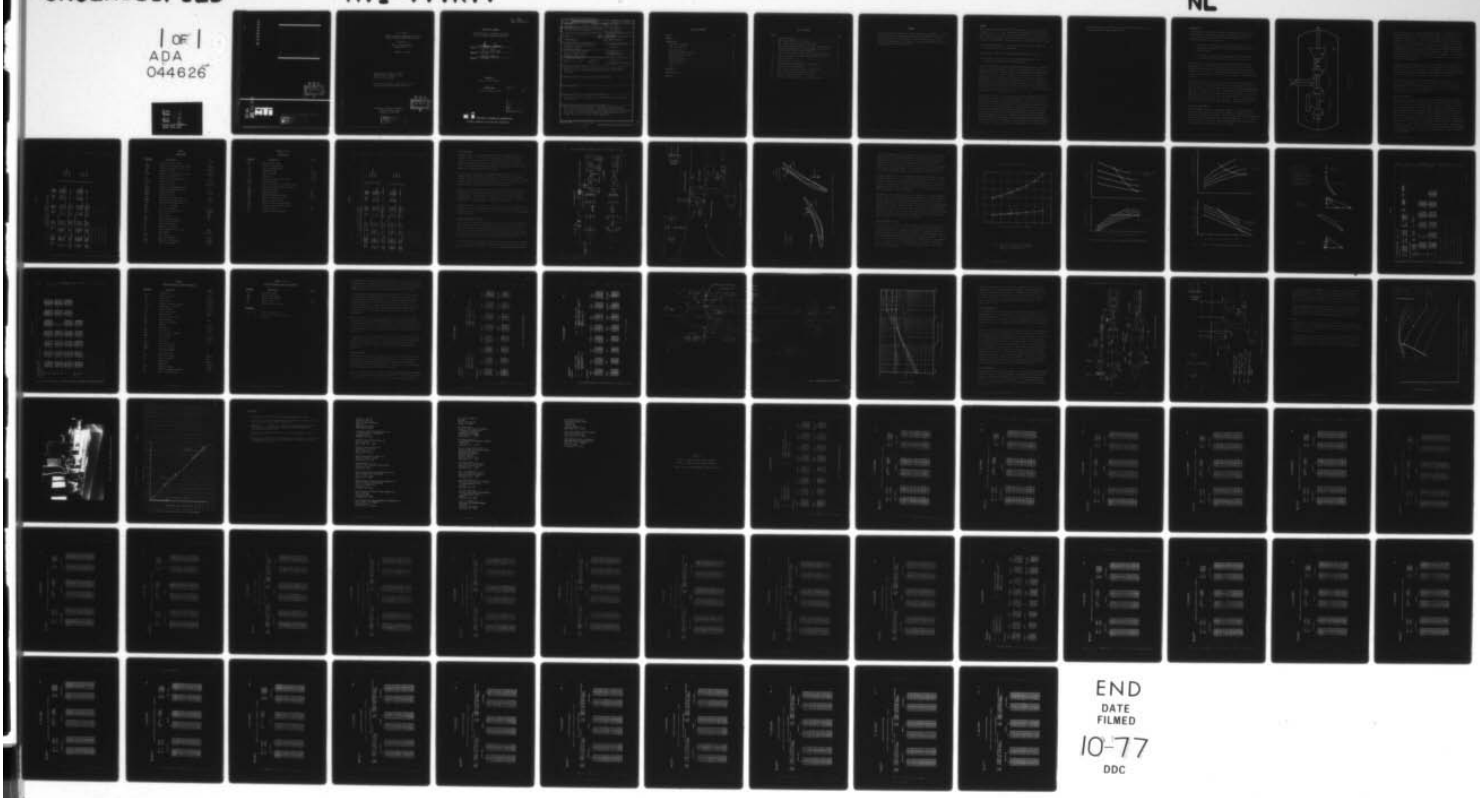
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TECHNICAL REPORT

RESEARCH PROGRAM ON COMPONENTS FOR CLOSED CYCLE GAS TURBINE PROPULSION MACHINERY

Author (s) Thomas J. Ivsan

Approved A.O. White

Approved Paul Lewis

Prepared for

Office of Naval Research

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This report presents the results of a component research program for a closed cycle gas turbine powerplant. The report encompasses a first year effort on a test and analysis project evaluating axial-flow compressor performance in a helium gas environment and evaluating helium gas film bearings for a closed cycle gas turbine powerplant.

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FOREWORD

The enclosed work by Mechanical Technology Incorporated is submitted as a final report to the Office of Naval Research under Contract N00014-76-C-0553. Those contributing to the program included T. Ivsan, P. Lewis, and A. O. White; supporting consultant was S. T. Robinson. The technical program officer representing ONR was LCDR William R. Seng.

SUMMARY

This report presents the results of the first phase of a research program on components for a closed cycle, helium gas turbine powerplant. The two fundamental objectives of the study were to do basic research on an axial compressor in a helium gas environment and to do research on helium gas film bearings for a closed cycle gas turbine. The objectives of the first phase effort included:

- To design and fabricate a closed loop for testing an axial compressor stage in a helium or air environment.
- To design a high reaction, highly loaded axial compressor stage.
- To examine the application of gas lubricated bearings for a gas turbine, using helium as the lubrication medium.

The first phase effort, conducted from May 1976 to August 1977, has addressed the above objectives; however, the scope of the program has been qualified to complement the closed cycle powerplant studies conducted by Westinghouse AESD for the Office of Naval Research. Based on early discussions with ONR and Westinghouse AESD, conditions for a representative powerplant were defined to give guidance to the compressor and bearing studies. The axial compressor design, the test programs for both compressor and bearing to be conducted, and the analytical and/or experimental information generated in the research program all reflect the consideration of the end objective: a closed cycle helium gas turbine for naval powerplant application.

The results of the first phase included all the necessary support work to conduct detail compressor and bearing tests during the following year. A closed test loop was designed for an axial compressor to evaluate a high reaction stage in an air and helium environment. The test loop was partially fabricated and tests were conducted to establish a performance datum for the detail compressor stage evaluation. The compressor stage components, both inlet guide vanes and an axial-flow rotor, were designed based on an isentropic-simple-radial-equilibrium solution. An aerodynamic design/test analysis procedure was also defined to test evaluate the compressor components, determine the loss characteristics in air and helium gas, and then develop a loss model for subsequent designs. Test parameters for gas film bearings for a closed cycle gas

turbine powerplant were partially defined based on a proposed powerplant as reviewed by ONR, Westinghouse AESD, and MTI.

INTRODUCTION

The first phase of the research program on components for closed cycle gas turbine propulsion machinery was conducted from May 1976 to August 1977. The work completed during this year's effort was supportive of the two fundamental objectives of the program:

1. To conduct a test program to accurately determine the actual aerodynamic performance of an axial compressor stage in a helium gas environment.

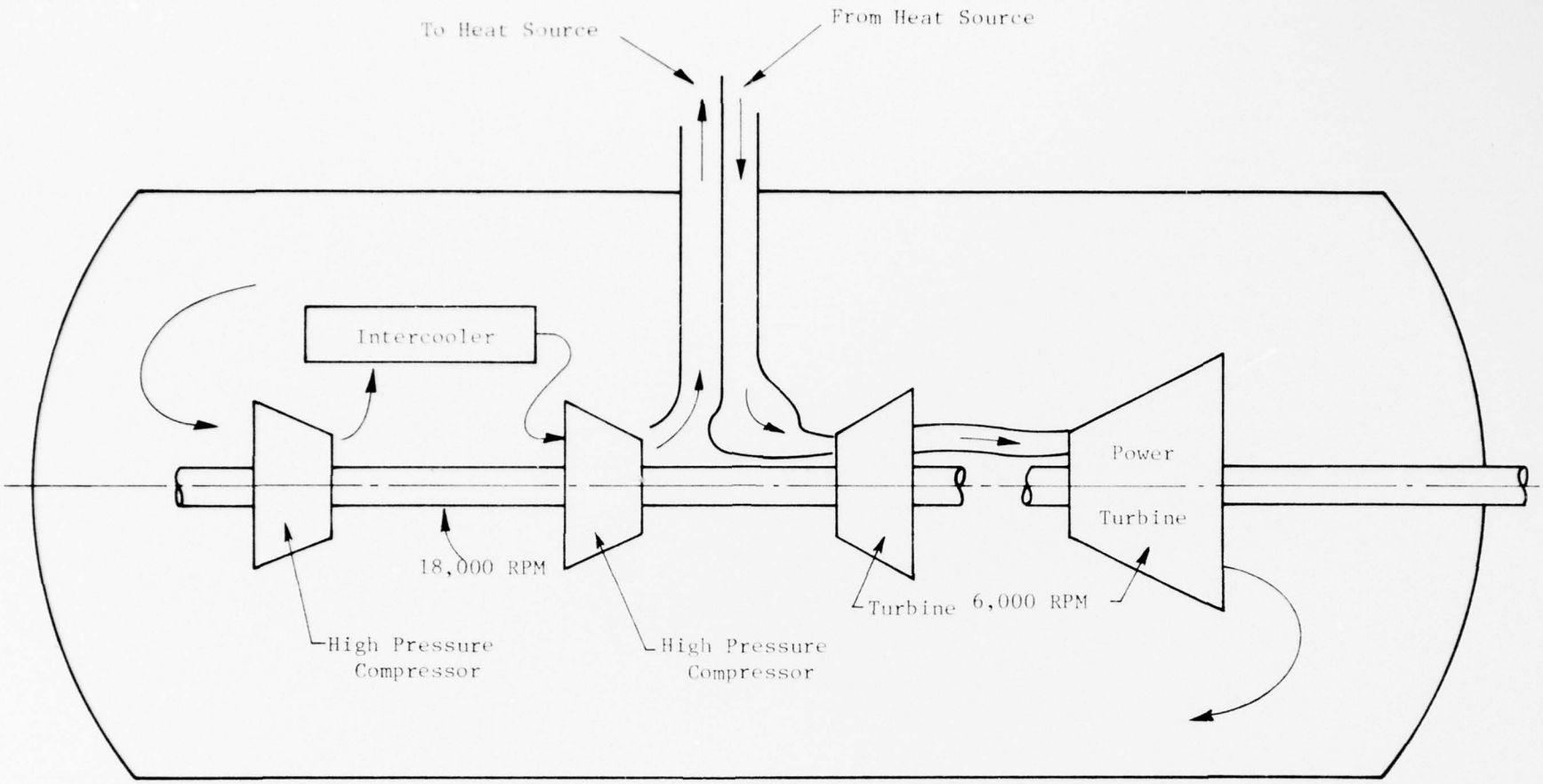
2. To conduct an analytical and test program on gas-film bearings to evaluate their application in a closed cycle gas turbine.

These two major tasks were defined further by considering their specific application. The closed cycle gas turbine selected as a first candidate configuration was nominally fixed at 70,000 shaft horsepower output, using helium as a power fluid. The turbomachinery arrangement for this unit consisted of a gas generator and free turbine spool, shown in a simplified form in Figure 1.

The low and high pressure compressors operate at 18,000 rpm and will require from 14 to 18 axial stage each to meet the cycle pressure ratio conditions. Since the number of compressor stages and the respective stage matching directly affects the performance of the overall powerplant, the compressor aerodynamics task, while determining general performance of an axial stage in helium, also addresses the practical design problem of establishing an accurate basis for stage matching in a multi-stage axial compressor. Similarly, the gas bearing task is defined to reflect load conditions for the candidate powerplant.

Compressor Aerodynamics

Actual experimental work with compressors, turbines, and cascades has been fairly extensive, especially in an air environment. The analytical and experimental work conducted on subsonic, axial flow compressors has been thoroughly investigated and documentation, such as provided in Reference 1, is as complete as would resonably be expected. However, while helium's basic properties are well known, detail experimental data is very limited.



Powerplant Schematic

Figure 1

Helium poses some special design problems, especially in the compressor, because of its low molecular weight. The low molecular weight of helium produces a high stagnation speed of sound, a characteristic which has a positive effect on the compressor aerodynamic design. Since the Mach number effects are reduced compared to an air compressor design, conventional low speed blade profiles can be selected for the compressor. The specific heat of the helium gas, however, has a contrasting effect. For a comparable work input into a single stage compressor, a lower pressure rise will be produced in helium gas as compared to air and, typically, many stages of compression are required in a powerplant. In the powerplant configuration shown in Figure 1, thirty-two axial compressor stages are required to meet the cycle conditions.

The primary concern then becomes one of stage matching, i.e., to establish the compressor blading such that all the stages are oriented in a fashion to maximize the efficiency of the entire compressor. The method used to attain this goal is to design the multi-stage compressor using contemporary computer tools supplemented by known compressor blade loss characteristics for helium gas.

The function of the compressor test rig developed in the first phase is to address the general question of helium gas properties as related to axial flow compressors; however, the practical objective is to develop an accurate loss model to design axial flow compressors and to indicate the attainable stage pressure ratio for a helium compressor.

Test Loop Conditions

The test loop was sized to evaluate an axial compressor stage representative of a stage for a moderate output closed-cycle helium propulsion unit. Typically, a 0.8 to 0.6 hub-tip ratio compressor rotor, 12 inches in diameter, operating at tip speeds of 1,200 feet per second, was considered as a representative size. The operating mass flows and pressure levels of the stage were selected such that a full range of Reynolds' number could be examined on the test compressor. Calculated gas properties and select compressor parameters are provided in Tables 1, 2, and 3 for an air and helium gas environment. The calculations were done for both an axial discharge stage which is representative of a high-reaction design and for a stage where the flow enters the rotor axially. The axial discharge stage (Table 1) is the candidate test stage and will operate at 22,900 rpm speed producing a 1.063:1 pressure ratio in helium gas at a blade chord Reynolds' number of 500000.

TABLE 1

HELIUM CASCADE LOOP PROGRAM

AXIAL COMPRESSOR+VENTURI AND HEAT EXCHANGER
HELIUM+ XRE=.500000

XN	22518	PHI	.50000	PSI	.60000	ETAS	.92000
CTIP	12.000	RHT	.66000	CHORD	.12500	DVENT	4.0000
XRE	5.000000E+05	TI	560.00	XK	1.6600	GAS	2.0000
R	386.00	XFA	1.0000	XF	1.0000	C	.98000

** COMPRESSOR **

UTIP =	1200.0	ALFI =	33.114	XMACI =	14594	XMAI =	.17718	Axial
CA =	595.99	BETAI =	69.346	PI =	48.378	XMIR =	.50222	
GIR =	1708.6	REACT =	1.1030	P2 =	51.438	T2 =	575.11	Discharge
WORK =	.65217	DELTU =	391.30	DELT =	15.114	RHOI =	3.22232E-02	
XA =	8.4574	XMP =	223.88	TOR =	615.07	RHOSI =	3.17239E-02	Stage
ER =	1.0613	ATI =	3403.9	GMU =	1.37000E-05	DFACT =	.32615	

** VENTURI & HEAT EXCHANGER **

XMW =	845.42	XMPR =	30.702	RHO2 =	3.42622E-02	PS2 =	20.730
CRITP =	25.059	PCRIT =	1288.8	ALF2 =	.0		
HLOAD =	5.6578E+05	CP =	1.2411	AI =	63.832		

** COMPRESSOR **

UTIP =	1200.0	ALFI =	.0	XMACI =	14594	XMAI =	.17718	Axial
CA =	595.99	BETAI =	63.440	PI =	61.315	XMIR =	.39620	
GIR =	1341.6	REACT =	.83696	P2 =	65.194	T2 =	575.11	Entry
WORK =	.65217	DELTU =	391.30	DELT =	15.114	RHOI =	4.08461E-02	
XA =	10.695	XMP =	283.79	TOR =	780.42	RHOSI =	4.02132E-02	Stage
ER =	1.0633	ATI =	3403.9	GMU =	1.37000E-05	DFACT =	.39528	

** VENTURI & HEAT EXCHANGER **

XMW =	1077.2	XMPR =	38.917	RHO2 =	4.34307E-02	PS2 =	26.277
CRITP =	31.765	PCRIT =	2070.9	ALF2 =	33.114		
HLOAD =	7.2225?E+05	CP =	1.2411	AI =	63.832		

TABLE 2

NOMENCLATURE

PARAMETER	DESCRIPTION	UNITS
A1	Flow area at rotor inlet	$in.^2$
ALF1	Absolute flow angle at rotor inlet	degrees
ALF2	Absolute gas angle at rotor exit	degrees
AT1	Acoustic velocity	ft/sec
BETA1	Relative flow angle at rotor inlet	degrees
C	Nozzle flow coefficient	-
CA	Axial velocity at rotor inlet	ft/sec
CHORD	Rotor blade chord	inches
CP	Gas specific heat	BTU/LB °R
CRITP	Nozzle critical pressure ratio	-
DELT	(T2-T1) Rotor temperature rise	°R
DELTU	Rotor inlet swirl	ft/sec
DFACT	Diffusion factor	-
DTIP	Tip diameter at rotor inlet	inches
DVENT	Venturi or flow nozzle diameter	inches
ETAS	Rotor isentropic efficiency	-
GAS	1 = air, 2 = helium	-
GMU	(g*ρ) - Inlet density	$lb/ft^2\ sec^2$
HLOAD	Heat load produced by rotor	BTU/HR
P1	Inlet pressure	PSIA
P2	Exit pressure	PSIA
PCRIT	Nozzle critical pressure	PSI
PHI	Flow coefficient = CX1/U1	-
PR	Stage pressure ratio	-
PSI	Pressure coefficient	-
PS2	Static pressure at rotor exit	PSIA
R	Gas constant	ft lb/lb °R
REACT	Rotor reaction	-
RHO1	Total inlet density	lb/ft^3
RHO2	Rotor exit total density	lb/ft^3
RHOS1	Static inlet density	lb/ft^3

TABLE 2 (contd.)

NOMENCLATURE

PARAMETER	DESCRIPTION	UNITS
RHT	Hub-tip radius ratio	-
T1	Inlet total temperature	°R
T2	Rotor exit temperature	°R
TOR	Torque produced	in.-lbs
UTIP	Rotor tip speed	ft/sec
WA	Mass flow	lbs/sec
WIR	Relative velocity at rotor inlet	ft/sec
WORK	Work coefficient	-
XF	Flow nozzle velocity of approach factor	-
XFA	Flow nozzle thermal expansion factor	-
XHACT	Head input to rotor	ft
XHP	Stage horsepower	HP
XHPR	Nozzle differential pressure	PSI
XHW	Nozzle differential pressure	in. water
XK	Ratio of specific heats	-
XM1R	Relative rotor inlet Mach number	-
XMA1	Absolute rotor inlet Mach number	-
XN	Rotational speed	RPM
XRE	Blade chord Reynolds number	-

TABLE 3

FREON CASCADE LOOP PROGRAM

TEST LOOP ON AIM T. IVSAN 8-16-76
XM=.500000,PR1=.50,PSI=.60,ETAS=.92

XN	16000	PR1	.50000	PSI	.60000	ETAS	.92000
DTIP	12.000	RHT	.06000	CHORD	.12500	DVENT	4.0000
XMF	5.000000E+05	T1	560.00	XK	1.3950	AAS	1.0000
R	54.000	XFA	1.0000	XF	1.0000	C	.98000

Axial Discharge Stage

** COMPRESSOR **

UTIP =	628.32	ALF1 =	33.114	XMACT =	4001.2	XMA1 =	.27162
CA =	314.16	BETA1 =	54.346	P1 =	12.075	XM1R =	.76989
U1R =	650.46	BEACT =	1.1030	P2 =	13.610	T2 =	580.98
WORK =	.65217	DELTU =	294.09	DELT =	20.901	RHO1 =	5.74981E-02
WA =	7.7192	WR =	74.155	TOR =	294.93	RHOS1 =	5.54305E-02
FR =	1.1671	A11 =	1162.0	GMU =	1.28000E-05	DFACT =	.32615

** VENTURI & HEAT EXCHANGER **

XFW =	376.05	XMFR =	11.396	RHO2 =	5.48081E-02	PS2 =	2.41081E-02
CRITP =	7.2012	FCRIT =	98.307	ALF2 =	.0		
MLOAD =	1.4617E+05	CP =	.24313	A1 =	63.832		

** COMPRESSOR **

UTIP =	628.32	ALF1 =	.0	XMACT =	4001.2	XMA1 =	.27162
CA =	314.16	BETA1 =	63.340	P1 =	15.309	XM1R =	.60736
U1R =	706.42	BEACT =	1.0836	P2 =	17.252	T2 =	580.98
WORK =	.65217	DELTU =	294.09	DELT =	20.901	RHO1 =	7.28845E-02
WA =	9.7845	WR =	71.152	TOR =	373.89	RHOS1 =	7.02636E-02
FR =	1.1671	A11 =	1162.0	GMU =	1.28000E-05	DFACT =	.39548

Axial Entry Stage

** VENTURI & HEAT EXCHANGER **

XFW =	476.48	XMFR =	17.661	RHO2 =	8.21500E-02	PS2 =	3.05594E-02
CRITP =	9.1683	FCRIT =	157.48	ALF2 =	33.114		
MLOAD =	1.8511E+05	CP =	.24313	A1 =	63.832		

Test Loop Design

A drawing of the test loop piping, compressor test section, and motor drive is shown in Figure 2. The drive system consists of a 300 HP alternating-current, electric motor coupled to an eddy-current magnetic clutch which provides a variable speed output to the gearbox. A rotary transformer torque-meter is coupled between the gearbox and test section, and it will be used to measure total compressor power during testing.

The test loop is constructed of standard seamless steel pipe. Starting at the removable 36-inch pipe section (see Figure 2), the gas flow is accelerated uniformly in the inlet transition to enter the compressor test section. Passing through the test stage, the flow is discharged into a 10-inch pipe elbow and directed through an expansion joint into a flow straightener.

The gas flow continues down a 10 diameter pipe section to enter the flow measuring nozzle. Downstream the gas flow passes through a controlling throttle valve and then is discharged into an expansion section adjoining a 36-inch diameter endbell. The gas flow passes through tubing in a heat exchanger and is directed to a settling chamber to begin the circuit again.

Peripheral items to the loop include a vacuum pump to evacuate the loop and a gas control to supply and maintain the air or helium inventory in the test loop. A rupture disc is also provided as a safety feature in case of excessive pressure levels in the loop.

Compressor Aerodynamic Design

Based on gas flow conditions established for the test loop, an axial compressor flowpath was developed for a 2/3 hub-tip ratio stage. As shown in Figure 3, the stage consists of 18 inlet guide vanes which introduce swirl into a 19 blade axial rotor. Another perspective of the guide vanes and rotor blading is shown in Figure 4, a top view which shows that the vanes introduce swirl against the direction of the rotor rotation to increase work output of the stage.

The high-reaction axial compressor stage was selected as the first test configuration so that the higher stage work capability could be evaluated along with the general aerodynamic characteristics. Axial flow compressors with high reaction

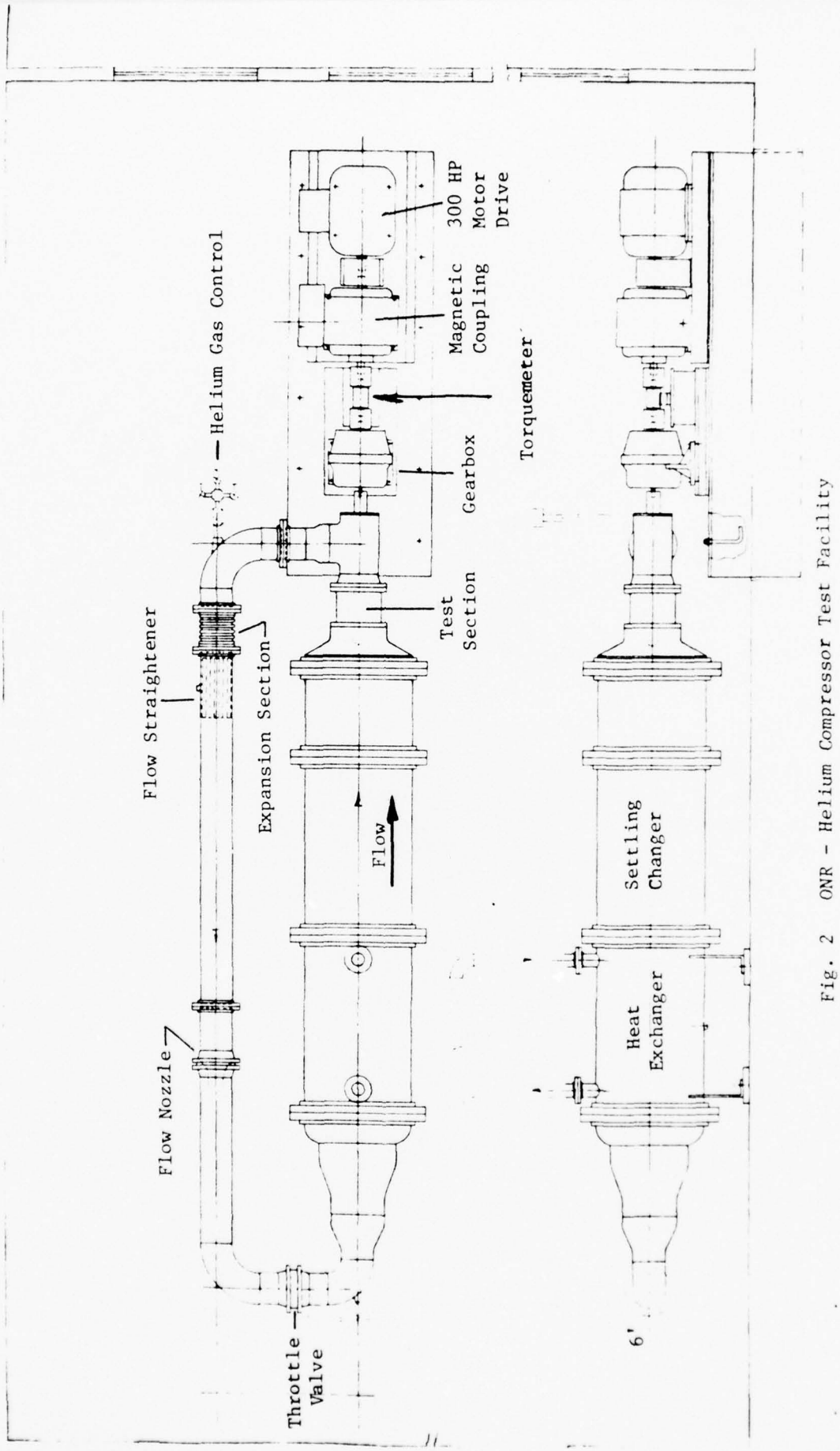


Fig. 2 ONR - Helium Compressor Test Facility

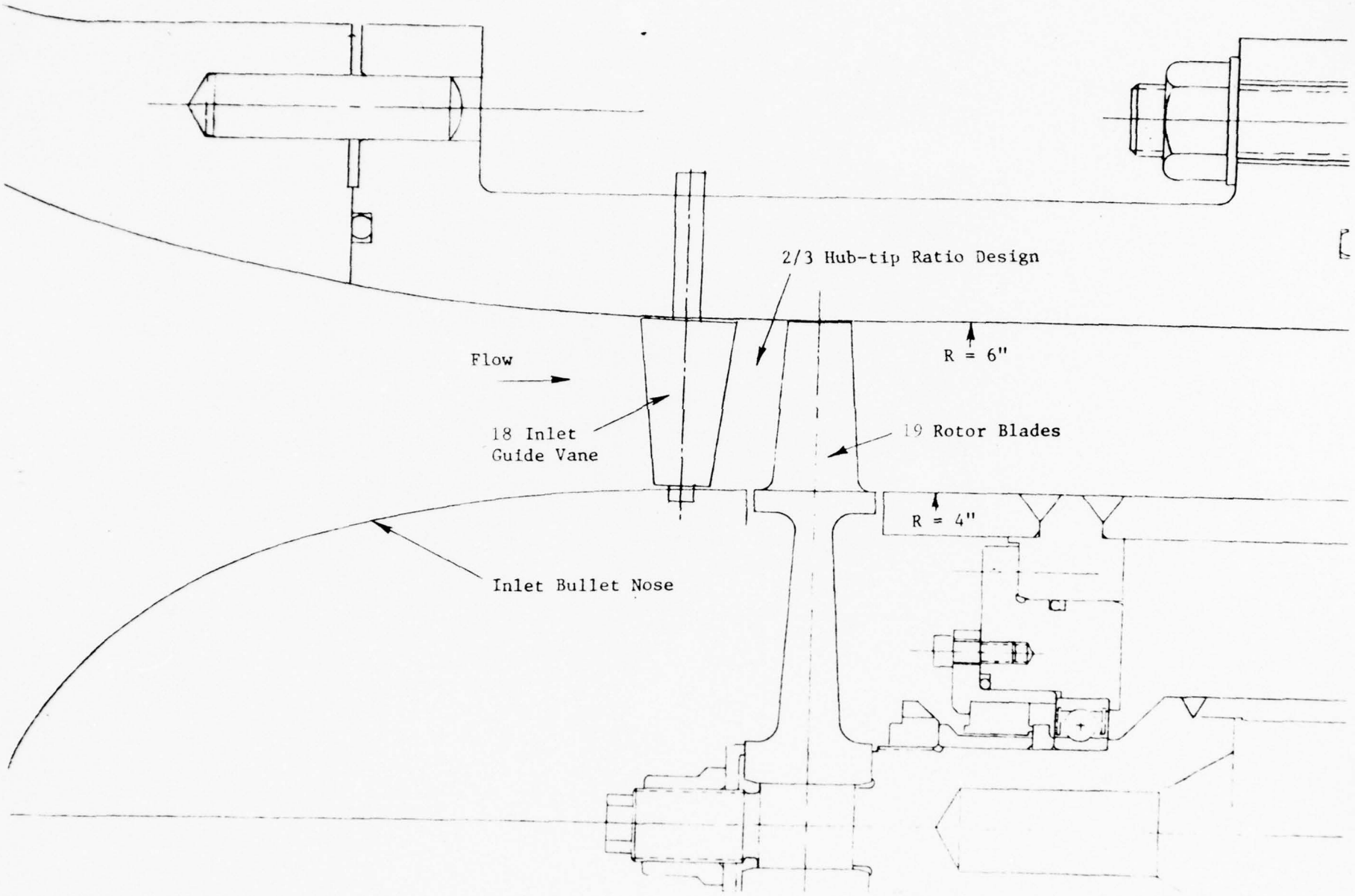


Fig. 3 ONR/Helium Cascade Test Section Flowpath

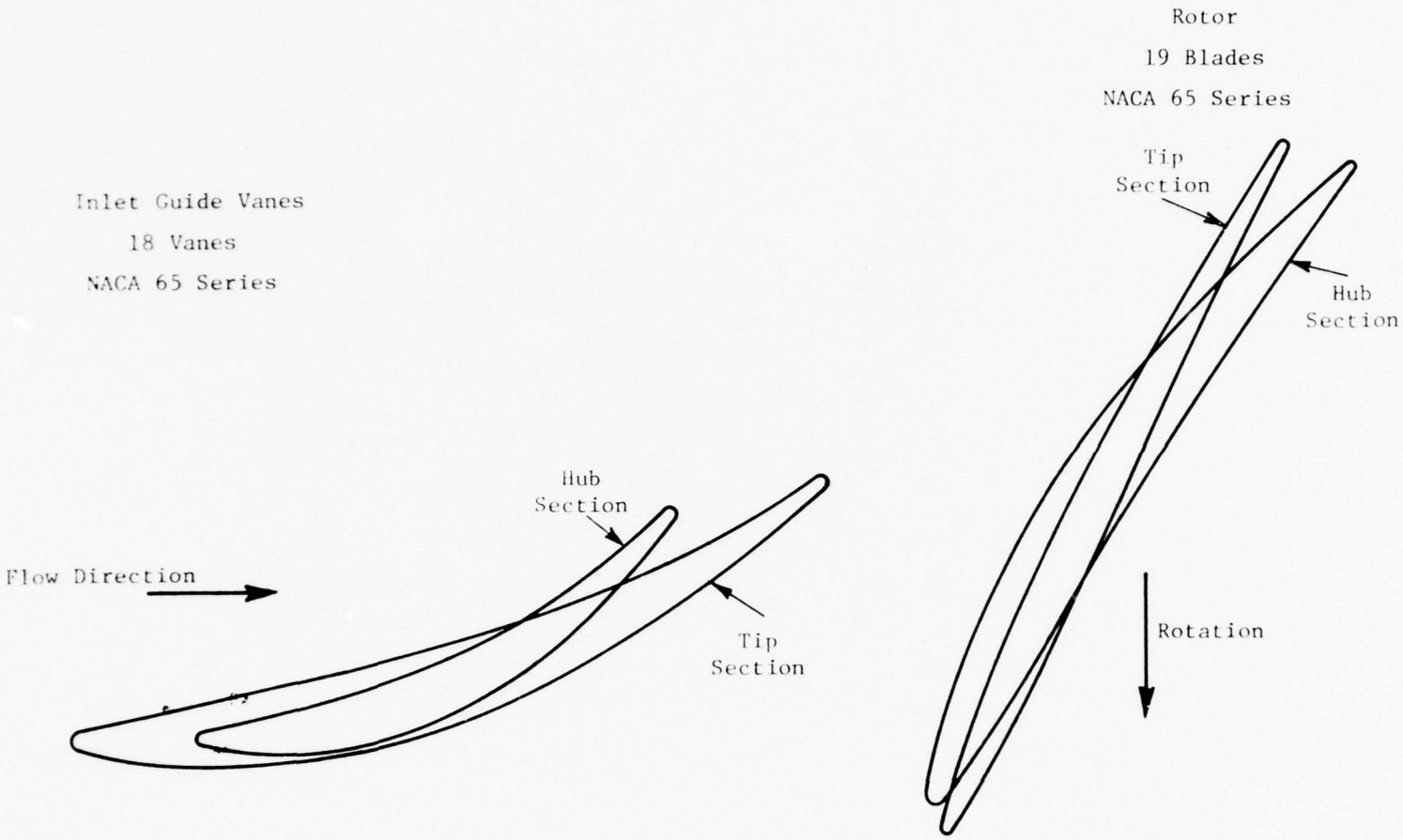


Fig. 4 ONR - Helium Compressor High Reaction Axial Stage Compressor

normally have demonstrated lower efficiency levels than a 50 percent reaction stage; however, the attainable performance has largely been affected by the Mach number limitations (see Reference 2). When considering the designs configuration for a compressor, the introduction of swirl into the rotor to increase reaction directly affects the level of the relative inlet Mach number. The increase in swirl from +10° to -30° in absolute air angle increases the rotor inlet relative Mach number for 1.29 to 2.00 in air (see Figure 5).

The Mach number level can be considered into the compressor design; however, the flow range and efficiency are normally reduced at these levels. On Figure 5, the Mach number level for helium is considerable lower since the acoustic velocity is approximately three times larger than that for air. The change is substantial enough so that the significance of the Mach number problem in the compressor design is drastically reduced.

The ability to design higher reaction axial compressors for helium gas application also allows consideration of higher work per stage. A simple comparison of rotor inlet swirl for a given gas deflection shows higher stage reaction with increased swirl into the rotor (see Figure 6). By assuming a maximum rotor diffusion factor limit of 0.60 as defined by Leiblein's calculation (Reference 1), the stage loading coefficient is shown to increase with increased reaction (see Figure 7), hence, the allowable stage pressure ratio increases with reaction. The test compressor presented below was designed in accordance with the Mach number and stage loading characteristics mentioned.

Detail Aerodynamic Design

The design velocity triangles for the inlet guide vanes and rotor are oriented per the convention shown in Figure 8. Flow calculations for the stage were conducted with the use of a computer program based on a constant axial velocity and free-vortex whirl distribution into the rotor. Isentropic-simple-radial-equilibrium (ISRE) was assumed for the rotor flow solution, providing a constant rotor efficiency along the blade radial span. A tabulation of the flow properties for the ISRE solution is provided in Table 4. Gas angles, velocities, pressures, temperatures, and other parameter nomenclature are listed in Table 5 for the flow calculation.

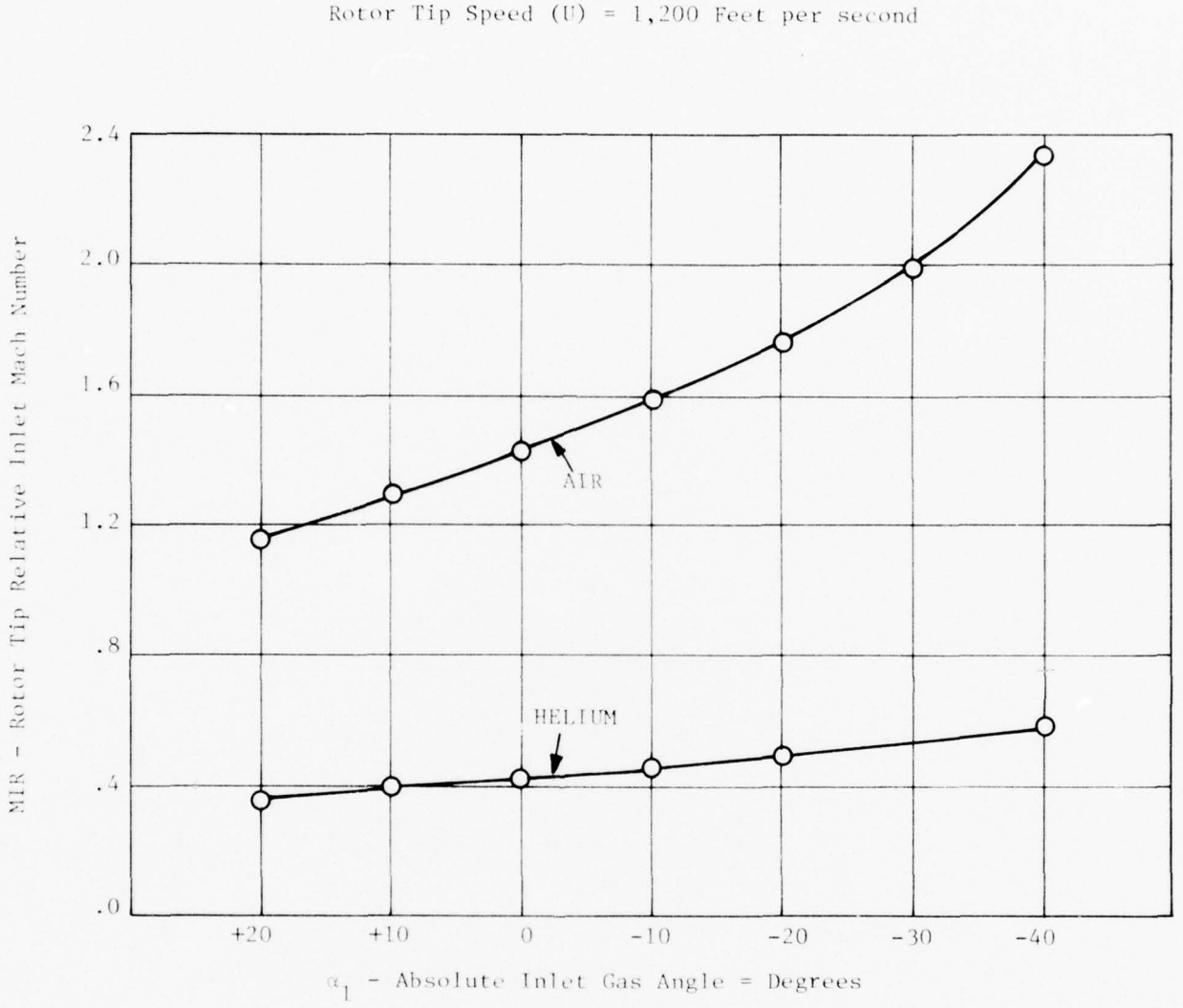


Fig. 5 Compressor Rotor Relative Inlet Mach Number as a Function of Inlet Swirl Angle for Air and Helium

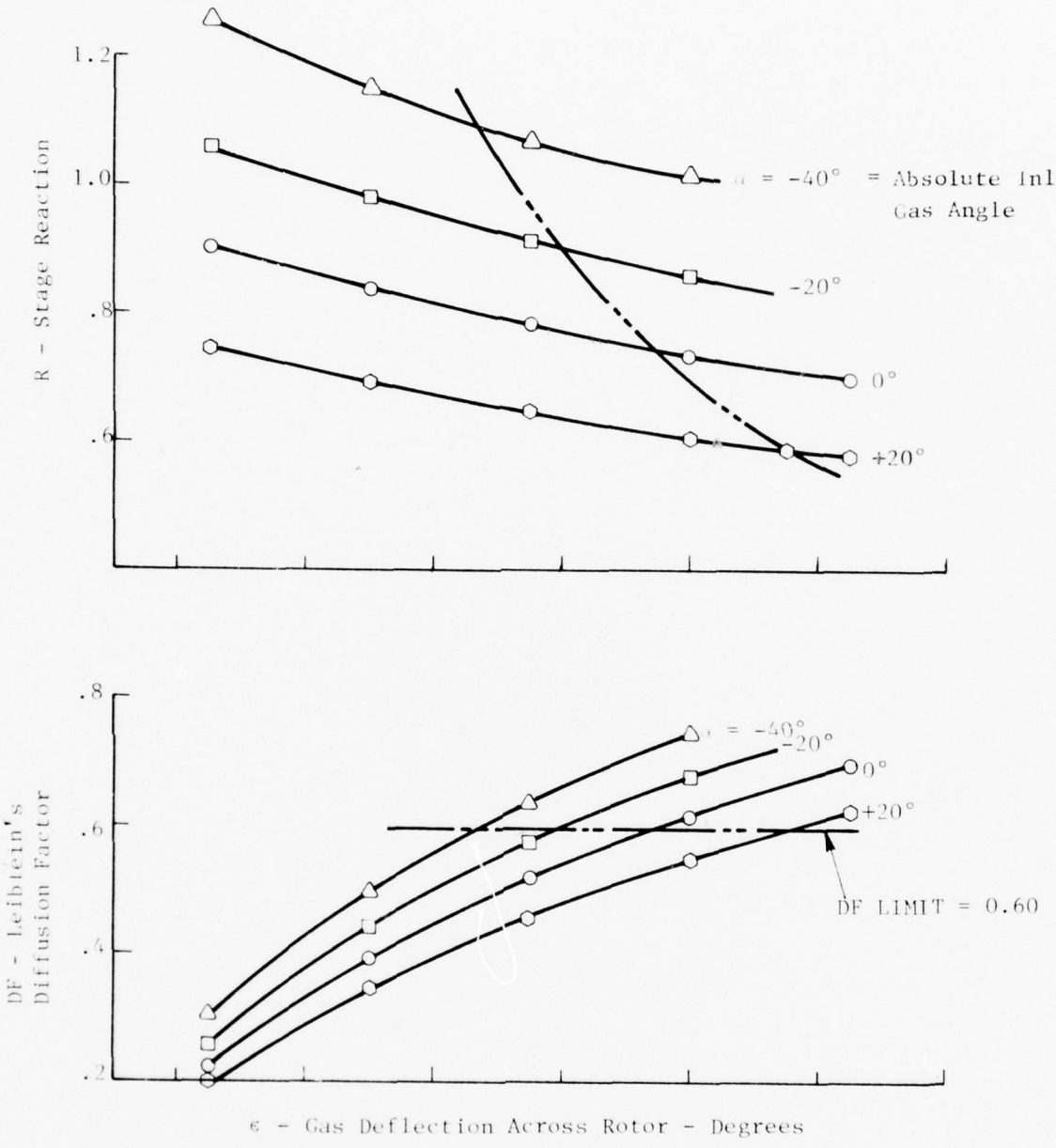


Fig. 6 Effect of Inlet Swirl on Stage Reaction and Diffusion Factor

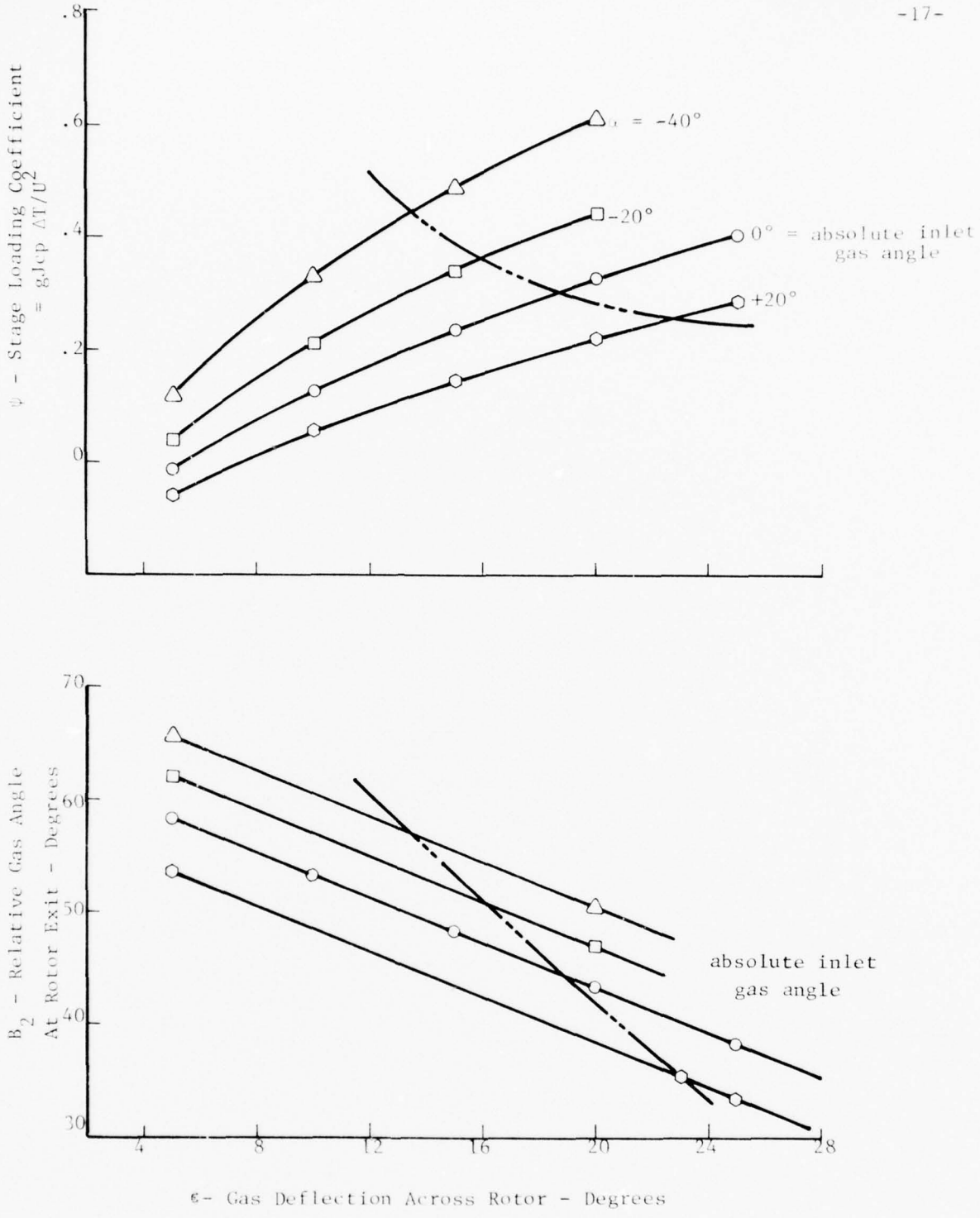
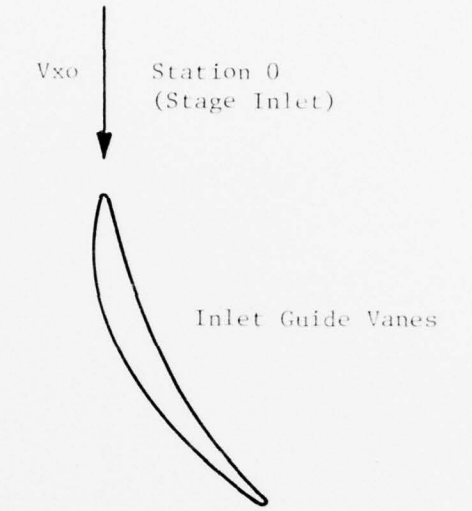
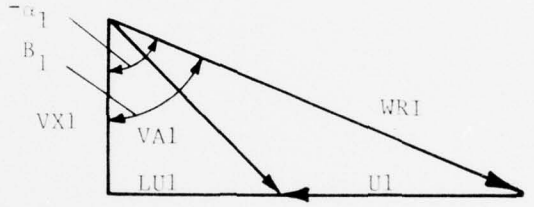


Fig. 7 Effect of Inlet Swirl on Stage Loading and Exit Gas Angle

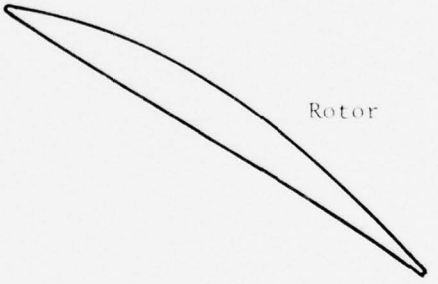
Velocity Triangles

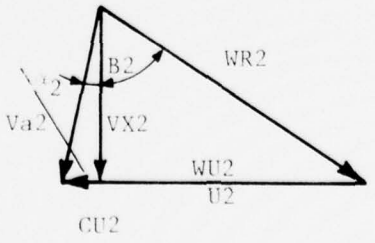
V_x - axial velocity
V_a - absolute velocity
W_R - relative velocity
C_u - absolute velocity (tangential component)
W_u - relative velocity (tangential component)
L - absolute gas angle
B - relative gas angle





Station 1
(Guide vane
Exit-Rotor Inlet)





Station 2
(Rotor Exit)

Figure 8

TABLE 4

HELIUM COMPRESSOR STAGE
2/3 HUB-TIP RATIO RCTCH T. IVSAN 10/8/76

*** INPUT ***

W	5.382E+00	XN	2.292E+04	RH0	4.000E+00	RH1	4.000E+00	RH2	4.000E+00
T0	5.660E+02	CUTIP	3.913E+02	RT0	6.000E+00	RT1	6.000E+00	RT2	6.000E+00
P0	4.837E+01	CP	1.241E+00	ZNI	3.100E+01	ZNR	3.200E+01		
RN	3.860E+02	SOLIT0	1.000E+00	SOLIT1	1.019E+00				
XK	1.666E+00	SOLIH0	1.000E+00	SOLIH1	1.273E+00				

*** INLET GLIDE VANE ***

A0	6.283E+01	CX0	3.852E+02	TS0	5.576E+02
RHO0	2.222E-02	AI0	3.404E+03	PS0	4.786E+01
RHOS0	2.223E-04	XM0	1.134E-01		
RHOR0	1.449E+02				

STRLN	R0	ALF0	ALF1	GAM0	THE0
1	4.000E+00	.0	-5.672E+01	-2.836E+01	5.672E+01
2	4.243E+00	.0	-5.516E+01	-2.758E+01	5.516E+01
3	4.690E+00	.0	-5.242E+01	-2.621E+01	5.242E+01
4	5.099E+00	.0	-5.008E+01	-2.504E+01	5.008E+01
5	5.427E+00	.0	-4.806E+01	-2.403E+01	4.806E+01
6	5.831E+00	.0	-4.627E+01	-2.313E+01	4.627E+01
7	6.000E+00	.0	-4.545E+01	-2.272E+01	4.545E+01

STRLN	CH01	PS1	TS1	XM1A	XM1R	XM1
1	8.107E-01	4.669E+01	5.521E+02	2.067E-01	4.238E-01	1.134E-01
2	8.595E-01	4.682E+01	5.527E+02	1.985E-01	4.280E-01	1.134E-01
3	9.502E-01	4.701E+01	5.536E+02	1.860E-01	4.385E-01	1.134E-01
4	1.033E+00	4.713E+01	5.542E+02	1.767E-01	4.503E-01	1.134E-01
5	1.110E+00	4.723E+01	5.547E+02	1.697E-01	4.628E-01	1.134E-01
6	1.182E+00	4.730E+01	5.550E+02	1.641E-01	4.756E-01	1.134E-01
7	1.216E+00	4.733E+01	5.552E+02	1.617E-01	4.820E-01	1.134E-01

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(continued)

HELIUM COMPRESSOR STAGE
2/3 HUB-TIP RATIO ROTOR T. IVSAN 10/8/76

*** ROTOR ***

STRLN	R1	BETA1	U1	WU1	CU1	CX1	W2
1	4.000E+00	7.448E+01	8.000E+02	1.387E+03	-5.869E+02	3.852E+02	8.823E+02
2	4.243E+00	7.464E+01	8.485E+02	1.402E+03	-5.534E+02	3.852E+02	9.265E+02
3	4.690E+00	7.501E+01	9.381E+02	1.439E+03	-5.006E+02	3.852E+02	1.009E+03
4	5.099E+00	7.541E+01	1.020E+03	1.480E+03	-4.604E+02	3.852E+02	1.086E+03
5	5.477E+00	7.582E+01	1.095E+03	1.524E+03	-4.286E+02	3.852E+02	1.157E+03
6	5.831E+00	7.620E+01	1.166E+03	1.569E+03	-4.026E+02	3.852E+02	1.224E+03
7	6.000E+00	7.639E+01	1.200E+03	1.591E+03	-3.913E+02	3.852E+02	1.256E+03

STRLN	R2	BETA2	U2	WU2	CU2	CX2	XM2R
1	4.000E+00	6.566E+01	8.000E+02	8.000E+02	.0	3.720E+02	1.081E-01
2	4.243E+00	6.632E+01	8.485E+02	8.485E+02	.0	3.720E+02	1.081E-01
3	4.690E+00	6.837E+01	9.381E+02	9.381E+02	.0	3.720E+02	1.081E-01
4	5.099E+00	6.996E+01	1.020E+03	1.020E+03	.0	3.720E+02	1.081E-01
5	5.477E+00	7.124E+01	1.095E+03	1.095E+03	.0	3.720E+02	1.081E-01
6	5.831E+00	7.231E+01	1.166E+03	1.166E+03	.0	3.720E+02	1.081E-01
7	6.000E+00	7.277E+01	1.200E+03	1.200E+03	.0	3.720E+02	1.081E-01

	W2/W1.	DFACR	PR2	XM2A	TS2	PS2	REA2
	6.129E-01	5.472E-01	1.063E+00	4.557E-02	5.747E+02	5.134E+01	1.334E+00
	6.373E-01	5.159E-01	1.063E+00	4.339E-02	5.748E+02	5.135E+01	1.297E+00
	6.776E-01	4.642E-01	1.063E+00	3.984E-02	5.748E+02	5.136E+01	1.243E+00
	7.097E-01	4.231E-01	1.063E+00	3.704E-02	5.749E+02	5.137E+01	1.205E+00
	7.359E-01	3.897E-01	1.063E+00	3.475E-02	5.749E+02	5.138E+01	1.178E+00
	7.577E-01	3.620E-01	1.063E+00	3.284E-02	5.749E+02	5.139E+01	1.157E+00
	7.673E-01	3.499E-01	1.063E+00	3.200E-02	5.749E+02	5.139E+01	1.148E+00

STRLN	PR1	PS1	CHD2	P2	T2
1	4.815E-01	1.350E+00	9.998E-01	5.143E+01	5.751E+02
2	4.540E-01	1.200E+00	1.035E+00	5.143E+01	5.751E+02
3	4.106E-01	9.818E-01	1.092E+00	5.143E+01	5.751E+02
4	3.777E-01	8.308E-01	1.135E+00	5.143E+01	5.751E+02
5	3.516E-01	7.200E-01	1.167E+00	5.143E+01	5.751E+02
6	3.303E-01	6.353E-01	1.191E+00	5.143E+01	5.751E+02
7	3.210E-01	6.000E-01	1.200E+00	5.143E+01	5.751E+02

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TABLE 5

VELOCITY TRIANGLE PROGRAM NOMENCLATURE

PARAMETER	DESCRIPTION	UNITS
A	Annulus area	$in.^2$
AT	Acoustic velocity	ft/sec
CHD	Blade chord	inches
CP	Specific heat	$BTU/lb/^oR$
CU	Absolute tangential velocity	ft/sec
CUTIP	Inlet swirl at rotor tip	ft/sec
CX	Axial velocity	ft/sec
GAM	Blade stagger angle	degrees
P	Total pressure	PSIA
PHI	Inlet flow coefficient	-
PS	Static pressure	PSIA
PSI	Pressure coefficient	-
R	Radius	inches
RH	Hub radius	inches
RHO	Total density	lb/ft^3
RHOR	Density ratio = RHO/RHOS	-
RHOS	Static density	lb/ft^3
RN	Gas constant	$ft\ lb/lb^oR$
RT	Tip radius	inches
SOLIH	Blade hub solidity	-
SOLIT	Blade tip solidity	-
STRLN	Streamline location 1 = hub 7 = tip	-
T	Total temperature	^oR
THE	Blade camber angle	degrees
TS	Static temperature	^oR
U	Blade speed	ft/sec
W	Mass flow	lbs/sec
W(#)	Relative velocity	ft/sec
WU	Relative tangential velocity	ft/sec
XK	Ratio of specific heats	-

TABLE 5 (cont'd.)

VELOCITY TRIANGLE PROGRAM NOMENCLATURE

PARAMETER	DESCRIPTION	UNITS
XM	Axial Mach number	-
XMA	Absolute Mach number	-
XMR	Relative Mach number	-
XN	Rotation speed	RPM
ZN	Number of blades or vanes	-

SUBSCRIPTS

0	=	Inlet to guide vane
1	=	Guide vane exit or rotor inlet
2	=	Rotor exit

The ISRE solution was selected since the loss profiles for the stage in a helium gas environment are unknown. As described later, it is intended that the test establish the inlet guide vane and rotor loss profiles and that a non-isentropic (NISRE) solution can be accurately calculated from an updated loss model.

The inlet guide vane and rotor blade profiles were defined in accordance with the correlations from NASA-SP-36, per the experimental data generated from two-dimensional cascade data (Reference 1). The inlet guide vanes are NACA 65 series profiles with a nominal 10 percent thickness distribution on a circular-arc meanline. Allowances were made for optimum incidence, and deviation was calculated by the modified Carter's rule method. The calculated profile data for the inlet guide vanes is provided in Table 6 for several streamlines.

NACA 65 series profiles were also selected for the rotor blade sections with a 10 percent to 6 percent thickness taper from the hub to tip of the blade. The thickness distribution was calculated along a circular-arc meanline, similar to the guide vane sections. The incidence and deviation calculations were also based on the Reference 1 data and are listed along with the blade coordinate data in Table 7.

A projection of the inlet guide vanes and rotor blades was provided in Figure 4. The top view projection is 2.5 times scale with the blade sections radially stacked on the center of gravity. As shown in the flowpath cross-section (Figure 3), the rotor is integrally bladed, and the inlet guide vanes are adjustable.

Mechanical Design

The compressor test section is shown in Figure 9 as a split-section layout for a 2/3 hub-tip ratio and 8/10 hub-tip ratio design. The rotating section is composed of the compressor rotor, shaft, and coupling and is supported to the outer case on rolling-element bearings. A carbon face seal is located behind the compressor rotor to seal the test section.

The entire rotating section was analyzed on MTI's computer programs to determine the critical speed and rotor response characteristics to assure a stable operation in the range to be tested. The critical speed map shown in Figure 10

BLADE STACKING
TEST CASE II

INPUT

I = 7 (NUMBER OF SECTIONS) XN = 18 (NUMBER OF BLADES OR VANES)

J = 0 (CALCULATE INCIDENCE = 1)
(READ INCIDENCE = 0) L = 1 (THICKNESS DISTRIBUTION = 1 65 SERIES)
(THICKNESS DISTRIBUTION = 2 NCA)

K = 0 (CALCULATE DEVIATION = 1)
(READ DEVIATION = 0) M = 2 (ROTOR = 1)
(INLET GUIDE VANE = 2)

SUMMARY

RADIUS (R)	BETA 1 (B1)	BETA 2 (B2)	INCIDENCE (XI)	DEVIATION (DEV)	CHORD (CHD)	SOLIDITY (SOL)	BETA 1* (B1S)
6.0000E+00	65.000E+00	32.310E+00	-11.900E-01	67.000E-01	2.0940E+00	9.9981E-01	65.190E+00
5.8310E+00	65.000E+00	31.560E+00	-12.100E-01	68.500E-01	2.0350E+00	9.9980E-01	66.210E+00
5.4770E+00	65.000E+00	29.890E+00	-12.700E-01	71.900E-01	1.9120E+00	1.0001E+00	66.270E+00
5.0990E+00	65.000E+00	27.940E+00	-13.500E-01	75.900E-01	1.7800E+00	1.0001E+00	66.350E+00
4.6900E+00	65.000E+00	25.620E+00	-14.300E-01	80.700E-01	1.6370E+00	9.9993E-01	66.430E+00
4.2340E+00	65.000E+00	22.770E+00	-15.300E-01	86.500E-01	1.4780E+00	1.0000E+00	66.530E+00
4.0000E+00	65.000E+00	21.030E+00	-15.900E-01	89.900E-01	1.3960E+00	9.9981E-01	66.590E+00

BETA 2* (B2S)	TMAXC	LER	TER	CAMBER (CAM)	STAGGER (GAM)	DEFLECTION (DEF)	AXIAL CHORD (AXC)
25.610E+00	.1000E+00	.1439E-01	.1000E-01	40.580E+00	45.900E+00	32.690E+00	.1457E+01
24.710E+00	.1000E+00	.1398E-01	.1000E-01	41.500E+00	45.460E+00	33.440E+00	.1427E+01
22.700E+00	.1000E+00	.1314E-01	.1000E-01	43.570E+00	44.485E+00	35.110E+00	.1364E+01
20.350E+00	.1000E+00	.1223E-01	.1000E-01	45.000E+00	43.350E+00	37.060E+00	.1294E+01
17.550E+00	.1000E+00	.1125E-01	.1000E-01	48.980E+00	41.990E+00	39.380E+00	.1217E+01
14.120E+00	.1000E+00	.1015E-01	.1000E-01	52.410E+00	40.325E+00	42.230E+00	.1127E+01
12.100E+00	.1000E+00	.9591E-02	.1000E-01	54.490E+00	39.345E+00	43.910E+00	.1080E+01

Table 6 Inlet Guide Vane Coordinates

BLADE STACKING
TEST CASE I

INPUT

I = 7 (NUMBER OF SECTIONS)

J = 0 (CALCULATE INCIDENCE = 1)
(READ INCIDENCE = 0)

K = 0 (CALCULATE DEVIATION = 1)
(READ DEVIATION = 0)

XN = 19 (NUMBER OF BLADES OR VANES)

L = 1 (THICKNESS DISTRIBUTION = 1 65 SERIES)
(THICKNESS DISTRIBUTION = 2 DCA)

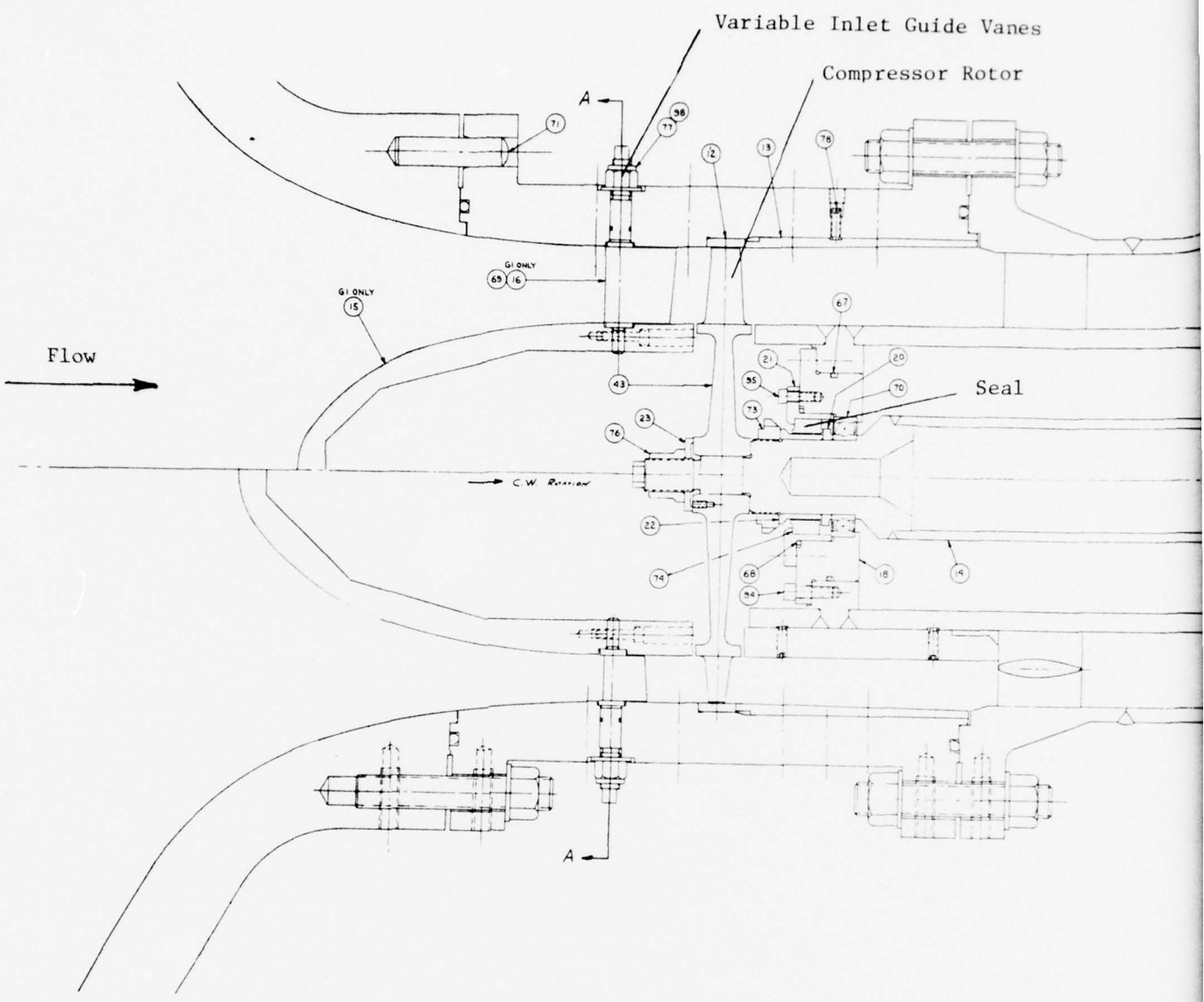
M = 1 (ROTOR = 1)
(INLET GUIDE VANE = 2)

SUMMARY

RADIUS (R)	BETA 1 (B1)	BETA 2 (B2)	INCIDENCE (XI)	DEVIATION (DEV)	CHORD (CHD)	SOLIDITY (SOL)	BETA 1* (B1S)
6.0000E+00	69.040E+00	63.860E+00	16.400E-01	33.700E-01	2.0000E+00	1.0080E+00	67.400E+00
5.8310E+00	68.760E+00	63.210E+00	15.300E-01	36.500E-01	2.0000E+00	1.0372E+00	67.230E+00
5.4770E+00	68.200E+00	61.740E+00	11.900E-01	43.300E-01	2.0000E+00	1.1042E+00	67.010E+00
5.0990E+00	67.610E+00	60.000E+00	65.000E-02	51.800E-01	2.0000E+00	1.1861E+00	66.960E+00
4.6900E+00	67.030E+00	57.890E+00	-80.000E-03	62.800E-01	2.0000E+00	1.2895E+00	67.110E+00
4.2430E+00	66.490E+00	55.240E+00	-11.700E-01	77.600E-01	2.0000E+00	1.4254E+00	67.660E+00
4.0000E+00	66.270E+00	53.650E+00	-19.800E-01	87.600E-01	2.0000E+00	1.5120E+00	68.250E+00

BETA 2* (B2S)	TMAXC	LER	TER	CAMBER (CAM)	STAGGER (GAM)	DEFLECTION (DEF)	AXIAL CHORD (AXC)
60.490E+00	.6000E-01	.1374E-01	.8000E-02	69.100E-01	63.945E+00	51.800E-01	.8785E+00
59.560E+00	.6340E-01	.1274E-01	.8000E-02	76.700E-01	63.395E+00	55.500E-01	.8957E+00
57.410E+00	.7050E-01	.1374E-01	.8000E-02	96.000E-01	62.210E+00	64.600E-01	.9325E+00
54.820E+00	.7800E-01	.1374E-01	.8000E-02	12.140E+00	60.890E+00	76.100E-01	.9730E+00
51.610E+00	.8620E-01	.1374E-01	.8000E-02	15.500E+00	59.360E+00	91.400E-01	.1019E+01
47.480E+00	.9510E-01	.1374E-01	.8000E-02	20.180E+00	57.570E+00	11.250E+00	.1073E+01
44.890E+00	.1000E+00	.1374E-01	.8000E-02	23.360E+00	56.570E+00	12.620E+00	.1102E+01

Table 7 Rotor Coordinates


Variable Inlet Guide Vanes
Compressor Rotor
Seal
Flow
A
A
GI ONLY
GI ONLY
C.W. ROTATION
71
38
77
12
13
78
69
16
15
67
21
20
95
70
73
43
23
76
22
74
68
18
14
94

(1)

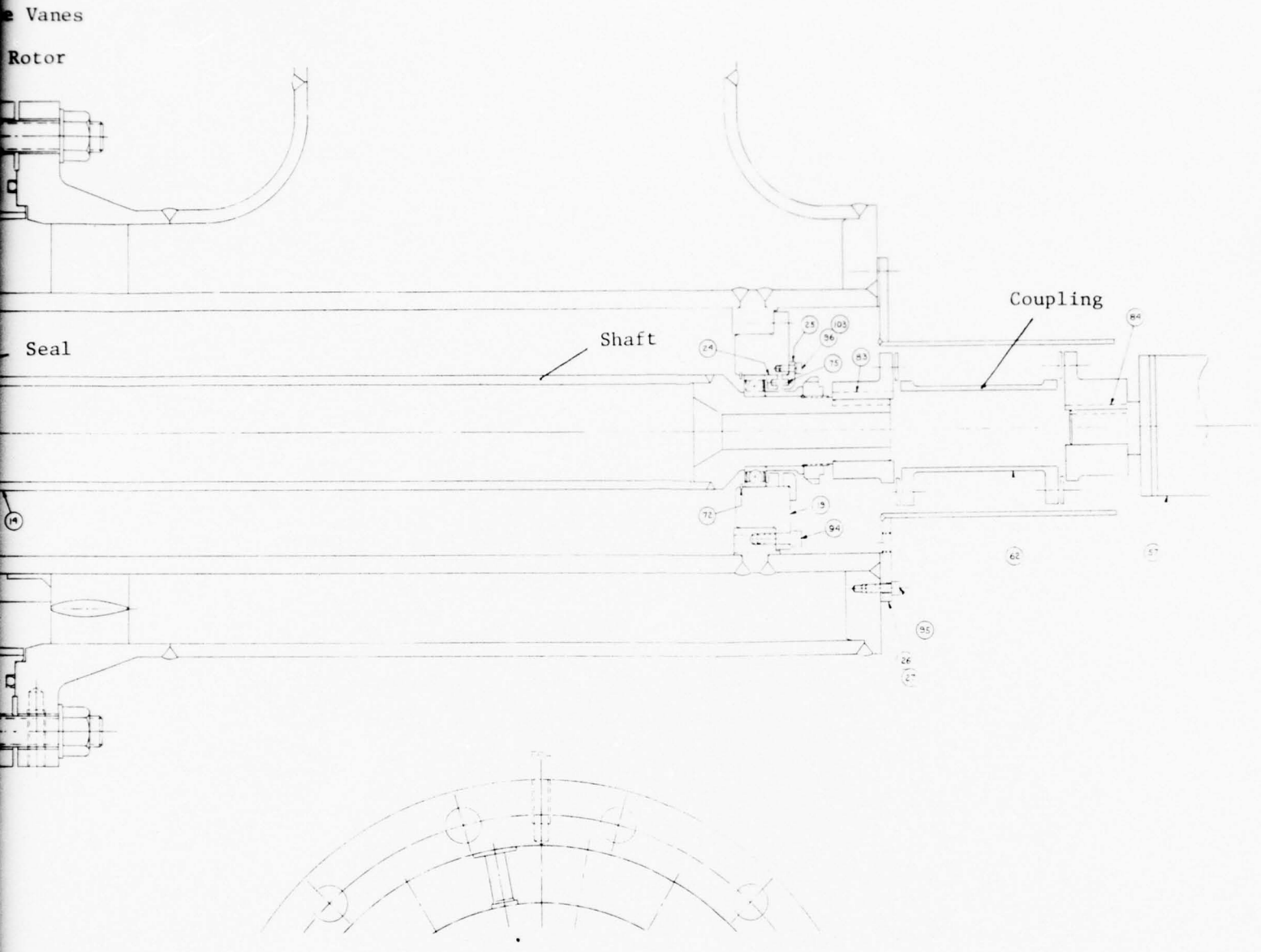


Fig. 9 ONR Compressor Test Section

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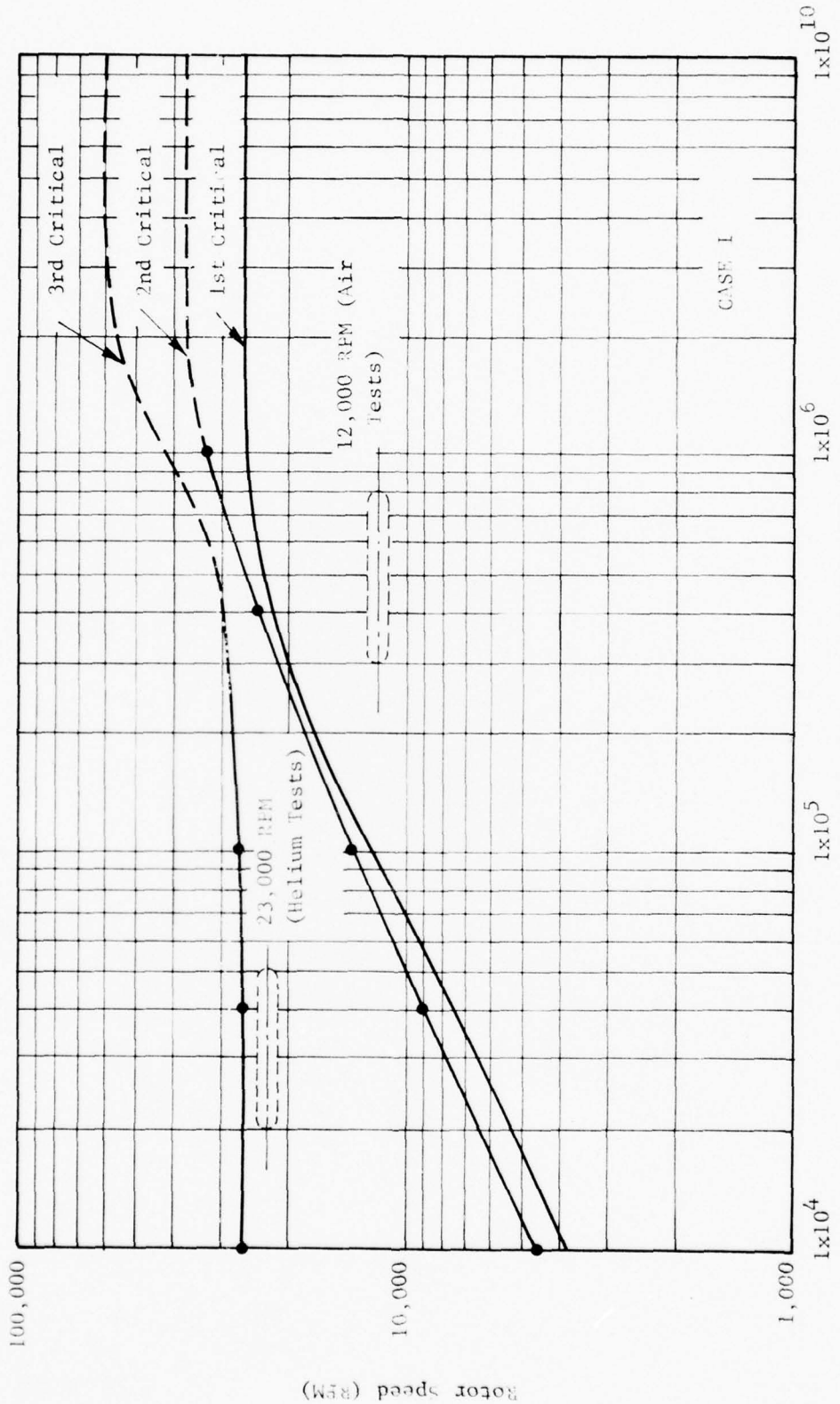


Fig. 10 Critical Speed Map ONR Compressor Test Section

displays two operating ranges for the test compressor. The air tests are conducted at a lower rotational speed to simulate a Reynold's number level based rotor blade chord measurement. At 12,000 speed, the rotating section is mounted on a relatively stiff support so that the testing is conducted below the first critical; a flexible bearing support is used on the helium gas tests to shift the operating characteristic between the second and third critical level.

Test Instrumentation

The instrumentation layout for the test loop is shown in Figure 11. The flow measurement section is equipped with the pressure and temperature probes to accurately measure the air or helium gas. Other measurements are made at the entry to the compressor; however, the detail aerodynamic characteristics will be evaluated based on the instrumentation located in the test section (Figure 12).

The test section instrumentation has been defined to evaluate inlet guide vane, rotor, and overall stage performance. At the stage inlet, the inlet total pressure and temperature are measured by four, five-element rakes (see Figure 12). A survey probe just upstream of the inlet guide vanes will be used to determine the radial profile at the compressor inlet. At the guide vane exit or rotor inlet (Plane 1), a total pressure and total temperature profile will be measured by a traverse probe. A similar probe is used at the Plane 2 to survey the rotor exit conditions. Approximately one-and-a half-chords downstream, multi-element total pressure and temperature rakes will measure stage exit conditions. Static pressure measurements are made at each station to provide a continuity check to the flow solution. The work input to the compressor will be calculated based on measured temperature rise across the stage and the measured torque from the strain-gauge torquemeter.

Test Data Analysis

The data taken from the compressor test will be analyzed so that the component performance can be accurately determined. Inlet guide vane performance will be measured in terms of total pressure loss and gas deflection across the vanes for a given loading. Rotor performance is evaluated similarly, with the pressure and temperature surveys, and the torquemeter used as a measurement of work.

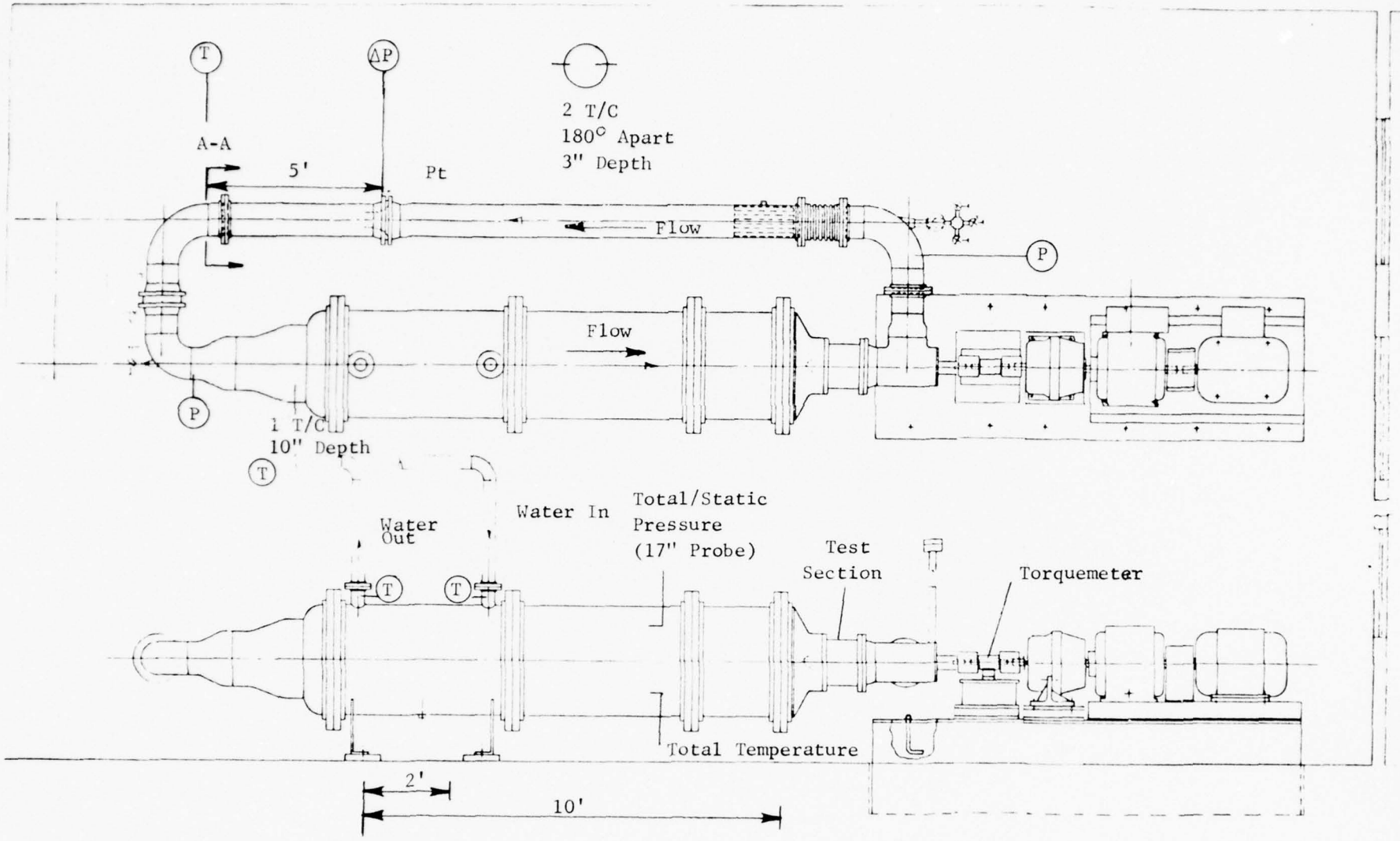


Fig. 11 ONR Test Loop Instrumentation

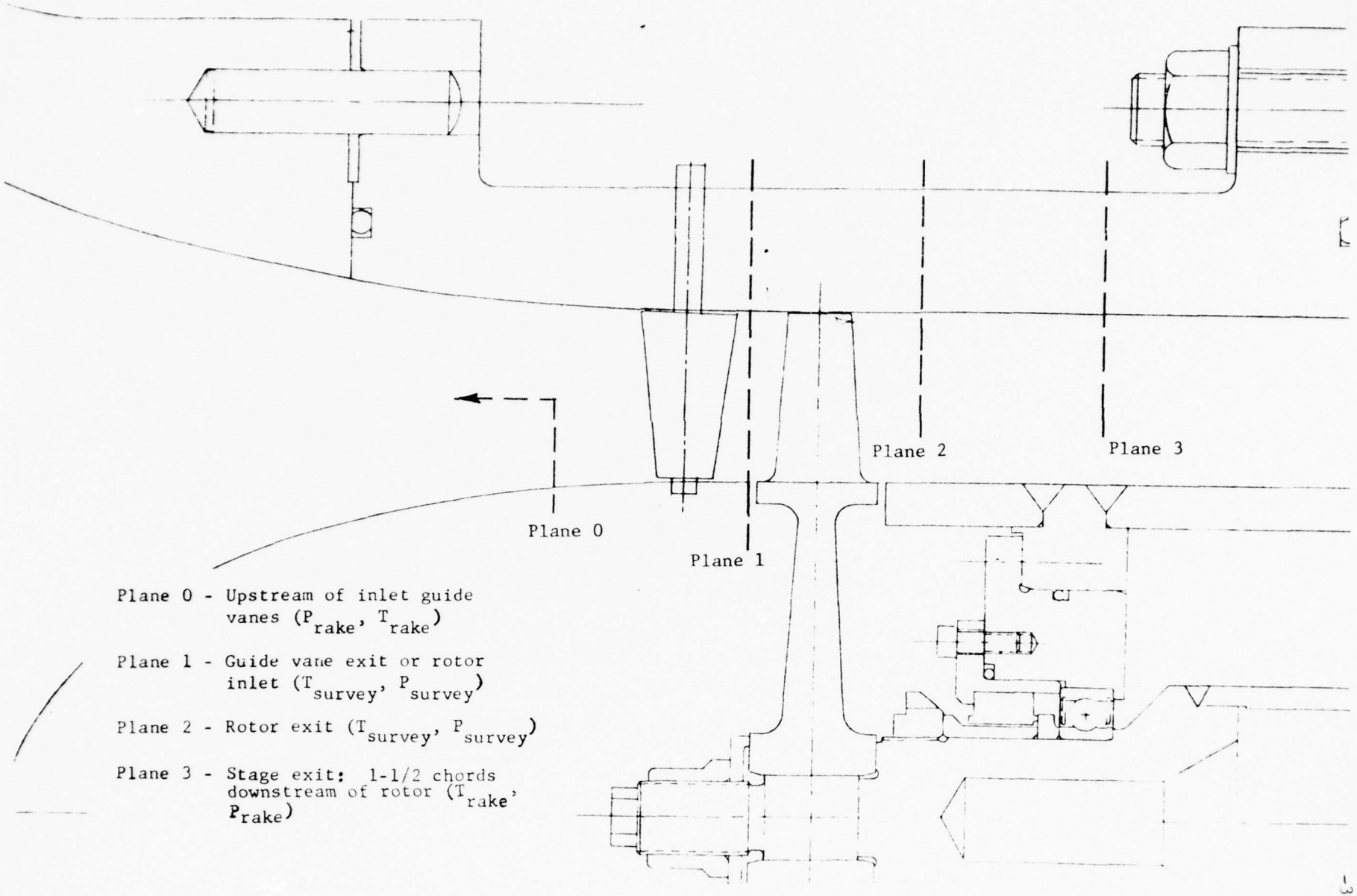


Fig. 12 ONR/Helium Cascade Test Section Instrumentation

The test data profiles established for each component will be analyzed on MTI Computer Program PN646 to provide a test data comparison to a full radial equilibrium flow calculation. Data matching the compressor test performance map to the computer generated compressor characteristics (such as shown in Figure 13) will provide a measurement to the guide vane and rotor loss models.

Tests in air and helium will be conducted over a range of blade chord Reynolds' number to establish effects on major parameters: flow, pressure ratio, work input, and surge margin. Data will be correlated on the 0.2 power relation examined in Reference 3, and subsequent treatments in References 4 and 5.

Test

A shakedown test was conducted on the motor drive/compressor test section in June 1977. The test assembly shown in Figure 14 was evaluated over the expected air test speed range to obtain baseline torquemeter readings for the "no-load" or zero datum conditions.

Although testing was shortened due to the electric motor developing a bearing problem, the no-load torque measurement up to 80 percent speed for air testing was completed (Figure 15). The curve shows that the parasitic losses are minimal, and the torquemeter will provide an accurate performance measurement.

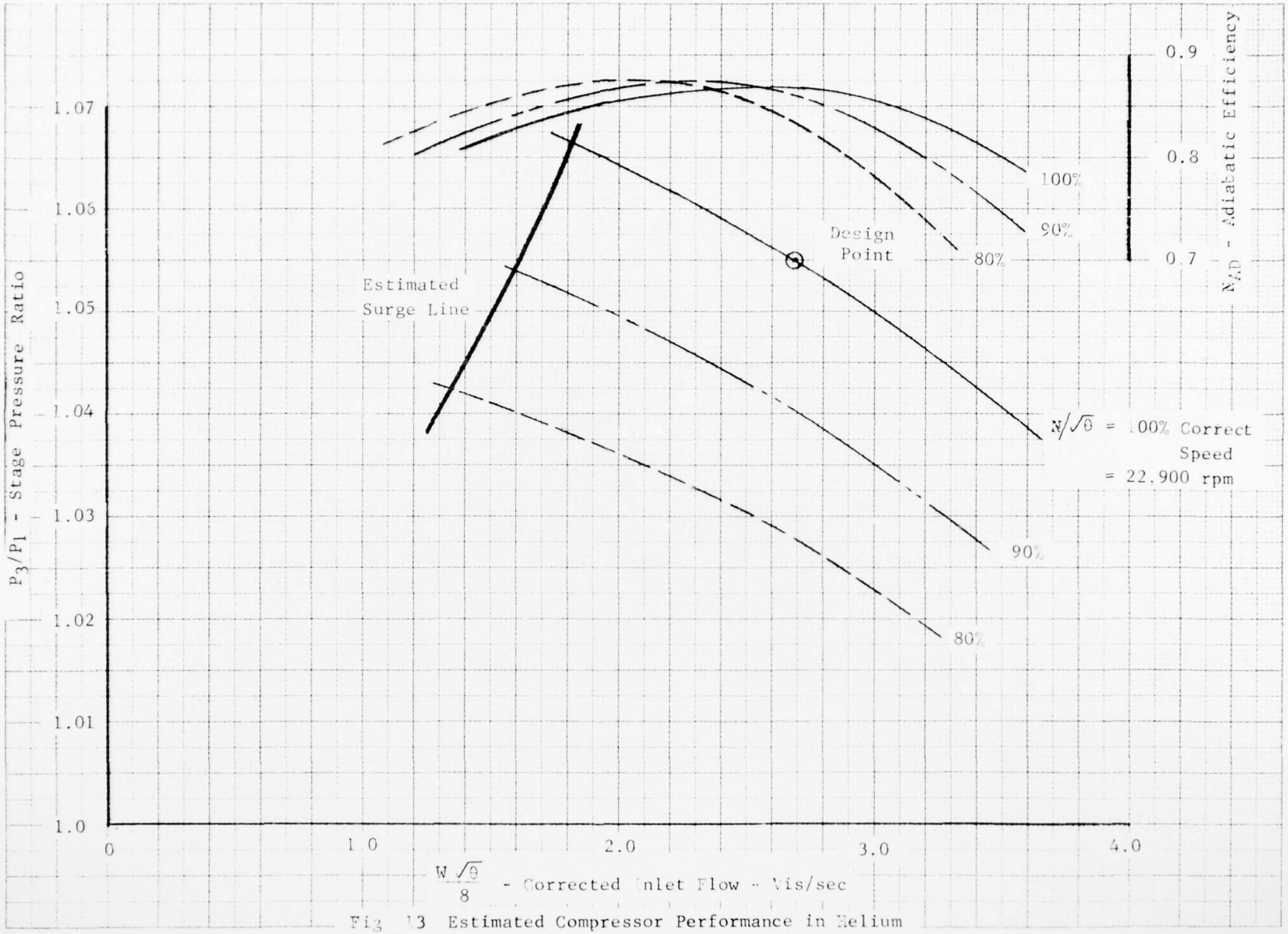


Fig 13 Estimated Compressor Performance in Helium

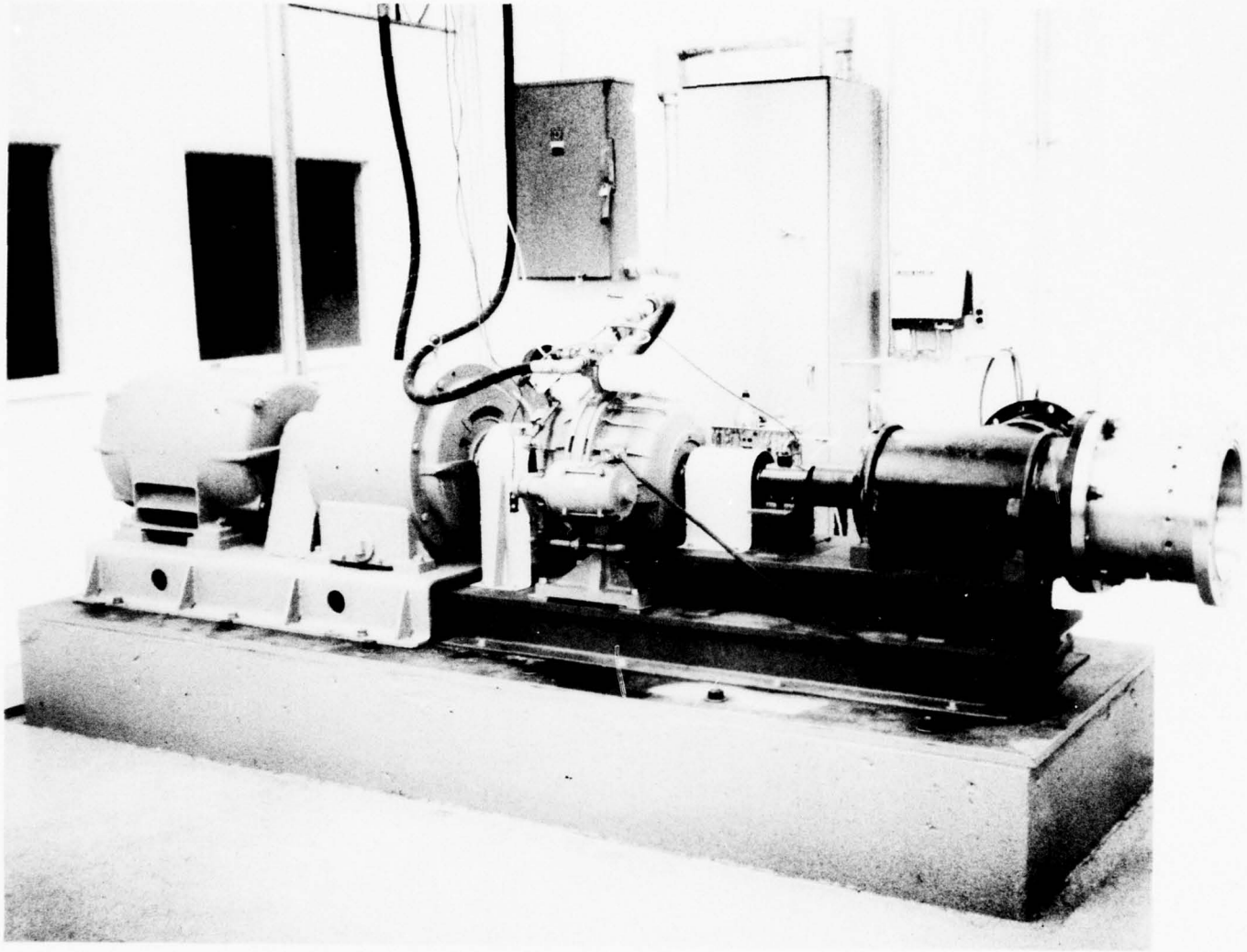


Fig. 14 ONR Test Drive and Compressor Test Section

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46 1510

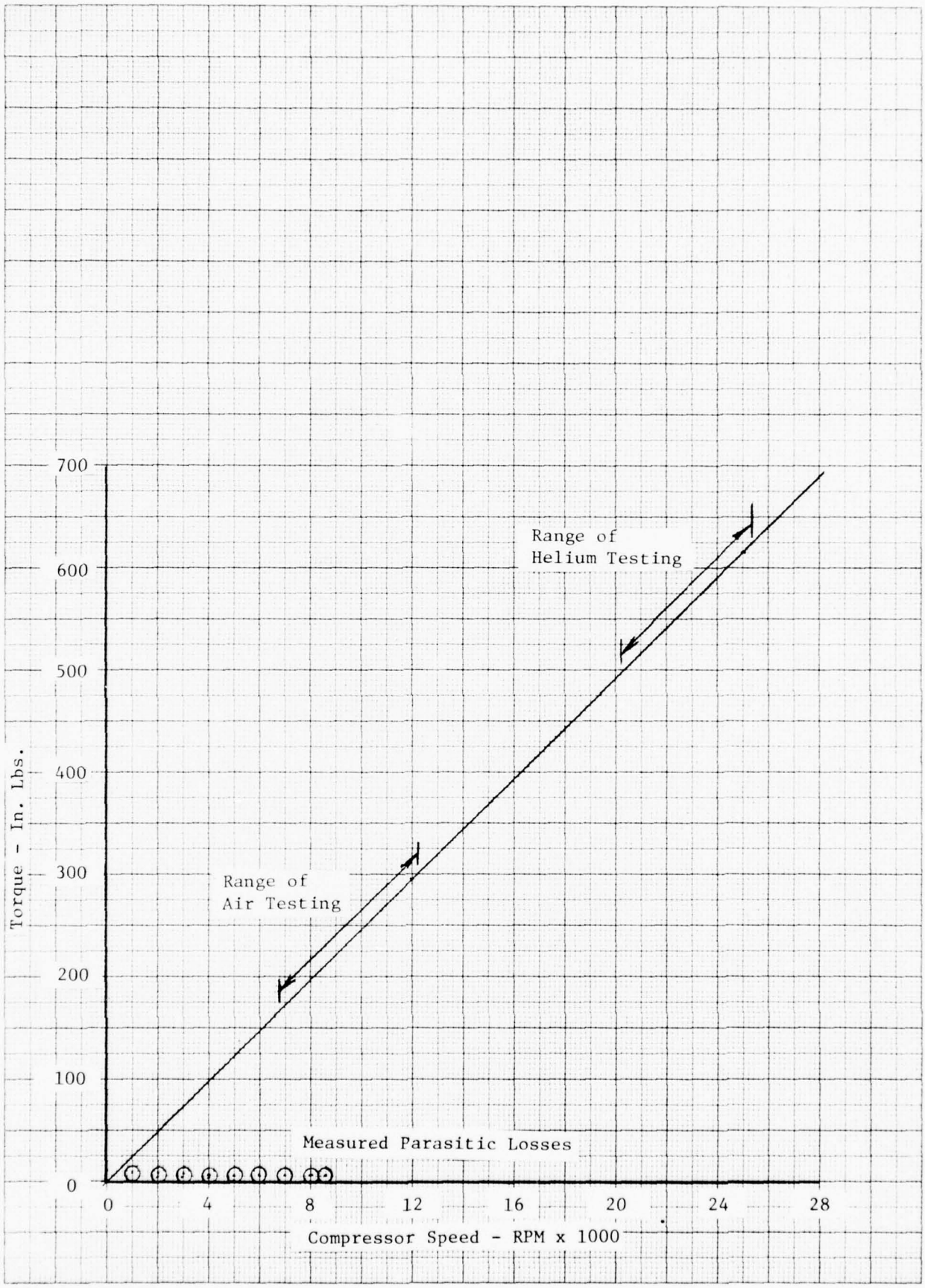


Fig. 15 ONR Test Compressor Parasitic Loss Test Measurement

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APPENDIX A

Table 6. Compressor Rotor Blade Coordinates

Table 7. Inlet Guide Vane Blade Coordinates

(Tables 6 and 7 are attached here in their entirety.)

BLADE STACKING
TEST CASE II

INPUT

I = 7 (NUMBER OF SECTIONS) XN = 18 (NUMBER OF BLADES OR VANES)

J = 0 (CALCULATE INCIDENCE = 1)
(READ INCIDENCE = 0) L = 1 (THICKNESS DISTRIBUTION = 1 65 SERIES)
(THICKNESS DISTRIBUTION = 2 DCA)

K = 0 (CALCULATE DEVIATION = 1)
(READ DEVIATION = 0) M = 2 (ROTOR = 1)
(INLET GUIDE VANE = 2)

SUMMARY

RADIUS (R)	BETA 1 (B1)	BETA 2 (B2)	INCIDENCE (XI)	DEVIATION (DEV)	CHORD (CHD)	SOLIDITY (SOL)	BETA 1* (B1S)
6.0000E+00	65.000E+00	32.310E+00	-11.900E-01	67.000E-01	2.0040E+00	9.9981E-01	66.190E+00
5.8310E+00	65.000E+00	31.560E+00	-12.100E-01	68.500E-01	2.0350E+00	9.9980E-01	66.210E+00
5.4770E+00	65.000E+00	29.890E+00	-12.700E-01	71.900E-01	1.9120E+00	1.0001E+00	66.270E+00
5.0990E+00	65.000E+00	27.940E+00	-13.500E-01	75.900E-01	1.7800E+00	1.0001E+00	66.350E+00
4.6900E+00	65.000E+00	25.620E+00	-14.300E-01	80.700E-01	1.6370E+00	9.9993E-01	66.430E+00
4.2340E+00	65.000E+00	22.770E+00	-15.300E-01	86.500E-01	1.4780E+00	1.0000E+00	66.530E+00
4.0000E+00	65.000E+00	21.030E+00	-15.900E-01	89.900E-01	1.3960E+00	9.9981E-01	66.590E+00

BETA 2* (B2S)	TMAXC	LER	TER	CAMBER (CAM)	STAGGER (GAM)	DEFLECTION (DEF)	AXIAL CHORD (AXC)
25.610E+00	.1000E+00	.1439E-01	.1000E-01	40.590E+00	45.900E+00	32.690E+00	.1457E+01
24.710E+00	.1000E+00	.1398E-01	.1000E-01	41.500E+00	45.460E+00	33.440E+00	.1427E+01
22.700E+00	.1000E+00	.1314E-01	.1000E-01	43.570E+00	44.485E+00	35.110E+00	.1364E+01
20.350E+00	.1000E+00	.1223E-01	.1000E-01	46.000E+00	43.350E+00	37.060E+00	.1294E+01
17.550E+00	.1000E+00	.1125E-01	.1000E-01	48.980E+00	41.990E+00	39.38[illegible]E+00	.1217E+01
14.120E+00	.1000E+00	.1015E-01	.1000E-01	52.410E+00	40.325E+00	42.230E+00	.1127E+01
12.100E+00	.1000E+00	.0591E-02	.1000E-01	54.490E+00	39.345E+00	43.910E+00	.1080E+01

Table 6 Inlet Guide Vane Coordinates

BLADE STACKING
TEST CASE II

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 6.00000E+00

LER	= .1439E-01	X CENTROID	= 15.172E-01	XRC	= 3.7623E+00
THMXC	= .1000E+00	Y CENTROID	= 17.172E-01	YRC	= -.2189E+00
		AREA	= 31.659E-02	RC	= 3.0193E+00
XLE	= .1006E+01			XTE	= .2448E+01
YLE	= .1013E+01			YTE	= .2499E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.89254E-01	1.01649E+00	1.00433E+00	1.00977E+00	1.01941E+00	1.00306E+00
9.88323E-01	1.02280E+00	1.00651E+00	1.01466E+00	1.02470E+00	1.00651E+00
9.88119E-01	1.03470E+00	1.01090E+00	1.02441E+00	1.03368E+00	1.01411E+00
9.91466E-01	1.06285E+00	1.02201E+00	1.04872E+00	1.05255E+00	1.03453E+00
1.00299E+00	1.11733E+00	1.04489E+00	1.09704E+00	1.08679E+00	1.07675E+00
1.01911E+00	1.17051E+00	1.06861E+00	1.14494E+00	1.11911E+00	1.11937E+00
1.03571E+00	1.22291E+00	1.09318E+00	1.19242E+00	1.15065E+00	1.16203E+00
1.07486E+00	1.32511E+00	1.14482E+00	1.28604E+00	1.21279E+00	1.24696E+00
1.12455E+00	1.42462E+00	1.19975E+00	1.37777E+00	1.27494E+00	1.33092E+00
1.17801E+00	1.52128E+00	1.25788E+00	1.46749E+00	1.33776E+00	1.41371E+00
1.23680E+00	1.61491E+00	1.31916E+00	1.55511E+00	1.40153E+00	1.49530E+00
1.30054E+00	1.70534E+00	1.38350E+00	1.64049E+00	1.46646E+00	1.57565E+00
1.36904E+00	1.79228E+00	1.45083E+00	1.72355E+00	1.53262E+00	1.65482E+00
1.44227E+00	1.87528E+00	1.52105E+00	1.80417E+00	1.59983E+00	1.73306E+00
1.52019E+00	1.95387E+00	1.59408E+00	1.88226E+00	1.66798E+00	1.81065E+00
1.60270E+00	2.02754E+00	1.66983E+00	1.95771E+00	1.73697E+00	1.88787E+00
1.68907E+00	2.09647E+00	1.74821E+00	2.03042E+00	1.80735E+00	1.96473E+00
1.77889E+00	2.16178E+00	1.82911E+00	2.10032E+00	1.88033E+00	2.03887E+00
1.86953E+00	2.22265E+00	1.91243E+00	2.16732E+00	1.95533E+00	2.11198E+00
1.96357E+00	2.27924E+00	1.99808E+00	2.23131E+00	2.03258E+00	2.18339E+00
2.05953E+00	2.33179E+00	2.08593E+00	2.29224E+00	2.11234E+00	2.25269E+00
2.15701E+00	2.38060E+00	2.17589E+00	2.35002E+00	2.19478E+00	2.31944E+00
2.25551E+00	2.42622E+00	2.26784E+00	2.40458E+00	2.28017E+00	2.38293E+00
2.35452E+00	2.46948E+00	2.36166E+00	2.45584E+00	2.36881E+00	2.44220E+00
2.45724E+00	2.50376E+00	2.45724E+00	2.50376E+00	2.45724E+00	2.50376E+00

BLADE STACKING
TEST CASE II

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 5.83100E+00

LER =	.1398E-01	X CENTROID =	15.057E-01	XRC =	3.6279E+00
TMAXC =	.1000E+00	Y CENTROID =	16.939E-01	YRC =	-.1585E+00
		AREA =	30.010E-02	RC =	2.8719E+00
XLE =	.1006E+01			XTE =	.2418E+01
YLE =	.1013E+01			YTE =	.2446E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.89542E-01	1.01604E+00	1.00421E+00	1.00951E+00	1.01888E+00	1.00298E+00
9.88635E-01	1.02218E+00	1.00633E+00	1.01426E+00	1.02403E+00	1.00634E+00
9.88435E-01	1.03376E+00	1.01060E+00	1.02374E+00	1.03276E+00	1.01373E+00
9.91692E-01	1.06114E+00	1.02141E+00	1.04739E+00	1.05112E+00	1.03365E+00
1.00292E+00	1.11415E+00	1.04367E+00	1.09439E+00	1.08442E+00	1.07463E+00
1.01768E+00	1.16589E+00	1.06678E+00	1.14098E+00	1.11588E+00	1.11606E+00
1.03486E+00	1.21677E+00	1.09073E+00	1.18714E+00	1.14659E+00	1.15751E+00
1.07508E+00	1.31627E+00	1.14111E+00	1.27812E+00	1.20715E+00	1.23997E+00
1.12175E+00	1.41300E+00	1.19476E+00	1.36722E+00	1.26774E+00	1.32144E+00
1.17409E+00	1.50692E+00	1.25160E+00	1.45432E+00	1.32910E+00	1.40171E+00
1.23169E+00	1.59784E+00	1.31155E+00	1.53930E+00	1.39142E+00	1.48077E+00
1.29418E+00	1.68556E+00	1.37455E+00	1.62206E+00	1.45491E+00	1.55855E+00
1.36134E+00	1.76982E+00	1.44049E+00	1.70248E+00	1.51965E+00	1.63514E+00
1.43315E+00	1.85016E+00	1.50931E+00	1.78046E+00	1.58547E+00	1.71076E+00
1.50956E+00	1.92611E+00	1.58090E+00	1.85590E+00	1.65225E+00	1.78569E+00
1.59045E+00	1.99718E+00	1.65518E+00	1.92869E+00	1.71991E+00	1.86021E+00
1.67512E+00	2.06353E+00	1.73205E+00	1.99875E+00	1.78898E+00	1.93397E+00
1.76216E+00	2.12629E+00	1.81140E+00	2.06598E+00	1.86064E+00	2.00568E+00
1.85195E+00	2.18463E+00	1.89313E+00	2.13030E+00	1.93432E+00	2.07596E+00
1.94407E+00	2.23870E+00	1.97714E+00	2.19161E+00	2.01022E+00	2.14452E+00
2.03804E+00	2.28874E+00	2.06332E+00	2.24984E+00	2.08859E+00	2.21093E+00
2.13348E+00	2.33505E+00	2.15154E+00	2.30491E+00	2.16961E+00	2.27477E+00
2.22991E+00	2.37815E+00	2.24171E+00	2.35675E+00	2.25350E+00	2.33534E+00
2.32683E+00	2.41888E+00	2.33369E+00	2.40529E+00	2.34055E+00	2.39170E+00
2.42736E+00	2.45047E+00	2.42736E+00	2.45047E+00	2.42736E+00	2.45047E+00

BLADE STACKING
TEST CASE II

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 5.47700E+00

LER =	.1314E-01	X CENTROID =	14.815E-01	XRC =	3.3582E+00
TMAXC =	.1000E+00	Y CENTROID =	16.453E-01	YRC =	-.3663E-01
		AREA =	26.718E-02	RC =	2.5760E+00
XLE =	.1005E+01			XTE =	.2355E+01
YLE =	.1012E+01			YTE =	.2376E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.90138E-01	1.01510E+00	1.00396E+00	1.00898E+00	1.01778E+00	1.00282E+00
9.89280E-01	1.02087E+00	1.00595E+00	1.01343E+00	1.02262E+00	1.00599E+00
9.89086E-01	1.03178E+00	1.00996E+00	1.02237E+00	1.03083E+00	1.01295E+00
9.92148E-01	1.05758E+00	1.02013E+00	1.04464E+00	1.04812E+00	1.03170E+00
1.00275E+00	1.10752E+00	1.04111E+00	1.08889E+00	1.07947E+00	1.07626E+00
1.01672E+00	1.15623E+00	1.06292E+00	1.13273E+00	1.10912E+00	1.10920E+00
1.03303E+00	1.20419E+00	1.08557E+00	1.17616E+00	1.13811E+00	1.14812E+00
1.07129E+00	1.29786E+00	1.13331E+00	1.26167E+00	1.19534E+00	1.22547E+00
1.11578E+00	1.38884E+00	1.18427E+00	1.34530E+00	1.25276E+00	1.30176E+00
1.16579E+00	1.47705E+00	1.23838E+00	1.42694E+00	1.31096E+00	1.37682E+00
1.22088E+00	1.56231E+00	1.29554E+00	1.50646E+00	1.37020E+00	1.45060E+00
1.28071E+00	1.64442E+00	1.35569E+00	1.58375E+00	1.43067E+00	1.52308E+00
1.34505E+00	1.72311E+00	1.41873E+00	1.65870E+00	1.49241E+00	1.59429E+00
1.41387E+00	1.79792E+00	1.48458E+00	1.73120E+00	1.55529E+00	1.66449E+00
1.48708E+00	1.86839E+00	1.55313E+00	1.80114E+00	1.61914E+00	1.73389E+00
1.56457E+00	1.93405E+00	1.62430E+00	1.86842E+00	1.68402E+00	1.80280E+00
1.64562E+00	1.99505E+00	1.69797E+00	1.93296E+00	1.75031E+00	1.87086E+00
1.72890E+00	2.05252E+00	1.77404E+00	1.99464E+00	1.81917E+00	1.93677E+00
1.81478E+00	2.10561E+00	1.85240E+00	2.05339E+00	1.89001E+00	2.00118E+00
1.90282E+00	2.15445E+00	1.93293E+00	2.10912E+00	1.96304E+00	2.06379E+00
1.99260E+00	2.19929E+00	2.01553E+00	2.16175E+00	2.03845E+00	2.12421E+00
2.08372E+00	2.24039E+00	2.10006E+00	2.21119E+00	2.11641E+00	2.18208E+00
2.17575E+00	2.27829E+00	2.18642E+00	2.25739E+00	2.19709E+00	2.23650E+00
2.26822E+00	2.31375E+00	2.27447E+00	2.30029E+00	2.28072E+00	2.28685E+00
2.36409E+00	2.33978E+00	2.36409E+00	2.33978E+00	2.36409E+00	2.33978E+00

BLADE STACKING
TEST CASE II

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 5.09900E+00

LER =	.1223E-01	X CENTROID =	14.550E-01	XRC =	3.0565E+00
TMAXC =	.1000E+00	Y CENTROID =	15.032E-01	YRC =	.8627E-01
		AREA =	23.400E-02	RC =	2.2778E+00
XLE =	.1005E+01			XTE =	.2285E+01
YLE =	.1011E+01			YTE =	.2218E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.90776E-01	1.01408E+00	1.00368E+00	1.00837E+00	1.01659E+00	1.00265E+00
9.89969E-01	1.01948E+00	1.00554E+00	1.01255E+00	1.02111E+00	1.00562E+00
9.89780E-01	1.02966E+00	1.00927E+00	1.02089E+00	1.02877E+00	1.01212E+00
9.92629E-01	1.05376E+00	1.01876E+00	1.04169E+00	1.04489E+00	1.02962E+00
1.00255E+00	1.10042E+00	1.03835E+00	1.08300E+00	1.07415E+00	1.06558E+00
1.01568E+00	1.14595E+00	1.05877E+00	1.12390E+00	1.10186E+00	1.10185E+00
1.03103E+00	1.19070E+00	1.08003E+00	1.16439E+00	1.12897E+00	1.13809E+00
1.06715E+00	1.27812E+00	1.12488E+00	1.24404E+00	1.18262E+00	1.20997E+00
1.10928E+00	1.36293E+00	1.17293E+00	1.32183E+00	1.23658E+00	1.28074E+00
1.15672E+00	1.44504E+00	1.22405E+00	1.39763E+00	1.29139E+00	1.35022E+00
1.20908E+00	1.52425E+00	1.27818E+00	1.47132E+00	1.34729E+00	1.41839E+00
1.26599E+00	1.60035E+00	1.33522E+00	1.54277E+00	1.40445E+00	1.48519E+00
1.32724E+00	1.67307E+00	1.39509E+00	1.61188E+00	1.46293E+00	1.55069E+00
1.39277E+00	1.74197E+00	1.45767E+00	1.67853E+00	1.52258E+00	1.61509E+00
1.46248E+00	1.80660E+00	1.52289E+00	1.74261E+00	1.58329E+00	1.67862E+00
1.53622E+00	1.86650E+00	1.59062E+00	1.80403E+00	1.64502E+00	1.74156E+00
1.61330E+00	1.92181E+00	1.66076E+00	1.86268E+00	1.70822E+00	1.80355E+00
1.69244E+00	1.97364E+00	1.73220E+00	1.91846E+00	1.77396E+00	1.86324E+00
1.77400E+00	2.02116E+00	1.80782E+00	1.97130E+00	1.84164E+00	1.92144E+00
1.85756E+00	2.06446E+00	1.88450E+00	2.02109E+00	1.91144E+00	1.97772E+00
1.94269E+00	2.10379E+00	1.96311E+00	2.06777E+00	1.98354E+00	2.03175E+00
2.02904E+00	2.13941E+00	2.04354E+00	2.11126E+00	2.05804E+00	2.08311E+00
2.11619E+00	2.17181E+00	2.12565E+00	2.15148E+00	2.13513E+00	2.13116E+00
2.20373E+00	2.20173E+00	2.20930E+00	2.18838E+00	2.21487E+00	2.17503E+00
2.29437E+00	2.22189E+00	2.29437E+00	2.22189E+00	2.29437E+00	2.22189E+00

BLADE STACKING
TEST CASE II

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 4.69000E+00

LER	= .1125E-01	X CENTROID	= 14.260E-01	XRC	= 2.8133E+00
TMAXC	= .1000E+00	Y CENTROID	= 15.366E-01	YRC	= .2089E+00
		AREA	= 20.052E-02	RC	= 1.9783E+00
XLE	= .1005E+01			XTE	= .2207E+01
YLE	= .1010E+01			YTE	= .2092E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.91471E+01	1.01299E+00	1.00339E+00	1.00773E+00	1.01531E+00	1.00247E+00
9.90722E-01	1.01797E+00	1.00510E+00	1.01159E+00	1.01948E+00	1.00520E+00
9.90540E-01	1.02737E+00	1.00854E+00	1.01929E+00	1.02654E+00	1.01121E+00
9.93166E-01	1.04963E+00	1.01728E+00	1.03849E+00	1.04140E+00	1.02735E+00
1.00236E+00	1.09272E+00	1.03538E+00	1.07660E+00	1.06840E+00	1.06049E+00
1.01457E+00	1.13477E+00	1.05429E+00	1.11432E+00	1.09401E+00	1.09388E+00
1.02889E+00	1.17608E+00	1.07400E+00	1.15163E+00	1.11911E+00	1.12718E+00
1.06269E+00	1.25671E+00	1.11578E+00	1.22494E+00	1.16887E+00	1.19316E+00
1.10224E+00	1.33483E+00	1.16065E+00	1.29640E+00	1.21906E+00	1.25796E+00
1.14688E+00	1.41032E+00	1.20852E+00	1.36588E+00	1.27017E+00	1.32143E+00
1.19622E+00	1.48297E+00	1.25932E+00	1.43326E+00	1.32242E+00	1.38354E+00
1.24992E+00	1.55258E+00	1.31294E+00	1.49841E+00	1.37597E+00	1.44424E+00
1.30775E+00	1.61885E+00	1.36929E+00	1.56121E+00	1.43084E+00	1.50358E+00
1.36963E+00	1.68137E+00	1.42827E+00	1.62156E+00	1.48691E+00	1.56175E+00
1.43544E+00	1.73969E+00	1.48977E+00	1.67933E+00	1.54410E+00	1.61897E+00
1.50500E+00	1.79339E+00	1.55367E+00	1.73443E+00	1.60235E+00	1.67548E+00
1.57766E+00	1.84256E+00	1.61987E+00	1.78676E+00	1.66208E+00	1.73095E+00
1.65218E+00	1.88837E+00	1.68824E+00	1.83621E+00	1.72430E+00	1.78405E+00
1.72891E+00	1.92991E+00	1.75865E+00	1.88270E+00	1.78840E+00	1.83549E+00
1.80744E+00	1.96731E+00	1.83099E+00	1.92615E+00	1.85453E+00	1.88499E+00
1.88738E+00	2.00078E+00	1.90511E+00	1.96648E+00	1.92283E+00	1.93217E+00
1.96838E+00	2.03056E+00	1.98088E+00	2.00360E+00	1.99339E+00	1.97664E+00
2.05004E+00	2.05714E+00	2.05817E+00	2.03747E+00	2.06629E+00	2.01779E+00
2.13203E+00	2.08120E+00	2.13683E+00	2.06800E+00	2.14163E+00	2.05480E+00
2.21672E+00	2.09515E+00	2.21672E+00	2.09515E+00	2.21672E+00	2.09515E+00

BLADE STACKING
TEST CASE II

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 4.23400E+00

LER	= .1015E-01	X CENTROID	= 13.929E-01	XRC	= 2.5351E+00
TMAXC	= .1000E+00	Y CENTROID	= 14.738E-01	YRC	= .3335E+00
		AREA	= 16.631E-02	RC	= 1.6735E+00
XLE	= .1004E+01			XTE	= .2117E+01
YLE	= .1000E+01			YTE	= .1954E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.92246E-01	1.01177E+00	1.00306E+00	1.00701E+00	1.01388E+00	1.00226E+00
9.91561E-01	1.01629E+00	1.00461E+00	1.01052E+00	1.01766E+00	1.00474E+00
9.91389E-01	1.02482E+00	1.00772E+00	1.01751E+00	1.02405E+00	1.01019E+00
9.93746E-01	1.04503E+00	1.01564E+00	1.03493E+00	1.03752E+00	1.02483E+00
1.00215E+00	1.0 414E+00	1.03208E+00	1.06949E+00	1.04201E+00	1.05483E+00
1.01333E+00	1.12231E+00	1.04930E+00	1.12366E+00	1.04528E+00	1.08501E+00
1.02649E+00	1.15979E+00	1.06730E+00	1.17743E+00	1.10812E+00	1.11508E+00
1.05766E+00	1.23288E+00	1.10559E+00	1.23370E+00	1.13353E+00	1.17452E+00
1.09426E+00	1.30357E+00	1.14887E+00	1.29815E+00	1.15948E+00	1.23273E+00
1.13570E+00	1.37171E+00	1.19105E+00	1.33764E+00	1.20642E+00	1.28957E+00
1.18158E+00	1.43709E+00	1.23805E+00	1.37104E+00	1.26453E+00	1.34500E+00
1.23158E+00	1.49949E+00	1.28776E+00	1.44224E+00	1.32394E+00	1.39898E+00
1.28547E+00	1.55864E+00	1.34008E+00	1.50510E+00	1.38469E+00	1.45156E+00
1.34313E+00	1.61412E+00	1.39489E+00	1.55851E+00	1.44665E+00	1.50290E+00
1.40443E+00	1.66552E+00	1.45210E+00	1.60936E+00	1.49976E+00	1.55320E+00
1.46915E+00	1.71240E+00	1.51155E+00	1.65754E+00	1.55397E+00	1.60247E+00
1.53669E+00	1.75488E+00	1.57317E+00	1.70295E+00	1.60965E+00	1.65101E+00
1.60585E+00	1.79412E+00	1.63679E+00	1.74549E+00	1.66772E+00	1.69887E+00
1.67698E+00	1.82920E+00	1.70228E+00	1.78509E+00	1.72759E+00	1.74038E+00
1.74968E+00	1.86021E+00	1.76952E+00	1.82164E+00	1.78936E+00	1.78303E+00
1.82358E+00	1.88737E+00	1.83836E+00	1.85509E+00	1.85314E+00	1.82281E+00
1.89834E+00	1.91090E+00	1.90866E+00	1.88535E+00	1.91897E+00	1.85980E+00
1.97363E+00	1.93124E+00	1.98026E+00	1.91237E+00	1.98690E+00	1.89349E+00
2.04912E+00	1.94909E+00	2.05303E+00	1.93608E+00	2.05604E+00	1.92308E+00
2.12681E+00	1.95645E+00	2.12681E+00	1.95645E+00	2.12681E+00	1.95645E+00

BLADE STACKING
TEST CASE II

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 4.23400E+00

LER =	.1015E-01	X CENTROID =	13.929E-01	XRC =	2.5351E+00
TMAXC =	.1000E+00	Y CENTROID =	14.738E-01	YRC =	.3335E+00
		AREA =	16.631E-02	RC =	1.6735E+00
XLE =	.1004E+01			XTE =	.2117E+01
YLE =	.1009E+01			YTE =	.1954E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.92246E-01	1.01177E+00	1.00306E+00	1.00701E+00	1.01388E+00	1.00226E+00
9.91561E-01	1.01629E+00	1.00461E+00	1.01052E+00	1.01766E+00	1.00474E+00
9.91389E-01	1.02482E+00	1.00772E+00	1.01751E+00	1.02405E+00	1.01019E+00
9.93766E-01	1.04503E+00	1.01564E+00	1.03493E+00	1.03752E+00	1.02483E+00
1.00215E+00	1.08414E+00	1.03208E+00	1.06949E+00	1.06201E+00	1.05483E+00
1.01333E+00	1.12231E+00	1.04930E+00	1.10366E+00	1.08528E+00	1.08501E+00
1.02649E+00	1.15979E+00	1.06730E+00	1.13743E+00	1.10812E+00	1.11508E+00
1.05766E+00	1.23288E+00	1.10559E+00	1.20370E+00	1.15353E+00	1.17452E+00
1.09426E+00	1.30357E+00	1.14687E+00	1.26815E+00	1.19948E+00	1.23273E+00
1.13570E+00	1.37171E+00	1.19105E+00	1.33064E+00	1.24642E+00	1.28957E+00
1.18158E+00	1.43709E+00	1.23805E+00	1.39104E+00	1.29453E+00	1.34500E+00
1.23158E+00	1.49949E+00	1.28776E+00	1.44924E+00	1.34394E+00	1.39898E+00
1.28547E+00	1.55864E+00	1.34008E+00	1.50510E+00	1.39469E+00	1.45156E+00
1.34313E+00	1.61412E+00	1.39489E+00	1.55851E+00	1.44666E+00	1.50290E+00
1.40443E+00	1.66552E+00	1.45210E+00	1.60936E+00	1.49976E+00	1.55320E+00
1.46915E+00	1.71240E+00	1.51156E+00	1.65754E+00	1.55397E+00	1.60267E+00
1.53669E+00	1.75488E+00	1.57317E+00	1.70295E+00	1.60965E+00	1.65101E+00
1.60585E+00	1.79412E+00	1.63679E+00	1.74549E+00	1.66772E+00	1.69687E+00
1.67698E+00	1.82920E+00	1.70228E+00	1.78509E+00	1.72759E+00	1.74098E+00
1.74968E+00	1.86021E+00	1.76952E+00	1.82164E+00	1.78936E+00	1.78308E+00
1.82358E+00	1.88737E+00	1.83836E+00	1.85509E+00	1.85314E+00	1.82281E+00
1.89834E+00	1.91090E+00	1.90866E+00	1.88535E+00	1.91897E+00	1.85980E+00
1.97363E+00	1.93126E+00	1.98026E+00	1.91237E+00	1.98690E+00	1.89348E+00
2.04912E+00	1.94909E+00	2.05303E+00	1.93608E+00	2.05694E+00	1.92308E+00
2.12681E+00	1.95645E+00	2.12681E+00	1.95645E+00	2.12681E+00	1.95645E+00

BLADE STACKING
TEST CASE II

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 4.00000E+00

LER =	.3591E-02	X CENTROID =	13.757E-01	XRC =	2.3992E+00
TMAXC =	.1000E+00	Y CENTROID =	14.412E-01	YRC =	.3942E+00
		AREA =	14.994E-02	RC =	1.5247E+00
XLE =	.1004E+01			XTE =	.2170E+01
YLE =	.1009E+01			YTE =	.1483E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.92645E-01	1.01114E+00	1.00290E+00	1.00665E+00	1.01315E+00	1.00215E+00
9.91993E-01	1.01542E+00	1.00436E+00	1.00996E+00	1.01672E+00	1.00451E+00
9.91826E-01	1.02351E+00	1.00730E+00	1.01659E+00	1.02277E+00	1.00967E+00
9.94074E-01	1.04266E+00	1.01480E+00	1.03309E+00	1.03552E+00	1.02353E+00
1.00204E+00	1.07973E+00	1.03038E+00	1.06532E+00	1.05872E+00	1.05192E+00
1.01268E+00	1.11590E+00	1.04673E+00	1.09818E+00	1.08078E+00	1.08045E+00
1.02524E+00	1.15141E+00	1.06385E+00	1.13013E+00	1.10245E+00	1.10885E+00
1.05505E+00	1.22061E+00	1.10034E+00	1.19277E+00	1.14562E+00	1.14493E+00
1.09014E+00	1.28747E+00	1.13976E+00	1.25361E+00	1.18939E+00	1.21975E+00
1.12991E+00	1.35193E+00	1.18204E+00	1.31250E+00	1.23416E+00	1.27318E+00
1.17400E+00	1.41346E+00	1.22705E+00	1.36932E+00	1.28012E+00	1.32518E+00
1.22208E+00	1.47215E+00	1.27473E+00	1.42393E+00	1.32739E+00	1.37571E+00
1.27391E+00	1.52763E+00	1.32495E+00	1.47622E+00	1.37599E+00	1.42491E+00
1.32938E+00	1.57968E+00	1.37760E+00	1.52606E+00	1.42582E+00	1.47264E+00
1.38831E+00	1.62730E+00	1.43255E+00	1.57334E+00	1.47679E+00	1.51938E+00
1.45051E+00	1.67067E+00	1.48969E+00	1.61775E+00	1.52887E+00	1.56523E+00
1.51536E+00	1.70970E+00	1.54899E+00	1.65960E+00	1.58241E+00	1.60990E+00
1.58171E+00	1.74556E+00	1.61001E+00	1.69879E+00	1.63830E+00	1.65202E+00
1.64990E+00	1.77730E+00	1.67291E+00	1.73483E+00	1.69592E+00	1.69239E+00
1.71954E+00	1.80563E+00	1.73745E+00	1.76783E+00	1.75537E+00	1.73064E+00
1.79025E+00	1.82894E+00	1.80349E+00	1.79774E+00	1.81674E+00	1.76653E+00
1.86172E+00	1.84927E+00	1.87088E+00	1.82447E+00	1.88004E+00	1.79965E+00
1.93362E+00	1.86644E+00	1.93946E+00	1.84736E+00	1.94530E+00	1.82940E+00
2.00567E+00	1.88107E+00	2.00908E+00	1.86817E+00	2.01250E+00	1.85527E+00
2.07959E+00	1.88505E+00	2.07959E+00	1.88505E+00	2.07959E+00	1.88505E+00

BLADE STACKING
TEST CASE II

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 5.00000E+00

ROTAT = -55.00E+00 (ROTATION ANGLE)

XCC =	3.000E+00	(X COORDINATE OF C.G. STACKING POINT)	YCC =	3.000E+00	(Y COORDINATE OF C.G. STACKING POINT)
LER =	1.439E-02	(LEADING EDGE RADIUS)	TER =	1.000E-02	(TRAILING EDGE RADIUS)
XXLE=	2.146E+00	(LEADING EDGE COORDINATE)	XXTE=	4.102E+00	(TRAILING EDGE COORDINATE)
YYLE=	3.166E+00	(LEADING EDGE COORDINATE)	YYTE=	2.487E+00	(TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.13139E+00	3.16564E+00	2.13139E+00	3.16564E+00	2.13139E+00	3.16564E+00
2.14180E+00	3.18235E+00	2.14208E+00	3.14584E+00	2.14237E+00	3.14933E+00
2.14712E+00	3.18585E+00	2.14743E+00	3.16593E+00	2.14774E+00	3.14600E+00
2.15782E+00	3.19107E+00	2.15812E+00	3.16607E+00	2.15842E+00	3.14108E+00
2.18475E+00	3.19993E+00	2.18485E+00	3.16627E+00	2.18495E+00	3.13261E+00
2.23899E+00	3.21251E+00	2.23831E+00	3.16596E+00	2.23763E+00	3.11942E+00
2.29358E+00	3.22128E+00	2.29175E+00	3.16471E+00	2.28992E+00	3.10613E+00
2.34842E+00	3.22743E+00	2.34517E+00	3.16251E+00	2.34191E+00	3.09758E+00
2.45853E+00	3.23337E+00	2.45184E+00	3.15527E+00	2.44514E+00	3.07716E+00
2.56887E+00	3.23220E+00	2.55518E+00	3.14425E+00	2.54150E+00	3.05631E+00
2.67906E+00	3.22460E+00	2.66407E+00	3.12948E+00	2.64908E+00	3.03437E+00
2.78877E+00	3.21050E+00	2.76937E+00	3.11098E+00	2.74998E+00	3.01105E+00
2.89766E+00	3.19134E+00	2.87395E+00	3.08875E+00	2.85024E+00	2.98614E+00
3.00541E+00	3.16601E+00	2.97768E+00	3.06283E+00	2.94995E+00	2.95966E+00
3.11158E+00	3.13472E+00	3.08042E+00	3.03326E+00	3.04927E+00	2.93181E+00
3.21573E+00	3.09731E+00	3.18206E+00	3.00007E+00	3.14839E+00	2.90284E+00
3.31737E+00	3.05366E+00	3.28245E+00	2.96330E+00	3.24753E+00	2.87295E+00
3.41635E+00	3.00452E+00	3.38148E+00	2.92301E+00	3.34661E+00	2.84149E+00
3.51307E+00	2.95162E+00	3.47902E+00	2.87923E+00	3.44498E+00	2.80683E+00
3.60697E+00	2.89429E+00	3.57495E+00	2.83202E+00	3.54293E+00	2.76975E+00
3.69800E+00	2.83297E+00	3.66915E+00	2.78145E+00	3.64030E+00	2.72992E+00
3.78618E+00	2.76821E+00	3.76150E+00	2.72757E+00	3.73681E+00	2.68693E+00
3.87161E+00	2.70050E+00	3.85166E+00	2.67046E+00	3.83215E+00	2.64042E+00
3.95459E+00	2.63050E+00	3.94018E+00	2.61018E+00	3.92578E+00	2.58986E+00
4.03564E+00	2.55905E+00	4.02630E+00	2.54682E+00	4.01695E+00	2.53458E+00
4.11012E+00	2.48044E+00	4.11012E+00	2.48044E+00	4.11012E+00	2.48044E+00

BLADE STACKING
TEST CASE II

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 5.83100E+00

ROTAT = -65.00E+00 (ROTATION ANGLE)

XCC =	3.000E+00 (X COORDINATE OF C.G. STACKING POINT)	YCC =	3.000E+00 (Y COORDINATE OF C.G. STACKING POINT)
LER =	1.398E-02 (LEADING EDGE RADIUS)	TER =	1.000E-02 (TRAILING EDGE RADIUS)
XXLE=	2.171E+00 (LEADING EDGE COORDINATE)	XXTE=	4.068E+00 (TRAILING EDGE COORDINATE)
YYLE=	3.165E+00 (LEADING EDGE COORDINATE)	YYTE=	2.491E+00 (TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.15739E+00	3.16507E+00	2.15739E+00	3.16507E+00	2.15739E+00	3.16507E+00
2.16751E+00	3.18133E+00	2.16779E+00	3.16507E+00	2.16507E+00	3.14922E+00
2.17268E+00	3.18474E+00	2.17239E+00	3.16536E+00	2.17329E+00	3.14598E+00
2.18304E+00	3.18982E+00	2.18334E+00	3.16550E+00	2.18368E+00	3.14119E+00
2.20929E+00	3.19844E+00	2.20939E+00	3.16570E+00	2.20949E+00	3.13296E+00
2.26207E+00	3.21067E+00	2.26139E+00	3.16539E+00	2.26071E+00	3.12011E+00
2.31521E+00	3.21916E+00	2.31338E+00	3.16413E+00	2.31155E+00	3.10910E+00
2.36858E+00	3.22509E+00	2.36534E+00	3.16193E+00	2.36209E+00	3.09878E+00
2.42575E+00	3.23069E+00	2.42690E+00	3.15472E+00	2.42742E+00	3.07875E+00
2.58315E+00	3.22928E+00	2.57251E+00	3.14375E+00	2.56187E+00	3.05923E+00
2.69039E+00	3.22152E+00	2.67547E+00	3.12905E+00	2.66055E+00	3.03658E+00
2.79713E+00	3.20774E+00	2.77783E+00	3.11063E+00	2.75853E+00	3.01351E+00
2.90304E+00	3.18819E+00	2.87945E+00	3.08851E+00	2.85586E+00	2.98884E+00
3.00779E+00	3.16293E+00	2.98021E+00	3.06273E+00	2.95263E+00	2.96253E+00
3.11095E+00	3.13180E+00	3.07997E+00	3.03332E+00	3.04898E+00	2.93484E+00
3.21207E+00	3.09465E+00	3.17859E+00	3.00031E+00	3.14512E+00	2.90598E+00
3.31067E+00	3.05136E+00	3.27596E+00	2.96376E+00	3.24125E+00	2.87615E+00
3.40659E+00	3.00258E+00	3.37194E+00	2.92370E+00	3.33729E+00	2.84473E+00
3.50025E+00	2.95032E+00	3.46641E+00	2.88020E+00	3.43257E+00	2.81088E+00
3.59108E+00	2.89359E+00	3.55924E+00	2.83330E+00	3.52740E+00	2.77301E+00
3.67901E+00	2.83295E+00	3.65031E+00	2.78307E+00	3.62161E+00	2.73319E+00
3.76408E+00	2.76843E+00	3.73950E+00	2.72958E+00	3.71492E+00	2.69023E+00
3.84638E+00	2.70200E+00	3.82670E+00	2.67290E+00	3.80702E+00	2.64379E+00
3.92620E+00	2.63283E+00	3.91179E+00	2.61309E+00	3.89737E+00	2.59335E+00
4.00407E+00	2.56220E+00	3.99455E+00	2.55024E+00	3.98524E+00	2.53828E+00
4.07519E+00	2.48444E+00	4.07519E+00	2.48444E+00	4.07519E+00	2.48444E+00

BLADE STACKING
TEST CASE II

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDRICAL COORDINATE AT RADIUS R(I) = 3.47700E+00

ROTAT = -65.00E+00 (ROTATION ANGLE)

XCC =	3.000E+00	(X COORDINATE OF C.G. STACKING POINT)	YCC =	3.000E+00	(Y COORDINATE OF C.G. STACKING POINT)
LER =	1.314E-02	(LEADING EDGE RADIUS)	TER =	1.000E-02	(TRAILING EDGE RADIUS)
XXLE=	2.225E+00	(LEADING EDGE COORDINATE)	XXTE=	3.995E+00	(TRAILING EDGE COORDINATE)
YYLE=	3.144E+00	(LEADING EDGE COORDINATE)	YYTE=	2.500E+00	(TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.21168E+00	3.16363E+00	2.21168E+00	3.16363E+00	2.21168E+00	3.16363E+00
2.22119E+00	3.17895E+00	2.22147E+00	3.15383E+00	2.22175E+00	3.14871E+00
2.22607E+00	3.18217E+00	2.22637E+00	3.15391E+00	2.22667E+00	3.14566E+00
2.23587E+00	3.18695E+00	2.23616E+00	3.15405E+00	2.23645E+00	3.14116E+00
2.26055E+00	3.19508E+00	2.26064E+00	3.15425E+00	2.26074E+00	3.13342E+00
2.31029E+00	3.20658E+00	2.31061E+00	3.15394E+00	2.31094E+00	3.12130E+00
2.36038E+00	3.21451E+00	2.35857E+00	3.15270E+00	2.35676E+00	3.11088E+00
2.41070E+00	3.21995E+00	2.40749E+00	3.14952E+00	2.40428E+00	3.10104E+00
2.51176E+00	3.22430E+00	2.50517E+00	3.13539E+00	2.49858E+00	3.08188E+00
2.61302E+00	3.22302E+00	2.60250E+00	3.11255E+00	2.59199E+00	3.06209E+00
2.71410E+00	3.21498E+00	2.69936E+00	3.08802E+00	2.68461E+00	3.04105E+00
2.81466E+00	3.20109E+00	2.79559E+00	3.06081E+00	2.77652E+00	3.01854E+00
2.91436E+00	3.18156E+00	2.89106E+00	3.03797E+00	2.86776E+00	2.99437E+00
3.01286E+00	3.15652E+00	2.98563E+00	3.00251E+00	2.95833E+00	2.96851E+00
3.10974E+00	3.12575E+00	3.07918E+00	2.96747E+00	3.04857E+00	2.94119E+00
3.20455E+00	3.08918E+00	3.17152E+00	2.93090E+00	3.13849E+00	2.91261E+00
3.29681E+00	3.04670E+00	3.26258E+00	2.89434E+00	3.22834E+00	2.88297E+00
3.38636E+00	2.99802E+00	3.35220E+00	2.85534E+00	3.31804E+00	2.85166E+00
3.47363E+00	2.94723E+00	3.44025E+00	2.81247E+00	3.40684E+00	2.81710E+00
3.55804E+00	2.89244E+00	3.52661E+00	2.76628E+00	3.49519E+00	2.78112E+00
3.63951E+00	2.83328E+00	3.61116E+00	2.71684E+00	3.58280E+00	2.74040E+00
3.71809E+00	2.77067E+00	3.69376E+00	2.66422E+00	3.66942E+00	2.69758E+00
3.79386E+00	2.70565E+00	3.77430E+00	2.60850E+00	3.75474E+00	2.65135E+00
3.86709E+00	2.63827E+00	3.85267E+00	2.61976E+00	3.83824E+00	2.60126E+00
3.93832E+00	2.56945E+00	3.92874E+00	2.55809E+00	3.91917E+00	2.54673E+00
4.00242E+00	2.49356E+00	4.00242E+00	2.49356E+00	4.00242E+00	2.49356E+00

BLADE STACKING
TEST CASE II

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 5.09900E+00

ROTAT = -65.00E+00 (ROTATION ANGLE)

XCC =	3.000E+00	(X COORDINATE OF C.G. STACKING POINT)	YCC =	3.000E+00	(Y COORDINATE OF C.G. STACKING POINT)
LER =	1.223E-02	(LEADING EDGE RADIUS)	TER =	1.000E-02	(TRAILING EDGE RADIUS)
XXLE=	2.282E+00	(LEADING EDGE COORDINATE)	XXTE=	3.917E+00	(TRAILING EDGE COORDINATE)
YYLE=	3.162E+00	(LEADING EDGE COORDINATE)	YYTE=	2.512E+00	(TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.27010E+00	3.16168E+00	2.27010E+00	3.16168E+00	2.27010E+00	3.16168E+00
2.27497E+00	3.17599E+00	2.27924E+00	3.16187E+00	2.27952E+00	3.14776E+00
2.28351E+00	3.17900E+00	2.28381E+00	3.16196E+00	2.28411E+00	3.14492E+00
2.29267E+00	3.18348E+00	2.29295E+00	3.16210E+00	2.29324E+00	3.14072E+00
2.31571E+00	3.19108E+00	2.31581E+00	3.16229E+00	2.31591E+00	3.13351E+00
2.36219E+00	3.20180E+00	2.36153E+00	3.16209E+00	2.36087E+00	3.12219E+00
2.40900E+00	3.20915E+00	2.40723E+00	3.15978E+00	2.40546E+00	3.11240E+00
2.45605E+00	3.21415E+00	2.45290E+00	3.15864E+00	2.44975E+00	3.10314E+00
2.50554E+00	3.21836E+00	2.54406E+00	3.15163E+00	2.53757E+00	3.08490E+00
2.64521E+00	3.21602E+00	2.63485E+00	3.14076E+00	2.62452E+00	3.06591E+00
2.73968E+00	3.20272E+00	2.72517E+00	3.12666E+00	2.71066E+00	3.04560E+00
2.83359E+00	3.18375E+00	2.81483E+00	3.10875E+00	2.79606E+00	3.02375E+00
2.92662E+00	3.17433E+00	2.90369E+00	3.08725E+00	2.88077E+00	3.00017E+00
3.01841E+00	3.14955E+00	2.99152E+00	3.06220E+00	2.96484E+00	2.97485E+00
3.10855E+00	3.11927E+00	3.07734E+00	3.03364E+00	3.04841E+00	2.94801E+00
3.19658E+00	3.08341E+00	3.16412E+00	3.00162E+00	3.13165E+00	2.91983E+00
3.28203E+00	3.04190E+00	3.24840E+00	2.96619E+00	3.21478E+00	2.89048E+00
3.36473E+00	2.99541E+00	3.33129E+00	2.92741E+00	3.29767E+00	2.85941E+00
3.44516E+00	2.94559E+00	3.41237E+00	2.88533E+00	3.37959E+00	2.82507E+00
3.52269E+00	2.89176E+00	3.49173E+00	2.84003E+00	3.46090E+00	2.78831E+00
3.59725E+00	2.83433E+00	3.56933E+00	2.79158E+00	3.54141E+00	2.74883E+00
3.66887E+00	2.77379E+00	3.64486E+00	2.74006E+00	3.62084E+00	2.70633E+00
3.73765E+00	2.71058E+00	3.71826E+00	2.68555E+00	3.69888E+00	2.66051E+00
3.80384E+00	2.64529E+00	3.78942E+00	2.62813E+00	3.77499E+00	2.61097E+00
3.86795E+00	2.57860E+00	3.85821E+00	2.56791E+00	3.84846E+00	2.55721E+00
3.92453E+00	2.50497E+00	3.92453E+00	2.50497E+00	3.92453E+00	2.50497E+00

BLADE STACKING
TEST CASE II

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 4.69000E+00

ROTAT = -45.00E+00 (ROTATION ANGLE)

XCC =	3.000E+00	(X COORDINATE OF C.G. STACKING POINT)	YCC =	3.000E+00	(Y COORDINATE OF C.G. STACKING POINT)
LER =	1.125E-02	(LEADING EDGE RADIUS)	TER =	1.000E-02	(TRAILING EDGE RADIUS)
XXLE =	2.345E+00	(LEADING EDGE COORDINATE)	XXTE =	3.834E+00	(TRAILING EDGE COORDINATE)
YYLE =	3.160E+00	(LEADING EDGE COORDINATE)	YYTE =	2.527E+00	(TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.33361E+00	3.15927E+00	2.33361E+00	3.15927E+00	2.33361E+00	3.15927E+00
2.34177E+00	3.17249E+00	2.34204E+00	3.15947E+00	2.34231E+00	3.14644E+00
2.34597E+00	3.17528E+00	2.34626E+00	3.15955E+00	2.34655E+00	3.14382E+00
2.35442E+00	3.17942E+00	2.35470E+00	3.15969E+00	2.35498E+00	3.13996E+00
2.37570E+00	3.18644E+00	2.37580E+00	3.15988E+00	2.37589E+00	3.13331E+00
2.41864E+00	3.19632E+00	2.41799E+00	3.15958E+00	2.41734E+00	3.12284E+00
2.46191E+00	3.20302E+00	2.46016E+00	3.15838E+00	2.45842E+00	3.11374E+00
2.50540E+00	3.20750E+00	2.50230E+00	3.15629E+00	2.49921E+00	3.10508E+00
2.59276E+00	3.21095E+00	2.58640E+00	3.14940E+00	2.58004E+00	3.08786E+00
2.68028E+00	3.20812E+00	2.67013E+00	3.13894E+00	2.65998E+00	3.06976E+00
2.76756E+00	3.19957E+00	2.75333E+00	3.12491E+00	2.73911E+00	3.05026E+00
2.85424E+00	3.18556E+00	2.83587E+00	3.10735E+00	2.81747E+00	3.02915E+00
2.94003E+00	3.16633E+00	2.91757E+00	3.08629E+00	2.89512E+00	3.00628E+00
3.02454E+00	3.14190E+00	2.99831E+00	3.06176E+00	2.97208E+00	2.98162E+00
3.10735E+00	3.11223E+00	3.07793E+00	3.03381E+00	3.04850E+00	2.95539E+00
3.18802E+00	3.07724E+00	3.15628E+00	3.00249E+00	3.12453E+00	2.92774E+00
3.26608E+00	3.03689E+00	3.23322E+00	2.96786E+00	3.20036E+00	2.89883E+00
3.34136E+00	2.99182E+00	3.30862E+00	2.92998E+00	3.27588E+00	2.86814E+00
3.41437E+00	2.94264E+00	3.38233E+00	2.88891E+00	3.35030E+00	2.83619E+00
3.48445E+00	2.88966E+00	3.45423E+00	2.84475E+00	3.42401E+00	2.79793E+00
3.55153E+00	2.83278E+00	3.52418E+00	2.79755E+00	3.49682E+00	2.75682E+00
3.61565E+00	2.77198E+00	3.59205E+00	2.74742E+00	3.56845E+00	2.71686E+00
3.67687E+00	2.70716E+00	3.65772E+00	2.69444E+00	3.63857E+00	2.67171E+00
3.73547E+00	2.63835E+00	3.72107E+00	2.63870E+00	3.70693E+00	2.62303E+00
3.79192E+00	2.56532E+00	3.78199E+00	2.58031E+00	3.77206E+00	2.57038E+00
3.84036E+00	2.51933E+00	3.84036E+00	2.51943E+00	3.84036E+00	2.51933E+00

BLADE STACKING
TEST CASE II

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 4.23400E+00

ROTAT = -65.00E+00 (ROTATION ANGLE)

XCC = 3.000E+00 (X COORDINATE OF C.G. STACKING POINT)
LER = 1.015E-02 (LEADING EDGE RADIUS)
XXLE= 2.415E+00 (LEADING EDGE COORDINATE)
YYLE= 3.156E+00 (LEADING EDGE COORDINATE)
YCC = 3.000E+00 (Y COORDINATE OF C.G. STACKING POINT)
TER = 1.000E-02 (TRAILING EDGE RADIUS)
XXTE= 3.741E+00 (TRAILING EDGE COORDINATE)
YYTE= 2.547E+00 (TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.40454E+00	3.15586E+00	2.40454E+00	3.15586E+00	2.40454E+00	3.15586E+00
2.41193E+00	3.16786E+00	2.41220E+00	3.15604E+00	2.41248E+00	3.14423E+00
2.41574E+00	3.17039E+00	2.41602E+00	3.15612E+00	2.41631E+00	3.14186E+00
2.42340E+00	3.17415E+00	2.42368E+00	3.15626E+00	2.42395E+00	3.13837E+00
2.44272E+00	3.18054E+00	2.44281E+00	3.15644E+00	2.44290E+00	3.13235E+00
2.48171E+00	3.19047E+00	2.48103E+00	3.15615E+00	2.48044E+00	3.12283E+00
2.52103E+00	3.19547E+00	2.51933E+00	3.15498E+00	2.51763E+00	3.11450E+00
2.56556E+00	3.19938E+00	2.55754E+00	3.15294E+00	2.55453E+00	3.10651E+00
2.63997E+00	3.20202E+00	2.63379E+00	3.14625E+00	2.62760E+00	3.09047E+00
2.71451E+00	3.19872E+00	2.70964E+00	3.13607E+00	2.69977E+00	3.07342E+00
2.79478E+00	3.18936E+00	2.78435E+00	3.12243E+00	2.77112E+00	3.05490E+00
2.87742E+00	3.17601E+00	2.85956E+00	3.10537E+00	2.84163E+00	3.03473E+00
2.95511E+00	3.15707E+00	2.93331E+00	3.08491E+00	2.91150E+00	3.01276E+00
3.03149E+00	3.13323E+00	3.00604E+00	3.06111E+00	2.98060E+00	2.98898E+00
3.10614E+00	3.10441E+00	3.07762E+00	3.03400E+00	3.04909E+00	2.96358E+00
3.17863E+00	3.07058E+00	3.14787E+00	3.00365E+00	3.11712E+00	2.93671E+00
3.24847E+00	3.03174E+00	3.21667E+00	2.97011E+00	3.18487E+00	2.90849E+00
3.31552E+00	2.98848E+00	3.28386E+00	2.93347E+00	3.25221E+00	2.87944E+00
3.38031E+00	2.94239E+00	3.34931E+00	2.89379E+00	3.31831E+00	2.84520E+00
3.44216E+00	2.89274E+00	3.41287E+00	2.85117E+00	3.38359E+00	2.80959E+00
3.50099E+00	2.83995E+00	3.47442E+00	2.80568E+00	3.44785E+00	2.77140E+00
3.55683E+00	2.78446E+00	3.53383E+00	2.75742E+00	3.51082E+00	2.73039E+00
3.60976E+00	2.72665E+00	3.59096E+00	2.70650E+00	3.57216E+00	2.68635E+00
3.66003E+00	2.66702E+00	3.64571E+00	2.65302E+00	3.63139E+00	2.63902E+00
3.70809E+00	2.60613E+00	3.69795E+00	2.59709E+00	3.68782E+00	2.58805E+00
3.74759E+00	2.53884E+00	3.74759E+00	2.53884E+00	3.74759E+00	2.53884E+00

BLADE STACKING
TEST CASE II

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 4.00000E+00

ROTAT = -65.00E+00 (ROTATION ANGLE)

XCC =	3.000E+00 (X COORDINATE OF C.G. STACKING POINT)	YCC =	3.000E+00 (Y COORDINATE OF C.G. STACKING POINT)
LER =	9.591E-03 (LEADING EDGE RADIUS)	TER =	1.000E-02 (TRAILING EDGE RADIUS)
XXLE=	2.451E+00 (LEADING EDGE COORDINATE)	XXTE=	3.694E+00 (TRAILING EDGE COORDINATE)
YYLE=	3.154E+00 (LEADING EDGE COORDINATE)	YYTE=	2.558E+00 (TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.44131E+00	3.15403E+00	2.44131E+00	3.15403E+00	2.44131E+00	3.15403E+00
2.44830E+00	3.16541E+00	2.44856E+00	3.15422E+00	2.44882E+00	3.14303E+00
2.45191E+00	3.16781E+00	2.45219E+00	3.15430E+00	2.45246E+00	3.14078E+00
2.45917E+00	3.17138E+00	2.45943E+00	3.15443E+00	2.45970E+00	3.13748E+00
2.47747E+00	3.17743E+00	2.47756E+00	3.15461E+00	2.47765E+00	3.13179E+00
2.51443E+00	3.18588E+00	2.51381E+00	3.15432E+00	2.51318E+00	3.12276E+00
2.55171E+00	3.19152E+00	2.55004E+00	3.15317E+00	2.54837E+00	3.11483E+00
2.58920E+00	3.19514E+00	2.58623E+00	3.15116E+00	2.58327E+00	3.10718E+00
2.66452E+00	3.19737E+00	2.65843E+00	3.14457E+00	2.65233E+00	3.09176E+00
2.73994E+00	3.19383E+00	2.73023E+00	3.13454E+00	2.72051E+00	3.07526E+00
2.81508E+00	3.18498E+00	2.80147E+00	3.12112E+00	2.78786E+00	3.05726E+00
2.88957E+00	3.17107E+00	2.87199E+00	3.10433E+00	2.85441E+00	3.03758E+00
2.96308E+00	3.15230E+00	2.94163E+00	3.08420E+00	2.92019E+00	3.01610E+00
3.03527E+00	3.12877E+00	3.01024E+00	3.06079E+00	2.98522E+00	2.99280E+00
3.10570E+00	3.10041E+00	3.07766E+00	3.03414E+00	3.04962E+00	2.96786E+00
3.17395E+00	3.06721E+00	3.14374E+00	3.00431E+00	3.11353E+00	2.94141E+00
3.23954E+00	3.02917E+00	3.20832E+00	2.97138E+00	3.17710E+00	2.91359E+00
3.30232E+00	2.98689E+00	3.27127E+00	2.93542E+00	3.24021E+00	2.88394E+00
3.36286E+00	2.94191E+00	3.33243E+00	2.89650E+00	3.30200E+00	2.85109E+00
3.42045E+00	2.89353E+00	3.39168E+00	2.85472E+00	3.36231E+00	2.81592E+00
3.47501E+00	2.84213E+00	3.44887E+00	2.81017E+00	3.42273E+00	2.77822E+00
3.52656E+00	2.78815E+00	3.50388E+00	2.76296E+00	3.48120E+00	2.73777E+00
3.57519E+00	2.73197E+00	3.55658E+00	2.71318E+00	3.53798E+00	2.69439E+00
3.62114E+00	2.67406E+00	3.60686E+00	2.66096E+00	3.59259E+00	2.64785E+00
3.66435E+00	2.61494E+00	3.65460E+00	2.60640E+00	3.64435E+00	2.59785E+00
3.69969E+00	2.54963E+00	3.69969E+00	2.54963E+00	3.69969E+00	2.54963E+00

BLADE STACKING
TEST CASE I

INPUT

I = 7 (NUMBER OF SECTIONS)

J = 0 (CALCULATE INCIDENCE = 1)
(READ INCIDENCE = 0)

K = 0 (CALCULATE DEVIATION = 1)
(READ DEVIATION = 0)

XN = 19 (NUMBER OF BLADES OR VANES)

L = 1 (THICKNESS DISTRIBUTION = 1 65 SERIES)
(THICKNESS DISTRIBUTION = 2 DCA)

M = 1 (ROTOR = 1)
(INLET GUIDE VANE = 2)

SUMMARY

RADIUS (R)	BETA 1 (B1)	BETA 2 (B2)	INCIDENCE (XI)	DEVIATION (DEV)	CHORD (CHD)	SOLIDITY (SOL)	BETA 1* (B1S)
6.0000E+00	69.040E+00	63.860E+00	16.400E-01	33.700E-01	2.0000E+00	1.0080E+00	67.400E+00
5.8310E+00	68.760E+00	63.210E+00	15.300E-01	36.500E-01	2.0000E+00	1.0372E+00	67.230E+00
5.4770E+00	69.200E+00	61.740E+00	11.900E-01	43.300E-01	2.0000E+00	1.1042E+00	67.010E+00
5.0990E+00	67.610E+00	60.000E+00	65.000E-02	51.800E-01	2.0000E+00	1.1861E+00	66.960E+00
4.6900E+00	67.030E+00	57.890E+00	-80.000E-03	62.800E-01	2.0000E+00	1.2835E+00	67.110E+00
4.2430E+00	66.490E+00	55.240E+00	-11.700E-01	77.600E-01	2.0000E+00	1.4254E+00	67.660E+00
4.0000E+00	66.270E+00	53.650E+00	-19.800E-01	87.600E-01	2.0000E+00	1.5120E+00	68.250E+00

BETA 2* (B2S)	TMAXC	LER	TER	CAMBER (CAM)	STAGGER (GAM)	DEFLECTION (DEF)	AXIAL CHORD (AXC)
60.490E+00	.6000E-01	.1374E-01	.8000E-02	69.100E-01	63.945E+00	51.800E-01	.8785E+00
59.560E+00	.6340E-01	.1374E-01	.8000E-02	76.700E-01	63.395E+00	55.500E-01	.8957E+00
57.410E+00	.7050E-01	.1374E-01	.8000E-02	96.000E-01	62.210E+00	64.600E-01	.9325E+00
54.820E+00	.7800E-01	.1374E-01	.8000E-02	12.140E+00	60.890E+00	76.100E-01	.9730E+00
51.610E+00	.8620E-01	.1374E-01	.8000E-02	15.500E+00	59.360E+00	91.400E-01	.1019E+01
47.480E+00	.9510E-01	.1374E-01	.8000E-02	20.180E+00	57.570E+00	11.250E+00	.1073E+01
44.890E+00	.1000E+00	.1374E-01	.8000E-02	23.360E+00	56.570E+00	12.620E+00	.1102E+01

Table 7 Rotor Coordinates

BLADE STACKING
TEST CASE I

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 6.00000E+00

LER =	.1374E-01	X CENTROID =	13.601E-01	XRC =	1.6319E+01
TMAXC =	.6000E-01	Y CENTROID =	17.743E-01	YRC =	-.5377E+01
		AREA =	16.651E-02	RC =	1.6593E+01
XLE =	.1005E+01			XTE =	.1875E+01
YLE =	.1013E+01			YTE =	.2790E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.95292E-01	1.01280E+00	1.00385E+00	1.00924E+00	1.01240E+00	1.00567E+00
9.95447E-01	1.01816E+00	1.00577E+00	1.01385E+00	1.01610E+00	1.00954E+00
9.96680E-01	1.02850E+00	1.00963E+00	1.02309E+00	1.02258E+00	1.01767E+00
1.00187E+00	1.05347E+00	1.01930E+00	1.04616E+00	1.03672E+00	1.03884E+00
1.01466E+00	1.10245E+00	1.03873E+00	1.09226E+00	1.06280E+00	1.08207E+00
1.02907E+00	1.15078E+00	1.05831E+00	1.13830E+00	1.08754E+00	1.12582E+00
1.04449E+00	1.19872E+00	1.07802E+00	1.18429E+00	1.11155E+00	1.16985E+00
1.07753E+00	1.29372E+00	1.11786E+00	1.27607E+00	1.15818E+00	1.25842E+00
1.11280E+00	1.38784E+00	1.15825E+00	1.36762E+00	1.20370E+00	1.34740E+00
1.14993E+00	1.48119E+00	1.19920E+00	1.45892E+00	1.24847E+00	1.43664E+00
1.18876E+00	1.57383E+00	1.24069E+00	1.54997E+00	1.29263E+00	1.52611E+00
1.22916E+00	1.66577E+00	1.28274E+00	1.64077E+00	1.33631E+00	1.61576E+00
1.27112E+00	1.75701E+00	1.32533E+00	1.73131E+00	1.37953E+00	1.70561E+00
1.31477E+00	1.84745E+00	1.36846E+00	1.82160E+00	1.42215E+00	1.79574E+00
1.36023E+00	1.93700E+00	1.41214E+00	1.91162E+00	1.46405E+00	1.88624E+00
1.40764E+00	2.02556E+00	1.45636E+00	2.00138E+00	1.50508E+00	1.97719E+00
1.45667E+00	2.11327E+00	1.50112E+00	2.09087E+00	1.54558E+00	2.06847E+00
1.50616E+00	2.20068E+00	1.54642E+00	2.18009E+00	1.58668E+00	2.15949E+00
1.55683E+00	2.28742E+00	1.59226E+00	2.26903E+00	1.62768E+00	2.25064E+00
1.60850E+00	2.37357E+00	1.63863E+00	2.35770E+00	1.66876E+00	2.34182E+00
1.66093E+00	2.45926E+00	1.68554E+00	2.44608E+00	1.71014E+00	2.43293E+00
1.71392E+00	2.54452E+00	1.73298E+00	2.53418E+00	1.75203E+00	2.52385E+00
1.76711E+00	2.62961E+00	1.78095E+00	2.62200E+00	1.79478E+00	2.61439E+00
1.82006E+00	2.71475E+00	1.82944E+00	2.70952E+00	1.83883E+00	2.70428E+00
1.87847E+00	2.79675E+00	1.87847E+00	2.79675E+00	1.87847E+00	2.79675E+00

BLADE STACKING
TEST CASE I

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 5.83100E+00

LER =	.1374E-01	X CENTROID =	13.644E-01	XRC =	1.4786E+01
TMAXC =	.6340E-01	Y CENTROID =	17.692E-01	YRC =	-.4787E+01
		AREA =	17.585E-02	RC =	1.4951E+01
XLE =	.1005E+01			XTE =	.1892E+01
YLE =	.1013E+01			YTE =	.2781E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.94846E-01	1.01302E+00	1.00388E+00	1.00923E+00	1.01291E+00	1.00543E+00
9.94916E-01	1.01843E+00	1.00582E+00	1.01384E+00	1.01672E+00	1.00925E+00
9.96034E-01	1.02882E+00	1.00970E+00	1.02306E+00	1.02337E+00	1.01738E+00
1.00105E+00	1.05390E+00	1.01944E+00	1.04611E+00	1.03783E+00	1.03831E+00
1.01364E+00	1.10301E+00	1.03904E+00	1.09215E+00	1.06444E+00	1.08128E+00
1.02795E+00	1.15143E+00	1.05879E+00	1.13812E+00	1.08963E+00	1.12481E+00
1.04333E+00	1.19943E+00	1.07870E+00	1.18403E+00	1.11406E+00	1.16862E+00
1.07644E+00	1.29450E+00	1.11897E+00	1.27564E+00	1.16149E+00	1.25678E+00
1.11194E+00	1.38862E+00	1.15985E+00	1.36698E+00	1.20776E+00	1.34535E+00
1.14943E+00	1.48192E+00	1.20134E+00	1.45805E+00	1.25326E+00	1.43419E+00
1.18874E+00	1.57443E+00	1.24345E+00	1.54884E+00	1.29816E+00	1.52324E+00
1.22974E+00	1.66620E+00	1.28616E+00	1.63934E+00	1.34257E+00	1.61249E+00
1.27241E+00	1.75715E+00	1.32947E+00	1.72956E+00	1.38653E+00	1.70193E+00
1.31689E+00	1.84731E+00	1.37339E+00	1.81948E+00	1.42988E+00	1.79165E+00
1.36331E+00	1.93645E+00	1.41790E+00	1.90911E+00	1.47250E+00	1.88176E+00
1.41180E+00	2.02452E+00	1.46302E+00	1.99844E+00	1.51424E+00	1.97235E+00
1.46201E+00	2.11165E+00	1.50873E+00	2.08746E+00	1.55545E+00	2.06327E+00
1.51280E+00	2.19840E+00	1.55504E+00	2.17618E+00	1.59728E+00	2.15395E+00
1.56485E+00	2.28442E+00	1.60194E+00	2.26458E+00	1.63904E+00	2.24474E+00
1.61796E+00	2.36977E+00	1.64943E+00	2.35267E+00	1.68090E+00	2.33556E+00
1.67196E+00	2.45458E+00	1.69751E+00	2.44044E+00	1.72312E+00	2.42629E+00
1.72645E+00	2.53895E+00	1.74618E+00	2.52788E+00	1.76591E+00	2.51681E+00
1.78123E+00	2.62308E+00	1.79543E+00	2.61500E+00	1.80963E+00	2.60691E+00
1.83578E+00	2.70727E+00	1.84526E+00	2.70178E+00	1.85474E+00	2.69629E+00
1.89567E+00	2.78823E+00	1.89567E+00	2.78823E+00	1.89567E+00	2.78823E+00

BLADE STACKING
TEST CASE I

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 5.47700E+00

LER	= .1374E-01	X CENTROID	= 13.726E-01	XRC	= 1.2001E+01
TMAXC	= .7050E-01	Y CENTROID	= 17.588E-01	YRC	= -.3668E+01
		AREA	= 19.557E-02	RC	= 1.1951E+01
XLE	= .1005E+01			XTE	= .1928E+01
YLE	= .1013E+01			YTE	= .2763E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.93885E-01	1.01348E+00	1.00391E+00	1.00921E+00	1.01394E+00	1.00495E+00
9.93769E-01	1.01897E+00	1.00587E+00	1.01382E+00	1.01798E+00	1.00867E+00
9.94622E-01	1.02951E+00	1.00980E+00	1.02303E+00	1.02498E+00	1.01655E+00
9.99230E-01	1.05481E+00	1.01965E+00	1.04604E+00	1.04007E+00	1.03728E+00
1.01130E+00	1.10424E+00	1.03949E+00	1.09200E+00	1.06768E+00	1.07976E+00
1.02531E+00	1.15290E+00	1.05952E+00	1.13788E+00	1.09373E+00	1.12285E+00
1.04053E+00	1.20109E+00	1.07975E+00	1.18367E+00	1.11897E+00	1.16625E+00
1.07365E+00	1.29640E+00	1.12077E+00	1.27499E+00	1.16789E+00	1.25359E+00
1.10951E+00	1.39060E+00	1.16256E+00	1.36597E+00	1.21560E+00	1.34134E+00
1.14768E+00	1.48385E+00	1.20511E+00	1.45660E+00	1.26253E+00	1.42934E+00
1.18795E+00	1.57618E+00	1.24841E+00	1.54686E+00	1.30887E+00	1.51754E+00
1.23019E+00	1.66761E+00	1.29247E+00	1.63676E+00	1.35476E+00	1.60591E+00
1.27435E+00	1.75812E+00	1.33729E+00	1.72629E+00	1.40022E+00	1.69446E+00
1.32060E+00	1.84758E+00	1.38285E+00	1.81544E+00	1.44510E+00	1.78330E+00
1.36906E+00	1.93587E+00	1.42915E+00	1.90420E+00	1.48925E+00	1.87253E+00
1.41988E+00	2.02286E+00	1.47620E+00	1.99258E+00	1.53252E+00	1.96229E+00
1.47268E+00	2.10870E+00	1.52399E+00	2.08055E+00	1.57530E+00	2.05240E+00
1.52627E+00	2.19400E+00	1.57251E+00	2.16813E+00	1.61875E+00	2.14225E+00
1.58132E+00	2.27837E+00	1.62177E+00	2.25529E+00	1.66222E+00	2.23221E+00
1.63760E+00	2.36190E+00	1.67175E+00	2.34204E+00	1.70590E+00	2.32217E+00
1.69485E+00	2.44473E+00	1.72246E+00	2.42836E+00	1.75006E+00	2.41199E+00
1.75283E+00	2.52698E+00	1.77389E+00	2.51426E+00	1.79494E+00	2.50153E+00
1.81114E+00	2.60890E+00	1.82603E+00	2.59972E+00	1.84093E+00	2.59055E+00
1.86925E+00	2.69080E+00	1.87889E+00	2.68475E+00	1.88854E+00	2.67869E+00
1.93246E+00	2.76932E+00	1.93246E+00	2.76932E+00	1.93246E+00	2.76932E+00

BLADE STACKING
TEST CASE I

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 5.09900E+00

LER =	.1374E-01	X CENTROID =	13.807E-01	XRC =	9.7025E+00
TMAXC =	.7800E-01	Y CENTROID =	17.485E-01	YRC =	-.2701E+01
		AREA =	21.668E-02	RC =	9.4569E+00
XLE =	.1005E+01			XTE =	.1968E+01
YLE =	.1013E+01			YTE =	.2741E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.92828E-01	1.01395E+00	1.00393E+00	1.00922E+00	1.01502E+00	1.00448E+00
9.92497E-01	1.01955E+00	1.00589E+00	1.01382E+00	1.01929E+00	1.00810E+00
9.93039E-01	1.03023E+00	1.00983E+00	1.02304E+00	1.02863E+00	1.01584E+00
9.97141E-01	1.05579E+00	1.01973E+00	1.04605E+00	1.04231E+00	1.03630E+00
1.00853E+00	1.10563E+00	1.03970E+00	1.09199E+00	1.07087E+00	1.07834E+00
1.02210E+00	1.15461E+00	1.05991E+00	1.13782E+00	1.09772E+00	1.12103E+00
1.03705E+00	1.20306E+00	1.08037E+00	1.18355E+00	1.12369E+00	1.16403E+00
1.07002E+00	1.29876E+00	1.12201E+00	1.27467E+00	1.17349E+00	1.25058E+00
1.10615E+00	1.39319E+00	1.16461E+00	1.36535E+00	1.22307E+00	1.33751E+00
1.14495E+00	1.48651E+00	1.20817E+00	1.45557E+00	1.27138E+00	1.42464E+00
1.18621E+00	1.57873E+00	1.25268E+00	1.54533E+00	1.31915E+00	1.51192E+00
1.22975E+00	1.66989E+00	1.29814E+00	1.63460E+00	1.36654E+00	1.59932E+00
1.27554E+00	1.75993E+00	1.34455E+00	1.72340E+00	1.41356E+00	1.68686E+00
1.32372E+00	1.84871E+00	1.39189E+00	1.81169E+00	1.46006E+00	1.77468E+00
1.37446E+00	1.93607E+00	1.44016E+00	1.89948E+00	1.50587E+00	1.86289E+00
1.42788E+00	2.02185E+00	1.48937E+00	1.98675E+00	1.55086E+00	1.95166E+00
1.48356E+00	2.10622E+00	1.53949E+00	2.07350E+00	1.59543E+00	2.04078E+00
1.54030E+00	2.18981E+00	1.59053E+00	2.15971E+00	1.64076E+00	2.12961E+00
1.59872E+00	2.27223E+00	1.64248E+00	2.24538E+00	1.68625E+00	2.21852E+00
1.65858E+00	2.35359E+00	1.69534E+00	2.33049E+00	1.73210E+00	2.30739E+00
1.71958E+00	2.43402E+00	1.74905E+00	2.41503E+00	1.77861E+00	2.39604E+00
1.78144E+00	2.51368E+00	1.80374E+00	2.49900E+00	1.82604E+00	2.48432E+00
1.84375E+00	2.59285E+00	1.85927E+00	2.58239E+00	1.87480E+00	2.57193E+00
1.90593E+00	2.67191E+00	1.91569E+00	2.66518E+00	1.92545E+00	2.65846E+00
1.97298E+00	2.74737E+00	1.97298E+00	2.74737E+00	1.97298E+00	2.74737E+00

BLADE STACKING
TEST CASE I

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 4.69000E+00

LER =	.1374E-01	X CENTROID =	13.892E-01	XRC =	7.8316E+00
TMAXC =	.8620E-01	Y CENTROID =	17.384E-01	YRC =	-.1884E+01
		AREA =	24.009E-02	RC =	7.4156E+00
XLE =	.1005E+01			XTE =	.2014E+01
YLE =	.1013E+01			YTE =	.2714E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.91616E-01	1.01445E+00	1.00391E+00	1.00924E+00	1.01620E+00	1.00403E+00
9.91031E-01	1.02015E+00	1.00587E+00	1.01386E+00	1.02070E+00	1.00756E+00
9.91196E-01	1.03101E+00	1.00979E+00	1.02309E+00	1.02839E+00	1.01516E+00
9.94661E-01	1.05689E+00	1.01966E+00	1.04614E+00	1.04467E+00	1.03538E+00
1.00516E+00	1.10725E+00	1.03964E+00	1.09214E+00	1.07412E+00	1.07703E+00
1.01813E+00	1.15666E+00	1.05992E+00	1.13801E+00	1.10172E+00	1.11935E+00
1.03266E+00	1.20549E+00	1.08052E+00	1.18374E+00	1.12838E+00	1.16199E+00
1.06528E+00	1.30178E+00	1.12264E+00	1.27477E+00	1.17999E+00	1.24776E+00
1.10158E+00	1.39662E+00	1.16598E+00	1.36523E+00	1.23038E+00	1.33383E+00
1.14102E+00	1.49015E+00	1.21055E+00	1.45509E+00	1.28007E+00	1.42002E+00
1.18333E+00	1.58240E+00	1.25632E+00	1.54434E+00	1.32931E+00	1.50628E+00
1.22834E+00	1.67335E+00	1.30330E+00	1.63296E+00	1.37826E+00	1.59257E+00
1.27597E+00	1.76295E+00	1.35147E+00	1.72094E+00	1.42697E+00	1.67894E+00
1.32640E+00	1.85100E+00	1.40083E+00	1.80826E+00	1.47526E+00	1.76553E+00
1.37977E+00	1.93732E+00	1.45136E+00	1.89491E+00	1.52296E+00	1.85250E+00
1.43621E+00	2.02169E+00	1.50307E+00	1.98086E+00	1.56992E+00	1.94003E+00
1.49525E+00	2.10430E+00	1.55593E+00	2.06611E+00	1.61660E+00	2.02791E+00
1.55567E+00	2.18582E+00	1.60993E+00	2.15063E+00	1.66420E+00	2.11543E+00
1.61802E+00	2.26585E+00	1.66508E+00	2.23441E+00	1.71214E+00	2.20298E+00
1.68204E+00	2.34448E+00	1.72136E+00	2.31745E+00	1.76067E+00	2.29041E+00
1.74740E+00	2.42189E+00	1.77875E+00	2.39971E+00	1.81009E+00	2.37752E+00
1.81381E+00	2.49826E+00	1.83725E+00	2.48119E+00	1.86069E+00	2.46411E+00
1.88078E+00	2.57390E+00	1.89684E+00	2.56187E+00	1.91290E+00	2.54984E+00
1.94773E+00	2.64928E+00	1.95753E+00	2.64173E+00	1.96732E+00	2.63419E+00
2.01928E+00	2.72077E+00	2.01928E+00	2.72077E+00	2.01928E+00	2.72077E+00

BLADE STACKING
TEST CASE I

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 4.24300E+00

LER =	.1374E-01	X CENTROID =	13.967E-01	XRC =	6.2795E+00
TMAXC =	.9510E-01	Y CENTROID =	17.273E-01	YRC =	-.1170E+01
		AREA =	26.651E-02	RC =	5.7079E+00
XLE =	.1005E+01			XTE =	.2067E+01
YLE =	.1013E+01			YTE =	.2682E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.90187E-01	1.01493E+00	1.00383E+00	1.00929E+00	1.01747E+00	1.00366E+00
9.89286E-01	1.02075E+00	1.00575E+00	1.01394E+00	1.02221E+00	1.00712E+00
9.88968E-01	1.03181E+00	1.00960E+00	1.02322E+00	1.03024E+00	1.01464E+00
9.91576E-01	1.05809E+00	1.01931E+00	1.04640E+00	1.04704E+00	1.03472E+00
1.00081E+00	1.10913E+00	1.03902E+00	1.09263E+00	1.07724E+00	1.07614E+00
1.01286E+00	1.15915E+00	1.05915E+00	1.13869E+00	1.10543E+00	1.11822E+00
1.02673E+00	1.20854E+00	1.07967E+00	1.18456E+00	1.13262E+00	1.16059E+00
1.05860E+00	1.30579E+00	1.12194E+00	1.27577E+00	1.18527E+00	1.24574E+00
1.09483E+00	1.40140E+00	1.16580E+00	1.36621E+00	1.23676E+00	1.33102E+00
1.13480E+00	1.49546E+00	1.21124E+00	1.45587E+00	1.28769E+00	1.41627E+00
1.17821E+00	1.58798E+00	1.25826E+00	1.54471E+00	1.33832E+00	1.50143E+00
1.22482E+00	1.67893E+00	1.30684E+00	1.63271E+00	1.38885E+00	1.58649E+00
1.27458E+00	1.76819E+00	1.35696E+00	1.71984E+00	1.43933E+00	1.67149E+00
1.32763E+00	1.85554E+00	1.40860E+00	1.80608E+00	1.48957E+00	1.75661E+00
1.38410E+00	1.94073E+00	1.46176E+00	1.89139E+00	1.53941E+00	1.84205E+00
1.44413E+00	2.02348E+00	1.51641E+00	1.97575E+00	1.58868E+00	1.92803E+00
1.50717E+00	2.10398E+00	1.57253E+00	2.05914E+00	1.63790E+00	2.01430E+00
1.57196E+00	2.18295E+00	1.63012E+00	2.14153E+00	1.68828E+00	2.10011E+00
1.63900E+00	2.25995E+00	1.68915E+00	2.22289E+00	1.73930E+00	2.18583E+00
1.70799E+00	2.33510E+00	1.74960E+00	2.30320E+00	1.79121E+00	2.27129E+00
1.77855E+00	2.40858E+00	1.81145E+00	2.38243E+00	1.84435E+00	2.35627E+00
1.85036E+00	2.48061E+00	1.87470E+00	2.46056E+00	1.89903E+00	2.44050E+00
1.92292E+00	2.55155E+00	1.93930E+00	2.53756E+00	1.95569E+00	2.52357E+00
1.99558E+00	2.62198E+00	2.00526E+00	2.61341E+00	2.01493E+00	2.60485E+00
2.07254E+00	2.68809E+00	2.07254E+00	2.68809E+00	2.07254E+00	2.68809E+00

BLADE STACKING
TEST CASE I

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 4.00000E+00

LER =	.1374E-01	X CENTROID =	13.991E-01	XRC =	5.5879E+00
TMAXC =	.1000E+00	Y CENTROID =	17.217E-01	YRC =	-.8304E+00
		AREA =	28.173E-02	RC =	4.9396E+00
XLE =	.1005E+01			XTE =	.2096E+01
YLE =	.1013E+01			YTE =	.2663E+01

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9.89312E-01	1.01514E+00	1.00374E+00	1.00935E+00	1.01817E+00	1.00356E+00
9.88206E-01	1.02103E+00	1.00562E+00	1.01402E+00	1.02303E+00	1.00701E+00
9.87566E-01	1.03219E+00	1.00939E+00	1.02336E+00	1.03121E+00	1.01452E+00
9.89574E-01	1.05871E+00	1.01889E+00	1.04667E+00	1.04822E+00	1.03462E+00
9.97882E-01	1.11021E+00	1.03826E+00	1.09314E+00	1.07865E+00	1.07607E+00
1.00922E+00	1.16067E+00	1.05811E+00	1.13941E+00	1.10699E+00	1.11816E+00
1.02253E+00	1.21047E+00	1.07842E+00	1.18548E+00	1.13431E+00	1.16050E+00
1.05367E+00	1.30848E+00	1.12045E+00	1.27699E+00	1.18722E+00	1.24549E+00
1.08961E+00	1.40474E+00	1.16433E+00	1.36761E+00	1.23905E+00	1.33049E+00
1.12968E+00	1.49933E+00	1.21006E+00	1.45733E+00	1.29043E+00	1.41533E+00
1.17356E+00	1.59221E+00	1.25760E+00	1.54609E+00	1.34164E+00	1.49997E+00
1.22100E+00	1.68334E+00	1.30694E+00	1.63387E+00	1.39289E+00	1.58440E+00
1.27190E+00	1.77258E+00	1.35806E+00	1.72062E+00	1.44422E+00	1.66866E+00
1.32642E+00	1.85966E+00	1.41094E+00	1.80631E+00	1.49546E+00	1.75296E+00
1.38468E+00	1.94430E+00	1.46556E+00	1.89091E+00	1.54643E+00	1.83752E+00
1.44679E+00	2.02618E+00	1.52189E+00	1.97437E+00	1.59698E+00	1.92257E+00
1.51215E+00	2.10548E+00	1.57990E+00	2.05667E+00	1.64765E+00	2.00787E+00
1.57951E+00	2.18294E+00	1.63959E+00	2.13777E+00	1.69967E+00	2.09261E+00
1.64930E+00	2.25811E+00	1.70091E+00	2.21764E+00	1.75252E+00	2.17717E+00
1.72122E+00	2.33110E+00	1.76385E+00	2.29624E+00	1.80648E+00	2.26138E+00
1.79485E+00	2.40212E+00	1.82838E+00	2.37354E+00	1.86191E+00	2.34497E+00
1.86984E+00	2.47139E+00	1.89447E+00	2.44951E+00	1.91910E+00	2.42764E+00
1.94567E+00	2.53931E+00	1.96209E+00	2.52412E+00	1.97852E+00	2.50892E+00
2.02170E+00	2.60651E+00	2.03123E+00	2.59733E+00	2.04075E+00	2.58815E+00
2.10184E+00	2.66912E+00	2.10184E+00	2.66912E+00	2.10184E+00	2.66912E+00

BLADE STACKING
TEST CASE I

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 6.00000E+00

ROTAT = -65.00E+00 (ROTATION ANGLE)

XCC =	3.000E+00 (X COORDINATE OF C.G. STACKING POINT)	YCC =	3.000E+00 (Y COORDINATE OF C.G. STACKING POINT)
LER =	1.374E-02 (LEADING EDGE RADIUS)	TER =	8.000E-03 (TRAILING EDGE RADIUS)
XXLE=	2.160E+00 (LEADING EDGE COORDINATE)	XXTE=	4.138E+00 (TRAILING EDGE COORDINATE)
YYLE=	3.000E+00 (LEADING EDGE COORDINATE)	YYTE=	2.963E+00 (TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.14606E+00	2.99916E+00	2.14606E+00	2.99916E+00	2.14606E+00	2.99916E+00
2.15567E+00	3.00883E+00	2.15605E+00	2.99957E+00	2.15644E+00	2.99031E+00
2.16059E+00	3.01096E+00	2.16105E+00	2.99978E+00	2.16151E+00	2.98860E+00
2.17048E+00	3.01421E+00	2.17105E+00	3.00018E+00	2.17162E+00	2.98616E+00
2.19531E+00	3.02006E+00	2.19605E+00	3.00118E+00	2.19678E+00	2.98229E+00
2.24510E+00	3.02917E+00	2.24604E+00	3.00304E+00	2.24698E+00	2.97692E+00
2.29500E+00	3.03653E+00	2.29604E+00	3.00476E+00	2.29709E+00	2.97300E+00
2.34496E+00	3.04282E+00	2.34605E+00	3.00633E+00	2.34714E+00	2.96984E+00
2.44503E+00	3.05302E+00	2.44607E+00	3.00901E+00	2.44712E+00	2.96501E+00
2.54523E+00	3.06083E+00	2.54611E+00	3.01109E+00	2.54700E+00	2.96135E+00
2.64553E+00	3.06663E+00	2.64616E+00	3.01257E+00	2.64680E+00	2.95850E+00
2.74589E+00	3.07059E+00	2.74622E+00	3.01344E+00	2.74654E+00	2.95629E+00
2.84633E+00	3.07283E+00	2.84628E+00	3.01371E+00	2.84626E+00	2.95459E+00
2.94672E+00	3.07336E+00	2.94634E+00	3.01338E+00	2.94596E+00	2.95339E+00
3.04713E+00	3.07203E+00	3.04639E+00	3.01244E+00	3.04566E+00	2.95285E+00
3.14751E+00	3.06867E+00	3.14644E+00	3.01090E+00	3.14539E+00	2.95313E+00
3.24781E+00	3.06313E+00	3.24648E+00	3.00875E+00	3.24515E+00	2.95438E+00
3.34802E+00	3.05577E+00	3.34650E+00	3.00601E+00	3.34499E+00	2.95625E+00
3.44816E+00	3.04785E+00	3.44651E+00	3.00266E+00	3.44486E+00	2.95747E+00
3.54819E+00	3.03858E+00	3.54649E+00	2.99870E+00	3.54479E+00	2.95882E+00
3.64810E+00	3.02816E+00	3.64645E+00	2.99415E+00	3.64479E+00	2.96013E+00
3.74790E+00	3.01685E+00	3.74637E+00	2.98899E+00	3.74485E+00	2.96113E+00
3.84758E+00	3.00487E+00	3.84627E+00	2.98323E+00	3.84495E+00	2.96159E+00
3.94718E+00	2.99262E+00	3.94613E+00	2.97686E+00	3.94507E+00	2.96111E+00
4.04672E+00	2.98061E+00	4.04594E+00	2.96990E+00	4.04516E+00	2.95918E+00
4.14572E+00	2.96233E+00	4.14572E+00	2.96233E+00	4.14572E+00	2.96233E+00

BLADE STACKING
TEST CASE I

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 5.83100E+00

ROTAT = -65.00E+00 (ROTATION ANGLE)

XCC =	3.000E+00 (X COORDINATE OF C.G. STACKING POINT)	YCC =	3.000E+00 (Y COORDINATE OF C.G. STACKING POINT)
LER =	1.374E-02 (LEADING EDGE RADIUS)	TER =	8.000E-03 (TRAILING EDGE RADIUS)
XXLE=	2.163E+00 (LEADING EDGE COORDINATE)	XXTE=	4.140E+00 (TRAILING EDGE COORDINATE)
YYLE=	3.006E+00 (LEADING EDGE COORDINATE)	YYTE=	2.950E+00 (TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.14885E+00	3.00512E+00	2.14885E+00	3.00512E+00	2.14885E+00	3.00512E+00
2.15848E+00	3.01530E+00	2.15885E+00	3.00551E+00	2.15923E+00	2.99572E+00
2.16341E+00	3.01752E+00	2.16385E+00	3.00570E+00	2.16430E+00	2.99388E+00
2.17330E+00	3.02090E+00	2.17385E+00	3.00608E+00	2.17441E+00	2.99125E+00
2.19815E+00	3.02695E+00	2.19886E+00	3.00699E+00	2.19957E+00	2.98703E+00
2.24797E+00	3.03629E+00	2.24886E+00	3.00868E+00	2.24975E+00	2.98107E+00
2.29791E+00	3.04379E+00	2.29888E+00	3.01021E+00	2.29985E+00	2.97664E+00
2.34791E+00	3.05014E+00	2.34890E+00	3.01157E+00	2.34988E+00	2.97301E+00
2.44807E+00	3.06030E+00	2.44895E+00	3.01379E+00	2.44982E+00	2.96728E+00
2.54837E+00	3.06791E+00	2.54901E+00	3.01534E+00	2.54965E+00	2.96277E+00
2.64877E+00	3.07336E+00	2.64908E+00	3.01622E+00	2.64939E+00	2.95908E+00
2.74923E+00	3.07684E+00	2.74915E+00	3.01643E+00	2.74908E+00	2.95603E+00
2.84972E+00	3.07846E+00	2.84923E+00	3.01598E+00	2.84873E+00	2.95349E+00
2.95022E+00	3.07824E+00	2.94930E+00	3.01485E+00	2.94837E+00	2.95146E+00
3.05070E+00	3.07601E+00	3.04935E+00	3.01305E+00	3.04801E+00	2.95008E+00
3.15111E+00	3.07162E+00	3.14940E+00	3.01058E+00	3.14769E+00	2.94954E+00
3.25142E+00	3.06489E+00	3.24942E+00	3.00744E+00	3.24743E+00	2.94999E+00
3.35160E+00	3.05620E+00	3.34943E+00	3.00364E+00	3.34725E+00	2.95107E+00
3.45170E+00	3.04684E+00	3.44940E+00	2.99916E+00	3.44711E+00	2.95148E+00
3.55165E+00	3.03602E+00	3.54934E+00	2.99401E+00	3.54704E+00	2.95201E+00
3.65145E+00	3.02395E+00	3.64925E+00	2.98820E+00	3.64705E+00	2.95245E+00
3.75111E+00	3.01090E+00	3.74911E+00	2.98172E+00	3.74712E+00	2.95253E+00
3.85062E+00	2.99713E+00	3.84893E+00	2.97457E+00	3.84724E+00	2.95200E+00
3.95003E+00	2.98303E+00	3.94870E+00	2.96675E+00	3.94737E+00	2.95046E+00
4.04938E+00	2.96917E+00	4.04841E+00	2.95826E+00	4.04745E+00	2.94735E+00
4.14807E+00	2.94911E+00	4.14807E+00	2.94911E+00	4.14807E+00	2.94911E+00

BLADE STACKING
TEST CASE I

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 5.47700E+00

ROTAT = -65.00E+00 (ROTATION ANGLE)

XCC =	3.000E+00 (X COORDINATE OF C.G. STACKING POINT)	YCC =	3.000E+00 (Y COORDINATE OF C.G. STACKING POINT)
LER =	1.374E-02 (LEADING EDGE RADIUS)	TER =	8.000E-03 (TRAILING EDGE RADIUS)
XXLE=	2.169E+00 (LEADING EDGE COORDINATE)	XXTE=	4.145E+00 (TRAILING EDGE COORDINATE)
YYLE=	3.017E+00 (LEADING EDGE COORDINATE)	YYTE=	2.921E+00 (TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.15483E+00	3.01696E+00	2.15483E+00	3.01696E+00	2.15483E+00	3.01696E+00
2.16446E+00	3.02820E+00	2.16484E+00	3.01731E+00	2.16521E+00	3.00642E+00
2.16939E+00	3.03063E+00	2.16984E+00	3.01748E+00	2.17028E+00	3.00433E+00
2.17930E+00	3.03431E+00	2.17984E+00	3.01781E+00	2.18039E+00	3.00132E+00
2.20417E+00	3.04082E+00	2.20486E+00	3.01861E+00	2.20555E+00	2.99640E+00
2.25408E+00	3.05077E+00	2.25490E+00	3.02005E+00	2.25572E+00	2.98933E+00
2.30410E+00	3.05864E+00	2.30494E+00	3.02128E+00	2.30578E+00	2.98393E+00
2.35420E+00	3.06521E+00	2.35499E+00	3.02231E+00	2.35578E+00	2.97940E+00
2.45458E+00	3.07547E+00	2.45510E+00	3.02372E+00	2.45561E+00	2.97197E+00
2.55512E+00	3.08278E+00	2.55521E+00	3.02430E+00	2.55530E+00	2.96581E+00
2.65576E+00	3.08760E+00	2.65533E+00	3.02404E+00	2.65490E+00	2.96047E+00
2.75646E+00	3.09012E+00	2.75544E+00	3.02294E+00	2.75442E+00	2.95575E+00
2.85717E+00	3.09049E+00	2.85554E+00	3.02100E+00	2.85390E+00	2.95151E+00
2.95787E+00	3.08871E+00	2.95562E+00	3.01822E+00	2.95336E+00	2.94773E+00
3.05849E+00	3.08461E+00	3.05567E+00	3.01460E+00	3.05284E+00	2.94460E+00
3.15899E+00	3.07300E+00	3.15568E+00	3.01015E+00	3.15238E+00	2.94230E+00
3.25931E+00	3.06870E+00	3.25566E+00	3.00486E+00	3.25201E+00	2.94101E+00
3.35942E+00	3.05713E+00	3.35559E+00	2.99873E+00	3.35176E+00	2.94032E+00
3.45937E+00	3.04460E+00	3.45546E+00	2.99176E+00	3.45156E+00	2.93892E+00
3.55910E+00	3.03037E+00	3.55528E+00	2.98396E+00	3.55145E+00	2.93754E+00
3.65859E+00	3.01466E+00	3.65502E+00	2.97532E+00	3.65145E+00	2.93597E+00
3.75786E+00	2.99778E+00	3.75469E+00	2.96584E+00	3.75152E+00	2.93391E+00
3.85691E+00	2.98000E+00	3.85427E+00	2.95554E+00	3.85164E+00	2.93108E+00
3.95579E+00	2.96177E+00	3.95377E+00	2.94439E+00	3.95175E+00	2.92702E+00
4.05457E+00	2.94372E+00	4.05316E+00	2.93242E+00	4.05175E+00	2.92111E+00
4.15246E+00	2.91961E+00	4.15246E+00	2.91961E+00	4.15246E+00	2.91961E+00

BLADE STACKING
TEST CASE I

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 5.09900E+00

ROTAT = -65.00E+00 (ROTATION ANGLE)

XCC =	3.000E+00 (X COORDINATE OF C.G. STACKING POINT)	YCC =	3.000E+00 (Y COORDINATE OF C.G. STACKING POINT)
LER =	1.374E-02 (LEADING EDGE RADIUS)	TER =	8.000E-03 (TRAILING EDGE RADIUS)
XXLE=	2.174E+00 (LEADING EDGE COORDINATE)	XXTE=	4.148E+00 (TRAILING EDGE COORDINATE)
YYLE=	3.029E+00 (LEADING EDGE COORDINATE)	YYTE=	2.887E+00 (TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.16076E+00	3.02868E+00	2.16076E+00	3.02868E+00	2.16076E+00	3.02868E+00
2.17037E+00	3.04108E+00	2.17077E+00	3.02902E+00	2.17117E+00	3.01696E+00
2.17530E+00	3.04374E+00	2.17578E+00	3.02919E+00	2.17625E+00	3.01463E+00
2.18522E+00	3.04777E+00	2.18579E+00	3.02951E+00	2.18637E+00	3.01125E+00
2.21012E+00	3.05485E+00	2.21083E+00	3.03026E+00	2.21154E+00	3.00567E+00
2.26010E+00	3.06560E+00	2.26090E+00	3.03158E+00	2.26171E+00	2.99756E+00
2.31023E+00	3.07399E+00	2.31099E+00	3.03263E+00	2.31174E+00	2.99127E+00
2.36046E+00	3.08092E+00	2.36107E+00	3.03341E+00	2.36169E+00	2.98591E+00
2.46112E+00	3.09149E+00	2.46126E+00	3.03419E+00	2.46140E+00	2.97689E+00
2.56197E+00	3.09865E+00	2.56144E+00	3.03390E+00	2.56092E+00	2.96915E+00
2.66294E+00	3.10292E+00	2.66162E+00	3.03255E+00	2.66030E+00	2.96219E+00
2.76396E+00	3.10450E+00	2.76178E+00	3.03014E+00	2.75960E+00	2.95578E+00
2.86498E+00	3.10357E+00	2.86191E+00	3.02667E+00	2.85883E+00	2.94977E+00
2.96594E+00	3.10012E+00	2.96199E+00	3.02214E+00	2.95805E+00	2.94416E+00
3.06676E+00	3.09397E+00	3.06202E+00	3.01655E+00	3.05728E+00	2.93912E+00
3.16738E+00	3.08491E+00	3.16199E+00	3.00990E+00	3.15660E+00	2.93488E+00
3.26770E+00	3.07275E+00	3.26180E+00	3.00219E+00	3.25606E+00	2.93163E+00
3.36769E+00	3.05794E+00	3.36168E+00	2.99342E+00	3.35567E+00	2.92890E+00
3.46743E+00	3.04184E+00	3.46138E+00	2.98359E+00	3.45533E+00	2.92535E+00
3.56682E+00	3.02373E+00	3.56098E+00	2.97271E+00	3.55513E+00	2.92170E+00
3.66585E+00	3.00386E+00	3.66045E+00	2.96078E+00	3.65505E+00	2.91770E+00
3.76453E+00	2.98257E+00	3.75979E+00	2.94779E+00	3.75506E+00	2.91302E+00
3.86287E+00	2.96017E+00	3.85899E+00	2.93375E+00	3.85511E+00	2.90734E+00
3.96095E+00	2.93715E+00	3.95804E+00	2.91866E+00	3.95512E+00	2.90017E+00
4.05888E+00	2.91421E+00	4.05691E+00	2.90253E+00	4.05494E+00	2.89084E+00
4.15562E+00	2.88534E+00	4.15562E+00	2.88534E+00	4.15562E+00	2.88534E+00

BLADE STACKING
TEST CASE I

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 4.69000E+00

ROTAT = -65.00E+00 (ROTATION ANGLE)

XCC =	3.000E+00 (X COORDINATE OF C.G. STACKING POINT)	YCC =	3.000E+00 (Y COORDINATE OF C.G. STACKING POINT)
LER =	1.374E-02 (LEADING EDGE RADIUS)	TER =	8.000E-03 (TRAILING EDGE RADIUS)
XXLE=	2.180E+00 (LEADING EDGE COORDINATE)	XXTE=	4.149E+00 (TRAILING EDGE COORDINATE)
YYLE=	3.041E+00 (LEADING EDGE COORDINATE)	YYTE=	2.846E+00 (TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.16636E+00	3.04065E+00	2.16636E+00	3.04065E+00	2.16636E+00	3.04065E+00
2.17591E+00	3.05436E+00	2.17638E+00	3.04101E+00	2.17685E+00	3.02767E+00
2.18083E+00	3.05730E+00	2.18139E+00	3.04119E+00	2.18195E+00	3.02508E+00
2.19074E+00	3.06174E+00	2.19142E+00	3.04153E+00	2.19209E+00	3.02133E+00
2.21566E+00	3.06954E+00	2.21648E+00	3.04233E+00	2.21730E+00	3.01512E+00
2.26574E+00	3.08130E+00	2.26662E+00	3.04367E+00	2.26749E+00	3.00603E+00
2.31600E+00	3.09043E+00	2.31676E+00	3.04467E+00	2.31752E+00	2.99890E+00
2.36539E+00	3.09789E+00	2.36691E+00	3.04533E+00	2.36742E+00	2.99276E+00
2.46745E+00	3.10902E+00	2.46721E+00	3.04563E+00	2.46697E+00	2.98223E+00
2.56875E+00	3.11621E+00	2.56751E+00	3.04457E+00	2.56627E+00	2.97294E+00
2.67019E+00	3.11999E+00	2.66779E+00	3.04216E+00	2.66539E+00	2.96433E+00
2.77167E+00	3.12063E+00	2.76802E+00	3.03839E+00	2.76437E+00	2.95616E+00
2.87312E+00	3.11828E+00	2.86820E+00	3.03327E+00	2.86327E+00	2.94826E+00
2.97445E+00	3.11297E+00	2.96829E+00	3.02679E+00	2.96213E+00	2.94062E+00
3.07557E+00	3.10448E+00	3.06829E+00	3.01896E+00	3.06101E+00	2.93345E+00
3.17525E+00	3.09259E+00	3.16817E+00	3.00978E+00	3.16009E+00	2.92697E+00
3.27609E+00	3.07709E+00	3.26792E+00	2.99925E+00	3.25917E+00	2.92140E+00
3.37650E+00	3.05850E+00	3.36752E+00	2.98737E+00	3.35855E+00	2.91624E+00
3.47591E+00	3.03820E+00	3.46695E+00	2.97414E+00	3.45799E+00	2.91008E+00
3.57479E+00	3.01551E+00	3.56619E+00	2.95957E+00	3.55759E+00	2.90363E+00
3.67311E+00	2.99072E+00	3.66523E+00	2.94366E+00	3.65734E+00	2.89660E+00
3.77090E+00	2.96419E+00	3.76404E+00	2.92641E+00	3.75718E+00	2.88863E+00
3.86817E+00	2.93629E+00	3.86261E+00	2.90782E+00	3.85704E+00	2.87936E+00
3.96503E+00	2.90755E+00	3.96091E+00	2.88791E+00	3.95680E+00	2.86827E+00
4.06164E+00	2.87873E+00	4.05894E+00	2.86666E+00	4.05624E+00	2.85460E+00
4.15668E+00	2.84410E+00	4.15668E+00	2.84410E+00	4.15668E+00	2.84410E+00

BLADE STACKING
TEST CASE I

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 4.24300E+00

ROTAT = -65.00E+00 (ROTATION ANGLE)

XCC =	3.000E+00 (X COORDINATE OF C.G. STACKING POINT)	YCC =	3.000E+00 (Y COORDINATE OF C.G. STACKING POINT)
LER =	1.374E-02 (LEADING EDGE RADIUS)	TER =	8.000E-03 (TRAILING EDGE RADIUS)
XXLE=	2.187E+00 (LEADING EDGE COORDINATE)	XXTE=	4.149E+00 (TRAILING EDGE COORDINATE)
YYLE=	3.053E+00 (LEADING EDGE COORDINATE)	YYTE=	2.796E+00 (TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.17324E+00	3.05216E+00	2.17324E+00	3.05216E+00	2.17324E+00	3.05216E+00
2.18262E+00	3.06736E+00	2.18328E+00	3.05262E+00	2.18394E+00	3.03787E+00
2.18752E+00	3.07064E+00	2.18830E+00	3.05284E+00	2.18908E+00	3.03504E+00
2.19740E+00	3.07560E+00	2.19834E+00	3.05327E+00	2.19928E+00	3.03094E+00
2.22232E+00	3.08434E+00	2.22345E+00	3.05427E+00	2.22458E+00	3.02420E+00
2.27248E+00	3.09754E+00	2.27368E+00	3.05594E+00	2.27488E+00	3.01433E+00
2.32291E+00	3.10776E+00	2.32393E+00	3.05717E+00	2.32494E+00	3.00657E+00
2.37353E+00	3.11607E+00	2.37418E+00	3.05795E+00	2.37483E+00	2.99983E+00
2.47514E+00	3.12828E+00	2.47470E+00	3.05819E+00	2.47425E+00	2.98810E+00
2.57710E+00	3.13585E+00	2.57520E+00	3.05666E+00	2.57330E+00	2.97748E+00
2.67925E+00	3.13938E+00	2.67567E+00	3.05336E+00	2.67208E+00	2.96735E+00
2.78144E+00	3.13914E+00	2.77605E+00	3.04830E+00	2.77067E+00	2.95745E+00
2.88357E+00	3.13532E+00	2.87634E+00	3.04146E+00	2.86911E+00	2.94760E+00
2.98550E+00	3.12795E+00	2.97649E+00	3.03286E+00	2.96748E+00	2.93777E+00
3.08708E+00	3.11679E+00	3.07647E+00	3.02250E+00	3.06583E+00	2.92821E+00
3.18815E+00	3.10151E+00	3.17625E+00	3.01038E+00	3.16436E+00	2.91916E+00
3.28852E+00	3.08218E+00	3.27581E+00	2.99651E+00	3.26310E+00	2.91084E+00
3.38812E+00	3.05907E+00	3.37511E+00	2.98088E+00	3.36209E+00	2.90269E+00
3.48707E+00	3.03373E+00	3.47411E+00	2.96351E+00	3.46115E+00	2.89329E+00
3.58519E+00	3.00551E+00	3.57279E+00	2.94439E+00	3.56040E+00	2.88328E+00
3.68245E+00	2.97474E+00	3.67113E+00	2.92355E+00	3.65980E+00	2.87235E+00
3.77887E+00	2.94184E+00	3.76907E+00	2.90097E+00	3.75927E+00	2.86010E+00
3.87450E+00	2.90720E+00	3.86661E+00	2.87667E+00	3.85872E+00	2.84615E+00
3.96946E+00	2.87142E+00	3.96370E+00	2.85066E+00	3.95795E+00	2.82990E+00
4.06400E+00	2.83533E+00	4.06032E+00	2.82294E+00	4.05665E+00	2.81055E+00
4.15644E+00	2.79353E+00	4.15644E+00	2.79353E+00	4.15644E+00	2.79353E+00

BLADE STACKING
TEST CASE I

COORDINATES ROTATED AND TRANSLATED

UNWRAPPED CYLINDERICAL COORDINATE AT RADIUS R(I) = 4.00000E+00

ROTAT = -65.00E+00 (ROTATION ANGLE)

XCC =	3.000E+00 (X COORDINATE OF C.G. STACKING POINT)	YCC =	3.000E+00 (Y COORDINATE OF C.G. STACKING POINT)
LER =	1.374E-02 (LEADING EDGE RADIUS)	TER =	8.000E-03 (TRAILING EDGE RADIUS)
XXLE=	2.191E+00 (LEADING EDGE COORDINATE)	XXTE=	4.148E+00 (TRAILING EDGE COORDINATE)
YYLE=	3.057E+00 (LEADING EDGE COORDINATE)	YYTE=	2.766E+00 (TRAILING EDGE COORDINATE)

UPPER SURFACE		MEANLINE		LOWER SURFACE	
XU	YU	XM	YM	XL	YL
2.17729E+00	3.05673E+00	2.17729E+00	3.05673E+00	2.17729E+00	3.05673E+00
2.18649E+00	3.07281E+00	2.18734E+00	3.05729E+00	2.18819E+00	3.04176E+00
2.19136E+00	3.07630E+00	2.19237E+00	3.05756E+00	2.19338E+00	3.03882E+00
2.20121E+00	3.08160E+00	2.20243E+00	3.05809E+00	2.20364E+00	3.03458E+00
2.22610E+00	3.09099E+00	2.22757E+00	3.05932E+00	2.22904E+00	3.02766E+00
2.27628E+00	3.10522E+00	2.27787E+00	3.06141E+00	2.27947E+00	3.01760E+00
2.32680E+00	3.11627E+00	2.32820E+00	3.06298E+00	2.32959E+00	3.00969E+00
2.37756E+00	3.12526E+00	2.37853E+00	3.06404E+00	2.37951E+00	3.00283E+00
2.47955E+00	3.13845E+00	2.47923E+00	3.06462E+00	2.47890E+00	2.99079E+00
2.58198E+00	3.14656E+00	2.57991E+00	3.06315E+00	2.57784E+00	2.97974E+00
2.68464E+00	3.15022E+00	2.68054E+00	3.05962E+00	2.67644E+00	2.96903E+00
2.78737E+00	3.14971E+00	2.78108E+00	3.05405E+00	2.77480E+00	2.95839E+00
2.89000E+00	3.14523E+00	2.88149E+00	3.04643E+00	2.87297E+00	2.94763E+00
2.99240E+00	3.13680E+00	2.98172E+00	3.03676E+00	2.97104E+00	2.93671E+00
3.09436E+00	3.12420E+00	3.08173E+00	3.02505E+00	3.06909E+00	2.92590E+00
3.19569E+00	3.10716E+00	3.18148E+00	3.01130E+00	3.16727E+00	2.91544E+00
3.29614E+00	3.08548E+00	3.28093E+00	2.99553E+00	3.26572E+00	2.90557E+00
3.39564E+00	3.05975E+00	3.38004E+00	2.97773E+00	3.36444E+00	2.89570E+00
3.49431E+00	3.03145E+00	3.47876E+00	2.95791E+00	3.46322E+00	2.88437E+00
3.59193E+00	2.99996E+00	3.57706E+00	2.93608E+00	3.56220E+00	2.87221E+00
3.68847E+00	2.96563E+00	3.67490E+00	2.91226E+00	3.66133E+00	2.85889E+00
3.78396E+00	2.92891E+00	3.77223E+00	2.88645E+00	3.76050E+00	2.84398E+00
3.87843E+00	2.89022E+00	3.86901E+00	2.85865E+00	3.85960E+00	2.82708E+00
3.97204E+00	2.85020E+00	3.96521E+00	2.82889E+00	3.95838E+00	2.80759E+00
4.06507E+00	2.80970E+00	4.06078E+00	2.79718E+00	4.05648E+00	2.78466E+00
4.15568E+00	2.76352E+00	4.15568E+00	2.76352E+00	4.15568E+00	2.76352E+00