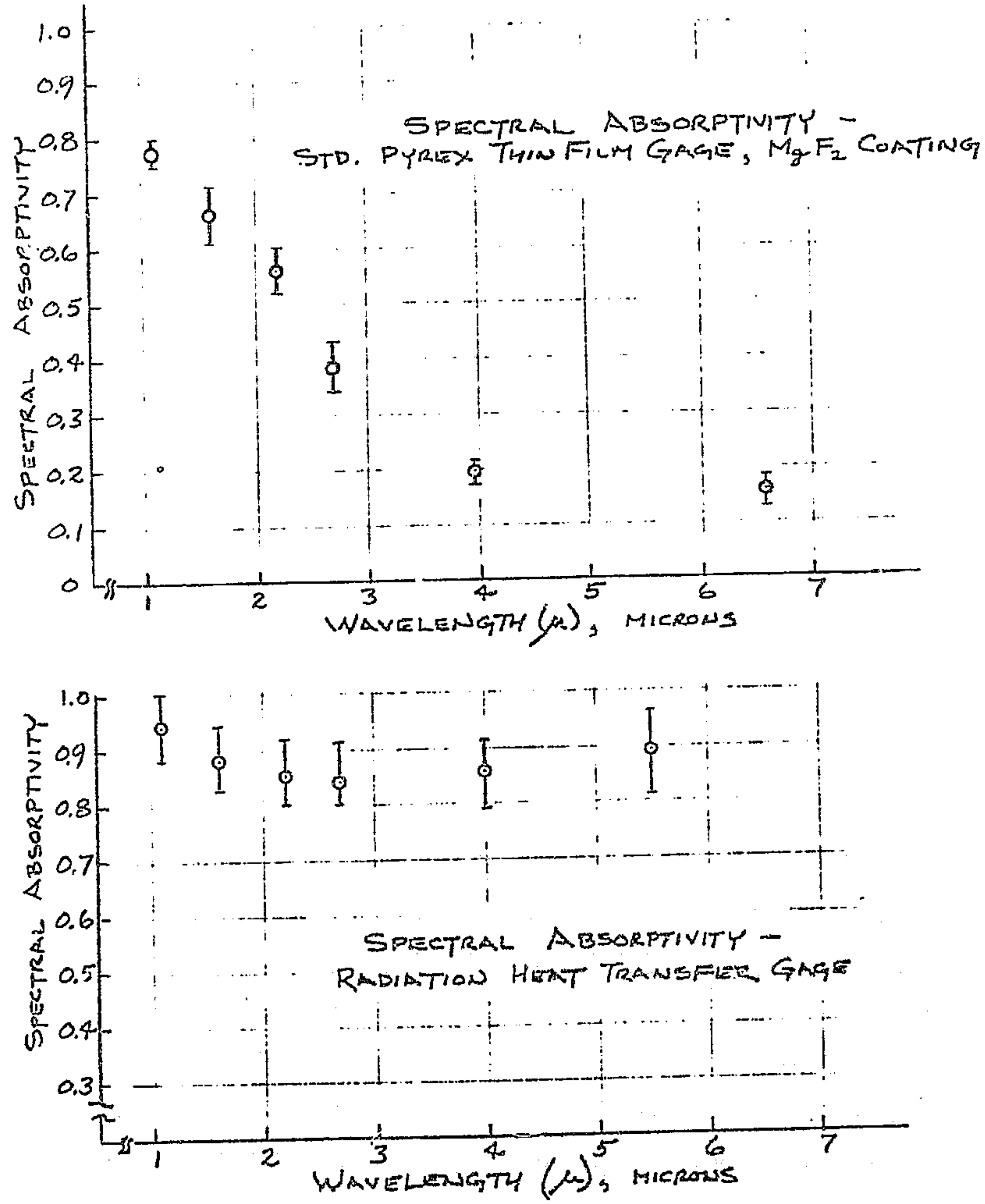

Figure 2. Heat Transfer Gage Spectral Absorptivity.

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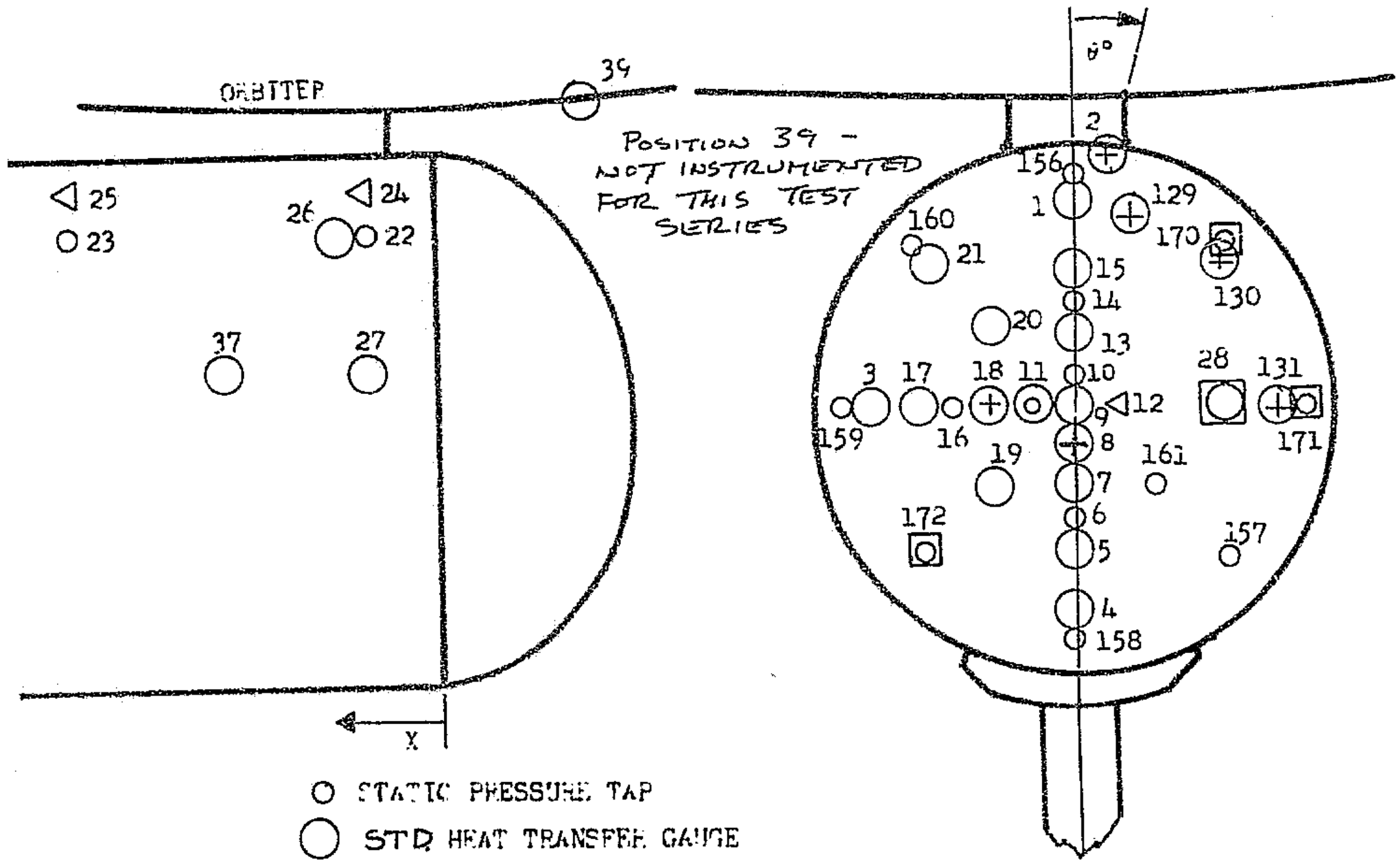


○ STATIC PRESSURE TAP

◯ STD HEAT TRANSFER GAUGE

⊕ RADIATION HEAT TRANSFER GAUGE

◎ GAS TEMPERATURE PROBE

◁ PITOT PROBE

INDICATES ADDED INSTRUMENTATION

INDICATES ADDED INSTRUMENTATION

a. External Tank

Figure 3. Model Instrumentation Locations.

EXTERNAL TANK BASE

NUMBER	Inches "R" Model Scale	Inches "R" Full Scale	"θ" Degrees	GAUGE TYPE
1	2.750	122.2	0	Std. Gage
2	3.645	162.0	7	Radiation gauge
3	2.750	122.2	270	Std. Gage
4	2.750	122.2	180	
5	1.980	88.0	180	
6	1.770	78.7	180	Pressure
7	1.000	44.4	180	Std. Gage
8	0.480	21.3	180	Radiation gauge
9	0	0	0	Std. Gage
10	0.250	11.1	0	Pressure
11	0.468	20.8	270	Gas temperature probe
12	0.375	16.7	90	Pitot probe
13	1.000	44.4	0	Std. Gage
14	1.770	78.7	0	Pressure
15	1.980	88.0	0	Std. Gage
16	1.812	80.5	270	Pressure
17	2.290	101.8	270	Std. Gage
18	1.300	57.8	270	Radiation gauge
19	1.812	80.5	225	Std. Gage
20	1.812	80.5	315	
21	2.734	121.5	315	
129	2.750	122.2	12 1/2	Radiation gauge
130	2.750	122.2	45	
131	2.750	122.2	90	
156	2.948	131.0	0	Pressure
157	2.948	131.0	135	
158	2.948	131.0	180	
159	2.948	131.0	270	
160	2.948	131.0	315	
161	1.463	65.0	135	
170	2.948	131.0	45	Pressure
171	2.948	131.0	90	Pressure
172	2.948	131.0	225	Pressure
28	2.290	101.8	90	Std. Gage

a. Continued

Figure 3. Continued.

EXTERNAL TANK SIDEWALL

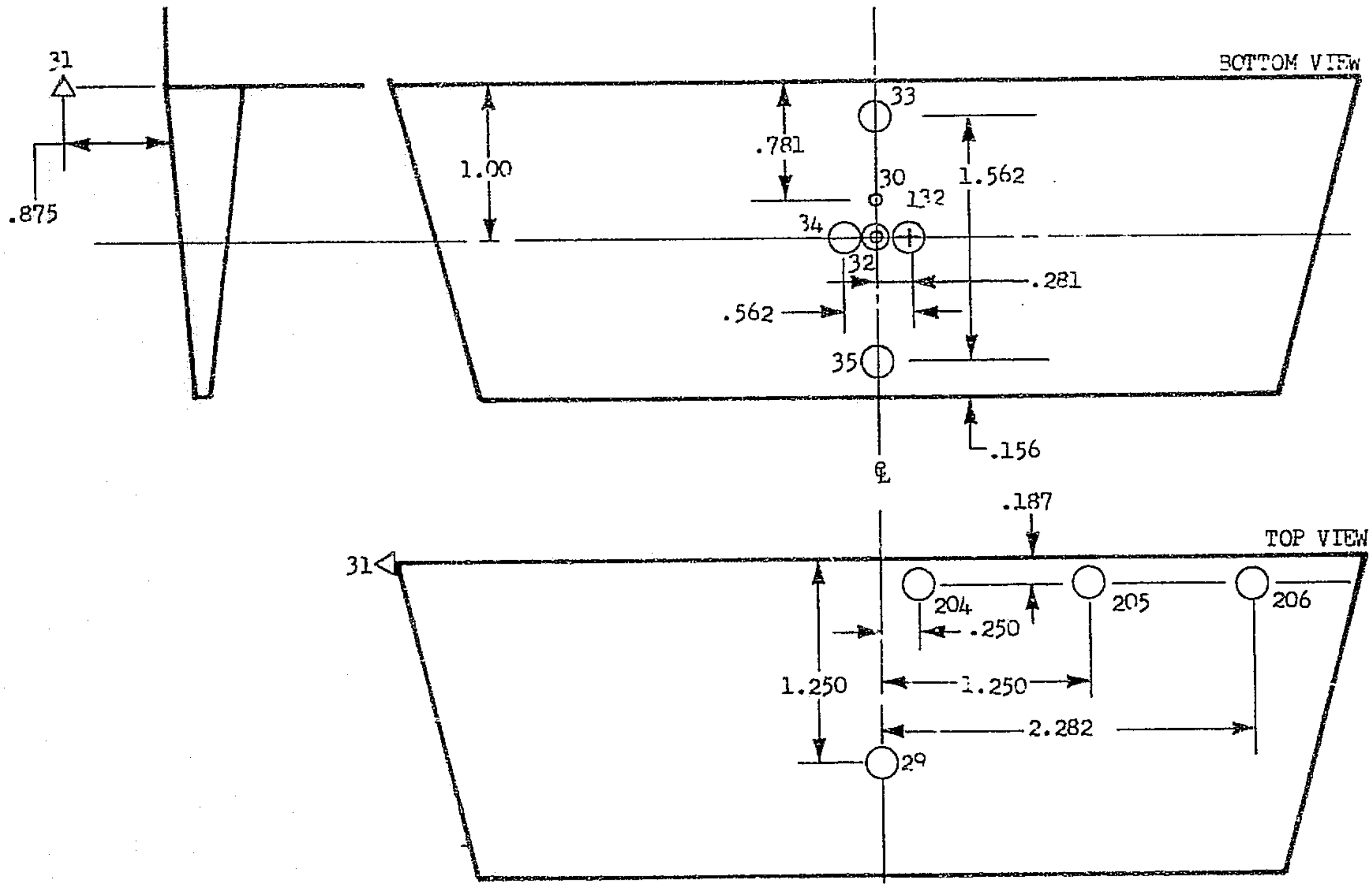
NUMBER	"X" Inches Model Scale	"X" Inches Full Scale	"R" Inches Model Scale	"R" Inches Full Scale	"θ" DEGREES	GAUGE TYPE
22	0.843	37.47	3.645	162	45	Pressure
23	8.593	381.91	3.645	162	45	
24	0.843	37.47	4.705	209.1	315	Pitot Probe
25	8.593	381.91	4.705	209.1	315	
26	0.843	37.47	3.645	162	315	Std. Gage
27	0.843	37.47	3.645	162	280	
37	3.843	170.80	3.645	162	280	

ORBITER FUSELAGE

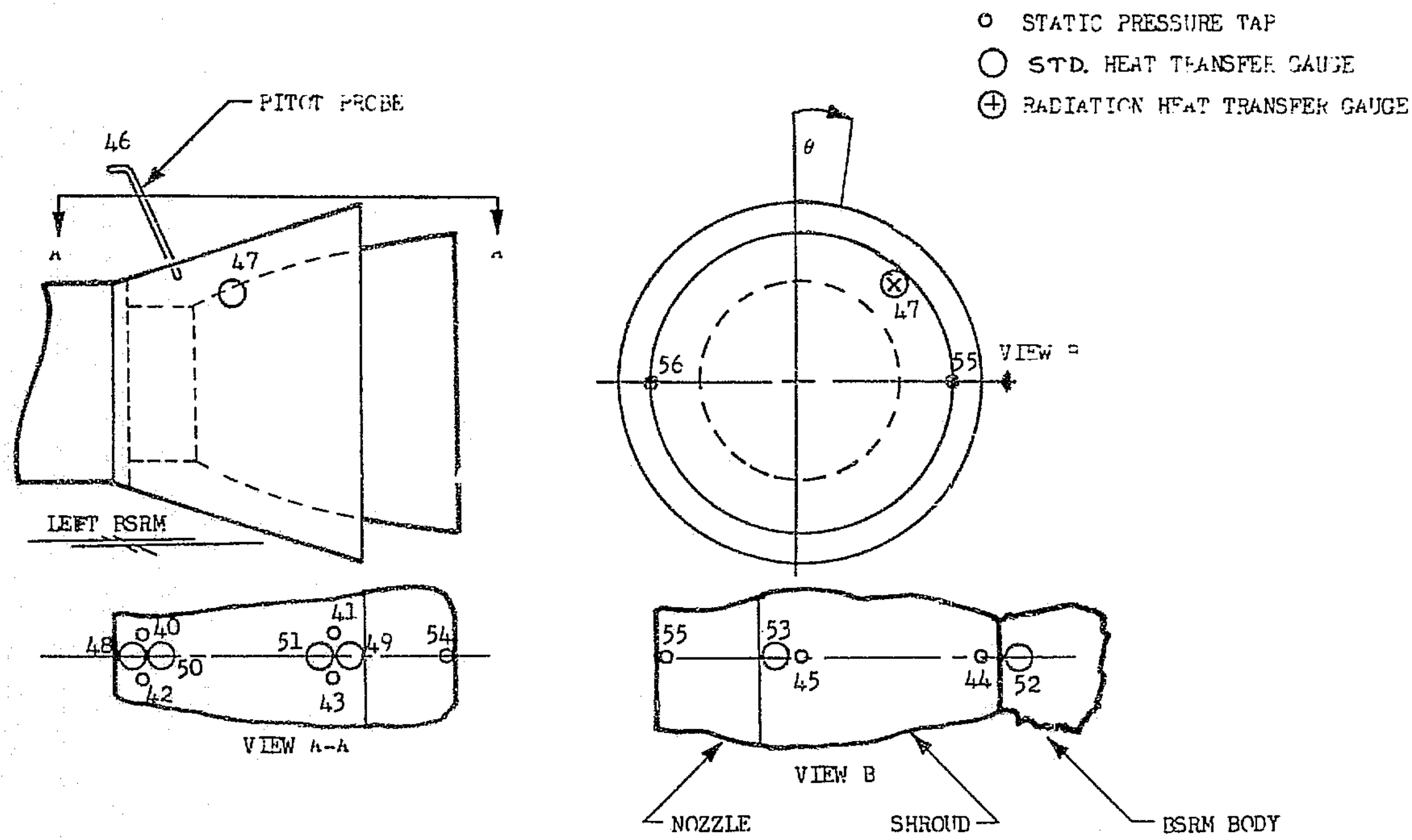
Number	M.S. Inches	Inches X_o Full Scale	Radial Position	Gauge Type
39	32.440	1441.778	On lower ℄	

POSITION 39 NOT INSTRUMENTED FOR THIS TEST SERIES

a. Continued
Figure 3. Continued.



b. Engine Heat Shield (Body Flap)
Figure 3. Continued.



NOTE: GAUGE 56 IS IN THE POSITION SHOWN BUT ON THE RIGHT-HAND BSRM

c. BSRM Nozzle and Shroud
Figure 3. Continued.

BSRM SHROUD

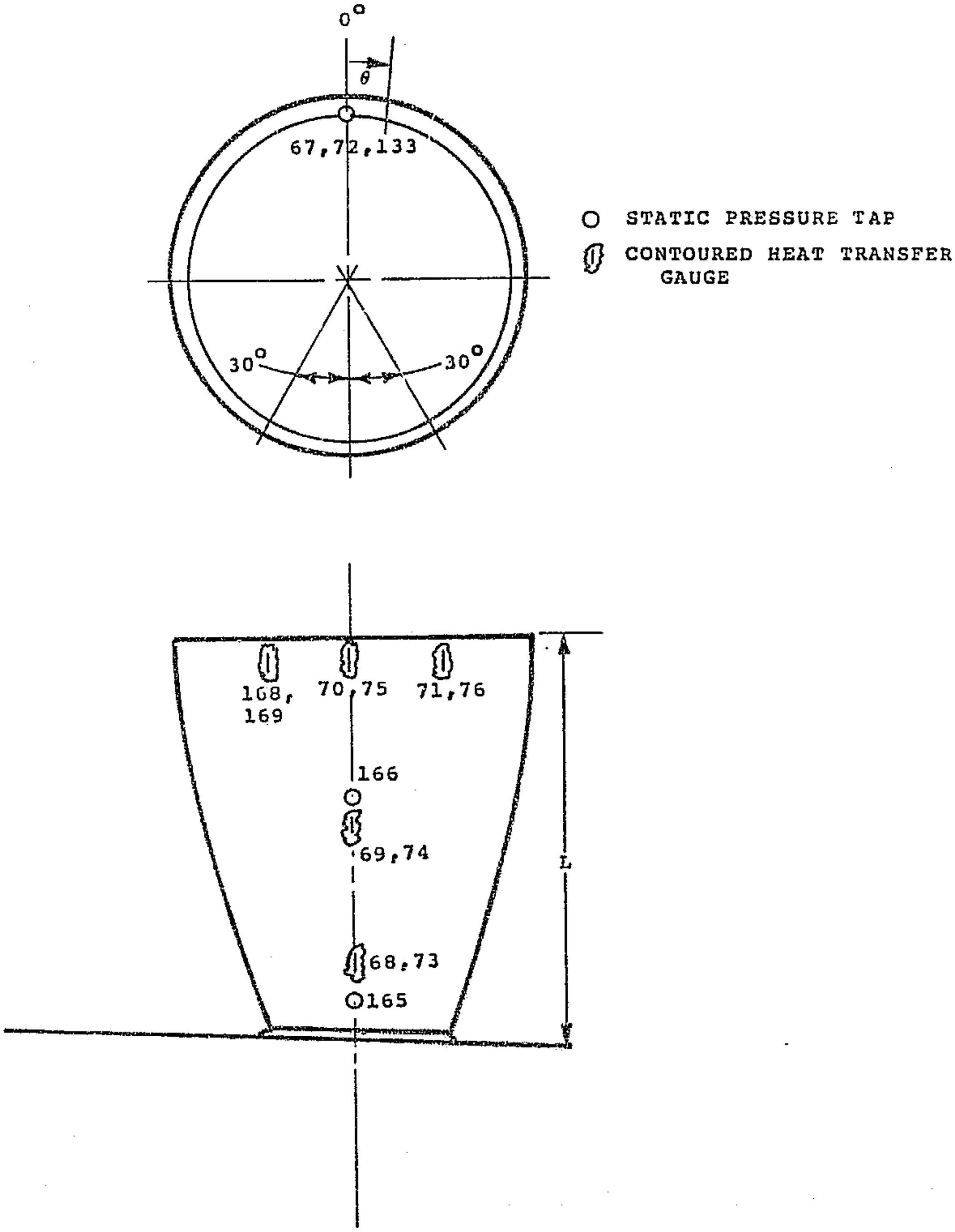
NUMBER	BSRM	SURFACE	AXIAL LOCATION	θ DEGREES	GAUGE TYPE
40	Left	External	Inlet	0	Pressure
41			Exit	0	
42		Internal	Inlet	0	
43			Exit	0	
44			Inlet	90	
45			Exit	90	
46		-	*	0	Pitot Probe
47		External	Shroud Length/2	45	Radiation Gauge
48			Inlet	0	Std. Gage
49			Exit	0	
50		Internal	Inlet	0	
51			Exit	0	
52		External	Inlet	90	
53			Exit	90	

BSRM NOZZLES

NUMBER	BSRM	SURFACE	AXIAL LOCATION	θ DEGREES	GAUGE TYPE
54	(#4) Left	External	Exit	0	Pressure
55		Internal		90	
56	(#5) Right			270	

* Pitot Probe #46 is in the same plane as the shroud inlet and at the same y & z locations as the other pitot probes (24, 25, & 31)

c. Continued
Figure 3. Continued.



NOTE: THE HEAT TRANSFER GAUGES ON EACH NOZZLE ARE ORIENTED TOWARDS THE CENTER OF THE BASE HEAT SHIELD

SSME Firing Nozzle Instrumentation

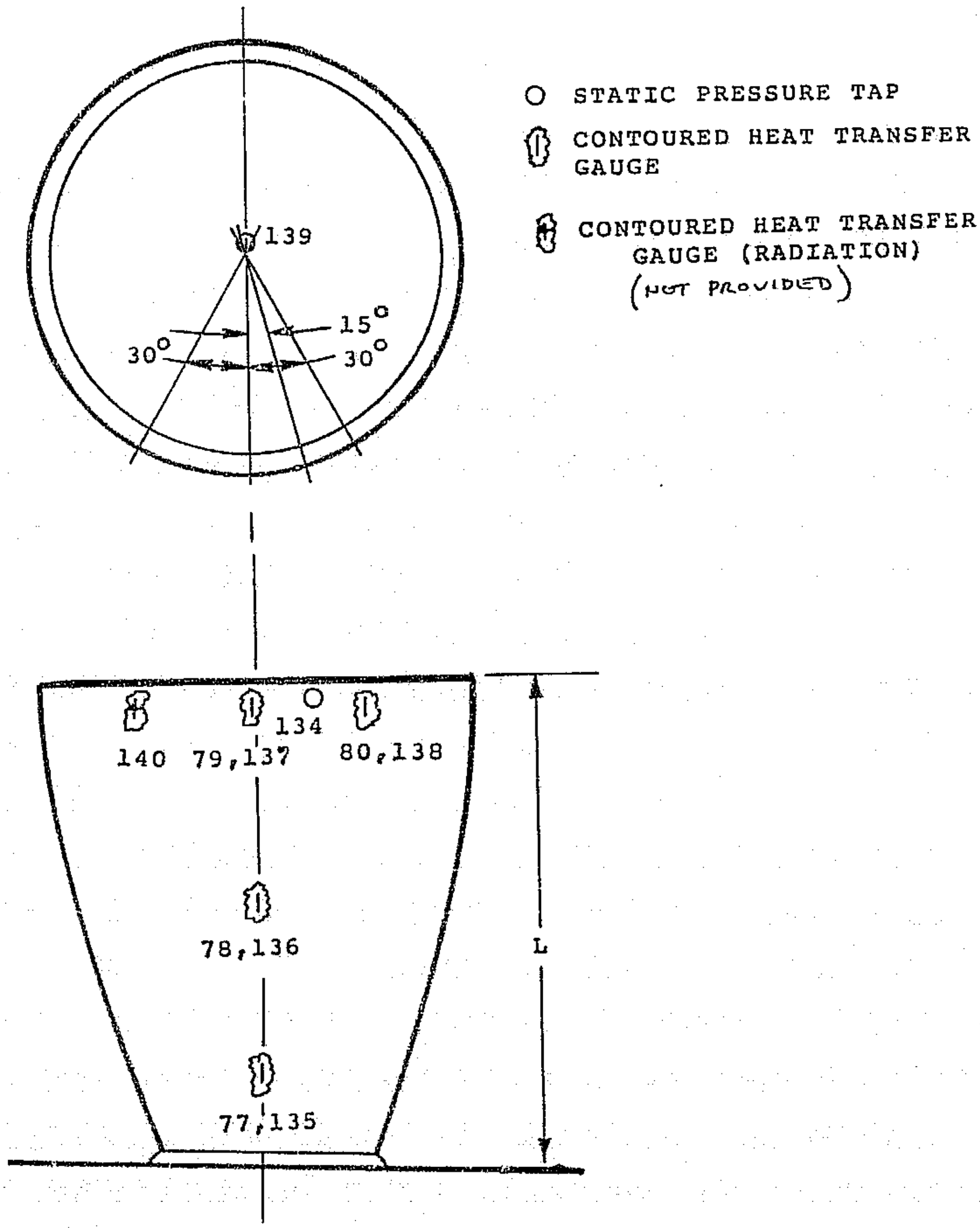
d. SSME Firing Nozzle

Figure 3. Continued.

NUMBER	NOZZLE	AXIAL LOCATION	SURFACE	"Θ" DEGREES	GAUGE TYPE
67	(#2) Lower Left	1.0 L	Internal	0	Pressure
68	(#2) Lower Left	2/9 L	External	180	Contoured Gauge
69	(#2) Lower Left	5/9 L	External	180	Contoured Gauge
70	(#2) Lower Left	8/9 L	External	180	Contoured Gauge
71	(#2) Lower Left	8/9 L	External	150	Contoured Gauge
168	(#2) Lower Left	8/9 L	External	210	Contoured Gauge
165	(#2) Lower Left	0.2 L	External	180	Pressure
166	(#2) Lower Left	0.6 L	External	180	Pressure
133	(#3) Lower Right	1.0 L	Internal	0	Pressure
72	(#1) Upper	1.0 L	Internal	0	Pressure
73	(#1) Upper	2/9 L	External	180	Contoured Gauge
74	(#1) Upper	5/9 L	External	180	Contoured Gauge
75	(#1) Upper	8/9 L	External	180	Contoured Gauge
76	(#1) Upper	8/9 L	External	150	Contoured Gauge
169	(#1) Upper	8/9 L	External	210	Contoured Gauge

L is the distance from the base heat shield to the end of the nozzle.

d. Continued
Figure 3. Continued.



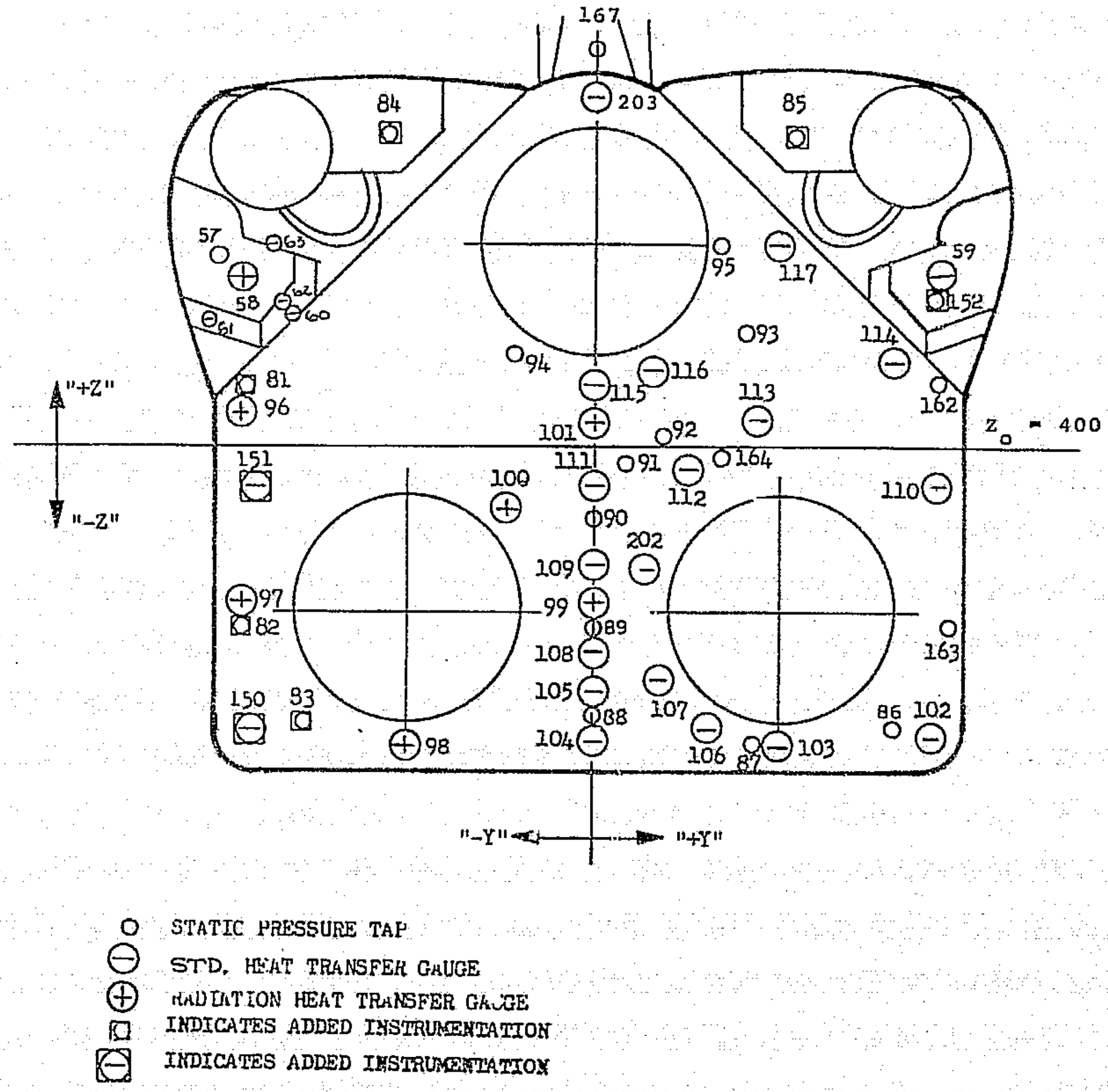
e. SSME Non-Firing Nozzle
Figure 3. Continued.

NUMBER	AXIAL LOCATION	SURFACE	"θ" DEGREES	GAUGE TYPE
77	2/9 L	External	0	Contoured Gauge
78	5/9 L	External	0	Contoured Gauge
79	8/9 L	External	0	Contoured Gauge
80	8/9 L	External	30	Contoured Gauge
134	8/9 L	External	15	Pressure
135	2/9 L	Internal	180	Contoured Gauge
136	5/9 L	Internal	180	Contoured Gauge
137	8/9 L	Internal	180	Contoured Gauge
138	8/9 L	Internal	210	Contoured Gauge
139	At Throat	-	-	Pressure
140	8/9 L	Internal	150	Contoured Radiation Gauge (NOT PROVIDED)

L is the distance from the base heat shield to the end of the nozzle.

e. Continued
Figure 3. Continued.

POSITION 167 AND ALL RIGHT OMS POD POSITIONS NOT INSTRUMENTED FOR THIS TEST SERIES



f. Orbiter Base Heat Shield
Figure 3. Continued.

BASE HEAT SHIELD

NUMBER	"Y" INCHES MODEL SCALE	"Y" INCHES FULL SCALE	"Z" INCHES MODEL SCALE	"Z" INCHES FULL SCALE	GAUGE TYPE
86	2.048	91.0	-1.840	-81.8	Pressure
87	1.073	47.7	-2.000	-88.9	Pressure
88	0	0	-1.813	-80.6	Pressure
89	0	0	-1.190	-52.9	Pressure
90	0	0	-0.468	-20.8	Pressure
91	0.218	9.7	-0.153	- 6.8	Pressure
92	0.465	20.7	0.045	2.0	Pressure
93	1.025	45.6	0.718	31.9	Pressure
94	-0.520	-23.1	0.613	27.2	Pressure
95	0.812	36.1	1.330	59.1	Pressure
96	-2.350	-104.4	0.230	10.2	Radiation Gauge
97	-2.350	-104.4	-1.030	-45.8	Radiation Gauge
98	-1.250	-55.6	-2.000	-88.9	Radiation Gauge
99	0	0	-1.000	-44.4	Radiation Gauge
100	-0.570	-25.3	-0.400	-17.8	Radiation Gauge
101	0	0	0.150	6.7	Radiation Gauge
102	2.282	101.4	-1.933	-85.9	Std. Gage
103	1.250	55.6	-2.000	-88.9	
104	0	0	-2.000	-88.9	
105	0	0	-1.628	-72.4	
106	0.780	34.7	-1.880	-83.6	
107	0.450	20.0	-1.550	-68.9	
108	0	0	-1.377	-61.2	
109	0	0	-0.750	-33.3	
110	2.350	104.4	-0.281	-12.5	
111	0	0	-0.281	-12.5	
112	0.630	28.0	-0.170	- 7.6	
113	1.093	48.6	0.175	7.6	
114	2.020	89.8	0.560	24.9	
115	0	0	0.400	17.8	
116	0.410	18.2	0.500	22.2	
117	1.245	55.3	1.330	59.1	
202	0.350	15.6	-0.820	-36.4	
162	2.363	105.0	0.548	24.4	Pressure
163	2.350	104.4	-1.025	-45.6	Pressure
164	0.810	36.0	-0.149	- 6.6	Pressure
203	0	0	2.266	100.7	Std. Gage

f. Continued
Figure 3. Continued.

BASE HEAT SHIELD (Continued)

NUMBER	"Y" INCHES MODEL SCALE	"Y" INCHES FULL SCALE	"Z" INCHES MODEL SCALE	"Z" INCHES FULL SCALE	GAUGE TYPE
81	-2.363	-105.0	+0.548	24.4	Pressure
82	-2.350	-104.4	-1.025	-45.6	Pressure
83	-2.048	-91.0	-1.840	-81.8	Pressure
84	-1.360	-60.4	+2.100	93.3	Pressure
85	+1.360	60.4	+2.100	93.3	Pressure
152	+2.750	122.2	+1.560	69.3	Pressure
150	-2.282	-101.4	-1.933	-85.9	Std. Gage
151	-2.350	-104.4	-0.281	-12.5	Std. Gage

OMS POD

NUMBER	"Y" INCHES MODEL SCALE	"Y" INCHES FULL SCALE	"Z" INCHES MODEL SCALE	"Z" INCHES FULL SCALE	GAUGE TYPE
58	-2.440	-108.4	1.250	55.6	Radiation
59	2.750	122.2	1.560	69.3	Standard
57	-2.750	-122.2	1.560	69.3	Pressure

f. Continued
Figure 3. Continued.

OMS POD

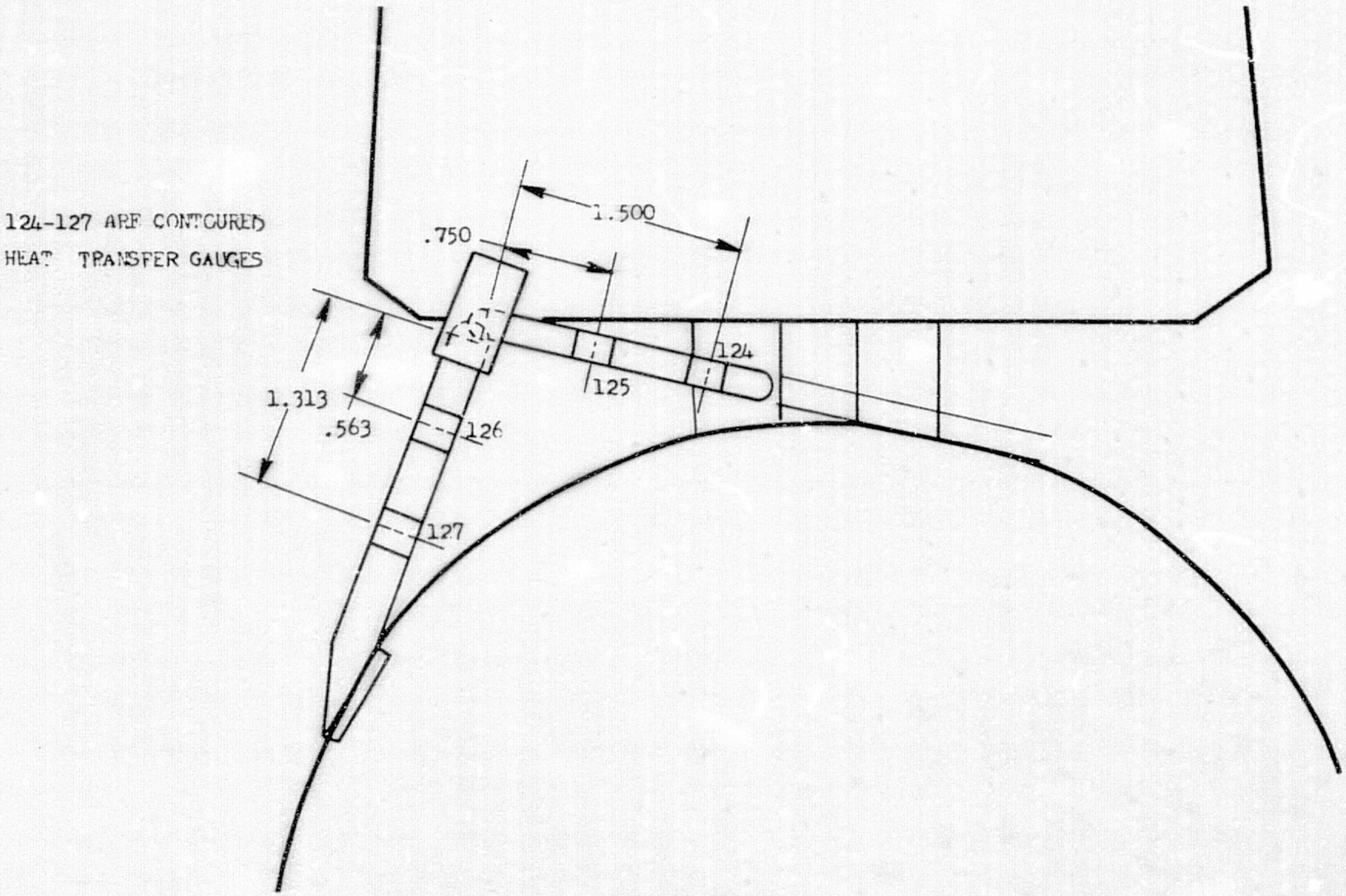
NUMBER	"X" INCHES MODEL SCALE	"X" INCHES FULL SCALE	GAUGE TYPE
60	0.968	43.0	Std. Gage
61	0.281	12.5	↓
62	0.281	12.5	↓
63	0.281	12.5	↓

OMS NOZZLE (ONE ONLY)

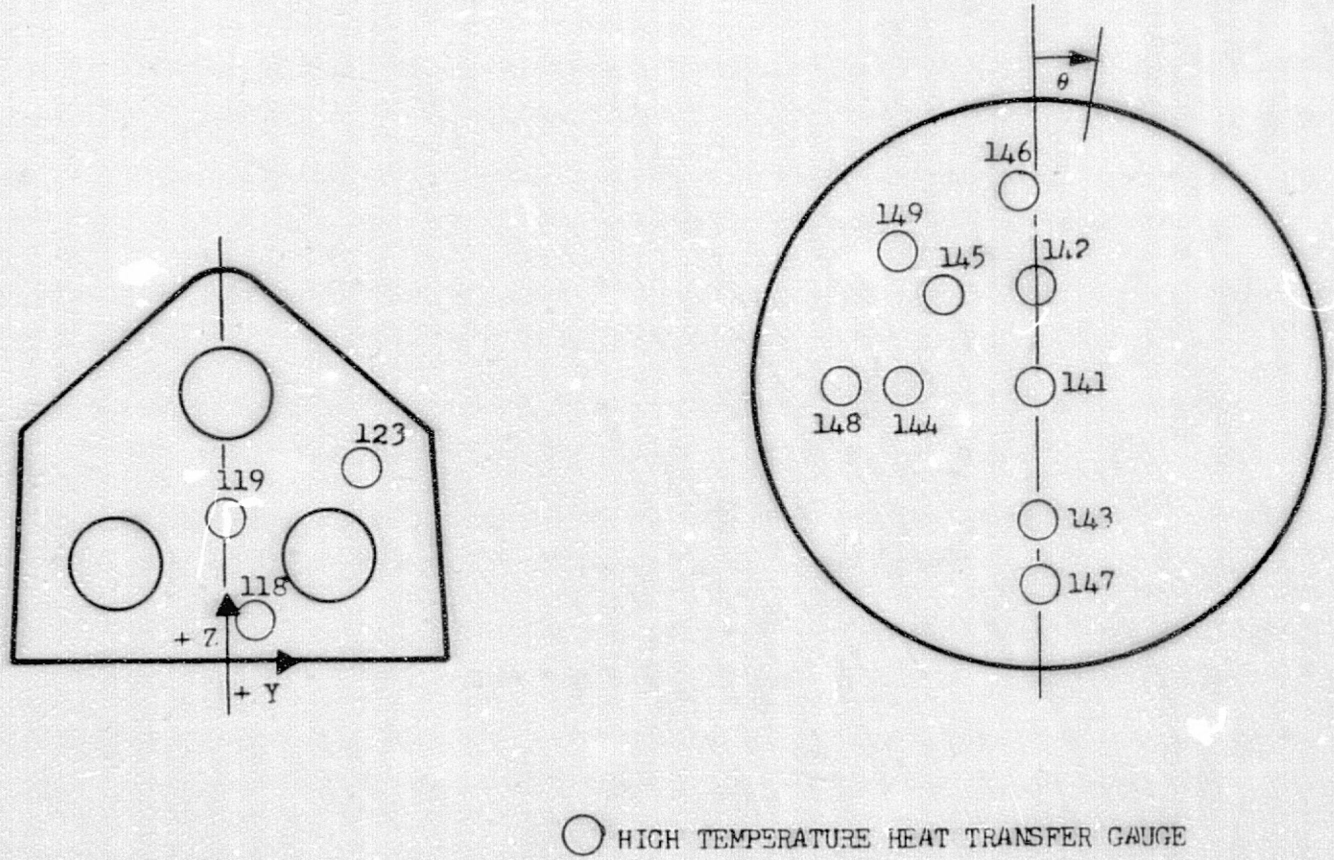
NUMBER	AXIAL LOCATION	SURFACE	θ DEGREES	GAUGE TYPE
64	At Throat	-	-	Pressure
65	End of Nozzle	External	0	Contoured Gauge
66	End of Nozzle	Internal	180	Contoured Gauge

f. Continued
Figure 3. Continued.

C-2



g. Aft Tank Strut
Figure 3. Continued.



h. Orbiter and External Tank Heated Base Plates
Figure 3. Continued.

EXTERNAL TANK HEATED BASE PLATE

NUMBER	"R" INCHES MODEL SCALE	"R" INCHES FULL SCALE	"θ" DEGREES	GAUGE TYPE
141	0	0	0	High Temperature Gauge
142	1.800	80.0	0	High Temperature Gauge
143	1.800	80.0	180	High Temperature Gauge
144	1.800	80.0	270	High Temperature Gauge
145	1.800	80.0	315	High Temperature Gauge
146	2.710	120.4	356	High Temperature Gauge
147	2.710	120.4	180	High Temperature Gauge
148	2.710	120.4	270	High Temperature Gauge
149	2.710	120.4	315	High Temperature Gauge

HEATED ORBITER BASE HEAT SHIELD

NUMBER	"Y" INCHES MODEL SCALE	"Y" INCHES FULL SCALE	"Z" INCHES MODEL SCALE	"Z" INCHES FULL SCALE	GAUGE TYPE
118	0.290	12.89	0.405	18.00	High Temp. Gauge
119	0	0	1.655	73.56	High Temp. Gauge
123	1.390	61.78	2.485	110.44	High Temp. Gauge

h. Continued
Figure 3. Continued.

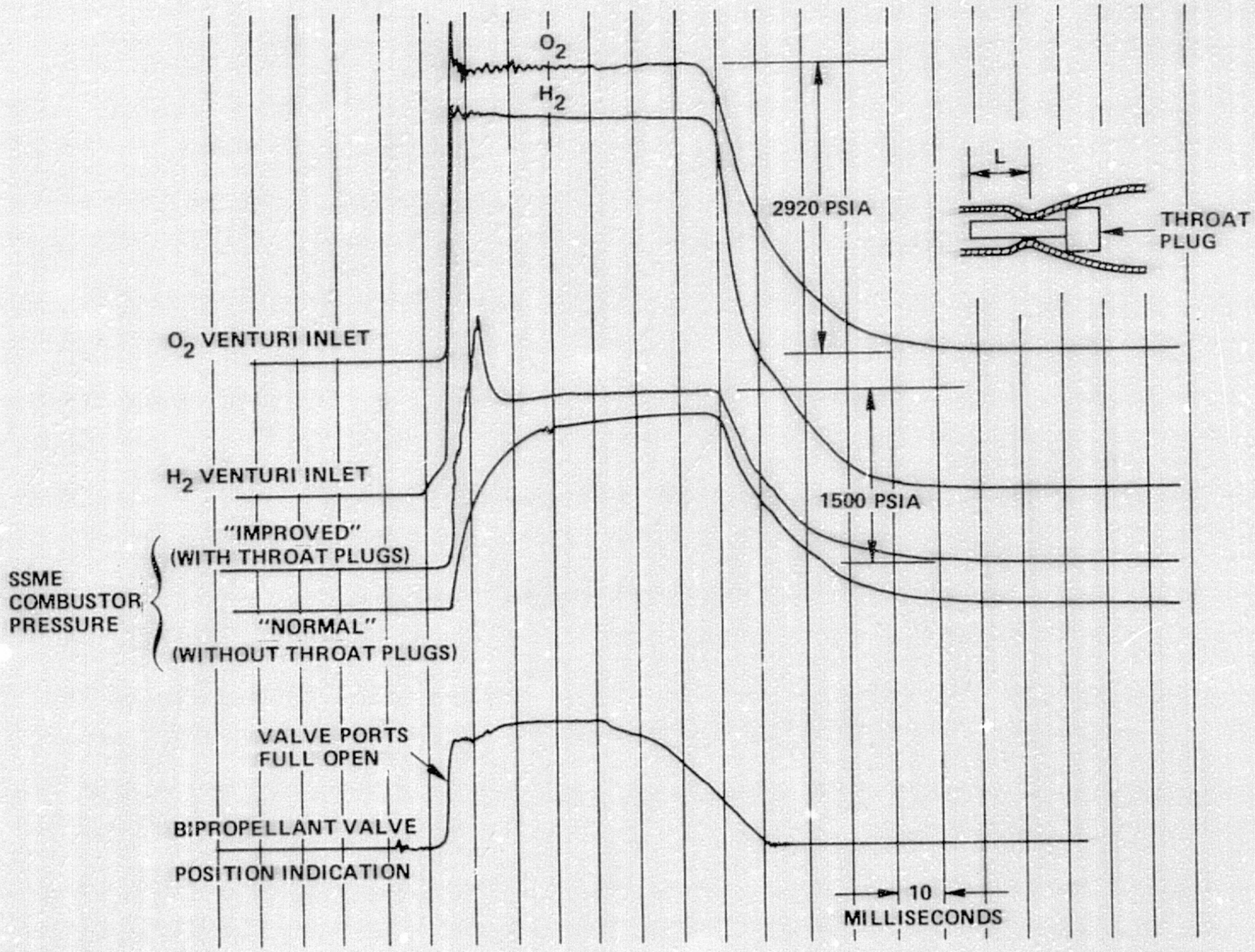


Figure 4. Representative SSME Operating Data.

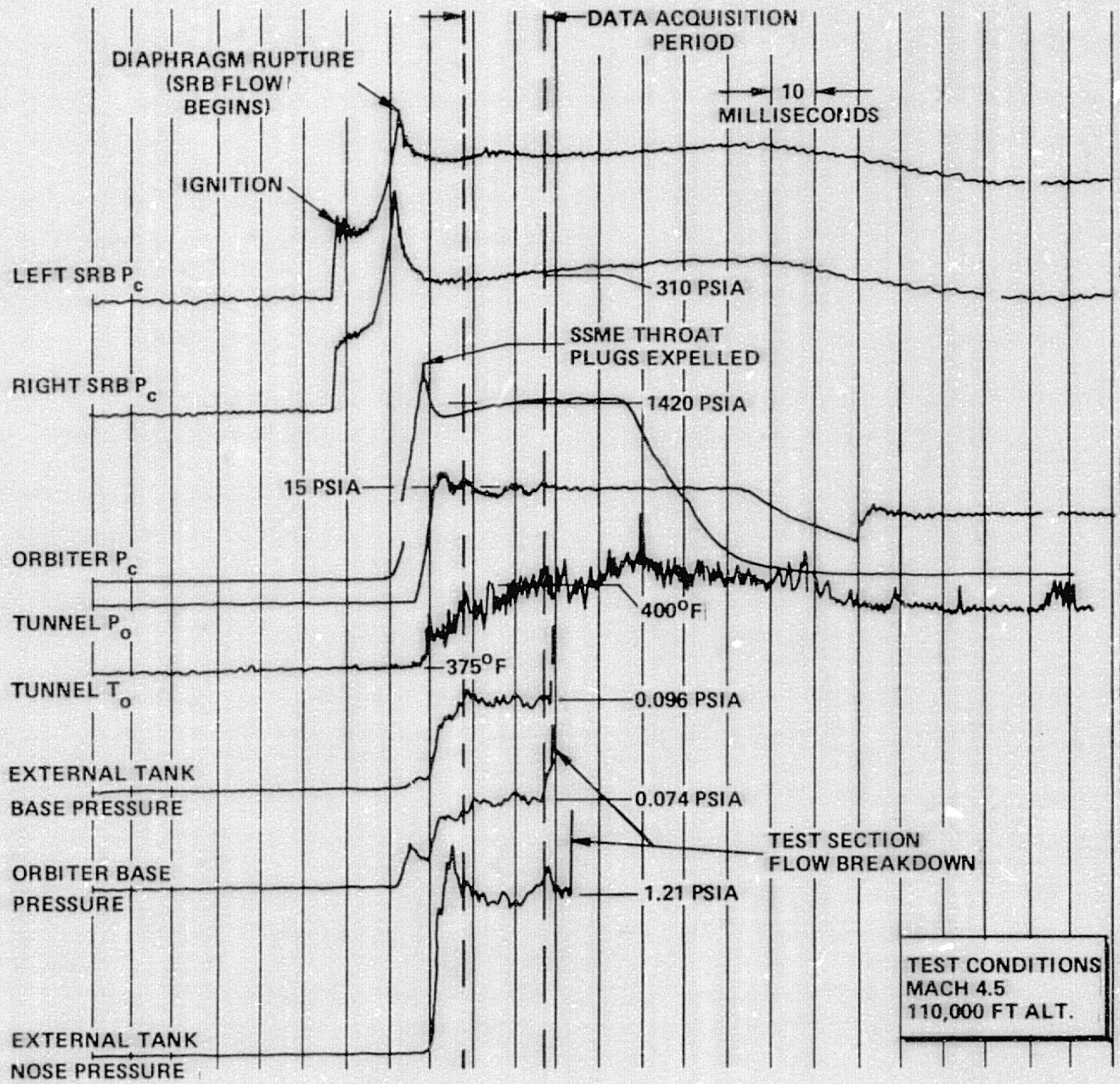


Figure 5. Composite Record of Tunnel and Model Operating Data.

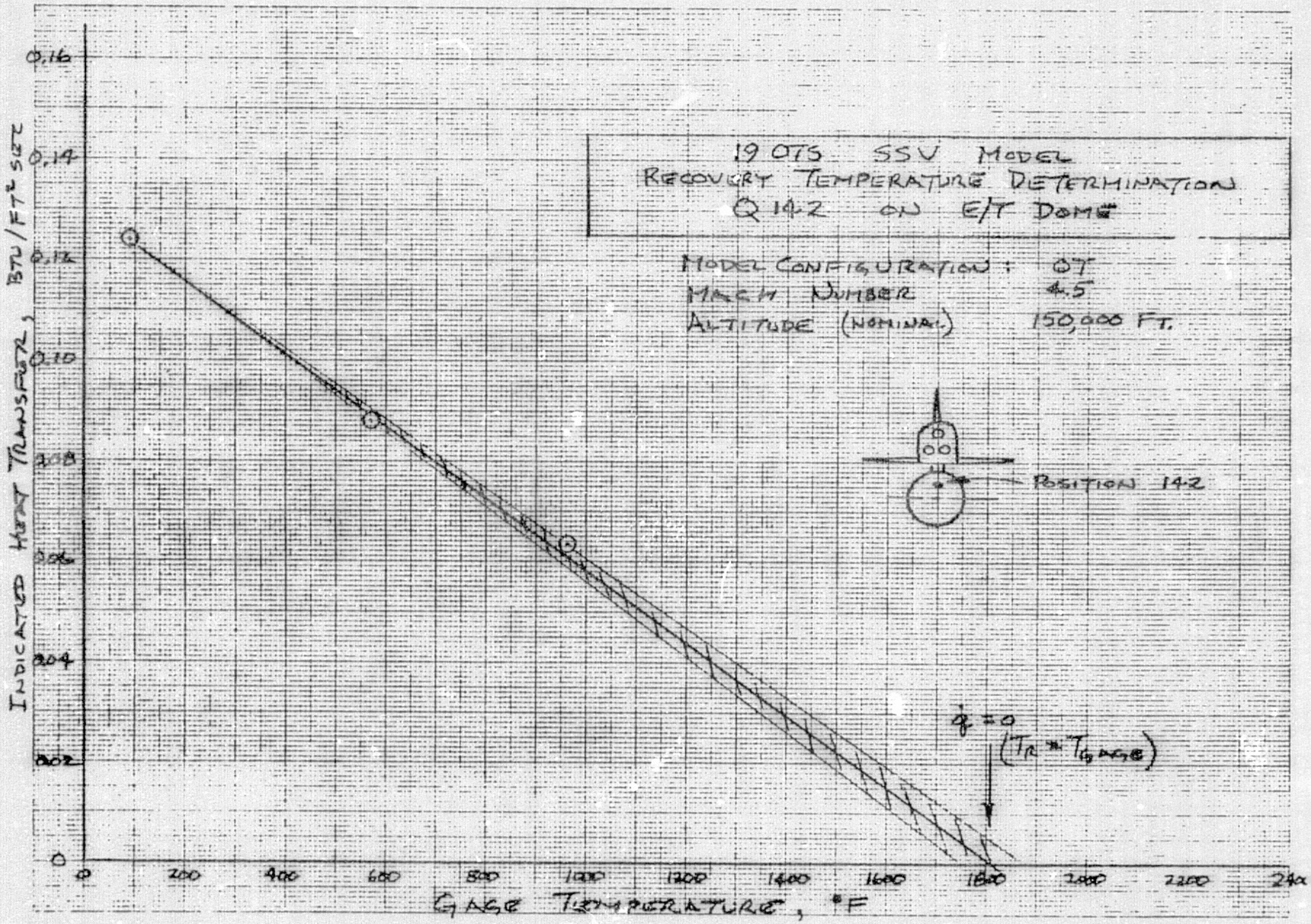


Figure 6. 19-OTS SSV Model Recovery Temperature Determination Q142 on E/T Dome.

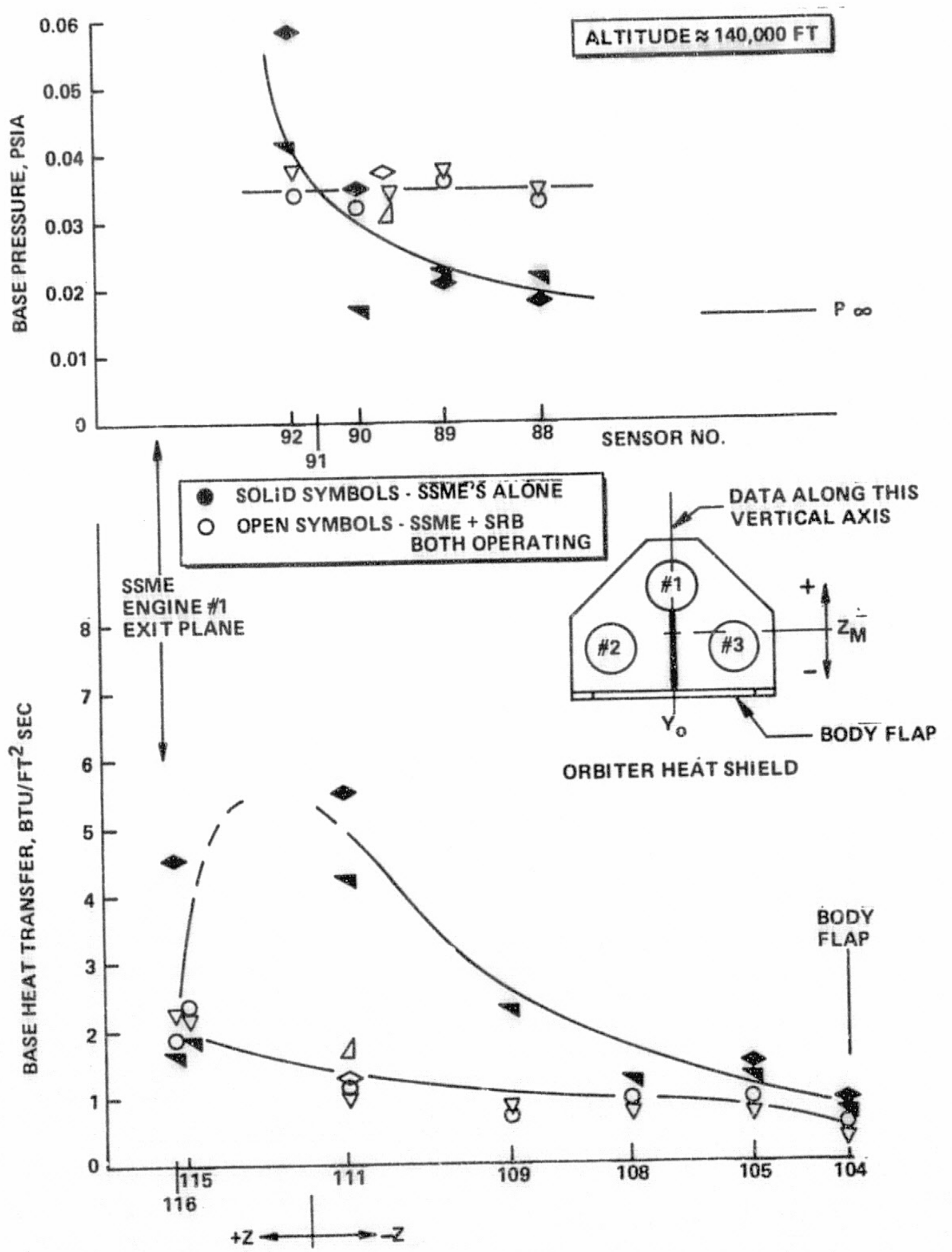


Figure 7. Representative Pressure and Heating Rate Distributions on the Orbiter Heat Shield.

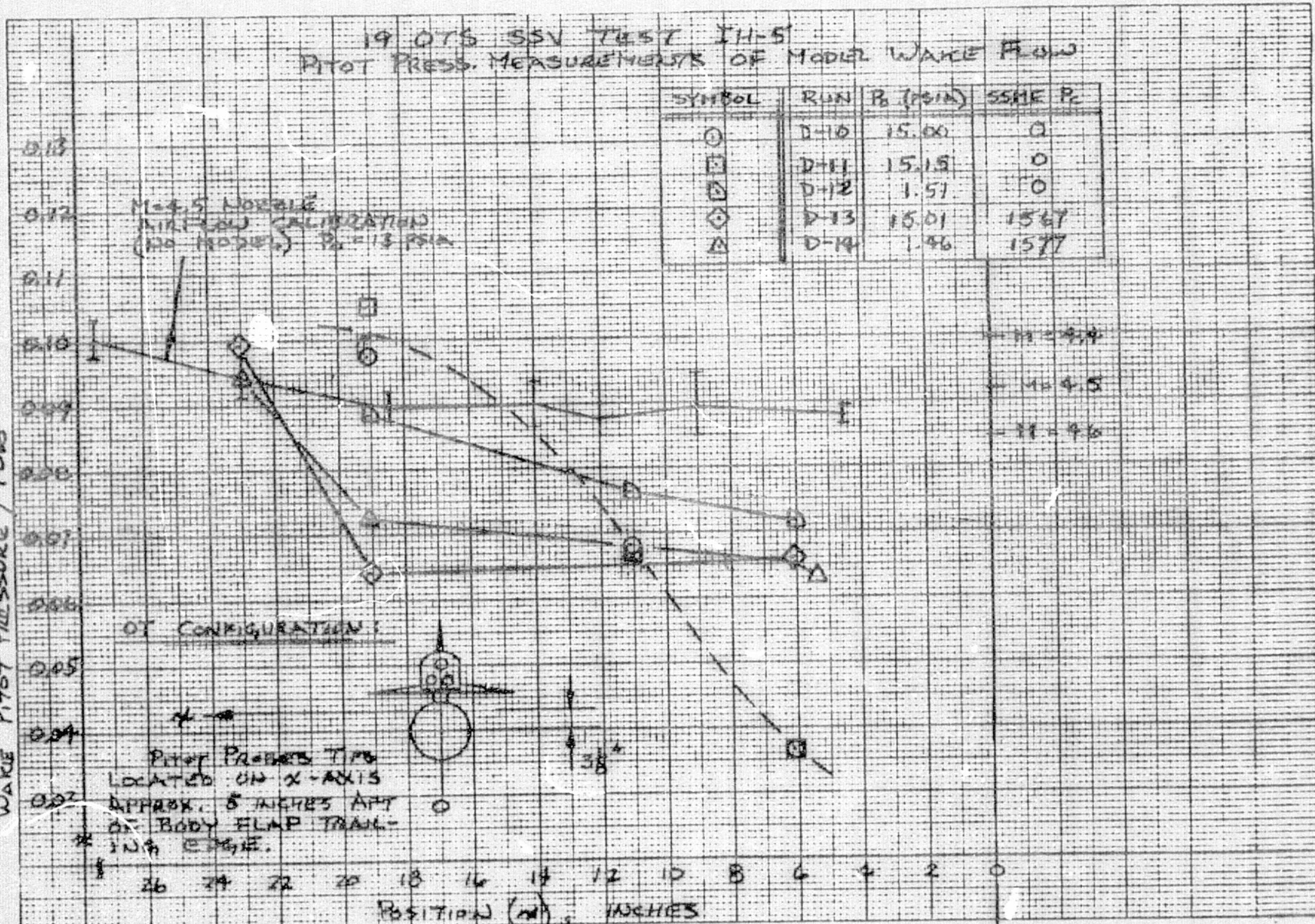


Figure 8. 19-OTS SSV Test IH5 Pitot Pressure Measurements of Model Wake Flow.

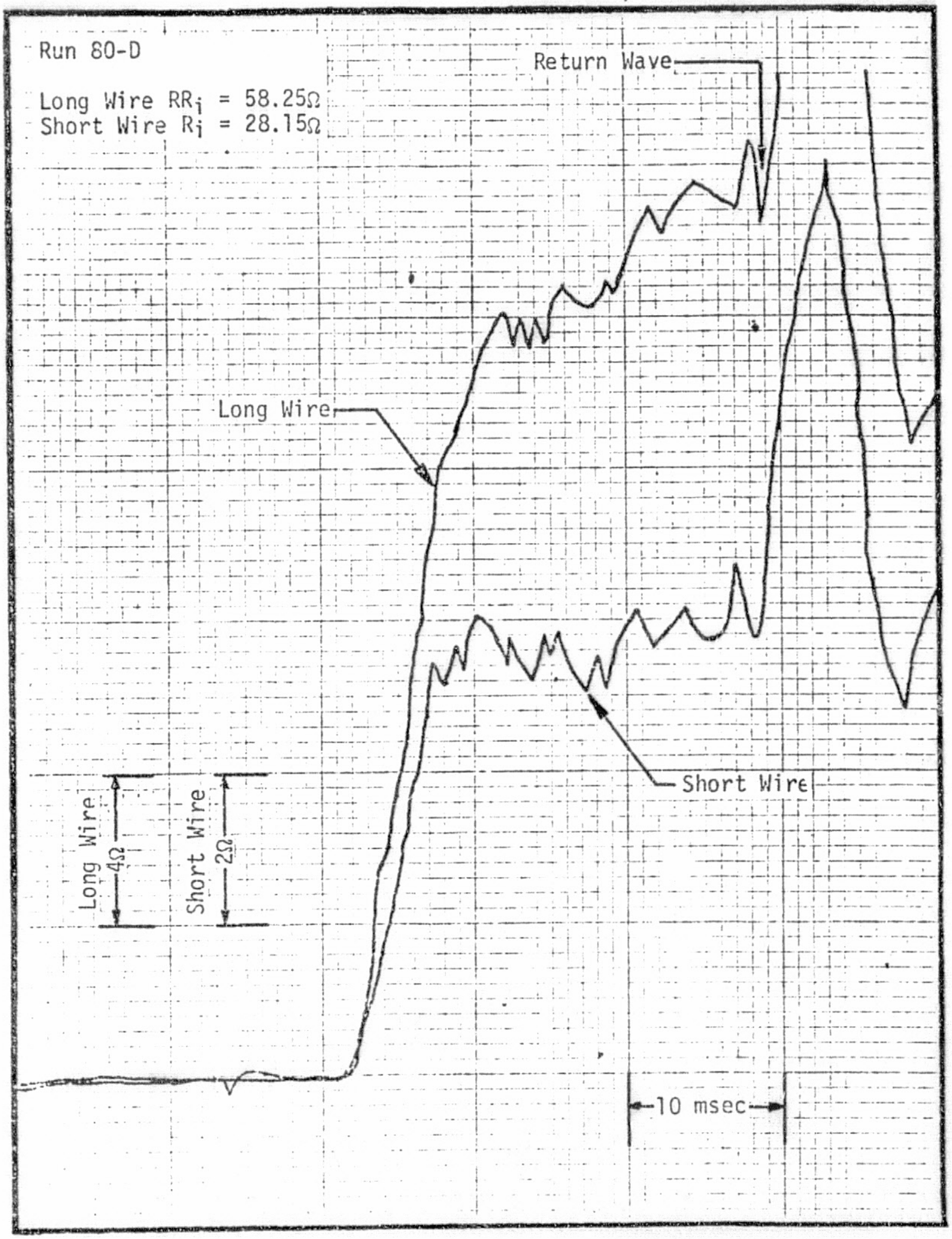


Figure 9. Wire Transient Resistance Data for Run 80-D at Location 11.

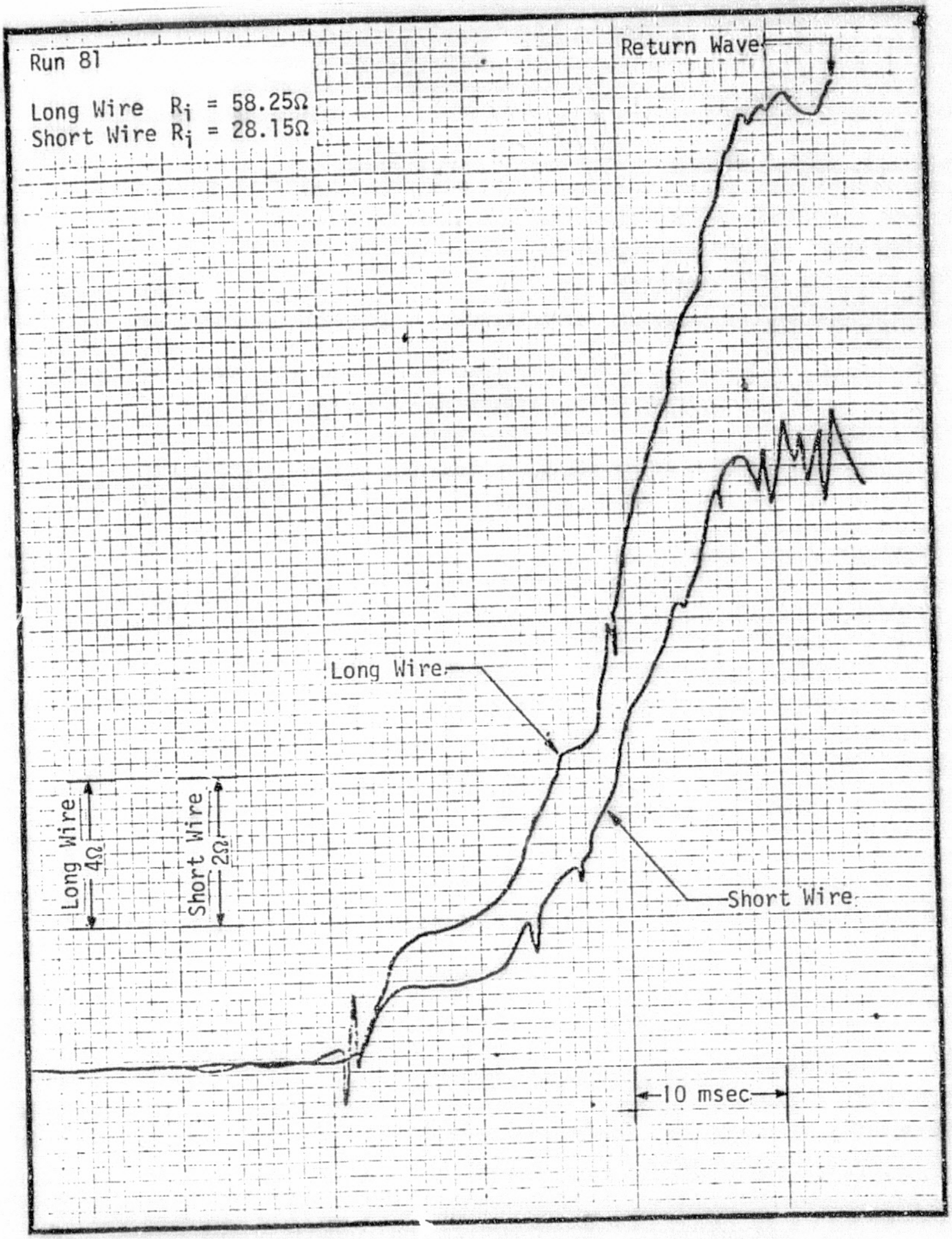


Figure 10. Wire Transient Resistance Data for Run 81 at Location 11.

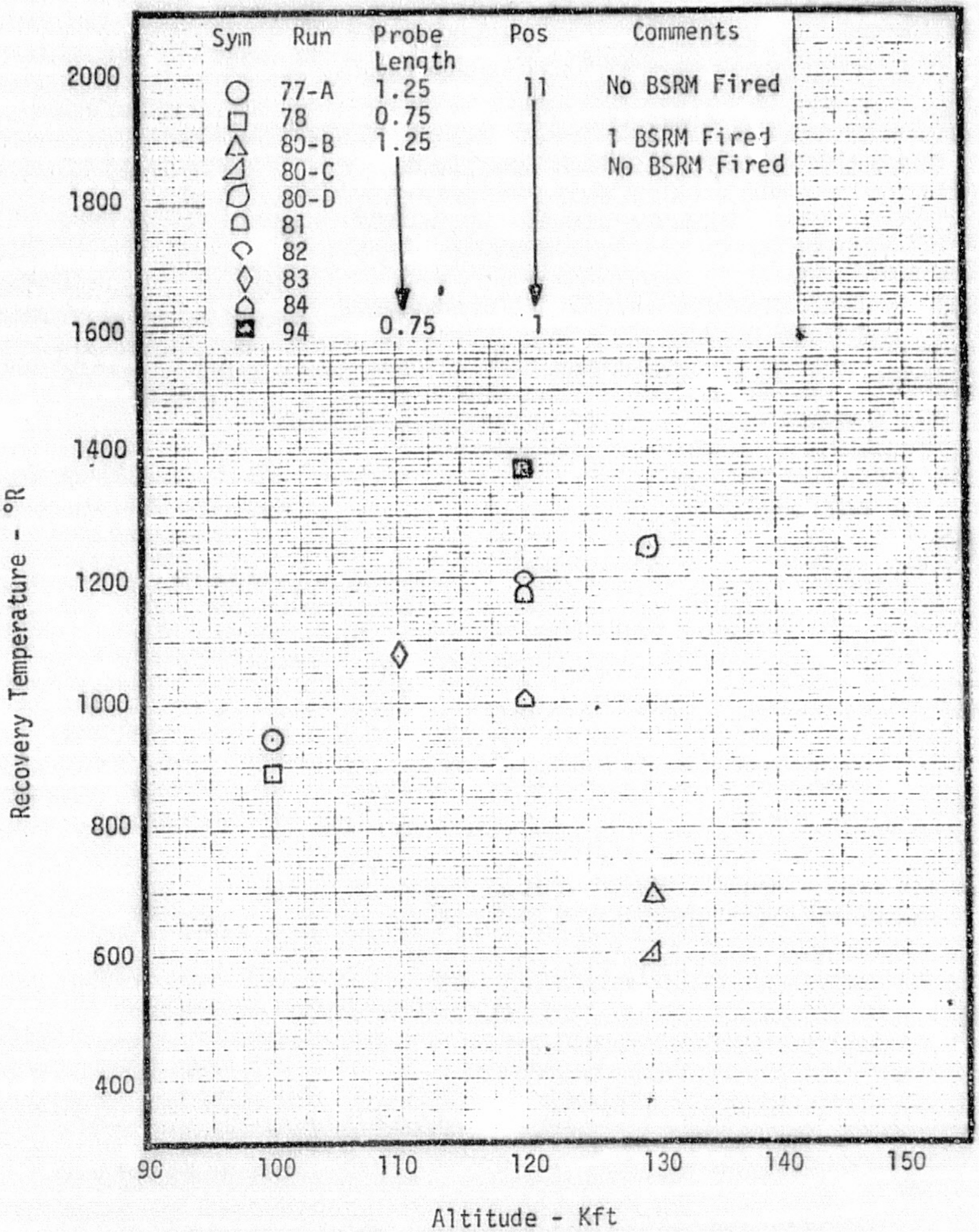


Figure 11. 19-OTS Recovery Temperature Measurements on ET Tank.

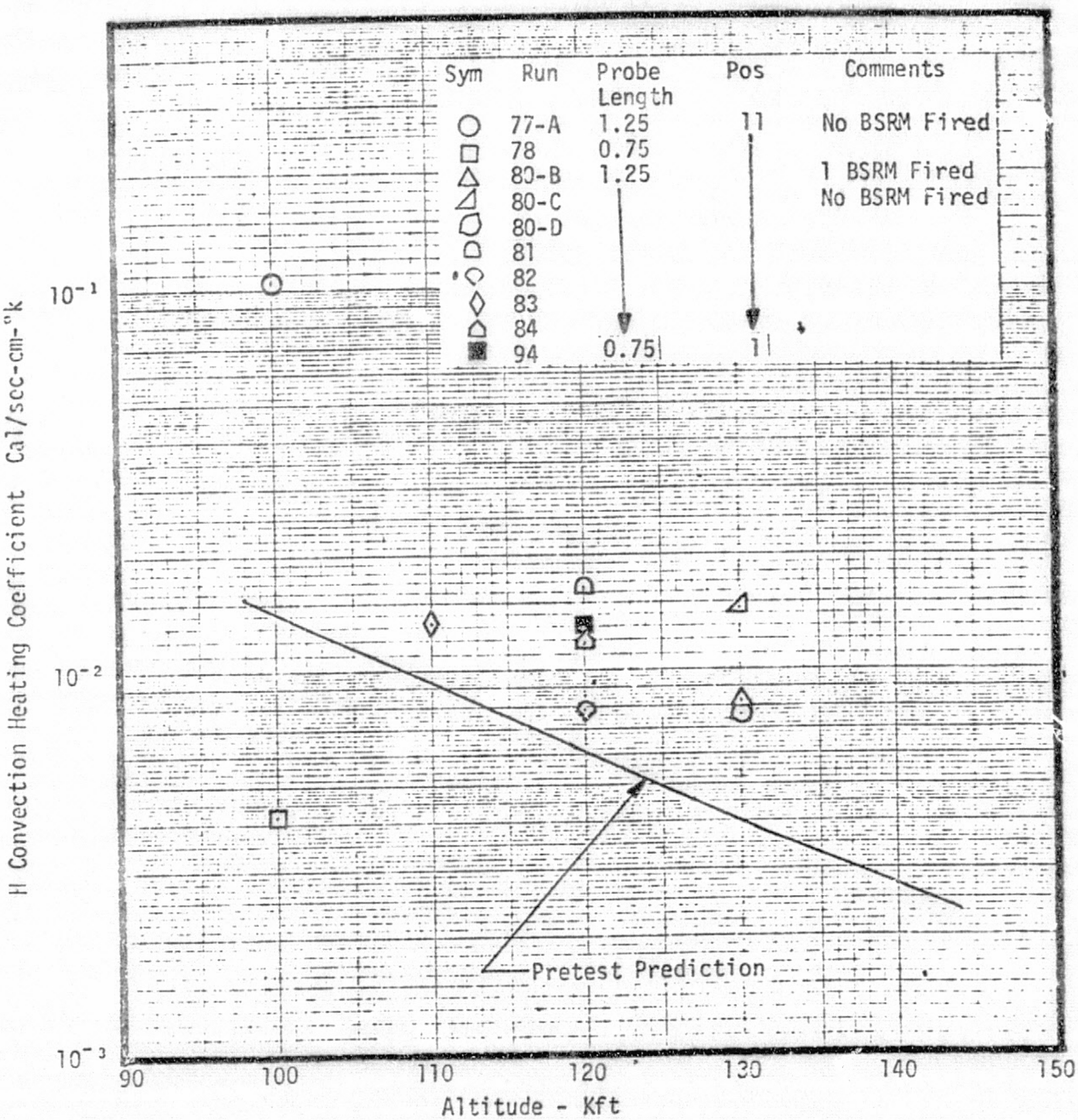


Figure 12. 19-OTS Thin Wire Convection Heating Coefficients on ET Tank.

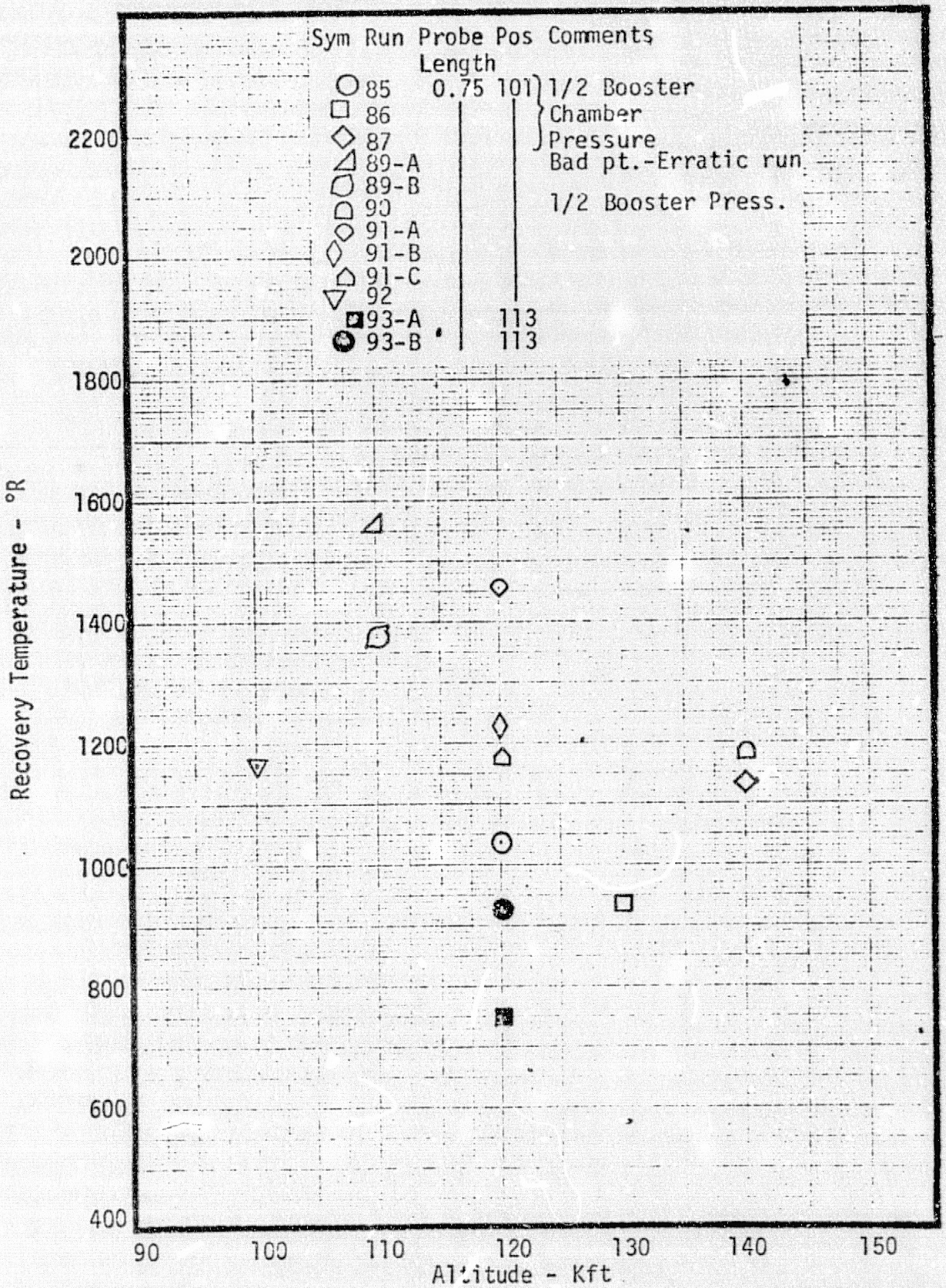


Figure 13. 19-OTS Recovery Temperature Measurements on Orbiter.

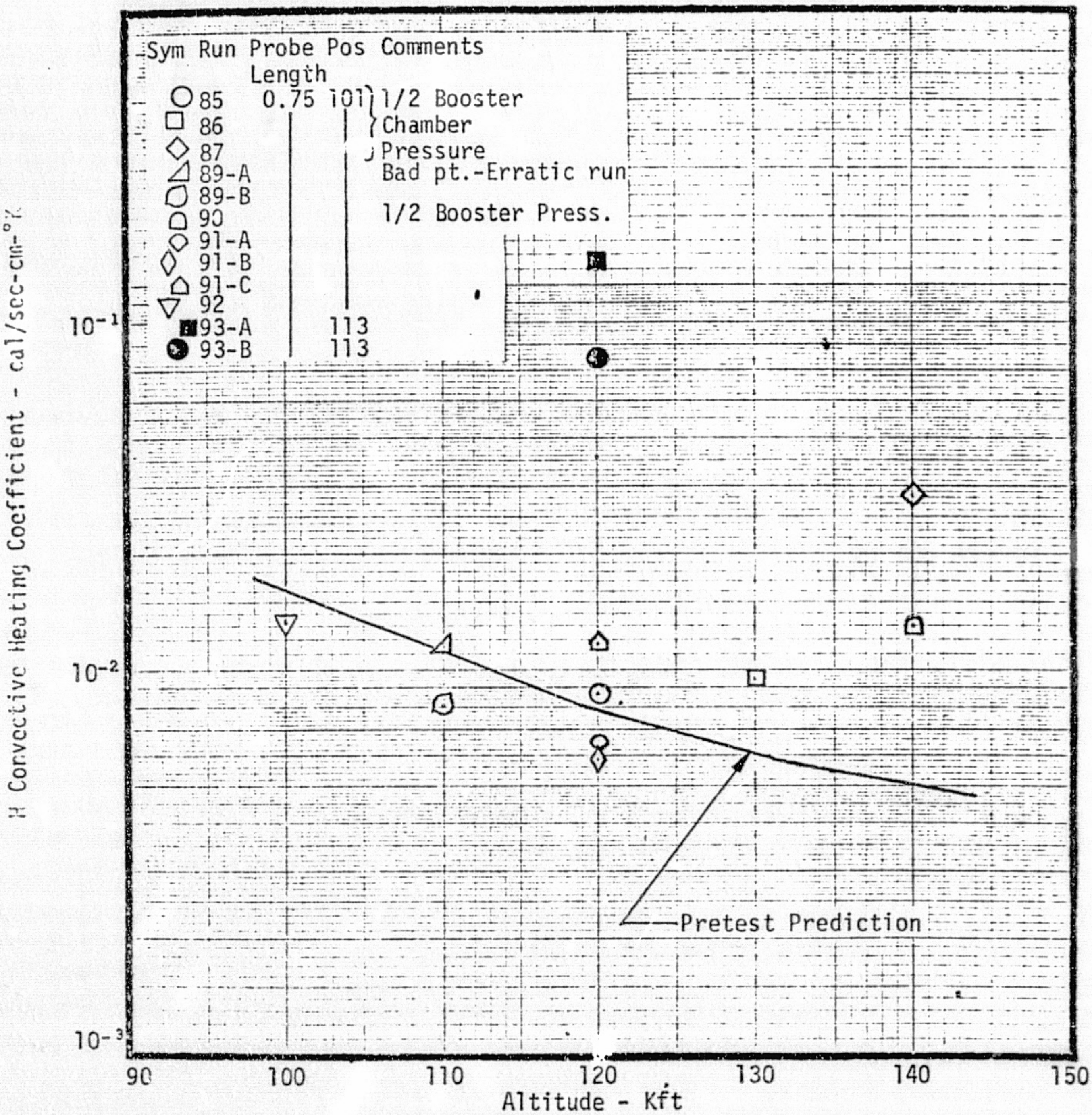


Figure 14. 19-OTS Thin Wire Convective Heating Coefficients Measurements on Orbiter.

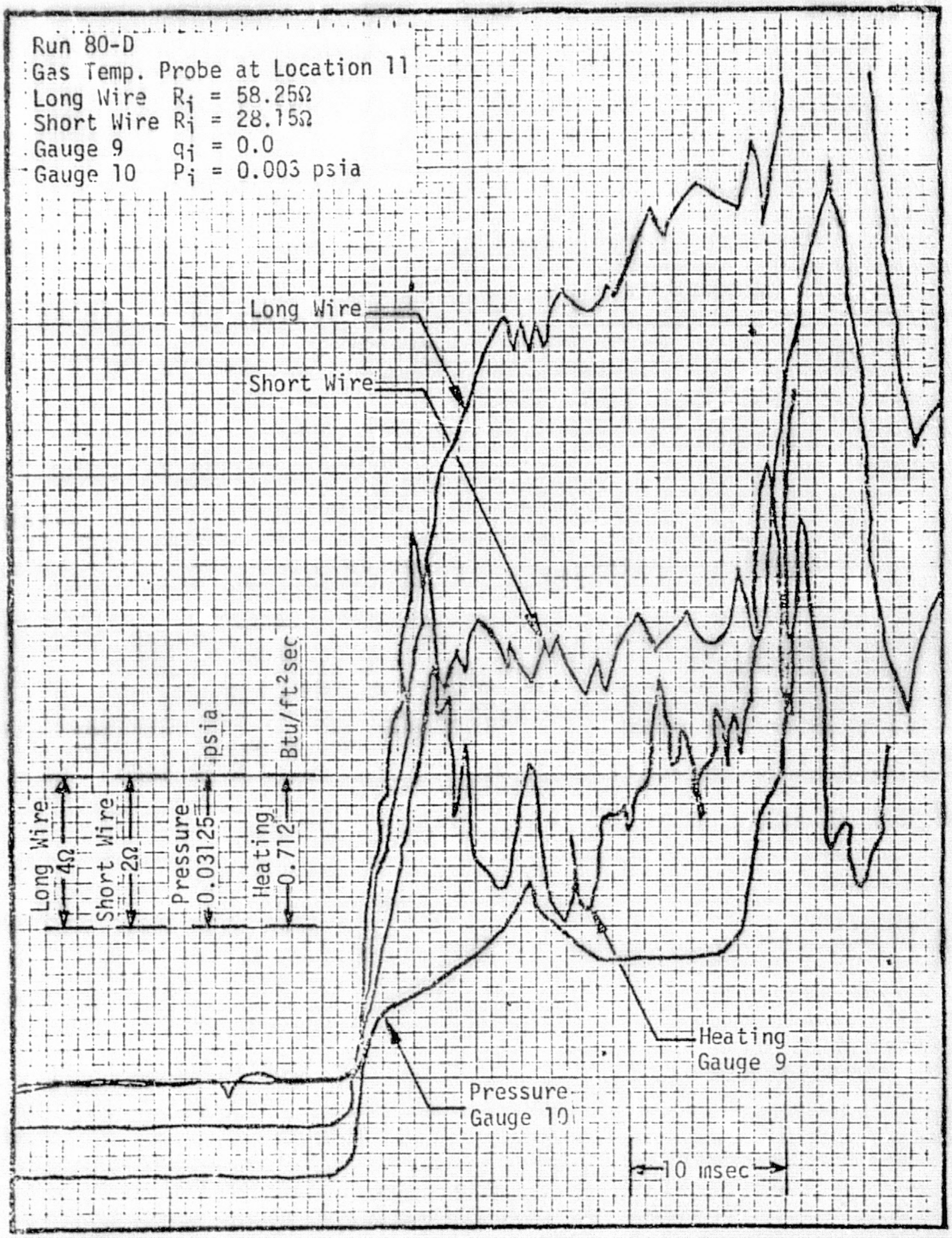


Figure 15. Transient Wire, Heating and Pressure Data on the ET Dome for Run 80-D.

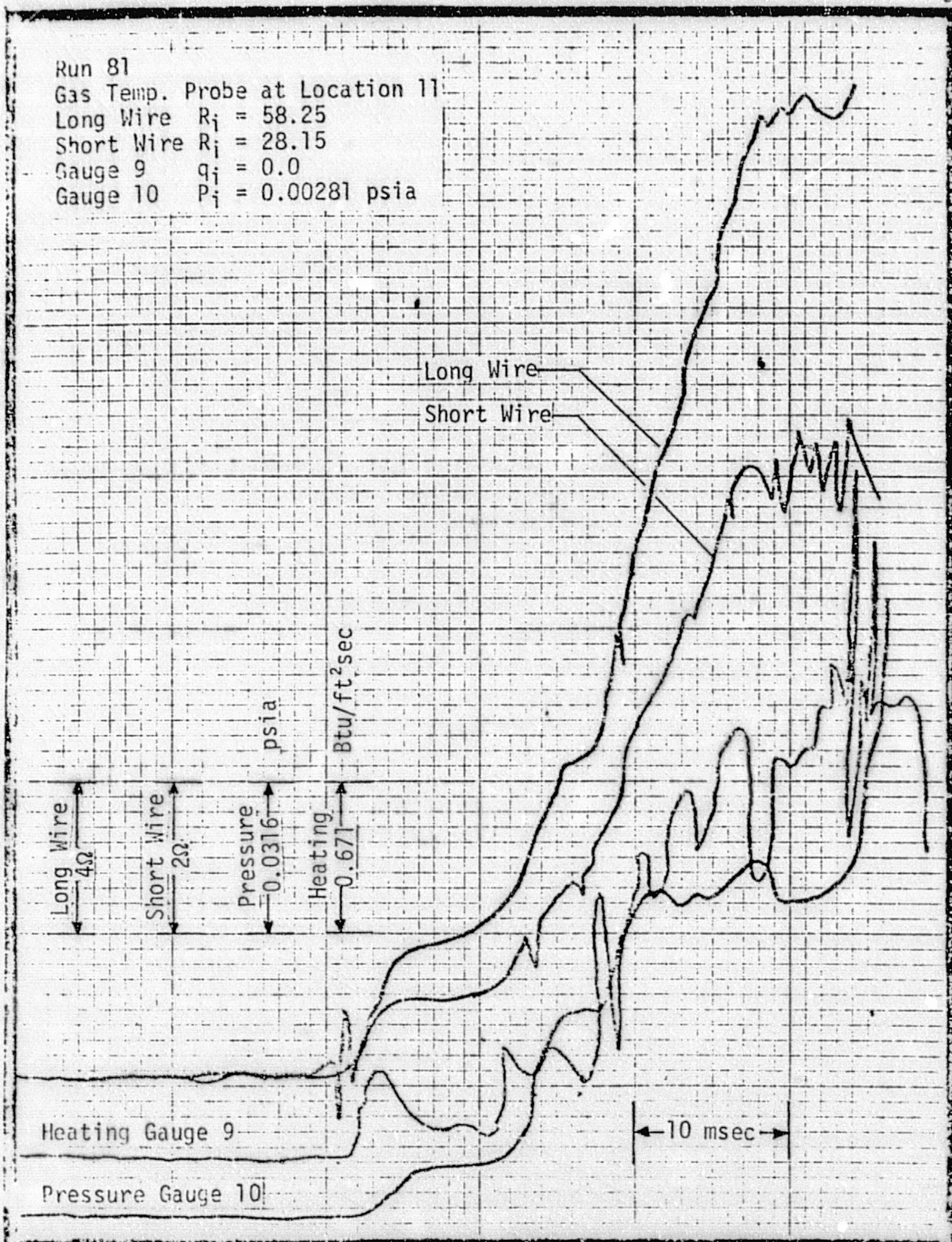


Figure 16. Transient Wire, Heating and Pressure Data on the ET Dome for Run 81.

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APPENDIX A

TABULATED SOURCE DATA:

Gas Recovery Temperatures

MEASURED THIN WIRE RESISTANCE AND THERMOCOUPLE DATA

AT STEADY STATE CONDITIONS

Run #	Probe Location	Read Time (msec)	Short Wire (SW)			Long Wire (LW)			Thermocouple Voltage Change	
			$R_{INITIAL}$ (300°K) (Ω)	ΔR (Ω)	R_{TOTAL} (Ω)	$R_{INITIAL}$ (300°K) (Ω)	ΔR (Ω)	R_{TOTAL} (Ω)	(SW) Δe (mv)	(LW) Δe (mv)
77-A	11-ET	50-55	33.00	10.00	43.00	59.75	20.00	79.75	-	-
78	11-ET	40-50	32.49	2.87	35.36	66.50	11.75	78.25	0.25	0.25
79	11-ET	40-45	28.35	5.00	33.35	64.75	15.00	79.75	0.15	0.15
80-B	11-ET	45-50	28.35	1.50	29.85	64.75	6.60	71.35	0.10	0.10
80-C	11-ET	40-45	28.15	0.80	28.95	58.25	2.20	60.45	-	-
80-D	11-ET	40-45	28.15	5.90	34.05	58.25	23.20	81.45	0.25	0.25
81	11-ET	45-50	28.15	7.84	35.99	58.25	24.80	83.05	0.10	0.10
82	11-ET	40-50	34.25	8.40	42.65	67.10	26.80	93.90	0.25	0.25
83	11-ET	45-50	29.80	6.76	36.56	52.65	17.60	70.25	0.42	0.55
84	11-ET	55	29.80	5.60	35.40	52.65	14.88	67.53	0.15	0.25
85	101-HS	45-50	28.00	4.50	32.50	62.25	19.00	81.25	0.30	0.30
86	101-HS	48	33.80	5.60	39.40	50.40	11.30	61.70	0.33	0.30
87	101-HS	45	33.80	12.20	46.00	50.40	21.00	71.40	0.50	0.55
88	101-HS	45-50	33.80	7.20	41.00	50.40	12.00	62.40	-	0.25
89-A	101-HS	45	33.80	14.68	48.80	50.40	29.50	79.90	0.75	0.90
89-B	101-HS	40-50	33.80	10.60	44.40	50.40	22.00	72.40	0.70	0.80
90	101-HS	35-45	33.80	10.40	44.20	50.40	20.00	70.40	0.55	0.55
91-A	101-HS	38-45	33.80	13.80	47.60	50.40	27.00	77.40	0.60	0.60
91-B	101-HS	34-39	33.80	7.40	41.20	50.40	16.20	66.60	0.30	0.45
91-C	101-HS	35-50	35.10	10.40	45.50	62.30	26.00	88.30	0.70	-
92	101-HS	42	35.10	10.60	45.70	62.30	30.00	92.30	0.40	-
93-A	113-HS	45	37.75	6.40	44.15	69.25	12.50	81.75	0.30	0.30
93-B	113-HS	50	37.75	10.80	48.55	69.25	22.00	91.25	0.30	0.30
94	01-HS	35-40	38.20	16.00	54.20	67.60	38.00	105.60	0.40	0.40

APPENDIX B

TABULATED SOURCE DATA:

HEAT TRANSFER AND PRESSURES

This Appendix presents pressure and heat transfer data for the 98 runs which produced useful data during the IH5 test program.

RUN NUMBER= 6
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.52 PSIA
PINF= 0.0156 PSIA
TOINF= 420.3 DEG F
RE/FT TIMES 10(-4)= 5.15
PC123= 1675.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 10.73

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)						1	0.06	18	0.04
	10	0.0109	0.698	-0.00472	1.000	3	0.04	129	0.0
	16	0.0106	0.679	-0.00502	0.972	4	0.0	130	0.0
	156	0.0109	0.698	-0.00472	1.000	5	0.06	131	0.0
	157	0.0114	0.730	-0.00422	1.046	7	0.19		
	158	0.0153	0.980	-0.00032	1.404	15	< 0.06		
	159	0.0112	0.717	-0.00442	1.028	17	0.05		
	170	0.0131	0.839	-0.00252	1.202	19	~0.05		
	171	0.0098	0.628	-0.00582	0.899	20	0.0		
	172	0.0099	0.634	-0.00572	0.908	21	0.0		
						28	< 0.06		
EXTERNAL TANK SIDEWALL						37	0.0		
BODY FLAP						29	0.87		
						33	0.0		
						34	0.0		
						35	0.0		
						206	0.0		
SSME NOZZLE #1	72	2.2400							

RUN 6 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #2								
67	2.4400							
SSME NOZZLE #3								
133	2.0200							
BASE HEAT SHIELD (COLD)								
82	0.0199	1.274	0.00428	0.774	202	2.08		
90	0.0257	1.646	0.01008	1.000				
ORBITER/TANK STRUT								
					124	0.08		
					125	0.14		

ORIGINAL PAGE IS OF POOR QUALITY

RUN NUMBER= 14C
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.42 PSIA
PINF= 0.0153 PSIA
TOINF= 482.0 DEG F
RE/FT TIMES 10(-4)= 4.80
PC123= 1594.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 10.44

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0096	0.628	-0.00568	1.000	9	0.11		
BODY FLAP									
						29	0.86		
						33	0.31		
						34	0.0		
						35	>5.95		
						204	2.14		
						206	0.33		
LEFT OMS POD									
	57	0.0191	1.251	0.00383		63	0.18	58	0.0

RUN 14C CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
82	0.0199	1.303	0.00463	0.437	102	0.24		
86	0.0168	1.100	0.00153	0.369	103	>1.86		
88	0.0170	1.113	0.00173	0.374	104	1.38		
89	0.0250	1.637	0.00973	0.549	105	>1.75		
90	0.0455	2.979	0.03023	1.000	106	1.18		
91	0.0316	2.069	0.01633	0.695	107	1.80		
92	0.0249	1.631	0.00963	0.547	108	2.64		
93	0.0201	1.316	0.00483	0.442	109	>1.61		
95	0.0201	1.316	0.00483	0.442	110	0.36		
162	0.0172	1.126	0.00193	0.378	150	0.28		
164	0.0191	1.251	0.00383	0.420	111	5.72		
					112	>1.39		
					113	1.07		
					114	0.91		
					115	>1.92		
					116	>2.36		
					117	0.52		
					202	3.34		
					151	0.69		

RUN NUMBER= 14D
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=141. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.68 PSIA
PINF= 0.0162 PSIA
TOINF= 454.2 DEG F
RE/FT TIMES 10(-4)= 5.19
PC123= 1680.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 10.39

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0088	0.545	-0.00736	1.000	9	0.15		
BODY FLAP									
						29	1.05		
						204	2.06		
						205	0.99		
LEFT OMS POD									
	57	0.0081	0.502	-0.00805				58	0.17
LEFT OMS NOZZLE									
						65	0.17		
SSME NOZZLE #1									
	72	2.5200							
SSME NOZZLE #2									
	67	2.1900							

RUN 14D CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
82	0.0161	0.996	0.00007	0.363	102	0.26		
86	0.0130	0.804	-0.00317	0.293	104	1.60		
88	0.0119	0.736	-0.00427	0.268	105	1.98		
89	0.0250	1.546	0.00883	0.563	106	1.39		
90	0.0444	2.746	0.02823	1.000	107	1.98		
91	0.0257	1.589	0.00953	0.579	108	2.57		
92	0.0242	1.497	0.00803	0.545	109	5.34		
93	0.0163	1.008	0.00013	0.367	110	0.37		
95	0.0199	1.231	0.00373	0.448	150	0.35		
162	0.0182	1.126	0.00203	0.410	111	6.09		
164	0.0208	1.286	0.00463	0.468	112	2.74		
					113	~1.45		
					115	4.15		
					116	2.86		
					202	3.79		
					151	0.62		

RUN NUMBER= 15
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=151. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 3.06 PSIA
PINF= 0.0106 PSIA
TOINF= 331.0 DEG F
RE/FT TIMES 10(-4)= 3.76
PC123= 1693.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 16.01

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0090	0.851	-0.00157	1.000	9	0.11		
EXTERNAL TANK SIDEWALL									
BODY FLAP									
						33	0.0	132	0.0
						34	0.06		
						35	0.18		
						204	1.93		
						205	1.04		
						206	0.32		
LEFT OMS POD									
	57	0.0163	1.542	0.00573		63	0.68		
LEFT OMS NOZZLE									
						65	0.12		
SSME NOZZLE #1									
	72	2.3400							

RUN 15 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #2								
67	2.0300							
SSME NOZZLE #3								
133	2.4100							
BASE HEAT SHIELD (COLD)								
82	0.0129	1.220	0.00233	0.268	102	0.23	96	0.05
86	0.0146	1.381	0.00403	0.304	104	1.53	97	0.0
88	0.0139	1.315	0.00333	0.289	105	2.03	99	0.0
89	0.0250	2.365	0.01443	0.520	106	1.34		
90	0.0481	4.550	0.03753	1.000	108	2.68		
91	0.0274	2.592	0.01683	0.570	109	4.76		
92	0.0240	2.270	0.01343	0.499	110	0.48		
93	0.0182	1.721	0.00763	0.378	150	0.24		
95	0.0168	1.589	0.00623	0.349	111	6.18		
162	0.0152	1.438	0.00463	0.316	112	2.29		
164	0.0180	1.703	0.00743	0.374	113	1.21		
					115	3.98		
					116	2.64		
					117	0.11		
					202	4.55		
					151	0.65		

RUN NUMBER= 16A
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=169. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.50 PSIA
PINF= 0.0052 PSIA
TOINF= 366.0 DEG F
RE/FT TIMES 10(-4)= 1.79
PC123= 1393.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 26.88

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0060	1.148	0.00077	1.000				
LEFT OMS POD								
57	0.0175	3.377	0.01232					
BASE HEAT SHIELD (COLD)								
82	0.0080	1.544	0.00282	0.630	104	~ 0.32		
86	0.0105	2.026	0.00532	0.827	105	0.49		
88	0.0112	2.161	0.00602	0.882	106	0.48		
90	0.0127 (?)	2.451	0.00752	1.000	107	0.79		
92	0.0131	2.528	0.00792	1.031	108	0.52		
93	0.0087	1.675	0.00350	0.683	110	0.17		
95	0.0088	1.696	0.00361	0.692	150	0.0		
162	0.0090	1.742	0.00385	0.711	112	0.91		
164	0.0096	1.847	0.00439	0.754	113	~ 0.43		
					114	0.54		
					115	~ 2.91		
					116	1.40		
					117	0.24		
					202	1.87		
					151	0.16		

RUN NUMBER= 19
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=108. K FT
ANGLE OF ATTACK= 0 DEGREES
TDB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 17.10 PSIA
PINF= 0.0591 PSIA
TOINF= 440.0 DEG F
RE/FT TIMES 10(-4)= 19.18
PC123= 1703.0 PSIA
PC4 288.0 PSIA
PC5= 315.0 PSIA
PC123/PINF TIMES 10(-4)= 2.88

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0967	1.637	0.03762	1.000	1	0.51	8	0.85
16	0.0795	1.346	0.02042	0.822	3	0.56	18	0.36
156	0.1040	1.760	0.04492	1.075	4	1.10	129	0.45
157	0.1050	1.777	0.04592	1.086	5	1.16	130	0.45
158	0.0872	1.476	0.02812	0.902	7	0.0		
159	0.0919	1.556	0.03282	0.950	9	1.17		
170	0.1080	1.828	0.04892	1.117	13	1.30		
171	0.0916	1.550	0.03252	0.947	15	1.10		
172	0.0847	1.434	0.02562	0.876	17	0.62		
					19	~1.14		
					20	0.0		
					21	5.79		
					28	0.64		
EXTERNAL TANK SIDEWALL								
25	0.0471	0.797	-0.01198					
BODY FLAP								
					33	0.80		
					34	1.33		
					35	2.04		
					206	0.0		
BSRM NOZZLE								
54	18.1100	306.531	18.05092					
55	26.6000							
56	25.4000							

RUN 19 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME HOZZLE #1								
72	1.7800							
SSME NOZZLE #2								
67								
SSME NOZZLE #3								
133	2.5200							
BASE HEAT SHIELD (COLD)								
					111	0.90		
					202	0.78		
					203	0.32		
ORBITER/TANK STRUT								
					126	0.0		
					127	0.86		

RUN NUMBER= 218
CONFIGURATION= OTS
MACH NUMBER= 0.0
ALTITUDE=178. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0037 PSIA
TOINF= 80.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 1587.0 PSIA
PC4 211.0 PSIA
PC5= 248.0 PSIA
PC123/PINF TIMES 10(-4)= 42.65

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0183	4.918	0.01458	1.000	9	1.54		
BODY FLAP									
						205	0.58	132	0.27
BSRM SHROUD									
						48	0.0	47	0.0
						49	1.26		
						50	0.49		
						51	0.27		
						53	0.57		
LEFT OMS POD									
	57	0.0079	2.120	0.00417					

RUN 218 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	[illegible]	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0060	1.604	[illegible]	0.316	102	0.35	96	0.23
88	0.0098	2.636	0.00609	0.519	103	0.69	97	0.42
89	0.0112	3.010	0.007[illegible]8	0.593	104	1.14	101	0.53
90	0.0189	5.079	0.015[illegible]8	1.000	105	1.49		
91	0.0251	6.745	0.02138	1.328	106	1.12		
92	0.0344	9.245	0.03068	1.820	107	1.35		
93	0.0102	2.741	0.00648	0.540	109	2.71		
95	0.0063	1.688	0.00256	0.332	110	0.77		
162	0.0082	2.214	0.00452	0.436	150	0.43		
164	0.0246	6.611	0.02088	1.302	111	2.57		
					112	4.23		
					113	3.05		
					114	1.38		
					116	2.93		
					117	1.01		

RUN NUMBER= 21C
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=109. K FT
ANGLE OF ATTACK= 0 DEGREES
TDB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 16.30 PSIA
PINF= 0.0563 PSIA
TOINF= 354.0 DEG F
RE/FT TIMES 10(-4)= 19.62
PC123= 1699.0 PSIA
PC4 220.0 PSIA
PC5= 238.0 PSIA
PC123/PINF TIMES 10(-4)= 3.02

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
						9	0.0		
EXTERNAL TANK SIDEWALL									
	24	~0.0019	0.034	-0.05438					
BODY FLAP									
						205	0.84	132	0.30
BSRM SHROUD									
	44	0.1280	2.273	0.07168		48	0.0	47	0.19
	46	0.7170	12.732	0.66068		49	1.88		
						50	1.13		
						51	0.27		
						53	0.49		
LEFT OMS POD									
								58	0.60
	57	0.0699	1.241	0.01358					
	84	0.0033	0.059	-0.05301					
SSME NOZZLE #1									
	72	2.1900							
SSME NOZZLE #2									
	67	0.0608							

RUN 21C CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSHE NOZZLE #3									
	133	2.5700							
BASE HEAT SHIELD (COLD)									
	86	0.0896	1.591	0.03328	0.001	102	1.06	96	0.47
	88	0.0845	1.500	0.02818	0.001	103	1.11	97	0.05
	92	0.0854	1.516	0.02908	0.001	104	1.50	99	0.62
	95	0.0819	1.454	0.02558	0.001	105	1.42		
	164	0.0774	1.374	0.02108	0.001	109	1.60		
						110	0.50		
						150	1.56		
						111	1.41		
						112	1.28		
						113	1.08		
						114	1.10		
						116	1.07		
						117	0.98		
						151	0.0		

RUN NUMBER= 238
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=123. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 9.61 PSIA
PINF= 0.0332 PSIA
TOINF= 467.0 DEG F
RE/FT TIMES 10(-4)= 10.56
PC123= 1645.0 PSIA
PC4 284.0 PSIA
PC5= 312.0 PSIA
PC123/PINF TIMES 10(-4)= 4.95

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0789	2.376	0.04570	1.000	9	1.81		
EXTERNAL TANK SIDEWALL								
24	2.2000	66.260	2.16680					
BODY FLAP								
					205	0.84	132	0.43
BSRM SHROUD								
					48	0.10 (?)	47	0.09 (?)
44	0.0864	2.602	0.05320		49	2.17		
46	0.4770	14.366	0.44380		50	1.00		
					51	0.50		
					52	0.69		
					53	0.47		
LEFT OMS POD								
57	0.0531	1.599	0.01990		63	0.31	58	0.81
LEFT OMS NOZZLE								
					66	0.18		
SSME NOZZLE #1								
72	2.4300							

129

RUN 238 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #2								
67	2.5200							
SSME NOZZLE #3								
133	2.6700							
BASE HEAT SHIELD (COLD)								
86	0.0721	2.172	0.03890	1.159	102	1.33	96	0.58
88	0.0663	1.997	0.03310	1.066	103	1.70	97	0.36
89	0.0685	2.063	0.03530	1.101	104	0.91	99	0.56
90	0.0622	1.873	0.02900	1.000	105	1.22	101	0.29
92	0.0611	1.840	0.02790	0.982	106	1.62		
93	0.0683	2.057	0.03510	1.098	107	1.61		
95	0.0594	1.789	0.02620	0.955	108	1.66		
162	0.0587	1.768	0.02550	0.944	109	1.22		
164	0.0585	1.762	0.02530	0.941	110	0.48		
					150	0.92		
					111	1.31		
					112	0.71		
					113	0.77		
					115	1.27		
					116	1.21		
					117	1.07		
					151	0.46		

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RUN NUMBER= 32
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=139 K FT./2
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 2.23 PSIA
PINF= 0.0077 PSIA
TOINF= 412.0 DEG F
RE/FT TIMES 10(-4)= 2.56
PC123= 808.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 10.46

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0069	0.897	-0.00079	1.000	1	0.0	2	0.0
16	0.0062	0.800	-0.00154	0.892	4	0.01	8	0.0
156	0.0072	0.927	-0.00056	1.033	7	0.03	18	0.0
157	0.0072	0.927	-0.00056	1.033	9	0.04	129	0.0
158	0.0061	0.787	-0.00164	0.877	13	0.0	130	0.0
159	0.0063	0.816	-0.00142	0.909	15	0.0	131	0.0
170	0.0073	0.943	-0.00044	1.051	17	0.05		
171	0.0067	0.872	-0.00099	0.971	19	0.0		
172	0.0064	0.824	-0.00136	0.918	20	0.0		
					21	0.03		
EXTERNAL TANK SIDEWALL								
25	0.0356	4.610	0.02788					
BODY FLAP								
					29	0.36		
					33	0.0		
					34	0.03		
					35	0.17		
					204	0.13		
					206	0.0		
LEFT OMS POD								
84	0.0119	1.541	0.00418		61	0.04		
					62	0.0		

RUN 32 CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSHE NOZZLE #1									
	72	1.2400							
SSHE NOZZLE #2									
	67	1.2900							
SSHE NOZZLE #3									
	133	1.3100							
BASE HEAT SHIELD (COLD)									
	82	0.0091	1.175	0.00135	0.353	111	3.79		
	90	0.0257	3.328	0.01798	1.000	202	1.41		
						203	0.0		
CRBITER/TANK STRUT									
						124	0.0		
						127	0.29		

RUN NUMBER= 33
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=139 K Ft./2
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 2.27 PSIA
PINF= 0.0078 PSIA
TOINF= 397.0 DEG F
RE/FT TIMES 10(-4)= 2.63
PC123= 797.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 10.18

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0082	1.047	0.00036	1.000	9	0.06		
BODY FLAP									
								132	0.0
LEFT OMS POD									
	57	0.0127	1.623	0.00487		63	0.0	58	0.0
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	1.1700				73	0.81		
						74	0.63		
						75	0.75		
						76	0.0		
SSME NOZZLE #2									
	67	1.2400				68	0.70		
						69	0.10		
						70	0.91		
SSME NOZZLE #3									
	133	1.2700							

RUN 33 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (COLD)								
86	0.0355	4.536	0.02767	1.740	102	0.10	96	0.03
88	0.0117	1.495	0.00387	0.574	103	0.25	97	0.0
89	0.0127	1.623	0.00487	0.623	104	0.71	99	0.0
90	0.0204	2.607	0.01257	1.000	105	0.0	101	0.03
92	0.0303	3.872	0.02247	1.485	106	0.26		
93	0.0158	2.019	0.00797	0.775	107	0.58		
95	0.0127	1.623	0.00487	0.623	108	1.05		
162	0.0118	1.508	0.00397	0.578	113	0.92		
164	0.0170	2.172	0.00917	0.833	117	0.26		
					151	0.14		

RUN NUMBER= 34
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=139 K FT./4
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.11 PSIA
PINF= 0.0038 PSIA
TOINF= 343.0 DEG F
RE/FT TIMES 10(-4)= 1.35
PC123= 371.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 9.67

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-F
EXTERNAL TANK BASE (COLD)									
	10	0.0039	1.017	0.00006	1.000	9	0.05		
BODY FLAP									
						205	0.0	132	0.0
LEFT OMS POD									
	57	0.0070	1.825	0.00316		63	0.0	58	0.0
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	0.5230				73	0.36		
						74	0.42		
						75	0.26		
						76	0.17		
						169	0.0		
SSME NOZZLE #2									
	67	0.5790				68	0.55		
						69	0.07		
						70	0.40		
						168	0.0		

RUN 34 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	C	GAGE	Q-R
SSME NOZZLE #3								
133	0.5820							
BASE HEAT SHIELD (COLD)								
86	0.0320	8.344	0.02816	2.540	104	0.29	96	0.0
88	0.0052	1.369	0.00141	0.417	106	0.08	97	0.0
89	0.0051	1.335	0.00128	0.406	108	0.55	99	0.0
90	0.0126	3.285	0.00876	1.000	111	1.32	101	0.0
92	0.0130	3.390	0.00916	1.032	112	1.00		
93	0.0078	2.031	0.00395	0.618	113	0.37		
95	0.0065	1.695	C.00266	0.516	115	0.75		
162	0.0060	1.565	0.00216	0.476	116	0.43		
164	0.0088	2.305	0.00500	0.702				

RUN NUMBER= 35B
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 30.0 DEG F

POINF= 4.50 PSIA
PINF= 0.0155 PSIA
TOINF= 441.0 DEG F
RE/FT TIMES 10(-4)= 5.04
PC123= 557.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 3.58

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0082	0.530	-0.00731	1.000				
LEFT OMS POD									
	57	0.0147	0.945	-0.00085					
SSME NOZZLE #1									
	72	0.8680							
SSME NOZZLE #2									
	67	0.8690							
SSME NOZZLE #3									
	133	0.8780							
BASE HEAT SHIELD (COLD)									
	86	0.0371	2.386	0.02155	3.118				
	88	0.0130	0.836	-0.00255	1.092				
	90	0.0119	0.765	-0.00365	1.000				
	92	0.0166	1.068	0.00105	1.395				
	93	0.0169	1.087	0.00135	1.420				
	95	0.0137	0.881	-0.00185	1.151				
	162	0.0124	0.798	-0.00315	1.042				
	164	0.0147	0.945	-0.00085	1.235				

RUN NUMBER= 35C
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.49 PSIA
PINF= 0.0155 PSIA
TOINF= 430.0 DEG F
RE/FT TIMES 10(-4)= 5.08
PC123= 1599.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 10.30

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0109	0.702	-0.00463	1.000	9	0.10		
BODY FLAP									
								132	0.0
LEFT OMS POD									
	57	0.0217	1.397	0.00617		63	0.0	58	0.0
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	2.3000				73	1.48		
						74	1.01		
						75	1.14		
						76	0.25		
						169	0.0		
SSME NOZZLE #2									
	67	2.3300				68	1.32		
SSME NOZZLE #3									
	133	2.3900							

RUN 35C CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0390	2.511	0.02347	0.935	102	0.28	96	0.0
88	0.0186	1.198	0.00307	0.446	104	1.11	97	0.0
90	0.0417	2.685	0.02617	1.000	106	0.43	99	0.0
92	0.0509	3.277	0.03537	1.221	108	2.45	101	0.14
93	0.0260	1.674	0.01047	0.624	113	1.68		
95	0.0219	1.410	0.00637	0.525	114	0.25		
162	0.0225	1.449	0.00697	0.540	116	~2.73		
164	0.0280	1.803	0.01247	0.671	151	0.26		

RUN NUMBER= 49
CONFIGURATION- DT
MACH NUMBER= 4.5
ALTITUDE=168. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.55 PSIA
PINF= 0.0053 PSIA
TOINF= 390.0 DEG F
RE/FT TIMES 10(-4)= 1.80
PC123= 1383.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 25.91

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0054	1.017	0.00009	1.000	1	0.05		
	16	0.0015	0.290	-0.00379	0.285	3	0.03		
	157	0.0041	0.761	-0.00128	0.748	9	0.01		
	159	0.0056	1.053	0.00028	1.035				
	170	0.0060	1.132	0.00070	1.112				
	171	0.0054	1.008	0.00004	0.991				
	172	0.0052	0.978	-0.00012	0.961				
BODY FLAP									
						29	0.53		
						35	0.05		
SSME NOZZLE #1									
	72	2.3000							
SSME NOZZLE #2									
	67	2.3300							
SSME NOZZLE #3									
	133	2.5000							
BASE HEAT SHIELD (COLD)									
	82	0.0031	0.588	-0.00220	0.382	111	0.90		
	90	0.0082	1.540	0.00288	1.000				

RUN 49 CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
ORBITER/TANK STRUT									
						127	0.06		

RUN NUMBER= 50
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=169. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.48 PSIA
PINF= 0.0051 PSIA
TOINF= 370.0 DEG F
RE/FT TIMES 10(-4)= 1.76
PC123= 1486.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 28.96

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	156	0.0052	1.012	0.00006	0.000	1	0.13	18	0.05
	157	0.0049	0.959	-0.00021	0.000	3	0.04	129	0.0
	158	0.0051	0.994	-0.00003	0.000	4	0.06	130	0.03
	170	0.0054	1.047	0.00024	0.000	5	0.0	131	0.0
	171	0.0048	0.936	-0.00033	0.000	7	0.0		
	172	0.0044	0.856	-0.00074	0.000	9	0.07		
						15	0.0		
						17	0.0		
						19	0.03		
						21	0.04		
BODY FLAP									
						29	0.31		
						34	0.11		
						35	0.13		
						204	0.0		
						206	0.0		
LEFT OMS POD									
	84	0.0079	1.548	0.00281		62	0.29		
SSME NOZZLE #1									
	72	2.0840							
SSME NOZZLE #2									
	67	2.1350							

RUN 50 CONTINUED

	GAGE	P	P/PINF	[illegible]	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #3									
	133	2.1900							
BASE HEAT SHIELD (COLD)									
	82	0.0081	1.573	0.00294	0.367				
	90	0.0220	4.288	0.01687	1.000				
ORBITER/TANK STRUT									
						124	0.0		
						126	0.0		
						127	0.05		

RUN NUMBER= 52
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=168. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.56 PSIA
PINF= 0.0054 PSIA
TOINF= 365.0 DEG F
RE/FT TIMES 10(-4)= 1.86
PC123= 1466.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 27.20

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0045	0.844	-0.00084	1.000	9	0.05		
BODY FLAP									
								132	0.0
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	2.0060				73	1.50		
						74	1.07		
						75	1.20		
						76	0.38		
SSME NOZZLE #2									
	67	1.9590				69	0.09		

RUN 52 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL
86	0.0107(?)	1.985	0.00531	0.514
90	0.0208	3.859	0.01541	1.000
93	0.0074	1.375	0.00202	0.356
95	0.0081	1.495	0.00267	0.388
162	0.0080	1.484	0.00261	0.385

GAGE	Q
102	0.03
103	0.06
104	0.54
105	0.98
107	0.0
108	1.42
109	2.64
110	0.0
150	0.05
111	4.56
112	1.11
113	0.79
116	1.38
117	0.57
151	0.24

GAGE	Q-R
96	0.0
97	0.0
99	0.0

RUN NUMBER= 53
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=167. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.62 PSIA
PINF= 0.0056 PSIA
TOINF= 400.0 DEG F
RE/FT TIMES 10(-4)= 1.88
PC123= 1550.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 27.69

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0071	1.272	0.00152	1.000	1	0.06	8	0.0
16	0.0030	0.531	-0.00263	0.417	3	0.10	18	0.03
156	0.0078	1.386	0.00216	1.090	4	0.14	129	0.02
157	0.0076	1.351	0.00196	1.062	5	0.10	130	0.0
158	0.0106	1.894	0.00500	1.489	7	0.11	131	0.03
159	0.0065	1.168	0.00094	0.919	9	0.07		
170	0.0088	1.565	0.00316	1.230	15	0.0		
172	0.0069	1.233	0.00130	0.969	17	0.0		
					19	0.02		
					20	0.0		
					21	0.0		
BODY FLAP								
					29	0.40		
					33	0.0		
					34	0.0		
					35	0.0		
					206	0.0		
LEFT OMS POD								
					61	0.31		
SSME NOZZLE #1								
72	1.9700							

RUN 53 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #2								
67	1.9300							
SSME NOZZLE #3								
133	2.2100							
BASE HEAT SHIELD (COLD)								
82	0.0079	1.406	0.00227	0.268	111	6.55		
90	0.0294	5.253	0.02380	1.000				

RUN NUMBER= 54
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=169. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.49 PSIA
PINF= 0.0051 PSIA
TOINF= 378.0 DEG F
RE/FT TIMES 10(-4)= 1.76
PC123= 1564.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 30.38

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0044	0.849	-0.00078	1.000	1	0.02	2	0.0
	156	0.0052	1.014	0.00007	1.195	3	0.05	8	0.0
	157	0.0049	0.942	-0.00030	1.110	4	0.10	18	0.0
	158	0.0052	1.006	0.00003	1.185	5	0.10	129	0.0
	170	0.0045	0.878	-0.00063	1.034	7	0.08	131	0.03
	171	0.0040	0.773	-0.00117	0.911	9	0.05		
	172	0.0044	0.857	-0.00074	1.009	13	0.0		
						15	0.0		
						17	0.0		
						19	0.09		
						20	0.0		
						21	0.02		
BODY FLAP									
						34	0.03		
						35	0.28		
						204	1.78		
LEFT OMS POD									
	84	0.0094	1.824	0.00424		61	0.10		
SSME NOZZLE #1									
	72	2.1400							
SSME NOZZLE #2									
	67	2.2800							

RUN 54 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #3								
133	2.3700							
BASE HEAT SHIELD (COLD)								
82	0.0087	1.700	0.00360	0.249	111	< 6.18*		
90	0.0352	6.838	0.03005	1.000				
ORBITER/TANK STRUT								
					126	0.20		
					127	0.05		

* $Q_{111} < 6.18$ BASED ON QUESTIONABLE CHANNEL CALIBRATION. BASED ON PRIOR CHANNEL CALIBRATION (RUN 51), $Q_{111} \approx 4.94$

RUN NUMBER= 55
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=168. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.56 PSIA
PINF= 0.0054 PSIA
TOINF= 370.0 DEG F
RE/FT TIMES 10(-4)= 1.85
PC123= 1598.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 29.74

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0043	0.804	-0.00105	1.000	9	0.06		
BODY FLAP									
								132	0.0
LEFT OMS POD									
	57	0.0094	1.750	0.00403		63	0.04		
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	2.1500				73	1.27		
						74	1.07		
						75	0.39		
						76	0.19		
SSME NOZZLE #2									
	67	1.6800				68	1.87		
						69	1.55		
						70	5.42		
SSME NOZZLE #3									
	133	2.2500							

RUN 55 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0090	1.677	0.00364	0.244	102	0.06	96	0.05 (?)
88	0.0359	6.682	0.03053	0.970	103	0.23	97	0.0
89	0.0463	8.618	0.04093	1.251	104	> 1.52	99	0.0
90	0.0370	6.887	0.03163	1.000	105	> 3.63		
92	0.0140	2.606	0.00863	0.378	107	2.05		
93	0.0084	1.569	0.00306	0.228	108	7.97		
95	0.0096	1.778	0.00418	0.258	109	10.60		
162	0.0086	1.603	0.00324	0.233	110	0.0		
164	0.0122	2.271	0.0[illegible]83	0.330	150	0.06		
					111	4.68		
					112	> 1.80		
					113	0.91		
					114	0.55		
					115	0.86		
					116	1.16		
					117	0.35		
					151	0.13		

RUN NUMBER= 56
CONFIGURATION= DT
MACH NUMBER= 4.5
ALTITUDE=167. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.65 PSIA
PINF= 0.0057 PSIA
TOINF= 359.0 DEG F
RE/FT TIMES 10(-4)= 1.97
PC123= 1461.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 25.71

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0052	0.910	-0.00051	1.000	9	0.05		
LEFT OMS POD									
	57	0.0082	1.450	0.00256					
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	1.8000				73	1.00		
						74	2.81		
						75	1.39		
						76	0.45		
SSME NOZZLE #2									
	67	1.3900				68	0.87		
						69	1.79		
						70	1.28		
SSME NOZZLE #3									
	133	1.8900							

RUN 56 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0096	1.687	0.00391	0.323	102	0.03	96	0.04
88	0.0086	1.515	0.00293	0.290	103	0.03	97	0.0
89	0.0098	1.724	0.00412	0.330	104	0.37	99	0.0
90	0.0297	5.226	0.02402	1.000	105	0.77		
92	0.0384	6.756	0.03272	1.293	107	0.72		
93	0.0058	1.028	0.00016	0.197	108	0.83		
95	0.0095	1.672	0.00382	0.320	109	1.85		
162	0.0090	1.576	0.00328	0.302	110	0.45		
164	0.0197	3.466	0.01402	0.663	150	0.0		
					111	5.54		
					112	>1.26		
					113	1.12		
					115	>2.00		
					116	~4.69		
					117	0.48		
					151	0.25(?)		

RUN NUMBER= 57
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.45 PSIA
PINF= 0.0154 PSIA
TOINF= 363.0 DEG F
RE/FT TIMES 10(-4)= 5.32
PC123= 1635.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 10.63

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0096	0.625	-0.00576	1.000	9	0.09		
LEFT OMS POD									
	57	0.0295	1.919	0.01413					
SSME NOZZLE #1									
	72	2.1800				73	1.47		
						74	0.88		
						75	0.95		
						76	0.16		
SSME NOZZLE #2									
	67	2.2800				68	1.13		
						69	0.90		
						70	1.51		
SSME NOZZLE #3									
	133	2.3300							

RUN 57 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (COLD)								
86	0.0219	1.424	0.00653	0.633	102	0.17	96	0.08
88	0.0174	1.132	0.00203	0.503	103	0.14		
89	0.0203	1.320	0.00493	0.587	104	0.73		
90	0.0346	2.250	0.01923	1.000	105	1.47		
92	0.0578	3.759	0.04243	1.671	109	3.32		
93	0.0267	1.737	0.01133	0.772	110	0.49		
95	0.0192	1.249	0.00383	0.555	150	0.12		
162	0.0226	1.470	0.00723	0.653	111	5.52		
164	0.0346	2.250	0.01923	1.000	113	2.03		
					116	4.52		
					117	0.77		
					151	0.12		

RUN NUMBER= 58
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=150. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 3.20 PSIA
PINF= 0.0111 PSIA
TOINF= 440.0 DEG F
RE/FT TIMES 10(-4)= 3.59
PC123= 1553.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 14.05

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0084	0.762	-0.00263	1.000	9	0.07		
LEFT OMS POD									
	57	0.0170	1.538	0.00594					
LEFT OMS NOZZLE									
						66	0.56		
SSME NOZZLE #1									
	72	2.1000				73	1.00		
						74	1.80		
						75	1.79 (?)		
						76	0.30		
SSME NOZZLE #2									
	67	2.2800				68	0.97		
						69	2.15		
						70	1.84		
SSME NOZZLE #3									
	133	2.2000							

RUN 58 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0142	1.284	0.00314	0.332	102	0.14	96	0.08
88	0.0154	1.393	0.00434	0.360	103	0.14		
89	0.0174	1.574	0.00634	0.407	104	0.62		
90	0.0428	3.871	0.03174	1.000	105	1.32		
92	0.0516	4.649	0.0405	1.206	108	1.92		
93	0.0202	1.827	0.00914	0.472	109	4.29		
95	0.0158	1.429	0.00474	0.369	110	0.68		
162	0.0184	1.664	0.00734	0.430	150	0.13		
164	0.0292	2.641	0.01814	0.682	111	7.64		
					113	1.76		
					114	0.79		
					116	10.80		
					117	0.73		
					151	0.28		

RUN NUMBER= 59
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=160. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 2.15 PSIA
PINF= 0.0074 PSIA
TOINF= 400.0 DEG F
RE/FT TIMES 10(-6)= 2.49
PC123= 1573.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 21.18

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0068	0.915	-0.00063	1.000	9	0.06		
BODY FLAP									
								132	0.0
LEFT OMS POD									
	57	0.0347	4.671	0.02727					
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	1.9100				73	1.18		
						75	2.07		
						76	0.37		
SSME NOZZLE #2									
	67	2.2900				68	1.22		
						69	2.01		
						70	1.09		
SSME NOZZLE #3									
	133	2.4600							

RUN 59 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0113	1.521	0.00387	0.366	102	0.09	96	-0.0
88	0.0114	1.535	0.00397	0.369	103	0.15	97	-0.0
89	0.0113	1.521	0.00387	0.366	104	0.40	99	-0.0
90	0.0309	4.160	0.02347	1.000	105	0.87		
92	0.0409	5.506	0.03347	1.324	108	1.28		
93	0.0118	1.589	0.00437	0.382	110	0.0		
95	0.0109	1.467	0.00347	0.353	150	0.06		
162	0.0129	1.737	0.00547	0.417	111	6.63		
164	0.0264	3.554	0.01897	0.854	113	1.36		
					116	5.76		
					117	0.65		
					151	0.34		

RUN NUMBER= 60
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=132. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 0.0 DEG F
TET= 80.0 DEG F

POINF= 6.69 PSIA
PINF= 0.0231 PSIA
TOINF= 376.0 DEG F
RE/FT TIMES 10(-4)= 7.90
PC123= 1122.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 4.86

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0112	0.485	-0.01190	1.000				
	157	0.0123	0.533	-0.01080	1.098				
	170	0.0127	0.550	-0.01040	1.134				
	171	0.0107	0.463	-0.01240	0.955				
	172	0.0099	0.430	-0.01316	0.887				
BODY FLAP								132	0.0
LEFT OMS POD									
	84	0.0110	0.476	-0.01210					
LEFT OMS NOZZLE						66	0.0		
SSME NOZZLE #1									
	72	2.4400				73	0.44		
						74	0.33		
						75	0.27		
						76	0.11		
SSME NOZZLE #2									
	67	2.4500				68	0.91		
						69	0.19		

RUN 60 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
90	0.0214 (?)	0.927	-0.00170	1.000	102	0.09	96	0.0
95	0.0239	1.035	0.00080	1.117	103	0.27	97	0.0
					104	0.76	99	0.0
					105	1.04		
					106	0.30		
					109	1.43		
					110	0.0		
					150	0.12		
					111	1.38		
					112	0.62		
					113	0.42		
					114	0.0		
					115	0.87		
					116	0.64		
					117	0.22		
					151	0.12		

RUN NUMBER= 61
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=122. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 9.85 PSIA
PINF= 0.0340 PSIA
TOINF= 423.0 DEG F
RE/FT TIMES 10(-4)= 11.20
PC123= 1580.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 4.64

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0149	0.438	-0.01913	1.000	9	0.06		
BODY FLAP									
								132	0.0
LEFT OMS POD									
								58	0.0
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
						73	0.25		
	72	1.7000				74	0.23		
						75	0.28		
						76	0.13		
SSME NOZZLE #2									
						68	0.85		
	67	2.3900				69	0.42		
						70	0.18		

RUN 61 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0349	1.026	0.00087	1.385	102	0.08	96	0.0
90	0.0252 (?)	0.740	-0.00883	1.000	103	0.26	97	0.0
92	0.0378	1.111	0.00377	1.500	104	0.39	99	0.0
93	0.0397	1.167	0.00567	1.575	105	0.80		
95	0.0340	0.999	0.0	1.349	107	0.62		
162	0.0344	1.011	0.00037	1.365	109	0.81		
164	0.0347	1.020	0.00067	1.377	110	0.0		
					150	0.23		
					111	0.86		
					112	0.81		
					113	0.26		
					114	0.0		
					115	0.49		
					116	0.57		
					117	0.08		
					151	0.19		

RUN NUMBER= 62
CONFIGURATION= DT
MACH NUMBER= 4.5
ALTITUDE=161. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 2.07 PSIA
PINF= 0.0072 PSIA
TOINF= 425.0 DEG F
RE/FT TIMES 10(-4)= 2.36
PC123= 1606.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 22.40

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0074	1.034	0.00024	1.000	9	0.04		
BODY FLAP									
								132	0.0
LEFT OMS POD									
	57	0.0456	6.361	0.03843					
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	2.1600				73	1.92		
						74	1.68		
						75	1.82		
						76	0.31		
SSME NOZZLE #2									
	67	2.1800				68	1.55		
						69	1.35		
						70	1.25		
SSME NOZZLE #3									
	133	2.3400							

RUN 62 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0165	2.302	0.00933	0.730	102	0.04	96	0.0
88	0.0139	1.939	0.00673	0.615	103	0.23	97	0.0
89	0.0135	1.883	0.00633	0.597	104	0.45	99	0.0
90	0.0226 (?)	3.152	0.01543	1.000	105	0.93	101	0.05
92	0.0479	6.681	0.04073	2.119	106	0.25		
93	0.0156	2.166	0.0084	0.690	107	0.65		
95	0.0137	1.911	0.00653	0.606	108	1.04		
162	0.0143	1.986	0.0071	0.633	109	2.03		
164	0.0365	5.069	0.0293	1.615	110	0.36		
					150	0.10		
					111	5.16		
					112	5.18		
					113	1.61		
					114	0.72		
					115	5.00		
					116	3.72		
					117	0.79		
					151	4.69		

RUN NUMBER= 63
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=151. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 3.08 PSIA
PINF= 0.0106 PSIA
TOINF= 424.0 DEG F
RE/FT TIMES 10(-4)= 3.50
PC123= 1540.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 14.47

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0091	0.860	-0.00149	1.000				
BODY FLAP									
								132	0.0
LEFT OMS POD									
	57	0.0537	5.046	0.04306					
SSME NOZZLE #1									
						169	0.17		
	72	2.0200				73	1.80		
						74	1.21		
						75	1.35		
						76	0.18		
.ME NOZZLE #2									
	67	1.9500				68	1.56		
						69	1.55		
						70	1.41		
SME NOZZLE #3									
	133	1.2000							

RUN 63 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (COLD)								
86	0.0178	1.673	0.00716	1.319	102	0.14	96	0.0
88	0.0156	1.466	0.00496	1.156	103	0.29	97	0.0
89	0.0153	1.438	0.00466	1.133	104	0.41	99	0.0
90	0.0135	1.269	0.00286	1.000	105	1.17	101	0.09
92	0.0531	4.990	0.04246	3.933	106	0.36		
93	0.0195	1.832	0.00886	1.444	107	1.11		
95	0.0157	1.475	0.00506	1.163	108	0.93		
162	0.0290	2.725	0.01836	2.148	109	2.98		
164	0.0219	2.058	0.01126	1.622	110	0.0		
					150	0.11		
					111	4.14		
					112	5.52		
					113	1.56		
					114	0.50		
					115	4.63		
					116	4.16		
					117	0.80		
					151	0.45		

RUN NUMBER= 64A
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=141. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.55 PSIA
PINF= 0.0157 PSIA
TOINF= 473.0 DEG F
RE/FT TIMES 10(-4)= 4.97
PC123= 520.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 3.31

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0093	0.592	-0.00640	1.000				
LEFT OMS POD								
57	0.0165	1.051	0.00080					
SSME NOZZLE #1								
72	0.8790							
SSME NOZZLE #2								
67	0.9660							
SSME NOZZLE #3								
133	0.9690							
SE HEAT SHIELD (COLD)								
86	0.0168	1.070	0.00110	2.305				
88	0.0144	0.917	-0.00130	1.975				
89	0.0135	0.860	-0.00220	1.852				
90	0.0073 (?)	0.464	-0.00841	1.000				
92	0.0143	0.911	-0.00140	1.962				
93	0.0167	1.063	0.00100	2.291				
95	0.0133	0.847	-0.00240	1.824				
162	0.0228	1.452	0.00710	3.128				

RUN NUMBER= 548
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 90.0 DEG F
TET= 30.0 DEG F

POINF= 4.44 PSIA
PINF= 0.0154 PSIA
TOINF= 471.0 DEG F
RE/FT TIMES 10(-4)= 4.87
PC123= 1483.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 9.66

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0134	0.873	-0.00196	1.000	9	0.07		
BODY FLAP									
								132	C.0
LEFT OMS POD									
	57	0.0240	1.563	0.00864					
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	2.1500				73	0.85		
						74	0.27		
						75	C.34		
						76	C.12		
SSME NOZZLE #2									
	67	2.1900				68	1.13		
						69	0.51		
						70	C.76		
SSME NOZZLE #3									
	133	2.3700							

RUN 64B CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL
36	0.0214	1.393	0.00604	1.321
88	0.0212	1.38C	0.00584	1.309
89	0.0220	1.433	0.00664	1.358
90	0.0162 (?)	1.055	0.00084	1.000
92	0.0413	2.689	0.02594	2.549
93	0.0251	1.634	0.00974	1.549
95	0.0209	1.361	0.00554	1.290
162	0.0388	2.526	0.02344	2.395
164	0.0271	1.765	0.01174	1.673

GAGE	Q
102	0.09
103	0.27
104	0.92
105	1.28
106	0.43
108	1.21
109	2.27
110	0.0
150	0.12
111	4.23
112	3.47
113	0.98
114	0.40
115	1.84
116	1.61
117	0.36
151	0.21

GAGE	Q-R
96	C.0
97	C.0
99	C.0
101	0.04

RUN NUMBER= 65
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=168. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 30.0 DEG F

POINF= 1.55 PSIA
PINF= 0.0053 PSIA
TOINF= 403.0 DEG F
RE/FT TIMES 10(-4)= 1.79
PC123= 1557.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 29.17

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0063	1.173	0.00092	1.000	9	0.03		
BODY FLAP									
								132	0.0
LEFT OMS POD									
	57	0.0096	1.793	0.00423					
SSME NOZZLE #1									
	72	2.2300				73	3.32		
						75	2.06		
						76	0.72		
SSME NOZZLE #2									
	67	2.2300				68	1.42		
						69	1.79		
						70	1.25		
SSME NOZZLE #3									
	133	2.3000							

RUN 65 CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (COLD)									
	86	0.0148	2.773	0.00946	1.807	102	0.04	96	0.0
	88	0.0114	2.136	0.00606	1.392	103	0.13	97	0.0
	89	0.0108	2.023	0.00546	1.319	104	0.46	99	0.0
	90	0.0104(?)	1.955	0.00506	1.000	105	0.92	101	0.07
	92	0.0445	8.336	0.03916	5.434	107	0.60		
	93	0.0127	2.379	0.00736	1.551	108	0.96		
	95	0.0116	2.173	0.00626	1.417	109	1.61		
	162	0.0188	3.522	0.01346	2.296	110	0.37		
	164	0.0347	6.501	0.02936	4.238	150	0.07		
						111	2.64		
						112	6.79		
						113	2.08		
						114	0.82		
						115	6.02		
						116	4.88		
						117	0.82		

RUN NUMBER= 66
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=147 K FT./2
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.59 PSIA
PINF= 0.0055 PSIA
TOINF= 368.0 DEG F
RE/FT TIMES 10(-4)= 1.89
PC123= 712.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 12.96

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0068	1.234	0.00129	1.000	9	0.04		
BODY FLAP									
								132	C.0
LEFT OMS POD									
	57	0.0217(?)	3.950	0.01621				58	0.0
SME NOZZLE #1									
	72	1.1400				73	0.80		
						75	0.45		
						76	0.19		
SME NOZZLE #2									
	67	1.1400				69	0.14		
						70	C.25		
SME NOZZLE #3									
	133	1.2400							

RUN 66 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0119	2.166	0.00641	0.534	102	0.04	96	0.0
88	0.0107	1.948	0.00521	0.480	103	0.1F	97	0.0
89	0.0106	1.930	0.00511	0.475	104	0.53	99	0.0
90	0.0223	4.059	0.01681	1.000	105	0.93	101	0.03
92	0.0255	4.642	0.02001	1.143	106	0.30		
93	0.0134	2.439	0.00791	0.601	107	0.68		
95	0.0101	1.839	0.00461	0.453	108	1.04		
164	0.0132	2.403	0.00771	0.592	109	1.64		
					110	0.24		
					150	0.02		
					112	2.56		
					113	0.82		
					114	0.45		
					115	2.33		
					116	1.45		
					117	0.33		
					151	0.18		

RUN NUMBER= 678
CONFIGURATION= OT
MACH NUMBER= 0.0
ALTITUDE=182. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0031 PSIA
TOINF= 80.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 307.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 9.94

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
					9	0.20		
SSME NOZZLE #1								
72	0.5290				73	0.12		
					76	0.18		
SSME NOZZLE #2								
67	0.5240				69	0.15		
					70	0.25		
SSME NOZZLE #3								
133	0.5460							

RUN 678 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0032	1.036	0.00011	0.476	102	0.0	101	0.0
90	0.0067	2.176	0.00363	1.000	103	0.0		
92	0.0058	1.862	0.00266	0.856	104	0.05		
93	0.0042	1.353	0.00109	0.622	105	0.14		
162	0.0045	1.454	0.00140	0.668	106	0.0		
164	0.0043	1.402	0.00124	0.644	107	0.09		
					108	0.18		
					109	0.40		
					110	0.0		
					150	0.02		
					111	0.67		
					112	0.54		
					113	0.23		
					114	0.0		
					115	0.63		
					116	0.44		
					117	0.10		
					151	0.0		

RUN NUMBER= 68A
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.42 PSIA
PINF= 0.0153 PSIA
TOINF= 421.0 DEG F
RE/FT TIMES 10(-4)= 5.03
PC123= 1433.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 9.38

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0104	0.681	-0.00487	1.000	9	0.05		
SSME NOZZLE #1									
	72	1.8600							
SSME NOZZLE #2									
	67	1.8500							
SSME NOZZLE #3									
	133	1.9800							

RUN 68A CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0172	1.126	0.00193	0.000	102	0.06	101	0.02
88	0.0194	1.270	0.00413	0.000	103	0.29		
89	0.0229	1.500	0.00763	0.000	104	~1.15		
92	0.0332	2.174	0.01793	0.000	105	>1.56		
93	0.0224	1.467	0.00713	0.000	106	1.48		
95	0.0190	1.244	0.00373	0.000	107	>1.31		
162	0.0196	1.283	0.00433	0.000	108	>1.93		
164	0.0260	1.703	0.01073	0.000	109	2.82		
					110	0.22		
					150	0.17		
					111	3.52 (?)		
					112	4.20		
					113	1.25		
					114	0.55		
					115	2.13		
					116	1.65		
					117	0.33		
					151	0.29		

RUN NUMBER= 68B
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 8[illegible].0 DEG F

PCINF= 4.47 PSIA
PINF= 0.0154 PSIA
TOINF= 406.0 DEG F
RE/FT TIMES 10(-4)= 5.15
PC123= 1514.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 9.80

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0105	0.680	-0.00494	1.000				
BODY FLAP									
								132	0.0
LEFT OMS POD									
								58	0.0
	57	0.0216	1.399	0.00616					
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
						73	1.28		
	72	2.3900				76	0.20		
SSME NOZZLE #2									
						69	0.98		
	67	2.4300				70	2.03		
						168	0.0		
SSME NOZZLE #3									
	133	[illegible].6300							

RUN 68B CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0187	1.211	0.00326	0.465	102	0.12	96	0.0
68	0.0199	1.289	0.00446	0.495	104	1.20	97	0.0
90	0.0402	2.603	0.02476	1.000	105	1.93	99	0.0
93	0.0230	1.489	0.00756	0.572	106	0.99	101	0.09
95	0.0194	1.256	0.00396	0.483	107	2.04		
162	0.0237	1.535	0.00826	0.590	108	2.16		
164	0.0300	1.943	0.01456	0.746	109	3.42		
					110	0.33		
					150	0.18		
					112	4.49		
					113	1.60		
					114	0.54		
					115	3.26		
					116	2.43		
					117	0.63		
					151	0.27		

RUN NUMBER= 69

CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=170. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.43 PSIA
PINF= 0.0049 PSIA
TOINF= 363.0 DEG F
RE/FT TIMES 10(-4)= 1.71
PC123= 1473.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 29.81

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0056	1.127	0.00063	1.000	9	0.07		
BODY FLAP									
								132	0.0
LEFT OMS POD									
	57	0.0103	2.085	0.00536				58	0.0
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	2.2500				73	2.70		
						75	0.56		
						76	0.26		
SSME NOZZLE #2									
	67	2.2500				69	2.05		
						70	2.23		
						168	0.0		
SME NOZZLE #3									
	133	2.4500							

RUN 69 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0095	1.921	0.00455	0.260	103	0.71	96	0.0
88	0.0135	2.732	0.00856	0.370	104	0.53	97	0.0
89	~0.0272	5.505	0.02226	0.745	105	>2.16	99	0.0
90	~0.0365	7.388	0.03156	1.000	106	0.63	101	0.02
92	0.0280	5.667	0.02306	0.767	107	1.26		
93	0.0123	2.490	0.00736	0.337	108	>2.72		
95	0.0093	1.878	0.00434	0.254	109	>3.27		
162	0.0136	2.753	0.00866	0.373	110	0.37		
164	0.0266	5.384	0.02166	0.729	150	0.12		
					111	6.43		
					112	5.74		
					113	2.48		
					114	0.78		
					115	1.96		
					116	1.67		
					117	0.53		
					151	0.20		

RUN NUMBER= 70
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=143. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.31 PSIA
PINF= 0.0149 PSIA
TOINF= 423.0 DEG F
RE/FT TIMES 10(-4)= 4.91
PC123= 1526.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 10.24

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0119	0.798	-0.00301	1.000	9	0.08		
BODY FLAP									
								132	0.0
LEFT OMS POD									
	57	0.0210	1.409	0.00609				58	0.0
SSME NOZZLE #1									
	72	2.3400				76	0.13		
SSME NOZZLE #2									
	67	2.3600				69	1.10		
						70	3.99		
SSME NOZZLE #3									
	133	2.5000							

RUN 70 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0185	1.241	0.00359	0.403	103	0.17	96	0.0
88	0.0333	2.234	0.01839	0.725	104	2.39	97	0.0
89	0.0520	3.488	0.03709	1.133	105	4.65	99	0.0
90	0.0459	3.079	0.03099	1.000	106	1.31	101	0.04
92	0.0243	1.630	0.00939	0.529	107	3.75		
93	0.0217	1.456	0.00679	0.473	108	5.91		
95	0.0205	1.375	0.00559	0.447	109	5.41		
162	0.0224	1.503	0.00749	0.488	110	0.13		
164	0.0222	1.489	0.00729	0.484	150	0.06		
					111	4.98		
					112	2.11		
					113	0.87		
					114	0.48		
					115	1.48		
					116	1.19		
					117	0.41		
					151	0.42		

RUN NUMBER= 71
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=170. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.44 PSIA
PINF= 0.0050 PSIA
TOINF= 272.0 DEG F
RE/FT TIMES 10(-4)= 1.86
PC123= 1479.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 29.83

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0059	1.182	0.00090	1.000	9	0.09		
BODY FLAP									
								132	0.0
LEFT OMS POD									
	57	0.0086	1.743	0.00368					
SSME NOZZLE #1									
	72	2.3000				73	0.89		
						75	0.22		
						76	0.35		
SME NOZZLE #2									
	67	2.3700				68	1.39		
						69	1.47		
						70	4.96		
SME NOZZLE #3									
	133	2.3500							

RUN 71 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (COLD)								
86	0.0086	1.739	0.00366	0.307	102	0.02	96	0.0
88	0.0305	6.152	0.02554	1.085	103	0.11	97	0.0
90	0.0281	5.668	0.02314	1.000	104	2.99	99	0.0
92	0.0122	2.461	0.00724	0.434	105	5.06	101	0.03
93	0.0089	1.793	0.00393	0.316	106	1.00		
95	0.0094	1.894	0.00443	0.334	107	3.13		
162	0.0101	2.037	0.00514	0.359	108	5.85		
164	0.0113	2.279	0.00634	0.402	109	4.07 (?)		
					110	0.0		
					150	0.02		
					111	3.14		
					113	0.88		
					114	1.40		
					115	0.12		
					116	0.39		
					117	0.19		
					151	0.22		

RUN NUMBER= 72A

CONFIGURATION= OT
MACH NUMBER= 0.0
ALTITUDE=180. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0033 PSIA
TOINF= 295.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 711.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 21.22

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0041	1.218	0.00073	1.000	9	0.0		
BODY FLAP									
								132	0.0
LEFT OMS POD									
								58	0.0
[illegible]T OMS NOZZLE									
						66	0.C		
SSME NOZZLE #1									
	72	1.0900				73	1.36		
						75	0.71		
						76	0.55		
SSME NOZZLE #2									
	67	1.1400				69	1.01		
						70	0.50		
SSME NOZZLE #3									
	133	1.1800							

ORIGINAL PAGE IS OF POOR QUALITY

RUN 72A CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL
86	0.0045	1.331	0.00111	0.402
88	0.0045	1.331	0.00111	0.402
89	0.0045	1.331	0.00111	0.402
90	0.0111	3.313	0.00775	1.000
91	0.0106	3.164	0.00725	0.955
92	0.0149	4.448	0.01155	1.342
93	0.0056	1.681	0.00228	0.507
95	0.0038	1.131	0.00044	0.341
162	0.0052	1.546	0.00183	0.467
164	0.0116	3.463	0.00825	1.045

GAGE	Q
102	0.0
103	0.0
104	0.24
105	0.44
106	0.04
107	0.29
108	0.51
109	1.05
110	0.32
150	0.03
111	1.70
112	2.73
113	1.51
114	0.67
115	1.88
116	1.83
117	0.46
151	0.18

GAGE	Q-R
96	0.0
97	0.0
99	0.0
101	0.02

RUN NUMBER= 73
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=138 K FT/4
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.12 PSIA
PINF= 0.0039 PSIA
TOINF= 292.0 DEG F
RE/FT TIMES 10(-4)= 1.42
PC123= 341.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 8.81

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	C-R
EXTERNAL TANK BASE (COLD)								
10	0.0040	1.036	0.00014	1.000				
LEFT OMS POD								
57	0.0063	1.638	0.00247					
SSME NOZZLE #1								
72	0.5960				73	0.36		
					75	0.43		
					76	0.29		
SSME NOZZLE #2								
67	0.6070				69	0.39		
					70	0.51		
SSME NOZZLE #3								
133	0.6550							

RUN 73 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (COLD)								
86	0.0057	1.476	0.00184	0.497	102	0.02	101	0.01
58	0.0046	1.199	0.00077	0.403	103	0.0		
89	0.0052	1.341	0.00132	0.451	104	0.23		
90	0.0115	2.972	0.00763	1.000	105	0.38		
91	0.0157	4.057	0.01183	1.365	106	0.03		
92	0.0115	2.972	0.00763	1.000	107	0.28		
93	0.0030	0.778	-0.00086	0.262	108	0.46		
95	0.0057	1.468	0.00181	0.494	109	1.00		
162	0.0058	1.489	0.00189	0.501	150	0.01		
164	0.0066	1.713	0.00276	0.577	112	1.17		
					113	0.39		
					115	1.20		
					116	0.82		
					117	0.13		
					151	0.08		

C-3

RUN NUMBER= 74
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=142 K FT/2
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 90.0 DEG F

POINF= 2.05 PSIA
PINF= 0.0071 PSIA
TOINF= 364.0 DEG F
RE/FT TIMES 10(-4)= 2.45
PC123= 684.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 9.66

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0064	0.909	-0.00064	1.000				
BODY FLAP								
							132	0.0
LEFT OMS POD								
57	0.0269	3.798	0.01982				58	0.0
LEFT OMS NOZZLE								
					66	0.0		
SSME NOZZLE #1								
72	1.1100				73	0.43		
					75	0.55		
					76	0.11		
SSME NOZZLE #2								
67	1.1400				69	0.94		
					70	0.69		
SSME NOZZLE #3								
133	1.2500							

RUN 74 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL
86	0.0074	1.046	0.00033	0.319
88	0.0093	1.312	0.00221	0.400
89	0.0111	1.567	0.00402	0.478
90	0.0232	3.276	0.01612	1.000
91	0.0253	3.572	0.01822	1.091
92	0.0176	2.485	0.01052	0.759
93	0.0047	0.659	-0.00241	0.201
95	0.0103	1.454	0.00322	0.444
162	0.0112	1.581	0.00412	0.483
164	0.0104	1.468	0.00332	0.448

GAGE	Q
102	0.05
103	0.04
104	0.58
105	0.93
106	0.06
107	0.62
108	1.11
109	2.28
150	0.13
112	1.72
113	0.71
114	0.40
115	2.92
116	1.84
117	0.19
151	0.06

GAGE	Q-R
96	0.0
97	C.0
99	C.C
101	0.04

ORIGINAL PAGE IS
OF POOR QUALITY

RUN NUMBER= 75

CONFIGURATION= OTS
MACH NUMBER= 0.0
ALTITUDE=159. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0077 PSIA
TOINF= 440.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 0.0 PSIA
PC4 290.0 PSIA
PC5= 252.0 PSIA
PC123/PINF TIMES 10(-4)= 0.0

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	C-R
EXTERNAL TANK BASE (COLD)									
	10	0.0135	1.747	0.00577	1.000	9	0.97		
LEFT OMS POD									
								58	0.54
SSME NOZZLE #1									
						73	1.04(?)		
SSME NOZZLE #2									
						69	0.50		
						70	0.94		

RUN 75 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0104	1.346	0.00267	0.717	102	0.32	97	0.25
88	0.0139	1.798	0.00617	0.959	103	0.32	101	0.37
89	0.0159	2.057	0.00817	1.097	104	0.79		
90	0.0145	1.876	0.00677	1.000	105	1.47		
92	0.0133	1.721	0.00557	0.917	106	0.55		
93	0.0156	2.018	0.00787	1.076	107	0.83		
95	0.0075	0.965	-0.00027	0.514	108	1.77		
162	0.0122	1.579	0.00447	0.841	109	1.86		
164	0.0101	1.307	0.00237	0.697	110	0.48		
					150	~1.61		
					111	1.52		
					112	0.70		
					113	0.53		
					114	1.63		
					115	1.36		
					116	1.07		
					117	0.72		
					151	0.36		

RUN NUMBER= 76
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.48 PSIA
PINF= 0.0155 PSIA
TOINF= 393.0 DEG F
RE/FT TIMES 10(-4)= 5.22
PC123= 1437.0 PSIA
PC4 181.0 PSIA
PC5= 163.0 PSIA
PC123/PINF TIMES 10(-4)= 9.28

ORIGINAL PAGE IS OF POOR QUALITY

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0440	2.843	0.02852	1.000	9	1.69		
BODY FLAP									
								132	0.45
LEFT OMS POD									
								58	0.20
LEFT OMS NOZZLE									
						66	0.46		
SSME NOZZLE #1									
						73	0.90		
						75	2.02		
						76	1.39		
SSME NOZZLE #2									
						69	0.36		
						70	1.68		

RUN 76 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0419	2.707	0.02642	1.318	102	0.68	96	0.65
88	0.0343	2.216	0.01882	1.079	103	0.39	97	0.44
89	0.0372	2.403	0.02172	1.170	104	0.51	99	0.62
90	0.0318	2.054	0.01632	1.000	105	0.97	101	0.66
91	0.0190	1.228	0.00352	0.597	106	0.50		
92	0.0339	2.190	0.01842	1.066	107	0.75		
93	0.0401	2.591	0.02462	1.261	108	0.96		
95	0.0281	1.815	0.01262	0.884	109	0.74		
162	0.0330	2.132	0.01752	1.038	110	0.59		
164	0.0361	2.332	0.02062	1.135	150	0.77		
					111	1.19		
					112	0.13		
					113	0.89		
					114	0.50		
					115	2.32		
					116	1.86		
					117	1.06		
					151	0.37		

RUN NUMBER= 77A
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=102. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 22.25 PSIA
PINF= 0.0769 PSIA
TOINF= 437.0 DEG F
RE/FT TIMES 10(-4)= 25.02
PC123= 1480.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 1.93

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0233	0.303	-0.05357	1.000	9	0.13		
SSME NOZZLE #1								
72	2.5200				73	0.29		
SSME NOZZLE #2								
67	2.5000				69	0.33		
					70	1.00		
SSME NOZZLE #3								
133	2.7400							

RUN 77A CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0494	0.643	-0.02747	1.033	102	0.22		
88	0.0408	0.531	-0.03607	0.854	104	0.25		
89	0.0491	0.639	-0.02777	1.027	105	0.51		
90	0.0478	0.622	-0.02907	1.000	106	0.06		
92	0.0503	0.654	-0.02657	1.052	107	0.26		
93	0.0601	0.782	-0.01677	1.257	108	0.52		
95	0.0470	0.611	-0.02987	0.983	109	0.63		
162	0.0468	0.609	-0.03007	0.979	110	0.37		
164	0.0518	0.674	-0.02507	1.084	150	0.09		
					111	0.79		
					112	0.45		
					113	0.18		
					114	0.33		
					115	0.81		
					116	0.80		
					117	0.22		
					151	0.34		

RUN NUMBER= 77C
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=101. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 22.70 PSIA
PINF= 0.0784 PSIA
TOINF= 422.2 DEG F
RE/FT TIMES 10(-4)= 25.83
PC123= 1482.0 PSIA
PC4 336.0 PSIA
PC5= 271.0 PSIA
PC123/PINF TIMES 10(-4)= 1.89

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.1430	1.823	0.06457	1.000	9	0.85		
BODY FLAP									
								132	0.0
LEFT OMS POD									
								58	0.31
SSME NOZZLE #1									
	72	2.3100				73	>1.56		
SSME NOZZLE #2									
	67	2.3800				69	1.26		
						70	2.33		
SSME NOZZLE #3									
	133	2.4300							

RUN 77C CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.1250	1.594	0.04657	1.225	102	>0.77	96	0.0
88	0.1040	1.326	0.02557	1.020	103	>1.30	97	0.16
89	0.1140	1.454	0.03557	1.118	104	0.56	99	0.34
90	0.1020	1.301	0.02357	1.000	105	1.48	101	0.15
91					106	0.99		
92	0.1030	1.313	0.02457	1.010	107	0.89		
93	0.1130	1.441	0.03457	1.108	108	1.62		
95	0.0907	1.156	0.01227	0.889	109	1.63		
162	0.1020	1.301	0.02357	1.000	110	0.51		
164	0.0944	1.204	0.01597	0.925	150	1.01		
					111	1.50		
					112	1.09		
					113	0.59		
					114	0.56		
					115	1.21		
					116	1.15		
					117	0.83		
					151	0.50		

RUN NUMBER= 78
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=102. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 22.20 PSIA
PINF= 0.0767 PSIA
TOINF= 416.0 DEG F
RE/FT TIMES 10(-4)= 25.39
PC123= 1457.0 PSIA
PC4 323.0 PSIA
PC5= 263.0 PSIA
PC123/PINF TIMES 10(-4)= 1.90

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.1120	1.460	0.03530	1.000				
BODY FLAP									
								132	0.0
ESRM SHROUD									
	44	0.1580	2.060	0.08130		48	0.07	47	0.05
	46	0.6820	8.892	0.60530		49	2.02		
						50	1.33 (?)		
						53	0.57		
LEFT OMS POD									
	57	0.0828	1.080	0.00610					
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	2.2000							
SSME NOZZLE #2									
	67	2.3000							

RUN 78 CONTINUED

SSME NOZZLE #3

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
133	2.2700							

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.1170	1.525	0.04030	1.309	102	1.39	96	0.0
88	0.0825	1.076	0.00580	0.923	103	2.53	97	0.0
89	0.1050	1.369	0.02830	1.174	105	1.78	99	0.0
90	0.0894	1.166	0.01270	1.000	106	2.18	101	0.23
91	0.0639	0.833	-0.01280	0.715	108	1.77		
92	0.0743	0.969	-0.00240	0.831	109	1.47		
93	0.1040	1.356	0.02730	1.163	110	1.17		
95	0.0868	1.132	0.01010	0.971	150	0.89		
162	0.0437	0.570	-0.03300	0.489	112	0.77		
164	0.0880	1.147	0.01130	0.984	114	0.99		
					115	1.10		
					116	0.99		
					117	~0.81		
					151	0.81		

RUN NUMBER= 79
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.48 PSIA
PINF= 0.0155 PSIA
TOINF= 378.0 DEG F
RE/FT TIMES 10(-4)= 5.28
PC123= 1514.0 PSIA
PC4 190.0 PSIA
PC5= 161.0 PSIA
PC123/PINF TIMES 10(-4)= 9.78

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0430	2.778	0.02752	1.000	9	1.81		
BSRM SHROUD									
	44	0.0606	3.915	0.04512		48	0.0	47	0.06
	46	0.2200	14.213	0.20452		49	3.25		
						50	1.35		
						51	0.0		
						52	0.0		
						53	0.28		
LEFT OMS POD									
	57	0.0300							
SSME NOZZLE #1									
	72	2.2600							
SSME NOZZLE #2									
	67	2.3100							
SSME NOZZLE #3									
	133	2.50							

RUN 79 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
					102	0.35	97	0.0
86	0.0374	2.416	0.02192	1.133	103	0.45	99	0.0
88	0.0324	2.093	0.01692	0.982	104	0.31	101	0.16
89	0.0353	2.281	0.01982	1.070	105	0.70		
90	0.0330	2.132	0.01752	1.000	106	0.50		
91	0.0346	2.235	0.01912	1.048	107	0.51		
92	0.0378	2.442	0.027[illegible]2	1.145	108	0.77		
93	0.038[illegible]	2.494	0.02312	1.170	109	0.75		
95	0.0327	2.113	0.01722	0.991	110	0.39		
162	0.0345	2.229	0.01902	1.045	150	0.64		
164	0.0349	2.255	0.01942	1.058	111	0.97		
					112	1.00		
					114	0.40		
					115	2.17		
					116	2.24		
					117	~1.08		
					151	0.35		

RUN NUMBER= 80C
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=136. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB=   80.0 DEG F
TET=   80.0 DEG F

POINF= 5.65 PSIA
PINF= 0.0195 PSIA
TOINF= 364.0 DEG F
RE/FT TIMES 10(-4)= 6.75
PC123= 1411.0 PSIA
PC4 13.5 PSIA
PC5= 13.5 PSIA
PC123/PINF TIMES 10(-4)= 7.22

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0139	0.711	-0.00564	1.000	9	0.12		
BSRM SHROUD									
	46	0.2310	11.823	0.21146		48	0.0		
						49	> 3.83		
						50	0.43		
						51	0.0		
						52	0.0		
						53	0.12		
LEFT OMS POD									
	57	0.0431	2.206	0.02356					
SSME NOZZLE #1									
	72	2.5000							
SSME NOZZLE #2									
	67	2.3700							
SSME NOZZLE #3									
	133	2.6700							

RUN 80C CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0257	1.315	0.00616	0.726	102	0.12	101	0.08
88	0.0229	1.172	0.00336	0.647	103	0.04		
89	0.0247	1.264	0.00516	0.698	104	0.46		
90	0.0354	1.812	0.01586	1.000	105	2.57		
91	0.0323	1.653	0.01276	0.912	106	0.18		
92	0.0447	2.288	0.02516	1.263	109	2.19		
93	0.0344	1.761	0.01486	0.972	110	0.45		
95	0.0236	1.208	0.00406	0.667	150	0.13		
162	0.0159	0.814	-0.00364	0.449	111	3.81		
164	0.0385	1.971	0.01896	1.088	112	3.75		
					114	0.77		
					115	2.28		
					116	2.53		
					117	-0.62		
					151	0.47		

RUN NUMBER= 80D
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=132. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 6.60 PSIA
PINF= 0.0228 PSIA
TOINF= 339.0 DEG F
RE/FT TIMES 10(-4)= 8.05
PC123= 1504.0 PSIA
PC4 164.0 PSIA
PC5= 135.0 PSIA
PC123/PINF TIMES 10(-4)= 6.60

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0530	2.324	0.03020	1.000	9	1.66		
SRM SHROUD									
	44	0.0667	2.925	0.04390		48	0.0	47	0.05
						49	1.44		
						50	0.42 (?)		
						51	0.0		
						52	0.0		
						53	0.26		
LEFT OMS POD									
	57	0.0354	1.552	0.01260				58	0.32
SSME NOZZLE #1									
	72	2.3000							
SSME NOZZLE #2									
	67	2.2900							
SSME NOZZLE #3									
	133	2.4100							

RUN 80D CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0407	1.785	0.01790	1.077	102	0.63	101	0.66 (?)
88	0.0368	1.614	0.01400	0.974	103	0.24		
89	0.0414	1.816	0.01860	1.095	105	0.53		
90	0.0378	1.658	0.01500	1.000	106	0.21		
91					108	0.65		
92	0.0388	1.702	0.01600	1.026	109	0.82		
93	0.0506	2.219	0.02780	1.339	110	0.33		
95	0.0351	1.539	0.01230	0.929	150	0.44		
162	0.0211	0.925	-0.00170	0.558	111	1.09		
164	0.0394	1.728	0.01660	1.042	112	1.20		
					114	0.31		
					115	2.14		
					116	2.26		
					117	~1.03		
					151	0.44		

RUN NUMBER= 81

CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=121. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 10.16 PSIA
PINF= 0.0351 PSIA
TOINF= 396.0 DEG F
RE/FT TIMES 10(-4)= 11.81
PC123= 1483.0 PSIA
PC4 188.0 PSIA
PC5= 156.0 PSIA
PC123/PINF TIMES 10(-4)= 4.22

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0686	1.954	0.03350	1.000	9	1.53		
SSRM SHROUD									
	44	0.0761	2.168	0.04100		48	0.04	47	0.0
						49	2.16		
						50	0.41		
						51	0.0		
						52	0.0		
						53	0.31		
LEFT OMS POD									
	57	0.0503	1.433	0.01520				58	0.0
SSME NOZZLE #1									
	72	2.3400							
SSME NOZZLE #2									
	67	2.2600							
SSME NOZZLE #3									
	133	2.5100							

RUN 81 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0496	1.413	0.01450	1.025	102	0.43	101	C.20
88	0.0473	1.347	0.01220	0.977	103	0.26		
89	0.0513	1.461	0.01620	1.060	104	0.30		
90	0.0484	1.379	C.01330	1.000	105	0.64		
91					106	0.27		
92	C.0515	1.467	C.01640	1.064	108	C.67		
93	0.0540	1.538	0.01890	1.116	109	C.61		
95	0.0486	1.385	0.01350	1.004	110	0.44		
162	0.0478	1.362	C.01270	0.988	150	0.33		
164	0.0488	1.390	0.01370	1.008	111	0.95		
					112	0.76		
					114	0.63		
					115	1.71		
					116	1.35		
					117	~ C.74		
					151	0.22		

RUN NUMBER= 82
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=122. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 9.74 PSIA
PINF= 0.0337 PSIA
TOINF= 373.0 DEG F
RE/FT TIMES 10(-4)= 11.54
PC123= 1397.0 PSIA
PC4 317.0 PSIA
PC5= 265.0 PSIA
PC123/PINF TIMES 10(-4)= 4.15

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0621	1.845	0.02845	1.000	9	1.96		
EXTERNAL TANK SIDEWALL									
	24								
BSRM SHROUD									
	44	0.0969	2.879	0.06325		48	0.09	47	0.06
	46	0.4140	12.302	0.38035		49	3.17 (?)		
						50	0.63		
						51	0.0		
						52	0.0		
						53	0.36		
LEFT OMS POD									
	57	0.0480	1.426	0.01435					
SSME NOZZLE #3									
	133	2.2100							

RUN 82 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0690	2.050	0.03535	1.423	102	1.19	101	0.64
88	0.0609	1.810	0.02725	1.256	103	0.50		
89	0.0579	1.721	0.02425	1.194	105	1.49		
90	0.0485	1.441	0.01485	1.000	108	1.59		
91					109	1.25		
92	0.0516(?)	1.533	0.01795	1.064	110	0.66		
93	0.0645	1.917	0.03085	1.330	150	1.15		
95	0.0502	1.492	0.01655	1.035	111	0.96		
162	0.0534	1.587	0.01975	1.101	112	0.52		
164	0.0481	1.429	0.01445	0.992	114	0.50		
					115	0.93		
					116	0.26		
					117	0.92		
					151	0.52		

RUN NUMBER= 63
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=112. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 14.85 PSIA
PINF= 0.0513 PSIA
TOINF= 403.0 DEG F
RE/FT TIMES 10(-4)= 17.17
PC123= 1439.0 PSIA
PC4 355.0 PSIA
PC5= 313.0 PSIA
PC123/PINF TIMES 10(-4)= 2.80

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0955	1.861	0.04418	1.000	9	1.78		
EXTERNAL TANK SIDEWALL									
	24								
BSRM SHROUD									
	44	0.1424	2.775	0.09108		48	0.09	47	0.04
	46	0.6820	13.288	0.63068		52	0.52		
						53	0.36		
LEFT OMS POD									
	57	0.0647	1.261	0.01338				58	0.48 (?)
SSME NOZZLE #1									
	72	2.2100							
SSME NOZZLE #2									
	67	2.1200							
SSME NOZZLE #3									
	133	2.0500							

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OF POOR QUALITY

RUN 83 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0964	1.878	C.04508	1.289	102	1.85	99	C.45
88	C.1006	1.960	C.04928	1.345	103	1.51	101	C.47
89	0.0800	1.559	0.0287	1.070	105	3.87		
9C	0.0748	1.457	C.02348	1.000	108	1.44		
91					109	1.00		
92	0.0753	1.467	0.02398	1.007	110	1.02		
93	0.0862	1.680	0.03488	1.152	111	0.65		
95	0.0733	1.428	0.02198	0.980	112	0.59		
162	0.0811	1.580	0.02978	1.084	114	>0.92		
164	0.0738	1.438	0.02248	0.987	115	1.09		
					117	1.48		
					151	0.62		

RUN NUMBER= 84
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=120 K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.85 PSIA
PINF= 0.0167 PSIA
TOINF= 375.0 DEG F
RE/FT TIMES 10(-4)= 5.73
PC123= 706.0 PSIA
PC4 179.0 PSIA
PC5= 149.0 PSIA
PC123/PINF TIMES 10(-4)= 4.22

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0385	2.300	0.02176	1.000	9	~0.88		
BODY FLAP									
								132	0.0
BSRM SHROUD									
	44	0.0702	4.194	0.05346		48	0.0	47	0.01
	46	0.2410	14.397	0.22426		49	0.91		
						50	0.44		
						51	0.0		
						52	0.0		
						53	0.44(?)		
LEFT OMS POD									
	57	0.0300	1.792	0.01326					
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	1.2200							
SSME NOZZLE #2									
	67	1.1500							

RUN 84 CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #3									
	133	1.2000							
BASE HEAT SHIELD (COLD)									
	86	0.0454	2.712	0.02866	1.428	102	0.76	96	0.17
	88	0.0332	1.983	0.01646	1.044	103	0.79 (?)	99	0.0
	89	0.0361	2.157	0.01936	1.135	105	0.67	101	0.11
	90	0.0318	1.900	0.01506	1.000	108	0.76		
	91	0.0295(?)	1.762	0.01276	0.928	109	0.62		
	92	0.0321	1.918	0.01536	1.009	110	0.58		
	93	0.0381	2.276	0.02136	1.198	111	0.67		
	95	0.0313	1.870	0.01456	0.984	112	0.47		
	162	0.0354	2.115	0.01866	1.113	115	0.56		
	164	0.0322	1.924	0.01546	1.013	116	0.36		
						117	0.32		
						151	0.25		

RUN NUMBER= 85
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=122. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 9.89 PSIA
PINF= 0.0342 PSIA
TOINF= 382.0 DEG F
RE/FT TIMES 10(-4)= 11.63
PC123= 1382.0 PSIA
PC4 146.0 PSIA
PC5= 131.0 PSIA
PC123/PINF TIMES 10(-4)= 4.04

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0591	1.730	0.02493	1.000	1	1.48	8	0.36
157	0.0631	1.847	0.02893	1.068	3	0.78	18	0.32
158	0.0418	1.223	0.00763	0.707	5	0.83	129	C.10
159	0.0534	1.563	0.01923	0.904	7	1.16	130	0.23
170	0.0561	1.642	0.02193	0.949	9	0.20 (?)	131	0.15
171	0.0556	1.627	0.02143	0.941	15	1.07		
172	0.0539	1.577	0.01973	0.912	17	0.92		
					21	0.54		
					28	C.91		
EXTERNAL TANK SIDEWALL								
25	C.0031 (?)	C.090	-0.03108		26	C.C		
BODY FLAP								
					29	C.39		
					33	C.37		
					34	C.71		
					35	1.53		
					204	C.16		
SRM NOZZLE								
54	0.0625	1.829	C.C2833					
55	3.6300							
56	4.8800							

RUN 85 CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
LEFT OMS POD									
						61	0.0		
SSME NOZZLE #1									
	72	2.2000							
SSME NOZZLE #2									
	67	2.2600							
SSME NOZZLE #3									
	133	2.3900							
BASE HEAT SHIELD (COLD)									
	82	0.0507	1.484	0.01653	1.105	111	0.08 (?)		
	90	0.0459	1.343	0.01173	1.000				

ORIGINAL PAGE IS OF POOR QUALITY

RUN NUMBER= 96

CONFIGURATION= OTS	POINF= 6.46 PSIA
MACH NUMBER= 4.5	PINF= 0.0223 PSIA
ALTITUDE=133. K FT	TOINF= 353.0 DEG F
ANGLE OF ATTACK= 0 DEGREES	RE/FT TIMES 10(-4)= 7.78
TOB= 80.0 DEG F	PC123= 1450.0 PSIA
TET= 80.0 DEG F	PC4 162.0 PSIA
	PC5= 145.0 PSIA
	PC123/PINF TIMES 10(-4)= 6.50

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0458	2.052	0.02348	1.000	1	0.70	8	0.50 (?)
156	0.0444	1.992	0.0221	0.969	3	0.83	18	0.44 (?)
157	0.0459	2.057	0.02358	1.002	4	1.10	129	0.24
158	0.0350	1.568	0.01268	0.764	5	1.25	130	0.27
159	0.0415	1.859	0.01918	0.906	7	1.61	131	0.22
170	0.0434	1.945	0.02108	0.948	9	2.03		
171	0.0425	1.904	0.02018	0.928	15	1.75		
172	0.0384	1.720	0.01608	0.838	17	0.88		
					21	0.75		
					28	1.45		
BODY FLAP								
					29	0.30		
					33	>0.39		
					34	0.83		
					35	1.75		
SRM NOZZLE								
54	0.0486	2.177	0.02628					
55	3.6200							
56	4.4600							
SSME NOZZLE #1								
72	2.5100							

RUN 86 CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #2									
	67	2.4500							
SSME NOZZLE #3									
	133	2.6400							
BASE HEAT SHIELD (COLD)									
	82	0.0357	1.601	0.0134	0.973	111	0.72		
	90	0.0367	1.644	0.01438	1.000				

RUN NUMBER= 87
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=141. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.63 PSIA
PINF= 0.0160 PSIA
TOINF= 376.0 DEG F
RE/FT TIMES 10(-4)= 5.46
PC123= 1522.0 PSIA
PC4 198.0 PSIA
PC5= 145.0 PSIA
PC123/PINF TIMES 10(-4)= 9.52

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0418	2.616	0.02582	1.000	1	0.94	8	0.65
	16	0.0521	3.260	0.03612	1.246	4	0.95	18	>1.60
	156	0.0412	2.578	0.02522	0.986	5	1.22	130	0.31
	157	0.0463	2.897	0.03032	1.108	7	1.55	131	0.24
	158	0.0361	2.259	0.02012	0.864	9	1.55		
	159	0.0363	2.272	0.02032	0.868	15	1.01		
	170	0.0435	2.722	0.02752	1.041	17	0.35		
	171	0.0437	2.735	0.02772	1.045	19	0.63		
	172	0.0340(?)	2.128	0.01802	0.813	20	0.90		
						21	0.36		
						28	1.93		
BODY FLAP									
						29	0.37		
						33	0.82		
						34	1.05		
						35	1.64		
ESRM NOZZLE									
	54	0.0479	2.998	0.03192					
	55	4.8300							
	56	4.3900							
SSME NOZZLE #1									
	72	2.5700							

RUN 87 CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #2									
	67	2.6000							
SSME NOZZLE #3									
	133	2.6700							
BASE HEAT SHIELD (COLD)									
	82	0.0334	2.090	0.01742	0.944	111	1.27		
	90	0.0354	2.215	0.01942	1.000				

RUN NUMBER= 88
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=119 K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.96 PSIA
PINF= 0.0171 PSIA
TOINF= 404.0 DEG F
RE/FT TIMES 10(-4)= 5.73
PC123= 717.0 PSIA
PC4 133.0 PSIA
PC5= 102.0 PSIA
PC123/PINF TIMES 10(-4)= 4.18

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0323	1.885	0.01516	1.000	3	0.53	8	0.38
	156	0.0304	1.774	0.01326	0.941	4	0.83	18	0.24
	157	0.0342	1.996	0.01706	1.059	5	0.86	129	0.17
	158	0.0282	1.646	0.01106	0.873	7	1.13	130	0.18
	159	0.0314	1.832	0.01426	0.972	9	1.23	131	0.11
	170	0.0381	2.223	0.02096	1.180	15	1.16		
	171	0.0296	1.727	0.01246	0.916	17	0.67		
	172	0.0270	1.576	0.00986	0.836	19	0.63		
						20	1.01		
						21	0.37		
						28	0.85		
BODY FLAP									
						29	0.42		
						33	0.58		
						34	0.80		
						35	1.59		
BSRM NOZZLE									
	54	0.0391	2.282	0.02196					
	55	3.3510							
	56	4.0320							
SSME NOZZLE #1									
	72	1.2230							

RUN 88 CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #2									
	67	1.1790							
SSME NOZZLE #3									
	133	1.3200							
BASE HEAT SHIELD (COLD)									
	82	0.0256	1.494	0.00846	0.905	111	0.46		
	90	0.0283	1.651	0.01116	1.000				

ORIGINAL PAGE IS OF POOR QUALITY

RUN NUMBER= 89A
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=112. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 14.80 PSIA
PINF= 0.0511 PSIA
TOINF= 347.0 DEG F
RE/FT TIMES 10(-4)= 17.92
PC123= 1452.0 PSIA
PC4 407.0 PSIA
PC5= 405.0 PSIA
PC123/PINF TIMES 10(-4)= 2.84

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0933	1.825	0.04217	1.000	1	2.25	8	0.97
	156	0.0828	1.619	0.03167	0.887	3	0.81	18	0.83
	159	0.0886	1.733	0.03747	0.950	4	1.87	129	0.55
	170	0.0949	1.856	0.04377	1.017	5	1.98	130	0.55
	172	0.0862	1.686	0.03507	0.924	7	2.27	131	0.41
						9	2.03		
						15	1.53		
						17	0.64		
						19	>1.88		
						20	1.78		
						21	1.23		
						28	1.14		
BODY FLAP									
						29	0.93		
						33	1.20		
						34	2.13		
						35	4.24		
						204	>0.95		
SRM NOZZLE									
	54	0.1180	2.308	0.06687					
LEFT OMS POD									
						61	0.72		

RUN 89A CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #1									
	72	2.5500							
SSME NOZZLE #2									
	67	2.5200							
SSME NOZZLE #3									
	133	2.6000							
BASE HEAT SHIELD (COLD)									
	82	0.0751	1.469	0.02397	0.872	111	0.09		
	90	0.0861	1.684	0.03497	1.000	202	1.72		

RUN NUMBER= 89B
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=112. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 14.50 PSIA
PINF= 0.0501 PSIA
TOINF= 408.0 DEG F
RE/FT TIMES 10(-4)= 16.69
PC123= 1461.0 PSIA
PC4 363.0 PSIA
PC5= 291.0 PSIA
PC123/PINF TIMES 10(-4)= 2.92

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0913	1.822	0.04120	1.000	1	2.46	8	0.75
156	0.0927	1.850	0.04260	1.015	3	0.87	18	0.40
157	0.0959	1.914	0.04580	1.050	4	1.40	130	0.22
158	0.0705	1.407	0.02040	0.772	5	1.11	131	0.13
159	0.0833	1.663	0.03320	0.912	9	1.79		
170	0.0854	1.705	0.03530	0.935	15	2.11		
171	0.0761	1.519	0.02600	0.834	17	0.61		
172	0.0792	1.581	0.02910	0.867	19	0.83		
					20	1.74		
					21	2.11		
					28	1.07		
BODY FLAP								
					33	0.95		
					34	1.36		
SRM NOZZLE								
54	0.1070	2.136	0.05690					
55	9.1400							
56	8.5300							
SSME NOZZLE #1								
72	2.4900							
SSME NOZZLE #2								
67	1.0300							

RUN 89B CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #3									
	133	2.5900							
BASE HEAT SHIELD (COLD)									
	82	0.0655	1.307	0.01540	0.793	111	1.79		
	90	0.0826	1.649	0.03250	1.000				

RUN NUMBER= 90
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.52 PSIA
PINF= 0.0156 PSIA
TOINF= 368.0 DEG F
RE/FT TIMES 10(-4)= 5.38
PC123= 1496.0 PSIA
PC4 173.0 PSIA
PC5= 178.0 PSIA
PC123/PINF TIMES 10(-4)= 9.58

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0424	2.715	0.02678	1.000	1	> 3.11	8	0.54
156	0.0322	2.062	0.01658	0.759	3	1.08	18	0.41
157	0.0399	2.555	0.02428	0.941	4	1.26	130	0.51
158	0.0305	1.953	0.01488	0.719	5	> 2.58	131	0.23
159	0.0368	2.356	0.02118	0.868	7	3.59		
170	0.0370	2.372	0.0214	0.873	9	2.81		
171	0.0386	2.472	0.02298	0.910	15	1.54		
172	0.0331	2.120	0.01748	0.781	17	1.18		
					19	1.62		
					20	2.14		
					21	1.01		
					28	2.09		
BODY FLAP								
					33	0.59		
					34	0.78		
BSRM NOZZLE								
54	0.0434	2.779	0.02778					
55	4.1700							
56	5.1100							
SSME NOZZLE #1								
72	2.4700							

RUN 90 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #2								
67	2.4500							
SSME NOZZLE #3								
133	2.6200							
BASE HEAT SHIELD (COLD)								
82	0.0331	2.120	0.01748	1.003	111	1.66		
90	0.0330	2.113	0.01738	1.000				

RUN NUMBER= 91A
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=122. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB=   80.0 DEG F
TET=   80.0 DEG F

POINF= 10.02 PSIA
PINF= 0.0346 PSIA
TOINF= 378.0 DEG F
RE/FT TIMES 10(-4)= 11.82
PC123= 1464.0 PSIA
PC4 471.0 PSIA
PC5= 375.0 PSIA
PC123/PINF TIMES 10(-4)= 4.23

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0845	2.441	0.04988	1.000	1	>6.29	8	1.02
156	0.0880	2.542	0.05338	1.041	3	1.90	18	0.85
157	0.0883	2.551	0.05368	1.045	4	2.66	131	0.27
158	0.0661	1.909	0.03148	0.782	5	1.93		
159	0.0766	2.213	0.04198	0.907	7	2.09		
170	0.1020	2.946	0.06738	1.207	9	>3.70		
171	0.0744	2.149	0.03978	0.880	15	2.16		
172	0.0756	2.184	0.04098	0.895	17	1.58		
					19	1.69		
					20	~3.65		
					21	3.06		
					28	3.65		
BODY FLAP								
					33	~2.46		
					34	>6.69		
BSRM NOZZLE								
54	0.0889	2.568	0.05428					
55	12.8800							
56	10.2500							
SSME NOZZLE #1								
72	2.5080							

RUN 91A CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #2									
	67	0.7880							
SSME NOZZLE #3									
	133	2.3920							
BASE HEAT SHIELD (COLD)									
	82	0.0760	2.195	0.04138	1.152	111	4.04		
	90	0.0660	1.906	0.03138	1.000				

RUN NUMBER= 918

CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=122. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 9.94 PSIA
PINF= 0.0343 PSIA
TOINF= 297.0 DEG F
RE/FT TIMES 10(-4)= 12.57
PC123= 1469.0 PSIA
PC4 289.0 PSIA
PC5= 252.0 PSIA
PC123/PINF TIMES 10(-4)= 4.28

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0750	2.185	0.04067	1.000	1	3.72	8	0.55
156	0.0722	2.103	0.03787	0.963	3	1.16	18	0.17
157	0.0781	2.275	0.04377	1.041	4	1.32	131	0.11
158	0.0605	1.763	0.02617	0.807	5	1.75		
159	0.0690	2.010	0.03467	0.920	7	2.83		
170	0.0771	2.246	0.04277	1.028	9	2.76		
171	0.0679	1.978	0.03357	0.905	15	2.16		
172	0.0596	1.736	0.02527	0.795	17	0.99		
					19	1.47		
					20	2.25		
					28	1.75		
BODY FLAP								
					33	1.39		
					34	1.52		
SRM NOZZLE								
54	0.0797	2.322	0.04537					
55	9.6600							
56	8.4000							
SSME NOZZLE #1								
72	2.5200							
SSME NOZZLE #2								
67	2.4800							

RUN 918 CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #3									
	133	2.6100							
BASE HEAT SHIELD (COLD)									
	82	0.0542	1.579	0.01987	1.006	111	1.37		
	90	0.0539	1.570	0.01957	1.000				

RUN NUMBER= 91C
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=121. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 10.30 PSIA
PINF= 0.0356 PSIA
TOINF= 348.0 DEG F
RE/FT TIMES 10(-4)= 12.46
PC123= 1476.0 PSIA
PC4 346.0 PSIA
PC5= 386.0 PSIA
PC123/PINF TIMES 10(-4)= 4.15

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0805	2.262	0.04491	1.000	1	2.74	8	0.66
	156	0.0873	2.453	0.05171	1.084	3	1.05	18	0.49
	157	0.0930	2.613	0.05741	1.155	4	1.41		
	158	0.0808	2.271	0.04521	1.004	5	1.66		
	159	0.0755	2.122	0.03991	0.938	7	2.50		
	170	0.1000	2.810	0.06441	1.242	17	0.86		
	171	0.0835	2.346	0.04791	1.037	19	1.16		
	172	0.0739	2.077	0.03831	0.918	20	1.81		
						21	4.19 (?)		
BSRM NOZZLE									
	54	0.0955	2.684	0.05991					
	55	8.6500							
	56	9.6500							
SSME NOZZLE #1									
	72	2.4000							
SSME NOZZLE #2									
	67	2.4600							
SSME NOZZLE #3									
	133	2.5700							

RUN 91C CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (COLD)								
82	0.0751	2.110	0.03951	1.128	111	2.11		
90	0.0666	1.871	0.03101	1.000				

RUN NUMBER= 92

CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=100. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 23.60 PSIA
PINF= 0.0815 PSIA
TOINF= 402.0 DEG F
RE/FT TIMES 10(-4)= 27.29
PC123= 1451.0 PSIA
PC4 351.0 PSIA
PC5= 294.0 PSIA
PC123/PINF TIMES 10(-4)= 1.78

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.1140	1.398	0.03246	1.000	1	2.02	8	0.46 (?)
156	0.1530	1.876	0.07146	1.342	3	0.72	18	0.46
157	0.1260	1.545	0.04446	1.105	4	0.87		
158	0.1010	1.239	0.01946	0.886	9	1.17		
159	0.1050	1.288	0.02346	0.921	17	0.71		
170	0.1170	1.435	0.03546	1.026	19	0.80		
171	0.0974	1.195	0.01586	0.854	20	1.14		
172	0.1010	1.239	0.01946	0.886	21	0.75		
					28	0.87		
EXTERNAL TANK SIDEWALL								
25								
BSRM NOZZLE								
54	0.1640	2.011	0.08246					
55	8.9000							
56	8.1400							
SSME NOZZLE #1								
72	2.2700							
SSME NOZZLE #2								
67	2.2400							

RUN 92 CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #3									
	133	2.5500							
BASE HEAT SHIELD (COLD)									
	82	0.1010	1.239	0.01946	0.990	111	1.82		
	90	0.1020	1.251	0.02046	1.000				

RUN NUMBER= 93A
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=122. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 9.85 PSIA
PINF= 0.0340 PSIA
TOINF=>340.0 DEG F
RE/FT TIMES 10(-4)= 12.00
PC123= 1407.0 PSIA
PC4=321.0 PSIA
PC5= 310.0 PSIA
PC123/PINF TIMES 10(-4)= 4.13

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0727	2.136	0.03867	1.000	3	1.08	8	0.39
156	0.0865	2.542	0.05247	1.190	4	1.06	18	0.43
157	0.0768	2.257	0.04277	1.056	5	1.38	131	0.17
158					7	1.90		
159	0.0680	1.998	0.03397	0.935	9	2.06		
170	0.0944	2.774	0.06037	1.298	15	2.91		
171	0.0650	1.910	0.03097	0.894	17	0.86		
172	0.0672	1.975	0.03317	0.924	19	1.06		
					20	2.19		
					21	1.15		
					28	1.78		
BSRM NOZZLE								
54	0.0880	2.586	0.05397					
55	8.9600							
56	8.6700							
LEFT OMS POD								
84	0.1407	4.134	0.10667					
SSME NOZZLE #1								
72	2.1710							
SSME NOZZLE #2								
67	2.4730							

ORIGINAL PAGE IS
OF POOR QUALITY

RUN 93A CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #3								
133	2.2610							
BASE HEAT SHIELD (COLD)								
82	0.0628	1.845	0.02877	1.030	111	1.52		
90	0.0610	1.792	0.02697	1.000				

RUN NUMBER= 938
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=121. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 10.34 PSIA
PINF= 0.0357 PSIA
TOINF= 416.0 DEG F
RE/FT TIMES 10(-4)= 11.82
PC123= 1475.0 PSIA
PC4=286.0 PSIA
PC5= 273.0 PSIA
PC123/PINF TIMES 10(-4)= 4.13

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0566	1.584	0.02088	1.000	1	3.29	8	0.62
16	0.0126	0.353	-0.02312	0.223	3	1.28	18	0.58
156	0.0734	2.055	0.03768	1.297	4	1.08	129	0.39
157	0.0699	1.957	0.03418	1.235	5	1.27	130	0.34
158	0.0511	1.430	0.01538	0.903	7	2.14		
159	0.0645	1.805	0.02878	1.140	9	2.53		
170	0.0720	2.015	0.03628	1.272	15	~ 2.46		
171	0.0627	1.755	0.02698	1.108	17	1.19		
172	0.0600	1.680	0.02428	1.060	19	1.69		
					20	2.05		
					21	1.19		
					28	1.22		
BODY FLAP								
					29	0.48		
SRM NOZZLE								
54	0.0751	2.102	0.03938					
55	7.5110							
56	8.2120							
SSME NOZZLE #1								
72	2.5210							
SSME NOZZLE #2								
67	2.4350							

RUN 93B CONTINUED

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
SSME NOZZLE #3									
	133	2.6570							
BASE HEAT SHIELD (COLD)									
	82	0.0582	1.629	0.02248	1.092	111	1.58		
	90	0.0533	1.492	0.01758	1.000				

RUN NUMBER= 94
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=121. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 10.20 PSIA
PINF= 0.0352 PSIA
TOINF= 422.0 DEG F
RE/FT TIMES 10(-4)= 11.61
PC123= 1469.0 PSIA
PC4=314.0 PSIA
PC5= 250.0 PSIA
PC123/PINF TIMES 10(-4)= 4.17

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0786	2.230	0.04336	1.000	9	2.04		
BODY FLAP									
								132	0.48
BSRM SHROUD									
						48	0.15		
						49	2.26		
SSME NOZZLE #1									
	72	2.6100							
SSME NOZZLE #2									
	67	2.5220							
SSME NOZZLE #3									
	133	2.7270							

RUN 94 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0722	2.049	0.03696	1.079	103	1.40	96	0.42
88	0.0701	1.989	0.03486	1.048	104	1.74	99	0.88
89	0.0722	2.049	0.03696	1.079	105	1.98		
90	0.0669	1.898	0.03166	1.000	106	1.52		
92	0.0661	1.876	0.03086	0.988	107	1.35		
93	0.0735	2.086	0.03826	1.099	108	2.09		
95	0.0636	1.805	0.02836	0.951	111	1.60		
162	0.0681	1.932	0.03286	1.018	112	0.98		
164	0.0642	1.822	0.02896	0.960	115	1.13		
					116	1.08		
					117	1.28		
					151	1.43		

RUN NUMBER= 96
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=159. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 2.29 PSIA
PINF= 0.0079 PSIA
TOINF= 446.0 DEG F
RE/FT TIMES 10(-4)= 2.56
PC123= 1430.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 18.07

ORIGINAL PAGE IS
OF POOR QUALITY

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0061	0.772	-0.00180	1.000	9	0.07		
BODY FLAP									
						29	0.06		
SSME NOZZLE #1									
	72	2.5100							
SSME NOZZLE #2									
	67	2.5800							
SSME NOZZLE #3									
	133	2.6100							
BASE HEAT SHIELD (COLD)									
	82	0.0093	1.172	0.00136	0.234	103	0.19	96	0.02
	86	0.0094	1.182	0.00144	0.236	104	0.89		
	88	0.0097	1.222	0.00176	0.244	105	0.14		
	89	0.0130	1.643	0.00509	0.327	108	1.31		
	90	0.0397	5.018	0.03179	1.000	112	2.65		
	92	0.0275	3.476	0.01959	0.693	116	2.43		
	93	0.0134	1.694	0.00549	0.338	117	0.39		
	95	0.0143	1.807	0.00639	0.360	151	0.48		
	162	0.0125	1.580	0.00459	0.315				

RUN NUMBER= 97
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=151. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 3.15 PSIA
PINF= 0.0109 PSIA
TOINF= 368.0 DEG F
RE/FT TIMES 10(-4)= 3.75
PC123= 1457.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 13.39

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0064	0.586	-0.00450	1.000	9	0.08		
BODY FLAP									
						29	0.04		
LEFT OMS NOZZLE									
						66	0.28 (?)		
SSME NOZZLE #1									
	72	2.5300							
SSME NOZZLE #2									
	67	2.5100							
SSME NOZZLE #3									
	133	2.6500							

RUN 97 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
82	0.0098	0.901	-0.00107	0.238	103	0.21	96	0.03
86	0.0109	1.002	0.00002	0.265	104	0.91		
88	0.0115	1.057	0.00062	0.279	105	1.25		
89	0.0149	1.369	0.00402	0.362	108	1.41		
90	0.0412	3.786	0.03032	1.000	111	7.44		
91	0.0360	3.308	0.02512	0.874	112	2.95		
92	0.0188	1.727	0.00792	0.456	116	4.29		
93	0.0071	0.651	-0.00379	0.172				
95	0.0149	1.369	0.00402	0.362				
162	0.0127	1.167	0.00182	0.308				
164	0.0218	2.003	0.01092	0.529				

RUN NUMBER= 98
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.51 PSIA
PINF= 0.0156 PSIA
TOINF= 360.0 DEG F
RE/FT TIMES 10(-4)= 5.40
PC123= 1383.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 8.88

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0060	0.385	-0.00958	1.000	9	0.19		
BODY FLAP									
						29	0.50	132	0.0
LEFT OMS POD									
	57	0.0154	0.988	-0.00018					
SSME NOZZLE #1									
	72	2.4100							
SSME NOZZLE #2									
	67	2.4600							
SSME NOZZLE #3									
	133	2.4500							

RUN 98 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0096	0.616	-0.00598	0.222	103	0.60	96	0.0
88	0.0136	0.873	-0.00198	0.314	104	0.36		
89	0.0180	1.155	0.00242	0.416	105	1.34		
90	0.0433	2.779	0.02772	1.000	111	4.19		
91	0.0390	2.503	0.02342	0.901	112	2.22		
92	0.0207	1.328	0.00512	0.478	116	1.61		
93	0.0155	0.995	-0.00008	0.358				
95	0.0136	0.873	-0.00198	0.314				
162	0.0157	1.008	0.00012	0.363				
164	0.0158	1.014	0.00022	0.365				

RUN NUMBER= 99
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=169. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.53 PSIA
PINF= 0.0053 PSIA
TOINF= 316.0 DEG F
RE/FT TIMES 10(-4)= 1.90
PC123= 1417.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 26.81

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0034	0.638	-0.00192	1.000	9	0.02		
BODY FLAP									
						29	1.16		
LEFT OMS POD									
	57	0.0068	1.294	0.00155					
SSME NOZZLE #1									
	72	2.4900							
SSME NOZZLE #2									
	67	2.4600							
SSME NOZZLE #3									
	133	2.6800							

RUN 99 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (COLD)								
82	0.0052	0.984	-0.00009	0.161	103	0.22		
88	0.0126	2.384	0.00731	0.391	104	1.52		
89	0.0251	4.748	0.01981	0.780	105	2.30		
90	0.0322	6.091	0.02691	1.000	106	0.52		
91	0.0339	6.413	0.02861	1.053	107	1.05		
92	0.0311	5.883	0.02581	0.966	108	3.07		
93	0.0074	1.396	0.00209	0.229	111	3.69		
95	0.0074	1.404	0.00213	0.230	112	3.86		
164	0.0152	2.875	0.00991	0.472	115	2.02		
					202	2.66		

RUN NUMBER= 100
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.44 PSIA
PINF= 0.0153 PSIA
TOINF= 356.0 DEG F
RE/FT TIMES 10(-4)= 5.33
PC123= 1449.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 9.45

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0088	0.576	-0.00650	1.000	9	0.10		
BODY FLAP								
					29	0.80		
LEFT OMS POD								
57	0.0237	1.545	0.00836					
SSME NOZZLE #1								
72	2.5000							
SSME NOZZLE #2								
67	2.4900							
SSME NOZZLE #3								
133	2.5800							

RUN 100 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (COLD)								
82	0.0112	0.730	-0.00414	0.370	103	> 1.57	96	0.05
86	0.0140	0.913	-0.00134	0.462	104	0.89		
88	0.0450	2.933	0.02966	1.485	105	4.24		
89	>0.0338	2.203	0.01846	1.116	106	2.00		
90	0.0303	1.975	0.01496	1.000	109	4.34		
91	0.0147	0.958	-0.00064	0.485	111	2.98		
92	0.0210	1.369	0.00566	0.693	112	1.92		
93	0.0224	1.460	0.00706	0.739	115	1.36		
95	0.0182	1.186	0.00286	0.601	116	7.66		
164	0.0189	1.232	0.00356	0.624	202	~6.04		

RUN NUMBER= 101

CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=169. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.53 PSIA
PINF= 0.0053 PSIA
TOINF= 324.0 DEG F
RE/FT TIMES 10(-4)= 1.89
PC123= 1394.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 26.37

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0041	0.778	-0.00118	1.000	9	0.05		
BODY FLAP									
						29	0.79		
LEFT OMS POD									
	57	0.0075	1.415	0.00219					
SSME NOZZLE #1									
	72	2.4600							
SSME NOZZLE #2									
	67	2.4200							
SSME NOZZLE #3									
	133	2.5300							

RUN 101 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (COLD)								
82	0.0058	1.099	0.00052	0.258	103	0.10	96	0.07
86	0.0071	1.347	0.00183	0.316	104	1.19	99	0.02
88	0.0066	1.243	0.00128	0.292	105	0.78		
89	0.0091	1.723	0.00382	0.405	106	0.41		
90	0.0225	4.256	0.01721	1.000	107	0.74		
91	0.0287	5.429	0.02341	1.276	108	0.98		
92	0.0316	5.978	0.02631	1.404	109	1.47		
93	0.0072	1.358	0.00189	0.319	111	2.74		
95	0.0086	1.634	0.00335	0.384	112	4.30		
164	0.0269	5.089	0.02161	1.196	115	6.06		

RUN NUMBER= 102
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=160. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 2.15 PSIA
PINF= 0.0074 PSIA
TOINF= 345.0 DEG F
RE/FT TIMES 10(-4)= 2.61
PC123= 1433.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 19.29

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0079	1.066	0.00049	1.000	9	0.23		
BODY FLAP									
						29	0.98		
LEFT OMS POD									
	57	0.0118	1.589	0.00437					
SSME NOZZLE #1									
	72	2.6100							
SSME NOZZLE #2									
	67	2.4800							
SSME NOZZLE #3									
	133	2.6300							

RUN 102 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
82	0.0095	1.282	0.00209	0.274	103	0.13	96	0.08
86	0.0117	1.575	0.00427	0.336	105	1.16	99	0.07
88	0.0100	1.346	0.00257	0.287	106	0.37		
89	0.0134	1.804	0.00597	0.385	107	1.02		
90	0.0348	4.685	0.02737	1.000	108	1.25		
91	0.0378	5.089	0.03037	1.086	111	6.71		
92	0.0281	3.783	0.02067	0.807	115	6.03		
93	0.0133	1.790	0.00587	0.382	116	1.62		
95	0.0134	1.804	0.00597	0.385	202	2.86		
164	0.0264	3.554	0.01897	0.759				

RUN NUMBER= 103
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=142. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.53 PSIA
PINF= 0.0157 PSIA
TOINF= 358.0 DEG F
RE/FT TIMES 10(-4)= 5.43
PC123= 1419.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 9.07

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0088	0.562	-0.00686	1.000	9	0.10		
BODY FLAP									
						29	0.80		
SSME NOZZLE #1									
	72	2.4300							
SSME NOZZLE #2									
	67	2.3600							
SSME NOZZLE #3									
	133	2.6800							

RUN 103 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
82	0.0172	1.099	0.00155	0.562	103	0.42	96	0.09
86	0.0157	1.003	0.00005	0.513	104	5.38	99	0.06
88	0.0541	3.457	0.03845	1.768	105	3.20		
90	0.030[illegible]	1.955	0.01495	1.000	106	4.00		
91	0.0193	1.233	0.00365	0.631	107	5.19		
92	0.0199	1.271	0.00425	0.650	108	10.70		
93	0.0205	1.310	0.00485	0.670	111	2.85		
95	0.0175	1.118	0.00185	0.572	112	1.43		
164	0.0181	1.156	0.00245	0.592	115	1.30		
					116	0.92		
					202	5.70		

RUN NUMBER= 104
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=150. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 90.0 DEG F
TET= 90.0 DEG F

POINF= 3.22 PSIA
PINF= 0.0111 PSIA
TOINF= 345.0 DEG F
RE/FT TIMES 10(-4)= 3.90
PC123= 1410.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 12.69

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (HEATED)								
					118	> 6.43		
					119	5.65		
					123	1.00		
EXTERNAL TANK BASE (HEATED)								
					141	0.12		
					142	0.13		
					143	0.11		
					144	0.16		
					145	0.10		
					146	0.08		
					147	0.07		
					148	0.10		
					149	0.08		

RUN NUMBER= 105
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=151. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 605.0 DEG F
TET= 590.0 DEG F

POINF= 3.05 PSIA
PINF= 0.0105 PSIA
TOINF= 385.0 DEG F
RE/FT TIMES 10(-4)= 3.58
PC123= 1461.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 13.86

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (HEATED)								
					118	1.01		
					119	4.09		
					123	0.56		
EXTERNAL TANK BASE (HEATED)								
					141	0.08		
					142	0.09		
					143	0.07		
					144	0.08		
					145	0.05		
					146	0.03		
					147	0.05		
					148	0.06		
					149	0.06		

RUN NUMBER= 106
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=151. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 960.0 DEG F
TET= 970.0 DEG F

POINF= 3.06 PSIA
PINF= 0.0106 PSIA
TOINF= 394.0 DEG F
RE/FT TIMES 10(-4)= 3.56
PC123= 1436.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 13.58

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (HEATED)								
					118	0.87		
					119	6.25		
					123	0.31		
EXTERNAL TANK BASE (HEATED)								
					141	-0.27		
					142	0.07		
					143	0.13		
					144	-0.17		
					145	-0.12		
					146	-0.14		
					147	0.0		
					148	0.10		
					149	0.30		

RUN NUMBER= 107
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=151. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 350.0 DEG F
TET= 300.0 DEG F

POINF= 3.08 PSIA
PINF= 0.0106 PSIA
TOINF= 379.3 DEG F
RE/FT TIMES 10(-4)= 3.63
PC123= 1304.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 12.25

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (HEATED)								
					118	0.44		
					119	2.59		
					123	0.56		
EXTERNAL TANK BASE (HEATED)								
					141	0.04		
					142	0.04		
					143	0.05		
					144	0.04		
					145	0.04		
					146	0.03		
					147	0.03		
					148	0.04		
					149	0.04		

RUN NUMBER= 108
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=151. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 770.0 DEG F
TET= 770.0 DEG F

POINF= 3.15 PSIA
PINF= 0.0109 PSIA
TOINF= 378.0 DEG F
RE/FT TIMES 10(-4)= 3.71
PC123= 1449.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 13.34

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (HEATED)								
					118	0.41		
					119	1.80		
					123	0.16		
EXTERNAL TANK BASE (HEATED)								
					141	0.0		
					142	0.06		
					143	0.0		
					144	0.03		
					145	-0.05		
					146	0.0		
					147	0.0		
					148	0.0		
					149	0.0		

RUN NUMBER= 01
CONFIGURATION= OT
MACH NUMBER= 0.0
ALTITUDE=137. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0188 PSIA
TOINF= 80.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 1547.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 8.34

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0229	1.218	0.00410	1.000	9	0.04		
LEFT OMS POD									
	57	0.0223	1.186	0.00350					
SSME NOZZLE #1									
	72	2.5100				73	1.47		
						74	1.33		
						75	1.24		
						76	0.51		
SSME NOZZLE #2									
	67	1.8700				68	1.08		
						69	1.48		
						70	1.16		
SSME NOZZLE #3									
	133	2.5800							

ORIGINAL PAGE IS OF POOR QUALITY

RUN D1 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0261	1.389	0.00730	0.913	102	0.04		
88	0.0230	1.224	0.00420	0.804	103	1.01		
89	0.0231	1.229	0.00430	0.808	104	0.28		
90	0.0286	1.522	0.00980	1.000	105	0.64		
92	0.0381	2.027	0.01930	1.332	108	1.11		
93	0.0233	1.240	0.00450	0.815	109	1.68		
95	0.0215	1.144	0.00270	0.752	110	0.27		
162	0.0230	1.224	0.00420	0.804	150	0.21		
164	0.0309	1.644	0.01210	1.080	111	2.97		
					113	1.67		
					114	0.67		
					115	>2.58		
					116	3.15		
					117	0.79		
					151	0.21		

RUN NUMBER= D2
CONFIGURATION= OT
MACH NUMBER= 0.0
ALTITUDE=187. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0026 PSIA
TOINF= 80.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 1526.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 59.61

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0038	1.488	0.00125	1.000	9	0.06		
LEFT OMS POD									
	57	0.0036	1.391	0.00100					
SSME NOZZLE #1									
	72	2.4700				73	2.65		
						74	1.92		
						75	1.72 (?)		
						76	0.79		
SSME NOZZLE #2									
	67	2.3300				68	0.96		
						69	1.70		
						70	1.17		
SSME NOZZLE #3									
	133	2.5300							

RUN D2 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0022	0.875	-0.00032	0.146	102	0.07		
88	0.0070	2.734	0.00444	0.458	103	0.28		
89	0.0086	3.375	0.00608	0.565	104	0.47		
90	0.0153	5.976	0.01274	1.000	105	0.89		
92	0.0212	8.281	0.01864	1.386	108	1.18		
93	0.0119	4.648	0.00934	0.778	109	1.98		
95	0.0083	3.226	0.00570	0.540	110	0.51		
162	0.0101	3.945	0.00754	0.660	150	0.05		
164	0.0229	8.945	0.02034	1.497	111	2.31		
					112	1.55		
					113	3.29		
					114	0.74		
					115	2.29		
					116	2.45		
					117	1.16		
					151	0.24		

ORIGINAL PAGE IS OF POOR QUALITY

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RUN NUMBER=  D3                                              POINF=        PSIA
        CONFIGURATION=  OT                                   PINF= 0.0018 PSIA
        MACH NUMBER= 0.0                                     TOINF=  80.0 DEG F
        ALTITUDE=196. K FT                                   RE/FT TIMES 10(-4)=
        ANGLE OF ATTACK= 0 DEGREES                           PC123= 1468.0 PSIA
        TOB=    80.0 DEG F                                   PC4=    0.0 PSIA
        TET=    80.0 DEG F                                   PC5=    0.0 PSIA
                                                             PC123/PINF TIMES 10(-4)= 82.50
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	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	̃	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0107	6.014	0.00892	1.000	9	0.02		
LEFT OMS POD									
	57	0.0035	1.945	0.00168					
SSME NOZZLE #1									
	72	2.4800				73	2.46		
						74	1.76		
						75	1.32		
						76	0.64		
SSME NOZZLE #2									
	67	2.3400				68	1.06		
						69	1.49		
						70	1.35		
SSME NOZZLE #3									
	133	2.6300							

RUN D3 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (COLD)								
88	0.0074	4.148	0.00560	0.453	102	0.04		
89	0.0093	5.210	0.00749	0.569	103	0.13		
90	0.0163	9.161	0.01452	1.000	104	0.35		
92	0.0208	11.690	0.01902	1.276	105	0.62		
93	0.0152	8.543	0.01342	0.933	108	0.89		
95	0.0083	4.648	0.00649	0.507	109	1.80		
162	0.0099	5.564	0.00812	0.607	110	0.48		
164	0.0221	12.420	0.02032	1.356	111	1.97		
					112	>1.62		
					113	>3.26		
					114	0.78		
					115	2.74		
					116	2.70		
					117	1.31		
					151	0.15		

RUN NUMBER= D4
CONFIGURATION= OT
MACH NUMBER= 0.0
ALTITUDE=157. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0085 PSIA
TOINF= 80.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 1540.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 18.12

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0114	1.341	0.00290	1.000	9	0.05		
LEFT OMS POD									
	57	0.0114	1.341	0.00290					
SSME NOZZLE #1									
	72	2.5100				73	2.22		
						74	1.81		
						75	1.37		
						76	0.70		
SSME NOZZLE #2									
	67	2.3300				68	0.65		
						69	1.46		
						70	1.31		
SSME NOZZLE #3									
	133	2.6000							

RUN D4 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (COLD)								
88	0.0127	1.494	0.00420	0.683	102	0.04	96	0.05
89	0.0115	1.353	0.00300	0.618	103	0.10		
90	0.0186	2.188	0.01010	1.000	104	0.39		
92	0.0415	4.883	0.03300	2.231	105	0.68		
93	0.0122	1.435	0.00370	0.656	108	0.91		
95	0.0095	1.118	0.00100	0.511	109	1.65		
164	0.0334	3.930	0.02490	1.796	110	0.46		
					150	0.02		
					111	4.42		
					113	0.91		
					114	0.69		
					115	>2.53		
					116	>4.77		
					117	1.08		
					151	0.17		

RUN NUMBER= D5
CONFIGURATION= OT
MACH NUMBER= 0.0
ALTITUDE=115. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0446 PSIA
TOINF= 80.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 1546.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 3.47

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
					9	0.04		
LEFT OMS POD								
57	0.0518	1.161	0.00720					
SSME NOZZLE #1								
72	2.5000				73	0.75		
					74	1.40		
					76	0.65		
					169	0.0		
SSME NOZZLE #2								
67	2.3700				68	0.32		
					69	0.56		
					70	0.89		
SSME NOZZLE #3								
133	2.6400							

RUN D5 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
88	0.0422	0.946	-0.00240	0.890	102	0.12	96	0.03
89	0.0475	1.065	0.00290	1.002	103	0.11		
90	0.0474	1.063	0.00280	1.000	104	0.13		
92	0.0505	1.132	0.00590	1.065	105	0.20		
93	0.0452	1.013	0.00060	0.954	108	0.51		
162	0.0415	0.930	-0.00310	0.876	109	0.69		
164	0.0440	0.986	-0.00060	0.928	110	0.18		
					150	0.05		
					111	0.70		
					113	0.33		
					114	0.35		
					116	1.04		
					117	0.38		
					151	0.07		

RUN NUMBER= D6
CONFIGURATION= OT
MACH NUMBER= 0.0
ALTITUDE=116. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0438 PSIA
TOINF= 80.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 1599.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 3.65

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0484	1.105	0.00459	1.000	9	0.03		
LEFT OMS POD									
	57	0.0476	1.087	0.00379					
SSME NOZZLE #1									
	72	2.4600				73	0.81		
						74	1.90		
SSME NOZZLE #2									
	67	2.3400				69	0.50		
						70	1.54		
SSME NOZZLE #3									
	133	2.6200							

RUN D6 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0491	1.121	0.00529	1.036	102	0.03		
88	0.0479	1.093	0.00409	1.011	103	0.09		
89	0.0481	1.098	0.00429	1.015	104	0.12		
90	0.0474	1.082	0.00359	1.000	105	0.24		
92	0.0511	1.166	0.00729	1.078	109	0.62		
93	0.0495	1.130	0.00569	1.044	150	0.03		
95	0.0474	1.082	0.00359	1.000	111	0.98		
162	0.0472	1.077	0.00339	0.996	112	0.68		
164	0.0498	1.137	0.00599	1.051	113	0.79		
					116	1.63		
					117	0.61		
					151	0.06		

ORIGINAL PAGE IS
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RUN NUMBER= D7
CONFIGURATION= OT
MACH NUMBER= 0.0
ALTITUDE= 86. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.1460 PSIA
TOINF= 80.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 1535.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 1.05

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.1590	1.089	0.01299	1.000	9	0.02		
LEFT OMS POD								
57	0.1450	0.993	-0.00101					
SSME NOZZLE #1								
					73	0.19		
					74	0.80		
SSME NOZZLE #2								
					69	0.32		
					70	0.27		
BASE HEAT SHIELD (COLD)								
86	0.1660	1.137	0.01999	1.037	102	0.02		
88	0.1610	1.103	0.01499	1.006	150	0.0		
89	0.1620	1.110	0.01599	1.012	111	0.15		
90	0.1600	1.096	0.01399	1.000	112	0.03		
92	0.1600	1.096	0.01399	1.000	113	0.13		
93	0.1620	1.110	0.01599	1.012	114	0.0		
95	0.1440	0.986	-0.00201	0.900	116	0.26		
162	0.1600	1.096	0.01399	1.000	117	0.08		
164	0.1640	1.123	0.01799	1.025	151	0.0		

RUN NUMBER= D8
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=169. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.54 PSIA
PINF= 0.0053 PSIA
TOINF= 340.0 DEG F
RE/FT TIMES 10(-4)= 1.88
PC123= 0.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 0.0

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0058	1.084	0.00045	1.000				
BASE HEAT SHIELD (COLD)								
86	0.0087	1.645	0.00343	0.000				
88	0.0065	1.212	0.00113	0.000				
89	0.0069	1.302	0.00161	0.000				
92	0.0069	1.289	0.00154	0.000				
93	0.0076	1.434	0.00231	0.000				
95	0.0055	1.028	0.00015	0.000				
162	0.0059	1.107	0.00057	0.000				
164	0.0078	1.472	0.00251	0.000				

RUN NUMBER= D11
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=111. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 15.15 PSIA
PINF= 0.0523 PSIA
TOINF= 480.0 DEG F
RE/FT TIMES 10(-4)= 16.48
PC123= 0.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 0.0

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0181	0.346	-0.03424	1.000	9	0.11		
BASE HEAT SHIELD (COLD)								
86	0.0436	0.833	-0.00874	1.101	111	0.23		
88	0.0353	0.674	-0.01704	0.891				
89	0.0402	0.768	-0.01214	1.015				
90	0.0396	0.757	-0.01274	1.000				
92	0.0393	0.751	-0.01304	0.992				
93	0.0429	0.820	-0.00944	1.083				
95	0.0367	0.701	-0.01564	0.927				
162	0.0373	0.713	-0.01504	0.942				
164	0.0373	0.713	-0.01504	0.942				

RUN NUMBER= D12
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=169. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.51 PSIA
PINF= 0.0052 PSIA
TOINF= 366.0 DEG F
RE/FT TIMES 10(-4)= 1.80
PC123= 0.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 0.0

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0050	0.951	-0.00026	1.000				
BASE HEAT SHIELD (COLD)								
86	0.0080	1.541	0.00282	1.147				
88	0.0063	1.213	0.00111	0.903				
89	0.0069	1.319	0.00166	0.981				
90	0.0070	1.344	0.00179	1.000				
92	0.0068	1.298	0.00155	0.966				
93	0.0077	1.478	0.00249	1.100				
95	0.0064	1.225	0.00117	0.912				
162	0.0065	1.250	0.00130	0.930				
164	0.0064	1.221	0.00115	0.909				

RUN NUMBER= D13
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=111. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 15.01 PSIA
PINF= 0.0519 PSIA
TOINF= 438.0 DEG F
RE/FT TIMES 10(-4)= 10.87
PC123= 1567.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 3.02

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0620	1.196	0.01014	1.000	9	>1.61		
BODY FLAP									
								132	0.0
LEFT OMS POD									
						63	0.08		
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	2.0800				73	1.09		
						74	2.51		
						75	3.00		
						76	1.23		
SSME NOZZLE #2									
	67	2.1600				68	0.15		
						69	0.92		
						70	1.91		
SSME NOZZLE #3									
	133	2.2800							

RUN D13 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0531	1.024	0.00124	1.090	102	0.27	96	0.07
88	0.0463	0.893	-0.00556	0.951	103	0.26	97	0.0
89	0.0533	1.028	0.00144	1.094	104	0.17	99	0.0
90	0.0487	0.939	-0.00316	1.000	105	0.24		
92	0.0484	0.933	-0.00346	0.994	108	0.42		
93	0.0511	0.985	-0.00076	1.049	109	0.32		
95	0.0490	0.945	-0.00286	1.006	110	0.0		
162	0.0489	0.943	-0.00296	1.004	150	0.30		
164	0.0485	0.935	-0.00336	0.996	111	0.58		
					112	0.65		
					113	0.95		
					114	0.53		
					116	> 1.36		
					117	1.15		
					151	0.21 (?)		

RUN NUMBER= D14
CONFIGURATION= OT
MACH NUMBER= 4.5
ALTITUDE=170. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 1.45 PSIA
PINF= 0.00[illegible]0 PSIA
TOINF= 35[illegible].0 DEG F
RE/FT TIMES 10(-4)= 1.74
PC123= 1577.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 31.37

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0079	1.570	0.00286	1.000	9	0.13		
BODY FLAP									
								132	0.0
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	2.2300				73	> 2.73		
						74	1.86		
						75	1.92		
						76	0.87		
SSME NOZZLE #2									
	67	2.2900				68	1.18		
						69	1.87		
						70	1.07		
SSME NOZZLE #3									
	133	2.3600							

RUN D14 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0113	2.248	0.00627	0.523	102	0.12	96	0.10
88	0.0099	1.975	0.00490	0.460	103	0.18	97	0.0
89	0.0101	2.009	0.00507	0.468	104	0.46	99	0.0
90	0.0216	4.297	0.01657	1.000	105	0.92		
92	0.0467	9.290	0.04167	2.162	108	1.10		
93	0.0096	1.914	0.00459	0.445	109	1.54		
95	0.0078	1.546	0.00274	0.360	110	0.65		
162	0.0114	2.268	0.00637	0.528	150	0.06		
164	0.0354	7.042	0.03037	1.639	111	~ 4.62		
					112	~ 5.03		
					113	3.41		
					114	0.94		
					116	6.78 (?)		
					117	1.11		
					151	0.30		

RUN NUMBER= D16
CONFIGURATION= OT
MACH NUMBER= 0.0
ALTITUDE=201. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0015 PSIA
TOINF= 80.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 1527.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)=102.54

ORIGINAL PAGE IS
OF POOR QUALITY

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0029	1.941	0.00140	1.000				
BODY FLAP									
								132	0.0
LEFT OMS POD									
	57	0.0054	3.640	0.00393					
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	2.0900				73	3.72		
						75	1.62		
						76	0.87		
SSME NOZZLE #2									
	67	2.0700				68	1.40		
						69	1.71		
						70	1.39		
SSME NOZZLE #3									
	133	2.0900							

RUN D16 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0158	10.610	0.01431	1.656	102	0.04	96	0.0
88	0.0091	6.104	0.00760	0.953	103	0.09	97	0.0
90	0.0095	6.407	0.00805	1.000	104	0.38	99	0.0
92	0.0312	20.952	0.02971	3.270	105	0.86	101	0.07
93	0.0167	11.215	0.01521	1.751	106	0.26		
95	0.0088	5.910	0.00731	0.922	107	0.66		
162	0.0094	6.319	0.00792	0.986	108	1.05		
164	0.0260	17.460	0.02451	2.725	110	0.37		
					111	2.96		
					112	6.13		
					113	3.48		
					114	0.99		
					115	2.81		
					116	2.99		
					117	1.23		
					151	0.56		

RUN NUMBER= D17
CONFIGURATION= OT
MACH NUMBER= 0.0
ALTITUDE=159. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0078 PSIA
TOINF= 80.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 1518.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 19.44

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0100	1.281	0.00219	1.000				
LEFT OMS POD									
	57	0.0091	1.168	0.00131					
SSME NOZZLE #1									
	72	2.1700				73	2.67		
						75	1.75		
						76	0.70		
SSME NOZZLE #2									
	67	2.2100				69	0.0		
						70	1.28		
SSME NOZZLE #3									
	133	2.4200							

RUN D17 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0094	1.200	0.00156	0.360	102	0.10	101	0.05
88	0.0113	1.447	0.00349	0.435	103	0.03		
89	0.0110	1.409	0.00319	0.423	104	0.45		
90	0.0260	3.330	0.01819	1.000	105	0.87		
92	0.0384	4.918	0.03059	1.477	106	0.33		
93	0.0157	2.011	0.00789	0.604	107	0.57		
95	0.0078	1.004	0.00003	0.302	108	0.96		
164	0.0322	4.124	0.02439	1.238	109	0.99		
					110	0.65		
					111	3.16		
					112	4.98		
					113	2.73		
					114	0.84		
					115	5.12		
					117	0.98		
					151	0.45		
					116	4.93		

RUN NUMBER= D18
CONFIGURATION= OT
MACH NUMBER= 0.0
ALTITUDE=174. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0043 PSIA
TOINF= 80.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 1443.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 33.33

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0061	1.409	0.00177	1.000	9	0.11		
BODY FLAP									
						205	0.0	132	0.0
SSME NOZZLE #1									
	72	1.9000				73	3.04		
						75	1.56		
						76	0.64		
						169	0.0		
SSME NOZZLE #2									
	67	2.0500				68	0.0		
						69	0.39		
						70	1.27		
SSME NOZZLE #3									
	133	2.0100							

RUN D18 CONTINUED

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
BASE HEAT SHIELD (COLD)								
86	0.0060	1.377	0.00163	0.213	102	0.06	96	0.0
88	0.0082	1.892	0.00386	0.292	103	0.25	97	0.0
89	0.0101	2.333	0.00577	0.361	104	0.69	99	0.0
90	0.0280	6.468	0.02367	1.000	105	1.34	101	0.03
92	0.0310	7.161	0.02667	1.107	107	0.68		
93	0.0093	2.155	0.00500	0.333	108	1.60		
95	0.0053	1.234	0.00101	0.191	150	0.12		
164	0.0192	4.435	0.01487	0.686	111	3.51		
					112	4.19		
					113	2.07		
					114	~0.66		
					115	~3.45		
					116	~3.20		
					117	0.88		
					151	0.46		

RUN NUMBER= D19
CONFIGURATION= OT
MACH NUMBER= 0.0
ALTITUDE=165. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0061 PSIA
TOINF= 80.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 1472.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 24.13

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0086	1.403	0.00246	1.000				
BODY FLAP									
								132	0.0
LEFT OMS POD									
	57	0.0157	2.573	0.00960				58	0.0
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
						73	2.02		
	72	1.9000				75	1.41		
						76	0.86		
						169	0.38		
SSME NOZZLE #2									
						69	0.37		
	67	2.0600				70	1.14		
SSME NOZZLE #3									
	133	2.2000							

RUN D19 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0080	1.305	0.00186	0.312	102	0.05	96	0.0
88	0.0109	1.786	0.00480	0.427	103	0.29	97	0.0
89	0.0123	2.016	0.00620	0.482	104	0.52	99	0.0
90	0.0255	4.179	0.01940	1.000	105	1.11	101	0.05
92	0.0287	4.704	0.02260	1.125	106	0.48		
95	0.0070	1.147	0.00090	0.275	107	1.06		
164	0.0200	3.278	0.01390	0.784	108	1.06		
					109	1.56		
					110	0.52		
					150	0.21		
					112	2.72		
					113	2.26		
					114	0.94		
					115	8.75		
					116	4.55		
					117	1.80		
					151	0.44		

RUN NUMBER= D20
CONFIGURATION= OT
MACH NUMBER= 0.0
ALTITUDE=212. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= PSIA
PINF= 0.0009 PSIA
TOINF= 80.0 DEG F
RE/FT TIMES 10(-4)=
PC123= 1453.0 PSIA
PC4 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)=156.40

	GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)									
	10	0.0010	1.076	0.00007	1.000	9	0.06		
BODY FLAP									
								132	0.0
LEFT OMS POD									
								58	0.0
LEFT OMS NOZZLE									
						66	0.0		
SSME NOZZLE #1									
	72	1.9000				73	2.76		
						75	1.87		
						76	0.89 (?)		
SSME NOZZLE #2									
	67	2.0300				69	0.32		
						70	1.25		
SSME NOZZLE #3									
	133	2.2000							

RUN D20 CONTINUED

BASE HEAT SHIELD (COLD)

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
86	0.0049	5.220	0.00392	0.192	102	0.10	96	0.0
88	0.0074	7.922	0.00643	0.292	103	0.27	97	0.0
89	0.0092	9.892	0.00826	0.365	104	0.53	99	0.0
90	0.0252	27.124	0.02427	1.000	105	0.94	101	0.03
92	0.0232	24.972	0.02227	0.921	107	0.79		
93	0.0260	27.986	0.02507	1.032	108	1.09		
95	0.0050	5.436	0.00412	0.200	110	0.41		
162	0.0102 (?)	10.979	0.00927	0.405	150	0.15		
164	0.0230	24.756	0.02207	0.913	111	2.01		
					112	-4.34		
					113	2.98		
					114	0.60		
					115	2.35		
					116	2.78		
					117	1.13		
					151	0.48		

RUN NUMBER=DIAG
CONFIGURATION= OTS
MACH NUMBER= 4.5
ALTITUDE=144. K FT
ANGLE OF ATTACK= 0 DEGREES
TOB= 80.0 DEG F
TET= 80.0 DEG F

POINF= 4.09 PSIA
PINF= 0.0141 PSIA
TOINF= 400.0 DEG F
RE/FT TIMES 10(-4)= 4.74
PC123= 0.0 PSIA
PC4= 0.0 PSIA
PC5= 0.0 PSIA
PC123/PINF TIMES 10(-4)= 0.0

GAGE	P	P/PINF	P-PINF	P/PCL	GAGE	Q	GAGE	Q-R
EXTERNAL TANK BASE (COLD)								
10	0.0131	0.927	-0.00103	1.000	9	0.09		
BSRM SHROUD								
44	0.0053	0.377	-0.00880		49	0.95		
46	0.1190	8.421	0.10487		50	0.48		
					53	0.08		
LEFT OMS POD								
57	0.0059	0.415	-0.00826					
SSME NOZZLE #1								
72	0.0447							
BASE HEAT SHIELD (COLD)								
86	0.0096	0.677	-0.00456	0.920				
88	0.0074	0.523	-0.00674	0.711				
89	0.0085	0.601	-0.00564	0.816				
90	0.0104	0.736	-0.00373	1.000				
91	0.0089	0.628	-0.00525	0.854				
92	0.0087	0.614	-0.00545	0.835				
93	0.0122	0.863	-0.00193	1.173				
95	0.0091	0.648	-0.00498	0.880				
162	0.0073	0.515	-0.00685	0.700				
164	0.0087	0.616	-0.00542	0.837				