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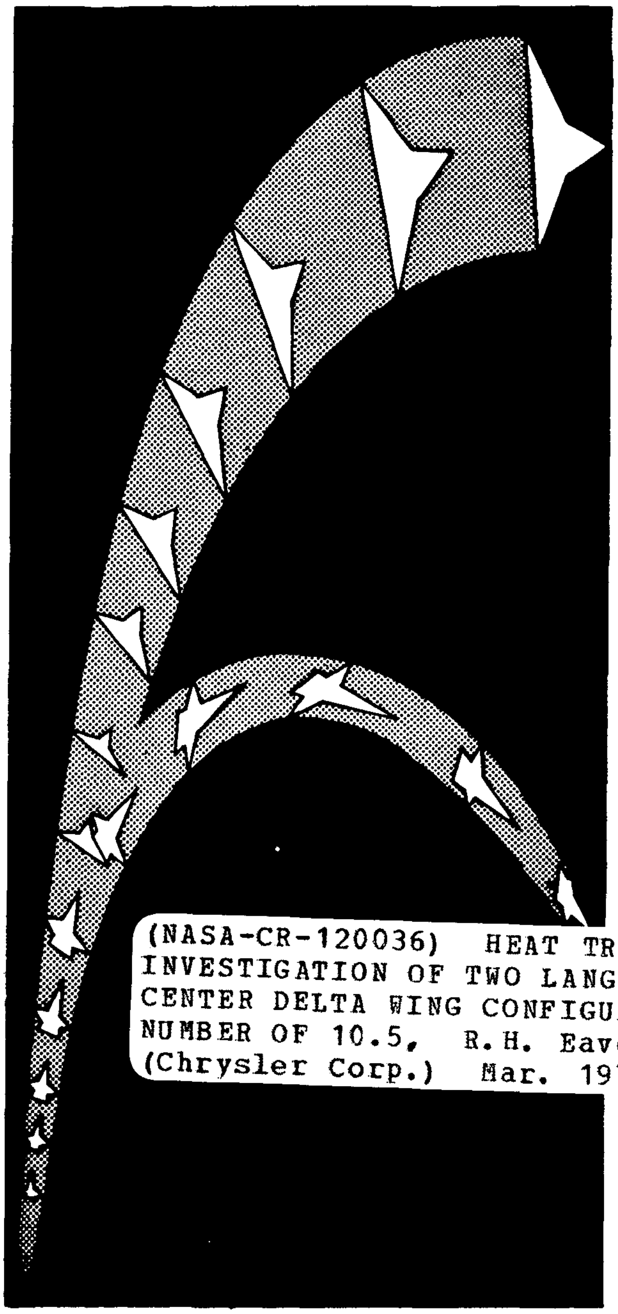

—SPACE SHUTTLE—

HEAT TRANSFER INVESTIGATION OF TWO LANGLEY RESEARCH CENTER DELTA WING CONFIGURATIONS AT A MACH NUMBER OF 10.5

by

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VKF - TUNNEL F

Arnold Engineering Development Center

SADSAC SPACE SHUTTLE
AEROTHERMODYNAMIC
DATA MANAGEMENT SYSTEM

CONTRACT NAS8-4016
MARSHALL SPACE FLIGHT CENTER

SPACE DIVISION CHRYSLER CORPORATION

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March, 1972

SADSAC/SPACE SHUTTLE

WIND TUNNEL TEST DATA REPORT

CONFIGURATION: Langley Research Center Delta Wings (Delta Body and Straight Body)

TEST PURPOSE: Heat Transfer Investigation of Two Delta Wing Configurations at a Mach Number of 10.5 and Flight Reynolds Numbers Based on Model Length

TEST FACILITY: AEDC-VKF Tunnel F

TESTING AGENCY: NASA-MSFC and NASA LaRC

TEST NO. & DATE: AEDC VT 1162-FOO; May 4 through June 4, 1971

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FOREWORD

The work reported herein was sponsored by Marshall Space Flight Center (MSFC), National Aeronautics and Space Administration (NASA). The results of tests were obtained by ARO, Inc. (a subsidiary of Sverdrup & Parcel and Associates, Inc.), contract operator of the Arnold Engineering Development Center (AEDC), Air Force Systems Command (AFSC), Arnold Air Force Station, Tennessee.

An extensive experimental investigation was conducted at various wind tunnels of the von Karman Gas Dynamics Facility (VKF), AEDC, on various space shuttle configurations for various Mach numbers over a large Reynolds number range. This report contains heat transfer results for two delta wing configurations submitted by Langley Research Center and tested in the VKF, Hypervelocity Wind Tunnel F. An additional SADSAC report is available from the VKF-Tunnel F facility which documents test results from the McDonnell Douglas delta wing orbiter.

ABSTRACT

Heat transfer tests for two delta wing configurations furnished by Langley Research Center were conducted at the Arnold Engineering Development Center (AEDC), von Karman Gas Dynamics Facility (VKF), in the Hypervelocity Wind Tunnel F. The 24-inch long models were tested at a Mach number of approximately 10.5 and at angles of attack of 20, 40, and 60 degrees over a length Reynolds number range from 5×10^6 to 23×10^6 on May 4-June 4, 1971. Heat transfer results were obtained from model surface heat gage measurements and thermographic phosphor paint.

TABLE OF CONTENTS

FIGURES AND TABLES

NOMENCLATURE

ALPHA	Model angle of attack, deg.
C_∞	Form of Chapman-Rubesin viscosity coefficient, $(\mu_w/\mu_\infty)(T_\infty/T_w)$
H	Model heat transfer coefficient, Q/(TO-T_w), Btu/ft^2-sec-^{o}R
HO	Stagnation enthalpy, Btu/Lbm
HREF or H_{ref}	Reference heat transfer coefficient, QO/(TO-T_w), Btu/ft^2-sec-^{o}R
H_w	Enthalpy at model wall temperature(T_w), Btu/Lbm
ℓ or L	Axial length of model, 24.0 in. (See Figure 3)
M-INF, MACH, or M_∞	Free-stream Mach number
p	Pressure, psia
P-INF or p_∞	Free-stream pressure, psia
PO	Reservoir pressure, psia
POP	Pitot pressure measured at the test section, psia
Q-INF	Free-stream dynamic pressure, psia
Q or $\dot{q}$	Model heat transfer rate, Btu/ft^2-sec.
QO or $\dot{q}_{ref}$	Stagnation heat transfer rate based on a hemisphere radius of 0.675 in., Btu/ft^2-sec.
r_n	Model profile nose radius, 0.675 in.
RE/FT or Re_∞/ft.	Reynolds number based on free stream conditions and a 1-foot length.
RE/L, RE-L, or $Re_{\infty,\ell}$	Reynolds number based on free-stream conditions and model length (24.0 in.)
RHO-INF	Free-stream density, Lbm/ft^3
STO	Stagnation Stanton number, QO/(RHO-INF)(U-INF)(HO-HW)
TIME or T	Test section time, milliseconds

T-INF or T_∞	Free-stream temperature, ^oR
TO	Reservoir temperature, ^oR
T_w	Temperature at model wall, $\approx 540^oR$
U-INF	Free-stream velocity, ft/sec.
V-INF	Hypersonic viscous parameter, $M_\infty (C_\infty)^{1/2} / Re_{\infty,\ell})^{1/2}$
x or X	Axial distance from the model nose, positive downstream, in. (See Figure 3)
y or Y	Lateral distance from the vertical centerline positive out right, in. (See Figure 3)
y_{max} or YMAX	Local semi-span at a given model station, in. (See Figure 3)
α	Angle of attack, degrees
μ_w	Gas viscosity at model wall
μ_∞	Gas viscosity in free-stream

I. INTRODUCTION

Heat transfer tests of two delta wing configurations supplied by Langley Research Center were sponsored by the Marshall Space Flight Center (MSFC) at Arnold Engineering Development Center (AEDC). Two, 24.0-inch long models were tested in Tunnel F at the AEDC-von Karman Gas Dynamics Facility (VKF) during the time period from May 4 to June 4, 1971. Heat transfer results were obtained from detailed instrumentation measurements and a thermographic phosphor paint technique. Limited pressure measurements were obtained during the tunnel entry. Data were obtained at a Mach number of approximately 10.5 over a Reynolds number range from 5.0×10^6 to 23.0×10^6 based on model length. The model was tested at angles of attack of 20, 40, and 60 degrees with limited phosphor paint results on the bottom surface for selected runs. The purpose of this test was to obtain heat-transfer distributions along the windward centerline at flight Reynolds numbers and to investigate the onset of transition zone over a large Reynolds number range.

II. APPARATUS

2.1 Wind Tunnel.

The Hypervelocity Wind Tunnel F (Figure 1) is an electric-arc-heated impulse hypersonic wind tunnel of the hotshot type developed at AEDC. The test gas, nitrogen or air, is initially confined in an arc chamber by a diaphragm located near the throat of a convergent-divergent nozzle. For the present tests, nitrogen was used as the test gas. The gas is heated and compressed by an electric arc discharge resulting in rupture of the diaphragm and subsequent expansion through a 4-degree half-angle conical nozzle to a maximum diameter of 108 inches. Testing is possible at either the maximum diameter for Mach numbers from 13 to 22 or at the 54-inch diameter station for Mach numbers from 10 to 17. Useful run times between 50 and 200 msec. are obtained. The present tests were conducted at the 54-inch diameter station with a useful run time of approximately 100 msec. utilizing the 4-cubic-foot arc chamber.

2.2 Model.

A photograph of the windward surface of the Langley delta wing model (LRC-DB) is shown in Figure 2. The LRC-DB and LRC-SB configurations were instrumented identically along the windward centerline, as shown in Figure 3. A complete layout of the instrumentation and model details is shown in Figure 3 for both Langley configurations. The models were designed and fabricated at Langley Research Center, Hampton, Virginia, from No. 416 stainless steel. A thin sheet metal cover was attached to the top surface to protect instrumentation leads and to streamline the flow in the sting region. The cover may be seen in the Schlieren photograph presented in Figure 4. The model dimensions corresponding to the instrumentation locations are tabulated in Table I. The SADSAC NO. tabulated in Table I corresponds to the gage location on magnetic tape.

2.3 Instrumentation.

Model heat transfer rates were measured with slug calorimeters and coaxial surface thermocouples. The slug calorimeters have a thin-film platinum resistance thermometer to sense the temperature of an aluminum disk which is exposed to the heat flux to be measured. The calorimeters are optimized to measure a given range of heat transfer by appropriate selection of the aluminum disk thickness. The coaxial surface thermocouple is comprised of an electrically insulated chromel wire enclosed in a constantan cylindrical jacket. A thin film junction is made between the chromel and constantan at the surface. In practical measurement applications, the surface thermocouple behaves as a homogeneous, one-dimensional, semi-infinite solid. The instrument provides an electromotive force (E.M.F.) directly proportional to surface temperature which may be related by theory to the incident heat flux. All heat-transfer gages were bench calibrated prior to their installation into the model. The precision of these calibrations is estimated to be ±3 percent. Post test calibrations were made for the majority of gages with calibration repeatability being within ±3 percent.

To monitor the tunnel conditions, two 1.0-inch diameter hemisphere cylinders instrumented with slug calorimeters were installed in the test section at an appropriate distance from the model to eliminate shock interference. A pitot probe was located near each hemisphere cylinder to measure the normal shock stagnation pressure. The reservoir pressure and pitot pressures were measured with strain-gage type transducers developed at the AEDC-VKF. Detailed information concerning the heat-transfer and pressure instrumentation can be found in Reference 1.

Model flow-field Schlieren photographs were obtained during the test. A typical photograph is shown in Figure 4 with the LRC-DB model at 40-degree angle of attack.

2.4 Phosphor Paint Requirements.

The following is a discussion of the equipment used to obtain the thermographic phosphor paint data. Although meaningful paint results could only be obtained on the lower surface, the complete paint coverage was set-up and requirements were initiated during the Langley model test. This was done to ensure proper functioning components during the McDonnell-Douglas orbiter paint tests which were to follow. Consequently, all descriptions relating to the phosphor paint coverage are based on full utilization of the viewing areas.

2.4.1 Ultraviolet Light Sources.

The ultraviolet light needed to excite the phosphorescence of the paint was generated by an Osram Xenon gas bulb XBO 1600w powered by an Ingersoll Product d.c. supply.

Three units were used for these tests. Each unit had a heat-absorbing glass and filter to eliminate all but the 3650 A (black light) wave length light.

2.4.2 Camera.

Four view-cameras with 4- x 5-inch Polaroid backs were used to record the pictures: two with 145mm lens were located on the side of the tunnel and two with 163mm lens were on the bottom. Each camera had a set of filters to pass only the 5000 to 6000 A light emitted by the paint. Type 57 Polaroid (ASA 3000) film was used to record the image.

2.4.3 Microdensitometer.

The optical density distributions of the pictures were read and recorded on a magnetic tape by a P-1000 Photoscan^{R} manufactured by Optronics International. The Photoscan is owned by the Biology Division of Oak Ridge National Laboratory.

The data on the magnetic tapes were input to the VKF CDC 1604B computer which was used to create contour mappings of heat-transfer rate.

III. PROCEDURES

3.1 Test Techniques.

3.1.1 Model Installation.

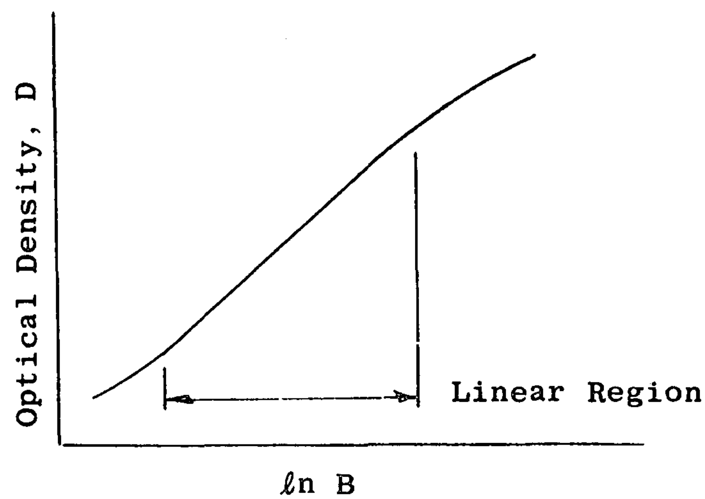
The Langley models were tested at angles of attack of 20, 40, and 60 degrees. Two tunnel runs were required to provide a continuous Reynolds number variation from 23 x 10^6 to 5 x 10^6, based on model length at a fixed angle of attack. The painted surface areas are summarized in Table II.

The sector angle range at the 54-inch diameter test section is ±20 degrees. Consequently, a prebend was required for the high angles of attack. In addition, the model sting had an effective 20-degree insert angle. The two sting arrangements used for these tests are illustrated in Figures 5 and 6. For angles of attack up to and including 40 degrees, the sting arrangement illustrated in Figure 5 was used. For angles of attack equal to and greater than 40 degrees, the installation shown in Figure 6 was used. Both sting installations were used at 40-degree angle of attack.

3.1.2 Testing with Phosphor Paint.

The test section set-up is shown in Figure 9. The locations of the Osram u-v light sources and still cameras are depicted. It was necessary to locate the two side cameras at the downstream end of the Schlieren windows to allow Schlieren optical coverage. The Osram light on the top of the tunnel had to be reflected onto the model because of the limited space between the tunnel and an overhead I-beam support for the Schlieren system.

The phosphorescent paint technique consists of photographing the painted model surface and measuring the optical density of the recorded image. The optical density of a photographic image is a function of the logarithm of the intensity of the exposure, for a given exposure time (Ref. 2), as illustrated by the figure below.



Thus, if the exposure from the phosphorescent paint falls within the linear region (i.e., logarithmically linear region), the optical density (D) is given by

$$D = A \ell n B + C$$

From the paint characteristics

$$\ell n B = \ell n\ f_1(I) + f_2(I,\ T_w);$$

therefore,

$$D = A \ell n\ f_1(I) + Af_2(I,\ T_w) + C$$

where I is the u-v light intensity, B is the emitted light intensity (brightness) of the paint, and A and C are constants. For small changes in intensity (I), the functional relation f_2 is given by

$$f_2(I,\ T_w) \propto T_w$$

When using the phosphorescent technique in the wind tunnel, the procedure is to take a photograph of the model before the tunnel run (i.e., a tare) and then to take another picture during the run. It is necessary that both pictures be taken in the "linear" region of the optical density curve. When the optical density of the tare photograph is subtracted from the optical density of the run photograph,

$$D - D_i \propto (T_w - T_{wi})$$

where the subscript i indicates the initial conditions, i.e., the tare photograph taken before the run.

It can be shown that the quantity $(T_w - T_{wi})$ is proportional to the heat-transfer rate to the model surface, for $T_w \ll T_{aw}$, and relatively short heating times ($\lesssim$ 1 sec.), regardless of whether the "heat-transfer model" assumed for the technique is a semi-infinite slab (either a relatively thick layer of paint, or a thin layer of paint mounted on a thick layer of material) or an infinite plate. This, of course, means that the optical density difference, $D - D_i$, is then proportional to the model heat-transfer rate.

$$D - D_i = \Delta D \propto \dot{q}$$

The best way of evaluating the constant of proportionality is to measure a few heat-transfer rates with standard heat-transfer instrumentation at the same time the paint data are taken. Heat-transfer rate as determined from gages gives a calibration for the paint, so the paint data yield the detailed heat-transfer rate distribution over the model.

3.1.2.1 Wall Material

The phosphor paint is applied as a thin coating to the model; therefore, the model wall material must be selected to give an observable temperature rise for the expected heat-transfer rate. The wall material selection, many times, is based on other things such as strength; hence, when the model material is not suitable to the paint technique, coatings are applied to produce the proper surface properties.

3.1.2.2 Phosphor Application.

The phosphor paint is a mixture of the phosphor material and a binder. The phosphor material is a fine grain powder ($\sim$ 10μ average size) of ZCdS (zinc-cadium-sulfate) with silver and nickel additives whose concentration control the temperature range of the phosphorescence. The binder can be any transparent or translucent liquid which can be sprayed. Normally, clear dope or epoxy is used.

3.2 Test Conditions.

A summary of the test conditions is given in Table II. A complete tabulation of all pertinent tunnel conditions is given in the Appendixes. In summary, the tests were conducted at an approximate Mach number of 10.5 over a Reynolds number range from 5×10^6 to 23×10^6 based on model length.

3.3 Data Reduction.

3.3.1 Model Instrumentation and Tunnel Conditions.

A complete description of the data reduction equations for the heat-transfer and pressure transducers is given in Reference 1. The method of determining flow conditions is briefly summarized as follows: instantaneous values of PO and POP are measured and an instantaneous value of $\dot{Q}O$ is inferred from a direct measurement of a shoulder heat rate on a 1.0-inch diameter hemisphere cylinder heat probe. Velocity, hence enthalpy (HO), is calculated from measured values of POP, $\dot{Q}O$, and the heat probe radius, using Fay-Riddell theory, Reference 3. With values of PO, POP, and HO known, the remaining flow conditions (M_∞, Re_∞/ft., etc.) are calculated as described in References 4 and 5. The HREF (heat transfer coefficient) value reported herein is based on the inferred $\dot{Q}O$ value as described above. Since the Fay-Riddell equation is used to calculate HO with a known value of $\dot{Q}O$, the value of HREF tabulated herein is consistent with a Fay-Riddell value for the given test conditions. For the short run times experienced in a hotshot tunnel, the model wall temperature ratio (T_W/TO) varied between 0.15 and 0.30, which approximates the condition of practical interest of reentry vehicles.

3.3.2 Thermographic Phosphor Paint.

The optical density distributions on the tare and run pictures are read and recorded by the scanning microdensitometer. The tare density is subtracted from the run density on the VKF-CDC 1604B digital computer, and the density differences are plotted on a CRT plotter, one density difference per plot. Each plot (i.e., density difference) is assigned a color and copied by hand in that color so that a color composite of all the plots is made. The boundaries of the colors are retraced, and the reference heat gages and model outline are located on this tracing.

The heat gage measurements and the optical density differences are plotted to obtain a relationship between the two. The relationship gives the heat-transfer values corresponding to the color regions. These values are noted on the color tracing, thereby resulting in a contour mapping of the heat-transfer rates on the model.

The model image is distorted by the viewing angle of the camera. This distorted view is reflected in the final contour mapping presented in Appendix III. However, all plots from the paint results are in a true normal projection, since the heat transfer gage locations were used to scale the centerline and span results that are plotted herein.

IV. DATA PRESENTATION

The following data presentation is presented in the Appendixes:

I. Tabulation of Gage Measurements and Tunnel Conditions

II. Selected Windward Surface Centerline Plots of Gage Measurement Results

III. Selected Plots of Heat-Transfer Results Using the Phosphor Paint Technique

Table III, Page 21-A, is a summary of the plotted data presented in this document.

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1. Ledford, R. L., Smotherman, W. E., and Kidd, C. T., "Recent Developments in Heat-Transfer Rate, Pressure, and Force Measurements for Hotshop Tunnels," AEDC-TR-66-228 (AD645764), January 1967.

2. Todd, H. N. and Zakier, R. D., Sensitometry, Rochester, Institute of Technology, 1962.

3. Fay, J. A. and Riddell, F. R., "Theory of Stagnation Point Heat Transfer in Dissociated Air," Journal of Aerospace Sciences, Vol. 25, No. 2, February 1958, pp. 73-85, 121.

4. Grabau, Martin, Smithson, H. K., Jr., and Little, Wanda J., "A Data Reduction Program for Hotshot Tunnels Based on the Fay-Riddell Heat-Transfer-Rate Using Nitrogen at Stagnation Temperatures from 1500 to 5000°K," AEDC-TR-64-50 (AD601070), June 1964.

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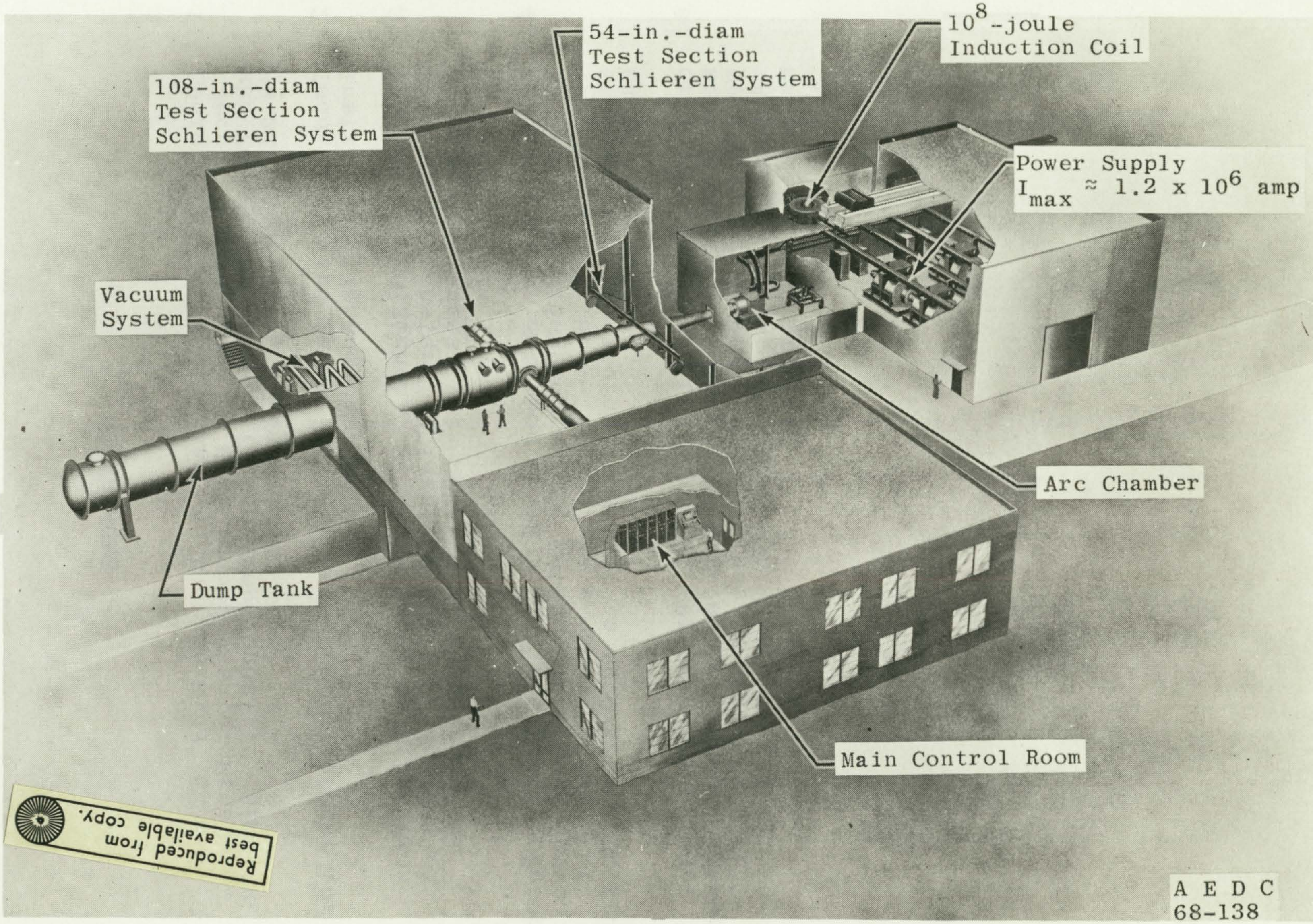


Fig. 1 AEDC-VKF Tunnel F Plant

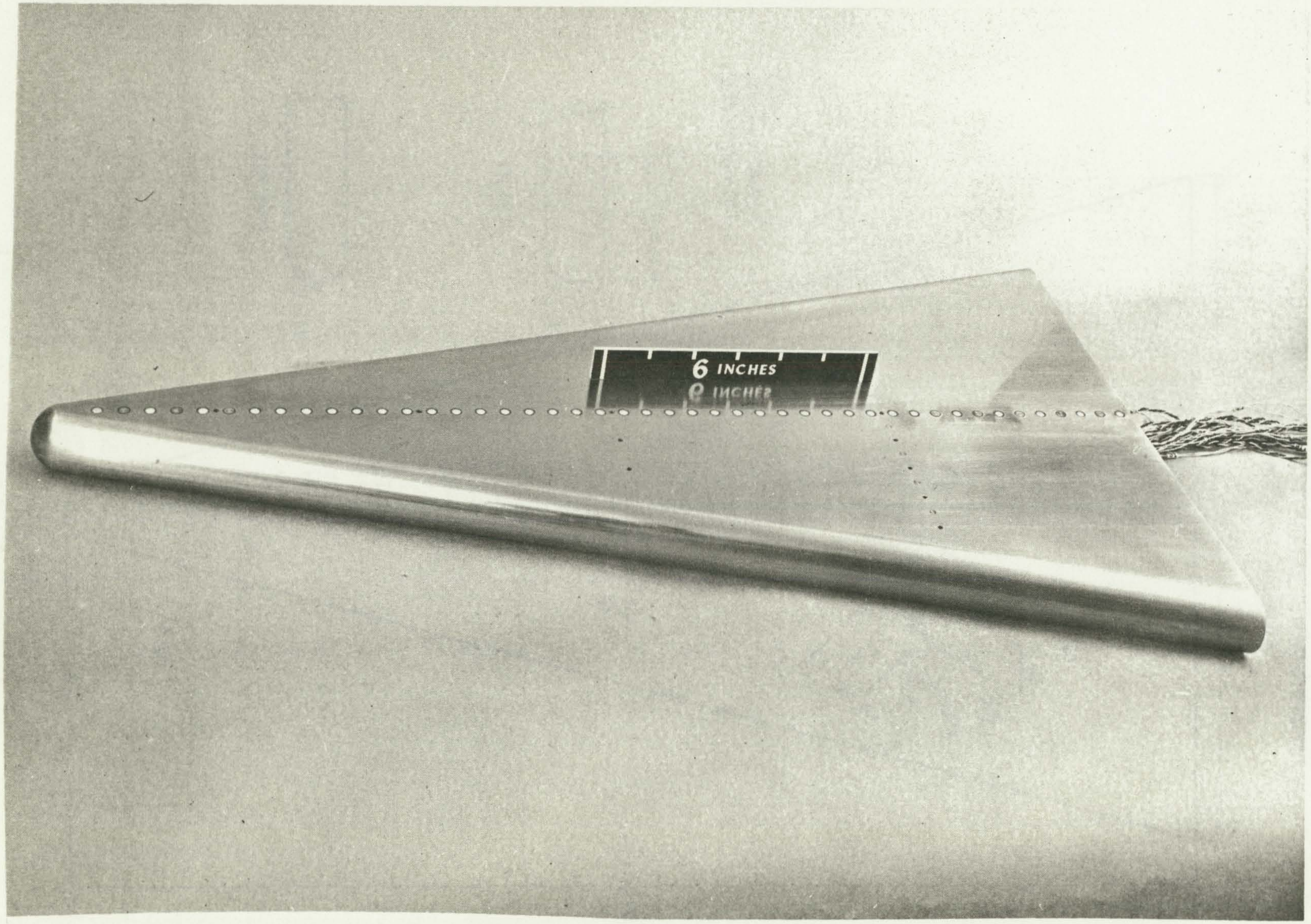
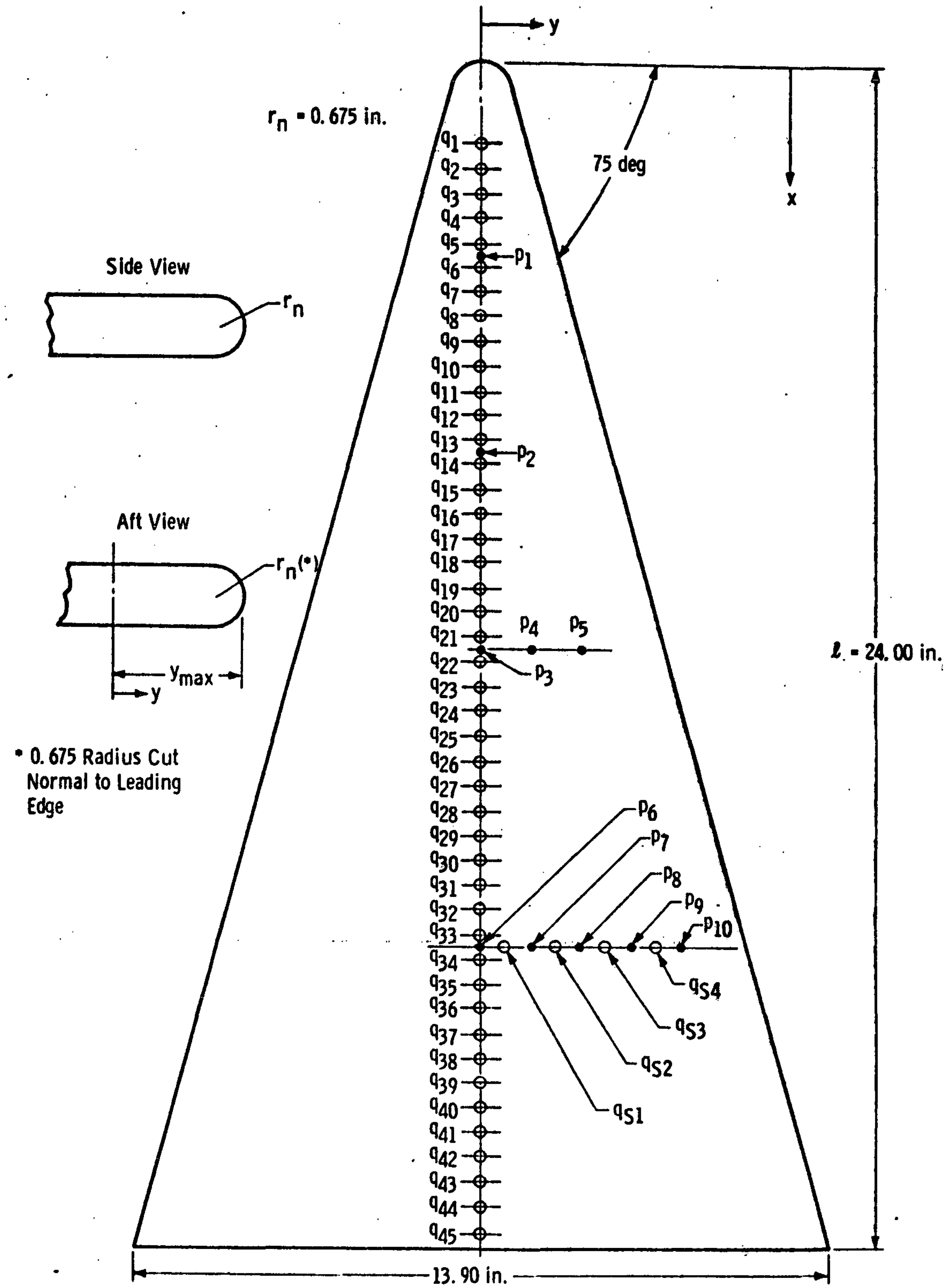
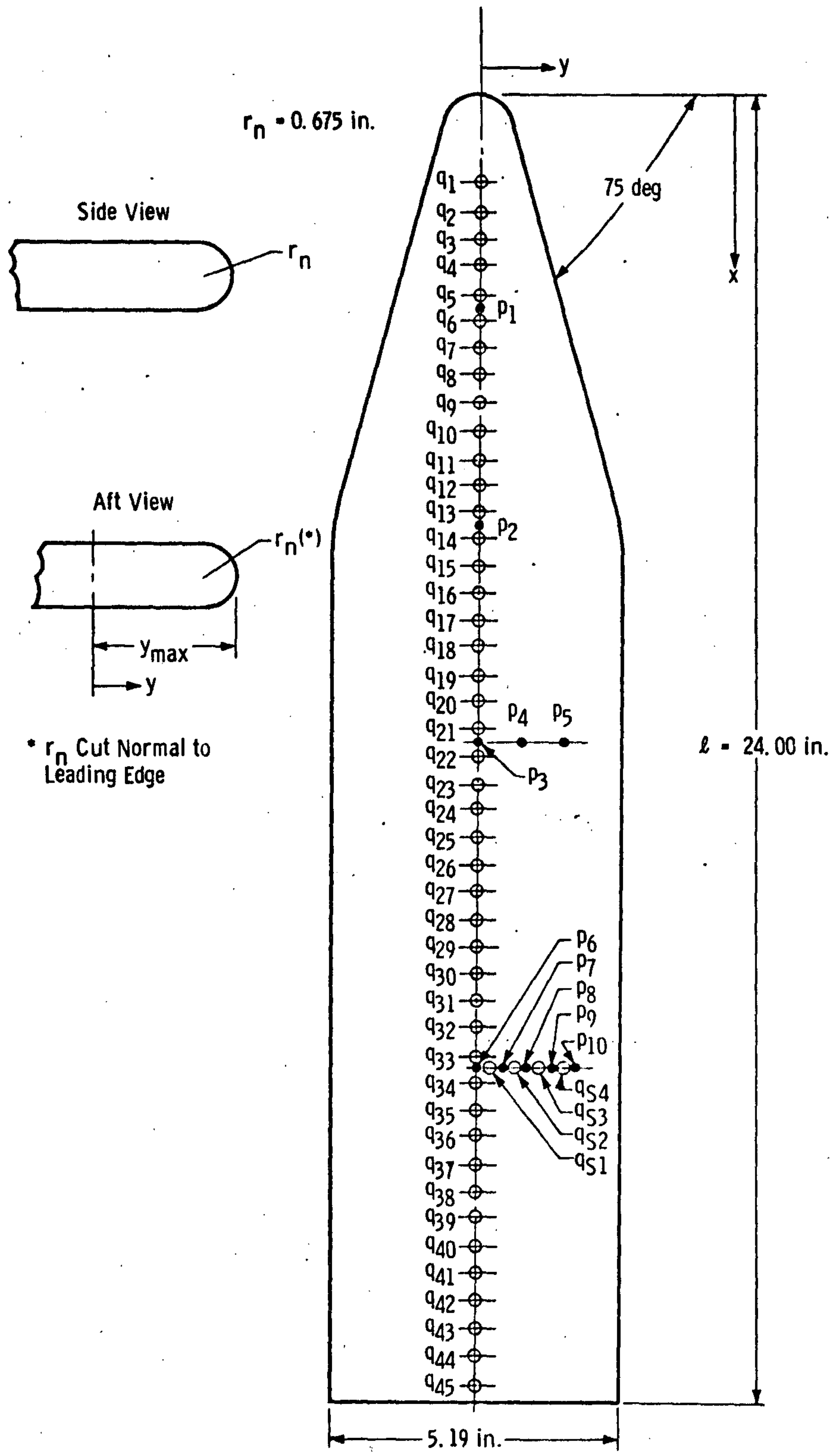


Fig. 2 Photograph of the Langley Delta Wing Model (LRC-DB) Windward Surface.



a. LRC-DB Model, Configuration 9

Fig. 3 Instrumentation Layout for the Tunnel F Langley Models



b. LRC-SB Model, Configuration 10
Fig. 3 Concluded

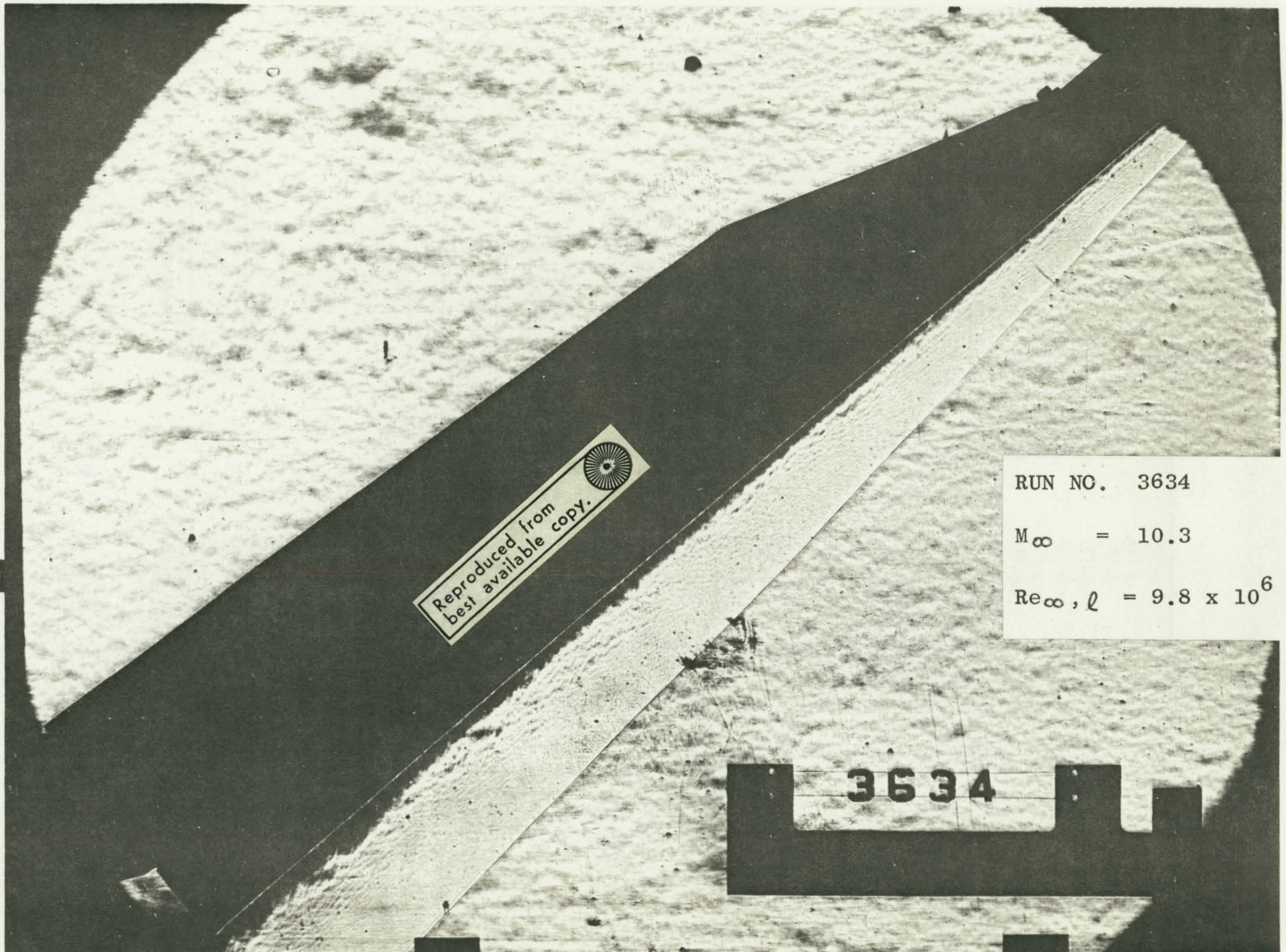


Fig. 4 Schlieren Photograph of the Langley Model (LRC-DB) in Tunnel F at 40 deg Angle of Attack.

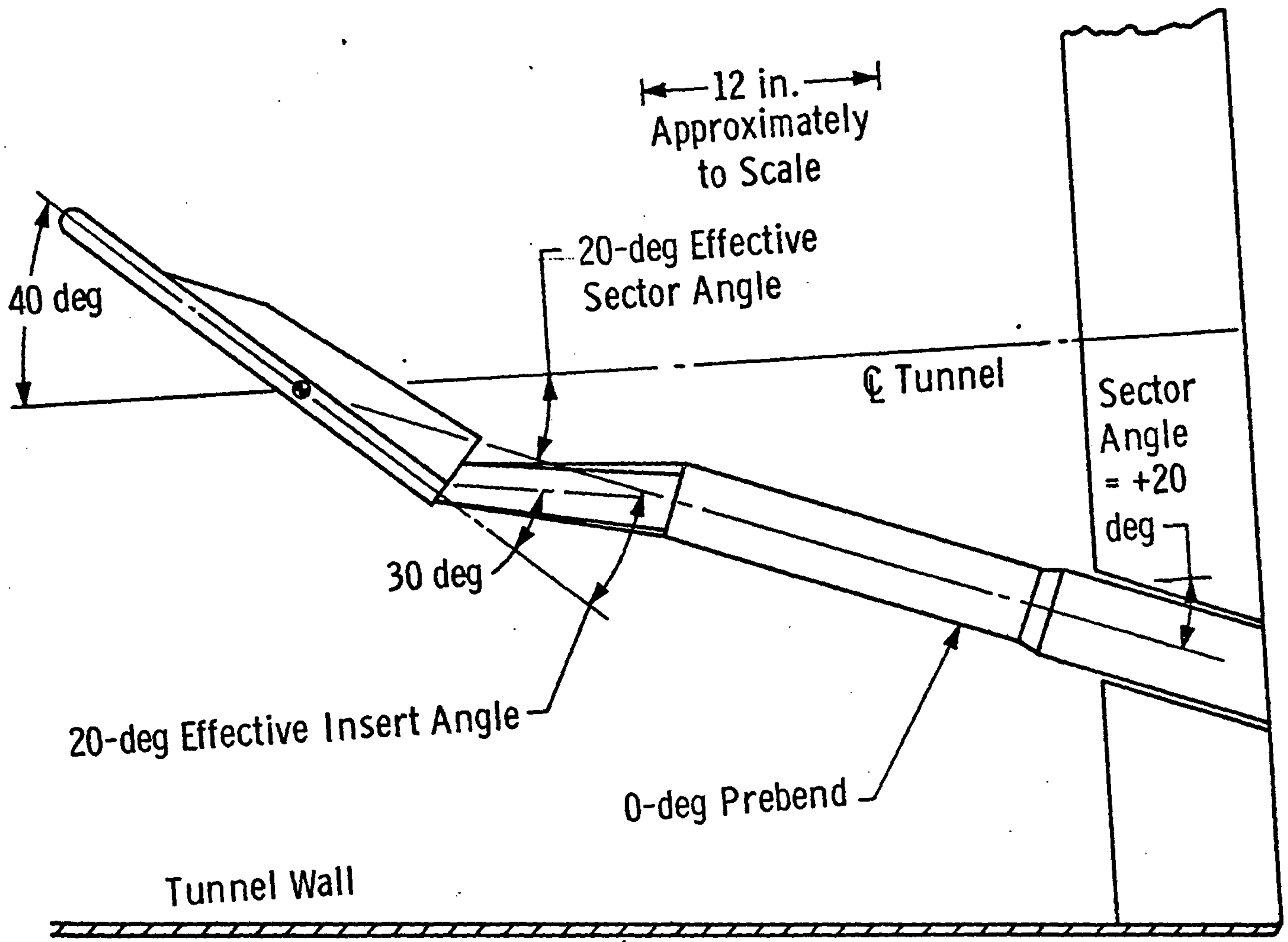


Fig. 5 Installation of the Langley Model in Tunnel F at 40 deg Angle of Attack

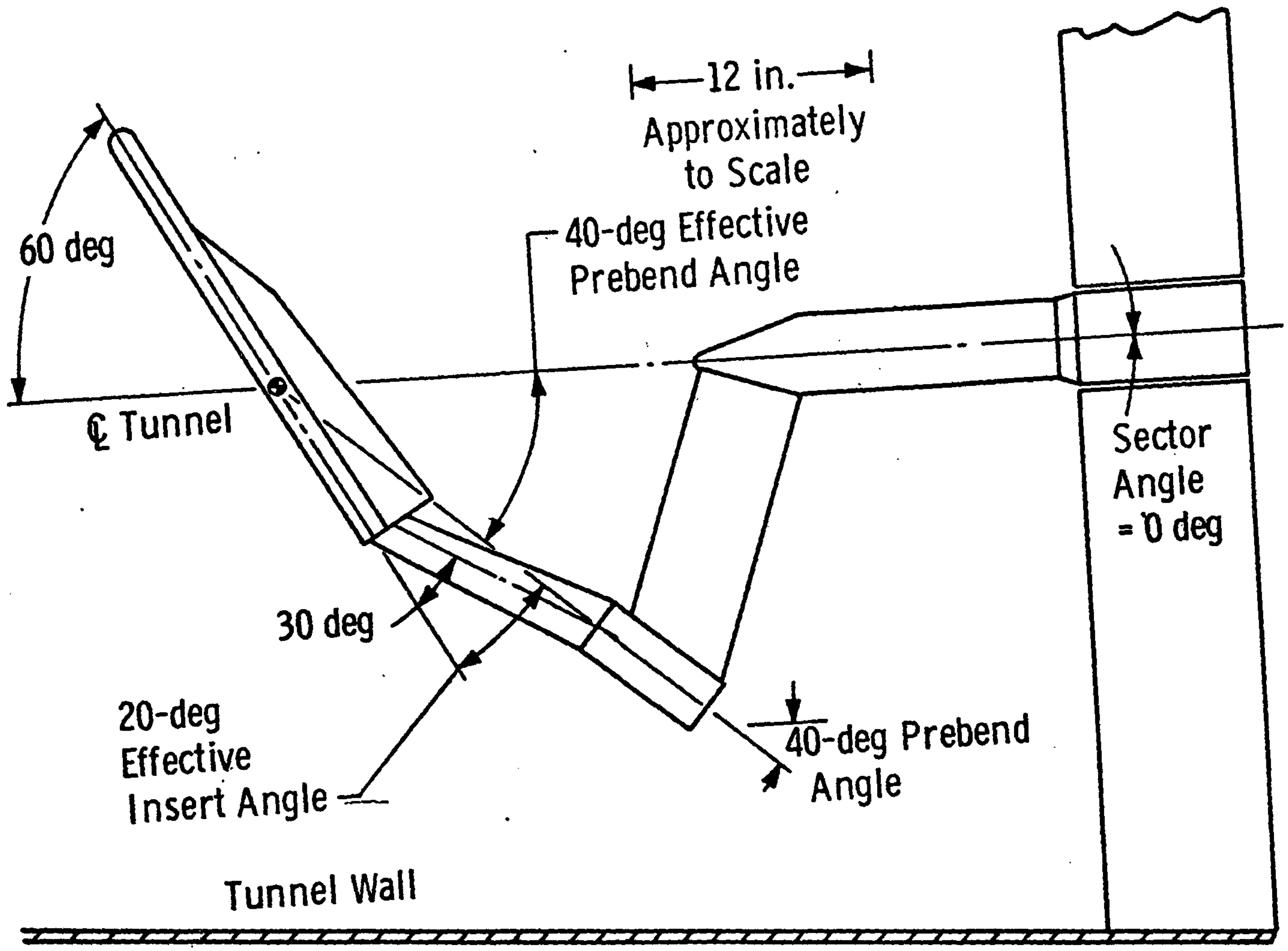


Fig. 6 Installation of the Langley Model in Tunnel F at 60 deg Angle of Attack

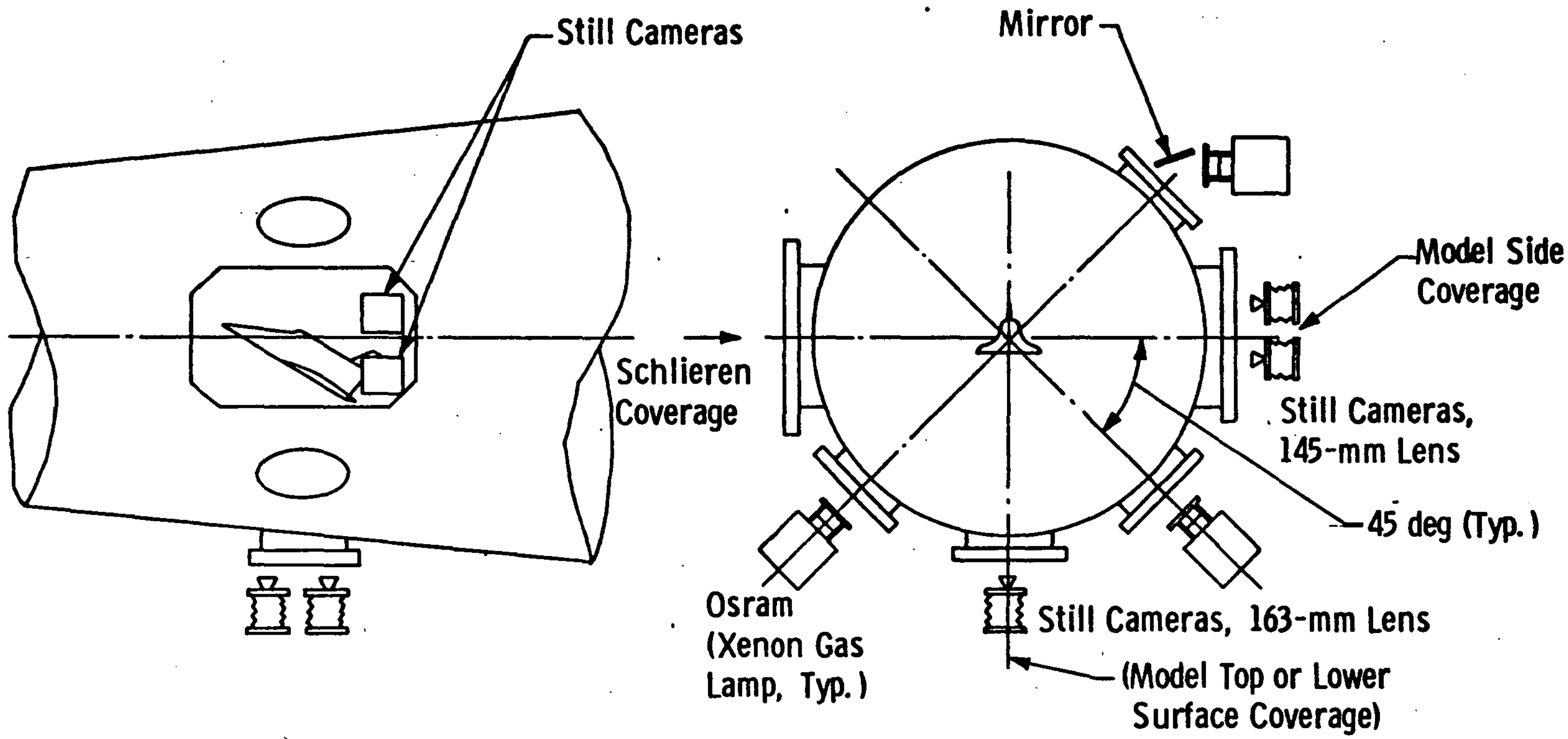


Fig. 7 Equipment Set-Up for the Phosphor Paint Technique

TABLE I

INSTRUMENTATION LOCATIONS FOR THE TUNNEL F LANGLEY MODELS

Total instrumentation of each model includes 49 heat-transfer-rate gages and 10 pressure sensors.

Config. No.: 9, Model: LRC-DB, ℓ, in.: 24
Config. No.: 10, Model: LRC-SB, ℓ, in.: 24

Pressure Sensors

Sadsac No.	Sensor	x/ℓ	Config. 9 y, in.	Config. 10 y, in.
1	p_1	0.1481	0	0
2	p_2	0.3181	0	0
3	p_3	0.4881	0	0
4	p_4	↓	1.00	0.75
5	p_5	↓	2.00	1.50
6	p_6	0.7431	0	0
7	p_7	↓	1.00	0.45
8	p_8	↓	2.00	0.90
9	p_9	↓	3.00	1.35
10	p_{10}	↓	4.00	1.80

x/ℓ	Config. 9 y_{max}, in.	Config. 10 y_{max}, in.
0.1481	1.471	1.471
0.3181	2.595	2.595
0.4881	3.674	↓
0.7431	5.298	↓

Centerline Heat-Transfer Sensors, Both Models, y = 0

Sadsac No.	Sensor	x/ℓ	Sadsac No.	Sensor	x/ℓ
1	$\dot{q}_1$	0.0525	24	$\dot{q}_{24}$	0.5413
2	$\dot{q}_2$	0.0738	25	$\dot{q}_{25}$	0.5625
3	$\dot{q}_3$	0.0950	26	$\dot{q}_{26}$	0.5838
4	$\dot{q}_4$	0.1163	27	$\dot{q}_{27}$	0.6050
5	$\dot{q}_5$	0.1375	28	$\dot{q}_{28}$	0.6263
6	$\dot{q}_6$	0.1588	29	$\dot{q}_{29}$	0.6475
7	$\dot{q}_7$	0.1800	30	$\dot{q}_{30}$	0.6688
8	$\dot{q}_8$	0.2013	31	$\dot{q}_{31}$	0.6900
9	$\dot{q}_9$	0.2225	32	$\dot{q}_{32}$	0.7113
10	$\dot{q}_{10}$	0.2438	33	$\dot{q}_{33}$	0.7325
11	$\dot{q}_{11}$	0.2650	34	$\dot{q}_{34}$	0.7538
12	$\dot{q}_{12}$	0.2863	35	$\dot{q}_{35}$	0.7750
13	$\dot{q}_{13}$	0.3075	36	$\dot{q}_{36}$	0.7963
14	$\dot{q}_{14}$	0.3288	37	$\dot{q}_{37}$	0.8175
15	$\dot{q}_{15}$	0.3500	38	$\dot{q}_{38}$	0.8388
16	$\dot{q}_{16}$	0.3713	39	$\dot{q}_{39}$	0.8600
17	$\dot{q}_{17}$	0.3925	40	$\dot{q}_{40}$	0.8813
18	$\dot{q}_{18}$	0.4138	41	$\dot{q}_{41}$	0.9025
19	$\dot{q}_{19}$	0.4350	42	$\dot{q}_{42}$	0.9238
20	$\dot{q}_{20}$	0.4563	43	$\dot{q}_{43}$	0.9450
21	$\dot{q}_{21}$	0.4775	44	$\dot{q}_{44}$	0.9663
22	$\dot{q}_{22}$	0.4988	45	$\dot{q}_{45}$	0.9875
23	$\dot{q}_{23}$	0.5200			

Span Heat-Transfer Sensors, x/ℓ = 0.7431

Sadsac No.	Sensor	Config. 9 y, in.	Config. 10 y, in.
46	$\dot{q}_{S1}$	0.50	0.225
47	$\dot{q}_{S2}$	1.50	0.675
48	$\dot{q}_{S3}$	2.50	1.125
49	$\dot{q}_{S4}$	3.50	1.575

TABLE II

TEST SUMMARY FOR THE TUNNEL F LANGLEY MODELS

Model	α, Deg.	Run	$\sim M_\infty$	$\sim Re_{\infty,\ell}$	Phosphor Paint Area	Final Paint Picture
LRC-DB	20.0	3631	10.4	$7\text{-}13 \times 10^6$	2	Yes
	20.0	3632	10.5	$7\text{-}21 \times 10^6$	1	No
	20.0	3633	10.4	$7\text{-}15 \times 10^6$	3	
	40.2	3634	10.4	$6\text{-}14 \times 10^6$	2	
	40.5	3635	10.4	$5\text{-}22 \times 10^6$	1	
	61.0	3636	10.8	$9\text{-}22 \times 10^6$	1	
	60.2	3637	10.4	$5\text{-}9 \times 10^6$	1	
	61.0	3638	10.6	9×10^6	3	
	60.5	3639	10.6	$10\text{-}20 \times 10^6$	2	
LRC-SB	20.2	3646	10.6	$10\text{-}18 \times 10^6$	2	No
	20.2	3647	10.3	$6\text{-}18 \times 10^6$		Yes
	40.2	3641	10.7	$7\text{-}16 \times 10^6$		Yes
	40.2	3645	10.6	$11\text{-}23 \times 10^6$		Yes
	60.2	3642	10.6	$5\text{-}10 \times 10^6$		No
	60.2	3648	10.6	$10\text{-}20 \times 10^6$		Yes
	60.5	3649	10.5	$6\text{-}17 \times 10^6$		No

Phosphor Paint Legend:

1 - Aft patches off centerline

2 - Entire lower surface

3 - Non-instrumented half

TABLE III
SUMMARY DATA PLOT INDEX

MODEL CONFIGURATION	PLOTTED DATA	REYNOLDS NUMBER, RE/L X 10^{6}																ANGLE OF ATTACK		
		PAGE	5	6	7	9	10	11	13	14	15	16	17	18	20	21	22	23	20	40	60
LRC-DB(H.T.)	A	41			X				X												
		42			X							X				X			X		
		43	X	X						X							X			X	
		44	X			X											X				X
LRC-DB(H.T.)		45			X	X	X								X						X
LRC-SB(H.T.)		46			X							X								X	
		47	X				X	X										X		X	X
		48		X			X							X					X		
LRC-SB(H.T.)	A	49			X		X						X		X						X
LRC-DB(PRESS.)	B	50			X				X										X		
		51			X							X				X			X		
		52	X	X						X							X			X	
		53	X			X											X				X
LRC-DB(PRESS.)		54			X	X	X								X						X
LRC-SB(PRESS.)		55			X							X								X	
		56	X				X	X										X		X	X
		57		X			X							X					X		
LRC-SB(PRESS.)	B	58			X		X						X		X						X
LRC-DB(PHOS.)	C	60					X												X		
LRC-SB(PHOS.)	C	61										X								X	
LRC-SB(PHOS.)	D	62										X								X	
LRC-SB(PHOS.)	C	63							X											X	
LRC-SB(PHOS.)	D	64							X											X	
LRC-SB(PHOS.)	C	65			X														X		
LRC-SB(PHOS.)	D	66			X														X		
LRC-SB(PHOS.)	C	67						X													X
LRC-SB(PHOS.)	D	68						X													X

A: GAGE
B: PRESSURE
C: PAINT
D: PAINT-GAGE

APPENDIX I

TABULATION

OF GAGE MEASUREMENTS AND TUNNEL CONDITIONS

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389
VON KARMAN GAS DYNAMICS FACILITY
HYPERSONIC HOTSHOT TUNNEL F

RUN 3631 NASA-SIS TEST
.RC-OR

TEST CONDITIONS   TEST GAS NITROGEN   Q-0, ST-0, AND HREF BASED ON .675 INCH RADIUS
ANGLE OF ATTACK 20.000 DEG.   ANGLE OF YAW 0 DEG.   ANGLE OF ROLL 0 DEG.   MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	HREF BTU/ SQFT SEC R	POP PSIA
71	.130048	.003335	101.8	5230	10.40	9.837	6.6721	13.3443	.00265	6377	2102	5.713E 02	77.5	.01016	.04963	18.132
77	.117564	.002841	108.1	5405	10.43	8.949	5.5347	11.0695	.00292	6060	2251	6.099E 02	80.5	.01101	.04705	16.505
83	.108505	.002611	108.5	5433	10.46	8.310	5.0915	10.1830	.00305	5766	2277	6.160E 02	78.8	.01151	.04535	15.328
89	.101472	.002487	106.5	5396	10.49	7.808	4.9071	9.8141	.00312	5490	2249	6.075E 02	74.7	.01175	.04374	14.402
95	.097556	.002379	107.1	5396	10.46	7.471	4.6713	9.3427	.00319	5229	2253	6.078E 02	73.2	.01202	.04271	13.780
101	.093249	.002266	107.5	5402	10.45	7.132	4.4382	8.8763	.00327	5007	2261	6.092E 02	71.7	.01232	.04168	13.154
104	.089858	.002199	106.7	5392	10.47	6.894	4.3281	8.6563	.00332	4885	2254	6.069E 02	70.1	.01250	.04091	12.715
110	.084302	.002076	106.1	5383	10.48	6.485	4.1031	8.2063	.00341	4647	2248	6.047E 02	67.6	.01285	.03958	11.960
116	.082084	.001992	107.0	5398	10.44	6.201	3.8939	7.7879	.00349	4432	2265	6.084E 02	67.1	.01314	.03889	11.547
125	.077725	.001902	106.7	5364	10.42	5.903	3.7259	7.4517	.00356	4153	2240	6.009E 02	63.9	.01340	.03758	10.886

PRESSURE DATA (PRESSURE / POP)

TIME	P2	P3	P4	P5	P6	P7	P8	P9	P10
71	.16228	.17115	.16669	.15794	.16047	.16460	.16589	.18440	.17215
77	.16137	.17033	.16603	.15857	.15849	.16310	.16183	.18075	.16960
83	.16070	.16872	.16497	.15772	.15641	.15990	.16028	.17994	.16864
89	.15894	.17033	.16491	.15898	.15754	.16040	.16171	.16069	.16985
95	.15557	.17824	.16553	.15851	.15525	.15960	.16147	.18150	.16966
101	.15803	.17564	.16316	.15749	.15256	.15820	.15625	.18044	.16883
104	.15837	.17162	.16191	.15785	.15218	.15760	.15099	.18061	.16976
110	.16071	.17710	.16317	.15693	.153 5	.15800	.15924	.18428	.17276
116	.15811	.17810	.16380	.15769	.15283	.15730	.15742	.18158	.17015
125	.15370	.16597	.15416	.15243	.14560	.15090	.14876	.17295	.16343

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21
71	.26433	.26473	.30314	.31777	.30061	.29603	.32429	.28890	.31510	.29881	.25095	.25009	.23402	.26973	.26478	.22803	.23735
77	.19633	.23140	.27260	.31361	.29829	.28945	.32395	.28072	.31624	.30315	.24981	.25001	.23110	.26456	.26441	.23388	.23948
83	.16897	.24051	.22471	.28604	.27413	.27522	.30762	.26947	.31489	.30742	.25009	.25056	.23489	.26862	.26930	.23828	.24233
89	.14376	.16576	.17563	.24042	.23058	.24485	.27304	.24674	.29682	.30455	.24417	.24713	.23609	.26030	.27050	.23917	.23967
95	.12061	.12673	.12576	.18979	.17745	.19868	.22058	.21214	.25587	.28088	.22679	.23873	.22689	.26455	.26250	.23545	.23237
101	.11317	.09765	.08732	.14925	.13684	.15619	.17494	.17453	.21671	.24147	.20590	.22251	.21115	.25254	.25033	.23216	.22419
104	.11621	.09851	.08257	.13867	.12449	.14296	.16218	.15739	.19975	.22594	.19485	.20969	.20729	.24691	.24760	.23124	.22441
110	.11237	.09532	.08564	.11864	.10649	.12192	.13459	.13008	.16283	.19439	.17002	.18237	.18966	.22932	.23135	.22201	.21918
116	.11560	.09959	.08752	.10071	.08669	.09938	.11114	.10917	.13170	.15960	.14543	.15354	.16606	.20338	.21074	.20691	.21096
125	.11413	.09820	.08698	.08410	.06719	.08125	.08504	.08399	.10309	.12398	.11456	.12882	.14302	.17799	.19421	.18826	.19529

TIME	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q37	Q39	Q40
71	.26348	.25748	.27559	.25276	.29356	.30852	.29793	.29586	.25817	.30333	.31300	.27961	.30012	.32634	.31703	.29188	.28558
77	.26910	.25991	.27685	.25532	.29321	.30092	.29670	.28870	.25542	.29461	.31562	.27388	.30035	.31587	.30810	.29162	.28164
83	.26326	.26238	.27488	.25743	.29152	.29338	.29857	.28624	.25745	.29178	.31252	.27293	.30373	.30566	.30577	.29657	.29460
89	.26958	.26107	.27078	.25741	.28961	.28598	.29906	.28464	.25812	.29358	.30711	.26944	.30191	.29648	.30230	.30083	.28906
95	.26681	.25415	.26536	.24968	.27977	.27555	.29188	.27279	.25319	.26287	.29689	.25776	.29212	.28373	.29183	.29503	.27603
101	.25918	.25122	.26271	.24415	.27714	.26653	.29006	.26250	.25203	.27296	.29558	.25099	.28675	.27542	.28272	.28251	.28148
104	.26233	.25128	.26603	.24621	.28415	.26926	.29602	.26525	.25597	.27542	.28648	.25340	.28868	.27519	.28300	.28017	.26534
110	.25011	.24691	.26516	.24872	.28565	.27192	.29832	.26270	.25316	.27014	.29218	.24708	.28766	.27302	.27871	.27659	.27617
116	.24761	.24051	.25543	.24291	.27522	.26109	.26622	.25528	.25235	.26318	.28225	.24308	.28332	.26507	.27669	.27023	.27373
125	.23259	.22959	.23495	.23451	.25629	.25232	.27649	.25334	.25462	.26278	.27862	.24652	.28346	.26355	.27271	.27011	.26345

TIME	Q41	Q42	Q43	Q44	Q45	Q51	Q52	Q53	Q54
71	.30751	.29973	.29940	.28098	.29722	.28905	.33870	.39209	.32616
77	.30265	.30195	.28814	.27641	.28526	.30424	.33179	.38885	.32182
83	.29335	.31671	.26582	.28485	.28073	.30976	.32866	.39992	.32943
89	.27861	.30976	.28142	.27960	.27800	.30252	.33875	.38761	.32889
95	.27646	.30391	.27317	.26695	.27260	.28844	.32556	.36756	.31076
101	.26715	.30125	.26680	.26329	.26439	.29115	.32105	.38830	.32033
104	.26826	.26390	.26859	.23673	.26203	.28019	.30473	.34704	.29058
110	.25894	.27308	.27130	.25813	.25884	.28736	.29246	.33114	.30102
116	.25107	.26334	.26464	.24030	.25619	.28091	.29945	.31215	.29176
125	.24893	.26941	.26423	.25003	.25349	.29384	.29212	.28828	.28125

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389
VON KARMAN GAS DYNAMICS FACILITY
HYPERSONIC HOTSHOT TUNNEL F

RUN 3632 NASA-SIS TEST
LRC-OH 11 SMOOTHING POINTS

TEST CONDITIONS TEST GAS NITROGEN Q-O, ST-O, AND HREF BASED ON .675 INCH RADIUS
ANGLE OF ATTACK 20.000 DEG. ANGLE OF YAW 0 DEG. ANGLE OF ROLL 0 DEG. MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	HREF BTU/ SQFT SEC R	POP PSIA
72	.166724	.004728	92.1	5189	10.85	13.727	10.3781	20.7562	.00222	10063	2015	5.603E 02	89.0	.00851	.06035	25.307
76	.162762	.004076	104.3	5477	10.76	13.187	8.3407	16.6813	.00246	9729	2260	6.247E 02	101.4	.00925	.05893	24.334
80	.165269	.003843	112.3	5620	10.64	13.087	7.4904	14.9807	.00256	9385	2384	6.583E 02	110.5	.00976	.05992	24.159
84	.166082	.003508	121.6	5786	10.53	12.879	6.6159	13.2317	.00270	9051	2528	6.983E 02	118.8	.01020	.05976	23.787
92	.159105	.003245	128.1	5892	10.44	12.148	5.8172	11.6344	.00289	8443	2626	7.247E 02	121.3	.01074	.05816	22.444
100	.149035	.002800	139.0	6100	10.38	11.234	4.7869	9.5738	.00313	7878	2810	7.771E 02	126.5	.01151	.05573	20.766
108	.137081	.002441	146.7	6245	10.34	10.267	4.0499	8.0999	.00339	7313	2943	8.148E 02	129.1	.01244	.05374	18.985
112	.130478	.002298	148.3	6281	10.35	9.778	3.7935	7.5871	.00350	7044	2978	8.242E 02	128.0	.01284	.05252	18.083
120	.119636	.002103	148.6	6293	10.36	8.980	3.4700	6.9399	.00366	6564	2994	8.273E 02	123.3	.01343	.05025	16.609
128	.112679	.002065	142.5	6164	10.36	8.461	3.4808	6.9617	.00366	6131	2887	7.936E 02	113.1	.01346	.04817	15.643

PRESSURE DATA (PRESSURE / POP)

TIME	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
72	.14930	.15510	.16395	.14810	.15210	.15020	.14810	.14980	.17040	.17200
76	.15110	.15250	.16047	.14750	.15100	.14770	.14680	.14690	.16850	.17030
80	.15030	.15040	.15294	.14720	.15020	.14420	.14290	.14410	.16600	.16850
84	.14890	.14788	.14902	.14630	.14990	.14200	.14200	.14380	.16540	.16610
92	.14670	.14416	.14269	.14401	.14834	.13326	.13852	.14136	.16255	.16159
100	.14710	.14349	.14431	.14401	.14821	.13378	.13996	.14308	.16571	.16490
108	.14900	.14446	.14696	.14627	.14971	.13399	.14147	.14354	.16669	.16356
112	.14650	.14291	.14590	.14431	.14715	.13167	.13991	.14117	.16415	.16096
120	.14410	.13952	.14369	.14149	.14704	.13020	.13734	.13969	.16322	.16011
128	.14460	.13887	.14463	.14135	.14595	.13000	.13533	.13659	.15909	.15440

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21
72	.17229	.22988	.32548	.30957	.27775	.28991	.28699	.29165	.29323	.26562	.24617	.24908	.21151	.21952	.23371	.22478	.27652
76	.12152	.16454	.30674	.30562	.27354	.28350	.28054	.27844	.28926	.26754	.23924	.24139	.21257	.22224	.23452	.22075	.26770
80	.11906	.11294	.27084	.30197	.27302	.27724	.27722	.26730	.28214	.27002	.23167	.23737	.20998	.22678	.23357	.21462	.25865
84	.10919	.10445	.23700	.28704	.26367	.26474	.26829	.25253	.26852	.26076	.21709	.22596	.20185	.22200	.22379	.20571	.24259
92	.11589	.10407	.17477	.27257	.26622	.25952	.26583	.24232	.26471	.26612	.21510	.22620	.19697	.22744	.22064	.20877	.23887
100	.11236	.07674	.12434	.23009	.24429	.24397	.25367	.23361	.26075	.26206	.20913	.22555	.19459	.22854	.21542	.21069	.23152
108	.11368	.06994	.08030	.16889	.19014	.19755	.21831	.20405	.23726	.24571	.19407	.21167	.18446	.21939	.20621	.20534	.21951
112	.11741	.07380	.07833	.14195	.15757	.17021	.19416	.18812	.22574	.24029	.19061	.20676	.18414	.21987	.20667	.20542	.21848
120	.11718	.07105	.07765	.10627	.10408	.11882	.13706	.13218	.16690	.20628	.16053	.17669	.16680	.20482	.19457	.19093	.20294
128	.11728	.06920	.05696	.08880	.07210	.07803	.09191	.08402	.11430	.15447	.12262	.13685	.14416	.17981	.17160	.16995	.18207

TIME	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q37	Q39	Q40
72	.26917	.25260	.27210	.24161	.26390	.29175	.26278	.28069	.25669	.26160	.28464	.26991	.27130	.26552	.27301	.26943	.28928
76	.27012	.24788	.26579	.23857	.26384	.29342	.26696	.28220	.25973	.26852	.28219	.26250	.26673	.26585	.27161	.27005	.29136
80	.26751	.24295	.25604	.23479	.26210	.29810	.26879	.27942	.25331	.27473	.28353	.27286	.27290	.25926	.27493	.26562	.29451
84	.25667	.23187	.24478	.22365	.25366	.28373	.26292	.27030	.24787	.26505	.28078	.26644	.27085	.24611	.26463	.25432	.29342
92	.24716	.23027	.24618	.22856	.25329	.27874	.27055	.27104	.23970	.26077	.27382	.26026	.27845	.24646	.25887	.23834	.27807
100	.23308	.22450	.24409	.22332	.25155	.26818	.26041	.25911	.23262	.25270	.26320	.25239	.27042	.23310	.24784	.23028	.26433
108	.22955	.22577	.23939	.22553	.25226	.26694	.26942	.25612	.23486	.24372	.25179	.23801	.26584	.23374	.23945	.21974	.26192
112	.21876	.22412	.23674	.22446	.24711	.25930	.26469	.25329	.22843	.24141	.24935	.23838	.26522	.23076	.23948	.22106	.25495
120	.24755	.21539	.22068	.21304	.23448	.24386	.25245	.23791	.21944	.22766	.24293	.22288	.25305	.21753	.22656	.21497	.24821
128	.22840	.21471	.21293	.21350	.23311	.24474	.25872	.24557	.22686	.23426	.23737	.22781	.25657	.22332	.22797	.21960	.24920

TIME	Q42	Q43	Q44	Q45	QS1	QS2	QS3	QS4
72	.27779	.29279	.30412	.26929	.33159	.31158	.41207	.36398
76	.28451	.29306	.28322	.26923	.32484	.31112	.40992	.34631
80	.26898	.29566	.28817	.27020	.31810	.30842	.40456	.33178
84	.26745	.26521	.27328	.25947	.31171	.30818	.39031	.32370
92	.27035	.27922	.28588	.25581	.31103	.31364	.37899	.32438
100	.26077	.26309	.24163	.24345	.29736	.30871	.36944	.31315
108	.26204	.26071	.23943	.23189	.28046	.28149	.35388	.27601
112	.26347	.25352	.24625	.23324	.27367	.27757	.34258	.25045
120	.26132	.24298	.23281	.22103	.26402	.26920	.32670	.22532
128	.25010	.24713	.21628	.22336	.25772	.26098	.28477	.17177

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389
VON KARMAN GAS DYNAMICS FACILITY
HYPERSONIC HOTSHOT TUNNEL F

RUN 3633 NASA-STS TEST
LRC-08

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0, AND HREF BASED ON .675 INCH RADIUS
ANGLE OF ATTACK 20.000 DEG. ANGLE OF YAW 0 DEG. ANGLE OF ROLL 0 DEG. MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	HREF BTU/ SQFT SEC R	POP PSIA
96	.108822	.003468	82.0	4705	10.43	8.279	7.7560	15.5120	.00247	5263	1662	4.623E 02	50.0	.00932	.04454	15.229
100	.104712	.003226	84.8	4787	10.43	7.973	7.0981	14.1962	.00258	5139	1737	4.785E 02	51.9	.00974	.04334	14.670
104	.101747	.003015	88.1	4874	10.41	7.722	6.4940	12.9880	.00269	5006	1815	4.960E 02	55.1	.01036	.04324	14.214
108	.101911	.002832	94.0	4998	10.34	7.630	5.8694	11.7388	.00281	4876	1925	5.220E 02	58.5	.01064	.04225	14.052
112	.099690	.002612	99.7	5132	10.31	7.416	5.2370	10.4740	.00297	4755	2040	5.503E 02	63.7	.01141	.04246	13.663
116	.093099	.002243	106.5	5314	10.33	6.952	4.4381	8.8761	.00323	4613	2194	5.901E 02	67.4	.01217	.04073	12.817
120	.088888	.002094	110.9	5425	10.34	6.645	3.9910	7.9820	.00341	4495	2288	6.150E 02	70.2	.01285	.04018	12.256
124	.085292	.001972	113.0	5476	10.34	6.376	3.7247	7.4495	.00353	4356	2331	6.265E 02	70.8	.01330	.03949	11.762
128	.083636	.001914	114.1	5493	10.31	6.228	3.5898	7.1776	.00359	4238	2348	6.306E 02	70.6	.01352	.03906	11.488

PRESSURE DATA (PRESSURE / POP)

TIME	P1	P2	P3	P4	P5	P6	P8	P9	P10
96	.14050	.15831	.15775	.15684	.15714	.15451	.15250	.17870	.17129
100	.14480	.15592	.15814	.15790	.16005	.15659	.15601	.18004	.17047
104	.14920	.15618	.16198	.15928	.16070	.15723	.15423	.17876	.16978
108	.14970	.15543	.16599	.15999	.15894	.15500	.15289	.17808	.16833
112	.14650	.15282	.16706	.15657	.15396	.15085	.15099	.17626	.16562
116	.14450	.15129	.16737	.15479	.15135	.14786	.14967	.17509	.16350
120	.14370	.15120	.16438	.15322	.14901	.14523	.14667	.17178	.16045
124	.14470	.15313	.16504	.15441	.14959	.14567	.14800	.17220	.16004
128	.14340	.15364	.16342	.15287	.14860	.14393	.14724	.17096	.15849

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q14	Q16	Q17	Q18	Q19	Q20	Q21	Q22
96	.12942	.10174	.15717	.15953	.18950	.21963	.25058	.24306	.27911	.30904	.27630	.26094	.28127	.26423	.25108	.25464	.30598
100	.12621	.08970	.12906	.15246	.18204	.22848	.25366	.24790	.27939	.30034	.27542	.25025	.27066	.25472	.24400	.25087	.30596
104	.12436	.08376	.11371	.15297	.18499	.21200	.24720	.24097	.27534	.28664	.26244	.24306	.25568	.24238	.23614	.24291	.29428
108	.12397	.08571	.10250	.13841	.16455	.17719	.21099	.21532	.24955	.26769	.25052	.22980	.24099	.23144	.22693	.23875	.28554
112	.12587	.08882	.09910	.11452	.13430	.13714	.17178	.16942	.20938	.23531	.21841	.21307	.22264	.21767	.21296	.22701	.27619
116	.12683	.08483	.08642	.09751	.11091	.10540	.13032	.12517	.16250	.19587	.18636	.17011	.20680	.19969	.19933	.21170	.26305
120	.12964	.08757	.08371	.08777	.09031	.08756	.10388	.09200	.12889	.16271	.15533	.14945	.18787	.18319	.17084	.19257	.24547
124	.13505	.08560	.08489	.07859	.07906	.07318	.09028	.07606	.10756	.13414	.13100	.13072	.16899	.16155	.16275	.16951	.22503
128	.13437	.08716	.08221	.07230	.06762	.06902	.08207	.07013	.09564	.11804	.12187	.11569	.15323	.14551	.14957	.15362	.20514

TIME	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q37	Q39	Q40	Q42
96	.26574	.25560	.25353	.28156	.29080	.29414	.29144	.27614	.28392	.29539	.29601	.30868	.29154	.29810	.29454	.33046	.32075
100	.26972	.26107	.25619	.28649	.29206	.29518	.29033	.27752	.28801	.28581	.29535	.30512	.29324	.29912	.28822	.31554	.32471
104	.25549	.25192	.25100	.27541	.28210	.28224	.27742	.26439	.27091	.28169	.27841	.29418	.28424	.28480	.27699	.29013	.31103
108	.25207	.24185	.24393	.26827	.27302	.27320	.27000	.25955	.26505	.27608	.27476	.28818	.27786	.27811	.26763	.29443	.30347
112	.24426	.23791	.23770	.26218	.26591	.26793	.26735	.25486	.26253	.26801	.26938	.27747	.27134	.27454	.25658	.29905	.31784
116	.23697	.22669	.23159	.25344	.25802	.26267	.26230	.25200	.25657	.25943	.26143	.27195	.26691	.26746	.25442	.28862	.31739
120	.22528	.21457	.22149	.24566	.24993	.25982	.25857	.24898	.25317	.25103	.25847	.26975	.26353	.26246	.25105	.28621	.30979
124	.21134	.20040	.21456	.23933	.24734	.26047	.25957	.25155	.25040	.24641	.25908	.27434	.26307	.26064	.25175	.28634	.31224
128	.19924	.18784	.20473	.23191	.23923	.25824	.25664	.24962	.25036	.24825	.26239	.27468	.26325	.26111	.25187	.27767	.30658

TIME	Q43	Q44	QS1	QS2	QS3	QS4
96	.32951	.29763	.35357	.41073	.52011	.39701
100	.31629	.29581	.35179	.39173	.50081	.36856
104	.30634	.28546	.34982	.37428	.46636	.34267
108	.29925	.28722	.34769	.36330	.40763	.33431
112	.28918	.29132	.34923	.34177	.35642	.28339
116	.28390	.28529	.35117	.32585	.30934	.21156
120	.27951	.27952	.33659	.29496	.27988	.17003
124	.27730	.27365	.34493	.30301	.25761	.16641
128	.27735	.27145	.32256	.27634	.22975	.14041

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389
VON KARMAN GAS DYNAMICS FACILITY
HYPERSONIC HOTSHOT TUNNEL F

UN 3634 NASA-SIS TEST
RC-08

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0, AND HREF BASED ON .675 INCH RADIUS
ANGLE OF ATTACK 40.200 DEG. ANGLE OF YAW 0 DEG. ANGLE OF ROLL 0 DEG. MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	HREF BTU/ SQFT SEC R	POP PSIA
71	.135818	.003456	102.6	5249	10.39	10.266	6.6842	13.7684	.00261	6624	2115	5.754E 02	80.0	.00999	.05083	18.925
76	.128846	.002922	115.2	5536	10.35	9.656	5.4698	10.9395	.00292	6364	2357	6.403E 02	90.0	.01098	.04951	17.816
81	.120903	.002537	124.5	5743	10.33	9.024	4.5614	9.1228	.00319	6095	2533	6.892E 02	97.7	.01207	.04902	16.662
86	.112575	.002230	131.6	5910	10.33	8.401	3.8956	7.7912	.00345	5832	2676	7.299E 02	101.9	.01296	.04768	15.520
91	.101711	.002018	131.6	5949	10.40	7.703	3.5538	7.1075	.00364	5592	2711	7.391E 02	99.2	.01365	.04570	14.231
111	.086711	.001915	118.2	5641	10.41	6.572	3.5599	7.1197	.00363	4690	2463	6.644E 02	79.3	.01383	.04122	12.130
121	.074806	.001715	115.4	5610	10.47	5.821	3.2476	6.4953	.00383	4310	2441	6.569E 02	73.5	.01459	.03864	10.743
131	.071394	.001664	112.0	5509	10.44	5.447	3.1881	6.3763	.00385	3962	2362	6.336E 02	66.5	.01451	.03651	10.049
136	.067255	.001614	110.0	5469	10.46	5.205	3.1264	6.2527	.00390	3819	2330	6.244E 02	63.6	.01469	.03553	9.602

PRESSURE DATA (PRESSURE / POP)

TIME	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
71	.51820	.50364	.47389	.48906	.45930	.48395	.49040	.49432	.52898	.46784
76	.52330	.51930	.46949	.49550	.45941	.48352	.49300	.48602	.52336	.47428
81	.52380	.52968	.49672	.48947	.45399	.47594	.48420	.47560	.51070	.47275
86	.53120	.53260	.50278	.49526	.45935	.47722	.48430	.47575	.50893	.47462
91	.53940	.53222	.51149	.50614	.46714	.49245	.49260	.48247	.51186	.47740
111	.53560	.53563	.50633	.49267	.45458	.47768	.48720	.47245	.50036	.48036
121	.55340	.54565	.52832	.50562	.46826	.49278	.50120	.46130	.50453	.48894
131	.54780	.53513	.52695	.50425	.46518	.48618	.49200	.47421	.49485	.48196
136	.55500	.53782	.52835	.50182	.46807	.48831	.49760	.47685	.49642	.48629

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21
71	.77967	.61441	.85490	.79894	.75350	.74625	.72662	.79426	.67920	.72834	.67450	.65210	.60414	.58226	.62198	.57949	.60770
76	.72943	.56693	.81075	.76621	.72160	.71217	.69639	.75164	.65529	.69966	.63777	.61743	.58109	.56889	.60023	.55498	.58573
81	.63871	.53595	.74040	.74795	.71062	.69543	.68341	.73113	.64928	.67944	.60836	.59363	.57504	.56048	.59238	.54124	.57383
86	.49118	.51137	.71218	.73642	.69861	.68668	.67132	.72485	.65346	.66448	.58772	.58226	.57293	.56546	.58748	.52865	.56761
91	.38173	.45910	.66269	.75340	.70939	.70449	.67724	.73540	.67924	.69036	.58977	.59322	.59564	.59402	.60643	.53570	.57590
111	.27359	.21975	.56127	.72256	.70878	.71676	.65377	.73453	.69953	.70070	.57568	.60433	.60547	.58769	.63348	.54640	.58055
121	.27442	.18322	.46641	.69372	.69062	.70005	.63317	.72384	.68221	.69060	.56525	.60070	.58763	.57133	.61366	.53284	.56377
131	.24129	.16765	.42773	.65948	.68572	.70403	.63055	.72330	.68884	.68289	.55788	.59769	.57114	.55212	.61443	.53664	.55395
136	.28592	.17230	.40872	.63982	.67347	.60559	.61740	.71268	.66683	.66414	.55592	.59036	.56090	.53078	.60801	.53307	.54574

TIME	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q31	Q32	Q33	Q34	Q35	Q37	Q40	Q41	Q42	Q43
71	.62066	.57307	.55934	.54059	.54053	.59095	.50314	.55117	.55465	.53225	.56392	.55300	.55396	.60338	.59403	.59235	.56727
76	.59591	.55190	.53812	.52657	.56528	.57063	.50239	.53917	.54796	.52393	.55147	.53509	.53223	.55430	.56406	.54161	.53069
81	.58020	.54518	.54136	.51570	.55513	.55542	.54547	.53145	.54670	.51695	.54400	.51841	.51981	.52588	.55509	.51590	.50774
86	.58213	.55299	.53522	.51548	.55247	.55274	.54734	.54141	.53884	.52405	.54584	.51427	.52047	.51431	.55159	.48790	.49108
91	.59950	.56708	.55293	.52346	.56514	.56240	.55079	.55450	.55969	.54072	.56125	.51699	.52972	.51077	.56716	.47643	.49847
111	.60055	.57667	.55449	.52017	.56730	.55308	.55583	.56063	.55739	.54434	.55870	.50081	.52277	.48032	.57447	.45734	.49666
121	.60431	.55146	.55065	.51459	.56060	.53792	.54507	.55641	.50490	.52100	.54057	.48592	.51278	.48211	.55395	.45717	.48506
131	.60985	.57007	.55508	.51190	.55429	.53365	.54904	.50071	.57125	.53141	.53609	.48840	.51438	.47781	.54203	.46700	.49577
136	.59996	.50961	.54066	.51134	.54529	.52275	.53455	.54431	.50663	.51862	.52812	.47947	.50513	.46948	.51947	.48847	.50520

TIME	Q44	Q45	Q51	Q52	Q53	Q54
71	.54403	.50099	.65402	.62747	.76376	.62021
76	.51384	.47195	.60543	.57141	.67942	.57457
81	.48193	.45539	.54467	.52621	.62879	.54490
86	.45680	.43957	.50914	.50082	.59047	.51984
91	.46505	.44674	.50934	.50168	.57515	.50446
111	.44063	.43823	.45632	.49970	.55526	.49258
121	.43169	.41556	.44302	.47640	.55101	.46707
131	.43033	.42456	.44556	.48382	.55235	.47243
136	.44955	.41807	.44945	.49156	.55546	.48508

RUN 3635 NASA-SIS TEST
RC-08

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0, AND HREF BASED ON .675 INCH RADIUS

ANGLE OF ATTACK 40.500 DEG. ANGLE OF YAW 0 DEG. ANGLE OF ROLL 0 DEG. MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	HREF BTU/ SQFT SEC R	POP PSIA
74	.182569	.005152	92.6	5085	10.60	14.365	11.0281	22.0562	.00210	9440	1939	5.391E 02	84.7	.00798	.06054	26.470
80	.176236	.004272	107.7	5428	10.49	13.574	8.3853	16.7705	.00239	8952	2234	6.149E 02	100.4	.00900	.05927	25.041
86	.169772	.003798	116.8	5609	10.41	12.865	7.1079	14.2157	.00257	8484	2391	6.570E 02	109.4	.00981	.05908	23.783
92	.160658	.003459	121.3	5700	10.38	12.119	6.3315	12.6630	.00272	8030	2473	6.787E 02	110.9	.01032	.05737	22.375
98	.153736	.003155	127.3	5809	10.33	11.480	5.6097	11.2195	.00287	7600	2570	7.051E 02	113.7	.01085	.05600	21.202
104	.144537	.002803	131.9	5901	10.31	10.752	4.5922	9.5844	.00304	7199	2652	7.278E 02	114.8	.01144	.05435	19.862
110	.136235	.002492	142.6	6112	10.26	10.038	4.1560	8.3120	.00332	6817	2836	7.810E 02	120.4	.01222	.05244	18.554
116	.127044	.002211	150.1	6257	10.24	9.331	3.5900	7.1801	.00356	6464	2966	8.185E 02	123.9	.01308	.05106	17.255
122	.117312	.002042	150.0	6272	10.27	8.665	3.3273	6.6546	.00371	6134	2983	8.225E 02	120.2	.01362	.04918	16.024
128	.111762	.001961	148.6	6236	10.26	8.222	3.2014	6.4027	.00378	5785	2956	8.131E 02	115.2	.01387	.04769	15.203
140	.098544	.001711	150.4	6275	10.26	7.266	2.7820	5.5640	.00406	5221	2997	8.231E 02	110.1	.01488	.04483	13.436
146	.091909	.001607	149.4	6264	10.28	6.800	2.6259	5.2518	.00418	4949	2990	8.202E 02	106.0	.01534	.04328	12.575

PRESSURE DATA (PRESSURE / POP)

TIME	P1	P2	P3	P4	P5	P6	P8	P9	P10
74	.55930	.51533	.52558	.50406	.48050	.49894	.49641	.55240	.52558
80	.54740	.51019	.50781	.49371	.47034	.49797	.50944	.55849	.51647
86	.53300	.50596	.48983	.48127	.45544	.48942	.50751	.54731	.49334
92	.52250	.50400	.48115	.47154	.44638	.42139	.49056	.52765	.47346
98	.52630	.51059	.48158	.46959	.44559	.47618	.48595	.51663	.46836
104	.53620	.51922	.46994	.47518	.44731	.47700	.48600	.51411	.47340
110	.54730	.53072	.50293	.48388	.45151	.48354	.48705	.51461	.48300
116	.55390	.53783	.50818	.48891	.45348	.49019	.48659	.51423	.48931
122	.55400	.53897	.50397	.49013	.45545	.49704	.49043	.51479	.49341
128	.54720	.53266	.50535	.48392	.45067	.49513	.48568	.51014	.49108
140	.54980	.53701	.51421	.48313	.44977	.49516	.48557	.50691	.49132
146	.55520	.53631	.51966	.48871	.45403	.49862	.48554	.50627	.49306

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21
74	1.1194	.88226	1.1070	1.0293	.88264	.81255	.79617	.84080	.74658	.76769	.72115	.66738	.65648	.66260	.71185	.65415	.72837
80	1.0225	.78564	.99562	.97443	.83803	.78423	.75150	.79382	.75919	.73695	.69366	.66101	.63544	.64654	.68702	.61471	.69521
86	.94941	.72341	.89006	.93450	.80319	.75973	.72360	.76097	.74406	.73125	.67020	.65034	.63221	.66077	.67255	.59573	.67401
92	.76977	.67350	.84548	.89710	.78641	.75647	.71108	.77770	.75158	.74509	.66401	.65495	.62914	.65033	.67943	.59073	.66065
98	.54649	.63428	.79432	.86102	.76725	.75521	.69102	.76911	.75344	.73865	.64484	.63129	.63076	.64726	.66877	.57927	.63412
104	.35649	.54732	.77506	.82140	.73354	.72606	.67075	.74424	.73908	.71869	.61324	.62030	.62533	.56522	.64768	.56627	.59417
110	.25871	.40220	.72288	.77161	.70561	.70207	.63143	.70428	.69725	.68456	.58496	.62064	.63655	.62022	.60739	.53708	.56566
116	.20321	.30773	.66123	.74987	.69165	.69374	.61026	.66132	.66531	.67600	.57423	.59686	.63075	.61098	.59877	.52599	.55613
122	.27561	.19435	.61494	.73462	.68978	.69364	.59849	.65321	.66815	.66001	.56318	.59344	.62176	.61047	.59228	.52401	.54311
128	.28429	.16375	.57275	.71368	.68654	.66288	.59392	.63072	.69623	.66124	.55376	.59675	.63014	.62204	.59578	.53009	.53627
140	.28709	.15492	.49429	.63054	.71429	.64927	.58259	.60815	.65019	.64448	.53974	.61156	.62930	.59311	.55173	.49109	.48641
146	.29106	.16503	.46316	.58543	.69307	.64203	.59913	.62107	.65204	.64057	.53716	.59713	.62855	.58692	.54214	.49051	.47787

TIME	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q31	Q32	Q33	Q34	Q35	Q37	Q39	Q40	Q42	Q43
74	.75032	.70102	.72297	.67391	.71764	.75164	.71210	.67583	.66967	.65508	.66808	.64025	.65451	.59906	.66490	.65849	.68293
80	.66072	.63390	.64387	.58941	.64437	.69141	.63671	.62547	.67528	.59845	.62326	.58143	.59136	.55985	.59973	.61752	.63764
86	.65198	.61126	.61509	.56882	.63351	.67415	.65190	.61144	.64617	.60003	.63328	.57035	.57791	.55082	.57234	.57225	.60107
92	.66023	.60362	.60279	.57264	.62516	.65649	.65221	.60241	.64008	.60621	.64833	.56320	.56649	.54061	.54724	.54780	.57952
98	.64179	.58407	.57655	.55360	.60613	.62405	.62601	.50517	.63390	.58665	.62607	.53704	.54300	.53553	.53102	.53539	.56365
104	.63656	.57362	.56128	.54253	.54253	.58333	.63712	.57380	.62784	.57658	.60371	.51792	.53499	.51745	.53037	.53711	.55193
110	.60995	.53408	.53866	.52280	.56070	.56055	.50491	.52923	.60665	.52726	.57385	.49118	.50291	.49710	.50938	.52581	.55043
116	.60444	.54223	.52793	.50655	.53843	.53954	.54702	.52150	.56764	.51453	.55086	.47087	.49055	.48304	.48311	.51824	.55484
122	.58766	.53882	.51525	.50514	.53748	.53144	.55519	.50973	.53465	.51449	.54934	.46739	.47855	.46724	.46458	.50584	.56443
128	.55394	.52608	.49545	.49804	.52919	.50504	.54496	.49130	.53539	.50360	.54646	.45670	.47181	.46800	.46313	.50682	.55630
140	.55844	.50015	.45723	.45751	.48729	.46294	.47265	.46233	.50571	.45872	.49841	.42298	.43786	.43719	.45231	.50088	.50299
146	.57119	.50104	.47526	.47180	.48345	.45938	.48569	.45020	.49565	.44712	.49867	.41748	.43341	.44057	.44875	.51285	.48722

TIME	Q44	Q51	Q52	Q53	Q54
74	.68422	.76121	.69951	.88177	.82350
80	.60253	.64542	.66650	.81324	.72948
86	.55010	.66847	.65939	.77149	.67374
92	.51760	.65033	.65644	.73217	.64478
98	.49615	.62707	.63835	.70141	.62011
104	.49206	.62485	.63292	.68994	.61337
110	.47943	.60378	.60840	.67169	.58808
116	.46589	.58209	.58441	.64719	.55632
122	.44473	.57015	.57457	.63579	.53814
128	.43541	.56097	.57216	.62339	.53056
140	.42184	.52460	.54649	.61718	.50879
146	.42303	.52475	.54655	.61418	.50139

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389
VON KARMAN GAS DYNAMICS FACILITY
HYPERSONIC HOTSHOT TUNNEL F

JN 3636 NASA-STS TEST
CRC-DH

TEST CONDITIONS   TEST GAS NITROGEN   Q-0, ST-0, AND HREF BASED ON .675 INCH RADIUS
ANGLE OF ATTACK 61.000 DEG.   ANGLE OF YAW 0 DEG.   ANGLE OF ROLL 0 DEG.   MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/SQFT-SEC	STO	HREF BTU/SQFT SEC R	POP PSIA
74	.144012	.004069	80.6	4898	10.95	12.077	11.0604	22.1208	.00217	9064	1778	4.988E 02	69.6	.00833	.05620	22.240
80	.138263	.004240	85.2	5010	10.89	11.477	9.7176	19.4352	.00230	8001	1881	5.223E 02	71.9	.00871	.05358	21.144
86	.130017	.003929	86.5	5048	10.89	10.792	8.9347	17.8694	.00240	8197	1918	5.301E 02	71.4	.00909	.05183	19.884
98	.121632	.003560	89.1	5083	10.80	9.937	7.9282	15.8564	.00253	7409	1959	5.379E 02	70.2	.00958	.04948	18.310
110	.104255	.003054	93.4	5192	10.78	8.674	6.6137	13.2274	.00276	6724	2059	5.613E 02	71.8	.01059	.04725	16.366
122	.096738	.002515	100.5	5372	10.75	7.824	5.2379	10.4757	.00310	6080	2217	6.009E 02	73.6	.01166	.04387	14.432
128	.091645	.002337	103.6	5447	10.73	7.381	4.7184	9.4368	.00325	5773	2284	6.180E 02	74.6	.01226	.04278	13.617
134	.088544	.002249	104.7	5457	10.70	7.095	4.4881	8.9761	.00333	5524	2296	6.204E 02	73.6	.01254	.04191	13.090

PRESSURE DATA (PRESSURE / POP)

TIME	P2	P3	P4	P5	P6	P8	P9	P10
74	.92487	.90510	.88047	.81874	.88629	.88162	.97080	.86302
80	.90698	.88331	.86728	.79699	.87550	.86701	.90328	.84908
86	.90330	.87735	.86077	.79106	.87946	.86930	.96667	.84753
98	.88935	.86049	.83964	.77817	.85300	.86022	.96528	.84072
110	.91693	.88909	.87472	.79892	.86872	.87227	.98454	.85475
122	.95825	.92750	.91320	.83209	.90456	.90194	.99635	.88872
128	.96167	.93720	.91571	.83921	.91523	.90804	.99245	.89457
134	.93969	.92292	.89741	.82679	.89699	.89297	.98763	.87679

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q9	Q10	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q23
74	.81149	.85915	.93815	.89345	.77945	.74620	.77005	.79699	.74205	.68278	.66660	.67634	.74317	.73824	.65494	.75030	.70498
80	.76636	.83207	.86825	.80113	.77972	.74706	.79273	.78235	.74522	.66556	.67426	.66952	.73401	.72597	.65147	.72386	.71582
86	.74527	.81650	.82120	.84999	.79046	.76263	.80060	.80000	.76303	.69542	.66641	.65871	.74476	.72971	.65478	.72222	.68012
98	.71806	.80367	.76106	.88457	.79216	.76249	.70985	.79785	.76734	.69043	.67524	.67105	.75107	.72953	.65990	.72516	.68359
110	.54515	.75309	.77550	.83153	.76210	.73563	.74904	.78148	.72257	.67430	.66938	.66234	.74604	.73104	.64953	.69470	.67996
122	.41205	.60809	.73441	.77193	.72550	.70774	.69494	.72987	.70175	.66108	.65770	.66103	.72606	.67058	.64526	.67514	.61647
128	.39744	.56630	.71136	.74562	.72912	.71579	.69134	.72743	.70599	.64957	.67495	.64871	.73055	.61789	.63950	.71261	.60984
134	.39973	.54050	.70975	.73498	.72239	.69773	.70487	.71917	.68282	.63835	.66313	.64900	.70765	.66271	.62044	.65258	.60521

TIME	Q24	Q25	Q26	Q27	Q28	Q29	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q39	Q40	Q41	Q44
74	.67217	.63021	.70947	.68123	.67312	.65793	.63241	.64756	.64836	.65768	.57337	.61497	.60632	.59979	.55429	.70387	.59884
80	.64744	.62251	.70503	.69545	.67117	.67317	.62745	.67230	.64984	.66694	.58827	.60500	.61265	.59540	.54936	.68486	.60661
86	.65475	.60234	.69441	.67094	.66681	.68733	.63497	.66624	.63389	.66047	.57971	.60377	.60822	.59153	.54772	.67434	.59036
98	.64425	.60726	.67540	.63380	.64149	.70376	.63512	.69645	.62593	.65773	.54992	.50578	.59452	.56471	.55274	.68529	.57031
110	.62107	.58750	.63744	.60734	.60328	.68242	.61659	.66392	.59968	.62935	.55541	.55472	.55715	.55596	.49051	.66894	.55506
122	.57478	.53371	.59939	.56463	.56274	.65694	.55043	.64208	.56294	.57221	.49817	.53930	.53395	.53497	.47417	.63724	.54505
128	.56825	.52233	.57841	.54317	.54376	.64214	.53528	.62064	.55771	.58462	.48872	.51163	.53456	.53320	.45734	.63161	.52035
134	.55756	.51039	.56931	.51478	.54130	.62526	.51918	.59820	.51603	.52763	.46005	.47942	.47422	.50078	.45161	.61342	.50591

TIME	Q45	Q51	Q52	Q53	Q54
74	.59630	.66045	.65496	.80650	.74060
80	.59406	.65409	.65539	.74921	.69337
86	.56599	.66069	.65630	.79462	.69318
98	.55536	.52135	.65298	.76547	.66340
110	.52787	.54674	.62855	.74191	.61378
122	.51246	.54405	.59720	.71245	.56230
128	.50599	.52382	.57271	.68489	.54453
134	.46989	.50070	.55663	.66343	.53372

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389
VON KARMAN GAS DYNAMICS FACILITY
HYPERSONIC HOTSHOT TUNNEL F

JN 3637 NASA-STS TEST
LRC-08

TEST CONDITIONS — TEST GAS NITROGEN — Q-0, ST-0, AND HREF BASED ON .675 INCH RADIUS

ANGLE OF ATTACK 60.200 DEG. — ANGLE OF YAW 0 DEG. — ANGLE OF ROLL 0 DEG. — MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	HREF BTU/ SQFT SEC R	POP PSIA
44	.077126	.002201	91.5	4899	10.27	5.695	4.5882	9.1764	.00316	3620	1855	5.017E 02	48.2	.01214	.03664	10.482
48	.071253	.001870	99.5	5148	10.35	5.343	3.7675	7.5351	.00351	3618	2066	5.537E 02	54.6	.01349	.03574	9.845
52	.069558	.001659	107.9	5329	10.29	5.082	3.1930	6.3859	.00380	3438	2221	5.936E 02	58.2	.01430	.03460	9.369
56	.063206	.001480	111.5	5427	10.31	4.700	2.8057	5.6114	.00406	3258	2304	6.155E 02	59.1	.01528	.03353	8.669
60	.058348	.001365	111.7	5461	10.37	4.389	2.6001	5.2001	.00424	3148	2332	6.230E 02	58.2	.01596	.03248	8.095
64	.056051	.001336	109.5	5422	10.39	4.237	2.5769	5.1539	.00427	3069	2300	6.141E 02	55.9	.01607	.03179	7.814
68	.055094	.001325	108.6	5392	10.38	4.155	2.5635	5.1269	.00427	2991	2276	6.074E 02	54.5	.01610	.03138	7.662
72	.054377	.001299	109.3	5393	10.35	4.076	2.4981	4.9962	.00432	2902	2278	6.077E 02	54.0	.01626	.03107	7.516

PRESSURE DATA (PRESSURE / POP)

TIME	P1	P3	P4	P5	P6	P7	P8	P9	P10
44	.95855	.88585	.85937	.84366	.86426	.08726	.84463	.92911	.84651
48	.97734	.91092	.88442	.86942	.88181	.08878	.86255	.95039	.87285
52	.97012	.91205	.88809	.85496	.88059	.08897	.85692	.93578	.85765
56	.97117	.90319	.88928	.86767	.86541	.08901	.86301	.96997	.92066
60	.98046	.89839	.88231	.88152	.84698	.08632	.85329	.99179	.83537
64	.98566	.91645	.89321	.87595	.86108	.08619	.85684	.96893	.83775
68	.97511	.93454	.90527	.85747	.89783	.08892	.86534	.90212	.83071
72	.96653	.93590	.90577	.86213	.89270	.08960	.86695	.92265	.83305

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q14	Q15	Q16	Q17	Q19	Q20	Q21	Q22
44	.65367	.65839	.85239	.81974	.66981	.75322	.72070	.72492	.68709	.73790	.68924	.59425	.58317	.61359	.53188	.64868	.62770
48	.50879	.51300	.78565	.81740	.66980	.73460	.71991	.69501	.68033	.72163	.66561	.59224	.57962	.60724	.52803	.65055	.62943
52	.43570	.42569	.75601	.80146	.66381	.71249	.71202	.66266	.66680	.70379	.63716	.58649	.57721	.59337	.52021	.63887	.62536
56	.41873	.40737	.68660	.78810	.65920	.69748	.70658	.64382	.66401	.68423	.62042	.58724	.57639	.60857	.51946	.62782	.61070
60	.40937	.38295	.62058	.77462	.65401	.67954	.69307	.62622	.66583	*****	.61205	.59589	.56250	.62425	.52634	.62408	.60089
64	.40076	.36704	.62212	.76002	.64900	.66382	*****	.60934	.66455	*****	.60581	.58735	.55738	.61030	.53427	.62116	.60005
68	.40724	.34118	.61819	.73573	*****	.64431	*****	.58592	*****	*****	.59424	.57920	.55269	.60254	.53253	.60613	*****
72	.41482	.34948	.62123	.71436	*****	.63315	*****	.56583	*****	*****	.52289	.57883	.55471	.58924	*****	.58084	*****

TIME	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q31	Q32	Q33	Q35	Q36	Q37	Q40	Q42	Q43	Q44
44	.55237	.58934	.51167	.60316	.63833	.53422	.52322	.51603	.55163	.54179	.53976	.59631	.51876	.51693	.57069	.48077	.57119
48	.56015	.58551	.50898	.59648	.61695	.54225	.53353	.52836	.55905	.53659	.50973	.55730	.50212	.48866	.54301	.48546	.53606
52	.56050	.57182	.50067	.58151	.59043	.54061	.53060	.52736	.54876	.54535	.49061	.48871	.49249	.42820	.45329	.47762	.45541
56	.55769	.55599	.45111	.56729	.56847	.53361	.52279	.51849	.53879	.54363	.47243	.47039	.47925	.43614	.44987	.46891	.45129
60	.55856	.54836	.48555	.56091	.55432	.53143	.51976	.51402	.53522	.54418	.46502	.46257	.47456	.42927	.44531	.46820	.44986
64	.55979	.54463	.48407	.55791	.54429	.53108	.51726	.51348	.53192	.54498	.46333	.45946	.47488	.41991	.44172	.47180	.44733
68	.55880	.53972	.48226	*****	.53443	.52847	.51046	.50929	.51378	.53736	.46097	.44897	.47253	.42653	.45068	.47004	.44275
72	.54918	.52765	.47307	*****	*****	*****	.49819	.49677	.49786	*****	.45208	.45086	.46093	.42806	.45126	.46320	.45684

TIME	Q45	Q51	Q52	Q53	Q54
44	.53106	.55240	.48563	.76449	.75560
48	.53842	.51517	.45578	.68617	.65593
52	.53244	.48352	.42390	.65733	.58933
56	.52764	.46726	.40835	.63514	.56293
60	.52379	.44061	.40078	.62112	.55576
64	.51202	.44371	.39261	.58957	.50140
68	.51823	.44046	.37562	.58564	.48359
72	.51076	.45053	.38417	.56366	.45461

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389
VON KARMAN GAS DYNAMICS FACILITY
HYPERSONIC HOTSHOT TUNNEL F

UN 3638 NASA-STS TEST
LRC-08

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0, AND HREF BASED ON .675 INCH RADIUS
ANGLE OF ATTACK 61.000 DEG. ANGLE OF YAW 0 DEG. ANGLE OF ROLL 0 DEG. MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	HREF BTU/ SQFT SEC R	POP PSIA
122	.064312	.001934	86.8	4988	10.74	5.190	4.3284	8.6569	.00340	4045	1919	5.182E 02	47.7	.01285	.03457	9.558
146	.054422	.001619	87.8	4995	10.69	4.356	3.5888	7.1775	.00372	3404	1933	5.198E 02	43.9	.01406	.03153	8.022

PRESSURE DATA (PRESSURE / POP)

TIME	P1	P3	P4	P5	P6	P8	P9	P10
122	.9976	.9022	.8771	.8667	.8794	.8596	.9512	.8576
146	1.0197	.8814	.8572	.8494	.8643	.8375	.9285	.8256

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21
122	.45727	.56248	.73849	.84951	.81364	.77378	.80531	.78389	.77765	.74769	.66901	.75780	.77032	.73278	.70986	.73074	.59987
146	.39230	.42466	.68694	.60804	.74369	.64536	.70664	.69278	.64859	.57035	.56096	.68173	.64718	.69871	.63696	.66507	.51564

TIME	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q39	Q40
122	.67939	.62015	.56018	.64731	.56115	.58979	.64859	.54771	.58179	.63795	.58184	.58075	.50098	.52318	.54264	.53261	.48151
146	.59995	.52143	.50816	.54695	.46622	.50865	.43923	.49056	.50612	.52746	.49193	.49571	.44324	.44619	.46823	.47984	.41708

TIME	Q41	Q43	Q44	Q51	Q52	Q53	Q54
122	.59760	.57922	.51524	.51236	.52307	.65760	.54111
146	.51878	.53681	.42063	.49784	.46262	.63249	.46271

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389
VON KARMAN GAS DYNAMICS FACILITY
HYPERSONIC HOTSHOT TUNNEL F

RUN 3639 NASA-SIS TEST
IC-08

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0, AND HREF BASED ON .675 INCH RADIUS
ANGLE OF ATTACK 60.500 DEG. ANGLE OF YAW 0 DEG. ANGLE OF ROLL 0 DEG. MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/SQFT-SEC	STO	HREF BTU/SQFT SEC R	POP PSIA
50	.215106	.005111	109.9	5578	10.87	17.150	10.1042	20.2085	.00221	11952	2320	6.485E 02	122.2	.00833	.06867	31.658
56	.202723	.004496	117.8	5744	10.82	15.994	8.5443	17.0886	.00239	11248	2406	6.877E 02	129.7	.00907	.06736	29.540
62	.194410	.003957	128.3	5945	10.53	15.079	7.1408	14.2817	.00260	10589	2643	7.373E 02	138.4	.00975	.06578	27.664
68	.178152	.003335	139.5	6184	10.50	13.756	5.7610	11.5219	.00288	9988	2855	7.980E 02	145.3	.01060	.06278	25.438
74	.163725	.003000	142.5	6254	10.51	12.650	5.1271	10.2542	.00306	9378	2922	8.160E 02	143.7	.01122	.06032	23.397
98	.123936	.002701	119.8	5804	10.63	9.809	5.0953	10.1907	.00310	7455	2561	7.021E 02	104.5	.01173	.05169	18.119

PRESSURE DATA (PRESSURE / POP)

TIME	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
50	.83404	.82945	.81494	.78661	.77472	.81412	.83540	.83693	.91165	.81675
56	.84497	.83396	.81396	.79317	.77939	.81264	.83430	.84010	.92009	.82401
62	.86547	.85395	.83187	.81354	.79552	.81736	.83340	.84375	.92562	.82650
68	.89233	.87762	.85245	.83621	.81323	.83497	.85560	.85959	.94569	.84007
74	.89454	.86070	.84881	.83420	.81120	.83063	.85790	.85647	.94630	.83740
98	.87985	.83235	.81474	.79419	.77704	.80318	.82860	.81788	.90735	.81198

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q8	Q9	Q10	Q12	Q13	Q14	Q15	Q16	Q19	Q20	Q21	Q22	Q23
50	.95896	.89636	.94806	.88777	.92122	.79647	.76390	.79798	.76095	.73988	.72047	.65956	.63245	.65550	.69931	.69357	.65995
56	.88765	.83491	.90037	.85759	.80613	.75399	.72967	.76063	.75682	.72538	.69528	.64149	.63283	.63518	.67405	.66731	.63418
62	.73335	.77285	.83838	.80225	.76610	.70577	.68454	.71614	.72277	.69913	.66009	.61897	.60883	.60407	.64089	.62847	.59980
68	.62209	.72159	.78532	.76652	.75025	.70344	.65930	.68451	.70336	.68151	.62837	.56080	.62376	.58957	.63342	.64183	.59672
74	.50570	.66873	.73463	.75487	.74563	.69520	.65708	.67767	.70985	.69541	.61775	.56534	.61477	.58942	.63230	*****	.58762
98	.43891	.60740	.70077	.71993	.74529	.70369	.67419	.67182	.72229	.72043	.60132	.56920	.61852	.60202	.64333	*****	.58744

TIME	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q40	Q41	Q42
50	.68782	.62803	.65921	.71363	.63445	.61038	.54220	.59150	.63700	.55704	.55975	.57328	.59882	.60655	.63340	.62226	.65976
56	.66215	.59496	.62853	.68939	.62553	.60781	.54342	.59556	.65208	.57118	.55935	.56957	.57911	.61015	.60309	.62346	.62926
62	.62972	.57071	.60544	.67954	.59274	.58083	.51568	.56615	.62257	.54702	.56343	.53090	.58074	.58045	.57938	.61186	.62067
68	.62264	.56507	.55744	.67132	.58649	.58905	.52597	.56245	.62470	.55648	.55925	.52164	.55403	.56564	.54646	.60302	.58398
74	.62831	.56150	.56707	.66193	.55723	.61582	.53231	.56865	.65435	.55787	.57752	.50631	.53503	.55038	.50236	.61067	.54503
98	.59330	.52526	.58432	.59857	.56798	*****	.56480	.54470	.64382	.53381	.54827	.48568	.52001	.53996	.47953	.58164	.53379

TIME	Q43	Q44	Q51	Q52	Q53	Q54
50	.63575	.64224	.67467	.60714	.69072	.67360
56	.62537	.60230	.63367	.59891	.68691	.66052
62	.60291	.56230	.61747	.59858	.69401	.63741
68	.60172	.54602	.56345	.57351	.68406	.61430
74	.59721	.51112	.56294	.56926	.67725	.59304
98	.60923	.49533	.52953	.54596	.65978	.58912

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AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389
VON KARMAN GAS DYNAMICS FACILITY
HYPERSONIC HOTSHOT TUNNEL F

RUN 3641 NASA-STS TEST
ARC-58 MODEL

TEST CONDITIONS — TEST GAS NITROGEN — Q-0, ST-0, AND HREF BASED ON .675 INCH RADIUS

ANGLE OF ATTACK 40.200 DEG. — ANGLE OF YAW 0 DEG. — ANGLE OF ROLL 0 DEG. — MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	HREF BTU/ SQFT SEC R	POP PSIA
80	.129277	.003759	89.8	5018	10.62	10.207	8.1829	16.3659	.00245	7026	1911	5.249E 02	68.3	.00926	.04984	18.802
86	.117007	.003296	92.7	5125	10.68	9.334	7.0965	14.1929	.00264	6715	2005	5.473E 02	70.9	.01015	.04841	17.201
92	.112247	.003085	95.0	5177	10.65	8.914	6.5469	13.0937	.00274	6427	2052	5.585E 02	71.4	.01052	.04722	16.430
98	.107155	.002880	97.2	5229	10.64	8.492	6.0381	12.0762	.00285	6167	2099	5.699E 02	71.8	.01093	.04604	15.654
110	.095502	.002407	103.6	5398	10.64	7.563	4.8854	9.7708	.00317	5666	2246	6.073E 02	73.5	.01195	.04310	13.951
122	.082551	.002016	106.9	5499	10.67	6.575	4.0400	8.0800	.00350	5122	2336	6.302E 02	72.5	.01317	.04037	12.132
134	.072141	.001750	107.7	5556	10.74	5.825	3.5186	7.0371	.00377	4761	2386	6.428E 02	70.3	.01420	.03809	10.750
146	.065004	.001605	105.8	5504	10.73	5.242	3.2526	6.5053	.00392	4297	2349	6.309E 02	64.8	.01477	.03586	9.672

PRESSURE DATA (PRESSURE / POP)

TIME	P1	P2	P3	P4	P6	P8	P9	P10
80	.46800	.46083	.42344	.44284	.42307	.41461	.40860	.36637
86	.47960	.47506	.43133	.45232	.42417	.40792	.40104	.35829
92	.47960	.47760	.43719	.45542	.41582	.39945	.39103	.34964
98	.47760	.48188	.43579	.45480	.41252	.39586	.38622	.34469
110	.48760	.49253	.44940	.45603	.41698	.39337	.38271	.34175
122	.49900	.49911	.45840	.45591	.41262	.39149	.38312	.34117
134	.49790	.51331	.45841	.45921	.41866	.39243	.38279	.34211
146	.49310	.51547	.45329	.45303	.41508	.38496	.37664	.33854

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q14	Q15	Q16	Q18	Q19	Q21	Q22	Q23
80	.81250	.81523	.72373	.88419	.80414	.84113	.80361	.81645	.78537	.81943	.76840	.74717	.68029	.73544	.61979	.64649	.66954
86	.75354	.75688	.68737	.87365	.79706	.83822	.79242	.79379	.77106	.81564	.76709	.74510	.69146	.74188	.61690	.64138	.67200
92	.71834	.72585	.67274	.86906	.78565	.84603	.78368	.80485	.78819	.81033	.74845	.72563	.68337	.73363	.61537	.63956	.66926
98	.66312	.70016	.65337	.85757	.77406	.85263	.81291	.80552	.76754	.80064	.71361	.71809	.68388	.70550	.60729	.60370	.65792
110	.57591	.65295	.62719	.83921	.75342	.86103	.80219	.77139	.75174	.75210	.67527	.69441	.63706	.67873	.58567	.60573	.63151
122	.42249	.59747	.61999	.81467	.73878	.85528	.71636	.76050	.71464	.70499	.65321	.68059	.58614	.66563	.56944	.60571	.63454
134	.26242	.37691	.52643	.73673	.69755	.80924	.69431	.73129	.63998	.64172	.61055	.66296	.55604	.67072	.54823	.59731	.57925
146	.21823	.19479	.26086	.55426	.63784	.76012	.70639	.72653	.63875	.64509	.61279	.64877	.53027	.66068	.54593	.57741	.56788

TIME	Q24	Q25	Q26	Q28	Q29	Q30	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42
80	.68128	.70379	.71374	.64173	.57985	.54736	.64375	.60582	.58295	.57245	.57932	.58706	.57382	.60372	.51442	.61135	.54307
86	.67473	.70250	.65864	.63934	.57235	.55729	.63820	.60700	.57366	.57435	.58125	.58374	.53375	.60661	.49799	.59305	.51157
92	.67677	.69039	.68229	.59567	.57550	.54107	.60209	.59858	.56940	.57413	.58393	.58692	.51657	.59771	.49133	.55110	.50536
98	.66855	.65505	.68470	.56516	.56949	.53643	.59228	.59468	.57806	.57920	.58704	.57314	.49491	.54681	.47869	.54316	.49946
110	.64117	.60120	.68165	.53010	.48451	.52162	.57366	.55077	.57185	.55589	.57593	.56320	.47963	.50912	.45766	.53745	.47715
122	.63326	.57514	.65767	.51610	.46957	.50126	.54879	.55196	.54922	.52521	.55932	.57473	.45237	.47802	.43829	.53290	.45607
134	.55961	.54234	.65074	.48655	.46223	.45756	.52950	.52139	.52962	.46068	.56070	.54317	.42763	.45346	.42250	.53223	.43429
146	.57317	.52968	.54868	.47826	.46585	.46583	.50769	.51777	.52818	.44973	.54862	.52561	.41802	.44855	.40866	.49397	.41978

TIME	Q43	Q44	Q45	QS1	QS2	QS3	QS4
80	.59373	.55918	.65788	.50478	.58738	.62857	.68479
86	.58434	.52541	.61219	.45862	.53802	.58275	.62616
92	.58646	.52563	.60099	.44512	.52298	.56607	.59497
98	.56619	.52580	.52258	.43189	.49987	.54871	.57322
110	.51109	.49429	.52910	.40109	.44557	.49291	.52646
122	.49936	.46777	.51862	.37743	.41363	.46712	.47808
134	.47755	.43911	.50950	.35070	.38068	.43757	.44052
146	.44125	.41337	.43289	.34211	.35850	.41196	.41624

ON 3642 NASA-SIS TEST
LRC-SB MODEL

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0, AND HREF BASED ON .675 INCH RADIUS
ANGLE OF ATTACK 60.200 DEG. ANGLE OF YAW 0 DEG. ANGLE OF ROLL 0 DEG. MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	HREF BTU/ SQFT SEC R	POP PSIA
80	.104032	.002483	109.4	5523	10.59	8.169	4.8835	9.7671	.00316	6042	2346	6.361E 02	81.9	.01189	.04538	15.074
86	.099072	.002317	111.7	5548	10.53	7.688	4.4826	8.9652	.00328	5604	2373	6.420E 02	80.6	.01234	.04398	14.187
98	.087757	.002077	110.4	5551	10.60	6.900	4.0695	8.1390	.00346	5235	2379	6.424E 02	76.4	.01303	.04157	12.734
110	.077437	.001870	108.2	5515	10.64	6.131	3.7130	7.4261	.00364	4762	2354	6.339E 02	70.6	.01369	.03894	11.313
122	.070906	.001679	110.3	5557	10.61	5.590	3.2957	6.5914	.00385	4367	2393	6.437E 02	70.0	.01471	.03778	10.317
134	.063878	.001493	111.7	5593	10.61	5.036	2.9115	5.8230	.00410	3993	2428	6.521E 02	67.7	.01563	.03584	9.295
146	.057448	.001361	110.3	5570	10.64	4.552	2.6775	5.3550	.00429	3674	2412	6.466E 02	62.7	.01612	.03348	8.400
152	.055103	.001305	110.3	5530	10.56	4.304	2.5502	5.1003	.00436	3375	2383	6.378E 02	59.7	.01641	.03239	7.941

PRESSURE DATA (PRESSURE / POP)

TIME	P1	P2	P3	P6	P8	P9	P10
80	.93638	.83569	.77381	.79352	.76293	.74256	.67294
86	.93130	.83102	.77204	.79988	.76250	.74561	.67549
98	.90967	.82727	.75670	.77403	.73914	.70819	.65258
110	.92590	.85077	.76147	.78605	.73695	.70496	.65378
122	.92023	.85380	.75115	.79938	.73272	.70596	.65242
134	.92186	.84630	.75635	.78939	.72655	.69938	.64722
146	.91463	.84891	.74966	.77862	.71549	.69260	.64271
152	.92087	.84852	.75380	.76011	.70815	.68674	.63774

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q18	Q19	Q21	Q22
80	.58472	.79013	.71371	.83176	.72573	.74379	.82043	.76049	.71882	.66735	.75642	.67765	.67025	.63874	.66742	.61371	.63241
86	.57505	.77836	.69425	.81207	.70342	.73492	.80695	.75236	.68942	.65874	.73249	.65473	.66422	.62107	.65323	.60842	.61822
98	.53720	.72630	.67417	.78342	.67522	.72048	.78363	.73298	.65639	.62342	.71066	.61040	.65674	.60349	.54619	.56842	.60486
110	.53786	.68461	.65379	.73241	.64116	.70668	.76429	.70652	.62062	.58769	.68822	.57547	.64326	.58766	.63752	.54229	.58269
122	.49532	.61838	.62078	.68095	.61340	.68472	*****	.65824	.59623	.56234	.65933	.53895	.63108	.54685	.63116	.49715	.55671
134	.48716	.54677	.58166	.63752	.59826	.67907	*****	.62416	.56741	.53879	.62361	.50876	.61378	.51769	.61285	.48106	.53243
146	.49645	.50643	.57906	.61572	.58621	.67022	*****	.58769	.53979	.52376	.57695	.48129	*****	.48975	.60352	.45233	.50818
152	.49645	.48149	.57206	.60733	.58008	.66823	*****	.58043	.51860	.51863	.56847	.47906	*****	.48063	.58918	.44379	.49761

TIME	Q23	Q24	Q25	Q28	Q29	Q30	Q31	Q33	Q34	Q35	Q36	Q37	Q39	Q40	Q41	Q42	Q43
80	.66041	.68614	.65278	.65727	.55649	.57652	.64601	.62102	.63109	.59766	.64042	.64379	.66102	.60317	.64348	.59765	.64008
86	.63257	.65733	.63714	.63134	.53924	.55237	.62327	.60033	.62078	.57349	.63117	.63728	.63467	.57439	.62109	.56340	.60233
98	.60385	.63695	.59918	.60175	.52065	.53185	.60020	.59111	.60364	.53986	.62239	.61124	.58319	.52763	.59374	.53671	.55695
110	.57642	.60837	.56248	.56349	.50642	.50650	.57169	.56132	.59261	.50824	.60189	.59432	.53642	.47387	.56485	.50207	.51838
122	.53829	.57621	.53389	.52785	.47926	.48268	.54231	.53145	.57467	.47964	.59378	.57641	.49655	.44416	.56093	.47363	.48567
134	.51869	.54266	.50619	.50391	.45261	.46711	.51816	.52018	.56223	.45267	.58760	.53477	.45877	.41624	.52137	.44276	.45622
146	.50188	.52931	.48763	.47865	.43176	.43875	.49271	.50103	.54349	.42340	.56024	.48729	.43471	.39874	.50375	.42713	.42789
152	.49326	.51863	.47109	.46342	.42485	.42081	.40064	.49160	.53488	.41567	.54832	.46428	.42142	.39147	.49743	.42183	.41734

TIME	Q44	Q51	Q52	Q53	Q54
80	.61534	.50375	.53564	.60252	.64185
86	.60743	.47483	.50292	.56392	.60372
98	.57467	.43765	.46358	.51742	.56485
110	.53641	.40012	.42169	.48374	.49878
122	.50128	.38642	.39460	.45611	.46240
134	.49120	.36254	.37352	.42309	.41371
146	.46379	.34139	.35273	.40053	.40029
152	.45462	.33356	.34166	.39141	.39576

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389
VON KARMAN GAS DYNAMICS FACILITY
HYPERSONIC HOTSHOT TUNNEL F

IN 3645 NASA-SIS TEST
IC-58 MODEL

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0, AND HREF BASED ON .675 INCH RADIUS
ANGLE OF ATTACK 40.200 DEG. ANGLE OF YAW 0 DEG. ANGLE OF ROLL 0 DEG. MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	HREF BTU/ SQFT SEC R	POP PSIA
71	.195266	.005446	93.6	5153	10.68	15.594	11.6767	23.3533	.00206	10514	1983	5.533E 02	93.2	.00791	.06457	28.743
76	.185626	.004839	100.2	5312	10.65	14.722	9.9940	19.9879	.00222	10051	2121	5.881E 02	97.6	.00836	.06171	27.151
81	.183713	.004708	101.9	5320	10.57	14.371	9.5758	19.1517	.00225	9582	2135	5.903E 02	97.0	.00848	.06080	26.502
86	.169821	.004359	101.8	5334	10.61	13.370	8.9001	17.8002	.00234	9137	2151	5.931E 02	94.2	.00882	.05850	24.658
91	.164587	.004195	102.5	5334	10.57	12.872	8.5078	17.0156	.00239	8724	2157	5.934E 02	92.6	.00900	.05723	23.739
101	.146875	.003644	105.3	5405	10.57	11.480	7.2903	14.5806	.00259	7954	2225	6.092E 02	91.0	.00972	.05402	21.176
111	.134271	.003356	104.5	5375	10.55	10.459	6.7277	13.4553	.00268	7256	2209	6.027E 02	85.4	.01010	.05118	19.288
116	.126151	.003174	103.8	5367	10.57	9.858	6.3930	12.7860	.00275	6932	2206	6.007E 02	82.5	.01037	.04954	18.181
121	.121938	.003075	103.6	5357	10.56	9.516	6.1962	12.3924	.00280	6696	2201	5.986E 02	80.6	.01053	.04855	17.550
126	.114799	.002834	105.8	5407	10.55	8.935	5.6431	11.2862	.00293	6336	2247	6.098E 02	80.4	.01102	.04711	16.481

PRESSURE DATA (PRESSURE / POP)

TIME	P1	P2	P3	P4	P5	P6	P8	P9	P10
71	.51015	.48388	.45523	.45555	.39265	.40834	.40674	.38582	.34668
76	.51530	.48569	.45463	.45633	.39337	.41248	.41067	.39184	.35340
81	.49661	.47556	.43779	.44183	.37926	.40570	.40576	.38961	.35291
86	.49497	.47071	.43083	.43890	.37913	.40530	.40727	.39014	.35528
91	.50144	.48680	.43005	.44176	.39723	.41455	.40910	.39116	.35762
101	.50152	.48730	.43428	.44844	.38402	.41562	.41146	.39305	.35674
111	.51503	.50566	.44657	.46269	.39652	.42333	.41099	.39308	.35702
116	.51978	.51191	.44989	.46867	.40020	.42504	.41154	.39485	.35877
121	.51607	.50369	.44515	.45577	.38790	.42435	.40741	.39089	.35420
126	.52848	.50772	.45299	.46719	.39657	.42981	.40982	.39150	.35498

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q18	Q19	Q20	Q21	Q22
71	.91867	.96750	.95702	.99875	.99655	.99932	.92156	.94486	.85082	.92539	.86906	.91916	.83212	.79562	.95883	.74609	.79872
76	.85916	.88589	.87467	.98362	.98426	.95150	.92435	.89462	.84528	.89282	.82765	.91189	.83267	.78378	.94779	.74361	.78785
81	.83292	.86358	.82597	.98417	.95322	.93424	.92509	.88471	.82975	.87491	.80676	.91383	.82899	.78263	.83097	.75300	.75837
86	.82160	.85128	.80361	.98340	.93040	.92659	.92032	.88311	.81947	.86059	.80172	.90264	.82057	.78565	.83144	.73373	.72881
91	.77755	.84230	.79046	.95457	.90346	.89779	.92066	.85132	.81135	.84217	.77819	.88618	.77604	.76118	.80767	.70197	.70594
101	.59392	.80261	.73997	.90599	.84776	.86254	.87098	.83138	.77267	.84306	.75954	.83936	.72789	.72489	.78562	.67484	.67151
111	.45437	.79612	.72261	.89196	.84263	.84228	.86942	.81860	.75349	.83789	.74540	.82040	.73130	.70751	.78035	.68245	.65399
116	.41837	.79551	.72076	.87611	.82946	.83399	.85233	.80578	.73421	.80659	.72616	.78810	.68609	.68708	.77726	.67330	.65397
121	.38579	.77350	.69944	.83335	.82387	.80679	.83975	.78134	.71835	.76353	.70716	.76193	.69348	.66736	.75129	.66673	.64370
126	.37756	.74759	.67989	.81456	.81167	.78170	.81609	.77555	.70424	.74611	.67258	.75159	.69499	.64849	.72781	.67377	.63952

TIME	Q23	Q24	Q25	Q28	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q42	Q43
71	.79523	.75882	.80500	.71186	.67582	.80162	.76523	.64922	.66955	.67134	.69504	.73313	.77394	.75449	.74586	.69743	.73684
76	.78875	.75918	.79459	.71097	.65079	.79345	.75783	.63371	.65846	.66250	.64421	.71952	.76875	.73798	.67525	.63625	.70332
81	.75935	.75780	.76554	.69155	.63684	.78015	.75231	.61244	.65212	.64561	.62039	.71049	.75394	.71923	.63877	.59886	.68506
86	.73199	.74884	.74545	.66154	.62576	.75163	.75021	.60063	.66413	.62107	.61190	.71626	.75130	.70798	.62587	.58123	.66188
91	.72466	.73387	.74187	.64160	.62337	.72485	.72844	.58988	.65540	.60531	.61307	.70968	.73703	.69380	.60970	.56413	.63676
101	.69569	.70903	.69624	.61095	.59211	.70520	.70100	.58193	.64269	.60081	.60351	.69522	.69179	.64040	.56291	.52866	.59641
111	.67902	.68667	.68349	.59031	.57514	.65671	.69437	.56807	.63907	.57447	.58592	.65412	.66996	.61428	.53547	.50995	.56514
116	.67183	.69066	.67522	.59660	.56620	.66423	.66160	.55821	.63522	.57891	.59440	.62238	.66658	.59088	.52856	.50522	.55058
121	.64791	.68326	.64680	.57345	.56268	.62727	.65840	.55045	.62468	.57292	.59524	.58947	.64970	.57317	.51457	.49516	.53452
126	.65022	.68822	.64852	.57936	.56245	.62999	.64758	.55964	.61940	.56948	.58319	.59232	.62016	.55677	.48975	.47890	.51887

TIME	Q44	Q45	Q51	Q52	Q53	Q54
71	.68754	.77731	.64355	.68931	.75053	.72931
76	.63745	.74213	.59196	.63700	.69275	.68115
81	.60596	.69516	.56565	.61392	.66710	.66092
86	.59939	.66587	.55652	.60119	.66746	.67163
91	.58207	.66355	.54699	.59816	.67005	.66326
101	.54609	.62375	.51198	.56880	.63593	.62255
111	.53514	.60542	.48272	.53916	.60451	.59520
116	.52988	.58206	.47850	.52841	.59830	.58820
121	.52613	.55649	.46590	.51747	.58707	.57117
126	.50404	.52981	.44706	.49490	.55981	.53885

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389
VON KARMAN GAS DYNAMICS FACILITY
HYPERSONIC HOTSHOT TUNNEL F

N 3645 NASA-STS TEST
LRC-58 MODEL

TEST CONDITIONS   TEST GAS NITROGEN   Q-O, ST-O, AND HREF BASED ON .675 INCH RADIUS
ANGLE OF ATTACK 20.200 DEG.   ANGLE OF YAW 0 DEG.   ANGLE OF ROLL 0 DEG.   MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	HREF BTU/ SQFT SEC R	POP PSIA
72	.189189	.004015	107.1	5458	10.58	14.925	9.1667	18.3335	.00230	10038	2244	6.211E 02	106.6	.00868	.06254	27.353
80	.162668	.004022	105.0	5465	10.67	12.953	8.1060	16.2120	.00247	9237	2258	6.224E 02	99.9	.00930	.05816	23.900
100	.144828	.003788	99.9	5257	10.55	11.208	7.7693	15.5386	.00249	7664	2106	5.764E 02	84.1	.00955	.05374	20.010
108	.124972	.003164	103.1	5383	10.53	9.895	6.4320	12.8056	.00276	7137	2215	6.039E 02	83.3	.01041	.04974	18.234
116	.116173	.003020	100.5	5307	10.62	9.173	6.2165	12.4329	.00281	6604	2159	5.871E 02	76.8	.01057	.04744	16.914
124	.113199	.002980	99.2	5243	10.56	8.833	6.1360	12.2719	.00281	6193	2112	5.733E 02	73.8	.01075	.04698	16.283
132	.105433	.002580	103.2	5336	10.52	8.166	5.3412	10.6824	.00300	5749	2195	5.939E 02	73.0	.01130	.04458	15.058
136	.101657	.002545	104.3	5355	10.52	7.908	5.0889	10.1778	.00307	5569	2213	5.982E 02	73.2	.01157	.04378	14.510

PRESSURE DATA (PRESSURE / POP)

TIME	P2	P3	P4	P6	P7	P8	P9	P10
72	.13759	.13776	.14993	.14550	.14840	.13447	.12505	.11053
80	.14595	.13901	.15081	.14999	.14960	.14031	.12843	.11338
100	.14385	.14715	.15932	.14561	.14890	.14002	.13175	.11710
108	.14486	.14324	.16222	.14707	.15190	.14004	.13563	.12050
116	.14659	.14380	.16350	.14656	.15160	.14006	.13085	.12237
124	.14267	.14874	.16391	.14350	.14960	.14290	.13391	.12019
132	.14353	.15727	.16814	.14650	.15200	.14404	.13347	.12181
136	.14328	.15870	.16720	.14564	.15190	.14605	.13053	.12278

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q18	Q19	Q20	Q21
72	.31457	.34269	.29246	.35976	.33942	.34326	.34168	.34731	.31102	.32067	.32328	.30528	.32054	.28070	.28965	.29041	.28575
80	.26018	.32344	.28486	.36268	.33840	.34355	.33040	.35112	.30911	.31377	.32689	.30131	.31683	.28321	.29080	.29044	.28135
100	.15554	.26159	.25744	.35192	.34496	.33998	.31977	.35025	.31019	.30737	.31861	.28554	.30660	.27013	.28527	.27658	.27790
108	.13213	.20703	.26519	.33943	.33745	.33727	.30496	.33962	.29573	.29076	.30887	.26651	.28995	.25717	.26313	.25708	.26773
116	.11833	.15571	.26418	.34820	.33879	.35199	.31925	.34235	.31409	.29235	.31925	.26321	.28690	.25358	.26138	.26366	.27268
124	.11306	.14876	.23416	.32346	.34044	.34321	.29206	.33172	.29941	.28578	.30635	.25672	.28013	.24662	.25150	.25602	.25914
132	.10999	.13965	.16344	.28193	.30310	.31002	.29546	.30177	.28258	.25469	.29084	.24447	.25943	.23162	.23967	.24418	.26063
136	.11551	.13506	.11835	.23244	.27716	.27857	.25124	.28856	.27226	.24780	.27740	.23959	.24711	.22888	.23291	.24466	.25692

TIME	Q22	Q23	Q24	Q25	Q28	Q30	Q31	Q32	Q33	Q35	Q36	Q37	Q39	Q41	Q42	Q43	Q44
72	.30470	.27318	.29256	.29731	.29626	.29564	.32374	.33561	.29816	.32723	.31868	.32147	.35842	.36571	.31068	.32327	.31617
80	.30850	.28715	.28911	.29099	.29687	.29201	.32169	.32874	.29812	.31370	.30136	.32047	.35076	.35327	.30521	.31954	.29251
100	.30945	.26503	.25495	.28079	.28583	.27217	.27875	.32526	.29051	.29439	.30115	.31767	.33201	.34131	.28168	.29946	.27702
108	.28819	.27792	.27114	.26835	.26718	.28535	.27752	.32716	.28440	.28523	.29613	.29546	.32757	.33028	.27942	.28472	.28235
116	.28378	.25524	.27318	.26873	.26249	.27452	.26489	.31304	.27821	.27106	.29870	.30853	.31060	.32458	.28013	.28601	.27601
124	.27962	.27699	.25215	.27526	.26650	.26500	.25792	.31360	.27916	.26891	.29640	.30996	.30092	.30625	.27863	.27270	.27407
132	.27650	.26161	.28177	.25363	.25359	.25551	.24985	.28870	.25359	.27166	.29164	.28462	.24769	.28976	.27028	.26626	.26563
136	.26447	.25416	.27335	.24574	.24560	.24875	.24601	.28981	.25020	.26048	.28746	.28864	.28541	.29271	.27594	.26751	.27096

TIME	Q51	Q52	Q53	Q54
72	.25835	.28265	.32821	.33682
80	.24407	.28827	.31547	.31687
100	.23654	.26437	.32773	.32456
108	.22392	.26788	.32421	.32618
116	.22539	.26378	.32724	.31547
124	.23031	.27395	.32673	.31616
132	.22743	.26761	.31922	.29103
136	.22543	.25867	.30572	.28517

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389
VON KARMAN GAS DYNAMICS FACILITY
HYPERSONIC HOTSHOT TUNNEL F

JN 3647 NASA-STS TEST
RC-58 MODEL

TEST CONDITIONS TEST GAS NITROGEN Q-O, ST-O, AND HREF BASED ON .675 INCH RADIUS
ANGLE OF ATTACK 20.000 DEG. ANGLE OF YAW 0 DEG. ANGLE OF ROLL 0 DEG. MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	HREF BTU/ SQFT SEC R	POP PSIA
80	.143395	.004324	86.6	4783	10.31	10.668	9.3037	18.6073	.00223	6318	1721	4.781E 02	59.9	.00841	.05073	19.629
88	.124555	.003198	101.7	5195	10.33	9.306	6.3628	12.7256	.00270	5900	2079	5.639E 02	74.0	.01035	.04805	17.151
96	.116852	.002683	115.7	5486	10.23	8.706	4.9554	9.9109	.00303	5515	2328	6.294E 02	83.3	.01141	.04656	16.060
100	.111920	.002477	118.6	5549	10.25	8.225	4.5373	9.0746	.00317	5317	2383	6.440E 02	85.0	.01211	.04610	15.177
116	.103909	.002168	125.2	5634	10.10	7.420	3.8008	7.6016	.00341	4613	2465	6.645E 02	84.2	.01300	.04378	13.692
124	.090554	.001809	130.7	5705	10.15	6.529	3.1190	6.2379	.00379	4270	2594	7.004E 02	84.9	.01432	.04134	12.054
132	.083242	.001686	129.0	5757	10.17	6.026	2.9318	5.8636	.00391	3988	2573	6.934E 02	80.5	.01481	.03958	11.125
136	.079720	.001630	127.7	5734	10.18	5.778	2.8499	5.6999	.00397	3845	2555	6.879E 02	77.9	.01505	.03868	10.666

PRESSURE DATA (PRESSURE / POP)

TIME	P2	P3	P4	P8	P9	P10
80	.13624	.13240	.15369	.14510	.12620	.11540
88	.14391	.14404	.16039	.14550	.12740	.11550
96	.14203	.14350	.15521	.13450	.12060	.11010
100	.14340	.14463	.15620	.13630	.12130	.11180
116	.14369	.14302	.15348	.12910	.11530	.10740
124	.14535	.14465	.15493	.12800	.11600	.10810
132	.14548	.14555	.15283	.12700	.11540	.10880
136	.14407	.14511	.15249	.12610	.11440	.10800

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q18	Q19	Q20	Q21
80	.26436	.34879	.32940	.30112	.28733	.28605	.31875	.27727	.27955	.25453	.28287	.28355	.26694	.24261	.24863	.26854	.26340
88	.15933	.22718	.26647	.29287	.29378	.28439	.27929	.28187	.26743	.24681	.26960	.27292	.25634	.23822	.24521	.26737	.25977
96	.12493	.13946	.16213	.26831	.28360	.27434	.26159	.27863	.26436	.24063	.26833	.27102	.25859	.23802	.23946	.26109	.25507
100	.12651	.12673	.15208	.24201	.27506	.26857	.26274	.28435	.26534	.24388	.20647	.27710	.25697	.24317	.23091	.26594	.26219
116	.12237	.10925	.10717	.15604	.23427	.23744	.24677	.28157	.26949	.24223	.26337	.27383	.25508	.24279	.24076	.26335	.26671
124	.11788	.10400	.09047	.13173	.20676	.22324	.22950	.28213	.27217	.24355	.26086	.26846	.25659	.24423	.24054	.25855	.26646
132	.11780	.10429	.08469	.11798	.18575	.20155	.21614	.27153	.27392	.23978	.25195	.26498	.24843	.23571	.24064	.25744	.28049
136	.11842	.10255	.08872	.10940	.17435	.19052	.20906	.27353	.26199	.24139	.25000	.26241	.25006	.23603	.23632	.25887	.25523

TIME	Q22	Q23	Q24	Q25	Q26	Q28	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q39	Q41	Q42	Q43
80	.28023	.26745	.24976	.28382	.30664	.27039	.30573	.30464	.30307	.31076	.29167	.31013	.28312	.31876	.30095	.29024	.27816
88	.29136	.26307	.25233	.27726	.29833	.26448	.27669	.29701	.28462	.30845	.27698	.30480	.27321	.31124	.29745	.27038	.28063
96	.29237	.27449	.25425	.28679	.30645	.26851	.26548	.28835	.26987	.29763	.27656	.29645	.27788	.30763	.30123	.25447	.26975
100	.29713	.27079	.25846	.28324	.30603	.26741	.26604	.29823	.28770	.29841	.27570	.29098	.27909	.30048	.30433	.24672	.26692
116	.28735	.27229	.27279	.27222	.29564	.25855	.26951	.26703	.28334	.29774	.26795	.27801	.27161	.30539	.29865	.23026	.25386
124	.28593	.27109	.26657	.27237	.29123	.25892	.20991	.27735	.28154	.29144	.26697	.27040	.27059	.30133	.28449	.22563	.24856
132	.26474	.26812	.25964	.26403	.28576	.25746	.21433	.27249	.27760	.29439	.26264	.26514	.27086	.29047	.27765	.22307	.24524
136	.27963	.26376	.25327	.25931	.28420	.25103	.20918	.27962	.28195	.29365	.25618	.26106	.27212	.29129	.27449	.21867	.24659

TIME	Q44	Q45	Q51	Q52	Q53	Q54
80	.31433	.33985	.26458	.32582	.38311	.39411
88	.28212	.31470	.26171	.30783	.34862	.35157
96	.26622	.29569	.24723	.27635	.30698	.30542
100	.26331	.28403	.23948	.26444	.29614	.28246
116	.24475	.26670	.22030	.23158	.23734	.18506
124	.23452	.26105	.20764	.21428	.20206	.13775
132	.23533	.24510	.20507	.20619	.19828	.13656
136	.22474	.24778	.20686	.20631	.20626	.12672

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389
VON KARMAN GAS DYNAMICS FACILITY
HYPERSONIC HOTSHOT TUNNEL F

RUN 3648 NASA-SIS TEST
RC-5H MODEL

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0, AND HREF BASED ON .675 INCH RADIUS
ANGLE OF ATTACK 60.200 DEG. ANGLE OF YAW 0 DEG. ANGLE OF ROLL 0 DEG. MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	HREF BTU/ SQFT SEC R	POP PSIA
60	.190710	.004899	101.7	5412	10.77	15.473	10.1594	20.3188	.00223	11109	2190	6.099E 02	105.9	.00839	.06417	28.547
80	.176596	.004349	106.1	5416	10.55	13.753	8.6510	17.3021	.00236	9247	2219	6.117E 02	100.3	.00891	.05973	25.37
116	.115967	.003003	100.9	5332	10.65	9.205	6.1840	12.3681	.00282	6715	2178	5.925E 02	78.1	.01063	.04766	16.975
124	.106226	.002694	103.0	5392	10.66	8.447	5.4957	10.9915	.00300	6294	2233	6.060E 02	77.4	.01129	.04573	15.581
132	.097369	.002547	99.8	5324	10.69	7.784	5.2909	10.5818	.00306	5877	2181	5.905E 02	71.4	.01153	.04352	14.354
136	.094499	.002466	100.1	5326	10.68	7.544	5.1142	10.2285	.00311	5701	2185	5.910E 02	70.4	.01172	.04279	13.911

PRESSURE DATA (PRESSURE / POP)

TIME	P1	P2	P3	P4	P5	P6	P8	P9	P10
60	.9361	.8741	.7994	.7888	.7643	.7635	.7574	.7205	.6706
80	.9523	.8540	.7725	.7865	.7440	.7572	.7572	.7241	.6810
116	1.0273	.8882	.7920	.8064	.7637	.8001	.7705	.7364	.6954
124	1.0281	.9000	.8000	.8150	.7720	.8084	.7727	.7404	.7008
132	1.0449	.9038	.7974	.8145	.7614	.8143	.7712	.7457	.7072
136	1.0453	.9126	.7991	.8150	.7707	.8193	.7733	.7460	.7070

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q9	Q10	Q12	Q13	Q14	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24
60	.81768	.85843	.79595	.81398	.77220	.80357	.83462	.72397	.75738	.75423	.76193	.68988	.78855	.73272	.76070	.76093	.73597
80	.77738	.79056	.71542	.79379	.77358	.69509	.72377	.69231	.72448	.72985	.70774	.68739	.74517	.68843	.66366	.69333	.72936
116	.57601	.76803	.69673	.80643	.76734	.68347	.69181	.66963	.65987	.70468	.69971	.67272	.69527	.66185	.62347	.64790	.73593
124	.52617	.73409	.68517	.77680	.75345	.67942	.68141	.64275	.67049	.68372	.66472	.64595	.65043	.65533	.61876	.62380	.70888
132	.50617	.73435	.70123	.77364	.74762	.68042	.64572	.64083	.67310	.66944	.64733	.62904	.63875	.65256	.61321	.61663	.65973
136	.50375	.70052	.68634	.77613	.73121	.67657	.63739	.63565	.67311	.65821	.64281	.62620	.63360	.65692	.60908	.61313	.65426

TIME	Q25	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q40	Q42	Q43	Q44	Q51
60	.76235	.69414	.70321	.61225	.77020	.77134	.71232	.66843	.72502	.77297	.78522	.81642	.73825	.79831	.79032	.77022	.63985
80	.67767	.64375	.69132	.59179	.70025	.73926	.62504	.64922	.61581	.63609	.66215	.71345	.64601	.63722	.68130	.65451	.54841
116	.61873	.62107	.67842	.55344	.65350	.67116	.59356	.62006	.55306	.57149	.62294	.66942	.57118	.54273	.59142	.59606	.47712
124	.59260	.58736	.65379	.54769	.64708	.65565	.57697	.62360	.54450	.56207	.59826	.63721	.54416	.51297	.55918	.57373	.45952
132	.58439	.55421	.63876	.53985	.64132	.64235	.56305	.63287	.53976	.55868	.57994	.63248	.53886	.50520	.55316	.58126	.45338
136	.58902	.54336	.62473	.54357	.63823	.63749	.56434	.62141	.53584	.53884	.56730	.63127	.51929	.48972	.54090	.57393	.45763

TIME	Q52	Q53	Q54
60	.71164	.77589	.76992
80	.63038	.69390	.67820
116	.54762	.63900	.60730
124	.52701	.60744	.58262
132	.51511	.58876	.56837
136	.51926	.59760	.57134

3649 NASA-STS TEST
ny-SH MODEL

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0, AND HREF BASED ON .675 INCH RADIUS

ANGLE OF ATTACK 60.500 DEG. ANGLE OF YAW 0 DEG. ANGLE OF ROLL 0 DEG. MODEL LENGTH 24.000 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	V-INF	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/SQFT-SEC	STO	HREF BTU/SQFT SEC R	POP PSIA
80	.180721	.004318	109.3	5496	10.54	14.066	8.4554	16.5109	.00239	9499	2283	6.301E 02	106.0	.00900	.06086	25.955
85	.159879	.003564	117.2	5684	10.53	12.414	6.7357	13.4715	.00257	8681	2448	6.739E 02	111.1	.01016	.05826	22.922
95	.156355	.003376	120.9	5732	10.46	11.903	6.2345	12.4690	.00276	8204	2495	6.858E 02	111.7	.01046	.05715	22.090
101	.148772	.003089	125.6	5922	10.41	11.269	5.5688	11.1376	.00291	7751	2577	7.078E 02	113.3	.01097	.05562	20.651
104	.141440	.002877	128.4	5886	10.42	10.748	5.1391	10.2782	.00303	7505	2633	7.233E 02	113.8	.01140	.05439	19.856
110	.134380	.002621	133.9	5987	10.38	10.132	4.5662	9.1324	.00320	7098	2724	7.487E 02	115.8	.01199	.05299	18.722
116	.128403	.002367	141.7	6121	10.32	9.504	3.9853	7.9706	.00341	6668	2845	7.829E 02	118.0	.01254	.05119	17.680
122	.119893	.002152	145.5	6194	10.30	8.902	3.5677	7.1354	.00359	6291	2913	8.020E 02	117.7	.01321	.04958	16.460
125	.117037	.002086	146.5	6206	10.28	8.663	3.4422	6.8845	.00365	6109	2925	8.050E 02	116.7	.01342	.04891	16.017
128	.114062	.002042	145.9	6184	10.28	8.432	3.3744	6.7487	.00369	5935	2913	8.005E 02	114.2	.01356	.04814	15.589

PRESSURE DATA (PRESSURE / POP)

TIME	P1	P2	P3	P4	P5	P6	P8	P9	P10
80	.9702	.8366	.7188	.7236	.7192	.6776	.7122	.6752	.6157
85	.9742	.8411	.7161	.7250	.7264	.6885	.7125	.6733	.6135
95	.9656	.8504	.7283	.7415	.7461	.7007	.7250	.6818	.6240
101	.9839	.8833	.7673	.7788	.7807	.7258	.7516	.7072	.6430
104	1.0041	.9012	.7843	.7963	.7986	.7367	.7002	.7177	.6534
110	1.0249	.9236	.8061	.8160	.8135	.7567	.7721	.7254	.6652
116	1.0120	.9118	.7994	.8117	.8127	.7567	.7727	.7289	.6603
122	1.0029	.9073	.8025	.8170	.8149	.7594	.7725	.7268	.6600
125	1.0034	.9039	.7994	.8132	.8072	.7557	.7056	.7212	.6561
128	1.0026	.9034	.7981	.8100	.8044	.7556	.7006	.7179	.6529

HEAT TRANSFER DATA (H / HREF)

TIME	Q2	Q4	Q6	Q7	Q9	Q10	Q12	Q13	Q14	Q15	Q17	Q18	Q19	Q20	Q21	Q22	Q23
80	.79943	.87059	.75983	.88842	.88327	.84613	.76346	.72275	.79838	.71375	.75368	.74236	.67755	.76800	.68938	.70044	.70633
85	.66536	.78890	.71750	.89042	.86929	.76530	.71607	.71053	.78329	.70648	.70695	.69739	.67792	.73635	.66007	.66520	.67875
95	.60713	.77051	.70714	.85194	.84870	.72225	.66674	.67747	.74661	.65748	.68421	.65265	.65379	.70088	.62089	.63922	.65329
101	.54777	.73905	.69140	.82489	.84335	.69069	.63921	.65429	.72340	.64171	.66084	.62793	.62972	.66897	.59283	.57494	.60201
104	.52463	.72518	.68402	.81664	.83724	.69145	.64027	.64722	.70592	.62466	.65128	.62450	.62229	.66334	.59033	.57948	.60049
110	.49144	.70679	.67056	.78203	.82786	.66842	.62630	.62940	.69142	.60942	.62576	.61030	.60311	.64786	.57828	.56742	.60944
116	.47447	.67878	.64762	.75020	.83222	.65309	.59689	.59847	.67913	.58321	.60138	.58054	.57552	.61597	.55031	.54646	.56176
122	.47079	.65971	.62936	.73697	.81022	.63280	.57077	.57811	.65879	.56748	.56845	.57667	.56392	.59772	.54684	.53945	.55238
125	.47351	.64984	.62095	.73435	.81178	.62337	.57719	.57402	.64911	.54073	.55712	.57633	.56465	.59047	.54200	.53561	.55907
128	.47033	.64572	.61665	.72277	.81566	.61545	.57280	.56592	.63321	.53769	.55108	.57678	.55820	.57760	.53023	.54392	.56238

TIME	Q24	Q25	Q28	Q29	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q43	Q44
80	.65099	.67111	.63946	.65537	.67390	.68827	.62628	.62949	.59568	.67134	.67683	.70519	.75133	.65214	.69733	.64574	.62317
85	.66173	.63925	.61998	.64670	.69646	.67342	.60021	.62038	.56092	.61539	.66945	.66094	.73708	.59521	.68645	.61623	.56113
95	.65239	.63446	.60488	.63488	.69643	.66932	.59466	.61103	.57777	.60009	.65862	.66650	.72696	.57983	.67987	.59357	.54993
101	.60958	.58187	.54746	.62375	.68745	.65771	.54029	.58430	.55163	.58365	.60461	.65942	.70644	.56496	.67124	.57442	.54233
104	.61493	.57771	.54045	.61573	.67633	.65195	.54903	.57914	.55131	.59102	.59971	.65233	.69456	.56127	.66804	.56894	.54899
110	.60775	.56067	.54508	.60946	.67107	.63053	.54752	.57876	.55512	.56920	.60190	.64592	.67507	.54958	.65993	.55614	.55117
116	.56968	.55335	.51739	.60127	.66632	.61704	.54590	.55860	.54198	.57137	.57504	.63657	.64922	.53849	.65129	.54100	.55335
122	.56315	.53793	.50368	.59160	.65840	.60950	.54139	.55429	.53305	.54769	.57659	.62843	.63071	.52979	.64766	.53067	.53657
125	.56963	.54428	.50993	.58943	.65047	.61411	.53931	.54989	.53060	.54240	.56942	.61566	.62046	.51133	.63920	.52884	.53382
128	.57129	.53516	.50079	.58769	.64255	.61849	.54262	.54453	.51265	.54663	.57183	.61071	.62081	.51066	.63448	.51707	.52462

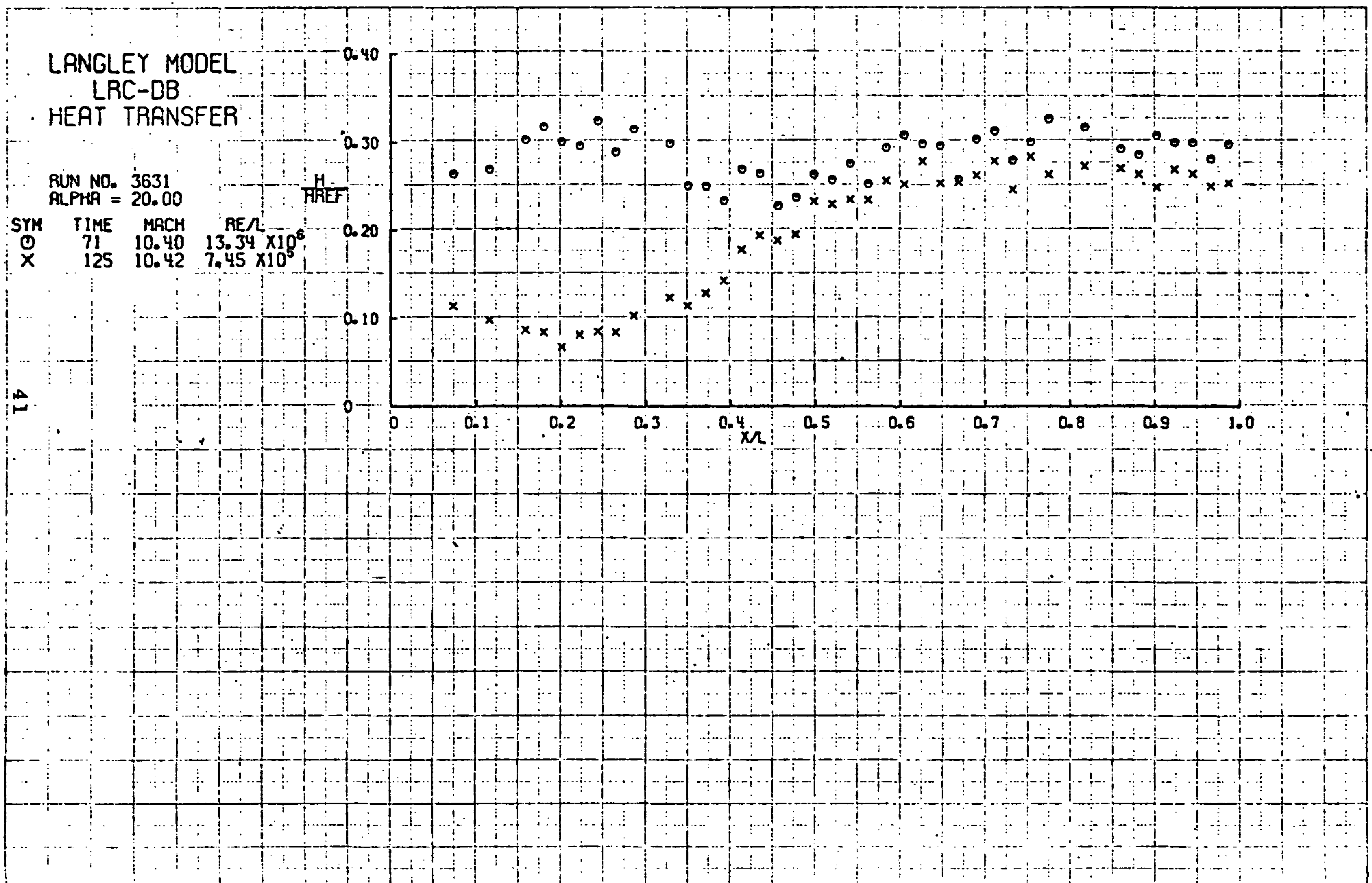
TIME	Q45	Q51	Q52	Q53	Q54
80	.69174	.57876	.61974	.65349	.76564
85	.66556	.52364	.57295	.63037	.68856
95	.65065	.52375	.56472	.61251	.67468
101	.64066	.51621	.55534	.60083	.66502
104	.63441	.51272	.55059	.59844	.65163
110	.62842	.50534	.53977	.58390	.61761
116	.61527	.48806	.52308	.56546	.57901
122	.60842	.46855	.49974	.55896	.54914
125	.59637	.45100	.45354	.55632	.54135
128	.58973	.45374	.48615	.55414	.53151

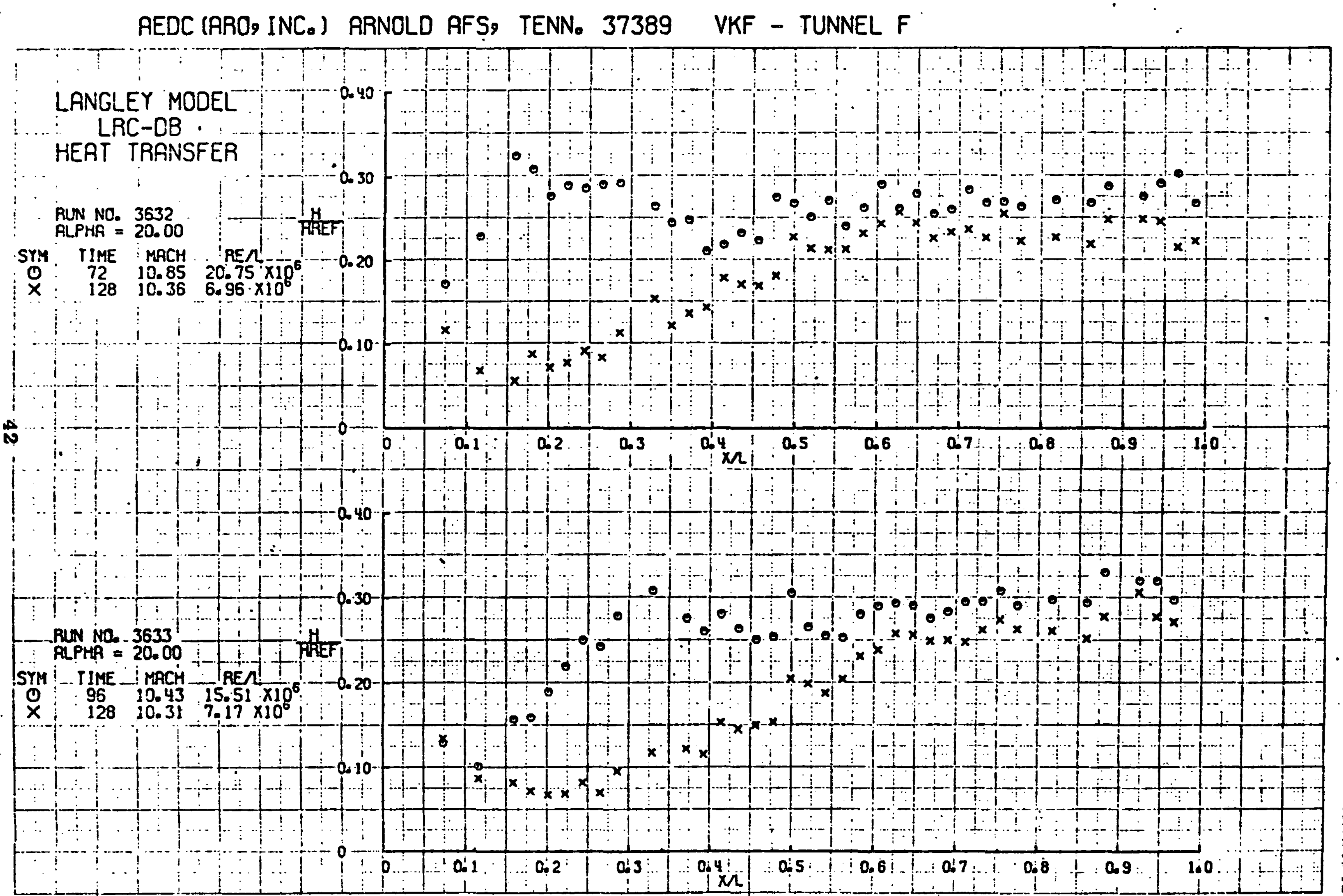
APPENDIX II

SELECTED WINDWARD SURFACE CENTERLINE PLOTS

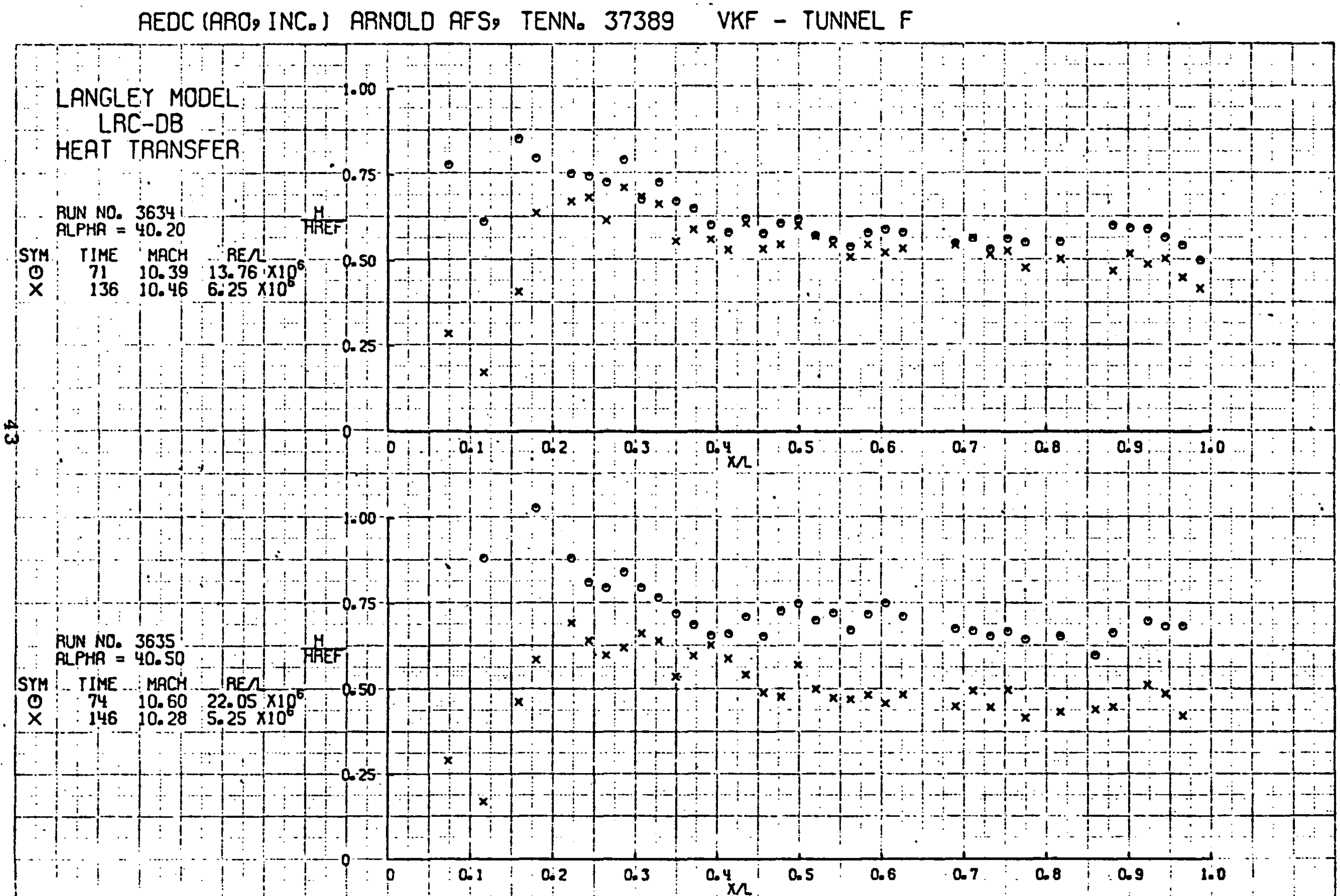
OF GAGE MEASUREMENT RESULTS

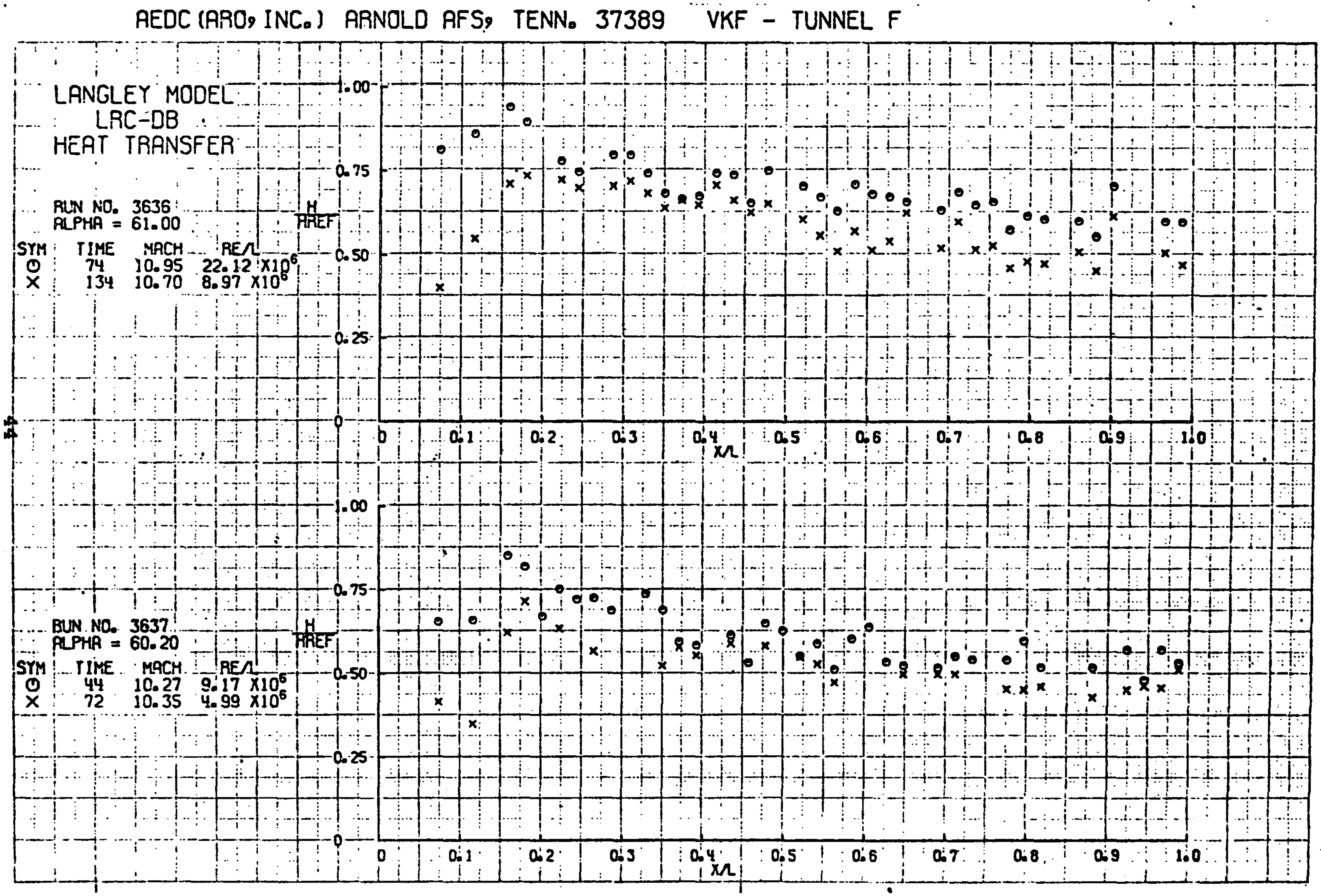
AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F



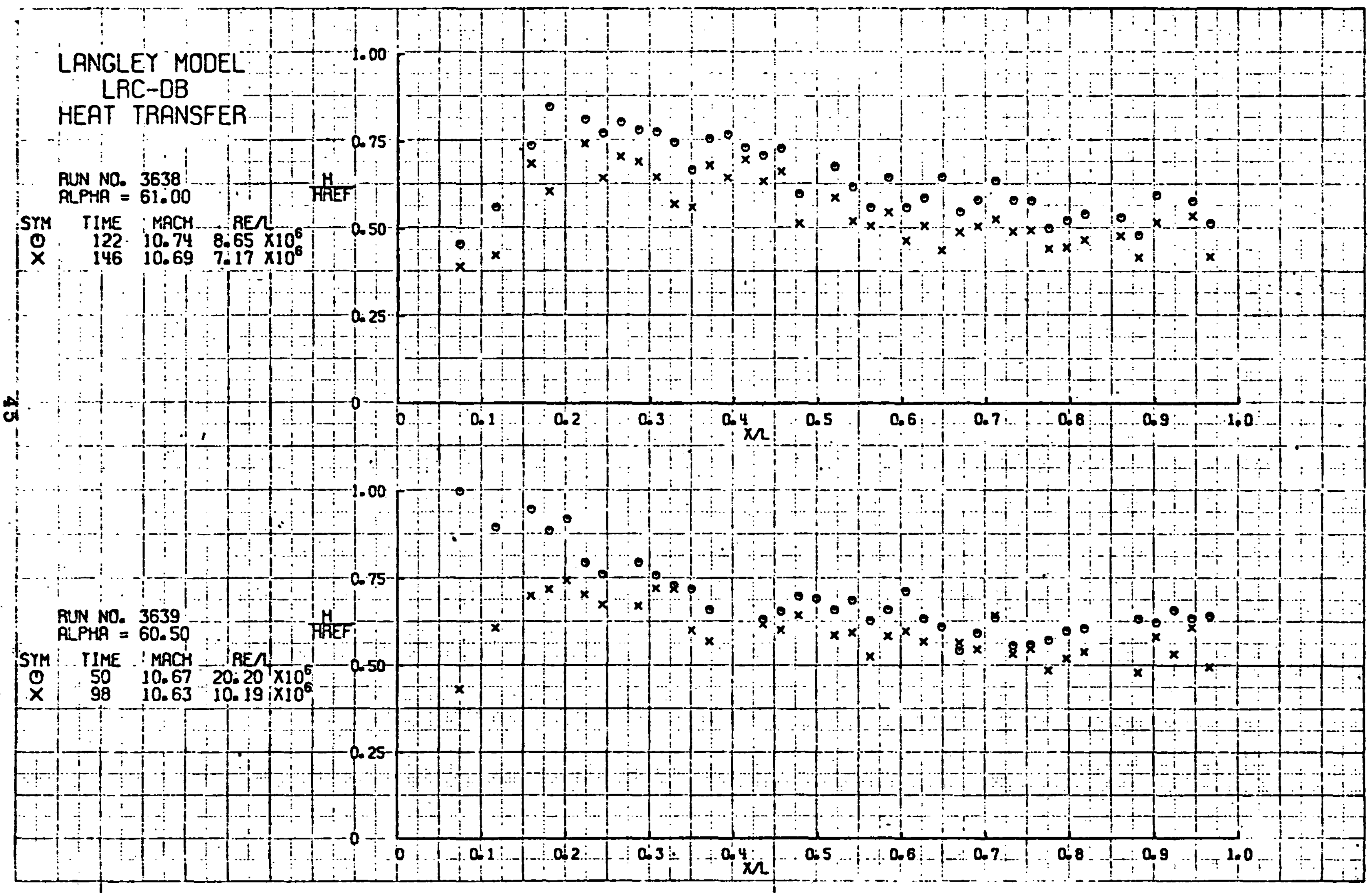


AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F
LANGLEY MODEL
LRC-DB
HEAT TRANSFER
RUN NO. 3632
ALPHA = 20.00
SYM TIME MACH RE/L
72 10.85 20.75 X10^6
128 10.36 6.96 X10^6
RUN NO. 3633
ALPHA = 20.00
SYM TIME MACH RE/L
96 10.43 15.51 X10^6
128 10.31 7.17 X10^6
H/HREF
X/L

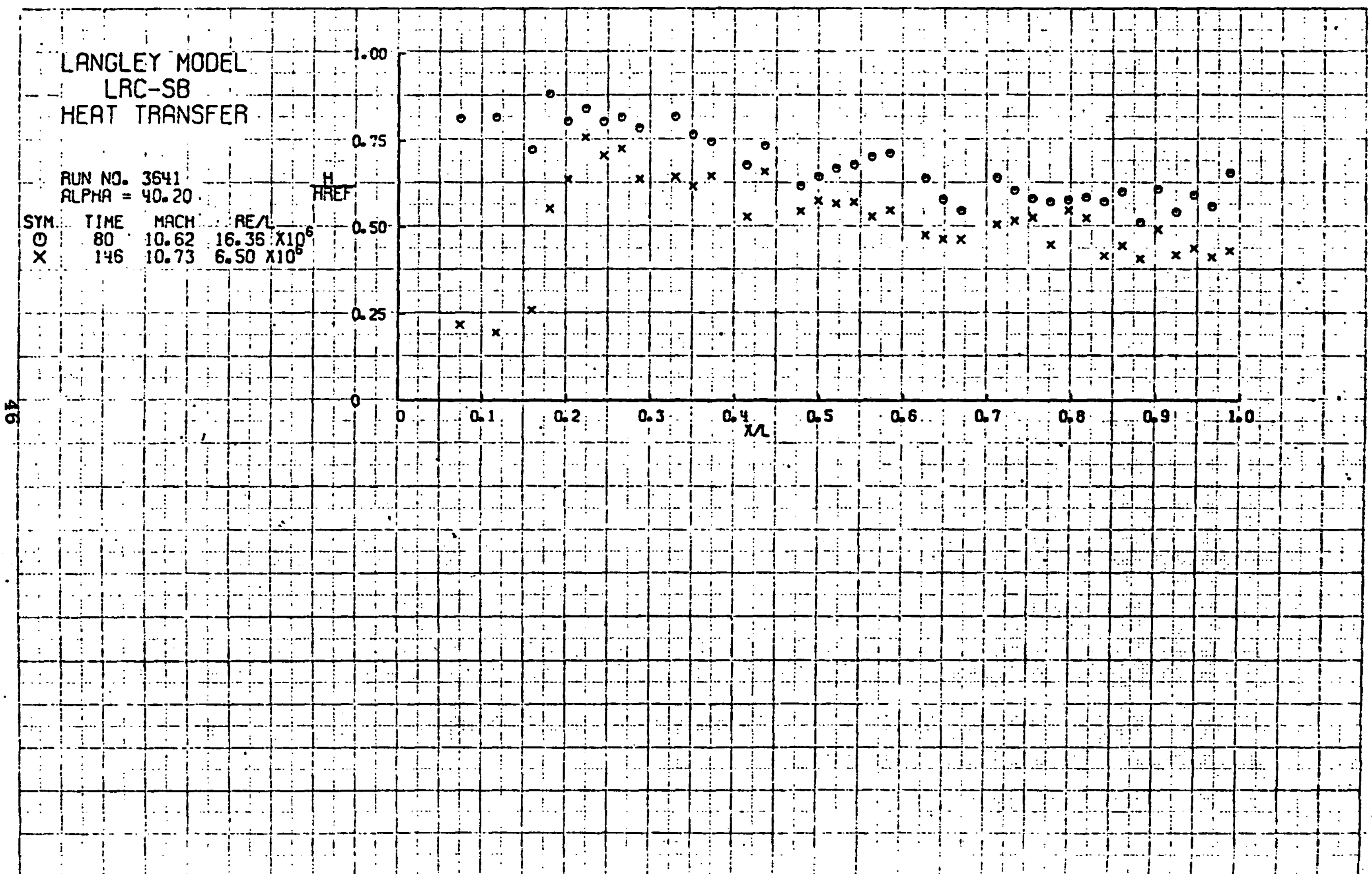

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F
LANGLEY MODEL
LRC-DB
HEAT TRANSFER
RUN NO. 3634
ALPHA = 40.20
SYM TIME MACH RE/L
⊙ 71 10.39 13.76 X10^6
X 136 10.46 6.25 X10^6
H/HREF
X/L
RUN NO. 3635
ALPHA = 40.50
SYM TIME MACH RE/L
⊙ 74 10.60 22.05 X10^6
X 146 10.28 5.25 X10^6


AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F
LANGLEY MODEL
LRC-DB
HEAT TRANSFER
RUN NO. 3636
ALPHA = 61.00
SYM TIME MACH RE/L
O 74 10.95 22.12 X10^6
X 134 10.70 8.97 X10^6
H/HREF
1.00
0.75
0.50
0.25
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
X/L
RUN NO. 3637
ALPHA = 60.20
SYM TIME MACH RE/L
O 44 10.27 9.17 X10^6
X 72 10.35 4.99 X10^6
H/HREF
1.00
0.75
0.50
0.25
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
X/L

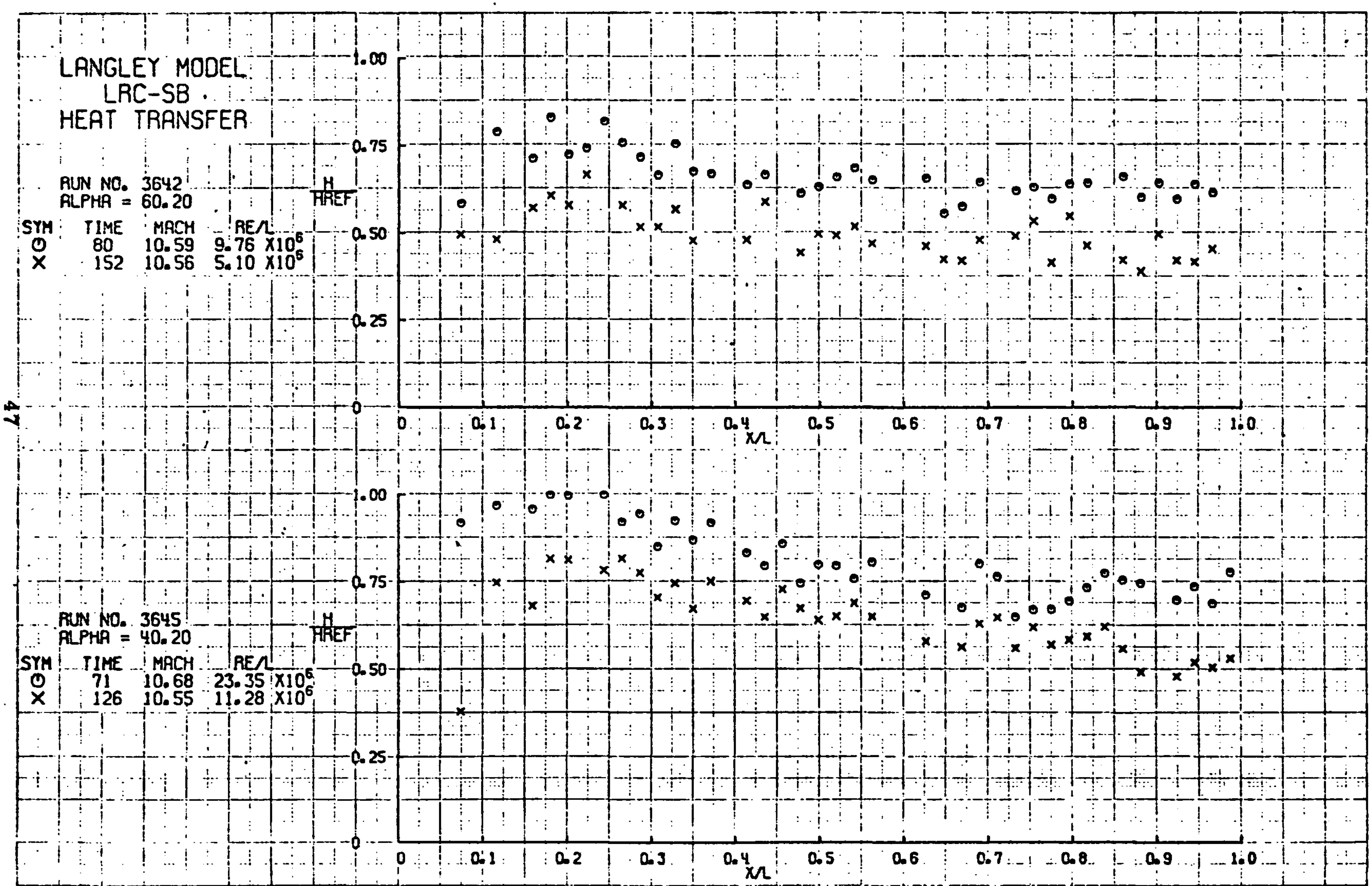
AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F

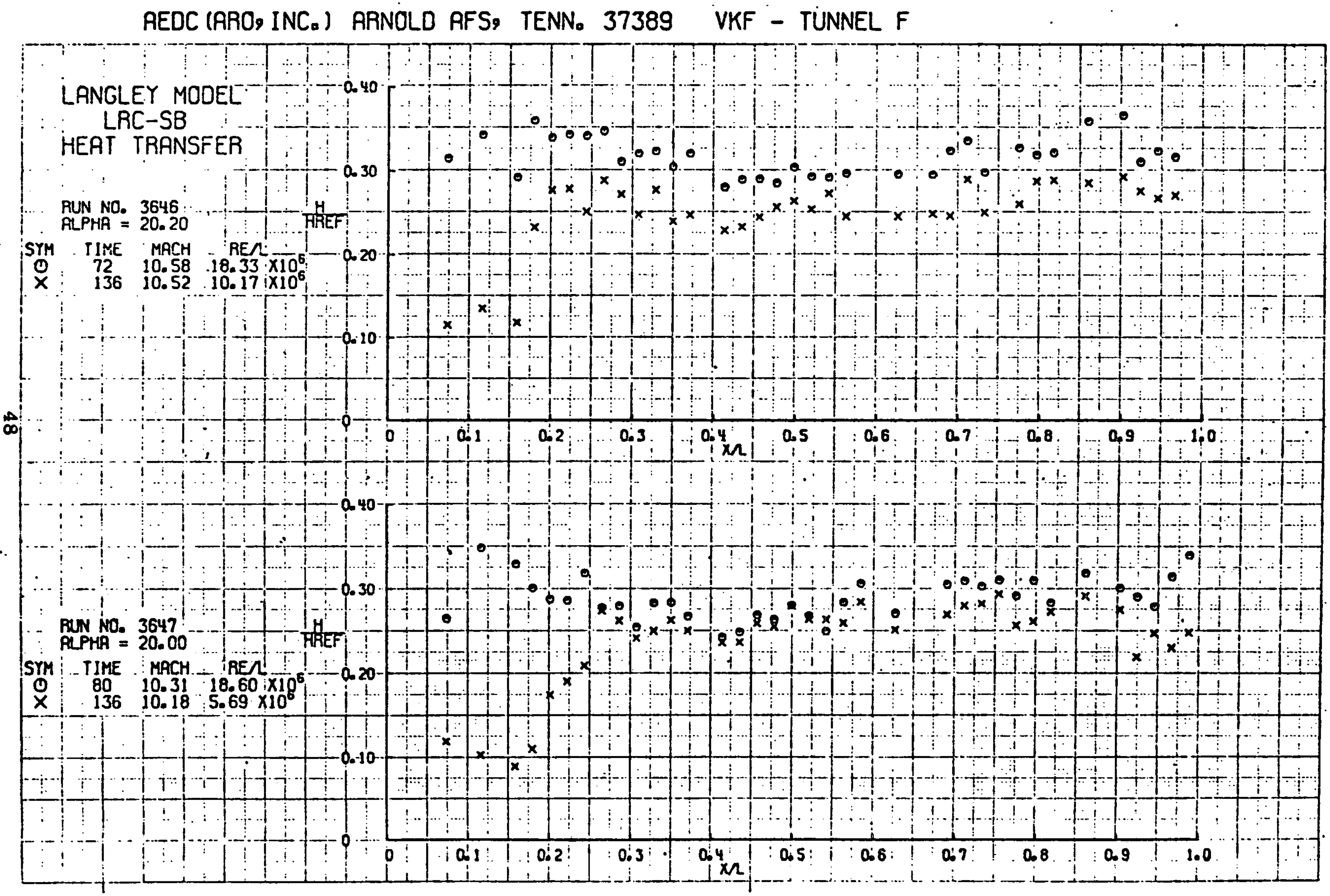


AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F

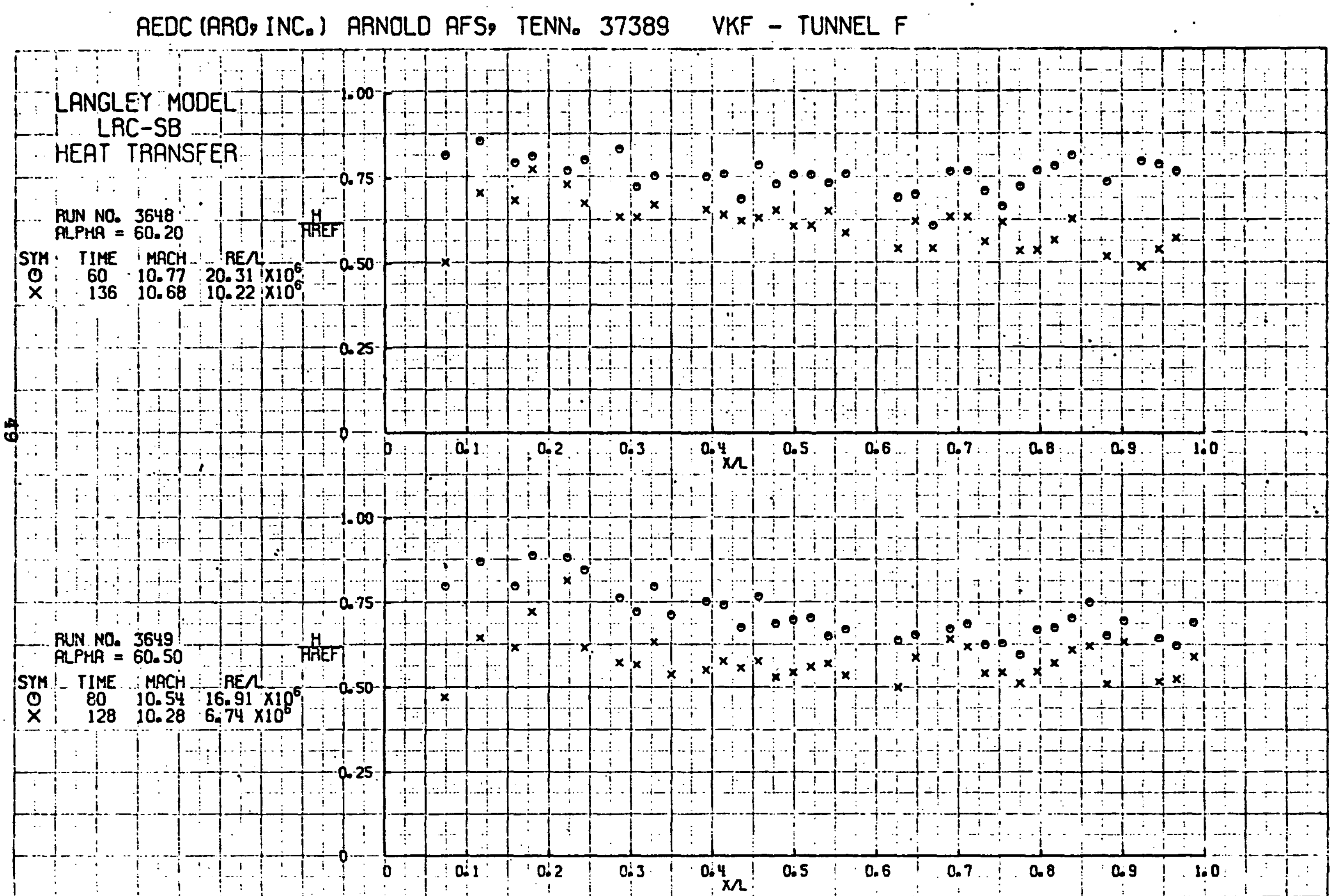


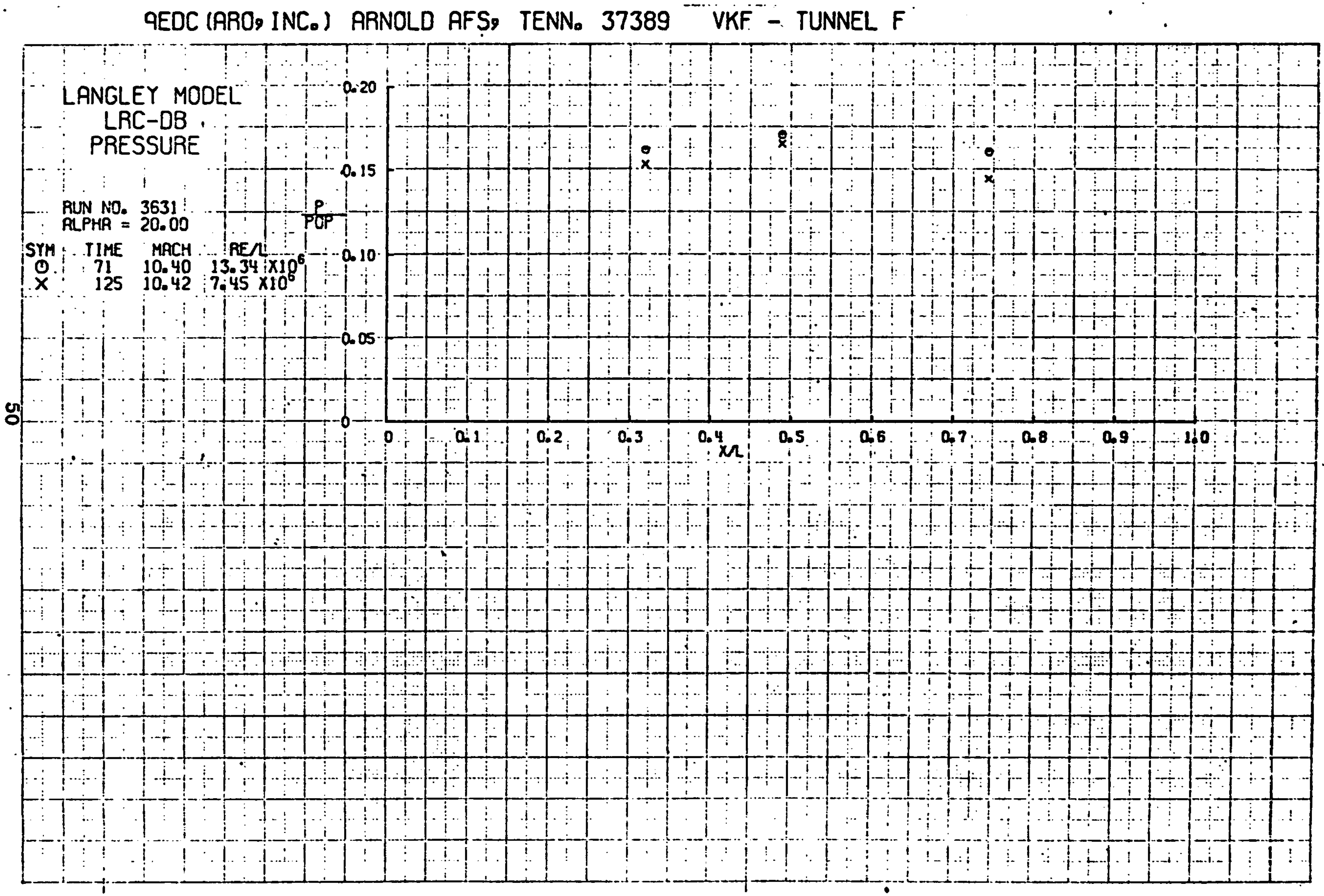
AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F



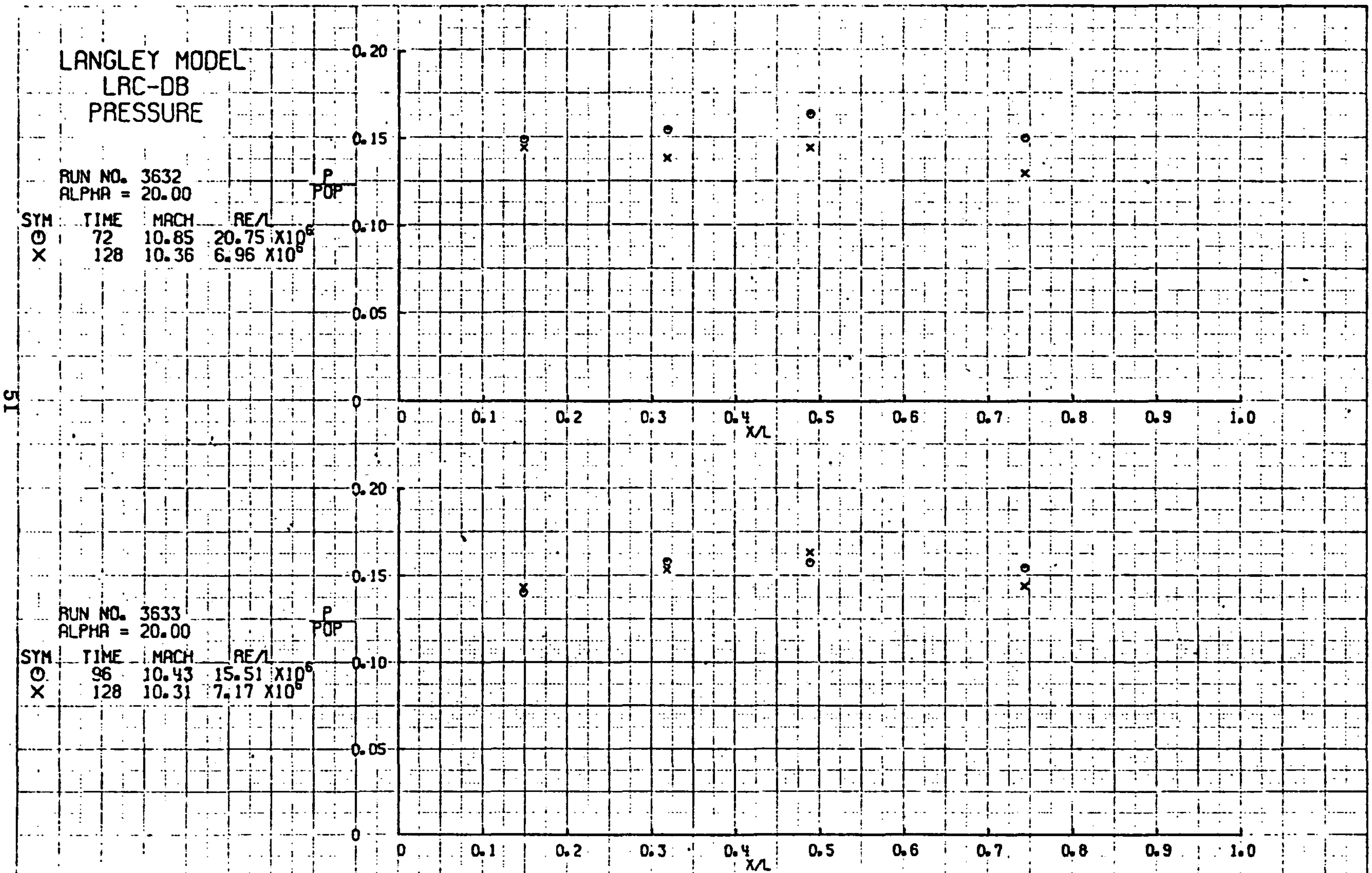


AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F
LANGLEY MODEL
LRC-SB
HEAT TRANSFER
RUN NO. 3646
ALPHA = 20.20
SYM TIME MACH RE/L
⊙ 72 10.58 18.33 X10^6
× 136 10.52 10.17 X10^6
H/HREF
0.40
0.30
0.20
0.10
0
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
X/L
RUN NO. 3647
ALPHA = 20.00
SYM TIME MACH RE/L
⊙ 80 10.31 18.60 X10^6
× 136 10.18 5.69 X10^6
H/HREF
X/L

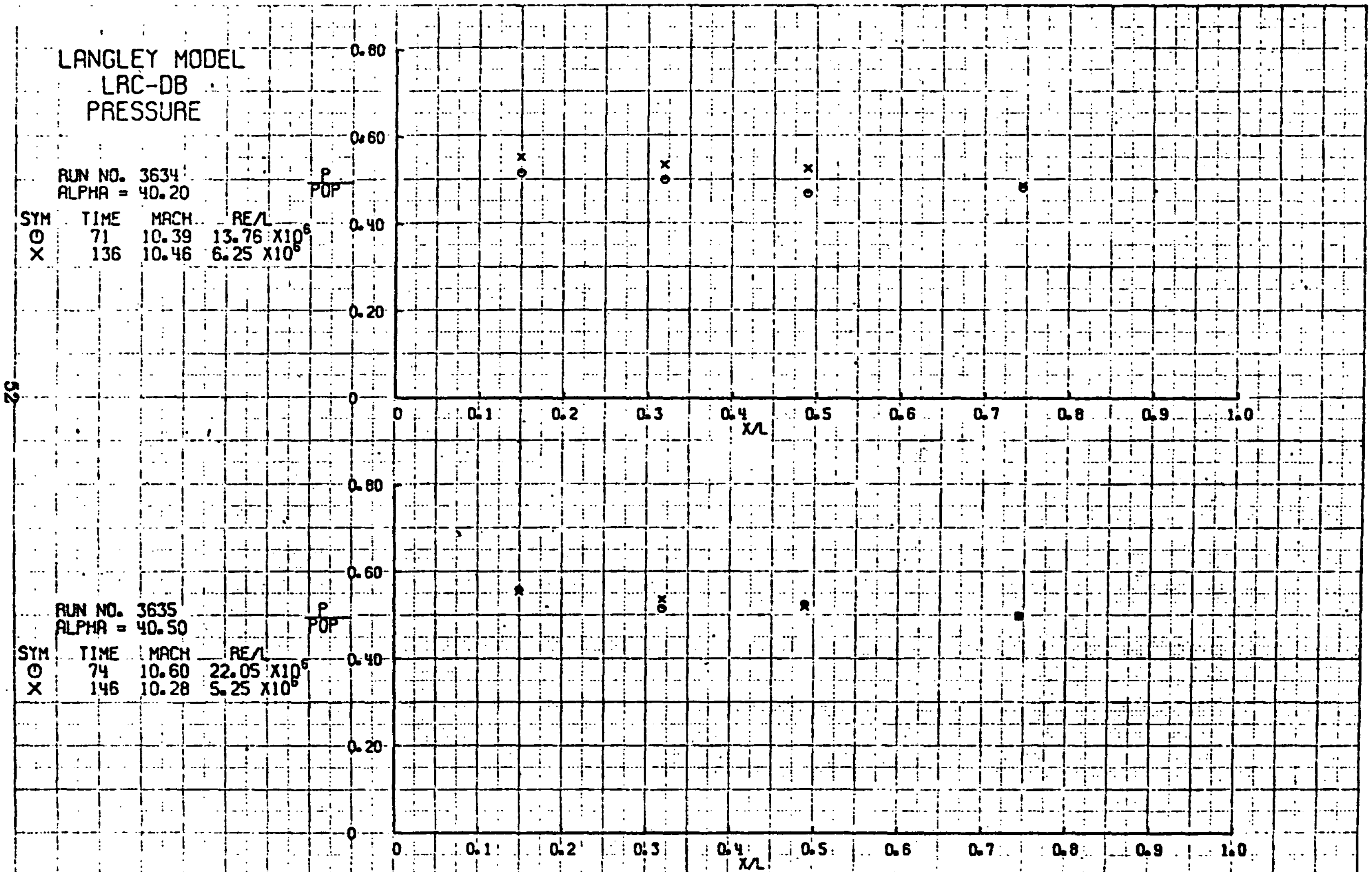

AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F
LANGLEY MODEL
LRC-SB
HEAT TRANSFER
RUN NO. 3648
ALPHA = 60.20
SYM TIME MACH RE/L
O 60 10.77 20.31 X10^6
X 136 10.68 10.22 X10^6
H/HREF
1.00
0.75
0.50
0.25
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
X/L
RUN NO. 3649
ALPHA = 60.50
SYM TIME MACH RE/L
O 80 10.54 16.91 X10^6
X 128 10.28 6.74 X10^6
H/HREF
1.00
0.75
0.50
0.25
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
X/L


AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F
LANGLEY MODEL
LRC-DB
PRESSURE
RUN NO. 3631
ALPHA = 20.00
SYM TIME MACH RE/L
⊙ 71 10.40 13.34 X10^6
X 125 10.42 7.45 X10^6
P/POP
0.20
0.15
0.10
0.05
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
X/L

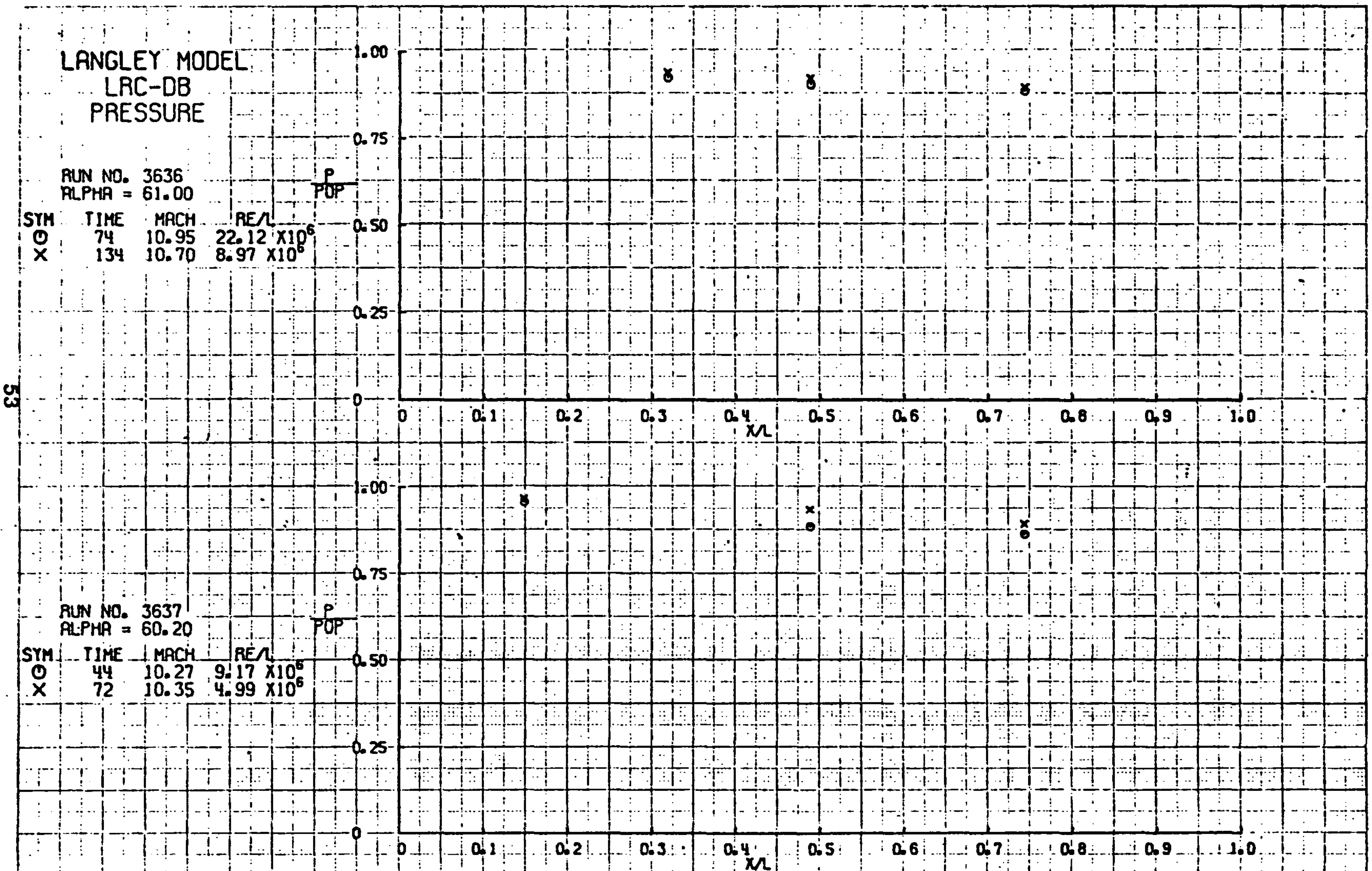
AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F



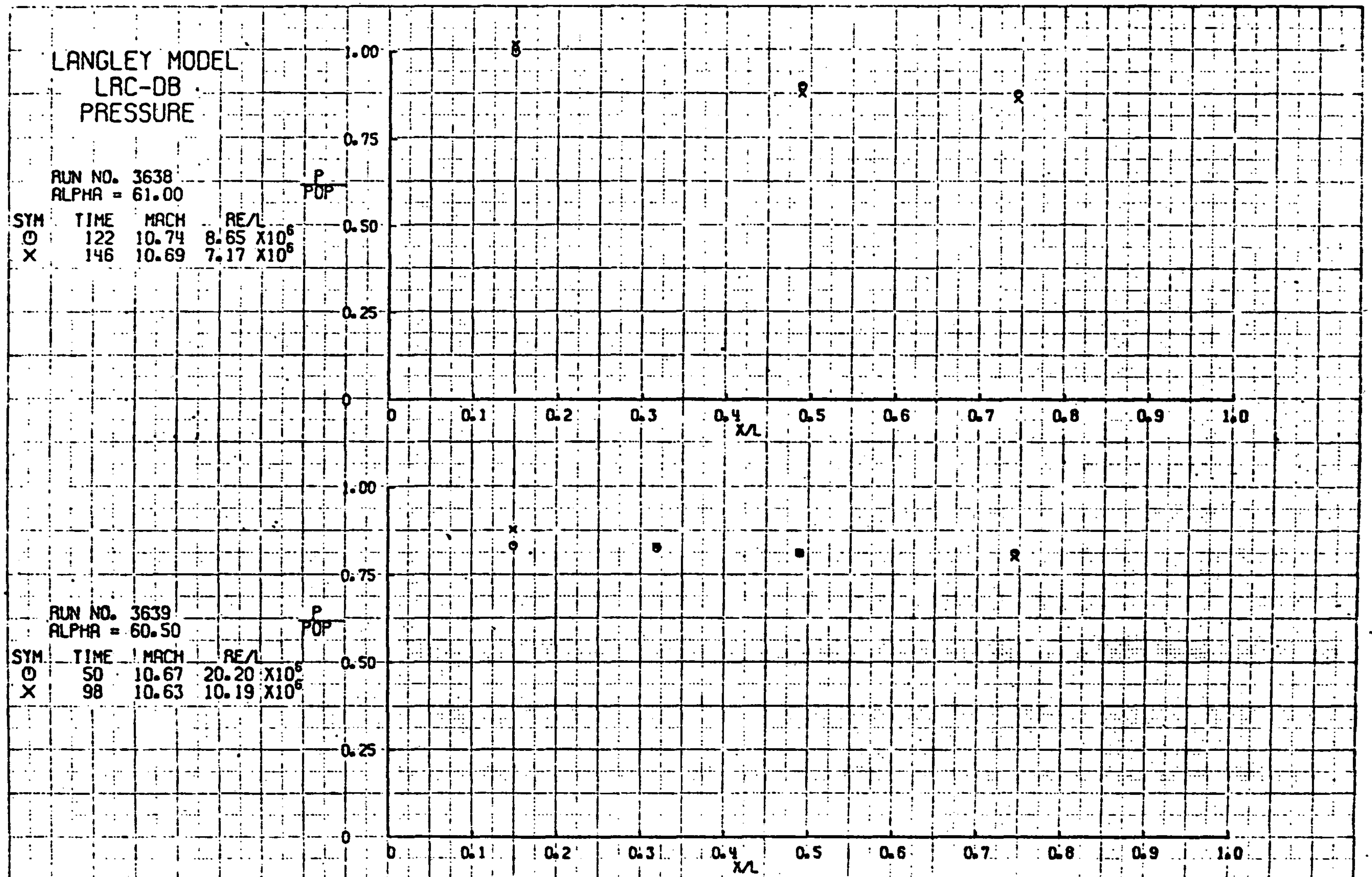
AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F



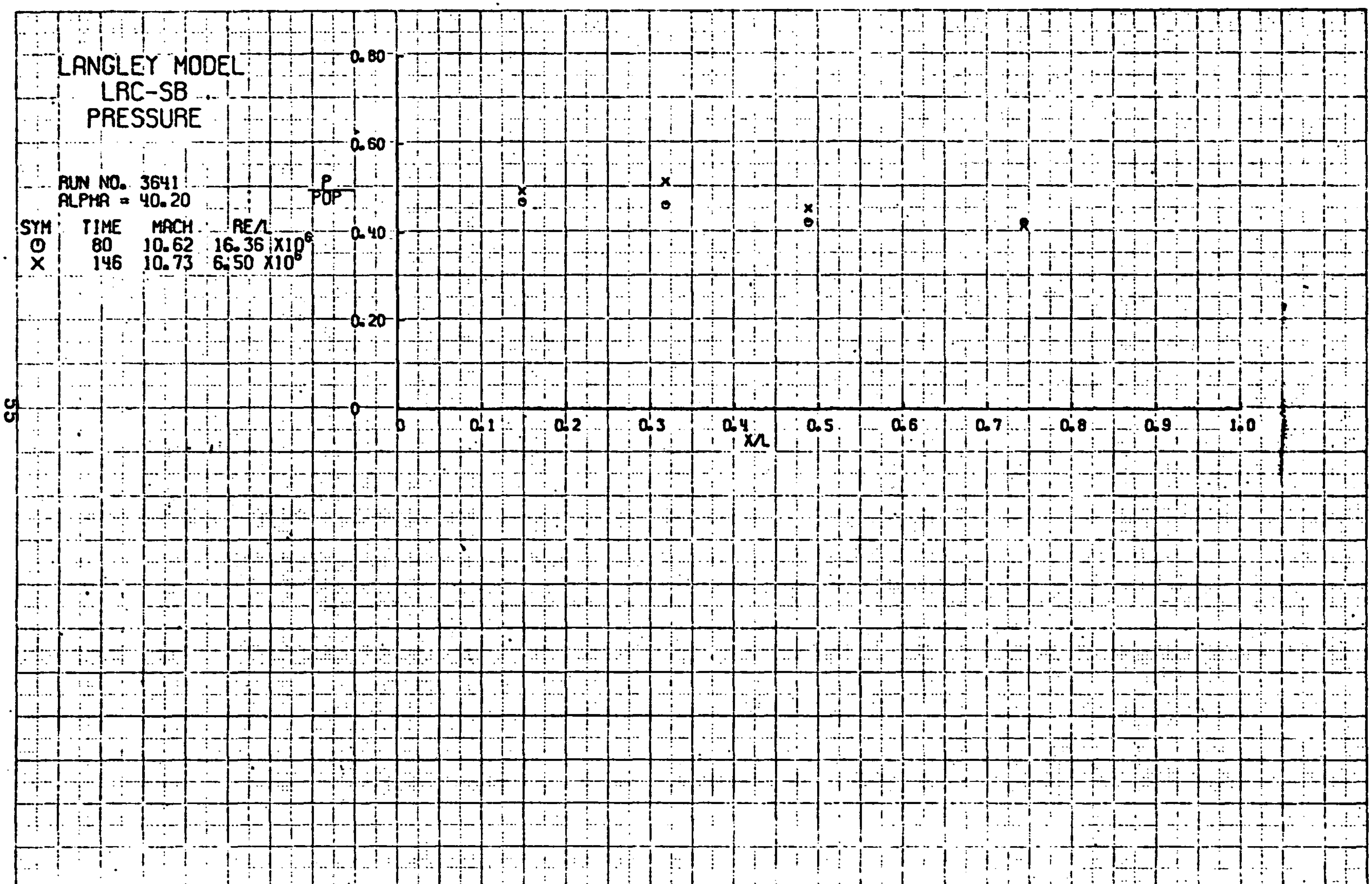
AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F



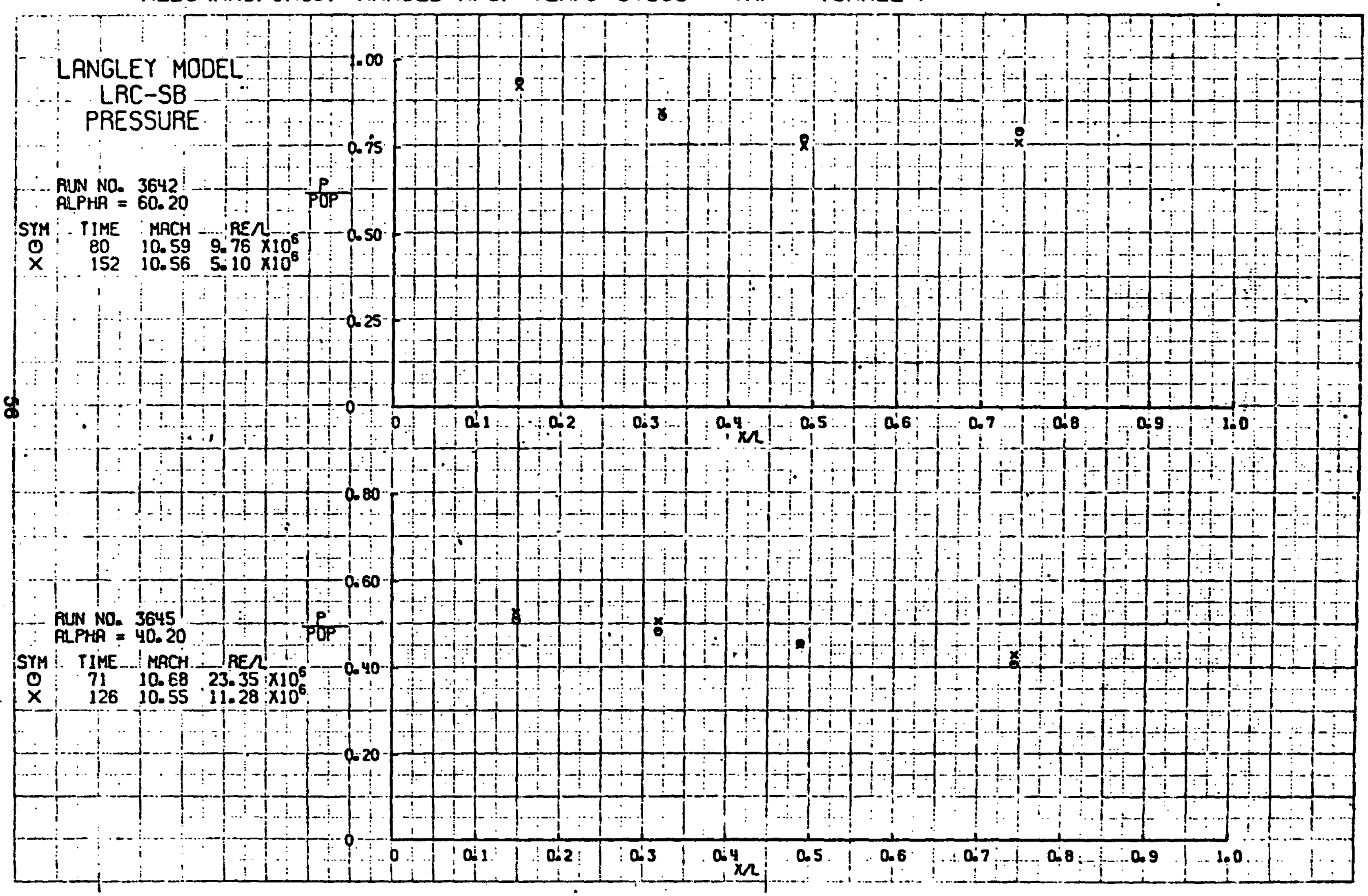
AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F



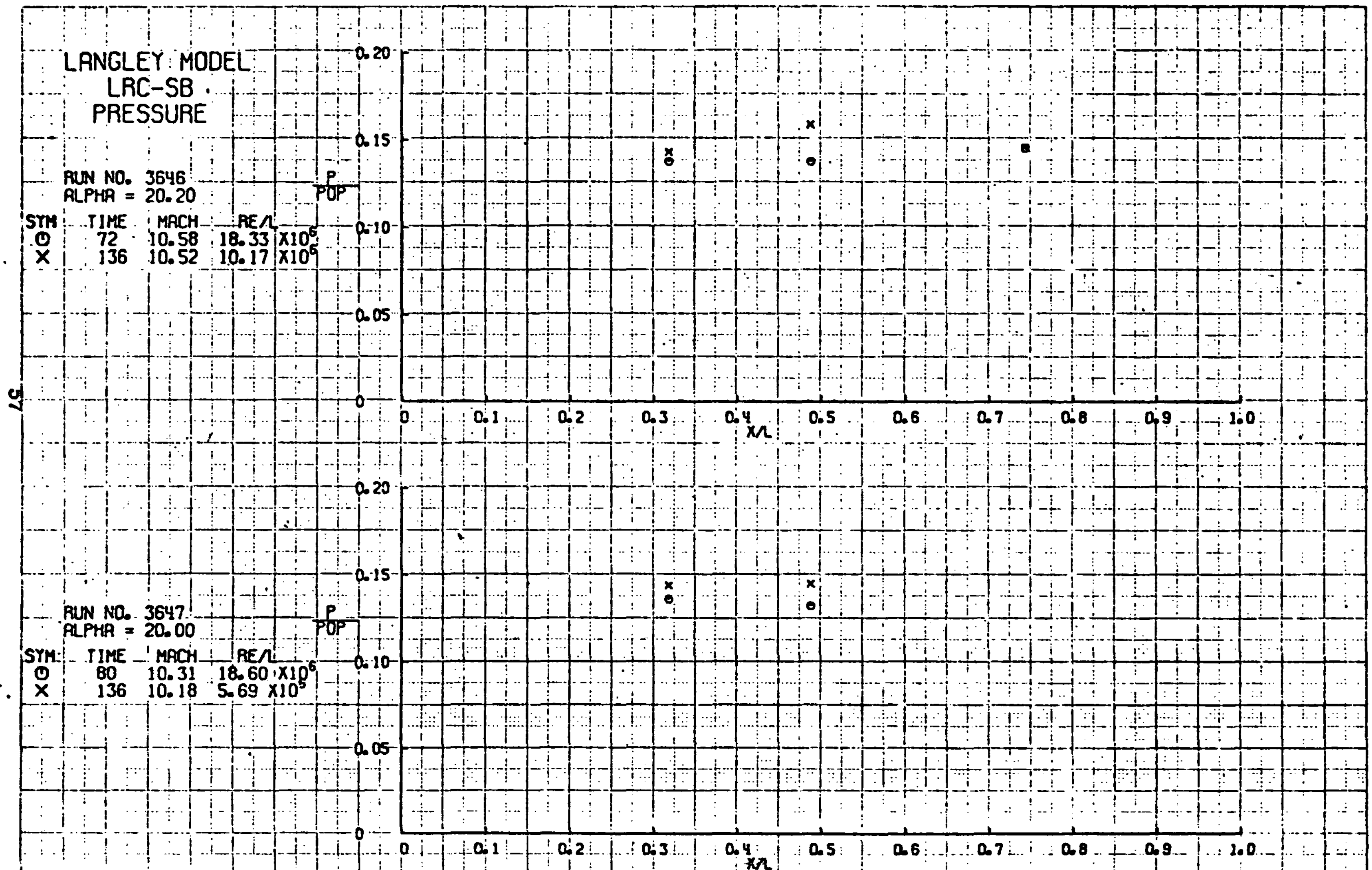
AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F



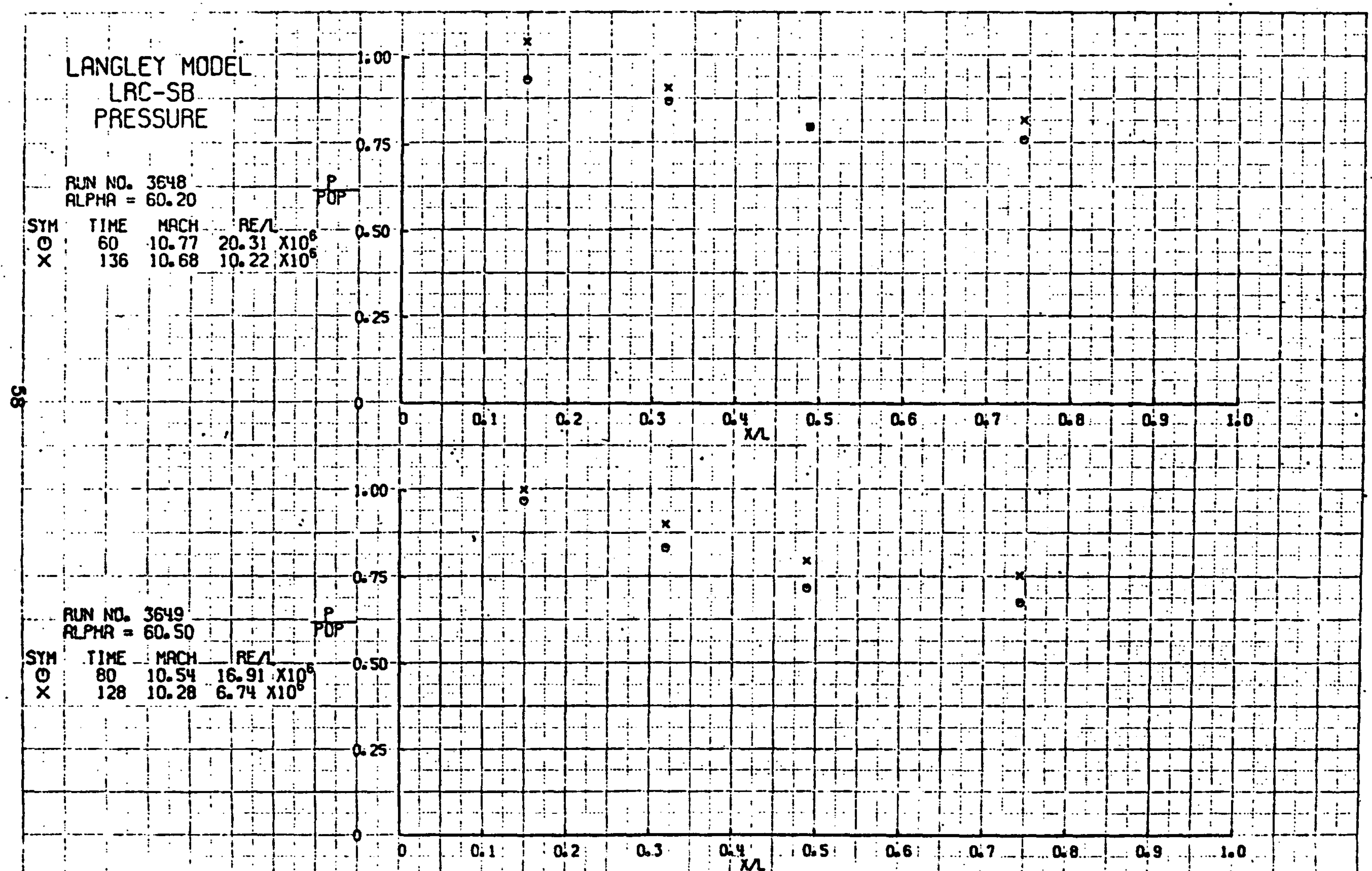
AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F



AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F



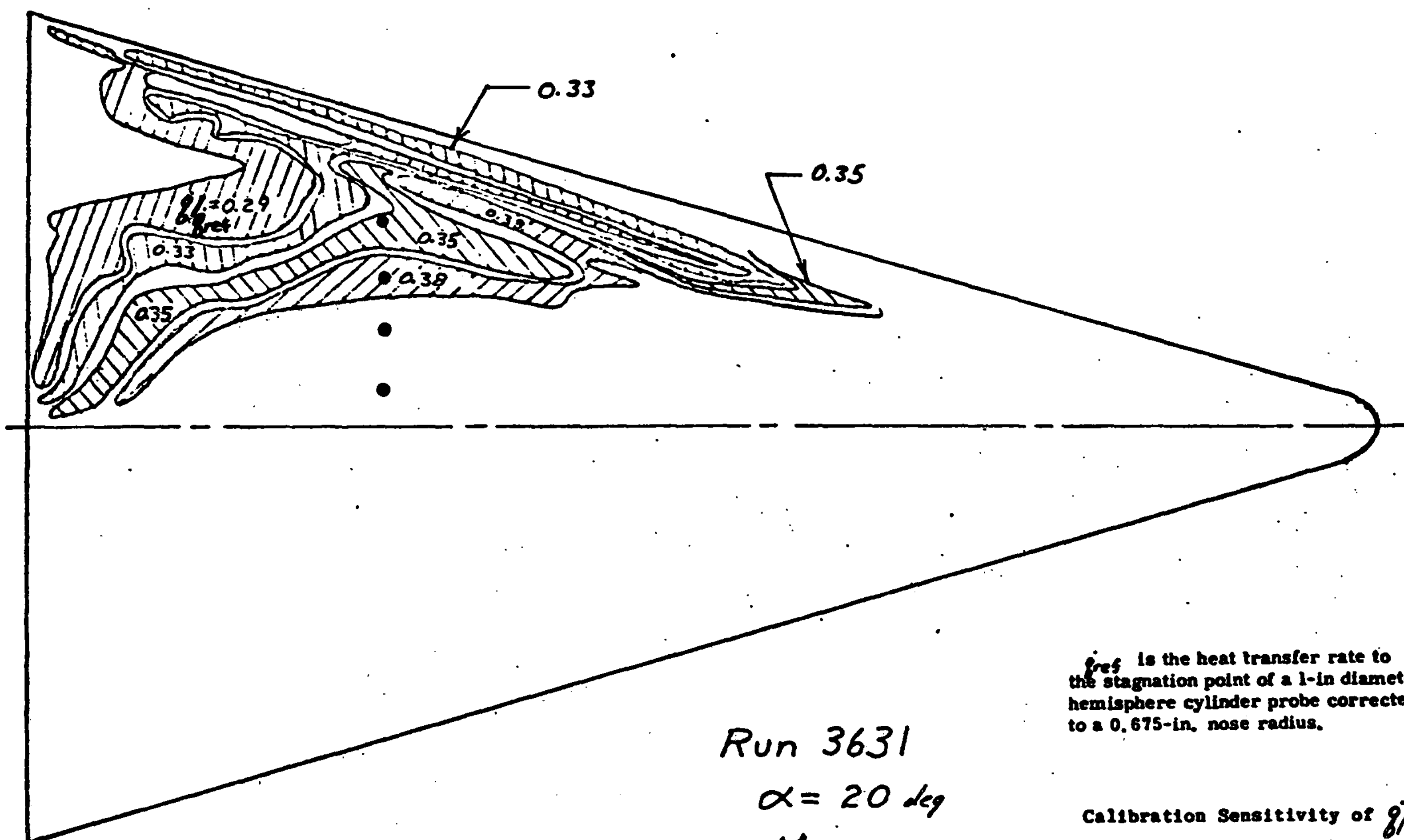
AEDC (ARO, INC.) ARNOLD AFS, TENN. 37389 VKF - TUNNEL F



APPENDIX III

SELECTED PLOTS OF HEAT-TRANSFER RESULTS USING THE PHOSPHOR PAINT TECHNIQUE

Note: These contours and model geometry are shown in the camera view.



$\dot{q}_{ref}$ is the heat transfer rate to the stagnation point of a 1-in diameter hemisphere cylinder probe corrected to a 0.675-in. nose radius.

Run 3631

$\alpha = 20$ deg

$M_\infty = 10.5$

$Re_{\infty,\ell} = 10.2 \times 10^6$

$t = 83$ msec

Calibration Sensitivity of $\dot{q}/\dot{q}_{ref}$ is 0.03

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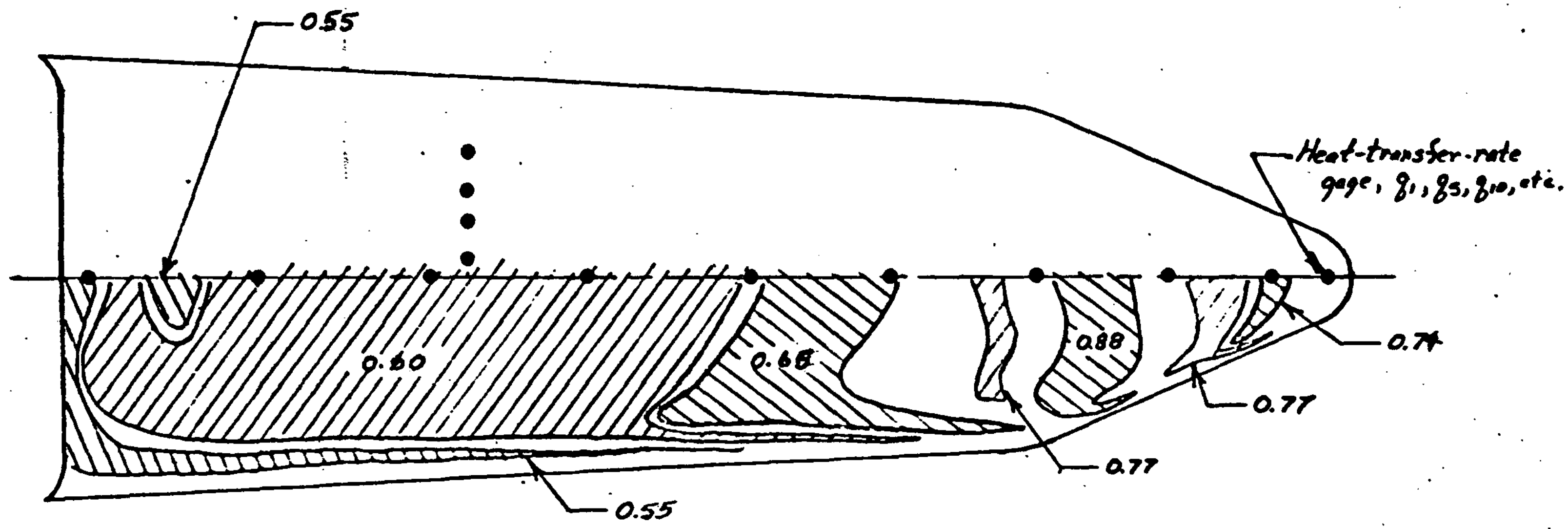
ARNOLD AFS, TENN. 37389

AUG 4 1971

Note: These contours and model geometry are shown in the camera view.



$\dot{q}_{ref}$ is the heat transfer rate to the stagnation point of a 1-in diameter hemisphere cylinder probe corrected to a 0.675-in nose radius.

Run 3641

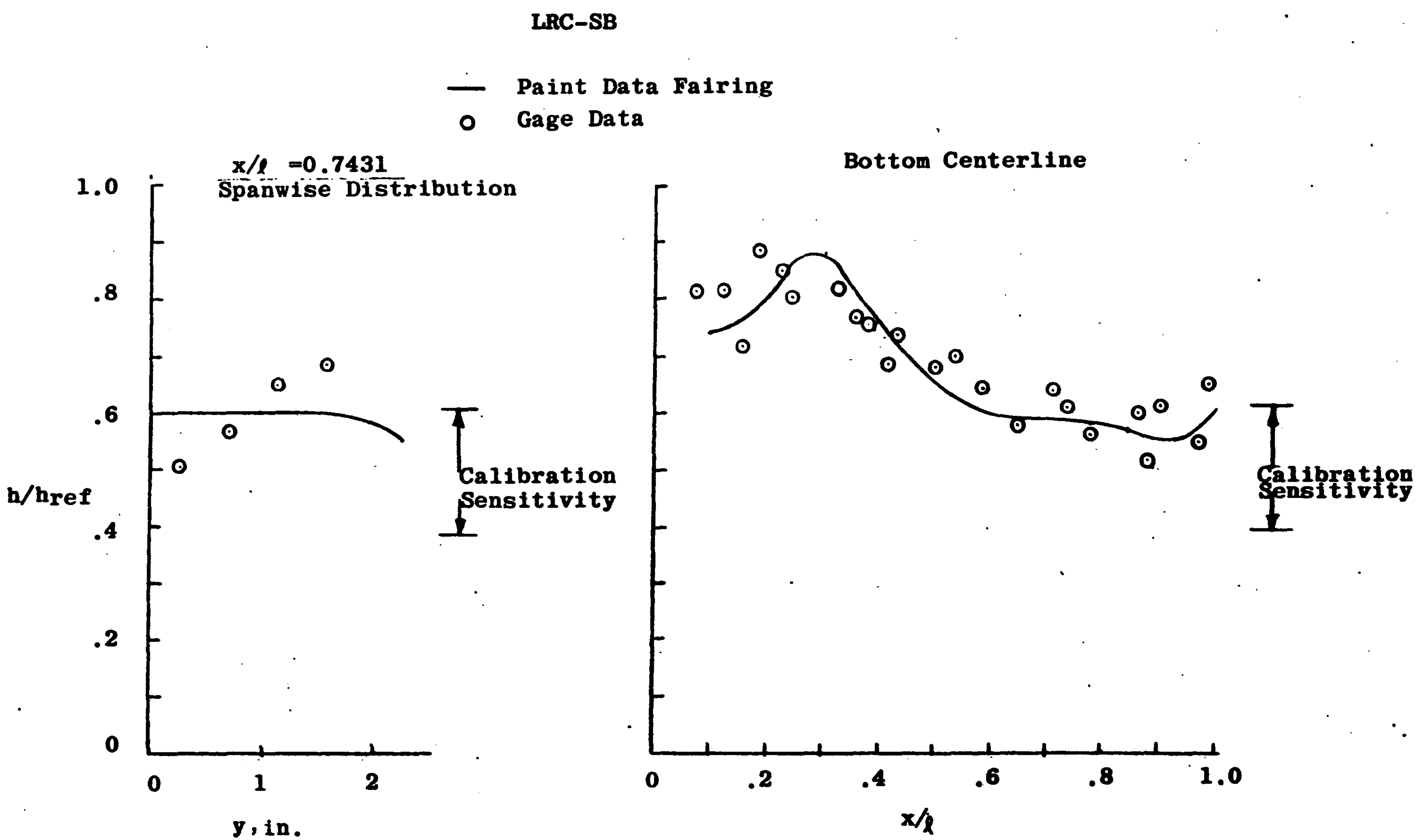
$\alpha = 40$ deg

$M_\infty = 10.6$

$Re_{\infty,\ell} = 16.4 \times 10^6$

$t = 80$ msec

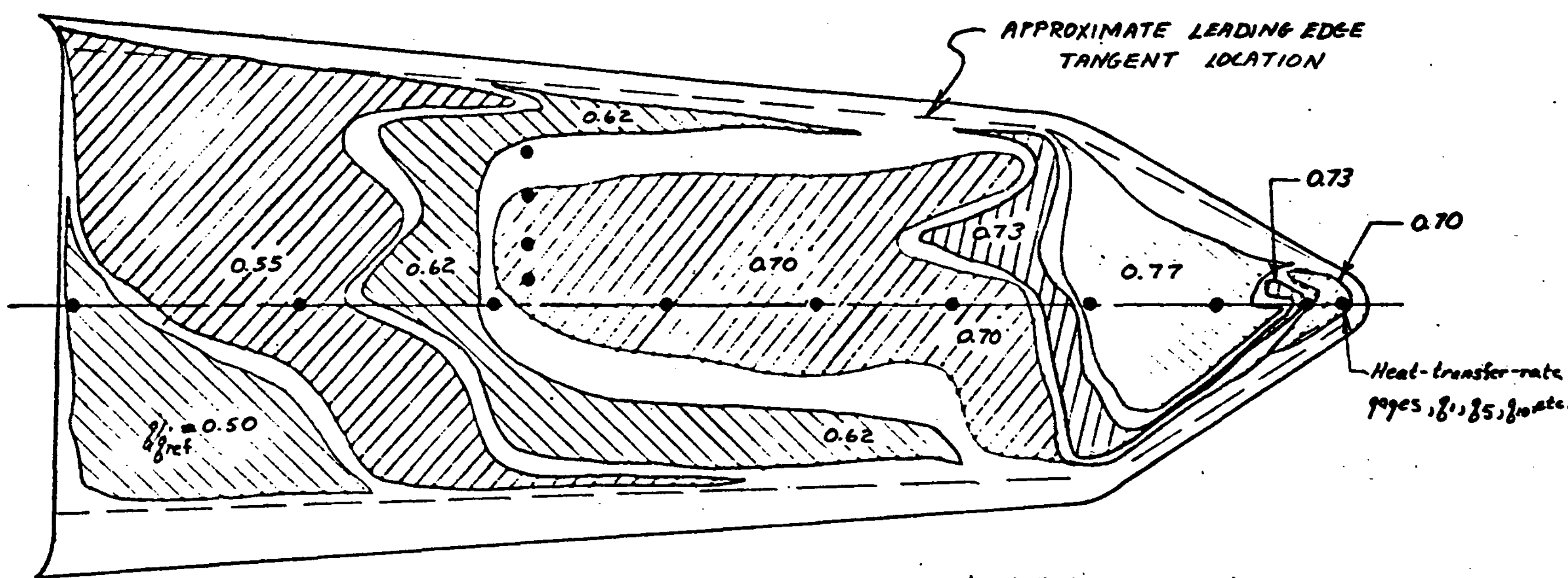
Calibration Sensitivity of $\dot{q}/\dot{q}_{ref}$ is $\pm 11\%$



LRC-SB, Run 3641, α = 40 deg, $Re_{\infty,\ell}$ = 16.4x10^6, M_∞ = 10.6

The calibration sensitivity is the uncertainty in the fairing of the paint data.

Note: These contours and model geometry are shown in the camera view.



$\dot{q}_{ref}$ is the heat transfer rate to the stagnation point of a 1-in diamerer hemisphere cylinder probe corrected to a 0.675-in. n ose radius.

Run 3645

$\alpha = 40$ deg

$M_\infty = 10.6$

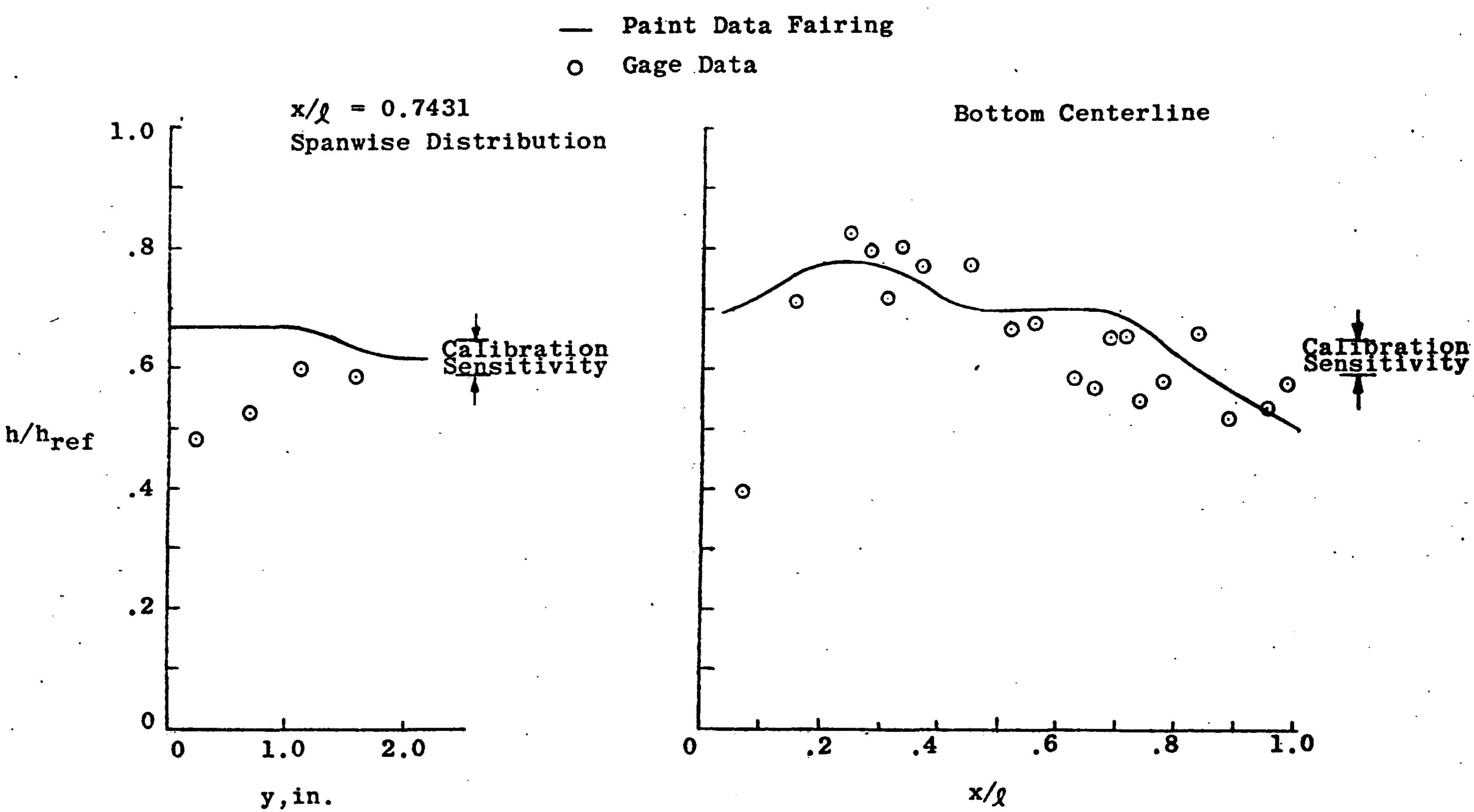
$Re_{\infty,\ell} = 12.8 \times 10^6$

$t = 116$ msec

Calibration Sensitivity of $\dot{q}/\dot{q}_{ref}$ is 0.03

AUG 4 1971

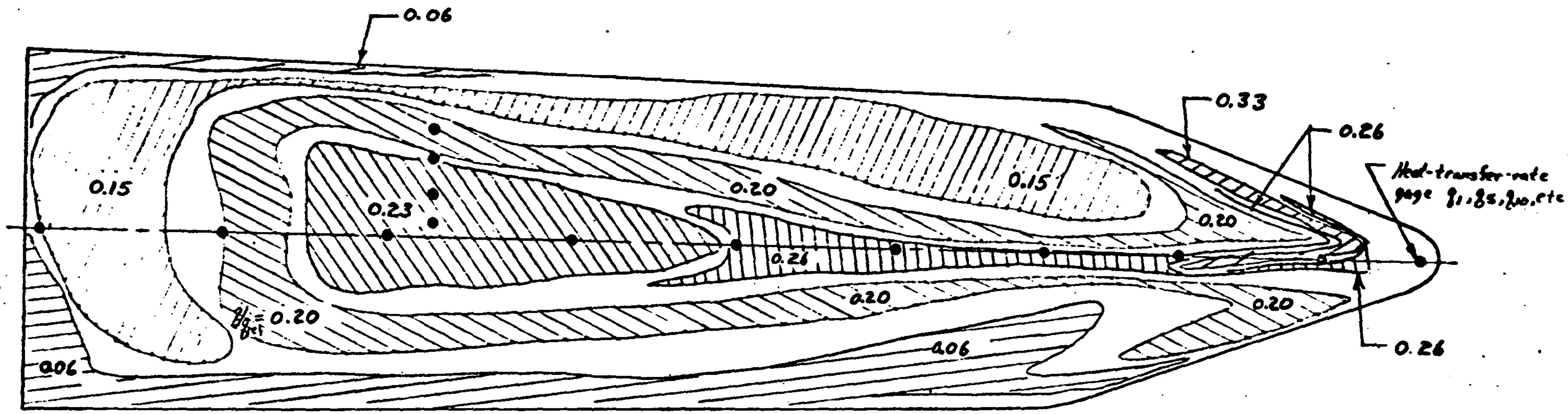
ARNOLD AFS, TENN. 37389



LRC-SB, Run 3645, α = 40 deg, $Re_{\infty,\ell} = 12.8\text{x}10^6$, M_∞ = 10.6

The calibration sensitivity is the uncertainty in the fairing of the paint data.

Note: These contours and model geometry are shown in the camera view.



Run 3647

$\alpha = 20$ deg

$M_\infty = 10.1$

$Re_{\infty,\ell} = 7.6 \times 10^6$

$t = 116$ msec

$\dot{q}_{ref}$ is the heat transfer rate to the stagnation point of a 1-in diameter hemisphere cylinder probe corrected to a 0.675-in. nose radius.

Calibration Sensitivity of $\dot{q}/\dot{q}_{ref}$ is 0.03

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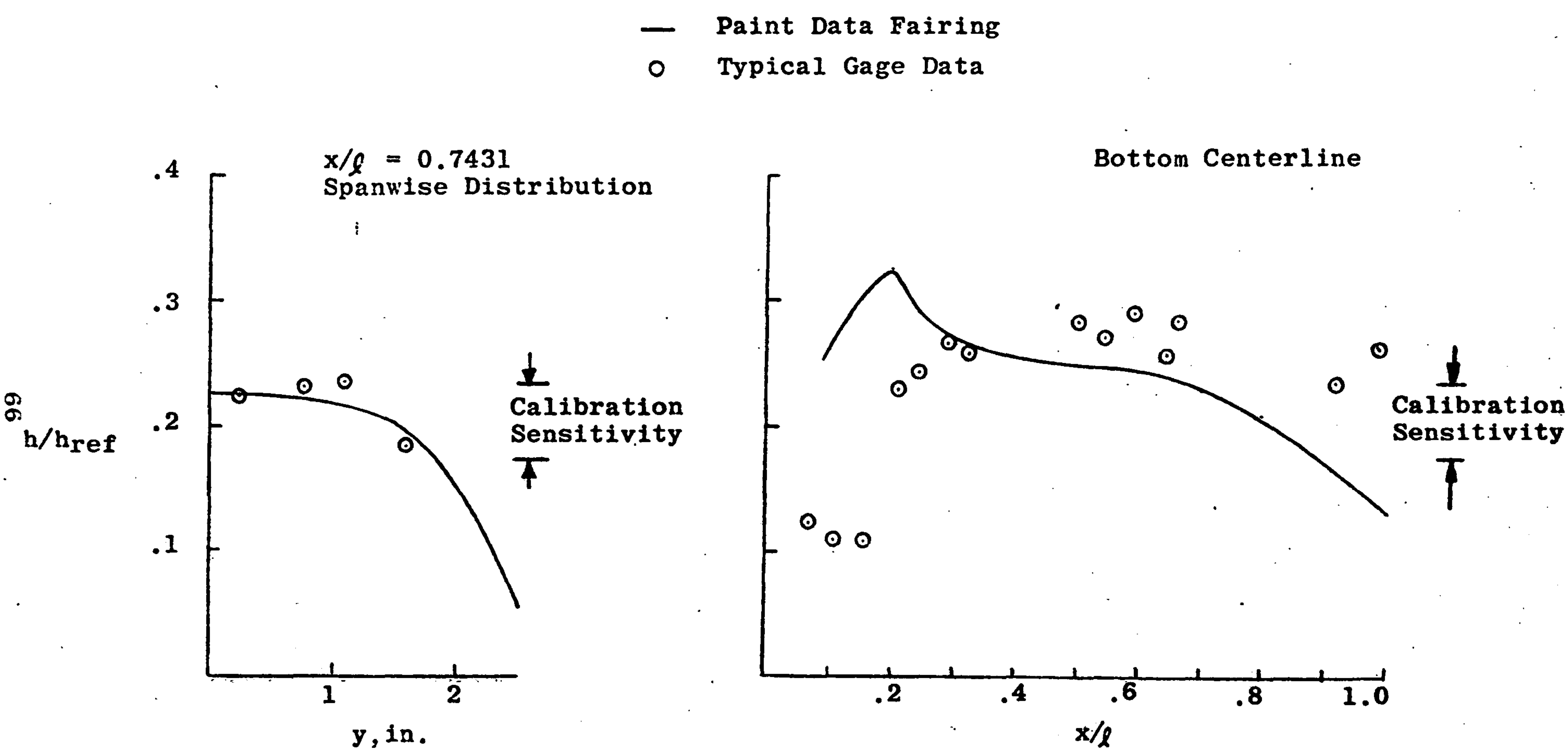
ARNOLD AFS, TENN 37389

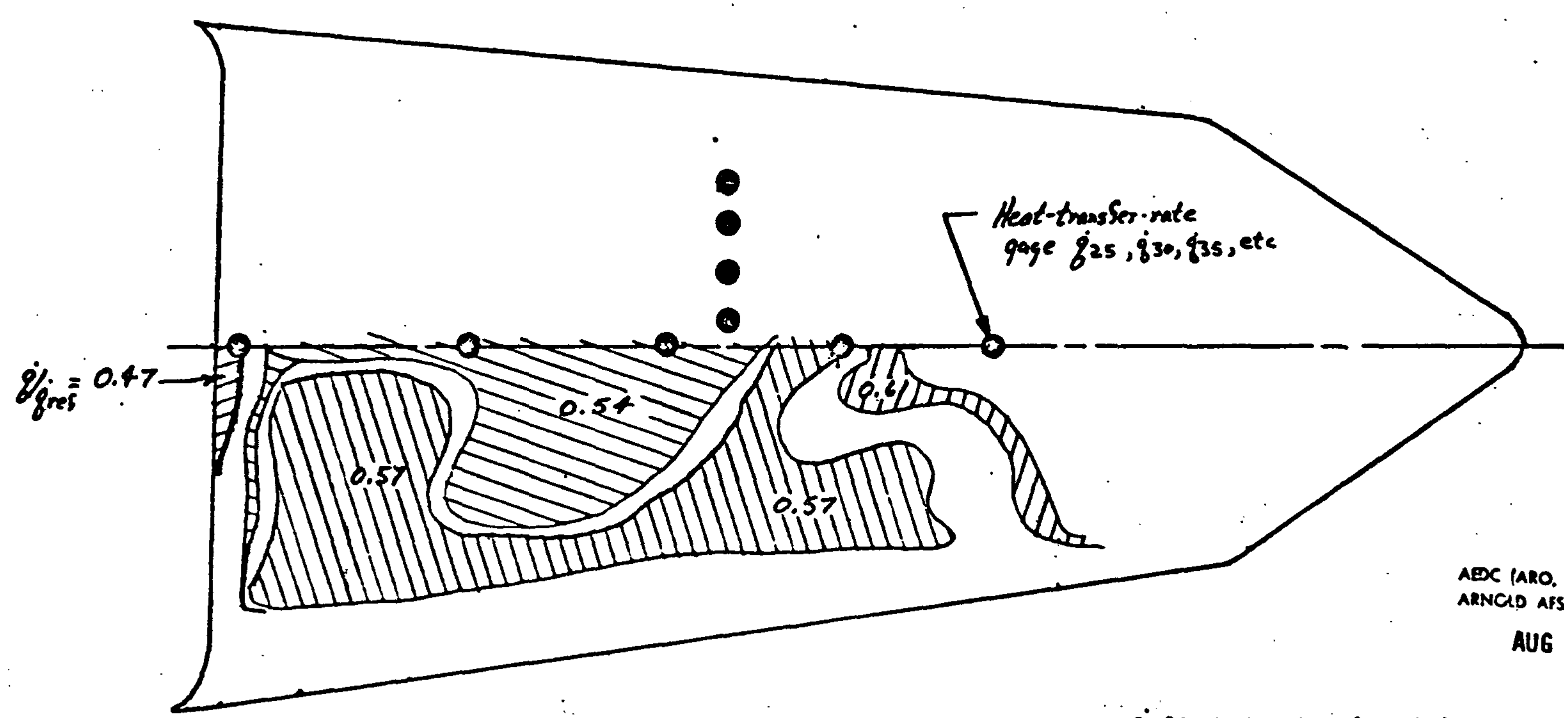
AUG 4 1971



LRC-SB, Run 3647, $\alpha = 20$ deg, $Re_{\infty,\ell} = 7.6 \times 10^6$, $M_\infty = 10.1$

The calibration sensitivity is the uncertainty in the fairing of the paint data.

Note: These contours and model geometry are shown in the camera view.



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AUG 4 1971

Run 3648

$\alpha = 60$ deg

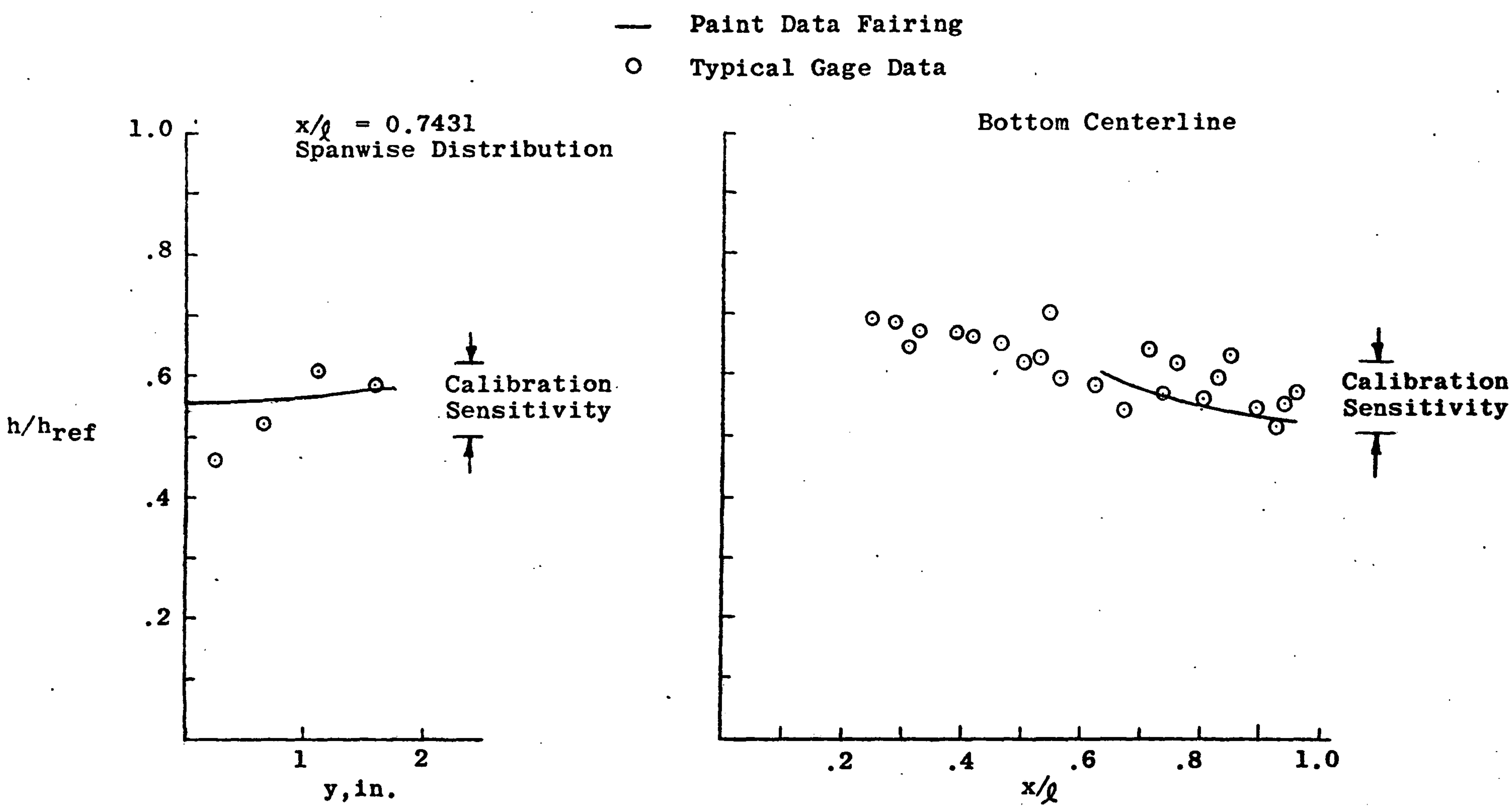
$M_\infty = 10.7$

$Re_{\infty,\ell} = 11 \times 10^6$

$t = 124$ msec

$\dot{q}_{ref}$ is the heat transfer rate to the stagnation point of a 1-in diameter hemisphere cylinder probe corrected to a 0.675-in. nose radius.

Calibration Sensitivity of $\dot{q}/\dot{q}_{ref}$ is 0.06



LRC-SB, Run 3648, α = 60 deg, $Re_{\infty,\ell} = 11 \times 10^6$, M_∞ = 10.7

The calibration sensitivity is the uncertainty in the fairing of the paint data.