AD 730359

AD

USAAVLABS TECHNICAL REPORT 70-72

AN EXPERIMENTAL STUDY OF HELICOPTER ROTOR IMPULSIVE NOISE

By

W. E. Bausch

C. L. Munch

R. G. Schlegel

June 1971

EUSTIS DIRECTORATE

U. S. ARMY AIR MOBILITY RESEARCH AND DEVELOPMENT LABORATORY

FORT EUSTIS, VIRGINIA

CONTRACT DAAJ02-69-C-0035

SIKORSKY AIRCRAFT

DIVISION OF UNITED AIRCRAFT CORPORATION

STRATFORD, CONNECTICUT

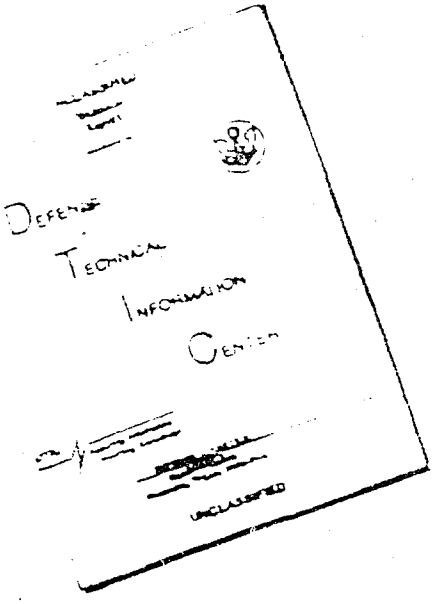
Approved for public release; distribution unlimited.

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
Springfield, Va. 22151

D D C
RECEIVED
SEP 28 1971
C

243

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

REPRODUCED FROM
BEST AVAILABLE COPY

Unclassified

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Sikorsky Aircraft Division of United Aircraft Corporation Stratford, Connecticut	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP

3. REPORT TITLE

AN EXPERIMENTAL STUDY OF HELICOPTER ROTOR IMPULSIVE NOISE

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Final Report

5. AUTHOR(S) (First name, middle initial, last name)

William E. Bausch
Charles L. Munch
Ronald G. Schlegel

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
June 1971	241	21

8a. CONTRACT OR GRANT NO. DAAJ02-69-C-0035 b. PROJECT NO. c. Task 1F162204A14235 d.	9a. ORIGINATOR'S REPORT NUMBER(S) USAAVLABS Technical Report 70-72 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) None

10. DISTRIBUTION STATEMENT

Approved for public release; distribution unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY U.S.Army Air Mobility Research and Development Laboratory Fort Eustis, Virginia

13. ABSTRACT

Results of a study of helicopter rotor impulsive noise (RIN) are presented in this report. Rotor noise, together with rotor blade dynamic and pressure data, was measured during hover and cruise of a CH-53A helicopter for use in a correlation study of calculated and measured noise. In addition, the rotor rotational noise analysis described in U. S. Army Aviation Materiel Laboratories (USAAVLABS) Technical Report 70-1B was modified to reduce computation time and to include blade flapping and coning motions. The inclusion of these motions, however, is shown to have little effect on the predicted noise.

Correlation of calculated and measured noise harmonic amplitudes is generally within 5 dB through the third harmonic at distances less than 1000 feet in front of the helicopter. Waveform correlation of calculated and measured time histories of acoustic pressure is good. RIN is identified as being primarily a rotational noise phenomenon, ordered at the blade passage frequency and its harmonics, rather than amplitude modulated broadband noise. Hover RIN is shown to be due to vortex interference (blade/wake interaction RIN), while cruise RIN is shown to be due to the combination of acoustic effects of a high subsonic tip Mach number on wave propagation and blade drag, and is herein referred to as advancing blade RIN.

DD FORM 1 NOV 65 1473

Unclassified

Security Classification

DISCLAIMERS

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission, to manufacture, use, or sell any patented invention that may in any way be related thereto.

Trade names cited in this report do not constitute an official endorsement or approval of the use of such commercial hardware or software.

DISPOSITION INSTRUCTIONS

Destroy this report when no longer needed. Do not return it to the originator.

ACCESSION for
NTIS WHITE SECTION
DDC BUFF SECTION
UNANNOUNCED
JUSTIFICATION
DISTRIBUTION/AVAILABILITY CODES
Dist. AVAIL. and/or SPECIAL
A

Unclassified

Security Classification

14. KEY WORDS	LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
Rotor Noise						
Rotational Noise						
Impulsive Rotor Noise						
Acoustics						
Airloads						
Helicopter Noise						

DD FORM 1 NOV 65 1473

Unclassified

Security Classification

DEPARTMENT OF THE ARMY
U. S. ARMY AIR MOBILITY RESEARCH & DEVELOPMENT LABORATORY
EUSTIS DIRECTORATE
FORT EUSTIS, VIRGINIA 23604

This contract was initiated (1) to acquire simultaneously CH-53A helicopter noise and rotor airloads data for impulsive and nonimpulsive flight conditions and (2) to correlate these data with noise and airload prediction methods. More specifically, knowing the airloads and the associated noise levels, an acoustic analysis developed under a previous contract was modified with the hope of being able to predict the occurrence of impulsive rotor noise. A marked improvement in the ability to make acoustic predictions during the design of a new helicopter was expected.

From this and earlier studies, the consensus is that impulsive rotor noise is not severe amplitude-modulated broadband noise, but ordered rotational noise rich in higher harmonic content. Consequently, the ability to predict the occurrence of impulsive rotor noise requires considerable knowledge of the high-frequency airload content. Existing rotor airloads analyses are adequate for investigations of rotor and fuselage dynamics, but they are sorely lacking in defining the higher harmonics of airloads necessary for detailed acoustic analyses. However, before this study was initiated, it was believed that knowledge of the chordal airload distribution could compensate for the lack of high-frequency airloads data. Results of this study do show that knowing the chordal airload distribution enhances prediction accuracy of the lower harmonics of rotational noise. However, knowing the chordal airload distribution, the analysis remains incapable of predicting the higher rotational noise harmonics characteristic of impulsive rotor noise. Consequently, it would appear reasonable to conclude that, with or without the airloads known, this analysis cannot predict the occurrence of impulsive rotor noise. However, an analysis such as the one reported herein does have the potential for predicting the occurrence of impulsive rotor noise; but to succeed, major advances in modeling the rotor wake and accounting for rotor blade/vortex wake interactions and compressibility effects are needed. Solutions to these needs cannot be anticipated in the near future.

This program was conducted under the technical direction of Mr. Joseph H. McGarvey of the Reliability and Maintainability Division of this Directorate.

Task 1F162204A14235
Contract DAAJ02-69-C-0035
USAAVLABS Technical Report 70-72
June 1971

AN EXPERIMENTAL STUDY OF HELICOPTER ROTOR IMPULSIVE NOISE

Final Report

By

W. E. Bausch
C. L. Munch
R. G. Schlegel

Prepared by

Sikorsky Aircraft
Division of United Aircraft Corporation
Stratford, Connecticut

for

EUSTIS DIRECTORATE
US ARMY AIR MOBILITY RESEARCH AND DEVELOPMENT LABORATORY
Fort Eustis, Virginia

Approved for public release;
distribution unlimited.

ABSTRACT

Results of a study of helicopter rotor impulsive noise (RIN) are presented in this report. Rotor noise, together with rotor blade dynamic and pressure data, was measured during hover and cruise of a CH-53A helicopter for use in a correlation study of calculated and measured noise. In addition, the rotor rotational noise analysis described in U. S. Army Aviation Materiel Laboratories (USAAVLABS) Technical Report 70-1B was modified to reduce computation time and to include blade flapping and coning motions. The inclusion of these motions, however, is shown to have little effect on the predicted noise.

Correlation of calculated and measured noise harmonic amplitudes is generally within 5 dB through the third harmonic at distances less than 1000 feet in front of the helicopter. Waveform correlation of calculated and measured time histories of acoustic pressure is good. RIN is identified as being primarily a rotational noise phenomenon, ordered at the blade passage frequency and its harmonics, rather than amplitude modulated broadband noise. Hover RIN is shown to be due to vortex interference (blade/wake interaction RIN), while cruise RIN is shown to be due to the combination of acoustic effects of a high subsonic tip Mach number on wave propagation and blade drag, and is herein referred to as advancing blade RIN.

FOREWORD

The work reported herein was performed by Sikorsky Aircraft, Division of United Aircraft Corporation, under contract DAAJ02-69-C-0025, Task 1F162204A14235, for the Eustis Directorate, US Army Air Mobility Research and Development Laboratory, Fort Eustis, Virginia. Portions of the data collection and analysis tasks were performed by H. R. Mull and Associates, Wilton, Connecticut. The work was carried out under the technical cognizance of Mr. Joseph McGarvey of the Eustis Directorate, USAAMRDL staff. Sikorsky Aircraft personnel directly associated with the project included Mr. W. E. Bausch, Mr. C. L. Munch, Mr R. G. Schlegel and Mr. J. J. DeFelice. H. R. Mull and Associates personnel directly involved included Mr. H. R. Mull, Mr. J. Dunmore, and Mr. A. Smardin.

TABLE OF CONTENTS

	Page
ABSTRACT	iii
FOREWORD	v
LIST OF ILLUSTRATIONS	ix
LIST OF TABLES	xiii
LIST OF SYMBOLS	xiv
1.0 INTRODUCTION	1
2.0 ROTOR IMPULSIVE NOISE (RIN) GENERATION	3
2.1 REVIEW OF THEORY	4
2.1.1 Rotational Noise	4
2.1.2 Impulse Characteristics	6
2.2 BLADE/WAKE INTERACTION RIN	6
2.3 ADVANCING BLADE RIN	7
3.0 EXPERIMENTAL PROGRAM	19
3.1 FLIGHT TEST	19
3.2 INSTRUMENTATION	19
3.2.1 Data Acquisition	19
3.2.1.1 Airborne FM	20
3.2.1.2 Airborne Direct	20
3.2.1.3 Ground Fm	20
3.2.2 Data Reduction	21
3.2.3 Instrumentation Response and Calibration	21
3.2.3.1 Blade Pressure and Blade Motion Measurement System	21
3.2.3.2 Internal Noise Measurement System	22
3.2.3.3 External Noise Measurement System	22
4.0 RESULTS	28
4.1 ROTATIONAL NOISE CORRELATION	28
4.1.1 Hover Noise	28
4.1.1.1 Correlation Using Measured Hover Airloads	28
4.1.1.2 Correlation Using Theoretical Hover Airloads	29

Page

4.1.2 Cruise Noise. 30

4.1.2.1 Correlation Using Measured Cruise Airloads . 30
4.1.2.2 Correlation Using Theoretical Cruise Airloads 32

4.1.3 Conclusions of External Noise Correlation Study . . 32

4.2 IMPULSIVE NOISE SOURCE LOCATION. 33

4.2.1 Hover 33
4.2.2 Forward Flight. 35

5.0 CONCLUSIONS 75

6.0 RECOMMENDATIONS 77

7.0 LITERATURE CITED. 78

APPENDIXES

I. COMPUTER PROGRAM MODIFICATION. 80

II. MEASURED AERODYNAMIC DATA. 111

III. PREDICTED AERODYNAMIC LOADING 164

IV. MEASURED ACOUSTIC DATA. 169

V. COMPUTER PROGRAM DESCRIPTION 189

DISTRIBUTION. 227

LIST OF ILLUSTRATIONS

Number		Page
1	Comparison of RIN Duration With Blade Stall Duration for Single-Rotor Helicopter (Reference 5)	10
2	Waveforms Resulting From Summation of First Twenty Fourier Sine Harmonics With Varying Amplitude Decay Rates (Harmonics Shifted 90° With Respect to the Fundamental)	11
3	Effect of Harmonic Phase Difference on Pressure Waveform (Harmonic Decay = -3dB per Octave)	12
4	Effect of Airloading Harmonic Decay Power Law on Sound Harmonic Levels (Reference 4)	13
5	Effect of Rotational Tip Mach Number on Sound Harmonic Amplitude 10° Below Rotor Disk in Hover (Reference 8)	14
6	Effect of Forward Speed on Radiated Sound Directivity (Reference 4)	15
7	Force Components on Rotor Blade Section	16
8	Airfoil Section Drag vs Mach Number for an NACA-0012-34 Airfoil at Zero Angle of Attack (Reference 12)	16
9	Calculated Harmonic Noise Spectra Due to Drag Divergence Effects for a Two-Blade Rotor (Reference 12)	17
10	Harmonic Noise Spectra of Thickness Noise for a Two-Blade Hovering Rotor (Reference 12)	18
11	CH-53A General Arrangement	24
12	Airborne Data Acquisition System	25
13	Internal Noise Microphone Installation	26
14	Ground-Based Data Acquisition System Layout	26
15	FM Data Reduction System	27
16	Typical Narrowband Spectrum of Helicopter Noise	27
17	Calculated Hover Noise Variation, Helicopter Heading 030 Degrees Magnetic, No RIN	37

Number		Page
18	Calculated Hover Noise Variation, Helicopter Heading 210 Degrees, Moderate RIN	39
19	Calculated Hover Noise Variation, Helicopter Heading 270 Degrees	41
20	Measured and Calculated Rotational Noise Spectra Two Locations in Hover, Helicopter Heading 210 Degrees	43
21	Calculated Time Histories of Acoustic Pressure at Several Azimuth Locations During Hover, Helicopter Heading 270 Degrees Magnetic, RIN Condition	44
22	Calculated Hover Noise Variation Using Theoretical Airloads	45
23	Rotational Noise Harmonic SPL-vs-Distance, Measured Airloads, 120 kt	46
24	Rotational Noise Harmonic SPL-vs-Distance, Measured Airloads, 140 kt	48
25	Rotational Noise Harmonic SPL-vs-Distance, Measured Airloads, 170 kt	50
26	Effect of Shaft Inclination and Blade Flapping on Calculated Noise, 170 kt, Starboard Side	53
27	Effect of Simulated Translational Mach Number on Calculated Noise, 170 kt, Centerline	55
28	Effect of Simulated Impulsive Chordwise Loading Distribution	55
29	Measured and Calculated Time Histories of Acoustic Pressure on Starboard Side	56
30	Rotational Noise Harmonic SPL-vs-Distance, Theoretical Airloads, 120 kt	57
31	Rotational Noise Harmonic SPL-vs-Distance, Theoretical Airloads, 140 kt	59
32	Rotational Noise Harmonic SPL-vs-Distance, Theoretical Airloads, 170 kt	61
33	Sound Pressure Recorded by Internal Microphones	63
34	Blade Section Airloading as a Function of Azimuth for Hover RIN and No-RIN Conditions (98% Span)	64

Number		Page
35	Harmonic Frequency Spectrum of a Rectangular Pulse. . . .	65
36	Airloading Harmonic Amplitude for Hover RIN and No-RIN Conditions	66
37	Chordwise Distribution of Differential Pressure as a Function of Azimuth, Hover RIN Condition.	67
38	Chordwise Pressure Distribution With and Without RIN, 98% Span, 160° Azimuth.	68
39	Range of Rotor Blade Locations at Instant of RIN Generation for OGE Hover.	69
40	Measured Time History of Acoustic Pressure, Advancing Blade Side, 170 kt.	70
41	Measured Time History of Acoustic Pressure, Retreating Blade Side, 170 kt.	72
42	Measured Time History of Acoustic Pressure, Advancing Blade Side, 140 kt.	72
43	Blade Section Airloading as a Function of Azimuth for Cruise RIN and No-RIN Conditions (98% Span)	73
44	Airloading Harmonic Amplitude for Cruise RIN and No-RIN Conditions (98% Span).	74
45	Coordinate Systems for Rotor Noise Calculation.	90
46	Resolution of Aerodynamic Forces.	90
47	Placement of Parameters on Cards.	91
48	Sample of CARD Input Mode	93
49	Sample of DRUM Input Mode	95
50	Sample Output	96
51	Differential Blade Pressures - Hover Without RIN.	112
52	Differential Blade Pressures - Hover With RIN	115
53	Octave Band Flyover Noise - 120 kt.	170
54	Octave Band Flyover Noise - 140 kt	174
55	Octave Band Flyover Noise - 170 kt.	179

Number		Page
56	Octave Band Hover Noise Contours	184
57	Narrow Bandwidth Spectrum (2.5 Hz) of CH-53A Hover Noise, No RIN	187
58	Narrow Bandwidth Spectrum (2.5 Hz) of CH-53A Hover Noise, RIN	188
59	Main Program E676	198
60	Subroutines	208

LIST OF TABLES

Number		Page
I	Pressure Transducer Location, Range, and Accuracy	73
II	Aerodynamic Data - Hover, No RIN, 030° Heading	118
III	Aerodynamic Data - Hover, RIN, 210° Heading	123
IV	Aerodynamic Data - Hover, RIN, 270° Heading	128
V	Aerodynamic Data - 120-Knot, East-to-West Flight	133
VI	Aerodynamic Data - 120-Knot, West-to-East Flight	138
VII	Aerodynamic Data - 140-Knot, East-to-West Flight	143
VIII	Aerodynamic Data - 140-Knot, West-to-East Flight	148
IX	Aerodynamic Data - 170-Knot, East-to-West Flight	153
X	Aerodynamic Data - 170-Knot, West-to-East Flight	158
XI	Aircraft Trim Conditions	163
XII	170-Knot Cruise Airloads (lb/in.)	165
XIII	140-Knot Cruise Airloads (lb/in.)	166
XIV	120-Knot Cruise Airloads (lb/in.)	167
XV	Hover Airloads (lb/in.)	168

LIST OF SYMBOLS

(Applies to Body of Report Only)

A	Amplitude of pressure pulse
B	Number of rotor blades
C	Radial force component
C_m	Sound pressure amplitude of mth sound harmonic
D	In-plane (drag) force component
dB	decibel, referenced to 0.0002 microbar
$J_n(Z)$	Bessel function of the first kind, order n, argument Z
L	Any force component (thrust, in-plane, radial)
M	Rotational tip Mach number
M_a	Advancing tip Mach number $(M + M_F)$
M_F	Flight Mach number
M_r	Component of flight Mach number in direction of observer
P	Period of pressure pulse
R	Rotor radius
SPL	Sound pressure level, decibels
T	Rotor thrust force component
V	Forward translational velocity
V_t	Tip speed of blade
a_o	Speed of sound
$a_{oT,oD,oC}$	Steady Fourier components of thrust, in-plane, and radial force components
$a_{\lambda T,\lambda D,\lambda C}$	Fourier cosine components of thrust, in-plane, and radial forces
$b_{\lambda T,\lambda D,\lambda C}$	Fourier sine components of thrust, in-plane, and radial forces
i	Imaginary number $\sqrt{-1}$

k	Airloading harmonics decay power law exponent
m	Sound harmonic number
r	Distance from hub to observer
x, y	Field point coordinates of observer
λ	Airloading harmonic number
Ω	Rotor rotational speed, radians/second
ψ	Azimuth angle in rotor disk measured from tail of aircraft

1.0 INTRODUCTION

Over the past several years, noise generated by all types of aircraft has become a source of increasing concern in military as well as civil applications. The civil operator is concerned with community acceptance (or tolerance) of the vehicle so that it may be used near or in population centers; the military operator is concerned with the aural detectability of the vehicle in an effort to improve its survivability and combat effectiveness.

The helicopter, because of its unique operational capabilities and the requirements placed upon it, is a prime candidate for noise studies. The past few years have seen the initiation and completion of many helicopter noise studies, both theoretical and experimental, to identify and quantify the mechanisms by which the noise is generated, propagated, and received and to find the means to reduce it.

The helicopter generates noise of both mechanical and aerodynamic origin. Mechanical noise, such as that due to the gearboxes, bearings, hydraulic systems, etc., is in most cases important only at locations near the helicopter. Of the aerodynamic sources, such as the main and tail rotors and the engine compressors, main rotor generated impulsive noise (when it occurs) can be by far the most predominant noise, exceeding even piston engine exhaust noise (as has been shown recently by Cox and Lynn, Reference 1). While the other aerodynamic sources of helicopter noise (rotor rotational noise, rotor vortex noise, turbine engine compressor noise, etc.) have been studied in quite some detail during the past few years, rotor impulsive noise has been generally referred to as a unique and separate phenomenon and has been largely ignored until very recently. The study reported herein seeks to experimentally identify the mechanism(s) which produce(s) rotor impulsive noise (RIN), to determine whether this noise is primarily rotational noise or amplitude modulated broadband noise, and to determine whether present theory can accurately predict this type of noise.

The study has been broken down into three phases: (1) flight test, (2) data reduction, and (3) analysis and correlation. During the flight test phase simultaneous measurements of rotor blade airloads and motions, aircraft operating parameters, and external noise on the ground were made on a CH-53A helicopter for hover and several forward cruise speeds. In addition, internally mounted directional microphones were placed against the windows on opposite sides of the cabin to determine the azimuthal locations of the rotor blades at the instant impulsive noise was generated.

The data reduction phase involved reducing the measured aerodynamic and acoustic data into useful forms. Rotor blade differential pressures were reduced to harmonics of 1 per rev for use in the noise prediction program and to time history pressure plots for correlation with the predicted external time histories and internal noise data. A real-time, narrow bandwidth spectrum analyzer reduced the measured external noise into amplitude-vs-frequency plots at specified intervals along the flight path for cruise and averaged spectra at several hover positions. External

noise was also reduced to octave band time histories during flyover and to octave band spectra at twelve azimuth locations in hover.

During the analysis and correlation phase, the measured aerodynamic and acoustic data were used to determine the locations in the rotor disk where impulsive rotor noise is generated during hover and cruise flight.

In addition, modifications were made to the rotational noise prediction program to include the effects of rigid body blade flapping and rotor shaft tilt, and to produce a time history of acoustic pressure at specific field points (Appendix I). This program was then used to predict the radiated noise using measured airloads as well as airloads predicted by the classical helicoidal wake analysis for correlation with noise measured at the ground station.

2.0 ROTOR IMPULSIVE NOISE (RIN) GENERATION

RIN, when it occurs, is the most significant and annoying of all helicopter noise sources. RIN (or "blade slap", "thump", "crack", "pop", etc., depending upon its intensity and pulse shape) can be observed on both single- and multiple-rotor helicopters, depending primarily upon the flight conditions and aircraft configuration. Because of the unique character and low fundamental frequency (fundamental blade passage frequency) of RIN, machines experiencing it can usually be detected at greater distances than similar, nonimpulsive noise-generating helicopters. Furthermore, helicopters exhibiting RIN are more annoying than those without this type of noise (Reference 5).

Several investigators (References 1 through 3) have postulated that the observed character of impulsive noise from rotors is due to severe amplitude modulation of broadband noise. While this phenomenon can be observed during RIN conditions, it is highly unlikely that it is the sole cause of the impulsive type waveforms which are observed by the ear to be impulsive noise.

RIN, occurring at the fundamental rotor blade passage frequency, is primarily a harmonic phenomenon, and its origin appears to be ordered rotational noise rather than random broadband noise. A Fourier analysis of periodic impulsive noise produces a frequency spectrum with very high harmonic content and relatively little amplitude decay with frequency. This has recently been demonstrated analytically by Lowson and Ollerhead (Reference 4) and Leverton (Reference 5), and experimentally by King and Schlegel (Reference 6). King and Schlegel found that during nonimpulsive noise conditions, blade airloading harmonics decay approximately as $1/\lambda^{1.4}$ to $1/\lambda^{1.6}$ while during impulsive noise conditions the airloads decay about as $1/\lambda^{0.6}$ (λ = airload harmonic order). The increased high frequency airloading harmonic levels for the impulsive noise case result in increased high frequency sound harmonic levels, yielding the observed "slap". Furthermore, the phasing of the sound harmonics is important in determining the impulsive nature of the observed sound; for example, a harmonic spectrum with harmonics phase shifted by, say, 90 degrees with respect to the fundamental, may be more impulsive than one with all harmonics in phase. In a recent paper, Sadler and Loewy (Reference 7) indicate that the high frequency content of RIN may be primarily associated with vortex (broadband) noise. This, too, appears to be highly unlikely since vortex noise is random in amplitude, frequency, and phase. Consequently, it does not contain the necessary harmonic content and phase coherence necessary to define an impulsive sound.

Classically, there have been three main mechanisms for the generation of RIN postulated in the literature. These are summarized by Leverton (Reference 5) as the following:

1. Fluctuating forces due to blade/vortex intersection.
2. Fluctuating forces resulting from stalling and unstalling of the blade.
3. Local shock wave formation on portions of the blade.

The literature is in general agreement that the first is the primary source on tandem-rotor machines and in some cases on single-rotor machines. The second mechanism, that due to stall effects, is generally losing support as a probable slap mechanism. Leverton discusses the reasons in some detail in Reference 5. To summarize, it is believed that the stall process is relatively slow and does not produce the sharp changes in loading necessary to produce RIN. This is illustrated in Figure 1 (from Reference 5) where the stall duration is compared with a typical impulse duration on the basis of azimuthal movement. The impulse location in the disk o Figure 1 is purely arbitrary. The third RIN mechanism, that of local shock formation due to high advancing tip Mach numbers, is quite a complex subject. However, as pointed out by Ollerhead and Lowson (Reference 8), these shocks cannot propagate to an observer unless the blade actually exceeds sonic velocity. This does not appear to be a primary mechanism of RIN generation.

The only mechanism remaining to explain the occurrence of RIN is blade/vortex interaction. This mechanism does not, however, explain the occurrence of RIN on single-rotor helicopters during high speed flight where the observed "slap" is very intense as the helicopter approaches, but rapidly decreases as the helicopter passes overhead and retreats. There must then be another mechanism which is responsible for this type of RIN. Ollerhead and Lowson (Reference 8) indicate that this phenomenon can be explained as an acoustic effect due to increased tip speeds, and Arndt and Borgman (Reference 12) show that compressibility effects may also contribute. Thus, it appears there are two types of impulsive noise, defined according to the mechanisms by which they are generated:

1. Blade/Wake Interaction RIN
2. Advancing Blade RIN

Before discussing these two types, a review of rotational noise theory is presented.

2.1 REVIEW OF THEORY

2.1.1 Rotational Noise

Several investigators (References 2, 4, 9, and 17 through 20) have developed theoretical methods for the prediction of rotor rotational noise. The basic assumptions made vary from one to another, but all should accurately predict the noise, presuming sufficient input data are available Most of these methods involve an open-form iterative computer solution. However, Lowson and Ollerhead made several additional simplifying assumptions which allowed them to develop a closed-form solution for far-field rotational noise in terms of Bessel functions (Reference 4). For the purposes of examining RIN, this solution is the least cumbersome and provides the necessary insight to the problem.

Ollerhead and Lowson present the theoretical result for the sound pressure amplitude of the mth sound harmonic due to the steady and fluctuating

forces as the relation

$$C_m = \sum_{\lambda=0}^{\infty} \frac{i^{-[mB-\lambda]}}{4\pi} \left\{ \frac{mB\Omega x}{a_0 r^2} \left\{ i a_{\lambda T} \left(J_{mB-\lambda} + [-1]^{\lambda} J_{mB+\lambda} \right) - b_{\lambda T} \left(J_{mB-\lambda} - [-1]^{\lambda} J_{mB+\lambda} \right) \right\} \right.$$

$$- \left\{ \frac{i a_{\lambda D}}{R r} \left((mB-\lambda) J_{mB-\lambda} + [-1]^{\lambda} (mB+\lambda) J_{mB+\lambda} \right) \right.$$

$$\left. - \frac{b_{\lambda D}}{R r} \left((mB-\lambda) J_{mB-\lambda} - [-1]^{\lambda} (mB+\lambda) J_{mB+\lambda} \right) \right\} + \frac{mB\Omega y}{a_0 r^2} \left\{ a_{\lambda C} \left(J_{mB-\lambda} + [-1]^{\lambda} J_{mB+\lambda} \right) \right.$$

$$\left. \left. + i b_{\lambda C} \left(J_{mB-\lambda} - [-1]^{\lambda} J_{mB+\lambda} \right) \right\} \right\} \qquad (1)$$

where the argument of Bessel functions is mBM_y/r.

The force components (i.e., $a_{\lambda T}$, $a_{\lambda D}$, $a_{\lambda C}$, $b_{\lambda T}$, $b_{\lambda D}$, $b_{\lambda C}$) are defined by the Fourier summations:

Thrust
$$T[\psi] = a_{0T} + \sum_{\lambda=1}^{\infty} a_{\lambda T} \cos\lambda\psi + b_{\lambda T} \sin\lambda\psi$$

Drag
$$D[\psi] = a_{0D} + \sum_{\lambda=1}^{\infty} a_{\lambda D} \cos\lambda\psi + b_{\lambda D} \sin\lambda\psi$$

Radial Components
$$C[\psi] = a_{0C} + \sum_{\lambda=1}^{\infty} a_{\lambda C} \cos\lambda\psi + b_{\lambda C} \sin\lambda\psi$$

The important fact to note is that all loading harmonics contribute to the noise radiated in each sound harmonic. Thus, it may be expected that increased high frequency airloading harmonics will cause increased levels of all sound harmonics. Lowson and Ollerhead (Reference 4) have shown that loading harmonics of order λ are significant radiators into the mth sound harmonic in the range

$$mB[1 - M] < \lambda < mB[1 + M]$$

Thus, increased high-frequency airloads can be expected to increase the higher sound harmonics more than the lower ones.

The effects of forward speed on the sound field can be accounted for by replacing the term r in Equation 1 by $r(1-M_r)$ where M_r is the component of hub translation Mach number in the direction of the observer (see References 4 and 8). It must be remembered when making this transformation that both r and M_r refer to the 'retarded' position of the helicopter; that is, the actual position of the helicopter when the sound was generated. This substitution also enters the argument of the Bessel function term and can be expected to influence the directivity characteristics of the radiated sound.

2.1.2 Impulse Characteristics

At this point it is necessary to examine the effects of harmonic amplitude and phase on the overall waveform. An impulsive waveform consists of many harmonically related frequencies whose amplitudes decay very slowly with increasing harmonic frequency. This is illustrated in Figure 2 where an impulsive and a nonimpulsive waveform are compared. This figure was prepared by summing the first twenty harmonics assuming only a sine component for each harmonic. For the impulsive waveform, the amplitude of the harmonics dropped off at the rate of 3 dB per octave from the level of the fundamental; for the nonimpulsive waveform, the decay rate was 10 dB per octave. In order to emphasize the full potential impulsiveness of the waveforms selected, all harmonics were shifted 90° with respect to the fundamental. It is readily apparent that the harmonic amplitudes determine the impulsive or nonimpulsive character of the sound. A sharp impulse contains many high amplitude harmonics, while a nonimpulsive sound contains relatively few harmonics of significant amplitude.

Of equal importance in determining the impulsive or nonimpulsive character of a waveform is the relative phasing between the harmonics. This was shown subjectively by Fricke (Reference 10), who found that the detectability of a complex signal was a function of the relative phase between components. The effect of phase on the waveform can be seen in Figure 3. Here the more impulsive of the two signals is the impulsive waveform of Figure 3 (90° phase difference), and the less impulsive waveform is constructed by summing the same twenty harmonics but with all harmonics in phase with respect to the fundamental. The effect of phase on impulsiveness is apparent.

2.2 BLADE/WAKE INTERACTION RIN

Returning now to the two fundamental types of RIN introduced in Section 2.0, blade/wake interaction RIN occurs when a blade passes through or near a wake shed from a preceding blade or another blade in juxtaposition. It results from the rapid pressure fluctuations on the blade as it encounters the velocity variations in the shed wake (tip

vortex). Normally, single main rotor helicopters do not experience this form of blade slap except during conditions of low inflow (e.g., autorotative descent, low power descents, etc.) and certain transient maneuvers. Recently, however, Clark and Leiper (Reference 11) showed that for multi-bladed single rotors under high lift conditions in hover and some forward flight conditions, a shed tip vortex passes very close under the following blade. In fact, in the presence of flapping or certain wind conditions the vortex may actually pass through or over the following blade. Blade/wake interaction RIN occurs on tandem-rotor helicopters primarily when the shed tip vortices from one rotor pass through the other rotor; thus, in many flight regimes it is a constantly occurring phenomenon.

The effect of high harmonic airloading (resulting from the sharp pressure variations on the blade) on the radiated sound was discussed briefly in Section 2.1.1. The specific effect of increasing the amplitude of the high airloading harmonics may be demonstrated with the aid of the technique presented by Lowson and Ollerhead (Reference 4). They found that in many cases it was possible to present the airload harmonic amplitude drop-off as approximately an inverse power law. That is, the amplitude of the λth airloading harmonic is related to the first harmonic of loading by the relation $L_\lambda = L_1\lambda^{-k}$, where L is a force (thrust, drag, radial component) and k is a constant. Reference 4 indicates the value of k to be about 2.0 for smooth inflow cases and suggests a value of 1.0 for rough running cases, including blade slap. Reference 6 indicates that for severe RIN conditions (blade slap), k should be closer to 0.6 (or 1.1 when corrected for random loading effects, as discussed in Reference 4).

Figure 4 (from Reference 4) demonstrates the effect of the airloading decay laws on the sound harmonic amplitudes for the first twelve harmonics. For a smooth inflow case (k = 2.5), the harmonics drop off at about -9.5 dB per octave, a rate which will produce the nonimpulsive waveform of Figure 2 . If, however, the "rough running" value of 1.1 suggested by King and Schlegel is used for k, the harmonics are of equal amplitude and produce the impulsive waveform of Figure 2. Thus, an airloading frequency spectrum containing significant harmonic components to very high frequencies due to blade/wake interaction will result in RIN.

Because of the way in which this type of RIN arises, namely, changing the airloading harmonic distribution, the directionality associated with it should not vary significantly from that expected for a similar non-slap case. This hypothesis can be seen by examining Equation 1. The detailed directionality is determined by the Bessel functions which do not depend upon the value of the loading harmonics. Only the amplitude terms are affected by loading. However, when going to the blade slap case, if the radial components change proportionally more or less than do the thrust and drag components, then gross changes in directionality may be expected.

2.3 ADVANCING BLADE RIN

This form of RIN was originally thought to be due to the formation of weak local shock waves on the advancing blade. As mentioned by Ollerhead and

Lowson (Reference 8) and discussed by Leverton (Reference 5), an observer can hear such a shock wave only if the blade speed is supersonic. If the blade speed is subsonic, the shock wave can not propagate to an observer's ear. However, the formation of local shocks can affect rotor noise levels by influencing the local blade airloading acting on the blade.

Advancing blade RIN as discussed in Reference 8 is basically an acoustic effect resulting from the coalescence of the harmonic wave fronts at high source translational speeds and, in fact, can be explained by the Lowson/Ollerhead theory (Equation 1). Figure 5 (from Reference 8) shows the effect of increasing tip Mach number on sound harmonic levels. As the tip Mach number approaches 1, the higher frequency harmonics increase in amplitude, producing exactly the same effect as the loading changes discussed in the preceding section. Furthermore, at tip speeds close to Mach 1, the fluctuating airloads become unimportant and the noise is controlled entirely by the steady loading.

The highly directional characteristic of advancing blade RIN observed when the helicopter flies directly overhead is also an acoustic effect which results from the forward speed correction made to Equation 1 in Section 2.1.1. Here the term $r(1-M_r)$ which replaces r in the equation enters the argument of the Bessel functions, thus influencing the directivity characteristics. This effect can be seen in Figure 6, taken from Reference 4. As forward speed increases, the radiated sound becomes highly directional in the forward direction, particularly for the higher harmonics. This means that the RIN experienced by a helicopter at high speeds will be radiated preferentially forward with the maximum at about 15-20 degrees below the plane of the rotor. This effect was shown experimentally by Cox (Reference 16) in full-scale wind tunnel tests. Thus, while the acoustic effect of a high tip Mach number is at least partially responsible for the generation of the impulsive noise, the aircraft forward speed accounts for the highly directional character of this type of RIN.

The aerodynamic forces used in current acoustic theory to predict radiated rotational noise are the in-plane (induced drag) and normal (thrust) components of the blade section lift (Figure 7). The profile drag is ignored, since it is small compared to the other terms. When advancing tip speeds exceed a critical Mach number, the drag increases rapidly (Figure 8), a phenomenon known as drag divergence. This increased drag term may be a significant contributor to the radiated noise. In a recent paper, Ardnt and Borgman (Reference 12) examined the effect of drag divergence on the radiated noise. Figure 9, taken from their paper, indicates that the effect of this term is to increase the levels of the higher harmonics of noise, the necessary condition for blade slap. While Ardnt and Borgman indicate that the addition of this term to the Lowson/Ollerhead noise equation enhances correlation, they unfortunately do not show to what degree. For small angles of attack (such as near the tip), the lift term may be quite small and the drag terms will dominate the noise radiation. In this case the associated directivity will be that of a dipole with its maximum directivity in the plane of rotation, thus further contributing to the observed directivity of advancing blade RIN.

An additional factor which may contribute to the observed directivity and character of advancing blade RIN is thickness noise. While it is not significant for highly loaded rotors at low forward speeds, thickness noise can become a significant noise source at high forward speeds. Arant and Borgman (Reference 12) crudely accounted for thickness noise by applying a forward speed correction to the theory developed by Diprose (Reference 21) for a static propeller. No attempt was made to correct for the nonuniform velocity field over the rotor disk. As Figure 10 (from Reference 12) demonstrates, thickness noise appears to be important only for the first few harmonics of noise; however, as tip speed increases, the levels of the higher harmonics increase quite rapidly. This effect, coupled with the associated directivity pattern, which is the same as for drag divergence generated noise, will tend to enhance the severity of the observed RIN.

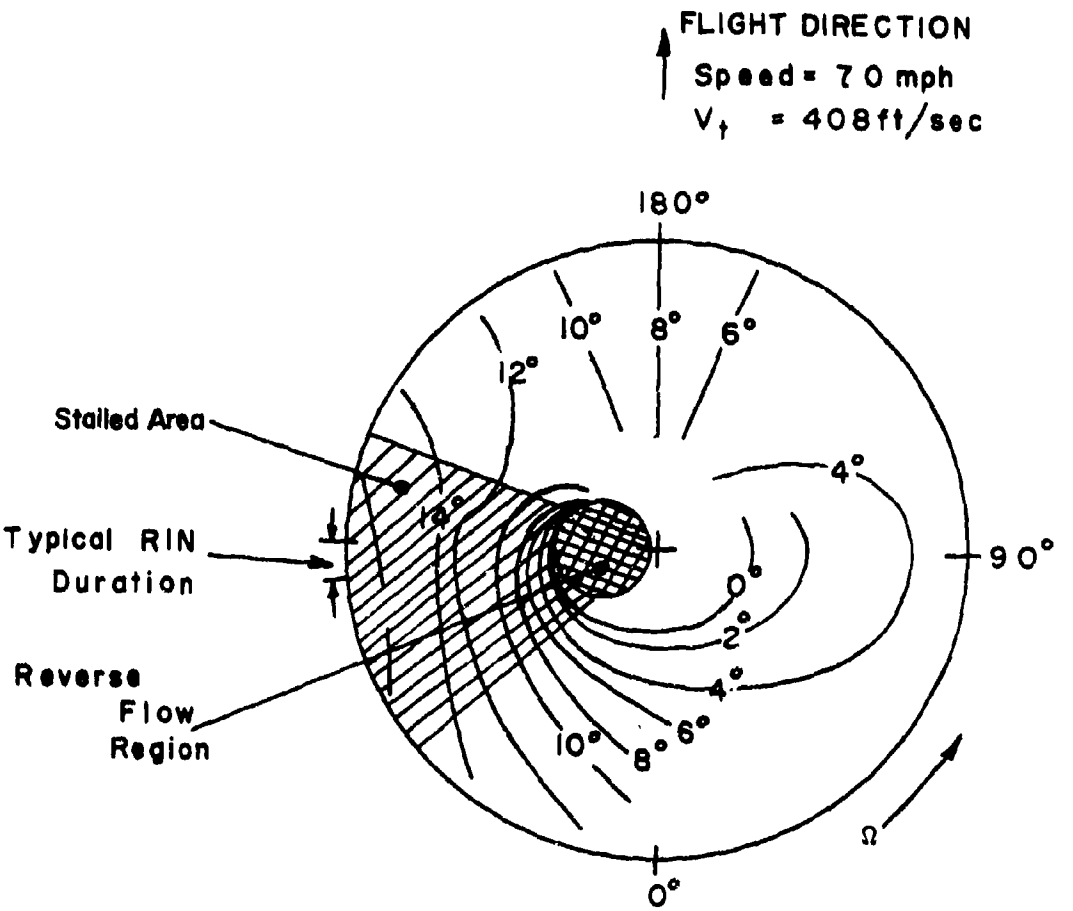


Figure 1. Comparison of RIN Duration With Blade Stall Duration for Single-Rotor Helicopter (Reference 5).

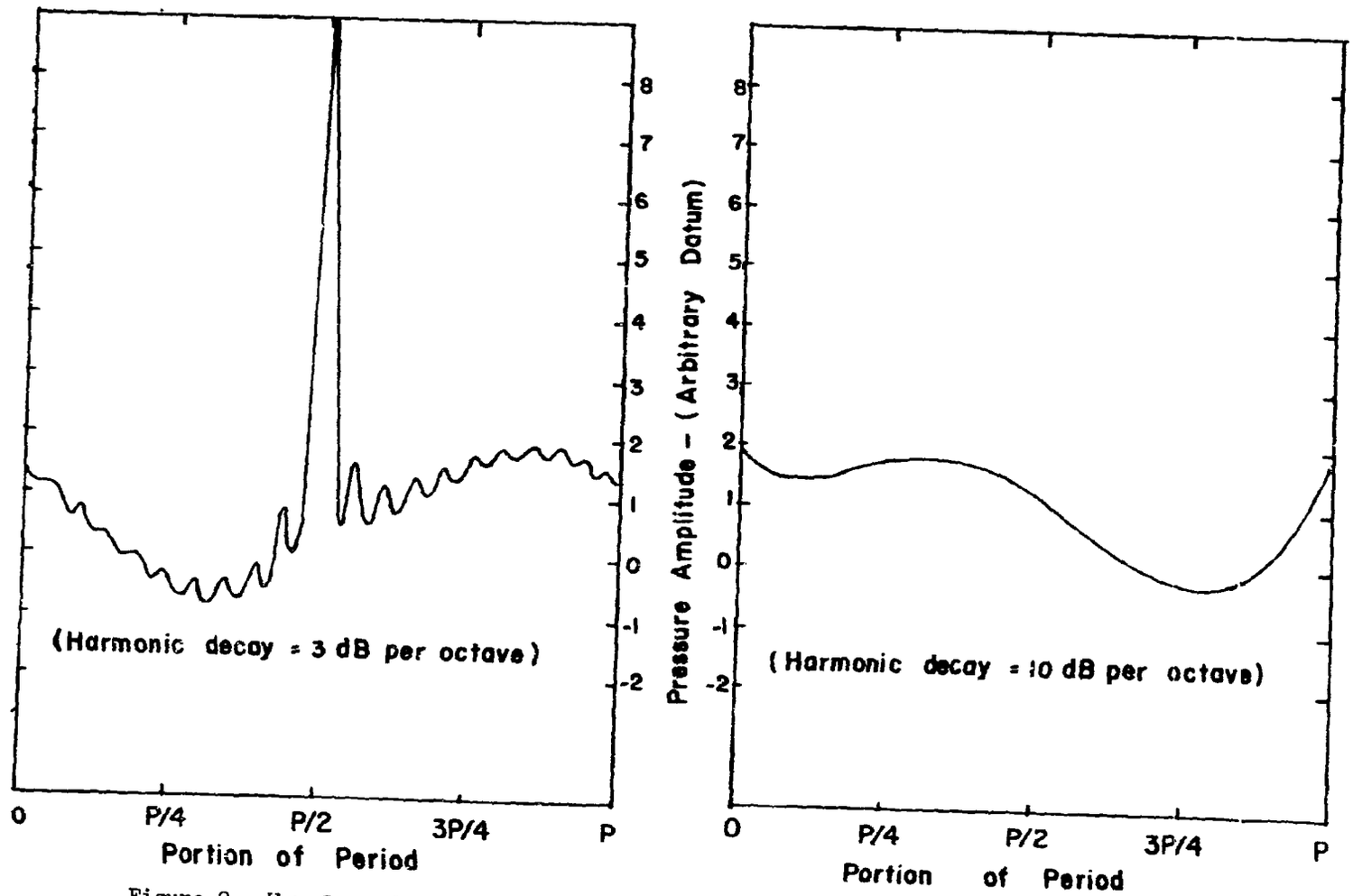


Figure 2. Waveforms Resulting From Summation of First Twenty Fourier Sine Harmonics With Varying Amplitude Decay Rates (Harmonics Shifted 90° With Respect to the Fundamental).

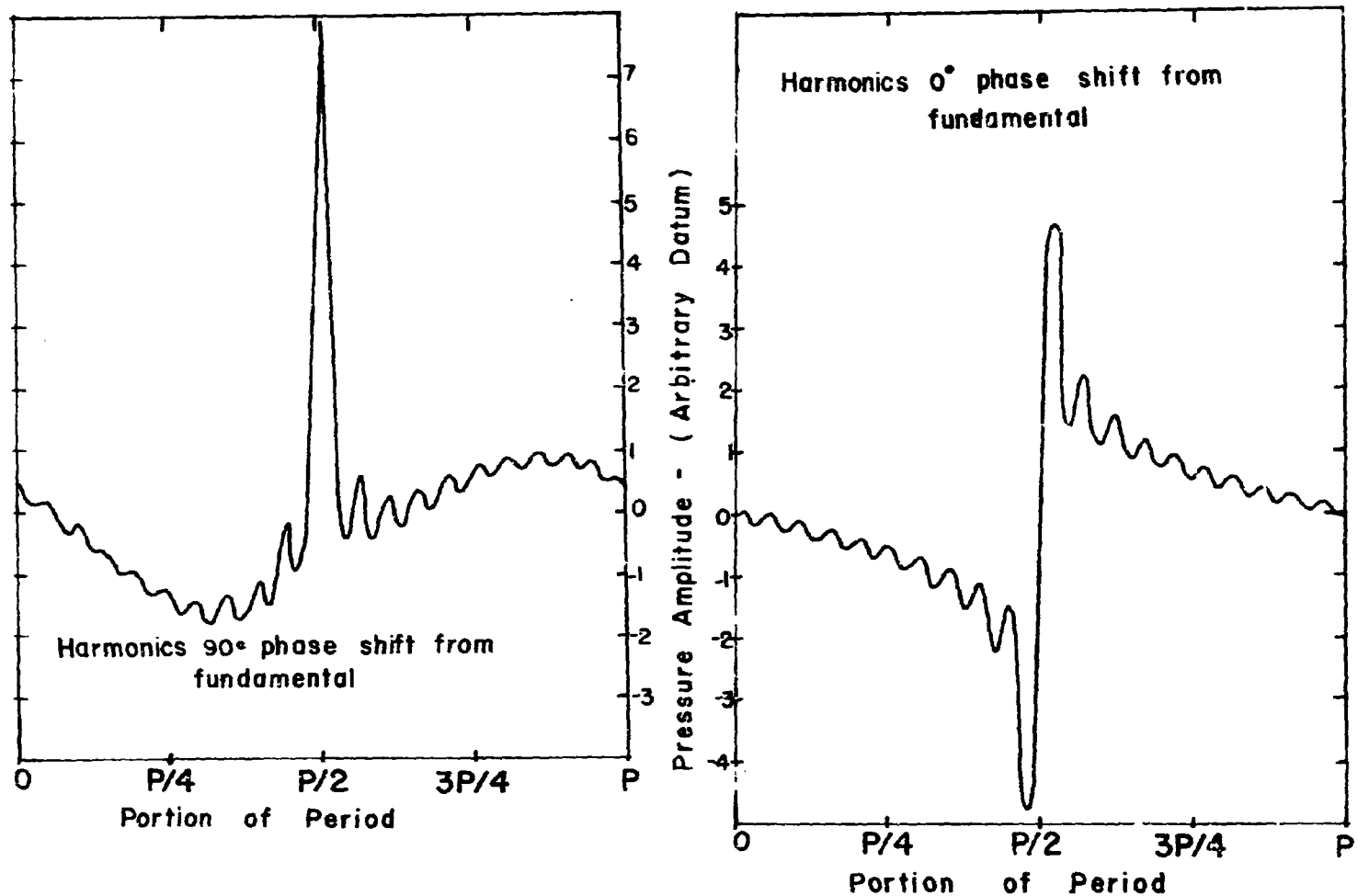


Figure 3. Effect of Harmonic Phase Difference on Pressure Waveform (Harmonic Decay = -3dB per Octave).

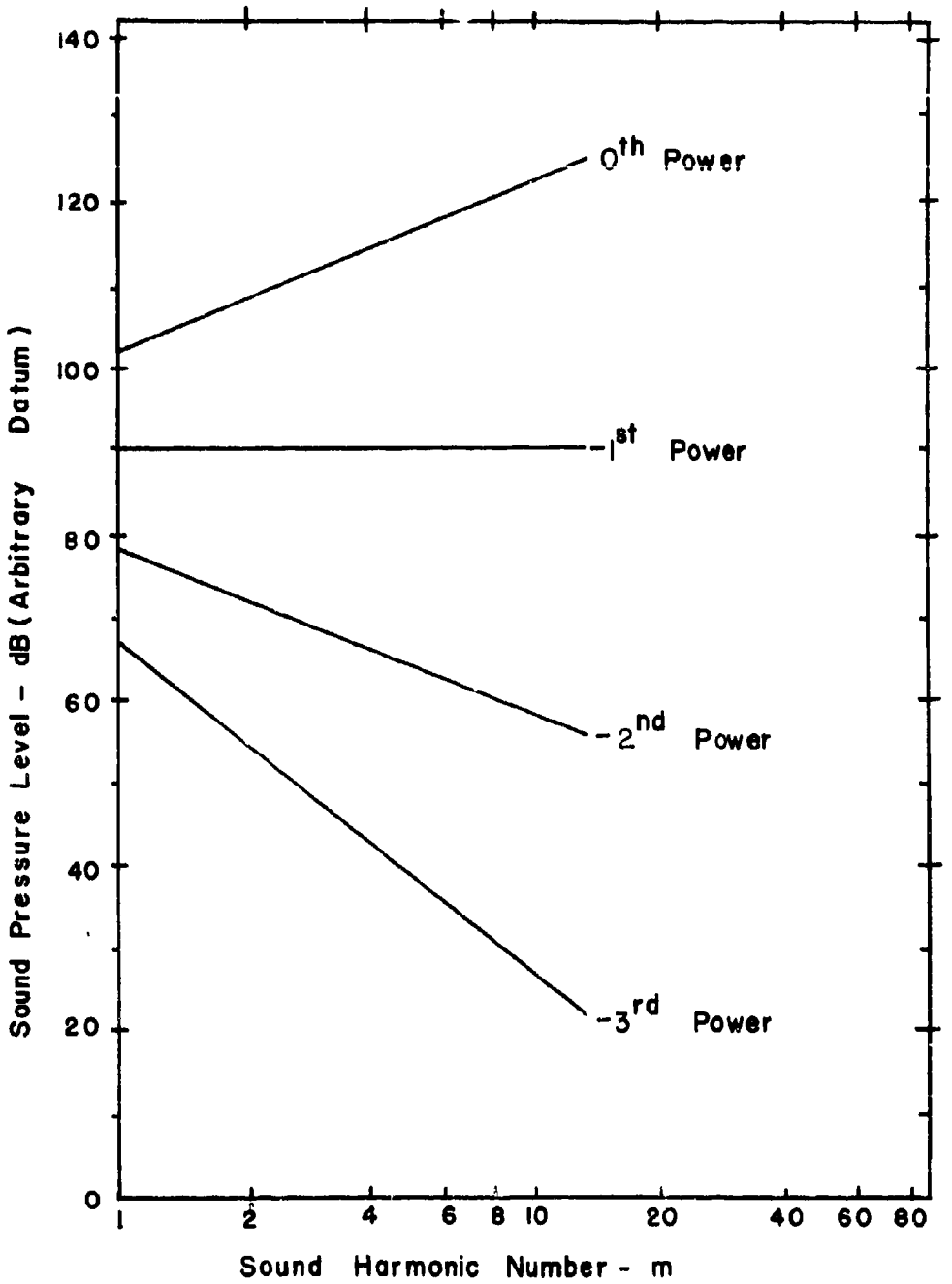


Figure 4. Effect of Airloading Harmonic Decay Power Law on Sound Harmonic Levels (Reference 4).

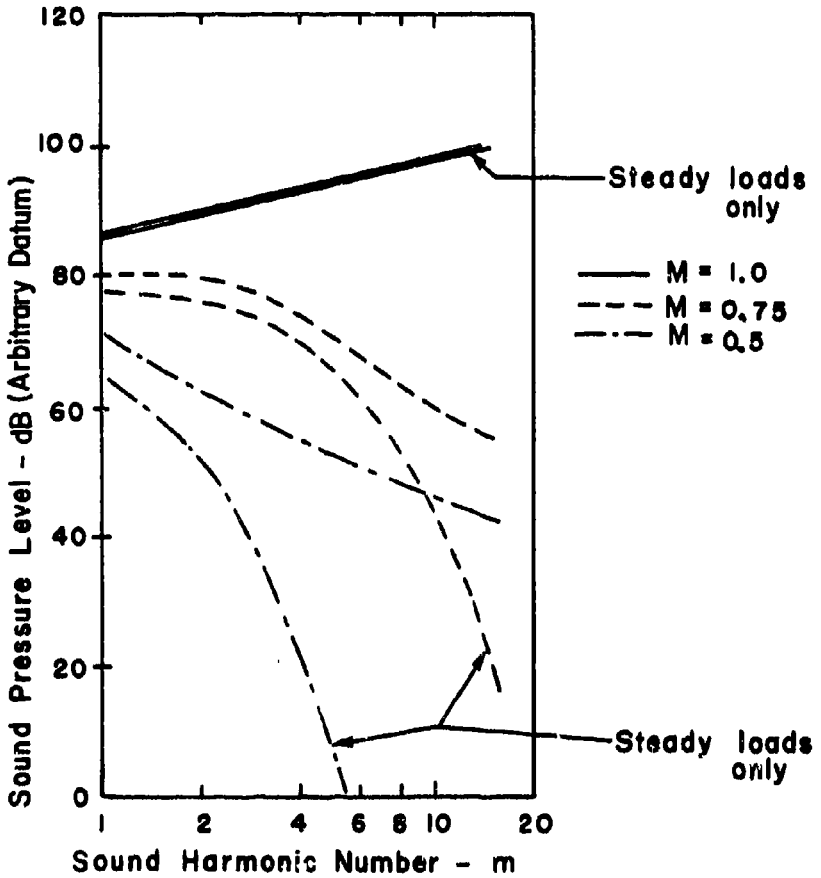
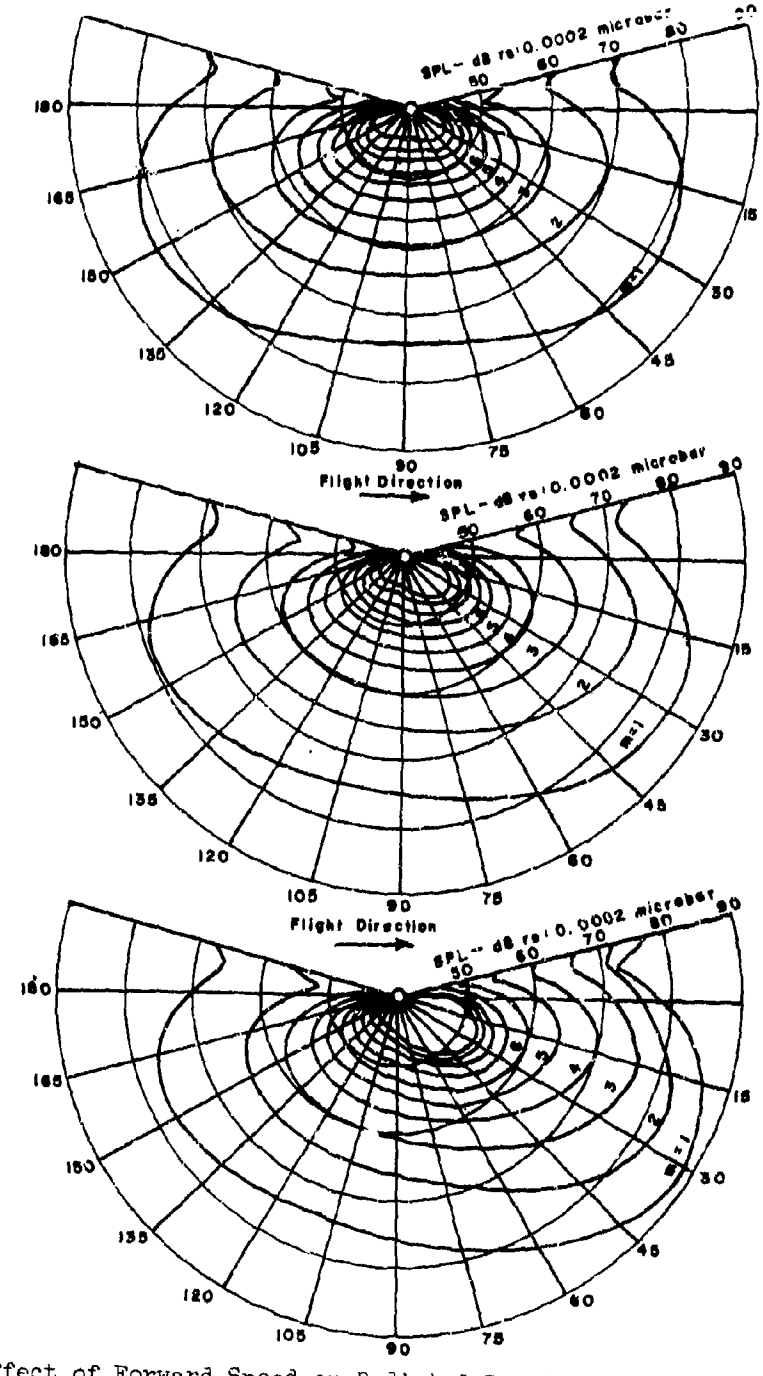


Figure 5. Effect of Rotational Tip Mach Number on Sound Harmonic Amplitude 10° Below Rotor Disk in Hover (Reference 8).

M = 0.5
B = 4
Thrust = 10,000 lb
Dia. = 40 ft
r = 1000 ft



a. Hover

b. Cruise Mach Number 0.125

c. Cruise Mach Number 0.25

Figure 6. Effect of Forward Speed on Radiated Sound Directivity (Reference 4).

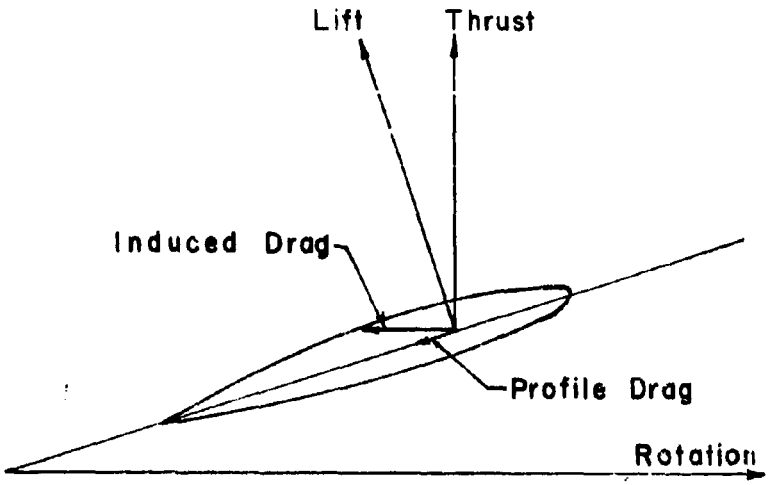


Figure 7. Force Components on Rotor Blade Section.

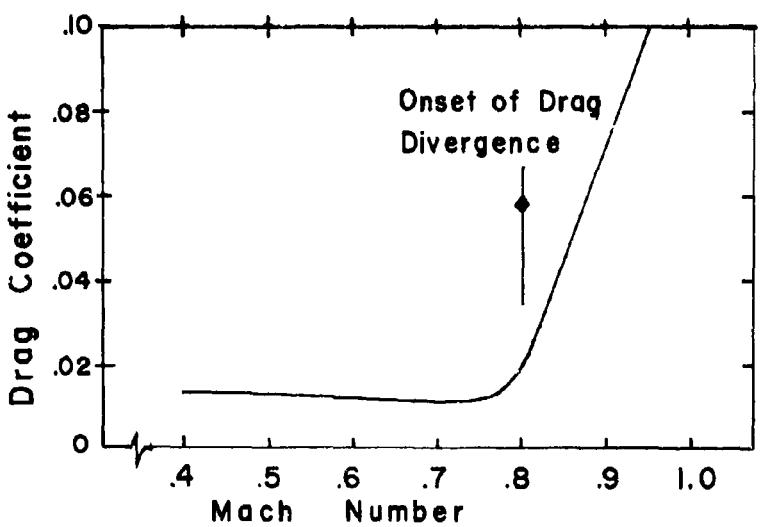


Figure 8. Airfoil Section Drag vs Mach Number for an NACA-0012-34 Airfoil at Zero Angle of Attack (Reference 12).

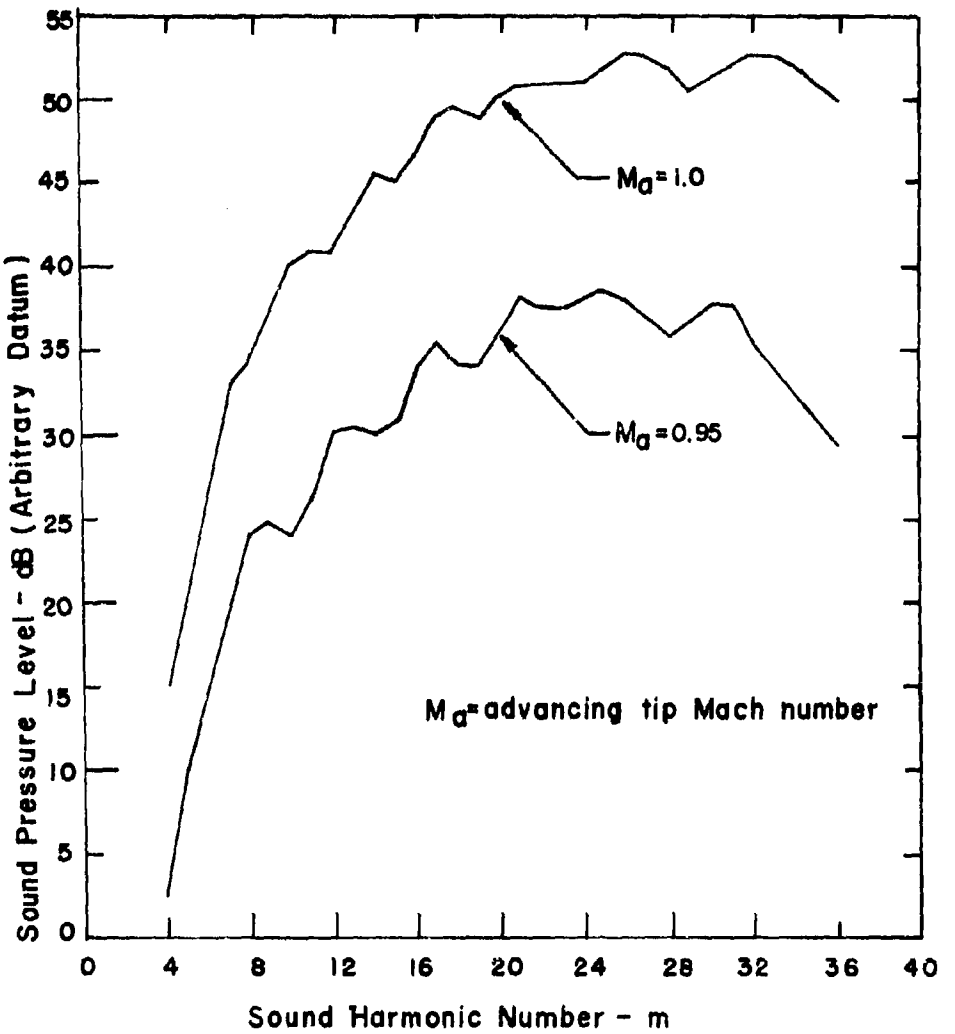


Figure 9. Calculated Harmonic Noise Spectra due to Drag Divergence Effects for a Two-Blade Rotor (Reference 12).

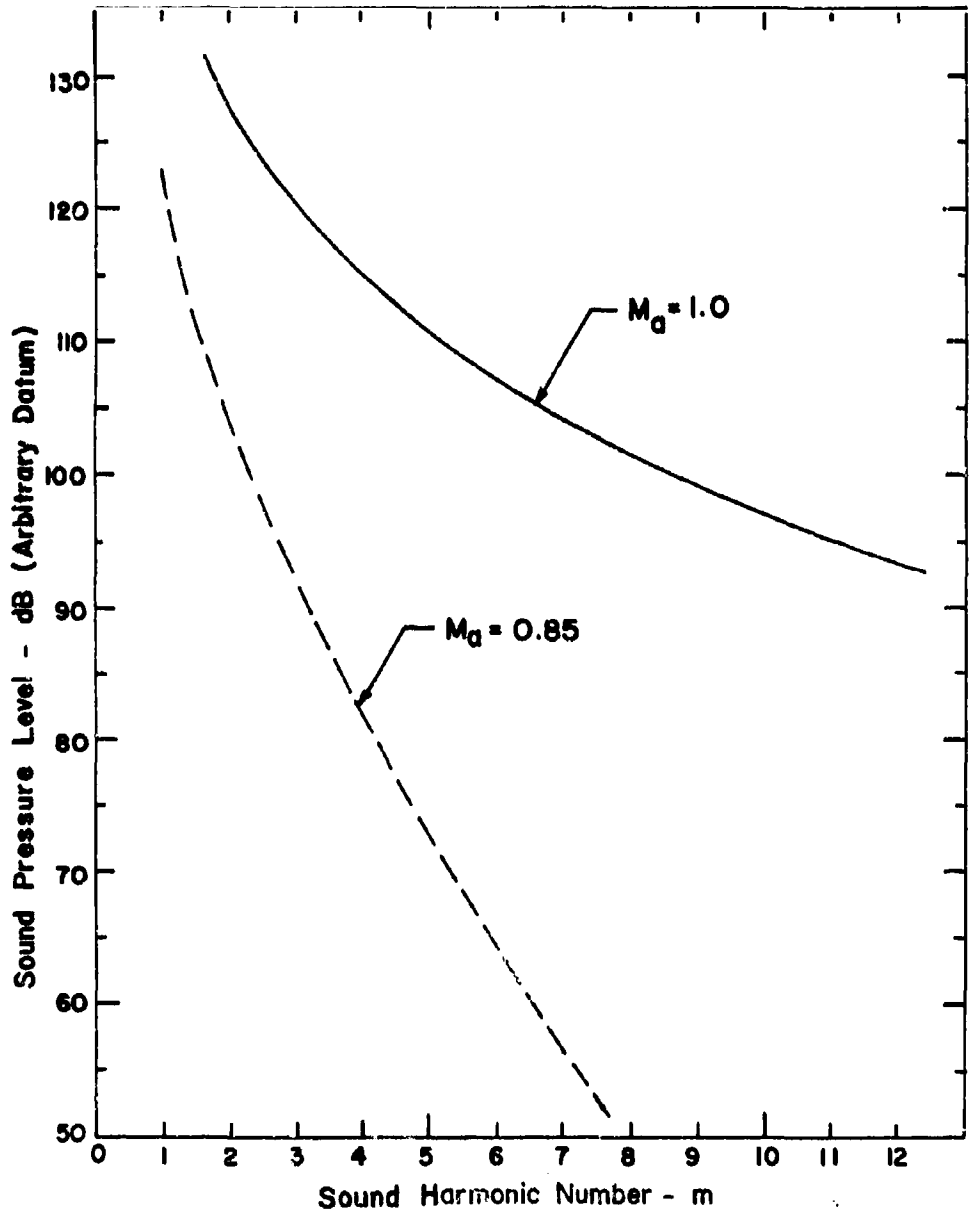


Figure 10. Harmonic Noise Spectra of Thickness Noise for a Two-Blade Hovering Rotor (Reference 12).

3.0 EXPERIMENTAL PROGRAM

The experimental phase of this study involved simultaneous measurement of rotor aerodynamics, rotor blade dynamics, and rotor noise on a CH-53A aircraft, as shown in Figure 11, during hover and forward flight conditions. These data were required for the prediction of impulsive and nonimpulsive rotor noise, for correlation of measured and predicted noise, and especially for the determination of how impulsive rotor noise is aerodynamically generated.

The blade pressure and dynamics instrumentation systems used in this contract were primarily the result of a rotor loads contract which was being run simultaneously. Since bandwidth limitations of the narrowband FM recording system restrict blade pressure measurements to 100 Hz or less, two portable direct record units were added to obtain high frequency pressure data at two chordwise stations (4.2% and 91% chord) near the tip of the blade (98% span). These data would determine whether the accuracy of calculated noise levels would be compromised by the frequency response limitations of the airborne data system. Appendix II discusses these high frequency pressure data.

Noise was measured at three locations inside the helicopter in the hope of locating where acoustic impulses originate in the rotor disk. These data were recorded on the FM system that recorded all rotor dynamics and aerodynamics in order to facilitate correlation of acoustic and aerodynamic data and to utilize the main rotor contactor information for correlation of the acoustic signal with main rotor position.

3.1 FLIGHT TEST

All data for this study were acquired during a flight test on October 15, 1969, at the Bridgeport Airport in Stratford, Connecticut. Noise data were recorded for a series of 14 flyovers and 13 hover orientations. One microphone was located on the centerline of the runway, and additional microphones were located 250 feet to each side of the center microphone perpendicular to the flight path (runway centerline) of the CH-53A helicopter. Forward flight data were recorded during unaccelerated flight from east to west and west to east at an altitude of 1000 feet at nominal airspeeds of 120 knots, 140 knots, and 170 knots. Hover data were recorded out of ground effect (OGE) at 13 helicopter headings at an altitude of 200 feet. Surface winds throughout the test were northerly from 3 to 8 knots. The mean temperature and relative humidity of the air were 50°F and 49%, respectively. Sea level barometric pressure was 30.12 in. Hg.

3.2 INSTRUMENTATION

3.2.1 Data Acquisition

Three data recording systems were used simultaneously during the flight test. An airborne FM multiplex system recorded aerodynamic pressures, blade pitch, blade flapping, blade azimuth angle, and internal noise. An

airborne direct-record system recorded differential pressure data from the fore and aft transducers at the 98% span station. A ground-based FM system recorded the acoustic data for the hover and forward flight test conditions.

3.2.1.1 Airborne FM

The heart of the FM multiplex recording system was an Ampex Model AR 200 recorder set for standard IRIG center frequencies and bandwidths operating at 15 inches per second (ips). Input signals to the recorder were preconditioned by voltage-controlled oscillators. The sensors that measured the aerodynamic and blade motion data were Sensotec (Division of Comtel Corp) pressure transducers and Baldwin-Lima-Hamilton angulators. Figure 12 presents a block diagram of the airborne FM system including the internal noise measurement system.

The microphones used to measure internal noise were housed in metal containers lined with 1-inch thick fiberglass to control reverberation inside the containers and vibration damping material covered the outer surfaces of the containers to prevent acoustic excitation of these surfaces. Each container was mounted in the center of a window as shown in Figure 13 to detect acoustic impulses coming through that window.

3.2.1.2 Airborne Direct

The differential pressures at 4.2% chord and 91% chord from the 98% span location were recorded on this system. In addition to the pressure transducers, the system consisted of two sound level meters and two Nagra portable tape recorders.

3.2.1.3 Ground FM

External helicopter noise was recorded at two locations on the ground with a Lockheed portable tape recorder operating at a tape speed of 15 inches per second. Three information channels were used, two to record noise data and a third to record a time code signal and comments. A fourth data channel had been set up, but the microphone that fed this channel malfunctioned during the flight test. Figure 14 shows the locations of the instrumentation along the helicopter's ground track.

The following procedure synchronized recording of data on the aircraft with recording on the ground and related data recorded on the ground with aircraft location along the flight path. The helicopter pilot radioed a "start" command as the aircraft passed over the end of the runway. This command started both the airborne data recording system and the time code generator on the ground. At this point, data records in the air and on the ground are synchronized, and the location of the aircraft is defined at one instant of time. For easterly flight, the "start" corresponds to a lateral distance of 1000 feet between the microphone array and the approaching helicopter. For westerly flight, this distance is 3700 feet.

3.2.2 Data Reduction

Rotor blade dynamic and aerodynamic data were converted from analog to digital form and then reduced to harmonics of rotor rotation. Data were sampled every 2.5 degrees of azimuth, giving 144 digitized data points for each data cycle from 0 degree to 357.5 degrees of azimuth inclusive. Thirty harmonics then were extracted from the data by performing a Fourier analysis of one typical data cycle for each flight condition. One cycle was used in order to preserve the high-frequency content of the data. This technique was necessary because slight differences between successive cycles cause the high-frequency components in a parameter's time history to be obscured when several consecutive cycles are averaged. The harmonic amplitudes were corrected for the attenuation characteristics of the 60 Hz low-pass filters that were used during the analog/digital conversion. Since all aerodynamic and blade motion data passed through identical filters, no phase corrections were required. A block diagram of the data reduction system is shown in Figure 15.

External noise data were processed into octaves and narrowband form as a function of time. Octave-band analysis involved charting the output of a General Radio Octave Band Analyzer. Narrowband analysis (2.5 Hz) was done with a Saicor Spectrum Analyzer and Saicor Digital Integrator terminating in a Midwestern Oscillograph to produce a 2.5 Hz bandwidth spectrum from 0 to 500 Hz every 0.20 second. Interpretation of the narrowband data was complicated by noise from the tail rotor since the third harmonic of main rotor rotational noise is separated by only 2 Hz from the first harmonic of tail rotor rotational noise. A typical narrowband spectrum is reproduced in Figure 16 to show both frequency content of the signature below 500 Hz and the problem of distinguishing main rotor noise from tail rotor noise.

3.2.3 Instrumentation Response and Calibration

The following section describes the pertinent response and calibration characteristics of each system used to acquire and analyze data. Aerodynamic parameters typically are within ±2% of transducer full scale, and acoustic levels typically are within ±3.5 dB and ±5.0 Hz.

3.2.3.1 Blade Pressure and Blade Motion Measurement System

Sensotec (formerly Scientific Advances) transducers, models SA-SA-M-7F and SA-SD-M-7F, were mounted on one main rotor blade to measure aerodynamic pressures acting on the surface of the blade. Table I contains the range of the transducers and the measurement/analysis system accuracy at each location on the blade. The system accuracy includes all components from transducers on the aircraft to final digital tape and is expressed as a percentage of transducer range. An airtight chamber was placed over each chordwise transducer array so that known pressures could be applied to obtain the response of each transducer. The transducer response measured this way determined values for the electronic R-cals that were made before and after each flight.

Blade pitch angle and flapping angle were measured with Baldwin-Lima-Hamilton angular position transducers, model 236. Pitch angle range was ±60 degrees. flapping angle range was ±30 degrees, and both were linear and temperature compensated over their entire range, giving a system accuracy of ±2% of full scale. Calibration was accomplished by mounting each angulator on an angular position table and recording the output voltage as a function of shaft rotation. Angulator response was determined for both clockwise and counterclockwise rotation of the input shaft to each angulator.

The azimuthal location of the instrumented rotor blade was measured photoelectrically. A metal disc with 72 equally spaced slots was attached to the main rotor shaft. Rotation of the shaft caused the disc to intercept a beam of light aimed at a light sensor, thereby producing 72 pulses per revolution. Accuracy of this signal is better than ±1 degree.

3.2.3.2 Internal Noise Measurement System

The absolute amplitude of the rotor noise measured inside the helicopter was of secondary importance compared to the shape of the acoustic waveforms and the relative phasing among the three internal noise signals. An amplitude reference was supplied for each location, however, with a General Radio Calibrator, model 1562A, that applied a 114-dB signal (±.5 dB) at 1000 Hz (±3 %) to each microphone.

3.2.3.3 External Noise Measurement System

Bruel and Kjaer microphones and amplifiers terminated in a Lockheed tape recorder model 417 operating at a tape speed of 15 ips were used to record external rotor noise. Type 4117 piezoelectric microphones were selected because of their good frequency response characteristics (±3 dB from 3 Hz to 10,000 Hz). A Bruel and Kjaer charge amplifier, type 2624, was connected to the output of each microphone to permit the use of long connecting cables. This charge amplifier's response is ±.4 dB from 5 Hz to 10,000 Hz. A noise limit indicator, type 2211, was inserted between each charge amplifier and the tape recorder to insure that the level of the input signal to the tape recorder stayed within acceptable limits. Response of this instrument is ±1.2 dB from 2 Hz to 35000 Hz, and tape recorder response is ±2 dB from 0 Hz to 5000 Hz. The complete system was calibrated at 114 dB with a General Radio calibrator, type 1562A, at frequencies of 125 Hz, 250 Hz, 500 Hz, 1000 Hz, and 2000 Hz. Indication of elapsed time and compensation for flutter and wow were accomplished by connecting a Systron Donner time code generator to a separate track of the tape recorder. Amplitude accuracy of the total noise recording system is estimated to be ±3 dB, while the worst possible accuracy, obtained by summing the deviations of each component, is ±7 dB.

Rotational noise data were analyzed with a Saicor spectrum analyzer, model 31A, and a Saicor digital integrator, model 21A. These instruments were calibrated with built-in references and checked with peripheral equipment whose accuracy is traceable to the National Bureau of Standards. Accuracy of the noise analysis equipment is ± .2 dB and ± 2.5 Hz. Accuracy of the total acoustic measurement/analysis system is estimated to be ± 3.5 dB, ± 5.0 Hz.

TABLE I. PRESSURE TRANSDUCER LOCATION, RANGE, AND ACCURACY

PERCENTAGE CHORDWISE	PERCENTAGE SPANWISE 40	75	85	95	98
4.2	3-18 PSIA				±10 PSID
	VIBRATORY ±2%				
	STEADY ± 2%				
15.8	3-18 PSIA				±10 PSID
	VIBRATORY ±2%				
	STEADY ±2%				
30.0	3-18 PSIA				±10 PSID
	VIBRATORY ±2%				
	STEADY ±2%				
60.0	±2 PSID				
	VIBRATORY ±2%				
	STEADY ±3%				
91.0	±2 PSID				+5 PSID
	VIBRATORY ±2%				
	STEADY ±3%				

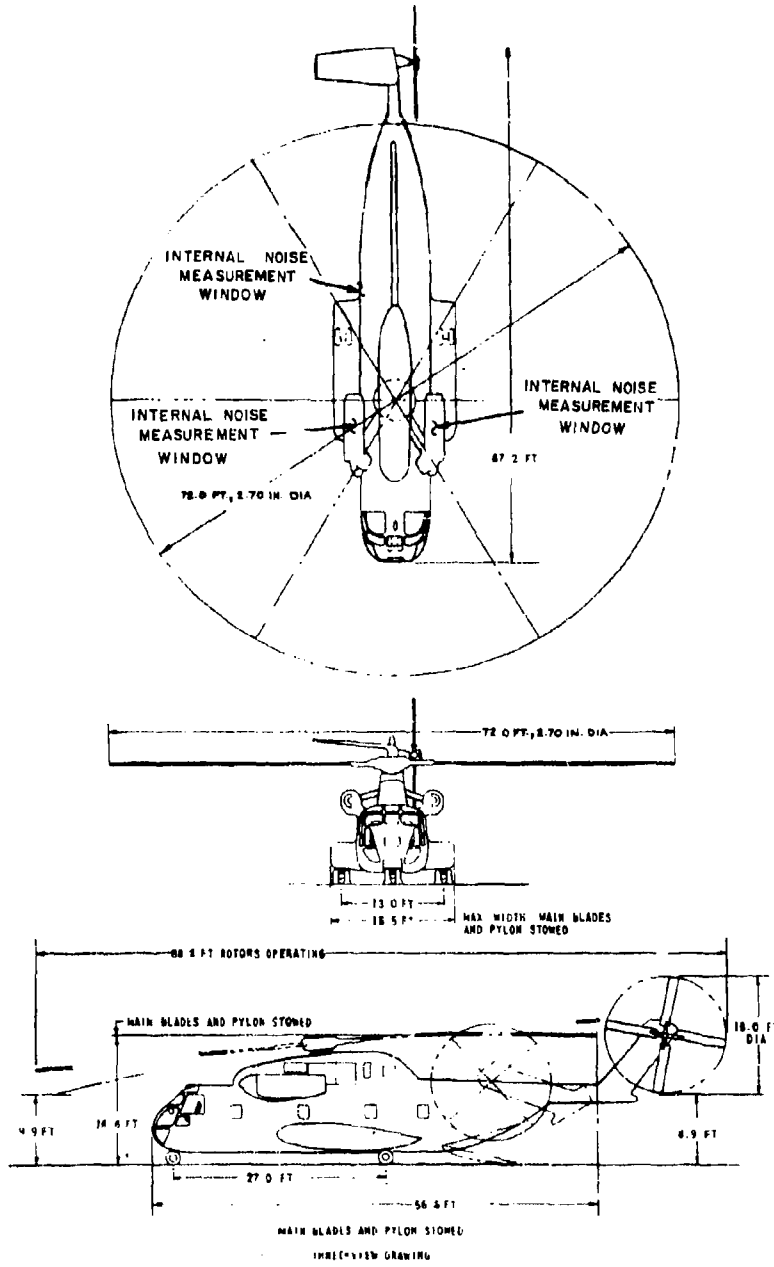


Figure 11. CH-53A General Arrangement.

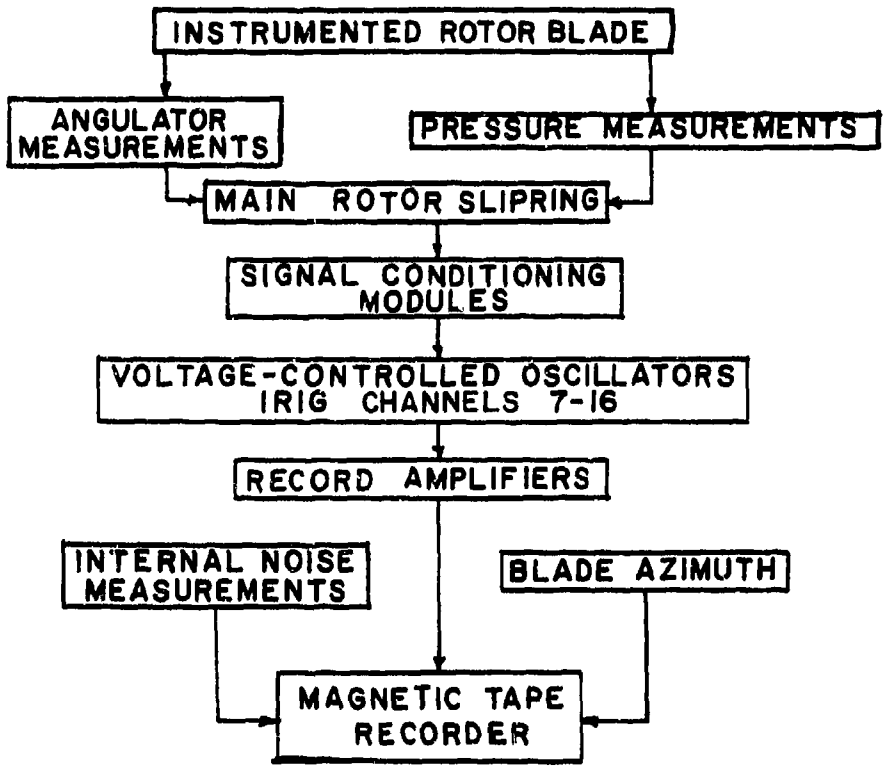


Figure 12. Airborne Data Acquisition System.

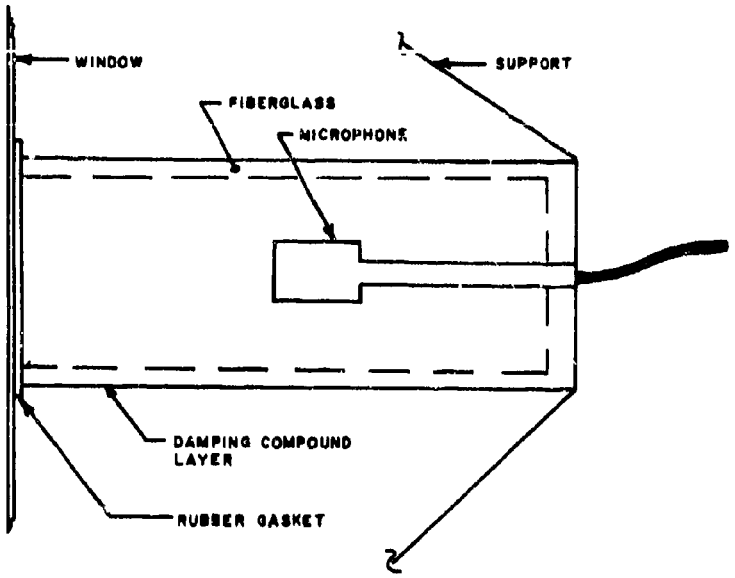


Figure 13. Internal Noise Microphone Installation.

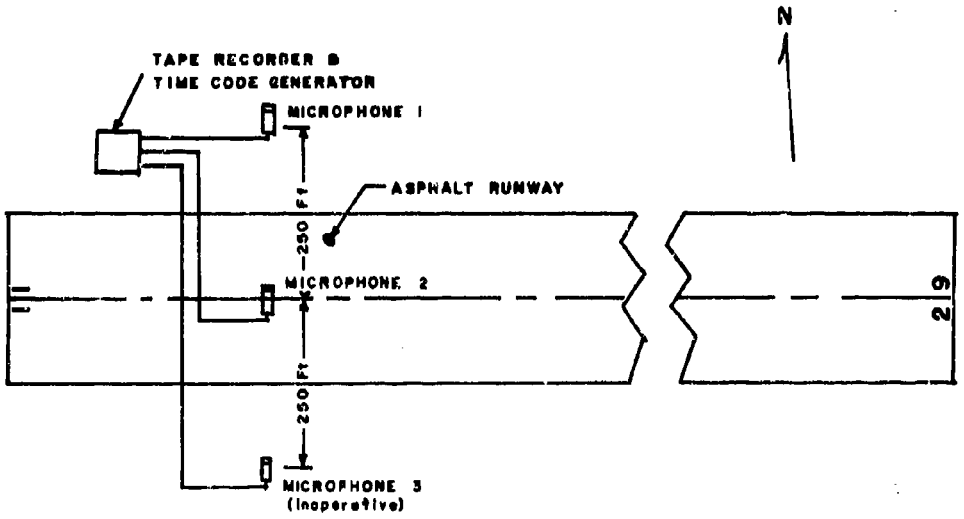


Figure 14. Ground-Based Data Acquisition System Layout.

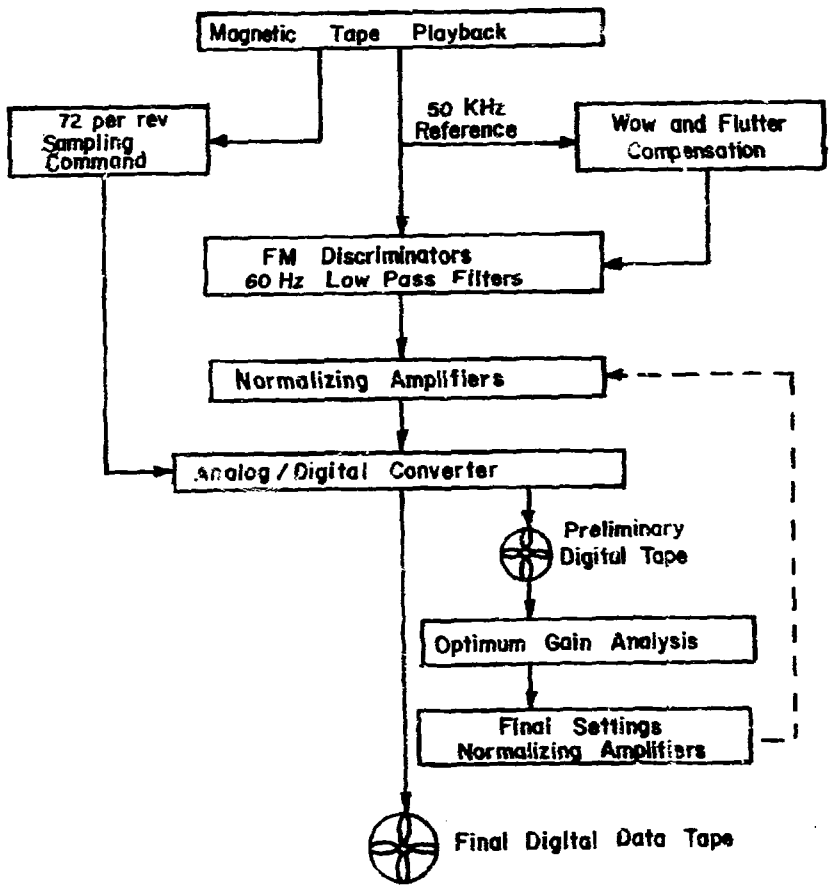


Figure 15. FM Data Reduction System

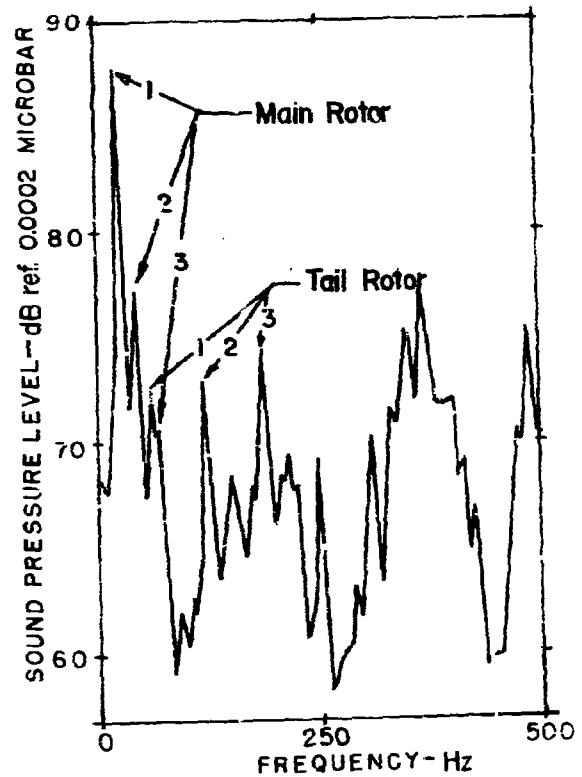


Figure 16. Typical Narrowband Spectrum of CH-53A Helicopter Noise, 170 Knots, 380-Foot Lateral Distance.

4.0 RESULTS

The present study seeks to define some of the characteristics of RIN and to determine how well these characteristics are predicted by the rotational noise analysis described in Reference 13. The present study also evaluates the ability to predict rotational noise levels from theoretical airload data. Section 4.1 describes the calculation procedures and correlation for rotational noise, and Section 4.2 investigates the aerodynamic noise generating mechanisms found in the CH-53A flight test data.

4.1 ROTATIONAL NOISE CORRELATION

The two qualities of rotational noise that determine the impulsiveness of the total rotor noise signature are harmonic amplitude fall-off and relative phasing among the noise harmonics. Comparison of measured and predicted root-mean-square sound pressure levels (SPL's) determined amplitude correlation, while comparison of measured and predicted time histories of acoustic pressure determined phase correlation. Predicted time histories are based on measured aerodynamic load data.

Time histories of acoustic pressure were not calculated from theoretical airloads. Experience has shown that currently available airload/blade response analyses predict amplitudes fairly well but predict phase behavior poorly even when variable inflow velocities for helical wake geometry are added to the calculations. Since the airload phasing can significantly affect calculated noise levels (Reference 4), it was decided that no new information would result from using theoretical airloads to calculate time histories of acoustic pressure.

4.1.1 Hover Noise

The most impulsive noise signature heard during the flight test occurred during hover out of ground effect. This RIN was caused by the main rotor blades cutting through wakes from tail rotor blades, a phenomenon which requires a quartering tail wind in order to occur during hover. Noise levels calculated from measured airloads reflect this blade/wake interaction, but levels calculated from theoretical hover airloads do not, since the airload prediction analysis considers only aerodynamics of the main rotor and does not simulate interactions of main rotor blades with tail rotor wakes.

4.1.1.1 Correlation Using Measured Hover Airloads

Calculated and measured SPL's agree fairly well through the fifth harmonic. In theory, 5 noise harmonics are all the analysis should calculate with confidence from 30 harmonics of airload for a 6-bladed rotor. Both calculated and measured noise levels changed radically with small changes in azimuthal position around the helicopter. Unfortunately, the azimuthal resolution of the measured noise data is insufficient to verify all the calculated variations around the hovering helicopter. To obtain this information, a circular array of microphones surrounding the helicopter would have been required. Since the instrumentation for such an approach was not available, hover noise data were recorded with one microphone on the runway centerline while the helicopter heading changed in 30-degree increments to achieve an

azimuthal traverse. The helicopter hovered 500 feet west of the microphone array at an altitude of 200 feet above the runway centerline. Some hover noise data also were recorded using the microphone 250 feet north of the runway centerline. The two microphones are roughly 26 degrees apart in terms of helicopter azimuth. Data from the sideline microphone has been corrected for the difference in distance caused by the right-triangle geometry setup of the hover test. Noise level changes due to directionality were ignored in this correction since the difference in elevation angle (angle between microphone, rotor hub, and horizontal) is approximately 2 degrees.

Plots of the azimuthal variation in calculated SPL are presented in Figures 17 through 19. The airload data used to generate Figure 17 do not correspond to RIN conditions, whereas the data for Figures 18 and 19 are associated with RIN. A measured SPL value is shown for each harmonic at the appropriate azimuth relative to the helicopter (zero azimuth is at the tail of the helicopter); it can be seen that predicted and measured levels generally agree within 10 dB, depending upon harmonic order and helicopter heading. The 5th harmonic in Figure 19 is an exception since the measured SPL is roughly 20 dB below the calculated SPL. A complete assessment of prediction accuracy - that is, SPL and directionality in vertical and horizontal planes - is beyond the scope of this study.

The calculated variation in SPL around the azimuth raised questions about the validity of the noise prediction computer program. Assuming that the airloads are fairly steady during RIN-free hover, the resultant rotational noise fundamental should radiate uniformly in all directions. A noise calculation using steady airloads resulted in a constant fundamental level around the azimuth. It is concluded that the computer program functions correctly, and that the calculated levels in Figure 17 vary azimuthally because of wind-induced asymmetric airloads. Cyclic changes in blade pitch are a secondary contributor to these calculated variations. For the hover conditions that produced moderate and pronounced RIN, the calculated variations are attributed to asymmetric loading due to wind effects and blade/wake interactions. The noise harmonic spectra shown in Figure 20 illustrate calculated and measured noise variations in a 26-degree azimuth increment. The calculated time history of acoustic pressure also can change radically with azimuth, as can be seen in Figure 21. Differences were observed in the two noise recordings taken for this helicopter heading, but the azimuthal spread was not sufficient to confirm the extremely impulsive signature calculated on the starboard side of the helicopter.

4.1.1.2 Correlation Using Theoretical Hover Airloads

In order to evaluate the ability to predict noise without airload information measured in flight, levels for 3 noise harmonics were calculated from theoretical rotor airloads. The results of this exercise confirm that accurate noise prediction is not presently possible for more than the fundamental using theoretical airloads. The theoretical airloads are restricted to too low a frequency range (typically 5 or 6 times the rotor hub rotational frequency), and the accuracy of the theoretical airload phasing tends to be unacceptable for acoustic prediction work. Existing rotor load analyses

of the prescribed wake/variable inflow/normal modes type used during this study are adequate for investigations of rotor and fuselage dynamics, but not for detailed acoustic studies.

Theoretical airloads were calculated using a variable inflow analysis to describe the air velocity distribution over the rotor disk for a given trim condition. The wake of each rotor blade is assumed to descend in the form of a helix from the rotor plane. The rotor trim condition is determined by a rotor blade dynamics analysis that uses the normal modes approach to calculate the loads on the blades and the response of the blades to the impressed loading. If inclusion of variable inflow changed the trim condition too much, the rotor was retrimmed with the variable inflow velocities included, new inflow velocities were calculated for the latest trim condition (control angles and blade motions), and the process was repeated until a converged answer was obtained.

Noise levels calculated from theoretical hover airloads are shown in Figure 22 along with noise levels measured for the RIN-free case. Slight azimuthal variations in the calculated fundamental SPL are caused by small higher-harmonic airloads. The variations shown for the calculated 2nd and 3rd harmonics have the same cause, but these variations are larger because the airload harmonics are more efficient acoustically for the higher noise harmonics. While the theoretical hover airload harmonics are sufficiently large to produce variations in the calculated noise fundamental, they are not large enough to give good agreement between calculated and measured noise harmonics above the fundamental.

4.1.2 Cruise Noise

Correlation between calculated and measured rotational noise levels during forward flight ranged from good to fair for the first three noise harmonics. Calculated fourth and fifth harmonic levels tended to be from 5 dB to 10 dB higher than measured within 1000 feet of the helicopter. At larger distances, measured levels tended to be higher than calculated. These results suggest that calculated directional characteristics place maximum radiation of the harmonics too far below the plane of the rotor. Including the effects of rigid-body blade coning and flapping motions on calculated directionality changed levels only by 1 to 2 dB on the average, and this difference tended to decrease calculated noise levels at large distances in front of the helicopter.

Calculated time histories of acoustic pressure reflected trends in measured data. During high-speed cruise at an altitude of 1000 feet, neither the calculated nor the measured time history sounded or looked impulsive at large distances ahead of the helicopter. As the helicopter drew closer, both measured and calculated time histories became more impulsive. Section 4.2 contains additional information on measured characteristics of high-speed RIN.

4.1.2.1 Correlation Using Measured Cruise Airloads

Measured and calculated harmonic noise levels are plotted against noise

origin location in Figures 23 through 25. Each point on the graph gives the noise harmonic level that originated at location, (X, Y, Z). These calculated SPL's include the effects of rotor shaft inclination and blade flapping and coning. Calculated SPL's are shown for lateral distances from 2000 feet to zero feet as the helicopter approaches. Measured SPL's are shown for lateral distances at which the first 5 noise harmonics are well defined. Consequently, the x-axis range of measured noise data varies from one flight condition to another. Since levels for port and starboard sides were obtained by passes in opposite directions at a given nominal airspeed, some acoustic differences between sides are from normal directivity associated with asymmetric airloads while some are from differences in airload amplitude and phase due to slight variations in aircraft trim and atmospheric turbulence between passes. Variations of calculated SPL with x-axis location reflect the effects of airload amplitude and phase on calculated directionality.

A major feature of the correlation presented in the figures is the consistently low calculated SPL at large distances ahead of the helicopter. Similar results were obtained in Reference 15, and an explanation offered at that time was that the orientation of the rotor system with respect to the ground should be included in the acoustic analysis. Consequently, the assumption of a flat rotor disk parallel to the ground was removed during the present study by adding shaft inclination and blade flapping and coning terms to the analysis (see Appendix I for analysis). As shown in Figure 26, the acoustic effect of these terms is small, even during high-speed cruise when forward shaft inclination and blade flapping are largest for a conventional (non-compound) helicopter. Reconsidering the problem in the light of these results, it appears that acoustic effects of forward flight must be included for improved correlation far in front of a rotor travelling at high speeds. These forward speed effects enter the problem both in the theory and in the airload data that are used with the theory Theoretically, the helical motion of a point acoustic source attached to a blade must be coupled with relative translational Mach number effects. Helical source trajectories were beyond the scope of the present study, but simulation of relative translational Mach effects was accomplished using a coordinate transformation proposed by Lowson and Ollerhead in Reference 4. The X, Y, and Z coordinates of each observer location were multiplied by $(1-M_r)$, where M_r is the component of the hub translational Mach number in the direction of the observer. This transformation effectively reduces the propagation distance between noise source and observer to increase the calculated noise levels by the amounts shown in Figure 27. Results obtained by recalculating noise with modified observer coordinates match results obtained by scaling originally calculated levels by $20 \log_{10} (1/(1-M_r))$, thereby confirming that hub translational motion alone does not alter relative phasing among the acoustic sources that define the rotor as a noise generator. In terms of aerodynamic effects, profile drag forces increase rapidly with forward speed, thereby augmenting forward-radiated noise.

The effect on calculated SPL of simulating an impulsive chordwise distribution of airload also was investigated briefly. The section lift force (pounds per inch of span) was concentrated over 10% of the blade chord. This is the same as increasing differential pressure by a factor of 10 and decreasing the area upon which it acts by the same factor. For this investigation, the pressure amplitude was constant across the chord. When a blade with this modified chordwise loading passes over a point in the rotor disk, that point experiences a pressure pulse whose amplitude is 10 times normal and whose duration is 0.1 times normal; that is, the loading is more impulsive. As can be seen in Figure 28, the more impulsive load changes calculated noise levels by only 1 to 2 dB. This result is not surprising since results of Reference 15 suggest that the lower harmonics of rotational noise are relatively insensitive to changes in chordwise distribution if high-frequency airload data are used in acoustic calculations.

Variations in correlation between different flight conditions are attributed to the effects of wind gusts and turbulence on both aerodynamic and noise data. Although the surface wind velocity was below 10 mph for most of the data acquisition period, the pilots reported considerable turbulence and wind gusts at the 1000-foot flight altitude. These unsteady conditions are believed to be the main cause of the time variations in measured noise over short time intervals as well as the cause of variations in measured rotor aerodynamic data.

Some aspects of the correlation between measured and calculated time histories of acoustic pressure are shown in Figure 29. At distances over 2000 feet, neither the measured nor the calculated time history appears impulsive (Figure 29a). As distances decrease to between 500 and 1000 feet, both signatures become more impulsive on the advancing blade side of the flight path (Figure 29b). Typical measured and calculated time histories for 140-knot flight are shown in Figure 29c, where the shape of the acoustic waveform is consistent with the subjective observation that RIN was not heard during flybys at 140 knots.

4.1.2.2 Correlation Using Theoretical Cruise Airloads

The same analytical techniques that were used to predict hover airloads were used to predict cruise airloads. Iterations between inflow and rotor response analyses were continued until the correct rotor lift and propulsive forces were obtained (±10%) with head moments less than 10,000 ft-lbs. Results presented in Figures 30 through 32 show again that correlation decreases rapidly with increasing noise harmonic order.

4.1.3 Conclusions of External Noise Correlation Study

The correlation study demonstrated that the open-form acoustic analysis can calculate certain qualities of rotational noise from measured airload data, such as the SPL of the first 3 noise harmonics at moderate distances from the helicopter and the qualitative differences in acoustic pressure waveforms with and without RIN. The study also demonstrated that inclusion of rotor orientation in the acoustic analysis does not significantly improve correlation. The authors currently believe that source motion effects

must be included in the acoustic analysis in order to improve correlation far in front of a high performance helicopter. In addition to including motion of the acoustic sources, it is particularly important to include the effects of compressible aerodynamics on the airload data that are used for noise calculations. Specifically, the aerodynamic forces in the plane of the rotor due to profile drag may strongly influence calculated acoustic directionality. The present analysis considers only induced drag effects on in-plane aerodynamic forces.

4.2 IMPULSIVE NOISE SOURCE LOCATION

Triangulation using the 3 microphones inside the cabin of the helicopter was employed to locate the position(s) in the disk responsible for the generation of impulsive noise. Successful use of this procedure relies on two basic requirements:

1. That impulses be observed at all three microphone stations.

2. That a given impulse be identified at all three microphone stations.

If either of these requirements is not met, the triangulation procedure will not be useable. Furthermore, a very accurate time base relating the three microphone signals must be used because variations of only 0.0001 second in time-of-arrival differences can cause errors of up to 10% in the location of the sources.

Examination of the microphone oscillograph pressure traces (Figure 33) revealed that for both hover and forward flight RIN, the first requirement was not met. In fact, in forward flight there was no discernible impulsiveness in any of the microphone signals, and in hover only the forward left side microphone (and to some extent the forward right microphone) showed impulsiveness. In both cases the aft right microphone was completely dominated by tail rotor rotational noise. Attempts to filter out these tail rotor components did not correct the situation, due primarily to the unavailability of a very narrow bandwidth, high attenuation band elimination filter.

These problems resulted in the use of an alternative method to locate the source areas. This method involved specifying the position of the rotor at the instant the impulse was generated and using the measured airloads to determine the blade responsible for the slap. However, since no impulse was discernible for the forward flight case, this method is applicable only to the hover case.

4.2.1 Hover

In hover, RIN conditions were encountered only for certain aircraft headings with respect to the wind. Continuous RIN was experienced only when the helicopter was on a compass heading of 270° (wind from heading 030°). At this heading the wind was sufficient to blow the tail rotor wake into

the main rotor disk, causing blade/vortex interaction RIN; thus, the impulse noise source area is expected to be in the quadrant 270°-360° (re: helicopter azimuth; 0° - 360° = tail). For other headings, RIN was not present, except at 210° and 240° where it was intermittent.

Examination of the noise recorded by the forward right and left interior mounted microphones (Figure 33) reveals that the intensity (severity) of the RIN is greatest at the left microphone, confirming that the RIN is indeed produced on the left side of the aircraft. Figure 34 shows that airloads near the tip (section load, pounds per inch of span) change in a smooth, gradual manner as the blade travels around the azimuth, except for the region from about 270° to 360° azimuth where the blade experiences rapid fluctuations in lift (loading) due to interaction with the tail rotor's shed wake. It is this rapid lift fluctuation that generates the high-amplitude, high-frequency airloading harmonics which, in turn, are responsible for the generation of RIN. Figure 34 also shows the azimuthal loading distribution for the no-RIN hover. There are no rapid changes in lift to increase the high-frequency airloads, and the general shape of the airload spectrum is quite different from the RIN case.

The harmonics of airloading are derived by performing a Fourier analysis of the waveforms shown in Figure 34 where the period is equal to one revolution. The pulse shape for the RIN case approximates a rectangular pulse with some modification due to the vortex intersections, and the no-RIN case is a rectangular pulse with a slow rise time. A Fourier analysis of these pulses should yield a harmonic amplitude spectrum which resembles that of a rectangular pulse (Figure 35). Figure 36 shows this to be the case. This figure also shows the expected increased levels of the high frequency airloads for the RIN case.

No changes were detected in the chordwise distribution of differential pressure when the instrumented main rotor blade passed through wakes from the tail rotor, and no significant differences were observed during hover with and without RIN. Figure 37 shows a family of pressure distributions in 2.5-degree increments from an azimuth angle of 305 degrees through 325 degrees. These pressure profiles correspond to the section loading data for the RIN case shown in Figure 34. Pressure distributions for hover conditions with and without RIN are presented in Figure 38 to show that distribution shape is not influenced by RIN. The RIN condition corresponds to a helicopter magnetic heading of 270 degrees, while the RIN-free condition corresponds to a magnetic heading of 030 degrees.

Further indication of the location of the impulse generating area is given by determining the location of the rotor at the instant the RIN is generated. This location is found through use of the 1-per-rev contactor channel recorded on the same tape as the internal microphone data. Examination of the recorded data shown in Figure 33a revealed that for one revolution of the instrumented blade, six impulses were recorded by the microphones (each blade passing through the tail rotor wake). Figure 39 illustrates the range of rotor locations at time of impulse for three revolutions of the blades (eighteen impulses). This range is found to be from about 300° to 325° azimuth, which agrees with the pressure traces of Figure 34. It thus

seems reasonable to assume that the RIN observed on the CH-53A during hover is due to main rotor blade/tail rotor wake interactions which occur at azimuth 300° - 325°. This RIN is observed at the two forward internal microphone stations, but is masked by tail rotor noise at the aft right microphone station.

4.2.2 Forward Flight

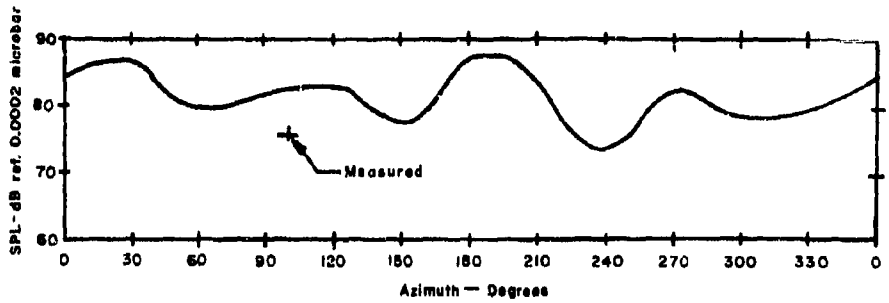
RIN was observed during forward flight only at high speed (170 kt). Observers on the ground noted that this form of RIN was highly directional and could be heard only during approach at large helicopter to observer distances where the angle of the observer below the rotor disk is small. As the helicopter approached and the angle became larger, the impulse could no longer be heard. Based on the directionality arguments presented in Section 2.3, this is not an unexpected observation. Simultaneous measurement of noise along the ground track and 250 feet to the side provided additional information on directional characteristics of forward-flight RIN. The acoustic signature directly ahead of the helicopter reached its maximum impulsiveness several seconds earlier than the signature 250 feet to the side of the flight path. The noise data exhibited mild RIN on the retreating blade side of the helicopter. Figure 40 illustrates the characteristics described above for the centerline microphone and advancing blade side microphone (flight from east to west). Note the impulsiveness of the centerline signal compared to the advancing blade side signal in Figure 40a, corresponding to a helicopter location over 2500 feet away. Figures 40b through 40d bring the helicopter nearly overhead. Figure 41 shows the two noise signals for flight from west to east, with 41a representing maximum impulsiveness on the retreating blade side of the aircraft. Comparison of the upper trace of this figure with that of Figure 40c shows the RIN on the retreating blade side to be less severe than on the advancing blade side. Figure 41b corresponds to the helicopter passing over the microphone array. For comparison, Figure 42 presents the most impulsive-looking signal recorded during 140-knot flight from east to west. Acoustic rise times are not short enough to produce RIN in this case.

Oscillograph traces of the noise recorded by the internal microphones (Figure 33b) showed no impulsiveness at the two forward stations. The aft microphone was completely dominated by tail rotor noise, and filtering the signal did not improve the situation. The fact that the impulse was not recorded by the internal microphones is to be expected, as can be shown by reference to Equation 1 (Section 2.1.1). The replacement of r by r $(1-M_r)$ to account for the effect of forward speed on the sound heard by a stationary observer reverts to simply r if the observer is moving with the helicopter. Thus, the acoustic effect of forward-flight RIN is not applicable to an observer on the helicopter. Some aerodynamic phenomenon, such as blade/wake interaction or compressibility-induced loading oscillations, must occur to cause RIN that can be detected inside the helicopter. Airload data do not show blade/wake interactions, so compressibility effects are left as the source of high-speed RIN that can be heard in the moving reference frame. Compressibility increases in-plane forces more than out-of-plane, which increases in-plane components of rotational noise. This will increase the first two or three rotational harmonics slightly inside the

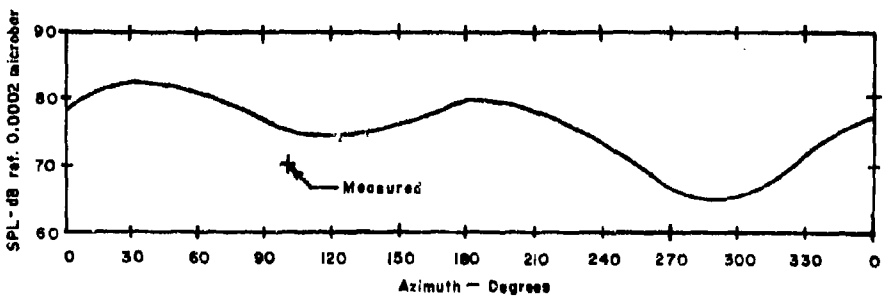
helicopter but will not be powerful enough to cause RIN to be heard inside the helicopter.

It was postulated in Section 2.3 that advancing blade RIN was primarily an acoustic effect of high tip Mach numbers rather than a result of high harmonic airloading. This can be seen by reference to Figure 43. The airloading variation with azimuth for the RIN and no-RIN cases is somewhat the same, except that the region of negative lift is of larger duration for the RIN case. However, there are no rapid changes in loading to cause increased high-frequency airloading harmonics. This can be seen more clearly in Figure 44, where the airloading harmonics have been plotted for the two cases. There is virtually no difference in the high-frequency airloads, and in fact, the amplitude decay with increasing harmonic frequency approaches λ^{-2} in both cases. Obviously, there are some differences in the harmonic content between the two cases, and this will cause differences in the character of the observed sound.

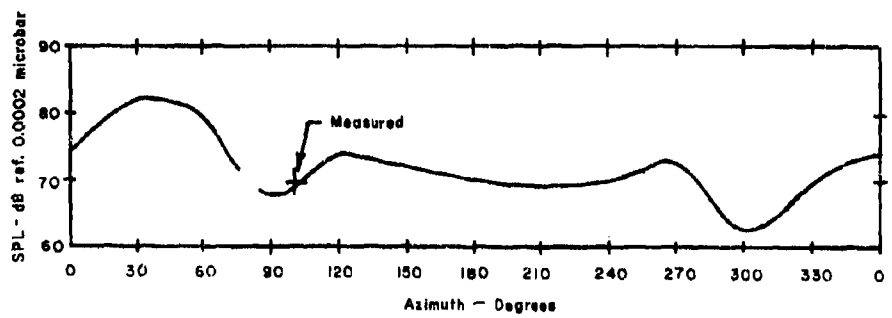
Based on the results of the measured airloading, and on the observed directionality of the radiated sound, it appears that for the CH-53A, advancing blade RIN is indeed a high tip Mach number acoustic effect rather than a result of increased-amplitude high-frequency airloads, as in the case of blade/wake interaction RIN. The observed directionality of the impulse confirms the theoretical explanation offered in Section 2.3. Compressibility effects, while enhancing the radiated slap, do not appear to be the primary cause of advancing blade slap. Compressibility generated noise is not highly directional, as shown in Section 2.3; however, the observed impulse is very directional in the plane of rotation. Since the advancing tip Mach number of 0.875 during 170-knot cruise is only slightly into drag divergence (Figure 8), the profile drag forces will not be predominant, and noise generated in this way will be a secondary, although possibly a significant, source.



a. Fundamental

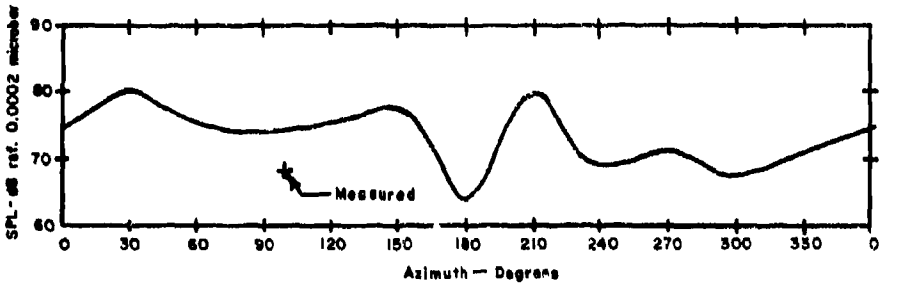


b. Second Harmonic

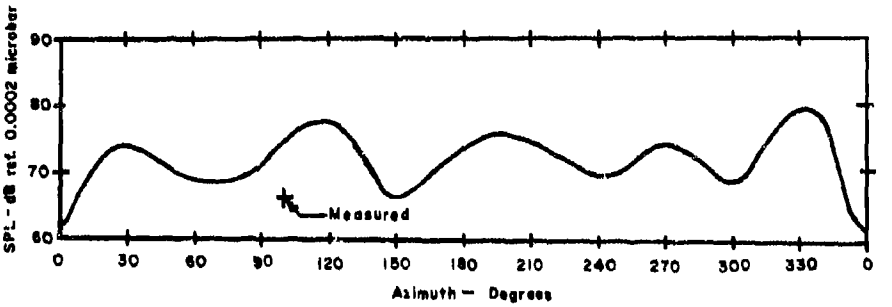


c. Third Harmonic

Figure 17. Calculated Hover Noise Variation, Helicopter Heading 030 Degrees, No RIN.

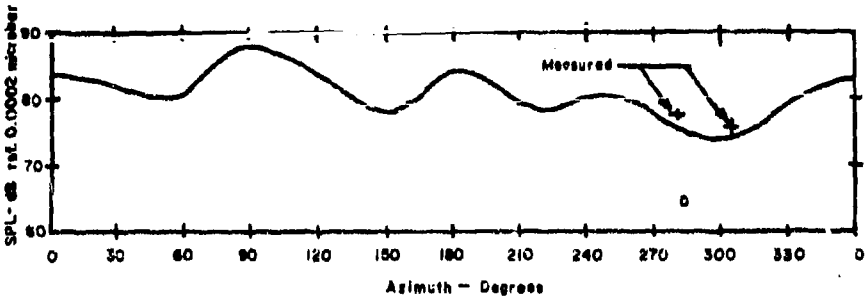


d. Fourth Harmonic

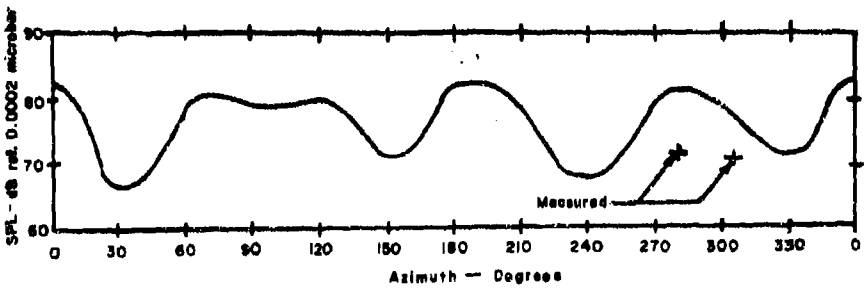


e. Fifth Harmonic

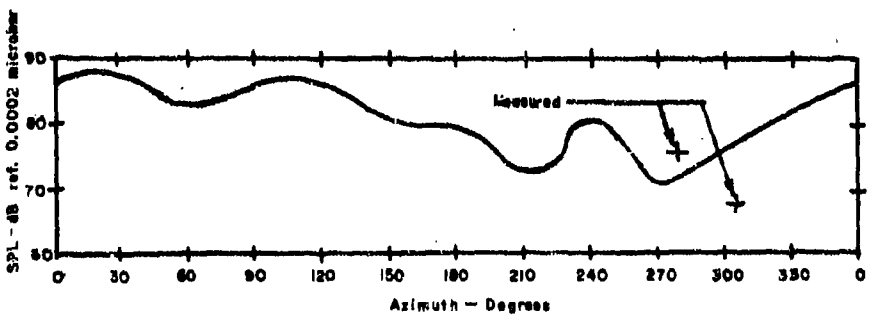
Figure 17. Concluded.



a. Fundamental

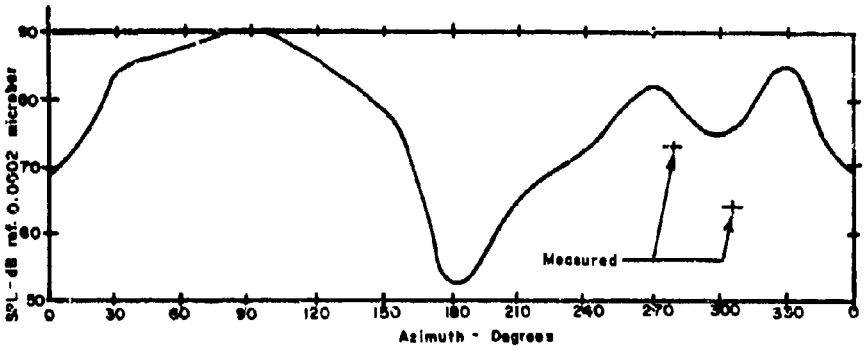


b. Second Harmonic

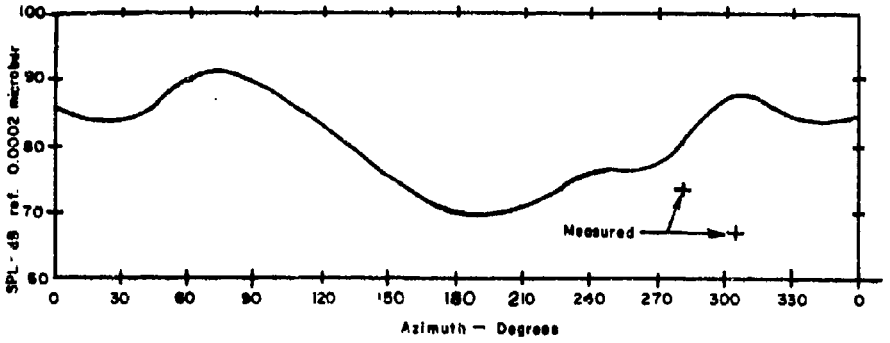


c. Third Harmonic

Figure 18. Calculated Hover-Noise Variation, Helicopter Heading 210 Degrees, Moderate RIN.

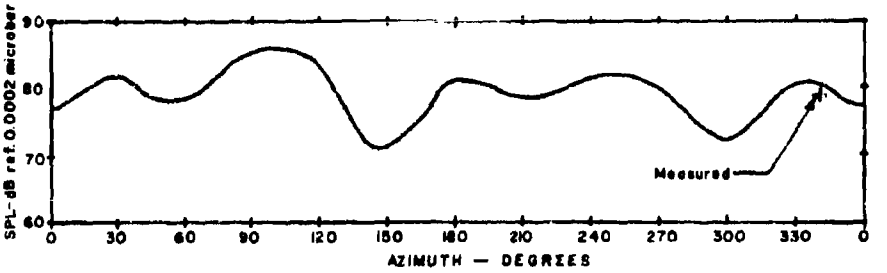


d. Fourth Harmonic

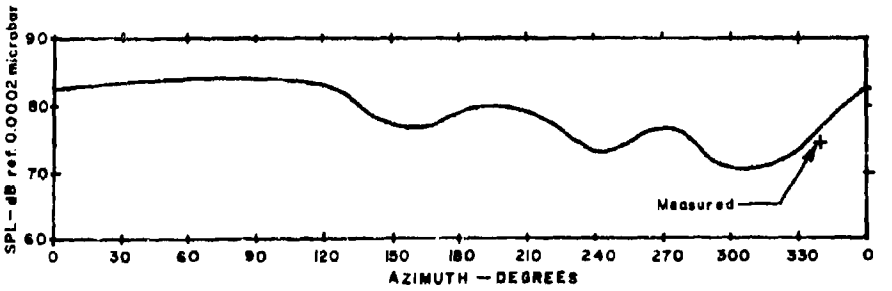


e. Fifth Harmonic

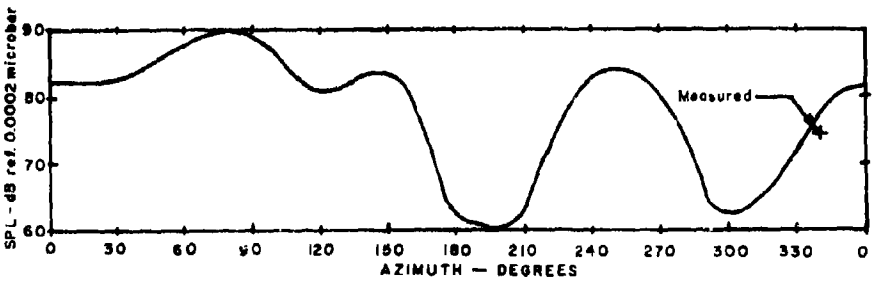
Figure 18. Concluded.



a. Fundamental

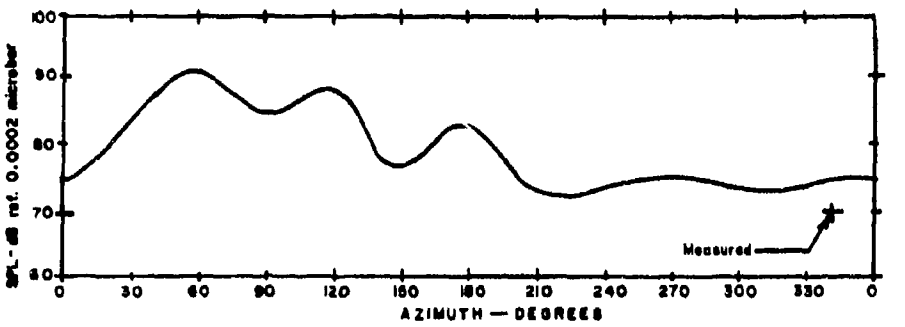


b. Second Harmonic

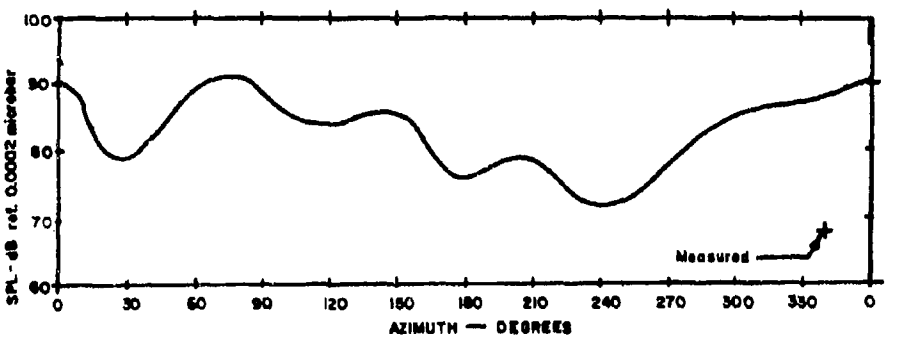


c. Third Harmonic

Figure 19. Calculated Hover Noise Variation, Helicopter Heading 270 Degrees, Proncunced RIN.

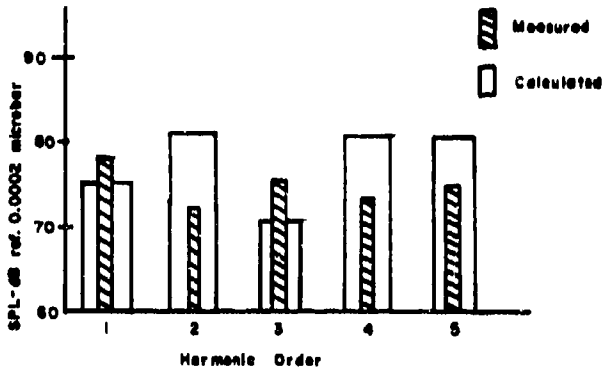


d. Fourth Harmonic

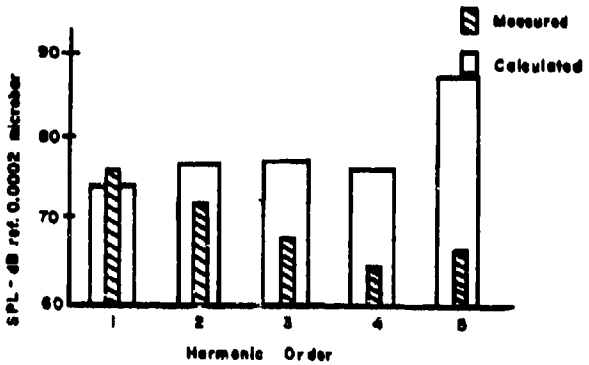


e. Fifth Harmonic

Figure 19. Concluded.



a. Azimuth Location 280 Degrees



b. Azimuth Location 306 Degrees

Figure 20. Measured and Calculated Rotational Noise Spectra at Two Locations During Hover, Helicopter Heading 210 Degrees.

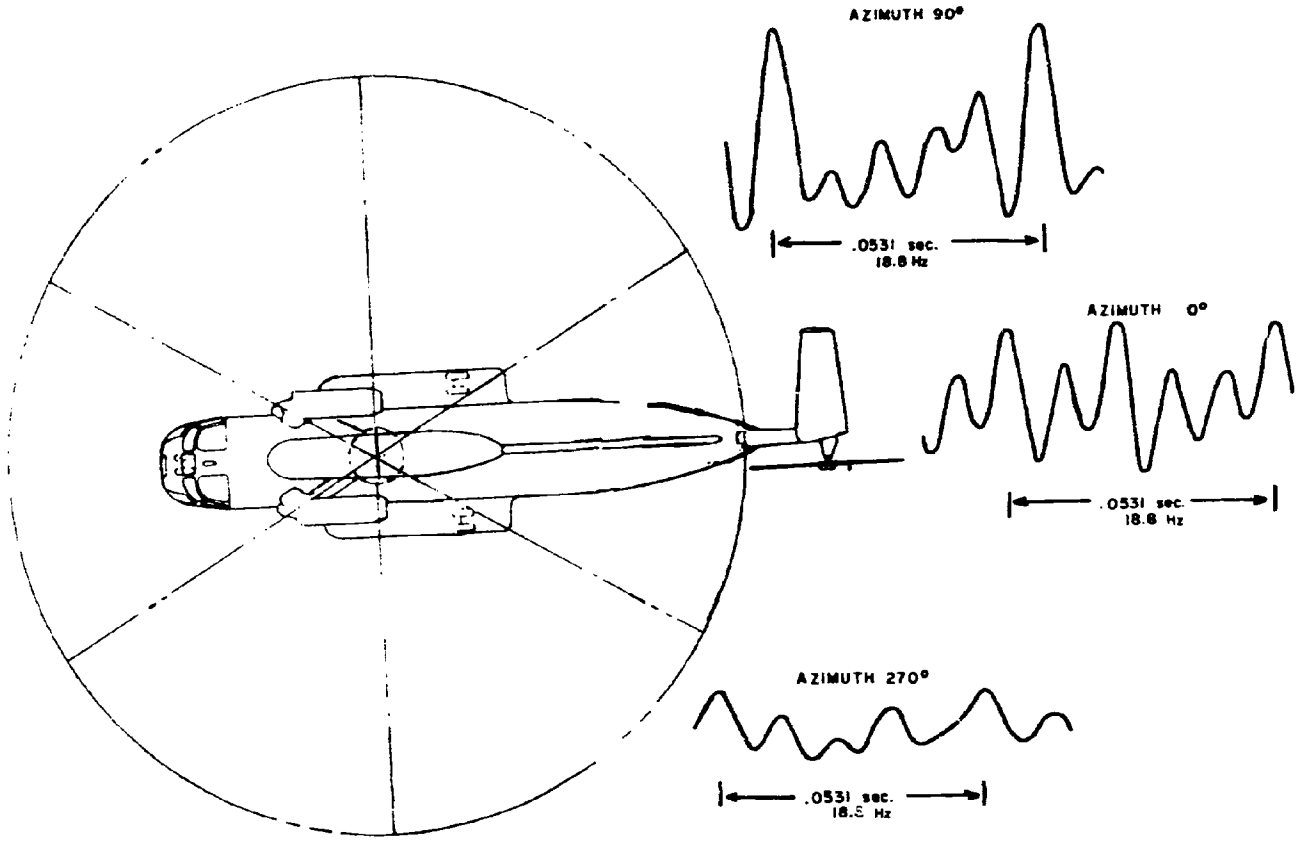
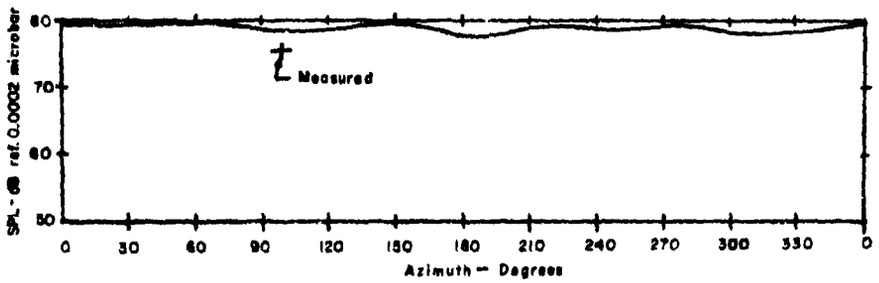
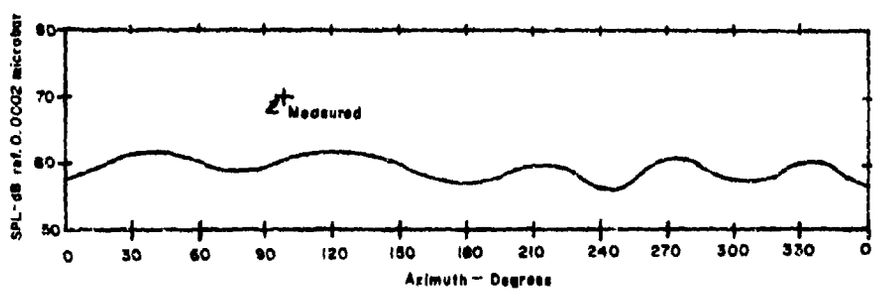


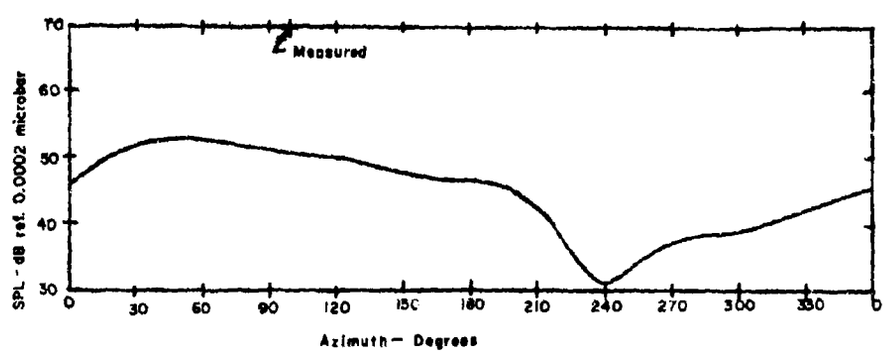
Figure 21. Calculated Time Histories of Acoustic Pressure at Several Azimuth Locations During Hover, Helicopter Heading 270 Degrees Magnetic, RIN Condition.



a. Fundamental

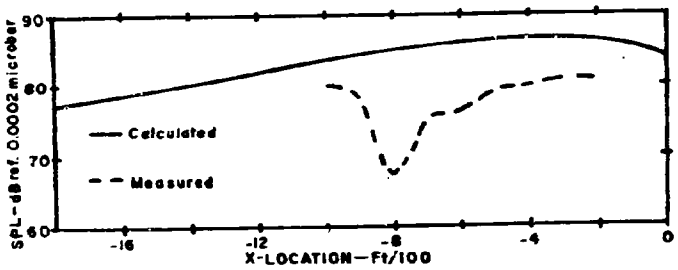


b. Second Harmonic

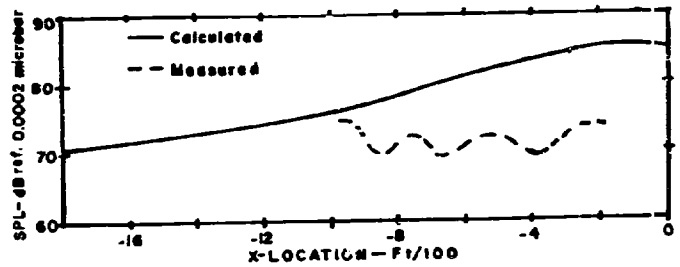


c. Third Harmonic

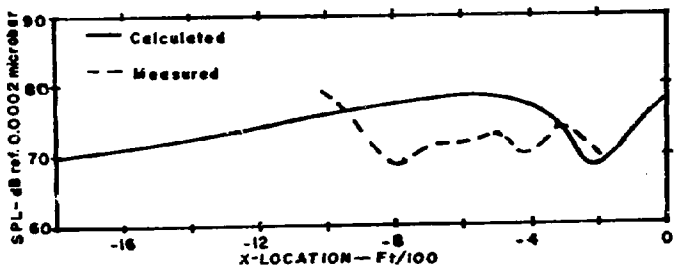
Figure 22. Calculated Rotor Noise Variation Using Theoretical Airloads.



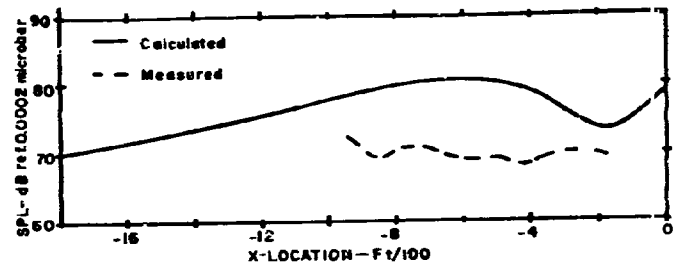
a. First Harmonic, Starboard Side



b. First Harmonic, Port Side

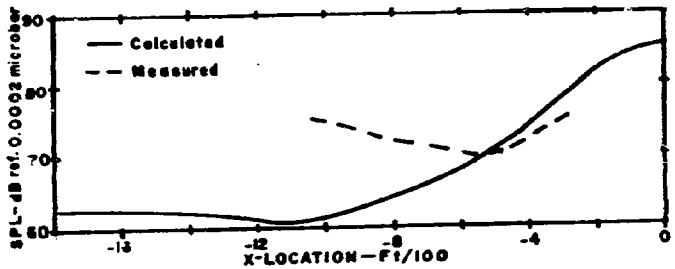


c. Second Harmonic, Starboard Side

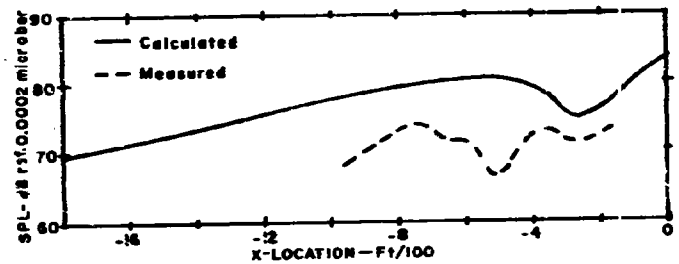


d. Second Harmonic, Port Side

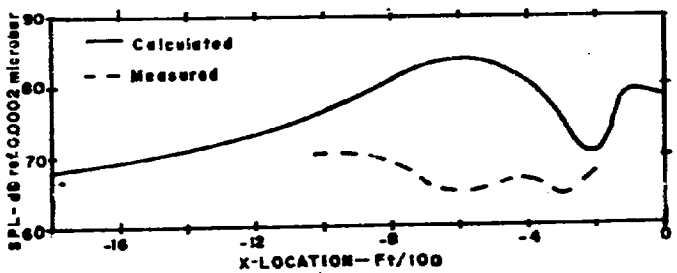
Figure 23. Rotational Noise Harmonic SPL-vs-Distance, Measured Airloads, 120 kt.



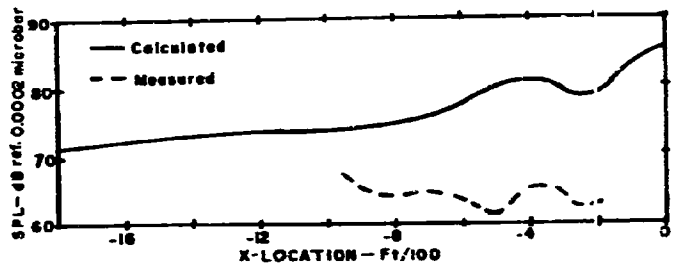
e. Third Harmonic, Starboard Side



f. Third Harmonic, Port Side

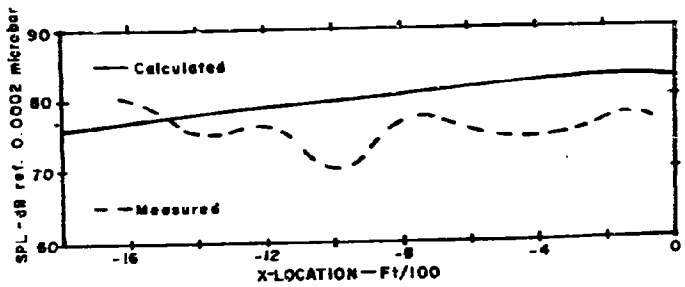


g. Fourth Harmonic, Starboard Side

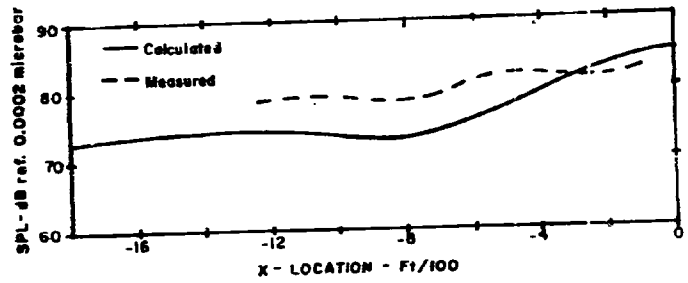


h. Fourth Harmonic, Port Side

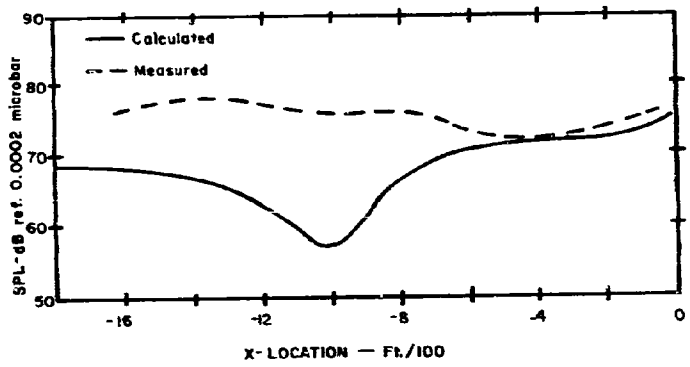
Figure 23. Concluded.



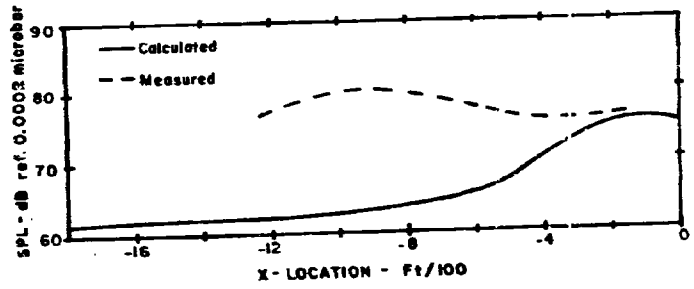
a. First Harmonic, Starboard Side



b. First Harmonic, Port Side

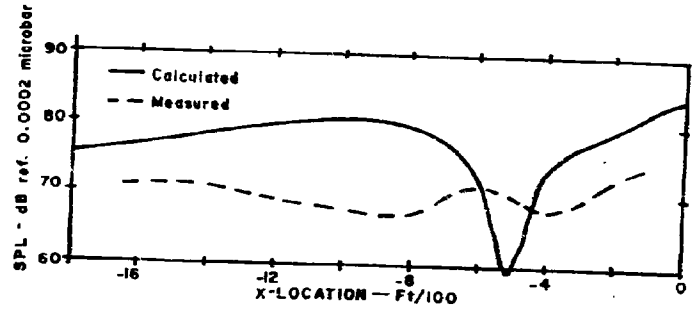


c. Second Harmonic, Starboard Side

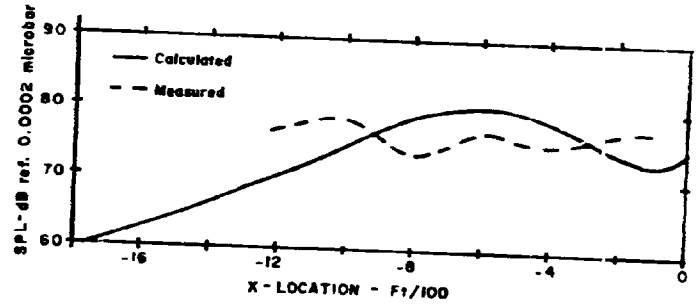


d. Second Harmonic, Port Side

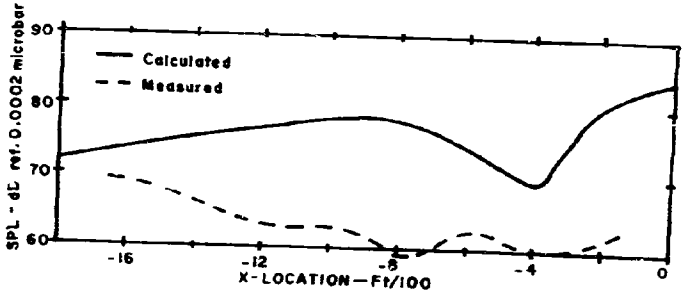
Figure 24. Rotational Noise Harmonic SPL-vs-Distance, Measured Airloads, 140 kt.



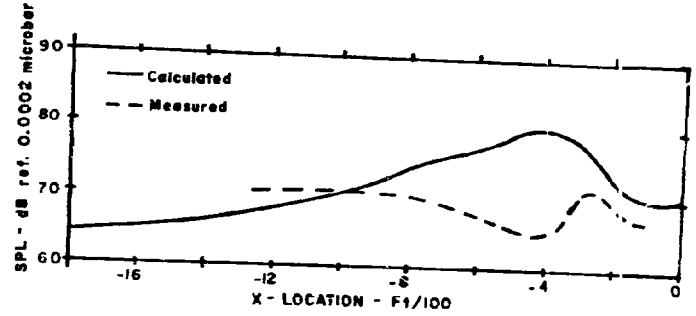
e. Third Harmonic, Starboard Side



f. Third Harmonic, Port Side

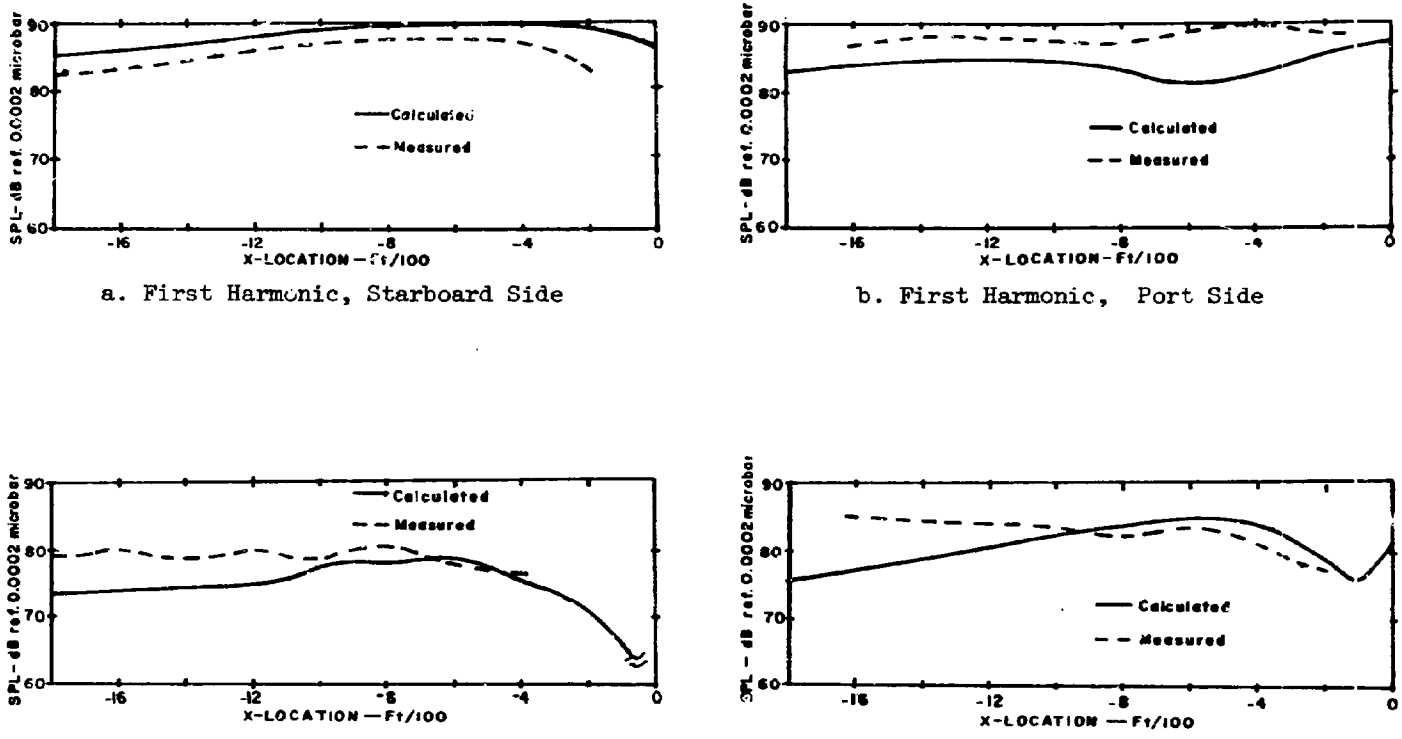


g. Fourth Harmonic, Starboard Side



h. Fourth Harmonic, Port Side

Figure 24. Concluded.



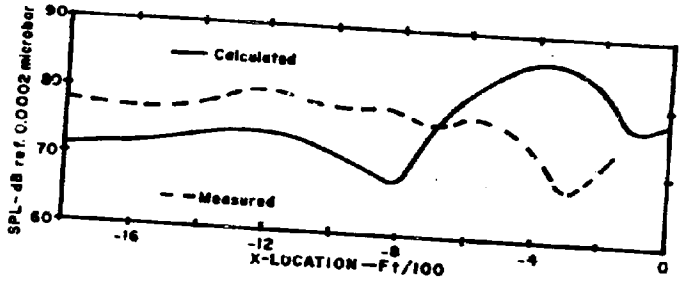
a. First Harmonic, Starboard Side

b. First Harmonic, Port Side

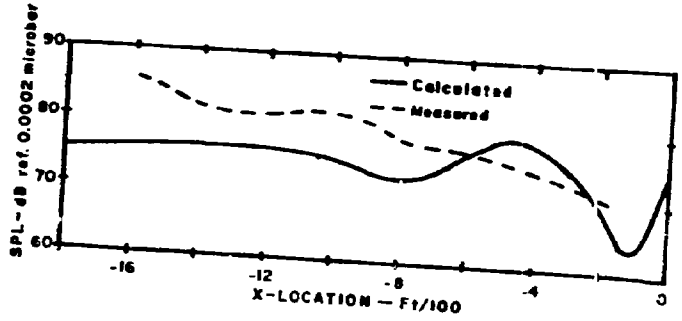
c. Second Harmonic, Starboard Side

d. Second Harmonic, Port Side

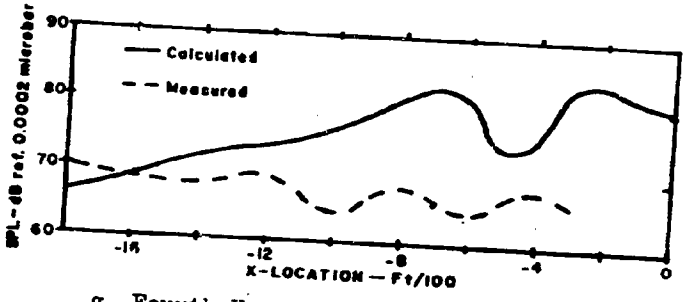
Figure 25. Rotational Noise Harmonic SPL-vs-Distance, Measured Airloads, 170 kt.



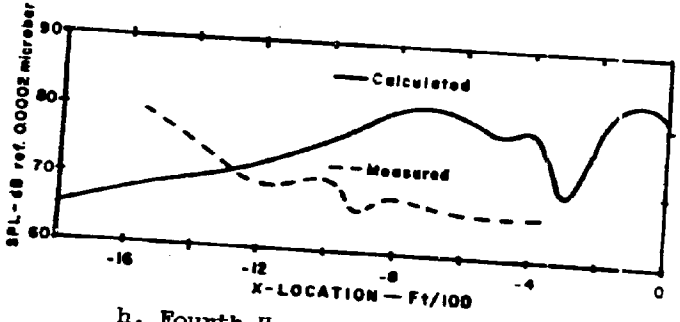
e. Third Harmonic, Starboard Side



f. Third Harmonic, Port Side

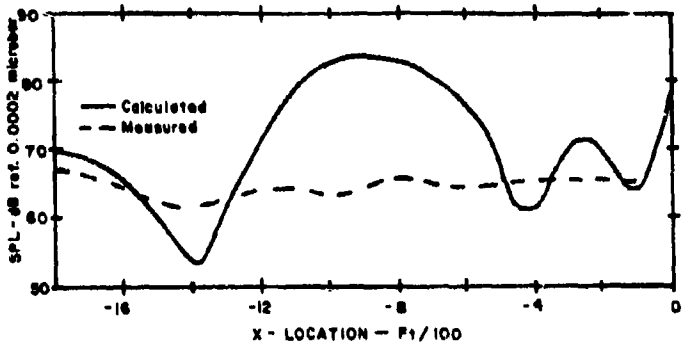


g. Fourth Harmonic, Starboard Side

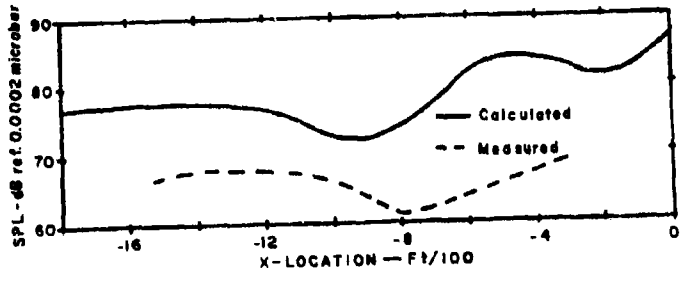


h. Fourth Harmonic, Port Side

Figure 25. Continued.

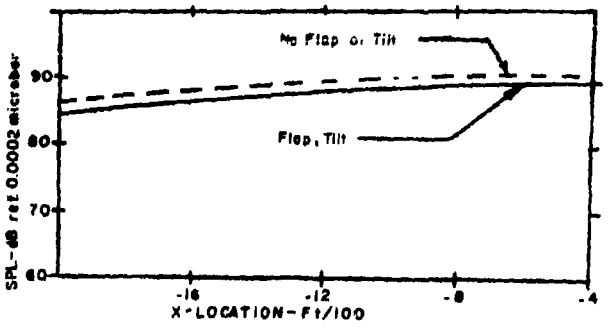


i. Fifth Harmonic, Starboard Side

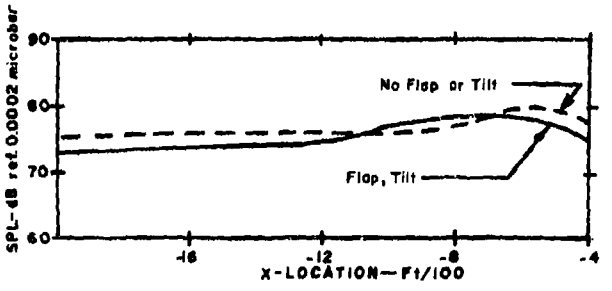


j. Fifth Harmonic, Port Side

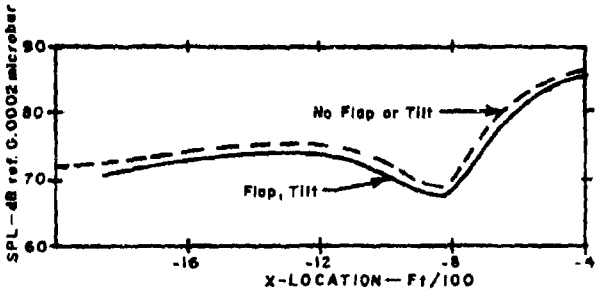
Figure 25. Concluded.



a. Fundamental

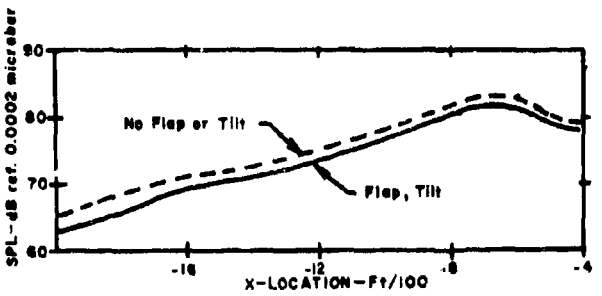


b. Second Harmonic

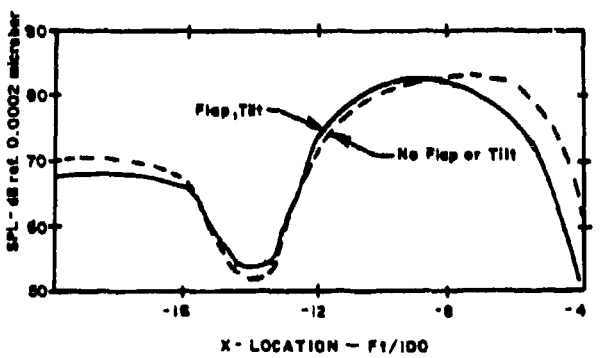


c. Third Harmonic

Figure 26. Effect of Shaft Inclination and Blade Flapping on Calculated Noise, Measured Airloads, 170 kt, Starboard Side.



d. Fourth Harmonic



e. Fifth Harmonic

Figure 26. Concluded.

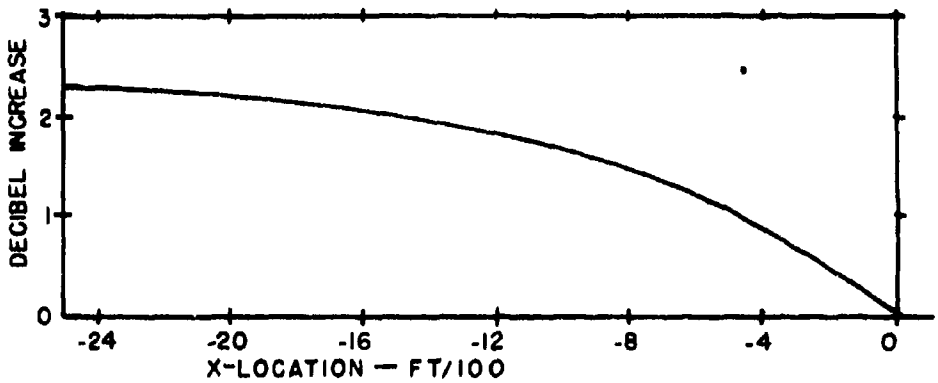


Figure 27. Effect of Simulated Translational Mach Number on Calculated Noise, 170 kt, Centerline.

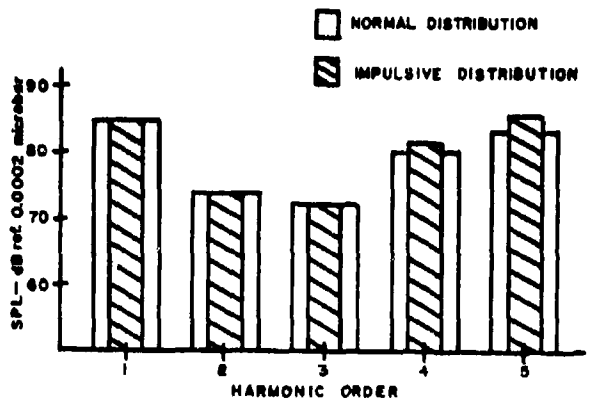
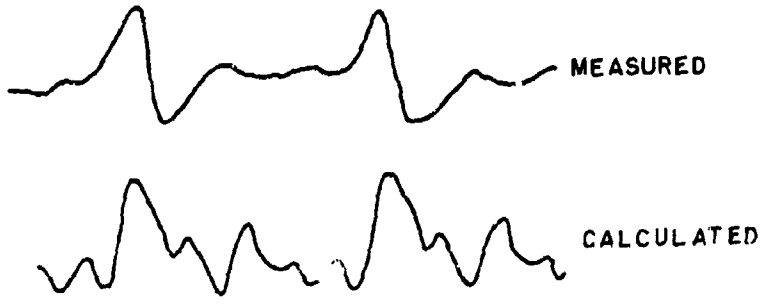
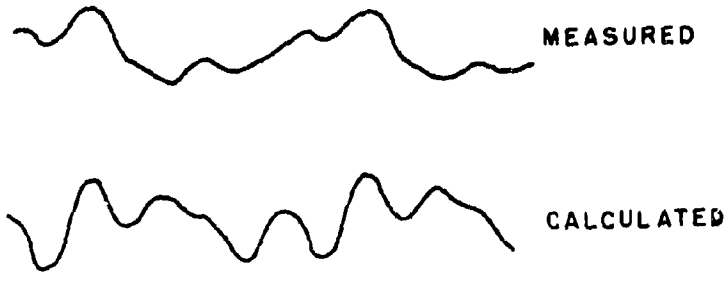


Figure 28. Effect of Simulated Impulsive Chordwise Loading Distribution.

a. 170 kt, No RIN, Helicopter Over 2500 ft Away

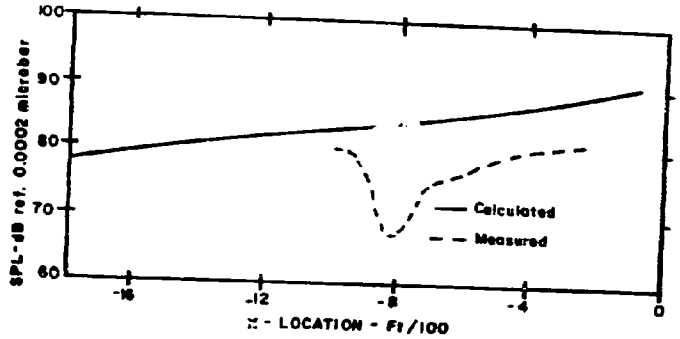


b. 170 kt, Maximum RIN, Helicopter 500 to 1000 ft Away

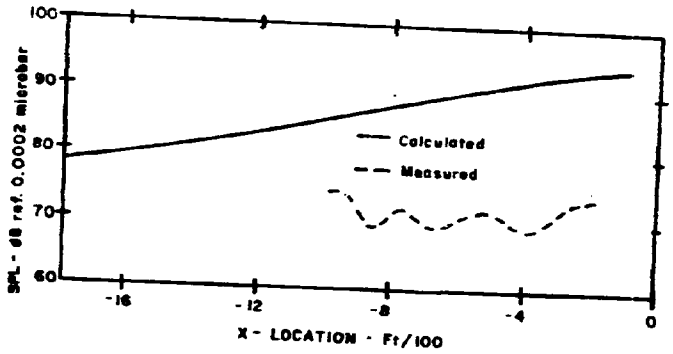


c. 140 kt, No RIN, Helicopter Approximately 500 ft Away

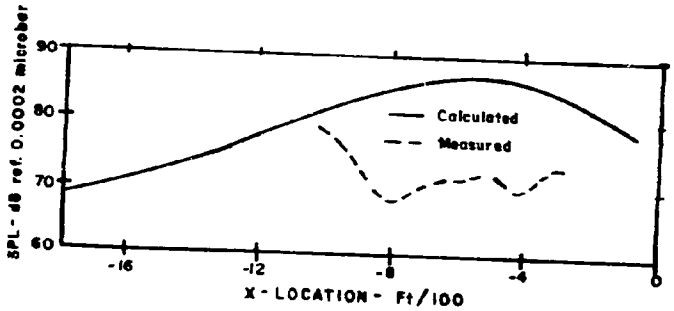
Figure 29. Measured and Calculated Time Histories of Acoustic Pressure on Starboard Side.



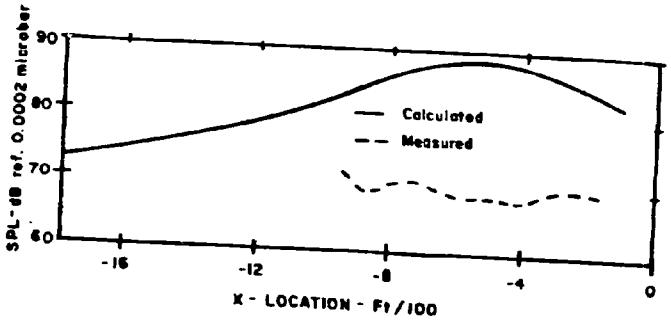
a. First Harmonic, Starboard Side



b. First Harmonic, Port Side

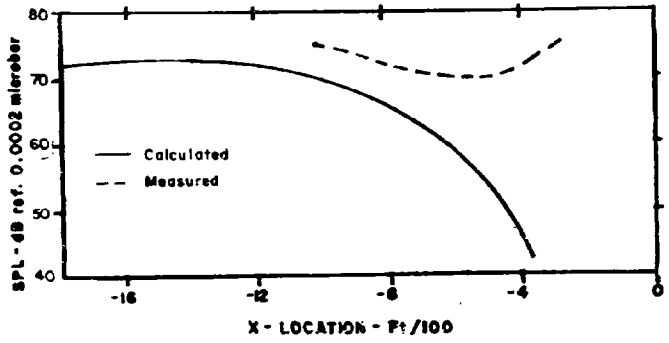


c. Second Harmonic, Starboard Side

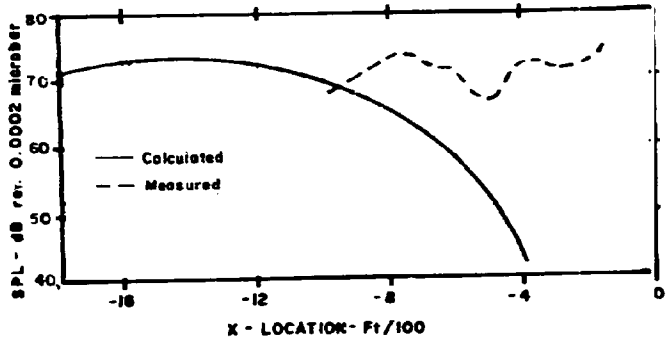


d. Second Harmonic, Port Side

Figure 30. Rotational Noise Harmonic SPL-vs-Distance, Theoretical Airloads, 120 kt.

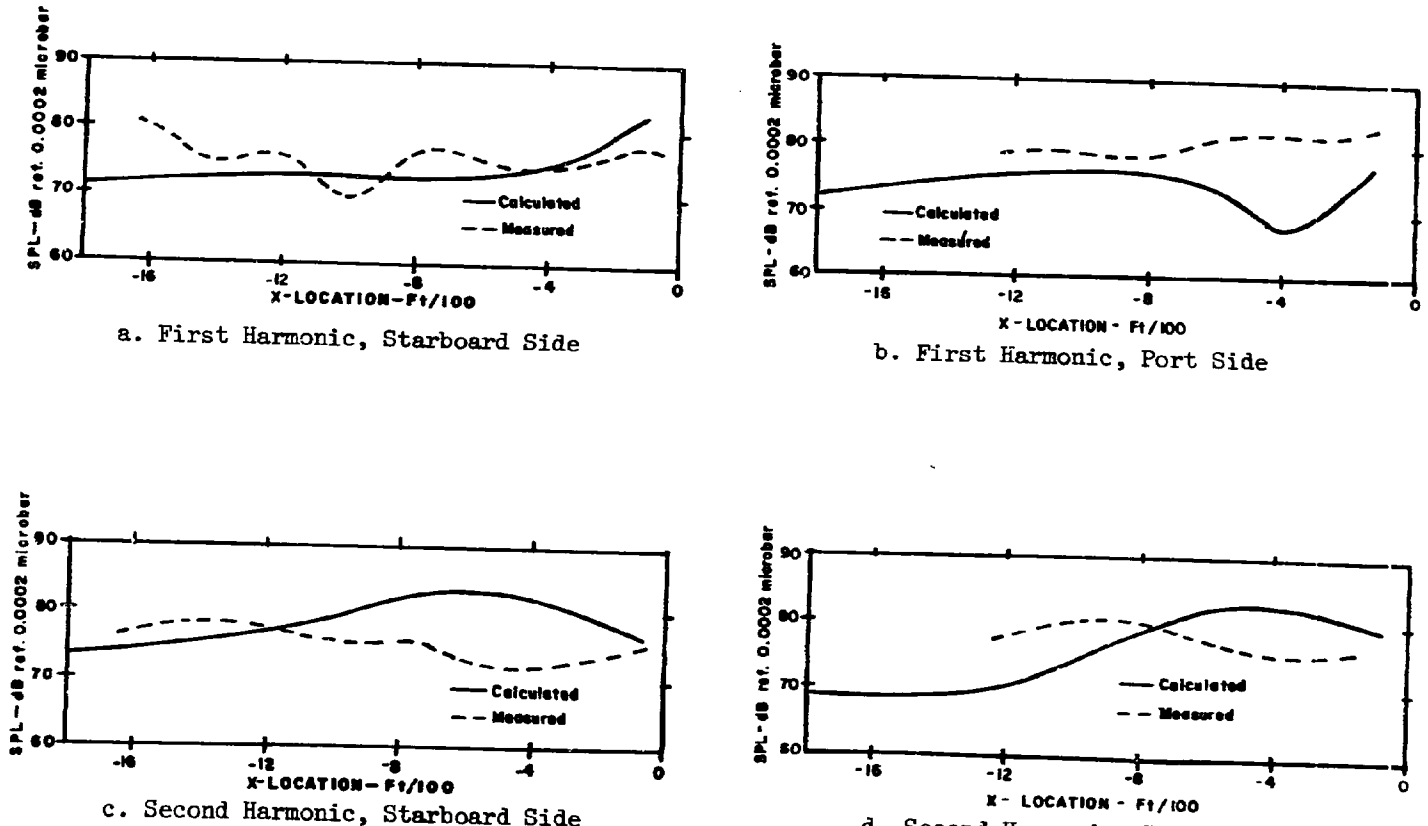


e. Third Harmonic, Starboard Side



f. Third Harmonic, Port Side

Figure 30. Concluded.



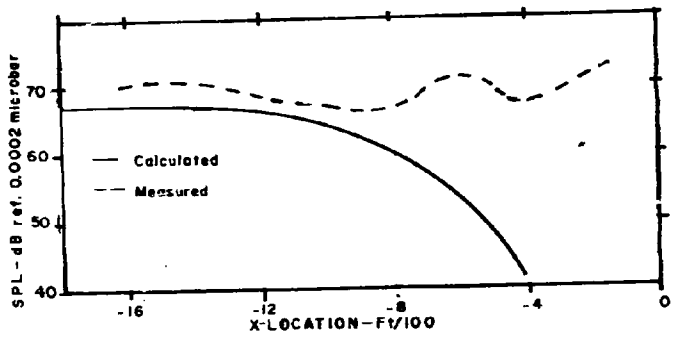
a. First Harmonic, Starboard Side

b. First Harmonic, Port Side

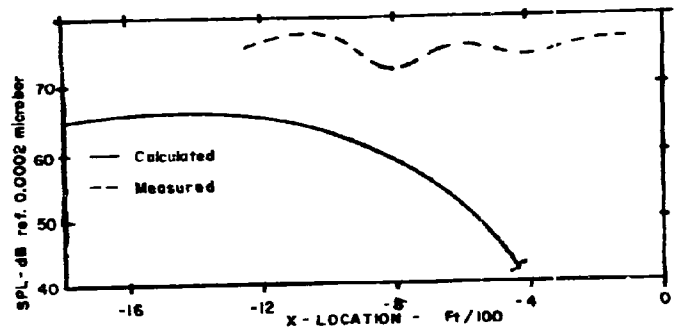
c. Second Harmonic, Starboard Side

d. Second Harmonic, Port Side

Figure 31. Rotational Noise Harmonic SPL-vs-Distance, Theoretical Airloads, 140 kt.

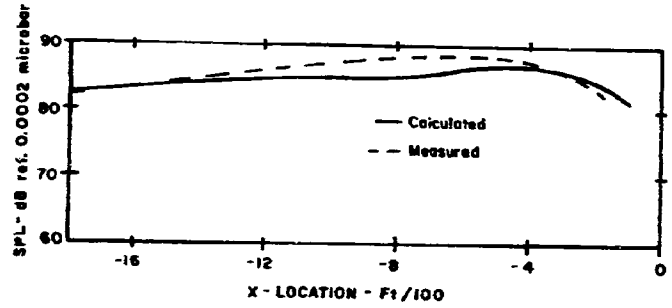


e. Third Harmonic, Starboard Side

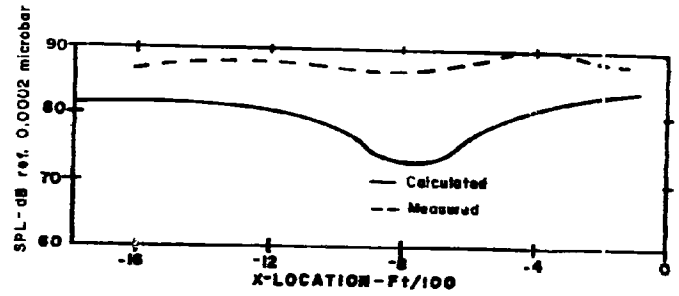


f. Third Harmonic, Port Side

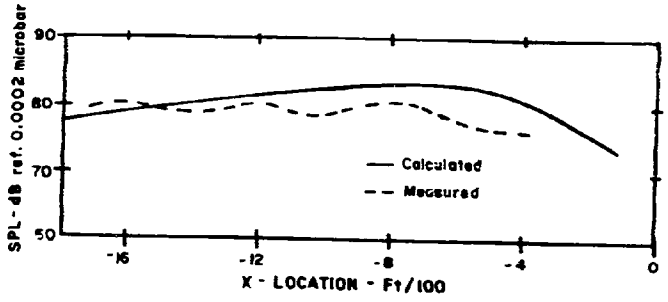
Figure 31. Concluded.



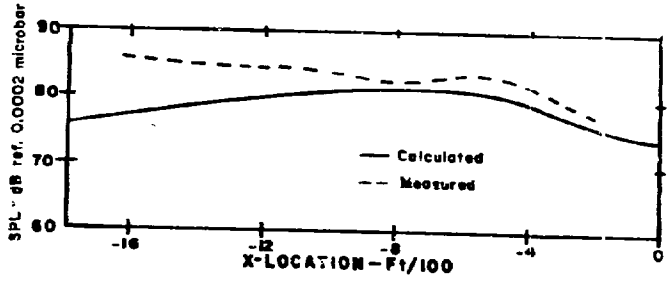
a. First Harmonic, Starboard Side



b. First Harmonic, Port Side

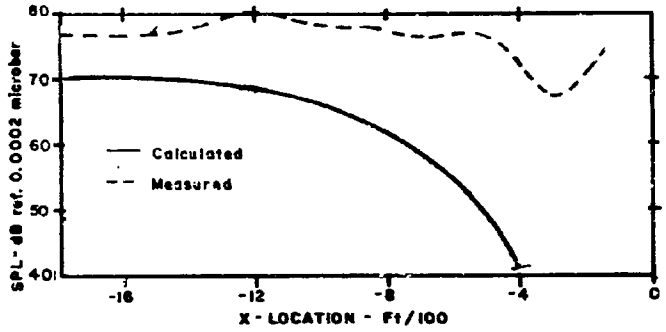


c. Second Harmonic, Starboard Side

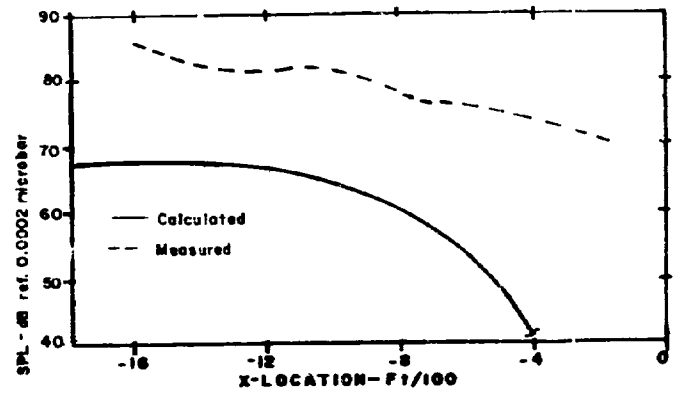


d. Second Harmonic, Port Side

Figure 32. Rotational Noise Harmonic SPL-vs-Distance, Theoretical Airloads, 170 kt.

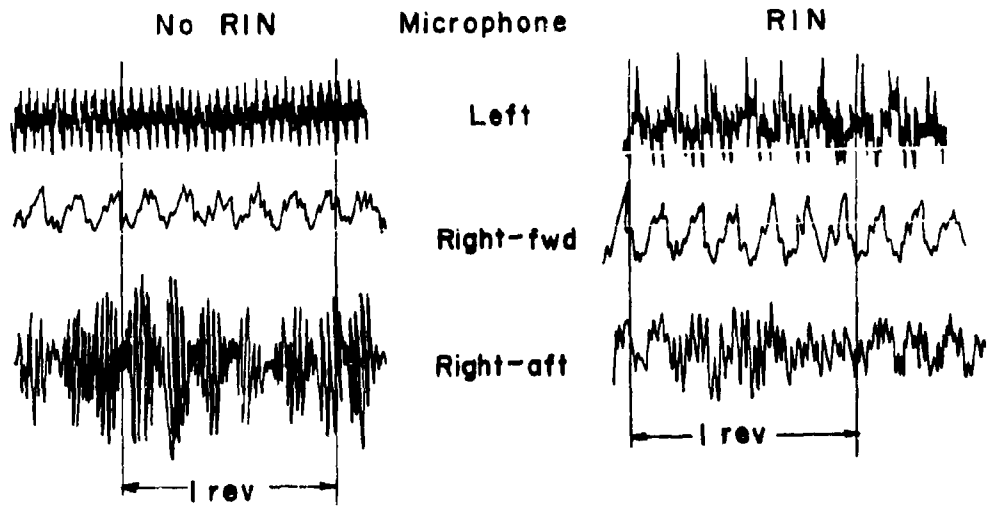


e. Third Harmonic, Starboard Side

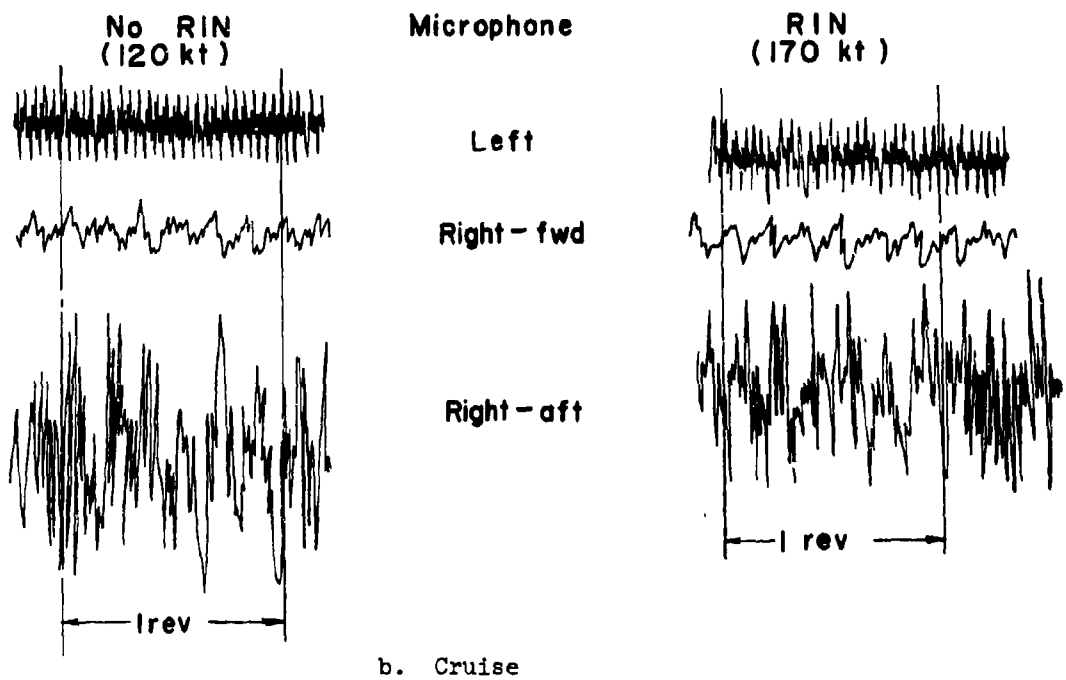


f. Third Harmonic, Port Side

Figure 32. Concluded.



a. Hover



b. Cruise

Figure 33. Sound Pressure Recorded by Internal Microphones.

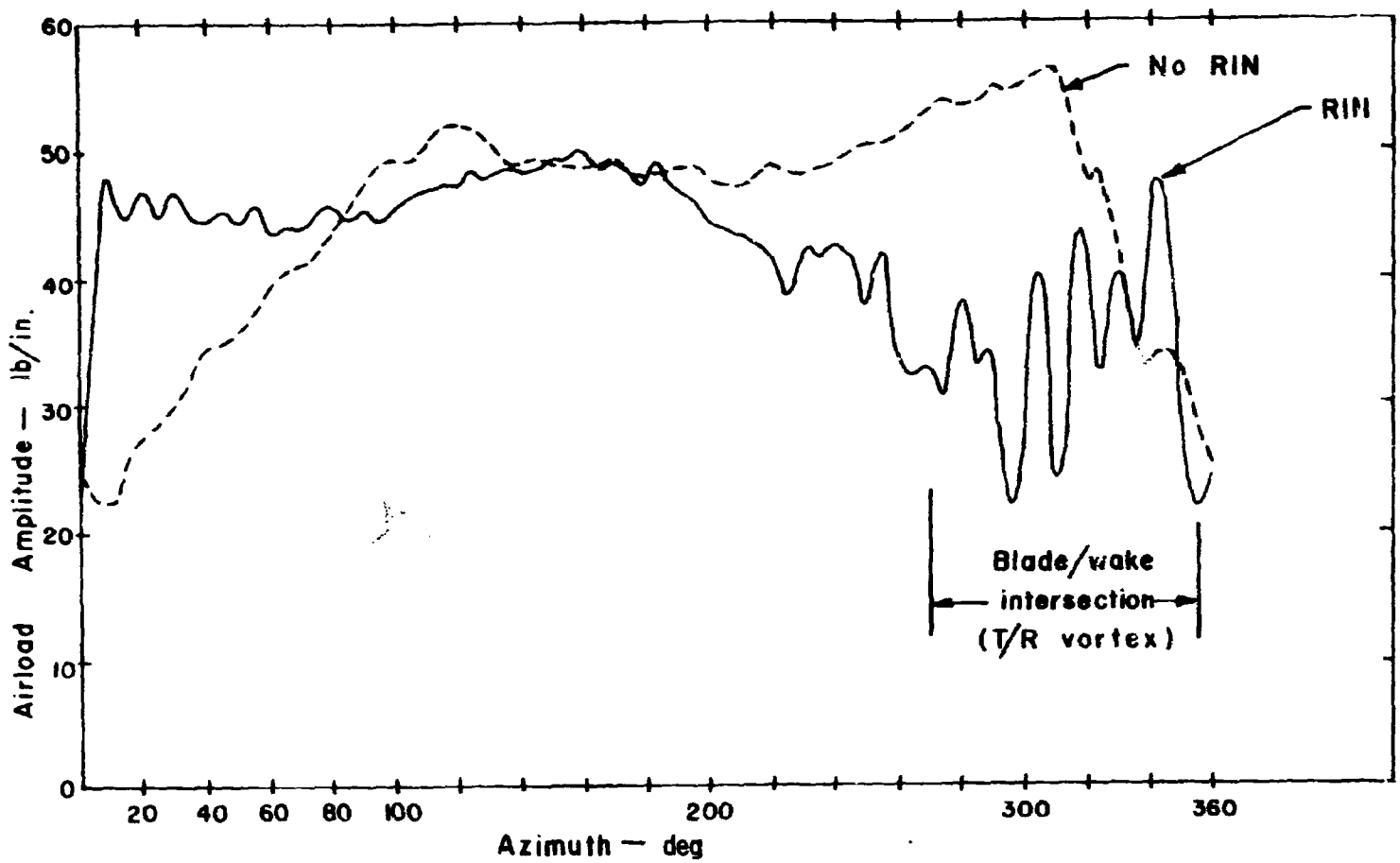


Figure 54. Blade Section Airloading as a Function of Azimuth for Hover RIN and No-RIN Conditions (.88 Span).

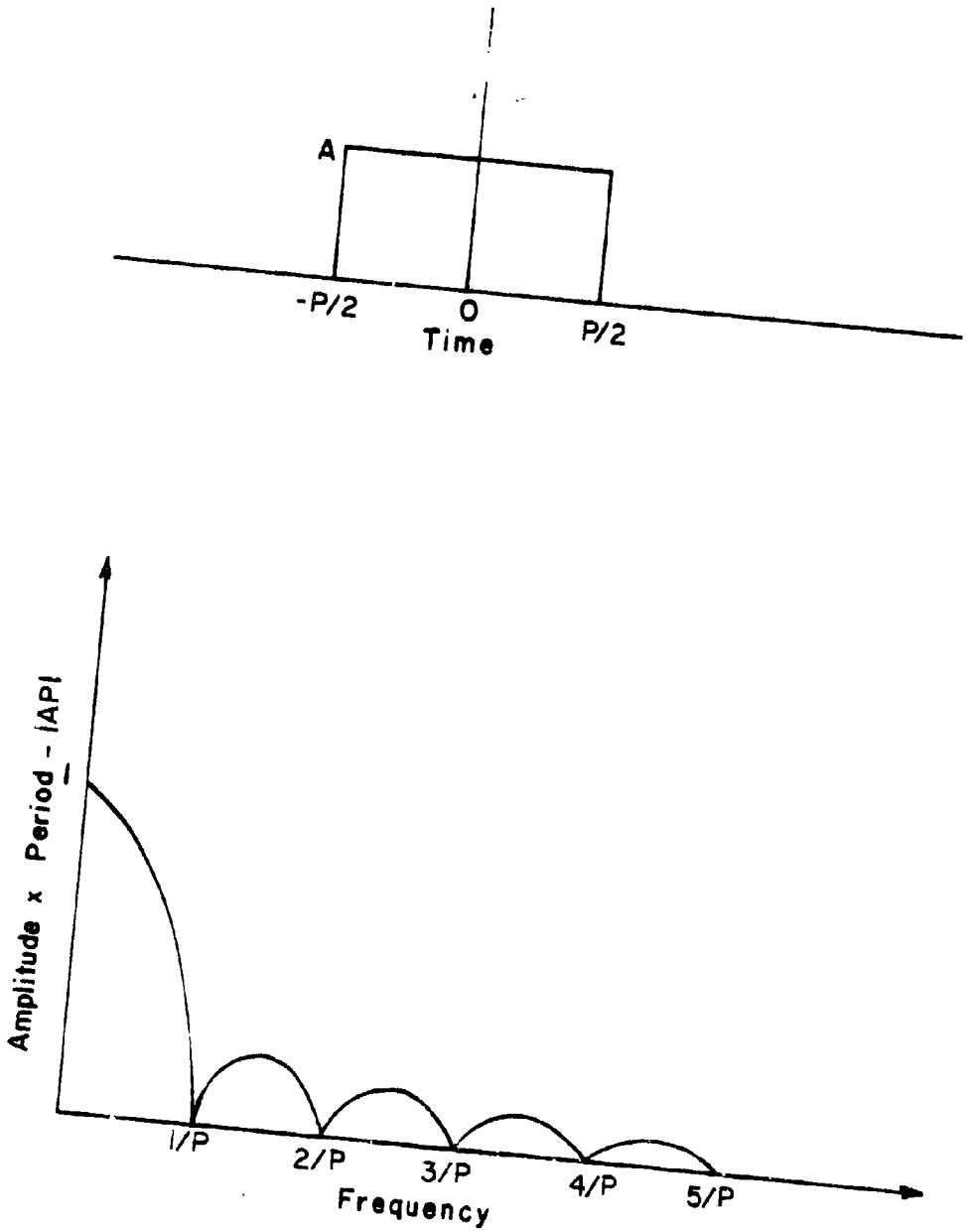


Figure 33. Harmonic Frequency Spectrum of a Rectangular Pulse.

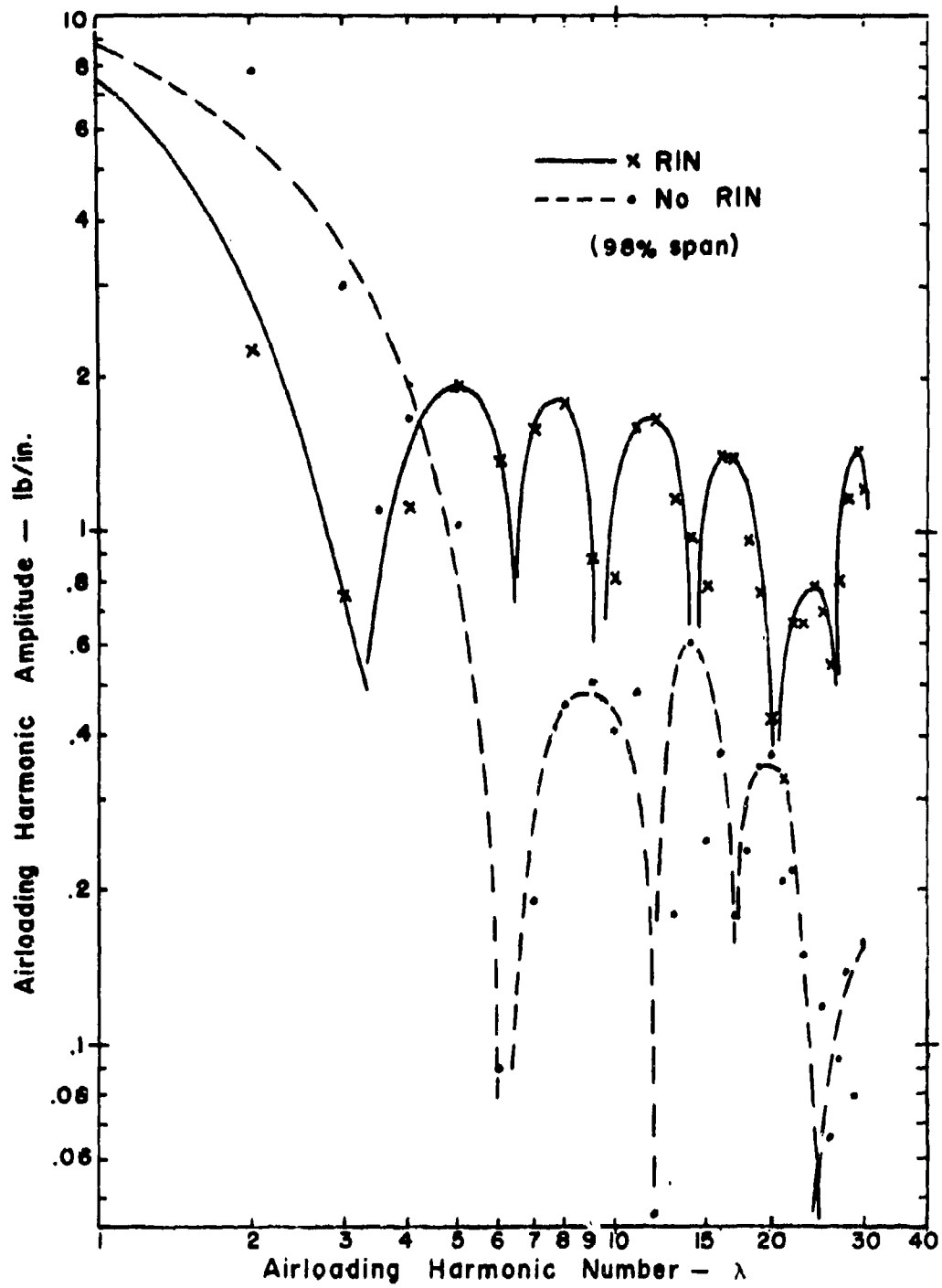


Figure 36. Airloading Harmonic Amplitude for Hover RIN and No-RIN Conditions.

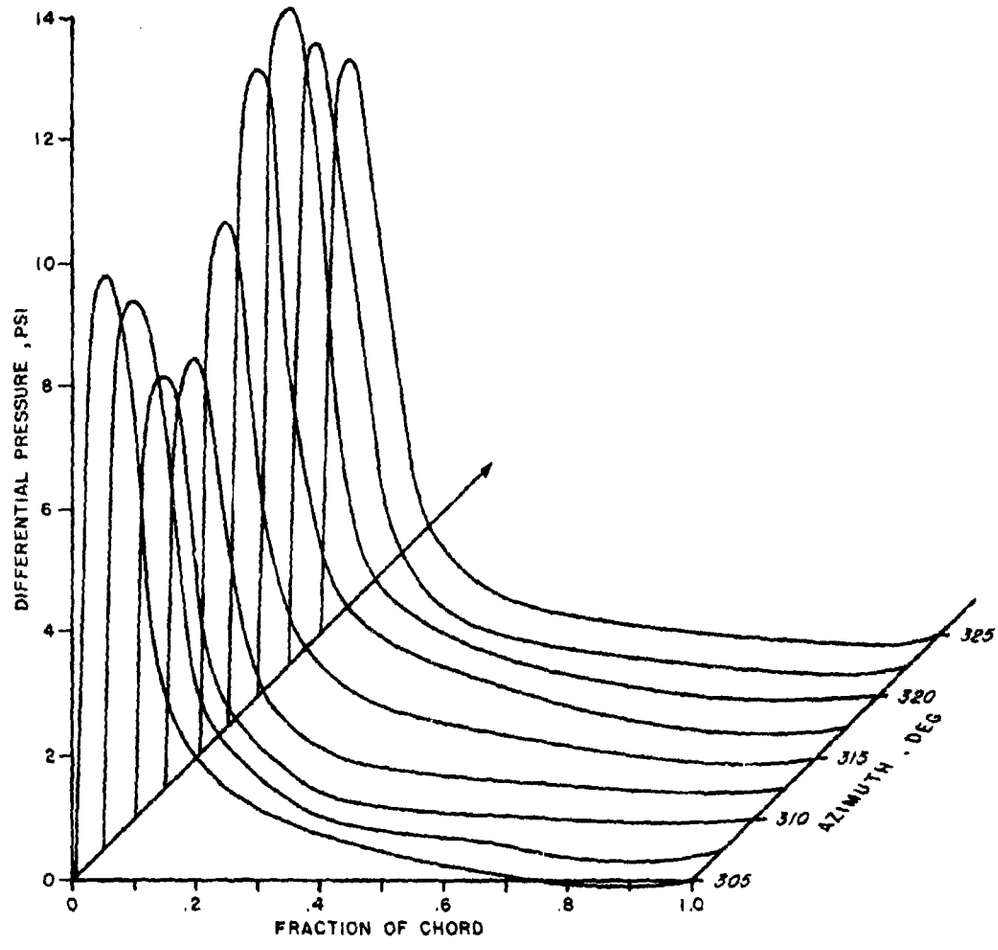
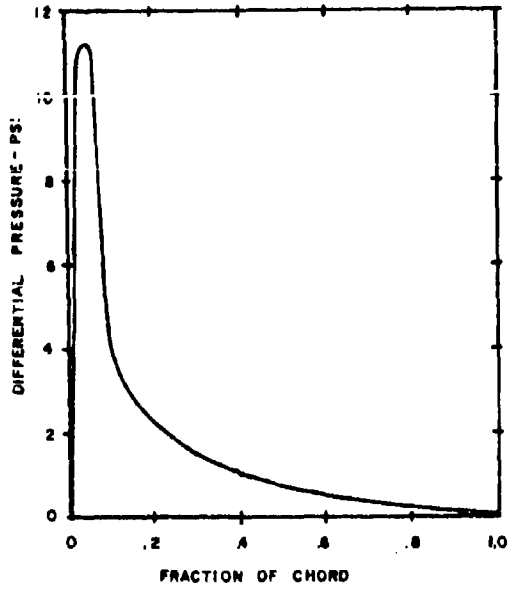
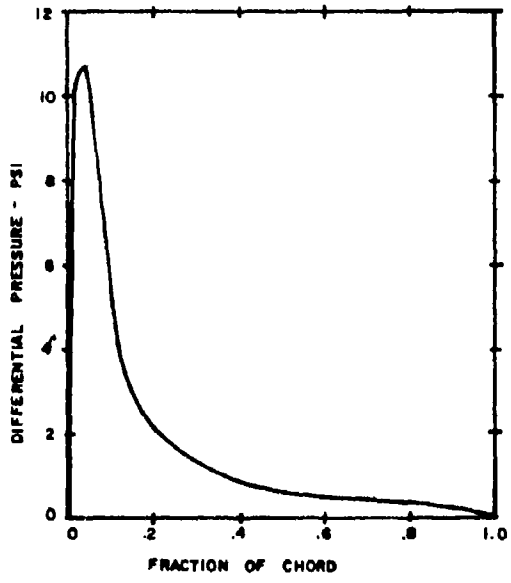


Figure 37. Chordwise Distribution of Differential Pressure as a Function of Azimuth, Hover RIN Condition.



a. RIN Present



b. RIN Not Present

Figure 38. Chordwise Pressure Distribution With and Without RIN, 98% Span, 160° Azimuth.

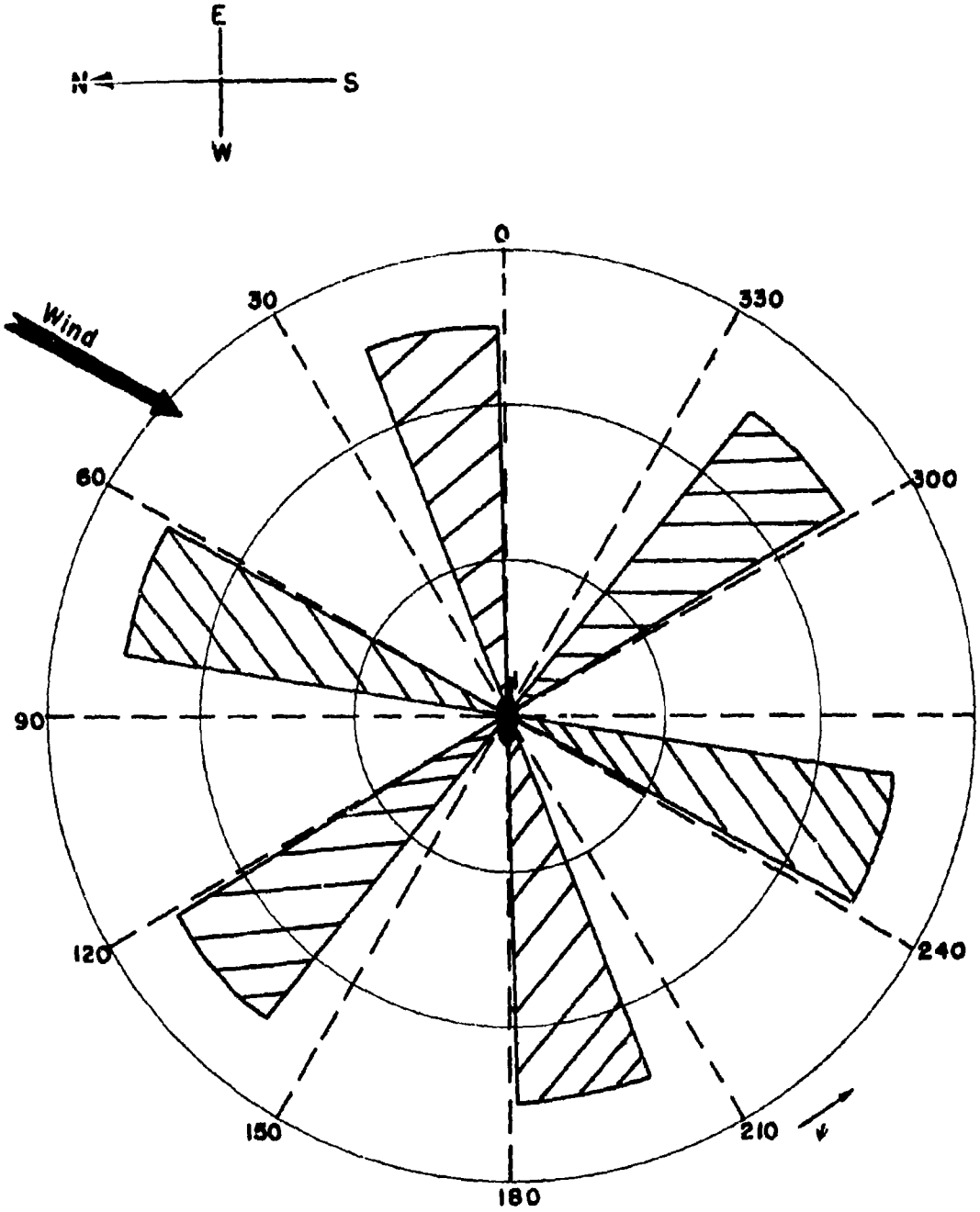
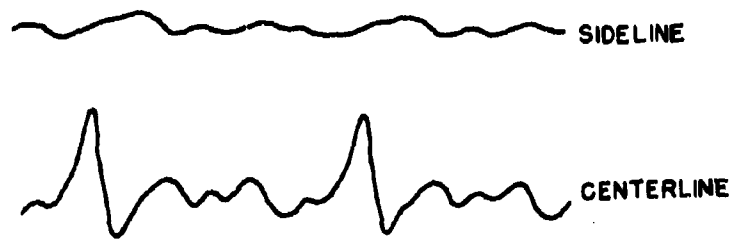


Figure 39. Range of Rotor Blade Locations at Instant of RIN Generation for OGE Hover.



a. Helicopter Over 2500 ft Away

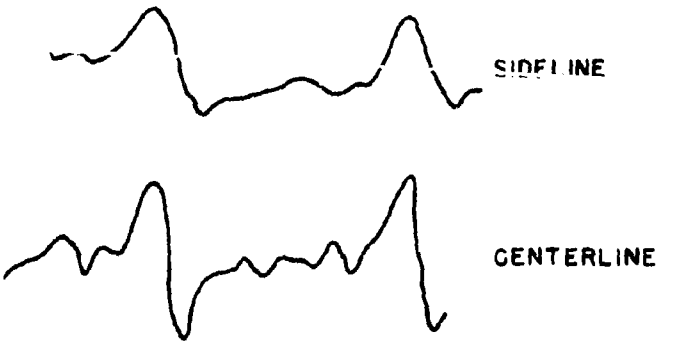
b. Helicopter Approximately 1500 ft Away

Figure 40. Measured Time History of Acoustic Pressure, Advancing Blade Side, 170 kt.

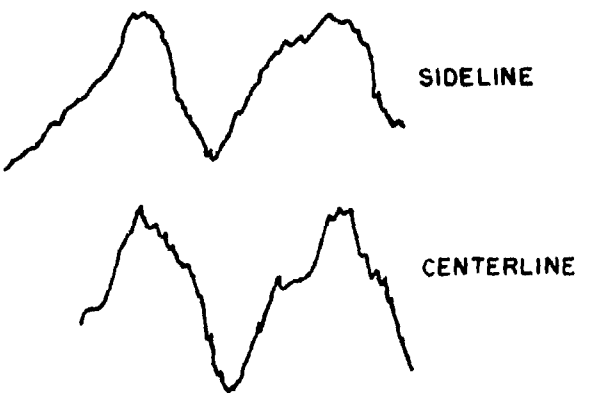
c. Helicopter Approximately 600 ft Away

d. Helicopter Passing Over Microphones

Figure 40. Concluded.



a. Maximum Sideline Impulse, Helicopter Approximately 600 ft Away



b. Helicopter Passing Over Microphones

Figure 41. Measured Time History of Acoustic Pressure, Retreating Blade Side, 170 kt.

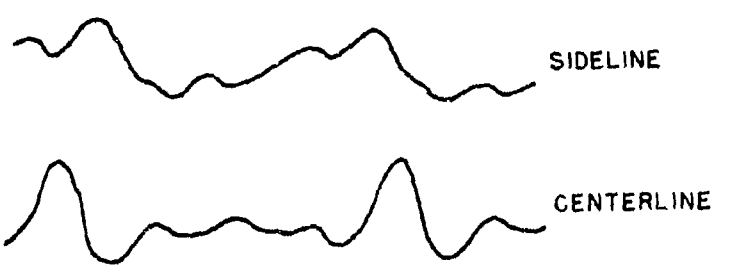


Figure 42. Measured Time History of Acoustic Pressure, Advancing Blade Side, 140 kt.

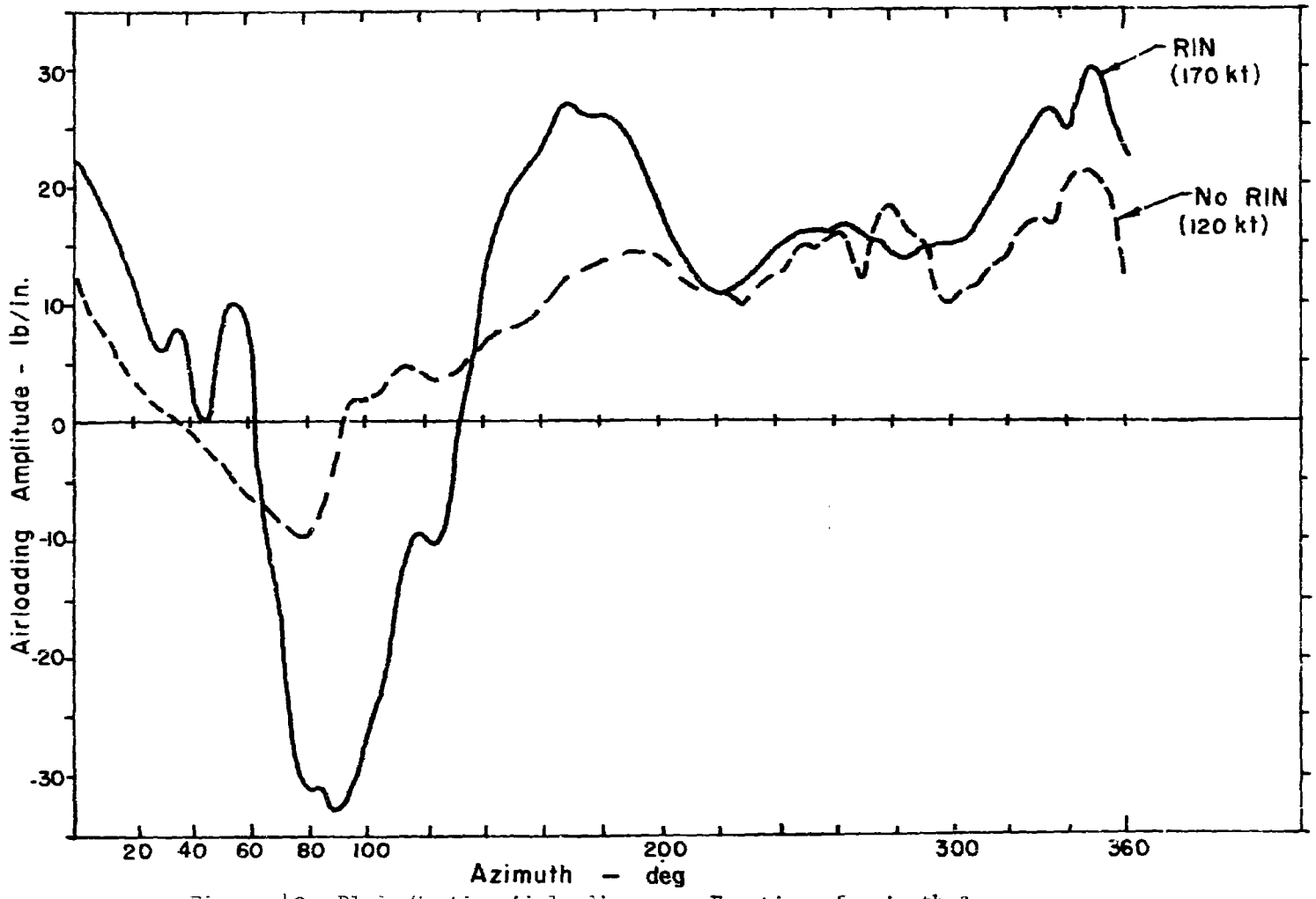


Figure 43. Blade Section Airloading as a Function of Azimuth for Cruise RIN and No-RIN Conditions (98% Span).

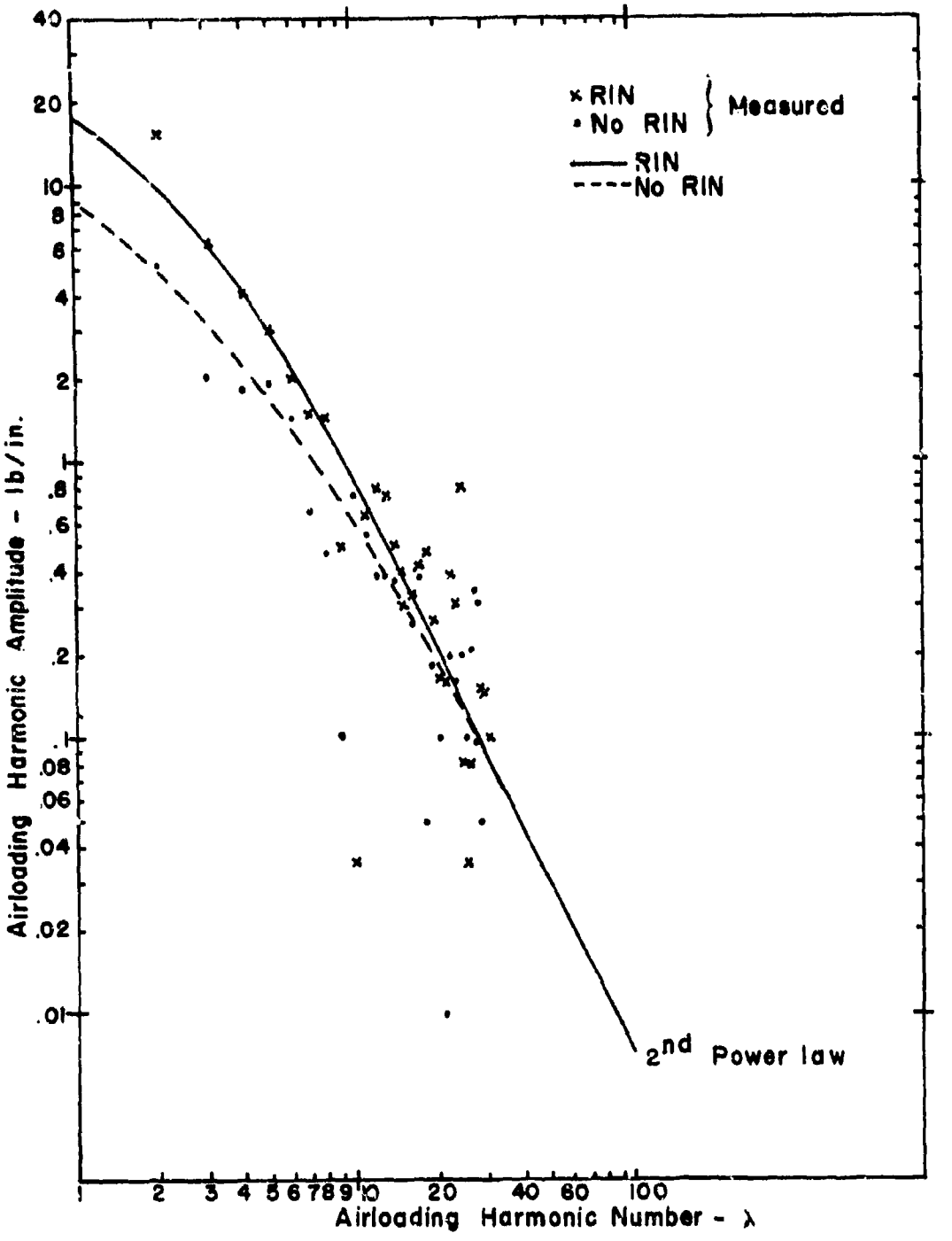


Figure 44. Airloading Harmonic Amplitude for Cruise RIN and No-RIN Conditions (98% Span).

5.0 CONCLUSIONS

Based on the results of this study of rotor impulsive noise (RIN) of a single rotor helicopter, it is concluded that:

1. RIN is characterized by an increase in SPL of the higher harmonics of rotational noise rather than increases in broadband noise amplitude and modulation. Rotor rotational noise harmonics up to the twenty-third (430 Hz) were measured during RIN conditions.

2. Cruise RIN and hover RIN of single-rotor helicopters appear to be generated by different aeroacoustic mechanisms. Cruise RIN results from the combination of acoustic effects of high subsonic tip Mach number and aerodynamic effects of drag divergence. Hover RIN results from high frequency oscillations in airloads commonly caused by blade/wake interactions.

3. Cruise RIN is highly directional, with maximum severity occurring directly ahead of the helicopter at small angles below the plane of the main rotor. The observed directionality of this RIN results from the directionality of drag divergence generated noise (maximum in the plane of the rotor) and the forward shift in directionality in the rotational noise lobes which occurs during high speed translation.

4. Aerodynamic shock effects do not appear to be a primary source of RIN for the helicopter studied.

5. The inclusion of blade flapping and coning in the acoustic analysis does not significantly improve correlation of measured and predicted noise levels.

6. Calculated time histories of acoustic pressure agree with trends in measured cruise data. Calculated and measured impulsiveness increases at 170 knots as the helicopter approaches the observer, while neither the calculated nor the measured waveform is impulsive at 140 knots.

7. Calculated noise harmonic levels correlate with measured data through the third harmonic at moderate distances from the helicopter. Correlation at large distances tends to be poor. Analytical omission of source motion and drag divergence effects seem to be the prime factors contributing to this inaccuracy. Atmospheric scattering of the noise may also be a contributing factor by causing shifts in the highly directional forward radiating patterns.

8. Theoretical airloads predicted from a Sikorsky-developed rotor loads and aeroelastic analysis (which uses a normal modes approach coupled with variable inflow) do not contain sufficient higher-harmonic amplitude and phase information to be useful for detailed acoustic predictions. These theoretical airloads give useful estimates only of the fundamental and the second harmonic of rotor rotational noise.

9. Limited ability of theoretical airload analyses to predict higher-harmonic amplitude and phase suggests that new empirical approaches are required to provide airload data for acoustic predictions.

6.0 RECOMMENDATIONS

Results from this study lead to the following recommendations for future research:

1. Modify the analysis used for the present study to incorporate the acoustic effects of profile drag and source motion. Evaluate improvement in correlation with noise data presented in this report and in Reference 15.

2. Develop a practical analysis for estimating rotor noise without measured airload data. This entails developing an empirical method for predicting airload spectrum shapes from measured rotor load data (such as H-34, NH-3A, CH-53A, and UH-1B data) and developing a computerized subroutine to construct an appropriate airload spectrum for the rotor geometry and flight condition of interest.

3. Improve the accuracy of broadband noise prediction by including the acoustic effects of vortex shedding, boundary layer turbulence, and oncoming vorticity in an acoustic analysis. Such an analysis should include the effects of blade tip geometry on shed vorticity and aerodynamic circulation. The study of basic generating mechanisms of rotor broadband noise currently supported by ARO-Durham under contract DAHC04-69-C-0089 should be invaluable in the recommended study.

7.0 LITERATURE CITED

1. Cox, C.R., and Lynn, R. R., A STUDY OF THE ORIGIN AND MEANS OF REDUCING HELICOPTER NOISE, Bell Helicopter Company; USATCREC Technical Report 62-73, U. S. Army Transportation Research Command, Fort Eustis, Virginia, November 1962.

2. Schlegel, R.G., King, R. J., and Mull, H.R., HELICOPTER ROTOR NOISE GENERATION AND PROPAGATION, Sikorsky Aircraft; USAAVLABS Technical Report 66-4, U. S. Army Aviation Materiel Laboratories, Fort Eustis, Virginia, October 1966, AD 645884.

3. Davidson, I. M., and Hargest, T.H., HELICOPTER NOISE, Jl. Royal Aero Soc., Vol. 69, May 1965.

4. Lowson, M.V., and Ollerhead, J.B., STUDIES OF HELICOPTER ROTOR NOISE, Wyle Laboratories; USSAVLABS Technical Report 68-60, U. S. Army Aviation Materiel Laboratories, Fort Eustis, Virginia, January 1969, AD 684394.

5. Leverton, J.W., HELICOPTER NOISE - BLADE SLAP, PART 1: REVIEW AND THEORETICAL STUDY, University of Southampton; NASA Contractor Report 1221, National Aeronautics and Space Administration, Washington, D.C., October 1968.

6. King, R. J., and Schlegel, R.G., PREDICTION METHODS AND TRENDS FOR HELICOPTER ROTOR NOISE, Proc. Third CAL/AVLABS Symposium, 18-20 June 1969, Buffalo, New York.

7. Sadler, S.G., and Loewy, R.G., THE IMPORTANCE OF VORTEX SHEDDING EFFECTS ON HELICOPTER ROTOR NOISE WITH AND WITHOUT BLADE SLAP, Proc. Third CAL AVLABS Symposium, 18-20 June 1969, Buffalo, New York.

8. Ollerhead, J.B., and Lowson, M.V., PROBLEMS OF HELICOPTER NOISE ESTIMATION AND REDUCTION, AIAA Paper No. 69-195, AIAA AHS VTOL Research Design, and Operations Meeting, February 1969.

9. Loewy, R.G., and Sutton, L.R., A THEORY FOR PREDICTING THE ROTATIONAL NOISE OF LIFTING ROTORS IN FORWARD FLIGHT, INCLUDING A COMPARISON WITH EXPERIMENT, Rochester Applied Science Associates, Inc.; USAAVLABS Technical Report 65-82, U. S. Army Aviation Materiel Laboratories, Fort Eustis, Virginia, January 1966, AD 629377.

10. Licke, J.E., MONAURAL PHASE EFFECTS IN AUDITORY SIGNAL DETECTION, Jl. Acoust. Soc. Am., Vol. 43, No. 3, March 1968, pp. 439-443.

11. Clark D.R., and Leiper, A.C., THE FREE WAKE ANALYSIS. A METHOD FOR THE PREDICTION OF HELICOPTER ROTOR HOVERING PERFORMANCE, Jl. Am. Helicopter Soc., Vol. 25, No. 1, January 1970.

12. Arndt, R.E.A., and Borgman, D.C., NOISE RADIATION FROM HELICOPTER ROTORS OPERATING AT HIGH TIP MACH NUMBERS, presented at 16th Annual National Forum of the Am. Helicopter Soc., Washington, D.C., June 1970, Amer. Helicopter Soc. Preprint No. 402.

13. Schlegel, R.G., and Bausch, W. E., HELICOPTER ROTOR ROTATIONAL NOISE PREDICTION AND CORRELATION. VOLUME II - DOCUMENTATION OF NOISE PREDICTION COMPUTER PROGRAM, Sikorsky Aircraft; USAAVLABS Technical Report 70-1B, U. S. Army Aviation Materiel Laboratories, Fort Eustis, Virginia, November 1970.

14. Gessow, A., and Meyers, G.C., AERODYNAMICS OF THE HELICOPTER, New York, Frederick Ungar Publishing Co., 1967.

15. Schlegel, R.G., and Bausch, W.E., HELICOPTER ROTOR ROTATIONAL NOISE PREDICTION AND CORRELATION. VOLUME I - ROTATIONAL NOISE PREDICTION AND CORRELATION UNDER NONUNIFORM INFLOW CONDITIONS, Sikorsky Aircraft; USAAVLABS Technical Report 70-1A, U.S. Army Aviation Materiel Laboratories, Fort Eustis, Virginia, November 1970.

16. Cox, C.R., ROTOR NOISE MEASUREMENTS IN WIND TUNNELS, Proc. Third CAL/AVLABS Symposium, 18-20 June 1969, Buffalo, New York

17. van de Vooren, A.I., and Zandbergen, P.J., NOISE FIELD OF A ROTATING PROPELLER IN FORWARD FLIGHT, AIAA Jl., Vol. 1, No. 7, July 1963, pp. 1518-1526.

18. Wright, S.E., SOUND RADIATION FROM A LIFTING ROTOR GENERATED BY ASYMMETRIC DISK LOADING, Jl. Sound Vib., Vol. 9, No. 2, 1969, pp. 223-240.

19. Wright, S.E., and Leverton, J.W., HELICOPTER ROTOR NOISE GENERATION, Proc. Third CAL/AVLABS Symposium, 18-20 June 1969, Buffalo, New York.

20. Sadler, S.G., and Loewy, R.G., A THEORY FOR PREDICTING THE ROTATIONAL AND VORTEX NOISE OF LIFTING ROTORS IN HOVER AND FORWARD FLIGHT, Rochester Applied Science Associates, Inc.; NASA Contractor Report 1333, National Aeronautics and Space Administration, Washington, D.C., May 1969.

21. Diprose, K. V., SOME PROPELLER NOISE CALCULATIONS SHOWING THE EFFECT OF THICKNESS AND PLANFORM, RAE Tech M.S. 19, 1955.

APPENDIX I
COMPUTER PROGRAM MODIFICATION

The computer program described in AVLABS Report 70-1B (Reference 13) was modified during the present study to reduce running time, to include rigid body blade flapping and rotor shaft inclination, and to obtain the time history of acoustic pressure at each location for which rotational noise levels are calculated. Modifications are described below.

I.1 RUNNING TIME

The computer program calculates rotational noise harmonic levels based on any arbitrary pressure distribution on the rotor blades. In order to relate the pressures on the blades to the noise heard by an observer, the pressure profile on a typical section of a blade at any given time is represented by a Fourier series whose coefficients are calculated by numerically integrating the pressure profile over the appropriate interval. Since the pressure profile changes as the blades move azimuthally, the Fourier series coefficients required for each noise harmonic must be calculated several hundred times to define the rotor system as a noise source. The calculation of these Fourier series accounts for 75% of the machine time used in the calculation of each noise harmonic.

These series coefficients are stored in the computer since they are not influenced by locations for which noise levels are calculated. In the original version, the coefficients were stored in the computer core and, consequently, were available only during the running of the program. If inspection of the computer output revealed that different observer locations were required to answer questions about the noise radiation patterns, it was necessary to re-run the program to reproduce the old Fourier series for the new observer locations. In the modified version, the series coefficients are stored on magnetic tape for each rotor operating condition. Machine time on subsequent runs is reduced from more than 150 seconds per noise harmonic to approximately 40 seconds by reading the coefficients from the tape. An input option, DRUM, has been added to specify that coefficients are to be read in from tape.

I.2 RIGID BODY FLAPPING

In the original noise prediction computer program, the rotor disk is represented by a flat plate that lies in a plane parallel to the ground. Directional characteristics of the rotor noise are caused solely by the distribution of aerodynamic forces over the rotor disk and by the pitch angle of the rotor blades as they rotate around the azimuth. Subsequent correlation work using this analysis indicated that correlation should be improved by removing the assumption of a horizontal, flat rotor disk in favor of a more realistic description of the rotor geometry and orientation relative to the ground.

The present study improved the mathematical model of the rotor system by adding rotor shaft fore/aft inclination and rigid-body blade flapping to the noise prediction equations. The sign conventions used are standard

for helicopters (Gessow and Meyers, Reference 14) with shaft inclination angle (θ) positive aft, and blade flapping angle (ϕ) positive above the plane perpendicular to the rotor shaft (Figure 45). These angles are used to define the x, y, and z components of the aerodynamic forces acting on the rotor blades. The effects of these angles on the distance between rotor and observer are neglected since this effect is small for normal helicopter operations.

The solution to the acoustic wave equation that is the foundation of the noise prediction analysis is given in Reference 15 as the relationship

$$P_m[x,y,z,t] = \frac{1}{4\pi}\int_0^b\int_0^R\int_0^{2\pi}\left\{\left\{g_{mx}\frac{\partial}{\partial x} + g_{my}\frac{\partial}{\partial y} + g_{mz}\frac{\partial}{\partial z}\right\}\frac{1}{S}\cos\left\{mn\Omega\left[t-\frac{\psi}{\Omega}-\frac{S}{c}\right]\right\}\right.$$

$$\left. + \left\{h_{mx}\frac{\partial}{\partial x} + h_{my}\frac{\partial}{\partial y} + h_{mz}\frac{\partial}{\partial z}\right\}\frac{1}{S}\sin\left\{mn\Omega\left[t-\frac{\psi}{\Omega}-\frac{S}{c}\right]\right\}\right\} db\,dr\,d\psi$$

where $P_m(x,y,z,t)$ is the mth harmonic of acoustic pressure as a function of time t and observer location (x, y, z) and g_{mx}, g_{my}, g_{mz}, h_{mx}, h_{my}, h_{mz} are related to the components of the aerodynamic forces in the x, y, and z directions as defined in Reference 15.

The flapping motion of the blades introduces radial components of aerodynamic forces in the rotor disk. Fore/aft inclination of the rotor shaft merely changes the orientation of the rotor system relative to the ground. Since both feathering (pitch) and flapping motions are measured with respect to the rotor shaft, it is convenient to develop the analysis in a shaft axis coordinate system (Figure 45). Inclination of the rotor shaft from the vertical then can be accounted for by a simple transformation of coordinates.

Coordinate Convention:

Origin:	Center of rotation
x :	$\perp$ shaft, + = aft ($\psi = 0^\circ$)
y :	$\perp$ shaft, + = starboard side ($\psi = 90^\circ$)
z :	Coincides with shaft axis, + = direction of positive rotor thrust
β :	Pitch angle on blade, + = leading edge up, function of radius and azimuth
ϕ :	flapping angle, + = above x-y plane, function of azimuth only (the blade is not permitted to bend or twist dynamically)
ψ :	Azimuth angle, normal helicopter (ccw from above, 0° on x-axis)

The g_{mx}, h_{mx}, etc.,parameters may be treated as components along each axis

of the aerodynamic forces acting on the rotor blades. For this analysis, aerodynamic forces always are perpendicular to both the chord line and the feathering axis of the rotor blades. These forces are projected onto the z-axis directly and onto the x-y plane as radial and azimuthal components. If F is the aerodynamic force vector as shown in Figure 46, then the radial component, F_R, is $F_R = |\vec{F}| \cos\beta \sin\phi$; the azimuthal component, F_A, is $F_A = |\vec{F}| \sin\beta$; and the vertical component, F_Z, is $F_Z = |\vec{F}| \cos\beta \cos\phi$. x- and y-axis components of $\vec{F}$ are easily found from the azimuthal and radial components

$$F_x = F_A \sin\psi - F_R \cos\psi$$

$$F_y = -\left(F_A \cos\psi + F_R \sin\psi\right)$$

$$F_z = |\vec{F}| \cos\beta \cos\phi$$

The above relationships translate into acoustic wave equation terminology as follows, where g_m is the magnitude of the unresolved aerodynamic force

$$g_{mx} = g_m\left(\sin\beta \sin\psi - \cos\beta \sin\phi \cos\psi\right)$$

$$g_{my} = -g_m\left(\sin\beta \cos\psi + \cos\beta \sin\phi \sin\psi\right)$$

$$g_{mz} = g_m \cos\beta \cos\phi$$

with analogous results for the h_m terms.

I.3 INCLINATION OF ROTOR SHAFT

The preceding equations are valid in the shaft-axis coordinate system, but this reference frame is not convenient for application to the noise prediction computer program. Consequently, the equations have been transformed from the shaft axis coordinate system to a more convenient system with the x-y plane parallel to the ground and z normal to the x-y plane (positive above this plane). By considering only fore/aft shaft inclination, the transformation consists of simple rotation about the y-axis. Using primed symbols for the shaft-axis system and unprimed for the transformed coordinates, the result is

$$x = x' \cos\theta + z' \sin\theta$$

$$y = y'$$

$$z = z' \cos\theta - x' \sin\theta$$

Consequently,

$$g_{mx} = g'_{mx} \cos\theta + g'_{mz} \sin\theta$$

$$g_{my} = g'_{my}$$

$$g_{mz} = g'_{mz} \cos\theta - g'_{mx} \sin\theta$$

so that the final result for g_m (or h_m) with the addition of flapping and longitudinal shaft tilt is

$$g_{mx} = g_m \left\{ \cos\theta \left(\sin\beta \sin\psi - \cos\beta \sin\phi \cos\psi \right) + \sin\theta \cos\beta \cos\phi \right\}$$

$$g_{my} = g_m \left\{ -\cos\beta \sin\phi \sin\psi - \sin\beta \cos\psi \right\}$$

$$g_{mz} = g_m \left\{ \cos\theta \cos\beta \cos\phi + \sin\theta \left(\cos\beta \sin\phi \cos\psi - \sin\beta \sin\psi \right) \right\}$$

The flapping and shaft tilt terms from g_m and h_m propagate through the analysis and ultimately influence only one basic term in the equations. That term, q_1, accounts for direction and distance from the rotor system to an observer location.

$$\begin{aligned} q_1 = {} & [x - r\cos\psi] \left\{ \cos\theta \left[\sin\beta \sin\psi - \cos\beta \sin\theta \cos\psi + \sin\theta \cos\beta \cos\phi \right] \right\} \\ & - [y - r\sin\psi] \left\{ \cos\beta \sin\phi \sin\psi + \sin\beta \cos\psi \right\} \\ & + z \left\{ \cos\theta \cos\beta \cos\phi + \sin\theta \left[\cos\beta \sin\phi \cos\psi - \sin\beta \sin\psi \right] \right\} \end{aligned}$$

I.4 ACOUSTIC PRESSURE TIME HISTORY

In previous correlation studies of rotor rotational noise (References 2 and 15), the root-mean-square sound pressure level (SPL) in decibels was the critical parameter. The present study has included the time history of acoustic pressure to determine how well the analysis predicts both amplitude and phase of the noise harmonics. The addition of the time history to the computer program was straightforward since the required acoustic parameters, u_m and v_m, are calculated for the rms SPL. The

acoustic pressure of the mth harmonic as a function of time is given as

$$p_m[t] = u_m \cos m\omega t + v_m \sin m\omega t$$

where ω is the blade passage frequency. The total acoustic pressure, P(t), can be constructed from

$$P[t] = \sum_{m=1}^{\infty} u_m \cos m\omega t + v_m \sin m\omega t$$

The computer program now divides the blade passage period into 40 segments to define the time history of acoustic pressure.

I.5 USE OF ROTATIONAL NOISE PREDICTION COMPUTER PROGRAM

The program calculates the root-mean-square (SPL) of up to 10 harmonics of rotor rotational noise at as many as 20 observer locations relative to the rotor system. The time history of acoustic pressure also is calculated.

Calculated noise levels can be based on different chordwise distributions of airloading. Flight test aerodynamic data are used whenever possible, so the chordwise distribution is arbitrary and reflects the effects of stall, compressibility, reversed flow, and blade wake interactions. Use of an arbitrary distribution without flight data requires the user to fabricate pressures that give the desired distribution.

Subroutine E386RN is provided to calculate noise levels based on a hypothetical constant airload across the blade chord. This subroutine is much faster and less complicated than the calculation procedure for an arbitrary chordwise distribution of load. The time history of acoustic pressure is not calculated when subroutine E386RN is used alone.

I.5.1 Hardware Requirements

The program was written in FORTRAN V specifically for use on the Univac 1108 system operated by the United Aircraft Research Laboratories (UARL). The program uses direct access input/output FH-332 drums, units 28 through 30, to manipulate data. One tape drive unit, number 14, is required to store or recall the Fourier series coefficients discussed in Section I.1. If the noise prediction program is to be run on a different computer, an analyst must go over the source deck to make the input/output calls compatible with available hardware. Without using overlay techniques, the program uses approximately 50,000 decimal words of storage.

I.5.2 Software Requirements

The program uses two software packages that are uniquely suited to the UARL system. One package, called NTRAN, was used in the original version of the noise prediction program. This routine allows the 1108 computer to proceed with calculations while parameters are being read into core or written out onto a storage file. While this feature is standard for the

1108, different computer installations may have a different name or call argument for the routine than the UARL system. All calls to NTRAN occur in the part of the program called E676. The other software package that is tailored to UARL's system is called Drum Data Transfer (DDT). This routine was added during the present study to expedite storage and retrieval of the coefficients discussed in Section I.1. The remainder of the present section describes where DDT is used in the program and outlines the requirements that a substitute storage/retrieval routine must satisfy.

Coefficients named GMAR and HMAR are calculated for each noise harmonic and are a function of the aerodynamic loading on the rotor blades. For each noise harmonic, there are 720 values of GMAR and 720 values of HMAR (144 azimuthal locations per spanwise location times 5 spanwise locations). Since the program is designed to calculate as many as 10 harmonics of noise, the storage system must accommodate 14,400 coefficients. Storage format should be conducive to retrieving all of the coefficients for a given noise harmonic at the start of the major loop on noise harmonics in E676.

The statements in the noise prediction computer program that involve DDT operations are identified below by the sequence numbers that are punched in the last 8 columns of each card. Comment cards precede each DDT operation to explain its purpose. The first 4 characters, L76M, label the cards as part of the main program E676. In the program version presented in Appendix V, statements for DDT operations have been changed to comment cards by placing a "C" in column 1. The relevant cards are: L76M0910, L76M2750, L76M3600 through L76M3640, L76M4020, L76M4890, L76M4900, L76M4920, and L76M4930.

Note that cards L76M2750, L76M4890, and L76M4900 use DDT when the DRUM input mode is not used. The computer program can be used without developing a substitute for DDT by deleting these 3 cards and using the CARD input mode. Section I.5.4 defines input parameters and illustrates proper placement on punched cards.

I.5.3 Data Requirements

Input data describe rotor geometry and flight condition, observer location relative to the rotor system, and aerodynamic loads acting on the rotor blades. These data are read from cards for each run or are built into the program in the block data subroutine BLODAT. Section I.5.6 discusses some features of this subroutine that might affect use of the program for a rotor system other than the CH-53A rotor that was used for this study. Output data normally consists of:

1. A display of input values including differential pressure as a function of azimuth for each chordwise and spanwise location on the blade.

2. A listing of Fourier series coefficients (Section I.1) as a function of azimuth for each span location and each noise harmonic.

3. A listing of the oscillatory components of acoustic pressure used in the final equation of section I.4.

4. A listing of SPL as a function of observer location for each noise harmonic.

I.5.4 Input Parameters and Format

The programming names of input parameters and their appropriate units are indicated in this section. Placement of these parameters on punched cards is illustrated in Figure 47. Figure 48 shows actual values in a complete sample data set for the CARD input mode. Numerical values of the input parameters must contain a decimal point unless an integer is specified.

BB	Maximum blade thickness; inches.
AA	Blade chord length; inches, assumed constant along the blade span.
BLADEL	Blade length (radius); inches, measured from center of rotation.
GAMA	Blade twist rate (linear); degrees per inch, positive value for normal negative twist from root to tip.
RO	Blade radial location where twist starts; inches, normally taken to be reference radius for blade pitch angle.
CC	Speed of sound in air; inches per second.
OMEG	Rotational speed of rotor; revolutions per minute.
DPSI	Azimuth angle increment for calculations; degrees, can be 1.25 degrees of multiple of 2.50 degrees.
NBLADE	Number of rotor blades; integer.
MLIMDP	Number of harmonics of blade pressure to be input, not greater than 30; integer.
MLIMRN	Highest noise harmonic order to be calculated, not greater than 10; integer.
LSPAN	Number of interpolated equidistant radial stations used in noise calculations, equals 10 or 20 only; integer.
IREELS	Number of input data tapes (not greater than 5), normally left equal to 1; integer.
TCOP	Option to read aerodynamic data from punched cards (CARD), or magnetic tape or fastran drum (DRUM); alphanumeric.
PUNCH	Option to punch aerodynamic pressure harmonics on cards, normally left N; alphanumeric.
INTERM	Option for intermediate output, left N; alphanumeric.
IDD	Option for intermediate output, left blank or 0 (zero); integer.
RR(IN)	Instrumented radial stations in terms of decimal fraction of span for IN = 1 (closest to root) to IN = 5 (closest to blade tip).
XA(IN,JN)	Instrumented chordwise in terms of decimal fraction of chord at chord locations JN = 1 (closest to leading edge) to JN = 5 (closest to trailing edge) for each span IN.

TIME — Time interval over which acoustic pressure is calculated, normally equals period of blade passage frequency (seconds per cycle); seconds.

THETA — Fore-aft inclination of main rotor shaft from Z-axis, negative for forward inclination; degrees, autogyro sign convention.

E3860P — Option to calculate noise based on constant chordwise load distribution, Y for yes or N for no; alphanumeric.

OPRONO — Option to calculate noise based on arbitrary chordwise distribution of airload, equals Y for yes or N for no.

Note: E3860P and OPRONO must not be Y simultaneously since OPRONO results will be meaningless due to an equivalencing of certain variables.

NFT — Number of observer locations at which noise levels are to be calculated, not greater than 20; integer.

Note: The parameters ANG, NHH, KEY 1, KEY 2, and KEY 3 are required only E3860P equals Y, in which case OPRONO must equal N.

ANG — Azimuthal increment used to calculate noise with E386RN; degrees, must satisfy (360/ANG) = even integer number, and ANG not less than 0.5 degree.

NHH — Number of section load harmonics to be calculated from input pressure harmonics, normally equal to or less than MLIMDP; integer.

KEY 1, KEY 2, KEY 3 — Options for intermediate print-out from E386RN, left equal to zero; integer.

Note: Observer locations are specified in spherical coordinates (CAPRF, THETAF, ALFAF) when E3860P equals Y and in rectangular coordinates (XFP, YFP, ZFP) when OPRONO equals Y. Origin of both systems is the rotor hub.

CAPRF — Line-of-sight distance from rotor hub to observer; feet.

THETAF — Azimuthal location of observer relative to rotor; degrees, normal helicopter azimuth convention.

ALFAF — Elevation angle of observer relative to rotor plane; degrees, negative for observer below rotor plane.

XFP — X-axis location of observer (parallel to THETAF equal zero); inches from rotor hub, positive along THETAF = 0.0° and negative along THETAF = 180.0° (ahead of helicopter).

YFP — Y-axis location of observer; inches, positive along THETAF = 90°.

ZFP — Z-axis location of observer; inches, positive along ALFAF = 90° (thrust axis of hovering rotor).

IBURST — Number of the data set being processed, significant only when TCOP equals TAPE; integer.

Note: The following parameters are not required if the DRUM input mode is used.

BO — Steady component of blade pitch angle; degrees.

B1C First harmonic cosine component of blade pitch angle; degrees, defined for a positive series.

B1S First harmonic sine component of blade pitch angle; degrees, defined for a positive series.

F0 Steady component of blade flapping angle (also called coning angle); degrees, positive for flapping up.

F1C First harmonic cosine component of oscillatory flapping; degrees, defined for a positive series.

F1S First harmonic sine component of oscillatory flapping; degrees, defined for a positive series.

CN(K,JN,IN) Cosine component of kth harmonic of differential pressure at chord JN and span IN; pounds per square inch, defined for positive series.

SN(K,JN,IN) Sine component of kth harmonic of differential pressure; as above.

K Order of harmonic of differential pressure, between 1 (steady) and 31 (30th oscillatory component); integer.

JN Location along blade chord between 1 (closest to leading edge) and 5 (closest to trailing edge); integer.

IN Location along blade span between 1 (closest to root) and 5 (closest to tip); integer.

During normal operation, the first run for a given operating condition will use aerodynamic pressure data on punched cards. This is indicated by placing the word CARD in the space allotted to variable TCOP. By saving the Fourier coefficients that describe the chordwise distribution of differential pressure, subsequent runs for the same flight condition will require relatively few data cards. To use coefficients from a previous run, the word DRUM is placed in the TCOP location, and the appropriate data are read in via unit 14. Figure 49 shows sample data for the DRUM input mode where data are read from the 4th file of tape "G" (unit 14).

I.5.5 Output Data

Figure 50 contains a typical computer output from rotational noise prediction program E676. Values of differential pressure are printed every 2.5 degrees of azimuth from 0° through 357.5°. These listing are read line-by-line from left to right. Fourier coefficients are listed after the differential pressures with cosine coefficients followed by sine coefficients for each span location (blade station) and each noise harmonic. The first line of cosine coefficients is indented 3 spaces, as is the first line of sine coefficients. These listings are read the same way as the differential pressure listings. Oscillatory components of acoustic pressure are listed next for each observer location, followed by the time history of acoustic pressure at each observer location (field point). These acoustic pressures are read line-by-line from left to right. The 1st value is the acoustic pressure at some arbitrary time t = 0, and the 41st value is the pressure at the time t = T (the period of the blade passage frequency). The value at t = T should nearly equal the value at t = 0 if the time interval, TIME, is equal to (1/blade passage frequency). Rotational noise levels as a function of field point for each noise harmonic are the last parameters to be printed out.

I.5.6 Changes to Subroutine BLODAT

Subroutine BLODAT contains numerical values that normally do not change from run to run. The program is designed to accept aerodynamic pressure data at 5 chord stations for each of 5 span stations, and the status of each of these locations is defined in BLODAT by parameters IRS(I) and NCHAN(I,J). If no data are available for a given chord or span location, changes are required to IRS(I) or NCHAN(I,J), or to both. Since the transducer at the 4th chord location of the 1st span location was inoperative during the present study, NCHAN(1,4) = 0 to indicate that no data would be input for that position. This also tells the program to use an averaged quadratic integration technique in all chordwise integrations at the 1st span location. For normal use, NCHAN(1,4) should be changed to 4. The proper format for these parameters is shown in the listing of the program (Appendix V).

I.5.7 Running Time and Page Requirements

Approximately 2.5 minutes of machine time should be allowed for each noise harmonic when the CARD input mode is used. This is reduced to approximately 0.6 minute per harmonic when the DRUM input mode is used. To be conservative, allow for 50 pages of output.

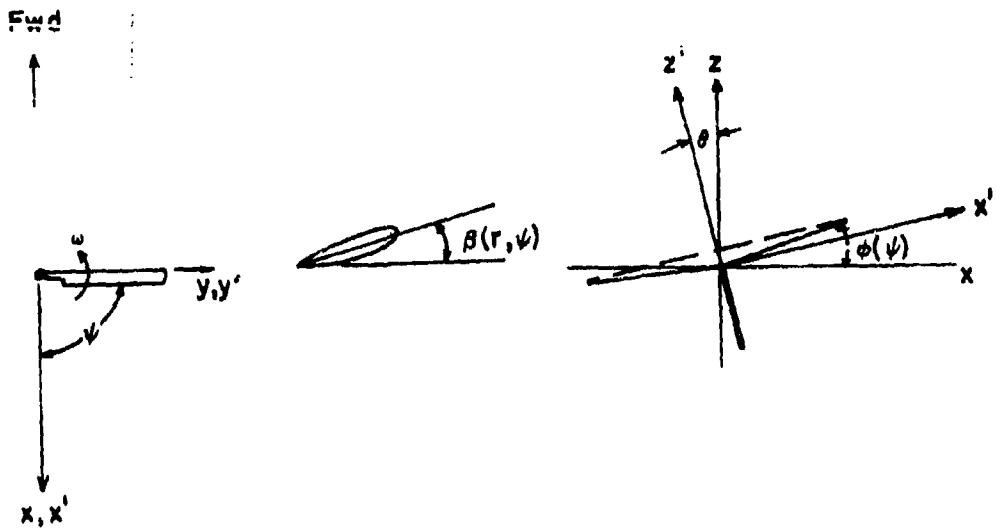


Figure 45. Coordinate Systems for Rotor Noise Calculation.

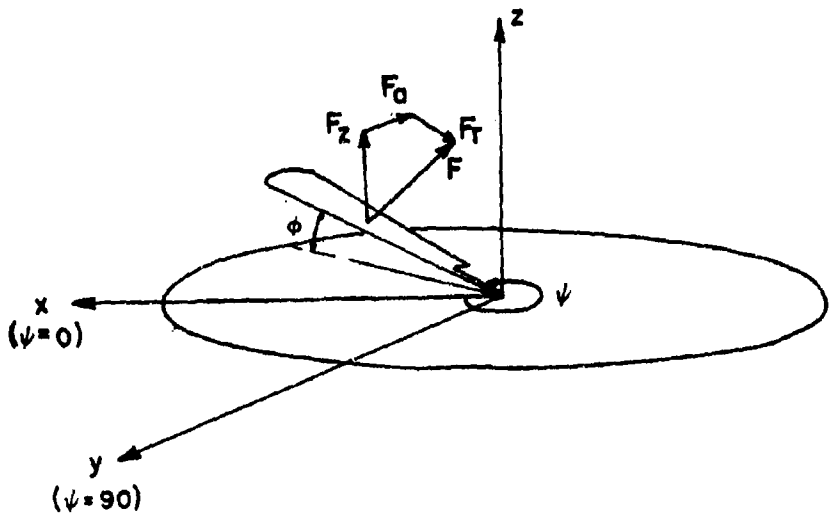


Figure 46. Resolution of Aerodynamic Forces.

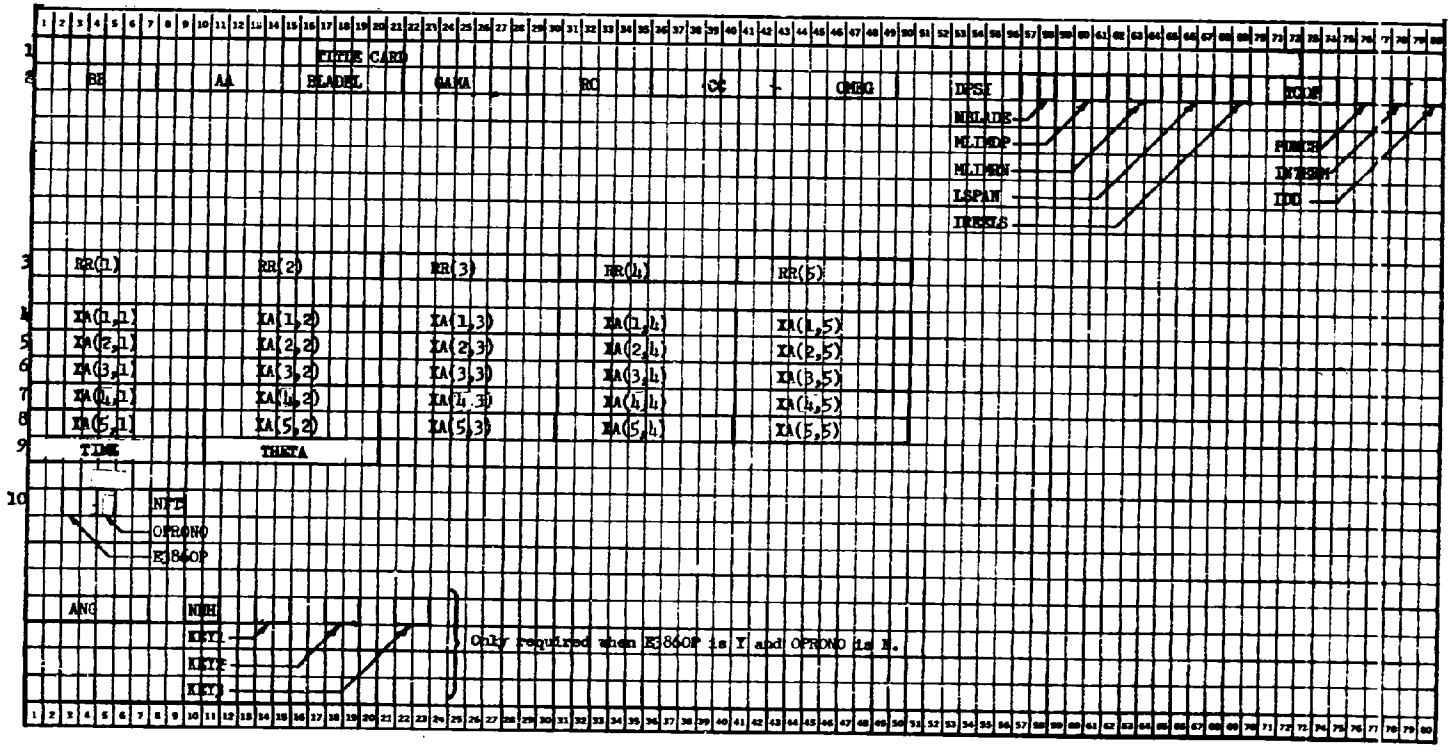


Figure 47. Placement of Parameters on Cards.

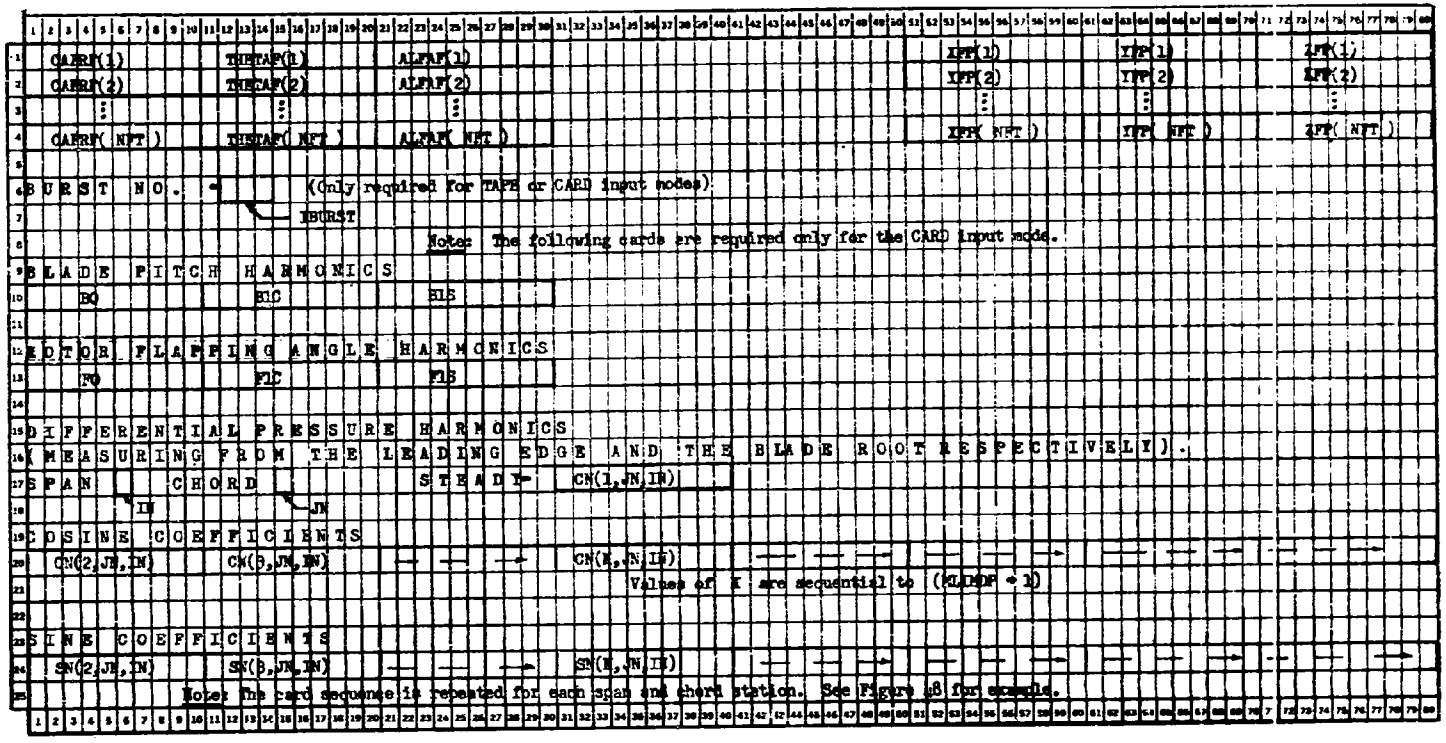


Figure 47. Concluded.

```
@ RUN E676WD441167609005000050        (633) BAUSCH,W    3      STATION''I''
@P    ASG    P
@P    ASG    S
@P    ASG    G=9362SY
@ XQT CUR
   FRS
   INF NOISE
   PEF G,G,G
@ XQT AF676
 E676 SAMPLE DECK SET-UP  20AUGUST70 TCOP = CARD
 2.86   26.0   433.4  .0131  118.0  13270. 188.    2.5   6  8  5 20 1 CARD N N
  .4       .75       .85       .95       .98
  .042     .158      .3        .6        .91
  .042     .158      .3        .6        .91
  .042     .158      .3        .6        .91
  .042     .158      .3        .6        .91
  .042     .158      .3        .6        .91
 .0531     0.0
  N Y   2
 538.52   0.        -30.                          5596.      0.        -3231.
 538.52   0.        -5.                           6438.      0.        -563.
BURST NO. =  7          *** ROTOR NOISE PUNCHED OUTPUT ***
BLADE PITCH HARMONICS
 1.3133+01 1.2684+00 1.4096+00  (COLLECTIVE, LONGITUDINAL, LATERAL RESPECTIVELY)
ROTOR FLAPPING ANGLE HARMONICS
 3.4965+00-9.2093-01 0.0000      (POSITIVE TAIL HIGH -- DEGREES)
DIFFERENTIAL PRESSURE HARMONICS FOR 5 CHORD STATIONS AT EACH OF THE 5 SPANS
(MEASURING FROM THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY).
SPAN 1  CHORD 1        STEADY=  1.3215+00
COSINE COEFFICIENTS
 1.7893-01 8.6379-02-9.1522-02 5.4074-02-1.4760-02 1.3739-02-3.2843-03 6.8900-03
SINE COEFFICIENTS
 2.5822-01 1.2173-01-7.8300-02 1.6145-02-2.9130-02 2.6313-02-8.1456-03 1.4022-02
SPAN 1  CHORD 2        STEADY=  5.2611-01
COSINE COEFFICIENTS
 6.3769-02 2.6989-02-2.6319-02 2.2534-02-1.1330-02 2.8795-03-8.5509-04 4.2238-03
SINE COEFFICIENTS
 1.0326-01 4.1014-02-2.4542-02 7.6643-03-4.6196-03 8.0691-03 7.9350-03 7.4742-03
SPAN 1  CHORD 3        STEADY=  2.7584-01
COSINE COEFFICIENTS
 5.3880-02 2.8974-02-2.9560-02 9.6782-03-6.2573-03 3.0683-03 1.4864-03 3.5357-03
SINE COEFFICIENTS
 7.3465-02 3.2867-02-1.2936-02 5.3314-03-6.4602-03 6.6668-03-7.8706-04 3.6909-03
SPAN 1  CHORD 4        STEADY=  0.0000
COSINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SPAN 1  CHORD 5        STEADY= -5.6346-02
COSINE COEFFICIENTS
-9.4211-03-4.8721-03 3.1423-03-3.3696-04-2.9359-05 4.4270-04-2.7112-04-9.1695-04
SINE COEFFICIENTS
-8.4587-04-4.6024-03 8.6588-05-1.6911-03 2.1953-03-3.2855-04 1.5774-04-2.6268-04
SPAN 2  CHORD 1        STEADY=  3.5155+00
COSINE COEFFICIENTS
 6.2205-01-5.0632-02 1.4693-02 3.2436-02-6.0388-02 2.5522-02-1.7416-03-5.5072-03
SINE COEFFICIENTS
 6.4991-01 1.7020-01 3.8880-02 8.0048-02 3.4875-03 1.5879-02 1.3939-02-4.9721-04
SPAN 2  CHORD 2        STEADY=  1.4074+00
COSINE COEFFICIENTS
```

Figure 48. Sample of CARD Input Mode.

```
 2.2125-01-1.4134-03 6.7880-03 2.1101-02-3.0086-02 1.3863-02-5.0205-03-1.6058-03
SINE COEFFICIENTS
 2.4252-01 7.7975-02 1.6632-02 3.2862-02 1.3079-02 7.4412-03 7.4750-03 5.3284-03
SPAN 2  CHORD 3        STEADY=  1.1239+00
COSINE COEFFICIENTS
 1.4021-01-2.5537-02 7.3251-04 1.2601-02-1.5888-02 6.8869-03 1.0343-04 2.9860-03
SINE COEFFICIENTS
 1.4063-01 3.6232-02 7.2472-03 2.2703-02-3.6062-04 7.2413-03 3.5772-03-4.5975-04
SPAN 2  CHORD 4        STEADY=  2.7872-01
COSINE COEFFICIENTS
 8.4155-02 2.6385-03-2.0558-03 9.6918-03-8.3669-03 9.2523-04-7.9473-04-2.9648-03
SINE COEFFICIENTS
 4.7117-02 2.0689-02 6.5795-03 5.4138-03 1.1244-02 4.4744-03 3.3201-03-6.1514-04
SPAN 2  CHORD 5        STEADY= -1.6337-01
COSINE COEFFICIENTS
 2.6125-02 3.8526-03-1.3509-03 3.7271-03-2.7216-03 6.2719-04 6.4998-04-1.5116-03
SINE COEFFICIENTS
-1.3585-02 4.4238-03-3.3623-03-1.4518-03 4.5007-03 2.1445-04 1.2701-03 4.2440-04
SPAN 3  CHORD 1        STEADY=  4.5398+00
COSINE COEFFICIENTS
 8.1344-01 2.4672-02-9.5280-02-6.1585-02-1.5801-01 5.5602-03 9.4039-02 1.1364-01
SINE COEFFICIENTS
 6.0212-01 1.9442-01 1.7576-02-4.8439-03 1.3575-01 7.2371-02 6.9967-02-6.1871-02
SPAN 3  CHORD 2        STEADY=  5.1488-01
COSINE COEFFICIENTS
 3.1920-01 3.6656-02-2.4089-02 3.2477-02-4.0168-02 3.1908-03 1.3488-02 9.5870-03
SINE COEFFICIENTS
 6.9666-02 9.5417-02 9.9914-03 1.6957-02 2.9003-02-2.0850-03 3.1961-03-3.1983-03
SPAN 3  CHORD 3        STEADY= -3.7077-01
COSINE COEFFICIENTS
 8.4995-02 5.2003-02-2.9669-02 1.2778-02-1.2519-02 9.4363-04 5.9984-03-1.5821-03
SINE COEFFICIENTS
-2.2669-03 6.2634-02-2.6832-03 1.3001-02 2.2155-02 4.6875-03-4.3110-03-6.0489-03
SPAN 3  CHORD 4        STEADY=  1.1764+00
COSINE COEFFICIENTS
 5.5060-03 1.5338-02-1.7025-02 1.1994-02-3.1227-04-1.0326-04 1.0875-03-8.7683-03
SINE COEFFICIENTS
-3.8908-02 2.8985-02-2.4007-04 1.0648-02 6.8600-03 8.6288-04-9.1648-03-7.1324-05
SPAN 3  CHORD 5        STEADY=  2.0242-01
COSINE COEFFICIENTS
 3.1762-03 4.9851-03-2.5603-03 5.8589-03 2.8196-03-4.5628-04-2.1767-04-5.9044-03
SINE COEFFICIENTS
-2.3438-02 9.5578-03 9.9387-04 3.4870-03 9.5972-04 7.8844-04-6.8262-03 9.5167-04
SPAN 4  CHORD 1        STEADY=  9.5341+00
COSINE COEFFICIENTS
-1.3684+00-8.4312-01-1.9837-01-2.4799-01-1.9390-01 7.3368-02 4.8595-02 5.4914-03
SINE COEFFICIENTS
-7.3405-01-8.1310-01 9.9605-02 2.6595-01 4.6046-02 4.8517-04-8.7989-03-1.4977-01
SPAN 4  CHORD 2        STEADY=  3.8796+00
COSINE COEFFICIENTS
-1.1079+00-3.8811-01-6.3380-02-1.2579-01-1.7367-01 1.2701-01 1.3918-01-4.6663-02
SINE COEFFICIENTS
-3.5022-01-6.0494-01 1.0944-01 1.7018-01 1.4051-01-6.0502-02 6.5529-02-8.6124-02
SPAN 4  CHORD 3        STEADY=  1.7704+00
COSINE COEFFICIENTS
-2.6249-01-1.9883-01-5.1591-02-7.2592-02-3.6821-02 4.2362-02 1.6471-02 1.0313-02
SINE COEFFICIENTS
-1.9704-01-2.0230-01-4.3912-02 1.1520-01 1.1838-02 1.8821-02 9.7173-03-6.5188-02
SPAN 4  CHORD 4        STEADY=  4.3502-01
COSINE COEFFICIENTS
```

Figure 48. Continued.

```
-4.8628-02-4.7619-02-1.2670-02-7.7182-03-1.3397-02 1.3703-02 1.8237-02 1.3705-03
SINE COEFFICIENTS
-9.6418-02-4.2627-02-2.2180-02 4.0290-02 1.2906-02 3.3787-04-7.7343-03-1.2327-02
SPAN 4  CHORD 5        STEADY= -3.7936-01
COSINE COEFFICIENTS
-8.4917-03-8.8517-03 9.6144-05-9.2092-04 6.0998-03 9.5912-03 2.2058-03 1.9945-03
SINE COEFFICIENTS
-4.7729-02-1.7351-02 7.0737-03 1.9094-02 2.9334-03 4.6809-04-5.7162-03-3.8534-03
SPAN 5  CHORD 1        STEADY=  9.8304+00
COSINE COEFFICIENTS
-1.6596+00-1.2404+00-6.6369-01-3.8059-01-1.1047-01-2.8423-02-5.4526-03 1.0968-02
SINE COEFFICIENTS
-6.8719-01-8.1859-01-1.1993-01 8.5975-02 3.3376-02 3.7790-02-4.4579-02-2.0696-02
SPAN 5  CHORD 2        STEADY=  2.5259+00
COSINE COEFFICIENTS
-3.7722-01-2.8959-01-1.1734-01-7.2880-02-6.9081-02-7.7209-03 5.1103-03 2.5126-03
SINE COEFFICIENTS
-9.8361-02-2.0992-01-6.1597-02 2.7910-02 1.4647-02-3.3070-03 3.4487-03-3.0249-02
SPAN 5  CHORD 3        STEADY=  1.2639+00
COSINE COEFFICIENTS
-2.4124-01-2.1881-01-8.3634-02-4.0030-02-4.7826-02 1.4367-02 1.0826-02 1.0908-02
SINE COEFFICIENTS
-1.5178-01-1.7806-01-4.8001-02 2.7917-02 1.3979-02-6.2101-03 2.4727-03-2.9592-02
SPAN 5  CHORD 4        STEADY=  4.7708-01
COSINE COEFFICIENTS
-7.9225-02-7.4821-02-2.3488-02-1.1087-02-2.3349-02 5.1036-03 6.3273-03 8.4353-03
SINE COEFFICIENTS
-7.1022-02-6.8677-02-2.6652-02 7.5530-03 1.0709-03-3.9655-03 6.1016-03-8.4271-03
SPAN 5  CHORD 5        STEADY=  1.8145-01
COSINE COEFFICIENTS
-7.0866-02-6.5144-02-1.4039-02-5.5659-03-8.1222-03 9.7118-03 1.1004-02 7.8894-03
SINE COEFFICIENTS
-7.9007-02-7.2525-02-1.2389-02 2.1958-02 3.9799-03-3.4117-03-2.4317-03-5.3973-03
@ XQT CUR
   TEF 0
   TRI 0
@ FIN
```

Figure 48. Concluded.

```
@ RUN E676WB441167609002000050        (633) BAUSCH,W   3     STATION''I''
@P   ASG   R
@P   ASG   S
@P   ASG   O=9362SN
@ XQT CUR
   ERS
   INF NOISE
   REF 0,0,0
   IN 0
   TRI 0
@ XQT AE676
 E676 SAMPLE DECK SET-UP  20 AUGUST 70 TCOP=DRUM
 2.86   26.0   433.4  .0131  118.0  13270. 188.    2.5   6  8  5 20 1 DRUM N N
  .4       .75       .85       .95       .98
  .042     .158      .3        .6        .91
  .042     .158      .3        .6        .91
  .042     .158      .3        .6        .91
  .042     .158      .3        .6        .91
  .042     .158      .3        .6        .91
 .0531     0.0
  N Y   2
 538.52   0.        -30.                          5596.      0.        -3231.
 538.52   0.        -5.                           6438.      0.        -563.
@ FIN
```

Figure 49. Sample of DRUM Input Mode.

E676 SAMPLE DECK SET-UP 20AUGUST70 TCOP = CARD

BLADE THICKNESS (IN)	= .2860+01	ZERO TWIST BLADE STA.	(IN)	=	.1180+03
BLADE CHORD (IN)	= .2600+02	SPEED OF SOUND	(IN/SEC)	=	.1327+05
BLADE LENGTH (IN)	= .4334+03	ROTOR ROT. SPEED	(RPM)	=	.1880+03
BLADE TWIST RATE (DEG/IN)	= .1310-01	AZIMUTH INCREMENT	(DEG)	=	.2500+01

NUMBER OF BLADES	= 6	TAPE / CARD / DRUM OPTION	= CARD
NO. OF HARMONICS TO REPRESENT PRESSURE CYCLES	= 8	PRESSURE HARMONIC PUNCH OPTION	= N
NO. OF ROTOR NOISE HARMONICS	= 2	INTERMEDIATE OUTPUT OPTION	= N
NO. OF INTERPOLATED SPAN STATIONS	= 20		
TOTAL NO. OF TAPE REELS	= 1		

COMBINED ROTOR SHAFT INCLINATION AND FUSELAGE PITCH ATTITUDE = .0000 DEGREES

TOTAL TIME FOR ACOUSTIC PRESSURE COMPUTATIONS IS .5310-01 SECONDS

OPTION TO USE PROGRAM E386 (THEORETICAL CONST. PRESSURE PULSE)	= N
OPTION TO USE ROTOR NOISE PROGRAM (MEASURED PRESSURE PULSE)	= Y
NO. OF FIELD POINTS	= 2

E386 FIELD POINTS

FP	R (FT)	THETA (DEG)	ALPHA (DEG)
1	.0000	.0000	.0000
2	.0000	.0000	.0000

ROTOR NOISE FIELD POINTS

FP	X (IN)	Y (IN)	Z (IN)
1	.5596+04	.0000	+.3231+04
2	.6438+04	.0000	-.5630+03

Figure 50. Sample Output.

DIFFERENTIAL PRESSURE CYCLES AT INSTRUMENTED BLADE STATIONS

SPAN STATION 1 CHORD STATION 1

1.5519+00	1.5683+00	1.5824+00	1.5939+00	1.6028+00	1.6093+00	1.6138+00	1.6170+00	1.6195+00	1.6222+00
1.6259+00	1.6312+00	1.6386+00	1.6484+00	1.6604+00	1.6744+00	1.6900+00	1.7063+00	1.7227+00	1.7381+00
1.7520+00	1.7634+00	1.7719+00	1.7771+00	1.7789+00	1.7773+00	1.7724+00	1.7646+00	1.7541+00	1.7413+00
1.7264+00	1.7097+00	1.6911+00	1.6707+00	1.6485+00	1.6242+00	1.5979+00	1.5695+00	1.5391+00	1.5069+00
1.4734+00	1.4390+00	1.4044+00	1.3703+00	1.3374+00	1.3062+00	1.2774+00	1.2512+00	1.2278+00	1.2072+00
1.1890+00	1.1730+00	1.1586+00	1.1454+00	1.1331+00	1.1215+00	1.1105+00	1.1005+00	1.0921+00	1.0859+00
1.0829+00	1.0841+00	1.0905+00	1.1026+00	1.1211+00	1.1460+00	1.1769+00	1.2130+00	1.2529+00	1.2950+00
1.3372+00	1.3773+00	1.4132+00	1.4428+00	1.4644+00	1.4766+00	1.4787+00	1.4706+00	1.4526+00	1.4257+00
1.3914+00	1.3514+00	1.3076+00	1.2621+00	1.2168+00	1.1733+00	1.1330+00	1.0969+00	1.0654+00	1.0388+00
1.0168+00	9.9994-01	9.8889-01	9.7366-01	9.6469-01	9.5741-01	9.5139-01	9.4636-01	9.4221-01	9.3898-01
9.3680-01	9.3584-01	9.3626-01	9.3815-01	9.4154-01	9.4632-01	9.5232-01	9.5925-01	9.6681-01	9.7470-01
9.8265-01	9.9053-01	9.9829-01	1.0060+00	1.0140+00	1.0226+00	1.0322+00	1.0432+00	1.0560+00	1.0710+00
1.0882+00	1.1075+00	1.1269+00	1.1519+00	1.1759+00	1.2004+00	1.2247+00	1.2482+00	1.2705+00	1.2912+00
1.3101+00	1.3275+00	1.3435+00	1.3585+00	1.3730+00	1.3877+00	1.4029+00	1.4190+00	1.4363+00	1.4547+00
1.4742+00	1.4942+00	1.5142+00	1.5337+00						

SPAN STATION 1 CHORD STATION 2

6.0800-01	6.1991-01	6.3056-01	6.3943-01	6.4622-01	6.5077-01	6.5317-01	6.5369-01	6.5274-01	6.5088-01
6.4870-01	6.4678-01	6.4502-01	6.4562-01	6.4701-01	6.4986-01	6.5403-01	6.5927-01	6.6517-01	6.7128-01
6.7712-01	6.8222-01	6.8621-01	6.8881-01	6.8988-01	6.8940-01	6.8749-01	6.8435-01	6.8025-01	6.7547-01
6.7031-01	6.6498-01	6.5965-01	6.5438-01	6.4914-01	6.4382-01	6.3825-01	6.3222-01	6.2553-01	6.1799-01
6.0948-01	5.9994-01	5.8938-01	5.7793-01	5.6576-01	5.5311-01	5.4024-01	5.2743-01	5.1495-01	5.0303-01
4.9186-01	4.8159-01	4.7232-01	4.6412-01	4.5706-01	4.5119-01	4.4658-01	4.4330-01	4.4148-01	4.4123-01
4.4269-01	4.4598-01	4.5115-01	4.5820-01	4.6706-01	4.7752-01	4.8925-01	5.0184-01	5.1475-01	5.2739-01
5.3912-01	5.4934-01	5.5747-01	5.6306-01	5.6579-01	5.6550-01	5.6220-01	5.5608-01	5.4748-01	5.3635-01
5.2474-01	5.1173-01	4.9835-01	4.8512-01	4.7244-01	4.6060-01	4.4977-01	4.4000-01	4.3124-01	4.2340-01
4.1632-01	4.0986-01	4.0390-01	3.9840-01	3.9336-01	3.8887-01	3.8506-01	3.8211-01	3.8018-01	3.7941-01
3.7989-01	3.8159-01	3.8441-01	3.8812-01	3.9241-01	3.9692-01	4.0122-01	4.0494-01	4.0775-01	4.0943-01
4.0990-01	4.0924-01	4.0767-01	4.0558-01	4.0347-01	4.0188-01	4.0138-01	4.0248-01	4.0559-01	4.1093-01
4.1857-01	4.2836-01	4.3995-01	4.5283-01	4.6636-01	4.7986-01	4.9265-01	5.0412-01	5.1382-01	5.2147-01
5.2702-01	5.3061-01	5.3263-01	5.3359-01	5.3413-01	5.3492-01	5.3661-01	5.3972-01	5.4465-01	5.5158-01
5.6046-01	5.7105-01	5.8290-01	5.9594-01						

SPAN STATION 1 CHORD STATION 3

3.6065-01	3.4701-01	3.5261-01	3.5736-01	3.6125-01	3.6439-01	3.6692-01	3.6909-01	3.7113-01	3.7329-01
3.7578-01	3.7876-01	3.8229-01	3.8635-01	3.9082-01	3.9552-01	4.0019-01	4.0455-01	4.0830-01	4.1117-01
4.1295-01	4.1350-01	4.1274-01	4.1071-01	4.0751-01	4.0331-01	3.9831-01	3.9276-01	3.8686-01	3.8079-01
3.7471-01	3.6866-01	3.6267-01	3.5669-01	3.5052-01	3.4434-01	3.3774-01	3.3072-01	3.2323-01	3.1526-01
3.0688-01	2.9820-01	2.8940-01	2.8068-01	2.7226-01	2.6435-01	2.5713-01	2.5072-01	2.4519-01	2.4054-01
2.3670-01	2.3357-01	2.3099-01	2.2883-01	2.2695-01	2.2525-01	2.2372-01	2.2238-01	2.2135-01	2.2080-01
2.2093-01	2.2200-01	2.2421-01	2.2774-01	2.3270-01	2.3910-01	2.4682-01	2.5563-01	2.6520-01	2.7509-01
2.8480-01	2.9379-01	3.0155-01	3.0759-01	3.1153-01	3.1310-01	3.1216-01	3.0871-01	3.0291-01	2.9503-01
2.8542-01	2.7453-01	2.6282-01	2.5076-01	2.3878-01	2.2725-01	2.1645-01	2.0680-01	1.9730-01	1.9811-01
1.8350-01	1.7791-01	1.7325-01	1.6942-01	1.6635-01	1.6396-01	1.6221-01	1.6105-01	1.6047-01	1.6046-01
1.6099-01	1.6203-01	1.6351-01	1.6535-01	1.6745-01	1.6969-01	1.7198-01	1.7420-01	1.7628-01	1.7821-01
1.7999-01	1.8169-01	1.8343-01	1.8537-01	1.8767-01	1.9051-01	1.9404-01	1.9837-01	2.0356-01	2.0959-01
2.1635-01	2.2368-01	2.3135-01	2.3910-01	2.4663-01	2.5369-01	2.6005-01	2.6554-01	2.7009-01	2.7373-01
2.7655-01	2.7875-01	2.8060-01	2.8238-01	2.8440-01	2.8693-01	2.9049-01	2.9432-01	2.9936-01	3.0527-01
3.1190-01	3.1903-01	3.2639-01	3.3369-01						

SPAN STATION 1 CHORD STATION 4

Figure 50. Continued.

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000						

SPAN STATION 1 CHORD STATION 5

-6.8609-02	-6.8922-02	-6.9122-02	-6.9227-02	-6.9267-02	-6.9277-02	-6.9298-02	-6.9367-02	-6.9515-02	-6.9760-02
-7.0106-02	-7.0542-02	-7.1037-02	-7.1549-02	-7.2026-02	-7.2408-02	-7.2639-02	-7.2668-02	-7.2455-02	-7.1978-02
-7.1232-02	-7.0231-02	-6.9088-02	-6.7608-02	-6.6089-02	-6.4511-02	-6.2933-02	-6.1407-02	-5.9974-02	-5.8658-02
-5.7470-02	-5.6[illegible]05-02	-5.5445-02	-5.4562-02	-5.3724-02	-5.2900-02	-5.2065-02	-5.1203-02	-5.0309-02	-4.9391-02
-4.8470-02	-4.[illegible]575-02	-4.6741-02	-4.6006-02	-4.5402-02	-4.4953-02	-4.4673-02	-4.4553-02	-4.4586-02	-4.4737-02
-4.4969-02	-4.5234-02	-4.5487-02	-4.5686-02	-4.5798-02	-4.5807-02	-4.5709-02	-4.5521-02	-4.5274-02	-4.5014-02
-4.4794-02	-4.4671-02	-4.4699-02	-4.4925-02	-4.5380-02	-4.6081-02	-4.7023-02	-4.8183-02	-4.9521-02	-5.0983-02
-5.2503-02	-5.4015-02	-5.5450-02	-5.6748-02	-5.7859-02	-5.8744-02	-5.9383-02	-5.9765-02	-5.9897-02	-5.9792-02
-5.9475-02	-5.8970-02	-5.8306-02	-5.7510-02	-5.6604-02	-5.5610-02	-5.4546-02	-5.3428-02	-5.2274-02	-5.1105-02
-4.9944-02	-4.8823-02	-4.7774-02	-4.6837-02	-4.6052-02	-4.5458-02	-4.5089-02	-4.4971-02	-4.5117-02	-4.5526-02
-4.6180-02	-4.7047-02	-4.8078-02	-4.9216-02	-5.0394-02	-5.1546-02	-5.2609-02	-5.3532-02	-5.4276-02	-5.4819-02
-5.5160-02	-5.5315-02	-5.5317-02	-5.5214-02	-5.5056-02	-5.4902-02	-5.4801-02	-5.4798-02	-5.4922-02	-5.5189-02
-5.5598-02	-5.6131-02	-5.6702-02	-5.7453-02	-5.8165-02	-5.8860-02	-5.9506-02	-6.0081-02	-6.0574-02	-6.0990-02
-6.1342-02	-6.1654-02	-6.1956-02	-6.2279-02	-6.2652-02	-6.3098-02	-6.3616-02	-6.4218-02	-6.4886-02	-6.5593-02
-6.6311-02	-6.7003-02	-6.7635-02	-6.8177-02						

SPAN STATION 2 CHORD STATION 1

4.0919+00	4.1629+00	4.2324+00	4.2991+00	4.3615+00	4.4165+00	4.4691+00	4.5126+00	4.5486+00	4.5770+00
4.5980+00	4.6119+00	4.6195+00	4.6215+00	4.6189+00	4.6124+00	4.6029+00	4.5911+00	4.5775+00	4.5625+00
4.5462+00	4.5286+00	4.5098+00	4.4895+00	4.4677+00	4.4442+00	4.4192+00	4.3928+00	4.3654+00	4.3373+00
4.3091+00	4.2816+00	4.2551+00	4.2303+00	4.2075+00	4.1868+00	4.1681+00	4.1510+00	4.1348+[illegible]	4.1185+00
4.1010+00	4.0809+00	4.0571+00	4.0281+00	3.9930+00	3.9511+00	3.9018+00	3.8453+00	3.781[illegible]	3.7124+00
3.6382+00	3.5607+00	3.4817+00	3.4032+00	3.3270+00	3.2550+00	3.1886+00	3.12[illegible]	[illegible]	3.0346+00
3.0001+00	2.9739+00	2.9554+00	2.9437+00	2.9376+00	2.9359+00	2.9372+00	2.9403+[illegible]	[illegible]	2.9467+00
2.9479+00	2.9468+00	2.9427+00	2.9354+00	2.9247+00	2.9106+00	2.8935+00	2.8738+00	2.8519+00	2.8286+00
2.8045+00	2.7806+00	2.7575+00	2.7361+00	2.7172+00	2.7015+00	2.6896+00	2.6819+00	2.6787+00	2.6802+00
2.6862+00	2.6966+00	2.7109+00	2.7284+00	2.7486+00	2.7705+00	2.7934+00	2.8164+00	2.8388+00	2.8599+00
2.8793+00	2.8966+00	2.9117+00	2.9245+00	2.9353+00	2.9445+00	2.9524+00	2.9597+00	2.9670+00	2.9747+00
2.9834+00	2.9935+00	3.0054+00	3.0194+00	3.0354+00	3.0536+00	3.0737+00	3.0956+00	3.1189+00	3.1434+00
3.1686+00	3.1942+00	3.2200+00	3.2455+00	3.2706+00	3.2953+00	3.3194+00	3.3432+00	3.3668+00	3.3906+00
3.4150+00	3.4406+00	3.4660+00	3.4978+00	3.5307+00	3.5674+00	3.6063+00	3.6539+00	3.7043+00	3.7596+00
3.8195+00	3.8835+00	3.9510+00	4.0208+00						

SPAN STATION 2 CHORD STATION 2

1.7023+00	1.7303+00	1.7691+00	1.7998+00	1.8275+00	1.8514+00	1.8711+00	1.8861+00	1.8965+00	1.9024+00
1.9042+00	1.9024+00	1.8978+00	1.8908+00	1.8823+00	1.8728+00	1.8629+00	1.8528+00	1.8428+00	1.8330+00
1.8233+00	1.8135+00	1.8036+00	1.7932+00	1.7824+00	1.7709+00	1.7589+00	1.7463+00	1.7333+00	1.7203+00

Figure 50. Continued.

1.7075+00	1.6952+00	1.6835+00	1.6728+00	1.6630+00	1.6541+00	1.6459+00	1.6381+00	1.6302+00	1.6218+00
1.6124+00	1.6013+00	1.5881+00	1.5724+00	1.5539+00	1.5326+00	1.5084+00	1.4816+00	1.4525+00	1.4216+00
1.3896+00	1.3571+00	1.3248+00	1.2936+00	1.2640+00	1.2367+00	1.2123+00	1.1912+00	1.1736+00	1.1598+00
1.1497+00	1.1433+00	1.1403+00	1.1402+00	1.1427+00	1.1471+00	1.1528+00	1.1591+00	1.1652+00	1.1706+00
1.1746+00	1.1767+00	1.1764+00	1.1736+00	1.1680+00	1.1598+00	1.1493+00	1.1368+00	1.1230+00	1.1085+00
1.0941+00	1.0805+00	1.0684+00	1.0584+00	1.0511+00	1.0467+00	1.0454+00	1.0472+00	1.0517+00	1.0587+00
1.0676+00	1.0779+00	1.0889+00	1.1000+00	1.1107+00	1.1207+00	1.1295+00	1.1370+00	1.1433+00	1.1485+00
1.1526+00	1.1561+00	1.1591+00	1.1621+00	1.1653+00	1.1688+00	1.1729+00	1.1776+00	1.1829+00	1.1888+00
1.1953+00	1.2022+00	1.2095+00	1.2172+00	1.2252+00	1.2336+00	1.2425+00	1.2520+00	1.2622+00	1.2730+00
1.2847+00	1.2970+00	1.3100+00	1.3235+00	1.3372+00	1.3509+00	1.3643+00	1.3773+00	1.3896+00	1.4013+00
1.4124+00	1.4230+00	1.4336+00	1.4445+00	1.4564+00	1.4696+00	1.4849+00	1.5027+00	1.5233+00	1.5469+00
1.5736+00	1.6030+00	1.6348+00	1.6681+00						

SPAN STATION 2 CHORD STATION 3

1.2460+00	1.2626+00	1.2783+00	1.2929+00	1.3060+00	1.3176+00	1.3277+00	1.3361+00	1.3432+00	1.3488+00
1.3531+00	1.3564+00	1.3586+00	1.3599+00	1.3604+00	1.3601+00	1.3592+00	1.3576+00	1.3555+00	1.3528+00
1.3497+00	1.3461+00	1.3422+00	1.3381+00	1.3338+00	1.3294+00	1.3250+00	1.3207+00	1.3166+00	1.3126+00
1.3088+00	1.3051+00	1.3016+00	1.2982+00	1.2948+00	1.2912+00	1.2876+00	1.2837+00	1.2794+00	1.2746+00
1.2692+00	1.2630+00	1.2560+00	1.2479+00	1.2386+00	1.2281+00	1.2162+00	1.2029+00	1.1882+00	1.1720+00
1.1546+00	1.1361+00	1.1169+00	1.0973+00	1.0777+00	1.0585+00	1.0403+00	1.0235+00	1.0085+00	9.9579-01
9.8551-01	9.7785-01	9.7281-01	9.7029-01	9.7003-01	9.7168-01	9.7479-01	9.7884-01	9.8331-01	9.8766-01
9.9142-01	9.9420-01	9.9568-01	9.9568-01	9.9412-01	9.9107-01	9.8666-01	9.8113-01	9.7477-01	9.6792-01
9.6092-01	9.5408-01	9.4770-01	9.4201-01	9.3720-01	9.3341-01	9.3070-01	9.2913-01	9.2868-01	9.2933-01
9.3105-01	9.3379-01	9.3748-01	9.4207-01	9.4748-01	9.5363-01	9.6040-01	9.6767-01	9.7527-01	9.8302-01
9.9071-01	9.9813-01	1.0050+00	1.0113+00	1.0167+00	1.0211+00	1.0246+00	1.0271+00	1.0287+00	1.0297+00
1.0302+00	1.0306+00	1.0311+00	1.0320+00	1.0335+00	1.0359+00	1.0392+00	1.0435+00	1.0486+00	1.0544+00
1.0607+00	1.0672+00	1.0736+00	1.0795+00	1.0848+00	1.0893+00	1.0929+00	1.0957+00	1.0977+00	1.0993+00
1.1007+00	1.1023+00	1.1045+00	1.1078+00	1.1125+00	1.1188+00	1.1270+00	1.1371+00	1.1492+00	1.1629+00
1.1781+00	1.1945+00	1.2115+00	1.2288+00						

SPAN STATION 2 CHORD STATION 4

3.6195-01	3.7215-01	3.8232-01	3.9209-01	4.0105-01	4.0883-01	4.1510-01	4.1960-01	4.2218-01	4.2277-01
4.2144-01	4.1836-01	4.1380-01	4.0810-01	4.0166-01	3.9489-01	3.8817-01	3.8187-01	3.7626-01	3.7154-01
3.6779-01	3.6501-01	3.6310-01	3.6189-01	3.6115-01	3.6064-01	3.6010-01	3.5931-01	3.5809-01	3.5633-01
3.5398-01	3.5102-01	3.4754-01	3.4362-01	3.3937-01	3.3492-01	3.3034-01	3.2572-01	3.2105-01	3.1631-01
3.1143-01	3.0630-01	3.0081-01	2.9484-01	2.8832-01	2.8119-01	2.7348-01	2.6525-01	2.5666-01	2.4791-01
2.3926-01	2.3099-01	2.2338-01	2.1691-01	2.1121-01	2.0702-01	2.0424-01	2.0287-01	2.0280-01	2.0389-01
2.0590-01	2.0854-01	2.1153-01	2.1456-01	2.1736-01	2.1970-01	2.2140-01	2.2235-01	2.2251-01	2.2187-01
2.2052-01	2.1855-01	2.1607-01	2.1324-01	2.1016-01	2.0697-01	2.0375-01	2.0058-01	1.9752-01	1.9462-01
1.9191-01	1.8944-01	1.8725-01	1.8540-01	1.8397-01	1.8304-01	1.8268-01	1.8298-01	1.8400-01	1.8577-01
1.8829-01	1.9153-01	1.9540-01	1.9978-01	2.0449-01	2.0935-01	2.1416-01	2.1872-01	2.2285-01	2.2640-01
2.2927-01	2.3143-01	2.3288-01	2.3369-01	2.3399-01	2.3393-01	2.3369-01	2.3346-01	2.3342-01	2.3373-01
2.3452-01	2.3586-01	2.3779-01	2.4032-01	2.4339-01	2.4693-01	2.5084-01	2.5499-01	2.5929-01	2.6362-01
2.6788-01	2.7198-01	2.7587-01	2.7948-01	2.8281-01	2.8581-01	2.8849-01	2.9086-01	2.9294-01	2.9476-01
2.9638-01	2.9787-01	2.9933-01	3.0087-01	3.0265-01	3.0482-01	3.0755-01	3.1100-01	3.1532-01	3.2063-01
3.2699-01	3.3441-01	3.4282-01	3.5207-01						

SPAN STATION 2 CHORD STATION 5

-1.3397-01	-1.3329-01	-1.3267-01	-1.3222-01	-1.3203-01	-1.3220-01	-1.3279-01	-1.3385-01	-1.3538-01	-1.3735-01
-1.3969-01	-1.4231-01	-1.4509-01	-1.4791-01	-1.5063-01	-1.5314-01	-1.5535-01	-1.5720-01	-1.5865-01	-1.5972-01
-1.6045-01	-1.6090-01	-1.6116-01	-1.6134-01	-1.6151-01	-1.6176-01	-1.6216-01	-1.6274-01	-1.6351-01	-1.6437-01
-1.6556-01	-1.6675-01	-1.6799-01	-1.6922-01	-1.7041-01	-1.7154-01	-1.7263-01	-1.7370-01	-1.7481-01	-1.7604-01
-1.7745-01	-1.7912-01	-1.8111-01	-1.8346-01	-1.8615-01	-1.8917-01	-1.9242-01	-1.9580-01	-1.9917-01	-2.0238-01
-2.0525-01	-2.0763-01	-2.0940-01	-2.1044-01	-2.1069-01	-2.1016-01	-2.0887-01	-2.0691-01	-2.0440-01	-2.0149-01
-1.9834-01	-1.9513-01	-1.9202-01	-1.8913-01	-1.8657-01	-1.8441-01	-1.8268-01	-1.8137-01	-1.8046-01	-1.7987-01
-1.7955-01	-1.7941-01	-1.7938-01	-1.7939-01	-1.7940-01	-1.7937-01	-1.7929-01	-1.7915-01	-1.7897-01	-1.7873-01

Figure 50. Continued.

-1.7866-01	-1.7815-01	-1.7779-01	-1.7737-01	-1.7685-01	-1.7621-01	-1.7540-01	-1.7441-01	-1.7320-01	-1.7177-01
-1.7015-01	-1.6835-01	-1.6644-01	-1.6448-01	-1.6256-01	-1.6075-01	-1.5914-01	-1.5779-01	-1.5676-01	-1.5608-01
-1.5574-01	-1.5572-01	-1.5598-01	-1.5644-01	-1.5701-01	-1.5760-01	-1.5812-01	-1.5849-01	-1.5864-01	-1.5852-01
-1.5811-01	-1.5740-01	-1.5640-01	-1.5515-01	-1.5369-01	-1.5208-01	-1.5035-01	-1.4858-01	-1.4678-01	-1.4501-01
-1.4329-01	-1.4164-01	-1.4008-01	-1.3861-01	-1.3725-01	-1.3603-01	-1.3494-01	-1.3402-01	-1.3328-01	-1.3275-01
-1.3243-01	-1.3232-01	-1.3243-01	-1.3272-01	-1.3315-01	-1.3368-01	-1.3425-01	-1.3479-01	-1.3522-01	-1.3551-01
-1.3560-01	-1.3547-01	-1.3513-01	-1.3461-01						

SPAN STATION 3 CHORD STATION 1

5.3763+00	5.4621+00	5.5329+00	5.5895+00	5.6342+00	5.6704+00	5.7020+00	5.7329+00	5.7661+00	5.8034+00
5.8451+00	5.8903+00	5.9363+00	5.9746+00	6.0160+00	6.0414+00	6.0522+00	6.0459+00	6.0213+00	5.9788+00
5.9205+00	5.8499+00	5.7713+00	5.6899+00	5.6105+00	5.5377+00	5.4748+00	5.4248+00	5.3857+00	5.3588+00
5.3409+00	5.3285+00	5.3175+00	5.3037+00	5.2834+00	5.2534+00	5.2119+00	5.1584+00	5.0935+00	5.0190+00
4.9374+00	4.8519+00	4.7656+00	4.6811+00	4.6008+00	4.5258+00	4.4565+00	4.3928+00	4.3325+00	4.2752+00
4.2191+00	4.1634+00	4.1066+00	4.0499+00	3.9942+00	3.9414+00	3.8941+00	3.8548+00	3.8262+00	3.8102+00
3.8078+00	3.8189+00	3.8418+00	3.8737+00	3.9104+00	3.9472+00	3.9790+00	4.0008+00	4.0086+00	3.9995+00
3.9724+00	3.9277+00	3.8679+00	3.7971+00	3.7203+00	3.6436+00	3.5727+00	3.5130+00	3.4687+00	3.4422+00
3.4342+00	3.4436+00	3.4674+00	3.5013+00	3.5403+00	3.5792+00	3.6133+00	3.6390+00	3.6540+00	3.6582+00
3.6529+00	3.6411+00	3.6273+00	3.6161+00	3.6123+00	3.6199+00	3.6415+00	3.6779+00	3.7280+00	3.7883+00
3.8539+00	3.9185+00	3.9754+00	4.0103+00	4.0417+00	4.0423+00	4.0191+00	3.9739+00	3.9113+00	3.8382+00
3.7635+00	3.6971+00	3.6489+00	3.6280+00	3.6414+00	3.6932+00	3.7845+00	3.9125+00	4.0714+00	4.2521+00
4.4435+00	4.6335+00	4.8097+00	4.9610+00	5.0785+00	5.1563+00	5.1917+00	5.1863+00	5.1446+00	5.0745+00
4.9858+00	4.8898+00	4.7977+00	4.7198+00	4.6646+00	4.6380+00	4.6430+00	4.6795+00	4.7445+00	4.8329+00
4.9378+00	5.0516+00	5.1668+00	5.2768+00						

SPAN STATION 3 CHORD STATION 2

8.6523-01	8.8535-01	9.0299-01	9.1806-01	9.3064-01	9.4094-01	9.4921-01	9.5575-01	9.6077-01	9.6441-01
9.6666-01	9.6739-01	9.6833-01	9.6315-01	9.5745-01	9.4887-01	9.3712-01	9.2286-01	9.0373-01	8.8230-01
8.5847-01	8.3266-01	8.0574-01	7.7863-01	7.5223-01	7.2741-01	7.0489-01	6.8520-01	6.6864-01	6.5521-01
6.4467-01	6.3650-01	6.2999-01	6.2427-01	6.1842-01	6.1147-01	6.0257-01	5.9098-01	5.7616-01	5.5779-01
5.3578-01	5.1026-01	4.8161-01	4.5036-01	4.1718-01	3.8285-01	3.4820-01	3.1404-01	2.8118-01	2.5037-01
2.2228-01	1.9750-01	1.7652-01	1.5971-01	1.4736-01	1.3963-01	1.3655-01	1.3805-01	1.4390-01	1.5373-01
1.6707-01	1.8329-01	2.0165-01	2.2131-01	2.4141-01	2.6103-01	2.7933-01	2.9551-01	3.0892-01	3.1909-01
3.2573-01	3.2877-01	3.2837-0.	3.2486-01	3.1877-01	3.1073-01	3.0145-01	2.9165-01	2.8201-01	2.7313-01
2.6548-01	2.5940-01	2.5508-01	2.5256-01	2.5180-01	2.5264-01	2.5492-01	2.5845-01	2.6308-01	2.6870-01
2.7525-01	2.8275-01	2.9124-01	3.0077-01	3.1137-01	3.2300-01	3.3557-01	3.4854-01	3.6251-01	3.7615-01
3.8926-01	4.0135-01	4.1191-01	4.2052-01	4.2692-01	4.3101-01	4.3289-01	4.3291-01	4.3161-01	4.2970-01
4.2801-01	4.2744-01	4.2882-01	4.3288-01	4.4013-01	4.5086-01	4.6503-01	4.8234-01	5.0217-01	5.2369-01
5.4591-01	5.6776-01	5.8821-01	6.0636-01	6.2153-01	6.3331-01	6.4161-01	6.4670-01	6.4913-01	6.4972-01
6.4946-01	6.4943-01	6.5070-01	6.5421-01	6.6071-01	6.7068-01	6.8431-01	7.0146-01	7.2174-01	7.4447-01
7.6886-01	7.9399-01	8.1895-01	8.4293-01						

SPAN STATION 3 CHORD STATION 3

-2.4782-01	-2.3806-01	-2.2862-01	-2.1957-01	-2.1099-01	-2.0300-01	-1.9579-01	-1.8960-01	-1.8469-01	-1.8135-01
-1.7985-01	-1.8043-01	-1.8324-01	-1.8853-01	-1.9566-01	-2.0504-01	-2.1618-01	-2.2867-01	-2.4206-01	-2.5542-01
-2.6944-01	-2.8251-01	-2.9456-01	-3.0533-01	-3.1466-01	-3.2251-01	-3.2900-01	-3.3432-01	-3.3878-01	-3.4276-01
-3.4664-01	-3.5080-01	-3.5560-01	-3.6132-01	-3.6817-01	-3.7627-01	-3.8564-01	-3.9624-01	-4.0795-01	-4.2060-01
-4.3397-01	-4.4784-01	-4.6196-01	-4.7608-01	-4.8995-01	-5.0333-01	-5.1595-01	-5.2758-01	-5.3796-01	-5.4683-01
-5.5394-01	-5.5904-01	-5.6193-01	-5.6263-01	-5.6044-01	-5.5591-01	-5.4891-01	-5.3958-01	-5.2818-01	-5.1503-01
-5.0055-01	-4.8521-01	-4.6949-01	-4.5387-01	-4.3882-01	-4.2470-01	-4.1181-01	-4.0037-01	-3.9048-01	-3.8213-01
-3.7527-01	-3.6976-01	-3.6543-01	-3.6213-01	-3.5971-01	-3.5804-01	-3.5708-01	-3.5681-01	-3.5727-01	-3.5851-01
-3.6060-01	-3.6361-01	-3.6754-01	-3.7234-01	-3.7790-01	-3.8401-01	-3.9041-01	-3.9678-01	-4.0277-01	-4.0805-01
-4.1231-01	-4.1535-01	-4.1706-01	-4.1744-01	-4.1665-01	-4.1495-01	-4.1270-01	-4.1035-01	-4.0832-01	-4.0706-01
-4.0691-01	-4.0808-01	-4.1065-01	-4.1452-01	-4.1942-01	-4.2494-01	-4.3051-01	-4.3555-01	-4.3940-01	-4.4151-01
-4.4138-01	-4.3872-01	-4.3338-01	-4.2546-01	-4.1526-01	-4.0325-01	-3.9008-01	-3.7646-01	-3.6317-01	-3.5094-01
-3.4038-01	-3.3199-01	-3.2607-01	-3.2269-01	-3.2174-01	-3.2291-01	-3.2571-01	-3.2958-01	-3.3387-01	-3.3794-01

Figure 50. Continued.

-3.4121-01	-3.4320-01	-3.4355-01	-3.4207-01	-3.3869-01	-3.3350-01	-3.2669-01	-3.1854-01	-3.0935-01	-2.9944-01	
-2.8912-01	-2.7864-01	-2.6818-01	-2.5788-01							

SPAN STATION 3 CHORD STATION 4

1.1841+00	1.1861+00	1.1889+00	1.1924+00	1.1965+00	1.2008+00	1.2050+00	1.2088+00	1.2116+00	1.2132+00	
1.2135+00	1.2122+00	1.2094+00	1.2052+00	1.1999+00	1.1938+00	1.1873+00	1.1808+00	1.1746+00	1.1691+00	
1.1645+00	1.1608+00	1.1562+00	1.1564+00	1.1554+00	1.1550+00	1.1549+00	1.1549+00	1.1548+00	1.1545+00	
1.1538+00	1.1527+00	1.1512+00	1.1494+00	1.1471+00	1.1446+00	1.1417+00	1.1386+00	1.1351+00	1.1313+00	
1.1270+00	1.1223+00	1.1172+00	1.1116+00	1.1057+00	1.0997+00	1.0938+00	1.0883+00	1.0835+00	1.0797+00	
1.0773+00	1.0764+00	1.0773+00	1.0801+00	1.0845+00	1.0906+00	1.0979+00	1.1061+00	1.1149+00	1.1236+00	
1.1324+00	1.1405+00	1.1478+00	1.1544+00	1.1602+00	1.1653+00	1.1702+00	1.1749+00	1.1799+00	1.1854+00	
1.1914+00	1.1982+00	1.2056+00	1.2134+00	1.2212+00	1.2286+00	1.2352+00	1.2405+00	1.2441+00	1.2457+00	
1.2451+00	1.2424+00	1.2378+00	1.2317+00	1.2245+00	1.2170+00	1.2096+00	1.2031+00	1.1979+00	1.1945+00	
1.1929+00	1.1932+00	1.1951+00	1.1983+00	1.2023+00	1.2065+00	1.2102+00	1.2131+00	1.2146+00	1.2165+00	
1.2129+00	1.2098+00	1.2056+00	1.2008+00	1.1959+00	1.1917+00	1.1885+00	1.1868+00	1.1870+00	1.1891+00	
1.1930+00	1.1983+00	1.2046+00	1.2112+00	1.2174+00	1.2226+00	1.2263+00	1.2279+00	1.2272+00	1.2241+00	
1.2189+00	1.2119+00	1.2037+00	1.1947+00	1.1858+00	1.1776+00	1.1705+00	1.1650+00	1.1614+00	1.1597+00	
1.1597+00	1.1613+00	1.1640+00	1.1673+00	1.1709+00	1.1743+00	1.1772+00	1.1794+00	1.1809+00	1.1817+00	
1.1821+00	1.1822+00	1.1824+00	1.1829+00							

SPAN STATION 3 CHORD STATION 5

2.1612-01	2.0958-01	2.0955-01	2.1001-01	2.1087-01	2.1195-01	2.1304-01	2.1393-01	2.1440-01	2.1427-01	
2.1344-01	2.1184-01	2.0953-01	2.0660-01	2.0323-01	1.9963-01	1.9601-01	1.9261-01	1.8961-01	1.8717-01	
1.8535-01	1.8419-01	1.8365-01	1.8362-01	1.8398-01	1.8458-01	1.8525-01	1.8587-01	1.8631-01	1.8650-01	
1.8641-01	1.8604-01	1.8540-01	1.8496-01	1.8355-01	1.8242-01	1.8120-01	1.7991-01	1.7854-01	1.7706-01	
1.7547-01	1.7372-01	1.7183-01	1.6982-01	1.6773-01	1.6567-01	1.6375-01	1.6212-01	1.6092-01	1.6031-01	
1.6040-01	1.6125-01	1.6289-01	1.6527-01	1.6826-01	1.7169-01	1.7534-01	1.7897-01	1.8235-01	1.8528-01	
1.8759-01	1.8921-01	1.9016-01	1.9052-01	1.9047-01	1.9025-01	1.9013-01	1.9040-01	1.9131-01	1.9304-01	
1.9569-01	1.9928-01	2.0369-01	2.0869-01	2.1400-01	2.1926-01	2.2407-01	2.2809-01	2.3102-01	2.3263-01	
2.3284-01	2.3167-01	2.2931-01	2.2603-01	2.2220-01	2.1823-01	2.1456-01	2.1158-01	2.0958-01	2.0878-01	
2.0924-01	2.1089-01	2.1354-01	2.1688-01	2.2053-01	2.2409-01	2.2717-01	2.2944-01	2.3066-01	2.3074-01	
2.2970-01	2.2770-01	2.2500-01	2.2197-01	2.1899-01	2.1647-01	2.1473-01	2.1403-01	2.1449-01	2.1611-01	
2.1874-01	2.2211-01	2.2584-01	2.2951-01	2.3269-01	2.3496-01	2.3601-01	2.3563-01	2.3374-01	2.3043-01	
2.2590-01	2.2050-01	2.1465-01	2.0880-01	2.0340-01	1.9887-01	1.9552-01	1.9354-01	1.9301-01	1.9385-01	
1.9588-01	1.9879-01	2.0225-01	2.0587-01	2.0930-01	2.1222-01	2.1443-01	2.1578-01	2.1628-01	2.1600-01	
2.1511-01	2.1363-01	2.1242-01	2.1112-01							

SPAN STATION 4 CHORD STATION 1

6.8097+00	6.7317+00	6.6777+00	6.6518+00	6.6572+00	6.6947+00	6.7634+00	6.8597+00	6.9781+00	7.1114+00	
7.2513+00	7.3892+00	7.5171+00	7.6282+00	7.7175+00	7.7826+00	7.8233+00	7.8420+00	7.8432+00	7.8329+00	
7.8181+00	7.8059+00	7.8029+00	7.8144+00	7.8443+00	7.8947+00	7.9657+00	8.0559+00	8.1627+00	8.2829+00	
8.4129+00	8.5495+00	8.6904+00	8.8341+00	8.9802+00	9.1293+00	9.2826+00	9.4415+00	9.6069+00	9.7794+00	
9.9579+00	1.0140+01	1.0323+01	1.0500+01	1.0665+01	1.0813+01	1.0937+01	1.1030+01	1.1090+01	1.1113+01	
1.1101+01	1.1055+01	1.0982+01	1.0888+01	1.0782+01	1.0672+01	1.0568+01	1.0476+01	1.0403+01	1.0352+01	
1.0324+01	1.0317+01	1.0328+01	1.0350+01	1.0378+01	1.0405+01	1.0424+01	1.0430+01	1.0420+01	1.0394+01	
1.0352+01	1.0297+01	1.0234+01	1.0169+01	1.0107+01	1.0054+01	1.0013+01	9.9886+00	9.9801+00	9.9867+00	
1.0006+01	1.0032+01	1.0063+01	1.0092+01	1.0116+01	1.0131+01	1.0137+01	1.0134+01	1.0125+01	1.0114+01	
1.0105+01	1.0103+01	1.0114+01	1.0141+01	1.0185+01	1.0248+01	1.0328+01	1.0419+01	1.0518+01	1.0616+01	
1.0708+01	1.0787+01	1.0849+01	1.0889+01	1.0909+01	1.0908+01	1.0893+01	1.0868+01	1.0840+01	1.0818+01	
1.0809+01	1.0817+01	1.0846+01	1.0896+01	1.0966+01	1.1049+01	1.1137+01	1.1221+01	1.1290+01	1.1332+01	
1.1339+01	1.1303+01	1.1219+01	1.1085+01	1.0903+01	1.0679+01	1.0420+01	1.0136+01	9.8365+00	9.5329+00	
9.2349+00	8.9505+00	8.6854+00	8.4431+00	8.2244+00	8.0281+00	7.8514+00	7.6905+00	7.5414+00	7.4010+00	
7.2669+00	7.1388+00	7.0178+00	6.9067+00							

SPAN STATION 4 CHORD STATION 2

Figure 50. Continued.

2.2403+00	2.2222+00	2.2074+00	2.1970+00	2.1923+00	2.1942+00	2.2035+00	2.2202+00	2.2439+00	2.2736+00
2.3081+00	2.3458+00	2.3851+00	2.4242+00	2.4619+00	2.4971+00	2.5289+00	2.5569+00	2.5811+00	2.6014+00
2.6183+00	2.6324+00	2.6441+00	2.6546+00	2.6650+00	2.6767+00	2.6916+00	2.7119+00	2.7404+00	2.7800+00
2.8338+00	2.9050+00	2.9961+00	3.1092+00	3.2454+00	3.4041+00	3.5836+00	3.7801+00	3.9885+00	4.2021+00
4.4130+00	4.6130+00	4.7938+00	4.9476+00	5.0684+00	5.1517+00	5.1959+00	5.2015+00	5.1723+00	5.1142+00
5.0354+00	4.9454+00	4.8536+00	4.7705+00	4.7045+00	4.6621+00	4.6476+00	4.6620+00	4.7037+00	4.7680+00
4.8481+00	4.9354+00	5.0205+00	5.0944+00	5.1487+00	5.1772+00	5.1759+00	5.1436+00	5.0818+00	4.9949+00
4.8890+00	4.7719+00	4.6518+00	4.5370+00	4.4345+00	4.3497+00	4.2860+00	4.2445+00	4.2238+00	4.2210+00
4.2514+00	4.2496+00	4.2702+00	4.2884+00	4.3006+00	4.3047+00	4.3004+00	4.2892+00	4.2740+00	4.2587+00
4.2477+00	4.2450+00	4.2539+00	4.2763+00	4.3123+00	4.3604+00	4.4171+00	4.4777+00	4.5364+00	4.5875+00
4.6255+00	4.6461+00	4.6468+00	4.6270+00	4.5887+00	4.5357+00	4.4740+00	4.4105+00	4.3529+00	4.3885+00
4.2836+00	4.2826+00	4.3075+00	4.3599+00	4.4302+00	4.5187+00	4.6154+00	4.7108+00	4.7952+00	4.8588+00
4.8932+00	4.8918+00	4.8506+00	4.7681+00	4.6460+00	4.4884+00	4.3017+00	4.0939+00	3.8742+00	3.6515+00
3.4344+00	3.2305+00	3.0453+00	2.8827+00	2.7444+00	2.6305+00	2.5392+00	2.4678+00	2.4125+00	2.3696+00
2.3356+00	2.3074+00	2.2829+00	2.2606+00						

SPAN STATION 4 CHORD STATION 3

1.2172+00	1.1939+00	1.1736+00	1.1580+00	1.1487+00	1.1468+00	1.1527+00	1.1661+00	1.1858+00	1.2103+00
1.2373+00	1.2646+00	1.2897+00	1.3109+00	1.3267+00	1.3365+00	1.3405+00	1.3395+00	1.3351+00	1.3294+00
1.3245+00	1.3225+00	1.3253+00	1.3341+00	1.3496+00	1.3716+00	1.3995+00	1.4318+00	1.4669+00	1.5032+00
1.5389+00	1.5728+00	1.6043+00	1.6333+00	1.6604+00	1.6866+00	1.7136+00	1.7428+00	1.7759+00	1.8137+00
1.8567+00	1.9046+00	1.9560+00	2.0089+00	2.0606+00	2.1079+00	2.1475+00	2.1764+00	2.1921+00	2.1931+00
2.1788+00	2.1500+00	2.1086+00	2.0574+00	2.0003+00	1.9412+00	1.8846+00	1.8341+00	1.7931+00	1.7637+00
1.7471+00	1.7429+00	1.7500+00	1.7661+00	1.7884+00	1.8135+00	1.8384+00	1.8603+00	1.8772+00	1.8880+00
1.8924+00	1.8913+00	1.8861+00	1.8789+00	1.8719+00	1.8674+00	1.8671+00	1.8721+00	1.8828+00	1.8986+00
1.9182+00	1.9397+00	1.9607+00	1.9788+00	1.9919+00	1.9982+00	1.9970+00	1.9882+00	1.9727+00	1.9523+00
1.9293+00	1.9064+00	1.8863+00	1.8717+00	1.8642+00	1.8650+00	1.8742+00	1.8909+00	1.9135+00	1.9396+00
1.9665+00	1.9914+00	2.0121+00	2.0268+00	2.0347+00	2.0359+00	2.0316+00	2.0240+00	2.0156+00	2.0096+00
2.0090+00	2.0163+00	2.0332+00	2.0605+00	2.0975+00	2.1425+00	2.1924+00	2.2433+00	2.2907+00	2.3302+00
2.3574+00	2.3687+00	2.3617+00	2.3352+00	2.2895+00	2.2263+00	2.1486+00	2.0602+00	1.9655+00	1.8692+00
1.7756+00	1.6884+00	1.6104+00	1.5432+00	1.4872+00	1.4420+00	1.4060+00	1.3772+00	1.3532+00	1.3317+00
1.3107+00	1.2890+00	1.2659+00	1.2417+00						

SPAN STATION 4 CHORD STATION 4

3.3830-01	3.3019-01	3.2140-01	3.1259-01	3.0447-01	2.9768-01	2.9272-01	2.8990-01	2.8930-01	2.9075-01
2.9390-01	2.9818-01	3.0296-01	3.0755-01	3.1132-01	3.1375-01	3.1449-01	3.1340-01	3.1057-01	3.0627-01
3.0099-01	2.9532-01	2.8992-01	2.8548-01	2.8262-01	2.8185-01	2.8354-01	2.8788-01	2.9490-01	3.0444-01
3.1623-01	3.2986-01	3.4488-01	3.6079-01	3.7708-01	3.9329-01	4.0899-01	4.2381-01	4.3742-01	4.4956-01
4.5999-01	4.6852-01	4.7498-01	4.7923-01	4.8119-01	4.8079-01	4.7805-01	4.7307-01	4.6604-01	4.5723-01
4.4703-01	4.3592-01	4.2443-01	4.1313-01	4.0261-01	3.9340-01	3.8595-01	3.8059-01	3.7753-01	3.7679-01
3.7827-01	3.8170-01	3.8575-01	3.9297-01	3.9994-01	4.0722-01	4.1447-01	4.2144-01	4.2880-01	4.3413-01
4.3992-01	4.4555-01	4.5121-01	4.5712-01	4.6342-01	4.7019-01	4.7737-01	4.8481-01	4.9224-01	4.9928-01
5.0554-01	5.1060-01	5.1411-01	5.1585-01	5.1571-01	5.1378-01	5.1034-01	5.0581-01	5.0078-01	4.9586-01
4.9172-01	4.8893-01	4.8795-01	4.8902-01	4.9220-01	4.9728-01	5.0382-01	5.1124-01	5.1880-01	5.2575-01
5.3141-01	5.3521-01	5.3682-01	5.3617-01	5.3351-01	5.2934-01	5.2443-01	5.1971-01	5.1619-01	5.1483-01
5.1645-01	5.2162-01	5.3058-01	5.4317-01	5.5883-01	5.7665-01	5.9539-01	6.1362-01	6.2980-01	6.4247-01
6.5034-01	6.5243-01	6.4814-01	6.3736-01	6.2041-01	5.9899-01	5.7154-01	5.4216-01	5.1159-01	4.8134-01
4.5288-01	4.2741-01	4.0579-01	3.8851-01	3.7563-01	3.6683-01	3.6148-01	3.5871-01	3.5752-01	3.5691-01
3.5596-01	3.5395-01	3.5041-01	3.4516-01						

SPAN STATION 4 CHORD STATION 5

-3.7764-01	-3.7991-01	-3.8323-01	-3.8730-01	-3.9177-01	-3.9632-01	-4.0066-01	-4.0456-01	-4.0790-01	-4.1063-01
-4.1281-01	-4.1456-01	-4.1608-01	-4.1756-01	-4.1921-01	-4.2119-01	-4.2361-01	-4.2652-01	-4.2987-01	-4.3355-01
-4.3738-01	-4.4115-01	-4.4462-01	-4.4757-01	-4.4979-01	-4.5116-01	-4.5160-01	-4.5110-01	-4.4973-01	-4.4760-01
-4.4489-01	-4.4177-01	-4.3842-01	-4.3499-01	-4.3161-01	-4.2834-01	-4.2518-01	-4.2211-01	-4.1904-01	-4.1589-01

Figure 50. Continued.

-4.1256-01	-4.0896-01	-4.0587-01	-4.0088-01	-3.9646-01	-3.9194-01	-3.8749-01	-3.8330-01	-3.7962-01	-3.7663-01
-3.7454-01	-3.7346-01	-3.7347-01	-3.7454-01	-3.7658-01	-3.7942-01	-3.8284-01	-3.8656-01	-3.9029-01	-3.9375-01
-3.9668-01	-3.9888-01	-4.0020-01	-4.0053-01	-4.0001-01	-3.9857-01	-3.9639-01	-3.9362-01	-3.9046-01	-3.8710-01
-3.8372-01	-3.8047-01	-3.7746-01	-3.7477-01	-3.7243-01	-3.7046-01	-3.6881-01	-3.6745-01	-3.6633-01	-3.6538-01
-3.6457-01	-3.6385-01	-3.6320-01	-3.6261-01	-3.6205-01	-3.6153-01	-3.6102-01	-3.6056-01	-3.5996-01	-3.5935-01
-3.5866-01	-3.5784-01	-3.5689-01	-3.5579-01	-3.5454-01	-3.5319-01	-3.5176-01	-3.5032-01	-3.4892-01	-3.4759-01
-3.4638-01	-3.4527-01	-3.4423-01	-3.4318-01	-3.4199-01	-3.4053-01	-3.3863-01	-3.3612-01	-3.3287-01	-3.2880-01
-3.2387-01	-3.1816-01	-3.1182-01	-3.0513-01	-2.9843-01	-2.9213-01	-2.8671-01	-2.8262-01	-2.8031-01	-2.8014-01
-2.8234-01	-2.8705-01	-2.9420-01	-3.0357-01	-3.1480-01	-3.2737-01	-3.4067-01	-3.5404-01	-3.6679-01	-3.7830-01
-3.8805-01	-3.9564-01	-4.0084-01	-4.0341-01	-4.0407-01	-4.0253-01	-3.9941-01	-3.9523-01	-3.9056-01	-3.8596-01
-3.8192-01	-3.7885-01	-3.7705-01	-3.7664-01						

SPAN STATION 5 CHORD STATION 1

5.7527+00	5.6632+00	5.6265+00	5.6278+00	5.6709+00	5.7536+00	5.8724+00	6.0228+00	6.1995+00	6.3964+00
6.6072+00	6.8255+00	7.0455+00	7.2617+00	7.4697+00	7.6663+00	7.8494+00	8.0181+00	8.1722+00	8.3149+00
8.4464+00	8.5700+00	8.6863+00	8.8039+00	8.9190+00	9.0352+00	9.1533+00	9.2735+00	9.3951+00	9.5169+00
9.6373+00	9.7544+00	9.8664+00	9.9719+00	1.0070+01	1.0159+01	1.0240+01	1.0314+01	1.0381+01	1.0443+01
1.0502+01	1.0560+01	1.0617+01	1.0674+01	1.0733+01	1.0793+01	1.0854+01	1.0913+01	1.0979+01	1.1022+01
1.1067+01	1.1103+01	1.1129+01	1.1143+01	1.1145+01	1.1136+01	1.1115+01	1.1084+01	1.1045+01	1.1001+01
1.0952+01	1.0903+01	1.0854+01	1.0809+01	1.0767+01	1.0731+01	1.0701+01	1.0678+01	1.0660+01	1.0647+01
1.0639+01	1.0634+01	1.0631+01	1.0630+01	1.0629+01	1.0628+01	1.0626+01	1.0623+01	1.0618+01	1.0612+01
1.0605+01	1.0596+01	1.0587+01	1.0577+01	1.0568+01	1.0560+01	1.0554+01	1.0550+01	1.0549+01	1.0551+01
1.0558+01	1.0570+01	1.0586+01	1.0606+01	1.0631+01	1.0660+01	1.0692+01	1.0727+01	1.0765+01	1.0803+01
1.0843+01	1.0883+01	1.0924+01	1.0967+01	1.1010+01	1.1057+01	1.1106+01	1.1160+01	1.1219+01	1.1283+01
1.1352+01	1.1426+01	1.1503+01	1.1581+01	1.1657+01	1.1728+01	1.1789+01	1.1836+01	1.1864+01	1.1869+01
1.1847+01	1.1794+01	1.1708+01	1.1587+01	1.1430+01	1.1237+01	1.1011+01	1.0754+01	1.0468+01	1.0158+01
9.8281+00	9.4830+00	9.1277+00	8.7669+00	8.4056+00	8.0486+00	7.7006+00	7.3660+00	7.0493+00	6.7549+00
6.4869+00	6.2492+00	6.0456+00	5.8792+00						

SPAN STATION 5 CHORD STATION 2

1.5997+00	1.5720+00	1.5556+00	1.5511+00	1.5588+00	1.5784+00	1.6090+00	1.6492+00	1.6968+00	1.7491+00
1.8056+00	1.8618+00	1.9161+00	1.9667+00	2.0122+00	2.0518+00	2.0855+00	2.1137+00	2.1375+00	2.1581+00
2.1772+00	2.1964+00	2.2171+00	2.2407+00	2.2679+00	2.2990+00	2.3341+00	2.3726+00	2.4137+00	2.4564+00
2.4997+00	2.5424+00	2.5838+00	2.6233+00	2.6603+00	2.6950+00	2.7273+00	2.7575+00	2.7860+00	2.8130+00
2.8386+00	2.8626+00	2.8848+00	2.9045+00	2.9210+00	2.9334+00	2.9409+00	2.9428+00	2.9387+00	2.9285+00
2.9126+00	2.8918+00	2.8673+00	2.8405+00	2.8133+00	2.7873+00	2.7643+00	2.7455+00	2.7319+00	2.7239+00
2.7215+00	2.7240+00	2.7303+00	2.7389+00	2.7483+00	2.7567+00	2.7627+00	2.7652+00	2.7634+00	2.7571+00
2.7467+00	2.7328+00	2.7168+00	2.6998+00	2.6834+00	2.6688+00	2.6572+00	2.6492+00	2.6452+00	2.6449+00
2.6477+00	2.6526+00	2.6586+00	2.6644+00	2.6690+00	2.6715+00	2.6717+00	2.6692+00	2.6645+00	2.6584+00
2.6519+00	2.6462+00	2.6426+00	2.6420+00	2.6452+00	2.6527+00	2.6641+00	2.6791+00	2.6966+00	2.7155+00
2.7342+00	2.7514+00	2.7658+00	2.7767+00	2.7835+00	2.7863+00	2.7857+00	2.7826+00	2.7784+00	2.7746+00
2.7728+00	2.7743+00	2.7800+00	2.7905+00	2.8057+00	2.8248+00	2.8466+00	2.8694+00	2.8910+00	2.9093+00
2.9219+00	2.9271+00	2.9231+00	2.9089+00	2.8839+00	2.8483+00	2.8025+00	2.7477+00	2.6852+00	2.6166+00
2.5435+00	2.4673+00	2.3893+00	2.3108+00	2.2324+00	2.1549+00	2.0785+00	2.0046+00	1.9327+00	1.8638+00
1.7987+00	1.7384+00	1.6843+00	1.6376+00						

SPAN STATION 5 CHORD STATION 3

6.6846-01	6.3821-01	6.1418-01	5.9583-01	5.8485-01	5.8198-01	5.8756-01	6.0141-01	6.2281-01	6.5057-01
6.8313-01	7.1867-01	7.5527-01	7.9114-01	8.2471-01	8.5482-01	8.8078-01	9.0244-01	9.2013-01	9.3463-01
9.4706-01	9.5870-01	9.7086-01	9.8476-01	1.0013+00	1.0212+00	1.0446+00	1.0713+00	1.1010+00	1.1328+00
1.1658+00	1.1991+00	1.2318+00	1.2633+00	1.2931+00	1.3210+00	1.3469+00	1.3711+00	1.3938+00	1.4153+00
1.4358+00	1.4552+00	1.4733+00	1.4897+00	1.5037+00	1.5146+00	1.5214+00	1.5235+00	1.5203+00	1.5115+00
1.4973+00	1.4783+00	1.4554+00	1.4300+00	1.4038+00	1.3785+00	1.3559+00	1.3376+00	1.3248+00	1.3181+00
1.3178+00	1.3235+00	1.3342+00	1.3485+00	1.3647+00	1.3810+00	1.3956+00	1.4070+00	1.4139+00	1.4157+00
1.4124+00	1.4042+00	1.3922+00	1.3776+00	1.3620+00	1.3468+00	1.3336+00	1.3234+00	1.3169+00	1.3145+00
1.3161+00	1.3209+00	1.3281+00	1.3366+00	1.3453+00	1.3532+00	1.3594+00	1.3636+00	1.3658+00	1.3663+00

Figure 50. Continued.

1.3659+00	1.3654+00	1.3660+00	1.3686+00	1.3740+00	1.3828+00	1.3951+00	1.4106+00	1.4285+00	1.4480+00
1.4676+00	1.4862+00	1.5025+00	1.5137+00	1.5251+00	1.5308+00	1.5331+00	1.5329+00	1.5315+00	1.5302+00
1.5306+00	1.5341+00	1.5415+00	1.5536+00	1.5702+00	1.5907+00	1.6137+00	1.6376+00	1.6602+00	1.6792+00
1.6922+00	1.6972+00	1.6927+00	1.6777+00	1.6518+00	1.6154+00	1.5696+00	1.5139+00	1.4563+00	1.3929+00
1.3279+00	1.2631+00	1.2004+00	1.1406+00	1.0846+00	1.0325+00	9.8400-01	9.3860-01	8.9563-01	8.5442-01
8.1446-01	7.7556-01	7.3784-01	7.0185-01						

SPAN STATION 5 CHORD STATION 4

2.8498-01	2.7219-01	2.6039-01	2.5004-01	2.4162-01	2.3559-01	2.3235-01	2.3211-01	2.3496-01	2.4075-01
2.4915-01	2.5958-01	2.7171-01	2.8454-01	2.9748-01	3.0988-01	3.2120-01	3.3108-01	3.3933-01	3.4595-01
3.5114-01	3.5525-01	3.5872-01	3.6208-01	3.658[illegible]-01	3.7041-01	3.7620-01	3.8344-01	3.9222-01	4.0250-01
4.1411-01	4.2679-01	4.4022-01	4.5406-01	4.6795-01	4.8160-01	4.9474-01	5.0718-01	5.1875-01	5.2935-01
5.3887-01	5.4724-01	5.5432-01	5.6001-01	5.6412-01	5.6650-01	5.6697-01	5.6540-01	5.6172-01	5.5595-01
5.4825-01	5.3888-01	5.2827-01	5.1697-01	5.0560-01	4.9466-01	4.8541-01	4.7788-01	4.7274-01	4.7032-01
4.7072-01	4.7382-01	4.7928-01	4.8658-01	4.9497-01	5.0375-01	5.1210-01	5.1930-01	5.2476-01	5.2803-01
5.2905-01	5.2775-01	5.2445-01	5.1961-01	5.1384-01	5.0783-01	5.0229-01	4.9767-01	4.9458-01	4.9323-01
4.9372-01	4.9589-01	4.9944-01	5.0391-01	5.0880-01	5.1358-01	5.1778-01	5.2106-01	5.2323-01	5.2430-01
5.2446-01	5.2403-01	5.2347-01	5.2328-01	5.2396-01	5.2591-01	5.2939-01	5.3451-01	5.4116-01	5.4904-01
5.5770-01	5.6657-01	5.7503-01	5.8248-01	5.8844-01	5.9254-01	5.9467-01	5.9490-01	5.9355-01	5.9109-01
5.8818-01	5.8549-01	5.8370-01	5.8340-01	5.8500-01	5.8867-01	5.9434-01	6.0166-01	6.1004-01	6.1870-01
6.2675-01	6.3323-01	6.3726-01	6.3808-01	6.3514-01	6.2812-01	6.1702-01	6.0209-01	5.8382-01	5.6289-01
5.4011-01	5.1633-01	4.9234-01	4.6885-01	4.4640-01	4.2533-01	4.0580-01	3.8777-01	3.7107-01	3.5543-01
3.4056-01	3.2619-01	3.1215-01	2.9838-01						

SPAN STATION 5 CHORD STATION 5

4.6318-02	3.5544-02	2.3951-02	1.2104-02	6.8125-04	-9.6008-03	-1.8068-02	-2.4164-02	-2.7569-02	-2.7944-02
-2.5546-02	-2.0620-02	-1.3668-02	-5.3321-03	3.6684-03	1.2615-02	2.0862-02	2.7902-02	3.3412-02	3.7284-02
3.9630-02	4.0763-02	4.1161-02	4.1410-02	4.2145-02	4.3981-02	4.7449-02	5.2953-02	6.0725-02	7.0812-02
8.3080-02	9.7226-02	1.1262-01	1.2934-01	1.4624-01	1.6296-01	1.7990-01	1.9395-01	2.0749-01	2.1942-01
2.2964-01	2.3811-01	2.4469-01	2.5066-01	2.5373-01	2.5599-01	2.5692-01	2.5659-01	2.5505-01	2.5235-01
2.4855-01	2.4375-01	2.3808-01	2.3174-01	2.2496-01	2.1803-01	2.1129-01	2.0506-01	1.9965-01	1.9534-01
1.9230-01	1.9065-01	1.9037-01	1.9133-01	1.9334-01	1.9609-01	1.9925-01	2.0247-01	2.0541-01	2.0781-01
2.0948-01	2.1032-01	2.1036-01	2.0972-01	2.0857-01	2.0717-01	2.0575-01	2.0467-01	2.0402-01	2.0396-01
2.0454-01	2.0573-01	2.0740-01	2.0937-01	2.1144-01	2.1340-01	2.1509-01	2.1638-01	2.1727-01	2.1782-01
2.1817-01	2.1856-01	2.1926-01	2.2053-01	2.2264-01	2.2576-01	2.3000-01	2.3534-01	2.4166-01	2.4872-01
2.5623-01	2.6383-01	2.7117-01	2.7793-01	2.8389-01	2.8894-01	2.9309-01	2.9650-01	2.9941-01	3.0219-01
3.0520-01	3.0881-01	3.1331-01	3.1885-01	3.2542-01	3.3281-01	3.4063-01	3.4830-01	3.5512-01	3.6031-01
3.6309-01	3.6276-01	3.5875-01	3.5072-01	3.3860-01	3.2256-01	3.0308-01	2.8087-01	2.5680-01	2.3189-01
2.0717-01	1.8358-01	1.6194-01	1.4286-01	1.2666-01	1.1340-01	1.0287-01	9.4618-02	8.8023-02	8.2363-02
7.6903-02	7.0981-02	6.4080-02	5.5885-02						

COS AND SIN COEFFICIENTS OF ACOUSTIC PRESSURE PULSE AT EACH OF 144 AZIMUTHAL STATIONS AT EACH BLADE STATION FOR HARMONIC M= 1

BLADE STATION= 1

2.0029-02	2.0527-02	2.0978-02	2.1357-02	2.1648-02	2.1840-02	2.1935-02	2.1940-02	2.1871-02	2.1741-02
2.1597-02	2.1437-02	2.1326-02	2.1254-02	2.1245-02	2.1305-02	2.1429-02	2.1610-02	2.1832-02	2.2079-02
2.2335-02	2.2582-02	2.2804-02	2.2989-02	2.3129-02	2.3218-02	2.3255-02	2.3245-02	2.3189-02	2.3114-02
2.3015-02	2.2907-02	2.2796-02	2.2688-02	2.2580-02	2.2466-02	2.2336-02	2.2176-02	2.1972-02	2.1714-02
2.1394-02	2.1014-02	2.0579-02	2.0100-02	1.9589-02	1.9062-02	1.8533-02	1.8014-02	1.7516-02	1.7046-02
1.6610-02	1.6212-02	1.5855-02	1.5541-02	1.5274-02	1.5056-02	1.4888-02	1.4774-02	1.4715-02	1.4714-02
1.4774-02	1.4901-02	1.5097-02	1.5365-02	1.5703-02	1.6105-02	1.6554-02	1.7032-02	1.7510-02	1.7957-02
1.8346-02	1.8650-02	1.8853-02	1.8949-02	1.8937-02	1.8823-02	1.8616-02	1.8327-02	1.7979-02	1.7559-02
1.7112-02	1.6644-02	1.6165-02	1.5681-02	1.5197-02	1.4719-02	1.4255-02	1.3816-02	1.3419-02	1.3066-02
1.2759-02	1.2498-02	1.2277-02	1.2089-02	1.1927-02	1.1786-02	1.1665-02	1.1562-02	1.1481-02	1.1424-02
1.1394-02	1.1392-02	1.1418-02	1.1470-02	1.1544-02	1.1634-02	1.1731-02	1.1829-02	1.1921-02	1.2000-02
1.2062-02	1.2108-02	1.2139-02	1.2162-02	1.2186-02	1.2224-02	1.2294-02	1.2410-02	1.2587-02	1.2836-02
1.3161-02	1.3558-02	1.4014-02	1.4512-02	1.5029-02	1.5540-02	1.6019-02	1.6445-02	1.6802-02	1.7079-02
1.7274-02	1.7390-02	1.7439-02	1.7438-02	1.7412-02	1.7388-02	1.7395-02	1.7459-02	1.7600-02	1.7828-02

Figure 50. Continued.

1.8146	1.8545-02	1.90[illegible]-02	1.9513-02							
-8.2116-03	-8.3771-03	-8.5257-03	-8.6480-03	-8.7374-03	-8.7901-03	-8.8059-03	-8.7870-03	-8.7389-03	-8.6687-03	
-8.5860-03	-8.4976-03	-8.4246-03	-8.3648-03	-8.3278-03	-8.3169-03	-8.3304-03	-8.3670-03	-8.4216-03	-8.4884-03	
-8.5608-03	-8.6323-03	-8.6971-03	-8.7504-03	-8.7888-03	-8.8107-03	-8.8161-03	-8.8069-03	-8.7842-03	-8.7578-03	
-8.7264-03	-8.6952-03	-8.6669-03	-8.6427-03	-8.6217-03	-8.6011-03	-8.5762-03	-8.5414-03	-8.4912-03	-8.4213-03	
-8.3297-03	-8.2165-03	-8.0845-03	-7.9399-03	-7.7817-03	-7.6211-03	-7.4604-03	-7.3034-03	-7.1527-03	-7.0097-03	
-6.8755-03	-6.7506-03	-6.6358-03	-6.5321-03	-6.4411-03	-6.3643-03	-6.3033-03	-6.2596-03	-6.2342-03	-6.2284-03	
-6.2436-03	-6.2813-03	-6.3430-03	-6.4296-03	-6.5407-03	-6.6739-03	-6.8241-03	-6.9840-03	-7.1437-03	-7.2926-03	
-7.4202-03	-7.5186-03	-7.5832-03	-7.6133-03	-7.6111-03	-7.5802-03	-7.5253-03	-7.4511-03	-7.3630-03	-7.2661-03	
-7.1649-03	-7.0628-03	-6.9604-03	-6.8564-03	-6.7482-03	-6.6347-03	-6.5167-03	-6.3975-03	-6.2805-03	-6.1692-03	
-6.0657-03	-5.9708-03	-5.8847-03	-5.8074-03	-5.7390-03	-5.6800-03	-5.6317-03	-5.5958-03	-5.5741-03	-5.5680-03	
-5.5781-03	-5.6039-03	-5.6439-03	-5.6952-03	-5.7541-03	-5.8169-03	-5.8775-03	-5.9331-03	-5.9793-03	-6.0131-03	
-6.0326-03	-6.0371-03	-6.0277-03	-6.0070-03	-5.9794-03	-5.9510-03	-5.9293-03	-5.9223-03	-5.9379-03	-5.9821-03	
-6.0582-03	-6.1663-03	-6.3028-03	-6.4611-03	-6.6325-03	-6.8067-03	-6.9736-03	-7.1243-03	-7.2515-03	-7.3587-03	
-7.4196-03	-7.4589-03	-7.4718-03	-7.4642-03	-7.4441-03	-7.4217-03	-7.4076-03	-7.4120-03	-7.4429-03	-7.5052-03	
-7.6000-03	-7.7251-03	-7.8747-03	-8.0404-03							

BLADE STATION= 2

3.9301-02	4.0189-02	4.1050-02	4.1884-02	4.2631-02	4.3273-02	4.3790-02	4.4165-02	4.4393-02	4.4478-02
4.4431-02	4.4271-02	4.4023-02	4.3710-02	4.3358-02	4.2989-02	4.2622-02	4.2270-02	4.1942-02	4.1642-02
4.1370-02	4.1122-02	4.0891-02	4.0670-02	4.0450-02	4.0223-02	3.9985-02	3.9732-02	3.9465-02	3.9136-02
3.8901-02	3.8613-02	3.8329-02	3.8054-02	3.7788-02	3.7534-02	3.7289-02	3.7047-02	3.6801-02	3.6542-02
3.6259-02	3.5940-02	3.5576-02	3.5158-02	3.4681-02	3.4144-02	3.3549-02	3.2904-02	3.2218-02	3.1534-02
3.0778-02	3.0054-02	2.9349-02	2.8676-02	2.8050-02	2.7482-02	2.6984-02	2.6564-02	2.6227-02	2.5977-02
2.5811-02	2.5727-02	2.5714-02	2.5763-02	2.5859-02	2.5987-02	2.6132-02	2.6277-02	2.6408-02	2.6512-02
2.6579-02	2.6601-02	2.6573-02	2.6493-02	2.6363-02	2.6189-02	2.5976-02	2.5735-02	2.5476-02	2.5210-02
2.4950-02	2.4705-02	2.4485-02	2.4299-02	2.4152-02	2.4050-02	2.3998-02	2.3999-02	2.4052-02	2.4158-02
2.4313-02	2.4512-02	2.4746-02	2.5006-02	2.5280-02	2.5558-02	2.5829-02	2.6086-02	2.6324-02	2.6539-02
2.6730-02	2.6899-02	2.7045-02	2.7169-02	2.7275-02	2.7364-02	2.7440-02	2.7507-02	2.7572-02	2.7641-02
2.7721-02	2.7819-02	2.7938-02	2.8082-02	2.8252-02	2.8448-02	2.8669-02	2.8914-02	2.9179-02	2.9462-02
2.9758-02	3.0063-02	3.0372-02	3.0680-02	3.0983-02	3.1277-02	3.1557-02	3.1821-02	3.2069-02	3.2301-02
3.2519-02	3.2730-02	3.2940-02	3.3161-02	3.3405-02	3.3687-02	3.4020-02	3.4417-02	3.4888-02	3.5442-02
3.6078-02	3.6794-02	3.7580-02	3.8423-02						
-5.0087-03	-5.1201-03	-5.2300-03	-5.3345-03	-5.4299-03	-5.5124-03	-5.5792-03	-5.6282-03	-5.6587-03	-5.6712-03
-5.6676-03	-5.6507-03	-5.6238-03	-5.5901-03	-5.5525-03	-5.5136-03	-5.4749-03	-5.4376-03	-5.4020-03	-5.3681-03
-5.3354-03	-5.3031-03	-5.2706-03	-5.2369-03	-5.2016-03	-5.1643-03	-5.1251-03	-5.0844-03	-5.0429-03	-5.0016-03
-4.9616-03	-4.9237-03	-4.8888-03	-4.8534-03	-4.8297-03	-4.8053-03	-4.7836-03	-4.7635-03	-4.7438-03	-4.7229-03
-4.6993-03	-4.6714-03	-4.6380-03	-4.5981-03	-4.5510-03	-4.4967-03	-4.4353-03	-4.3676-03	-4.2945-03	-4.2172-03
-4.1371-03	-4.0557-03	-3.9744-03	-3.8948-03	-3.8132-03	-3.7460-03	-3.6796-03	-3.6201-03	-3.5685-03	-3.5257-03
-3.4921-03	-3.4679-03	-3.4529-03	-3.4465-03	-3.4477-03	-3.4552-03	-3.4672-03	-3.4820-03	-3.4976-03	-3.5119-03
-3.5230-03	-3.5293-03	-3.5294-03	-3.5225-03	-3.5081-03	-3.4865-03	-3.4585-03	-3.4252-03	-3.3883-03	-3.3497-03
-3.3114-03	-3.2755-03	-3.2436-03	-3.2174-03	-3.1978-03	-3.1856-03	-3.1811-03	-3.1840-03	-3.1937-03	-3.2094-03
-3.2297-03	-3.2531-03	-3.2781-03	-3.3050-03	-3.3265-03	-3.3474-03	-3.3652-03	-3.3795-03	-3.3907-03	-3.3994-03
-3.4064-03	-3.4128-03	-3.4194-03	-3.4268-03	-3.4356-03	-3.4460-03	-3.4582-03	-3.4720-03	-3.4873-03	-3.5038-03
-3.5213-03	-3.5394-03	-3.5580-03	-3.5769-03	-3.5961-03	-3.6159-03	-3.6364-03	-3.6581-03	-3.6815-03	-3.7070-03
-3.7350-03	-3.7657-03	-3.7990-03	-3.8347-03	-3.8726-03	-3.9119-03	-3.9520-03	-3.9922-03	-4.0319-03	-4.0706-03
-4.1081-03	-4.1445-03	-4.1803-03	-4.2165-03	-4.2544-03	-4.2956-03	-4.3419-03	-4.3950-03	-4.4563-03	-4.5267-03
-4.6067-03	-4.6962-03	-4.7941-03	-4.8991-03						

BLADE STATION= 3

3.6803-02	3.7269-02	3.7703-02	3.8097-02	3.8446-02	3.8765-02	3.8995-02	3.9190-02	3.9329-02	3.9408-02
3.9424-02	3.9372-02	3.9205-02	3.9050-02	3.8772-02	3.8413-02	3.7976-02	3.7464-02	3.6887-02	3.6259-02
3.5595-02	3.4915-02	3.4238-02	3.3583-02	3.2966-02	3.2400-02	3.1895-02	3.1456-02	3.1085-02	3.0778-02
3.0528-02	3.0323-02	3.0151-02	2.9992-02	2.9829-02	2.9642-02	2.9412-02	2.9121-02	2.8755-02	2.8304-02
2.7762-02	2.7132-02	2.6419-02	2.5625-02	2.4798-02	2.3931-02	2.3059-02	2.2209-02	2.1407-02	2.0679-02
2.0048-02	1.9529-02	1.9135-02	1.8871-02	1.8738-02	1.8730-02	1.8837-02	1.9046-02	1.9341-02	1.9706-02
2.0122-02	2.0572-02	2.1041-02	2.1513-02	2.1977-02	2.2423-02	2.2845-02	2.3237-02	2.3596-02	2.3920-02
2.4206-02	2.4453-02	2.4656-02	2.4812-02	2.4917-02	2.4969-02	2.4968-02	2.4914-02	2.4811-02	2.4666-02
2.4489-02	2.4289-02	2.4081-02	2.3876-02	2.3689-02	2.3535-02	2.3428-02	2.3380-02	2.3402-02	2.3501-02
2.3678-02	2.3930-02	2.4246-02	2.4613-02	2.5014-02	2.5428-02	2.5838-02	2.6223-02	2.6570-02	2.6866-02
2.7104-02	2.7281-02	2.7400-02	2.7469-02	2.7500-02	2.7508-02	2.7511-02	2.7524-02	2.7563-02	2.7639-02
2.7760-02	2.7926-02	2.8136-02	2.8383-02	2.8658-02	2.8950-02	2.9248-02	2.9540-02	2.9817-02	3.0870-02

Figure 50. Continued.

3.0291-02	3.0474-02	3.0618-02	3.0724-02	3.0796-02	3.0844-02	3.0879-02	3.0914-02	3.0962-02	3.1036-02
3.1148-02	3.1307-02	3.1516-02	3.1778-02	3.2091-02	3.2452-02	3.2856-02	3.3296-02	3.3766-02	3.4259-02
3.4768-02	3.5285-02	3.5802-02	3.6311-02						
-1.7668-03	-1.8356-03	-1.8930-03	-1.9382-03	-1.9716-03	-1.9951-03	-2.0101-03	-2.0200-03	-2.0269-03	-2.0330-03
-2.0393-03	-2.0463-03	-2.0520-03	-2.0578-03	-2.0581-03	-2.0511-03	-2.0337-03	-2.0037-03	-1.9594-03	-1.8004-03
-1.8277-03	-1.7437-03	-1.6516-03	-1.5554-03	-1.4593-03	-1.3675-03	-1.2833-03	-1.2097-03	-1.1484-03	-1.1001-03
-1.0646-03	-1.0405-03	-1.0255-03	-1.0166-03	-1.0105-03	-1.0035-03	-9.9224-04	-9.7357-04	-9.4517-04	-9.0543-04
-8.5375-04	-7.9033-04	-7.1921-04	-6.3360-04	-5.4283-04	-4.4799-04	-3.5085-04	-2.5360-04	-1.5831-04	-6.6699-05
1.9737-05	9.9707-05	1.7284-04	2.3567-04	2.8966-04	3.3295-04	3.6491-04	3.8490-04	3.9269-04	3.8840-04
3.7265-04	3.4656-04	3.1185-04	2.7073-04	2.2597-04	1.8061-04	1.3792-04	1.0114-04	7.3141-05	5.6182-05
5.1704-05	6.0097-05	8.0700-05	1.1187-04	1.5113-04	1.9548-04	2.4162-04	2.8623-04	3.2622-04	3.5898-04
3.8253-04	3.9570-04	3.9814-04	3.9080-04	3.7373-04	3.4999-04	3.2136-04	2.9008-04	2.5818-04	2.2720-04
1.9809-04	1.7107-04	1.4572-04	1.2112-04	9.6021-05	6.9083-05	3.9096-05	5.1739-08	-3.3122-05	-7.5674-05
-1.2166-04	-1.6971-04	-2.2786-04	-2.6382-04	-3.0517-04	-3.3969-04	-3.6567-04	-3.8222-04	-3.8934-04	-3.8817-04
-3.8070-04	-3.6968-04	-3.5826-04	-3.4978-04	-3.4742-04	-3.5401-04	-3.7177-04	-4.0218-04	-4.4572-04	-5.0179-04
-5.6851-04	-6.4292-04	-7.2115-04	-7.9887-04	-8.7173-04	-9.3578-04	-9.8822-04	-1.0274-03	-1.0536-03	-1.0686-03
-1.0755-03	-1.0783-03	-1.0812-03	-1.0884-03	-1.1034-03	-1.1288-03	-1.1662-03	-1.2161-03	-1.2782-03	-1.3509-03
-1.4317-03	-1.5175-03	-1.6044-03	-1.6888-03						

BLADE STATION= 4

4.0274-02	4.0253-02	4.0195-02	4.0071-02	3.9900-02	3.9651-02	3.9454-02	3.9274-02	3.9198-02	3.9273-02
3.9517-02	3.9925-02	4.0477-02	4.1143-02	4.1898-02	4.2719-02	4.3586-02	4.4473-02	4.5330-02	4.6082-02
4.6651-02	4.6960-02	4.6989-02	4.6763-02	4.6309-02	4.5856-02	4.5437-02	4.5232-02	4.5347-02	4.5863-02
4.6851-02	4.8393-02	5.0607-02	5.3654-02	5.7664-02	6.2311-02	6.6698-02	7.0420-02	7.3630-02	7.6583-02
7.9124-02	8.1530-02	8.3721-02	8.5663-02	8.7294-02	8.8536-02	8.9318-02	8.9588-02	8.9332-02	8.8586-02
8.7443-02	8.6053-02	8.4604-02	8.3278-02	8.2199-02	8.1414-02	8.0908-02	8.0650-02	8.0606-02	8.0750-02
8.1061-02	8.1519-02	8.2095-02	8.2744-02	8.3397-02	8.3970-02	8.4382-02	8.4563-02	8.4474-02	8.4109-02
8.3497-02	8.2697-02	8.1788-02	8.0863-02	8.0012-02	7.9312-02	7.8817-02	7.8553-02	7.8511-02	7.8656-02
7.8932-02	7.9269-02	7.9595-02	7.9848-02	7.9981-02	7.9973-02	7.9831-02	7.9592-02	7.9310-02	7.9056-02
7.8897-02	7.8890-02	7.9074-02	7.9469-02	8.0072-02	8.0858-02	8.1783-02	8.2785-02	8.3790-02	8.4712-02
8.5467-02	8.5979-02	8.6188-02	8.6065-02	8.5616-02	8.4883-02	8.3951-02	8.2941-02	8.1997-02	8.1277-02
8.0924-02	8.1037-02	8.1651-02	8.2736-02	8.4205-02	8.5928-02	8.7746-02	8.9491-02	9.0992-02	9.2087-02
9.2635-02	9.2526-02	9.1686-02	9.0090-02	8.7754-02	8.4733-02	8.1117-02	7.7017-02	7.2565-02	6.7913-02
6.3232-02	5.8723-02	5.4597-02	5.1042-02	4.8041-02	4.5682-02	4.3886-02	4.2577-02	4.1664-02	4.1058-02
4.0677-02	4.0456-02	4.0341-02	4.0292-02						
-5.2741-03	-5.3255-03	-5.3716-03	-5.4034-03	-5.4178-03	-5.4081-03	-5.3910-03	-5.3617-03	-5.3350-03	-5.3210-03
-5.3265-03	-5.3551-03	-5.4080-03	-5.4849-03	-5.5851-03	-5.7078-03	-5.8507-03	-6.0091-03	-6.1728-03	-6.3258-03
-6.4503-03	-6.5290-03	-6.5540-03	-6.5253-03	-6.4456-03	-6.3496-03	-6.2449-03	-6.1614-03	-6.1190-03	-6.1328-03
-6.2170-03	-6.3880-03	-6.6681-03	-7.0871-03	-7.6691-03	-8.3585-03	-8.9976-03	-9.5156-03	-9.9430-03	-1.0314-02
-1.0644-02	-1.0941-02	-1.1208-02	-1.1441-02	-1.1634-02	-1.1779-02	-1.1868-02	-1.1895-02	-1.1859-02	-1.1765-02
-1.1626-02	-1.1464-02	-1.1305-02	-1.1175-02	-1.1087-02	-1.1043-02	-1.1036-02	-1.1056-02	-1.1094-02	-1.1146-02
-1.1206-02	-1.1272-02	-1.1341-02	-1.1409-02	-1.1469-02	-1.1513-02	-1.1531-02	-1.1517-02	-1.1467-02	-1.1381-02
-1.1265-02	-1.1125-02	-1.0972-02	-1.0818-02	-1.0674-02	-1.0550-02	-1.0454-02	-1.0387-02	-1.0351-02	-1.0340-02
-1.0348-02	-1.0367-02	-1.0388-02	-1.0406-02	-1.0415-02	-1.0412-02	-1.0399-02	-1.0380-02	-1.0362-02	-1.0352-02
-1.0357-02	-1.0382-02	-1.0429-02	-1.0498-02	-1.0588-02	-1.0693-02	-1.0809-02	-1.0929-02	-1.1044-02	-1.1145-02
-1.1224-02	-1.1272-02	-1.1282-02	-1.1252-02	-1.1182-02	-1.1077-02	-1.0945-02	-1.0801-02	-1.0662-02	-1.0548-02
-1.0477-02	-1.0462-02	-1.0507-02	-1.0606-02	-1.0749-02	-1.0921-02	-1.1102-02	-1.1274-02	-1.1421-02	-1.1524-02
-1.1569-02	-1.1546-02	-1.1445-02	-1.1265-02	-1.1004-02	-1.0668-02	-1.0262-02	-9.7960-03	-9.2794-03	-8.7264-03
-8.1556-03	-7.5925-03	-7.0667-03	-6.6016-03	-6.2086-03	-5.8898-03	-5.6410-03	-5.4552-03	-5.3241-03	-5.2394-03
-5.1937-03	-5.1804-03	-5.1936-03	-5.2272-03						

BLADE STATION= 5

4.0706-02	4.0459-02	4.0415-02	4.0527-02	4.0796-02	4.1251-02	4.1913-02	4.2778-02	4.3815-02	4.4978-02
4.6210-02	4.7457-02	4.8584-02	4.9795-02	5.0866-02	5.1675-02	5.2405-02	5.3022-02	5.3563-02	5.4064-02
5.1544-02	5.5004-02	5.5426-02	5.5777-02	5.6020-02	5.6104-02	5.5962-02	5.5499-02	5.4608-02	5.3220-02
5.1329-02	5.0371-02	4.9587-02	4.9204-02	4.9106-02	4.9201-02	4.9420-02	4.9714-02	5.0050-02	5.0404-02
5.0756-02	5.1092-02	5.1395-02	5.1651-02	5.1842-02	5.1954-02	5.1972-02	5.1886-02	5.1691-02	5.1389-02
5.0991-02	5.0516-02	4.9992-02	4.9450-02	4.8927-02	4.8460-02	4.8079-02	4.7808-02	4.7660-02	4.7634-02
4.7721-02	4.7902-02	4.8152-02	4.8483-02	4.8747-02	4.9032-02	4.9270-02	4.9437-02	4.9517-02	4.9500-02
4.9388-02	4.9135-02	4.8940-02	4.8649-02	4.8351-02	4.8074-02	4.7841-02	4.7668-02	4.7566-02	4.7535-02
4.7572-02	4.7663-02	4.7794-02	4.7942-02	4.8086-02	4.8205-02	4.8283-02	4.8310-02	4.8282-02	4.8205-02
4.8093-02	4.7963-02	4.7839-02	4.7743-02	4.7699-02	4.7724-02	4.7829-02	4.8016-02	4.8277-02	4.8595-02

Figure 50. Continued.

4.8944-02	4.9294-02	4.9616-02	4.9830-02	5.0066-02	5.0162-02	5.0164-02	5.0084-02	4.9940-02	4.9758-02
4.9573-02	4.9419-02	4.9328-02	4.9325-02	4.9428-02	4.9639-02	4.9950-02	5.0336-02	5.0762-02	5.1187-02
5.1563-02	5.1849-02	5.2005-02	5.2002-02	5.1822-02	5.1460-02	5.0930-02	5.0272-02	4.9543-02	4.8823-02
4.8204-02	4.7787-02	4.7659-02	4.7855-02	4.8260-02	4.8476-02	4.8107-02	4.7259-02	4.6159-02	4.4976-02
4.3825-02	4.2780-02	4.1868-02	4.1187-02						
-4.8289-03	-4.8771-03	-4.9529-03	-5.0467-03	-5.1541-03	-5.2747-03	-5.4079-03	-5.5508-03	-5.6987-03	-5.8455-03
-5.9850-03	-6.1118-03	-6.2290-03	-6.3135-03	-6.3849-03	-6.4379-03	-6.4767-03	-6.5086-03	-6.5407-03	-6.5786-03
-6.6234-03	-6.6724-03	-6.7189-03	-6.7535-03	-6.7657-03	-6.7430-03	-6.6706-03	-6.5299-03	-6.3014-03	-5.9746-03
-5.6016-03	-5.2763-03	-5.0269-03	-4.8439-03	-4.7115-03	-4.6162-03	-4.5478-03	-4.4993-03	-4.4657-03	-4.4432-03
-4.4291-03	-4.4211-03	-4.4169-03	-4.4148-03	-4.4129-03	-4.4098-03	-4.4041-03	-4.3952-03	-4.3826-03	-4.3667-03
-4.3484-03	-4.3292-03	-4.3108-03	-4.2954-03	-4.2848-03	-4.2806-03	-4.2836-03	-4.2934-03	-4.3088-03	-4.3275-03
-4.3470-03	-4.3646-03	-4.3785-03	-4.3874-03	-4.3907-03	-4.3883-03	-4.3804-03	-4.3677-03	-4.3510-03	-4.3314-03
-4.3104-03	-4.2894-03	-4.2701-03	-4.2537-03	-4.2411-03	-4.2326-03	-4.2280-03	-4.2265-03	-4.2271-03	-4.2287-03
-4.2303-03	-4.2312-03	-4.2307-03	-4.2283-03	-4.2238-03	-4.2166-03	-4.2069-03	-4.1945-03	-4.1797-03	-4.1629-03
-4.1446-03	-4.1255-03	-4.1061-03	-4.0871-03	-4.0694-03	-4.0537-03	-4.0406-03	-4.0304-03	-4.0232-03	-4.0183-03
-4.0149-03	-4.0117-03	-4.0076-03	-4.0015-03	-3.9924-03	-3.9800-03	-3.9641-03	-3.9451-03	-3.9236-03	-3.9007-03
-3.8777-03	-3.8560-03	-3.8373-03	-3.8231-03	-3.8143-03	-3.8116-03	-3.8147-03	-3.8231-03	-3.8354-03	-3.8504-03
-3.8666-03	-3.8829-03	-3.8988-03	-3.9139-03	-3.9287-03	-3.9444-03	-3.9634-03	-3.9896-03	-4.0285-03	-4.0873-03
-4.1749-03	-4.3010-03	-4.4736-03	-4.6987-03	-4.9349-03	-5.1305-03	-5.2129-03	-5.2009-03	-5.1352-03	-5.0472-03
-4.9590-03	-4.8852-03	-4.8351-03	-4.8151-03						

COS AND SIN COEFFICIENTS OF ACOUSTIC PRESSURE PULSE AT EACH OF 144 AZIMUTHAL STATIONS AT EACH BLADE STATION FOR HARMONIC N= 2

BLADE STATION= 1

1.6959-02	1.7390-02	1.7769-02	1.8089-02	1.8337-02	1.8505-02	1.8595-02	1.8615-02	1.8577-02	1.8499-02
1.8402-02	1.8309-02	1.8241-02	1.8214-02	1.8238-02	1.8316-02	1.8443-02	1.8611-02	1.8807-02	1.9017-02
1.9227-02	1.9423-02	1.9593-02	1.9729-02	1.9823-02	1.9873-02	1.9879-02	1.9845-02	1.9765-02	1.9687-02
1.9579-02	1.9464-02	1.9346-02	1.9229-02	1.9111-02	1.8987-02	1.8848-02	1.8683-02	1.8482-02	1.8237-02
1.7943-02	1.7601-02	1.7215-02	1.6795-02	1.6352-02	1.5898-02	1.5444-02	1.5002-02	1.4580-02	1.4185-02
1.3821-02	1.3492-02	1.3198-02	1.2941-02	1.2723-02	1.2544-02	1.2406-02	1.2311-02	1.2261-02	1.2259-02
1.2308-02	1.2414-02	1.2579-02	1.2807-02	1.3096-02	1.3441-02	1.3831-02	1.4247-02	1.4668-02	1.5067-02
1.5420-02	1.5704-02	1.5905-02	1.6011-02	1.6022-02	1.5941-02	1.5772-02	1.5524-02	1.5208-02	1.4839-02
1.4430-02	1.3996-02	1.3548-02	1.3095-02	1.2643-02	1.2199-02	1.1773-02	1.1377-02	1.1018-02	1.0702-02
1.0431-02	1.0202-02	1.0010-02	9.8475-03	9.7092-03	9.5903-03	9.4882-03	9.4025-03	9.3344-03	9.2862-03
9.2599-03	9.2569-03	9.2772-03	9.3190-03	9.3790-03	9.4522-03	9.5331-03	9.6154-03	9.6933-03	9.7624-03
9.8200-03	9.8659-03	9.9026-03	9.9359-03	9.9741-03	1.0028-02	1.0111-02	1.0234-02	1.0410-02	1.0645-02
1.0940-02	1.1293-02	1.1691-02	1.2181-02	1.2562-02	1.2995-02	1.3403-02	1.3759-02	1.4058-02	1.4292-02
1.4458-02	1.4561-02	1.4610-02	1.4621-02	1.4615-02	1.4614-02	1.4641-02	1.4716-02	1.4856-02	1.5066-02
1.5353-02	1.5702-02	1.6102-02	1.6532-02						
-1.5435-02	-1.5745-02	-1.6024-02	-1.6253-02	-1.6420-02	-1.6520-02	-1.6550-02	-1.6517-02	-1.6429-02	-1.6300-02
-1.6148-02	-1.5992-02	-1.5852-02	-1.5743-02	-1.5676-02	-1.5657-02	-1.5686-02	-1.5756-02	-1.5859-02	-1.5985-02
-1.6121-02	-1.6254-02	-1.6375-02	-1.6473-02	-1.6542-02	-1.6581-02	-1.6588-02	-1.6567-02	-1.6515-02	-1.6469-02
-1.6407-02	-1.6345-02	-1.6288-02	-1.6239-02	-1.6195-02	-1.6151-02	-1.6099-02	-1.6028-02	-1.5929-02	-1.5793-02
-1.5616-02	-1.5400-02	-1.5149-02	-1.4872-02	-1.4578-02	-1.4275-02	-1.3974-02	-1.3679-02	-1.3397-02	-1.3130-02
-1.2879-02	-1.2646-02	-1.2432-02	-1.2239-02	-1.2069-02	-1.1926-02	-1.1811-02	-1.1729-02	-1.1681-02	-1.1670-02
-1.1698-02	-1.1768-02	-1.1883-02	-1.2046-02	-1.2255-02	-1.2505-02	-1.2789-02	-1.3091-02	-1.3394-02	-1.3677-02
-1.3921-02	-1.4111-02	-1.4237-02	-1.4299-02	-1.4298-02	-1.4243-02	-1.4141-02	-1.4002-02	-1.3836-02	-1.3652-02
-1.3458-02	-1.3262-02	-1.3065-02	-1.2864-02	-1.2655-02	-1.2437-02	-1.2212-02	-1.1985-02	-1.1763-02	-1.1552-02
-1.1357-02	-1.1178-02	-1.1016-02	-1.0870-02	-1.0741-02	-1.0630-02	-1.0540-02	-1.0472-02	-1.0432-02	-1.0421-02
-1.0440-02	-1.0489-02	-1.0565-02	-1.0661-02	-1.0772-02	-1.0890-02	-1.1005-02	-1.1110-02	-1.1197-02	-1.1260-02
-1.1297-02	-1.1306-02	-1.1289-02	-1.1251-02	-1.1201-02	-1.1149-02	-1.1111-02	-1.1100-02	-1.1131-02	-1.1216-02
-1.1361-02	-1.1565-02	-1.1823-02	-1.2121-02	-1.2442-02	-1.2769-02	-1.3083-02	-1.3365-02	-1.3604-02	-1.3791-02
-1.3921-02	-1.3996-02	-1.4022-02	-1.4010-02	-1.3976-02	-1.3936-02	-1.3913-02	-1.3924-02	-1.3985-02	-1.4104-02
-1.4284-02	-1.4520-02	-1.4802-02	-1.5113-02						

BLADE STATION= 2

3.8131-02	3.8966-02	3.9825-02	4.0618-02	4.1336-02	4.1955-02	4.2453-02	4.2815-02	4.3037-02	4.3121-02
4.3079-02	4.2929-02	4.2693-02	4.2396-02	4.2060-02	4.1707-02	4.1355-02	4.1017-02	4.0702-02	4.0413-02
4.0152-02	3.9915-02	3.9694-02	3.9482-02	3.9272-02	3.9056-02	3.8829-02	3.8589-02	3.8334-02	3.8069-02
3.7796-02	3.7521-02	3.7249-02	3.6984-02	3.6729-02	3.6484-02	3.6246-02	3.6012-02	3.5774-02	3.5522-02
3.5247-02	3.4939-02	3.4586-02	3.4183-02	3.3723-02	3.3205-02	3.2632-02	3.2011-02	3.1350-02	3.0662-02
2.9962-02	2.9264-02	2.8583-02	2.7934-02	2.7328-02	2.6779-02	2.6297-02	2.5889-02	2.5562-02	2.5318-02

Figure 50. Continued.

2.5156-02	2.5073-02	2.5059-02	2.5105-02	2.5197-02	2.5320-02	2.5459-02	2.5599-02	2.5725-02	2.5816-02
2.5890-02	2.5911-02	2.5884-02	2.5807-02	2.5682-02	2.5514-02	2.5310-02	2.5079-02	2.4831-02	2.4576-02
2.4327-02	2.4092-02	2.3881-02	2.3701-02	2.3559-02	2.3460-02	2.3408-02	2.3405-02	2.3454-02	2.3542-02
2.3699-02	2.3888-02	2.4112-02	2.4362-02	2.4626-02	2.4896-02	2.5160-02	2.5411-02	2.5645-02	2.5858-02
2.6048-02	2.6216-02	2.6361-02	2.6486-02	2.6591-02	2.6678-02	2.6751-02	2.6815-02	2.6876-02	2.6940-02
2.7015-02	2.7105-02	2.7217-02	2.7353-02	2.7515-02	2.7702-02	2.7915-02	2.8151-02	2.8407-02	2.8680-02
2.8966-02	2.9260-02	2.9558-02	2.9854-02	3.0144-02	3.0424-02	3.0691-02	3.0942-02	3.1177-02	3.1396-02
3.1603-02	3.1802-02	3.2002-02	3.2213-02	3.2446-02	3.2717-02	3.3037-02	3.3421-02	3.3876-02	3.44[illegible]0-02
3.5024-02	3.5715-02	3.6473-02	3.7285-02						
-9.8614-03	-1.0086-02	-1.0296-02	-1.0591-02	-1.0688-02	-1.0850-02	-1.0981-02	-1.1078-02	-1.1138-02	-1.[illegible]162-02
-1.1156-02	-1.1123-02	-1.1070-02	-1.1005-02	-1.0931-02	-1.0855-02	-1.0780-02	-1.0707-02	-1.0637-02	-1.05[illegible]1-02
-1.0506-02	-1.0443-02	-1.0379-02	-1.0313-02	-1.0244-02	-1.0171-02	-1.0094-02	-1.0014-02	-9.9324-03	-9.85[illegible]3-03
-9.7727-03	-9.6984-03	-9.6300-03	-9.5685-03	-9.5141-03	-9.4663-03	-9.4237-03	-9.3844-03	-9.3456-03	-9.3046-03
-9.2581-03	-9.2034-03	-9.1378-03	-9.0593-03	-8.9669-03	-8.8602-03	-8.7396-03	-8.6066-03	-8.4629-03	-8.31[illegible]1-03
-8.1537-03	-7.9936-03	-7.8338-03	-7.6770-03	-7.5262-03	-7.3841-03	-7.2532-03	-7.1359-03	-7.0342-03	-6.9496-03
-6.8833-03	-6.8354-03	-6.8057-03	-6.7930-03	-6.7952-03	-6.8097-03	-6.8335-03	-6.8626-03	-6.8932-03	-6.9214-03
-6.9434-03	-6.9558-03	-6.9562-03	-6.9427-03	-6.9146-03	-6.8723-03	-6.8172-03	-6.7518-03	-6.6794-03	-6.6815-03
-6.5283-03	-6.4576-03	-6.3956-03	-6.3433-03	-6.3047-03	-6.2807-03	-6.2717-03	-6.2773-03	-6.2963-03	-6.32[illegible]0-03
-6.3667-03	-6.4126-03	-6.4616-03	-6.5105-03	-6.5566-03	-6.5978-03	-6.6326-03	-6.6609-03	-6.6831-03	-6.70[illegible]4-03
-6.7146-03	-6.7273-03	-6.7404-03	-6.7552-03	-6.7727-03	-6.7934-03	-6.8174-03	-6.8446-03	-6.8746-03	-6.90[illegible]0-03
-6.9412-03	-6.9766-03	-7.0130-03	-7.0500-03	-7.0877-03	-7.1263-03	-7.1666-03	-7.2092-03	-7.2552-03	-7.30[illegible]3-03
-7.3603-03	-7.4205-03	-7.4860-03	-7.5562-03	-7.6304-03	-7.7075-03	-7.7862-03	-7.8650-03	-7.9429-03	-8.01[illegible]7-03
-8.0922-03	-8.1635-03	-8.2337-03	-8.3047-03	-8.3791-03	-8.4601-03	-8.5512-03	-8.6555-03	-8.7759-03	-8.9144-03
-9.0717-03	-9.2475-03	-9.4400-03	-9.6461-03						

BLADE STATION= 3

3.5752-02	3.6202-02	3.6620-02	3.7001-02	3.7340-02	3.7651-02	3.7875-02	3.8066-02	3.8202-02	3.8280-02
3.8295-02	3.8244-02	3.8078-02	3.7926-02	3.7653-02	3.7302-02	3.6874-02	3.6376-02	3.5815-02	3.5206-02
3.4564-02	3.3908-02	3.3255-02	3.2625-02	3.2033-02	3.1490-02	3.1006-02	3.0586-02	3.0230-02	2.9935-02
2.9694-02	2.9496-02	2.9328-02	2.9173-02	2.9013-02	2.8830-02	2.8603-02	2.8319-02	2.7962-02	2.7513-02
2.6997-02	2.6385-02	2.5694-02	2.4935-02	2.4125-02	2.3285-02	2.2441-02	2.1619-02	2.0844-02	2.0141-02
1.9531-02	1.9031-02	1.8653-02	1.8401-02	1.8277-02	1.8274-02	1.8384-02	1.8592-02	1.8884-02	1.9243-02
1.9651-02	2.0092-02	2.0550-02	2.1011-02	2.1464-02	2.1899-02	2.2310-02	2.2692-02	2.3042-02	2.3359-02
2.3640-02	2.3882-02	2.4083-02	2.4239-02	2.4346-02	2.4402-02	2.4404-02	2.4355-02	2.4259-02	2.4123-02
2.3948-02	2.3754-02	2.3549-02	2.3348-02	2.3163-02	2.3009-02	2.2900-02	2.2849-02	2.2866-02	2.2959-02
2.3127-02	2.3370-02	2.3675-02	2.4031-02	2.4420-02	2.4823-02	2.5220-02	2.5594-02	2.5929-02	2.6214-02
2.6441-02	2.6609-02	2.6720-02	2.6782-02	2.6806-02	2.6809-02	2.6807-02	2.6816-02	2.6852-02	2.6925-02
2.7044-02	2.7209-02	2.7416-02	2.7660-02	2.7931-02	2.8218-02	2.8510-02	2.8796-02	2.9066-02	2.9310-02
2.9522-02	2.9695-02	2.9828-02	2.9923-02	2.9986-02	3.0029-02	3.0051-02	3.0079-02	3.0121-02	3.0191-02
3.0298-02	3.0451-02	3.0654-02	3.0909-02	3.1213-02	3.1564-02	3.1955-02	3.2380-02	3.2833-02	3.3308-02
3.3797-02	3.4294-02	3.4790-02	3.5279-02						
-3.4497-03	-3.5851-03	-3.6981-03	-3.7872-03	-3.8531-03	-3.8994-03	-3.9289-03	-3.9484-03	-3.9622-03	-3.9742-03
-3.9867-03	-4.0004-03	-4.0118-03	-4.0239-03	-4.0237-03	-4.0098-03	-3.9758-03	-3.9166-03	-3.8292-03	-3.7130-03
-3.5699-03	-3.4044-03	-3.2230-03	-3.0336-03	-2.8445-03	-2.6636-03	-2.4979-03	-2.3529-03	-2.2321-03	-2.1371-03
-2.0671-03	-2.0196-03	-1.9900-03	-1.9725-03	-1.9604-03	-1.9466-03	-1.9242-03	-1.8873-03	-1.8312-03	-1.7523-03
-1.6509-03	-1.5259-03	-1.3798-03	-1.2159-03	-1.0382-03	-8.5140-04	-6.6002-04	-4.6847-04	-2.8077-04	-1.0023-04
7.0021-05	2.2758-04	3.7013-04	4.9586-04	6.0197-04	6.8730-04	7.5027-04	7.8965-04	8.0497-04	7.9645-04
7.6530-04	7.1376-04	6.4518-04	5.6400-04	4.7559-04	3.8606-04	3.0184-04	2.2921-04	1.7395-04	1.4852-04
1.3170-04	1.4831-04	1.8901-04	2.5053-04	3.2805-04	4.1558-04	5.0663-04	5.9463-04	6.7351-04	7.3811-04
7.8454-04	8.1046-04	8.1523-04	7.9992-04	7.6701-04	7.2020-04	6.6375-04	6.0213-04	5.3931-04	4.7837-04
4.2112-04	3.6802-04	3.1824-04	2.6992-04	2.2061-04	1.6766-04	1.0868-04	4.1916-05	-3.3582-05	-1.1731-04
-2.0791-04	-3.0259-04	-3.9745-04	-4.8797-04	-5.6938-04	-6.3732-04	-6.8841-04	-7.2087-04	-7.3478-04	-7.3231-04
-7.1752-04	-6.9569-04	-6.7314-04	-6.5641-04	-6.5189-04	-6.6498-04	-7.0019-04	-7.6036-04	-8.4647-04	-9.572[illegible]-04
-1.0890-03	-1.2359-03	-1.3903-03	-1.5436-03	-1.6873-03	-1.8135-03	-1.9168-03	-1.9940-03	-2.0455-03	-2.074[illegible]-03
-2.0883-03	-2.0936-03	-2.0992-03	-2.1133-03	-2.1427-03	-2.1926-03	-2.2662-03	-2.3647-03	-2.4870-03	-2.630[illegible]-03
-2.7894-03	-2.9584-03	-3.1298-03	-3.2959-03						

BLADE STATION= 4

3.9301-02	3.9265-02	3.9196-02	3.9065-02	3.8893-02	3.8651-02	3.8462-02	3.8295-02	3.8231-02	3.8115-02
3.8562-02	3.8968-02	3.9510-02	4.0161-02	4.0893-02	4.1687-02	4.2520-02	4.3369-02	4.4188-02	4.4981-02
4.5443-02	4.5735-02	4.5762-02	4.5547-02	4.5117-02	4.4693-02	4.4304-02	4.4123-02	4.4242-02	4.476[illegible]-02
4.5735-02	[illegible].7236-02	4.9381-02	5.2325-02	5.6189-02	6.0665-02	6.4895-02	6.8492-02	7.1603-02	7.439[illegible]-02

Figure 50. Continued.

7.6937-02	7.9277-02	8.1409-02	8.3300-02	8.4888-02	8.6100-02	8.6862-02	8.7127-02	8.6876-02	8.6154-02
8.5041-02	8.3687-02	8.2272-02	8.0994-02	7.9913-02	7.9134-02	7.8628-02	7.8364-02	7.8311-02	7.8443-02
7.8741-02	7.9184-02	7.9746-02	8.0380-02	8.1020-02	8.1585-02	8.1992-02	8.2176-02	8.2097-02	8.1750-02
8.1161-02	8.0390-02	7.9513-02	7.8620-02	7.7798-02	7.7124-02	7.6649-02	7.6398-02	7.6364-02	7.6512-02
7.6786-02	7.7120-02	7.7442-02	7.7693-02	7.7825-02	7.7818-02	7.7660-02	7.7444-02	7.7166-02	7.6912-02
7.6749-02	7.6733-02	7.6905-02	7.7281-02	7.7862-02	7.8621-02	7.9519-02	8.0493-02	8.1471-02	8.2370-02
8.3108-02	8.3609-02	8.3817-02	8.3701-02	8.3268-02	8.2560-02	8.1658-02	8.0679-02	7.9766-02	7.9071-02
7.8732-02	7.8845-02	7.9446-02	8.0506-02	8.1940-02	8.3621-02	8.5397-02	8.7103-02	8.8572-02	8.9646-02
9.0187-02	9.0086-02	8.9274-02	8.7783-02	8.5451-02	8.2513-02	7.8994-02	7.5007-02	7.0680-02	6.6161-02
6.1617-02	5.7243-02	5.3242-02	4.9767-02	4.6886-02	4.4600-02	4.2860-02	4.1590-02	4.0703-02	4.0112-02
3.9737-02	3.9514-02	3.9392-02	3.9332-02						
-1.0431-02	-1.0532-02	-1.0623-02	-1.0685-02	-1.0713-02	-1.0694-02	-1.0661-02	-1.0604-02	-1.0552-02	-1.0525-02
-1.0536-02	-1.0593-02	-1.0698-02	-1.0850-02	-1.1048-02	-1.1291-02	-1.1573-02	-1.1885-02	-1.2208-02	-1.2509-02
-1.2755-02	-1.2910-02	-1.2960-02	-1.2903-02	-1.2747-02	-1.2558-02	-1.2352-02	-1.2188-02	-1.2105-02	-1.2133-02
-1.2300-02	-1.2638-02	-1.3191-02	-1.4018-02	-1.5166-02	-1.6526-02	-1.7787-02	-1.8810-02	-1.9655-02	-2.0387-02
-2.1040-02	-2.1629-02	-2.2156-02	-2.2618-02	-2.3001-02	-2.3288-02	-2.3464-02	-2.3517-02	-2.3446-02	-2.3260-02
-2.2986-02	-2.2666-02	-2.2351-02	-2.2092-02	-2.1918-02	-2.1831-02	-2.1816-02	-2.1855-02	-2.1931-02	-2.2032-02
-2.2150-02	-2.2281-02	-2.2418-02	-2.2553-02	-2.2672-02	-2.2759-02	-2.2795-02	-2.2767-02	-2.2668-02	-2.2499-02
-2.2269-02	-2.1992-02	-2.1689-02	-2.1385-02	-2.1100-02	-2.0855-02	-2.0664-02	-2.0533-02	-2.0461-02	-2.0439-02
-2.0455-02	-2.0493-02	-2.0537-02	-2.0572-02	-2.0588-02	-2.0583-02	-2.0557-02	-2.0520-02	-2.0484-02	-2.0464-02
-2.0474-02	-2.0522-02	-2.0615-02	-2.0752-02	-2.0928-02	-2.1137-02	-2.1367-02	-2.1603-02	-2.1830-02	-2.2031-02
-2.2186-02	-2.2281-02	-2.2302-02	-2.2243-02	-2.2105-02	-2.1896-02	-2.1636-02	-2.1351-02	-2.1076-02	-2.0852-02
-2.0712-02	-2.0682-02	-2.0770-02	-2.0967-02	-2.1250-02	-2.1588-02	-2.1947-02	-2.2288-02	-2.2578-02	-2.2782-02
-2.2872-02	-2.2826-02	-2.2628-02	-2.2271-02	-2.1756-02	-2.1091-02	-2.0290-02	-1.9368-02	-1.8347-02	-1.7254-02
-1.6127-02	-1.5015-02	-1.3976-02	-1.3057-02	-1.2281-02	-1.1651-02	-1.1160-02	-1.0792-02	-1.0533-02	-1.0366-02
-1.0275-02	-1.0248-02	-1.0273-02	-1.0339-02						

BLADE STATION= 5

3.9560-02	3.9311-02	3.9250-02	3.9361-02	3.9615-02	4.0051-02	4.0689-02	4.1527-02	4.2533-02	4.3664-02
4.4862-02	4.6076-02	4.7174-02	4.8356-02	4.9342-02	5.0191-02	5.0904-02	5.1507-02	5.2035-02	5.2524-02
5.2992-02	5.3439-02	5.3849-02	5.4193-02	5.4433-02	5.4522-02	5.4395-02	5.3963-02	5.3124-02	5.1811-02
5.0305-02	4.9119-02	4.8390-02	4.8042-02	4.7968-02	4.8078-02	4.8306-02	4.8604-02	4.8942-02	4.9295-02
4.9646-02	4.9980-02	5.0282-02	5.0536-02	5.0727-02	5.0839-02	5.0859-02	5.0776-02	5.0585-02	5.0289-02
4.9897-02	4.9429-02	4.8912-02	4.8376-02	4.7859-02	4.7396-02	4.7017-02	4.6747-02	4.6597-02	4.6569-02
4.6652-02	4.6829-02	4.7075-02	4.7364-02	4.7666-02	4.7949-02	4.8187-02	4.8356-02	4.8437-02	4.8423-02
4.8315-02	4.8125-02	4.7874-02	4.7587-02	4.7292-02	4.7017-02	4.6786-02	4.6614-02	4.6512-02	4.6481-02
4.6517-02	4.6608-02	4.6737-02	4.6885-02	4.7029-02	4.7149-02	4.7228-02	4.7256-02	4.7231-02	4.7158-02
4.7049-02	4.6924-02	4.6804-02	4.6753-02	4.6673-02	4.6703-02	4.6807-02	4.6994-02	4.7254-02	4.7570-02
4.7917-02	4.8264-02	4.8583-02	4.8845-02	4.9030-02	4.9126-02	4.9130-02	4.9052-02	4.8912-02	4.8735-02
4.8555-02	4.8405-02	4.8317-02	4.8316-02	4.8418-02	4.8628-02	4.8935-02	4.9315-02	4.9736-02	5.0154-02
5.0525-02	5.0806-02	5.0959-02	5.0955-02	5.0776-02	5.0416-02	4.9869-02	4.9233-02	4.8504-02	4.7779-02
4.7148-02	4.6709-02	4.6547-02	4.6697-02	4.7049-02	4.7222-02	4.6837-02	4.5995-02	4.4913-02	4.3753-02
4.2626-02	4.1601-02	4.0727-02	4.0036-02						
-9.5448-03	-9.6903-03	-9.7905-03	-9.9762-03	-1.0189-02	-1.0427-02	-1.0691-02	-1.0973-02	-1.1266-02	-1.1556-02
-1.1831-02	-1.2082-02	-1.2314-02	-1.2480-02	-1.2621-02	-1.2725-02	-1.2802-02	-1.2865-02	-1.2928-02	-1.3003-02
-1.3091-02	-1.3188-02	-1.3280-02	-1.3348-02	-1.3372-02	-1.3328-02	-1.3185-02	-1.2938-02	-1.2457-02	-1.1813-02
-1.1077-02	-1.0436-02	-9.9446-03	-9.5840-03	-9.3232-03	-9.1355-03	-9.0010-03	-8.9055-03	-8.8394-03	-8.7954-03
-8.7679-03	-8.7522-03	-8.7443-03	-8.7404-03	-8.7369-03	-8.7309-03	-8.7198-03	-8.7022-03	-8.6774-03	-8.6460-03
-8.6098-03	-8.5716-03	-8.5351-03	-8.5043-03	-8.4831-03	-8.4745-03	-8.4801-03	-8.4992-03	-8.5293-03	-8.5662-03
-8.6045-03	-8.6395-03	-8.6670-03	-8.6847-03	-8.6913-03	-8.6867-03	-8.6713-03	-8.6463-03	-8.6133-03	-8.5746-03
-8.5329-03	-8.4914-03	-8.4529-03	-8.4203-03	-8.3952-03	-8.3783-03	-8.3691-03	-8.3660-03	-8.3671-03	-8.3703-03
-8.3735-03	-8.3752-03	-8.3763-03	-8.3697-03	-8.3608-03	-8.3468-03	-8.3276-03	-8.3039-03	-8.2738-03	-8.2407-03
-8.2046-03	-8.1667-03	-8.1284-03	-8.0931-03	-8.0563-03	-8.0254-03	-7.9996-03	-7.9798-03	-7.9657-03	-7.9563-03
-7.9458-03	-7.9438-03	-7.9358-03	-7.9237-03	-7.9059-03	-7.8814-03	-7.8501-03	-7.8125-03	-7.7701-03	-7.7248-03
-7.6793-03	-7.6367-03	-7.5999-03	-7.5719-03	-7.5548-03	-7.5496-03	-7.5561-03	-7.5728-03	-7.5974-03	-7.6271-03
-7.6592-03	-7.6916-03	-7.7227-03	-7.7524-03	-7.7813-03	-7.6119-03	-7.8489-03	-7.8998-03	-7.9757-03	-8.0909-03
-8.2629-03	-8.5107-03	-8.8502-03	-9.2814-03	-9.7583-03	-1.0143-02	-1.0305-02	-1.0281-02	-1.0150-02	-9.9763-03
-9.8018-03	-9.6559-03	-9.5569-03	-9.5193-03						

UTRAP VALUES FOR FIELD POINT 1
-5.641257-05 -1.907795-06

Figure 50. Continued.

```
VTRAP VALUES FOR FIELD POINT  1
-2.921837-05 -2.318169-05

UTRAP VALUES FOR FIELD POINT  2
-5.802590-05 -4.133724-06

VTRAP VALUES FOR FIELD POINT  2
-1.238774-05 -1.255837-06


PRESSURES AT FIELD POINT   1

-5.832056-05 -6.924993-05 -7.782530-05 -8.338473-05 -8.544820-05 -8.376291-05 -7.832926-05 -6.940456-05 -5.748518-05 -4.326673-05
-2.758798-05 -1.136242-05  4.495752-06  1.914439-05  3.187825-05  4.218005-05  4.975313-05  5.453300-05  5.667713-05  5.653421-05
 5.459650-05  5.144008-05  4.765908-05  4.380079-05  4.030783-05  3.747337-05  3.541367-05  3.406073-05  3.317545-05  3.238012-05
 3.120662-05  2.915549-05  2.575972-05  2.064667-05  1.359171-05  4.557872-06 -6.282740-06 -1.854834-05 -3.166813-05 -4.492261-05
-5.750003-05


PRESSURES AT FIELD POINT   2

-5.415962-05 -5.565995-05 -5.547906-05 -5.363859-05 -5.022999-05 -4.540777-05 -3.937879-05 -3.238854-05 -2.470560-05 -1.660561-05
-8.355976-06 -2.026120-07  7.640309-06  1.499701-05  2.173278-05  2.775282-05  3.299771-05  3.743620-05  4.105654-05  4.385722-05
 4.583854-05  4.699585-05  4.731536-05  4.677310-05  4.533700-05  4.297221-05  3.964869-05  3.535060-05  3.008619-05  2.389704-05
 1.686563-05  9.120068-06  8.352629-07 -7.769854-06 -1.643925-05 -2.489044-05 -3.282823-05 -3.996053-05 -4.601500-05 -5.075524-05
-5.399515-05


                    ROTATIONAL NOISE PROGRAM E676

HARMONIC =  1
                          FIELD POINT COORDINATES (IN)                    SOUND PRESSURE LEVEL
 FIELD                                                                          DECIBELS
 POINT                X              Y              Z

   1            5.5960+03      0.0000        -3.2310+03                     8.3801+01
   2            6.4380+03      0.0000        -5.6300+02                     8.1982+01

HARMONIC =  2
                          FIELD POINT COORDINATES (IN)                    SOUND PRESSURE LEVEL
 FIELD                                                                          DECIBELS
 POINT                X              Y              Z

   1            5.5960+03      0.0000        -3.2310+03                     7.5074+01
   2            6.4380+03      0.0000        -5.6300+02                     6.0452+01
```

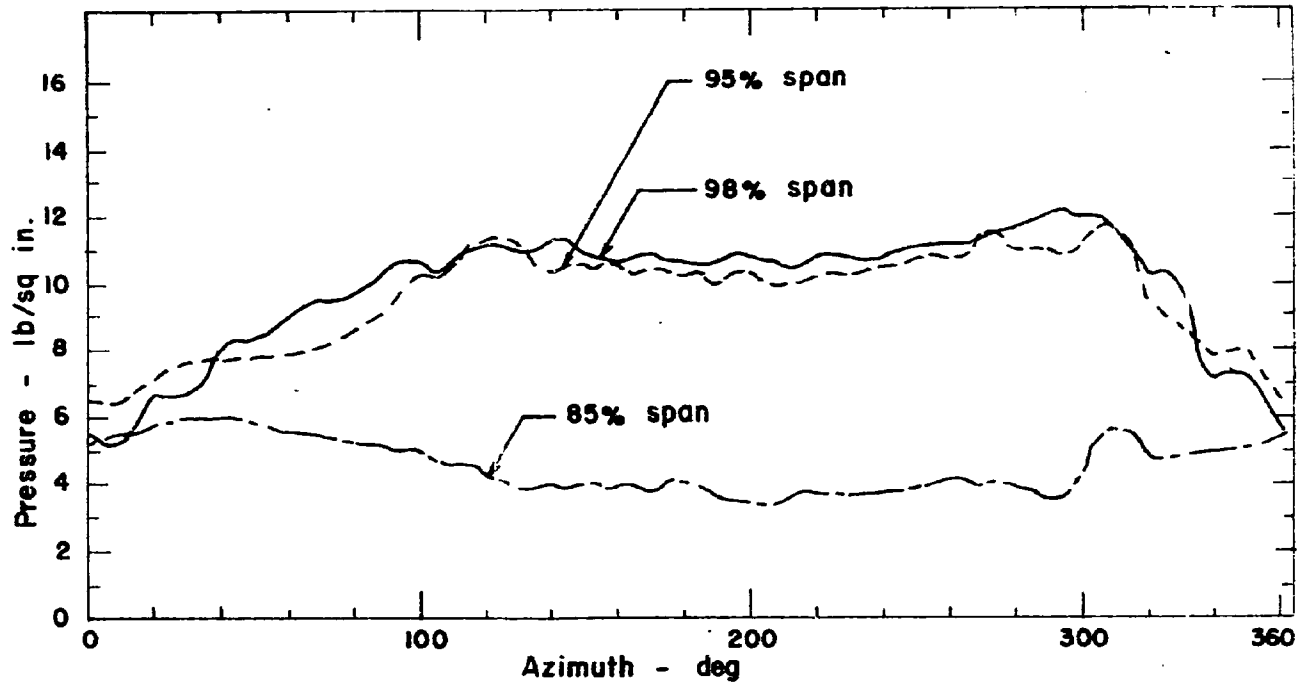
Figure 50. Concluded.

APPENDIX II
MEASURED AERODYNAMIC DATA

Figures 51 and 52 compare the azimuthal histories of differential pressure on a CH-53A main rotor blade for hover conditions with and without RIN. Pressures at 85% span do not show rapid fluctuations associated with blade/wake interaction RIN. However, pressures at 95% and 98% span do reflect the blade/wake interactions for the RIN condition. Traces for 75% and 40% span are not presented since they are as inactive as those at 85% span.

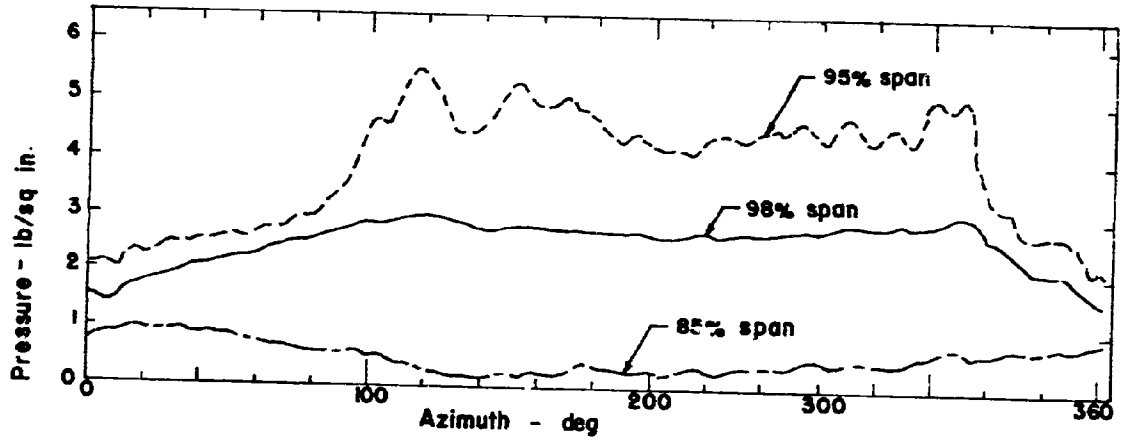
Measured aerodynamic data are presented in Tables II through X. These tables contain blade angulator and differential pressure data in harmonic form for a positive series ($A(\psi) = A_o + A_1 \cos \psi + \beta_1 \sin \psi + \ldots + A_n \cos n\psi + \beta_n \sin n\psi$). Angulator data are in units of degrees while differential pressure data are in units of pounds per square inch. Harmonics of pressure are read line-by-line from left to right for each spanwise and chordwise location. Note that the pressures for Span 1, Chord 4 (.4 span, .6 chord) are zero because of an inoperative transducer. Adverse effects of losing these data are negligible for the present study, because this inboard portion of the blade does not control the acoustic characteristics of the blade. Table XI contains trim parameters for each flight condition. Shaft inclination is referenced to vertical and is defined as positive for aft inclination (normal autogyro sign convention).

Differential pressure data recorded on the airborne direct system were analyzed to determine if more than 30 harmonics were present. Spectrum averaging with real-time analysis equipment revealed no more than 30 significant harmonics for the flight conditions of the present study. Since rotational noise levels were calculated from 30 loading harmonics, the present study made full use of the data's potential for rotational noise prediction.

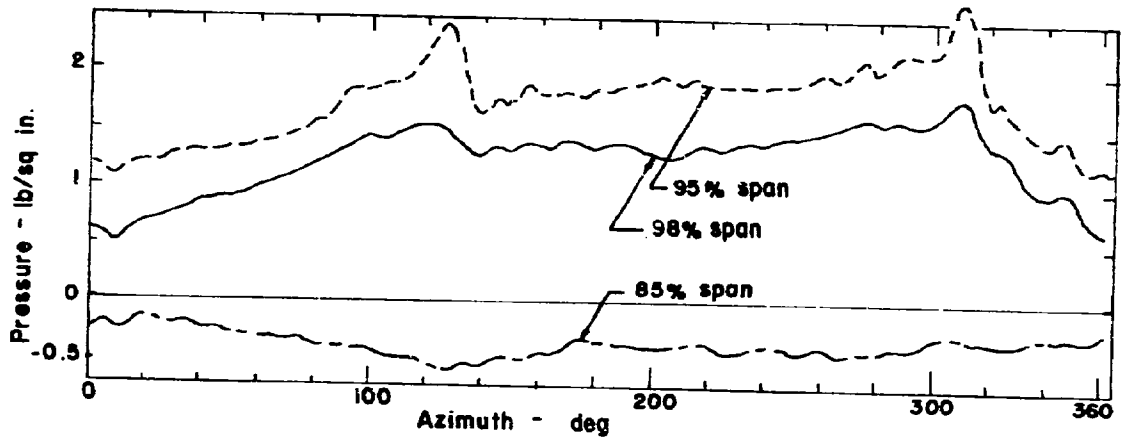


a. 4% Chord Station (Leading Edge)

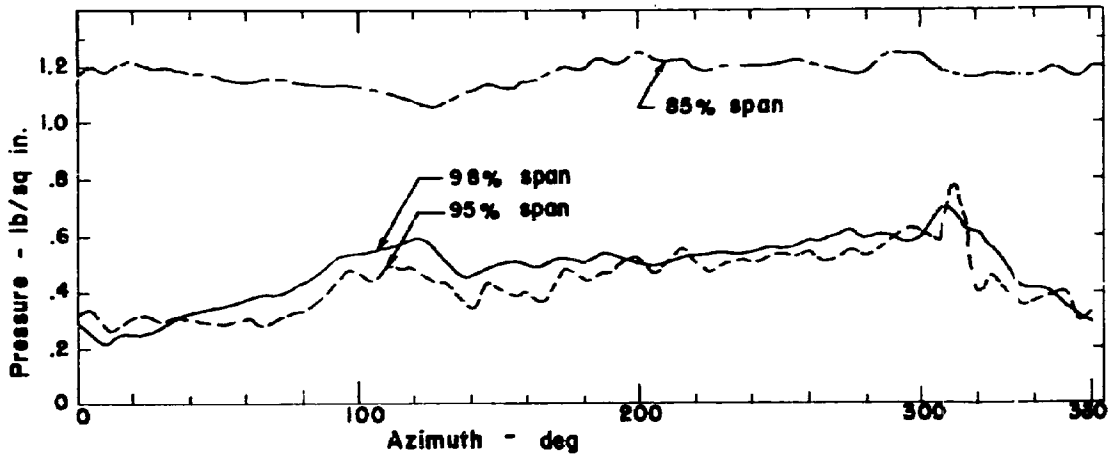
Figure 51. Differential Blade Pressures - Hover Without RIN.



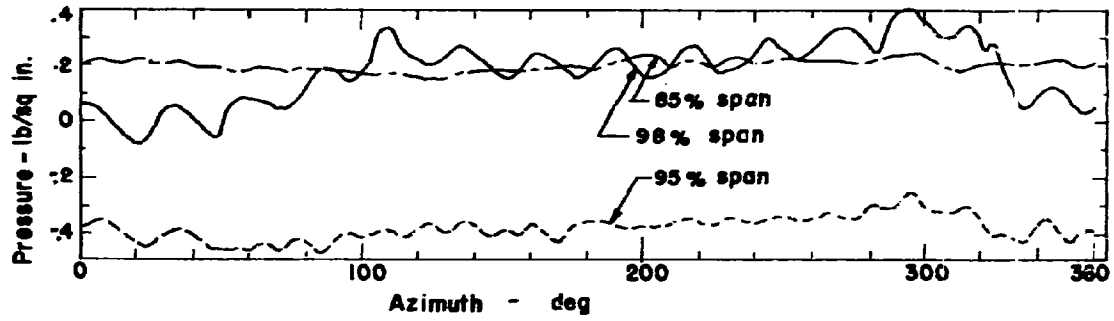
b. 15% Chord Station



c. 30% Chord Station
Figure 51. Continued.

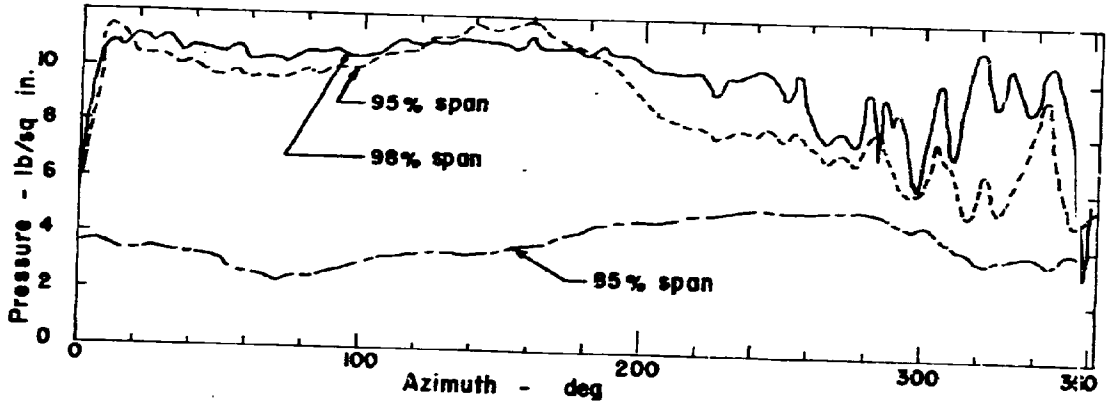


d. 60% Chord Station

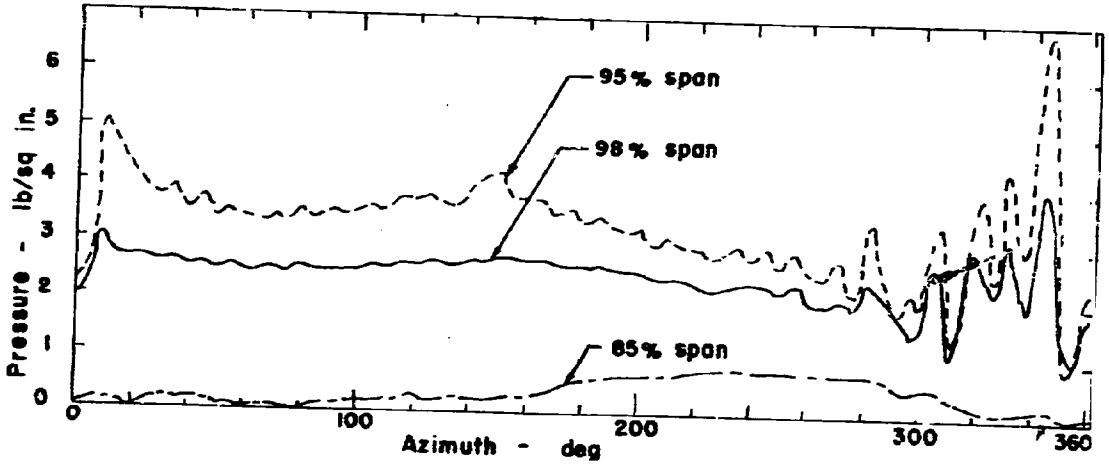


e. 91% Chord Station (Trailing Edge)

Figure 51. Concluded.

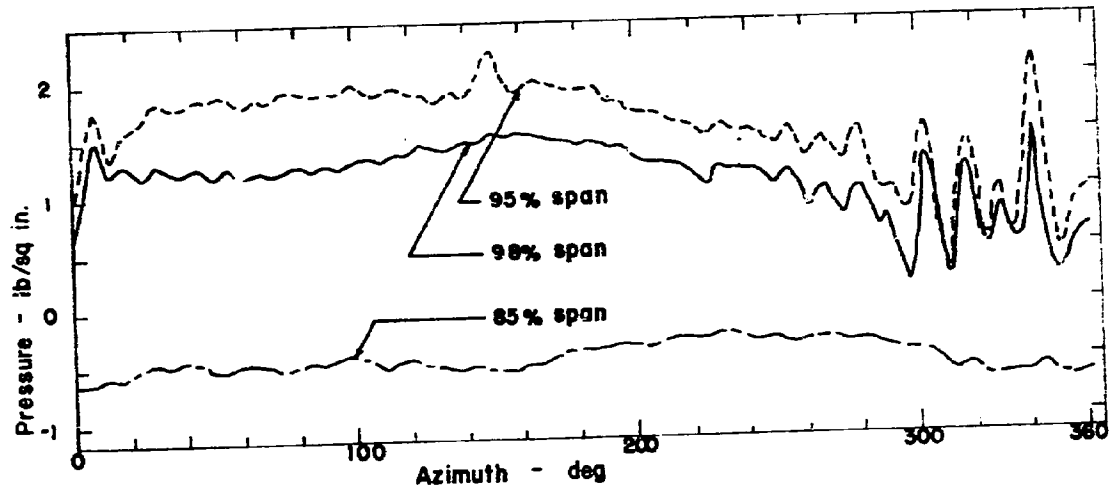


a. 4% Chord Station (Leading Edge)

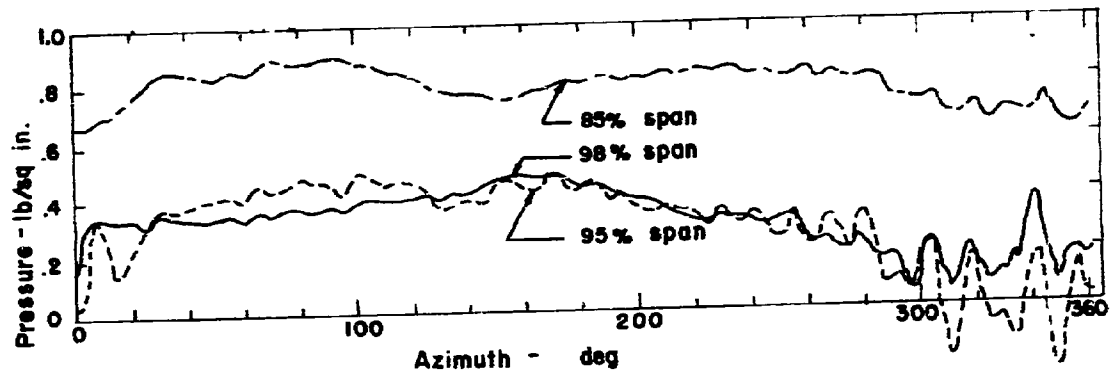


b. 15% Chord Station

Figure 52. Differential Blade Pressures - Hover With RIN.

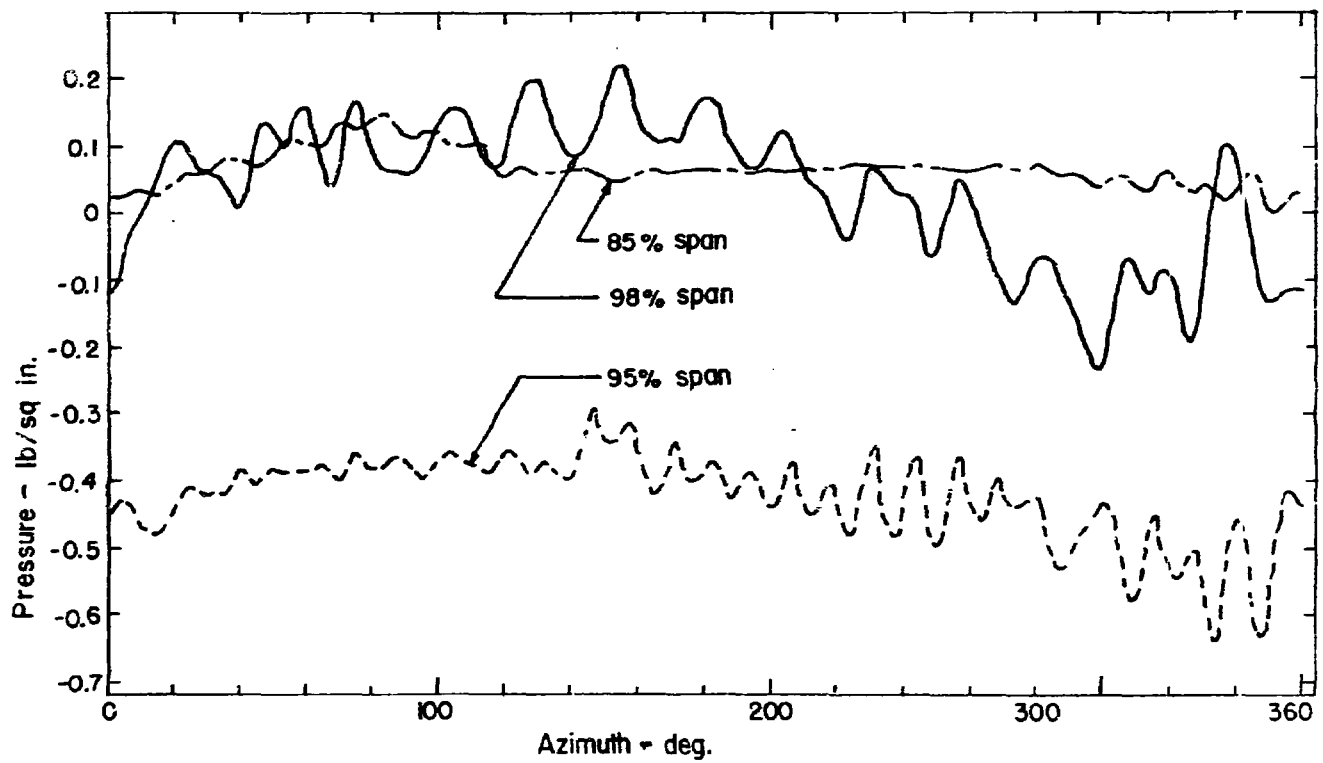


c. 30% Chord Station



d. 60% Chord Station

Figure 52. Continued.



e. 91% Chord Station (Trailing Edge)

Figure 52. Concluded.

TABLE II. AERODYNAMIC DATA - HOVER, NO SIN, 030° HEADING

```
BURST NO. # 7            *** ROTOR NOISE PUNCHED OUTPUT ***
BLADE PITCH HARMONICS
 1.3133&01 1.2684&00 1.4096&00  %COLLECTIVE, LONGITUDINAL, LATERAL RESPECTIVELY%
ROTOR FLAPPING ANGLE HARMONICS
 3.4965&00-9.2093-01 0.0000      %POSITIVE TAIL HIGH -- DEGREES%
DIFFERENTIAL PRESSURE HARMONICS FOR 5 CHORD STATIONS AT EACH OF THE 5 SPANS
%MEASURING FROM THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY%.
SPAN 1  CHORD 1          STEADY%  1.3215&00
COSINE COEFFICIENTS
 1.7893-01 8.6379-02-9.1522-02 5.4074-02-1.4760-02 1.3734-02-3.2843-03 6.8900-03
-1.9970-03-3.4915-03 8.4930-04-1.1290-03-6.9407-03 3.9449-03-9.0343-04 4.3004-03
 4.3959-03 3.0881-04 9.1279-03-5.5478-03-4.8316-05 4.9040-03 3.4661-03-3.2388-03
-1.5023-03-4.7401-03 4.2240-03-1.9447-03-2.2745-03-9.3408-03
SINE COEFFICIENTS
 2.5822-01 1.2173-01-7.8300-02 1.6145-02-2.9130-02 2.6313-02-8.1456-03 1.4022-02
 4.4771-05 8.4027-03 9.5388-03 1.0633-02 5.3334-03 2.9976-03 2.5466-03 8.0187-03
-3.6435-03 2.5755-03-5.3787-03-4.4364-03 3.3528-03 3.4018-03 6.9199-03 5.5968-03
-1.0017-02 9.9794-05-1.6761-03 1.0711-02 1.4144-03 2.0408-03
SPAN 1  CHORD 2          STEADY%  5.2611-01
COSINE COEFFICIENTS
 6.3769-02 2.6989-02-2.6319-02 2.2534-02-1.1330-02 2.8795-03-8.5509-04 4.2238-03
 3.1026-03 1.9779-03 3.8844-03-1.8980-03 2.1659-03-3.2059-04 3.5903-04-2.8702-03
 3.9076-04-5.7715-03-1.1922-02 4.5250-03 6.7258-03 1.7215-03 3.4697-03-2.3070-03
 2.7648-03-4.0455-03-4.0322-03-1.3050-03-8.7565-03 2.6422-02
SINE COEFFICIENTS
 1.0326-01 8.1014-02-2.4542-02 7.6643-03-4.6196-03 8.0691-03 7.9350-03 7.4742-03
-3.5750-03-2.0922-03-1.5032-04 2.7277-03-1.3113-03 2.4368-03 6.6702-05 4.5762-04
 9.8543-04-3.2046-03-4.5313-03 2.1323-03 1.8519-04 1.0419-03 2.1888-03-3.3102-03
-4.5418-03 7.5371-03-4.1295-03-1.2611-03-5.6943-03 9.7307-03
SPAN 1  CHORD 3          STEADY%  2.7584-01
COSINE COEFFICIENTS
 5.3880-02 2.8974-02-2.9560-02 9.6782-03-6.2573-03 3.0683-03 1.4864-03 3.5357-03
-2.6590-03-4.1112-04 3.7660-03 1.8135-03-4.6702-04 9.3446-04 8.9288-04 3.0574-04
 1.1809-03 1.0868-03-7.3116-04-8.6081-04 1.6214-03 9.3992-04-1.5457-03 3.1568-03
 2.9810-04-1.9213-03 3.3486-03-3.8306-03 4.5115-04-3.0356-03
SINE COEFFICIENTS
 7.3465-02 3.2867-02-1.2936-02 5.3314-03-6.4602-03 6.6668-03-7.8706-04 3.6909-03
 1.5718-03 3.2335-03 2.2136-03 2.8958-04 1.9336-03-1.3150-03-7.5293-04 7.0550-04
-1.6301-03 1.3701-03-5.9663-03 3.8544-03 2.8686-03 2.3121-03 1.0317-03 2.3985-03
-6.7346-04-2.8555-05 1.8868-03 1.9076-03-6.0112-04-5.8683-04
SPAN 1  CHORD 4          STEADY%  0.0000
COSINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SPAN 1  CHORD 5          STEADY% -5.6346-02
COSINE COEFFICIENTS
-9.4211-03-4.8721-03 3.1423-03-3.3696-04-2.9359-05 4.4270-04-2.7112-04-9.1695-04
 2.6616-04 3.1085-04 3.8000-04 1.8462-04-2.0502-04 6.7544-04 8.3109-04 5.1657-05
 7.5813-04-1.6474-04 7.6090-04-3.0417-04 2.1672-04-1.2764-04-4.5281-04 8.5783-04
-1.8388-05 3.2837-04-7.3904-04-4.1605-04-7.0243-04-3.7858-04
SINE COEFFICIENTS
-8.4587-04-4.6024-03 8.6588-05-1.6911-03 2.1983-03-3.2865-04 1.5774-04-2.6268-04
-4.8398-04 1.0617-04-2.8801-04 9.0521-04-2.2690-04-3.8574-05-6.9851-04 1.5426-04
-7.2141-05 3.9775-04 1.1860-03-7.9125-04 4.8384-05-2.3706-05-6.4754-05-1.0166-03
-6.9057-04-4.8320-04 1.0969-04-1.3911-04 3.3358-05 2.6347-06
```

TABLE II - Continued

```
SPAN 2  CHORD 1        STEADY#  3.5155800
COSINE COEFFICIENTS
 6.2205-01-5.0632-02 1.4693-02 3.2436-02-6.0388-02 2.5522-02-1.7416-03-5.5072-03
 1.1860-02-5.4898-03 1.8868-02 1.7013-03-7.0031-03 8.4396-03 9.0738-03 8.9960-03
-4.0411-03 9.4131-04 1.1452-03 2.6997-03 5.8287-03-4.9967-03-5.5136-04-1.7133-03
-2.1006-03-7.3604-03 2.2492-03 9.8086-04 2.3835-03 8.7400-03
SINE COEFFICIENTS
 6.0991-01 1.7020-01 3.8480-02 8.0048-02 3.4875-03 1.5879-02 1.3939-02-4.9721-04
 1.6311-02 2.5767-02 8.5079-03 9.2934-03 1.9989-02 9.6852-03 1.4059-02-3.3363-03
-2.1918-03 5.0861-03-8.8771-05-1.7950-04 2.1624-03 1.1886-02-8.9021-03 1.3144-02
 5.8140-03 1.3763-02 1.2142-02 6.0306-03-6.0559-03 5.8436-03
SPAN 2  CHORD 2        STEADY#  1.4074800
COSINE COEFFICIENTS
 2.9125-01-1.4134-03 6.7889-03 2.1101-02-3.0086-02 1.3803-02-5.0205-03-1.6058-03
 2.7946-03-2.0997-03 7.8461-03 4.9558-03-5.5405-03 4.1930-03 4.0955-03 2.5070-03
-6.9420-03-2.9400-03-1.0118-02 6.1578-03 4.7728-04-6.7487-04 2.1611-03-5.0470-03
-1.3996-03 4.3807-04 4.5519-03-2.5978-04 3.1004-03 2.7694-03
SINE COEFFICIENTS
 2.4252-01 7.7975-02 1.6632-02 3.2862-02 1.3079-02 7.4412-03 7.4750-03 5.3284-03
 5.5524-03 1.2052-02 1.4467-05 1.3798-03 1.0131-02-2.3284-03-1.9046-03 1.5630-03
-3.8372-03-1.6881-03 6.2252-03 5.1712-04-1.6817-03-4.6572-04-2.4231-03 7.6010-03
 2.5987-03 4.7418-03-7.1681-04-2.7080-03 2.1766-03-1.8385-03
SPAN 2  CHORD 3        STEADY#  1.1239800
COSINE COEFFICIENTS
 1.4021-01-2.5537-02 7.3251-04 1.2601-02-1.5888-02 6.8869-03 1.0343-04 2.9860-03
 3.7106-03-6.3201-04-3.2924-04 3.6240-04-3.2937-03 9.1033-04 3.8301-03-6.1639-04
-3.1995-03 8.7501-04 4.1110-04 4.6413-03-1.1904-03 2.5720-03-7.0616-04-2.6867-03
 1.2705-03-1.1158-03 1.6909-03-1.7204-03-1.7354-03-3.6505-03
SINE COEFFICIENTS
 1.4063-01 3.6232-02 7.2472-03 2.2703-02-3.6062-04 7.2413-03 3.5772-03-4.5975-04
 1.8374-03 5.7147-03-1.3828-03 4.9614-04 1.2895-03 1.0870-03-2.1114-03-5.3780-04
 1.2634-03-1.6645-03 1.5366-03-1.5986-03 8.5367-04 7.2630-04-3.3847-03 5.8619-03
 3.6215-03 3.6907-03 6.9162-04-1.6133-03 4.1089-04 1.5620-03
SPAN 2  CHORD 4        STEADY#  2.7872-01
COSINE COEFFICIENTS
 8.4155-02 2.6385-03-2.0558-03 9.6918-03-8.3669-03 9.2523-04-7.9473-04-2.9648-03
 2.1314-03 7.2286-05 9.2409-04 7.9965-04-4.6974-04-1.9052-04 1.5216-03-5.9636-04
 5.1233-05-1.0101-03-3.6540-04-2.8228-04 1.5125-04 4.4250-04 8.4629-05-5.1707-04
-6.2209-04-5.2277-04 2.1462-03-6.2797-04-1.0745-03 7.7548-05
SINE COEFFICIENTS
 4.7117-02 2.0689-02 6.5795-03 5.4138-03 1.1244-02 4.4744-03 3.3201-03-6.1514-04
-1.4586-04 4.0916-03 6.4142-04 2.3465-03 2.4332-03-2.6687-04-1.2663-03 2.1877-04
 6.9879-04 3.8897-04 9.3088-04-7.3644-04-1.0069-03-3.6329-04 6.1305-04 1.5469-03
-6.7162-04 4.8457-04 9.6107-04 8.8164-04-1.4996-04 4.8214-04
SPAN 2  CHORD 5        STEADY# -1.6337-01
COSINE COEFFICIENTS
 2.6125-02 3.8526-03-1.3509-03 3.7271-03-2.7216-03 6.2719-04 6.4998-04-1.5116-03
 1.6085-04 2.4534-04-1.1709-03 1.2073-03 8.1225-04 5.0774-04 1.1509-04 8.8855-05
 7.6715-04 1.3301-03 1.1530-03-4.4466-04-5.9289-04-9.0354-04 4.8799-06 1.4151-03
 3.8776-04 1.3138-04 1.4145-03 3.0636-04-5.7415-04-1.0304-04
SINE COEFFICIENTS
-1.3585-02 4.4238-03-3.3623-03-1.4518-03 4.5007-03 2.1445-04 1.2701-03 4.2440-04
 3.5165-04 1.9229-04 2.1429-04 1.0522-03 8.4828-04 1.9464-04 2.1339-05 4.8124-04
 4.7610-04 3.2276-04 3.1395-04-1.9230-03-3.4524-04 1.9437-04 1.0141-03 7.6594-04
 1.3039-04 2.5523-04-6.4601-04 3.8514-04-1.1134-03-1.1669-04
```

TABLE II - Continued

```
SPAN 3  CHORD 1        STEADY#  4.5398800
COSINE COEFFICIENTS
 9.1344-01 2.4672-02-9.5280-02-6.1585-02-1.5801-01 5.5692-03 9.4039-02 1.1364-01
-4.8008-02-4.4187-02-1.0871-01 5.4083-03 3.5277-02 5.6363-02 3.1177-02-1.9043-02
-3.2661-02 5.0311-03-5.9869-03 8.5206-03-5.8866-03 5.6496-03-5.7473-03 2.2078-03
 1.2413-02 8.1592-03-1.4068-02-2.7078-02 1.3375-02-3.6504-03
SINE COEFFICIENTS
 6.0212-01 1.9442-01 1.7576-02-4.8439-03 1.3575-01 7.2371-02 6.9967-02-6.1871-02
-1.1948-01-1.6037-02 1.3864-02 8.4033-02 4.5553-02-9.9201-03-3.3830-02-2.5898-02
 6.4035-03 1.6180-02 2.1443-02-2.3009-03 8.4952-03 4.9311-03 7.0763-03 3.9102-03
 6.2789-03-7.0755-03 1.4883-02-2.2117-02 4.3998-02-9.5085-03
SPAN 3  CHORD 2        STEADY#  5.1488-01
COSINE COEFFICIENTS
 3.1920-01 3.6656-02-2.4089-02 3.2477-02-4.0168-02 3.1998-03 1.3488-02 9.5870-03
-1.6324-02-3.4432-03-3.2245-03 7.5349-03-2.9376-04 3.7356-03-3.6568-04-7.1000-03
-3.0104-04 3.2427-03-8.8079-03 5.6712-03-3.0231-03 7.6622-03-2.1359-03-1.7513-03
 6.3915-03-4.0997-03 2.4094-03-2.3917-03 1.5254-03-2.8373-03
SINE COEFFICIENTS
 6.9666-02 9.5417-02 9.9914-03 1.6957-02 2.9003-02-2.0850-03 3.1961-03-3.1983-03
-7.5608-03 5.5986-03 5.1504-03 1.9627-03 1.2282-03-9.4530-03-7.3499-03-5.3253-03
 1.0441-02-8.2811-03 8.2889-03 3.2551-03 4.7143-03-2.1886-03 1.8540-03 8.0500-03
 4.7956-03-1.1204-02 9.5085-03-6.1570-03-9.8546-03-7.0809-03
SPAN 3  CHORD 3        STEADY# -3.7077-01
COSINE COEFFICIENTS
 9.4995-02 5.2003-02-2.9669-02 1.2778-02-1.2519-02 9.4363-04 5.9984-03-1.5821-03
-1.3751-02 2.7460-03-9.6099-03 3.0029-03 2.3433-03-7.1157-04 5.1523-03-4.7482-03
-1.8145-03 3.7707-03 4.8344-03 1.5368-03-2.4066-04 6.8058-04-8.6469-04 2.6589-03
 8.2060-03-4.2631-03-1.5364-03-4.6039-04 4.0766-03-1.7138-04
SINE COEFFICIENTS
-2.2669-03 6.2634-02-2.6832-03 1.3001-02 2.2155-02 4.6875-03-4.3110-03-6.0489-03
-8.8835-04-2.6791-03 7.1113-03 6.8703-04 4.5805-03-2.0644-03-2.1633-03 2.8066-04
 9.0530-03-3.8696-03 5.4391-04 3.5017-03 2.4168-03 3.1966-03 6.6476-03 6.1629-03
 5.6723-03-2.5686-03 4.2196-04 3.3113-03-4.0813-03 4.5622-03
SPAN 3  CHORD 4        STEADY#  1.1764800
COSINE COEFFICIENTS
 5.5060-03 1.5338-02-1.7025-02 1.1994-02-3.1227-04-1.0326-04 1.0875-03-8.7683-03
-5.5866-03 3.8759-03 2.8888-03 1.0275-04-2.5925-03-3.2028-03 5.4465-04-1.1663-03
 4.5118-04-2.3452-04-5.0419-04 3.2957-03-3.2744-04 6.5977-04 2.6995-03 9.0911-04
 3.0434-03-2.9738-03 1.5306-03-1.2794-03 2.0087-03-8.1781-04
SINE COEFFICIENTS
-3.8908-02 2.8985-02-2.4007-04 1.0648-02 6.8600-03 8.6288-04-9.1648-03-7.1324-05
 2.9426-03 2.9361-03 4.7852-03-5.6196-03 1.7945-03-2.8448-04-4.2911-04 1.0654-03
 1.8981-03-1.0507-04 1.6196-03 1.7150-03-1.1110-03 2.9154-03 5.4937-04 2.4146-03
 8.6896-05 5.9057-04 1.2109-03 1.0767-03-2.2987-04 6.3612-04
SPAN 3  CHORD 5        STEADY#  2.0242-01
COSINE COEFFICIENTS
 3.1762-03 4.9851-03-2.5603-03 5.8589-03 2.8196-03-4.5628-04-2.1767-04-5.9044-03
-6.3671-04 3.5209-04 3.9482-03-7.8798-04-6.8180-04-2.5325-03-8.7711-04 6.7480-04
 5.6727-04 2.5505-04 5.9795-04 6.5134-04-8.1177-04-4.7351-04 3.0004-03-1.1878-03
 1.5512-03-1.9229-03-1.4143-03 7.6162-04-1.1564-03 1.8107-03
SINE COEFFICIENTS
-2.3438-02 9.5578-03 9.9387-04 3.4870-03 9.5972-04 7.8844-04-6.8262-03 9.5167-04
 1.6053-03 2.9658-03 1.9493-03-4.6311-03 1.4959-03-4.4600-04 1.9675-03 9.7045-04
 1.7314-03-6.6614-05 1.7845-03 8.4139-06-2.0118-03 3.1844-03-1.9083-04 1.3417-03
 3.5526-04-2.1735-03 1.6984-03-3.8924-04 6.3088-04-7.8175-04
```

TABLE II - Continued

```
SPAN 4  CHORD 1        STEADY#  9.5341800
COSINE COEFFICIENTS
-1.3684800-8.4312-01-1.9837-01-2.4799-01-1.9390-01 7.3308-02 4.8595-02 5.4914-03
-6.6775-03-1.4721-01-9.0591-02-9.1341-03 1.8089-03 5.0508-02-2.2830-03-3.1198-02
-5.2273-02-3.0054-02-3.8927-02 2.2098-03 1.5133-02 1.5988-02-2.1017-02-2.2794-03
 2.5028-02 4.2023-05-9.7581-03-1.3757-02 1.6881-02 1.0201-02
SINE COEFFICIENTS
-7.3405-01-8.1310-01 9.9605-02 2.6595-01 4.6046-02 4.8517-04-8.7989-03-1.4977-01
-1.6010-01-8.3455-02-5.0482-02 7.5381-02 1.4215-02-9.5309-02-1.0773-02-5.3507-02
-2.5218-02-8.2992-03 6.2344-02 5.8983-02-2.9136-02 5.1984-03 3.8143-02 1.8088-02
-2.7920-02 3.3486-02-1.0842-02 3.6688-02-2.8224-03 3.8492-02
SPAN 4  CHORD 2        STEADY#  3.8796800
COSINE COEFFICIENTS
-1.1079800-3.8811-01-6.3380-02-1.2579-01-1.7367-01 1.2701-01 1.3918-01-4.6663-02
 8.8304-03-5.3028-02-9.8897-02 2.0301-02-1.3747-02 4.3704-04 3.1276-02-2.2334-02
-7.8128-03-6.2278-03-9.8328-03-2.7295-02 1.2925-02-3.8420-03 4.8009-03 6.4983-02
 8.5580-03-1.1926-02-3.5742-02-3.5270-03 1.4664-02 3.2219-03
SINE COEFFICIENTS
-3.5022-01-6.0494-01 1.0944-01 1.7018-01 1.4051-01-6.0592-02 6.5529-02-8.6124-02
-1.4504-01 1.5192-02-1.9686-02 2.0229-02 7.3208-02-7.0087-02 3.4363-02-1.2989-02
-2.7187-02-7.3026-03 3.1731-02 2.4635-03-1.0559-02 3.6536-02 3.3797-02-4.8835-03
-4.1087-02 1.9825-03-8.5268-04 1.6166-02 2.3482-02 4.6819-02
SPAN 4  CHORD 3        STEADY#  1.7704800
COSINE COEFFICIENTS
-2.6249-01-1.9883-01-5.1591-02-7.2592-02-3.6821-02 4.2362-02 1.6471-02 1.0313-02
 2.2379-02-6.7883-02-8.9710-03-1.4320-03-2.2842-02 2.8183-02 7.1747-03-1.3095-02
-3.8257-03-2.8890-02-1.6426-02 2.2795-02 1.2125-02 1.7684-02 7.2674-03-1.1140-02
 7.3705-03-1.2288-02-4.9375-03 1.8689-02 1.6197-04 1.8488-02
SINE COEFFICIENTS
-1.9704-01-2.0230-01-4.3912-02 1.1520-01 1.1838-02 1.8821-02 9.7173-03-6.5188-02
-1.3810-02-9.9860-03-3.1193-02 4.4519-02 1.1462-02-1.0973-02 5.3716-03-2.8734-02
-1.2845-02 1.3334-02 3.0942-03 2.9604-02 1.8697-02-2.0232-02-3.1933-03 2.3911-03
 1.1915-03 9.1756-03 2.9021-03 1.9768-02 6.9495-03-1.1946-02
SPAN 4  CHORD 4        STEADY#  4.3502-01
COSINE COEFFICIENTS
-4.8628-02-4.7619-02-1.2670-02-7.7182-03-1.3397-02 1.3703-02 1.8237-02 1.3705-03
-2.1859-03-3.1607-03-9.6090-03 1.9575-03-3.3055-03 1.2500-03 1.1314-02-5.6686-04
 1.6763-03-1.0080-02-6.8390-03 1.0183-03-2.5432-03 1.2895-02 4.7617-03-3.2997-03
 3.3472-03-1.1393-02-1.7096-03-7.6077-03 7.5587-03 7.1984-03
SINE COEFFICIENTS
-8.6418-02-4.2627-02-2.2180-02 4.0290-02 1.2906-02 3.3787-04-7.7343-03-1.2327-02
-8.5932-03-6.4330-03-6.8807-03 4.0859-03 9.2643-03-2.6250-03 3.8312-03-8.9611-03
-5.0431-04-9.8795-03 1.0879-02 1.6004-02 1.1777-02 4.4553-03-2.1780-03-5.2995-03
-2.7080-03-2.3385-03 5.2847-03 1.0298-02 2.0439-05 5.0925-03
SPAN 4  CHORD 5        STEADY# -3.7936-01
COSINE COEFFICIENTS
-8.4917-03-8.8517-03 9.6144-05-9.2092-04 6.0998-03 9.5912-03 2.2058-03 1.9945-03
-8.8767-04 3.4331-03 1.3717-03-2.5022-03-6.7829-03-2.8007-03-3.5518-03 1.2209-03
-1.9448-03 4.3594-03 2.9051-04 6.1218-04-2.6776-03 4.4277-03 7.1966-03 2.0035-03
-5.1467-03-3.7851-04 3.5406-03-1.9203-03-1.7568-03-4.5369-03
SINE COEFFICIENTS
-4.7729-02-1.7351-02 7.0737-03 1.9094-02 2.9334-03 4.6804-04-3.7162-03-3.8534-03
-1.8753-03-5.0572-06 2.6993-03 7.7569-03 3.6277-03 1.0549-02 5.9268-03 4.2084-03
-2.9645-03-2.7871-03 1.2635-03-5.7055-04 5.2044-03 1.7211-03-3.8385-03-1.6438-03
-6.6820-04-7.5529-03 8.2384-05-3.7954-03 1.0034-03 2.0277-03
```

TABLE II - Concluded

```
SPAN 5  CHOPD 1        STEADY#  9.8304&00
COSINE COEFFICIENTS
-1.6596&00-1.2404&00-6.6369-01-3.8059-01-1.1047-01-2.8423-02-5.4526-03 1.0968-02
-3.8994-03-1.5860-02 1.7104-02-1.1093-02-2.7075-02-9.0516-02-2.1754-02-2.4752-02
-4.1009-02-1.8956-02-1.3232-02 3.7125-03 1.2127-02 3.6494-02 2.6005-02 2.6624-03
 7.8025-03 2.4996-02-3.4414-02-1.7907-02-1.3129-02-1.0545-02
SINE COEFFICIENTS
-6.8719-01-8.1859-01-1.1993-01 8.5975-02 3.3376-02 3.7790-02-4.4579-02-2.0696-02
-8.2308-03-4.8822-02-6.9061-02-6.5330-02-4.4534-02-2.0549-01-9.6744-02-5.9658-02
-3.8119-02 1.2303-02 6.0929-02 8.1873-02 3.5231-02 1.2802-02 1.3826-02-1.1200-02
-2.0696-02 9.6773-03-2.6531-02 5.9396-03 9.2508-03 2.5196-02
SPAN 5  CHOPD 2        STEADY#  2.5259&00
COSINE COEFFICIENTS
-3.7722-01-2.8959-01-1.1734-01-7.2880-02-6.9081-02-7.7209-03 5.1103-03 2.5126-03
 6.3896-03-1.8722-02-1.9751-02-8.3092-03-1.4490-02-8.5917-03 1.2548-03-8.7066-03
-2.2100-03-9.5015-03-9.9068-03 3.4556-03 8.6775-03 1.0221-02 6.5280-03 6.3178-03
 5.3227-03 9.2505-03-1.0978-03 2.0117-03 8.4952-04 4.4717-04
SINE COEFFICIENTS
-9.8361-02-2.0992-01-6.1597-02 2.7910-02 1.4647-02-3.3070-03 3.4487-03-3.0249-02
-3.7474-02-2.3711-02-2.9421-02 1.3507-04-6.1121-03-1.4266-02-6.5356-04-8.0299-03
-1.2949-03-1.2461-03 1.4980-02 1.3076-02 7.9412-03 3.9418-03-1.7798-03-3.6476-03
-7.1338-03-8.1590-04 2.2453-04 5.6537-03 8.0248-03 1.5282-02
SPAN 5  CHOPD 3        STEADY#  1.2639&00
COSINE COEFFICIENTS
-2.4124-01-2.1881-01-8.3634-02-4.0030-02-4.7826-02 1.4367-02 1.0826-02 1.0908-02
 9.3417-03-1.8416-02-1.7671-02 2.6224-04-6.0860-03-2.1235-03 9.0087-03-1.1013-02
-4.5433-03-1.1041-02-1.3626-03 4.8760-03 6.2006-03 9.0849-03 7.2772-03-1.6576-03
 2.7372-03-1.8826-03-1.4716-03 4.7916-03 4.6726-03 3.6969-03
SINE COEFFICIENTS
-1.5178-01-1.7806-01-4.8001-02 2.7917-02 1.3979-02-6.2191-03 2.4727-03-2.9592-02
-3.4499-02-1.4772-02-1.9321-02 1.0746-02 4.7960-03-1.0340-02-5.3674-03-1.1636-02
-1.6140-03 5.1261-03 1.6911-02 1.0681-02-3.6546-04-1.2568-04-6.1935-04 5.0139-09
-4.5858-03 1.8797-03 1.6431-03 8.8396-03 5.0994-03 5.4623-03
SPAN 5  CHOPD 4        STEADY#  4.7708-01
COSINE COEFFICIENTS
-7.9225-02-7.4821-02-2.3488-02-1.1087-02-2.3349-02 5.1036-03 6.3273-03 8.4353-03
 5.9461-03-6.6398-03-5.9131-03 1.6228-03-2.0853-03 8.8724-04 3.1532-03-3.8317-03
-7.7469-04-4.4396-03 1.7617-03 4.1118-03 4.1378-03 3.7725-03 2.0608-03-9.7410-04
 2.3043-03-1.4790-03 1.4708-03 3.4300-04 1.1362-03 1.3324-03
SINE COEFFICIENTS
-7.1022-02-6.8677-02-2.6652-02 7.5530-03 1.0709-03-3.9665-03 6.1016-03-8.4271-03
-1.2929-02-4.3641-03-8.7898-03 7.0681-03 2.6996-03-2.9661-03-2.0662-03-4.6562-03
-5.2572-05 2.6007-03 4.9700-03 3.5243-03 1.2128-03-1.3730-03-1.7840-03 1.6872-03
-1.3981-03-7.9569-04 3.2221-04 3.0294-03-3.5878-04 7.7917-05
SPAN 5  CHOPD 5        STEADY#  1.8145-01
COSINE COEFFICIENTS
-7.0866-02-6.5144-02-1.4039-02-5.5659-03-8.1222-03 9.7118-03 1.1004-02 7.8894-03
 2.4851-03 8.3311-03 8.5385-03 1.2029-03 1.5242-02-2.5991-02-8.9675-03-3.8741-03
 1.6540-03-6.4288-03-4.6925-03 3.3192-03 3.9116-03 2.5401-03 4.6753-05 1.2859-03
 3.4350-03 8.7009-04 1.4517-03-6.4478-04-1.2123-03 3.4983-03
SINE COEFFICIENTS
-7.9007-02-7.2525-02-1.2389-02 2.1958-02 3.9799-03-3.4117-03-2.4317-03-5.3973-03
-8.3407-03-6.0708-03-4.8531-03-1.6882-03-1.5945-02 3.5526-02 1.0049-02-1.6938-03
 1.6474-04 3.5160-03-6.1722-04 3.3869-03 7.0822-03 1.0413-03-2.6955-03-6.0742-04
-8.6310-04-9.0140-03 1.5820-03 4.6135-03 1.9016-03 4.6161-03
```

TABLE III. AERODINAMIC DATA - HOVER, RIN, 210° HEADING

```
BURST NO. # 8            *** ROTOR NOISE PUNCHED OUTPUT ***
BLADE PITCH HARMONICS
 1.3149&01-5.1298-01 1.5972&00  %COLLECTIVE, LONGITUDINAL, LATERAL RESPECTIVELY%
ROTOR FLAPPING ANGLE HARMONICS
 1.6186&00-1.8674&00 0.0000      %POSITIVE TAIL HIGH -- DEGREES%
DIFFERENTIAL PRESSURE HARMONICS FOR 5 CHORD STATIONS AT EACH OF THE 5 SPANS
%MEASURING FROM THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY%.
SPAN 1  CHORD 1        STEADY%  1.2647&00
COSINE COEFFICIENTS
-6.3271-02 1.5366-01-2.3798-02 1.9142-02-6.4235-04 2.1418-02 2.9006-03 4.3904-03
 1.7620-03 7.6723-04 2.7176-03 7.1654-03-1.1713-02-7.1462-04-1.0302-02 5.7290-03
-1.4834-03 3.7584-03 7.5091-03-1.1189-03 1.8806-04-3.6035-03-1.3170-02 3.8185-03
-6.0449-03-4.6755-03-4.9406-03 4.3349-05-3.2237-03-6.9466-03
SINE COEFFICIENTS
-6.7975-02 1.1582-01 1.6155-02 9.6492-03 9.3598-04 2.4391-02 6.8212-03 8.3991-03
 8.8690-05 3.8080-03 8.0825-03 1.0828-02-3.6018-03 4.7461-03 3.3214-03 2.4827-03
-8.3148-03 2.3212-03 3.4229-03-3.2708-03-7.9586-04 1.3454-03-7.3544-03-9.2106-03
-3.0386-03-5.0275-03 4.7932-03 2.8240-03 5.7599-03-4.1448-03
SPAN 1  CHORD 2        STEADY%  5.1060-01
COSINE COEFFICIENTS
-2.1787-02 4.9361-02-1.3132-02 1.0606-02 6.0639-03 1.1250-02 1.5358-03-1.0683-04
 6.5109-03-1.8269-03 1.3765-04 6.9291-04-3.4552-03-2.7963-04-3.3681-03 3.0101-03
-7.5558-04 1.9744-03-1.9263-03 1.0037-04 7.0569-03 1.8911-03 3.9040-03-1.2772-03
-3.8435-04-9.5977-04 2.4985-03-8.1280-03-5.8801-03 4.0514-03
SINE COEFFICIENTS
-2.3541-02 4.0190-02 8.9051-04 6.4219-04 5.7319-03 8.5890-03 4.7969-03 5.7645-03
 1.7015-03 2.9611-03 4.0187-04 2.1719-03 1.5255-03 2.0816-03 4.6504-03 1.6018-03
-2.9568-03-1.5157-03-6.5650-03 5.8280-03 5.9581-04-2.1374-04 1.6758-03-6.8024-04
-3.6145-03-7.1126-03-1.8618-03 3.6644-03-2.4072-03 3.2561-03
SPAN 1  CHORD 3        STEADY%  2.3034-01
COSINE COEFFICIENTS
 3.9569-05 3.4833-02-7.4390-03 9.5495-03-6.8038-03 6.7903-03 4.2903-03-8.8721-04
-3.4871-03 3.0704-03 5.8936-03 1.0261-02-4.4525-03 4.2405-04-1.3115-03-4.0145-03
-2.5574-03 5.5405-03-1.6810-04 2.2049-03-1.8030-03 5.8978-04 3.8212-03-2.7464-03
-3.8807-04-4.7112-04-6.3374-03-1.7289-03-4.9188-03 1.9365-03
SINE COEFFICIENTS
-1.8026-02 3.4091-02 1.5406-02 2.2868-03 3.8950-03 2.9831-04 3.8640-03 2.1162-03
 6.7870-04 3.0249-03-1.3121-03 7.6481-04 2.9948-03 2.8343-04 1.9835-03-1.1111-03
-6.2693-04-2.0618-03-1.8063-03-2.2800-04 6.2882-04 4.0359-04 1.8732-03-6.6305-03
-1.3897-03 3.7408-03 4.0968-03 3.2987-03 3.0029-04-5.3583-04
SPAN 1  CHORD 4        STEADY%  0.0000
COSINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SPAN 1  CHORD 5        STEADY% -3.0049-02
COSINE COEFFICIENTS
 5.9828-03-6.4795-03 1.2106-03 7.2676-04 1.7298-03 4.6916-05 3.7134-04-1.4315-04
-4.2133-04 5.6123-04-6.9857-04-2.1011-03 7.2182-04 8.2735-04 9.5652-04 6.9424-04
 1.7673-03-1.7699-03-8.9845-04 3.9407-04 7.1498-04 5.1366-04-5.1396-04 1.5802-03
 3.6310-04 2.2840-03-2.0721-05-1.0779-04-5.6919-04-3.5682-04
SINE COEFFICIENTS
-2.9976-03-2.7345-03-4.9350-03 1.5257-04 1.1329-03-9.9202-04 5.9322-04 2.1750-04
 7.5164-04-6.8477-04 5.8769-04-8.4726-04-1.7529-03 1.3102-04-5.4939-04 3.3300-04
 5.3858-04 1.2756-03 1.7809-03-9.1001-04 2.3246-04 7.6588-05-6.3374-04 1.7986-03
-5.2556-05-1.4435-03-2.0153-03-1.6285-03-1.0511-03 2.7341-04
```

TABLE III - Continued

```
SPAN 2  CHOPD 1        STEADY#  3.1557&00
COSINE COEFFICIENTS
-6.0432-01 6.5378-02 9.6619-02 1.2051-01-8.6912-03 6.1809-03 4.5970-02 1.0740-01
 6.5133-02 6.3285-02 4.6977-02-2.2366-02-3.0634-02-2.1811-02-1.2074-02-2.7465-02
-1.9019-02 8.3302-03 4.8263-02 6.4169-02 6.1966-02 1.9765-02-3.8532-02-4.1872-02
-1.8000-02-1.2138-02-4.8403-02-5.6375-03 4.5449-02 6.4245-02
SINE COEFFICIENTS
-3.1147-01 1.9749-01 1.3007-01 1.0749-01 1.0290-01 2.9494-02 5.2923-02 6.9593-02
 7.5040-03 8.5045-03-4.0499-02-6.4891-02-5.2857-02-2.3774-02-1.8771-02-2.7523-03
 2.2699-02 6.4261-02 5.1962-02 9.9979-03-3.6232-02-7.1369-02-5.6708-02-4.0063-03
 1.1965-02 2.3019-03 2.9952-02 5.2038-02 4.6977-02-1.0361-02
SPAN 2  CHOPD 2        STEADY#  1.2420&00
COSINE COEFFICIENTS
-2.9688-01 2.2162-02 5.4326-02 6.8796-02 5.8967-03 2.5945-03 2.1725-02 4.9006-02
 2.2770-02 1.8230-02 1.9796-02 1.0125-03-1.6452-02-1.7981-02-7.0519-03-1.9017-02
-9.5399-03 1.4670-02 1.1905-02 2.7229-02 1.9316-02 6.6694-04-1.8130-02-1.6789-02
 6.8949-05-1.5715-02-1.2159-02 1.4596-02 2.7591-02 2.1538-02
SINE COEFFICIENTS
-1.1105-01 9.6526-02 5.4579-02 4.0758-02 3.4068-02 1.4822-02 2.2670-02 1.6158-02
-2.5893-03-8.6142-05-1.1205-02-2.1416-02-1.3914-02-2.6999-03-6.0317-03 6.3848-03
 9.0211-03 2.4896-02 1.0860-02-9.3201-03-2.4301-02-2.7891-02-2.2639-02-3.8832-03
 4.4773-03-2.7975-03 1.5003-02 1.6177-02 8.1507-04-1.4791-02
SPAN 2  CHOPD 3        STEADY#  1.0430&00
COSINE COEFFICIENTS
-1.4331-01 3.2466-03 2.6389-02 3.9561-02-9.5510-04 8.1906-03 1.7911-02 2.4234-02
 9.3848-03 9.5470-03 1.1601-02 4.9699-04-7.0805-03-2.6373-03 1.7075-04-6.3756-03
-5.1851-03 7.9365-03 8.6847-03 1.5030-02 6.1438-03-5.1859-03-1.3181-02-1.0405-02
-5.5005-03-7.1186-04 5.1593-05 9.5756-03 1.2390-02 5.4115-03
SINE COEFFICIENTS
-6.8149-02 4.6958-02 2.0458-02 1.7331-02 1.9161-02 9.8082-03 8.9644-03 4.8526-03
-2.3109-03 5.8140-03-9.1807-03-1.6390-02-4.6924-03-6.0459-04-3.3126-03-1.5029-03
 5.1611-03 9.5756-03 2.3312-03-5.2159-03-1.1476-02-1.2930-02-5.8177-03 1.1056-03
 4.7294-03 6.6884-03 6.3732-03 5.4411-03-1.1330-03-6.9694-03
SPAN 2  CHOPD 4        STEADY#  2.0854-01
COSINE COEFFICIENTS
-8.2805-02 2.1139-02 2.4472-02 2.5180-02 7.8439-03 3.7468-03 2.0914-03 1.2098-02
-1.8329-03-4.9836-04 3.9886-03 3.2809-03-7.4841-03-4.4422-03 1.4615-03-1.8726-03
-7.0024-04 6.1951-03 1.9999-03 6.0500-04-1.3104-03-4.1757-03-3.6371-03-4.8886-03
-7.0238-04 3.2332-03 4.0347-03 1.0154-03-1.0260-03-2.0070-03
SINE COEFFICIENTS
-8.6759-03 4.0215-02 1.6522-02 3.2601-03 1.6760-02-1.2167-03 9.7461-04-2.6032-03
-3.4172-03 6.1326-03 2.8021-03-3.5061-03 5.3758-04 4.7844-03-8.7069-04 1.2789-03
 9.0836-04-3.3735-03-2.3045-03-3.2293-03-3.3185-03-3.5701-03-1.3816-03-2.6053-03
 3.7388-03 1.7221-03 1.0407-03-3.2553-03-1.8171-04-1.2848-03
SPAN 2  CHOPD 5        STEADY# -1.7373-01
COSINE COEFFICIENTS
-2.9849-02 4.9327-03 5.1380-03 6.3509-03 2.8857-03 1.0807-03-1.7863-03 1.0247-03
-2.7573-03-4.0863-03-1.4608-03 1.0106-03-1.8954-03-2.3643-03-1.9088-03-1.4083-03
-1.4083-04 5.1061-03 3.2543-03-3.2554-03-3.0671-03-3.1204-03-1.9335-04-1.3266-03
 1.3023-03 7.6369-04 3.5292-03 6.7610-04 3.5904-04-3.2659-03
SINE COEFFICIENTS
 1.3031-02 1.1137-02 4.4920-03-1.2502-03 3.0421-03-2.5363-03-1.9006-03-3.5707-03
-2.7431-03 1.4676-03 3.7955-03-2.6112-04 6.7564-04 2.3361-03 9.1367-04 1.3211-03
 4.6693-04-4.2658-03-3.0528-03-1.9801-03-7.6793-04 7.3475-04 1.5424-03-9.1915-04
 1.4732-03 1.0880-03 1.5391-05-2.0337-03-2.2257-03 6.1778-04
```

TABLE III - Continued

```
SPAN 3  CHORD 1          STEADY#  4.1991E00
COSINE COEFFICIENTS
-9.1580-01-2.0433-01 3.4551-01 4.6275-01-1.3142-02-3.5954-01-1.2598-01 1.0159-01
-1.3641-01-1.2202-01 1.5811-01 1.4193-01-9.6021-03-3.9774-03 7.2505-02 9.4394-02
 1.4752-01 1.1030-01 8.5376-03 5.6976-02 1.0851-01 2.2780-02-1.0697-01-1.6016-01
-7.3138-02-1.7324-02-2.8502-02-8.2004-02-1.2302-01-8.7892-02
SINE COEFFICIENTS
-8.1974-01 1.8345-01 3.2030-01-1.5886-01-3.4188-01-1.6819-01 5.4953-02 3.1822-02
 7.6153-02 3.2147-01 2.4369-01 8.3325-03-1.4919-02 6.7174-02 7.2360-02 8.9527-02
 5.6776-02-4.1482-02-3.6621-03 5.5582-02-4.1511-02-1.6654-01-1.4265-01-4.7483-02
 4.6857-02-2.5095-02-7.1594-02-7.2688-02-6.1893-03 6.9352-02
SPAN 3  CHORD 2          STEADY#  3.6573-01
COSINE COEFFICIENTS
-3.2430-01 1.6397-02 6.9283-02 3.8051-02-3.0686-02-6.9092-02-1.7758-02 2.5484-02
-3.9342-02-2.1727-02 5.2016-02 4.3413-02 7.7074-03 1.5680-02 1.9280-02 1.4556-02
 3.0684-02 2.4022-02 8.7488-03 1.7367-02 2.7889-02-1.1265-02-4.3295-02-3.2657-02
 5.8352-03 4.7004-03-1.8784-02-3.5088-02-1.8150-02-1.4837-02
SINE COEFFICIENTS
-6.4595-02 1.4279-01 1.1383-01 6.1514-03-3.4080-02-1.9948-02-7.7462-03-1.3139-02
 9.3781-03 6.1883-02 3.5458-02 1.1610-02 5.8686-03 1.3120-03-1.8488-03 2.1381-02
 1.4394-02-1.7543-02-2.4562-02 3.0018-03-1.6856-02-3.2813-02-1.2521-02 3.4030-02
 4.2922-02-5.2281-03-5.8381-03 3.4666-03 1.8177-02 2.3179-02
SPAN 3  CHORD 3          STEADY# -4.9018-01
COSINE COEFFICIENTS
-1.0782-01-1.8570-03 8.9802-03 7.2332-03-1.5093-02-4.6556-02-2.3168-02 8.1793-03
-2.9525-02-7.1025-03 2.5327-02 2.7953-02 5.5150-03 9.3457-03 1.1379-02 1.0916-02
 1.9807-02 7.8309-03 1.0577-03 7.4527-03 1.5331-02-1.3137-02-2.7436-02-1.3626-02
 1.0046-02-5.7974-04-2.1791-02-2.1275-02-3.2249-04-1.0632-03
SINE COEFFICIENTS
-3.5829-03 1.2166-01 9.2377-02 6.7222-04-7.9642-03-1.6653-02-9.0665-03-2.0620-02
 6.2252-03 3.5475-02 1.7789-02 2.6031-03 5.1917-03 6.0054-04-7.3531-03 2.3527-03
 6.8851-03-4.0234-03-3.8469-03 8.7292-05-1.7609-02-1.6502-02-6.5461-04 3.1935-02
 1.5099-02-2.8720-03-8.1479-04 1.8574-02 2.0775-02 1.3814-02
SPAN 3  CHORD 4          STEADY#  8.5786-01
COSINE COEFFICIENTS
-1.5770-02 6.4496-03-1.5248-02-1.4446-02-2.8034-03-3.9121-03-7.6607-03-3.7357-03
-1.5199-02-6.4580-03 6.8966-03 1.4035-02 3.2885-03 5.7797-03 1.7411-03-2.2001-03
-1.1700-04-2.6888-03 8.2266-04 3.1858-03 4.9670-04-5.1621-03-8.4129-03-1.4547-03
 8.8594-03 3.7607-03-6.5378-03 6.3317-04 1.0913-02 5.6450-03
SINE COEFFICIENTS
 3.5503-02 5.9841-02 2.4812-02 1.4649-03 1.5504-02 6.8211-03-2.8931-03-1.4748-02
-5.8968-03 2.9377-03-1.1389-03 6.4843-04 8.4922-03 4.7058-03-3.6292-03-3.5898-04
 2.0892-03-1.7047-03-4.8315-03-4.6179-03-6.0430-03 6.4950-04 8.7485-03 1.7217-02
 4.0626-03-6.5689-03 3.5113-04 1.1703-02 7.1326-03 2.1089-03
SPAN 3  CHORD 5          STEADY#  7.6976-02
COSINE COEFFICIENTS
-9.4304-03 6.6213-03-5.9602-03-1.6223-03 7.5222-03 1.1258-04-8.4720-03-6.3688-03
-3.9951-03 9.7301-04 4.9368-03 7.7317-03 2.9744-04 9.6218-04 3.3901-04-1.7625-03
 9.7535-05-3.4285-03-1.0426-03-8.2563-04-4.0519-03-4.1627-03-2.0371-03 3.1503-03
 2.0683-03 4.9178-03 1.3242-03 4.1463-03 4.0486-03 1.5131-03
SINE COEFFICIENTS
 1.9178-02 1.0140-02-6.7500-03-2.0332-03 1.4432-02 1.3894-02 3.7452-03-7.4457-03
-1.0512-02-7.3133-03-5.6339-03 3.0177-04 7.4695-03 7.4368-04-2.8715-03-2.1269-03
-1.2855-04 1.4430-03-1.5211-03-5.5326-03 3.7338-04 4.1684-03 2.7179-03 5.0986-03
-2.0828-03-3.2783-03 1.9913-03 4.2878-03 4.4103-03 9.7982-04
```

TABLE III - Continued

```
SPAN 4  CHOPP 1        STEADY#  9.1557800
COSINE COEFFICIENTS
 8.3673-01-5.8406-01 2.6990-01 2.3069-01 2.1317-01 3.1326-01 7.7373-03 4.4229-02
-3.1146-01-2.7154-01-1.9498-01-1.2855-02-1.5934-01-9.7142-03 7.0245-02-3.3795-02
-3.5508-02-9.5375-02-1.5153-01 9.4888-02 1.2963-01-4.5549-02-1.2703-01 3.6806-02
 2.0198-01 4.6721-02-1.5185-01-2.2553-02 1.4025-02-1.4441-01
SINE COEFFICIENTS
 1.5196800-6.5040-01 5.6420-01 5.3098-01 3.1304-01-1.6634-01-2.5070-01-1.7232-01
-1.4183-01 1.0814-01 2.1519-01 4.5652-02 1.1578-01 1.8044-01-6.0483-02-5.1772-02
-3.9416-02-1.1571-01 3.4024-02 1.0790-01-4.6614-02-1.2979-01-2.1229-02 1.6038-01
-5.3972-03-2.5519-01-7.4533-02 2.6438-02-1.1106-01-2.6578-02
SPAN 4  CHOPP 2        STEADY#  3.3409800
COSINE COEFFICIENTS
 4.1240-01-7.6599-02 1.5347-01 1.1755-01 4.9830-02 9.2946-02-6.8618-02-1.0911-01
-1.9899-01-1.9591-01-1.4735-01-6.2476-02-1.1454-01-2.9008-02-2.8874-02-6.2518-02
-3.1156-03-7.4801-03-5.9361-02 3.4450-02 3.9089-02-1.2419-02-5.2035-02-1.9472-03
 7.4843-02 1.7616-02-4.6100-02-7.9780-03-3.2450-02-4.1840-02
SINE COEFFICIENTS
 4.4801-01-1.3411-01 1.9004-01 1.5209-01 1.2861-01-1.0402-01-6.1205-02-2.9415-02
-2.0835-02 5.4545-02 1.6593-01 8.4618-02 9.1515-02 1.0119-01 8.9375-03 4.2362-02
 4.1312-02-6.0614-02 1.3596-02 3.6530-02-5.5046-02-7.3506-02-2.4362-02 3.9901-02
-2.2227-02-1.0804-01-4.4879-02-2.5170-02-7.0282-02 1.7892-02
SPAN 4  CHOPP 3        STEADY#  1.7318800
COSINE COEFFICIENTS
 1.4047-01-9.1700-02 2.5284-02 1.7300-02 3.4116-02 5.1952-02-8.5635-03-1.6263-02
-5.5984-02-4.7289-02-2.8464-02 8.7838-03-1.7982-02 1.8483-02 7.1904-03-1.6800-02
 2.1212-02 1.4554-02-4.7444-02-7.3769-03 1.5218-02-1.0153-03-1.5812-02 1.5092-02
 3.7665-02-1.3299-02-1.9411-02 1.7071-02-8.0007-03-9.3165-03
SINE COEFFICIENTS
 2.6453-01-6.6361-02 1.0989-01 6.1972-02 3.9806-02-4.0403-02-7.1185-03-5.4125-03
-6.3001-03 1.6727-02 7.4339-02 3.5969-02 2.5920-02 1.9217-02-1.0772-02 1.6227-02
 1.5202-03-5.2643-02-1.9754-02 1.4085-02-1.5579-02-1.4829-02 2.5828-03 1.4977-02
-2.4330-02-2.2850-02 2.3288-02 8.2909-03-5.1308-03 2.0914-02
SPAN 4  CHOPP 4        STEADY#  3.[illegible]34-01
COSINE COEFFICIENTS
 2.8826-02-2.9908-02-9.9324-03-9.8280-03 2.2682-02 1.5260-02 1.0494-04 1.0579-02
-5.3990-03-9.6781-03-8.3166-03 8.2451-03 8.3519-03 1.0573-02-3.5718-03-1.3969-02
 9.8721-03 2.2071-02-1.1175-02-8.7916-03 1.4946-02 3.3207-03-1.7528-02 4.1396-03
 1.7798-02-6.4746-03-1.8366-02 1.6058-03-1.0886-03-3.4343-03
SINE COEFFICIENTS
 8.2309-02-2.4141-02 1.4770-02 1.5771-02-3.5224-03-1.1022-02 5.5523-03-4.4959-04
-3.3445-03 4.3547-03 2.8900-02 2.5847-02 1.5306-02 8.5821-03 4.7898-03 1.9686-02
 1.8880-02-3.0030-03 3.7769-03 9.4800-03 2.2451-03-8.5680-03-4.7796-03 7.1699-03
-1.6628-03-1.2701-02-6.5155-03 2.7905-03-6.6780-03 4.0410-04
SPAN 4  CHOPP 5        STEADY# -4.1377-01
COSINE COEFFICIENTS
 1.2440-02-1.2577-02-2.6790-03-7.6369-03 2.6838-03-4.6745-03 2.9262-03 2.2626-04
 1.6403-03 2.5258-03-5.1709-04-6.4062-04 9.8404-03 6.1756-03-9.9783-03 4.2872-03
 8.0766-03 6.1280-03-2.9670-03 3.4057-03 1.0880-02 1.4237-03-9.6147-03 2.7417-03
 2.6310-03-5.4443-03-2.2578-03-4.4965-03-1.3301-02 2.4562-03
SINE COEFFICIENTS
 2.8875-02-1.4423-02-8.3499-03 1.7[illegible]8-02-1.6359-03-2.3580-03 1.1205-02 7.3783-03
 3.8976-03-4.5946-03 5.7636-03 4.[illegible]76-03 1.1449-03-7.9393-03 7.0904-03 7.7025-03
 1.1927-03 3.8851-03 6.3806-03 6.[illegible]487-03 4.0538-03-3.7408-04-8.2303-03 1.4612-03
 9.0379-04 1.0594-04-5.5641-03 2.1603-03 2.6551-03 5.7811-03
```

TABLE III - Concluded

```
SPAN 5  CHORD 1        STEADYW  1.0140&01
COSINE COEFFICIENTS
 8.1270-01-3.5370-01 2.4003-01 2.5036-01-3.1892-02 2.4952-01-3.5342-01-4.4937-02
-2.7319-01-3.6220-01-2.8402-01 1.2658-01-6.0639-02 4.4470-02-6.0244-02-1.0252-01
-1.4074-02-3.9253-03-1.5175-01-3.9921-03-1.7202-02-2.0508-02-2.3080-01-1.4872-01
 2.0452-01 3.5410-02-8.7708-02 1.1638-01 3.5198-02-1.5819-01
SINE COEFFICIENTS
 6.6957-01-6.3023-01 6.2842-01-2.7872-01 1.3366-01-3.4347-01-1.7288-01-1.2556-01
-2.3129-01-3.9932-02 2.9022-01 8.0567-02 6.7052-02 2.5116-03-1.9218-01 2.6627-02
-3.0270-02-8.8990-02-3.8876-02 6.2461-02-5.7976-02-6.6608-02-8.7663-02 2.6946-01
 1.2571-01-1.2988-01 2.9635-02 5.0079-02-1.8889-01 6.0941-03
SPAN 5  CHORD 2        STEADYW  2.5385&00
COSINE COEFFICIENTS
 1.5805-01-7.3870-02 9.9888-02 6.8284-02 1.5492-02 7.0019-02-4.7606-02-2.1748-02
-7.4740-02-6.8947-02-3.9431-02 1.3075-02-3.7381-02 2.6241-02 3.9248-03-3.0443-02
-7.9848-03-4.2538-03-3.4262-02 5.1022-03-3.0950-03-1.0287-02-5.8107-02-9.4768-03
 5.1425-02-1.0871-02-2.7557-02 2.9741-02-8.9474-03-1.2226-02
SINE COEFFICIENTS
 1.2599-01-1.2648-01 1.2680-01-1.7043-02 3.6776-02-7.6547-02-5.1485-02-2.7991-02
-1.8366-02 2.5667-02 7.8913-02 1.2459-02 3.0507-02 3.7347-02-2.5686-02 2.9658-03
 4.3175-03-2.7577-02-6.9273-05 1.3829-02-9.6055-03-2.1131-02-9.3092-03 5.8727-02
-2.5129-03-4.6704-02 1.3584-02-2.1486-04-4.1262-02 2.1977-02
SPAN 5  CHORD 3        STEADYW  1.2635&00
COSINE COEFFICIENTS
 7.3466-02-7.0374-02 6.3303-02 4.6185-02 2.4770-02 6.7845-02-1.3275-03-7.8711-04
-4.8294-02-4.4529-02-2.8239-02 3.7700-03-3.8129-02 9.7305-03-8.1173-05-3.0978-02
-5.2614-03 3.8798-03-2.5313-02 1.2591-02 1.2101-02 3.2786-03-2.1399-02 1.0774-02
 3.4202-02-2.3749-02-2.6667-02 1.7965-02-1.0135-02-5.3685-03
SINE COEFFICIENTS
 1.5251-01-1.2009-01 8.7390-02 2.8835-02 3.7487-02-4.5329-02-3.4307-02-3.2549-02
-2.5132-02 6.8652-03 4.3240-02 4.0766-04 1.3471-02 2.8356-02-1.9328-02 5.9568-03
 1.5737-02-1.8055-02 1.3480-02 2.1090-02-6.1718-03-1.3105-02-4.0518-03 1.8661-02
-2.6480-02-4.2246-02 1.4142-02 3.4376-03-2.1985-02 2.2550-02
SPAN 5  CHORD 4        STEADYW  3.7704-01
COSINE COEFFICIENTS
 1.4621-02-2.4624-02 2.1900-02 1.1867-02 8.7505-03 3.0769-02 1.0575-02 3.0434-03
-1.0202-02-5.5399-03-5.0127-03-7.3016-05-1.3514-02 2.4298-03 2.4012-03-1.1622-02
-3.5791-03 4.1703-03-5.2615-03 6.9210-03 5.7129-03 2.1700-03-2.0291-03 7.1668-03
 8.9510-03-7.4209-03-9.4787-03 4.5003-03-1.6163-03-1.0888-03
SINE COEFFICIENTS
 6.8741-02-4.9530-02 2.6234-02 1.7611-02 1.4285-02-1.1065-02-1.2902-02-9.9176-03
-5.0025-03 2.5469-03 1.1709-02-3.7950-03 2.3204-03 9.3883-03-5.5018-03 2.5214-03
 4.4152-03-9.1177-03 4.6128-03 8.2800-03-2.2532-03-3.6395-03-4.3014-03-5.1822-03
-1.4782-02-1.4095-02 4.5181-03 2.0990-03-3.2509-03 7.5090-03
SPAN 5  CHORD 5        STEADYW  8.5374-02
COSINE COEFFICIENTS
 5.2951-02-[illegible]1-02 7.1416-03-6.1708-03-9.4801-03 1.6480-02 9.7270-03 1.3731-02
 8.2455-03-[illegible]7-03-2.1267-02-1.2361-02-1.3046-02-1.8234-02-2.3370-04-2.1166-03
 3.0837-03 5.[illegible]7-03-1.4226-02 4.2858-03 3.2564-03-1.8473-03-2.4293-03 2.3379-03
 1.3046-02 1.2941-02-5.2921-03-9.5100-03-1.5936-03-1.2265-02
SINE COEFFICIENTS
 6.5530-02-5.5066-02 5.7374-03 4.5241-03-2.6133-03-7.7641-03-1.1234-02-1.2238-02
-2.0758-02-2.0038-02-5.4267-03-5.8830-03-1.9541-02 5.0524-02 1.6466-03 2.8462-03
 3.7767-04-6.6161-03 5.5116-03 1.6024-02 5.3359-03-9.9931-04-8.6674-03-6.4790-03
-7.7335-03-1.3026-02-9.8746-03 1.0012-02 7.0186-03 7.6939-03
```

TABLE IV. AERODYNAMIC DATA - HOVER, RIN, 270° HEADING

```
BURST NO. #  9            *** ROTOR NOISE PUNCHED OUTPUT ***
BLADE PITCH HARMONICS
 1.3162801-1.7935-03 4.1504-01  %COLLECTIVE, LONGITUDINAL, LATERAL RESPECTIVELY%
ROTOR FLAPPING ANGLE HARMONICS
 1.7319800-1.3847800 0.0000      %POSITIVE TAIL HIGH -- DEGREES%
DIFFERENTIAL PRESSURE HARMONICS FOR 5 CHORD STATIONS AT EACH OF THE 5 SPANS
%MEASURING FROM THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY%.
SPAN 1  CHORD 1        STEADY%  1.3391800
COSINE COEFFICIENTS
 1.6842-01 1.7908-01-3.5315-02 2.8173-02 2.3828-03 1.5747-02-3.2480-03 1.2006-02
-6.9201-04 1.3176-02 2.1840-03 1.2291-02-6.2994-03-2.2842-03 5.5529-03-6.8462-03
-8.4238-04-5.0420-03-4.5405-03 5.0863-03 6.3481-06 1.2869-04 5.9835-03 4.1914-03
 7.0458-04 4.7696-03-1.8723-03-1.3809-03 1.0794-02-3.1627-03
SINE COEFFICIENTS
-1.0774-01 1.2533-01 2.5883-02 3.0283-02 1.1103-03 3.3590-03 2.0545-03-1.6305-02
-3.2701-03-4.1357-03-3.3415-04 1.0375-02 1.1655-03 1.3834-03-2.5365-03 1.2223-03
 0.9692-04 1.3464-03 2.7204-03-5.3835-03 2.8116-03-2.1243-03 5.4538-03 4.6632-03
-4.7221-03-1.7358-02-4.1309-03-1.4680-02-1.1529-02-1.0957-02
SPAN 1  CHORD 2        STEADY%  5.2963-01
COSINE COEFFICIENTS
 6.5183-02 6.2497-02-1.0866-02 1.5569-02 3.7416-03 1.2803-02 2.8519-03 4.7005-03
 4.9648-03 3.8806-03 2.5518-03 3.1892-03-2.3467-03 5.8831-03 2.9942-03 7.0651-03
 0.7411-03 5.1261-03 1.1215-02-4.7935-03 3.1659-03-1.7238-05 3.6137-03 2.9904-03
 6.2268-04 5.5744-03 3.1856-04 4.4807-03 6.8716-03-1.3382-03
SINE COEFFICIENTS
-4.1635-02 4.5124-02 1.1334-03 5.1235-03 6.9334-03 6.3343-03 6.3573-03-4.0175-03
 6.5418-03-4.2926-03-4.9978-04 1.5605-03 3.1924-03 3.4042-03 1.2453-04-2.1022-03
-1.0278-04-2.4990-03-8.0563-03-7.2549-04-3.8805-03 3.7382-03-6.5514-03 5.9456-04
-5.7738-03 3.9550-04 1.6530-03-7.9366-04 9.7936-05 8.6308-03
SPAN 1  CHORD 3        STEADY%  2.8376-01
COSINE COEFFICIENTS
 3.3210-02 5.0086-02-9.3304-03 7.7756-03-5.4065-03 6.7043-03-1.4983-03 1.0917-04
 1.2784-03 5.8428-03-2.0919-04 6.5764-03 1.7223-03 1.5305-03 3.4672-03 2.6321-03
 6.6373-04-3.1118-03 2.6301-03 1.8344-03 2.3464-03 1.6020-03 3.9973-03 1.1912-03
-4.3748-03-5.4227-04-2.1922-03-1.2280-03-1.9227-04-3.3436-03
SINE COEFFICIENTS
-3.0616-02 2.0031-02 1.2894-02-1.8955-04-3.7763-03 2.9879-03 3.8278-04-5.2959-03
-2.4786-04-2.7343-03-6.6859-04-6.3080-03 4.6086-03-2.6047-03 1.1879-05-1.8410-03
 2.0149-04-1.5701-03 4.4580-03-3.0795-03-4.5819-03-3.5676-04 1.1841-03 1.4580-03
-1.3838-03 6.2292-04-1.5123-03-7.1171-04-2.2079-03 1.0266-03
SPAN 1  CHORD 4        STEADY%  0.0000
COSINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SPAN 1  CHORD 5        STEADY% -2.7157-02
COSINE COEFFICIENTS
 1.8794-03-6.2034-03 2.4910-03-5.7309-04 1.6969-03 2.1634-04 7.1328-04 9.1138-04
 3.8050-04-6.3485-04 4.1897-05-1.2326-03-6.2899-04 1.1293-04 4.9786-04 4.7237-04
 1.9680-05 1.4987-03-5.7762-04 7.3349-05-2.2365-04 2.3623-04-2.3995-04-1.8601-08
 1.5844-03 8.2817-04 8.3523-04 1.3409-03-1.7806-04-4.3220-04
SINE COEFFICIENTS
 1.9348-03-2.3587-03-1.2961-03-2.5200-04 1.6961-03 3.9584-04-1.1352-04 1.8030-03
 8.4068-04 3.4002-04 3.9703-04 1.4278-03-1.1958-03-2.1222-04-2.2918-04 5.0728-04
 2.6442-04-4.2189-04-9.2546-04 3.4865-04-4.3003-04 1.2678-03 2.2019-04 1.0739-08
-7.9604-04-8.8730-04-6.9859-06-3.4260-04-1.0216-03-1.6639-03
```

TABLE IV - Continued

```
SPAN 2  CHOPD 1          STEADYN  3.2561800
COSINE COEFFICIENTS
-2.6195-02 8.0566-02 3.8465-02 5.6249-02-7.8726-02-1.2002-02-1.2332-02-1.6883-02
 2.2656-03 2.3082-03 9.7369-04 6.2183-03-5.6697-03 2.6308-03 1.6342-02 3.3699-04
 4.1323-03 1.7636-03 1.8751-03-4.4843-03-7.6846-03-4.4864-03-5.7316-03-5.9995-03
-2.5590-03-6.7405-05-8.2191-03-1.4797-02-2.1517-02-1.1420-02
SINE COEFFICIENTS
-6.3450-01 1.7086-01 9.2658-02 1.0183-01 2.1776-02-3.2702-03-3.7421-03 1.7851-02
-1.1219-03 1.3734-02 7.3057-03 2.4148-03-7.1798-03-6.4609-03-5.0405-04-1.2543-04
-1.1970-02-2.2791-02-9.1097-03-9.2838-03 1.7900-03-3.7235-03-3.3249-03-5.6776-03
-1.3751-02-1.1019-02-8.6526-03-1.1350-02-1.0347-02 1.9506-03
SPAN 2  CHOPD 2          STEADYN  1.2693800
COSINE COEFFICIENTS
-4.8758-02 3.4287-02 2.2895-02 2.6289-02-2.4423-02-6.8174-03-4.0348-03 2.3721-03
-2.9188-03 8.2303-03 3.4610-04 1.4508-03-1.8291-04 1.0405-03 3.9079-03-8.1748-03
-8.2847-03-5.7993-03-7.1088-03 4.0863-03 5.0607-04 4.1048-03 2.5819-03 3.0918-04
 1.9839-03 4.2255-03-4.1933-03-2.8798-03-7.9674-03-2.9209-03
SINE COEFFICIENTS
-2.7179-01 6.9954-02 4.1479-02 4.1469-02 2.2001-02-4.4597-03 2.1074-03 1.0134-02
 2.3286-03 5.1213-03 1.1271-04-4.4107-03-1.1333-03-5.6304-03-1.5437-03-5.9161-03
 3.1332-03-1.0027-02-3.5750-03-2.0628-03 1.4416-03-1.3282-03 2.7653-03 4.9278-03
-7.6357-03-5.6498-03-2.0884-03 6.9701-04 3.2825-03-1.9327-03
SPAN 2  CHOPD 3          STEADYN  1.0478800
COSINE COEFFICIENTS
-2.0367-02 1.1062-02 1.9063-02 1.5497-02-1.8905-02-1.9825-03-5.8708-03-6.9556-03
 3.3738-03 4.8633-03-8.6791-04-1.0168-03 3.9069-08 2.3976-03 1.8303-03-2.8230-03
-4.3755-03-3.5636-03 1.8212-05-5.4817-04 7.1949-04-4.0145-04 2.5551-03-7.4207-06
-1.3055-03 1.0391-03-3.3311-03 8.3712-04-6.3477-04 4.6841-04
SINE COEFFICIENTS
-1.2919-01 5.1023-02 2.0659-02 2.6308-02 8.2394-03-7.6041-03-1.0229-03 3.6919-03
 1.2307-03 8.9076-04-3.4287-03-2.8222-03 7.0954-04-4.4967-03-3.5940-03-3.5981-03
-4.6273-03-2.1272-03-3.5937-03 2.8430-03 5.6018-04-1.0009-04 1.0749-03 1.3241-03
 2.0789-03-2.6046-03 1.4323-04 1.0453-03-2.0407-03-4.3347-03
SPAN 2  CHOPD 4          STEADYN  2.2396-01
COSINE COEFFICIENTS
-3.4617-02 9.7481-03 3.6468-03 1.1163-02-2.9207-03-5.1566-03-4.1690-03 6.9874-04
-3.3803-03-9.1202-04-2.1850-03-1.2833-03-5.1229-04-5.4819-04-9.4343-04-2.0412-03
-3.7180-03-3.3778-03-2.5591-03 1.1165-03 4.2077-05-1.0721-03 6.7509-04-8.4610-04
-1.9912-03-3.4545-03-1.4642-04 5.8660-04 2.7592-03 3.1306-03
SINE COEFFICIENTS
-6.0153-02 2.4012-02 8.9261-03 1.4478-02 1.4226-02 7.0629-04 1.9482-03 5.1061-03
 7.2583-04-3.6246-04-1.3369-04 4.2040-04 1.6956-03 1.2487-03-1.2699-03 7.6353-04
-3.6030-04-4.9988-04 1.2949-03 8.6286-04-1.4042-03-1.0072-03-5.9902-04 2.4425-03
 1.3756-03 2.9639-03 1.7051-03 4.1654-03 2.3288-03-3.2252-03
SPAN 2  CHOPD 5          STEADYN -1.6116-01
COSINE COEFFICIENTS
-2.2659-02 2.5924-03-3.5514-05 2.6237-03 8.4183-04-2.0539-03-1.3637-03 9.4403-04
-1.4671-03-1.5209-03-9.6818-04-1.2330-03-1.0208-03-1.5671-03-1.6839-03-5.1690-04
-3.0767-03-1.8811-03 6.0385-04-1.9055-04-2.1852-04-4.9888-04 8.9262-05-3.0953-04
-6.6990-04-6.4567-04 1.0379-04 1.5322-03 1.3567-03 5.0039-04
SINE COEFFICIENTS
-1.6026-02 1.6514-03-4.0837-04 2.1208-03 5.5532-03 1.0592-03 5.3534-04 2.5056-03
 1.5163-04-4.6982-04-1.3347-04 2.2237-04 1.6104-03 5.3541-04-2.6404-04-6.2724-04
 6.3986-04 1.4777-03 2.1207-03-3.3149-04-9.1427-04-1.4963-03 1.3560-04 2.0680-03
 9.6467-04 2.3070-03 2.1588-03 2.2973-03 4.8202-06-3.0195-03
```

TABLE IV - Continued

```
SPAN 3  CHORD 1        STEADY#  3.0626800
COSINE COEFFICIENTS
-4.2140-01-1.6558-02 1.2506-01 6.4239-02-3.4769-02 2.4057-02-6.3731-03 1.5331-02
-5.7983-03-6.3181-03 6.3240-03 3.2763-02 2.5458-02 2.8540-02 1.5897-02-1.2944-02
 7.2647-05 1.2205-02-2.9486-03-1.8692-02-2.4929-02-2.1527-02-8.7497-03 1.1472-03
 2.0388-03-3.2909-02-2.4275-02-1.8849-02 3.7591-03 1.9837-02
SINE COEFFICIENTS
-1.0416800 1.2569-01 1.7118-01 1.8483-01-4.2923-02-7.8210-02-4.1324-02-3.4874-03
-1.8301-02 1.4401-02 1.7617-02 3.8529-02-1.9226-02-2.5921-02-1.9675-02-1.4380-02
 1.2239-02-1.1805-02-5.6710-03-1.6661-02-1.0705-04 5.4242-03 4.8282-03 1.0997-02
-2.1203-03-3.2240-03-6.7643-03 1.8059-02 2.1719-02 2.9656-02
SPAN 3  CHORD 2        STEADY#  3.3146-01
COSINE COEFFICIENTS
-2.1848-01-5.0264-02 5.2682-03 1.7882-02-2.0651-02 6.8383-03-4.8721-03 3.5145-03
-2.9584-03-7.0348-03-1.0563-02 2.0016-03 1.6515-03 9.2537-03-3.5019-03-5.2661-03
-4.4317-03 5.9353-03 6.1150-03-2.0287-03 3.2696-03-7.0669-03-3.6144-03 8.8753-04
 7.1454-03 6.1320-03 1.3376-03-1.7130-03 4.0424-03 1.1619-03
SINE COEFFICIENTS
-2.9814-01 7.7145-02 3.4331-02 4.8915-02-1.8029-02-2.1838-02-1.7281-02-2.8042-03
-8.7475-03 2.0173-04-1.1275-04 1.3432-02 9.6817-03 3.5653-03-2.4981-03 4.2670-03
 1.7197-02 9.9131-03 5.5513-03-1.9114-03-5.7420-03 1.4436-03 9.5463-04 4.3343-03
-3.4854-03-1.6883-03-2.1644-03 1.2679-02-4.5356-03 2.0273-03
SPAN 3  CHORD 3        STEADY# -4.4979-01
COSINE COEFFICIENTS
-9.5793-02-7.1902-02-7.6209-03 1.2592-02-1.4049-02-2.3423-03-1.4657-02 5.6066-03
-5.3438-03-5.7385-03-1.8098-03 6.9503-03-2.1559-03-3.4010-03-8.0407-04-5.8360-03
 2.8641-03 8.7755-03 2.7494-03-1.5923-03-7.3590-03-2.5182-03-2.9563-03 1.5963-03
 6.6154-03 2.1767-03 7.4627-03 4.9333-03 4.1267-03-6.5402-03
SINE COEFFICIENTS
-6.8109-02 8.3157-02 1.5324-02 2.6898-02-6.4314-03-1.7204-02-8.7530-03-4.3594-03
-3.4567-03-5.0939-03 4.2684-03 7.8569-03 7.6368-03-6.0725-04-2.4121-03 6.5580-03
 8.5757-03 9.4218-03 9.2585-03-6.6195-03-2.4063-03 4.5978-03 2.5429-03-2.1029-03
 1.5153-03-4.5033-03-2.6445-03-3.0406-03-4.2355-03-9.1063-03
SPAN 3  CHORD 4        STEADY#  7.9353-01
COSINE COEFFICIENTS
-4.0169-02-5.4460-02-1.0922-02 4.2998-03-1.2180-02-7.5628-03-1.1814-02-2.0996-03
-2.2545-03 1.9594-04-5.5772-04-2.6191-04-1.0740-03-4.6783-04 9.4286-05-3.5778-03
-1.3062-03 3.2497-03 4.3041-03 2.0664-03 1.2499-03-9.8367-04 1.9897-04 2.0608-03
 5.6335-03 4.5079-03 3.8177-03 3.2941-03 1.3671-03-3.3256-03
SINE COEFFICIENTS
 3.4146-02 4.9330-02-3.5623-03 9.4769-03-2.1329-04-7.4740-03-2.3722-03-4.5061-03
-4.7427-03-4.4192-03 2.4550-03 3.7065-03 5.7557-03 1.7625-03-1.6956-04 5.5753-03
 4.6334-03 5.5609-03 1.3309-03-6.4593-04 2.6695-04 2.4788-03 2.9238-03 6.2991-04
 1.0335-03-1.3731-03 4.2059-04-2.0933-03-8.2350-03-6.2518-03
SPAN 3  CHORD 5        STEADY#  6.4519-02
COSINE COEFFICIENTS
-9.3133-03-2.4053-02-9.3614-03 3.7301-03-3.9428-04-4.0633-03-3.6451-03 4.5874-04
-1.4067-04 7.3348-04-1.6821-03-1.1019-03 1.5991-03-4.3772-04-2.6460-03-2.3488-03
-8.1775-04 3.7212-04 2.0448-03 2.5213-03 6.1371-04 2.6314-04-1.5569-03-1.2911-03
 2.7018-03 4.1399-03 3.7660-03 1.2470-03 8.6298-04-8.0648-04
SINE COEFFICIENTS
 2.3950-02 1.2823-02-7.9419-03-2.7610-03 2.9375-03 3.8406-05-9.3617-04-4.7201-04
-5.5036-04-1.1437-03 9.6820-04-9.3591-04 1.2898-03 2.8183-03 1.7813-03 1.8581-03
 1.1236-03 2.8907-03 9.5604-04 1.8101-03 1.6073-03 1.6682-03 2.1632-03-9.8397-04
-1.6060-03 8.4104-04 1.3321-03-3.4968-03-3.1927-03-1.8345-03
```

TABLE IV - Continued

```
SPAN 4  CHORD 1        STEADY#  9.0058800
COSINE COEFFICIENTS
-1.1492800 3.8078-01 1.7800-02 8.3182-02-1.6421-01-1.4946-01-3.0543-01-2.9599-01
-2.8082-01-2.7511-01-3.3663-01-2.5401-01-9.1879-02-7.5363-02-1.5932-01-2.0747-01
-1.2408-01 2.1149-02 6.2863-02 7.2757-02-4.0358-02-8.3896-02-3.9773-02-2.3268-02
 2.8077-02 2.7723-02 6.2708-02 7.9086-02-5.1973-02-1.2174-01
SINE COEFFICIENTS
 1.9394800 2.1087-01 8.2461-01 1.5438-01 1.9904-01 8.9929-02 1.3679-02 1.6838-01
 1.3341-01 1.5562-01 1.6570-01 2.9415-01 2.0550-01 1.5552-01 2.2645-02 9.6219-02
 1.7040-01 1.3576-01 4.7977-02-7.0558-02-8.7145-02-7.3946-02-8.4334-03 1.1666-02
-3.3724-02-2.8842-02-3.9658-02-7.9881-02-1.0100-01-2.9902-02
SPAN 4  CHORD 2        STEADY#  3.2994800
COSINE COEFFICIENTS
-2.9398-02 2.8984-01 1.3228-01-5.0713-02-1.4276-01-2.6222-01-2.5028-01-2.4615-01
-1.9077-01-1.9184-01-2.4217-01-1.5832-01-1.4267-01-1.2688-01-1.2595-01-1.5579-01
-7.1580-03 8.1608-02 1.1353-01 1.0836-01 3.3532-02 5.4116-02 9.0 06-02 1.3710-01
 1.5179-01 1.3342-01 1.2917-01 4.1765-02-7.0764-02-1.6589-01
SINE COEFFICIENTS
 5.6157-01-2.2641-02 9.5820-02-8.7039-02-4.1179-02-2.9812-03 3.3586-02 1.2966-01
 8.3767-02 1.0693-01 1.0190-01 1.3237-01 1.3437-01 6.7023-02 1.0220-01 1.5686-01
 1.7290-01 1.4916-01 4.2285-02-1.5745-02-3.6615-02 1.4696-02 2.6522-02-1.2121-02
-5.1901-02-1.1073-01-1.7022-01-2.3969-01-2.1132-01-1.0862-01
SPAN 4  CHORD 3        STEADY#  1.5881800
COSINE COEFFICIENTS
-2.9098-01-1.5789-02-2.6181-02 1.1179-02-2.9421-02-4.8791-02-2.3155-02-3.4674-02
-2.9105-02-3.8662-02-6.4827-02-1.8561-02-1.5970-02-5.5640-03-7.8043-03-1.5892-02
 4.5313-02 4.8138-02 5.0238-02 1.1520-02-1.0163-02-4.3501-03-8.1319-03 2.6395-02
 1.2595-02 8.3651-03-1.0334-02-5.1271-02-6.7287-02-5.6728-02
SINE COEFFICIENTS
 3.7514-01 1.3157-01 9.1250-02-4.6774-03 1.0908-03-1.6145-02-2.5779-03 1.2650-02
-1.5688-02 2.4381-02 4.0638-02 5.8026-02 6.0632-02 4.2182-02 6.8179-02 8.2146-02
 6.7969-02 3.1604-02-1.8746-02-1.5652-02-3.5766-02 1.1148-02 3.9999-03-4.5401-03
-2.0909-02-4.2979-02-5.2564-02-6.3307-02-1.2746-02 3.9517-02
SPAN 4  CHORD 4        STEADY#  3.0277-01
COSINE COEFFICIENTS
-1.4223-01-4.5810-02-1.8435-02 1.5628-02-1.0634-02-2.7205-03-4.6960-04 4.9624-04
 8.4933-03 2.6286-04-5.3519-03 6.6316-03 1.3129-03-1.1718-04-5.8467-03-7.1568-03
 1.2835-02 1.4436-02 9.2786-03-3.5886-03-3.8303-03-1.2983-02-8.3611-03-1.1999-03
-2.8506-03-1.0296-03-3.2705-03-6.9384-03-2.5639-02-2.2413-02
SINE COEFFICIENTS
 1.3345-01 7.3291-02 3.7994-02 1.2772-02 9.1338-03-4.8293-03 9.6660-03 5.3354-03
-4.6102-03 7.4767-03 1.0160-02 1.2187-02 9.6256-03 7.3097-03 1.5602-02 1.9852-02
 1.9274-02 7.2291-03-3.7912-03-2.1836-02-1.6249-02-1.9784-03-7.2531-03-2.0783-04
-1.3036-02-7.3959-03-1.6255-02-1.9748-02-1.1298-02 1.2267-02
SPAN 4  CHORD 5        STEADY# -4.2792-01
COSINE COEFFICIENTS
-4.7019-02-1.3724-02-3.1574-03 3.4981-03 5.1660-03 2.1604-03 1.0941-02 5.5365-03
 5.6379-03 3.9389-03 2.0462-03 1.1110-02-7.5641-04 4.2778-03-1.8454-03 3.6020-03
 1.3505-02 9.9705-03 3.9846-03-9.4549-04 8.9292-04-6.1911-04-1.4858-03-2.1100-04
 1.7966-03-1.3044-02-6.6043-03 6.9296-04-1.1892-02-4.5377-03
SINE COEFFICIENTS
 5.1595-02 1.6903-02 2.3673-02 1.5794-03 5.5796-03 3.5055-03 6.6480-04 1.6928-03
-7.5197-03 4.0236-03 6.8609-04-1.8864-03-1.5678-03-6.4372-04 6.6957-03 6.9564-03
 4.6385-03-1.9804-03-6.0872-03-5.6597-03 2.3696-03-4.1551-03-6.5229-03-5.4794-03
-7.8054-03-1.1027-02-1.7940-03 8.2144-04-5.2134-03 2.0461-02
```

TABLE IV - Concluded

```
SPAN 5  CHORD 1        STEADY#  9.9371800
COSINE COEFFICIENTS
-6.0827-01 2.7319-01-2.3469-02-3.6815-01-4.4227-01-2.7694-01-3.9475-01-2.9318-01
-4.2998-02-8.7159-02-3.0186-01-2.8867-01-1.2665-01-1.3524-01-1.6564-01-2.6496-01
-1.6879-01-5.0285-02-1.1625-02 2.9200-02-5.1592-02-1.8349-01-1.3961-01-1.9779-02
 9.9594-02 9.6213-02 1.4791-01 1.3039-02-2.0274-01-2.2062-01
SINE COEFFICIENTS
 1.0464800 2.1076-01 3.3096-02-5.8076-02 1.1000-01 1.4126-01 8.3728-02 2.8146-01
 2.3309-01-1.2403-02-4.8116-02 1.1772-01 1.3986-01 1.5624-01 1.7098-02 1.2892-01
 2.4948-01 1.8664-01 1.3938-01 5.5215-02-2.3028-02 3.8770-02 1.7478-01 1.9501-01
 1.2535-01 5.1018-02-3.1513-02-1.6543-01-1.5418-01 1.1013-01
SPAN 5  CHORD 2        STEADY#  2.4312800
COSINE COEFFICIENTS
-4.8108-02 1.4446-01 1.3685-02-5.1488-02-1.0377-01-9.2343-02-1.0235-01-8.8501-02
-4.2025-02-6.4962-02-1.0340-01-8.2115-02-5.6245-02-4.3506-02-6.4640-02-8.8082-02
-3.7701-02 5.2474-03 3.0525-02 4.1988-02 1.1707-02-5.3303-03 2.2505-02 5.7071-02
 8.0383-02 7.3765-02 6.7132-02 2.2106-02-4.6381-02-5.7716-02
SINE COEFFICIENTS
 2.1606-01-2.3335-02-2.8074-02-6.3380-02-1.2380-02 1.1196-02 2.5424-02 5.7915-02
 4.4586-02 2.2026-02 3.6355-02 7.3436-02 6.6233-02 5.0544-02 3.8063-02 7.8334-02
 1.0767-01 9.8765-02 4.9175-02 3.3855-02 1.2337-02 3.7714-02 5.0828-02 4.2677-02
 1.3687-03-3.4270-02-6.3258-02-9.7659-02-7.9639-02-3.5164-02
SPAN 5  CHORD 3        STEADY#  1.1457800
COSINE COEFFICIENTS
-2.4527-01 5.6637-02 7.4967-03-6.1796-03-4.2951-02-2.9705-02-2.5635-02-2.3783-02
-1.2049-02-3.7678-02-5.4034-02-3.3477-02-1.5469-02-3.2069-03-1.5968-02-2.6059-02
 1.1721-02 3.0024-02 3.7766-02 3.4077-02 2.9848-03-1.4622-02-1.9873-03 1.5084-02
 2.3848-02 1.9720-02 7.0547-03-3.0676-02-6.6614-02-5.8300-02
SINE COEFFICIENTS
 2.3424-01 8.0627-02 7.6542-02 6.4737-03 3.4986-02 3.5772-02 2.8117-02 3.2389-02
 1.0842-02 1.2313-02 3.2784-02 5.6530-02 4.6478-02 3.7762-02 2.9375-02 5.0552-02
 5.4222-02 3.5874-02 1.4182-02-2.0419-02-2.6300-02-7.3620-03 2.8993-03 8.3257-03
-1.2733-02-3.1236-02-4.9182-02-5.7860-02-2.2242-02 1.6864-02
SPAN 5  CHORD 4        STEADY#  3.2058-01
COSINE COEFFICIENTS
-9.7978-02 2.6093-02 4.5624-03 1.1747-02-8.4286-03-2.6038-03-1.0875-03-1.0375-02
-1.5772-03-8.1145-03-1.3218-02-7.5366-03-1.1116-03 2.2930-03-1.3621-03-3.5840-03
 5.0619-03 5.7118-03 6.5819-03 4.6171-03 6.5591-04-5.7831-03-4.5844-03-4.1745-04
 2.3818-03 6.0762-04-2.7882-03-1.0170-02-1.6714-02-1.0417-02
SINE COEFFICIENTS
 8.9161-02 3.2622-02 2.4302-02-2.9534-03 7.2718-03 3.6063-03 3.1751-03 4.2036-03
 5.1663-04 4.3205-03 9.2968-03 1.4501-02 1.2372-02 9.0445-03 6.7347-03 9.2036-03
 7.0369-03 1.7710-03-2.6076-03-7.2529-03-9.4363-03-2.5980-03-1.1655-03 5.0617-03
 8.3535-05-4.5633-03-6.8534-03-8.1088-03 2.8944-03 1.3177-02
SPAN 5  CHORD 5        STEADY#  2.9080-02
COSINE COEFFICIENTS
-7.5962-02 1.7043-02 1.5677-04-5.2604-03-1.3253-02-8.7536-03-9.4362-03-1.9447-02
-1.4931-02-2.0200-02-1.3825-02-1.2621-02-1.5843-02 4.1064-02 3.2690-03 1.2713-03
 4.1836-03 7.8333-03 4.3685-03 4.2320-04-5.2100-03-5.7101-03-2.5326-03-2.1040-03
 3.7589-04-5.9612-03-2.2397-03 6.1892-03-3.1348-03 2.0977-03
SINE COEFFICIENTS
 1.0193-01 2.7529-02 1.1419-02-1.3953-02-6.8675-03 5.9157-03 5.5643-03 6.5323-03
 9.1863-04 6.0095-04 3.3281-03 8.7541-03 5.3276-03 1.7684-02 2.7949-03-6.6509-03
 1.9094-03-3.3910-03-6.9624-03-2.5813-03-7.0699-03-8.7087-03-6.9721-03 7.6937-03
 7.4446-03 6.9831-03 1.3745-03-1.0284-02-6.9086-03 1.2807-03
```

TABLE V. AERODYNAMIC DATA - 120-KNOT, EAST-TO-WEST FLIGHT

```
BURST NO. # 22            *** ROTOR NOISE PUNCHED OUTPUT ***
BLADE PITCH HARMONICS
 1.2625&01 3.5712&00-5.1429&00  %COLLECTIVE, LONGITUDINAL, LATERAL RESPECTIVELY#
ROTOR FLAPPING ANGLE HARMONICS
 1.9390&00 3.2634-01 0.0000     %POSITIVE TAIL HIGH -- DEGREES#
DIFFERENTIAL PRESSURE HARMONICS FOR 5 CHORD STATIONS AT EACH OF THE 5 SPANS
%MEASURING FROM THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY#.
SPAN 1  CHORD 1        STEADY#  1.4568&00
COSINE COEFFICIENTS
-7.4482-01 5.7765-01-1.7217-01-7.9422-02-4.2300-02 8.1176-03-2.0610-02-1.4874-02
-4.8917-03-7.2146-03 6.8540-03 1.8963-04-4.5696-03 9.2308-03-3.1371-05 1.6227-03
-6.7244-03 1.4672-03-1.3230-02 3.1987-03 3.1619-03-2.3549-03-7.2003-03-5.1666-03
-7.6619-03-1.6835-02-1.5855-03-6.1061-03-1.1113-02 1.9844-03
SINE COEFFICIENTS
 4.6525-01 7.8078-02 2.3710-01 5.5845-02-7.1875-02 2.8246-02-2.3821-02 5.7133-03
-1.2296-02-5.7320-04-1.1370-02-5.2076-03 2.3773-03-9.3344-03 1.5070-03-3.9605-03
 3.1831-03 9.8516-03 7.0955-03 2.2616-03 6.9634-03 5.2881-03-7.0636-03 8.8973-03
-1.1884-02-7.6464-03-8.6827-03-4.9929-03-1.9067-02-5.3780-03
SPAN 1  CHORD 2        STEADY#  5.4156-01
COSINE COEFFICIENTS
-2.4636-01 2.0155-01-4.9338-02-1.5852-02-1.9650-02 5.6638-03-2.7492-02-9.2798-03
 1.0997-03-2.5682-02-1.0031-02 2.1103-03-3.3353-03-1.7690-02 1.0430-02 3.0415-02
-2.3046-03-1.0057-02 7.7924-03 3.4162-04-1.8156-02 2.6505-02-9.1599-03 2.0058-02
-1.1976-02 1.5860-02 1.8897-03 9.1921-04 6.2731-03 1.2220-02
SINE COEFFICIENTS
 2.5516-01-9.9657-03 9.1324-02 1.8870-02-5.8307-03 3.3587-02 4.6306-03-2.4508-03
 1.3630-02 1.1632-02-8.2042-03 4.1081-05-3.3960-03 5.2048-03 1.0476-02-1.4143-03
-4.8729-02-1.1569-02 4.2906-04-2.5889-02-8.9785-03-2.3390-02 2.6361-03-2.6353-03
-8.6197-03-2.1535-03-7.3608-03-5.9645-03-1.3473-03-5.7290-03
SPAN 1  CHORD 3        STEADY#  2.0702-01
COSINE COEFFICIENTS
-1.4976-01 1.5017-01-4.7000-02-1.9800-02-1.8586-02 1.0418-02-9.1389-03-2.0345-03
-2.1773-03 1.6361-03-2.8154-03-2.2022-03-2.5311-03-9.7465-04 3.1904-04 1.4679-04
-1.6788-03 5.8812-04-3.1973-03 2.4294-03-1.6418-04-3.3378-03-1.8380-03-2.8117-03
-2.4129-04-2.5920-03 1.0302-03-5.4132-04 1.3102-04-2.1952-03
SINE COEFFICIENTS
 1.1891-01-9.8714-03 3.9401-02 1.5518-02-1.4820-02 1.2132-02-6.9932-04 3.4399-03
-3.6431-04 1.5494-03-2.4100-03-2.3941-03-5.5364-03 1.6429-03-1.3129-03 3.2366-03
-1.4123-03-7.4724-04 2.1920-03-4.5327-03-1.7192-03-2.0403-03 1.7560-03-3.2223-03
 3.1668-04-3.4183-04-2.6214-03-3.0882-03-4.5381-03-5.2426-03
SPAN 1  CHORD 4        STEADY#  0.0000
COSINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SPAN 1  CHORD 5        STEADY#  1.8378-01
COSINE COEFFICIENTS
 4.2233-03-2.7972-02-8.3308-04 5.1288-04 1.5295-03-1.5990-04 9.2070-04 4.0257-04
 9.4991-05-2.3272-04 3.4959-05 7.1013-04 5.8079-04 1.8464-04-4.2370-04-3.5136-05
 8.7300-05 8.1967-04 6.9089-04-4.4642-04-4.5523-04 5.1218-04 2.2215-04 3.1602-04
-4.5999-04-1.4355-04-2.4600-04 4.1947-04 5.4477-05 1.2274-04
SINE COEFFICIENTS
 4.3927-02 4.8164-03 4.8729-03-1.9127-03 2.3182-03-5.3892-04 1.6917-03-4.7524-04
-4.8457-04-1.7800-03-1.7275-04 5.8059-04 6.9052-04 4.4626-04 5.5114-04-2.6664-04
 1.8028-04-6.0664-04-7.1408-04 7.9988-04 1.1400-04-1.4340-04 1.8722-04 1.3294-03
-3.8967-05 1.6861-04-3.0716-04 1.3327-04 2.5797-04 9.8862-05
```

TABLE V - Continued

```
SPAN 2  CHORD 1        STEADY#  4.2722400
COSINE COEFFICIENTS
-2.3649-01 1.5318800 1.5158-02 2.3440-01-2.5583-01 2.8661-01-2.2117-01 8.1035-02
-6.0594-02 6.0470-02-8.6874-02 2.4340-02 9.6925-03-3.8683-02-5.5372-03-2.0649-02
 2.0734-02-6.4705-02 3.1226-02-1.7829-02 9.8389-03-1.8134-02 2.8859-02-1.3211-02
-2.2058-03 1.1020-02-3.6638-03-6.5718-03-1.3667-02 6.0296-03
SINE COEFFICIENTS
 5.2138-02 4.4109-01-4.4853-02-1.6782-01-2.0936-01-3.1471-02-9.7771-02-4.2937-02
 7.1904-02-1.4118-01 4.1161-02-4.9886-02 3.1363-02-7.4708-02 4.5057-02-4.2731-02
-1.9634-02-1.8077-02 9.8917-03-2.1562-02-2.2859-02 2.8224-02-3.2639-02-1.6496-03
-1.3169-02 1.1753-02-2.8154-02 7.5791-03-1.0934-02 6.9984-04
SPAN 2  CHORD 2        STEADY#  1.7564800
COSINE COEFFICIENTS
 2.4430-02 6.3029-01 3.5406-02 5.5528-02-9.9657-02 9.8290-02-6.6809-02-5.4583-03
 4.8262-03 6.5483-03-1.8989-02 6.1269-04 1.2150-02-1.4224-02-2.9350-03-1.8880-03
 1.1128-03-1.0442-02 1.3955-02-1.3369-02-3.3570-03-4.7733-03 5.8630-04-5.0625-03
-9.2579-03 1.7942-03-7.0164-03-7.5876-03-6.8897-03 5.4202-03
SINE COEFFICIENTS
-1.6657-01 1.6537-01 2.2208-02-9.3301-02-7.6919-02-1.7151-02-2.7948-02-1.8272-02
 2.3453-02-3.6943-02 2.2799-03 4.2177-03-5.4021-04-1.5144-02 4.8246-03-3.6005-03
-1.8131-02 6.2545-03-2.0468-03-1.0135-03-3.6062-03 4.9982-03-6.3333-03-1.1087-03
-1.9168-03 2.7236-04-1.0288-03 2.6163-03 1.7299-03-1.5207-02
SPAN 2  CHORD 3        STEADY#  1.4598800
COSINE COEFFICIENTS
 2.2511-02 3.6158-01 2.9670-02-8.1435-03-5.2049-02 6.4869-02-2.2885-02-3.0881-02
 6.0847-03 2.3359-02-6.0422-03-2.8202-02 4.8255-03 1.3468-02-3.5428-03-1.8616-02
-3.3992-03 2.0576-02 2.0275-03-2.3411-02-3.7878-03 2.5415-02 1.0877-03-2.6266-02
-3.1227-03 3.2343-02-4.4579-04-3.6554-02 3.3873-03 3.5356-02
SINE COEFFICIENTS
 3.0172-02 6.1531-02 5.4186-02-5.7561-02-6.7475-02-9.0848-03 6.9631-03-3.5980-03
-1.8405-02-1.8802-02 1.9977-02 5.7739-03-3.0787-02-1.4436-03 2.4975-02 9.7050-04
-3.5249-02 1.6301-03 2.5442-02-7.0773-03-2.8837-02 2.1569-03 2.2229-02-4.3321-03
-2.8145-02 2.6202-03 2.7854-02-3.4656-03-3.0225-02-4.7867-03
SPAN 2  CHORD 4        STEADY#  2.8750-01
COSINE COEFFICIENTS
-1.5777-01 2.2544-01 4.6429-02 7.0774-03-2.3378-02 1.7624-02 2.0778-03-5.8818-03
 3.0637-03-1.1361-03-1.1694-03-1.9702-03 2.4146-03-2.8752-03-3.6467-03 1.7119-03
 8.1808-04-9.0785-04-4.4631-04 3.1964-03-2.3056-03-8.9511-04-1.0922-03 2.0212-03
-2.4735-03-1.7343-03 7.9123-04 1.3782-03-3.5898-03-1.6883-03
SINE COEFFICIENTS
-1.9855-01-9.4690-03-1.0131-02-3.7702-02-7.7190-03-8.7350-03-1.0490-02 1.5194-03
-3.1548-03-7.9898-03-5.2153-03 5.8143-03-5.5728-03-4.5219-04 6.7259-04 6.7203-04
-6.8408-03-3.5542-05-1.7459-04 1.0072-03-2.4067-03-1.4061-04 1.5742-03-2.6067-03
-2.3164-03 4.9780-04 1.2144-03-4.1108-03 4.5598-04 8.5182-04
SPAN 2  CHORD 5        STEADY# -2.1236-01
COSINE COEFFICIENTS
-1.8048-02 5.7544-02 1.4526-02-2.9197-03-1.8478-03 2.1982-03 4.3128-03-3.1864-03
 2.7489-03-2.4889-03 2.1316-03-1.5358-03 1.7566-04 1.3953-03-1.9439-03 2.3691-03
-3.2888-03 2.0995-03-2.8652-03 3.7502-03-4.6492-04 3.0487-05-1.7971-03 1.3268-04
-6.3037-04-1.6462-03-6.3803-04 4.0261-04 1.1596-03-2.2121-03
SINE COEFFICIENTS
-2.0536-01-1.3468-03-6.9293-03-8.4404-03 3.2130-03-4.2153-03-3.7461-03 2.4358-03
-2.5767-03-9.4456-04-2.7604-03 5.1314-03-6.5623-03 8.7684-04-1.2620-03 2.6795-03
-2.6315-03-7.2211-04 9.4115-04 1.0325-03-1.0996-03-8.6236-04 2.9955-03-1.3021-03
-8.4877-04-8.0294-04 2.7616-03-1.8390-03-1.2594-03 7.0805-04
```

TABLE V - Continued

```
SPAN 3  CHORD 1        STEADY#  5.0278800
COSINE COEFFICIENTS
 1.0424800 1.6650800 1.9028-01 2.1068-01-4.3720-02-1.3843-01 1.0831-01 1.3226-01
-1.3109-01 7.4559-02 7.2098-02-6.4662-02 7.1090-02-4.1483-02-4.4403-02 8.2176-02
-5.7059-02-1.6204-02 6.2011-02-4.4524-02 2.7830-02 2.1205-02-4.7924-02 3.7390-02
-2.8163-02-3.7839-02 3.7416-02-3.5942-02-2.3428-02 1.9978-02
SINE COEFFICIENTS
-3.0113-01 2.6807-01 4.4775-01-5.8180-01-2.9404-01 1.2776-01-1.5443-01 1.6001-02
-1.5213-02-5.8790-02 1.2276-01-8.9101-02-5.2156-02 1.0013-01-6.4027-02-4.3964-02
 2.6436-02-6.0526-02 2.8424-02-1.6250-02-5.9177-02 3.6733-02-3.9539-03-3.0193-02
 4.0370-02-3.0515-02 2.5586-03 1.2249-02-6.0649-02 9.3748-03
SPAN 3  CHORD 2        STEADY#  4.1445-01
COSINE COEFFICIENTS
 5.4260-01 6.6204-01 9.3063-02-5.3235-03 1.4614-02-2.1057-02 2.2224-02 2.7817-02
-4.3444-02 5.3779-03 3.2122-02-1.7330-02 1.1218-02-7.9375-03-1.3440-02 2.8506-02
-1.7349-02-1.1185-02 1.9985-02-1.5819-02 3.3136-03-5.9482-03 2.9050-04 1.8759-02
-2.5194-02 1.9804-03 1.6197-02-5.5710-04-1.1419-02-5.4071-03
SINE COEFFICIENTS
-1.0178800 2.3249-02 2.0564-01-2.3303-01-1.2795-01 6.5960-02-3.1235-02-1.7776-02
 2.2658-04-1.9850-02 2.1739-02-2.4181-02-1.6462-02 3.2430-02-1.7944-02-1.1781-02
 1.1839-02-2.2416-02 6.6177-04 3.0618-03-2.8102-03 4.5852-03-2.1083-02 8.0087-03
 8.0558-03-2.1393-02 2.5145-03 1.0046-02 5.7084-04-1.3029-02
SPAN 3  CHORD 3        STEADY#  1.3696800
COSINE COEFFICIENTS
 6.8649-02 4.0684-01 8.6174-02-8.0687-03-3.5912-02 2.7245-02 1.6812-02-1.9448-02
-1.7870-02 2.3730-02 1.5250-02-2.7392-02-2.3170-03 2.7432-02 6.7491-04-2.4072-02
-5.4663-04 2.3328-02 7.4809-03-2.6180-02-6.8593-03 2.8800-02-1.2320-03-3.2040-02
 2.9541-03 2.9387-02-4.9411-03-3.0444-02-3.0846-03 3.0826-02
SINE COEFFICIENTS
-4.3772-01-5.4682-02 1.0577-01-1.1929-01-9.5043-02 2.6650-02 1.7434-02-1.9932-02
-3.5260-02-2.7143-03 2.7159-02-1.0729-02-3.5108-02 6.0998-03 2.6802-02-1.0308-02
-2.7446-02 1.9612-04 2.4146-02-3.2497-03-2.9976-02-5.1463-03 2.5999-02 1.4024-03
-2.7361-02 4.3472-03 2.6702-02-4.5198-03-3.2309-02-5.9820-03
SPAN 3  CHORD 4        STEADY# -4.8522-01
COSINE COEFFICIENTS
-3.1555-02 1.6562-01 4.2202-02 1.5081-02-2.8691-02 6.7586-03 1.2966-02 1.2489-03
-4.1574-03-4.3356-04 3.8774-03 1.7146-03-2.6127-03 8.1047-04 2.1286-03-3.7438-03
-1.2850-03 1.3807-03 4.0549-04 1.1272-03-1.4030-03-9.4900-04 2.2790-03 7.2734-04
-4.7602-05 6.3411-04-2.3064-03-1.5214-03 7.7795-05-1.3587-03
SINE COEFFICIENTS
-2.6761-01-4.0909-02 2.2303-02-4.5977-02-2.2532-02 5.6359-04 5.3325-04-7.7331-03
-6.6103-03 2.7408-03-1.2037-03-3.0685-03-1.1404-03-1.7081-03 2.1310-03-1.9878-03
-5.3704-03 6.6354-04-1.7894-03-1.3694-03-5.9406-04-1.4078-03-4.3264-04 7.2587-10
-1.1409-03-5.5914-04 1.1059-03-1.4666-03-1.3175-03-9.7568-04
SPAN 3  CHORD 5        STEADY# -2.2523-01
COSINE COEFFICIENTS
-5.6236-03 3.7976-02 1.1218-02 4.4105-03-8.9230-03 2.5730-03 4.1095-03-2.3992-03
-1.0679-03-2.0028-03 4.0642-04 1.6663-03-2.6063-03 4.8169-04 3.1926-03-2.5335-03
 4.6742-04-9.7663-04-8.4114-04 3.5605-03 2.2934-04-1.6814-03 3.2858-03-8.2625-04
-8.3204-05 1.1199-03-1.3638-03-3.3676-04 1.7880-03-2.1325-03
SINE COEFFICIENTS
-1.4354-01-9.5747-03-8.3747-03-9.5525-03 2.4382-03-4.3180-04-1.3643-03-4.0234-03
-1.3973-03 1.9441-03-3.5099-03-2.2320-04 1.1648-03-1.5222-03 1.7194-03-1.3587-04
-2.6398-03 1.0870-03-9.9843-04-1.2343-03 1.1842-03-1.8439-03 3.7856-04 2.6835-03
-2.9669-03-3.8299-04 1.0732-03-1.3046-03 3.5129-04-5.1669-04
```

TABLE V - Continued

```
SPAN 4  CHOPD 1        STEADY#  4.2219800
COSINE COEFFICIENTS
 1.5395800 1.3025800 4.5019-01 3.2314-01-2.0864-01-4.2311-02 2.1454-02-9.1243-02
 3.3637-02 8.7441-02-4.0901-02-8.4593-02 4.1848-02 5.3768-02-4.3535-02-5.0351-02
 4.1671-02 2.4115-02-2.2737-02 3.6890-03 1.4419-02-1.5116-02-2.5145-02 1.2484-02
 1.4992-02-1.7823-02-1.2061-02 1.5942-03-3.3570-03-2.9734-02
SINE COEFFICIENTS
-1.4750800-4.0320-01-1.8623-02-1.6500-01-4.4765-01-1.7309-01 1.2043-01 5.0733-02
-1.4596-01-6.0190-02 6.5443-02 1.1394-02-3.8037-02 1.7802-02 8.6268-03-4.6018-02
-1.9743-02 2.7926-02-2.8598-02-4.4890-02-7.9898-03 3.4738-02-6.6040-03-3.0579-02
 2.1329-02 2.5153-03-2.4160-02-4.7104-03 9.1453-03-3.8098-03
SPAN 4  CHOPD 2        STEADY#  1.3534800
COSINE COEFFICIENTS
 8.7141-01 5.9179-01 2.1200-01-7.6427-02-2.4871-01 1.0245-01 1.2633-01-9.7509-02
 9.4810-03 7.1545-02-4.8101-02-3.3708-02 3.9035-02 1.7589-02-2.1185-02-2.0148-02
 3.3545-02 4.3082-03-2.7864-02 2.0512-02 3.7025-03-1.8362-02-9.9363-04 7.8105-03
-4.8898-03-1.7172-02 5.9590-03-1.0584-03-1.1472-02-1.2197-02
SINE COEFFICIENTS
-8.0772-01-1.7945-01 2.3104-01 5.0903-02-3.3207-01-2.2649-01 1.3692-01 8.7372-02
-1.0873-01-1.5619-02 3.7619-02-2.8562-02-9.6808-03 6.2956-03-7.7632-03-3.0161-02
-1.0498-02 3.3286-02-3.2465-02-3.5785-02 1.5881-02 7.4866-03-5.0605-03-8.2417-03
 1.6579-02-5.6543-03-1.1504-02 5.7042-03 4.8261-03-1.4736-04
SPAN 4  CHOPD 3        STEADY#  7.8889-01
COSINE COEFFICIENTS
 3.6248-01 3.1924-01 1.5049-01 1.0468-01-1.6017-01-8.1154-02 1.1455-01 3.0603-02
-5.9182-02 2.8653-02 3.5645-02-5.7182-02-4.5233-03 5.6208-02 6.7634-03-4.3613-02
-2.6304-02 2.7047-02 1.8801-02-2.0775-02-2.8112-02 3.1986-02 3.1424-02-2.9086-02
-2.4594-02 2.6488-02 1.9916-02-3.3295-02-1.2059-02 2.9742-02
SINE COEFFICIENTS
-5.8614-01-1.9595-01-2.0951-02 3.6030-02-8.2791-03-1.4133-01-6.7488-02 1.0612-01
 1.7874-02-7.9768-02 6.8581-03 3.8734-02-1.4104-02-1.1407-02 1.0631-03 1.0284-02
 5.5557-03-1.8175-02-1.2953-02 1.5168-02 5.8733-03-3.2380-02-1.2285-02 2.2755-02
 1.1507-02-2.4589-02-1.3442-02 1.6206-02 8.2495-03-9.5520-03
SPAN 4  CHOPD 4        STEADY# -9.4500-02
COSINE COEFFICIENTS
 8.1175-02 1.3453-01 3.0133-02 1.4487-02-2.0257-02-1.6455-03-4.8325-04 6.3979-03
 2.8579-03-3.6149-03-1.3725-03 2.1989-03-5.6105-05 2.5207-03 3.0945-03-2.7816-03
-4.4216-03-4.4980-03 2.9586-03 4.0436-03-2.2778-03-5.9428-04 1.2087-03 8.9990-04
-1.3650-03-2.0076-03-1.0659-03-4.0665-03 3.4466-03 9.4887-04
SINE COEFFICIENTS
-4.3940-01-6.0715-02 3.2676-02-1.9340-02-3.4017-02-6.2035-03 3.5839-03 8.9499-03
 7.6510-04-1.3049-02-6.5094-03 5.3235-03 5.1398-03-1.0520-03-1.0021-03-1.9938-03
 2.3759-03-7.7407-05-2.3469-03 7.0212-04 2.0335-03-9.4908-04-1.3443-03 1.0391-04
 1.5854-03 5.0593-04-1.8310-03-2.2283-03-3.2088-03 2.0972-04
SPAN 4  CHOPD 5        STEADY# -5.2422-01
COSINE COEFFICIENTS
-5.5308-02 1.3909-02-1.9432-03 2.7499-03-2.0954-03 3.7729-03-1.8425-03 4.9534-03
 3.2417-03-4.2805-03-3.0168-04 5.3817-03 1.3319-03-1.7170-04 2.4519-03 2.0211-03
-3.3441-03-2.2564-03 5.4989-03-2.7941-03-4.3480-03-3.0633-04-2.7898-03-8.3308-03
 4.5245-03 1.4307-02-6.1378-03-3.8744-03-1.7685-03 3.8547-04
SINE COEFFICIENTS
-1.8923-01-1.9514-02 1.3358-02-3.2211-03 1.4284-03 4.9905-03 7.1813-04 7.6918-05
 5.0195-03-1.7106-03-2.6179-03 2.5519-03 1.9689-03-3.3523-03-2.8841-03 5.7150-04
-1.2006-03-3.1719-03 5.7323-03 4.4992-04-2.2730-03 1.2670-03-5.9358-04 5.6622-03
 7.3842-03 1.1565-03-2.0662-03 1.4282-04 3.0123-03 6.7332-03
```

TABLE V - Concluded

```
SPAN 5  CHORD 1          STEADY#  4.0794800
COSINE COEFFICIENTS
 1.6320800 1.0345800 5.5733-01 5.2797-01-8.1597-02-9.4733-02 9.6334-02-1.1048-03
-7.7758-02 2.4794-03 1.9271-03-9.1527-02-1.4054-01-3.3881-02 4.8126-02-3.7017-02
-1.0439-01-4.0029-02 4.2593-02 1.7934-02-4.1813-03-3.0920-03 2.7664-02-3.3953-07
-3.8697-02-2.5103-02-1.2134-02-3.9232-02-4.1636-02-1.1391-02
SINE COEFFICIENTS
-8.7231-01-5.5587-01-2.7464-01-1.8629-01-3.8493-01-3.7006-01-1.5998-01 2.6569-02
-1.2955-01-2.5171-01-8.7524-02 4.5626-02 4.1242-02-1.8058-01-6.5988-02 2.7126-02
 2.7822-02-4.1604-02-1.1683-02 4.1723-02-3.7507-02-4.2395-02-1.3078-02-1.3176-02
-2.4700-02-4.9869-02-5.7453-02-6.2289-03-3.0548-02-1.6428-02
SPAN 5  CHORD 2          STEADY#  1.0785800
COSINE COEFFICIENTS
 2.4566-02 2.0730-01 1.4726-01 2.1827-02-9.6305-02 2.5040-02 2.5082-02-2.9232-02
 1.9610-02 3.7238-02-3.3776-02-5.0026-02 1.7069-02 5.4532-02 6.0839-03-5.7406-02
-1.2057-02 4.0516-02-2.7389-03-3.9892-02 1.0315-02 5.3264-02-1.1537-02-6.0441-02
 5.6521-03 6.4047-02-4.6132-03-6.5913-02 9.4463-03 6.1140-02
SINE COEFFICIENTS
-1.5764-01-2.4628-01-6.6378-02 3.4277-02-4.7703-02-8.3079-02-7.0114-02 2.8966-02
 7.3878-02-5.7924-04-8.0982-02-2.4167-02 6.5775-02 8.4083-03-5.8874-02-9.1064-04
 5.2164-02 2.4647-03-6.8990-02-1.3862-02 5.7362-02 1.0580-02-5.4039-02-1.0578-02
 5.6184-02 1.3510-03-6.3779-02-2.8340-03 7.2195-02 9.0538-03
SPAN 5  CHORD 3          STEADY#  1.6410-01
COSINE COEFFICIENTS
-2.6946-01 1.0556-01 4.8799-02 4.8932-02-7.3060-02-6.5702-03 2.0596-02-8.5573-03
-1.2082-03 1.0108-02-3.1347-03-5.7847-03 4.4663-03-2.2928-03 2.7550-03-2.1232-04
-5.2060-03-3.4002-03-3.5374-04 3.8460-03-4.4867-03 3.6618-03 5.1080-03-4.4754-03
-9.1358-04 7.1126-03-4.4139-04-6.9210-03 3.8912-03-4.8343-04
SINE COEFFICIENTS
-5.0316-01-1.4849-01 3.6860-02 3.3007-02-5.6248-02-4.2807-02 1.1976-02 3.7488-02
-4.0298-03-1.5871-02-7.8382-03-3.2948-03 9.3037-03 6.4567-03-8.9829-03-3.3997-03
 9.5132-04 3.0977-03 2.0947-03-5.0343-04-6.8336-03-7.4559-03 6.9313-03 2.0097-03
-4.2458-03-1.8832-03-8.4219-04-1.8250-03-1.2632-03 3.8594-03
SPAN 5  CHORD 4          STEADY# -2.9532-01
COSINE COEFFICIENTS
-3.3002-01 1.6966-02-3.9320-03 9.5084-03-9.9660-03 2.8621-03-5.8104-03-4.3206-03
 6.2674-03 7.9514-04-1.4501-03-3.4289-03 2.5162-03 2.3951-03-2.1823-04-9.2692-04
-4.0730-04 2.1082-03-5.8085-04-1.4226-03 1.7174-03-1.8213-03-4.1439-05-7.6932-04
 1.0753-03 2.2513-03 1.7290-04-1.4588-04 1.3390-03 6.3959-04
SINE COEFFICIENTS
-2.1927-01-4.3440-02 3.0464-02 6.8247-04-1.7954-02-1.0338-03-1.0402-03 5.4159-03
 5.1780-03 5.2981-04-4.3179-03-1.3176-03 1.2694-03 5.1592-03-1.8182-04-2.9745-03
-2.1049-03 1.8236-03 4.0824-03-1.3017-03-8.6702-04-1.2061-03-1.4779-03-1.2055-04
-3.7944-04 2.3827-04-1.3405-03 3.7605-04-1.2408-03 2.1761-03
SPAN 5  CHORD 5          STEADY# -5.4996-01
COSINE COEFFICIENTS
-1.2693-01-2.0660-02-8.0705-03 1.0484-02 6.3474-04 7.1189-03-5.5877-03-1.5001-03
 9.4024-03 1.4100-02 5.9984-03 7.4685-03 1.7111-02-4.4516-02-6.9642-03-1.0299-03
-6.1952-04 5.4070-04-1.8118-03-1.7896-03-5.1636-04 4.9739-04-1.7209-03-2.3372-04
-4.3905-04 4.0345-04-2.1098-03-4.8911-04 6.5655-05-1.6389-03
SINE COEFFICIENTS
-2.2250-01-1.5898-02 2.1463-02 1.7537-02-1.4998-02 1.2921-03-4.9869-03 4.2669-03
 5.2296-03 3.3989-03-5.4843-03-8.2889-03 1.3989-03 6.7094-03-1.7538-03-5.0530-04
-3.1772-03 2.9021-03 1.2229-04 3.4489-03-1.6710-03 2.1896-04 4.9931-05-8.0991-04
 1.2359-03 3.1782-03-4.8867-04-3.0986-03 2.3357-03 2.6529-03
```

TABLE VI. AERODYNAMIC DATA - 120-KNOT, WEST-TO-EAST FLIGHT

```
BURST NO. # 13              *** ROTOR NOISE PUNCHED OUTPUT ***
BLADE PITCH HARMONICS
 1.1655&01 3.8118&00-4.4990&00  %COLLECTIVE, LONGITUDINAL, LATERAL RESPECTIVELY#
ROTOR FLAPPING ANGLE HARMONICS
 1.8620&00 2.3988-01 0.0000      %POSITIVE TAIL HIGH -- DEGREES#
DIFFERENTIAL PRESSURE HARMONICS FOR 5 CHORD STATIONS AT EACH OF THE 5 SPANS
%MEASURING FROM THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY#.
SPAN 1  CHORD 1          STEADY#  1.7694&00
COSINE COEFFICIENTS
-7.5170-01 5.4576-01-1.9337-01-1.8140-02-1.2594-02-3.4101-03-1.0181-02 1.1191-02
-2.0304-02 8.7802-03-2.0313-02 1.9376-02-2.1629-02-3.8817-02-1.3646-02-2.5201-02
-2.4527-02-1.4736-02-2.5566-02-1.6921-03 6.3757-04-2.7940-02 3.1563-03-9.6939-03
-1.4288-02 1.2005-02-1.6829-02 4.7947-03-4.3391-04-1.8142-02
SINE COEFFICIENTS
 5.1720-01 2.6738-01 1.5931-01-8.5007-03-8.5373-02 4.3306-02 1.9723-02 9.0404-04
-2.0486-02 3.2938-02 5.8468-02 2.3150-02 2.6626-02 1.8542-02 1.8515-02 1.8530-02
-2.2601-02 3.7740-03-1.4594-03-1.0460-02-9.8242-04-1.6166-02-4.4921-03 7.6054-03
-1.6880-02-6.1982-03 9.7203-04-2.1845-02 7.9175-03-2.4267-02
SPAN 1  CHORD 2          STEADY#  6.3098-01
COSINE COEFFICIENTS
-2.4020-01 1.9289-01-4.1643-02-9.3803-04-2.4187-02-3.6638-04 3.2773-03 8.0028-04
 7.7740-04 1.0917-02 7.0730-04 1.1040-02-1.4191-02-1.0970-02-1.5848-02-1.1412-02
-1.4545-02-7.7488-03 1.5106-02 2.6517-02 1.4778-02-2.6947-02 2.0740-02-9.6608-03
-2.1464-02 2.2522-02-2.5430-02 2.2682-03 2.0372-03 3.8938-03
SINE COEFFICIENTS
 2.8750-01 5.5752-02 7.1402-02 1.7626-02-2.4192-02 6.0528-03 3.5409-03 8.9071-03
-1.4742-02 1.8746-02 1.0996-02 2.4904-02 7.9666-03 2.3586-03 5.6477-03-3.0392-03
-9.1570-03-5.3121-03 5.7601-03-5.1451-02-4.0322-02 8.5404-04-9.2531-03-9.3195-04
-1.0168-02 1.4442-02-1.5445-02 9.1168-03-1.4088-02 1.1957-03
SPAN 1  CHORD 3          STEADY#  3.3565-01
COSINE COEFFICIENTS
-1.5953-01 1.6216-01-4.1400-02-2.2474-02-7.1217-03 1.2323-02-5.7052-03-1.2307-02
-6.7263-03 1.1647-02-4.9938-04-7.0179-03-1.4748-03 7.2055-03-4.0812-03-1.6262-02
-7.0208-03 2.3711-03-7.9461-03-1.1492-02 1.7656-03 1.1476-02 1.4181-04-1.2794-02
-4.4629-04 1.4294-02-3.0616-03-8.0629-03 4.7150-03 1.7202-02
SINE COEFFICIENTS
 1.4188-01 2.9355-02 3.9311-02 6.8192-03-3.9528-02 1.6980-02 7.0551-03 1.1667-02
-1.7890-02 1.1603-02 1.1039-02 3.9630-03-7.4319-03 2.7769-03 1.3150-02 1.3780-03
-1.3611-02-1.5647-03 8.5243-03-3.9351-03-1.6658-02-3.5108-03 8.1001-03-4.7569-03
-1.2959-02-1.0185-03 7.5402-03-3.9786-03-1.1777-02-2.6102-04
SPAN 1  CHORD 4          STEADY#  0.0000
COSINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SPAN 1  CHORD 5          STEADY#  8.5796-02
COSINE COEFFICIENTS
 6.3679-03-3.0014-02-1.4572-03 3.3435-04 6.8510-04-1.3561-03 2.1095-04 7.1982-04
 8.1312-04 1.9492-04 6.2370-04-7.0713-04-8.9106-05-6.6626-04-2.5105-04 1.0089-03
 1.5769-03 8.7792-04 7.6464-04-7.5278-04-5.8657-04-1.5434-04 6.1898-04-1.9866-03
-4.0516-04-1.3713-04 2.2986-04 2.6223-04-1.6214-03-3.4156-04
SINE COEFFICIENTS
 2.7897-02-8.1992-04 1.5351-03-9.7345-04 1.8917-03-1.2602-03-3.4635-05-1.8352-03
 9.6371-04-1.6812-03 4.7364-04-1.0821-03 1.5935-04-1.0532-03 8.5260-04-9.8078-04
-2.9040-04-3.9777-04-3.3435-04 1.6624-03 1.0366-03-5.7665-04-5.4119-06 9.3844-04
 8.5986-04 6.8951-04-1.1016-03 3.7871-05-3.1104-04-7.4194-04
```

TABLE VI - Continued

```
SPAN 2  CHOPD 1        STEADYH  4.3369800
COSINE COEFFICIENTS
 3.1971-02 1.2778800 1.8152-02 2.0998-01-1.4152-01 2.3409-01-1.6243-01 4.2499-02
-1.1443-02 4.9020-02-9.5116-02 4.9124-02-2.3611-02 4.5303-03-3.0236-02-4.4193-03
 1.8607-02-5.4000-03-8.3990-03 1.8697-02 1.4655-02-4.3092-02 5.1082-03 3.0937-02
-3.3112-02 3.6613-03 2.6416-02-2.2412-02-8.7200-03 2.2042-02
SINE COEFFICIENTS
 2.9122-01 8.2917-01-1.2647-01-2.0071-01-1.4389-01 4.7232-02-1.5237-01 5.5325-02
 7.6180-02-6.4444-02-2.7330-02 3.8587-02 4.8149-03-7.5083-02 6.9719-02-2.8547-02
-3.8408-02 2.9372-03 3.7969-02-3.4068-02 6.6259-03 3.4009-02-2.5070-02-1.0991-02
 2.0115-02-1.6927-02 8.5356-03 3.8836-03-2.5492-03 7.8574-03
SPAN 2  CHOPD 2        STEADYH  1.7781800
COSINE COEFFICIENTS
 1.1152-01 5.3741-01 3.4295-02 5.6679-02-5.1116-02 9.6608-02-6.3626-02 1.3644-02
 1.6266-02 4.2510-03-2.4152-02 7.6185-03-1.4163-03-4.9504-03 4.2733-03-2.6632-03
 1.5270-02 4.2269-03 6.7367-03-2.1888-03 1.0479-02-1.1903-02 5.7414-03 8.2134-03
-4.4553-04-3.6114-03 5.3567-03-6.9034-04-1.5886-02 4.4130-03
SINE COEFFICIENTS
-3.3236-02 3.0270-01-2.6599-02-9.0732-02-6.3050-02 1.5423-02-4.1935-02 1.6489-03
 3.8250-02-2.5269-02-6.1523-03 1.3715-02 3.0279-03-2.2242-02 1.7617-02 4.3942-04
-1.1435-02-3.8535-03 6.2118-03-9.3384-03-8.2163-04 4.5082-03-5.9924-03-1.0948-02
 7.7840-03 1.0668-03 5.5400-03 7.4888-03-4.1963-04-2.3107-04
SPAN 2  CHOPD 3        STEADYH  1.4212800
COSINE COEFFICIENTS
 7.3731-02 2.8196-01 1.7839-02 2.6598-02-2.8872-02 4.6280-02-1.9594-02-4.6127-03
 8.8809-03 8.6577-04-6.4897-03-3.4441-03 1.2193-03-2.0129-03-1.3506-03-1.1267-03
 4.6765-04-4.4043-04-2.6228-03 4.7920-03 1.7536-03-5.5452-03-4.3822-03 4.0152-03
 2.2755-03-3.3496-03 1.7567-03 7.8990-04-2.3201-03-1.4481-03
SINE COEFFICIENTS
 1.1471-01 1.4698-01 3.1271-03-5.7119-02-3.8920-02-6.1768-04-6.1656-03 1.0122-03
 1.1292-02-3.7559-03-3.2892-03 1.7541-03 1.7847-03-2.8290-03-2.3786-03 9.9194-04
-3.5016-04 8.3542-04 7.0164-04-1.5368-03-1.7970-03-5.0048-03 3.8131-03 2.3268-03
-1.3726-04 6.7708-04 1.6535-03-3.5654-03 8.7553-04 1.5803-03
SPAN 2  CHOPD 4        STEADYH  3.3088-01
COSINE COEFFICIENTS
-1.2912-01 2.1027-01 4.0753-02 1.6216-02-1.4254-02 1.9773-02-3.8320-05 4.2707-03
 3.1920-03 5.5747-04 3.5748-03-6.3172-03-8.4391-04 2.3443-03-8.8825-04-3.7812-03
 4.3955-04 3.1797-04-1.9360-03-1.3080-04 2.2508-03 1.1907-03 1.4440-04-7.0511-04
-1.4327-04-9.4458-04-6.6669-04 2.3604-03-1.5813-03 5.2424-04
SINE COEFFICIENTS
-1.4707-01 3.2591-02-1.5018-02-3.2793-02-8.9613-03-2.0016-03-1.8730-03-2.9986-03
 1.4064-03-1.3956-03-4.5706-05 1.9180-03-1.4255-04 7.8103-04 3.1734-04 1.9517-04
-1.0639-03-8.5334-04-1.6158-03 1.3332-03-1.0074-03-2.8231-04 3.2077-03-2.4423-04
-4.0421-03 2.1967-03 2.9039-04-1.2905-03-1.2245-03 1.0155-03
SPAN 2  CHOPD 5        STEADYH -1.8261-01
COSINE COEFFICIENTS
-1.0157-02 6.0845-02 1.3514-02-2.0794-03 3.2263-03 3.2181-03 2.4555-03 2.7304-03
 1.1535-03-1.3184-03 2.6684-03-1.8225-03-6.3885-04 1.1343-03 1.5786-03-1.6936-03
-2.4161-03 1.1687-03-1.7009-03-2.2426-04 9.4610-04 2.3763-03-1.2171-03 1.7690-04
-1.8600-03-5.8504-04 1.3804-03 4.8941-04-3.6066-03 3.5704-04
SINE COEFFICIENTS
-1.9732-01 2.6981-03 6.4492-05-9.0351-03-7.6550-04 2.8009-04-2.0594-03-6.0049-04
-2.0468-04-3.9396-04 2.6800-04 2.1120-03-2.6579-03 9.3080-04 8.1560-04 1.6318-03
-1.6955-03-9.6011-04-2.4909-04 7.4565-04-1.4359-03 1.3820-03 2.1315-03 3.0637-04
-3.7379-04 3.0158-04-3.4333-04 8.3474-04-1.8071-03-8.1720-04
```

TABLE VI - Continued

```
SPAN 3  CHOPD 1          STEADY#  5.0507&00
COSINE COEFFICIENTS
 1.3825&00 1.4887&00 2.0795-01 3.3733-01-8.4563-02-7.8254-02 1.0298-01 9.5053-02
-1.0873-01 8.0426-03 1.6649-02 1.1028-02 1.9801-02-5.2045-02 7.1535-03 6.9338-02
-3.9317-02-4.3481-02 7.0216-03 3.5059-02 2.0833-02-5.0134-02 1.5528-02 7.4299-02
-4.2241-02-1.6495-02 4.0336-02-1.1366-02-1.6290-02 1.9028-02
SINE COEFFICIENTS
 3.5130-02 7.6023-01 3.6147-01-4.1125-01-2.2360-01 1.6466-01-5.7856-03 1.1243-02
-4.4100-02 7.0492-02 9.6403-02-8.7833-02-2.6169-02 9.8243-02-1.3585-02-2.4986-02
-1.4871-02 1.0954-04 2.3095-02-2.5992-02-1.3153-02 3.1106-02-2.4709-02 1.7944-02
-7.6730-04-4.5543-02 3.0891-02 2.9048-02-3.5640-02-1.5040-02
SPAN 3  CHOPD 2          STEADY#  4.0409-01
COSINE COEFFICIENTS
 6.8438-01 5.3477-01 9.5445-02 6.5512-02-4.6863-02 1.4313-02 7.6625-02-4.0569-03
-3.9311-02 1.5397-02-3.9268-03 3.1078-03 9.5746-03-3.4076-03-1.0546-02 1.6768-02
 8.5805-03-1.3061-02-2.5410-04 1.2079-02-1.2601-03-1.1347-02-1.6089-03 1.3397-02
 9.9328-03-1.9556-02 1.0915-02 1.2587-02-1.9495-02 6.0499-03
SINE COEFFICIENTS
-8.9359-01 2.0829-01-1.3544-01-1.2517-01 3.4670-02 2.4287-02 4.5061-03
-4.7514-02 2.4927-02 3.6571-02-3.5545-02-2.0617-02 3.7014-02 1.1435-02-2.9137-02
 3.4840-04 1.9700-02 1.6227-03-1.1384-02 1.8387-03 1.0095-02-5.1355-03-1.1267-02
 8.5299-03-2.7107-03-1.0062-02 1.4591-02-8.3661-03-1.5835-02
SPAN 3  CHOPD 3          STEADY# -4.7725-01
COSINE COEFFICIENTS
 1.6359-01 3.1865-01 6.7634-02 5.8930-02-4.6773-02 2.2593-02 2.8200-02 1.7343-03
-2.1223-02 2.9836-03 3.8672-03-7.5031-04-2.3782-03 7.4298-03-8.0009-05 1.1662-03
 8.2075-04-2.6886-03-9.1639-04 6.5657-03-1.7947-03-2.8967-05-1.5389-03-1.5790-03
 3.2173-03-5.6018-03-2.5344-03 5.5606-04-4.7637-03-7.0705-03
SINE COEFFICIENTS
-3.5439-01 6.7284-02 3.8961-02-8.3471-02-6.6631-02 1.8657-02 2.6183-02-1.9549-02
-2.9205-02 1.3423-02 2.2423-02-1.9500-02-2.0026-02 1.4430-02 9.2772-03-1.3679-02
-4.9926-03 8.4765-03 2.3426-03-2.8698-03-6.0585-03 1.0650-03 1.9672-03 1.8535-04
 1.3506-03 6.0493-03 4.0716-03 6.3753-03-1.2420-03-3.9130-03
SPAN 3  CHOPD 4          STEADY#  8.5327-02
COSINE COEFFICIENTS
-2.7656-03 1.5432-01 4.2404-02 2.4767-02-2.7521-02 1.4746-02 1.2704-02 5.2493-03
-6.5127-03 8.4618-04 2.7522-03 1.5979-03-3.1963-03 4.3252-03 3.4195-03-1.9140-03
-2.0756-04 2.1873-03 2.6159-03-4.0909-04-2.4211-03-1.4815-03 7.1173-04 2.0608-03
-3.2587-04-2.7828-03 4.0690-04 9.1374-04-1.1366-03-1.9378-03
SINE COEFFICIENTS
-2.3629-01 8.8615-03 1.6114-02-3.3094-02-2.4174-02 3.2137-03 7.0870-03-5.5177-03
-6.6973-03 4.1160-03 4.8944-03-3.9296-03-3.5107-03 1.5104-03 3.9681-03-4.5451-03
-2.2527-03 3.1904-03 3.1383-03-2.2344-03-3.5350-03 4.9108-04 1.8946-03 6.2991-04
-5.8595-04 7.8155-04 2.2486-03 1.1114-03-3.0599-03 4.7690-04
SPAN 3  CHOPD 5          STEADY# -1.3263-01
COSINE COEFFICIENTS
-8.1742-04 3.9968-02 1.0075-02 2.3009-03-7.6032-03 5.1197-03 2.6942-03 2.6633-03
-1.0593-03-7.5843-05 3.0317-03 1.5458-03-3.2164-03 2.0615-03 2.3286-03-2.3404-04
 3.5013-04 1.1926-03 2.4263-03 1.5200-03-1.7784-03-5.4583-04-7.1053-04 1.1878-03
 2.2535-03-2.8043-03-1.8661-03 1.9203-03 1.4336-03-1.5179-03
SINE COEFFICIENTS
-1.3713-01-8.1253-04-2.7859-03-8.7348-03 5.0472-04 6.1089-04-2.1385-04-7.0121-03
-1.9903-03 1.1375-03-1.3745-03-9.6906-04-8.7485-04-8.6029-04 3.9617-04-2.5718-03
-2.0286-03 1.6314-03-5.2252-04 1.1781-03-7.0512-04-1.2377-03 3.2895-03 4.4722-04
-3.6548-04 2.2224-03 8.7697-05 1.7153-03 1.3401-04-9.9605-04
```

TABLE VI - Continued

```
SPAN 4  CHOPD 1        STEADYH  4.2952400
COSINE COEFFICIENTS
 1.8536400 1.2335800 5.9149-01 4.2753-01-1.1638-01-7.8775-03 6.9343-03-9.3482-02
 7.5327-02 1.0116-01-1.0726-01-9.3537-02 1.0206-01 8.4530-02-6.6670-02-3.7490-02
 5.2527-02-8.9999-04-8.6916-03 4.7046-02 1.534.-02-5.9711-02 4.0849-03 6.4836-02
-3.4622-03-4.8006-02 1.1006-02 1.5705-02-2.4635-02-7.3539-03
SINE COEFFICIENTS
-1.3172800 6.5611-02 1.6336-02-6.5811-02-3.9929-01-1.430)-01 1.7707-01 9.4212-02
-1.3689-01-6.0306-02 6.7223-02-6.8443-03-4.4512-03 5.5608-02-6.1071-03-6.3466-02
 4.3396-02 7.0812-02-4.0524-02-5.5426-02 3.6465-02 3.1858-02-4.3465-02 6.0099-03
 2.3735-02-2.2832-02-2.4533-02 4.4709-02 1.2455-02-5.4263-02
SPAN 4  CHOPD 2        STEADYH  1.2251800
COSINE COEFFICIENTS
 1.1089800 5.2594-01-1.0604-03 7.2270-02-1.0684-01 5.8568-02 1.2274-01-1.0872-01
-2.7636-02 1.3152-01-4.9052-02-9.7978-02 7.2057-02 4.0398-02-3.9863-02 6.4594-03
 1.1057-02-6.5010-03 3.6015-03 2.4519-03-3.0932-03-1.2863-02 7.5564-03 1.2587-02
 7.7552-03-1.6340-02-1.3497-02 2.2080-02 2.6005-03-2.1014-02
SINE COEFFICIENTS
-7.8936-01 2.1314-01 1.5544-01-6.8080-02-2.3111-01-1.6550-01 1.2726-01 1.4484-01
-1.4973-01-6.7204-02 1.0948-01-2.7839-02-3.6652-02 4.6162-02-2.8155-02-2.2272-02
 3.4743-02 1.5989-02-7.7223-03-1.7975-02 3.3888-03 3.3454-03-8.5269-03 1.3996-03
 5.8801-03 5.3757-03-1.7082-02 6.3400-03 2.0699-02-9.7273-04
SPAN 4  CHOPD 3        STEADYH  7.7701-01
COSINE COEFFICIENTS
 4.7931-01 2.0347-01 6.3908-02 2.5102-01-6.9436-02-1.7388-01 6.5778-02 1.0836-01
-2.9315-02-2.3238-02 1.8195-02-4.1148-02-3.3685-02 7.2172-02 4.9140-02-7.2268-02
-5.8547-02 5.6758-02 4.4540-02-3.6368-02-3.0902-02 2.7915-02 1.9453-02-1.2721-02
-1.0769-03 1.3716-02-5.6426-03-2.8800-04 1.2450-02-1.0966-03
SINE COEFFICIENTS
-4.9547-01-4.1105-04-9.6728-02-1.5278-02 6.9970-02-8.1615-02-1.1203-01 9.2733-02
 5.5419-02-7.3241-02-3.4181-04 4.7107-02-3.8135-02-5.2091-02 3.0253-02 5.3279-02
-5.9834-02-3.7669-02 4.9806-02 2.8026-02-3.8056-02-2.0822-02 2.3625-02 9.7217-03
-1.8103-02-5.5202-03 1.0336-02-4.2560-03 2.1469-03 1.6204-02
SPAN 4  CHOPD 4        STEADYH -2.2087-02
COSINE COEFFICIENTS
 1.0859-01 1.3646-01 3.0952-02 3.0192-02-1.4019-02 2.1162-03-1.2077-03 7.3941-03
 4.7135-03-2.1719-03-1.3938-03-4.4921-04 1.1047-04 8.8793-03 6.5663-03-1.6713-03
-3.1954-03-1.6708-03 2.0437-03 4.9662-03 1.3639-03-3.8855-03-2.1956-05 4.3195-03
 4.1150-03 2.7414-03 2.2242-04 5.0265-04 2.1049-03 2.1103-03
SINE COEFFICIENTS
-4.2102-01-1.7455-02 3.5328-02-1.2316-02-3.2147-02-1.0142-02 5.3367-03 1.4980-02
-1.5251-03-1.5836-02-1.0944-03 3.0562-03 4.7768-03-2.7156-03-1.4131-03-3.1612-03
-8.2878-04-1.6031-04-9.2841-04-3.5971-03-1.0976-03-2.0935-03-1.5038-03-8.3129-04
 4.8809-04 2.9100-04 4.8950-04 4.8653-03-1.8501-03 6.4888-04
SPAN 4  CHOPD 5        STEADYH -4.6603-01
COSINE COEFFICIENTS
-5.5083-02 1.9809-02 4.8924-03 1.5942-03-6.0462-03 2.0988-03-1.8528-04-1.0917-03
 5.4968-05-1.0932-03 1.2262-03-1.3988-03-8.3719-04-8.9749-05-3.3046-04-4.1880-03
 1.3230-03 7.1504-03-8.3628-04-9.8319-04 5.1404-03-2.0614-03-5.0099-03 1.4341-02
 1.0015-02-6.1898-03 5.8831-03 2.8552-03 1.7634-04 1.1440-03
SINE COEFFICIENTS
-1.8313-01-1.9897-02 1.5545-02-1.4822-03-4.5674-03 2.6134-03-1.4022-03 4.5563-04
-6.5550-05-6.4057-04 2.4049-03 3.0640-03 1.7130-05-3.3681-03 6.5196-04 3.0163-03
-4.5565-04 3.6142-04 5.8697-04-1.7254-03-5.4098-04 2.5244-03 3.1115-03 2.0554-08
-4.3076-03-3.0440-03-4.2146-04 2.2482-03 3.9253-03 8.5428-04
```

TABLE VI - Concluded

```
SPAN 5  CHORD 1        STEADY#  5.5359800
COSINE COEFFICIENTS
 1.7702800 9.6457-01 4.3684-01 5.1700-01-8.6165-02-2.4677-02 1.5004-01-4.8647-02
-7.6347-02 1.4419-01 1.3188-01-1.1365-01-1.3679-01 1.8044-01 1.3396-01-7.4896-02
-1.1811-01 3.9097-02 7.8559-02-3.7032-02-5.9939-02 1.4020-02 1.0049-02-4.2602-02
-5.9943-03 4.7380-02 1.5408-02-5.9892-02-1.4282-02 4.1499-02
SINE COEFFICIENTS
-8.4892-01-1.6435-02-9.0069-02 2.6235-02-2.5214-01-3.3542-01 7.3775-02 2.3425-01
-8.0568-02-2.8843-01-2.8654-02 6.8463-02-6.5512-02-5.8847-02 1.1408-02 1.8582-02
-9.8569-02-1.1167-01 4.6765-02 2.8489-02-1.1140-01-9.9674-02 3.5252-02 2.5035-02
-4.7178-02-3.1878-02 2.9547-02-5.9813-03-4.8932-02 1.4649-02
SPAN 5  CHORD 2        STEADY#  1.0080800
COSINE COEFFICIENTS
 1.2178-01 1.2419-01 1.1673-01 1.3068-01-8.3871-02-2.8732-02 2.6044-02-1.8721-03
 2.1801-02 4.4887-03-1.3124-02-1.8110-02-9.1779-03 1.5274-02 4.0659-02 8.5122-03
-3.8745-02-3.1559-02 1.6871-02 3.6405-02 8.6553-03-2.6279-02-1.2065-02 1.4952-02
-1.3692-04-7.7852-03 4.8408-03 1.2397-02-1.0455-02-1.3265-02
SINE COEFFICIENTS
-1.6315-01-9.1100-02-4.3247-02 5.5817-02-7.4307-02-9.4477-02 7.1223-04 5.6727-02
 1.7233-02-2.4632-02-2.1311-02 4.0869-03 1.5696-02-1.5714-02-1.2315-02 1.8354-02
 1.6315-02-1.5021-02-2.2217-02 8.0433-04 1.3455-02 1.1234-03-1.7567-02 4.7419-03
 1.6258-02-1.1028-02-1.7076-02 7.4741-03 1.8364-02-3.5750-03
SPAN 5  CHORD 3        STEADY#  1.7249-02
COSINE COEFFICIENTS
-1.0366-01 1.8006-01 1.1431-02 8.7741-02-2.9480-02-2.2487-02 2.6913-03 4.8785-03
 6.8663-03 7.3962-03-8.4026-03-1.0679-02 5.7514-03 2.2101-03 4.6348-03 2.3739-03
-3.7847-03-1.4138-02 6.2791-03 8.6512-03 1.4459-03-3.2548-03-3.1093-03 1.6579-04
 3.5646-04 1.8438-03-1.0066-03-7.7171-05-6.3023-03-2.4030-03
SINE COEFFICIENTS
-7.7471-01-1.3476-02 2.2156-02 5.8632-03-3.8852-02-2.8488-02-1.2810-02 4.3435-02
 1.2978-02-2.0537-02-1.3935-02-5.6497-03 1.9071-02 7.7844-03-1.1537-02-1.2044-02
 7.1623-03 1.6741-03-3.5752-03 2.3236-03-5.3038-03-3.4431-03-6.6140-04 4.8806-03
 4.3300-04-1.3205-03-5.8378-03 4.5584-04 1.9017-03 1.6856-03
SPAN 5  CHORD 4        STEADY# -1.4542-01
COSINE COEFFICIENTS
-3.0921-01 1.9918-02-1.7579-03 1.6344-02-4.7683-03 1.7596-03-1.1114-02-4.1561-03
 1.0336-02 2.0821-03-6.0677-03-5.3122-03 1.9346-03 8.8618-04 1.0530-03 7.1449-04
 1.4586-03-4.0434-03-3.7446-03 2.7397-03 4.9736-03-4.1642-05-3.4761-03-1.8090-03
 8.1934-04 1.2032-03 1.1563-03-2.2394-04-2.0891-03-1.1739-03
SINE COEFFICIENTS
-2.1462-01-2.5651-02 2.2966-02-5.1896-04-2.0851-02-1.8738-03-5.2562-03 7.8901-03
 8.8554-03 2.3363-03-5.7113-03-6.3453-03 3.5120-03 6.8024-03-1.7679-03-6.0399-03
-1.2454-03 3.9690-03-1.0601-03-9.6680-04-3.8801-04 1.3775-03 3.9508-05-1.9283-03
 1.9142-03 6.7271-04-8.4929-04-3.0162-04 4.4893-04 1.2552-03
SPAN 5  CHORD 5        STEADY# -3.9769-01
COSINE COEFFICIENTS
-1.2862-01-1.9108-02-4.2228-03 6.3179-03-2.6947-03-2.5637-03-1.6692-02-2.7261-04
-2.9621-04-3.8906-03-1.9882-03-3.2191-03-1.2603-02 1.7977-02 7.3915-03 3.5082-03
-3.5391-03-2.3979-03-4.2294-03 6.1334-03-3.0402-05-8.3412-04 1.9567-03-2.2209-03
-2.7220-03 1.5626-03 3.3443-03-1.2406-03-6.7444-04-4.2403-04
SINE COEFFICIENTS
-2.0137-01-1.4110-02 1.8727-02 1.9274-02-6.1960-03-2.1404-03-1.0131-02 1.0137-02
 1.8058-02 4.4379-03-4.8086-03 6.5606-03 2.1006-02-3.4644-02-9.9011-03-5.6664-03
-4.2575-03-6.9436-03-5.0682-03 4.6512-03-1.6667-03-4.4194-03-3.2754-03-2.6321-03
-2.1823-03-4.1239-03-1.4507-03-2.8976-03-7.3468-03-3.3138-03
```

TABLE VII. AERODYNAMIC DATA - 140-KNOT, EAST-TO-WEST FLIGHT

```
BURST NO. # 16              *** ROTOR NOISE PUNCHED OUTPUT ***
BLADE PITCH HARMONICS
 1.2660&01 3.5189&00-5.4378&00  %COLLECTIVE, LONGITUDINAL, LATERAL RESPECTIVELY%
ROTOR FLAPPING ANGLE HARMONICS
 1.8056&00-2.4824-01-7.6813-02  %POSITIVE TAIL HIGH -- DEGREES%
DIFFERENTIAL PRESSURE HARMONICS FOR 5 CHORD STATIONS AT EACH OF THE 5 SPANS
%MEASURING FROM THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY%.
SPAN 1  CHORD 1        STEADY%  1.5717&00
COSINE COEFFICIENTS
-1.0399&00 7.5633-01-3.7464-01-4.1783-02-1.0663-01 7.4181-02-7.3632-02 3.7777-02
-2.9714-02 3.2592-02-2.5193-02 6.1458-03-2.8729-02 5.9236-03-2.0129-02 1.3137-03
-1.2622-02 5.5308-03 2.4149-03 1.8297-05-1.6873-03 9.3427-03-3.5102-03-1.1375-03
-7.6830-03-3.4986-03-2.9614-03-8.7449-03-4.5212-03 7.9618-03
SINE COEFFICIENTS
 5.7542-01-6.4825-03 3.0207-01 3.2483-02-6.8737-02 5.5362-02-6.7961-03 1.9779-02
-1.3582-02 8.1893-03-7.7728-03-1.0863-02-1.5824-02-2.0059-02-4.7943-03-2.1894-02
-5.9257-03-2.7471-02-1.3277-02-1.8856-02-2.2521-03-1.5816-02 6.5961-03-7.9315-03
 4.3151-03 4.0255-04 6.0884-03 1.5587-02-7.5364-04-2.4154-03
SPAN 1  CHORD 2        STEADY%  5.5893-01
COSINE COEFFICIENTS
-3.2250-01 2.4744-01-1.2910-01-1.4341-02-3.9860-02 1.0190-02-3.9342-02-7.7715-03
-1.3762-02 9.0389-03-4.0694-03-1.9648-02-1.4714-02 1.6614-02 1.3429-03-1.1911-02
-2.1694-02 2.4592-02 9.3097-03-5.3578-03 1.6177-02 3.2004-03-2.5141-03-4.1192-03
-5.1289-03-3.2618-03 3.1328-03-2.3456-02-2.2754-03-1.9139-03
SINE COEFFICIENTS
 3.2079-01-2.3804-02 1.0925-01-1.5871-02-7.9892-03 2.1819-02-1.3650-03-1.5377-02
-1.7598-02-2.1815-02-8.7594-04-7.1410-03 [illegible]9563-02 2.3375-03 3.0391-03-1.2647-02
 1.7237-02 3.8285-02 1.1167-02-1.9953-02 [illegible]-02-1.3840-02 9.5293-03 1.3605-03
-1.7750-02 1.1535-02-1.5677-02 2.4617-02-2.3343-02 [illegible]-03
SPAN 1  CHORD 3        STEADY%  2.5193-01
COSINE COEFFICIENTS
-2.2264-01 1.8897-01-8.0707-02-2.4400-02-2.3587-02 1.5721-02-9.4920-03 8.8229-03
-4.2383-03 8.7480-04-6.2239-03-2.3416-03-5.2135-03-5.3529-04-2.7656-03-2.2199-03
-3.8170-03 4.9137-04-1.5779-03 1.0264-03-1.1525-03-4.2563-04-1.5525-03-3.2430-03
 3.9779-04 4.6939-04 3.2734-03 2.4731-03 2.4884-03-3.6194-03
SINE COEFFICIENTS
 1.5354-01-4.3676-02 5.2738-02 2.4771-03-1.5151-02 5.6092-03 4.8906-03 2.5545-03
-4.1595-03-1.1162-03-1.6245-03-3.3369-03-5.2894-03-3.1826-03-4.8466-03-5.7059-04
-4.2043-03-4.0674-03-7.2478-03-2.1026-04-4.6259-03-1.3689-03-2.3447-03 5.2117-04
-4.7201-03-2.2723-03 2.2204-03-4.1802-03 1.0681-04 1.4969-04
SPAN 1  CHORD 4        STEADY%  0.0000
COSINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SPAN 1  CHORD 5        STEADY%  1.1633-01
COSINE COEFFICIENTS
 9.8842-03-3.6420-02 7.6790-04 3.6568-04-1.1146-03-1.3476-03-4.6976-04-1.1290-03
-1.0044-03-1.1146-03-4.6778-04 1.2949-04 1.3712-04-4.1319-04-4.9333-04 9.0107-04
 7.2940-04 1.1592-03 9.7980-04-3.1639-04 1.3490-04-3.2772-04-7.3254-05 9.0275-05
-3.7497-04-4.9621-04 7.1931-04-3.0896-04 1.0414-03 4.8562-04
SINE COEFFICIENTS
 4.9724-02 8.6151-03 3.9729-03-1.3977-03 1.6336-03-1.4067-03-3.8740-04-1.1129-04
 3.1683-05-1.0185-03 5.8690-04 6.9941-04 1.8522-03 7.5606-04 1.9254-03-1.0231-03
 1.6802-03 6.4488-04 2.5144-03-6.8592-04-5.3402-05 3.2903-05-6.0223-04 1.5642-04
-2.1190-04-1.2668-03-8.1897-05-7.4128-04-7.1469-04 1.0421-03
```

TABLE VII - Continued

```
SPAN 2  CHORD 1        STEADY=  4.5323+00
COSINE COEFFICIENTS
-1.7940-01 1.7619+00-3.7789-01 3.5856-01-2.3206-01 1.4205-01 5.2186-02-1.5252-01
 8.2101-02-1.1951-01 8.7269-02-9.2070-02-7.2593-03 1.9484-02-5.0856-02 4.2 22-02
-6.1884-02 4.9378-02-2.7763-02-2.8632-02 2.0482-02-5.0281-02 1.9937-02-5.0475-02
 1.7240-02-5.8386-03-2.7221-02 1.8571-02-3.2158-02 2.1056-02
SINE COEFFICIENTS
 3.8236-01 3.8532-01 2.4026-01-6.2043-01-3.4437-02-1.8838-01 1.1593-01-1.7658-01
 3.8184-02-1.2526-02-9.8332-02 5.4902-02-9.0934-03 6.0470-02-8.2695-02-5.2664-03
 2.8870-03-5.6567-02 3.9640-02-5.3495-02 2.7394-02-2.7976-02-1.7737-02 6.5670-03
-4.7008-02 2.4239-02-4.0531-02 1.8312-02-1.6535-02-9.7951-03
SPAN 2  CHORD 2        STEADY=  1.8513+00
COSINE COEFFICIENTS
 4.5741-02 7.1327-01-1.0328-01 1.0908-01-7.8798-02 4.9984-02 2.1732-02-6.5278-02
 2.0718-02-1.6030-02 9.3353-03-1.2599-02-1.7281-02 7.2092-03-1.5112-02-1.3006-03
-5.1626-03 8.5096-04 3.4789-03-2.1151-02 1.2033-02-5.7802-03 4.0308-05-8.2477-03
-1.7554-03 3.9107-03-1.6404-03-4.5673-03-6.1434-03-5.6874-03
SINE COEFFICIENTS
-4.2244-02 1.2124-01 1.0374-01-2.7166-01-3.4589-02-4.7420-02 3.6124-02-4.6882-02
-9.5801-03 8.4860-03-3.7532-02 1.2442-02-1.2368-02 4.5665-03-1.6033-02-5.9656-03
 8.4553-03-2.4288-02 2.2579-02-1.2442-02-5.3551-03-6.0635-03-7.8602-03-2.1799-03
-1.5682-02 1.5542-03 1.7302-03-1.9262-03 2.0578-03-7.4908-03
SPAN 2  CHORD 3        STEADY=  1.4711+00
COSINE COEFFICIENTS
 2.4704-02 3.6126-01-4.4450-02 3.6962-02-4.1617-02 3.4132-02 1.4042-02-2.6245-02
-5.8314-03-1.3758-03 1.0822-03-1.0352-02-6.1856-03 3.8450-03-4.8402-03-7.2371-03
 2.1947-05-6.9575-04-5.8525-03-6.8766-03 1.8852-03-3.1694-03-4.0915-03-2.3305-03
-6.5034-03 1.1054-03-4.4736-03 1.8706-03-5.0403-03-9.1576-04
SINE COEFFICIENTS
 1.5842-01 4.5420-02 7.1085-02-1.3907-01-3.1719-02-1.1048-02 3.0212-03+1.3924-02
-1.3689-03-5.3495-03-1.3400-02 3.2802-03-9.3908-04-1.8944-03-5.4201-03-5.3817-03
 2.8228-03-1.9468-03-3.0780-03-2.7200-03 1.5915-04-5.9690-04-2.1446-03-1.4655-03
-3.0303-03-6.6307-03-7.1154-03-1.8214-03-8.8891-04-2.1607-03
SPAN 2  CHORD 4        STEADY=  3.3822-01
COSINE COEFFICIENTS
-1.9818-01 2.6690-01 1.5157-02 1.3185-02-2.6935-02 1.7451-02 1.1716-02-4.0181-03
-9.1603-03 4.5397-03 7.8183-04-3.6246-03-5.1278-03 1.4103-03 1.1162-03-6.7983-03
 3.0550-04-2.3217-03 1.3382-03-3.6719-03 7.9875-04 2.7478-04-2.5723-03-3.1964-03
-4.1691-03-2.3562-04-2.2709-03-8.7881-04-2.6000-03-4.3432-04
SINE COEFFICIENTS
-1.9410-01-3.1865-02 7.1949-03-7.2241-02-8.4870-03-5.4846-03-9.8401-03-3.7830-03
-4.8302-03-5.3166-03-4.4687-03-8.3279-04 2.5732-03-3.8840-03-3.4916-04-3.5617-03
-5.7262-04-2.7812-04-3.7568-03-1.4458-03-1.0140-03 1.0643-03-1.4649-03-2.1168-03
-2.8634-04-4.2956-03+3.4196-03-2.9870-03 1.5834-04-3.7106-03
SPAN 2  CHORD 5        STEADY= -2.1155-01
COSINE COEFFICIENTS
-2.9914-02 7.7471-02 9.5966-03-8.5501-04-6.0925-03 4.0236-03 1.9076-03 1.5176-03
-4.3965-03 5.0761-03-9.5919-04 2.9989-04-1.5374-03 3.2433-04 2.9475-03-5.8954-03
 9.0923-04-1.2299-03 2.8499-03-2.3609-03-2.1797-03 2.3583-03 1.5863-04-4.8643-04
-3.2080-03 1.5213-03 1.0327-03-2.0041-03-5.3994-04-1.5626-03
SINE COEFFICIENTS
-2.4134-01-4.5372-03-7.2578-03-1.2976-02-6.1165-04 7.4773-04-5.9536-03 1.4214-03
-9.5814-04-4.2210-04-1.0184-04-3.2805-03 1.9857-03-4.0377-03 1.3338-03-4.8830-04
-9.9125-04 1.9618-03+3.5592-03 2.8514-03-1.7683-03 8.1225-04-9.6392-04-6.8936-04
 1.2423-03-1.2970-03 1.7130-03-1.9580-03 1.5034-03-9.9697-04
```

TABLE VII - Continued

```
SPAN 3  CHORD 1          STEADY=  5.0899+00
COSINE COEFFICIENTS
 1.4138+00 2.1062+00-9.6492-02 2.1610-01 1.3195-02-1.3131-01-4.7121-02 1.3861-01
-6.6271-02-7.5611-02 6.7105-02-8.4713-02-2.5270-02 2.2284-02-1.0220-01-1.5459-02
 5.3233-02-8.8177-02 6.6572-03 3.4897-02-4.6769-02 2.4652-02 2.6807-03-4.8205-02
 1.3893-02 1.0124-02-4.9997-02 2.3050-02-1.3123-02-3.3012-02
SINE COEFFICIENTS
-2.8365-01 2.9484-01 5.5342-01-6.8690-01-3.0563-01 1.3176-01-1.1214-01-1.6008-02
-6.5277-03-1.2223-01 2.8109-02 2.7001-02-1.2797-01 6.9192-03 3.6768-02-9.2376-02
 1.9832-02 2.4649-03-6.6605-02 4.3095-02 4.2520-06-4.3883-02 3.4607-02-1.2844-02
-5.6925-02 2.9227-02-4.0928-02-3.3545-02 1.4907-02-3.3766-02
SPAN 3  CHORD 2          STEADY=  2.0644-01
COSINE COEFFICIENTS
 7.3224-01 9.7440-01-4.1951-02-6.8101-02 2.3821-02-4.9558-02 3.5084-03 5.8280-02
-4.5411-02-2.4172-02 1.8268-02-1.7607-03-1.7963-02 1.6821-03-1.7803-02-1.4357-02
 1.9847-02-2.2879-02 1.4638-02 5.1401-03-1.1363-02-7.2808-03-3.0931-03+8.1221-03
-1.1249-02 1.6539-02-9.9994-03-1.9597-02 1.8293-03-9.8462-03
SINE COEFFICIENTS
-1.3782+00 9.4754-02 3.1306-01-2.8956-01-1.6408-01 3.1926-02-6.8949-02 1.3465-02
-3.8350-03-2.8389-02 1.4671-03 1.0370-02-1.6497-02-1.5657-02 1.4066-02-2.5674-02
-4.3110-03-7.8095-03-2.2010-02 9.5720-03 2.1865-03-7.1203-03-2.2406-03 5.1142-03
-1.4254-02-1.1608-02 1.4152-02-1.0766-02-8.9969-03-5.0944-03
SPAN 3  CHORD 3          STEADY= -2.5086-01
COSINE COEFFICIENTS
 1.0924-01 1.4247-01 6.1491-02 1.9672-01-9.7216-02-5.2597-02 2.4189-02-1.5102-02
 2.8157-02 4.0777-03-3.9904-02-1.0752-02 4.8054-03 9.6268-03 4.2944-03-1.7091-02
-5.9611-03 2.3406-03 1.8043-02-1.0639-03-4.6159-03-3.2004-03-5.8965-03 1.0888-02
 2.9965-03-8.3086-03-1.0052-02-1.1824-03-2.2238-03 4.8815-03
SINE COEFFICIENTS
-5.5620-02-1.0047-01-1.7288-01-9.3416-02 2.9472-02-4.1383-02-2.3998-03-2.5882-02
-4.4848-02 4.5212-02 1.6687-02-2.0263-02-1.9109-02-6.8838-03 2.2457-02 1.0627-03
-1.7648-02-1.8207-02-1.6176-03 1.3676-02-2.6654-03-5.2164-03-1.1699-02-9.3563-03
 9.6920-03 1.5205-03-1.0473-02-4.3639-03-5.2852-03 1.8605-03
SPAN 3  CHORD 4          STEADY= -9.7465-02
COSINE COEFFICIENTS
-1.9503-02 2.2175-01 7.7990-03 1.5428-03-2.0499-02 5.6832-03 1.2824-02-3.2823-04
-7.6758-03-4.7927-03-2.1867-03 2.2179-03-1.8914-03-3.7096-03 6.2222-04-1.4324-03
-2.3804-03 2.9179-03-6.8540-04-2.8700-03 1.2895-03-1.4736-04-1.6370-03 1.2121-04
-8.5362-04 8.0716-04-5.3382-04-1.5172-03-2.3777-03 1.2178-03
SINE COEFFICIENTS
-3.0872-01-4.5429-02 3.8436-02-7.0371-02-3.1469-02-8.3436-03 9.8034-04 1.2894-03
-1.2553-02-2.0839-03 1.2114-03 6.5886-04 6.6393-05-1.3742-03 5.4131-04 1.2721-03
-4.9538-03-3.0933-03 8.0487-04-6.9093-04-3.8331-03-3.4419-04-6.8970-04-4.1992-04
-1.3585-03-2.7404-03-6.7157-04-7.3131-04-1.4734-03-2.2124-03
SPAN 3  CHORD 5          STEADY= -1.4145-01
COSINE COEFFICIENTS
-7.0444-03 5.4987-02 8.3275-03-5.6938-04-6.7115-03 2.5331-03 4.0079-03 6.6472-05
-1.4771-03 1.4513-03-5.6299-04 3.6166-03 1.9017-03-1.7697-03 2.3289-03 6.0481-04
-2.2325-03 2.0083-03-1.6198-03-7.7031-04 1.5405-03-9.5990-04-1.8487-03 3.3569-03
-2.1493-04-9.6803-05 1.6276-03-1.1074-03-1.7796-03 1.9140-03
SINE COEFFICIENTS
-1.6845-01-1.5453-02-7.8643-03-1.4858-02-2.2990-03-4.3885-03-1.1468-03+1.1737-03
-5.0913-03 1.4049-03 5.3881-04-1.2166-03 7.7595-04-2.5135-03-1.8020-03 2.8280-03
-1.6393-03-3.3342-03 3.0618-03-3.5866-04-2.1033-03 6.9886-04-2.2744-03-9.8398-04
 2.5164-03-2.7198-03-2.1794-04 1.3682-04-2.1097-03-7.1681-04
```

TABLE VII - Continued

```
SPAN 4  CHORD 1          STEADY=  4.3236+00
COSINE COEFFICIENTS
 1.9715+00 1.7273+00 1.4510-01 3.6523-01-1.8989-01-7.0262-02-5.0374-02-8.1551-02
-1.3054-02 2.2191-02-2.7233-02-8.8619-02 3.8543-03 5.8714-02-5.2274-03-4.7682-02
 1.5209-02 2.4063-02-3.2421-02-3.1019-02 7.6739-03-1.2409-02-3.8463-02 1.0477-02
 2.2750-02-8.5650-03-2.8257-02 1.2685-02 5.6627-03-2.9764-02
SINE COEFFICIENTS
-1.7004+00-4.4107-01-1.6725-01-4.0294-01-3.8747-01-1.6028-01 3.3269-02 5.9933-02
-1.0367-01-5.7492-02 2.4667-02 3.2600-02-3.3191-02-2.6417-04 1.0415-03-5.0303-02
-2.5114-02 2.1249-02 1.0795-02-5.2152-02-2.5693-02 2.2832-02-1.0688-02-3.2052-02
-1.8994-03 8.2123-03-2.4198-02-3.3753-02 8.7118-03-3.2610-03
SPAN 4  CHORD 2          STEADY=  1.2050+00
COSINE COEFFICIENTS
 1.2423+00 7.6758-01-1.6780-01 1.1740-01-1.3123-01-9.3285-02 8.9736-02-4.3166-02
 4.7550-02 5.4762-02-5.6047-02-2.5415-02-2.8998-02 5.3950-02 6.4827-03-3.3707-02
 1.6422-02-8.3394-03-4.2393-03-5.1300-03 2.1730-02-1.3131-02-1.7508-02-5.2371-03
 7.1466-03 8.2349-03-7.0405-03 1.2010-02-6.0110-03-1.4993-02
SINE COEFFICIENTS
-9.7625-01 1.0403-01 1.2466-01-2.2126-01-7.3795-02-1.6345-01-4.6459-03 6.9424-02
-9.3400-02 3.4776-02 6.3129-03 7.0378-03-2.1291-02-4.0789-02 2.4843-02-2.8320-02
 7.2172-03 4.7534-03-1.0973-02-2.2262-02-1.6288-02 2.0220-02-1.6970-02-1.0356-02
-2.4989-02 2.3262-04-6.5719-03-2.9085-04 4.6294-03-5.2734-03
SPAN 4  CHORD 3          STEADY=  1.0717+00
COSINE COEFFICIENTS
 4.4963-01 8.3456-02-2.3113-02 1.0889-01 1.7004-02 2.1714-02 1.1169-02 3.4136-02
-1.0639-01-5.3970-02 8.4566-02-9.4600-03 7.3584-02 4.3102-02-8.7931-02-3.8947-02
-5.7450-02 4.5283-02 1.1128-01-2.5284-02 2.1506-03-3.8745-02-5.0018-02 7.3130-03
 1.1933-02 6.1519-02 5.6549-04-3.3694-02-2.1095-02-1.3396-02
SINE COEFFICIENTS
-1.7907-01-1.7007-01-1.5906-01-1.5639-01-9.7307-02 2.1396-02 2.6342-02 9.0315-02
 4.3062-02-1.4499-01-3.7597-02 1.4058-02-2.7820-02 1.0284-01 2.3038-02-2.3830-02
-3.2716-02-1.0252-01 3.1659-02 4.4045-02 4.6705-03 4.4070-02-3.0891-02-3.5992-02
-3.3781-02 2.8668-04 5.4115-02 6.3574-03-9.3105-03-2.6533-02
SPAN 4  CHORD 4          STEADY= -9.9500-02
COSINE COEFFICIENTS
 8.8545-02 2.5226-01 1.7002-02-2.6905-02-2.8211-02-3.2769-03 8.9155-03 5.1615-03
 7.9514-03-1.0162-02 2.5602-03 6.3093-03 1.0036-03-3.8267-03 5.4993-03 6.2450-05
-7.3830-03 5.6060-04 6.7769-03-5.4648-03-1.8509-03-9.0334-04-5.1794-03-4.7395-03
 5.6189-03 7.6473-03-3.1342-03 3.5130-03 6.3448-03-3.7929-03
SINE COEFFICIENTS
-6.0061-01-6.4250-02 7.1578-02-9.5353-03-4.4522-02-1.0975-02-5.4469[illegible]-03
 3.6648-03-2.9450-03-1.2587-02 9.0692-03 1.1790-02-4.9902-03-4.9866[illegible]-04
 1.9772-03-1.0195-02 1.1108-02-4.2796-04-6.5972-03 2.0631-03 4.8269[illegible]-03
-4.3462-03 1.2799-03 4.6337-04-5.8436-03 3.5874-03 2.1539-03
SPAN 4  CHORD 5          STEADY= -5.2357-01
COSINE COEFFICIENTS
-7.9665-02 2.8101-02 9.7941-03-3.3593-03-6.3725-03 1.4941-03 2.8592-03[illegible]-04
 1.1706-03 8.0555-04 2.0628-03 2.3176-03 1.6306-03 2.6175-04 2.1273-03 2.1280-03
-1.1364-03 4.8706-03 6.4884-03 3.4328-03-2.6707-03 1.7490-03-1.6357-03 4.9562-03
 1.5034-03 1.4787-03-1.4458-04 5.0410-03-2.3900-03 5.5268-03
SINE COEFFICIENTS
-2.2812-01-3.0271-02 8.6824-03 9.6914-03-4.3660-03 1.0240-03 1.6224-03 2.3124-04
 1.4639-03 3.8227-03-3.3329-03 6.3064-03 4.7951-03-2.8931-03-7.5772-04 6.5209-03
 2.6779-03-2.1302-03-2.1474-03 4.2896-03-2.6924-03-6.7841-03 1.5857-03 6.7580-03
-9.8096-03-3.3866-03 2.6719-03-2.6086-05-3.3305-03 1.6305-03
```

TABLE VII Concluded

```
SPAN 5  CHORD 1        STEADY=  3.8522+00
COSINE COEFFICIENTS
 2.0919+00 1.5811+00 2.9130-01 5.0501-01-3.9004-02-1.3974-01-5.7719-02-9.3646-02
-1.3519-01-9.8406-02-1.2932-02-3.3734-02-7.0961-02-3.9397-02 9.3866-02 4.2265-02
-5.6323-02-1.2288-02 5.4187-02 2.1286-02-7.2295-02-5.3138-02-8.8187-03-7.2273-03
-4.1520-02 2.5115-02 4.0744-02 5.4266-03-1.5099-02 1.1267-02
SINE COEFFICIENTS
-1.2370+00-5.8802-01-4.2915-01-6.2079-01-4.7978-01-3.6031-01-2.2704-01-2.8163-02
-8.7805-02-1.6219-01-4.8759-02 1.1078-01 5.3981-02-1.5028-01-5.9752-02-2.5220-02
-6.2986-02-1.3975-01-1.0505-01-3.4907-02-7.2623-02-8.8903-02-3.9709-02 1.9106-02
-1.8672-02-5.4239-02-1.2458-02 9.1485-03-2.6611-02-4.6692-02
SPAN 5  CHORD 2        STEADY=  1.1609+00
COSINE COEFFICIENTS
 2.2748-01 3.6384-01-3.2215-01-1.9117-01 1.6325-01 1.9713-01-3.1060-02-1.1201-02
-3.0325-03-9.4680-02 2.4410-02 4.6282-03-9.4527-02 3.8611-02 1.3153-01 8.1431-03
-6.4468-02-1.1217-02-1.3480-02-3.6093-02-1.2164-02 1.2793-02 4.2200-02 2.3797-02
-1.3501-02-9.4418-03-9.2455-03-3.9680-02-2.1732-02 2.5066-02
SINE COEFFICIENTS
-2.4403-01 7.4926-02 1.7887-01-3.8162-01-3.4688-01 7.4007-02 1.1341-01 3.6621-02
 6.6840-02-2.7779-02-8.0613-02 5.9548-02-2.2783-02-1.2342-01 6.1039-03 9.4822-02
 1.7434-02-1.4412-02 1.4598-02-1.2096-02-4.8456-02-4.0312-02-1.0275-02 2.8816-02
 2.5462-02-7.7183-04 1.5776-02-3.3395-03-4.1172-02-3.2656-02
SPAN 5  CHORD 3        STEADY=  1.8184-01
COSINE COEFFICIENTS
-3.4178-01 2.2636-01-3.2560-02-1.4013-01 9.7603-02 1.7576-01-1.1957-01-6.8889-02
-7.3469-02-1.2066-02 1.8852-01 4.9582-02-8.9640-02-7.5860-02-3.5698-02 6.7314-02
 7.3391-02-1.3246-02-5.0218-02-2.4489-02 1.2512-03 2.3562-02 4.1121-02-7.9562-03
-4.6243-02-1.2566-02 1.2377-02 3.5705-02 1.0164-02-2.4814-02
SINE COEFFICIENTS
-5.1914-01-2.0836-01 1.7745-01-1.1459-01-2.3937-01 1.5470-01 1.3532-01-7.8029-04
-1.3380-02-1.6750-01-4.9251-02 1.6154-01 7.4310-02-1.2855-02-8.5447-02-7.4803-02
 8.3211-02 7.4409-02 1.7776-02-3.1357-02-3.4416-02-2.6320-02 1.6348-02 5.1677-02
 3.7095-03-3.1554-02-2.8456-02-5.1743-03 3.6051-02 2.0984-02
SPAN 5  CHORD 4        STEADY= -1.9193-01
COSINE COEFFICIENTS
-3.9314-01 7.0409-02 2.5496-03 3.6392-03-2.7981-02 1.0094-03-7.9245-03-8.4421-04
 6.0007-03 7.7451-04-2.1974-04-1.0170-03-1.0344-03 4.1036-03 9.9115-04-1.7013-04
-6.1498-04-8.2977-04-1.1422-04 3.4584-04 1.8544-03 1.4852-03-4.3563-03-6.9525-05
-1.7413-03 2.0535-03-5.2038-04-1.1668-03 8.2218-05 1.5667-03
SINE COEFFICIENTS
-2.6216-01-7.5712-02 4.1631-02 6.0684-03-8.7412-03-5.8244-03-3.0011-03 7.3681-03
 4.7052-03 3.6956-03-5.8810-03-2.7051-03 1.5559-03 2.8091-03 2.6170-03-2.5764-03
-1.4684-03-3.7160-05 1.1852-03 1.4538-03-2.0710-03 1.2430-03 6.3242-04 3.6152-04
-1.8165-04-7.3682-04 9.6047-04-1.9318-03-7.8798-04 1.3296-03
SPAN 5  CHORD 5        STEADY= -4.3901-01
COSINE COEFFICIENTS
-1.6340-01-2.7109-03-7.3843-03 4.0004-03-1.0941-02 1.5422-02-2.6676-03-4.3488-03
 3.1469-03 7.5604-03 4.7359-03 2.9112-03 1.3975-02-2.4671-02-2.8420-03-3.4610-03
-7.8810-04 3.3814-04-6.9932-03 6.8667-05 7.0719-03-8.3436-05-1.5762-03 2.3385-04
 3.0705-03-8.3413-04 2.2771-03 1.7025-03 3.0090-03 2.5441-03
SINE COEFFICIENTS
-2.4782-01-2.3698-02 2.4086-02 2.7757-02-7.9328-03-9.5922-03 5.2043-03 5.1507-03
 4.1839-03 5.6710-04-3.1119-03-1.6578-02-9.7995-03 4.0075-02 1.2444-02 1.9845-04
 3.3750-03 6.7822-03 2.3900-03-2.0297-03 7.9301-04 3.3486-03 4.8541-04 1.2148-03
 1.1255-03 1.3947-03-2.4436-04 3.8726-03 8.2530-04 4.5212-03
```

NOT REPRODUCIBLE

TABLE VIII. AERODYNAMIC DATA - 140-KNOT, WEST-TO-EAST FLIGHT

```
BURST NO. # 23            *** ROTOR NOISE PURSUED OUTPUT ***
BLADE PITCH HARMONICS
 1.2486&01 3.1825&00-5.4590&00  %COLLECTIVE, LONGITUDINAL, LATERAL RESPECTIVELY#
ROTOR FLAPPING ANGLE HARMONICS
 1.6400&00 2.4828-01 0.0000      %POSITIVE TAIL HIGH -- DEGREES#
DIFFERENTIAL PRESSURE HARMONICS FOR 5 CHORD STATIONS AT EACH OF THE 5 SPANS
%MEASURING FROM THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY#.
SPAN 1  CHORD 1          STEADY#  1.4340&00
COSINE COEFFICIENTS
-8.7874-01 7.1484-01-3.0694-01-4.4989-02-1.3330-01 6.3239-02-8.6684-02 1.8630-02
-5.3068-02 2.3941-02-4.5362-02-5.3878-03-3.3959-02-4.5089-04-2.4391-02-4.5592-03
-2.5207-02 1.0213-03-9.7478-03 1.1614-02-5.1615-03 1.3763-02 1.0093-02-8.0250-03
-2.1242-04 1.0761-03-9.4748-03-3.7920-03-4.2746-03-9.7850-03
SINE COEFFICIENTS
 6.5338-01 6.2492-02 3.9053-01 1.1666-01-3.2466-02 6.2006-02 7.5729-03 3.6348-02
 9.5052-03 2.4870-02 3.8347-03 7.2457-03 4.0980-03-5.3440-03-9.9445-04-2.2815-02
-1.4517-02-2.5601-02-3.7192-03-2.4937-02-9.1851-03-1.4664-02 5.9914-03-1.5957-02
-3.6172-03-1.1585-02 7.7[illegible]-03-9.5806-04-8.9636-03-1.3665-02
SPAN 1  CHORD 2          STEADY#  5.4473-01
COSINE COEFFICIENTS
-3.0225-01 2.1700-01-1.1553-01-2.6728-02-5.5898-02 4.2305-03-4.6233-02-2.0659-03
-2.0846-02 2.3386-03 1.7843-03-1.6328-02-8.5534-03 3.3427-02 1.6826-02-3.6135-02
-1.4708-02 3.4336-02 2.4594-03 1.7907-02 8.7563-03 9.9761-03 1.8707-02-5.8819-03
 1.9566-02-8.0813-03 1.1289-02-1.4383-02-6.7143-03-2.2319-02
SINE COEFFICIENTS
 3.5827-01 1.0530-02 1.5153-01 4.3532-02 1.7294-02 4.4564-02 2.6098-02 1.7979-02
 1.3407-02 7.3889-03 1.7632-02 1.2439-02-5.3148-03 3.3715-04-1.8562-02-1.3984-02
 4.7696-03 3.7285-03 2.0920-02-4.1993-03-1.3032-02-5.1518-03 7.4878-03-1.4612-02
 1.2383-02-1.0490-02 1.3237-02-1.3391-02-8.1526-03-8.5740-03
SPAN 1  CHORD 3          STEADY#  1.7820-01
COSINE COEFFICIENTS
-1.9004-01 1.7851-01-6.6939-02-1.7299-02-3.0073-02 1.7263-02-1.5017-02 5.4770-03
-8.9028-03 1.1538-03-4.8926-03-5.6285-03-3.9304-03-1.8216-03-3.7051-03-5.1657-03
-9.2318-04-2.8435-03-1.4183-05 2.5970-03 4.3818-06 2.6398-03-6.7997-04 1.4290-03
 2.5287-03 3.1129-04 1.4623-04-3.0497-03-1.2532-03 1.0408-03
SINE COEFFICIENTS
 1.8595-01-1.6215-02 8.4336-02 3.0863-02-1.1531-02 1.6131-02 7.2811-03 6.9570-03
-1.6345-03 4.6558-03 2.4842-03 1.5022-03 2.9586-03-1.8465-03-1.6681-03-1.3205-03
-8.3347-04-4.3646-03-2.7298-04-2.5428-03-9.9858-04-3.0436-03-3.4701-03-3.8967-03
-3.3171-03 1.5185-05 7.7675-04 2.2507-03-1.5983-03 5.4818-04
SPAN 1  CHORD 4          STEADY#  0.0000
COSINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SPAN 1  CHORD 5          STEADY#  2.0679-01
COSINE COEFFICIENTS
 8.4039-03-3.4984-02 2.5648-03-1.2759-03 1.9745-03-1.7336-03 4.0416-05-8.6213-04
 6.1971-04 9.6005-06 7.7133-04 6.7053-04 1.7610-04 8.4334-04-1.0271-04 8.6809-04
-1.8759-04-1.7472-04-5.3840-04-1.1281-05-9.3874-04-2.3010-04 9.2592-04 9.0275-05
 8.9976-04 9.6660-04 1.5811-03 9.7413-04 7.1062-04-7.9382-04
SINE COEFFICIENTS
 3.6284-02 7.3932-03 1.2710-03-3.2689-03-4.1976-04-1.4850-03-1.4269-04-1.1829-03
 1.1139-04-8.7763-04 3.5134-04 1.3716-04 1.0734-03 1.6360-04 4.8294-04-1.3103-03
-2.2989-04-5.8366-04-7.7723-04 1.2986-03 1.2950-03 1.0889-03 1.3752-03 7.8203-04
 1.6209-03 5.5983-04-2.7793-04 1.7452-04 1.6796-04-8.2305-04
```

TABLE VIII - Continued

```
SPAN 2  CHORD 1        STEADY#  4.1495800
COSINE COEFFICIENTS
 2.0497-01 1.5885800-1.9094-01 2.4764-01-2.5134-01 1.9323-01 2.8384-02-9.7484-02
 5.7413-02-7.1897-02 7.8027-02-7.9187-02 2.2220-02 1.0234-02-3.2931-02 3.7803-02
-5.5312-02 6.5381-02-3.5078-02 1.6665-02 1.4064-02-1.3261-02 2.4319-02-3.8681-02
 4.3270-02-7.0932-03 3.2563-03 6.3751-03-6.9985-03 3.3273-02
SINE COEFFICIENTS
 4.5836-01 5.6924-01 3.6997-01-4.0758-01 4.0585-02-1.0826-01 1.4385-01-8.0024-02
 1.1718-01 2.9027-02-2.8150-02 7.1455-02-2.9803-02 8.8705-02-4.6938-02 5.5389-02
 1.6075-02-2.4777-02 4.0714-02-2.6319-02 4.8098-02-3.2531-02 2.8999-02 4.0067-03
-1.6223-02 2.5976-02-1.2364-02 1.2877-02-1.8484-02 1.4018-02
SPAN 2  CHORD 2        STEADY#  1.6678800
COSINE COEFFICIENTS
 1.0782-01 6.6408-01-3.6098-02 7.2265-02-9.0166-02 8.0200-02 2.0279-02-4.6111-02
 2.3246-02-9.6724-03 1.0238-02-1.4213-02-6.0417-03 1.4123-02-1.4746-02 1.2418-02
-2.1891-03 5.0931-03-2.0293-03-3.3419-03 1.1225-02-5.3649-03 5.6827-03-3.4853-03
 4.3398-03 2.2936-03-1.4198-03 7.0706-03-8.1818-04 3.8964-04
SINE COEFFICIENTS
-4.8381-02 2.0987-01 1.5258-01-1.7657-01 1.5114-03-2.5867-02 4.9398-02-1.6982-02
 3.1736-02 2.1651-02-1.3732-02 2.6868-02 2.3043-03 1.9549-02-1.4593-03 7.8296-03
 1.7407-02-5.6798-03 1.9369-02-4.9624-03 2.3779-03 4.4731-04-6.0600-03 8.2434-03
-6.5607-03 4.9062-04 3.0995-04 2.5734-03 3.2855-04 3.2147-03
SPAN 2  CHORD 3        STEADY#  1.4145800
COSINE COEFFICIENTS
 1.0701-01 3.4474-01-5.9335-03 2.0535-02-5.4806-02 4.8337-02 1.2665-02-1.7619-02
-2.7277-03-2.2539-04 5.7945-03-9.1742-03 1.0403-03 5.5817-03-4.3757-03 8.3118-04
 2.5289-03-1.0211-05-6.9980-03 1.1900-03 7.9408-03 1.9521-03-2.8921-03 1.8554-03
-1.3962-03-1.9682-03-2.6614-03 3.7291-03 2.6643-03-7.0814-04
SINE COEFFICIENTS
 1.5106-01 9.8864-02 1.0496-01-8.3167-02-1.7693-03-7.7889-03 1.3390-02 3.3000-04
 2.0397-02 6.0711-03-1.2474-03 1.2708-02 4.5386-03 2.3149-03 2.9261-04 6.4200-03
 7.8222-03-3.0478-03 4.4285-03-5.8666-04 1.8263-03 5.2003-03-4.3565-04 2.9310-03
-4.5253-04-2.1487-03-7.5452-04-2.5031-03-9.9566-04 5.1405-03
SPAN 2  CHORD 4        STEADY#  2.3909-01
COSINE COEFFICIENTS
-1.6427-01 2.5080-01 2.8126-02 1.1419-02-2.4656-02 2.1281-02 1.0006-02 7.5032-04
-6.8432-03 1.9082-03 1.2563-03-1.8465-03-2.4350-03 2.4663-03-8.8062-04-4.7107-03
 2.6440-03 1.3220-03-1.8428-04-3.1407-03 1.6714-04 2.7063-03-5.5203-04 5.6405-04
 7.9377-04 1.8619-03-5.2085-04-6.0527-04 9.9270-04 4.7207-05
SINE COEFFICIENTS
-1.6144-01-7.3921-03 2.1577-02-4.2443-02 8.1691-03-2.8208-03-2.7250-03 2.8406-03
 7.1094-03 1.9637-04-1.3631-03 4.3469-03 7.6220-03-2.6334-04 2.5707-03 1.5491-04
 2.9742-03 2.2065-03 1.2993-03 8.5527-04-7.4683-04 8.6451-05-2.1226-03 3.0938-03
 2.1048-03-6.0585-04 9.7673-04 1.1129-03 1.9126-03-8.7971-04
SPAN 2  CHORD 5        STEADY# -2.4270-01
COSINE COEFFICIENTS
-3.1236-02 7.4330-02 1.0086-02 8.5297-04-1.8428-03 3.7905-03 1.4632-03 2.0652-03
-2.6638-03 2.8309-03 1.5485-04-2.0732-03 7.1869-04 8.0536-04 2.2192-03-4.2879-03
 2.3174-04 6.2183-04 1.9550-03-9.9506-04-1.7854-03 3.6697-03-5.7817-04 6.6335-04
-8.4700-04-9.9614-04 2.2213-03-2.3120-03 1.4421-03 1.0282-04
SINE COEFFICIENTS
-2.2332-01-2.3622-03-3.5269-03-4.3183-03 4.0028-03-1.8676-04-4.5723-03 9.9386-04
 2.4172-03-1.2651-03 9.2622-04 4.2671-04 2.7231-03-1.5372-03 2.3551-03 1.5839-03
-1.3254-03 4.8007-04-3.3068-03 3.4790-03-6.0879-04 3.3349-04 1.4111-03 5.3615-04
 2.6113-03-8.2404-04 3.5933-04-5.2649-04 6.9604-04 1.2827-03
```

TABLE VIII - Continued

```
SPAN 3  CHOPD 1        STEADYN  4.6217400
COSINE COEFFICIENTS
 1.8001400 1.8397400 5.2699-02 1.8407-01-9.8675-02-5.5541-02-4.9690-02 1.0797-01
-8.8533-02-7.2509-02 5.5413-02-2.4398-02-1.8795-02 3.0521-02-4.7627-02 5.8482-03
 4.8926-02-4.3333-02-1.3243-02 3.3535-02-2.7286-02 9.8975-03 1.4385-02-2.6289-02
 1.6515402 1.8545-02-2.3604-02 2.3913-02 1.2209-02-1.9702-02
SINE COEFFICIENTS
-2.3579-01 6.2355-01 5.7155-01-4.6036-01-1.6935-01 1.6415-01-1.2249-02 2.1414-02
 4.6968602-3.2980-02 7.7086-02 4.9025-02-5.8260-02 4.4282-02 4.6335-02-5.0285-02
 1.5685-02 1.2420-02-3.0809-02 3.5421-02 3.4757-03-3.3679-02 4.3713-02 8.3506-03
-1.7953-02 3.9379-02-6.2427-03-1.7336-02 2.1563-02-1.1342-04
SPAN 3  CHOPD 2        STEADYN  1.0838-01
COSINE COEFFICIENTS
 8.0775-01 8.1767-01 1.2930-02-6.9963-02-1.4689-02-7.5263-03-1.6896-02 5.4032-02
-4.0292402-2.7696-02 3.3123-02-1.9776-02-4.4662-03 6.9802-03-1.3682-02 6.7630-03
-4.0312403-9.1519-03-3.0938-03 1.3010-02-1.7911-03-1.1561-02 1.8676-02 1.5455-03
-5.8165-03-6.2246-03-1.1717-03 1.3649-02 1.0530-03-1.3642-03
SINE COEFFICIENTS
-1.2593400 2.0895-01 2.7736-01-1.9121-01-1.1814-01 5.4737-02-1.8944-02 2.4026-03
 2.4537402-1.4725-02 3.2957-02 1.7144-02-3.2413-02 2.1415-02 1.2597-02 2.2783-03
 1.4904-03 2.1233-03 8.1790-03-8.3939-03 1.1858-02-9.6313-03-1.0806-04 2.0674-02
-7.0857-03 5.4526-03-1.3370-02 6.3376-03 1.2524-02-6.5888-04
SPAN 3  CHOPD 3        STEADYN  1.2898400
COSINE COEFFICIENTS
 1.9775-01 4.0129-01 4.1139-03 2.4884-02-3.0772-02-2.9508-02 9.1375-03 3.6126-02
-3.0390-02-3.1084-02 4.8011-03 1.3235-02-1.6099-03-1.1310-02 5.2304-03 5.5201-03
-2.8674-03-9.7252-04-7.3075-03 2.6024-03 2.8005-03-7.6002-03 2.6116-03 2.4510-03
 6.7486-03-4.0983-03 5.2097-04 3.9748-03 4.0192-03-8.2935-04
SINE COEFFICIENTS
-4.4021-01 3.5334-02 8.2507-02-1.2981-01-1.8605-02 1.7512-02-2.3333-02 7.1384-03
 1.8282-02-2.4941-03-2.3395-03 1.5127-04 6.1738-03-1.9674-03 2.6927-03-1.2106-03
-4.9300-03 3.8883-03 1.8530-03-3.5367-04-1.4084-03 2.6512-03 1.2755-03 2.9251-04
-1.0932-03 4.3912-03-3.4162-04 1.3638-03-7.1986-04 4.9188-03
SPAN 3  CHOPD 4        STEADYN -5.9369-01
COSINE COEFFICIENTS
-3.1939-03 1.9091-01 2.6635-02 3.1220-03-2.5171-02 4.3134-03 1.0260-02 5.4775-03
-8.2419-03-4.1849-03 8.3741-04 3.6287-03 1.7223-03-9.1471-04 5.4767-04-7.1306-05
-1.9886-03 5.3397-04 1.8502-03-1.2542-04 1.2022-03-1.3874-03-2.6618-04 6.0613-04
 1.7432-03 1.6529-04-3.2711-05 3.7247-05-3.8346-04 1.7507-03
SINE COEFFICIENTS
-2.7166-01-2.0818-02 4.0086-02-4.0317-02-1.1121-02-4.0238-03 1.8875-03 4.6834-03
-2.5574-03 2.5160-03 5.1430-03-3.6835-04 1.9382-04 2.0094-03 3.5421-03 2.6969-03
-2.6285-03-2.2118-04 3.3515-03 1.1239-03-1.3359-03-5.3956-05 1.2818-04 1.6797-03
-1.1155-03 1.1472-03 5.7940-04 2.4210-03-2.7984-04 1.0178-04
SPAN 3  CHOPD 5        STEADYN -2.2170-01
COSINE COEFFICIENTS
-8.8295-03 5.0322-02 9.2771-03-1.3756-04-4.4485-03 1.9364-03 2.4801-03-3.1585-04
-9.0095-04 1.1061-03 2.5304-04 2.4574-03 2.2322-03-8.3511-04 2.5039-03 5.8304-04
-2.4278-03 4.8725-04 2.2250-03-1.0059-03 1.5810-03-1.8073-03-1.7088-03 1.3428-03
 7.4764-04-1.1875-03 1.1193-03-4.6276-04-7.7219-04 1.8466-03
SINE COEFFICIENTS
-1.5570-01-1.1072-02-5.9127-03-9.8178-03 2.5236-03-2.8820-03-6.2447-04-2.2192-03
-3.3562-03 1.5544-03 1.2720-03-2.3183-03 4.1513-04-5.2387-04-2.0933-05 3.2302-03
-1.1894-03-1.0041-03 1.0442-03 1.5776-03-5.5618-04 1.2988-03 2.0637-04 1.0734-03
 5.2330-04-1.3243-03-1.2978-03 1.0245-03-1.5675-03 1.4037-05
```

TABLE VIII - Continued

```
SPAN 4  CHOPD 1        STEADY#  3.7895800
COSINE COEFFICIENTS
 2.0476800 1.5019800 1.8422-01 3.2336-01-1.9702-01-7.0542-02-2.1020-02-4.0690-02
-1.0936-02 1.7241-02-2.1046-02-5.4869-02 7.9125-03 6.4300-02 6.8571-03-4.3788-02
 1.6008-02 3.7613-02 4.6565-03-1.9309-02 1.0507-02 1.6009-02-1.1713-02-4.0824-03
 3.2483-02 6.9130-03-2.1894-02 9.9147-03 2.5404-02-4.8435-03
SINE COEFFICIENTS
-1.6729800-1.1049-01 6.3047-03-3.0514-01-2.1896-01-5.8885-02 6.3013-02 1.0773-01
-6.6723-02-4.4623-02 6.8065-02 5.5311-02-1.0264-02 2.4901-03 1.7918-02-1.3609-03
-7.7359-03 1.5439-02 2.0411-02-2.8174-02-1.4582-02 3.0693-02 9.0972-03-1.4258-02
-5.2369-03 2.7654-02 7.6240-03-2.8823-02 5.2808-03 2.7065-02
SPAN 4  CHOPD 2        STEADY#  9.8028-01
COSINE COEFFICIENTS
 1.3530800 7.8215-01-1.8164-01 6.5023-02-1.0137-01-7.1201-02 6.0045-02-1.3510-02
 7.1105-03 4.7708-02-3.4233-02-4.7332-02 6.4499-03 5.9972-02 4.1789-04-5.5356-02
 2.1016-02 1.4951-02-1.4779-02 1.0436-02-9.5479-03-2.4606-04-4.3784-03-2.4836-03
 8.9736-03 1.6963-03 1.1215-02-6.8452-03-3.8983-03 9.3964-04
SINE COEFFICIENTS
-1.1260800 3.1550-01 2.2570-01-2.2306-01-5.4271-02-9.7410-02-2.7053-03 8.7143-02
-5.6545-02 3.8218-03 5.8280-02 4.2883-03-3.1031-02-1.6243-02 3.7705-02-4.8232-03
-1.8516-02 2.6881-02-2.1177-03-9.4070-03-7.1900-04-1.6168-03 4.6313-03-1.0813-02
-1.6807-03 1.8980-04 9.7946-03 2.1420-02-8.8502-03 1.4861-03
SPAN 4  CHOPD 3        STEADY#  8.4055-01
COSINE COEFFICIENTS
 5.5892-01 7.6080-02-5.9357-02 2.2438-01-2.3654-02-1.8103-02 2.0309-02-5.6504-02
-2.3723-02-1.9427-02 1.9630-02 9.8881-02-1.1632-03-5.1765-02-2.5610-02-4.5115-02
 2.9846-02 6.0755-02-5.7273-03 5.0553-03-4.1427-02-4.3826-02 4.0077-02 3.7977-02
 3.5962-03 1.2038-03-2.9210-02-6.2328-03 1.4205-02 1.2725-02
SINE COEFFICIENTS
-3.2608-01 3.1929-02-1.8825-01-1.4604-01 4.4392-02-9.5601-03 7.5014-02 6.4851-02
-5.0713-02-3.8565-02-6.1764-02 3.4147-02 1.0315-01 4.1141-03-1.2149-02-3.4224-02
-5.7165-02 2.3195-02 2.5554-02 2.6508-02 3.5528-02-4.9408-02-5.0322-02 1.5481-02
 2.2328-02 2.7914-02 5.5079-03-2.7301-02-1.1328-02-1.0362-02
SPAN 4  CHOPD 4        STEADY# -1.5639-01
COSINE COEFFICIENTS
 8.4512-02 1.9730-01 3.7625-02-9.5393-03-3.0487-02 9.4723-04 6.2888-03 3.4871-03
 7.7535-03-4.6734-03-3.1819-03-3.3633-03 9.1013-03 5.4803-03-4.4425-03-2.9507-03
-7.8875-04-3.0539-03 3.4600-03 4.4365-03-3.1403-03-6.4036-04 7.1387-04 1.3199-03
-4.5696-03-1.3391-03 6.2033-03 4.7193-03-3.0054-03 6.1366-04
SINE COEFFICIENTS
-5.1966-01-4.5289-02 5.2622-02 3.0745-03-2.5181-02-9.8308-03 4.5428-03 8.4908-03
 2.2244-04 4.2285-04-1.7814-03 3.2938-03 1.7931-03-1.7009-03 1.2030-03-1.8337-03
 2.7959-03-3.0183-04-2.5036-03-5.1321-03 7.2513-03 2.2410-03 1.3647-03 2.0782-04
 1.2286-03-4.9634-03-1.1706-03 2.6976-03-1.1681-03-1.3475-03
SPAN 4  CHOPD 5        STEADY# -5.5243-01
COSINE COEFFICIENTS
-8.5499-02 2.1206-02-2.9795-03-4.5067-03 3.0733-03 1.3211-03-7.6966-04
 1.0747-03-3.6383-03-1.8011-04-4.3083-04 3.1180-03 2.3086-03 4.3511-04-3.5361-04
-8.4913-04-1.4498-03 5.6174-04-3.3064-03-7.1377-03-4.6901-03 3.9933-03 3.0580-03
-5.9295-03-1.6693-03-1.1440-03-4.3379-03 3.5448-03 9.4749-03
SINE COEFFICIENTS
-2.0677401-2.8514-02 6.4653-03 7.9050-03-2.6037-03 8.9366-04-7.3615-04 4.1049-03
 1.9244-03-7.9017-04-3.5772-03 6.9699-04 1.0306-03-7.2752-03 2.5070-03 1.7779-04
-2.1302403-6.6663-04-2.1447-03 1.7038-03-6.0347-03-2.4002-03 7.2012-03-9.1320-04
-5.0709-03-8.2222-04 2.9074-03 2.2186-03 7.8190-03 6.4600-03
```

TABLE VIII - Concluded

NOT REPRODUCIBLE

```
SPAN 5  CHORD 1        STEADY#  3.6497E00
COSINE COEFFICIENTS
 2.0277E00 1.3024E00 2.2681-01 4.1923-01-1.4887-02-6.7468-02 5.5693-02 5.7308-02
-5.0617-02-2.8293-02 2.7600-02-3.6355-02-8.7841-02-4.1474-02 2.9569-02 7.2543-03
-6.3235-02-3.5220-02 6.5149-02 7.4098-02 2.5441-02-5.2351-03 4.4104-02 7.2651-02
-2.0340-03 1.2303-02 3.5950-02 2.6939-02-5.1836-03-1.6202-02
SINE COEFFICIENTS
-1.1566E00-1.7720-01-1.1327-01-3.4715-01-2.1762-01-1.5729-01-9.1517-02 6.3307-02
-4.7277-02-1.6186-01-6.2769-02 6.1147-02 6.5199-02-1.6143-01-7.3657-02 3.1757-02
 6.2352-02-2.6921-03-6.8240-03 4.6261-02 3.7016-02-1.1441-02-2.9357-02 3.6235-02
 1.0029-02-3.5744-02-2.1460-02 2.1073-02 3.0960-02-5.1907-02
SPAN 5  CHORD 2        STEADY#  9.8433-01
COSINE COEFFICIENTS
 2.3623-01 2.0755-01-1.6073-01-1.5630-01 6.7003-02 2.5198-01 2.4780-02-1.2809-01
-6.3830-02-1.7025-02 1.7007-02 1.4478-02-3.7850-02 5.1684-02 1.1389-01-1.9770-02
-1.1524-01-3.7047-02 3.0055-02 2.2345-02 2.0762-02 2.2722-02 1.4114-02-9.4769-03
-3.1279-02-2.7929-02-5.3298-05 1.0649-02 2.9966-02 2.1511-02
SINE COEFFICIENTS
-2.9570-01 5.8596-02 1.5026-01-2.2683-01-3.1934-01 2.4044-02 2.2752-01 9.9327-02
-4.5270-02-5.0971-02-4.1055-02 2.6997-02-7.9782-03-7.3933-02 3.0619-02 1.2202-01
 2.0746-02-6.8339-02-3.6912-02-1.7099-02-1.0608-02 8.0144-03 2.6565-02 3.1734-02
 8.9777-03-2.1068-02-3.1911-02-1.5742-02 2.7311-03 2.0797-02
SPAN 5  CHORD 3        STEADY#  1.9086-01
COSINE COEFFICIENTS
-2.2339-01-9.3401-02-3.9034-02 1.3886-01 2.2747-02 9.8829-02-9.0263-02-1.9725-01
 4.8642-02 1.7705-01 3.2405-02-7.5076-02-9.0414-02-1.8792-02 9.4839-02 7.3484-02
-5.7869-02-7.2646-02 9.4855-03 4.1854-02 3.3613-02-1.1978-02-3.5572-02-3.3151-03
 2.5644-02 5.8041-03-3.1287-03-5.8630-03-6.5022-03 1.8002-03
SINE COEFFICIENTS
-2.8208-01-6.1251-02-1.2936-01-7.7748-02-2.7768-02 7.6246-02 1.7263-01-4.5564-02
-2.0363-01-4.2131-03 1.2435-01 7.5154-02-9.4281-03-1.0182-01-6.2724-02 7.5078-02
 8.0258-02-2.7045-02-5.9453-02-1.6459-02 2.1843-02 3.5444-02 2.2052-04-3.0432-02
-8.1517-03 1.3568-02 5.5960-03 3.7145-03 9.3813-04-8.2746-03
SPAN 5  CHORD 4        STEADY# -3.8329-01
COSINE COEFFICIENTS
-3.6187-01 2.1246-02 1.2440-02 2.6984-02-2.1395-02-1.2230-02-7.1884-03 1.9346-02
 4.4623-03-1.4888-02-2.6982-03 1.3933-02-1.0462-04-1.1569-02-2.6798-04 1.4995-02
-4.6342-04-1.8020-02-5.6408-04 1.7653-02 8.8426-04-1.8946-02-2.5260-03 1.9900-02
 1.7415-04-2.0125-02-7.1857-04 1.8877-02 4.[illegible]44-05-2.3760-02
SINE COEFFICIENTS
-2.0043-01-4.7243-02 8.2882-03 1.4584-03 1.3432-02-4.7546-03-2.0488-02 1.0935-02
 2.0655-02 2.7275-03-2.0034-02-2.5219-03 1.8332-02 2.3446-03-1.4805-02-3.2807-03
 1.7108-02 4.8605-04-1.6557-02-2.9254-04 1.7365-02-1.1549-03-1.9522-02 1.4461-03
 2.0356-02 9.9128-04-2.1400-02 2.2587-04 2.1969-02-6.0752-04
SPAN 5  CHORD 5        STEADY# -5.7754-01
COSINE COEFFICIENTS
-1.6072-01-1.1016-02 2.1280-03 4.3326-03-1.5985-03 5.4335-03-2.7068-03 1.0081-03
 7.5208-03 1.0360-02-1.3959-03 4.5645-03 1.9450-02-3.9934-02-2.2050-03-7.5476-03
 3.4811-03-6.3923-03-3.6775-03-1.5817-03-2.1451-05 2.3725-03-5.4076-03-3.3899-03
 5.9754-03-1.7975-03-1.7873-03-6.5757-03 2.2701-03-1.7754-03
SINE COEFFICIENTS
-2.1563-01-1.5051-02 1.9670-02 1.5776-02-7.4650-03-4.7539-03 2.6133-03 2.5928-03
-2.6560-03-2.1273-03-2.8327-03-1.0653-02-6.9958-04 2.0171-02 7.9891-03 1.0255-03
-9.5703-04 1.1313-02 5.2463-04 4.0573-05-1.7358-03-7.2365-04 5.7763-03-1.4173-03
 1.3313-03 4.3058-03-2.4426-04 2.0009-03 3.5849-04 9.3970-03
```

TABLE IX. AERODYNAMIC DATA - 170-KNOT, EAST-TO-WEST FLIGHT

```
BURST NO. # 24              *** ROTOR DISC PUNCHED OUTPUT ***
BLADE PITCH HARMONICS
 1.5546&01 4.9134&00-8.4462&00  %COLLECTIVE, LONGITUDINAL, LATERAL RESPECTIVEL
ROTOR FLAPPING ANGLE HARMONICS
 1.9927&00 3.9739-01 0.0000     %POSITIVE TAIL HIGH -- DEGREES%
DIFFERENTIAL PRESSURE HARMONICS FOR 5 CHORD STATIONS AT EACH OF THE 5 SPANS
%MEASURING FROM THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY%.
SPAN 1  CHORD 1        STEADY#  1.1983&00
COSINE COEFFICIENTS
-1.0415&00 1.2808&00-7.7225-01-2.5942-01-1.4078-01 1.5697-01-9.2889-02 3.4479-04
 1.6256-02 1.0277-02 2.9061-03-3.9422-03-4.2291-03-1.3762-02-4.1117-03 8.5788-04
-5.0536-03 5.0310-03 1.4332-02 1.8746-03 1.6661-03 6.0260-03 4.8956-03-6.3040-03
-5.2236-03 4.9684-03-2.6315-03-2.3534-03 6.9054-03 1.3314-03
SINE COEFFICIENTS
 2.6313-01 2.7256-01 7.4164-01-8.7592-02-2.0768-01 1.3183-02 2.5878-02-5.5683-02
-2.6174-02-1.4816-02-2.9247-02-2.1113-03-7.7634-03 8.4036-03-2.4053-03 4.1907-03
 4.7974-04 6.0961-03 2.7657-03-7.6328-03-6.8676-03-1.1038-02-5.4443-03-5.6225-03
-4.1854-03-4.6181-03 3.3433-03 6.9911-03 3.9864-03-5.1586-04
SPAN 1  CHORD 2        STEADY#  4.6796-01
COSINE COEFFICIENTS
-3.4656-01 4.3822-01-2.5723-01-9.0981-02-3.8631-02 8.2267-02-1.5171-02 1.2184-02
 1.9120-02 5.1382-03 6.5025-03-8.2903-03-9.6184-03 5.0489-03-3.1380-03-3.4102-02
-1.7709-02 5.0765-03-5.3043-03 2.0901-02-1.1406-02-2.4565-03-1.4235-02-8.8784-03
-7.5605-03-1.1770-03 3.7395-03-1.6006-02 2.4025-03-3.4868-03
SINE COEFFICIENTS
 2.0562-01 3.2633-02 2.5790-01-7.0077-02-8.5451-02 3.1197-03 2.8500-02-2.0355-02
-1.4504-02-3.7135-03-1.8101-02-8.5968-03 5.9224-03-1.0937-02-3.9987-02 3.0814-03
 9.9306-03 4.9847-03-1.9643-03-6.8712-04-3.3972-03-4.8080-05-3.4930-03-1.2801-03
-6.6481-03 1.2615-03 3.0860-02-1.5372-02 3.7652-03 1.7988-03
SPAN 1  CHORD 3        STEADY#  1.8890-01
COSINE COEFFICIENTS
-2.1163-01 3.2840-01-1.6134-01-7.4263-02-3.7848-02 4.3147-02-9.6868-03 9.2986-03
 6.5271-03 4.3619-03-1.8861-03-5.7542-03-6.2236-03-7.6062-03-3.0733-03-4.7009-04
-1.3567-03 1.5421-03 5.3955-03 1.5111-03 3.1283-03 1.2200-03 2.7522-03 3.1988-03
-1.0480-03-1.4849-03 9.4185-04-2.2565-03-3.8551-03-3.4842-03
SINE COEFFICIENTS
 8.9873-02 1.0249-02 1.6048-01-4.9467-03-3.7758-02 2.8715-03 1.0686-02-1.0537-02
-1.7477-02-1.0229-02-1.2466-02-7.8926-03-6.2611-03 1.4166-03 9.2012-04 9.5054-03
 5.1543-03 4.7969-03 1.7600-03 2.9961-04-2.6060-03-2.1518-03-6.1817-04 2.9234-03
-5.4433-03-1.1648-03-5.8600-03-1.6078-03 2.5289-03 9.1946-04
SPAN 1  CHORD 4        STEADY#  0.0000
COSINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SPAN 1  CHORD 5        STEADY#  2.4822-01
COSINE COEFFICIENTS
 1.5614-02-7.9506-02-9.8549-03 1.8233-02 1.3463-02-9.2831-03-6.2258-03-1.7259-03
-1.9158-04-1.6235-03-3.0597-04 8.2641-08 6.1880-04 3.6085-04-8.3794-04 5.6118-05
 3.4340-04-8.1961-04-2.3392-03 2.4796-04 5.5208-04 2.2820-04 1.4864-03 2.7087-04
 7.7029-04 6.3238-04-5.7180-05-6.2263-04-1.6305-03-8.7847-04
SINE COEFFICIENTS
 3.0899-02-3.8654-03 1.9442-02 7.4190-03-8.0427-03-7.1367-03 3.7625-05-6.2299-04
-6.7709-04-1.4674-03 4.7060-04-5.5450-04 1.0394-03-1.0342-03-2.8766-04 3.3704-04
 1.6435-04-1.0668-03-1.3921-03-3.3349-04 1.2718-03 1.6211-03 3.0092-04-6.2560-04
-9.9254-04 1.3053-04 1.0119-03-4.7312-04-1.2227-03-4.8460-05
```

TABLE IX - Continued

```
SPAN 2  CHOPD 1        STEADY#  4.7725800
COSINE COEFFICIENTS
 3.5886-01 2.9252800-1.0779800 3.0307-01-2.3727-01 9.2486-02-1.2349-01-1.2012-01
-7.3617-04-8.4920-04-7.7934-02 4.0506-02-5.9496-02 2.9282-02-8.6680-03 1.1381-02
 2.2748-03 1.3671-02 1.9562-03 3.2678-02-3.3773-02 4.1828-02-3.5414-02 3.2025-02
-2.8650-02 1.2830-02-1.7567-02 9.1328-03-1.2558-02 1.2963-02
SINE COEFFICIENTS
 4.9567-01 1.2248800 1.3854800-6.0349-01 1.2426-01-7.9076-02 2.3082-01-1.0683-01
-2.8400-02-7.7081-03 1.6900-03-4.9056-02 3.5206-02-8.5150-02 3.8878-02-4.9115-02
 6.3483-03-2.5685-02-8.9622-04-1.2825-03-2.4891-03-5.7976-03 1.0123-02-1.1098-02
 2.4122-02-8.1665-03 1.8098-02-3.3055-04-5.4594-03 8.7333-03
SPAN 2  CHOPD 2        STEADY#  1.8233800
COSINE COEFFICIENTS
 3.1961-01 1.2757800-4.4302-01-7.6088-02 1.3925-02 5.2431-02-1.7461-02-4.3483-02
 3.3540-02-2.6191-03-2.5856-02 9.6249-03-6.4617-03-7.7001-04 1.4277-02-6.5255-03
-2.5207-03 5.1948-04 1.4825-02-3.7499-03-4.7894-05-1.1009-03-8.3118-03-9.7630-03
 2.3863-03 7.1919-03 3.0449-03-1.0892-03-9.6495-03-4.5406-03
SINE COEFFICIENTS
-1.7829-01 5.2018-01 6.8863-01-4.1142-01-7.8270-02 4.2288-02 7.0980-02-2.1698-02
-3.6989-02 3.6121-02-9.4956-03-1.4694-02 6.0133-05-1.8418-02 7.7414-03 3.1900-03
-2.3059-03-6.5619-03-7.0880-03 2.7527-03 2.9923-03 5.3803-03 7.2488-03-3.8511-03
 1.0714-03 4.2441-03 8.5747-03 2.5766-03-1.7599-03 2.4739-04
SPAN 2  CHOPD 3        STEADY#  1.5831800
COSINE COEFFICIENTS
 1.3964-01 6.5127-01-1.8722-01-5.4681-02-2.4686-02 4.6989-02 4.5694-03-3.5030-02
 7.6772-03 7.7846-03-1.0395-03 2.5103-03-1.3304-03 9.3567-05 2.6334-03 1.6923-03
-1.8535-03-5.2507-03 5.5020-03-4.7049-06 9.9842-04-3.2128-03 1.2410-03 4.3784-04
-5.6905-03 7.5569-04 6.9370-03-2.1862-03 1.5069-04-3.8407-03
SINE COEFFICIENTS
 1.9357-01 2.1102-01 3.8881-01-1.7702-01-3.7097-02-1.0510-03 4.3610-02 9.6184-04
-3.0440-02 6.8360-03 1.9298-03-1.3726-04-9.8667-04-3.9929-03-1.9949-03 1.3234-03
 3.0610-03-3.4377-03-2.0478-03-1.8753-03-1.4940-03-4.0519-04 2.9016-03 2.1982-03
-7.7300-04-6.5659-03 1.2434-03-2.1935-03 4.0903-03 1.1065-03
SPAN 2  CHOPD 4        STEADY#  2.9698-01
COSINE COEFFICIENTS
-1.6812-01 4.4107-01-2.5996-02-2.6129-02-3.1692-02 2.6235-02 1.6997-02-8.6634-03
-3.5682-04 5.7083-03 3.1925-03-6.5668-04 2.6990-03 6.5954-04-1.4317-03 8.3379-04
-1.1503-03 1.6816-03 1.6105-03-8.4667-04 2.6705-03-2.4780-03-2.4271-05 6.1104-04
 8.6151-04 2.3324-03-1.7690-03-4.1630-04-1.8893-04-6.7245-04
SINE COEFFICIENTS
-2.3039-01 2.5502-02 1.5832-01-6.4467-02 8.9594-03-1.2335-02 1.9288-02 8.9155-03
-1.0667-02-1.0577-03 3.8078-03 1.3407-03-2.4538-03 1.7861-03-7.9197-04 5.6083-04
-1.0135-03-1.6816-03 7.8811-04-1.2548-03 2.0948-03 1.4230-03-1.5010-03-7.3272-04
 1.0526-04-1.1521-04 1.0061-03-2.0286-03 6.3431-04-1.6102-03
SPAN 2  CHOPD 5        STEADY# -2.6337-01
COSINE COEFFICIENTS
-9.6094-03 1.1584-01 1.1843-02-3.7187-03-9.2077-03 6.1254-03 6.6090-03 6.6840-04
-7.3581-04 4.2037-05 2.7349-03-1.3286-03 2.2495-03-1.1906-04-2.1904-03 2.3284-04
-2.0128-04 1.5013-03-1.9171-03-1.7734-04 1.7155-03-1.3118-03-1.1317-03 1.5036-03
 1.9337-03 5.0786-05-1.8781-03 4.1324-04 1.0974-03 2.0379-03
SINE COEFFICIENTS
-2.6818-01 1.4077-03 1.5463-02-3.3815-03 8.9460-03-6.5003-03 1.4724-03 2.6025-03
-5.7282-05-2.8664-03 8.7875-04-1.1582-03-1.8454-03 2.8902-03 3.2435-04-1.9370-03
-1.3834-03 5.0776-04 1.2286-03-2.0535-03 5.6025-04 1.2567-03-1.1583-03-7.6596-04
 1.1521-05 8.6136-04-2.1141-04-1.2757-03-7.1546-04-1.6703-03
```

TABLE IX - Continued

```
SPAN 3  CHORD 1        STEADY#  5.1823800
COSINE COEFFICIENTS
 2.2570800 3.1470800-5.1358-01 4.7075-01 1.2882-01 1.6706-01-1.0173-01 5.8350-02
 1.4786-02-3.1681-02-7.4824-03-4.5033-02-3.9007-02 2.9765-02-3.5841-02-2.0117-02
 6.5171-03 5.8995-03-3.4599-02 7.8900-03-1.2573-0 -5.0949-03-7.2155-03 1.4967-02
-4.6724-03 1.7131-02-1.2802-02-8.0220-05-3.1289-03-1.3133-03
SINE COEFFICIENTS
-5.2157-01 1.2374800 1.0522800-6.3274-01-1.7517-01 2.3778-01 5.7513-02-7.3329-03
 5.9612-02-5.2277-02-2.6550-03-1.9116-02-1.2255-03-2.7836-02 6.0808-02-2.4482-02
 3.0979-02 1.5172-02 3.6989-02-2.1385-02 2.1488-02-1.8920-02 1.0348-02-1.0370-02
-7.4861-04-9.0604-03 4.6982-03-1.2918-02-1.0903-02 1.5720-03
SPAN 3  CHORD 2        STEADY#  2.0432-01
COSINE COEFFICIENTS
 1.1562800 1.3687800-3.5691-01-7.2984-02-7.9698-02-4.1210-02 1.4928-01-1.9936-02
 3.3968-02-5.2807-02 8.6209-03-3.2444-02-7.0769-03 1.5901-02-1.0814-02 4.6495-02
-1.3014-02 2.6046-02-4.0787-02 1.0527-02-1.9177-02 3.1263-03 1.2110-03 1.5618-02
-7.6344-03 2.5235-02-5.8727-03-1.0174-02-8.0782-03-3.3886-03
SINE COEFFICIENTS
-1.3979800 5.9095-01 6.2184-01-3.5393-01-2.6881-02-1.3717-01 1.3156-02 8.8141-02
 1.5721-02 3.5897-02-3.9840-02 3.7051-02-5.8721-02 1.7827-02-4.3910-02 1.3409-02
-2.8059-04 2.2199-02 5.2531-03-1.0736-02 2.2385-03-1.0367-02-1.0495-02 5.6654-03
-1.0692-03-6.1727-03 2.6606-02-7.5391-03 1.0790-02-2.0367-02
SPAN 3  CHORD 3        STEADY#  1.5635800
COSINE COEFFICIENTS
 2.6394-01 8.1040-01-1.8544-01-2.8748-01 2.5070-01 8.3947-02-1.6072-01 5.8006-02
-1.4270-01 9.8226-02 1.3071-01-9.5408-02 2.4625-03-3.3271-02 2.3541-03 4.4794-02
 3.7848-03-1.3678-02 5.9855-03-7.1641-03-3.5504-02 3.6803-02 1.1060-03-1.6391-02
 2.6050-02-4.1956-02-2.5654-04 3.0831-02-1.0887-02 6.0531-03
SINE COEFFICIENTS
-4.1649-01 1.3298-01 5.0604-01-3.5456-01-2.3495-01 2.8707-01-2.9178-02 2.8247-02
-3.3893-03-1.8608-01 1.2862-01 5.2693-02-2.0410-02 5.3480-03-5.6513-02 4.6060-03
 2.1219-02 8.8411-03-1.4151-02 2.1004-02-2.2470-02-2.5048-02 3.9990-02-1.6786-02
 1.6027-02 1.2984-02-4.7072-02 1.1164-02 8.3027-03-4.4989-03
SPAN 3  CHORD 4        STEADY# -5.7183-01
COSINE COEFFICIENTS
 5.5642-02 3.4949-01 4.9369-03-3.9735-03-7.3704-02 2.9052-02 3.9419-02-2.0415-02
-7.4937-03 9.8424-03-1.7218-03-3.4748-04 4.9164-03-4.1153-03-7.7982-04 1.6645-03
-2.1633-03-1.2891-03 1.4029-03 5.1527-04-1.0016-03-2.1729-04-6.9404-05-1.3335-03
 1.5218-04-8.9753-04 5.3888-04 1.1859-04 5.5289-04-7.1255-05
SINE COEFFICIENTS
-3.5234-01 1.8736-02 1.1472-01-2.2027-02-2.7132-04-5.2074-02 2.1845-02 2.4717-02
-1.6450-02-3.0566-03 2.3071-03-1.5874-03 4.2682-03 2.2857-03-3.2485-03 6.0910-04
 7.0283-04-2.5972-03-1.2007-03 1.8825-03-5.6223-05-5.4322-04 1.1514-03-1.4698-03
 8.5948-04 4.0374-04-2.3657-04 3.9440-04 9.2572-04 3.3942-04
SPAN 3  CHORD 5        STEADY# -1.0950-01
COSINE COEFFICIENTS
 6.6056-03 7.7608-02 2.5922-02 1.7370-03-1.3234-02 7.0057-03 7.8664-03-9.5143-04
-2.4890-03 2.7065-03-3.0657-03 3.8332-04 2.0433-03-1.6609-03 1.6934-04 6.6970-04
-1.1377-03-5.6068-04-1.0953-03 2.4207-04-4.2831-04 1.4273-03 1.8256-03-1.5489-04
 9.0107-05-1.4097-03 1.8377-03 1.2672-03 7.8430-05-1.1296-03
SINE COEFFICIENTS
-1.8934-01-1.6027-02 5.5875-03 1.5515-03 1.2611-02-6.6645-03 3.6865-03 6.7642-03
 3.6086-04 2.2528-04-9.6297-04-2.0166-03 2.3234-03 9.5871-04-2.0024-03 6.2201-04
 4.7360-04-1.1812-03 2.4081-03 1.2569-04-1.8319-04-2.5294-04-6.0310-05-9.8397-04
 1.1753-04 1.0303-03-2.5195-04 2.1241-03-2.4639-04-1.3296-03
```

TABLE IX - Continued

```
SPAN 4  CHOPP 1        STEADY#  4.4997800
COSINE COEFFICIENTS
 2.5692800 2.5774800-8.6861-02 4.1095-01-1.5493-01 1.5648-01-2.0620-02 1.1915-02
 8.0607-02 1.0422-01 3.8312-02 2.2419-02 1.0381-02 1.1083-02 1.1115-03-9.4664-03
-1.8215-02-3.3762-03 1.2935-03 2.6999-04 1.2487-02 1.2486-02 1.8888-03 5.4762-03
-4.9377-03-7.8480-03-1.8752-02-9.0277-03-7.4173-03 3.4371-03
SINE COEFFICIENTS
-1.7935800 1.6543-01 2.9866-01-4.0499-01-2.7766-01 5.2550-02 8.2447-02 2.3807-02
-7.0703-03-2.3133-02 6.8030-03-2.0897-02-2.6632-02-3.2720-02-1.8053-02-2.5287-02
-5.6197-03-4.0333-04 1.0117-03 1.1917-02 4.4435-03-3.4998-03-1.5068-02-8.3073-03
-1.8186-02-4.2309-04 1.0566-02 1.4275-02 2.6792-02 2.6779-02
SPAN 4  CHOPP 2        STEADY#  1.6640800
COSINE COEFFICIENTS
 1.9254800 1.4196800-4.8549-01-2.1387-01-4.6178-01-2.0788-01-5.2214-02-6.2245-02
 1.3855-01 7.1662-02 1.2143-01-2.8076-02 9.3311-02 3.7116-02 3.3236-02-7.9065-02
-2.5649-02-6.4054-02-2.6111-02-5.1895-02-1.8235-02 1.6183-02 3.6028-03 9.6549-03
 1.6620-02 4.1044-02 6.1626-03 8.9025-03-2.3564-02 3.9167-03
SINE COEFFICIENTS
-7.9952-01 7.1398-01 7.4940-01-1.9815-01-6.0630-02-2.7136-01-7.8233-02-1.6083-01
-4.7123-02-3.7802-02 4.7038-02 1.5594-02-2.5104-02 4.7073-02 6.2923-02 5.2083-02
-1.8213-02 2.6636-02-2.4713-02 1.9475-02-6.0333-02 1.4833-02-2.5057-02 1.1041-02
-3.7956-02 2.2852-02 7.6268-03 3.0766-02-6.7535-03 1.4643-02
SPAN 4  CHOPP 3        STEADY#  1.1109800
COSINE COEFFICIENTS
 7.6488-01 6.2993-01-3.5769-01-2.2520-01 1.3009-01 1.3398-01 1.2370-01 1.0342-02
-1.3118-01-8.0909-02-1.9700-01 2.5813-02 3.4778-02 1.2466-01 6.5851-02-1.0015-01
-8.9782-03-9.5197-02 3.1653-02 3.4087-02 5.0123-02 1.3483-02-1.9190-02-8.3020-03
-5.2123-02 4.9681-02-1.8984-02 3.6314-02 1.5776-02-2.2453-02
SINE COEFFICIENTS
-4.1626-01 1.8368-01 2.9603-01-4.7852-01-2.9824-01 9.3601-03 1.6665-02 2.1565-01
 6.3029-02 6.2728-02-5.7216-02-1.4151-01-2.4167-02-3.4666-02 1.7017-01 3.4619-02
 2.5815-02-2.6698-02-7.9718-02 1.1229-02-7.8825-03 6.8186-02 4.0363-03 4.1701-02
-3.7331-02-2.0558-02 1.3430-02-3.5182-02 4.5702-02-2.5652-02
SPAN 4  CHOPP 4        STEADY# -5.7031-02
COSINE COEFFICIENTS
 1.0097-01 2.2139-01 1.2210-01 7.5849-02-1.4001-01-1.0300-02-2.4536-02-7.7384-03
 8.7075-02-1.6996-02-4.7516-02 2.6770-02-6.9292-03-7.4781-03 1.5011-02-1.0395-02
-1.6128-02 1.0451-02 7.7227-03-1.0708-02-6.0688-03 7.7821-03-8.9027-04 2.5197-03
-4.0571-03-4.3248-03 4.2781-03 7.1494-03-1.7505-03-1.0685-03
SINE COEFFICIENTS
-5.4576-01-1.3472-01-1.4746-02 8.4265-02 4.0551-02-2.7462-02-5.7068-03-3.6138-02
 1.1193-02 5.8583-02-2.3600-02-1.4565-02 2.4995-02-1.2364-02 5.4550-03 2.0561-02
-5.5836-03-1.1342-02 1.2721-02 4.0536-03-9.6957-03 1.8488-03 2.1008-03-4.1565-04
 1.2389-03 1.1227-04-7.2288-03 9.8765-04 3.4533-03-8.6452-03
SPAN 4  CHOPP 5        STEADY# -5.8878-01
COSINE COEFFICIENTS
-8.3080-02 3.9914-02 4.4827-02 4.9705-03-2.8020-02 6.5446-03 1.0631-02-5.5015-03
-1.1308-02 5.3233-03 4.4510-03-7.3973-04 1.2494-03 4.0847-03-2.4798-03-1.0872-03
 3.7422-03-2.8996-03-3.7564-04-3.5183-03-3.2536-03-5.4585-03 1.3675-03-6.3272-03
-6.7118-03 2.8503-04-7.8514-03-3.5754-03-3.7225-03 3.3623-03
SINE COEFFICIENTS
-2.7098-01-6.6386-02-1.4476-02 2.3105-02 2.0055-03-2.3576-02-2.0902-03 1.0912-02
-5.1237-03-5.3327-03 4.2315-03-1.4173-03 2.3106-03-1.5879-03 4.6499-03 1.1406-03
-2.3584-03 5.1113-04 1.4798-03 1.6360-03-1.1989-03 2.8964-03 1.5285-04 5.2953-08
 1.2698-03-3.8162-04-6.7273-03 3.8531-03 2.4502-05-7.3904-03
```

TABLE IX - Concluded

```
SPAN 5  CHORD 1        STEADY#  4.5892800
COSINE COEFFICIENTS
 2.8633800 2.7698800 9.1614-02 4.4193-01 5.1579-02 1.0216-01-6.7607-02-5.7356-02
 8.4660-02 6.4952-02 9.6763-03-4.0066-02-4.7657-02 2.5327-02-8.5713-03-3.2209-02
-1.2784-02-2.4354-02-3.1326-02-3.2158-02-3.7541-02-3.5606-03 1.5858-02 2.8527-02
 1.6343-02 9.2622-03 4.4607-03 1.4459-02 1.6778-02-9.4630-03
SINE COEFFICIENTS
-1.3014800 1.7734-01 4.8163-01-4.4156-01-2.3911-01 5.0871-02 4.7032-02-5.2641-02
-8.3331-02-4.8772-02-2.2755-02-1.2429-02-4.8134-03-1.1673-01-2.6348-02-2.5343-02
-3.0608-02 5.3978-03 2.0897-02 4.1260-02 8.5068-03 1.6655-02 1.3342-02 1.3835-02
 8.3063-03 8.7411-03-7.0301-03-5.5649-02-8.6941-03 1.9748-02
SPAN 5  CHORD 2        STEADY#  1.3087800
COSINE COEFFICIENTS
 5.8805-01 7.3414-01-8.3101-01-4.0179-01 6.6345-03 1.2108-02 5.8080-02 1.1176-01
 7.7600-02 1.8018-01 5.1774-02-5.6002-02-1.7865-02-1.4554-01-8.9212-02 4.0102-02
-7.6362-03 5.3603-03 3.2117-02 3.0673-02 7.8260-02-1.9205-02-5.8138-02-1.6849-03
-4.0478-02-1.8610-02 1.1218-02-6.8134-03 2.7798-02 2.9902-02
SINE COEFFICIENTS
-2.4093-01 6.8113-01 5.6526-01-5.6885-01-3.0105-01-7.1629-02-1.3772-01-1.3542-02
-1.9872-02 2.1723-02 1.7664-01 6.2527-02 8.0349-02 5.5729-02-1.0979-01-5.7094-02
-3.2182-03-4.7143-02-1.3207-02-2.2000-02 3.6913-02 9.7585-02 1.9502-03 2.1886-03
 8.8781-03-3.7690-02-1.5275-02-1.8044-02-2.6807-02 1.3391-02
SPAN 5  CHORD 3        STEADY# -1.2170-03
COSINE COEFFICIENTS
-4.2044-01 8.1966-01-2.2005-01-3.2109-01 2.8609-02 2.6447-01 2.0720-01-1.5296-01
-1.1673-01-8.1589-02-8.0813-02 1.4809-01 7.5671-02 2.3262-02-1.0018-02-6.9505-02
-4.3227-02 9.2045-03 5.0920-02-5.1389-05-7.9441-03-1.3288-02-1.7663-02 3.6466-03
 2.5691-02 7.2725-03-1.8693-02-1.4444-02-3.8747-03 1.4549-02
SINE COEFFICIENTS
-1.1259800-1.6904-01 5.6224-01-2.8326-01-3.0063-01-4.4096-02 2.2398-01 2.4494-01
-2.6009-02 1.0834-02-1.5503-01-1.0245-01 6.5102-02 4.2599-02 7.3504-02 1.4972-02
-3.6853-02-5.5661-02 1.7612-03 3.6214-02 1.1746-02 1.4542-02-1.0538-02-1.7226-02
-1.4107-03 2.6351-02 1.2809-02-1.6244-03-1.3184-02-9.4976-03
SPAN 5  CHORD 4        STEADY# -2.9898-01
COSINE COEFFICIENTS
-4.9155-01 1.3699-01 7.9957-02 5.4904-02-9.1894-02-2.1110-03 5.8429-03-5.7488-03
-1.8761-03-1.5937-02-6.2445-03 2.8863-04-4.9712-03-5.7009-03 2.7911-03 3.6283-03
 2.6452-04-1.6967-03-4.3513-03-6.1058-04-6.8322-03-5.0659-03-5.2010-03-4.8705-03
-5.1444-03-4.7818-03-4.2085-03-3.2433-03-1.3762-03-2.5017-04
SINE COEFFICIENTS
-3.6452-01-2.0124-01 4.1346-03 2.2739-02 2.3865-02-3.9308-02-2.1961-02-8.7742-03
 5.4129-03 5.4569-03-5.8893-03 2.5616-04 6.2542-03-1.6618-03-1.0369-03 1.9410-03
 2.2989-04-2.3096-03-5.8958-03-4.7214-03-1.8487-03-3.1720-03-1.3685-04 2.4101-04
 1.1800-03 2.5333-03 2.1945-03 3.3253-03 1.4362-03 2.4963-03
SPAN 5  CHORD 5        STEADY# -5.6370-01
COSINE COEFFICIENTS
-1.5708-01-2.3667-03 2.6760-02 3.1444-02-2.8040-02 5.1128-03 1.1036-02-1.1794-03
-9.3548-03-7.4234-03 1.6355-02 1.3589-02 1.5759-02-4.6509-02-1.5987-03 4.1420-03
-4.6091-03-8.6759-03 9.5424-04 6.2858-03 2.2362-03-8.4122-04-6.7600-03-6.8967-03
-1.9119-03 6.5765-03 1.2308-02-2.0583-03-6.6752-03-6.0387-03
SINE COEFFICIENTS
-3.0373-01-5.6127-02-1.7757-02 1.2359-02-1.0442-02-3.6979-02-1.4981-02 7.3772-03
-9.9536-05-2.6300-03-6.9568-03 5.8757-03 1.1404-02-8.6524-03-7.6217-03 2.6439-03
 4.5117-03-2.9020-03-4.0178-03-9.0200-03-1.7294-03-3.0837-03-7.0056-04-4.6568-03
-4.3504-03-3.7263-03 3.9826-03 1.1402-02 2.3687-03-1.2653-02
```

TABLE X. AERODYNAMIC DATA - 170-KNOT, WEST-TO-EAST FLIGHT

```
BURST NO. # 19            *** ROTOR NOISE PUNCHED OUTPUT ***
BLADE PITCH HARMONICS
 1.5280&01 4.6161&00-8.7611&00  %COLLECTIVE, LONGITUDINAL, LATERAL RESPECTIVELY%
ROTOR FLAPPING ANGLE HARMONICS
 1.7527&00 6.5371-01 0.0000      %POSITIVE TAIL HIGH -- DEGREES%
DIFFERENTIAL PRESSURE HARMONICS FOR 4 CHORD STATIONS AT EACH OF THE 5 SPANS
%MEASURING FROM THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY%.
SPAN 1  CHORD 1        STEADY%  1.1973&00
COSINE COEFFICIENTS
-1.1367&00 1.3108&00-6.7139-01-2.4904-01-1.8298-01 1.1502-01-1.0455-01-3.6747-02
-1.3179-02-2.2318-02-1.3193-02-2.4750-02-1.3826-02-2.0115-02-1.3912-02 1.4478-03
 8.1159-03 3.2395-02 1.7598-02 2.3198-02 2.1458-02 2.1137-02 4.5993-03 8.9851-03
 3.6702-03-2.9763-03-9.0618-03-1.2432-02-8.3881-03-8.9101-03
SINE COEFFICIENTS
 2.5000-01 1.2900-01 7.6152-01-1.4656-02-1.4885-01 4.1248-03 5.2221-02-3.3884-02
-2.7906-02-2.3118-02-5.0657-02-1.7068-02-3.4766-02-1.3425-02-1.9280-02-8.5524-03
-9.5864-03-2.0204-02-2.0293-02-1.8647-02-7.3041-03-9.7500-04-1.3684-03 8.8973-03
 1.0487-02 6.8672-03 2.2152-02 5.5265-03 5.0289-03-1.4249-03
SPAN 1  CHORD 2        STEADY%  4.9342-01
COSINE COEFFICIENTS
-3.6947-01 4.6739-01-2.1656-01-9.7127-02-6.2233-02 3.8409-02-4.9038-02-1.0236-02
-5.9475-03-3.1078-03 3.0284-03-1.3065-02 5.8492-04 3.4335-03 6.8378-03 1.3640-02
 2.4571-02 3.8422-02-3.9667-03-9.3191-03-6.7050-03-7.3627-03 9.1109-03-5.1459-03
 2.0327-03 1.3526-02-1.5329-02-7.1691-03-1.9573-03-1.4850-02
SINE COEFFICIENTS
 2.3733-01 2.6322-03 2.9927-01-2.0120-02-5.0622-02 2.2213-02 2.6359-02-1.2497-02
-1.8904-02-2.5759-02-1.4958-02-8.3016-03-1.8700-02-4.4546-03-2.7752-02 1.5458-03
 1.2279-02-3.0079-02-5.3254-02-4.6184-03-8.7101-03-1.5908-03 2.1437-02-1.6904-02
-2.1729-03-5.1581-03 1.4750-03 5.3046-03-8.1535-03 9.1407-03
SPAN 1  CHORD 3        STEADY%  2.5332-01
COSINE COEFFICIENTS
-2.4255-01 3.2970-01-1.3899-01-7.1937-02-5.2919-02 3.2497-02-1.4971-02-2.3581-03
-6.3584-03-3.4566-03-4.4624-03-7.0270-03-1.1920-02-8.1572-03-4.4644-03-1.1015-03
 4.1813-03 6.3851-03 1.0687-02 7.2686-03 8.1210-03 6.6332-03 2.5336-03 5.9474-03
 4.7865-03-2.0453-03 1.9310-04-5.0108-04-7.3823-03-4.2828-03
SINE COEFFICIENTS
 9.2377-02-3.2150-02 1.5880-01 5.3901-03-3.4096-02-4.5502-04 1.7769-02-6.2028-03
-1.3157-02-5.8220-03-1.1508-02-8.8312-03-1.1315-02 6.6187-04-5.8479-03-2.6673-04
 1.8176-03-1.5762-03-1.2637-03-8.7870-03-3.0330-03-2.6617-03 1.5921-04-1.3123-03
 5.3732-04 7.5655-04 1.2317-03-3.8901-05 3.2116-03-6.4994-04
SPAN 1  CHORD 4        STEADY%  0.0000
COSINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SINE COEFFICIENTS
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
SPAN 1  CHORD 5        STEADY%  1.9879-01
COSINE COEFFICIENTS
 1.4060-02-6.9589-02-4.8070-04 1.1378-02 7.6102-03-3.8549-03-2.6610-03-3.9084-03
 1.6526-04 2.8098-03-2.7621-04-8.3939-04 5.4645-04 1.0756-03-3.5241-04 1.4721-03
-7.6911-04-2.0853-03-1.5528-03-9.5559-04 2.1007-04-5.3746-04 2.3741-04 5.8692-04
 1.8508-03 1.9327-03 2.0337-03 6.9061-04 1.5003-04 2.2547-04
SINE COEFFICIENTS
 3.4337-02 6.2483-03 1.0394-02-6.5110-04-5.6964-03-2.6736-03-1.0309-03 3.5232-04
 3.4044-03-1.0822-03-8.6063-04-9.7629-05 1.7111-03-2.0164-03-8.3581-04-1.7685-03
-1.3681-03-2.3302-04-2.3168-03 1.0103-03 2.0814-03 1.3958-03 5.7364-04 1.7987-03
 7.4468-04 6.4562-04-2.6219-04-2.2776-05 9.7369-05-1.8398-05
```

TABLE X - Continued

```
SPAN 2  CHORD 1        STEADY#  4.6124800
COSINE COEFFICIENTS
 1.9253-01 2.9756400-9.5601-01 2.2914-01-2.5519-01 8.8947-02-8.0210-02-1.5388-01
 1.3710-02 7.5670-03-6.0277-02 4.4355-02-3.6226-02 1.4928-02 1.8955-02-1.5061-02
 2.8432-02-7.2381-03-1.6696-02 2.8084-02-3.2443-02 3.3962-02-3.7309-02 8.8503-03
-7.7774-03 3.4515-04-7.4425-03-1.0249-02-6.6665-03 2.1991-02
SINE COEFFICIENTS
 4.0948-01 9.4962-01 1.4237800-6.9900-01 1.0139-01-1.3778-01 2.2708-01-1.0693-01
-7.3644-02-2.2223-02 7.2081-03-7.2343-02 4.9756-02-1.0292-01 4.8609-02-5.4614-02
 2.6820-02-2.6968-02-1.3697-03-1.5436-02 1.8464-02-2.7702-02 3.6250-02-3.7697-02
 3.4232-02-2.6995-02 5.2480-03-1.3081-02-1.1735-02-5.5445-03
SPAN 2  CHORD 2        STEADY#  1.7404800
COSINE COEFFICIENTS
 2.1244-01 1.2984800-3.6280-01-8.2102-02 6.6962-03 7.9629-02-1.8404-03-6.2754-02
 3.2250-02 6.6024-03-3.0100-02 1.1710-02-3.4868-03 4.5987-04 8.5262-03-1.2787-02
 1.2169-03-4.9179-03 8.6680-04-3.3315-03-3.7060-03 8.4274-03-7.9745-03-1.6020-03
 2.9807-03-8.9656-04 4.4142-03-8.5993-03 5.8597-03-1.4180-03
SINE COEFFICIENTS
-2.0946-01 3.6778-01 6.8604-01-3.0585-01-9.5156-02 2.5283-02 8.0534-02-1.0981-02
-6.2497-02 3.6430-02-1.2932-02-1.4841-02 1.2763-02-1.6025-02 6.6001-03-2.7361-03
-4.5594-03-5.2038-04 5.1362-03 5.3800-03-1.0956-02 5.2683-03 4.9629-03-4.9813-03
-3.3535-03 3.0828-04-6.0092-03-9.8580-04-4.1285-03 8.4414-03
SPAN 2  CHORD 3        STEADY#  1.5237800
COSINE COEFFICIENTS
 8.1262-02 6.5431-01-1.4249-01-5.2956-02-3.2219-02 5.9177-02 1.5874-02-3.7463-02
-1.5968-03 6.8229-03 1.5845-03 4.8829-03 1.9804-03 2.7531-03-4.3078-03-6.3908-03
 3.3589-03-4.3153-03-1.4316-03-6.2515-04-1.0554-03 2.1242-03 1.8599-03 5.6400-04
-1.2349-03 8.3028-04 1.9644-03-1.6097-03-1.0484-03-4.7590-04
SINE COEFFICIENTS
 1.6788-01 1.3088-01 5.7414-01-1.7119-01-4.7592-02-1.2072-02 4.8265-02 1.0603-02
-3.4307-02-3.4615-05-1.9283-03 1.1166-03-1.8220-03-5.2140-04 2.3412-03-3.2044-03
 8.6647-04-4.5070-03-5.4327-03-1.7446-04 7.2570-04-2.0546-03 3.0642-04-3.2652-03
 2.9924-03-2.9127-03-5.4843-03 2.1334-03-4.2069-03 2.3390-04
SPAN 2  CHORD 4        STEADY#  2.9323-01
COSINE COEFFICIENTS
-2.1329-01 4.3829-01-6.5742-03-2.3480-02-2.6951-02 2.7435-02 2.1619-02-8.0815-03
-1.6264-03 4.7190-03 6.3045-03-8.4076-04 2.6271-04 2.9666-03 1.0130-03 2.1207-04
-2.5308-03-4.0367-04 2.4199-03-7.5526-04 2.6301-03-3.4510-04 1.5952-03 7.5206-04
-1.1832-04 6.0177-04-1.4184-03 9.8242-06-4.1174-04 8.2307-04
SINE COEFFICIENTS
-2.1984-01-2.1221-02 1.4638-01-6.5693-02 6.7783-03-1.7992-02 1.7319-02 1.2424-02
-1.0465-02-3.3727-03 4.9404-04 3.9567-03-3.8721-03-4.7907-04 1.2519-03 1.3710-03
 1.0141-03-2.3174-03 1.3301-03-2.1744-03-5.5543-04 1.0258-05-9.0937-04 1.1398-03
 2.4669-04 3.3228-04-1.3727-03-1.1221-04-4.9498-04-1.0926-03
SPAN 2  CHORD 5        STEADY# -2.5088-01
COSINE COEFFICIENTS
-2.1289-02 1.1568-01 1.5745-02-2.1128-03-6.3504-03 6.6633-03 7.4014-03 2.6457-03
 1.2016-05 4.4918-05 2.9935-03-1.5641-03 1.6956-03 9.3242-04-2.1451-03-2.2294-04
-7.8625-04 3.4630-03 7.1393-04-3.8537-03 2.8193-03 2.0065-04-1.0957-03-6.6331-04
 9.9925-04 2.6500-03-1.4297-03-6.1512-04 8.9138-04-1.0273-03
SINE COEFFICIENTS
-2.6855-01-1.0117-02 1.0352-02-3.3657-03 9.2875-03-8.3408-03 4.8773-04 3.2431-03
 2.5174-03-3.2163-03-6.2892-05-1.0494-03-2.2371-03 1.8348-03 4.3339-05 5.1338-04
-1.5340-03 8.3623-04 2.1490-03-2.1509-03-2.2254-03 1.5762-03 8.5232-04 7.6588-05
-1.4025-03 1.5106-03 1.7433-03-1.2354-03-2.5584-04 3.2864-04
```

TABLE X - Continued

```
SPAN 3  CHORD 1        STEADY#  4.9470800
COSINE COEFFICIENTS
 2.0558800 3.1709800-4.6844-01 3.6457-01 1.3011-01 2.2563-01-6.8195-02 1.0031-01
 6.1499-02-8.4407-03 3.4403-02-3.5102-02-6.9434-02 1.3660-02-1.7265-02-5.8694-02
 2.7806-02-3.0208-02-1.7657-02 8.5854-03 1.7431-02-2.4162-02 1.0128-02-7.0481-03
-1.9012-02 1.1265-02-1.4417-02-6.9734-03 8.3555-04-9.7029-03
SINE COEFFICIENTS
-5.3778-01 9.2845-01 1.0751800-7.1621-01-2.8421-01 1.8861-01 1.8706-02-2.2640-02
 3.5427-02-2.6523-02 9.7373-03 3.8547-02 5.3822-03-2.9572-02 6.1056-02-3.9061-02
 8.8835-03 1.7425-02-4.5315-03-2.0560-02 1.4312-02-9.8788-03 1.1530-03-4.6008-03
 2.5453-03-1.1491-02 1.4197-02-2.7154-02-7.1005-04 9.9767-05
SPAN 3  CHORD 2        STEADY#  2.3388-01
COSINE COEFFICIENTS
 1.0168800 1.3995800-2.4853-01-3.4509-02-3.5876-02-5.2433-02 8.9556-02-3.4932-02
 6.8495-03-2.9085-02 2.1024-02 2.1425-02-1.3363-02 1.5526-02-2.7824-02 1.2228-02
-1.0606-02 3.4896-02-2.1944-02 3.1979-03-8.1365-03-7.6875-03-8.1258-03 6.8901-03
 7.2676-03-5.8507-03 2.8715-03-1.6781-02 2.6084-02-4.1637-04
SINE COEFFICIENTS
-1.4632800 3.9582-01 5.9230-01-3.3543-01 6.1987-03-7.0688-02 2.5137-03 7.5905-02
-2.1332-02 1.2726-02-6.0930-02 4.1074-02-1.4007-02 3.0249-02-9.1851-03-1.0542-02
-1.3368-02 7.9531-03 3.3842-02-2.5649-02 1.3526-02-1.5517-02 2.7768-03-1.7941-02
 1.7274-02-6.8298-03 1.4752-02-1.3426-02-1.3290-02 5.9944-03
SPAN 3  CHORD 3        STEADY# -2.2684-01
COSINE COEFFICIENTS
 1.9991-01 8.0335-01-1.1334-01-3.0365-01 2.0440-01 1.5468-01-1.8398-01 7.8705-02
-1.1636-01 2.5027-02 1.6171-01-8.9865-02-1.7787-02-1.1249-02-5.3139-03 4.7011-02
 1.3478-03-2.5107-02-1.6737-02 2.4546-02-2.0876-02 6.5428-03 2.8117-02-3.0209-02
 2.6375-02-7.9146-03-3.1553-02 2.8969-02 3.1594-03-6.0356-03
SINE COEFFICIENTS
-3.9087-01 2.3973-02 4.9070-01-3.0658-01-2.8619-01 2.6386-01 3.9637-03-1.4944-02
 5.2347-02-1.8550-01 8.5287-02 9.4112-02-4.5092-02 1.2930-02-4.7280-02 2.7945-03
 3.1735-02 1.5313-02-2.1844-02-2.7991-03 1.4248-02-3.4706-02 2.7301-02-1.0044-06
-1.5110-02 3.5329-02-2.4101-02-1.8840-02 2.5236-02-7.7286-03
SPAN 3  CHORD 4        STEADY# -3.5305-01
COSINE COEFFICIENTS
 2.5704-02 3.4358-01 9.6317-03 6.6699-03-6.6812-02 2.3826-02 4.5981-02-1.5572-02
-1.2655-02 8.7199-03 2.0140-03-2.7622-04 4.4953-03-1.6905-03-8.8198-04 2.2159-03
 2.0056-04 3.1282-04 2.2135-03-3.5092-04-3.2441-05-5.2583-04-2.5888-04-2.0002-03
 8.5387-04-4.2886-04-2.1642-04-2.1970-04-4.9990-04-2.1946-03
SINE COEFFICIENTS
-3.3900-01-1.0778-02 1.0081-01-3.3158-02 8.2482-03-5.6669-02 1.6413-02 2.9264-02
-1.6044-02-8.0537-03-3.0585-04-2.0375-03 1.1382-03 2.2947-03-3.4695-03 1.5525-04
-7.5805-05-1.1327-03 3.8950-05-2.5040-04 3.4609-04-2.4379-04 2.2010-04-1.0497-04
-6.5412-04-5.7713-06 2.9073-04 3.1834-04 9.4174-04 6.3385-05
SPAN 3  CHORD 5        STEADY# -1.6344-01
COSINE COEFFICIENTS
 1.0314-03 7.7055-02 2.3831-02 2.3665-03-8.0631-03 6.5765-03 1.0842-02 2.2689-03
-2.7372-03 3.3910-03-2.1977-03 6.9453-05 3.9277-03-4.2113-04-8.1939-04 8.6537-04
 2.2370-04 3.6070-04 2.8409-03-1.6096-03-4.0816-04 2.1466-03-3.5106-04 2.5826-04
 7.3493-04-3.6981-04 7.7213-04-8.9325-05 8.1435-05-7.1862-04
SINE COEFFICIENTS
-1.8488-01-2.1138-02 1.8617-03-1.4646-03 1.3157-02-8.3561-03 8.0022-05 7.1226-03
 6.5573-04-2.1585-03-9.1394-04-3.3692-03-1.8859-04 1.3471-03-2.2113-03-3.0741-04
 6.5909-04-5.1014-04-1.2270-03 2.0260-03-1.9685-04-2.3670-04 8.0736-04-2.6837-04
-3.9671-04-1.7692-04-6.5587-04 9.5051-04-1.7276-04-3.5363-04
```

TABLE X - Continued

```
SPAN 4  CHOPP 1        STEADY#  4.4276&00
COSINE COEFFICIENTS
 2.5307&00 2.5081&00-5.5026-02 3.6817-01-2.4987-01 1.1323-01-8.6795-02-8.4417-02
 2.2382-02 8.8171-02 6.6595-02 3.7250-02 2.8717-02 2.7642-02 1.5729-02-1.3030-02
-2.6652-02-2.9640-02-4.2179-02-7.3107-03 2.2765-03 5.7460-04 1.0108-02 1.0375-02
 3.7224-03-4.8346-03-2.0211-02-1.7179-02-1.0460-02-9.8186-03
SINE COEFFICIENTS
-1.8193&00-1.0883-01 1.9101-01-4.8571-01-3.4380-01-2.8008-02 8.9185-02 2.5368-02
-6.4777-03 7.0592-04 3.5832-02-4.6360-03-3.0979-02-4.5333-02-4.2888-02-4.4131-02
-3.2880-02-1.0615-02 4.0514-03 9.0479-03 1.1075-02 8.3519-03-2.9073-03-2.2919-02
-9.9848-03-1.5219-02-2.1713-03 2.8677-03 1.8065-02 1.3015-02
SPAN 4  CHOPP 2        STEADY#  1.4744&00
COSINE COEFFICIENTS
 1.7464&00 1.3667&00-4.0689-01-1.3896-01-4.2099-01-1.3822-01-3.4129-03-4.6449-02
 1.6378-01 5.1981-02 1.5326-01-5.7552-02 1.2387-02 1.4028-02 1.0044-02-6.0229-02
-6.4493-02-2.6668-02-2.1693-02 1.1629-03-5.1074-03 4.4714-02 2.9472-02 2.0728-02
-1.4016-02 2.9012-02-2.3991-02 2.1815-03-5.0083-02-6.9340-04
SINE COEFFICIENTS
-9.1665-01 5.0062-01 6.2418-01-2.2708-01-7.9092-02-3.0223-01-5.0359-02-1.5375-01
-2.0440-02-7.6149-03 6.7446-02 1.1813-01-2.4477-02 6.0467-02 2.6874-02 6.4517-02
-4.6580-02-1.4264-02-5.6339-02-5.8702-03-5.6291-02-1.0662-02-4.4438-03 4.5624-02
-3.6246-03 3.0362-02 1.9253-02 2.0655-02 4.5544-03-1.0480-02
SPAN 4  CHOPP 3        STEADY#  1.0017&00
COSINE COEFFICIENTS
 6.7078-01 6.4152-01-2.6548-01-1.8530-01 1.0462-01 1.3317-01 7.2024-02 9.5129-03
-1.2855-01-4.3958-02-1.6261-01 6.7559-03 5.1538-02 8.8334-02 1.0579-01-9.8525-02
-2.3131-02-8.2674-02 1.0649-02 5.3016-02 4.0482-02 4.5308-02-3.1114-02 2.9081-03
-6.1539-02 2.0800-02 9.4498-03 6.9153-03 4.7034-02-3.6635-02
SINE COEFFICIENTS
-4.7603-01 7.0361-02 2.8645-01-3.8959-01-2.4339-01 4.9808-02 3.2490-02 1.7224-01
 4.1345-02 2.2926-02-2.1205-02-1.4832-01-1.1477-02-3.8218-02 1.5228-01 8.1056-02
 4.0476-03 3.1050-03-1.0148-01-8.6939-04-1.2899-02 5.0809-02 2.1546-02 1.5850-02
-5.5858-03-5.2988-02 1.3106-02-3.6306-02 3.0966-02 2.4272-02
SPAN 4  CHOPP 4        STEADY# -4.3401-02
COSINE COEFFICIENTS
 8.9684-02 2.2452-01 1.1446-01 8.1247-02-1.5921-01-6.3518-03 7.6727-03-1.6704-02
 4.2116-02 1.4504-03-5.4139-02 5.8498-03 1.4019-02-3.8460-03 7.8687-03-8.8079-03
-2.2074-02 4.5113-03 1.7225-02-4.5895-03-4.5467-03 3.8017-03 1.0491-03-3.1797-03
 1.1203-02 6.2096-03 2.7036-03-8.0688-03 5.5651-05 6.8743-03
SINE COEFFICIENTS
-5.4288-01-1.4041-01-1.5178-02 8.4167-02 5.2929-02-6.0179-02 1.5500-04-1.1680-02
-4.0083-03 5.8520-02-5.1798-04-3.4507-02 7.6665-03 2.6188-03 7.1836-03 1.8792-02
-2.9156-03-1.8974-02 1.1480-02 1.0929-02 4.6954-03 1.8983-03 4.1982-03-7.1699-03
-1.3746-03 1.1940-03 7.8258-03 3.3101-04-6.3593-03-1.8023-04
SPAN 4  CHOPP 5        STEADY# -5.6057-01
COSINE COEFFICIENTS
-9.0972-02 3.2996-02 3.9979-02 6.9683-03-2.8208-02-2.1835-04 1.0840-02-1.5438-03
-1.0699-02 1.2660-03-4.3263-04-9.4291-04-2.6302-03-1.9961-03-1.6262-03-5.1682-03
 1.6857-03-1.9143-03 1.0530-03-1.2567-03 4.0846-04 8.0337-04-2.2056-03-3.5855-03
 4.9678-04 4.6480-03 3.0634-03 6.1349-04 1.3938-03 8.1864-03
SINE COEFFICIENTS
-2.6124-01-6.0774-02-1.4956-02 1.9319-02 7.1580-03-2.1317-02-7.9041-03 9.2636-03
-1.3450-03-6.0326-03-4.8744-04-3.6688-03-2.4867-03-5.8977-03 2.7827-03 2.0457-03
-5.1659-03-7.9302-04 2.0484-03-2.0790-03-4.8293-03 7.9175-04 1.7573-03 7.3065-04
-4.0974-03 2.1691-03 3.2185-03 2.5558-03 4.7534-03-2.0144-04
```

TABLE X Concluded

```
SPAN 5  CHOPD 1        STEADY#  4.3714800
COSINE COEFFICIENTS
 2.7370800 2.7593800 2.0321-01 4.5946-01 6.8829-02 1.6418-01-3.4084-02-1.1315-01
 1.3476-02 5.8099-02 4.9943-02-1.4363-02 2.9845-03-8.9468-02-3.0797-02-3.6555-02
-4.1046-02-5.2907-02-3.9971-02-3.3311-02 8.3219-03 1.0134-02 9.8701-03 1.2552-02
 2.9235-03 2.0192-02 1.2513-02-1.5632-03 1.1286-02 1.1075-02
SINE COEFFICIENTS
-1.3257800-8.8339-02 3.9693-01-4.7290-01-2.7674-01 2.3609-02 9.0834-02-3.3156-02
-1.0972-01-7.4225-02-3.0455-02-2.0079-02-7.7535-03-1.0203-01-3.4406-02-1.5188-02
-1.5526-02-3.8571-02 5.6404-03 8.4011-03 4.1529-02 3.5647-02 2.3119-02 1.6471-02
 1.8252-02-1.4357-02-2.9109-02-1.9165-02-1.1765-02 5.3937-03
SPAN 5  CHOPD 2        STEADY#  1.2520800
COSINE COEFFICIENTS
 5.0493-01 7.4529-01-7.5595-01-3.8287-01 4.3558-02 7.3093-02 7.1778-02 1.0476-01
 4.0224-02 1.4148-01 6.5716-02-8.0587-02-1.8287-02-1.1443-01-1.0450-01 3.3472-02
 2.8826-02 3.5992-02 4.0730-02 5.5714-03 7.0368-02 2.1271-02-7.7009-02-3.2011-02
-2.8008-02-1.6162-02 1.4016-02-2.6342-03 2.7750-02 4.2720-02
SINE COEFFICIENTS
-3.0512-01 5.1823-01 5.2869-01-5.7726-01-3.2488-01-5.5625-02-8.5631-02 3.3984-02
 2.1239-02 1.5708-02 1.7326-01 7.7830-02 4.9492-02 6.2539-02-1.0143-01-9.3661-02
-2.9990-02-4.0855-02 3.2603-03-6.1854-03 1.2767-03 1.0266-01 3.7977-02-1.6049-02
-4.7320-03-3.2325-02-1.9257-02-1.0069-02-3.0750-02 1.9382-02
SPAN 5  CHOPD 3        STEADY# -8.7778-03
COSINE COEFFICIENTS
-4.5268-01 8.3064-01-1.5175-01-3.2281-01-1.3295-02 2.4368-01 2.1067-01-1.3908-01
-1.5659-01-4.7462-02-8.0176-02 1.3623-01 1.1644-01 1.6165-02-9.1977-03-7.8773-02
-5.1961-02 4.3808-03 7.2125-02 3.1227-02-9.5547-03-1.6065-02-3.1352-02-1.9891-03
 2.3952-02 2.7968-02-6.5692-03-1.3963-02-1.5325-02 2.2713-04
SINE COEFFICIENTS
-1.1174800-2.5351-01 5.6996-01-2.2840-01-2.9273-01-6.3932-02 1.9858-01 2.6651-01
-3.8067-02-7.3695-03-1.2334-01-1.3359-01 7.3285-02 7.2092-02 7.4047-02 2.1442-02
-5.0548-02-7.5035-02-2.2296-02 4.6958-02 2.6175-02 1.8517-02-7.0507-03-3.2155-02
-2.0829-02 1.4263-02 2.2565-02-6.0743-05-1.0754-02-2.5821-02
SPAN 5  CHOPD 4        STEADY# -2.2891-01
COSINE COEFFICIENTS
-4.8663-01 1.2575-01 6.4962-02 5.3635-02-9.1654-02-4.8927-03 1.3559-02 1.4914-03
 1.1967-03-1.4913-02-9.6172-03-8.1797-03-8.6882-03-1.2289-02-7.0609-03-6.4245-03
-9.0952-03-8.5356-03-8.1948-03-2.1891-03-2.9901-03-2.8060-03-1.8497-03-1.2524-03
 3.6228-03 5.1070-03 3.3520-03 7.0846-03 7.0674-03 8.8695-03
SINE COEFFICIENTS
-3.2074-01-1.9110-01 7.9528-03 1.0418-02 2.9890-02-4.5022-02-2.6775-02-8.1156-03
 5.3649-03 3.3914-03-1.0311-02-7.9115-03-6.2563-04 4.9735-04 5.1116-04 5.1458-03
 5.1098-03 6.8762-03 5.7814-03 5.4434-03 9.7513-03 8.6038-03 9.6596-03 8.6771-03
 6.7609-03 7.4923-03 5.4650-03 3.8115-03 2.8083-03 2.2467-03
SPAN 5  CHOPD 5        STEADY# -5.0105-01
COSINE COEFFICIENTS
-1.7749-01-6.0144-03 1.3876-02 3.0909-02-2.6989-02 1.9799-03 1.0931-02 6.7939-03
-2.5439-03-1.1020-02 9.6259-03 5.3299-03 1.0945-02-3.2643-02-5.1064-04-2.3541-03
-3.7777-03-6.0282-03 2.9022-03-1.7787-03-4.6323-03-6.8709-04-3.3911-03 5.0265-03
-4.3233-03 2.0855-03-4.2973-03 3.6942-03 3.2752-04 1.7731-03
SINE COEFFICIENTS
-2.7422-01-5.4820-02-1.6145-02 1.1136-02 6.2709-03-4.1626-02-1.8555-02 1.8362-03
 1.3022-03-1.0041-02-1.4302-02-9.0268-03-1.1211-02 3.9885-02-5.3402-04 7.1120-03
 3.3042-03 7.6460-03-4.9142-03 8.5319-03-1.0004-03 3.1839-03 8.5765-04 2.0242-04
 7.6982-03-6.9246-04 4.4177-03 4.2896-03 5.2101-03-6.3603-03
```

NOT REPRODUCIBLE

TABLE XI. AIRCRAFT TRIM CONDITIONS

Nominal Airspeed (kt)	Calibrated Airspeed (kt)	Aircraft Heading (deg)	Rotor Speed (rpm)	Shaft Angle (deg)
0	0	030	188	-1.7
0	0	210	188	- .7
0	0	270	188	- .9
120	115	290	188	-3.7
120	116	110	188	-4.9
140	139	290	190	-4.8
140	139	110	189	-4.8
170	163	290	189	-5.7
170	164	110	188	-6.3

APPENDIX III
PREDICTED AERODYNAMIC LOADING

Tables XII through XV contain 10 predicted harmonics of aerodynamic section loading (pounds per inch of span) for forward flight and for hover. These section loading data include the effects of variable inflow from a prescribed helicoidal wake analysis and the effects of blade motions from a normal modes blade dynamics analysis. Ten harmonics of loading are considered to be the practical limit of the section loading prediction method in its present form.

Airpseed: 170 kt

Inflow : Variable

Blade Pitch at Root: 18.067°

Rotor Shaft Angle : -8.468°(fwd)

A_{is}: 2.000

B_{is}: -9.000

TABLE XII. 170-KNOT CRUISE AIRLOADS (lb/in.)

Airloading Harmonic Number	98.5% SPAN		94.1% SPAN		88.3% SPAN		79.8% SPAN		38.3% SPAN	
	Cosine	Sine	Cosine	Sine	Cosine	Sine	Cosine	Sine	Cosine	Sine
STEADY	0.2771		34.8891		34.9268		30.6087		5.9336	
1	-.3275	.3149	-9.0662	12.1640	-5.9314	4.6795	-3.8742	-.5892	3.7311	-4.2441
2	-.3564	-.0676	1.3862	16.7727	1.4551	20.5090	1.3202	23.2733	-1.1523	5.9897
3	-.1347	-.2584	5.6775	6.5508	8.0448	7.1403	8.4552	3.6182	3.6033	.4125
4	+.1079	-.1625	-.6739	2.8777	.7224	-.1272	.3464	-1.2710	1.4280	.5723
5	+.1797	.0154	2.2296	-.4683	.6613	-.7593	1.5272	.4423	.7080	-.7097
6	+.0540	.1004	-.8972	-1.0289	-.0049	.1595	-.4684	.0143	-.1915	.0865
7	-.0537	.0771	1.3638	1.3896	.9864	.3238	-.0071	.4053	.3450	.2323
8	-.0495	-.0051	1.2948	.0716	.1464	-.1356	.6739	-.0662	-.2825	.0457
9	-.0002	-.0427	.8053	-.7882	.8975	-.2760	.2308	.2128	.8711	.1797
10	+.0215	-.0145	-.3447	-.8009	-.3272	-.7493	-.1277	-.0924	-.5503	-.9153

Airspeed: 140 kt Blade Pitch at Root: 13.801° A_{1s}: +2.000

Inflow : Variable Rotor Shaft Angle : -6.650°(fwd) B_{1s}: -5.000

TABLE XIII. 140-KNOT CRUISE AIRLOADS (lb/in.)

Airloading Harmonic Number	98.5% SPAN		94.1% SPAN		88.3% SPAN		79.8% SPAN		38.3% SPAN	
	Cosine	Sine	Cosine	Sine	Cosine	Sine	Cosine	Sine	Cosine	Sine
STEADY	0.0432		32.1562		32.9131		29.1304		5.5119	
1	.0344	.0059	+12.0380	-3.4406	4.6208	-3.9159	-1.3674	-3.5540	-3.0354	4.4670
2	-.0175	-.0069	3.3554	-5.6222	8.2819	-5.7225	12.1635	-3.0718	2.5126	-.7131
3	-.0075	-.0149	4.6631	-.8978	5.8059	2.1099	3.0618	3.2793	.4691	1.0319
4	+.0026	-.0069	.2990	-.5617	-1.0220	-.8627	.3693	-2.9325	.5579	1.0731
5	+.0009	-.0002	-.3969	-2.4232	.0375	-2.9653	-.0366	.0693	-.8611	.5496
6	-.0034	-.0024	.3872	-1.2138	1.1321	.4331	-.1178	-.2770	-.5274	-.2659
7	+.0042	-.0042	1.7338	-.0734	.0770	.3897	.7934	.2279	-.0889	-.9283
8	+.0037	+.0050	.2188	1.3698	.5892	-.3548	.0491	-.6395	1.3744	.1140
9	-.0035	+.0029	-.4309	-.8629	.5336	-.4563	.8525	-.0403	-.5071	1.1284
10	-.0034	-.0028	-.1201	-.1418	-.6592	.4934	-1.3641	1.1039	-.4840	-.6068

Airspeed : 120 kt Blade Pitch at Root: 12.600° A_{1s}: -1.500

Inflow : Variable Rotor Shaft Angle : -4.170 (fwd) B_{1s}: + 5.000

TABLE XIV. 120-KNOT CRUISE AIRLOADS (lb/in.)

Airloading Harmonic Number	98.5% SPAN		94.1% SPAN		88.3% SPAN		79.5% SPAN		38.3 SPAN	
	Cosine	Sine	Cosine	Sine	Cosine	Sine	Cosine	Sine	Cosine	Sine
STEADY	0.0467		35.4338		35.8693		32.0217		6.7611	
1	.0307	.0013	+8.7841	-3.3866	2.0889	-3.9953	-2.4914	-3.6462	-2.4743	4.6143
2	-.0138	-.0096	2.3521	-6.2696	7.1741	-6.0052	11.1633	-1.5397	1.9734	-.8133
3	-.0078	-.0144	3.6054	-1.6737	4.6207	1.4388	.4686	.8783	.3839	.3178
4	+.0030	-.0056	1.2238	-1.1348	-.3132	-1.9736	1.5938	-4.3840	1.9376	.7998
5	.0027	.0035	-.5474	-1.3549	-.6322	-1.8785	-.7179	1.3471	-1.2212	2.0714
6	-.0025	.0009	.5069	-.8239	1.0478	.1487	.4944	-1.1818	-1.0441	-1.5058
7	.0025	-.0024	1.3055	1.2260	.5708	.8813	.3239	-.1144	1.3853	-.9341
8	.0044	.0040	-.1527	.5486	.5172	-1.2566	-.2277	-1.4106	.4869	1.8736
9	-.0035	.0032	-.0811	-.3725	1.1232	.4458	1.8609	2.3049	-1.4299	-1.0215
10	-.0033	-.0034	-.4420	-.6011	-.6988	.5848	-2.0736	.4954	1.4369	.1567

Airspeed : Hover Blade Pitch at Root: 12.799° A_{1s}: 0.0

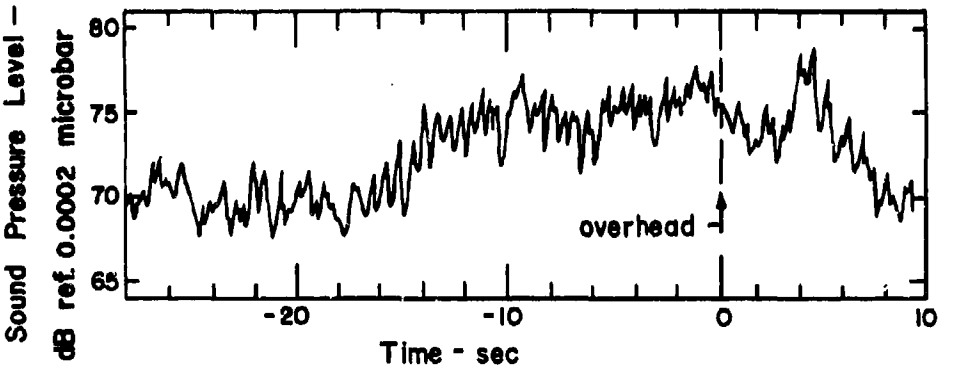
Inflow : Variable Rotor Shaft Angle : 0.0 B_{1s}: 0.0

TABLE XV. HOVER AIRLOADS (lb/in.)

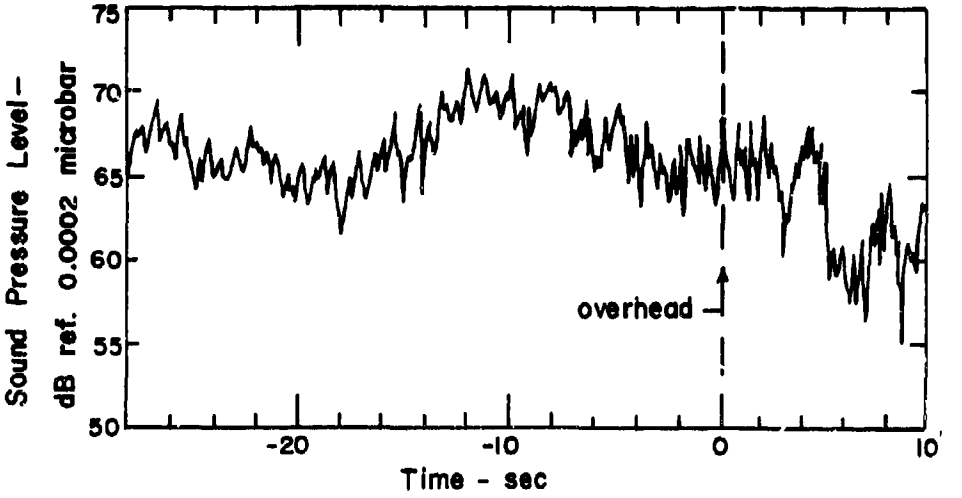
Airloading Harmonic Number	98.0% SPAN		95.0% SPAN		85.0% SPAN		75.0% SPAN		40.0% SPAN	
	Cosine	Sine	Cosine	Sine	Cosine	Sine	Cosine	Sine	Cosine	Sine
STEADY	0.0373		33.2492		30.7245		26.4747		8.236	
1	-.0001	-.0001	-.0570	-.0846	-.0387	-.1043	-.0195	-.1215	.0079	-.0322
2	.0	-.0001	-.0153	-.0490	-.0168	-.0531	-.0140	-.0503	.0149	-.0122
3	-.0001	-.0001	-.0491	-.0761	-.0522	-.0614	-.0471	-.0394	.0092	.0157
4	.0	.0	-.0063	-.0367	-.0221	-.0545	-.0371	-.0606	-.0036	.0170
5	-.0003	.0	-.1110	-.0349	-.0307	-.0902	.0315	-.1301	-.0368	.0152
6	-.0001	-.0001	-.0357	-.0346	+.0149	-.0165	.0519	.0080	.0015	.0413
7	.0	-.0001	-.0164	-.0551	.0037	-.0360	.0204	-.0192	-.0092	-.0076
8	.0	-.0001	-.0171	-.0402	-.0053	-.0239	.0060	-.0104	-.0058	-.0072
9	-.0001	-.0001	-.0313	-.0284	-.0170	-.0186	-.0029	-.0091	-.0061	-.0053
10	-.0001	.0	-.0276	-.0252	-.0137	-.0174	-.0017	-.0096	-.0062	-.0036

APPENDIX IV
MEASURED ACOUSTIC OCTAVE DATA

Octave band noise data for the forward flight cases is presented in Figures 53 through 55 as plots of SPL vs time. These data are for flyovers at an altitude of 1000 feet for the nominal airspeeds given in the figure titles. Figure 56 presents azimuthal plots of the noise level in each octave. Levels tend to be highest in the vicinity of 330 degrees of azimuth, corresponding to the occurrence of RIN as explained in Section 4.2.1. Figures 57 and 58 are included to show the difference between typical RIN and no-RIN hover noise observed during this program. Each spectrum is an average of 16 spectra. Averaging tends to broaden the peaks of the discrete frequency components because of slight variations in rotor rotational speed and small deviations due to lead-lag motion of the rotor blades.

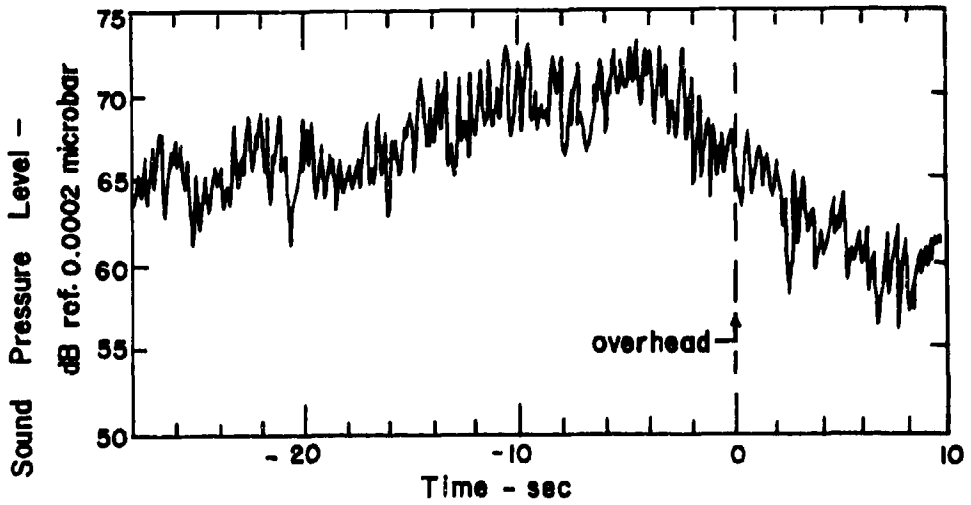


a. Overall

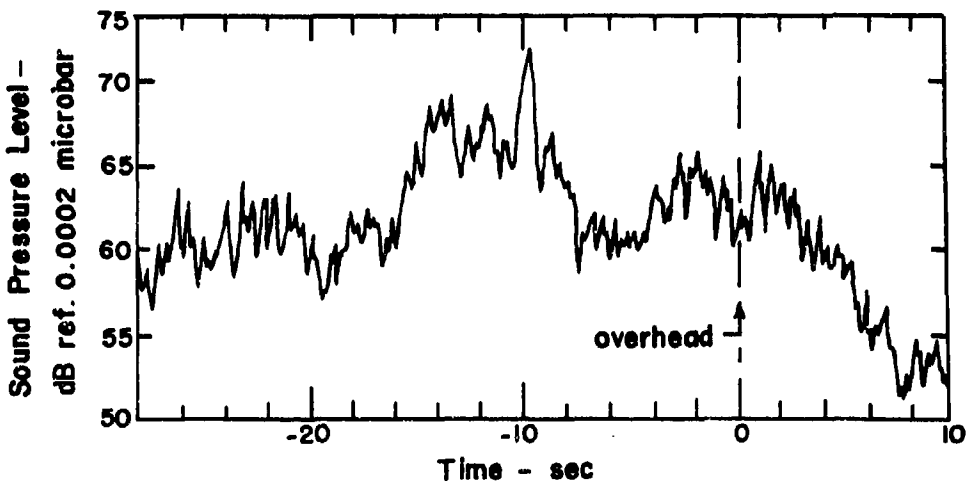


b. 31.5 Hz Octave

Figure 53 Octave Band Flyover Noise - 120 kt.

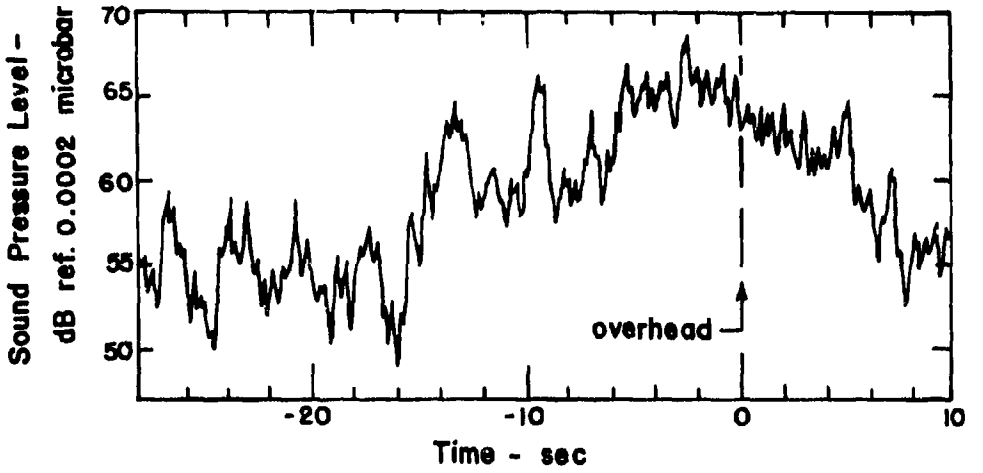


c. 63 Hz Octave

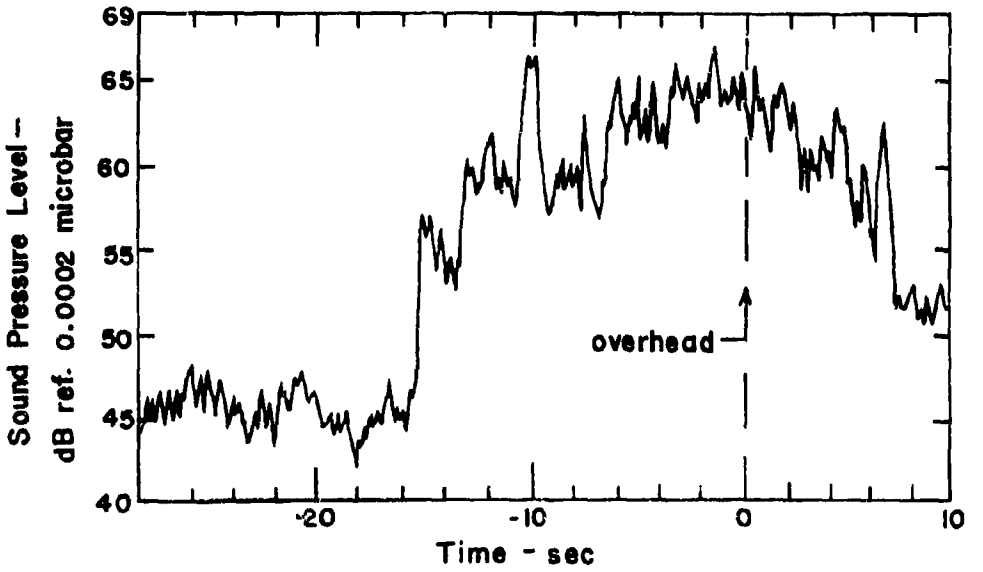


d. 125 Hz Octave

Figure 53. Continued.

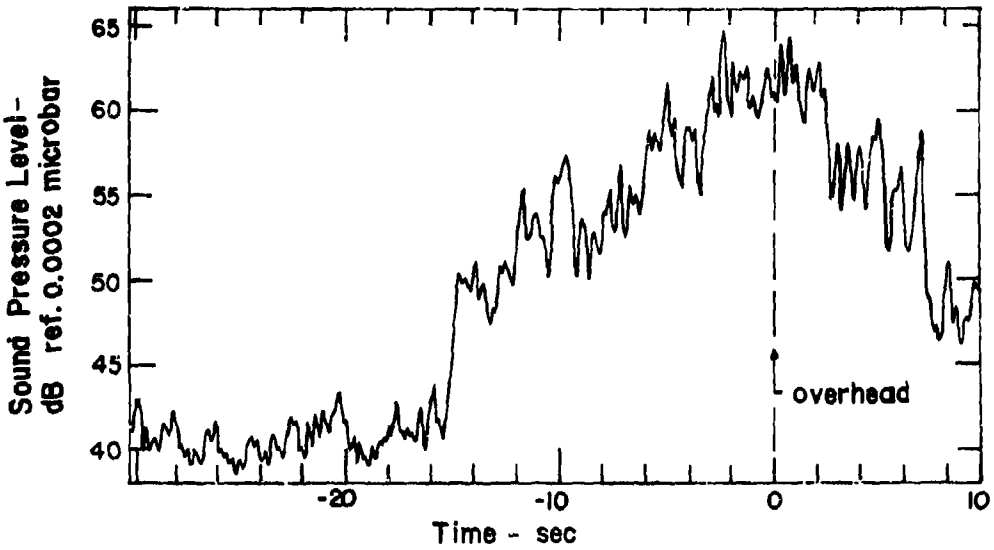


e. 250 Hz Octave

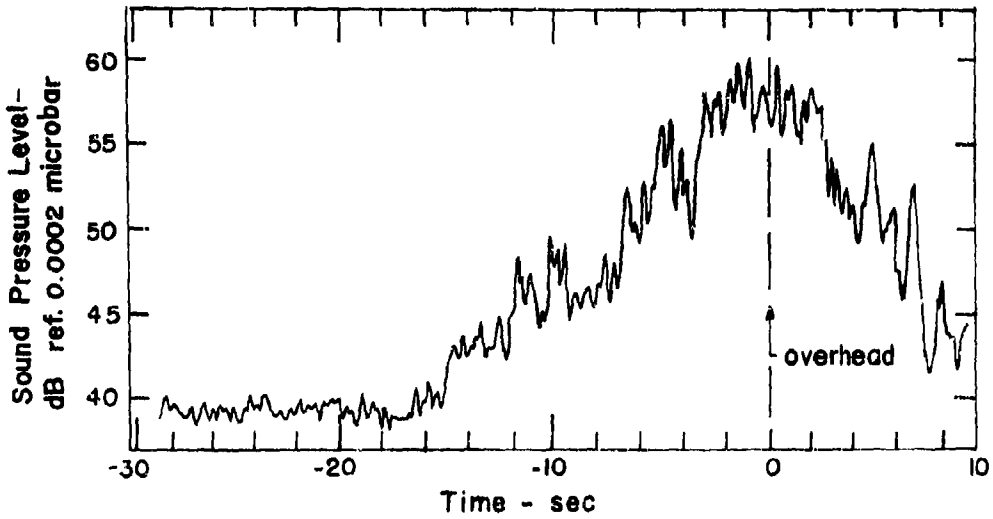


f. 500 Hz Octave

Figure 53. Continued.

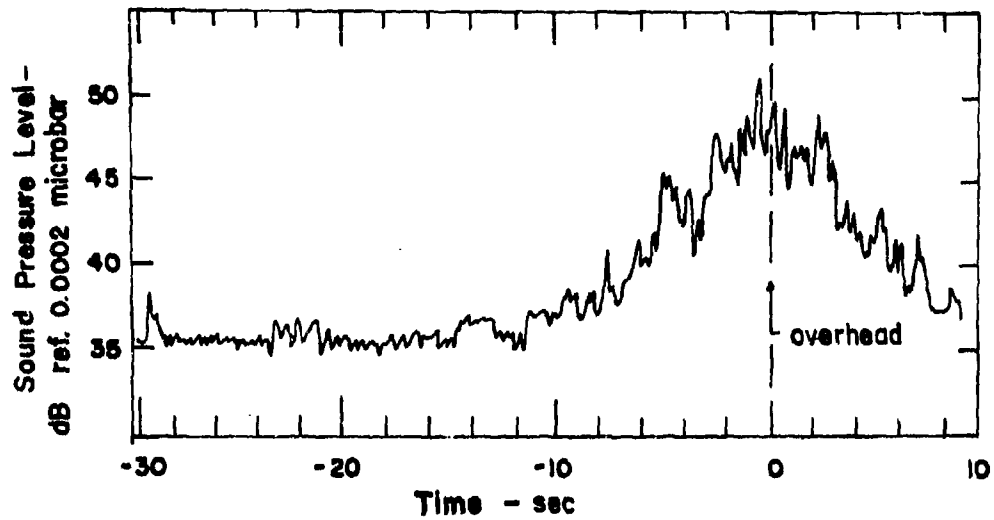


g. 1000 Hz Octave



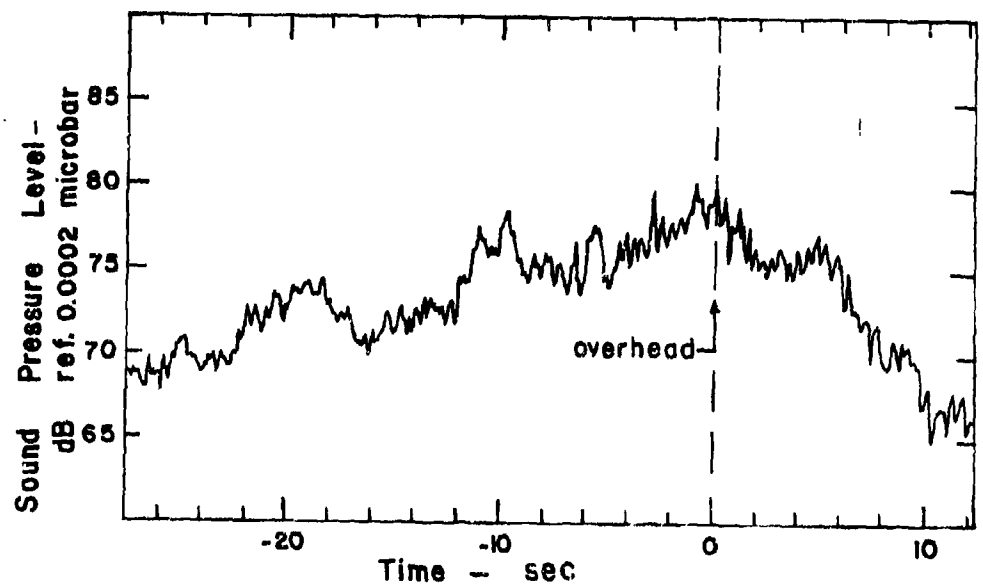
h. 2000 Hz Octave

Figure 53. Continued.



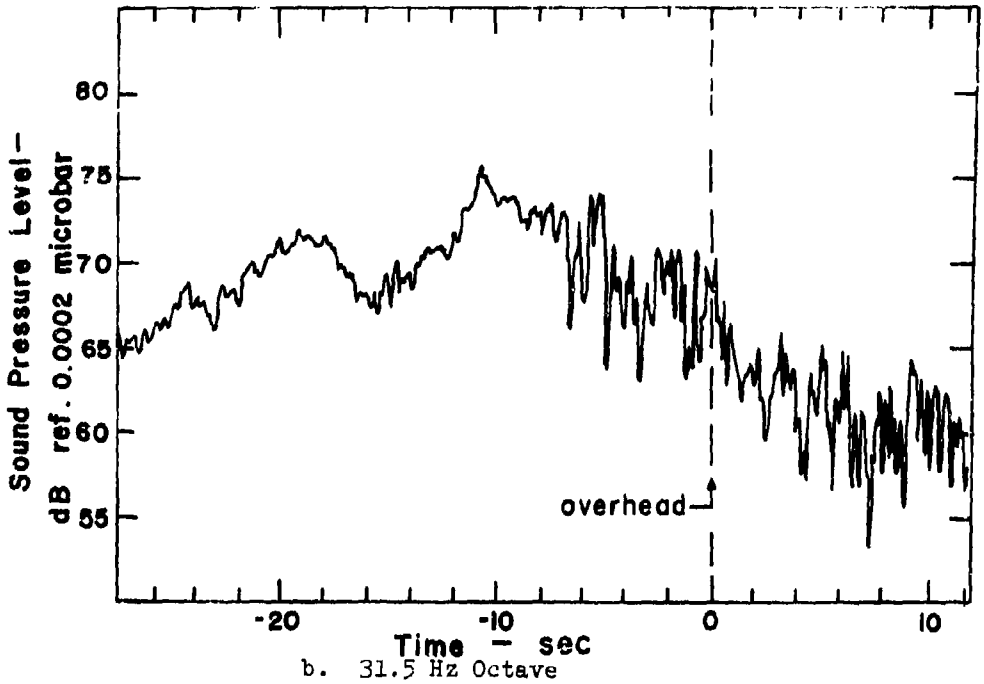
i. 4000 Hz Octave

Figure 53. Concluded.

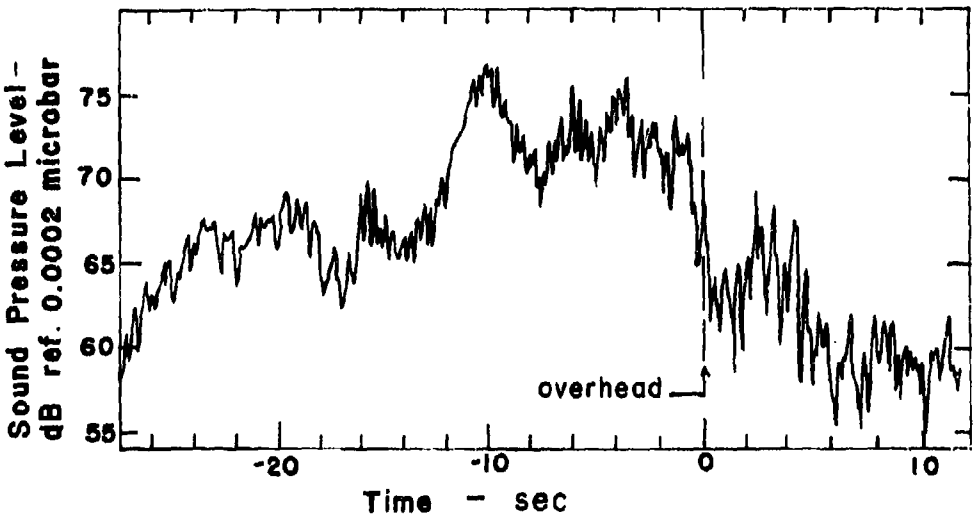


a. Overall

Figure 54. Octave Band Flyover Noise - 140 kt.

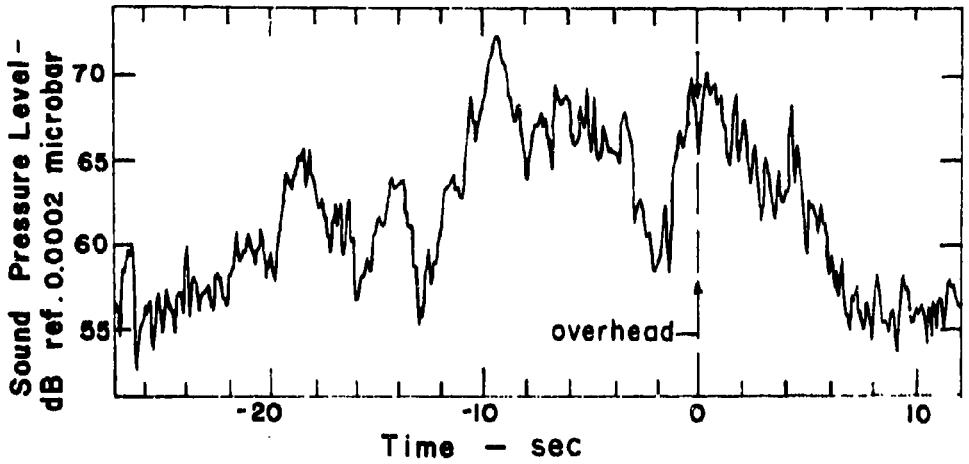


b. 31.5 Hz Octave

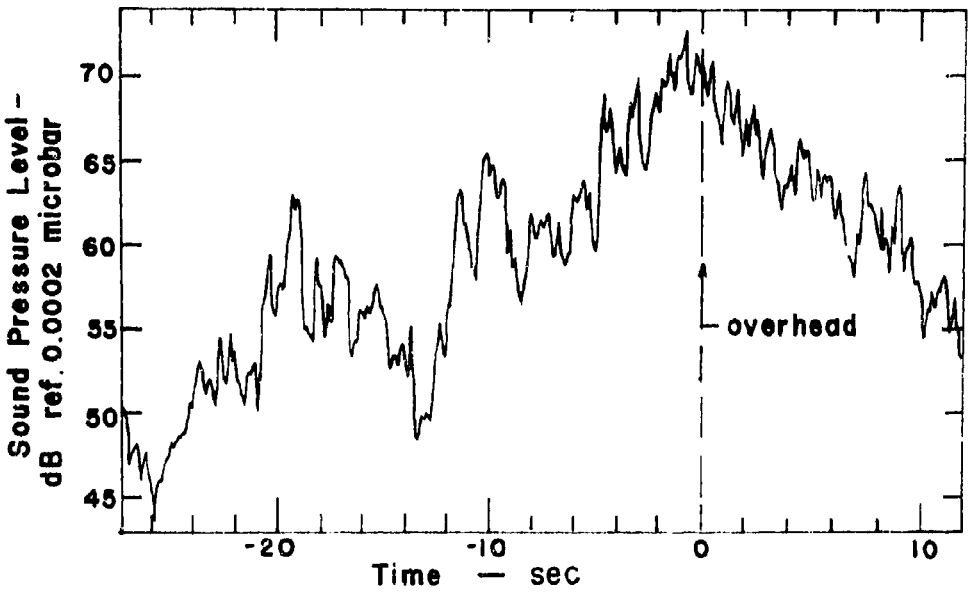


c. 63 Hz Octave

Figure 54. Continued.

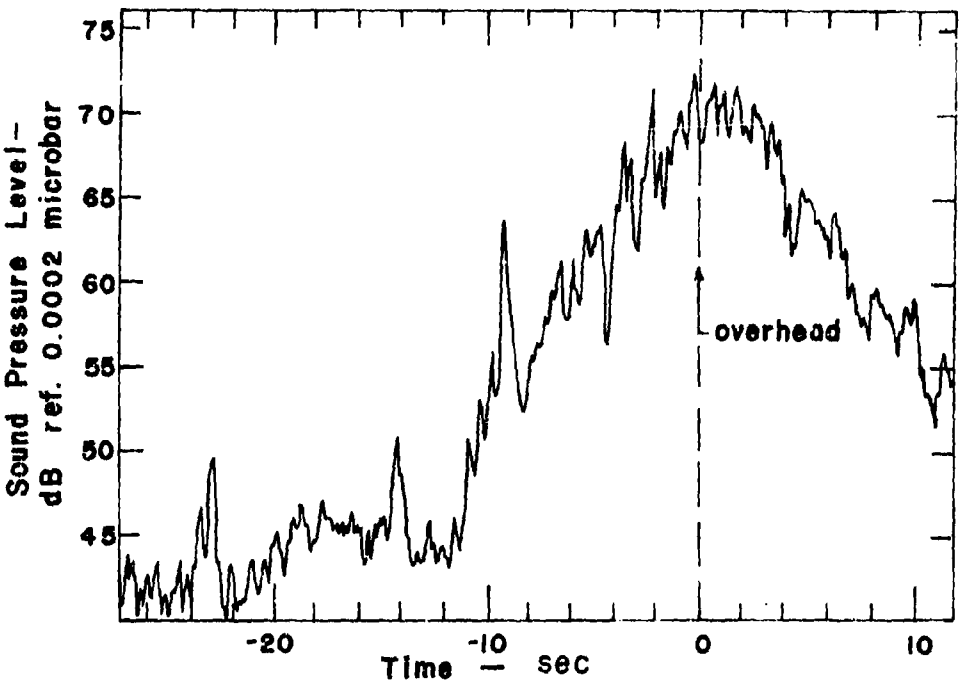


d. 125 Hz Octave

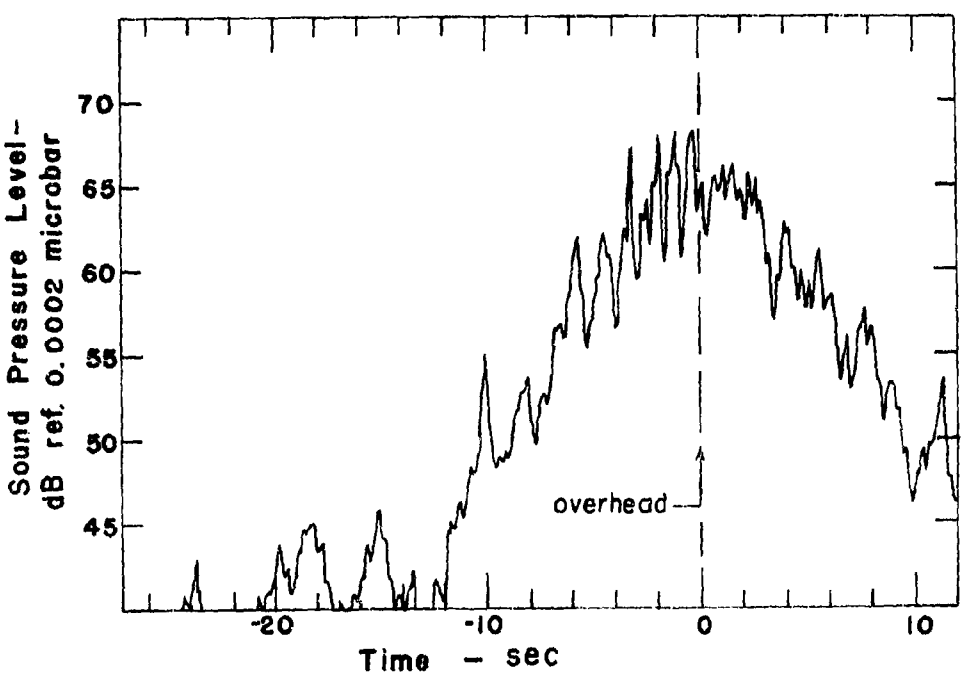


e. 250 Hz Octave

Figure 54. Continued.

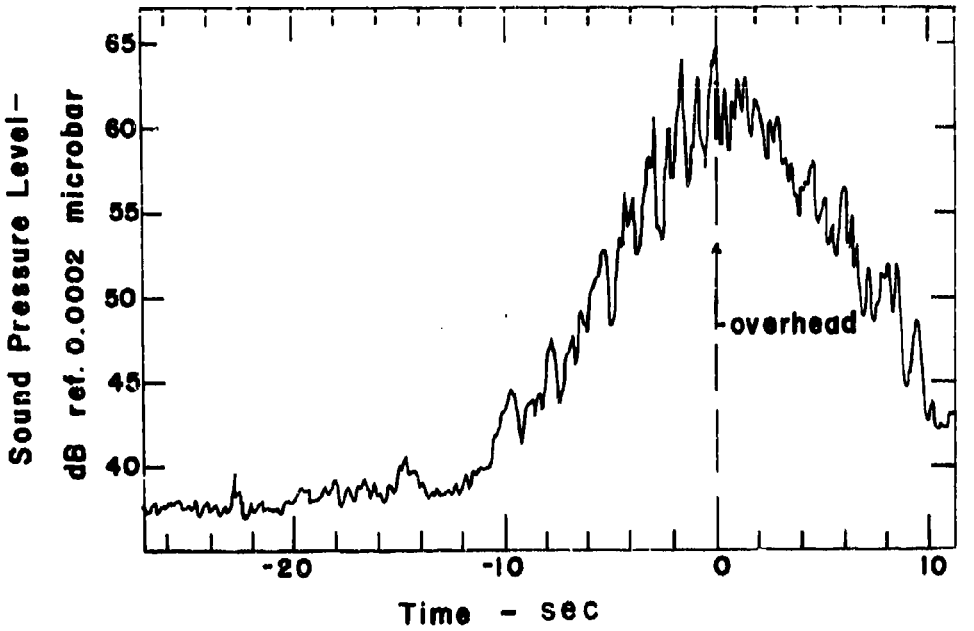


f. 500 Hz Octave

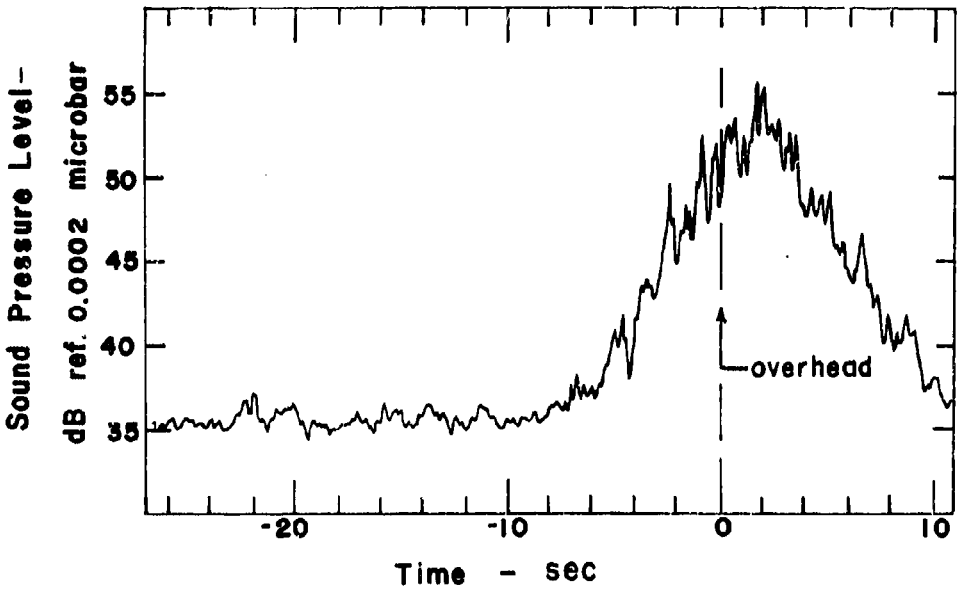


g. 1000 Hz Octave

Figure 54. Continued.

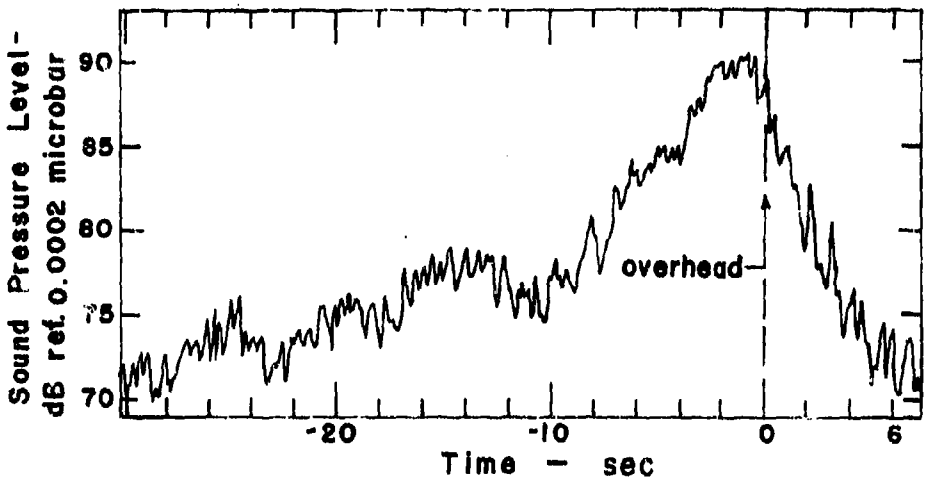


h. 2000 Hz Octave

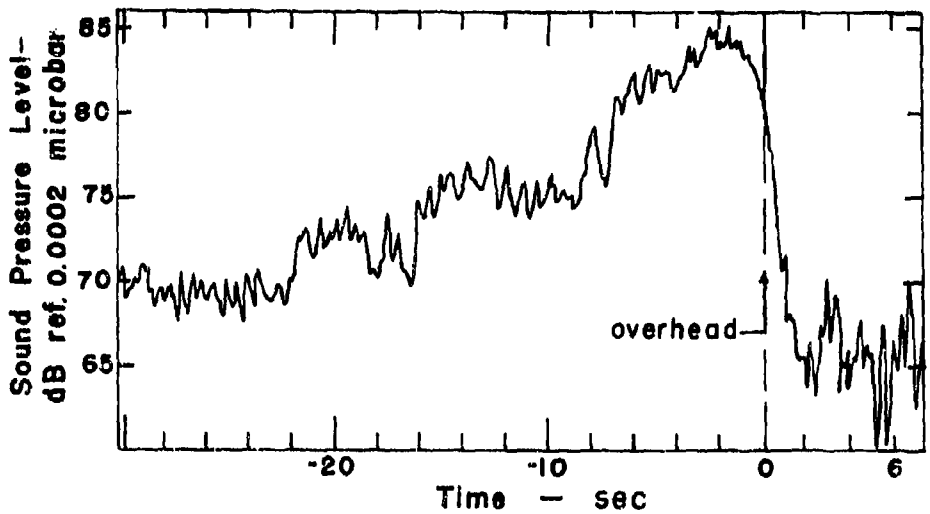


i. 4000 Hz Octave

Figure 54. Concluded.

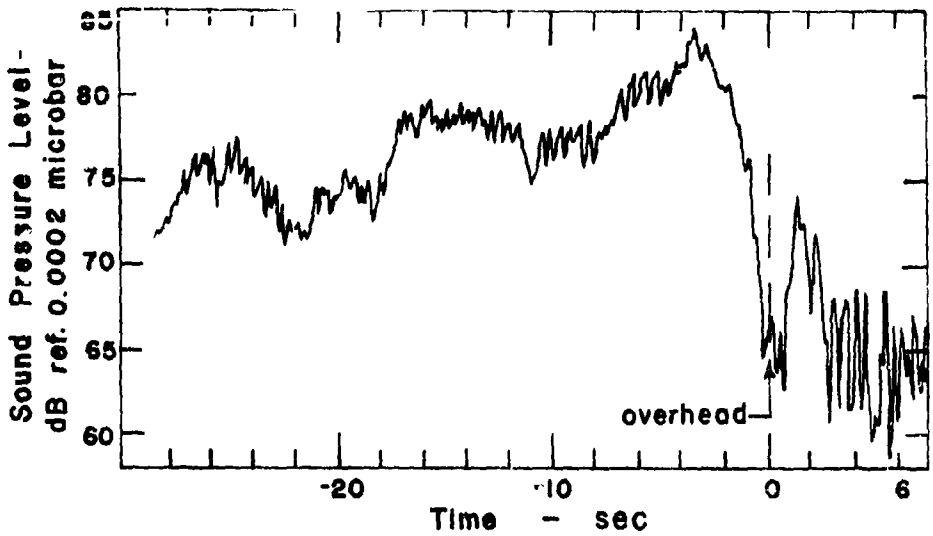


a. Overall

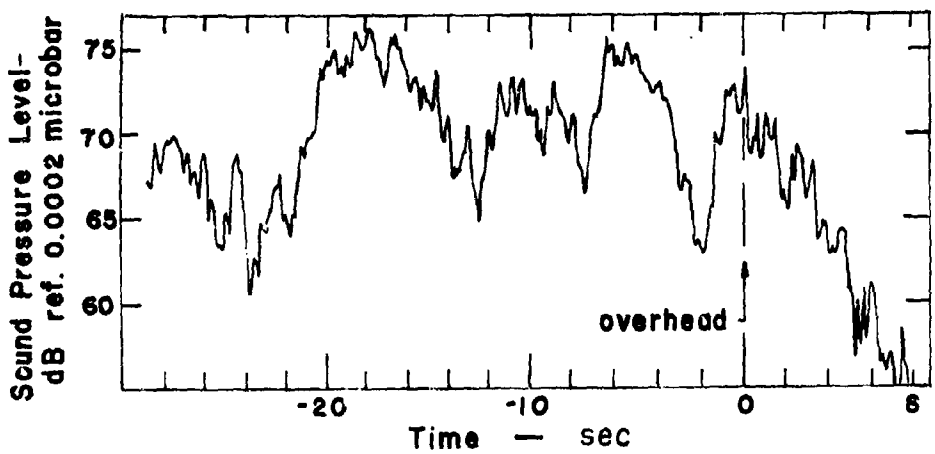


b. 31.5 Hz Octave

Figure 55. Octave Band Flyover Noise - 170 kt.

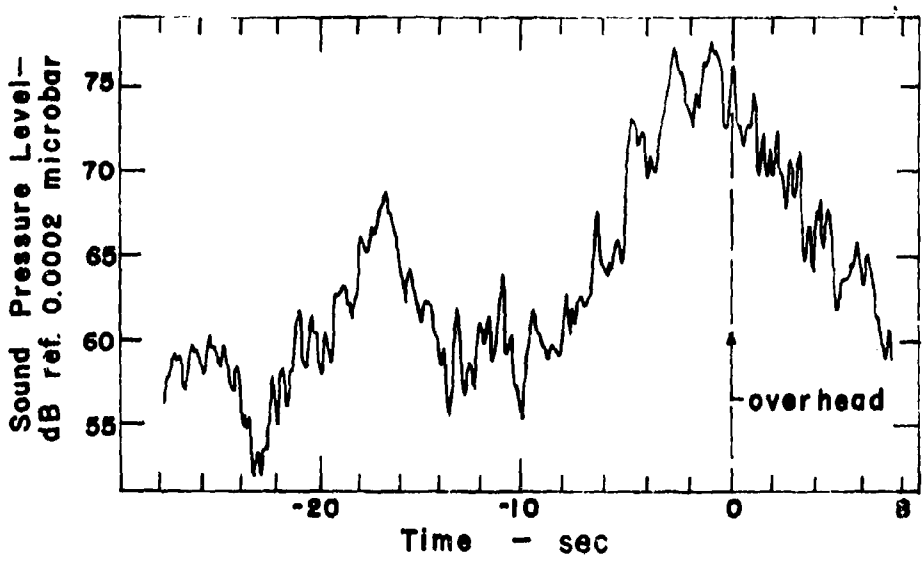


c. 63 Hz Octave

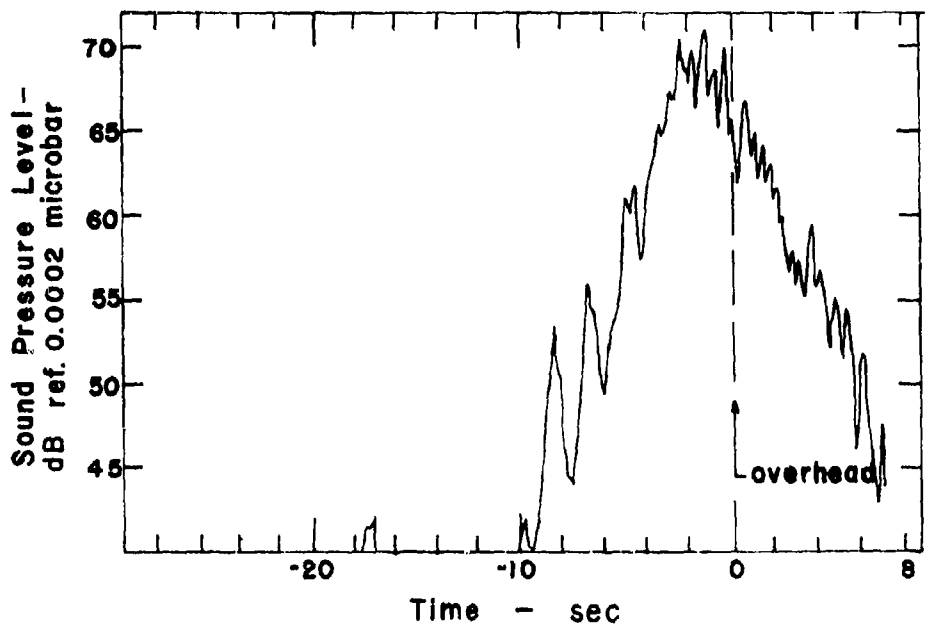


d. 125 Hz Octave

Figure 55. Continued.

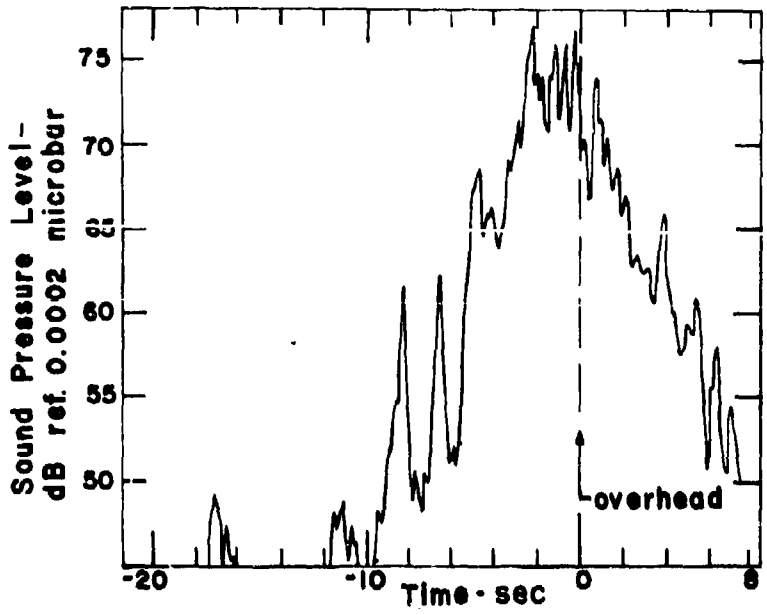


e. 250 Hz Octave

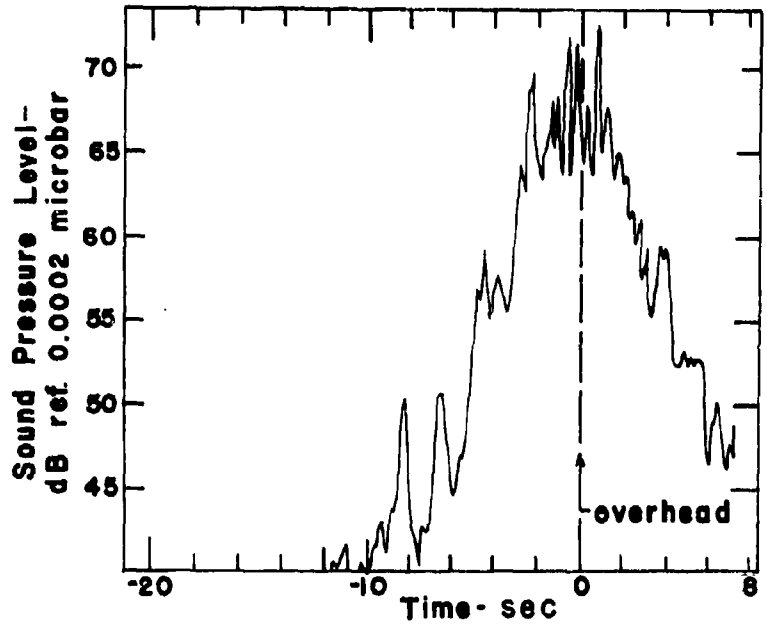


f. 500 Hz Octave

Figure 55. Continued.

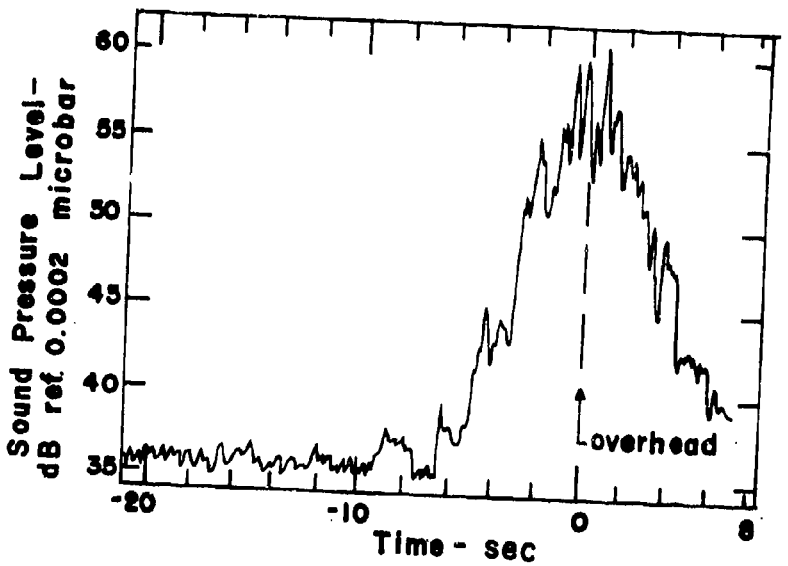


g. 1000 Hz Octave



h. 2000 Hz Octave

Figure 55. Continued.



i. 4000 Hz Octave

Figure 55. Concluded.

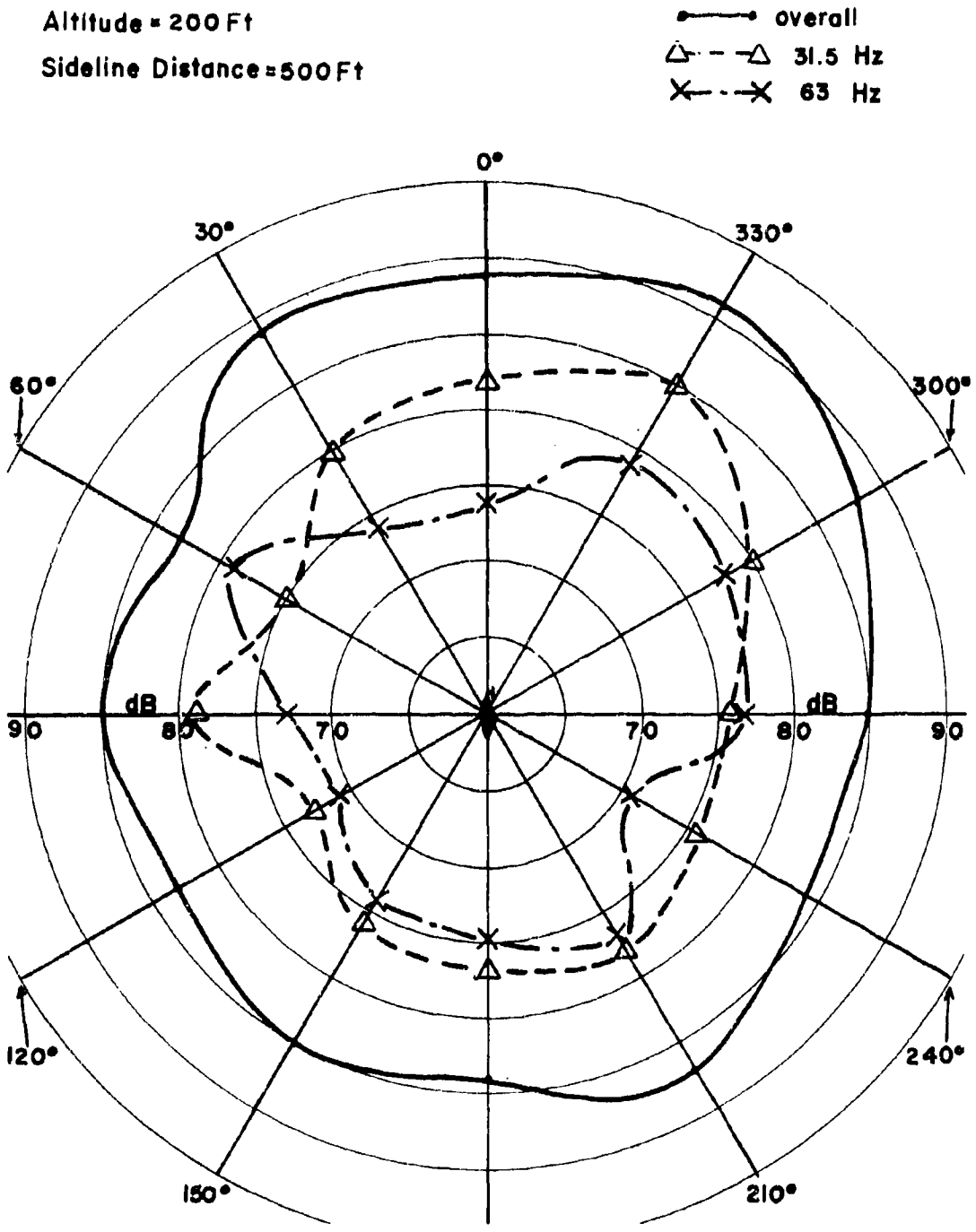


Figure 56. Octave Band Hover Noise Contours.

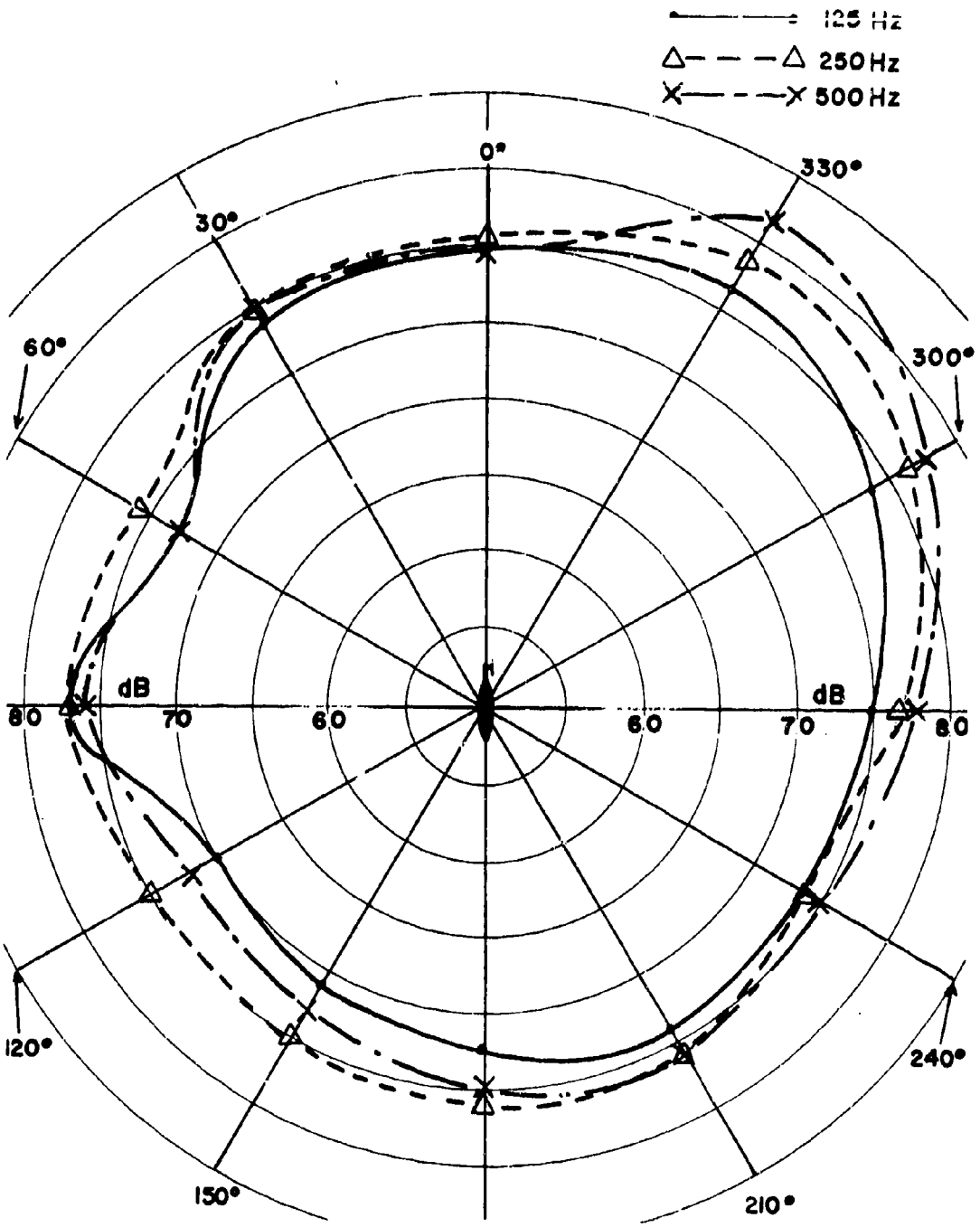


Figure 56. Continued.

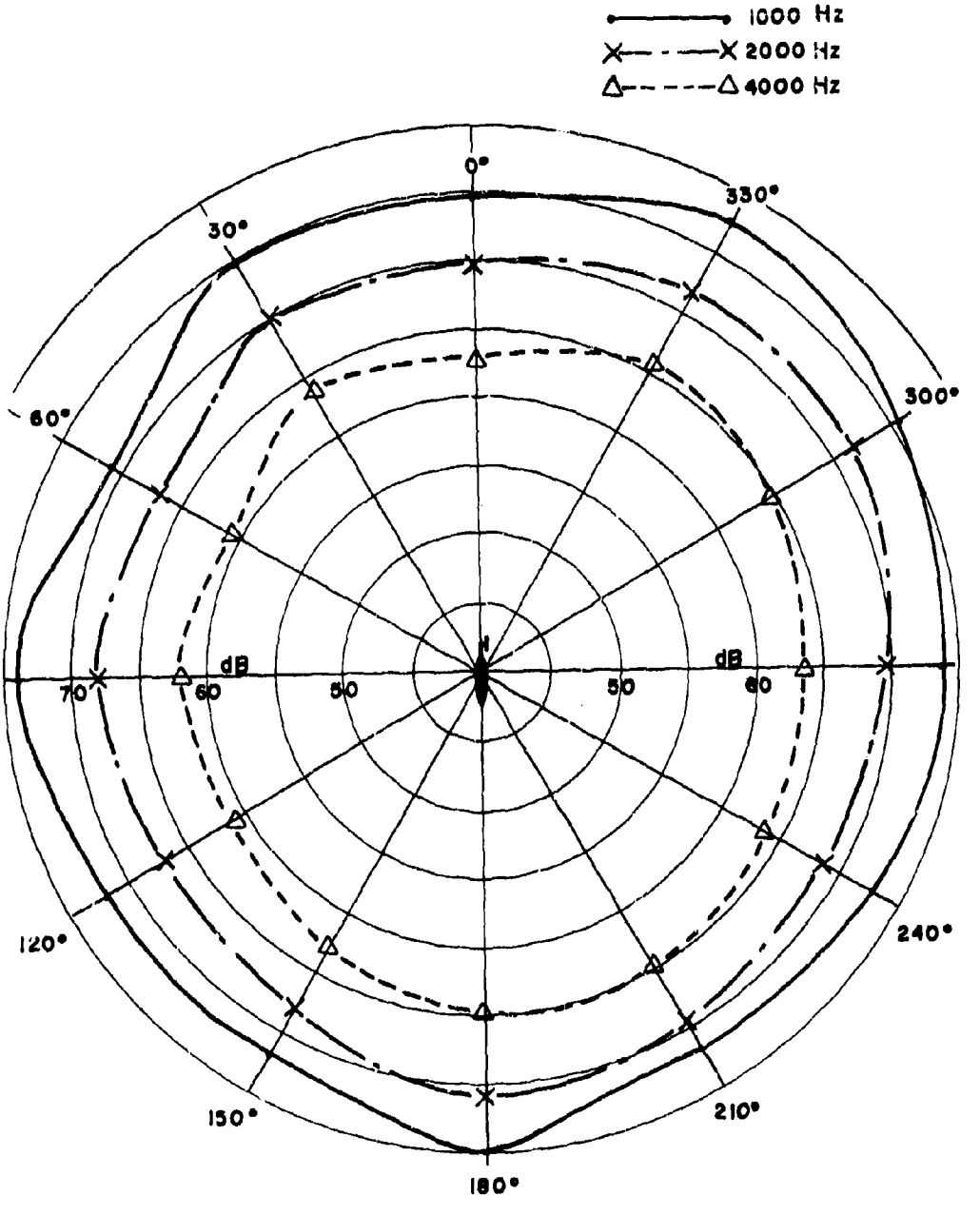


Figure 56. Concluded.

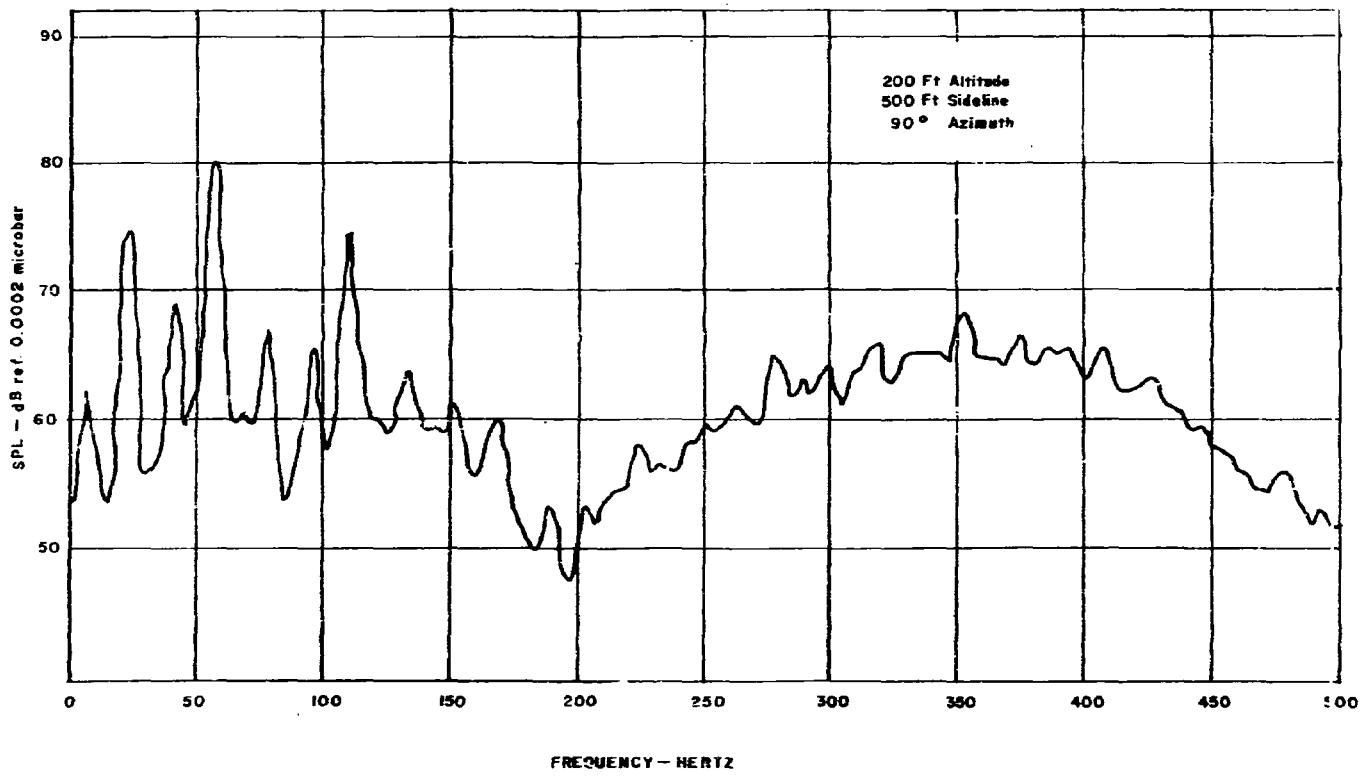


Figure 57. Narrow Bandwidth Spectrum (2.5 Hz) of CH-53A Hover Noise, No RIN.

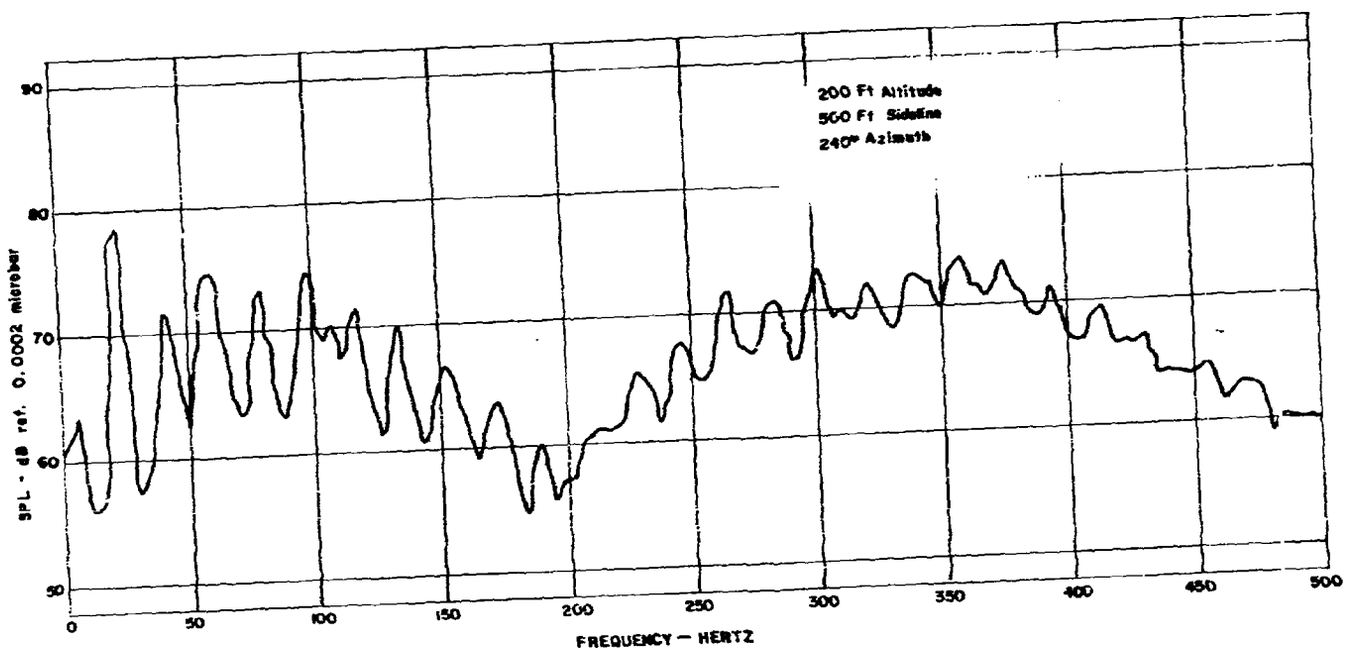


Figure 58. Narrow Bandwidth Spectrum (2.5 Hz) of CH-53A Hover Noise, RIN.

APPENDIX V

COMPUTER PROGRAM DESCRIPTION

The mechanics of a rotational noise prediction computer program are described in this appendix. Basic equations are presented in terms of engineering symbols, and names of variables used in the program are defined. User instructions, and hardware and software requirements are not repeated here since Appendix I contains this information.

V.1 Fundamental Equations

The notation of Sections I.2 through I.4 is used in the following equations. The acoustic pressure of harmonic m as a function of time is

$$P_m[t] = U_m \cos m\omega t + V_m \sin m\omega t$$

where ω is the blade passage frequency. Since acoustic data normally are root-mean-square quantities, the preceding equation is more readily used in the form

$$P_{m_{rms}} = \frac{1}{\sqrt{2}}\sqrt{U_m^2 + V_m^2}$$

which is the basis of sound pressure level of the mth harmonic in decibels given by

$$SPL_m = 20 \log_{10}\left[\frac{P_{m_{rms}}}{2.9 \times 10^{-9}}\right]$$

The constant (2.9×10^{-9}) is the acoustic reference pressure converted from microbar units to pound per square inch units.

The following equations trace the progression from u_m and v_m values back to the starting point of differential pressure c the rotor blades.

$$U_m = \frac{1}{4\pi}\int_0^{2\pi}\int_0^{R} b\, q_1 q_2\, r\, dr\, d\psi$$

$$V_m = \frac{1}{4\pi}\int_0^{2\pi}\int_0^{R} b\, q_1 q_3\, r\, dr\, d\psi$$

The factors q_1, q_2, and q_3 are given by

$$q_1 = [x - r\cos\psi]\left\{\cos\theta[\sin\beta\sin\psi - \cos\beta\sin\theta\cos\psi + \sin\theta\cos\beta\cos\phi]\right\}$$

$$- [y - r\sin\psi]\left\{\cos\beta\sin\phi\sin\psi + \sin\beta\cos\psi\right\}$$

$$+ z\left\{\cos\theta\cos\beta\cos\phi + \sin\theta[\cos\beta\sin\phi\cos\psi - \sin\beta\sin\psi]\right\}$$

$$q_2 = g_m\left(-\frac{\cos\eta}{s^3} - \frac{m\omega}{a_0 s^2}\sin\eta\right) + h_m\left(\frac{\sin\eta}{s^3} - \frac{m\omega}{a_0 s^2}\cos\eta\right)$$

$$q_3 = g_m\left(-\frac{\sin\eta}{s^3} + \frac{m\omega}{a_0 s^2}\cos\eta\right) + h_m\left(-\frac{\cos\eta}{s^3} - \frac{m\omega}{a_0 s^2}\sin\eta\right)$$

where

$$\eta = m\omega\left(\frac{\psi}{\Omega} + \frac{s}{a_0}\right)$$

and s, the distance from a point in the rotor disk to an observer, is

$$s = \sqrt{(x - r\cos\psi)^2 + (y - r\sin\psi)^2 + z^2}$$

The final link in the progression connects the g_m and h_m terms with the differential pressure $L(r, \psi)$ acting across the blade chord at radial station r and azimuthal blade location ψ.

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

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

Here, n is the number of rotor blades, b is the maximum thickness of the blade, and c is the length of the blade chord.

The present analysis assumes that b is not a function of radius and, therefore, may be treated as a constant term in all integrations.

Important correspondences between engineering symbols and the symbols used in the programmed equations are

g_m	=	GMAR, GMARI
h_m	=	HMAR, HMARI
s	=	S
rq_1	=	Q1
q_2Q1	=	Q2

$q_3 Q1$	=	Q3
u_m	=	UMF
v_m	=	VMF
$P_{m_{rms}}$	=	PMRMS
SPL_m	=	SPLM

V.2 Program Symbols

The following symbols are generated within the program and are used for the CARD or DRUM input modes (input modes are explained in Section I.5.4). Symbols used during the processing of raw data from analog tapes (TAPE input mode) are not included because the tape notation and format is unique to Sikorsky Aircraft, and inclusion of these particular symbols would not make the computer program any easier to review. Symbols for input data are described in Section I.5.4.

AZMTH(I)	Azimuth array 0 to 360 deg in 2.5-deg increments (I = 1 to 144)
AZMTH2(I)	Azimuth array 0 to 2π rad in $(2.5\pi/180)$ rad increments (I = 1 to 144)
AZMTH3(I)	Azimuth array every DPRAD radians from 0 to 2π, maximum I of 288
AZRAD	2.5° expressed in radians
AZ41(I)	Azimuth points I along the chord for a given nominal azimuth
B	Blade pitch angle
BEE	Equals "B" in Hollerith used to designate bottom of blade
BLADES	Number of blades
CHORD(I)	Chord station array used in the average quadratics integration to get airloads (I = chord)
CHORD2(I)	Interpolated chord station array used in integration of g_m (ψ , R) and h_m (ψ,R)
COSINE(I)	Cosine array defined every DPSI degrees

COSRN(I)	Cosine array whose elements are calculated at each instrumented chord station and used in calculating Fourier coefficients of acoustic airloads
DATA1(I, J,K)	Scaled and corrected average pressure cycles where: I = data point, J = chord, K = radial station
DEE	Equals "D" in Hollerith used to designate differential pressure
DPRAD	$\Delta\psi$ expressed in radians
DPSI1(I)	Differential pressure array along chard, used in averaged quadratics integration
FI(I,J)	Gaussian integration factors for radial station I and chord station J
FN(I)	Temporary array used to store airloads just before harmonic analysis
GMAR(I,K)	m^{th} cosine coefficient of acoustic pressure pulse where K = radial station, I = azimuthal station
GMARI(I,K)	m^{th} cosine coefficient of acoustic pressure pulse after interpolation. I = up to 288, K = 10 or 20
GPSI(I)	Differential pressure array along a chord, used in average quadratics integration
GPSI1(I)	Array used in integration of g_m (ψ,R) and h_m (ψ,R)
GPSI2(I)	Differential pressure array along a chord, used in average quadratics integration
HARMS	Array name for pitch and flapping angle harmonics used for DRUM input mode
HMAR(I,K)	m^{th} sine coefficient of acoustic pressure pulse where K = radial station, I = azimuthal station
HMARI(I,K)	m^{th} sine coefficient of acoustic pressure pulse after interpolation. I = up to 288, K = 10 or 20

IRS(I)	Instrumented radial station counter, counting from blade root. If station bad, then IRS(I) = 0
ISI	ISI = (DPSI/2.5) $\geq$ 1; if $\leq$ 0 then ISI = 1
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
LAZI	The number of aximuth stations as a result of interpolation. This is calculated knowing DPSI
LIRS	Number of good radial stations
NBLANK	Word with all blanks in it
NCH(I)	Total number of chord stations for radial position I
NCHAN(I,J)	Blade instrumented station designation for radial station I, chord station J. If = 0, then that station is not useable
NO	Control word used to check whether or not to execute an option
NOPTS1	Number of radial stations before interpolation (including end points .194 and 1.0) (up to 7)
NXY	Number of Gauss points and weights to be used
PI	PI = 3.14159
PI2	PI2 = 6.28318
PMRMS(I,J)	Sound pressure of harmonic I at field point J
POINT(15)	Gauss integration points (normalized)
Q1(I,J) Q2(I,J) Q3(I,J)	Functions used in a double integration, I = azimuth and J = span
S	Distance from element of rotor disk to field point
SINE(I)	Sine array defined every DPSI degrees

SINRN(I)	Sine array calculated for each instrumented chord station and used in Fourier analysis of acoustic airloads
SPAN(L)	Radial stations used in a double integration, L = 1 to 20
SPLM(I,J)	Sound pressure level of harmonic I at field point J
TEE	Equals "T" in Hollerith used to designate top of blade
TEM1(I) TEM2(I)	Temporary arrays used in Fourier analysis subroutine arguments
TEMP1(I) TEMP2(I) TEMP3(I)	Temporary work arrays used in the interpolation of GMAR and HMAR
UMF(I,J) VMF(I,J)	Components of sound pressure, I = harmonic order, J = field point number
W(I)	Temporary work array, I = 1,14
WPOINT(I)	Gauss integration weights, I = 1,15
XLM(I,J)	Cosine component of section loading harmonic J at radial station I
XMM(I,J)	Sine component of section loading harmonic J at radial station I
XLO(I)	Steady component of section loading at radial station I
XO(I)	Array used in interpolation routine
YES	Control word used to check whether or not to execute an option
YO(I)	Array used in interpolation routine

V.3 Program Logic and Subroutine Names

The general flow of operations in the program is as follows for the CARD input mode.

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 (airload, pounds per inch of span) by integrating the differential pressures across the chord at each span station. A trapezoidal integration routine is used. If E386 is not desired, skip to Step 4.

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). If noise based on the actual chordwise distribution is not desired, skip to Step 12.

5. Calculate GMAR and HMAR for a particular noise harmonic and store them on magnetic tape via I/O unit 14.

6. Interpolate GMAR and HMAR if 288 azimuthal and/or 20 radial points are desired. This interpolation produces GMARI and HMARI.

7. Calculate Q arrays for the first field point.

8. Calculate UMF and VMF components of acoustic 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).

Steps 1 through 5 are omitted when the DRUM input mode is used. The GMAR and HMAR coefficients stored on tape are read into the memory of the computer, and calculations begin with the interpolation to produce GMARI and HMARI.

Subroutines called by the main program, E676, are listed below. System subroutines, such as COS, SIN, ALOG10, NTRAN, etc., are not mentioned. Sequence codes are explained in Section V.4.

AVQUAD	Performs integration by averaged quadratics based on Lagrange interpolation; sequence code is L76A.
BLODAT	BLOCK DATA subroutine; sequence code is L76B.
CUBIC	Subroutine used by CURVIT; sequence code is L76F.

CUE	Calculates an array (Q1, Q2,Q3) which is a function of azimuth, radius and observer location. A double integration of this variable yields the sound pressure components u_m and v_m; sequence code is L76C.
CURVIT	Cubic interpolation subroutine; sequence code is L76V.
DFSRIE	Computes the coefficients of a Fourier series; sequence code is L76D.
E386RN	Calculates SPL based on a rectangular chordwise distribution of pressure; sequence code is L76E.
INPUTA	Reads and prints out card input; sequence code is L76I.
INTERP	Linearly interpolates pressure pulse harmonics up to 20 blade span stations and 288 azimuths; sequence code is L76P.
OUTSPL	Output subroutine; sequence code is L76O.
PARAM	Subroutine used by CURVIT: sequence code is L76X.
SIMCOR	Simpson's integration boutine; sequence code is L76S.
TRIDAG	Subroutine ed by CURVIT; sequence code is L76T.

The next three subroutines are used to process aerodynamic data contained on digital tape.

MERGES	Combines the absolute pressure of the instrumented top and bottom blade stations, to produce only differential pressures for all blade stations; sequence code is L76G.
RDKU	Reads in one record from the proper input tape, where two records make up one azimuthal pressure cycle; sequence code is L76R.
UNPACK	Unpacks an array containing tape information (two records) into separate arrays representing azimuthal pressure cycles for each pressure transducer channel; sequence code is L76U.

V.4 Program Listing

Figures 59 and 60 contain a listing of the source deck of the computer program. The last 8 columns of the 80-column cards have been used to sequence the deck. The first 4 characters of a sequence number identify a

statement with a specific subroutine or with the main program, and the last 4 characters locate the statement serially within the appropriate area of the program. Symbols are defined in Sections I.5.4 and V.2.

```
@I  FOR  E676                                                           00001
C ROTOR NOISE PROGRAM FOR W. BAUSCH BY G. CAMPE.                        L76M0010  00002
      COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,  L76M0020  00003
     * MLIMDP,XFP(20),YFP(20),ZFP(20),GAMA,RO,BLADEL,BO,B1C,B1S,PUNCH,  L76M0030  00004
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,    L76M0040  00005
     * IRS(5),ITRACK(5),F1(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,    L76M0050  00006
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,HCH(5),INTERM,    L76M0060  00007
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,   L76M0070  00008
     * NOCH(5),LAZI                                                     L76M0080  00009
      COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,      L76M0090  00010
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XLM(7),XLM(7,40),L76M0100  00011
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),  L76M0110  00012
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,DEE,DEE,GMARI(288,20),             L76M0120  00013
     * HMARI(288,20),XO(20)                                             L76M0130  00014
      COMMON /BK3/ SPLM(10,20),AZMTH3(288),                             L76M0140  00015
     * SPAN(20),                          PHRMS(10,20),                L76M0150  00016
     * ICHANL(10,5),COSINE(288),SINE(288),BLADES,CARD,TAPE              L76M0160  00017
      INTEGER TCOP,CARD,TAPE,E3860P,OPRONO,YES                          L76M0170  00018
      DIMENSION ID(10)                                                  L76M0180  00019
      DATA ID/'H1','H2','H3','H4','H5','H6','H7','H8','H9','H10'/       L76M0190  00020
      COMMON /TEMPUS/ TIME,COUNT                                        L76M0200  00021
      DIMENSION DATA1(144,10,5),DATA2(144,10,5),FN(144),CHORD(7),       L76M0210  00022
     * GPSI(7),GPSI1(7),TEM1(30),TEM2(30),CHORD2(41),GPSI2(41),GPSI3(41)L76M0220  00023
     *,COSRN(41),SINRN(41)                                              L76M0230  00024
      EQUIVALENCE (ND1,DATA1),(ND2,DATA2),(NN,FN),(TEMP1,CHORD),        L76M0240  00025
     * (TEMP2,GPSI),(TEMP3,GPSI1)                                       L76M0250  00026
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),          L76M0260  00027
     * GMAR(144,5),HMAR(144,5)                                          L76M0270  00028
     * ,Q1(288,20),Q2(288,20)                                           L76M0280  00029
      EQUIVALENCE    (ND2(5761),HMAR),                                  L76M0290  00030
     $               (GMARI,AN),                                        L76M0300  00031
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN),(ND2,Q2)             L76M0310  00032
      EQUIVALENCE (ND1(5761),GMAR),(ND1,Q1)                             L76M0320  00033
      DIMENSION AZ41(41)                                                L76M0330  00034
      DIMENSION DBI(289)                                                L76M0340  00035
      EQUIVALENCE (DBI,SINE)                                            L76M0350  00036
      COMMON /NEW/ F0,F1C,F1S,TOTIME,THETA                              L76M0360  00037
      DIMENSION XU(10,20),XV(10,20),P(41),COSARG(41,20),SINARG(41,20)   L76M0370  00038
      DIMENSION HARMS(6),BHARM(3),FHARM(3)                              L76M0380  00039
      EQUIVALENCE (B0,BHARM),(F0,FHARM)                                 L76M0390  00040
      NTIME=41                                                          L76M0400  00041
      MSTART=1                                                          L76M0410  00042
      CALL INPUTA                                                       L76M0420  00043
      IF(TCOP.NE.TAPE) GO TO 199                                        L76M0430  00044
      REWIND 8                                                          L76M0440  00045
      REWIND 9                                                          L76M0450  00046
      REWIND 10                                                         L76M0460  00047
      REWIND 11                                                         L76M0470  00048
      REWIND 12                                                         L76M0480  00049
      REWIND 13                                                         L76M0490  00050
  199 LIRS = 0                                                          L76M0500  00051
      PI = 3.14159265                                                   L76M0510  00052
      DO 1 I=1,5                                                        L76M0520  00053
      IF(IRS(I).NE.0) LIRS = LIRS+1                                     L76M0530  00054
    1 CONTINUE                                                          L76M0540  00055
      DPRAD = DPSI*6.28318531/360.                                      L76M0550  00056
      AZRAD = (2.5*PI)/180.                                             L76M0560  00057
      AZMTH(1) = 0.                                                     L76M0570  00058
      AZMTH2(1) = 0.                                                    L76M0580  00059
      DO 2 I=2,144                                                      L76M0590  00060
      AZMTH2(I) = AZMTH2(I-1)+AZRAD                                     L76M0600  00061
    2 AZMTH(I)  = AZMTH(I-1)+2.5                                        L76M0610  00062
      PI2 = 6.283185                                                    L76M0620  00063
      AZMTH3(1)=0.                                                      L76M0630  00064
      COSINE(1)=1.                                                      L76M0640  00065
```

Figure 59. Main Program E676.

```
      SINE(1)=0.                                                        L76M0650  00066
      T1=(PI2/DPRAD)+.001                                               L76M0660  00067
      J=T1                                                              L76M0670  00068
      IF(J.LE.288) GO TO 211                                            L76M0680  00069
      WRITE(6,212)                                                      L76M0690  00070
  212 FORMAT(1H1, 63HTHE DIMENSION OF AZMTH3 HAS BEEN EXCEEDED AT STATEMLL76M0700  00071
     * *ENT NO. 211      )                                              L76M0710  00072
      WRITE(6,35) (AZMTH3(L),L=1,288)                                   L76M0720  00073
      WRITE(6,35)PI2                                                    L76M      00074
      STOP                                                              L76M0730  00075
  211 DO 4 LAZI=2,J                                                     L76M0740  00076
      AZMTH3(LAZI) = AZMTH3(LAZI-1)+DPRAD                               L76M0750  00077
      COSINE(LAZI) = COS(AZMTH3(LAZI))                                  L76M0760  00078
    4 SINE(LAZI)   = SIN(AZMTH3(LAZI))                                  L76M0770  00079
      IF(IDD.NE.1) GO TO 210                                            L76M0780  00080
      WRITE(6,213)                                                      L76M0790  00081
  213 FORMAT(1H1,11HAZMTH3(288))                                        L76M0800  00082
      WRITE(6,35) (AZMTH3(L),L=1,288)                                   L76M0810  00083
  210 BLADES = NOLADE                                                   L76M0620  00084
      T1 = 1./41.                                                       L76M0830  00085
      CHORD2(1) = 0.                                                    L76M0840  00086
      DO 6 L=2,40                                                       L76M0850  00087
    6 CHORD2(L) = CHORD2(L-1) + T1                                      L76M0855  00088
C                                                                       L76M0860  00089
C *** A LONG LOOP ON BURSTS IS NEXT.                                    L76M0870  00090
    7 IF(IDD.NE.1) GO TO 9300                                           L76M0880  00091
      CALL START                                                        L76M0890  00092
 9300 IF(TCOP.EQ.CARD) GO TO 10                                         L76M0900  00093
C                                                                       L76M0907  00094
C  CARD  L76M0910  BRANCHES TO STATEMENT 57  IF DRUM INPUT REQUESTED    L76M0908  00095
C                                                                       L76M0909  00096
C     IF (TCOP .EQ. 'DRUM')  GO TO 57                                   L76M0910  00097
      READ(5,8) IBURST                                                  L76M0920  00098
C GET START OF BURST TIME                                               L76M0930  00099
    8 FORMAT( 11X,I3 )                                                  L76M0940  00100
C                                                                       L76M0950  00101
C *** A CHOISE I MADE NEXT (OPTION) TO EITHER  ACEPT TAPE OR CARD INPUT.L76M0960  00102
      DO 9 I=1,144                                                      L76M0970  00103
      DO 9 J=1,10                                                       L76M0980  00104
      DO 9 K=1,5                                                        L76M0990  00105
    9 ND2(I,J,K) = 0                                                    L76M1000  00106
C                                                                       L76M1010  00107
C *** LOOP ON TAPE REELS FOLLOWS.                                       L76M1020  00108
      DO 11 IREEL=1,IREELS                                              L76M1030  00109
      KU = KUNIT(IREEL)                                                 L76M1040  00110
      IF(IDD.EQ.1)                                                      L76M1050  00111
     XWRITE(6,231) IREEL,KU                                             L76M1060  00112
   12 CALL RDKU(1)                                                      L76M1070  00113
      IF(IBURST.NE.KBURST) GO TO 12                                     L76M1080  00114
      IF(IDD.EQ.1)                                                      L76M1090  00115
     XWRITE(6,231) IREEL,KU,KREC,KBURST,KTRACK                          L76M1100  00116
      GO TO (13,13,13,13,13,13,13,13,14,15,16,17),KU                    L76M1110  00117
   13 BACKSPACE 8                                                       L76M1120  00118
      GO TO 18                                                          L76M1130  00119
   14 BACKSPACE 9                                                       L76M1140  00120
      GO TO 18                                                          L76M1150  00121
   15 BACKSPACE 10                                                      L76M1160  00122
      GO TO 18                                                          L76M1170  00123
   16 BACKSPACE 11                                                      L76M1180  00124
      GO TO 18                                                          L76M1190  00125
   17 BACKSPACE 12                                                      L76M1200  00126
      BACKSPACE 13                                                      L76M1210  00127
   18 NCYCLE = 0                                                        L76M1220  00128
C *** THE FIRST CYCLE IN BURST IBURST IS READ.                          L76M1230  00129
      CALL RDKU(1)                                                      L76M1240  00130
      CALL RDKU(2)                                                      L76M1250  00131
```

Figure 59. Continued.

```
      KB = KBURST                                                       L76M1260  00132
      GO TO 19                                                          L76M1270  00133
C *** THE REMAINING CYCLES IN BURST IBURST ARE READ AND AVERAGED.        L76M1280  00134
   20 CALL RDKU(1)                                                      L76M1290  00135
      IF(KBURST.NE.KB) GO TO 21                                         L76M1300  00136
      CALL RDKU(2)                                                      L76M1310  00137
      IF(KBURST.NE.KB) GO TO 21                                         L76M1320  00138
C                                                                       L76M1330  00139
C *** SUBR. UNPACK UNPACKS NN(435) TO FORM ND1(I,J,K) WHERE I=DATA POINTL76M1340  00140
C *** J=CHANNEL, K=REEL NO.                                             L76M1350  00141
   19 CALL UNPACK                                                       L76M1360  00142
      NCYCLE = NCYCLE+1                                                 L76M1370  00143
C *** CHANNEL LOOP                                                      L76M1380  00144
      K = NOCH(IREEL)                                                   L76M1390  00145
      DO 22 J=1,K                                                       L76M1400  00146
      NC = ICHANL(J,IREEL)                                              L76M1410  00147
      IF(IDD-1) 234,236,234                                             L76M1420  00148
  236 IF(IREEL-1) 234,235,234                                           L76M1430  00149
  235 IF(IDD.EQ.1)                WRITE(6,231) NCYCLE,K,NC,ND1(1,NC,IREEL76M1440  00150
     X  L)                                                              L76M1450  00151
  234 CONTINUE                                                          L76M1460  00152
  231 FORMAT(4I13)                                                      L76M1470  00153
      DO 22 I=1,144                                                     L76M1480  00154
      ND2(I,NC,IREEL) = ND2(I,NC,IREEL) + ND1(I,NC,IREEL)               L76M1490  00155
   22 CONTINUE                                                          L76M1500  00156
      GO TO 20                                                          L76M1510  00157
C *** AT THIS POINT THE END OF BURST HAS BEEN REACHED.                  L76M1520  00158
   21 GO TO (27,23,23,23,23,23,23,23,24,25,26,27),KU                    L76M1530  00159
   23 BACKSPACE 8                                                       L76M1540  00160
      GO TO 28                                                          L76M1550  00161
   24 BACKSPACE 9                                                       L76M1560  00162
      GO TO 28                                                          L76M1570  00163
   25 BACKSPACE 10                                                      L76M1580  00164
      GO TO 28                                                          L76M1590  00165
   26 BACKSPACE 11                                                      L76M1600  00166
      GO TO 28                                                          L76M1610  00167
   27 BACKSPACE 12                                                      L76M1620  00168
      BACKSPACE 13                                                      L76M1630  00169
   28 CYCLES = NCYCLE                                                   L76M1640  00170
C *** THE AVERAGE CYCLES ARE FOUND NEXT.                                L76M1650  00171
      K = NOCH(IREEL)                                                   L76M1660  00172
      DO 29 J=1,K                                                       L76M1670  00173
      NC = ICHANL(J,IREEL)                                              L76M1680  00174
      DO 29 I=1,144                                                     L76M1690  00175
      T1 = ND2(I,NC,IREEL)                                              L76M1700  00176
   29 DATA2(I,NC,IREEL) = T1/CYCLES.                                    L76M1710  00177
   11 CONTINUE                                                          L76M1720  00178
C *** FILTER ROLL OFF CORRECTION AND TAPE DATA SCALING FOLLOWS.         L76M1730  00179
      DO 30 IREEL=1,IREELS                                              L76M1740  00180
      K = NOCH(IREEL)                                                   L76M1750  00181
      DO 30 J=1,K                                                       L76M1760  00182
      NC = ICHANL(J,IREEL)                                              L76M1770  00183
      DO 31 I=1,144                                                     L76M1780  00184
   31 FN(I) = DATA2(I,NC,IREEL)                                         L76M1790  00185
      CALL DFSRIE (144,MLIMDP,FN,TEM1,TEM2)                             L76M1800  00186
      AN(1,NC,IREEL) = TEM1(1)                                          L76M1810  00187
      DO 32 I=1,MLIMDP                                                  L76M1820  00188
      AN(I+1,NC,IREEL) = TEM1(I+1)                                      L76M1830  00189
   32 BN(I,NC,IREEL) = TEM2(I+1)                                        L76M1840  00190
      IF(IDD.NE.1) GO TO 30                                             L76M1850  00191
      WRITE(6,33) IREEL,NC,(FN(NAZ),NAZ=1,144)                          L76M1860  00192
   33 FORMAT(1H0, 5HREEL=,I3, 7X, 8HCHANNEL=, I3, 7X, 35HAVE, CYCLE AND L76M1870  00193
     1ITS HARMONICS FOLLOW // (2X,1PE10.3,12E10.3) )                    L76M1880  00194
      I=MLIMDP+1                                                        L76M1890  00195
      WRITE(6,34) (AN(L,NC,IREEL),L=1,I)                                L76M1900  00196
      WRITE(6,35) (BN(L,NC,IREEL),L=1,MLIMDP)                           L76M1910  00197
```

Figure 59. Continued.

```
   34 FORMAT(1H0,1X,1PE10.3 / (2X,13E10.3))                          L76M1920  00198
   35 FORMAT( /  (2X,1PE10.3,12E10.3))                               L76M1930  00199
   30 CONTINUE                                                       L76M1940  00200
      DO 36 IREEL=1,IREELS                                           L76M1950  00201
      IF(IDD.EQ.1) WRITE(6,40) IREEL                                 L76M1960  00202
   40 FORMAT(1H0,10HREEL NO. =,I3,10X, 77HAVE. PRESSURE CYCLE HARMONICS L76M1970  00203
     X(CORRECTED FOR FILTER ROLL-OFF AND ENGR. UNITS)  )             L76M1980  00204
      K=NOCH(IREEL)                                                  L76M1990  00205
      DO 36 J=1,K                                                    L76M2000  00206
      NC = ICHANL(J,IREEL)                                           L76M2010  00207
      AN(1,NC,IREEL) = AN(1,NC,IREEL)*SLOPE(NC,IREEL)+OFFSET(NC,IREEL) L76M2020  00208
      DO 37 I=1,MLIMDP                                               L76M2030  00209
      T1 = FROC(I)*SLOPE(NC,IREEL)                                   L76M2040  00210
      AN(I+1,NC,IREEL) = AN(I+1,NC,IREEL)*T1                         L76M2050  00211
   37 BN(I,NC,IREEL) = BN(I,NC,IREEL)*T1                             L76M2060  00212
      IF(IDD.NE.1) GO TO 36                                          L76M2070  00213
      WRITE(6,38)  NC,AN(1,NC,IREEL),(AN(I+1,NC,IREEL),I=1,MLIMDP)   L76M2080  00214
   38 FORMAT(1X,  8HCHANNEL=,I3,5X, 11(1PE10.3) /  (27X,10E10.3 / ) ) L76M2090  00215
      WRITE(6,39) (BN(I,NC,IREEL),I=1,MLIMDP)                        L76M2100  00216
   39 FORMAT( 27X,10(1PE10.3) / (27X,10E10.3) )                      L76M2110  00217
   36 CONTINUE                                                       L76M2120  00218
C *** THE FOLLOWING SUBR. COMBINES THE TOP AND BOTTOM ABSOLUTE PRESSURE L76M2130  00219
C    COEFFICIENT                                                     L76M2140  00220
C      TO PRODUCE DIFFERENTIAL PRESS. COEFF.  CN(31,5,5), SN(30,5,5)WHERE L76M2150  00221
C      FIRST SUBS. = HARMONIC, SECOND SUBS. = CHORD, THIRD SUBS. = SPAN. L76M2160  00222
C      BLADE PITCH HARMONICS, B0,B1C,B1S  ARE ALSO CALCULATED.         L76M2170  00223
      CALL MERGES                                                    L76M2180  00224
      IF(IDD.NE.1) GO TO 240                                         L76M2190  00225
      DO 239 I=1,5                                                   L76M2200  00226
      DO 239 J=1,5                                                   L76M2210  00227
      WRITE(6,47) CN(1,J,I)                                          L76M2220  00228
      WRITE(6,47) (CN(K+1,J,I),K=1,MLIMDP)                           L76M2230  00229
  239 WRITE(6,47) (SN(K,J,I),K=1,MLIMDP)                             L76M2240  00230
C *** NOW THE DIFFERENTIAL PRESSURE FOURIER COEFFICIENTS OF THE AVERAGE L76M2250  00231
C       CYCLES IS PUNCHED OUT.                                        L76M2260  00232
C       CYCLES IS PUNCHED OUT.                                        L76M2270  00233
      IF(PUNCH.NE.YES) GO TO 41                                      L76M2280  00234
  240 WRITE(7,42) IBURST                                             L76M2290  00235
   42 FORMAT( 11HBURST NO. =,I3,11X, 34H*** ROTOR NOISE PUNCHED OUTPUT *L76M2300  00236
     X**)                                                            L76M2310  00237
      WRITE (7,43) B0,B1C,B1S,F0,F1C,F1S                             L76M2320  00238
   43 FORMAT('BLADE PITCH HARMONICS'/1P3E10.4,2X'(COLLECTIVE, LONGITUDINL76M2330  00239
     $AL, LATERAL RESPECTIVELY)'/'ROTOR FLAPPING ANGLE HARMONICS'/1P3E10L76M2340  00240
     $.4,2X'(POSITIVE TAIL HIGH -- DEGREES)')                        L76M2350  00241
      WRITE (7,431)                                                  L76M2360  00242
  431 FORMAT(                          'DIFFERENTIAL PRESSURE HARMOL76M2370  00243
     $NICS FOR 5 CHORD STATIONS AT EACH OF THE 5 SPANS'/'(MEASURING FROML76M2380  00244
     $ THE LEADING EDGE AND THE BLADE ROOT RESPECTIVELY).' )         L76M2390  00245
C *** SPAN LOOP                                                      L76M2400  00246
      DO 44 I=1,5                                                    L76M2410  00247
C *** CHORD LOOP                                                     L76M2420  00248
      DO 44 J=1,5                                                    L76M2430  00249
      WRITE(7,49) I,J,CN(1,J,I)                                      L76M2440  00250
   49 FORMAT( 4HSPAN,I2,2X, 5HCHORD,I2,7X, 8HSTEADY= , 1PE10.4 )     L76M2450  00251
      WRITE(7,45)                                                    L76M2460  00252
   45 FORMAT( 19HCOSINE COEFFICIENTS )                               L76M2470  00253
   47 FORMAT(  8(1PE10.4) )                                          L76M2480  00254
      WRITE(7,47) (CN(K+1,J,I),K=1,MLIMDP)                           L76M2490  00255
      WRITE(7,48)                                                    L76M2500  00256
   48 FORMAT( 17HSINE COEFFICIENTS )                                 L76M2510  00257
   44 WRITE(7,47) (SN(K,J,I),K=1,MLIMDP)                             L76M2520  00258
      GO TO 41                                                       L76M2530  00259
C *** CARD INPUT (INSTEAD OF TAPE INPUT) IS ACCEPTED NEXT.           L76M2540  00260
   10 READ(5,42) IBURST                                              L76M2550  00261
      READ (5,43) B0,B1C,B1S,F0,F1C,F1S                              L76M2560  00262
      READ (5,431)                                                   L76M2570  00263
```

Figure 59. Continued.

```
C *** SPAN LOOP                                                         L76M2580  00264
      DO 50 I=1,5                                                       L76M2590  00265
C *** CHORD LOOP                                                        L76M2600  00266
      DO 50 J=1,5                                                       L76M2610  00267
      READ(5,49) IN,JN,CN(1,JN,IN)                                      L76M2620  00268
      READ(5,45)                                                        L76M2630  00269
      READ(5,47) (CN(K+1,J,I),K=1,MLIMDP)                               L76M2640  00270
      READ(5,48)                                                        L76M2650  00271
   50 READ(5,47) (SN(K,J,I),K=1,MLIMDP)                                 L76M2660  00272
C *** AVERAGE DIFFERENTIAL PRESSURE CYCLES FOR SPAN I CHORD J AZIMUTH K L76M2670  00273
C     FOUND BY SUMMING THE CORRECTED HARMONICS.                         L76M2680  00274
C *** SPAN LOOP                                                         L76M2690  00275
C A) THIS POINT THE PRESSURE INPUT HAS BEEN ACCEPTED (TAPE OR CARD INPUTL76M2700  00276
   41 CONTINUE                                                          L76M2710  00277
      DO 120 I=1,3                                                      L76M2720  00278
      HARMS(I)=BHARM(I)                                                 L76M2730  00279
  120 HARMS(I+3)=FHARM(I)                                               L76M2740  00280
C                                                                       L76M2747  00281
C  CARD  L76M2750  STORES  BLADE  ANGLE  HARMONICS  ON  DRUM            L76M2748  00282
C                                                                       L76M2749  00283
C     CALL DATCUR ('HARMS',0,14,HARMS,6)                                L76M2750  00284
      IF(IDD.NE.1) GO TO 9301                                           L76M2760  00285
      CALL CLOCK                                                        L76M2770  00286
 9301 DO 51 I=1,5                                                       L76M2780  00287
C *** CHORD LOOP                                                        L76M2790  00288
      DO 51 J=1,5                                                       L76M2800  00289
      T1 = -AZRAD                                                       L76M2810  00290
C *** AZIMUTH (POINT) LOOP                                              L76M2820  00291
      DO 51 K=1,144                                                     L76M2830  00292
      DATA1(K,J,I) = CN(1,J,I)                                          L76M2840  00293
      T1 = T1+AZRAD                                                     L76M2850  00294
      T3 = 0.                                                           L76M2860  00295
C *** HARMONIC LOOP                                                     L76M2870  00296
      DO 51 L=1,MLIMDP                                                  L76M2880  00297
      T3 = T3+1.                                                        L76M2890  00298
      T2 = T1*T3                                                        L76M2900  00299
   51 DATA1(K,J,I) = DATA1(K,J,I)+CN(L+1,J,I)*COS(T2)+SN(L,J,I)*SIN(T2) L76M2910  00300
      WRITE(6,54)                                                       L76M2920  00301
   54 FORMAT(1H1,59HDIFFERENTIAL PRESSURE CYCLES AT INSTRUMENTED BLADE SL76M2930  00302
     XTATIONS // )                                                      L76M2940  00303
      DO 53 I=1,5                                                       L76M2950  00304
      DO 53 J=1,5                                                       L76M2960  00305
      WRITE(6,55) I,J                                                   L76M2970  00306
   55 FORMAT(1H0, 12HSPAN STATION,I3,5X,13HCHORD STATION, I3//)         L76M2980  00307
   53 WRITE(6,56) (DATA1(K,J,I),K=1,144)                                L76M2990  00308
   56 FORMAT( 2X,10(1PE13.4) )                                          L76M3000  00309
C *** THE FOLLOWING INPUT OPTION DESIDES WHETHER OR NOT TO CALL THE ACOUL76M3010  00310
C     STICS PROGRAM E386 WHICH IS A SIMPLIFIED VERSION OF THIS PROGRAM. L76M3020  00311
   52 IF(E386OP.NE.YES) GO TO 57                                        L76M3030  00312
      KK = 1                                                            L76M3040  00313
      XLO(1) = 0.                                                       L76M3050  00314
      DO 9501 J=1,NHH                                                   L76M3060  00315
      XLM(1,KK) = 0.                                                    L76M3070  00316
 9501 XMM(1,KK) = 0.                                                    L76M3080  00317
C *** RADIAL STATION LOOP                                               L76M3090  00318
      DO 58 I=1,5                                                       L76M3100  00319
      KK = KK+1                                                         L76M3110  00320
      IF(IRS(I).EQ.0) GO TO 58                                          L76M3120  00321
      IF(NCH(I).EQ.5) GO TO 59                                          L76M3130  00322
      NT1 = NCH(I)+2                                                    L76M3140  00323
      K=1                                                               L76M3150  00324
      CHORD(1) = 0.                                                     L76M3160  00325
      DO 60 L=1,5                                                       L76M3170  00326
      IF(NCHAN(I,L).EQ.0) GO TO 60                                      L76M3180  00327
      K=K+1                                                             L76M3190  00328
      CHORD(K)=XA(L,I)                                                  L76M3200  00329
```

Figure 59. Continued.

```
   60 CONTINUE
      CHORD(K+1)=1.                                                     L76M3210  00330
      GPSI(1)=0.                                                        L76M3220  00331
      DO 61 J=1,144                                                     L76M3230  00332
      K=1                                                               L76M3240  00333
      DO 62 L=1,5                                                       L76M3250  00334
      IF(HCHAN(1,L).EQ.0) GO TO 62                                      L76M3260  00335
      K=K+1                                                             L76M3270  00336
      GPSI(K) = DATA1(J,L,I)                                            L76M3280  00337
   62 CONTINUE                                                          L76M3290  00338
      GPSI(K+1) = 0.                                                    L76M3300  00339
      CALL AVQUAD(NT1,CHORD,GPSI,AREA)                                  L76M3310  00340
   61 FN(J) = AREA*AA                                                   L76M3320  00341
      GO TO 63                                                          L76M3330  00342
   59 DO 64 J=1,144                                                     L76M3340  00343
      FN(J) = 0.                                                        L76M3350  00344
      DO 65 L=1,5                                                       L76M3360  00345
   65 FN(J) = FN(J)+DATA1(J,L,I)*FI(I,L)                                L76M3370  00346
   64 FN(J) = FN(J)*AA                                                  L76M3380  00347
   63 CALL DFSRIE(144,NHH,FN,TEM1,TEM2)                                 L76M3390  00348
      XLO(KK) = TEM1(1)                                                 L76M3400  00349
      DO 66 J=1,NHH                                                     L76M3410  00350
      XLM(KK,J) = TEM1(J+1)                                             L76M3420  00351
   66 XHM(KK,J) = TEM2(J+1)                                             L76M3430  00352
   58 CONTINUE                                                          L76M3440  00353
      KK = KK+1                                                         L76M3450  00354
      XLO(KK) = 0.                                                      L76M3460  00355
      DO 9500 J=1,NHH                                                   L76M3470  00356
      XLM(KK,J) = 0.                                                    L76M3480  00357
 9500 XHM(KK,J) = 0.                                                    L76M3490  00358
      WRITE(6,201)                                                      L76M3500  00359
  201 FORMAT(1H1, 11HXLO XLM XHM ,///)                                  L76M3510  00360
      DO 202 KK=1,7                                                     L76M3520  00361
      WRITE(6,203) XLO(KK),(XLM(KK,J),J=1,NHH),(XHM(KK,J),J=1,NHH)      L76M3530  00362
  220 FORMAT(//(1PE13.5))                                               L76M3540  00363
  203 FORMAT(F8.2/(10F8.2))                                             L76M3550  00364
  202 CONTINUE                                                          L76M3560  00365
  200 CALL E386RN                                                       L76M3570  00366
   57 IF(OPRONO.NE.YES) GO TO 7                                         L76M3580  00367
C                                                                       L76M3590  00368
C  CARDS  L76M3600  THRU  L76M3640  READ PRESSURES FROM DRUM            L76M3597  00369
C                                                                       L76M3598  00370
C     IF (TCOP .NE. 'DRUM')  GO TO 122                                  L76M3599  00371
C     CALL PCFDRD ('HARMS',0,HARMS,6)                                   L76M3600  00372
C     DO 121 I=1,3                                                      L76M3610  00373
C     BHARM(I) = HARMS(I)                                               L76M3620  00374
C 121 FHARM(I) = HARMS(I+3)                                             L76M3630  00375
  122 CONTINUE                                                          L76M3640  00376
C BEGINNING OF ROTOR NOISE ANALYSIS                                     L76M3650  00377
      IF(IDD.NE.1) GO TO 9302                                           L76M3660  00378
      CALL START                                                        L76M3670  00379
 9302 T1 = LSPAN-1                                                      L76M3680  00380
       T1 = (0.7695 * BLADEL)/T1                                        L76M3690  00381
       SPAN(1) = 99.9                                                   L76M3700  00382
      DELSPN = 0.5*T1                                                   L76M3710  00383
      DO 67 L=2,LSPAN                                                   L76M3720  00384
   67 SPAN(L) = SPAN(L-1)+T1                                            L76M3730  00385
      L=MSTART-1                                                        L76M3740  00386
      FM=L                                                              L76M3750  00387
      T4 = BLADES/(PI*BB)                                               L76M3760  00388
      DIMENSION RSO(18)                                                 L76M3770  00389
      REWIND 28                                                         L76M3780  00390
      IF(IDD.NE.1) GO TO 9103                                           L76M3790  00391
      GC2=SPAN(1)+DELSPN                                                L76M3800  00392
      J=LSPAN-2                                                         L76M3810  00393
      DO 10005 I=1,J                                                    L76M3820  00394
                                                                        L76M3830  00395
```

Figure 59. Continued.

```
      GC1=GC2+T1                                                        L76M3840  00396
      RSQ(I)= PI*(GC1**2-GC2**2)/(288.*SPAN(I+1))                       L76M3850  00397
10005 GC2=GC1                                                           L76M3860  00398
      WRITE(6,8826) (RSQ(I),I=1,18)                                     L76M3870  00399
      GO TO 9103                                                        L76M3880  00400
 9100 WRITE(6,9104) LSD2                                                L76M3890  00401
 9104 FORMAT(1H0,11HNTRAN ERROR , 5I13)                                 L76M3900  00402
      STOP                                                              L76M3910  00403
 9103 IF(TCOP.EQ.'DRUM') GO TO 114                                      L76M3920  00404
      WRITE (28) ND1                                                    L76M3930  00405
  114 CONTINUE                                                          L76M3940  00406
      WRITE(28) (SINE(I),I=1,288),BLADES                                L76M3950  00407
      END FILE 28                                                       L76M3960  00408
      LSD2= 1                                                           L76M3970  00409
C *** HARMONIC LOOP                                                     L76M3980  00410
      DO 83 M=MSTART,MLIMRN                                             L76M3990  00411
      REWIND 28                                                         L76M4000  00412
      FM = FM+1.                                                        L76M4010  00413
C                                                                       L76M4017  00414
C  CARD  L76M4020  BY PASSES  HARMONIC  GENERATION                      L76M4018  00415
C                                                                       L76M4019  00416
C     IF (TCOP .EQ. 'DRUM')  GO TO 111                                  L76M4020  00417
      READ (28) (ND1(I),I=1,7200)                                       L76M4030  00418
C *** RADIAL STATION LOOP                                               L76M4040  00419
      CALL NTRAN(29,10)                                                 L76M4050  00420
      DO 69 K=1,5                                                       L76M4060  00421
      IF(IRS(K).EQ.0) GO TO 69                                          L76M4070  00422
      T5=AA/(2.*RR(K)*BLADEL)                                           L76M4080  00423
C *** AZIMUTHAL LOOP                                                    L76M4090  00424
      DO 99 I=1,144                                                     L76M4100  00425
      T1=-T5                                                            L76M4110  00426
      T2= T5                                                            L76M4120  00427
      T3 =  (T2-T1)/40.                                                 L76M4130  00428
      T6=T1*BLADES*FM                                                   L76M4140  00429
      COSRN(1) = COS(T6)                                                L76M4150  00430
      SINRN(1) = SIN(T6)                                                L76M4160  00431
      T6=T2*BLADES*FM                                                   L76M4170  00432
      COSRN(41) = COS(T6)                                               L76M4180  00433
      SINRN(41) = SIN(T6)                                               L76M4190  00434
      AZ41(1)=T1                                                        L76M4200  00435
      AZ41(41)=T2                                                       L76M4210  00436
      L=0                                                               L76M4220  00437
      DO 71 J=2,40                                                      L76M4230  00438
      T1=T1+T3                                                          L76M4240  00439
      T6=T1*BLADES*FM                                                   L76M4250  00440
      AZ41(J)=T1                                                        L76M4260  00441
      COSRN(J) = COS(T6)                                                L76M4270  00442
      SINRN(J) = SIN(T6)                                                L76M4280  00443
   71 CONTINUE                                                          L76M4290  00444
      NT1 = NCH(K)+2                                                    L76M4300  00445
      KKK = 1                                                           L76M4310  00446
      CHORD(1)=0.                                                       L76M4320  00447
      GPSI(1)=0.                                                        L76M4330  00448
      DO 72 L=1,5                                                       L76M4340  00449
      IF(NCHAN(K,L).EQ.0) GO TO 72                                      L76M4350  00450
      KKK = KKK + 1                                                     L76M4360  00451
      CHORD(KKK) = XA(L,K)                                              L76M4370  00452
      GPSI(KKK) = DATA1(I,L,K)                                          L76M4380  00453
   72 CONTINUE                                                          L76M4390  00454
      CHORD(KKK+1) = 1.                                                 L76M4400  00455
      GPSI(KKK+1) = 0.                                                  L76M4410  00456
C *** THE MEASURED PRESSURE POINTS ALONG THE CHORD ARE INTERPOLATED TO  L76M4420  00457
C     41 POINTS                                                         L76M4430  00458
      CHORD2(1)=0.                                                      L76M4440  00459
      CHORD2(41) = 1.                                                   L76M4450  00460
      AREA = 1./41.                                                     L76M4460  00461
```

Figure 59. Continued.

```
      DO 9307 L=2,40                                                    L76M4470  00462
 9307 CHORD2(L) = CHORD2(L-1) + AREA                                    L76M4480  00463
      CALL CURVIT(NT1,CHORD,GPSI,N,41,CHORD2,GPSI2)                     L76M4490  00464
      DO 73 L=1,41                                                      L76M4500  00465
   73 GPSI3(L) = GPSI2(L)*COSRN(L)                                      L76M4510  00466
      CALL AVQUAD(41,AZ41  ,GPSI3,AREA)                                 L76M4520  00467
      AREA = AREA*T4                                                    L76M4530  00468
 9105 IF(LSD2+1) 9100,9105,9106                                         L76M4540  00469
 9106 CALL NTRAN(29,1,1,AREA,LSD2)                                      L76M4550  00470
      IF( IDD.NE.1) GO TO 2741                                          L76M4560  00471
      IF(I.GT.10) GO TO 2741                                            L76M4570  00472
      IF(K.GT.2) GO TO 2741                                             L76M4580  00473
      WRITE(6,2742) I,K,M,NT1                                           L76M4590  00474
 2742 FORMAT(1H0,2HI=,I5,5X,2HK=,I5,5X,2HM=,I5,10X,                     L76M4600  00475
     X  33 HACOUSTIC PRESSURE PULSE COS TERM     ,10X,I5)               L76M4610  00476
      WRITE(6,2747)  COSRN                                              L76M4620  00477
      WRITE(6,2747)  CHORD                                              L76M4630  00478
      WRITE(6,2747)  GPSI                                               L76M4640  00479
      WRITE(6,2747)  CHORD2                                             L76M4650  00480
      WRITE(6,2747)  GPSI2                                              L76M4660  00481
      WRITE(6,2747)  T1,T2,T3,T4,T5,GMAR(I,K),AREA,FM                   L76M4670  00482
 2747 FORMAT(2X,1P10E13.5)                                              L76M4680  00483
 2741 DO 74 L=1,41                                                      L76M4690  00484
   74 GPSI3(L) = GPSI2(L)*SINRN(L)                                      L76M4700  00485
      CALL AVQUAD(41,AZ41  ,GPSI3,AREA)                                 L76M4710  00486
      AREA = AREA*T4                                                    L76M4720  00487
 9107 IF(LSD2+1)9100,9107,9108                                          L76M4730  00488
 9108 CALL NTRAN(29,1,1,AREA,LSD2)                                      L76M4740  00489
   99 CONTINUE                                                          L76M4750  00490
   69 CONTINUE                                                          L76M4760  00491
 9200 IF(LSD2+1) 9100,9200,9201                                         L76M4770  00492
 9201 CALL NTRAN(29,10)                                                 L76M4780  00493
      DO 9109 K=1,5                                                     L76M4790  00494
      DO 9109 I=1,144                                                   L76M4800  00495
 9110 IF(LSD2+1) 9100,9110,9111                                         L76M4810  00496
 9111 CALL NTRAN(29,2,1,AREA,LSD2)                                      L76M4820  00497
 9112 IF(LSD2+1) 9100,9112,9113                                         L76M4830  00498
 9113 GMAR(I,K)=AREA                                                    L76M4840  00499
      CALL NTRAN(29,2,1,AREA,LSD2)                                      L76M4850  00500
 9114 IF(LSD2+1) 9100,9114,9115                                         L76M4860  00501
 9115 HMAR(I,K) = AREA                                                  L76M4870  00502
 9109 CONTINUE                                                          L76M4880  00503
C                                                                       L76M4887  00504
C  CARDS  L76M4890  AND  L76M4900  STORE NEW HARMONICS ON DRUM          L76M4888  00505
C                                                                       L76M4889  00506
C     CALL DATCUR ('GMAR',ID(M),14,GMAR,720)                            L76M4890  00507
C     CALL DATCUR ('HMAR',ID(M),14,HMAR,720)                            L76M4900  00508
      GO TO 112                                                         L76M4910  00509
C                                                                       L76M4917  00510
C  CARDS  L76M4920  AND  L76M4930  READ IN HARMONICS FROM DRUM          L76M4918  00511
C                                                                       L76M4919  00512
C     CALL PCFORD ('GMAR',ID(M),GMAR,720)                               L76M4920  00513
C     CALL PCFORD ('HMAR',ID(M),HMAR,720)                               L76M4930  00514
  112 CONTINUE                                                          L76M4940  00515
      WRITE(6,76) M                                                     L76M4950  00516
   76 FORMAT(1H0,123HCOS AND SIN COEFFICIENTS OF ACOUSTIC PRESSURE PULSEL76M4960  00517
     X AT EACH OF 144 AZIMUTHAL STATIONS AT EACH BLADE STATION FOR HARMOL76M4970  00518
     XNIC M=,I3 )                                                       L76M4980  00519
      DO 77 I=1,5                                                       L76M4990  00520
      WRITE(6,78) I                                                     L76M5000  00521
   78 FORMAT(1H0,14HBLADE STATION=,I2)                                  L76M5010  00522
      WRITE(6,56) (GMAR(K,I),K=1,144)                                   L76M5020  00523
   77 WRITE(6,56) (HMAR(K,I),K=1,144)                                   L76M5030  00524
C *** THE FOLLOWING SUBR. INTERPOLATES ACOUSTIC PRESSURE PULSE HARMONICSL76M5040  00525
C     UP TO 288 AZIMUTH AND 20 BLADE STATIONS                           L76M5050  00526
   75 IF(IDD.NE.1) GO TO 9303                                           L76M5060  00527
```

Figure 59. Continued.

```
      CALL CLOCK                                                        L76M5070  00528
 9303 CALL INTERP                                                       L76M5080  00529
      IF(IDD.NE.1) GO TO 79                                             L76M5090  00530
      CALL CLOCK                                                        L76M5100  00531
      WRITE(6,80) LAZI,LSPAN                                            L76M5110  00532
   80 FORMAT(1H1, 51HINTERPOLATED ACOUSTIC PRESSURE PULSE COEFFICIENTS (L76M5120  00533
     X ,I3,1X,17HAZIMUTH STATIONS, ,I3,1X,17HBLADE STATIONS  )  ///)    L76M5130  00534
      DO 81 I=1,LSPAN                                                   L76M5140  00535
      WRITE(6,82) SPAN(I)                                               L76M5150  00536
   82 FORMAT(1H0,11HBLADE SPAN=, F8.2,10X,21HGMARI(J,I),HMARI(J,I)  )   L76M5160  00537
      WRITE(6,56) (GMARI(J,I),J=1,LAZI)                                 L76M5170  00538
   81 WRITE(6,56) (HMARI(J,I),J=1,LAZI)                                 L76M5180  00539
C *** DOUBLE INTEGRATION FOLLOWS                                        L76M5190  00540
   79 ISI = (DPSI/2.5)+.01                                              L76M5200  00541
      T1 = BB/(4.*PI)                                                   L76M5210  00542
C *** FIELD POINT LOOP                                                  L76M5220  00543
      DO 83 NFIELD=1,NFT                                                L76M5230  00544
      MFIELD = NFIELD                                                   L76M5240  00545
      IF(INTERM.EQ.NO)GO TO 84                                          L76M5250  00546
      WRITE(6,85) NFIELD,XFP(NFIELD),YFP(NFIELD),ZFP(NFIELD),M          L76M5260  00547
   85 FORMAT(1H1, 12HFIELD POINT=,I3,5X, 4HXFP=,1PE10.4,5X,4HYFP=,1PE10.L76M5270  00548
     X 4,5X, 4HZFP=,1PE10.4,15X, 11HHARMONIC M=,I3 )                    L76M5280  00549
C *** SUBR. CUE WILL CALCULATE Q1 AND Q2=Q1*Q2  Q1(288,20),Q2(288,20)   L76M5290  00550
   84 READ(28) (SINE(I),I=1,288),BLADES                                 L76M5300  00551
      BACKSPACE 28                                                      L76M5310  00552
      CALL CUE(2,FM,MFIELD)                                             L76M5320  00553
      IF(INTERM.EQ.NO)GO TO 86                                          L76M5330  00554
      WRITE(6,87) LAZI,LSPAN                                            L76M5340  00555
   87 FORMAT(1H0, 3HQ1(,I3,1H,,I2,1H))                                  L76M5350  00556
      DO 88 I=1,LSPAN                                                   L76M5360  00557
      WRITE(6,89) I,XO(I)                                               L76M5370  00558
   89 FORMAT(1H0, 13HSPAN STATION=,I3, 1H(, F6.3,1H) )                  L76M5380  00559
   88 WRITE(6,90) (Q1(J,I),J=1,LAZI)                                    L76M5390  00560
   90 FORMAT( 2X,13(1PE10.3))                                           L76M5400  00561
C *** THE FOLLOWING LOOP EFFECTS A DOUBLE INTEGRATION WHICH YIELDS THE  L76M5410  00562
C     SOUND PRESSURE COMPONENTS UMF(M,NFIELD) AND VMF(M,NFIELD).        L76M5420  00563
   86 DO 91 K=1,2                                                       L76M5430  00564
      IF(INTERM.EQ.NO) GO TO 92                                         L76M5440  00565
      I=K+1                                                             L76M5450  00566
      WRITE(6,93) I,LAZI,LSPAN                                          L76M5460  00567
   93 FORMAT(1H0, 1HQ,I1,1H(,I3,1H,,I2,1H))                             L76M5470  00568
      DO 94 I=1,LSPAN                                                   L76M5480  00569
      WRITE(6,89) I,XO(I)                                               L76M5490  00570
   94 WRITE(6,90) (Q2(J,I),J=1,LAZI)                                    L76M5500  00571
C *** A DOUBLE INTEGRATION IS DONE NEXT.                                L76M5510  00572
   92 IF(IDD.NE.1) GO TO 9304                                           L76M5520  00573
      CALL CLOCK                                                        L76M5530  00574
C RING ITEGRATION                                                       L76M5540  00575
      IAUDRE=LSPAN-2                                                    L76M5550  00576
      AREA=0.                                                           L76M5560  00577
      DO 10006 J=1,IAUDRE                                               L76M5570  00578
      QAVR = 0.                                                         L76M5580  00579
      DO 10007 I=1,LAZI                                                 L76M5590  00580
10007 QAVR=QAVR+Q2(I,J+1)                                               L76M5600  00581
      QAVR=QAVR*RSQ(J)                                                  L76M5610  00582
      WRITE(6,10008) J,QAVR                                             L76M5620  00583
10008 FORMAT(  5H RING,I3,20X,E13.5)                                    L76M5630  00584
10006 AREA=AREA+QAVR                                                    L76M5640  00585
      IF(K.EQ.2) GO TO 10009                                            L76M5650  00586
      URING=AREA*T1                                                     L76M5660  00587
      GO TO 10010                                                       L76M5670  00588
10009 VRING=AREA*T1                                                     L76M5680  00589
10010 CONTINUE                                                          L76M5690  00590
 9304 IAUDRE = LSPAN-1                                                  L76M5700  00591
      DO 8820 I=1,LAZI                                                  L76M5710  00592
      DBI(I)=0.                                                         L76M5720  00593
```

Figure 59. Continued.

```
      DO 8821 J=2,IAUDRE                                                L76M5730  00594
      DBI(I)=DBI(I)+Q2(I,J)                                             L76M5740  00595
 8821 DBI(I)= (DBI(I)*2.+Q2(I,1)+Q2(I,LSPAN))*DELSPN                    L76M5750  00596
 8820 DBI(LAZI+1) = DBI(1)                                              L76M5760  00597
      IF(IDD.NE.1) GO TO 8825                                           L76M5770  00598
      WRITE(6,8826) (DBI(I),I=1,145),DELSPN                             L76M5780  00599
 8826 FORMAT(1H0,1X,10E13.5)                                            L76M5790  00600
      CALL SIMCOR(LAZI+1,DPRAD,DBI,QAVR,I)                              L76M5800  00601
      TEMP1(K)=QAVR                                                     L76M5810  00602
 8825 QAVR = 0.                                                         L76M5820  00603
      DO 9701 I=1,LAZI                                                  L76M5830  00604
 9701 QAVR=QAVR+DBI(I)                                                  L76M5840  00605
      QAVR=QAVR*DPRAD*T1                                                L76M5850  00606
      IF(K.EQ.2) GO TO 9703                                             L76M5860  00607
      UTRAP=QAVR                                                        L76M5870  00608
      GO TO 9702                                                        L76M5880  00609
 9703 VTRAP=QAVR                                                        L76M5890  00610
C SIMPSON S                                                             L76M5900  00611
 9702 IF(IDD.NE.1) GO TO 9305                                           L76M5910  00612
      QAVR=2.*DELSPN                                                    L76M5920  00613
      DO 10000 I=1,LAZI                                                 L76M5930  00614
      DO 10001 J=1,IAUDRE                                               L76M5940  00615
10001 AZ41(J)=Q2(I,J+1)                                                 L76M5950  00616
      CALL SIMCOR(IAUDRE,QAVR,AZ41,AREA,J)                              L76M5960  00617
10000 DBI(I)=AREA                                                       L76M5970  00618
      DBI(LAZI+1) = DBI(1)                                              L76M5980  00619
      WRITE(6,8826) (DBI(I),I=1,145),QAVR                               L76M5990  00620
      CALL SIMCOR(LAZI+1,DPRAD,DBI,QAVR,I)                              L76M6000  00621
      IF(K.EQ.2) GO TO 10002                                            L76M6010  00622
      USIMP=QAVR*T1                                                     L76M6020  00623
      GO TO 10003                                                       L76M6030  00624
10002 VSIMP=QAVR*T1                                                     L76M6040  00625
10003 WRITE(6,2222) TEMP1(K),RO,BLADEL,T1,BB                            L76M6050  00626
 2222 FORMAT(1H0,5E20.6)                                                L76M6060  00627
      CALL CLOCK                                                        L76M6070  00628
      QAVR=0.                                                           L76M6080  00629
      DO 901 IROMA=1,20                                                 L76M6090  00630
      DO 901 IAUDRE=1,144                                               L76M6100  00631
  901 QAVR=QAVR+Q2(IAUDRE,IROMA)                                        L76M6110  00632
      QAVR=QAVR/2880.                                                   L76M6120  00633
      WRITE(6,902) QAVR                                                 L76M6130  00634
  902 FORMAT (1H0,11HG AVERAGE=     ,1PE20.5)                           L76M6140  00635
 9305 IF(K.EQ.2) GO TO 91                                               L76M6150  00636
C *** SUBR. CUE WILL CALCULATE Q2=Q1+Q2                                 L76M6160  00637
      READ(28) (SINE(I),I=1,288),BLADES                                 L76M6170  00638
      BACKSPACE 28                                                      L76M6180  00639
      CALL CUE(3,FM,NFIELD)                                             L76M6190  00640
   91 CONTINUE                                                          L76M6200  00641
      XU(M,NFIELD)=UTRAP                                                L76M6210  00642
      XV(M,NFIELD)=VTRAP                                                L76M6220  00643
      READ(28) (SINE(I),I=1,288),BLADES                                 L76M6230  00644
      BACKSPACE 28                                                      L76M6240  00645
      TEMP1(1)       = TEMP1(1)*T1                                      L76M6250  00646
      TEMP1(2)       = TEMP1(2)*T1                                      L76M6260  00647
      IF(IDD.NE.1) GO TO 95                                             L76M6270  00648
      WRITE(6,9704)                                                     L76M6280  00649
 9704 FORMAT(1H0,85 HTHE FOLLOWING ANSWERS ARE OBTAINED BY USING TRAPAZOL76M6290  00650
     XIDAL INTERGRATION ALONG THE BLADE, /                              L76M6300  00651
     X 44HAND SIMPSON S INTEGRATION ALONG THE AZIMUTH.                  L76M6310  00652
      WRITE(6,96) M,NFIELD,TEMP1(1)      ,M,NFIELD,TEMP1(2)             L76M6320  00653
   96 FORMAT(1H0,  4HUMF(,I2,1H,,I2,3H) =,1PE10.4,13X,                  L76M6330  00654
     X                4HVMF(,I2,1H,,I2,3H) =,1PE10.4 )                  L76M6340  00655
C *** SOUND PRESSURE AND SOUND PRESSURE LEVEL ARE CALCULATED NEXT       L76M6350  00656
   95 PMRMS(M,NFIELD) = (1./1.41421356)*SQRT(UTRAP**2+VTRAP**2)         L76M6360  00657
      SPLM(M,NFIELD) = 20.*ALOG10(PMRMS(M,NFIELD)/2.9E-09)              L76M6370  00658
      IF(INTERM.EQ.NO) GO TO 31000                                      L76M6380  00659
```

Figure 59. Concluded.

```
      WRITE(6,97) M,NFIELD,PHHMS(M,NFIELD),M,NFIELD,SPLM(M,NFIELD)        L76M6390  00660
   97 FORMAT(1H0,  6HPHRMS(,I2,1H,,I2,3H) =,1PE10.4,10X,                 L76M6400  00661
     X            6H SPLM(,I2,1H,,I2,3H) =,1PE10.4 )                     L76M6410  00662
31000 IF(IDD.NE.1) GO TO 83                                              L76M6420  00663
      WRITE(6,9705)                                                      L76M6430  00664
 9705 FORMAT(1H0,95 HTHE FOLLOWING ANSWERS ARE OBTAINED BY USING TRAPAZOL76M6440  00665
     XIDAL INTEGRATION ALONG THE BLADE AND AZIMUTH      )                L76M6450  00666
      WRITE(6,96) M,NFIELD,    P,M,NFIELD,VTRAP                          L76M6460  00667
      UTRAP=(1./1.41421356)*SQRT(UTRAP**2+VTRAP**2)                      L76M6470  00668
      VTRAP=20.*ALOG10(UTRAP/2.9E-09)                                    L76M6480  00669
      WRITE(6,97) M,NFIELD,UTRAP,M,NFIELD,VTRAP                          L76M6490  00670
      WRITE(6,10004)                                                     L76M6500  00671
10004 FORMAT(1H0, 17H SIMPSON, SIMPSON     )                             L76M6510  00672
      WRITE(6,96) M,NFIELD,USIMP,M,NFIELD,VSIMP                          L76M6520  00673
      USIMP= (1./1.41421356)*SQRT(USIMP**2+VSIMP**2)                     L76M6530  00674
      VSIMP=20.*ALOG10(USIMP/2.9E-09)                                    L76M6540  00675
      WRITE(6,97) M,NFIELD,USIMP,M,NFIELD,VSIMP                          L76M6550  00676
      WRITE(6,10011)                                                     L76M6560  00677
10011 FORMAT(1H0,    6H RINGS    )                                       L76M6570  00678
      WRITE(6,96) M,NFIELD,URING,M,NFIELD,VRING                          L76M6580  00679
      URING=(1./1.41421356)*SQRT(URING**2+VRING**2)                      L76M6590  00680
      VRING=20.*ALOG10(URING/2.9E-09)                                    L76M6600  00681
      WRITE(6,97) M,NFIELD,URING,M,NFIELD,VRING                          L76M6610  00682
   83 CONTINUE                                                           L76M6620  00683
      DO 115 I=1,NFT                                                     L76M6630  00684
      WRITE (6,116) I,(XU(J,I),J=1,MLIMRN)                               L76M6640  00685
  116 FORMAT('0UTRAP VALUES FOR FIELD POINT'I3/(1P10E13.6))              L76M6650  00686
      WRITE (6,117) I,(XV(J,I),J=1,MLIMRN)                               L76M6660  00687
  117 FORMAT('0VTRAP VALUES FOR FIELD POINT'I3/(1P10E13.6))              L76M6670  00688
  115 CONTINUE                                                           L76M6680  00689
      DO 98  I=1,MLIMRN                                                  L76M6690  00690
      COSARG(1,I)=1.                                                     L76M6700  00691
   98 SINARG(1,I)=0.                                                     L76M6710  00692
      DT=TOTIME/(NTIME-1)                                                L76M6720  00693
      FAC=BLADES*OMEG*PI/30.*DT                                          L76M6730  00694
      FAC2=0.                                                            L76M6740  00695
      DO 100 I=2,NTIME                                                   L76M6750  00696
      FAC2=FAC2+FAC                                                      L76M6760  00697
      DO 100 J=1,MLIMRN                                                  L76M6770  00698
      ARG=FAC2*J                                                         L76M6780  00699
      COSARG(I,J)=COS(ARG)                                               L76M6790  00700
  100 SINARG(I,J)=SIN(ARG)                                               L76M6800  00701
      DO 101 I=1,NFT                                                     L76M6810  00702
      DO 102 J=1,NTIME                                                   L76M6820  00703
      SUM=0.                                                             L76M6830  00704
      DO 103 K=1,MLIMRN                                                  L76M6840  00705
  103 SUM=SUM+XU(K,I)*COSARG(J,K)+XV(K,I)*SINARG(J,K)                    L76M6850  00706
  102 P(J)=SUM                                                           L76M6860  00707
  101 WRITE (6,104) I,(P(J),J=1,NTIME)                                   L76M6870  00708
  104 FORMAT(//'0PRESSURES AT FIELD POINT'I4//(1P10E13.6))               L76M6880  00709
C *** THE FOLLOWING SUBR, PRINTS OUT SOUND PRESSURE LEVELS FOR ALL       L76M6890  00710
C     CALCULATED HARMONICS.                                              L76M6900  00711
      CALL OUTSPL                                                        L76M6910  00712
      IF(IDD.NE.1) GO TO 105                                             L76M6920  00713
      CALL CLOCK                                                         L76M6930  00714
  105 IF(TCOP.NE.'DRUH') GO TO 7                                         L76M6940  00715
      END                                                                L76M6950  00716
B1  FOR  BLODAT                                                          00717
      BLOCK DATA                                                         L76B0010  00718
       COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,  L76B0020  00719
     * MLIMDP,XFP(20),YFP(20),ZFP(20),GAMA,RO,BLADEL,B0,B1C,B1S,PUNCH,   L76B0030  00720
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,     L76B0040  00721
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,     L76B0050  00722
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,     L76B0060  00723
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,    L76B0070  00724
     * NOCH(5),LAZI                                                      L76B0080  00725
```

a. End of E676, Start of BLODAT

Figure 60. Subroutines.

```
      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),X0(20)
      COMMON /BK3/ SPLM(10,20),AZMTH3(288),
     * SPAN(20),
     * ICHANL(10,5),COSINE(288),SINE(288),BLADES,CARD,TAPE
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),
     * GMAR(144,5),HMAR(144,5)
     * ,Q1(288,20),Q2(288,20)
      EQUIVALENCE    (ND2(5761),HMAR),
     $               (GMARI,AN),
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN),(ND2,Q2)
      EQUIVALENCE (ND1(5761),GMAR),(ND1,Q1)
C IRS(I) IS AN INSTRUMENTED RADIAL STATION COUNTER, COUNTING FROM THE
C     BLADE ROOT.
C IF IRS(I)=0, THEN THAT STATION IS NO GOOD.
      DATA (IRS(I),I=1,5) /1,2,3,4,5/
C NCHAN(I,J) IS AN ISTRUMENTED CHORD STATION COUNTER J FOR EACH RADIAL
C     STATION I
C IF CHORD STATION J IS NO GOOD, THEN NCHAN(I,J)=0
      DATA ((NCHAN(I,J),J=1,5),I=1,5)/1,2,3,0,5, 1,2,3,4,5, 1,2,3,4,5,
     X 1,2,3,4,5, 1,2,3,4,5/
C NCH(I) IS THE TOTAL NO. OF CHORD STATIONS FOR RADIAL STATION I.
      DATA (NCH(I),I=1,5)/5,5,5,5,5/
C FI(I,J) GAUSSIAN INTEGRATION FACTORS FOR RADIAL STATIONI, CHORD
C     STATION J.
      DATA ((FI(I,J),J=1,5),I=1,5) /.1,.1,.222,.355,.222,
     X .1,.1,.222,.355,.222,          .1,.1,.222,.355,.222,
     X .1,.1,.222,.355,.222,          .1,.1,.222,.355,.222 /
      DATA (NDIV(I),I=1,4)/0 001 000 000 000, 0 000 001 000 000,
     X 0 000 000 001 000, 0 000 000 000 001/,(BMASK(I),I=1,6)/
     X 0 777 000 000 000, 0 000 777 000 000, 0 000 000 777 000,
     X 0 000 000 000 777, 0 777 777 000 000, 0 000 000 777 777/,
     X YES/1HY/,NO/1HN/,TAPE/4HTAPE/,CARD/4HCARD/
      DATA TEE,BEE,DEE /1HT,1HB,1HD/
      END
BI  FOR  INPUTA
      SUBROUTINE INPUTA
C THIS SUBR. RECEIVES CARD INPUT
      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,BC,B1C,B1S,PUNCH,
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUHIT(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,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),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),X0(20)
      COMMON /BK3/ SPLM(10,20),AZMTH3(288),
     * SPAN(20),
     * ICHANL(10,5),COSINE(288),SINE(288),BLADES,CARD,TAPE
      EQUIVALENCE    (ND2(5761),HMAR),
     $               (GMARI,AN),
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN),(ND2,Q2)
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),
     * GMAR(144,5),HMAR(144,5)
     * ,Q1(288,20),Q2(288,20)
      EQUIVALENCE (ND1(5761),GMAR),(ND1,Q1)
      COMMON /NEW/ F0,F1C,F1S,TOTIME,THETA
      INTEGER TCOP,CARD,TAPE,E3860P,YES,OPRONO
      READ(5,1) (NN(I),I=1,14)
```

b. End of BLODAT, Start of INPUTA

Figure 60. Continued.

```
    1 FORMAT( 13A6,A2 )                                                 L7610280  00792
      WRITE(6,2) (NN(I),I=1,14)                                         L7610290  00793
    2 FORMAT(1H1,25X,13A6,A2)                                           L7610300  00794
      READ(5,3) BB,AA,BLADEL,GAMA,RO,CC,OMEG,DPSI,NBLADE,MLIMDP,MLIMRN, L7610310  00795
     * LSPAN,IREELS,TCOP,PUNCH,INTERM,IDD                               L7610320  00796
    3 FORMAT( 8E7.0,1X,I1,3(1X,I2),1X,I1,1X,A4,2(1X,A1),1X,I1)          L7610330  00797
      READ (5,15) RR,XA                                                 L7610340  00798
   15 FORMAT(5F10.0)                                                    L7610350  00799
      READ (5,15) TOTIME,THETA                                          L7610360  00800
      IF(TCOP.NE.TAPE) GO TO 45                                         L7610370  00801
      DO 100 I=1,5                                                      L7610380  00802
      DO 100 JJ=1,10                                                    L7610390  00803
      NSTATC(I,JJ) = 100                                                L7610400  00804
  100 NSTATR(I,JJ) = 100                                                L7610410  00805
      DO 16 JJ=1,IREELS                                                 L7610420  00806
      READ(5,4) IREEL,ITRACK(IREEL),ISET(IREEL),KUNIT(IREEL)            L7610430  00807
      WRITE(6,77)                                                       L7610440  00808
     X          IREEL,ITRACK(IREEL),ISET(IREEL),KUNIT(IREEL)           L7610450  00809
   77 FORMAT( 5I13)                                                     L7610460  00810
    4 FORMAT(I1,2(1X,I2),6X,I2)                                         L7610470  00811
      NOCH(IREEL)= 0                                                    L7610480  00812
    6 READ(5,5) NC,NTBDX(IREEL,NC),NSTATC(IREEL,NC),NSTATR(IREEL,NC),   L7610490  00813
     * SLOPE(NC,IREEL),OFFSET(NC,IREEL),NCEND                           L7610500  00814
    5 FORMAT(2X,I2,1X,A1,2(1X,I1),1X,E13.1,3X,E13.1,39X,I1)             L7610510  00815
      NOCH(IREEL) = NOCH(IREEL)+1                                       L7610520  00816
      K=NOCH(IREEL)                                                     L7610530  00817
      ICHANL(K,JJ) = NC                                                 L7610540  00818
      IF(NCEND.EQ.0) GO TO 6                                            L7610550  00819
   16 CONTINUE                                                          L7610560  00820
      READ(5,7) (FROC(J),J=1,30)                                        L7610570  00821
    7 FORMAT(6E13.1,2X)                                                 L7610580  00822
   45 READ(5,8) E3860P,OPRONO,NFT                                       L7610590  00823
    8 FORMAT(1X,2(1X,A1),2X,I2)                                         L7610600  00824
      IF(E3860P.NE.YES)GO TO 9                                          L7610610  00825
      READ(5,10) ANG,NHH,KEY1,KEY2,KEY3                                 L7610620  00826
   10 FORMAT( E7.0,4(2X,I2))                                            L7610630  00827
    9 DO 11 I=1,NFT                                                     L7610640  00828
      IF(E3860P.NE.YES)GO TO 12                                         L7610650  00829
      READ(5,13) CAPRF(I),THETAF(I),ALFAF(I),XFP(I),YFP(I),ZFP(I)       L7610660  00830
   13 FORMAT( 3E10.1,20X,3E10.1)                                        L7610670  00831
      GO TO 11                                                          L7610680  00832
   12 READ(5,14) XFP(I),YFP(I),ZFP(I)                                   L7610690  00833
   14 FORMAT( 50X,3E10.1)                                               L7610700  00834
   11 CONTINUE                                                          L7610710  00835
C *** NOW THE INPUT IS PRINTED OUT.                                     L7610720  00836
      WRITE(6,20) BB,RO,AA,CC,BLADEL,OMEG,DPSI,GAMA                     L761      00837
   20 FORMAT(1H0,1X, 28HBLADE THICKNESS (IN)       = , E10.4, 8X,       L7610730  00838
     1 35HZERO TWIST BLADE STA.      (IN)   = , E10.4 //  2X,           L7610740  00839
     2 28HBLADE CHORD      (IN)       = ,E10.4, 8X,35HSPEED OF SOUND    L7610750  00840
     3   (IN/SEC)  = ,E10.4 //  2X,28HBLADE LENGTH     (IN)       =     L7610760  00841
     3 , E10.4,8X,                                                      L7610770  00842
     4 35HROTOR ROT. SPEED           (RPM)  = ,E10.4  //  48X,35HAZIMUTH L7610780  00843
     5INCREMENT        (DEG)   = ,E10.4 /  2X, 28HBLADE TWIST RATE (DEG/L7610790  00844
     6IN) = ,E10.4 )                                                    L7610800  00845
      WRITE(6,21) NBLADE,TCOP,MLIMDP,PUNCH,MLIMRN,INTERM,LSPAN,IREELS   L7610810  00846
   21 FORMAT('0 NUMBER OF BLADES'32X'= 'I2,14X'TAPE / CARD / DRUM  OPTIOL7610820  00847
     $N'7X'= 'A4//2X                  49HNO. OF HARMONICS TO REPRESENT PREL7610830  00848
     2SSURE CYCLES    =  , I3, 14X, 35HPRESSURE HARMONIC PUNCH OPTION   =L7610840  00849
     3 , A1 // 2X, 28HNO. OF ROTOR NOISE HARMONICS, 20X,2H= , I2, 14X,  L7610850  00850
     4 26HINTERMEDIATE OUTPUT OPTION, 7X, 2H= , A1 // 2X, 33HNO. OF INTEL7610860  00851
     5RPOLATED SPAN STATIONS, 15X, 2H= , I2 // 2X, 23HTOTAL NO. OF TAPE L7610870  00852
     6REELS, 25X,2H= , I2 /  )                                          L7610880  00853
      WRITE (6,17) THETA,TOTIME                                         L7610890  00854
   17 FORMAT('0COMBINED ROTOR SHAFT INCLINATION AND FUSELAGE PITCH ATTITL7610900  00855
     $UDE = 'E10.4,'  DEGREES'/'0TOTAL TIME FOR ACOUSTIC PRESSURE COMPUTL7610910  00856
     $ATIONS IS 'E10.4,'  SECONDS')                                     L7610920  00857
```

c. INPUTA Continued

Figure 60. Continued.

```
      IF(ICUP.NE.IAPE) GO TO 46                                         L7610930  00858
      DO 22 IREEL=1,IREELS                                              L7610940  00859
      WRITE(6,23) IREEL,ITRACK(IREEL),ISET(IREEL),KUNIT(IREEL)          L7610950  00860
   23 FORMAT(1H0,1X, 11HREEL NO. = ,I1, 4X,12HTRACK NO. = , I2, 4X,     L7610960  00861
     1 10HSET NO. = , I2, 4X, 24HLOGICAL TAPE UNIT NO. = , I2 //  8X,   L7610970  00862
     2  7HCHANNEL, 24X, 5HSLOPE, 14X, 6HOFFSET )                        L7610980  00863
      K=NOCH(IREEL)                                                     L7610990  00864
      DO 22 I=1,K                                                       L7611000  00865
      NC = ICHANL(I,IREEL)                                              L7611010  00866
      WRITE(6,24) NC,NTBDX(IREEL,NC),NSTATC(IREEL,NC),NSTATR(IREEL,NC), L7611020  00867
     1 SLOPE(NC,IREEL),OFFSET(NC,IREEL)                                 L7611030  00868
   24 FORMAT( 10X,I2,6X,A1,6X,I1,6X,I1,6X,1PE12.6,7X,  E12.6  )         L7611040  00869
      SLOPE(NC,IREEL) = SLOPE(NC,IREEL)/256.                            L7611050  00870
   22 CONTINUE                                                          L7611060  00871
      WRITE(6,25)                                                       L7611070  00872
   25 FORMAT(//// 3X, 8HHARMONIC, 5X,18HFREQ. CORR. FACTOR, 19X,8HHARMONL7611080  00873
     1IC, 5X, 18HFREQ. CORR. FACTOR // )                                L7611090  00874
      DO 26 J=1,15                                                      L7611100  00875
      JJ = J+15                                                         L7611110  00876
      WRITE(6,63) J,FROC(J),JJ,FROC(JJ)                                 L7611120  00877
   63 FORMAT( 10X,I2,13X,1PE11.4,25X,I2,13X,1PE11.4)                    L7611130  00878
   26 CONTINUE                                                          L7611140  00879
   46 WRITE(6,27) E3860P,OPRONO,NFT                                     L7611150  00880
   27 FORMAT( 2H0 , 62HOPTION TO USE PROGRAM E386 (THEORETICAL CONST. PRL7611160  00881
     1ESSURE PULSE) ,8X,2H= , A1 //  2X, 59HOPTION TO USE ROTOR NOISE PRL7611170  00882
     2OGRAM (MEASURED PRESSURE PULSE) ,11X, 2H= , A1 //  2X, 19HNO. OF FL7611180  00883
     3IELD POINTS, 51X, 1H= , I2 //  )                                 L7611190  00884
      IF(E3860P.NE.YES)GO TO 28                                         L7611200  00885
      WRITE(6,29) ANG,NHH,KEY1,KEY2,KEY3                                L7611210  00886
   29 FORMAT(2X, 43HINCR. OF INTEGRATION USED IN E386 (DEG.) = , F7.4,  L7611220  00887
     1 4X, 28HNO. OF AIR LOAD HARMONICS = ,I2,4X, 6HKEY1= ,I2,2X,6HKEY2=L7611230  00888
     2 ,I2,2X,6HKEY3= ,I2///)                                           L7611240  00889
C *** FIELD POINTS PRINTED OUT NEXT.                                    L7611250  00890
   28 IF(E3860P.NE.YES.AND.OPRONO.NE.YES) GO TO 60                      L7611260  00891
      WRITE(6,36)                                                       L7611270  00892
   36 FORMAT(   25X,17HE386 FIELD POINTS, 32X,24HROTOR NOISE FIELD POINTL7611280  00893
     1S //  6X,2HFP,7X,  6HR (FT),7X, 24HTHETA (DEG)  ALPHA (DEG), 9X, L7611290  00894
     2 2HFP, 7X, 6HX (IN), 7X,6HY (IN),7X,6HZ (IN) / )                  L7611300  00895
      GO TO 31                                                          L7611310  00896
   60 IF(E3860P.NE.YES) GO TO 30                                        L7611320  00897
      WRITE(6,37)                                                       L7611330  00898
   37 FORMAT(   25X,17HE386 FIELD POINTS // 6X,2HFP, 7X, 6HR (FT), 7X,  L7611340  00899
     1 24HTHETA (DEG)  ALPHA (DEG) / )                                  L7611350  00900
      GO TO 31                                                          L7611360  00901
   30 WRITE(6,38)                                                       L7611370  00902
   38 FORMAT( 74X, 24HROTOR NOISE FIELD POINTS // 61X, 2HFP, 7X, 6HX (INL7611380  00903
     1), 7X,6HY (IN),7X,6HZ (IN) /  )                                   L7611390  00904
   31 DO 32 I=1,NFT                                                     L7611400  00905
      IF(E3860P.NE.YES.AND.OPRONO.NE.YES) GO TO 33                      L7611410  00906
      WRITE(6,39) I,CAPRF(I),THETAF(I),ALFAF(I),I,XFP(I),YFP(I),ZFP(I)  L7611420  00907
   39 FORMAT( 6X,I2,4X, 3(3X,E10.4),10X,I2,2X, 3(3X,E10.4)  )           L7611430  00908
      GO TO 32                                                          L7611440  00909
   33 IF(E3860P.NE.YES) GO TO 34                                        L7611450  00910
      WRITE(6,39) I,CAPRF(I),THETAF(I),ALFAF(I)                         L7611460  00911
      GO TO 32                                                          L7611470  00912
   34 WRITE(6,40) I,XFP(I),YFP(I),ZFP(I)                                L7611480  00913
   40 FORMAT( 61X,I2,2X, 3(3X,E10.4) )                                  L7611490  00914
   32 CONTINUE                                                          L7611500  00915
      RETURN                                                            L7611510  00916
      END                                                               L7611520  00917
QI  FOR  RDKU                                                           00918
      SUBROUTINE RDKU(N)                                                L76R0010  00919
C *** THIS SUBR. READS THE PROPER TAPE (UNIT 8,9,10,11, OR 12)          L76R0020  00920
      COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,  L76R0030  00921
     * MLIMDP,XFP(20),YFP(20),ZFP(20),GAMA,R0,BLADEL,B0,B1C,B1S,PUNCH,  L76R0040  00922
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,    L76R0050  00923
```

d. End of INPUTA, Start of RDKU

Figure 60. Continued.

```
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,     L76R0060  00924
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,     L76R0070  00925
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,    L76R0080  00926
     * NOCH(5),LAZI                                                      L76R0090  00927
      COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,       L76R0100  00928
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XL0(7),XLM(7,40),  L76R0110  00929
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),   L76R0120  00930
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,DEE,DEE,GMARI(288,20),              L76R0130  00931
     * HMARI(288,20),X0(20)                                              L76R0140  00932
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),           L76R0150  00933
     * GMAR(144,5),HMAR(144,5)                                           L76R0160  00934
      DIMENSION NNPS(219)                                                L76R0170  00935
      EQUIVALENCE    (ND2(5761),HMAR),                                   L76R0180  00936
     $               (GMARI,AN),                                         L76R0190  00937
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN)                       L76R0200  00938
      EQUIVALENCE (FTRACK,KTRACK),(FBURST,KBURST),(FREC,KREC)            L76R0210  00939
      EQUIVALENCE (ND1(5761),GMAR)                                       L76R0220  00940
      GO TO (1,2),N                                                      L76R0230  00941
    1 LIM1 = 1                                                           L76R0240  00942
      LIM2 = 219                                                         L76R0250  00943
      GO TO 3                                                            L76R0260  00944
    2 LIM1 = 217                                                         L76R0270  00945
      LIM2 = 435                                                         L76R0280  00946
    3 I=KU-7                                                             L76R0290  00947
      GO TO (4,5,6,7,8),I                                                L76R0300  00948
    4 READ(8) (NN(I),I=LIM1,LIM2)                                        L76R0310  00949
      GO TO 9                                                            L76R0320  00950
    5 READ(9) (NN(I),I=LIM1,LIM2)                                        L76R0330  00951
      GO TO 9                                                            L76R0340  00952
    6 READ(10)(NN(I),I=LIM1,LIM2)                                        L76R0350  00953
      GO TO 9                                                            L76R0360  00954
    7 READ(11)(NN(I),I=LIM1,LIM2)                                        L76R0370  00955
      GO TO 9                                                            L76R0380  00956
    8 READ(12)(NN(I),I=LIM1,LIM2)                                        L76R0390  00957
      READ (13) (NNPS(I),I=1,219)                                        L76R0400  00958
      I=-1                                                               L76R0410  00959
      DO 20 J=LIM1,LIM2,3                                                L76R0420  00960
      I=I+3                                                              L76R0430  00961
   20 NN(J)=NNPS(I)                                                      L76R0440  00962
    9 FTRACK = AND(NN(LIM2-2),BMASK(6))                                  L76R0450  00963
      FBURST = AND(NN(LIM2-1),BMASK(6))                                  L76R0460  00964
      FREC   = AND(NN(LIM2)  ,BMASK(6))                                  L76R0470  00965
      IF(IDD.EQ.1)                                                       L76R0480  00966
     XWRITE(6,10) (NN(I),I=LIM1,LIM2)                                    L76R0490  00967
   10 FORMAT(1H0, 19H(NN(I),I=LIM1,LIM2) / (2X,10O13))                   L76R0500  00968
      RETURN                                                             L76R0510  00969
      END                                                                L76R0520  00970
@I  FOR  UNPACK                                                                   00971
      SUBROUTINE UNPACK                                                  L76U0010  00972
C *** THIS SUBR. UNPACKS A CYCLE NN(435) TO FORM THE ARRAY               L76U0020  00973
C     ND1(144,10,IREEL)                                                  L76U0030  00974
C     WHERE THE FIRST SUBSCRIPT REPRESENTS AZIMUTH, AND THE SECOND ARRAYL76U0040  00975
C     REPRESENTS CHANNEL NO.                                             L76U0050  00976
      COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,   L76U0060  00977
     * MLIMDP,XFP(20),YFP(20),ZFP(20),GAMA,R0,BLADEL,B0,B1C,B1S,PUNCH,   L76U0070  00978
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,     L76U0080  00979
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,     L76U0090  00980
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,     L76U0100  00981
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,    L76U0110  00982
     * NOCH(5),LAZI                                                      L76U0120  00983
      COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,       L76U0130  00984
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XL0(7),XLM(7,40),  L76U0140  00985
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),   L76U0150  00986
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,DEE,DEE,GMARI(288,20),              L76U0160  00987
     * HMARI(288,20),X0(20)                                              L76U0170  00988
      EQUIVALENCE    (ND2(5761),HMAR),                                   L76U0180  00989
```

e. End of RDKU, Start of UNPACK

Figure 60. Continued.

```
     $                (GMARI,AN),
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN)
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),
     * GMAR(144,5),HMAR(144,5)
      EQUIVALENCE (ND1(5761),GMAR)
      DATA SIN/0 400 000 000 000/
      EQUIVALENCE  (V2,IV2)
      WRITE(6,6) NN
    6 FORMAT(2X,10I13)
      NW = 0
C *** AZIMUTH POINT LOOP
      DO 1 I=1,144
      NCT = 0
C *** WORDS IN A FRAME LOOP
      DO 1 J=1,3
      NW = NW+1
      N10 = 5
C *** DATA WORDS TO UNPACK LOOP
      DO 1 K=1,4
      N10 = N10-1
      IF(J.EQ.3.AND.K.GT.2) GO TO 1
      NCT = NCT+1
      N1 = NN(NW)
      IF(K.EQ.1) GO TO 2
      N1 = N1*NDIV(N10)
    2 N1 = N1/NDIV(1)
      IV2=N1
      V2=AND(V2,SIN)
      IV2=IV2/2
      IF(IV2.NE.0) N1=N1-1
      ND1(I,NCT,IREEL) = N1
    1 CONTINUE
      IF(IDD.NE.1.AND.NCYCLE.GT.0) RETURN
      WRITE(6,5) IREEL,(ND1(1,K,IREEL),K=1,10)
    5 FORMAT(1H0,  6HIREEL=,I3,10X,
     X 18HND1(144,10,IREEL)  /2X,10I13)
      RETURN
      END
QI  FOR  MERGES
      SUBROUTINE MERGES
C *** THIS SUBR. PRODUCES DIFFERENTIAL PRESSURES FROM ABSOLUTE TOP AND
C     BOTTOM READINGS.
      COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,
     * MLINDP,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),OPROND,NCH(5),INTERM,
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,
     * NOCH(5),LAZI
      COMMON /NEW/ F0,F1C,F1S
      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),X0(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(5761),HMAR),
     $               (GMARI,AN),
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN)
      EQUIVALENCE (ND1(5761),GMAR)
      INTEGER DEE,BEE
      DO 1 I=1,5
      DO 1 J=1,5
      CN(1,I,J) = 0.0
      DO 1  K=1,30
```

f. End of UNPACK, Start of MERGES

Figure 60. Continued.

```
      CN(K+1,I,J) = 0.0                                                 L76G0280  01056
    1 SN(K,I,J) = 0.0                                                   L76G0290  01057
C *** SPAN LOOP                                                         L76G0300  01058
      ISWTCH=0                                                          L76G0310  01059
      DO 2 I=1,5                                                        L76G0320  01060
C *** CHORD LOOP                                                        L76G0330  01061
      DO 2 J=1,5                                                        L76G0340  01062
      ISW = 0                                                           L76G0350  01063
      IREEL = 0                                                         L76G0360  01064
    3 IREEL = IREEL+1                                                   L76G0370  01065
      IF  (IREEL .GT. 5) GO TO 2                                        L76G0380  01066
      NC = 0                                                            L76G0390  01067
    4 NC = NC+1                                                         L76G0400  01068
      IF(IDD.NE.1) GO TO 25                                             L76G0410  01069
      WRITE(6,20) I,J,NC,IREEL,NSTATR(IREEL,NC),NSTATC(IREEL,NC),       L76G0420  01070
     X    NTBDX(IREEL,NC)                                               L76G0430  01071
   20 FORMAT(    6I13,5X,A6)                                            L76G0440  01072
   25 IF(NC.GT.10) GO TO 3                                              L76G0450  01073
      IF(NSTATR(5,2).EQ.0 .AND. IREEL.EQ.5 .AND. NC.EQ.2)   GO TO 5     L76G0460  01074
      IF(NSTATR(5,3).EQ.0 .AND. IREEL.EQ.5 .AND. NC.EQ.3)   GO TO 55    L76G0470  0107
   15 IF(NSTATR(IREEL,NC).NE.I) GO TO 4                                 L76G0480  0107b
      IF(NSTATC(IREEL,NC).NE.J) GO TO 4                                 L76G0490  01077
      IF(NTBDX(IREEL,NC).EQ.DEE) GO TO 6                                L76G0500  01078
      IF(NTBDX(IREEL,NC).EQ.BEE) GO TO 7                                L76G0510  01079
      IRTOP = IREEL                                                     L76G0520  01080
      NCTOP = NC                                                        L76G0530  01081
      ISW = ISW+1                                                       L76G0540  01082
      GO TO 8                                                           L76G0550  01083
    7 IRBOT = IREEL                                                     L76G0560  01084
      NCBOT = NC                                                        L76G0570  01085
      ISW = ISW+1                                                       L76G0580  01086
    8 IF(ISW.NE.2) GO TO 4                                              L76G0590  01087
      CN(1,J,I) = AN(1,NCBOT,IRBOT) - AN(1,NCTOP,IRTOP)                 L76G0600  01088
      DO 10 K=1,30                                                      L76G0610  01089
      CN(K+1,J,I) = AN(K+1,NCBOT,IRBOT)-AN(K+1,NCTOP,IRTOP)             L76G0620  01090
   10 SN(K,J,I) = BN(K,NCBOT,IRBOT)-BN(K,NCTOP,IRTOP)                   L76G0630  01091
      GO TO 2                                                           L76G0640  01092
C *** COLLECTIVE, LONGITUDINAL CYCLIC, AND LATERAL CYCLIC PITCH ANGLES  L76G0650  01093
C     FOUND NEXT.                                                       L76G0660  01094
    5 CONTINUE                                                          L76G0670  01095
      B0  = AN(1,2,5)                                                   L76G0680  01096
      B1C = AN(2,2,5)                                                   L76G0690  01097
      B1S = BN(1,2,5)                                                   L76G0700  01098
      IF  (IDD .EQ. 1)   WRITE(6,21)    B0,B1C,B1S,IREEL,NC,I,J         L76G0710  01099
      GO TO 4                                                           L76G0720  01100
   55 CONTINUE                                                          L76G      01101
      F0  = AN(1,3,5)                                                   L76G0730  01102
      F1C = AN(2,3,5)                                                   L76G0740  01103
      F1S = BN(1,3,5)                                                   L76G0750  01104
      IF  (IDD .EQ. 1)   WRITE(6,21)    F0,F1C,F1S,IREEL,NC,I,J         L76G0760  01105
   21 FORMAT(' ',7G13.6)                                                L76G0770  01106
      GO TO 4                                                           L76G0780  01107
    6 CN(1,J,I) = AN(1,NC,IREEL)                                        L76G0790  01108
      DO 11 K=1,30                                                      L76G0800  01109
      CN(K+1,J,I) = AN(K+1,NC,IREEL)                                    L76G0810  01110
   11 SN(K,J,I) = BN(K,NC,IREEL)                                        L76G0820  01111
    2 CONTINUE                                                          L76G0830  01112
      RETURN                                                            L76G0840  01113
      END                                                               L76G0850  01114
@I  FOR  DFSRIE                                                         01115
      SUBROUTINE DFSRIE(NP,NH,Y,A,B)                                    L76D0010  01116
      DIMENSION Y(NP),A(1),B(1)                                         L76D0020  01117
C                 ------------------------------------------------------L76D0030  01118
C                 NUMBER OF HARMONICS  MUST NOT EXCEED HALF             L76D0040  01119
C                 THE NUMBER OF DATA POINTS INPUTED.                    L76D0050  01120
C                 ------------------------------------------------------L76D0060  01121
```

g. End of MERGES, Start of DFSRIE

Figure 60. Continued.

```
      NNH=MINO(NH,NP/2)                                                 L76D0070  01122
C-----------------------------------------------------------------------L76D0080  01123
C     INITIALIZATION AND CONSTANTS.                                     L76D0090  01124
C-----------------------------------------------------------------------L76D0100  01125
      SP=0.                                                             L76D0110  01126
      CP=1.                                                             L76D0120  01127
      RN=2./NP                                                          L76D0130  01128
      A(1)=0.                                                           L76D0140  01129
      A(1)=0.                                                           L76D0150  01130
      ARG=RN*3.14159265                                                 L76D0160  01131
      C=COS(ARG)                                                        L76D0170  01132
      S=SIN(ARG)                                                        L76D0180  01133
C-----------------------------------------------------------------------L76D0190  01134
C     COMPUTE A FOR THE ZEROTH HARMONIC                                 L76D0200  01135
C-----------------------------------------------------------------------L76D0210  01136
      DO10I=1,NP                                                        L76D0220  01137
10    A(1)=A(1)+Y(I)                                                    L76D0230  01138
      A(1)=RN*A(1) /2.                                                  L76D0240  01139
C-----------------------------------------------------------------------L76D0250  01140
C     MAIN LOOP.                                                        L76D0260  01141
C-----------------------------------------------------------------------L76D0270  01142
       DO 100 K=1,NNH                                                   L76D0280  01143
      X=C*CP-S*SP                                                       L76D0290  01144
      SP=C*SP+S*CP                                                      L76D0300  01145
      CP=X                                                              L76D0310  01146
      U=0.                                                              L76D0320  01147
      V=0.                                                              L76D0330  01148
C     COMPUTE RECURSIVE U,S                                             L76D0340  01149
      DO20II=2,NP                                                       L76D0350  01150
      J=NP-II+2                                                         L76D0360  01151
      W=Y(J)+2.*CP*V-U                                                  L76D0370  01152
      U=V                                                               L76D0380  01153
20    V=W                                                               L76D0390  01154
      A(K+1)=RN*(Y(1)+CP*V-U)                                           L76D0400  01155
100   B(K+1)=RN*SP*V                                                    L76D0410  01156
      RETURN                                                            L76D0420  01157
      END                                                               L76D0430  01158
QI  FOR  CUE                                                                    01159
      SUBROUTINE CUE(N,FH,MFIELD)                                       L76C0010  01160
       COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN, L76C0020  01161
     * MLIMDP,XFP(20),YFP(20),ZFP(20),GAMA,R0,BLADEL,B0,B1C,B1S,PUNCH,  L76C0030  01162
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,    L76C0040  01163
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,ANG,KEY1,KEY2,    L76C0050  01164
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,    L76C0060  01165
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,   L76C0070  01166
     * NOCH(5),LAZI                                                     L76C0080  01167
       COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,     L76C0090  01168
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XL0(7),XLM(7,40), L76C0100  01169
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),  L76C0110  01170
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,BEE,DEE,GMARI(288,20),             L76C0120  01171
     * HMARI(288,20),X0(20)                                             L76C0130  01172
       COMMON /BK3/ SPLM(10,20),AZMTH3(288),                            L76C0140  01173
     * SPAN(20),                          PMRMS(10,20),                L76C0150  01174
     * ICHANL(10,5),COSINE(288),SINE(288),BLADES,CARD,TAPE              L76C0160  01175
       EQUIVALENCE     (ND2(5761),HMAR),                                L76C0170  01176
     $                 (GMARI,AN),                                      L76C0180  01177
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN),(ND2,Q2)             L76C0190  01178
       DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),         L76C0200  01179
     * GMAR(144,5),HMAR(144,5)                                          L76C0210  01180
     * ,Q1(288,20),Q2(288,20)                                           L76C0220  01181
       EQUIVALENCE (ND1(5761),GMAR),(ND1,Q1)                            L76C0230  01182
       COMMON /NEW/ F0,F1C,F1S,TOTIME,THETA                             L76C0240  01183
        GAMMA(J) = (F0 + F1C*COSINE(J) + F1S*SINE(J)) * T5              L76C0250  01184
       T1=PI/30.                                                        L76C0260  01185
       T5=PI/180.                                                       L76C0270  01186
       THETAR=THETA*T5                                                  L76C0280  01187
```

h. End of DFSRIE, Start of CUE

Figure 60. Continued.

```
C *** SPAN LOOP                                                         L76C0290  01188
      IF(IDD.NE.1) GO TO 7                                              L76C0300  01189
      WRITE(6,3) XFP                                                    L76C0310  01190
      WRITE(6,3) YFP                                                    L76C0320  01191
      WRITE(6,3) ZFP                                                    L76C0330  01192
      WRITE(6,3) SPAN                                                   L76C0340  01193
      WRITE(6,3) COSINE                                                 L76C0350  01194
      WRITE(6,3) SINE                                                   L76C0360  01195
      WRITE(6,3) AZMTH3                                                 L76C0370  01196
      WRITE(6,3) OMEG,CC,GAMA,RO,BO,B1C,B1S,FM,BLADES,T1,T5             L76C0380  01197
    3 FORMAT(1H0/(2X,1P10E13.5))                                        L76C0390  01198
    7 DO 1 I=1,LSPAN                                                    L76C0400  01199
C *** AZIMUTH LOOP                                                      L76C0410  01200
      DO 1 J=1,LAZI                                                     L76C0420  01201
      S = SQRT((XFP(MFIELD)-SPAN(I)*COSINE(J))**2 + (YFP(MFIELD)-SPAN(I)L76C0430  01202
     X *SINE(J))**2 + ZFP(MFIELD)**2)                                   L76C0440  01203
      B =(BO - GAMA*(SPAN(I)-RO) + B1C*COSINE(J) + B1S*SINE(J))*T5      L76C0450  01204
      SINB = SIN(B)                                                     L76C0460  01205
      COSB = COS(B)                                                     L76C0470  01206
      T4 = FM*BLADES*(AZMTH3(J)+(S*OMEG*T1)/CC)                         L76C0480  01207
      T2 = COS(T4)                                                      L76C0490  01208
      T3 = SIN(T4)                                                      L76C0500  01209
      T4= (FM*BLADES*OMEG/(CC*S**2))*T1                                 L76C0510  01210
      IF(N.EQ.3) GO TO 2                                                L76C0520  01211
      Q1(J,I) = SPAN(I)                                                 L76C0530  01212
     $          * ( (XFP(MFIELD) - SPAN(I)*COSINE(J))                   L76C0540  01213
     $          * ( (SINB*SINE(J) - COSB*SIN(GAMMA(J))*COSINE(J))       L76C0550  01214
     $                                          * COS(THETAR)           L76C0560  01215
     $                          + COSB*COS(GAMMA(J))*SIN(THETAR) )      L76C0570  01216
     $            - (YFP(MFIELD) - SPAN(I)*SINE(J))                     L76C0580  01217
     $               * (SINB*COSINE(J)                                  L76C0590  01218
     $                          + COSB*SIN(GAMMA(J))*SINE(J ))          L76C0600  01219
     $            +  ZFP(MFIELD) * ( COSB*COS(GAMMA(J))*COS(THETAR)     L76C0610  01220
     $                            + ( COSB*SIN(GAMMA(J))*COSINE(J)      L76C0620  01221
     $                                - SINB*SINE(J))*SIN(THETAR) ) )   L76C0630  01222
      Q2(J,I) = Q1(J,I)*(GMARI(J,I)*(-T2/S**3 - T4*T3) +                L76C0640  01223
     X HMARI(J,I)*(T3/S**3 - T4*T2))                                    L76C0650  01224
      IF(IDD.NE.1) GO TO 1                                              L76C0660  01225
      IF(I.GT.2) GO TO 1                                                L76C0670  01226
      IF(J.GT.20) GO TO 1                                               L76C0680  01227
      WRITE(6,4) I,J,MFIELD                                             L76C0690  01228
    4 FORMAT(1H0,6I13)                                                  L76C0700  01229
      WRITE(6,3) S,B,SINB,COSB,T2,T3,T4,GMARI(J,I),HMARI(J,I),          L76C0710  01230
     X  Q1(J,I),Q2(J,I)                                                 L76C0720  01231
      GO TO 1                                                           L76C      01232
    2 Q2(J,I) = Q1(J,I)*(GMARI(J,I)*(-T3/S**3 + T4*T2) +                L76C0730  01233
     X HMARI(J,I)*(-T2/S**3 - T4*T3))                                   L76C0740  01234
    1 CONTINUE                                                          L76C0750  01235
      RETURN                                                            L76C0760  01236
      END                                                               L76C0770  01237
BI  FOR  INTERP                                                         01238
      SUBROUTINE INTERP                                                 L76P0010  01239
C *** THIS SUBR. INTERPOLATES PRESSURE PULSE HARMONICS FOR UP TO 20 SPANL76P0020  01240
C     STATIONS AND 288 AZIMUTHS.                                        L76P0030  01241
      COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,NLIMRN,  L76P0040  01242
     * NLIMOP,XFP(20),YFP(20),ZFP(20),GAMA,RO,BLADEL,BQ,B1C,B1S,PUNCH,  L76P0050  01243
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,    L76P0060  01244
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E3860P,NFT,AN8,KEY1,KEY2,    L76P0070  01245
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,    L76P0080  01246
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,   L76P0090  01247
     * NOCH(5),LAZI                                                     L76P0100  01248
      COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,      L76P0110  01249
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XL0(7),XLH(7,40), L76P0120  01250
     * XNH(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),  L76P0130  01251
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,BEE,DEE,GMARI(288,20),             L76P0140  01252
     * HMARI(288,20),XO(20)                                             L76P0150  01253
```

i. End of CUE, Start of INTERP

Figure 60. Continued.

```
      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(5761),HMAR),
     $               (GMARI,AN),
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN)
      EQUIVALENCE (ND1(5761),GMAR)
      DIMENSION YO(20)
       T1 = .2305
       T2 = .7695
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.
      CALL CURVIT (NOPTS1,TEMP2,TEMP1,W,LSPAN,XO,YO)
      DO 3 K=1,LSPAN
    3 GMARI(1,K) = YO(K)
      CALL CURVIT(NOPTS1,TEMP2,TEMP3,W,LSPAN,XO,YO)
      DO 4 K=1,LSPAN
    4 HMARI(1,K) = YO(K)
      D = (DPSI/2.5) + .00001
      ISI = D
      JJ = ISI
      JAZ2 = 1
      J = 3
      ISI2=ISI
      IF(ISI.EQ.0) ISI2=1
      LOW = ISI2+1
C *** AZIMUTH LOOP
      DO 5 JAZ=LOW,144,ISI2
      JAZ2 = JAZ2+1
      KKK=1
      DO 6 K=1,5
      IF(IRS(K).EQ.0) GO TO 6
      KKK = KKK+1
      TEMP1(KKK) = GMAR(JAZ,K)
      TEMP3(KKK) = HMAR(JAZ,K)
    6 CONTINUE
      CALL CURVIT(NOPTS1,TEMP2,TEMP1,W,LSPAN,XO,YO)
      IF(ISI.GE.1) J=JAZ2
      DO 7 K=1,LSPAN
    7 GMARI(J,K) = YO(K)
      CALL CURVIT(NOPTS1,TEMP2,TEMP3,W,LSPAN,XO,YO)
      DO 8 K=1,LSPAN
    8 HMARI(J,K) = YO(K)
      IF(JJ.NE.0) GO TO 5
      DO 9 K=1,LSPAN
```

j. INTERP Continued

Figure 60. Continued.

```
      GMARI(J-1,K) = (GMARI(J,K)+GMARI(J-2,K))/2.                       L76P0810  01320
    9 HMARI(J-1,K) = (HMARI(J,K)+HMARI(J-2,K))/2.                       L76P0820  01321
      J=J+2                                                             L76P0830  01322
    5 CONTINUE                                                          L76P0840  01323
      IF(JJ.NE.0) RETURN                                                L76P0850  01324
      J=J-2                                                             L76P0860  01325
      DO 10 K=1,LSPAN                                                   L76P0870  01326
      GMARI(J+1,K) = (GMARI(1,K) + GMARI(J  ,K))/2.                     L76P0880  01327
   10 HMARI(J+1,K) = (HMARI(1,K) + HMARI(J  ,K))/2.                     L76P0890  01328
      RETURN                                                            L76P0900  01329
      END                                                               L76P0910  01330
GI  FOR  CURVIT                                                                 01331
      SUBROUTINE CURVIT (MM, X9, Y9, W, N, X0, Y0)                      L76V0010  01332
C                                                                       L76V0020  01333
C                                                                       L76V0030  01334
C        PRESENTLY W IS NOT USED IN THIS ROUTINE, HOWEVER, IT SHOULD BE L76V0040  01335
C     DIMENSIONED IN THE CALLING PROGRAM.                               L76V0050  01336
C                                                                       L76V0060  01337
C   *    W  WILL BE USED LATER FOR A WORK VECTOR. -- COEF'S DIMENSION   L76V0070  01338
C*****   WILL BE CHANED ALSO.-SO.FOR NOW ASSUME THE INPUT IS SORTED*****L76V0080  01339
C   *                                                                   L76V0090  01340
      DIMENSION  X(14),Y(7), W(1), X0(1), Y0(1), CUBE(3), ROOT(3),      L76V0100  01341
     *   ROOTI(3), X9(1), Y9(1)                                         L76V0110  01342
       COMMON /COTAN/ TIN( 7,2), COEF(4, 7,2)                           L76V0120  01343
       DO 1 I=1,MM                                                      L76V0130  01344
      X(I) = X9(I)                                                      L76V0140  01345
      X(I+7) = Y9(I)                                                    L76V0150  01346
    1 Y(I) = Y9(I)                                                      L76V0160  01347
      IF (MM .GE. 2) GO TO 10                                           L76V0170  01348
      IF (MM .EQ. 0) Y = 0.                                             L76V0180  01349
      DO  5  I=1,N                                                      L76V0190  01350
    5 Y0(I) = Y                                                         L76V0200  01351
      WRITE (6,100)     ( X0(I), Y0(I), I=1,N)                          L76V0210  01352
  100 FORMAT ( 94H0 PROBLEM WITH CURVE FITS (CURVIT) - LESS THAN TWO POIL76V0220  01353
     *NTS ON THIS CURVE. - INPUT X    OUTPUT Y, /(72X, 2E11.4, /) )     L76V0230  01354
      RETURN                                                            L76V0240  01355
   10 CALL PARAM (MM, X,        2)                                      L76V0250  01356
      DO  90  J=1,N                                                     L76V0260  01357
      TUM1=1                                                            L76V0270  01358
      DO  20  I=1,MM                                                    L76V0280  01359
      K=I-1                                                             L76V0290  01360
   20 IF( X0(J) .LT. X(I) ) GO TO 30                                    L76V0300  01361
      IF( X0(J) .EQ. X(I) ) GO TO 48                                    L76V0310  01362
      TUM1=-1                                                           L76V0320  01363
      I=  MM                                                            L76V0330  01364
   25 TUM1=-TUM1                                                        L76V0340  01365
      SLOPE = TIN(I,2)/TIN(I,1)* TUM1                                   L76V0350  01366
      CONST = Y(I) - SLOPE*X(I)                                         L76V0360  01367
      Y0(J) = SLOPE*X0(J) + CONST                                       L76V0370  01368
      GO TO 90                                                          L76V0380  01369
   30 IF (I .EQ. 1) GO TO 25                                            L76V0390  01370
   35 IF (X0(J) .EQ. X9(K)) GO TO 64                                    L76V0400  01371
C        K REFER TO THE SECTION FROM WHICH WE NEED THE COEFFICIENTS.    L76V0410  01372
      D= COEF(4,K,1)                                                    L76V0420  01373
      DO  40 I=1,3                                                      L76V0430  01374
   40 CUBE(I) = COEF(I,K,1)/D                                           L76V0440  01375
      CUBE(1) = CUBE(1) - X0(J)/D                                       L76V0450  01376
      CALL CUBIC (CUBE(3), CUBE(2), CUBE, ROOT, ROOTI )                 L76V0460  01377
      DO  50 I=1,3                                                      L76V0470  01378
      IF ( ABS(ROOT(I))  .LE. .0001) ROOT(I) = 0.                       L76V0480  01379
      IF ( ABS(ROOT(I)-1.).GT..0001) GO TO 49                           L76V0490  01380
   48 ROOT(I) = 1.                                                      L76V0500  01381
      Y0(J) = Y9(K+1)                                                   L76V0510  01382
      GO TO 90                                                          L76V0520  01383
   49 IF(ROOTI(I).NE.0.) GO TO 50                                       L76V0530  01384
      IF(ROOT(I).LT.0.) GO TO 50                                        L76V0540  01385
```

k. End of INTERP, Start of CURVIT

Figure 60. Continued.

```
      IF(ROOTI(I).GT.1.) GO TO 50
      GO TO 60                                                          L76V0550  01386
   50 CONTINUE                                                          L76V0560  01387
C     **  THERE IS NO SOLN.  **                                         L76V0570  01388
      WRITE(6,101) (COEF(I,K,1), I=1,4), K, Y0(J), (ROOT(I),ROOTI(I),I=1L76V0580  01389
     *,3)                                                               L76V0590  01390
  101 FORMAT ( 39H0   A ROOT FOR THE CUBIC EQUATION   X =, E11.4,3H + , L76V0600  01391
     *  E11.4, 7H * T + , E11.4, 9H * T*T + , E11.4, 7H * T**3,13H  IN SL76V0610  01392
     *ECTION , I3, // 6X, 42H DOES NOT EXIST BETWEEN 0. AND 1. WHEN X = ,L76V0620  01393
     *E13.5,47H AND THE ROOTS ARE -     REAL          IMAGINARY,(/77X,   L76V0630  01394
     *E15.7, 2X,E15.7 ) )                                               L76V0640  01395
      T = .5                                                            L76V0650  01396
      GO TO 61                                                          L76V0660  01397
   64 T= 0.                                                             L76V0670  01398
      GO TO 61                                                          L76V0680  01399
   60 T = ROOT(I)                                                       L76V0690  01400
   61 Y0(J) = COEF(1,K,2) + COEF(2,K,2)*T + COEF(3,K,2)*T*T +            L76V0700  01401
     *        COEF(4,K,2)*T**3                                          L76V0710  01402
   90 CONTINUE                                                          L76V0720  01403
      END                                                               L76V      01404
QI  FOR  AVQUAD                                                         L76V0730  01405
      SUBROUTINE AVQUAD (N,X,Y,AREA)                                    L76A0010  01406
C     INTEGRATION BY AVERAGED QUADRATICS BASED ON LAGRANGE INTERPOLATIONL76A0020  01407
      DIMENSION X(12),Y(12)                                             L76A0030  01408
      AREA=0.                                                           L76A0040  01409
      T1=Y(1)/((X(1)-X(2))*(X(1)-X(3)))                                 L76A0050  01410
      T2=Y(2)/((X(2)-X(1))*(X(2)-X(3)))                                 L76A0060  01411
      T3=Y(3)/((X(3)-X(1))*(X(3)-X(2)))                                 L76A0070  01412
      A2=T1+T2+T3                                                       L76A0080  01413
      B2=-(T1*(X(2)+X(3))+T2*(X(1)+X(3))+T3*(X(1)+X(2)))                L76A0090  01414
      C2=T1*X(2)*X(3)+T2*X(1)*X(3)+T3*X(1)*X(2)                         L76A0100  01415
      AREA=AREA+(A2/3.)*((X(2)**3)-(X(1)**3))+(B2/2.)*((X(2)**2)-(X(1)**L76A0110  01416
     12))+C2*(X(2)-X(1))                                                L76A0120  01417
      N2=N-2                                                            L76A0130  01418
      DO 101 K=2,N2                                                     L76A0140  01419
      A1=A2                                                             L76A0150  01420
      B1=B2                                                             L76A0160  01421
      C1=C2                                                             L76A0170  01422
      T1=Y(K)/((X(K)-X(K+1))*(X(K)-X(K+2)))                             L76A0180  01423
      T2=Y(K+1)/((X(K+1)-X(K))*(X(K+1)-X(K+2)))                         L76A0190  01424
      T3=Y(K+2)/((X(K+2)-X(K))*(X(K+2)-X(K+1)))                         L76A0200  01425
      A2=T1+T2+T3                                                       L76A0210  01426
      B2=-(T1*(X(K+1)+X(K+2))+T2*(X(K)+X(K+2))+T3*(X(K)+X(K+1)))        L76A0220  01427
      C2=T1*X(K+1)*X(K+2)+T2*X(K)*X(K+2)+T3*X(K)*X(K+1)                 L76A0230  01428
      A=(A1+A2)/2.                                                      L76A0240  01429
      B=(B1+B2)/2.                                                      L76A0250  01430
      C=(C1+C2)/2.                                                      L76A0260  01431
  101 AREA=AREA+(A/3.)*((X(K+1)**3)-(X(K)**3))+(B/2.)*((X(K+1)**2)-(X(K)L76A0270  01432
     1**2))+C*(X(K+1)-X(K))                                             L76A0280  01433
      AREA=AREA+(A2/3.)*((X(N)**3)-(X(N-1)**3))+(B2/2.)*((X(N)**2)-(X(N-L76A0290  01434
     11)**2))+C2*(X(N)-X(N-1))                                          L76A0300  01435
      RETURN                                                            L76A0310  01436
      END                                                               L76A0320  01437
QI  FOR  CUBIC                                                          L76U0010  01438
      SUBROUTINE CUBIC ( P, Q, R, ROOT, ROOTI )                         L76U0020  01439
C  CUBIC FINDS THE REAL + COMPLEX ROOTS OF (X**3)+P*(X**2)+Q*(X)+R=0    L76U0030  01440
      DIMENSION              ROOT(3),ROOTI(3)                           L76U0040  01441
   90 DO 220 I=1,3                                                      L76U0050  01442
      ROOT(I)= 0.                                                       L76U0060  01443
  220 ROOTI(I)=0.                                                       L76U0070  01444
      P3  = P/3.                                                        L76U0080  01445
      SMALLA  =  Q - P*P3                                               L76U0090  01446
      SMALLB  =  2. *P3**3 - P3* Q +R                                   L76U0100  01447
      AD3  =  SMALLA/3.                                                 L76U0110  01448
      SB2  =  SMALLB/2.                                                 L76U0120  01449
      B4 =    SB2**2                                                    L76U0130  01450
                                                                        L76U0120  01451
```

1. End of CURVIT, AVQUAD, Start of CUBIC

Figure 60. Continued.

```
      A27 =   AD3 **3                                                   L76U0130  01452
      SMALLC =  D4 + A27                                                L76U0140  01453
      IF (SMALLC)14 , 1 ,5                                              L76U0150  01454
    1 XA=SQRT (-AD3)                                                    L76U0160  01455
      IF (SMALLB) 3,4,4                                                 L76U0170  01456
    3 XA=-XA                                                            L76U0180  01457
    4 ROOT(1) =XA-P3                                                    L76U0190  01458
      ROOT(2) = ROOT(1)                                                 L76U0200  01459
      ROOT(3) = -XA-XA-P3                                               L76U0210  01460
      GO TO 22                                                          L76U0220  01461
    5 POWER = 1./ 3.                                                    L76U0230  01462
      B2 =  - SMALLB / 2.                                               L76U0240  01463
      SBA= SQRT  ( SMALLC)                                              L76U0250  01464
      BIGA = B2 + SBA                                                   L76U0260  01465
      BIGB =  B2 -SBA                                                   L76U0270  01466
      IF ( BIGA ) 6  , 7 , 8                                            L76U0280  01467
    6 BIGA1 =-((-BIGA )** POWER  )                                      L76U0290  01468
      GO TO 9                                                           L76U0300  01469
    7 BIGA1 =0.                                                         L76U0310  01470
      GOTO  9                                                           L76U0320  01471
    8 BIGA1 =   ( BIGA)** POWER                                         L76U0330  01472
    9 IF ( BIGB )10 , 11, 12                                            L76U0340  01473
   10 BIGB1 =-((-BIGB) ** POWER  )                                      L76U0350  01474
      GO TO 13                                                          L76U0360  01475
   11 BIGB1 = 0.                                                        L76U0370  01476
      GO TO 13                                                          L76U0380  01477
   12 BIG B1  = (BIGB) ** POWER                                         L76U0390  01478
   13 AB = BIGA1+BIGB1                                                  L76U0400  01479
      ROOT (1) = AB-P3                                                  L76U0410  01480
      ROOTI(1) =   0.                                                   L76U0420  01481
      ROOT (2) = -AB/2.-P3                                              L76U0430  01482
      ROOT (3) =    ROOT(2)                                             L76U0440  01483
      ROOTI(2) =  SQRT (3.)/2. *( BIGA1 - BIGB1)                        L76U0450  01484
      ROOTI(3) =  - ROOTI (2)                                           L76U0460  01485
      GO TO 22                                                          L76U0470  01486
   14 RAD  = 57.2957795                                                 L76U0480  01487
      CON  = 120./ RAD                                                  L76U0490  01488
      A3   =  SQRT  ( -AD3)                                             L76U0500  01489
      IF  (SMALLB ) 15, 16, 17                                          L76U0510  01490
   15 COT = 0.                                                          L76U0520  01491
      CP = 1.                                                           L76U0530  01492
      GO TO 18                                                          L76U0540  01493
   16 PH3 = 30./ RAD                                                    L76U0550  01494
      GO TO 19                                                          L76U0560  01495
   17 COT  = 180. /RAD                                                  L76U0570  01496
      CP= -1.                                                           L76U0580  01497
   18 B4A27 =  - B4 /A27                                                L76U0590  01498
      COSPHI =  CP* SQRT ( B4A27)                                       L76U0600  01499
      XK   = SQRT  ( 1.- B4A27)                                         L76U0610  01500
      PHI  = ATAN ( XK/ COSPHI )                                        L76U0620  01501
      PH3 = (COT + PHI*CP/3.)                                           L76U0630  01502
   19 DO  20  I= 1,3                                                    L76U0640  01503
   20 ROOTI(I) = 0.                                                     L76U0650  01504
      AK = A3+ A3                                                       L76U0660  01505
      ANGLE  =PH3                                                       L76U0670  01506
      DO 21 I = 1,3                                                     L76U0680  01507
      ROOT (I) = AK * COS  (ANGLE)-P3                                   L76U0690  01508
   21 ANGLE = ANGLE +CON                                                L76U0700  01509
   22 RETURN                                                            L76U0710  01510
      END                                                               L76U0720  01511
BI  FOR  SIMCOR                                                                   01512
      SUBROUTINE SIMCOR (N,H,Y,XINT,IERR)                               L76S0010  01513
C     PURPOSE                                                           L76S0020  01514
C                                                                       L76S0030  01515
C         TO INTEGRATE A FUNCTION F(X) OVER A RANGE (A,B)               L76S0040  01516
C                                                                       L76S0050  01517
```

m. End of CUBIC, Start of SIMCOR

Figure 60. Continued.

```
C     METHOD
C
C         SIMPSONS RULE WITH A CORRECTION FACTOR INCORPORATED
C          IN THE EQUATION IS USED IF (N-1) IS DIVISIBLE BY
C          BOTH 2 AND 4
C
C         SIMPSONS RULE IS USED WITHOUT THE CORRECTION FACTOR
C          IF (N-1) IS ONLY DIVISIBLE BY 2
C
C         IF (N-1) IS NOT DIVISIBLE BY 2 THIS IMPLIES THAT N
C           IS EVEN AND THIS SUBROUTINE CAN NOT BE USED.
C
C     CALLING SEQUENCE
C
C         CALL SIMCOR (N,H,Y,XINT,IERR)
C
C     DESCRIPTION OF PARAMETERS
C
C           N   -NUMBER OF POINTS THAT ARE TAKEN OVER THE CURVE
C
C           H   -CONSTANT INTERVAL BETWEEN THE POINTS
C
C           Y   -SUPPLIED FUNCTION
C
C           XINT-TOTAL AREA UNDER THE CURVE BETWEEN A AND B
C
C           IERR-ERROR CODE
C                IERR = 0  (N-1) NOT DIVISIBLE BY 2 THEREFORE N IS EVEN
C                IERR = 1  (N-1) IS  DIVISIBLE BY 2
C                IERR = 2  (N-1) IS  DIVISIBLE BY BOTH 2 AND 4
C
C
      DIMENSION Y(1)
      IERR = 0
      K = MOD ((N-1),4) + 1
      IF (K .EQ. 2 .OR. K .EQ. 4) RETURN
      XINT = Y(1) + 4.* Y(N-1) + Y(N)
      N3 = N - 3
      DO 10 I = 2,N3,2
   10 XINT = XINT + 4.* Y(I) + 2.* Y(I+1)
      XINT = H/3.0 * XINT
      IERR = 1
      IF(K .EQ. 3 .OR. N .LT. 9) RETURN
      XINT1= Y(1) + 4.* Y(N-2) + Y(N)
      N6 = N-6
      DO 20 I = 3,N6,4
   20 XINT1= XINT1+ 4.* Y(I) + 2.* Y(I+2)
      XINT1= 2.* H/3. * XINT1
      XINT = XINT + (XINT - XINT1)/15.
      IERR = 2
      RETURN
      END
Q1  FOR  TRIDAG
      SUBROUTINE TRIDAG(A,G,K1,Z )
      DIMENSION A( 7,8),B(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
C         *********-------- ***        ***
C         *   *   *       - * *        * *
C         * S * R *       - * *        * *
C         *   *   *       - * *        * *
C         *************   - * *        * *
C         *   *   *   *   - * *        * *
```

n. End of SIMCOR, Start of TRIDAG

Figure 60. Continued.

```
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
      DO 20 I=2,K3
      J = K1-I
      S = A(J+1,J+1)
      R = A(J+1,J+2)
      T = A(J+1,J)
      IF(T .EQ. 0. ) GO TO 25
      Z(J) = ( G(J+1)-S*Z(J+1)-R*Z(J+2))/T
   20 CONTINUE
      Z(1) = (G(1)-A(1,2)*Z(2))/A(1,1)
      RETURN
   25 WRITE(6,1)
      RETURN
      END
QI  FOR  PARAM
      SUBROUTINE PARAM (N, P,       IJ )
      DIMENSION G( 7), P( 7,2),DEL( 7,2),DIST( 7),A( 7, 8),Q( 7,2)
       COMMON /COTAN/   T( 7,2), COE (4, 7,2)
      N1 = N-1
```

0. End of TRIDAG, Start of PARAM

Figure 60. Continued.

```
      N2 = N-2                                                          L76X0050  01650
      N3 = N-3                                                          L76X0060  01651
      N0=N2                                                             L76X0070  01652
      IGO = 2                                                           L76X0080  01653
      DO  15 I=1,N1                                                     L76X0090  01654
      DO 10 J=1,2                                                       L76X0100  01655
   10 DEL(I,J) =  P(I+1,J) - P(I,J)                                     L76X0110  01656
   15 DIST(I)  =  SQRT(DEL(I,1)**2 + DEL(I,2)**2)                       L76X0120  01657
      DO  20 I=1,N                                                      L76X0130  01658
      DO  20 J=1,N                                                      L76X0140  01659
   20 A(I,J) = 0.                                                       L76X0150  01660
      A(1,3) = DIST(1)                                                  L76X0160  01661
      A(N2,N2) = DIST(N1)                                               L76X0170  01662
      DO  30  I=2,N3                                                    L76X0180  01663
      A(I,I)   = DIST(I+1)                                              L76X0190  01664
      A(I,I+1) = 2.*(DIST(I)+DIST(I+1))                                 L76X0200  01665
      A(I,I+2) = DIST(I)                                                L76X0210  01666
      DO 30 J=1,2                                                       L76X0220  01667
   30 G(I,J)   = 3.*(DIST(I)/DIST(I+1)*DEL(I+1,J)+DIST(I+1)/DIST(I)*DEL(L76X0230  01668
     * I,J))                                                            L76X0240  01669
   12 A(1,2) = 2.* DIST(1) + DIST(2)*1.5                                L76X0250  01670
C  12 A(1,2) = 2.*(DIST(1) + DIST(2))                                   L76X0260  01671
      DO 33 J=1,2                                                       L76X0270  01672
C 33 G(1,J) = 3.*(DIST(1)/DIST(2)*DEL(2,J)+DIST(2)/DIST(1)*DEL(1,J)) -  L76X0280  01673
   33 G(1,J) = 3.*(DIST(1)/DIST(2)*DEL(2,J)+DIST(2)/DIST(1)*DEL(1,J)/2.)L76X0290  01674
C    * DIST(2)* T(1,J)                                                  L76X0300  01675
C  22 A(N2, N1 ) = 2.*(DIST(N2 ) + DIST(N1 ))                           L76X0310  01676
   22 A(N2, N1 ) =1.5* DIST(N2 ) + DIST(N1 )*2.                         L76X0320  01677
      DO 27 J=1,2                                                       L76X0330  01678
   27 G(N2, J)    =1.5*(DIST(N2 )/DIST(N1 )*DEL(N1, J)   +DIST(N1 )/DIST L76X0340  01679
C  27 G(N2, J)    = 3.*(DIST(N2 )/DIST(N1 )*DEL(N1, J)   +DIST(N1 )/DIST L76X0350  01680
     *(N2 )*DEL(N2, J))                                                 L76X0360  01681
C    *(N2 )*DEL(N2, J)) - DIST(N2 )* T(N,J)                             L76X0370  01682
   17 DO 45 J=1,2                                                       L76X0380  01683
      DO  36  I=1,N0                                                    L76X0390  01684
   36 G(I)=G(I,J)                                                       L76X0400  01685
      CALL TRIDAG(A(1,2),G,N0,T(2,J))                                   L76X0410  01686
      T(1,J) = 1.5/DIST*DEL(1,J) - .5*T(2,J)                            L76X0420  01687
      T(N,J) = 1.5/DIST(N1)*DEL(N1,J) - .5*T(N1,J)                      L76X0430  01688
   44 DO  45  I=1,N1                                                    L76X0440  01689
      COE(4,I,J)=-2.*DEL(I,J) + DIST(I)*( T(I+1,J)+T(I,J) )             L76X0450  01690
      COE(3,I,J)= 3.*DEL(I,J) - DIST(I)*( T(I+1,J)+2.*T(I,J) )          L76X0460  01691
      COE(2,I,J)= DIST(I)*T(I,J)                                        L76X0470  01692
   45 COE(1,I,J)= P(I,J)                                                L76X0480  01693
      RETURN                                                            L76X0490  01694
      END                                                               L76X0500  01695
GI  FOR  E386RN                                                                 01696
      SUBROUTINE E386RN                                                 L76E0010  01697
C     ACOUSTIC PRESSURE      V.BERECZ FOR R.KING     DECK E386          L76E0020  01698
      COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,  L76E0030  01699
     * MLIMOP,XFP(20),YFP(20),ZFP(20),GAMA,RO,BLADEL,B0,B1C,B1S,PUNCH,  L76E0040  01700
     * LSPAN,FROC(30),TGOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,    L76E0050  01701
     * IRS(5),ITRACK(5),FI(5,5),NCHAN(5,5),E386OP,NFT,ANG,KEY1,KEY2,    L76E0060  01702
     * KEY3,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERM,    L76E0070  01703
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,   L76E0080  01704
     * NOCH(5),LAZI                                                     L76E0090  01705
      COMMON /BK2/ NOCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,     L76E0100  01706
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XL0(7),XLM(7,40), L76E0110  01707
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTH2(144),AZMTH(144),  L76E0120  01708
     * OPRAD,AZRAD,NO,YES,NBLANK,TEE,DEE,DEE,GMARI(288,20),             L76E0130  01709
     * HMARI(288,20),XO(20)                                             L76E0140  01710
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),          L76E0150  01711
     * GMAR(144,5),HMAR(144,5)                                          L76E0160  01712
      EQUIVALENCE    (ND2(5761),HMAR),                                  L76E0170  01713
     $               (GMARI,AN),                                        L76E0180  01714
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN)                      L76E0190  01715
```

p. End of PARAM, Start of E386RN

Figure 60. Continued.

```
      EQUIVALENCE (NDI(5761),GHAR)                                      L76E0200  01716
      DIMENSION          Q(721,8),R(8),V8(8),V8I(8),                    L76E0210  01717
     1 V25(721),V25I(721),PSI(721),PRAD(721)                            L76E0220  01718
      EQUIVALENCE (Q,ND1),(V25,ND2),(V25I,ND2(1,1,2)),(PSI,ND2(1,1,3)), L76E0230  01719
     $            (PRAD,ND2(1,1,4))                                     L76E0240  01720
C                                                                       L76E0250  01721
C     READ FLT. COND. PARAMETERS AND BLADE SECTION LOADING, PRINT SAME. L76E0260  01722
C                                                                       L76E0270  01723
      RBN=NBLADE                                                        L76E0280  01724
      EQUIVALENCE                                                       L76E0290  01725
     X      (CH,AA),(SOS,CC),(B01,B0),(B1,B1C),(B11,B1S),(G,GAMA),      L76E0300  01726
     X (NHAR,MLIMRN),            (NFT,NFP),(OMG,OMEG)                   L76E0310  01727
      NRAD = LIRS+2                                                     L76E0320  01728
      GATC1=B0                                                          L76E0330  01729
      GATC2=B1C                                                         L76E0340  01730
      GATC3=B1S                                                         L76E0350  01731
      GATC4=GAMA                                                        L76E0360  01732
      GATC5=OMEG                                                        L76E0370  01733
      SOS = SOS/12.0                                                    L76E0380  01734
      J=1                                                               L76E0390  01735
      R(1)=0.                                                           L76E0400  01736
      DO 730 I=1,5                                                      L76E0410  01737
      J=J+1                                                             L76E0420  01738
      IF(IRS(I).EQ.0) GO TO 730                                         L76E0430  01739
      R(J)=RR(I)*BLADEL                                                 L76E0440  01740
  730 CONTINUE                                                          L76E0450  01741
      J=J+1                                                             L76E0460  01742
      R(J)=BLADEL                                                       L76E0470  01743
      RAD= 1./57.2957795                                                L76E0480  01744
      NP=(360./ANG)+1.001                                               L76E0490  01745
      NT=NP-1                                                           L76E0500  01746
      PSI(1)= 0.                                                        L76E0510  01747
      PRAD(1)=0.                                                        L76E0520  01748
      DO 4 I=2,NP                                                       L76E0530  01749
      PSI(I)= PSI(I-1)+ ANG                                             L76E0540  01750
    4 PRAD(I)= PSI(I)*RAD                                               L76E0550  01751
      DO 77 I=1,NRAD                                                    L76E0560  01752
      DO 77 J=1,NP                                                      L76E0570  01753
      Q(J,I)=XLO(I)                                                     L76E0580  01754
      DO 77 K=1,NHH                                                     L76E0590  01755
      X=K                                                               L76E0600  01756
   77 Q(J,I)=Q(J,I)+XLM(I,K)*COS(X*PRAD(J))+XMM(I,K)*SIN(X*PRAD(J))     L76E0610  01757
      IF(KEY1.NE.99) GO TO 88                                           L76E0620  01758
      DO 86 I=1,NRAD                                                    L76E0630  01759
   86 WRITE (6,87) XLO(I),((XLM(I,J),XMM(I,J)),J=1,NHAR)                L76E0640  01760
   87 FORMAT (E25.8/,(2E25.8))                                          L76E0650  01761
   88 WRITE (6,8) B01,B1,B11,CH,OMG,RBN,RO,(R(I),I=1,NRAD)              L76E0660  01762
    8 FORMAT (4H0B01,E15.6,4H  B1,E15.6,5H  B11,E15.6,7H  CHORD,E15.6,  L76E0670  01763
     1 7H  OMEGA,E15.6,8H  BLADES,F7.0,//25H RADIUS AT START OF TWIST,  L76E0680  01764
     2 E15.6,////30X,21HBLADE SECTION LOADING,///7H RADIUS,10X,1H1,14X, L76E0690  01765
     3 1H2,14X,1H3,14X,1H4,14X,1H5,14X,1H6,14X,1H7,14X,1H8,/8H AZIMUTH, L76E0700  01766
     4 2X,8E15.6,//)                                                    L76E0710  01767
      DO 9 I=1,NP                                                       L76E0720  01768
    9 WRITE (6,10) I,PSI(I),(Q(I,K),K=1,NRAD)                           L76E      01769
   10 FORMAT (I4,F7.1,8E15.6)                                           L76E0730  01770
      OMG=3.14159265*OMG/30.                                            L76E0740  01771
      SOS=12.*SOS                                                       L76E0750  01772
      B01=B01*RAD                                                       L76E0760  01773
      B1=B1*RAD                                                         L76E0770  01774
      B11=B11*RAD                                                       L76E0780  01775
      G=G*RAD                                                           L76E0790  01776
C                                                                       L76E0800  01777
C     BEGIN MAJOR LOOP ON FIELD POINTS                                  L76E0810  01778
C                                                                       L76E0820  01779
      DO 999 II=1,NFP                                                   L76E0830  01780
      CAPR=CAPRF(II)                                                    L76E0840  01781
```

q. E386RN Continued.

Figure 60. Continued.

```
      THETA=THETAF(II)
      ALFA=ALFAF(II)                                                    L76E0850  01782
   11 FORMAT (3F12.4)                                                   L76E0060  01783
      WRITE (6,12) CAPR,THETA,ALFA                                      L76E0070  01784
   12 FORMAT (12H0FIELD POINT,10X,6HRADIUS,E15.6,5X,7HAZIMUTH,E15.6,5X, L76E0080  01785
     1 9HELEVATION,E15.6,/20X,8HHARMONIC,10X,14HSOUND PRESSURE,13X,     L76E0890  01786
     2 3HSPL)                                                           L76E0900  01787
      CAPR=12.*CAPR                                                     L76E0910  01788
      ALFA= RAD*ALFA                                                    L76E0920  01789
      THETA= RAD*THETA                                                  L76E0930  01790
      DO 999 M=1,NHAR                                                   L76E0940  01791
      DO 990 KK=1,NRAD                                                  L76E0950  01792
      DO 99  JJ=1,NT                                                    L76E0960  01793
      CAPS= SQRT(CAPR*CAPR+R(KK)*R(KK)-2.*CAPR*R(KK)*COS(     ALFA)*    L76E0970  01794
     1 COS(PRAD(JJ)-THETA))                                             L76E0980  01795
      BETA=B01-G*(R(KK)-R0)+B1*COS( PRAD(JJ)  )+B11*SIN( PRAD(JJ)  )    L76E0990  01796
      SBTA=SIN(BETA)                                                    L76E1000  01797
      CBTA=COS(BETA)                                                    L76E1010  01798
      V= M                                                              L76E1020  01799
      V= V*(RBN*OMG*CAPS/SOS+.5*CH*RBN/R(KK)+RBN* PRAD(JJ))             L76E1030  01800
      IF (KEY3.EQ.99) WRITE (6,9874) CAPS, BETA, V                      L76E1040  01801
 9874 FORMAT (3E25.8)                                                   L76E1050  01802
      TEMP=  M                                                          L76E1060  01803
      V25(JJ)=Q(JJ,KK)*SIN(.5*TEMP*RBN*CH/R(KK))*(COS(V)/CAPS+(TEMP*RBNL76E1070  01804
     1 *OMG/SOS)*SIN(V))*(SBTA*COS(ALFA)*SIN(PRAD(JJ)-THETA)+SIN(ALFA) *L76E1080  01805
     2CBTA)*R(KK))/(TEMP*CAPS*CAPS)                                     L76E1090  01806
      V25I(JJ)=Q(JJ,KK)*SIN(.5*TEMP*RBN*CH/R(KK))*(COS(V)*TEMP*RBN*OMG  L76E1100  01807
     1 /SOS-SIN(V)/CAPS)*(SBTA*COS(ALFA)*SIN(PRAD(JJ)-THETA)+SIN(ALFA) *L76E1110  01808
     2CBTA)*R(KK))/(TEMP*CAPS*CAPS)                                     L76E1120  01809
   99 CONTINUE                                                          L76E1130  01810
      V25(NP)=V25(1)                                                    L76E1140  01811
      V25I(NP)=V25I(1)                                                  L76E1150  01812
      CALL SIMCOR(NP,PRAD(2),V25 ,AR,IERR)                              L76E1160  01813
      IF(IERR .EQ. 0) WRITE(6,8418)                                     L76E1170  01814
 8418 FORMAT(///25X,23HERROR IN SIMCOR, IERR=0  ///)                    L76E1180  01815
      V8(KK)=AR                                                         L76E1190  01816
      CALL SIMCOR(NP,PRAD(2),V25I,AR,IERR)                              L76E1200  01817
       IF(IERR .EQ. 0) WRITE(6,8418)                                    L76E1210  01818
      V8I(KK)=AR                                                        L76E1220  01819
      IF(KEY2.EQ.99) WRITE (6,9876) V8(KK),(V25(I),I=1,NP)              L76E1230  01820
      IF(KEY2.EQ.99) WRITE (6,9876) V8I(KK),(V25I(I),I=1,NP)            L76E1240  01821
 9876 FORMAT (//E25.8/,(5E25.8/))                                       L76E1250  01822
  990 CONTINUE                                                          L76E1260  01823
      CALL AVQUAD (NRAD,R,V8,PRTAR)                                     L76E1270  01824
      CALL AVQUAD (NRAD,R,V8I,PRTAI )                                   L76E1280  01825
      IF (KEY1.EQ.99) WRITE (6,9875)PRTAR,(V8(KK),KK=1,NRAD)            L76E1290  01826
      IF (KEY1.EQ.99) WRITE (6,9875)PRTAI,(V8I(KK),KK=1,NRAD)           L76E1300  01827
 9875 FORMAT (//E25.8,/4E25.8,/4E25.8,//)                               L76E1310  01828
      PRTA=(.03582245*CAPR/CH)*SQRT(PRTAR**2+PRTAI**2)                  L76E1320  01829
      SPL= 20.*ALOG10(ABS(PRTA/2.9E-9))                                 L76E1330  01830
      WRITE (6,997) M,PRTA,SPL                                          L76E1340  01831
  997 FORMAT (25X,I2,5X,2E20.8)                                         L76E1350  01832
  999 CONTINUE                                                          L76E1360  01833
      B0=GATC1                                                          L76E1370  01834
      B1C=GATC2                                                         L76E1380  01835
      B1S=GATC3                                                         L76E1390  01836
      GAMA=GATC4                                                        L76E1400  01837
      OMEG=GATC5                                                        L76E1410  01838
      RETURN                                                            L76E1420  01839
      END                                                               L76E1430  01840
Q1  FOR  OUTSPL                                                         L76E1440  01841
      SUBROUTINE OUTSPL                                                           01842
      COMMON /BK1/ IDD,BB,AA,XA(5,5),DPSI,RR(5),OMEG,CC,NBLADE,MLIMRN,  L7600010  01843
     * MLIMOP,XFP(20),YFP(20),ZFP(20),GAMA,R0,BLADE1 ,B0,B1C,B1S,PUNCH,  L7600020  01844
     * LSPAN,FROC(30),TCOP,SLOPE(10,5),OFFSET(10,5),KUNIT(5),IBURST,    L7600030  01845
     * IRS(5),ITRACK(5),FI(5,5),NCHAII(5,5),E386OP,NFT,ANG,KEY1,KEY2,   L7600040  01846
                                                                        L7600050  01847
```

r. End of E386RN, Start of OUTSPL

Figure 60. Continued.

```
     * KEYS,NHH,CAPRF(20),THETAF(20),ALFAF(20),OPRONO,NCH(5),INTERH,     L7600060  01848
     * IREEL,NC,NTBDX(5,10),NSTATC(5,10),NSTATR(5,10),ISET(5),IREELS,    L7600070  01849
     * NOCH(5),LAZI                                                      L7600080  01850
      COMMON /BK2/ NCYCLE,CYCLES,KU,NDIV(4),BMASK(6),NN(435),LIRS,       L7600090  01851
     * KTRACK,KBURST,KREC,ND1(144,10,5),ND2(144,10,5),XL0(7),XLM(7,40),  L7600100  01852
     * XMM(7,40),TEMP1(7),TEMP2(7),TEMP3(7),PI,AZMTHZ(144),AZMTH(144),   L7600110  01853
     * DPRAD,AZRAD,NO,YES,NBLANK,TEE,GEE,DEE,GMARI(288,20),              L7600120  01854
     * HMARI(288,20),XO(20)                                              L7600130  01855
      COMMON /BK3/ SPLM(10,20),AZMTH3(288),                              L7600140  01856
     * SPAN(20),                          PMRMS(10,20),                 L7600150  01857
     * ICHANL(10,5),COSINE(288),SINE(288),BLADES,CARD,TAPE               L7600160  01858
      DIMENSION CN(31,5,5),SN(30,5,5),AN(31,10,5),BN(30,10,5),           L7600170  01859
     * GMAR(144,5),HMAR(144,5)                                           L7600180  01860
     * ,Q1(288,20),Q2(288,20)                                            L7600190  01861
      EQUIVALENCE    (ND2(5761),HMAR),                                   L7600200  01862
     $               (GMARI,AN),                                         L7600210  01863
     * (GMARI(1551),BN),(HMARI,CN),(HMARI(776),SN),(ND2,Q2)              L7600220  01864
      EQUIVALENCE (ND1(5761),GMAR),(ND1,Q1)                              L7600230  01865
C *** HARMONIC LOOP                                                      L7600240  01866
      DO 1 I=1,MLIMRN,2                                                  L7600250  01867
      WRITE(6,2) I                                                       L7600260  01868
    2 FORMAT(1H1, 28X, 29HROTATIONAL NOISE PROGRAM E676 / 8X,            L7600270  01869
     X 10HHARMONIC =, I3 )                                               L7600280  01870
      WRITE(6,3)                                                         L7600290  01871
    3 FORMAT(1H0, 8X, 5HFIELD, 11X, 28HFIELD POINT COORDINATES (IN),     L7600300  01872
     X 16X, 20HSOUND PRESSURE LEVEL / 8X, 5HPOINT, 10X,1HX,14X,1HY,      L7600310  01873
     X 14X,1HZ, 20X, 8HDECIBELS / )                                      L7600320  01874
C *** FIELD POINT LOOP                                                   L7600330  01875
      DO 4 J=1,NFT                                                       L7600340  01876
    4 WRITE(6,5) J,XFP(J),YFP(J),ZFP(J),SPLM(I,J)                        L7600350  01877
    5 FORMAT( 9X,I2,2X, 3(5X,1PE10.4),15X, 1PE10.4 )                     L7600360  01878
      IF(I.GE.MLIMRN) GO TO 7                                            L7600370  01879
      K=I+1                                                              L7600380  01880
      WRITE(6,6) K                                                       L7600390  01881
    6 FORMAT(1H2  / 8X,10HHARMONIC =,I3 )                                L7600400  01882
      WRITE(6,3)                                                         L7600410  01883
C *** FIELD POINT LOOP                                                   L7600420  01884
      DO 8 J=1,NFT                                                       L7600430  01885
    8 WRITE(6,5) J,XFP(J),YFP(J),ZFP(J),SPLM(K,J)                        L7600440  01886
    1 CONTINUE                                                           L7600450  01887
    7 RETURN                                                             L7600460  01888
      END                                                                L7600470  01889
QI  FOR  START                                                                   01890
      SUBROUTINE START                                                   L76Y0010  01891
      COMMON /TEMPUS/ TIME,COUNT                                         L76Y0020  01892
      INTEGER COUNT                                                      L76Y0030  01893
      DATA COUNT /0/                                                     L76Y0040  01894
      CALL RTMINS (TIME)                                                 L76Y0050  01895
      COUNT = COUNT + 1                                                  L76Y0060  01896
      CALL CLOCK                                                         L76Y0070  01897
      RETURN                                                             L76Y0080  01898
      END                                                                L76Y0090  01899
QI  FOR  CLOCK                                                                   01900
      SUBROUTINE CLOCK                                                   L76K0010  01901
      COMMON /TEMPUS/ TIME,COUNT                                         L76K0020  01902
      INTEGER COUNT                                                      L76K0030  01903
      CALL RTMINS (BALLS)                                                L76K0040  01904
      T    = BALLS - TIME                                                L76K0050  01905
      WRITE (6,100) COUNT , T                                            L76K0060  01906
  100 FORMAT (1H255X,18(1H*)/56X,8H*      (I2,8H)      */56X,18H* ELAPSEL76K0070  01907
     XD TIME = */56X,1H*16X,1H*/56X,2H* F8.4,8H  MIN  */56X,1H*16X,1H*/5L76K0080  01908
     X6X,18(1H*)//)                                                      L76K0090  01909
      RETURN                                                             L76K0100  01910
      END                                                                L76K0110  01911
```

s. End of OUTSPL, START, CLOCK

Fibure 60. Concluded.