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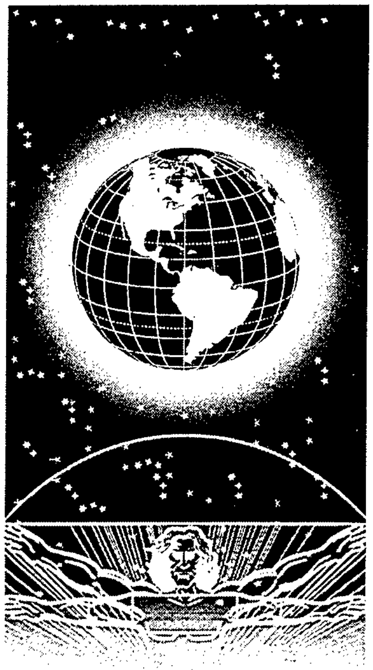

UNITED STATES AIR FORCE RESEARCH LABORATORY

NMAP 7.0 User's Manual

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FOR THE COMMANDER

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NMAP 7.0 is the most current version of the Department of Defense (DOD) computer program suite for the modeling of aircraft noise from aircraft flight and static events at an airbase. This report describes the features of the NOISEMAP (NMAP) 7.0 computer program and its operation. The entire suite encompassed by NMAP 7.0 includes several different programs. The three primary IBM-compatible PC-based programs in the suite are BASEOPS 7.0, NMAP 7.0, and NMPLOT 4.2. The report shows the relationship of these primary programs to the other secondary programs, as well as the conceptual flow of data. BASEOPS is used to enter all aircraft operational data including number of flight and static events, flight and static profiles, flight tracks, etc. NMAP is the computational module. This module accepts the data entered in the BASEOPS program, and estimates noise levels caused by aircraft events at many points on the ground in the airbase vicinity. NMPLOT is used to draw lines of equal noise level (noise contours) to determine the overall noise exposure and related environmental impacts (from aircraft and other sources).

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Introduction 1

Overview

The purpose of this report is to describe the features of the NOISEMAP (NMAP) 7.0 computer program and its operation. NMAP 7.0 is the most current version of the Department of Defense (DOD) computer program suite for the modeling of aircraft noise from aircraft flight and static events at an airbase.

The entire suite encompassed by NMAP 7.0 includes several different programs. The three primary IBM-compatible Personal Computer (PC)-based programs in the suite are BASEOPS 7.0, NMAP 7.0, and NMPLOT 4.2. Figure 1-1 shows the relationship of these primary programs to the other secondary programs, as well as the conceptual flow of data. BASEOPS is used to enter all aircraft operational data including number of flight and static events, flight and static profiles, flight tracks, etc. NMAP is the computational module. This module accepts the data entered in the BASEOPS program, and estimates noise levels caused by aircraft events at many points on the ground in the airbase vicinity. NMPLOT is used to draw lines of equal noise level (noise contours) to determine the overall noise exposure and related environmental impacts (from aircraft and other sources).

Manual Layout

Chapter 1 summarizes the report. Chapter 2 highlights the differences between Version 7.0 and the previous version of NMAP – Version 6.5. Chapter 3 reviews the features of the program, and Chapter 4 describes the program's operation. The files RUN, OPX, LOG, and POI mentioned in Chapters 2 and 4 are the subjects of Appendices A through D, respectively. Appendix E describes the topography files (ELV, IMP).

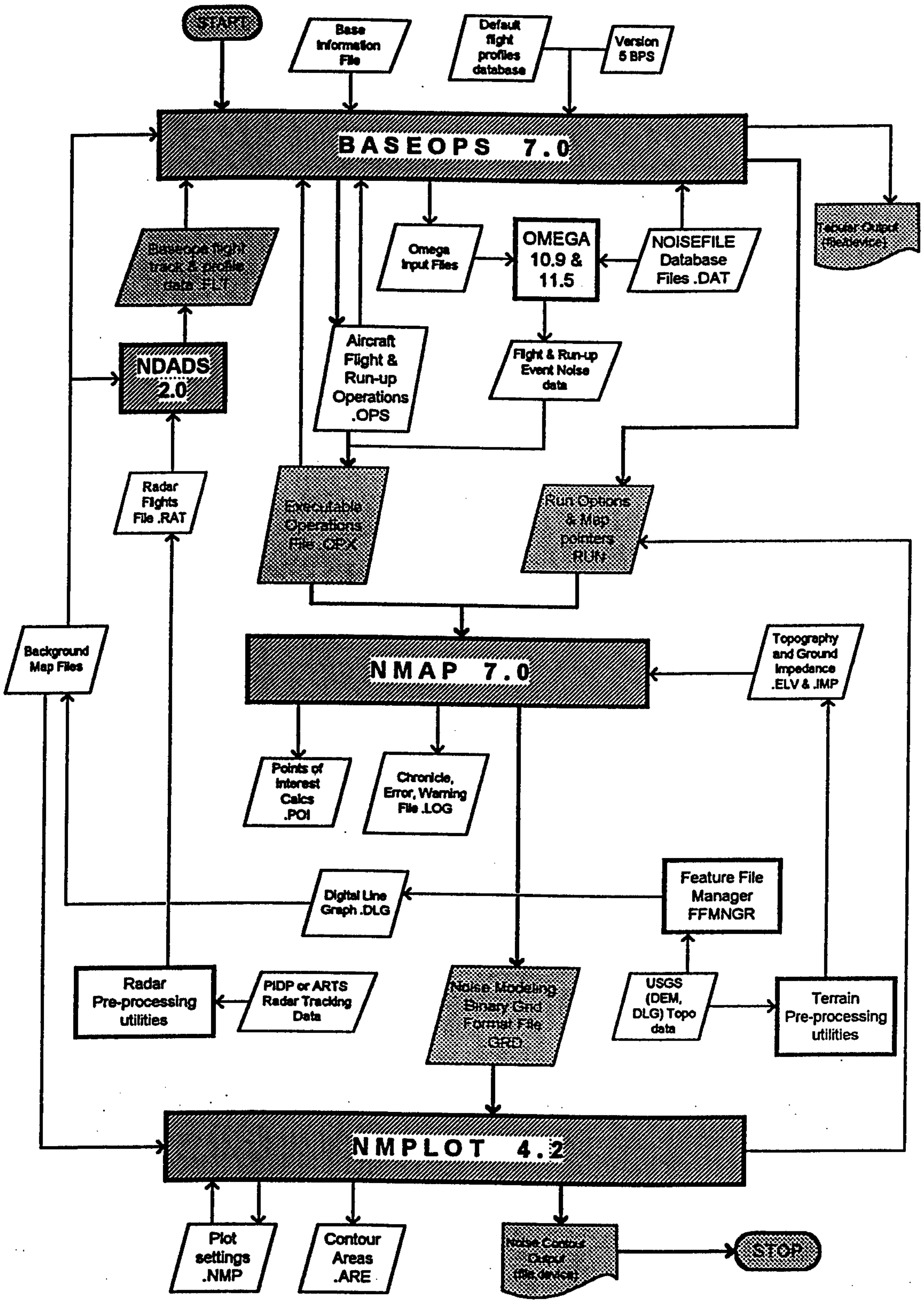

Figure 1-1. NOISEMAP 7.0 Flowchart

Version Differences 2

This chapter acquaints the user experienced with previous versions of the NMAP computer program, with an overview of recent changes to the program.

2.1 Primary Differences

Three primary differences exist between NMAP 7 and previous NMAP versions:

- The user is no longer restricted to a fixed 100-X-100 noise grid, but can specify the size of the grid to be computed.
- NMAP 7 is now a Microsoft® Windows®-based program so that it can mate with BASEOPS 7.0 and NMPLOT 4.2, which are also Windows programs with Windows graphical user interfaces.
- NMAP 7 allows for modeling the effects of topography and ground impedance.[1]

2.2 Secondary Differences

The following summarizes the secondary differences between NMAP 7 and earlier versions.

- Most NMAP 6.1–6.5 programs are executed through the use of the Master Control Module (MCM) program. Although the method of executing NMAP 7 from a DOS command line has been retained, the MCM program has been deleted and its functionality changed to the new BASEOPS program. As such, the command line of the NMAP program has been simplified from including the NMAP input (NMI) file, Chronicle (CRO) file, and Grid (GRD) file to include only the name of one new input file – the RUN file. A new feature of the RUN file is that it now allows you to name the directory from which the NMAP program will read its input and to which it will write its output. The RUN file also allows you to name the output files rather than having them named by NMAP 6.5's MCM. Chapter 4 discusses the RUN file in detail.
- The Operations (OPX) file replaces the NMI file. The OPX file format is a hybrid of the NMI and Version 5.0 BASEOPS Source (BPS) files. The LOG file replaces the informational content and purpose of the Chronicle. The format and file type of the GRD file has been changed from an ASCII file to the NMPLOT Binary Grid File (NMBGF) format.[2] The name of the SPO file

has been changed to POI (Points-of-Interest), and its format has been modified slightly. Chapter 4 provides further discussion of all these file formats.

Ranking of contributors to the overall noise level at points of interest in the POI file can be automatically sorted by either the daily noise metric or by the event noise metric. If NMAP 7 is executed a second time with an identical RUN file, the LOG, POI, and GRD files are overwritten rather than appended.

- **Regarding the RUN and OPX files, NMAP relies heavily on BASEOPS for error checking of input data. If you create your own RUN and OPX files, you should import them into BASEOPS for error checking before executing NMAP.**
- Functionally, NMAP 7 can also be interactively executed from within the NMPLOT program for refining noise contours (by interactively defining supplementary grids) and/or determining noise levels and the aircraft contributing thereto at points of interest to the user (by defining alternative points).
- In addition to the modeling of departures, arrivals, and closed patterns, NMAP 7 is capable of modeling interfacility events such as those from Air Stations to Outlying Landing Fields. Section 3.3 provides additional interfacility event information.
- To implement the new file formats and functionality, the NMAP FORTRAN code has been significantly restructured. For example, NMAP 6.5 computed noise levels by reading certain keywords in the NMI file. In contrast, NMAP 7 reads the entire OPX file and then computes noise levels.
- For pre-flight and maintenance run-ups, NMAP 7 provides more refined noise exposure estimation of run-ups by utilizing 19 angles to define the run-up noise directivity pattern. NMAP 6.5 utilizes only nine angles.
- Takeoff roll calculations, in terms of initial directivity and acceleration modeling, have also been refined. BASEOPS 7 ensures that a directivity pattern is applied to every military aircraft except helicopters (whether from measured run-up data in NOISEFILE or via substitution of like aircraft). This has made the 'default' military directivity in NMAP 6.5 obsolete. For helicopters, no initial takeoff directivity is applied. For civilian aircraft, the number of angles used to define the initial directivity on takeoff roll is increased from 9 in NMAP 6.5 to 19 in NMAP 7. The acceleration part of the takeoff roll model has been refined for NMAP 7 by the implementation of an additional segment. NMAP 6.5 uses the 0, 2/3, and 1 fractions of the takeoff roll to model the acceleration. NMAP 7 adds the 1/3 fraction of takeoff roll to this set.
- NMAP 7 correctly applies the altitude thrust adjustment described in Section 3.5. The correct implementation causes NMAP 7 exposure levels to be 0.2 dB per 1,000 feet in flight altitude lower than those in NMAP 6.5.

- For contributors to each POI, NMAP 6.5 reports the absolute minimum slant distance, called the Point of Closest Approach (PCA), of all subflights (and the associated altitude). The reported power setting in NMAP 6.5 is that of the subflight at maximum noise exposure, and the reported airspeed is always 160 knots. To make the reported data more consistent, NMAP 7 reports the aircraft's slant distance, altitude, power setting, and airspeed at the PCA.
- In the non-topographic mode, Z coordinates of POI, Runways, and Static Pads are not ignored. They are used for slant distance calculations. Their effect, however, is minimized since the elevation of the 'flat-earth' is set equal to the elevation of the Airfield Reference Point (ARP) plus five feet.
- Regarding the topography and impedance algorithms of NMAP 7, Version 6.5 considers the ground in the vicinity* of the airbase of interest to be flat and have a uniform impedance similar to that of grass-covered ground. Recent research[1] and dramatic increases in speed of PCs have led to the development of computational algorithms based on the theory of outdoor sound propagation to account for varied terrain and terrain surface. These algorithms have been validated with an extensive measurement program[1] and continue to be studied by the scientific community. For implementation of the algorithms, most of the data in the OPX file has been augmented to allow for entry of altitude or elevation. All altitudes/elevations, except those for POI, are entered and stored in the OPX file in feet relative to Mean Sea Level (MSL). POI elevations are entered and stored in the OPX file as feet relative to Above Ground Level (AGL). Note also that although the algorithms are optimized for A-weighted sound levels, they are also applied to the Perceived Noise Levels (PNL) used in the Noise Exposure Forecast (NEF) and Weighted Effective Continuous Perceived Noise Level (WECPNL) calculations.
- If topography mode is invoked and the terrain is specified to be flat and soft, contours may differ from the results for NMAP's standard non-topographic mode. This is because the ground effects model in the topographic mode is more sophisticated than the standard lateral attenuation model, accounting for receiver height as well as source elevation angle. For example, consider the case of flat, soft ground adjacent to the beginning of an aircraft's takeoff roll. The non-topographic mode produces sideline exposure levels, along the ground roll, approximately 7 dB greater than in topographic mode.
- Lastly, topography calculations, when requested, significantly increase the execution time of the program. For typical cases, you should expect run times to increase by one order of magnitude from their value to equivalent non-topographic calculations.

*Vicinity means within approximately a 20-mile radius of the facility.

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Features 3

This chapter summarizes the computational features of the NMAP 7.0 program. Noise metrics, lateral sound attenuation, modeled aircraft events, airspeed correction, altitude thrust adjustment, grid calculations, Points-of-Interest (POI) calculations, takeoff roll modeling, and topography and ground impedance are the topics of Sections 3.1 through 3.9, respectively.

3.1 Noise Metrics

NMAP 7 computes five noise metrics: Day-night Average Sound Level (DNL), Community Noise Equivalent Level (CNEL), 24-hour Equivalent Sound Level (LEQ), Noise Exposure Forecast (NEF), and Weighted Effective Continuous Perceived Noise Level (WECPNL). DNL and CNEL are common metrics used in the United States, NEF is common in Canada, and WECPNL is a common noise metric in Europe and Japan. Moulton[3] lists the equations for these metrics as implemented in the NMAP program.

3.2 Lateral Sound Attenuation

For cases in which topography and ground impedance calculations are not requested, NMAP 7 utilizes the lateral attenuation algorithms described in Reference 4 for civilian jet and propeller-driven aircraft (not "based" or "transient") and in Reference 5 for military ("based" and "transient") jet and propeller-driven aircraft and helicopters.

Note that NMAP and its Federal Aviation Administration (FAA) counterpart, the Integrated Noise Model (INM), apply Reference 4's lateral attenuation algorithms to propeller aircraft even though Reference 4 states that its lateral attenuation should not be applied to propeller aircraft.

3.3 Modeled Aircraft Events

NMAP 7 models two categories of aircraft events, flight and static. The following sections describe these events.

3.3.1 Modeled Flight Events

Four basic event types comprise the modeled flight events:

Departure – A fully modeled departure event is one in which an aircraft performs a pre-flight run-up (described in Section 3.3.2), accelerates on the ground, lifts off the runway, and exits the vicinity of the airfield.

Arrival – An arrival event is one in which an aircraft enters the vicinity of the airfield, descends, and configures itself to land on a runway. The modeling of an arrival does not include the ground roll where the aircraft decelerates to a full stop.

Closed Pattern – A closed pattern event is one in which the aircraft's ground track resembles that of a closed circuit or closed loop. A closed pattern typically begins with an aircraft completing an arrival as described previously, maintaining a designated pattern altitude while traveling the first few legs of the circuit, and reconfiguring the aircraft for its final approach.

Interfacility – An interfacility event is similar to a closed pattern except that its ground track is not a circuit. The ground track of an interfacility event originates at the home airfield and ends at a nearby (remote) airfield (or vice versa). Military aircraft typically use remote airfields for training purposes.

3.3.2 Modeled Static Events

Modeled static events are ground-based pre-flight and maintenance run-ups. A 'run-up' event consists of a stationary aircraft or aircraft engine running at a potentially high-power setting either outdoors or inside an acoustical enclosure for a given amount of time.

Pre-flight – A pre-flight run-up is typically conducted when an aircraft is readying for takeoff at the threshold of a runway prior to brake release.

Maintenance – A maintenance run-up is conducted for purposes of aircraft/engine testing and occurs at designated locations on the airfield.

3.4 Airspeed Correction

To minimize the size of its input file, NMAP 7 requires all reference noise data to be normalized to 160 knots indicated airspeed. NMAP contains a simple algorithm to correct the 160-knot airspeed data to the airspeed requested by the user:

$$\text{Airspeed Adjustment} = -10 * \log_{10} (V/160)$$

where V is the airspeed in knots. NOISEMAP's (and INM's) use of indicated airspeed is another approximation to the true groundspeed. The approximation weakens for high and/or hot airports or airports averaging more than 8 knots of headwind.[6]

3.5 Adjustment of Noise Levels Caused by Non-reference Altitude

The reference noise data input to NMAP is normalized to sea-level conditions. When an aircraft ascends above 1000 feet (ft) above Mean Sea Level (MSL), a correction is applied to correct the reference noise data. The correction effectively decreases the reference noise data by 2 dB per 10,000 ft. The correction assumes that noise output is reduced as effective thrust decreases and effective thrust decreases with altitude.[7]

The formula for the adjustment is

$$\text{Altitude thrust adjustment} = \log_{10}^{-1} [0.00002 * (1000\text{-alti})]$$

Where *alti* is the aircraft altitude in ft MSL.

3.6 Grid Calculations

The noise gridding algorithm is described in Section 2.3.2 of Reference 3. It consists primarily, of locating the grid point nearest the beginning of the flight track, and continuing to neighboring grid points until a built-in noise threshold is reached. The thresholds built into NMAP 7 are 35 dB for DNL, CNEL, and WECPNL calculations and 0 dB for NEF. The thresholds make for efficient execution times of the NMAP program.

3.7 POI Calculations

POI calculations are identical to those performed for grid points except that the grid thresholds mentioned in Section 3.6 do not apply. It is because of these grid thresholds that overall noise levels for POI can be different (more precise) than those for grid points.

3.8 Takeoff Roll Modeling

The takeoff roll modeling of any aircraft in NMAP is accomplished via two parts: initial directivity (via a specified or default pre-flight run-up), and an acceleration model. These are fully described by Mills[8] and Moulton[9]. One characteristic worth noting is that military fixed-wing aircraft can have higher noise exposure along the takeoff roll than their civilian counterparts (e.g., KC-10 and DC-10) because of the application of the acceleration to military fixed-wing aircraft only.

3.9 Topography and Ground Impedance

The program has the capability of accounting for ground cover and topographical features. This feature uses the methodology developed by the NATO/CCMS Working Group on Topography[1,10,11]. The following situations are treated:

Flat ground

(a) hard or soft surfaces

(b) a mixture of hard and soft surfaces

Valley – where the aircraft is over one flat area and the receiver is over another, the two forming a gentle "V".

Hill – where a high spot occurs between aircraft and receiver. The high spot can be a wedge or a vertical wall. Flat terrain can be on either or both sides of the hill.

The algorithms require specification of receiver height above the ground. This is taken to be five feet, a nominal ear height for a standing person.

When this feature is selected, NMAP requires actual terrain data for the analysis area. The program models the actual terrain profile from the flight path to the receiver as one of the above geometries.

You must supply terrain data as a grid file (described in Appendix E). The terrain grid area must be large enough to encompass all propagation paths. If it is not, then areas beyond the defined terrain will be taken to be at elevation equal to the closest defined point. You must also supply a ground impedance file (Appendix E). Ground locations may be specified as either hard (pavement, water) or soft (most unpaved areas).

Two aircraft with the same altitude profile and track, but different power and speed schedules may have different topographic attenuation because of NMAP's differing segmentation of the profiles.

For straight flight segments, NMAP determines the endpoints of the segment and the segment's point of closest approach as described in Reference 3. If topography mode is invoked, NMAP computes the attenuation due to the topography at these three points relative to the free field, and computes the overall topographic attenuation of the flight segment as the weighted average of the three values. The weighted average calculation equally weights the endpoint values but doubly weights the point of closest approach value.

For curved flight segments, NMAP determines the endpoints of the segment. If topography mode is invoked, NMAP computes the attenuation due to the topography at these two points relative to the free field, and computes the overall topographic attenuation of the flight segment as the arithmetic average of the two values.

Program Operation 4

4.1 Execution of the NMAP 7.0 Program

The NMAP7.0 program can be executed via the following command line:

nmap70 *runfilename*

where *runfilename* is the name (eight-character prefix and three-character suffix (i.e., 'RUN') delimited by a period) of the file containing the run options and settings.

The format of the ASCII RUN file and a sample file are shown in Appendix A. The primary contents of the RUN file are the OPX filename, LOG filename, POI filename, and/or GRD filename and the noise metric to be calculated.

If POI from NMPLOT are requested, their specification is required in the RUN file. If GRD is requested, the grid specification is required. If topography and ground impedance are requested, the elevation (ELV) filename and impedance (IMP) filenames are required.

One of NMAP's first tasks is to read the OPX file specified in the RUN file. The format of the ASCII OPX file and a sample file are shown in Appendix B.

As the program runs the user's case, status messages appear on the computer screen. Status messages include the flight or static profile being executed, warning messages, an error message if the program fails gracefully, and duration of the run.

4.2 Completion of the Program

When execution is successfully completed (no errors), NMAP completes the LOG file, which contains the same status messages that appeared on the screen. The format and a sample of the ASCII LOG file are included as Appendix C.

If requested, NMAP also completes the POI and GRD files. The format and a sample of the ASCII POI file are contained in Appendix D. See Wasmer[2] for information regarding the binary GRD format.

Note that the GRD and LOG files are appended rather than overwritten.

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Appendix A

Format of the Run (.RUN) File

Two files provide the necessary information to compute the noise exposure from aircraft operating on multiple flight tracks. They are named via their file extensions – **RUN** and **OPS** or **OPX**. The **RUN** file contains the specifications for the execution of the noise model and the **OPS/OPX** file contains a description of the flight and run-up events. Since NMAP and the Rotorcraft Noise Model (RNM)[A1] are intended to use common input files and structures therein, this appendix mentions the RNM. Note that the RNM can use either the **OPS** or **OPX** files but NOISEMAP can use only the **OPX** file. Both files are referenced in this appendix as **OPX**, and are identical except that the **OPX** file also contains the reference noise data and pointers to that data needed by the NOISEMAP program. This appendix describes the **RUN** file.

The **RUN** file is a fixed format ASCII text file and contains three keywords – **RUN**, **MAP**, and **ENDRUN**. The information within these keywords primarily includes the name of the **OPX** file to be read and parameters for the computation of POI and noise grids and utilization of topography. **Note that Version 1.0 of the RNM does not support the MAP keyword**. The RUN file is usually created by the BASEOPS program when you are ready to execute your case.

Figure A-1 shows a sample **RUN** file. The following paragraphs describe the contents of the keywords in further detail. When these descriptions cite "Line" number, they refer to the number in the Line column of Table A-1, not the line of the actual or sample **RUN** file.

```
123456789012345678901234567890123456789012345678901234567890
RUN
f16dr.run                  7.0 21-May-1998 11:45:00      1
WP91 baseline - F16A dep F16P on 3RD4 rup 16A at F16A
c:\sources\nmap68\testcase\f16deprup\
f16dr.opx
f16dr.log
COMPUTEPOI           f16dr.poi                DAILY      0
IGNORETOP            fromken.elv           fromken.imp
COMPUTEGRD           f16dr.grd                DNL
-50000    -50000     50000     50000
1000      1000             0  W
MAP                1
c:\you_gotta_be_kidding_me\
1984 SPOT satellite imagery
unintelligible cityscape
ENDRUN
123456789012345678901234567890123456789012345678901234567890
```

Figure A-1. Sample RUN File

In the tables presented here, three letters appear in the format column: A, I, and F. The letter A appearing under the format column signifies a character input, while the letter I signifies an integer value (e.g., A10 represents a data field that may be 10 characters long, and I10 represents an integer data field that may be 10 elements long). All text strings (A* format) must be left-justified in their respective fields, and must be capitalized where noted. The letter F represents a floating point number whose number of digits (both before and after the decimal point) is given after the letter F (e.g., F3.1 signifies a floating-point number, 3 digits in length with 1 digit to the right of the decimal). The number 10.0 is of format F3.1.

Keyword **RUN**

Table A-1 shows the contents and format of the RUN keyword. The RUN keyword is written to Line 1 of the **RUN** file.

Lines 2 and 3 self-document the **RUN** file as they contain the full name of the file, its date and time (when it was last saved), and a user-specified description of the **RUN** file (e.g., "WPAFB, 10 pts ranked by event, no topo, normal grid"). The description can be up to five lines of 60 characters each. Line 4 contains the path for the input and output files. Lines 5 and 6 store the names of the **OPX** and **LOG** files to be used and created by the noise model, respectively. Upon execution of the noise model, the program writes status information (including error and warning messages) to the **LOG** file. The **LOG** file is most useful for diagnosing potential run-time problems with the **RUN** or **OPX** files.

Lines 7 through 9 contain data pertaining to the computation of POI or alternative POI. You can specify POI in the **OPX** file. Alternative POI are usually specified by the user during an interactive session of NMPLOT. The flags COMPUTEPOI and IGNOREPOI instruct the noise model to perform POI calculations and to ignore the POI, respectively; however, if alternative POI exist in the RUN file, the noise model automatically performs POI calculations for the alternative POI only. If COMPUTEPOI is specified, then a **POI** file name must be specified.

As stated in Appendix D, calculations for each POI include the aircraft type, speed, power setting and altitude of each flight profile, which significantly contributes to the overall noise level at the POI. The contributors can be ranked by each profile's daily or single-event noise levels as specified on Line 7 via the flags DAILY and EVENT, respectively.

Alternative POI are specified similarly to POI from the **OPX** file as shown on line 8 via their (x,y,z) and (latitude, longitude) coordinates and a 42-character description for each point. The sample RUN file of Figure A-1 does not contain alternative POI.

Line 9 contains data pertaining to the inclusion of topographical and terrain effects in the noise calculations. The flags COMPUTETOP and IGNORETOP instruct the noise model to perform topographical and terrain attenuation calculations and to ignore these effects, respectively. The RNM 1.0 does not support COMPUTETOP or IGNORETOP. Such attenuation calculations involve the use of two binary-formatted data files (named via their extensions) – **ELV** and **IMP**. The **ELV** file stores a grid of ground elevation data and the IMP file stores a grid of ground impedance data. (Appendix E describes the formats for the **ELV** and **IMP** files.) Ground elevations are expressed in feet above MSL, and ground impedance is expressed as either hard ground or soft ground. Hard ground assumes a flow resistivity of 1,000,000 kN*s/m^4 and is represented by the number 1 in the **IMP** file for applicable grid points. Soft ground assumes a flow resistivity of 200 kN*s/m^4 and is represented by the number 0 in the **IMP** file for applicable grid points. IGNORETOP also instructs the noise model to use a default lateral attenuation algorithm.

Lines 10 through 12 contain data pertaining to the computation of the noise grid. Line 11 stores the compute flag and the grid file name whose extension will be GRD. The flags COMPUTEGRD and IGNOREGRD instruct the noise model to perform grid calculations and write the results to the **GRD** file, and not to perform grid calculations, respectively.

If COMPUTEGRD is specified, then you must also specify (a) the full GRD filename on Line 10, and (b) grid parameters on Lines 11 and 12. The grid parameters are the bounds of the grid, the grid spacings, and the grid orientation. The bounds of the grid are represented by the (x,y) coordinates of its lower left and upper right corners. The grid spacings are specified for the x and y directions. The grid orientation is specified as the grid declination in degrees relative to true North.

If IGNOREGRD is specified, grid calculations are not performed and the contents per Lines 11 and 12 must not be present in the RUN file.

The noise metric on Line 10 must always be present regardless of COMPUTEGRD or IGNOREGRD. The noise metric is specified via the flags

- **DNL** – Day-Night Average Sound Level
- **CNEL** – Community Noise Equivalent Level
- **LEQ** – (24-hour) Equivalent Sound Level
- **NEF** – Noise Exposure Forecast
- **WECPNL** – Weighted Equivalent Continuous Perceived Noise Level.

These flags are also the metrics' standard abbreviations.

The notes below Table A-1 further explain the items within the RUN keyword.

RUN Keyword Section

Line	Column	Format	Description
1	1–3	A3	keyword for run options/specification data (RUN)
2	1–12	A12	RUN filename
	13–26	Blank	
	27–29	F3.1	RUN file version (e.g., 7.0)
	30	Blank	
	31–41	A11	date of RUN file (dd-mmm-yyyy)
	42	Blank	
	43–50	A8	Time of RUN file (hh:mm:ss)
	51–58	Blank	
	59–60	I2	Number of RUN case description lines (5 max)
3	1–60	A60	RUN case description
4	1–243	A243	path to the user's case directory where I/O files reside (last character must be '\')
5	1–12	A12	OPX filename
6	1–12	A12	LOG filename
7	1–10	A10	flag for computing POINT data ("COMPUTEPOI" or "IGNOREPOI")
	11–20	Blank	
	21–32	A12	POI filename
	33–45	Blank	
	46–50	A5	flag for contributor ranking (by "DAILY" metric or by "EVENT" metric)
	51–57	Blank	
	58–60	I3	number of alternative points (100 max)
8	1–10	A10	identification of alternative point
	11–20	I10	x-coordinate (ft)
	21–30	I10	y-coordinate (ft)
	31–40	I10	z-coordinate (ft, AGL)
	41-59	D19.12	longitude (decimal degrees)
	60	A1	longitude direction ("W" or "E" for West or East)
	61–79	D19.12	latitude (decimal degrees)
	80	A1	latitude direction ("N" or "S" for North or South)
	81	Blank	
	82–123	A42	description of alternative point
9	1–10	A10	flag for computing with topography and ground impedance data ("COMPUTETOP" or "IGNORETOP")
	11–20	Blank	
	21–32	A12	Topography (ELV) filename
	33–40	Blank	
	41–52	A12	Ground Impedance (IMP) filename
10	1–10	A10	flag for computing GRD data ("COMPUTEGRD" or "IGNOREGRD")
	11–20	Blank	
	21–32	A12	GRD filename
	33–45	Blank	
	46–51	A6	Noise metric (DNL, CNEL, LEQ, NEF, or WECPNL)
11	1–10	I10	x-coordinate of lower left corner of grid (ft)
	11–20	I10	y-coordinate of lower left corner of grid (ft)
	21–30	I10	x-coordinate of upper right corner of grid (ft)
	31–40	I10	y-coordinate of upper right corner of grid (ft)
12	1–10	I10	grid spacing in x direction (ft)
	11–20	I10	grid spacing in y direction (ft)
	21–26	Blank	
	27–29	I3	grid declination (degrees, 0–180)
	30	A1	grid declination direction ("W" or "E" for West or East)

Notes for Table A-1:

(1) Line 3 should be repeated to satisfy the number of case description lines.
(2) If alternative points are entered in the RUN file, the points in the OPS file will be ignored.
(3) Line 8 should be repeated to satisfy the number of alternative points.
(4) The data in lines 11 and 12 should yield a grid size no larger than 200 kft by 200 kft and/or grid spacing less than 200 ft.
(5) The exact quotient of the difference of like grid coordinates and the associated grid spacing must be a whole number (e.g., if x-coordinate upper right = 50,000 ft and x-coordinate lower left = -50,000 ft, then grid spacing in x direction must be a number that divides evenly into the difference between upper right and lower left. The difference between upper right and lower left in this example is 100,000 ft, so the grid spacing in the x direction must be, say, 1000 ft)
(6) Lines 11 and 12 should not exist if the IGNOREGRD flag is set in line 10.

Table A-1. RUN Keyword

Keyword MAP

MAP is a storage location for data needed by the NMPLOT and BASEOPS programs. Table A-2 shows the format for the MAP keyword. Line 1 contains the MAP keyword and the number of map files to be listed via the formats of lines 2 through 4. Line 2 stores the path to the map file including the full filename of the map file. Line 3 allows for a 60-character description of the map file, and Line 4 specifies the category of the map data. **Note that the RNM 1.0 does not support the MAP keyword.**

MAP Keyword Section

Line	Column	Format	Description
1	1–3	A3	keyword for map file data
	4–18	Blank	
	19–20	I2	number of map files (10 max)
2	1–243	A243	path to map file and file name (last character must be a '\')
3	1–60	A60	map file description (e.g., 1984 SPOT satellite imagery)
4	1–60	A60	category of geographic data (e.g., roads, water, runways)

Note: (1) Lines 2 through 4 should be repeated to satisfy the number of map files.

Table A-2. MAP Keyword

Keyword ENDRUN

ENDRUN concludes the **RUN** file. Table A-3 shows the format for the ENDRUN keyword.

ENDRUN Keyword Section

Line	Column	Format	Description
1	1–6	A6	keyword for end of run data (ENDRUN)

Table A-3. ENDRUN Keyword

REFERENCE FOR APPENDIX A

A1. Lucas, M., *Rotorcraft Noise Model User's Manual*, Wyle Research Report WR 98-21, September 1998.

Appendix B

Format of the Executable Operations (.OPX) File

Two files provide the necessary information to compute the noise exposure from aircraft operating on multiple flight tracks. They are named via their file extensions – **RUN** and **OPS** or **OPX**. The **RUN** file contains the specifications for the execution of the noise model, and the **OPS/OPX** file contains a description of the flight and run-up events. Since NMAP and the RNM are designed to use common input files and structures therein, this appendix mentions the RNM. Note that the RNM can use either the **OPS** or **OPX** files but NOISEMAP can use only the **OPX** file. Both files are referenced in this appendix as **OPX**, and are identical except that the **OPX** file also contains the reference noise data needed by the NOISEMAP program. This appendix describes the **OPX** file.

The **OPX** file is a fixed format ASCII text file and contains 16 keywords – **CASE**, **AIRFIELD**, **POINT**, **NAVAID**, **RUNWAY**, **VTOLPAD**, **STATICPAD**, **TRACK**, **FLIGHTAC**, **FLIGHTPROF**, **STATICAC**, **STATICPROF**, **ENDOPS**, **FLIGHTNOISE**, **STATICNOISE**, and **ENDNOISE**. The information within these keywords describes the flight and static (run-up) events at a given airfield/vertiport for a user-specified case or scenario.

Figure B-1 shows a sample **OPX** file. The order of the keyword sections is unimportant except that the CASE keyword must be first and the ENDNOISE (ENDOPS for RNM) keyword must be last. Some **OPX** files however, may have only flight data or only run-up data rather than both flight and run-up data as described below. All operations keywords must exist in the **OPX** file. The FLIGHTNOISE keyword must exist if the number of flight profiles is greater than ten. The STATICNOISE keyword must exist if the number of departures is greater than zero or if the number of run-up profiles is greater than zero.

Sample OPX File:

```
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234890
CASE
testopx.ops                 7.0 21-May-1998 11:30:20          3
          WRIGHT-PATTERSON AFB 1991 BASELINE
          [Author :Bill Lichtinger]  This case was converted from a
          Baseops Version 5.0 File

AIRFIELD
          Unnamed Airfield (Old Baseops Format)
 AirfldRP:          0          0        825     84.031392500000W     39.837562500000N
          Airfield Reference Point
    4.40W           2          6
          [Annual Flying Days: 365.00]  Wright-Patterson AFB 1991
          BASELINE This file includes the following AFCESA files that
          have beenconverted to BASEOPS 5.0 files and duplications
          removed:WP135A, WPC12, WPF16, WPC21, WP135E, WPC141, WPC18,
          WPT39,WPAERO, and WPTRANDATA COLLECTION 21-29 OCT 1991

ANYDGL.DGL          01-JAN-1997 10:20:30
  Modeled:        66.0F    70.0%RH 29.90inHg
  Monthly:        66.0     70.0.    29.90
                  66.0     70.0     29.90
                  66.0     70.0     29.90
                  66.0     70.0     29.90
                  66.0     70.0     29.90
                  66.0     70.0     29.90
                  66.0     70.0     29.90
                  66.0     70.0     29.90
                  66.0     70.0     29.90
                  66.0     70.0     29.90
                  66.0     70.0     29.90
                  66.0     70.0     29.90
POINT                20
22               -2754    -16261          5     84.057658187953W     39.770148345315N 22
34              -38070    -30909          5     83.960785245227W     39.729968402370N 34
35              -40068    -28938          5     83.955304665899W     39.735374919816N 35
24               -8769    -29264          5     84.041158846280W     39.734480691156N 24
6                 1800     17952          5     84.070149958855W     39.863995722976N 6
25              -24603    -28664          5     83.997725666557W     39.736126510775N 25
14               11858     -2894          5     84.097739381720W     39.806814463375N 14
37              -25414    -22588          5     83.995501067040W     39.752793177441N 37
26              -28204    -29564          5     83.987848005815W     39.733657781347N 26
38              -20967    -26136          5     84.007699333443W     39.743060897433N 38
27              -30521    -28139          5     83.981492399056W     39.737566602941N 27
16              -21215    -24490          5     84.007019061334W     39.747575929252N 16
39              -19403    -17309          5     84.011989436581W     39.767273647048N 39
28              -31479    -28714          5     83.978864573733W     39.735989359140N 28
17                5425     -3753          5     84.080093452381W     39.804458198288N 17
29              -34727    -27441          5     83.969955203533W     39.739481239763N 29
18                2623     -4351          5     84.072407474764W     39.802817864736N 18
30              -37663    -32282          5     83.961901659535W     39.726202218477N 30
31              -39912    -36388          5     83.955732578999W     39.714939326223N 31
32              -40797    -41291          5     83.953304995063W     39.701490236910N 32
NAVAID               1
TACA             -6854     -7351        825     84.046411753895W     39.794588766645N TACA
RUNWAY               4
23R                  0         0        825      -9468      -8316         825
   84.031392500000W     39.837562500000N     84.065212500000W     39.814752800000N300
05L              -9468     -8316        825          0          0         825
   84.065212500000W     39.814752800000N     84.031392500000W     39.837562500000N300
23L               -429     -2136        825      -5690      -6737         825
   84.032925000000W     39.831706100000N     84.051716100000W     39.819085300000N300
05R              -5690     -6737        825       -429      -2136         825
   84.051716100000W     39.819085300000N     84.032925000000W     39.831706100000N300
VTOLPAD              2
VT1                -43      -104        825     84.031555600000W     39.837277800000N
VT2                 84       207        825     84.031083300000W     39.838138900000N
STATICPAD           13
TC                -502     -6097        825     84.063835497586W     39.798028529647N TC
HH               -3410     -7787        825     84.055858758503W     39.793392804389N HH
2R1              -1550      1400        825     84.060960799320W     39.818593045776N 2R1
R1               -2089        28        825     84.059482304696W     39.814829604916N R1
R2               -2615      -433        825     84.058039469497W     39.813565066842N R2
R3               -3216      -961        825     84.056390906847W     39.812116745578N R3
F16A             -2471     -6962        825     84.058434466206W     39.795655806364N F16A
C12P             -2691     -4893        825     84.057830999013W     39.801331141014N C12P
C21P             -2691     -4893        825     84.057830999013W     39.801331141014N C21P
C12R             -1861     -6293        825     84.060107716151W     39.797490895238N C12R
STUB             -3924       147        825     84.054448839697W     39.815156025806N STUB
C21R             -1861     -6293        825     84.060107716151W     39.797490895238N C21R
2TC              -4400     -4250        825     84.053143156133W     39.803094911038N 2TC
TRACK                1
3RD4              DEP23R                            0.00          0          3
                 18600       0.0     18600      18600
                 12000     93.0L     19477      38077
                300000       0.0    300000     338077
FLIGHTAC             1
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234890
```

(Continued)

```
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234890
FM04401   F-16A              F100-PW-100
0002      HELICOPTER CH-46
FLIGHTPROF        1
F16P      BASED      FM04401   RM04401          5 SECONDS  C TIT
3RD4              0          0       4.95       0.00       0.15          2          7
          MIL DEP

                  0        825     850.00  VARIABLE         0            RM0440104
               2500        825     850.00  VARIABLE       155            FM0440107
              13100       1825     850.00  VARIABLE       275            FM0440107
              27600       2025     850.00  VARIABLE       325            FM0440107
              42600       3025     850.00  VARIABLE       370            FM0440107
              84779       7025     700.00  VARIABLE       320            FM0440104
             200000       7025     700.00  VARIABLE       320            FM0440104
STATICAC          1
RM04401   F-16A              F100-PW-100          NONE
STATICPROF        1
16A       RM04401   F16A           252.00          0          2 SEGMENTS C TIT
             483.00   1  VARIABLE        0.50       0.00       0.00       2164          RM0440102
             620.00   1  VARIABLE        0.50       0.00       0.00         22          RM0440103
ENDOPS
FLIGHTNOISE
                FLIGHT AIRCRAFT ID: FM04401
              FLIGHT AIRCRAFT NAME: F-16A
                       ENGINE NAME: F100-PW-100
                 NUMBER OF ENGINES: 1
 MEASURED FLIGHT NOISE DATA UPDATED: 24 JUN 1987
        SOURCE OF FLIGHT NOISE DATA: U.S.A.F.
 NUMBER OF POWER SETTINGS REQUESTED:  4

PROFILE ID   INTERPOLATION TYPE    POWER SETTING    SPEED (KNOTS)   POWER DESCRIPTION

FM0440102          VARIABLE          530.00 C TIT          160        TRAFFIC PATTERN

 Distance    SEL (dB)       EPNL (EPNdB)       ALM (dBA)      PNLT (PNdB)
   (ft)     A-G    G-G       A-G    G-G       A-G    G-G       A-G    G-G
   200      94.5   94.5      98.1   98.1      89.9   89.9     102.4  102.5
   250      93.0   93.0      96.5   96.5      87.7   87.7     100.2  100.3
   315      91.5   90.0      94.9   94.1      85.6   84.2      98.0   97.2
   400      89.9   87.2      93.2   91.4      83.5   80.7      95.7   93.9
   500      88.3   84.8      91.4   88.9      81.2   77.7      93.3   90.9
   630      86.7   82.4      89.5   86.3      79.0   74.7      90.9   87.7
   800      84.9   80.1      87.5   83.6      76.7   71.8      88.3   84.3
  1000      83.2   77.8      85.4   80.7      74.3   69.0      85.6   80.8
  1250      81.4   75.6      83.3   77.7      71.9   66.2      82.8   77.2
  1600      79.5   73.6      81.1   75.0      69.4   63.5      80.0   74.0
  2000      77.5   71.5      78.8   72.4      66.8   60.9      77.1   70.7
  2500      75.4   69.5      76.3   69.7      64.1   58.2      74.0   67.4
  3150      73.1   67.4      73.7   66.9      61.3   55.6      70.8   64.0
  4000      70.8   65.4      70.9   64.0      58.3   52.9      67.5   60.6
  5000      68.3   63.0      67.9   60.7      55.2   49.9      64.0   56.9
  6300      65.6   60.4      64.7   57.5      51.9   46.7      60.3   53.2
  8000      62.7   57.4      61.3   53.6      48.4   43.2      56.5   48.8
 10000      59.6   54.0      57.7   48.6      44.7   39.1      52.3   43.2
 12500      56.3   49.6      53.7   42.4      40.9   34.1      47.8   36.5
 16000      52.8   44.6      49.5   34.8      36.8   28.6      42.9   28.2
 20000      49.1   39.2      44.4   24.6      32.5   22.5      37.3   17.4
 25000      45.2   33.5      38.3   14.4      28.0   16.2      30.5    6.7

FM0440103          VARIABLE          600.00 C TIT          160        APPROACH POWER

 Distance    SEL (dB)       EPNL (EPNdB)       ALM (dBA)      PNLT (PNdB)
   (ft)     A-G    G-G       A-G    G-G       A-G    G-G       A-G    G-G
   200     100.0  100.0     103.6  104.0      95.6   95.6     108.3  108.7
   250      98.5   98.5     102.0  102.4      93.5   93.5     106.1  106.5
   315      96.9   95.4     100.3   99.9      91.4   89.9     103.9  103.4
   400      95.3   92.6      98.6   97.2      89.2   86.4     101.6  100.1
   500      93.7   90.1      96.9   94.7      87.0   83.4      99.2   97.0
   630      92.1   87.7      95.0   92.1      84.8   80.4      96.7   93.8
   800      90.4   85.3      93.1   89.3      82.5   77.4      94.2   90.4
  1000      88.6   83.0      91.1   86.4      80.1   74.5      91.6   87.0
  1250      86.8   80.8      89.1   83.5      77.7   71.6      89.0   83.4
  1600      84.9   78.7      86.9   80.8      75.2   68.9      86.2   80.1
  2000      82.9   76.6      84.6   78.1      72.6   66.2      83.4   76.8
  2500      80.9   74.5      82.3   75.4      69.9   63.5      80.4   73.5
  3150      78.7   72.4      79.8   72.6      67.2   60.8      77.3   70.2
  4000      76.4   70.2      77.1   69.7      64.3   58.1      74.1   66.7
  5000      74.0   67.8      74.3   66.4      61.2   55.0      70.8   62.9
  6300      71.4   65.2      71.3   63.0      58.0   51.8      67.3   59.0
  8000      68.6   62.2      68.2   59.5      54.7   48.2      63.7   55.0
 10000      65.7   58.8      64.8   55.2      51.1   44.3      59.7   50.1
 12500      62.6   54.5      61.1   49.7      47.4   39.4      55.5   44.1
 16000      59.3   49.7      57.2   43.3      43.5   34.0      51.0   37.0
 20000      55.8   44.7      52.9   34.8      39.4   28.3      46.0   28.0
 25000      52.0   39.5      47.7   25.6      35.1   22.6      40.3   18.2

FM0440104          VARIABLE          700.00 C TIT          160        INTERMEDIATE POWER
Distance     SEL (dB)       EPNL (EPNdB)       ALM (dBA)      PNLT (PNdB)
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234890
```

(Continued)

12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234890

(ft)	A-G	G-G	A-G	G-G	A-G	G-G	A-G	G-G
200	107.4	107.4	110.7	111.1	102.7	102.7	115.4	115.7
250	105.8	105.8	109.1	109.5	100.6	100.6	113.2	113.5
315	104.3	102.7	107.4	106.9	98.5	96.8	110.9	110.3
400	102.7	99.8	105.7	104.2	96.3	93.3	108.5	107.0
500	101.1	97.3	104.0	101.7	94.1	90.2	106.2	103.9
630	99.4	94.8	102.1	99.0	91.8	87.2	103.8	100.6
800	97.7	92.4	100.3	96.2	89.5	84.1	101.3	97.2
1000	96.0	90.0	98.4	93.3	87.1	81.2	98.8	93.7
1250	94.1	87.7	96.3	90.3	84.7	78.3	96.2	90.1
1600	92.2	85.5	94.2	87.5	82.2	75.5	93.5	86.8
2000	90.2	83.4	92.1	84.8	79.6	72.7	90.7	83.5
2500	88.2	81.2	89.8	82.1	76.9	69.9	87.8	80.1
3150	86.0	78.9	87.4	79.3	74.1	67.1	84.8	76.7
4000	83.6	76.7	84.7	76.2	71.2	64.2	81.6	73.1
5000	81.2	74.1	81.9	72.8	68.2	61.1	78.3	69.2
6300	78.6	71.4	79.0	69.5	65.0	57.7	74.8	65.4
8000	75.8	68.3	75.9	66.2	61.6	54.0	71.2	61.5
10000	72.9	64.8	72.5	62.4	58.1	50.0	67.3	57.2
12500	69.8	60.5	69.0	57.6	54.3	45.1	63.2	51.8
16000	66.4	55.7	65.2	51.9	50.4	39.7	58.8	45.5
20000	62.9	50.6	61.1	44.9	46.2	34.0	54.1	37.9
25000	59.1	45.5	56.6	36.6	41.8	28.3	49.0	29.0

FM0440107 VARIABLE 850.00 C TIT 160 TAKEOFF POWER

Distance	SEL (dB)		EPNL (EPNdB)		ALM (dBA)		PNLT (PNdB)	
(ft)	A-G	G-G	A-G	G-G	A-G	G-G	A-G	G-G
200	118.1	118.1	121.6	122.1	113.1	113.1	124.8	125.3
250	116.6	116.6	120.0	120.4	111.0	111.0	122.6	123.0
315	115.0	113.7	118.3	118.1	108.8	107.5	120.3	120.1
400	113.4	111.0	116.5	115.5	106.6	104.2	117.9	116.9
500	111.8	108.5	114.7	113.0	104.4	101.1	115.5	113.8
630	110.1	106.0	112.8	110.3	102.1	98.0	113.0	110.5
800	108.3	103.6	110.8	107.5	99.7	95.0	110.4	107.1
1000	106.5	101.2	108.7	104.6	97.3	92.0	107.7	103.6
1250	104.6	98.9	106.6	101.5	94.8	89.1	105.0	99.9
1600	102.6	96.7	104.4	98.9	92.2	86.3	102.2	96.7
2000	100.5	94.5	102.1	96.1	89.5	83.6	99.3	93.3
2500	98.3	92.4	99.7	93.4	86.7	80.8	96.3	90.0
3150	96.0	90.2	97.1	90.6	83.8	78.0	93.1	86.6
4000	93.5	87.9	94.1	87.4	80.7	75.1	89.7	83.0
5000	90.8	85.4	91.0	84.0	77.4	72.0	86.1	79.1
6300	87.9	82.7	87.7	80.8	73.9	68.7	82.4	75.5
8000	84.7	79.6	84.1	77.4	70.1	65.0	78.4	71.6
10000	81.3	76.1	80.2	73.5	66.1	60.9	74.0	67.4
12500	77.5	71.6	76.1	68.8	61.7	55.8	69.4	62.1
16000	73.2	66.4	71.8	63.2	56.9	50.0	64.4	55.9
20000	68.6	60.7	67.0	56.6	51.6	43.7	59.0	48.7
25000	63.5	54.4	61.6	48.8	45.9	36.8	53.1	40.2

STATICNOISE

STATIC AIRCRAFT ID: RM04401
STATIC AIRCRAFT NAME: F-16A
ENGINE NAME: F100-PW-100
NOISE SUPPRESSION SYSTEM: NONE
NUMBER OF ENGINES: 1
MEASURED STATIC NOISE DATA UPDATED: 13 APR 1976
SOURCE OF STATIC NOISE DATA: U.S.A.F.
NUMBER OF POWER SETTINGS REQUESTED: 3

PROFILE ID	INTERPOLATION TYPE	POWER SETTING	POWER DESCRIPTION
RM0440102	VARIABLE	483.00 C TIT	IDLE

ALM dBA WITH EXCESS SOUND ATTENUATION

Distance									Angle (Degrees)										
(ft)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
200	96.7	94.3	97.3	93.8	93.0	90.7	87.8	83.4	79.9	76.1	76.8	79.3	82.4	83.1	82.2	80.5	78.5	77.0	62.7
250	94.5	92.0	95.1	91.5	90.7	88.4	85.6	81.2	77.7	73.9	74.6	77.0	80.2	80.8	80.0	78.2	76.3	74.8	60.5
315	92.2	89.5	92.8	89.1	88.1	85.9	83.1	78.5	75.0	71.0	71.5	73.7	76.7	77.4	76.7	75.2	73.2	72.1	57.9
400	89.8	86.9	90.5	86.6	85.4	83.2	80.5	75.8	72.3	68.0	68.5	70.2	73.1	73.8	73.5	72.2	70.2	69.4	55.4
500	86.8	83.9	87.5	83.7	82.4	80.2	77.5	72.8	69.3	65.0	65.5	67.2	70.1	70.8	70.4	69.2	67.2	66.4	52.4
630	83.6	80.7	84.3	80.5	79.3	77.0	74.3	69.6	66.2	61.9	62.4	64.1	67.0	67.7	67.3	66.0	64.0	63.2	49.3
800	80.2	77.4	81.0	77.2	76.0	73.8	71.0	66.3	62.9	58.7	59.2	61.0	63.9	64.6	64.1	62.7	60.8	60.0	46.0
1000	76.6	74.0	77.4	73.7	72.6	70.3	67.6	62.8	59.5	55.5	55.8	57.6	60.6	61.3	60.7	59.3	57.5	56.7	42.6
1250	72.9	70.3	73.7	70.0	69.0	66.7	63.9	59.1	55.9	52.2	52.3	54.2	57.1	57.8	57.2	55.7	54.1	53.3	39.1
1600	69.6	67.1	70.5	66.8	65.7	63.5	60.7	55.8	52.8	49.1	49.1	50.8	53.7	54.4	53.9	52.4	51.0	50.2	36.1
2000	66.1	63.7	67.2	63.4	62.4	60.1	57.3	52.3	49.6	46.0	45.9	47.4	50.2	51.0	50.6	49.1	47.8	47.0	32.9
2500	62.5	60.3	63.7	60.0	59.0	56.7	53.9	48.7	46.3	43.0	42.6	44.1	46.8	47.7	47.3	45.7	44.7	43.9	29.7
3150	58.9	56.8	60.3	56.5	55.7	53.4	50.5	45.2	43.1	39.9	39.4	40.9	43.7	44.5	44.1	42.4	41.6	40.7	26.6
4000	55.5	53.7	57.1	53.3	52.5	50.2	47.3	42.0	40.1	37.0	36.4	37.8	40.7	41.6	41.1	39.2	38.6	37.7	23.5
5000	51.4	50.0	53.2	49.5	49.0	46.7	43.6	38.3	36.6	33.7	33.1	34.7	37.7	38.5	37.9	35.8	35.4	34.4	20.1
6300	47.3	46.2	49.2	45.6	45.3	42.9	39.8	34.6	33.1	30.4	29.7	31.5	34.8	35.5	34.7	32.4	32.1	30.9	16.5
8000	42.8	42.1	44.8	41.3	41.1	38.7	35.5	30.7	29.2	26.7	26.3	28.2	31.6	32.2	31.3	28.8	28.7	27.1	12.5
10000	38.0	37.5	39.9	36.6	36.6	33.9	30.7	26.5	25.0	22.8	22.6	24.6	28.1	28.6	27.7	25.1	25.1	23.0	8.1
12500	32.3	32.1	34.0	30.9	31.0	28.2	24.9	21.6	20.2	18.2	18.5	20.4	23.8	24.2	23.3	20.9	20.8	18.3	2.9
16000	26.2	26.1	27.6	24.7	24.8	21.9	18.7	16.4	15.2	13.4	14.3	15.9	19.0	19.4	18.6	16.7	16.2	13.4	-2.6

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20000	19.9	19.9	20.9	18.2	18.4	15.7	12.5	11.2	10.5	9.1	10.2	11.5	14.0	14.4	13.7	12.8	11.7	8.9	8.0
25000	13.6	13.7	14.1	11.5	11.9	10.0	6.9	6.4	6.3	5.2	6.5	7.5	9.2	9.7	9.1	9.1	7.5	4.8	-12.9

PNLT PNdB WITH EXCESS SOUND ATTENUATION

Distance (ft)	Angle (Degrees) 0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
200	112.6	110.6	113.4	109.8	109.5	107.3	104.6	100.8	96.9	93.6	95.0	98.2	101.5	102.1	99.8	97.4	95.7	93.6	78.0
250	110.4	108.3	111.2	107.6	107.2	105.0	102.3	98.5	94.6	91.3	92.7	95.9	99.2	99.7	97.5	95.1	93.4	91.3	75.7
315	107.9	105.2	108.7	105.1	104.0	101.8	99.0	95.2	91.5	87.8	89.2	92.4	95.7	96.3	94.0	91.6	90.0	88.5	73.1
400	105.3	102.5	106.1	102.4	100.8	98.4	96.1	91.7	88.6	84.3	85.5	88.5	91.8	92.3	90.1	87.9	86.9	85.5	70.1
500	102.2	99.4	103.1	99.3	97.7	95.3	93.0	88.6	85.5	81.2	82.4	85.4	88.7	89.3	87.0	84.8	83.8	82.4	66.9
630	99.0	96.1	99.8	96.1	94.5	92.0	89.7	85.4	82.2	77.9	79.1	82.2	85.5	86.1	83.8	81.6	80.5	79.1	63.5
800	95.5	92.7	96.4	92.7	91.1	88.7	86.3	82.0	78.8	74.4	75.7	78.9	82.2	82.8	80.5	78.2	77.0	75.7	59.9
1000	91.9	89.2	92.8	89.1	87.5	85.2	82.7	78.5	75.2	70.9	72.2	75.4	78.7	79.3	77.0	74.7	73.4	72.1	56.0
1250	88.1	85.3	89.0	85.2	83.7	81.5	78.8	74.7	71.4	67.2	68.5	71.6	75.0	75.6	73.3	70.9	69.6	68.3	51.6
1600	84.7	82.0	85.6	81.8	80.2	77.8	75.4	71.0	67.9	63.6	64.7	67.7	71.1	71.7	69.4	67.1	66.2	64.8	47.9
2000	81.1	78.4	82.0	78.2	76.6	74.2	71.7	67.3	64.1	59.8	61.0	63.3	66.7	67.3	65.1	63.3	62.5	61.0	43.4
2500	77.2	74.5	78.2	74.4	72.8	70.2	67.8	63.3	60.2	55.8	56.8	58.6	62.0	62.6	61.0	59.4	58.4	57.0	38.6
3150	73.1	70.5	74.2	70.3	68.7	66.1	63.7	59.0	55.9	51.2	52.5	53.4	56.6	57.4	56.6	54.9	54.0	52.5	33.1
4000	68.9	66.2	69.9	66.0	64.3	61.8	59.1	54.2	51.3	46.2	47.3	48.0	51.2	52.2	52.0	50.3	48.8	47.3	25.0
5000	63.2	60.6	64.3	60.2	58.7	56.5	53.2	47.8	44.9	38.9	40.7	41.7	46.1	46.6	45.8	44.3	42.4	40.7	14.9
6300	57.2	54.6	58.2	54.3	53.5	51.1	47.9	41.2	38.5	32.6	32.7	35.6	40.8	41.0	40.1	38.1	37.5	34.6	4.9
8000	50.6	48.3	52.4	48.0	47.3	44.5	40.8	33.9	31.3	25.2	25.6	29.4	35.2	35.5	34.8	30.9	30.6	27.0	-5.1
10000	42.9	41.1	44.9	40.2	39.8	36.4	32.2	27.0	21.2	11.6	13.1	19.9	28.0	28.9	28.0	20.7	21.9	14.7	-15.1
12500	34.8	33.7	36.5	32.0	32.3	26.0	18.9	14.2	8.2	-1.7	1.1	9.0	19.2	20.3	17.4	8.7	12.7	7.3	-24.8
16000	23.1	22.7	25.7	19.0	21.0	11.1	5.7	1.3	-4.9	-14.9	-10.9	-1.9	8.8	7.6	6.7	-3.4	3.6	-0.2	-34.4
20000	7.5	7.0	9.3	6.0	7.0	-3.9	-7.6	-11.6	-17.9	-28.2	-22.9	-12.8	-1.6	-5.1	-4.0	-15.4	-5.6	-7.7	-44.1
25000	-8.1	-8.8	-7.2	-7.1	-7.0	-18.9	-20.8	-24.5	-30.9	-41.4	-34.9	-23.7	-12.0	-17.8	-14.6	-27.4	-14.8	-15.2	-53.7

ALMX dBA WITHOUT EXCESS SOUND ATTENUATION

Distance (ft)	Angle (Degrees) 0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
200	96.7	94.3	97.3	93.8	93.0	90.7	87.8	83.4	79.9	76.1	76.8	79.3	82.4	83.1	82.2	80.5	78.5	77.0	62.7
250	94.5	92.0	95.1	91.5	90.7	88.4	85.6	81.2	77.7	73.9	74.6	77.0	80.2	80.8	80.0	78.2	76.3	74.8	60.5
315	92.2	89.7	92.8	89.2	88.4	86.1	83.2	78.8	75.4	71.7	72.3	74.7	77.9	78.5	77.7	75.8	74.0	72.5	58.3
400	89.8	87.3	90.4	86.8	86.0	83.7	80.8	76.4	73.0	69.3	70.0	72.3	75.5	76.1	75.3	73.4	71.7	70.2	55.9
500	87.3	84.8	88.0	84.3	83.5	81.2	78.3	73.9	70.6	67.0	67.6	69.8	73.0	73.6	72.8	70.9	69.3	67.8	53.6
630	84.7	82.3	85.4	81.8	80.9	78.6	75.8	71.3	68.1	64.5	65.1	67.3	70.4	71.1	70.3	68.4	66.9	65.3	51.1
800	81.9	79.6	82.7	79.1	78.2	75.9	73.0	68.6	65.5	62.0	62.6	64.7	67.8	68.4	67.7	65.7	64.4	62.8	48.6
1000	79.0	76.7	79.9	76.3	75.4	73.0	70.2	65.7	62.8	59.4	59.9	62.0	65.0	65.7	65.0	63.0	61.8	60.1	45.9
1250	76.0	73.7	76.9	73.3	72.4	70.0	67.2	62.7	60.0	56.7	57.2	59.2	62.2	62.8	62.3	60.1	59.2	57.3	43.1
1600	72.7	70.6	73.7	70.1	69.2	66.8	64.0	59.5	57.1	53.9	54.5	56.3	59.3	60.0	59.4	57.2	56.4	54.5	40.2
2000	69.2	67.3	70.4	66.8	65.9	63.5	60.6	56.2	54.0	51.1	51.6	53.5	56.5	57.1	56.6	54.2	53.7	51.5	37.2
2500	65.6	63.8	66.8	63.3	62.5	60.0	57.1	52.9	50.9	48.2	48.8	50.7	53.6	54.2	53.7	51.3	50.9	48.4	34.1
3150	61.7	60.3	63.0	59.6	59.0	56.4	53.5	49.4	47.8	45.2	45.9	47.8	50.8	51.4	50.9	48.3	48.0	45.3	30.8
4000	57.7	56.6	59.1	55.8	55.3	52.7	49.7	46.0	44.6	42.2	43.1	45.0	47.9	48.5	48.0	45.3	45.2	42.1	27.5
5000	53.6	52.9	55.0	51.9	51.5	48.9	45.8	42.6	41.3	39.1	40.2	42.2	45.0	45.6	45.0	42.4	42.3	38.8	24.1
6300	49.6	49.0	50.8	47.9	47.6	44.9	41.9	39.1	38.0	35.9	37.2	39.2	42.0	42.5	42.0	39.3	39.3	35.4	20.6
8000	45.6	45.1	46.5	43.9	43.6	40.8	37.8	35.7	34.6	32.7	34.2	36.2	38.8	39.3	38.9	36.3	36.2	32.0	17.1
10000	41.5	41.0	42.1	39.7	39.3	36.5	33.7	32.1	31.2	29.3	31.0	33.0	35.4	35.9	35.6	33.1	33.0	28.5	13.4
12500	37.3	36.7	37.5	35.3	34.9	32.2	29.5	28.4	27.6	25.9	27.7	29.6	31.8	32.4	32.1	29.8	29.7	25.0	9.6
16000	32.9	32.3	32.8	30.8	30.2	27.7	25.3	24.6	24.0	22.3	24.3	26.1	28.1	28.7	28.4	26.3	26.3	21.3	5.7
20000	28.4	27.6	27.9	26.1	25.4	23.3	21.1	20.7	20.3	18.7	20.7	22.5	24.2	24.7	24.6	22.7	22.7	17.6	1.6
25000	23.8	22.9	22.9	21.4	20.6	18.9	17.0	16.8	16.4	15.0	16.9	18.6	20.1	20.6	20.5	19.0	19.0	13.8	-2.6

PNLTX PNdB WITHOUT EXCESS SOUND ATTENUATION

Distance (ft)	Angle (Degrees) 0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
200	112.6	110.6	113.4	109.8	109.5	107.3	104.6	100.8	96.9	93.6	95.0	98.2	101.5	102.1	99.8	97.4	95.7	93.6	78.0
250	110.4	108.3	111.2	107.6	107.2	105.0	102.3	98.5	94.6	91.3	92.7	95.9	99.2	99.7	97.5	95.1	93.4	91.3	75.7
315	108.0	105.9	108.8	105.2	104.8	102.6	99.9	96.1	92.2	88.9	90.3	93.5	96.8	97.3	95.1	92.7	91.0	88.9	73.4
400	105.7	103.4	106.5	102.9	102.3	100.1	97.4	93.6	89.7	86.4	87.8	91.0	94.3	94.8	92.6	90.2	88.5	86.5	71.0
500	103.2	100.8	104.0	100.4	99.7	97.5	94.7	91.0	87.1	83.8	85.2	88.3	91.7	92.2	90.0	87.6	85.9	84.0	68.5
630	100.6	98.0	101.4	97.8	96.9	94.7	92.0	88.2	84.5	81.1	82.4	85.6	88.9	89.5	87.2	84.8	83.2	81.4	65.9
800	97.9	95.3	98.7	95.1	94.0	91.7	89.0	85.3	81.7	78.2	79.6	82.7	86.0	86.6	84.3	81.9	80.4	78.7	63.1
1000	95.0	92.4	95.8	92.2	90.8	88.6	85.9	82.1	78.9	75.1	76.5	79.6	82.8	83.4	81.2	78.8	77.6	75.8	60.2
1250	91.9	89.3	92.7	89.1	87.6	85.2	82.8	78.7	75.8	71.9	73.2	76.3	79.5	80.1	77.9	75.4	74.6	72.8	57.0
1600	88.5	86.0	89.4	85.8	84.2	81.8	79.5	75.4	72.6	68.7	70.0	72.7	75.9	76.5	74.3	72.0	71.4	69.5	53.5
2000	84.9	82.4	85.8	82.3	80.7	78.2	75.9	71.8	69.1	65.3	66.6	68.8	72.0	72.6	70.5	68.6	67.9	66.0	49.4
2500	81.0	78.6	81.9	78.3	76.8	74.3	72.0	68.0	65.3	61.5	62.8	64.6	67.8	68.4	66.7	64.8	64.3	62.1	44.8
3150	76.7	74.3	77.6	74.1	72.5	70.1	67.7	63.7	61.1	57.3	58.7	61.0	64.2	64.4	63.4	60.7	60.8	57.9	39.2
4000	71.6	69.3	72.4	68.9	67.4	64.9	62.5	58.5	56.0	52.4	54.4	56.8	60.0	60.2	59.5	56.4	56.6	53.0	31.7
5000	66.0	63.8	66.7	63.3	61.8	59.4	56.7	53.2	50.7	47.8	49.9	52.3	55.5	55.8	55.3	52.1	52.1	48.3	20.0
6300	59.9	58.2	60.5	57.1	56.9	53.4	50.1	47.9	45.7	42.4	44.9	47.5	50.6	51.0	51.0	47.4	47.3	43.0	7.7
8000	54.1	53.1	54.5	51.3	51.5	47.8	44.3	42.4	40.4	36.6	39.2	42.2	45.0	45.9	46.3	42.5	42.2	36.8	-4.7
10000	48.6	47.5	48.7	45.6	45.6	41.8	38.1	35.6	34.4	30.9	34.5	37.3	39.8	40.8	41.1	37.1	37.3	29.4	-17.0
12500	42.8	41.7	43.0	39.7	39.2	35.3	30.9	29.1	27.6	24.4	29.1	32.6	35.4	36.3	36.7	32.4	32.5	22.4	-29.0
16000	37.4	35.9	36.7	34.0	32.7	27.9	22.6	21.3	19.3	14.6	21.8	26.1	29.6	30.8	31.3	26.2	26.5	7.5	-41.0
20000	30.5	28.7	29.7	25.7	23.2	17.2	9.5	13.4	11.1	4.9	9.3	18.4	20.8	21.7	23.6	16.5	17.3	-7.4	-53.0
25000	21.3	19.0	17.8	13.9	6.9	6.6	-3.5	5.6	2.8	-4.9	-3.3	10.6	8.4	12.0	12.3	6.8	8.2	-22.2	-65.0

RM0440103 VARIABLE 620.00 C TIT 80 % RPM ENG RUNUP

ALM dBA WITH EXCESS SOUND ATTENUATION

Distance (ft)	Angle (Degrees) 0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
200	93.7	95.1	94.9	94.5	94.6	94.0	92.9	91.9	92.3	91.2	92.9	95.0	96.8	98.0	98.3	99.4	96.8	83.9	63.9

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250	91.5	92.9	92.7	92.3	92.4	91.8	90.8	89.7	90.2	89.1	90.8	92.9	94.8	95.9	96.3	97.3	94.8	81.8	61.8
315	88.3	89.8	89.3	88.9	89.1	88.6	87.6	86.3	86.6	85.3	86.7	88.6	90.1	90.9	91.4	93.3	90.7	78.7	58.7
400	85.3	86.8	86.1	85.5	85.9	85.5	84.5	83.0	83.2	81.8	82.8	84.6	85.6	86.1	86.8	89.1	86.5	75.3	55.3
500	82.3	83.7	83.0	82.5	82.8	82.5	81.5	79.9	80.1	78.7	79.7	81.5	82.4	82.9	83.8	86.3	83.5	72.7	52.7
630	79.2	80.7	79.9	79.5	79.8	79.4	78.4	76.8	77.1	75.7	76.6	78.5	79.4	79.8	81.0	83.5	80.6	70.2	50.2
800	76.0	77.6	76.8	76.5	76.7	76.4	75.3	73.8	74.1	72.7	73.7	75.6	76.6	77.0	78.3	80.8	77.8	67.8	47.8
1000	72.7	74.5	73.6	73.4	73.6	73.3	72.2	70.7	71.1	69.7	70.8	72.8	73.9	74.3	75.7	78.3	75.2	65.4	45.4
1250	69.4	71.4	70.4	70.4	70.5	70.2	69.1	67.5	68.1	66.8	68.0	70.0	71.2	71.7	73.2	75.8	72.7	63.0	43.0
1600	66.4	68.6	67.4	67.6	67.7	67.4	66.2	64.7	65.3	64.1	65.3	67.4	68.6	69.2	70.6	73.2	70.0	60.6	40.6
2000	63.4	65.7	64.4	64.7	64.8	64.5	63.4	61.8	62.6	61.3	62.6	64.7	66.1	66.7	68.1	70.6	67.4	58.2	38.2
2500	60.4	62.9	61.5	61.9	62.0	61.7	60.5	59.0	59.8	58.6	60.0	62.1	63.6	64.2	65.5	67.8	64.6	55.5	35.5
3150	57.5	60.1	58.6	59.2	59.2	58.9	57.7	56.1	57.1	55.9	57.3	59.5	61.0	61.7	62.7	64.8	61.6	52.6	32.6
4000	54.6	57.3	55.8	56.4	56.4	56.1	54.9	53.4	54.4	53.2	54.7	56.9	58.5	59.1	59.7	61.6	58.4	49.4	29.4
5000	51.5	54.2	52.8	53.4	53.3	53.0	51.7	50.3	51.4	50.2	51.8	54.0	55.7	56.3	56.7	58.2	55.0	45.9	25.9
6300	48.2	50.8	49.6	50.2	50.1	49.7	48.5	47.1	48.2	47.1	48.8	51.0	52.8	53.5	53.8	55.1	52.0	42.6	22.6
8000	44.6	47.1	46.1	46.6	46.5	46.0	44.8	43.6	44.7	43.6	45.5	47.7	49.7	50.5	51.1	52.7	49.5	40.3	20.3
10000	40.6	42.8	42.3	42.6	42.5	41.9	40.7	39.7	40.8	39.8	41.8	44.1	46.3	47.4	48.3	50.2	47.0	37.9	17.9
12500	35.9	37.7	37.6	37.8	37.7	37.0	35.8	35.0	36.1	35.3	37.4	39.7	42.1	43.5	45.2	47.4	44.4	35.5	15.5
16000	30.7	32.1	32.3	32.4	32.3	31.6	30.5	29.9	31.0	30.3	32.5	34.8	37.5	39.4	41.9	44.6	41.6	33.1	13.1
20000	25.1	26.2	26.8	26.6	26.6	26.0	25.0	24.6	25.6	25.2	27.5	29.7	32.7	35.2	38.7	41.8	38.9	30.5	10.5
25000	19.5	20.2	21.0	20.7	20.9	20.5	19.8	19.5	20.4	20.4	22.5	24.7	27.9	31.1	35.5	38.9	36.0	27.8	7.8

PNLT PNdB WITH EXCESS SOUND ATTENUATION

Distance (ft)	Angle (Degrees) 0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
200	107.7	108.1	109.0	108.0	108.2	107.7	106.8	106.0	105.9	104.8	106.3	107.8	109.8	111.6	112.8	114.4	112.0	102.3	81.0
250	105.5	105.8	106.7	105.7	106.0	105.4	104.6	103.8	103.6	102.5	104.1	105.6	107.7	109.5	110.7	112.3	109.9	100.2	78.6
315	102.6	102.9	103.5	102.4	102.8	102.4	101.5	100.5	100.5	99.3	100.6	102.1	103.4	105.4	107.2	108.9	106.3	97.0	75.1
400	99.5	99.7	100.2	99.0	99.6	99.2	98.3	97.0	97.2	95.9	97.0	98.6	99.3	100.9	103.4	105.2	102.5	93.6	70.9
500	96.4	96.6	97.1	95.9	96.4	96.1	95.2	93.9	94.1	92.8	93.9	95.5	96.2	97.7	100.8	102.7	99.8	91.1	68.0
630	93.1	93.3	93.8	92.6	93.2	92.8	92.0	90.6	90.8	89.5	90.6	92.2	93.0	94.9	98.2	100.1	97.3	88.6	65.1
800	89.7	90.0	90.4	89.2	89.8	89.5	88.6	87.3	87.5	86.2	87.3	88.9	89.7	92.1	95.6	97.7	94.7	86.1	62.1
1000	86.2	86.5	86.9	85.9	86.4	86.0	85.1	83.9	84.0	82.8	83.9	85.5	86.5	89.4	93.0	95.2	92.2	83.5	59.1
1250	82.5	82.9	83.3	82.3	82.7	82.4	81.5	80.3	80.4	79.2	80.4	81.9	83.5	86.6	90.4	92.7	89.6	80.6	55.7
1600	79.1	79.7	79.9	78.8	79.4	79.1	78.2	76.9	77.2	75.9	77.0	78.7	80.4	83.5	87.6	90.1	87.0	77.7	52.2
2000	75.6	76.4	76.4	75.4	76.0	75.7	74.8	73.4	73.7	72.5	73.6	75.5	77.3	80.4	84.9	87.4	84.2	74.6	47.9
2500	72.0	73.0	72.7	71.8	72.3	72.1	71.2	69.8	70.2	69.0	70.1	72.2	73.9	77.1	81.7	84.4	81.1	71.4	42.8
3150	68.2	69.5	68.9	68.3	68.8	68.5	67.8	66.3	66.6	65.6	66.8	69.0	70.9	73.6	78.1	81.1	77.4	68.0	37.3
4000	64.6	66.0	65.2	64.8	65.2	65.0	64.2	62.7	63.1	62.1	63.6	65.8	67.9	70.1	74.1	77.0	73.4	63.6	30.4
5000	60.7	62.2	61.1	61.0	61.4	61.1	60.4	58.8	59.3	58.2	60.0	62.4	64.7	66.2	70.0	72.8	69.2	58.9	21.7
6300	56.4	58.1	56.9	56.9	57.1	56.9	56.0	54.3	55.4	54.4	56.3	58.9	61.3	62.9	66.1	68.9	65.2	53.9	11.6
8000	51.3	53.6	53.0	52.9	53.0	52.5	51.3	50.1	51.2	50.2	52.6	55.4	57.9	59.6	62.9	65.8	62.1	50.1	1.5
10000	46.3	48.1	48.4	48.2	48.4	47.6	46.2	45.4	46.5	45.5	48.1	51.1	54.0	55.9	59.5	62.6	58.7	45.1	-8.6
12500	39.8	41.2	42.1	41.6	42.0	41.1	39.4	38.6	40.1	39.3	42.5	45.6	49.1	51.5	55.7	59.0	55.0	40.0	-18.3
16000	31.6	33.9	34.0	33.9	33.7	32.5	31.3	30.0	32.1	31.3	35.2	39.1	43.0	46.0	51.4	55.3	51.2	35.6	-28.1
20000	23.0	24.6	25.8	25.4	24.8	23.2	20.9	19.9	22.4	20.5	26.7	31.0	36.5	40.0	47.0	51.4	47.0	30.7	-37.8
25000	9.4	10.9	12.0	11.6	11.1	9.4	10.5	9.8	6.8	9.6	14.9	19.7	27.7	33.7	41.8	47.0	41.9	25.5	-47.5

ALMX dBA WITHOUT EXCESS SOUND ATTENUATION

Distance (ft)	Angle (Degrees) 0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
200	93.7	95.1	94.9	94.5	94.6	94.0	92.9	91.9	92.3	91.2	92.9	95.0	96.8	98.0	98.3	99.4	96.8	83.9	63.9
250	91.5	92.9	92.7	92.3	92.4	91.8	90.8	89.7	90.2	89.1	90.8	92.9	94.8	95.9	96.3	97.3	94.8	81.8	61.8
315	89.2	90.7	90.5	90.1	90.2	89.6	88.6	87.5	88.0	86.9	88.6	90.7	92.7	93.9	94.2	95.3	92.8	79.8	59.8
400	87.0	88.4	88.2	87.9	88.0	87.4	86.3	85.3	85.8	84.7	86.5	88.6	90.6	91.8	92.2	93.3	90.7	77.7	57.7
500	84.6	86.1	85.8	85.6	85.7	85.1	84.1	83.0	83.6	82.5	84.3	86.4	88.4	89.7	90.1	91.2	88.7	75.7	55.7
630	82.3	83.8	83.5	83.2	83.3	82.8	81.7	80.6	81.3	80.2	82.1	84.2	86.3	87.5	88.0	89.1	86.6	73.6	53.6
800	79.8	81.4	81.0	80.8	80.9	80.4	79.3	78.2	78.9	77.9	79.8	82.0	84.1	85.4	85.8	87.1	84.5	71.5	51.5
1000	77.3	78.9	78.5	78.4	78.4	77.9	76.9	75.8	76.5	75.6	77.5	79.7	81.8	83.2	83.7	85.0	82.4	69.4	49.4
1250	74.7	76.3	75.9	75.9	75.9	75.4	74.3	73.3	74.1	73.1	75.2	77.4	79.6	81.0	81.5	82.9	80.3	67.3	47.3
1600	72.0	73.7	73.3	73.3	73.3	72.8	71.7	70.7	71.6	70.7	72.7	75.0	77.3	78.7	79.3	80.7	78.2	65.2	45.2
2000	69.3	70.9	70.6	70.6	70.6	70.1	69.0	68.1	69.0	68.1	70.3	72.5	74.9	76.4	77.0	78.5	76.0	63.1	43.1
2500	66.5	68.1	67.8	67.9	67.8	67.3	66.3	65.4	66.3	65.5	67.7	70.0	72.4	74.0	74.7	76.3	73.8	60.9	40.9
3150	63.6	65.1	65.0	65.0	65.0	64.4	63.4	62.6	63.5	62.8	65.1	67.4	69.9	71.6	72.3	74.1	71.6	58.7	38.7
4000	60.6	62.0	62.1	62.0	62.0	61.4	60.4	59.7	60.7	60.0	62.4	64.7	67.2	69.1	69.9	71.8	69.3	56.5	36.5
5000	57.6	58.8	59.1	58.9	58.9	58.2	57.3	56.7	57.7	57.1	59.5	61.9	64.5	66.4	67.4	69.4	66.9	54.2	34.2
6300	54.4	55.4	55.9	55.7	55.7	55.0	54.1	53.6	54.5	54.1	56.6	58.9	61.6	63.7	64.8	67.0	64.5	51.9	31.9
8000	51.1	51.8	52.6	52.2	52.2	51.6	50.8	50.4	51.3	50.9	53.4	55.8	58.5	60.8	62.0	64.4	61.9	49.5	29.5
10000	47.6	48.1	49.1	48.6	48.6	48.0	47.3	47.0	47.8	47.5	50.1	52.5	55.3	57.7	59.2	61.8	59.3	47.0	27.0
12500	44.0	44.2	45.4	44.7	44.8	44.2	43.7	43.4	44.2	44.0	46.7	49.0	51.9	54.5	56.1	59.0	56.5	44.4	24.4
16000	40.1	40.1	41.4	40.7	40.8	40.2	39.9	39.7	40.4	40.3	43.0	45.3	48.2	51.0	53.0	56.1	53.6	41.7	21.7
20000	36.0	35.8	37.2	36.3	36.6	36.1	35.9	35.7	36.3	36.4	39.0	41.4	44.4	47.3	49.6	53.1	50.5	38.8	18.8
25000	31.6	31.3	32.8	31.8	32.1	31.7	31.7	31.5	32.1	32.3	34.9	37.2	40.2	43.4	46.0	49.8	47.1	35.8	15.8

PNLTX PNdB WITHOUT EXCESS SOUND ATTENUATION

Distance (ft)	Angle (Degrees) 0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
200	107.7	108.1	109.0	108.0	108.2	107.7	106.8	106.0	105.9	104.8	106.3	107.8	109.8	111.6	112.8	114.4	112.0	102.3	81.0
250	105.5	105.8	106.7	105.7	106.0	105.4	104.6	103.8	103.6	102.5	104.1	105.6	107.7	109.5	110.7	112.3	109.9	100.2	78.6
315	103.2	103.5	104.4	103.3	103.7	103.1	102.3	101.5	101.3	100.2	101.8	103.4	105.5	107.3	108.6	110.3	107.8	98.1	76.3
400	100.9	101.2	102.0	101.0	101.3	100.7	99.9	99.1	99.0	97.9	99.4	101.2	103.3	105.1	106.4	108.2	105.7	95.9	73.9
500	98.4	98.7	99.5	98.5	98.8	98.3	97.4	96.6	96.6	95.4	97.0	98.9	101.1	102.9	104.2	106.0	103.5	93.7	71.4
630	95.9	96.2	97.0	95.9	96.3	95.8	94.9	94.1	94.1	92.9	94.6	96.6	98.8	100.7	102.0	103.8	101.3	91.5	68.8
800	93.2	93.5	94.2	93.2	93.6	93.1	92.3	91.4	91.4	90.3	92.1	94.1	96.4	98.3	99.7	101.6	99.1	89.2	66.3
1000	90.4	90.8	91.4	90.4	90.7	90.3	89.5	88.5	88.7	87.6	89.6	91.7	94.0	96.0	97.4	99.4	96.8	86.9	63.7
1250	87.5	87.9	88.4	87.3	87.8	87.4	86.6	85.5	85.8	85.0	87.0	89.1	91.4	93.5	95.0	97.1	94.5	84.3	60.9
1600	84.3	84.9	85.2	84.2	84.7	84.3	83.5	82.3	82.8	82.2	84.4	86.4	88.9	91.1	92.6	94.8	92.2	81.7	58.1
2000	81.0	81.7	81.9	81.1	81.4	81.0	80.2	79.4	80.0	79.4	81.6	83.7	86.2	88.5	90.1	92.4	89.8	79.1	55.1

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2500	77.4	78.3	78.6	78.1	78.4	77.8	77.0	76.4	77.0	76.5	78.7	80.9	83.4	85.9	87.6	90.0	87.3	76.4	51.9
3150	74.3	75.0	75.5	75.0	75.3	74.7	73.9	73.3	74.0	73.5	75.8	78.0	80.6	83.1	84.9	87.6	84.8	73.6	47.6
4000	70.9	71.6	72.2	71.7	72.0	71.4	70.6	70.1	70.7	70.3	72.7	74.9	77.6	80.2	82.1	85.1	82.2	70.4	43.7
5000	67.5	68.1	68.7	68.2	68.5	68.0	67.2	66.7	67.4	67.1	69.5	71.8	74.6	77.3	79.1	82.3	79.3	67.1	39.5
6300	63.9	64.3	65.1	64.6	64.9	64.4	63.6	63.1	63.9	63.6	66.1	68.4	71.3	74.2	76.1	79.4	76.4	63.7	35.1
8000	60.0	60.5	61.3	60.8	61.1	60.5	59.8	59.3	60.1	59.8	62.5	65.0	67.9	71.0	73.0	76.4	73.4	60.1	30.7
10000	55.9	56.3	57.3	56.7	57.0	56.5	55.7	55.3	56.2	55.9	58.7	61.3	64.3	67.6	69.7	73.3	70.2	56.5	25.0
12500	51.5	51.7	52.9	52.3	52.6	52.0	51.3	50.9	51.8	51.7	54.6	57.4	60.5	64.0	66.3	70.1	66.9	53.1	19.7
16000	46.5	46.6	48.1	47.3	47.6	46.8	46.2	45.9	46.8	47.0	50.3	53.1	56.4	60.2	62.8	66.7	63.4	49.6	12.6
20000	41.0	40.7	42.6	41.5	41.8	41.4	40.8	40.7	41.6	41.9	45.4	48.3	52.0	56.0	59.0	63.1	59.7	45.4	5.4
25000	35.3	34.5	36.7	35.6	35.7	35.4	34.9	34.8	35.6	35.9	39.8	42.8	46.9	51.3	55.0	59.1	55.8	40.3	-1.8

RM0440104 VARIABLE 850.00 C TIT

ALM dBA WITH EXCESS SOUND ATTENUATION

Distance (ft)	Angle (Degrees) 0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
200	102.0	103.7	105.0	104.9	103.7	103.7	103.4	102.3	104.3	104.8	106.6	109.7	113.8	117.1	116.8	115.7	112.9	102.1	89.4
250	99.9	101.6	102.9	102.8	101.6	101.6	101.2	100.1	102.2	102.6	104.5	107.5	111.7	115.0	114.7	113.6	110.8	100.0	87.3
315	95.9	97.7	99.0	99.2	98.1	98.3	98.2	96.8	99.0	99.4	101.0	103.8	107.4	110.5	109.9	108.9	105.8	95.3	82.6
400	92.0	93.8	95.0	95.5	94.7	94.9	95.1	93.5	95.8	96.4	97.7	100.2	103.2	106.2	105.3	104.3	101.0	90.7	78.0
500	88.9	90.7	91.9	92.4	91.7	91.9	92.0	90.5	92.8	93.3	94.6	97.1	100.1	103.0	102.3	101.2	97.8	87.6	74.9
630	86.0	87.8	89.0	89.6	88.7	89.0	89.1	87.4	89.8	90.2	91.6	94.1	97.1	100.0	99.3	98.1	94.7	84.6	71.9
800	83.2	85.0	86.3	86.8	85.8	86.1	86.1	84.5	86.8	87.2	88.6	91.2	94.2	97.1	96.5	95.3	91.8	81.8	69.1
1000	80.4	82.3	83.5	84.1	83.0	83.3	83.1	81.5	83.8	84.0	85.6	88.3	91.5	94.4	93.8	92.6	89.1	79.1	66.5
1250	77.7	79.6	80.8	81.4	80.2	80.4	80.1	78.6	80.8	80.9	82.6	85.4	88.8	91.6	91.2	89.9	86.4	76.5	63.9
1600	75.1	77.0	78.2	78.8	77.5	77.8	77.4	75.8	78.0	78.0	79.8	82.7	86.2	89.0	88.6	87.4	83.8	74.0	61.3
2000	72.5	74.5	75.6	76.3	74.8	75.1	74.6	73.0	75.2	75.1	77.1	80.0	83.6	86.5	86.1	84.8	81.3	71.5	58.8
2500	69.9	71.9	73.1	73.7	72.2	72.4	71.8	70.3	72.4	72.2	74.3	77.3	81.0	83.9	83.5	82.2	78.7	68.9	56.2
3150	67.3	69.4	70.5	71.1	69.5	69.7	69.0	67.5	69.6	69.3	71.6	74.6	78.4	81.3	80.9	79.6	76.0	66.3	53.6
4000	64.6	66.7	67.8	68.4	66.8	67.0	66.2	64.8	66.8	66.5	68.8	71.9	75.8	78.7	78.2	76.8	73.3	63.5	50.9
5000	61.7	63.9	64.9	65.4	63.8	64.0	63.1	61.7	63.7	63.4	65.8	68.9	73.0	75.9	75.3	73.9	70.4	60.6	47.9
6300	58.7	60.8	61.9	62.3	60.6	60.7	59.8	58.5	60.4	60.0	62.6	65.8	70.0	72.9	72.5	71.1	67.5	57.7	45.0
8000	55.3	57.4	58.5	58.7	57.0	57.0	56.0	54.8	56.7	56.3	59.0	62.3	66.7	69.7	69.5	68.3	64.8	55.0	42.3
10000	51.6	53.6	54.8	54.7	53.0	52.8	51.7	50.7	52.6	52.3	55.1	58.5	63.1	66.2	66.4	65.3	61.8	52.0	39.4
12500	46.9	48.8	50.0	49.7	47.9	47.6	46.4	45.7	47.4	47.3	50.2	53.7	58.6	61.9	62.5	61.7	58.3	48.6	35.9
16000	41.6	43.3	44.6	44.0	42.2	41.7	40.5	40.1	41.8	42.0	44.9	48.5	53.6	57.2	58.4	57.8	54.6	44.9	32.3
20000	35.8	37.3	38.6	37.7	36.0	35.4	34.3	34.4	35.9	36.5	39.3	42.9	48.3	52.2	54.2	53.8	50.7	41.1	28.4
25000	29.5	30.7	32.0	30.9	29.5	28.9	28.2	28.6	29.9	30.9	33.6	37.2	42.8	47.1	50.0	49.9	46.8	37.3	24.6

PNLT PNdB WITH EXCESS SOUND ATTENUATION

Distance (ft)	Angle (Degrees) 0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
200	114.5	114.8	116.2	115.8	115.3	115.4	116.1	115.3	117.3	118.7	119.9	122.7	126.3	130.5	130.4	129.5	126.6	116.7	103.7
250	112.3	112.6	114.0	113.6	113.1	113.2	113.9	113.1	115.1	116.4	117.6	120.5	124.2	128.4	128.3	127.4	124.5	114.6	101.5
315	108.2	108.8	110.2	109.9	110.0	110.2	111.0	110.0	112.1	113.3	114.5	117.2	120.2	124.4	123.9	123.6	120.3	110.5	97.2
400	104.8	105.4	106.7	106.7	106.8	107.0	107.9	106.7	109.0	110.2	111.2	113.8	116.5	120.6	120.2	119.4	116.0	106.2	92.8
500	101.7	102.3	103.6	103.6	103.7	104.0	104.8	103.6	105.9	107.1	108.2	110.7	113.4	117.5	117.3	116.2	112.7	103.0	89.5
630	98.5	99.0	100.4	100.4	100.5	100.8	101.6	100.4	102.6	103.9	104.9	107.5	110.2	114.4	114.4	113.3	109.8	100.1	86.4
800	95.2	95.8	97.1	97.1	97.2	97.5	98.3	97.1	99.3	100.5	101.6	104.2	106.9	111.3	111.6	110.6	107.1	97.4	83.5
1000	91.9	92.5	93.9	93.8	93.9	94.0	94.8	93.7	95.9	97.1	98.2	100.8	103.7	108.1	108.8	108.0	104.4	94.6	80.5
1250	88.8	89.4	90.9	90.7	90.4	90.5	91.2	90.1	92.3	93.5	94.7	97.3	100.4	104.9	106.1	105.3	101.7	91.9	77.5
1600	85.9	86.5	87.9	87.7	87.2	87.4	88.0	86.8	89.0	90.2	91.4	94.1	97.3	101.8	103.3	102.6	99.0	89.1	74.4
2000	83.0	83.6	85.0	84.7	84.1	84.2	84.6	83.4	85.8	86.7	88.0	90.7	94.3	98.6	100.5	99.9	96.3	86.2	71.0
2500	79.9	80.6	81.9	81.7	80.8	81.0	81.3	80.1	82.4	83.2	84.6	87.3	91.1	95.5	97.5	96.9	93.3	83.1	67.2
3150	76.8	77.6	78.8	78.7	77.7	77.8	77.9	76.8	79.0	79.7	81.3	84.0	88.1	92.4	94.2	93.8	90.2	79.8	63.2
4000	73.5	74.6	75.7	75.6	74.5	74.7	74.6	73.5	75.7	76.3	78.0	80.7	85.0	89.2	90.7	90.4	86.8	75.9	58.7
5000	69.9	71.2	72.3	72.2	71.0	71.2	71.0	69.9	72.0	72.5	74.4	77.2	81.7	85.6	87.0	86.7	82.9	71.8	54.0
6300	66.1	67.6	68.6	68.6	67.3	67.4	67.0	65.9	68.1	68.5	70.7	73.6	78.3	82.2	83.4	82.9	79.1	68.2	49.0
8000	61.8	63.9	64.9	64.8	63.4	63.4	62.6	61.7	63.8	64.2	66.6	70.0	75.0	78.8	80.3	79.8	76.0	65.0	44.0
10000	57.5	59.7	60.9	60.4	59.0	58.9	57.8	57.2	59.0	59.5	62.5	66.1	71.2	75.1	76.9	76.5	72.8	61.3	38.8
12500	52.4	54.2	55.6	54.7	53.5	53.2	51.8	51.6	53.5	54.1	57.4	61.1	66.6	70.9	73.2	72.9	69.0	57.1	33.0
16000	46.2	48.0	49.1	48.3	46.8	46.1	44.9	45.0	47.1	47.7	51.2	55.5	61.5	65.9	69.1	69.0	65.0	52.6	26.6
20000	39.1	40.4	42.0	40.8	39.1	37.9	36.6	37.1	39.4	40.1	44.4	49.0	55.8	60.5	64.9	64.9	60.9	47.7	19.5
25000	29.4	30.1	32.3	30.3	28.4	27.2	27.1	28.8	29.5	31.7	35.9	41.2	49.3	54.9	60.3	60.7	56.4	42.5	12.1

ALMX dBA WITHOUT EXCESS SOUND ATTENUATION

Distance (ft)	Angle (Degrees) 0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
200	102.0	103.7	105.0	104.9	103.7	103.7	103.4	102.3	104.3	104.8	106.6	109.7	113.8	117.1	116.8	115.7	112.9	102.1	89.4
250	99.9	101.6	102.9	102.8	101.6	101.6	101.2	100.1	102.2	102.6	104.5	107.5	111.7	115.0	114.7	113.6	110.8	100.0	87.3
315	97.7	99.4	100.7	100.7	99.4	99.4	99.0	98.0	100.0	100.4	102.3	105.4	109.6	112.9	112.7	111.6	108.8	98.0	85.3
400	95.6	97.3	98.6	98.5	97.2	97.2	96.8	95.8	97.8	98.2	100.1	103.2	107.5	110.8	110.6	109.5	106.7	95.9	83.2
500	93.4	95.1	96.4	96.3	95.0	95.0	94.6	93.5	95.5	95.9	97.9	101.0	105.3	108.7	108.4	107.4	104.6	93.8	81.1
630	91.1	92.9	94.1	94.1	92.7	92.7	92.2	91.2	93.2	93.5	95.6	98.7	103.1	106.5	106.3	105.3	102.5	91.7	79.1
800	88.9	90.6	91.8	91.8	90.4	90.4	89.9	88.9	90.8	91.1	93.3	96.4	100.9	104.3	104.1	103.2	100.4	89.6	76.9
1000	86.5	88.3	89.5	89.5	88.0	88.0	87.4	86.4	88.4	88.7	90.9	94.1	98.6	102.0	101.9	101.0	98.3	87.5	74.8
1250	84.1	85.9	87.1	87.0	85.6	85.5	84.9	84.0	85.9	86.1	88.4	91.7	96.3	99.8	99.7	98.8	96.1	85.3	72.6
1600	81.7	83.4	84.6	84.5	83.0	82.9	82.3	81.4	83.3	83.5	85.9	89.2	93.9	97.4	97.4	96.6	93.9	83.1	70.4
2000	79.1	80.8	82.0	81.9	80.4	80.3	79.6	78.7	80.6	80.8	83.3	86.6	91.5	95.0	95.1	94.3	91.6	80.9	68.2
2500	76.4	78.1	79.4	79.2	77.6	77.5	76.7	76.0	77.7	78.0	80.6	84.0	89.0	92.5	92.7	92.0	89.3	78.6	65.9
3150	73.7	75.3	76.6	76.4	74.7	74.6	73.7	73.2	74.8	75.1	77.8	81.2	86.4	90.0	90.2	89.6	87.0	76.2	63.5
4000	70.8	72.4	73.7	73.3	71.7	71.5	70.6	70.2	71.8	72.1	74.9	78.4	83.6	87.3	87.7	87.1	84.5	73.8	61.1
5000	67.7	69.2	70.6	70.1	68.5	68.2	67.3	67.1	68.5	69.0	71.8	75.4	80.8	84.6	85.0	84.6	82.0	71.3	58.6
6300	64.5	65.9	67.3	66.7	65.0	64.7	63.8	63.8	65.2	65.7	68.6	72.3	77.8	81.7	82.2	81.9	79.4	68.7	56.0
8000	61.0	62.3	63.7	63.0	61.4	61.0	60.2	60.4	61.6	62.4	65.3	68.9	74.6	78.6	79.3	79.1	76.6	66.0	53.3

1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234890

(Continued)

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.123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234890
  10000     57.3  58.5  59.9  59.0  57.5  57.0  56.3  56.8  57.9  58.8  61.7  65.5  71.3  75.4  76.2  76.1  73.7  63.1  50.4
  12500     53.3  54.3  55.8  54.7  53.3  52.8  52.3  53.0  54.0  55.1  58.0  61.8  67.8  72.0  72.9  73.0  70.6  60.1  47.4
  16000     49.0  49.9  51.3  50.1  48.8  48.4  48.1  49.0  49.9  51.2  54.1  57.8  64.0  68.3  69.5  69.7  67.4  56.9  44.2
  10000     57.3  58.5  59.9  59.0  57.5  57.0  56.3  56.8  57.9  58.8  61.7  65.5  71.3  75.4  76.2  76.1  73.7  63.1  50.4
  12500     53.3  54.3  55.8  54.7  53.3  52.8  52.3  53.0  54.0  55.1  58.0  61.8  67.8  72.0  72.9  73.0  70.6  60.1  47.4
  16000     49.0  49.9  51.3  50.1  48.8  48.4  48.1  49.0  49.9  51.2  54.1  57.8  64.0  68.3  69.5  69.7  67.4  56.9  44.2
  20000     44.4  45.1  46.5  45.2  44.1  43.8  43.8  44.9  45.6  47.1  50.0  53.7  60.0  64.4  65.8  66.2  63.8  53.4  40.7
  25000     39.6  40.1  41.5  40.0  39.2  39.1  39.4  40.5  41.1  42.8  45.5  49.3  55.7  60.2  61.8  62.5  60.0  49.7  37.0

PNLTX PNdB    WITHOUT EXCESS SOUND ATTENUATION
 Distance                                            Angle (Degrees)
   (ft)      0    10    20    30    40    50    60    70    80    90   100   110   120   130   140   150   160   170   180
    200   114.5 114.8 116.2 115.8 115.3 115.4 116.1 115.3 117.3 118.7 119.9 122.7 126.3 130.5 130.4 129.5 126.6 116.7 103.7
    250   112.3 112.6 114.0 113.6 113.1 113.2 113.9 113.1 115.1 116.4 117.6 120.5 124.2 128.4 128.3 127.4 124.5 114.6 101.5
    315   110.2 110.4 111.8 111.4 110.8 110.9 111.6 110.8 112.8 114.1 115.4 118.3 122.0 126.2 126.1 125.3 122.4 112.5  99.3
    400   107.9 108.2 109.5 109.1 108.5 108.6 109.3 108.5 110.5 111.8 113.0 116.0 119.8 124.0 124.0 123.1 120.3 110.4  97.1
    500   105.6 105.9 107.2 106.8 106.1 106.2 106.9 106.1 108.0 109.3 110.6 113.6 117.5 121.8 121.8 120.9 118.2 108.2  94.8
    630   103.3 103.6 104.9 104.4 103.6 103.7 104.4 103.6 105.6 106.8 108.2 111.1 115.2 119.5 119.5 118.7 116.0 106.0  92.5
    800   100.9 101.1 102.4 102.0 101.1 101.2 101.8 101.0 102.9 104.1 105.6 108.6 112.9 117.2 117.2 116.5 113.8 103.8  90.2
   1000    98.4  98.6  99.9  99.4  98.5  98.6  99.0  98.2 100.2 101.4 103.0 105.9 110.4 114.8 114.9 114.2 111.5 101.5  87.8
   1250    95.8  96.0  97.2  96.7  95.8  95.9  96.1  95.3  97.3  98.6 100.2 103.1 107.9 112.4 112.5 111.9 109.2  99.1  85.3
   1600    93.1  93.2  94.5  93.9  93.0  93.1  93.1  92.3  94.4  95.6  97.3 100.4 105.4 109.9 110.0 109.5 106.8  96.6  82.8
   2000    90.2  90.4  91.6  91.1  90.1  90.1  89.9  89.3  91.3  92.4  94.3  97.6 102.7 107.3 107.5 107.0 104.4  94.1  80.2
   2500    87.2  87.4  88.6  88.1  87.1  87.1  86.7  86.4  88.2  89.1  91.4  94.8  99.9 104.6 104.9 104.6 101.9  91.6  77.5
   3150    84.3  84.4  85.6  85.0  83.9  83.9  83.4  83.3  84.8  85.9  88.4  91.8  97.1 101.9 102.2 102.0  99.4  88.9  74.4
   4000    81.0  81.2  82.4  81.7  80.7  80.6  79.9  80.1  81.5  82.7  85.2  88.7  94.1  98.9  99.4  99.4  96.8  86.1  71.3
   5000    77.5  77.8  79.1  78.3  77.2  77.1  76.5  76.8  78.1  79.3  82.0  85.5  91.1  95.9  96.5  96.7  94.0  83.2  68.1
   6300    73.9  74.2  75.6  74.6  73.6  73.3  72.9  73.3  74.5  75.8  78.5  82.1  88.0  92.8  93.5  93.8  91.1  80.2  64.7
   8000    70.0  70.4  71.9  70.8  69.7  69.3  69.1  69.6  70.8  72.1  74.9  78.6  84.7  89.6  90.4  90.8  88.2  77.0  61.2
  10000    65.8  66.4  67.9  66.6  65.5  65.2  65.1  65.7  66.9  68.2  71.1  74.8  81.2  86.2  87.1  87.8  85.0  73.6  57.2
  12500    61.5  62.0  63.5  62.0  60.9  60.9  60.8  61.6  62.6  64.0  67.1  70.9  77.6  82.7  83.7  84.6  81.7  70.2  53.2
  16000    56.8  57.2  58.8  57.1  56.1  56.1  56.0  57.1  57.9  59.5  62.7  66.6  73.6  78.9  80.2  81.1  78.2  66.5  48.4
  20000    51.5  51.8  53.5  51.8  51.1  51.0  51.0  52.3  53.0  54.7  58.1  62.1  69.4  74.9  76.5  77.5  74.3  62.4  43.4
  25000    45.7  45.7  47.6  46.0  45.4  45.4  45.6  47.1  47.7  49.5  53.1  57.2  64.6  70.3  72.4  73.4  70.1  57.8  38.1
ENDNOISE
123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234890
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Figure B - 1. Sample OPX File

In the tables presented here, three letters appear in the format column: A, I, and F. The letter A appearing under the format column signifies a character input, while the letter I signifies an integer value. For example, A10 represents a data field that may be 10 characters long. I10 represents an integer data field that may be 10 elements long. All text strings (A* format) must be left-justified in their respective fields and must be capitalized where noted. The letter F represents a floating point number whose number of digits (both before and after the decimal point) is given after the letter F. For example, F3.1 signifies a floating-point number, 3 digits in length with 1 digit to the right of the decimal. The number 10.0 is of format F3.1.

The following paragraphs describe the contents of the keywords in further detail. When these descriptions cite "Line" number, it refers to the number in the Line column of the aforementioned table, not the line of the actual or sample **OPX** file.

Keyword CASE

Table B-1 shows the contents and format of the data within the CASE keyword. Line 1 contains the CASE keyword. Lines 2 through 4 self-document the **OPX** file. They contain the full name of the **OPX** file, the date and time it was last saved, and a user-specified OPX case description. The case description starts with a banner line, and can then be followed by up to four more lines of 60 characters each (e.g., "Wright-Patt AFB Existing 1998 Ops, 260 operational days/year"). It is recommended that the OPX case description be different than the RUN case description, which was discussed in Appendix A.

CASE Keyword Section

Line	Column	Format	Description
1	1–4	A4	keyword for case data
2	1–12	A12	OPS filename
	13–26	Blank	
	27–29	F3.1	OPS file version (e.g., 7.0)
	30	Blank	
	31–41	A11	date of OPS file (dd-mmm-yyyy)
	42	Blank	
	43–50	A8	time of OPS file (hh:mm:ss)
	51–58	Blank	
	59–60	I2	number of case description lines (5 max)
3	1–10	Blank	
	11–70	A60	OPS case banner (long name)
4	1–10	Blank	
	11–70	A60	OPS case description

Note: Line 4 should be repeated to satisfy the number of case description lines.

Table B - 1. CASE Keyword

Keyword AIRFIELD

Table B-2 presents the content and format of the data within the AIRFIELD keyword. The purpose of the AIRFIELD keyword section is to store data about the airfield, which generally includes the airbase name, the airfield reference point, the Feature file, and climatological information. The term airbase applies to Air Force Bases, Naval and Marine Corps Air Stations, Army Airfields, civilian airports, etc.

Line 1 contains the AIRFIELD keyword. Line 2 allows for a 60-character airbase name. Line 3 contains the (x,y,z) and (latitude,longitude) coordinates of the airfield reference point. This is the point from which all other (x,y,z) coordinates are related. The z value is the elevation of the airfield reference point in feet (ft) above MSL. Line 4 stores a 60-character description of the reference point. Line 5 contains data for the magnetic declination of the airfield reference point, the number of daily periods, and the number of 60-character comment lines (up to 15) which will follow per the format in Line 6. The number of daily periods (2 or 3) refers to the noise metric specified in the RUN file (see Appendix A). The DNL and NEF metrics require two daily periods (daytime and nighttime), whereas the CNEL and WECPNL metrics require three daily periods (daytime, evening, and nighttime). The number of periods is irrelevant to the LEQ metric.

Line 7 allows for specification of the Feature filename, date, and time. (The details of the Feature file had not yet been defined at the time of this writing.) Lines 8 and 9 contain the climatological information for the airfield in terms of modeled and monthly average temperatures, relative humidity, and atmospheric pressure. The OMEGA10 and OMEGA11 computer programs use the modeled weather data to generate reference noise data for the core NOISEMAP computer program. **Note that the RNM 1.0 does not use the data on Lines 8 and 9**. The BASEOPS program derives the modeled weather data from the monthly values. The purpose of storing the monthly values on Line 9 is for BASEOPS' recall. The notes below Table B-2 further explain the items within the AIRFIELD keyword.

AIRFIELD Keyword Section

Line	Column	Format	Description
1	1–8	A8	keyword for airfield data
2	1–10	Blank	
	11–70	A60	airbase name (e.g., Wright-Patterson AFB)
3	1	Blank	
	2–10	A9	"AirfldRP:"
	11–20	I10	x-coordinate airfield reference point (+x=feet east of reference point)
	21–30	I10	y-coordinate airfield reference point (+y=feet north of reference point)
	31–40	I10	z-coordinate airfield reference point (+z=feet above MSL)
	41–59	D19.12	longitude (decimal degrees)
	60	A1	longitude direction ("W" or "E" for West or East)
	61–79	D19.12	latitude (decimal degrees)
	80	A1	latitude direction ("N" or "S" for North or South)
4	1–10	Blank	
	11–70	A60	reference point description
5	1–3	Blank	
	4–9	F6.2	magnetic declination (degrees, 0.00–180.00)
	10	A1	magnetic declination direction ("W" or "E" for West or East)
	11–18	Blank	
	19–20	I2	number of daily periods (2 or 3)
	21–28	Blank	
	29–30	I2	number of comment lines (15 max)
6	1–10	Blank	
	11–70	A60	comment text
7	1–12	A12	Feature (DLG) filename
	13–20	Blank	
	21–30	A10	date of DLG file (dd-mmm-yyyy in the form: 15-DEC-1997)
	31–32	Blank	
	33–40	A8	time of DLG file (hh:mm:ss)
8	1–2	Blank	
	3–10	A8	"Modeled:"
	11–15	Blank	
	16–19	F4.1	modeled temperature (degrees F or C)
	20	A1	temperature units ("F" or "C" for Fahrenheit or Celsius)
	21–23	Blank	
	24–27	F4.1	modeled relative humidity (%RH)
	28–30	A3	humidity units ("%RH")
	31	Blank	
	32–36	F5.2	modeled barometric pressure (inHg)
	37–40	A4	pressure units ("inHg")
9	1–2	Blank	
	3–10	A8	"Monthly:"
	11–15	Blank	
	16–19	F4.1	monthly temperature (same units as modeled)
	20–23	Blank	
	24–27	F4.1	monthly relative humidity (same units as modeled)
	28–31	Blank	
	32–36	F5.2	monthly barometric pressure (same units as modeled)

Notes:
(1) Line 6 should be repeated to satisfy the number of comment lines.
(2) Line 9 fields 11–36 (with blanks in fields 1–10) should be repeated to satisfy 12 months of data.
(3) Modeled temperature and humidity would typically be computed by BASEOPS from the monthly values.
(4) The first AIRFIELD comment line must contain the number of operational days per year in the form: XXX operational days per year.

Table B - 2. AIRFIELD Keyword

Keyword **POINT**

Table B-3 shows the content and format for the data within the POINT keyword section. This section describes the data pertaining to your POI, for which more detailed noise exposure calculations can be made. POI are typically local schools, hospitals, churches, and other noise-sensitive locations. Appendix A discusses additional noise exposure calculations.

Line 1 cites the POINT keyword and the number of POI to follow per format of Line 2. Line 2 stores the (x,y,z) and (latitude, longitude) coordinates of each POI as well as allowing for a 42-character description for each POI. As shown in Note 2 of Table B-3, the z value is in terms of ft AGL and not MSL.

POINT Keyword Section

Line	Column	Format	Description
1	1–5	A5	keyword for points of interest
	6–17	Blank	
	18–20	I3	number of points (100 max)
2	1–10	A10	point identification
	11–20	I10	x-coordinate (ft)
	21–30	I10	y-coordinate (ft)
	31–40	I10	z-coordinate (ft, AGL)
	41–59	D19.12	longitude (decimal degrees)
	60	A1	longitude direction ("W" or "E" for West or East)
	61–79	D19.12	latitude (decimal degrees)
	80	A1	latitude direction ("N" or "S" for North or South)
	81	Blank	
	82–123	A42	description of point

Notes: (1) Line 2 should be repeated to satisfy the number of points.
(2) Z axis for points is in AGL, all other Z axes are in MSL.

Table B - 3. POINT Keyword

Keyword **NAVAID**

Table B-4 shows the content and format of the data within the NAVAID keyword section. The purpose of this section is to describe Navigational Aids (Navaids). Navigational Aids are points on the ground usually representing facilities providing Terminal Area Control and Navigation (TACAN) services, Very-high Omnidirectional Radio (VOR) signals, or Non-Directional Beacon (NDB) signals. Navaids can also be ground points representing significant features such as road intersections used to guide pilots. Navaids are not used by the RNM or by the core NMAP program for noise exposure calculations **but are passed by these programs to the NMPLOT program** for plotting via the **GRD** file. Navaids are typically used (in the BASEOPS program) to develop the modeled flight tracks.

Line 1 contains the NAVAID keyword and the number of NAVAIDs to follow per format of Line 2. Line 2 stores the (x,y,z) and (latitude, longitude) coordinates of each NAVAID as well as allowing for a 42-character description for each NAVAID .

NAVAID Keyword Section

Line	Column	Format	Description
1	1–6	A6	keyword for navigational aid data
	7–17	Blank	
	18–20	I3	number of navigational aids (15 max)
2	1–10	A10	navaid identification
	11–20	I10	x-coordinate (ft)
	21–30	I10	y-coordinate (ft)
	31–40	I10	z-coordinate (ft, MSL)
	41–59	D19.12	longitude (decimal degrees)
	60	A1	longitude direction ("W" or "E" for West or East)
	61–79	D19.12	latitude (decimal degrees)
	80	A1	latitude direction ("N" or "S" for North or South)
	81	Blank	
	82–123	A42	description of navigational aid

Note: Line 2 should be repeated to satisfy the number of navigational aids

Table B - 4. NAVAID Keyword

Keyword RUNWAY

Table B-5 shows the content and format of the data within the RUNWAY keyword section. The RUNWAY section contains a description of the runways at the airfield. Fixed-wing aircraft typically use runways to arrive at or to depart from an airfield.

Line 1 contains the RUNWAY keyword and the number of runways to follow per the format of Lines 2 and 3. For each runway, Lines 2 and 3 store runway identification and the (x,y,z) and (latitude, longitude) centerline coordinates for each end of the runway. The total runway width (in feet) is also specified on Line 3.

RUNWAY Keyword Section

Line	Column	Format	Description
1	1–6	A6	keyword for runway data
	7–18	Blank	
	19–20	I2	number of runways (20 max)
2	1–10	A10	runway identification
	11–20	I10	x-coordinate at beginning of runway(ft)
	21–30	I10	y-coordinate at beginning of runway (ft)
	31–40	I10	z-coordinate at beginning of runway (ft, MSL)
	41–50	I10	x-coordinate at end of runway(ft)
	51–60	I10	y-coordinate at end of runway (ft)
	61–70	I10	z-coordinate at end of runway (ft, MSL)
3	1–19	D19.12	longitude at beg. (decimal degrees)
	20	A1	longitude direction ("W" or "E" for West or East)
	21–39	D19.12	latitude at beg. (decimal degrees)
	40	A1	latitude direction ("N" or "S" for North or South)
	41–59	D19.12	longitude at end (decimal degrees)
	60	A1	longitude direction ("W" or "E" for West or East)
	61–79	D19.12	latitude at end (decimal degrees)
	80	A1	latitude direction ("N" or "S" for North or South)
	81–83	I3	runway width (feet)

Note: Lines 2 and 3 should be repeated to satisfy the number of runways.

Table B - 5. RUNWAY Keyword

Keyword **VTOLPAD**

Table B-6 shows the content and format for the data within the VTOLPAD keyword section. This section contains the description of each Vertical Takeoff and Landing (VTOL) pad. A VTOL pad can be used by rotary-wing aircraft (e.g., helicopters), rotorcraft (e.g., V-22), and vertical lift aircraft (e.g., AV-8 Harrier).

Line 1 contains the VTOLPAD keyword and the number of VTOL pads to be described per the format on Line 2. Line 2 stores the identification, (x,y,z) and (latitude,longitude) coordinates and a 42-character description of each VTOL pad.

VTOLPAD Keyword Section

Line	Column	Format	Description
1	1–7	A7	keyword for VTOL pad data
	8–18	Blank	
	19–20	I2	number of VTOL pads (20 max)
2	1–10	A10	VTOL pad identification
	11–20	I10	x-coordinate (ft)
	21–30	I10	y-coordinate (ft)
	31–40	I10	z-coordinate (ft, MSL)
	41–59	D19.12	longitude (decimal degrees)
	60	A1	longitude direction ("W" or "E" for West or East)
	61–79	D19.12	latitude (decimal degrees)
	80	A1	latitude direction ("N" or "S" for North or South)
	81	Blank	
	82–123	A42	description of VTOL pad

Note: Line 2 should be repeated to satisfy the number of VTOL pads.

Table B - 6. VTOLPAD Keyword

Keyword **STATICPAD**

Table B-7 contains the content and format of the data within the STATICPAD keyword section. This section contains the information necessary to describe each static pad at the airfield. A static pad is the location at which static maintenance checks typically called "run-ups" are performed on engines/aircraft. The term 'run-up' was derived from the cycle executed by the aircraft conducting the maintenance check whereby an engine is initially run at low power settings and then increased to higher power settings. Run-ups can be conducted individually on out-of-frame engines or on in-frame engines, indoors (i.e., in a test cell building or an acoustical enclosure, a/k/a "hush house") or outdoors.

Line 1 contains the STATICPAD keyword and the number of static pads to be described per the format on Line 2. Line 2 stores the identification, (x,y,z) and (latitude,longitude) coordinates and a 42-character description of each static pad.

STATICPAD Keyword Section

Line	Column	Format	Description
1	1–9	A9	keyword for static pad data
	10–18	Blank	
	19–20	I2	number of static pads (50 max)
2	1–10	A10	static pad identification
	11–20	I10	x-coordinate (ft)
	21–30	I10	y-coordinate (ft)
	31–40	I10	z-coordinate (ft, MSL)
	41–59	D19.12	longitude (decimal degrees)
	60	A1	longitude direction ("W" or "E" for West or East)
	61–79	D19.12	latitude (decimal degrees)
	80	A1	latitude direction ("N" or "S" for North or South)
	81	Blank	
	82–123	A42	description of static pad

Note: Line 2 should be repeated to satisfy the number of static pads.

Table B - 7. STATICPAD Keyword

Keyword **TRACK**

Table B-8 contains the content and format for the data within the TRACK keyword section. The TRACK keyword section stores the information necessary to describe the modeled flight tracks. A flight track is the projection of an aircraft's path on the ground.

Line 1 contains the TRACK keyword and the number of tracks to be specified per the formats of Lines 2 through 4. Line 2 stores such track parameters as identification, type, runway/VTOL pad, the number of track comment lines, and the number of segments associated with a track. There are four types of tracks: arrival, departure, (closed) pattern, and interfacility. Arrival and departure tracks are self-explanatory. A closed pattern track begins and ends at the same point, and is typically used to model Touch-and-Go, Field Carrier Landing Practice, and Ground-Controlled Approach Box events. An interfacility track begins at one airfield and ends at another (nearby) airfield/location. For example, Medivac flights usually proceed from a hospital and return to an airport. Interfacility tracks require specification of a destination runway/VTOL pad on Line 2. If the track originates from a VTOL pad, the initial magnetic heading is written to Line 2. To self-document the track modeling process, Line 3 allows for up to 15 60-character comment lines.

Line 4 encapsulates the track specification via the turn angle (degrees Left or Right) and length (radius for turn segments) for each track segment. The running cumulative track length for each segment is also on Line 4. The order of segment specification for departure, pattern, and interfacility tracks is in the order in which the track is flown (e.g., a departure track starts at the beginning of a runway and proceeds in the direction of travel). An arrival track, however, is specified opposite the direction of travel (e.g., for a fixed-wing aircraft, an arrival track begins at the point on the runway at which the runway threshold is crossed and proceeds as if the aircraft is flying away from the airfield rather than towards the airfield). The notes below Table B-8 further explain the items within the TRACK keyword.

TRACK Keyword Section

Line	Column	Format	Description
1	1–5	A5	keyword for flight track data
	6–17	Blank	
	18–20	I3	number of flight tracks (400 max)
2	1–10	A10	flight track identification
	11–17	Blank	
	18–20	A3	type of flight track ("ARR", "DEP", "PAT", or "ITF" for Arrival, Departure, Closed Pattern, or Interfacility)
	21–30	A10	identification of runway/VTOL pad of origination
	31–40	A10	identification of runway/VTOL pad of destination
	41–44	Blank	
	45–50	F6.2	VTOL magnetic heading (degrees)
	51–58	Blank	
	59–60	I2	number of comment lines (15 max)
	61–68	Blank	
	69–70	I2	number of flight track segments (50 max)
3	1–10	Blank	
	11–70	A60	comment text
4	1–10	Blank	
	11–20	I10	segment distance (straight) or radius (turn), (ft)
	21–23	Blank	
	24–29	F6.1	segment turn angle (degrees)
	30	A1	segment turn direction ("L", "R", or Blank for Left, Right, or Straight)
	31–40	I10	segment length (ft)
	41–50	I10	cumulative flight track length (ft)

Notes:
(1) Line 3 should be repeated to satisfy the number of comment lines.
(2) Line 4 should be repeated to satisfy the number of flight track segments.
(3) Lines 2-4 should be repeated to satisfy the number of flight tracks.
(4) Line 2 columns 21–40 can be populated for closed patterns and interfacility types. Departures would only have columns 21–30 populated. Arrivals would only have columns 31–40 populated.
(5) Segment distance or radius must be greater than 0 and the first segment must be a straight segment.
(6) Segment turn angle must be greater than or equal to 0.
(7) Segment turn angle is actually F5.1 excluding its sign, which NMAP subsequently assigns.
(8) Cumulative track length should be ascending with ascending segment number.

Table B - 8. TRACK Keyword

Keyword FLIGHTAC

Table B-9 contains the format and content of the data within the FLIGHTAC keyword section. This section lists all aircraft for which flight profiles are given in the FLIGHTPROF keyword section. **The RNM 1.0 does not support this keyword.**

Line 1 contains the FLIGHTAC keyword and the number of identifications to be listed per the format of Line 2. Line 2 stores three flight aircraft parameters: identification, name, and engine name.

FLIGHTAC Keyword Section

Line	Column	Format	Description
1	1–8	A8	keyword for flight aircraft data
	9–17	Blank	
	18–20	I3	number of unique flight aircraft IDs in all flight profiles (200 max)
2	1–10	A10	flight aircraft identification ("F" plus the 6-character aircraft code)
	11–30	A20	flight aircraft name
	31–50	A20	flight aircraft's engine name

Note: Line 2 should be repeated to satisfy the number of flight aircraft IDs.

Table B - 9. FLIGHTAC Keyword

Keyword **FLIGHTPROF**

Table B-10 contains the content and format for the data within the FLIGHTPROF keyword section, which is one of the most significant sections for NMAP 7.0 **OPX** files. **The RNM 1.0 does not support this keyword.** The FLIGHTPROF keyword section describes the flight profiles for each of the flight aircraft listed under the FLIGHTAC keyword. A flight profile is primarily an aircraft's power setting, altitude, and airspeed as a function of distance along a given flight track.

Line 1 contains the FLIGHTPROF keyword and the number of profiles to follow per the formats in Lines 2 through 5. Lines 2 through 4 list the following profile parameters: identification (ID), aircraft category, aircraft ID, pre-flight aircraft ID, pre-flight run-up duration and power units, track ID with displacement, number of events, and profile comment lines.

Four aircraft categories **based**, **transient**, **civilian**, and **helicopter** are designated to aide you in grouping your profiles (e.g., at some airbases, based aircraft fly differently than transient aircraft of the same type). These categories are also useful for differentiating noise exposure computations between groups of aircraft types (e.g., a based F/A-18 Hornet aircraft can be modeled separately from a transient F/A-18 aircraft). In fact, the BASEOPS program makes available default departure and arrival profiles for most transient aircraft types and for all civilian aircraft types. BASEOPS' civilian aircraft type profiles and are taken directly from the FAA's INM. The reference noise data used by the core NOISEMAP program for these civilian types is also from the INM, whereas the noise data for the military (based, transient, and most of the helicopter) types is from NOISEMAP's own database. Additionally, parts of the noise exposure computations for the civilian aircraft are done with the INM methodology, whereas they are done with NOISEMAP's own methodology for the other aircraft categories[B1-B3]. These categories also provide separate sources for noise data.

Most military fixed-wing aircraft conduct pre-flight run-ups. A pre-flight run-up is a static run-up, usually conducted at the beginning of the takeoff roll on the runway at runway heading prior to brake release. (The STATICPROF keyword contains additional information about run-ups.) As reference noise data for this type of event is not available for all aircraft in the database, the pre-flight aircraft ID and power units are specified on Line 2. Similar to the static maintenance run-up profiles, Line 2 also specifies the duration of the run-up in seconds.

Each flight profile is assigned to a flight track (Line 2) and, as previously discussed for the TRACK keyword, each track is assigned to a runway/VTOL pad. Since some fixed-wing flight events do not begin or end at the beginning of the runway however, a takeoff or landing displacement is allowed on Line 3. Interfacility tracks/profiles may have takeoff and landing displacements.

Line 3 also contains the number of times the flight profile is conducted per day in two or three periods of each day. This is referred to in Table B-10 as the number of daytime, evening, and nighttime events. Per the format on Line 4, Line 3 allows up to 15 60-character comment lines.

Line 5 contains the altitude (ft, MSL), power setting, interpolation code, airspeed (knots), and noise profile ID for each specified cumulative (track) distance. As explained in Reference B1, the interpolation code describes the type of processing to be performed on the "raw" noise data for the specified power setting. The NMAP noise database does not contain data for every power setting/aircraft configuration for each of its aircraft types, but rather noise data for representative power settings and aircraft configurations. For this reason, the associated OMEGA programs are allowed to do two types of interpolations (PARALLEL and VARIABLE) between the representative settings/configurations as stated by the interpolation code. The interpolation code FIXED instructs the OMEGA programs to not interpolate the noise data to the user-specified power setting.

The noise profile ID does not appear in **OPS** files but only in **OPX** files. The notes below Table B-10 further explain the items within the FLIGHTPROF keyword.

FLIGHTPROF Keyword Section

Line	Column	Format	Description
1	1–10	A10	keyword for flight profile data
	11–16	Blank	
	17–20	I4	number of flight profiles (1000 max)
2	1–10	A10	flight profile identification
	11–20	A10	aircraft category ("BASED", "TRANSIENT", "CIVILIAN", or "HELICOPTER")
	21–30	A10	flight aircraft ID
	31–40	A10	pre-flight aircraft ID
	41–47	Blank	
	48–50	I3	pre-flight run-up duration (seconds)
	51	Blank	
	52–58	A7	"SECONDS"
	59–60	Blank	
	61–70	A10	power unit text
3	1–10	A10	flight track ID
	11–20	I10	takeoff displacement (ft)
	21–30	I10	landing displacement (ft)
	31–32	Blank	
	33–40	F8.2	number of daytime (0700–1900 or 0700–2200) events
	41–42	Blank	
	43–50	F8.2	number of evening (1900–2200) events
	51–52	Blank	
	53–60	F8.2	number of nighttime (2200–0700) events
	61–68	Blank	
	69–70	I2	number of comment lines (15 max)
	71–78	Blank	
	79–80	I2	number of profile segments (30 max)
4	1–10	Blank	
	11–70	A60	comment text
5	1–10	Blank	
	11–20	I10	cumulative flight track distance (ft)
	21–30	I10	altitude (ft, MSL)
	31	Blank	
	32–40	F9.2	power setting
	41–42	Blank	
	43–50	A8	power interpolation code ("FIXED", "PARALLEL", or "VARIABLE")
	51–57	Blank	
	58–60	I3	indicated airspeed (kts)
	61–70	Blank	
	71–80	A10	flight noise profile ID (or static noise profile ID for first segment of applicable departure)

Notes:
(1) Line 4 should be repeated to satisfy the number of comment lines.
(2) Line 5 should be repeated to satisfy the number of flight profile segments.
(3) Lines 2–5 should be repeated to satisfy the number of flight profiles.
(4) Flight profiles must be grouped or sorted by flight aircraft ID.
(5) Departures must have an initial airspeed of 0 kts.
(6) Helicopter and Civilian aircraft categories do not conduct pre-flight run-ups.
(7) Based and Transient aircraft categories and interfacility flights that have 0 initial airspeed must have the pre-flight aircraft ID field populated (true or surrogate run-up data for the associated flight aircraft) even if a 0-second duration is requested.
(8) Arrivals and Closed Patterns would have the pre-flight aircraft ID, pre-flight run-up duration, and "SECONDS" fields as blank.
(9) The flight noise profile ID consists of the aircraft ID plus a two-digit sequence number, which is unique for each, power setting.
(10) The OPX file must only contain profiles with non-zero events.

Table B - 10. FLIGHTPROF Keyword

Keyword **STATICAC**

Table B-11 contains the format and content of the data within the STATICAC keyword section. The purpose of this section is to list all of the aircraft/engines for which static (maintenance check/run-up) profiles are given in the STATICPROF keyword section. **The RNM 1.0 does not support this keyword.**

Line 1 contains the STATICAC keyword and the number of identifications to be listed per the format of Line 2. Line 2 stores four static aircraft/engine parameters: identification, name, engine name, and noise suppression name.

STATICAC Keyword Section

Line	Column	Format	Description
1	1–8	A8	keyword for static aircraft data
	9–17	Blank	
	18–20	I3	number of unique static aircraft IDs in all static profiles (200 max)
2	1–10	A10	static aircraft identification ("R" plus the 6-character aircraft code)
	11–30	A20	static aircraft name
	31–50	A20	static aircraft's engine name
	51–70	A20	static aircraft's noise suppression name

Note: (1) Line 2 should be repeated to satisfy the number of static aircraft IDs.
(2) Only maintenance run-up aircraft belong in this section (no pre-flight run-ups).

Table B - 11. STATICAC Keyword

Keyword **STATICPROF**

Table B-12 contains the content and format for the data within the STATICPROF keyword section, which is one of the most significant sections of an NMAP 7.0 **OPX** file. The STATICPROF keyword section describes the static (maintenance run-up) profiles for each of the static aircraft/engines listed under the STATICAC keyword. A static profile is primarily power setting, number of events, and duration at a given static pad. **The RNM 1.0 does not support this keyword.**

Line 1 contains the STATICPROF keyword and the number of profiles to follow per the formats in Lines 2 through 5. Lines 2 through 4 list the following profile parameters: identification (ID), aircraft/engine ID, magnetic heading, number of profile comment lines and segments, and the power units.

Each static profile is assigned to a pad (Line 2). Each profile must also have an assigned magnetic heading (degrees) – the direction to which the aircraft or engine is pointed during its run-up. A static profile can have up to 20 segments – some run-up cycles are long and complicated. As maintenance run-ups are typically conducted with one engine type or aircraft at a time, the power setting is written once on Line 2 rather than repeating it for each profile segment. Per the format on Line 3, up to 15 60-character comment lines are allowed.

Line 4 contains the power setting, number of engines running, interpolation code, the number of times the flight profile is conducted per day (in two or three periods of each day), duration, and static noise profile ID. As explained in Reference B4, the interpolation code describes the type of processing to be performed on the "raw" noise data for the specified power setting. The NMAP noise database does not contain data for every power setting/aircraft configuration for each of its aircraft/engine types, but rather noise data for representative power settings and engine configurations. For this reason, the associated OMEGA programs are allowed to do one type of interpolation between the representative settings/configurations as stated by the interpolation code VARIABLE. The interpolation code FIXED instructs the OMEGA programs to not interpolate the noise data to the user-specified power setting.

The number of times the flight profile is conducted per day is referred to in Table B-12 as the number of daytime, evening, and nighttime events. For each event, the time spent at the specified power setting is called the duration and is provided in seconds. The static noise profile ID does not appear in **OPS** files but only in **OPX** files. The notes below Table B-12 further explain the items within the STATICPROF keyword.

STATICPROF Keyword

Line	Column	Format	Description
1	1–10	A10	keyword for static profile data
	11–17	Blank	
	18–20	I3	number of static profiles (200 max)
2	1–10	A10	static profile identification
	11–20	A10	static aircraft ID
	21–30	A10	static pad ID
	31–34	Blank	
	35–40	F6.2	magnetic heading (degrees)
	41–48	Blank	
	49–50	I2	number of comment lines (15 max)
	51–58	Blank	
	59–60	I2	number of segments (20 max)
	61	Blank	
	62–69	A8	"SEGMENTS"
	70	Blank	
	71–80	A10	power unit text
3	1–10	Blank	
	11–70	A60	comment text
4	1–11	Blank	
	12–20	F9.2	power setting
	21–22	Blank	
	23–24	I2	number of engines running
	25–26	Blank	
	27–34	A8	power interpolation code ("FIXED" or "VARIABLE")
	35–36	Blank	
	37–44	F8.2	number of daytime (0700–1900 or 0700–2200) events
	45–46	Blank	
	47–54	F8.2	number of evening (1900–2200) events
	55–56	Blank	
	57–64	F8.2	number of nighttime (2200–0700) events
	65–69	Blank	
	70–74	I5	duration (seconds)
	75–84	Blank	
	85–94	A10	static noise profile ID

Notes:
(1) Line 3 should be repeated to satisfy the number of comment lines.
(2) Line 4 should be repeated to satisfy the number of static profile segments.
(3) Lines 2-4 should be repeated to satisfy the number of static profiles.
(4) Static profiles must be grouped or sorted by static aircraft ID.
(5) The static noise profile ID consists of the aircraft ID plus a two-digit sequence number, which is unique for each, power setting.
(6) The OPX file must only contain profiles with non-zero events and non-zero durations.

Table B - 12. STATICPROF Keyword

Keyword ENDOPS

ENDOPS concludes the operations portion of the **OPS/OPX** file. Table B-13 shows the format for the ENDOPS keyword.

ENDOPS Keyword Section

Line	Column	Format	Description
1	1–6	A6	keyword for end of operations data

Table B - 13. ENDOPS Keyword

Keyword FLIGHTNOISE

Table B-14 shows the content and format of the data within the FLIGHTNOISE keyword section. This keyword lists all single-event noise data as a function of distance as used by the core NMAP program for all of the flight noise profile IDs listed within the FLIGHTPROF keyword section. **The RNM 1.0 does not support this keyword.**

The noise data is presented for all single-event metrics applicable to the daily noise metrics described in Appendix A for the **RUN** file. Air-to-ground and ground-to-ground data is presented for all metrics. For RUN cases for which topography calculations are desired, the NMAP program does not use the ground-to-ground data. Inspection of Figure B-1 reveals that the data within the FLIGHTNOISE keyword is self-explanatory and can be easily deciphered via the 'description' column of Table B-14.

FLIGHTNOISE Keyword Section

Line	Column	Format	Description
1	1–11	A11	keyword for flight aircraft (FLIGHTNOISE)
2	1–17	Blank	
	18–36	A19	"FLIGHT AIRCRAFT ID:"
	37	Blank	
	38–44	A7	flight aircraft ID
3	1–15	Blank	
	16–36	A21	"FLIGHT AIRCRAFT NAME:"
	37	Blank	
	38–57	A20	flight aircraft name (max 20 characters)
4	1–24	Blank	
	25–36	A12	"ENGINE NAME:"
	37	Blank	
	38–57	A20	engine name (max 20 characters)
5	1–18	Blank	
	19–36	A18	"NUMBER OF ENGINES:"
	37	Blank	
	38	I1	number of engines
6	1	Blank	
	2–36	A35	"MEASURED FLIGHT NOISE DATA UPDATED:"
	37	Blank	
	38–48	A11	date in the form DA MON YEAR
7	1–8	Blank	
	9–36	A28	"SOURCE OF FLIGHT NOISE DATA:"
	37	Blank	
	38–49	A12	country, etc. (e.g., U.S.A.F.)
8	1	Blank	
	2–36	A35	"NUMBER OF POWER SETTINGS REQUESTED:"
	37	Blank	
	38–39	I2	number of flight noise power settings requested for this aircraft
9	All	Blank	
10	1–10	A10	"PROFILE ID"
	11–13	Blank	
	14–31	A18	"INTERPOLATION TYPE"
	32–35	Blank	
	36–48	A13	"POWER SETTING"
	49–52	Blank	
	53–65	A13	"SPEED (KNOTS)"
	66–68	Blank	
	69–85	A17	"POWER DESCRIPTION"
11	All	Blank	
12	1–10	A10	profile ID (aircraft ID + 2-digit sequence number)
	11–18	Blank	
	19–26	A8	interpolation type (FIXED, VARIABLE, or PARALLEL)
	27–32	Blank	
	33–41	F9.2	power setting value
	42	Blank	
	43–52	A10	power setting units (e.g., % RPM)
	53–57	Blank	
	58–60	I3	speed in knots
	61–68	Blank	
	69–88	A20	power description (e.g., TAKEOFF POWER)
13	All	Blank	
14	1	Blank	
	2–9	A8	"Distance"
	10–13	Blank	
	14–21	A8	"SEL (dB)"

	22–27	Blank	
	28–39	A12	"EPNL (EPNdB)"
	40–45	Blank	
	46–54	A9	"ALM (dBA)"
	55–59	Blank	
	60–70	A11	"PNLT (PNdB)"
15	1–3	Blank	
	4–7	A4	"(ft)"
	8–12	Blank	
	13–15	A3	"A–G" (for air-to-ground data)
	16–19	Blank	
	20–22	A3	"G–G" (for ground-to-ground data)
	23–28	Blank	
	29–31	A3	"A–G"
	32–35	Blank	
	36–38	A3	"G–G"
	39–44	Blank	
	45–47	A3	"A–G"
	48–51	Blank	
	52–54	A3	"G–G"
	55–60	Blank	
	61–63	A3	"A–G"
	64–67	Blank	
	68–70	A3	"G–G"
16	1–2	Blank	
	3–7	I5	profile slant distance in feet
	8–11	Blank	
	12–16	F5.1	air-to-ground SEL in dB
	17–18	Blank	
	19–23	F5.1	ground-to-ground SEL in dB
	24–27	Blank	
	28–32	F5.1	air-to-ground EPNL in EPNdB
	33–34	Blank	
	35–39	F5.1	ground-to-ground EPNL in EPNdB
	40–43	Blank	
	44–48	F5.1	air-to-ground ALM in dBA
	49–50	Blank	
	51–55	F5.1	ground-to-ground ALM in dBA
	56–59	Blank	
	60–64	F5.1	air-to-ground PNLT in PNdB
	65–66	Blank	
	67–71	F5.1	ground-to-ground PNLT in PNdB

Notes: (1) Lines 2 to 10 are repeated for each new flight aircraft.
(2) Lines 11 to 16 are repeated for each aircraft power setting.
(3) Line 16 is repeated for each of the 22 profile distances.

Table B - 14. FLIGHTNOISE Keyword

Keyword STATICNOISE

Table B-15 shows the content and format of the data within the STATICNOISE keyword section. This keyword lists all single-event noise data as a function of distance and azimuth relative to the noise of the aircraft/engine as used by the core NMAP program for all of the static noise profile IDs listed within the STATICPROF keyword section. **The RNM 1.0 does not support this keyword.**

The noise data is presented for all single-event metrics applicable to the daily noise metrics described in Appendix A for the **RUN** file. **For RUN cases for which topography calculations are desired, the "without excess sound attenuation" data is substituted for the "with excess sound attenuation" data (Line 15).** Inspection of Figure B-1 reveals that the data within the STATICNOISE keyword is self-explanatory and can be easily deciphered via the 'description' column of Table B-15.

STATICNOISE Keyword Section

Line	Column	Format	Description
1	1–11	A11	keyword for static aircraft noise (STATICNOISE)
2	1–17	Blank	
	18–36	A19	"STATIC AIRCRAFT ID:"
	37	Blank	
	38–44	A7	static aircraft ID
3	1–15	Blank	
	16–36	A21	"STATIC AIRCRAFT NAME:"
	37	Blank	
	38–57	A20	static aircraft name (max 20 characters)
4	1–24	Blank	
	25–36	A12	"ENGINE NAME:"
	37	Blank	
	38–57	A20	engine name (max 20 characters)
5	1–11	Blank	
	12–36	A25	"NOISE SUPPRESSION SYSTEM:"
	37	Blank	
	38–51	A14	noise suppressor name (or NONE)
6	1–18	Blank	
	19–36	A18	"NUMBER OF ENGINES:"
	37	Blank	
	38	I1	number of engines
7	1	Blank	
	2–36	A35	"MEASURED STATIC NOISE DATA UPDATED:"
	37	Blank	
	38–48	A11	date in the form DA MON YEAR
8	1–8	Blank	
	9–36	A28	"SOURCE OF STATIC NOISE DATA:"
	37	Blank	
	38–49	A12	country, etc. (e.g., U.S.A.F.)
9	1	Blank	
	2–36	A35	"NUMBER OF POWER SETTINGS REQUESTED:"
	37	Blank	
	38–39	I2	number of static noise power settings requested for this aircraft
10	All	Blank	
11	1–10	A10	"PROFILE ID"
	11–13	Blank	
	14–31	A18	"INTERPOLATION TYPE"
	32–35	Blank	
	36–48	A13	"POWER SETTING"
	49–54	Blank	
	55–71	A17	"POWER DESCRIPTION"
12	All	Blank	
13	1–10	A10	profile ID (aircraft ID + 2-digit sequence number)
	11–18	Blank	
	19–26	A8	interpolation type (FIXED or VARIABLE)
	27–33	Blank	
	34–42	F9.2	power setting value

	43	Blank	
	44–53	A10	power setting units (e.g., % RPM)
	54	Blank	
	55–74	A20	power description (e.g., TAKEOFF POWER)
14	All	Blank	
15	1–10	A10	noise measure name and units (e.g., ALM dBA, ALMX dBA, PNLT PNdB, or PNLTX PNdB)
	11–13	Blank	
	14–45	A32	"WITHOUT EXCESS SOUND ATTENUATION" or "WITH EXCESS SOUND ATTENUATION"
16	1	Blank	
	2–9	A8	"Distance"
	10–60	Blank	
	61–75	A15	"Angle (Degrees)"
17	1–3	Blank	
	4–7	A4	"(ft)"
	8	Blank	
	9–122	19(I6)	angles 0,10,20,...,180 degrees; 19 angles used as column headers.
18	1–2	Blank	
	3–7	I5	profile slant distance in feet
	8–9	Blank	
	10–123	19(F6.1)	noise measure values for 200-ft slant distance for angles 0 to 180 degrees

Notes:
(1) Lines 2 –11 are repeated for each new static aircraft.
(2) Lines 12 and 13 are repeated for each new aircraft power setting.
(3) Lines 14 to 18 are repeated for each noise measure within each aircraft power setting.
(4) Line 18 is repeated for each of the 22 profile distances.
(5) Number of engines on Line 6 refers to the total number of engines on the aircraft, not the number of engines running.
(6) Noise data always represents one engine running.

Table B - 15. STATICNOISE Keyword

Keyword **ENDNOISE**

ENDNOISE concludes the noise data portion of the **OPS/OPX** file. Table B-16 shows the format for the ENDNOISE keyword.

ENDNOISE Keyword Section

Line	Column	Format	Description
1	1–8	A8	keyword for end of noise data (ENDNOISE)

Table B - 16. ENDNOISE Keyword

REFERENCES FOR APPENDIX B

B1. Aerospace Information Report, *Procedure for the Calculation of Airplane Noise in the Vicinity of Airports,* SAE AIR 1845, issued March 1986.

B2. Mills, J.F., *Calculation of Sideline Noise Levels During Takeoff Roll*, Bolt Berenak and Newman, Inc., Report No. 3293 (also AMRL-TR-76-123), September 1976.

B3. Moulton, C.L., and Brown, D., *An Improved Takeoff Roll Noise Model for NOISEMAP 6.2,* Wyle Research Report WR 92-9, September 1992.

B4. Mohlman, H.T., *Updated Computer Programs for Predicting Single-Event Aircraft Noise Data for Specific Engine Power and Meteorological Conditions*, University of Dayton Research Institute Report No. AL/OE-TR-1994-0008, April 1993.

Appendix C

Format of the Log (.LOG) File

NMAP generates up to three output files, which provide the results of the noise exposure computations. They are named via their file extensions: LOG, POI, and GRD. The LOG file contains status run-time messages, the POI file contains the POI results, and the GRD file primarily contains the noise grid data used to generate noise contours. This appendix describes the LOG file.

The LOG file is a fixed format ASCII text file of status and warning messages written by the NMAP program during its execution. If the program comes upon a preconceived error, a LOG file may write an error message. NMAP also writes a completion message if the run completed successfully. These messages allow you to debug problems should they arise, and they inform you of the steps taken by NMAP to compute the noise exposure. The LOG file also serves as a receipt of NMAP's execution, as the same messages which appear on the screen are written to the LOG file. The RNM 1.0 does not have a LOG file.

Figure C-1 shows a sample LOG file. Line 1 contains the filename of the LOG file. The date and start time of the run follow on lines 2 and 3. The NOISEMAP version number is specified, and the RUN file and RUN case description self-document the LOG file.

```
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
File: f16dr.log
Date of start of NMAP run: 05/21/1998
Time of start of NMAP run: 14:08:28

 NMAP Version 7.0

 Run Case File: f16dr.run
 Run Case Description:
        WP91 baseline - F16A dep F16P on 3RD4 rup 16A at F16A

 Processing    1 Flight Profiles
 -------------------------------
                     Flight     Flight               Events
Aircraft Name        Profile    Track      Daytime  Evening  Nighttime
-------------------- ---------- ---------- -------- -------- ---------
F-16A                F16P       3RD4           4.95     0.00      0.15

 Processing    1 Runup Profiles
 ------------------------------
                     Runup      Runup Pad      Profile
Aircraft Name        Profile    ID          Heading  Segment
-------------------- ---------- ----------  -------  -------

F-16A                16A        F16A        252.00     01
F-16A                16A        F16A        252.00     02

Date of end of NMAP run: 05/21/1998
Time of end of NMAP run: 14:08:33
Duration of NMAP run:    00:00:04
NMAP completed.
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
```

Figure C - 1. Sample LOG File

For each flight profile executed, the associated aircraft name, flight profile ID, flight track, and number of events are written to the LOG file. The OPX file that was used for the sample LOG file of Figure C-1 contained only one flight profile.

For each run-up segment of each run-up profile, the associated aircraft name, profile ID, run-up pad ID, aircraft heading, and segment ID are written to the LOG file. The OPX file that was used for the sample LOG file of Figure C-1 contained only one two-segment run-up profile.

The end of each LOG file contains the end date and end time of the run. From the start and end dates and times, the duration of the NMAP run is computed and written to the LOG file. The last line of each LOG file contains the phrase "NMAP completed."

Appendix D

Format of the Points of Interest (.POI) File

NMAP generates up to three output files, which provide the results of the noise exposure computations. They are named via their file extensions – LOG, POI, and GRD. The LOG file contains status run-time messages; the POI file contains the POI results; and the GRD file primarily contains the noise grid data used to generate noise contours. This appendix describes the POI file.

NMAP computes the aircraft type, speed, power setting, and altitude of each flight profile which significantly contributes to the overall noise level at each POI. It writes this information, ranking the contributing profiles by their daily or single-event noise level, to a fixed format ASCII text file usually with a user-specified **.POI** extension. To learn how to state such specifications, see Appendix A.

Figure D-1 shows a sample POI file. A POI file can have up to five sections: header, summary, legend, ranked flight events, and ranked static events. The following describes the sections of a POI file in the order in which they appear.

1. **Header** – Each POI file begins with a **header** containing the POI and OPX filenames, the airbase name and OPX case description (from the OPX file), and the date and time of the start of the NMAP run.
2. **Summary** – The **summary** follows the **header** section.
3. **Legend** – The third section of each POI file is the **legend section**. The legend section describes the column headings of the ranked flight events and ranked static events sections which follow. The legends for flight events and run-up events appear only if either of these events exist in the case. The legend section is targeted to the (U.S.) noise metrics of DNL and CNEL.
4. **Ranked flight events** – If flight events exist in the user's case, the fourth section is the **ranked flight events section**. This section contains the profiles (and their associated data), which contributed the most to the overall flight noise exposure at each POI for each POI. See the legend section of Figure D-1 for a listing of the associated profile data.
5. **Ranked static events** – If static events exist in the user's case, the final section is the **ranked static events section**. This section contains the profiles (and their associated data), which contributed the most to the overall static noise exposure at each POI for each POI. See the legend section of Figure D-1 for a listing of the associated profile data.

1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

POI File: f16dr.poi
OPX File: f16dr.opx
Airbase Name: Unnamed Airfield (Old Baseops Format)
OPX Case: WRIGHT-PATTERSON AFB 1991 BASELINE
(Author :Bill Lichtinger) This case was converted from a
Baseops Version 5.0 File
Date of start of NMAP run: 5/21/1998
Time of start of NMAP run: 15: 1:55

SUMMARY OF TOTAL DNL

		LOCATION							
		LATITUDE	LONGITUDE	X	Y	Z	DNL (dB)		
POINT-ID	DESCRIPTION	(decimal degrees)	(decimal degrees)	(ft)	(ft)	(ft AGL)	FLIGHT	STATIC	TOTAL
22	22	0.397701483453D+02	0.840576581880D+02	-2754	-16261	5	36.3	12.1	36.3
34	34	0.397299684024D+02	0.839607852452D+02	-38070	-30909	5	20.2	-19.8	20.2
35	35	0.397353749198D+02	0.839553046659D+02	-40068	-28938	5	18.8	-20.1	18.8
24	24	0.397344806912D+02	0.840411588463D+02	-8769	-29264	5	45.8	-6.2	45.8
6	6	0.398639957230D+02	0.840701499589D+02	1800	17952	5	29.6	-7.2	29.6
25	25	0.397361265108D+02	0.839977256666D+02	-24603	-28664	5	38.3	-11.4	38.3
14	14	0.398068144634D+02	0.840977393817D+02	11858	-2894	5	35.2	-3.2	35.2
37	37	0.397527931774D+02	0.839955010670D+02	-25414	-22588	5	39.7	-7.9	39.7
26	26	0.397336577813D+02	0.839878480058D+02	-28204	-29564	5	32.3	-13.9	32.3
38	38	0.397430608974D+02	0.840076993334D+02	-20967	-26136	5	48.0	-7.3	48.0
27	27	0.397375666029D+02	0.839814923991D+02	-30521	-28139	5	29.8	-14.5	29.8
16	16	0.397475759293D+02	0.840070190613D+02	-21215	-24490	5	48.8	-5.6	48.8
39	39	0.397672736470D+02	0.840119894366D+02	-19403	-17309	5	54.0	1.3	54.0
28	28	0.397359893591D+02	0.839788645737D+02	-31479	-28714	5	28.4	-15.3	28.4
17	17	0.398044581983D+02	0.840800934524D+02	5425	-3753	5	40.5	-4.5	40.5
29	29	0.397394812398D+02	0.839699552035D+02	-34727	-27441	5	24.7	-16.5	24.7
18	18	0.398028178647D+02	0.840724074748D+02	2623	-4351	5	44.0	11.1	44.0
30	30	0.397262022185D+02	0.839619016595D+02	-37663	-32282	5	20.5	-20.2	20.5
31	31	0.397149393262D+02	0.839557325790D+02	-39912	-36388	5	18.1	-23.0	18.1
32	32	0.397014902369D+02	0.839533049951D+02	-40797	-41291	5	14.4	-25.7	14.4

COLUMN HEADER LEGEND (U.S.) FOR FLIGHT EVENTS

Heading	Description
POINT ID	identification of the point of interest
RANK	rank of profile DNL/CNEL to all other profiles
PROFILE ID	identification of the profile
TRACK TYPE	type of flight track (arrival, departure, etc.)
TRACK ID	identification of the track
POWER	power setting value (1)
UNITS	power units
SPEED	indicated airspeed (knots) (2)
ALTITUDE	altitude (ft MSL) (3)
SLANT	slant range (ft) (3)
DAYTIME	number of daytime (0700-2200 or 0700-1900) events
EVENING	number of evening (1900-2200) events
NIGHTTIME	number of nighttime (2200-0700) events
SEL	effective air-ground Sound Exposure Level (dB) due to this profile (4, 5)
DNL or CNEL	Day-Night Average Sound Level or Community Noise Equivalent Level (dB) due to this profile (5)
CUMU	cumulative DNL or CNEL of this and all higher ranking profiles (5)

COLUMN HEADER LEGEND (U.S.) FOR STATIC EVENTS

Heading	Description
POINT ID	identification of the point of interest
RANK	rank of profile DNL/CNEL to all other profiles
NOISE SUPPRESSION	type of noise suppression equipment installed
PROFILE ID	identification of the profile
PAD ID	identification of the run-up pad
HEAD	magnetic heading of noise source during static event
POWER	power setting value
UNITS	power units
ENG	number of engines running during event
SLANT	slant range (ft)
ANGLE	azimuthal angle (degrees) of receiver relative to aircraft/engine heading (see Figure 6 of AL-TR-1992-0059)
DAYTIME	number of daytime (0700-2200 or 0700-1900) events
EVENING	number of evening (1900-2200) events
NIGHTTIME	number of nighttime (2200-0700) events
DUR	duration of static event (seconds)
AL	Maximum A-weighted Sound Level (dB) due to this profile (4, 5)
DNL or CNEL	Day-Night Average Sound Level or Community Noise Equivalent Level (dB) due to this profile (5)
CUMU	cumulative DNL or CNEL of this and all higher ranking profiles (5)

(1) power setting prior to or of the point of closest approach (PCA);
if the pre-flight run-up is the contributor, the power setting is not that of the run-up but that of rotation;
the noise exposure includes the pre-flight run-up;
(2) airspeed prior to or of the PCA
(3) interpolated value at the PCA
(4) includes lateral or topographical attentuation and number of engines running; not necessarily at the PCA;
(5) decibels re: 20 micropascals; negative values are possible;

1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

DNL-RANKED FLIGHT EVENTS

POINT ID	RANK	AIRCRAFT NAME	ENGINE NAME	PROFILE ID	TRACK TYPE	TRACK ID	POWER	UNITS	SPEED (KIAS)	ALTITUDE (ft MSL)	SLANT (ft)	EVENTS DAYTIME	EVENTS EVENING	EVENTS NIGHTTIME	SEL (dB)	DNL (dB)	CUMU (dB)
22	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	155	1788	10444	4.95	0.00	0.15	77.7	36.3	36.3
34	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2336	21498	4.95	0.00	0.15	61.6	20.2	20.2
35	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2280	22913	4.95	0.00	0.15	60.2	18.8	18.8
24	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2968	4975	4.95	0.00	0.15	87.2	45.8	45.8
6	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	0	825	18042	4.95	0.00	0.15	71.0	29.6	29.6
25	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2404	8168	4.95	0.00	0.15	79.7	38.3	38.3
14	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	0	825	12206	4.95	0.00	0.15	76.6	35.2	35.2
37	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2157	7513	4.95	0.00	0.15	81.1	39.7	39.7
26	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2387	11786	4.95	0.00	0.15	73.7	32.3	32.3
38	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2351	4038	4.95	0.00	0.15	89.3	48.0	48.0
27	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2320	13506	4.95	0.00	0.15	71.2	29.8	29.8
16	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2267	3790	4.95	0.00	0.15	90.2	48.8	48.8
39	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	275	1994	2435	4.95	0.00	0.15	95.4	54.0	54.0
28	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2329	14581	4.95	0.00	0.15	69.8	28.4	28.4
17	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	0	825	6596	4.95	0.00	0.15	81.9	40.5	40.5
29	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2271	17389	4.95	0.00	0.15	66.1	24.7	24.7
18	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	0	825	5000	4.95	0.00	0.15	85.4	44.0	44.0
30	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2370	21545	4.95	0.00	0.15	61.9	20.5	20.5
31	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2440	25161	4.95	0.00	0.15	59.5	18.1	18.1
32	1	F-16A	F100-PW-100	F16P	DEP	3RD4	850.00	C TIT	325	2529	28184	4.95	0.00	0.15	55.8	14.4	14.4

DNL-RANKED STATIC EVENTS

POINT ID	RANK	AIRCRAFT NAME	ENGINE NAME	NOISE SUPPRESSION	PROFILE ID	PAD ID	HEAD (deg)	POWER	UNITS	ENG	SLANT (ft)	ANGLE (deg)	EVENTS DAYTIME	EVENTS EVENING	EVENTS NIGHTTIME	DUR (sec)	AL (dB)	DNL (dB)	CUMU (dB)
22	1	F-16A	F100-PW-100	NONE	16A	F16A	252.00	483.00	C TIT	1	9303	65	0.50	0.00	0.00	2164	30.8	11.6	11.6
22	2	F-16A	F100-PW-100	NONE	16A	F16A	252.00	620.00	C TIT	1	9303	65	0.50	0.00	0.00	22	41.8	2.8	12.1
34	1	F-16A	F100-PW-100	NONE	16A	F16A	252.00	483.00	C TIT	1	42903	11	0.50	0.00	0.00	2164	-0.9	-20.0	-20.0
34	2	F-16A	F100-PW-100	NONE	16A	F16A	252.00	620.00	C TIT	1	42903	11	0.50	0.00	0.00	22	6.5	-32.6	-19.8
35	1	F-16A	F100-PW-100	NONE	16A	F16A	252.00	483.00	C TIT	1	43548	7	0.50	0.00	0.00	2164	-1.2	-20.3	-20.3
35	2	F-16A	F100-PW-100	NONE	16A	F16A	252.00	620.00	C TIT	1	43548	7	0.50	0.00	0.00	22	5.9	-33.2	-20.1
24	1	F-16A	F100-PW-100	NONE	16A	F16A	252.00	483.00	C TIT	1	23174	51	0.50	0.00	0.00	2164	12.5	-6.7	-6.7
24	2	F-16A	F100-PW-100	NONE	16A	F16A	252.00	620.00	C TIT	1	23174	51	0.50	0.00	0.00	22	23.1	-16.0	-6.2
6	1	F-16A	F100-PW-100	NONE	16A	F16A	252.00	483.00	C TIT	1	25277	-122	0.50	0.00	0.00	2164	9.2	-10.0	-10.0
6	2	F-16A	F100-PW-100	NONE	16A	F16A	252.00	620.00	C TIT	1	25277	-122	0.50	0.00	0.00	22	28.7	-10.4	-7.2
25	1	F-16A	F100-PW-100	NONE	16A	F16A	252.00	483.00	C TIT	1	30996	22	0.50	0.00	0.00	2164	7.5	-11.7	-11.7
25	2	F-16A	F100-PW-100	NONE	16A	F16A	252.00	620.00	C TIT	1	30996	22	0.50	0.00	0.00	22	15.6	-23.4	-11.4
14	1	F-16A	F100-PW-100	NONE	16A	F16A	252.00	483.00	C TIT	1	14895	173	0.50	0.00	0.00	2164	13.6	-5.6	-5.6
14	2	F-16A	F100-PW-100	NONE	16A	F16A	252.00	620.00	C TIT	1	14895	173	0.50	0.00	0.00	22	32.1	-7.0	-3.2
37	1	F-16A	F100-PW-100	NONE	16A	F16A	252.00	483.00	C TIT	1	27758	11	0.50	0.00	0.00	2164	11.0	-8.1	-8.1
37	2	F-16A	F100-PW-100	NONE	16A	F16A	252.00	620.00	C TIT	1	27758	11	0.50	0.00	0.00	22	17.8	-21.3	-7.9
26	1	F-16A	F100-PW-100	NONE	16A	F16A	252.00	483.00	C TIT	1	34249	18	0.50	0.00	0.00	2164	5.0	-14.2	-14.2
26	2	F-16A	F100-PW-100	NONE	16A	F16A	252.00	620.00	C TIT	1	34249	18	0.50	0.00	0.00	22	13.1	-26.0	-13.9
38	1	F-16A	F100-PW-100	NONE	16A	F16A	252.00	483.00	C TIT	1	26641	23	0.50	0.00	0.00	2164	11.6	-7.6	-7.6
38	2	F-16A	F100-PW-100	NONE	16A	F16A	252.00	620.00	C TIT	1	26641	23	0.50	0.00	0.00	22	19.4	-19.7	-7.3
27	1	F-16A	F100-PW-100	NONE	16A	F16A	252.00	483.00	C TIT	1	35146	14	0.50	0.00	0.00	2164	4.4	-14.7	-14.7
27	2	F-16A	F100-PW-100	NONE	16A	F16A	252.00	620.00	C TIT	1	35146	14	0.50	0.00	0.00	22	12.0	-27.1	-14.5
16	1	F-16A	F100-PW-100	NONE	16A	F16A	252.00	483.00	C TIT	1	25662	20	0.50	0.00	0.00	2164	13.3	-5.8	-5.8
16	2	F-16A	F100-PW-100	NONE	16A	F16A	252.00	620.00	C TIT	1	25662	20	0.50	0.00	0.00	22	20.4	-18.6	-5.6

123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

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12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
39     1 F-16A      F100-PW-100     NONE      16A   F16A   252.00   483.00 C TIT   1 19843    9   0.50   0.00    0.00 2164   20.2    1.1    1.1
39     2 F-16A      F100-PW-100     NONE      16A   F16A   252.00   620.00 C TIT   1 19843    9   0.50   0.00    0.00   22   26.4  -12.7    1.3

28     1 F-16A      F100-PW-100     NONE      16A   F16A   252.00   483.00 C TIT   1 36257   14   0.50   0.00    0.00 2164    3.6  -15.6  -15.6
28     2 F-16A      F100-PW-100     NONE      16A   F16A   252.00   620.00 C TIT   1 36257   14   0.50   0.00    0.00   22   11.2  -27.9  -15.3

17     1 F-16A      F100-PW-100     NONE      16A   F16A   252.00   483.00 C TIT   1  8523  179   0.50   0.00    0.00 2164   14.1   -5.0   -5.0
17     2 F-16A      F100-PW-100     NONE      16A   F16A   252.00   620.00 C TIT   1  8523  179   0.50   0.00    0.00   22   25.5  -13.6   -4.5
29     1 F-16A      F100-PW-100     NONE      16A   F16A   252.00   483.00 C TIT   1 38207   10   0.50   0.00    0.00 2164    2.4  -16.7  -16.7
29     2 F-16A      F100-PW-100     NONE      16A   F16A   252.00   620.00 C TIT   1 38207   10   0.50   0.00    0.00   22    9.3  -29.8  -16.5

18     1 F-16A      F100-PW-100     NONE      16A   F16A   252.00   483.00 C TIT   1  5724 -175   0.50   0.00    0.00 2164   29.7   10.5   10.5
18     2 F-16A      F100-PW-100     NONE      16A   F16A   252.00   620.00 C TIT   1  5724 -175   0.50   0.00    0.00   22   41.1    2.0   11.1

30     1 F-16A      F100-PW-100     NONE      16A   F16A   252.00   483.00 C TIT   1 43354   13   0.50   0.00    0.00 2164   -1.3  -20.5  -20.5
30     2 F-16A      F100-PW-100     NONE      16A   F16A   252.00   620.00 C TIT   1 43354   13   0.50   0.00    0.00   22    6.4  -32.6  -20.2

31     1 F-16A      F100-PW-100     NONE      16A   F16A   252.00   483.00 C TIT   1 47620   15   0.50   0.00    0.00 2164   -4.2  -23.4  -23.4
31     2 F-16A      F100-PW-100     NONE      16A   F16A   252.00   620.00 C TIT   1 47620   15   0.50   0.00    0.00   22    4.4  -34.7  -23.0

32     1 F-16A      F100-PW-100     NONE      16A   F16A   252.00   483.00 C TIT   1 51452   19   0.50   0.00    0.00 2164   -7.0  -26.1  -26.1
32     2 F-16A      F100-PW-100     NONE      16A   F16A   252.00   620.00 C TIT   1 51452   19   0.50   0.00    0.00   22    2.9  -36.2  -25.7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
```

Figure D - 1. Sample POI File

Appendix E

Format of the Elevation (.ELV) and Impedance (.IMP) Files

The topography mode of NMAP requires two files: an elevation file (**ELV**), and an impedance (**IMP**) file. The creation and format of these files are described in this appendix. Section E.1 addresses items common to **ELV** and **IMP** files. Sections E.2 and E.3 address the **ELV** and **IMP** files, respectively.

E.1 General

ELV and **IMP** files follow the NMBGF 1.0 format, and contain grids of altitude and ground impedance, respectively. The following NMBGF keywords are used: **TITL** GridVers 1 0, **CASE**, **DECM FLOT**, **FEET** or **METR**, **DIDJ**, **IRJR**, **NINJ**, **MTRC** Zalt or Flow, **XRYR**, **ZALT** or **FLOW**, **ENDF**.

Each keyword must be followed by its associated user data. MTRC type Zalt or Flow, and keyword ZALT or Flow correspond to the **ELV** and **IMP** files, respectively.

ZALT and FLOW introduce the grids of elevations and ground flow resistivity. Elevations are in feet or meters, according to whether FEET or METR was specified. Flow resistivity is in MKS rayls. Soft ground has a nominal value of 200, and hard ground 10,000 or greater.

Reference E1 provides additional detail regarding the NMBGF 1.0 format.

E.2 Ground Elevation (ELV) File

The **ELV** file for the NMAP 7.0 test case (Wright-Patterson AFB) was derived from United States Geological Survey (USGS) hypsography 1:100,000 digital line graph (DLG) data. DLG files are available on-line from the Eros Data Center File Transfer Protocol (FTP) site:

ftp://edcftp.cr.usgs.gov/pub/data/DLG/100K

The FTP site arranges its files by quadrangle name. Downloads are free. Files may also be obtained on magnetic tape, for a nominal cost.

Depending on where the DLG files are obtained (download or tape order), the names may be formatted in one of several ways. For subsequent processing, the files must be named in the form:

nnnHPsii

or

nnnHPfii

with no extension and no intervening characters ("." or "-" or "_"). The element **nnn** is a three-character alphanumeric code identifying the quadrangle name; **HP** is the two-letter code denoting hypsography; and **sii** or **fii** is a code (**s** or **f**, and a two-digit number) identifying the portion of the quadrangle.

Utility programs are required and provided to process a DLG file into an **ELV** file. The following subsections describe the utilities ADDCR80, MAKECTL, DLGHGT and GRIDIT.

ADDCR80

DLG files are in ASCII, with 80 character lines, and must have breaks (line feed and/or carriage return) at the end of each line. Some files do not have line breaks. The utility program ADDCR80 is supplied to add line breaks if they are not present. ADDCR80 is run by the command line:

ADDCR80 *infile outfile*

where *infile* is the original **nnnHPsii** or **nnnHPfii** file (with no breaks) and *outfile* is the converted file. *Outfile* must be a different name than *infile*. Some operating systems have utility programs to add line breaks which can be used instead of ADDCR80.

MAKECTL

When DLG files have been collected (e.g., from the FTP site), properly named, and formatted (i.e., inclusion of line breaks), a "control file" is prepared listing the files that will be used. A control file is created by execution of the utility program MAKECTL.

If MAKECTL is in the directory containing the DLG files, a scrolling list of files appears. Use the space bar to tag the files to be prepared. When your selection is complete, press ENTER. You will be prompted for a file name. After entering the file name, the control file will be saved.

DLGHGT

Raw elevation data are extracted from the DLG files via the program DLGHGT. DLGHGT is run via the command line:

DLGHGT control.CTL case.XYZ

where *control.CTL* is the control file created by MAKECTL, and *case.XYZ*" is the elevation file to be created. The latter file must have the extension ".XYZ".

GRIDIT

The program GRIDIT creates the **ELV** file. GRIDIT requires two files: *case.XYZ*, as created above, and *case.SIZ*, which specifies details of the **ELV** file. Both files must have the same prefix as symbolized by the word "case". Extensions .XYZ, .SIZ and .ELV are hard-wired.

The following is a sample SIZ file:

```
1234567890123456789012345678901234567890123456789012345678901234567890
 -84.0313925000  39.8375625000  ;Long, lat of ref XR,YR
         0.          0.         ;Coordinates at ref (XR,YR)
       300.        300.         ;Grid mesh size (DI,DJ)
  351  351                      ;Dimensions of grid (NI,NJ)
  176  176                      ;Ref point on grid (IR,JR)
1234567890123456789012345678901234567890123456789012345678901234567890
```

The format of the SIZ file is as follows: the two items on the first line occupy 15 spaces each; the items on the second and third lines occupy 10 spaces each; and the items on the fourth and fifth lines occupy five spaces each. All items are right justified in these spaces.

The parameters are similar to those used to define the output noise grid. The first two lines must be consistent with the positioning of the coordinates for the current case; the remaining items do not have to match those used for the noise grid.

To generate the **ELV** file, enter the command line:

GRIDIT *case*

where *case* is the name (no extension) of the files to process. Inputs will be *case*.SIZ and *case*.XYZ. Elevation file *case*.ELV will be created.

A sample **ELV** file, for the area around Wright Patterson Air Force Base, is provided as part of the NMAP test case distribution.

E.3 Ground Impedance (IMP) File

At the time of this writing, no tools were available to prepare **IMP** files, or to prepare **ELV** files from other than USGS DLG hypsography. The file structure is well defined by the NMBGF 1.0 standard however, and the source code for GRIDIT may be consulted as a template for writing the file.

Sample **IMP** files are provided for uniform soft and hard ground. These **IMP** files can be used with any **ELV** file. It is not necessary therefore, to prepare **IMP** files unless ground impedance varies.

References for Appendix E

E-1. Wasmer, F., A Description of the Noise Model Binary Grid File Format Version 1.1, September 1993.

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