USER'S MANUAL FOR GENERATING SUPersonic DATA BASES
FOR MILITARY OPERATIONS AREAS

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SPECTRUM SCIENCES & SOFTWARE, INC.
2004-B LEWIS TURNER BLVD.
FORT WALTON BEACH, FL 32548

OCTOBER 1986

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NOISE AND SONIC BOOM IMPACT TECHNOLOGY (NSBIT) ADPO
HUMAN SYSTEMS DIVISION
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This report documents the development of supersonic data bases for five military operations areas (MOAs) and presents a user's guide to the two programs that were used to develop the data bases. Data bases were developed for Holloman, Luke, Oceana, Tyndall and Nellis MOAs. These data bases were generated on the Tyndall AFB Cyber Computer using two computer programs (MOAOPS and BOOM-MAP) developed by BBN Laboratories that extract and analyze data from the Tactical Air Crew Training Systems/Air Combat Maneuvering Instrumentation (TACTS/ACMI) manufactured by Cubic Corporation. The TACTS/ACMI system digitizes various positional and performance parameters of the aircraft on the range at frequent intervals for later replay in graphic or tabular form during aircrew debriefings. The MOAOPS program extracts information from TACTS/ACMI mission standard data tapes and compiles a library of engineering data concerning the supersonic operations. The
BOOM-MAP program calculates various statistics on the supersonic operations. It also calculates expected sonic boom levels on the ground based on the extracted information.

The results of the work performed on this contract verify the production capability of the MOAOPS and BOOM-MAP programs for extracting and analyzing data from TACTS/ACMI data tapes. Output from the BOOM-MAP program in terms of supersonic and boom producing flight track maps and noise contour maps, provide the environmental and range planner with important and useful tools to analyze MOA operations.
ABSTRACT

This report documents the development of supersonic data bases for five military operations areas (MOAs) and presents a user's guide to the two programs that were used to develop the data bases. Data bases were developed for Holloman, Luke, Oceana, Tyndall and Nellis MOAs. These data bases were generated on the Tyndall AFB Cyber Computer using two computer programs (MOAOPS and BOOM-MAP) developed by BBN Laboratories that extract and analyze data from the Tactical Air Crew Training Systems/Air Combat Maneuvering Instrumentation (TACTS/ACMI) manufactured by Cubic Corporation. The TACTS/ACMI system digitizes various positional and performance parameters of the aircraft on the range at frequent intervals for later replay in graphic or tabular form during aircrew debriefings.

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SUMMARY

This report documents the development of supersonic data bases for five military operations areas (MOAs) and presents a user's guide to the two programs that were used to develop the data bases. Data bases were developed for Holloman, Luke, Oceana, Tyndall and Nellis MOAs. These data bases were generated on the Tyndall AFB Cyber Computer using two computer programs (MOAOPS and BOOM-MAP) developed by BBN Laboratories that extract and analyze data from the Tactical Air Crew Training Systems/Air Combat Maneuvering Instrumentation (TACTS/ACMI) manufactured by Cubic Corporation. The TACTS/ACMI system digitizes various positional and performance parameters of the aircraft on the range at frequent intervals for later replay in graphic or tabular form during aircrew debriefings.

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The MOAOPS program was originally written to read data directly from TACTS/ACMI mission tapes; however, this was not possible on the Tyndall computer. Data on the mission tape was first copied to a disk file before executing the MOAOPS program. This restriction only impacts data extraction when a single mission is contained on two tapes because of limited storage capacity on the Tyndall computer. The user must obtain a dedicated disk pack for two mission tapes.

The results of the work performed on this contract verify the production capability of the MOAOPS and BOOM-MAP programs for extracting and analyzing data from TACTS/ACMI data tapes. Output from the BOOM-MAP program in terms of supersonic and boom producing flight track maps and noise contour maps, provide the environmental and range planner with important and useful tools to analyze MOA operations.
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SECTION 1. OVERVIEW

This report documents the development of supersonic data bases for five military operations areas (MOAs) and presents a user's guide to the two programs that were used to develop the data bases. Data bases were developed for Holloman, Luke, Oceana, Tyndall and Nellis MOAs. These data bases were generated using two computer programs (MOAOPS and BOOM-MAP) developed by BBN Laboratories that extract and analyze data from the Tactical Air Crew Training Systems/Air Combat Maneuvering Instrumentation (TACTS/ACMI) manufactured by Cubic Corporation. The TACTS/ACMI system digitizes various positional and performance parameters of the aircraft on the range at frequent intervals for later replay in graphic or tabular form during aircrew debriefings.

The MOAOPS program extracts information from TACTS/ACMI mission standard data tapes and compiles a library of information concerning the supersonic operations. The BOOM-MAP program calculates various statistics on the supersonic operations. It also calculates expected sonic boom levels on the ground based on the extracted information.

This work was accomplished using the Tyndall AFB Cyber 170 computer and Calcomp plotter. The two BBN programs, MOAOPS and BOOM-MAP, required modification before they could be used. Section 2 discusses the generation and modification of the supersonic data bases using the MOAOP program to extract and modify aircraft mission data from TACTS/ACMI mission tapes. Section 3 discusses the generation of output plots using the BOOM-MAP program to analyze the supersonic data bases and to generate the necessary input files for the General Purpose Contouring Program (GPCP II). Appendix A contains examples of
output from the MOAOPS program and includes mission and aircraft indexes for each MOA. Appendix B contains examples of output from the BOOM-MAP program and plots, depicting supersonic flight tracks, sonic boom producing flight tracks, overpressure contours, CSEL contours and CLDN contours obtained from the data bases. Plots are included for each MOA except Oceana. The BOOM-MAP program would not accept data from the Oceana LIBRY file. In addition, BOOM-MAP would not accept some of the data in the Tyndall LIBRY file. These two problems are being investigated by BBN Laboratories. The user is cautioned that all plots have been reduced for this report; therefore, the scale is not accurate. Additional information concerning MOAOP and BOOM-MAP can be found in the BBN User’s Guide written by Wilby [1].
SECTION 2  SUPersonic DATA BASE GENERATION AND MAINTENANCE

2.1 INTRODUCTION

This section will outline the procedures used to generate the supersonic data bases for Holloman, Luke, Oceana, Nellis and Tyndall MOAs. The MOAOP program actually consists of two separate programs: EXTRACT and DELETE. EXTRACT contains the code to extract data from the TACTS/ACMI mission tapes and DELETE is used to delete references from the INDEX file and to change mission names on existing index and library files. The EXTRACT program generates three files: two index files ("INDEX" and "MINDEX") and one library file ("LIBRY").

The MINDEX file contains a list of all mission numbers analyzed from TACTS/ACMI tapes. The MINDEX file serves as a record of missions analyzed and is updated when additional TACTS/ACMI tapes are read and when the DELETE program is run in the "CHANGE" mode. MINDEX is not used by the BOOM-MAP program. The INDEX file contains mission number, date, mission start and end time, TACTS/ACMI site name and number, aircraft type and tail number, the total number of records written to the LIBRY file, and the number of supersonic records written to the LIBRY file. The LIBRY file contains specific time, position, G load and velocity for each aircraft. Although aircraft information is recorded for each aircraft at 100 to 200 millisecond intervals, data was extracted from the TACTS/ACMI mission tapes at 1.5 second intervals. Only supersonic data was extracted from the TACTS/ACMI tapes. However, the EXTRACT program will still create a three record entry in the LIBRY file for non-supersonic data. These records can be deleted using the DELETE program but they will not cause any problems if they are left in the INDEX and LIBRY files.
2.2 File Management on the Tyndall Cyber

The Tyndall Cyber 170/730 computer, hereafter referred to as Cyber, current operating system is Nos 2.4.3 level 647. All permanent files on the Cyber are classified according to the manner in which they are accessed: indirect or direct access. These two access methods should not be confused with file types. The EXTRACT program generates two different file types: sequential and direct access. The INDEX and LIBRY files are direct access and the MINDEX file is sequential. The user is cautioned that a direct access type file e.g., an INDEX or LIBRY file cannot be altered with a text editor. You can examine a direct access file with the XEDIT editor but you must exit XEDIT with the "STOP" command. If you exit XEDIT with the "QUIT" command you may destroy the file key and render the file useless.

The access mode is determined by the command used to make the file permanent. How the file is made permanent also determines the command you must enter to access the file. If the user is not familiar with the permanent file storage and access commands they can be found in NOS Version 2 Reference Set, Volume 2. The INDEX and LIBRY files are usually stored as direct access permanent files while the MINDEX file is stored as an indirect access file. The Cyber has the NOS/BE "STORE" command installed which will automatically determine the storage method depending on file size. The user can store the MINDEX file as a direct access file.

2.3 Program EXTRACT

2.3.1 General Description

The EXTRACT program reads a TACTS/ACMI Mission Standard Data tape, extracts relevant information and appends this information to either a
new or existing data base. The TACTS/ACMI mission tapes contain data on up to 8 instrumented aircraft flying a mission on the MOA. Among the data collected is real time information on aircraft position, velocity and acceleration, updated at intervals of 100 to 200 milliseconds. The program extracts this data at approximately 1.5 second intervals in order to minimize both the time taken to read the tapes and the quantity of information to be stored. Storage capacity is extremely limited on the Cyber.

The number of tapes required to record an entire mission depends on the length of the mission and the number of aircraft involved. The EXTRACT program is designed to read data directly from TACTS/ACMI tapes; however, this is not possible on the Cyber. The TACTS/ACMI tape must be copied to a disk file before the data can be extracted. This does not cause any difficulty unless a single mission is on two tapes. Because of the size of the disk file generated by two TACTS/ACMI tapes, the user must obtain a dedicated disk pack and increased storage allocation from AFESC/SI. This assumes the user is using the Tyndall Cyber.

The information is then appended to either a new or an existing library file, which accumulates the information from all the mission tapes analyzed. The library file is indexed, so that a particular mission, aircraft type, etc., can be accessed by the sonic boom analysis program.

Two index files are formed. The mission index file (MINDEX) contains only the mission names, dates and site location for all the tapes analyzed. The second index (INDEX) contains information on every aircraft flying for every mission analyzed, such as aircraft type, aircraft tail number, starting and ending time of the mission.
Each entry in this index file is associated with a time series of data stored in the library file, and the appropriate record numbers for the library file access are stored in the index file. This index file is then used by the sonic boom analysis program to retrieve the appropriate flights to be analyzed.

During a mission, it is possible that changes may occur in the aircraft flying, or that erroneous data has been included in the mission tape and later corrected. The program detects any change in the number of aircraft flying, aircraft type or aircraft tail numbers and signifies the start of a new mission segment when this occurs. The index file contains one entry for each aircraft flying in each mission segment. The library file has an associated time series of data for each aircraft flying each mission segment.

Two choices are available for the data extraction program.
1. Only supersonic data (M>0.99) may be stored in the library file or all data (subsonic and supersonic) may be stored. It is important to keep the index and library files for these two cases distinctly separate, as the sonic boom analysis program uses only the supersonic data.
2. The sonic boom analysis program only requires data at time intervals of approximately 1.5 seconds for reasonable accuracy. However, an option in the data extraction program is available to read and store data in the library file at 100 or 200 millisecond intervals. The intention is to make it possible to analyze a few flight tracks in great detail if necessary. This option is not recommended for building a data base of many missions as the quantity of data could
become prohibitively large and should not be used for the
BOOM-MAP data base.

In addition to the data extraction program, a program to delete
entries from the index files has been written. The program does not
delete any information from the library file, but deletes the index
entry and all references giving access to the library information
associated with the index entry. The index deletion feature is
necessary in case mission tapes have been analyzed that should not
form part of the permanent data base, or some index entries show
errors that occurred on the TACTS/ACMI tapes.

2.3.2 Program EXTRACT Input Data

Only 5 lines are required for input, each in character form,
contained in apostrophes.

1. 'SUPERSONIC DATA ONLY' or 'ALL DATA SELECTED'. The
   first option selects dynamic records for Mach number
   \( M > 0.99 \). The second option selects subsonic and
   supersonic data, with no restriction on Mach number.

2. 'DATA AT =1 SECOND INTERVALS' or 'ALL DYNAMIC DATA'.
   The first option reads dynamic data records at
   approximately 1.5 second intervals. The second option
   reads all the dynamic data output at 100 or 100
   millisecond intervals, but should not be used in
   forming the supersonic database for BOOM-MAP.

3. 'NEW INDEX AND LIBRARY FILES TO BE CREATED' or 'OLD
   INDEX AND LIBRARY FILES TO BE USED'. The first option
   is used only for the first mission tape analyzed in
starting the library and index files. The second option is used for the second mission tape analyzed and thereafter.

4. 'FULL INDEX PRINTED' or 'UPDATED INDEX ONLY'. As many tapes are analyzed, the index file may get quite large. The 'FULL' index prints the whole file, while 'UPDATED' prints only the mission currently being analyzed.

5. 'ONE = NUMBER OF FIRST TAPE REEL READ' or 'ANY = NUMBER OF FIRST TAPE REEL READ'. If the option 'ONE' is used, the program will stop unless tape reel number 1 is mounted. The option 'ANY', permits any reel number to be the first tape reel, but multiple tape reels must still follow in sequence.

2.3.3 Program EXTRACT Batch File Examples

The job control language (JCL) and the input data required to extract information from a TACTS/ACMI mission tape using the EXTRACT program is shown in Table 2.1. The batch file in Table 2.1 was used to analyze the first mission tape for the Tyndall MOA. The index and library files are all direct access permanent files because the "DEFINE" command was used to create them. Since the MINDEX is a small file it could have been declared an indirect access permanent file by using the "SAVE" command. It is up to the user to determine the permanent file storage type for the MINDEX file. As mentioned earlier the size of the INDEX and LIBRY file dictate that these files will be direct access permanent files. In this example, the file "EXTRACT" in the statement "GET, LGO = EXTRACT", is the executable code for the program EXTRACT. The user can compile the DELETE PROGRAM for each run.
/JOB
SPECTUM,T400.
/USER
CHARGE(*)
SETTL,5000.
*
* CREATION BATCH FILE FOR TYNDALL
*
DEFINE, INDEX=TYNINDEX.
DEFINE, LIBRY=TYNLIB.
DEFINE, MINDEX=TYNMDEX.
LABEL, TAPE, VSN=000004, NT, D=PE, LB=KU, F=L, FO=R.
COPY, I=TAPE, O=TAPE1, BS=2000.
UNLOAD, TAPE.
REWIND, TAPE1.
GET, LGO=EXTRACT.
LDSET, PRESET=ZERO.
LGO(*PL=30000)
RETURN, TAPE1, MINDEX, INDEX, LIBRY.
DAYFILE.
REWIND, OUTPUT.
ROUTE, OUTPUT, DC=PR.
/EOR
'SUPERSONIC DATA ONLY'
'DATA AT>1 SECOND INTERVALS'
'NEW INDEX AND LIBRARY FILES TO BE USED'
'FULL INDEX PRINTED'
'ANY = NUMBER OF FIRST TAPE REEL READ'
/EOF

Table 2.1 Batch file for a creation run.
but is not as efficient as using the LGO FILE. An example of a batch file to update the Tyndall MOA file is depicted in Table 2.2. The only change required in the input data is to change "new" to "old" in the third line. In the JCL, the "DEFINE" commands have been replaced by "ATTACH" commands because the files were created on the initial run.

2.3.4 Program EXTRACT Output Data

Examples of the output from program EXTRACT are given in Appendix A. Table A-1 contains information on the mission tape being analyzed and includes any warning messages that may occur during the analysis. These include parity errors, unidentified block types, etc., which may be useful to determine if the data in a mission segment is suspect. This table should be scrutinized to determine whether any mission segments should be deleted from the index at a later date. The possible reasons for deletions are:

1. Obvious errors in aircraft data, such as omission of A/C type.

2. Many parity errors, indicating a poor quality tape and insufficient data.

3. False start of a mission (due to data omission or poor tape) giving a very short initial mission segment, which could be ignored.

4. No supersonic activity.

Table A-2 is a direct echo of the information stored on the library file and has been deliberately left in the same format.

Table A-3 is a listing of the index file, either the FULL index or the UPDATED index only (the mission currently being analyzed), as specified by the input.
/JOB
SPECTRUM,T400.
/USER
CHARGE(*)
SETTL,5000.
*
*  UPDATE BATCH FILE FOR TYNDALL
*
ATTACH, INDEX=TYNINDEX/M=W.
ATTACH, LIBRY=TYNLIB/M=W.
ATTACH, MINDEX=TYNMDEX/M=W.
LABEL, TAPE, VSN=000004, NT,D=PE, LB=KU, F=L, PO=R.
COPY, I=TAPE, O=TAPE1, BS=2000.
UNLOAD, TAPE.
REWIND, TAPE1.
GET,LGO=EXTRACT.
LDSET, PRESET=ZERO.
LGO(*PL=30000)
RETURN, TAPE1, MINDEX, INDEX, LIBRY.
DAYFILE.
REWIND, OUTPUT.
ROUTE, OUTPUT, DC=PR.
/EOR
'SUPERSONIC DATA ONLY'
'DATA AT>1 SECOND INTERVALS'
'OLD INDEX AND LIBRARY FILES TO BE USED'
'FULL INDEX PRINTED'
'ANY = NUMBER OF FIRST TAPE REEL READ'
/EOF

Table 2.2 Batch file for an update run.
Table A-4 is a listing of the mission tapes analyzed for the database.

The remainder of Appendix A contains current index and mission index files for all five MOAs that were created under this contract.

2.4 Program DELETE

2.4.1 General Description

The DELETE program operates in one of two modes: the "delete" mode and the "change" mode. When using the DELETE program to delete data from the index file, the job should be run in the batch mode. The "change" option should be run interactively. In order to delete data on a specific mission or aircraft from the database 'LIBRY', created using program EXTRACT, it is only necessary to delete all references to that specific data from the index files 'INDEX' and 'MINDEX'. The program DELETE reads the existing files 'INDEX' and 'MINDEX', modifies them as selected by the input and outputs new files 'INDEXN' and 'MINDEXN' in the same format with the appropriate index entries deleted.

The file 'INDEXN' should again be defined as a direct access file for permanent storage if the file 'INDEX' was previously so defined. The users' permanent file names used for storing the existing files 'INDEX' and 'MINDEX' and the new modified 'INDEXN' and 'MINDEXN' files should differ. On completion of the program, the output will list the index entries deleted and this output should be checked before purging the old 'INDEX' file and thus permanently preventing access to the deleted entries. Typically the deletions will not be necessary until the database is to be accessed by the BOOM-MAP program. A copy of the full, unmodified index should be kept on the back-up magnetic tape.
The DELETE program can also be used to change mission names in the "LIBRY" and "INDEX" files. This feature is extremely useful if you want to analyze data for a particular type of mission. The change mode will allow you to change selected mission names. The requested mission names are changed in the "INDEX" and "LIBRY" files as well as the date and time in the first record of these two files. Only the date and time in the first record is changed in the new "MINDEX" file. The change mode is designed to be operated interactively. A record of all changes made during the session are written to a local file named "TAPE1". An example of file TAPE1 will be shown later in Section 2.4.3. This file should be reviewed before the old "LIBRY" and "INDEX" files are purged and the new files catalogued.

2.4.2 Program DELETE Input Data for the "delete" Mode

The data for the "delete" mode is input in character strings or integers, one entry per line. All character strings must be enclosed within single quotation marks.

'MISSION NAMES TO BE DELETED'  (Max No. 25)

'5203-15'  An example of a mission name.

This must match exactly the entries in the mission index and library index files.
When running the DELETE program in the "change" mode the user will be prompted for the input. The program asks you to verify that the correct files were attached. The program then asks for the "INDEX" file entry number of the mission name you want to change. After confirming the correct mission name, you are asked to enter the new mission name. The new mission name is written in the new "LIBRY" and "INDEX" files.

2.4.3 Program DELETE Batch File Example for "delete" Mode

Table 2.3 shows a sample batch file that can be used by the DELETE program in the "delete" mode. This example deletes mission numbers and particular entry numbers in the reference index file. In fact, this particular example deletes all non-supersonic data from the Tyndall INDEX file, TYNIDEX, listed in Table A-13. Notice that all character input data is enclosed in single quotation marks. The entry numbers should be left justified. There is no need to attach the
/JOB
SPECTUM,T400.
/USER
CHARGE(*)
SETTL,5000.
*
* BATCH FILE FOR DELETE PROGRAM
*
ATTACH,INDEX=TYNINDEX.
ATTACH,LIBRY=TYNLIB.
GET,LGO=DELETE.
LDSET,PRESET=ZERO.
LGO(#PL=30000)
DAYFILE.
REWIND,OUTPUT.
ROUTE,OUTPUT,DC=PR.
/EOR
'MISSION NAMES TO BE DELETED'
'6074-1'
'6169-7'
'6170-7'
'6220-1'
'ENTRY NUMBERS TO BE DELETED'
9
13
14
19
34
35
37
39
40
41
42
44
46
47
52
54
/EOF

Table 2.3 Batch file for running the DELETE program using the delete mode.
library file because only the index file is modified; the actual data remains in the library file. Table 2.4 depicts the commands required to run the DELETE program in the "change" mode. The files "INDEXN" and "LIBRYN" are the new index and library files respectively, that are created. File "DELETER" is the binary executable file for the DELETE program. All files must be attached before the program is executed. The last batch command in Table 2.4, "DELETER" executes the program. Table 2.5 illustrates program prompts from a sample session. Although the "delete" mode can be run interactively, this part of the program is not menu driven. It is recommended that the "delete" mode be run only in the batch mode. When using the "change" mode the system prompt is a question mark (?). When answering the first prompt be sure to include your response in single quotation marks ('CHA'). The program uses the date and time of the INDEX and LIBRY files to verify that the correct files have been attached. To change a mission name you must enter the index file entry number for that particular mission. If there is more than one line number for that mission, each line must be entered separately. One line number entry will not change all entries with the same mission number.

If you enter the wrong line number you can enter "N" when the user is asked to verify if the correct mission name has been selected. If a mission number is out of range the program will not accept the number and will request another value. The program is terminated by entering a zero (0) for the line number. During the execution of the program all transactions have been recorded on a local file called TAPE1. This file should be reviewed before discarding the old INDEX and LIBRY files. Of course, the old files can also be retained if the user wants to keep them. Table 2.6 is an example of file TAPE1.
/ATTACH, INDEX=CEAIDEX/M=R
/DEFINE, INDEXN=NEWIDEX
/ATTACH, LIBR=CEALIB/M=R
/DEFINE, LIBR=NEWLIB
/ATTACH, MINDEX=CEAMDEX/M=R
/GET, DELETER
/DELETER

Table 2.4 List of batch commands required to run DELETE in the 'change' mode.
**Table 2.5. Sample Interactive Session Using the CHANGE Mode of the DELETE Program.**
Table 2.5. Continued
**LOG OF DELETE PROGRAM CHANGE MODE RUN**

**MISSION NAME:** LAA60312619 **HAS BEEN REPLACED BY**
**MISSION NAME:** DACT **IN THE INDEX AND LIBRARY FILES.**

**MISSION NAME:** LAA60312617 **HAS BEEN REPLACED BY**
**MISSION NAME:** 64N **IN THE INDEX AND LIBRARY FILES.**

***************

<table>
<thead>
<tr>
<th>ENTRY</th>
<th>MISSION</th>
<th>MISSION NAME</th>
<th>SITE</th>
<th>LOCATION</th>
<th>STARTING</th>
<th>FINISHING</th>
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<td>10</td>
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</tr>
</tbody>
</table>

Table 2.6. Example of TAPE 1 produced by the "CHANGE" Mode of the DELETE Program.
PRINT THE FIRST LIBRARY RECORD FOR EACH MISSION:

THE FIRST TWO FIELDS ARE THE LIBRARY INDEX ENTRY NUMBER AND
THE FIRST LIBRARY FILE RECORD NUMBER FOR THAT MISSION SEGMENT.

<table>
<thead>
<tr>
<th>INDEX ENTRY</th>
<th>LIBRARY START</th>
<th>MISSION NAME</th>
<th>MISSION START DATE</th>
<th>MISSION START TIME</th>
<th>A/C NO</th>
<th>A/C TYPE</th>
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<td>5426</td>
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<td>03/12/86</td>
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<td>5426</td>
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<td>03/11/86</td>
<td>0910</td>
<td>2095</td>
<td>F-4</td>
</tr>
</tbody>
</table>

MISSION INDEX FILE
- UPDATED: 06/10/15.
- 13.03.01.
- SUPERSONIC DATA ONLY.

MISSION MISSION SITE
NAME DATE LOCATION
LAA683120639 03/12/86 OCEANA
LAA683106019 03/10/86 OCEANA
LAA683110630 03/11/86 OCEANA

CHECK THE ABOVE MISSION NAME CHANGES BEFORE
PURGING THE OLD MINDEX, INDEX, AND LIBRY FILES.

DON'T FORGET TO REPLACE THE 'MINDEXN' FILE.

EXIT THE CHANGE MODE VERSION OF THE DELETE PROGRAM.

PROGRAM ENDS.

Table 2.6. Continued.
This particular example was generated using the session depicted in Table 2.5.
3.0 BOOM-MAP, SUPERSONIC AIRCRAFT ACTIVITY SUMMARY

AND BOOM STRENGTH PREDICTION PROGRAM

3.1 General Description

The BOOM-MAP data analysis computer program accesses the TACTS/ACMI database generated by the MOAOPS computer program discussed in Section 2.0. The data analysis program produces statistical and graphic output describing aircraft position parameters as well as various measures of predicted boom strength. This program utilizes the data available in the TACTS/ACMI flight data library to produce graphic and tabular descriptions of MOA range activity.

Tabular output are produced by the BOOM-MAP program and are output directly to the line printer. To produce graphic output, BOOM-MAP creates a file compatible with California Computer Products' (CALCOMP) General Purpose Contouring Program (GPCP II). GPCP II reads this file and generates the necessary plotter directives on file TAPE II to produce hard copy graphic output.

Users control the database subset to be extracted from the library run through the use of an input data file. Through this file the user specifies:

1) the name(s) of the MOA ranges to be considered
2) mission names or dates
3) bounding times of day
4) aircraft types (specific tail numbers optional).

Users also specify desired output products. These include:

1) A statistical summary of position, speed, and boom strength variables. This summary includes distribution functions of range x-coordinates and y-coordinates, and the aircraft z-coordinate....

24
(height above the range), all in feet. It also includes a
distribution function of effective height \( h_e \). Distribution
functions of Mach number, cutoff Mach number and effective Mach
number are also presented. Estimated boom strength distribution
functions include peak overpressure (in pounds per square foot),
the peak overpressure (in dB, re: 20 microPascals), and the
A-weighted sound exposure level (in dB). The estimated boom
strength are those calculated directly below the extended
aircraft flight trajectory. Also included are root mean square
values for effective height, Mach number, effective Mach number,
and cutoff Mach number.

2) A flight track map depicting ground projections of flight paths
during supersonic activity.

3) A flight track map depicting ground projections of flight paths
during sonic boom producing activity.

4) A noise contour map of average C-weighted sound exposure levels
\((CSEL)\).

5) A noise contour map of C-weighted day/night average levels
\((CLDN)\), requiring input of the reference number of daytime
operations which will be used to convert \( CSEL \) to \( CLDN \).

6) A noise contour map of flight averaged peak over-presures (in
pounds per square foot).

Figure 3.1 presents a functional block diagram of the BOOM-MAP
software package. The user supplied directives (described in detail
in this section) are read first and stored in memory. Information on
the library entries are then read one at a time from the library
index file and the sortie parameters compared with the qualifiers
Figure 3.1. Functional Relationships Between Elements of BOOM-MAP Compute Program.
A library sortie meets the screening criteria, its time history file is read from the library and the flight is processed by the BOOM-MAP program. A journal is concurrently output to the line printer (one line per sortie) which identifies the mission name, the date, the site location, the sortie starting and ending times, the aircraft type and tail number, the amount of supersonic time and the amount of boom producing time. This journal presents users with a complete listing of all qualifying sorties.

Processing of library data stops when all entries in the index file have been searched.

When the library index has been exhausted, the program prints the statistical summary tables (if requested) and then prepares an output file to the contouring and plotting program, GPCP II. The BOOM-MAP program then terminates. When GPCP II is called, the file prepared by BOOM-MAP (TAPE11) provides a complete input directive list to GPCP. GPCP then produces flight track and contour maps as requested by the user.

The files required for input or output by the BOOM-MAP program are

1) Index file "INDEX" - direct access, record length 98
2) Database file "LIBRY" - direct access, record length 70
3) Two temporary output files TAPE3 and TAPE4 - sequential
4) Output file for input to GPCP II program, TAPE11 - sequential
3.2 BOOM-MAP INPUT DATA

This section presents a user's guide for operating the BOOM-MAP program. The guide describes the file of input cards necessary to control a BOOM-MAP run.

The complete run specification consists of three groups of information. These groups are:

1) a title card which is printed on all output products.
2) qualifiers used to control the particular flights extracted from the library.
3) specifiers used to control the particular output products required by the user.

All input file data cards are free format. That is, data is not restricted to particular card columns. Instead, a key word at the beginning of the card specifies the type of data to follow, and parameter values are simply separated by commas in most cases. Spaces between parameters are ignored and if the parameter list exceeds the 80 column allowable card width, the user may continue on the next card without the need for any special continuation characters.

3.2.1 TITLE Card

This card must be the first card in the input file. The key word "TITLE" followed by a space tells the program to accept up to 70 characters for a title. This title will be printed on all output products. The format is:

    TITLE  title of run

3.2.2 Library Data Qualifier Cards

Access to the information stored in the database library is through the use of qualifier cards. These qualifier cards allow the
user to specify criteria for records that are to be included for analysis. The input file may contain from one to five "packets" of qualifiers, where a packet consists of four of the six available qualifier input cards. The input cards are "SITE", "MISSION", "DATE", "TIME", "AIRCRAFT" and "ACWTN". "ACWTN" is the qualifier to call for aircraft with tail numbers. The input cards must correspond with the following sequence.

"SITE"
"MISSION" or "DATE"
"TIME"
"AIRCRAFT" or "ACWTN"

Each input card is followed by one or more parameters separated by a comma or by the word "ALL". The maximum number of parameters allowed is based on the input card. Note that when specific parameters (e.g., missions, aircraft, etc.) are specified they must match exactly the way they are stored in the library index, character for character. In addition, if a sortie qualifies in more than one way with the user input directives it will still be included only once in the analysis.

CARD I: (SITE)

The SITE card allows the specification of 1 or more MOA site location names in the input file. The user is allowed a maximum of 20 site location names separated by commas. Site names can occur on more than one line if necessary.

Example: SITE Loc 1, Loc 1, Loc 3,...Loc 20

SITE Loc 1, Loc 2,
Loc 3, ...Loc 20
The parameter "ALL" is used when all site locations are to be included.

Example: SITE ALL

CARD II: (MISSION or DATE)

The input card "MISSION" allows the specification of one to ten mission names separated by commas. Mission names may occur on more than one line if necessary.

Example: MISSION Name 1, Name 2,...,Name 10

-or-

MISSION Name 1,

Name 2,...,Name 10

The parameter "ALL" is used when all Missions are to be included. When the user specifies the "MISSION" card instead of the "DATE" card for input Card II, all dates are considered legal. Once "MISSION" is specified in a packet "DATE" is no longer legal.

The input card "DATE" allows for the specification of one to ten date intervals separated by a comma. Date intervals may occur on more than one line. A date interval consists of a start date followed by a hyphen followed by an end date or simply a start date. All dates must appear as MM/DD/YY format. If only a start date is given, then the end date will be considered identical to the start date.

Example: DATE 01/21/85-02/1/85, 4/8/85,

7/18/86-7/19/86

The parameter "ALL" may be used when all dates are to be included. When the user specifies the "DATE" card instead of the
"MISSION" card as input card II, "MISSION" is no longer legal within that packet.

**CARD III (TIME)**

The input card "TIME" allows for the specification of one to ten time intervals separated by commas. Time intervals may occur on more than one line. A time interval consists of a start time followed by a hyphen followed by an end time or simply a start time. All times must appear as HHMM format. If only a start time is given, then the end time will default to 2359.

Example TIME: 1100-1200, 1300-1330
1400-1500, 1700

The parameter "ALL" is used when all time intervals are to be included.

**CARD IV: AIRCRAFT OR ACWTN**

Aircraft may be specified in two ways; either by aircraft type alone, or by a specific aircraft type and tail number.

The input card "AIRCRAFT" allows the specification of one or more aircraft types in the input file. The user is allowed a maximum of ten aircraft types separated by commas. Aircraft types may occur on more than one line. Once "AIRCRAFT" has been specified, "ACWTN" is no longer legal within that packet. The parameter "ALL" may be used when all aircraft types are to be included. When using the parameter "ALL" on the "AIRCRAFT" card, be sure that there are no blank aircraft type entries in INDEX file. If there are INDEX entries without an aircraft type, either specify aircraft type on the "AIRCRAFT" card or use the DELETE program to delete that particular entry in the INDEX file. The aircraft type is required to compute peak overpressure values. Although the program will run, the results may not be accurate. The
aircraft type must exactly match aircraft types in the "INDEX" files. For Example: "F15" will cause an error because it is represented as "F-15" in the "INDEX" files.

Example: AIRCRAFT Type 1, Type 2, Type 3, Type 4...

Example: AIRCRAFT ALL

The input card "ACWTN" allows the specification of one or more aircraft types followed by their corresponding tail numbers. The user is allowed a maximum of ten aircraft/tail number pairs separated by commas. Aircraft/tail number pairs may continue on more than one line.

Example: ACWTN AC1 TN1, AC2 TN2, AC3 TN3

The parameter "ALL" may be used when all aircraft types and tail numbers are considered legal. Once "ACWTN" has been used, "AIRCRAFT" is no longer considered legal. If the user specified "AIRCRAFT" as input card IV, then all tail numbers are considered to be legal.

3.2.3 Output Product Specification Cards

The type of output data desired by the user is specified by one or more output specification cards. These cards may be entered in any order.

"STATS" Card

This card tells the program to print a full statistics summary. An example of this summary is shown in Tables B-1 through B-5 and includes distribution functions of x, y, and z position variables, effective height, Mach number, and estimated boom strength (directly
below the aircraft). Also included are RMS values of effective height, Mach number, cutoff Mach number, and effective Mach number.

"MACHTRK" Card

This card directs the program to generate a flight track map showing those portions of sortie flight tracks where the aircraft Mach number exceeded 1.0. This card contains one numeric parameter which specifies the map scale ratio. For example, to produce a map of one inch equals 10,000 feet the scale ratio is 120,000.

The smallest scale factor possible is 1:2600 feet dictated by the numerical input limitations to GPCP. The largest realistic scale factor is 1:45,000 feet, giving a plot approximately 5" x 5" in size.

Example: MACHTRK 120000

"BOOMTRK" Card

This card directs the program to generate a flight track map showing those portions of sortie flight tracks where sonic booms were generated which propagated to the ground. This card contains a numeric parameter specifying the map scale ratio. For example, a map of one inch equals 10,000 feet is specified by a scale ratio of 120,000.

Example: BOOMTRK 120000

"CONTOUR" Cards

Contour cards are used to direct the program to produce maps depicting contours of equal boom strength. Three different types of contour maps may be specified: (1) CSEL, (2) CLDN, and (3) peak overpressure, in psf. The CONTOUR cards contain a number of parameters which must be entered in a specific order.
CSEL contour maps are specified using the keyword CONTOUR followed by CSEL. Additional parameters must be separated by commas, and must be input in the following order. The first is the scale ratio of the contour map (see MACHTRK or BOOMTRK cards for a description of the scale ratio). Following the scale ratio at least one (up to a maximum of 20) CSEL contour values must be specified.

Example: CONTOUR CSEL, 120000, 95, 100, 105

Peak overpressure contour maps are specified using the keyword CONTOUR followed by PKOP. Additional parameters must be separated by commas, and are input in the same order as with CSEL contours. The first parameter is the scale ratio of the contour map. Following this parameter must be at least one (up to a maximum of 20) peak overpressure contour values in pounds per square foot. Fractional values are acceptable but the program rounds the user specified values to the nearest tenth of a psf for plotting purposes.

Example: CONTOUR PKOP, 120000, 0.5, 0.8, 1.0, 2.0

CLDN contour maps are specified using the keyword CONTOUR followed by CLDN. Additional parameters must be separated by commas and must be input in the following order. The first parameter is the map scale ratio. The second parameter is the reference number of daytime operations which will be used on a \(10 \log (N)\) basis to convert CSEL values to CLDN. Following these two parameters must be at least one (up to a maximum of 19) CLDN contour values to be plotted.

Example: CONTOUR CLDN, 120000, 44.5, 55, 60, 65, 70, 75

"WIDTH" Card

The WIDTH card contains a single parameter which tells the plotting software the paper width (in inches) of the plotting device.
used for the map output products. If the paper width is too narrow to accommodate the entire map, the plot software will automatically split the map into several panels which can then be assembled to form the full size map. This card may appear anywhere amongst the output product specification cards or immediately preceding them. The default width if this card is omitted is 34 inches. The default value was changed from 36 inches contained in the original BBN program delivered to the Air Force. Thirty-four inches is the maximum plotting area available on the Tyndall Calcomp plotter.

Example: WIDTH 30

3.2.4 Input Example

The following are examples of input data. The first example is a simple case. The second example shows effective use of the data qualifier cards.

Example 1: Shown below is the input data deck for a relatively simple case:

TITLE NELLIS MOA -- ALL ACTIVITY

SITE NELLIS
MISSION ALL
TIME ALL
AIRCRAFT ALL

STATS
MACHTRK 96000

In this example the title printed on all output is "NELLIS MOA -- ALL ACTIVITY".
The processing software will utilize data only from the NELLIS MOA site. It will, however, select all missions, times of day, and aircraft types. For output products the statistics package will be printed and a map showing flight tracks where aircraft exceeded Mach 1.0 will be plotted to a scale of 1 inch equals 8000 feet.

Example 2: In this example more explicit input qualifiers have been specified.

**TITLE**  HOLLOMAN MOA

**SITE**  HOLLOMAN

**MISSION**  5284711-14DA, 5282717-20GI

**TIME**  0700-2159

**AIRCRAFT**  F-15, F-4

**SITE**  HOLLOMAN

**MISSION**  5282723-26RO

**TIME**  0700-2159

**AIRCRAFT**  ALL

**BOOMTRK**  9600

**CONTOUR**  CSEL 96000, 95, 100, 105

**CONTOUR**  CLDN 9600, 15.2, 65, 70, 75

In this example the title "HOLLOMAN MOA" will be printed on all output products. In contrast to the first example, the program will be fairly selective about the data it extracts from the library. Two packets of data qualifiers are included. Thus the program will select data from the library when either of the two packet conditions are met. It will select data when
a) the site name is HOLLOMAN, and the mission numbers are 5284711-14DA or 5282717-20GI, and the mission starting time is between 0700 and 2159, and the aircraft type is an F-15 or F-4.

or when

b) the site name is HOLLOMAN, and the mission name is 5282723-26RO, and the mission starting time is between 0700 and 2159 for any aircraft sortie meeting these conditions.

The output products will include a flight track map of boom producing track segments to a scale of 1 inch equals 8000 feet. Two contour maps will be plotted. The first will be a CSEL contour map to a scale of 1 inch equals 8000 feet, containing the 65, 70, and 75 dB contours. The second will be a CLDN contour map also plotted to a scale of 1 inch equals 8000 feet. The reference number of daily operations is 25.2 sorties and the desired contours are 65, 70 and 75 dB.

3.3 BOOM-MAP File Examples

Table 3.1 shows the JCL and data input for a sample BOOM-MAP case. Only the INDEX and LIBRY files need to be attached. Files TAPE 3 and TAPE 4 are temporary files containing grid data and can be saved if the user desires.

In this sample, TAPE11, the GPCPII plot file is saved for review as file UNIT11. If the user requests statistical output by including the "STATS" card, the output can be printed or saved as a disk file on both. File "BOOMLGO" is the binary executable file of the BOOM-MAP program. File TAPE9T is the executable file used by the CALCOMP plotter to generate the plots.
/JOB
SPECTUM.
/USER
CHARGE(*).
SETTL(50000).
SETASL(*).
SETJSL(*).
ATTACH, INDEX=TYNINDEX.
ATTACH, LIBRARY=TYNLIB.
ATTACH, LG0=BOOM2GO.
MAP, ON.
MAP, PART.
LDSET(PRESET=ZERO).
LGO.
REWIND, TAPE11.
COPYF, TAPE11, UNIT11.
STORE, UNIT11.
REWIND, TAPE11.
REWIND, TAPE3.
REWIND, TAPE4.
STORE, TAPE3.
STORE, TAPE4.
ATTACH, GPCP2/UN=APPLIB/NA.
COPYE, GPCP2, ABS, VERIFY.
RETURN, GPCP2.
REWIND, ABS.
ABS, TAPE11, JUNK.
REWIND, TAPE3.
COPYE, TAPE9, TAPE9T, VERIFY.
STORE, TAPE9T.
STORE, JUNK.
DAYFILE.
REWIND, OUTPUT.
ROUTE, OUTPUT, DC=PR.
/EOR
/NOSQ
TITLE TYNDALE, HOA - ALL MISSIONS AS OF 8/21/86
SITE TYNDALE
MISSION ALL
TIME ALL
AIRCRAFT F-4, F-15, F-16, F-18
MACITRK 300000
MACITRK 300000
NOOITRK 300000
CONTOR C3SL, 300000, 105, 115, 125, 135, 145
CONTOR PKOF, 300000, 0.5, 1.0, 1.5, 2.0
CONTOR CDLN, 300000, 10, 55, 65, 75, 85
WIDTH 34.0
STAT
/EOF

Table 3.1 Batch file example to run BOOM-MAP.
3.4 BOOM-MAP Output

An example of BOOM-MAP output is shown in Appendix B. Table B-1 depicts the first output page echoes the input specification cards provided by the user. It also summarizes in table form the library qualifier information which will be used to select specific flight data from the library for processing. The second page echoes the specific flights selected from the data base which qualify for processing based on the user supplied input specifications and is shown in Table B-2.

The third page (Table B-3) contains distribution functions of distance, speed, and overpressure variables for times during which the aircraft Mach number is greater than cutoff. Each distribution function contains a number of histogram cells of specified cell size. the first and last cells are underrange and overrange cells used to collect the tails of the distribution which lie outside the expected range of the particular parameter. the remaining cells are of specific parameter range (identified as cell size in the printout).

For example, cell number N extends from

\[
\text{Lower bound} = (\text{lower band cell } 2) + (N-2) \times \text{cell size}
\]

\[
\text{Upper bound} = (\text{lower band cell } 2) + (N-1) \times \text{cell size}
\]

Each cell contains the number of occurrences of the parameter in the cell range at one second intervals. That is, the number contained in cell N is the number of seconds the parameter was observed in the cell parameter range.

The eleven parameters, defined in Appendix A, are:

1) range x-coordinate in feet (range: \(-132,000\) to \(+132,000\) feet)
2) range y-coordinate in feet (range: \(-132,000\) to \(+132,000\) feet)
3) aircraft height above range center altitude in feet
4) aircraft effective height, \( h_e \), above range center altitude in feet (range: 0 to 50000 feet)

5) aircraft Mach number (range: 1.00 to 2.14)

6) aircraft cutoff Mach number (range: 1.00 to 2.14)

7) aircraft effective Mach number (range: 1.00 to 2.14)

8) boom strength overpressure under the projected flight path in pounds per square foot (range: 0.00 to 14.25 psf)

9) boom strength overpressure under the projected flight path in dB re: 20 micro Pascals (range: 115.0 to 153.5 dB)

10) C-weighted sound exposure level under the projected flight path in dB (range: 90.0 to 128.5 dB)

11) A-weighted sound exposure level under the projected flight path in dB (range: 80.0 to 118.5 dB)

The fourth and fifth pages shown in Table B-4 and B-5 respectively are a combined two-dimensional distribution function of the \( x/y \) range coordinates, parameters 1 and 2 on the previous page. This distribution function shows the spatial distribution of aircraft position during boom producing activity. Cells 1 and 52 in both dimensions are the underrange and overrange tails of the distribution. In the \( x \)-direction cells 1 through 30 are shown in the first half of the table; cells 31 through 52 in the second half.

Examples of the flight track and contour maps output by GPCP II for four MOAs are also shown. Map annotation in the title block indicates the type of map plotted. Range coordinates are plotted on the left and top of the map, and a cross is plotted at the range center (coordinates \( x = 0 \), \( y = 0 \)). The \( y \)-axis points true north, and
the latitude and longitude of the range center are given in the title block.
REFERENCES

APPENDIX A

MOAOPS PROGRAM OUTPUT EXAMPLES
Table A-1. Analysis of Mission Tape Analyzed.

<table>
<thead>
<tr>
<th>SEGMENT TYPE</th>
<th>STARTING TIME</th>
<th>FINISHING TIME</th>
<th>A/C TYPE</th>
<th>TAIL NO</th>
<th>DURATION</th>
<th>% TIME SUPERSONIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-16</td>
<td>16:02:56:72</td>
<td>16:07:56:75</td>
<td>WHAM</td>
<td></td>
<td></td>
<td>.42</td>
</tr>
<tr>
<td>F-16</td>
<td>16:12:56:72</td>
<td>16:17:56:75</td>
<td>WHAM</td>
<td></td>
<td></td>
<td>.50</td>
</tr>
</tbody>
</table>

Table A-2. Data Written to the LIBRY File.
Table A-3. Data written to the INDEX File.
Table A-3. Data written to the INDEX File.
**MISSION INDEX FILE**
*UPDATED: 86/09/21.*
*SUPERSONIC DATA ONLY*

<table>
<thead>
<tr>
<th>MISSION NAME</th>
<th>MISSION DATE</th>
<th>SITE LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>5674-1</td>
<td>03/17/86</td>
<td>TYNDALE</td>
</tr>
<tr>
<td>6073-9</td>
<td>03/14/86</td>
<td>TYNDALE</td>
</tr>
<tr>
<td>6169-6</td>
<td>06/13/86</td>
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</tr>
<tr>
<td>6169-8</td>
<td>06/13/86</td>
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<tr>
<td>6169-7</td>
<td>06/13/86</td>
<td>TYNDALE</td>
</tr>
<tr>
<td>6170-7</td>
<td>06/13/86</td>
<td>TYNDALE</td>
</tr>
<tr>
<td>6170-1</td>
<td>06/13/86</td>
<td>TYNDALE</td>
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<td>6199-3</td>
<td>07/13/86</td>
<td>TYNDALE</td>
</tr>
<tr>
<td>6199-5</td>
<td>07/13/86</td>
<td>TYNDALE</td>
</tr>
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<td>6199-4</td>
<td>07/13/86</td>
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<td>08/02/86</td>
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<td>08/05/86</td>
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</table>

**NUMBER OF MISSION TAPES ANALYZED = 13**

Table A-4. Data Written to the MINDEX File.
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<th>ENTRY NO</th>
<th>MISSION NO</th>
<th>MISSION SITE</th>
<th>STARTING DATE</th>
<th>FINISHING DATE</th>
<th>A/C</th>
<th>NO. TAIL</th>
<th>NO. RECORDS</th>
<th>NO. OF SUPERSONIC RECORDS</th>
</tr>
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<tbody>
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<td>HOLLOMAN</td>
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<td>11/16/69</td>
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</tbody>
</table>

Table A.5. Full INDEX File for Holloman MOA.
MISSION INDEX FILE
* UPDATED: 86/10/13 *
* 15:14:30 *
* SUPERSONIC DATA ONLY *

<table>
<thead>
<tr>
<th>MISSION NAME</th>
<th>MISSION DATE</th>
<th>SITE LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>6108702-5RD0</td>
<td>6/69</td>
<td>HOLLOMAN</td>
</tr>
<tr>
<td>6107803-6/SN</td>
<td>7/86</td>
<td>HOLLOMAN</td>
</tr>
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<td>6107701-4/RO</td>
<td>7/86</td>
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<tr>
<td>6087801-4/CO</td>
<td>8/86</td>
<td>HOLLOMAN</td>
</tr>
<tr>
<td>5282806-8PAL</td>
<td>9/85</td>
<td>HOLLOMAN</td>
</tr>
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<td>5284711-14DA</td>
<td>1/85</td>
<td>HOLLOMAN</td>
</tr>
<tr>
<td>5282723-26RO</td>
<td>9/85</td>
<td>HOLLOMAN</td>
</tr>
<tr>
<td>5280721-24</td>
<td>7/85</td>
<td>HOLLOMAN</td>
</tr>
<tr>
<td>5282717-20GI</td>
<td>9/85</td>
<td>HOLLOMAN</td>
</tr>
</tbody>
</table>

NUMBER OF MISSION TAPES ANALYZED = 9

Table A-6. Mission Index File for Holloman MOA.
Table A-7. Full INDEX File for Luke MOA.
MISSION INDEX FILE
UPDATED: 06/10/13
15:20:12
SUPersonic DATA ONLY

MISSION NAME   MISSION DATE   SITE LOCATION
6063-11         4/86            LUKE
6062-11         3/86            LUKE
6063-4          4/86            LUKE
6062-8          3/86            LUKE
5196-18         5/85            LUKE
5203-15         2/85            LUKE
5197-5-DACT     6/85            LUKE
5203-5-DACT     2/85            LUKE

NUMBER OF MISSION TAPES ANALYZED = 8

Table A-9. Full INDEX File for Nellis MOA.

<table>
<thead>
<tr>
<th>ENTRY NO</th>
<th>MISSION NAME</th>
<th>MISSION DATE</th>
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### Table A-12. Mission INDEX File for Oceana MOA.

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- **UPDATED: 86/10/13**
- **15:45:05**
- **SUPERSONIC DATA ONLY**

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Table A-13. Full INDEX File for Tyndall MOA.
Table A-14. Mission INDEX File for Tyndall MOA.

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</table>

**NUMBER OF MISSION TAPES ANALYZED = 15**
APPENDIX B

BOOM-MAP PROGRAM OUTPUT EXAMPLES

NOTE: ALL PLOTS HAVE BEEN REDUCED AND
THE SCALE IS INCORRECT
### Table B-1. Page 1 of BOOM-MAP Output.

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<th>(MHMM-MHMM)</th>
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<th>NUMBER</th>
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**SOURCE LISTING:**

- **TITLE:** TYNDALL AOA - ALL MISSIONS AS OF 3/03/86
- **SITE:** TYNDALL
- **MISSION:** 6073-3, 6170-7, 6199-5, 6199-6, 5199-4, 6213-3, 6223-1
- **AIRCRAFT:** F-4, F-15, F-16
- **MACHINE:** 300000
- **INPUT FILE:** 300000
- **CONTOUR:** CELF, 360000, 95, 100, 105
- **CONTOUR:** PKOP, 360000, 0, 6, 9, 3, 1, 9, 2, 0
- **CONTOUR:** CLIW, 200000, -40, -55, -55, -75
- **WIDTH:** 36.0
- **STAT:**
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<th>FINISHING TIME</th>
<th>TYPE</th>
<th>TAIL NO</th>
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<th>BOOM TIME (SEC)</th>
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**Table B-2. Page 2 of BOOM-MAP Output.**
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</table>

Table B-3. Page 3 of BOOM-MAP Output.
Figure B-1.
HOLLOWAY VOA - ALL MISSIONS AS OF 23 SEP 1966

FLIGHT TRACK SEGMENTS OF SONIC BOOM PRODUCING AIRCRAFT ACTIVITY

SCALE: 1 INCH = 25000 FEET
ORIGIN: LAT 33 48.0 N LONG 108 25.0 W

Figure B-2.
Figure B-3.

HOLLOW MDA - ALL MISSIONS AS OF 23 SEP 1986

CONTOURS OF AVERAGE PEAK OVERPRESSURE IN POUNDS PER SQUARE FOOT

SCALE: 1 INCH = 25000 FEET ORIGIN: LAT 33.480 N LONG 106.110 W

B-8
Figure B-4.

HOLLOW VOA - ALL MISSIONS AS OF 23 SEP 1986
CONTOURS OF AVERAGE C-WEIGHTED SOUND EXPOSURE LEVEL (CSE1, IN DB
SCALE: 1 INCH = 25000 FEET ORIGIN: LAT 33.46.0 W LONG 106.25.0 W
HOLLOWAY WOA - ALL MISSIONS AS OF 73 SEP 1988

CONTOURS OF C-WEIGHTED DAY/NOCT AVERAGE LEVEL (ONLY) IN DB

SCALE: 1 INCH = 25000 FEET ORIGIN: LAT 33 48.0 N LONG 100 25.0 W

Figure B-5.
Figure B-7.
Figure B-8.
Figure B-9.
Figure B-10.
P. L. E. IS A D A - AS OF 24 JUL 88
FLIGHT TRACK SEGMENTS OF SUPERSONIC AIRCRAFT ACTIVITY (MACH = 1.1)
SCALE: 1 INCH = 25000 FEET ORIGIN: LAT 36° 50.20N LONG 115° 25.35W

Figure B-11.
Figure B-12.
Figure B-13.
Figure B-14.
Figure B-15.
Figure B-16.
Figure B-17.
Figure B-18.
Figure B-19.
Figure B-20.

SYNDALL NOA - ALL MISSIONS AS OF 9/03/88

CONTOURS OF C-WEIGHTED DAY/NIGHT AVERAGE LEVEL (DNL), IN DB

SCALE: 1 INCH = 25000 FEET  ORIGIN: LAT 29.320 N  LONG 64.370 W

B-25
END
DATE
FILMD
3-88
PHIC