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USAAVLABS TECHNICAL REPORT 70-1B

HELICOPTER ROTOR ROTATIONAL NOISE PREDICTION AND CORRELATION

VOLUME II

DOCUMENTATION OF NOISE PREDICTION COMPUTER PROGRAM

By

Ronald G. Schlegel

William E. Bausch

FILE COPY

November 1970

U. S. ARMY AVIATION MATERIEL LABORATORIES
FORT EUSTIS, VIRGINIA

CONTRACT DA 44-177-AMC-448(T)
SIKORSKY AIRCRAFT
DIVISION OF UNITED AIRCRAFT CORPORATION
STRATFORD, CONNECTICUT

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This contract was initiated to acquire NH-3A/S-61F helicopter noise measurements simultaneously with low- and high-frequency aerodynamic rotor loads for the purpose of verifying the accuracy of a rotational noise prediction program. The program itself was modified from the previously assumed rectangular chordal airload distribution to the actual measured chordal airload distribution or to any arbitrary chordal distribution that the program user wished to assume.

Results of this contract demonstrate the importance of high-frequency airloads and the chordal airload distribution in rotational noise predictions. Although inconclusive regarding how many loading harmonics are necessary, findings do show that knowledge of the chordal airload distribution can compensate for a lack of high-frequency airload data.

There are a few available analytical solutions to helicopter rotational noise in addition to that reported herein. These analyses vary in rigor of approach, degree of difficulty of usage, and quantity of input data required, but all appear to be uniformly accurate for the first three or four harmonics of rotational noise under the few normal rotor operating conditions examined.

A program is currently under way to: (1) simultaneously acquire noise and rotor airloads data for "slapping" and "nonslapping" flight conditions of a CH-53A helicopter and (2) correlate these data with noise and airloads prediction methods. The acoustic analyses presented herein will be modified and used in an attempt to predict the occurrence of impulsive rotor noise.

Task 1F162203A14801
Contract DA 44-177-AMC-448(T)
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November 1970

HELICOPTER ROTOR ROTATIONAL NOISE PREDICTION AND CORRELATION

Final Report

Volume II

DOCUMENTATION OF NOISE PREDICTION COMPUTER PROGRAM

By

Ronald G. Schlegel

William E. Bausch

Prepared by

Sikorsky Aircraft
Division of United Aircraft Corporation
Stratford Connecticut

For

U. S. ARMY AVIATION MATERIEL LABORATORIES
FORT EUSTIS, VIRGINIA

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ABSTRACT

A computer program for rotational noise prediction is documented in the following sections of this report. The program was developed as a part of a study to develop more accurate methods for predicting rotational noise levels under conditions of nonuniform inflow over the rotor disc.

The computer program will calculate the root-mean-square sound pressure level for up to the 10th harmonic of rotor noise at any field point in the near or far field outside of the rotor disc. Noise levels can be calculated either from a rectangular chordwise distribution of pressure or from the measured chordwise distribution. The equations for noise prediction using the arbitrary (measured) chordwise distribution are derived in Volume I of this report. Although this report concentrated on a helicopter rotor, the analytical results are applicable to propellers in general.

FOREWORD

A computer program for rotational noise prediction was written by Sikorsky Aircraft, Division of United Aircraft Corporation, as part of Contract DA 44-177-AMC-448(T), Task 1F162203A14801. USAAVLABS Project Engineer was Mr. Joseph H. McGarvey.

Acknowledgement is made to Mr. Gediminias Campe for his help in designing the computer program and in bringing it to operational status.

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INTRODUCTION

This report describes a computer program for calculating noise harmonic levels of rotor (or propeller) rotational noise at any point in the acoustic near or far field. In order to simplify the analysis, noise due to blade thickness and aerodynamic shears is not considered, and the rotor disc is assumed to be a flat circular plate perpendicular to the thrust of the rotor system.

The basic physics of the noise prediction analysis are straightforward. Acoustic dipoles (sources and sinks) are the mathematical models used to describe the pressure variations caused by a rotor blade passing over any given point in the rotor disc. By applying an acoustic wave equation, the pressure variations at this point in the disc are transformed to a rotational noise component at a particular field point or observer location. In order to calculate the net rotational noise for a given harmonic and field point, the contributions of many points in the rotor disc are added (vector addition with magnitude and phase) to produce the root-mean-square sound pressure level (SPL) in decibels (dB).

The form of the pressure pulse seen by a point in the rotor disc is important in determining how much noise will be generated. The noise prediction program is designed to use a pulse of arbitrary form, namely the measured chordwise distribution of differential pressure on the section of rotor blade that passes over the point of interest in the rotor disc.

PROGRAMMER/USER INFORMATION

HARDWARE AND SOFTWARE REQUIREMENTS

The noise prediction computer program is written in FORTRAN V for a UNIVAC 1108 digital computing system. In order to manipulate all of the data generated by the program, direct-access storage devices are used. These devices should be UNIVAC FH-332 drums, each with a capacity of at least 90,000 words. Three drum units are called by the program.

PROGRAM DESCRIPTION

The following sections of this report describe the subroutines, structure, and running of the noise prediction computer program.

Subroutines

The name and function of each of the program subroutines are listed below. During normal operation, i.e.,all input data on punched cards, the subroutines dealing with magnetic tape will not be called by the main program

E676 Main program, calculates SPL based on the actual chordwise distribution of pressure.

BLODAT BLOCK DATA subroutine.

RDKU Reads in one record from the proper input tape, where two records make up one azimuthal pressure cycle.

UNPACK Unpacks an array containing tape information (two records) into separate arrays representing azimuthal pressure cycles for each pressure transducer channel.

INTERP Linearly interpolates pressure pulse harmonics up to 20 blade span stations and 288 azimuths.

CUE Calculates an array which is a function of azimuth and blade station. A double integration of this variable yields the sound pressure components Um and Vm.

INPUTA Reads and prints out card input.

MERGES Combines the absolute pressure of the instrumented top and bottom blade stations, to produce only differential pressures for all blade stations.

OUTSPL Output subroutine.

DFSRIE Computes the coefficients of a Fourier series.

AVQUAD Performs integration by averaged quadratics based on Lagrange interpolation.

E386RN Calculates SPL based on a rectangular chordwise distribution of pressure.

SIMCOR Simpson's Rule integration subroutine.

CURVIT Cubic interpolation subroutine.

PARAM Subroutine used by CURVIT.

CUBIC Subroutine used by CURVIT.

TRIDAG Subroutine used by CURVIT.

START Initializes the clock subroutine CLOCK.

CLOCK Calls the computer clock for the time.

Overlay Structure

In order to pack the data and processing instructions into the memory of the UNIVAC 1108, an overlay technique was used. The overlay map is given below. The small "b" indicates a blank space on the punched card.

```
bbMAPbE676,,OVER

bbbbbbbSEGbE676-(*E386RN,*ALPHA)

ALPHAbbSEGb*RDKU-*UNPACK-*INTERP-*CUE-*INPUTA-*MERGES-*OUTSPL-*DFSRIE

7/8bABSbOVER,AE676

7/8bXQTbCUR
```

Program Symbols

Both the definition of the alpha-numeric symbols and their proper input units are indicated below. These symbols are used in the programmed equations and in the sample input that are presented later in this report. During normal operation, only those symbols under CARD INPUT need to be included in the input data set.

TAPE INPUT	CARD INPUT	PROGRAM SYMBOL	UNITS	DESCRIPTION
XX	X	BB	in.	Blade thickness; floating point
XX	X	AA	in.	Blade chord; floating point
XX	X	BLADEL	in.	Length of blade (root to tip); floating point

TAPE INPUT	CARD INPUT	PROGRAM SYMBOL	UNITS	DESCRIPTION
XX	X	GAMA	deg/in.	Twist rate of main rotor blade; floating point
XX	X	RO	in.	Radial station with zero twist; floating point
XX	X	CC	in./sec	Speed of sound; floating point
XX	X	OMEG	rpm	Rotor rotational speed; floating point
XX	X	DPSI	deg	Delta azimuth angle=1.25° or a multiple of 2.5°. All calculations are done at this increment
XX	X	NBLADE		Number of main rotor blades; fixed point
XX	X	MLIMDP		Highest order of harmonic desired to represent all pressure cycles (=1 to 30); fixed point
XX	X	MLIMRN		Highest order of harmonic desired in the rotor noise calculations (=1 to 10); fixed point
XX	X	LSPAN		The number of radial stations as a result of interpolation (=10 or 20). This is an option
XX	X	IREELS		Total number of reels (up to 5)
XX	X	TCOP		=TAPE, data will be read from tape =CARD, data will be read from cards
XX	X	PUNCH		=YES (option to punch out pressure cycle coefficients)
XX	X	INTERM		Intermediate output to be used for checkout; =YES or = NO
XX	X	IDD		Debug printout option; = 0, do not print; =1, print
XX	X	E3860P		=YES, call rotor noise subroutine E386RN =NO, do not call E386RN

TAPE INPUT	CARD INPUT	PROGRAM SYMBOL	UNITS	DESCRIPTION
XX	X	OPRONO		Option to calculate SPL from actual chordwise loading =YES, perform rotor noise program =NO, go to subroutine E386RN
XX	X	NFT		Number of field points (up to 20); fixed point
XX	X	ANG	deg	Increment of integration used in E386 subroutine; floating point
XX	X	NHH		Number of Air Load harmonics for E386 program (up to 30); fixed point
XX	X	KEY1		=99, have intermediate output
XX	X	KEY2		from the E386 program
XX	X	KEY3		=00, no intermediate output
XX	X	CAPRF(I)	ft	Spherical coordinates of field
XX	X	THETAF(I)	deg	point I, used in subroutine
XX	X	ALFAF(I)	deg	E386RN; floating point
XX	X	XFP(I)	in.	Coordinates of field point I,
XX	X	YFP(I)	in.	origin being at center of
XX	X	ZFP(I)	in.	rotor disc (I=variable= 1 to 20); floating point
XX	X	IBURST		Burst number being processed, identifies data on telemetry tape
	X	BO	deg	Collective pitch angle; floating point
	X	BIC	deg	Longitudinal cyclic pitch; floating point
	X	BIS	deg	Lateral cyclic pitch; floating point
	X	IN		Spanwise station number, fixed point
	X	JN		Chordwise station number, fixed point
	X	CN(I,JN,IN)	psi	Fourier coefficients of differential
	X	SN(I,JN,IN)	psi	pressure where: I = harmonic, JN= chord, IN= span

TAPE INPUT	CARD INPUT	PROGRAM SYMBOL	UNITS	DESCRIPTION
XX		SLOPE(I,K)	psi / full scale	Conversion factors used to get the tape data into engineering units for each tape parameter. I = channel number, K = reel number
XX		OFFSET(I,K)	psi / full scale	
XX		KUNIT(I)		Tape drive units on which to mount tape reels
XX		IREEL		Input tape reel number
XX		NC		Channel number
XX		NTBDX(I,J)		Designates top or bottom pressure gage I = IREEL, J = NC
XX		NSTATC(I,J)		Relative chordal position of pressure gage from leading edge (=1,2,3,4,5). I=IREEL, J = NC
XX		NSTATR(I,J)		Relative radial station measured from root of blade (=1,2,3,4,5) I = IREEL, J = NC
XX		NCEND		Input control word. When NCEND is not blank, card specifying reel number follows
XX		ISET(I)		Set number for reel IREEL
XX		FROC(K)		Filter roll-off correction curve, where K represents the order of the loading harmonic (K= 1 to 30)
		Q1(288,20) Q2(288,20) Q3(288,20)		Functions used in the double integration
		UMF(10,20) VMF(10,20)		Components of sound pressure
		PMRMS(10,20)		Sound pressure
		SPLM(10,20)		Sound pressure level
		LAZI		The number of azimuth stations as a result of interpolation This is calculated knowing DPSI

TAPE INPUT	CARD INPUT	PROGRAM SYMBOL	UNITS	DESCRIPTION
		IRS(I)		Instrumented radial station counter, counting from blade root. If station N.G. then IRS(I) = 0
		ITRACK(I)		Track number for reel number I
		FI(I,J)		Gaussian integration factors for radial station I, chord station J
		NCHAN(I,L)		Blade instrumented station designation for radial station I, chord station J. If = 0, then that station is N.G.
		RR(I)	fraction	Fractional radial station measured from hub center. I = span station = 1 to 5
		XA(I,J)	fraction	Fraction of distance along chord from leading edge. J = span = 1 to 5, I = chord station = 1 to 5
		NCH(I)		Total number of chord stations for radial position I
		XLO(I) XLM(I,J) XMM(I,J)	lb/in. lb/in. lb/in.	Air Load harmonics used in subroutine E386 where: I = radial station and J = harmonic
		CHORD(I)	fraction	Chord station array used in the average quadratics integration to get Air Loads (I = chord)
		GPSI(I)	psi	Differential pressure array along a chord, used in average quadratics integration
		FN(I)		Temporary array used to store Air Loads just before harmonic analysis
		PI	rad	PI = 3.14159
		AZMTH2(I)	rad	Azimuth array 0 to 2π rad in $(2.5\pi/180)$ rad increments (I = 1 to 144)
		AZMTH(I)	deg	Azimuth array 0 to 360 deg in 2.5-degree increments (I = 1 to 144)

TAPE INPUT	CARD INPUT	PROGRAM SYMBOL	UNITS	DESCRIPTION
		AZMTH3(288)		Azimuth array every DPRAD radians from 0 to 2π
		DPRAD	rad	$\Delta\psi$ expressed in radians
		BLADES		Number of blades
		SPAN(L)	in.	Radial stations used in the double integration, L = 1 to 20
		S	in.	Distance from element of rotor disc to field point
		B	deg	Blade pitch angle
		GPSI1(I)	psi	Array used in integration of $g_m(\psi,R)$ and $h_m(\psi,R)$
		CHORD2(I)	fraction	Interpolated chord station array used in integration of $g_m(\psi,R)$ and $h_m(\psi,R)$
		AN(I,J,K) BN(I,J,K)		Cosine and sine Fourier coefficients used in filter roll-off correction. I = harmonic, J = channel, K = reel
		TEM1(I) TEM2(I)		Temporary arrays used in Fourier analysis subroutine arguments
		AZRAD	rad	2.5° expressed in radians
		ICHANL(I,J)		Tape channel designation, where J = 1 to NOCH(J) and I = 1 to IREELS
		NO YES		Control words used to check whether or not to execute an option
		NBLANK		Word with all blanks in it
		TEE		Equals "T" in Hollerith used to designate top of blade
		BEE		Equals "B" in Hollerith used to designate bottom of blade
		DEE		Equals "D" in Hollerith used to designate differential pressure

TAPE INPUT	CARD INPUT	PROGRAM SYMBOL	UNITS	DESCRIPTION
		COSINE(I)	deg	Cosine array defined every DPSI degrees
		SINE(I)	deg	Sine array defined every DPSI degrees
		AZ41(I)	rad	Azimuth points I along the chord for a given nominal azimuth
		NCYCLE		Cycles in a burst, counter
		CYCLES		Total number of cycles in a burst
		KU		Current tape unit number
		NDIV(4)		Used to shift integer numbers
		BMASK(6)		Used to mask out parts of a word
		NOCH(I)		Total number of good channels on reel number I
		LIRS		Number of good radial stations
		FTRACK		Current track numbers being read from tape (2nd half of NN(217))
		FBURST		Current burst number being read from tape (2nd half of NN(218))
		FREC		Current record number being read from tape (2nd half of NN(219))
		NN(435)		Tape data cycle array made up of 2 records (Last 3 words are control words)
		ND1(I,J,K) ND2(I,J,K)		Unpacked raw data arrays where: I = azimuthal data point, J = chord station, K = radial station
		DATA2(I,J,K)		Unpacked average raw data cycle where:I = data point, J = chord station, K = radial station
		DATA1(I,J,K)	psi	Scaled and corrected average pressure cycles where: I = data point, J = chord, K = radial station

TAPE INPUT	CARD INPUT	PROGRAM SYMBOL	UNITS	DESCRIPTION
		COSRN(I) SINRN(I)		Cosine and sine arrays, the elements being calculated at each instrumented chord station. Used in calculating Fourier coefficients of acoustic Air Loads
		GPSI2(I)	psi	Differential pressure array along a chord, used in average quadratics integration
		GMAR(I,K)		mth cosine coefficient of acoustic pressure pulse where K = radial station, I = azimuthal station
		HMAR(I,K)		mth sine coefficient of acoustic pressure pulse where K = radial station, I = azimuthal station
		DPSI1(I)	psi	Differential pressure array along chord, used in averaged quadratics integration
		GMARI(I,K)		mth cosine coefficient of acoustic pressure pulse after interpolation. I = up to 288, K = 10 or 20
		HMARI(I,K)		mth sine coefficient of acoustic pressure pulse after interpolation. I = up to 288, K = 10 or 20
		TEMP1(I) TEMP2(I) TEMP3(I)		Temporary work arrays used in the interpolation of GMAR and HMAR
		XO(I) YO(I)		Arrays used in interpolation, I = 1 to 20
		W(I)		Temporary work array, I = 1,14
		NOPTS1		Number of radial stations before interpolation (including end points .194 and 1.0)(up to 7)
		ISI		ISI = (DPSI/2.5) $\geq$ 1; if $\leq$ 0 then ISI = 1
		POINT(15)		Gauss integration points (normalized)

TAPE INPUT	CARD INPUT	PROGRAM SYMBOL	UNITS	DESCRIPTION
		WPOINT(15)		Gauss integration weights
		NXY		Number of Gauss points and weights to be used
		PI2	rad	PI2 = 6.28318
		IX		The number of radial intervals to be used in the double integration
		IY		The number of azimuthal intervals to be used in the double integration

Input/Output

The input format is defined symbolically in Figure 1. Note that the blank lines are used to insure legibility. Normal input data would have no blank lines (unpunched cards) unless all of the parameters on a particular card happen to be equal to zero. Figure 2 is a sample numerical input for the first span station with 8 harmonics of pressure for each chord station. The format for the pressure harmonics CN(I,J,K) and SN(I,J,K) for the remaining span stations is completely analogous to that for Span 1. Span stations are specified from root to tip of the blade, and chord stations are specified from leading edge to trailing edge.

Normal output from the noise prediction program contains the following information:

1. Listing of the input parameters except the harmonics of pressure.
2. Values of differential pressure at each span and chord station every DPSI degrees of azimuth from the sum of the input pressure harmonics.
3. Field point coordinates and the corresponding predicted SPL for each noise harmonic.

A typical output is contained in Figure 3.

Operating Instructions

The noise prediction computer program has several options that may be selected. For normal operation, the print options for INTERM and IDD should be refused. If this is not done, several hundred pages of non-essential output will be generated. The following suggestions assume that the input pressure data are on punched cards so that option TCOP is equal to CARD (i.e., no data on magnetic tape).

The azimuthal increment of integration for E676 can be varied from 1.25 degrees to integral multiples of 2.5 degrees, while the value of ANG used in subroutine E386RN can be any value greater than 0.5 degree as long as

(360/ANG) is an even integer. Normally, DPSI and ANG should be equal. If only the first harmonic of noise is being calculated, an increment of 10.0 degrees is acceptable. If 4 harmonics of noise are desired, an increment of 2.5 degrees is recommended. The number of interpolated span stations can be 10 or 20. The larger is recommended for DPSI of 2.5 degrees or less.

Results presented in Volume I of this report demonstrate the importance of high-frequency loading harmonics for prediction of the higher harmonics of noise. At least 15 loading harmonics are recommended for calculation of up to the fourth noise harmonic. However, if only the level of the fundamental is desired, 2 or 3 loading harmonics probably will suffice.

Running time will be a function of the angular increment selected. Calculation of 4 harmonics of rotor noise at 20 field points from both the actual and the hypothetical rectangular chordwise pressure distributions requires approximately 6 minutes of machine time (excluding time for CUR instructions and compilation which can be on the order of 1 minute). Calculations with the actual chordwise distribution take roughly 5 minutes while the corresponding calculations with the rectangular distribution require approximately 1 minute. Running time increases as the azimuthal increment becomes smaller.

The coordinate system for E676 is right-handed Cartesian with Z positive up (in direction of rotor thrust), X positive aft, and Y positive to starboard. The origin of the system is at the center of rotation of the rotor. The coordinate system for E386RN is spherical in which R is the distance between the center of rotation and the field point, θ is the azimuth angle in the plane of the rotor disc, and σ is the elevation angle relative to the rotor disc (positive for field points above the disc). Figure 4 contains the coordinate systems for OPRONO and E386OP as used for a conventional helicopter rotor.

If the noise prediction program is used to calculate rotational noise for a propeller rather than a rotor, the following coordinate system definition applies. Z and σ are positive for field points on the positive thrust side of the rotor disc. The X-axis and θ = zero line coincide with the reference point for the azimuthal loading harmonics.

It is advisable to calculate rotational noise via both the OPRONO and E386OP options to determine if the loading details included in OPRONO need to be considered for the configuration being studied. If the rectangular chordwise loading distribution yields acceptable results, use E386 exclusively in order to save computing time.

Detailed instructions regarding control cards and execution commands must be provided by a programmer who is familiar with the particular UNIVAC 1108 installation that is to be used. When the input data and overlay structure are specified correctly, no problems should be encountered in running the program.

Program Logic

Program E676 proceeds as follows for card input (TCOP = CARD):

1. Accept harmonics of differential pressure from cards. Sum these harmonics to produce the differential pressure at each span and chord station every DPSI degrees of azimuth.
2. If output from E386 is desired, calculate the blade section loading (pounds per inch of span) by integrating the differential pressures across the chord at each span station. A trapezoidal integration routine is used.
3. Proceed through E386.
4. If noise levels based on the actual chordwise pressure distribution are required, interpolate to provide 41 points along the blade chord. These points are required to define the Fourier coefficients of the pulse shape (chordwise pressure distribution).
5. Calculate GMAR and HMAR for a particular noise harmonic.
6. Interpolate GMAR and HMAR if 288 azimuthal points and 20 radial points are desired. This interpolation produces GMARI and HMARI.
7. Calculate CUE array for the first field point.
8. Calculate UMF and VMF components of sound pressure for the first field point.
9. Calculate SPLM for the first field point.
10. Repeat steps 7, 8, and 9 for the rest of the field points (field point loop).
11. Repeat steps 5 through 10 for the rest of the noise harmonics (harmonic loop).
12. Repeat steps 1 through 11 for the remaining flight conditions or "data bursts" (burst loop).

Program Equations

Volume I of this report contains the derivation of the noise prediction equations. The critical parameters are GMARI, HMARI, S, Q1, Q2, Q3, UMF, VMF, PMRMS, and SPLM. The relationship between these program symbols and their engineering counterparts is:

GMARI = g_m

HMARI = h_m

S = s

Q1 = rq_1

Q2 = $Q1q_2$

Q3 = $Q1q_3$

UMF = U_m

VMF = V_m

PMRMS = P_m

SPLM = SPL_m

UMF $$u_m = \frac{1}{4\pi}\int_0^{2\pi}\int_0^{r_t} b\ q_1 q_2\ r\ dr\ d\psi$$

VMF $$v_m = \frac{1}{4\pi}\int_0^{2\pi}\int_0^{r_t} b\ q_1 q_3\ r\ dr\ d\psi$$

Q $$q_1 \equiv (x - r\cos\psi)\sin\beta\ \sin\psi - (y - r\sin\psi)\sin\beta\ \cos\psi + z\ \cos\beta$$

$$q_2 \equiv g_m\left(\frac{-\cos\phi}{s^3} - \frac{mn\Omega}{cs^2}\sin\phi\right) + h_m\left(\frac{\sin\phi}{s^3} - \frac{mn\Omega}{cs^2}\cos\phi\right)$$

$$q_3 \equiv g_m\left(\frac{-\sin\phi}{s^3} + \frac{mn\Omega}{cs^2}\cos\phi\right) + h_m\left(\frac{-\cos\phi}{s^3} - \frac{mn\Omega}{cs^2}\sin\phi\right)$$

$$\phi = mn\Omega\left(\frac{\psi}{\Omega} + \frac{s}{c}\right)$$

GMAR $$\vec{g_m}(r,\psi) = \frac{n}{\pi b}\int_{-a/2r}^{a/2r} \vec{L}(r,\psi)\cos mn\psi\ d\psi$$

HMAR $$\vec{h_m}(r,\psi) = \frac{n}{\pi b}\int_{-a/2r}^{a/2r} \vec{L}(r,\psi)\sin mn\psi\ d\psi$$

S $$s=\left[(x-r\cos\psi)^2+(y-r\sin\psi)^2+z^2\right]^{\frac{1}{2}}$$

Program Listing

The listing for the complete noise prediction deck is contained in Figures 5 through 38. Figure titles correspond to the program or subroutine contained in the figure.

Limitations of the Program

Some aspects of the rotational noise prediction program limit its immediate operation by new users. The direct-access storage drums are called 28, 29, and 30 by the program and the NTRAN routine. It probably will be necessary to change these call numbers to match those used on the UNIVAC 1108 system.

Some additional changes will be required in the programmed equations if the rotor blades being studied differ from those of the NH-3A described in Volume I of this report. In particular, the span stations for which input pressure data are available are assumed to be 40%, 75%, 85%, 95%, and 98% of the radius (BLADEL). The program further assumes that the input chord stations or transducer locations are at 4.2%, 15.8%, 30%, 60%, and 91% chord (AA). In addition, the lifting surface of the blade is assumed to consist of the outer 80.1% of span. Changes in the chord locations will affect the interpolation routine used to calculate GMAR and HMAR, while changes to the span will affect the interpolation used to calculate GMARI and HMARI. These changes are not difficult to make once the programmer is familiar with the deck.

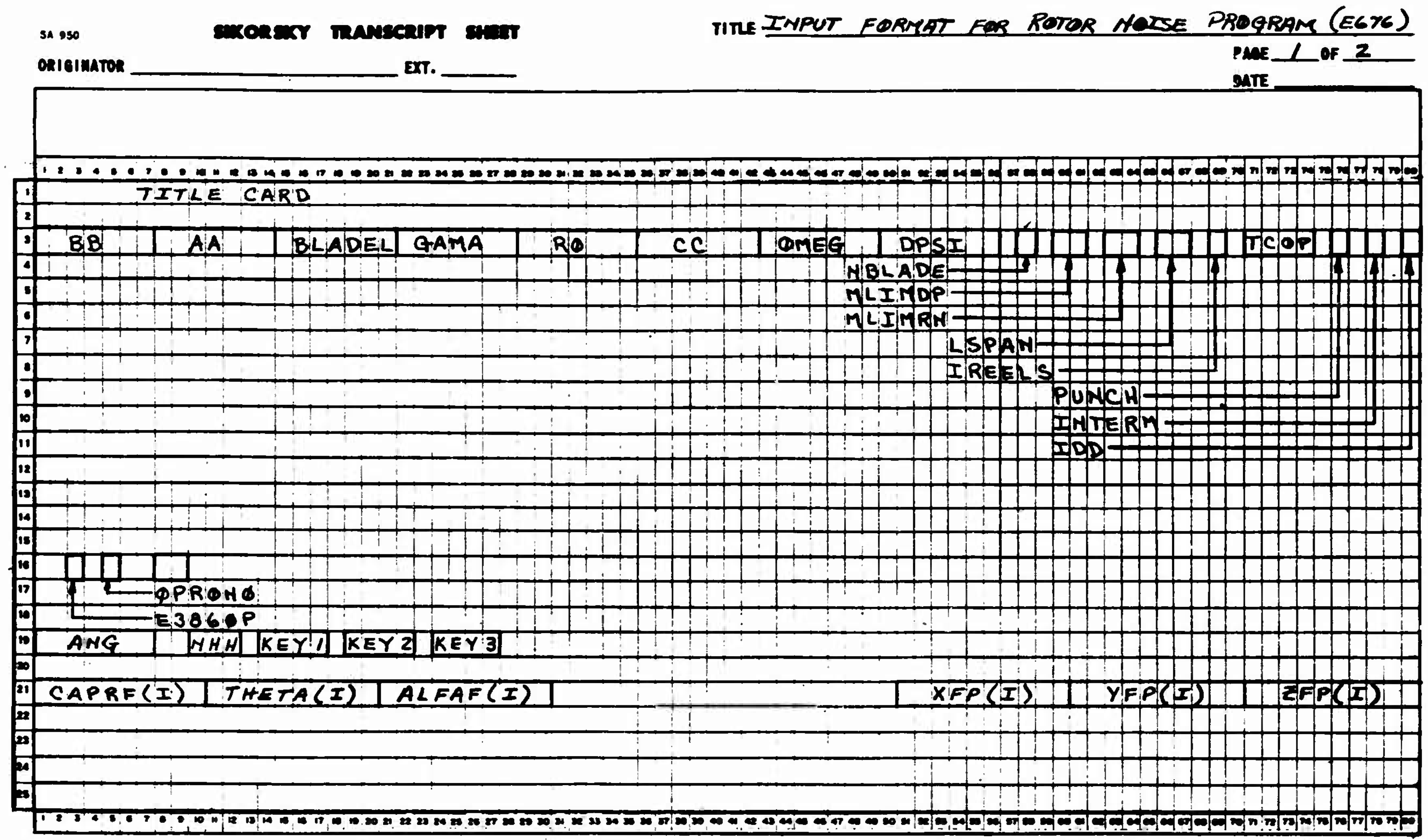

Figure 1. Sample Input, Symbolic.

SA 950 **SIKORSKY TRANSCRIPT SHEET** TITLE INPUT FORMAT FOR ROTOR NOISE PROGRAM (E676)

ORIGINATOR _____ EXT. _____ PAGE 2 OF 2

DATE _____

```
BURST NO. =IBURST          *** ROTOR NOISE PUNCHED OUTPUT ***

BLADE PITCH HARMONICS

                                (COLLECTIVE, LONGITUDINAL, LATERAL RESPECTIVELY)

DIFFERENTIAL PRESSURE HARMONICS FOR 5 CHORD STATIONS AT EACH OF THE 5 SPANS
(MEASURING FROM THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY).

        IN        JN
SPAN    CHORD          STEADY=  CN(1,JN,IN)

COSINE COEFFICIENTS

CN(2,JN,IN) CN(3,JN,IN)  ...

SINE COEFFICIENTS

SN(1,JN,IN)  SN(2,JN,IN)  ...
```

Figure 1. Sample Input, Symbolic - Concluded.

SA 950 **SIKORSKY TRANSCRIPT SHEET** TITLE SAMPLE INPUT

ORIGINATOR _____ EXT. _____ PAGE 1 OF 3

DATE _____

```
S-61F 165KT LOW WING LOADING-8HARMONICS L(R, PSI)

  2.0     18.2  372.0 0.0134   72.0  13040.0 204.0  2.5   5   8   4 20 0 CARD N N 0
  Y Y  10
   2.5   4  00  00  00
1545.0     169.9      -23.20                          -16800.0  3000.0    -7320.0
1197.0     166.0      -30.33                          -12000.0  3000.0    -7296.0
1114.0     164.5      -33.07                          -10800.0  3000.0    -7296.0
1035.0     162.2      -35.97                           -9600.0  3000.0    -7296.0
 960.0     160.3      -39.28                           -8400.0  3000.0    -7296.0
 890.0     157.3      -43.08                           -7200.0  3000.0    -7296.0
 826.0     153.4      -47.40                           -6000.0  3000.0    -7296.0
 769.0     148.0      -52.18                           -4800.0  3000.0    -7296.0
 723.0     140.2      -57.28                           -3600.0  3000.0    -7296.0
 687.0     128.7      -62.23                           -2400.0  3000.0    -7296.0
```

Figure 2. Sample Input, Numeric.

SA 950 **SIKORSKY TRANSCRIPT SHEET**

ORIGINATOR _____ EXT. _____

TITLE SAMPLE INPUT

PAGE 2 OF 3

DATE _____

```
BURST NO.=13      *** ROTOR NOISE PUNCHED OUTPUT ***
BLADE PITCH HARMONICS
9.5150     1.7878     9.1546     (COLLECTIVE,LONGITUDINAL,LATERAL RESPECTIVELY)
DIFFERENTIAL PRESSURE HARMONICS FOR 5 CHORD STATIONS AT EACH OF 5 SPANS
(MEASURING FROM THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY)
SPAN 1   CHORD 1          STEADY=1.0363+00
COSINE COEFFICIENTS
-9.8263-01 5.9133-01 2.4036-01-1.1329-01-1.0611-01-5.3502-02 1.0455-02-7.4505-03
SINE COEFFICIENTS
 7.7656-01-6.8249-01 5.7926-01 2.5240-01 1.2384-01 2.5328-02 4.5821-02-1.0433-02
SPAN 1   CHORD 2          STEADY=5.7707-01
COSINE COEFFICIENTS
-4.8362-01 2.6994-01 1.3409-01-5.6017-02-7.3457-02-2.3293-02 7.8033-03-7.2251-03
SINE COEFFICIENTS
 5.1175-01-3.7734-01 2.2282-01 1.3558-01 5.6567-02 9.7851-03 2.8522-02-1.2267-02
SPAN 1   CHORD 3          STEADY=2.3444-01
COSINE COEFFICIENTS
-3.6099-01 1.7189-01 4.9981-02-2.3969-02-5.2198-02-1.2333-02-5.7960-04-2.1508-03
SINE COEFFICIENTS
 2.6526-01-3.0031-01 9.3589-02 5.8273-02 2.8389-02 1.3377-02 1.3645-02-1.0780-02
SPAN 1   CHORD 4          STEADY=-4.9016-02
COSINE COEFFICIENTS
-1.1094-01 8.3637-02 1.9119-02-8.1379-03-1.9951-02 7.0415-04-3.1862-03 1.9911-03
SINE COEFFICIENTS
 3.5763-02-1.2231-01 2.6333-02 2.9186-02 1.0332-02-4.3339-03 8.9812-04-6.2971-03
```

Figure 2. Sample Input, Numeric - Continued.

SA 950 SIKORSKY TRANSCRIPT SHEET

ORIGINATOR _____ EXT. _____

TITLE SAMPLE INPUT

PAGE 3 OF 3

DATE

```
SPAN 1 CHORD 5          STEADY=-4.7925-02
COSINE COEFFICIENTS
-6.9048-03 1.9961-02-1.8405-03-1.1350-02 3.8156-03 1.0718-02-1.5727-03 5.5342-04
SINE COEFFICIENTS
 8.3695-02-3.3696-02-1.1692-02 4.1600-03 1.2237-02-8.4147-04-5.0161-03-4.3599-03
```

Figure 2. Sample Input, Numeric - Concluded.

S-61F 165KT LOW WING LOADING - 16 HARMONICS L(R,PSI) 110276

BLADE THICKNESS (IN) = .2000+01 ZERO TWIST BLADE STA. (IN) = .7600+02

BLADE CHORD (IN) = .1820+02 SPEED OF SOUND (IN/SEC) = .1304+05

BLADE LENGTH (IN) = .3720+03 ROTOR ROT. SPEED (RPM) = .2040+03

AZIMUTH INCREMENT (DEG) = .2500+01

BLADE TWIST RATE (DEG/IN) = .1340-01

NUMBER OF BLADES = 5 TAPE / CARD OPTION = CARD

NO. OF HARMONICS TO REPRESENT PRESSURE CYCLES = 16 PRESSURE HARMONIC PUNCH OPTION = N

NO. OF ROTOR NOISE HARMONICS = 4 INTERMEDIATE OUTPUT OPTION = N

NO. OF INTERPOLATED SPAN STATIONS = 20

TOTAL NO. OF TAPE REELS = 1

OPTION TO USE PROGRAM E386 (THEORETICAL CONST. PRESSURE PULSE) = Y

OPTION TO USE ROTOR NOISE PROGRAM (MEASURED PRESSURE PULSE) = Y

NO. OF FIELD POINTS =14

INCR. OF INTEGRATION USED IN E386 (DEG.) = 2.5000 NO. OF AIR LOAD HARMONICS = 16 KEY1= 0 KEY2= 0 KEY3= 0

E386 FIELD POINTS

FP	R (FT)	THETA (DEG)	ALPHA (DEG)
1	.1545+04	.1699+03	-.2320+02
2	.1197+04	.1660+03	-.3033+02
3	.1114+04	.1645+03	-.3307+02
4	.1035+04	.1622+03	-.3597+02
5	.9600+03	.1603+03	-.3928+02
6	.8900+03	.1573+03	-.4308+02
7	.8260+03	.1534+03	-.4740+02
8	.7690+03	.1480+03	-.5218+02
9	.7230+03	.1402+03	-.5728+02
10	.6870+03	.1287+03	-.6223+02
11	.6590+03	.1218+03	-.6590+02
12	.6820+03	.5130+02	-.6200+02
13	.8220+03	.2660+02	-.4710+02
14	.1031+04	.1740+02	-.3570+02

ROTOR NOISE FIELD POINTS

FP	X (IN)	Y (IN)	Z (IN)
1	-.1680+05	.3000+04	-.7320+04
2	-.1200+05	.3000+04	-.7296+04
3	-.1080+05	.3000+04	-.7296+04
4	-.9600+04	.3000+04	-.7296+04
5	-.8400+04	.3000+04	-.7296+04
6	-.7200+04	.3000+04	-.7296+04
7	-.6000+04	.3000+04	-.7296+04
8	-.4800+04	.3000+04	-.7296+04
9	-.3600+04	.3000+04	-.7296+04
10	-.2400+04	.3000+04	-.7296+04
11	-.1200+04	.3000+04	-.7224+04
12	.2400+04	.3000+04	-.7224+04
13	.6000+04	.3000+04	-.7224+04
14	.9600+04	.3000+04	-.7224+04

Figure 3. Sample Output.

DIFFERENTIAL PRESSURE CYCLES AT INSTRUMENTED BLADE STATIONS

SPAN STATION 1 CHORD STATION 1

6.2306-01	8.0127-01	9.6152-01	1.0958+00	1.2034+00	1.2879+00	1.3535+00	1.4021+00	1.4317+00	1.4383+00
1.4179+00	1.3690+00	1.2937+00	1.1969+00	1.0844+00	9.6082-01	8.2831-01	6.8676-01	5.3573-01	3.7674-01
2.1489-01	5.8847-02	-8.0817-02	-1.9450-01	-2.7627-01	-3.2526-01	-3.4504-01	-3.4134-01	-3.1898-01	-2.7936-01
-2.1981-01	-1.3488-01	-1.9212-02	1.2926-01	3.0724-01	5.0610-01	7.1393-01	9.1915-01	1.1141+00	1.2970+00
1.4724+00	1.6485+00	1.8336+00	2.0324+00	2.2438+00	2.4604+00	2.6702+00	2.8605+00	3.0213+00	3.1478+00
3.2416+00	3.3093+00	3.3604+00	3.4038+00	3.4452+00	3.4861+00	3.5237+00	3.5528+00	3.5684+00	3.5676+00
3.5512+00	3.5226+00	3.4866+00	3.4466+00	3.4019+00	3.3471+00	3.2724+00	3.1670+00	3.0229+00	2.8391+00
2.6236+00	2.3934+00	2.1703+00	1.9759+00	1.8249+00	1.7204+00	1.6532+00	1.6038+00	1.5493+00	1.4699+00
1.3559+00	1.2100+00	1.0466+00	8.8599-01	7.4754-01	6.4338-01	5.7480-01	5.3289-01	5.0267-01	4.6908-01
4.2243-01	3.6126-01	2.9177-01	2.2436-01	1.6891-01	1.3090-01	1.0985-01	1.0043-01	9.5579-02	8.9921-02
8.1915-02	7.3846-02	6.9838-02	7.3022-02	8.3352-02	9.7214-02	1.0900-01	1.1389-01	1.1034-01	1.0104-01
9.1706-02	8.8150-02	9.3198-02	1.0489-01	1.1712-01	1.2259-01	1.1685-01	1.0148-01	8.4732-02	7.8873-02
9.5111-02	1.3807-01	2.0224-01	2.7227-01	3.2738-01	3.4842-01	3.2509-01	2.6025-01	1.6958-01	7.6530-02
4.2341-03	-3.2360-02	-3.1269-02	-3.2555-03	3.3236-02	5.9971-02	6.6530-02	5.4695-02	3.7990-02	3.6708-02
7.0448-02	1.5109-01	2.7880-01	4.4231-01						

SPAN STATION 1 CHORD STATION 2

3.5609-01	4.3257-01	5.0269-01	5.6492-01	6.1930-01	6.6599-01	7.0421-01	7.3199-01	7.4682-01	7.4680-01
7.3176-01	7.0358-01	6.6579-01	6.2225-01	5.7587-01	5.2760-01	4.7642-01	4.2024-01	3.5734-01	2.8781-01
2.1426-01	1.4162-01	7.5924-02	2.2705-02	-1.4398-02	-3.4269-02	-3.7952-02	-2.7508-02	-4.6428-03	3.0265-02
7.8274-02	1.4107-01	2.1959-01	3.1274-01	4.1684-01	5.2611-01	6.3421-01	7.3618-01	8.3017-01	9.1800-01
1.0045+00	1.0956+00	1.1956+00	1.3056+00	1.4220+00	1.5372+00	1.6418+00	1.7271+00	1.7878+00	1.8235+00
1.8382+00	1.8394+00	1.8350+00	1.8310+00	1.8305+00	1.8328+00	1.8351+00	1.8339+00	1.8272+00	1.8154+00
1.8007+00	1.7859+00	1.7726+00	1.7597+00	1.7429+00	1.7160+00	1.6724+00	1.6084+00	1.5242+00	1.4247+00
1.3186+00	1.2155+00	1.1236+00	1.0467+00	9.8398-01	9.3056-01	8.7974-01	8.2573-01	7.6584-01	7.0127-01
6.3622-01	5.7583-01	5.2375-01	4.8032-01	4.4233-01	4.0416-01	3.6025-01	3.0748-01	2.4678-01	1.8318-01
1.2411-01	7.6812-02	4.5720-02	3.0832-02	2.7800-02	2.9594-02	2.9111-02	2.1674-02	6.4700-03	-1.3596-02
-3.3477-02	-4.8280-02	-5.5295-02	-5.4939-02	-5.0286-02	-4.5475-02	-4.3769-02	-4.6135-02	-5.0991-02	-5.5169-02
-5.5624-02	-5.1045-02	-4.2570-02	-3.3226-02	-2.6315-02	-2.3470-02	-2.3325-02	-2.1526-02	-1.2227-02	9.4299-03
4.4855-02	9.0647-02	1.3902-01	1.8003-01	2.0483-01	2.0879-01	1.9321-01	1.6494-01	1.3406-01	1.1028-01
9.9669-02	1.0271-01	1.1450-01	1.2703-01	1.3253-01	1.2675-01	1.1075-01	9.0767-02	7.6141-02	7.6175-02
9.7150-02	1.4052-01	2.0285-01	2.7731-01						

SPAN STATION 1 CHORD STATION 3

3.8096-03	3.5325-02	6.4503-02	8.8804-02	1.0747-01	1.2108-01	1.3072-01	1.3708-01	1.4003-01	1.3860-01
1.3159-01	1.1823-01	9.8706-02	7.4258-02	4.6742-02	1.7961-02	-1.0964-02	-3.9855-02	-6.9226-02	-9.9629-02
-1.3090-01	-1.6168-01	-1.8942-01	-2.1093-01	-2.2328-01	-2.2460-01	-2.1449-01	-1.9390-01	-1.6453-01	-1.2803-01
-8.5498-02	-3.7337-02	1.6301-02	7.4881-02	1.3696-01	2.0014-01	2.6165-01	3.1930-01	3.7249-01	4.2277-01
4.7343-01	5.2847-01	5.9095-01	6.6150-01	7.3763-01	8.1405-01	8.8407-01	9.4154-01	9.8272-01	1.0073+00
1.0183+00	1.0208+00	1.0205+00	1.0213+00	1.0253+00	1.0320+00	1.0392+00	1.0449+00	1.0478+00	1.0478+00
1.0461+00	1.0437+00	1.0410+00	1.0367+00	1.0283+00	1.0128+00	9.8772-01	9.5242-01	9.0830-01	8.5854-01
8.0702-01	7.5710-01	7.1057-01	6.6729-01	6.2558-01	5.8318-01	5.3830-01	4.9044-01	4.4052-01	3.9046-01
3.4234-01	2.9752-01	2.5621-01	2.1743-01	1.7965-01	1.4150-01	1.0246-01	6.3202-02	2.5333-02	-9.1201-03
-3.8437-02	-6.1752-02	-7.9263-02	-9.2051-02	-1.0162-01	-1.0938-01	-1.1626-01	-1.2256-01	-1.2810-01	-1.3250-01
-1.3545-01	-1.3693-01	-1.3717-01	-1.3660-01	-1.3566-01	-1.3464-01	-1.3370-01	-1.3288-01	-1.3217-01	-1.3162-01
-1.3124-01	-1.3097-01	-1.3050-01	-1.2919-01	-1.2600-01	-1.1964-01	-1.0876-01	-9.2273-02	-6.9784-02	-4.1841-02
-1.0113-02	2.2700-02	5.3227-02	7.8044-02	9.4413-02	1.0098-01	9.8180-02	8.8237-02	7.4608-02	6.1051-02
5.0526-02	4.4298-02	4.1556-02	3.9734-02	3.5473-02	2.5936-02	1.0019-02	-1.0966-02	-3.3429-02	-5.2444-02
-6.3188-02	-6.2402-02	-4.9349-02	-2.5970-02						

SPAN STATION 1 CHORD STATION 4

Figure 3. Sample Output - Continued.

-8.8635-02	-8.6987-02	-8.6039-02	-8.5464-02	-8.4647-02	-8.3209-02	-8.1390-02	-8.0108-02	-8.0666-02	-8.4235-02
-9.1370-02	-1.0177-01	-1.1442-01	-1.2800-01	-1.4146-01	-1.5441-01	-1.6718-01	-1.8059-01	-1.9543-01	-2.1196-01
-2.2968-01	-2.4738-01	-2.6351-01	-2.7668-01	-2.8602-01	-2.9132-01	-2.9278-01	-2.9068-01	-2.8503-01	-2.7540-01
-2.6116-01	-2.4187-01	-2.1774-01	-1.8993-01	-1.6040-01	-1.3145-01	-1.0501-01	-8.2041-02	-6.2182-02	-4.3917-02
-2.5150-02	-3.9917-03	2.0531-02	4.8109-02	7.7247-02	1.0576-01	1.3144-01	1.5269-01	1.6882-01	1.8004-01
1.8713-01	1.9107-01	1.9270-01	1.9266-01	1.9143-01	1.8957-01	1.8779-01	1.8691-01	1.8770-01	1.9048-01
1.9499-01	2.0035-01	2.0525-01	2.0841-01	2.0893-01	2.0656-01	2.0169-01	1.9505-01	1.8732-01	1.7880-01
1.6925-01	1.5802-01	1.4441-01	1.2805-01	1.0921-01	8.8792-02	6.8085-02	4.8386-02	3.0577-02	1.4891-02
9.3755-04	-1.2047-02	-2.4835-02	-3.7887-02	-5.1197-02	-6.4363-02	-7.6810-02	-8.8073-02	-9.7985-02	-1.0673-01
-1.1471-01	-1.2236-01	-1.2998-01	-1.3757-01	-1.4494-01	-1.5178-01	-1.5782-01	-1.6291-01	-1.6702-01	-1.7024-01
-1.7260-01	-1.7412-01	-1.7472-01	-1.7433-01	-1.7291-01	-1.7048-01	-1.6711-01	-1.6284-01	-1.5771-01	-1.5172-01
-1.4494-01	-1.3754-01	-1.2989-01	-1.2244-01	-1.1558-01	-1.0937-01	-1.0342-01	-9.6896-02	-8.8786-02	-7.8343-02
-6.5545-02	-5.1387-02	-3.7820-02	-2.7286-02	-2.1965-02	-2.2988-02	-2.9911-02	-4.0696-02	-5.2250-02	-6.1374-02
-6.5791-02	-6.4892-02	-5.9907-02	-5.3433-02	-4.8495-02	-4.7485-02	-5.1365-02	-5.9429-02	-6.9669-02	-7.9583-02
-8.7079-02	-9.1128-02	-9.1940-02	-9.0640-02						

SPAN STATION 1 CHORD STATION 5

-4.0680-02	-4.1627-02	-4.2030-02	-4.1855-02	-4.1058-02	-3.9686-02	-3.7944-02	-3.6199-02	-3.4877-02	-3.4297-02
-3.4513-02	-3.5260-02	-3.6030-02	-3.6274-02	-3.5627-02	-3.4073-02	-3.1967-02	-2.9884-02	-2.8373-02	-2.7710-02
-2.7752-02	-2.7976-02	-2.7659-02	-2.6156-02	-2.3134-02	-1.8678-02	-1.3240-02	-7.4440-03	-1.8621-03	3.1627-03
7.5598-03	1.1448-02	1.4980-02	1.8194-02	2.0966-02	2.3069-02	2.4327-02	2.4764-02	2.4694-02	2.4673-02
2.5339-02	2.7200-02	3.0450-02	3.4900-02	4.0035-02	4.5180-02	4.9701-02	5.3157-02	5.5357-02	5.6320-02
5.6178-02	5.5078-02	5.3142-02	5.0481-02	4.7250-02	4.3682-02	4.0070-02	3.6690-02	3.3688-02	3.1009-02
2.8396-02	2.5499-02	2.2031-02	1.7931-02	1.3422-02	8.9389-03	4.9383-03	1.6626-03	-1.0326-03	-3.6994-03
-7.1369-03	-1.2101-02	-1.8995-02	-2.7675-02	-3.7450-02	-4.7301-02	-5.6227-02	-6.3579-02	-6.9264-02	-7.3715-02
-7.7657-02	-8.1774-02	-8.6402-02	-9.1405-02	-9.6252-02	-1.0028-01	-1.0304-01	-1.0447-01	-1.0504-01	-1.0553-01
-1.0675-01	-1.0927-01	-1.1322-01	-1.1829-01	-1.2395-01	-1.2970-01	-1.3534-01	-1.4104-01	-1.4730-01	-1.5464-01
-1.6338-01	-1.7343-01	-1.8415-01	-1.9451-01	-2.0330-01	-2.0940-01	-2.1195-01	-2.1055-01	-2.0521-01	-1.9637-01
-1.8477-01	-1.7137-01	-1.5728-01	-1.4358-01	-1.3115-01	-1.2050-01	-1.1159-01	-1.0385-01	-9.6288-02	-8.7878-02
-7.7955-02	-6.6601-02	-5.4803-02	-4.4302-02	-3.7133-02	-3.4979-02	-3.8550-02	-4.7214-02	-5.9029-02	-7.1197-02
-8.0799-02	-8.5592-02	-8.4590-02	-7.8258-02	-6.8274-02	-5.6954-02	-4.6559-02	-3.8715-02	-3.4114-02	-3.2547-02
-3.3201-02	-3.5060-02	-3.7246-02	-3.9201-02						

SPAN STATION 2 CHORD STATION 1

5.3076+00	5.3657+00	5.3880+00	5.3760+00	5.3351+00	5.2707+00	5.1852+00	5.0775+00	4.9446+00	4.7852+00
4.6015+00	4.3999+00	4.1884+00	3.9727+00	3.7535+00	3.5256+00	3.2812+00	3.0145+00	2.7269+00	2.4288+00
2.1370+00	1.8690+00	1.6352+00	1.4342+00	1.2531+00	1.0735+00	8.8174-01	6.7725-01	4.7675-01	3.0986-01
2.0790-01	1.8987-01	2.5169-01	3.6431-01	4.8269-01	5.6320-01	5.8312-01	5.5400-01	5.2276-01	5.5854-01
7.2924-01	1.0759+00	1.5947+00	2.2338+00	2.9066+00	3.5171+00	3.9894+00	4.2882+00	4.4268+00	4.4568+00
4.4469+00	4.4570+00	4.5193+00	4.6313+00	4.7626+00	4.8719+00	4.9259+00	4.9127+00	4.8451+00	4.7522+00
4.6664+00	4.6094+00	4.5837+00	4.5746+00	4.5574+00	4.5097+00	4.4206+00	4.2943+00	4.1468+00	3.9973+00
3.8603+00	3.7395+00	3.6285+00	3.5158+00	3.3920+00	3.2557+00	3.1147+00	2.9834+00	2.8762+00	2.8017+00
2.7595+00	2.7409+00	2.7335+00	2.7265+00	2.7150+00	2.7002+00	2.6877+00	2.6822+00	2.6844+00	2.6893+00
2.6881+00	2.6723+00	2.6372+00	2.5843+00	2.5199+00	2.4520+00	2.3863+00	2.3235+00	2.2600+00	2.1908+00
2.1137+00	2.0325+00	1.9573+00	1.9017+00	1.8771+00	1.8880+00	1.9294+00	1.9879+00	2.0469+00	2.0924+00
2.1185+00	2.1294+00	2.1368+00	2.1553+00	2.1964+00	2.2643+00	2.3556+00	2.4614+00	2.5726+00	2.6830+00
2.7918+00	2.9023+00	3.0186+00	3.1427+00	3.2722+00	3.4014+00	3.5239+00	3.6363+00	3.7397+00	3.8401+00
3.9446+00	4.0586+00	4.1814+00	4.3070+00	4.4256+00	4.5283+00	4.6118+00	4.6798+00	4.7425+00	4.8120+00
4.8971+00	4.9992+00	5.1109+00	5.2188+00						

SPAN STATION 2 CHORD STATION 2

3.2571+00	3.3087+00	3.3519+00	3.3902+00	3.4258+00	3.4577+00	3.4822+00	3.4948+00	3.4925+00	3.4764+00
3.4513+00	3.4240+00	3.4004+00	3.3819+00	3.3641+00	3.3386+00	3.2956+00	3.2280+00	3.1350+00	3.0216+00
2.8966+00	2.7682+00	2.6405+00	2.5117+00	2.3759+00	2.2284+00	2.0703+00	1.9118+00	1.7712+00	1.6696+00

Figure 3. Sample Output - Continued.

1.6226+00	1.6335+00	1.6896+00	1.7660+00	1.8334+00	1.8708+00	1.8743+00	1.8620+00	1.8691+00	1.9367+00
2.0966+00	2.3588+00	2.7050+00	3.0922+00	3.4641+00	3.7680+00	3.9685+00	4.0572+00	4.0514+00	3.9858+00
3.8995+00	3.8226+00	3.7693+00	3.7364+00	3.7094+00	3.6715+00	3.6115+00	3.5287+00	3.4317+00	3.3337+00
3.2462+00	3.1739+00	3.1135+00	3.0559+00	2.9907+00	2.9108+00	2.8152+00	2.7082+00	2.5971+00	2.4882+00
2.3646+00	2.2855+00	2.1878+00	2.0891+00	1.9898+00	1.8938+00	1.8070+00	1.7347+00	1.6795+00	1.6395+00
1.6097+00	1.5838+00	1.5574+00	1.5297+00	1.5035+00	1.4831+00	1.4717+00	1.4690+00	1.4704+00	1.4686+00
1.4560+00	1.4281+00	1.3850+00	1.3313+00	1.2742+00	1.2204+00	1.1738+00	1.1341+00	1.0981+00	1.0620+00
1.0242+00	9.8639-01	9.5374-01	9.3277-01	9.2864-01	9.4286-01	9.7255-01	1.0114+00	1.0521+00	1.0891+00
1.1201+00	1.1465+00	1.1722+00	1.2017+00	1.2377+00	1.2809+00	1.3301+00	1.3832+00	1.4391+00	1.4974+00
[illegible]91+00	1.6249+00	1.6944+00	1.7657+00	1.8361+00	1.9030+00	1.9660+00	2.0268+00	2.0891+00	2.1568+00
2.[illegible]24+00	2.3150+00	2.4008+00	2.4844+00	2.5608+00	2.6283+00	2.6886+00	2.7468+00	2.8086+00	2.8783+00
2.9563+00	3.0390+00	3.1203+00	3.1943+00						

SPAN STATION 2 CHORD STATION 3

1.7878+00	1.8038+00	1.8105+00	1.8061+00	1.7906+00	1.7658+00	1.7344+00	1.6997+00	1.6639+00	1.6278+00
1.5902+00	1.5488+00	1.5004+00	1.4428+00	1.3753+00	1.2996+00	1.2193+00	1.1391+00	1.0632+00	9.9395-01
9.3078-01	8.7055-01	8.0855-01	7.4046-01	6.6445-01	5.8268-01	5.0154-01	4.3039-01	3.7903-01	3.5471-01
3.5962-01	3.8990-01	4.3663-01	4.8858-01	5.3601-01	5.7412-01	6.0501-01	6.3733-01	6.8360-01	7.5596-01
8.6182-01	1.0006+00	1.1640+00	1.3362+00	1.4993+00	1.6377+00	1.7416+00	1.8089+00	1.8450+00	1.8595+00
1.8629+00	1.8633+00	1.8643+00	1.8654+00	1.8630+00	1.8536+00	1.8351+00	1.8085+00	1.7770+00	1.7449+00
1.7155+00	1.6902+00	1.6674+00	1.6439+00	1.6162+00	1.5817+00	1.5398+00	1.4920+00	1.4413+00	1.3905+00
1.3417+00	1.2955+00	1.2515+00	1.2089+00	1.1677+00	1.1288+00	1.0941+00	1.0659+00	1.0460+00	1.0345+00
1.0300+00	1.0301+00	1.0314+00	1.0317+00	1.0292+00	1.0239+00	1.0161+00	1.0063+00	9.9432-01	9.7924-01
9.5948-01	9.3357-01	9.0081-01	8.6172-01	8.1799-01	7.7200-01	7.2617-01	6.8236-01	6.4166-01	6.0466-01
5.7198-01	5.4483-01	5.2519-01	5.1553-01	5.1801-01	5.3359-01	5.6124-01	5.9780-01	6.3851-01	6.7811-01
7.1226-01	7.3863-01	7.5744-01	7.7124-01	7.8399-01	7.9978-01	8.2160-01	8.5061-01	8.8598-01	9.2536-01
9.6574-01	1.0044+00	1.0396+00	1.0709+00	1.0995+00	1.1273+00	1.1567+00	1.1899+00	1.2285+00	1.2730+00
1.3227+00	1.3760+00	1.4302+00	1.4824+00	1.5299+00	1.5707+00	1.6041+00	1.6309+00	1.6530+00	1.6731+00
1.6937+00	1.7163+00	1.7408+00	1.7656+00						

SPAN STATION 2 CHORD STATION 4

5.3725-01	5.3835-01	5.3714-01	5.3387-01	5.2888-01	5.2239-01	5.1432-01	5.0431-01	4.9194-01	4.7691-01
4.5919-01	4.3899-01	4.1662-01	3.9232-01	3.6612-01	3.3791-01	3.0766-01	2.7569-01	2.4284-01	2.1040-01
1.7978-01	1.5208-01	1.2768-01	1.0606-01	8.6101-02	6.6665-02	4.7297-02	2.8774-02	1.3173-02	3.3906-03
2.2134-03	1.1281-02	3.0343-02	5.7149-02	8.8058-02	1.1921-01	1.4781-01	1.7311-01	1.9660-01	2.2144-01
2.5117-01	2.8831-01	3.3330-01	3.8410-01	4.3675-01	4.8646-01	5.2905-01	5.6203-01	5.8506-01	5.9970-01
6.0854-01	6.1417-01	6.1833-01	6.2158-01	6.2347-01	6.2312-01	6.1991-01	6.1387-01	6.0578-01	5.9682-01
5.8810-01	5.8014-01	5.7267-01	5.6474-01	5.5511-01	5.4273-01	5.2707-01	5.0833-01	4.8724-01	4.6483-01
4.4212-01	4.1989-01	3.9865-01	3.7873-01	3.6045-01	3.4415-01	3.3024-01	3.1903-01	3.1062-01	3.0482-01
3.0112-01	2.9881-01	2.9716-01	2.9555-01	2.9347-01	2.9055-01	2.8644-01	2.8073-01	2.7299-01	2.6287-01
2.5025-01	2.3536-01	2.1884-01	2.0157-01	1.8454-01	1.6857-01	1.5419-01	1.4161-01	1.3087-01	1.2202-01
1.1525-01	1.1097-01	1.0967-01	1.1165-01	1.1688-01	1.2475-01	1.3423-01	1.4403-01	1.5298-01	1.6030-01
1.6581-01	1.6990-01	1.7334-01	1.7700-01	1.8160-01	1.8760-01	1.9512-01	2.0407-01	2.1426-01	2.2545-01
2.3740-01	2.4979-01	2.6231-01	2.7464-01	2.8662-01	2.9838-01	3.1043-01	3.2358-01	3.3875-01	3.5656-01
3.7708-01	3.9958-01	4.2270-01	4.4468-01	4.6391-01	4.7939-01	4.9097-01	4.9932-01	5.0565-01	5.1124-01
5.1694-01	5.2296-01	5.2889-01	5.3393-01						

SPAN STATION 2 CHORD STATION 5

-2.9588-01	-3.1349-01	-3.3155-01	-3.5043-01	-3.7005-01	-3.8989-01	-4.0920-01	-4.2739-01	-4.4435-01	-4.6056-01
-4.7692-01	-4.9430-01	-5.1309-01	-5.3277-01	-5.5201-01	-5.6905-01	-5.8230-01	-5.9101-01	-5.9557-01	-5.9746-01
-5.9862-01	-6.0075-01	-6.0460-01	-6.0968-01	-6.1453-01	-6.1736-01	-6.1685-01	-6.1279-01	-6.0619-01	-5.9888-01
-5.9273-01	-5.8884-01	-5.8704-01	-5.8598-01	-5.8373-01	-5.7867-01	-5.7024-01	-5.5929-01	-5.4775-01	-5.3781-01
-5.3089-01	-5.2695-01	-5.2430-01	-5.2019-01	-5.1179-01	-4.9737-01	-4.7698-01	-4.5257-01	-4.2730-01	-4.0444-01
-3.8624-01	-3.7320-01	-3.6399-01	-3.5612-01	-3.4693-01	-3.3461-01	-3.1879-01	-3.0053-01	-2.8176-01	-2.6442-01
-2.4977-01	-2.3792-01	-2.2804-01	-2.1884-01	-2.0919-01	-1.9863-01	-1.8747-01	-1.7657-01	-1.6684-01	-1.5876-01
-1.5219-01	-1.4640-01	-1.4043-01	-1.3354-01	-1.2547-01	-1.1656-01	-1.0753-01	-9.9086-02	-9.1641-02	-8.5125-02

Figure 3. Sample Output - Continued.

-7.9088-02	-7.2979-02	-6.6475-02	-5.9692-02	-5.3195-02	-4.7787-02	-4.4193-02	-4.2775-02	-4.3412-02	-4.5879-02
-4.8586-02	-5.1847-02	-5.5074-02	-5.8288-02	-6.1684-02	-6.5410-02	-6.9388-02	-7.3251-02	-7.6443-02	-7.8407-02
-7.8794-02	-7.7577-02	-7.5038-02	-7.1642-02	-6.7864-02	-6.4060-02	-6.0440-02	-5.7126-02	-5.4262-02	-5.2093-02
-5.0952-02	-5.1160-02	-5.2878-02	-5.5997-02	-6.0124-02	-6.4689-02	-6.9132-02	-7.3098-02	-7.6536-02	-7.9682-02
-8.2908-02	-8.6537-02	-9.0686-02	-9.5224-02	-9.9852-02	-1.0425-01	-1.0826-01	-1.1190-01	-1.1540-01	-1.1909-01
-1.2307-01	-1.2756-01	-1.3255-01	-1.3811-01	-1.4447-01	-1.5205-01	-1.6145-01	-1.7317-01	-1.8742-01	-2.0396-01
-2.2215-01	-2.4107-01	-2.5989-01	-2.7816-01						

SPAN STATION 3 CHORD STATION 1

8.2907+00	8.2104+00	8.0435+00	7.8020+00	7.5095+00	7.1950+00	6.8847+00	6.5948+00	6.3280+00	6.0799+00
5.8197+00	5.5481+00	5.2536+00	4.9409+00	4.6231+00	4.3163+00	4.0322+00	3.7725+00	3.5289+00	3.2863+00
3.0303+00	2.7540+00	2.4616+00	2.1675+00	1.8896+00	1.6416+00	1.4270+00	1.2369+00	1.0552+00	8.6650-01
6.6600-01	4.6529-01	2.9154-01	1.7981-01	1.6083-01	2.4884-01	4.3447-01	6.8559-01	9.5637-01	1.2014+00
1.3898+00	1.5141+00	1.5911+00	1.6540+00	1.7397+00	1.8758+00	2.0717+00	2.3173+00	2.5886+00	2.8573+00
3.1011+00	3.3096+00	3.4858+00	3.6394+00	3.7819+00	3.9192+00	4.0487+00	4.1613+00	4.2461+00	4.2958+00
4.3106+00	4.2986+00	4.2725+00	4.2446+00	4.2220+00	4.2046+00	4.1854+00	4.1546+00	4.1039+00	4.0298+00
3.9345+00	3.8253+00	3.7105+00	3.5973+00	3.4890+00	3.3859+00	3.2869+00	3.1918+00	3.1028+00	3.0253+00
2.9657+00	2.9300+00	2.9210+00	2.9377+00	2.9753+00	3.0272+00	3.0864+00	3.1468+00	3.2041+00	3.2550+00
3.2970+00	3.3273+00	3.3433+00	3.3436+00	3.3282+00	3.2990+00	3.2600+00	3.2153+00	3.1687+00	3.1228+00
3.0791+00	3.0393+00	3.0069+00	2.9875+00	2.9886+00	3.0178+00	3.0798+00	3.1740+00	3.2936+00	3.4264+00
3.5579+00	3.6761+00	3.7748+00	3.8557+00	3.9284+00	4.0065+00	4.1039+00	4.2301+00	4.3874+00	4.5707+00
4.7691+00	4.9695+00	5.1601+00	5.3335+00	5.4874+00	5.6246+00	5.7515+00	5.8759+00	6.0051+00	6.1443+00
6.2956+00	6.4583+00	6.6288+00	6.8021+00	6.9734+00	7.1393+00	7.2998+00	7.4572+00	7.6153+00	7.7761+00
7.9370+00	8.0880+00	8.2117+00	8.2864+00						

SPAN STATION 3 CHORD STATION 2

4.0340+00	4.1810+00	4.3486+00	4.5202+00	4.6715+00	4.7765+00	4.8128+00	4.7682+00	4.6438+00	4.4541+00
4.2229+00	3.9766+00	3.7370+00	3.5156+00	3.3113+00	3.1121+00	2.9014+00	2.6644+00	2.3952+00	2.1001+00
1.7970+00	1.5109+00	1.2662+00	1.0797+00	9.5498-01	8.8148-01	8.3786-01	7.9879-01	7.4309-01	6.6059-01
5.5521-01	4.4406-01	3.5159-01	3.0195-01	3.1133-01	3.8307-01	5.0698-01	6.6319-01	8.2906-01	9.8680-01
1.1293+00	1.2616+00	1.3996+00	1.5617+00	1.7626+00	2.0065+00	2.2835+00	2.5711+00	2.8397+00	3.0603+00
3.2119+00	3.2868+00	3.2912+00	3.2427+00	3.1636+00	3.0752+00	2.9918+00	2.9190+00	2.8544+00	2.7911+00
2.7220+00	2.6433+00	2.5561+00	2.4656+00	2.3782+00	2.2991+00	2.2299+00	2.1678+00	2.1074+00	2.0425+00
1.9686+00	1.8850+00	1.7943+00	1.7018+00	1.6135+00	1.5342+00	1.4665+00	1.4109+00	1.3665+00	1.3321+00
1.3073+00	1.2927+00	1.2888+00	1.2959+00	1.3124+00	1.3349+00	1.3587+00	1.3786+00	1.3902+00	1.3912+00
1.3819+00	1.3642+00	1.3410+00	1.3151+00	1.2880+00	1.2598+00	1.2295+00	1.1958+00	1.1583+00	1.1180+00
1.0782+00	1.0434+00	1.0193+00	1.0113+00	1.0234+00	1.0574+00	1.1119+00	1.1829+00	1.2637+00	1.3467+00
1.4247+00	1.4925+00	1.5475+00	1.5921+00	1.6311+00	1.6717+00	1.7207+00	1.7832+00	1.8605+00	1.9498+00
2.0455+00	2.1406+00	2.2291+00	2.3077+00	2.3770+00	2.4403+00	2.5032+00	2.5707+00	2.6465+00	2.7313+00
2.8236+00	2.9207+00	3.0193+00	3.1171+00	3.2127+00	3.3053+00	3.3937+00	3.4767+00	3.5528+00	3.6216+00
3.6853+00	3.7494+00	3.8228+00	3.9151+00						

SPAN STATION 3 CHORD STATION 3

2.9525+00	2.9614+00	3.0123+00	3.0399+00	3.0598+00	3.0709+00	3.0762+00	3.0807+00	3.0873+00	3.0934+00
3.0909+00	3.0700+00	3.0263+00	2.9680+00	2.9191+00	2.9153+00	2.9928+00	3.1731+00	3.4496+00	3.7826+00
4.1065+00	4.3479+00	4.4497+00	4.3911+00	4.1966+00	3.9282+00	3.6635+00	3.4669+00	3.3659+00	3.3414+00
3.3383+00	3.2915+00	3.1579+00	2.9413+00	2.6988+00	2.5239+00	2.5125+00	2.7227+00	3.1456+00	3.6983+00
4.2441+00	4.6330+00	4.7507+00	4.5556+00	4.0935+00	3.4824+00	2.8749+00	2.4097+00	2.1714+00	2.1699+00
2.3464+00	2.6007+00	2.8294+00	2.9592+00	2.9654+00	2.8702+00	2.7248+00	2.5838+00	2.4836+00	2.4319+00
2.4107+00	2.3902+00	2.3444+00	2.2631+00	2.1549+00	2.0403+00	1.9409+00	1.8689+00	1.8219+00	1.7858+00
1.7423+00	1.6779+00	1.5906+00	1.4898+00	1.3918+00	1.3118+00	1.2579+00	1.2284+00	1.2137+00	1.2026+00
1.1873+00	1.1674+00	1.1487+00	1.1394+00	1.1449+00	1.1644+00	1.1904+00	1.2128+00	1.2197+00	1.2095+00
1.1885+00	1.1527+00	1.1231+00	1.1007+00	1.0848+00	1.0693+00	1.0462+00	1.0098+00	9.6066-01	9.0560-01
8.5558-01	8.2156-01	8.1046-01	8.2308-01	8.5470-01	8.9789-01	9.4588-01	9.9501-01	1.0450+00	1.0972+00
1.1525+00	1.2090+00	1.2625+00	1.3081+00	1.3431+00	1.3690+00	1.3916+00	1.4195+00	1.4598+00	1.5155+00
1.5838+00	1.6568+00	1.7253+00	1.7825+00	1.8268+00	1.8627+00	1.8984+00	1.9424+00	2.0001+00	2.0717+00

Figure 3. Sample Output - Continued.

2.1529+00	2.2374+00	2.3201+00	2.3984+00	2.4733+00	2.5468+00	2.6201+00	2.6918+00	2.7578+00	2.8134+00
2.8558+00	2.8858+00	2.9079+00	2.9285+00						

SPAN STATION 3 CHORD STATION 4

1.7042-01	1.5219-01	1.3310-01	1.1253-01	9.0002-02	6.5381-02	3.8924-02	1.1192-02	-1.7189-02	-4.5807-02
-7.4661-02	-1.0421-01	-1.3523-01	-1.6861-01	-2.0501-01	-2.4470-01	-2.8754-01	-3.3302-01	-3.8050-01	-4.2934-01
-4.7901-01	-5.2900-01	-5.7860-01	-6.2675-01	-6.7183-01	-7.1177-01	-7.4425-01	-7.6716-01	-7.7911-01	-7.7980-01
-7.7023-01	-7.5263-01	-7.3007-01	-7.0589-01	-6.8302-01	-6.6338-01	-6.4752-01	-6.3451-01	-6.2221-01	-6.0781-01
-5.8846-01	-5.6199-01	-5.2748-01	-4.8543-01	-4.3778-01	-3.8739-01	-3.3751-01	-2.9105-01	-2.5007-01	-2.1548-01
-1.8709-01	-1.6392-01	-1.4466-01	-1.2814-01	-1.1360-01	-1.0081-01	-8.9869-02	-8.0964-02	-7.4117-02	-6.9049-02
-6.5226-02	-6.2059-02	-5.9148-02	-5.6471-02	-5.4413-02	-5.3631-02	-5.4795-02	-5.8321-02	-6.4199-02	-7.1981-02
-8.0921-02	-9.0204-02	-9.9154-02	-1.0734-01	-1.1452-01	-1.2055-01	-1.2516-01	-1.2791-01	-1.2822-01	-1.2555-01
-1.1961-01	-1.1061-01	-9.9277-02	-8.6796-02	-7.4533-02	-6.3758-02	-5.5388-02	-4.9864-02	-4.7178-02	-4.7016-02
-4.8949-02	-5.2574-02	-5.7589-02	-6.3765-02	-7.0886-02	-7.8685-02	-8.6826-02	-9.4921-02	-1.0256-01	-1.0931-01
-1.1465-01	-1.1793-01	-1.1827-01	-1.1470-01	-1.0636-01	-9.2797-02	-7.4347-02	-5.2344-02	-2.9063-02	-7.3466-03
1.0031-02	2.1099-02	2.5281-02	2.3638-02	1.8635-02	1.3497-02	1.1314-02	1.4191-02	2.2706-02	3.5843-02
5.1414-02	6.6810-02	7.9843-02	8.5387-02	9.5649-02	1.0001-01	1.0454-01	1.1131-01	1.2184-01	1.3671-01
1.5548-01	1.7685-01	1.9900-01	2.1995-01	2.3789-01	2.5137-01	2.5944-01	2.6171-01	2.5833-01	2.4995-01
2.3760-01	2.2247-01	2.0573-01	1.8824-01						

SPAN STATION 3 CHORD STATION 5

-5.4397-01	-5.6649-01	-5.8849-01	-6.0934-01	-6.2881-01	-6.4716-01	-6.6496-01	-6.8286-01	-7.0132-01	-7.2044-01
-7.3988-01	-7.5902-01	-7.7714-01	-7.9366-01	-8.0824-01	-8.2078-01	-8.3131-01	-8.3986-01	-8.4629-01	-8.5036-01
-8.5182-01	-8.5057-01	-8.4681-01	-8.4107-01	-8.3408-01	-8.2654-01	-8.1890-01	-8.1124-01	-8.0331-01	-7.9475-01
-7.8538-01	-7.7547-01	-7.6575-01	-7.5729-01	-7.5103-01	-7.4735-01	-7.4572-01	-7.4465-01	-7.4199-01	-7.3548-01
-7.2349-01	-7.0554-01	-6.8255-01	-6.5664-01	-6.3057-01	-6.0692-01	-5.8743-01	-5.7252-01	-5.6131-01	-5.5200-01
-5.4249-01	-5.3112-01	-5.1706-01	-5.0052-01	-4.8257-01	-4.6464-01	-4.4804-01	-4.3358-01	-4.2135-01	-4.1085-01
-4.0122-01	-3.9165-01	-3.8162-01	-3.7109-01	-3.6045-01	-3.5032-01	-3.4133-01	-3.3387-01	-3.2800-01	-3.2346-01
-3.1972-01	-3.1621-01	-3.1246-01	-3.0820-01	-3.0342-01	-2.9830-01	-2.9315-01	-2.8830-01	-2.8397-01	-2.8025-01
-2.7710-01	-2.7441-01	-2.7204-01	-2.6995-01	-2.6819-01	-2.6691-01	-2.6629-01	-2.6651-01	-2.6761-01	-2.6949-01
-2.7194-01	-2.7466-01	-2.7748-01	-2.8022-01	-2.8293-01	-2.8576-01	-2.8886-01	-2.9230-01	-2.9591-01	-2.9930-01
-3.0192-01	-3.0318-01	-3.0267-01	-3.0027-01	-2.9628-01	-2.9136-01	-2.8642-01	-2.8244-01	-2.8024-01	-2.8038-01
-2.8302-01	-2.8796-01	-2.9472-01	-3.0260-01	-3.1090-01	-3.1892-01	-3.2615-01	-3.3230-01	-3.3730-01	-3.4137-01
-3.4491-01	-3.4841-01	-3.5233-01	-3.5694-01	-3.6225-01	-3.6798-01	-3.7364-01	-3.7872-01	-3.8284-01	-3.8592-01
-3.8820-01	-3.9024-01	-3.9270-01	-3.9622-01	-4.0121-01	-4.0785-01	-4.1610-01	-4.2588-01	-4.3716-01	-4.5008-01
-4.6488-01	-4.8180-01	-5.0087-01	-5.2181-01						

SPAN STATION 4 CHORD STATION 1

8.8080+00	8.5549+00	8.3034+00	8.0504+00	7.7850+00	7.4964+00	7.1808+00	6.8407+00	6.4913+00	6.1480+00
5.8239+00	5.5252+00	5.2506+00	4.9939+00	4.7496+00	4.5154+00	4.2940+00	4.0894+00	3.9027+00	3.7278+00
3.5502+00	3.3514+00	3.1150+00	2.8354+00	2.5221+00	2.1996+00	1.9011+00	1.6581+00	1.4907+00	1.4006+00
1.3717+00	1.3763+00	1.3855+00	1.3795+00	1.3537+00	1.3188+00	1.2948+00	1.3016+00	1.3610+00	1.4424+00
1.5633+00	1.6958+00	1.8241+00	1.9409+00	2.0497+00	2.1629+00	2.2959+00	2.4604+00	2.6694+00	2.8858+00
3.1246+00	3.3576+00	3.5681+00	3.7449+00	3.8831+00	3.9834+00	4.0499+00	4.0876+00	4.1020+00	4.0983+00
4.0820+00	4.0586+00	4.0332+00	4.0089+00	3.9856+00	3.9596+00	3.9248+00	3.8747+00	3.8051+00	3.7158+00
3.6111+00	3.4981+00	3.3848+00	3.2772+00	3.1786+00	3.0891+00	3.0077+00	2.9342+00	2.8703+00	2.8197+00
2.7866+00	2.7736+00	2.7813+00	2.8059+00	2.8423+00	2.8850+00	2.9303+00	2.9766+00	3.0241+00	3.0725+00
3.1197+00	3.1612+00	3.1907+00	3.2030+00	3.1965+00	3.1746+00	3.1455+00	3.1194+00	3.1052+00	3.1082+00
3.1289+00	3.1652+00	3.2157+00	3.2831+00	3.3753+00	3.5030+00	3.6753+00	3.8935+00	4.1479+00	4.4173+00
4.6749+00	4.8963+00	5.0681+00	5.1938+00	5.2928+00	5.3944+00	5.5272+00	5.7091+00	5.9487+00	6.2062+00
6.4798+00	6.7361+00	6.9600+00	7.1517+00	7.3250+00	7.5005+00	7.6954+00	7.9155+00	8.1528+00	8.3887+00
8.6021+00	8.7785+00	8.9160+00	9.0252+00	9.1235+00	9.2262+00	9.3380+00	9.4492+00	9.5385+00	9.5796+00
9.5522+00	9.4484+00	9.2760+00	9.0547+00						

SPAN STATION 4 CHORD STATION 2

Figure 3. Sample Output - Continued.

4.1000+00	4.1721+00	4.2522+00	4.3273+00	4.3819+00	4.4020+00	4.3785+00	4.3098+00	4.2016+00	4.0649+00
3.9127+00	3.7571+00	3.6070+00	3.4679+00	3.3422+00	3.2310+00	3.1339+00	3.0498+00	2.9754+00	2.9050+00
2.8308+00	2.7440+00	2.6379+00	2.5101+00	2.3646+00	2.2110+00	2.0624+00	1.9312+00	1.8262+00	1.7492+00
1.6962+00	1.6589+00	1.6291+00	1.6018+00	1.5769+00	1.5586+00	1.5528+00	1.5633+00	1.5891+00	1.6242+00
1.6593+00	1.6853+00	1.6976+00	1.6986+00	1.6976+00	1.7084+00	1.7445+00	1.8151+00	1.9214+00	2.0565+00
2.2067+00	2.3552+00	2.4863+00	2.5877+00	2.6528+00	2.6799+00	2.6714+00	2.6321+00	2.5685+00	2.4880+00
2.3986+00	2.3085+00	2.2251+00	2.1538+00	2.0967+00	2.0517+00	2.0137+00	1.9757+00	1.9311+00	1.8761+00
1.8107+00	1.7384+00	1.6651+00	1.5966+00	1.5371+00	1.4880+00	1.4485+00	1.4169+00	1.3916+00	1.3727+00
1.3617+00	1.3607+00	1.3713+00	1.3933+00	1.4243+00	1.4604+00	1.4971+00	1.5310+00	1.5598+00	1.5832+00
1.6014+00	1.6151+00	1.6242+00	1.6282+00	1.6269+00	1.6206+00	1.6115+00	1.6031+00	1.5994+00	1.6042+00
1.6199+00	1.6475+00	1.6867+00	1.7374+00	1.7999+00	1.8748+00	1.9629+00	2.0629+00	2.1707+00	2.2792+00
2.3792+00	2.4622+00	2.5234+00	2.5639+00	2.5912+00	2.6173+00	2.6549+00	2.7132+00	2.7946+00	2.8941+00
3.0006+00	3.1018+00	3.1880+00	3.2560+00	3.3098+00	3.3587+00	3.4132+00	3.4809+00	3.5634+00	3.6555+00
3.7476+00	3.8290+00	3.8917+00	3.9326+00	3.9540+00	3.9616+00	3.9620+00	3.9606+00	3.9604+00	3.9628+00
3.9690+00	3.9817+00	4.0050+00	4.0436+00						

SPAN STATION 4 CHORD STATION 3

1.9663+00	1.9927+00	1.9844+00	1.9079+00	1.7557+00	1.5540+00	1.3563+00	1.2242+00	1.2032+00	1.3034+00
1.4926+00	1.7072+00	1.8744+00	1.9391+00	1.8827+00	1.7282+00	1.5280+00	1.3409+00	1.2080+00	1.1378+00
1.1040+00	1.0625+00	9.7002-01	8.0497-01	5.7689-01	3.2187-01	8.7134-02	-8.8267-02	-1.8790-01	-2.2165-01
-2.1798-01	-2.0918-01	-2.1703-01	-2.4542-01	-2.8271-01	-3.1169-01	-3.2116-01	-3.1264-01	-2.9850-01	-2.9226-01
-2.9651-01	-2.9515-01	-2.5542-01	-1.4033-01	7.3299-02	3.7906-01	7.3542-01	1.0743+00	1.3222+00	1.4249+00
1.3683+00	1.1835+00	9.3696-01	7.0698-01	5.5656-01	5.1329-01	5.6348-01	6.6228-01	7.5473-01	7.9856-01
7.7965-01	7.1382-01	6.3633-01	5.8371-01	5.7716-01	6.1421-01	6.7196-01	7.1927-01	7.3186-01	7.0311-01
6.4592-01	5.8527-01	5.4575-01	5.3997-01	5.6352-01	5.9839-01	6.2277-01	6.2236-01	5.9746-01	5.6264-01
5.3942-01	5.4549-01	5.8605-01	6.5118-01	7.2052-01	7.7288-01	7.9592-01	7.9146-01	7.7383-01	7.6227-01
7.7131-01	8.0365-01	8.4916-01	8.9022-01	9.1081-01	9.0465-01	8.7866-01	8.4979-01	8.3707-01	8.5271-01
8.9660-01	9.5699-01	1.0168+00	1.0627+00	1.0916+00	1.1125+00	1.1414+00	1.1925+00	1.2701+00	1.3648+00
1.4568+00	1.5244+00	1.5544+00	1.5485+00	1.5237+00	1.5049+00	1.5144+00	1.5615+00	1.6390+00	1.7264+00
1.7995+00	1.8417+00	1.8516+00	1.8427+00	1.8372+00	1.8545+00	1.9025+00	1.9735+00	2.0486+00	2.1075+00
2.1381+00	2.1431+00	2.1378+00	2.1418+00	2.1681+00	2.2147+00	2.2645+00	2.2925+00	2.2783+00	2.2172+00
2.1247+00	2.0306+00	1.9659+00	1.9470+00						

SPAN STATION 4 CHORD STATION 4

4.3393-01	4.3344-01	4.3306-01	4.3237-01	4.3102-01	4.2889-01	4.2614-01	4.2322-01	4.2066-01	4.1888-01
4.1803-01	4.1786-01	4.1794-01	4.1758-01	4.1636-01	4.1414-01	4.1118-01	4.0807-01	4.0551-01	4.0408-01
4.0405-01	4.0530-01	4.0742-01	4.0988-01	4.1219-01	4.1407-01	4.1548-01	4.1657-01	4.1752-01	4.1846-01
4.1941-01	4.2030-01	4.2102-01	4.2156-01	4.2195-01	4.2231-01	4.2271-01	4.2311-01	4.2334-01	4.2310-01
4.2213-01	4.2033-01	4.1785-01	4.1512-01	4.1271-01	4.1117-01	4.1084-01	4.1172-01	4.1348-01	4.1561-01
4.1760-01	4.1910-01	4.2000-01	4.2047-01	4.2074-01	4.2102-01	4.2136-01	4.2164-01	4.2167-01	4.2134-01
4.2071-01	4.2004-01	4.1975-01	4.2018-01	4.2147-01	4.2344-01	4.2563-01	4.2744-01	4.2839-01	4.2825-01
4.2722-01	4.2575-01	4.2442-01	4.2367-01	4.2364-01	4.2413-01	4.2470-01	4.2490-01	4.2446-01	4.2347-01
4.2229-01	4.2142-01	4.2127-01	4.2196-01	4.2324-01	4.2462-01	4.2555-01	4.2567-01	4.2497-01	4.2380-01
4.2271-01	4.2222-01	4.2261-01	4.2376-01	4.2526-01	4.2653-01	4.2711-01	4.2685-01	4.2599-01	4.2503-01
4.2455-01	4.2496-01	4.2632-01	4.2833-01	4.3046-01	4.3215-01	4.3303-01	4.3306-01	4.3253-01	4.3191-01
4.3163-01	4.3193-01	4.3276-01	4.3383-01	4.3472-01	4.3511-01	4.3487-01	4.3414-01	4.3327-01	4.3267-01
4.3269-01	4.3349-01	4.3498-01	4.3690-01	4.3888-01	4.4057-01	4.4171-01	4.4218-01	4.4205-01	4.4148-01
4.4072-01	4.4003-01	4.3964-01	4.3968-01	4.4013-01	4.4086-01	4.4159-01	4.4203-01	4.4190-01	4.4110-01
4.3969-01	4.3794-01	4.3621-01	4.3482-01						

SPAN STATION 4 CHORD STATION 5

-2.1187-01	-2.1652-01	-2.2478-01	-2.3779-01	-2.5464-01	-2.7255-01	-2.8774-01	-2.9676-01	-2.9763-01	-2.9057-01
-2.7778-01	-2.6264-01	-2.4854-01	-2.3774-01	-2.3089-01	-2.2713-01	-2.2488-01	-2.2277-01	-2.2041-01	-2.1857-01
-2.1876-01	-2.2243-01	-2.3002-01	-2.4045-01	-2.5121-01	-2.5900-01	-2.6070-01	-2.5444-01	-2.4007-01	-2.1919-01
-1.9461-01	-1.6947-01	-1.4648-01	-1.2740-01	-1.1300-01	-1.0329-01	-9.7962-02	-9.6658-02	-9.9063-02	-1.0476-01

Figure 3. Sample Output - Continued.

-1.1300-01	-1.2260-01	-1.3203-01	-1.3978-01	-1.4481-01	-1.4687-01	-1.4660-01	-1.4529-01	-1.4434-01	-1.4472-01
-1.4657-01	-1.4918-01	-1.5123-01	-1.5135-01	-1.4860-01	-1.4283-01	-1.3467-01	-1.2527-01	-1.1588-01	-1.0747-01
-1.0056-01	-9.5237-02	-9.1342-02	-8.8735-02	-8.7408-02	-8.7464-02	-8.8970-02	-9.1782-02	-9.5471-02	-9.9401-02
-1.0295-01	-1.0577-01	-1.0793-01	-1.0988-01	-1.1225-01	-1.1549-01	-1.1962-01	-1.2411-01	-1.2804-01	-1.3047-01
-1.3080-01	-1.2906-01	-1.2595-01	-1.2263-01	-1.2031-01	-1.1988-01	-1.2164-01	-1.2533-01	-1.3032-01	-1.3588-01
-1.4149-01	-1.4692-01	-1.5213-01	-1.5709-01	-1.6161-01	-1.6523-01	-1.6739-01	-1.6759-01	-1.6568-01	-1.6193-01
-1.5699-01	-1.5166-01	-1.4657-01	-1.4197-01	-1.3770-01	-1.3339-01	-1.2876-01	-1.2393-01	-1.1953-01	-1.1656-01
-1.1609-01	-1.1881-01	-1.2468-01	-1.3286-01	-1.4189-01	-1.5011-01	-1.5610-01	-1.5910-01	-1.5909-01	-1.5670-01
-1.5293-01	-1.4883-01	-1.4520-01	-1.4251-01	-1.4089-01	-1.4016-01	-1.3996-01	-1.3973-01	-1.3878-01	-1.3642-01
-1.3213-01	-1.2591-01	-1.1844-01	-1.1124-01	-1.0637-01	-1.0598-01	-1.1157-01	-1.2337-01	-1.4011-01	-1.5921-01
-1.7752-01	-1.9235-01	-2.0239-01	-2.0816-01						

SPAN STATION 5 CHORD STATION 1

7.8284+00	7.4869+00	7.0825+00	6.6284+00	6.1435+00	5.6457+00	5.1486+00	4.6601+00	4.1856+00	3.7305+00
3.3034+00	2.9159+00	2.5806+00	2.3068+00	2.0972+00	1.9456+00	1.8373+00	1.7523+00	1.6693+00	1.5712+00
1.4474+00	1.2964+00	1.1225+00	9.3754-01	7.5368-01	5.8227-01	4.3114-01	3.0340-01	1.9759-01	1.0888-01
3.1129-02	-4.0720-02	-1.0867-01	-1.7058-01	-2.2045-01	-2.5008-01	-2.5173-01	-2.2882-01	-1.5776-01	-6.8160-02
3.8856-02	1.5364-01	2.6931-01	3.8407-01	5.0166-01	6.2962-01	7.7616-01	9.4656-01	1.1407+00	1.3525+00
1.5713+00	1.7846+00	1.9817+00	2.1550+00	2.3015+00	2.4213+00	2.5163+00	2.5884+00	2.6394+00	2.6708+00
2.6853+00	2.6874+00	2.6829+00	2.6777+00	2.6760+00	2.6778+00	2.6792+00	2.6728+00	2.6509+00	2.6081+00
2.5443+00	2.4647+00	2.3786+00	2.2964+00	2.2259+00	2.1706+00	2.1293+00	2.0977+00	2.0713+00	2.0482+00
2.0298+00	2.0210+00	2.0270+00	2.0516+00	2.0945+00	2.1516+00	2.2161+00	2.2807+00	2.3401+00	2.3919+00
2.4358+00	2.4729+00	2.5032+00	2.5258+00	2.5387+00	2.5410+00	2.5343+00	2.5235+00	2.5164+00	2.5210+00
2.5439+00	2.5876+00	2.6523+00	2.7352+00	2.8358+00	2.9565+00	3.1025+00	3.2794+00	3.4885+00	3.7230+00
3.9667+00	4.1969+00	4.3908+00	4.5346+00	4.6297+00	4.6947+00	4.7609+00	4.8617+00	5.0204+00	5.2403+00
5.5011+00	5.7655+00	5.9916+00	6.1497+00	6.2352+00	6.2737+00	6.3151+00	6.4185+00	6.6323+00	6.9767+00
7.4351+00	7.9564+00	8.4693+00	8.9017+00	9.2003+00	9.3431+00	9.3417+00	9.2330+00	9.0638+00	8.8754+00
8.6912+00	8.5131+00	8.3254+00	8.1042+00						

SPAN STATION 5 CHORD STATION 2

1.7821+00	1.5385+00	1.3153+00	1.1998+00	1.2601+00	1.5173+00	1.9310+00	2.4073+00	2.8262+00	3.0791+00
3.1032+00	2.8997+00	2.5302+00	2.0930+00	1.6887+00	1.3888+00	1.2172+00	1.1518+00	1.1413+00	1.1303+00
1.0809+00	9.8365-01	8.5375-01	7.1816-01	5.9947-01	5.0540-01	4.2789-01	3.5112-01	2.6317-01	1.6467-01
6.9368-02	-3.7753-03	-4.3098-02	-5.4672-02	-6.4730-02	-1.1181-01	-2.3125-01	-4.3863-01	-7.1962-01	-1.0313+00
-1.3151+00	-1.5167+00	-1.6042+00	-1.5781+00	-1.4684+00	-1.3207+00	-1.1774+00	-1.0620+00	-9.7247-01	-8.8671-01
-7.7636-01	-6.2255-01	-4.2662-01	-2.1114-01	-1.1069-02	1.4057-01	2.2610-01	2.4972-01	2.3477-01	2.1321-01
2.1241-01	2.4489-01	3.0544-01	3.7599-01	4.3545-01	4.6974-01	4.7737-01	4.6840-01	4.5810-01	4.5857-01
4.7283-01	4.9397-01	5.0957-01	5.0890-01	4.8912-01	4.5733-01	4.2759-01	4.1431-01	4.2556-01	4.5937-01
5.0502-01	5.4852-01	5.7955-01	5.9635-01	6.0631-01	6.2182-01	6.5359-01	7.0469-01	7.6833-01	8.3043-01
8.7583-01	8.9511-01	8.8881-01	8.6699-01	8.4434-01	8.3344-01	8.3920-01	8.5731-01	8.7728-01	8.8862-01
8.8689-01	8.7681-01	8.7077-01	8.8343-01	9.2506-01	9.9678-01	1.0899+00	1.1896+00	1.2813+00	1.3559+00
1.4128+00	1.4578+00	1.4988+00	1.5407+00	1.5831+00	1.6210+00	1.6496+00	1.6683+00	1.6834+00	1.7061+00
1.7473+00	1.8113+00	1.8913+00	1.9712+00	2.0316+00	2.0591+00	2.0533+00	2.0295+00	2.0124+00	2.0260+00
2.0814+00	2.1701+00	2.2660+00	2.3352+00	2.3511+00	2.3069+00	2.2201+00	2.1256+00	2.0597+00	2.0423+00
2.0648+00	2.0916+00	2.0739+00	1.9728+00						

SPAN STATION 5 CHORD STATION 3

-5.7085-01	-7.3682-01	-8.5335-01	-9.2409-01	-9.8502-01	-1.0934+00	-1.3040+00	-1.6424+00	-2.0889+00	-2.5612+00
-2.9634+00	-3.1882+00	-3.1683+00	-2.8991+00	-2.4430+00	-1.9116+00	-1.4305+00	-1.0999+00	-9.6583-01	-1.0117+00
-1.1721+00	-1.3623+00	-1.5114+00	-1.5866+00	-1.5986+00	-1.5904+00	-1.6124+00	-1.6987+00	-1.8512+00	-2.0401+00
-2.2179+00	-2.3396+00	-2.3810+00	-2.3464+00	-2.2633+00	-2.1689+00	-2.0927+00	-2.0460+00	-2.0205+00	-1.9971+00
-1.9594+00	-1.9048+00	-1.8484+00	-1.8168+00	-1.8356+00	-1.9158+00	-2.0454+00	-2.1918+00	-2.3115+00	-2.3656+00
-2.3335+00	-2.2191+00	-2.0477+00	-1.8555+00	-1.6760+00	-1.5291+00	-1.4176+00	-1.3306+00	-1.2517+00	-1.1684+00
-1.0776+00	-9.8502-01	-9.0061-01	-8.3218-01	-7.8066-01	-7.3965-01	-6.9908-01	-6.5084-01	-5.9336-01	-5.3259-01
-4.7901-01	-4.4210-01	-4.2527-01	-4.2359-01	-4.2585-01	-4.1963-01	-3.9702-01	-3.5821-01	-3.1100-01	-2.6668-01
-2.3424-01	-2.1581-01	-2.0559-01	-1.9281-01	-1.6728-01	-1.2467-01	-6.9098-02	-1.1508-02	3.5240-02	6.2248-02

Figure 3. Sample Output - Continued.

6.8571-02	6.1399-02	5.2369-02	5.1859-02	6.4082-02	8.5377-02	1.0651-01	1.1780-01	1.1447-01	9.9557-02
8.2836-02	7.6358-02	8.8735-02	1.2107-01	1.6658-01	2.1404-01	2.5337-01	2.8048-01	2.9880-01	3.1676-01
3.4239-01	3.7791-01	4.1730-01	4.4830-01	4.5829-01	4.4119-01	4.0185-01	3.5546-01	3.2165-01	3.1587-01
3.4188-01	3.8914-01	4.3676-01	4.6252-01	4.5296-01	4.0996-01	3.5044-01	2.9901-01	2.7680-01	2.9146-01
3.3317-01	3.7869-01	4.0173-01	3.8498-01	3.2798-01	2.4699-01	1.6660-01	1.0704-01	7.3142-02	5.0771-02
1.2837-02	-6.7409-02	-2.0202-01	-3.8014-01						

SPAN STATION 5 CHORD STATION 4

-1.4346+00	-1.4987+00	-1.5744+00	-1.6608+00	-1.7511+00	-1.8350+00	-1.9025+00	-1.9476+00	-1.9716+00	-1.9823+00
-1.9915+00	-2.0107+00	-2.0463+00	-2.0976+00	-2.1573+00	-2.2142+00	-2.2578+00	-2.2819+00	-2.2862+00	-2.2751+00
-2.2544+00	-2.2277+00	-2.1935+00	-2.1455+00	-2.0751+00	-1.9752+00	-1.8444+00	-1.6891+00	-1.5228+00	-1.3593+00
-1.2161+00	-1.1020+00	-1.0202+00	-9.6749-01	-9.3769-01	-9.2500-01	-9.2643-01	-9.4226-01	-9.7438-01	-1.0235+00
-1.0866+00	-1.1562+00	-1.2215+00	-1.2714+00	-1.2981+00	-1.2993+00	-1.2787+00	-1.2441+00	-1.2046+00	-1.1669+00
-1.1338+00	-1.1042+00	-1.0748+00	-1.0428+00	-1.0073+00	-9.7057-01	-9.3653-01	-9.0873-01	-8.8839-01	-8.7339-01
-8.5899-01	-8.3980-01	-8.1219-01	-7.7603-01	-7.3487-01	-6.9462-01	-6.6110-01	-6.3771-01	-6.2421-01	-6.1703-01
-6.1100-01	-6.0165-01	-5.8699-01	-5.6811-01	-5.4824-01	-5.3099-01	-5.1842-01	-5.1000-01	-5.0285-01	-4.9307-01
-4.7761-01	-4.5563-01	-4.2888-01	-4.0091-01	-3.7553-01	-3.5531-01	-3.4078-01	-3.3070-01	-3.2313-01	-3.1672-01
-3.1155-01	-3.0907-01	-3.1111-01	-3.1858-01	-3.3052-01	-3.4399-01	-3.5499-01	-3.5996-01	-3.5732-01	-3.4805-01
-3.3529-01	-3.2289-01	-3.1373-01	-3.0849-01	-3.0549-01	-3.0170-01	-2.9445-01	-2.8307-01	-2.6964-01	-2.5851-01
-2.5480-01	-2.6240-01	-2.8246-01	-3.1295-01	-3.4940-01	-3.8655-01	-4.2014-01	-4.4813-01	-4.7091-01	-4.9053-01
-5.0951-01	-5.2972-01	-5.5183-01	-5.7556-01	-6.0024-01	-6.2539-01	-6.5092-01	-6.7681-01	-7.0263-01	-7.2719-01
-7.4890-01	-7.6664-01	-7.8097-01	-7.9480-01	-8.1327-01	-8.4230-01	-8.8655-01	-9.4734-01	-1.0217+00	-1.1032+00
-1.1837+00	-1.2569+00	-1.3207+00	-1.3777+00						

SPAN STATION 5 CHORD STATION 5

-7.7242-01	-7.7638-01	-7.7852-01	-7.7857-01	-7.7621-01	-7.7129-01	-7.6410-01	-7.5546-01	-7.4659-01	-7.3875-01
-7.3276-01	-7.2857-01	-7.2510-01	-7.2054-01	-7.1293-01	-7.0092-01	-6.8448-01	-6.6510-01	-6.4550-01	-6.2882-01
-6.1758-01	-6.1265-01	-6.1280-01	-6.1484-01	-6.1436-01	-6.0691-01	-5.8926-01	-5.6022-01	-5.2101-01	-4.7895-01
-4.2674-01	-3.8144-01	-3.4360-01	-3.1656-01	-3.0207-01	-3.0028-01	-3.0981-01	-3.2808-01	-3.5165-01	-3.7671-01
-3.9959-01	-4.1736-01	-4.2830-01	-4.3220-01	-4.3033-01	-4.2503-01	-4.1909-01	-4.1492-01	-4.1402-01	-4.1667-01
-4.2205-01	-4.2867-01	-4.3500-01	-4.3987-01	-4.4278-01	-4.4373-01	-4.4300-01	-4.4082-01	-4.3719-01	-4.3196-01
-4.2511-01	-4.1702-01	-4.0863-01	-4.0134-01	-3.9658-01	-3.9534-01	-3.9775-01	-4.0291-01	-4.0918-01	-4.1468-01
-4.1794-01	-4.1836-01	-4.1629-01	-4.1283-01	-4.0921-01	-4.0628-01	-4.0415-01	-4.0220-01	-3.9946-01	-3.9514-01
-3.8909-01	-3.8193-01	-3.7490-01	-3.6934-01	-3.6614-01	-3.6543-01	-3.6650-01	-3.6817-01	-3.6932-01	-3.6932-01
-3.6829-01	-3.6695-01	-3.6620-01	-3.6664-01	-3.6820-01	-3.7016-01	-3.7140-01	-3.7100-01	-3.6865-01	-3.6489-01
-3.6095-01	-3.5830-01	-3.5806-01	-3.6055-01	-3.6525-01	-3.7101-01	-3.7665-01	-3.8147-01	-3.8563-01	-3.9012-01
-3.9634-01	-4.0554-01	-4.1829-01	-4.3419-01	-4.5204-01	-4.7022-01	-4.8730-01	-5.0248-01	-5.1577-01	-5.2784-01
-5.3962-01	-5.5180-01	-5.6455-01	-5.7740-01	-5.8950-01	-5.9990-01	-6.0802-01	-6.1383-01	-6.1787-01	-6.2110-01
-6.2460-01	-6.2932-01	-6.3589-01	-6.4459-01	-6.5537-01	-6.6794-01	-6.8186-01	-6.9655-01	-7.1134-01	-7.2554-01
-7.3853-01	-7.4984-01	-7.5925-01	-7.6673-01						

Figure 3. Sample Output - Continued.

XLO XLM XMM

.00									
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00								
3.37									
-4.87	2.88	1.00	-.50	-.65	-.14	.00	-.02	.13	-.20
-.08	-.04	.02	-.01	.12	.05	3.99	-4.07	1.96	1.15
.56	.09	.18	-.14	.07	.03	.01	.08	.15	.01
.01	.01								
15.68									
.47	6.93	3.43	-1.66	-.09	.46	-.30	-.07	.30	-.14
-.28	.22	.23	-.21	-.04	.14	1.41	-4.23	2.58	1.21
-.42	-.35	.54	-.25	-.02	.28	-.04	-.15	.22	.11
-.17	.04								
17.46									
6.29	6.77	2.89	-.89	.32	.58	.50	-.01	-.71	.12
.00	-.47	.25	.52	-.18	-.17	.63	-3.45	1.80	.41
-.10	-.87	.47	.87	-.20	-.52	.44	.04	-.53	.17
.35	-.15								
18.99									
8.33	5.58	1.44	-1.22	.08	.14	-.27	.42	.30	-.25
-.10	.32	.10	.00	-.04	-.45	-4.66	-4.01	1.31	-.07
-.72	-.54	.00	-.20	.17	.12	-.13	.12	.24	.01
.22	.16								
-3.70									
1.49	3.25	-.08	.92	1.22	-.29	-.01	.51	-.13	-.28
-.39	-.28	.09	.03	.18	.27	-14.05	-4.43	-1.97	-2.28
-.33	-.80	-.40	.26	.38	.23	.34	.07	-.05	-.28
-.43	-.17								
.00									
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00								

B01 .851500+01 B1 .178780+01 B11 -.915460+01 CHORD .182000+02 OMEGA .204000+03 BLADES 5.

RADIUS AT START OF TWIST .740000+02

BLADE SECTION LOADING

RADIUS		1	2	3	4	5	6	7	8
AZIMUTH		.000000	.148800+03	.279000+03	.316200+03	.353400+03	.364560+03	.372000+03	
1	.0	.000000	.106036+01	.250871+02	.332642+02	.333852+02	.279480+01	.000000	
2	2.5	.000000	.165807+01	.252873+02	.332935+02	.331405+02	.629414-00	.000000	
3	5.0	.000000	.219971+01	.253528+02	.332073+02	.327594+02	-.148130+01	.000000	
4	7.5	.000000	.265998+01	.252857+02	.329744+02	.320694+02	-.336203+01	.000000	
5	10.0	.000000	.303862+01	.251021+02	.325735+02	.309940+02	-.495501+01	.000000	
6	12.5	.000000	.334723+01	.248204+02	.320037+02	.296041+02	-.635305+01	.000000	
7	15.0	.000000	.359401+01	.244525+02	.312838+02	.281075+02	-.776272+01	.000000	
8	17.5	.000000	.377395+01	.240007+02	.304417+02	.267758+02	-.940912+01	.000000	
9	20.0	.000000	.386849+01	.234617+02	.294982+02	.258384+02	-.114211+02	.000000	
10	22.5	.000000	.385404+01	.228336+02	.284548+02	.253866+02	-.137470+02	.000000	
11	25.0	.000000	.371428+01	.221213+02	.272944+02	.253306+02	-.161410+02	.000000	

Figure 3. Sample Output - Continued.

12	27.5	.000000	.344982+01	.213366+02	.259991+02	.254310+02	-.182316+02	.000000
13	30.0	.000000	.308021+01	.204927+02	.245769+02	.253908+02	-.196501+02	.000000
14	32.5	.000000	.263719+01	.195970+02	.230869+02	.249729+02	-.201696+02	.000000
15	35.0	.000000	.215249+01	.186460+02	.216450+02	.240915+02	-.197988+02	.000000
16	37.5	.000000	.164613+01	.176278+02	.204019+02	.228397+02	-.187929+02	.000000
17	40.0	.000000	.112094+01	.165313+02	.194950+02	.214411+02	-.175737+02	.000000
18	42.5	.000000	.566111-00	.153574+02	.189912+02	.201481+02	-.165890+02	.000000
19	45.0	.000000	-.316421-01	.141274+02	.188421+02	.191289+02	-.161658+02	.000000
20	47.5	.000000	-.674517-00	.128811+02	.188768+02	.183956+02	-.164109+02	.000000
21	50.0	.000000	-.134398+01	.116648+02	.188412+02	.178010+02	-.171951+02	.000000
22	52.5	.000000	-.199980+01	.105126+02	.184753+02	.171068+02	-.182235+02	.000000
23	55.0	.000000	-.258856+01	.943093+01	.176039+02	.160928+02	-.191579+02	.000000
24	57.5	.000000	-.305827+01	.839519+01	.162045+02	.146583+02	-.197430+02	.000000
25	60.0	.000000	-.337270+01	.736281+01	.144225+02	.128731+02	-.198852+02	.000000
26	62.5	.000000	-.351955+01	.630024+01	.125255+02	.109570+02	-.196595+02	.000000
27	65.0	.000000	-.350887+01	.521250+01	.108070+02	.919680+01	-.192489+02	.000000
28	67.5	.000000	-.336301+01	.416107+01	.947868+01	.783959+01	-.188487+02	.000000
29	70.0	.000000	-.310294+01	.325861+01	.859301+01	.700525+01	-.185793+02	.000000
30	72.5	.000000	-.273734+01	.263789+01	.803050+01	.665534+01	-.184464+02	.000000
31	75.0	.000000	-.225995+01	.240388+01	.756115+01	.662653+01	-.183592+02	.000000
32	77.5	.000000	-.165613+01	.258749+01	.695815+01	.670988+01	-.181951+02	.000000
33	80.0	.000000	-.915862-00	.312148+01	.611872+01	.673824+01	-.178761+02	.000000
34	82.5	.000000	-.467672-01	.385275+01	.514044+01	.664336+01	-.174199+02	.000000
35	85.0	.000000	.919450-00	.459139+01	.431622+01	.646117+01	-.169425+02	.000000
36	87.5	.000000	.193109+01	.518153+01	.404222+01	.628891+01	-.166113+02	.000000
37	90.0	.000000	.293047+01	.556790+01	.466840+01	.622039+01	-.165716+02	.000000
38	92.5	.000000	.387266+01	.583082+01	.634729+01	.629407+01	-.168801+02	.000000
39	95.0	.000000	.474142+01	.617224+01	.894088+01	.648001+01	-.174766+02	.000000
40	97.5	.000000	.555529+01	.685332+01	.120266+02	.671079+01	-.182050+02	.000000
41	100.0	.000000	.636062+01	.810280+01	.150072+02	.693791+01	-.188747+02	.000000
42	102.5	.000000	.721342+01	.100283+02	.172898+02	.718151+01	-.193335+02	.000000
43	105.0	.000000	.815639+01	.125636+02	.184721+02	.754384+01	-.195201+02	.000000
44	107.5	.000000	.919976+01	.154717+02	.184695+02	.817416+01	-.194743+02	.000000
45	110.0	.000000	.103129+02	.184062+02	.175372+02	.919770+01	-.193016+02	.000000
46	112.5	.000000	.114304+02	.210091+02	.161809+02	.106405+02	-.191099+02	.000000
47	115.0	.000000	.124697+02	.230108+02	.149879+02	.123870+02	-.189493+02	.000000
48	117.5	.000000	.133548+02	.242999+02	.144392+02	.141951+02	-.187807+02	.000000
49	120.0	.000000	.140375+02	.249382+02	.147690+02	.157674+02	-.184888+02	.000000
50	122.5	.000000	.145083+02	.251190+02	.159146+02	.168528+02	-.179329+02	.000000
51	125.0	.000000	.147955+02	.250881+02	.175691+02	.173373+02	-.170122+02	.000000
52	127.5	.000000	.149522+02	.250573+02	.193085+02	.172840+02	-.157173+02	.000000
53	130.0	.000000	.150384+02	.251420+02	.207422+02	.169072+02	-.141456+02	.000000
54	132.5	.000000	.151027+02	.253430+02	.216314+02	.164869+02	-.124739+02	.000000
55	135.0	.000000	.151724+02	.255727+02	.219384+02	.162620+02	-.109002+02	.000000
56	137.5	.000000	.152513+02	.257120+02	.217979+02	.163442+02	-.957932+01	.000000
57	140.0	.000000	.153269+02	.256696+02	.214321+02	.166875+02	-.857757+01	.000000
58	142.5	.000000	.153814+02	.254222+02	.210509+02	.171237+02	-.786310+01	.000000
59	145.0	.000000	.154022+02	.250188+02	.207764+02	.174459+02	-.733263+01	.000000
60	147.5	.000000	.153867+02	.245538+02	.206177+02	.175016+02	-.686043+01	.000000
61	150.0	.000000	.153415+02	.241229+02	.204971+02	.172565+02	-.634783+01	.000000
62	152.5	.000000	.152758+02	.237814+02	.203082+02	.168012+02	-.575405+01	.000000
63	155.0	.000000	.151929+02	.235244+02	.199762+02	.163040+02	-.509877+01	.000000
64	157.5	.000000	.150831+02	.232942+02	.194922+02	.159308+02	-.444014+01	.000000
65	160.0	.000000	.149226+02	.230089+02	.189111+02	.157715+02	-.384187+01	.000000
66	162.5	.000000	.146775+02	.225998+02	.183183+02	.158046+02	-.334534+01	.000000
67	165.0	.000000	.143134+02	.220382+02	.177846+02	.159135+02	-.295812+01	.000000
68	167.5	.000000	.138063+02	.213438+02	.173320+02	.159446+02	-.266088+01	.000000
69	170.0	.000000	.131517+02	.205712+02	.169258+02	.157787+02	-.242544+01	.000000
70	172.5	.000000	.123693+02	.197838+02	.164949+02	.153832+02	-.223269+01	.000000
71	175.0	.000000	.115003+02	.190284+02	.159686+02	.148214+02	-.208062+01	.000000
72	177.5	.000000	.105994+02	.183212+02	.153117+02	.142183+02	-.197917+01	.000000
73	180.0	.000000	.972221+01	.176504+02	.145424+02	.137017+02	-.193639+01	.000000

Figure 3. Sample Output - Continued.

74	182.5	.000000	.891287+01	.169929+02	.137249+02	.133453+02	-.194457+01	.000000
75	185.0	.000000	.819412+01	.163348+02	.129437+02	.131427+02	-.197507+01	.000000
76	187.5	.000000	.756373+01	.156853+02	.122704+02	.130214+02	-.198508+01	.000000
77	190.0	.000000	.699768+01	.150771+02	.117404+02	.128870+02	-.193322+01	.000000
78	192.5	.000000	.645925+01	.145546+02	.113484+02	.126772+02	-.179579+01	.000000
79	195.0	.000000	.591125+01	.141541+02	.110620+02	.123955+02	-.157526+01	.000000
80	197.5	.000000	.532768+01	.138882+02	.108456+02	.121121+02	-.129623+01	.000000
81	200.0	.000000	.470121+01	.137395+02	.106816+02	.119289+02	-.991110-00	.000000
82	202.5	.000000	.404431+01	.136684+02	.105785+02	.119298+02	-.682671-00	.000000
83	205.0	.000000	.338385+01	.136282+02	.105622+02	.121383+02	-.372672-00	.000000
84	207.5	.000000	.275126+01	.135830+02	.106569+02	.125041+02	-.425769-01	.000000
85	210.0	.000000	.217189+01	.135174+02	.108643+02	.129246+02	.333735-00	.000000
86	212.5	.000000	.165734+01	.134349+02	.111534+02	.132902+02	.771576-00	.000000
87	215.0	.000000	.120336+01	.133477+02	.114659+02	.135315+02	.126076+01	.000000
88	217.5	.000000	.793834-00	.132619+02	.117339+02	.136452+02	.176242+01	.000000
89	220.0	.000000	.409015-00	.131676+02	.119031+02	.136882+02	.221961+01	.000000
90	222.5	.000000	.344755-01	.130380+02	.119502+02	.137420+02	.257736+01	.000000
91	225.0	.000000	-.332888-00	.128395+02	.118863+02	.138680+02	.280305+01	.000000
92	227.5	.000000	-.684157-00	.125459+02	.117462+02	.140739+02	.289802+01	.000000
93	230.0	.000000	-.100311+01	.121514+02	.115697+02	.143094+02	.289518+01	.000000
94	232.5	.000000	-.127411+01	.116749+02	.113817+02	.144926+02	.284440+01	.000000
95	235.0	.000000	-.148972+01	.111533+02	.111832+02	.145528+02	.279260+01	.000000
96	237.5	.000000	-.165444+01	.106279+02	.109545+02	.144703+02	.276808+01	.000000
97	240.0	.000000	-.178323+01	.101292+02	.106694+02	.142908+02	.277568+01	.000000
98	242.5	.000000	-.189528+01	.966869+01	.103137+02	.141088+02	.280410+01	.000000
99	245.0	.000000	-.200603+01	.924092+01	.989813+01	.140271+02	.284051+01	.000000
100	247.5	.000000	-.212102+01	.883471+01	.946149+01	.141134+02	.288443+01	.000000
101	250.0	.000000	-.223434+01	.844817+01	.906213+01	.143738+02	.295369+01	.000000
102	252.5	.000000	-.233230+01	.809914+01	.876277+01	.147581+02	.307993+01	.000000
103	255.0	.000000	-.240055+01	.782542+01	.861489+01	.151928+02	.329639+01	.000000
104	257.5	.000000	-.243119+01	.767352+01	.864863+01	.156248+02	.362482+01	.000000
105	260.0	.000000	-.242647+01	.768023+01	.887054+01	.160540+02	.406803+01	.000000
106	262.5	.000000	-.239730+01	.785515+01	.926748+01	.165356+02	.461113+01	.000000
107	265.0	.000000	-.235745+01	.817207+01	.981266+01	.171503+02	.522932+01	.000000
108	267.5	.000000	-.231632+01	.857382+01	.104701+02	.179558+02	.589635+01	.000000
109	270.0	.000000	-.227410+01	.898914+01	.111960+02	.189429+02	.658773+01	.000000
110	272.5	.000000	-.222197+01	.935530+01	.119396+02	.200214+02	.727672+01	.000000
111	275.0	.000000	-.214751+01	.963742+01	.126459+02	.210440+02	.792624+01	.000000
112	277.5	.000000	-.204262+01	.983734+01	.132639+02	.218621+02	.848427+01	.000000
113	280.0	.000000	-.190976+01	.998898+01	.137598+02	.223889+02	.888989+01	.000000
114	282.5	.000000	-.176272+01	.101431+02	.141301+02	.226414+02	.909192+01	.000000
115	285.0	.000000	-.162049+01	.103480+02	.144089+02	.227403+02	.907483+01	.000000
116	287.5	.000000	-.149651+01	.106343+02	.146637+02	.228663+02	.887969+01	.000000
117	290.0	.000000	-.138828+01	.110087+02	.149787+02	.231889+02	.860715+01	.000000
118	292.5	.000000	-.127293+01	.114572+02	.154284+02	.237996+02	.839497+01	.000000
119	295.0	.000000	-.111268+01	.119559+02	.160530+02	.246769+02	.837382+01	.000000
120	297.5	.000000	-.869578-00	.124818+02	.168427+02	.256998+02	.861633+01	.000000
121	300.0	.000000	-.524579-00	.130194+02	.177399+02	.267023+02	.910104+01	.000000
122	302.5	.000000	-.931402-01	.135618+02	.186581+02	.275454+02	.970978+01	.000000
123	305.0	.000000	.370356-00	.141062+02	.195114+02	.281740+02	.102650+02	.000000
124	307.5	.000000	.783219-00	.146500+02	.202442+02	.286341+02	.105970+02	.000000
125	310.0	.000000	.105814+01	.151879+02	.208483+02	.290446+02	.106157+02	.000000
126	312.5	.000000	.113227+01	.157154+02	.213634+02	.295369+02	.103574+02	.000000
127	315.0	.000000	.990984-00	.162334+02	.218593+02	.301927+02	.998419+01	.000000
128	317.5	.000000	.676661-00	.167530+02	.224099+02	.310075+02	.973047+01	.000000
129	320.0	.000000	.277974-00	.172943+02	.230673+02	.318962+02	.981561+01	.000000
130	322.5	.000000	-.975471-01	.178804+02	.238478+02	.327368+02	.103546+02	.000000
131	325.0	.000000	-.358291-00	.185256+02	.247316+02	.334290+02	.113037+02	.000000
132	327.5	.000000	-.458084-00	.192259+02	.256758+02	.339392+02	.124644+02	.000000
133	330.0	.000000	-.409458-00	.199540+02	.266327+02	.343097+02	.135465+02	.000000
134	332.5	.000000	-.275629-00	.206651+02	.275639+02	.346285+02	.142672+02	.000000
135	335.0	.000000	-.144173-00	.213105+02	.284478+02	.349751+02	.144463+02	.000000

Figure 3. Sample Output - Continued.

136	337.5	.000000	-.923152-01	.218543+02	.292756+02	.353705+02	.140602+02	.000000
137	340.0	.000000	-.156881-00	.222878+02	.300437+02	.357583+02	.132330+02	.000000
138	342.5	.000000	-.319983-00	.226324+02	.307460+02	.360266+02	.121702+02	.000000
139	345.0	.000000	-.515339-00	.229320+02	.313715+02	.360626+02	.110650+02	.000000
140	347.5	.000000	-.652163-00	.232359+02	.319080+02	.358127+02	.100164+02	.000000
141	350.0	.000000	-.647071-00	.235792+02	.323484+02	.353173+02	.899642+01	.000000
142	352.5	.000000	-.451864-00	.239690+02	.326951+02	.347002+02	.787797+01	.000000
143	355.0	.000000	-.673450-01	.243818+02	.329580+02	.341157+02	.651026+01	.000000
144	357.5	.000000	.460734-00	.247717+02	.331474+02	.336745+02	.480529+01	.000000
145	360.0	.000000	.106036+01	.250871+02	.332642+02	.333852+02	.279480+01	.000000

FIELD POINT RADIUS .154500+04 AZIMUTH .169900+03 ELEVATION -.232000+02

HARMONIC	SOUND PRESSURE	SPL
1	.30746830-04	.80508046+02
2	.61724728-05	.66561222+02
3	.19928954-05	.56741729+02
4	.50246394-05	.64774136+02

FIELD POINT RADIUS .119700+04 AZIMUTH .165970+03 ELEVATION -.303300+02

HARMONIC	SOUND PRESSURE	SPL
1	.48707879-04	.84504022+02
2	.80634497-05	.68882456+02
3	.38760025-05	.62519719+02
4	.81912515-05	.69019043+02

FIELD POINT RADIUS .111400+04 AZIMUTH .164480+03 ELEVATION -.330700+02

HARMONIC	SOUND PRESSURE	SPL
1	.55254716-04	.85599425+02
2	.82697833-05	.69101921+02
3	.50112356-05	.64750934+02
4	.91960707-05	.70024085+02

FIELD POINT RADIUS .103500+04 AZIMUTH .162250+03 ELEVATION -.359700+02

HARMONIC	SOUND PRESSURE	SPL
1	.62364990-04	.86650855+02
2	.79715445-05	.68782887+02
3	.65207674-05	.67038012+02
4	.98726369-05	.70640702+02

FIELD POINT RADIUS .960000+03 AZIMUTH .160350+03 ELEVATION -.392800+02

HARMONIC	SOUND PRESSURE	SPL
1	.69750150-04	.87622940+02
2	.75677435-05	.68331366+02
3	.86041009-05	.69446149+02
4	.10340351-04	.71042743+02

FIELD POINT RADIUS .890000+03 AZIMUTH .157330+03 ELEVATION -.430800+02

HARMONIC	SOUND PRESSURE	SPL
1	.77289732-04	.88514473+02
2	.64200964-05	.66902869+02
3	.11214161-04	.71147373+02
4	.97663680-05	.70546699+02

FIELD POINT RADIUS .826000+03 AZIMUTH .153430+03 ELEVATION -.474000+02

HARMONIC	SOUND PRESSURE	SPL
1	.84002302-04	.89237861+02
2	.48359390-05	.64441655+02
3	.14103144-04	.73738356+02
4	.78029282-05	.68597191+02

FIELD POINT RADIUS .769000+03 AZIMUTH .148010+03 ELEVATION -.521800+02

HARMONIC	SOUND PRESSURE	SPL

Figure 3. Sample Output - Continued.

```
                    1          .88713944-04        .89711875+02
                    2          .35515691-05        .61760443+02
                    3          .16948111-04        .75334465+02
                    4          .45795711-05        .63968535+02

FIELD POINT      RADIUS    .723000+03    AZIMUTH    .140200+03    ELEVATION    -.572800+02
                HARMONIC       SOUND PRESSURE            SPL
                    1          .89569774-04        .89795267+02
                    2          .45853212-05        .63979433+02
                    3          .19854157-04        .76709068+02
                    4          .28748377-05        .59924305+02

FIELD POINT      RADIUS    .687000+03    AZIMUTH    .128670+03    ELEVATION    -.622300+02
                HARMONIC       SOUND PRESSURE            SPL
                    1          .85585877-04        .89400079+02
                    2          .75959000-05        .66363623+02
                    3          .22163404-04        .77664767+02
                    4          .40051114-05        .62804330+02

FIELD POINT      RADIUS    .659000+03    AZIMUTH    .121800+03    ELEVATION    -.659000+02
                HARMONIC       SOUND PRESSURE            SPL
                    1          .81181397-04        .88941169+02
                    2          .90659782-05        .69900331+02
                    3          .22688380-04        .77868108+02
                    4          .40829200-05        .62971456+02

FIELD POINT      RADIUS    .682000+03    AZIMUTH    .513000+02    ELEVATION    -.620000+02
                HARMONIC       SOUND PRESSURE            SPL
                    1          .51113038-04        .84922672+02
                    2          .14506783-04        .73983460+02
                    3          .17393360-04        .75559707+02
                    4          .33396810-05        .61226138+02

FIELD POINT      RADIUS    .822000+03    AZIMUTH    .266000+02    ELEVATION    -.471000+02
                HARMONIC       SOUND PRESSURE            SPL
                    1          .40724800-04        .82949216+02
                    2          .78601208-05        .68660622+02
                    3          .10790065-04        .71412520+02
                    4          .11445665-05        .51924859+02

FIELD POINT      RADIUS    .103100+04    AZIMUTH    .174000+02    ELEVATION    -.357000+02
                HARMONIC       SOUND PRESSURE            SPL
                    1          .26010733-04        .79055090+02
                    2          .32408909-05        .60965327+02
                    3          .71731905-05        .67866286+02
                    4          .19797893-05        .56684418+02
```

Figure 3. Sample Output - Continued.

ROTATIONAL NOISE PROGRAM E676

HARMONIC = 1

FIELD POINT	FIELD POINT COORDINATES (IN) X	Y	Z	SOUND PRESSURE LEVEL DECIBELS
1	-1.6800+04	3.0000+03	-7.3200+03	8.0674+01
2	-1.2000+04	3.0000+03	-7.2960+03	8.4818+01
3	-1.0800+04	3.0000+03	-7.2960+03	8.5917+01
4	-9.6000+03	3.0000+03	-7.2960+03	8.7012+01
5	-8.4000+03	3.0000+03	-7.2960+03	8.8074+01
6	-7.2000+03	3.0000+03	-7.2960+03	8.9058+01
7	-6.0000+03	3.0000+03	-7.2960+03	8.9897+01
8	-4.8000+03	3.0000+03	-7.2960+03	9.0497+01
9	-3.6000+03	3.0000+03	-7.2960+03	9.0735+01
10	-2.4000+03	3.0000+03	-7.2960+03	9.0462+01
11	-1.2000+03	3.0000+03	-7.2240+03	8.9636+01
12	2.4000+03	3.0000+03	-7.2240+03	8.3730+01
13	6.0000+03	3.0000+03	-7.2240+03	7.9509+01
14	9.6000+03	3.0000+03	-7.2240+03	7.5340+01

HARMONIC = 2

FIELD POINT	FIELD POINT COORDINATES (IN) X	Y	Z	SOUND PRESSURE LEVEL DECIBELS
1	-1.6800+04	3.0000+03	-7.3200+03	6.7485+01
2	-1.2000+04	3.0000+03	-7.2960+03	6.8965+01
3	-1.0800+04	3.0000+03	-7.2960+03	6.8820+01
4	-9.6000+03	3.0000+03	-7.2960+03	6.8491+01
5	-8.4000+03	3.0000+03	-7.2960+03	6.8567+01
6	-7.2000+03	3.0000+03	-7.2960+03	7.0262+01
7	-6.0000+03	3.0000+03	-7.2960+03	7.3457+01
8	-4.8000+03	3.0000+03	-7.2960+03	7.6751+01
9	-3.6000+03	3.0000+03	-7.2960+03	7.9431+01
10	-2.4000+03	3.0000+03	-7.2960+03	8.1343+01
11	-1.2000+03	3.0000+03	-7.2240+03	8.2463+01
12	2.4000+03	3.0000+03	-7.2240+03	7.7527+01
13	6.0000+03	3.0000+03	-7.2240+03	6.1343+01
14	9.6000+03	3.0000+03	-7.2240+03	6.7794+01

Figure 3. Sample Output - Continued.

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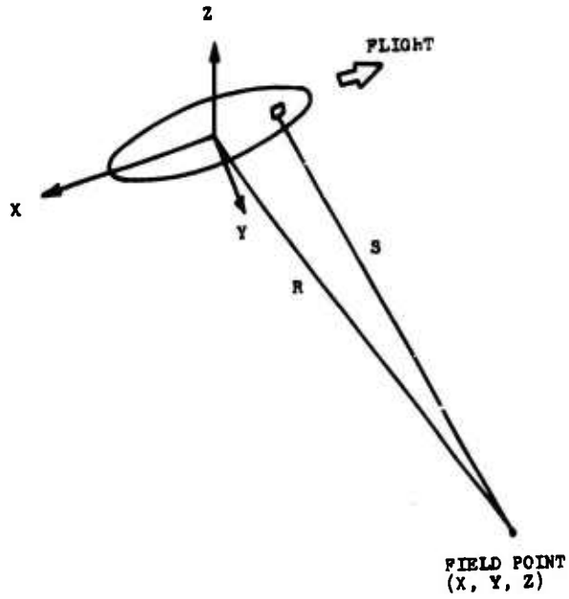
HARMONIC = 3

FIELD POINT	FIELD POINT COORDINATES (IN) X	Y	Z	SOUND PRESSURE LEVEL DECIBELS
1	-1.6800+04	3.0000+03	-7.3200+03	7.0854+01
2	-1.2000+04	3.0000+03	-7.2960+03	7.4959+01
3	-1.0800+04	3.0000+03	-7.2960+03	7.6184+01
4	-9.6000+03	3.0000+03	-7.2960+03	7.7293+01
5	-8.4000+03	3.0000+03	-7.2960+03	7.8147+01
6	-7.2000+03	3.0000+03	-7.2960+03	7.8525+01
7	-6.0000+03	3.0000+03	-7.2960+03	7.8139+01
8	-4.8000+03	3.0000+03	-7.2960+03	7.7259+01
9	-3.6000+03	3.0000+03	-7.2960+03	7.8703+01
10	-2.4000+03	3.0000+03	-7.2960+03	8.2059+01
11	-1.2000+03	3.0000+03	-7.2240+03	8.3364+01
12	2.4000+03	3.0000+03	-7.2240+03	7.9220+01
13	6.0000+03	3.0000+03	-7.2240+03	7.4849+01
14	9.6000+03	3.0000+03	-7.2240+03	6.6092+01

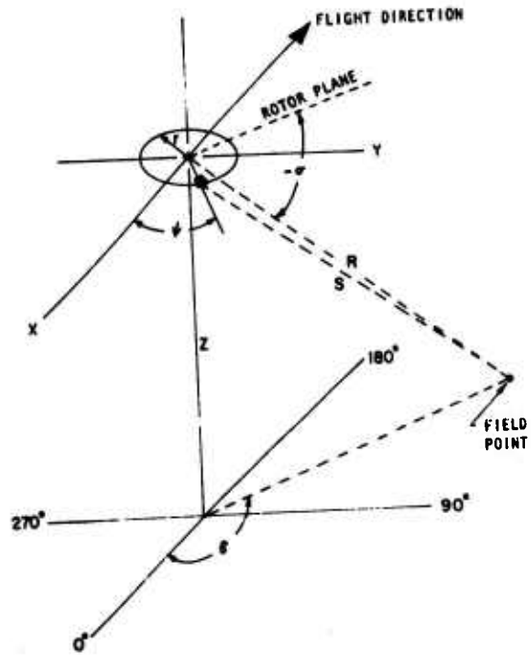
HARMONIC = 4

FIELD POINT	FIELD POINT COORDINATES (IN) X	Y	Z	SOUND PRESSURE LEVEL DECIBELS
1	-1.6800+04	3.0000+03	-7.3200+03	6.2514+01
2	-1.2000+04	3.0000+03	-7.2960+03	6.8894+01
3	-1.0800+04	3.0000+03	-7.2960+03	7.1066+01
4	-9.6000+03	3.0000+03	-7.2960+03	7.3444+01
5	-8.4000+03	3.0000+03	-7.2960+03	7.5815+01
6	-7.2000+03	3.0000+03	-7.2960+03	7.7899+01
7	-6.0000+03	3.0000+03	-7.2960+03	7.9145+01
8	-4.8000+03	3.0000+03	-7.2960+03	7.8402+01
9	-3.6000+03	3.0000+03	-7.2960+03	7.1984+01
10	-2.4000+03	3.0000+03	-7.2960+03	7.0577+01
11	-1.2000+03	3.0000+03	-7.2240+03	7.8219+01
12	2.4000+03	3.0000+03	-7.2240+03	7.3212+01
13	6.0000+03	3.0000+03	-7.2240+03	7.0343+01
14	9.6000+03	3.0000+03	-7.2240+03	5.1346+01

Figure 3. Sample Output - Concluded.



a. OPRONO Coordinates.



b. E3860P Coordinates.

Figure 4. Coordinate Systems for Noise Prediction.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

C ROTOR NOISE PROGRAM FOR W. BAUSCH BY G. CAMPE.                                    001
      COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,              002
     * MLIMOP,XFP(20),YFP(20),ZFP(20),GAMA,RO,BLADEL,BO,B1C,B1S,PUNCH,              003
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,                004
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,                005
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPROND,NCH(5),INTERM,                006
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,               007
     * NOCH(5),LAZI                                                                 008
      COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,                  009
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XL0(7),XLM(7,40),             010
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),              011
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,BEE,DEE,GMARI(288,20),                         012
     * HMARI(288,20),XO(20)                                                         013
      COMMON /BK3/ SPLM(10,20),AZMTH3(288),                                         014
     * SPAN(20),                          PMRMS(10,20),                             015
     * ICHANL(10,5),COSINE(288),SINE(288),BLADES,CARD,TAPE                          016
      COMMON /TEMPUS/ TIME,COUNT                                                    017
      DIMENSION DATA1(144,10,5),DATA2(144,10,5),FN(144),CHORD(7),                   018
     * GPSI(7),GPSI1(7),TEM1(30),TEM2(30),CHORD2(41),GPSI2(41),GPSI3(41)            019
     *,COSRN(41),SINRN(41)                                                          020
      EQUIVALENCE (ND1,DATA1),(ND2,DATA2),(NN,FN),(TEMP1,CHORD),                    021
     * (TEMP2,GPSI),(TEMP3,GPSI1)                                                   022
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),                      023
     * GMAR(144,5),HMAR(144,5)                                                      024
     * ,Q1(288,20),Q2(288,20)                                                        025
      EQUIVALENCE                    (ND2(5671),HMAR),(GMARI,AN),                   026
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN),(ND2,Q2)                         027
      EQUIVALENCE (ND1(5761),GMAR),(ND1,Q1)                                         028
      DIMENSION AZ41(41)                                                            029
      DIMENSION DBI(289)                                                            030
      EQUIVALENCE (DBI,SINE)                                                        031
      MSTART=1                                                                      032
      CALL INPUTA                                                                   033
      IF(TCOP.EQ.CARD) GO TO 199                                                    034
      REWIND 8                                                                      035
      REWIND 9                                                                      036
      REWIND 10                                                                     037
      REWIND 11                                                                     038
      REWIND 12                                                                     039
      REWIND 13                                                                     040
  199 LIRS = 0                                                                      041
      PI = 3.14159265                                                               042
      DO 1 I=1,5                                                                    043
      IF(IRS(I).NE.0) LIRS = LIRS+1                                                 044
    1 CONTINUE                                                                      045
      DPRAD = DPSI*6.28318531/360.                                                  046
      AZRAD = (2.5*PI)/180.                                                         047
      AZMTH(1) = 0.                                                                 048
      AZMTH2(1) = 0.                                                                049
      DO 2 I=2,144                                                                  050
      AZMTH2(I) = AZMTH2(I-1)+AZRAD                                                 051
    2 AZMTH(I)  = AZMTH(I-1)+2.5                                                    052
      PI2 = 6.283185                                                                053
      AZMTH3(1)=0.                                                                  054
```

Figure 5. Program Listing - Main.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0   CD COUNT
      COSINE(1)=1.                                                                  055
      SINE(1)=0.                                                                    056
      T1=(PI2/DPRAD)+.001                                                           057
      J=T1                                                                          058
      IF(J.LE.288) GO TO 211                                                        059
      WRITE(6,212)                                                                  060
  212 FORMAT(1H1, 63HTHE DIMENSION OF AZMTH3 HAS BEEN EXCEEDED AT                   061
     *ENT NO. 211      )                                                            062
      WRITE(6,35) (AZMTH3(L),L=1,288)                                               063
      WRITE(6,35) PI2                                                               064
      STOP                                                                          065
  211 DO 4 LAZI=2,J                                                                 066
      AZMTH3(LAZI) = AZMTH3(LAZI-1)+DPRAD                                           067
      COSINE(LAZI) = COS(AZMTH3(LAZI))                                              068
    4 SINE(LAZI)   = SIN(AZMTH3(LAZI))                                              069
      IF(IDD.NE.1) GO TO 210                                                        070
      WRITE(6,213)                                                                  071
  213 FORMAT(1H1,11HAZMTH3(288))                                                    072
      WRITE(6,35) (AZMTH3(L),L=1,288)                                               073
  210 BLADES = NBLADE                                                               074
      T1 = 1./41.                                                                   075
      CHORD2(1) = 0.                                                                076
      CHORD2(41) = 1.                                                               077
      DO 6 L=2,40                                                                   078
    6 CHORD2(L) = CHORD2(L-1)+T1                                                    079
C                                                                                   080
C *** A LONG LOOP ON BURSTS IS NEXT.                                                081
    7 IF(IDD.NE.1) GO TO 9300                                                       082
      CALL START                                                                    083
 9300 IF(TCOP.EQ.CARD) GO TO 10                                                     084
      READ(5,8) IBURST                                                              085
C GET START OF BURST TIME                                                           086
    8 FORMAT( 11X,I3 )                                                              087
C                                                                                   088
C *** A CHOISE I MADE NEXT (OPTION) TO EITHER  ACEPT TAPE OR CARD INPUT.            089
      DO 9 I=1,144                                                                  090
      DO 9 J=1,10                                                                   091
      DO 9 K=1,5                                                                    092
    9 ND2(I,J,K) = 0                                                                093
C                                                                                   094
C *** LOOP ON TAPE REELS FOLLOWS.                                                   095
      DO 11 IREEL=1,IREELS                                                          096
      KU = KUNIT(IREEL)                                                             097
      IF(IDD.EQ.1)                                                                  098
     XWRITE(6,231) IREEL,KU                                                         099
   12 CALL RDKU(1)                                                                  100
      IF(IBURST.NE.KBURST) GO TO 12                                                 101
      IF(IDD.EQ.1)                                                                  102
     XWRITE(6,231) IREEL,KU,KREC,KBURST,KTRACK                                      103
      GO TO (13,13,13,13,13,13,13,13,14,15,16,17),KU                                104
   13 BACKSPACE 8                                                                   105
      GO TO 18                                                                      106
   14 BACKSPACE 9                                                                   107
      GO TO 18                                                                      108
```

Figure6 . Program Listing - Main.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

   15 BACKSPACE 10
      GO TO 18
   16 BACKSPACE 11
      GO TO 18
   17 BACKSPACE 12
      BACKSPACE 13
   18 NCYCLE = 0
C *** THE FIRST CYCLE IN BURST IBURST IS READ.
      CALL RDKU(1)
      CALL RDKU(2)
      KB = KBURST
      GO TO 19
C *** THE REMAINING CYCLES IN BURST IBURST ARE READ AND AVERAGED.
   20 CALL RDKU(1)
      IF(KBURST.NE.KB) GO TO 21
      CALL RDKU(2)
      IF(KBURST.NE.KB) GO TO 21
C
C *** SUBR. UNPACK UNPACKS NN(435) TO FORM ND1(I,J,K) WHERE I=DATA POINT,
C *** J=CHANNEL, K=REEL NO.
   19 CALL UNPACK
      NCYCLE = NCYCLE+1
C *** CHANNEL LOOP
      K = NOCH(IREEL)
      DO 22 J=1,K
      NC = ICHANL(J,IREEL)
      IF(IDD-1) 234,236,234
  236 IF(IREEL-1) 234,235,234
  235 IF(IDD.EQ.1)                WRITE(6,231) NCYCLE,K,NC,ND1(1,NC,IREE
     X  L)
  234 CONTINUE
  231 FORMAT(4I13)
      DO 22 I=1,144
      ND2(I,NC,IREEL) = ND2(I,NC,IREEL) + ND1(I,NC,IREEL)
   22 CONTINUE
      GO TO 20
C *** AT THIS POINT THE END OF BURST HAS BEEN REACHED.
   21 GO TO (23,23,23,23,23,23,23,23,24,25,26,27),KU
   23 BACKSPACE 8
      GO TO 28
   24 BACKSPACE 9
      GO TO 28
   25 BACKSPACE 10
      GO TO 28
   26 BACKSPACE 11
      GO TO 28
   27 BACKSPACE 12
      BACKSPACE 13
   28 CYCLES = NCYCLE
C *** THE AVERAGE CYCLES ARE FOUND NEXT.
      K = NOCH(IREEL)
      DO 29 J=1,K
      NC = ICHANL(J,IREEL)
      DO 29 I=1,144
```

Figure 7. Program Listing - Main.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

      T1 = ND2(I,NC,IREEL)                                                          163
   29 DATA2(I,NC,IREEL) = T1/CYCLES                                                 164
   11 CONTINUE                                                                      165
C *** FILTER ROLL OFF CORRECTION AND TAPE DATA SCALING FOLLOWS.                     166
      DO 30 IREEL=1,IREELS                                                          167
      K = NOCH(IREEL)                                                               168
      DO 30 J=1,K                                                                   169
      NC = ICHANL(J,IREEL)                                                          170
      DO 31 I=1,144                                                                 171
   31 FN(I) = DATA2(I,NC,IREEL)                                                     172
      CALL DFSRIE (144,MLIMDP,FN,TEM1,TEM2)                                         173
      AN(1,NC,IREEL) = TEM1(1)                                                      174
      DO 32 I=1,MLIMDP                                                              175
      AN(I+1,NC,IREEL) = TEM1(I+1)                                          9999    176
   32 BN(I,NC,IREEL) = TEM2(I+1)                                                    177
      IF(IDD.NE.1) GO TO 30                                                         178
      WRITE(6,33) IREEL,NC,(FN(L),L=1,144)                                          179
   33 FORMAT(1H0, 5HREEL=,I3, 7X, 8HCHANNEL=, I3, 7X, 35HAVE. CYCLE AND             180
     1ITS HARMONICS FOLLOW // (2X,1PE10.3,12E10.3) )                                181
      I=MLIMDP+1                                                                    182
      WRITE(6,34) (AN(L,NC,IREEL),L=1,I)                                            183
      WRITE(6,35) (BN(L,NC,IREEL),L=1,MLIMDP)                                       184
   34 FORMAT(1H0,1X,1PE10.3 / (2X,13E10.3))                                         185
   35 FORMAT( /  (2X,1PE10.3,12E10.3))                                              186
   30 CONTINUE                                                                      187
      DO 36 IREEL=1,IREELS                                                          188
      IF(IDD.EQ.1) WRITE(6,40) IREEL                                                189
   40 FORMAT(1H0,10HREEL NO. =,I3,10X, 77HAVE. PRESSURE CYCLE HARMONICS             190
     X(CORRECTED FOR FILTER ROLL-OFF AND ENGR. UNITS)  )                            191
      K=NOCH(IREEL)                                                                 192
      DO 36 J=1,K                                                                   193
      NC = ICHANL(J,IREEL)                                                          194
      AN(1,NC,IREEL) = AN(1,NC,IREEL)*SLOPE(NC,IREEL)+OFFSET(NC,IREEL)              195
      DO 37 I=1,MLIMDP                                                              196
      T1 = FROC(I)*SLOPE(NC,IREEL)                                                  197
      AN(I+1,NC,IREEL) = AN(I+1,NC,IREEL)*T1                                        198
   37 BN(I,NC,IREEL) = BN(I,NC,IREEL)*T1                                            199
      IF(IDD.NE.1) GO TO 36                                                         200
      WRITE(6,38)  NC,AN(1,NC,IREEL),(AN(I+1,NC,IREEL),I=1,MLIMDP)                  201
   38 FORMAT(1X,  8HCHANNEL=,I3,5X, 11(1PE10.3) /  (27X,10E10.3 / ) )               202
      WRITE(6,39) (BN(I,NC,IREEL),I=1,MLIMDP)                                       203
   39 FORMAT( 27X,10(1PE10.3) / (27X,10E10.3) )                                     204
   36 CONTINUE                                                                      205
C *** THE FOLLOWING SUBR. COMBINES THE TOP AND BOTTOM ABSOLUTE PRESSURE COEFF.     206
C     TO PRODUCE DIFFERENTIAL PRESS. COEFF.  CN(31,5,5), SN(30,5,5) WHERE THE       207
C     FIRST SUBS. = HARMONIC, SECOND SUBS. = CHORD, THIRD SUBS. = SPAN.             208
C     BLADE PITCH HARMONICS, B0,B1C,B1S  ARE ALSO CALCULATED.                       209
      CALL MERGES                                                                   210
      IF(IDD.NE.1) GO TO 240                                                        211
      DO 239 I=1,5                                                                  212
      DO 239 J=1,5                                                                  213
      WRITE(6,47) CN(1,J,I)                                                         214
      WRITE(6,47) (CN(K+1,J,I),K=1,MLIMDP)                                          215
  239 WRITE(6,47) (SN(K,J,I),K=1,MLIMDP)                                            216
```

Figure 8. Program Listing - Main.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0   CD COUNT

C *** NOW THE DIFFERENTIAL PRESSURE FOURIER COEFFICIENTS OF THE AVERAGE CYCLES
C     IS PUNCHED OUT.
      IF(PUNCH.NE.YES) GO TO 41
  240 WRITE(7,42) IBURST
   42 FORMAT( 11HBURST NO. =,I3,11X, 34H*** ROTOR NOISE PUNCHED OUTPUT *
     X**)
      WRITE(7,43) B0,B1C,B1S
   43 FORMAT( 21HBLADE PITCH HARMONICS /  3(1PE10.4),2X, 46H(COLLECTIVE,
     XLONGITUDINAL,LATERAL RESPECTIVELY) /  75HDIFFERENTIAL PRESSURE HAR
     XMONICS FOR 5 CHORD STATIONS AT EACH OF THE 5 SPANS / 66H(MEASURING
     X FROM THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY).  )
C *** SPAN LOOP
      DO 44 I=1,5
C *** CHORD LOOP
      DO 44 J=1,5
      WRITE(7,49) I,J,CN(1,J,I)
   49 FORMAT( 4HSPAN,I2,2X, 5HCHORD,I2,7X, 8HSTEADY= , 1PE10.4 )
      WRITE(7,45)
   45 FORMAT( 19HCOSINE COEFFICIENTS )
   47 FORMAT(  8(1PE10.4) )
      WRITE(7,47) (CN(K+1,J,I),K=1,MLIMDP)
      WRITE(7,48)
   48 FORMAT( 17HSINE COEFFICIENTS )
   44 WRITE(7,47) (SN(K,J,I),K=1,MLIMDP)
      GO TO 41
C *** CARD INPUT (INSTEAD OF TAPE INPUT) IS ACCEPTED NEXT.
   10 READ(5,42) IBURST
      READ(5,43) B0,B1C,B1S
C *** SPAN LOOP
      DO 50 I=1,5
C *** CHORD LOOP
      DO 50 J=1,5
      READ(5,49) IN,JN,CN(1,JN,IN)
      READ(5,45)
      READ(5,47) (CN(K+1,J,I),K=1,MLIMDP)
      READ(5,48)
   50 READ(5,47) (SN(K,J,I),K=1,MLIMDP)
C *** AVERAGE DIFFERENTIAL PRESSURE CYCLES FOR SPAN I CHORD J AZIMUTH K ARE
C     FOUND BY SUMMING THE CORRECTED HARMONICS.
C *** SPAN LOOP
C AT THIS POINT THE PRESSURE INPUT HAS BEEN ACCEPTED (TAPE OR CARD INPUT)
   41 IF(IDD.NE.1) GO TO 9301
      CALL CLOCK
 9301 DO 51 I=1,5
C *** CHORD LOOP
      DO 51 J=1,5
      T1 = -AZRAD
C *** AZIMUTH (POINT) LOOP
      DO 51 K=1,144
      DATA1(K,J,I) = CN(1,J,I)
      T1 = T1+AZRAD
      T3 = 0.
C *** HARMONIC LOOP
      DO 51 L=1,MLIMDP
```

Figure 9. Program Listing - Main.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0   CD COUNT

      T3 = T3+1.                                                                  271
      T2 = T1*T3                                                                  272
   51 DATA1(K,J,I) = DATA1(K,J,I)+CN(L+1,J,I)*COS(T2)+SN(L,J,I)*SIN(T2)           273
      WRITE(6,54)                                                                 274
   54 FORMAT(1H1,59HDIFFERENTIAL PRESSURE CYCLES AT INSTRUMENTED BLADE S          275
     XTATIONS // )                                                                276
      DO 53 I=1,5                                                                 277
      DO 53 J=1,5                                                                 278
      WRITE(6,55) I,J                                                             279
   55 FORMAT(1H0, 12HSPAN STATION,I3,5X,13HCHORD STATION, I3//)                   280
   53 WRITE(6,56) (DATA1(K,J,I),K=1,144)                                          281
   56 FORMAT( 2X,10(1PE13.4) )                                                    282
C *** THE FOLLOWING INPUT OPTION DESIDES WHETHER OR NOT TO CALL THE ACOUSTICS     283
C     PROGRAM E386 WHICH IS A SIMPLIFIED VERSION OF THIS PROGRAM.                 284
   52 IF(E3860P.NE.YES) GO TO 57                                                  285
      KK = 1                                                                      286
      XLO(1) = 0.                                                                 287
      DO 9501 J=1,NHH                                                             288
      XLM(1,KK) = 0.                                                              289
 9501 XMM(1,KK) = 0.                                                              290
C *** RADIAL STATION LOOP                                                         291
      DO 58 I=1,5                                                                 292
      KK = KK+1                                                                   293
      IF(IRS(I).EQ.0) GO TO 58                                                    294
      IF(NCH(I).EQ.5) GO TO 59                                                    295
      NT1 = NCH(I)+2                                                              296
      K=1                                                                         297
      CHORD(1) = 0.                                                               298
      DO 60 L=1,5                                                                 299
      IF(NCHAN(I,L).EQ.0) GO TO 60                                                300
      K=K+1                                                                       301
      CHORD(K)=XA(L,I)                                                            302
   60 CONTINUE                                                                    303
      CHORD(K+1)=1.                                                               304
      GPSI(1)=0.                                                                  305
      DO 61 J=1,144                                                               306
      K=1                                                                         307
      DO 62 L=1,5                                                                 308
      IF(NCHAN(I,L).EQ.0) GO TO 62                                                309
      K=K+1                                                                       310
      GPSI(K) = DATA1(J,L,I)                                                      311
   62 CONTINUE                                                                    312
      GPSI(K+1) = 0.                                                              313
      CALL AVQUAD(NT1,CHORD,GPSI,AREA)                                            314
   61 FN(J) = AREA*AA                                                             315
      GO TO 63                                                                    316
   59 DO 64 J=1,144                                                               317
      FN(J) = 0.                                                                  318
      DO 65 L=1,5                                                                 319
   65 FN(J) = FN(J)+DATA1(J,L,I)*FI(I,L)                                          320
   64 FN(J) = FN(J)*AA                                                            321
   63 CALL DFSRIE(144,NHH,FN,TEM1,TEM2)                                           322
      XLO(KK) = TEM1(1)                                                           323
      DO 66 J=1,NHH                                                               324
```

Figure 10. Program Listing - Main.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

      XLM(KK,J) = TEM1(J+1)
   66 XMM(KK,J) = TEM2(J+1)
   58 CONTINUE
      KK = KK+1
      XLO(KK) = 0.
      DO 9500 J=1,NHH
      XLM(KK,J) = 0.
 9500 XMM(KK,J) = 0.
      WRITE(6,201)
  201 FORMAT(1H1, 11HXLO XLM XMM ,///)
      DO 202 KK=1,7
      WRITE(6,203) XLO(KK),(XLM(KK,J),J=1,NHH),(XMM(KK,J),J=1,NHH)
  220 FORMAT(//(1PE13.5))
  203 FORMAT(F8.2/(10F8.2))
  202 CONTINUE
  200 CALL E386RN
   57 IF(OPRONO.NE.YES) GO TO 7
C BEGINNING OF ROTOR NOISE ANALYSIS
      IF(IDD.NE.1) GO TO 9302
      CALL START
 9302 T1 = LSPAN-1
      T1 = 298./T1
      DELSPN = T1/2.
      SPAN(1) = 74.
      DO 67 L=2,LSPAN
   67 SPAN(L) = SPAN(L-1)+T1
      L=MSTART-1
      FM=L
      T4 = BLADES/(PI*BB)
      DIMENSION RSQ(18)
      REWIND 28
      IF(IDD.NE.1) GO TO 9103
      GC2=SPAN(1)+DELSPN
      J=LSPAN-2
      DO 10005 I=1,J
      GC1=GC2+T1
      RSQ(I)= PI*(GC1**2-GC2**2)/(288.*SPAN(I+1))
10005 GC2=GC1
      WRITE(6,8826) (RSQ(I),I=1,18)
      GO TO 9103
 9100 WRITE(6,9104) LSD2
 9104 FORMAT(1H0,11HNTRAN ERROR , 5I13)
      STOP
 9103 WRITE(28) (ND1(I),I=1,7200)
      WRITE(28) (SINE(I),I=1,288),BLADES
      END FILE 28
      LSD2= 1
C *** HARMONIC LOOP
      DO 83 M=MSTART,MLIMRN
      REWIND 28
      READ (28) (ND1(I),I=1,7200)
      FM = FM+1.
C *** RADIAL STATION LOOP
      CALL NTRAN(29,10)
```

Figure 11. Program Listing - Main, Noise Analysis Begins.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT
      DO 69 K=1,5
      IF(IRS(K).EQ.0) GO TO 69
      T5=AA/(2.*RR(K)*BLADEL)
C *** AZIMUTHAL LOOP
      DO 99 I=1,144
      T1=-T5
      T2= T5
      T3 =  (T2-T1)/40.
      T6=T1*BLADES*FM
      COSRN(1) = COS(T6)
      SINRN(1) = SIN(T6)
      T6=T2*BLADES*FM
      COSRN(41) = COS(T6)
      SINRN(41) = SIN(T6)
      AZ41(1)=T1
      AZ41(41)=T2
      L=0
      DO 71 J=2,40
      T1=T1+T3
      T6=T1*BLADES*FM
      AZ41(J)=T1
      COSRN(J) = COS(T6)
      SINRN(J) = SIN(T6)
   71 CONTINUE
      NT1 = NCH(K)+2
      KKK = 1
      CHORD(1)=0.
      GPSI(1)=0.
      DO 72 L=1,5
      IF(NCHAN(K,L).EQ.0) GO TO 72
      KKK = KKK + 1
      CHORD(KKK) = XA(L,K)
      GPSI(KKK) = DATA1(I,L,K)
   72 CONTINUE
      CHORD(KKK+1) = 1.
      GPSI(KKK+1) = 0.
C *** THE MEASURED PRESSURE POINTS ALONG THE CHORD ARE INTERPOLATED TO 41 POINTS
      CHORD2(1)=0.
      CHORD2(41) = 1.
      AREA = 1./41.
      DO 9307 L=2,40
 9307 CHORD2(L) = CHORD2(L-1) + AREA
      CALL CURVIT(NT1,CHORD,GPSI,W,41,CHORD2,GPSI2)
      DO 73 L=1,41
   73 GPSI3(L) = GPSI2(L)*COSRN(L)
      CALL AVQUAD(41,AZ41  ,GPSI3,AREA)
      AREA = AREA*T4
 9105 IF(LSD2+1) 9100,9105,9106
 9106 CALL NTRAN(29,1,1,AREA,LSD2)
      IF(IDD.NE.1) GO TO 2741
      IF(I.GT.10) GO TO 2741
      IF(K.GT.2) GO TO 2741
      WRITE(6,2742) I,K,M,NT1
 2742 FORMAT(1H0,2HI=,I5,5X,2HK=,I5,5X,2HM=,I5,10X,
```

Figure 12. Program Listing - Main.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

     X  33 HACOUSTIC PRESSURE PULSE COS TERM     ,10X,I5)                              433
      WRITE(6,2747)  COSRN                                                             434
      WRITE(6,2747)  CHORD                                                             435
      WRITE(6,2747)  GPSI                                                              436
      WRITE(6,2747)  CHORD2                                                            437
      WRITE(6,2747)  GPSI2                                                             438
      WRITE(6,2747)  T1,T2,T3,T4,T5,GMAR(I,K),AREA,FM                                  439
 2747 FORMAT(2X,1P10E13.5)                                                             440
 2741 DO 74 L=1,41                                                                     441
   74 GPSI3(L) = GPSI2(L)*SINRN(L)                                                     442
      CALL AVQUAD(41,AZ41  ,GPSI3,AREA)                                                443
      AREA = AREA*T4                                                                   444
 9107 IF(LSD2+1)9100,9107,9108                                                         445
 9108 CALL NTRAN(29,1,1,AREA,LSD2)                                                     446
   99 CONTINUE                                                                         447
   69 CONTINUE                                                                         448
 9200 IF(LSD2+1) 9100,9200,9201                                                        449
 9201 CALL NTRAN(29,10)                                                                450
      DO 9109 K=1,5                                                                    451
      DO 9109 I=1,144                                                                  452
 9110 IF(LSD2+1) 9100,9110,9111                                                        453
 9111 CALL NTRAN(29,2,1,AREA,LSD2)                                                     454
 9112 IF(LSD2+1) 9100,9112,9113                                                        455
 9113 GMAR(I,K)=AREA                                                                   456
      CALL NTRAN(29,2,1,AREA,LSD2)                                                     457
 9114 IF(LSD2+1) 9100,9114,9115                                                        458
 9115 HMAR(I,K) = AREA                                                                 459
 9109 CONTINUE                                                                         460
      IF(IDD.NE.1) GO TO 75                                                            461
      WRITE(6,76) M                                                                    462
   76 FORMAT(1H0,123HCOS AND SIN COEFFICIENTS OF ACOUSTIC PRESSURE PULSE               463
     X AT EACH OF 144 AZIMUTHAL STATIONS AT EACH BLADE STATION FOR HARMO               464
     XNIC M=,I3 )                                                                      465
      DO 77 I=1,5                                                                      466
      WRITE(6,78) I                                                                    467
   78 FORMAT(1H0,14HBLADE STATION=,I2)                                                 468
      WRITE(6,56) (GMAR(K,I),K=1,144)                                                  469
   77 WRITE(6,56) (HMAR(K,I),K=1,144)                                                  470
C *** THE FOLLOWING SUBR. INTERPOLATES ACOUSTIC PRESSURE PULSE HARMONICS UP TO         471
C     288 AZIMUTH AND 20 BLADE STATIONS                                                472
   75 IF(IDD.NE.1) GO TO 9303                                                          473
      CALL CLOCK                                                                       474
 9303 CALL INTERP                                                                      475
      IF(IDD.NE.1) GO TO 79                                                            476
      CALL CLOCK                                                                       477
      WRITE(6,80) LAZI,LSPAN                                                           478
   80 FORMAT(1H1, 51HINTERPOLATED ACOUSTIC PRESSURE PULSE COEFFICIENTS (               479
     X ,I3,1X,17HAZIMUTH STATIONS, ,I3,1X,17HBLADE STATIONS  )  ///)                   480
      DO 81 I=1,LSPAN                                                                  481
      WRITE(6,82) SPAN(I)                                                              482
   82 FORMAT(1H0,11HBLADE SPAN=, F8.2,10X,21HGMARI(J,I),HMARI(J,I)  )                  483
      WRITE(6,56) (GMARI(J,I),J=1,LAZI)                                                484
   81 WRITE(6,56) (HMARI(J,I),J=1,LAZI)                                                485
C *** DOUBLE INTEGRATION FOLLOWS                                                       486
```

Figure 13. Program Listing - Main.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

   79 ISI = (DPSI/2.5)+.01                                                            487
      T1 = BB/(4.*PI)                                                                 488
C *** FIELD POINT LOOP                                                                489
      DO 83 NFIELD=1,NFT                                                              490
      MFIELD = NFIELD                                                                 491
      IF(INTERM.EQ.NO)GO TO 84                                                        492
      WRITE(6,85) NFIELD,XFP(NFIELD),YFP(NFIELD),ZFP(NFIELD),M                        493
   85 FORMAT(1H1, 12HFIELD POINT=,I3,5X, 4HXFP=,1PE10.4,5X,4HYFP=,1PE10.              494
     X 4,5X, 4HZFP=,1PE10.4,15X, 11HHARMONIC M=,I3 )                                 495
C *** SUBR. CUE WILL CALCULATE Q1 AND Q2=Q1*Q2        Q1(288,20),Q2(288,20)           496
   84 READ(28) (SINE(I),I=1,288),BLADES                                               497
      BACKSPACE 28                                                                    498
      CALL CUE(2,FM,MFIELD)                                                           499
      IF(INTERM.EQ.NO)GO TO 86                                                        500
      WRITE(6,87) LAZI,LSPAN                                                          501
   87 FORMAT(1H0, 3HQ1(,I3,1H,,I2,1H))                                                502
      DO 88 I=1,LSPAN                                                                 503
      WRITE(6,89) I,XO(I)                                                             504
   89 FORMAT(1H0, 13HSPAN STATION=,I3, 1H(, F6.3,1H) )                                505
   88 WRITE(6,90) (Q1(J,I),J=1,LAZI)                                                  506
   90 FORMAT( 2X,13(1PE10.3))                                                         507
C *** THE FOLLOWING LOOP EFFECTS A DOUBLE INTEGRATION WHICH YIELDS THE SOUND          508
C     PRESSURE COMPONENTS UMF(M,NFIELD) AND VMF(M,NFIELD).                            509
   86 DO 91 K=1,2                                                                     510
      IF(INTERM.EQ.NO) GO TO 92                                                       511
      I=K+1                                                                           512
      WRITE(6,93) I,LAZI,LSPAN                                                        513
   93 FORMAT(1H0, 1HQ,I1,1H(,I3,1H,,I2,1H))                                           514
      DO 94 I=1,LSPAN                                                                 515
      WRITE(6,89) I,XO(I)                                                             516
   94 WRITE(6,90) (Q2(J,I),J=1,LAZI)                                                  517
C *** A DOUBLE INTEGRATION IS DONE NEXT.                                              518
   92 IF(IDD.NE.1) GO TO 9304                                                         519
      CALL CLOCK                                                                      520
C RING ITEGRATION                                                                     521
      IAUDRE=LSPAN-2                                                                  522
      AREA=0.                                                                         523
      DO 10006 J=1,IAUDRE                                                             524
      QAVR = 0.                                                                       525
      DO 10007 I=1,LAZI                                                               526
10007 QAVR=QAVR+Q2(I,J+1)                                                             527
      QAVR=QAVR*RSQ(J)                                                                528
      WRITE(6,10008) J,QAVR                                                           529
10008 FORMAT(  5H RING,I3,20X,E13.5)                                                  530
10006 AREA=AREA+QAVR                                                                  531
      IF(K.EQ.2) GO TO 10009                                                          532
      URING=AREA*T1                                                                   533
      GO TO 10010                                                                     534
10009 VRING=AREA*T1                                                                   535
10010 CONTINUE                                                                        536
 9304 IAUDRE = LSPAN-1                                                                537
      DO 8820 I=1,LAZI                                                                538
      UBI(I)=0.                                                                       539
      DO 8821 J=2,IAUDRE                                                              540
```

Figure 14. Program Listing - Main.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0     CD COUNT

 8821 DBI(I)=DBI(I)+Q2(I,J)                                                          541
 8820 DBI(I)= (DBI(I)*2.+Q2(I,1)+Q2(I,LSPAN))*DELSPN                                 542
      DBI(LAZI+1) = DBI(1)                                                           543
      IF(IDD.NE.1) GO TO 8825                                                        544
      WRITE(6,8826) (DBI(I),I=1,145),DELSPN                                          545
 8826 FORMAT(1H0,1X,10E13.5)                                                         546
      CALL SIMCOR(LAZI+1,DPRAD,DBI,QAVR,I)                                           547
      TEMP1(K)=QAVR                                                                  548
 8825 QAVR = 0.                                                                      549
      DO 9701 I=1,LAZI                                                               550
 9701 QAVR=QAVR+DBI(I)                                                               551
      QAVR=QAVR*DPRAD*T1                                                             552
      IF(K.EQ.2) GO TO 9703                                                          553
      UTRAP=QAVR                                                                     554
      GO TO 9702                                                                     555
 9703 VTRAP=QAVR                                                                     556
C SIMPSON S                                                                          557
 9702 IF(IDD.NE.1) GO TO 9305                                                        558
      QAVR=2.*DELSPN                                                                 559
      DO 10000 I=1,LAZI                                                              560
      DO 10001 J=1,IAUDRE                                                            561
10001 AZ41(J)=Q2(I,J+1)                                                              562
      CALL SIMCOR(IAUDRE,QAVR,AZ41,AREA,J)                                           563
10000 DBI(I)=AREA                                                                    564
      DBI(LAZI+1) = DBI(1)                                                           565
      WRITE(6,8826) (DBI(I),I=1,145),QAVR                                            566
      CALL SIMCOR(LAZI+1,DPRAD,DBI,QAVR,I)                                           567
      IF(K.EQ.2) GO TO 10002                                                         568
      USIMP=QAVR*T1                                                                  569
      GO TO 10003                                                                    570
10002 VSIMP=QAVR*T1                                                                  571
10003 WRITE(6,2222) TEMP1(K),RO,BLADEL,T1,B8                                         572
 2222 FORMAT(1H0,5E20.6)                                                             573
      CALL CLOCK                                                                     574
      QAVR=0.                                                                        575
      DO 901 IROMA=1,20                                                              576
      DO 901 IAUDRE=1, 44                                                            577
  901 QAVR=QAVR+Q2(IAUDRE,IROMA)                                                     578
      QAVR=QAVR/2880.                                                                579
      WRITE(6,902) QAVR                                                              580
  902 FORMAT (1H0,11HQ AVERAGE=     ,1PE20.5)                                        581
 9305 IF(K.EQ.2) GO TO 91                                                            582
C *** SUBR. CUE WILL CALCULATE Q2=Q1*Q2                                              583
      READ(28) (SINE(I),I=1,288),BLADES                                              584
      BACKSPACE 28                                                                   585
      CALL CUE(3,FM,MFIELD)                                                          586
   91 CONTINUE                                                                       587
      READ(28) (SINE(I),I=1,288),BLADES                                              588
      BACKSPACE 28                                                                   589
      TEMP1(1)       = TEMP1(1)*T1                                                   590
      TEMP1(2)       = TEMP1(2)*T1                                                   591
      IF(IDD.NE.1) GO TO 95                                                          592
      WRITE(6,9704)                                                                  593
 9704 FORMAT(1H0,85 HTHE FOLLOWING ANSWERS ARE OBTAINED BY USING TRAPAZO             594
```

Figure 15. Program Listing - Main.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0   CD COUNT
     XIDAL INTERGRATION ALONG THE BLADE, /                                          595
     X 44HAND SIMPSON S INTEGRATION ALONG THE AZIMUTH.                  )           596
      WRITE(6,96) M,NFIELD,TEMP1(1)      ,M,NFIELD,TEMP1(2)                          597
   96 FORMAT(1H0,  4HUMF(,I2,1H,,I2,3H) =,1PE10.4,13X,                              598
     X             4HVMF(,I2,1H,,I2,3H) =,1PE10.4 )                                 599
C *** SOUND PRESSURE AND SOUND PRESSURE LEVEL ARE CALCULATED NEXT                   600
   95 PMRMS(M,NFIELD) = (1./1.41421356)*SQRT(UTRAP**2+VTRAP**2)                     601
      SPLM(M,NFIELD) = 20.*ALOG10(PMRMS(M,NFIELD)/2.9E-09)                          602
      IF(INTERM.EQ.NO) GO TO 31000                                                  603
      WRITE(6,97) M,NFIELD,PMRMS(M,NFIELD),M,NFIELD,SPLM(M,NFIELD)                  604
   97 FORMAT(1H0,  6HPMRMS(,I2,1H,,I2,3H) =,1PE10.4,10X,                            605
     X             6H SPLM(,I2,1H,,I2,3H) =,1PE10.4 )                               606
31000 IF(IDD.NE.1) GO TO 83                                                         607
      WRITE(6,9705)                                                                 608
 9705 FORMAT(1H0,95 HTHE FOLLOWING ANSWERS ARE OBTAINED BY USING TRAPAZO            609
     XIDAL INTEGRATION ALONG THE BLADE AND AZIMUTH      )                           610
      WRITE(6,96) M,NFIELD,UTRAP,M,NFIELD,VTRAP                                     611
      UTRAP=(1./1.41421356)*SQRT(UTRAP**2+VTRAP**2)                                 612
      VTRAP=20.*ALOG10(UTRAP/2.9E-09)                                               613
      WRITE(6,97) M,NFIELD,UTRAP,M,NFIELD,VTRAP                                     614
      WRITE(6,10004)                                                                615
10004 FORMAT(1H0, 17H SIMPSON, SIMPSON     )                                        616
      WRITE(6,96) M,NFIELD,USIMP,M,NFIELD,VSIMP                                     617
      USIMP= (1./1.41421356)*SQRT(USIMP**2+VSIMP**2)                                618
      VSIMP=20.*ALOG10(USIMP/2.9E-09)                                               619
      WRITE(6,97) M,NFIELD,USIMP,M,NFIELD,VSIMP                                     620
      WRITE(6,10011)                                                                621
10011 FORMAT(1H0,    6H RINGS    )                                                  622
      WRITE(6,96) M,NFIELD,URING,M,NFIELD,VRING                                     623
      URING=(1./1.41421356)*SQRT(URING**2+VRING**2)                                 624
      VRING=20.*ALOG10(URING/2.9E-09)                                               625
      WRITE(6,97) M,NFIELD,URING,M,NFIELD,VRING                                     626
   83 CONTINUE                                                                      627
C *** THE FOLLOWING SUBR. PRINTS OUT SOUND PRESSURE LEVELS FOR ALL CALCULATED       628
C     HARMONICS.                                                                    629
      CALL OUTSPL                                                                   630
      IF(IDD.NE.1) GO TO 7                                                          631
      CALL CLOCK                                                                    632
      GO TO 7                                                                       633
      STOP                                                                          634
      END                                                                           635
@IXG   FOR CURVIT,CURVIT                                                            636
      SUBROUTINE CURVIT (MM, X9, Y9, W, N, X0, Y0)                                  637
C                                                                                   638
C                                                                                   639
C        SIONED IN THE CALLING PROGRAM.                                             640
C        PRESENTLY W IS NOT USED IN THIS ROUTINE, HOWEVER, IT SHOULD BE DIMEN-      641
C                                                                                   642
C   *    W  WILL BE USED LATER FOR A WOPK VECTOR. -- COEF'S DIMENSION WILL          643
C*****   BE CHANED ALSO. - SO, FOR NOW ASSUME THE INPUT IS SORTED **** **** ****    644
C   *                                                                               645
      DIMENSION  X(14),Y(7), W(1), X0(1), Y0(1), CUBE(3), ROOT(3),                  646
     *   ROOTI(3), X9(1), Y9(1)                                                     647
       COMMON /COTAN/ TIN( 7,2), COEF(4, 7,2)                                       648
```

Figure 16. Program Listing - Main, CURVIT.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

      DO 1 I=1,MM
      X(I) = X9(I)
      X(I+7) = Y9(I)
  1   Y(I) = Y9(I)
      IF (MM .GE. 2) GO TO 10
      IF (MM .EQ. 0) Y = 0.
      DO  5  I=1,N
  5   Y0(I) = Y
      WRITE (6,100)     ( X0(I), Y0(I), I=1,N)
  100 FORMAT ( 94H0 PROBLEM WITH CURVE FITS (CURVIT) - LESS THAN TWO POI
     *NTS ON THIS CURVE. - INPUT X     OUTPUT Y, /(72X, 2E11.4, /) )
      RETURN
  10  CALL PARAM (MM, X,        2)
      DO  90  J=1,N
      TUM1=1
      DO  20  I=1,MM
      K=I-1
  20  IF( X0(J) .LT. X(I) ) GO TO 30
      IF( X0(J) .EQ. X(I) ) GO TO 48
      TUM1=-1
      I=  MM
  25  TUM1=-TUM1
      SLOPE = TIN(I,2)/TIN(I,1)* TUM1
      CONST = Y(I) - SLOPE*X(I)
      Y0(J) = SLOPE*X0(J) + CONST
      GO TO 90
  30  IF (I .EQ. 1) GO TO 25
  35  IF (X0(J) .EQ. X9(K)) GO TO 64
C        K REFER TO THE SECTION FROM WHICH WE NEED THE COEFFICIENTS.
      D= COEF(4,K,1)
      DO  40 I=1,3
  40  CUBE(I) = COEF(I,K,1)/D
      CUBE(1) = CUBE(1) - X0(J)/D
      CALL CUBIC (CUBE(3), CUBE(2), CUBE, ROOT, ROOTI )
      DO  50 I=1,3
      IF ( ABS(ROOT(I))  .LE. .0001) ROOT(I) = 0.
      IF ( ABS(ROOT(I)-1.).GT..0001) GO TO 49
  48  ROOT(I) = 1.
      Y0(J) = Y9(K+1)
      GO TO 90
   49 IF(ROOTI(I).NE.0.) GO TO 50
      IF(ROOT(I).LT.0.) GO TO 50
      IF(ROOT(I).GT.1.) GO TO 50
      GO TO 60
  50  CONTINUE
C    **  THERE IS NO SOLN.  **
      WRITE(6,101) (COEF(I,K,1), I=1,4), K, X0(J), (ROOT(I),ROOTI(I),I=1
     *,3)
  101 FORMAT ( 39H0   A ROOT FOR THE CUBIC EQUATION   X =, E11.4,3H + ,
     *  E11.4, 7H * T + , E11.4, 9H * T*T + , E11.4, 7H * T**3,13H  IN S
     *ECTION , I3, // 6X, 42H DOES NOT EXIST BETWEN 0. AND 1. WHEN X = ,
     *E13.5,47H AND THE ROOTS ARE -     REAL           IMAGINARY,(/77X,
     *E15.7, 2X,E15.7 ) )
      T = .5
```

Figure 17. Program Listing - CURVIT.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT
      GO TO 61
   64 T= 0.
      GO TO 61
   60 T = ROOT(I)
   61 YU(J) = COEF(1,K,2) + COEF(2,K,2)*T + COEF(3,K,2)*T*T +
     *        COEF(4,K,2)*T**3
   90 CONTINUE
      END
BIX6   FOR RDKU,RDKU
      SUBROUTINE RDKU(N)
C *** THIS SUBR. READS THE PROPER TAPE (UNIT 8,9,10,11, OR 12)
       COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,
     * MLIMDP,XFP(20),YFP(20),ZFP(20),GAMA,RO.BLADEL,B0,B1C,B1S,PUNCH,
     * LSPAN,FHOC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,
     * IPS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,
     * IREEL,NC,NTBOX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,
     * NOCH(5),LAZI
       COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XLO(7),XLM(7,40),
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,BEE,DEE,GMARI(288,20),
     * HMARI(288,20),XO(20)
       DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),
     * GMAR(144,5),HMAR(144,5)
       DIMENSION NNPS(219)
       EQUIVALENCE                (ND2(5671),HMAR),(GMARI,AN),
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN)
       EQUIVALENCE (FTRACK,KTRACK),(FBURST,KBURST),(FREC,KREC)
       EQUIVALENCE (ND1(5761),GMAR)
       GO TO (1,2),N
     1 LIM1 = 1
       LIM2 = 219
       GO TO 3
     2 LIM1 = 217
       LIM2 = 435
     3 I=KU-7
       GO TO (4,5,6,7,8),I
     4 READ(8) (NN(I),I=LIM1,LIM2)
       GO TO 9
     5 READ(9) (NN(I),I=LIM1,LIM2)
       GO TO 9
     6 READ(10)(NN(I),I=LIM1,LIM2)
       GO TO 9
     7 READ(11)(NN(I),I=LIM1,LIM2)
       GO TO 9
     8 READ(12)(NN(I),I=LIM1,LIM2)
       READ (13) (NNPS(I),I=1,219)
       I=-1
       DO 20 J=LIM1,LIM2,3
       I=I+3
    20 NN(J)=NNPS(I)
     9 FTRACK = AND(NN(LIM2-2),BMASK(6))
       FBURST = AND(NN(LIM2-1),BMASK(6))
```

Figure 18. Program Listing - CURVIT, RDKU.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0   CD COUNT

      FREC   = AND(NN(LIM2)  ,BMASK(6))
      IF(IDD.EQ.1)
     XWRITE(6,10) (NN(I),I=LIM1,LIM2)
   10 FORMAT(1H0, 19H(NN(I),I=LIM1,LIM2) / (2X,10013))
      RETURN
      END
QIXG   FOR INTERP,INTERP
      SUBROUTINE INTERP
C *** THIS SUBR. INTERPOLATES PRESSURE PULSE HARMONICS FOR UP TO 20 SPAN
C     STATIONS AND 288 AZIMUTHS.
       COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,
     * MLIMDP,XFP(20),YFP(20),ZFP(20),GAMA,RO,BLADEL,BO,B1C,B1S,PUNCH,
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E386OP,NFT,ANG,KEY1,KEY2,
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,
     * NOCH(5),LAZI
      COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XLO(7),XLM(7,40),
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,BEE,DEE,GMARI(288,20),
     * HMARI(288,20),XO(20)
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),
     * GMAR(144,5),HMAR(144,5)
      EQUIVALENCE                    (ND2(5671),HMAR),(GMARI,AN),
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN)
      EQUIVALENCE (ND1(5761),GMAR)
      DIMENSION YO(20)
      T1=.199
      T2=.801
C *** WE FIRST DEFINE THE RADIAL STATION GRID XO(20)
      XO(1) = T1
      XO(LSPAN) = 1.
      K=LSPAN-1
      DEL=K
      DEL = T2/DEL
      DO 1 J=2,K
    1 XO(J)=XO(J-1)+DEL
      KKK = 1
      TEMP1(1) = 0.
      TEMP3(1) = 0.
      TEMP2(1) = T1
C *** RADIAL STATION LOOP   (ZERO AZIMUTH BEGIN)
      DO 2 K=1,5
      IF(IRS(K).EQ.0) GO TO 2
      KKK = KKK+1
      TEMP1(KKK) = GMAR(1,K)
      TEMP3(KKK) = HMAR(1,K)
      TEMP2(KKK) = RR(K)
    2 CONTINUE
      NOPTS1 = KKK+1
      TEMP1(NOPTS1) = 0.
      TEMP3(NOPTS1) = 0.
      TEMP2(NOPTS1) = 1.
```

Figure 19. Program Listing - RDKU, INTERP.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0   CD COUNT
      CALL CURVIT (NOPTS1,TEMP2,TEMP1,W,LSPAN,XO,YO)                                 811
      DO 3 K=1,LSPAN                                                                 812
    3 GMARI(1,K) = YO(K)                                                             813
      CALL CURVIT(NOPTS1,TEMP2,TEMP3,W,LSPAN,XO,YO)                                  814
      DO 4 K=1,LSPAN                                                                 815
    4 HMARI(1,K) = YO(K)                                                             816
      D = (DPSI/2.5) + .00001                                                        817
      ISI = D                                                                        818
      JJ = ISI                                                                       819
      JAZ2 = 1                                                                       820
      J = 3                                                                          821
      ISI2=ISI                                                                       822
      IF(ISI.EQ.0) ISI2=1                                                            823
      LOW = ISI2+1                                                                   824
C *** AZIMUTH LOOP                                                                   825
      DO 5 JAZ=LOW,144,ISI2                                                          826
      JAZ2 = JAZ2+1                                                                  827
      KKK=1                                                                          828
      DO 6 K=1,5                                                                     829
      IF(IRS(K).EQ.0) GO TO 6                                                        830
      KKK = KKK+1                                                                    831
      TEMP1(KKK) = GMAR(JAZ,K)                                                       832
      TEMP3(KKK) = HMAR(JAZ,K)                                                       833
    6 CONTINUE                                                                       834
      CALL CURVIT(NOPTS1,TEMP2,TEMP1,W,LSPAN,XO,YO)                                  835
      IF(ISI.GE.1) J=JAZ2                                                            836
      DO 7 K=1,LSPAN                                                                 837
    7 GMARI(J,K) = YO(K)                                                             838
      CALL CURVIT(NOPTS1,TEMP2,TEMP3,W,LSPAN,XO,YO)                                  839
      DO 8 K=1,LSPAN                                                                 840
    8 HMARI(J,K) = YO(K)                                                             841
      IF(JJ.NE.0) GO TO 5                                                            842
      DO 9 K=1,LSPAN                                                                 843
      GMARI(J-1,K) = (GMARI(J,K)+GMARI(J-2,K))/2.                                    844
    9 HMARI(J-1,K) = (HMARI(J,K)+HMARI(J-2,K))/2.                                    845
      J=J+2                                                                          846
    5 CONTINUE                                                                       847
      IF(JJ.NE.0) RETURN                                                             848
      J=J-2                                                                          849
      DO 10 K=1,LSPAN                                                                850
      GMARI(J+1,K) = (GMARI(1,K) + GMARI(J  ,K))/2.                                  851
   10 HMARI(J+1,K) = (HMARI(1,K) + HMARI(J  ,K))/2.                                  852
      RETURN                                                                         853
      END                                                                            854
$IXG   FOR MERGES,MERGES                                                             855
      SUBROUTINE MERGES                                                              856
C *** THIS SUBR. PRODUCES DIFFERENTIAL PRESSURES FROM ABSOLUTE TOP AND BOTTOM        857
C     READINGS.                                                                      858
       COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,              859
     * MLIMUP,XFP(20),YFP(20),ZFP(20),GAMA,RO,BLADEL,B0,B1C,B1S,PUNCH,               860
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,                861
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,                862
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,                863
     * IREEL,NC,NTBOX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,               864
```

Figure 20. Program Listing - INTERP, MERGES.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

     * NGCH(5),LAZI                                                                  865
      COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,                   866
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XLO(7),XLM(7,40),              867
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),               868
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,BEE,DEE,GMARI(288,20),                          869
     * HMARI(288,20),XO(20)                                                          870
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),                       871
     * GMAR(144,5),HMAR(144,5)                                                       872
      EQUIVALENCE                    (ND2(5671),HMAR),(GMARI,AN),                   873
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN)                                   874
      EQUIVALENCE (ND1(5761),GMAR)                                                   875
      INTEGER DEE,BEE                                                                876
      DO 1 I=1,5                                                                     877
      DO 1 J=1,5                                                                     878
      CN(1,I,J) = 0.0                                                                879
      DO 1  K=1,30                                                                   880
      CN(K+1,I,J) = 0.0                                                              881
    1 SN(K,I,J) = 0.0                                                                882
C *** SPAN LOOP                                                                      883
      ISWTCH=0                                                                       884
      DO 2 I=1,5                                                                     885
C *** CHORD LOOP                                                                     886
      DO 2 J=1,5                                                                     887
      ISW = 0                                                                        888
      IREEL = 0                                                                      889
    3 IREEL = IREEL+1                                                                890
      NC = 0                                                                         891
    4 NC = NC+1                                                                      892
      IF(IDU.NE.1) GO TO 25                                                          893
      WRITE(6,20) I,J,NC,IREEL,NSTATR(IREEL,NC),NSTATC(IREEL,NC),                    894
     X    NTBDX(IREEL,NC)                                                             895
   20 FORMAT(    6I13,5X,A6)                                                         896
   25 IF(NC.GT.10) GO TO 3                                                           897
      IF(ISWTCH.EQ.1) GO TO 15                                                       898
      IF(NSTATR(IREEL,NC).EQ.0) GO TO 5                                              899
   15 IF(NSTATR(IREEL,NC).NE.I) GO TO 4                                              900
      IF(NSTATC(IREEL,NC).NE.J) GO TO 4                                              901
      IF(NTBDX(IREEL,NC).EQ.DEE) GO TO 6                                             902
      IF(NTBDX(IREEL,NC).EQ.BEE) GO TO 7                                             903
      IRTOP = IREEL                                                                  904
      NCTOP = NC                                                                     905
      ISW = ISW+1                                                                    906
      GO TO 8                                                                        907
    7 IRBOT = IREEL                                                                  908
      NCBOT = NC                                                                     909
      ISW = ISW+1                                                                    910
    8 IF(ISW.NE.2) GO TO 4                                                           911
      CN(1,J,I) = AN(1,NCBOT,IRBOT) - AN(1,NCTOP,IRTOP)                              912
      DO 10 K=1,30                                                                   913
      CN(K+1,J,I) = AN(K+1,NCBOT,IRBOT)-AN(K+1,NCTOP,IRTOP)                          914
   10 SN(K,J,I) = BN(K,NCBOT,IRBOT)-BN(K,NCTOP,IRTOP)                                915
      GO TO 2                                                                        916
C *** COLLECTIVE, LONGITUDINAL CYCLIC, AND LATERAL CYCLIC PITCH ANGLES FOUND         917
C     NEXT.                                                                          918
```

Figure 21. Program Listing - MERGES.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

    5 B0 = AN(1,NC,IREEL)
      B1C = AN(2,NC,IREEL)
      B1S = BN(1,NC,IREEL)
      ISWTCH=1
      IF(IDD.EQ.1) WRITE(6,20) B0,B1C,B1S,IREEL,I,J
      GO TO 4
    6 CN(1,J,I) = AN(1,NC,IREEL)
      DO 11 K=1,30
      CN(K+1,J,I) = AN(K+1,NC,IREEL)
   11 SN(K,J,I) = BN(K,NC,IREEL)
    2 CONTINUE
      RETURN
      END
@IXG   FOR       DFSRIE,DFSRIE
      SUBROUTINE DFSRIE(NP,NH,Y,A,B)                                    DFSRI
      DIMENSION Y(NP),A(1),B(1)                                         DFSRI
C                  ------------------------------------------------
C                  NUMBER OF HARMONICS  MUST NOT EXCEED HALF
C                  THE NUMBER OF DATA POINTS INPUTED.
C                  ------------------------------------------------
      NNH=MIN0(NH,NP/2)
C-----------------------------------------------------------------
C     INITIALIZATION AND CONSTANTS.                                     DFSRI
C-----------------------------------------------------------------
      SP=0.                                                             DFSRI
      CP=1.                                                             DFSRI
      RN=2./NP                                                          DFSRI
      B(1)=0.                                                           DFSRI
      A(1)=0.                                                           DFSRI
      ARG=RN*3.14159265                                                 DFSRI
      C=COS(ARG)                                                        DFSRI
      S=SIN(ARG)                                                        DFSRI
C-----------------------------------------------------------------
C     COMPUTE A FOR THE ZEROTH HARMONIC                                 DFSRI
C-----------------------------------------------------------------
      DO10I=1,NP                                                        DFSRI
10    A(1)=A(1)+Y(I)                                                    DFSRI
      A(1)=RN*A(1) /2.                                                  DFSRI
C-----------------------------------------------------------------
C     MAIN LOOP.                                                        DFSRI
C-----------------------------------------------------------------
       DO 100 K=1,NNH
      X=C*CP-S*SP                                                       DFSRI
      SP=C*SP+S*CP
      CP=X                                                              DFSRI
      U=0.                                                              DFSRI
      V=0.                                                              DFSRI
C     COMPUTE RECURSIVE U,S                                             DFSRI
      DO20II=2,NP                                                       DFSRI
      J=NP-II+2                                                         DFSRI
      W=Y(J)+2.*CP*V-U                                                  DFSRI
      U=V                                                               DFSRI
20    V=W                                                               DFSRI
      A(K+1)=RN*(Y(1)+CP*V-U)                                           DFSRI
```

Figure 22. Program Listing - MERGES, DFSRIE.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

100   B(K+1)=RN*SP*V                                                  DFSRI        973
      RETURN                                                          DFSRI        974
      END                                                             DFSRI        975
@IXG  FOR CUE,CUE                                                                  976
      SUBROUTINE CUE(N,FM,MFIELD)                                                  977
       COMMON /BK1/ IDO,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,            978
     * MLIMDP,XFP(20),YFP(20),ZFP(20),GAMA,R0,BLADEL,B0,B1C,B1S,PUNCH,             979
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,               980
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,               981
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,               982
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,              983
     * NOCH(5),LAZI                                                               984
       COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,               985
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XL0(7),XLM(7,40),           986
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),            987
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,BEE,DEE,GMARI(288,20),                       988
     * HMARI(288,20),XO(20)                                                       989
       COMMON /BK3/ SPLM(10,20),AZMTH3(288),                                      990
     * SPAN(20),                          PMRMS(10,20),                          991
     * ICHANL(10,5),COSINE(288),SINE(288),BLADES,CARD,TAPE                        992
       EQUIVALENCE                 (ND2(5671),HMAR),(GMARI,AN),                   993
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN),(ND2,Q2)                       994
       DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),                   995
     * GMAR(144,5),HMAR(144,5)                                                    996
     * ,Q1(288,20),Q2(288,20)                                                      997
       EQUIVALENCE (ND1(5761),GMAR),(ND1,Q1)                                      998
       T1=PI/30.                                                                  999
       T5=PI/180.                                                                 000
C *** SPAN LOOP                                                                   001
       IF(IDO.NE.1) GO TO 7                                                       002
       WRITE(6,3) XFP                                                             003
       WRITE(6,3) YFP                                                             004
       WRITE(6,3) ZFP                                                             005
       WRITE(6,3) SPAN                                                            006
       WRITE(6,3) COSINE                                                          007
       WRITE(6,3) SINE                                                            008
       WRITE(6,3) AZMTH3                                                          009
       WRITE(6,3) OMEG,CC,GAMA,R0,B0,B1C,B1S,FM,BLADES,T1,T5                      010
     3 FORMAT(1H0/(2X,1P10E13.5))                                                 011
     7 DO 1 I=1,LSPAN                                                             012
C *** AZIMUTH LOOP                                                                013
       DO 1 J=1,LAZI                                                              014
       S = SQRT((XFP(MFIELD)-SPAN(I)*COSINE(J))**2 + (YFP(MFIELD)-SPAN(I)         015
      X *SINE(J))**2 + ZFP(MFIELD)**2)                                            016
       B =(B0 - GAMA*(SPAN(I)-R0) + B1C*COSINE(J) + B1S*SINE(J))*T5               017
       SINB = SIN(B)                                                              018
       COSB = COS(B)                                                              019
       T4 = FM*BLADES*(AZMTH3(J)+(S*OMEG*T1)/CC)                                  020
       T2 = COS(T4)                                                               021
       T3 = SIN(T4)                                                               022
       T4= (FM*BLADES*OMEG/(CC*S**2))*T1                                          023
       IF(N.EQ.3) GO TO 2                                                         024
       W1(J,I) =SPAN(I)* ((XFP(MFIELD)-SPAN(I)*COSINE(J))*SINB*SINE(J)-           025
      X (YFP(MFIELD)-SPAN(I)*SINE(J))*SINB*COSINE(J)+ZFP(MFIELD)*COSB)            026
```

Figure 23. Program Listing - DFSRIE, CUE.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

      Q2(J,I) = Q1(J,I)*(GMARI(J,I)*(-T2/S**3 - T4*T3) +                              027
     X HMARI(J,I)*(T3/S**3 - T4*T2))                                                  028
      IF(IOD.NE.1) GO TO 1                                                            029
      IF(I.GT.2) GO TO 1                                                              030
      IF(J.GT.20) GO TO 1                                                             031
      WRITE(6,4) I,J,MFIELD                                                           032
    4 FORMAT(1H0,6I13)                                                                033
      WRITE(6,3) S,B,SINB,COSB,T2,T3,T4,GMARI(J,I),HMARI(J,I),                        034
     X  Q1(J,I),Q2(J,I)                                                               035
      GO TO 1                                                                         036
    2 Q2(J,I) = Q1(J,I)*(GMARI(J,I)*(-T3/S**3 + T4*T2) +                              037
     X HMARI(J,I)*(-T2/S**3 - T4*T3))                                                 038
    1 CONTINUE                                                                        039
      RETURN                                                                          040
      END                                                                             041
@IXG   FOR BLODAT,BLODAT                                                              042
      BLOCK DATA                                                                      043
       COMMON /BK1/ IDO,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,HLIMRN,               044
     * HLIMDP,XFP(20),YFP(20),ZFP(20),GAMA,RO,BLADEL,BO,BIC,BIS,PUNCH,                045
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,                  046
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,                  047
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,                  048
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,                 049
     * NOCH(5),LAZI                                                                   050
      COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,                    051
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XLO(7),XLM(7,40),               052
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),                053
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,BEE,DEE,GMARI(288,20),                           054
     * HMARI(288,20),XO(20)                                                           055
      COMMON /BK3/ SPLM(10,20),AZMTH3(288),                                           056
     * SPAN(20),                          PMRMS(10,20),                              057
     * ICHANL(10,5),COSINE(288),SINE(288),BLADES,CARD,TAPE                            058
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),                        059
     * GMAR(144,5),HMAR(144,5)                                                        060
     * ,Q1(288,20),Q2(288,20)                                                         061
      EQUIVALENCE                    (ND2(5671),HMAR),(GMARI,AN),                     062
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN),(ND2,Q2)                           063
      EQUIVALENCE (ND1(5761),GMAR),(ND1,Q1)                                           064
C IRS(I) IS AN INSTRUMENTED RADIAL STATION COUNTER, COUNTING FROM THE BLADE ROOT      065
C IF IRS(I)=0, THEN THAT STATION IS NO GOOD.                                          066
      DATA (IRS(I),I=1,5) /1,2,3,4,5/                                                 067
C NCHAN(I,J) IS AN ISTRUMENTED CHORD STATION COUNTER J FOR EACH RADIAL STATION I      068
C IF CHORD STATION J IS NO GOOD, THEN NCHAN(I,J)=0                                    069
      DATA ((NCHAN(I,J),J=1,5),I=1,5)/1,2,3,4,5, 1,2,3,4,5, 1,2,3,4,5,                070
     X 1,2,3,4,5, 1,2,3,4,5/                                                          071
C XA(I,J) IS THE FRACTIONAL DISTANCE ALONG THE CHORD FROM THE LEADING EDGE WHERE      072
C J=SPAN AND I=CHORD STATION.                                                         073
      DATA ((XA(I,J),I=1,5),J=1,5)/ .042,.158,.300,.600,.910,                         074
     X .042,.158,.300,.600,.910,     .042,.158,.300,.600,.910,                        075
     X .042,.158,.300,.600,.910,     .042,.158,.300,.600,.910/                        076
C NCH(I) IS THE TOTAL NO. OF CHORD STATIONS FOR RADIAL STATION I.                     077
      DATA (NCH(I),I=1,5)/5,5,5,5,5/                                                  078
C RR(I) IS THE FRACTIONAL RADIAL STATION MEASURED FROM THE HUB CENTER WHERE           079
C I=SPAN STATION.                                                                     080
```

Figure 24. Program Listing - CUE, BLODAT.

```
1         1         2         3                   5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0   CD COUNT

      DATA (RR(I),I=1,5)/.40,.75,.85,.95,.98/                                     081
C FI(I,J) GAUSSIAN INTEGRATION FACTORS FOR RADIAL STATIONI, CHORD STATION J.      082
      DATA ((FI(I,J),J=1,5),I=1,5) /.1,.1,.222,.355,.222,                         083
     X .1,.1,.222,.355,.222,          .1,.1,.222,.355,.222,                        084
     X .1,.1,.222,.355,.222,          .1,.1,.222,.355,.222 /                       085
      DATA (NDIV(I),I=1,4)/0 001 000 000 000, 0 000 001 000 000,                  086
     X 0 000 000 001 000, 0 000 000 000 001/,(BMASK(I),I=1,6)/                    087
     X 0 777 000 000 000, 0 000 777 000 000, 0 000 000 777 000,                   088
     X 0 000 000 000 777, 0 777 777 000 000, 0 000 000 777 777/,                  089
     X YES/1HY/,NO/1HN/,TAPE/4HTAPE/,CARD/4HCARD/                                 090
      DATA TEE,BEE,DEE /1HT,1HB,1HD/                                              091
      END                                                                         092
@IXG  FOR INPUTA,INPUTA                                                           093
      SUBROUTINE INPUTA                                                           094
C THIS SUBR. RECEIVES CARD INPUT                                                  095
      COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,            096
     * MLIMDP,XFP(20),YFP(20),ZFP(20),GAMA,RO,BLADEL,B0,B1C,B1S,PUNCH,             097
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,               098
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,               099
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,               100
     * IREEL,NC,NTBCX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,              101
     * NOCH(5),LAZI                                                               102
      COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,                103
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XL0(7),XLM(7,40),            104
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),             105
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,BEE,DEE,GMARI(288,20),                        106
     * HMARI(288,20),XO(20)                                                       107
      COMMON /BK3/ SPLM(10,20),AZMTH3(288),                                       108
     * SPAN(20),                          PMRMS(10,20),                           109
     * ICHANL(10,5),COSINE(288),SINE(288),BLADES,CARD,TAPE                        110
      EQUIVALENCE                    (ND2(5671),HMAR),(GMARI,AN),                111
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN),(ND2,Q2)                       112
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),                    113
     * GMAR(144,5),HMAR(144,5)                                                    114
     * ,Q1(288,20),Q2(288,20)                                                      115
      EQUIVALENCE (ND1(5761),GMAR),(ND1,Q1)                                       116
      READ(5,1) (NN(I),I=1,14)                                                    117
    1 FORMAT( 13A6,A2 )                                                           118
      WRITE(6,2) (NN(I),I=1,14)                                                   119
    2 FORMAT(1H1,25X,13A6,A2)                                                     120
      READ(5,3) BB,AA,BLADEL,GAMA,RO,CC,OMEG,DPSI,NBLADE,MLIMDP,MLIMRN,           121
     * LSPAN,IREELS,TCOP,PUNCH,INTERM,IDD                                          122
    3 FORMAT( 8E7.0,1X,I1,3(1X,I2),1X,I1,1X,A4,2(1X,A1),1X,I1)                    123
      IF(TCOP.EQ.CARD) GO TO 45                                                   124
      DO 100 I=1,5                                                                125
      DO 100 JJ=1,10                                                              126
      NSTATC(I,JJ) = 100                                                          127
  100 NSTATR(I,JJ) = 100                                                          128
      DO 16 J=1,IREELS                                                            129
      READ(5,4) IREEL,ITRACK(IREEL),ISET(IREEL),KUNIT(IREEL)                      130
      WRITE(6,77)                                                                 131
     X          IREEL,ITRACK(IREEL),ISET(IREEL),KUNIT(IREEL)                     132
   77 FORMAT( 5I13)                                                               133
    4 FORMAT(I1,2(1X,I2),6X,I2)                                                   134
```

Figure 25. Program Listing - BLODAT, INPUTA.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

      NOCH(IREEL)= 0
    6 READ(5,5) NC,NTBDX(IREEL,NC),NSTATC(IREEL,NC),NSTATR(IREEL,NC),
     * SLOPE(NC,IREEL),OFFSET(NC,IREEL),NCEND
    5 FORMAT(2X,I2,1X,A1,2(1X,I1),1X,E13.1,3X,E13.1,39X,I1)
      NOCH(IREEL) = NOCH(IREEL)+1
      K=NOCH(IREEL)
      ICHANL(K,JJ) = NC
      IF(NCEND.EQ.0) GO TO 6
   16 CONTINUE
      READ(5,7) (FROC(J),J=1,30)
    7 FORMAT(6E13.1,2X)
   45 READ(5,8) E3860P,OPRONO,NFT
    8 FORMAT(1X,2(1X,A1),2X,I2)
      IF(E3860P.NE.YES)GO TO 9
      READ(5,10) ANG,NHH,KEY1,KEY2,KEY3
   10 FORMAT( E7.0,4(2X,I2))
    9 DO 11 I=1,NFT
      IF(E3860P.NE.YES)GO TO 12
      READ(5,13) CAPRF(I),THETAF(I),ALFAF(I),XFP(I),YFP(I),ZFP(I)
   13 FORMAT( 3E10.1,20X,3E10.1)
      GO TO 11
   12 READ(5,14) XFP(I),YFP(I),ZFP(I)
   14 FORMAT( 50X,3E10.1)
   11 CONTINUE
C *** NOW THE INPUT IS PRINTED OUT.
      WRITE(6,20) BB,RO,AA,CC,BLADEL,OMEG,DPSI,GAMA
   20 FORMAT(1H0,1X, 28HBLADE THICKNESS (IN)       = , E10.4, 8X,
     1 35HZERO TWIST BLADE STA.      (IN)    = , E10.4 //  2X,
     2 28HBLADE CHORD      (IN)       = ,E10.4, 8X,35HSPEED OF SOUND
     3   (IN/SEC)  = ,E10.4 //  2X,28HBLADE LENGTH     (IN)       =
     3 , E10.4,8X,
     4 35HROTOR ROT. SPEED           (RPM)  = ,E10.4  //  48X,35HAZIMUTH
     5INCREMENT          (DEG)    = ,E10.4 /  2X, 28HBLADE TWIST RATE (DEG/
     6IN) = ,E10.4 )
      WRITE(6,21) NBLADE,TCOP,MLIMDP,PUNCH,MLIMRN,INTERM,LSPAN,IREELS
   21 FORMAT(1H0,17H NUMBER OF BLADES, 32X,2H= , I2, 14X, 18HTAPE / CARD
     1 OPTION, 15X, 2H= , A4 // 2X, 49HNO. OF HARMONICS TO REPRESENT PRE
     2SSURE CYCLES    =  , I3, 14X, 35HPRESSURE HARMONIC PUNCH OPTION    =
     3 , A1 // 2X, 28HNO. OF ROTOR NOISE HARMONICS, 20X,2H= , I2, 14X,
     4 26HINTERMEDIATE OUTPUT OPTION, 7X, 2H= , A1 // 2X, 33HNO. OF INTE
     5RPOLATED SPAN STATIONS, 15X, 2H= , I2 // 2X, 23HTOTAL NO. OF TAPE
     6REELS, 25X,2H= , I2 /  )
      IF(TCOP.EQ.CARD) GO TO 46
      DO 22 IREEL=1,IREELS
      WRITE(6,23) IREEL,ITRACK(IREEL),ISET(IREEL),KUNIT(IREEL)
   23 FORMAT(1H0,1X, 11HREEL NO. = ,I1, 4X,12HTRACK NO. = , I2, 4X,
     1 10HSET NO. = , I2, 4X, 24HLOGICAL TAPE UNIT NO. = , I2 //  8X,
     2  7HCHANNEL, 24X, 5HSLOPE, 14X, 6HOFFSET )
      K=NOCH(IREEL)
      DO 22 I=1,K
      NC = ICHANL(I,IREEL)
      WRITE(6,24) NC,NTBDX(IREEL,NC),NSTATC(IREEL,NC),NSTATR(IREEL,NC),
     1 SLOPE(NC,IREEL),OFFSET(NC,IREEL)
   24 FORMAT( 10X,I2,6X,A1,6X,I1,6X,I1,6X,1PE12.6,7X,  E12.6  )
```

Figure 26. Program Listing - INPUTA.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0   CD COUNT

      SLOPE(NC,IREEL) = SLOPE(NC,IREEL)/256.                                        189
   22 CONTINUE                                                                      190
      WRITE(6,25)                                                                   191
   25 FORMAT(//// 3X, 8HHARMONIC, 5X,18HFREQ. CORR. FACTOR, 19X,8HHARMON            192
     11C, 5X, 18HFREQ. CORR. FACTOR // )                                            193
      DO 26 J=1,15                                                                  194
      JJ = J+15                                                                     195
      WRITE(6,63) J,FROC(J),JJ,FROC(JJ)                                             196
   63 FORMAT( 10X,I2,13X,1PE11.4,25X,I2,13X,1PE11.4)                                197
   26 CONTINUE                                                                      198
   46 WRITE(6,27) E3860P,OPRONO,NFT                                                 199
   27 FORMAT( 2H0 , 62HOPTION TO USE PROGRAM E386 (THEORETICAL CONST. PR            200
     1ESSURE PULSE) ,8X,2H= , A1 //  2X, 59HOPTION TO USE ROTOR NOISE PR            201
     2OGRAM (MEASURED PRESSURE PULSE) ,11X, 2H= , A1 //  2X, 19HNO. OF F            202
     3IELD POINTS, 51X, 1H= , I2 //  )                                              203
      IF(E3860P.NE.YES)GO TO 28                                                     204
      WRITE(6,29) ANG,NHM,KEY1,KEY2,KEY3                                            205
   29 FORMAT(2X, 43HINCR. OF INTEGRATION USED IN E386 (DEG.) = , F7.4,               206
     1 4X, 28HNO. OF AIR LOAD HARMONICS = ,I2,4X, 6HKEY1= ,I2,2X,6HKEY2=            207
     2 ,I2,2X,6HKEY3= ,I2///)                                                       208
C *** FIELD POINTS PRINTED OUT NEXT.                                                209
   28 IF(E3860P.NE.YES.AND.OPRONO.NE.YES) GO TO 60                                  210
      WRITE(6,36)                                                                   211
   36 FORMAT(   25X,17HE386 FIELD POINTS, 32X,24HROTOR NOISE FIELD POINT            212
     1S //  6X,2HFP,7X,  6HR (FT),7X, 24HTHETA (DEG)  ALPHA (DEG), 9X,              213
     2 2HFP, 7X, 6HX (IN), 7X,6HY (IN),7X,6HZ (IN) / )                              214
      GO TO 31                                                                      215
   60 IF(E3860P.NE.YES) GO TO 30                                                    216
      WRITE(6,37)                                                                   217
   37 FORMAT(   25X,17HE386 FIELD POINTS // 6X,2HFP, 7X, 6HR (FT), 7X,               218
     1 24HTHETA (DEG)  ALPHA (DEG) / )                                              219
      GO TO 31                                                                      220
   30 WRITE(6,38)                                                                   221
   38 FORMAT( 74X, 24HROTOR NOISE FIELD POINTS // 61X, 2HFP, 7X, 6HX (IN            222
     1), 7X,6HY (IN),7X,6HZ (IN) /  )                                               223
   31 DO 32 I=1,NFT                                                                 224
      IF(E3860P.NE.YES.AND.OPRONO.NE.YES) GO TO 33                                  225
      WRITE(6,39) I,CAPRF(I),THETAF(I),ALFAF(I),I,XFP(I),YFP(I),ZFP(I)              226
   39 FORMAT( 6X,I2,4X, 3(3X,E10.4),10X,I2,2X, 3(3X,E10.4)  )                       227
      GO TO 32                                                                      228
   33 IF(E3860P.NE.YES) GO TO 34                                                    229
      WRITE(6,39) I,CAPRF(I),THETAF(I),ALFAF(I)                                     230
      GO TO 32                                                                      231
   34 WRITE(6,40) I,XFP(I),YFP(I),ZFP(I)                                            232
   40 FORMAT( 61X,I2,2X, 3(3X,E10.4) )                                              233
   32 CONTINUE                                                                      234
      RETURN                                                                        235
      END                                                                           236
QIXG   FOR UNPACK,UNPACK                                                            237
      SUBROUTINE UNPACK                                                             238
C *** THIS SUBR. UNPACKS A CYCLE NN(435) TO FORM THE ARRAY ND1(144,10,IREEL)        239
C     WHERE THE FIRST SUBSCRIPT REPRESENTS AZIMUTH, AND THE SECOND ARRAY            240
C     REPRESENTS CHANNEL NO.                                                        241
       COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,             242
```

Figure 27. Program Listing - INPUTA, UNPACK.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT
     * MLIMUP,XFP(20),YFP(20),ZFP(20),GAMA,RO,BLADEL,B0,B1C,B1S,PUNCH,                243
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,                  244
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,                  245
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,                  246
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,                 247
     * NOCH(5),LAZI                                                                   248
      COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIBS,                    249
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XL0(7),XLM(7,40),               250
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),                251
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,BEE,DEE,GMARI(288,20),                           252
     * HMARI(288,20),XO(20)                                                           253
      EQUIVALENCE                    (ND2(5671),HMAR),(GMARI,AN),                    254
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN)                                    255
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),                        256
     * GMAR(144,5),HMAR(144,5)                                                        257
      EQUIVALENCE (ND1(5761),GMAR)                                                    258
      DATA SIN/O 400 000 000 000/                                                     259
      EQUIVALENCE  (V2,IV2)                                                           260
      WRITE(6,6) NN                                                                   261
    6 FORMAT(2X,10O13)                                                                262
      NW = 0                                                                          263
C *** AZIMUTH POINT LOOP                                                              264
      DO 1 I=1,144                                                                    265
      NCT = 0                                                                         266
C *** WORDS IN A FRAME LOOP                                                           267
      DO 1 J=1,3                                                                      268
      NW = NW+1                                                                       269
      N10 = 5                                                                         270
C *** DATA WORDS TO UNPACK LOOP                                                       271
      DO 1 K=1,4                                                                      272
      N10 = N10-1                                                                     273
      IF(J.EQ.3.AND.K.GT.2) GO TO 1                                                   274
      NCT = NCT+1                                                                     275
      N1 = NN(NW)                                                                     276
      IF(K.EQ.1) GO TO 2                                                              277
      N1 = N1*NDIV(N10)                                                               278
    2 N1 = N1/NDIV(1)                                                                 279
      IV2=N1                                                                          280
      V2=AND(V2,SIN)                                                                  281
      IV2=IV2/2                                                                       282
      IF(IV2.NE.0) N1=N1-1                                                            283
      ND1(I,NCT,IREEL) = N1                                                           284
    1 CONTINUE                                                                        285
      IF(IDD.NE.1.AND.NCYCLE.GT.0) RETURN                                             286
      WRITE(6,5) IREEL,(ND1(1,K,IREEL),K=1,10)                                        287
    5 FORMAT(1H0,  6HIREEL=,I3,10X,                                                   288
     X 18HND1(144,10,IREEL)  /2X,10I13)                                               289
      RETURN                                                                          290
      END                                                                             291
QIXG  FOR PARAM,FARAM                                                                 292
      SUBROUTINE PARAM (N, P,       IJ )                                            293
      DIMENSION G( 7), P( 7,2),DEL( 7,2),DIST( 7),A( 7, 8),Q( 7,2)                    294
       COMMON /COTAN/   T( 7,2), COE (4, 7,2)                                         295
      N1 = N-1                                                                        296
```

Figure 28. Program Listing - UNPACK, PARAM.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

      N2 = N-2
      N3 = N-3
      N0=N2
      IGO = 2
      DO  15 I=1,N1
      DO 10 J=1,2
   10 DEL(I,J) =  P(I+1,J) - P(I,J)
   15 DIST(I)  =  SQRT(DEL(I,1)**2 + DEL(I,2)**2)
      DO  20 I=1,N
      DO  20 J=1,N
   20 A(I,J) = 0.
      A(1,3) = DIST(1)
      A(N2,N2) = DIST(N1)
      DO  30  I=2,N3
      A(I,I)   = DIST(I+1)
      A(I,I+1) = 2.*(DIST(I)+DIST(I+1))
      A(I,I+2) = DIST(I)
      DO 30 J=1,2
   30 Q(I,J)   = 3.*(DIST(I)/DIST(I+1)*DEL(I+1,J)+DIST(I+1)/DIST(I)*DEL(
     *  I,J))
   12 A(1,2) = 2.* DIST(1) + DIST(2)*1.5
C  12 A(1,2) = 2.*(DIST(1) + DIST(2))
      DO 33 J=1,2
C 33 Q(1,J) = 3.*(DIST(1)/DIST(2)*DEL(2,J)+DIST(2)/DIST(1)*DEL(1,J)) -
   33 Q(1,J) = 3.*(DIST(1)/DIST(2)*DEL(2,J)+DIST(2)/DIST(1)*DEL(1,J)/2.)
C    * DIST(2)* T(1,J)
C  22 A(N2, N1 ) = 2.*(DIST(N2 ) + DIST(N1 ))
   22 A(N2, N1 ) =1.5* DIST(N2 ) + DIST(N1 )*2.
      DO 27 J=1,2
   27 Q(N2, J)   =1.5*(DIST(N2 )/DIST(N1 )*DEL(N1, J)   +DIST(N1 )/DIST
C  27 Q(N2, J)   = 3.*(DIST(N2 )/DIST(N1 )*DEL(N1, J)   +DIST(N1 )/DIST
     *(N2 )*DEL(N2, J))
C    *(N2 )*DEL(N2, J)) - DIST(N2 )* T(N,J)
   17 DO 45 J=1,2
      DO  36  I=1,N0
   36 G(I)=Q(I,J)
      CALL TRIDAG(A(1,2),G,N0,T(2,J))
      T(1,J) = 1.5/DIST*DEL(1,J) - .5*T(2,J)
      T(N,J) = 1.5/DIST(N1)*DEL(N1,J) - .5*T(N1,J)
   44 DO  45  I=1,N1
      COE(4,I,J)=-2.*DEL(I,J) + DIST(I)*( T(I+1,J)+T(I,J) )
      COE(3,I,J)= 3.*DEL(I,J) - DIST(I)*( T(I+1,J)+2.*T(I,J) )
      COE(2,I,J)= DIST(I)*T(I,J)
   45 COE(1,I,J)= P(I,J)
      RETURN
      END
@IXG  FOR TRIDAG,TRIDAG
      SUBROUTINE TRIDAG(A,G,K1,Z )
      DIMENSION A( 7,8),G(7),Z(7)
    1 FORMAT (10X,50HT=0. .OR. S=0. IN TRIDAG.  CANNOT DIVIDE BY S OR T)
C
C     PURPOSE
C         TO SOLVE THE TRIDIAGONAL MATRIX EQUATION
C
```

Figure 29. Program Listing - PARAM, TRIDAG.

```
1        1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0   CD COUNT
C         ******************* ***        ***
C         *   *   *        - * *        * *
C         * S * R *        - * *        * *
C         *   *   *        - * *        * *
C         *************    - * *        * *
C         *   *   *   *    - * *        * *
C         * T * S * R *    - * *        * *
C         *   *   *   *    - * *  ---   * *
C         ****************  *Z*        *G*
C         -   *   *   *    * * *  ---   * *
C         -   * T * S * R * * *        * *
C         -   *   *   *    * * *        * *
C         -   ************* * *        * *
C         -       *   *    * * *        * *
C         -       * T * S * * *        * *
C         -       *   *    * * *        * *
C         --------********* ***        ***
C
C     FOR THE SOLUTIONS Z, WHERE GAUSS IS NOT USED AND THE SUB-MATRICES
C     ALL CONSIST OF A SINGLE ELEMENT.
C
C     DESCRIPTION OF PARAMETERS
C         A -- MATRIX WHOSE THREE DIAGONALS CENTERED ON THE PRINCIPAL
C                DIAGONAL BECOME THE TRIDIAGONAL MATRIX.
C         G -- RIGHT HAND SIDE OF EQUATION.  VECTOR OF LENGTH K1.
C         K1-- NUMBER OF ROWS IN THE MATRIX A.
C         Z -- SOLUTIONS, VECTOR (COLUMN) OF LENGTH K1 .
C
C
C     FIND THE LAST SOLUTION, Z(K1)
C
      S= A(1,1)
      R= A(1,2)
      IF (S .EQ. 0.) GO TO 25
      C= G(1)/S
      D= -R/S
      K2 = K1-1
      DO 10 I=2,K2
      T = A(I,I-1)
      S = A(I,I)
      R = A(I,I+1)
      DENOM = T*D+S
      C = (G(I)-C*T)/DENOM
      D = -R/DENOM
   10 CONTINUE
      S= A(K1,K1)
      T= A(K1,K1-1)
      Z(K1)=(G(K1)-T*C)/(T*D+S)
C
C     CALCULATE OTHER SOLUTIONS, PROCEEDING BACKWARDS
C
      IF(T .EQ. 0. ) GO TO 25
      Z(K1-1) = ( G(K1)-Z(K1)*S)/T
   15 K3=K2-1
```

Figure 30. Program Listing - TRIDAG.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

      DO 20 I=2,K3                                                                    405
      J = K1-I                                                                        406
      S = A(J+1,J+1)                                                                  407
      R = A(J+1,J+2)                                                                  408
      T = A(J+1,J)                                                                    409
      IF(T .EQ. 0. ) GO TO 25                                                         410
      Z(J) = ( G(J+1)-S*Z(J+1)-R*Z(J+2))/T                                            411
   20 CONTINUE                                                                        412
      Z(1) = (G(1)-A(1,2)*Z(2))/A(1,1)                                                413
      RETURN                                                                          414
   25 WRITE(6,1)                                                                      415
      RETURN                                                                          416
      END                                                                             417
BIXG  FOR CUBIC,CUBIC                                                                 418
      SUBROUTINE CUBIC ( P,Q,R , ROOT, ROOTI )                                        419
C  CUBIC  FINDS  THE REAL + COMPLEX ROOTS OF   (X**3)+P*(X**2)+Q*(X) +R =0            420
      DIMENSION              ROOT(3),ROOTI(3)                                         421
  90  DO 220 I=1,3                                                                   422
      ROOT(I)= 0.                                                                     423
  220 ROOTI(I)=0.                                                                     424
      P3  = P/3.                                                                      425
      SMALLA  =  Q - P*P3                                                             426
      SMALLB  =  2. *P3**3 - P3* Q +R                                                 427
      AD3  =  SMALLA/3.                                                               428
      SB2  =  SMALLB/2.                                                               429
      B4 =   SB2**2                                                                   430
      A27 =   AD3 **3                                                                 431
      SMALLC =  B4 + A27                                                              432
      IF (SMALLC)14 , 1 ,5                                                            433
    1 XA=SQRT (-AD3)                                                                  434
      IF (SMALLB) 3,4,4                                                               435
    3 XA=-XA                                                                          436
    4 ROOT(1) =XA-P3                                                                  437
      ROOT(2) = ROOT(1)                                                               438
      ROOT(3) = -XA-XA-P3                                                             439
      GO TO 22                                                                        440
    5 POWER = 1./ 3.                                                                  441
      B2 =  - SMALLB / 2.                                                             442
      SBA= SQRT  ( SMALLC)                                                            443
      BIGA = B2 + SBA                                                                 444
      BIGB =  B2 -SBA                                                                 445
      IF ( BIGA ) 6 , 7 , 8                                                           446
    6 BIGA1 =-((-BIGA )** POWER  )                                                    447
      GO TO 9                                                                         448
    7 BIGA1 =0.                                                                       449
      GOTO  9                                                                         450
    8 BIGA1 =   ( BIGA)** POWER                                                       451
    9 IF ( BIGB )10 , 11, 12                                                          452
   10 BIGB1 =-((-BIGB) ** POWER  )                                                    453
      GO TO 13                                                                        454
   11 BIGB1 = 0.                                                                      455
      GO TO 13                                                                        456
   12 BIG B1  = (BIGB) ** POWER                                                       457
   13 AB = BIGA1+BIGB1                                                                458
```

Figure 31. Program Listing - TRIDAG, CUBIC.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

      ROOT (1) = AB-P3                                                              459
      ROOTI(1) =   0.                                                               460
      ROOT (2) = -AB/2.-P3                                                          461
      ROOT (3) =     ROOT(2)                                                        462
      ROOTI(2) =  SQRT (3.)/2. *( BIGA1 - BIGB1)                                    463
      ROOTI(3) =  - ROOTI (2)                                                       464
      GO TO 22                                                                      465
   14 RAD  = 57.2957795                                                             466
      CON  = 120./ RAD                                                              467
      A3   =  SQRT  ( -AD3)                                                         468
      IF  (SMALLB ) 15, 16, 17                                                      469
   15 COT = 0.                                                                      470
      CP = 1.                                                                       471
      GO TO 18                                                                      472
   16 PH3 = 30./ RAD                                                                473
      GO TO 19                                                                      474
   17 COT  = 180. /RAD                                                              475
      CP= -1.                                                                       476
   18 B4A27 =  - B4 /A27                                                            477
      COSPHI =  CP* SQRT ( B4A27)                                                   478
      XK    = SQRT  ( 1.- B4A27)                                                    479
      PHI   = ATAN ( XK/ COSPHI )                                                   480
      PH3 = (COT + PHI*CP/3.)                                                       481
   19 DO  20  I= 1,3                                                                482
   20 ROOTI(I) = 0.                                                                 483
      AK = A3+ A3                                                                   484
      ANGLE  =PH3                                                                   485
      DO 21 I = 1,3                                                                 486
      ROOT (I) = AK * COS  (ANGLE)-P3                                               487
   21 ANGLE = ANGLE +CON                                                            488
   22 RETURN                                                                        489
      END                                                                           490
@IXG   FOR OUTSPL,OUTSPL                                                            491
      SUBROUTINE OUTSPL                                                             492
       COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,             493
     * MLIMDP,XFP(20),YFP(20),ZFP(20),GAMA,RO,BLADEL,BO,B1C,B1S,PUNCH,              494
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,                495
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,                496
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,                497
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,               498
     * NOCH(5),LAZI                                                                 499
      COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,                  500
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XLQ(7),XLM(7,40),             501
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),              502
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,BEE,DEE,GMARI(288,20),                         503
     * HMARI(288,20),XO(20)                                                         504
      COMMON /BK3/ SPLM(10,20),AZMTH3(288),                                         505
     * SPAN(20),                          PMRMS(10,20),                            506
     * ICHANL(10,5),COSINE(288),SINE(288),BLADES,CARD,TAPE                          507
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),                      508
     * GMAR(144,5),HMAR(144,5)                                                      509
     * ,Q1(288,20),Q2(288,20)                                                       510
      EQUIVALENCE                    (ND2(5671),HMAR),(GMARI,AN),                  511
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN),(ND2,Q2)                         512
```

Figure 32. Program Listing - CUBIC, OUTSPL.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

      EQUIVALENCE (ND1(5761),GMAR),(ND1,Q1)
C *** HARMONIC LOOP
      DO 1 I=1,MLIMRN,2
      WRITE(6,2) I
    2 FORMAT(1H1, 28X, 29HROTATIONAL NOISE PROGRAM E676 / 8X,
     X 10HHARMONIC =, I3 )
      WRITE(6,3)
    3 FORMAT(1H0, 8X, 5HFIELD, 11X, 28HFIELD POINT COORDINATES (IN),
     X 16X, 20HSOUND PRESSURE LEVEL / 8X, 5HPOINT, 10X,1HX,14X,1HY,
     X 14X,1HZ, 20X,  8HDECIBELS / )
C *** FIELD POINT LOOP
      DO 4 J=1,NFT
    4 WRITE(6,5) J,XFP(J),YFP(J),ZFP(J),SPLM(I,J)
    5 FORMAT( 9X,I2,2X, 3(5X,1PE10.4),15X, 1PE10.4 )
      IF(I.GE.MLIMRN) GO TO 7
      K=I+1
      WRITE(6,6) K
    6 FORMAT(1H2  / 8X,10HHARMONIC =,I3 )
      WRITE(6,3)
C *** FIELD POINT LOOP
      DO 8 J=1,NFT
    8 WRITE(6,5) J,XFP(J),YFP(J),ZFP(J),SPLM(K,J)
    1 CONTINUE
    7 RETURN
      END
QIXG   FOR       AVQUAD,AVQUAD
      SUBROUTINE AVQUAD (N,X,Y,AREA)
C     INTEGRATION BY AVERAGED QUADRATICS BASED ON LAGRANGE INTERPOLATION
      DIMENSION X(12),Y(12)
      AREA=0.
      T1=Y(1)/((X(1)-X(2))*(X(1)-X(3)))
      T2=Y(2)/((X(2)-X(1))*(X(2)-X(3)))
      T3=Y(3)/((X(3)-X(1))*(X(3)-X(2)))
      A2=T1+T2+T3
      B2=-(T1*(X(2)+X(3))+T2*(X(1)+X(3))+T3*(X(1)+X(2)))
      C2=T1*X(2)*X(3)+T2*X(1)*X(3)+T3*X(1)*X(2)
      AREA=AREA+(A2/3.)*((X(2)**3)-(X(1)**3))+(B2/2.)*((X(2)**2)-(X(1)**
     12))+C2*(X(2)-X(1))
      N2=N-2
      DO 101 K=2,N2
      A1=A2
      B1=B2
      C1=C2
      T1=Y(K)/((X(K)-X(K+1))*(X(K)-X(K+2)))
      T2=Y(K+1)/((X(K+1)-X(K))*(X(K+1)-X(K+2)))
      T3=Y(K+2)/((X(K+2)-X(K))*(X(K+2)-X(K+1)))
      A2=T1+T2+T3
      B2=-(T1*(X(K+1)+X(K+2))+T2*(X(K)+X(K+2))+T3*(X(K)+X(K+1)))
      C2=T1*X(K+1)*X(K+2)+T2*X(K)*X(K+2)+T3*X(K)*X(K+1)
      A=(A1+A2)/2.
      B=(B1+B2)/2.
      C=(C1+C2)/2.
  101 AREA=AREA+(A/3.)*((X(K+1)**3)-(X(K)**3))+(B/2.)*((X(K+1)**2)-(X(K)
     1**2))+C*(X(K+1)-X(K))
```

Figure 33. Program Listing -OUTSPL, AVQUAD.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0   CO COUNT

      AREA=AREA+(A2/3.)*((X(N)**3)-(X(N-1)**3))+(B2/2.)*((X(N)**2)-(X(N-
     1))**2))+C2*(X(N)-X(N-1))
      RETURN
      END
WIX6   FOR       E386RN,E386RN
      SUBROUTINE E386RN
C     ACOUSTIC PRESSURE      V.BERECZ FOR R.KING     DECK E386
      COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,
     * MLIMOP,XFP(20),YFP(20),ZFP(20),GAMA,RO,BLADEL,BO,B1C,B1S,PUNCH,
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,
     * IREEL,NC,NTBOX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,
     * NOCH(5),LAZI
      COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XL0(7),XLM(7,40),
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,BEE,DEE,GMARI(288,20),
     * HMARI(288,20),XO(20)
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),
     * GMAR(144,5),HMAR(144,5)
      EQUIVALENCE                    (ND2(5671),HMAR),(GMARI,AN),
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN)
      EQUIVALENCE (ND1(5761),GMAR)
      DIMENSION                 Q(721,8),R(8),V8(8),V8I(8),
     1 V25(721),V25I(721),PSI(721),PRAD(721)
C
C C   READ FLT. COND. PARAMETERS AND BLADE SECTION LOADING, PRINT SAME.
C
      RBN=NBLADE
      EQUIVALENCE
     X       (CM,AA),(SOS,CC),(B01,BO),(B1,B1C),(B11,B1S),(G,GAMA),
     X (NHAR,MLIMRN),              (NFT,NFP),(OMG,OMEG)
      NRAD = LIRS+2
      GATC1=BO
      GATC2=B1C
      GATC3=B1S
      GATC4=GAMA
      GATC5=OMEG
      SOS = SOS/12.0
      J=1
      R(1)=0.
      DO 730 I=1,5
      J=J+1
      IF(IRS(I).EQ.0) GO TO 730
      R(J)=RR(I)*BLADEL
  730 CONTINUE
      J=J+1
      R(J)=BLADEL
      RAD= 1./57.2957795
      NP=(360./ANG)+1.001
      NT=NP-1
      PSI(1)= 0.
      PRAD(1)=0.
```

Figure 34. Program Listing - AVQUAD, E386RN.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

      DO 4 I=2,NP
      PSI(I)= PSI(I-1)+ ANG
    4 PRAD(I)= PSI(I)*RAD
      DO 77 I=1,NRAD
      DO 77 J=1,NP
      Q(J,I)=XLO(I)
      DO 77 K=1,NHH
      X=K
   77 Q(J,I)=Q(J,I)+XLM(I,K)*COS(X*PRAD(J))+XMM(I,K)*SIN(X*PRAD(J))
      IF(KEY1.NE.99) GO TO 88
      DO 86 I=1,NRAD
   86 WRITE (6,87) XLO(I),((XLM(I,J),XMM(I,J)),J=1,NHAR)
   87 FORMAT (E25.8/,(2E25.8))
   88 WRITE (6,8) B01,B1,B11,CH,OMG,RBN,RO,(R(I),I=1,NRAD)
    8 FORMAT (4H0B01,E15.6,4H  B1,E15.6,5H  B11,E15.6,7H  CHORD,E15.6,
     1 7H  OMEGA,E15.6,8H  BLADES,F7.0,//25H RADIUS AT START OF TWIST,
     2 E15.6,////30X,21HBLADE SECTION LOADING,///7H RADIUS,10X,1H1,14X,
     3 1H2,14X,1H3,14X,1H4,14X,1H5,14X,1H6,14X,1H7,14X,1H8,/8H AZIMUTH,
     4 2X,8E15.6,//)
      DO 9 I=1,NP
    9 WRITE (6,10) I,PSI(I),(Q(I,K),K=1,NRAD)
   10 FORMAT (I4,F7.1,8E15.6)
      OMG=3.14159265*OMG/30.
      SOS=12.*SOS
      B01=B01*RAD
      B1=B1*RAD
      B11=B11*RAD
      G=G*RAD
C
C     BEGIN MAJOR LOOP ON FIELD POINTS
C
      DO 999 II=1,NFP
      CAPR=CAPRF(II)
      THETA=THETAF(II)
      ALFA=ALFAF(II)
   11 FORMAT (3F12.4)
      WRITE (6,12) CAPR,THETA,ALFA
   12 FORMAT (12H0FIELD POINT,10X,6HRADIUS,E15.6,5X,7HAZIMUTH,E15.6,5X,
     1 9HELEVATION,E15.6,/20X,8HHARMONIC,10X,14HSOUND PRESSURE,15X,
     2 3HSPL)
      CAPR=12.*CAPR
      ALFA= RAD*ALFA
      THETA= RAD*THETA
      DO 999 M=1,NHAR
      DO 990 KK=1,NRAD
      DO 99  JJ=1,NT
      CAPS= SQRT(CAPR*CAPR+R(KK)*R(KK)-2.*CAPR*R(KK)*COS(     ALFA)*
     1 COS(PRAD(JJ)-THETA))
      BETA=B01-G*(R(KK)-RO)+B1*COS( PRAD(JJ)  )+B11*SIN( PRAD(JJ)  )
      SBTA=SIN(BETA)
      CBTA=COS(BETA)
      V= M
      V= V*(RBN*OMG*CAPS/SOS+.5*CH*RBN/R(KK)+RBN* PRAD(JJ))
      IF (KEY3.EQ.99) WRITE (6,9874) CAPS, BETA, V
```

Figure 35. Program Listing - E386RN.

```
1         1         2         3         4         5         6         7         8
........0.........0.........0.........0.........0.........0.........0.........0     CD COUNT

 9874 FORMAT (3E25.8)                                                                675
      TEMP=  M                                                                       676
      V25(JJ)=(Q(JJ,KK)*SIN(.5*TEMP*RBN*CH/R(KK))*(COS(V)/CAPS+(TEMP*RBN             677
     1 *OMG/SOS)*SIN(V))*(SBTA*COS(ALFA)*SIN(PRAD(JJ)-THETA)+SIN(ALFA) *             678
     2CBTA)*R(KK))/(TEMP*CAPS*CAPS)                                                  679
      V25I(JJ)=(Q(JJ,KK)*SIN(.5*TEMP*RBN*CH/R(KK))*(COS(V)*TEMP*RBN*OMG               680
     1 /SOS-SIN(V)/CAPS)*(SBTA*COS(ALFA)*SIN(PRAD(JJ)-THETA)+SIN(ALFA) *              681
     2CBTA)*R(KK))/(TEMP*CAPS*CAPS)                                                  682
   99 CONTINUE                                                                       683
      V25(NP)=V25(1)                                                                 684
      V25I(NP)=V25I(1)                                                               685
      CALL SIMCOR(NP,PRAD(2),V25 ,AR,IERR)                                           686
      IF(IERR .EQ. 0) WRITE(6,8418)                                                  687
 8418 FORMAT(///25X,23HERROR IN SIMCOR, IERR=0  ///)                                 688
      V8(KK)=AR                                                                      689
      CALL SIMCOR(NP,PRAD(2),V25I,AR,IERR)                                           690
       IF(IERR .EQ. 0) WRITE(6,8418)                                                 691
      V8I(KK)=AR                                                                     692
      IF(KEY2.EQ.99) WRITE (6,9876) V8(KK),(V25(I),I=1,NP)                           693
      IF(KEY2.EQ.99) WRITE (6,9876) V8I(KK),(V25I(I),I=1,NP)                         694
 9876 FORMAT (//E25.8/,(5E25.8/))                                                    695
  990 CONTINUE                                                                       696
      CALL AVQUAD (NRAD,R,V8,PRTAR)                                                  697
      CALL AVQUAD (NRAD,R,V8I,PRTAI )                                                698
      IF (KEY1.EQ.99) WRITE (6,9875)PRTAR,(V8(KK),KK=1,NRAD)                         699
      IF (KEY1.EQ.99) WRITE (6,9875)PRTAI,(V8I(KK),KK=1,NRAD)                        700
 9875 FORMAT (//E25.8,/4E25.8,/4E25.8,//)                                            701
      PRTA=(.03582245*CAPR/CH)*SQRT(PRTAR**2+PRTAI**2)                               702
      SPL= 20.*ALOG10(ABS(PRTA/2.9E-9))                                              703
      WRITE (6,997) M,PRTA,SPL                                                       704
  997 FORMAT (25X,I2,5X,2E20.8)                                                      705
  999 CONTINUE                                                                       706
      B0=GATC1                                                                       707
      B1C=GATC2                                                                      708
      B1S=GATC3                                                                      709
      GAMA=GATC4                                                                     710
      OMEG=GATC5                                                                     711
      RETURN                                                                         712
      END                                                                            713
@IXG  FOR SIMCOR,SIMCOR                                                              714
      SUBROUTINE SIMCOR (N,H,Y,XINT,IERR)                                            715
C     PURPOSE                                                                        716
C                                                                                    717
C         TO INTEGRATE A FUNCTION F(X) OVER A RANGE (A,B)                            718
C                                                                                    719
C     METHOD                                                                         720
C                                                                                    721
C         SIMPSONS RULE WITH A CORRECTION FACTOR INCORPORATED                        722
C          IN THE EQUATION IS USED IF (N-1) IS DIVISIBLE BY                          723
C          BOTH 2 AND 4                                                              724
C                                                                                    725
C         SIMPSONS RULE IS USED WITHOUT THE CORRECTION FACTOR                        726
C          IF (N-1) IS ONLY DIVISIBLE BY 2                                           727
C                                                                                    728
```

Figure 36. Program Listing - E386RN, SIMCOR.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

C         IF (N-1) IS NOT DIVISIBLE BY 2 THIS IMPLIES THAT N                          729
C           IS EVEN AND THIS SUBROUTINE CAN NOT BE USED.                              730
C                                                                                     731
C     CALLING SEQUENCE                                                                732
C                                                                                     733
C         CALL SIMCOR (N,H,Y,XINT,IERR)                                               734
C                                                                                     735
C     DESCRIPTION OF PARAMETERS                                                       736
C                                                                                     737
C           N   -NUMBER OF POINTS THAT ARE TAKEN OVER THE CURVE                       738
C                                                                                     739
C           H   -CONSTANT INTERVAL BETWEEN THE POINTS                                 740
C                                                                                     741
C           Y   -SUPPLIED FUNCTION                                                    742
C                                                                                     743
C           XINT-TOTAL AREA UNDER THE CURVE BETWEEN A AND B                           744
C                                                                                     745
C           IERR-ERROR CODE                                                           746
C                 IERR = 0  (N-1) NOT DIVISIBLE BY 2 THEREFORE N IS EVEN              747
C                 IERR = 1  (N-1) IS  DIVISIBLE BY 2                                  748
C                 IERR = 2  (N-1) IS  DIVISIBLE BY BOTH 2 AND 4                       749
C                                                                                     750
C                                                                                     751
      DIMENSION Y(1)                                                                  752
      IERR = 0                                                                        753
      K = MOD ((N-1),4) + 1                                                           754
      IF (K .EQ. 2 .OR. K .EQ. 4) RETURN                                              755
      XINT = Y(1) + 4.* Y(N-1) + Y(N)                                                 756
      N3 = N - 3                                                                      757
      DO 10 I = 2,N3,2                                                                758
   10 XINT = XINT + 4.* Y(I) + 2.* Y(I+1)                                             759
      XINT = H/3.0 * XINT                                                             760
      IERR = 1                                                                        761
      IF(K .EQ. 3 .OR. N .LT. 9) RETURN                                               762
      XINT1= Y(1) + 4.* Y(N-2) + Y(N)                                                 763
      N6 = N-6                                                                        764
      DO 20 I = 3,N6,4                                                                765
   20 XINT1= XINT1+ 4.* Y(I) + 2.* Y(I+2)                                             766
      XINT1= 2.* H/3. * XINT1                                                         767
      XINT = XINT + (XINT - XINT1)/15.                                                768
      IERR = 2                                                                        769
      RETURN                                                                          770
      END                                                                             771
@IXG  FOR START,START                                                                 772
      SUBROUTINE START                                                                773
      COMMON /TEMPUS/ TIME,COUNT                                                      774
      INTEGER COUNT                                                                   775
      DATA COUNT /0/                                                                  776
      CALL RTMINS (TIME)                                                              777
      COUNT = COUNT + 1                                                               778
      CALL CLOCK                                                                      779
      RETURN                                                                          780
      END                                                                             781
@IXG  FOR CLOCK,CLOCK                                                                 782
```

Figure 37. Program Listing - SIMCOR, START, CLOCK.

```
1         1         2         3         4         5         6         7         8
.........0.........0.........0.........0.........0.........0.........0.........0    CD COUNT

      SUBROUTINE CLOCK
      COMMON /TEMPUS/ TIME,COUNT
      INTEGER COUNT
      CALL RTMINS (BALLS)
      T    = BALLS - TIME
      WRITE (6,100) COUNT , T
 100  FORMAT (1H255X,18(1H*)/56X,8H*       (I2,8H)       */56X,18H* ELAPSE
     XD TIME = */56X,1H*16X,1H*/56X,2H* F8.4,8H  MIN  */56X,1H*16X,1H*/5
     X6X,18(1H*)//)
      RETURN
      END
@ MAP L676,,OVER
       SEG L676-(*E386RN,*ALPHA)
ALPHA  SEG *RDKU-*UNPACK-*INTERP-*CUE-*INPUTA-*MERGES-*OUTSPL-*DFSRIE
@ ABS OVER,AE676
@ XQT CUR
  OUT Z,2
  TEF Z
  OUT Z,1,3,4
  TEF Z
  TRW Z
  ERS
  IN Z
  TOC
  ERS
  IN Z
  TOC
  TRI Z
```

Figure 38. Program Listing -CLOCK, End.

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13. ABSTRACT

A computer program for rotational noise prediction is documented. The program was developed as a part of a study to develop more accurate methods for predicting rotational noise levels under conditions of nonuniform inflow over the rotor disc.

The computer program will calculate the root-mean-square sound pressure level for up to the 10th harmonic of rotor noise at any field point in the near or far field outside of the rotor disc. Noise levels can be calculated either from a rectangular chordwise distribution of pressure or from the measured chordwise distribution. The equations for noise prediction using the arbitrary (measured) chordwise distribution are derived in Volume I of this report. Although this report concentrated on a helicopter rotor, the analytical results are applicable to propellers in general.

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