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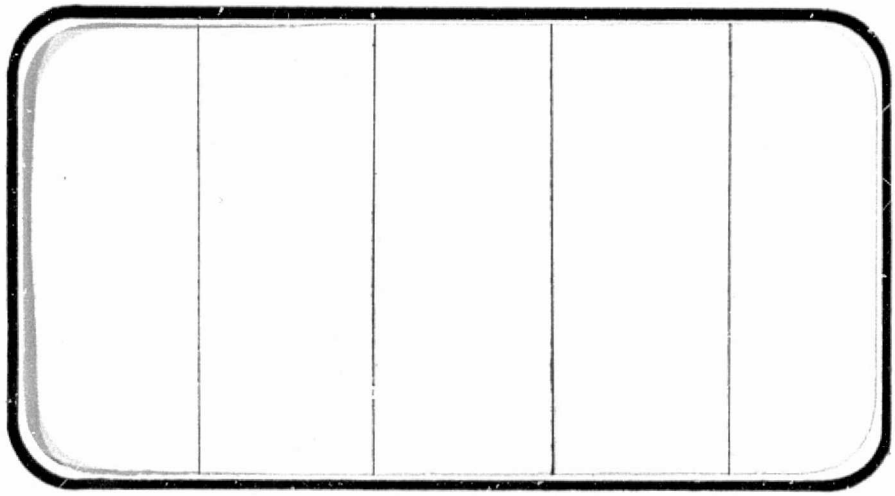

SPACE SHUTTLE

AEROTHERMODYNAMIC DATA REPORT

JOHNSON SPACE CENTER

HOUSTON, TEXAS

DATA MANagement services

SPACE DIVISION CHRYSLER CORPORATION

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RESULTS OF TESTS OF A ROCKWELL INTERNATIONAL SPACE SHUTTLE ORBITER (-139 CONFIGURATION) 0.0175-SCALE MODEL (NO. 29-0) IN AEDC TUNNEL F TO DETERMINE HYPERSONIC HEATING EFFECTS (OH11)

By

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Prepared under NASA Contract Number NAS9-13247

By

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for

Engineering Analysis Division

Johnson Space Center
National Aeronautics and Space Administration
Houston, Texas

WIND TUNNEL TEST SPECIFICS:

Test Number	AEDC F VA 354
NASA Series Number:	OH11
Model Number:	29-0
Test Dates:	24 October through 2 November, 1973
Occupancy Hours:	37

FACILITY COORDINATOR:

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ABSTRACT

This report presents the results from wind tunnel tests to determine hypersonic aerodynamic heating rates on a NASA/Rockwell Space Shuttle Orbiter.

The objectives of this test were to determine Mach number effects, if any, and to obtain overall heating rate data at high Mach numbers from 10.5 to 16. The model used was a 0.0175-scale model built to Rockwell Orbiter lines VL70-000139. The model identity number is 29-0. These tests, designated OH11, were conducted in the AEDC Tunnel F.

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INTRODUCTION

This report presents the test description and data obtained from wind tunnel tests conducted to determine hypersonic aerodynamic heating rates on a NASA/Rockwell Space Shuttle Orbiter configuration. Mach number effects were of special interest. The NASA/Rockwell number for this test was OH11 and the facility project number was VA 354. These tests were conducted in Tunnel F of the von Karman Facility at the Arnold Engineering Development Center (AEDC) from October 24 through November 2, 1973.

The model used was an 0.0175-scale Orbiter model based on Rockwell lines VL70-000139. The number assigned to this model was 29-0.

NOMENCLATURE

Symbol	Computer Printout	Definition
B/2		wing semispan, 8.2 in.
h	H	heat-transfer coefficient determined at a particular gauge location, $Q/(T_{aw} - T_w)$
h_{ref}	HREF	reference heat-transfer coefficient based on test section stagnation conditions on a 0.21-in. radius hemisphere, $QO/(T_o - T_w)$
H_o	HO	stagnation enthalpy, Btu/lbm
h_w		enthalpy at model wall temperature, 134.2 Btu/lbm
	L	model length, 23.226 in.
M_∞	M-INF	free-stream Mach number
p_o	PO	tunnel reservoir pressure, psia
p_o'	POP	stagnation pressure measured behind the free-stream normal shock, psia
p_∞	P-INF	free-stream static pressure, psia
$\dot{q}$	Q	heat-transfer rate, Btu/ft^2-sec
q_∞	Q-INF	free-stream dynamic pressure, psia
$\dot{q}_o$	QO or Q-O	stagnation heat-transfer rate on a 0.21-in. radius hemisphere, Btu/ft^2-sec
	Q1-Q89	heat-transfer gauge designations on model
$\dot{q}_{ref}$	QREF	reference heat-transfer rate (same as $\dot{q}_o$), Btu/ft^2-sec
Re_∞/ft	RE/FT	Reynolds number based on free-stream conditions and 1-ft length
	RE-L	Reynolds number based on free-stream conditions and the model length of 23.226 in.

NOMENCLATURE (Concluded)

Symbol	Computer Printout	Definition
ρ_∞	RHO-INF	free-stream density, lbm/ft^3
	STO or ST-O	Stanton number for measured hemisphere stagnation heat-transfer rate, $QO/[\rho_\infty (U_\infty) (H_o - h_w)]$
T_o	TO	reservoir temperature, °R
T_∞	T-INF	free-stream static temperature, °R
T_{aw}		adiabatic wall temperature, $(T_{aw} = \eta T_o)$
T_w		model wall temperature, ≃ 540°R
U_∞	U-INF	free-stream velocity, ft/sec
X		axial distance along the model measured from the nose, in.
X'		axial distance along the model measured from the leading edge of the wing, in.
α		angle of attack, deg
δ		local flow deflection angle, $\alpha + \theta$, deg
η		enthalpy recovery factor, $\eta = 0.867 + 0.133 \sin^{1.55}\delta$
θ		local model surface angle relative to centerline, deg (see Table III)
ϕ		angle between a guage and vertical plane through the centerline of the model, deg

NOTE: Reference stagnation conditions ($\dot{q}_{ref}$ and $\dot{q}_o$) were measured on a 0.50-in. radius hemisphere and reference to a 0.21-in. radius by multiplying by $\sqrt{\frac{0.50}{0.21}}$

REMARKS

Wind tunnel tests were conducted on a 0.0175-scale model of the Rockwell International Space Shuttle Orbiter to determine aerodynamic heating rates on the vehicle. Data from these tests were compared with data from other tunnel tests. Since tunnel F has a high Mach number capability, it was of special interest to use these data for the determination of Mach number effects on heating rates.

Data were recorded using resistance thermometer slug calorimeters and co-axial surface thermocouples. Details on this instrumentation are given in the Instrumentation Section.

Model angles of attack were varied from 25° to 45° with 0° sideslip. Nominal Mach number range was from 10.5 to 16 and Reynolds number from 1.0 to 10.0 x 10^6/ft. Tunnel F operates using a constant volume reservoir with set initial charge densities. Reservoir conditions decay with time during each run, resulting in varying Mach and Reynolds numbers over a run. Initial reservoir conditions are set so that the sweep in values of the tunnel parameters will include the requested Mach/Reynolds number combination. The Run Schedule shows the nominal conditions and the Reynolds number range in which tabulated data were collected.

This test is also documented by AEDC report number AEDC-DR-74-16 (Reference 2) by A. H. Boudreau (ARO, Inc.). Much of the information contained in the following text was obtained from that source. In addition, the AEDC report contains plots of the data with some comparisons made with theory and with data obtained during another test (in tunnel B, also at AEDC).

CONFIGURATIONS INVESTIGATED

The model tested was an 0.0175-scale model of the Space Shuttle Orbiter built to Rockwell lines VL70-000139 (designated model number 29-0). This model was fabricated from 15-5 PH stainless steel. The wing and vertical tail were each built as one solid piece. Exterior contour lines followed the control surfaces in a undeflected position.

Since the model contained no removable, deflectable, or interchangeable parts, configuration variations could not be tested. Therefore, individual components were not referred to. The run schedule merely lists the model by its number, 29-0. However, for information, the following nomenclature symbols had been assigned to the components of the configuration tested.

B_{17}	Fuselage body
C_7	Canopy
F_5	Body flap
M_4	OMS pods
V_7	Vertical tail
W_{107}	Wing

Component geometry is detailed in Table III.

INSTRUMENTATION

Sixty gauges of two types were used to measure heating rates on the model surface. Locations of these gauges are shown in Figure 2a. The two types of gauges were resistance thermometer slug calorimeters (RT) and co-axial surface thermometers (co-ax).

Fourteen RT gauges were installed on model leeward surfaces. The RT gauges were built 0.250-in. diameter to be used where the heat transfer rate range was expected to be 0.05 to 50 Btu/ft^2-sec. These gauges used a thin-film platinum resistance thermometer to sense the back surface temperature of an aluminum disc, the front of which was flush to the model surface. The calorimeters were optimized to measure a given range of heat flux by an appropriate selection of the aluminum disc thickness. Unfortunately, since these discs were made flat across their surface, a small deviation from model surface contour resulted across the diameter of the gauges when they were installed.

Forty-six 0.125-in. diameter co-ax thermocouple gauges were also used on this model. The surface contour of these gauges matched exactly that of the model since the thermocouple sensing surface could be worked to the model shape and still function properly. These gauges were comprised of an electrically insulated chromel wire enclosed in a constantan cylindrical jacket. A thin-film junction was made at the model surface by lightly polishing with fine sandpaper. They had a higher operating range (5 to 500 Btu/ft^2-sec.) than the RT gauges and were placed in areas such as the lower surface where higher heating rates were expected. Because

they matched the model surface contour so well, they did not cause early boundary layer transition with its subsequent higher heating rate.

Tunnel conditions were monitored using two 1-inch diameter hemisphere-cylinders instrumented with slug calorimeters. The hemisphere-cylinders were installed 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. Test section pitot pressures as well as ARC chamber reservoir pressures were measured with semiconductor strain-gauge transducers.

TEST FACILITY DESCRIPTION

The Hypervelocity Wind Tunnel (F) is an arc-driven wind tunnel of the hotshot type and capable of providing Mach numbers from about 7.5 to 20 over a unit Reynolds number range from 0.05×10^6 to 75×10^6 per foot. Test sections of 108-in. diameter (M_∞ = 14 to 20) and 54-in. diameter (M_∞ = 10 to 17) are available using a 4-deg., half-angle conical nozzle. The range of Mach numbers at a particular test station in the conical nozzle is obtained by using various throat diameters. The M_∞ = 8 contoured nozzled has a 25-in. exit diameter which connects to the 54-in. diameter test section and provides a free-jet exhaust. The test gas can be either air or nitrogen. The test gas is confined in either a 2.5 cu. ft. or a 4.0 cu. ft. arc chamber where it is heated and compressed by an electric arc discharge. The increase in pressure results in a diaphram rupture with the subsequent flow expansion through the nozzle. Test times are typically from 50 to 200 msec. Shadowgraphs and Schlieren coverage are available at both test sections.

This test was conducted in the 54-in. diameter test section of the conical nozzle for M_∞ = 10.1-16.2. Nitrogen was the test gas. The 2.5 and 4.0 ft^3 arc chambers were used, and useful test times up to approximately 100 msec. were obtained.

TEST PROCEDURE

Variables for this test were Mach number, Reynolds number, and angle of attack. Prior to making a run, these variables were set with the proper facility nozzle, throat diameter, arc chamber pressure and sting angle.

The tunnel was fired with an electric arc discharge. The nitrogen within the arc chamber was heated by this discharge and the resultant increase in pressure ruptured a diaphram,which released the gas into the nozzle.

As gas left the arc chamber, reservoir pressure declined with a resulting decay of tunnel parameters. Gauge output was scanned with a digital system. Oscillographs were also used to record the output of each channel as a back-up and for a quick look at results. As reservoir pressure declined, timewise scans of data resulted in variations of Reynolds number. Thus, a single run contained data for a range of Reynolds numbers.

DATA REDUCTION

Output of the heat transfer gauges was converted by AEDC from direct functions of temperature vs. time to Q/Q_{ref} and H/H_{ref} vs. time. Tabulations of these values for each run are presented in the back of this report.

Statements made below on data uncertainty are based on information presented in the AEDC data report for this test, AEDC-DR-74-16 by A. H. Boudreau (ARO, Inc.).

The determination of the free-stream and reservoir conditions was based on the measured balues $p_{0}^{\prime}$, p_0, and $\dot{q}_0$. Uncertainties for these parameters are ±4, ±5, and ±5 percent, respectively, based on calibration and data acquisition accuracy as well as uncertainties associated with testing under dynamic conditions. Using the Taylor series method of error propagation resulted in the following uncertainties in tunnel conditions:

Parameter	Uncertainty (percent)
M_∞	±1.5
Re_∞/ft	±10
T_∞	±6
ρ_∞	±6
T_0	±4
H_0	±5

Uncertainties in heat transfer rates ($\dot{q}$) were a function of flow condition, angle of attack, and location on the model. Low heat transfer rates

sometimes approached the limits of the instrumentation, which resulted in higher data uncertainties. Bottom centerline gauges 34, 38, 41, 44, 47, and 50 (figure 2-a) had low outputs, so pre-amp units were used to boost the signal to noise ratio. Separate uncertainty values are provided for these gauges. The table below lists the uncertainties in the heat transfer rates by their location on the model.

Location of Model	Range (Btu/ft^2-sec)	Uncertainty (percent)
Bottom centerline (w/o pre-amps)	$\dot{q} > 5$	$\pm$ 9
	$\dot{q} < 5$	$\pm$ 15
Bottom Centerline (w/ pre-amps)	$\dot{q} > 1$	$\pm$ 9
Bottom of Wing	$\dot{q} > 5$	$\pm$ 9
	$\dot{q} < 5$	$\pm$ 15
Model Upper Surface	$\dot{q} > 0.2$	$\pm$ 9
	$\dot{q} < 0.2$	$\pm$ 15

The uncertainties associated with model data non-dimensionalized with free-stream cor ‘itions (h) or stagnation conditions and free stream (h_{ref}) are based on the uncertainties of tunnel parameters and $\dot{q}$'s given above. These uncertainties are propagated through the appropriate equations by the Taylor series method of error propagation to yield the following estimates of data uncertainty (T_w uncertainty considered negligible):

DATA REDUCTION (Concluded)

Parameter	Uncertainty (Percent)	Comments
h	$\pm$ 10	for $\dot{q}$ with $\pm$ 9 percent uncertainty
h	$\pm$ 16	for $\dot{q}$ with $\pm$ 15 percent uncertainty
h_{ref}	$\pm$ 6	
$\dot{q}_{ref}$	$\pm$ 5	
$\dot{q}/\dot{q}_{ref}$	$\pm$ 10	for $\dot{q}$ with $\pm$ 9 percent uncertainty
$\dot{q}/\dot{q}_{ref}$	$\pm$ 16	for $\dot{q}$ with $\pm$ 15 percent uncertainty
h/h_{ref}	$\pm$ 12	for $\dot{q}$ with $\pm$ 9 percent uncertainty
h/h_{ref}	$\pm$ 17	for $\dot{q}$ with $\pm$ 15 percent uncertainty

REFERENCES

1. Wilkinson, E. E., "Pretest Information for Tests of the 0.0175-Scale Space Shuttle Vehicle Heat Transfer Model 29-O in the AEDC Tunnel F (Test OH-11)," SD73-SH-0204, dated July 11, 1973.

2. Boudreau, A. H., "Test Results from the NASA/RI Shuttle Heating Test OH-11 in the AEDC-VKF Tunnel F," AEDC-DR-74-16, dated February 7, 1974.

TABLE I.

TEST : OH11 DATE : Post-test

TEST CONDITIONS

MACH NUMBER	REYNOLDS NUMBER (per foot)	STAGNATION PRESSURE (psi)	STAGNATION TEMPERATURE (degrees Rankine)
10.5	1.0×10^6	3500	3500
	3.7	3000	2200
	6.0	6000	2000
	10.0	5000	2200
12.0	1.0	3000	3000
	3.7	5000	3000
	6.0	12000	2500
14.0	1.0	14000	3000
	3.7	15000	3000
	1.0	12000	4000

BALANCE UTILIZED: None

	CAPACITY:	ACCURACY:	COEFFICIENT TOLERANCE:
NF			
SF			
AF			
PM			
RM			
YM			

COMMENTS: Large variation in test conditions during each run. Given conditions are approximate.

TABLE II.

TEST: CH.11 — DATA SET/RUN NUMBER COLLATION SUMMARY — DATE: Post-test

TUNNEL RUN	CONFIGURATION	SCHD. α	SCHD. β	Re/ft x 10^6 REQUESTED	Re/ft x 10^6 Range ATTAINED			COMMENTS	NO. OF RUNS	MACH NUMBERS
4504	29-0	25	0	1.0	1.6	TO	2.6			10.5
4506	"	35	"	3.7	2.1	TO	6.5			"
4507	"	30	"	10.0	4.0	TO	10.1			"
4508	"	30	"	10.0	4.8	TO	10.0			"
4509	"	30	"	6.0	5.7	TO	10.5			"
4510	"	30	"	3.7	3.2	TO	6.2			"
4511	"	25	"	3.7	3.4	TO	5.8			"
4512	"	30	"	6.0	3.9	TO	8.1			12.0
4513	"	30	"	3.7	1.6	TO	3.4	FAILED TO REACH DESIRED Re		"
4514	"	30	"	1.0	.39	TO	2.0			"
4515	"	30	"	3.7	1.7	TO	3.8			14.0
4516	"	30	"	1.0	1.0	TO	2.5			14.0
4517	"	30	"	1.0	.75	TO	1.5			16.0
4518	"	35	"	3.7	1.5	TO	3.6			12.0
4519	"	35	"	3.7	2.0	TO	3.9	B.L. TRIPPED BY PARTICLE IMPACT ON MODEL		14.0
4520	"	25	"	3.7	1.5	TO	3.8			12.0
4521	"	25	"	1.0	.75	TO	1.0			12.0
4522	"	25	"	3.7	2.5	TO	3.8			14.0

TEST RUN NUMBERS

1 7 13 19 25 31 37 43 49 55 61 67 73 76

COEFFICENTS IDVAR (1) IDVAR (2) IDV

α OR β SCHEDULES: α = angle of attack, deg

TABLE II. - Concluded.

TEST: OH11 — DATA SET/RUN NUMBER COLLATION SUMMARY — DATE: Post-Test

TUNNEL RUN	CONFIGURATION	SCHD. α	SCHD. β	$Re/ft \times 10^6$ REQUESTED	$Re/ft \times 10^6$ RANGE ATTAINED			COMMENTS	NO. OF RUNS	MACH NUMBERS
4523	29-0	45	0	3.7	2.1	TO	3.9			12.0
4524		30		3.7	1.5	TO	4.1	RE-RUN OF 4513		12.0
4525		35		3.7	1.8	TO	3.6	RE-RUN OF 4519		14.0
4526		35		1.0	1.3	TO	2.3			14.0
4527		35		1.0	.65	TO	1.0			12.0

TEST RUN NUMBERS

1 7 13 19 25 31 37 43 49 55 61 67 75 76

COEFFICENTS IDVAR (1) IDVAR (2) NCV

α OR β SCHEDULES

TABLE III MODEL DIMENSIONAL DATA

MODEL COMPONENT : BODY - B_{17}

GENERAL DESCRIPTION : Fuselage, 3 configuration, lightweight orbiter per Rockwell Lines VL70-000139

MODEL SCALE: 0.0175

DRAWING NUMBER : VL70-000139

DIMENSIONS :	FULL SCALE	MODEL SCALE
Length, In.	1290.3	22.580
Max Width , In.	267.6	4.683
Max Depth , In.	244.5	4.279
Fineness Ratio	4.822	4.822
Area - Ft^2		
Max. Cross-Sectional	386.67	6.767
Planform		
Wetted		
Base		

TABLE III (CONT'D)

MODEL COMPONENT : CANOPY - C_7

GENERAL DESCRIPTION : Configuration 3 per Rockwell Lines VL70-000139

MODEL SCALE: 0.0175

DRAWING NUMBER : VL70-000139

DIMENSIONS :	FULL SCALE	MODEL SCALE
Length (X_o=433 to X_o578)in.F.S.	145.0	2.538
Max Width		
Max Depth		
Fineness Ratio		
Area		
Max. Cross-Sectional		
Planform		
Wetted		
Base		

TABLE III (CONT'D)

MODEL COMPONENT : BODY FLAP – F_5

GENERAL DESCRIPTION : Configuration per Rockwell Lines VL70-000139

MODEL SCALE: 0.0175

DRAWING NUMBER : VL70-000139

DIMENSIONS :	FULL SCALE	MODEL SCALE
Length , In.	84.70	1.482
Max Width, In.	267.6	4.683
Max Depth		
Fineness Ratio		
Area – Ft^2		
Max. Cross-Sectional		
Planform	142.5	0.044
Wetted		
Base	38.096	0.012

TABLE III (CONT'D)

MODEL COMPONENT : OMS POD – M_4

GENERAL DESCRIPTION : Configuration 3 per Rockwell Lines VL70-000139.

NOTE: M_4 identical to M_3, except intersection to fuselage

MODEL SCALE: 0.0175

DRAWING NUMBER : VL70-000139

DIMENSIONS :	FULL SCALE	MODEL SCALE
Length , In.	346.0	6.055
Max Width, In.	108.0	0.890
Max Depth , In.	113.0	1.978
Fineness Ratio		
Area		
Max. Cross-Sectional		
Planform		
Wetted		
Base		

TABLE III (CONT'D)

MODEL COMPONENT: VERTICAL - V_7

GENERAL DESCRIPTION: Centerline vertical tail, double-wedge airfoil with rounded leading edge.

NOTE: Same as V_5, but with manipulator housing removed.

MODEL SCALE: 0.0175

DRAWING NUMBER: VL70-000139

DIMENSIONS:	FULL SCALE	MODEL SCALE
TOTAL DATA		
Area (Theo) - Ft^2		
Planform	425.92	0.130
Span (Theo) - In.	315.72	5.525
Aspect Ratio	1.675	1.675
Rate of Taper	0.507	0.507
Taper Ratio	0.404	0.404
Sweep-Back Angles, Degrees.		
Leading Edge	45.000	45.000
Trailing Edge	26.249	26.249
0.25 Element Line	41.130	41.130
Chords:		
Root (Theo) WP	268.50	4.699
Tip (Theo) WP	108.47	1.898
MAC	199.81	3.497
Fus. Sta. of .25 MAC	1463.50	25.611
W.P. of .25 MAC	635.522	11.116
B.L. of .25 MAC	0.00	0.00
Airfoil Section		
Leading Wedge Angle - Deg.	10.00	10.00
Trailing Wedge Angle - Deg.	14.920	14.920
Leading Edge Radius	2.00	2.00
Void Area	13.17	0.004
Blanketed Area	0.0	0.0

TABLE III (CONL'D)

MODEL COMPONENT: WING-W_{107}

GENERAL DESCRIPTION: Configuration 3 per Rockwell Lines VL70-000139B

NOTE: Same as W_{103}, except cuff, airfoil and incidence angle.

MODEL SCALE: 0.0175

TEST NO. DWG. NO.

DIMENSIONS:	FULL-SCALE	MODEL SCALE
TOTAL DATA		
Area (Theo.) Ft^2		
Planform	2690.00	0.824
Span (Theo In.	936.68	16.392
Aspect Ratio	2.265	2.265
Rate of Taper	1.177	1.177
Taper Ratio	0.200	0.200
Dihedral Angle, degrees	3.500	3.500
Incidence Angle, degrees	0.500	0.500
Aerodynamic Twist, degrees	3.000	3.000
Sweep Back Angles, degrees		
Leading Edge	45.000	45.000
Trailing Edge	- 10.240	- 10.240
0.25 Element Line	35.209	35.209
Chords:		
Root (Theo) B.P.O.O.	689.24	12.062
Tip, (Theo) B.P.	137.85	2.412
MAC	474.81	8.309
Fus. Sta. of .25 MAC	1136.89	19.896
W.P. of .25 MAC	290.857	3.672
B.L. of .25 MAC	182.13	3.18
EXPOSED DATA		
Area (Theo) Ft^2	1752.29	0.537
Span, (Theo) In. BP108	720.68	12.612
Aspect Ratio	2.058	2.058
Taper Ratio	0.245	0.245
Chords		
Root BP108	562.40	9.842
Tip 1.00 $\frac{b}{2}$	137.85	2.412
MAC	393.03	6.878
Fus. Sta. of .25 MAC	1184.21	20.743
W.P. of .25 MAC	290.683	5.139
B.L. of .25 MAC	251.76	4.406
Airfoil Section (Rockwell Mod NASA) XXXX-64		
Root $\frac{b}{2}$ =	0.100	0.100
Tip $\frac{b}{2}$ =	0.120	0.120
Data for (1) of (2) Sides		
Leading Edge Cuff Planform Area Ft^2	118.333	0.036
Leading Edge Intersects Fus M. L. @ Sta	500.00	8.750
Leading Edge Intersects Wing @ Sta	1083.4	18.960

TABLE IV. - FUSELAGE GAUGE LOCATIONS

Normalized Length vs. Local Model Surface Angle

FUSELAGE LOWER SURFACE CENTERLINE			RADIAL GAUGES		
			X/L = .15		
Gauge #	X/L	θ - deg	Gauge #	ø - deg	θ - deg
1	.005	52.25	10	0	3.25
2	.020	20.5	11	20°	3.25
3	.040	13.5	12	30°	3.25
6	.060	10.0			
7	.080	7.25			
8	.100	5.5	X/L = .30		
10	.150	3.25			
16	.200	2.0	Gauge #	ø-deg	θ - deg
20	.250	1.25			
23	.300	1.0	23	0°	1.0
31	.400	1.0	25	40°	1.0
34	.500	1.0	26	45°	1.0
38	.600	1.0			
41	.700	1.0			
44	.800	1.0			
47	.900	-2.0			
50	1.000	-4.5			

TABLE V. - WING GAUGE LOCATIONS

WING LOWER SURFACE

25% HALFSPAN			40% HALFSPAN		
Gauge #	X/C	θ-deg	Gauge #	X/C	θ-deg
52	.082	5.35	59	.1	6.7
53	.302	2.5	60	.2	5.65
54	.447	2.65	61	.3	4.65
55	.591	2.25	62	.56	2.85
56	.736	0	63	.7	1.4
57	.881	-0.75	64	.9	-4.75
50% HALFSPAN			60% HALFSPAN		
Gauge #	X/C	θ-deg	Gauge #	X/C	θ-deg
65	.176	4.55	68	.1	4.95
66	.484	5.0	69	.2	4.8
82	.7	1.85	70	.43	5.4
			71	.6	3.5
			72	.8	-1.55
75% HALFSPAN			85% HALFSPAN		
Gauge #	X/C	θ-deg	Gauge #	X/C	θ-deg
74	.1	5.3	79	.1	5.6
			80	.3	5.35
			81	.5	4.6

Notes:

1. Positive directions of force coefficients, moment coefficients, and angles are indicated by arrows
2. For clarity, origins of wind and stability axes have been displaced from the center of gravity

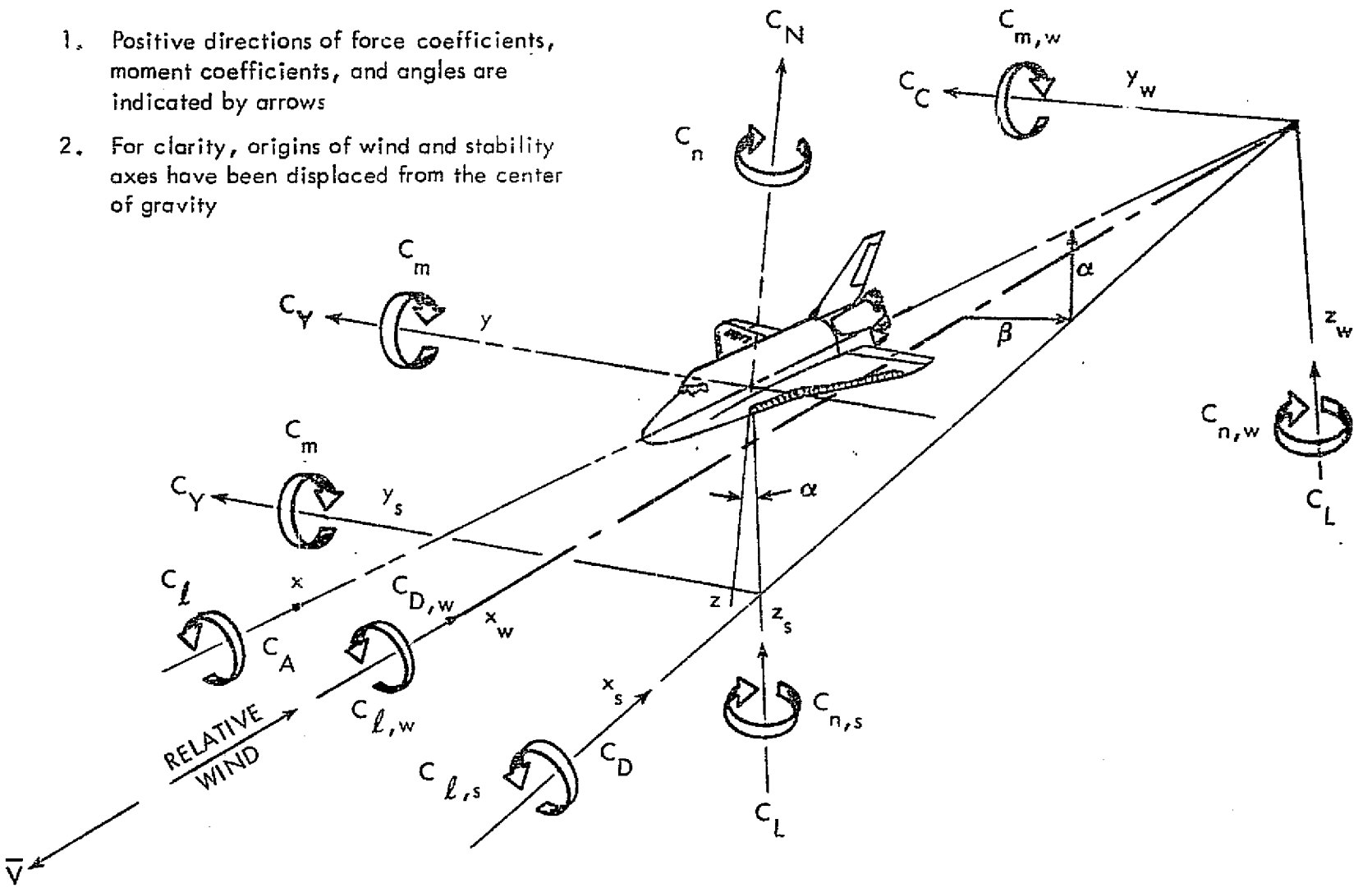
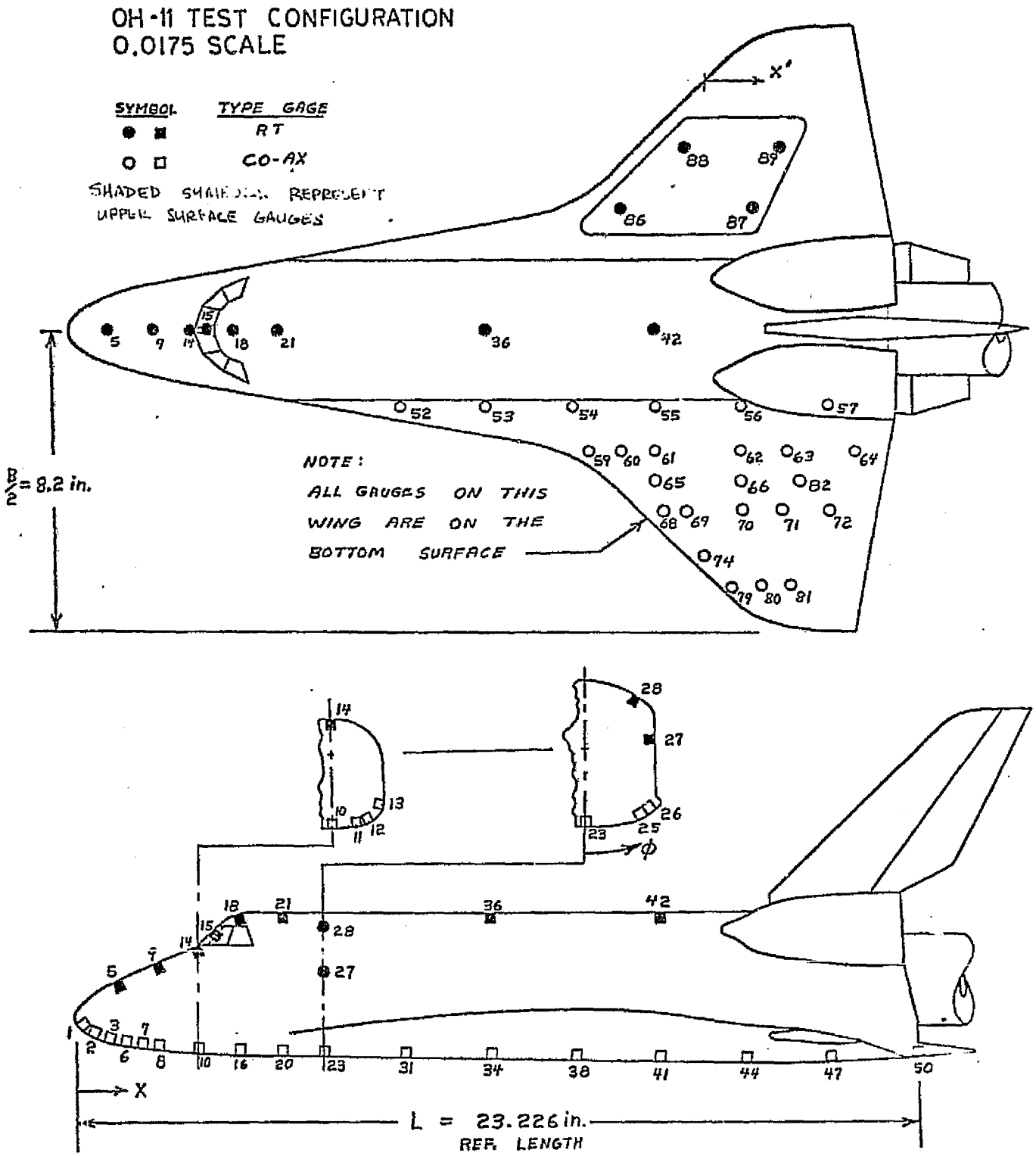
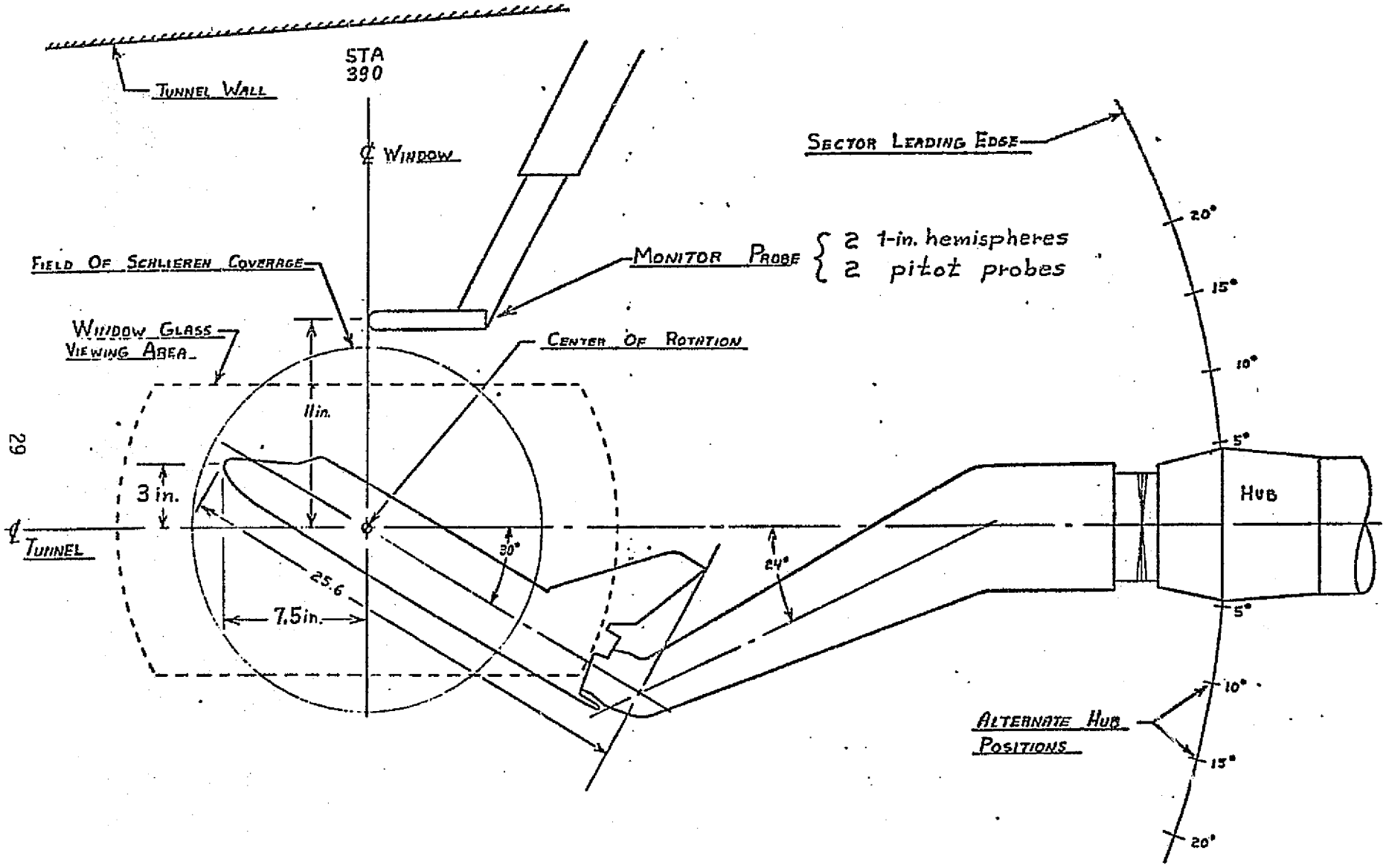


Figure 1. - Axis Systems.



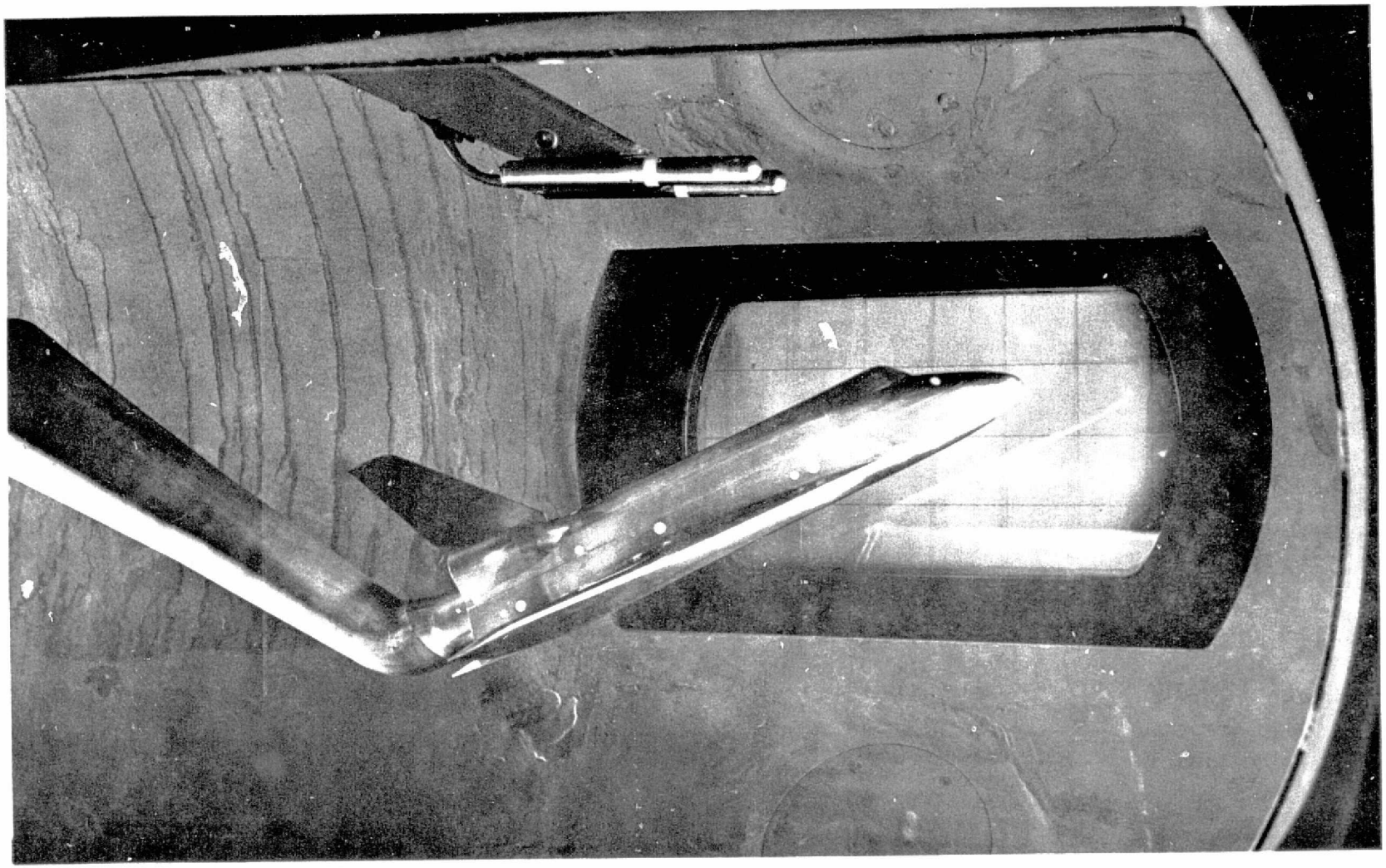
a. Shuttle Orbiter Model 29-0

Figure 2.- Model sketches.



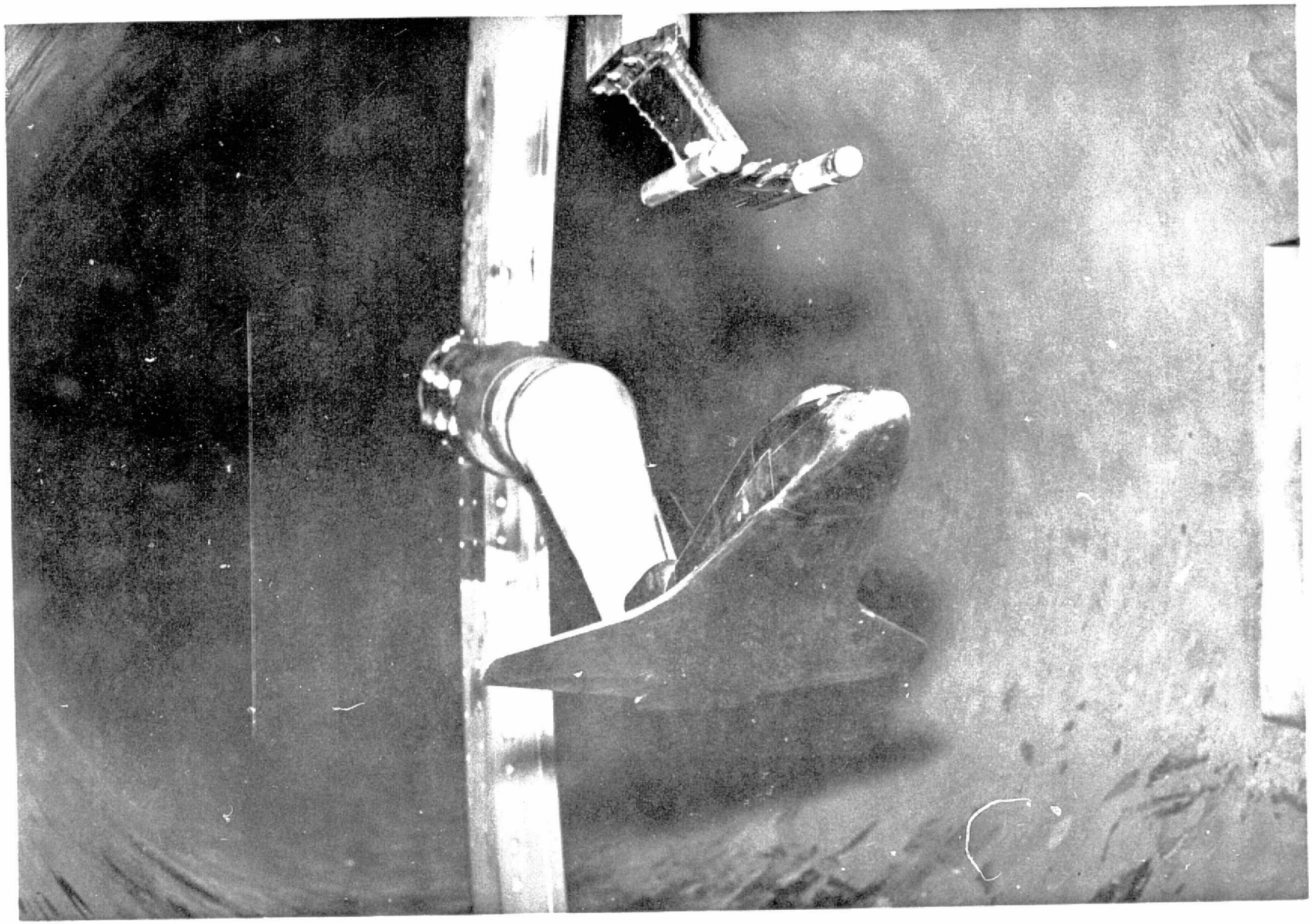
b. Shuttle OH11 Installation in the 54-Inch Test Section

Figure 2. - Concluded.



a. Side View of Model Installation

Figure 3. - Model photographs.



b. Lower Front View of Model Installation

Figure 3. - Concluded.

DATE = 10-23-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OM-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 25.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	POP PSIA	HREF BTU/ SQFT-SEC
60	.079412	.001542	134.5	5857	10.13	5.705	2.6160	5.0632	3783	2660	7.181E 02	147.2	.02788	10.535	.0694
116	.043173	.001042	109.5	5394	10.34	3.268	1.9991	3.8693	2362	2283	6.078E 02	86.7	.03255	6.025	.0497
128	.037918	.000913	108.5	5392	10.38	2.861	1.7673	3.4205	2130	2283	6.072E 02	81.0	.03477	5.276	.0465
138	.035206	.000829	111.1	5437	10.35	2.644	1.5820	3.0619	1959	2321	6.175E 02	79.9	.03662	4.875	.0448

NOTE: QREF is the same as QO

RUN 4504

DATE = 10-23-73

PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H/HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
60	.47299	.25752	.16864	.13169	.10267	.08581	.09241	.08752	.09035	.08509	.05305	.04434	.04309	.09095	.04241
116	.46708	.25035	.16825	.13676	.10341	.08684	.09190	.08628	.08995	.08228	.05302	.05032	.04243	.08692	.04575
128	.46306	.25920	.16866	.13620	.10519	.08740	.09171	.08575	.09109	.08285	.05355	.05090	.04289	.08946	.04552
138	.46304	.25796	.16377	.13557	.10390	.08791	.09242	.08512	.09193	.08279	.05298	.05143	.04286	.08572	.04537

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
60	.04115	.04002	.03843	.03581	.02650	.01903	.08529	.07017	.05996	.04202	.04344	.04571	.11624	.09587	.07985
116	.04255	.04392	.05135	.05719	.07041	.05116	.08180	.06318	.05530	.03988	.04572	.04542	.11909	.09074	.07803
128	.04266	.04403	.04689	.05204	.06348	.04651	.08124	.06261	.05462	.04045	.04658	.04485	.11685	.09247	.07841
138	.04320	.04206	.04400	.04812	.05863	.04298	.08062	.06257	.05362	.04144	.04772	.04458	.11453	.09012	.07684

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
60	.06332	.06307	.03542	.14962	.09886	.07768	.14888	.10510	.10043	.06997	.04260	.17622	.20410	.09764	.14572
116	.06141	.05723	.03246	.14818	.10110	.07985	.15816	.09438	.08799	.07207	.04541	.17605	.20745	.10324	.08809
128	.06198	.05677	.03177	.14592	.09940	.07928	.15929	.09212	.08949	.07263	.04599	.18056	.20970	.10381	.08765
138	.06193	.05644	.03139	.14620	.09595	.07865	.16032	.09036	.08794	.07315	.04661	.18157	.21182	.10374	.08739

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q89
60	.02356	.00812	.00400	.03179	.00789	.00200	.00183	.01401	.00720	.00354	.00286	.00127
116	.02416	.00944	.00357	.02911	.00875	.00244	.00213	.01565	.00702	.00466	.00322	.00099
128	.02543	.00955	.00357	.02842	.00909	.00242	.00229	.01571	.00708	.00506	.00339	.00101
138	.02449	.00931	.00356	.02829	.00920	.00247	.00228	.01481	.00673	.00506	.00340	.00101

RUN 4504

DATE = 10-23-73
PROJECT NUMBER VA354-21EA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
6B	.47000	.24000	.15400	.11900	.09201	.07650	.05527	.07750	.08000	.07441	.04680	.03900	.03790	.08000	.03730
11B	.46400	.24000	.15300	.12300	.09220	.07700	.05450	.07596	.07920	.07150	.04650	.04400	.03710	.07600	.04000
12B	.46000	.24079	.15356	.12250	.09379	.07750	.05433	.07550	.08020	.07200	.04696	.04450	.03750	.07821	.03980
13B	.46000	.23974	.14900	.12200	.09270	.07800	.05500	.07500	.08100	.07200	.04650	.04500	.03750	.07500	.03970

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
6B	.03620	.03520	.03380	.03150	.02311	.01700	.07600	.06200	.05300	.03710	.03810	.04000	.10400	.08550	.07100
11B	.03720	.03640	.04440	.05000	.06100	.04400	.07250	.05550	.04860	.03500	.03965	.03950	.10600	.08050	.06900
12B	.03730	.03650	.04100	.04550	.05500	.04000	.07200	.05500	.04800	.03550	.04060	.03900	.10400	.08203	.06934
13B	.03760	.03660	.03650	.04210	.05084	.03700	.07150	.05500	.04716	.03640	.04162	.03880	.10200	.08000	.06800

TIME	Q62	Q63	Q64	Q65	Q66	Q67	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
6B	.05600	.05290	.03100	.13300	.08800	.06850	.13250	.09350	.08950	.06600	.03720	.15700	.18200	.08700	.12955
11B	.05400	.05010	.02790	.13100	.08950	.07000	.14000	.08350	.07800	.06350	.03940	.15600	.18400	.09150	.07769
12B	.05450	.04970	.02731	.12900	.08800	.06950	.14100	.08150	.07932	.06400	.03990	.16000	.18600	.09200	.07750
13B	.05450	.04944	.02700	.12933	.08500	.06900	.14200	.08000	.07800	.06450	.04047	.16100	.18800	.09200	.07732

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q24	Q27	Q36	Q42	Q86	Q89
6B	.02060	.00710	.00350	.02780	.00690	.00175	.00160	.01225	.00630	.00310	.00250	.00111
11B	.02100	.00820	.00310	.02530	.00760	.00212	.00165	.01360	.00610	.00405	.00280	.00086
12B	.02210	.00830	.00310	.02470	.00790	.00210	.00199	.01365	.00615	.00440	.00295	.00088
13B	.02150	.00810	.00310	.02460	.00800	.00215	.00198	.01288	.00585	.00440	.00296	.00088

RUN 4504

DATE = 10-23-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / AI OH-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 35.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	POP PSIA	HREF BTU/ SQFT-SEC
70	.127504	.003224	103.3	5323	10.51	9.850	6.4744	12.5312	6734	2173	5.911E 02	144.2	.01837	18.164	.0883
100	.083494	.001812	120.4	5776	10.56	6.519	3.3880	6.5574	5032	2569	6.95bE 02	150.8	.02563	12.030	.0743
110	.074957	.001596	122.7	5828	10.55	5.845	2.9528	5.7151	4579	2618	7.085E 02	146.3	.02737	10.795	.0704
130	.057310	.001290	116.0	5721	10.66	4.554	2.4795	4.7990	3760	2536	6.820E 02	122.6	.03030	8.408	.0615

RUN 4506

DATE = 10-23-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
70	.56517	.34585	.23822	.20940	.16981	.14009	.11684	.13342	.15763	.09459	.10810	.09104	.12324	.13323	.10103
100	.53015	.33489	.22892	.19569	.15933	.13728	.11407	.13820	.14588	.08759	.10239	.08172	.11275	.12037	.07068
110	.53015	.32720	.22459	.19240	.15601	.13504	.11292	.13266	.14252	.08394	.09904	.07947	.10983	.11590	.07726
130	.51552	.31373	.21513	.18284	.14845	.12642	.09985	.12753	.13715	.08248	.08962	.07623	.10506	.10827	.07402

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q61	Q62
70	.12814	.20084	.30699	.32531	.30380	.22602	.13578	.17458	.24908	.34502	.36200	.29708	.27150	.35185	.38078
100	.06311	.09939	.15461	.20762	.23404	.17968	.11336	.09784	.09144	.08964	.18277	.18980	.14113	.13325	.17900
110	.06775	.08389	.13245	.18544	.20968	.16610	.10895	.09010	.07578	.07038	.12742	.15535	.12913	.10918	.14489
130	.06146	.07070	.10655	.14583	.18484	.15416	.10031	.07806	.05962	.05503	.10638	.13884	.11837	.08741	.10986

TIME	Q63	Q74	Q65	Q66	Q68	Q69	Q70	Q72	Q74	Q79	Q80	Q81	Q5	Q9	Q14
70	.32711	.23072	.49547	.45493	.34325	.50457	.46092	.21269	.65710	.60700	.55168	.54989	.01188	.01067	.01384
100	.18972	.15509	.18137	.16148	.18946	.16748	.15257	.12688	.42515	.43566	.45779	.42932	.01156	.00990	.01328
110	.13880	.11720	.15498	.11441	.14863	.15169	.11874	.10234	.37048	.37015	.42760	.38763	.01144	.00961	.01344
130	.11144	.10007	.14035	.09823	.12121	.13324	.09593	.08907	.29443	.26693	.39541	.31581	.01146	.00945	.01420

TIME	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
70	.00870	.00807	.00815	.00073	.01569	.00424	.00773	.00118	.00756	.00190
100	.00816	.00819	.00823	.00076	.01477	.00282	.00430	.00098	.00733	.00202
110	.00972	.00829	.00229	.00084	.01476	.00193	.00280	.00103	.00699	.00190
130	.00853	.00876	.00234	.00110	.01443	.00159	.00206	.00136	.00750	.00222

RUN 4506

DATE = 10-23-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
70	.56500	.33000	.22300	.19400	.15600	.12800	.10600	.13918	.14300	.08200	.09768	.08200	.11100	.12000	.09100
100	.53000	.32300	.21500	.18200	.14700	.12600	.10400	.12600	.13300	.07650	.09300	.07400	.10210	.10900	.06400
110	.53000	.31300	.21100	.17900	.14400	.12400	.10300	.12100	.13000	.07337	.09000	.07200	.09950	.10500	.07000
130	.51557	.30000	.20200	.17000	.13692	.11600	.09100	.11623	.12500	.07200	.08137	.06900	.09510	.09800	.06700

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q61	Q62
70	.11542	.18089	.27630	.29300	.27100	.20000	.12400	.15800	.22553	.31200	.32500	.26607	.24900	.32062	.34500
100	.05715	.09000	.14000	.18800	.21000	.16000	.10400	.08900	.08321	.08147	.16500	.17095	.13000	.12200	.16300
110	.04138	.07600	.12000	.16800	.18825	.14800	.10000	.08200	.06900	.06400	.11500	.14000	.11900	.10000	.13200
130	.03563	.06400	.09626	.13200	.16578	.13721	.09200	.07098	.05424	.05000	.09600	.12500	.10900	.08000	.10000

TIME	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q72	Q74	Q79	Q80	Q81	Q5	Q9	Q14
70	.29500	.26400	.45134	.41500	.31000	.46000	.42100	.19003	.60000	.55478	.50400	.50100	.01030	.00925	.01200
100	.17200	.13800	.16000	.14800	.17200	.15340	.14000	.11400	.39000	.40000	.42000	.39300	.01010	.00865	.01160
110	.12590	.10435	.14180	.10500	.13500	.13900	.10900	.09200	.34000	.34000	.38789	.35500	.01000	.00840	.01175
130	.10100	.08900	.12642	.09000	.11000	.12200	.08800	.08000	.27000	.24500	.36266	.28900	.01000	.00825	.01240

TIME	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
70	.05262	.00700	.00186	.00063	.01360	.00368	.00670	.00102	.00655	.00165
100	.05342	.00715	.00195	.00066	.01290	.00247	.00376	.00086	.00640	.00176
110	.05220	.00725	.00200	.00073	.01290	.00169	.00245	.00090	.00611	.00166
130	.05109	.00765	.00204	.00096	.01260	.00139	.00180	.00119	.00655	.00194

RUN 4506

DATE = 10-23-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OR-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 30.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	POP PSIA	HREF BTU/ SQFT-SEC
94	.140817	.004411	83.4	4898	10.76	11.412	10.0951	19.5391	8056	1794	4.997E 02	121.6	.01537	21.014	.0970
98	.133716	.004003	87.2	5006	10.75	10.817	8.9478	17.3185	7754	1890	5.219E 02	124.9	.01606	19.927	.0925
116	.111546	.003142	92.7	5119	10.66	8.877	6.7576	13.0794	6391	2004	5.460E 02	123.5	.01863	16.358	.0844
122	.099745	.002834	91.9	5134	10.74	8.056	6.1685	11.9391	6061	2019	5.489E 02	118.6	.01963	14.846	.0802
136	.085690	.002466	93.7	5099	10.73	6.910	5.3973	10.4464	5260	1998	5.412E 02	107.6	.02100	12.732	.0738
150	.072948	.001911	99.7	532	10.70	5.843	3.9753	7.6942	4579	2198	5.908E 02	111.0	.02386	10.774	.0670

RUN 4507

DATE = 10-23-73

PROJECT NUMBER VA354-21FA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
94	.59660	.35069	.23134	.19875	.15606	.13794	.11303	.14242	.15355	.10079	.11126	.14127	.12874	.13386	.20507
98	.59155	.34953	.23198	.19886	.15567	.13758	.11215	.14090	.14991	.09767	.10754	.13062	.12494	.13062	.18855
116	.59152	.34903	.23096	.20293	.15972	.13834	.10566	.13713	.15174	.09732	.09820	.10645	.11761	.12514	.14495
122	.58315	.34618	.22984	.20274	.15702	.13662	.10450	.13618	.15169	.09786	.08686	.09915	.11603	.12396	.11958
136	.59152	.34798	.23747	.19788	.15806	.13668	.10117	.13602	.15176	.09966	.08579	.08085	.11722	.12459	.09061
150	.58139	.35045	.23197	.19779	.15475	.13561	.09853	.13436	.15115	.09280	.07996	.07121	.11954	.12123	.08120

TIME	Q34	Q38	Q41	Q44	Q47	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61	Q62
94	.26773	.30391	.32583	.32355	.31082	.18197	.22440	.30243	.37318	.37613	.28197	.34063	.34972	.37991	.42900
98	.25443	.29419	.32372	.32031	.30752	.17235	.20491	.28011	.36080	.37082	.27994	.31556	.32422	.35449	.41382
116	.18685	.23215	.28491	.29444	.28250	.13841	.13973	.20047	.29209	.32609	.25742	.21780	.21075	.22935	.33765
122	.15056	.20376	.25471	.27395	.27048	.13390	.12841	.17451	.25478	.30372	.23788	.19773	.17947	.20131	.29253
136	.11439	.15856	.20387	.23445	.24708	.12351	.10481	.11264	.15452	.23864	.22198	.16449	.13383	.14546	.20825
150	.09311	.12405	.15788	.19172	.21519	.12034	.08408	.06058	.11232	.19120	.19052	.14110	.11999	.12261	.18320

TIME	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5	Q9
94	.35040	.22777	.51985	.48084	.36348	.43283	.53290	.45739	.22528	.62623	.55192	.47127	.52876	.01739	.00858
98	.33844	.22350	.47502	.45491	.35563	.35510	.49346	.44711	.22246	.61563	.44003	.46556	.52285	.01756	.00855
116	.29178	.19272	.28986	.32296	.31506	.19234	.32364	.39919	.21014	.58052	.27659	.42973	.49011	.01807	.00863
122	.25663	.17995	.24837	.27816	.29124	.15874	.26664	.35365	.19521	.56693	.26240	.41534	.47250	.01830	.00869
136	.19907	.16043	.18468	.21977	.23040	.10874	.13220	.21452	.16219	.53704	.25989	.39853	.45436	.01877	.00892
150	.18712	.14071	.16609	.16155	.17486	.10918	.09949	.12616	.12847	.50387	.26114	.37367	.41582	.01925	.00899

TIME	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
94	.01068	.05193	.00869	.00306	.00126	.01820	.00782	.00415	.00159	.00893	.00252
98	.01041	.05116	.00860	.00305	.00123	.01791	.00771	.00419	.00158	.00866	.00244
116	.00904	.04443	.00857	.00302	.00120	.01726	.00765	.00452	.00162	.00823	.00220
122	.00852	.04771	.00851	.00299	.00120	.01726	.00770	.00475	.00162	.00828	.00208
136	.00886	.04693	.00834	.00295	.00121	.01738	.00782	.00510	.00172	.00830	.00195
150	.00905	.04623	.00830	.00293	.00122	.01836	.00646	.00542	.00182	.00836	.00194

RUN 4507

DATE = 10-23-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
94	.59500	.32861	.21200	.18000	.14000	.12300	.10000	.12600	.13585	.08637	.09800	.12400	.11300	.11750	.18000
98	.59000	.32800	.21300	.18050	.14000	.12300	.09950	.12500	.13300	.08400	.09500	.11500	.11000	.11500	.16600
116	.59000	.32800	.21800	.18461	.14400	.12400	.09400	.12200	.13500	.08400	.08700	.09400	.10385	.11050	.12800
122	.58166	.32539	.21150	.18449	.14161	.12250	.09300	.12120	.13500	.08450	.07699	.08759	.10250	.10950	.10563
136	.59000	.32700	.21845	.18000	.14248	.12250	.09000	.12100	.13500	.08600	.07600	.07138	.10350	.11000	.08000
150	.56000	.33000	.21400	.18050	.14000	.12200	.08800	.12000	.13500	.08050	.07113	.06315	.10600	.10750	.07200

TIME	Q34	Q38	Q41	Q44	Q47	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61	Q62
94	.23500	.26676	.28600	.28400	.27000	.16217	.19800	.26700	.32900	.32900	.24600	.30500	.31200	.33775	.37900
98	.22400	.25900	.28500	.28200	.26800	.15400	.18132	.24800	.31900	.32536	.24500	.28326	.29000	.31600	.36663
116	.16500	.20500	.25600	.26000	.24700	.12400	.12400	.17800	.25900	.28700	.22600	.19600	.18900	.20500	.30000
122	.13300	.18000	.22500	.24200	.23658	.12000	.11400	.15500	.22600	.26741	.20893	.17800	.16100	.19000	.26000
136	.10100	.14000	.18000	.20700	.21600	.11064	.09300	.10000	.13700	.21000	.19485	.14801	.12000	.13000	.18500
150	.08700	.11000	.14000	.17000	.18900	.10821	.07491	.05400	.10000	.16900	.16800	.12742	.10800	.11000	.16342

TIME	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5	Q9
94	.30800	.19600	.46200	.42800	.32000	.38500	.47500	.40500	.19600	.55800	.49230	.42000	.47000	.01490	.00735
98	.29837	.19300	.42330	.40600	.31400	.31671	.44100	.39700	.19416	.55000	.39352	.41600	.46600	.01510	.00735
116	.25800	.16700	.25900	.28900	.27900	.17200	.29000	.35544	.18400	.52000	.24800	.38500	.43800	.01560	.00745
122	.22700	.15600	.22200	.24900	.25800	.14200	.23900	.31500	.17100	.50800	.23541	.37222	.42240	.01580	.00750
136	.17600	.13900	.16500	.19664	.20400	.09723	.11844	.19099	.14200	.48100	.23300	.35700	.40600	.01620	.00770
150	.16614	.12253	.14096	.14510	.19548	.09800	.08948	.11277	.11300	.45300	.23500	.33600	.37300	.01670	.00780

TIME	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
94	.00915	.04450	.00745	.00262	.00108	.01560	.00670	.00355	.00135	.00765	.00216
98	.00895	.04400	.00740	.00262	.00106	.01540	.00665	.00360	.00136	.00745	.00210
116	.00780	.04180	.00740	.00261	.00104	.01490	.00660	.00390	.00140	.00710	.00190
122	.00770	.04120	.00735	.00258	.00104	.01490	.00665	.00410	.00140	.00715	.00180
136	.00765	.04050	.00720	.00246	.00104	.01500	.00675	.00440	.00148	.00716	.00168
150	.00765	.04010	.00720	.00203	.00106	.01593	.00560	.00470	.00158	.00725	.00168

RUN 4507

DATE = 10-25-73
PROJECT NUMBER VA354-21FA
ARC, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OF-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-DOT ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 30.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QDOT BTU/ SQFT-SEC	STDP	PDP PSIA	HREF BTU/ SQFT-SEC
80	.166341	.004035	93.7	5199	10.77	13.509	10.0148	19.3836	9666	2030	5.629E 02	159.4	.01542	24.905	.1070
102	.128876	.003050	110.4	5543	10.58	10.105	5.9679	11.5509	7277	2347	6.407E 02	165.2	.01927	18.648	.0914
106	.119062	.002873	108.2	5513	10.63	9.418	5.7032	11.0385	6944	2326	6.336E 02	156.8	.01981	17.380	.0878
124	.089812	.002326	100.9	5374	10.73	7.241	4.8270	9.3426	5643	2224	6.014E 02	127.1	.02174	13.356	.0754
130	.078233	.002164	93.5	5226	10.84	6.433	4.7547	9.2027	5212	2105	5.684E 02	111.6	.02248	11.860	.0713

RUN 4508

DATE = 10-25-73

PROJECT NUMBER VA354-21FA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
80	.62159	.37445	.23692	.20946	.17294	.15499	.13480	.17524	.17861	.11461	.13762	.15165	.15844	.16297	.21503
102	.60146	.35955	.23007	.20452	.16325	.14307	.11616	.14173	.15879	.10688	.10764	.09898	.12485	.13727	.12261
106	.57055	.35006	.23704	.20129	.15998	.13867	.11173	.14002	.15977	.10497	.10207	.08799	.12377	.13548	.11252
124	.55824	.34506	.23157	.19069	.15105	.13232	.10344	.13523	.15620	.10024	.09215	.08466	.12349	.12737	.11069
130	.55442	.32504	.22966	.17869	.15107	.13138	.09847	.13459	.15304	.09821	.09009	.08328	.12428	.12824	.09039

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
80	.30331	.33160	.35908	.35947	.35431	.22208	.20294	.25338	.31516	.39898	.43602	.32896	.37761	.40567	.42490
102	.15635	.20809	.26095	.28008	.27077	.19106	.14425	.14890	.19247	.26666	.32722	.28161	.24640	.22725	.24647
106	.14244	.19466	.24754	.26330	.26750	.18732	.13763	.13663	.17574	.24657	.30927	.26363	.22057	.20514	.21691
124	.11272	.14053	.20068	.21755	.22873	.16056	.12483	.11442	.12334	.19423	.25807	.21876	.16603	.16436	.17714
130	.11165	.13347	.18077	.20920	.22361	.15646	.12030	.11581	.12362	.18567	.24937	.21703	.17734	.16693	.18068

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
80	.48458	.39568	.25139	.57045	.53610	.43901	.45822	.55770	.51155	.48561	.64715	.66879	.49765	.56171	.01794
102	.37023	.32389	.21346	.31146	.34213	.34328	.22230	.25073	.35312	.21599	.36718	.29543	.42363	.49159	.01816
106	.34120	.30904	.20523	.28931	.29739	.32432	.18301	.21126	.31259	.19746	.57511	.28606	.41059	.47728	.01817
124	.27338	.24745	.17572	.21936	.21478	.23944	.13363	.15894	.18227	.15000	.53124	.25805	.37769	.42999	.01809
130	.26953	.23981	.16803	.24821	.21523	.22990	.14567	.16102	.19024	.15199	.50283	.24106	.36983	.40715	.01802

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
80	.00363	.00932	.05117	.00857	.00333	.00109	.04107	.00753	.00442	.00148	.00891	.00316
102	.00836	.00862	.04695	.00816	.00298	.00110	.04069	.00804	.00470	.00131	.00979	.00215
106	.00890	.00851	.04635	.00805	.00291	.00112	.04047	.00805	.00477	.00138	.00992	.00205
124	.00922	.00830	.04634	.00806	.00273	.00120	.04000	.00766	.00507	.00167	.00934	.00128
130	.00936	.00841	.04682	.00811	.00269	.00122	.04087	.00780	.00520	.00172	.00953	.00185

DATE = 10-25-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
80	.62000	.35200	.21805	.19100	.15600	.13900	.12000	.15600	.15900	.09900	.12200	.13400	.14000	.14400	.19000
102	.60000	.33900	.22000	.18700	.14800	.12900	.10400	.12689	.14216	.09300	.09600	.08800	.11100	.12204	.10900
106	.59916	.33000	.21900	.18400	.14500	.12500	.10000	.12532	.14300	.09130	.09100	.07820	.11000	.12041	.10000
124	.59676	.32501	.21369	.17408	.13671	.11909	.09243	.12083	.13957	.08700	.08201	.07511	.11000	.11300	.09820
130	.59292	.30580	.21161	.16284	.13646	.11800	.08779	.12000	.13645	.08500	.08000	.07371	.11000	.11350	.08000

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
80	.26800	.29300	.31728	.31365	.31000	.19274	.18191	.22500	.28000	.35400	.38400	.28900	.34000	.36400	.38000
102	.13900	.18500	.23200	.24900	.23848	.18700	.14000	.13300	.17200	.23800	.24000	.24900	.22300	.20500	.22200
106	.12659	.17300	.22060	.23400	.23552	.16367	.12400	.12200	.15700	.22000	.27400	.23301	.20500	.18500	.19500
124	.10060	.13000	.18336	.19300	.20160	.14000	.11230	.10200	.11000	.17300	.22822	.19300	.15000	.14800	.15900
130	.09900	.11814	.16000	.18516	.19600	.13605	.10800	.10300	.11000	.16500	.22000	.19100	.15990	.15000	.16900

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
80	.43060	.35008	.21600	.51000	.48000	.36900	.41000	.50000	.45576	.25026	.58000	.60000	.44609	.50227	.01550
102	.33106	.28831	.18643	.28000	.30800	.30600	.20000	.22600	.31641	.19051	.51109	.26646	.38179	.44200	.01580
106	.30500	.27500	.17918	.26000	.26764	.28900	.18460	.19036	.28000	.17410	.51807	.25794	.37993	.42900	.01580
124	.24397	.21981	.15310	.19683	.19300	.21300	.12000	.14300	.16300	.13200	.47761	.23236	.33976	.36588	.01570
130	.24000	.21253	.14000	.22224	.19300	.20404	.14000	.14457	.16975	.13342	.45133	.21658	.33200	.36401	.01560

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
80	.00745	.00805	.04420	.00740	.00288	.00094	.01820	.00650	.00382	.00128	.00770	.00273
102	.00727	.00750	.04085	.00710	.00259	.00096	.01800	.00699	.00409	.00114	.00851	.00187
106	.00774	.00740	.04049	.00700	.00253	.00097	.01780	.00700	.00415	.00120	.00862	.00178
124	.00800	.00720	.04022	.00700	.00237	.00104	.01736	.00665	.00440	.00145	.00811	.00167
130	.00810	.00728	.04225	.00702	.00233	.00106	.01720	.00675	.00450	.00149	.00825	.00160

RUN 4508

DATE = 10-25-73
PROJECT NUMBER VA354-21EA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / AI OM-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 30.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	POP PSIA	HREF BTU/ SQFT-SEC
82	.153452	.004692	85.4	4917	10.67	12.231	10.5220	20.3693	8286	1808	5.038E 02	127.4	.01493	22.523	.1005
90	.131423	.003695	92.9	5151	10.72	10.672	7.9830	15.4511	7633	2015	5.527E 02	137.3	.01721	19.486	.0931
104	.114409	.002972	100.6	5317	10.64	9.059	6.1218	11.8488	6577	2168	5.892E 02	137.6	.01912	16.705	.0846
120	.093482	.002432	92.8	5145	10.72	7.514	5.6885	11.0101	5651	2034	5.514E 02	115.3	.02038	13.847	.0772

RUN 4509

DATE = 10-25-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / AT OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
82	.60101	.35209	.23018	.19537	.15599	.13676	.11581	.15253	.16496	.10555	.11348	.11615	.13835	.15316	.17878
90	.59151	.33515	.22242	.18903	.15414	.13106	.10675	.13485	.15366	.09961	.10156	.09057	.12737	.13699	.12454
104	.56962	.32399	.21580	.17979	.14598	.12734	.10060	.12364	.14339	.09690	.09336	.07673	.11848	.12694	.09253
120	.53567	.30248	.20640	.17744	.14419	.12153	.09267	.12383	.14153	.09492	.08459	.07095	.11408	.12330	.07278

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
82	.27839	.32404	.36710	.35528	.33367	.22861	.15254	.18578	.28305	.39447	.43079	.32422	.32263	.37535	.41038
90	.21511	.26027	.32176	.32040	.29776	.20474	.13391	.13969	.22182	.32133	.36122	.28848	.22219	.20928	.28187
104	.14995	.21075	.27124	.28323	.26431	.17799	.11572	.12240	.16163	.24275	.32829	.25157	.18612	.18897	.23419
120	.11161	.16975	.23051	.25610	.23972	.16151	.12493	.10134	.11255	.18820	.29747	.23446	.15863	.15803	.18895

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
82	.46209	.39231	.26172	.46114	.53435	.41249	.36876	.58313	.52378	.29335	.65064	.63876	.49575	.56915	.01726
90	.41001	.35276	.23073	.31329	.42417	.37516	.21241	.40952	.46568	.25896	.59910	.42763	.44862	.50837	.01672
104	.34600	.31329	.20086	.25100	.33864	.31734	.17835	.28925	.36938	.22003	.56643	.26445	.39970	.45564	.01740
120	.31718	.26784	.18795	.21514	.28254	.27200	.11462	.22306	.30752	.18523	.52034	.24101	.36000	.41468	.01648

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
82	.00814	.01003	.04805	.00861	.00330	.00104	.01846	.00770	.00397	.00162	.00851	.00251
90	.00807	.00857	.04656	.00776	.00309	.00104	.01753	.00758	.00397	.00159	.00790	.00229
104	.00783	.00815	.04499	.00782	.00279	.00107	.01638	.00743	.00421	.00152	.00761	.00217
120	.00743	.00803	.04515	.00741	.00237	.00112	.01520	.00671	.00381	.00144	.00764	.00168

RUN 4509

DATE = 10-25-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
82	.60000	.33000	.21100	.17700	.14000	.12200	.10250	.13500	.14600	.09050	.10000	.10200	.12150	.13450	.15700
90	.59000	.31500	.20503	.17200	.13900	.11750	.09500	.12000	.13674	.08600	.09000	.08000	.11250	.12100	.11000
104	.56400	.30500	.19900	.16400	.13200	.11450	.08980	.11037	.12800	.08400	.08300	.06800	.10500	.11250	.08200
120	.53451	.29000	.18998	.16150	.13007	.10900	.08250	.11024	.12600	.08200	.07499	.06270	.10081	.10895	.06431

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
82	.24648	.28808	.32239	.31200	.29008	.19700	.13600	.16400	.25000	.34792	.37700	.28[illegible]0	.28900	.33500	.36500
90	.19000	.24756	.28421	.28300	.26042	.17762	.12000	.12400	.19700	.28500	.31800	.25[illegible]4	.20000	.18773	.25200
104	.13200	.18677	.24039	.25190	.23200	.15500	.10400	.10900	.14400	.21600	.29000	.22170	.16800	.17000	.21000
120	.09881	.15000	.20900	.22630	.20976	.14019	.11200	.09000	.10000	.16700	.26200	.20600	.14284	.14181	.16900

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
82	.40842	.34500	.22500	.41000	.47584	.36331	.32815	.52000	.46400	.25535	.58000	.57000	.44200	.50012	.01480
90	.36438	.31200	.20000	.28000	.37967	.33231	.19000	.36704	.41675	.22682	.53678	.38344	.40202	.45443	.01443
104	.30900	.27800	.18000	.22500	.30400	.28200	.16000	.26000	.33000	.19340	.50000	.23786	.35922	.40851	.01509
120	.28200	.23700	.16300	.19236	.25300	.24104	.10257	.20000	.27400	.16232	.46639	.21623	.32273	.37083	.01424

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
82	.00698	.00960	.04120	.00738	.00283	.00089	.01583	.00660	.00340	.00139	.00730	.00215
90	.00697	.00740	.04020	.00670	.00267	.00090	.01514	.00655	.00343	.00137	.00682	.00198
104	.00679	.00706	.03900	.00678	.00242	.00093	.01420	.00644	.00365	.00132	.00660	.00188
120	.00642	.00694	.03900	.00640	.00205	.00097	.01313	.00580	.00329	.00124	.00660	.00145

RUN 4509

DATE = 10-25-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 30.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	POP PSIA	HREF BTU/ SQFT-SEC
70	.122681	.003085	103.9	5351	10.53	7.523	6.1906	11.9818	6623	2197	5.973E 02	144.1	.01884	17.563	.0870
100	.079150	.002171	95.2	5228	10.75	6.398	4.6427	8.9859	5007	2111	5.692E 02	111.5	.02256	11.794	.0710
122	.065369	.001880	90.8	5103	10.74	5.279	4.1152	7.9649	4161	2016	5.424E 02	94.3	.02406	9.727	.0639
132	.058544	.001709	89.4	5077	10.77	4.752	3.7805	7.3172	3819	1997	5.368E 02	88.1	.02519	8.755	.0605
140	.055005	.001517	94.7	5196	10.71	4.416	3.2414	6.2738	3536	2101	5.625E 02	91.0	.02693	8.139	.0583

RUN 4510

DATE = 10-25-73

PROJECT NUMBER VA354-21FA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / AI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
70	.54134	.32921	.21897	.18848	.15033	.12783	.09965	.12876	.14331	.09107	.09555	.09586	.11165	.12293	.10375
100	.51630	.30025	.20294	.16917	.13726	.11912	.08972	.11184	.12785	.08356	.08067	.07456	.09252	.10050	.07230
122	.51632	.31789	.20431	.17429	.13418	.11823	.09158	.11462	.13115	.08571	.08519	.08208	.10455	.10182	.07964
132	.52035	.31393	.20546	.17150	.13534	.12051	.09218	.11635	.13153	.08575	.08579	.08381	.09618	.04967	.07702
140	.53247	.30988	.20622	.17089	.13513	.11797	.09165	.11416	.12656	.08149	.08384	.07922	.09491	.10150	.07833

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
70	.13533	.18157	.25767	.28862	.25163	.18352	.14903	.14703	.17837	.23363	.25908	.24723	.21261	.22110	.23853
100	.09360	.12199	.20097	.23046	.22244	.15178	.09913	.08093	.08652	.14064	.23574	.20781	.12753	.10358	.11722
122	.08491	.12114	.18080	.22190	.21267	.14639	.09655	.07773	.07544	.13529	.21695	.19478	.12331	.10591	.10626
132	.09155	.11213	.17442	.21295	.20476	.13839	.08931	.07438	.07033	.12238	.20796	.18569	.12225	.10483	.10583
140	.06998	.10282	.16497	.20340	.19967	.13226	.08808	.07191	.06345	.11929	.19271	.17614	.11979	.10205	.09689

TIME	Q62	Q63	Q64	Q65	Q66	Q67	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
70	.32233	.28241	.19469	.27875	.35071	.30304	.21613	.31272	.36510	.21375	.53758	.26670	.40534	.46376	.01561
100	.18079	.19389	.14154	.15634	.16016	.19715	.07699	.11136	.17965	.14352	.54697	.23968	.35308	.40351	.01571
122	.17215	.17072	.13113	.15562	.13295	.15354	.07267	.08145	.12126	.09933	.42969	.23638	.35125	.34603	.01587
132	.16773	.16064	.12812	.15447	.12294	.13440	.07046	.06747	.10109	.08681	.37962	.23647	.33714	.37491	.01622
140	.16362	.16250	.12681	.14476	.10336	.12750	.06564	.06237	.08169	.08232	.32534	.23932	.33003	.36831	.01582

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
70	.00749	.00807	.04418	.00732	.00244	.00081	.01642	.00692	.00424	.00150	.00715	.00193
100	.00716	.00797	.04212	.00739	.00236	.00102	.01617	.00647	.00464	.00151	.00715	.00141
122	.00747	.00793	.04378	.00788	.00232	.00114	.01668	.00625	.00449	.00167	.00729	.00167
132	.00711	.00788	.04276	.00788	.00226	.00115	.01669	.00603	.00417	.00176	.00753	.00181
140	.00786	.00754	.04160	.00762	.00229	.00114	.01606	.00601	.00393	.00183	.00768	.00186

RUN 4510

DATE = 10-25-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
70	.54000	.31000	.20200	.17200	.13100	.11500	.08900	.11500	.12800	.07900	.08500	.08500	.09900	.10900	.09200
100	.51500	.28250	.18700	.15418	.12400	.10700	.08000	.09972	.11400	.07233	.07164	.06600	.08190	.08896	.08400
122	.51500	.29478	.18800	.15859	.12100	.10600	.08150	.10200	.11671	.07400	.07550	.07250	.09235	.09994	.07034
132	.52500	.29500	.18900	.15600	.12200	.10800	.08200	.10350	.11700	.07400	.07600	.07400	.08492	.08800	.08800
140	.53113	.29153	.19000	.15572	.12205	.10550	.08171	.10178	.11283	.07052	.07444	.07011	.08400	.08983	.08932

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
70	.12000	.16100	.22048	.25593	.22100	.15993	.13400	.13100	.15900	.20800	.22900	.21800	.19200	.19900	.21400
100	.07400	.10799	.17790	.20400	.19500	.13200	.08900	.07199	.07700	.12500	.20800	.18291	.11500	.09309	.10500
122	.07500	.10700	.16500	.19600	.18600	.12700	.08652	.06900	.06700	.12000	.19100	.17106	.11100	.09500	.09500
132	.07200	.09900	.15400	.18831	.17900	.12000	.08000	.06600	.06744	.10850	.18300	.16300	.11000	.09400	.09458
140	.06193	.09100	.14600	.18037	.17500	.11500	.07906	.06395	.05646	.10500	.17000	.15500	.10800	.09169	.08678

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
70	.28751	.25074	.16953	.25000	.31500	.26944	.19400	.28123	.32635	.18800	.48331	.24000	.36447	.41600	.01354
100	.16100	.17165	.12300	.14000	.14363	.17500	.06900	.10000	.16032	.12600	.49100	.21536	.31700	.36139	.01360
122	.15300	.15100	.11367	.13900	.11900	.13600	.06500	.07300	.10800	.08700	.38500	.21200	.31476	.34507	.01379
132	.14900	.14201	.11100	.13810	.11000	.11900	.06300	.06045	.09000	.07600	.34000	.21200	.30200	.33500	.01400
140	.14586	.14400	.11000	.12960	.09268	.11315	.05900	.05600	.07289	.07225	.29200	.21500	.24626	.32981	.01369

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
70	.00650	.00700	.03032	.00635	.00212	.00070	.01424	.00600	.00368	.00130	.00620	.00167
100	.00620	.00690	.03046	.00640	.00204	.00088	.01400	.00560	.00402	.00131	.00619	.00122
122	.00645	.00685	.03780	.00640	.00200	.00098	.01440	.00540	.00388	.00144	.00629	.00144
132	.00605	.00680	.03090	.00680	.00195	.00099	.01440	.00520	.00360	.00152	.00650	.00156
140	.00680	.00653	.03000	.00659	.00198	.00099	.01390	.00520	.00340	.00158	.00665	.00161

RUN 4510

DATE = 10-23-73
PROJECT NUMBER PA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-II SHUTTLE ORBITER TEST

TEST CONDITIONS ---------- TEST GAS NITROGEN ---------- Q-D. ST-D BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 25.000 DEG. MODEL LENGTH 23.226 INCHES

TIME	P-INF	RHO-INF	T-INF	U-INF	M-INF	Q-INF	RE/FT	RE-L	PO	TO	HO	QD BTU/	STO	POP	HREF BTU/
MSEC	PSIA	LBM/CU-FT	DEG R	FT/SEC		PSIA	X10-6	X10-6	PSIA	DEG R	BTU/LBM	SQFT-SEC		PSIA	SQFT-SEC
76	.110630	.002416	110.4	5421	10.35	8.291	5.0034	9.6841	5496	2272	6.140E 02	140.3	.02060	15.292	.0810
100	.084860	.002038	108.8	5372	10.33	6.340	3.9212	7.5895	4281	2246	6.029E 02	119.3	.02323	11.692	.0699
116	.068344	.001832	97.4	5133	10.43	5.205	3.7593	7.2762	3644	2052	5.501E 02	95.6	.02442	9.589	.0632
138	.059600	.001644	94.7	4994	10.30	4.422	3.3796	6.5411	2940	1943	5.212E 02	79.6	.02503	8.142	.0568

RUN 451I

DATE = 10-23-73

PROJECT NUMBER VA354-21FA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / RT OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
76	.50836	.26914	.18147	.14123	.11218	.09588	.06816	.09770	.11644	.08517	.06272	.06172	.09266	.10159	.06864
100	.49327	.25713	.17054	.13476	.10942	.09035	.06819	.09377	.10797	.08292	.05420	.05563	.08807	.09729	.05905
116	.49841	.25690	.17107	.13508	.10848	.09211	.06563	.09359	.10916	.08330	.05444	.05461	.09083	.09852	.05749
138	.49345	.25936	.17143	.13204	.10036	.09068	.06296	.09272	.11023	.08495	.05173	.05478	.09216	.09463	.05536

TIME	Q14	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
76	.09208	.10639	.14643	.17732	.16162	.11397	.09875	.08540	.08536	.10826	.15204	.14335	.13485	.12402	.12441
100	.08868	.09500	.13163	.16024	.14728	.10822	.09597	.07690	.07686	.09121	.13777	.16111	.13716	.11280	.11316
116	.08611	.09198	.12647	.14946	.14120	.10196	.09344	.07723	.07719	.08588	.13841	.15608	.14347	.11325	.11362
138	.08343	.08073	.12316	.13867	.13392	.09382	.09093	.07540	.06914	.08040	.13306	.12462	.13058	.10680	.09745

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
76	.14218	.14282	.09897	.18215	.15817	.15974	.14696	.25952	.23838	.14411	.18059	.19734	.10721	.26280	.02279
100	.13087	.12003	.08734	.16413	.13564	.11986	.13572	.16933	.17035	.09228	.17874	.20581	.09941	.27830	.02211
116	.13143	.11482	.08193	.17048	.13619	.11466	.13627	.14086	.13639	.07881	.18140	.20306	.10769	.27130	.02245
138	.11462	.10941	.07647	.16103	.13087	.11500	.11388	.10860	.10866	.06977	.18190	.20208	.10612	.25070	.02275

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
76	.00777	.00564	.03856	.00880	.00256	.00146	.01565	.00898	.00230	.00184	.01047	.00175
100	.00763	.00501	.03455	.00838	.00253	.00158	.01551	.00852	.00328	.00198	*****	.00129
116	.00804	.00474	.03332	.00833	.00243	.00175	.01477	.00856	.00373	.00212	*****	.00121
138	.00836	.00476	.03117	.00865	.00245	.00203	.01474	.00859	.00409	.00232	*****	.00117

RUN 4511

DATE = 10-23-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
76	.50500	.25000	.16500	.12700	.10000	.08500	.06000	.08600	.10250	.07400	.05500	.05395	.08100	.08880	.06000
100	.49000	.23877	.15500	.12114	.09750	.08006	.06000	.08250	.09500	.07200	.04750	.04861	.07694	.08500	.05159
116	.49500	.23800	.15500	.12100	.09630	.08130	.05750	.08200	.09564	.07200	.04750	.04750	.07900	.08569	.05000
138	.49000	.23988	.15500	.11800	.08886	.07982	.05500	.08100	.09630	.07318	.04500	.04750	.07990	.08206	.04800

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
76	.08249	.09300	.12800	.15500	.14000	.09800	.08750	.07500	.07500	.09500	.13250	.12464	.12000	.11000	.11000
100	.06000	.06300	.11500	.14000	.12750	.09300	.08500	.06750	.06750	.08000	.12000	.14000	.12200	.10000	.10000
116	.05750	.08000	.11000	.13000	.12166	.08718	.08243	.06750	.06750	.07500	.12000	.13500	.12713	.10000	.10000
138	.05500	.07000	.10680	.12016	.11500	.07994	.08000	.06570	.06028	.07000	.11500	.10745	.11540	.09406	.08553

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
76	.12500	.12500	.08500	.16100	.14000	.14000	.14000	.23000	.21000	.12500	.16000	.17500	.09500	.25000	.01980
100	.11500	.11500	.07500	.14500	.12000	.10500	.12000	.15000	.15000	.08000	.15828	.16242	.08805	.24591	.01920
116	.11500	.10000	.07000	.15000	.12000	.10000	.12000	.12428	.11959	.06800	.16000	.17928	.09500	.23874	.01940
138	.10000	.09500	.06000	.14128	.11500	.10000	.10000	.09555	.09500	.06000	.16000	.17793	.09336	.22000	.01960

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
76	.00675	.00490	.03350	.00765	.00222	.00127	.01360	.00780	.00200	.00160	.00910	.00152
100	.00680	.00435	.03000	.00728	.00220	.00137	.01347	.00740	.00285	.00172	*****	.00112
116	.00695	.00410	.02880	.00720	.00210	.00151	.01276	.00740	.00322	.00183	*****	.00105
138	.00720	.00410	.02886	.00745	.00211	.00175	.01270	.00740	.00353	.00200	*****	.00101

RUN 4511

DATE * 10-30-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RT OH-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 30.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QD BTU/ SQFT-SEC	STD	PQP PSIA	HREF BTU/ SQFT-SEC
70	.113181	.003265	90.5	5754	12.13	11.658	8.0857	15.6499	14718	2412	6.835E 02	197.0	.01907	21.544	.1052
82	.100909	.002717	97.0	5897	12.01	10.188	6.4338	12.4527	12824	2554	7.184E 02	197.1	.02103	18.834	.0979
112	.073129	.002018	94.6	5782	11.92	7.277	4.8053	9.3006	9180	2502	6.911E 02	158.0	.02428	13.448	.0805
130	.063248	.001834	90.1	5596	11.83	6.192	4.4384	8.5906	7539	2368	6.475E 02	133.3	.02528	11.434	.0729

RUN 4512

DATE = 10-30-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11, SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
70	.58641	.34029	.22277	.19125	.15430	.13456	.11083	.14785	.16180	.09757	.10250	.13934	.13757	.13709	.17979
82	.55131	.31879	.21385	.17780	.14305	.12058	.10025	.14480	.15594	.09505	.09353	.08465	.10823	.11103	.08075
112	.56730	.30512	.19882	.16705	.13322	.11512	.09627	.13491	.14778	.09112	.08559	.08080	.09988	.10213	.07632
130	.53341	.30111	.19844	.15854	.12792	.11087	.09212	.12506	.14099	.08869	.08127	.07309	.09558	.10013	.07534

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
70	.23261	.29778	.29216	.32139	.30981	.21484	.15521	.24305	.30185	.37209	.39000	.31634	.34224	.36329	.38886
82	.10318	.12225	.16150	.23888	.24333	.18472	.10735	.09936	.11092	.18882	.27898	.27370	.15118	.14038	.17236
112	.09539	.09509	.12265	.15712	.16762	.13351	.10188	.09049	.09045	.11627	.16886	.18730	.13344	.12170	.13872
130	.08540	.09445	.10156	.13156	.14754	.11665	.10094	.08618	.08241	.11201	.15054	.15941	.12261	.12190	.13229

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
70	.44132	.35266	.23677	.48011	.50094	.36267	.39534	.48101	.44743	.22719	.57241	.37471	.43236	.50004	.01625
82	.26694	.24955	.18321	.22976	.21354	.24723	.09866	.15269	.15359	.11294	.53131	.24882	.39621	.46586	.01615
112	.17855	.15417	.11876	.18872	.14190	.15447	.11093	.11294	.11248	.08370	.44302	.23237	.34551	.41717	.01559
130	.14534	.13464	.09728	.18180	.13881	.13458	.10912	.10204	.11380	.07934	.42936	.22722	.33278	.38026	.01516

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q87	Q88
70	.00729	.00835	.04477	.00717	.00207	.00068	.01710	.00678	.00442	.00096	.00137	.00918
82	.00710	.00767	.04295	.00678	.00200	.00101	.01661	.00653	.00458	.00100	.00121	.00833
112	.00722	.00693	.04069	.00649	.00204	.00123	.01662	.00596	.00453	.00105	.00097	.00785
130	.00724	.00669	.04021	.00661	.00218	.00130	.01565	.00546	.00450	.00117	.00154	.00775

RUN 4512

DATE = 10-30-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OM-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
70	.58500	.32100	.20600	.17500	.14000	.12143	.09932	.13250	.14500	.08500	.09150	.12400	.12242	.12200	.16000
82	.55000	.30100	.19d00	.16300	.13000	.10900	.09000	.13000	.14000	.08300	.08365	.07548	.09650	.04900	.07200
112	.56595	.28d00	.18400	.15300	.12100	.10400	.08628	.12104	.13259	.07950	.07650	.07200	.08900	.09100	.06800
130	.53211	.28395	.18344	.14500	.11600	.10000	.08250	.11200	.12627	.07720	.07250	.06500	.08500	.04905	.06700

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
70	.20700	.26500	.26000	.28600	.27316	.18800	.14000	.21730	.27000	.33242	.34600	.28000	.31000	.32800	.35000
82	.09200	.10400	.14400	.21300	.21500	.16200	.09700	.08900	.09940	.16900	.24800	.24275	.13717	.12696	.15541
112	.08500	.08473	.10429	.14000	.14800	.11700	.09200	.08100	.08100	.10400	.15000	.16600	.12100	.11000	.12500
130	.07595	.08400	.09032	.11700	.13000	.10200	.09100	.07700	.07367	.10000	.13346	.14100	.11100	.11000	.11900

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
70	.39500	.31423	.20700	.43200	.45137	.32360	.35600	.43395	.40128	.20060	.51625	.33826	.39000	.45000	.01416
82	.23936	.22279	.16056	.20710	.19279	.22102	.08900	.13798	.13800	.09993	.48000	.22500	.35800	.43800	.01410
112	.16000	.14200	.10400	.17000	.12800	.13800	.10000	.10200	.10100	.07400	.40000	.21000	.31240	.37585	.01360
130	.13000	.11980	.08500	.16349	.12500	.12000	.09821	.09200	.10200	.07000	.38701	.20500	.30000	.34200	.01320

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q87	Q88
70	.00635	.00728	.03700	.00625	.00180	.00077	.01490	.00591	.00385	.00084	.00119	.00799
82	.00620	.00670	.03750	.00592	.00175	.00088	.01460	.00570	.00400	.00097	.00106	.00727
112	.00630	.00605	.03550	.00566	.00178	.00107	.01450	.00520	.00395	.00092	.00085	.00685
130	.00630	.00600	.03500	.00575	.00190	.00113	.01380	.00475	.00392	.00102	.00134	.00675

RUN 4512

DATE = 10-30-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / AT OH-II SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0. ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 30.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	POP PSIA	HREF BTU/ SQFT-SEC
84	.042442	.001119	99.1	5685	11.46	3.899	2.5016	4.8418	4428	2485	6.697E 02	110.7	.03248	7.201	.0569
92	.039759	.001085	95.7	5579	11.44	3.642	2.4644	4.7699	4093	2402	6.452E 02	101.7	.03284	6.724	.0546
112	.034541	.000998	90.4	5388	11.37	3.125	2.3180	4.4864	3402	2253	6.021E 02	83.6	.03319	5.764	.0488
132	.029132	.000861	85.3	5258	11.42	2.568	2.0685	4.0036	2865	2149	5.730E 02	71.3	.03585	4.734	.0443
156	.025255	.000762	84.0	5338	11.35	2.033	1.5454	2.9912	2272	2221	5.916E 02	65.5	.04055	3.750	.0390

RUN 4513

DATE = 10-30-73
PROJECT NUMBER VA354-23FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
84	.50756	.28079	.19452	.14961	.12113	.10241	.08026	.10591	.12263	.08255	.07050	.06511	.09542	.10103	.05978
92	.49119	.22794	.19468	.15302	.12125	.10528	.07924	.10747	.12276	.08496	.07170	.06518	.09665	.10452	.05844
112	.51126	.29720	.19282	.15947	.12701	.11106	.08501	.11465	.12864	.09096	.07637	.06760	.10252	.11041	.05746
132	.52130	.29749	.20066	.16997	.13275	.11681	.08741	.12047	.13766	.09211	.07876	.06660	.10611	.11175	.05644
158	.49522	.28138	.20049	.16979	.13039	.11389	.08841	.11831	.13691	.08986	.07886	.06425	.10371	.11273	.05749

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
84	.06002	.05555	.05135	.05500	.04815	.03082	.09692	.07933	.06227	.05479	.05115	.05041	.12133	.10402	.08880
92	.06069	.05619	.05170	.05547	.04690	.03200	.09834	.08054	.06373	.05598	.05299	.04972	.12421	.10413	.08889
112	.06196	.05633	.05633	.05746	.05095	.03095	.10556	.08522	.07061	.06284	.06216	.05211	.12724	.10768	.09243
132	.06096	.05644	.06096	.05549	.04844	.02987	.10831	.08726	.07747	.06858	.06308	.05700	.13022	.10772	.09494
158	.06087	.05636	.06539	.05185	.04552	.02409	.11031	.08800	.07625	.07073	.07469	.05894	.12730	.10884	.08648

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
84	.07310	.06381	.04243	.13343	.08807	.08341	.07877	.05576	.05570	.04752	.19386	.21028	.12239	.26644	.01582
92	.07467	.05555	.05262	.13338	.08602	.06295	.08052	.05210	.05353	.05066	.19961	.20979	.12196	.26672	.01550
112	.07840	.06631	.04244	.13702	.08652	.06539	.08571	.06444	.07377	.05906	.19743	.21983	.12223	.27845	.01554
132	.07630	.06315	.04139	.13726	.08303	.08893	.08920	.07825	.07950	.05804	.18925	.22021	.11131	.27311	.01616
158	.06724	.05695	.03903	.12504	.07582	.09127	.09243	.08781	.08499	.05909	.15937	.21661	.10561	.24974	.01636

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q87	Q88
84	.00711	.00642	.04127	.00745	.00189	.00131	.01445	.00536	.00422	.00113	.00126	.01134
92	.00743	.00700	.04167	.00746	.00195	.00132	.01435	.00540	.00453	.00115	.00109	.01102
112	.00725	.00726	.04260	.00807	.00213	.00147	.01485	.00576	.00484	.00150	.00115	*****
132	.00762	.00716	.04213	.00889	.00231	.00166	.01674	.00600	.00508	.00208	.00127	*****
158	.00795	.00691	.04096	.00899	.00246	.00163	.01750	.00599	.00489	.00248	.00161	*****

RUN 4513

DATE = 10-30-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
84	.50634	.26500	.18000	.13700	.11000	.09250	.07200	.09500	.11000	.07200	.06300	.05800	.08500	.09000	.05325
92	.49000	.21500	.18000	.14000	.11000	.09500	.07100	.09630	.11000	.07400	.06400	.05800	.08600	.09300	.05200
112	.51000	.28000	.17600	.14563	.11500	.10000	.07600	.10250	.11500	.07900	.06800	.06000	.09100	.09800	.05100
132	.52000	.28000	.18500	.15500	12000	.10500	.07800	.10750	.12284	.07981	.07000	.05900	.09400	.09900	.05000
156	.49399	.26502	.18500	.15500	.11800	.10250	.07900	.10571	.12233	.07799	.07000	.05700	.09200	.10000	.05100

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
84	.05400	.04549	.04574	.04900	.04250	.02700	.08750	.07100	.05575	.04900	.04542	.04466	.11000	.09400	.08000
92	.05400	.05000	.04600	.04900	.04134	.02800	.08870	.07200	.05700	.05000	.04700	.04400	.11250	.09400	.08000
112	.05500	.05000	.05000	.05100	.04480	.02700	.09500	.07600	.06300	.05600	.05500	.04600	.11500	.09700	.08300
132	.05400	.05000	.05400	.04951	.04250	.02600	.09731	.07768	.06900	.06100	.05571	.05021	.11750	.09687	.08510
156	.05400	.05000	.05800	.04600	.04000	.02100	.09923	.07844	.06800	.06300	.06600	.05200	.11500	.09800	.07762

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
84	.06550	.05691	.03715	.12053	.07222	.07450	.07100	.05035	.05000	.04200	.17500	.19000	.11050	.24000	.01380
92	.06700	.05038	.04000	.12000	.07750	.07400	.07250	.04700	.04800	.04472	.18000	.18935	.11000	.24000	.01350
112	.07000	.05894	.03700	.12300	.07778	.07600	.07700	.05800	.06600	.05200	.17757	.19800	.11000	.25000	.01350
132	.06400	.05061	.03600	.12300	.07451	.07900	.08000	.07031	.07100	.05100	.17000	.19800	.10000	.24477	.01400
156	.06000	.05059	.03400	.11219	.06813	.08118	.08300	.07900	.07600	.05200	.14333	.14500	.09500	.22411	.01420

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q87	Q88
84	.00620	.00560	.03600	.00650	.00165	.00114	.01260	.00468	.00368	.00098	.00110	.00990
92	.00647	.00610	.03629	.00650	.00170	.00115	.01250	.00470	.00395	.00100	.00095	.00960
112	.00630	.00631	.03700	.00701	.00185	.00128	.01260	.00500	.00420	.00130	.00100	*****
132	.00660	.00620	.03650	.00770	.00200	.00144	.01450	.00520	.00440	.00180	.00110	*****
156	.00690	.00600	.03655	.00740	.00214	.00159	.01519	.00520	.00425	.00215	.00140	*****

RUN 4513

DATE = 10-30-73
PROJECT NUMBER.. VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0. ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 30.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QD BTU/ SQFT-SEC	STO	POP PSIA	HREF BTU/ SQFT-SEC
64	.037802	.000810	162.2	6995	11.02	3.216	1.0241	1.9822	3679	3649	1.017E 03	174.7	.04638	5.960	.0562
78	.032356	.000433	145.1	7549	10.84	2.662	.8540	1.2658	3089	4202	1.186E 03	190.3	.05529	4.939	.0520
98	.025823	.000325	207.8	7720	10.74	2.086	.4713	.9122	2408	4387	1.241E 03	179.1	.06452	3.871	.0465
118	.019599	.000259	197.6	7577	10.81	1.603	.3875	.7500	1893	4242	1.195E 03	149.2	.07162	2.975	.0403

RUN 4514

DATE = 10-30-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / AI OH-1; SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
6A	.58128	.34270	.22278	.18697	.14881	.12896	.10493	.13530	.14634	.09290	.10308	.09225	.11103	.10087	.08558
7A	.56120	.33175	.22241	.18342	.14850	.12868	.10688	.12947	.13809	.08924	.10172	.08980	.10311	.10948	.08204
9A	.54160	.31301	.20892	.17031	.13715	.11806	.09683	.11838	.12939	.08127	.09061	.08064	.09576	.09556	.07429
11A	.52930	.30013	.20032	.16767	.13350	.11522	.09255	.11155	.12395	.07906	.08402	.07538	.09145	.09622	.06873

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
6A	.07869	.06891	.06224	.06446	.05268	.03329	.10969	.09018	.07302	.06330	.05851	.05082	.14494	.11190	.10121
7A	.07599	.06652	.06098	.06209	.05365	.03263	.09422	.08806	.07267	.06630	.05920	.04957	.13826	.11106	.09748
9A	.06869	.06094	.05727	.05761	.05026	.02923	.09198	.07724	.06618	.05742	.05494	.04787	.12955	.10627	.09159
11A	.06651	.05986	.05543	.05543	.04873	.02813	.09148	.07342	.06401	.05745	.05640	.04622	.12551	.10398	.08780

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
6A	.07575	.06932	.03039	.15612	.10441	.09198	.10337	.08151	.07174	.05093	.20396	.26130	.11529	.23298	.01756
7A	.07167	.06313	.03049	.15646	.10308	.08631	.10972	.09311	.07708	.05571	.19449	.24415	.11778	.11603	.02022
9A	.06835	.05976	.03488	.14677	.09626	.07959	.10527	.08758	.07923	.04909	.18772	.24620	.12335	.09615	.02009
11A	.06618	.05768	.03265	.14476	.09320	.07701	.10093	.08571	.08147	.05023	.19173	.24084	.12050	.08782	.01999

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q87	Q88
6A	.00751	.00549	.03498	.00821	.00195	.00167	.01558	.00457	.00446	.00171	.00102	.01254
7A	.00771	.00525	.03274	.00843	.00201	.00189	.01525	.00467	.00418	.00209	.00105	.01248
9A	.00790	.00508	.02894	.00880	.00220	.00186	.01423	.00356	.00395	.00283	.00107	.01129
11A	.00791	.00530	.02634	.00870	.00237	.00184	.01415	.00316	.00361	.00328	.00112	.01186

RUN 4514

DATE = 10-30-73
PROJECT NUMBER VA354-21EA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
64	.58000	.32500	.20750	.17250	.13625	.11750	.09500	.12250	.13250	.08200	.09300	.08300	.09990	.10875	.07700
78	.56000	.31500	.20750	.17000	.13625	.11750	.09700	.11750	.12532	.07900	.09200	.08100	.09300	.09875	.07400
98	.54065	.29445	.19500	.15750	.12590	.10786	.08793	.10750	.11750	.07200	.08200	.07278	.08643	.08625	.06705
118	.52817	.28500	.19250	.15500	.12250	.10522	.08400	.10125	.11250	.07000	.07600	.06800	.08250	.08680	.06200

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
64	.06900	.06200	.05000	.05800	.04700	.02950	.09990	.08148	.06600	.05715	.05250	.04550	.13250	.10200	.09200
78	.06800	.06000	.05500	.05600	.04800	.02900	.08600	.07975	.06584	.06000	.05325	.04450	.12666	.10145	.08881
98	.06200	.05500	.05169	.05200	.04500	.02600	.08400	.07000	.06000	.05200	.04900	.04300	.11875	.09713	.06349
118	.06000	.05400	.05000	.05000	.04360	.02500	.08351	.06650	.05800	.05200	.05074	.04150	.11500	.09500	.08000

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
64	.06451	.05484	.03400	.14187	.09500	.08250	.09400	.07425	.06500	.04550	.18573	.23814	.10500	.21174	.01550
78	.06515	.05700	.03233	.14250	.09400	.07803	.10000	.08500	.07000	.04990	.17750	.22300	.10750	.19569	.01790
98	.06200	.05400	.03100	.13375	.08793	.07200	.09600	.08000	.07200	.04400	.17141	.22500	.11265	.08763	.01780
118	.06000	.05227	.02900	.13146	.08500	.06963	.09200	.07825	.07400	.04500	.17500	.22000	.11000	.08000	.01770

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q87	Q88
64	.00662	.00485	.03079	.00725	.00172	.00147	.01375	.00403	.00393	.00150	.00090	.01107
78	.00642	.00465	.02900	.00747	.00178	.00167	.01350	.00360	.00370	.00185	.00093	.01105
98	.00700	.00450	.02564	.00780	.00195	.00165	.01261	.00315	.00350	.00250	.00094	.01000
118	.00700	.00469	.02336	.00770	.00210	.00162	.01253	.00280	.00320	.00290	.00099	.01050

RUN 4S14

DATE = 10-31-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / AT OM-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 30.000 DEG. MODEL LENGTH 23.226 INCHES

TIME	P-INF	RHO-INF	T-INF	U-INF	M-INF	Q-INF	RE/FT	RE-L	PO	TO	HO	QO BTU/	STO	POP	HREF BTU/
MSEC	PSIA	LBM/CU-FT	DEG R	FT/SEC		PSIA	X10-6	X10-6	PSIA	DEG R	BTU/LBM	SQFT-SEC		PSIA	SQFT-SEC
82	.035385	.001164	78.1	6428	14.59	5.274	3.7973	7.3497	17368	2926	8.445E 02	174.5	.03226	9.771	.0731
86	.034982	.001124	81.3	6525	14.52	5.159	3.5145	6.8023	16892	3016	8.703E 02	179.6	.03326	9.560	.0725
106	.032851	.000943	91.0	6806	14.31	4.709	2.7466	5.3161	15289	3285	9.476E 02	194.3	.03720	8.732	.0708
126	.029625	.000772	100.2	7086	14.20	4.179	2.1259	4.1146	13849	3560	1.027E 03	201.9	.04131	7.754	.0669
160	.026338	.000635	108.3	7239	13.95	3.589	1.6537	3.2007	11505	3735	1.073E 03	197.3	.04567	6.661	.0618

RUN 4515

DATE = 10-31-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / HI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
82	.58133	.35127	.23184	.19284	.14872	.12644	.09432	.13316	.15592	.10923	.08687	.07871	.11667	.12846	.07819
86	.58132	.33812	.22609	.19029	.14796	.12157	.09487	.13785	.15755	.10617	.08528	.07813	.11326	.12962	.07813
106	.60135	.35362	.23654	.17642	.14771	.12765	.09815	.13834	.15494	.10507	.09091	.07797	.11436	.12830	.07240
126	.60133	.35333	.23628	.18949	.14750	.12627	.09392	.13260	.15371	.10345	.08649	.07519	.11120	.12788	.07228
160	.58127	.34790	.24852	.19034	.15598	.13197	.10325	.13800	.16114	.10616	.09055	.07221	.11110	.12846	.06110

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
82	.09495	.11170	.12287	.13404	.14649	.11917	.11580	.10099	.09513	.09083	.11203	.14035	.14813	.13328	.12073
86	.10610	.10604	.11142	.11720	.14919	.11339	.11572	.10668	.09442	.09453	.12709	.12781	.14894	.13756	.12148
106	.07574	.08354	.08354	.08911	.09549	.07919	.11551	.10093	.08869	.09434	.10054	.11194	.15514	.13351	.12447
126	.06672	.07228	.06072	.07228	.07289	.05645	.11534	.10077	.08301	.08865	.08921	.08940	.15064	.13170	.12107
160	.06918	.06790	.07089	.06646	.07842	.05639	.11984	.10068	.08548	.08013	.078001	.07815	.15959	.12754	.11496

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
82	.12424	.12735	.09086	.16844	.13248	.13371	.17114	.12555	.12032	.11486	.06889	.24163	.24691	.24468	.35369
86	.12212	.12263	.08511	.16570	.13238	.12804	.17186	.12142	.11754	.10526	.06184	.23593	.23962	.25473	.34850
106	.11060	.10014	.07358	.17045	.13215	.12772	.16335	.12120	.10926	.10130	.05991	.20905	.24185	.16598	.31972
126	.10509	.09441	.06214	.16542	.13195	.11426	.16052	.11002	.10434	.09386	.05600	.20200	.24600	.12632	.30319
160	.10355	.08678	.05643	.16409	.12381	.10154	.16938	.12018	.10629	.09018	.06065	.20210	.25205	.12613	.29358

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q87	Q88
82	.01680	.00758	.00889	.04673	.00729	.00205	.00151	.01767	.00581	.00508	.00133	.00847
86	.01651	.00797	.00877	.04614	.00731	.00199	.00154	.01720	.00579	.00518	.00125	.00843
106	.01627	.00795	.00863	.04610	.00772	.00203	.00164	.01761	.00609	.00544	.00108	.00839
126	.01648	.00804	.00816	.04421	.00805	.00210	.00170	.01417	.00536	.00549	.00096	.00816
160	.01585	.00781	.00810	.04459	.00861	.00215	.00173	.01755	.00544	.00562	.00119	.00923

RUN 4515

DATE = 10-31-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
82	.58000	.33231	.21572	.17725	.13560	.11470	.08500	.12000	.14051	.09584	.07800	.07046	.10444	.11500	.07000
86	.58000	.32000	.21000	.17500	.13500	.11035	.08555	.12432	.14208	.09323	.07663	.07000	.10147	.11613	.07000
106	.60000	.33500	.22000	.16250	.13500	.11608	.08868	.12500	.14000	.09250	.08185	.07000	.10267	.11519	.06500
126	.60000	.33500	.22000	.17475	.13500	.11500	.08500	.12000	.13911	.09126	.07800	.06762	.10000	.11500	.06500
160	.58000	.33000	.23154	.18305	.14287	.12029	.09352	.12500	.14596	.09375	.08174	.06500	.10000	.11563	.05500

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
82	.09500	.10000	.11000	.12000	.13000	.10500	.10500	.09800	.08557	.08162	.10000	.12500	.13485	.12096	.11649
86	.09506	.09500	.10000	.10500	.13250	.10000	.10500	.09600	.08500	.08500	.11353	.11393	.13568	.12492	.11000
106	.06800	.07500	.07500	.08000	.08500	.07000	.10500	.09100	.08000	.08500	.09000	.10000	.14157	.12147	.11291
126	.06000	.06500	.06000	.06500	.06500	.05000	.10500	.09100	.07500	.08000	.08000	.08000	.13766	.12000	.11000
160	.06227	.06112	.06341	.06000	.07000	.05000	.10919	.09100	.07730	.07238	.07000	.07000	.14595	.11630	.10453

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q88	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
82	.11183	.11414	.08000	.15237	.12000	.12000	.15500	.11366	.10912	.10358	.06122	.21907	.22405	.24000	.32000
86	.11000	.11000	.07500	.15000	.12000	.11500	.15576	.11000	.10667	.09500	.05500	.21405	.21759	.23114	.31553
106	.10000	.09000	.06500	.15477	.12000	.11494	.14831	.11000	.09933	.09159	.05339	.19000	.22000	.19088	.29000
126	.09500	.08500	.05500	.15062	.12000	.10300	.14597	.10000	.09500	.08500	.05000	.18386	.22410	.11500	.27543
160	.09369	.08000	.05000	.14917	.11269	.09162	.15415	.10933	.09585	.08174	.05421	.18411	.22980	.11492	.26693

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q87	Q88
82	.01474	.00700	.00780	.04100	.00640	.00180	.00132	.01550	.00510	.00446	.00117	.00743
86	.01450	.00700	.00770	.04052	.00642	.00175	.00135	.01510	.00508	.00455	.00110	.00740
106	.01433	.00700	.00760	.04059	.00680	.00178	.00144	.01550	.00536	.00478	.00095	.00739
126	.01454	.00709	.00720	.03900	.00710	.00185	.00150	.01250	.00473	.00484	.00085	.00720
160	.01400	.00690	.00715	.03938	.00760	.00190	.00152	.01550	.00480	.00497	.00105	.00815

RUN 4515

DATE = 10-31-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 20.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QD BTU/ SQFT-SEC	STD	POP PSIA	HREF BTU/ SQFT-SEC
110	.021104	.000787	70.1	6002	14.38	3.056	2.6263	5.0831	9680	2653	7.368E 02	111.7	.03922	5.655	.0529
120	.020150	.000675	78.0	6286	14.28	2.876	2.1193	4.1019	9220	2899	8.084E 02	121.4	.04240	5.324	.0515
130	.019151	.000575	87.0	6592	14.18	2.695	1.6981	3.2867	8789	3170	8.893E 02	133.6	.04662	4.994	.0508
174	.016696	.000435	105.1	7064	13.82	2.233	1.0866	2.1032	7092	3625	1.023E 03	146.7	.05630	4.142	.0476

RUN 4516

DATE = 10-31-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q4	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
110	.62146	.36516	.24111	.20170	.15939	.13813	.11015	.14390	.16411	.11321	.10721	.08370	.12042	.13201	.07749
120	.60138	.34358	.23164	.19043	.15357	.13375	.10655	.13874	.15393	.10717	.10305	.08045	.11732	.12432	.07039
130	.60136	.34848	.23452	.19283	.15329	.13623	.10633	.13989	.15229	.10461	.10227	.07804	.11427	.12541	.07124
174	.62137	.36381	.25233	.21350	.17040	.14599	.10936	.15188	.16944	.11097	.10198	.08226	.12228	.13895	.07548

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
110	.07336	.06497	.06945	.06980	.07347	.05124	.11885	.10863	.09363	.08928	.09831	.10698	.16516	.13034	.12187
120	.06888	.06242	.06021	.05587	.05636	.03569	.11450	.09967	.08450	.07681	.07151	.07861	.15382	.12091	.11054
130	.06669	.06243	.05797	.05128	.04779	.02870	.11204	.09768	.07988	.07220	.06429	.06722	.15901	.12099	.10755
174	.07114	.06336	.05069	.05082	.04629	.02546	.12354	.10247	.08299	.07754	.07246	.06205	.16957	.13166	.11553

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q88	Q89	Q70	Q71	Q72	Q74	Q79	Q80	Q81
110	.11139	.11243	.06037	.17455	.13281	.11173	.15824	.10797	.10209	.08672	.05757	.19604	.24856	.12714	.32134
120	.10001	.08705	.05340	.16309	.12146	.05947	.15186	.10364	.09375	.08048	.05178	.18755	.24250	.11571	.30402
130	.09204	.08040	.04759	.16000	.11902	.09731	.15155	.10343	.09026	.07526	.04941	.18167	.24202	.11009	.27582
174	.08847	.08144	.04630	.16234	.11991	.10206	.15391	.11273	.10206	.08702	.05293	.19220	.24690	.11530	.14859

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q87	Q88
110	.01601	.00766	.00778	.04460	.00915	.00217	.00181	.01658	.00560	.00480	.00091	.00858
120	.01693	.00764	.00724	.04161	.00912	.00214	.00177	.01539	.00536	.00474	.00088	.00855
130	.01640	.00762	.00703	.04036	.00910	.00223	.00176	.01592	.00512	.00472	.00085	.00864
174	.01756	.00793	.00716	.03739	.00952	.00238	.00185	.01636	.00619	.00453	.00082	.00935

RUN 4516

DATE = 10-31-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
110	.62000	.34500	.22341	.18500	.14500	.12500	.09900	.12934	.14750	.09900	.09600	.07472	.10750	.11785	.06918
120	.60000	.32500	.21500	.17500	.14000	.12130	.09600	.12500	.13868	.09400	.09250	.07200	.10500	.11127	.06300
130	.60000	.33000	.21800	.17750	.14000	.12380	.09600	.12630	.13750	.09200	.09200	.07000	.10250	.11250	.06390
174	.62000	.34500	.23500	.19696	.15600	.13300	.09900	.13750	.15339	.09793	.09200	.07400	.11000	.12500	.06790

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
110	.06549	.05900	.06200	.06231	.06500	.04500	.10750	.09742	.08400	.08000	.08750	.09500	.15000	.11800	.11000
120	.06165	.05587	.05389	.05000	.05000	.03144	.10380	.08960	.07600	.06900	.06382	.07000	.14000	.10971	.10000
130	.06000	.05600	.05200	.04600	.04250	.02595	.10250	.08800	.07200	.06500	.05750	.06000	.14500	.11000	.09750
174	.06400	.05700	.05100	.04500	.04130	.02255	.11250	.09257	.07500	.07000	.06500	.05555	.15500	.12000	.10500

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
110	.10000	.10049	.06000	.15750	.12000	.10000	.14256	.09750	.09236	.07800	.05100	.17729	.22500	.11500	.29000
120	.09000	.07800	.04700	.14750	.11000	.08925	.13750	.09380	.08500	.07256	.04600	.17000	.22000	.10489	.27500
130	.09300	.07220	.04200	.14500	.10800	.08750	.13750	.09380	.08200	.06800	.04400	.16500	.22000	.10000	.25000
174	.09000	.07335	.04100	.14750	.10900	.09203	.14000	.10250	.09295	.07884	.04728	.17500	.22500	.10500	.13500

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q87	Q88
110	.01400	.00670	.00080	.03900	.00800	.00190	.00158	.01450	.00490	.00420	.00080	.00750
120	.01450	.00670	.00035	.03650	.00800	.00188	.00155	.01350	.00470	.00416	.00077	.00750
130	.01442	.00670	.00018	.03550	.00800	.00196	.00155	.01400	.00450	.00415	.00075	.00760
174	.01550	.00700	.00030	.03300	.00840	.00210	.00163	.01443	.00470	.00400	.00072	.00825

RUN 4516

DATE = 10-31-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OV-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 30.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	POP PSIA	HREF BTU/ SQFT-SEC
96	.011308	.000402	73.8	6945	16.22	2.092	1.4745	2.8539	13021	3421	9.817E 02	135.2	.05707	3.882	.0469
118	.012780	.000341	98.8	7842	15.49	2.145	1.0352	2.0036	12029	4106	1.191E 03	171.8	.06245	3.986	.0482
148	.011904	.000272	114.4	8112	15.21	1.929	.7510	1.4525	10815	4609	1.342E 03	191.1	.07170	3.587	.0470

RUN 4517

DATE = 10-31-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
9s	.63140	.36402	.24715	.20506	.16623	.14834	.12584	.16477	.17693	.11007	.13461	.12943	.13077	.13911	.12242
11s	.61132	.35815	.24271	.20345	.16354	.14345	.11993	.15763	.16534	.10623	.12499	.12422	.12477	.12755	.11646
14s	.60127	.34205	.24095	.19129	.15786	.14220	.12105	.14856	.15847	.09539	.12974	.11071	.11769	.11625	.10296

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
9s	.10664	.10461	.10795	.10906	.10774	.08024	.12013	.10860	.10246	.14284	.16741	.13980	.16964	.14234	.14869
11s	.09582	.09760	.09760	.09760	.10176	.07430	.11234	.10604	.10357	.11882	.13346	.11701	.17205	.14236	.13726
14s	.09300	.08414	.07307	.06844	.06696	.04494	.11490	.10470	.08961	.07813	.07836	.06706	.15579	.12847	.12059

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
9s	.16696	.14451	.08456	.18009	.15185	.13190	.16508	.11835	.10991	.09835	.05717	.19789	.24716	.12092	.23684
11s	.13744	.12187	.06984	.18040	.14568	.12172	.17445	.12625	.10404	.09295	.05249	.20059	.25570	.12472	.16254
14s	.09695	.08626	.04721	.16203	.11538	.09113	.16979	.13019	.10285	.09001	.05016	.18605	.24604	.11763	.12687

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q87	Q88
9s	.01929	.00817	.00760	.03631	.00930	.00216	.00170	.01607	.00444	.00426	.00130	.01248
11s	.01910	.00791	.00791	.03142	.00904	.00227	.00175	.01582	.00373	.00384	.00101	.01017
14s	.01906	.00767	.00526	.02876	.00864	.00222	.00178	.01466	.00350	.00361	.00089	.00970

RUN 4517

DATE = 10-31-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OR-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
96	.63000	.34500	.23000	.18900	.15203	.13500	.11380	.14900	.16000	.09700	.12130	.11630	.11750	.12500	.11000
118	.61000	.34000	.22634	.18800	.15000	.13094	.10880	.14300	.15000	.09400	.11300	.11200	.11250	.11500	.10500
148	.60000	.32500	.22500	.17700	.14500	.13000	.11000	.13500	.14400	.08459	.11750	.10000	.10630	.10500	.09300

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
96	.09000	.09400	.09700	.09800	.09600	.07100	.10928	.09800	.09250	.12880	.15000	.12500	.15491	.12960	.13500
118	.09000	.08800	.08800	.08800	.09100	.06600	.10250	.09600	.09380	.10750	.12000	.10500	.15756	.13000	.12500
148	.08400	.07660	.06000	.06200	.06000	.04000	.10500	.09495	.08130	.07081	.07059	.06029	.14289	.11750	.11000

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
96	.15000	.13000	.07300	.16400	.13800	.11880	.15000	.10750	.10000	.06900	.05100	.18000	.22500	.11000	.21500
118	.12500	.11000	.06200	.16470	.13269	.11000	.15900	.11502	.09494	.08438	.04700	.18300	.23348	.11380	.14800
148	.08800	.07e00	.04200	.14775	.10534	.08250	.15500	.11880	.09400	.08184	.04500	.17000	.22500	.10750	.11571

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q87	Q88
96	.01700	.00720	.00670	.03200	.00820	.00190	.00150	.01416	.00391	.00375	.00115	.01100
118	.01690	.00700	.00700	.02780	.00800	.00201	.00155	.01400	.00330	.00340	.00089	.00900
148	.01690	.00680	.00466	.02550	.00766	.00197	.00157	.01300	.00310	.00320	.00079	.00860

RUN 4517

DATE = 10-31-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q=0. ST=0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 35.000 DEG. MODEL LENGTH 23.226 INCHES

TIME	P-INF	RHO-INF	T-INF	U-INF	M-INF	Q-INF	RE/FT	RE-L	PO	TO	HO	QO BTU/	STO	POP	HREF BTU/
MSEC	PSIA	LBM/CU-FT	DEG R	FT/SEC		PSIA	X10-6	X10-6	PSIA	DEG R	BTU/LBM	SQFT-SE		PSIA	SQFT-SEC
60	.062165	.001614	100.6	5808	11.61	5.869	3.6290	7.0239	6841	2556	6.984E 02	143.9	.02719	10.845	.0714
78	.049112	.001264	120.5	6314	11.54	4.576	2.1725	4.2049	5670	3000	8.258E 02	157.5	.03386	8.467	.0640
96	.038310	.000780	128.3	6527	11.56	3.582	1.5452	2.9906	4706	3198	8.824E 02	152.3	.03996	6.632	.0573
118	.031857	.000726	114.7	6159	11.54	2.969	1.5108	2.9396	3769	2890	7.859E 02	118.5	.04064	5.491	.0504

RUN 4518

DATE = 10-2, 73

PROJECT NUMBER. VA354-21FA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
60	.59017	.35553	.23959	.20969	.17127	.15255	.12614	.16455	.17552	.10536	.11837	.11597	.13254	.13806	.10162
78	.56047	.32759	.22038	.19397	.16430	.14745	.12296	.15093	.16394	.09680	.10969	.10176	.12213	.12651	.08581
96	.51987	.30254	.21706	.18141	.15533	.13506	.11547	.13639	.14666	.08753	.10407	.09339	.11536	.11536	.07361
118	.53338	.30212	.21853	.17793	.15274	.13290	.10938	.13713	.14608	.08056	.10429	.09107	.11561	.11628	.07928

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
60	.11045	.10824	.11547	.18741	.26597	.19073	.12264	.10445	.11814	.17797	.25288	.24985	.17372	.15119	.10386
78	.07976	.07620	.07041	.07701	.10421	.07826	.10733	.08979	.07987	.07331	.08827	.10505	.13374	.09769	.09880
96	.07416	.07141	.06592	.07141	.09686	.07863	.10309	.08205	.07108	.06568	.07162	.08281	.12432	.09758	.08698
118	.07157	.06612	.05742	.05088	.06617	.04476	.10326	.07921	.06848	.06074	.06074	.06808	.12454	.09532	.08608

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
60	.23305	.22168	.18210	.20762	.19642	.17627	.24557	.21878	.20880	.15346	.11131	.29437	.44661	.59145	.33159
78	.09048	.09340	.07608	.14155	.10875	.09328	.10988	.15880	.11166	.08224	.06096	.23360	.25577	.34109	.20685
96	.08196	.08121	.06143	.13595	.09776	.08220	.17460	.13935	.10307	.07548	.05534	.20077	.22347	.31357	.14506
118	.08104	.07148	.04927	.13621	.09794	.08924	.17415	.14156	.10327	.08101	.06060	.20466	.22482	.27658	.14164

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q87	Q88
60	.01144	.01019	.01003	.06127	.00836	.00240	.00109	.01591	.00155	.00228	.00192	.01376
78	.01139	.00934	.01001	.06264	.00909	.00239	.00120	.01537	.00125	.00125	.00204	.01025
96	.01152	.00875	.01440	.06252	.01000	.00250	.00114	.01478	.00108	.00102	.00210	.00978
118	.01169	.00844	.01355	.06568	.01060	.00262	.00120	.01425	.00091	.00160	.00222	.00969

RUN 4518

DATE = 10-31-73
PROJECT NUMBER. VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
60	.59000	.34000	.22500	.19500	.15800	.14000	.11500	.15000	.16000	.09200	.10750	.10500	.12000	.12500	.09200
78	.56631	.31383	.21500	.18090	.15200	.13579	.11250	.13800	.15000	.08500	.10000	.09250	.11101	.11500	.07800
96	.51973	.29000	.20451	.16935	.14391	.12452	.10578	.12495	.13436	.07700	.09500	.08500	.10500	.10500	.06700
118	.53323	.28932	.20563	.16584	.14126	.12230	.10000	.12537	.13355	.07592	.09500	.08271	.10500	.10561	.07200

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
60	.10000	.09800	.10500	.16900	.23861	.16981	.11250	.09500	.10750	.16174	.22826	.22500	.16000	.14800	.15000
78	.07250	.06527	.06400	.07040	.09390	.07000	.09850	.08197	.07295	.06688	.04000	.09500	.12358	.09000	.09076
96	.06750	.06500	.06000	.06500	.08740	.07045	.09500	.07500	.06500	.06000	.06500	.07500	.11500	.09000	.08000
118	.06500	.06006	.05215	.04631	.05956	.04000	.09458	.07226	.06250	.05537	.05500	.06152	.11500	.08775	.07902

TIME	Q62	Q63	Q64	Q65	Q66	Q68	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
60	.21219	.20095	.16201	.19000	.14000	.16000	.24500	.20036	.19157	.14000	.10000	.27000	.41000	.46000	.30350
78	.09000	.08560	.06680	.13000	.10000	.08500	.17459	.14594	.10290	.07530	.05500	.21500	.23560	.36000	.19000
96	.07500	.07400	.05500	.12500	.09000	.07500	.16072	.12822	.09500	.06920	.05000	.18500	.20608	.29898	.13340
118	.07400	.06500	.04400	.12500	.09000	.08145	.16000	.13000	.09500	.07411	.05462	.18822	.20694	.26361	.13000

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q87	Q88
60	.00999	.00850	.01400	.05350	.00730	.00210	.00055	.01389	.00135	.00199	.00168	.01202
78	.01000	.00820	.01318	.05500	.00798	.00210	.00105	.01350	.00110	.00110	.00180	.00900
96	.01013	.00770	.01267	.05500	.00880	.00220	.00160	.01300	.00095	.00089	.00185	.00860
118	.01025	.00740	.01188	.05760	.00930	.00230	.00105	.01250	.00080	.00140	.00195	.00850

RUN 4518

DATE = 11- 1-73
PROJECT NUMBER VA354-21EA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NIT

ANGLE OF ATTACK 35.000 DEG.

Q-0. ST-0 BASED ON .210 INCH RADIUS
MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	POP PSIA	HREF BTU/ SQFT-SEC
88	.035863	.001264	77.8	6392	14.53	5.302	3.8515	7.4545	17074	2999	8.351E 02	172.3	.03193	9.822	.0731
108	.035088	.000969	94.6	6872	14.17	4.932	2.7405	5.3042	15409	3345	9.664E 02	203.6	.03674	9.146	.0726
142	.029134	.000749	101.6	7658	14.04	4.022	2.0258	3.9210	12793	3548	1.020E 03	196.4	.04192	7.462	.0653

This Run was tripped by roughness at x/L = 0.05

RUN 4519

DATE = 11- 1-73

PROJECT NUMBER VA356-21FA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / AT OM-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
86	.74021	.42812	.30288	.28968	.23786	.21515	.18812	.19669	.20736	.10945	.20857	.26423	.16294	.17065	.24923
106	.70019	.41713	.27579	.24623	.20278	.17883	.15161	.17670	.18978	.10332	.13682	.13172	.14599	.15148	.15368
142	.64754	.39609	.28003	.23534	.18611	.16704	.14165	.17543	.19069	.10430	.12575	.10965	.13434	.14255	.09869

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
86	.30205	.29176	.27389	.26198	.29779	.17903	.18263	.19731	.24652	.29618	.30918	.24568	.29238	.26611	.27559
106	.18661	.19758	.20856	.23052	.25464	.16324	.15614	.15740	.17481	.21329	.24218	.20740	.24845	.21126	.21728
142	.10965	.10965	.10969	.12610	.14376	.10579	.13866	.12666	.11460	.12020	.13195	.11901	.21046	.16236	.14653

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
86	.29894	.26722	.19596	.32688	.30470	.26350	.31562	.26676	.30434	.28417	.19412	.32618	.35848	.44571	.36715
106	.22931	.19736	.14504	.26041	.23878	.19711	.23881	.22805	.21683	.19074	.13047	.27549	.29256	.36393	.28251
142	.13636	.12748	.08915	.19543	.15181	.12033	.21081	.20072	.15164	.12522	.07731	.25362	.25527	.31416	.19283

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
86	.01197	.00958	.01596	.06221	.00957	.00222	.00108	.01710	.00100	.00119	.00117	.01619	.00217
106	.01192	.00880	.01468	.05847	.00908	.00238	.00124	.01707	.00114	.00124	.00128	.01334	.00238
142	.01190	.00879	.01417	.05985	.00998	.00258	.00142	.01702	.00105	.00136	.00139	.01292	.00253

This Run was tripped by roughness at x/L = 0.05

RUN 4519

DATE = 11- 1-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
86	.74000	.41900	.28500	.27000	.22000	.19800	.17199	.17983	.18959	.09600	.19000	.24000	.14800	.15500	.22637
106	.70000	.40400	.26000	.23000	.18800	.16500	.14900	.16200	.17400	.09100	.12500	.12000	.13300	.13800	.14000
142	.64736	.38000	.26416	.22000	.17270	.15426	.14000	.16100	.17500	.09200	.11500	.10000	.12251	.13000	.09000

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
86	.27435	.26500	.24868	.23795	.26810	.16000	.16800	.18000	.22500	.27000	.28000	.22200	.27000	.24500	.25300
106	.17000	.18000	.19000	.21000	.23000	.14640	.14400	.14400	.16000	.19500	.22000	.18800	.23000	.14500	.20000
142	.10000	.10000	.10000	.11500	.13000	.09500	.12800	.11600	.10500	.11000	.12000	.10800	.19500	.15000	.13500

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
86	.27300	.24300	.17500	.30000	.28000	.24000	.29000	.24500	.28000	.26000	.17500	.30000	.33000	.41000	.33700
106	.21000	.18000	.13000	.24000	.22000	.18000	.22000	.21000	.20000	.17500	.11800	.25404	.27000	.34331	.26000
142	.12500	.11000	.08000	.18000	.14000	.11000	.14439	.18500	.14000	.11500	.07000	.23408	.23590	.25000	.15000

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
86	.01050	.00875	.01400	.05457	.00840	.00195	.00095	.01500	.00087	.00104	.00102	.01420	.00190
106	.01050	.00775	.01293	.05150	.00800	.00210	.00109	.01503	.00100	.00109	.00113	.01175	.00209
142	.01050	.00775	.01250	.05279	.00880	.00228	.00125	.01501	.00092	.00120	.00122	.01140	.00223

This Run was tripped by roughness at x/L = 0.05

RUN 4519

DATE = 11- 1-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OM-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0. ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 25.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QD BTU/ SQFT-SEC	STD	POP PSIA	HREF BTU/ SQFT-SEC
72	.056281	.001945	95.7	5651	11.59	5.665	3.7844	7.3247	6447	2431	6.613E 02	131.2	.02675	10.462	.0694
78	.056281	.001325	110.9	6039	11.50	5.211	2.8098	5.4384	6076	2761	7.557E 02	150.7	.03029	9.634	.0679
88	.049110	.001493	117.4	6211	11.50	4.544	2.2521	4.3590	5485	2914	7.992E 02	150.0	.03323	8.406	.0632
96	.044776	.000986	118.6	6239	11.49	4.140	2.0222	3.9140	5053	2943	8.064E 02	145.0	.03503	7.658	.0603
108	.038576	.000846	119.1	6276	11.53	3.592	1.7355	3.3592	4535	2981	8.160E 02	137.3	.03791	6.646	.0562
128	.028400	.000748	100.9	5879	11.74	2.788	1.6985	3.2875	3713	2650	7.159E 02	102.4	.04003	5.192	.0485
142	.026697	.000676	103.2	5893	11.64	2.531	1.5038	2.9105	3279	2668	7.189E 02	98.2	.04215	4.676	.0462

RUN 4520

DATE = 11- 1-73

PROJECT NUMBER VA354-21FA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / RI OM-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
72	.54856	.28466	.19209	.15756	.12455	.11026	.08610	.11953	.13822	.09639	.07278	.06720	.09411	.10380	.06160
78	.54341	.27479	.18928	.15478	.12261	.10757	.08347	.11618	.13536	.09250	.07132	.06586	.08913	.09878	.06018
88	.52324	.27318	.18140	.14607	.11922	.10517	.08118	.11149	.12792	.08663	.07025	.06349	.08331	.09238	.05781
96	.51317	.26778	.18028	.14350	.11806	.10178	.07954	.10639	.12103	.08319	.06760	.06119	.07989	.08839	.05666
108	.50310	.26203	.17477	.13794	.11124	.09616	.07653	.10129	.11423	.07974	.06551	.05664	.07646	.08382	.05324
128	.48809	.24661	.16975	.13289	.10602	.08975	.07003	.09431	.10730	.07891	.05928	.05154	.07561	.08186	.04775
142	.46305	.24141	.16753	.12725	.10321	.08749	.06662	.09147	.10558	.07603	.05667	.04888	.07730	.08241	.04547

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
72	.06274	.06160	.06274	.07700	.09397	.05796	.04230	.07267	.06016	.05000	.05149	.04587	.13732	.10121	.09701
78	.06018	.05877	.05877	.06245	.06233	.03690	.08968	.07009	.05763	.04242	.04555	.03994	.13387	.09656	.09436
88	.05668	.05228	.04987	.05101	.04645	.02290	.09113	.06720	.05528	.03953	.03979	.03702	.12542	.09506	.08861
96	.05485	.05149	.04759	.04533	.04698	.02470	.08504	.06639	.05275	.03782	.03750	.03316	.12260	.09329	.08677
108	.05211	.04888	.04312	.04049	.04205	.02070	.08757	.06490	.05198	.03943	.03635	.03384	.11978	.08941	.07846
128	.04622	.04321	.03658	.03635	.03714	.01617	.07857	.06452	.05092	.04078	.03649	.03428	.11878	.08747	.07648
142	.04320	.03959	.03665	.03663	.02974	.01475	.07743	.06338	.04977	.03856	.03705	.03428	.11597	.08633	.07647

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
72	.07373	.06608	.04350	.15234	.11832	.09728	.21522	.11534	.09004	.08151	.04640	.18013	.21146	.10919	.28515
78	.07002	.06351	.04062	.14608	.11502	.09344	.20202	.10948	.07946	.07552	.04461	.17378	.20723	.10762	.22977
88	.06765	.05061	.03651	.14024	.10924	.08703	.19450	.10090	.07498	.07090	.04176	.16792	.20133	.10521	.17387
96	.06611	.05772	.03454	.13459	.10361	.08422	.17813	.09527	.07384	.06883	.03963	.16563	.19568	.10356	.14579
108	.06310	.05525	.03240	.12804	.09798	.08023	.16799	.08975	.07270	.06748	.04107	.16201	.19003	.10067	.11658
128	.05993	.05338	.03178	.13165	.09118	.07542	.16483	.08432	.07294	.06772	.03969	.15660	.18523	.09877	.08774
142	.05879	.05336	.03177	.12855	.08706	.07314	.15320	.08149	.07405	.06883	.04123	.15165	.18389	.09651	.08435

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
72	.02559	.00857	.00425	.03270	.00832	.00204	.00195	.01348	.00780	.00403	.00333	.01148	.00112
78	.02512	.00879	.00411	.03193	.00845	.00203	.00199	.01342	.00731	.00411	.00334	.01108	.00111
88	.02465	.00869	.00388	.02907	.00809	.00203	.00203	.01326	.00684	.00422	.00336	.01049	.00103
96	.02343	.00877	.00376	.02849	.00798	.00205	.00207	.01310	.00638	.00433	.00342	.01026	.00116
108	.02335	.00854	.00353	.02734	.00780	.00205	.00211	.01310	.00619	.00456	.00346	.00977	.00094
128	.02287	.00823	.00365	.02630	.00755	.00206	.00215	.01247	.00572	.00480	.00359	.00964	.00089
142	.02201	.00800	.00354	.02618	.00755	.00206	.00215	.01256	.00565	.00497	.00359	.00960	.00086

RUN 4520

DATE = 11- 1-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / AI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
72	.54500	.26500	.17500	.14200	.11130	.09800	.07600	.10550	.12200	.08400	.06400	.05900	.08250	.09100	.05400
78	.54030	.26000	.17300	.14000	.11000	.09600	.07400	.10300	.12000	.08100	.06300	.05800	.07850	.08700	.05300
88	.52000	.25500	.16644	.13303	.10711	.09400	.07209	.09900	.11350	.07600	.06215	.05602	.07350	.08150	.05100
96	.51000	.25000	.16500	.13000	.10609	.09100	.07100	.09450	.10750	.07300	.06000	.05400	.07050	.07800	.05000
108	.50000	.24468	.16000	.12500	.10000	.08600	.06800	.09000	.10150	.07000	.05800	.05000	.06750	.07400	.04700
128	.48500	.23000	.15500	.12007	.09500	.08000	.06200	.08350	.09500	.06900	.05229	.04533	.06650	.07200	.04200
142	.48000	.22500	.15300	.11500	.09250	.07800	.05900	.08100	.09350	.06650	.05000	.04300	.06800	.07250	.04000

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
72	.05500	.05400	.05500	.06750	.01165	.05000	.04200	.06400	.05200	.04400	.04500	.04000	.12250	.09000	.08600
78	.05300	.05000	.05000	.05500	.05443	.03200	.04000	.06200	.05100	.03750	.04000	.03500	.11990	.08800	.08400
88	.05030	.04512	.04400	.04500	.04063	.01990	.03142	.05954	.04900	.03500	.03500	.03250	.11250	.08500	.07900
96	.04840	.04544	.04200	.04000	.04111	.02147	.07600	.05664	.04678	.03350	.03300	.02912	.11000	.08344	.07738
108	.04600	.04315	.03807	.03592	.03681	.01800	.07028	.05254	.04611	.03494	.03200	.02973	.10750	.08000	.07000
128	.04065	.03800	.03393	.03250	.03238	.01400	.07000	.05700	.04500	.03600	.03200	.03000	.10626	.07800	.06900
142	.03800	.03463	.03400	.03214	.02594	.01278	.06900	.05600	.04400	.03404	.03250	.03000	.10377	.07700	.06800

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
72	.06500	.05800	.03750	.13500	.10500	.08550	.14096	.10230	.08000	.07200	.04037	.16000	.16800	.09700	.25273
78	.06200	.05600	.03529	.13000	.10250	.08250	.14000	.09750	.07000	.06700	.03900	.15500	.16500	.09400	.20452
88	.06000	.05300	.03170	.12500	.09750	.07750	.16500	.09000	.06700	.06300	.03657	.15000	.16000	.09400	.15500
96	.05986	.05100	.03000	.12000	.09250	.07450	.15900	.08500	.06400	.06100	.03473	.14800	.17500	.09255	.13000
108	.05600	.04963	.02950	.11500	.08750	.07100	.15000	.08011	.06500	.06000	.03600	.14481	.17000	.09000	.10399
128	.05300	.04700	.02758	.11648	.08115	.06650	.14468	.07500	.06500	.06000	.03465	.13950	.16516	.08800	.07800
142	.05200	.04700	.02750	.11250	.07750	.06450	.13636	.07250	.06600	.06100	.03600	.13512	.16400	.08600	.07500

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
72	.02250	.00781	.00370	.02850	.00725	.00178	.00170	.01175	.00680	.00351	.00290	.01000	.00098
78	.02200	.00770	.00360	.02796	.00740	.00178	.00174	.01175	.00640	.00360	.00293	.00970	.00098
88	.02160	.00762	.00344	.02550	.00710	.00178	.00178	.01163	.00600	.00370	.00295	.00920	.00090
96	.02100	.00770	.00330	.02500	.00700	.00180	.00182	.01150	.00560	.00350	.00300	.00900	.00102
108	.02050	.00750	.00310	.02400	.00685	.00180	.00185	.01150	.00544	.00400	.00300	.00858	.00042
128	.02000	.00720	.00310	.02300	.00660	.00180	.00188	.01125	.00500	.00420	.00310	.00843	.00077
142	.01925	.00740	.00310	.02290	.00660	.00180	.00188	.01099	.00494	.00435	.00314	.00840	.00075

RUN 4520

DATE = 11- 1-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RT OM-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 25.000 DEG. MODEL LENGTH 23.226 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	V-INF FT/SEC	M-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	PO PSIA	TO DEG R	HO BTU/LBM	QD BTU/ SQFT-SEC		SID	POP PSIA	HREF BTU/ SQFT-SEC
76	.029413	.000438	175.4	7657	10.99	2.487	.7061	1.3666	2965	3908	1.095E 03	168.0	.05500		4.612	.0499
96	.021403	.000360	155.4	6951	11.18	1.874	.6267	1.2129	2364	3618	1.003E 03	131.1	.06033		3.472	.0426
114	.017251	.000374	129.8	6230	11.38	1.564	.7523	1.4561	1981	2970	8.04BE 02	88.9	.05687		2.893	.0366

RUN 4521

DATE = 11- 1-73

PROJECT NUMBER VA354-21FA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (h / HmFF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
76	.06036	.29569	.20173	.15068	.12537	.10751	.08500	.11185	.12747	.08598	.07407	.06303	.08889	.09452	.06006
96	.04508	.26702	.18268	.13740	.11078	.09796	.07617	.10082	.11762	.08046	.06744	.05974	.07890	.08234	.05523
114	.04298	.24632	.17478	.13243	.10847	.09281	.07204	.09567	.11143	.07861	.06326	.05551	.07590	.08157	.05237

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
76	.05855	.05602	.05087	.04839	.04537	.02169	.08674	.06956	.05713	.04822	.04400	.03618	.14181	.10117	.08579
96	.05523	.05472	.04452	.04339	.04026	.01944	.08006	.06385	.05161	.04268	.03956	.03341	.13314	.09447	.08177
114	.05098	.04645	.04135	.04078	.03770	.01783	.07607	.06091	.04961	.03782	.03749	.03188	.10920	.09166	.07959

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q84	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
76	.06494	.05564	.03541	.15045	.10908	.08083	.17810	.09912	.08673	.07903	.04396	.18351	.21670	.11676	.10308
96	.06342	.05351	.02975	.13952	.10031	.07647	.16166	.09035	.08395	.07612	.04312	.17264	.20366	.11003	.09486
114	.06065	.05262	.02969	.13714	.09519	.07459	.14560	.08292	.07830	.07815	.04252	.16487	.19899	.10628	.08969

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
76	.02541	.00950	.00346	.02545	.00837	.00226	.00238	.01346	.00498	.00464	.00407	.00950	.00078
96	.02436	.00997	.00380	.02493	.00839	.00227	.00238	.01332	.00453	.00442	.00408	.00929	.00091
114	.02392	.01037	.00347	.02506	.00843	.00228	.00245	.01245	.00422	.00439	.00410	.00934	.00098

RUN 4521

DATE = 11- 1-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
76	.56304	.27769	.18954	.13725	.11333	.09672	.07600	.10000	.11397	.07600	.06600	.05601	.07900	.08400	.05337
96	.48260	.25900	.16080	.12500	.10000	.08800	.06800	.09000	.10500	.07100	.06000	.05300	.07000	.07305	.04900
114	.48000	.23000	.16000	.12000	.09750	.08300	.06400	.08500	.09900	.06900	.05600	.04900	.06700	.07200	.04623

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
76	.05203	.04978	.04450	.04300	.04000	.01900	.07800	.06207	.05100	.04300	.03900	.03200	.12800	.09105	.07700
96	.04900	.04500	.03950	.03850	.03543	.01700	.07189	.05688	.04600	.03800	.03500	.02950	.12000	.08490	.07328
114	.04500	.04100	.03650	.03600	.03300	.01550	.06800	.05400	.04400	.03350	.03300	.02800	.09800	.08200	.07100

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q88	Q89	Q70	Q71	Q72	Q74	Q79	Q80	Q81
76	.05800	.04950	.03100	.13500	.09800	.07200	.15998	.08900	.07800	.07071	.03881	.16500	.19500	.10500	.09250
96	.05700	.04753	.02800	.12500	.08998	.06800	.14500	.08100	.07539	.06800	.03800	.15500	.18300	.09880	.08500
114	.05400	.04650	.02579	.12230	.08500	.06900	.13000	.07400	.07000	.06948	.03726	.14735	.17800	.09500	.08000

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
76	.02246	.00840	.00340	.02250	.00740	.00200	.00210	.01225	.00440	.00410	.00360	.00840	.00069
96	.02150	.00820	.00335	.02200	.00740	.00200	.00210	.01175	.00400	.00390	.00360	.00820	.00080
114	.02100	.00810	.00340	.02200	.00740	.00200	.00215	.01128	.00370	.00385	.00360	.00820	.00086

RUN 4521

DATE = 11- 6-73

PROJECT NUMBER VA354-21FA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / RI OH-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-D, ST-D BASED ON .210 INCH RADIUS

ANGLE OF ATTACK 25.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QD BTU/ SQFT-SEC	STD	POP PSIA	HREF BTU/ SQFT-SEC
74	.036383	.001185	80.2	6540	14.66	5.467	3.7673	7.2916	18480	3012	8.740E 02	186.0	.03241	10.131	.0752
84	.034077	.001018	87.4	6793	14.58	5.068	3.0844	5.9699	17549	3247	9.433E 02	197.9	.03533	9.398	.0731
104	.031439	.000827	88.0	6805	14.50	4.627	2.7717	5.3647	15900	3276	9.467E 02	190.0	.03706	8.579	.0694
124	.027789	.000674	83.0	6627	14.59	4.141	2.7207	5.2658	14489	3131	8.976E 02	167.6	.03787	7.675	.0647
142	.024613	.000790	81.4	6584	14.64	3.693	2.4899	4.8192	13232	3107	8.880E 02	155.6	.03977	6.844	.0606

RUN 4522

DATE = 11- 6-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
74	.31931	.32015	.21385	.17100	.13068	.10956	.08697	.11701	.13220	.09947	.07114	.06341	.10418	.11777	.06115
84	.35359	.31017	.20723	.16522	.12767	.10711	.08085	.11005	.12536	.09431	.06967	.06215	.09945	.11188	.05876
104	.33764	.29944	.20326	.15968	.12418	.10671	.08013	.10778	.12630	.09088	.06974	.05762	.09306	.10394	.05761
124	.33054	.29926	.20128	.16048	.12780	.10679	.07964	.11026	.12510	.09100	.06958	.05656	.09275	.10180	.05316
142	.34430	.29940	.19892	.15945	.12094	.10379	.07615	.11017	.12349	.08918	.06428	.05601	.09277	.10221	.05402

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
74	.06268	.06341	.06341	.06988	.06166	.03491	.10959	.09246	.07889	.06545	.07722	.06600	.16932	.12570	.11542
84	.06162	.05763	.05424	.05198	.05013	.02753	.10541	.09196	.07892	.06525	.07252	.05791	.16457	.12031	.11176
104	.05623	.04971	.04486	.04067	.03645	.01949	.10044	.08888	.07197	.05742	.05778	.04995	.15521	.11151	.10064
124	.05203	.04864	.04298	.03959	.03397	.01837	.09832	.08492	.06981	.05523	.05379	.04498	.14913	.10884	.09739
142	.05168	.04877	.04299	.03847	.03255	.01838	.09945	.08434	.06767	.05524	.05219	.04661	.14783	.10341	.09853

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
74	.09667	.08556	.05242	.21073	.14273	.10506	.22168	.17910	.15542	.11243	.06307	.18099	.21590	.11071	.21855
84	.09106	.07943	.04591	.20362	.13688	.09695	.21010	.15247	.13919	.09954	.05832	.17974	.20971	.10828	.15661
104	.08420	.06884	.04251	.19230	.12004	.08792	.19888	.14179	.12275	.08863	.04779	.17088	.20297	.10597	.13421
124	.07877	.06779	.03792	.18365	.11463	.08351	.19715	.13342	.11617	.08424	.04557	.17687	.20319	.10452	.12876
142	.07878	.06761	.03793	.17920	.11405	.08397	.20146	.13207	.11151	.08425	.04578	.17882	.20582	.10157	.11758

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
74	.02676	.00864	.00433	.03258	.00797	.00198	.00219	.01452	.00727	.00421	.00370	.01070	.00107
84	.02670	.00825	.00471	.03048	.00784	.00210	.00214	.01396	.00670	.00409	.00364	.01087	.00106
104	.02545	.00843	.00420	.02954	.00819	.00210	.00210	.01392	.00667	.00396	.00349	.01113	.00103
124	.02502	.00910	.00409	.02948	.00796	.00210	.00214	.01393	.00648	.00393	.00364	.01148	.00100
142	.02503	.00933	.00404	.03015	.00820	.00210	.00222	.01422	.00635	.00432	.00393	.01131	.00104

RUN 4522

DATE # 11-6-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
74	.61551	.29900	.19502	.15500	.11750	.09800	.07695	.10400	.11750	.08735	.06300	.05600	.09200	.10400	.05400
84	.59000	.29100	.19000	.15000	.11500	.09600	.07200	.09800	.11163	.08300	.06200	.05500	.08800	.09900	.05200
104	.58369	.28000	.18642	.14500	.11188	.09566	.07137	.09600	.11250	.08000	.06190	.05100	.08308	.09200	.05099
124	.56707	.27871	.18437	.14545	.11502	.09563	.07066	.09810	.11130	.08000	.05814	.05000	.08200	.09000	.04700
142	.55092	.27695	.18643	.14145	.10883	.09293	.06774	.09800	.10985	.07839	.05698	.04950	.08200	.09034	.04775

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
74	.05500	.05600	.05000	.06100	.05400	.02950	.09800	.08200	.07000	.05800	.06800	.05800	.15200	.11250	.10300
84	.05400	.05100	.04800	.04600	.04400	.02400	.09443	.08163	.07016	.05794	.06400	.05100	.14800	.10787	.09992
104	.04860	.04400	.03900	.03600	.03200	.01700	.09000	.07900	.06400	.05100	.05100	.04400	.13962	.10000	.09000
124	.04600	.04300	.03600	.03500	.02978	.01630	.08860	.07539	.06200	.04900	.04742	.03950	.13400	.09750	.08700
142	.04567	.04311	.03600	.03400	.02853	.01600	.08900	.07487	.06010	.04900	.04600	.04100	.13281	.09263	.08800

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
74	.08600	.07600	.04600	.18800	.12750	.09300	.19800	.15900	.13900	.10000	.05600	.16897	.19320	.09900	.19500
84	.08100	.06948	.04000	.18200	.12250	.08600	.18800	.13638	.12471	.08870	.05125	.16100	.18800	.09700	.14000
104	.07848	.06100	.03765	.17200	.10750	.07800	.17800	.12685	.11000	.07900	.04200	.15847	.18200	.09496	.12000
124	.07000	.06000	.03300	.16400	.10250	.07400	.17626	.11923	.10400	.07500	.04000	.15829	.18200	.09356	.11500
142	.07000	.06000	.03330	.16000	.10250	.07439	.18008	.11800	.09980	.07500	.04016	.16000	.18432	.09090	.10500

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
74	.02350	.00759	.00340	.02861	.00700	.00173	.00192	.01275	.00638	.00370	.00325	.00940	.00094
84	.02350	.00779	.00379	.02700	.00690	.00185	.00189	.01229	.00590	.00360	.00320	.00956	.00093
104	.02241	.00730	.00370	.02600	.00721	.00185	.00185	.01225	.00588	.00348	.00307	.00980	.00091
124	.02200	.00700	.00340	.02627	.00700	.00185	.00185	.01225	.00570	.00346	.00320	.01009	.00088
142	.02200	.00720	.00355	.02650	.00721	.00185	.00195	.01250	.00558	.00380	.00345	.00994	.00091

RUN 4522

DATE = 11- 7-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / AI OH-II SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0: ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 45.000 DEG. MODEL LENGTH 23.226 INCHES

TIME SEC	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	PO PSIA	TO DEG R	HO BTU/LBM	QQ BTU/ SQFT-SEC	STG	POP PSIA	HREF BTU/ SQFT-SEC
52	.071248	.001774	104.7	5648	11.45	6.541	3.8521	7.4557	7132	2588	7.087E 02	154.9	.02598	12.086	.0767
66	.062134	.001372	118.3	6202	11.44	5.689	2.8019	5.4231	6547	2894	7.972E 02	167.3	.02964	10.524	.0711
80	.048080	.001019	123.3	6324	11.42	4.392	2.0352	3.9392	5248	3016	8.284E 02	155.1	.03463	8.126	.0626
96	.039885	.0009C1	115.0	6179	11.56	3.712	1.6876	3.6535	4662	2896	7.909E 02	133.7	.03651	6.866	.0567
112	.033008	.0008413	99.2	5941	11.66	3.132	2.1236	4.1102	3876	2453	6.587E 02	97.0	.03589	5.783	.0507

RUN 4523

DATE = 11- 7-73

PROJECT NUMBER VA354-21EA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
52	.58160	.40936	.30108	.25565	.20870	.18592	.17259	.20832	.21418	.11446	.16037	.14473	.18010	.18225	.16081
60	.54817	.37711	.27418	.24563	.19998	.17718	.15834	.19756	.19993	.10832	.13280	.11661	.15198	.15186	.10289
80	.53969	.34766	.26093	.21929	.18377	.16481	.14595	.18033	.18621	.10025	.12839	.11153	.14435	.14467	.10315
92	.51103	.32728	.24372	.19864	.17366	.15646	.13825	.16483	.17015	.09121	.12164	.10135	.12879	.12625	.08999
112	.49427	.33199	.24931	.20147	.17406	.15261	.13223	.15336	.16529	.08635	.11771	.09659	.12342	.12342	.08585

TIME	Q34	Q38	Q41	Q44	Q47	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61	Q62
52	.18225	.22256	.25193	.27873	.32439	.16949	.17081	.19208	.22434	.30505	.28013	.25333	.24620	.25896	.27083
60	.11234	.10699	.11769	.16049	.21579	.13832	.11014	.11717	.10663	.14484	.17202	.14943	.12681	.11729	.14904
80	.08537	.08321	.08019	.08594	.09164	.12156	.10531	.09274	.07460	.08577	.09132	.13380	.10456	.09673	.08512
92	.09488	.07537	.07203	.07490	.07552	.11623	.09319	.09054	.07464	.07148	.08063	.12647	.09304	.08258	.08064
112	.09204	.09457	.08545	.09122	.09202	.12322	.10152	.09079	.07486	.08138	.08629	.13093	.10594	.09029	.08540

TIME	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
52	.25108	.24207	.30786	.30876	.28744	.39236	.36626	.28597	.29717	.20046	.36021	.42344	.31779	.31843	.00826
60	.14963	.14260	.15433	.13761	.14012	.23853	.16957	.14464	.14568	.11473	.25942	.26515	.17917	.17697	.00821
80	.08011	.08519	.13598	.08912	.08534	.21570	.15394	.10569	.10153	.07568	.23060	.25079	.15142	.13681	.00797
92	.07264	.08796	.12059	.08093	.08249	.18910	.12726	.09210	.08975	.07140	.21017	.21876	.14010	.12693	.00798
112	.08340	.07041	.12751	.08490	.08565	.18577	.14865	.10601	.10656	.07568	.21945	.22722	.14843	.12749	.00803

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
52	.02289	.02391	.08470	.01818	.00190	.00097	.01877	.00435	.00415	.00126	.00630	.00273
60	.02201	.02260	.08209	.01710	.00205	.00098	.01847	.00433	.00353	.00116	.00621	.00268
80	.02059	.02132	.07857	.01660	.00222	.00100	.01757	.00349	.00296	.00107	.00604	.00251
92	.02052	.02152	.07704	.01596	.00228	.00100	.01687	.00349	.00295	.00105	.00599	.00245
112	.01996	.01960	.07341	.01549	.00227	.00103	.01652	.00390	.00298	.00106	.00585	.00235

RUN 4523

DATE = 11- 7-73

PROJECT NUMBER VA354-21FA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / RI OH-II SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
52	.58000	.40000	.29000	.24423	.19800	.17558	.16200	.14555	.20104	.10000	.15001	.13500	.16800	.17000	.15000
60	.54707	.38672	.28436	.23485	.19001	.16759	.14889	.18578	.18800	.09500	.12646	.10899	.14167	.14193	.09616
80	.53861	.34000	.25168	.20601	.17469	.15597	.13733	.16967	.17520	.08804	.12040	.10431	.13500	.13529	.09646
92	.51000	.32200	.23500	.19000	.16500	.14800	.14000	.15500	.16000	.08000	.11400	.09472	.12000	.11800	.08411
112	.49323	.32429	.24000	.19233	.16500	.14400	.12400	.14382	.15500	.07528	.11000	.09000	.11500	.11500	.08000

TIME	Q34	Q38	Q41	Q44	Q47	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61	Q62
52	.17000	.20797	.23500	.26000	.30000	.16000	.10000	.18000	.21000	.26654	.26000	.24000	.23268	.24401	.25394
60	.16500	.16000	.11000	.15000	.20000	.13078	.10336	.11000	.10000	.13500	.16000	.14178	.12000	.11070	.14000
80	.09919	.07638	.07500	.09000	.09500	.11500	.09889	.08712	.07000	.08000	.08500	.12701	.09899	.09134	.08000
92	.09868	.07444	.06732	.07000	.07000	.10490	.08744	.08500	.07000	.06662	.07500	.12000	.08804	.07794	.07575
112	.08576	.08440	.08000	.08500	.08500	.11662	.09500	.08500	.07000	.07561	.08000	.12393	.10000	.08500	.08000

TIME	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81	Q5
52	.23447	.22206	.29000	.29120	.26876	.37090	.28869	.27090	.27914	.18563	.34000	.40000	.30000	.30000	.00722
60	.14000	.13113	.14542	.13000	.15000	.22530	.16010	.13678	.13708	.10648	.24526	.25087	.16941	.16701	.00720
80	.07500	.06000	.12838	.08424	.08000	.20385	.14504	.10000	.09559	.07028	.21813	.23741	.14325	.12917	.00700
92	.06796	.06250	.11379	.07645	.07728	.17862	.12015	.08709	.08445	.06026	.19870	.20698	.13247	.11978	.00700
112	.07500	.07000	.12000	.08900	.09000	.17503	.14000	.10000	.10000	.07000	.20695	.21445	.14000	.12000	.00700

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
52	.02000	.02069	.07400	.01588	.00166	.00085	.01640	.00380	.00362	.00110	.00550	.00239
60	.01930	.02000	.07200	.01560	.00180	.00085	.01620	.00380	.00310	.00102	.00545	.00235
80	.01869	.01872	.06900	.01468	.00195	.00087	.01543	.00350	.00260	.00094	.00530	.00220
92	.01800	.01800	.06827	.01400	.00200	.00087	.01480	.00350	.00260	.00092	.00525	.00215
112	.01740	.01700	.06400	.01350	.00198	.00090	.01440	.00340	.00260	.00092	.00510	.00205

RUN 4523

DATE = 11- 7-73
PROJECT NUMBER. VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RT OV-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN U-0, ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 30.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QD BTU/ SQFT-SEC	STD	POP PSIA	HREF BTU/ SQFT-SEC
66	.053244	.001765	93.6	5587	11.58	5.939	4.1031	7.9416	6660	2375	6.464E 02	130.2	.02576	10.966	.0709
7h	.054522	.001293	110.1	6034	11.53	5.075	2.7591	5.3402	5998	2756	7.541E 02	148.4	.03066	9.383	.0669
9d	.049366	.000940	112.2	6126	11.60	3.805	2.0008	3.8726	4810	2848	7.770E 02	132.0	.03563	7.037	.0572
13J	.028749	.000698	107.6	6014	11.63	2.722	1.9201	2.9421	3545	2768	7.488E 02	107.6	.04168	5.032	.0483

RUN 4524

DATE = 11- 7-73

PROJECT NUMBER VA354-21FA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / RI OV-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
6a	.60000	.33846	.23147	.19898	.15497	.13668	.11124	.15519	.16665	.10941	.09614	.08770	.11988	.12848	.08320
7a	.58128	.31204	.21352	.17865	.14057	.12143	.11336	.14226	.15448	.09821	.08924	.08280	.10629	.11444	.07608
9a	.51469	.28298	.19399	.15615	.12845	.11031	.09328	.12524	.13686	.08898	.08187	.07385	.09843	.10415	.06707
13a	.52161	.29435	.19517	.16339	.13177	.11401	.09335	.12446	.13780	.08792	.08143	.07160	.09655	.10122	.06536

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
6a	.08442	.09219	.10794	.15403	.17161	.14837	.11535	.09960	.08389	.08848	.10150	.12428	.15463	.13156	.12265
7a	.07552	.07049	.08490	.07808	.09283	.08823	.10161	.08688	.07237	.06465	.07294	.07873	.13420	.10152	.10182
9a	.06736	.06387	.05549	.05925	.05639	.03749	.09270	.07790	.06118	.04566	.04474	.04495	.12417	.09581	.08610
13a	.06144	.05818	.05259	.05058	.04515	.02815	.09497	.07796	.07014	.04904	.04219	.04273	.12429	.09709	.08300

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
6a	.11497	.10735	.07853	.17235	.14589	.14050	.14437	.11111	.08217	.08813	.06317	.39453	.25823	.37549	.43359
7a	.08962	.08382	.05640	.14946	.10503	.10362	.13269	.09293	.06957	.06863	.04510	.25394	.23728	.29150	.34868
9a	.06929	.06373	.03873	.13702	.09225	.08363	.12148	.09315	.06523	.05874	.04126	.18395	.22235	.19002	.29866
13a	.06462	.06146	.03680	.14723	.08844	.08045	.12117	.09331	.06691	.06218	.04509	.16619	.22070	.11043	.28777

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
6a	.01826	.00704	.00804	.04256	.00735	.00201	.00154	.01689	.00597	.00448	.00190	.00851	.00152
7a	.01759	.00764	.00727	.03997	.00742	.00194	.00151	.01597	.00565	.00434	.00194	.00834	.00142
9a	.01620	.00719	.00662	.03879	.00787	.00192	.00146	.01460	.00542	.00445	.00205	.00864	.00123
13a	.01660	.00776	.00685	.04146	.00858	.00194	.00151	.01530	.00548	.00491	.00234	.00913	.00153

RUN 4524

DATE = 11- 7-73
PROJECT NUMBER . VA354-21EA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI 0M-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
66	.54455	.31919	.21376	.18200	.14054	.12328	.09969	.13900	.14927	.09525	.08578	.07800	.10662	.11427	.07400
7o	.55000	.29500	.19800	.16400	.12800	.11000	.10200	.12890	.13900	.08600	.08000	.07400	.09500	.10228	.06800
9H	.51370	.26761	.18000	.14344	.11705	.10000	.09400	.11279	.12325	.07800	.07346	.06606	.08805	.09317	.06000
13o	.52000	.27425	.18100	.15000	.12000	.10329	.09400	.11200	.12400	.07700	.07300	.06400	.08630	.09048	.05842

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
66	.07500	.08200	.09000	.13700	.15122	.12975	.10400	.08900	.07500	.07900	.09000	.10994	.14000	.11872	.11034
7o	.06750	.06360	.05000	.06000	.08223	.06000	.09200	.07800	.06500	.05800	.06500	.07000	.12200	.09200	.09200
9H	.06026	.05714	.05000	.05300	.05000	.03300	.08400	.07000	.05500	.04100	.03990	.04000	.11297	.08690	.07786
13o	.06492	.05200	.04701	.04521	.04000	.02300	.08600	.07000	.06300	.04400	.03700	.03800	.11300	.08800	.07500

TIME	Q62	Q63	Q64	Q65	Q66	Q67	Q68	Q69	Q70	Q71	Q72	Q74	Q79	Q80	Q81
6o	.10265	.09560	.06002	.15500	.13139	.12529	.13000	.10000	.07500	.07900	.05574	.35565	.23300	.33853	.39000
7o	.08000	.07500	.05000	.13500	.09500	.09284	.12000	.08400	.06300	.06000	.04000	.22989	.21500	.26394	.31500
9H	.06233	.05708	.03407	.12307	.08351	.07500	.10955	.08427	.05911	.05293	.03663	.16066	.20163	.14500	.27000
13o	.06808	.05500	.03164	.13300	.08000	.07209	.10959	.08435	.06060	.05600	.04000	.15047	.20000	.18000	.26000

TIME	Q5	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
6o	.01540	.00700	.00700	.03705	.00640	.00175	.00134	.01470	.00520	.00390	.00165	.00741	.00132
7o	.01540	.00660	.00617	.03500	.00650	.00170	.00132	.01398	.00495	.00380	.00170	.00730	.00124
9H	.01420	.00630	.00580	.03400	.00690	.00168	.00128	.01280	.00475	.00390	.00180	.00740	.00108
13o	.01471	.00660	.00600	.03666	.00760	.00170	.00132	.01340	.00480	.00430	.00205	.00800	.00134

RUN 4524

DATE = 11- 7-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-D, ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 35.000 DEG. MODEL LENGTH 23.226 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	PO PSIA	TO DEG R	HO BTU/LBM	QD BTU/ SQFT-SEC	STO	POP PSIA	HREF BTU/ SQFT-SEC
84	.038907	.001157	81.1	6530	14.55	5.320	3.6316	7.0289	17513	3014	8.715E 02	102.8	.03278	9.858	.0739
102	.033951	.000945	93.8	6914	14.32	4.872	2.7142	5.2534	16012	3375	9.778E 02	205.3	.03722	9.037	.0724
124	.030675	.000767	104.4	7206	14.15	4.297	2.0635	3.9939	14209	3670	1.063E 03	213.4	.04153	7.975	.0682
150	.027539	.000646	104.9	7182	14.07	3.814	1.8295	3.5409	12468	3668	1.056E 03	199.5	.04391	7.079	.0638

RUN 4525

DATE = 11- 7-73

PROJECT NUMBER VA354-21EA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
84	.66120	.41335	.28147	.24255	.19016	.16939	.13989	.16796	.17719	.11030	.12065	.11440	.14222	.14803	.12760
102	.65062	.39416	.27142	.23549	.18981	.16472	.13651	.16358	.17885	.10913	.11649	.10390	.13170	.14048	.10536
124	.64017	.39704	.28611	.22990	.18958	.16668	.13504	.16507	.17861	.12008	.11803	.09850	.12932	.14027	.09206
150	.59748	.36265	.24868	.20593	.17053	.15328	.12875	.16118	.17329	.09798	.11207	.08988	.12589	.13058	.08614

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
84	.14080	.15180	.17050	.17820	.19087	.13414	.15642	.16647	.16202	.18632	.20410	.16806	.23265	.20622	.20681
102	.12073	.12512	.13170	.14487	.15094	.12169	.14682	.14810	.14605	.15831	.17522	.13787	.21926	.17873	.17923
124	.10959	.10959	.11507	.12055	.13262	.10205	.13859	.13314	.11592	.12013	.12986	.10662	.19043	.14920	.14103
150	.08430	.08767	.09316	.09370	.12163	.08903	.12458	.11337	.10172	.08191	.10440	.09361	.16579	.12743	.11350

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q72	Q74	Q79	Q80	Q81	Q5
84	.22768	.18239	.13200	.25042	.21747	.18654	.25013	.25024	.21722	.12634	.28707	.30080	.31907	.31352	.01142
102	.17468	.14509	.10719	.23341	.20076	.17784	.21598	.22802	.19725	.11276	.24939	.24918	.37008	.28642	.01164
124	.13083	.11422	.08241	.18441	.15173	.11499	.20595	.18930	.15349	.07947	.23824	.24118	.30568	.15733	.01176
150	.10053	.09922	.06682	.15703	.11267	.09305	.19847	.16526	.12499	.06379	.22884	.24575	.25987	.13697	.01218

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q89	3088
84	.00996	.01788	.00115	.00924	.00233	.00097	.01709	.00118	.00185	.00148	.00215	.00879
102	.00940	.01630	.00903	.00954	.00238	.00122	.01718	.00095	.00123	.00132	.00215	.01042
124	.00935	.01507	.00891	.01008	.00258	.00127	.01659	.00089	.00097	.00134	.00211	.01096
150	.00935	.01362	.00720	.01020	.00239	.00162	.01646	.00129	.00152	.00181	.00208	.01203

RUN 4525

DATE = 11- 7-73
PROJECT NUMBER. VA354-21EA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
84	.66191	.39600	.26500	.22622	.17600	.15600	.14800	.15369	.16213	.09686	.11000	.10400	.12929	.13454	.11600
102	.65044	.37800	.25610	.22000	.17600	.15200	.12518	.15000	.16400	.09614	.10644	.09467	.12000	.12800	.09600
124	.64000	.38100	.27000	.21500	.17600	.15400	.12400	.15157	.16400	.10600	.10800	.08988	.11800	.12800	.08400
150	.59732	.34800	.23467	.19259	.15831	.14162	.11822	.14800	.15912	.08649	.10255	.08202	.11487	.11915	.07860

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
84	.12800	.13400	.15500	.16200	.17200	.12000	.14400	.15200	.14800	.17000	.18500	.15200	.21500	.19000	.19000
102	.11000	.11400	.12000	.13200	.13600	.10916	.13543	.13562	.13370	.14476	.15920	.12500	.20300	.16500	.16500
124	.10010	.10000	.10500	.11000	.12000	.09170	.12800	.12200	.10626	.11000	.11817	.09681	.17653	.13791	.13000
150	.07665	.08000	.08500	.08550	.11006	.08000	.11505	.10388	.09325	.07500	.09500	.08500	.15368	.11778	.10462

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q72	Q74	Q79	Q80	Q81	Q5
84	.19000	.16600	.11800	.23000	.20000	.17000	.24000	.23000	.20000	.11400	.26423	.27711	.38579	.24800	.01003
102	.16000	.13600	.09600	.21500	.18500	.16243	.19900	.21000	.18198	.10200	.23000	.23000	.34136	.19000	.01025
124	.12000	.10400	.07400	.16994	.14000	.10518	.19000	.17456	.14178	.07200	.22000	.22290	.28231	.14500	.01038
150	.09608	.09063	.06000	.14554	.10395	.08511	.18310	.15286	.11545	.05779	.21132	.22711	.24000	.12624	.01075

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q89	3088
84	.00875	.01500	.05370	.00812	.00205	.00085	.01500	.00104	.00162	.00130	.00189	.00808
102	.00863	.01436	.05200	.00840	.00210	.00107	.01514	.00084	.00108	.00116	.00190	.00959
124	.00825	.01330	.05200	.00840	.00228	.00112	.01500	.00078	.00086	.00118	.00186	.01010
150	.00865	.01220	.05040	.00900	.00255	.00143	.01453	.00114	.00134	.00160	.00184	.01108

RUN 4525

DATE = 11-1-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-DOT ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 35.000 DEG. MODEL LENGTH 23.226 INCHES

TIME	P-INF	RHO-INF	T-INF	U-INF	M-INF	Q-INF	RE/FT	RE-L	PO	TO	HO	QO BTU/	STO	POP	HREF BTU/
MSEC	PSIA	LBM/CU-FT	DEG R	FT/SEC		PSIA	X10-6	X10-6	PSIA	DEG R	BTU/LBM	SQFT-SEC		PSIA	SQFT-SEC
116	.020208	.000715	73.0	6145	14.35	2.911	2.3182	4.4869	9336	2777	7.723E 02	114.6	.04085	5.388	.0512
129	.019111	.000636	78.4	6436	14.35	2.754	2.0022	3.8752	9129	2942	8.211E 02	121.3	.04378	5.101	.0505
142	.018203	.000527	90.2	6673	14.10	2.532	1.5201	2.9422	8199	3250	9.116E 02	133.7	.04886	4.692	.0493
164	.016966	.000446	93.0	6798	14.10	2.223	1.2622	2.4429	7423	3373	9.461E 02	131.5	.05338	4.121	.0464

RUN 4526

DATE = 11- 1-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
116	.62018	.37608	.26545	.22547	.17963	.15661	.12763	.15327	.17079	.10846	.10994	.08596	.13644	.14878	.08156
129	.62017	.38108	.26081	.23157	.18159	.16077	.12968	.15526	.17057	.10940	.11133	.08695	.13482	.15005	.08255
142	.62017	.38562	.27589	.23861	.18397	.16228	.12570	.16019	.17081	.10681	.10536	.08653	.12905	.14093	.08127
164	.65018	.38351	.29168	.23521	.19844	.17339	.12513	.15704	.17231	.10274	.10353	.09219	.12622	.13445	.08231

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q61	Q62
116	.07945	.07715	.08938	.07271	.07196	.04369	.13601	.10753	.08883	.07908	.07738	.07090	.16691	.10903	.08988
129	.07924	.07704	.08274	.06714	.06884	.04250	.13645	.10739	.08982	.08005	.07616	.06855	.16888	.10890	.08976
142	.07781	.07249	.07340	.06590	.06093	.03794	.13018	.10776	.09073	.08098	.07600	.06402	.16859	.10898	.08715
164	.07917	.07095	.06773	.05993	.05504	.03567	.13010	.10797	.09176	.08093	.07893	.06851	.16196	.10846	.08395

TIME	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q72	Q74	Q79	Q80	Q81	Q5	Q9
116	.08146	.05830	.16141	.12525	.10773	.20094	.16566	.12511	.05997	.21764	.23920	.23937	.14721	.01227	.00959
129	.08176	.04477	.16339	.12230	.10346	.19995	.16651	.12359	.05738	.21897	.24152	.22822	.14159	.01225	.00957
142	.08008	.04662	.16091	.11561	.09448	.19766	.16732	.12474	.06033	.21676	.23949	.15453	.13438	.01245	.00943
164	.07697	.04027	.15236	.11113	.08944	.20839	.17156	.12466	.05866	.21686	.23473	.13043	.11804	.01249	.01011

TIME	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
116	.01541	.06165	.01153	.00291	.00133	.01668	.00071	.00086	.00206	.00868	.00217
129	.01529	.06224	.01156	.00296	.00143	.01616	.00080	.00103	.00211	.00866	.00204
142	.01449	.05757	.01165	.00315	.00164	.01666	.00111	.00165	.00239	.00920	.00177
164	.01437	.05676	.01233	.00318	.00190	.01719	.00114	.00220	.00264	.01029	.00186

RUN 4526

DATE = 11- 1-73
PROJECT NUMBER VA354-21EA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
116	.62000	.36000	.25000	.21000	.16600	.14600	.11658	.14000	.15600	.09500	.10005	.07800	.12380	.13500	.07400
120	.62000	.36500	.25300	.21589	.16800	.14800	.11860	.14200	.15600	.09600	.10145	.07900	.12250	.13633	.07500
142	.62000	.36969	.26099	.22279	.17049	.14985	.11519	.14680	.15653	.09400	.09621	.07879	.11750	.12831	.07400
164	.65000	.36778	.27500	.21973	.18400	.16000	.11474	.14400	.15800	.09051	.09460	.08400	.11500	.12250	.07500

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q61	Q62
116	.07200	.07000	.08110	.06598	.06471	.03906	.14560	.09800	.08100	.07200	.07000	.06400	.15400	.10000	.08200
120	.07200	.07000	.07522	.06100	.06200	.03800	.14555	.09800	.08200	.07300	.06900	.06196	.15600	.10000	.08200
142	.07065	.06600	.06720	.06000	.05500	.03400	.14000	.09854	.08300	.07400	.06900	.05800	.15600	.10027	.07977
164	.07214	.06465	.06171	.05461	.04973	.03200	.12000	.09880	.08400	.07400	.07172	.06212	.14995	.09985	.07690

TIME	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q72	Q74	Q79	Q80	Q81	Q5	Q9
116	.07400	.05200	.14800	.11500	.09800	.18400	.15200	.11500	.05400	.20000	.22000	.22000	.13500	.01075	.00840
120	.07438	.04000	.15000	.11242	.09423	.18377	.15297	.11374	.05175	.20146	.22239	.21000	.13000	.01075	.00840
142	.07300	.04175	.14000	.10646	.08623	.18200	.15400	.11500	.05453	.19979	.22092	.14245	.12361	.01096	.00830
164	.07021	.04148	.14022	.10240	.08169	.19200	.15800	.11500	.05306	.20000	.21666	.12031	.10865	.01100	.00890

TIME	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
116	.01350	.05400	.01010	.00254	.00116	.01461	.00062	.00075	.00180	.00760	.00190
120	.01342	.05461	.01015	.00260	.00125	.01418	.00070	.00090	.00185	.00760	.00179
142	.01275	.05467	.01075	.00277	.00144	.01466	.00097	.00145	.00210	.00810	.00155
164	.01266	.05000	.01087	.00280	.00167	.01515	.00100	.00194	.00232	.00906	.00164

RUN 4528

DATE = 11- 1-73
PROJECT NUMBER...VA354-21EA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

TEST CONDITIONS TEST GAS NITROGEN Q-0, ST-0 BASED ON .210 INCH RADIUS
ANGLE OF ATTACK 35.000 DEG. MODEL LENGTH 23.226 INCHES

TIME MSEC	P-INF PSIA	RHO-INF LBM/CU-FT	T-INF DEG R	U-INF FT/SEC	H-INF	Q-INF PSIA	RE/FT X10-6	RE-L X10-6	PO PSIA	TO DEG R	HO BTU/LBM	QO BTU/ SQFT-SEC	STO	POP PSIA	HREF BTU/ SQFT-SEC
72	.032298	.000553	152.4	6825	11.09	2.780	.9657	1.8691	3240	3494	9.678E 02	152.9	.04853	5.150	.0518
92	.025517	.000434	153.7	6850	11.08	2.194	.7531	1.4577	2602	3523	9.748E 02	137.0	.05484	4.065	.0459
112	.019542	.000344	148.9	6783	11.15	1.705	.6099	1.1805	2092	3465	9.555E 02	117.9	.06153	3.158	.0403
134	.016289	.000326	130.4	6384	11.21	1.434	.6224	1.2046	1739	3107	8.458E 02	91.0	.06136	2.653	.0355

RUN 4527

DATE * 11- 1-73
PROJECT NUMBER VA354-21FA
ARO, INC.
ARNOLD AIR FORCE STATION, TENN.
NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (H / HREF)

TIME	Q1	Q2	Q3	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q16	Q23	Q25	Q26	Q31
72	.54953	.33288	.23749	.19745	.15737	.13854	.11335	.14583	.15695	.09187	.10399	.09312	.11480	.11626	.08336
92	.54515	.34399	.23823	.19471	.15520	.13949	.11842	.14984	.16128	.09636	.10389	.09431	.11546	.11844	.08554
112	.54015	.33361	.23115	.17121	.15524	.13465	.11063	.14312	.15479	.09188	.10064	.09215	.11119	.10761	.08369
130	.55636	.32349	.23145	.16933	.15334	.14202	.11532	.14649	.15142	.09329	.10255	.09203	.10851	.10773	.08867

TIME	Q34	Q38	Q41	Q44	Q47	Q50	Q52	Q53	Q54	Q55	Q56	Q57	Q59	Q60	Q61
72	.08012	.07458	.06710	.06581	.05531	.03453	.10727	.08847	.07315	.06230	.05940	.05456	.13624	.10460	.09233
92	.08115	.07786	.07128	.06690	.06083	.03506	.10509	.08965	.07532	.06229	.05829	.05514	.13363	.10392	.09335
112	.07898	.07459	.06692	.06602	.05722	.03343	.10187	.08520	.07207	.06121	.05762	.05402	.12546	.09962	.08904
130	.08144	.07646	.06828	.06849	.05988	.03386	.10205	.08319	.07459	.05874	.05733	.05193	.12438	.09924	.08485

TIME	Q62	Q63	Q64	Q65	Q66	Q82	Q68	Q69	Q70	Q72	Q74	Q79	Q80	Q81	Q5
72	.07237	.06585	.04233	.14191	.10113	.07550	.19201	.15464	.12134	.04861	.20999	.22522	.15603	.11672	.01219
92	.07711	.06761	.04459	.14659	.10223	.08205	.19503	.15603	.12024	.05271	.21671	.22953	.14343	.12214	.01219
112	.07312	.06465	.04181	.13848	.09763	.07698	.18226	.14652	.11052	.05304	.21027	.22525	.12788	.12760	.01206
130	.07130	.06545	.04359	.13961	.09563	.07507	.17910	.14408	.11072	.05222	.20022	.21058	.12556	.13600	.01209

TIME	Q9	Q14	Q15	Q18	Q21	Q28	Q27	Q36	Q42	Q86	Q88	Q89
72	.00794	.01164	.05323	.10500	.00301	.00142	.01531	.00147	.00306	.00159	.01230	.00193
92	.00771	.01057	.05231	.10999	.00300	.00150	.01519	.00164	.00329	.00210	.01191	.00209
112	.00753	.00976	.05105	.11117	.00289	.00145	.01475	.00170	.00329	.00261	.01123	.00225
130	.00791	.00887	.05004	.10694	.00267	.00141	.01365	.00173	.00319	.00276	.01104	.00225

RUN 4527

DATE = 11- 1-73

PROJECT NUMBER...VA354-21EA

ARO, INC.

ARNOLD AIR FORCE STATION, TENN.

NASA / RI OH-11 SHUTTLE ORBITER TEST

HEAT TRANSFER DATA (Q/QREF)

TIME	G1	G2	G3	G6	G7	G8	G10	G11	G12	G13	G16	G23	G25	G26	G31
72	.54938	.31932	.22400	.18454	.14600	.12791	.10400	.13380	.14400	.08100	.09508	.08490	.10466	.10600	.07600
92	.54500	.33000	.22000	.18200	.14400	.12880	.10866	.13750	.14800	.08500	.09500	.08600	.10529	.10800	.07800
112	.54000	.32000	.21000	.16000	.14400	.12430	.10149	.13130	.14200	.08100	.09200	.08400	.10136	.09810	.07629
130	.55620	.31000	.21400	.15400	.14200	.13087	.10558	.13412	.13864	.08200	.09356	.08372	.09871	.09800	.08066

TIME	G34	G38	G41	G44	G47	G50	G52	G53	G54	G55	G56	G57	G59	G60	G61
72	.07304	.06400	.06400	.06000	.05000	.03100	.09900	.08100	.06700	.05700	.05400	.04950	.12620	.04662	.08505
92	.07400	.07100	.06500	.06100	.05500	.03148	.09700	.08200	.06900	.05700	.05300	.05003	.12380	.04600	.08600
112	.07200	.06600	.06100	.06100	.05172	.03000	.09400	.07800	.06600	.05600	.05238	.04900	.11620	.04200	.08200
130	.07408	.06955	.06211	.05539	.05400	.03042	.09400	.07600	.07000	.05363	.05200	.04700	.11500	.04148	.07800

TIME	G62	G63	G64	G65	G66	G82	G69	G69	G70	G72	G74	G79	G80	G81	G5
72	.06633	.06011	.03797	.13067	.09324	.06900	.17701	.14250	.11200	.04400	.19377	.20800	.14400	.10750	.01075
92	.07068	.06172	.04000	.13500	.09426	.07500	.17982	.14380	.11100	.04772	.20000	.21200	.13239	.11250	.01075
112	.06700	.05900	.03750	.12750	.09000	.07045	.16800	.13500	.10700	.04800	.19400	.20800	.11800	.11750	.01063
130	.06521	.05961	.03900	.12830	.08800	.06900	.16478	.13250	.10700	.04715	.18439	.19410	.11565	.12500	.01063

TIME	G9	G14	G15	G18	G21	G28	G27	G36	G42	G86	G88	G89
72	.00700	.01026	.04093	.09260	.00265	.00125	.01350	.00130	.00270	.00140	.01084	.00170
92	.00880	.00932	.04614	.09700	.00265	.00142	.01340	.00145	.00290	.00186	.01050	.00184
112	.00664	.00841	.04500	.09800	.00255	.00128	.01300	.00150	.00290	.00230	.00990	.00198
130	.00660	.00780	.04400	.09400	.00235	.00124	.01200	.00152	.00280	.00243	.00970	.00198

RUN 4527