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NOISEMAP COMPUTER PROGRAM OPERATOR MANUAL ADDENDUM FOR VERSION 3.4 OF NOISEMAP

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NOISEMAP is a computerized procedure for predicting contours of equal noise exposure around airbases. It is routinely used to aid airbase planners to prevent community encroachment limiting the aircraft operational effectiveness of installations and for conducting environmental noise assessment studies.

This technical memorandum describes the four new features

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered) incorporated into version 3.4 of the NOISEMAP program. These are (1) new sideline noise exposure algorithm, (2) estimation of maximum allowed cutoff for computation, (3) estimation of grid spacing on the basis of runway utilization, (4) additions to the GPCP interface to make Compatible Use District Maps in the preferred format for USAF AICUZ analyses.

PREFACE

This report is one of a series describing the contractural and in-house research program undertaken by the Aerospace Medical Research Laboratory under Project/Task 723104, Measurement of Noise and Vibration Environments of Air Force Operations, to develop a procedure for predicting the community noise exposure resulting from aircraft operations. Other reports previously published under this research program include: AMRL-TR-73-105, "Community Noise Exposure Resulting From Aircraft Operations: Application Guide for Predictive Procedure"; AMRL-TR-73-106, "Community Noise Exposure Resulting From Aircraft Operations: Technical Review"; AMRL-TR-73-107, "Community Noise Exposure Resulting From Aircraft Operations: Acquisition and Analysis of Aircraft Noise and Performance Data"; AMRL-TR-73-108, "Community Noise Exposure Resulting From Aircraft Operations: Computer Program Operator's Manual"; AMRL-TR-73-109, "Community Noise Exposure Resulting From Aircraft Operations: Computer Program Description"; AMRL-TR-73-108, Appendix "Community Noise Exposure Resulting From Aircraft Operations: NOISEMAP Program Operator's Manual"; AMRL-TR-73-108, "Addendum For Version 3.3 of NOISEMAP". Technical monitor for this effort was Mr. Jerry Speakman of the Biodynamic Environment Branch.

NOISEMAP COMPUTER PROGRAM OPERATOR MANUAL
ADDENDUM FOR VERSION 3.4 OF NOISEMAP

This technical memorandum describes four new features which have been added to NOISEMAP Version 3.4. The technical aspects of the implementation are well documented in technical reports and memoranda prepared for the sponsor under previous Contract No. F33615-76-C-0507. The additional graphics capabilities were included to facilitate the operations at USAF/AFCEC, and have no further impact on the technical or modeling side of the program. No data decks already in existence have to be modified in order to execute properly under version 3.4.

Incorporated in this version are the following items:

1. Takeoff sideline algorithm described in BBN Report 3298 (September 1976, Draft). Because the user has to specify when the new algorithm is to be used, no changes are required for old decks. Old decks must, however, be modified if the new algorithm is to be used.

2. Computation of DNL cutoff level to insure adequate accuracy of the lowest contour level given the operations at the base. Criteria and assumptions are described in BBN Technical Memorandum: "Selection of Minimum Day/Night Levels for NOISEMAP Contour Calculations", (November 1976). These criteria are presented as part of the output of the DATASCREEN version parallel to NOISEMAP 3.4.

3. Analysis of the grid spacing for NOISEMAP contours following the guidelines of BBN Technical Memorandum "NOISEMAP Grid Spacing Analysis", (August 1976).

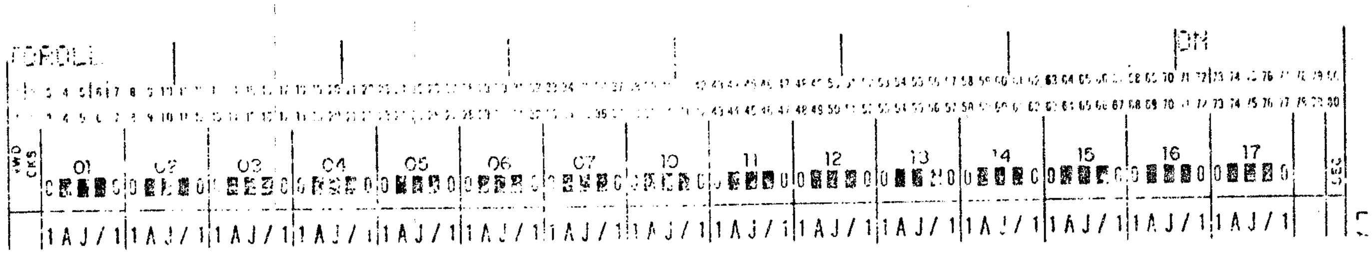
4. Incorporation of a special set of contour and accident potential maps for AICUZ planning studies. As a consequence of the restructuring of the NOISEMAP/GPCP interface the PLOT card will print some additional information on plot block assignment. This information is meaningful for installations which allow operator intervention and have a driver unit for the plotter which allows individual blocks to be addressed.

SECTION I

TAKE-OFF SIDELINE NOISE EXPOSURE

To obtain a more realistic model for the noise exposure during the initial ground roll, a new algorithm was developed. BBN Report 3298 describes the technical justification for this alternative method of computation. It is necessary, in order to obtain valid results, that the DSEL profile be coded differently because the algorithm will take care of some of the adjustments which had to be entered manually before. Full instructions on the preparation of the DSEL profile are given in Report 3289.

The program default mode is TOROLL - OFF. This forces the user to explicitly start the new computations with a TOROLL card. As a consequence decks prepared prior to this version of NOISEMAP will execute properly.



++ TAKEOFF ROLL SIDELINE ALGORITHM ENABLED

The user must prepare his data in accordance with the instructions of Appendix A of Report 3298 items 1 through 7 only. The ground runup part must NOT be added. The necessary computations will be automatically generated by NOISEMAP. As a consequence there will also not appear a ground runup listing in the chronicle, and no reference to this part of the model will appear in the DATASCREEN operations summary.

The algorithm can be turned on and off at will by repeated use of the TOROLL card placing the proper function "ON" or "OFF" in columns 71 to 73. Because this card requires special DSEL profiles, and has a profound influence on the manner in which computations are performed, the chronicle echo for this card is enclosed in a banner of asterisks. This is similar to the treatment accorded to PROCES and NOPROC cards.

The new sideline algorithm is effective only for take-offs. Since touch-and-go operations may be coded as either take-off or landing the results will be different. The program will not realize that a T/G operation contains a take-off section when it is coded as a landing. Consequently the sideline algorithm will not be used, even though it is currently enabled under these conditions.

SECTION II
SELECTION OF CUTOFF CRITERION

The capability of selecting a cutoff level other than the default of 35 DNL has been available for quite sometime. Guidelines as to which value to select have been missing. DATASCREEN will now provide some assessment of the value to be chosen. The end of run program will list the number of flight cards which were encountered for each runway, and compute from this a cutoff value. This is intended as a guidance for the user only, DATASCREEN will not modify the input deck to reflect its values!

It is important to recognize that the value arrived at assumes a fairly homogeneous distribution of flights over the area covered. No checks are performed, however, to see if this assumption is satisfied. Furthermore all flight cards are treated on an equal footing, which may also not be justified when very different types of aircraft are present. Since the runway activity schedule forms the most obvious bias in the value computed, DATASCREEN will print this as part of the output. The engineering judgement of the user governs which value is ultimately used in subsequent NOISEMAP runs. BBN Report 3409: "Community Noise Exposure Resulting From Aircraft Operations". NOISEMAP Computer Program Operator Manual, Addendum for version 3.3 of NOISEMAP" describes on page 8 the format of the DNL card to set this limit.

The algorithm used to arrive at the cutoff is described in BBN Technical Memorandum "Selection of Minimum Day/Night Levels for NOISEMAP Contour Calculations" (November 1976). The requirement based solely on the number of runways and number of flight cards may not be sufficiently conservative in order to provide reliable machine computation of contours. Therefore the GPCP interface also imposes a limit on what cutoff values are acceptable. Both factors are listed in the output.

```
RUNWAY
NAME  ACTIVITY
 02      57
 20      52

BASED ON ABOVE RUNWAY LAYOUT THE MINIMUM CUTOFF SHOULD BE 41.7 CURRENT
CUTOFF IS 35.0, NOISEMAP REQUIRES 40.0 FOR A PLOT OF 60.0
```

This message has the following interpretation. The lowest contour requested by the program was 60 DNL. (DATASCREEN keeps track of the lowest value requested on any PLOT, AREA, ARPLOT or PRPLOT card.) Based on the algorithm the cutoff could be set as high as 41.7. The contouring program interface will, however, require data down to 40.0 DNL when a 60 DNL plot is requested. Therefore, the user needs to specify at least 40 as the cutoff. If 41.7 were specified the 60 contour would be suppressed when a PLOT card with the value was found.

This duality stems from two problems which are associated with the cutoff. The first is whether or not the values which NOISEMAP computes are reliable down to a sufficiently low value. The second question is whether or not the contouring program can draw accurate contours through the data. These two requirements are to be satisfied simultaneously if the resulting contours are to have any useful purpose.

Again, the value printed by DATASCREEN is a guide only, and not a requirement. This situation changes, however, if the cutoff is higher than DATASCREEN computes. In that case some change is very definitely required to obtain reliable results. In this situation a warning message is printed.

```
MINIMUM GRID WALK CUTOFF IS  **.* WHICH IS LESS THAN CUTOFF
REQUIRED BY DATASCREEN   **.*
```

SECTION III
NOISEMAP GRID SPACING ANALYSIS

One problem which has plagued most users of NOISEMAP is the selection of a proper grid spacing for the computations. The spacing was originally set to 1,000 feet by default, without any user override. This was changed in later versions, but the question remains, what is an appropriate spacing. Whereas the cutoff criterion discussed above pertains primarily to the accuracy of the lowest valued contour, the grid spacing is the crucial variable in the accuracy of the highest valued (smallest area) contour. It also is a determining factor in the total computer time used for the calculations.

An initial attempt to solve this problem has been made. A technical memorandum entitled "NOISEMAP Grid Spacing Analysis" containing these results describes the work in more detail. The basic philosophy is that one can make a fairly accurate estimate of the actual areas of the L_{dn} 65 contour computed under the proper grid spacing, given what the area is when a 10,000 ft. grid spacing is used.

If A represents the area under the 65 contour at 10,000 feet, one may estimate the proper area from:

(1) $$\text{Area} = \frac{A}{(3.5 - 1.1 * \text{Log}_{10} A)}$$

The assumption is then made that the overall shape of the contours is an ellips with a major axis five times the size of the minor axis. Therefore the estimated grid spacing is

(2) $$G = 666 * \sqrt{\text{Area}}$$ (Area in sq. mi.)
(G in feet)

Considering the assumptions made in this scheme, it is clearly not intended that the value of G derived is to be given the meaning of being the *exact* grid spacing to obtain optimal results. Rather it is intended as a guide for the engineer, who should also take into consideration such variables as total contour size, and the shape of the contours. For example, if the contours are dominated by landing noise, giving rise to very narrow elongated contours, the five to one ratio is not satisfied, and for sufficient accuracy a narrower grid spacing would be appropriate.

In order to develop some feeling for the values version 3.4 of NOISEMAP will now print an area estimate based on equation (2) above next to every area computed using an ARPLOT or AREA card. In addition, the close-out routine XEND will now print the following information:

```
GRID SPACING ANALYSIS BASED ON
DNL    CONTOUR CALCULATED  ESTIMATED
         65.0       ****.*       ****.*
         80.0       ****.*       ****.*
```

The calculated value is based on equation (2) using the actual area calculated during the run, the estimated value is computed on the basis of the area equation (1). That is, the area computed during the run is assumed to be "A" rather than "Area".

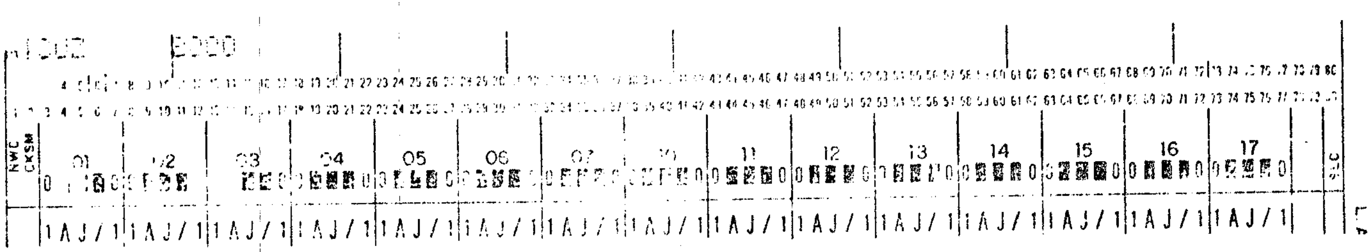
It should be noted also that the approximations, although they appear to hold reasonably well for a relatively small sample of bases, are by no means based on any sound theoretical model. When grid spacings other than 10,000 ft. are used for the estimate, the predictions may be grossly inaccurate. The program also does not make any allowance for contours which do not close within the map area. This also has some influence of the computations, since the areas are in fact larger than the program can determine.

SECTION IV
COMPATIBLE USE DISTRICT MAPS
AND EXPANDED PLOT DIAGNOSTICS

Version 3.4 of NOISEMAP has also incorporated in it the ability to make USAF standard compatible land use maps. The program will produce a special sequence of GPCP directives for this purpose. For this option to work properly it is necessary that the Calcomp software which drives the plotter is capable of producing searchable address blocks. The program will print the contents of each plotter block and provide the block address, so that the plotter operator can superpose the plot blocks in the order desired.

The AICUZ card has two options. One may specify the width of the clear zone to be either 2,000 or 3,000 feet in the data field 1, and one may specify in data field 2 that the 60 L_{dn} contour must also be plotted. The program default is 2,000 foot clear zone no 60 L_{dn} contour. A non-standard clear zone size will result in a diagnostic; the default value is used for the plot. Any non-zero value will cause a 60 L_{dn} contour to be computed; the program does not check the value, only if it is non-zero.

The program will assume that all data cards for GPCP go to TAPE11 (with the exception of the initial JOBX, BAS , and EDIT cards). It is, however, possible to split the GPCP files by specifying a negative width for the width of the clear zone. (i.e., a -2000 clear zone will cause the cards to be placed on TAPE8 rather than TAPE11). This is exactly similar to the use of negative plot options on PLOT cards. AICUZ maps are always plotted to a scale of 1:48000. This cannot be changed by the user.



```
+  COMPATIBLE USE DISTRICT MAP  -  WIDTH OF CLEAR ZONE IS  2000.0 FT
                  CONTOURS SHOWN ARE  65.0  70.0  75.0  80.0
                  PLOTTER BLOCK   1 IS CONTOURS
                  PLOTTER BLOCK   2 IS BORDER
                  PLOTTER BLOCK   3 IS CRASH AREA
                  PLOTTER BLOCK   4 IS LAYOUT
                  PLOTTER BLOCK   5 IS ADVANCE
```

The AICUZ card can generate a number of diagnostics, which are self-explanatory:

```
NON-STANDARD CLEAR ZONE  -  2000.0 ASSUMED
NO DATA - PLOT SUPPRESSED
NO RUNWAYS - NO ACCIDENT POTENTIAL MAP
NO GRID VALUES - NO CONTOURS
```

In all cases the cause is followed by the action taken by the program.

The block assignment is also printed for the PLOT card, so that the user can find the particular information more easily.

Both PLOT and AICUZ cards will, for plotters thus equipped, change pens during the plotting. For PLOT cards the contours are plotted with pen #1, the remainder with pen #2. For AICUZ cards everything is plotted with pen #1, except for the airfield name and scale, which are drawn with pen #2.