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EVALUATION OF ALTERNATIVE PROCEDURES FOR ATMOSPHERIC ABSORPTION--ETC(U)

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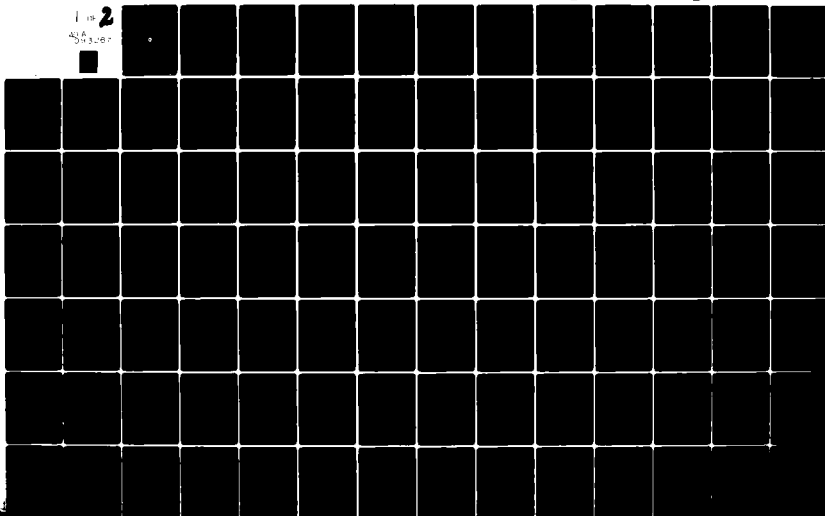
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DYTEC-7927

FAA/EE-80-46-VOL-2

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1 of 2
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Report No: FAA-EE-80-46, Vol. II

10/15/80
Vol. II
(12)

EVALUATION OF ALTERNATIVE PROCEDURES FOR ATMOSPHERIC ABSORPTION ADJUSTMENTS DURING NOISE CERTIFICATION

Volume II: Computer Program

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OCTOBER 1980
FINAL REPORT

Document is available to the U.S. public through
The National Technical Information Service,
Springfield, Virginia 22161

DEC 23 1980

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Prepared for
U.S. DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
Office of Environment and Energy
Washington, D.C. 20591

AD A093267

REF FILE COPY

80 12 22 179

Technical Report Documentation Page

1. Report No. FAA/EE-80-46, Vol. II	2. Government Accession No. AD-A093 267	3. Recipient's Catalog No. 1700.7
4. Title and Subtitle Evaluation of Alternative Procedures for Atmospheric Absorption Adjustments During Noise Certification, Volume II: Computer Program.	5. Report Date April 1980	6. Performing Organization Code
7. Author(s) Alan H. Marsh	8. Performing Organization Report No. DyTec Report 7927	9. Performing Organization Name and Address DyTec Engineering, Inc. 2750 East Spring Street Long Beach, CA 90806
10. Work Unit No. (TRIS)	11. Contract or Grant No. DOT-FA78WA-4121	12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Office of Environment and Energy Washington, DC 20591
13. Type of Report and Period Covered Final Report.	14. Sponsoring Agency Code	15. Supplementary Notes Richard N. Tedrick of the Noise Abatement Division of the Office of Environment and Energy was the FAA Technical Project Manager.
16. Abstract The work reported here extends that in FAA-RD-77-167, December 1977, to the problem of adjusting actual aircraft noise 1/3-octave-band spectra measured at 0.5-s intervals. Test-day spectra are used to calculate PNL, PNLT, EPNL, AL, and SEL. The test-day spectrum at the time of PNLT and at the time of ALM are adjusted to acoustical-reference conditions using the atmospheric-absorption method in American National Standard ANSI S1.26-1978 and applied, using measurements of air temperature and relative humidity at various heights above the ground, by integrating over the frequency range of the passband of ideal filters and by calculating the absorption at the exact band center frequencies only. SAE ARP866A is also used with the vertical-profile temperature/humidity data and with data at 10.0 m to determine adjustments from test to reference conditions. The adjustment methods are applied to noise data from 9 aircraft. Volume I describes the analyses and results of the study. Volume II presents the computer program that was developed and illustrates its use with a test case. Volume III presents tables of attenuation due to atmospheric absorption over a 300-m path. Attenuations were calculated using ANSI S1.26-1978 for pure tones at band center frequencies and for 3 noise spectral slopes by a band-integration method, and using SAE ARP866A. For each of the 5 methods, the tables cover 34 air temperatures from 2 to 35C, 10 relative humidities from 10 to 100 percent, and 24 nominal band center frequencies from 50 to 10,000 Hz.		
17. Key Words Atmospheric absorption of sound Aircraft noise certification ANSI S1.26-1978 SAE ARP866A FAR Part 36	18. Distribution Statement Availability unlimited. Report is available to the public through the National Technical Information Service, Springfield, VA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 98
22. Price		

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METRIC CONVERSION FACTORS

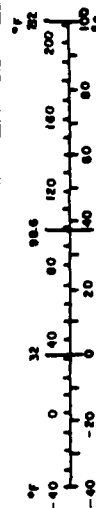
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
sq ft	square feet	0.09	square centimeters	cm ²
sq yd	square yards	0.8	square meters	m ²
sq mi	square miles	2.6	square kilometers	km ²
ac	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
lsp	teaspoons	5	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
cu ft	cubic feet	0.03	cubic meters	m ³
cu yd	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

* 1 in = 2.54 exactly. For other exact conversions and more detailed tables, see NBS Mon. Publ. 286, Units of Length and Masses, Price \$2.25, SO Catalog No. C13.102-286

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
km	kilometers	1.1	miles	mi
		0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
ha	hectares	0.4	square miles	mi ²
	hectares (10,000 m ²)	2.6	acres	ac
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	st
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
		1.06	quarts	qt
		0.26	gallons	gal
		36	cubic feet	cu ft
		1.3	cubic yards	cu yd
TEMPERATURE (exact)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



EVALUATION OF ALTERNATIVE PROCEDURES FOR
ATMOSPHERIC ABSORPTION ADJUSTMENTS
DURING NOISE CERTIFICATION

VOLUME II: COMPUTER PROGRAM

1. INTRODUCTION

This Volume contains the source-code statements for the computer program that was prepared to perform the calculations for the analyses described in Volume I. The program was written in the extended FORTRAN IV programming language for compilation and execution on a large-scale digital computer. Input data can be entered from an interactive terminal, digital magnetic tape, or punched cards to a disk file for access during execution. Results can be output to a line printer or to an interactive terminal.

The objective of the program is to calculate adjustment factors to be applied to test-day 1/3-octave-band sound pressure levels from aircraft flyover noise measurements to account for differences in atmospheric absorption along the sound propagation path under test and acoustical-reference conditions. The band adjustment factors are calculated by four different procedures.

To achieve the objective, the program reads in measured sound pressure levels at 0.5-s intervals. From the measured sound pressure levels, the program calculates corresponding values of perceived noise levels (PNL), tone-corrected perceived noise levels (PNLT), and A-weighted sound levels (AL). The sets of PNLs, PNLTs, and sound levels are searched to find the maximum values: PNLM, PNLTM, and ALM. Effective perceived noise level (EPNL) is calculated from the set of PNLT values; sound exposure level (SEL) is calculated from the AL values. The range over which the PNLT or AL values are summed to find EPNL or SEL is determined by a specification of the 10-dB-down values from PNLTM and ALM, respectively. The time of occurrence of PNLTM and of ALM during the flyover defines the

test-day spectra and propagation paths to be used in determining band adjustment factors.

To perform the atmospheric-absorption adjustments, the program reads an input data file for air temperatures and relative humidities at various heights above ground level. Barometric pressure is also read in. The air temperatures, relative humidities, and barometric pressure represent values that have been previously interpolated to the time of the flyover noise measurement.

After the test-day spectra have been adjusted to reference-day meteorological conditions by the four procedures, PNL, PNLT, and AL values are calculated from the reference-day sound pressure levels. Reference-day EPNLs are found from the reference-day PNLTMs and reference-day SELs are found from the reference-day ALMs by adding the corresponding values of test-day duration-correction factors.

As output, the program lists the measured test-day sound pressure levels and corresponding PNLs, PNLTs, and ALs, EPNLs, and SELs. Meteorological data are also listed. The adjusted reference-day sound pressure levels and corresponding PNL, PNLT, EPNL, AL, and SEL values are tabulated on separate pages. The program interrogates the input data file for another set of data until the data are exhausted.

The program was written as one main routine called TESTREF with nine subroutines. There is one labeled common block of literal data used for the legend on the final two output pages. The main routine reads in the input data, calls the subroutines to perform the calculations, and controls and specifies the output data listings.

It is noted that while the program is relatively efficient (requiring on the order of only 30 seconds of central-processor-unit time for all the calculations for one set of flyover noise measurements), greater emphasis was placed on producing an operational program that met the objective of the program than on maximizing computing efficiency. The program statements include a generous number of descriptive comments to assist the user in understanding the various steps.

The balance of this Volume contains four additional Sections. Section 2 describes and defines most of the parameters and variables used in the program along with their accompanying symbols and preferred units. Those parameters and variables not included in Section 2 are unique to a subroutine and are defined in the program statements for the subroutine. Section 2 also omits definitions for standard intrinsic FORTRAN subprograms such as ABS for the absolute-value function, COS for the cosine function, INT for the integer-part function, and LOG10 for the function to calculate base-10 logarithms. Definitions for ordinary DO-loop index counters are not included, nor are standard FORTRAN logical or arithmetic functions such as .LE. for less than or equal to, .GT. for greater than, and so on.

Section 3 contains the listing of all the program statements for the main routine and all nine subroutines. There are a total of 2024 lines of source-code for the main routine and the subroutines.

Sections 4 and 5 present the data for a sample or test case from one of the cases used for the analyses in Volume I. Section 4 contains the input data in card-image format. Section 5 contains the corresponding listings of output data.

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2. PARAMETERS AND VARIABLES USED IN MAIN PROGRAM AND SUBROUTINES

Symbols	Description and Units
AH	height, in meters, of the airplane reference point above the ground plane when over the microphone. AH is read from the input data file.
AHR	array of the average of the relative humidities, in percent, measured at two consecutive heights above ground level. The average relative humidities in AHR correspond with the average heights of the layers of the atmosphere in array HMI.
AHSAM, AHSPTM	difference between the height of the airplane and the height of the microphone at the time when (a) for AHSAM, the maximum A-weighted sound level, and (b) for AHSPTM, the maximum tone-corrected perceived noise level was noted at the microphone, m
AL	array of the A-weighted sound levels at 0.5-s intervals corresponding to the measured test-day 1/3-octave-band sound pressure levels at 0.5-s intervals during a flyover, dB
ALM	maximum value of A-weighted test-day sound levels in array AL (note that if there is more than one sound level with the same maximum value, then ALM is the one that occurs last), dB
ALMB, ALMC, ALMD, ALME	A-weighted sound levels corresponding to the reference-day spectra SPLAB, SPLAC, SPLAD, and SPLAE at the time of occurrence, at the microphone, of ALM, dB
AM	airplane flight Mach number when over the microphone. AM is read from the input data file.
AMH	distance between the airplane reference point and the microphone at the time the airplane was overhead (equal to the difference between airplane height above the ground, AH, and microphone height above the ground, ZM), m
ANSAB	name of a subroutine for calculating pure-tone atmospheric absorption coefficients, in dB/m, by the method of American National Standard ANSI S1.26-1978, given the air temperature, in degrees kelvin, relative humidity, in percent, air pressure,

in standard atmospheres, and the frequency of the sound wave in hertz

AP ratio of the A-weighted squared sound pressure to the square of the reference pressure in a calculation of A-weighted sound level, in array AL, from a set of test-day 1/3-octave-band sound pressure levels

APMB, ratios, as for AP above, except used in the calculations of ALMB,
APMC, ALMC, ALMD, and ALME from reference-day spectra SPLAB, SPLAC,
APMD, SPLAD, and SPLAE
APME

APNL name for a dummy variable used in the call for subroutine CPNL when calculating the array of test-day perceived noise levels corresponding to the 1/3-octave-band sound pressure levels, SPL(I,J), and, specifically, to the SPL spectrum ASPL(J) for a particular time index I at some 0.5-s interval after the first set of test-day data

AR in method E for adjusting the test-day sound pressure levels to reference-day conditions, AR is the pure-tone atmospheric sound absorption coefficient, in dB/m, returned by the call for subroutine ANSAB for the defined, uniform, reference meteorological conditions with a reference air temperature of $TKR = 298.15$ K, a reference relative humidity of $HRR = 70.0$ percent, a reference air pressure of 1.0 standard atmosphere, and at the exact center frequency, FC in hertz, of a 1/3-octave band

ARP866A name of a subroutine for calculating pure-tone atmospheric-absorption coefficients, in dB/m, applicable to 1/3-octave band sound pressure levels, according to the method of SAE Aerospace Recommended Practice ARP866A, 15 March 1975, given the 1/3-octave-band center-frequency index counter J (where $J = 1$ to 24 for nominal center frequencies between 50 and 10,000 Hz), the air temperature in degrees celsius, and the relative humidity in percent

AS airplane airspeed, in m/s, when over the microphone. AS is read from the input data file.

ASPL array of 1/3-octave-band sound pressure levels used with APNL in the call for subroutine CPNL to calculate the test-day perceived noise levels at 0.5-s intervals corresponding to the test-day sound pressure levels, SPL(I,J), dB

array of average air temperatures over horizontal layers of the atmosphere, with a layer defined by two consecutive heights above ground level where test-day meteorological data, appropriate for the time of the aircraft noise measurement, were measured, C

ATE in adjustment method E, pure-tone atmospheric sound absorption coefficient, in dB/m, as in AR above but for test-day meteorological conditions along segments of the sound propagation path defined by the heights where meteorological data were measured

ATK an array like ATC above except for air temperatures in degrees kelvin

ATTAC in adjustment method C, attenuation, in dB, for test-day meteorological conditions over a segment of the sound propagation path as well as over the entire pathlength PDAM corresponding to the relative data-sample-time TRAM associated with the spectrum SPLAM at the time of occurrence of the maximum test-day A-weighted sound level ALM and with atmospheric absorption calculated by the method of SAE ARP866A

ATTPTC attenuation, in dB, like ATTAC above, except for the propagation pathlength PDPTM corresponding to the relative time TRPTM associated with SPLPTM at the time of the maximum test-day tone-corrected perceived noise level PNLTM

AVALFAC in adjustment method C, average pure-tone atmospheric sound absorption coefficient, in dB/m, applicable to a 1/3-octave band and defined by the ratio of the attenuation to the propagation pathlength (i.e., the ratio ATTAC/PDAM) and used with the atmospheric absorption coefficient RALPHA (calculated also by the method of ARP866A but for the defined, uniform, reference meteorological conditions) to determine a band-adjustment factor to be added to the test-day sound pressure levels SPLAM at the time of ALM to yield the reference-day spectrum SPLAC

AVALFPTC like AVALFAC above, except calculated from the average attenuation ATTPTC and propagation distance PDPTM to determine the band-adjustment factor to be added to the test-day sound pressure levels SPLPTM at the time of PNLTM to yield the reference-day spectrum SPLPTC

AW at the nominal center frequencies of the 1/3-octave bands between 50 and 10,000 Hz, a data array of 24 frequency-response weighting factors relative to the response at 1000 Hz for the A-weighting scale from the International Standard on sound level meters, dB

BAAD array of 24 band-adjustment factors to be added to the 1/3-octave-band test-day sound pressure levels, SPLAM, at the time of ALM to determine the reference-day spectrum, SPLAD, according to adjustment method D, dB

BAAE similar to BAAD above, except that BAAE is used to determine the reference-day spectrum, SPLAE, according to adjustment method E, and except that BAAE is not an array but a variable determined anew for each of the 24 bands, dB

BAPTD an array like BAAD above, except that the band-adjustment factors are to be added to the test-day spectrum, SPLPTM, at the time of PNLTM to determine the reference-day spectrum, SPLPTD, according to adjustment method D, dB

BAPTE similar to BAPTD above, except that BAPTE is used to determine the reference-day spectrum, SPLPTE, according to adjustment method E, and, like BAAE, except that BAPTE is not an array but a variable determined anew for each of the 24 bands, dB

BP barometric pressure of the air (usually at a height of 10 m above ground level) and read from the file of input data, in. Hg

C array, one for each set of test-day 1/3-octave-band sound pressure levels at 0.5-s intervals, of the maximum values of the tone-correction factors, in dB, calculated, according to the rules of the 3 April 1978 amendment to FAR Part 36, by procedures in subroutine P36TC when P36TC is passed a set of test-day sound pressure levels in dummy array ASPL(J). Subroutine P36TC returns the maximum tone-

correction factor $C(I)$ for the spectrum $ASPL(J)$ at each relative-time index counter, I .

CMX CMX is the name used in subroutine P36TC for the maximum tone-correction factor, in dB, in a calculation of tone-corrected perceived noise level for any set of sound pressure levels

CMXB,
CMXC,
CMXD,
CMXE maximum tone-correction factor returned by subroutine P36TC when passed the spectra SPLPTB, SPLPTC, SPLPTD, and SPLPTE, respectively, dB

CPNL name of a subroutine that accepts an array of 24 1/3-octave-band sound pressure levels at nominal band center frequencies from 50 to 10,000 Hz and calculates the corresponding perceived noise level, PNL, using data constants from SAE ARP865A, 15 August 1969

DAM array of the lengths, in meters, of the segments along the sound propagation path from the aircraft reference point to the microphone at the time of the maximum A-weighted sound level, ALM, for test-day atmospheric conditions. Segment lengths are determined from the thickness of the horizontal layers of the atmosphere defined by two consecutive heights above ground level where test-day meteorological data were measured, by the sound propagation angle relative to the flight path direction $\psi_{A,max}$ at the time of ALM, and by the flight path angle, γ , relative to the horizontal. These angles are called PSIAM and GAMAR in the program statements and in this symbol list.

DATA10 subroutine INTEG numerically integrates, over a specified duration, a set of specified input data, in dB, that vary with time. The input data can be any desired physical variable, but, in program TESTREF, subroutine INTEG is used to numerically integrate, by a summation process, (1) the tone-corrected perceived noise level, PNLT, to determine the effective perceived noise level, EPNL, and (2) the A-weighted sound level, AL, to determine the sound exposure level, SEL. The limits of the numerical integration are specified by the value of DATA10 which is 10.0 dB less than the corresponding maximum value of the input data, i.e., $DATA10 = PNLT_{max} - 10.0$ or $AL_{max} - 10.0$, in dB.

DATE a number, defined to be an integer (not a real) constant that is read from the file of input data giving the day of the month when the flyover noise measurements were recorded. DATE is used for label information on the output pages for the test-day sound pressure levels.

DB DB is the distance measured along the aircraft's flight path between the overhead point and the position of the aircraft reference point at the point of closest approach to the microphone, m

DCF duration correction factor in the formulation of EPNL and determined for the test-day data from $DCF = EPNL - PNLTM$, dB

DM minimum distance between the microphone and the aircraft flight path (at the closest point of approach), m

DOAM distance, in meters, along the flight path from the overhead point to the position of the aircraft reference point at the relative time TRAM corresponding to the maximum test-day A-weighted sound level, ALM

DOPTM distance, in meters, like DOAM above, except at the relative time TRPTM of the maximum test-day tone-corrected perceived noise level, PNLTM

DPTM like DAM above, an array of segment lengths, in meters, along the sound propagation path, except at the time of PNLTM and at propagation direction angle $\psi_{PNLT,max}$ or PSIPTM

DSEL duration of the sound exposure level, SEL, and, like DCF above for EPNL, the difference between SEL and ALM, dB

EPNL effective perceived noise level, in dB, as calculated by subroutine INTEG from test-day PNLT data with the corresponding value of PNLTM as DATA10 and with specified values for IFP, ILP, and NS

EPNLB, EPNLC, EPNLD, EPNLE effective perceived noise level, in dB, calculated from $PNLTMB + DCF$, $PNLTMC + DCF$, $PNLTMD + DCF$, and $PNLTME + DCF$, respectively, where DCF is the duration-correction factor for the test-day PNLT values and PNLTM to PNLTIME are the tone-corrected perceived noise levels for the reference-day spectra SPLPTB to SPLPTE

FC exact center frequency, in Hz, of a 1/3-octave-band filter. FC is calculated from $10^{\text{ISBN}/10}$ using the international standard band numbers (ISBN) that range from 17 for the 50-Hz band to 40 for the 10,000-Hz band.

FMX array of nominal center frequencies, in kHz, of the 1/3-octave bands that yielded the largest tone-correction factors, $C(I)$, for the test-day sound pressure levels, $\text{SPL}(I,J)$. For each SPL spectrum, the band level that produced $C(I)$ is identified by frequency-band index counter JMX in order to locate the nominal band center frequency FMX in the data array FREQ.

FMXB,
FMXC,
FMXD,
FMXE nominal center frequencies for the bands producing the reference-day tone-correction factors CMXB to CMXE, kHz

FREQ a data array consisting of the 24 nominal center frequencies, in Hz, of the 1/3-octave-band filters and ranging from 50 to 10,000 Hz. The frequencies in array FREQ are declared to be integer constants.

GAMAD angle γ , or gamma, in degrees. Angle γ is the acute angle the aircraft flight path makes with the local horizontal. For calculation purposes, the engine thrust axis is assumed to be parallel to the flight path. Angle γ is positive for climbing flight, negative for descending flight, and is measured relative to the direction of flight.

GAMAR angle γ in radians

GROUND array of literal characters read from the input data file that gives a description of the type of ground surface that was under the microphone at the time of the test (e.g., asphalt or concrete). The description is used as label information for the output pages containing the test-day sound pressure levels.

HM array of heights, in meters, above ground level where the input meteorological data were measured. Array HM is read from the input data file.

HMEA array of the measured or test-day values of the atmospheric humidity, expressed as the molar concentration of water vapor in percent, and determined at the average heights in array HMI for the average test-day temperatures in array ATK, the average relative humidities in array AHR, and an air pressure of 1.0 standard atmosphere. At each increment of height, the humidity values in the array HMEA are calculated by calling subroutine MOLAR.

HMI array of heights that are midway between two consecutive heights where meteorological data were measured, (i.e., the average height above the ground plane for each layer of the atmosphere), m

HR array of test-day relative humidities, in percent, measured at the heights in array HM and read from the input data file

HREF array of atmospheric humidities, expressed as the molar concentration of water vapor, in percent, like the humidities in array HMEA and at the same heights, but calculated for defined, reference lapse rates of air temperature, relative humidity, and pressure rather than the measured test-day temperatures and relative humidities and a constant air pressure of 1.0 standard atmosphere. Subroutine MOLAR is called to calculate the values of HREF at each increment of height.

HRR reference-day relative humidity for a uniform atmosphere and set equal to 70.0 percent

HR10 relative humidity for the test-day conditions interpolated, or read directly, from the measured vertical-profile meteorological data for a height of 10.0 m, percent.

IAM index from the relative test-time indexes, I, in the array of relative test times TT(I) for that value of the A-weighted sound level selected from the set of sound levels, AL(I), and identified as the maximum A-weighted sound level, ALM, i.e., $AL(I) = AL(IAM) = ALM$. If, in the search from the first to the last relative time (over the index range from $I = 1$ to $I = NS$), more than one AL value has the same maximum value, then IAM is set equal to the last value or the last time when $AL = ALM$.

IE, IS relative-time index counters used for identifying and printing out the columns of test-day sound pressure levels, perceived noise levels,

tone-corrected perceived noise levels, and FMX values. Initially, IS = 1 and IE = 14 to print out 14 samples at 0.5-second intervals on the first page corresponding to relative test times TT(1) = 0.0 to TT(14) = 6.5. IS and IE, for I Start and I End, are incremented by appropriate values until all data samples have been listed, i.e., at IE = NS.

IFA, IFP,
ILA, ILP relative-time index counters determined by subroutine INTEG for the first and last times when the test-day A-weighted sound level AL(I) is closest to ALM - 10.0 (i.e., IFA and ILA), or when the test-day tone-corrected perceived noise level PNLT(I) is closest to PNLTM - 10.0 (i.e., IFP and ILP). The index counters are used to denote the relative times on the output page for beginning and ending times in the calculation of duration correction factors for EPNL and SEL; DCF is calculated for times ranging from TT(IFP) to TT(ILP) and DSEL is for times from TT(IFA) to TT(ILA) where TT(I) is the array of relative test times at 0.5-s intervals.

INTEG name of a subroutine that performs a numerical integration, by a simple summation of rectangular approximations, of the square of a quantity, derived from an array of input values in decibels, over a range of relative test times which are the first and the last times when the input data are closest to DATA10. The answer returned by INTEG is called SUMDAT for the power sum of the input data.

IPM,
IPTM like IAM above, except the relative time indexes for that value of PNL(I) which is set equal to PNLM and for that value of PNLT(I) which is set equal to PNLTM

ISBN international standard band numbers for 1/3-octave-band filters, see FC above. ISBN is defined to be a real (not an integer) variable.

JMX,
JMXB,
JMXC,
JMXD,
JMXE frequency band index counters returned by subroutine P36TC in a calculation of tone-corrected perceived noise level and used to determine the nominal center frequency of the 1/3-octave band that produced the largest tone-correction factor [C(I) or CMXB to CMXE depending on which set of sound pressure levels were being examined]. The nominal band center frequencies associated with the maximum

tone-correction factors are found from $FMX = \text{FREQ}(JMX)$, $FMXB = \text{FREQ}(JMXB)$, $FMXC = \text{FREQ}(JMXC)$, and so on. See descriptions of $C(I)$, FMX , and FREQ .

KAA, KAP for the propagation distances at the time of maximum test-day A-weighted sound level, ALM, and at the time of maximum test-day tone-corrected perceived noise level, PNLTM, and for the corresponding heights of the aircraft reference point above the microphone height, AHSAM and AHSPTM, index counters KAA and KAP represent the heights from the array $HM(K)$ of heights for meteorological data which are equal to, or just less than, the corresponding height of the aircraft reference point above the microphone height, i.e., $KAA = K - 1$ when $[HM(K) - ZM]$ is first greater than AHSAM in a search from $K = 1$ to $K = NH$ and correspondingly for KAP when $[HM(K) - ZM]$ is first greater than AHSPTM.

KAA1, KAP1 like the height-array index counters KAA and KAP defined above, except that $KAA1 = KAA - 1$ and $KAP1 = KAP - 1$ to specify those heights from the $HM(K)$ array which are stored in the locations that are 1 less than the locations defined by KAA and KAP

KK index of the height array $HM(K)$ when $HM(K)$ is first greater than the microphone height ZM in a search from 1 to NH . To find the lengths of the propagation-path segments in arrays $DAM(K)$ and $DPTM(K)$, index KK is used as the starting index for calculations backwards along the sound propagation path from the microphone to the aircraft reference point.

KLA, KLP final indexes of the propagation-pathlength-segment arrays $DAM(K)$ and $DPTM(K)$ for the last segment of the path from the microphone back to the aircraft reference point: $KLA = KAA1 - KK + 3$ and $KLP = KAP1 - KK + 3$. Indexes KLA and KLP are used in the layered-atmosphere procedures of methods C, D, and E to define the range of steps in the calculation of the test-day attenuation over the propagation path in each frequency band.

LPAGE, LPGTOT page number counters used to label the pages of the output listing the test-day sound pressure levels at 0.5-s intervals and the associated values of PNL, PNLT, AL, and FMX. LPGTOT is the total number of pages of input data, printed with a maximum of 14 columns of SPL per page, and LPAGE is the running page number counter with a value between 1 and LPGTOT.

MIC abbreviation for microphone number, a label assigned during the flyover noise measurement to identify the microphone and its location. MIC is read in from the input data file and is only used to label the output pages.

MOLAR name of a subroutine that calculates the humidity of the atmosphere as the molar concentration of water vapor, in percent, given the air temperature, in degrees kelvin, relative humidity, in percent, and air pressure, in standard atmospheres

MONTH integer array read in from the input data file and consisting of one 4-character computer word giving the month of the year when the flyover noise data were measured (e.g., OCT or JAN). MONTH, DATE, and YEAR are used as label information for the output pages containing the test-day sound pressure levels.

NH integer constant read in from the input data file that specifies the total number of heights (in array HM) where the test-day meteorological data (in arrays TC and HR) were measured

NPG symbol for an integer variable used in the DO loop for printing out pages 2 and 3 of the summary output pages. Information on page 2 (the EPNL page) is printed when NPG = 1, that on page 3 (the SEL page) when NPG = 2.

NS integer constant read from the input data file to specify the total number of 0.5-s samples of test-day 1/3-octave-band sound pressure levels which are available and are to be read in from the input data file as the array SPL(I,J) where I ranges from 1 to NS for the time index and J ranges from 1 to 24 for the frequency-band index

NUMINT name of a subroutine that performs the numerical integrations in method D for determining the 1/3-octave-band adjustment factors for the differences in attenuation over the propagation pathlength as a

result of differences in atmospheric absorption under test and reference meteorological conditions. NUMINT returns an array of the band-adjustment factors, in dB, given: (1) an array of 24 test-day sound pressure levels in dB, (2) the reference-day uniform-atmosphere air temperature, TKR, in degrees kelvin, (3) the reference-day uniform-atmosphere relative humidity, HRR, in percent, (4) the reference-day uniform-atmosphere air pressure, PAR, in standard atmospheres, (5) the array of average test-day air temperatures, ATK, in degrees kelvin, (6) the array of average test-day relative humidities, AHR, in percent, (7) the test-day atmospheric pressure, PA, in standard atmospheres, (8) the array of propagation-pathlength segments along the sound propagation path from the microphone back to the aircraft reference point, and (9) the index counter for the last segment in the array of propagation path segments. If the array of test-day sound pressure levels is given by SPLPTM(J), with the array of propagation path segments given by DPTM(K) and the last index counter specified by KLP, then NUMINT returns the array of band-adjustment factors BAPTD(J). Similarly, SPLAM(J) with DAM(J) and KLA returns the array BAAD(J).

PA	test-day atmospheric pressure, in standard atmospheres, calculated from BP/RBPO and assumed to be uniform over the sound propagation path
PAR	reference-day air pressure for a uniform atmosphere and set equal to 1.0 standard atmosphere
PDAM, PDPTM	total propagation distance from the aircraft reference point to the microphone at the relative time of occurrence of ALM with sound directivity angle PSIAM for the distance PDAM, and at the relative time of occurrence of PNLTM with sound directivity angle PSIPTM for the distance PDPTM, m
PHIAM, PHIPTM	angle ϕ (or PHI) defines the location of the aircraft on the flight path at the relative time of occurrence at the microphone of ALM and PNLTM, respectively. Angle ϕ , in radians, is measured, relative to the direction of flight, between the flight path and the line from and aircraft reference point to the microphone.
PI	3.141592654 radians (360°)

PNL array of perceived noise levels at 0.5-s intervals corresponding to the test-day sound pressure levels in array SPL, dB

PNLM maximum value of test-day perceived noise levels in array PNL (the last one if there is more than one PNL with the same maximum value), dB

PNLMB, PNLMC, PNLMD, PNLME similar to ALMB to ALME above, except for perceived noise levels instead of A-weighted sound levels and except that the test-day spectrum SPLPTM at the time of occurrence at the microphone of PNLTM is adjusted to reference-day conditions by methods B, C, D, and E to yield the spectra SPLPTB to SPLPTE from which the perceived noise levels PNLMB to PNLME are calculated, dB

PNLT array of tone-corrected perceived noise levels corresponding to the array of test-day sound pressure levels in array SPL and perceived noise levels in array PNL, dB

PNLTM maximum value of test-day tone-corrected perceived noise levels in array PNLT (the last one if there is more than one PNLT with the same maximum value), dB

PNLTMB, PNLTMC, PNLTMD, PNLTME similar to PNLMB to PNLME above except for tone-corrected perceived noise levels in dB. The values are found from $PNLTMB = PNLMB + CMXB$, $PNLTME = PNLME + CMXC$, etc.

PSIAM, PSIPTM at the same relative times as for angles PHIAM and PHIPTM above, but for the sound directivity angles PSIAM and PSIPTM between the flight path and the line to the microphone from the point on the flight path where the aircraft reference point was when the aircraft emitted the sound which resulted in the value of ALM or PNLTM, radians. Note that $PSIAM = PHIAM - \sin^{-1}[AM \sin (PHIAM)]$ and $PSIPTM = PHIPTM - \sin^{-1}[AM \sin (PHIPTM)]$.

P36TC name of a subroutine that calculates tone-correction factors according to the April 1978 version of Part 36 of the Federal Aviation Regulations. Given a spectrum of 24 1/3-octave-band sound pressure levels, P36TC returns the maximum value of the tone-correction factors for that spectrum and the corresponding frequency-band index counter [e.g., C(I) and JMX are returned for

each of the SPL(I,J) spectra [or each ASPL(J)], CMXB and JMXB for SPLPTB(J), etc.]

RALPHA for each 1/3-octave band, the reference-day sound absorption coefficient calculated by subroutine ARP866A for uniform reference meteorological conditions with air temperature given by TCR and relative humidity given by HRR and used in finding the band-adjustment factors in methods B and C, dB/m

RBPO reference, sea-level, standard-day barometric pressure of 29.921 in. Hg and used with BP to determine PA

RHM reference height above ground level fo 10.0 m used to define the starting height for the calculations of reference vertical profiles of reference air temperature RTK, reference relative humidity RHR, and reference air pressure RPA

RHR array for the reference vertical profile of relative humidity starting from a value set by RHRO at the reference height RHM and decreasing at the rate specified by RHRL, percent

RHRL reference lapse rate for the reference relative humidities in array RHR with the value of -0.0065 percentage points/m (-6.5 percentage points/km)

RHRO reference relative humidity, at the reference height RHM, with the value of 70.0 percent

RPA array for the reference vertical profile of air pressure starting from a value of 1.0 standard atmosphere at the reference height RHM, standard atmospheres

RPAL exponent for the lapse rate of air pressure in standard atmospheres or a range of heights from mean sea level to 11 km and having the value of -5.25588

RTK array for the reference vertical profile of air temperature starting from a value set by RTKO at the reference height RHM and decreasing at the rate specified by RTKL, K

RTKL reference lapse rate for the reference air temperatures in array RTK with the value -0.0065 K/m (-6.5 K/km)

RTKO reference air temperature at the reference height RHM with the value of 298.15 K (i.e., 25.0 C)

RUN integer constant that is read from the input data file to specify the run number assigned at the time of the measurements to the set of input test-day sound pressure levels and used for label information on the output pages

SEL sound exposure level, in dB, as calculated by subroutine INTEG from test-day AL data with the corresponding value of ALM as DATA10 and with specified values for IFA, ILA, and NS

SELB, SELC, SELD, SELE sound exposure levels, in dB, calculated from the SEL duration factor, DSEL, and the maximum A-weighted sound levels for reference-day meteorological conditions by methods B to E: SELB = ALMB + DSEL, SELC = ALMC + DSEL, etc.

SPL a 2-dimensional array SPL(I,J) representing the test-day sound pressure levels read from the input data file at the I-intervals of time during the flyover noise recording for the J 1/3-octave bands, dB

SPLAB, SPLAC, SPLAD, SPLAE, SPLAM SPLAM represents the array of 24 1/3-octave-band test-day sound pressure levels that are associated with the maximum test-day A-weighted sound level, ALM; SPLAB to SPLAE represent the corresponding arrays of sound pressure levels adjusted to uniform reference-day conditions by adjustment methods B to E, respectively, dB

SPLPTB, SPLPTC, SPLPTD, SPLPTE, SPLPTM SPLPTM represents the array of 24 1/3-octave-band test-day sound pressure levels that are associated with the maximum test-day tone-corrected perceived noise level, PNLTM; SPLPTB to SPLPTE represent the corresponding arrays of sound pressure levels adjusted to uniform reference-day conditions by adjustment methods B to E, respectively, dB

SUMDAT SUMDAT is the value of the summation returned by subroutine INTEG as the nondimensional power sum $\sum_i 10^{[DATA(I)]/10}$ between the values of the test-day times when DATA is closest to DATA10. If DATA is the array of PNL values and DATA10 = PNLTM - 10.0, then SUMDAT is used to determine EPNL; if DATA is the array of AL values and DATA10 = ALM - 10.0, then SUMDAT is used to determine SEL.

TALM a quantity used with the output listing of test-day sound pressure levels to indicate the time of occurrence of ALM. TALM, in seconds, is determined by the value of the relative test time from array TT(I) at the index IAM [i.e., $TALM = TT(IAM)$].

TALPHA for band-adjustment method B, an absorption coefficient calculated by subroutine ARP866A at a frequency defined in the subroutine for the air temperature and relative humidity TC10 and HR10 at a height of 10.0 m, dB/m

TC array of test-day air temperatures measured at the heights defined by array HM and read from the input data file, C

TCR reference-day air temperature for a uniform atmosphere and set equal to 25.0 C

TC10 air temperature for test-day conditions interpolated, or read directly, from the measured vertical-profile data for a height of 10.0 m, C

TEXT,
TEXTA names for the two arrays of literal characters that are declared to be labeled COMMON and which are defined in BLOCK DATA for use on summary output pages 2 and 3. The 372-computer-word array TEXT is a 12x31, 2-dimensional array of 12 computer words on 31 lines of descriptive text. Each line has a maximum of 48 literal characters at 4 characters per computer word. There are 31 possible lines of text to correspond with the data at the 24 1/3-octave-band center frequencies with an allowance for 7 blank lines that are used for spacing when printing the output listings. TEXTA is a 12-computer-word, one-dimensional array that is used in place of TEXT(12,3) when printing the third line of descriptive text on page 3 of summary output. Page 3 contains the values of maximum A-weighted sound level and sound exposure level while page 2 contains the perceived noise levels and effective perceived noise levels.

TITLE1,
TITLE2 arrays of 20 4-character computer words that are read from the input data files and used for titles on the output pages. TITLE1 is used on the pages containing the input test-day sound pressure levels and describes general characteristics for the type of aircraft

tested. TITLE2 is used on the test-day SPL pages and also on pages 2 and 3 of the summary output pages to describe particular characteristics of the aircraft, engine, and test-site location.

TKR reference-day air temperature for a uniform atmosphere and set equal to 298.15 K

TOH time, in seconds, on the day of the test when the aircraft was directly over the microphone (i.e., the time at overhead). TOH is read from the input data file as the time after midnight on the basis of 86,400 seconds per day (e.g., TOH = 44184 s means 12 hours, 16 minutes, and 24 seconds after midnight or 1216:24 hours).

TPNLM, similar to TALM above, except here the symbols indicate the relative times, in seconds, from array TT at the time of occurrence of PNLN [TPNLM = TT(IPM)] and of PNLTM [TPNLTM = TT(IPTM)].

TPNLTM

TRAM, relative times of occurrence, in seconds, of ALM and PNLTM. The relative times are determined relative to the time of day TOH when the aircraft was directly over the microphone and the time TS of the first sample of test-day sound pressure level. A 0.25-s factor is included in the calculation of TRAM and TRPTM to shift the relative time scale to the center of the 0.5-s data sample; thus $TRAM = TS + 0.25 + TT(IAM) - TOH$ and $TRPTM = TS + 0.25 + TT(IPTM) - TOH$.

TRPTM

TS time of day, in seconds, read from the input data file and defined as the time at the beginning of the first 0.5-s sample of test-day sound pressure levels [i.e., at the start of the first relative test time TT(1)], and, like TOH, on a 86,400-s daily basis

TT array of times associated with each set of test-day sound pressure levels, seconds. The test times in array TT are determined relative to 0.0 seconds at the midpoint of the averaging period for the first data sample. For computational purposes, each data sample was considered to have been averaged for exactly 0.5 seconds.

YEAR a number, declared to be an integer constant, read from the input data file (e.g., as 74 or 76) and used with DATE and MONTH for specifying when the flyover noise measurements were made

ZM

height of the microphone above the ground plane for the flyover
noise measurements and read from the input data file, m

3. LISTING OF PROGRAM STATEMENTS

TESTREF is the name for the main, or driver, program that calculates spectral adjustment factors for differences in atmospheric absorption. The program is specifically applicable to aircraft noise measurements made under test conditions and adjusted to reference meteorological conditions. Four separate adjustment procedures are included.

The program reads in 1/3-octave-band sound pressure levels at regular intervals of time during a recording of aircraft flyover noise. Meteorological and other associated test data are also read in. The required calculations are performed by nine subroutines that are called by the main program. An array of labeled common is included as BLOCK DATA and contains the text of explanatory legends for some of the tabular output listings.

Program TESTREF and the BLOCK DATA require about 6825 words or 28,000 bytes of source-code storage capacity. With subroutines, approximately 37,500 bytes are required for storage of the total source code.

The total number of lines of computer program coding are substantially more than required for reading in the data, performing the calculations, and printing the output pages. To assist the user, several comments have been included in the main program and subroutines to explain and describe the methods used and options selected.

The program was written in the FORTRAN IV-extended programming language. It was written for a compiler and central processor that are compatible with an IBM System 370 computer. The program makes use of certain features permitted by the compiler that may not be available on another machine. For the user's information, those features that may require special attention during implementation of the program are listed below.

1. Extended assignment of a value to several variables simultaneously is permitted, as $A = B = C = D = E = 0.0$.

2. GOTO is a permitted format; GO TO is not required.

3. LOG10 and LOG are permitted forms; ALOG10 and ALOG are not required for logarithms.

4. ASIN is permitted for the arcsine; ARSIN is not required.

5. The name of a function or a variable can have as many as 8 characters; some systems have a limit of 6 characters.

6. Arithmetic operations are permitted in the range of a DO loop and in the specification of a READ or WRITE statement, as DO 20 J = 1, 3*NN or READ (5, 15) TC + 273.15.

7. Two or more statements can be combined on one line, but separated by semicolons as PNM = -10.0; PNT = 0.0.

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1.000 C*** PROGRAM TESTREF
2.000 C
3.000 C PROGRAM TESTREF WAS PREPARED BY DYTEC ENGINEERING, INC. OF
4.000 C LONG BEACH, CA. VERSION 12 AUGUST 1979.
5.000 C
6.000 C THE PURPOSE OF THE PROGRAM IS TO ADJUST MEASURED AIRCRAFT
7.000 C FLYOVER NOISE LEVELS FOR DIFFERENCES IN ATMOSPHERIC ABSORPTION
8.000 C LOSSES UNDER TEST AND REFERENCE METEOROLOGICAL CONDITIONS.
9.000 C
10.000 C ADJUSTMENTS ARE DETERMINED USING PURE-TONE ATMOSPHERIC
11.000 C ABSORPTION CALCULATED BY THE PROCEDURES OF SAE ARP 866A (MARCH
12.000 C 1975) AND ANS S1.26-1978. ABSORPTION LOSSES AND ADJUSTMENTS
13.000 C FROM TEST TO ACOUSTICAL REFERENCE METEOROLOGICAL CONDITIONS
14.000 C FOR 1/3-OCTAVE-BAND SOUND PRESSURE LEVELS ARE CALCULATED
15.000 C BY A NUMBER OF METHODS.
16.000 C
17.000 C THE EFFECT OF USING THE VARIOUS METHODS IS DETERMINED FOR
18.000 C 1/3-OCTAVE-BAND SOUND PRESSURE LEVELS, PERCEIVED NOISE LEVELS,
19.000 C TONE-CORRECTED PERCEIVED NOISE LEVELS, EFFECTIVE PERCEIVED
20.000 C NOISE LEVELS, MAXIMUM A-WEIGHTED SOUND LEVELS, AND SOUND
21.000 C EXPOSURE LEVELS. VARIOUS AIRCRAFT NOISE SPECTRA, SOUND
22.000 C PROPAGATION DISTANCES, AND TEST-DAY METEOROLOGICAL CONDITIONS
23.000 C ARE EXAMINED BY VARYING THE INPUT DATA.
24.000 C
25.000 C*****
26.000 C
27.000 C*** INPUT DATA FILE:
28.000 C
29.000 C FOR EACH SET OF INPUT DATA, THE INPUT FILE THAT IS READ ON
30.000 C DEVICE 5 CONTAINS: RUN; MIC, NS, DATE, MONTH, AND YEAR;
31.000 C TS, TOH, AH, ZM, AS, AM, AND GAMAD; SPL; NH AND HM; TC AND HR;
32.000 C BP; AND TITLE1, TITLE2, AND GROUND FOR LABELS ON OUTPUT PAGES.
33.000 C
34.000 C*** SYMBOLS AND UNITS FOR PARAMETERS AND VARIABLES ARE DEFINED
35.000 C IN COMMENTS AND IN ACCOMPANYING TEXT IN MORE DETAIL.
36.000 C
37.000 C*****
38.000 C
39.000 C DIMENSION AHR(31),AL(100),ASPL(24),ATC(31),ATK(31),AW(24),
40.000 C 1BAAD(24),BAPTD(24),C(100),DAM(31),DPTM(31),FMX(100),FREQ(24),
41.000 C 2GROUND(5),HM(31),HMEA(31),HMI(31),HR(31),HREF(31),MONTH(1),
42.000 C 3PNL(100),PNLT(100),RHR(31),RPA(31),RTK(31),SPL(100,24),
43.000 C 4SPLAB(24),SPLAC(24),SPLAD(24),SPLAE(24),SPLAM(25),SPLPTB(24),
44.000 C 5SPLPTC(24),SPLPTD(24),SPLPTE(24),SPLPTM(25),TC(31),TT(100),
45.000 C 6TITLE1(20),TITLE2(20)
46.000 C
47.000 C THE DIMENSIONS OF AHR,ATC,ATK,DAM,DPTM,HM,HMEA,HMI,HR,
48.000 C HREF,RHR,RPA,RTK, AND TC ARE SPECIFIED FOR METEOROLOGICAL
49.000 C MEASUREMENTS AT 31 HEIGHTS ABOVE GROUND. IF THERE ARE MORE
50.000 C HEIGHT INTERVALS (LAYERS) THAN 31, THE DIMENSION WILL HAVE
51.000 C TO BE INCREASED ACCORDINGLY, HERE AND IN CORRESPONDING SUBROUTINES.
52.000 C

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53.000      COMMON /CTEXT/ TEXT(12,31),TEXTA(12)
54.000      INTEGER DATE,FREQ,RUN,YEAR
55.000      REAL ISBN
56.000 C
57.000 C      DATA FREQ = 24 NOMINAL 1/3-OCTAVE-BAND CENTER FREQUENCIES
58.000 C
59.000      DATA FREQ /50,63,80,100,125,160,200,250,315,400,500,630,800,
60.000 11000,1250,1600,2000,2500,3150,4000,5000,6300,8000,10000/
61.000 C
62.000 C      DATA AW = A-SCALE FREQUENCY WEIGHTINGS AT THE 24 CENTER
63.000 C      FREQUENCIES OF THE 1/3-OCTAVE BANDS.
64.000 C
65.000      DATA AW /-30.2,-26.2,-22.5,-19.1,-16.1,-13.4,-10.9,-8.6,
66.000 1-6.6,-4.8,-3.2,-1.9,-0.8,0.0,0.6,1.0,1.2,1.3,1.2,1.0,
67.000 20.5,-0.1,-1.1,-2.5/
68.000 C
69.000 C***** READ INPUT FILE FOR AIRCRAFT NOISE LEVELS AND ASSOCIATED DATA
70.000 C
71.000 C      READ RUN,MIC,NS,DATE,MONTH,YEAR,TS,TOH,AH,ZM,AS,AM, AND
72.000 C GAMAD.
73.000 C
74.000      READ (5,10) RUN
75.000 10      FORMAT (I3)
76.000 11      READ (5,12) MIC,NS,DATE,MONTH,YEAR
77.000 12      FORMAT (I1,I4,I3,1A4,I3)
78.000      READ (5,13) TS,TOH,AH,ZM,AS,AM,GAMAD
79.000 13      FORMAT(F7.1,F8.1,F6.1,F4.1,F5.1,F6.3,F5.1)
80.000 C
81.000 C      CALCULATE TT(I), THE ARRAY OF TEST TIMES RELATIVE TO THE
82.000 C      TIME OF THE FIRST DATA SAMPLE ASSUMING DATA TIME INTERVALS
83.000 C      OF EXACTLY 0.5 SECONDS.
84.000 C
85.000      TT(1)=0.0
86.000      DO 14 I=2,NS
87.000 14      TT(I)=TT(I-1)+0.5
88.000 C
89.000      DO 25 I=1,NS
90.000 C
91.000 C      READ SPL(I,J), THE 24 1/3-OCTAVE-BAND SPLS AT 0.5-S INTERVALS.
92.000 C
93.000      READ (5,15) (SPL(I,J),J=1,24)
94.000 15      FORMAT(12F6.1)
95.000 C
96.000      DO 17 J=1,24
97.000 17      ASPL(J)=SPL(I,J)
98.000 C
99.000 C      CALCULATE PERCEIVED NOISE LEVEL, PNL(I)
100.000 C
101.000      CALL CPNL(ASPL,APNL)
102.000      PNL(I)=APNL
103.000 C
104.000 C      CALCULATE TONE-CORRECTED PERCEIVED NOISE LEVELS, PNLT(I)
105.000 C
106.000      CALL P36TC(ASPL,C(I),JMX)
107.000      PNLT(I)=PNL(I)+C(I)
108.000 C

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109.000 C      FIND FMX(I), THE NOMINAL CENTER FREQUENCY IN KHZ OF THE
110.000 C      BAND THAT PRODUCED CMX AND HAD FREQUENCY BAND INDEX COUNTER
111.000 C      JMX.
112.000 C
113.000      FMX(I)=(FLOAT(FREQ(JMX)))/1000.0
114.000 C
115.000 C      CALCULATE A-WEIGHTED SOUND PRESSURE LEVEL, AL(I).
116.000 C      SET AL(I)=0.0 DB IF ALL SPL(J)=0.0 DB.
117.000 C
118.000      AP=0.0
119.000      DO 20 J=1,24
120.000 20    AP=AP+10.0**((SPL(I,J)+AW(J))/10.0)
121.000      IF(AP.LT.15.0)GOTO 23
122.000      AL(I)=10.0*LOG10(AP)
123.000      GOTO 25
124.000 23    AL(I)=0.0
125.000 25    CONTINUE
126.000 C
127.000 C      FIND PNLM, THE MAXIMUM VALUE OF THE PERCEIVED NOISE LEVELS
128.000 C      PNL(I); IPM, THE TIME INDEX COUNTER WHEN PNL(I)=PNLM; AND
129.000 C      TPNLM, THE RELATIVE TEST TIME TT(IPM) WHEN I=IPM.
130.000 C
131.000 C      FIND PNLTM, THE MAXIMUM VALUE OF THE TONE-CORRECTED
132.000 C      PERCEIVED NOISE LEVELS PNLT(I); IPTM, THE TIME INDEX COUNTER
133.000 C      WHEN PNLT(I)=PNLTM; AND TPNLTM, THE RELATIVE TEST TIME
134.000 C      TT(IPTM) WHEN I=IPTM.
135.000 C
136.000 C      ALSO, FIND ALM, THE MAXIMUM VALUE OF THE A-WEIGHTED SOUND
137.000 C      PRESSURE LEVELS AL(I); IAM, THE TIME INDEX COUNTER WHEN
138.000 C      AL(I)=ALM; AND TALM, THE RELATIVE TEST TIME TT(IAM) WHEN
139.000 C      I=IAM.
140.000 C
141.000      PNLM=PNLTM=ALM=-1000.0
142.000      DO 30 I=1,NS
143.000      IF(PNL(I).LE.PNLM)GOTO 26
144.000      PNLM=PNL(I)
145.000      IPM=I
146.000      TPNLM=TT(IPM)
147.000 C
148.000 26    IF(PNLT(I).LE.PNLTM)GOTO 27
149.000      PNLTM=PNLT(I)
150.000      IPTM=I
151.000      TPNLTM=TT(IPTM)
152.000 C
153.000 27    IF(AL(I).LE.ALM)GOTO 30
154.000      ALM=AL(I)
155.000      IAM=I
156.000      TALM=TT(IAM)
157.000 30    CONTINUE
158.000 C
159.000 C      LABEL THE 1/3-OCTAVE-BAND SPLS, SPLPTM(J), CORRESPONDING
160.000 C      TO THE TIME OF OCCURRENCE OF PNLTM=PNLT(IPTM).
161.000 C
162.000      DO 33 J=1,24
163.000 33    SPLPTM(J)=SPL(IPTM,J)
164.000 C

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165.000 C LABEL THE 1/3-OCTAVE-BAND SPLS ,SPLAM(J),
166.000 C CORRESPONDING TO THE TIME OF OCCURRENCE
167.000 C OF ALM = AL(IAM).
168.000 C
169.000 DO 34 J=1,24
170.000 34 SPLAM(J)=SPL(IAM,J)
171.000 C
172.000 C READ NH, THE NUMBER OF HEIGHTS ABOVE GROUND LEVEL WHERE
173.000 C METEOROLOGICAL DATA WERE MEASURED, AND HM(K), THE VALUES
174.000 C OF THE HEIGHTS.
175.000 C
176.000 READ (5,35) NH
177.000 35 FORMAT(I3)
178.000 READ (5,36) (HM(K),K=1,NH)
179.000 36 FORMAT(F6.1)
180.000 C
181.000 C READ TC(K) AND HR(K), THE AIR TEMPERATURE AND RELATIVE
182.000 C HUMIDITY AT THE TIME OF THE FLYOVER NOISE MEASUREMENT
183.000 C AND AT THE VARIOUS HEIGHTS ABOVE GROUND LEVEL.
184.000 C
185.000 C READ BP, THE BAROMETRIC PRESSURE AT THE TIME OF THE
186.000 C FLYOVER NOISE TEST. THE BAROMETRIC PRESSURE IS USUALLY
187.000 C MEASURED AT A HEIGHT OF 10 M.
188.000 C
189.000 READ (5,37) ((TC(K),HR(K)),K=1,NH)
190.000 37 FORMAT(2F5.1)
191.000 READ (5,38) BP
192.000 38 FORMAT(F6.3)
193.000 C
194.000 C READ INFORMATION FOR LABELING OUTPUT PAGES.
195.000 C
196.000 READ (5,39) TITLE1
197.000 39 FORMAT(20A4)
198.000 READ (5,40) TITLE2
199.000 40 FORMAT(20A4)
200.000 READ (5,41) GROUND
201.000 41 FORMAT(5A4)
202.000 C
203.000 C***** END OF READING OF INPUT DATA AND OF INITIAL CALCULATIONS.
204.000 C
205.000 C CALCULATE THE EFFECTIVE PERCEIVED NOISE LEVEL, EPNL, FROM
206.000 C THE INPUT ARRAY OF PNLT(I) VALUES. ALSO, FIND INDICES IFP AND
207.000 C ILP FOR THE RELATIVE TIMES AT THE START AND END OF THE SUMMATION
208.000 C OVER THE 10-DB-DOWN TIME OF THE SQUARE OF THE TONE-CORRECTED
209.000 C PERCEIVED NOISINESS.
210.000 C
211.000 C INTEGRATION FOLLOWS THE RULE OF SECTION B36.9(E) AND IS
212.000 C JUST BETWEEN THE RELATIVE TIMES OF THE 0.5-SEC DATA SAMPLES
213.000 C THAT ARE CLOSEST TO THE VALUE OF PNLTM-10.0 DB. INTEGRATION
214.000 C IS PERFORMED BY SUBROUTINE INTEG.
215.000 C
216.000 DATA10=PNLTM-10.0
217.000 CALL INTEG(NS,PNLT,DATA10,IFP,ILP,SUMDAT)
218.000 EPNL=10.0*LOG10(SUMDAT)-10.0*LOG10(2.0) -10.0
219.000 C

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220.000 C      FIND DURATION CORRECTION FACTOR, DCF
221.000 C
222.000 C      DCF=EPNL-PNLTM
223.000 C
224.000 C      CALCULATE THE SOUND EXPOSURE LEVEL, SEL, FROM THE ARRAY OF
225.000 C      INPUT A-WEIGHTED SOUND LEVELS, AL(1). ALSO FIND THE INDEXES
226.000 C      IFA AND ILA FOR THE RELATIVE TIMES AT THE START AND END OF
227.000 C      SUMMATION OVER THE 10-DB-DOWN TIME FOR THE SQUARED A-WEIGHTED
228.000 C      SOUND PRESSURE.
229.000 C
230.000 C      DATA10=ALM-10.0
231.000 C      CALL INTEG(NS,AL,DATA10,IFA,ILA,SUMDAT)
232.000 C      SEL=10.0*LOG10(SUMDAT)-10.0*LOG10(2.0)
233.000 C
234.000 C      FIND DSEL, DURATION OF SEL
235.000 C
236.000 C      DSEL=SEL-ALM
237.000 C
238.000 C      DETERMINE TEST-DAY AIR PRESSURE IN STANDARD ATMOSPHERES
239.000 C      USING A REFERENCE ATMOSPHERIC PRESSURE OF 29.921 IN. OF HG.
240.000 C
241.000 C      RBPO=29.921
242.000 C      PA=BP/RBPO
243.000 C
244.000 C      FOR A UNIFORM REFERENCE ATMOSPHERE, DEFINE REFERENCE AIR
245.000 C      TEMPERATURE IN DEGREES CELSIUS AND KELVIN, RELATIVE HUMIDITY
246.000 C      IN PERCENT, AND AIR PRESSURE IN STANDARD ATMOSPHERES.
247.000 C
248.000 C      TCR=25.0
249.000 C      TKR=298.15
250.000 C      HRR=70.0
251.000 C      PAR=1.0
252.000 C
253.000 C      IF APPLICABLE, USE LINEAR INTERPOLATION ON THE VALUES OF
254.000 C      AIR TEMPERATURE AND RELATIVE HUMIDITY AT THE FIRST AND SECOND
255.000 C      HEIGHTS READ FROM THE INPUT FILE TO OBTAIN CORRESPONDING VALUES
256.000 C      AT A HEIGHT OF 10.0 M. (HM(2) IS ASSUMED TO BE > 10.0 M AND
257.000 C      HM(1) IS ASSUMED TO BE < OR = 10.0 M.)
258.000 C
259.000 C      TC10=TC(1)-((TC(1)-TC(2))*((10.0-HM(1))/(HM(2)-HM(1))))
260.000 C      HR10=HR(1)-((HR(1)-HR(2))*((10.0-HM(1))/(HM(2)-HM(1))))
261.000 C
262.000 C      FIND THE MOLAR CONCENTRATION OF WATER VAPOR FOR THE
263.000 C      TEST-DAY CONDITIONS AT 10 M.
264.000 C
265.000 C      CALL MOLAR(TC10+273.15,HR10,PA,H10)
266.000 C
267.000 C
268.000 C      DEFINE THE REFERENCE HEIGHT, RHM, OF 10.0 M AS THE HEIGHT
269.000 C      AT WHICH THE REFERENCE AIR TEMPERATURE, RTKO OF 298.15 DEG K,
270.000 C      REFERENCE RELATIVE HUMIDITY, RHRO OF 70.0 PERCENT, AND
271.000 C      REFERENCE AIR PRESSURE OF 1.0 STANDARD ATMOSPHERE ARE SPECIFIED.
272.000 C      ALSO DEFINE THE REFERENCE LAPSE RATES AS A FUNCTION OF HEIGHT
273.000 C      ABOVE THE REFERENCE HEIGHT OF RTKL= -0.0065 DEG K/M,
274.000 C      RHRL= -0.0065 PERCENTAGE POINTS/M, AND RPAL= -5.25588 FOR THE
275.000 C      EXPONENT OF THE EXPRESSION FOR LAPSE RATE OF THE REFERENCE
276.000 C      AIR PRESSURE IN STANDARD ATMOSPHERES.

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277.000 C
278.000 RHM=10.0
279.000 RTKO=298.15
280.000 RTKL=-0.0065
281.000 RHRO=70.0
282.000 RHRL=-0.0065
283.000 RPAL=-5.25588
284.000 C
285.000 C NOW CALCULATE THE VALUE OF THE HEIGHTS AT THE MIDDLE
286.000 C OF EACH HEIGHT INTERVAL (LAYER).
287.000 C
288.000 C FOR THE REFERENCE LAPSE RATES, CALCULATE THE CORRESPONDING
289.000 C REFERENCE TEMPERATURES, RELATIVE HUMIDITIES, AND PRESSURES.
290.000 C ALSO CALCULATE THE AVERAGE VALUES OF THE MEASURED AIR
291.000 C TEMPERATURES AND RELATIVE HUMIDITIES AT THE MIDPOINTS OF
292.000 C THE HEIGHT INTERVALS.
293.000 C
294.000 C MEASURED TEMPERATURES ARE CONVERTED FROM DEGREES CELSIUS
295.000 C TO KELVINS.
296.000 C
297.000 C ALSO CALCULATE THE VERTICAL PROFILES OF HMEA AND HREF FOR THE
298.000 C MOLAR CONCENTRATION OF WATER VAPOR UNDER TEST-DAY AND REFERENCE-
299.000 C DAY LAPSE-RATE CONDITIONS.
300.000 C
301.000 DO 42 K=1,NH-1
302.000 HMI(K)=(HM(K+1)+HM(K))/2.
303.000 RTK(K)=RTKO+RTKL*(HMI(K)-RHM)
304.000 RHR(K)=RHRO+RHRL*(HMI(K)-RHM)
305.000 RPA(K)=((RTKO-10.0)/((RTKO-10.0)+(RTKL*HMI(K))))**RPAL
306.000 ATC(K)=(TC(K+1)+TC(K))/2.
307.000 ATK(K)=ATC(K)+273.15
308.000 AHR(K)=(HR(K+1)+HR(K))/2.
309.000 CALL MOLAR(ATK(K),AHR(K),PA,HMEA(K))
310.000 42 CALL MOLAR(RTK(K),RHR(K),RPA(K),HREF(K))
311.000 C
312.000 C IF HM(1), THE FIRST HEIGHT AT WHICH METEOROLOGICAL DATA
313.000 C WERE MEASURED, IS > ZM, THEN THE METEOROLOGICAL PARAMETERS
314.000 C CALCULATED ABOVE WILL NOT BE DEFINED OVER THE LAYER OF THE
315.000 C ATMOSPHERE THAT INCLUDES THE MICROPHONE AT HEIGHT ZM.
316.000 C IN THIS CASE, RENUMBER THE INDEX OF THE PARAMETERS
317.000 C (INCREASING IT BY 1) AND DEFINE A NEW SET OF PARAMETERS FOR
318.000 C INDEX 1 EQUAL TO THE PREVIOUS SET FOR OLD INDEX 1 (OR NEW
319.000 C INDEX 2), THEREBY MAKING THE PARAMETERS IDENTICAL FOR THE FIRST
320.000 C TWO LAYERS.
321.000 C
322.000 IF(HM(1).GT.ZM)GOTO 43
323.000 GOTO 47
324.000 43 DO 45 L=1,NH
325.000 LL=(NH+2)-L
326.000 HMI(LL)=HMI(LL-1)
327.000 RTK(LL)=RTK(LL-1)
328.000 RHR(LL)=RHR(LL-1)
329.000 RPA(LL)=RPA(LL-1)
330.000 ATC(LL)=ATC(LL-1)
331.000 ATK(LL)=ATK(LL-1)
332.000 AHR(LL)=AHR(LL-1)
333.000 HMEA(LL)=HMEA(LL-1)
334.000 45 HREF(LL)=HREF(LL-1)

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335.000 C
 336.000 C FOR THE RELATIVE TEST TIMES TT(IPTM) AND TT(IAM)
 337.000 C CORRESPONDING TO PNLTM AND ALM, DETERMINE THE TOTAL
 338.000 C LENGTHS OF THE SOUND PROPAGATION PATHS, PDPTM AND PDAM,
 339.000 C AND THE LENGTHS OF THE VARIOUS SEGMENTS DPTM(K) AND
 340.000 C DAM(K), ALONG THE PATHS THAT CORRESPOND TO THE INTERVALS
 341.000 C OF HEIGHT FOR THE METEOROLOGICAL MEASUREMENTS.
 342.000 C
 343.000 C DETERMINE THE TIMES, TRPTM AND TRAM, FOR THE POSITIONS ON
 344.000 C THE FLIGHT PATH WHERE THE AIRPLANE WAS WHEN THE SOUND PRESSURE
 345.000 C LEVELS SPLPTM(J) AND SPLAM(J), CORRESPONDING TO PNLTM AND ALM,
 346.000 C WERE RECEIVED AT THE MICROPHONE.
 347.000 C
 348.000 C TIMES TRPTM AND TRAM ARE CALCULATED RELATIVE TO THE
 349.000 C TIME, TOH, WHEN THE AIRPLANE WAS DIRECTLY OVER THE MICROPHONE
 350.000 C AND TO THE DATA ANALYSIS START TIME, TS.
 351.000 C
 352.000 C A FACTOR OF 0.25 SECONDS IS INCLUDED TO SHIFT THE
 353.000 C RELATIVE TIME SCALE TO THE MIDDLE OF EACH 0.5-S
 354.000 C SPL DATA SAMPLE.
 355.000 C
 356.000 47 $TRPTM = TS + 0.25 + TT(IPTM) - TOH$
 357.000 $TRAM = TS + 0.25 + TT(IAM) - TOH$
 358.000 C
 359.000 C FIND THE DISTANCE BETWEEN THE AIRCRAFT AND THE MICROPHONE
 360.000 C AT THE TIME THE AIRCRAFT WAS OVERHEAD.
 361.000 C
 362.000 $AMH = AH - ZM$
 363.000 C
 364.000 C DEFINE PI
 365.000 C
 366.000 $PI = 3.141592654$
 367.000 C
 368.000 C SPECIFY THE FLIGHT PATH ANGLE, GAMAR, IN RADIANS--POSITIVE
 369.000 C FOR CLIMBING.
 370.000 C
 371.000 $GAMAR = GAMAD * PI / 180.0$
 372.000 C
 373.000 C CALCULATE DM, THE MINIMUM DISTANCE BETWEEN THE MICROPHONE
 374.000 C AND THE FLIGHT PATH; DB, THE DISTANCE ALONG THE FLIGHT PATH
 375.000 C FROM THE OVERHEAD POINT TO THE POINT OF CLOSEST APPROACH; AND
 376.000 C DISTANCES ALONG THE FLIGHT PATH FROM THE OVERHEAD POINT TO
 377.000 C THE AIRCRAFT POSITION AT THE TIME THE SOUND WAS RECEIVED AT
 378.000 C THE MICROPHONE, I.E., DISTANCES DPTM AND DOAM AT RELATIVE
 379.000 C TIMES TRPTM AND TRAM, RESPECTIVELY.
 380.000 $DM = AMH * \cos(GAMAR)$
 381.000 $DB = AMH * \sin(GAMAR)$
 382.000 C
 383.000 C DETERMINE SOUND PROPAGATION ANGLES, PSI, RELATIVE TO THE
 384.000 C FLIGHT PATH AND THE DIRECTION OF FLIGHT, AT THE TIME WHEN THE
 385.000 C NOISE WAS EMITTED WHICH WAS LATER RECEIVED AT THE MICROPHONE AT
 386.000 C RELATIVE TIMES OF PNLTM AND ALM.
 387.000 C

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388.000      DOPTM=AS*TRPTM
389.000      IF(DB+DOPTM.LT.0.0)PHIPTM=(ATAN(-DM/(DB+DOPTM)))
390.000      IF(DB+DOPTM.EQ.0.0)PHIPTM=PI/2.0
391.000      IF(DB+DOPTM.GT.0.0)PHIPTM=PI-(ATAN(DM/(DB+DOPTM)))
392.000      PSIPTM=PHIPTM-ASIN(AM*SIN(PHIPTM))
393.000 C
394.000      DOAM=AS*TRAM
395.000      IF(DB+DOAM.LT.0.0)PHIAM=(ATAN(-DM/(DB+DOAM)))
396.000      IF(DB+DOAM.EQ.0.0)PHIAM=PI/2.0
397.000      IF(DB+DOAM.GT.0.0)PHIAM=PI-(ATAN(DM/(DB+DOAM)))
398.000      PSIAM=PHIAM-ASIN(AM*SIN(PHIAM))
399.000 C
400.000 C      NOW FIND THE TOTAL LENGTH OF THE PROPAGATION DISTANCE
401.000 C      FROM THE SOURCE TO THE RECEIVER AT THE TIMES OF
402.000 C      PNLTM AND ALM.
403.000 C
404.000      PDPTM=DM/SIN(PSIPTM)
405.000      PDAM=DM/SIN(PSIAM)
406.000 C
407.000 C      DETERMINE, AHS, THE HEIGHT OF THE AIRPLANE ABOVE THE
408.000 C      MICROPHONE HEIGHT AT THE TIME THE MAXIMUM NOISE WAS RECEIVED
409.000 C      AT THE MICROPHONE.
410.000 C
411.000      AHSPTM=PDPTM*SIN(PSIPTM-GAMAR)
412.000      AHSAM=PDAM*SIN(PSIAM-GAMAR)
413.000 C
414.000 C      NOW DETERMINE THE INDICES FROM THE ARRAY OF HEIGHTS FOR
415.000 C      THE METEOROLOGICAL MEASUREMENTS THAT ARE ONE AND TWO LESS THAN
416.000 C      THE HEIGHT OF THE AIRCRAFT ABOVE THE MICROPHONE HEIGHT AT THE
417.000 C      TIMES OF MAXIMUM NOISE.
418.000 C
419.000      DO 50 K=1,NH
420.000      IF(HM(K)-ZM.GT.AHSPTM)GOTO 53
421.000 50    CONTINUE
422.000 53    KAP=K-1
423.000      KAP1=KAP-1
424.000 C
425.000      DO 55 K=1,NH
426.000      IF(HM(K)-ZM.GT.AHSAM)GOTO 57
427.000 55    CONTINUE
428.000 57    KAA=K-1
429.000      KAA1=KAA-1
430.000 C
431.000 C      NOW FIND THE LENGTHS OF THE SEGMENTS OF DISTANCE ALONG
432.000 C      THE PROPAGATION PATHS CORRESPONDING TO THE INTERVALS OF
433.000 C      HEIGHT FOR THE METEOROLOGICAL MEASUREMENTS, DPTM AND DAM.
434.000 C
435.000      DO 60 K=1,NH
436.000      IF((HM(K)-ZM).GT.0.0)GOTO 65
437.000 60    CONTINUE
438.000 65    KK=K
439.000 C
440.000      DPTM(1)=(HM(KK)-ZM)/SIN(PSIPTM-GAMAR)
441.000      DO 70 K=KK,KAP1
442.000 70    DPTM(K-KK+2)=(HM(K+1)-HM(K))/SIN(PSIPTM-GAMAR)
443.000      DPTM(KAP1-KK+3)=(AHSPTM-(HM(KAP)-ZM))/SIN(PSIPTM-GAMAR)
444.000 C

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445.000      DAM(1)=(HM(KK)-ZM)/SIN(PSIAM-GAMAR)
446.000      DO 72 K=KK,KAA1
447.000  72    DAM(K-KK+2)=(HM(K+1)-HM(K))/SIN(PSIAM-GAMAR)
448.000      DAM(KAA1-KK+3)=(AHSAM-(HM(KAA)-ZM))/SIN(PSIAM-GAMAR)
449.000  C
450.000  C      NOW COMPUTE THE 1/3-OCTAVE-BAND ADJUSTMENT FACTORS FOR
451.000  C      DIFFERENCES IN ATMOSPHERIC ABSORPTION UNDER TEST AND REFERENCE
452.000  C      METEOROLOGICAL CONDITIONS AND APPLY THE ADJUSTMENTS TO THE SPL
453.000  C      SPECTRUM AT THE TIME OF PNLTM AND ALM.
454.000  C
455.000  C      NOTE THAT IF THE TEST-DAY BAND LEVEL IS = 0.0 DB, THEN
456.000  C      THE REFERENCE-DAY BAND LEVEL IS ALSO = 0.0 DB.
457.000  C
458.000      APMB=APMC=APMD=APME=0.0
459.000  C
460.000      DO 85 J=1,24
461.000  C
462.000  C      FIRST, DETERMINE ATMOSPHERIC ABSORPTION ADJUSTMENT FACTORS
463.000  C      USING SAE ARP 866A, MARCH 1975, AND TEST-DAY AIR TEMPERATURE
464.000  C      AND RELATIVE HUMIDITY DATA AT A HEIGHT OF 10 M.
465.000  C
466.000  C      SOUND ABSORPTION COEFFICIENTS FOR REFERENCE-DAY METEOROLOGICAL
467.000  C      CONDITIONS ARE CALCULATED DIRECTLY FOR THE SPECIFIED CONDITIONS.
468.000  C
469.000      CALL ARP866A(J,TC10,HR10,TALPHA)
470.000      CALL ARP866A(J,TCR,HRR,RALPHA)
471.000      IF(SPLPTM(J).EQ.0.0)GOTO 74
472.000      SPLPTB(J)=SPLPTM(J)+(TALPHA-RALPHA)*PDPTM
473.000      GOTO 75
474.000  74    SPLPTB(J)=0.0
475.000  75    IF(SPLAM(J).EQ.0.0)GOTO 76
476.000      SPLAB(J)=SPLAM(J)+(TALPHA-RALPHA)*PDAM
477.000      GOTO 77
478.000  76    SPLAB(J)=0.0
479.000  77    APMB=APMB+10.0***((SPLAB(J)+AW(J))/10.0)
480.000  C
481.000  C      SECOND, DETERMINE ATMOSPHERIC ABSORPTION ADJUSTMENT FACTORS
482.000  C      USING SAE ARP 866A FOR ATMOSPHERIC ABSORPTION COEFFICIENTS
483.000  C      IN DB/M AND AVERAGE AIR TEMPERATURE AND RELATIVE HUMIDITY ALONG
484.000  C      SEGMENTS OF THE SOUND PROPAGATION PATH DEFINED BY HORIZONTAL
485.000  C      LAYERS OF THE ATMOSPHERE.
486.000  C
487.000  C      AN AVERAGE SOUND ABSORPTION COEFFICIENT FOR TEST METEOROLOGICAL
488.000  C      CONDITIONS IS COMPUTED FROM THE RATIO OF THE TOTAL ATTENUATION OVER
489.000  C      THE PROPAGATION PATH TO THE LENGTH OF THE PROPAGATION PATH.
490.000  C
491.000  C      DEFINE AN INDEX COUNTER FOR THE LAST SEGMENT OF
492.000  C      DISTANCES GOING BACK ALONG THE SOUND PROPAGATION PATH
493.000  C      FROM THE MICROPHONE TO THE AIRPLANE.
494.000  C
495.000      KLP=KAP1-KK+3
496.000      KLA=KAA1-KK+3
497.000  C
498.000      ATTPTC=ATTAC=0.0
499.000  C

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500.000      DO 80 K=1,KLP
501.000      CALL ARP866A(J,ATC(K),AHR(K),TALPHA)
502.000 80    ATTPTC=ATTPTC+(TALPHA*DPTM(K))
503.000 C
504.000      DO 81 K=1,KLA
505.000      CALL ARP866A(J,ATC(K),AHR(K),TALPHA)
506.000 81    ATTAC=ATTAC+(TALPHA*DAM(K))
507.000 C
508.000      AVALFPTC=ATTPTC/PDPTM
509.000      AVALFAC=ATTAC/PDAM
510.000      IF(SPLPTM(J).EQ.0.0)GOTO 82
511.000      SPLPTC(J)=SPLPTM(J)+(AVALFPTC-RALPHA)*PDPTM
512.000      GOTO 83
513.000 82    SPLPTC(J)=0.0
514.000 83    IF(SPLAM(J).EQ.0.0)GOTO 84
515.000      SPLAC(J)=SPLAM(J)+(AVALFAC-RALPHA)*PDAM
516.000      GOTO 85
517.000 84    SPLAC(J)=0.0
518.000 85    APMC=APMC+10.0**((SPLAC(J)+AW(J))/10.0)
519.000 C
520.000 C      THIRD, DETERMINE ATMOSPHERIC-ABSORPTION BAND-ADJUSTMENT
521.000 C FACTORS USING ANS S1.26-1978 FOR PURE-TONE ATMOSPHERIC
522.000 C ABSORPTION COEFFICIENTS AND COMPUTE THE ADJUSTMENT FACTORS
523.000 C BY INTEGRATING OVER THE BANDWIDTH OF THE 1/3-OCTAVE-BAND
524.000 C FILTERS ASSUMING EACH FILTER'S TRANSMISSION RESPONSE IS THAT
525.000 C OF AN IDEAL FILTER WITH THE SAME GEOMETRIC MEAN FREQUENCY.
526.000 C
527.000 C      COMPUTE THE TOTAL DIFFERENCE IN ATTENUATION UNDER TEST
528.000 C AND REFERENCE METEOROLOGICAL CONDITIONS AS THE SUM OF THE
529.000 C DIFFERENCES IN ATTENUATION OVER SEGMENTS OF THE SOUND
530.000 C PROPAGATION PATH. THE SEGMENTS ARE DEFINED BY HORIZONTAL
531.000 C LAYERS OF THE ATMOSPHERE OVER WHICH THE AIR TEMPERATURE
532.000 C AND RELATIVE HUMIDITY ARE ASSUMED TO HAVE THE AVERAGE
533.000 C VALUES GIVEN AT THE HEIGHTS OF THE MIDPOINTS OF EACH LAYER.
534.000 C
535.000 C      CALL SUBROUTINE NUMINT TO GET THE BAND ADJUSTMENT FACTORS,
536.000 C BA, FROM TEST TO REFERENCE METEOROLOGICAL CONDITIONS ALONG
537.000 C THE SOUND PROPAGATION PATH FOR EACH 1/3-OCTAVE BAND.
538.000 C
539.000      CALL NUMINT(SPLPTM,TKR,HRR,PAR,ATK,AHR,PA,DPTM,KLP,BAPTD)
540.000 C
541.000      CALL NUMINT(SPLAM,TKR,HRR,PAR,ATK,AHR,PA,DAM,KLA,BAAD)
542.000 C
543.000 C      CALCULATE SPLS ADJUSTED TO REFERENCE CONDITIONS
544.000 C
545.000      DO 93 J=1,24
546.000 C
547.000      IF(SPLPTM(J).EQ.0.0)GOTO 90
548.000      SPLPTD(J)=SPLPTM(J)+BAPTD(J)
549.000      GOTO 91
550.000 90    SPLPTD(J)=0.0
551.000 91    IF(SPLAM(J).EQ.0.0)GOTO 92
552.000      SPLAD(J)=SPLAM(J)+BAAD(J)
553.000      GOTO 93
554.000 92    SPLAD(J)=0.0
555.000 93    APMD=APMD+10.0**((SPLAD(J)+AW(J))/10.0)
556.000 C

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557.000 C      FOURTH, DETERMINE ATMOSPHERIC-ABSORPTION BAND-ADJUSTMENT
558.000 C FACTORS, BAPTE AND BAAE, USING ANS S1.26-1978 FOR PURE-TONE
559.000 C ATMOSPHERIC ABSORPTION COEFFICIENTS.
560.000 C
561.000 C      APPROXIMATE THE ATTENUATION OVER THE FREQUENCY RANGE OF
562.000 C EACH 1/3-OCTAVE-BAND FILTER BY THE ATTENUATION AT THE
563.000 C GEOMETRIC MEAN FREQUENCY ONLY. COMPUTE THE APPROXIMATE
564.000 C DIFFERENCE IN TOTAL ATTENUATION UNDER TEST AND REFERENCE
565.000 C METEOROLOGICAL CONDITIONS AS THE SUM OF THE DIFFERENCES IN
566.000 C ATTENUATION OF THE GEOMETRIC MEAN FREQUENCY OVER SEGMENTS
567.000 C OF THE SOUND PROPAGATION PATH DEFINED BY HORIZONTAL LAYERS
568.000 C OF THE ATMOSPHERE OVER WHICH THE AIR TEMPERATURE AND
569.000 C RELATIVE HUMIDITY ARE ASSUMED TO HAVE THE AVERAGE VALUES
570.000 C GIVEN AT THE HEIGHTS OF THE MIDPOINTS OF EACH LAYER.
571.000 C
572.000      DO 100 J=1,24
573.000 C
574.000      ISBN=16+J
575.000      FC=10.0**((ISBN/10.0))
576.000      CALL ANSAB(TKR,HRR,PAR,FC,AR)
577.000 C
578.000      BAPTE=BAAE=0.0
579.000      DO 95 K=1,KLP
580.000          CALL ANSAB(ATK(K),AHR(K),PA,FC,ATE)
581.000 95      BAPTE=BAPTE+(ATE-AR)**DPTM(K)
582.000 C
583.000      DO 96 K=1,KLA
584.000          CALL ANSAB(ATK(K),AHR(K),PA,FC,ATE)
585.000 96      BAAE=BAAE+(ATE-AR)**DAM(K)
586.000 C
587.000      IF(SPLPTM(J).EQ.0.0)GOTO 97
588.000      SPLPTE(J)=SPLPTM(J)+BAPTE
589.000      GOTO 98
590.000 97      SPLPTE(J)=0.0
591.000 98      IF(SPLAM(J).EQ.0.0)GOTO 99
592.000      SPLAE(J)=SPLAM(J)+BAAE
593.000      GOTO 100
594.000 99      SPLAE(J)=0.0
595.000 100     APME=APME+10.0**(((SPLAE(J)+AW(J))/10.0))
596.000 C
597.000 C      CALCULATE CORRESPONDING PNL, PNLT, AND EPNL
598.000 C
599.000      CALL CPNL(SPLPTB,PNLMB)
600.000      CALL P36TC(SPLPTB,CMXB,JMxB)
601.000      FMXB=(FLOAT(FREQ(JMxB)))/1000.0
602.000      PNLTMB=PNLMB+CMXB
603.000      EPNLB=PNLTMB+DCF
604.000 C
605.000      CALL CPNL(SPLPTC,PNLMC)
606.000      CALL P36TC(SPLPTC,CMXC,JMxC)
607.000      FMXC=(FLOAT(FREQ(JMxC)))/1000.0
608.000      PNLTMC=PNLMC+CMXC
609.000      EPNLC=PNLTMC+DCF
610.000 C

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611.000      CALL CPNL(SPLPTD,PNLMD)
612.000      CALL P36TC(SPLPTD,CMXD,JMXD)
613.000      FMXD=(FLOAT(FREQ(JMXD)))/1000.0
614.000      PNLTMD=PNLMD+CMXD
615.000      EPNLD=PNLTMD+DCF
616.000 C
617.000      CALL CPNL(SPLPTE,PNLME)
618.000      CALL P36TC(SPLPTE,CMXE,JMXE)
619.000      FMXE=(FLOAT(FREQ(JMXE)))/1000.0
620.000      PNLTME=PNLME+CMXE
621.000      EPNLE=PNLTME+DCF
622.000 C
623.000 C      CALCULATE CORRESPONDING AL AND SEL
624.000 C
625.000      ALMB=10.0*LOG10(APMB)
626.000      SELB=ALMB+DSEL
627.000 C
628.000      ALMC=10.0*LOG10(APMC)
629.000      SELC=ALMC+DSEL
630.000 C
631.000      ALMD=10.0*LOG10(APMD)
632.000      SELD=ALMD+DSEL
633.000 C
634.000      ALME=10.0*LOG10(APME)
635.000      SELE=ALME+DSEL
636.000 C
637.000 C*****      END OF CALCULATIONS      *****
638.000 C
639.000 C      SET PAGE COUNTERS AND INITIAL VALUES OF TIME INDEX COUNTERS
640.000 C
641.000      LPGTOT=INT((FLOAT(NS)/14.0)+0.99)
642.000      IS=1
643.000      IE=14
644.000      LPAGE=0
645.000      IF(NS.GT.150) STOP 'NS EXCEEDS 150'
646.000 C
647.000 C      LIST THE TEST-DAY SPL DATA AND THE TEST-DAY NOISE MEASURES
648.000 C
649.000 990      LPAGE=LPAGE+1
650.000      WRITE (6,995) RUN,MIC,LPAGE,LPGTOT
651.000 995      FORMAT('1',/,T14,'RUN NO.: ',I3,'; MIC NO.: ',I1,
652.000      1T80,'DATA PAGE ',I2,' OF ',I2)
653.000      WRITE (6,1000) TITLE1
654.000 1000      FORMAT(/,T1,'1',T20,20A4,T111,'1')
655.000      WRITE (6,1010) TITLE2
656.000 1010      FORMAT(T20,20A4)
657.000      WRITE (6,1020) DATE,MONTH,YEAR,ZM,TS
658.000 1020      FORMAT(/,T27,'TEST DATE: ',I2,1A4,' ',I2,'; '
659.000      1'MIC HT: ',F3.1,' M; START TIME: ',F7.1,' S')
660.000      WRITE (6,1030) TOH,AH,AS,GROUND
661.000 1030      FORMAT(T17,'TIME OH: ',F7.1,' S; HT OH: ',F6.1,' M; '
662.000      1'AIRSPD OH: ',F4.1,' M/S; GRND SURF: ',5A4)
663.000      WRITE (6,1040)
664.000 1040      FORMAT(/,T12,'CENTER',12X,'1/3-OCTAVE-BAND SOUND PRESSURE '
665.000      1'LEVEL, DB RE 20 MICROPASCALS')
666.000      WRITE (6,1050)
667.000 1050      FORMAT(T12,'FREQ.,',27X,'TIME RELATIVE TO START TIME, S')
668.000      WRITE (6,1060) (TT(I),I=IS,IE)
669.000 1060      FORMAT(T14,'HZ',2X,14F6.1)

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670.000      DO 1090 J=1,24
671.000      NJ=J-1
672.000      IF(NJ.EQ.0)GOTO 1070
673.000      IF(MOD(NJ,3).EQ.0)GOTO 1070
674.000      GOTO 1080
675.000 1070  WRITE (6,1075) (FREQ(J),(SPL(I,J),I=IS,IE))
676.000 1075  FORMAT(/,T13,I5,14F6.1)
677.000      GOTO 1090
678.000 1080  WRITE (6,1085) (FREQ(J),(SPL(I,J),I=IS,IE))
679.000 1085  FORMAT(T13,I5,14F6.1)
680.000 1090  CONTINUE
681.000      WRITE (6,1100) (PNL(I),I=IS,IE)
682.000 1100  FORMAT(/,T12,'PNL,DB',14F6.1)
683.000      WRITE (6,1110) (PNLT(I),I=IS,IE)
684.000 1110  FORMAT(T11,'PNLT,DB',14F6.1)
685.000      WRITE (6,1120) (AL(I),I=IS,IE)
686.000 1120  FORMAT(T1,'|',T13,'AL,DB',14F6.1,T111,'|')
687.000      WRITE(6,1122) (FMX(I),I=IS,IE)
688.000 1122  FORMAT(T11,'FMX,KHZ',14F6.3)
689.000      WRITE(6,1124)
690.000 1124  FORMAT(T18,'FMX IS THE CENTER FREQUENCY, IN KHZ, OF THE '
691.000      1'1/3-OCTAVE BAND THAT PRODUCES C(I)')
692.000      WRITE(6,1126)
693.000 1126  FORMAT(T12,'C(I) IS THE LARGEST OF THE TONE-CORRECTION '
694.000      1'FACTORS FOR THE CORRESPONDING '
695.000      2'SPECTRUM SPL(I,J)')
696.000      IF(IE.NE.NS)GOTO 1150
697.000      WRITE (6,1130) PNLM,TPNLM,PNLTM,TPNLTM,DCF,TT(IFP),TT(ILP)
698.000 1130  FORMAT(/,T11,'PNLM= ',F5.1,' DB AT ',F4.1,' S; PNLTM= ',
699.000      1F5.1,' DB AT ',F4.1,' S; DCF= ',F4.1,' DB FROM ',F4.1,
700.000      2' TO ',F4.1,' S')
701.000      WRITE (6,1140) EPNL
702.000 1140  FORMAT(T1,'|',T11,'EPNL=PNLTM+DCF= ',F5.1,' DB',T111,'|')
703.000      WRITE (6,1145) ALM,TALM,SEL,TT(IFA),TT(ILA)
704.000 1145  FORMAT(T11,'ALM= ',F5.1,' DB AT ',F4.1,' S; SEL= ',F5.1,
705.000      1' DB; TSEL FROM ',F4.1,' TO ',F4.1,' S')
706.000 C
707.000 C      REITERATE FOR NEXT PAGE UNTIL GET TO LAST PAGE FOR INPUT DATA
708.000 C
709.000      IF(IE.EQ.NS)GOTO 1800
710.000 1150  IS=MIN0(IE+1,NS)
711.000      IE=MIN0(IE+14,NS)
712.000      IF(IE.LE.NS)GOTO 990
713.000 C
714.000 C      TABULATE THE RESULTS OF APPLYING VARIOUS METHODS FOR ADJUSTING
715.000 C      SOUND PRESSURE LEVELS FOR DIFFERENCES IN ATMOSPHERIC ABSORPTION
716.000 C      UNDER TEST AND REFERENCE METEOROLOGICAL CONDITIONS
717.000 C

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718.000 C      SUMMARY OUTPUT PAGE 1 FOR METEOROLOGICAL DATA
719.000 C
720.000 1800  WRITE (6,1810) RUN,MIC
721.000 1810  FORMAT('1',5/,T1,'1',T17,'RUN NO.: ',I3,'; MIC NO.: ',I1,
722.000      1T48,'METEOROLOGICAL DATA',T76,'PAGE 1 OF SUMMARY',18X,'1')
723.000      WRITE (6,1820)
724.000 1820  FORMAT(/,T16,'HEIGHT AT MEAS. TEMP. MEAS. R.H. MEAS.'
725.000      1' MOLAR REF. TEMP. REF. R.H. REF. MOLAR')
726.000      WRITE (6,1830)
727.000 1830  FORMAT(T15,'MIDPOINT OF OVER HEIGHT OVER HEIGHT CONC.'
728.000      1' OF AT MID. OF AT MID. OF CONC. OF')
729.000      WRITE (6,1840)
730.000 1840  FORMAT(T16,'INTERVAL, INTERVAL, INTERVAL, WATER '
731.000      1'VAPOR, INTERVAL, INTERVAL, WATER VAPOR,')
732.000      WRITE (6,1850)
733.000 1850  FORMAT(T20,'M C PCT. PCT.'
734.000      1' C PCT. PCT.')
```

```

735.000      WRITE (6,1855)
736.000 1855  FORMAT (/)
737.000      IF(HM(1).GT.ZM)GOTO 1857
738.000      GOTO 1858
739.000 1857  WRITE(6,1860)((HMI(K),ATK(K)-273.15,AHR(K),HMEA(K),
740.000      1RTK(K)-273.15,RHR(K),HREF(K)),K=1,NH)
741.000      GOTO 1860
742.000 1858  WRITE(6,1860)((HMI(K),ATK(K)-273.15,AHR(K),HMEA(K),
743.000      1RTK(K)-273.15,RHR(K),HREF(K)),K=1,NH-1)
744.000 1860  FORMAT(T17,F6.1,9X,F4.1,9X,F4.1,8X,F5.3,9X,F4.1,9X,F4.1,8X,F5.3)
745.000      WRITE (6,1870) PA:101.325,PA
746.000 1870  FORMAT (/,T24,'STATION BAROMETRIC PRESSURE = ',F7.3,
747.000      1' KPA ( ',F5.3,' STD. ATM )')
```

```

748.000      WRITE (6,1880) TC10,HR10,H10
749.000 1880  FORMAT(/,T1,'1',T12,'AT 10 M: MEAS. AIR TEMP.= ',F4.1,
750.000      1' DEG C; MEAS. REL. HUM.= ',F4.1,' PCT; MEAS. MOLAR CONC.'
751.000      2'= ',F5.3,' PCT',T111,'1')
```

```

752.000      WRITE (6,1890)
753.000 1890  FORMAT(T23,'REF.AIR TEMP.= 25.0 DEG C; REF. REL. HUM.'
754.000      1'= 70.0 PCT; REF. MOLAR CONC.= 2.18774 PCT')
```

```

755.000 C
756.000 C      SUMMARY OUTPUT PAGES 2 AND 3 FOR NOISE DATA
757.000 C
758.000      DO 2300 NPG=1,2
759.000      IF(NPG.EQ.1)WRITE(6,2000)RUN,MIC
760.000      IF(NPG.EQ.2)WRITE(6,2010)RUN,MIC
761.000 2000  FORMAT('1',2/,T1,'1',T14,'RUN NO.: ',I3,'; MIC NO.: ',I1,
762.000      1T51,'PNL AND EPNL',T76,'PAGE 2 OF SUMMARY',18X,'1')
```

```

763.000 2010  FORMAT('1',3/,T1,'1',T14,'RUN NO.: ',I3,'; MIC NO.: ',I1,
764.000      1T52,'AL AND SEL',T76,'PAGE 3 OF SUMMARY',18X,'1')
```

```

765.000      WRITE (6,2020)
766.000 2020  FORMAT(/,T21,'TEST-DAY NOISE DATA ADJUSTED TO '
767.000      1'ACOUSTICAL REFERENCE-DAY CONDITIONS')
```

```

768.000      WRITE (6,2030) TITLE2
769.000 2030  FORMAT(T20,20A4)
770.000      WRITE (6,2040)
771.000 2040  FORMAT(T19,'REF.-DAY COND.: AIR TEMP = 25.0 C; REL HUM = '
772.000      1'70.0 PCT; PRESS = 1.0 STD ATM')
```

```

773.000      WRITE (6,2050)
774.000 2050  FORMAT(/,T13,'BAND',3X,'(A)',4X,'(B)',4X,'(C)',4X,'(D)',
775.000      14X,'(E)')
776.000      WRITE (6,2060)
777.000 2060  FORMAT(T12,'CENTER',2X,'TEST',3X,'ADJ.',3X,'ADJ.',3X,'ADJ.',
778.000      13X,'ADJ')
779.000      WRITE (6,2070)
780.000 2070  FORMAT(T12,'FREQ.',',',2X,'SPL',',',3X,'SPL',',',3X,'SPL',',',3X,'SPL',',',
781.000      13X,'SPL',',')
782.000      WRITE (6,2080)
783.000 2080  FORMAT(T14,'HZ',5X,'DB',5X,'DB',5X,'DB',5X,'DB',5X,'DB',5X,'DB',/)
784.000      JJ=0
785.000      DO 2160 J=1,24
786.000      JJ=JJ+1
787.000 C
788.000 C      PRINT OUTPUT DATA AND A LINE OF TEXT
789.000 C
790.000      IF(NPG.EQ.1)GOTO 2110
791.000      IF(J.EQ.3.AND.NPG.EQ.2)GOTO 2130
792.000      IF(NPG.EQ.2)GOTO 2120
793.000 2100  FORMAT(T13,I5,F6.1,4F7.1,T58,12A4)
794.000 2110  WRITE (6,2100) (FREQ(J),SPLPTM(J),SPLPTB(J),SPLPTC(J),
795.000      1SPLPTD(J),SPLPTE(J)),(TEXT(II,JJ),II=1,12)
796.000      GOTO 2140
797.000 2120  WRITE(6,2100)(FREQ(J),SPLAM(J),SPLAB(J),SPLAC(J),
798.000      1SPLAD(J),SPLAE(J)),(TEXT(II,JJ),II=1,12)
799.000      GOTO 2140
800.000 2130  WRITE(6,2100)(FREQ(J),SPLAM(J),SPLAB(J),SPLAC(J),
801.000      1SPLAD(J),SPLAE(J)),(TEXTA(II),II=1,12)
802.000 2140  IF(MOD(J,3).NE.0)GOTO 2150
803.000      IF(J.EQ.24)GOTO 2170
804.000 C
805.000 C      PRINT A LINE OF TEXT ONLY
806.000 C
807.000      JJ=JJ+1
808.000      WRITE (6,2150) (TEXT(II,JJ),II=1,12)
809.000 2150  FORMAT(T58,12A4)
810.000 2160  CONTINUE
811.000 2170  IF(NPG.EQ.1)GOTO 2180
812.000      IF(NPG.EQ.2)GOTO 2240
813.000 C
814.000 C      BOTTOM OF PAGE 2
815.000 C
816.000 2180  WRITE (6,2190) (PNLM,PNLMB,PNLMC,PNLMD,PNLME)
817.000 2190  FORMAT(/,T12,'PNL,DB',F6.1,4F7.1)
818.000      WRITE (6,2200) (PNLTM,PNLTMB,PNLTMC,PNLTMD,PNLTME)
819.000 2200  FORMAT(T11,'PNLT,DB',F6.1,4F7.1)
820.000      WRITE (6,2210) (EPNL,EPNLB,EPNLC,EPNLD,EPNLE)
821.000 2210  FORMAT(T11,'EPNL,DB',F6.1,4F7.1)
822.000      WRITE (6,2215) (FMXB,FMXC,FMXD,FMXE)
823.000 2215  FORMAT(T11,'FMX,KHZ',T24,4F7.3)
824.000      WRITE (6,2220) AMH
825.000 2220  FORMAT(/,T21,'AIRPLANE HEIGHT OVER MICROPHONE '
826.000      1'= ',F6.1,' M')
827.000      WRITE (6,2230) PDPTM
828.000 2230  FORMAT(T1,'I',T21,'SOUND PROPAGATION PATHLENGTH'
829.000      1' FOR TEST SPLS AT PNLTM = ',F6.1,' M',T11,'I')
830.000      WRITE (6,2235) (PSIPTM:57.29577951)
831.000 2235  FORMAT(T21,'SOUND PROPAGATION ANGLE RELATIVE TO'
832.000      1' DIRECTION OF FLIGHT = ',F5.1,' DEG AT PNLTM')

```

```

833.000      GOTO 2300
834.000 C
835.000 C      BOTTOM OF PAGE 3
836.000 C
837.000 2240  WRITE(6,2250)(ALM,ALMB,ALMC,ALMD,ALME)
838.000 2250  FORMAT(/,T13,'AL,DB',F6.1,4F7.1)
839.000      WRITE(6,2260)(SEL,SELB,SELC,SELD,SELE)
840.000 2260  FORMAT(T12,'SEL,DB',F6.1,4F7.1)
841.000      WRITE(6,2270) AMH
842.000 2270  FORMAT(/,T21,'AIRPLANE HEIGHT OVER MICROPHONE '
843.000      1' = ',F6.1,' M')
844.000      WRITE(6,2280) PDAM
845.000 2280  FORMAT(T1,'1',T21,'SOUND PROPAGATION PATHLENGTH'
846.000      1' FOR TEST SPLS AT ALM = ',F6.1,' M',T111,'1')
847.000      WRITE (6,2290) (PSIAM:57.29577951)
848.000 2290  FORMAT(T21,'SOUND PROPAGATION ANGLE RELATIVE'
849.000      1' TO DIRECTION OF FLIGHT = ',F5.1,' DEG AT ALM')
850.000 2300  CONTINUE
851.000 C
852.000 C      READ NEXT SET OF INPUT DATA.  STOP IF RUN NO. = 999.
853.000 C
854.000      READ (5,10) RUN
855.000      IF(RUN.NE.999)GOTO 11
856.000      STOP 'END OF INPUT DATA'
857.000      END
858.000 C
859.000 C      END OF STATEMENTS FOR MAIN PROGRAM.

```

BLOCK DATA

The labeled common statements in BLOCK DATA contain, in 384 computer words, the text for 31 lines on output summary pages 2 and 3. Some of the lines of text are blank. The words of the text describe the legends for the columns labeled (A), (B), (C), (D), and (E) of measured test-day and reference-day 1/3-octave-band sound pressure levels.

```

860.000 C
861.000 C*****
862.000 C
863.000 C*** LISTING OF BLOCK DATA FOR CODES ON OUTPUT SUMMARY PAGES
864.000 C
865.000 BLOCK DATA
866.000 C
867.000 COMMON /CTEXT/ TEXT1(12),TEXT2(12),TEXT3(12),TEXT4(12),
868.000 1TEXT5(12),TEXT6(12),TEXT7(12),TEXT8(12),TEXT9(12),TEXT10(12),
869.000 2TEXT11(12),TEXT12(12),TEXT13(12),TEXT14(12),TEXT15(12),
870.000 3TEXT16(12),TEXT17(12),TEXT18(12),TEXT19(12),TEXT20(12),
871.000 4TEXT21(12),TEXT22(12),TEXT23(12),TEXT24(12),TEXT25(12),
872.000 5TEXT26(12),TEXT27(12),TEXT28(12),TEXT29(12),TEXT30(12),
873.000 6TEXT31(12),TEXTA(12)
874.000 C
875.000 DIMENSION TEXT(12,31)
876.000 C
877.000 EQUIVALENCE (TEXT(1,1),TEXT1(1))
878.000 C
879.000 DATA TEXT/372(4H )/
880.000 DATA TEXT1/' COLUMN CODES: '/'
881.000 DATA TEXT3/'(A)TEST-DAY SPLS AT TIME OF TEST-DAY PNLTM + '/'
882.000 DATA TEXT4/' ASSOCIATED INTEGRATED NOISE MEASURES. '/'
883.000 DATA TEXT6/'THEN, TEST-DAY SPLS ADJUSTED TO ACOUSTICAL '/'
884.000 DATA TEXT7/'REFERENCE-DAY CONDITIONS + ASSOCIATED '/'
885.000 DATA TEXT8/'MEASURES. ADJUSTMENTS MADE USING: '/'
886.000 DATA TEXT10/' (B)10-M MET. DATA AND SAE ARP 866A; '/'
887.000 DATA TEXT11/' (C)LAYERED MET. DATA ALOFT AND SAE ARP 866A; '/'
888.000 DATA TEXT12/' (D)LAYERED MET. DATA ALOFT AND ABSORPTION BY '/'
889.000 DATA TEXT13/' ANS S1.26-1978 INTEGRATED OVER PASSBAND; '/'
890.000 DATA TEXT14/' (E)LAYERED MET. DATA ALOFT AND ABSORPTION BY '/'
891.000 DATA TEXT15/' ANS S1.26-1978 AT BAND CENT. FREQ. ONLY. '/'
892.000 C
893.000 DATA TEXTA/'(A)TEST-DAY SPLS AT TIME OF TEST-DAY ALM + '/'
894.000 C
895.000 END

```

SUBROUTINE CPNL(SPL, PNL)

Subroutine CPNL accepts an array of 24 1/3-octave-band sound pressure levels and calculates the corresponding perceived noise level, PNL. It requires about 355 computer words or approximately 1400 bytes of storage capacity.

```

896.000 C
897.000 SUBROUTINE CPNL(SPL,PNL)
898.000 C
899.000 C*****
900.000 C
901.000 C SPL IS INPUT ARRAY OF 1/3-OCTAVE-BAND SPLS FROM 50 TO 10,000 HZ
902.000 C FOR WHICH PNL IS TO BE DETERMINED; DB.
903.000 C
904.000 C PERCEIVED NOISINESS, PN, IN NOYS IS CALCULATED FOR THE
905.000 C CORRESPONDING 1/3-OCTAVE-BAND SOUND PRESSURE LEVEL, SPL, AND
906.000 C BAND INDEX COUNTER, J, WHERE J RANGES FROM 1 TO 24 FOR THE
907.000 C NOMINAL BAND CENTER FREQUENCIES FROM 50 TO 10,000 HZ.
908.000 C
909.000 C THE BAND PERCEIVED NOISINESS IS SET EQUAL TO 0.0 NOYS FOR ANY
910.000 C BAND SPL LESS THAN THE CORRESPONDING CONSTANTS L1 IN THE
911.000 C DATA LIST.
912.000 C
913.000 C IF ALL SPL(J) ARE < L1(J), THEN THE PNL IS SET = 0.0 DB.
914.000 C
915.000 C THE COMPUTATION ASSUMES THAT NO BAND SOUND PRESSURE LEVEL
916.000 C IS GREATER THAN 150.0 DB.
917.000 C
918.000 C DATA CONSTANTS ARE FROM SAE ARP 865A, 15 AUGUST 1969.
919.000 C
920.000 C PNL IS THE PERCEIVED NOISE LEVEL CORRESPONDING TO THE ARRAY
921.000 C OF SPLS; DB.
922.000 C
923.000 C*****
924.000 C
925.000 REAL L1,M1,L2,M2,L3,M3,LC,L4,M4
926.000 DIMENSION L1(24),M1(24),L2(24),M2(24),L3(24),M3(24),
927.000 1LC(24),L4(24),M4(24),SPL(24)
928.000 C
929.000 DATA L1/49.,44.,39.,34.,30.,27.,24.,21.,18.,16.,16.,16.,16.,
930.000 116.,15.,12.,9.,5.,4.,5.,6.,10.,17.,21./
931.000 DATA M1/.079520,.068160,.068160,.059640,.053013,.053013,
932.000 1.053013,.053013,.053013,.053013,.053013,.053013,.053013,
933.000 2.053013,.059640,.053013,.053013,.047712,.047712,.053013,
934.000 3.053013,.068160,.079520,.059640/
935.000 DATA L2/55.,51.,46.,42.,39.,36.,33.,30.,27.,25.,25.,25.,25.,
936.000 125.,23.,21.,18.,15.,14.,14.,15.,17.,23.,29./
937.000 DATA M2/.058098,.058098,.052288,.047534,.043573,.043573,
938.000 1.040221,.037349,.034859,.034859,.034859,.034859,.034859,
939.000 2.034859,.034859,.040221,.037349,.034859,.034859,.034859,
940.000 3.034859,.037349,.037349,.043573/
941.000 DATA L3/64.,60.,56.,53.,51.,48.,46.,44.,42.,40.,40.,40.,40.,
942.000 140.,38.,34.,32.,30.,29.,29.,30.,31.,37.,41./
943.000 DATA M3/.043478,.040570,.036831,.036831,.035336,.033333,
944.000 1.033333,.032051,.030675,.030103,.030103,.030103,.030103,
945.000 2.030103,.030103,.029960,.029960,.029960,.029960,.029960,
946.000 3.029960,.029960,.042285,.042285/
947.000 DATA LC/91.01,85.88,87.32,79.85,79.76,75.96,73.96,74.91,94.63,
948.000 1100.,100.,100.,100.,100.,100.,100.,100.,100.,100.,
949.000 2100.,44.29,50.72/

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```

950.000      DATA M4/.030103,.030103,.030103,.030103,.030103,.030103,
951.000      1.030103,.030103,.030103,.030103,.030103,.030103,.030103,
952.000      2.030103,.030103,.029960,.029960,.029960,.029960,.029960,
953.000      3.029960,.029960,.029960,.029960/
954.000      DATA L4/52.,51.,49.,47.,46.,45.,43.,42.,41.,40.,40.,40.,
955.000      140.,40.,38.,34.,32.,30.,29.,29.,30.,31.,34.,37./
956.000 C
957.000      PNSUM=0.0; PNMX=-10.0
958.000      DO 80 J=1,24
959.000      IF(SPL(J).LT.L1(J))GOTO 5
960.000      GOTO 7
961.000 5     PN=0.0
962.000      GOTO 75
963.000 7     IF(SPL(J).GE.L1(J).AND.SPL(J).LT.L2(J)) GOTO 10
964.000      GOTO 20
965.000 10    PN=0.1**((M1(J))*(SPL(J)-L1(J)))
966.000      GOTO 75
967.000 20    IF(SPL(J).GE.L2(J).AND.SPL(J).LT.L3(J)) GOTO 30
968.000      GOTO 40
969.000 30    PN=10.**((M2(J))*(SPL(J)-L3(J)))
970.000      GOTO 75
971.000 40    IF(SPL(J).GE.L3(J).AND.SPL(J).LT.LC(J)) GOTO 50
972.000      GOTO 60
973.000 50    PN=10.**((M3(J))*(SPL(J)-L3(J)))
974.000      GOTO 75
975.000 60    IF(SPL(J).GE.LC(J).AND.SPL(J).LE.150.) GOTO 70
976.000 70    PN=10.**((M4(J))*(SPL(J)-L4(J)))
977.000 75    PNMX=AMAX(PNMX,PN)
978.000      PNSUM=PNSUM + PN
979.000 80    CONTINUE
980.000      PNT=0.85*PNMX + 0.15*PNSUM
981.000      IF(PNT)90,90,85
982.000 85    PNL=40.0 + 33.22*LOG10(PNT)
983.000      RETURN
984.000 90    PNL=0.0
985.000      RETURN
986.000      END

```

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SUBROUTINE P36TC(SPL, CMX, JMX)

Subroutine P36TC accepts an array of 24 1/3-octave-band sound pressure levels and calculates a tone-correction penalty, CMX, appropriate for that spectrum using a procedure consistent with the requirements of the April 1978 version of Part 36 of the Federal Aviation Regulations. The index counter, JMX, for the 1/3-octave-band producing the largest tone correction factor is also found and returned. If certain requirements are not satisfied, no tone-correction factor is calculated (CMX = 0.0 dB) and a value of JMX = 1 is returned to indicate the impossible, by definition, result of a tone in the band at 50 Hz as a warning that no tone correction was calculated.

P36TC requires about 400 words or about 1650 bytes of storage for the source code.

```

987.000 C
988.000 SUBROUTINE P36TC(SPL,CMX,JMX)
989.000 C
990.000 C=====
991.000 C
992.000 C SPL IS THE INPUT ARRAY OF 24 SPL VALUES FOR 1/3-OCTAVE BANDS
993.000 C FROM 50 TO 10,000 HZ AT THE I-TH INSTANT OF TIME DURING
994.000 C A FLYOVER; DB.
995.000 C
996.000 C CMX IS THE LARGEST VALUE OF THE TONE-CORRECTION FACTORS
997.000 C CALCULATED BY SUBROUTINE P36TC; DB
998.000 C
999.000 C JMX IS THE FREQUENCY BAND INDEX COUNTER FOR THE 1/3-OCTAVE
1000.000 C BAND PRODUCING THE VALUE OF C IDENTIFIED AS CMX BY THE
1001.000 C SUBROUTINE.
1002.000 C
1003.000 C=====
1004.000 C
1005.000 C SUBROUTINE P36TC(SPL,CMX,JMX) EXAMINES A SET OF 1/3-OCTAVE-
1006.000 C BAND SOUND PRESSURE LEVELS AND DETERMINES A TONE-CORRECTION
1007.000 C PENALTY WHICH IS TO BE ADDED TO THE PERCEIVED NOISE LEVEL FOR THE
1008.000 C SPL SPECTRUM TO GIVE THE TONE-CORRECTED PNL, OR PNLT.
1009.000 C
1010.000 C TONE-CORRECTION FACTORS FOR THE PRESENCE OF PRONOUNCED
1011.000 C IRREGULARITIES IN THE SPL SPECTRUM ARE CALCULATED BY THE
1012.000 C PROCEDURE GIVEN IN SECTION B36.5 OF APPENDIX B TO FAR PART 36,
1013.000 C CHANGE 8, EFFECTIVE 3 APRIL 1978, WITH INTERPRETATIONS DESCRIBED
1014.000 C BELOW.
1015.000 C
1016.000 C THE REQUIREMENT OF A36.5(D)(3) OF CHANGE 8 OF PART 36 THAT NO
1017.000 C EPNL BE CALCULATED OR REPORTED IF ANY SPECTRUM WITHIN THE
1018.000 C 10-DB-DOWN DURATION HAS MORE THAN FOUR MISSING BAND LEVELS OUT
1019.000 C OF 24 IN THE RANGE OF BAND CENTER FREQUENCIES FROM 50 TO 10,000 HZ
1020.000 C IS SPECIFICALLY NOT INCORPORATED HERE BECAUSE TO HAVE DONE SO WOULD
1021.000 C HAVE ELIMINATED THE PNLT AND EPNL CALCULATIONS FOR SOME OF
1022.000 C THE AIRCRAFT NOISE MEASUREMENTS AVAILABLE FOR THE STUDY OF
1023.000 C ATMOSPHERIC ABSORPTION ADJUSTMENTS FOR AIRCRAFT NOISE DATA.
1024.000 C
1025.000 C PARAGRAPH B36.5(M) OF PART 36, CHANGE 8, PERMITS THE EXCLUSION
1026.000 C OF TONE-CORRECTION PENALTIES RESULTING FROM SPECTRAL IRREGULARITIES
1027.000 C (OR PSEUDOTONES) CAUSED BY GROUND-REFLECTION EFFECTS IN THE FREQUENCY
1028.000 C RANGE COVERED BY THE 1/3-OCTAVE BANDS WITH CENTER FREQUENCIES OF
1029.000 C 800 HZ AND LOWER (I.E., BAND NO. 13 AND LOWER).
1030.000 C
1031.000 C SINCE MOST AVAILABLE AIRCRAFT FLYOVER NOISE DATA WERE MEASURED
1032.000 C BY MICROPHONES LOCATED 1.2 M ABOVE THE GROUND PLANE, MOST OF
1033.000 C THE MEASURED SOUND PRESSURE LEVELS WERE KNOWN TO CONTAIN LOW-
1034.000 C FREQUENCY SPECTRAL IRREGULARITIES CAUSED BY GROUND-REFLECTION
1035.000 C EFFECTS.
1036.000 C
1037.000 C BECAUSE THERE WAS NO CONVENIENT WAY TO ELIMINATE THE
1038.000 C SPECTRAL IRREGULARITIES CAUSED BY GROUND REFLECTION EFFECTS
1039.000 C AND BECAUSE IT WAS NECESSARY TO HAVE A CONSISTENT DETERMINATION
1040.000 C OF THE EFFECTS OF DIFFERENT METHODS OF ACCOUNTING FOR
1041.000 C ATMOSPHERIC ABSORPTION ON TONE-CORRECTED PNLS AND EPNLS,

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1042.000 C SUBROUTINE P36TC INCORPORATES THE OPTION OF B36.5(M) AND
1043.000 C CALCULATES TONE CORRECTIONS ONLY OVER THE RANGE OF BAND
1044.000 C CENTER FREQUENCIES FROM 1000 HZ (BAND 14) TO 10,000 HZ
1045.000 C (BAND 24).
1046.000 C
1047.000 C THE AIRCRAFT NOISE SPECTRA WHICH ARE BEING EXAMINED ARE KNOWN
1048.000 C TO HAVE BAND LEVELS WHICH HAVE BEEN SET ARBITRARILY TO 0.0 DB
1049.000 C BECAUSE THE SPL SIGNAL FROM THE AIRCRAFT IN THAT BAND AT SOME
1050.000 C PARTICULAR INSTANT OF TIME WAS NOT MORE THAN 5 DB GREATER THAN
1051.000 C THE CORRESPONDING AMBIENT NOISE LEVEL IN THAT BAND. STRAIGHT-
1052.000 C FORWARD APPLICATION OF THE FAR PART 36 TONE-CORRECTION PROCEDURE
1053.000 C WOULD INDICATE THAT SPECTRA WITH MISSING BAND LEVELS WOULD HAVE
1054.000 C PRONOUNCED SPECTRAL IRREGULARITIES, EVEN THOUGH IT WAS NOT BECAUSE
1055.000 C OF A PURE-TONE NOISE SOURCE ON THE AIRCRAFT.
1056.000 C
1057.000 C A PROCEDURE, ADOPTED FROM THE USAF OMEGA 5.5 COMPUTER
1058.000 C PROGRAM FOR ANALYZING AIRCRAFT FLYOVER NOISE MEASUREMENTS,
1059.000 C IS USED TO AVOID SPURIOUS TONE CORRECTIONS FOR THOSE SPECTRA
1060.000 C WITH MISSING BAND LEVELS. BY THIS PROCEDURE, THE SPL SPECTRUM
1061.000 C IS SEARCHED FOR SPECTRAL IRREGULARITIES ONLY OVER A LIMITED
1062.000 C RANGE OF 1/3-OCTAVE BANDS. THE LIMITED RANGE IS DETERMINED BY
1063.000 C STARTING AT THE BAND CONTAINING THE MAXIMUM SPL FOR THE SPECTRUM
1064.000 C AND WORKING TOWARD LOWER FREQUENCIES UNTIL THE SPL BECOMES LESS
1065.000 C THAN 20.0 DB AND THEN WORKING TOWARD HIGHER FREQUENCIES UNTIL
1066.000 C THE SPL AGAIN BECOMES LESS THAN 20.0 DB. THERE MUST BE AT LEAST
1067.000 C 6 CONSECUTIVE BANDS CONTAINING SPLS THAT ARE > OR = 20.0 DB FOR
1068.000 C THE TONE-CORRECTION CALCULATION TO PROCEED. IF THERE ARE FEWER
1069.000 C THAN 6 BANDS IN THIS RANGE, THEN THE TONE-CORRECTION FACTOR C
1070.000 C IS SET = 0.0 DB AND RETURNED TO THE CALLING PROGRAM ALONG WITH
1071.000 C JMX=1 FOR THE 50-HZ BAND AS A WARNING.
1072.000 C
1073.000 C USE OF A LIMITED FREQUENCY RANGE TO DETERMINE TONE-CORRECTION
1074.000 C FACTORS FOR THE SPL SPECTRUM AT ANY SPECIFIC INSTANT OF TIME IS
1075.000 C DERIVED FROM SECTION B36.5(L) OF PART 36 WHERE PERMISSION IS GIVEN
1076.000 C TO USE A NARROW BAND ANALYSIS TO PROVE THAT A CALCULATED TONE
1077.000 C CORRECTION IS NOT THE RESULT OF AN AIRCRAFT NOISE SOURCE IF IT
1078.000 C IS SUSPECTED THAT DISCRETE-FREQUENCY AIRCRAFT NOISES ARE NOT
1079.000 C ACTUALLY PRESENT. THE INTENT OF PARAGRAPH (L) IS ASSUMED TO
1080.000 C BE TO CREATE TONE-CORRECTION PENALTIES ONLY FOR SPECTRAL
1081.000 C IRREGULARITIES RESULTING FROM DISCRETE-FREQUENCY AIRCRAFT
1082.000 C NOISE SOURCES.
1083.000 C
1084.000 C NO ATTEMPT IS MADE TO SYNTHESIZE A COMPLETE 24-BAND
1085.000 C SPECTRUM BY ESTIMATING SPLS FOR THOSE BANDS CONTAMINATED BY
1086.000 C HIGH BACKGROUND NOISE LEVELS.
1087.000 C
1088.000 C *****
1089.000 C
1090.000 C DIMENSION F(24),JCT(24),S(24),SP(25),SPL(24),SPLP(24),SPLPP(24)
1091.000 C
1092.000 C SET INITIAL VALUES FOR THE TONE-CORRECTION FACTORS.
1093.000 C
1094.000 C C=0.0; CMX=0.0
1095.000 C

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1096.000 C SEARCH THE SPL SPECTRUM FROM BAND 14 (1000 HZ) TO BAND 24
1097.000 C (10,000 HZ) AND IDENTIFY THE MAXIMUM SPL VALUE AND THE
1098.000 C CORRESPONDING BAND NUMBER JM.
1099.000 C
1100.000 SPLM=-1000.0
1101.000 DO 20 J=14,24
1102.000 IF(SPL(J)-SPLM)20,10,10
1103.000 10 JM=J
1104.000 SPLM=SPL(J)
1105.000 20 CONTINUE
1106.000 C
1107.000 C NOW SEARCH THE SPL SPECTRUM FROM SPLM TO HIGHER FREQUENCIES
1108.000 C AND TO LOWER FREQUENCIES TO FIND THE BANDS, IF ANY, WHERE THE
1109.000 C SPL FIRST BECOMES LESS THAN 20.0 DB AND NOTE THE CORRESPONDING
1110.000 C BAND NUMBERS JL1 AND JH1.
1111.000 C
1112.000 DO 30 J=JM,24
1113.000 JH1=J
1114.000 IF(SPL(J).LT.20.0)GOTO 40
1115.000 30 CONTINUE
1116.000 GOTO 50
1117.000 C
1118.000 C IF A BAND LEVEL HAS BEEN FOUND THAT IS < 20.0 DB, THEN RE-SET
1119.000 C THE JH1 COUNTER TO THE NEXT LOWER VALUE TO IDENTIFY THE BAND
1120.000 C BEFORE THE BAND WHERE THE LEVEL IS < 20.0 DB.
1121.000 C
1122.000 40 JH1=JH1-1
1123.000 C
1124.000 50 DO 60 J=14,JM
1125.000 C
1126.000 C CHANGE TO A NEW COUNTER TO SEARCH THE SPLS FROM THE BAND AT
1127.000 C JM BACKWARDS TO LOWER FREQUENCIES.
1128.000 C
1129.000 JL1=JM-J+14
1130.000 IF(SPL(JL1).LT.20.0)GOTO 70
1131.000 60 CONTINUE
1132.000 GOTO 80
1133.000 C
1134.000 C IF A LOW-FREQUENCY BAND LEVEL HAS BEEN FOUND THAT IS < 20.0 DB,
1135.000 C RE-SET THE JL1 COUNTER TO THE NEXT HIGHER VALUE.
1136.000 C
1137.000 70 JL1=JL1+1
1138.000 C
1139.000 C JL1 AND JH1 ARE INDICES FOR THE RANGE OF 1/3-OCTAVE BANDS
1140.000 C WHERE THE SPLS ARE ALL > OR = 20.0 DB. TO PROCEED WITH THE
1141.000 C CALCULATION OF A TONE-CORRECTION FACTOR, THERE MUST BE AT
1142.000 C LEAST 5 BANDS IN THE RANGE FROM JL1 TO JH1. IF (JH1-JL1-4)
1143.000 C IS < 1, THEN THERE ARE AT MOST ONLY 5 BAND LEVELS IN THE
1144.000 C RANGE WHICH ARE > OR = 20.0 DB.
1145.000 C
1146.000 C IN THIS CASE, A TONE-CORRECTION FACTOR OF CMX = 0.0 DB IS
1147.000 C DECLARED AND RETURNED ALONG WITH THE INDEX JMX=1 (50 HZ)
1148.000 C AS A WARNING.
1149.000 C
1150.000 80 IF(JH1-JL1-4)270,270,90
1151.000 C

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1152.000 C      FROM HERE TO STATEMENT NUMBER 120 CORRESPONDS TO STEPS 1, 2, AND
1153.000 C      3 OF SECTION B36.5 OF FAR PART 36.
1154.000 C
1155.000 C      SET INITIAL VALUES FOR THE FIRST CALCULATION OF BAND-LEVEL
1156.000 C      SLOPE S(J) AND OF THE FLAG FOR THE BAND INDEX COUNTER JCT(J).
1157.000 C
1158.000 90      S(JL1)=0.0
1159.000          JCT(JL1)=0
1160.000 C
1161.000 C      SET BAND INDEX COUNTERS FOR 1 AND 2 MORE THAN JL1.
1162.000 C
1163.000          JL2=JL1+1
1164.000          JL3=JL2+1
1165.000          JCT(JL2)=0
1166.000 C
1167.000 C      COMPUTE VALUE OF SECOND BAND SLOPE.
1168.000 C
1169.000          S(JL2)=SPL(JL2)-SPL(JL1)
1170.000 C
1171.000 C      COMPUTE BAND-LEVEL CHANGES (SLOPES) FOR REMAINDER OF THE
1172.000 C      FREQUENCY RANGE TO BAND INDEX JH1. SET THE JCT(J) FLAG = 1
1173.000 C      FOR THOSE SPLS WHICH ARE TO BE ENCIRCLED ACCORDING TO RULES
1174.000 C      OF STEPS 2 AND 3 OF B36.5 OF FAR PART 36.
1175.000 C
1176.000          DO 120 J=JL3, JH1
1177.000          JCT(J)=0
1178.000          S(J)=SPL(J)-SPL(J-1)
1179.000          IF(ABS(S(J)-S(J-1))-5.0)120,120,100
1180.000 100      IF(S(J).GT.0.0.AND.S(J).GT.S(J-1))GOTO 110
1181.000          IF(S(J).LE.0.0.AND.S(J-1).GT.0.0)JCT(J-1)=1
1182.000          GOTO 120
1183.000 110      JCT(J)=1
1184.000 120      CONTINUE
1185.000 C
1186.000 C      FROM HERE TO TWO LINES AFTER STATEMENT NUMBER 160 CORRESPONDS
1187.000 C      TO STEPS 4 AND 5 OF B36.5 OF FAR PART 36.
1188.000 C
1189.000 C      STEP 4-COMPUTE THE INITIAL ESTIMATE, SPLP(J), FOR THE BROADBAND
1190.000 C      PART OF THE NOISE SPECTRUM.
1191.000 C
1192.000          SPLP(JL1)=SPL(JL1)
1193.000          DO 160 J=JL2, JH1
1194.000 C
1195.000 C      TEST THE FLAG FOR THE ENCIRCLED BAND LEVELS.
1196.000 C
1197.000          IF(JCT(J))130,130,140
1198.000 130      SPLP(J)=SPL(J)
1199.000          GOTO 160
1200.000 C
1201.000 C      SPECIAL CALCULATION FOR SPLP IF THE FLAG IS SET FOR THE
1202.000 C      LAST BAND.
1203.000 C
1204.000 140      IF(J.EQ.JH1)GOTO 150
1205.000 C
1206.000 C      COMPUTE SPLP(J) FOR ENCIRCLED BAND LEVELS.

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1207.000 C
1208.000     SPLP(J)=0.5*(SPL(J-1)+SPL(J+1))
1209.000     GOTO 160
1210.000 150   SPLP(J)=SPL(J-1)+S(J-1)
1211.000 C
1212.000 C     STEP 5-COMPUTE NEW BAND LEVEL SLOPES, SP(J), FOR THE SPLP(J)
1213.000 C     VALUES.
1214.000 C
1215.000 160   SP(J)=SPLP(J)-SPLP(J-1)
1216.000 C
1217.000 C     COMPUTE VALUE OF SP FOR FIRST BAND AND FOR FICTITIOUS BAND
1218.000 C     AFTER THE BAND AT JH1.
1219.000 C
1220.000     SP(JL1)=SP(JL2)
1221.000     SP(JH1+1)=SP(JH1)
1222.000 C
1223.000 C     FROM HERE TO STATEMENT NUMBER 260 CORRESPONDS TO STEPS 6 TO 10
1224.000 C     IN B36.5 OF FAR PART 36.
1225.000 C
1226.000 C     COMPUTE AN INITIAL VALUE FOR THE FINAL ESTIMATE, SPLPP(J), OF
1227.000 C     THE BROADBAND COMPONENT OF THE NOISE SPECTRUM.
1228.000 C
1229.000     SPLPP(JL1)=SPL(JL1)
1230.000     DO 260 J=JL1,JH1
1231.000 C
1232.000 C     TEST J TO SEE IF J=JH1.  USE SPECIAL RULE TO FIND F(J) FACTOR
1233.000 C     WHEN J=JH1.
1234.000 C
1235.000     IF(J-JH1)170,180,180
1236.000 C
1237.000 C     STEP 6-COMPUTE THE ARITHMETIC AVERAGE, SA, OF THE 3 ADJACENT
1238.000 C     SP(J) BAND LEVEL SLOPES.
1239.000 C
1240.000 170   SA=(SP(J)+SP(J+1)+SP(J+2))/3.0
1241.000 C
1242.000 C     STEP 7-COMPUTE REMAINDER OF VALUES OF SPLPP(J).
1243.000 C
1244.000     SPLPP(J+1)=SPLPP(J)+SA
1245.000 C
1246.000 C     STEP 8-CALCULATE F(J) FACTORS AS THE DIFFERENCE BETWEEN THE
1247.000 C     ORIGINAL BAND LEVEL, SPL(J), AND THE FINAL ESTIMATE OF THE
1248.000 C     BROADBAND COMPONENT OF THE NOISE SPECTRUM, SPLPP(J).
1249.000 C
1250.000 180   F(J)=SPL(J)-SPLPP(J)
1251.000 C
1252.000 C     NOTE THOSE F(J) VALUES > OR = 0.0 DB.  NEGLECT ANY F(J) < 0.0 DB.
1253.000 C
1254.000     IF(F(J))260,190,190
1255.000 C
1256.000 C     STEP 9-FIND TONE-CORRECTION FACTORS C WITH SPECIAL RULE (TABLE
1257.000 C     B2 OF B36.5 OF FAR PART 36) FOR FREQUENCY BANDS 14 TO 21 (1000
1258.000 C     TO 5000 HZ).
1259.000 C
1260.000 190   IF(J.GE.14.AND.J.LE.21)GOTO 220
1261.000 C

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1262.000 C      COMPUTE TONE-CORRECTION FACTOR C FOR BAND CENTER FREQUENCIES
1263.000 C      BETWEEN 6300 AND 10,000 HZ AS APPROPRIATE TO THE RANGE
1264.000 C      FROM J11 TO JH1.
1265.000 C
1266.000 C      NOTE SPECIAL RULE TO LIMIT C IF F(J) > 20.0 DB.
1267.000 C
1268.000      IF(F(J)-20.0)200,210,210
1269.000 200    C=F(J)/6.0
1270.000      GOTO 250
1271.000 210    C=3.3333333
1272.000      GOTO 250
1273.000 C
1274.000 C      COMPUTE C FOR BAND CENTER FREQUENCIES BETWEEN 1000 AND 5000 HZ.
1275.000 C
1276.000 220    IF(F(J)-20.0)230,240,240
1277.000 230    C=F(J)/3.0
1278.000      GOTO 250
1279.000 240    C=6.6666667
1280.000 C
1281.000 C      STEP 10-COMPUTE LARGEST OF C VALUES AND STORE IN CMX.
1282.000 C
1283.000 250    CMX=AMAX(CMX,C)
1284.000 C
1285.000 C      TEST CMX AGAINST C TO SET THE BAND INDEX JMX=J WHEN CMX=C.
1286.000 C
1287.000      IF(CMX.EQ.C)JMX=J
1288.000 260    CONTINUE
1289.000      RETURN
1290.000 270    CMX=0.0
1291.000 C
1292.000 C      IF THE CALCULATION WAS SENT TO STATEMENT NO. 270, SET
1293.000 C      JMX=1 AS A WARNING FLAG THAT THERE WERE NOT ENOUGH BANDS
1294.000 C      WITH SPL > 20.0 DB.
1295.000 C
1296.000      JMX=1
1297.000      RETURN
1298.000      END

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SUBROUTINE INTEG(NS, DATA, DATA10, IF, IL, SUMDAT)

Subroutine INTEG takes the number of samples, NS, the array of input data as a function of time (in dummy array DATA), and the quantity DATA10 (a number which is 10 dB less than the maximum value of DATA) and determines the energy summation, SUMDAT, of the quantities specified by DATA from the first, IF, to the last, IL, time that DATA = DATA10. The DATA array can be tone-corrected perceived noise levels, PNLT, or A-weighted sound pressure levels, AL, or any other quantity which is to be integrated over defined limits. If the input data are PNLT or AL values, then DATA10 is PNLT-10.0 or AL-10.0, and SUMDAT is used to calculate effective perceived noise level, EPNL, or sound exposure level, SEL.

INTEG requires about 90 words or about 350 bytes for storage of the source code.

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1299.000 C
1300.000 SUBROUTINE INTEG(NS,DATA,DATA10,IF,IL,SUMDAT)
1301.000 C
1302.000 C*****
1303.000 C
1304.000 C SUBROUTINE INTEG DETERMINES THE INDEXES IF AND IL FOR THE FIRST
1305.000 C AND LAST OF THE RELATIVE TIMES WHEN THE INPUT DATA ARE EITHER
1306.000 C EQUAL OR CLOSEST TO 10-DB LESS THAN THE MAXIMUM VALUE OF THE
1307.000 C DATA (I.E., EQUAL OR CLOSEST TO DATA10).
1308.000 C
1309.000 C SUMDAT IS THE ENERGY SUMMATION OF THE DECIBEL VALUES
1310.000 C OF THE DATA OVER THE TIME INDEXES FROM IF TO IL.
1311.000 C
1312.000 C DATA IS A DUMMY ARRAY CONTAINING THE INPUT VALUES IN
1313.000 C DECIBELS OF PNLT(I) OR AL(I) USED FOR CALCULATIONS
1314.000 C OF EPNL OR SEL, RESPECTIVELY.
1315.000 C
1316.000 C NS IS THE NUMBER OF DATA SAMPLES PASSED BY THE CALL STATEMENT
1317.000 C IN THE MAIN PROGRAM.
1318.000 C
1319.000 C*****
1320.000 C
1321.000 C DIMENSION DATA(1)
1322.000 C
1323.000 C DETERMINE IF, THE RELATIVE TIME INDEX COUNTER WHERE DATA(I)
1324.000 C IS FOR THE FIRST TIME GREATER THAN, OR IS CLOSEST TO, DATA10.
1325.000 C
1326.000 C DO 10 I=1,NS
1327.000 C IF=I
1328.000 C IF(DATA(I).GT.DATA10)GOTO 20
1329.000 10 CONTINUE
1330.000 C
1331.000 C TEST THE VALUE OF IF, OBTAINED FROM THE ABOVE SEARCH FOR
1332.000 C THE FIRST TIME INDEX COUNTER, AGAINST THE INITIAL TIME
1333.000 C INDEX I=1.
1334.000 C
1335.000 20 IF(IF-1)40,40,30
1336.000 C
1337.000 C WHEN IF IS > 1, THEN TEST THE VALUE OF (DATA(IF)-DATA10) TO
1338.000 C SEE IF IT IS LESS THAN THE VALUE OF (DATA10-DATA(IF-1)) AND,
1339.000 C IF IT IS NOT, THEN RE-SET THE VALUE OF IF TO THE NEXT SMALLER
1340.000 C VALUE (IF=IF-1) TO FIX THE STARTING TIME FOR THE SUMMATION.
1341.000 C
1342.000 C THERE ARE THREE POSSIBLE CASES WHEN IF IS RE-SET TO IF-1:
1343.000 C (1) WHEN DATA(IF-1)=DATA10; (2) WHEN DATA(IF) AND DATA(IF-1)
1344.000 C ARE MORE AND LESS THAN DATA10 BY EQUAL AMOUNTS; AND (3) WHEN
1345.000 C DATA(IF-1) IS LESS THAN DATA10 BY AN AMOUNT THAT IS LESS
1346.000 C THAN THE AMOUNT BY WHICH DATA(IF) IS GREATER THAN DATA10.
1347.000 C
1348.000 C THERE ARE TWO POSSIBLE CASES WHEN IF IS NOT RE-SET TO IF-1:
1349.000 C (1) WHEN DATA(IF-1) IS LESS THAN DATA10 BY AN AMOUNT THAT
1350.000 C IS GREATER THAN THE AMOUNT BY WHICH DATA(IF) IS GREATER
1351.000 C THAN DATA10 (I.E., WHEN DATA(IF) IS CLOSER TO DATA10
1352.000 C THAN IS DATA(IF-1); AND (2) WHEN IF=1 (I.E., WHEN THE
1353.000 C FIRST VALUE OF DATA(I)=DATA(1) IS = OR > DATA10).

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1354.000 C
1355.000 30 IF((DATA(IF)-DATA10).LT.(DATA10-DATA(IF-1)))GOTO 40
1356.000 IF=IF-1
1357.000 C
1358.000 C NOW DETERMINE IL, THE RELATIVE-TIME INDEX COUNTER WHERE
1359.000 C DATA(I) IS FOR THE LAST TIME GREATER THAN, OR CLOSEST
1360.000 C TO, DATA10.
1361.000 C
1362.000 40 DO 50 I=1,NS
1363.000 IL=NS-I+1
1364.000 IF(DATA(IL).GT.DATA10)GOTO 60
1365.000 50 CONTINUE
1366.000 C
1367.000 C TEST THE VALUE OF IL, OBTAINED FROM THE ABOVE SEARCH FOR
1368.000 C THE LAST TIME INDEX COUNTER, AGAINST THE LAST TIME
1369.000 C INDEX WHEN I=NS.
1370.000 C
1371.000 60 IF(IL-NS)70,80,80
1372.000 C
1373.000 C WHEN IL IS = OR > NS, THEN USE THE VALUE OF IL DETERMINED
1374.000 C BY THE ABOVE SEARCH SINCE THIS RESULT MEANS THAT THE LAST
1375.000 C VALUE OF DATA(I)=DATA(NS) IS = OR > DATA10.
1376.000 C
1377.000 C WHEN IL IS < NS, THEN RE-SET IL TO IL+1 TO DETERMINE THE
1378.000 C RELATIVE-TIME INDEX COUNTER FOR THE VALUE OF DATA(I)
1379.000 C WHICH IS EITHER EQUAL, OR CLOSEST TO, THE VALUE OF DATA10.
1380.000 C
1381.000 70 IF((DATA(IL)-DATA10).LT.(DATA10-DATA(IL+1)))GOTO 80
1382.000 IL=IL+1
1383.000 C
1384.000 C NOW DETERMINE THE SUMMATION, ON AN ENERGY BASIS, OF THE
1385.000 C INPUT VALUES OF DATA(I) IN DECIBELS BETWEEN THE 10-DB-DOWN
1386.000 C TIMES IF TO IL.
1387.000 C
1388.000 80 SUMDAT=0.0
1389.000 DO 90 I=IF,IL
1390.000 90 SUMDAT=SUMDAT+10.0**((DATA(I)/10.0)
1391.000 C
1392.000 C RETURN TO THE MAIN PROGRAM WITH THE VALUES OF IF, IL,
1393.000 C AND SUMDAT.
1394.000 C
1395.000 RETURN
1396.000 END

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SUBROUTINE MOLAR(TK, HR, PA, WV)

Subroutine MOLAR calculates the molar concentration, WV, of water vapor in the air, in percent, for given air temperature, TK, relative humidity, HR, and air pressure, PA.

MOLAR requires about 85 words or about 350 bytes for storage.

```

1397.000 C
1398.000      SUBROUTINE MOLAR (TK,HR,PA,WV)
1399.000 C
1400.000 C*****
1401.000 C
1402.000 C      SUBROUTINE MOLAR CALCULATES WV, THE MOLAR CONCENTRATION OF
1403.000 C WATER VAPOR IN THE AIR IN PERCENT.  A WV VALUE IS CALCULATED
1404.000 C FOR THE AIR TEMPERATURE, RELATIVE HUMIDITY, AND AIR PRESSURE
1405.000 C SPECIFIED BY THE CALLING ROUTINE.
1406.000 C
1407.000 C      TK      IS AIR TEMPERATURE, DEG KELVIN
1408.000 C
1409.000 C      HR      IS RELATIVE HUMIDITY, PERCENT
1410.000 C
1411.000 C      PA      IS AIR PRESSURE, STANDARD ATMOSPHERES
1412.000 C
1413.000 C      WV      IS MOLAR CONCENTRATION OF WATER VAPOR, PERCENT
1414.000 C
1415.000 C*****
1416.000 C
1417.000      REAL LPSOP0
1418.000      T0=293.15
1419.000      T01=273.16
1420.000      LPSOP0=10.79586*(1.-(T01/TK)) - 5.02808*LOG10(TK/T01)
1421.000      1      +1.50474E-4*(1.-10.**(-8.29692*((TK/T01)-1.)))
1422.000      2      +0.42873E-3*(10.**((4.76955*(1.-(T01/TK)))-1.))
1423.000      3      -2.2195983
1424.000      PSOP0=10.**LPSOP0
1425.000      WV=HR*PSOP0/PA
1426.000      RETURN
1427.000      END

```

SUBROUTINE ARP866A(J, TC, HR, ALPHA)

Subroutine ARP866A uses the procedure of SAE ARP866A (March 1975) to calculate the pure-tone atmospheric absorption coefficient, ALPHA in dB/m, applicable to a 1/3-octave band specified by index counter J and for given temperature, TC, and relative humidity HR. TC is in degrees celsius and HR is in percent.

ARP866A requires about 280 words or about 1100 bytes for storage.

```

1428.000 C
1429.000 SUBROUTINE ARP866A (J,TC,HR,ALPHA)
1430.000 C
1431.000 C*****
1432.000 C
1433.000 C J IS THE INDEX COUNTER FOR THE GEOMETRIC MEAN FREQUENCY OF
1434.000 C THE 1/3-OCTAVE BANDS FROM 50 TO 10,000 HZ.
1435.000 C
1436.000 C TC IS AIR TEMPERATURE, DEGREES CELSIUS.
1437.000 C
1438.000 C HR IS RELATIVE HUMIDITY OF THE AIR, PERCENT.
1439.000 C
1440.000 C ALPHA IS THE VALUE OF THE ATMOSPHERIC ABSORPTION COEFFICIENT IN
1441.000 C DB/M CALCULATED BY THE METHOD OF SAE ARP 866A, MARCH 1975.
1442.000 C
1443.000 C*****
1444.000 C
1445.000 DIMENSION FREQ(24),TABLE(58)
1446.000 DATA TABLE /0.00,0.00,0.250,0.315,0.50,0.70,0.6,0.84,0.7,0.93,
1447.000 10.8,0.975,0.9,0.996,1.0,1.0,1.1,0.97,1.2,0.9,1.3,0.84,1.5,0.75,
1448.000 21.7,0.67,2.0,0.57,2.3,0.495,2.5,0.45,2.8,0.4,3.0,0.37,3.30,0.33,
1449.000 33.6,0.3,4.15,0.26,4.45,0.245,4.80,0.23,5.25,0.22,5.7,0.21,
1450.000 46.05,0.205,6.5,0.2,7.0,0.2,10.0,0.2/
1451.000 DATA FREQ /50.,63.,80.,100.,125.,160.,200.,250.,315.,400.,500.,
1452.000 1630.,800.,1000.,1250.,1600.,2000.,2500.,3150.,4000.,4500.,
1453.000 25600.,7100.,9000./
1454.000 B=1.328924-3.179768E-02*TC+2.173716E-04*TC**2.-1.7496E-06*TC**3.
1455.000 ABSHUM=10.0**((LOG10(HR)-B)
1456.000 AMOLMX=10.0**((LOG10(FREQ(J))+8.42994E-03*TC-2.755624)
1457.000 HMOLMX=SQRT(FREQ(J)/1010.)
1458.000 HUMRAT=ABSHUM/HMOLMX
1459.000 L=2
1460.000 IF(HUMRAT.LE.TABLE(1))GOTO 40
1461.000 DO 10 I=3,57,2
1462.000 L=I+1
1463.000 IF(TABLE(I)-HUMRAT)10,40,20
1464.000 10 CONTINUE
1465.000 GOTO 40
1466.000 20 I=I-2
1467.000 IF(I.GE.3)GOTO 30
1468.000 I=I+2
1469.000 30 XA1=HUMRAT-TABLE(I)
1470.000 XA0=HUMRAT-TABLE(I-2)
1471.000 XA2=HUMRAT-TABLE(I+2)
1472.000 X01=TABLE(I-2)-TABLE(I)
1473.000 X02=TABLE(I-2)-TABLE(I+2)
1474.000 X12=TABLE(I)-TABLE(I+2)
1475.000 ALPRAT=TABLE(I-1)*(XA1/X01)*(XA2/X02)
1476.000 1 -TABLE(I+1)*(XA0/X01)*(XA2/X12)
1477.000 2 +TABLE(I+3)*(XA0/X02)*(XA1/X12)
1478.000 GOTO 50
1479.000 40 ALPRAT=TABLE(L)
1480.000 50 ALPMOL=ALPRAT*AMOLMX
1481.000 ALPCLA=10.0**((2.05*LOG10(FREQ(J)/1000.) + 1.1394E-03*TC
1482.000 1 - 1.916984)
1483.000 ALPHA=0.01*(ALPCLA + ALPMOL)
1484.000 RETURN
1485.000 END

```

SUBROUTINE ANSAB(TK, HR, PA, F, A)

Subroutine ANSAB uses the procedure of American National Standard ANS S1.26-1978 to calculate the pure-tone atmospheric absorption of sound A, in dB/m, at frequency F, in Hz, for given air temperature TK, in degrees kelvin, relative humidity HR, in percent, and air pressure PA, in standard atmospheres.

ANSAB requires about 200 words or about 850 bytes for storage.

```

1486.000 C
1487.000 SUBROUTINE ANSAB (TK,HR,PA,F,A)
1488.000 C
1489.000 C*****
1490.000 C
1491.000 C SUBROUTINE ANSAB CALCULATES PURE-TONE SOUND ABSORPTION
1492.000 C COEFFICIENTS ACCORDING TO THE PROCEDURE OF AMERICAN NATIONAL
1493.000 C STANDARD ANS S1.26-1978 FOR THE ATMOSPHERIC ABSORPTION OF
1494.000 C SOUND.
1495.000 C
1496.000 C TK IS AIR TEMPERATURE, DEGREES KELVIN.
1497.000 C
1498.000 C HR IS THE RELATIVE HUMIDITY OF THE AIR, PERCENT.
1499.000 C
1500.000 C PA IS THE PRESSURE OF THE AIR, STANDARD ATMOSPHERES.
1501.000 C
1502.000 C F IS THE FREQUENCY OF THE SOUND, HZ.
1503.000 C
1504.000 C A IS THE PURE-TONE ATMOSPHERIC SOUND ABSORPTION COEFFICIENT,
1505.000 C DB/M.
1506.000 C
1507.000 C T0 AND T01 ARE REFERENCE TEMPERATURES, DEGREES KELVIN.
1508.000 C
1509.000 C LPSOP0 IS THE LOGARITHM OF THE RATIO OF THE VAPOR PRESSURE
1510.000 C AT SATURATION TO THE STANDARD ATMOSPHERIC PRESSURE, I.E., THE
1511.000 C LOGARITHM OF PSOP0.
1512.000 C
1513.000 C H IS THE MOLAR CONCENTRATION OF WATER VAPOR, PERCENT.
1514.000 C
1515.000 C FRO2 AND FRN2 ARE THE RELAXATION FREQUENCIES OF OXYGEN
1516.000 C AND NITROGEN, RESPECTIVELY, HERTZ.
1517.000 C
1518.000 C ALPHA IS THE ATMOSPHERIC ABSORPTION COEFFICIENT,
1519.000 C NEPERS/M.
1520.000 C
1521.000 C*****
1522.000 C
1523.000 REAL LPSOP0
1524.000 T0=293.15
1525.000 T01=273.16
1526.000 LPSOP0=10.79586*((1.-(T01/TK))- 5.02808*LOG10(TK/T01)
1527.000 1 +1.50474E-4*((1.-10.**(-8.29692*((TK/T01)-1.)))
1528.000 2 +0.42873E-3*(10.**((4.76955*(1.-(T01/TK)))-1.)
1529.000 3 -2.2195983
1530.000 PSOP0=10.**LPSOP0
1531.000 H=HR*PSOP0/PA
1532.000 FRO2=PA*(24.+4.41E04*H*((0.05+H)/(0.391+H)))
1533.000 FRN2=(PA/SQRT(TK/T0))*(9.+
1534.000 1 350.*H*EXP(-6.142*((TK/T0)**(-1./3.))-1.)))
1535.000 ALPHA=(F**2.)*(((1.84E-11)*(1./PA)*SQRT(TK/T0))
1536.000 1 +((TK/T0)**(-5./2.))*((1.278E-2*
1537.000 2 (EXP(-2239.1/TK))/(FRO2+((F**2.)/FRO2)))
1538.000 3 +(0.1068*(EXP(-3352./TK))/(FRN2+((F**2.)/FRN2)))))
1539.000 A=8.686*ALPHA
1540.000 RETURN
1541.000 END

```

SUBROUTINE NUMINT (SPL, TKR, HRR, PAR, ATK, AHR, PA, D, KL, BA)

Subroutine NUMINT calculates the array of band adjustment factors BA, in decibels, appropriate for the set of measured test-day 1/3-octave-band sound pressure levels specified in dummy array SPL. The reference atmospheric conditions (given by parameters TKR, HRR, and PAR) and the test-day atmospheric conditions as a function of height above ground level (given by arrays ATK and AHR) and the uniform pressure PA are specified by the calling program as is the array D of pathlength segments along the sound propagation path from the microphone back to the aircraft at its position on the flight path at the time it emitted the sound measured by the microphone as the sound pressure levels SPL.

Subroutine NUMINT uses a numerical integration technique to integrate the product of an equivalent, normalized sound pressure spectral density function and an absorption function over the sound propagation path for the two atmospheric conditions and thereby calculate a band adjustment factor for ideal 1/3-octave-band filters.

Subroutine DIFFS is called to calculate a set of band-level differences, or slopes, for the input SPL array. The differences are used in the approximation of the sound pressure spectral density function over the bandwidth of each filter.

Subroutine ANSAB is called to determine a pure-tone sound absorption coefficient at specified frequencies over the filter bandwidth and over the sound propagation path.

Subroutine QSF is called to perform the actual numerical integration, at equally spaced frequency intervals, of the calculated integrand values over the bandwidth of the ideal filter.

NUMINT requires about 470 computer words or about 1900 bytes for storage.

```

1542.000 C
1543.000 SUBROUTINE NUMINT(SPL,TKR,HRR,PAR,ATK,AHR,PA,D,KL,BA)
1544.000 C
1545.000 C*****
1546.000 C
1547.000 C SUBROUTINE NUMINT USES A NUMERICAL INTEGRATION TECHNIQUE
1548.000 C TO CALCULATE AN ADJUSTMENT FACTOR TO BE APPLIED TO 1/3-
1549.000 C OCTAVE-BAND SOUND PRESSURE LEVELS TO ACCOUNT FOR DIFFERENCES
1550.000 C IN THE ATMOSPHERIC ABSORPTION OF SOUND OVER A SEGMENTED SOUND
1551.000 C PROPAGATION PATH UNDER TWO DIFFERENT SETS OF METEOROLOGICAL
1552.000 C CONDITIONS, I.E., TEST AND REFERENCE CONDITIONS.
1553.000 C
1554.000 C SPL -- THE ARRAY OF 24 MEASURED 1/3-OCTAVE-BAND SPLS
1555.000 C WITH NOMINAL BAND CENTER FREQUENCIES BETWEEN 50 AND
1556.000 C 10,000 HZ, DB.
1557.000 C
1558.000 C TKR -- THE REFERENCE AIR TEMPERATURE, DEG KELVIN.
1559.000 C
1560.000 C HRR -- THE REFERENCE RELATIVE HUMIDITY OF THE AIR, PERCENT.
1561.000 C
1562.000 C PAR -- THE REFERENCE ATMOSPHERIC PRESSURE, STANDARD ATMO-
1563.000 C SPHERES.
1564.000 C
1565.000 C ATK -- THE ARRAY OF AVERAGE AIR TEMPERATURES, OVER EACH
1566.000 C SEGMENT OF THE SOUND PROPAGATION PATH, MEASURED AT
1567.000 C THE TIME THE MEASURED SPLS WERE OBTAINED, DEG KELVIN.
1568.000 C
1569.000 C AHR -- THE ARRAY OF AVERAGE RELATIVE HUMIDITIES, OVER EACH
1570.000 C SEGMENT OF THE SOUND PROPAGATION PATH, MEASURED AT THE
1571.000 C TIME THE MEASURED SPLS WERE OBTAINED, PERCENT.
1572.000 C
1573.000 C PA -- THE ATMOSPHERIC PRESSURE AT THE TIME THE MEASURED
1574.000 C SPLS WERE OBTAINED, STANDARD ATMOSPHERES.
1575.000 C
1576.000 C D -- THE ARRAY OF DISTANCES ALONG THE SEGMENTS OF THE SOUND
1577.000 C PROPAGATION PATH CORRESPONDING TO THE HORIZONTAL LAYERS
1578.000 C DEFINED BY THE INTERVALS OF HEIGHT WHERE THE AIR
1579.000 C TEMPERATURE AND RELATIVE HUMIDITY WERE MEASURED, METERS.
1580.000 C
1581.000 C KL -- THE INDEX COUNTER FOR THE ARRAYS ATK, AHR, AND D THAT
1582.000 C INDICATES THE LAST INCREMENT ALONG THE PATH FROM
1583.000 C THE MICROPHONE TO THE AIRPLANE.
1584.000 C
1585.000 C BA -- THE BAND-ADJUSTMENT FACTOR TO BE ADDED TO THE
1586.000 C MEASURED SPL TO DETERMINE THE SPL THAT WOULD HAVE BEEN
1587.000 C MEASURED UNDER REFERENCE METEOROLOGICAL CONDITIONS, DB.
1588.000 C
1589.000 C**** SUBROUTINE NUMINT CALLS SUBROUTINE DIFFS TO DETERMINE THE BAND
1590.000 C LEVEL DIFFERENCES, OR DATA SLOPES, IN DB/BAND OVER THE
1591.000 C LOWER AND UPPER HALVES OF EACH OF THE 24 FILTER BANDS
1592.000 C CORRESPONDING TO THE BAND LEVELS IN THE ARRAY SPL.
1593.000 C
1594.000 C**** SUBROUTINE NUMINT ALSO CALLS SUBROUTINE ANSAB TO DETERMINE
1595.000 C PURE-TONE ATMOSPHERIC ABSORPTION COEFFICIENTS, IN DB/M,
1596.000 C AS A FUNCTION OF FREQUENCY FOR SPECIFIED AIR TEMPERATURE,
1597.000 C RELATIVE HUMIDITY, AND AIR PRESSURE.

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1598.000 C
1599.000 C*** THE ACTUAL PROCESS OF NUMERICALLY INTEGRATING THE ARRAY
1600.000 C OF CALCULATED INTEGRAND VALUES OVER THE BANDWIDTH
1601.000 C OF THE 1/3-OCTAVE-BAND FILTERS (ASSUMED TO BE IDEAL
1602.000 C FILTERS) IS PERFORMED BY A STANDARD ROUTINE DESCRIBED
1603.000 C IN SUBROUTINE QSF WHICH IS ALSO CALLED BY SUBROUTINE
1604.000 C NUMINT.
1605.000 C
1606.000 C*** NOTE THAT A VARIETY OF COMPARABLE NUMERICAL INTEGRATION
1607.000 C METHODS COULD BE SUBSTITUTED FOR SUBROUTINE QSF WITH
1608.000 C APPROPRIATE MODIFICATIONS TO THE PROGRAM STATEMENTS.
1609.000 C
1610.000 C*****
1611.000 C
1612.000 C DIMENSION AHR(31),ATK(31),BA(24),D(31),NSTEP(24),
1613.000 C 1SLOPE(24,2),SPL(25),YNL(16),YNU(16),ZNL(16),ZNU(16)
1614.000 C
1615.000 C DATA NSTEP/13**4,5,6,7,8,9,10,11,12,13,14,15/
1616.000 C
1617.000 C THE DIMENSIONS OF THE ARRAYS HAVE BEEN SET TO SPECIFIC
1618.000 C VALUES TO AGREE WITH THE CORRESPONDING ARRAYS IN THE
1619.000 C CALLING ROUTINE, OR, IN THE CASE OF THE Y AND Z ARRAYS,
1620.000 C TO 1 MORE THAN THE LARGEST NUMBER OF FREQUENCY STEPS, NSTEP,
1621.000 C OVER THE WIDEST BANDWIDTH OF EACH HALF OF THE IDEAL
1622.000 C FILTER AT BAND 24 (10,000 HZ).
1623.000 C
1624.000 C DEFINE RF, THE EXACT VALUE OF THE FREQUENCY RATIO
1625.000 C FOR 1/3-OCTAVE BANDS.
1626.000 C
1627.000 C RF=10.0**0.1
1628.000 C
1629.000 C DETERMINE FC, THE EXACT BAND CENTER FREQUENCY, IN HZ,
1630.000 C FROM THE DEFINITION BASED ON THE SET OF INTERNATIONAL
1631.000 C STANDARD BAND NUMBERS, ISBN, STARTING WITH ISBN=17 FOR
1632.000 C THE FIRST BAND, J=1, WITH NOMINAL CENTER FREQUENCY OF 50 HZ.
1633.000 C
1634.000 C DO 30 J=1,24
1635.000 C
1636.000 C ISBN=16+J
1637.000 C FC=10.0**((ISBN/10.0))
1638.000 C
1639.000 C CALCULATE THE EXACT LOWER, FL, AND UPPER, FU, BANDEDGE
1640.000 C FREQUENCIES FOR THE FILTER BAND.
1641.000 C
1642.000 C CALCULATE THE FREQUENCY INTERVALS FOR THE LOWER, DELFL,
1643.000 C AND UPPER, DELFU, HALVES OF THE FILTER BAND.
1644.000 C
1645.000 C FL=FC/SQRT(RF)
1646.000 C FU=FC*SQRT(RF)
1647.000 C
1648.000 C DELFL=(FC-FL)/NSTEP(J)
1649.000 C DELFU=(FU-FC)/NSTEP(J)
1650.000 C
1651.000 C ASSIGN THE VALUES FOR THE FREQUENCIES F1 AND F2 BEFORE
1652.000 C THE START OF THE NUMERICAL INTEGRATION OVER THE LOWER
1653.000 C AND UPPER HALVES OF THE FILTER BAND.

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1654.000 C
1655.000 F1=FL-DELFL
1656.000 F2=FC-DELFU
1657.000 C
1658.000 C CALCULATE NN, THE TOTAL NUMBER OF STEPS (OR FREQUENCY
1659.000 C INTERVALS) IN THE NUMERICAL INTEGRATION OVER EACH HALF
1660.000 C OF A FILTER BAND.
1661.000 C
1662.000 NN=NSTEP(J)+1
1663.000 C
1664.000 C FIND THE BAND-LEVEL SLOPES, IN DB/BAND, CORRESPONDING
1665.000 C TO THE INPUT SPLS.
1666.000 C
1667.000 CALL DIFFS(SPL,SLOPE)
1668.000 C
1669.000 C CALCULATE SPSL AND SPSU FOR THE ESTIMATED SLOPES OF THE
1670.000 C NORMALIZED SOUND PRESSURE SPECTRAL DENSITY FUNCTIONS OVER
1671.000 C THE LOWER AND UPPER HALVES OF THE FILTER BAND BY USING THE
1672.000 C CORRESPONDING BAND-LEVEL SLOPES.
1673.000 C
1674.000 SPSL=SLOPE(J,1)/(10.0*LOG10(RF))
1675.000 SPSU=SLOPE(J,2)/(10.0*LOG10(RF))
1676.000 C
1677.000 C TEST THE VALUE OF THE SLOPES TO DETERMINE WHICH FORM TO
1678.000 C USE FOR CALCULATING THE DENOMINATOR TERMS FOR THE LOWER HALF
1679.000 C OF THE BAND, DEN1, AND THE UPPER HALF OF THE BAND, DEN2.
1680.000 C
1681.000 IF(SPSL.NE.0.0)DEN1=(FC/SPSL)**(1.-(RF**(-SPSL/2.)))
1682.000 IF(SPSL.EQ.0.0)DEN1=(FC/2.)*LOG(RF)
1683.000 C
1684.000 IF(SPSU.NE.0.0)DEN2=(FC/SPSU)**((RF**((SPSU/2.))-1.)
1685.000 IF(SPSU.EQ.0.0)DEN2=(FC/2.)*LOG(RF)
1686.000 C
1687.000 C DETERMINE THE ARRAY OF INTEGRAND VALUES FOR THE NUMERATOR
1688.000 C TERMS OVER THE LOWER AND UPPER HALVES OF A FILTER BAND.
1689.000 C
1690.000 DO 20 JJ=1,NN
1691.000 C
1692.000 C DETERMINE THE FREQUENCY AT EACH STEP IN THE LOWER, F1,
1693.000 C AND UPPER, F2, HALF OF THE BANDWIDTH.
1694.000 C
1695.000 F1=F1+DELFL
1696.000 F2=F2+DELFU
1697.000 C
1698.000 C DETERMINE THE VALUE OF THE NORMALIZED SOUND PRESSURE
1699.000 C SPECTRAL DENSITY FUNCTION AT FREQUENCIES F1 AND F2.
1700.000 C
1701.000 XL=(F1/FC)**(-1.+SPSL)
1702.000 XU=(F2/FC)**(-1.+SPSU)
1703.000 C
1704.000 C DETERMINE THE ATMOSPHERIC ABSORPTION COEFFICIENTS FOR
1705.000 C THE REFERENCE METEOROLOGICAL CONDITIONS AT FREQUENCIES
1706.000 C F1 AND F2 WITH THE ASSUMPTION OF A UNIFORM REFERENCE ATMOSPHERE.

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1707.000 C
1708.000 CALL ANSAB(TKR,HRR,PAR,F1,AR1)
1709.000 CALL ANSAB(TKR,HRR,PAR,F2,AR2)
1710.000 C
1711.000 C DETERMINE THE EXPONENT, AE, OF THE ATMOSPHERIC-ABSORPTION
1712.000 C ATTENUATION FACTOR, AF, BY SUMMING THE DIFFERENCES IN
1713.000 C ATTENUATION UNDER TEST AND REFERENCE METEOROLOGICAL CONDITIONS
1714.000 C OVER THE SEGMENTS ALONG THE LENGTH OF THE SOUND PROPAGATION
1715.000 C PATH.
1716.000 C
1717.000 AEL=AEU=0.0
1718.000 DO 10 K=1,KL
1719.000 CALL ANSAB(ATK(K),AHR(K),PA,F1,A1)
1720.000 CALL ANSAB(ATK(K),AHR(K),PA,F2,A2)
1721.000 AEL=AEL+(A1-AR1)*D(K)
1722.000 10 AEU=AEU+(A2-AR2)*D(K)
1723.000 C
1724.000 AFL=10.0**((AEL/10.0)
1725.000 AFU=10.0**((AEU/10.0)
1726.000 C
1727.000 C DETERMINE THE VALUES OF THE NUMERATOR INTEGRANDS AS THE
1728.000 C PRODUCTS OF THE NORMALIZED EQUIVALENT SOUND PRESSURE SPECTRAL
1729.000 C DENSITY FUNCTIONS AND THE ATMOSPHERIC-ABSORPTION FACTORS.
1730.000 C STORE THE RESULTS IN ARRAYS YNL AND YNU.
1731.000 C
1732.000 YNL(JJ)=XL*AFL
1733.000 20 YNU(JJ)=XU*AFU
1734.000 C
1735.000 C CALL THE NUMERICAL INTEGRATION SUBROUTINE QSF TO
1736.000 C INTEGRATE THE INTEGRAND ARRAYS OVER THE LOWER AND UPPER
1737.000 C HALVES OF THE FILTER BANDWIDTH.
1738.000 C
1739.000 CALL QSF(DEFL,YNL,ZNL,NN)
1740.000 CALL QSF(DELFU,YNU,ZNU,NN)
1741.000 C
1742.000 C THE LAST VALUE AT NN OF THE OUTPUT ARRAYS ZNL AND ZNU
1743.000 C IS THE RESULT OF THE NUMERICAL INTEGRATION OVER
1744.000 C THE RANGE OF FREQUENCIES IN EACH HALF OF THE FILTER BAND.
1745.000 C
1746.000 C DETERMINE THE BAND ADJUSTMENT FACTOR, BA, FROM
1747.000 C THE RESULTS OF THE NUMERICAL INTEGRATIONS.
1748.000 C
1749.000 30 BA(J)=10.0*LOG10((ZNL(NN)+ZNU(NN))/(DEN1+DEN2))
1750.000 C
1751.000 RETURN
1752.000 END

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SUBROUTINE DIFFS(SPL, SLOPE)

Subroutine DIFFS accepts an array of 24 1/3-octave-band sound pressure levels and calculates the spectral slopes (SLOPE) or band-level differences over the lower and upper halves of each band. Special rules are defined for the first and last bands and for handling bands where the indicated sound pressure level has been set equal to 0.0 dB because the signal level was not more than 5.0 dB greater than the corresponding background noise level.

DIFFS requires about 170 words or about 700 bytes for storage of the source code.

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1753.000 C
1754.000 SUBROUTINE DIFFS(SPL,SLOPE)
1755.000 C
1756.000 C*****
1757.000 C
1758.000 C SUBROUTINE DIFFS COMPUTES THE DIFFERENCES IN THE LEVEL OF
1759.000 C THE 1/3-OCTAVE-BAND SOUND PRESSURE LEVELS OVER THE LOWER AND
1760.000 C UPPER HALVES OF EACH OF THE 24 BANDS WITH CENTER FREQUENCIES
1761.000 C FROM 50 HZ TO 10,000 HZ. THE LOWER HALF OF A BAND IS
1762.000 C DEFINED TO BE FROM THE LOWER BANDEDGE FREQUENCY TO THE
1763.000 C EXACT GEOMETRIC MEAN FREQUENCY; THE UPPER HALF IS FROM THE
1764.000 C GEOMETRIC MEAN FREQUENCY TO THE UPPER BANDEDGE FREQUENCY.
1765.000 C THE FILTER BANDS ARE ASSUMED TO HAVE IDEAL TRANSMISSION
1766.000 C RESPONSE CHARACTERISTICS.
1767.000 C
1768.000 C SPL THE ARRAY OF 24 SOUND PRESSURE LEVELS, IN DB,
1769.000 C PASSED BY THE CALLING PROGRAM PLUS A LEVEL
1770.000 C OF 0.0 DB FOR A FICTITIOUS BAND 25.
1771.000 C
1772.000 C SLOPE THE ARRAY OF LOWER AND UPPER BAND-LEVEL
1773.000 C DIFFERENCES, OR SLOPES, CALCULATED FOR EACH
1774.000 C OF THE 24 BANDS, IN DB/BAND.
1775.000 C
1776.000 C*****
1777.000 C
1778.000 C DIMENSION SLOPE(24,2),SPL(25),SS(24)
1779.000 C
1780.000 C DATA SS/3*1.,13*0.,-1.,-2.,-3.,-4.,-5.,-7.,-10.,-15./
1781.000 C
1782.000 C SPL(25)=0.0
1783.000 C
1784.000 C DO 70 J=1,23
1785.000 C IF(J.LT.23)GOTO 10
1786.000 C
1787.000 C SPECIAL RULE FOR BAND 24 (10,000 HZ) WHEN SPL(24) IS > 0.0 DB,
1788.000 C BUT SPL(23) IS < OR = 0.0 DB.
1789.000 C
1790.000 C IF(SPL(24).GT.0.0.AND.SPL(23).LE.0.0)GOTO 80
1791.000 C
1792.000 C ANOTHER SPECIAL RULE FOR BAND 24 WHEN SPL(23) IS > 0.0 DB
1793.000 C BUT SPL(24) IS < OR = 0.0 DB.
1794.000 C
1795.000 C IF(SPL(23).GT.0.0.AND.SPL(24).LE.0.0)GO TO 90
1796.000 C
1797.000 C ANOTHER SPECIAL RULE FOR BAND 24 WHEN SPL(23) AND SPL(24)
1798.000 C ARE BOTH < OR = 0.0 DB.
1799.000 C
1800.000 C IF(SPL(23).LE.0.0.AND.SPL(24).LE.0.0)GOTO 100
1801.000 C
1802.000 C IF SPL(J) IS < OR = 0.0 DB, THEN IN ORDER TO HAVE SOME
1803.000 C SPECIFIC VALUE TO USE IN SUBSEQUENT CALCULATIONS SET THE SLOPE
1804.000 C FOR THIS BAND ARBITRARILY TO +1 DB/BAND.
1805.000 C
1806.000 C A SLOPE OF +1 DB/BAND REPRESENTS A WHITE-NOISE SPECTRUM AND,
1807.000 C WITH SUBROUTINE NUMINT, YIELDS A MEASURE OF THE "AVERAGE"
1808.000 C ATTENUATION OVER THE FREQUENCY RANGE OF THE 1/3-OCTAVE BAND.

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```

1809.000 C
1810.000 10 IF(SPL(J).LE.0.0)GOTO 60
1811.000 IF(J.GT.1)GOTO 20
1812.000 C
1813.000 C SPECIAL RULE FOR BAND 1 (50 HZ) WHEN SPL(1) IS > 0.0 DB,
1814.000 C BUT SPL(2) IS < OR = 0.0 DB.
1815.000 C
1816.000 IF(SPL(2).LE.0.0)GOTO 50
1817.000 IF(J.EQ.1)GOTO 30
1818.000 C
1819.000 C SPECIAL RULE FOR THE CASE WHEN J IS BETWEEN 2 AND 23
1820.000 C AND SPL(J) IS > 0.0 DB, BUT SPL(J-1) AND SPL(J+1) ARE
1821.000 C BOTH < OR = 0.0 DB.
1822.000 C
1823.000 20 IF(SPL(J-1).LE.0.0.AND.SPL(J+1).LE.0.0)GOTO 50
1824.000 C
1825.000 C PROCEED WITH NORMAL CALCULATION OF BAND-LEVEL SLOPES
1826.000 C WHEN SPL(J) AND SPL(J+1) ARE BOTH > 0.0 DB.
1827.000 C
1828.000 IF(SPL(J+1).GT.0.0)GOTO 30
1829.000 C
1830.000 C IF SPL(J) > 0.0 DB, BUT SPL(J+1) IS < OR = 0.0 DB, THEN
1831.000 C SKIP SLOPE CALCULATION BY NORMAL PROCEDURE BECAUSE THIS CASE
1832.000 C IS TREATED AS THOUGH THE BAND WHERE SPL(J) IS > 0.0 DB IS
1833.000 C THE LAST BAND WITH VALID DATA AND THE SEARCH STARTS OVER
1834.000 C AGAIN AT SPL(J+2). THE SLOPE FOR THE UPPER HALF OF THE BAND
1835.000 C AT J IS EXTRAPOLATED FROM THE SLOPE CALCULATED FOR THE
1836.000 C LOWER HALF. THE ARBITRARY SLOPE OF +1 DB/BAND IS CALCULATED
1837.000 C FOR THE BAND AT J+1 IN THIS CASE.
1838.000 C
1839.000 GOTO 70
1840.000 C
1841.000 C FIRST, FIND SLOPE OVER UPPER HALF OF BAND AT J.
1842.000 C
1843.000 30 SLOPE(J,2)=SPL(J+1)-SPL(J)
1844.000 C
1845.000 C SLOPE OVER LOWER HALF OF BAND AT J+1=SLOPE OVER UPPER
1846.000 C HALF OF BAND AT J.
1847.000 C
1848.000 SLOPE(J+1,1)=SLOPE(J,2)
1849.000 IF(J.GT.1)GOTO 40
1850.000 C
1851.000 C SPECIAL RULE FOR SLOPE OVER LOWER HALF OF BAND 1 WHEN
1852.000 C SPL(1) AND SPL(2) ARE BOTH > 0.0 DB.
1853.000 C
1854.000 SLOPE(1,1)=SLOPE(1,2)
1855.000 GOTO 70
1856.000 C
1857.000 C SPECIAL RULE FOR THE SLOPE OVER THE UPPER HALF OF THE
1858.000 C BAND AT J+1 WHEN SPL(J) AND SPL(J+1) ARE BOTH > 0.0 DB,
1859.000 C BUT THE SPL(J+2) IS < OR = 0.0 DB. THIS RULE ALSO APPLIES
1860.000 C TO BAND 24 WHEN SPL(23) AND SPL(24) ARE BOTH > 0.0 DB
1861.000 C SINCE SPL(25) IS ARBITRARILY SET = 0.0 DB.
1862.000 C
1863.000 40 IF(SPL(J+2).LE.0.0)SLOPE(J+1,2)=SLOPE(J+1,1)

```

```

1864.000 C
1865.000 C      SPECIAL RULE FOR THE SLOPE OVER THE LOWER HALF OF THE BAND
1866.000 C      AT J IF SPL(J-1) IS < OR = 0.0 DB AND J IS > 1.
1867.000 C
1868.000 C      IF(SPL(J-1).LE.0.0)SLOPE(J,1)=SLOPE(J,2)
1869.000 C      GOTO 70
1870.000 C
1871.000 C      FOR THOSE BANDS WHERE SPL IS > 0.0 DB BUT SPL(J-1) AND
1872.000 C      SPL(J+1) ARE BOTH < OR = 0.0 DB, USE THE ARBITRARY SUBSTITUTE
1873.000 C      BAND-LEVEL SLOPES SS(J) FROM THE DATA STATEMENT.
1874.000 C
1875.000 50      SLOPE(J,1)=SLOPE(J,2)=SS(J)
1876.000 C      GOTO 70
1877.000 C
1878.000 C      SPECIAL RULE FOR BANDS WHERE SPL(J) IS < OR = 0.0 DB.
1879.000 C
1880.000 60      SLOPE(J,1)=SLOPE(J,2)=1.0
1881.000 C
1882.000 70      CONTINUE
1883.000 C
1884.000 C      RETURN
1885.000 C
1886.000 C      SPECIAL RULE FOR BAND 24 WHEN SPL(24) IS > 0.0 DB
1887.000 C      BUT SPL(23) IS < OR = 0.0 DB.
1888.000 C
1889.000 80      SLOPE(23,1)=SLOPE(23,2)=1.0
1890.000 C      SLOPE(24,1)=SLOPE(24,2)=SS(24)
1891.000 C      RETURN
1892.000 C
1893.000 C      SPECIAL RULE FOR BAND 24 WHEN SPL(23) IS > 0.0 DB,
1894.000 C      BUT SPL(24) IS < OR = 0.0 DB.
1895.000 C
1896.000 90      SLOPE(24,1)=SLOPE(24,2)=1.0
1897.000 C      RETURN
1898.000 C
1899.000 C      SPECIAL RULE FOR BANDS 23 AND 24 WHEN BOTH SPL(23) AND
1900.000 C      SPL(24) ARE < OR = 0.0 DB.
1901.000 C
1902.000 100     SLOPE(23,1)=SLOPE(23,2)=SLOPE(24,1)=SLOPE(24,2)=1.0
1903.000 C      RETURN
1904.000 C
1905.000 C      END

```

SUBROUTINE QSF(H, Y, Z, NDIM)

Subroutine QSF numerically integrates the array of function values Y to determine the array of integral values Z at the specified increment H for the argument of Y. NDIM is the dimension of arrays Y and Z. A combination of Simpson's and Newton's rules is used to perform the calculations. The QSF program is taken from the IBM Scientific Subroutine Package. It is included here for completeness. Other numerical integration methods could be used in place of QSF with appropriate modifications to Subroutine NUMINT.

QSF requires about 310 words or about 1250 bytes for storage.

```

1906.000 C
1907.000 SUBROUTINE QSF(H,Y,Z,NDIM)
1908.000 C
1909.000 C*****C
1910.000 C
1911.000 C SUBROUTINE QSF FROM IBM SCIENTIFIC SUBROUTINE PACKAGE (SSP),
1912.000 C FIFTH EDITION,AUGUST 1970.
1913.000 C
1914.000 C PURPOSE
1915.000 C TO COMPUTE THE ARRAY OF INTEGRAL VALUES FOR A GIVEN
1916.000 C EQUIDISTANT TABLE OF FUNCTION VALUES.
1917.000 C
1918.000 C USAGE
1919.000 C CALL QSF (H,Y,Z,NDIM)
1920.000 C
1921.000 C DESCRIPTION OF PARAMETERS
1922.000 C H -THE INCREMENT OF ARGUMENT VALUES.
1923.000 C Y -THE INPUT ARRAY OF FUNCTION VALUES.
1924.000 C Z -THE RESULTING ARRAY OF INTEGRAL VALUES. Z MAY BE
1925.000 C IDENTICAL WITH Y.
1926.000 C NDIM -THE DIMENSION OF ARRAYS Y AND Z.
1927.000 C
1928.000 C REMARKS
1929.000 C NO ACTION IN CASE NDIM LESS THAN 3.
1930.000 C NO SUBROUTINES OR FUNCTION SUBPROGRAMS ARE REQUIRED.
1931.000 C
1932.000 C METHOD
1933.000 C BEGINNING WITH Z(1)=0, EVALUATION OF ARRAY Z IS DONE BY
1934.000 C MEANS OF SIMPSON'S RULE TOGETHER WITH NEWTON'S 3/8 RULE OR
1935.000 C A COMBINATION OF THESE TWO RULES. TRUNCATION ERROR IS OF
1936.000 C ORDER H**5 (I.E.,FOURTH ORDER METHOD). ONLY IN CASE NDIM=3
1937.000 C IS THE TRUNCATION ERROR OF Z(2) OF ORDER H**4.
1938.000 C
1939.000 C*****C
1940.000 C
1941.000 C DIMENSION Y(1),Z(1)
1942.000 C
1943.000 C HT=0.3333333*H
1944.000 C IF(NDIM-5)7,8,1
1945.000 C
1946.000 C NDIM IS GREATER THAN 5. PREPARATION OF INTEGRATION LOOP.
1947.000 C
1948.000 1 SUM1=Y(2)+Y(2)
1949.000 SUM1=SUM1+SUM1
1950.000 SUM1=HT*(Y(1)+SUM1+Y(3))
1951.000 AUX1=Y(4)+Y(4)
1952.000 AUX1=AUX1+AUX1
1953.000 AUX1=SUM1+HT*(Y(3)+AUX1+Y(5))
1954.000 AUX2=HT*(Y(1)+3.875*(Y(2)+Y(5))+2.625*(Y(3)+Y(4))+Y(6))
1955.000 SUM2=Y(5)+Y(5)
1956.000 SUM2=SUM2+SUM2
1957.000 SUM2=AUX2-HT*(Y(4)+SUM2+Y(6))
1958.000 Z(1)=0.0
1959.000 AUX=Y(3)+Y(3)
1960.000 AUX=AUX+AUX
1961.000 Z(2)=SUM2-HT*(Y(2)+AUX+Y(4))
1962.000 Z(3)=SUM1
1963.000 Z(4)=SUM2
1964.000 IF(NDIM-6)5,5,2

```

```

1965.000 C
1966.000 C      INTEGRATION LOOP.
1967.000 C
1968.000 2      DO 4 I=7,NDIM,2
1969.000          SUM1=AUX1
1970.000          SUM2=AUX2
1971.000          AUX1=Y(I-1)+Y(I-1)
1972.000          AUX1=AUX1+AUX1
1973.000          AUX1=SUM1+HT*(Y(I-2)+AUX1+Y(I))
1974.000          Z(I-2)=SUM1
1975.000          IF(I-NDIM)3,6,6
1976.000 3      AUX2=Y(I)+Y(I)
1977.000          AUX2=AUX2+AUX2
1978.000          AUX2=SUM2+HT*(Y(I-1)+AUX2+Y(I+1))
1979.000 4      Z(I-1)=SUM2
1980.000 5      Z(NDIM-1)=AUX1
1981.000          Z(NDIM)=AUX2
1982.000          RETURN
1983.000 6      Z(NDIM-1)=SUM2
1984.000          Z(NDIM)=AUX1
1985.000          RETURN
1986.000 C
1987.000 C      END OF INTEGRATION LOOP FOR NDIM GREATER THAN 5.

```

```

1988.000 C
1989.000 7 IF (NDIM-3)12,11,8
1990.000 C
1991.000 C NDIM IS EQUAL TO 4 OR 5.
1992.000 C
1993.000 8 SUM2=1.125*HT*(Y(1)+Y(2)+Y(2)+Y(2)+Y(3)+Y(3)+Y(3)+Y(4))
1994.000 SUM1=Y(2)+Y(2)
1995.000 SUM1=SUM1+SUM1
1996.000 SUM1=HT*(Y(1)+SUM1+Y(3))
1997.000 Z(1)=0.0
1998.000 AUX1=Y(3)+Y(3)
1999.000 AUX1=AUX1+AUX1
2000.000 Z(2)=SUM2-HT*(Y(2)+AUX1+Y(4))
2001.000 IF(NDIM-5)10,9,9
2002.000 C
2003.000 C HERE NDIM IS EQUAL TO 5.
2004.000 C
2005.000 9 AUX1=Y(4)+Y(4)
2006.000 AUX1=AUX1+AUX1
2007.000 Z(5)=SUM1+HT*(Y(3)+AUX1+Y(5))
2008.000 C
2009.000 C HERE NDIM IS EQUAL TO 4.
2010.000 C
2011.000 10 Z(3)=SUM1
2012.000 Z(4)=SUM2
2013.000 RETURN
2014.000 C
2015.000 C HERE NDIM IS EQUAL TO 3.
2016.000 C
2017.000 11 SUM1=HT*(1.25*Y(1)+Y(2)+Y(2)-0.25*Y(3))
2018.000 SUM2=Y(2)+Y(2)
2019.000 SUM2=SUM2+SUM2
2020.000 Z(3)=HT*(Y(1)+SUM2+Y(3))
2021.000 Z(1)=0.0
2022.000 Z(2)=SUM1
2023.000 12 RETURN
2024.000 END

```

4. SAMPLE INPUT DATA FILE

The next four pages present an input data file in punched-card-image format for use as a test case with the program statements of Section 3. The test case selected was run 378 from the DC-9 data analyzed in Volume I.

The data are stored in the order and with the format that they are read by program TESTREF. For the test case shown, there are 211 lines of data arranged as follows:

line nos.	description
1	RUN stored as I3
2	MIC, NS, DATE, MONTH, YEAR and stored as I1, I4, I3, 1A4, I3
3	TS, TOH, AH, ZM, AS, AM, GAMAD and stored as F7.1, F8.1, F6.1, F4.1, F5.1, F6.3, F5.1
4 to 143	SPL(I,J) where I = 1, NS and J = 1,24 and stored two lines at a time as 12F6.1 for NS data samples (here NS = 70 for 34.5 seconds of data starting at 0.0 seconds)
144	NH stored as I3
145 to 175	HM(K) where K = 1, NH and stored as F6.1 for NH data samples (here NH = 31)
176 to 206	TC(K), HR(K) where K = 1, NH and stored as 2F5.1 for the NH data samples
207	BP stored as F6.3
208	TITLE1 stored as 20A4
209	TITLE2 stored as 20A4
210	GROUND stored as 5A4
211	999 for the run number used to indicate the end of the data and to signal the program to STOP execution and END calculations

The symbols for the various data items described above are those used in the program statements and are defined in Section 2.

EXAMPLE INPUT DATA FILE

line number	Data
1.000	378
2.000	4 70 25 OCT 74
3.000	44184.0 44199.7 158.0 1.2 72.6 0.212 0.0
4.000	.0 .0 .0 .0 .0 .0 .0 .0 50.3 51.5 .0 .0
5.000	.0 51.5 52.0 49.1 47.8 46.1 43.8 44.8 44.3 .0 .0 .0
6.000	.0 .0 .0 .0 .0 .0 .0 .0 50.3 .0 48.0 50.6
7.000	.0 50.6 50.6 .0 46.8 44.6 43.8 44.8 44.3 .0 .0 .0
8.000	.0 .0 .0 .0 .0 .0 .0 .0 .0 .0 50.1 52.5
9.000	48.8 50.3 51.3 48.1 48.1 43.3 43.8 44.8 44.3 .0 .0 .0
10.000	.0 .0 .0 .0 .0 .0 .0 .0 52.6 55.1 55.1
11.000	48.8 50.6 52.0 53.0 51.1 44.1 43.8 44.8 44.3 .0 .0 .0
12.000	.0 .0 .0 .0 .0 .0 .0 52.8 51.3 52.6 54.6 53.8
13.000	.0 51.3 51.3 53.0 51.1 46.6 43.8 44.8 44.3 .0 .0 .0
14.000	.0 .0 .0 .0 .0 .0 .0 52.6 52.6 52.6 53.0 52.1
15.000	.0 49.8 52.0 54.3 55.8 50.5 46.1 44.8 44.3 .0 .0 .0
16.000	.0 .0 .0 .0 .0 .0 .0 54.8 55.8 52.8 52.6 51.1
17.000	51.8 53.0 55.8 57.0 56.8 53.8 46.8 44.8 44.3 .0 .0 .0
18.000	.0 .0 .0 .0 .0 .0 59.1 59.6 57.1 54.6 49.8 49.8
19.000	51.1 54.6 55.3 55.1 56.3 50.8 46.3 44.8 44.3 .0 .0 .0
20.000	.0 .0 .0 .0 .0 .0 59.8 61.0 59.0 54.0 51.1 .0
21.000	.0 54.3 53.6 54.1 55.8 50.5 46.1 44.8 44.3 .0 .0 .0
22.000	.0 .0 .0 .0 .0 59.3 61.8 59.8 58.8 56.6 52.3 50.1
23.000	51.8 59.5 59.1 53.6 53.1 51.3 47.6 44.8 44.3 .0 .0 .0
24.000	.0 .0 .0 .0 .0 59.8 63.0 62.8 61.8 58.3 54.6 51.5
25.000	53.8 60.8 62.3 58.0 58.3 54.0 51.0 46.3 44.3 .0 .0 .0
26.000	.0 .0 .0 .0 .0 60.8 64.5 65.3 62.8 59.1 56.6 56.1
27.000	63.1 64.6 63.5 64.6 63.6 61.8 56.8 52.8 44.3 .0 .0 .0
28.000	.0 .0 .0 .0 .0 64.1 63.5 64.6 59.8 59.6 55.5 61.5
29.000	68.3 72.3 71.8 66.0 68.5 63.6 59.6 55.1 44.8 .0 .0 .0
30.000	.0 .0 .0 .0 .0 60.8 63.5 61.5 57.6 55.6 51.3 58.8
31.000	63.0 67.6 63.5 60.1 62.6 58.1 56.3 52.3 44.3 .0 .0 .0
32.000	.0 .0 .0 .0 64.0 59.3 61.6 61.3 57.6 52.6 54.1 62.8
33.000	64.3 67.6 63.8 64.0 63.1 60.1 57.8 55.1 44.3 .0 .0 .0
34.000	.0 .0 .0 .0 .0 61.8 62.1 60.3 54.6 .0 51.3 60.1
35.000	63.1 64.6 60.5 66.0 64.1 59.3 57.1 57.3 45.1 .0 .0 .0
36.000	.0 .0 .0 .0 .0 60.1 62.1 61.0 54.6 48.3 58.6 61.8
37.000	61.1 59.5 62.8 62.6 61.6 58.3 55.1 57.6 44.5 .0 .0 .0
38.000	.0 .0 .0 .0 .0 60.1 63.5 61.3 55.0 57.6 64.8 64.8
39.000	65.3 62.3 64.5 62.8 60.8 58.1 56.8 58.3 45.8 .0 .0 .0
40.000	.0 .0 .0 .0 62.6 63.1 64.0 60.3 52.6 58.3 63.8 66.6
41.000	61.1 59.8 63.8 60.3 63.1 58.1 56.3 57.3 46.3 .0 .0 .0
42.000	.0 .0 .0 .0 64.0 64.3 59.3 57.1 52.1 61.8 63.3 64.8
43.000	60.1 65.6 64.5 62.8 61.8 59.1 56.8 58.6 47.1 .0 .0 .0
44.000	.0 .0 .0 .0 63.3 64.1 62.3 55.3 57.0 66.3 68.8 67.8
45.000	62.1 69.3 65.3 67.0 65.0 63.3 61.6 62.8 51.3 .0 .0 .0
46.000	.0 .0 .0 66.8 64.3 63.1 59.3 54.8 62.1 68.8 70.3 66.3
47.000	65.3 71.3 66.3 68.6 67.1 63.3 61.8 63.1 52.6 .0 .0 .0
48.000	.0 .0 .0 66.5 65.3 65.8 57.3 57.5 65.6 68.0 68.5 63.0
49.000	67.1 65.6 65.8 64.5 65.0 61.6 59.8 62.8 51.8 .0 .0 .0
50.000	.0 .0 .0 65.8 65.3 60.1 55.8 64.1 71.0 72.0 69.3 65.3
51.000	71.1 67.1 67.8 68.5 67.1 65.8 65.1 67.3 56.5 .0 .0 .0
52.000	.0 .0 69.1 67.1 67.0 .0 60.3 68.1 74.0 72.8 68.0 70.6
53.000	70.8 68.6 68.0 68.5 67.6 65.1 63.3 69.6 58.5 .0 .0 .0
54.000	.0 .0 68.6 66.8 62.6 60.8 68.3 71.5 72.0 69.3 66.5 71.8

55.000	67.6	69.6	67.5	66.6	67.5	64.1	64.3	67.6	59.6	50.0	.0	.0
56.000	.0	.0	69.1	65.8	.0	63.8	71.3	74.6	73.6	66.5	72.3	71.6
57.000	71.3	70.1	69.5	69.0	69.0	67.8	67.6	69.8	62.3	54.8	.0	.0
58.000	.0	.0	.0	.0	.0	69.6	75.6	73.5	70.1	70.5	74.0	69.8
59.000	71.3	70.6	69.0	69.5	67.6	67.3	67.1	70.6	62.6	56.1	.0	.0
60.000	.0	.0	.0	.0	69.6	71.5	75.3	75.1	70.5	78.8	76.5	75.6
61.000	74.3	74.1	74.3	74.1	73.5	72.3	73.8	78.1	69.6	63.3	57.8	.0
62.000	.0	.0	.0	.0	72.8	78.3	78.1	70.6	77.0	78.5	77.8	77.6
63.000	76.1	76.6	76.0	76.5	75.5	75.8	79.6	87.1	71.8	68.0	67.8	56.0
64.000	74.8	.0	.0	71.3	79.0	80.6	79.1	73.0	81.5	77.5	80.8	78.3
65.000	77.8	76.6	77.3	78.1	76.6	78.8	83.1	85.6	74.1	73.3	71.3	59.1
66.000	.0	.0	.0	76.0	82.0	81.3	77.1	80.6	83.0	80.0	80.8	81.8
67.000	80.3	79.3	79.8	79.5	77.6	79.8	85.6	82.3	78.6	76.8	73.3	62.6
68.000	.0	.0	67.8	78.0	81.6	83.8	77.1	85.0	83.1	83.5	81.8	81.8
69.000	80.8	80.3	80.8	80.0	79.0	81.6	86.6	82.3	80.8	79.0	74.8	66.3
70.000	.0	.0	69.3	80.0	84.0	83.1	76.6	84.0	85.0	85.0	82.3	83.6
71.000	82.8	81.1	81.3	79.5	79.1	82.8	88.1	84.1	82.8	80.3	76.8	67.6
72.000	76.0	.0	69.3	77.5	85.1	85.8	82.6	83.0	86.1	83.0	85.3	83.3
73.000	83.1	81.6	82.0	82.5	81.1	84.3	86.8	85.6	82.8	81.3	77.1	68.3
74.000	74.5	.0	.0	78.0	85.1	85.6	87.6	80.0	87.5	84.3	84.8	82.6
75.000	81.3	81.6	81.0	78.5	79.6	81.3	83.6	83.6	80.1	77.5	73.1	64.6
76.000	81.3	78.5	70.0	78.1	82.6	86.3	87.8	81.0	84.5	85.8	81.0	81.8
77.000	80.1	78.8	77.3	76.5	77.5	79.6	81.6	79.1	77.6	73.3	67.8	59.0
78.000	80.1	81.3	79.1	73.8	81.0	86.8	89.1	86.0	78.1	85.3	81.0	83.1
79.000	80.1	78.3	77.8	75.5	75.5	78.1	79.6	76.6	73.8	70.3	64.0	54.3
80.000	81.6	82.8	81.8	74.1	74.8	84.1	87.1	86.0	76.1	80.5	78.3	76.6
81.000	74.8	75.3	73.5	72.5	71.6	75.8	76.3	74.1	70.6	66.5	59.1	49.8
82.000	81.8	83.3	83.1	77.5	72.3	77.6	82.8	83.0	78.0	76.3	78.0	72.3
83.000	73.8	72.1	71.5	69.1	68.1	73.3	72.1	68.3	64.8	59.8	52.3	.0
84.000	84.5	84.6	86.0	79.1	71.0	76.1	82.1	82.5	79.0	72.8	79.3	76.8
85.000	75.3	72.3	71.5	70.5	69.6	75.8	73.3	70.8	67.3	61.8	54.1	.0
86.000	84.5	82.6	85.8	82.8	72.6	69.5	78.3	81.5	79.6	73.3	73.0	75.1
87.000	71.3	71.3	71.8	69.6	68.1	73.6	71.1	68.3	64.6	58.3	.0	.0
88.000	85.6	86.5	86.0	84.1	74.1	67.3	71.6	80.0	80.5	75.8	70.3	76.6
89.000	70.8	72.8	71.3	68.6	68.6	73.6	71.3	68.6	64.3	58.1	.0	.0
90.000	83.1	84.8	87.3	84.3	76.6	64.8	68.1	72.1	76.5	72.8	66.0	68.3
91.000	67.8	66.8	65.8	63.6	63.6	67.3	64.8	62.1	57.0	50.3	.0	.0
92.000	83.0	81.8	85.3	85.1	77.6	69.1	63.0	68.6	72.6	70.5	65.3	64.5
93.000	64.3	62.3	64.5	61.3	60.6	66.3	63.1	59.3	54.1	.0	.0	.0
94.000	82.1	85.6	85.8	81.8	79.6	70.0	59.3	63.3	69.6	69.0	65.8	59.8
95.000	61.1	58.5	60.5	57.8	58.1	60.8	58.1	53.8	49.1	.0	.0	.0
96.000	83.0	83.8	83.1	83.6	81.0	71.1	61.0	63.6	68.1	69.3	66.8	60.3
97.000	62.5	59.3	62.3	57.3	56.8	60.3	56.6	54.3	48.6	.0	.0	.0
98.000	78.8	79.8	82.8	82.6	80.5	73.1	62.1	62.8	68.6	69.5	69.0	62.5
99.000	62.0	61.5	58.8	56.8	56.0	59.6	56.3	51.6	47.3	.0	.0	.0
100.000	81.3	81.6	81.3	80.0	78.1	73.5	65.6	60.6	66.1	68.8	69.0	64.3
101.000	59.1	63.8	58.3	59.8	58.1	62.1	58.8	53.3	47.3	.0	.0	.0
102.000	79.3	82.1	84.0	82.6	78.5	73.5	67.1	59.1	69.0	71.5	70.8	66.8
103.000	60.6	66.3	64.0	64.6	63.6	66.1	62.1	56.3	49.8	.0	.0	.0
104.000	77.6	77.6	76.8	82.1	79.0	75.1	67.3	57.6	62.6	67.3	66.3	62.5
105.000	54.8	60.3	59.1	57.0	56.0	58.3	54.6	49.5	44.3	.0	.0	.0
106.000	77.6	75.3	79.8	78.5	75.8	71.0	66.1	57.6	59.3	63.3	66.8	64.0
107.000	55.8	55.6	59.8	51.3	53.3	57.1	54.3	47.5	44.3	.0	.0	.0
108.000	72.6	77.1	77.1	79.1	74.8	69.1	64.0	56.6	54.0	61.6	66.8	68.1
109.000	60.0	55.6	60.3	53.6	55.5	56.8	52.1	46.3	44.3	.0	.0	.0

110.000	75.3	75.8	75.1	73.8	73.6	70.1	65.8	57.5	51.3	56.6	63.8	65.0
111.000	59.5	54.1	58.8	55.3	57.3	60.8	54.8	49.0	44.3	.0	.0	.0
112.000	73.3	76.0	77.1	74.6	72.6	68.8	65.3	56.8	50.8	54.8	64.3	66.3
113.000	63.0	55.1	58.3	54.6	54.6	55.8	53.3	45.3	44.3	.0	.0	.0
114.000	73.0	73.3	78.3	74.8	69.6	67.8	63.5	57.5	52.0	52.3	59.6	63.5
115.000	62.6	54.6	55.8	55.6	53.8	56.3	52.6	45.0	44.3	.0	.0	.0
116.000	74.1	72.8	74.1	73.0	70.5	65.1	61.0	58.8	51.6	49.6	58.1	61.0
117.000	62.1	55.1	54.1	54.1	48.1	53.0	49.1	44.8	44.3	.0	.0	.0
118.000	.0	71.6	70.6	70.6	71.5	64.8	57.6	57.1	51.3	.0	56.6	59.3
119.000	59.1	56.1	52.6	52.6	.0	51.0	47.6	44.8	44.3	.0	.0	.0
120.000	.0	.0	71.8	70.1	66.6	63.0	59.6	53.8	50.3	.0	52.5	57.8
121.000	57.6	54.1	48.8	48.3	.0	48.1	43.8	44.8	44.3	.0	.0	.0
122.000	.0	.0	.0	65.3	65.8	62.1	.0	.0	.0	.0	48.1	51.8
123.000	55.1	53.1	45.8	.0	.0	47.8	43.8	44.8	44.3	.0	.0	.0
124.000	.0	.0	.0	66.8	.0	59.8	.0	.0	.0	.0	47.3	50.6
125.000	51.8	51.8	.0	.0	.0	45.0	43.8	44.8	44.3	.0	.0	.0
126.000	.0	.0	.0	68.8	62.6	.0	55.1	.0	.0	.0	.0	.0
127.000	51.1	50.6	46.1	.0	.0	46.3	43.8	44.8	44.3	.0	.0	.0
128.000	71.8	70.8	.0	67.1	64.6	58.8	.0	52.6	51.3	.0	.0	.0
129.000	50.8	50.1	46.8	.0	.0	47.3	43.8	44.8	44.3	.0	.0	.0
130.000	.0	.0	72.8	68.6	63.0	61.3	56.1	52.6	52.6	.0	.0	50.6
131.000	52.6	52.6	50.0	.0	.0	47.1	43.8	44.8	44.3	.0	.0	.0
132.000	.0	71.5	69.3	68.6	68.1	64.3	61.0	56.6	56.6	.0	.0	52.6
133.000	50.6	50.3	48.8	.0	.0	43.8	43.8	44.8	44.3	.0	.0	.0
134.000	73.3	.0	68.5	69.5	66.3	64.6	58.8	58.0	55.6	50.3	.0	.0
135.000	.0	.0	47.6	.0	.0	43.3	43.8	44.8	44.3	.0	.0	.0
136.000	73.0	.0	.0	.0	62.6	61.3	55.1	.0	52.1	54.0	.0	.0
137.000	48.6	48.6	45.1	.0	.0	43.3	43.8	44.8	44.3	.0	.0	.0
138.000	.0	.0	.0	.0	.0	.0	54.8	.0	.0	48.6	.0	.0
139.000	.0	49.1	45.5	.0	.0	43.3	43.8	44.8	44.3	.0	.0	.0
140.000	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
141.000	.0	51.3	48.6	.0	.0	43.3	43.8	44.8	44.3	.0	.0	.0
142.000	.0	.0	.0	65.8	.0	.0	.0	.0	51.3	.0	.0	.0
143.000	50.0	55.1	52.0	.0	.0	43.3	43.8	44.8	44.3	.0	.0	.0
144.000	31											
145.000	1.2											
146.000	30.5											
147.000	61.0											
148.000	91.5											
149.000	122.0											
150.000	152.5											
151.000	183.0											
152.000	213.5											
153.000	244.0											
154.000	274.5											
155.000	305.0											
156.000	335.5											
157.000	366.0											
158.000	396.5											
159.000	427.0											
160.000	457.5											
161.000	488.0											
162.000	518.5											
163.000	549.0											
164.000	579.5											

165.000	610.0
166.000	640.5
167.000	671.0
168.000	701.5
169.000	732.0
170.000	762.5
171.000	793.0
172.000	823.5
173.000	854.0
174.000	884.5
175.000	915.0
176.000	20.6 47.7
177.000	20.2 48.1
178.000	20.4 46.9
179.000	19.9 48.0
180.000	19.5 49.8
181.000	19.2 51.3
182.000	18.9 51.6
183.000	18.8 51.4
184.000	18.6 52.1
185.000	18.4 51.7
186.000	18.2 50.2
187.000	18.0 51.1
188.000	17.9 50.4
189.000	17.8 49.9
190.000	17.5 50.1
191.000	17.7 48.9
192.000	17.4 49.1
193.000	17.3 49.5
194.000	17.2 48.1
195.000	17.3 46.0
196.000	17.3 44.3
197.000	17.8 46.8
198.000	18.0 46.7
199.000	17.8 44.0
200.000	17.9 44.7
201.000	17.7 46.9
202.000	17.3 48.1
203.000	17.1 48.6
204.000	16.8 49.1
205.000	16.6 49.8
206.000	16.3 50.6
207.000	29.669
208.000	
209.000	
210.000	CONCRETE
211.000	999

MEASURED TEST-DAY NOISE DATA FOR COMMERCIAL JET TRANSPORT
 DC-9-10/JT80-1 FLYOVER NOISE TESTS AT FRESNO AIR TERMINAL

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5. SAMPLE OUTPUT LISTING

The next eight pages contain the listings of output data that resulted from running program TESTREF in Section 3 with the input data in Section 4. The output data are in the order and with the format specified by the WRITE and FORMAT statements in TESTREF.

The first five of the eight pages are called the data pages. They contain the test-day sound pressure levels [read from input-data array $SPL(I,J)$] at 0.5-s intervals for the 1/3-octave bands with center frequencies from 50 to 10,000 Hz. They also contain the test-day PNL, PNLT, and AL values. The center frequency, FMX in kHz, of the 1/3-octave-band sound pressure level that produced the largest tone-correction factor is also listed on the data pages. The magnitude of the tone-correction factor can be seen by subtracting the PNL from the PNLT value. A value of .0 for a sound pressure level means that the aircraft noise signal at that time for that band was not more than 5.0 dB greater than the corresponding background noise level (ambient noise + instrument noise).

The fifth, or final, data page also contains the values of the test-day PNLM, PNLTM, and ALM along with their relative times of occurrence. The value of the duration-correction factor, DCF, for the test-day EPNL is given with the relative times over which the PNLT integration was performed to find EPNL. Test-day EPNL is listed on the line below that with PNLM, PNLTM, and DCF. The last line on the fifth page contains ALM, SEL, and the relative times over which the AL values were integrated to find SEL.

The sixth page lists the test-day and reference-day meteorological data at the heights above ground level corresponding to the midpoints of the layers of the atmosphere defined by the heights in input data array HM(K). At the foot of the listings is the station barometric pressure; the air temperature, relative humidity, and molar concentration of water vapor interpolated at a height of 10.0 m from the actual measured data; and the corresponding uniform-atmosphere values for acoustical-reference-day conditions.

The final two pages contain the last two pages of summary output data. The seventh page contains the test-day SPLs at the time of occurrence of PNLTM, the corresponding reference-day SPLS adjusted by the four methods, and the corresponding PNL, PNL_T, and EPNL values. The eighth page contains similar data except at the time of occurrence of ALM with corresponding reference-day values of AL and SEL. At the foot of each page is the height of the airplane over the microphone and the sound propagation pathlength and directivity angle at the time of the test-day PNLTM or ALM.

MEASURED TEST DAY NOISE DATA FOR COMMERCIAL RT TRANSDUCER
 HC-9 10/1180 1 FLYOVER NOISE TESTS AT LEGEND AIR TERMINAL

TEST DATE: 25 OCT 74; MIC H1: 1.2 M; START TIME: 4414.0 S
 TIME H1: 4419.7 S; H1 CR: 150.0 M; AIR-REF: 01: 77.6 M/S; GND SURF: CONCRETE

CENTER FREQ., HZ	1/3-OCTAVE BAND SOUND PRESSURE LEVEL, DB RE 20 MICROPASCALS TIME RELATIVE TO START TIME, S													
	.0	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
63	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
80	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
100	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
125	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
160	.0	.0	.0	.0	.0	.0	.0	.0	.0	59.3	59.8	60.8	64.1	60.8
200	.0	.0	.0	.0	.0	.0	54.8	59.1	57.8	61.0	63.0	64.5	63.5	63.5
250	.0	.0	.0	.0	52.8	52.6	55.8	59.6	61.0	62.8	65.3	64.6	61.5	61.5
315	50.3	50.3	.0	.0	51.3	52.6	52.8	57.1	59.0	61.8	62.8	59.8	57.6	57.6
400	51.5	.0	.0	52.6	52.6	52.6	52.6	54.6	54.0	56.6	58.3	59.1	59.6	55.6
500	.0	40.0	50.1	55.1	54.6	53.0	52.8	49.8	51.1	52.3	54.6	55.6	55.5	51.3
630	.0	50.6	52.5	55.1	53.8	52.1	51.1	49.8	.0	50.1	51.5	56.1	61.5	58.8
800	.0	.0	48.8	48.8	.0	.0	51.8	51.1	.0	51.8	53.8	63.1	68.3	63.0
1000	51.5	50.6	50.3	50.6	51.3	49.8	53.0	54.6	54.3	59.5	60.8	64.6	72.3	67.6
1250	52.0	50.6	51.3	52.0	51.3	52.0	55.8	55.3	53.6	59.1	62.3	63.5	71.8	63.5
1600	49.1	.0	48.1	53.0	53.0	54.3	57.0	55.1	54.1	53.6	58.0	64.6	66.0	60.1
2000	47.8	46.8	48.1	51.1	51.1	55.8	56.8	56.3	55.8	53.1	58.3	63.6	68.5	62.6
2500	46.1	44.6	43.3	44.1	46.6	50.5	53.8	50.8	50.5	51.3	54.0	61.8	63.6	58.1
3150	43.8	41.8	43.8	43.8	43.8	46.1	46.8	46.3	46.1	42.6	51.0	56.8	59.6	56.3
4000	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	46.3	52.8	55.1	52.3
5000	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.8	44.8	44.3
6300	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
8000	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
10000	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
FM1-DB	67.0	66.2	67.4	70.3	70.8	73.4	75.4	75.3	74.3	75.2	78.6	81.3	86.9	81.9
FM1+DB	67.4	66.2	68.0	70.8	71.2	74.5	75.9	76.4	75.4	75.8	79.6	83.8	88.2	83.1
AL-DB	58.6	57.6	58.9	61.3	61.1	62.3	64.5	64.1	63.4	65.6	68.4	72.7	77.9	72.2
FMX-KB7	1.250	.050	2.000	2.000	1.600	2.000	2.000	2.000	2.000	1.250	1.250	4.000	2.000	2.000

FMX IS THE CENTER FREQUENCY, IN KHZ, OF THE 1/3 OCTAVE BAND THAT ENVELOPES F(C)
 C(C) IS THE FACTOR OF THE TONE CORRECTION FACTORS FOR THE CORRESPONDING SPECTRUM SP(C, D)

RUN NO.: 3282 MIC NO.: 4

DATA PAGE 2 OF 5

MEASURED TEST DAY NOISE DATA FOR COMMERCIAL JET TRANSPORT
 DC 9-102/JTP 1 FLYOVER NOISE TESTS AT FRESDO AIR TERMINAL

TEST DATE: 25 OCT 74; MIC NO: 1-2 H; START TIME: 44194.0 S
 TIME (H): 44199.7 S; H: 0H; 158.0 M; AIRSPEED (H): 72.6 M/S; GRND SURF: CONCRETE

CENTER FREQ., HZ	1/3 OCTAVE BAND SOUND PRESSURE LEVEL, DB RE 20 MICRO-PASCALS TIME RELATIVE TO START TIME, S													
	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
63	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
80	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	49.1	48.6	49.1	.0
100	.0	.0	.0	.0	.0	.0	.0	44.8	44.5	45.8	47.1	46.8	45.8	.0
125	44.0	.0	.0	.0	42.6	44.0	43.3	44.3	45.3	45.3	47.0	42.6	.0	.0
160	59.3	61.8	60.1	60.1	63.1	64.3	64.1	63.1	65.8	60.1	.0	60.8	63.8	49.6
200	61.6	62.1	62.1	63.5	64.0	59.3	62.3	59.3	57.3	55.8	60.3	68.3	71.3	75.6
250	61.3	60.3	61.0	61.3	60.3	57.1	55.3	54.8	57.5	64.1	60.1	71.5	74.6	73.5
315	57.6	54.6	54.6	55.0	52.6	52.1	57.6	62.1	65.6	71.0	74.0	72.0	73.6	70.1
400	52.6	.0	48.3	52.6	58.3	61.8	66.3	68.8	68.0	72.0	72.8	69.3	66.5	70.5
500	54.1	51.3	58.6	64.8	63.8	63.3	68.8	70.3	68.5	69.3	68.0	66.5	72.3	74.0
630	62.8	60.1	61.8	64.8	66.6	64.8	67.8	66.3	63.0	65.3	70.6	71.8	71.6	69.8
800	64.3	63.1	61.1	65.3	61.1	60.1	62.1	65.3	67.1	71.1	70.8	67.6	71.3	71.3
1000	67.6	64.6	59.5	62.3	59.8	65.6	69.3	71.3	65.6	67.1	68.6	69.6	70.1	70.6
1250	63.8	60.5	62.8	64.5	63.8	64.5	65.3	66.3	65.8	67.8	68.0	67.5	69.5	69.0
1600	64.0	66.0	62.6	62.8	60.3	62.8	67.0	68.6	64.5	68.5	68.5	66.6	69.0	69.5
2000	63.1	64.1	61.6	60.8	63.1	61.8	65.0	67.1	65.0	67.1	67.6	67.5	69.0	67.6
2500	60.1	59.3	58.3	58.1	58.1	59.1	63.3	63.3	61.6	65.8	65.1	64.1	67.8	67.3
3150	57.8	57.1	55.1	56.8	56.3	56.8	61.6	61.8	59.8	65.1	63.3	64.3	67.6	67.4
4000	55.1	57.3	57.6	58.3	57.3	58.6	62.8	63.1	62.8	67.3	62.6	67.6	69.8	70.6
5000	44.3	45.1	44.5	43.8	44.3	47.1	51.3	52.6	51.8	54.5	58.5	59.6	62.3	62.6
6300	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	50.0	54.8	56.1
8000	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
10000	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

FM 1-DB 83.1 82.6 81.4 82.3 83.0 82.8 84.4 82.8 86.5 90.1 91.6 91.0 93.0 93.2
 FM 1+DB 84.0 84.7 84.0 84.7 85.0 85.0 88.5 89.7 88.8 92.2 94.5 92.8 94.6 95.1
 AL-DB 73.3 72.5 70.9 72.6 72.0 72.7 76.1 72.5 75.3 78.4 79.2 78.4 80.5 80.5
 FMX-KH7 4.000 4.000 4.000 4.000 4.000 4.000 4.000 4.000 4.000 4.000 4.000 4.000 4.000 4.000 4.000

FMX IS THE CENTER FREQUENCY, IN KHZ, OF THE 1/3 octave band that includes C(1)
 C(1) IS THE LARGEST OF THE 10% CORRECTION FACTORS FOR THE CORRESPONDING SPECTRUM SPL(1,1)

RUN NO.: 378; MIC NO.: 4

DATA LOG 3 OF 5

MEASURED TEST DAY NOISE DATA FOR COMMERCIAL JET TRANSPORT
DC 9-10/78BP 1 FLYOVER NOISE TESTS AT FRESNO AIR TERMINAL

TEST DATE: 25 OCT 78; MIC HT: 1.2 M; START TIME: 44184.0 S
TIME ON: 44192.7 S; HT ON: 158.0 M; AIRSPEED ON: 72.6 M/S; GRND SURF: CONCRETE

CENTER FREQ., HZ	1/3 OCTAVE BAND SOUND PRESSURE LEVEL, DB RE 20 MICRODYNES/CM ²														
	TIME RELATIVE TO START TIME, S														
	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20.0	20.5	
50	.0	.0	74.8	.0	.0	.0	76.0	74.5	81.3	80.1	81.6	83.8	84.5	84.5	
63	.0	.0	.0	.0	.0	.0	.0	.0	78.5	81.3	82.8	83.3	84.6	82.6	
80	.0	.0	.0	.0	67.8	69.3	69.3	.0	70.0	79.1	81.8	83.1	86.0	85.8	
100	.0	.0	71.3	76.0	78.0	80.0	77.5	78.0	78.1	73.8	74.1	77.5	79.1	82.8	
125	69.6	72.8	79.0	82.0	81.6	84.0	85.1	85.1	82.6	81.0	74.8	72.3	71.0	72.6	
160	71.5	78.3	80.6	81.3	83.8	83.1	85.8	85.6	86.3	86.8	84.1	77.6	76.1	69.5	
200	75.3	78.1	79.1	77.1	77.1	76.6	82.6	87.6	87.8	89.1	87.1	82.8	82.1	78.3	
250	75.1	70.6	73.0	80.6	85.0	84.0	83.0	80.0	81.0	86.0	86.0	83.0	82.5	81.5	
315	70.5	72.0	81.5	83.0	83.1	85.0	86.1	87.5	84.5	78.1	76.1	78.0	79.0	79.6	
400	78.8	78.5	77.5	80.0	83.5	85.0	83.0	84.3	85.8	85.3	80.5	76.3	72.8	73.3	
500	76.5	77.8	80.8	80.8	81.8	82.3	85.3	84.8	81.0	81.0	78.3	78.0	79.3	73.0	
630	75.6	77.6	78.3	81.8	81.8	83.6	83.3	82.6	81.8	83.1	76.6	72.3	76.8	75.1	
800	74.3	76.1	77.8	80.3	80.8	82.8	83.1	81.3	80.1	80.1	74.8	73.8	75.3	71.3	
1000	74.1	76.6	76.6	79.3	80.3	81.1	81.6	81.6	78.8	78.3	75.3	72.1	72.3	71.3	
1250	74.3	76.0	77.3	79.8	80.8	81.3	82.0	81.0	77.3	77.8	73.5	71.5	71.5	71.8	
1600	74.1	76.5	78.1	79.5	80.0	79.5	82.5	78.5	76.5	75.5	72.5	69.1	70.5	69.6	
2000	73.5	75.5	76.6	77.6	79.0	79.1	81.1	79.6	77.5	75.5	71.6	68.1	69.6	68.1	
2500	72.3	75.8	78.8	79.8	81.6	82.8	84.3	81.3	79.6	78.1	75.8	73.3	75.8	73.6	
3150	73.8	79.6	83.1	85.6	86.6	88.1	86.8	83.6	81.6	79.6	76.3	72.1	73.3	71.1	
4000	78.1	87.1	85.6	87.3	87.3	84.1	85.6	83.6	79.1	76.6	74.1	60.3	70.8	68.3	
5000	67.6	71.8	74.1	78.6	80.8	82.8	82.8	80.1	77.6	73.8	70.6	64.8	67.3	64.6	
6300	63.3	68.0	73.3	76.8	79.0	80.3	81.3	77.5	73.3	70.3	66.5	55.8	61.8	58.3	
8000	57.8	67.8	71.3	73.3	74.8	76.8	77.1	73.1	67.8	64.0	59.1	52.3	54.1	.0	
10000	.0	56.0	59.1	62.6	66.3	67.6	68.3	64.6	59.0	54.3	49.8	.0	.0	.0	
FMT, DB	99.5	105.7	106.7	107.1	108.3	109.6	109.6	107.4	107.4	105.6	104.3	101.3	98.0	99.6	97.6
FMTH, DB	101.6	109.5	108.5	108.6	109.9	111.1	110.0	107.8	106.1	104.8	102.0	99.1	101.0	98.9	
GM, DB	85.7	90.7	91.3	92.3	93.4	94.6	95.1	93.1	91.1	90.3	87.0	84.0	87.2	83.2	
FMX, DB	4.000	4.000	3.150	3.150	3.150	3.150	4.000	3.150	3.150	3.150	2.500	2.500	2.500	2.500	

FMX IS THE CENTER FREQUENCY, IN KHZ, OF THE 1/3 OCTAVE BAND THAT PRODUCES C(1)
C(1) IS THE LARGEST OF THE TIME CORRECTION FACTORS FOR THE CORRESPONDING SPECTRUM SET (1-3)

DATA PAGE 4 OF 5

RUN NO.: 3781 MIC NO.: 4

MEASURED TEST DAY NOISE DATA FOR COMMERCIAL JET TRANSPORT
MC-9-10/JT80-1 FLYOVER NOISE TESTS AT FRESNO AIR TERMINALTEST DATE: 25 OCT 74; MIC HI: 1.2 HI; START TIME: 14184.0 S
TIME OH: 44199.7 S; HI OH: 158.0 HI; AIRSPEED OH: 77.6 M/S; GRND SURF: CONCRETE

CENTER FREQUENCY	1/3-OCTAVE-BAND SOUND PRESSURE LEVEL, IN RE 20 MICRO-PASCALS									
	TIME RELATIVE TO START TIME, S									
HZ	21.0	21.5	22.0	22.5	23.0	23.5	24.0	24.5	25.0	25.5
50	85.6	83.1	83.0	82.1	83.0	78.8	81.3	79.3	77.6	77.6
63	86.5	84.8	81.8	85.6	83.8	79.8	81.6	82.1	77.6	75.3
80	86.0	87.3	85.3	85.8	83.1	82.8	81.3	84.0	76.8	79.8
100	84.1	84.3	85.1	81.8	83.6	82.6	80.0	82.6	82.1	78.5
125	74.1	76.6	77.6	79.6	81.0	80.5	78.1	78.5	79.0	75.8
160	67.3	64.8	69.1	70.0	71.1	73.1	73.5	73.5	75.1	71.0
200	71.6	68.1	63.0	59.3	61.0	62.1	65.6	67.1	67.3	66.1
250	80.0	72.1	68.6	63.3	63.6	62.8	60.6	59.1	57.6	57.6
315	80.5	76.5	72.6	69.6	68.1	68.6	66.1	69.0	62.6	59.3
400	75.8	72.8	70.5	69.0	69.3	69.5	68.8	71.5	67.3	63.3
500	70.3	66.0	65.3	65.8	66.8	69.0	67.0	70.8	66.3	66.8
630	76.6	68.3	64.5	59.8	60.3	62.5	64.3	66.8	62.5	64.0
800	70.8	67.8	64.3	61.1	62.5	67.0	59.1	60.6	54.8	55.8
1000	72.8	66.8	62.3	58.5	59.3	61.5	63.8	66.3	60.3	55.6
1250	71.3	65.8	64.5	60.5	62.3	58.8	58.3	64.0	59.1	59.8
1600	68.6	63.6	61.3	57.8	57.3	56.8	59.8	64.6	57.0	51.3
2000	68.6	63.6	60.6	58.1	56.8	56.0	58.1	63.6	56.0	51.3
2500	73.6	67.3	66.3	60.8	60.3	59.6	62.1	66.1	58.3	52.1
3150	71.3	64.8	63.1	58.1	56.6	56.3	58.8	62.1	54.6	54.3
4000	68.6	62.1	59.3	53.8	54.3	51.6	53.3	56.3	49.5	47.5
5000	64.3	57.0	54.1	49.1	48.6	47.3	47.3	49.8	44.3	44.3
6300	58.1	50.3	.0	.0	.0	.0	.0	.0	.0	.0
8000	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
10000	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
FWL-DR	92.7	93.2	91.6	89.6	89.6	88.8	88.2	90.7	87.5	85.0
FWL-T-DR	98.9	94.2	93.1	90.5	91.0	90.0	89.4	91.8	88.5	87.1
AL-DR	83.4	78.3	76.1	73.6	73.8	73.8	71.8	76.6	72.2	71.4
FWL-AHZ	2.500	2.500	2.500	1.250	2.500	2.500	2.500	2.500	1.250	2.500

FWL IS THE CENTER FREQUENCY, IN kHz, OF THE 1/3 OCTAVE BAND THAT INCLUDES F(1)
F(1) IS THE LARGEST OF THE FOUR CORRECTION FACTORS FOR THE CORRESPONDING SECTION 501 (1.1)

RUN NO.: 3785 MIC NO.: 4

MEASURED TEST DAY NOISE DATA FOR COMMERCIAL RT TRASHOUT
IN 2 10/1000 1 FLYOVER NOISE TESTS AT FRESH AIR TERMINAL

TEST DATE: 25 OCT 74; MIC H11 1.2 M; START TIME: 44184.0 S
TIME H01: 44199.7 S; H11 H01: 158.0 M; AIRSPEED H01: 22.6 M/S; GRND SURF: CONCRETE

CENTER FREQ. HZ	1/3 OCTAVE BAND SOUND PRESSURE LEVEL, DB RE 20 MICROPAAS									
	TIME RELATIVE TO START TIME, S									
	28.0	30.5	33.0	35.5	38.0	40.5	43.0	45.5	48.0	50.5
50	24.1	.0	.0	.0	.0	71.8	.0	.0	73.3	73.0
63	23.8	21.6	.0	.0	.0	70.8	.0	71.5	.0	.0
80	24.1	20.6	21.8	.0	.0	.0	72.8	69.3	68.5	.0
100	23.0	20.6	20.1	65.3	66.8	68.8	67.1	68.4	68.6	69.5
125	20.5	21.5	66.6	65.8	.0	62.6	64.6	63.0	68.1	66.3
160	65.1	64.8	63.0	62.1	59.8	.0	58.8	61.3	64.3	64.6
200	61.0	57.6	59.6	.0	.0	55.1	.0	56.1	61.0	58.8
250	58.8	57.1	53.8	.0	.0	.0	52.6	52.6	56.6	58.0
315	51.6	51.3	50.3	.0	.0	.0	51.3	52.6	56.6	55.6
400	49.6	.0	.0	.0	.0	.0	.0	.0	50.3	54.0
500	58.1	56.6	52.5	48.1	47.3	.0	.0	.0	.0	.0
630	61.0	59.3	57.8	51.8	50.6	.0	50.6	52.6	.0	.0
800	62.1	59.1	57.6	55.1	51.8	51.1	50.8	52.6	50.6	.0
1000	55.1	56.1	54.1	53.1	51.8	50.6	50.1	52.6	50.3	.0
1250	54.1	52.6	48.8	45.8	.0	46.1	46.8	50.0	48.8	47.6
1600	54.1	52.6	48.3	.0	.0	.0	.0	.0	.0	.0
2000	48.1	.0	.0	.0	.0	.0	.0	.0	.0	.0
2500	53.0	51.0	48.1	47.8	45.0	46.3	47.3	47.1	43.8	43.3
3150	49.1	47.6	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8
4000	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8
5000	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3
6300	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
8000	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
10000	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
FM H01	29.9	27.6	24.8	62.5	62.1	68.3	70.1	72.6	73.6	72.3
FM H02	81.3	27.6	24.8	62.5	62.1	68.3	70.1	72.6	73.6	72.3
AL H01	67.1	65.4	63.3	60.3	57.9	57.7	58.4	60.4	61.0	59.4
FMX-H07	2.500	.050	.050	.050	.050	.050	.050	.050	.050	.050

FMV IS THE CENTER FREQUENCY, IN HZ, OF THE 1/3 OCTAVE BAND THAT INCLUDES F(1)
F(1) IS THE LARGEST OF THE TONE CORRECTION FACTORS FOR THE CORRESPONDING SPECTRUM SP(1,1)

FROM- 109.6 DB AT 17.0 M; TO H01 111.1 DB AT 16.5 M; H01 112.6 DB FROM 14.0 TO 12.0 S
FROM- 109.6 DB AT 17.0 M; TO H02 111.1 DB AT 16.5 M; H02 112.6 DB FROM 14.0 TO 12.0 S
AL H01 109.6 DB AT 17.0 M; TO H01 111.1 DB AT 16.5 M; H01 112.6 DB FROM 14.0 TO 12.0 S

RUN NO.: 378; MIC NO.: 4		METEOROLOGICAL DATA			PAGE 1 OF SUMMARY		
HEIGHT AT MIDPOINT OF INTERVAL, M	MEAS. TEMP. OVER HEIGHT INTERVAL, C	MEAS. R.H. OVER HEIGHT INTERVAL, PCT.	MEAS. MOLAR CONC. OF WATER VAPOR, PCT.	REF. TEMP. AT MID. OF INTERVAL, C	REF. R.H. AT MID. OF INTERVAL, PCT.	REF. MOLAR CONC. OF WATER VAPOR, PCT.	
15.8	20.4	47.9	1.142	25.0	70.0	2.186	
45.8	20.3	47.5	1.126	24.8	69.8	2.162	
74.3	20.1	47.4	1.114	24.6	69.6	2.138	
106.8	19.7	48.9	1.116	24.4	69.4	2.115	
137.3	19.3	50.6	1.129	24.2	69.2	2.091	
167.8	19.0	51.4	1.128	24.0	69.0	2.068	
198.3	18.8	51.5	1.115	23.8	68.8	2.045	
228.8	18.7	51.8	1.110	23.6	68.6	2.022	
259.3	18.5	51.9	1.100	23.4	68.4	2.000	
289.8	18.3	50.9	1.066	23.2	68.2	1.978	
320.3	18.1	50.6	1.046	23.0	68.0	1.955	
350.8	17.9	50.8	1.039	22.8	67.8	1.933	
381.3	17.8	50.1	1.020	22.6	67.6	1.912	
411.8	17.6	50.0	1.004	22.4	67.4	1.890	
442.3	17.6	49.5	.991	22.2	67.2	1.869	
472.8	17.5	49.0	.978	22.0	67.0	1.848	
503.3	17.3	49.3	.971	21.8	66.8	1.827	
533.8	17.3	48.8	.956	21.6	66.6	1.806	
564.3	17.3	47.1	.921	21.4	66.4	1.785	
594.8	17.3	45.1	.887	21.2	66.2	1.765	
625.3	17.5	45.6	.909	21.0	66.0	1.745	
655.8	17.9	46.8	.954	20.8	65.8	1.725	
686.3	17.9	45.3	.925	20.6	65.6	1.705	
716.8	17.8	44.3	.902	20.4	65.4	1.685	
747.3	17.8	45.8	.929	20.2	65.2	1.666	
777.8	17.5	47.5	.945	20.0	65.0	1.647	
808.3	17.2	48.4	.944	19.8	64.8	1.627	
838.8	16.9	48.9	.939	19.6	64.6	1.609	
869.3	16.7	49.4	.935	19.4	64.4	1.590	
899.8	16.4	50.2	.934	19.2	64.2	1.571	

STATION BAROMETRIC PRESSURE = 100.472 KPA (.992 STD. ATM.)

MEAS. AIR TEMP. = 20.5 DEG C; MEAS. REL. HUM. = 47.0 PCT; MEAS. MOLAR CONC. = 1.146 PCT
 REF. AIR TEMP. = 25.0 DEG C; REF. REL. HUM. = 70.0 PCT; REF. MOLAR CONC. = 2.18774 PCT

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F/G 20/1

EVALUATION OF ALTERNATIVE PROCEDURES FOR ATMOSPHERIC ABSORPTION--ETC(U)

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DATE
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TEST-DAY NOISE DATA ADJUSTED TO ACQUISITION REFERENCE DAY CONDITIONS

PC-9-10/J18R-1 FLYOVER NOISE TESTS AT PLESMO AIR TERMINAL

REF. - DAY COND.1 AIR TEMP = 25.0 C1 REL HUM = 70.0 PCT1 PRESS = 1.0 STD ATM

BAND CENTER FREQ., HZ	(A)		(B)		(C)		(D)		(E)	
	TEST SPL, DB	ADJ. SPL, DB	TEST SPL, DB	ADJ. SPL, DB	TEST SPL, DB	ADJ. SPL, DB	TEST SPL, DB	ADJ. SPL, DB	TEST SPL, DB	ADJ. SPL, DB
50	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0
80	69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.3
100	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
125	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
160	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1
200	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6	76.6
250	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
315	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0
400	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0
500	82.3	82.3	82.3	82.3	82.3	82.3	82.3	82.3	82.3	82.3
630	83.6	83.6	83.6	83.6	83.6	83.6	83.6	83.6	83.6	83.6
800	82.8	82.7	82.7	82.7	82.7	82.7	82.6	82.6	82.6	82.6
1000	81.1	81.0	81.0	81.0	81.0	81.0	80.9	80.9	80.9	80.9
1250	81.3	81.2	81.2	81.2	81.2	81.2	81.0	81.0	81.0	81.0
1600	79.5	79.4	79.4	79.4	79.4	79.4	79.2	79.2	79.2	79.2
2000	79.1	79.0	79.0	79.0	79.0	79.0	78.9	78.9	78.9	78.9
2500	82.8	82.8	82.8	82.8	82.8	82.8	82.8	82.8	82.8	82.8
3150	88.1	88.3	88.3	88.3	88.3	88.3	88.5	88.5	88.5	88.5
4000	84.1	84.7	84.7	84.7	84.7	84.7	85.1	85.1	85.1	85.1
5000	82.8	83.9	83.9	83.9	83.9	83.9	84.8	84.8	84.8	84.8
6300	80.3	82.3	82.3	82.3	82.3	82.3	83.8	83.8	83.8	83.8
8000	76.8	80.4	80.4	80.5	80.5	80.5	82.4	82.4	82.4	82.4
10000	67.6	73.6	73.6	73.7	73.7	73.7	76.4	76.4	76.4	76.4
FMI, DB	109.6	110.0	110.0	110.0	110.0	110.0	110.3	110.3	110.3	110.3
FMT, DB	111.1	111.5	111.5	111.5	111.5	111.5	111.8	111.8	111.8	111.8
FFWL, DB	105.6	105.9	105.9	105.9	105.9	105.9	106.2	106.2	106.2	106.2
FMX, KHZ	3.150	3.150	3.150	3.150	3.150	3.150	3.150	3.150	3.150	3.150

COLUMN COMMENTS

(A) TEST-DAY SPLS AT TIME OF TEST-DAY FNLTH + ASSOCIATED INTEGRATED NOISE MEASURES.

(B) TEST-DAY SPLS ADJUSTED TO ACQUISITION REFERENCE DAY CONDITIONS + ASSOCIATED MEASURES. ADJUSTMENTS MADE USING:

- (B) 10-M NET, DATA AND SAF ARE R66A1
- (C) LAYERED NET, DATA ALOFT AND SAF ARE R66A1
- (D) LAYERED NET, DATA ALOFT AND ABSORPTION BY ANS 51.26 1978 INTEGRATED OVER PASSBAND
- (E) LAYERED NET, DATA ALOFT AND ABSORPTION BY ANS 51.26-1978 AT BAND CENT. FREQ. ONLY.

AIRPLANE HEIGHT OVER MICROPHONE - 156.8 M
SOUND PROPAGATION PATHLENGTH FOR TEST SPLS AT FNLTH - 162.3 M
SOUND PROPAGATION ANGLE RELATIVE TO DIRECTION OF FLIGHT - 105.0 DEG AT FNLTH

RUN NO.: 378) MIC NO.: 4 AL AND REF PAGE 3 OF SUMMARY

TEST-DAY NOISE DATA ADJUSTED TO ACQUISITION REFERENCE- DAY CONDITIONS

IC-9-10/JRB-1 FLYOVER NOISE TESTS AT GRESSO AIR TERMINAL
REF-DAY COND.: AIR TEM = 25.0 C; REL HUM = 70.0 PC; PRESS = 1.0 STD ATM

BAND CENTER FREQ., HZ	(A) DR	(B) ADJ. SPL, DR	(C) ADJ. SPL, DR	(D) ADJ. SPL, DR	(E) ADJ. SPL, DR
50	76.0	76.0	76.0	76.0	76.0
63	0	0	0	0	0
80	69.3	69.3	69.3	69.3	69.3
100	77.5	77.5	77.5	77.5	77.5
125	85.1	85.1	85.1	85.1	85.1
160	85.8	85.8	85.8	85.8	85.8
200	82.6	82.6	82.6	82.6	82.6
250	83.0	83.0	83.0	83.1	83.1
315	86.1	86.1	86.1	86.2	86.2
400	83.0	83.0	83.0	83.0	83.0
500	85.3	85.3	85.3	85.3	85.3
630	83.3	83.2	83.2	83.2	83.2
800	83.1	83.0	83.0	82.9	82.9
1000	81.6	81.5	81.5	81.3	81.3
1250	82.0	81.9	81.9	81.7	81.7
1600	82.5	82.4	82.3	82.2	82.2
2000	81.1	81.0	81.0	80.9	80.9
2500	84.3	84.3	84.3	84.3	84.3
3150	86.8	87.0	87.0	87.2	87.2
4000	85.6	86.3	86.3	86.6	86.6
5000	82.8	83.8	83.9	84.9	84.9
6300	81.3	83.4	83.5	85.0	85.1
8000	77.1	81.0	81.1	83.1	83.4
10000	68.3	74.8	74.8	77.8	78.3
AL, DR	95.1	95.5	95.5	95.9	95.9
SEL, DR	99.7	100.0	100.1	100.4	100.4

CHUHN CODES:

(A) TEST-DAY SPLS AT TIME OF TEST-DAY ALM + ASSOCIATED INTEGRATED NOISE MEASURES.

THEN, TEST-DAY SPLS ADJUSTED TO ACQUISITION REFERENCE DAY CONDITIONS + ASSOCIATED MEASURES. ADJUSTMENTS MADE USING:

(B) 10-M MET. DATA AND SAE ARP 866A1

(C) LAYERED MET. DATA ALDFT AND SAE ARP 866A1

(D) LAYERED MET. DATA ALDFT AND ABSORPTION BY

ANS S1-26-1978 INTEGRATED OVER PASSBAND

(E) LAYERED MET. DATA ALDFT AND ABSORPTION BY

ANS S1-26-1978 AT BAND CENT. FREQ. 0M Y.

AIRPLANE HEIGHT OVER MICROPHONE = 156.8 M

SOUND PROPAGATION PATHLENGTH FOR TEST SPLS AT ALM = 174.1 M

SOUND PROPAGATION ANGLE RELATIVE TO DIRECTION OF FLIGHT = 115.8 DEG AT ALM