NASA TECHNICAL MEMORANDUM

NASA TM X-2484

NASA TM X-2484

PERFORMANCE OF TANDEM-BLADED TRANSONIC COMPRESSOR ROTOR WITH TIP SPEED OF [illegible] FEET PER SECOND

by [illegible] and David C. Janetzke

[illegible] Research Center
Cleveland, Ohio [illegible]

NATIONAL [illegible] ADMINISTRATION • WASHINGTON [illegible]

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA TM X-2484		

4. Title and Subtitle	5. Report Date
PERFORMANCE OF TANDEM-BLADED TRANSONIC COMPRESSOR ROTOR WITH TIP SPEED OF 1375 FEET PER SECOND	March 1972
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Donald C. Urasek and David C. Janetzke	E-6388
	10. Work Unit No. 764-74

9. Performing Organization Name and Address	11. Contract or Grant No.
Lewis Research Center National Aeronautics and Space Administration Cleveland, Ohio 44135	

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
National Aeronautics and Space Administration Washington, D.C. 20546	Technical Memorandum
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The design and experimental performance of a 20-inch-diameter tandem-bladed axial-flow transonic compressor rotor is presented. Radial surveys were made of the flow conditions. At design speed the peak efficiency was 0.88 and occurred at an equivalent weight flow of 63 pounds per second. At peak efficiency the total-pressure and total-temperature ratios were 1.77 and 1.20, respectively. The stall margin at design speed was 10 percent based on weight flows and total-pressure ratios at peak efficiency and near stall.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Transonic axial-flow compressor rotor Tandem-bladed axial-flow compressor	Unclassified - unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified	87	$3.00

* For sale by the National Technical Information Service, Springfield, Virginia 22151

PERFORMANCE OF TANDEM-BLADED TRANSONIC COMPRESSOR ROTOR WITH TIP SPEED OF 1375 FEET PER SECOND

by Donald C. Urasek and David C. Janetzke

Lewis Research Center

SUMMARY

A 20-inch-diameter tandem bladed axial-flow transonic compressor rotor, having a design tip speed of 1375 feet per second, was tested. Radial surveys of the flow conditions at the blade inlet and outlet were made. The flow and performance parameters were calculated at the blade leading and trailing edges at 11 radial positions. The radial surveys were made over the rotor stable operating flow range at equivalent rotative speeds which varied from 50 to 100 percent of design speed.

At the design weight flow of 65.3 pounds per second (41.6 lb/(ft^2)(sec) of annulus area), the experimental pressure ratio of 1.67 compared favorably with the design value of 1.65, and the experimental overall efficiency of 0.85 was 2 percentage points higher than the design value of 0.83. At design speed the peak efficiency was 0.88 and occurred at an equivalent weight flow of 63 pounds per second. Total-pressure ratio and total-temperature ratio at the equivalent weight flow corresponding to peak efficiency were 1.77 and 1.20, respectively.

Results indicated that the losses are, in general, lower than design across the complete span of the blade. An exception to the low level of losses occurred locally in the hub region and behind the blade vibratory damper.

The stall margin at design speed was 10 percent based on weight flows and total-pressure ratios at peak efficiency and near stall.

For all blade elements at design speed the minimum loss incidence angles were within 1.0° of the design incidence angles of zero. The deviation angles were within 2° of the design values.

INTRODUCTION

The Lewis Research Center of the National Aeronautics and Space Administration is engaged in a research program on axial-flow fans and compressors for advanced air-

breathing engines. The program is directed primarily toward providing the technology to permit reductions in the size and weight of these components while maintaining high-level performance. In support of this program studies are being conducted to evaluate the performance of several series of experimental blades designed for operation at transonic inlet relative Mach numbers.

Transonic compressor blades are designed for a shock wave to occur near the entrance to the blade passage, which is followed by subsonic diffusion of the flow in the region downstream of the shock. However, shock boundary-layer interaction generally causes some flow separation from the blade suction surface in this subsonic flow region. If separation occurs immediately behind the shock, the subsonic diffusion will be ineffective, and high flow losses will result.

One method for reducing the extent of separated flow in the downstream subsonic diffusion region is the use of tandem blading (ref. 1). A tandem blade allows the start of a new suction-surface boundary layer as the fluid enters the highly loaded portion of the blade. In addition, the high-energy fluid energizes the suction-surface boundary layer, thereby reducing the possibility of flow separation in the subsonic diffusion region and extending the compressor flow range to lower weight flows. In an investigation of a tandem bladed axial blower (ref. 2), good performance was recorded over the low subsonic flow conditions tested.

The purpose of this report is to present the design and experimental performance of a compressor rotor with tandem blading operating in the transonic flow regime. The multiple circular arc blade described in reference 3 was incorporated into a tandem bladed configuration by forming two short airfoils from the profile section of the multiple circular arc blade. The two airfoils were then displaced in a manner such that a slot was formed between them. Both overall and blade-element performance data are presented over the rotor stable operating flow range at rotative speeds which varied from 50 to 100 percent of design speed. Surveys of the flow conditions were taken at 11 radial positions. The tests were conducted in the single-stage compressor test facility at the Lewis Research Center.

COMPRESSOR ROTOR DESIGN

The rotor blade was designed using the multiple circular arc (MCA) blade shape described in reference 3. The tandem blade was then formed by separating the MCA blade into two portions. The multiple circular arc blade has two independent double circular arc sections, which are tangent at their point of contact. With this blade shape,

it is possible to independently control the amount of turning (camber) over each section of the blade, which should minimize overall blade losses.

The MCA blade design procedure uses three separate computer programs. These programs are the Streamline Analysis Program, the Blade Geometry Program, and the Blade Coordinate Program. Each of these programs will be briefly discussed. In addition, the method used to form the tandem blade will be described. The blade design is based on flow conditions in the meridional plane. Blade elements at 11 radial stations are computed on conical surfaces approximating the stream surfaces passing through the blade. The blade elements are then stacked on a line about their center of gravity. Cartesian blade coordinates are then computed for fabrication of the blades.

The overall performance parameters, blade-element performance parameters, and the blade geometry compiled from the three design programs are listed in tables I to III. The symbols used in this report are defined in appendix A. The equations used for calculating the overall blade-element performance parameters are presented in appendix B. All definitions along with the units presented in the tables are defined in appendix C.

Multiple Circular Arc Blade Shape

Streamline analysis program. - The Streamline Analysis Program calculates the design velocity diagrams at several axial planes including the instrumentation survey planes and planes approximating the blade leading and trailing edges. The calculations used in this program assume axisymmetric flow and use solutions that satisfy radial equilibrium, continuity, and energy addition. These equations are summarized in reference 4. These equations account for streamline curvatures and a radial distribution of enthalpy and entropy. Boundary-layer blockage factors of 0.02 and 0.04 were assumed at the rotor inlet and outlet, respectively.

The design input variables for this program include flow path geometry (fig. 1), weight flow, rotor speed, and the desired radial distributions of total pressure and total temperature both upstream and downstream of the rotor.

Blade geometry program. - The blade geometry program is used to design the blade shape that will produce the desired velocity diagrams computed in the Streamline Analysis Program. The blade shape is dependent on incidence and deviation angles, the blade maximum thickness location, and several parameters that control the rate of turning (camber) in the blade passage.

The program then calculates the radial distribution of total loss at the rotor outlet. The method used to compute the total loss is explained later in this section. With the

calculated radial distribution of total loss and the desired radial distribution of total pressure at the plane approximating the blade trailing edge, an outlet total-temperature distribution is then calculated. This total-temperature distribution is then compared with the total-temperature distribution used in the Streamline Analysis Program. If the two distributions do not agree, an iterative procedure between the two design programs is carried out until the total-temperature distribution converge to the desired accuracy.

The input to this program includes the flow velocities and flow angles computed in the Streamline Analysis Program, total-pressure and total-temperature distribution at the rotor inlet and outlet, incidence angle, and several parameters that control the blade shape.

Incidence angles were set at zero with respect to the blade suction surface for all blade elements. It was assumed that a zero incidence angle on the suction surface of the blade results in minimum loss especially for supersonic relative inlet Mach numbers.

Deviation angles were estimated using Carter's rule. The form used is

$$\delta^{o} = \frac{(\varphi_c)(m)}{\sqrt{T}}$$

The equation for calculating m, based on curves presented in reference 5, is

$$m = x\left(\frac{2a}{c}\right) y$$

where

$$x = 0.219 + 0.0008916\,\gamma_b + 0.000027085\,\gamma_b^2$$

$$y = 2.175 - 0.035528\,\gamma_b + 0.00015167\,\gamma_b^2$$

The equivalent camber φ_c was calculated by the method presented in reference 6. Equivalent camber accounts for the difference in deviation angle between a two-dimensional cascade and a three-dimensional blade element.

The calculation of blade-element total loss was based on a calculation of both a profile loss and a shock loss. The profile loss calculation was based on the correlation of loss as a function of diffusion factor and percent of blade span presented in reference 4.

The shock-loss calculation was based on the method presented in reference 7 for all blade elements for which the inlet relative flow is supersonic. This method basically calculates a loss across a normal shock based on an average of the inlet and suction-surface Mach numbers. The suction-surface Mach number is determined from the inlet Mach number and the acceleration resulting from a Prandtl-Meyer expansion based on the turning of the suction surface ahead of the shock. The method, which was based on supersonic inlet flow, was also used to calculate the shock losses at the high subsonic inlet flow condition. To calculate a shock loss for blade elements that operate at high subsonic inlet flow conditions, the inlet Mach number was assumed to be unity. A Prandtl-Meyer expansion was then assumed to provide an indication of the Mach number ahead of the shock. This method will likely overestimate the Mach number at the point of shock and, thus, overestimate the shock loss. It was used in the design of this rotor to provide a smooth variation in total loss with respect to span through the transonic region. A shock loss was applied at all subsonic radii except at the hub.

Blade coordinate program. - After the blade geometry is defined, the blade coordinate program presented in reference 8 is used to compute the blade elements on conical surfaces approximating the stream surfaces passing through the blade. The program then stacks the blade elements on a line through their centers of gravity and computes the Cartesian blade coordinate for fabrication.

Inputs to this program include the number of blade elements and the tangential and axial lean angles of the stacking line. For each blade element the following must be specified: (1) the inlet and outlet radii, (2) the inlet, maximum, and outlet blade thickness, (3) the blade centerline angles at the inlet, transition point, and outlet, and (4) the axial distance to the maximum thickness point, transition point, and outlet.

Tandem Blade Shape

To form the tandem blade, the multiple circular arc blade was separated into two portions. A typical cross section of the tandem blade is shown in figure 2. From the tip to 30 percent span from the tip, the slot was located at the calculated shock position. Over the remainder of the blade (30 to 100 percent span), the slot was arbitrarily located at the midchord position. With the center of gravity fixed, the two portions of the MCA blade were relocated 0.060 inch apart in a direction normal to the aerodynamic blade chord. Seven axially positioned webs were used to provide structural support for the blade. The webs physically blocked off 14 percent of the slot area.

The rotor had 47 blades. A selected blade-tip solidity of 1.30 resulted in a blade-tip aerodynamic chord of 1.72 inches.

The selected camber distributions for each blade element resulted in the area ratio choke margin varying across the blade from a low value of 1.033 at 70 percent span to a high value of 1.083 at the tip (table III). The area ratio choke margin is defined as the ratio of actual flow area to critical area where the local Mach number is unity. The choke margin calculation assumes the minimum area to occur immediately behind the assumed shock location and accounts for both streamline convergence and the loss across the shock.

APPARATUS AND PROCEDURE

Test Compressor

The compressor shaft is supported by two hydrodynamic journal bearings, which are located downstream of the compressor rotor. With this design arrangement the rotor is overhung at the end of the rotating shaft. Also, with this arrangement it is unnecessary to disturb the compressor shaft assembly when removing or changing test rotors. The axial thrust of the rotor is absorbed by a tapered land thrust bearing. A carbon face seal is used to isolate the oil from the air stream.

A photograph of the test rotor is shown in figure 3. The slots were formed with an electrical discharge machine. The part span dampers, used to reduce blade vibratory stresses, are located at 45 percent of blade span from the outlet rotor tip. The maximum thickness of the damper was 0.075 inch. The nonrotating radial tip clearance of the rotor was set at a nominal 0.020 inch at ambient conditions. This resulted in a measured rotating radial tip clearance of approximately 0.012 inch at design speed. Proximity probes are used to detect shaft movements in the vertical and horizontal directions and to indicate the blade rotating radial clearance. Several blades are strain gaged in order to observe the rotating blade stresses. The strain signals and the proximity probe voltage signals are monitored on oscilloscopes during all of the tests. Accelerometers are used to determine the horizontal and vertical components of force on the journal bearing housings. Their signals are also monitored during all of the tests.

Test Facility

A schematic diagram of the test facility is shown in figure 4. The drive system consists of a 3000-horsepower electric motor with a variable-frequency power supply. Motor speed may be controlled from 400 to 3600 rpm. The motor is coupled to a 5.52 gear ratio speed increaser gear box that in turn drives the test rotor. The facility was sized for a maximum flow rate of 100 pounds per second. The working fluid is atmospheric air. Air enters the test facility at an inlet located on the roof of the building. The air then passes through a flow measuring station consisting of a thin-plate orifice, through inlet butterfly throttle valves and then into a plenum chamber. The air is then accelerated to the compressor section, through the test section and into a collector through a sleeve throttle valve. The air then passes through a water cooler and is exhausted back into the atmosphere. Airflow can be controlled by either the upstream butterfly valves or the downstream collector sleeve valve. For the present investigation, the upstream throttle valves remained fully open while the collector sleeve valve was used to throttle the airflow.

Instrumentation

Radial surveys of the flow were made at the inlet and outlet of the rotor. Photographs of the survey probes are shown in figure 5. Total pressure, total temperature, and flow angle were measured with the combination probe (fig. 5(a)), and the static pressure was measured with an 8° C-shaped wedge probe (fig. 5(b)). Each probe was positioned with a null-balancing, stream-directional-sensitive control system that automatically alined the probe to the direction of flow. The material used for thermocouples was iron-constantan. The wedge static probes were calibrated in a low-speed air tunnel. Two combination probes and two static wedge probes were used both upstream and downstream of the rotor.

Inner and outer wall static pressure taps were located at the same axial station as the survey probes. The axial and circumferential locations of the probes along with the inner- and outer-wall static taps are shown in figure 6.

A calibrated flat-plate orifice was used to determine the flow rate, and an electronic speed counter, in conjunction with a magnetic pickup, was used to measure rotative speed (rpm).

Test Procedure

The rotor data were taken over a range of weight flow from maximum flow to stall conditions at equivalent rotative speeds of 50, 60, 70, 80, 90, and 100 percent of design speed. (Design speed is 16 000 rpm.) The operating curve for each speed line was defined by five data points.

Stall points were established by increasing the back pressure on the rotor (closing the sleeve valve in the collector) until a rotating stall pattern appeared in the signal from a hot-wire anemometer probe located approximately 8 inches upstream of the test rotor, near the outer casing diameter. Evidence of rotor stall was correlated by a drop in rotor outlet total pressure which was measured by a probe located at midpassage and recorded on an X-Y plotter. The near stall data point was taken within 1 pound per second of the recorded stall condition.

At each selected flow, the radial distributions of flow conditions were surveyed simultaneously at measuring stations located approximately 1 inch upstream of the blade leading edge and 0.7 inch downstream of the blade trailing edge (see fig. 6). Measurements of total pressure, total temperature, and flow angle were recorded at radial positions of 5, 10, 30, 40, 42.5, 45, 47.5, 50, 70, 90, and 95 percent of the blade span from the rotor tip. Static pressure measurements were recorded only at 30, 40, 42.5, 45, 47.5, 50, 70, and 90 percent of the blade span from the rotor tip.

Performance Calculation Procedure

Because of the physical size of the C-shaped static pressure wedges, it was not possible to obtain static pressure measurements at 5, 10, and 95 percent of blade span. The static pressure at 95 percent span was obtained by assuming a linear variation in static pressure between the inner-wall static pressure and the probe measurement at 90 percent span. A similar variation was assumed between the static-pressure measurement at the outer wall and 30 percent span to obtain the static pressure at 5 and 10 percent span.

The data, measured at stations upstream and downstream of the rotor, are translated to the blade leading and trailing edges along calculated streamlines in the following manner. Total temperature and total pressure are assumed constant along the streamlines. Static pressure is adjusted to account for area contraction and stream line curvature. The flow angle is adjusted by assuming constant angular momentum. The blade-element data presented are the translated values.

Orifice weight flow, total pressure, static pressures and temperatures were corrected to sea-level conditions based on the rotor inlet conditions.

Data Accuracy and Reliability

The estimated errors of the data based on inherent accuracies of the instrumentation and recording system are as follows:

Flow rate, lb/sec	±0.5
Rotative speed, rpm	±30
Flow angle, deg	±1
Temperature, ^{o}R	±1
Rotor inlet total pressure, psi	±0.02
Rotor outlet total pressure, psi	±0.15
Rotor inlet static pressure, psi	±0.05
Rotor outlet static pressure, psi	±0.10

The primary method for determining the reliability of the measured data is with comparisons of the integrated weight flows at the blade inlet and outlet measuring stations with the values measured with the orifice. These comparisons are presented in figure 7. The integrated flows at the inlet measuring station were within 1 percent of the orifice weight flow at all rotative speeds. At the outlet measuring station the integrated weight flows are within 5.5 percent of the orifice weight flow at the rotative speeds of 70, 80, 90, and 100 percent of equivalent design speed. At the lower speed lines (50 and 60 percent of equivalent design speed) the error is as high as 9 percent.

RESULTS AND DISCUSSION

The experimental results from this test rotor are presented in two main sections. The overall performance is presented first followed by the blade-element performance, which includes both radial distributions and variations with incidence angle. The data presented in the figures are machine plotted. Occasionally a data point will be omitted when it falls outside the range of parameters shown in the figure.

The plotted data along with several additional parameters not shown in the figures are presented in tabular form. Both the overall and the blade-element performance data are presented in tables IV and V. The definitions and units used for the tabular data are presented in appendix C.

Overall Performance

The overall performance curves for the range of speeds tested are shown in figure 8 where the mass-averaged values of total-pressure ratio, total-temperature ratio, and temperature-rise efficiency are plotted as functions of equivalent weight flow. At the design weight flow of 65.3 pounds per second (41.6 lb/(sec)(ft^2) of annulus area), the experimental pressure ratio of 1.67 compares favorably with the design value of 1.65, and the experimental overall efficiency of 0.85 was 2 percentage points higher than the design value of 0.83. Peak efficiency for the rotor at the design tip speed of 1375 feet per second was 0.88 and occurred at an equivalent weight flow rate of 63 pounds per second. Total pressure ratio and total temperature ratio at the equivalent weight flow corresponding to peak efficiency were 1.77 and 1.20, respectively. Stall margin at design speed was 10 percent based on the equivalent weight flow and pressure ratio at which peak efficiency occurred as compared with the values just before stall. At the lower rotor speeds, temperature-rise efficiencies of up to 91 percent were recorded.

Blade Element Performance

Radial distributions. - The radial distributions of selected flow and performance parameters at design speed are shown in figure 9. The data shown represent the flow conditions of near stall, peak efficiency, and near choke. The design values are shown by solid symbols. In this section flow and performance results at a near design weight flow of 65.6 pounds per second are compared with design values.

The experimental deviation angles were less than design values with exceptions in the damper region. Although the design deviation angles were overestimated, the experimental values were within 2°.

The total loss parameter distribution shows the losses to be lower than design with the exception of the regions near the damper and near the hub. However, the blade loading at a weight flow of 65.6 pounds per second, as indicated by the diffusion factor, achieved design values with the exception of the hub region. These results indicate that the design losses for this rotor were overestimated.

Corresponding to the lower-than-design losses, the temperature-rise efficiency was greater than design with exceptions, again, in the regions near the damper and rotor hub. The pressure ratios from the tip to 40 percent span were considerably greater than the design values.

The damper had a pronounced effect on the aerodynamic performance of the rotor. No attempt was made in the aerodynamic design of the rotor to account for any damper effects. Also, the aerodynamic design did not adequately account for the steep loss gradient near the hub.

Variation with incidence angle. - The variations of selected blade-element performance parameters are presented in figure 10. The data are presented for 60, 80, and 100 percent of design speed at blade elements located at 5, 10, 30, 50, 70, 90, and 95 percent of blade span as measured from the rotor tip. Design values are shown by solid symbols. The incidence angle curves are presented primarily for future use in comparing the performance of these blades with other blade forms. Only a few brief observations will be made from the curves at present.

The blades were designed for a zero incidence angle at the blade suction surface. The data indicate that the suction surface incidence angles corresponding to minimum losses were within 1.0° of the design values for all blade elements at design speed. The loss curves for the elements near the tip continue to decrease as the incidence angle is decreased. In the region of 50 percent blade span the loss curves indicate a minimum loss value near design incidence, with the losses increasing at both higher and lower values of incidence angle. In the hub region the curves are essentially flat over the entire incidence angle range. At all elements except near the hub (95 percent span) the measured losses were lower than the design values at design incidence. With the exception of the hub region (90 and 95 percent span) peak element efficiencies occur at incidence angles approximately 1.0° higher than design. As shown in figure 8, peak efficiency for the rotor occurred at a weight flow somewhat less than design where the higher incidence angles are obtained.

SUMMARY OF RESULTS

This report presents the aerodynamic design and both the overall and blade-element performance of a tandem bladed transonic compressor rotor. Radial surveys of the flow conditions at the blade inlet and outlet were made over the rotor stable operating flow range at equivalent rotative speeds from 50 to 100 percent of design speed. Flow and performance parameters were calculated across a number of selected blade elements. The following principal results were obtained:

1. At the design weight flow of 65.3 pounds per second (41.6 pounds per second per square foot of annulus area) the experimental pressure ratio of 1.67 compared favorably with the design value of 1.65, and the experimental overall efficiency of 0.85 was 2 percentage points higher than the design value of 0.83. Peak efficiency for the rotor at the design tip speed of 1375 feet per second was 0.88 and occurred at an equivalent weight flow rate of 63.0 pounds per second.

2. Total pressure ratio and total temperature ratio at the equivalent weight flow corresponding to peak efficiency were 1.77 and 1.20.

3. Stall margin at design speed was 10 percent based on weight flows and total pressure ratios at peak efficiency and near stall.

4. The measured total loss parameter distribution for this rotor showed the loss to be lower than the design values except for the regions near the damper and the rotor hub.

5. At design speed the suction-surface incidence angle corresponding to minimum loss was within 1.0° of the design incidence angle of zero for all blade elements.

6. At design conditions (zero incidence angle on the suction surface) deviation angles were within 2° of design values for all blade elements.

Lewis Research Center,
National Aeronautics and Space Administration,
Cleveland, Ohio, October 7, 1971,
764-74.

APPENDIX A

SYMBOLS

A_{an}	annulus area at rotor leading edge
A_f	frontal area at rotor leading edge
a	distance from blade leading edge to maximum camber point, in.
C_p	specific heat at constant pressure, 0.24 Btu/(lb)(^oR)
c	chord length, in.
D	diffusion factor
g	acceleration of gravity, 32.17 ft/sec^2
i_{mc}	mean incidence angle, angle between inlet air direction and line tangent to blade mean camber line at leading edge, deg
i_{ss}	suction surface incidence angle, angle between inlet air direction and line tangent to blade suction surface at leading edge, deg
J	mechanical equivalent of heat, 778.16 ft-lb/Btu
N	rotative speed, rpm
P	total pressure, psia
p	static pressure, psia
r	radius, in.
SM	stall margin, percent
T	total temperature, ^oR
U	wheel speed, ft/sec
V	air velocity, ft/sec
W	weight flow, lbm/sec
z	axial distance referenced from rotor blade hub leading edge, in.
α_c	cone angle, deg
α_s	streamline slope, deg
β	air angle, angle between air velocity and axial direction, deg
β'_c	relative meridional air angle based on cone angle, arc $\tan\left[\tan \beta'_m(\cos \alpha_c/\cos \alpha_s)\right]$, deg
γ	ratio of specific heats (1.40)

γ_b blade setting angle

δ ratio of rotor inlet total pressure to standard pressure of 14.69 psia

δ^o deviation angle, angle between exit air direction and blade mean camber line at trailing edge, deg

θ ratio of rotor inlet total temperature to standard temperature of 518.7^o R

η efficiency

κ_{mc} angle between blade mean camber line and meridional plane, deg

κ_{ss} angle between the blade suction surface camber line at leading edge and meridional plane, deg

σ solidity, ratio of chord to spacing

φ camber angle, deg

φ_c equivalent camber

$\overline{\omega}$ total loss coefficient

$\overline{\omega}_p$ profile loss coefficient

$\overline{\omega}_s$ shock loss coefficient

Subscripts:

ad adiabatic (temperature - rise)

id ideal

LE blade leading edge

m meridional direction

mom momentum

r radial direction

ref reference

TE blade trailing edge

z axial direction

θ tangential direction

1 instrument plane upstream of rotor

2 instrument plane downstream of rotor

Superscript:

' relative to rotor

APPENDIX B

EQUATIONS

Performance parameters are defined as follows:

Suction surface incidence angle -

$$i_{ss} = \left(\beta'_c\right)_{LE} - (\kappa_{ss}) \tag{B1}$$

Mean incidence angle -

$$i_{mc} = \left(\beta'_c\right)_{LE} - \left(\kappa_{mc}\right)_{LE} \tag{B2}$$

Deviation -

$$\delta^o = \left(\beta'_c\right)_{TE} - \left(\kappa_{mc}\right)_{TE} \tag{B3}$$

Diffusion factor -

$$D = 1 - \frac{(V')_{TE}}{(V')_{LE}} + \frac{\left(rV_\theta\right)_{TE} - \left(rV_\theta\right)_{LE}}{\left[(r)_{LE} + (r)_{TE}\right]\sigma(V')_{LE}} \tag{B4}$$

Total loss coefficient -

$$\overline{\omega} = \frac{\left(P'_{id}\right)_{TE} - (P')_{TE}}{(P')_{LE} - (p)_{LE}} \tag{B5}$$

Profile loss coefficient -

$$\overline{\omega}_p = \overline{\omega} - \overline{\omega}_s \tag{B6}$$

Total loss parameter -

$$\frac{\overline{\omega} \cos \left(\beta'_m\right)_{TE}}{2\sigma} \tag{B7}$$

Profile loss parameter -

$$\frac{(\omega - \omega_s) \cos \left(\beta'_m\right)_{TE}}{2\sigma} \tag{B8}$$

Adiabatic efficiency -

$$\eta_{ad} = \frac{\left[\frac{(P)_{TE}}{(P)_{LE}}\right]^{(\gamma-1)/\gamma} - 1}{\frac{(T)_{TE}}{(T)_{LE}} - 1} \tag{B9}$$

Momentum rise efficiency -

$$\eta_{mom} = \frac{\left[\frac{(P)_{TE}}{(P)_{LE}}\right]^{(\gamma-1)/\gamma} - 1}{\frac{(UV_\theta)_{LE} - (UV_\theta)_{LE}}{(T)_{LE} g J C_p}} \tag{B10}$$

Equivalent weight flow -

$$\frac{W\sqrt{\theta}}{\delta} \tag{B11}$$

Equivalent rotative speed -

$$\frac{N}{\sqrt{\theta}} \tag{B12}$$

Stall margin -

$$SM = \left\{ \frac{\left[\frac{(P)_{TE}}{(P)_{LE}}\right]_{stall}}{\left[\frac{(P)_{TE}}{(P)_{LE}}\right]_{ref}} \times \frac{\left[\frac{W\sqrt{\theta}}{\delta}\right]_{ref}}{\left[\frac{W\sqrt{\theta}}{\delta}\right]_{stall}} - 1 \right\} 100 \qquad \text{(B13)}$$

Weight flow per unit frontal area -

$$\frac{\frac{W\sqrt{\theta}}{\delta}}{A_f} \qquad \text{(B14)}$$

Weight flow per unit annulus area -

$$\frac{\frac{W\sqrt{\theta}}{\delta}}{A_{an}} \qquad \text{(B15)}$$

Head rise coefficient -

$$\frac{gJC_pT_{LE}}{U_{Tip}^2}\left[\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma} - 1\right]$$

Flow coefficient -

$$\left(\frac{V_z}{U_{Tip}}\right)_{LE} \qquad \text{(B17)}$$

APPENDIX C

DEFINITIONS AND UNITS USED IN TABLES

ABS	absolute
AERO CHORD	aerodynamic chord, in.
AREA RATIO	ratio of actual flow area to critical area (where Mach number is 1)
BETAM	meridional air angle, deg
CONE ANGLE	angle between axial direction and conical surface representing blade element, deg
DELTA INC	difference between mean camber blade angle and suction surface blade angle at leading edge, deg
DEV	deviation angle (defined by eq. (B3)), deg
D-FACT	diffusion factor (defined by eq. (B4))
EFF	abiabatic efficiency (defined by eq. (B9))
IN	inlet (leading edge of blade)
INCIDENCE	incidence angle (suction surface defined by eq. (B1) and mean defined by eq. (B2))
KIC	angle between blade mean camber line at leading edge and meridional plane, deg
KOC	angle between blade mean camber line at trailing edge and meridional plane, deg
KTC	angle between blade mean camber line at transition point and meridional plane, deg
LOSS COEFF	loss coefficient (total defined by eq. (B5) and profile defined by eq. (B6))
LOSS PARAM	loss parameter (total defined by eq. (B7) and profile defined by eq. (B8))
MERID	meridional
MERID VEL R	meridional velocity ratio
OUT	outlet (trailing edge of blade)
PERCENT SPAN	percent of blade span from tip at rotor outlet

PHISS	suction-surface camber ahead of assumed shock location, deg
PRESS	pressure, psia
PROF	profile
RADII	radius, in.
REL	relative to blade
RI	inlet radius (leading edge of blade), in.
RO	outlet radius (trailing edge of blade), in.
RP	radial position
RPM	equivalent rotative speed, rpm
SETTING ANGLE	angle between aerodynamic chord and meridional plane, deg
SOLIDITY	ratio of aerodynamic chord to blade spacing
SPEED	speed, ft/sec
SS	suction surface
STREAMLINE SLOPE	slope of streamline, deg
TANG	tangential
TEMP	temperature, ^{o}R
TI	thickness of blade at leading edge, in.
TM	thickness of blade at maximum thickness, in.
TO	thickness of blade at trailing edge, in.
TOT	total
TOTAL CAMBER	difference between inlet and outlet blade mean camber line, deg
VEL	velocity, ft/sec
WT FLOW	equivalent weight flow, lbm/sec
X-FACTOR	ratio of suction surface camber ahead of assumed shock location of a multiple circular arc blade section to that of a double circular arc blade section
ZMC	axial distance to blade maximum thickness point from inlet, in.
ZOC	axial distance to blade trailing edge from inlet, in.
ZTC	axial distance to transition point from inlet, in.

REFERENCES

1. Sinnette, John T., Jr.; and Costello, George R.: Possible Application of Blade Boundary-Layer Control to Improvement of Design and Off-Design Performance of Axial-Flow Turbomachines. NACA TN 2371, 1951.

2. Sheets, H. E.: The Slotted-Blade Axial-Flow Blower. Trans. ASME, vol. 78, no. 8, Nov. 1956, pp. 1683-1690.

3. Monsarrat, N. T.; and Keenan, K. J.: Experimental Evaluation of Transonic Stators-Preliminary Analysis and Design Report. Rep. PWA-2749, Pratt & Whitney Aircraft (NASA CR-54620), 1967.

4. Johnsen, Irving A.; and Bullock, Robert O., eds.: Aerodynamic Design of Axial-Flow Compressors. NASA SP-36, 1965.

5. Carter, A. D. S.; and Hughes, Hazel P.: A Theoretical Investigation into the Effect of Profile Shape on the Performance of Aerofoils in Cascade. R & M 2384, Aeronautical Research Council, Gt. Brit., Mar. 1946.

6. Seyler, D. R.; and Smith, Leroy H., Jr.: Single Stage Experimental Evaluation of High Mach Number Compressor Rotor Blading. Part I - Design of Rotor Blading. Rep. R66FPD321, pt. 1, General Electric Co. (NASA CR-54581), Apr. 1, 1967.

7. Schwenk, Francis C.; Lewis, George W.; and Hartmann, Melvin J.: A Preliminary Analysis of the Magnitude of Shock Losses in Transonic Compressors. NACA RM E57A30, 1957.

8. Crouse, James E.; Janetzke, David C.; and Schwirian, Richard E.: A Computer Program for Composing Compressor Blading from Simulated Circular-Arc Elements on Conical Surfaces. NASA TN D-5437, 1969.

TABLE I. - DESIGN OVERALL PARAMETERS

FOR ROTOR 7

TOTAL PRESSURE RATIO	1.650
TOTAL TEMPERATURE RATIO	1.186
EFFICIENCY	0.827
WT FLOW PER UNIT FRONTAL AREA	30.819
WT FLOW PER UNIT ANNULUS AREA	41.592
WT FLOW	65.261
RPM	16000.000
TIP SPEED	1375.599

TABLE II. - DESIGN BLADE-ELEMENT PARAMETERS FOR ROTOR 7

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
TIP	9.852	9.818	0.	46.1	63.6	56.0	518.7	1.248	14.69	1.650
1	9.717	9.623	-0.	43.8	63.0	55.2	518.7	1.232	14.69	1.650
2	9.508	9.429	-0.	41.7	62.0	54.4	518.7	1.217	14.69	1.650
3	8.635	8.650	0.	39.0	58.6	50.2	518.7	1.189	14.69	1.650
4	8.180	8.261	0.	39.1	57.1	47.3	518.7	1.183	14.69	1.650
5	8.065	8.164	0.	39.2	56.7	46.4	518.7	1.182	14.69	1.650
6	7.949	8.067	0.	39.4	56.4	45.6	518.7	1.181	14.69	1.650
7	7.832	7.969	0.	39.5	56.0	44.7	518.7	1.181	14.69	1.650
8	7.714	7.872	0.	39.6	55.6	43.8	518.7	1.180	14.69	1.650
9	6.726	7.094	0.	40.4	53.0	35.1	518.7	1.172	14.69	1.650
10	5.592	6.315	0.	41.1	51.5	24.4	518.7	1.164	14.69	1.650
11	5.266	6.121	0.	41.3	51.5	21.5	518.7	1.162	14.69	1.650
HUB	5.014	5.926	-0.	41.3	51.0	18.5	518.7	1.159	14.69	1.650

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
TIP	682.8	784.5	1535.7	972.0	682.8	543.9	0.	565.3	1375.6	1370.9
1	690.0	776.5	1522.1	982.5	690.0	560.9	-0.	537.0	1356.7	1343.7
2	704.7	771.1	1503.1	988.5	704.7	575.7	-0.	513.0	1327.6	1316.5
3	735.6	773.9	1412.3	938.7	735.6	601.4	0.	487.1	1205.6	1207.8
4	739.4	784.3	1360.6	897.0	739.4	608.7	0.	494.6	1142.2	1153.5
5	739.3	787.8	1347.1	885.7	739.3	610.3	0.	498.0	1126.1	1139.9
6	738.7	791.6	1333.3	874.2	738.7	611.9	0.	502.1	1109.9	1126.3
7	737.8	795.4	1319.2	863.1	737.8	613.8	0.	505.9	1093.5	1112.7
8	736.5	799.3	1304.8	852.4	736.5	615.7	0.	509.7	1077.1	1099.1
9	707.3	836.4	1175.6	778.2	707.3	636.5	0.	542.6	939.1	990.5
10	620.8	881.9	997.5	729.7	620.8	664.4	0.	579.9	780.8	881.8
11	585.9	894.0	940.1	722.3	585.9	672.0	0.	589.6	735.3	854.6
HUB	567.1	907.8	900.9	718.9	567.1	681.8	-0.	599.4	700.1	827.4

	ABS MACH NO		REL MACH NO		MERID MACH NO		STREAMLINE SLOPE		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
TIP	0.636	0.655	1.430	0.812	0.636	0.454	-8.64	-6.66	0.797	1.605
1	0.643	0.653	1.419	0.826	0.643	0.472	-7.79	-5.48	0.813	1.593
2	0.658	0.652	1.404	0.836	0.658	0.487	-6.45	-4.29	0.817	1.578
3	0.690	0.663	1.324	0.804	0.690	0.515	-0.71	0.83	0.817	1.527
4	0.693	0.675	1.276	0.772	0.693	0.524	2.40	3.62	0.823	1.508
5	0.693	0.678	1.263	0.763	0.693	0.525	3.21	4.35	0.826	1.504
6	0.693	0.682	1.250	0.753	0.693	0.527	4.04	5.10	0.828	1.500
7	0.692	0.685	1.237	0.744	0.692	0.529	4.89	5.87	0.832	1.496
8	0.691	0.690	1.223	0.736	0.691	0.531	5.77	6.66	0.836	1.492
9	0.661	0.728	1.098	0.677	0.661	0.554	14.10	14.04	0.900	1.467
10	0.574	0.775	0.923	0.641	0.574	0.584	26.07	24.46	1.070	1.288
11	0.540	0.788	0.866	0.637	0.540	0.592	29.84	27.76	1.147	1.211
HUB	0.522	0.802	0.829	0.635	0.522	0.603	32.84	31.19	1.202	1.157

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
TIP	0.	2.6	0.0	7.6	0.508	0.619	0.343	0.235	0.073	0.050
1	5.00	2.8	0.0	6.7	0.485	0.664	0.290	0.186	0.061	0.039
2	10.00	3.0	0.0	6.0	0.466	0.709	0.244	0.146	0.052	0.031
3	30.00	4.2	0.0	5.0	0.450	0.814	0.153	0.079	0.033	0.017
4	40.00	4.8	0.0	4.9	0.456	0.840	0.136	0.072	0.029	0.015
5	42.50	4.9	0.0	4.9	0.458	0.844	0.133	0.073	0.029	0.016
6	45.00	5.1	0.0	4.9	0.461	0.847	0.132	0.074	0.028	0.016
7	47.50	5.2	0.0	4.9	0.463	0.851	0.130	0.074	0.028	0.016
8	50.00	5.4	0.0	4.9	0.464	0.855	0.128	0.075	0.028	0.016
9	70.00	6.5	0.0	5.3	0.461	0.892	0.108	0.075	0.023	0.016
10	90.00	7.3	0.0	6.9	0.398	0.937	0.079	0.076	0.015	0.015
11	95.00	7.4	0.0	7.8	0.364	0.951	0.068	0.067	0.012	0.012
HUB	100.00	7.5	0.0	9.1	0.336	0.965	0.050	0.050	0.009	0.009

TABLE III. - BLADE GEOMETRY FOR ROTOR 7

RP	PERCENT SPAN	RADII RI	RADII RO	BLADE ANGLES KIC	BLADE ANGLES KTC	BLADE ANGLES KOC	DELTA INC
TIP	0.	9.852	9.818	61.27	59.53	48.55	2.57
1	5.	9.717	9.623	60.39	58.83	48.51	2.75
2	10.	9.508	9.429	59.08	57.74	48.33	3.03
3	30.	8.635	8.650	54.43	53.07	45.16	4.18
4	40.	8.180	8.261	52.27	50.40	42.35	4.77
5	43.	8.065	8.164	51.75	49.69	41.52	4.91
6	45.	7.949	8.067	51.22	48.96	40.63	5.06
7	48.	7.832	7.969	50.70	48.23	39.71	5.21
8	50.	7.714	7.872	50.19	47.49	38.76	5.35
9	70.	6.726	7.094	46.38	41.40	29.63	6.46
10	90.	5.592	6.315	44.06	36.61	17.09	7.30
11	95.	5.266	6.121	43.89	36.11	13.27	7.42
HUB	100.	5.014	5.926	43.87	35.93	9.32	7.48

RP	BLADE THICKNESSES TI	BLADE THICKNESSES TM	BLADE THICKNESSES TO	AXIAL DIMENSIONS ZMC	AXIAL DIMENSIONS ZTC	AXIAL DIMENSIONS ZOC	CONE ANGLE
TIP	0.020	0.059	0.020	0.421	0.560	0.893	-2.181
1	0.020	0.061	0.020	0.432	0.561	0.922	-5.794
2	0.020	0.066	0.020	0.449	0.563	0.951	-4.776
3	0.020	0.083	0.020	0.509	0.551	1.069	0.842
4	0.020	0.092	0.020	0.538	0.535	1.132	4.083
5	0.020	0.094	0.020	0.545	0.530	1.148	4.922
6	0.020	0.096	0.020	0.552	0.524	1.165	5.771
7	0.020	0.099	0.020	0.560	0.518	1.181	6.638
8	0.020	0.101	0.020	0.567	0.512	1.197	7.520
9	0.020	0.120	0.020	0.624	0.445	1.328	15.492
10	0.020	0.142	0.020	0.669	0.351	1.438	26.702
11	0.020	0.148	0.020	0.676	0.324	1.459	30.363
HUB	0.020	0.153	0.020	0.680	0.302	1.477	31.686

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	X FACTOR	PHISS	AREA RATIO
TIP	1.719	58.28	12.72	1.308	0.514	5.14	1.083
1	1.745	57.50	11.88	1.350	0.532	5.11	1.075
2	1.744	56.39	10.74	1.378	0.559	5.12	1.063
3	1.742	51.62	9.27	1.508	0.672	5.88	1.042
4	1.744	48.84	9.92	1.587	0.730	6.61	1.038
5	1.745	48.09	10.23	1.609	0.745	6.83	1.038
6	1.746	47.31	10.59	1.631	0.760	7.06	1.037
7	1.748	46.52	10.99	1.655	0.775	7.30	1.037
8	1.750	45.71	11.43	1.679	0.790	7.54	1.036
9	1.781	38.55	16.75	1.929	0.915	9.63	1.033
10	1.889	30.54	26.96	2.374	1.000	11.35	1.050
11	1.944	28.55	30.62	2.555	1.000	11.41	1.063
HUB	1.963	26.69	34.54	2.685	1.000	11.35	1.074

TABLE IV. - OVERALL PERFORMANCE FOR ROTOR 7

(a) Percent of design speed, 100

	Reading number				
	125	126	127	128	130
ROTOR TOTAL PRESSURE RATIO	1.590	1.714	1.780	1.804	1.811
ROTOR TOTAL TEMPERATURE RATIO	1.167	1.191	1.205	1.214	1.220
ROTOR TEMP. RISE EFFICIENCY	0.849	0.870	0.872	0.859	0.842
ROTOR MOMENTUM RISE EFFICIENCY	0.792	0.835	0.825	0.815	0.799
ROTOR HEAD RISE COEFFICIENT	0.232	0.273	0.294	0.302	0.303
FLOW COEFFICIENT	0.432	0.421	0.403	0.381	0.370
WT FLOW PER UNIT FRONTAL AREA	30.962	30.429	29.506	28.276	27.668
WT FLOW PER UNIT ANNULUS AREA	41.785	41.066	39.820	38.161	37.340
WT FLOW AT ORIFICE	65.565	64.437	62.481	59.878	58.591
WT FLOW AT ROTOR INLET	65.882	64.704	62.697	60.060	58.841
WT FLOW AT ROTOR OUTLET	63.138	61.988	59.679	57.180	55.741
RPM	16033.005	16030.127	16022.121	16018.255	16046.847
PERCENT OF DESIGN SPEED	100.206	100.188	100.138	100.114	100.293

(b) Percent of design speed, 90

	Reading number				
	131	132	133	134	135
ROTOR TOTAL PRESSURE RATIO	1.461	1.564	1.596	1.614	1.611
ROTOR TOTAL TEMPERATURE RATIO	1.131	1.151	1.160	1.168	1.173
ROTOR TEMP. RISE EFFICIENCY	0.876	0.904	0.894	0.870	0.842
ROTOR MOMENTUM RISE EFFICIENCY	0.835	0.854	0.838	0.817	0.778
ROTOR HEAD RISE COEFFICIENT	0.232	0.276	0.290	0.297	0.297
FLOW COEFFICIENT	0.439	0.417	0.397	0.370	0.346
WT FLOW PER UNIT FRONTAL AREA	29.068	27.926	26.858	25.423	24.112
WT FLOW PER UNIT ANNULUS AREA	39.229	37.688	36.247	34.310	32.541
WT FLOW AT ORIFICE	61.554	59.136	56.875	53.835	51.060
WT FLOW AT ROTOR INLET	61.799	59.423	57.165	53.960	51.118
WT FLOW AT ROTOR OUTLET	59.977	57.063	54.468	51.273	48.349
RPM	14429.951	14437.576	14420.623	14413.677	14389.660
PERCENT OF DESIGN SPEED	90.187	90.235	90.129	90.085	89.935

(c) Percent of design speed, 80

	Reading number				
	138	139	140	141	142
ROTOR TOTAL PRESSURE RATIO	1.346	1.417	1.438	1.452	1.454
ROTOR TOTAL TEMPERATURE RATIO	1.099	1.116	1.123	1.129	1.136
ROTOR TEMP. RISE EFFICIENCY	0.893	0.903	0.890	0.869	0.832
ROTOR MOMENTUM RISE EFFICIENCY	0.807	0.832	0.820	0.806	0.777
ROTOR HEAD RISE COEFFICIENT	0.226	0.268	0.280	0.288	0.289
FLOW COEFFICIENT	0.440	0.406	0.386	0.361	0.329
WT FLOW PER UNIT FRONTAL AREA	26.650	24.882	23.881	22.609	21.002
WT FLOW PER UNIT ANNULUS AREA	35.965	33.580	32.228	30.512	28.344
WT FLOW AT ORIFICE	56.433	52.690	50.570	47.877	44.475
WT FLOW AT ROTOR INLET	56.733	52.952	50.779	48.014	44.287
WT FLOW AT ROTOR OUTLET	54.661	50.967	48.554	46.011	42.689
RPM	12870.719	12823.017	12823.544	12831.349	12820.927
PERCENT OF DESIGN SPEED	80.442	80.144	80.147	80.196	80.131

TABLE IV. - Concluded. OVERALL PERFORMANCE FOR

ROTOR 7

(d) Percent of design speed, 70

	Reading number				
	144	145	146	147	148
ROTOR TOTAL PRESSURE RATIO	1.245	1.286	1.309	1.323	1.330
ROTOR TOTAL TEMPERATURE RATIO	1.071	1.083	1.091	1.097	1.104
ROTOR TEMP. RISE EFFICIENCY	0.907	0.903	0.881	0.858	0.818
ROTOR MOMENTUM RISE EFFICIENCY	0.849	0.853	0.830	0.818	0.783
ROTOR HEAD RISE COEFFICIENT	0.216	0.250	0.268	0.279	0.284
FLOW COEFFICIENT	0.440	0.408	0.377	0.354	0.319
WT FLOW PER UNIT FRONTAL AREA	23.700	22.245	20.818	19.665	18.078
WT FLOW PER UNIT ANNULUS AREA	31.985	30.021	28.095	26.539	24.398
WT FLOW AT ORIFICE	50.187	47.106	44.083	41.642	38.282
WT FLOW AT ROTOR INLET	50.615	47.449	44.296	41.876	38.242
WT FLOW AT ROTOR OUTLET	49.329	46.167	42.850	40.753	37.386
RPM	11216.400	11215.573	11211.270	11224.076	11225.510
PERCENT OF DESIGN SPEED	70.103	70.097	70.070	70.150	70.159

(e) Percent of design speed, 60

	Reading number				
	160	161	162	163	164
ROTOR TOTAL PRESSURE RATIO	1.168	1.193	1.216	1.228	1.237
ROTOR TOTAL TEMPERATURE RATIO	1.049	1.057	1.065	1.071	1.078
ROTOR TEMP. RISE EFFICIENCY	0.919	0.903	0.882	0.854	0.808
ROTOR MOMENTUM RISE EFFICIENCY	0.806	0.815	0.806	0.781	0.742
ROTOR HEAD RISE COEFFICIENT	0.207	0.236	0.262	0.274	0.284
FLOW COEFFICIENT	0.442	0.412	0.376	0.348	0.303
WT FLOW PER UNIT FRONTAL AREA	20.855	19.558	18.068	16.818	14.912
WT FLOW PER UNIT ANNULUS AREA	28.145	26.394	24.384	22.697	20.125
WT FLOW AT ORIFICE	44.162	41.415	38.261	35.614	31.578
WT FLOW AT ROTOR INLET	44.514	41.708	38.459	35.835	31.600
WT FLOW AT ROTOR OUTLET	42.712	39.686	36.432	33.525	29.076
RPM	9606.595	9604.773	9624.320	9626.912	9636.937
PERCENT OF DESIGN SPEED	60.041	60.030	60.152	60.168	60.231

(f) Percent of design speed, 50

	Reading number				
	155	156	157	158	159
ROTOR TOTAL PRESSURE RATIO	1.100	1.110	1.138	1.149	1.160
ROTOR TOTAL TEMPERATURE RATIO	1.031	1.033	1.042	1.047	1.053
ROTOR TEMP. RISE EFFICIENCY	0.903	0.909	0.889	0.859	0.819
ROTOR MOMENTUM RISE EFFICIENCY	0.771	0.789	0.790	0.767	0.742
ROTOR HEAD RISE COEFFICIENT	0.182	0.198	0.247	0.267	0.284
FLOW COEFFICIENT	0.456	0.448	0.383	0.347	0.302
WT FLOW PER UNIT FRONTAL AREA	18.216	18.029	15.501	14.118	12.435
WT FLOW PER UNIT ANNULUS AREA	24.584	24.331	20.920	19.053	16.782
WT FLOW AT ORIFICE	38.575	38.178	32.826	29.897	26.333
WT FLOW AT ROTOR INLET	38.895	38.230	33.065	30.060	26.422
WT FLOW AT ROTOR OUTLET	37.066	36.649	30.817	27.547	23.999
RPM	8023.594	8019.785	8017.383	8003.740	8016.198
PERCENT OF DESIGN SPEED	50.147	50.124	50.109	50.023	50.101

TABLE V. -BLADE-ELEMENT DATA AT BLADE EDGES

(a) Percent of design speed, 100; reading number, 125

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	2.1	40.7	62.4	54.5	520.0	1.209	14.38	1.662
2	9.508	9.429	1.8	39.2	60.6	53.6	519.5	1.196	14.66	1.634
3	8.635	8.650	2.0	37.1	57.6	49.6	518.6	1.168	14.73	1.609
4	8.180	8.261	2.5	40.7	55.8	48.3	518.5	1.160	14.73	1.535
5	8.065	8.164	2.5	41.0	55.4	48.7	518.4	1.159	14.72	1.506
6	7.949	8.067	2.5	41.5	55.1	47.8	518.5	1.159	14.73	1.504
7	7.832	7.969	2.6	41.9	54.7	45.3	518.4	1.160	14.73	1.538
8	7.714	7.872	2.2	41.9	54.5	43.3	518.3	1.162	14.72	1.556
9	6.726	7.094	3.1	41.6	51.5	34.6	518.5	1.151	14.73	1.586
10	5.592	6.315	2.5	44.8	50.1	22.4	518.3	1.146	14.72	1.589
11	5.266	6.121	2.3	46.7	50.3	19.5	518.4	1.149	14.70	1.567

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	696.3	784.5	1503.7	1023.7	695.8	594.6	25.4	511.8	1358.4	1345.3
2	737.4	784.0	1501.0	1024.0	737.0	607.5	23.3	495.5	1330.9	1319.9
3	752.5	785.6	1401.7	967.8	752.1	626.9	25.9	473.5	1208.7	1210.8
4	755.7	768.4	1344.1	876.8	755.0	582.8	32.5	500.7	1144.5	1155.8
5	756.0	753.9	1331.3	862.6	755.3	569.0	32.7	494.6	1129.0	1142.9
6	754.1	758.6	1316.6	846.3	753.3	568.5	33.0	502.3	1112.7	1129.2
7	752.2	786.2	1301.3	831.4	751.4	585.2	33.9	525.0	1096.3	1115.5
8	749.7	803.7	1290.5	822.9	749.2	598.6	28.1	536.3	1078.9	1101.0
9	719.6	841.5	1153.9	765.0	718.5	629.6	38.4	558.3	941.4	992.9
10	631.3	885.5	983.3	680.4	630.7	628.8	27.6	623.4	782.0	883.1
11	592.2	881.6	926.0	641.2	591.7	604.5	23.7	641.7	736.0	855.5

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.649	0.666	1.401	0.869	0.648	0.505	0.854	1.554
2	0.691	0.670	1.406	0.875	0.690	0.519	0.824	1.532
3	0.707	0.681	1.317	0.839	0.707	0.543	0.834	1.485
4	0.710	0.667	1.263	0.761	0.710	0.506	0.772	1.454
5	0.711	0.654	1.252	0.748	0.710	0.493	0.753	1.450
6	0.709	0.658	1.237	0.734	0.708	0.493	0.755	1.446
7	0.707	0.684	1.223	0.723	0.706	0.509	0.779	1.441
8	0.704	0.700	1.212	0.717	0.704	0.521	0.799	1.445
9	0.673	0.740	1.080	0.673	0.672	0.554	0.876	1.403
10	0.585	0.786	0.911	0.604	0.584	0.558	0.997	1.227
11	0.546	0.780	0.854	0.568	0.546	0.535	1.022	1.159

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	2.1	-0.6	6.0	0.438	0.749	0.206	0.114	0.044	0.024
2	10.00	1.6	-1.4	5.3	0.431	0.768	0.182	0.094	0.039	0.020
3	30.00	3.1	-1.1	4.5	0.416	0.868	0.100	0.035	0.021	0.008
4	40.00	3.5	-1.3	6.0	0.458	0.813	0.142	0.091	0.030	0.019
5	42.50	3.6	-1.3	7.2	0.461	0.781	0.167	0.117	0.034	0.024
6	45.00	3.8	-1.3	7.1	0.467	0.779	0.171	0.124	0.035	0.026
7	47.50	3.9	-1.3	5.5	0.476	0.816	0.147	0.102	0.031	0.022
8	50.00	4.2	-1.1	4.5	0.481	0.830	0.138	0.095	0.030	0.021
9	70.00	4.9	-1.5	4.8	0.457	0.935	0.059	0.037	0.013	0.008
10	90.00	5.9	-1.4	5.0	0.444	0.968	0.037	0.036	0.007	0.007
11	95.00	6.2	-1.2	5.8	0.449	0.916	0.109	0.109	0.020	0.020

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(b) Percent of design speed, 100; reading number, 126

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	2.0	48.3	63.0	53.2	519.9	1.250	14.40	1.867
2	9.508	9.429	1.9	44.6	61.2	53.0	519.5	1.230	14.64	1.812
3	8.635	8.650	2.0	43.2	58.2	48.9	518.6	1.195	14.73	1.748
4	8.180	8.261	2.5	46.2	56.7	46.8	518.6	1.189	14.72	1.692
5	8.065	8.164	2.3	47.0	56.4	46.5	518.4	1.189	14.72	1.672
6	7.949	8.067	2.2	46.6	56.1	45.6	518.6	1.190	14.74	1.666
7	7.832	7.969	2.2	47.6	55.8	44.2	518.6	1.188	14.73	1.668
8	7.714	7.872	2.7	45.6	55.3	43.3	518.5	1.183	14.73	1.673
9	6.726	7.094	3.5	45.9	52.5	34.4	518.4	1.167	14.73	1.666
10	5.592	6.315	2.2	48.2	51.1	22.7	518.2	1.154	14.72	1.632
11	5.266	6.121	3.4	50.2	50.9	19.6	518.3	1.159	14.70	1.615

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	679.7	822.6	1498.2	913.2	679.3	547.0	23.4	614.4	1358.7	1345.6
2	717.9	800.3	1490.7	948.2	717.5	570.1	23.7	561.6	1330.3	1319.2
3	731.8	795.3	1389.3	882.3	731.4	580.1	25.6	544.1	1206.8	1208.9
4	731.9	792.2	1331.0	801.3	731.2	548.4	32.5	571.7	1144.6	1156.0
5	730.5	787.0	1319.3	781.0	729.9	537.1	29.4	575.2	1128.3	1142.2
6	730.8	790.7	1307.9	776.5	730.3	543.2	28.0	574.6	1113.0	1129.5
7	726.2	799.1	1290.7	752.1	725.7	538.8	28.3	590.1	1095.7	1114.8
8	723.7	800.9	1270.8	770.0	722.9	560.2	33.5	572.4	1078.7	1100.8
9	691.4	830.1	1133.3	700.9	690.1	578.1	41.6	595.8	940.6	992.0
10	611.7	862.4	974.2	622.8	611.2	574.5	23.9	643.2	782.5	883.7
11	573.2	860.1	906.4	584.4	572.2	550.6	33.9	660.8	736.9	856.5

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.632	0.689	1.393	0.765	0.632	0.458	0.805	1.567
2	0.671	0.675	1.393	0.799	0.671	0.481	0.795	1.540
3	0.686	0.681	1.302	0.756	0.685	0.497	0.793	1.494
4	0.686	0.680	1.247	0.688	0.685	0.471	0.750	1.468
5	0.684	0.676	1.236	0.670	0.684	0.461	0.736	1.469
6	0.685	0.679	1.225	0.667	0.684	0.466	0.744	1.468
7	0.680	0.687	1.209	0.647	0.680	0.463	0.742	1.465
8	0.677	0.691	1.190	0.664	0.677	0.483	0.775	1.454
9	0.645	0.724	1.057	0.611	0.644	0.504	0.838	1.424
10	0.565	0.760	0.901	0.549	0.565	0.506	0.940	1.246
11	0.528	0.756	0.835	0.513	0.527	0.484	0.962	1.149

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	2.7	-0.0	4.7	0.536	0.780	0.210	0.117	0.047	0.026
2	10.00	2.2	-0.8	4.7	0.494	0.804	0.177	0.089	0.039	0.019
3	30.00	3.8	-0.4	3.7	0.489	0.886	0.100	0.035	0.022	0.008
4	40.00	4.4	-0.4	4.4	0.526	0.858	0.127	0.075	0.027	0.016
5	42.50	4.6	-0.3	5.0	0.537	0.839	0.145	0.094	0.031	0.020
6	45.00	4.8	-0.3	5.0	0.535	0.828	0.157	0.108	0.034	0.023
7	47.50	5.0	-0.2	4.5	0.550	0.839	0.149	0.102	0.032	0.022
8	50.00	5.0	-0.3	4.5	0.522	0.866	0.124	0.082	0.027	0.018
9	70.00	5.9	-0.5	4.6	0.512	0.939	0.063	0.040	0.013	0.009
10	90.00	6.9	-0.4	5.2	0.503	0.973	0.033	0.032	0.006	0.006
11	95.00	6.8	-0.6	5.8	0.502	0.923	0.110	0.110	0.020	0.020

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(c) Percent of design speed, 100; reading number, 127

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	9.717	9.623	1.6	52.2	64.3	52.6	519.7	1.276	14.39	1.981
2	9.508	9.429	1.4	49.6	62.6	52.6	519.5	1.251	14.64	1.907
3	8.635	8.650	1.9	47.3	59.6	48.4	518.7	1.212	14.73	1.823
4	8.180	8.261	2.3	49.8	58.2	46.2	518.6	1.204	14.74	1.765
5	8.065	8.164	1.9	50.4	58.0	45.7	518.6	1.203	14.73	1.750
6	7.949	8.067	2.0	51.1	57.6	45.2	518.6	1.203	14.73	1.732
7	7.832	7.969	2.0	50.9	57.4	44.0	518.5	1.200	14.73	1.733
8	7.714	7.872	1.9	49.7	57.1	43.5	518.4	1.194	14.72	1.724
9	6.726	7.094	2.6	49.0	54.2	33.9	518.4	1.176	14.73	1.713
10	5.592	6.315	2.9	50.2	52.3	22.3	518.3	1.161	14.72	1.668
11	5.266	6.121	2.6	52.7	52.5	19.3	518.3	1.164	14.70	1.642

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	644.4	844.8	1487.1	852.8	644.1	517.9	17.8	667.5	1358.1	1345.0
2	679.1	819.5	1477.5	873.8	678.9	531.1	16.7	624.1	1329.0	1318.0
3	694.2	806.5	1372.3	823.7	693.8	546.6	23.2	593.1	1207.2	1209.3
4	692.6	803.3	1312.4	748.6	692.0	518.2	27.6	613.8	1142.8	1154.1
5	691.5	801.4	1302.9	731.4	691.1	510.7	23.0	617.7	1127.5	1141.3
6	689.6	799.5	1287.6	712.5	689.1	501.7	24.2	622.5	1111.9	1128.4
7	685.0	803.7	1271.1	705.9	684.6	507.4	23.9	623.3	1095.0	1114.1
8	682.9	800.1	1257.8	713.2	682.6	517.4	22.6	610.3	1079.1	1101.2
9	656.6	830.0	1122.5	655.4	655.9	544.0	30.0	626.9	940.9	992.4
10	582.9	856.3	951.4	592.0	582.2	547.7	29.3	658.2	781.8	882.8
11	546.4	849.9	897.0	545.3	545.8	514.7	24.9	676.2	736.6	856.2

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID PEAK SS VEL R	MERID PEAK SS MACH NO
1	0.597	0.701	1.377	0.708	0.597	0.430	0.804	1.595
2	0.632	0.686	1.374	0.731	0.631	0.445	0.782	1.570
3	0.647	0.687	1.280	0.701	0.647	0.465	0.788	1.521
4	0.646	0.686	1.224	0.639	0.645	0.442	0.749	1.499
5	0.645	0.684	1.215	0.625	0.644	0.436	0.739	1.503
6	0.643	0.683	1.200	0.609	0.642	0.429	0.728	1.501
7	0.638	0.688	1.184	0.604	0.638	0.434	0.741	1.500
8	0.636	0.686	1.172	0.612	0.636	0.444	0.758	1.501
9	0.610	0.721	1.043	0.569	0.609	0.472	0.829	1.477
10	0.537	0.751	0.877	0.520	0.537	0.481	0.941	1.248
11	0.502	0.744	0.824	0.477	0.501	0.451	0.943	1.182

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	4.0	1.3	4.1	0.587	0.782	0.227	0.129	0.051	0.029
2	10.00	3.6	0.6	4.2	0.557	0.806	0.191	0.099	0.042	0.022
3	30.00	5.2	1.0	3.3	0.538	0.885	0.110	0.043	0.024	0.009
4	40.00	5.9	1.1	3.8	0.571	0.862	0.134	0.080	0.029	0.017
5	42.50	6.2	1.2	4.2	0.581	0.852	0.144	0.090	0.031	0.020
6	45.00	6.4	1.3	4.6	0.590	0.839	0.158	0.107	0.034	0.023
7	47.50	6.6	1.4	4.3	0.588	0.851	0.148	0.099	0.032	0.021
8	50.00	6.9	1.5	4.7	0.574	0.868	0.131	0.083	0.028	0.018
9	70.00	7.7	1.2	4.1	0.558	0.945	0.061	0.032	0.013	0.007
10	90.00	8.1	0.8	4.8	0.526	0.980	0.027	0.026	0.005	0.005
11	95.00	8.5	1.1	5.6	0.546	0.929	0.105	0.105	0.019	0.019

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(d) Percent of design speed, 100; reading number, 128

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	1.4	55.5	65.9	53.8	519.9	1.289	14.46	2.004
2	9.508	9.429	1.1	52.2	64.6	52.8	519.5	1.267	14.62	1.949
3	8.635	8.650	1.1	49.7	61.5	48.6	518.7	1.222	14.73	1.851
4	8.180	8.261	1.9	52.7	60.0	46.7	518.7	1.213	14.73	1.790
5	8.065	8.164	2.0	53.0	59.7	45.9	518.8	1.212	14.72	1.777
6	7.949	8.067	2.4	54.0	59.3	45.2	518.9	1.211	14.73	1.765
7	7.832	7.969	2.3	52.9	59.0	44.5	518.2	1.206	14.72	1.754
8	7.714	7.872	2.0	52.6	58.8	43.9	518.6	1.200	14.72	1.742
9	6.726	7.094	2.8	50.8	55.9	34.5	518.3	1.181	14.73	1.724
10	5.592	6.315	3.8	52.0	53.6	21.6	518.1	1.165	14.72	1.688
11	5.266	6.121	2.8	53.9	54.0	18.9	518.2	1.168	14.70	1.664

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	601.7	841.7	1472.1	807.6	601.5	477.0	14.7	693.4	1358.3	1345.1
2	625.6	824.6	1458.9	837.2	625.5	505.6	11.7	651.4	1329.8	1318.7
3	647.8	807.6	1358.5	789.8	647.7	522.3	12.2	616.0	1206.3	1208.4
4	647.0	803.0	1295.0	709.7	646.7	487.0	21.3	638.4	1143.3	1154.6
5	645.3	803.1	1278.6	694.2	644.9	482.8	22.8	641.8	1126.8	1140.6
6	644.5	805.8	1262.0	672.4	643.9	474.0	26.7	651.7	1112.1	1128.6
7	641.5	800.6	1245.9	677.0	641.0	482.7	26.0	638.8	1094.3	1113.5
8	640.1	797.8	1234.1	672.2	639.7	484.7	22.1	633.7	1077.4	1099.5
9	617.7	820.2	1099.9	629.4	616.9	518.5	30.4	635.5	940.9	992.4
10	551.1	855.1	926.3	566.2	549.9	526.2	36.4	674.0	781.8	882.9
11	517.4	847.8	879.3	528.0	516.8	499.6	25.0	685.0	736.4	855.9

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.555	0.695	1.357	0.667	0.554	0.394	0.793	1.628
2	0.578	0.686	1.349	0.696	0.578	0.421	0.808	1.612
3	0.601	0.685	1.260	0.669	0.601	0.443	0.806	1.567
4	0.600	0.683	1.201	0.604	0.600	0.414	0.753	1.542
5	0.598	0.683	1.186	0.591	0.598	0.411	0.749	1.538
6	0.597	0.686	1.170	0.572	0.597	0.403	0.736	1.533
7	0.595	0.683	1.155	0.578	0.594	0.412	0.753	1.532
8	0.593	0.682	1.144	0.575	0.593	0.414	0.758	1.535
9	0.571	0.710	1.017	0.545	0.571	0.449	0.840	1.524
10	0.506	0.749	0.851	0.496	0.505	0.461	0.957	1.250
11	0.474	0.740	0.805	0.461	0.473	0.436	0.967	1.198

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	5.6	2.8	5.3	0.621	0.761	0.259	0.157	0.057	0.034
2	10.00	5.6	2.6	4.5	0.585	0.787	0.221	0.125	0.049	0.027
3	30.00	7.1	2.9	3.4	0.566	0.869	0.131	0.058	0.029	0.013
4	40.00	7.7	3.0	4.3	0.603	0.849	0.155	0.095	0.034	0.021
5	42.50	7.9	3.0	4.4	0.608	0.842	0.164	0.108	0.035	0.023
6	45.00	8.0	3.0	4.5	0.620	0.835	0.173	0.120	0.037	0.026
7	47.50	8.3	3.0	4.8	0.607	0.844	0.163	0.112	0.035	0.024
8	50.00	8.5	3.1	5.0	0.605	0.858	0.148	0.098	0.032	0.021
9	70.00	9.3	2.9	4.7	0.574	0.931	0.079	0.046	0.017	0.010
10	90.00	9.4	2.1	4.2	0.544	0.977	0.033	0.033	0.007	0.006
11	95.00	10.0	2.5	5.2	0.558	0.931	0.110	0.110	0.020	0.020

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(e) Percent of design speed, 100; reading number, 130

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	9.717	9.623	0.7	57.6	66.8	54.2	520.0	1.301	14.46	2.015
2	9.508	9.429	0.4	53.6	65.4	53.0	519.7	1.277	14.63	1.963
3	8.635	8.650	0.5	51.4	62.5	48.8	518.7	1.228	14.73	1.860
4	8.180	8.261	1.3	53.3	61.0	46.8	518.7	1.219	14.73	1.803
5	8.065	8.164	1.9	53.9	60.5	46.2	518.7	1.218	14.73	1.787
6	7.949	8.067	2.0	54.1	60.3	45.1	518.6	1.217	14.72	1.776
7	7.832	7.969	1.5	54.8	60.0	44.8	518.5	1.213	14.73	1.759
8	7.714	7.872	1.3	53.5	59.8	43.9	518.5	1.207	14.73	1.751
9	6.726	7.094	3.4	52.2	56.6	34.9	518.2	1.184	14.72	1.721
10	5.592	6.315	3.5	52.0	54.5	21.7	518.1	1.167	14.72	1.704
11	5.266	6.121	1.7	54.5	55.0	18.9	518.2	1.171	14.70	1.668

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	581.4	849.6	1473.9	778.0	581.3	455.1	7.2	717.4	1361.7	1348.5
2	606.9	829.1	1459.4	817.8	606.9	492.0	4.4	667.3	1331.6	1320.5
3	627.0	809.7	1357.0	767.5	627.0	505.1	5.1	632.8	1208.5	1210.6
4	628.2	805.1	1294.2	703.0	628.0	481.3	14.7	645.4	1146.4	1157.7
5	626.8	804.5	1273.7	684.1	626.4	473.9	20.7	650.1	1129.6	1143.5
6	623.4	807.7	1255.8	670.2	623.0	473.3	22.3	654.6	1112.7	1129.2
7	622.8	802.5	1246.4	651.4	622.6	462.0	16.4	656.1	1096.2	1115.3
8	621.2	799.7	1232.8	660.7	621.0	475.9	14.1	642.7	1079.0	1101.1
9	598.4	815.7	1085.5	609.5	597.3	500.0	35.3	644.5	941.6	993.1
10	537.2	856.5	922.5	567.2	536.2	527.1	32.8	675.2	783.5	884.8
11	506.2	846.2	882.0	519.1	506.0	491.0	15.5	689.2	737.8	857.6

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID PEAK SS VEL R	MERID PEAK SS MACH NO
1	0.535	0.698	1.356	0.639	0.535	0.374	0.783	1.656
2	0.560	0.687	1.346	0.678	0.560	0.408	0.811	1.636
3	0.580	0.684	1.256	0.649	0.580	0.427	0.806	1.595
4	0.581	0.683	1.198	0.596	0.581	0.408	0.766	1.571
5	0.580	0.683	1.179	0.581	0.580	0.402	0.757	1.561
6	0.577	0.686	1.162	0.569	0.576	0.402	0.760	1.558
7	0.576	0.683	1.153	0.554	0.576	0.393	0.742	1.564
8	0.575	0.682	1.140	0.563	0.575	0.406	0.766	1.565
9	0.552	0.704	1.002	0.526	0.551	0.432	0.837	1.545
10	0.493	0.749	0.847	0.496	0.492	0.461	0.983	1.269
11	0.463	0.738	0.807	0.453	0.463	0.428	0.970	1.229

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	6.5	3.7	5.7	0.650	0.735	0.294	0.185	0.064	0.040
2	10.00	6.4	3.4	4.7	0.604	0.767	0.248	0.146	0.054	0.032
3	30.00	8.1	3.9	3.7	0.588	0.849	0.154	0.076	0.034	0.017
4	40.00	8.7	3.9	4.4	0.611	0.836	0.172	0.107	0.037	0.023
5	42.50	8.7	3.8	4.6	0.617	0.828	0.183	0.123	0.039	0.026
6	45.00	9.0	3.9	4.4	0.622	0.823	0.190	0.133	0.041	0.029
7	47.50	9.3	4.0	5.1	0.634	0.822	0.191	0.134	0.041	0.029
8	50.00	9.5	4.1	5.1	0.617	0.841	0.170	0.114	0.036	0.025
9	70.00	10.1	3.6	5.1	0.588	0.911	0.106	0.071	0.023	0.015
10	90.00	10.3	3.0	4.2	0.542	0.984	0.023	0.022	0.004	0.004
11	95.00	11.0	3.5	5.2	0.573	0.922	0.124	0.124	0.023	0.023

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(f) Percent of design speed, 90; reading number, 131

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	1.4	35.6	62.7	52.6	520.2	1.163	14.40	1.539
2	9.508	9.429	1.4	33.2	60.9	52.5	519.7	1.149	14.63	1.503
3	8.635	8.650	1.7	33.7	57.7	49.2	518.6	1.127	14.73	1.464
4	8.180	8.261	1.6	36.6	56.2	47.5	518.5	1.124	14.73	1.419
5	8.065	8.164	1.7	37.1	55.8	47.6	518.5	1.124	14.73	1.396
6	7.949	8.067	1.7	37.8	55.4	46.7	518.3	1.126	14.74	1.392
7	7.832	7.969	1.8	39.2	55.1	43.5	518.3	1.130	14.73	1.430
8	7.714	7.872	1.7	38.5	54.8	41.7	518.4	1.131	14.74	1.450
9	6.726	7.094	3.3	38.7	51.6	34.8	518.3	1.119	14.73	1.444
10	5.592	6.315	3.6	42.2	49.5	21.5	518.3	1.118	14.71	1.463
11	5.266	6.121	2.0	44.1	50.3	18.7	518.4	1.122	14.69	1.445

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	624.3	734.8	1358.8	984.2	624.1	597.3	15.2	428.0	1222.1	1210.3
2	659.2	724.3	1353.1	996.7	659.1	606.2	15.8	396.4	1197.5	1187.5
3	675.2	717.0	1263.4	913.1	674.9	596.4	19.5	398.0	1087.5	1089.4
4	678.0	706.3	1216.9	839.2	677.7	566.7	19.5	421.6	1030.3	1040.5
5	677.1	695.7	1203.7	823.4	676.8	554.7	20.4	419.9	1015.8	1028.3
6	676.0	699.6	1191.4	805.8	675.7	552.5	19.8	429.3	1001.1	1015.9
7	674.3	734.3	1176.8	784.8	674.0	569.5	21.7	463.6	986.4	1003.6
8	672.8	751.5	1165.6	787.5	672.6	588.1	19.8	467.9	971.7	991.6
9	644.4	765.9	1034.9	728.2	643.3	598.1	36.8	478.4	847.4	893.8
10	570.6	825.5	877.4	657.4	569.4	611.8	36.3	554.3	703.9	794.9
11	534.9	820.5	837.0	622.5	534.6	589.5	19.0	570.7	663.0	770.7

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.577	0.634	1.255	0.849	0.577	0.515	0.957	1.425
2	0.612	0.628	1.255	0.864	0.611	0.526	0.920	1.397
3	0.628	0.629	1.176	0.800	0.628	0.523	0.884	1.364
4	0.631	0.619	1.133	0.736	0.631	0.497	0.836	1.355
5	0.630	0.609	1.121	0.721	0.630	0.486	0.820	1.353
6	0.629	0.613	1.109	0.706	0.629	0.484	0.818	1.354
7	0.628	0.644	1.095	0.689	0.627	0.500	0.845	1.352
8	0.626	0.660	1.085	0.692	0.626	0.517	0.874	1.356
9	0.598	0.678	0.960	0.645	0.597	0.529	0.930	1.234
10	0.525	0.737	0.808	0.587	0.524	0.546	1.074	1.072
11	0.491	0.730	0.768	0.554	0.490	0.525	1.103	1.043

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	2.4	-0.4	4.1	0.388	0.807	0.146	0.101	0.033	0.023
2	10.00	1.8	-1.2	4.2	0.365	0.826	0.124	0.082	0.027	0.018
3	30.00	3.3	-0.9	4.1	0.377	0.907	0.063	0.035	0.014	0.008
4	40.00	3.8	-0.9	5.2	0.415	0.848	0.105	0.083	0.022	0.018
5	42.50	4.0	-0.9	6.1	0.420	0.807	0.135	0.114	0.028	0.024
6	45.00	4.2	-0.9	6.1	0.430	0.788	0.152	0.132	0.032	0.028
7	47.50	4.3	-0.9	3.7	0.448	0.830	0.128	0.110	0.028	0.024
8	50.00	4.5	-0.9	2.9	0.440	0.855	0.112	0.094	0.025	0.021
9	70.00	5.0	-1.5	5.0	0.410	0.929	0.061	0.059	0.013	0.013
10	90.00	5.3	-2.0	4.0	0.384	0.975	0.029	0.029	0.006	0.006
11	95.00	6.3	-1.2	5.0	0.396	0.912	0.111	0.111	0.021	0.021

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(g) Percent of design speed, 90; reading number, 132

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	9.717	9.623	2.0	43.9	63.6	51.9	520.3	1.194	14.44	1.693
2	9.508	9.429	1.8	41.0	62.2	52.1	519.9	1.177	14.61	1.639
3	8.635	8.650	1.1	41.6	59.2	48.4	518.5	1.153	14.73	1.588
4	8.180	8.261	1.4	44.6	57.8	46.1	518.5	1.150	14.74	1.548
5	8.065	8.164	1.1	45.0	57.5	45.5	518.5	1.151	14.73	1.538
6	7.949	8.067	1.5	44.6	57.1	44.6	518.5	1.150	14.73	1.533
7	7.832	7.969	1.3	44.5	56.9	43.3	518.3	1.147	14.74	1.540
8	7.714	7.872	1.3	42.9	56.6	42.7	518.2	1.142	14.74	1.541
9	6.726	7.094	3.1	45.5	53.5	34.9	518.4	1.133	14.73	1.507
10	5.592	6.315	3.4	47.0	51.6	21.6	518.2	1.126	14.71	1.507
11	5.266	6.121	3.0	49.1	51.8	18.9	518.2	1.129	14.70	1.485

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	599.0	751.9	1344.5	878.7	598.6	542.0	20.6	521.1	1224.5	1212.7
2	621.5	729.4	1330.1	895.7	621.2	550.4	19.2	478.7	1195.3	1185.4
3	640.6	723.7	1252.1	815.7	640.5	541.3	12.8	480.3	1088.7	1090.6
4	640.5	722.1	1201.1	741.8	640.3	514.1	15.4	507.0	1031.5	1041.8
5	638.8	721.4	1190.1	727.3	638.6	509.9	12.2	510.3	1016.4	1028.9
6	636.7	724.2	1173.3	723.8	636.5	515.4	16.4	508.7	1002.1	1016.9
7	634.3	731.2	1161.1	717.4	634.1	521.8	14.6	512.2	987.2	1004.5
8	631.5	730.9	1146.1	728.6	631.4	535.7	14.8	497.3	971.3	991.2
9	603.8	743.1	1013.1	634.5	602.9	520.4	32.9	530.4	847.1	893.5
10	533.8	794.4	858.1	582.6	532.9	541.8	31.8	581.0	704.4	795.5
11	501.9	787.5	810.6	545.5	501.2	516.1	26.6	594.8	663.6	771.4

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID PEAK SS VEL R	MERID PEAK SS MACH NO
1	0.552	0.640	1.239	0.748	0.551	0.462	0.906	1.441
2	0.574	0.624	1.229	0.767	0.574	0.471	0.886	1.418
3	0.594	0.627	1.161	0.707	0.594	0.469	0.845	1.405
4	0.594	0.626	1.113	0.643	0.594	0.446	0.803	1.398
5	0.592	0.626	1.103	0.631	0.592	0.442	0.798	1.402
6	0.590	0.628	1.087	0.628	0.590	0.447	0.810	1.399
7	0.588	0.636	1.076	0.624	0.588	0.454	0.823	1.404
8	0.585	0.638	1.062	0.635	0.585	0.467	0.848	1.405
9	0.558	0.652	0.936	0.556	0.557	0.456	0.863	1.265
10	0.490	0.704	0.787	0.516	0.489	0.480	1.017	1.102
11	0.459	0.696	0.742	0.482	0.459	0.456	1.030	1.046

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	3.3	0.5	3.4	0.484	0.838	0.144	0.098	0.033	0.022
2	10.00	3.1	0.1	3.7	0.451	0.854	0.123	0.082	0.027	0.018
3	30.00	4.8	0.6	3.3	0.472	0.923	0.062	0.031	0.014	0.007
4	40.00	5.5	0.7	3.8	0.512	0.884	0.098	0.072	0.021	0.016
5	42.50	5.7	0.8	3.9	0.520	0.870	0.111	0.086	0.024	0.019
6	45.00	5.9	0.8	3.9	0.513	0.864	0.118	0.095	0.026	0.021
7	47.50	6.1	0.9	3.6	0.513	0.894	0.092	0.069	0.020	0.015
8	50.00	6.3	0.9	3.9	0.491	0.928	0.062	0.041	0.014	0.009
9	70.00	6.9	0.5	5.1	0.505	0.937	0.061	0.059	0.013	0.013
10	90.00	7.4	0.1	4.1	0.465	0.990	0.013	0.013	0.002	0.002
11	95.00	7.8	0.3	5.2	0.476	0.927	0.103	0.103	0.019	0.019

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(h) Percent of design speed, 90; reading number, 133

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	0.9	47.6	65.3	52.0	520.5	1.210	14.42	1.744
2	9.508	9.429	0.9	46.4	63.5	52.0	520.3	1.192	14.63	1.692
3	8.635	8.650	0.7	45.0	60.7	48.5	518.5	1.163	14.73	1.622
4	8.180	8.261	1.3	47.3	59.2	46.0	518.2	1.159	14.73	1.588
5	8.065	8.164	1.4	47.9	58.9	45.2	518.5	1.159	14.73	1.582
6	7.949	8.067	1.2	47.8	58.7	44.4	518.0	1.158	14.74	1.572
7	7.832	7.969	1.4	47.3	58.3	43.7	518.2	1.155	14.73	1.568
8	7.714	7.872	1.5	46.9	57.9	43.0	518.3	1.150	14.73	1.565
9	6.726	7.094	3.1	48.0	55.2	35.9	518.2	1.139	14.73	1.521
10	5.592	6.315	2.7	48.6	53.3	21.6	518.1	1.130	14.72	1.530
11	5.266	6.121	2.4	51.1	53.4	18.8	518.2	1.132	14.70	1.500

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	559.1	756.8	1337.6	828.6	559.0	510.1	8.6	559.0	1223.8	1211.9
2	591.6	739.0	1326.8	827.8	591.5	509.6	9.7	535.1	1197.4	1187.4
3	605.9	722.2	1236.8	771.3	605.9	511.1	7.8	510.3	1086.0	1087.9
4	605.1	723.5	1182.0	706.2	604.9	490.7	13.8	531.6	1029.2	1039.4
5	604.1	725.5	1169.3	690.7	604.0	486.6	14.7	538.2	1015.9	1028.4
6	600.1	725.5	1155.8	682.1	600.0	487.1	12.4	537.7	1000.3	1015.1
7	598.7	724.7	1140.3	679.7	598.5	491.1	14.9	532.9	985.5	1002.7
8	598.4	724.0	1127.2	676.6	598.2	494.5	15.4	528.8	970.8	990.6
9	568.4	727.9	994.0	601.2	567.6	487.1	30.8	540.8	846.8	893.1
10	507.4	784.9	847.6	558.9	506.8	519.5	24.1	588.4	703.5	794.5
11	477.3	774.9	799.2	513.6	476.8	486.2	20.2	603.4	661.6	769.0

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.513	0.640	1.227	0.701	0.513	0.431	0.913	1.490
2	0.545	0.629	1.221	0.704	0.545	0.434	0.862	1.459
3	0.560	0.623	1.142	0.665	0.560	0.441	0.844	1.440
4	0.559	0.625	1.092	0.610	0.559	0.424	0.811	1.433
5	0.558	0.627	1.080	0.597	0.558	0.421	0.806	1.434
6	0.554	0.628	1.067	0.590	0.554	0.421	0.812	1.442
7	0.553	0.628	1.053	0.589	0.553	0.425	0.821	1.441
8	0.552	0.629	1.041	0.587	0.552	0.429	0.827	1.442
9	0.523	0.635	0.915	0.525	0.522	0.425	0.858	1.292
10	0.465	0.693	0.776	0.493	0.464	0.459	1.025	1.131
11	0.436	0.682	0.730	0.452	0.435	0.428	1.020	1.069

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	5.0	2.2	3.5	0.532	0.822	0.171	0.117	0.039	0.027
2	10.00	4.5	1.5	3.7	0.519	0.846	0.139	0.092	0.031	0.020
3	30.00	6.2	2.1	3.3	0.511	0.911	0.078	0.043	0.017	0.009
4	40.00	6.9	2.1	3.6	0.541	0.888	0.101	0.073	0.022	0.016
5	42.50	7.1	2.2	3.7	0.549	0.880	0.110	0.083	0.024	0.018
6	45.00	7.4	2.4	3.8	0.550	0.873	0.118	0.091	0.026	0.020
7	47.50	7.6	2.4	4.0	0.542	0.888	0.104	0.079	0.023	0.017
8	50.00	7.7	2.3	4.2	0.537	0.912	0.081	0.057	0.018	0.012
9	70.00	8.6	2.2	6.1	0.532	0.915	0.090	0.087	0.019	0.018
10	90.00	9.1	1.8	4.2	0.490	0.997	0.004	0.004	0.001	0.001
11	95.00	9.3	1.9	5.1	0.512	0.932	0.099	0.099	0.018	0.018

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(i) Percent of design speed, 90; reading number, 134

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	9.717	9.623	-0.3	51.9	67.1	52.7	521.3	1.221	14.45	1.769
2	9.508	9.429	0.3	50.9	65.6	52.2	521.1	1.203	14.61	1.730
3	8.635	8.650	-0.1	47.6	62.7	49.1	518.6	1.172	14.73	1.640
4	8.180	8.261	1.2	49.3	61.2	46.4	518.1	1.168	14.72	1.610
5	8.065	8.164	2.0	50.7	60.8	45.6	518.1	1.167	14.73	1.599
6	7.949	8.067	1.2	51.2	60.6	44.8	518.1	1.167	14.73	1.593
7	7.832	7.969	1.9	51.3	60.2	44.4	517.8	1.164	14.74	1.582
8	7.714	7.872	1.4	50.8	60.1	43.8	517.9	1.159	14.73	1.572
9	6.726	7.094	3.8	51.1	57.1	35.9	517.9	1.147	14.73	1.535
10	5.592	6.315	3.8	50.4	54.8	22.4	517.7	1.133	14.72	1.534
11	5.266	6.121	2.3	52.7	55.2	19.2	517.8	1.136	14.71	1.513

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	516.5	758.3	1329.1	770.9	516.5	467.4	-2.7	597.1	1222.0	1210.2
2	541.7	746.8	1311.3	769.3	541.7	471.4	3.0	579.3	1197.2	1187.2
3	561.9	717.2	1223.2	738.5	561.9	483.7	-0.8	529.5	1085.7	1087.6
4	560.6	720.1	1162.0	681.4	560.5	469.7	11.3	545.8	1029.2	1039.3
5	557.2	722.0	1139.7	653.8	556.9	457.2	19.2	558.8	1013.6	1026.1
6	556.7	724.7	1134.6	640.1	556.6	454.2	12.0	564.6	1000.8	1015.7
7	552.4	719.6	1112.6	629.9	552.1	450.3	18.6	561.3	984.5	1001.8
8	549.9	716.3	1103.3	627.5	549.7	452.9	13.0	555.0	969.6	989.4
9	526.1	723.9	966.6	561.5	525.0	454.7	34.7	563.2	846.3	892.6
10	474.8	769.2	822.4	529.9	473.7	490.0	31.4	592.9	703.6	794.6
11	448.2	764.7	784.7	490.4	447.8	463.1	17.8	608.5	662.2	769.8

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID PEAK SS VEL R	MERID PEAK SS MACH NO
1	0.472	0.637	1.214	0.648	0.472	0.393	0.905	1.540
2	0.496	0.632	1.200	0.651	0.496	0.399	0.870	1.512
3	0.517	0.616	1.125	0.634	0.517	0.415	0.861	1.495
4	0.516	0.620	1.069	0.587	0.516	0.404	0.838	1.485
5	0.512	0.622	1.048	0.563	0.512	0.394	0.821	1.480
6	0.512	0.624	1.043	0.551	0.512	0.391	0.816	1.494
7	0.508	0.620	1.023	0.543	0.508	0.388	0.816	1.494
8	0.505	0.619	1.014	0.542	0.505	0.391	0.824	1.507
9	0.483	0.630	0.886	0.488	0.481	0.395	0.866	1.311
10	0.434	0.677	0.751	0.466	0.433	0.431	1.034	1.136
11	0.408	0.672	0.715	0.431	0.408	0.407	1.034	1.094

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	6.8	4.1	4.2	0.586	0.799	0.202	0.141	0.045	0.032
2	10.00	6.6	3.6	3.9	0.572	0.835	0.158	0.105	0.035	0.023
3	30.00	8.2	4.0	3.9	0.540	0.885	0.106	0.065	0.023	0.014
4	40.00	8.8	4.1	4.1	0.559	0.870	0.126	0.093	0.027	0.020
5	42.50	8.9	4.0	4.1	0.574	0.858	0.140	0.111	0.031	0.024
6	45.00	9.3	4.3	4.1	0.586	0.852	0.147	0.116	0.032	0.025
7	47.50	9.5	4.3	4.6	0.583	0.851	0.150	0.121	0.032	0.026
8	50.00	9.8	4.5	5.0	0.579	0.866	0.134	0.104	0.029	0.022
9	70.00	10.6	4.1	6.1	0.565	0.888	0.128	0.125	0.027	0.026
10	90.00	10.6	3.3	4.9	0.509	0.975	0.036	0.036	0.007	0.007
11	95.00	11.2	3.8	5.5	0.534	0.925	0.116	0.116	0.021	0.021

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(j) Percent of design speed, 90; reading number, 135

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	9.717	9.623	-1.4	54.5	68.8	53.6	522.4	1.228	14.45	1.760
2	9.508	9.429	-2.3	52.3	67.3	52.5	522.2	1.210	14.62	1.730
3	8.635	8.650	-1.6	50.7	64.6	49.8	518.6	1.178	14.72	1.632
4	8.180	8.261	1.1	52.7	63.0	47.2	517.6	1.174	14.74	1.600
5	8.065	8.164	0.2	53.4	62.9	46.5	517.6	1.173	14.73	1.593
6	7.949	8.067	1.2	54.2	62.5	45.8	517.6	1.173	14.72	1.581
7	7.832	7.969	1.1	55.0	62.3	45.7	517.6	1.171	14.73	1.567
8	7.714	7.872	1.4	55.2	62.0	45.1	517.6	1.168	14.72	1.557
9	6.726	7.094	2.7	53.0	59.2	35.5	517.6	1.150	14.73	1.542
10	5.592	6.315	3.6	50.8	56.3	22.1	517.4	1.134	14.72	1.543
11	5.266	6.121	3.3	52.7	56.4	19.0	517.4	1.136	14.70	1.524

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	477.5	753.2	1319.5	736.6	477.3	437.0	-12.0	613.4	1218.2	1206.4
2	507.7	745.4	1316.1	748.4	507.3	455.5	-20.7	590.0	1193.7	1183.8
3	522.4	713.8	1217.4	699.8	522.2	452.0	-14.8	552.5	1084.9	1086.8
4	518.2	715.1	1141.4	638.6	518.1	433.8	10.0	568.5	1027.1	1037.2
5	517.8	716.4	1135.4	620.4	517.8	427.1	2.2	575.1	1012.7	1025.2
6	512.9	716.5	1112.5	601.1	512.8	418.9	10.4	581.3	997.6	1012.4
7	511.1	710.9	1099.3	584.4	511.0	408.2	9.7	582.0	983.0	1000.2
8	509.0	708.9	1083.8	574.0	508.9	404.8	12.1	581.9	969.0	988.8
9	490.7	725.7	957.4	536.6	490.2	436.6	23.0	579.6	845.4	891.6
10	450.4	769.3	810.2	524.6	449.5	486.2	28.3	596.2	702.4	793.2
11	424.5	766.5	765.8	490.8	423.9	464.2	24.2	610.0	662.0	769.5

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID PEAK SS VEL R	MERID PEAK SS MACH NO
1	0.434	0.630	1.200	0.616	0.434	0.366	0.916	1.584
2	0.463	0.628	1.200	0.631	0.463	0.384	0.898	1.569
3	0.479	0.611	1.115	0.599	0.478	0.387	0.866	1.554
4	0.475	0.614	1.046	0.548	0.475	0.372	0.837	1.536
5	0.475	0.615	1.041	0.533	0.475	0.367	0.825	1.549
6	0.470	0.615	1.019	0.516	0.470	0.360	0.817	1.550
7	0.468	0.611	1.007	0.502	0.468	0.351	0.799	1.559
8	0.466	0.610	0.993	0.494	0.466	0.348	0.796	1.475
9	0.449	0.630	0.876	0.466	0.448	0.379	0.891	1.359
10	0.411	0.677	0.739	0.462	0.410	0.428	1.082	1.155
11	0.386	0.674	0.697	0.431	0.386	0.408	1.095	1.095

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	8.5	5.7	5.1	0.617	0.769	0.239	0.172	0.053	0.038
2	10.00	8.3	5.3	4.2	0.599	0.808	0.188	0.123	0.042	0.027
3	30.00	10.2	6.0	4.6	0.580	0.842	0.150	0.100	0.032	0.021
4	40.00	10.7	5.9	4.9	0.595	0.826	0.176	0.138	0.038	0.030
5	42.50	11.1	6.2	5.0	0.611	0.820	0.183	0.143	0.039	0.031
6	45.00	11.3	6.2	5.2	0.618	0.809	0.200	0.162	0.043	0.035
7	47.50	11.5	6.3	5.9	0.627	0.802	0.208	0.171	0.044	0.036
8	50.00	11.7	6.4	6.3	0.629	0.805	0.206	0.183	0.043	0.038
9	70.00	12.7	6.2	5.7	0.595	0.878	0.144	0.140	0.030	0.030
10	90.00	12.1	4.8	4.6	0.510	0.988	0.018	0.018	0.004	0.004
11	95.00	12.4	4.9	5.2	0.521	0.940	0.097	0.097	0.018	0.018

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(k) Percent of design speed, 80; reading number, 138

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	9.717	9.623	-0.0	32.8	63.3	52.4	521.6	1.119	14.46	1.396
2	9.508	9.429	-0.0	31.0	61.5	52.1	520.7	1.110	14.66	1.370
3	8.635	8.650	-0.0	30.1	58.5	49.1	518.3	1.095	14.73	1.348
4	8.180	8.261	-0.0	33.9	57.1	47.2	518.0	1.095	14.72	1.316
5	8.065	8.164	-0.0	35.0	56.7	46.6	517.9	1.096	14.72	1.308
6	7.949	8.067	-0.0	36.1	56.4	45.4	517.9	1.098	14.72	1.308
7	7.832	7.969	-0.0	36.3	56.0	43.0	518.2	1.099	14.73	1.331
8	7.714	7.872	-0.0	36.3	55.7	41.8	518.0	1.099	14.72	1.337
9	6.726	7.094	-0.0	37.5	52.9	34.4	518.1	1.093	14.72	1.332
10	5.592	6.315	-0.0	40.6	51.3	21.0	518.1	1.094	14.70	1.357
11	5.266	6.121	-0.0	42.2	51.3	18.8	518.4	1.096	14.68	1.339

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	548.8	662.4	1223.1	912.8	548.8	556.7	-0.0	359.0	1093.0	1082.4
2	580.1	655.8	1216.0	915.0	580.1	562.1	-0.0	337.8	1068.7	1059.8
3	595.1	647.3	1137.4	855.0	595.1	559.9	-0.0	324.8	969.2	970.9
4	595.4	638.3	1095.4	780.2	595.4	529.9	-0.0	355.9	919.3	928.4
5	594.9	637.2	1084.1	760.0	594.9	522.1	-0.0	365.2	906.3	917.4
6	594.0	643.5	1072.7	740.6	594.0	519.9	-0.0	379.1	893.1	906.4
7	592.9	666.2	1061.4	734.8	592.9	537.0	-0.0	394.1	880.3	895.7
8	591.6	673.4	1048.6	728.2	591.6	543.0	-0.0	398.2	865.8	883.5
9	569.6	689.3	944.7	662.8	569.6	546.6	-0.0	420.0	753.7	794.9
10	503.5	752.0	804.6	611.6	503.5	571.0	-0.0	489.4	627.5	708.6
11	473.3	743.9	757.7	581.9	473.3	550.8	-0.0	500.1	591.7	687.8

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID PEAK SS VEL R	MERID PEAK SS MACH NO
1	0.502	0.578	1.120	0.796	0.502	0.486	1.014	1.335
2	0.533	0.575	1.118	0.802	0.533	0.492	0.969	1.304
3	0.549	0.572	1.050	0.756	0.549	0.495	0.941	1.301
4	0.550	0.564	1.011	0.689	0.550	0.468	0.890	1.317
5	0.549	0.563	1.001	0.671	0.549	0.461	0.878	1.324
6	0.548	0.568	0.990	0.654	0.548	0.459	0.875	1.235
7	0.547	0.589	0.979	0.650	0.547	0.475	0.906	1.230
8	0.546	0.596	0.968	0.644	0.546	0.481	0.918	1.223
9	0.524	0.613	0.870	0.589	0.524	0.486	0.960	1.159
10	0.461	0.673	0.736	0.547	0.461	0.511	1.134	1.021
11	0.432	0.664	0.692	0.520	0.432	0.492	1.164	0.964

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	3.0	0.3	3.9	0.362	0.840	0.106	0.087	0.024	0.020
2	10.00	2.5	-0.5	3.7	0.348	0.855	0.090	0.075	0.020	0.017
3	30.00	4.0	-0.2	3.9	0.343	0.933	0.040	0.030	0.009	0.007
4	40.00	4.8	-0.0	4.9	0.391	0.862	0.087	0.078	0.019	0.017
5	42.50	4.9	0.0	5.1	0.404	0.835	0.106	0.097	0.023	0.021
6	45.00	5.1	0.0	4.7	0.419	0.814	0.123	0.120	0.027	0.026
7	47.50	5.3	0.0	3.3	0.421	0.857	0.098	0.096	0.022	0.021
8	50.00	5.4	0.0	3.0	0.420	0.875	0.087	0.085	0.019	0.019
9	70.00	6.4	-0.1	4.6	0.417	0.922	0.061	0.061	0.013	0.013
10	90.00	7.0	-0.3	3.6	0.376	0.975	0.026	0.026	0.005	0.005
11	95.00	7.3	-0.1	5.1	0.371	0.904	0.114	0.114	0.021	0.021

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(l) Percent of design speed, 80; reading number, 139

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	41.1	65.3	52.0	522.4	1.143	14.48	1.496
2	9.508	9.429	-0.0	39.3	63.6	51.9	521.4	1.132	14.64	1.466
3	8.635	8.650	-0.0	38.1	60.5	48.7	518.1	1.116	14.73	1.429
4	8.180	8.261	-0.0	41.8	59.2	46.1	517.9	1.116	14.72	1.407
5	8.065	8.164	-0.0	42.3	58.9	45.3	517.8	1.116	14.72	1.402
6	7.949	8.067	-0.0	42.9	58.6	44.2	517.8	1.117	14.72	1.402
7	7.832	7.969	-0.0	41.3	58.3	43.5	517.9	1.115	14.73	1.404
8	7.714	7.872	-0.0	41.6	58.0	42.5	517.8	1.111	14.72	1.405
9	6.726	7.094	-0.0	43.9	55.6	35.6	517.9	1.104	14.72	1.374
10	5.592	6.315	-0.0	45.7	53.7	21.1	517.8	1.101	14.71	1.389
11	5.266	6.121	-0.0	47.7	53.6	18.4	518.0	1.103	14.70	1.371

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	499.6	664.3	1196.6	812.1	499.6	500.2	-0.1	437.0	1087.3	1076.8
2	527.3	651.4	1187.2	816.3	527.3	504.0	-0.1	412.7	1063.6	1054.8
3	546.0	639.7	1109.2	761.9	546.0	503.1	-0.1	395.1	965.5	967.2
4	544.8	640.9	1065.2	689.0	544.8	477.5	-0.1	427.6	915.2	924.3
5	543.6	642.1	1052.9	676.1	543.6	475.2	-0.1	431.8	901.6	912.7
6	543.5	649.1	1043.4	662.5	543.5	475.1	-0.1	442.2	890.6	903.8
7	541.7	650.5	1030.9	672.9	541.7	488.4	-0.1	429.5	877.0	892.4
8	540.2	653.4	1018.8	662.2	540.2	488.3	-0.1	434.2	863.7	881.4
9	515.8	656.5	912.1	582.1	515.8	473.5	-0.0	454.8	752.3	793.4
10	459.8	717.0	776.8	536.6	459.8	500.4	-0.0	513.5	626.1	707.0
11	434.0	710.5	731.7	504.0	434.0	478.2	-0.0	525.5	589.1	684.8

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.455	0.572	1.090	0.700	0.455	0.431	1.001	1.384
2	0.482	0.564	1.085	0.707	0.482	0.436	0.956	1.357
3	0.502	0.559	1.019	0.666	0.502	0.440	0.921	1.362
4	0.501	0.561	0.979	0.603	0.501	0.418	0.876	1.278
5	0.499	0.562	0.967	0.592	0.499	0.416	0.874	1.272
6	0.499	0.568	0.958	0.580	0.499	0.416	0.874	1.270
7	0.497	0.570	0.947	0.590	0.497	0.428	0.902	1.264
8	0.496	0.574	0.936	0.582	0.496	0.429	0.904	1.258
9	0.473	0.579	0.836	0.513	0.473	0.417	0.918	1.191
10	0.419	0.637	0.709	0.477	0.419	0.445	1.089	1.044
11	0.395	0.630	0.666	0.447	0.395	0.424	1.102	0.982

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	5.0	2.3	3.5	0.456	0.853	0.119	0.097	0.027	0.022
2	10.00	4.6	1.6	3.5	0.438	0.874	0.096	0.078	0.021	0.017
3	30.00	6.1	1.9	3.5	0.431	0.925	0.056	0.043	0.012	0.009
4	40.00	6.9	2.2	3.8	0.480	0.887	0.089	0.084	0.019	0.018
5	42.50	7.1	2.2	3.8	0.486	0.873	0.102	0.098	0.022	0.021
6	45.00	7.3	2.3	3.5	0.496	0.870	0.106	0.103	0.023	0.023
7	47.50	7.5	2.3	3.7	0.474	0.888	0.092	0.089	0.020	0.020
8	50.00	7.7	2.3	3.7	0.478	0.922	0.063	0.061	0.014	0.013
9	70.00	9.0	2.6	5.8	0.495	0.912	0.081	0.081	0.017	0.017
10	90.00	9.5	2.2	3.7	0.457	0.979	0.024	0.024	0.005	0.005
11	95.00	9.6	2.2	4.7	0.462	0.919	0.108	0.108	0.020	0.020

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(m) Percent of design speed, 80; reading number, 140

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	9.717	9.623	-0.0	46.1	66.5	52.4	523.0	1.151	14.49	1.524
2	9.508	9.429	-0.0	43.3	64.8	52.1	522.0	1.141	14.66	1.494
3	8.635	8.650	-0.0	41.6	61.8	48.6	517.9	1.125	14.72	1.457
4	8.180	8.261	-0.0	44.3	60.5	46.3	517.7	1.123	14.72	1.432
5	8.065	8.164	-0.0	45.2	60.3	45.5	517.8	1.123	14.72	1.428
6	7.949	8.067	-0.0	45.6	60.0	44.4	517.5	1.124	14.72	1.425
7	7.832	7.969	-0.0	45.5	59.7	43.9	517.6	1.121	14.72	1.417
8	7.714	7.872	-0.0	45.2	59.4	43.4	517.8	1.118	14.72	1.411
9	6.726	7.094	-0.0	47.2	57.0	35.2	517.7	1.110	14.72	1.393
10	5.592	6.315	-0.0	47.4	55.1	21.2	517.7	1.104	14.70	1.403
11	5.266	6.121	-0.0	49.4	55.1	18.7	517.9	1.106	14.69	1.383

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	472.1	663.5	1185.1	754.8	472.1	460.1	-0.1	478.0	1086.9	1076.4
2	501.8	652.1	1177.4	771.9	501.8	474.4	-0.1	447.4	1065.1	1056.3
3	518.0	640.2	1096.5	724.4	518.0	479.0	-0.0	424.7	966.4	968.1
4	517.0	638.5	1051.6	662.0	517.0	457.1	-0.0	445.8	915.6	924.7
5	516.1	641.0	1040.7	644.8	516.1	451.8	-0.1	454.8	903.7	914.8
6	514.6	645.1	1027.8	631.4	514.6	451.1	-0.0	461.1	889.7	902.9
7	512.4	641.7	1014.7	624.7	512.4	449.9	-0.1	457.6	875.7	891.0
8	510.7	638.9	1002.0	619.6	510.7	449.9	-0.1	453.6	862.0	879.6
9	488.1	654.2	897.2	543.6	488.1	444.1	-0.1	480.4	752.7	793.9
10	436.4	707.1	762.9	513.3	436.4	478.4	-0.0	520.7	625.7	706.6
11	410.9	699.3	718.4	480.7	410.9	455.3	-0.0	530.8	589.3	685.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID PEAK SS VEL R	MERID PEAK SS MACH NO
1	0.429	0.569	1.076	0.648	0.429	0.395	0.975	1.417
2	0.457	0.562	1.073	0.665	0.457	0.409	0.945	1.390
3	0.475	0.558	1.005	0.631	0.475	0.417	0.925	1.404
4	0.474	0.557	0.964	0.577	0.474	0.399	0.884	1.303
5	0.473	0.559	0.954	0.562	0.473	0.394	0.875	1.299
6	0.472	0.563	0.942	0.551	0.472	0.394	0.877	1.293
7	0.469	0.560	0.930	0.545	0.469	0.393	0.878	1.286
8	0.468	0.558	0.918	0.541	0.468	0.393	0.881	1.279
9	0.446	0.575	0.820	0.478	0.446	0.390	0.910	1.212
10	0.397	0.627	0.695	0.455	0.397	0.424	1.096	1.057
11	0.373	0.619	0.653	0.425	0.373	0.403	1.108	0.997

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	6.2	3.5	3.9	0.512	0.846	0.132	0.108	0.030	0.024
2	10.00	5.8	2.7	3.7	0.482	0.859	0.115	0.094	0.026	0.021
3	30.00	7.4	3.2	3.4	0.468	0.911	0.072	0.056	0.016	0.012
4	40.00	8.2	3.5	4.0	0.505	0.882	0.100	0.094	0.022	0.021
5	42.50	8.5	3.6	4.0	0.517	0.872	0.110	0.106	0.024	0.023
6	45.00	8.7	3.6	3.7	0.524	0.861	0.122	0.118	0.027	0.026
7	47.50	8.9	3.7	4.2	0.522	0.862	0.121	0.118	0.026	0.026
8	50.00	9.1	3.7	4.6	0.518	0.875	0.110	0.108	0.024	0.023
9	70.00	10.5	4.0	5.4	0.537	0.905	0.094	0.094	0.020	0.020
10	90.00	10.9	3.6	3.8	0.480	0.978	0.027	0.027	0.005	0.005
11	95.00	11.1	3.7	5.0	0.486	0.917	0.118	0.118	0.022	0.022

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(n) Percent of design speed, 80; reading number, 141

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	48.7	68.0	53.1	524.0	1.160	14.50	1.541
2	9.508	9.429	-0.0	46.1	66.3	52.2	522.4	1.149	14.66	1.520
3	8.635	8.650	-0.0	45.5	63.4	49.0	517.9	1.132	14.72	1.470
4	8.180	8.261	-0.0	48.3	62.3	46.5	517.6	1.130	14.72	1.448
5	8.065	8.164	-0.0	49.1	62.0	45.9	517.5	1.130	14.73	1.441
6	7.949	8.067	-0.0	50.2	61.8	45.3	517.6	1.131	14.72	1.434
7	7.832	7.969	-0.0	51.2	61.6	45.2	517.5	1.130	14.72	1.421
8	7.714	7.872	-0.0	50.4	61.3	44.6	517.4	1.127	14.72	1.415
9	6.726	7.094	-0.0	48.6	58.8	35.4	517.5	1.114	14.71	1.408
10	5.592	6.315	-0.0	48.7	56.6	21.6	517.6	1.106	14.71	1.413
11	5.266	6.121	-0.0	50.9	56.7	18.9	517.7	1.107	14.69	1.393

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	438.4	659.9	1172.5	726.5	438.4	435.7	-0.0	495.5	1087.4	1076.9
2	467.2	653.0	1162.1	740.1	467.2	453.2	-0.0	470.1	1064.0	1055.2
3	484.8	637.3	1081.2	681.1	484.8	447.0	-0.1	454.2	966.3	968.0
4	480.6	639.3	1034.6	617.3	480.6	425.0	-0.1	477.5	916.1	925.2
5	480.0	638.3	1022.9	600.8	480.0	417.8	-0.1	482.5	903.2	914.3
6	478.1	639.3	1011.3	581.8	478.1	409.4	-0.0	491.0	891.1	904.3
7	474.7	633.2	998.1	563.4	474.7	396.9	-0.1	493.4	878.0	893.3
8	473.3	630.8	985.7	565.0	473.3	402.5	-0.1	485.7	864.5	882.2
9	455.5	650.0	879.3	527.4	455.5	429.8	-0.0	487.7	752.1	793.3
10	412.2	697.7	749.4	495.7	412.2	460.7	-0.0	523.9	625.8	706.7
11	387.1	691.4	705.6	460.9	387.1	436.1	-0.0	536.5	589.8	685.6

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.397	0.563	1.061	0.620	0.397	0.372	0.994	1.461
2	0.425	0.561	1.056	0.635	0.425	0.389	0.970	1.433
3	0.443	0.553	0.988	0.591	0.443	0.388	0.922	1.355
4	0.439	0.556	0.945	0.537	0.439	0.369	0.884	1.337
5	0.439	0.555	0.935	0.522	0.439	0.363	0.870	1.331
6	0.437	0.555	0.924	0.505	0.437	0.356	0.856	1.327
7	0.434	0.550	0.912	0.489	0.434	0.345	0.836	1.323
8	0.432	0.549	0.900	0.491	0.432	0.350	0.850	1.316
9	0.415	0.570	0.802	0.462	0.415	0.377	0.944	1.234
10	0.375	0.617	0.681	0.438	0.375	0.408	1.118	1.073
11	0.351	0.611	0.640	0.407	0.351	0.385	1.126	1.013

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	7.7	5.0	4.6	0.536	0.824	0.160	0.132	0.036	0.029
2	10.00	7.3	4.2	3.9	0.509	0.853	0.128	0.104	0.028	0.023
3	30.00	8.9	4.7	3.8	0.510	0.882	0.102	0.092	0.022	0.020
4	40.00	10.0	5.2	4.1	0.549	0.857	0.130	0.124	0.028	0.027
5	42.50	10.2	5.3	4.4	0.560	0.844	0.144	0.139	0.031	0.030
6	45.00	10.5	5.4	4.6	0.575	0.828	0.162	0.157	0.035	0.034
7	47.50	10.8	5.6	5.5	0.586	0.811	0.181	0.177	0.039	0.038
8	50.00	11.0	5.7	5.8	0.575	0.819	0.174	0.170	0.037	0.036
9	70.00	12.3	5.8	5.6	0.548	0.898	0.108	0.108	0.023	0.023
10	90.00	12.4	5.1	4.2	0.495	0.978	0.030	0.030	0.006	0.006
11	95.00	12.7	5.3	5.2	0.507	0.925	0.111	0.111	0.021	0.021

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(o) Percent of design speed, 80; reading number, 142

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	55.2	70.4	54.9	524.7	1.171	14.53	1.545
2	9.508	9.429	-0.0	51.0	68.6	53.2	522.9	1.160	14.65	1.526
3	8.635	8.650	-0.0	49.7	65.7	50.0	517.9	1.142	14.72	1.467
4	8.180	8.261	-0.0	51.7	64.6	47.1	517.4	1.139	14.72	1.452
5	8.065	8.164	-0.0	52.8	64.5	46.8	517.3	1.138	14.72	1.442
6	7.949	8.067	-0.0	53.7	64.2	46.3	517.4	1.137	14.72	1.434
7	7.832	7.969	-0.0	54.1	63.9	46.3	517.5	1.136	14.72	1.422
8	7.714	7.872	-0.0	53.7	63.7	45.4	517.3	1.134	14.72	1.418
9	6.726	7.094	-0.0	50.2	60.9	35.7	517.5	1.119	14.71	1.416
10	5.592	6.315	-0.0	49.8	58.4	21.8	517.4	1.107	14.70	1.419
11	5.266	6.121	-0.0	52.0	58.3	19.0	517.5	1.109	14.70	1.398

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	386.8	658.3	1151.6	652.2	386.8	375.4	-0.0	540.8	1084.6	1074.2
2	417.2	651.2	1142.3	685.1	417.2	410.2	-0.0	505.7	1063.3	1054.5
3	436.8	630.8	1060.5	635.7	436.8	408.3	-0.1	480.8	966.3	968.0
4	434.6	636.4	1013.3	579.4	434.6	394.2	-0.1	499.7	915.3	924.4
5	431.1	633.5	999.9	560.3	431.1	383.3	-0.1	504.4	902.1	913.2
6	430.2	632.6	987.2	541.8	430.2	374.3	-0.1	510.0	888.5	901.7
7	429.3	626.5	976.4	532.1	429.3	367.5	-0.0	507.4	876.9	892.2
8	427.5	626.3	963.6	527.9	427.5	370.4	-0.0	505.1	863.5	881.2
9	419.9	646.8	862.2	510.1	419.9	414.4	-0.0	496.6	753.0	794.2
10	385.1	691.7	735.3	480.8	385.1	446.3	-0.0	528.5	626.4	707.4
11	363.9	685.6	692.8	446.8	363.9	422.5	-0.0	539.9	589.6	685.3

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.349	0.559	1.038	0.553	0.349	0.319	0.970	1.528
2	0.377	0.556	1.034	0.585	0.377	0.350	0.983	1.500
3	0.398	0.545	0.966	0.549	0.398	0.352	0.935	1.402
4	0.396	0.551	0.923	0.502	0.396	0.341	0.907	1.378
5	0.393	0.549	0.911	0.485	0.393	0.332	0.889	1.374
6	0.392	0.548	0.899	0.469	0.392	0.324	0.870	1.366
7	0.391	0.543	0.889	0.461	0.391	0.318	0.856	1.362
8	0.389	0.543	0.877	0.458	0.389	0.321	0.866	1.355
9	0.382	0.566	0.784	0.446	0.382	0.362	0.987	1.263
10	0.350	0.611	0.667	0.425	0.350	0.394	1.159	1.093
11	0.330	0.605	0.628	0.394	0.330	0.373	1.161	1.029

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	10.1	7.3	6.3	0.607	0.776	0.219	0.183	0.047	0.039
2	10.00	9.6	6.5	4.9	0.560	0.805	0.183	0.152	0.040	0.033
3	30.00	11.2	7.1	4.9	0.551	0.813	0.177	0.164	0.038	0.035
4	40.00	12.3	7.5	4.8	0.584	0.809	0.188	0.180	0.040	0.039
5	42.50	12.7	7.8	5.3	0.597	0.800	0.200	0.193	0.043	0.041
6	45.00	12.9	7.8	5.6	0.611	0.792	0.210	0.205	0.045	0.043
7	47.50	13.1	7.9	6.6	0.613	0.780	0.225	0.220	0.047	0.046
8	50.00	13.4	8.0	6.6	0.610	0.785	0.222	0.217	0.046	0.045
9	70.00	14.3	7.9	5.9	0.562	0.882	0.134	0.134	0.028	0.028
10	90.00	14.2	6.9	4.4	0.507	0.981	0.026	0.026	0.005	0.005
11	95.00	14.3	6.9	5.3	0.519	0.923	0.120	0.120	0.022	0.022

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(p) Percent of design speed, 70; reading number, 144

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	26.0	63.6	53.2	520.0	1.083	14.52	1.265
2	9.508	9.429	-0.0	27.5	61.7	52.1	519.3	1.079	14.69	1.253
3	8.635	8.650	-0.0	27.3	58.9	49.2	518.5	1.068	14.71	1.240
4	8.180	8.261	-0.0	30.3	57.5	47.0	518.5	1.069	14.71	1.227
5	8.065	8.164	-0.0	30.4	57.1	46.5	518.4	1.069	14.71	1.225
6	7.949	8.067	-0.0	31.4	56.8	45.2	518.4	1.070	14.71	1.227
7	7.832	7.969	-0.0	31.8	56.4	43.5	518.6	1.071	14.71	1.238
8	7.714	7.872	-0.0	31.9	56.1	42.6	518.4	1.069	14.71	1.241
9	6.726	7.094	-0.0	33.7	53.3	35.3	518.5	1.068	14.71	1.243
10	5.592	6.315	-0.0	38.0	51.3	21.9	518.4	1.069	14.70	1.257
11	5.266	6.121	-0.0	40.2	51.6	19.1	518.6	1.071	14.67	1.246

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	471.3	572.8	1060.1	860.1	471.3	514.7	-0.1	251.3	949.5	940.3
2	501.0	577.1	1057.1	832.4	501.0	511.8	-0.1	266.6	930.8	923.0
3	509.7	567.6	985.9	772.7	509.7	504.5	-0.1	260.0	843.8	845.3
4	511.2	565.8	950.5	716.6	511.2	488.8	-0.1	285.1	801.2	809.2
5	510.6	564.9	940.1	707.7	510.6	487.3	-0.1	285.7	789.2	798.9
6	510.0	572.7	930.7	692.9	510.0	488.6	-0.0	298.8	778.5	790.1
7	509.4	585.7	920.9	685.5	509.4	497.5	-0.1	309.0	767.1	780.5
8	508.2	589.5	910.6	679.8	508.2	500.7	-0.1	311.1	755.5	770.9
9	490.4	607.8	821.3	619.4	490.4	505.7	-0.1	337.2	658.8	694.8
10	438.1	662.5	701.0	562.9	438.1	522.2	-0.0	407.8	547.2	617.9
11	409.4	658.5	658.5	532.4	409.4	503.0	-0.1	425.0	515.8	599.5

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.429	0.505	0.966	0.758	0.429	0.454	1.092	1.157
2	0.458	0.510	0.966	0.736	0.458	0.453	1.022	1.127
3	0.467	0.504	0.902	0.687	0.467	0.448	0.990	1.096
4	0.468	0.503	0.870	0.637	0.468	0.434	0.956	1.082
5	0.467	0.502	0.861	0.629	0.467	0.433	0.954	1.077
6	0.467	0.509	0.852	0.615	0.467	0.434	0.958	1.075
7	0.466	0.521	0.843	0.609	0.466	0.442	0.977	1.070
8	0.465	0.525	0.833	0.605	0.465	0.446	0.985	1.065
9	0.448	0.542	0.751	0.553	0.448	0.451	1.031	1.011
10	0.399	0.594	0.638	0.505	0.399	0.468	1.192	0.886
11	0.372	0.589	0.598	0.477	0.372	0.450	1.229	0.838

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	3.3	0.6	4.7	0.276	0.836	0.095	0.095	0.021	0.021
2	10.00	2.7	-0.3	3.7	0.304	0.847	0.085	0.084	0.019	0.019
3	30.00	4.4	0.3	4.1	0.304	0.934	0.036	0.036	0.008	0.008
4	40.00	5.1	0.4	4.6	0.341	0.879	0.069	0.069	0.015	0.015
5	42.50	5.3	0.4	4.9	0.342	0.863	0.081	0.081	0.017	0.017
6	45.00	5.5	0.4	4.5	0.355	0.856	0.087	0.087	0.019	0.019
7	47.50	5.6	0.4	3.7	0.358	0.891	0.068	0.068	0.015	0.015
8	50.00	5.8	0.4	3.7	0.356	0.929	0.044	0.044	0.010	0.010
9	70.00	6.8	0.3	5.5	0.355	0.948	0.038	0.038	0.008	0.008
10	90.00	7.1	-0.2	4.5	0.327	0.974	0.025	0.025	0.005	0.005
11	95.00	7.5	0.1	5.4	0.327	0.909	0.103	0.103	0.019	0.019

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(q) Percent of design speed, 70; reading number, 145

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	34.4	65.4	52.6	519.8	1.100	14.53	1.329
2	9.508	9.429	-0.0	33.9	63.5	52.0	519.3	1.094	14.68	1.311
3	8.635	8.650	-0.0	34.3	60.7	49.1	518.5	1.082	14.72	1.289
4	8.180	8.261	-0.0	36.8	59.4	46.7	518.5	1.080	14.71	1.277
5	8.065	8.164	-0.0	37.8	59.1	46.0	518.5	1.081	14.71	1.274
6	7.949	8.067	-0.0	38.0	58.8	44.8	518.6	1.081	14.71	1.273
7	7.832	7.969	-0.0	38.5	58.4	43.5	518.5	1.081	14.72	1.277
8	7.714	7.872	-0.0	37.0	58.2	43.2	518.5	1.079	14.71	1.277
9	6.726	7.094	-0.0	39.8	55.6	35.5	518.5	1.075	14.71	1.268
10	5.592	6.315	-0.0	42.2	53.7	22.3	518.5	1.075	14.70	1.279
11	5.266	6.121	-0.0	44.0	53.9	19.4	518.6	1.076	14.67	1.270

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	435.6	573.4	1047.4	779.7	435.6	473.3	-0.1	323.6	952.4	943.2
2	464.6	570.2	1041.3	769.1	464.6	473.4	-0.1	318.0	931.9	924.1
3	473.8	558.3	969.4	704.0	473.8	461.0	-0.1	314.9	845.6	847.1
4	474.3	558.8	931.4	652.0	474.3	447.2	-0.1	335.1	801.6	809.5
5	472.3	558.3	919.6	634.7	472.3	441.1	-0.1	342.2	788.9	798.6
6	470.4	563.0	907.7	625.4	470.4	443.5	-0.1	346.8	776.3	787.8
7	469.9	569.8	897.7	615.0	469.9	445.9	-0.1	354.8	764.9	778.2
8	468.2	569.5	888.1	624.4	468.2	455.0	-0.1	342.4	754.6	770.1
9	450.7	583.8	797.5	551.5	450.7	448.7	-0.1	373.4	657.9	693.9
10	402.8	634.3	680.1	507.5	402.8	469.6	-0.0	426.4	548.0	618.8
11	376.4	631.8	638.4	481.9	376.4	454.4	-0.0	438.9	515.5	599.2

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.396	0.501	0.952	0.682	0.396	0.414	1.087	1.201
2	0.423	0.500	0.949	0.674	0.423	0.415	1.019	1.167
3	0.432	0.492	0.885	0.621	0.432	0.407	0.973	1.132
4	0.433	0.493	0.850	0.575	0.433	0.395	0.943	1.115
5	0.431	0.493	0.839	0.560	0.431	0.389	0.934	1.109
6	0.429	0.497	0.828	0.552	0.429	0.391	0.943	1.103
7	0.429	0.503	0.819	0.543	0.429	0.394	0.949	1.098
8	0.427	0.504	0.810	0.552	0.427	0.402	0.972	1.096
9	0.411	0.518	0.726	0.489	0.411	0.398	0.996	1.036
10	0.366	0.565	0.617	0.452	0.366	0.419	1.166	0.909
11	0.341	0.562	0.579	0.429	0.341	0.405	1.207	0.858

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	5.1	2.4	4.1	0.370	0.844	0.110	0.109	0.025	0.025
2	10.00	4.5	1.5	3.7	0.372	0.852	0.099	0.098	0.022	0.022
3	30.00	6.3	2.1	3.9	0.382	0.920	0.053	0.053	0.011	0.011
4	40.00	7.1	2.3	4.3	0.414	0.900	0.069	0.069	0.015	0.015
5	42.50	7.3	2.4	4.4	0.426	0.887	0.080	0.080	0.017	0.017
6	45.00	7.5	2.4	4.2	0.429	0.877	0.089	0.089	0.019	0.019
7	47.50	7.7	2.5	3.8	0.435	0.892	0.080	0.080	0.018	0.018
8	50.00	7.9	2.6	4.4	0.413	0.918	0.060	0.060	0.013	0.013
9	70.00	9.0	2.6	5.7	0.433	0.931	0.058	0.058	0.012	0.012
10	90.00	9.5	2.2	4.8	0.394	0.973	0.031	0.031	0.006	0.006
11	95.00	9.8	2.4	5.7	0.390	0.924	0.097	0.097	0.018	0.018

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(r) Percent of design speed, 70; reading number, 146

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	40.9	67.2	53.2	519.7	1.112	14.56	1.356
2	9.508	9.429	-0.0	39.8	65.4	51.9	519.2	1.105	14.67	1.347
3	8.635	8.650	-0.0	39.9	62.6	49.7	518.6	1.092	14.71	1.311
4	8.180	8.261	-0.0	42.5	61.4	46.4	518.5	1.090	14.70	1.307
5	8.065	8.164	-0.0	42.5	61.1	45.8	518.6	1.090	14.71	1.304
6	7.949	8.067	-0.0	43.6	60.9	45.2	518.4	1.090	14.72	1.299
7	7.832	7.969	-0.0	43.6	60.6	44.5	518.6	1.090	14.71	1.296
8	7.714	7.872	-0.0	44.4	60.3	43.7	518.5	1.088	14.71	1.292
9	6.726	7.094	-0.0	43.8	57.8	35.7	518.6	1.082	14.72	1.287
10	5.592	6.315	-0.0	44.9	55.6	22.1	518.5	1.078	14.70	1.297
11	5.266	6.121	-0.0	47.0	55.9	19.8	518.6	1.079	14.67	1.279

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	400.2	565.6	1031.3	712.9	400.2	427.3	-0.1	370.6	950.5	941.3
2	425.2	569.2	1021.9	708.0	425.2	437.2	-0.1	364.5	929.1	921.4
3	438.4	548.2	952.3	649.7	438.4	420.6	-0.1	351.6	845.3	846.8
4	435.6	557.7	911.1	596.0	435.6	411.3	-0.1	376.6	800.1	808.1
5	435.0	556.7	901.0	588.7	435.0	410.2	-0.1	376.4	788.9	798.6
6	432.6	556.5	890.3	571.8	432.6	402.9	-0.1	383.9	778.1	789.7
7	432.1	556.7	880.2	564.8	432.1	402.8	-0.1	384.2	766.7	780.1
8	431.2	557.1	869.7	550.6	431.2	397.8	-0.1	390.0	755.2	770.7
9	414.7	572.9	777.3	509.0	414.7	413.5	-0.1	396.5	657.3	693.3
10	374.9	622.0	663.2	474.9	374.9	440.2	-0.0	439.4	547.0	617.7
11	349.3	613.1	622.8	444.0	349.3	417.7	-0.0	448.7	515.5	599.2

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.363	0.492	0.935	0.620	0.363	0.371	1.068	1.236
2	0.386	0.497	0.929	0.618	0.386	0.381	1.028	1.203
3	0.399	0.481	0.867	0.570	0.399	0.369	0.959	1.165
4	0.396	0.490	0.829	0.524	0.396	0.361	0.944	1.146
5	0.396	0.489	0.820	0.517	0.396	0.360	0.943	1.142
6	0.394	0.489	0.810	0.502	0.394	0.354	0.931	1.139
7	0.393	0.489	0.801	0.496	0.393	0.354	0.932	1.133
8	0.392	0.490	0.791	0.484	0.392	0.350	0.922	1.128
9	0.377	0.506	0.706	0.450	0.377	0.365	0.997	1.061
10	0.340	0.553	0.601	0.422	0.340	0.391	1.174	0.924
11	0.316	0.544	0.563	0.394	0.316	0.371	1.196	0.875

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	6.9	4.1	4.7	0.441	0.815	0.146	0.145	0.032	0.032
2	10.00	6.4	3.4	3.5	0.436	0.847	0.116	0.115	0.026	0.026
3	30.00	8.2	4.0	4.5	0.440	0.877	0.093	0.093	0.020	0.020
4	40.00	9.1	4.4	4.0	0.477	0.883	0.093	0.093	0.020	0.020
5	42.50	9.3	4.4	4.3	0.477	0.877	0.099	0.099	0.021	0.021
6	45.00	9.6	4.6	4.5	0.491	0.863	0.113	0.113	0.024	0.024
7	47.50	9.8	4.6	4.8	0.491	0.852	0.124	0.124	0.027	0.027
8	50.00	10.0	4.6	4.9	0.502	0.865	0.113	0.113	0.024	0.024
9	70.00	11.2	4.8	5.9	0.481	0.912	0.083	0.083	0.018	0.018
10	90.00	11.4	4.1	4.6	0.432	0.984	0.020	0.020	0.004	0.004
11	95.00	11.9	4.4	6.1	0.439	0.919	0.112	0.112	0.021	0.021

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(s) Percent of design speed, 70; reading number, 147

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	43.4	68.3	53.7	519.8	1.120	14.58	1.372
2	9.508	9.429	-0.0	43.4	66.7	52.3	519.2	1.114	14.69	1.363
3	8.635	8.650	-0.0	44.1	64.3	50.0	518.6	1.100	14.71	1.325
4	8.180	8.261	-0.0	45.4	63.2	46.6	518.5	1.097	14.71	1.324
5	8.065	8.164	-0.0	46.4	62.9	46.2	518.5	1.097	14.71	1.316
6	7.949	8.067	-0.0	47.0	62.6	45.6	518.5	1.096	14.71	1.310
7	7.832	7.969	-0.0	48.4	62.4	45.2	518.5	1.095	14.71	1.304
8	7.714	7.872	-0.0	47.8	62.1	44.4	518.5	1.094	14.71	1.302
9	6.726	7.094	-0.0	46.3	59.4	35.1	518.5	1.086	14.70	1.305
10	5.592	6.315	-0.0	47.1	57.1	22.1	518.5	1.080	14.70	1.303
11	5.266	6.121	-0.0	48.5	57.2	19.8	518.6	1.081	14.68	1.290

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	378.6	562.1	1024.1	690.1	378.6	408.5	-0.1	386.0	951.4	942.2
2	401.6	567.5	1013.9	674.2	401.6	412.4	-0.1	389.8	930.9	923.2
3	408.0	546.3	939.5	610.7	408.0	392.6	-0.0	379.9	846.2	847.7
4	405.9	557.6	899.3	569.6	405.9	391.7	-0.0	396.8	802.4	810.3
5	404.5	554.1	887.3	551.6	404.5	382.0	-0.1	401.4	789.6	799.3
6	402.3	552.6	875.5	538.7	402.3	376.9	-0.1	404.2	777.5	789.1
7	401.1	550.7	865.5	519.2	401.1	365.7	-0.1	411.7	766.8	780.2
8	399.7	551.5	855.2	518.4	399.7	370.3	-0.1	408.7	755.9	771.4
9	389.6	576.1	766.2	485.9	389.6	397.7	-0.1	416.7	659.7	695.8
10	353.8	612.9	651.9	450.1	353.8	417.0	-0.1	449.1	547.5	618.3
11	332.0	606.7	613.3	427.6	332.0	402.2	-0.0	454.2	515.6	599.3

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.343	0.486	0.927	0.597	0.343	0.354	1.079	1.262
2	0.364	0.493	0.920	0.586	0.364	0.358	1.027	1.232
3	0.371	0.477	0.853	0.533	0.371	0.343	0.962	1.196
4	0.369	0.488	0.817	0.499	0.369	0.343	0.965	1.178
5	0.367	0.485	0.806	0.483	0.367	0.334	0.944	1.171
6	0.365	0.484	0.795	0.472	0.365	0.330	0.937	1.166
7	0.364	0.482	0.786	0.455	0.364	0.320	0.912	1.161
8	0.363	0.483	0.776	0.454	0.363	0.325	0.926	1.157
9	0.353	0.508	0.695	0.428	0.353	0.351	1.021	1.085
10	0.320	0.544	0.590	0.399	0.320	0.370	1.179	0.940
11	0.300	0.538	0.554	0.379	0.300	0.356	1.211	0.887

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	8.0	5.2	5.2	0.465	0.787	0.180	0.178	0.040	0.039
2	10.00	7.6	4.6	3.9	0.474	0.809	0.158	0.157	0.035	0.035
3	30.00	9.8	5.6	4.8	0.484	0.841	0.131	0.131	0.028	0.028
4	40.00	10.9	6.1	4.2	0.506	0.857	0.124	0.124	0.027	0.027
5	42.50	11.1	6.2	4.6	0.520	0.845	0.136	0.136	0.029	0.029
6	45.00	11.4	6.3	4.9	0.527	0.839	0.143	0.143	0.031	0.031
7	47.50	11.6	6.4	5.5	0.545	0.828	0.155	0.155	0.033	0.033
8	50.00	11.9	6.5	5.6	0.538	0.833	0.152	0.152	0.032	0.032
9	70.00	12.9	6.4	5.2	0.511	0.913	0.089	0.089	0.019	0.019
10	90.00	12.9	5.6	4.6	0.464	0.983	0.022	0.022	0.004	0.004
11	95.00	13.2	5.8	6.1	0.459	0.932	0.098	0.098	0.018	0.018

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(t) Percent of design speed, 70; reading number, 148

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	9.717	9.623	-0.0	54.7	70.7	55.5	519.9	1.139	14.60	1.384
2	9.508	9.429	-0.0	51.1	69.4	53.7	519.3	1.130	14.68	1.372
3	8.635	8.650	-0.0	47.6	66.6	50.1	518.5	1.108	14.71	1.338
4	8.180	8.261	-0.0	49.3	65.5	47.3	518.5	1.104	14.71	1.329
5	8.065	8.164	-0.0	50.0	65.3	46.8	518.5	1.103	14.[illegible]	1.324
6	7.949	8.067	-0.0	50.7	65.0	46.6	518.4	1.102	14.[illegible]	1.317
7	7.832	7.969	-0.0	51.6	64.7	46.3	518.6	1.101	14.71	1.309
8	7.714	7.872	-0.0	51.8	64.5	45.6	518.5	1.099	14.71	1.306
9	6.726	7.094	-0.0	48.7	61.5	35.3	518.5	1.089	14.70	1.310
10	5.592	6.315	-0.0	48.9	59.0	21.7	518.4	1.081	14.69	1.312
11	5.266	6.121	-0.0	50.2	58.9	19.8	518.6	1.082	14.69	1.295

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	332.6	568.5	1007.7	579.7	332.6	328.2	-0.1	464.2	951.2	942.0
2	350.6	565.6	995.5	600.0	350.6	355.1	-0.0	440.2	931.7	923.9
3	365.7	548.5	921.5	576.3	365.7	369.7	-0.1	405.2	845.8	847.3
4	364.4	552.5	879.8	530.5	364.4	360.1	-0.1	419.0	800.7	808.7
5	363.4	551.1	869.9	517.7	363.4	354.1	-0.1	422.3	790.2	799.9
6	363.7	547.8	860.1	505.1	363.7	347.0	-0.1	423.9	779.4	790.9
7	362.0	544.3	848.5	489.4	362.0	337.9	-0.0	426.8	767.4	780.8
8	360.8	543.9	837.6	480.6	360.8	336.1	-0.1	427.7	755.8	771.3
9	357.8	569.8	749.4	461.3	357.8	376.3	-0.0	427.8	658.5	694.5
10	329.6	609.4	639.5	431.2	329.6	400.6	-0.0	459.2	547.9	618.7
11	310.8	601.0	602.4	409.0	310.8	384.9	-0.0	461.5	516.0	599.7

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID PEAK SS VEL R	MERID PEAK SS MACH NO
1	0.300	0.488	0.910	0.497	0.300	0.282	0.987	1.315
2	0.317	0.487	0.900	0.517	0.317	0.306	1.013	1.291
3	0.331	0.477	0.835	0.502	0.331	0.322	1.011	1.239
4	0.330	0.482	0.797	0.463	0.330	0.314	0.988	1.216
5	0.329	0.481	0.788	0.452	0.329	0.309	0.974	1.212
6	0.329	0.478	0.779	0.441	0.329	0.303	0.954	1.206
7	0.328	0.475	0.768	0.427	0.328	0.295	0.933	1.199
8	0.327	0.475	0.758	0.420	0.327	0.294	0.932	1.193
9	0.324	0.501	0.678	0.406	0.324	0.331	1.052	1.108
10	0.298	0.540	0.578	0.382	0.298	0.355	1.215	0.958
11	0.281	0.532	0.544	0.362	0.281	0.341	1.239	0.903

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	10.4	7.7	7.0	0.595	0.698	0.295	0.292	0.062	0.061
2	10.00	10.4	7.3	5.4	0.557	0.726	0.259	0.256	0.056	0.055
3	30.00	12.2	8.0	4.9	0.521	0.805	0.177	0.177	0.038	0.038
4	40.00	13.2	8.5	4.9	0.548	0.816	0.175	0.175	0.037	0.037
5	42.50	13.5	8.6	5.3	0.557	0.812	0.180	0.180	0.038	0.038
6	45.00	13.7	8.6	5.9	0.565	0.805	0.189	0.189	0.040	0.040
7	47.50	14.0	8.8	6.6	0.577	0.795	0.200	0.200	0.042	0.042
8	50.00	14.2	8.9	6.8	0.580	0.799	0.199	0.199	0.041	0.041
9	70.00	15.0	8.5	5.5	0.536	0.900	0.109	0.109	0.023	0.023
10	90.00	14.8	7.5	4.3	0.486	0.994	0.008	0.008	0.002	0.002
11	95.00	14.9	7.5	6.0	0.482	0.934	0.101	0.101	0.019	0.019

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(u) Percent of design speed, 60; reading number, 160

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	26.0	63.8	52.5	519.4	1.056	14.55	1.180
2	9.508	9.429	-0.0	26.3	61.9	51.8	519.0	1.053	14.68	1.168
3	8.635	8.650	-0.0	27.4	58.9	48.5	518.5	1.046	14.71	1.162
4	8.180	8.261	-0.0	30.7	57.5	46.1	518.6	1.047	14.71	1.155
5	8.065	8.164	-0.0	31.2	57.2	45.5	518.8	1.047	14.71	1.152
6	7.949	8.067	-0.0	32.6	56.8	44.3	518.3	1.048	14.71	1.152
7	7.832	7.969	-0.0	30.4	56.5	43.2	518.2	1.049	14.71	1.163
8	7.714	7.872	-0.0	31.1	56.1	41.8	518.8	1.048	14.71	1.167
9	6.726	7.094	-0.0	34.1	53.3	34.1	518.5	1.048	14.71	1.168
10	5.592	6.315	-0.0	36.2	51.0	21.5	518.6	1.050	14.70	1.184
11	5.266	6.121	-0.0	38.2	51.2	19.4	518.8	1.052	14.69	1.172

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	401.5	501.7	908.1	740.3	401.5	451.1	-0.0	219.6	814.5	806.6
2	425.4	500.5	904.2	724.8	425.4	448.7	-0.0	221.9	797.8	791.2
3	435.5	494.5	844.3	663.3	435.5	439.1	-0.1	227.3	723.2	724.4
4	436.7	493.2	812.5	611.2	436.7	424.0	-0.0	251.8	685.1	691.9
5	436.1	492.6	804.5	601.3	436.1	421.3	-0.1	255.2	676.0	684.3
6	435.1	496.3	795.1	584.5	435.1	418.3	-0.1	267.1	665.4	675.3
7	435.1	508.1	787.8	601.3	435.1	438.5	-0.1	256.8	656.7	668.2
8	434.3	515.0	779.0	591.0	434.3	440.8	-0.1	266.3	646.6	659.9
9	421.6	531.9	705.1	531.3	421.6	440.2	-0.0	298.6	565.2	596.1
10	378.9	581.4	602.2	504.1	378.9	469.0	-0.0	343.7	468.1	528.6
11	356.1	574.8	567.9	478.7	356.1	451.6	-0.0	355.5	442.3	514.1

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.364	0.446	0.824	0.657	0.364	0.401	1.124	0.991
2	0.387	0.445	0.822	0.645	0.387	0.399	1.055	0.966
3	0.396	0.442	0.768	0.592	0.396	0.392	1.008	0.935
4	0.397	0.440	0.739	0.545	0.397	0.378	0.971	0.920
5	0.397	0.439	0.732	0.536	0.397	0.376	0.966	0.918
6	0.396	0.443	0.724	0.522	0.396	0.373	0.961	0.914
7	0.396	0.454	0.717	0.537	0.396	0.392	1.008	0.912
8	0.395	0.460	0.708	0.528	0.395	0.394	1.015	0.907
9	0.383	0.476	0.641	0.475	0.383	0.394	1.044	0.862
10	0.343	0.522	0.546	0.453	0.343	0.421	1.238	0.753
11	0.322	0.515	0.514	0.429	0.322	0.405	1.268	0.713

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	3.5	0.7	3.9	0.274	0.859	0.072	0.072	0.016	0.016
2	10.00	2.9	-0.1	3.4	0.287	0.858	0.069	0.069	0.015	0.015
3	30.00	4.5	0.3	3.4	0.304	0.950	0.024	0.024	0.005	0.005
4	40.00	5.2	0.4	3.7	0.346	0.900	0.051	0.051	0.011	0.011
5	42.50	5.4	0.5	4.0	0.352	0.870	0.068	0.068	0.015	0.015
6	45.00	5.5	0.5	3.6	0.369	0.855	0.079	0.079	0.017	0.017
7	47.50	5.7	0.5	3.4	0.336	0.899	0.057	0.057	0.012	0.012
8	50.00	5.8	0.5	2.9	0.344	0.940	0.034	0.034	0.008	0.008
9	70.00	6.7	0.3	4.2	0.359	0.945	0.037	0.037	0.008	0.008
10	90.00	6.8	-0.5	4.1	0.290	0.989	0.010	0.010	0.002	0.002
11	95.00	7.1	-0.3	5.6	0.289	0.900	0.108	0.108	0.020	0.020

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(v) Percent of design speed, 60; reading number, 161

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	33.4	65.4	52.5	519.4	1.068	14.58	1.216
2	9.508	9.429	-0.0	32.8	63.5	51.7	519.1	1.064	14.68	1.204
3	8.635	8.650	-0.0	33.7	60.7	48.8	518.7	1.056	14.71	1.191
4	8.180	8.261	-0.0	33.1	59.4	47.1	518.6	1.056	14.71	1.184
5	8.065	8.164	-0.0	36.2	59.1	45.6	518.9	1.056	14.70	1.184
6	7.949	8.067	-0.0	35.9	58.8	44.9	517.8	1.056	14.70	1.183
7	7.832	7.969	-0.0	37.0	58.4	43.2	518.7	1.057	14.71	1.188
8	7.714	7.872	-0.0	37.1	58.1	42.3	518.0	1.055	14.71	1.189
9	6.726	7.094	-0.0	40.0	55.5	34.5	518.7	1.053	14.70	1.184
10	5.592	6.315	-0.0	40.9	53.3	21.0	518.7	1.053	14.70	1.199
11	5.266	6.121	-0.0	40.7	53.3	20.3	518.9	1.055	14.70	1.188

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	373.4	493.2	896.7	675.4	373.4	411.5	-0.0	271.8	815.2	807.4
2	396.9	491.3	889.9	667.0	396.9	413.0	-0.0	266.1	796.5	789.8
3	405.9	481.6	829.9	608.1	405.9	400.5	-0.0	267.5	723.9	725.1
4	405.6	478.4	796.7	588.5	405.6	400.7	-0.0	261.4	685.7	692.5
5	405.4	484.3	789.3	558.6	405.4	390.6	-0.0	286.3	677.2	685.5
6	404.0	484.8	778.8	554.2	404.0	392.6	-0.0	284.5	665.8	675.7
7	403.3	493.1	769.8	540.6	403.3	393.8	-0.0	296.7	655.6	667.1
8	402.8	497.2	762.1	536.2	402.8	396.8	-0.0	299.6	647.0	660.2
9	388.6	509.8	685.5	473.7	388.6	390.6	-0.0	327.6	564.7	595.6
10	348.9	559.3	583.4	452.9	348.9	422.9	-0.0	366.0	467.5	528.0
11	329.1	550.3	550.5	445.0	329.1	417.4	-0.0	358.6	441.3	513.0

	ABS MACH NO		REL MACH NO		MERID MACH NO			
RP	IN	OUT	IN	OUT	IN	OUT	MERID VEL R	PEAK SS MACH NO
1	0.338	0.435	0.812	0.596	0.338	0.363	1.102	1.023
2	0.360	0.434	0.807	0.590	0.360	0.365	1.041	0.993
3	0.369	0.427	0.753	0.540	0.369	0.355	0.987	0.964
4	0.368	0.425	0.723	0.522	0.368	0.356	0.988	0.949
5	0.368	0.430	0.716	0.496	0.368	0.347	0.964	0.947
6	0.367	0.431	0.708	0.492	0.367	0.349	0.972	0.941
7	0.366	0.438	0.699	0.480	0.366	0.350	0.976	0.936
8	0.366	0.442	0.692	0.477	0.366	0.353	0.985	0.934
9	0.352	0.454	0.622	0.422	0.352	0.348	1.005	0.884
10	0.316	0.500	0.528	0.405	0.316	0.378	1.212	0.769
11	0.297	0.491	0.497	0.397	0.297	0.373	1.268	0.727

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	5.1	2.3	3.9	0.359	0.843	0.098	0.098	0.022	0.022
2	10.00	4.5	1.5	3.4	0.359	0.848	0.090	0.090	0.020	0.020
3	30.00	6.3	2.1	3.7	0.374	0.914	0.050	0.050	0.011	0.011
4	40.00	7.1	2.3	4.7	0.365	0.889	0.069	0.069	0.015	0.015
5	42.50	7.3	2.4	4.1	0.406	0.883	0.075	0.075	0.016	0.016
6	45.00	7.5	2.4	4.2	0.401	0.878	0.080	0.080	0.017	0.017
7	47.50	7.6	2.4	3.5	0.415	0.884	0.079	0.079	0.017	0.017
8	50.00	7.8	2.5	3.5	0.415	0.920	0.053	0.053	0.012	0.012
9	70.00	8.9	2.5	4.6	0.436	0.926	0.058	0.058	0.012	0.012
10	90.00	9.1	1.8	3.5	0.364	0.996	0.004	0.004	0.001	0.001
11	95.00	9.3	1.8	6.6	0.329	0.909	0.112	0.112	0.020	0.020

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(w) Percent of design speed, 60; reading number, 162

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	9.717	9.623	-0.0	41.3	67.3	52.6	519.6	1.080	14.60	1.246
2	9.508	9.429	-0.0	38.0	65.7	51.9	519.3	1.075	14.68	1.239
3	8.635	8.650	-0.0	40.3	63.0	49.2	518.5	1.066	14.70	1.218
4	8.180	8.261	-0.0	42.2	61.7	46.2	518.4	1.064	14.70	1.213
5	8.065	8.164	-0.0	41.1	61.4	45.8	518.3	1.064	14.71	1.211
6	7.949	8.067	-0.0	43.3	61.1	44.9	517.9	1.064	14.71	1.207
7	7.832	7.969	-0.0	42.8	60.8	44.2	518.7	1.064	14.70	1.205
8	7.714	7.872	-0.0	43.1	60.5	43.2	518.6	1.063	14.70	1.206
9	6.726	7.094	-0.0	45.3	57.9	34.4	518.5	1.059	14.71	1.201
10	5.592	6.315	-0.0	45.2	55.6	20.7	518.6	1.057	14.70	1.212
11	5.266	6.121	-0.0	46.6	55.6	18.5	518.8	1.059	14.69	1.200

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	341.4	492.3	884.6	608.5	341.4	369.8	-0.0	324.9	816.0	808.1
2	360.8	488.7	876.9	624.9	360.8	385.3	-0.0	300.5	799.2	792.6
3	370.9	475.7	816.0	555.4	370.9	362.9	-0.1	307.6	726.7	728.0
4	369.7	480.7	780.0	513.9	369.7	356.0	-0.0	322.9	686.7	693.5
5	369.4	478.7	771.7	517.8	369.4	360.9	-0.1	314.4	677.5	685.8
6	367.7	479.6	761.6	493.0	367.7	349.2	-0.0	328.8	666.9	676.8
7	367.2	479.8	752.5	490.7	367.2	351.8	-0.0	326.2	656.8	668.3
8	366.5	482.5	744.3	483.4	366.5	352.2	-0.0	329.9	647.8	661.0
9	353.6	498.6	665.5	424.7	353.6	350.4	-0.0	354.7	563.7	594.6
10	321.4	543.5	569.4	409.3	321.4	382.8	-0.0	385.8	470.0	530.7
11	303.2	538.6	536.9	390.4	303.2	370.3	-0.0	391.2	443.0	515.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID PEAK SS VEL R	MERID PEAK SS MACH NO
1	0.308	0.432	0.799	0.534	0.308	0.324	1.083	1.060
2	0.326	0.430	0.793	0.549	0.326	0.339	1.068	1.036
3	0.336	0.420	0.739	0.490	0.336	0.321	0.979	1.003
4	0.335	0.425	0.707	0.454	0.335	0.315	0.963	0.984
5	0.335	0.423	0.699	0.458	0.335	0.319	0.977	0.980
6	0.333	0.424	0.690	0.436	0.333	0.309	0.950	0.976
7	0.333	0.424	0.681	0.434	0.333	0.311	0.958	0.970
8	0.332	0.427	0.674	0.428	0.332	0.312	0.961	0.966
9	0.320	0.443	0.602	0.377	0.320	0.311	0.991	0.908
10	0.290	0.485	0.514	0.365	0.290	0.341	1.191	0.792
11	0.274	0.479	0.484	0.348	0.274	0.330	1.221	0.748

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	7.0	4.2	4.0	0.448	0.808	0.142	0.142	0.032	0.032
2	10.00	6.7	3.7	3.6	0.411	0.838	0.114	0.114	0.026	0.026
3	30.00	8.5	4.4	4.0	0.444	0.882	0.083	0.083	0.018	0.018
4	40.00	9.4	4.6	3.8	0.472	0.883	0.087	0.087	0.019	0.019
5	42.50	9.6	4.7	4.3	0.456	0.880	0.090	0.090	0.020	0.020
6	45.00	9.9	4.8	4.2	0.486	0.870	0.099	0.099	0.022	0.022
7	47.50	10.0	4.8	4.4	0.480	0.850	0.118	0.118	0.026	0.026
8	50.00	10.2	4.9	4.4	0.484	0.872	0.101	0.101	0.022	0.022
9	70.00	11.4	4.9	4.6	0.504	0.917	0.075	0.075	0.016	0.016
10	90.00	11.4	4.1	3.3	0.433	0.993	0.009	0.009	0.002	0.002
11	95.00	11.6	4.2	4.8	0.426	0.909	0.123	0.123	0.023	0.023

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(x) Percent of design speed, 60; reading number, 163

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	49.6	69.0	54.1	519.9	1.090	14.61	1.256
2	9.508	9.429	-0.0	43.0	67.4	52.4	519.4	1.084	14.68	1.254
3	8.635	8.650	-0.0	45.6	64.8	49.4	518.6	1.072	14.71	1.232
4	8.180	8.261	-0.0	46.7	63.7	46.2	518.5	1.071	14.70	1.229
5	8.065	8.164	-0.0	47.2	63.4	45.8	517.9	1.070	14.70	1.224
6	7.949	8.067	-0.0	46.9	63.1	45.2	518.8	1.070	14.70	1.221
7	7.832	7.969	-0.0	49.5	62.8	44.8	518.5	1.069	14.70	1.215
8	7.714	7.872	-0.0	49.5	62.5	43.8	518.3	1.068	14.70	1.214
9	6.726	7.094	-0.0	49.4	59.8	34.3	518.5	1.062	14.70	1.212
10	5.592	6.315	-0.0	46.3	57.4	21.9	518.5	1.058	14.70	1.217
11	5.266	6.121	-0.0	49.7	57.5	17.7	518.6	1.059	14.70	1.207

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	313.6	488.5	874.8	539.1	313.6	316.4	-0.0	372.2	816.6	808.7
2	333.6	486.2	867.0	583.3	333.6	355.8	-0.0	331.3	800.2	793.6
3	341.8	475.2	802.7	511.1	341.8	332.5	-0.0	339.4	726.3	727.6
4	340.6	482.0	768.1	477.5	340.6	330.6	-0.0	350.7	688.4	695.3
5	339.2	478.5	756.9	466.1	339.2	325.2	-0.0	351.0	676.6	684.9
6	338.9	477.9	749.1	463.9	338.9	326.8	-0.0	348.7	668.0	677.9
7	337.9	476.1	739.4	435.5	337.9	309.0	-0.0	362.2	657.7	669.2
8	337.3	477.9	730.2	429.6	337.3	310.1	-0.0	363.6	647.6	660.8
9	328.8	495.0	653.8	389.8	328.8	321.9	-0.0	376.1	565.1	596.0
10	300.4	529.1	556.9	393.7	300.4	365.3	-0.0	382.8	468.9	529.5
11	281.7	530.2	524.1	360.1	281.7	343.1	-0.0	404.2	441.9	513.7

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.283	0.426	0.789	0.470	0.283	0.276	1.009	1.093
2	0.301	0.426	0.783	0.511	0.301	0.311	1.067	1.069
3	0.309	0.418	0.726	0.450	0.309	0.293	0.973	1.032
4	0.308	0.425	0.695	0.421	0.308	0.291	0.970	1.015
5	0.307	0.422	0.685	0.411	0.307	0.287	0.959	1.008
6	0.306	0.421	0.677	0.409	0.306	0.288	0.964	1.004
7	0.305	0.420	0.669	0.384	0.305	0.272	0.915	0.998
8	0.305	0.422	0.660	0.379	0.305	0.274	0.920	0.992
9	0.297	0.438	0.591	0.345	0.297	0.285	0.979	0.930
10	0.271	0.471	0.503	0.350	0.271	0.325	1.216	0.804
11	0.254	0.472	0.473	0.320	0.254	0.305	1.218	0.760

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	8.7	5.9	5.5	0.541	0.750	0.207	0.207	0.045	0.045
2	10.00	8.3	5.3	4.1	0.465	0.795	0.163	0.163	0.036	0.036
3	30.00	10.4	6.2	4.3	0.504	0.849	0.119	0.119	0.026	0.026
4	40.00	11.4	6.6	3.8	0.523	0.858	0.118	0.118	0.026	0.026
5	42.50	11.6	6.7	4.2	0.529	0.856	0.121	0.121	0.026	0.026
6	45.00	11.8	6.8	4.6	0.524	0.839	0.138	0.138	0.030	0.030
7	47.50	12.0	6.8	5.1	0.560	0.828	0.150	0.150	0.032	0.032
8	50.00	12.2	6.9	5.0	0.561	0.834	0.146	0.146	0.031	0.031
9	70.00	13.3	6.8	4.5	0.557	0.907	0.092	0.092	0.020	0.020
10	90.00	13.2	5.9	4.4	0.447	0.994	0.008	0.008	0.002	0.002
11	95.00	13.5	6.0	4.0	0.475	0.942	0.082	0.082	0.015	0.015

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(y) Percent of design speed, 60; reading number, 164

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	64.4	72.2	58.4	519.4	1.108	14.64	1.278
2	9.508	9.429	-0.0	58.4	70.7	55.3	519.1	1.101	14.68	1.267
3	8.635	8.650	-0.0	50.9	67.9	49.7	518.7	1.081	14.70	1.246
4	8.180	8.261	-0.0	52.0	66.8	46.7	518.5	1.078	14.71	1.240
5	8.065	8.164	-0.0	53.8	66.5	46.6	518.5	1.077	14.71	1.236
6	7.949	8.067	-0.0	53.5	66.2	46.0	518.8	1.077	14.71	1.232
7	7.832	7.969	-0.0	54.6	65.9	46.2	518.6	1.075	14.70	1.225
8	7.714	7.872	-0.0	54.8	65.6	45.4	518.5	1.074	14.70	1.223
9	6.726	7.094	-0.0	51.8	62.6	35.6	518.5	1.066	14.70	1.219
10	5.592	6.315	-0.0	49.9	59.8	21.3	518.6	1.060	14.70	1.224
11	5.266	6.121	-0.0	51.3	59.9	18.3	518.9	1.062	14.70	1.215

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	262.2	503.9	857.5	415.9	262.2	217.9	-0.0	454.3	816.4	808.5
2	279.4	491.7	845.3	453.1	279.4	257.9	-0.0	418.6	797.8	791.1
3	294.3	478.8	783.8	466.9	294.3	302.0	-0.0	371.5	726.4	727.6
4	295.2	481.8	748.3	432.4	295.2	296.6	-0.0	379.7	687.6	694.4
5	295.1	480.2	740.7	412.6	295.1	283.3	-0.0	387.7	679.3	687.7
6	295.0	478.2	730.8	409.3	295.0	284.6	-0.0	384.3	668.6	678.5
7	295.0	472.6	721.9	395.5	295.0	273.9	-0.0	385.1	658.8	670.3
8	295.1	472.9	713.5	388.2	295.1	272.5	-0.0	386.4	649.5	662.8
9	293.8	485.9	638.0	369.4	293.8	300.2	-0.0	382.0	566.3	597.3
10	273.6	522.2	543.8	361.0	273.6	336.3	-0.0	399.5	470.0	530.8
11	257.0	521.0	511.9	342.9	257.0	325.5	-0.0	406.8	442.7	514.6

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.236	0.436	0.772	0.360	0.236	0.189	0.831	1.155
2	0.252	0.427	0.762	0.394	0.252	0.224	0.923	1.128
3	0.266	0.420	0.707	0.409	0.266	0.265	1.026	1.082
4	0.266	0.423	0.675	0.380	0.266	0.260	1.005	1.059
5	0.266	0.422	0.668	0.362	0.266	0.249	0.960	1.057
6	0.266	0.420	0.659	0.359	0.266	0.250	0.965	1.049
7	0.266	0.415	0.651	0.348	0.266	0.241	0.929	1.042
8	0.266	0.416	0.644	0.341	0.266	0.240	0.923	1.037
9	0.265	0.429	0.576	0.326	0.265	0.265	1.022	0.962
10	0.247	0.464	0.490	0.321	0.247	0.299	1.229	0.826
11	0.231	0.462	0.461	0.304	0.231	0.289	1.266	0.780

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	11.9	9.1	9.9	0.710	0.669	0.332	0.332	0.064	0.064
2	10.00	11.7	8.6	7.0	0.643	0.693	0.296	0.296	0.061	0.061
3	30.00	13.5	9.3	4.5	0.562	0.798	0.184	0.184	0.039	0.039
4	40.00	14.5	9.7	4.3	0.583	0.813	0.178	0.178	0.038	0.038
5	42.50	14.7	9.8	5.1	0.607	0.805	0.187	0.187	0.040	0.040
6	45.00	14.9	9.9	5.3	0.602	0.800	0.196	0.196	0.042	0.042
7	47.50	15.1	9.9	6.4	0.615	0.795	0.200	0.200	0.042	0.042
8	50.00	15.3	9.9	6.6	0.619	0.796	0.201	0.201	0.042	0.042
9	70.00	16.1	9.6	5.8	0.580	0.879	0.133	0.133	0.028	0.028
10	90.00	15.6	8.3	3.9	0.500	0.990	0.013	0.013	0.003	0.003
11	95.00	15.8	8.4	4.6	0.497	0.926	0.114	0.114	0.021	0.021

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(z) Percent of design speed, 50; reading number, 155

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	9.717	9.623	-0.0	21.2	63.3	52.8	519.7	1.033	14.59	1.103
2	9.508	9.429	-0.0	24.4	61.4	51.6	519.2	1.032	14.69	1.094
3	8.635	8.650	-0.0	23.9	58.3	48.6	518.5	1.028	14.71	1.095
4	8.180	8.261	-0.0	27.0	56.9	46.0	518.4	1.029	14.71	1.092
5	8.065	8.164	-0.0	27.5	56.6	45.4	517.7	1.028	14.70	1.090
6	7.949	8.067	-0.0	28.5	56.2	44.5	518.9	1.030	14.70	1.089
7	7.832	7.969	-0.0	28.9	55.8	42.4	517.8	1.030	14.70	1.097
8	7.714	7.872	-0.0	25.9	55.5	42.5	519.2	1.031	14.70	1.101
9	6.726	7.094	-0.0	31.1	52.5	33.8	518.4	1.030	14.70	1.104
10	5.592	6.315	-0.0	32.8	50.1	22.3	518.5	1.033	14.70	1.117
11	5.266	6.121	-0.0	36.5	50.2	18.3	518.3	1.034	14.69	1.111

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	340.9	423.6	759.9	652.6	340.9	395.0	-0.0	153.0	679.1	672.5
2	363.1	422.9	758.2	619.6	363.1	385.1	-0.1	174.7	665.5	660.0
3	372.5	419.6	709.6	580.1	372.5	383.7	-0.1	169.9	603.9	605.0
4	373.9	420.0	684.3	539.2	373.9	374.3	-0.1	190.5	573.0	578.7
5	372.7	419.1	676.2	529.6	372.7	371.6	-0.1	193.7	564.1	571.1
6	373.9	421.8	671.7	520.0	373.9	370.6	-0.1	201.5	558.0	566.3
7	372.8	434.1	662.6	514.7	372.8	379.9	-0.0	210.0	547.7	557.3
8	372.5	437.5	656.8	533.7	372.5	393.4	-0.1	191.4	540.9	552.0
9	361.9	455.7	594.2	469.4	361.9	390.0	-0.1	235.7	471.1	496.9
10	327.1	498.5	510.1	453.1	327.1	419.2	-0.0	269.9	391.3	441.9
11	307.8	499.1	480.7	422.8	307.8	401.4	-0.0	296.6	369.2	429.1

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID PEAK SS VEL R	MERID PEAK SS MACH NO
1	0.308	0.378	0.686	0.583	0.308	0.353	1.159	0.816
2	0.329	0.378	0.686	0.554	0.329	0.344	1.061	0.793
3	0.338	0.376	0.643	0.520	0.338	0.344	1.030	0.769
4	0.339	0.376	0.620	0.483	0.339	0.335	1.001	0.759
5	0.338	0.376	0.613	0.475	0.338	0.333	0.997	0.756
6	0.339	0.377	0.608	0.465	0.339	0.332	0.991	0.755
7	0.338	0.389	0.601	0.461	0.338	0.341	1.019	0.749
8	0.337	0.392	0.595	0.478	0.337	0.352	1.056	0.747
9	0.328	0.409	0.538	0.421	0.328	0.350	1.077	0.709
10	0.296	0.448	0.461	0.407	0.296	0.377	1.281	0.621
11	0.278	0.449	0.434	0.380	0.278	0.361	1.304	0.588

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	3.0	0.3	4.2	0.215	0.852	0.061	0.061	0.014	0.014
2	10.00	2.4	-0.7	3.2	0.266	0.817	0.073	0.073	0.016	0.016
3	30.00	3.9	-0.3	3.4	0.262	0.939	0.024	0.024	0.005	0.005
4	40.00	4.6	-0.2	3.7	0.300	0.884	0.049	0.049	0.011	0.011
5	42.50	4.7	-0.2	3.9	0.306	0.880	0.052	0.052	0.011	0.011
6	45.00	4.9	-0.2	3.9	0.319	0.815	0.086	0.086	0.019	0.019
7	47.50	5.0	-0.2	2.7	0.320	0.894	0.050	0.050	0.011	0.011
8	50.00	5.2	-0.2	3.7	0.275	0.900	0.049	0.049	0.011	0.011
9	70.00	5.9	-0.5	4.0	0.316	0.948	0.031	0.031	0.007	0.007
10	90.00	5.9	-1.4	4.9	0.230	0.973	0.023	0.023	0.004	0.004
11	95.00	6.1	-1.3	4.6	0.250	0.900	0.097	0.097	0.018	0.018

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(aa) Percent of design speed, 50; reading number, 156

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	29.2	65.0	52.3	519.4	1.044	14.61	1.132
2	9.508	9.429	-0.0	31.7	63.2	51.2	519.2	1.041	14.67	1.128
3	8.635	8.650	-0.0	31.3	60.4	48.5	518.7	1.036	14.71	1.121
4	8.180	8.261	-0.0	21.5	56.5	47.4	518.5	1.028	14.71	1.086
5	8.065	8.164	-0.0	25.2	56.1	45.8	517.6	1.026	14.70	1.084
6	7.949	8.067	-0.0	26.7	55.7	44.6	519.2	1.029	14.71	1.084
7	7.832	7.969	-0.0	28.0	55.4	42.0	518.5	1.029	14.70	1.094
8	7.714	7.872	-0.0	23.8	55.0	42.8	518.6	1.028	14.70	1.097
9	6.726	7.094	-0.0	30.0	52.0	33.6	518.5	1.029	14.70	1.102
10	5.592	6.315	-0.0	32.1	49.7	21.7	518.6	1.033	14.70	1.119
11	5.266	6.121	-0.0	35.5	49.6	18.6	518.6	1.034	14.69	1.107

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	316.4	416.2	749.7	593.8	316.4	363.3	-0.0	203.2	679.6	673.0
2	336.5	417.1	746.1	566.3	336.5	354.9	-0.0	219.0	665.9	660.4
3	342.2	406.3	693.4	524.3	342.2	347.1	-0.1	211.2	603.0	604.1
4	378.8	419.4	686.3	576.3	378.8	390.2	-0.1	153.8	572.2	577.9
5	378.8	420.8	679.4	546.1	378.8	380.7	-0.1	179.2	563.9	570.8
6	379.6	424.8	673.7	532.6	379.6	379.4	-0.1	191.1	556.5	564.8
7	378.9	441.3	666.5	524.1	378.9	389.6	-0.0	207.3	548.3	557.9
8	379.0	441.7	660.4	550.5	379.0	404.2	-0.1	178.1	540.7	551.8
9	368.7	462.2	598.2	480.2	368.7	400.1	-0.0	231.4	471.0	496.8
10	332.5	509.3	513.8	464.6	332.5	431.6	-0.0	270.4	391.6	442.3
11	313.4	501.2	483.8	430.7	313.4	408.2	-0.0	290.9	368.5	428.4

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.286	0.370	0.677	0.527	0.286	0.323	1.148	0.844
2	0.304	0.371	0.674	0.504	0.304	0.316	1.055	0.822
3	0.309	0.362	0.627	0.467	0.309	0.310	1.014	0.796
4	0.343	0.376	0.622	0.516	0.343	0.350	1.030	0.753
5	0.344	0.378	0.616	0.490	0.344	0.342	1.005	0.750
6	0.344	0.380	0.610	0.477	0.344	0.340	0.999	0.747
7	0.343	0.396	0.604	0.470	0.343	0.349	1.028	0.745
8	0.343	0.396	0.599	0.494	0.343	0.363	1.067	0.742
9	0.334	0.415	0.542	0.431	0.334	0.359	1.085	0.704
10	0.301	0.458	0.464	0.418	0.301	0.388	1.298	0.619
11	0.283	0.451	0.437	0.387	0.283	0.367	1.303	0.583

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	4.7	2.0	3.8	0.308	0.821	0.098	0.098	0.022	0.022
2	10.00	4.2	1.2	2.8	0.347	0.865	0.069	0.069	0.016	0.016
3	30.00	6.0	1.8	3.4	0.345	0.926	0.039	0.039	0.008	0.008
4	40.00	4.2	-0.6	5.0	0.231	0.837	0.069	0.069	0.015	0.015
5	42.50	4.3	-0.6	4.3	0.279	0.888	0.044	0.044	0.010	0.010
6	45.00	4.4	-0.6	3.9	0.297	0.811	0.083	0.083	0.018	0.018
7	47.50	4.6	-0.6	2.2	0.308	0.888	0.051	0.051	0.011	0.011
8	50.00	4.7	-0.7	3.9	0.248	0.942	0.026	0.026	0.006	0.006
9	70.00	5.4	-1.1	3.7	0.300	0.963	0.021	0.021	0.004	0.004
10	90.00	5.5	-1.8	4.3	0.213	0.990	0.008	0.008	0.002	0.002
11	95.00	5.6	-1.8	4.9	0.236	0.869	0.124	0.124	0.023	0.023

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(bb) Percent of design speed, 50; reading number, 157

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	9.717	9.623	-0.0	39.5	67.4	52.7	519.2	1.050	14.61	1.155
2	9.508	9.429	-0.0	36.1	65.3	52.2	518.9	1.048	14.69	1.149
3	8.635	8.650	-0.0	37.7	62.6	49.3	518.7	1.042	14.71	1.137
4	8.180	8.261	-0.0	39.9	61.3	46.3	518.6	1.042	14.70	1.134
5	8.065	8.164	-0.0	40.8	61.0	45.4	518.4	1.041	14.71	1.135
6	7.949	8.067	-0.0	41.7	60.7	44.7	518.8	1.042	14.70	1.134
7	7.832	7.969	-0.0	42.1	60.4	43.5	519.1	1.043	14.70	1.135
8	7.714	7.872	-0.0	41.8	60.0	42.7	518.2	1.042	14.70	1.134
9	6.726	7.094	-0.0	42.9	57.3	35.0	518.6	1.039	14.70	1.130
10	5.592	6.315	-0.0	43.2	55.1	21.0	518.7	1.038	14.70	1.139
11	5.266	6.121	-0.0	45.3	55.2	17.7	519.0	1.040	14.69	1.133

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	283.6	408.8	736.9	520.1	283.6	315.4	-0.0	260.0	680.2	673.6
2	306.1	405.0	732.7	533.6	306.1	327.2	-0.0	238.7	665.7	660.2
3	313.0	394.9	680.1	478.8	313.0	312.3	-0.0	241.8	603.7	604.8
4	313.3	399.3	651.7	443.8	313.3	306.4	-0.0	256.0	571.4	577.1
5	312.6	401.4	644.7	433.2	312.6	304.0	-0.0	262.2	563.8	570.8
6	312.8	402.6	638.6	422.7	312.8	300.6	-0.0	267.8	556.7	564.9
7	312.4	406.5	631.9	416.1	312.4	301.8	-0.0	272.4	549.2	558.8
8	311.4	406.9	623.3	412.5	311.4	303.2	-0.0	271.3	539.9	551.0
9	301.3	415.3	558.4	371.7	301.3	304.4	-0.0	282.5	470.1	495.8
10	272.5	456.8	476.0	356.6	272.5	332.9	-0.0	312.9	390.3	440.8
11	256.4	458.7	449.4	338.4	256.4	322.4	-0.0	326.3	369.1	429.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID PEAK SS VEL R	MERID PEAK SS MACH NO
1	0.256	0.362	0.664	0.460	0.256	0.279	1.112	0.883
2	0.276	0.359	0.661	0.473	0.276	0.290	1.069	0.855
3	0.283	0.351	0.614	0.425	0.283	0.277	0.998	0.825
4	0.283	0.355	0.588	0.394	0.283	0.272	0.978	0.810
5	0.282	0.357	0.582	0.385	0.282	0.270	0.973	0.808
6	0.282	0.358	0.576	0.376	0.282	0.267	0.961	0.806
7	0.282	0.361	0.570	0.370	0.282	0.268	0.966	0.803
8	0.281	0.362	0.563	0.367	0.281	0.270	0.974	0.798
9	0.272	0.370	0.504	0.331	0.272	0.271	1.011	0.750
10	0.246	0.408	0.429	0.319	0.246	0.297	1.222	0.652
11	0.231	0.409	0.405	0.302	0.231	0.288	1.258	0.619

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	7.1	4.3	4.1	0.424	0.833	0.108	0.108	0.024	0.024
2	10.00	6.3	3.3	3.8	0.390	0.849	0.093	0.093	0.021	0.021
3	30.00	8.2	4.0	4.1	0.414	0.887	0.071	0.071	0.015	0.015
4	40.00	9.0	4.2	4.0	0.443	0.882	0.079	0.079	0.017	0.017
5	42.50	9.2	4.3	3.9	0.455	0.891	0.074	0.074	0.016	0.016
6	45.00	9.4	4.3	4.0	0.468	0.864	0.095	0.095	0.021	0.021
7	47.50	9.6	4.4	3.8	0.473	0.857	0.103	0.103	0.023	0.023
8	50.00	9.8	4.4	3.9	0.469	0.881	0.086	0.086	0.019	0.019
9	70.00	10.8	4.3	5.2	0.469	0.914	0.071	0.071	0.015	0.015
10	90.00	10.9	3.6	3.6	0.398	0.994	0.007	0.007	0.001	0.001
11	95.00	11.2	3.8	4.0	0.400	0.910	0.117	0.117	0.022	0.022

TABLE V. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

(cc) Percent of design speed, 50; reading number, 158

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	48.5	69.2	54.3	519.0	1.059	14.63	1.168
2	9.508	9.429	-0.0	44.3	67.5	52.5	518.7	1.055	14.69	1.166
3	8.635	8.650	-0.0	44.4	64.9	49.7	518.7	1.048	14.70	1.152
4	8.180	8.261	-0.0	45.5	63.7	46.6	518.5	1.047	14.70	1.149
5	8.065	8.164	-0.0	46.4	63.4	46.2	518.8	1.047	14.70	1.146
6	7.949	8.067	-0.0	47.5	63.2	45.5	518.6	1.047	14.70	1.145
7	7.832	7.969	-0.0	48.8	62.9	45.0	518.6	1.047	14.70	1.142
8	7.714	7.872	-0.0	48.1	62.5	44.0	518.5	1.046	14.70	1.141
9	6.726	7.094	-0.0	48.5	59.9	34.7	518.8	1.042	14.69	1.139
10	5.592	6.315	-0.0	47.9	57.5	20.5	518.9	1.040	14.70	1.144
11	5.266	6.121	-0.0	48.5	57.6	18.2	518.7	1.040	14.69	1.139

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	257.6	402.6	727.0	457.3	257.6	266.7	-0.0	301.6	679.7	673.2
2	275.1	404.7	719.7	475.3	275.1	289.7	-0.0	282.7	665.0	659.5
3	282.6	392.4	666.6	433.4	282.6	280.6	-0.0	274.4	603.7	604.8
4	281.7	396.7	636.8	404.3	281.7	277.9	-0.0	283.1	571.1	576.7
5	281.8	394.8	629.8	393.3	281.8	272.1	-0.0	286.0	563.2	570.1
6	280.7	395.1	622.0	381.0	280.7	266.9	-0.0	291.4	555.0	563.3
7	280.2	394.1	614.4	367.4	280.2	259.7	-0.0	296.5	546.8	556.4
8	280.2	395.6	606.9	367.1	280.2	264.2	-0.0	294.5	538.4	549.4
9	271.8	409.0	541.7	329.4	271.8	270.7	-0.0	306.5	468.6	494.2
10	248.8	443.6	462.8	317.3	248.8	297.1	-0.0	329.3	390.2	440.6
11	234.2	442.8	436.6	308.8	234.2	293.3	-0.0	331.8	368.5	428.3

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.232	0.355	0.655	0.403	0.232	0.235	1.035	0.912
2	0.248	0.357	0.649	0.420	0.248	0.256	1.053	0.889
3	0.255	0.347	0.601	0.384	0.255	0.248	0.993	0.857
4	0.254	0.352	0.574	0.358	0.254	0.246	0.986	0.840
5	0.254	0.350	0.568	0.349	0.254	0.241	0.965	0.836
6	0.253	0.350	0.561	0.338	0.253	0.237	0.951	0.833
7	0.253	0.349	0.554	0.326	0.253	0.230	0.927	0.828
8	0.253	0.351	0.547	0.325	0.253	0.234	0.943	0.823
9	0.245	0.364	0.488	0.293	0.245	0.241	0.996	0.770
10	0.224	0.396	0.417	0.283	0.224	0.265	1.194	0.668
11	0.211	0.395	0.393	0.275	0.211	0.262	1.252	0.633

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	8.9	6.2	5.8	0.524	0.767	0.178	0.178	0.038	0.038
2	10.00	8.5	5.5	4.1	0.482	0.809	0.140	0.140	0.031	0.031
3	30.00	10.5	6.3	4.5	0.486	0.853	0.109	0.109	0.023	0.023
4	40.00	11.4	6.7	4.2	0.506	0.863	0.106	0.106	0.023	0.023
5	42.50	11.6	6.7	4.7	0.517	0.850	0.119	0.119	0.026	0.026
6	45.00	11.9	6.8	4.9	0.532	0.846	0.124	0.124	0.027	0.027
7	47.50	12.1	6.9	5.3	0.549	0.833	0.138	0.138	0.029	0.029
8	50.00	12.2	6.9	5.2	0.541	0.837	0.136	0.136	0.029	0.029
9	70.00	13.3	6.9	4.9	0.542	0.904	0.090	0.090	0.019	0.019
10	90.00	13.3	6.0	3.1	0.473	0.982	0.022	0.022	0.004	0.004
11	95.00	13.5	6.1	4.5	0.453	0.944	0.077	0.077	0.014	0.014

TABLE V. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES

(dd) Percent of design speed, 50; reading number, 159

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	9.717	9.623	-0.0	62.0	72.2	58.1	519.7	1.072	14.65	1.184
2	9.508	9.429	-0.0	57.7	70.7	55.4	519.2	1.068	14.69	1.179
3	8.635	8.650	-0.0	51.3	68.0	49.8	518.7	1.056	14.70	1.165
4	8.180	8.261	-0.0	52.7	66.9	46.7	518.6	1.053	14.70	1.162
5	8.065	8.164	-0.0	53.6	66.6	46.8	518.5	1.053	14.70	1.159
6	7.949	8.067	-0.0	54.5	66.3	46.3	518.4	1.052	14.70	1.155
7	7.832	7.969	-0.0	55.5	66.0	46.5	518.2	1.051	14.70	1.151
8	7.714	7.872	-0.0	55.4	65.7	45.5	518.1	1.050	14.70	1.149
9	6.726	7.094	-0.0	51.3	62.8	35.0	518.6	1.046	14.70	1.150
10	5.592	6.315	-0.0	49.5	60.0	21.1	518.6	1.041	14.70	1.152
11	5.266	6.121	-0.0	50.5	60.1	18.5	518.8	1.042	14.70	1.145

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	217.9	411.1	714.4	366.0	217.9	193.2	-0.0	362.9	680.4	673.8
2	233.3	408.0	706.4	384.4	233.3	218.2	-0.0	344.7	666.7	661.1
3	243.9	398.1	651.2	385.6	243.9	249.1	-0.0	310.5	603.8	604.8
4	244.1	401.3	621.9	354.9	244.1	243.2	-0.0	319.2	572.0	577.6
5	244.3	398.0	615.8	345.1	244.3	236.1	-0.0	320.4	565.2	572.2
6	243.8	396.9	607.2	333.4	243.8	230.3	-0.0	323.3	556.1	564.4
7	243.8	392.0	599.3	322.4	243.8	221.9	-0.0	323.2	547.4	557.0
8	243.2	392.1	590.3	317.3	243.2	222.6	-0.0	322.8	537.9	548.9
9	242.1	408.0	529.8	311.4	242.1	255.1	-0.0	318.4	471.2	497.0
10	225.5	436.8	451.2	304.0	225.5	283.7	-0.0	332.1	390.8	441.3
11	212.1	434.6	424.9	291.8	212.1	276.7	-0.0	335.2	368.1	427.9

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.196	0.360	0.642	0.320	0.196	0.169	0.886	0.962
2	0.210	0.358	0.635	0.337	0.210	0.192	0.935	0.941
3	0.220	0.351	0.586	0.340	0.220	0.220	1.022	0.899
4	0.220	0.355	0.560	0.314	0.220	0.215	0.996	0.881
5	0.220	0.352	0.554	0.305	0.220	0.209	0.966	0.879
6	0.219	0.351	0.547	0.295	0.219	0.204	0.945	0.872
7	0.220	0.347	0.540	0.285	0.220	0.196	0.910	0.866
8	0.219	0.347	0.532	0.281	0.219	0.197	0.915	0.858
9	0.218	0.362	0.477	0.276	0.218	0.226	1.054	0.801
10	0.203	0.389	0.406	0.271	0.203	0.253	1.258	0.687
11	0.191	0.387	0.382	0.260	0.191	0.246	1.305	0.649

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	11.9	9.2	9.6	0.675	0.686	0.296	0.296	0.058	0.058
2	10.00	11.7	8.7	7.1	0.632	0.710	0.264	0.264	0.054	0.054
3	30.00	13.6	9.4	4.6	0.566	0.804	0.171	0.171	0.037	0.037
4	40.00	14.6	9.8	4.4	0.592	0.822	0.163	0.163	0.035	0.035
5	42.50	14.8	9.9	5.3	0.602	0.816	0.170	0.170	0.036	0.036
6	45.00	15.1	10.0	5.7	0.615	0.812	0.176	0.176	0.037	0.037
7	47.50	15.2	10.0	6.8	0.626	0.804	0.184	0.184	0.038	0.038
8	50.00	15.4	10.1	6.6	0.627	0.808	0.183	0.183	0.038	0.038
9	70.00	16.3	9.8	5.2	0.572	0.886	0.123	0.123	0.026	0.026
10	90.00	15.8	8.5	3.6	0.491	1.009	-0.012	-0.012	-0.002	-0.002
11	95.00	16.0	8.6	4.8	0.479	0.937	0.094	0.094	0.018	0.018

Axial location, z, in.	Hub contour, r, in.	Casing contour, r, in.
-5.65	3.700	9.970
-4.65	3.700	↓
-3.65	3.760	↓
-2.65	3.940	↓
-1.73	4.220	↓
-.75	4.620	9.960
0	5.050	9.854
1.51	6.019	9.689
2.28	6.380	9.617
3.28	6.560	↓
4.15	6.570	↓
5.15	6.570	↓

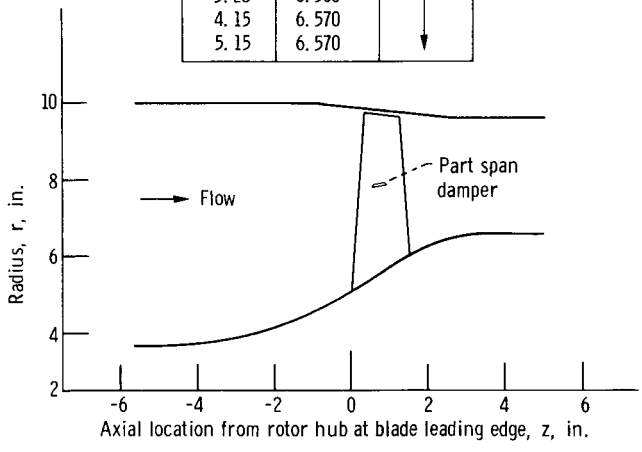
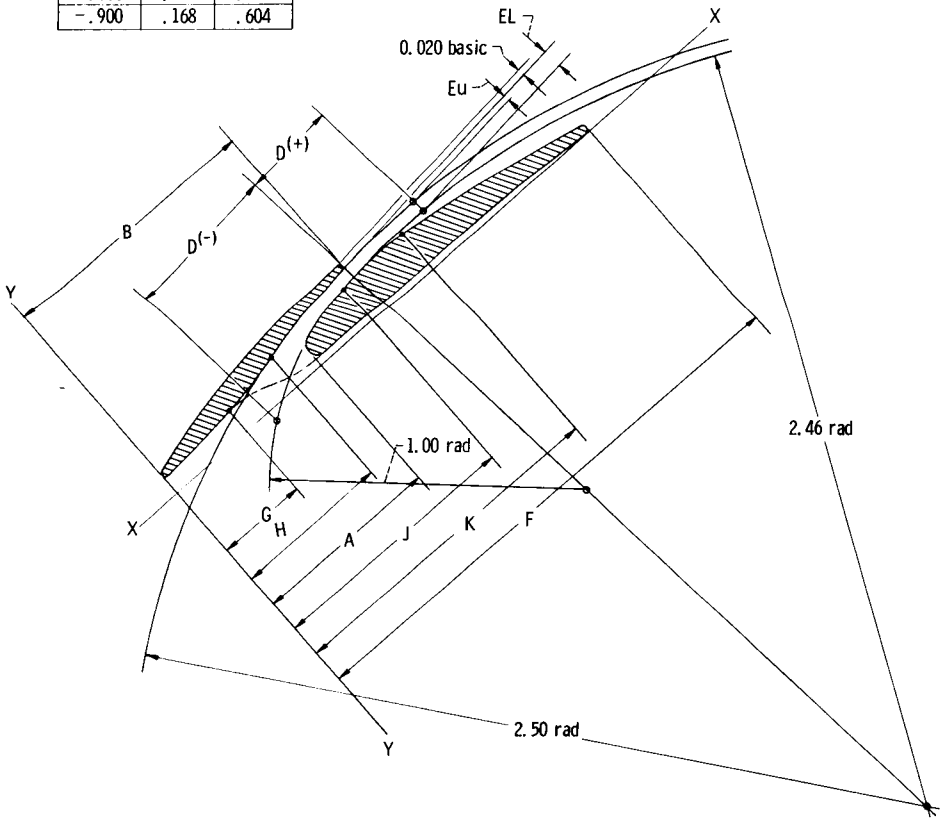


Figure 1. - Compressor flow path.

Slot coordinates (same at all radial positions)		
D	Eu	EL
+0.300	0.018	0.058
+ .200	.008	.049
+ .100	.002	.042
0	0	.040
−.100	.002	.045
−.200	.008	.060
−.300	.018	.086
−.400	.032	.124
−.500	.051	.154
−.600	.073	.240
−.700	.100	.326
−.800	.131	.440
−.900	.168	.604

Blade coordinates								
Section	A ±0.005	B ±0.002	C Gage	F ±0.005	G ±0.010	H ±0.010	J ±0.010	K ±0.010
B-B	0.581	0.889	97°0'	1.712	0.110	0.416	0.740	1.100
C-C	.571	.882	94°53'	1.733	.125	.435	.808	1.101
D-D	.602	.878	96°02'	1.738	.200	.563	.808	1.073
E-E	.617	.875	95°41'	1.741	.221	.572	.783	1.065
F-F	.652	.882	96°02'	1.743	.322	.612	.827	1.126
G-G	.773	.984	95°34'	1.743	.400	.736	.938	1.252
H-H	.922	1.087	95°17'	1.745	.509	.852	1.029	1.349
J-J	-----	-----	-----	1.740	-----	-----	-----	-----



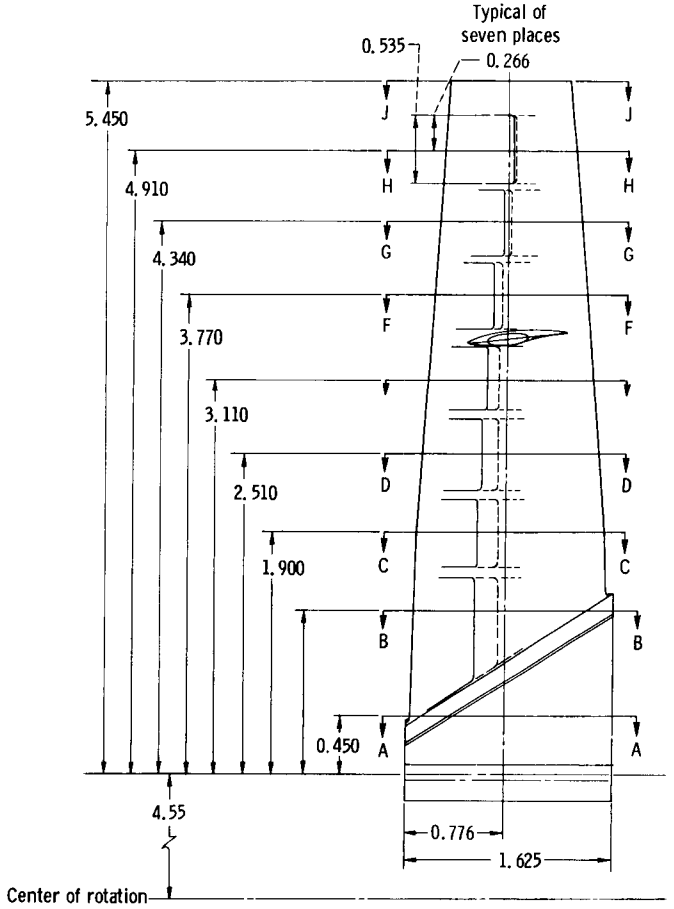


Figure 2. - Cross section geometry of tandem blade.

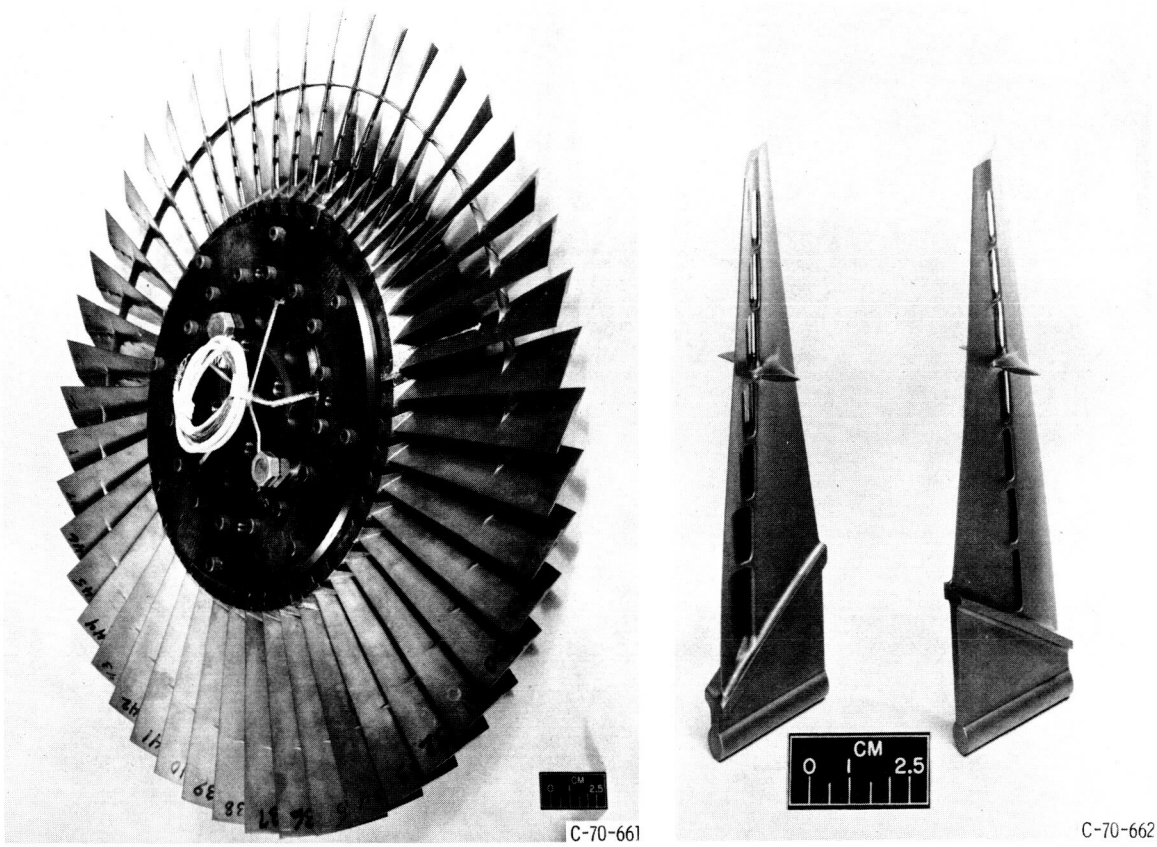


Figure 3. - Tandem bladed compressor rotor.

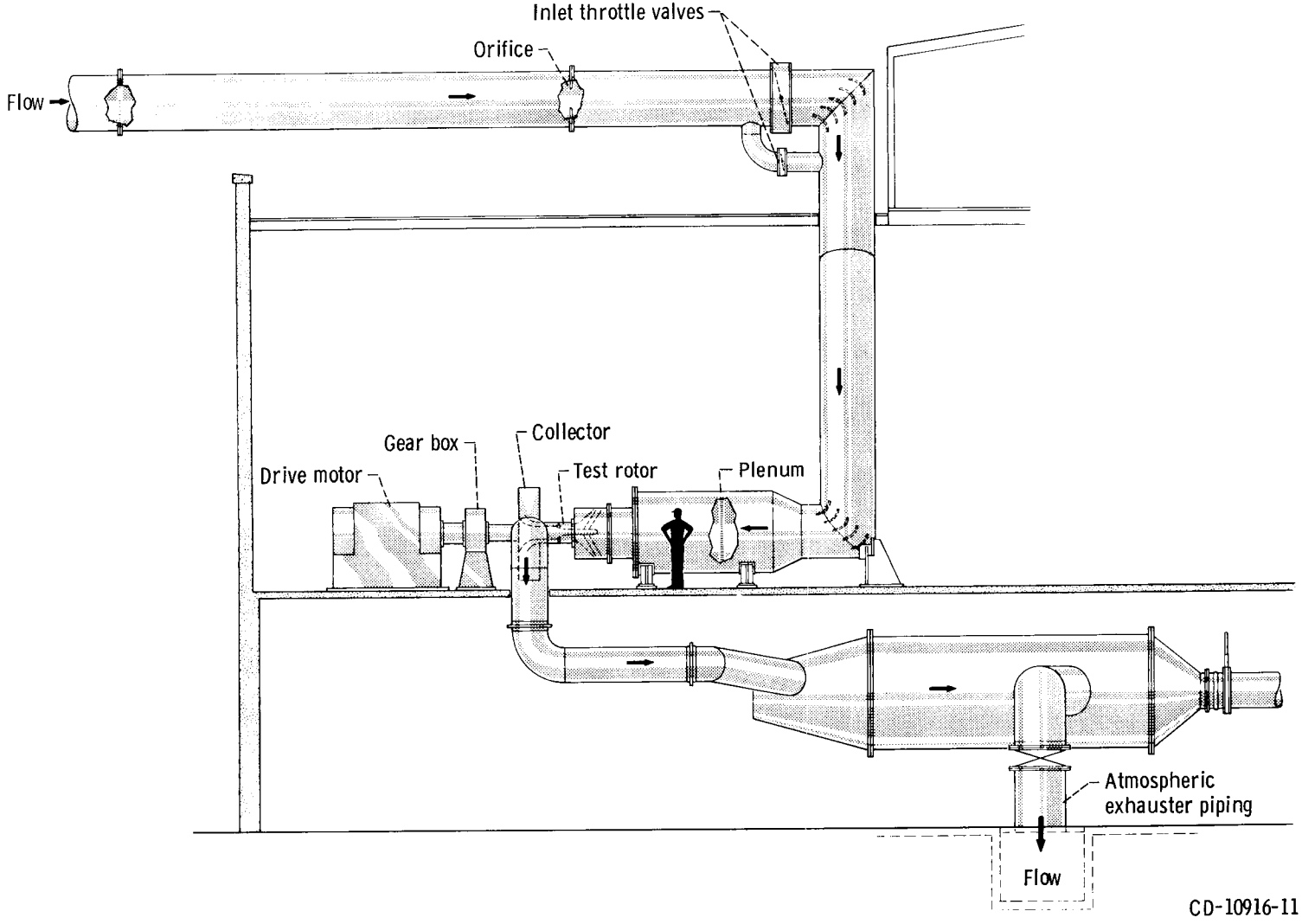
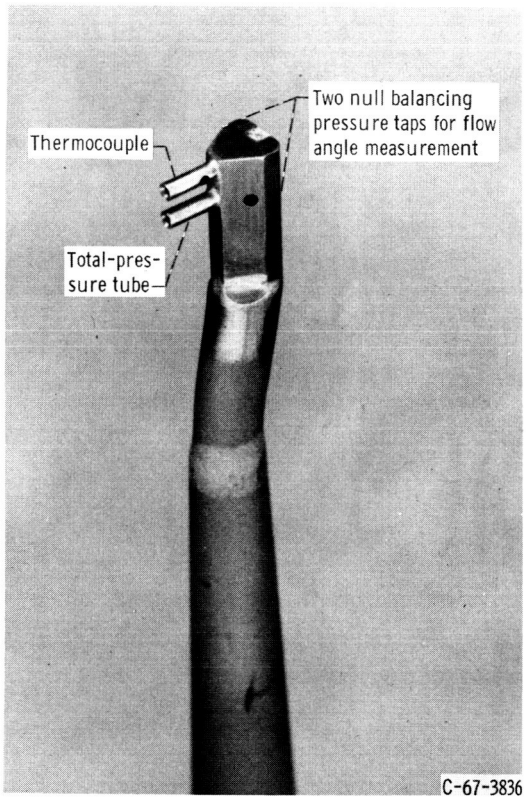


Figure 4. - Test facility.



(a) Combination total pressure, total temperature, and flow angle probe (double barrel probe).

(b) Static pressure probe ("C" type static probe).

Figure 5. - Survey probes.

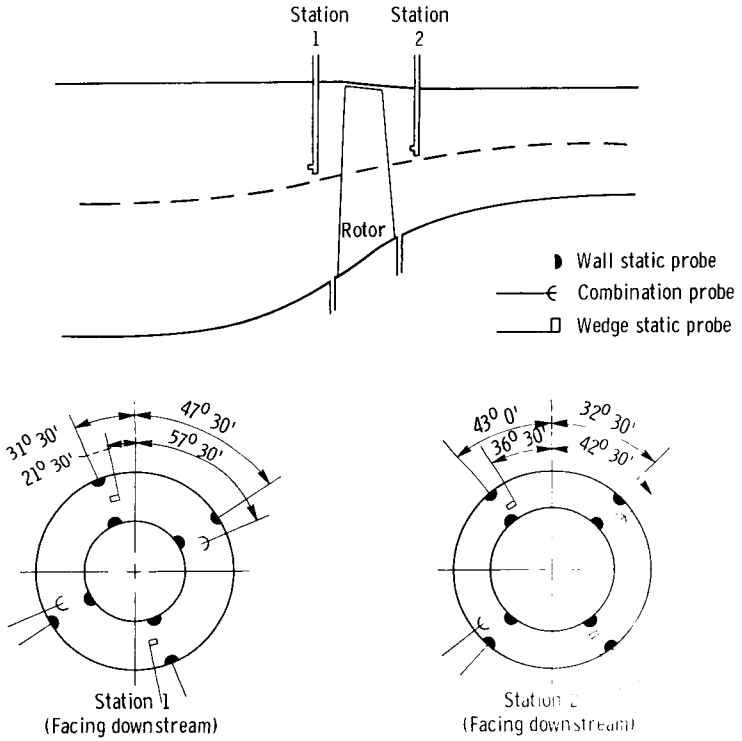


Figure 6. - Circumferential location of measurements.

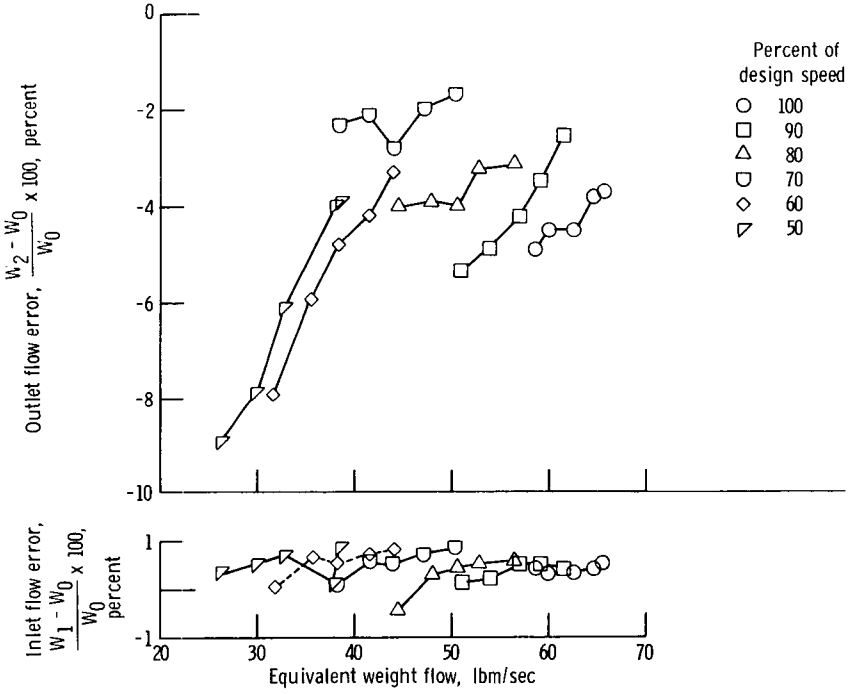


Figure 7. - Comparison of integrated flows at blade inlet and outlet with those measured by an orifice.

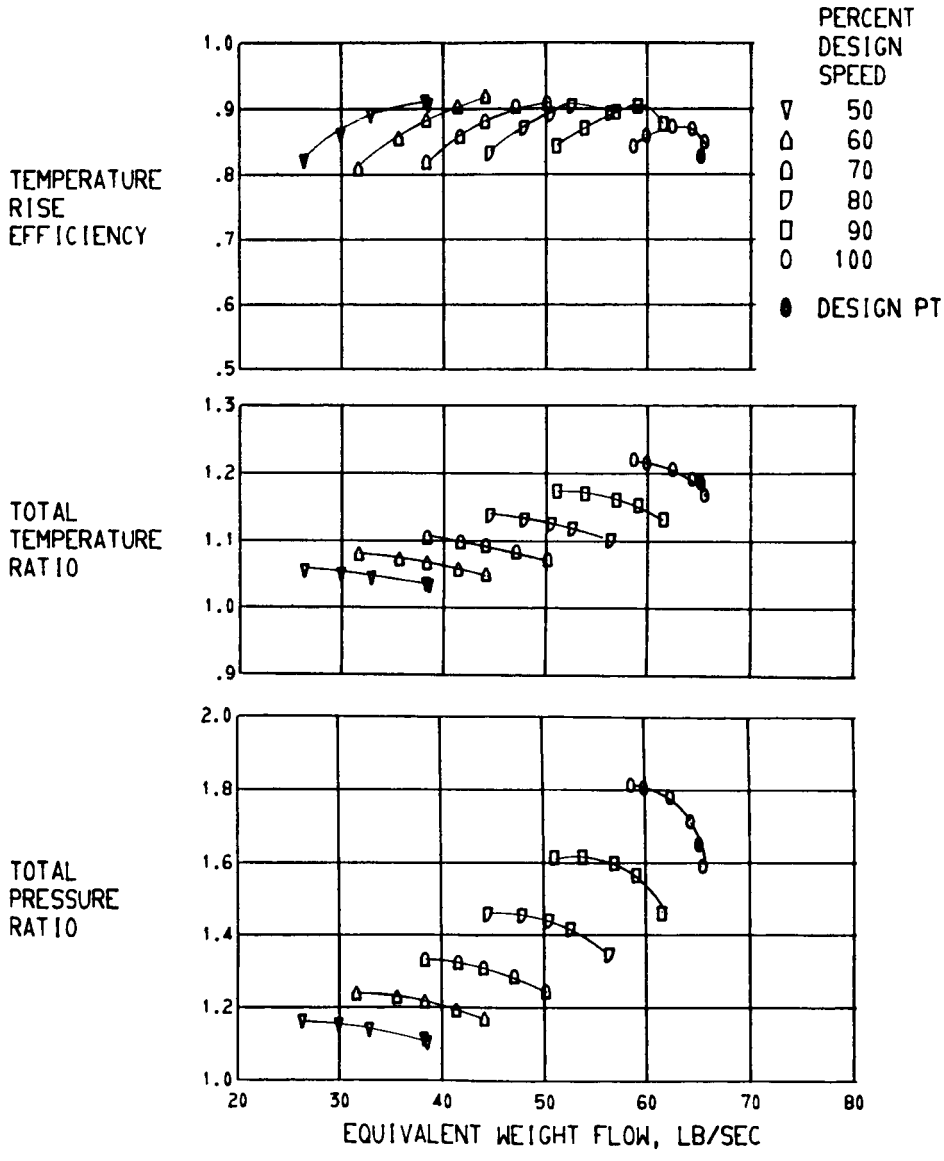


FIGURE 8 - OVERALL PERFORMANCE FOR ROTOR NO. 7

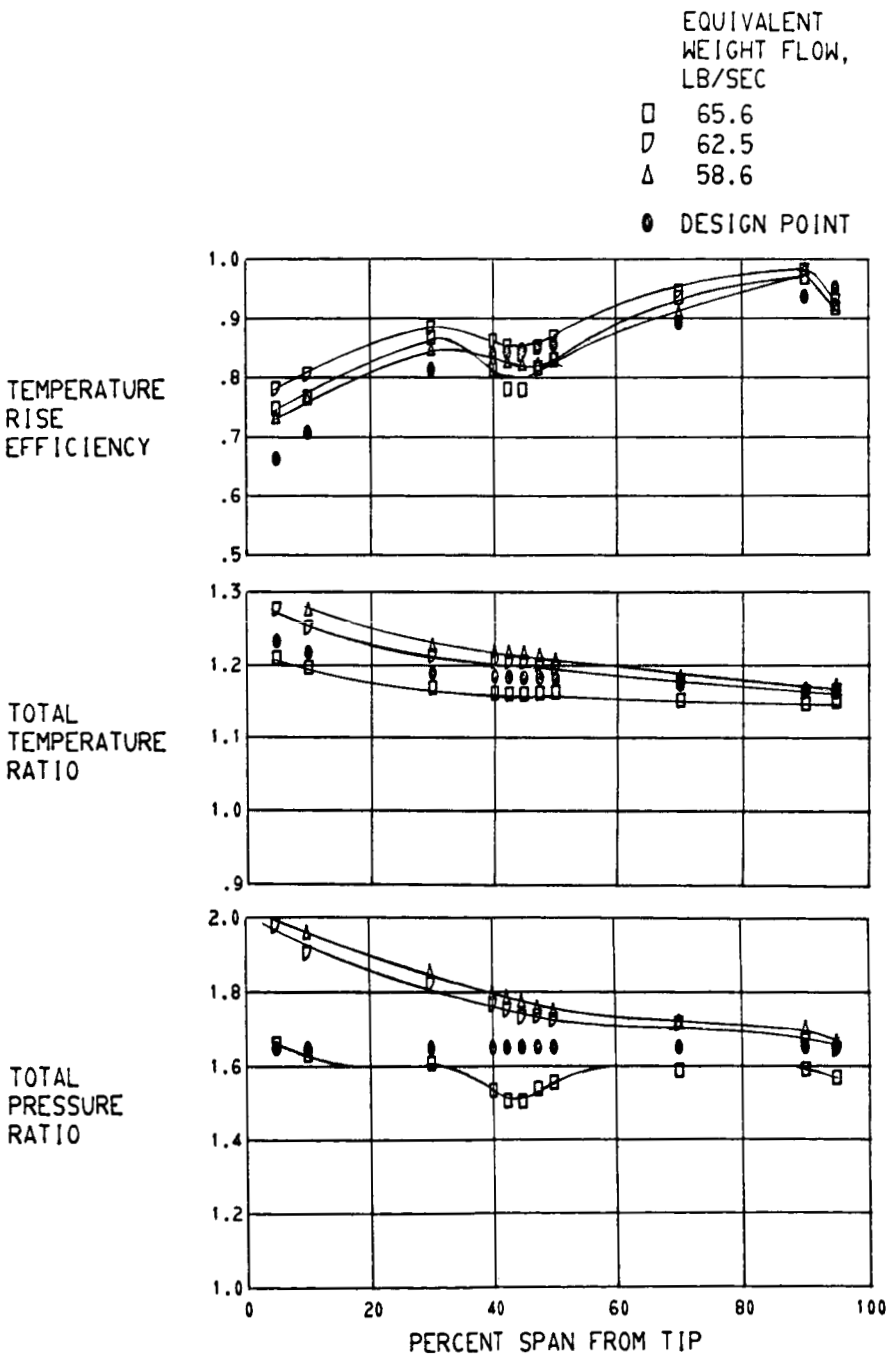


FIGURE 9 .-RADIAL DISTRIBUTION OF PERFORMANCE FOR ROTOR 7. 100 PERCENT DESIGN SPEED.

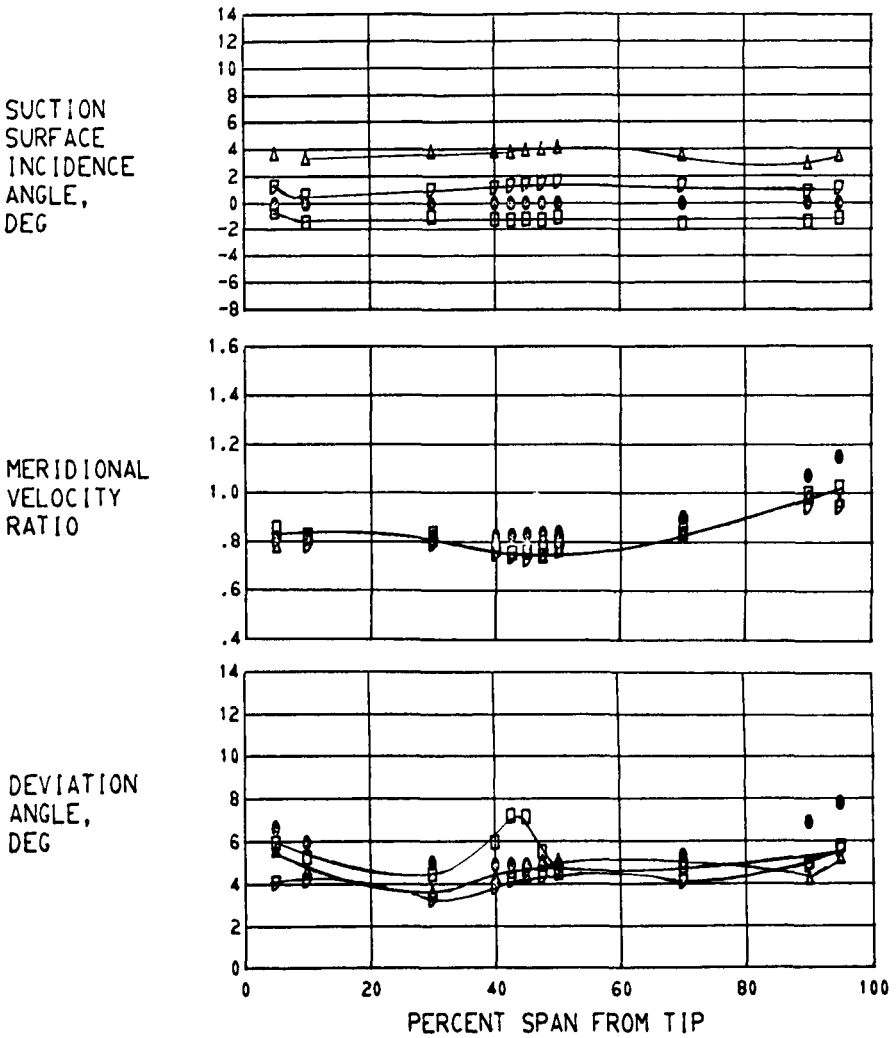


FIGURE 9 .-CONTINUED.

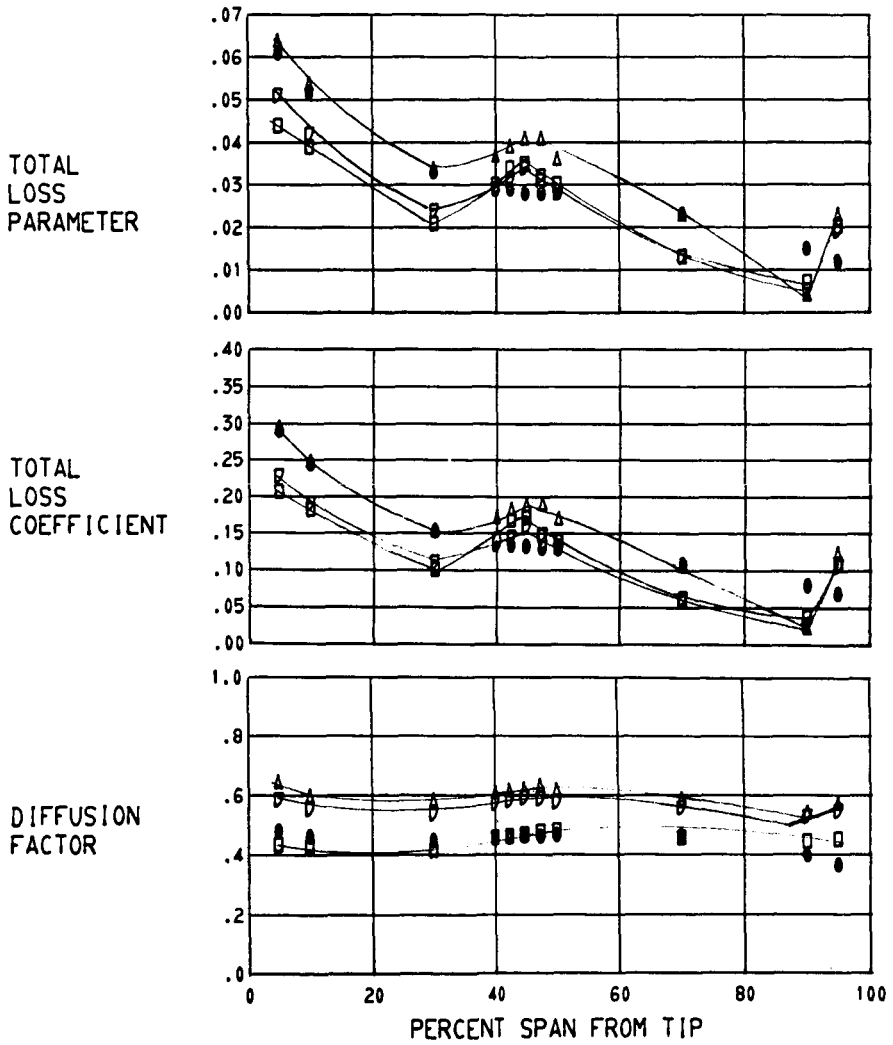
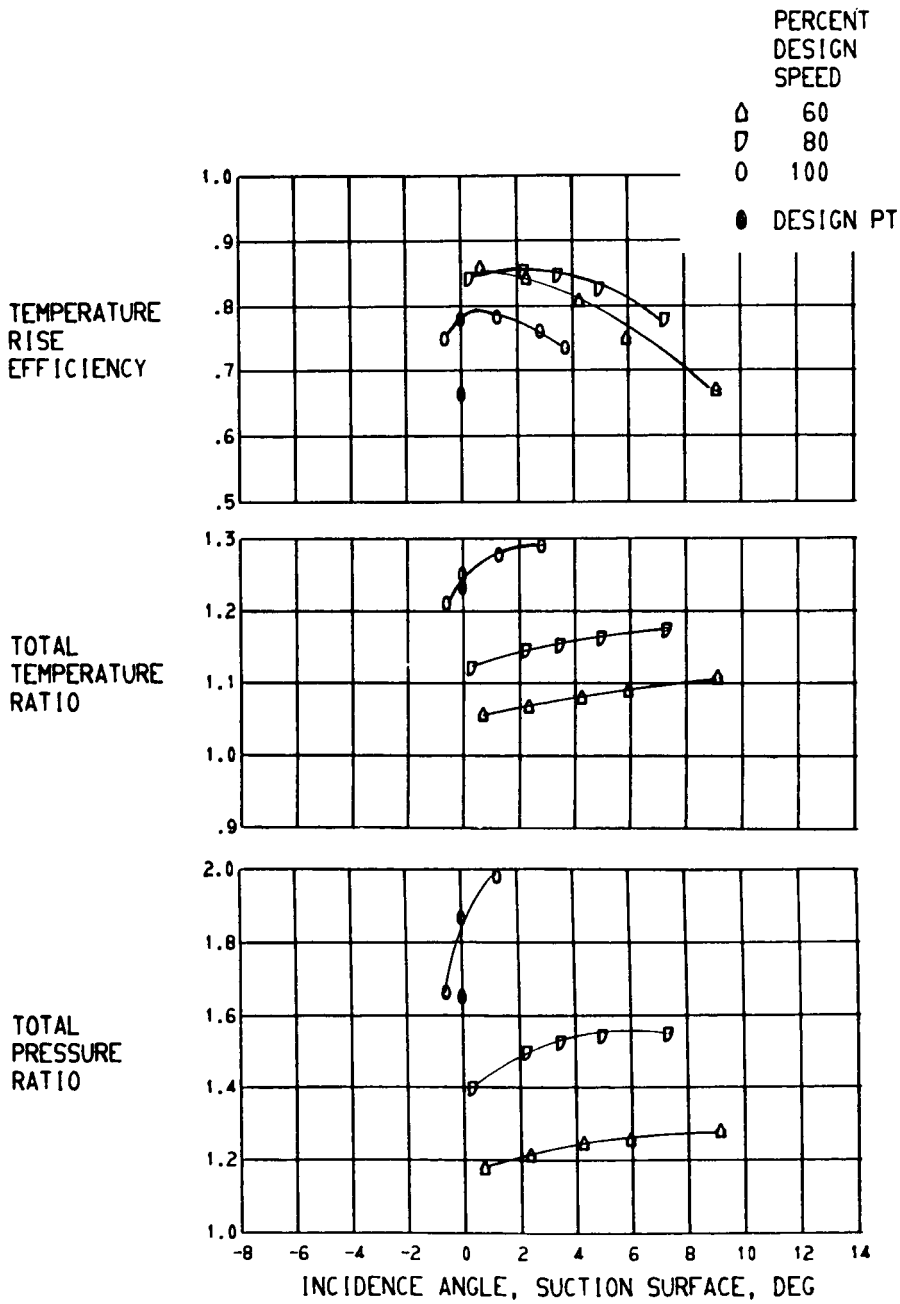
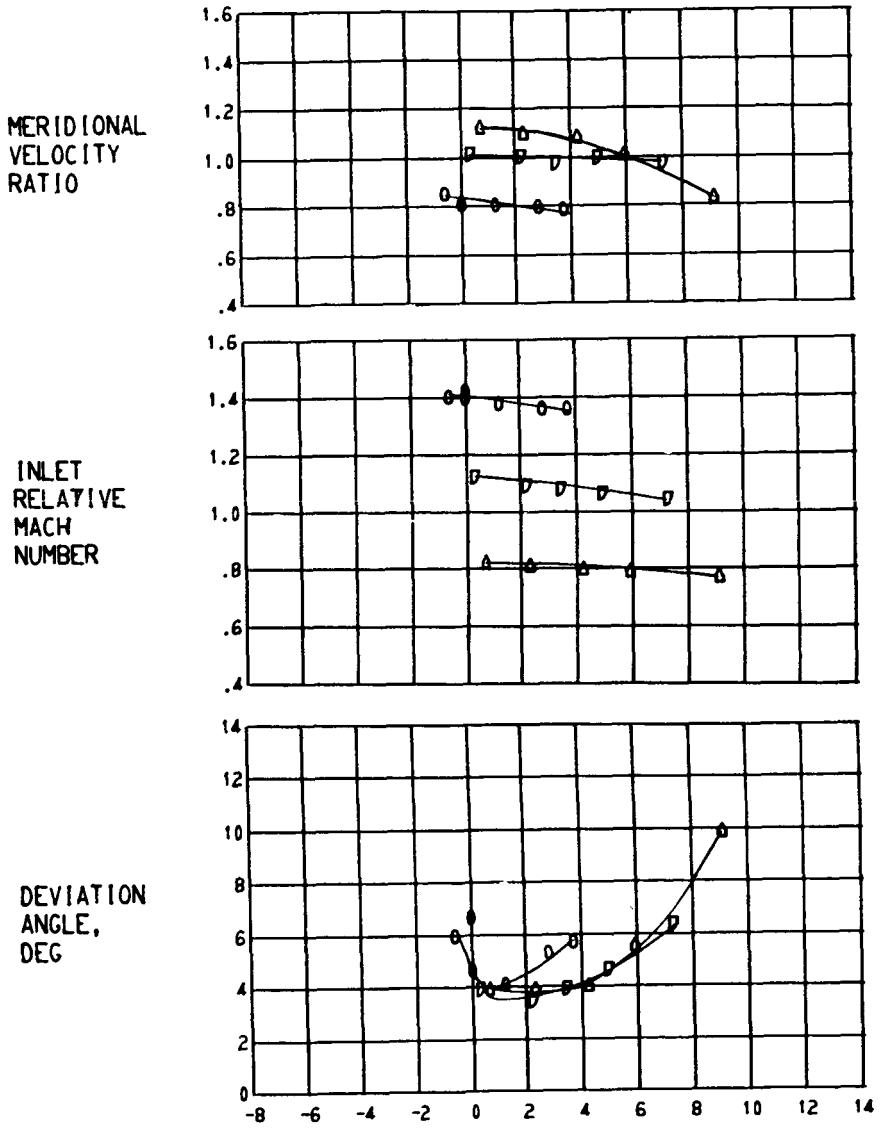


FIGURE 9 .-CONCLUDED.



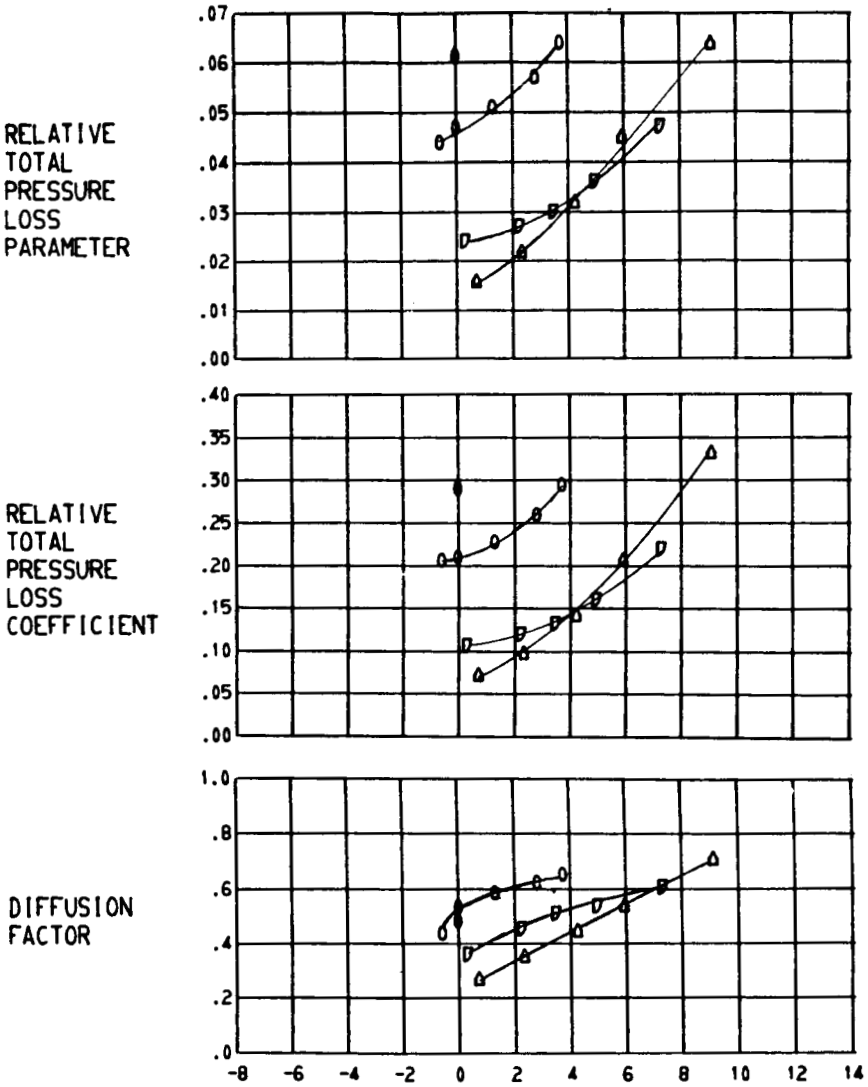
(A) 5.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



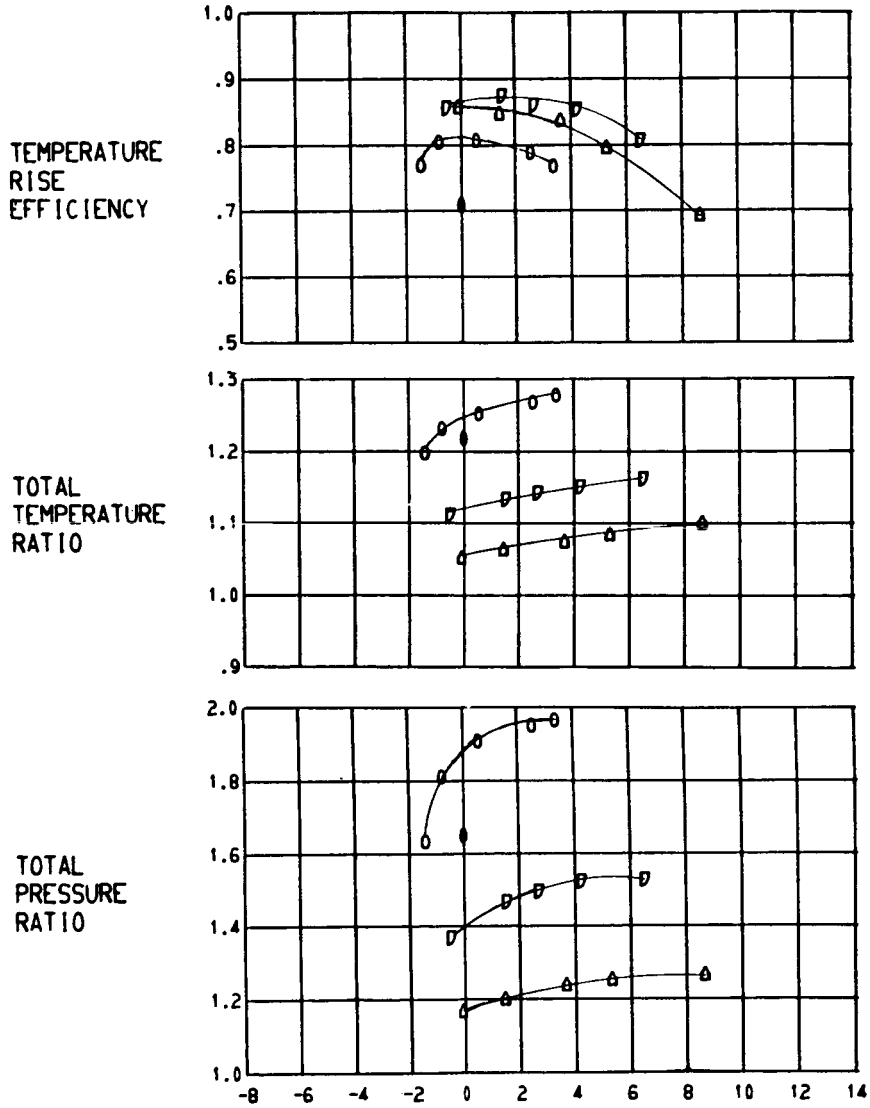
(A) CONTINUED. 5.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



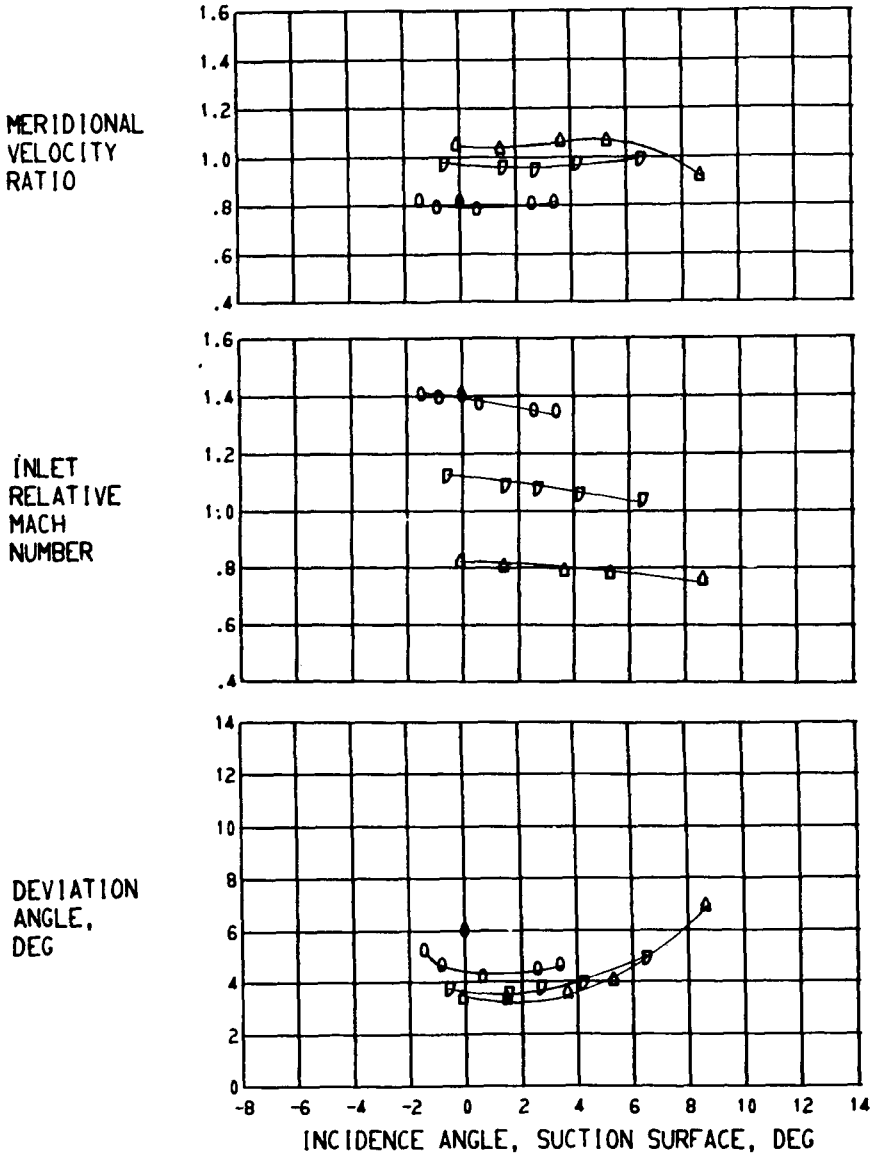
(A) CONCLUDED. 5.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



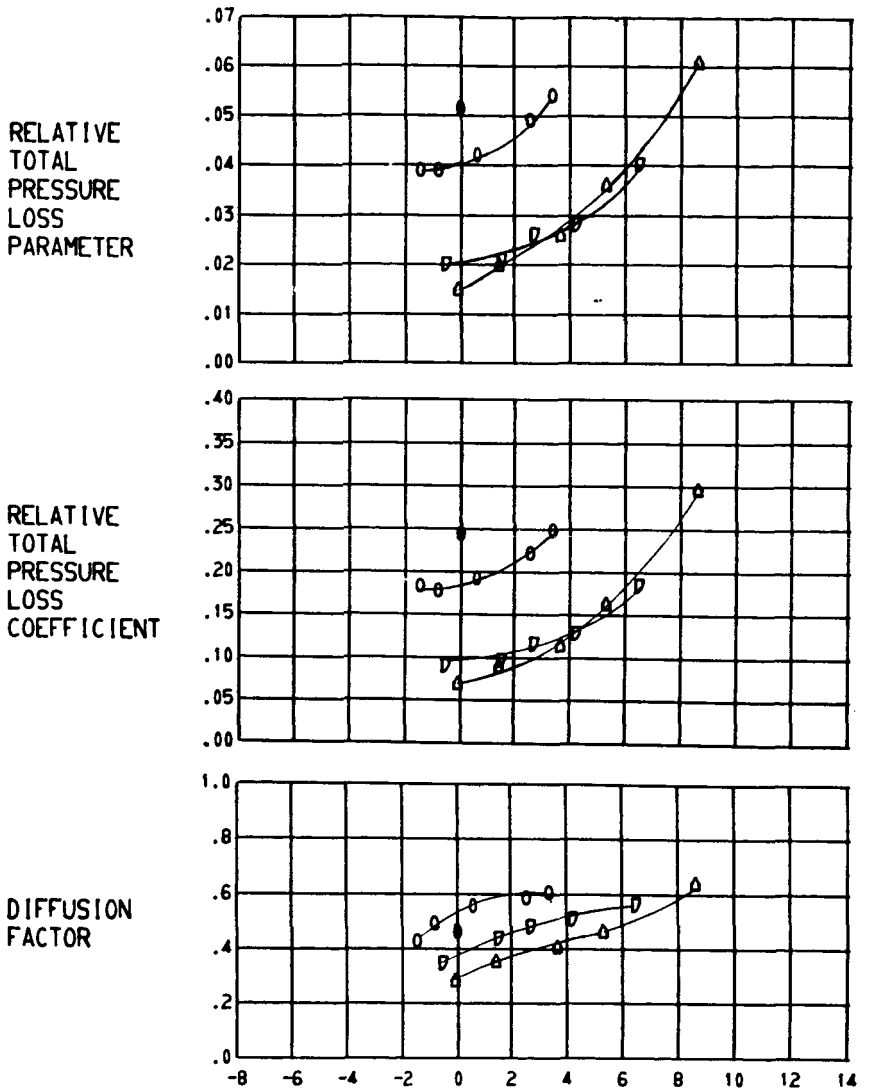
(B) 10.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



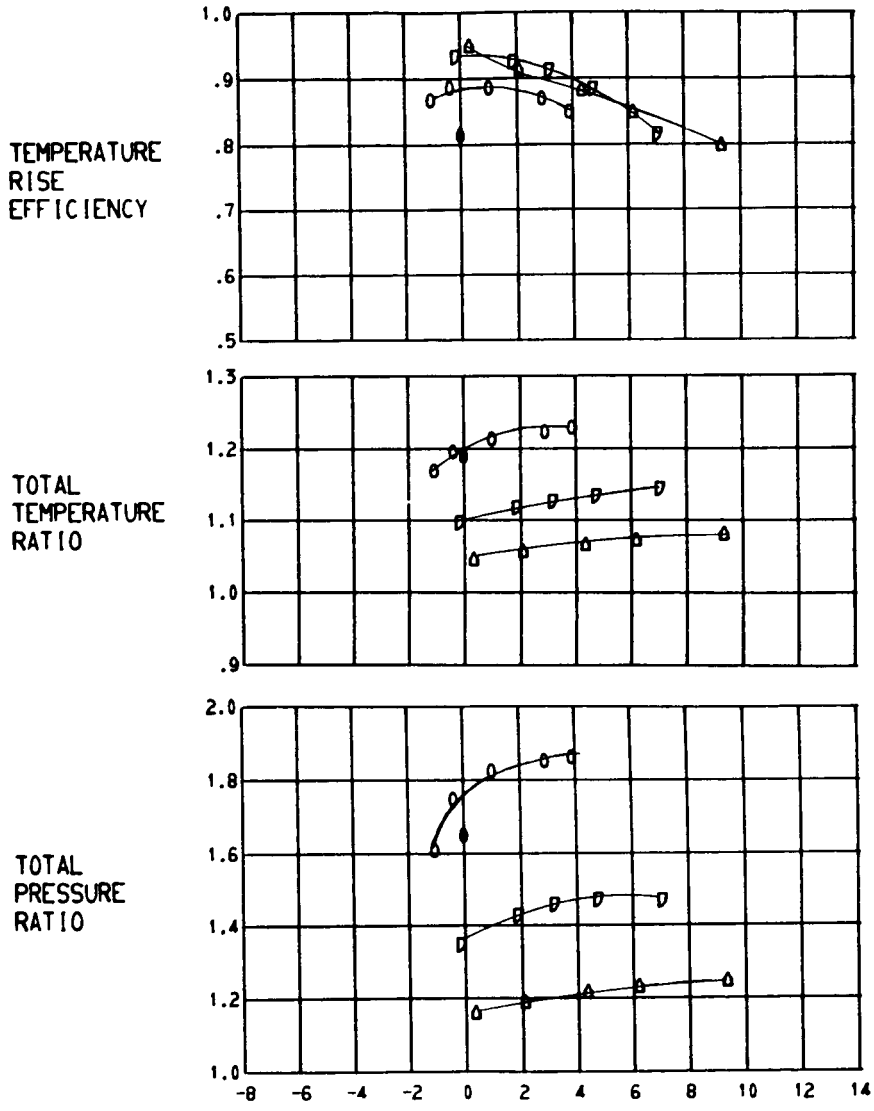
(B) CONTINUED. 10.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



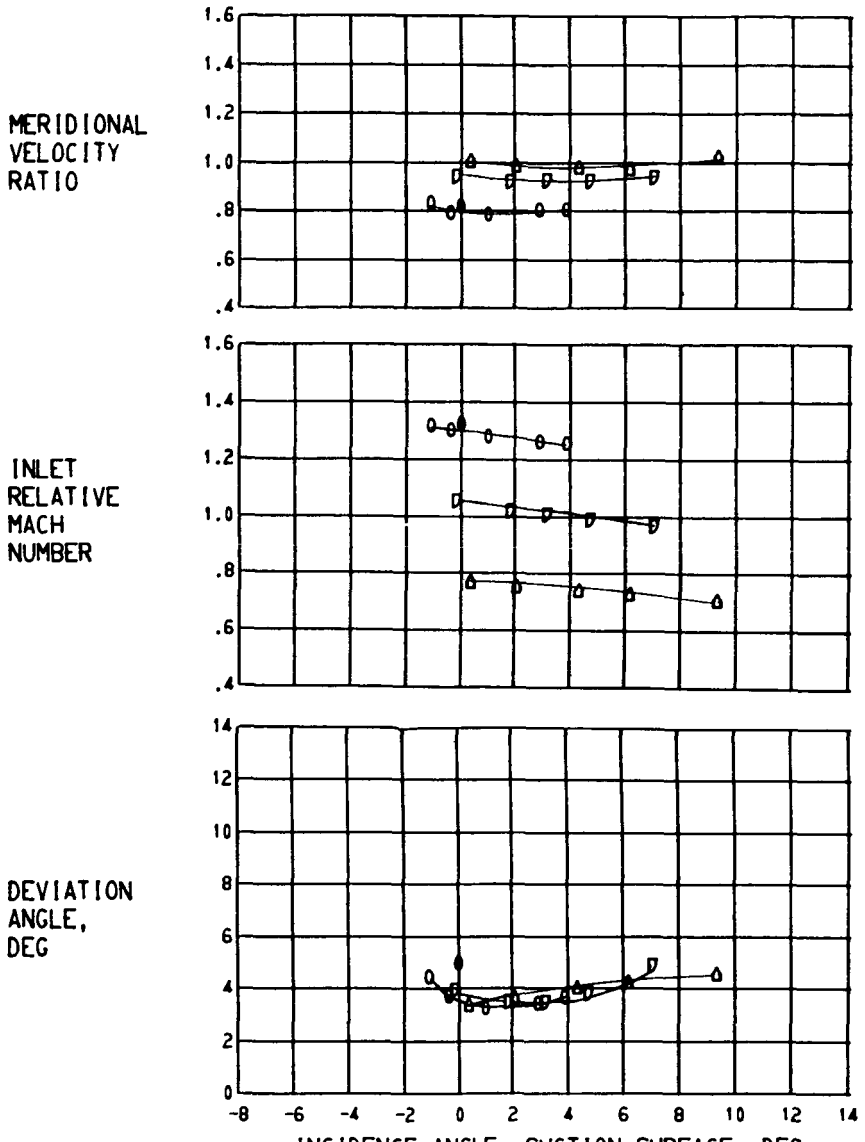
(B) CONCLUDED. 10.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



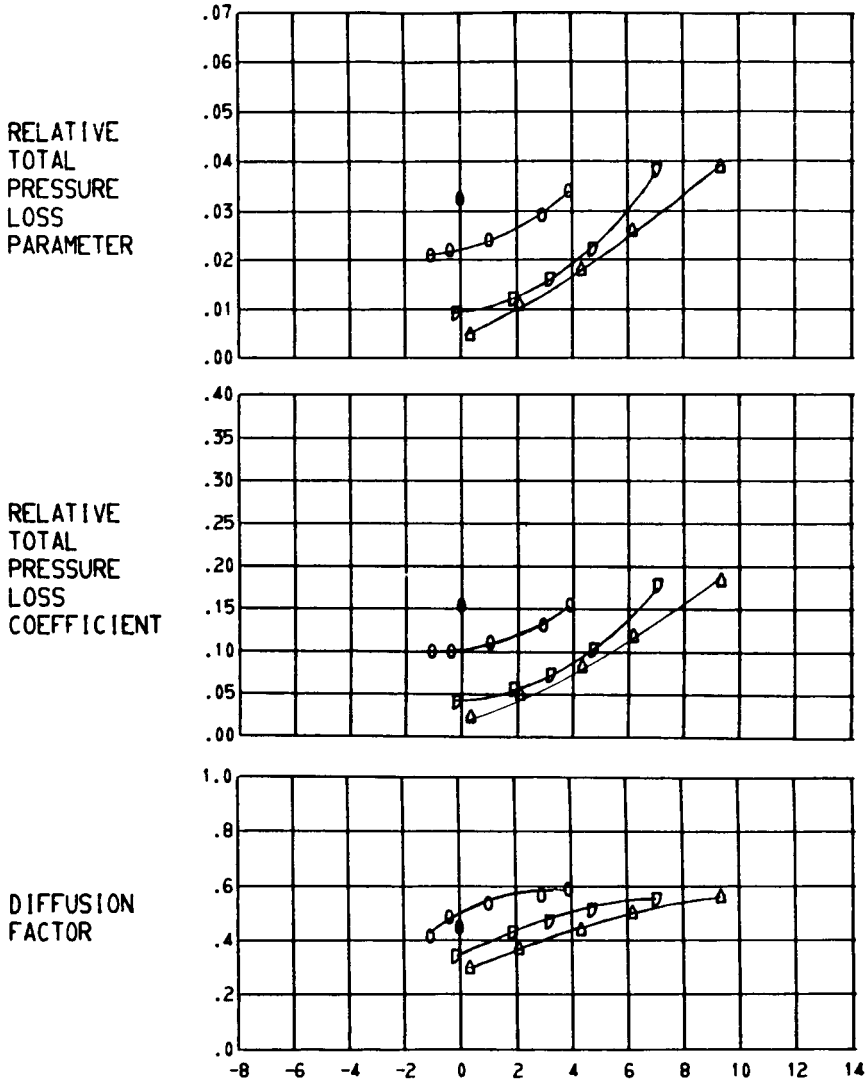
(C) 30.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



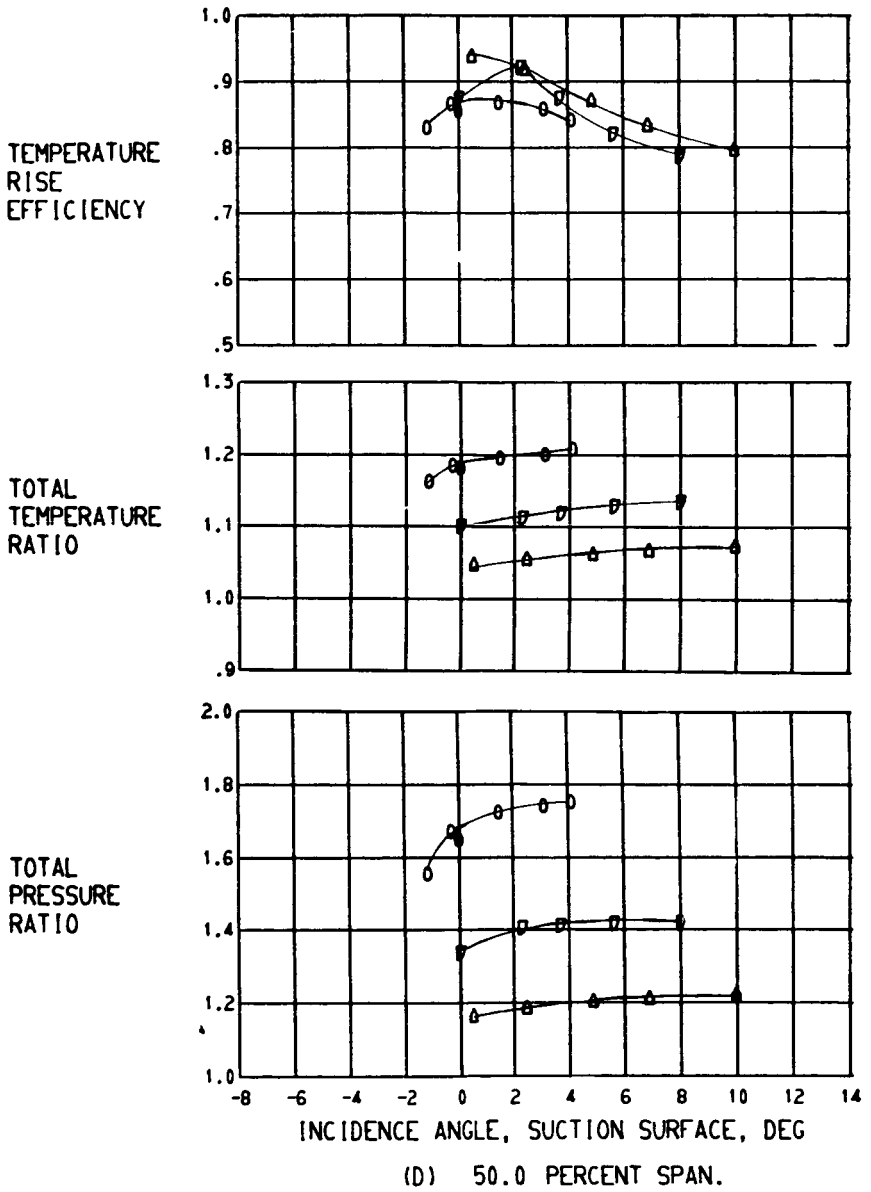
(C) CONTINUED. 30.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



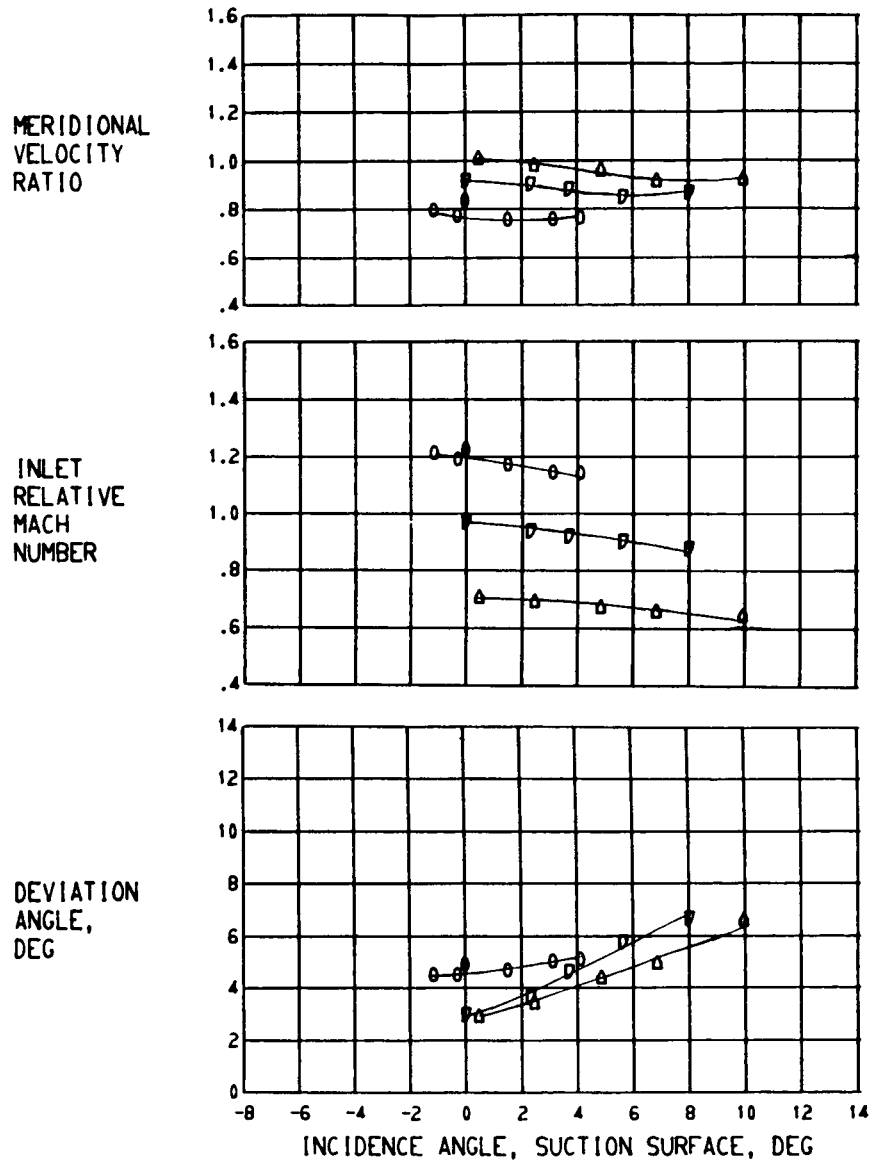
(C) CONCLUDED. 30.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



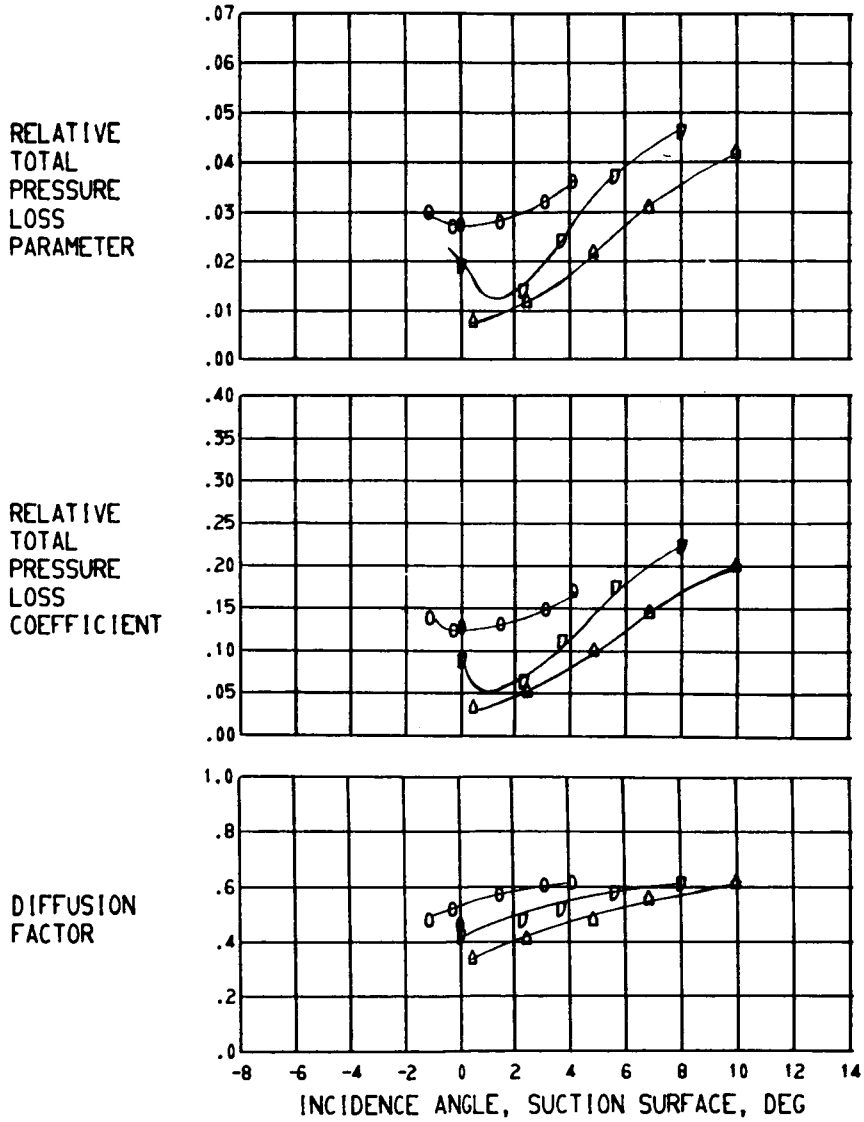
(D) 50.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



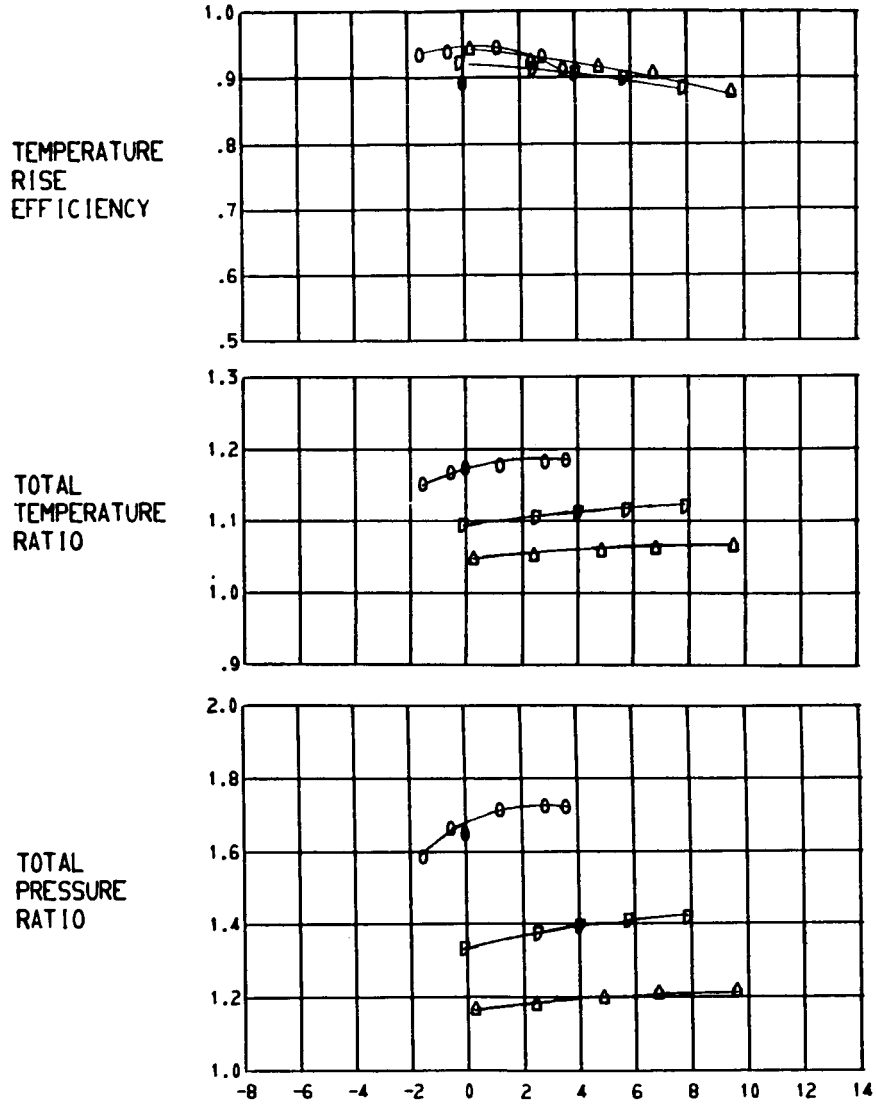
(D) CONTINUED. 50.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



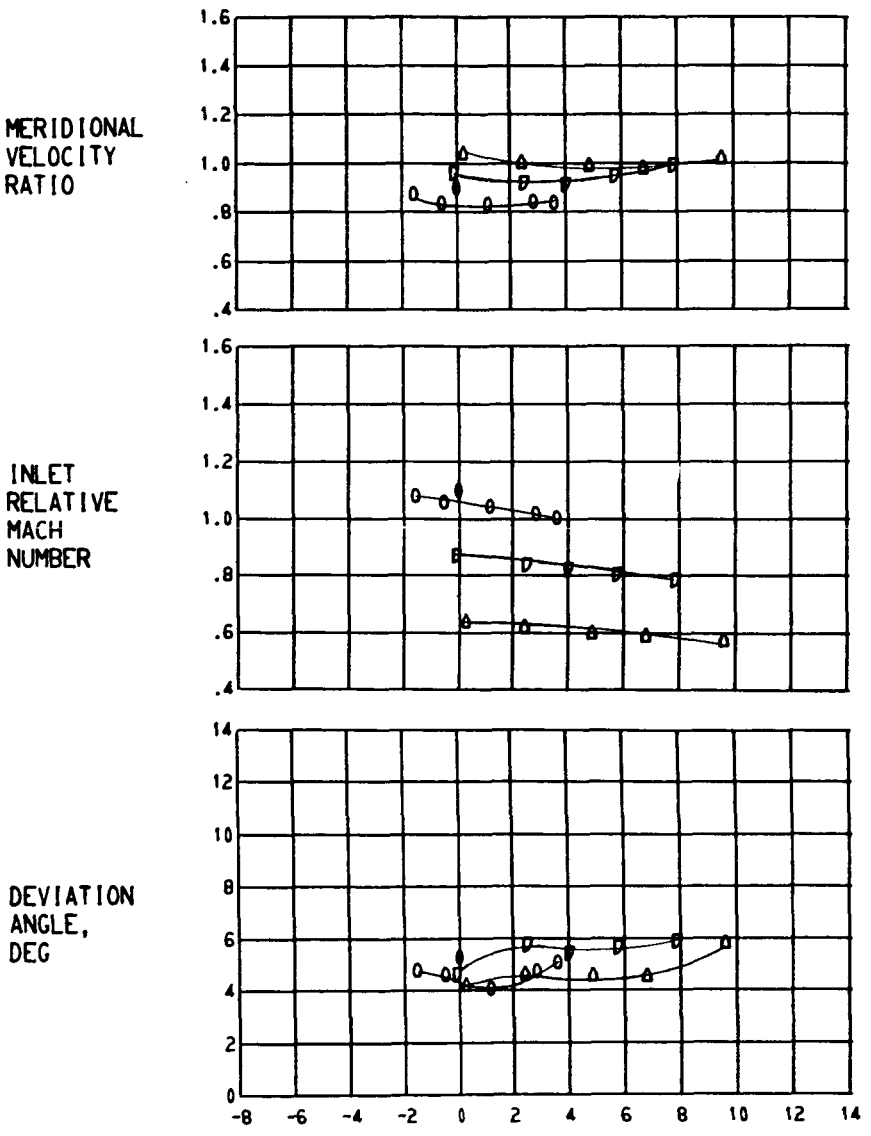
(D) CONCLUDED. 50.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



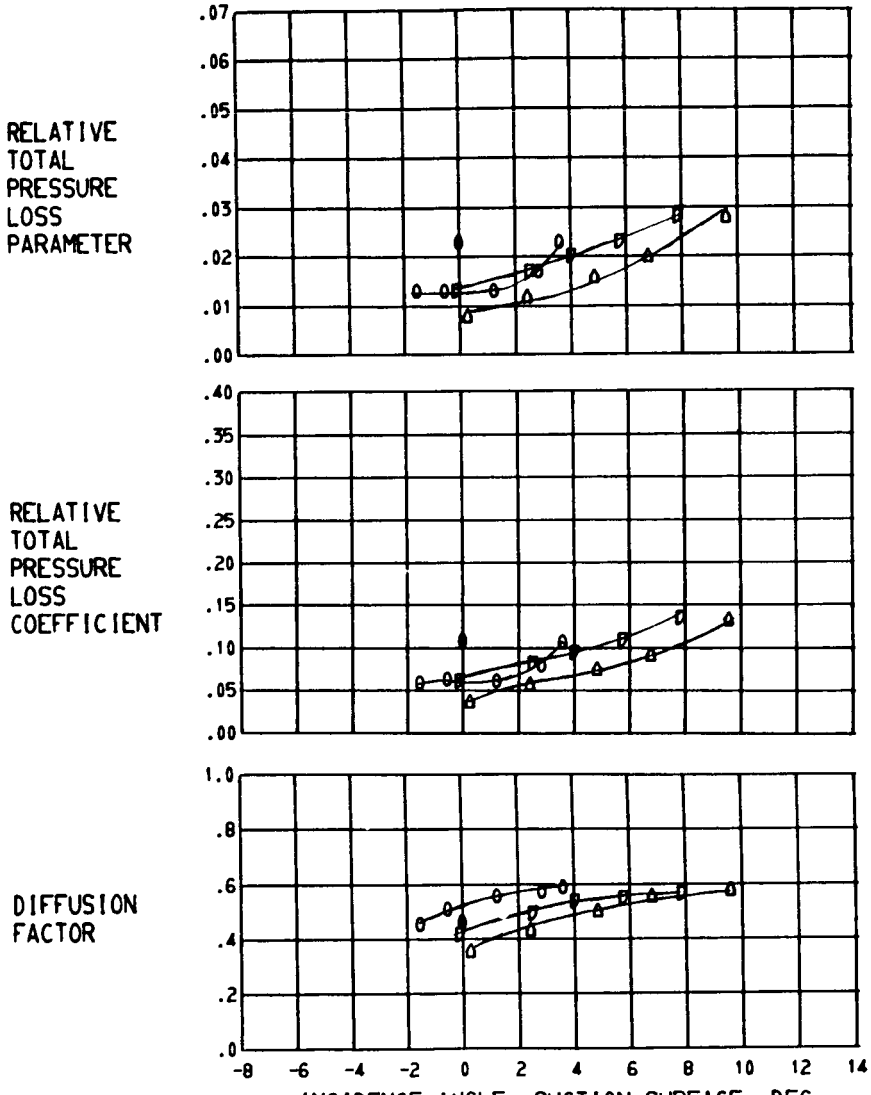
(E) 70.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



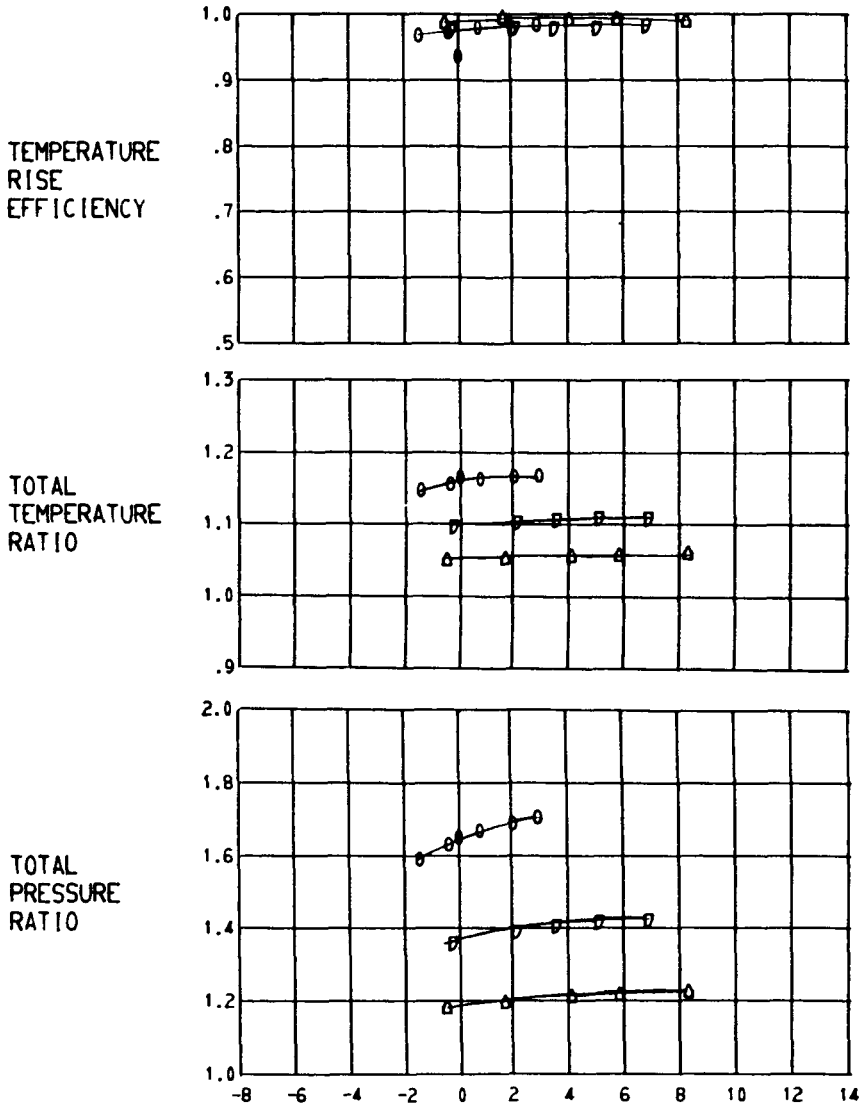
(E) CONTINUED. 70.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



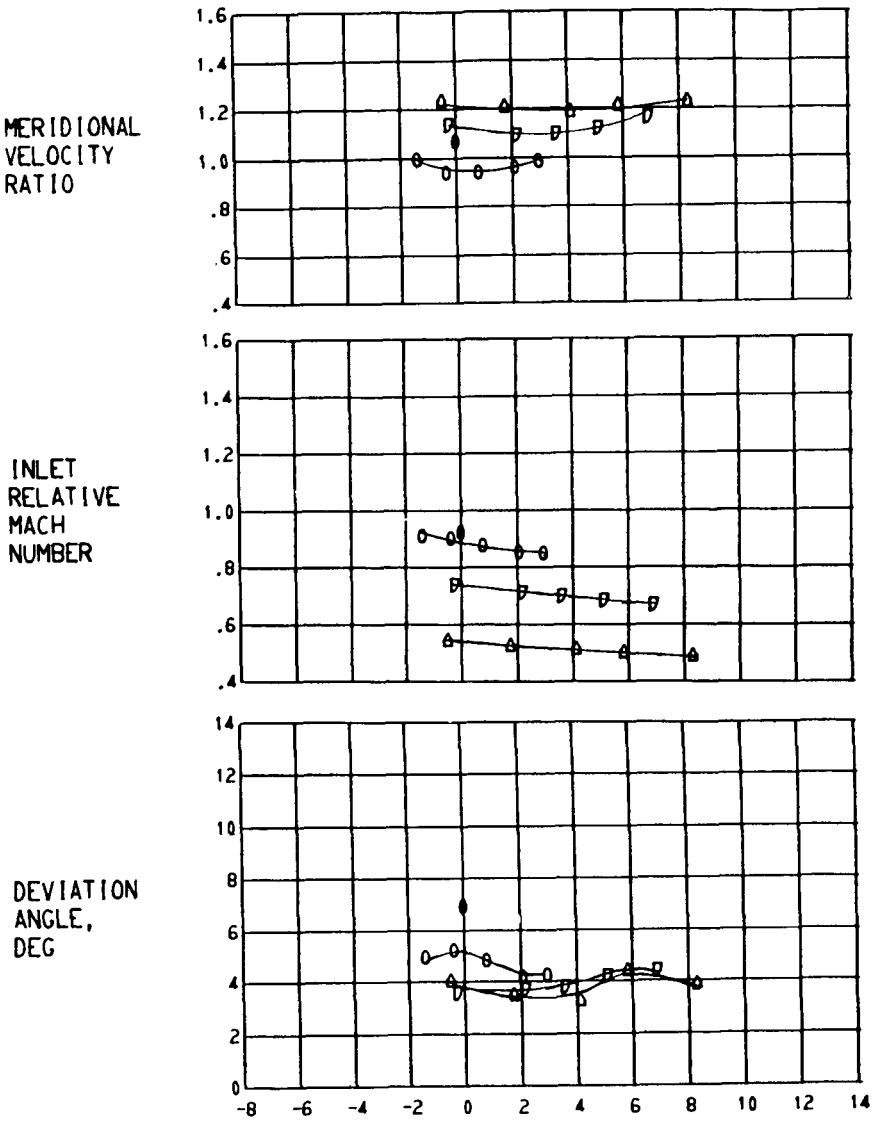
(E) CONCLUDED. 70.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



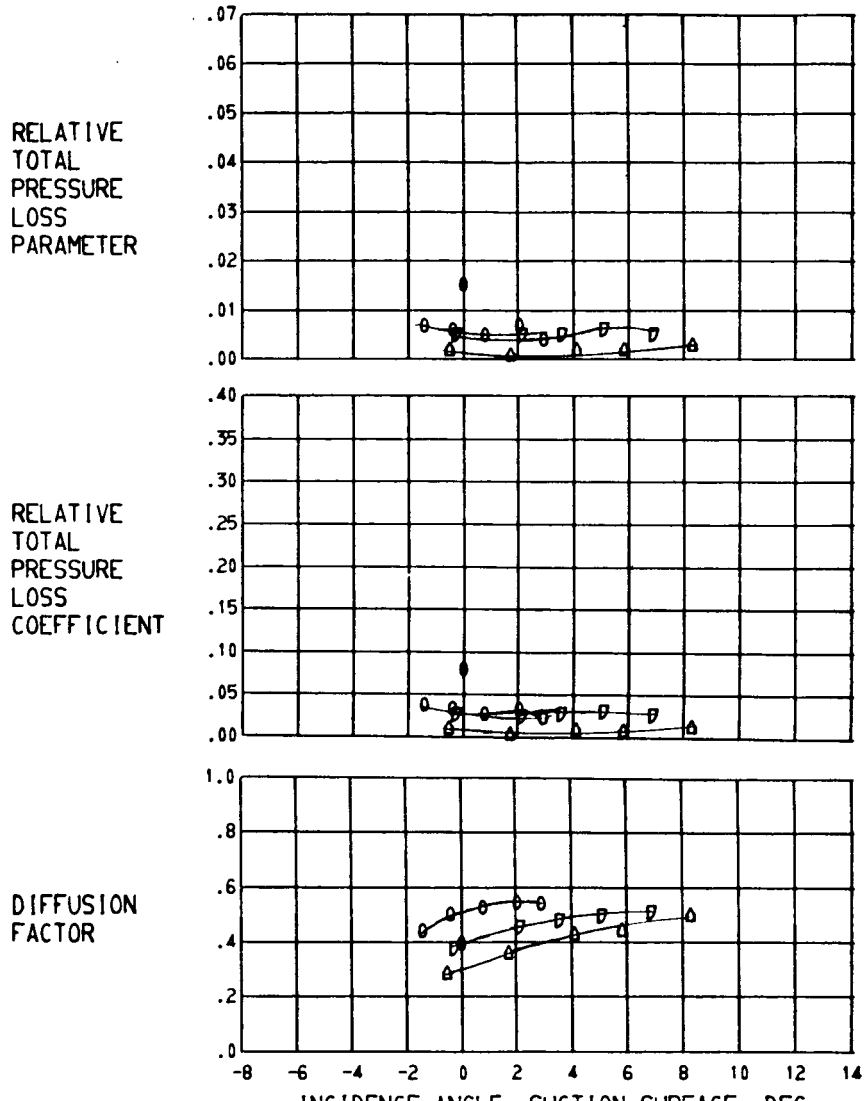
(F) 90.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



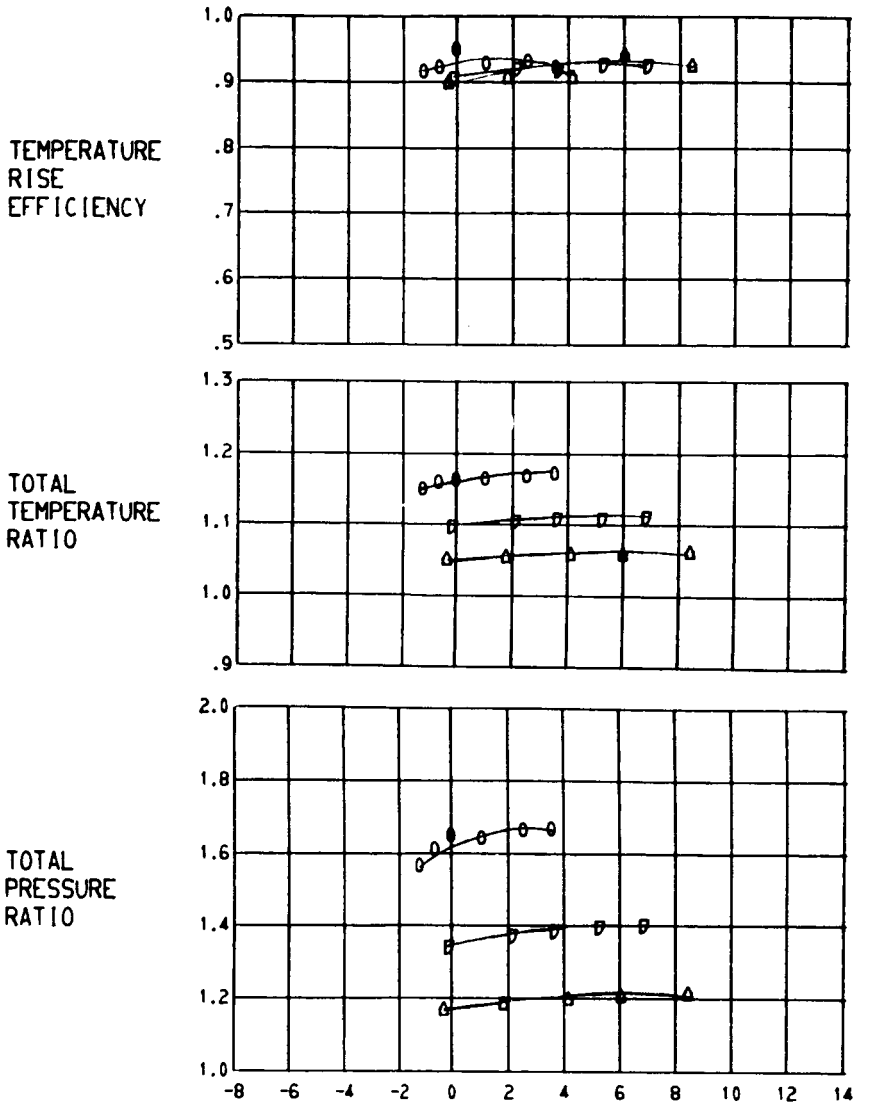
(F) CONTINUED. 90.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



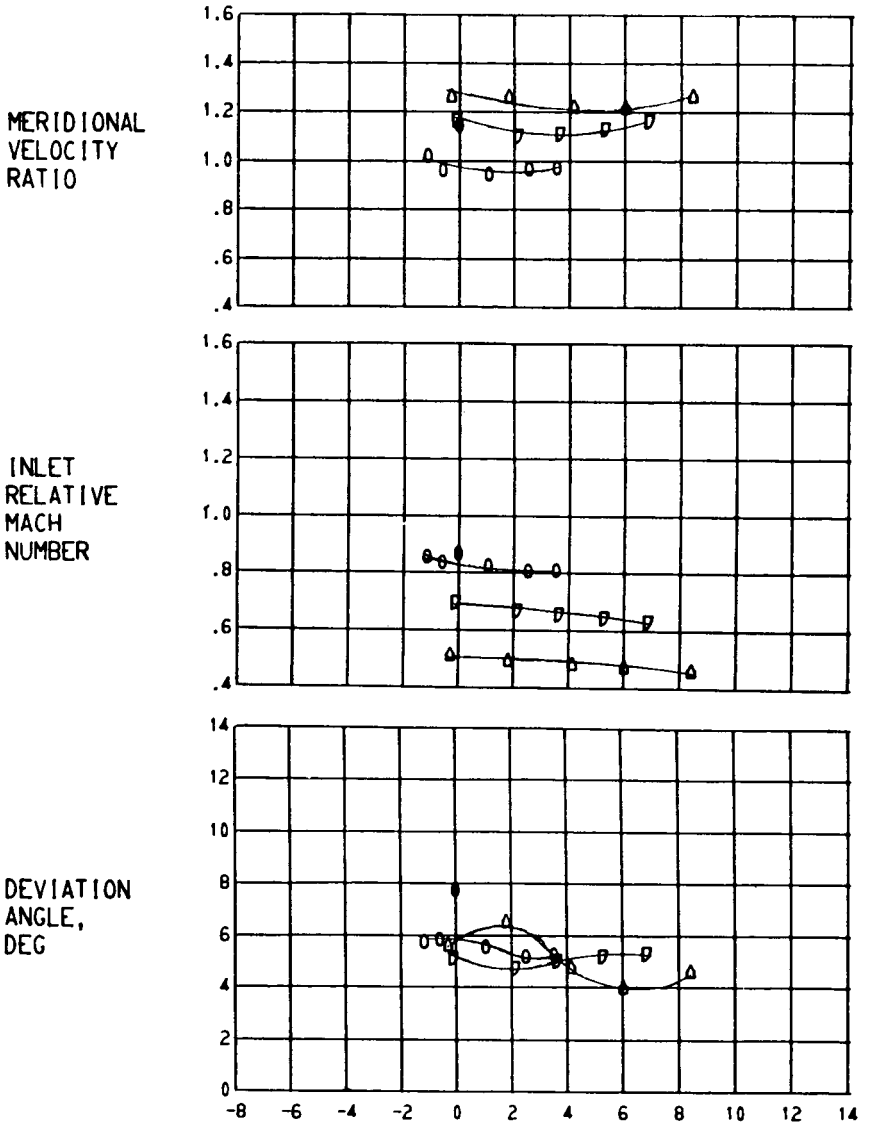
(F) CONCLUDED. 90.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



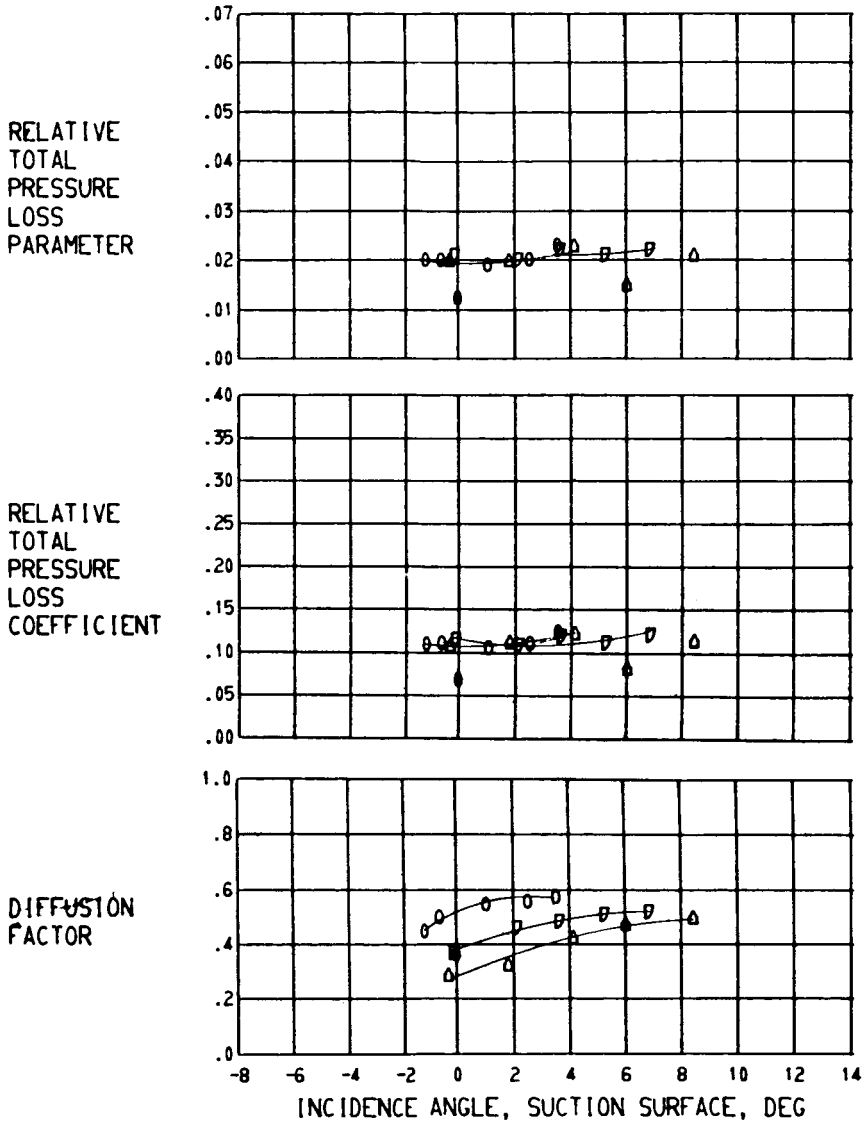
(G) 95.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



(G) CONTINUED. 95.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7



(G) CONCLUDED. 95.0 PERCENT SPAN.

FIGURE 10 - BLADE ELEMENT PERFORMANCE FOR ROTOR NO. 7

N72-18773

ERRATA

NASA Technical Memorandum X-2484

PERFORMANCE OF TANDEM-BLADED TRANSONIC COMPRESSOR ROTOR WITH TIP SPEED OF 1375 FEET PER SECOND

Donald C. Urasek and David C. Janetzke

March 1972

Page 4, first equation: The denominator on the right side should be $\sqrt{\sigma}$.

Issued April 1977