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SUMMARY

The Langley 0.3-m Transonic Cryogenic Tunnel has provision for boundary removal from the sidewalls to reduce sidewall interference effects on the test data. This report describes the tests carried out to determine the change in the empty test section sidewall boundary-layer thickness at the model station with upstream boundary-layer mass removal. The boundary-layer measurements showed that the upstream removal region is effective in reducing the boundary-layer thickness at the model station. The boundary-layer displacement thickness reduced from about 1.2 percent to about .4 percent of the test section width. The boundary-layer velocity profiles followed a power law variation in the outer region and showed good correlation when plotted in terms of boundary-layer momentum thickness.

INTRODUCTION

The Langley 0.3-m Transonic Cryogenic Tunnel (0.3-m TCT) is a unique high Reynolds number airfoil test facility. Its first successful operation in 1973 demonstrated the application of cryogenic concept and showed the cooling of the test gas is both economical and practicable to generate high Reynolds number transonic flows. Since then, several additional features added at various stages, make 0.3-m TCT a unique facility for testing airfoils. Reference (1) gives a full description of the evolution and operational characteristics of the 0.3-m TCT.

In its present form, the 0.3-m TCT has two distinct features to overcome the limitation of conventional tunnels. First, the operation at low temperatures makes the test gas denser and less viscous. This cryogenic feature coupled with the capability to operate at increased pressures of about 6 atmospheres enables the testing of airfoil models at flight equivalent Reynolds numbers. Second, the application of the adaptive wall concept for the test section reduces wall interference. The adaptive floor and ceiling are of solid, flexible steel plates. The wall contours of the floor and ceiling are adjusted during a test to correspond to nearly free air streamline shapes. This helps to reduce significantly the wall interference effects on model measurements.

An additional source of interference arises in two-dimensional airfoil testing. The model flow field affects the growth of the boundary-layer on the sidewalls of the test section. This interaction gives rise to non-uniformity of the flow across the model span. It is difficult to compensate completely for sidewall effects by adjusting the top and bottom walls only. Hence, modern airfoil test facilities use some type of boundary-layer treatment on the sidewalls.

The 0.3-m TCT employs a boundary-layer removal system to reduce sidewall interference effects. The system consists of a pair of perforated plates mounted on the sidewalls upstream of the model station. The perforated plates act as suction medium to remove the boundary-layer mass flow. The flow coming out of the perforated plates exhausts directly to the atmosphere in the passive mode. In the active mode of operation, a compressor injects the flow back into the tunnel.

The mass flow removal from the test section sidewalls has two effects. First, the test Mach number at the model station changes. The drop in Mach number is approximately proportional to the amount of mass removed. In conventional tunnels with no provision for wall adjustment, a correction is necessary for Mach number change with mass flow removal. Adaptive walls have the advantage of adjusting the wall contours to give uniform Mach number distribution. Second, the boundary-layer thickness reduces due to removal of low energy mass in the boundary-layer. However, downstream of the suction region, the boundary-layer is much thinner and grows rapidly due to higher skin friction. Hence, if the model station is too far downstream, the benefits of boundary-layer removal becomes smaller.

For the 0.3-m TCT, there was no attempt during the design to optimize the location of the boundary-layer removal station. The primary effort was towards development of an advanced perforated plate and the associated boundary-layer removal system. With minor modification, it is possible to remove the boundary-layer at the model station or at a downstream station.

The suction region of the perforated plates currently being used in the 0.3-m TCT for boundary-layer removal is 6" wide. The downstream edge of the plates is 11.25" ahead of the model turntable center. This report gives details of the sidewall boundary-layer measurements made recently to determine whether the upstream removal location was effective in reducing the boundary-layer thickness at the model station. The tests conducted in the empty test section involved measurement of boundary-layer profiles on the sidewalls at the model station. The range of mass flow removal rates covered in these test were from zero to maximum obtainable with passive operation. The empty test section boundary-layer displacement thickness(δ^*) and shape factor (H) calculated from the profiles are useful in correcting airfoil test data for the sidewall effects.

NOMENCLATURE

b	:	Test section width
H	:	Boundary-layer shape factor
L	:	Reference length (1 inch)
m	:	Mass flow
M	:	Mach number
n	:	Index of power-law for the velocity profile ($U \propto y^{1/n}$)
R	:	Reynolds number per foot
U	:	Velocity
y	:	Distance from the wall
δ	:	Boundary-layer thickness
δ^*	:	Boundary-layer displacement thickness
θ	:	Boundary-layer momentum thickness

Subscripts

e	:	refers to conditions outside the boundary-layer
bl	:	refers to boundary-layer removal
ts	:	refers to test section

APPARATUS

0.3-m Transonic Cryogenic Tunnel

The 0.3-m TCT (figure 1) is a continuous fan driven tunnel using cryogenic nitrogen as test gas. A 3000 HP variable frequency motor drives the fan. The test Mach number is variable in the range from about 0.05 to 0.9. The stagnation pressure and temperature are variable in the range 1.2 - 6 atmosphere, and 80 - 320 K, respectively. The liquid nitrogen injected into the tunnel circuit before the first corner cools the tunnel to the required stagnation temperature. Under steady conditions, the cooling capacity of the liquid nitrogen is equal to the heat dissipated by the fan. An exhaust valve located near the third corner controls the stagnation pressure in the tunnel. A sophisticated control system enables independent variation of test Mach number, stagnation pressure and temperature.

Adaptive Wall Test Section

The adaptive wall test section (figure 2) has rigid sidewalls, and adjustable floor and ceiling. The cross section is a 13 inch square when the ceiling and floor are parallel. The overall length of the test section is 73.2 inches. Figure (3) shows a schematic arrangement of the 0.3-m TCT adaptive wall test section and the location of the boundary-layer removal region.

The flexible ceiling and floor are of stainless steel plates to withstand cryogenic operating conditions. The plate thickness varies along the length. At the upstream fixed end, the thickness is maximum (.375 inches). Near the turntable region, the plate is much thinner (.063 inch) to permit contouring the wall to the streamline shapes. The downstream end moves freely in a sliding joint. The flexible floor and ceiling are supported along the length at twenty-one locations by separate electrically operated jacks. Separate stepping motors drive each of these jacks to the desired contour. For operational convenience, the stepping motors and the jacks are outside the cryogenic environment and the pressure shell enclosing the test section. The push rod attachments between the plates and the jacks pass through the pressure shell. A micro-processor monitors the wall movements and limits the minimum radius of curvature to 30 inches to avoid excessive stresses.

The adjustment of wall shapes to free air streamline shapes requires a knowledge of the current wall position and the fluid velocity. Linear Variable Displacement Transducers (LVDT) located at the jack stations, and the pressure orifices on the plate provide this information. Using these data, a wall adjustment strategy calculates the wall position required to simulate the free air conditions in the tunnel. The calculation uses data at only the first eighteen jacks. The last three jacks provide a faring of the wall shapes to the test section exit or diffuser entry. Reference (2) describes in detail the adaptive wall test section and the wall adjustment strategy to eliminate interference.

Boundary-Layer Removal System

Figures (1) through (3) show 0.3-m TCT sidewall boundary-layer removal scheme. Reference (3) describes in detail the complete system. The purpose of this system is to reduce the sidewall boundary-layer thickness at the model station. The smaller boundary-layer thickness minimizes the tendency for separation and consequent adverse effects on the airfoil measurements. Also, the correction to test Mach number, if any, will be much smaller.

Figure (4) shows the details of the boundary-layer removal medium for the adaptive wall test section. It consists of a pair of perforated plates mounted flush on the tunnel sidewalls upstream of the model. The suction region of the perforated plates are 6" wide and 13" high. The plates extend from tunnel floor to the ceiling. The plates have fine holes drilled by using the electron beam technique. The holes are 0.012-inch diameter and 0.032-inch apart giving a nominal open area of about 11 percent. The perforated plates are glued to a honeycomb-large hole plate (fig 4) structure. This fabrication technique provided a rigid, porous medium for boundary-layer removal.

The surface exposed to the test section flow is smooth obtained by etching and polishing of the surface. Earlier studies (references 4 and 5) had shown that these perforated plates to be superior to conventional sintered type materials. With no flow, the boundary-layer growth due to surface roughness or hole openings will be much less for these plates. The boundary-layer mass taken out of the test section passes through digital flow control valves. These digital valves consist of a number of calibrated sonic nozzles. The nozzles open or close in appropriate combination to control the rate of mass removal from the test section. A dedicated micro-processor commands the opening and closing of the nozzles.

The boundary-layer removal system, as shown in figure 1, operates in two modes, either passive or active. In the passive mode of operation (figure 5), the boundary-layer mass removed exhausts directly to the atmosphere. Therefore, for this mode to be effective, the test section static pressure must be higher than the ambient value. Also, the maximum amount of boundary-layer mass taken out cannot exceed the amount of gas produced by the liquid nitrogen injected to remove heat of compression and maintain maintain test pressure and temperature. The amount of liquid nitrogen injected into the tunnel is considerable at higher Mach numbers due to larger power dissipation. Instead of the normal exhaust procedure, taking out nitrogen gas through boundary-layer removal system offers a convenient operating mode at transonic speeds.

The active mode is most useful at low test Mach numbers when the amount of liquid nitrogen injected is quite small. To maintain stable tunnel flow conditions, it is necessary to inject back most of the boundary-layer mass removed. The gas removed passes through a centrifugal compressor. The compressed gas then enters the tunnel circuit at the diffuser location. For the present tests, the boundary-layer removal system operation was in the passive mode for convenience.

Boundary-Layer Measurements

A boundary-layer rake (figure 6) mounted on the right sidewall turntable was used to measure the total pressures in the boundary-layer. The rake had 15 total pressure probes spaced equally .04in apart. The first tube of the rake was at a distance of about 0.04 inch from the wall. For most of the test conditions, the rake was within the sidewall boundary-layer. Hence, it was possible to obtain reliable estimates of the boundary-layer displacement thickness and shape factor. The probe tips were of stainless steel tubing with 0.02 inch outside diameter and 0.01 inch inside diameter. The probe tips were at a distance of 10.125 inch from the downstream edge of the suction region (Figure 6).

RESULTS AND DISCUSSION

For the test data in this report, the boundary-layer operation was in the mode. The adaptive wall ceiling and floor contours were set to aerodynamically straight shapes. Hence, with sidewall boundary-layer removal there was a slight drop in the Mach number at the turntable location. This change in Mach number does not have a major effect on the sidewall boundary-layer measurements. The stagnation temperature and pressure varied from about 125K to 230K, and 26 to 71 psi, respectively. The corresponding unit Reynolds number was 26.6 million per foot. With these conditions, the maximum amount of mass flow removal was about 1.7 percent (Figure 7) in the passive mode. For testing under conditions above Mach number of 0.7, the passive removal capability appears adequate.

Reference (6) gives the details of calculating the boundary-layer parameters from the measurements. The computer program described in reference (6), converts the boundary-layer rake total pressures to velocities. Integration of these velocities gives the displacement and momentum thicknesses and the shape factor. Figure (8) shows the calculated velocity profiles at the turn- table for a sample case at a Mach number of 0.766, with different levels of boundary-layer removal. With increasing suction rates, the velocity within the boundary-layer increases continuously. Figure (8) also demonstrates that the present upstream location of the boundary-layer removal station is still effective in reducing the boundary-layer thickness at the turntable.

Most of the data points in the boundary-layer lie in the outer region of the turbulent boundary-layer. Hence, the program of reference (6) uses a power law velocity variation for extrapolating the experimental data from the first tube to the wall. Figures 9a-c, compare the results of power-law velocity variation with the measured velocities, for Mach numbers .5, .765 and .8. For all the conditions, the comparison indicates that the velocity profiles are close to power velocity variation.

The index n in the power law for velocity is a strong function of the suction velocity (figure 10). It increase from about 7 for zero mass flow removal to about 13 with maximum removal. The dependence on Mach number is not significant. For zero mass flow removal, it is close to 7 over the Mach number range 0.3 to 0.8 (Figure 11).

The displacement thickness and shape factor are of particular interest in correcting the test data for sidewall effects. Figures (12) and (13) show their variation with increasing mass flow removal. The displacement thickness is about 1.3 percent of the test section width when there is no mass removal. It reduces to about 0.6 percent with maximum removal. However, the mass flow removal is most effective from 0 to about 1 percent. Beyond one percent removal, the decrease in boundary-layer thickness is rather small. Also, with suction the initial spread in data at zero removal, almost vanishes.

The shape factor variation is similar for conditions with and without mass removal. The shape factor reduces by about .1 under maximum removal condition. The dependence on Mach number is strong. It increases from from 1.25 at low Mach numbers to about 1.4 at a Mach number of about .8.

Figures 14a-c compare the boundary-layer velocity profiles at different Mach numbers for fixed boundary-layer removal rates. This demonstrates that the sidewall boundary-layer velocity variation depends primarily on the rate of boundary-layer removal. The effect of Mach number is secondary. Figures 15a-c correlate the variation of the boundary-layer velocity with distance from the wall in terms of the boundary-layer momentum thickness (y/θ). The data for different non-zero boundary-layer removal rates correlate satisfactorily.

The results presented in this report cover only one Reynolds number at 26.6 million per foot. Appendix A tabulates the calculated boundary-layer parameters and the velocity profile details for all the data points. At lower Reynolds numbers, the boundary-layer thickness will be larger. But with suction, the effect of Reynolds number may become secondary. With about 1.5 percent suction rate, the sidewall boundary-layer displacement thickness is about .4 percent of the test section width ($2\delta^*/b$).

The correction for the airfoil test data for sidewall boundary-layer interference effects depends on the empty test section boundary-layer characteristics ($2\delta^*/b$ and H), the airfoil model aspect ratio and the test Mach number. At transonic speeds, the present boundary-layer measurements suggest that the maximum correction to the test Mach number will be about -0.004. This correction is based on one-dimensional changes in the flow area due to changes in the sidewall boundary-layer thickness. Three-dimensional effects tend to make the corrections much smaller. It may be noted that the correction is valid only as long as the boundary-layer remains attached to the sidewall.

CONCLUSION

Sidewall boundary-layer measurements at the model location show that the upstream removal location is quite effective. The boundary-layer displacement thickness reduces from about 1.2 percent to about .4 percent of the test section width, with passive boundary-layer removal. The measured velocity profiles follow a power law variation in the outer region and show good correlation when plotted in terms of boundary-layer momentum thickness.

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2. Wolf, S. W. D.: Evaluation of a Flexible Wall Testing Technique to Minimize Wall Interferences in the NASA Langley 0.3-m Transonic Cryogenic Tunnel. AIAA Paper 88-0140, Jan. 1988.

3. Johnson, C. B.; Murthy, A. V.; and Ray, E. J.: A Description of the Active and Passive Sidewall-Boundary-Layer Removal Systems of the 0.3-Meter Transonic Cryogenic Tunnel. NASA Technical Memorandum 87764, November 1986.

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TABLE I
Summary of 0.3-m TCT Sidewall Boundary-Layer Measurements
(TEST: 213)

T R P	M	R_e	P_t psi	T_t K	m_{bl} %	δ/L	δ^*/L	θ	H
213- 03- 01	.7025	.269E+08	70.91	230.7	0.00	.6666	.0889	.0605	1.47
213- 03- 02	.7023	.270E+08	71.12	230.6	0.50	.5415	.0572	.0406	1.40
213- 03- 03	.7037	.269E+08	70.89	230.6	1.00	.4961	.0464	.0335	1.38
213- 03- 04	.7032	.269E+08	70.88	230.6	1.40	.4700	.0405	.0294	1.37
213- 04- 05	.7324	.269E+08	69.23	230.8	0.00	.6528	.0857	.0580	1.47
213- 04- 06	.7333	.269E+08	69.08	230.7	0.50	.5305	.0554	.0390	1.42
213- 04- 07	.7310	.269E+08	69.24	230.6	1.00	.4981	.0466	.0333	1.40
213- 04- 08	.7308	.270E+08	69.39	230.7	1.60	.4635	.0385	.0278	1.38
213- 05- 09	.7516	.266E+08	67.50	230.9	0.00	.6267	.0805	.0544	1.48
213- 05- 10	.7523	.269E+08	68.18	231.0	0.50	.5369	.0565	.0395	1.43
213- 05- 11	.7511	.270E+08	68.52	230.8	1.00	.4903	.0451	.0320	1.40
213- 05- 12	.7497	.268E+08	68.04	230.6	1.60	.4578	.0373	.0267	1.39
213- 06- 13	.7622	.269E+08	67.53	230.8	0.00	.6371	.0829	.0556	1.49
213- 06- 14	.7599	.268E+08	67.53	231.1	0.50	.5326	.0554	.0387	1.43
213- 06- 15	.7607	.267E+08	67.21	230.8	1.00	.4975	.0464	.0328	1.41
213- 06- 16	.7630	.269E+08	67.58	230.6	1.70	.4567	.0367	.0262	1.39
213- 07- 18	.7794	.268E+08	66.78	231.1	0.00	.6247	.0810	.0541	1.49
213- 07- 19	.7816	.270E+08	66.86	230.9	0.50	.5305	.0553	.0382	1.44
213- 07- 20	.7807	.269E+08	66.77	230.8	1.00	.4895	.0455	.0319	1.42
213- 07- 21	.7806	.266E+08	66.02	230.8	1.76	.4517	.0356	.0253	1.40
213- 08- 22	.8000	.268E+08	66.45	232.8	0.00	.6093	.0792	.0524	1.51
213- 08- 23	.8048	.267E+08	65.44	231.1	0.50	.5322	.0556	.0381	1.45
213- 08- 24	.8005	.270E+08	66.13	231.0	1.00	.4897	.0457	.0318	1.43
213- 08- 25	.8048	.272E+08	66.37	230.8	1.80	.4473	.0343	.0242	1.41
213- 09- 26	.6539	.269E+08	74.42	230.7	0.00	.6284	.0807	.0562	1.43
213- 09- 28	.6498	.269E+08	74.55	230.6	0.50	.5341	.0550	.0399	1.37
213- 09- 29	.6535	.271E+08	74.80	230.6	1.00	.4962	.0463	.0340	1.36
213- 10- 32	.2988	.270E+08	63.08	130.5	0.00	.5948	.0708	.0541	1.30
213- 10- 33	.3031	.275E+08	62.97	129.8	0.50	.5313	.0546	.0430	1.26
213- 10- 34	.3013	.273E+08	62.90	129.8	0.80	.4973	.0466	.0372	1.25
213- 11- 35	.5016	.271E+08	40.35	129.7	0.00	.6161	.0758	.0556	1.36
213- 11- 36	.4995	.270E+08	40.35	129.8	0.50	.5446	.0565	.0427	1.32
213- 11- 37	.4997	.266E+08	39.65	129.8	1.00	.5049	.0467	.0359	1.29

TABLE I
Summary of 0.3-m TCT Sidewall Boundary-Layer Measurements
(TEST: 213)

T R P	M	R_e	P_t psi	T_t K	m_{bl} %	δ/L	δ^*/L	θ	H
213- 12- 38	.8189	.265E+08	28.70	130.4	0.00	.6191	.0785	.0519	1.51
213- 12- 39	.8213	.267E+08	27.13	125.0	0.50	.5399	.0569	.0387	1.46
213- 12- 40	.8187	.266E+08	27.10	124.9	1.00	.4905	.0451	.0312	1.44
213- 12- 41	.8196	.262E+08	26.67	124.9	1.80	.4578	.0361	.0254	1.42
213- 13- 42	.8405	.268E+08	35.49	151.7	0.00	.6291	.0795	.0522	1.52
213- 13- 44	.8393	.269E+08	35.49	151.5	0.50	.5351	.0554	.0375	1.47
213- 13- 45	.8454	.269E+08	35.41	151.3	1.00	.5078	.0475	.0325	1.45
213- 13- 46	.8431	.271E+08	35.68	151.4	1.66	.4623	.0368	.0256	1.43

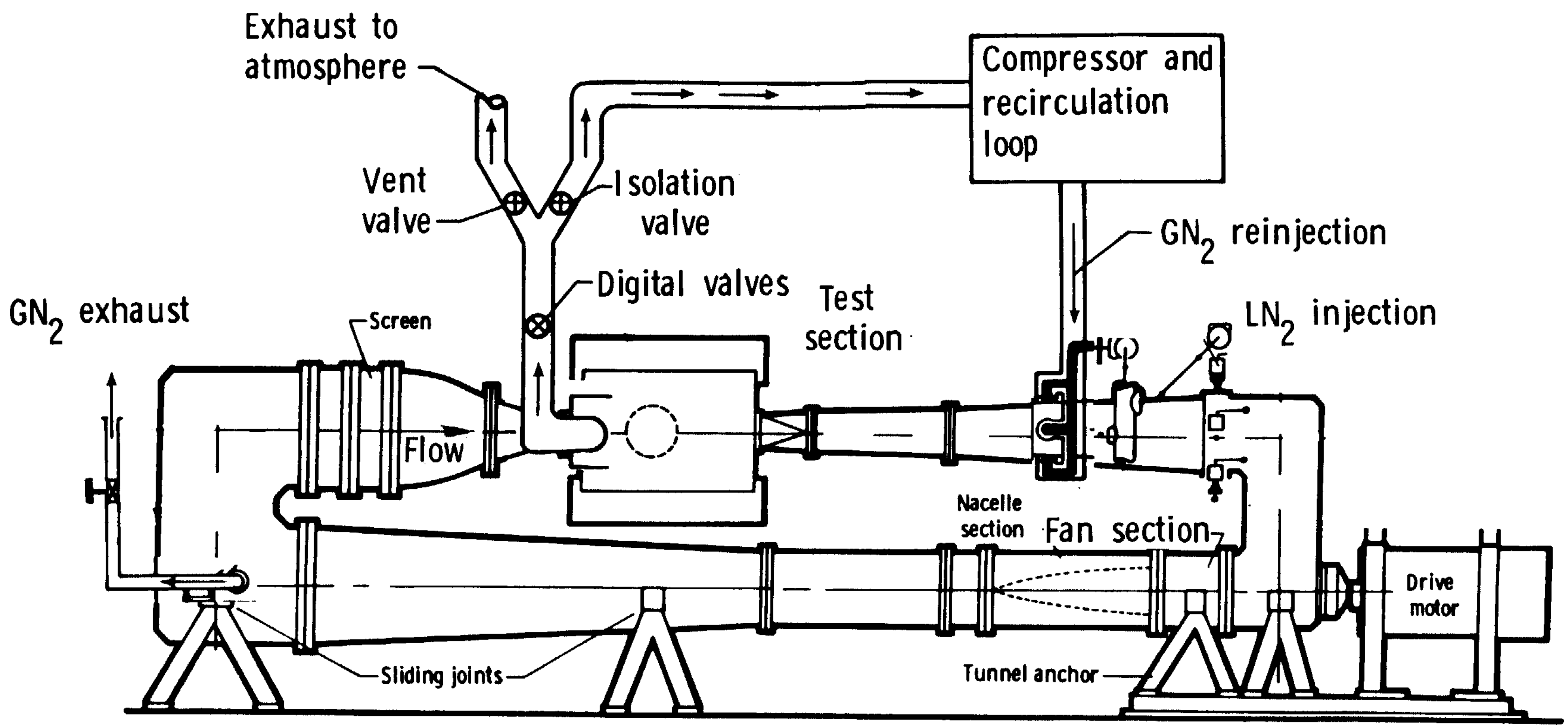

Figure 1: Schematic Layout of the Langley 0.3-Meter Transonic Cryogenic Tunnel

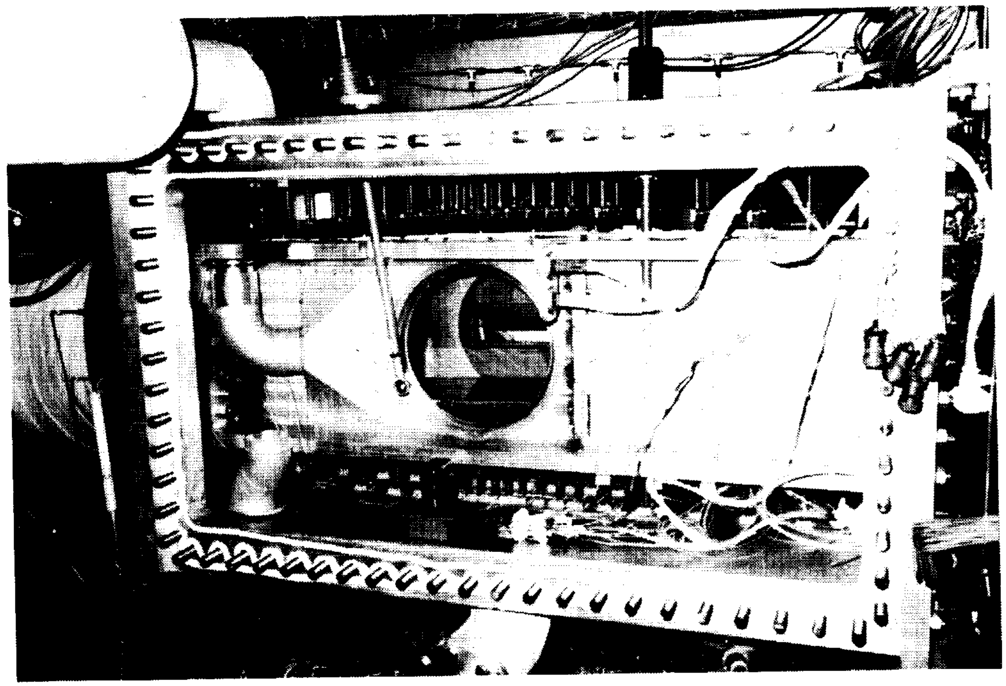

Figure 2: Adaptive Wall Test Section of the 0.3-m TCT

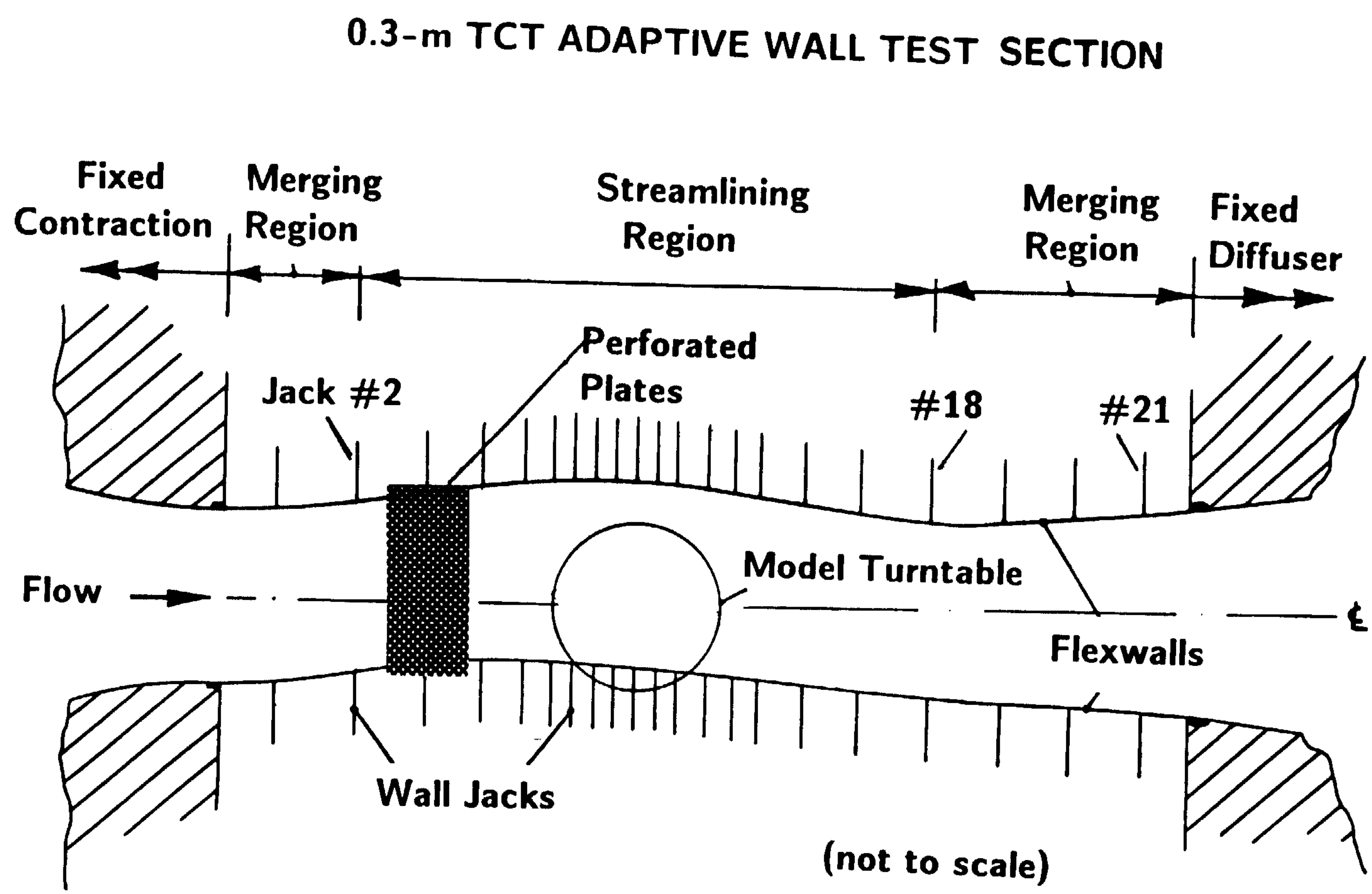

Figure 3: Location of Ceiling and Floor Jacks, and Perforated Plates for Boundary-Layer Removal

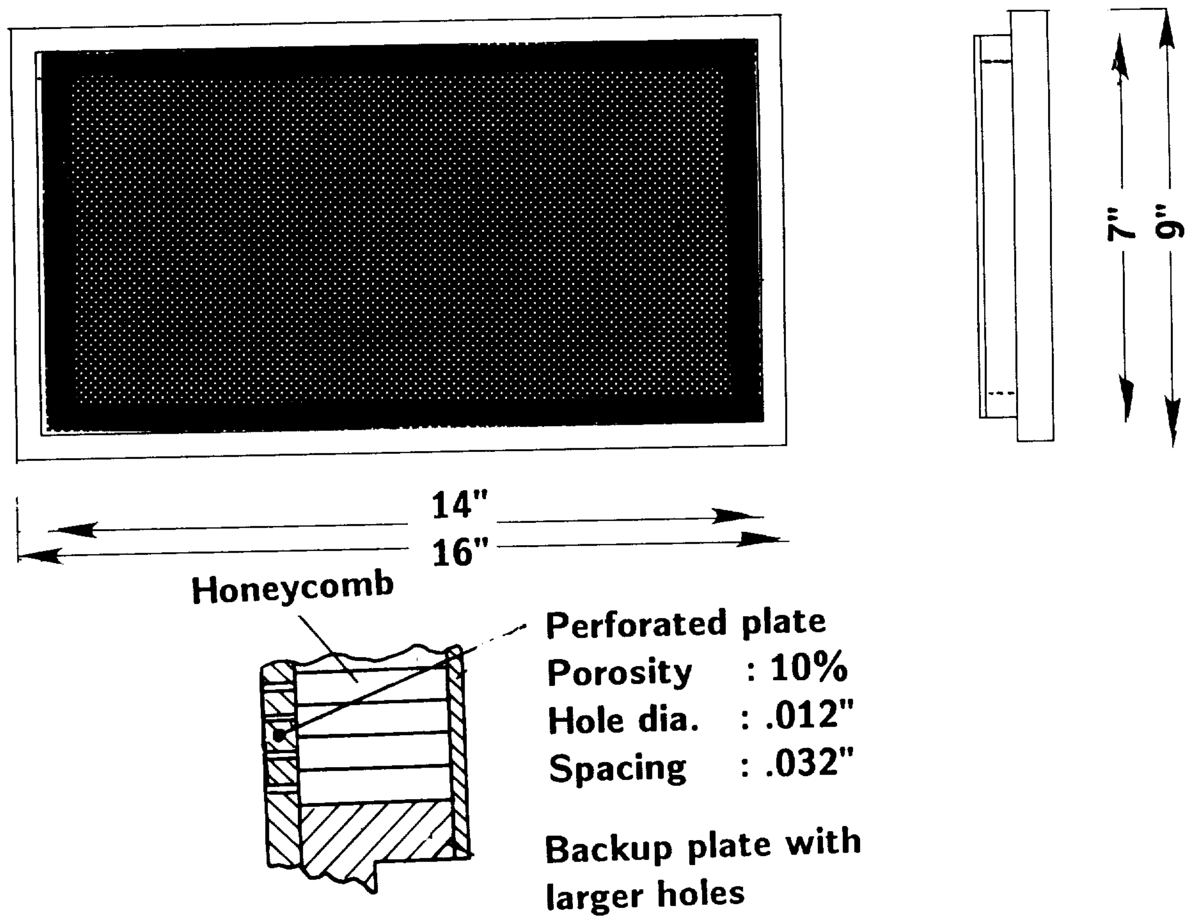

Figure 4: Details of Perforated Plates used for Boundary-Layer Removal

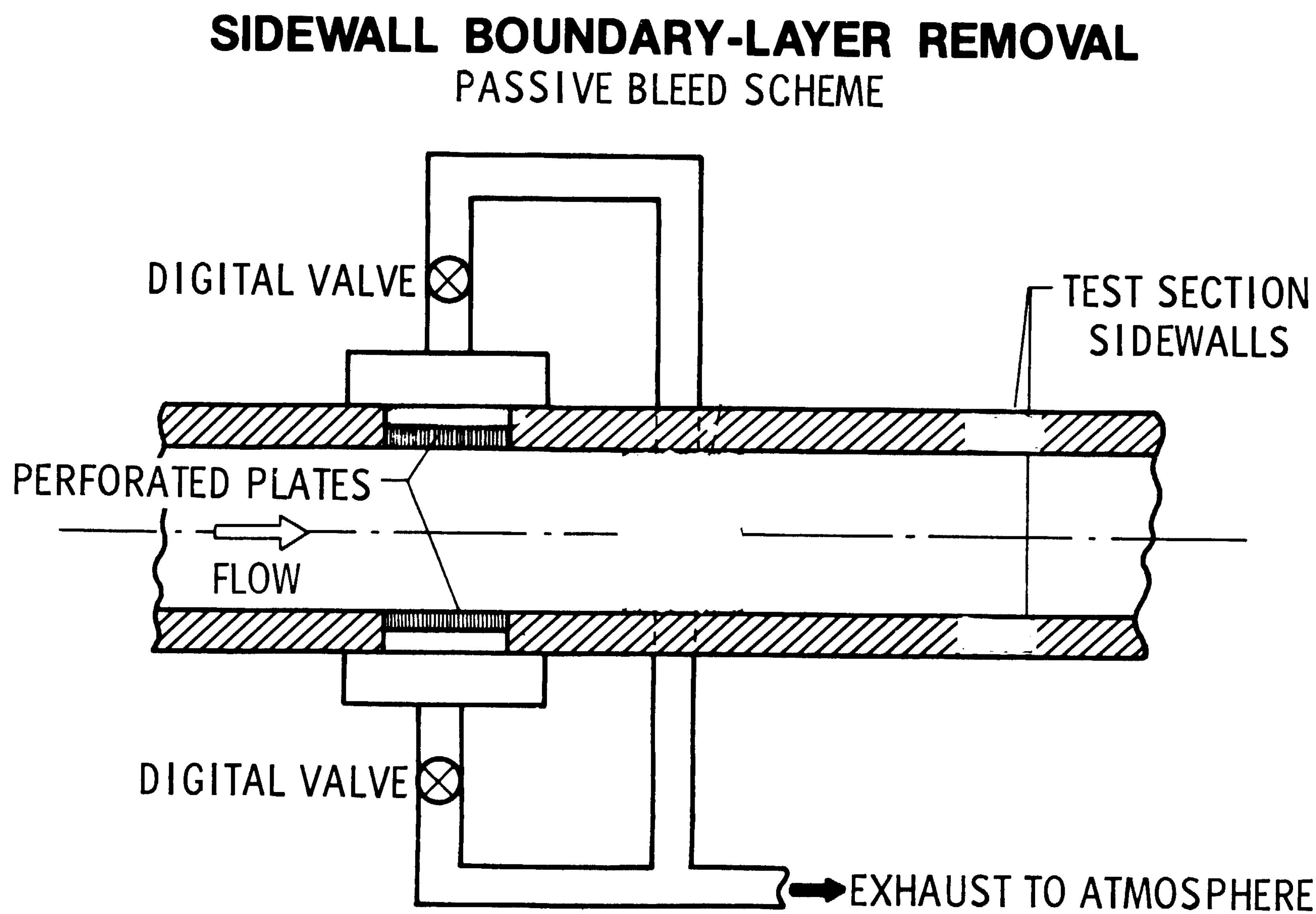

Figure 5: Side Wall Boundary-Layer Passive Removal Scheme

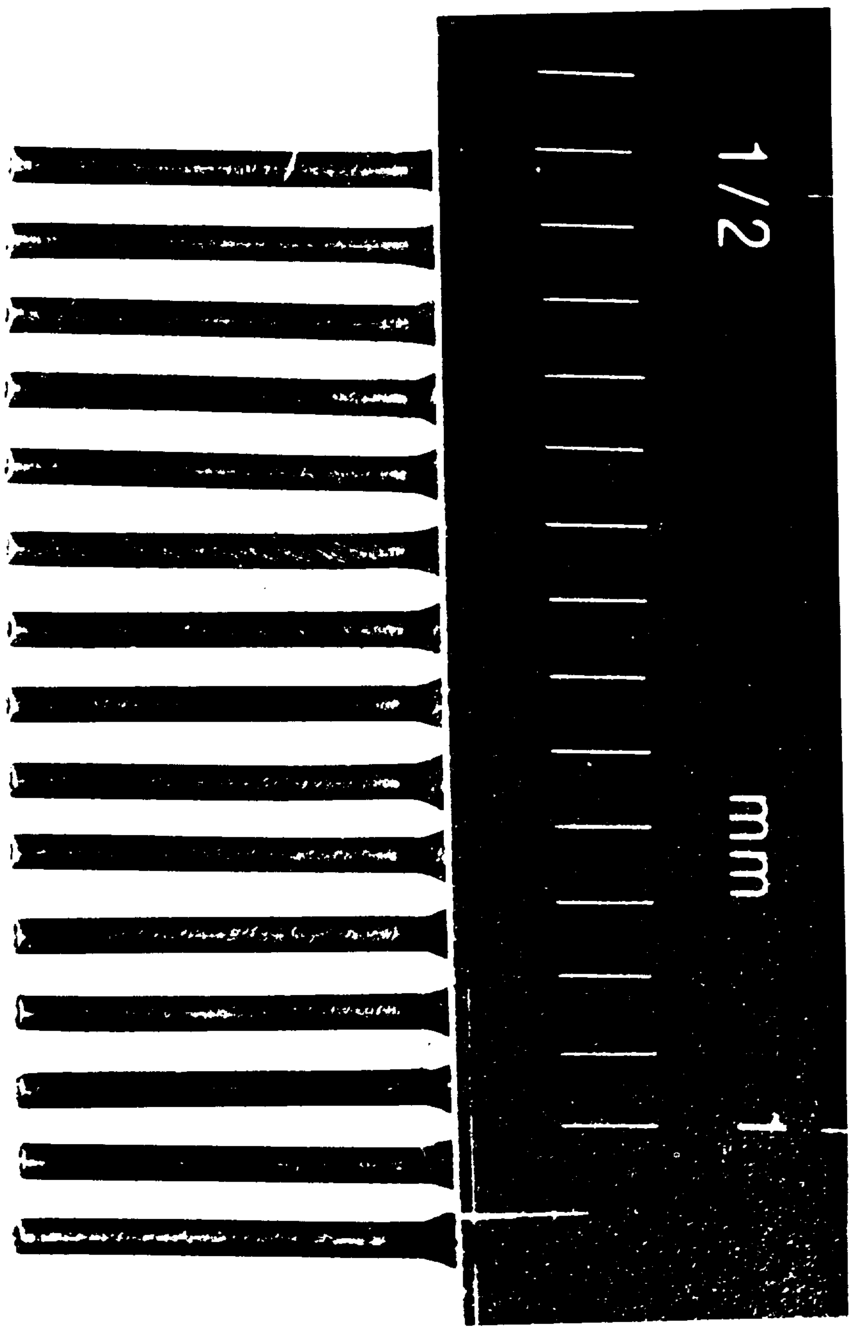

Figure 6: Boundary-Layer Rake Total Pressure Tubes (Enlarged View)

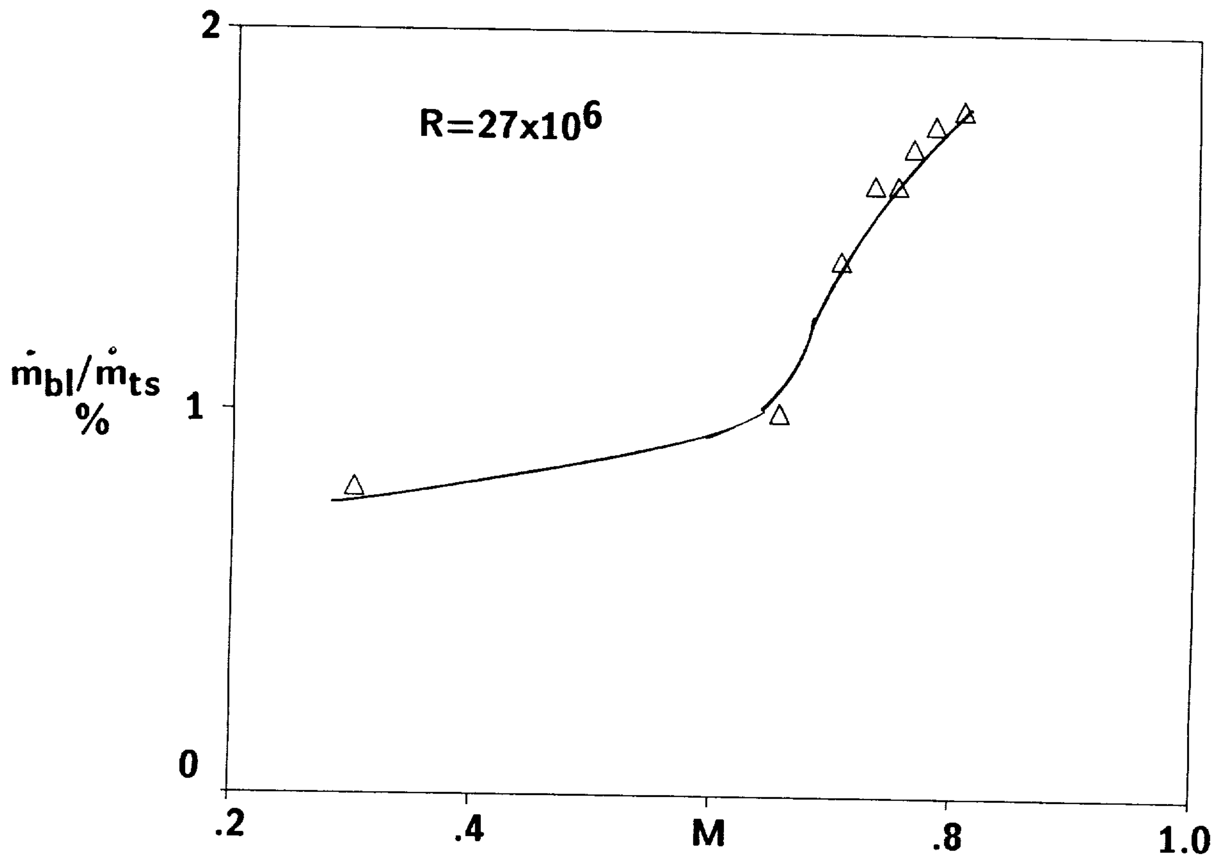

Figure 7: Passive Boundary-Layer Removal Capability Variation with Mach Number

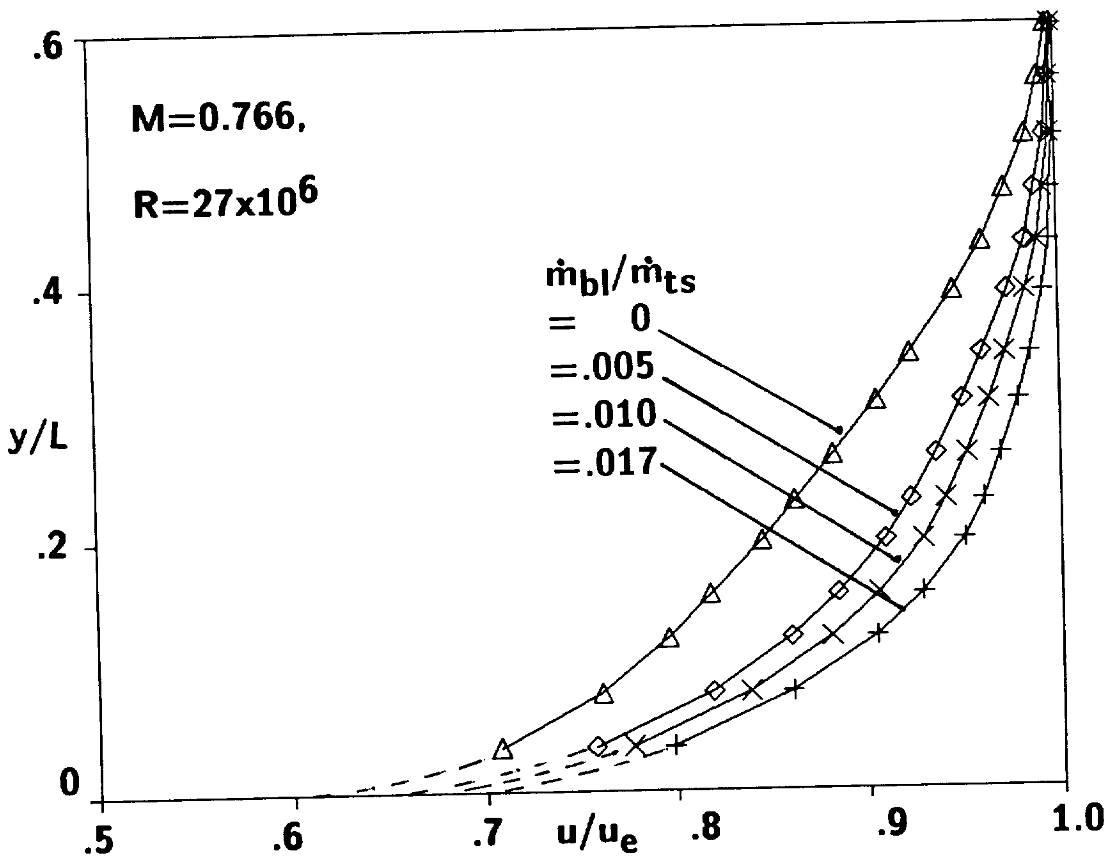

Figure 8: Boundary-Layer Velocity Profiles for Different Suction Rates

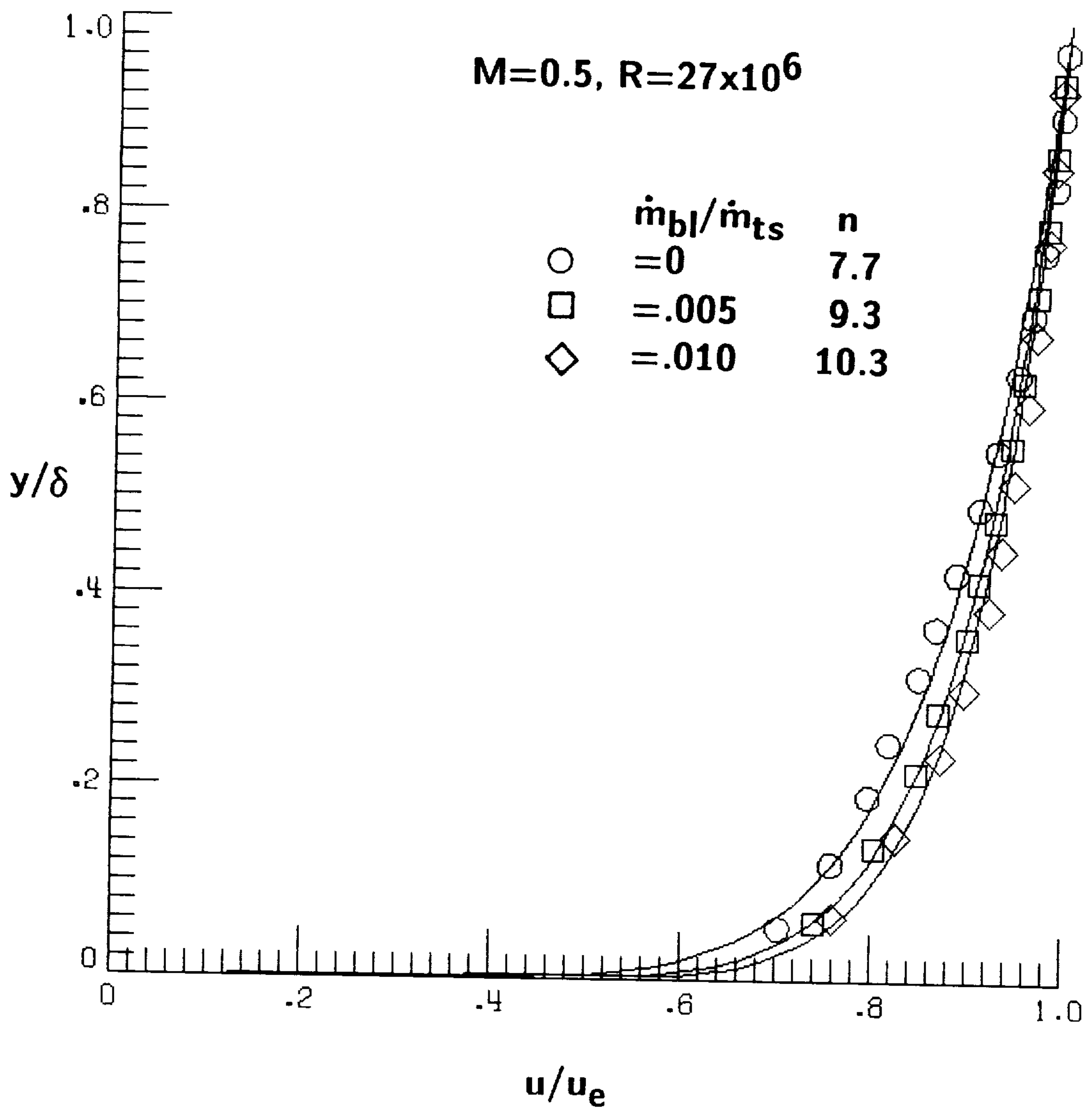

Figure 9a: Comparison of Measured Velocity Profiles with Power-law variation

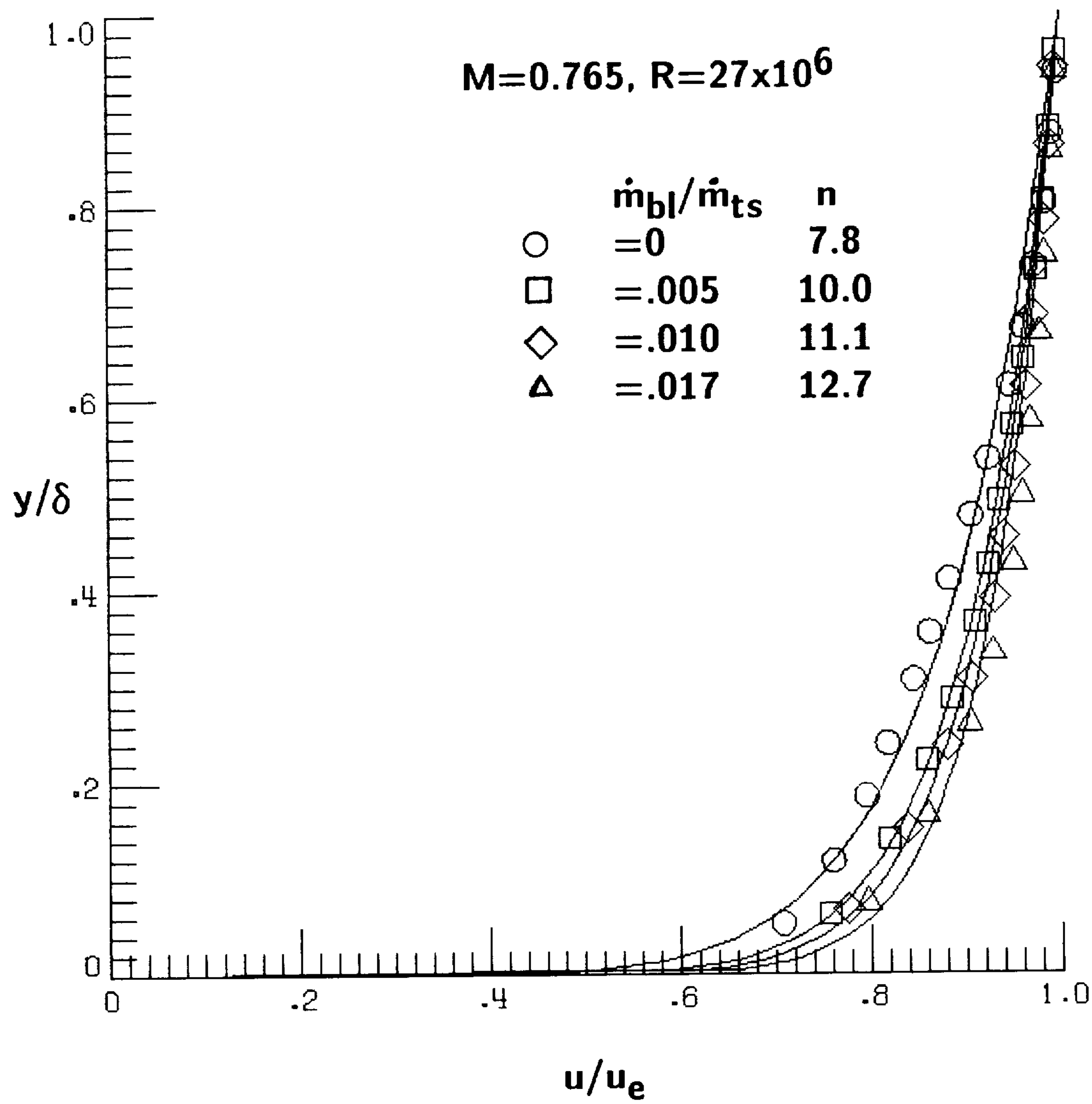

Figure 9b: Comparison of Measured Velocity Profiles with Power-law variation

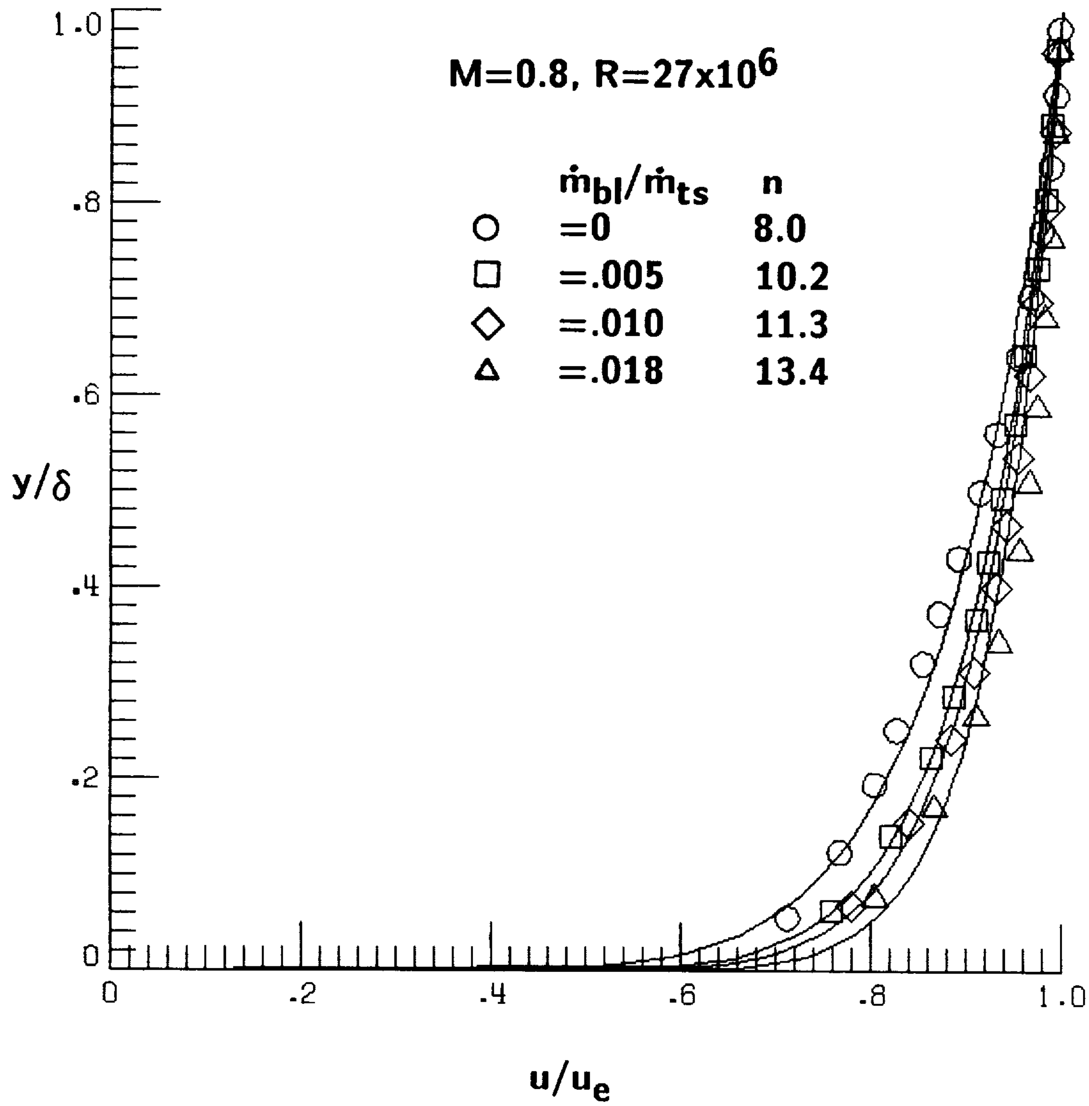

Figure 9c: Comparison of Measured Velocity Profiles with Power-law variation

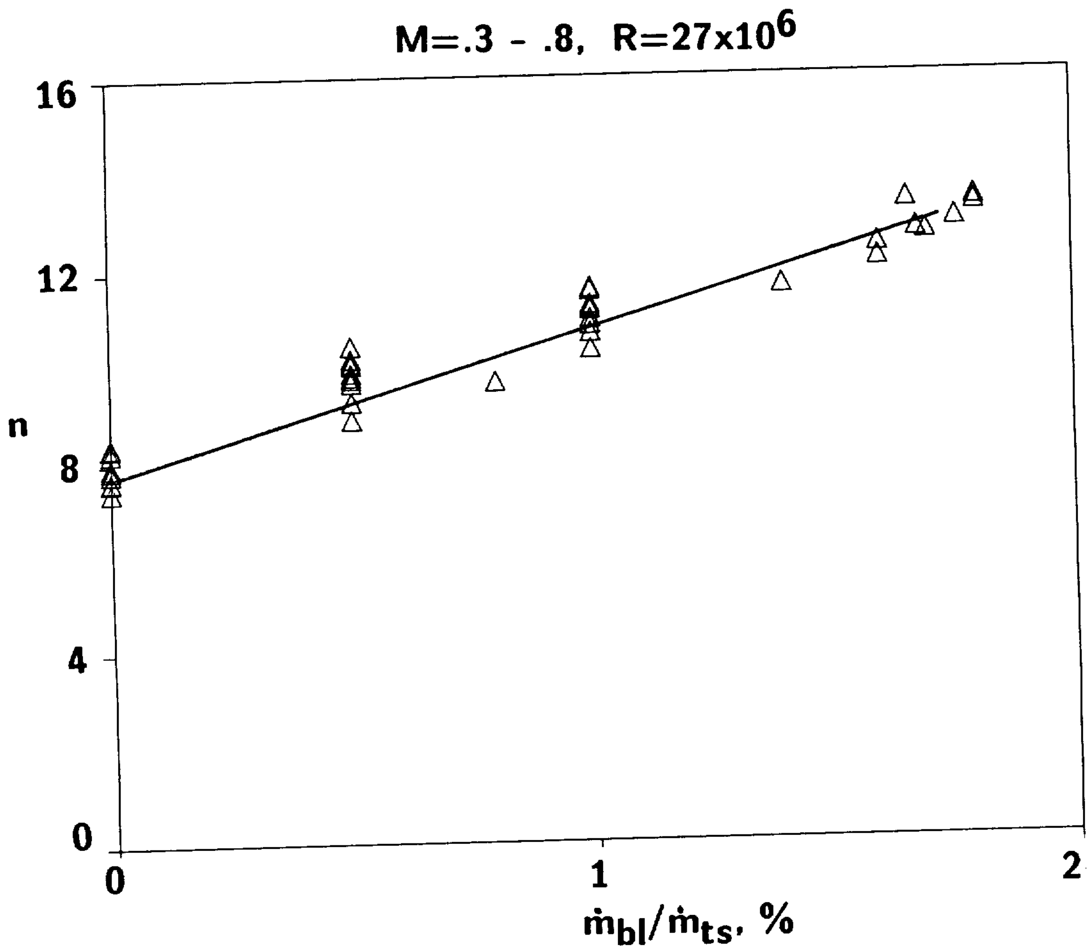

Figure 10: Variation of Index n in Power-law with Rate of Suction

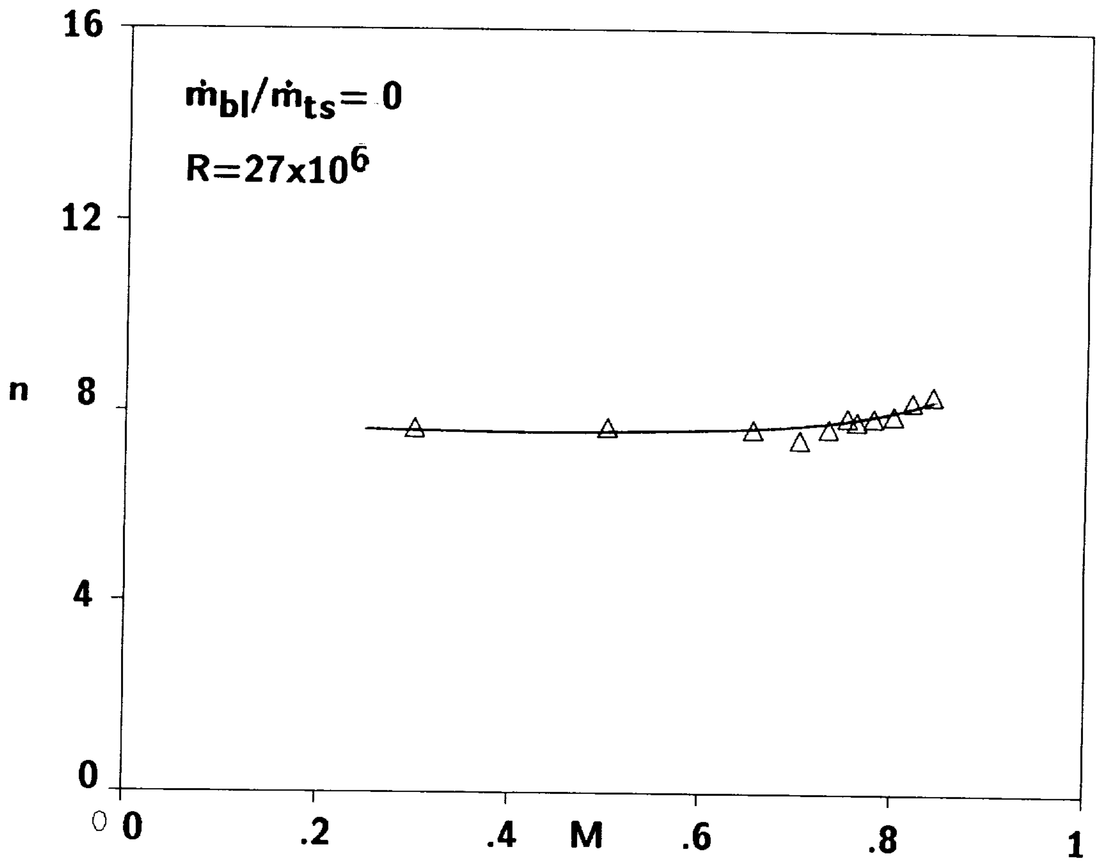

Figure 11: Variation of Index n in Power-law with Mach number for Zero Suction Rate

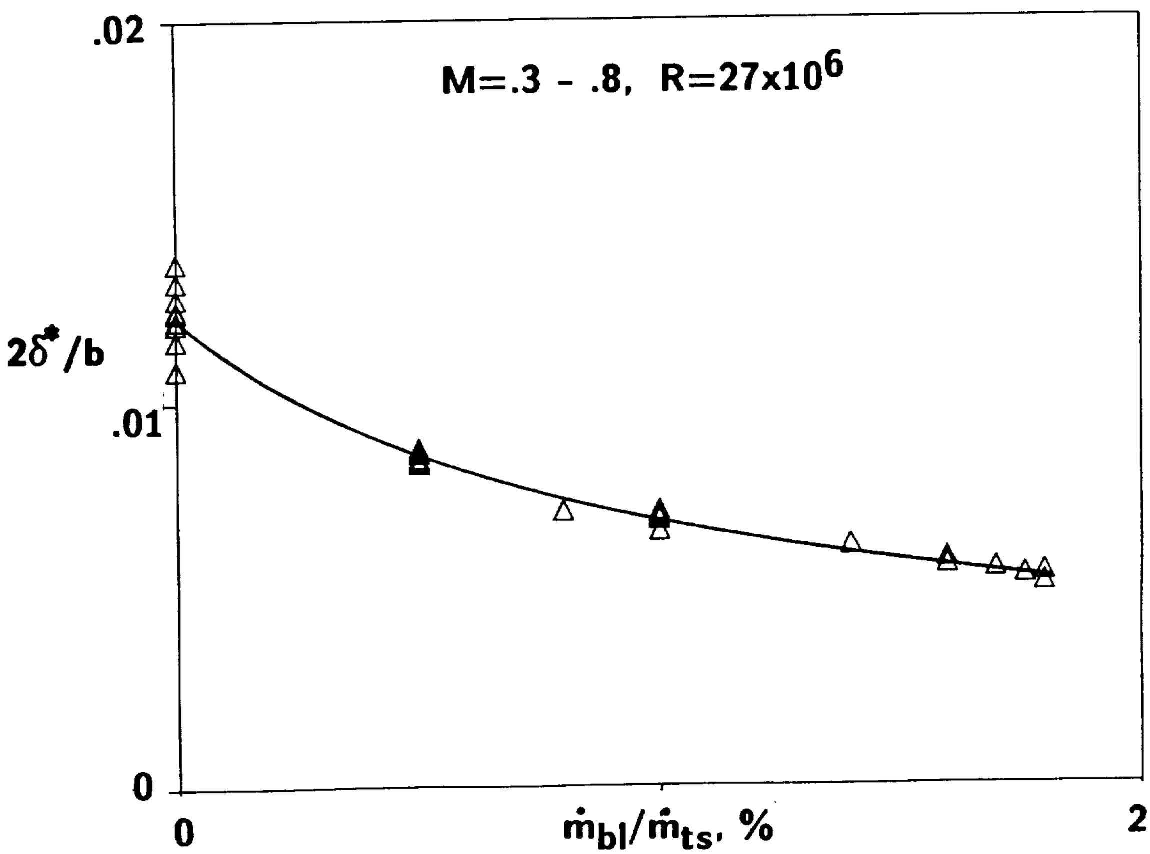

Figure 12: Variation of Side Wall Boundary-Layer Displacement Thickness at Model Station with upstream suction.

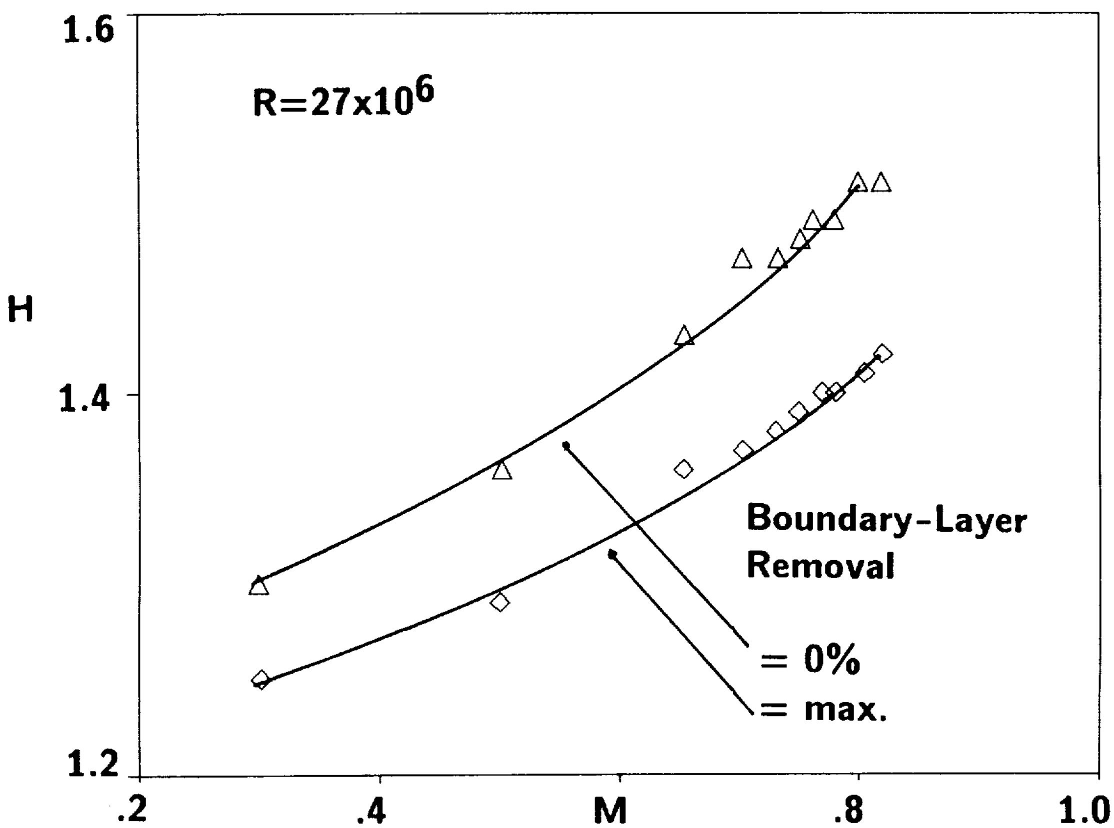

Figure 13: Variation of Side Wall Boundary-Layer Shape Factor at Model Station with upstream suction.

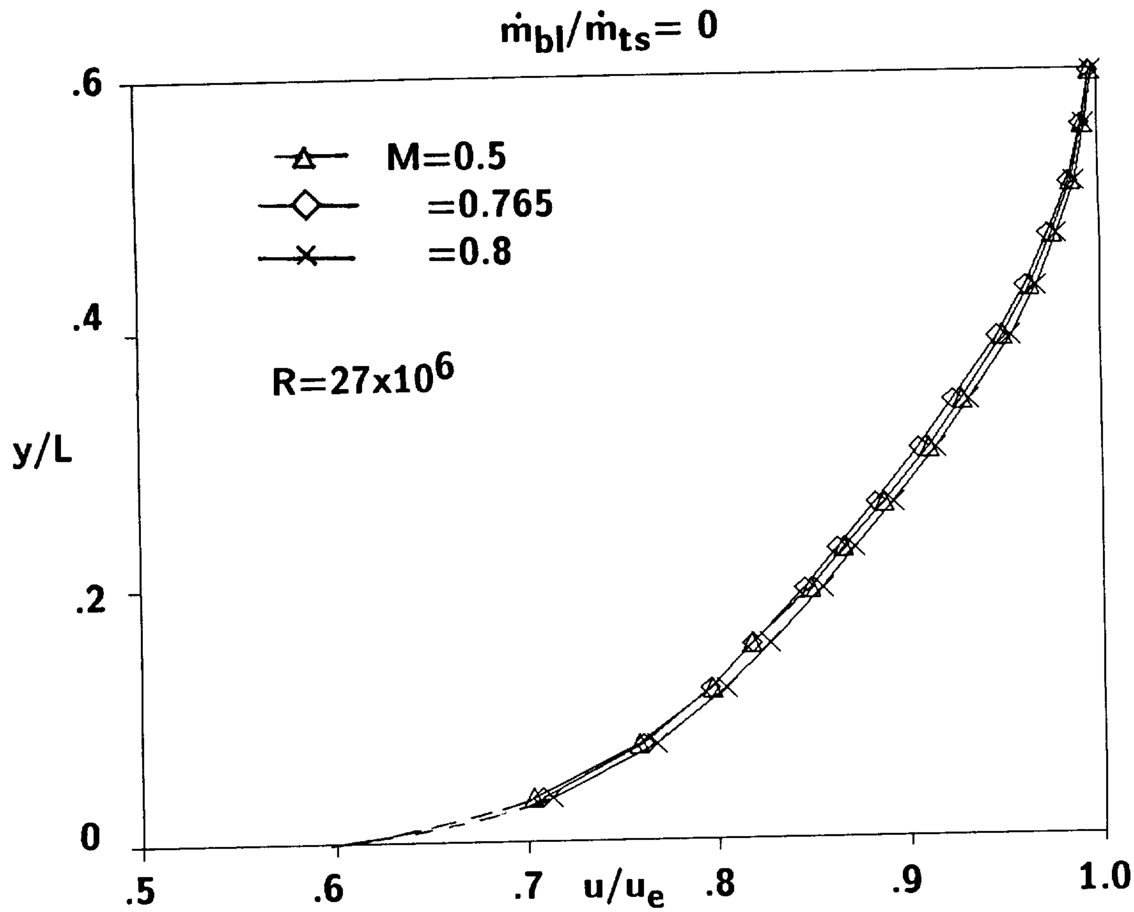

Figure 14a: Comparison of Boundary-Layer Profiles for Different Mach Numbers with no Mass Flow Removal.

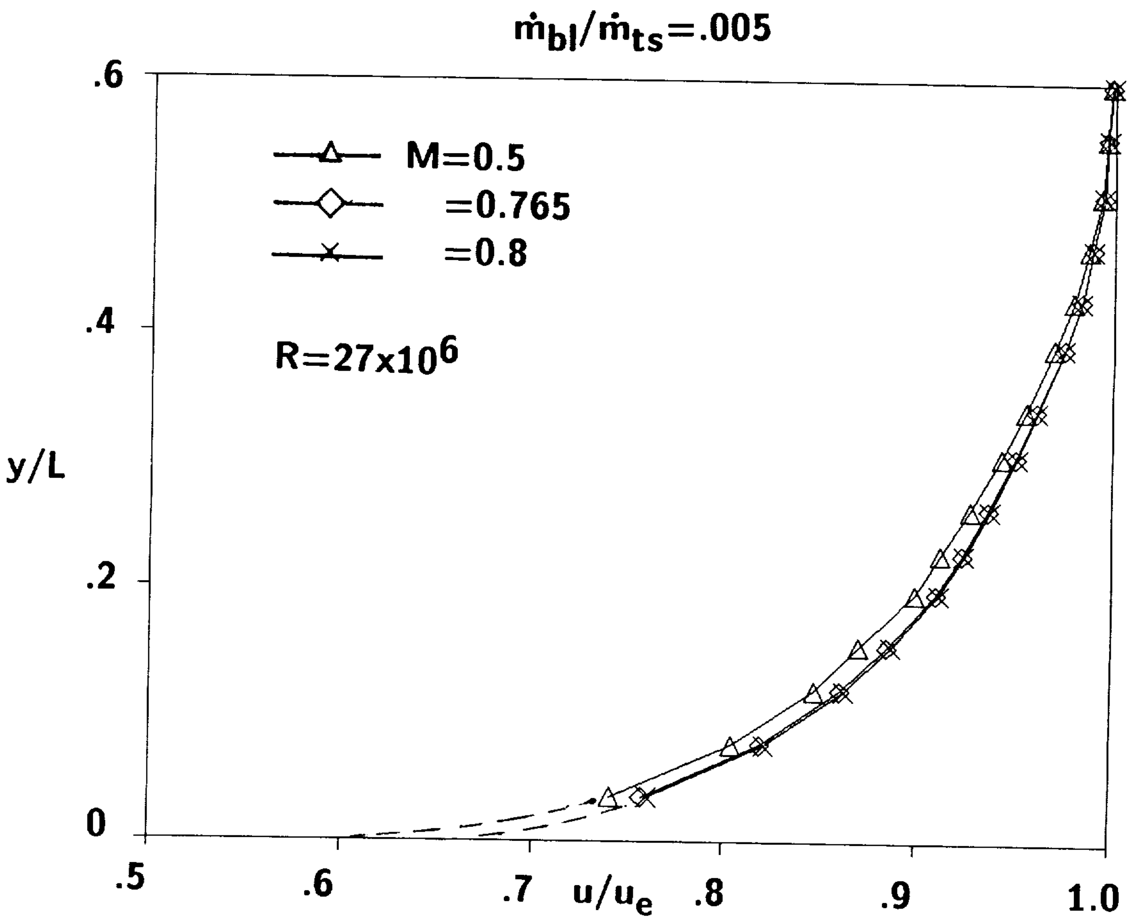

Figure 14b: Comparison of Boundary-Layer Profiles for Different Mach Numbers with 0.5 percent Mass Flow Removal.

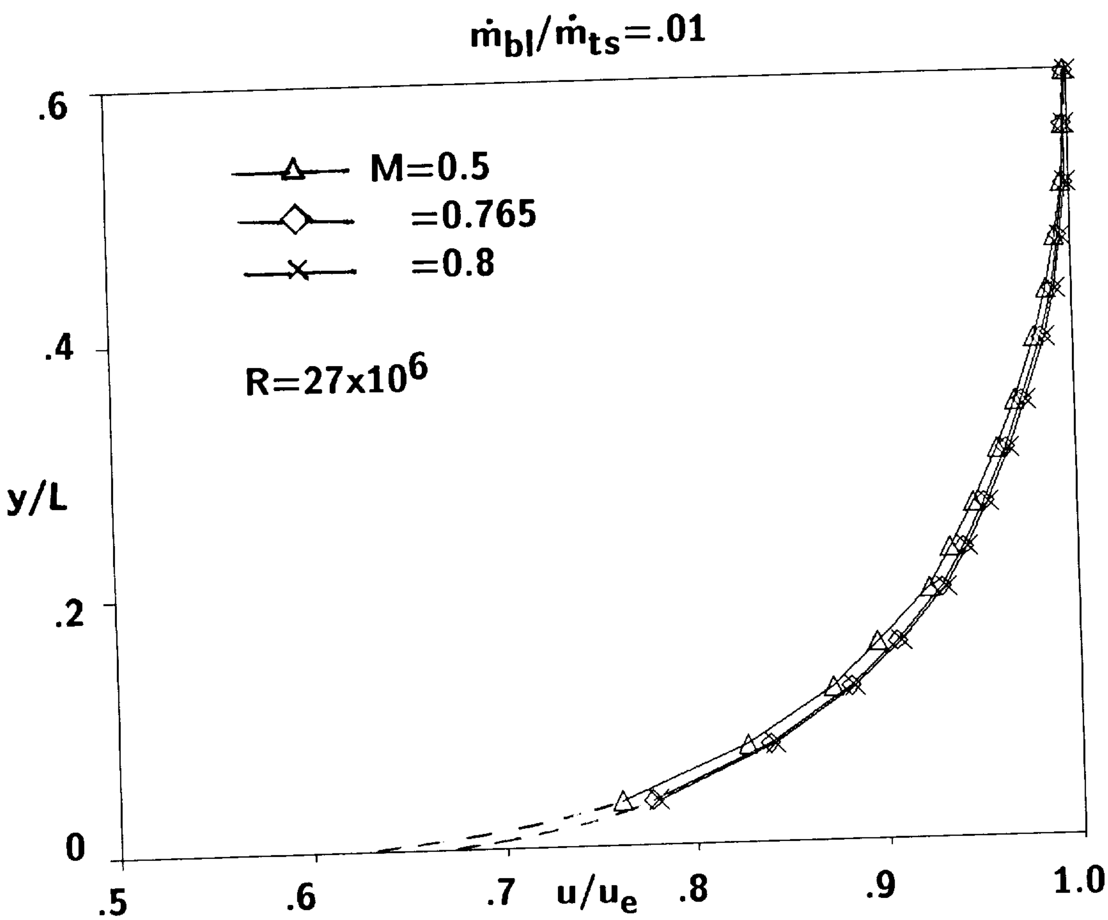

Figure 14c: Comparison of Boundary-Layer Profiles for Different Mach Numbers with 1.0 percent Mass Flow Removal.

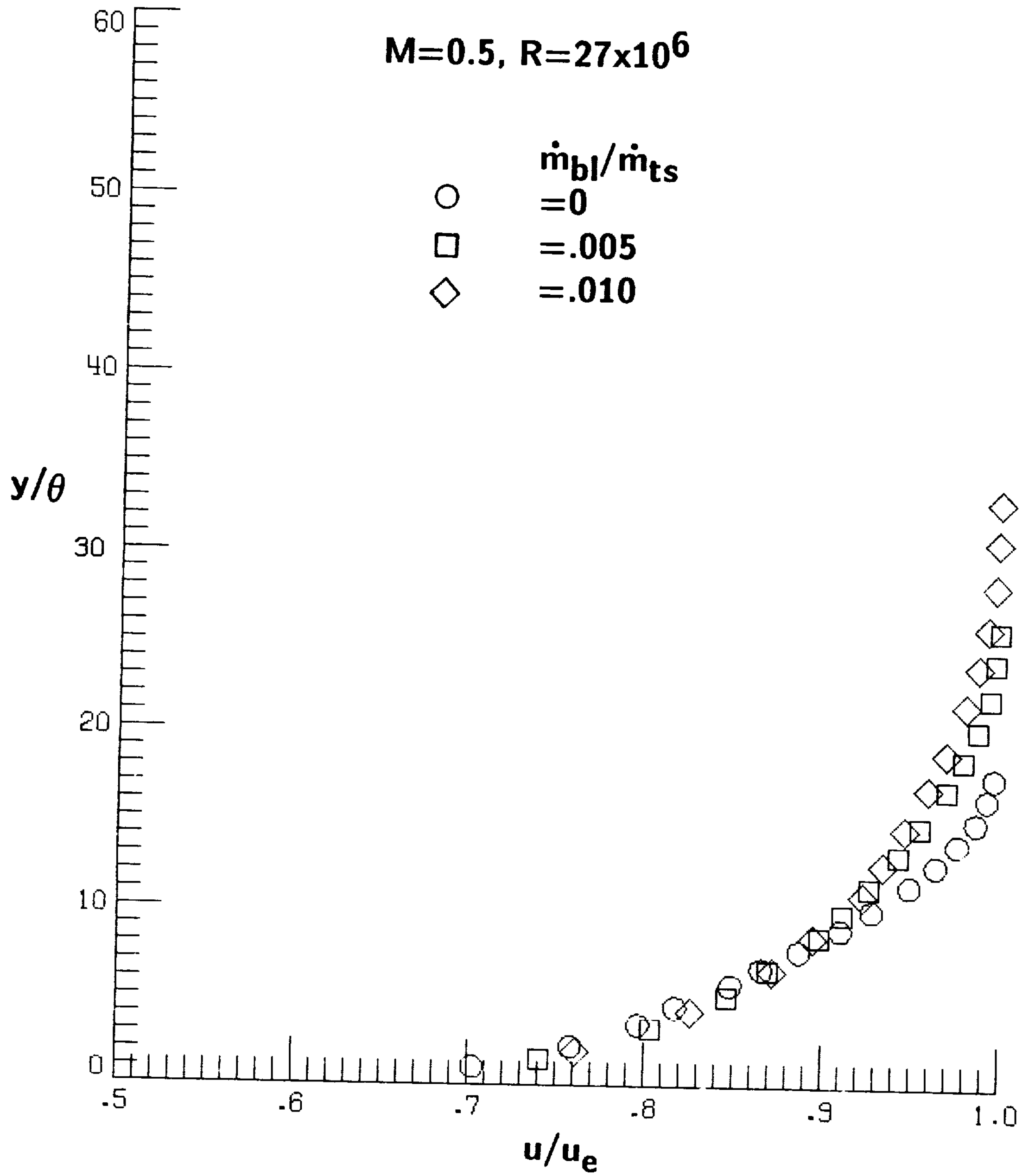

Figure 15a: Correlation of Boundary-Layer Profiles in terms of Momentum Thickness for M=0.5

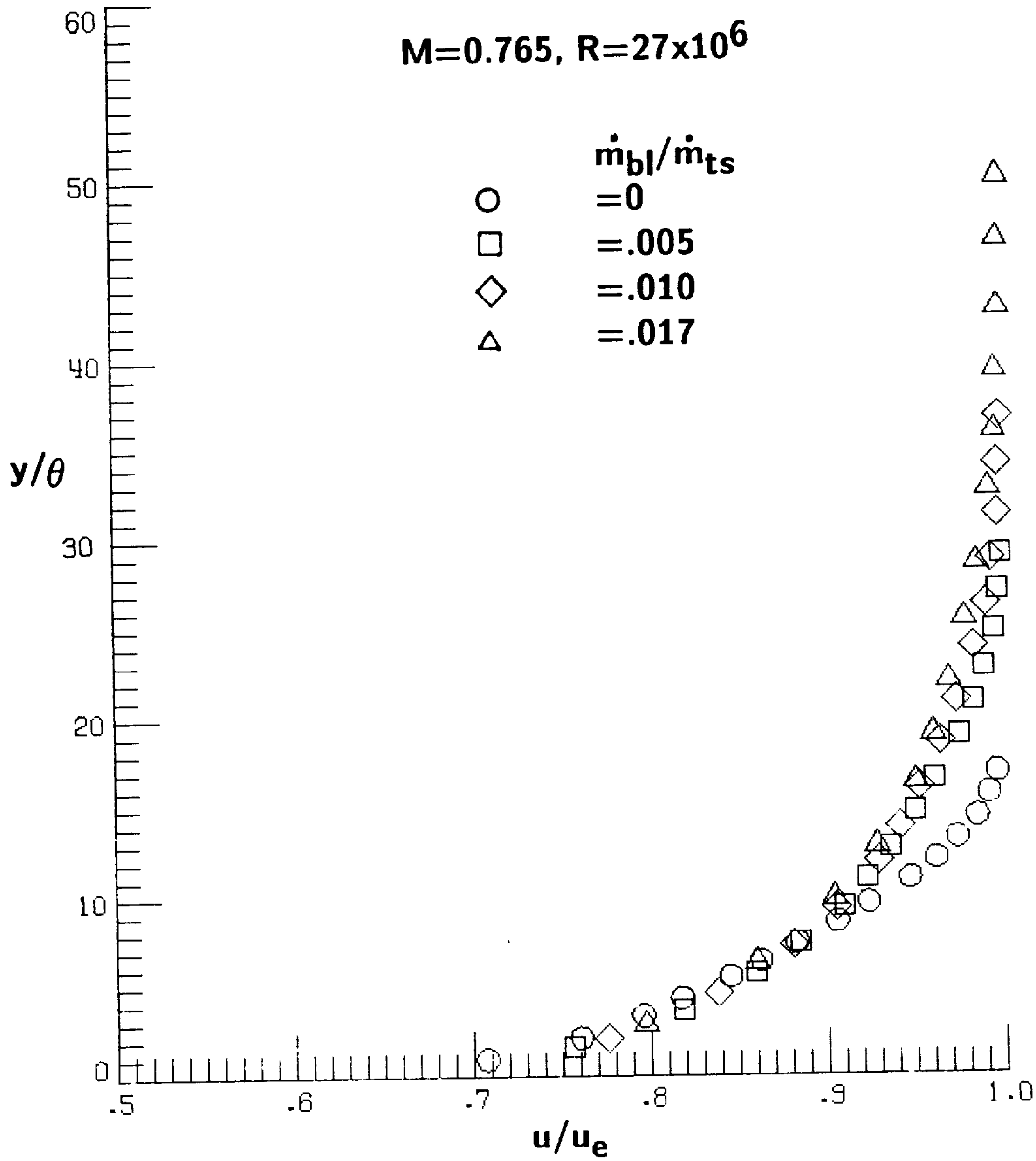

Figure 15b: Correlation of Boundary-Layer Profiles in terms of Momentum Thickness for M=0.765

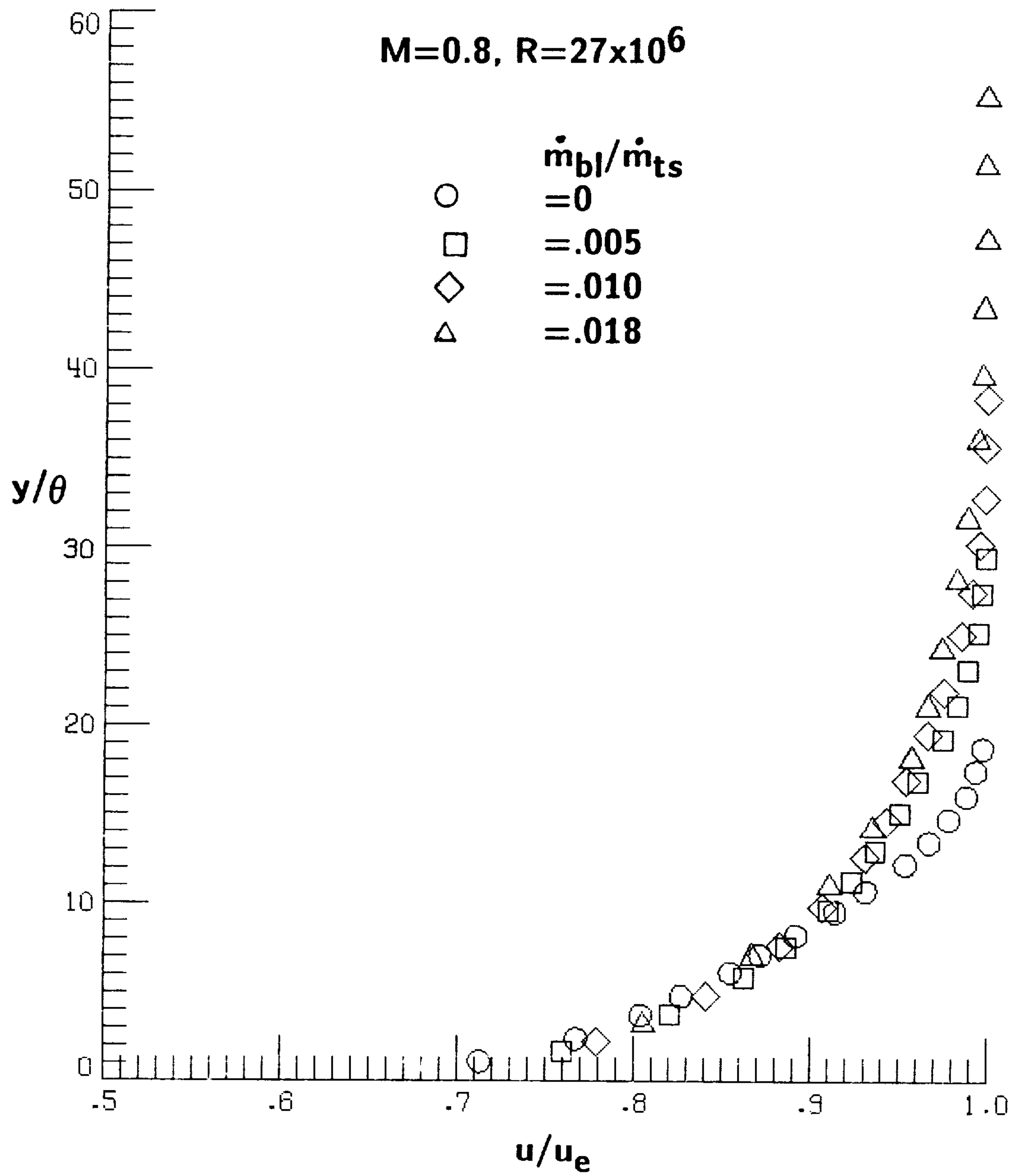

Figure 15c: Correlation of Boundary-Layer Profiles in terms of Momentum Thickness for M=0.8

APPENDIX A

0.3-M TCT ADAPTIVE WALL TEST SECTION SIDEWALL BOUNDARY-LAYER MEASUREMENTS

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 3 - 1   0.00% TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.7025
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	70.9145
AVERAGE STAGNATION TEMPERATURE K	:	230.7589
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	7.4295
BOUNDARY-LAYER THICKNESS DELTA/L	:	.6666
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0889
MOMENTUM THICKNESS THETA/L	:	.0605
SHAPE FACTOR	:	1.4700

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER
TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED
USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.6782	.8403	1.0467	.6939
2	.0754	.7320	.8615	1.0399	.7464
3	.1184	.7675	.8767	1.0351	.7809
4	.1530	.7894	.8865	1.0321	.8020
5	.1955	.8189	.9002	1.0280	.8303
6	.2272	.8362	.9086	1.0255	.8468
7	.2624	.8583	.9196	1.0222	.8678
8	.3043	.8839	.9329	1.0184	.8920
9	.3417	.9042	.9438	1.0153	.9111
10	.3903	.9315	.9590	1.0111	.9366
11	.4289	.9498	.9695	1.0082	.9536
12	.4696	.9647	.9784	1.0058	.9675
13	.5114	.9789	.9869	1.0035	.9806
14	.5567	.9878	.9924	1.0020	.9888
15	.5981	.9940	.9963	1.0010	.9945

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 3 - 2   0.50% TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.7023
AVERAGE REYNOLDS NUMBER/FT	:	.270E+08
AVERAGE STAGNATION PRESSURE PSIA	:	71.1248
AVERAGE STAGNATION TEMPERATURE K	:	230.6466
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	9.6759
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5415
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0572
MOMENTUM THICKNESS THETA/L	:	.0406
SHAPE FACTOR	:	1.4084

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER
TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED
USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7345	.8626	1.0395	.7489
2	.0754	.7989	.8908	1.0308	.8111
3	.1184	.8434	.9122	1.0244	.8536
4	.1530	.8689	.9251	1.0207	.8778
5	.1955	.8966	.9397	1.0165	.9040
6	.2272	.9110	.9475	1.0143	.9174
7	.2624	.9260	.9559	1.0119	.9315
8	.3043	.9415	.9648	1.0095	.9460
9	.3417	.9534	.9717	1.0076	.9570
10	.3903	.9687	.9808	1.0051	.9712
11	.4289	.9788	.9869	1.0035	.9805
12	.4696	.9856	.9911	1.0024	.9868
13	.5114	.9924	.9952	1.0013	.9930
14	.5567	.9950	.9969	1.0008	.9954
15	.5981	.9974	.9984	1.0004	.9976

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 3 - 3 1.00% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7037
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	70.8912
AVERAGE STAGNATION TEMPERATURE K	:	230.6354
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	10.8461
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4961
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0464
MOMENTUM THICKNESS THETA/L	:	.0335
SHAPE FACTOR	:	1.3878

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7571	.8718	1.0367	.7709
2	.0754	.8234	.9021	1.0274	.8346
3	.1184	.8695	.9252	1.0206	.8785
4	.1530	.8953	.9388	1.0167	.9028
5	.1955	.9221	.9536	1.0126	.9279
6	.2272	.9343	.9605	1.0106	.9392
7	.2624	.9468	.9677	1.0087	.9509
8	.3043	.9597	.9753	1.0066	.9629
9	.3417	.9696	.9812	1.0050	.9720
10	.3903	.9815	.9885	1.0030	.9830
11	.4289	.9890	.9931	1.0018	.9899
12	.4696	.9927	.9954	1.0012	.9933
13	.5114	.9966	.9979	1.0006	.9969
14	.5567	.9972	.9982	1.0005	.9974
15	.5981	.9984	.9990	1.0003	.9986

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 3 - 4 1.40% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7032
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	70.8868
AVERAGE STAGNATION TEMPERATURE K	:	230.6685
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	11.6376
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4700
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0405
MOMENTUM THICKNESS THETA/L	:	.0294
SHAPE FACTOR	:	1.3775

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7694	.8772	1.0350	.7827
2	.0754	.8369	.9088	1.0254	.8475
3	.1184	.8846	.9331	1.0183	.8927
4	.1530	.9110	.9474	1.0143	.9174
5	.1955	.9363	.9617	1.0103	.9411
6	.2272	.9479	.9684	1.0085	.9519
7	.2624	.9588	.9748	1.0067	.9620
8	.3043	.9701	.9816	1.0049	.9725
9	.3417	.9785	.9867	1.0035	.9802
10	.3903	.9881	.9925	1.0020	.9890
11	.4289	.9936	.9960	1.0011	.9941
12	.4696	.9955	.9972	1.0007	.9959
13	.5114	.9981	.9988	1.0003	.9983
14	.5567	.9978	.9986	1.0004	.9980
15	.5981	.9987	.9992	1.0002	.9988

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 4 - 5 0.00% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7324
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	69.2327
AVERAGE STAGNATION TEMPERATURE K	:	230.8422
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	7.6573
BOUNDARY-LAYER THICKNESS DELTA/L	:	.6528
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0857
MOMENTUM THICKNESS THETA/L	:	.0580
SHAPE FACTOR	:	1.4788

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.6849	.8313	1.0497	.7018
2	.0754	.7394	.8545	1.0421	.7548
3	.1184	.7752	.8711	1.0369	.7894
4	.1530	.7973	.8818	1.0336	.8106
5	.1955	.8256	.8962	1.0292	.8376
6	.2272	.8434	.9055	1.0264	.8544
7	.2624	.8652	.9173	1.0229	.8751
8	.3043	.8901	.9313	1.0189	.8985
9	.3417	.9099	.9428	1.0156	.9170
10	.3903	.9364	.9588	1.0111	.9416
11	.4289	.9537	.9697	1.0081	.9576
12	.4696	.9680	.9788	1.0057	.9707
13	.5114	.9811	.9874	1.0033	.9828
14	.5567	.9891	.9927	1.0019	.9901
15	.5981	.9947	.9965	1.0009	.9952

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 4 - 6 0.50% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7333
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	69.0852
AVERAGE STAGNATION TEMPERATURE K	:	230.7872
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	9.8761
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5305
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0554
MOMENTUM THICKNESS THETA/L	:	.0390
SHAPE FACTOR	:	1.4223

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7386	.8539	1.0423	.7541
2	.0754	.8029	.8844	1.0328	.8160
3	.1184	.8473	.9074	1.0259	.8582
4	.1530	.8732	.9216	1.0217	.8826
5	.1955	.9006	.9373	1.0172	.9083
6	.2272	.9145	.9455	1.0148	.9213
7	.2624	.9295	.9545	1.0123	.9352
8	.3043	.9452	.9642	1.0096	.9497
9	.3417	.9570	.9717	1.0076	.9606
10	.3903	.9720	.9814	1.0050	.9744
11	.4289	.9816	.9877	1.0033	.9832
12	.4696	.9879	.9918	1.0022	.9890
13	.5114	.9939	.9959	1.0011	.9945
14	.5567	.9960	.9973	1.0007	.9964
15	.5981	.9982	.9988	1.0003	.9983

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 4 - 7 1.00% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7310
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	69.2463
AVERAGE STAGNATION TEMPERATURE K	:	230.6756
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	10.9769
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4981
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0466
MOMENTUM THICKNESS THETA/L	:	.0333
SHAPE FACTOR	:	1.4007

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7589	.8639	1.0392	.7736
2	.0754	.8243	.8958	1.0293	.8363
3	.1184	.8694	.9199	1.0222	.8790
4	.1530	.8953	.9346	1.0179	.9033
5	.1955	.9215	.9499	1.0136	.9277
6	.2272	.9340	.9575	1.0115	.9393
7	.2624	.9463	.9651	1.0094	.9507
8	.3043	.9594	.9734	1.0071	.9628
9	.3417	.9692	.9797	1.0054	.9719
10	.3903	.9812	.9874	1.0033	.9828
11	.4289	.9887	.9924	1.0020	.9896
12	.4696	.9925	.9950	1.0013	.9932
13	.5114	.9967	.9977	1.0006	.9970
14	.5567	.9973	.9982	1.0005	.9975
15	.5981	.9986	.9991	1.0002	.9988

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 4 - 8 1.60% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7308
AVERAGE REYNOLDS NUMBER/FT	:	.270E+08
AVERAGE STAGNATION PRESSURE PSIA	:	69.3937
AVERAGE STAGNATION TEMPERATURE K	:	230.7121
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	12.1708
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4635
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0385
MOMENTUM THICKNESS THETA/L	:	.0278
SHAPE FACTOR	:	1.3858

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7762	.8721	1.0366	.7903
2	.0754	.8431	.9057	1.0264	.8542
3	.1184	.8903	.9317	1.0188	.8986
4	.1530	.9167	.9471	1.0144	.9233
5	.1955	.9419	.9624	1.0101	.9466
6	.2272	.9526	.9691	1.0083	.9565
7	.2624	.9628	.9756	1.0065	.9660
8	.3043	.9733	.9823	1.0047	.9756
9	.3417	.9811	.9874	1.0033	.9827
10	.3903	.9896	.9930	1.0018	.9905
11	.4289	.9945	.9963	1.0010	.9950
12	.4696	.9959	.9973	1.0007	.9963
13	.5114	.9982	.9988	1.0003	.9983
14	.5567	.9978	.9985	1.0004	.9980
15	.5981	.9986	.9991	1.0002	.9988

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 5 - 9 0.00% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7516
AVERAGE REYNOLDS NUMBER/FT	:	.266E+08
AVERAGE STAGNATION PRESSURE PSIA	:	67.5030
AVERAGE STAGNATION TEMPERATURE K	:	230.9341
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	7.9104
BOUNDARY-LAYER THICKNESS DELTA/L	:	.6267
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0805
MOMENTUM THICKNESS THETA/L	:	.0544
SHAPE FACTOR	:	1.4813

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.6935	.8274	1.0510	.7109
2	.0754	.7485	.8523	1.0429	.7644
3	.1184	.7851	.8702	1.0372	.7996
4	.1530	.8081	.8821	1.0335	.8215
5	.1955	.8366	.8974	1.0289	.8486
6	.2272	.8546	.9075	1.0258	.8656
7	.2624	.8766	.9201	1.0221	.8863
8	.3043	.9010	.9347	1.0179	.9090
9	.3417	.9200	.9465	1.0146	.9267
10	.3903	.9449	.9625	1.0101	.9497
11	.4289	.9606	.9728	1.0073	.9641
12	.4696	.9732	.9813	1.0050	.9756
13	.5114	.9845	.9891	1.0029	.9859
14	.5567	.9908	.9935	1.0017	.9917
15	.5981	.9954	.9968	1.0009	.9959

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 5 - 10 0.50% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7523
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	68.1838
AVERAGE STAGNATION TEMPERATURE K	:	231.0054
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	9.8849
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5369
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0565
MOMENTUM THICKNESS THETA/L	:	.0395
SHAPE FACTOR	:	1.4329

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7378	.8470	1.0446	.7540
2	.0754	.8016	.8785	1.0346	.8153
3	.1184	.8455	.9021	1.0274	.8570
4	.1530	.8711	.9168	1.0231	.8811
5	.1955	.8987	.9332	1.0183	.9069
6	.2272	.9128	.9419	1.0159	.9200
7	.2624	.9276	.9512	1.0132	.9337
8	.3043	.9431	.9612	1.0105	.9481
9	.3417	.9551	.9691	1.0083	.9590
10	.3903	.9702	.9793	1.0055	.9729
11	.4289	.9802	.9861	1.0037	.9820
12	.4696	.9868	.9907	1.0025	.9880
13	.5114	.9933	.9952	1.0013	.9939
14	.5567	.9956	.9969	1.0008	.9960
15	.5981	.9977	.9984	1.0004	.9979

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 5 - 11 1.00% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7511
AVERAGE REYNOLDS NUMBER/FT	:	.270E+08
AVERAGE STAGNATION PRESSURE PSIA	:	68.5258
AVERAGE STAGNATION TEMPERATURE K	:	230.8910
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	11.2207
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4903
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0451
MOMENTUM THICKNESS THETA/L	:	.0320
SHAPE FACTOR	:	1.4091

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7627	.8593	1.0406	.7780
2	.0754	.8278	.8927	1.0303	.8403
3	.1184	.8731	.9182	1.0227	.8830
4	.1530	.8992	.9337	1.0182	.9074
5	.1955	.9251	.9498	1.0136	.9314
6	.2272	.9374	.9576	1.0115	.9428
7	.2624	.9497	.9656	1.0092	.9541
8	.3043	.9622	.9740	1.0070	.9656
9	.3417	.9718	.9804	1.0052	.9744
10	.3903	.9833	.9883	1.0031	.9848
11	.4289	.9902	.9931	1.0018	.9911
12	.4696	.9936	.9955	1.0012	.9942
13	.5114	.9973	.9981	1.0005	.9976
14	.5567	.9977	.9984	1.0004	.9979
15	.5981	.9989	.9992	1.0002	.9990

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 5 - 12 1.60% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7497
AVERAGE REYNOLDS NUMBER/FT	:	.268E+08
AVERAGE STAGNATION PRESSURE PSIA	:	68.0496
AVERAGE STAGNATION TEMPERATURE K	:	230.6618
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	12.4592
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4578
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0373
MOMENTUM THICKNESS THETA/L	:	.0267
SHAPE FACTOR	:	1.3936

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7802	.8683	1.0378	.7948
2	.0754	.8465	.9033	1.0271	.8579
3	.1184	.8938	.9306	1.0191	.9022
4	.1530	.9197	.9466	1.0145	.9264
5	.1955	.9443	.9622	1.0102	.9491
6	.2272	.9549	.9691	1.0083	.9588
7	.2624	.9650	.9759	1.0064	.9681
8	.3043	.9752	.9828	1.0046	.9774
9	.3417	.9828	.9880	1.0032	.9844
10	.3903	.9910	.9937	1.0017	.9919
11	.4289	.9956	.9969	1.0008	.9960
12	.4696	.9967	.9977	1.0006	.9971
13	.5114	.9989	.9992	1.0002	.9990
14	.5567	.9983	.9988	1.0003	.9984
15	.5981	.9991	.9994	1.0002	.9992

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 6 - 13   0.00%   TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.7622
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	67.5338
AVERAGE STAGNATION TEMPERATURE K	:	230.8791
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	7.8211
BOUNDARY-LAYER THICKNESS DELTA/L	:	.6371
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0829
MOMENTUM THICKNESS THETA/L	:	.0556
SHAPE FACTOR	:	1.4910

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.6895	.8216	1.0530	.7076
2	.0754	.7441	.8466	1.0447	.7606
3	.1184	.7806	.8647	1.0389	.7956
4	.1530	.8034	.8767	1.0352	.8175
5	.1955	.8324	.8925	1.0303	.8450
6	.2272	.8506	.9028	1.0272	.8621
7	.2624	.8723	.9156	1.0235	.8825
8	.3043	.8968	.9305	1.0191	.9054
9	.3417	.9160	.9426	1.0157	.9231
10	.3903	.9412	.9590	1.0111	.9464
11	.4289	.9572	.9698	1.0081	.9611
12	.4696	.9703	.9788	1.0056	.9730
13	.5114	.9826	.9875	1.0033	.9843
14	.5567	.9900	.9928	1.0019	.9910
15	.5981	.9953	.9966	1.0009	.9957

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 6 - 14   0.50%   TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.7599
AVERAGE REYNOLDS NUMBER/FT	:	.268E+08
AVERAGE STAGNATION PRESSURE PSIA	:	67.5317
AVERAGE STAGNATION TEMPERATURE K	:	231.1243
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	10.0315
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5326
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0554
MOMENTUM THICKNESS THETA/L	:	.0387
SHAPE FACTOR	:	1.4343

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7404	.8456	1.0450	.7569
2	.0754	.8045	.8779	1.0348	.8184
3	.1184	.8484	.9021	1.0275	.8600
4	.1530	.8740	.9170	1.0230	.8840
5	.1955	.9012	.9335	1.0182	.9093
6	.2272	.9153	.9424	1.0157	.9225
7	.2624	.9298	.9518	1.0131	.9359
8	.3043	.9450	.9618	1.0103	.9499
9	.3417	.9566	.9695	1.0082	.9605
10	.3903	.9716	.9799	1.0054	.9742
11	.4289	.9811	.9865	1.0036	.9829
12	.4696	.9874	.9910	1.0024	.9886
13	.5114	.9937	.9955	1.0012	.9943
14	.5567	.9959	.9970	1.0008	.9962
15	.5981	.9980	.9986	1.0004	.9982

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 6 - 15 1.00% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7607
AVERAGE REYNOLDS NUMBER/FT	:	.267E+08
AVERAGE STAGNATION PRESSURE PSIA	:	67.2186
AVERAGE STAGNATION TEMPERATURE K	:	230.8500
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	11.1441
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4975
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0464
MOMENTUM THICKNESS THETA/L	:	.0328
SHAPE FACTOR	:	1.4152

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7606	.8551	1.0420	.7764
2	.0754	.8252	.8889	1.0314	.8381
3	.1184	.8706	.9149	1.0237	.8809
4	.1530	.8969	.9308	1.0190	.9054
5	.1955	.9225	.9469	1.0144	.9291
6	.2272	.9351	.9552	1.0121	.9408
7	.2624	.9475	.9633	1.0099	.9521
8	.3043	.9601	.9719	1.0075	.9637
9	.3417	.9698	.9786	1.0057	.9726
10	.3903	.9816	.9868	1.0035	.9833
11	.4289	.9887	.9919	1.0021	.9898
12	.4696	.9925	.9946	1.0014	.9932
13	.5114	.9963	.9974	1.0007	.9967
14	.5567	.9969	.9977	1.0006	.9972
15	.5981	.9981	.9986	1.0004	.9983

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 6 - 16 1.70% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7630
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	67.5874
AVERAGE STAGNATION TEMPERATURE K	:	230.6847
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	12.7006
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4567
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0367
MOMENTUM THICKNESS THETA/L	:	.0262
SHAPE FACTOR	:	1.3982

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7827	.8656	1.0386	.7977
2	.0754	.8487	.9016	1.0276	.8604
3	.1184	.8957	.9297	1.0194	.9043
4	.1530	.9218	.9462	1.0146	.9285
5	.1955	.9456	.9619	1.0103	.9504
6	.2272	.9565	.9693	1.0082	.9604
7	.2624	.9664	.9761	1.0064	.9695
8	.3043	.9764	.9831	1.0045	.9786
9	.3417	.9837	.9883	1.0031	.9852
10	.3903	.9915	.9938	1.0016	.9923
11	.4289	.9956	.9968	1.0008	.9960
12	.4696	.9965	.9975	1.0007	.9969
13	.5114	.9985	.9989	1.0003	.9987
14	.5567	.9979	.9985	1.0004	.9981
15	.5981	.9987	.9991	1.0002	.9988

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 7 - 18 0.00% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7794
AVERAGE REYNOLDS NUMBER/FT	:	.268E+08
AVERAGE STAGNATION PRESSURE PSIA	:	66.7803
AVERAGE STAGNATION TEMPERATURE K	:	231.1210
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	7.9120
BOUNDARY-LAYER THICKNESS DELTA/L	:	.6247
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0810
MOMENTUM THICKNESS THETA/L	:	.0541
SHAPE FACTOR	:	1.4985

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.6913	.8156	1.0550	.7101
2	.0754	.7477	.8425	1.0460	.7647
3	.1184	.7848	.8618	1.0399	.8003
4	.1530	.8084	.8746	1.0358	.8227
5	.1955	.8375	.8913	1.0307	.8503
6	.2272	.8553	.9019	1.0275	.8670
7	.2624	.8768	.9151	1.0236	.8871
8	.3043	.9009	.9304	1.0192	.9095
9	.3417	.9199	.9429	1.0156	.9270
10	.3903	.9446	.9597	1.0109	.9497
11	.4289	.9602	.9707	1.0078	.9640
12	.4696	.9726	.9796	1.0054	.9752
13	.5114	.9841	.9881	1.0032	.9857
14	.5567	.9907	.9930	1.0019	.9916
15	.5981	.9955	.9966	1.0009	.9959

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 7 - 19 0.50% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7816
AVERAGE REYNOLDS NUMBER/FT	:	.270E+08
AVERAGE STAGNATION PRESSURE PSIA	:	66.8692
AVERAGE STAGNATION TEMPERATURE K	:	230.9010
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	10.0950
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5305
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0553
MOMENTUM THICKNESS THETA/L	:	.0382
SHAPE FACTOR	:	1.4463

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7411	.8385	1.0474	.7584
2	.0754	.8048	.8721	1.0366	.8194
3	.1184	.8490	.8976	1.0288	.8612
4	.1530	.8750	.9135	1.0241	.8854
5	.1955	.9020	.9308	1.0191	.9105
6	.2272	.9160	.9400	1.0164	.9235
7	.2624	.9305	.9498	1.0136	.9368
8	.3043	.9455	.9602	1.0107	.9506
9	.3417	.9571	.9684	1.0085	.9612
10	.3903	.9718	.9790	1.0056	.9745
11	.4289	.9814	.9860	1.0037	.9832
12	.4696	.9878	.9908	1.0024	.9890
13	.5114	.9940	.9954	1.0012	.9946
14	.5567	.9962	.9971	1.0008	.9965
15	.5981	.9983	.9987	1.0003	.9985

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 7 - 20 1.00% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7807
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	66.7721
AVERAGE STAGNATION TEMPERATURE K	:	230.8819
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	11.2068
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4895
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0455
MOMENTUM THICKNESS THETA/L	:	.0319
SHAPE FACTOR	:	1.4273

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7611	.8490	1.0440	.7777
2	.0754	.8267	.8847	1.0327	.8401
3	.1184	.8723	.9120	1.0245	.8830
4	.1530	.8988	.9288	1.0196	.9076
5	.1955	.9246	.9459	1.0147	.9314
6	.2272	.9374	.9546	1.0123	.9431
7	.2624	.9498	.9633	1.0099	.9545
8	.3043	.9625	.9723	1.0074	.9660
9	.3417	.9720	.9792	1.0056	.9747
10	.3903	.9835	.9876	1.0033	.9851
11	.4289	.9902	.9926	1.0019	.9912
12	.4696	.9936	.9952	1.0013	.9942
13	.5114	.9972	.9979	1.0006	.9975
14	.5567	.9975	.9981	1.0005	.9977
15	.5981	.9987	.9990	1.0003	.9988

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 7 - 21 1.76% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.7806
AVERAGE REYNOLDS NUMBER/FT	:	.266E+08
AVERAGE STAGNATION PRESSURE PSIA	:	66.0217
AVERAGE STAGNATION TEMPERATURE K	:	230.8177
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	12.9600
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4517
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0356
MOMENTUM THICKNESS THETA/L	:	.0253
SHAPE FACTOR	:	1.4065

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7855	.8618	1.0399	.8010
2	.0754	.8514	.8993	1.0283	.8634
3	.1184	.8983	.9285	1.0197	.9071
4	.1530	.9247	.9459	1.0147	.9314
5	.1955	.9483	.9622	1.0102	.9531
6	.2272	.9590	.9698	1.0081	.9629
7	.2624	.9687	.9768	1.0062	.9717
8	.3043	.9784	.9839	1.0043	.9805
9	.3417	.9855	.9891	1.0029	.9869
10	.3903	.9925	.9943	1.0015	.9933
11	.4289	.9962	.9971	1.0008	.9966
12	.4696	.9969	.9976	1.0006	.9972
13	.5114	.9987	.9990	1.0003	.9988
14	.5567	.9980	.9985	1.0004	.9982
15	.5981	.9988	.9991	1.0002	.9989

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 8 - 22 0.00% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.8000
AVERAGE REYNOLDS NUMBER/FT	:	.268E+08
AVERAGE STAGNATION PRESSURE PSIA	:	66.4562
AVERAGE STAGNATION TEMPERATURE K	:	232.8282
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	7.9585
BOUNDARY-LAYER THICKNESS DELTA/L	:	.6093
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0792
MOMENTUM THICKNESS THETA/L	:	.0524
SHAPE FACTOR	:	1.5100

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.6930	.8084	1.0575	.7127
2	.0754	.7496	.8366	1.0480	.7674
3	.1184	.7878	.8573	1.0413	.8039
4	.1530	.8121	.8712	1.0369	.8269
5	.1955	.8415	.8888	1.0315	.8546
6	.2272	.8598	.9002	1.0280	.8717
7	.2624	.8816	.9143	1.0239	.8921
8	.3043	.9056	.9304	1.0192	.9142
9	.3417	.9243	.9434	1.0155	.9315
10	.3903	.9486	.9608	1.0106	.9536
11	.4289	.9634	.9717	1.0076	.9670
12	.4696	.9753	.9808	1.0051	.9778
13	.5114	.9863	.9893	1.0028	.9877
14	.5567	.9923	.9939	1.0016	.9931
15	.5981	.9965	.9972	1.0007	.9969

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 8 - 23 0.50% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.8048
AVERAGE REYNOLDS NUMBER/FT	:	.267E+08
AVERAGE STAGNATION PRESSURE PSIA	:	65.4447
AVERAGE STAGNATION TEMPERATURE K	:	231.1720
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	10.1807
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5322
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0556
MOMENTUM THICKNESS THETA/L	:	.0381
SHAPE FACTOR	:	1.4589

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7416	.8307	1.0500	.7599
2	.0754	.8056	.8660	1.0385	.8210
3	.1184	.8493	.8925	1.0304	.8621
4	.1530	.8750	.9091	1.0254	.8861
5	.1955	.9016	.9269	1.0202	.9106
6	.2272	.9157	.9367	1.0174	.9236
7	.2624	.9302	.9470	1.0144	.9369
8	.3043	.9452	.9578	1.0114	.9506
9	.3417	.9566	.9663	1.0091	.9609
10	.3903	.9714	.9775	1.0060	.9743
11	.4289	.9809	.9849	1.0040	.9829
12	.4696	.9874	.9900	1.0027	.9887
13	.5114	.9939	.9951	1.0013	.9945
14	.5567	.9962	.9970	1.0008	.9966
15	.5981	.9985	.9988	1.0003	.9986

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 8 - 24 1.00% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.8005
AVERAGE REYNOLDS NUMBER/FT	:	.270E+08
AVERAGE STAGNATION PRESSURE PSIA	:	66.1365
AVERAGE STAGNATION TEMPERATURE K	:	231.0120
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	11.2610
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4897
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0457
MOMENTUM THICKNESS THETA/L	:	.0318
SHAPE FACTOR	:	1.4389

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7622	.8431	1.0459	.7795
2	.0754	.8269	.8798	1.0342	.8409
3	.1184	.8718	.9078	1.0258	.8830
4	.1530	.8981	.9252	1.0207	.9073
5	.1955	.9240	.9431	1.0155	.9312
6	.2272	.9365	.9519	1.0131	.9426
7	.2624	.9492	.9612	1.0105	.9541
8	.3043	.9620	.9707	1.0079	.9658
9	.3417	.9719	.9781	1.0058	.9747
10	.3903	.9837	.9872	1.0034	.9853
11	.4289	.9905	.9925	1.0020	.9915
12	.4696	.9941	.9953	1.0012	.9947
13	.5114	.9977	.9982	1.0005	.9979
14	.5567	.9980	.9984	1.0004	.9982
15	.5981	.9992	.9994	1.0002	.9993

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 8 - 25 1.80% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.8048
AVERAGE REYNOLDS NUMBER/FT	:	.272E+08
AVERAGE STAGNATION PRESSURE PSIA	:	66.3702
AVERAGE STAGNATION TEMPERATURE K	:	230.8500
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	13.4122
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4473
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0343
MOMENTUM THICKNESS THETA/L	:	.0242
SHAPE FACTOR	:	1.4165

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7896	.8568	1.0415	.8058
2	.0754	.8553	.8963	1.0292	.8677
3	.1184	.9024	.9274	1.0200	.9114
4	.1530	.9289	.9460	1.0147	.9357
5	.1955	.9525	.9633	1.0099	.9572
6	.2272	.9625	.9708	1.0078	.9663
7	.2624	.9717	.9778	1.0059	.9746
8	.3043	.9807	.9848	1.0041	.9827
9	.3417	.9871	.9897	1.0027	.9884
10	.3903	.9934	.9947	1.0014	.9941
11	.4289	.9965	.9972	1.0007	.9969
12	.4696	.9968	.9975	1.0007	.9972
13	.5114	.9983	.9986	1.0004	.9985
14	.5567	.9975	.9980	1.0005	.9978
15	.5981	.9983	.9986	1.0004	.9984

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 9 - 26   0.00% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.6539
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	74.4294
AVERAGE STAGNATION TEMPERATURE K	:	230.7564
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	7.6399
BOUNDARY-LAYER THICKNESS DELTA/L	:	.6284
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0807
MOMENTUM THICKNESS THETA/L	:	.0562
SHAPE FACTOR	:	1.4353

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.6897	.8627	1.0395	.7032
2	.0754	.7445	.8824	1.0333	.7568
3	.1184	.7813	.8967	1.0290	.7926
4	.1530	.8037	.9057	1.0263	.8142
5	.1955	.8336	.9184	1.0226	.8430
6	.2272	.8520	.9265	1.0202	.8606
7	.2624	.8743	.9366	1.0173	.8819
8	.3043	.8992	.9482	1.0141	.9055
9	.3417	.9187	.9577	1.0114	.9240
10	.3903	.9437	.9701	1.0080	.9474
11	.4289	.9601	.9786	1.0057	.9629
12	.4696	.9729	.9854	1.0039	.9748
13	.5114	.9845	.9916	1.0022	.9856
14	.5567	.9909	.9950	1.0013	.9916
15	.5981	.9953	.9974	1.0007	.9956

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 9 - 28   0.5% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.6498
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	74.5524
AVERAGE STAGNATION TEMPERATURE K	:	230.6831
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	9.7499
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5341
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0550
MOMENTUM THICKNESS THETA/L	:	.0399
SHAPE FACTOR	:	1.3784

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7373	.8810	1.0338	.7496
2	.0754	.8027	.9064	1.0261	.8131
3	.1184	.8483	.9256	1.0205	.8569
4	.1530	.8737	.9370	1.0172	.8812
5	.1955	.9013	.9498	1.0136	.9075
6	.2272	.9153	.9565	1.0117	.9207
7	.2624	.9298	.9636	1.0098	.9343
8	.3043	.9450	.9711	1.0077	.9486
9	.3417	.9563	.9769	1.0061	.9593
10	.3903	.9706	.9843	1.0042	.9726
11	.4289	.9805	.9895	1.0028	.9818
12	.4696	.9863	.9926	1.0020	.9872
13	.5114	.9927	.9960	1.0010	.9932
14	.5567	.9951	.9974	1.0007	.9955
15	.5981	.9975	.9986	1.0004	.9977

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 9 - 29   1.0%   TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.6535
AVERAGE REYNOLDS NUMBER/FT	:	.271E+08
AVERAGE STAGNATION PRESSURE PSIA	:	74.8034
AVERAGE STAGNATION TEMPERATURE K	:	230.6511
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	10.6757
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4962
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0463
MOMENTUM THICKNESS THETA/L	:	.0340
SHAPE FACTOR	:	1.3642

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7558	.8868	1.0320	.7678
2	.0754	.8222	.9136	1.0240	.8320
3	.1184	.8691	.9342	1.0180	.8769
4	.1530	.8946	.9461	1.0147	.9011
5	.1955	.9213	.9590	1.0111	.9264
6	.2272	.9342	.9654	1.0093	.9385
7	.2624	.9467	.9717	1.0076	.9502
8	.3043	.9595	.9783	1.0058	.9623
9	.3417	.9696	.9836	1.0043	.9717
10	.3903	.9812	.9898	1.0027	.9826
11	.4289	.9889	.9940	1.0016	.9897
12	.4696	.9926	.9959	1.0011	.9931
13	.5114	.9967	.9982	1.0005	.9969
14	.5567	.9972	.9985	1.0004	.9974
15	.5981	.9983	.9991	1.0002	.9984

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 10 - 32   0.00%   TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.2988
AVERAGE REYNOLDS NUMBER/FT	:	.270E+08
AVERAGE STAGNATION PRESSURE PSIA	:	63.0846
AVERAGE STAGNATION TEMPERATURE K	:	130.5740
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	7.6239
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5948
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0708
MOMENTUM THICKNESS THETA/L	:	.0541
SHAPE FACTOR	:	1.3082

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.6955	.9687	1.0083	.6984
2	.0754	.7562	.9740	1.0069	.7588
3	.1184	.8052	.9786	1.0057	.8074
4	.1530	.8182	.9798	1.0053	.8203
5	.1955	.8569	.9838	1.0043	.8588
6	.2272	.8696	.9851	1.0039	.8713
7	.2624	.8916	.9875	1.0033	.8931
8	.3043	.9168	.9902	1.0026	.9179
9	.3417	.9342	.9922	1.0020	.9351
10	.3903	.9510	.9941	1.0015	.9518
11	.4289	.9664	.9960	1.0011	.9669
12	.4696	.9793	.9975	1.0007	.9797
13	.5114	.9867	.9984	1.0004	.9869
14	.5567	.9915	.9990	1.0003	.9916
15	.5981	.9936	.9992	1.0002	.9937

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 10 - 33 0.50% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.3031
AVERAGE REYNOLDS NUMBER/FT	:	.275E+08
AVERAGE STAGNATION PRESSURE PSIA	:	62.9717
AVERAGE STAGNATION TEMPERATURE K	:	129.8082
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	8.8833
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5313
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0546
MOMENTUM THICKNESS THETA/L	:	.0430
SHAPE FACTOR	:	1.2690

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7281	.9706	1.0078	.7309
2	.0754	.7943	.9769	1.0061	.7967
3	.1184	.8473	.9823	1.0047	.8493
4	.1530	.8631	.9840	1.0042	.8650
5	.1955	.8972	.9877	1.0032	.8986
6	.2272	.9085	.9890	1.0029	.9098
7	.2624	.9251	.9909	1.0024	.9262
8	.3043	.9444	.9932	1.0018	.9453
9	.3417	.9576	.9948	1.0014	.9583
10	.3903	.9693	.9962	1.0010	.9698
11	.4289	.9813	.9977	1.0006	.9816
12	.4696	.9904	.9988	1.0003	.9906
13	.5114	.9947	.9993	1.0002	.9948
14	.5567	.9961	.9995	1.0001	.9962
15	.5981	.9962	.9995	1.0001	.9962

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 10 - 34 0.80% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.3013
AVERAGE REYNOLDS NUMBER/FT	:	.273E+08
AVERAGE STAGNATION PRESSURE PSIA	:	62.9098
AVERAGE STAGNATION TEMPERATURE K	:	129.8044
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	9.6692
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4973
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0466
MOMENTUM THICKNESS THETA/L	:	.0372
SHAPE FACTOR	:	1.2521

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7454	.9725	1.0073	.7481
2	.0754	.8135	.9791	1.0055	.8158
3	.1184	.8673	.9846	1.0041	.8691
4	.1530	.8835	.9864	1.0036	.8851
5	.1955	.9190	.9903	1.0025	.9202
6	.2272	.9265	.9912	1.0023	.9276
7	.2624	.9412	.9929	1.0019	.9421
8	.3043	.9585	.9949	1.0013	.9592
9	.3417	.9700	.9963	1.0010	.9704
10	.3903	.9788	.9974	1.0007	.9791
11	.4289	.9887	.9986	1.0004	.9888
12	.4696	.9955	.9994	1.0001	.9956
13	.5114	.9977	.9997	1.0001	.9977
14	.5567	.9979	.9997	1.0001	.9980
15	.5981	.9971	.9996	1.0001	.9971

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 11 - 35   0.00% TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.5016
AVERAGE REYNOLDS NUMBER/FT	:	.271E+08
AVERAGE STAGNATION PRESSURE PSIA	:	40.3588
AVERAGE STAGNATION TEMPERATURE K	:	129.7746
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	7.6564
BOUNDARY-LAYER THICKNESS DELTA/L	:	.6161
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0758
MOMENTUM THICKNESS THETA/L	:	.0556
SHAPE FACTOR	:	1.3634

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.6947	.9159	1.0232	.7028
2	.0754	.7508	.9287	1.0195	.7581
3	.1184	.7898	.9383	1.0168	.7964
4	.1530	.8112	.9438	1.0152	.8173
5	.1955	.8430	.9523	1.0129	.8484
6	.2272	.8607	.9572	1.0115	.8657
7	.2624	.8827	.9635	1.0098	.8871
8	.3043	.9070	.9706	1.0078	.9105
9	.3417	.9252	.9760	1.0064	.9281
10	.3903	.9471	.9828	1.0045	.9492
11	.4289	.9620	.9876	1.0033	.9636
12	.4696	.9744	.9916	1.0022	.9755
13	.5114	.9851	.9950	1.0013	.9857
14	.5567	.9918	.9972	1.0007	.9921
15	.5981	.9958	.9986	1.0004	.9960

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 11 - 36   0.50% TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.4995
AVERAGE REYNOLDS NUMBER/FT	:	.270E+08
AVERAGE STAGNATION PRESSURE PSIA	:	40.3580
AVERAGE STAGNATION TEMPERATURE K	:	129.8244
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	9.2535
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5446
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0565
MOMENTUM THICKNESS THETA/L	:	.0427
SHAPE FACTOR	:	1.3218

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7331	.9251	1.0206	.7406
2	.0754	.7970	.9406	1.0161	.8034
3	.1184	.8411	.9522	1.0129	.8465
4	.1530	.8645	.9586	1.0111	.8693
5	.1955	.8944	.9671	1.0088	.8983
6	.2272	.9079	.9711	1.0077	.9114
7	.2624	.9235	.9757	1.0064	.9265
8	.3043	.9404	.9809	1.0051	.9427
9	.3417	.9529	.9848	1.0040	.9549
10	.3903	.9678	.9895	1.0028	.9691
11	.4289	.9781	.9928	1.0019	.9790
12	.4696	.9862	.9955	1.0012	.9868
13	.5114	.9928	.9976	1.0006	.9931
14	.5567	.9960	.9987	1.0003	.9962
15	.5981	.9980	.9993	1.0002	.9981

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 11 - 37   1.00%   TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.4997
AVERAGE REYNOLDS NUMBER/FT	:	.266E+08
AVERAGE STAGNATION PRESSURE PSIA	:	39.6549
AVERAGE STAGNATION TEMPERATURE K	:	129.8313
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	10.3355
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5049
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0467
MOMENTUM THICKNESS THETA/L	:	.0359
SHAPE FACTOR	:	1.2993

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7534	.9298	1.0192	.7606
2	.0754	.8205	.9466	1.0145	.8264
3	.1184	.8668	.9592	1.0110	.8715
4	.1530	.8911	.9661	1.0091	.8951
5	.1955	.9194	.9745	1.0068	.9225
6	.2272	.9311	.9780	1.0058	.9338
7	.2624	.9440	.9820	1.0048	.9462
8	.3043	.9575	.9862	1.0036	.9592
9	.3417	.9676	.9894	1.0028	.9689
10	.3903	.9787	.9930	1.0018	.9796
11	.4289	.9861	.9954	1.0012	.9867
12	.4696	.9913	.9971	1.0008	.9916
13	.5114	.9954	.9985	1.0004	.9956
14	.5567	.9970	.9990	1.0003	.9971
15	.5981	.9982	.9994	1.0002	.9982

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 12 - 38   0.00%   TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.8189
AVERAGE REYNOLDS NUMBER/FT	:	.265E+08
AVERAGE STAGNATION PRESSURE PSIA	:	28.7069
AVERAGE STAGNATION TEMPERATURE K	:	130.4389
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	8.2562
BOUNDARY-LAYER THICKNESS DELTA/L	:	.6191
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0785
MOMENTUM THICKNESS THETA/L	:	.0519
SHAPE FACTOR	:	1.5125

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7012	.8049	1.0587	.7215
2	.0754	.7560	.8336	1.0490	.7743
3	.1184	.7907	.8533	1.0426	.8074
4	.1530	.8146	.8675	1.0381	.8299
5	.1955	.8434	.8855	1.0325	.8570
6	.2272	.8607	.8968	1.0291	.8732
7	.2624	.8823	.9113	1.0248	.8932
8	.3043	.9056	.9275	1.0200	.9146
9	.3417	.9238	.9406	1.0162	.9313
10	.3903	.9481	.9587	1.0112	.9533
11	.4289	.9621	.9695	1.0082	.9660
12	.4696	.9746	.9794	1.0055	.9772
13	.5114	.9855	.9881	1.0032	.9870
14	.5567	.9923	.9936	1.0017	.9931
15	.5981	.9968	.9974	1.0007	.9971

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 12 - 39   0.50% TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.8213
AVERAGE REYNOLDS NUMBER/FT	:	.267E+08
AVERAGE STAGNATION PRESSURE PSIA	:	27.1364
AVERAGE STAGNATION TEMPERATURE K	:	125.0725
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	10.1768
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5399
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0569
MOMENTUM THICKNESS THETA/L	:	.0387
SHAPE FACTOR	:	1.4695

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7417	.8250	1.0519	.7607
2	.0754	.8040	.8605	1.0403	.8200
3	.1184	.8456	.8864	1.0322	.8591
4	.1530	.8717	.9036	1.0270	.8834
5	.1955	.8988	.9223	1.0215	.9084
6	.2272	.9128	.9323	1.0186	.9213
7	.2624	.9278	.9433	1.0155	.9350
8	.3043	.9429	.9546	1.0123	.9487
9	.3417	.9548	.9637	1.0098	.9594
10	.3903	.9701	.9757	1.0065	.9733
11	.4289	.9790	.9828	1.0046	.9812
12	.4696	.9865	.9889	1.0030	.9879
13	.5114	.9929	.9941	1.0016	.9937
14	.5567	.9961	.9968	1.0008	.9965
15	.5981	.9986	.9988	1.0003	.9987

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 12 - 40   1.00% TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.8187
AVERAGE REYNOLDS NUMBER/FT	:	.266E+08
AVERAGE STAGNATION PRESSURE PSIA	:	27.1096
AVERAGE STAGNATION TEMPERATURE K	:	124.9405
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	11.5568
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4905
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0451
MOMENTUM THICKNESS THETA/L	:	.0312
SHAPE FACTOR	:	1.4451

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7664	.8394	1.0471	.7842
2	.0754	.8302	.8772	1.0351	.8446
3	.1184	.8732	.9051	1.0266	.8847
4	.1530	.9000	.9236	1.0212	.9094
5	.1955	.9263	.9425	1.0157	.9335
6	.2272	.9383	.9514	1.0132	.9445
7	.2624	.9509	.9609	1.0106	.9559
8	.3043	.9631	.9704	1.0080	.9669
9	.3417	.9725	.9778	1.0059	.9754
10	.3903	.9839	.9869	1.0035	.9856
11	.4289	.9898	.9916	1.0022	.9909
12	.4696	.9935	.9946	1.0014	.9942
13	.5114	.9969	.9974	1.0007	.9972
14	.5567	.9979	.9982	1.0005	.9981
15	.5981	.9992	.9993	1.0002	.9993

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 12 - 41   1.80% TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.8196
AVERAGE REYNOLDS NUMBER/FT	:	.262E+08
AVERAGE STAGNATION PRESSURE PSIA	:	26.6745
AVERAGE STAGNATION TEMPERATURE K	:	124.9023
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	13.2817
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4578
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0361
MOMENTUM THICKNESS THETA/L	:	.0254
SHAPE FACTOR.	:	1.4249

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7891	.8521	1.0430	.8059
2	.0754	.8531	.8917	1.0306	.8661
3	.1184	.8971	.9214	1.0218	.9068
4	.1530	.9236	.9404	1.0163	.9311
5	.1955	.9476	.9584	1.0113	.9530
6	.2272	.9575	.9659	1.0092	.9619
7	.2624	.9677	.9739	1.0070	.9710
8	.3043	.9772	.9814	1.0049	.9796
9	.3417	.9842	.9871	1.0034	.9859
10	.3903	.9916	.9931	1.0018	.9925
11	.4289	.9947	.9957	1.0011	.9953
12	.4696	.9961	.9968	1.0009	.9965
13	.5114	.9979	.9983	1.0005	.9981
14	.5567	.9982	.9985	1.0004	.9984
15	.5981	.9993	.9994	1.0002	.9994

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 13 - 42   0.00% TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.8405
AVERAGE REYNOLDS NUMBER/FT	:	.268E+08
AVERAGE STAGNATION PRESSURE PSIA	:	35.4939
AVERAGE STAGNATION TEMPERATURE K	:	151.7030
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	8.3597
BOUNDARY-LAYER THICKNESS DELTA/L	:	.6291
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0795
MOMENTUM THICKNESS THETA/L	:	.0522
SHAPE FACTOR	:	1.5236

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7023	.7971	1.0614	.7236
2	.0754	.7562	.8264	1.0514	.7754
3	.1184	.7909	.8469	1.0447	.8083
4	.1530	.8142	.8614	1.0401	.8303
5	.1955	.8426	.8798	1.0343	.8569
6	.2272	.8590	.8910	1.0309	.8722
7	.2624	.8803	.9058	1.0264	.8918
8	.3043	.9030	.9223	1.0215	.9127
9	.3417	.9214	.9361	1.0176	.9294
10	.3903	.9454	.9547	1.0123	.9512
11	.4289	.9599	.9664	1.0091	.9643
12	.4696	.9729	.9770	1.0061	.9759
13	.5114	.9845	.9867	1.0035	.9862
14	.5567	.9915	.9927	1.0019	.9925
15	.5981	.9964	.9969	1.0008	.9968

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 13 - 44   0.50%   TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.8393
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	35.4998
AVERAGE STAGNATION TEMPERATURE K	:	151.5505
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	10.4443
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5351
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0554
MOMENTUM THICKNESS THETA/L	:	.0375
SHAPE FACTOR	:	1.4760

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7467	.8215	1.0531	.7663
2	.0754	.8085	.8581	1.0411	.8249
3	.1184	.8495	.8847	1.0328	.8633
4	.1530	.8750	.9023	1.0274	.8869
5	.1955	.9021	.9218	1.0217	.9119
6	.2272	.9157	.9319	1.0187	.9243
7	.2624	.9306	.9432	1.0155	.9377
8	.3043	.9453	.9547	1.0123	.9511
9	.3417	.9569	.9640	1.0097	.9616
10	.3903	.9719	.9763	1.0063	.9750
11	.4289	.9807	.9836	1.0044	.9829
12	.4696	.9877	.9895	1.0028	.9891
13	.5114	.9937	.9946	1.0014	.9945
14	.5567	.9964	.9969	1.0008	.9968
15	.5981	.9985	.9987	1.0003	.9987

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 13 - 45   1.00%   TOTAL BL REMOVAL   PORT=0

AVERAGE MACH NUMBER	:	.8454
AVERAGE REYNOLDS NUMBER/FT	:	.269E+08
AVERAGE STAGNATION PRESSURE PSIA	:	35.4116
AVERAGE STAGNATION TEMPERATURE K	:	151.3873
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	11.6066
BOUNDARY-LAYER THICKNESS DELTA/L	:	.5078
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0475
MOMENTUM THICKNESS THETA/L	:	.0325
SHAPE FACTOR	:	1.4598

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7669	.8310	1.0499	.7858
2	.0754	.8282	.8691	1.0376	.8436
3	.1184	.8694	.8972	1.0290	.8819
4	.1530	.8946	.9153	1.0236	.9051
5	.1955	.9198	.9342	1.0181	.9281
6	.2272	.9320	.9437	1.0154	.9392
7	.2624	.9451	.9541	1.0125	.9510
8	.3043	.9578	.9643	1.0096	.9624
9	.3417	.9677	.9725	1.0074	.9713
10	.3903	.9800	.9828	1.0046	.9823
11	.4289	.9869	.9886	1.0030	.9884
12	.4696	.9918	.9929	1.0019	.9928
13	.5114	.9962	.9967	1.0009	.9966
14	.5567	.9976	.9979	1.0006	.9978
15	.5981	.9991	.9992	1.0002	.9992

0.3-M TCT ADAPTIVE WALL TEST SECTION
RIGHT SIDEWALL BOUNDARY-LAYER MEASUREMENTS

213 - 13 - 46 1.66% TOTAL BL REMOVAL PORT=0

AVERAGE MACH NUMBER	:	.8431
AVERAGE REYNOLDS NUMBER/FT	:	.271E+08
AVERAGE STAGNATION PRESSURE PSIA	:	35.6863
AVERAGE STAGNATION TEMPERATURE K	:	151.4078
PRANDTL NUMBER	:	.7600
RATIO OF SPECIFIC HEATS	:	1.4000
RECOVERY FACTOR	:	.9126
REFERENCE LENGTH SCALE L (INCHES)	:	1.0000
VALUE OF N IN POWER LAW PROFILE	:	13.3667
BOUNDARY-LAYER THICKNESS DELTA/L	:	.4623
DISPLACEMENT THICKNESS DELTASTAR/L	:	.0368
MOMENTUM THICKNESS THETA/L	:	.0256
SHAPE FACTOR	:	1.4384

A: DISPLACEMENT AND MOMENTUM THICKNESS REFER TO COMPRESSIBLE VALUES.
B: DISPLACEMENT AND MOMENTUM THICKNESS CALCULATED USING POWER-LAW FROM WALL TO FIRST TUBE.

NO.	Y/L	M/MINF	P/PT	T/TINF	U/UINF
1	.0337	.7910	.8462	1.0449	.8086
2	.0754	.8521	.8857	1.0325	.8658
3	.1184	.8957	.9165	1.0232	.9060
4	.1530	.9212	.9356	1.0177	.9293
5	.1955	.9450	.9541	1.0124	.9508
6	.2272	.9556	.9627	1.0101	.9604
7	.2624	.9661	.9713	1.0077	.9699
8	.3043	.9759	.9794	1.0055	.9786
9	.3417	.9831	.9855	1.0039	.9850
10	.3903	.9911	.9923	1.0020	.9921
11	.4289	.9947	.9954	1.0012	.9953
12	.4696	.9963	.9967	1.0009	.9967
13	.5114	.9982	.9985	1.0004	.9984
14	.5567	.9983	.9985	1.0004	.9985
15	.5981	.9993	.9994	1.0002	.9994

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15. Supplementary Notes

Langley Technical Monitor: Edward J. Ray

16. Abstract

The Langley 0.3-Meter Transonic Cryogenic Tunnel has provision for boundary removal from the sidewalls to reduce sidewall interference effects on the test data. This report describes the tests carried out to determine the change in the empty test section sidewall boundary-layer thickness at the model station with upstream boundary-layer mass removal. The boundary-layer measurements showed that the upstream removal region is effective in reducing the boundary-layer thickness at the model station. The boundary-layer displacement thickness reduced from about 1.2 percent to about .4 percent of the test section width. The boundary-layer velocity profiles followed a power law variation in the outer region and showed good correlation when plotted in terms of boundary-layer momentum thickness.

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