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TECHNICAL REPORT 4980

INTERGRATED PROJECTILE SYSTEMS SYNTHESIS
MODEL (IPSSM)

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AUGUST 1976



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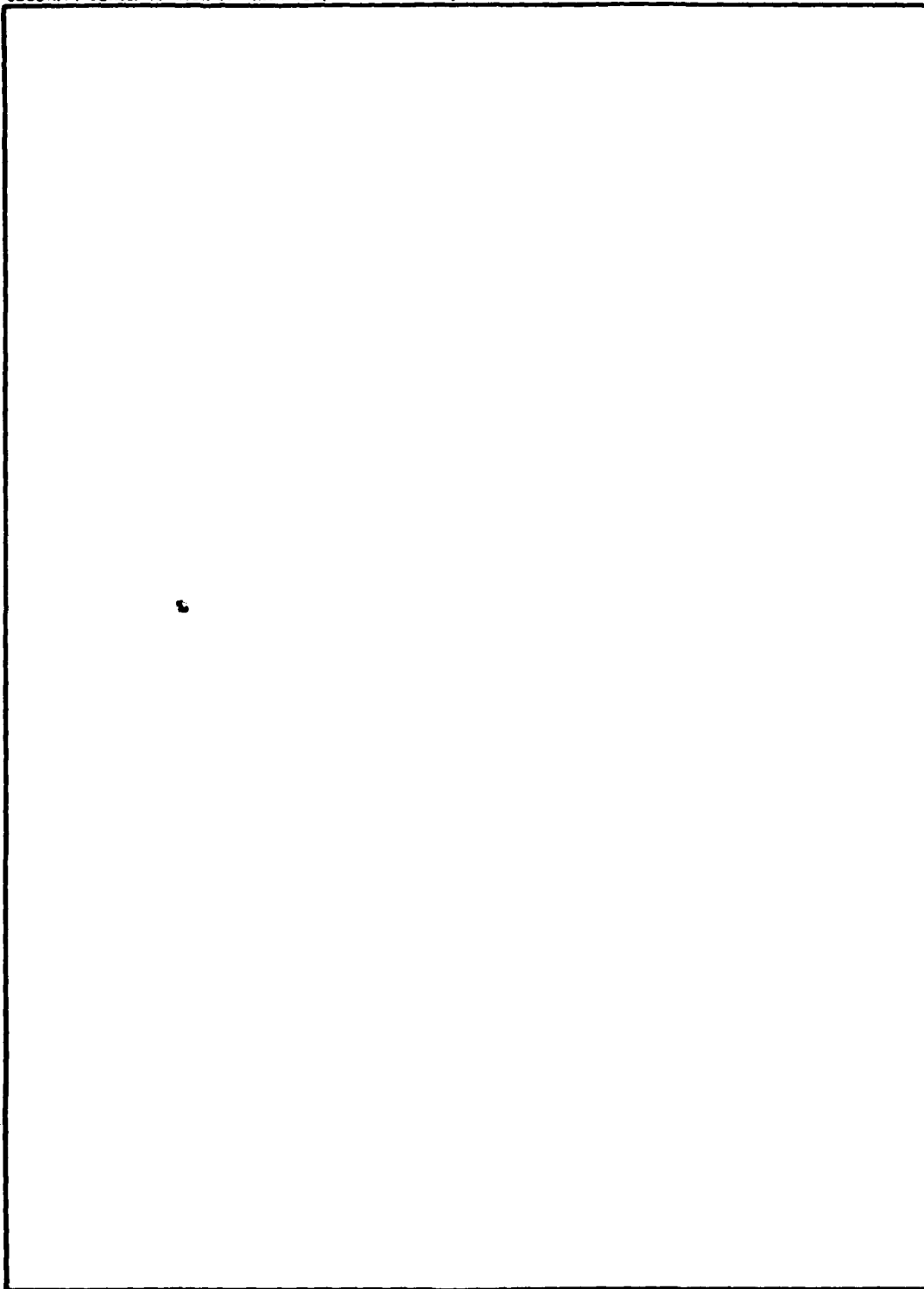
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Computer model called IPSSM (Integrated Projectile Systems Synthesis Model) is being developed for use in the preliminary design of large caliber projectiles. Complete capabilities of the interim version of this model are detailed, and instructions are given for users of the program in both the interactive teletype and batch modes. The use of this initial version of IPSSM will determine additional modules to be added as well as refinements in the over-all operation of the system.														

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A

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OBJECTIVES AND APPROACH

The objective of this program is to develop a complete computer model for use in the preliminary design of large caliber projectiles. This model, called IPSSM (Integrated Projectile Systems Synthesis Model), is a set of computer program modules and subroutines integrated in such a manner as to provide a realistic, interactive, computational tool for engineers and designers engaged in the development of preliminary design information for projectiles. The model described in this report includes the capability of performing extensive calculations necessary to formulate projectile designs. Computations include interior and exterior ballistics, static shell property calculations, aerodynamic properties generation, lethal area effectiveness, 6-D trajectory calculations, recoil mechanism design, and sabot design.

The general approach in the complete development of the model calls for the selection and modification of existing computer programs to accomplish specific calculations as well as the identification of programming tasks required to complete the model. The essential ingredient of IPSSM is its common data base and a well coordinated and integrated set of computer programs which are not only extracting information from previously run programs within the system but are also generating specific data for subsequent use by other programs. These programs will either continue or modify the design process or be used for optimization. They are modular in nature so as to facilitate future improvements or replacements of the design programs. Over-all control of the model is accomplished by the user through the executive program.

The objective of this report is to provide an initial user's manual for the IPSSM System currently available. Additional features, updates, and modifications will be accomplished as use is made of this initial version of IPSSM.

BACKGROUND

In May 1970, DARCOM (AMC) initiated a feasibility study directed toward weapon system computer modeling which would provide preliminary design parameters for tactical missile weapon system concepts. After DARCOM (AMC) had presented the concept and preliminary comments of subordinate commands to the CAD-E Council in October 1970, the IWSSM (Integrated Weapon System Synthesis Model) Ad Hoc Working Group of the Council was established to study the concept in more detail. After a six-month effort, the working group concluded that such a system was both feasible and desirable, but initially it should be limited to the construction of a number of computer models, each

addressing a particular military commodity. It was considered too large an undertaking to develop one model that would handle all commodity designs such as guns, projectiles, missiles, aircraft, vehicles, etc.

The recommendation of the IWSSM Working Group was that each command submit a Program Data Sheet outlining a proposed activity directed toward a specific commodity. The Integrated Projectile System Synthesis Model (IPSSM) Program was established at Picatinny Arsenal to address the preliminary design of large caliber projectiles such as artillery and mortar rounds.

The Picatinny IPSSM program was funded as a CAD-E task on 1 April 1972. A substantial initial effort was directed toward a survey of existing computer programs in use at Picatinny and other government agencies which would be suitable for incorporation into the IPSSM System. Major areas of design interest were identified by system engineers, and computer programs within each area were identified. The programs were examined for (1) adequate documentation and technical adaptability within the design area, and (2) adaptability of input and output data formats that would be consistent with the over-all requirements of the executive program.

Existing computer programs to determine static and aerodynamic shell properties, perform interior and exterior ballistics calculations, compute lethal areas, do 6-D trajectory calculations, and design recoil mechanisms and sabots were selected. Source listings were obtained and put into update format, and proper operation was verified with test cases. Each of the nine codes (Weight, Spinner, Aerol, Interior Ballistics, Lethal Area, 6-D Trajectory, Recoil Mechanism, Sabot Design and Heppner-Interior Ballistics) has been made operational under both the interactive teletype (TTY) and batch mode to facilitate entry and exit from the executive program. Major effort was devoted to the design and checkout of the preliminary IPSSM executive program. The system has been used on a trial basis and is now ready for general use to determine its adequacy as a design tool.

Several user sessions have been conducted to acquaint engineers and scientists involved in projectile design and evaluation with the operation of the current IPSSM system. These sessions will continue as more personnel become involved. As a result of these initial meetings, several important modifications were made to improve the operational capabilities of the system. For example, an optional abbreviated input format can now be utilized to quicken system response in the TTY mode. Testing of user responses in the TTY interactive mode has also been incorporated to avoid program abort as a result of

trivial user typing errors. In addition, an independent computer program (IPSDATA) has been written to simplify the establishment of initial data base files. Output from this program provides the basis for accurate checking of input data files.

PRESENT STATUS

The present IPSSM System can execute nine applications programs from either batch or teletype (TTY) mode. These programs perform the following computations: (1) Static Properties Calculations, (2) Generation of Aerodynamic Coefficients, (3) Interior Ballistics, (4) Exterior Ballistics, (5) Lethal Area Computations, (6) 6-D Trajectory Calculations, (7) Recoil Mechanism Design, (8) Sabot Design, and (9) Heppner-Interior Ballistics.

In TTY mode, the executive program contains options for examining and modifying common data base information. In both modes the program allows the user to modify the data base variables, to store the modified data base in a new permanent file if desired, and to run linked cases of selected variables to facilitate the execution of parametric analyses. Special abbreviated output can be generated and stored automatically for later examination at the TTY. Options also exist for directing entire input/output for each set of application runs to the user's batch terminal or to the central site. The system is also capable of generating input data in the format required for running the graphics projectile measurement program (PROMS) (Reference 2). Output from PROMS can then be entered into the common data base for subsequent computations within the IPSSM System. Figure 1 illustrates the executive module operation in the batch or TTY mode. Figure 2 shows the input-output interface scheme utilized within IPSSM. Although this chart shows the technique for the exterior ballistic interface, the same system has been applied for all application programs. Figure 3 shows the latest flow diagram for IPSSM. The small boxes between the applications programs represent the input-output interfaces controlled by the executive program. Data analysis and optimization will be incorporated to a much greater extent as directed by future user requirements.

Options have also been installed to allow either the current data base to be automatically updated with the results of the current program or to have a separate and distinct new data base created with the same generated results.

EXECUTIVE MODULE OPERATION (IPSSM)

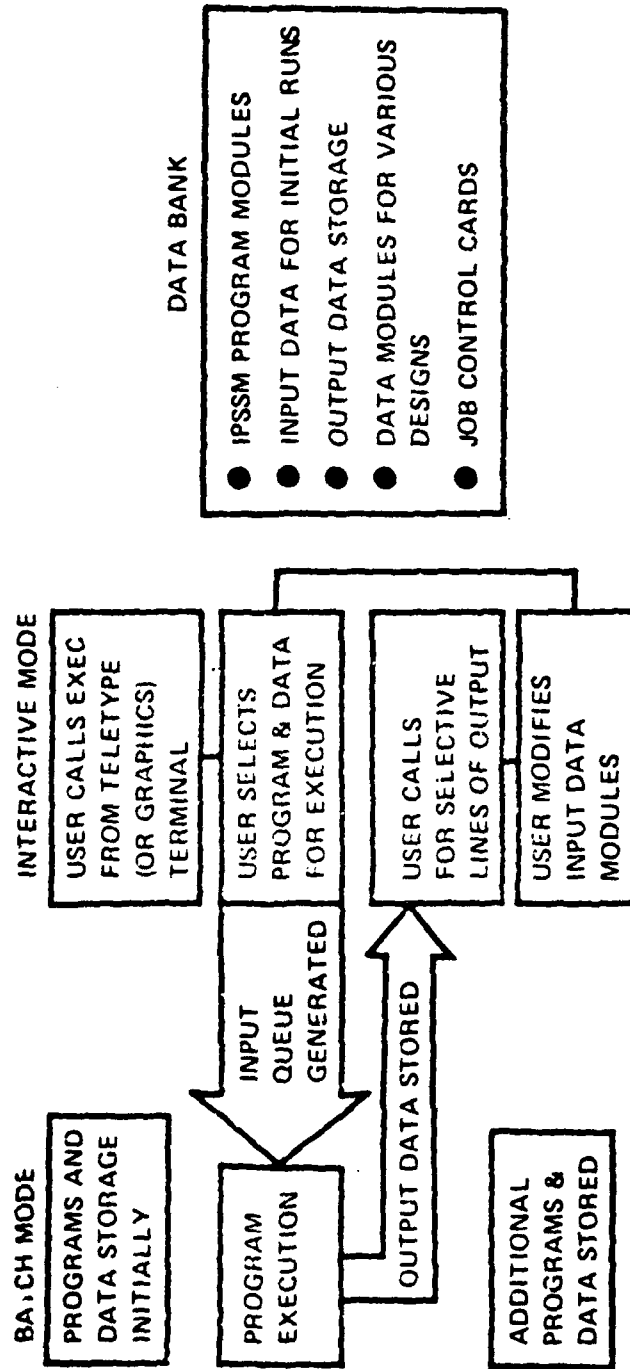


FIGURE 1

INPUT - OUTPUT INTERFACE

(EXTERIOR BALLISTICS)

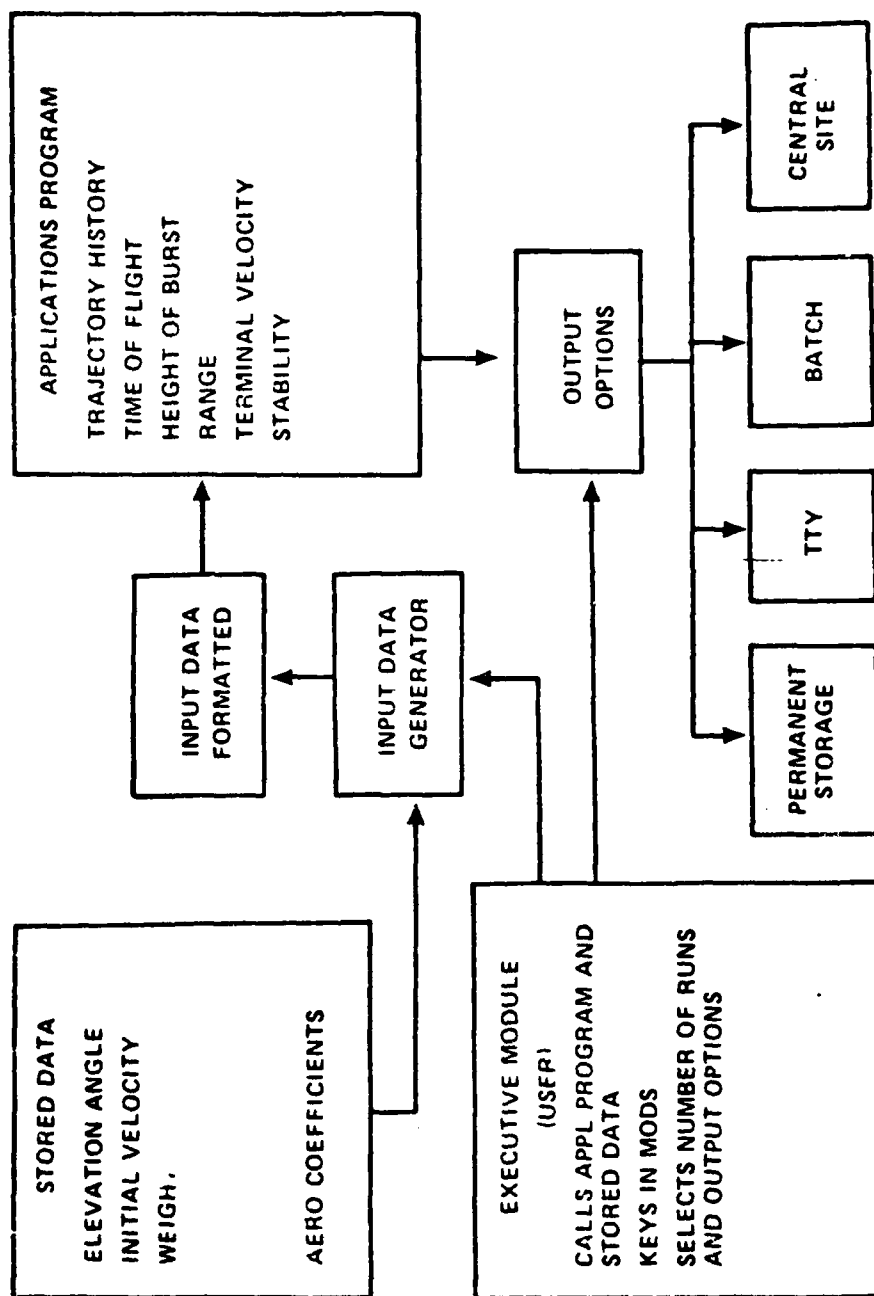


FIGURE 2

IPSSM FLOW DIAGRAM (HE VERSION)

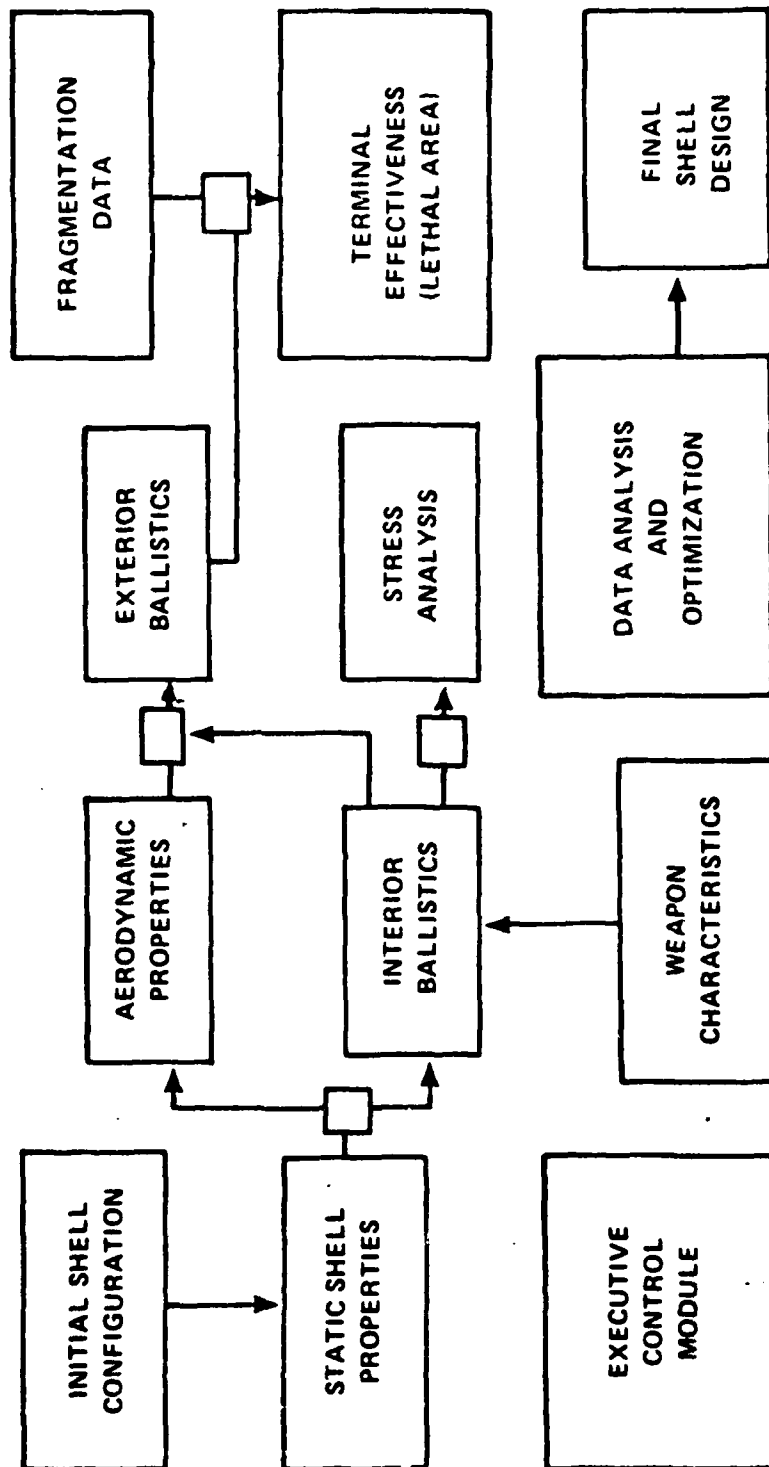


FIGURE 3

USER INSTRUCTIONS

A. Data Preparation

1. General

In order to execute the IPSSM Program, a data base containing the generic characteristics of the projectile to be analyzed must be available. This is established initially through the use of a program called IPSDATA (Cycle 5). Subsequent to this, data may be added, deleted, or changed either by rerunning IPSDATA with the modified data base cards or by using IPSSM's executive program, which is called IPSM (Cycle 5). The latter option may be accomplished through either the batch or the teletype (TTY) mode.

2. Data Base Generation Using IPSDATA

The program called IPSDATA was written for easy cataloging and checking of an entire data base. Use of the following deck of cards will result in your data base being entered on whichever permanent file you specify:

(JOB CARD), CM75000.

(COMMENT CARD)

ATTACH,IPSM,IPSD,CY=5,ID=NICHOLS,MR=1

IPSM.

(7/8/9 CARD)

(DATA BASE CARDS)

(6/7/8/9 CARD)

The first data base card contains the title to be associated with your data base. The second card contains the cycle number followed by a comma and the permanent file name (up to 10 alpha- numerics) in which you wish your data base to be stored. These two cards are followed by the key variable data cards. Each such card is identified by its three-letter symbol in the first three columns. The fourth column is blank. The value of the variable is then entered in free floating point format (cannot be integer) on the card anywhere in the next ten columns. Following the last key variable data card is a

card with the word "END" punched in the first three columns (see Sample Input for Initial Data Base Generation).

The key variable data are followed by the table entries required to execute the AERO 1 (AR), WEIGHT (WT), and LETHAL AREA (LA) Programs. Format for entering these tables is described in the discussions of programs in "Application Programs and Descriptions".

"Sample Input for Initial Data Base Generation" contains an example of a set of data base cards for the M106 8-inch Projectile which permits execution of the first five programs listed on page 3. Other data sets were generated in a similar manner to execute the remaining programs currently in operation within IPSSM. These sample data can be used to test the operation of each application program within IPSSM. (See "Sample Test Cases and Setup" for typical batch and TTY runs). These files will remain in the system as a permanent file for users to become familiar with the IPSSM System.

When establishing an initial data base, it should be noted that IPSDATA will store the data base in the requested cycle under a permanent file name of the form PFNXX, where PFN is the particular permanent file name you have selected, and XX is the symbol for the particular application program being run (AR, WT, LA, etc.). IPSDATA attaches these last two letters automatically by determining what data are being catalogued in that particular run. For example, if for an initial run of IPSDATA, the user includes data for the AR and LA programs and specifies that he wishes the data base stored in JOHN, cy=5, IPSDATA will automatically create two data bases: JOHNAR, cy=5 will contain the data needed to run the AR program and JOHNLA, cy=5 will contain the data needed to run the LA program. NOTE: This automatic appending of the two-letter program symbol is only done when running through IPSDATA; any subsequent modification of data bases using the executive program IPSH will recatalog the modified data base exactly as specified at the time of modification.

3. Multiple Value Option for Running Parametric Studies

As part of the general data base setup within IPSSM, a provision exists for entering up to six values for each key variable. Such an option can be useful in preparing combinations of runs where key variables take on different values and, in addition, may require the simultaneous change of other key variables. The technique for entering such data is described in subsequent paragraphs. The symbols, P, L, and N will aid in this description. These symbols can be associated with the words "permutation", "link", and "number", respectively.

This system is not unique to IPSSM. It has been used quite successfully in several other programs written at Picatinny Arsenal.

To begin with, each key variable has a P, L and N number (all integers) associated with it. N simply denotes the number of different values currently available for the given key variable. The P and L values are used to set up run combinations. The value of L determines whether or not the given key variable is "linked" with any other key variable. That is, in a combination of runs, if the L value for two or more key variables is the same, each of these variables will change their values simultaneously on each successive run. Finally, the P value determines the variable to be changed on each run and the number of runs to be made. For those variables which are linked through the L value, only one of these variables can have a nonzero P value. This is evident since when one linked variable changes its value, all other variables linked to it will also change. By assigning different L values, it is clear that sets of linked variables can be identified. Since L is currently restricted to the integers 1 through 9, nine sets of linked variables can be defined, if necessary. It should be stressed that only one variable within each set can have a nonzero P value.

As an example, suppose three key variables AXX, BXX, and CXX were to be varied in a combination of runs. Let AXX have two values and be independent of BXX and CXX. Let BXX and CXX have three values each and suppose they are linked. Then, to run all combinations under these assumptions AXX, BXX and CXX would have the following P, L and N numbers:

	P	L	N
AXX	2	0	2
BXX	3	1	3
CXX	0	1	3

NOTE: Variable BXX in this case is used as the "permuted" variable.

4. Format and Use of P, L and N Numbers

At this point the meaning of the P, L and N numbers (abbreviated PLN numbers) should be clear. This paragraph describes how data are entered and modified within the data base when PLN numbers are involved. In paragraph 2 preceding, the entering of only single values for each key variable was described. In this case, the IPSDATA

program automatically associates a PLN of 101 to each entry. If a PLN number other than 101 is used, then a comma is entered in column four (rather than a blank) and the PLN number is entered in columns 5, 6 and 7. The N values (up to 6) are then entered in the remaining columns of the card in free floating point format separated by commas. No blanks are permitted following the first data entry.

Modifications of an existing data base to include PLN values other than 101 are described in the instructions for running the executive program in Batch or TTY mode. (See parts B and C of this section.)

5. Data Base Modification Using the Executive Program

In order to modify an existing data base using the executive program (IPSH) (as opposed to creating an entirely new data base file using IPSDATA), the initial data base must first be available as a permanent file. The procedure using the teletype is explained in Part B of this Section titled "Instructions for Teletype Mode" under question 10. This question, namely, "MODIFY DATA BASE, YES OR NO =" is answered "YES". This invokes questions 11 and 12 which allow the user to enter data for key variables, even if no values currently exist for that variable. In this way data can be entered for a number of variables. Where limited data entries are required, for example, in executing the Interior Ballistics Program or the Aerodynamic Coefficient Program, this method would be preferable. For entering data via the Batch mode, the user should refer to part C of this section.

B. Instructions for TTY Mode

1. General

The following pages indicate the instructions used to execute the executive program (IPSH) in the TTY mode. This mode is conversational and requires limited response to perform many useful operations. It is required for users who do not have access to a Batch Terminal, and is particularly useful in conjunction with a portable teletype. The system allows the user to access any program within the IPSSM System. Where extensive production runs are required, it is recommended that the Batch Mode be used. However, certain options for some programs are currently available only in the TTY mode.

The first instruction required to enter the INTERCOM System (see Reference 7, page 3-2) from the teletype is "LOGIN". The system

responds with "ENTER USER NAME" to which you type XXXXYYYYZZZ where XXXX is a four letter user code assigned by the MISD.

YYY = Cost Center Code (See Reference 8, page 4-8)

ZZZ = Charge Code (See Reference 8, page 4-5a)

The system responds with "ENTER PASSWORD" to which you respond with the Picatinny Arsenal Code (Consult MISD).

The system then types some accounting information followed by the word "COMMAND:". From this point on, see the following table for specific IPSSM TTY instructions.

2. Explanation of "INPUT/OUTPUT OPTION LIST" (see question 23, page 18).

a. Teletype Options

The first two digits control the teletype function.

Put a "1" in the second place if you wish to come back to the teletype for the results of your run when it has finished. You will be asked to supply a permanent file name on which the results will be stored for eventual teletype display. In most cases, the results stored for teletype retrieval will be an abbreviated version of the complete results.

If, in addition to these abbreviated results, you would like the values of specific variables to be printed out, include a "1" in the first place. You will then be asked to identify these variables (up to 6).

b. Data Base Transfer Option

The third and fourth digits are used to replace particular data base values with new values obtained during your current execution of an application program.

This option can currently be used in two modes: when running the SP program, part of the SP output contains variables that are required in the AR input. Likewise, portions of the WT output are variables that are used as SP input. Thus, either an AR or SP data base can be automatically updated with this option when running either the SP or WT programs, respectively.

<u>Specific TTY Instructions</u>		TABLE 1	
<u>QUESTION</u>	<u>EXPLANATION</u>		<u>RESPONSE EXAMPLE</u>
a. Command	Attach the executive program (IPSM)		ATTACH, IPSM, IPSH, CY=5, ID=NICHOLS, MR=1
b. Command	Start Execution		IPSM.
1. THIS IS IPSSM MODE TTY OR BATCH =			TTY
2. WILL THIS BE A NEW RUN, YES OR NO =	YES indicates a new run, NO signals the program that you have previously entered a run and are now coming back for the results.		YES
3. PROGRAM =	Enter the two-letter symbol and one digit corresponding to one of the nine application program names in IPSSM's library and the current operational cycle number of that program. Current library symbols are:		AR5 or

<u>QUESTION</u>	<u>EXPLANATION</u>	<u>RESPONSE EXAMPLE</u>
	AR - aeroballistics program IB - interior ballistics SP - spinner (aerodynamic coefficients) etc. WT - weight (static properties) LA - lethal area TR - six-D trajectory program RM - recoil mechanism design program SD - sabot design program IH - Heppner-interior ballistics	IB5
4. DATA LOCATION: CY, PFNAME =	Enter the cycle number, a comma, and then the name of the permanent file where your data base is stored.	4,XM58
5. GRAPHICS YES OR NO =	This question will be asked only if you are running the WT program. If you answer YES, you will be asked to name a permanent file to store data to be used at the graphics terminal	YES

<u>QUESTION</u>	<u>EXPLANATION</u>	<u>RESPONSE EXAMPLE</u>
(The title of your data base will be written out)		
6. EXAMINE DATA BASE, YES OR NO =	NO - Program will skip to question 10 YES - If you wish to ask the value(s) of specific variables in your data base.	YES (no response)
7. SYM =	Type in one three-letter variable symbol from the application program, or type in the word ALL if you wish to examine all of the key variables for that program.	WGT
8. P = X, L = Y, N = Z VALUES = XX.X, YY.Y	See pages 8 - 10 for explanation of P,L and N	
9. SYM =	Type in the next three-letter variable symbol you wish to inspect. When you have finished examining data base values, type END.	END

<u>QUESTION</u>	<u>EXPLANATION</u>	<u>RESPONSE EXAMPLE</u>
10. MODIFY DATA BASE, YES OR NO =	No - if you wish to run the data as it is stored program will skip to next appropriate question. YES - if you wish to change one or more values.	YES
11. SYM, PLN =	See instructions for creating initial data base	WGT,202
12. VALUES =	The number of values entered must be the same as the last digit entered from previous question. Use a decimal point in each value. Separate the values with commas. (Leave no blanks)	200.,202.5
13. SYM, PLN =	When you have finished changing the data base for this run, type END.	END

QUESTION

EXPLANATION

RESPONSE EXAMPLE

- | | | |
|-----------------------------------|---|-----|
| 14. DELETE TABLES, YES
OR NO = | This question will be asked only if you previously indicated that you are running the AR program. For other programs, it will skip to question #18. The AR program will not run successfully if there are too many tables left in the data base for the number of flight phases that are being run in the present case. Accordingly, tables may have to be deleted. | YES |
| 15. TABLE NO. = | Insert the number of the first table you wish deleted. | 12 |
| 16. TABLE NO. = | Insert the number of the next table you wish deleted. | 13 |
| 17. TABLE NO. * = | When you have finished deleting tables, type END. | END |

<u>QUESTION</u>	<u>EXPLANATION</u>	<u>RESPONSE EXAMPLE</u>
18. CHG ITEMS YES OR NO =	This question will be asked if you have indicated that you are running the WT program. A response of NO signals the system to ask question 19. If you type YES a series of additional questions are asked to change, add, or delete shell items. (See pages 26-27 for these procedures).	NO
19. STORE MOD DATA, YES OR NO =	This question will be asked if you answered yes to either of questions 10 or 14.	YES
20. NEW TITLE =	Enter a title for your new data base.	M106 TEST CASE
21. WHERE DO YOU WISH TO STORE MOD DATA: CY, PFNAME =	Specify cycle number and name of permanent file (10 or less alpha-numerics).	3,TEST
22. MOD DATA STORED: CY = 3, PF = TEST		(No Response)

<u>QUESTION</u>	<u>EXPLANATION</u>	<u>RESPONSE EXAMPLE</u>
23. INPUT/OUTPUT OPTION LIST (Y=1, N=0) TTY, DB, TERM, CS =	This question calls for a response of two digits (either 1 or 0 signifying yes or no, respectively) for each of the four input/output option categories: teletype, data base, terminal, central site. (See paragraph 2 for further details.)	11001100
24. CORE REQD: CM,T =	Note - CM values must be octal. T is in system seconds (decimal).	177000,180
25. COST CENTER - CHARGE CODE XXX-XXX =		123-123
26. STOP 00	First response example will place the run in the input queue of the central site. Second response example will place the run in the input queue of remote terminal XX.	BATCH(JOB,INPUT) OR BATCH(JOB,INPUT,XX)
27. IPSMXXX.\$0000 etc.	Job is now in input queue under the name of IPSM.	(No Response)

<u>QUESTION</u>	<u>EXPLANATION</u>	<u>RESPONSE EXAMPLE</u>
28. COMMAND -	If you wish to enter another case, the second response example will recycle the IPSSM program.	LOGOUT OR IPSM.

A "0" in the third position together with a "1" in the fourth position indicates an automatic replacement of old values with current ones in the AR or SP data base specified. If a "1" is entered in both the third and fourth positions, the system will take the current output values and update the old data base specified into a new data base defined by the user, and, in addition, will allow the user to enter a title for his new data base. In this instance, the old AR or SP data base will remain intact with its original values.

A "0" in both the third and fourth positions indicates that no data transfers will be made.

c. Batch Terminal Option

The fifth and sixth digits control printing on remote terminals.

A "1" in the sixth position will provide a complete set of results at the remote terminal.

A "1" in the fifth position will cause the input data sets (as modified for the present run) to be printed out at the remote terminal site also. This will facilitate future identification of the computer run with the input data base that generated it.

d. Central Site Option

The seventh and eighth digits control the disposition of output to the central site.

A "1" in the eighth position disposes the results at the central site.

A "1" in the seventh position also copies the input data sets to the central site.

3. IPSSM Short TTY Inputs

For users who have become familiar with the TTY mode, input can be entered more quickly as shown below:

a. If the run is going to be a new one, questions 1, 2, 3, 4 of paragraph 2 may be answered at once in the following manner:

Question 1. THIS IS IPSSM

MODE: TTY OR BATCH =

TTY,AR5,5,XM58

If one of the answers is not accepted by the program, an error message will be printed and the program will ask you to correct the information.

b. Questions 22 and 23 may always be answered together in the following manner:

Question 22. TTY, DB, TERM, CS =

11001100,177000,180

C. Instructions for Batch Mode Operation

1. General

If the user has access to a card reader at the central site or at a batch terminal, he will probably find it more useful to run IPSSM via card input. Four options are currently available:

- a. Modify and store new data base file.
- b. Delete tables used in the exterior ballistics (AR) program.
- c. Prepare data for the graphics (PROM) program.
- d. Perform and store error computations for the exterior ballistics (AR) program.

2. Control Cards

In this mode, the executive program generates input data on a local file named TAPE9. The executable (LG0) file of the program selected is copied to a local file named TAPE8. The control cards listed on the following page provide the necessary cards to attach and run the executive program, which, in turn, executes the selected application program. Cards enclosed in brackets are included only if you are making use of the error analysis option. The cycle number

which you specify here when cataloging the permanent file ERROR must agree with the number you specify on the ERROR card (paragraph 3).

(JOBNAME),CM145000,T210.

(COMMENTCARD)

ATTACH(IPSM,IPSH,CY=5,ID=NICHOLS,MR=1)

IPSM.

REQUEST,TEMP3,*PF.

REWIND,TAPE9.

COPYSBF,TAPE9.

REWIND,TAPE9,TAPE6,TAPE10.

RFL,145000.

MAP(OFF)

REWIND,TAPE12.

COPYBF(TAPE12,TEMP1)

REWIND,TEMP1.

RETURN,TAPE12.

TAPE8(TAPE9).

REWIND,TAPE6.

COPYBF(TAPE6,OUTPUT)

REWIND,TAPE12.

COPYBF(TAPE12,TEMP2)

REWIND,TEMP2.

REWIND,TAPE12.

COPYBF(TEMP1,TAPE12)
 BKSP(TAPE12,1)
 COPYBF(TEMP2,TAPE12)
 REWIND,TAPE12.
 COPYBF(TAPE12,TEMP3)
 RETURN,TAPE12.
 REWIND,TEMP3.
 CATALOG(TEMP3,ERROR,CY=N,ID=NICHOLS)
 (7/8/9CARD)
 (BATCHINSTRUCTIONCARDS)
 (6/7/8/9CARD)

NOTE: The CM and T values specified on the job card must
 both agree with the values specified on card (b) of
 the batch instruction cards (see next paragraph).

3. Batch Instruction Cards

In order to explain the use of batch instruction cards, the
 following example illustrates all available options:

- a. BATCH,AR5,5,M106AR
- b. 00011100,145000,210
- c. DATA
 VMX,202
 2500.,2700.
 THD
 30.
 END

- d. TABLE,2,NEWM106 NEW PROJECTILE RUN
 11
 12
 END
- e. GRAPHICS,4,PFNAME1 GRAPHIC DISPLAY TITLE
- f. ERRØR,1,NICHØLS

The explanation is given in terms of the card numbers designated on the left.

CARD a:

The word "BATCH "is entered in the first five columns followed by a comma in column 6. Columns 7 and 8 will have the two-letter symbol corresponding to the program in IPSSM's library that is being run. Column 9 is the number specifying the current operational cycle number of that program (usually 5). Column 10 contains a comma, followed by the cycle number, a comma, and the name of the permanent file where data base is located.

CARD b:

In columns 1-8 are entered the input/output option list values (for explanation-see question 23 and paragraph 3 of Part B), followed by a comma in column 9. The computer core and time required to execute the applications program are entered next, separated by a comma. The core requirement is designated in octal. See note on page 23.

CARD c:

If changes in the data base are to be made, then a card with the word "DATA" entered in columns 1-4 is inserted next. The next card follows with the symbol of the key variable to be changed entered in columns 1-3. The PLN value of 101 will be assumed for that variable unless it is followed by a comma in column 4, in which case the different PLN number is entered in columns 5-7. The next card provides the value(s) for that variable in free floating point format (No blanks; start in column 1.) After all the data changes have been entered, a card with the word "END" punched in columns 1-3 is inserted to terminate this option.

CARD d:

If the AR program is being run and table deletion is desired, then a card with the word "TABLE" entered in columns 1-5 is inserted next. One of the table numbers to be deleted is entered in the first two columns of the next card. Each table number is indicated on a separate card. A card with the word "END" punched in columns 1-3 is inserted last to terminate this option. NOTE: A table card is permissible only if you are running the AR program. Otherwise an error message will be printed and your job will resume execution.

4. Storage Options

If it is desired to store the new data as modified by any run, additional entries can be made on either the DATA or TABLE cards as follows:

A comma is placed after the word "DATA" or "TABLE", followed by the cycle number and the name of the permanent file where the modified data base is to be stored. These entries must also be separated by a comma. A new title card for the new data base is also entered on the card in columns 25-80.

CARD e:

If the WT program is being run and it is desired to have the output made available for later display on the graphics projectile measurement program (PROMS), then a graphics card is included. The word "GRAPHICS" is entered in columns 1-8, followed by a comma. The cycle number in column 10, a comma, and the permanent file name (starting in column 12) where you wish to store the graphics input follow. The title for the graphics display is also entered on the same card in columns 25-80. NOTE: A graphics card is permissible only when running the WT program. Otherwise an error message will be printed and your job will resume execution.

CARD f:

If the AR program is being run and it is desired that an error analysis be performed on the data for future teletype retrieval, then an ERROR card is included. The word "ERROR" is punched in columns 1-5, followed by a comma. Then the cycle number (corresponding to the one specified in the control cards) is punched in column 7, followed by a comma and the ID name, NICHOLS (starting in column 9). Example 11 on page 56 illustrates the method of retrieving on the

teletype the error analysis stored in this way. NOTE: An ERROR card is permissible only when running the AR program. Otherwise an error message will be printed and your job will resume execution. NOTE: Only the first two cards and the ERROR card are order-dependent. The DATA, TABLE, and GRAPHICS cards can be inserted in any order or any one or all of them can be left out. If the ERROR card is included, it must directly precede the 6/7/8/9 card.

APPLICATION PROGRAMS AND DESCRIPTIONS

In order to have this manual somewhat self-contained without making it too cumbersome, a brief description of each application program is provided in this section. References to more complete documentation are given, together with options available through the use of the executive program (IPSH). References are also made to specific appendices which describe key variable input and tables required to each program.

A. Static Properties and Stability Calculations (WT)

The program used in IPSSM for performing static property calculations is a program currently known as WEIGHT. An earlier version of this program was called DAGMAR. Reference 1 contains the latest complete instructions and use of the weight program. The key variables associated with this program through IPSSM are given in Appendix A1. In addition to the key variable input, the description of each shell item, i.e. body, fin, known and ogival is entered following a card with the name WGTTAB punched on it, starting in Column 1. The format for entering this information is identical to that used in the WEIGHT program. For completeness, this format is given in Appendix A2; however, for a complete explanation of reference points, associated diagrams and the equations used, see Reference 1. The variables named NBI, NOF, NFP, NKI and NOI provide the number of body, fin, fin pieces, known and ogival items, respectively. The number of cards following WGTTAB must agree and correspond with the values given for the key variables. Following the shell description cards is the card with ENDWGT punched in columns 1 to 6.

The executive program (IPSH) is capable of changing the shell items in a similar way to that done at the graphics terminal. The procedure is written in conversational mode that starts with the question: "CHG ITEMS, YES OR NO = ". (See question 18 -- TTY Instructions). If the answer is NO, the executive routine continues by asking the question; "STORE MOD DATA YES OR NO = " (question 19).

However, if you answer YES, the program asks the following: "ITEM TYPE - BDY, FIN, KNO, OGV OR END -". You may then select the appropriate type or end the process with END. Having selected an item type, the next question is; "DEL, ADD, OR CHG -". Typing DEL means you wish to delete one entire item (line) of the type you selected. The program will then ask for the item number: "ITEM NO. =". The item number corresponds to the particular location of the item, i.e., line number within its group (body, fin, or ogive). This can most easily be determined by looking at a previous WT run on which the items are numbered within their group.

WARNING: DEL should be the last operation specified, after all ADDs and CHGs are performed, as the lines will be automatically re-numbered after each deletion and any subsequent attempts to add or change item numbers will most likely be inaccurate.

For the same reason all deletions should be specified in the order of the highest item number first to the lowest item number last. ADD requires that you specify additional data for the item type selected. The data are then typed in free floating point format as it is asked for and the new item is automatically entered into the data base for the run being made. These changes are not permanent unless you store the modified data base. The CHG option requires that you specify the item you wish to change and then the field within that item that you wish to modify. Field one represents the first formatted entry on that particular body, fin, or ogive card; field two the second, and so on.

These options allow for limited modifications of the shell configuration via the teletype. Obviously, the graphics system called PROMS (Reference 2) with a visual display is much easier to work with, particularly if you are working with new shell designs. However, for a limited number of straightforward design changes the user may find it more convenient to use the teletype located in his immediate area. The TTY procedure is not recommended for any extensive changes.

In addition to this option, the executive program can also prepare data for use with the PROMS system. After selecting the weight program (WT), the question "GRAPHICS YES OR NO=" will be asked. If your answer is YES, you are then required to specify a cycle number and permanent file name to store the data for a subsequent graphics run.

The graphics output (currently in the form of cards) can then be re-entered into the data base for additional IPSSM runs.

B. Generation of Aerodynamic Coefficients (SP)

The program used in IPSSM for calculating aerodynamic coefficients is a program known as SPINNER. The documentation for this program is given in Reference 3. The program was originally written in Fortran IV for use of the IBM 360/65. Later it was converted to run on the CDC 6500. Computational techniques used to estimate the aerodynamic coefficients of spin-stabilized projectiles are based upon the use of empirical equations and apply for Mach numbers from 0.01 to 3.0. The key variable data required to execute the program are given in Appendix B. The following aerodynamic coefficients are predicted by SPINNER for projectiles of 3.6 to 9.0 calibers in length, with ogival nose lengths of 1.8 to 4.0 calibers and boattail lengths between 0.0 (square base) and 1.0 calibers:

Zero Yaw Drag Coefficient

Normal Force Coefficient Derivative

Pitching Moment Coefficient

Magnus Force Coefficient Derivative

Magnus Moment Coefficient Derivative

Damping in Pitch Coefficient Derivative

Spin Deceleration Coefficient

The formulas are based upon the use of "standard" projectile length, and center of gravity from the standard.

The SPINNER Program does provide the engineer with a rapid, accurate technique for estimating the aerodynamic coefficients for use in preliminary design studies. However, SPINNER results should be checked against reliable aerodynamic data when available. (The above remarks are excerpts from Reference 3.)

C. Interior Ballistics Calculations (IB)

The program used in IPSSM for interior ballistic calculations is a short FORTRAN program called INTERIOR BALLISTICS, and is described in Reference 4. The program uses a series of simple equations to compute muzzle velocity given charge weight, chamber volume, maximum pressure, and other variables shown in Appendix C. The program can also be used to calculate charge weight if the muzzle velocity is known. However, the process used in this case is an iterative scheme which usually converges. Maximum pressure can also be estimated by another iterative process. The codes required for the key variable PKI are 1.0, 2.0, 5.0, 6.0, 8.0, 9.0, 10.0, 15.0, 17.0, 26.0, 30.0, 31.0 which represent the propellants M1, M2, M5, M6, M8, M9, M10, M15, M17, M26, M30, and M31, respectively.

D. Exterior Ballistics Calculations (AR)

The program used in IPSSM for exterior ballistic calculations is a two-stage, point-mass trajectory program called AEROI with drag cancelling and stability calculation options. One of the original versions of the program was known as RKTCAN, which was written in 1962. The most recent documentation for this program can be found in Reference 5. It was written for the IBM 360/65 and did not contain the stability calculations. In 1966 a new version of RKTCAN was written to include stability, and is currently known as AEROI. Documentation for this program is contained in Reference 6. Basically, the program can be used for both one and two-stage missiles or Rocket-Assisted Projectiles (RAP). The trajectory calculations are divided into the following four phases:

- | | |
|-----------|---|
| Phase I | Acceleration of Booster and Main Stage |
| | a. Start from Launcher (VMX=0.) |
| | b. Start without Launcher (VMX greater than zero) |
| Phase II | Coasting of Main Stage |
| Phase III | Acceleration of Main Stage |
| Phase IV | Free Flight of Main Stage |

For calculations involving Rocket-Assisted Projectiles, only Phases III and IV are required. Other combinations can be used, depending on the functions of the missile or projectile. A purely ballistic trajectory may be simulated by either Phase II or Phase IV. A listing of the key variables used in this program is given in Appendix D1, together with an explanation of their meaning, values, and format. The program tables required for the program are given in Appendix D2. For consistency, all tables are described by the same format, which requires six cards. The first three denote values of the independent variable (mach number, altitude, or time); the last three give the values of the dependent variable (drag coefficient, thrust, weight, density, temperature, etc.). Each card is in 10F7.0 format.

All table cards are inserted in the initial IPSDATA data deck behind two table control cards. The first card has the name EXTTAB punched on it starting in column 1. The second card denotes the tables to follow. Each column of the card corresponds to the number of the table to be inserted. A 1 in any given column indicates that the correspondingly numbered table will be included. For example, a 1 punched in column 1 of the card would indicate that six cards for Table 1 would appear next. A blank in any column indicates no corresponding table will be inserted. Thus, the second card indicates the tables that follow (in order) corresponding to the column number containing a 1. Depending on the value of certain key variables listed in Appendix D1, certain tables must be inserted for proper execution of the AEROI Program. However, any table can be stored initially in the data base as long as the appropriate ones are deleted when setting up a run through the executive program (IPSH). The AERO I table cards must be followed by a card with ENDEXT punched in columns 1 to 6. For the TTY mode, tables, by number, can be deleted one at a time (see Instruction for TTY mode, page 10). For the batch mode, tables are deleted by a number following the card labelled "TABLE" (see Instruction for Batch Mode, page 21). All aerodynamic coefficients are "C" coefficients. The conversion of "k" coefficients to "C" coefficients is given in Reference 6.

A fixed flat earth and the 1959 ARDC standard atmosphere are used when no other option is identified. Provision for inserting nonstandard atmospheres is provided by the use of the key variable NAT and Tables 19 and 20.

E. Terminal Effectiveness Calculations (LA)

The effectiveness program used in IPSSM computes the lethal area of fragmentation ammunition. It has many options and computational features that are described in references. The essential input to the program is the fragmentation data as a function of "zones" described with respect to the axis of symmetry of the shell. A zone is the region between two conical surfaces whose axes are at the center of gravity of the round and whose half-angle is measured from the nose end of the round. Fragmentation data within each zone consist of the number of fragments within given weight groups and the initial velocity of the fragments. Each fragment in a weight group has a weight equal to the average fragment weight. All fragments within a given zone are assumed to have the same initial velocity. However, their drag is dependent upon a shape factor, the size and weight of the fragments themselves, and the type of media (air, grass, leaves, etc.) through which the fragment will travel.

The shell is assumed to detonate at some point in space above the target area or at impact with the ground plane. The shell may have a terminal velocity at detonation. Its angle of fall with respect to the ground plane is also required input. The targets for this program are personnel in various postures such as prone, standing, or in fox-holes and are also assumed to be in some stage of military readiness. These military situations are described further in the references. Those who use the program will recognize the required key variables given in Appendix E.

The program is also capable of generating probability of kill (PK) matrices in the ground plane. In this case, the target area is divided into rectangular cells that can be specified by the user or generated internally, depending upon the option called for by the input data. The PK is then calculated for each cell. The PK matrices can then be used in other lethality programs to determine the effectiveness of volley fire and multiple round firings. Programs which evaluate multiple round effectiveness could be incorporated into IPSSM at some future date, if desired.

Another significant feature of the program is its ability to account for velocity decay of the fragments as they pass through different layers between planes parallel to the ground plane. The regions between layers can represent various types of media representative of environments such as grass, jungle tangle, or high canopy forests.

It should be emphasized that for purposes of the IPSSM system some of these sophistications need not be used to obtain a preliminary estimate of the shell's lethal potential. However, having this program available does allow for parametric studies to be made in an easy manner by varying the key variable data.

The format of the fragmentation data is identical to that used when running the lethal area program independent of IPSSM. Preceding the fragmentation data is a card labelled FVMTAB in columns 1 to 6, and following the last fragmentation data card is a card labelled ENDFVM. Data describing the fragment drag tables are separated in a similar manner by cards labelled FDXTAB and ENDFDX in columns 1 to 6. This table is required and must contain at least two values for both the dependent and independent variables.

F. 6-D Trajectory Program (TR) (references 9, 13)

The six degree-of-freedom missile trajectory program may be utilized to compute trajectories for one and two-stage rockets and/or ballistic projectiles (fin and spin-stabilized) and consists of the following phases:

- | | |
|-----------|--|
| Phase I | Acceleration of Booster and Main Stage |
| Phase II | Coasting of Booster and Main Stage |
| Phase III | Separation of Booster from Main Stage |
| Phase IV | Coasting of Main Stage |
| Phase V | Acceleration of Main Stage |
| Phase VI | Free-flight of Main Stage |

Any of these phases may be excluded in the computation. For ballistic trajectory computations, only Phase VI is required.

Thrust values for the acceleration phases (I and V) are obtained in the computation by linear interpolation of a thrust versus time table. Provisions in the program permit altering the table thrust values by using a constant thrust modifier term. Also, the correction of presented thrust data for changes of atmospheric pressure with altitude may be performed, if desired, by the user.

Thrust misalignments may be introduced by establishing the thrust misalignment distances and angles as input data. Also, a constant jet torque may be introduced.

A linear change in mass during acceleration or a change in mass as a function of the thrust and specific impulse of the rocket propellant is another option for phases one and five. If a separation thrust is required in phase three, only a linear mass change is computed.

During all acceleration phases, center of gravity and moments of inertia are varied linearly with time.

Range, cross-range, and vertical winds may be introduced in the program in tables as functions of range and altitude for flat earth profiles. At present, wind equations for a spherical earth have not been included in the computer program because data formats for these wind profiles have not been made available. Constant flat earth winds may also be introduced for the entire trajectory. Inclusion of winds in the computation is an option and not required for all trajectories.

Normal force, yaw damping, drag ballistic coefficients, and normal force center of pressure axial positions are introduced in the program as table functions of mach number and angle of attack. When they are available, magnus, roll moment, and roll damping (or spin deceleration) ballistic coefficients and the magnus force center of pressure positions may also be included as table functions of mach numbers and angle of attack. For entry of tabular data, consult Aeroballistics Branch, FRL, Picatinny Arsenal.

G. Recoil Mechanism Design (RM)

This program was written at Rodman Laboratories, Rock Island. Documentation is not available at this time. It is suggested that Mr. B. Moody at Rodman be contacted for further information.

H. Sabot Design Program (SD)

The program SABOT DESIGN is currently used in IPSSM for the determination of sabot design parameters. Before a weapon system can be designed and tailored to achieve stated objectives, adequate design criteria must be established. In the case of weapon systems employing sabotated flechettes, many interdependent variables are present that serve to confound the design process. Reference 10 contains the latest complete instructions for the use of the SABOT DESIGN Program, which can accomplish the coordination of such

variables as sabot geometry, inbore pressure, intersegment spacing, bore friction, sabot density, and flechette weight. These and other key variables associated with this program through IPSSM are listed in Appendix H.

In addition to various numerical analyses, SABOT DESIGN is capable of producing Calcomp and printer plots of inbore loading through the use of the NANCY plotting routine. Examples can be found in Reference 9.

The SABOT DESIGN Program enables a sound engineering approach to sabot design that, in the past, largely relied upon numerous cut and try methods. At Frankford Arsenal, where the program was written, it has already been used to design two functional flechette/sabot assemblies.

I. Heppner Interior Ballistics (IH) (reference 11)

The use of multigranulation propellant charges requires improved ballistic theory for the prediction of interior ballistic phenomena. Accordingly, the Hitchcock equations of interior ballistics were modified and new procedures developed that are more applicable to the high charge-to-projectile weight systems. These modifications, incorporated into the Heppner Interior Ballistics Program, give more reliable predictions of the effects of changes in the weight of the charge, the weight of the projectile, web size, and type of propellant and granulation of ammunition. The program performs all necessary computations for the high-velocity guns for any shape of propellant grain and multigrain charges.

Principal output is proportion of propellant burned, projectile travel and velocity, chamber pressure, pressure on the base of the projectile (all as a function of time), and "variable quickness" (as a function of projectile travel in the tube of the gun). Another feature of the IH program is that if experimental data (velocity and maximum pressure) are available for a particular system (gun, projectile, or propellant), the data can be used as a "basis" for calculations of additional pressure and velocity charge relationships for new systems to be studied. The closer the new system is to the basis system, the more accurate the calculations will be.

SAMPLE INPUT FOR INITIAL DATA BASE GENERATION

Following is a list of the data base cards used to generate the data base titled "PROJECTILE 8-INCH M106", using the IPSDATA program. These cards would be inserted into the deck format shown on page 7, and as a result of this run, five different permanent files (M106AR, M106TR, M106SP, M106WT, and M106LA) are created and catalogued (cy=5), as discussed on page 8. Note that these five different files are created as a result of both 5, M106 being specified on the second data base card and the inclusion of data used by each of the five application programs. Appendix J shows the output of this run.

```
PROJECTILE 8 INCH M106
E.M106
DES 1.0
NY4 1.0
KFT 1.0
KTH 2.0
KTH 1.0
MXX 2.0
MIF 2.0
MID 1.0
YCD 5.0
TCD 20.0
VMX 2200.
WGT 200.
DIA 7.99
TL2 786.5
DT2 4.13
CAM 2.0
TV2 7.0
TV3 10.0
TV4 2000.
ECT 1.0
FFA 1.0
DI2 .005
DI3 .005
DI4 .005
DW2 1.0
DW3 1.0
DW4 4.0
TV5 20.0
```

IRP	1.25
THP	2.0
VMP	50.
IRP	1.21
TCR	.2
VSR	2.0
PII	2.5433
YIT	155.
VOT	200.
MST	50500.
DMT	12.65
DCI	8.58
DKI	17.
MVI	0.
DIS	4.315
NLS	2.272
DIC	.503
CCS	2.315
OTS	7.99
AVS	1828.
TMS	15500.
WTS	202.200..180.
TCY	2.
PCS	0.
CTC	1.0
NRI	25.
NCT	4.
NCA	2.
EXP	1.
ADI	2.
MT7	2.
DEB	20.
ACE	47.
TVM	1000.

NOZ 37.									
CCK 1.0									
CKO .5905									
MCD 11.									
COP 2.									
MCC 12.									
FAD									
EXRTAR									
11									
0.010	0.600	0.0	.9	.95	1.00	1.05	1.100	1.20	1.35
1.5	1.75	2.0	2.5	3.0					
0.135	.135	.14	.177	.227	.335	.361	.360	.469	.428
.313	.288	.263	.229	.200					
0.010	0.600	0.0	.9	.95	1.00	1.05	1.100	1.20	1.35
1.5	1.75	2.0	2.5	3.0					
0.135	.135	.14	.177	.227	.335	.361	.360	.469	.428
.313	.288	.263	.229	.200					
FADFYR									
WGTTAR									
7.95	7.95	7.83	.283	19.28				CR0DY1	1
7.98	7.98	1.80	.283	29.32				CR0DY2	1
7.98	6.75	4.00	.283	31.12				CR0DY3	1
7.99	7.99	.78	.283	18.50				CR0DY4	1
7.90	7.98	.40	.283	18.10				CR0DY5	1
7.91	7.91	.17	.283	29.12				CR0DY6	1
7.91	7.98	.10	.283	29.22				CR0DY7	1
6.47	6.47	6.00	-.223	18.10				TR0DY1	
4.86	4.53	1.42	-.223	31.11				TR0DY2	
6.07	5.50	2.50	-.223	26.50				TR0DY3	
5.50	4.86	2.11	-.223	29.00				TR0DY7	
6.30	6.07	1.20	-.223	25.30				TR0DY4	
6.47	6.30	1.20	-.223	24.10				TR0DY5	
6.00	6.00	.12	0.0	35.00				TR0DY6	
1.6	1.6	.10	0.0	3.75				FR0DY8	
1.6	2.0	.10	0.0	3.85				FR0DYC	
2.0	1.6	.10	0.0	3.95				FR0DYD	
1.6	2.0	.1	0.0	4.05				FR0DYF	
1.6	2.0	.1	0.0	4.35				FR0DYG	
2.0	1.6	.1	0.0	4.35				FR0DYH	
1.6	2.0	.1	0.0	4.45				FR0DYI	
2.0	1.6	.1	0.0	4.55				FR0DYJ	
1.6	2.0	.1	0.0	4.65				FR0DYK	
2.0	1.6	.1	0000000.0	4.75				FR0DY	
1.6	1.6	1.15	.64	4.05				FR0DYM	
8.05	8.14	1.0	.283	27.12				CR0DTA	1
8.05	8.08	.20	.283	28.12				CR0DTR	1
8.14	8.14	.15	.283	28.32				CR0DTC	1
8.14	8.28	.20	.283	28.47				CR0DTH	1
8.28	8.28	.10	.283	28.67				CR0DTF	1
7.91	7.91	.15	.283	28.77				CR0DTF	1
8.12	8.12	.08	.283	28.02				CR0DTG	1
8.12	7.98	.12	.283	29.00				CR0DTH	1
7.53	7.53	2.00		27.12				TR0DTA	
-18.90	60.	14.35	.283	3.75	64.10			COGIVE	1
-17.90	60.	13.25	-.223	4.85	63.40			LOGIVE	
-18.50	60.	3.75	.1	0.0	63.0			ENGIVE	1
	-1.26	1.0	-.223	32.52	1.0			ICURVE	
FADWGT									
FYMtar									
0.000	2.500	1.250	2150.000	2366.667	2150.000			1.000	
1.000									

0.000						
2.500	7.500	5.000	2366.667	2575.000	2800.000	1.000
1.000						
0.000						
7.500	12.500	10.000	2575.000	2325.000	2350.000	1.000
1.000						
0.000						
12.500	17.500	15.000	2325.000	2850.000	2300.000	1.000
1.000						
0.000						
17.500	22.500	20.000	2850.000	3100.000	3400.000	1.000
1.000						
0.000						
22.500	27.500	25.000	3100.000	2900.000	2800.000	1.000
1.000						
0.000						
27.500	32.500	30.000	2900.000	3100.000	3000.000	1.000
1.000						
0.000						
32.500	37.500	35.000	3100.000	3275.000	3200.000	1.000
.176						
32.798						
37.500	42.500	40.000	3275.000	3450.000	3350.000	2.000
.098	1.662					
31.321	7.825					
42.500	47.500	45.000	3450.000	3550.000	3550.000	2.000
.160	5.965					
36.400	9.094					
47.500	52.500	50.000	3550.000	4200.000	3550.000	4.000
.225	1.351	3.724	39.240			
19.063	9.517	9.517	9.517			
52.500	57.500	55.000	4200.000	4200.000	4850.000	4.000
.312	1.441	2.253	50.601			
65.932	9.407	9.407	9.407			
57.500	62.500	60.000	4200.000	3375.000	3550.000	7.000
.139	1.360	2.394	7.456	9.070	43.778	973.973
161.195	9.466	18.982	9.466	18.982	18.982	9.466
62.500	67.500	65.000	3375.000	3350.000	3200.000	11.000
.217	1.432	3.384	7.297	10.961	16.163	26.568
45.897	92.441	100.099	210.210			
113.791	9.466	18.982	9.466	9.466	28.448	9.466
18.982	9.466	9.466	9.466			
67.500	72.500	70.000	3350.000	3625.000	3500.000	17.000
.127	1.694	2.051	13.823	19.480	29.009	40.267
82.934	92.772	108.445	141.429	171.171	236.882	259.258
390.390	487.486	539.541				
179.971	18.948	9.474	9.474	9.474	9.474	28.423
9.474	9.474	18.948	18.948	9.474	18.948	9.474
9.474	9.474	9.474				
72.500	77.500	75.000	3625.000	3825.000	3750.000	13.000
.097	1.510	2.858	5.505	9.841	12.012	30.713
42.763	103.102	172.171	232.000	438.438	571.000	
180.038	37.892	37.892	9.462	9.462	9.462	37.892
9.462	9.462	9.462	28.429	9.462	28.429	
77.500	82.500	80.000	3825.000	4200.000	3900.000	18.000
.224	1.540	3.154	7.799	8.771	11.900	16.225
23.342	30.795	43.042	57.778	78.261	117.667	179.000
435.282	820.000	1117.576	2426.426			
246.389	37.886	47.358	9.471	18.943	28.415	9.471
9.471	37.886	9.471	9.471	18.943	28.415	28.415
18.943	28.415	47.358	9.471			
82.500	87.500	85.000	4200.000	4500.000	4500.000	14.000
.192	1.453	3.991	6.160	12.778	31.225	61.462
108.108	175.174	286.285	317.318	447.447	618.166	1404.405
350.531	37.892	47.396	28.450	18.946	18.946	9.442
9.442	9.442	9.442	9.442	9.442	56.838	9.442

97.500	97.500	90.000	4500.000	4425.000	4500.000	15.000
.153	1.573	3.318	7.143	12.423	17.053	29.880
46.547	55.209	87.438	120.120	182.183	308.309	853.333
1213.213						
417.276	9.487	85.384	28.461	18.974	28.461	37.948
9.487	37.948	9.487	9.487	9.487	9.487	56.922
9.487						
97.500	97.500	95.000	4425.000	3850.000	4350.000	22.000
.163	1.542	3.426	6.407	13.143	18.036	20.982
70.656	41.812	51.372	65.072	77.679	84.363	91.330
108.667	129.139	170.333	243.378	420.289	618.000	1383.723
2386.667						
369.687	47.396	37.917	9.479	47.396	18.958	9.479
47.396	75.833	9.479	18.958	9.479	9.479	9.479
28.438	9.479	28.438	18.958	18.958	56.875	47.396
28.438						
97.500	102.500	100.000	3850.000	3425.000	3350.000	24.000
.182	1.539	3.511	6.738	8.799	11.890	17.320
22.817	30.377	43.515	66.097	74.423	87.336	95.984
104.276	128.436	178.111	225.056	267.146	350.778	446.277
758.833	1485.784	4115.734				
767.654	123.177	132.775	104.180	9.398	37.993	37.993
28.395	56.789	47.391	37.993	28.395	18.996	37.993
37.993	18.996	85.384	37.993	47.391	85.384	18.996
56.789	66.387	75.786				
102.500	107.500	105.000	3425.000	3200.000	3500.000	14.000
.222	1.522	2.643	7.126	9.811	11.733	15.706
28.447	39.640	54.255	77.559	102.192	471.471	509.511
265.294	9.450	9.450	9.450	9.450	20.432	9.450
9.450	9.450	9.450	9.450	9.450	9.450	9.450
107.500	112.500	110.000	3200.000	2725.000	2900.000	7.000
.098	1.162	4.802	33.354	37.438	54.856	200.201
123.117	9.469	18.957	9.469	9.469	9.469	9.469
112.500	117.500	115.000	2725.000	2550.000	2550.000	7.000
.131	1.342	11.279	20.580	78.880	241.240	711.144
85.152	9.456	18.928	9.456	9.456	9.456	18.928
117.500	122.500	120.000	2550.000	2650.000	2550.000	7.000
.236	2.042	5.877	9.610	11.201	25.607	327.327
56.637	9.430	9.430	9.430	9.430	9.430	9.430
122.500	127.500	125.000	2650.000	2750.000	2750.000	7.000
.187	1.604	4.574	5.324	8.069	92.694	210.210
151.648	18.962	9.459	9.459	9.459	9.459	9.459
127.500	132.500	130.000	2750.000	2825.000	2750.000	13.000
.212	1.429	2.303	5.667	10.890	10.240	31.432
35.276	97.619	133.132	158.159	298.297	426.426	
680.759	66.210	9.420	28.350	28.350	9.420	9.420
9.420	9.420	9.420	9.420	9.420	9.420	
132.500	137.500	135.000	2825.000	2825.000	2900.000	9.000
.217	1.341	10.480	16.616	20.321	25.916	175.412
296.297	509.511					
811.825	54.773	9.113	9.113	9.113	9.113	18.226
9.113	9.113					
137.500	142.500	140.000	2825.000	2625.000	2750.000	10.000
.277	1.438	2.743	7.637	10.240	22.954	34.574
89.841	99.360	102.102				
543.737	39.421	39.421	7.884	7.884	15.768	7.884
7.884	7.884	7.884				
142.500	147.500	145.000	2625.000	2525.000	2500.000	4.000
.208	1.600	2.547	40.019			
552.130	32.871	19.710	13.161			
147.500	152.500	150.000	2525.000	2550.000	2550.000	5.000
.133	1.356	2.573	7.679	19.288		
345.976	21.626	16.220	5.406	5.406		
152.500	157.500	155.000	2550.000	2600.000	2550.000	8.000
.243	1.425	3.193	6.706	12.238	32.853	136.135
491.480						

213.575	26.164	26.164	4.351	8.731	4.351	4.351
4.351						
157.500	162.500	160.000	2600.000	2675.000	2650.000	12.000
.243	1.392	3.443	6.836	8.921	12.853	17.217
41.799	92.312	121.120	253.252	345.345		
209.494	16.945	23.661	20.268	6.756	3.362	13.512
6.756	3.362	3.362	3.362	3.362		
162.500	167.500	165.000	2675.000	2600.000	2700.000	16.000
.244	1.322	2.862	6.522	9.396	12.048	17.958
23.414	31.649	42.799	56.676	65.167	74.138	80.532
116.942	149.150					
144.475	19.585	48.978	12.237	4.889	14.697	19.585
4.889	4.889	4.889	2.460	7.348	4.889	2.460
4.889	2.460					
167.500	172.500	170.000	2600.000	2575.000	2500.000	23.000
.295	1.585	3.476	6.447	9.207	12.373	16.867
23.468	31.110	47.927	50.111	64.817	77.171	85.798
97.919	107.667	175.912	235.382	380.381	492.492	529.529
1661.661	2124.123					
107.916	16.727	13.684	16.727	4.554	6.087	7.597
3.043	6.087	3.043	1.511	3.043	3.043	3.043
1.511	4.554	3.043	3.043	1.511	1.511	1.511
1.511	1.511					
172.500	177.500	175.000	2575.000	3116.667	2650.000	24.000
.310	1.607	3.428	6.187	9.107	12.230	17.642
21.680	29.433	39.826	54.297	63.013	73.357	88.006
92.989	112.588	138.714	174.333	230.354	278.361	330.334
403.798	619.166	1539.471				
111.672	23.702	29.611	17.484	6.798	9.707	8.266
5.819	10.197	6.798	2.420	2.909	1.468	.979
2.420	3.389	4.867	5.819	2.420	.979	2.420
.979	2.909	7.776				
177.500	180.000	178.750	3116.667	3350.000	3350.000	21.000
.238	1.424	3.313	6.757	8.267	11.980	17.923
20.934	29.012	43.573	50.961	61.969	72.733	110.445
128.436	175.174	231.231	414.414	890.223	1515.500	2669.167
17.400	1.472	3.347	1.002	.333	1.339	1.002
.669	1.339	2.008	.333	.669	1.002	.669
.669	.333	.333	.333	1.339	2.008	1.339
FNDPVM						
FNDTAR						
0.0	670.0	893.0	1116.0	1339.0	1562.0	1786.0
2232.0	3348.0	5580.0	10044.0			
0.53	0.54	0.56	0.62	0.68	0.70	0.70
0.68	0.64	0.60	0.56			
FNDPDX						

SAMPLE TEST CASES AND SETUP

A. Introduction

This section provides sample cases of both TTY and Batch runs using IPSSM. They are given to illustrate the use of the system as well as to show specific techniques. It is recommended that some or all of these cases be run by new users. The permanent file named M106 (Cycle 5) is available for this use and is used by all the examples. However, other data base files may be generated by the use of IPSSDATA (Cycle 5). Care should be taken to specify different permanent file names than those catalogued in these examples to avoid conflict and possible job abort.

B. TTY Examples

1. General Information

The following lines show the initial login and attach procedure that is common to all the teletype examples mentioned in this manual. All subsequent examples will begin with the first statement generated by IPSSM, namely, "THIS IS IPSSM,

CONTROL DATA INTERCON 4.8
DATE 05/28/76
TIME 13.18.48.

PLEASE LOGIN
LOG:IN

ENTER USER NAME- LLPH880700

~~REMEMBER~~ ENTER PASSWORD-

05/28/76 LOGGED IN AT 13.20.23.
WITH USER-ID JO
EQUIP/PORT 48/16

COMMAND- ATTACH, IPEN, IPEN, CY-5, ID-NICHOLS, NR-1.

COMMAND- IPEN

THIS IS IPSSM
MODE- TTY OR BATCH -

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PERMIT FULLY LEGIBLE PRODUCTION**

MODE: TTY or BATCH=". All information shown underlined is user-supplied. Continuous reference to Table 1 should be made while reviewing the following examples; the batch outputs generated by these runs are shown in Appendix K.

2. Representative TTY Examples

a. Example 1 illustrates the running of the Static Shell Properties Program (WT) using the M106 data without modification.

```
THIS IS IPROM
MODE- TTY OR BATCH - TTY,UTS,S,M106OUT
TITLE-
PROJECTILE 8 INCH M106
REQUEST(TAPE12,BPF)
REQUEST(TAPE13,BPF)
GRAPHICS, YES OR NO - NO
EXAMINE DATA BASE, YES OR NO - NO
MODIFY DATA, YES OR NO- NO
CHK ITEMS YES OR NO - NO
INPUT/OUTPUT OPTION LIST
(V-1 M-6) TTY,SS,TERM,CS - 11001100
CORE RECD- CR,T -120000,115
TTY INPUT LIST- SYMBOLS - NOI
SPECIFY PFWAVE FOR TTY RESULTS-
PFWAVE,CY,IS- SAWENT,1,NICHOLS
CATALOG CYCLE WAS 1
CT IS- NICHOLS PFW-SAWENT
CT CY- 001 00000100 U0000..1
COST CENTER-CHARGE CODE,
XXX-XXX - 000-700
STOP 00
.514 CP SECONDS EXECUTION TIME
CONFIRM- BATCH,JOB,INPUT,AS
```

**COPY AVAILABLE TO DDC DOES NOT
PERMIT FULLY LEGIBLE PRODUCTION**

Note that the short TTY input (page 21) is used to answer question 1. Also, TTY results (a summary) are asked for and will be saved on a permanent file called SAVEWT (cycle 1), in addition to the more complete batch results that will be sent to the remote terminal site (see Appendix K-1 for entire batch output). Also, the number of shell body items (NBI) has been selected to be included in the TTY results for the user's own reference.

The following TTY run was used to obtain the TTY results stored previously on the file SAVEWT (Cycle 1). Note that, for reference, the number of shell body items (NBI) is also provided.

```
THIS IS IPSSM
MODE- TTY OR BATCH -      TTY
WILL THIS BE A NEW RUN, YES OR NO - NO
WHERE WERE RESULTS STORED, PFNAME, CY, ID-  SAVEWT, 1, NICHOL
LS
NBI      35.000

PROJECTILE  8 INCH  N106

PROPERTIES OF ENTIRE SHELL

WEIGHT-  200.8185 POUNDS

CG TO REF-  22.7413 INCHES

POLAR INERTIA- 1800.5168 POUND INCH SQUARE

TRANSVERSE INERTIA-15082.7227 POUND INCH SQUARE

OUTER VOLUME- 1230.1000 CUBIC INCHES

END OF TTY RESULTS
STOP 000
.103 CP SECONDS EXECUTION TIME
CONFIRM-
```

**COPY AVAILABLE TO DDC DOES NOT
PERMIT FULLY LEGIBLE PRODUCTION**

b. Example 2 below also illustrates the running of the Static Shell Properties Program (WT), but, in this case, the density of body item number 3 is changed to 0.300. Ogival item number 4 has also been deleted. The complete remote output is given in Appendix K-2.

```

THIS IS IPSCH
MODE- TTY OR BATCH -      TTY,UTS,S,M100UT
TITLE-
  PROJECTILE 8 INCH M106
  REQUEST(TAPE12,SPF)
  REQUEST(TAPE9,SPF)
  GRAPHICS, YES OR NO -      NO
  EXAMINE DATA BASE, YES OR NO -      NO
  MODIFY DATA, YES OR NO-      NO
  CHG ITEMS YES OR NO -      YES
  ITEM TYPE- BDY,FIN,KNO,OGU OR END - BDY
  DEL, ADD OR CHG -CHG
  ITEM NO. -      03
  FIELD NO., VALUE -      4,0.3
  ITEM TYPE- BDY,FIN,KNO,OGU OR END - OGU
  DEL, ADD OR CHG -DEL
  ITEM NO. -      04
  ITEM TYPE- BDY,FIN,KNO,OGU OR END - END
  STORE MOD DATA, YES OR NO -NO

  INPUT/OUTPUT OPTION LIST
  (V=1 N=0) TTY,DB,TERM,CS -      00001100
  CORE RECD- CH,T -120000,115

  COST CENTER-CHARGE CODE,
  XXX-XXX -      000-700

  STOP 00
  .517 CP SECONDS EXECUTION TIME
  CONFIRM- BATCH,JOB,INPUT,AD

```

**COPY AVAILABLE TO DDC DOES NOT
PERMIT FULLY LEGIBLE REPRODUCTION**

c. Example 3 illustrates the running of the Aeroballistics Coefficients Program (SP). TTY input is shown below. Batch output for this run is given in Appendix K-3. In this case, the key variable CGS (distance in calibers of the center of gravity from the nose of the projectile) is changed from 3.315 to 3.50. Note also that the two values of WTS (shell weight in pounds) are changed by re-entering only one value. The option to automatically generate a new data base with the permanent file name MOD (Cycle 1) and the title "MOD 8 IN PROJECTILE" is also accomplished. This data base can then be used by the Exterior Ballistics Program (AR) with the drag tables generated and stored by the SP program in the MOD file (Example 4).

```

THIS IS IPSPH
MODE- TTY OR BATCH -      TTY,SPS,S,M100SP

TITLE-
  PROJECTILE 8 INCH M100
  REQUEST(TAPE12,SPF)
  REQUEST(TAPE19,SPF)
  EXAMINE DATA BASE, YES OR NO -      YES
    SYN -      WTS
      P - 2      L - 0      N - 2
      VALUES - 800.000 100.000
    SYN "      CGS
      P - 1      L - 0      N - 1
      VALUES - 3.315
    SYN -      END
  MODIFY DATA, YES OR NO-      YES
    SYN,PLN-      WTS,101
      VALUES -      800.0
    SYN,PLN-      CGS,101
      VALUES -      3.5
    SYN,PLN-      END
  STORE MOD DATA, YES OR NO -NO

  INPUT/OUTPUT OPTION LIST
  (Y=1 N=0) TTY,SP,TERM,CS -      0011100
  AR DATA BASE TO BE UPDATED-CY,PFN-      S,M100AR
  NEW DATA BASE FILE-CY,PFNAME -      1,MOD
  NEW TITLE -      MOD 8 IN PROJECTILE
  CORE REQ- CR,T -10000,100

  GDSY CENTER-CHARGE CODE,
  100-100 -      000-100

  STOP 00
  .343 UP CHARGE DURATION TIME
  CONTINUE- BATCH,MOD,SPUT,AD

```

COPY AVAILABLE TO DDC DOES NOT
PERMIT FULLY LEGIBLE PRODUCTION

d. Example 4 shows the running of the Exterior Ballistics Program (AR) using the MOD drag data generated by the SP program in Example 3. A recently added provision for conducting a partial error analysis in the AR program is utilized here. The data produced by the AR program are analyzed and stored in the permanent file ERRAN (Cycle 1). A second run is necessary to produce the analyzed results after the initial execution is completed. Below is the TTY input yielding the first set of results shown in Appendix K-4.

```

THIS IS JPOPM
MODE- TTY OR BATCH -      TTY,ANS,1,NO
TITLE-
  MOD 8 IN PROJECTILE
  REQUEST(TAPE12,SPF)
  REQUEST(TAPE13,SPF)
  EXAMINE DATA BASE, YES OR NO -      NO
  MODIFY DATA, YES OR NO-      NO
  ERROR ANALYSIS YES OR NO -YES
  DELETE TABLES, YES OR NO - NO

  INPUT/OUTPUT OPTION LIST
  (V=1 N=6) TTY,SO,TERM,CS -      01001100
  CORE REQS- CH,T -100000,300
  SPECIFY PPMME FOR TTY RESULTS-
  PPMME,CV,IS-      ERRAN,1,NICHOLS
  CATALOG CYCLE WAS 1
  CT IS- NICHOLS PPM-ERRAN
  CT CY- 001 00000120 UNDS.1
  COST CENTER-CHARGE CODE,
  XXX-XXX -      000-700

  STOP 00
  .001 CP RECORDS EXECUTION TIME
  COMMAND- BATCH,JOB,INPUT,AD
  FILE NAME-IPR000, DISF-INPUT , IS-AD

```

NOTE: The permanent file, ERRAN,1,NICHOLS is available for recall. It does not have to be recreated by rerunning this example.

**COPY AVAILABLE TO DDC DOES NOT
PERMIT FULLY LEGIBLE PRODUCTION**

The following run was used to analyze the TTY results previously stored on the file ERRAN. The generated table gives the errors in range contributed by the deviations caused by changing drag data, angle of elevation (THD), and initial muzzle velocity (VMX).

THIS IS IPROM
 NAME- TTY OR BATCH - TTY
 WILL THIS BE A NEW RUN, YES OR NO - NO
 WHERE WERE RESULTS STORED, PFWAVE, CV, ID- ERRAN.1, MICHEL
8

RESULTS OF ERROR ANALYSIS				
NOMINAL RANGE - 14700.00				
UNREABLE	NOMINAL	NOMINAL	STANDARD	RANGE
PERTURBED	VALUE	VARIATION	DEVIATION	DEVIATION
N				
THD	0.000	1.000	1.010	-25.340
THD	20.000	2.000	.000	177.000
VMX	2300.000	50.000	2.000	15.001

END OF TTY RESULTS
 STOP 000
 .104 OF SECONDS EXECUTION TIME
 CONTINUED

COPY AVAILABLE TO DDC DOES NOT
 PERMIT FULLY LEGIBLE PRODUCTION

e. Example 5 shows the running of the Interior Ballistics Program (IB). Two new values of the propellant weight (PCI) are entered via the TTY as a temporary change to examine differences in muzzle velocity. Appendix K-5 shows the batch results. The TTY input necessary to produce this run is shown below.

```

THIS IS FROM
MODE- TTY OR BATCH - TTY,IBB,S,RIGID

TITLE-
PROJECTILE 8 INCH R100
REQUEST(TAPE12,SPF)
REQUEST(TAPE13,SPF)
CHANGE DATA BASE, YES OR NO - YES
SVR - PCI
P - 1 L - 0.000 H - 1
VALUES - END 8.000
SVR - END
MODIFY DATA, YES OR NO- YES
SVR,PLN- PCI,800
VALUES - 8.0.0.0
SVR,PLN- END
STORE MOD DATA, YES OR NO -NO
INPUT/OUTPUT OPTION LIST 00001000
(V-1 N-0) TTY,IBB,TEMP,CS -
CORE REED- CH,T -100000.115
COST CENTER-CHARGE CODE. 000-700
1001-1001 -
STOP 00
-000 00 SECONDS EXECUTION TIME
CONTINUE- BATCH,IBB,INPUT,NO

```

COPY AVAILABLE TO DDC DOES NOT
PERMIT FULLY LEGIBLE PRODUCTION

f. Example 6 shows the running of the Lethal Area Program (LA), where two variables, burst height (PHB) and angle of fall (AOF), are linked by the L parameter discussed on page 9. Even though both variables have two values each, they are changed simultaneously (the permuted variable is PHB). This run also used the option to store the modified data in a permanent file called LAM002 (cycle 2) with the new title, "LA M002 8 IN PROJECTILE". The batch output is shown in Appendix K-6. The TTY input is given below. Note that, in this example, the user initially typed the wrong symbol for the burst height. The system allows corrections as shown without aborting.

```
THIS IS IPSSM
MODE- TTY OR BATCH -      TTY,LA5,5,M106LA

TITLE-
  PROJECTILE 8 INCH M106
  REQUEST(TAPE12,SPF)
  REQUEST(TAPE9,SPF)

  EXAMINE DATA BASE, YES OR NO -      NO
  MODIFY DATA, YES OR NO-      YES
    SYN,PLN-      PHB,212

    PHB IS INCORRECT SYMBOL
    SYN,PLN-      PHB,212
    VALUES -      20.,25.
    SYN,PLN-      AOF,012
    VALUES -      47.,42.
    SYN,PLN-      END

  STORE MOD DATA, YES OR NO -YES
  NEW TITLE -      LA MOD2 8 IN PROJECTILE
  WHERE DO YOU WISH TO STORE MOD DATA: CY,PFNAME -      2,LA
  MOD2

  MOD DATA STORED: CY = 2   PF = LAMOD2

  REQUEST(TAPE10,SPF)
  CT ID- NICHOLS PFN-LAMOD2
  CT CY- 002 00001472 WORDS.1

  INPUT/OUTPUT OPTION LIST
  (Y=1 N=0) TTY,SS,TERM,CS -      00001100

  CORE REQ- CR,T -120000,400

  COST CENTER-CHARGE CODE,
  XXX-XXX -      800-700

  STOP 00
  1.885 CP SECONDS EXECUTION TIME
  CONSUMED- BATCH,JOB,INPUT,AD
```

COPY AVAILABLE TO DDC DOES NOT
PERMIT FULLY LEGIBLE PRODUCTION

g. Example 7 illustrates the running of the Interior Ballistics Program (IB). Here the option of examining all values of the data base is utilized by typing the word ALL in answer to the question "EXAMINE DATA, YES OR NO =". TTY input is shown below, and batch output is given in Appendix K-7.

```
THIS IS IPSSB
MODE- TTY OR BATCH -      TTY,IB5,5,M106IB
TITLE-
PROJECTILE 8 INCH M106
REQUEST(TAPE12,SPF)
REQUEST(TAPE9,SPF)
EXAMINE DATA BASE, YES OR NO -      YES
SVN -      ALL

      SVN  PLN  VALUES
      DII  101      3.543
      XLI  101     155.000
      UOI  101     300.000
      MPI  101    50500.000
      PWI  101     12.650
      PCI  101      8.500
      PKI  101     17.000
      MUI  101      0.000
MODIFY DATA, YES OR NO-      NO

INPUT/OUTPUT OPTION LIST
(V=1 N=0) TTY,DB,TERM,CS -      00001100
CORE RECD- CR,T -150000,115

COST CENTER-CHARGE CODE,
      XXX-XXX -      820-700

STOP 00
.293 CP SECONDS EXECUTION TIME
COMMAND- BATCH,JOB,INPUT,AD
FILE NAME-IPSSBDC, DISP-INPUT , IB-AD
```

COPY AVAILABLE TO DDC DOES NOT
PERMIT FULLY LEGIBLE PRODUCTION

h. Example 8 illustrates the running of the Recoil Mechanism Design Program (RM). In this case, the option to examine results of the run (in summary) on the TTY is selected. Note that the value of the rise-fall time of the rod pull curve (TIR) is selected for initial printout when the results stored in RMD1 (cycle 2) are later retrieved (page 52). The data base for this run is located in TESTRM (cycle 1). Also, the recoil tables in RMTAB (cycle 1) must be specified. TTY input is shown below. Batch output is given in Appendix K-8.

```
THIS IS IPSSM
MODE- TTY OR BATCH -      TTY,RMS,1,TESTRM
TITLE-
  RECOIL MECHANISM TEST
  REQUEST(TAPE12,SPF)
  REQUEST(TAPE9,SPF)
  EXAMINE DATA BASE, YES OR NO -      NO
  MODIFY DATA, YES OR NO-      NO
  INPUT/OUTPUT OPTION LIST
  (V=1 M=0) TTY,DB,TERM,CS -      11001100
  CORE REQ- CH,7 -120000,110
  TTY INPUT LIST- SYMBOLS - TIR
  SPECIFY PFNAME FOR TTY RESULTS-PFNAME,CY,ID- RMD1,2,NICHOLS
  CATALOG CYCLE WAS 2
  RECOIL TABLES - PFNAME,CY,ID-
  CT ID- NICHOLS PFN-RMD1
  CT CY- 000 00000128 WORDS. RMTAB,1,NICHOLS
  COST CENTER-CHARGE CODE,
  XXX-XXX -      880-700
  STOP 00
  .307 CP SECONDS EXECUTION TIME
  CONTINUED- BATCH,JOB,INPUT,AD
```

**COPY AVAILABLE TO DDC DOES NOT
PERMIT FULLY LEGIBLE PRODUCTION**

The following run is necessary to retrieve the results stored in RMD1 (cycle 2) on the previous page. Note that the first line printed out contains the value of TIR, as requested when RMD1 was initially created.

THIS IS IPSSR
MODE- TTY OR BATCH - TTY
WILL THIS BE A NEW RUN, YES OR NO - NO
WHERE WERE RESULTS STORED, PFNAME, CV, ID- RMD1, 2, NICHOLS

TIR .010

1

INPUT DATA

.01000	.28300	50000.00000	.27000
	10.35000	.24000	.05700
26.00000	36.00000	7635.70000	38520.00000
	.00310	5000.00000	11.25000
.00100	.00100	.00200	.01000
	2.00000	.05000	3.50000
3.50000	0.00000	1000.00000	2.00000
	60.00000	1.50000	85.00000
77.00000			

PRM1	TR5	TWL	PRM1
PRM1	PRM1	PRM2	DRCLR
5000.00000	.00510	11E23	100450.25130
	71161.62100	2500.00000	3.12220
DRCLP	UPR5	THRCLO	DRCLCO
	MRCLC	KLBO	DRCLR
4.66473	110.88440	.00027	5.70000
	200.07500	50.50000	1.00000
DRCLP	THSL0	DRCCO	UPR5
	THRECC	MRCC	KLBO
3.34555	.10000	0.00000	30.87042
	.15013	110.14003	61.31520
TDR	MR	MR	DR
	ZTIP	OFFSET	UPDRNT
3.00100	343.01000	4400.00000	274445.01000
	200045.40100	.00070	6702.00070

END OF TTY RESULTS

STOP 000

120 CP SECONDS EXECUTION TIME

CONTINUED

COPY AVAILABLE TO DDC DOES NOT
PERMIT FULLY LEGIBLE PRODUCTION

i. Example 9 illustrates the running of the 6-D Trajectory Program (TR). Here the data base is located in TRAJFLTR (cycle 3). Also, a file containing 6-D coefficients (TRDATA, cycle 1) must be specified. Note that the short format for entering CM and T values has been utilized. TTY input is shown below. Batch output is given in Appendix K-9.

```
THIS IS IPSSM
MODE- TTY OR BATCH -      TTY,TR5,3,TRAJFLTR
TITLE-
      XM 483 SPINNER  ALL DALE  BODY
REQUEST(TAPE12,1PF)
REQUEST(TAPE5,1PF)
6D COEFFICIENTS - PFNAME,CY,ID-      TRDATA,1,NICHOLS
EXAMINE DATA BASE, YES OR NO -      NO
MODIFY DATA, YES OR NO-      NO
INPUT/OUTPUT OPTION LIST
(V=1 N=0) TTY,DB,TERM,CS -      00001100,150000,200
COST CENTER-CHARGE CODE,
      XXX-XXX -      800-700
STOP 00
.731 CP SECONDS EXECUTION TIME
COMMAND- BATCH,JOB,INPUT,AD
FILE NAME-IPSSMSU, DISP-INPUT , ID-AD
```

**COPY AVAILABLE TO 000 DOES NOT
PERMIT FULLY REPRODUCIBLE PRODUCTION**

j. Example 10 illustrates the running of the Sabot Design Program (SD), whose data base is located in SFRSD (cycle 1). Here the NPR parameter (Appendix 8) is set equal to 3.0, which is the option to obtain printer and Calcomp plots. The modified data are stored in PLOT (cycle 5) so that the graphs may be obtained again at a future date, if so desired (page 55). TTY input is shown below. Batch output, together with the Calcomp plot obtained, is given in Appendix K-10.

```
THIS IS IPSSM
MODE- TTY OR BATCH -      TTY,SDS,1,SFRSD
TITLE-
      SABOT DESIGN - SFR
REQUEST(TAPE12,2PF)
REQUEST(TAPE9,2PF)
EXAMINE DATA BASE, YES OR NO -      NO
MODIFY DATA, YES OR NO-      YES
      SYN,PLN-      NPR,101
      VALUES -      3.0
      SYN,PLN-      END
STORE MOD DATA, YES OR NO -YES
NEW TITLE -      PRINTER & CALCOMP PLOTTING
WHERE DO YOU WISH TO STORE MOD DATA- CY,PFNAME -      5,PL
OT
      MOD DATA STORED- CY = 5   PF = PLOT
REQUEST(TAPE10,2PF)
CT ID- NICHOLS PFN-PLOT
CT CY- 005 00000000 WORDS.1
INPUT/OUTPUT OPTION LIST
(V=1 N=0) TTY,DB,TERM,CS -      00001100
CORE REQ- CH.T -150000,400
COST CENTER-CHARGE CODE,
      XXX-XXX -      000-700
STOP 00
.378 CP SECONDS EXECUTION TIME
COMMAND- BATCH,JOB,INPUT,AD
FILE NAME-IPSSMCH. DISP-INPUT
```

**COPY AVAILABLE TO DDC DOES NOT
PERMIT FULLY LEGIBLE PRODUCTION**

The following TTY run is necessary to obtain extra copies
of the plots stored previously (page 54) on PLOT (cycle 5).

```
THIS IS IPSSM
MODE- TTY OR BATCH - TTY,SDS,5,PLOT
TITLE-
PRINTER & CALCOMP PLOTTING
REQUEST(TAPE12,SPF)
REQUEST(TAPE9,SPF)
EXAMINE DATA BASE, YES OR NO - YES
  SYN - NPR
    P - 1 L - 0 N - 1
    VALUES - 3.000
  SYN - END
MODIFY DATA, YES OR NO- NO
INPUT/OUTPUT OPTION LIST
(V=1 N=0) TTY,DB,TERM,CS - 00001100
CORE READ- CH,T -150000,800
COST CENTER-CHARGE CODE,
XOX-XOX - 800-700
STOP 00
.800 CP SECONDS EXECUTION TIME
COMMAND- BATCH,JOB,INPUT,AS
```

COPY AVAILABLE TO DDC DOES NOT
PERMIT FULLY LEGIBLE PRODUCTION

k. Example 11 shows the run necessary to retrieve the error analysis stored in the batch mode in ERROR (page 60).

THIS IS IPROM
MODE- TTY OR BATCH - TTY
WILL THIS BE A NEW RUN, YES OR NO - NO
WHERE WERE RESULTS STORED, PPNAME, CV, ID- ERROR, 2, NOERR

RESULTS OF ERROR ANALYSIS				
NORMAL NAME - <u>DATA.04</u>				
VARIABLE	NOMINAL	NOMINAL	STANDARD	RANGE
PURPOSED	VALUE	VARIAION	DEVIATION	DEVIATIO
T13	0.000	1.000	1.010	-104.819
T10	20.000	2.000	.000	128.771
ATK	2000.000	50.000	2.000	21.170

END OF TTY RESULTS
STOP 000
.117 OF SECONDS EXECUTION TIME
CONTINUED-

COPY AVAILABLE TO DDC DOES NOT
REQUIRE FULLY LEGAL
STATION

THIS IS IPSON
NONE- TTY OR BATCH - TTY, INS, 1, NEPIN

TITLE-

```
REQUEST(TAPE12,SPF)
REQUEST(TAPE3,SPF)
```

EXAMINE DATA BASE. YES OR NO - YES

SYN • REP

VALUES = 0.0000.000 N = 1
SYM = UOH

P = 1 L = 0 N = 1
VALUES = 5000.000
SYM = END

MODIFY DATA, YES OR NO- YES

SYN. PLN- PEP

VALUES - 59400.

SYN, PLN- UON, 101

VALUES = 4850.

SYR,PLN- END

STORE MOD DATA, YES OR NO -YES

NEW TITLE - EXPERIMENT IN

WHERE DO YOU WISH TO STORE MOD DATA- CY, PTHANE - 1, TE
 NPIH

NOO DATA STORED- CY - 1 PF - TEMPIN

**SUBJECT(TIME 10, EFF)
CT ID- MICHAEL PFM-TENPIN
CT CY- 001 00000000 WONGS.**

INPUT/OUTPUT OPTION LIST
(Y=1 N=0) TTY,SG,TERM,CS -

00001100, 150000, 200

**COST CENTER-CHARGE CODE,
XXX-XXX :**

800-700

CONTROL CASES WRITTEN

STUDY

STEP 00
430 CP SECONDS EXECUTION TIME
COMMAND- BATCH, JOB, INPUT, 00

FILE NAME-IPSONOU, DIOP-INPUT , ID-40

57

C. Batch Examples

1. General Input Information

Section C, page 21 provides general instructions for running IPSSM in the batch mode. The examples below will show only the batch instruction cards necessary to run certain options. The complete set of control cards is given in pages 22,23.

2. Representative Batch Examples

a. Example 1 is the same run illustrated in Example 3 of the TTY runs. Note that the DATA card is used to change the key variable CGS from 3.315 (value in data base) to 3.50 and also to delete one value of WTS. Batch output shown in Appendix K-12 is identical with Appendix K-3. Batch instruction cards are shown below:

```
BATCH,SP5,5,M106SP
00001100,120000,115
DATA
WTS
200.
CGS
3.5
END
```

b. Example 2 shows the use of the TABLE card. This card is used to delete exterior ballistic tables before running the AR program. In the case below, Table 12 is deleted, since only phase 2 of the trajectory is to be run. Table 12 is used only if phase 1 is to be run. Appendix K-13 shows the output for this run.

NOTE: When rerunning examples 2c and 2d care should be taken to specify different permanent file names than 1,M106GRAPH and 2,TEST1 and ERROR,3 to avoid conflict and possible job abort.

BATCH,AR5,5,M106AR
00001100,120000,115

TABLE

12

END

c. Example 3 illustrates the use of setting up a data set compatible with the PROMS graphics program. The WT program is called for with the M106 data. The graphics data set is cataloged as M106GRAPH (cycle 1). Appendix K-14 shows the output for this run.

BATCH,WT5,5,M106WT
00001100,120000,115
GRAPHICS,1,M106GRAPH

d. Example 4 illustrates the use of the DATA, TABLE, and ERROR cards in the AR program. Modified data are stored in TEST1 (cycle 2). Table 12 is also deleted. The ERROR card stores error analysis results in ERROR (cycle 3) for future teletype retrieval (page 56). Appendix K-15 shows the batch output for this run.

BATCH,AR5,5,M106AR
01001100,145000,210

DATA,2,TEST1

VMX,202

2500., 2700.

THD

30.

END

TABLE

12

END

ERRØR,3,NICHØLS

REFERENCES

1. J. Klappholz, "A Computer Program to Calculate the Weight and Stability Factor of a Shell", Technical Report 3537, Picatinny Arsenal, February 1967.
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6. E.M. Friedman, "Description of the Revised AER01 Program, PA No. G10417", Technical Memorandum 2151, Picatinny Arsenal, June 1974.
7. Control Data Corporation, Intercom Reference Manual, 6000 Version 3, 1971 (or newer versions as they become available).
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9. John Nielsen, "Computer Program for Six-Degree-of-Freedom Missile Trajectories", Technical Memorandum 1292, Picatinny Arsenal, November 1963.
10. Andrew Semeister and John Zavada, "Studies in Flechette and Sabot Technology - Part I: Slip Model for Single Flechette Sabot Assemblies, Part II: Axial Stress Model for Single Flechette Sabot Assemblies, ARMC0M-FA Report R-3006, 3007, April 1974.

11. L.D. Heppner, "Final Report of Special Study of an Electronic Computer Program for Interior Ballistics", Technical Report DPS-1711, Ballistic Research Laboratories, July 1965.
12. Management Information Systems Directorate, "Plotting Routines", Information Report 73-6, Picatinny Arsenal, (Updated through February 1973 or any later version).
13. Bruce Barnett, "Trajectory Equations for a Six-Degree-of-Freedom Missile Using a Fixed-Plane Coordinate System", Technical Report 3391, Picatinny Arsenal, June 1966.

APPENDIX A1
STATIC PROPERTIES CALCULATION PROGRAM (WT)
KEY VARIABLE INPUT

I. Number of Each Shell Item:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
NBI	F10.4	Number of body items*
NOF	F10.4	Number of fins
NFP	F10.4	Number of fin pieces*
NKI	F10.4	Number of known items*
NOI	F10.4	Number of ogival items*

II. Control for Program Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
WTC	0.0	Do weight calculation
	1.0	Do not do weight calculation
DRS	0.0	Provide shell drawing
	1.0	Do not provide shell drawing
STC	0.0	Do not do stability calculation
	1.0	Do stability calculation
	2.0	Supply volume of entire shell (VOW)
	3.0	Supply PIW, CGW, TIW
NAR	F10.4	Number of additional runs
DDC	1.0	Drawing of each change
COO	F10.4	Number of copies of output

*The total number of these items should correspond to the number of cards following the WGTAB card referred to on page 26.

III. Additional Cards Required for Stability Calculation:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
PIW	F10.4	Polar moment of inertia
CGW	F10.4	Center of gravity
TIW	F10.4	Transverse moment of inertia
VOW	F10.4	Volume
BDW	F10.4	Bore diameter
BAD	F10.4	Base diameter
TEW	F10.4	Temperature (degrees F)
TWW	F10.4	Twist
PVM	F10.4	Projectile velocity
COS	F10.4	Copies of stability output

APPENDIX A2
STATIC PROPERTIES CALCULATION PROGRAM (WT)
FORMAT OF SHELL ITEM INPUTS

Body Item Card:

Columns 1-10	D1, diameter on left
Columns 11-20	D2, diameter on right
Columns 21-30	H, length
Columns 31-40	R, density
Columns 41-50	BARX, distance from D1 surface to reference. If D1 is to the right of the reference, BARX is positive.
Columns 61-71	Identification
Column 72	If blank, then this element is not a part of the outer surface of the shell. If "1", then this element is a part of the outer surface of the shell. Column 72 must contain either a blank or a 1.

Fin Item Card:

Columns 1-10	FD1, radius on left
Columns 11-20	FD2, radius on right
Columns 21-30	FH, length
Columns 31-40	FR, density
Columns 41-50	FBARX, distance from FD1 surface to reference
Columns 51-60	FD, thickness of fin
Columns 61-71	Identification
Column 72	If blank, this element is not a part of outer volume. If "1", this element is part of the outer volume.

Known Item Card:

Columns 1-10	Weight
Columns 11-20	Polar inertia
Columns 21-30	Transverse inertia
Columns 31-40	Distance of CG to reference
Columns 41-50	Volume, if needed for column 72
Columns 61-71	Identification
Column 72	If 0, not outer volume. If "1", outer volume

Ogival Item Card:

Columns 1-10	GA, see Reference 1
Columns 11-20	GB, see Reference 1
Columns 21-30	GS, length of ogive
Columns 31-40	GRH, density
Columns 41-50	GREP, distance to reference
Columns 51-60	GRAD, radius of ogive
Columns 61-71	Identification
Column 72	If blank, no outer volume. If "L" outer volume

The dimension cards are included only for a weight calculation or a plot. If a stability calculation only is required, there will be no dimension cards.

APPENDIX B
AEROBALLISTIC COEFFICIENTS PROGRAM (SP)
KEY VARIABLE INPUT

I. Program Constants and Parameters

<u>SYMBOL</u>	<u>VALUE OR FORMAT</u>	<u>MEANING</u>
PLS	F10.4	Projectile length (calibers)
NLS	F10.4	Nose length (calibers)
BLS	F10.4	Boattail length (calibers)
CGS	F10.4	Distance of CG from nose (calibers)
DIS	F10.4	Diameter of shell (calibers)
AMS	F10.4	Axial moment of inertia (lb-in ²)
TMS	F10.4	Traverse moment of inertia (lb-in ²)
WTS	F10.4	Weight (lb)
TST	F10.4	Twist (caliber/turn)
BOS	F10.4	Boom length (calibers)

II. Program Options

<u>SYMBOL</u>	<u>VALUE OR FORMAT</u>	<u>MEANING</u>
STS	1.0	Calculate stability
	0.0	Do not calculate stability
ARS	1.0	Punch AERO I tables
	0.0	Do not punch AERO I tables

<u>SYMBOL</u>	<u>VALUE OR FORMAT</u>	<u>MEANING</u>
SLS	1.0	Punch SAUL 7 tables
	0.0	Do not punch SAUL 7 tables
N6S	1.0	Punch NOL6D tables
	0.0	Do not punch NOL6D tables
NGS	1.0	Punch graph output
	0.0	Do not punch graph output

APPENDIX C
INTERIOR BALLISTICS PROGRAM (IB)
KEY VARIABLE INPUT

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
DII	F10.4	Diameter of gun (inches)
XLI	F10.4	Length of projectile traveled (inches)
VOI	F10.4	Chamber volume (cubic inches)
MPI	F10.4	Maximum pressure (psi)
PMI	F10.4	Projectile weight (lb)
PCI	F10.4	Propellant weight (lb)
PKI	F10.4	Propellant type (code)
MVI	F10.4	Muzzle velocity (fps)

NOTE:

One of the above values must remain zero in order for the interior ballistics to execute properly. The parameter that is set initially to zero is variable to be calculated. Thus, seven of the above eight variables require data input.

APPENDIX D1
EXTERIOR BALLISTICS PROGRAM (AR)
KEY VARIABLE INPUT

I. Phase Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
NX1	1.0	Compute Phase I
	0.0	Do not compute Phase I
NX2	1.0	Compute Phase II
	0.0	Do not compute Phase II
NX3	1.0	Compute Phase III
	0.0	Do not compute Phase III
NX4	1.0	Compute Phase IV
	0.0	Do not compute Phase IV

II. Initial Conditions and Constants:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
THD	F10.4	Quadrant elevation (Q.E.) (degrees)
VMX	F10.4	Initial velocity (ft/sec)
WGT	F10.4	Missile weight (lb)
DIA	F10.4	Diameter (inches) of projectile
XIN	F10.4	Initial range (ft)
YIN	F10.4	Initial altitude (ft)
TIN	F10.4	Initial time (sec)
TWS	F10.4	Effective gun twist (1/25 use 25.0, etc.)

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
YLA	F10.4	Launcher length (ft)
DEL	F10.4	Integration increment (sec)
SDT	F10.4	Initial spin rate (rad/sec)
YFA	F10.4	Terminal altitude (ft) on descent of trajectory
FFA	F10.4	Factor used for temperature variations
CKD	F10.4	Constant drag coefficient (Only necessary when KDC=2.0)
FCT	F10.4	Form factor for all drag tables. This value may be left blank when form factor is unity.
BIA	F10.4	Sustaining thrust (lb) in addition to that which is necessary to overcome drag. (Use only when CAN=1.0).
TK1	F10.4	Constant rolling moment (lb-ft) during Phase I.
TK2	F10.4	Constant rolling moment (lb-ft) during Phase II.
TK3	F10.4	Constant rolling moment (lb-ft) during Phase III.

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
TK4	F10.4	Constant rolling moment (lb-ft) during Phase IV

III. Phase I and III Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
NTH	1.0	Use variable thrust
	2.0	Use constant thrust
MXX	1.0	Use variable burning rate
	2.0	Use constant burning rate

IV. Phase I Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
THR	F10.4	Constant thrust value (lb) for Phase I (NTH = 2.0)
DTM	F10.4	Constant burning rate (lb-sec) during Phase I (MXX = 2.0)
BWT	F10.4	Booster weight (lb): weight of metal parts that are dropped off immediately following burnout in Phase I.

V. Phase III Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
TH2	F10.4	Constant thrust value (lb) for Phase III (NTH = 2.0)
DT2	F10.4	Constant burning rate (lb/sec) during Phase III (MXX = 2.0)

VI. Time Constants for Each Phase:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
TM1	F10.4	Time in seconds at end of completion of Phase I.
TM2	F10.4	Time in seconds at end of completion of Phase II.
TM3	F10.4	Time in seconds at end of completion of Phase III.
TM4	F10.4	Time in seconds at end of completion of Phase IV.
DL1	F10.4	Integration increment (sec) for Phase I.
DL2	F10.4	Integration increment (sec) for Phase II.
DL3	F10.4	Integration increment (sec) for Phase III.
DL4	F10.4	Integration increment (sec) for Phase IV.

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
DW1	F10.4	Printout interval (sec) for Phase I
DW2	F10.4	Printout interval (sec) for Phase II
DW3	F10.4	Printout interval (sec) for Phase III
DW4	F10.4	Printout interval (sec) for Phase IV

VII. Program Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
KDC	1.0	Use variable drag coefficients
	2.0	Use constant drag coefficients
KTH	1.0	Input magnus force and magnus center of pressure coefficients
	2.0	Input magnus moment coefficients
NUN	1.0	Output given in feet
	2.0	Output given in meters
JZN	F5.1	Number of trajectories to be computed
NJR	F5.1	Number identifying first trajectory run in the set specified by JZN

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
ISP	0.0	Compute spin and stability calculation
	1.0	Perform only spin calculations
	2.0	Omit spin and stability inputs (Tables I thru II)
IAX	F5.1	Frequency of stability calculations in terms of printout (Example - if it is desired to have stability calculations every third printout, set IAX equal to 3.0)
NOR	XX.X	Number of time points entered in the "G-Norm" Table
NAT	F5.1	Number of nonstandard altitudes, temperatures and densities to be entered (NAT is set equal 0.0 if 1959 ARDC standard atmosphere is to be used)
CAN	1.0	Cancel drag
	2.0	Do not cancel drag

VIII. Constant Factors for Table Changes:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
T12	0.0 or 1.0 F10.4	No change to Table 12 Multiply all dependent variable values by the given constant

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
T13	0.0 or 1.0 F10.4	No change to Table 13 Multiply all dependent variable values by the given constant

NOTE: Symbols T14 through T18 perform the same function for
Tables 14 through 18, respectively, as T12 and T13
described above.

IX. Factors Used in Error Analysis (See Example 4):

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
13P	X.XXX	Nominal variation factor for Drag Table 13
THP	XX.XXX	Nominal variation factor for the Thrust (THD)
VMP	XXX.XX	Nominal variation factor for the Initial Velocity (VMX)
13D	X.XXX	Standard deviation factor for Drag Table 13
TSD	XX.XXX	Standard deviation factor for the Thrust (THD)
VSD	XXX.XX	Standard deviation factor for the Initial Velocity (VMX)

X. Constants Used to Plot Trajectory Output:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
NSY	33.0 =	Code numbers defining symbol to be plotted at data points. For a complete listing, see Reference 6.
	54.0 =	
	12.0 =	
	16.0 =	
	14.0 =	
NPL	1.0	Plot trajectory
	0.0	Do not plot trajectory
DXG	XX.X	Number of Range Units (feet or meters) per inch on the X-axis of the graph
DYG	XX.X	Number of Altitude Units on the Y-axis of the graph

APPENDIX D2
EXTERIOR BALLISTICS PROGRAM (AR)
LIST OF TABLES

<u>TABLE NUMBER</u>	<u>MEANING</u>
1	Roll damping coefficients vs. mach no.
2	Roll moment coefficients vs. mach no.
3	Normal force coefficients vs. mach no. (Omit when ISP = 1. or 2.)
4	Normal centers of pressure (calibers from nose) vs. mach no. (Omit when ISP = 1. or 2.)
5	Magnus moment coefficients vs. mach no. (Omit when either ISP = 1. or when KTH = 1.)
6	Magnus force coefficient vs. mach no. (Omit when either ISP = 1. or when KTH = 2.)
7	Magnus centers of pressure (calibers from nose) vs. mach no. (Omit when either ISP = 1. or when KTH = 2.)
8	YAW damping moment coefficients vs. mach no. (Omit when ISP = 1.)
9	Centers of gravity (calibers from nose) vs. time. (Omit when ISP = 1.)
10	Transverse moment of inertia (lb-ft^2) vs. time. (Omit when ISP = 1.)
11	Axial moment of inertia (lb-ft^2) vs. time.
12	Drag coefficients vs. mach. no. for Phase I. (Omit when either NX1 = 0. or when KDC = 2.)
13	Drag coefficients vs. mach no. for Phases II and IV. (Omit when either NX2 = 0. and NX4 = 0. or when KDC = 2.)

<u>TABLE NUMBER</u>	<u>MEANING</u>
14	Drag coefficients vs. mach no. for Phase III. (Omit when either NX3 = 0. or KDC = 2.)
15	Thrust (lb) vs. time for Phase I. (Omit when either NX1 = 0. or NTH = 2.)
16	Missile weight (lb) vs. time for Phase I. (Omit when either NX1 = 0. or MXX = 2.)
17	Thrust (lb) vs. time for Phase III. (Omit when either NX3 = 0. or NTH = 2.)
18	Missile weight (lb) vs. time for Phase III. (Omit when either NX3 = 0. or MXX = 2.)
19	Altitude (ft) vs. temperature in degrees Rankine (Omit when NAT = 0.)
20	Altitude (ft) vs. density (lb-sec ² /ft ⁴).
21	Normal acceleration in "g's" vs. time (Omit if NOR = 0.)

NOTE: The same increments in altitude must be used in Tables 19 and 20.

APPENDIX E
TERMINAL EFFECTIVENESS PROGRAM (LA)
KEY VARIABLE INPUT

I. Terminal Conditions and Constants:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
PHB	F10.4	Burst height (feet)
AOF	F10.4	Angle of fall (degrees)
TVM	F10.4	Terminal velocity (ft/sec)
COR	F10.4	Scale factor to correct for total fragment weight (set to 0.0 if no factor is to be used.)
NOZ	F10.4	Number of fragmentation zones

II. Lethal Area Computation Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
TRP	0.0	Use Simpson's Rule Integration.
	1.0	Use Trapezoidal Rule
NQA	3.0	Compute lethal areas for fox-hole and prone targets only.
	2.0	Compute lethal areas for standing, foxhole, and prone targets only
	1.0	Compute lethal areas for standing, foxhole, prone and the six-point standing target
SKP	1.0	Lethal areas are computed as defined by NQA stated above
	2.0	If NQA = 1.0, compute standing target lethal area only; if NQA = 2.0, compute six-point standing target lethal area only

III. Lethal Area Cut-Off Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
BET	F10.4	Cutoff angle (degrees)
COP	1.0	Use constant cutoff velocity (CVL)
	2.0	Compute cutoff velocity for each weight group using constant shape factor (CKQ)
	3.0	Compute cutoff velocity for each weight group using constant A/M value (AQM)
CVL	F10.4	Constant cutoff velocity
	0.0	No cutoff mass used
RMC	F10.4	Constant mass cutoff (used if nonzero value is entered)

IV. Fragment Blast Option:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
BLT	0.0	Blast effects are not included
	1.0	Use blast radii
RB1	F10.4	First blast radius
RB2	F10.4	Second blast radius (RB2 must be greater than RB1)

V. Fragment Drag Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
CCK	0.0	Compute shape factor given C12 and AMB
	1.0	Use shape factor (CKQ)

CKQ	F10.4	Shape factor
C12	F10.4	Constant to determine shape factor
AMB	F10.4	Average value of A/M
NCD	F10.4	Number of values in drag vs. velocity table (must be equal to or greater than two)

VI. Casualty Criteria Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
ABC	0.0	Use casualty index value
	1.0	Enter AXC, BXC, CXC values
NCC	XX.X	Casualty criteria index
AXC	F10.4	Casualty criteria constant
BXC	F10.4	Casualty criteria constant
CXC	F10.4	Casualty criteria constant

VII. Print and Punch Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
IOU	0.0	Do not print zone data output
	1.0	Print zone data output
NDL	1.0	Print PK arcs vs. range (If matrix is to be generated CLS must also be equal to 1.0)
	2.0	Do not print
CLS	0.0	Do not print
	1.0	Print PK arcs vs. range if matrix is to be generated

NT7	1.0	Print and Punch avg PK vs. range
	2.0	Do not print or punch
	3.0	Print avg PK vs. range

VIII. Matrix Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
MAT	0.0	Do not compute matrix
	1.0	Compute matrix
NDG	F10.4	Number of cells in deflection
NRG	F10.4	Number of cells in range
RAD	1.0	Use cell size in range and deflection and matrix center (RAM, DAM and CNT)
	2.0	Compute cell size based on maximum effective range
	3.0	Use cell size in range and deflection directions. RAX, DAY, DAX number of cells based upon maximum range.
DAM	F10.4	Cell size in deflection Used with RAD = 1.0
RAM	F10.4	Cell size in range Used when RAD = 1.0
CNT	F10.4	Center of matrix Used when RAD = 1.0
DAY	F10.4	Cell size in deflection Used when RAD = 3.0
RAX	F10.4	Cell size in range Used when RAD = 3.0

MCT	0.0	Insures at least two arcs cutting each cell of probability of kill matrix
	F10.4	Specifies given number of cuts in each cell of matrix
OSK	0.0	Do not punch matrix cards
	1.0	Punch matrix cards

IX. Target Posture for Matrix:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
IN2	0.0	Do not compute matrix for ORO foxhole
	1.0	Compute matrix for ORO foxhole
IN4	0.0	Do not compute matrix for BRL prone
	1.0	Compute matrix for BRL prone
IN7	0.0	Do not compute matrix for one-point standing target
	1.0	Compute matrix for one-point standing target
IN8	0.0	Do not compute matrix for six-point standing target
	1.0	Compute matrix for six-point standing target

NOTE: Only one of the above postures may be selected for any given computer run.

APPENDIX F
6-D TRAJECTORY PROGRAM (TR)
KEY VARIABLE INPUT

I. Control Parameters:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
NER	1.0	Flat earth.
	2.0	Spherical earth.
ROT	1.0	Rotating earth.
	2.0	No earth rotation.
NWD	1.0	Include wind tables.
	2.0	Do not include wind tables.
NKC	1.0	Use "k" coefficients.
	2.0	Use "c" coefficients.
NIR	1.0	Include atmosphere table.
	2.0	Use standard atmosphere.
MAL	1.0	Use cutoff at max. alt.
	2.0	Use no cutoff at max. alt.
NKS	1.0	Print coefficient tables.
	2.0	Do not print coefficient tables.
KFC	1.0	Include magnus (force) coefficients as input.
	2.0	Do not include magnus coefficients as input.
KPC	1.0	Include roll moment coefficients.
	2.0	Do not include roll moment coefficients.
KZC	1.0	Include (yaw) roll damping coefficients.

	2.0	Do not include (yaw) roll damping coefficients.
KCM	1.0	Include magnus force C.P.
	2.0	Do not include magnus force C.P.
NTV	0.0	Use table of thrust vs. time
	1.0	Use table of thrust vs. altitude.
KTP	1.0	Punch card output for PMTASS input.
	0.0	Do not punch card output.
KON	0.0	Assume KFC input to be based on $\pi/16$
	1.0	Assume KFC input to be based on $\pi/8$.
KMR	0.0	Print output in feet.
	1.0	Print output in meters.
KSP	1.0	For three-way table lookup of KFC and CPF. KFC and CPF will now be a function of mach no., angle of attack, and spin.
	0.0	For two-way table lookup of KFC and CPF.
NTA	24.0	Number of entries in atmosphere table. Default value is 24.0.
NIW	40.0	Number of entries in wind table. Default value is 40.0.
NAX	F10.4	Max. number of angle of attack arguments in coefficients.
NMX	F10.4	Max. number of mach number arguments.

NUR	F10.4	Number of trajectories to be computed using same control parameters, atmosphere, thrust, wind, and ballistic coefficients.
NRU	F10.4	Starting number of trajectories indicated by NUR above.
NNW	F10.4	Number of range values in wind tables (max. 40). <u>NOTE:</u> 40 altitudes must be given for <u>each</u> range value.
NSP	F10.4	Max. number of spin variables to be supplied when KSP=1.0.
DMA	F10.4	Max. time interval (DLT max.).
	0.0	Set DLT min. = 0.00005.
DMI	F10.4	Min. time interval (DLT min.).
	0.0	Set DLT min. = 0.5.

II. Phase Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
N1X	0.0	Do not compute Phase I.
	1.0	Compute Phase I.
N2X	0.0	Do not compute Phase II.
	1.0	Compute Phase II.
N3X	0.0	Do not compute Phase III.
	1.0	Compute Phase III.
N4X	0.0	Do not compute Phase IV.
	1.0	Compute Phase IV.
N5X	0.0	Do not compute Phase V.
	1.0	Compute Phase V.

N6X	0.0	Do not compute Phase VI.
	1.0	Compute Phase VI.
N7X	0.0	Do not compute Phase VII.
	1.0	Compute Phase VII.

III. Initial Conditions:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
ANA	F10.4	Longitude (degrees).
ANB	F10.4	Latitude (degrees).
AZI	F10.4	Azimuthal heading (degrees).
QEL	F10.4	Angle of elevation (degrees).
XOT	F10.4	Initial displacement (feet or meters).
YOT	F10.4	Initial altitude (feet or meters).
TAS	F10.4	Time at start (seconds).
AKN	F10.4	Multiplies air densities by this factor (0.0 is read as 1.0).
DTR	F10.4	Diameter (inches).
WTR	F10.4	Weight (pounds).
VXP	F10.4	V_x feet per second.
VYP	F10.4	V_y feet per second.
VZP	F10.4	V_z feet per second.
SPT	F10.4	Missile spin rate (rad/sec).
WYP	F10.4	Pitch rate (rad/sec).
WZP	F10.4	Yaw rate (rad/sec).

CIX	F10.4	Booster initial I_x (axial moment, lb-sq in).
CIY	F10.4	Booster initial I_y (transverse moment, lb-sq in).
XCG	F10.4	Booster initial center of gravity from nose (inches).
PUB	F10.4	Booster specific impulse (lb-sec/lb fuel).
WDT	F10.4	Booster burning rate (lb-fuel/sec).
CX2	F10.4	Booster final I_x (axial moment lb-sq in).
CY2	F10.4	Booster final I_y (transverse moment, lb-sq in).
CG2	F10.4	Booster final center of gravity (inches).
ANO	F10.4	Booster nozzle diameter (inches).
AMA	F10.4	Booster mal. angle, A (degrees).
TMA	F10.4	Booster mal. angle, T (degrees).
RXT	F10.4	Booster mal. distance, R_x (inches).
RYT	F10.4	Booster mal. distance, R_y (inches).
RZT	F10.4	Booster mal. distance, R_z (inches).
TKA	F10.4	Booster jet torque moment (inches).
TMD	F10.4	Booster thrust modifier.
CXS	F10.4	Main stage initial I_x (lb-sq in).
CYS	F10.4	Main stage initial I_y (lb-sq in).
CGM	F10.4	Main stage initial center of gravity (inches).

PUS	F10.4	Main stage specific impulse (lb-sec/lb).
WRS	F10.4	Main stage burning rate (lb/sec).
CX6	F10.4	Main stage final I_x (lb-sq in).
CY6	F10.4	Main stage final I_y (lb-sq in).
CG6	F10.4	Main stage final center of gravity (inches).
D05	F10.4	Main stage nozzle diameter (inches).
AL5	F10.4	Main stage mal. angle, A (degrees).
TL5	F10.4	Main stage mal. angle, T (degrees).
RX5	F10.4	Main stage mal. distance, R_x (degrees).
RY5	F10.4	Main stage mal. distance, R_y (inches).
RZ5	F10.4	Main stage mal. distance, R_z (inches).
TK5	F10.4	Main stage jet torque arm (inches).
TM5	F10.4	Main stage thrust modifier.
TI1	F10.4	Time at end of Phase I (seconds).
TI2	F10.4	Time at end of Phase II (seconds).
TI3	F10.4	Time at end of Phase III (seconds).
TI4	F10.4	Time at end of Phase IV (seconds).
TI5	F10.4	Time at end of Phase V (seconds).
TI6	F10.4	Time at end of Phase VI (seconds).
WT5	F10.4	Initial main stage weight (pounds).

BRB	F10.4	Burning rate at separation (lb/sec).
FF1	F10.4	Phase I form factor drag.
FF2	F10.4	Phase II form factor drag.
FF3	F10.4	Phase III form factor drag.
FF4	F10.4	Phase IV form factor drag.
FF5	F10.4	Phase V form factor drag.
FF6	F10.4	Phase VI form factor drag.
FF7	F10.4	Phase VII form factor drag.
ST5	F10.4	Separation thrust (pounds).

IV. Integration and Print Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
DI1	F10.4	Phase I integration step size (seconds).
DI2	F10.4	Phase II integration step size (seconds).
DI3	F10.4	Phase III integration step size (seconds).
DI4	F10.4	Phase IV integration step size (seconds).
DI5	F10.4	Phase V integration step size (seconds).
DI6	F10.4	Phase VI integration step size (seconds).
DI7	F10.4	Phase VII integration step size (seconds).

DAZ	F10.4	Diameter (in.) of second stage. If left blank will be assumed= DTR
DS1	F10.4	Phase I output spacing (seconds).
DS2	F10.4	Phase II output spacing (seconds).
DS3	F10.4	Phase III output spacing (seconds).
DS4	F10.4	Phase IV output spacing (seconds).
DS5	F10.4	Phase V output spacing (seconds).
DS6	F10.4	Phase VI output spacing (seconds).
DS7	F10.4	Phase VII output spacing (seconds).
SPZ	F10.4	Spin rate of second stage. If left blank, SPT will be assumed to be that which existed at end of last phase.

V. Constants and Parameters:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
PRS	F10.4	Static test atmospheric pressure (lb/sq in).
VWX	F10.4	Constant range wind (feet/sec).
VWY	F10.4	Constant cross-range wind (feet/sec).
VWZ	F10.4	Constant vertical wind (feet/sec).
IYO	F10.4	Initial deflection (feet).
TZF	F10.4	Terminal altitude (feet).
COD	F10.4	CODE (three numeric characters to identify job - are printed out).

APPENDIX G
RECOIL MECHANISM DESIGN PROGRAM (RM)
KEY VARIABLE INPUT

I. Program Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
XND	0.0	Run next set of input data
	1.0	Do not run next set of input data
PRT	0.0	Print auxiliary output data
	1.0	Do not print auxiliary output data
ISW	0.0	Switch to bypass namelist

II. Constants and Parameters :

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
TIR	F10.4	Rise-fall time of rod pull curve (sec)
RH1	F10.4	Density of primary material-steel (lb/in. ²)
SIG	F10.4	Allowable stress in primary material (lb/in. ²)
RH2	F10.4	Density of secondary material-bronze (lb/in. ³)
XMR	F10.4	Mass of recoiling parts-initially the mass of gun tube and components (in-slug).
XMP	F10.4	Mass of projectile (in-slug).
XMC	F10.4	Mass of propelling charge (in-slug)
RSR	F10.4	Design recoil length-short (in.)
RLR	F10.4	Design recoil length-long (in.)
XIR	F10.4	Net impulse imparted (lb-sec)

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
VOR	F10.4	Projectile muzzle velocity (in./sec)
ALP	F10.4	Time to centroid of breech force (sec)
PMX	F10.4	Design fluid pressure-recoil (lb/in. ²)
DGT	F10.4	Diameter of gun tube at breech (in.)
DR1	F10.4	Allowable expansion (recoil)
DR2	F10.4	Allowable expansion ($C \leq$ recoil inner)
DR3	F10.4	Allowable expansion ($C \leq$ recoil outer)
DLM	F10.4	Allowable deflection (breech ring)
XNR	F10.4	Number of recoil cylinders
CDR	F10.4	Discharge coefficient for recoil
SC1	F10.4	Stress concentration for threaded members
SC2	F10.4	Stress concentration for grooves and thread reliefs
OVS	F10.4	Allowable difference in size between recoil and $C \leq$ recoil
DLP	F10.4	Increment of design fluid pressure (lb/in. ²)
CLR	F10.4	Clearance between gun tubes and cylinders (in.)
TRU	F10.4	Height from floor to trunnions (in.)

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
BAL	F10.4	Thickness of rotor for ballistic protection (in.)
CMT	F10.4	Distance from front (muzzle end) of breech to gun tube center of gravity (in.)
ROF	F10.4	Distance from floor to roof in cab (in.)
PGS	F10.4	Starting value of maximum gas pressure (lb/in. ²)

APPENDIX H
SABOT DESIGN PROGRAM (SD)
KEY VARIABLE INPUT

I. Program Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
SOC	0.0	Segments of sabot are open
	1.0	Segments of sabot are closed
GFC	0.0	Rear geometry is cylinder
	1.0	Rear geometry is frustrum
NPR	1.0	Printer plotting
	2.0	CALCOMP plotting
	3.0	Printer and CALCOMP plotting

II. Constants and Parameters

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
PKP	F10.4	Peak pressure (PSI)
PFW	F10.4	Projectile-flechette weight (lb)
KK1	F10.4	Percentage head friction
CCF	F10.4	Percentage rear strut friction
NNS	F10.4	Number of sabot segments
WOB	F10.4	Weight of obturator (lb)
FRB	F10.4	Major frustrum radius (in.)
FRL	F10.4	Minor frustrum radius (in.)
LFR	F10.4	Length of frustrum (in.)
RVB	F10.4	Volume of rear section - 0.0 is meaningless (in. ³)
FVH	F10.4	Volume of sabot head (in. ³)

SPS	F10.4	Sabot material density (lb/in ³)
THK	F10.4	Thickness of rear strut (in.)
PFD	F10.4	Diameter of projectile (in.)
MBD	F10.4	Mean diameter between lands and grooves of bore (in.)

APPENDIX I
HEPPNER-INTERIOR BALLISTICS (IH)
KEY INPUT VARIABLES

I. Program Options:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
ICK	F10.4	Plotting parameter for sub-routine SYMBOL (angle at which text is to be printed - see Reference 11).
IPL	1.0	Printout only
	2.0	Plot only
	3.0	Printout and plot
RNS	F10.4	Number of runs
ZLI	F10.4	Number of lines between typeout.

II. Constants and Parameters:

<u>SYMBOL</u>	<u>VALUES OR FORMAT</u>	<u>MEANING</u>
PEP	F10.1	Peak pressure (PSI)
VOM	F10.1	Muzzle velocity (ft/in ²)
CHV	F8.3	Chamber volume (in ³)
CSA	F8.3	Cross-section of bore (in ²)
WTG	F8.2	Weight of gun and recoiling parts (lb)
DST	F8.3	Distance travelled along tube (in.)
PWT	F8.3	Projectile weight (lb)
SER	F8.4	Specific energy ratio
INP	F8.3	Initial pressure (PSI)
AFQ	F8.6	Adjustment factor for Q
AFR	F8.6	Adjustment factor for R

PRF	F8.3	Pressure factor
TP1	F10.4	Type of propellant
CW1	F10.4	Weight (lb)
WB1	F10.4	Web (in.)
TP2	F10.4	Type of propellant
CW2	F10.4	Weight (lb)
WB2	F10.4	Web (in.)
TP3	F10.4	Type of propellant
CW3	F10.4	Weight (lb)
WB3	F10.4	Web (in.)
TP4	F10.4	Type of propellant
CW4	F10.4	Web (in.)
WB4	F10.4	Web (in.)

APPENDIX J
IPSDATA SAMPLE OUTPUT

18,243	32,116	47,366	62,731	78,104	93,479	108,854	124,229	139,604	154,979	170,354	185,729	201,104	216,479	231,854	247,229	262,604	277,979	293,354	308,729	324,104	339,479	354,854	370,229	385,604	400,979	416,354	431,729	447,104	462,479	477,854	493,229	508,604	523,979	539,354	554,729	570,104	585,479	600,854	616,229	631,604	646,979	662,354	677,729	693,104	708,479	723,854	739,229	754,604	770,979	785,354	800,729	816,104	831,479	846,854	862,229	877,604	893,979	908,354	923,729	939,104	954,479	969,854	985,229	1,000,604	1,015,979	1,031,354	1,046,729	1,062,104	1,077,479	1,092,854	1,108,229	1,123,604	1,138,979	1,154,354	1,169,729	1,185,104	1,200,479	1,215,854	1,231,229	1,246,604	1,261,979	1,277,354	1,292,729	1,308,104	1,323,479	1,338,854	1,354,229	1,369,604	1,384,979	1,400,354	1,415,729	1,431,104	1,446,479	1,461,854	1,477,229	1,492,604	1,507,979	1,523,354	1,538,729	1,554,104	1,569,479	1,584,854	1,600,229	1,615,604	1,630,979	1,646,354	1,661,729	1,677,104	1,692,479	1,707,854	1,723,229	1,738,604	1,753,979	1,769,354	1,784,729	1,800,104	1,815,479	1,830,854	1,846,229	1,861,604	1,876,979	1,892,354	1,907,729	1,923,104	1,938,479	1,953,854	1,969,229	1,984,604	1,999,979	2,015,354	2,030,729	2,046,104	2,061,479	2,076,854	2,092,229	2,107,604	2,122,979	2,138,354	2,153,729	2,169,104	2,184,479	2,199,854	2,215,229	2,230,604	2,245,979	2,261,354	2,276,729	2,292,104	2,307,479	2,322,854	2,338,229	2,353,604	2,368,979	2,384,354	2,399,729	2,415,104	2,430,479	2,445,854	2,461,229	2,476,604	2,491,979	2,507,354	2,522,729	2,538,104	2,553,479	2,568,854	2,584,229	2,599,604	2,614,979	2,630,354	2,645,729	2,661,104	2,676,479	2,691,854	2,707,229	2,722,604	2,737,979	2,753,354	2,768,729	2,784,104	2,799,479	2,814,854	2,830,229	2,845,604	2,860,979	2,876,354	2,891,729	2,907,104	2,922,479	2,937,854	2,953,229	2,968,604	2,983,979	2,999,354	3,014,729	3,030,104	3,045,479	3,060,854	3,076,229	3,091,604	3,106,979	3,122,354	3,137,729	3,153,104	3,168,479	3,183,854	3,199,229	3,214,604	3,229,979	3,245,354	3,260,729	3,276,104	3,291,479	3,306,854	3,322,229	3,337,604	3,352,979	3,368,354	3,383,729	3,399,104	3,414,479	3,429,854	3,445,229	3,460,604	3,475,979	3,491,354	3,506,729	3,522,104	3,537,479	3,552,854	3,568,229	3,583,604	3,598,979	3,614,354	3,629,729	3,645,104	3,660,479	3,675,854	3,691,229	3,706,604	3,721,979	3,737,354	3,752,729	3,768,104	3,783,479	3,798,854	3,814,229	3,829,604	3,844,979	3,860,354	3,875,729	3,891,104	3,906,479	3,921,854	3,937,229	3,952,604	3,967,979	3,983,354	3,998,729	4,014,104	4,029,479	4,044,854	4,060,229	4,075,604	4,090,979	4,106,354	4,121,729	4,137,104	4,152,479	4,167,854	4,183,229	4,198,604	4,213,979	4,229,354	4,244,729	4,260,104	4,275,479	4,290,854	4,306,229	4,321,604	4,336,979	4,352,354	4,367,729	4,383,104	4,398,479	4,413,854	4,429,229	4,444,604	4,459,979	4,475,354	4,490,729	4,506,104	4,521,479	4,536,854	4,552,229	4,567,604	4,582,979	4,598,354	4,613,729	4,629,104	4,644,479	4,659,854	4,675,229	4,690,604	4,705,979	4,721,354	4,736,729	4,752,104	4,767,479	4,782,854	4,798,229	4,813,604	4,828,979	4,844,354	4,859,729	4,875,104	4,890,479	4,905,854	4,921,229	4,936,604	4,951,979	4,967,354	4,982,729	4,998,104	5,013,479	5,028,854	5,044,229	5,059,604	5,074,979	5,090,354	5,105,729	5,121,104	5,136,479	5,151,854	5,167,229	5,182,604	5,197,979	5,213,354	5,228,729	5,244,104	5,259,479	5,274,854	5,290,229	5,305,604	5,320,979	5,336,354	5,351,729	5,367,104	5,382,479	5,397,854	5,413,229	5,428,604	5,443,979	5,459,354	5,474,729	5,490,104	5,505,479	5,520,854	5,536,229	5,551,604	5,566,979	5,582,354	5,597,729	5,613,104	5,628,479	5,643,854	5,659,229	5,674,604	5,689,979	5,705,354	5,720,729	5,736,104	5,751,479	5,766,854	5,782,229	5,797,604	5,812,979	5,828,354	5,843,729	5,859,104	5,874,479	5,889,854	5,905,229	5,920,604	5,935,979	5,951,354	5,966,729	5,982,104	5,997,479	6,012,854	6,028,229	6,043,604	6,058,979	6,074,354	6,089,729	6,105,104	6,120,479	6,135,854	6,150,229	6,165,604	6,180,979	6,196,354	6,211,729	6,227,104	6,242,479	6,257,854	6,273,229	6,288,604	6,303,979	6,319,354	6,334,729	6,350,104	6,365,479	6,380,854	6,396,229	6,411,604	6,426,979	6,442,354	6,457,729	6,473,104	6,488,479	6,503,854	6,519,229	6,534,604	6,549,979	6,565,354	6,580,729	6,596,104	6,611,479	6,626,854	6,642,229	6,657,604	6,672,979	6,688,354	6,703,729	6,719,104	6,734,479	6,749,854	6,765,229	6,780,604	6,795,979	6,811,354	6,826,729	6,842,104	6,857,479	6,872,854	6,888,229	6,903,604	6,918,979	6,934,354	6,949,729	6,965,104	6,980,479	6,995,854	7,011,229	7,026,604	7,041,979	7,057,354	7,072,729	7,088,104	7,103,479	7,118,854	7,134,229	7,149,604	7,164,979	7,180,354	7,195,729	7,211,104	7,226,479	7,241,854	7,257,229	7,272,604	7,287,979	7,303,354	7,318,729	7,334,104	7,349,479	7,364,854	7,380,229	7,395,604	7,410,979	7,426,354	7,441,729	7,457,104	7,472,479	7,487,854	7,503,229	7,518,604	7,533,979	7,549,354	7,564,729	7,580,104	7,595,479	7,610,854	7,626,229	7,641,604	7,656,979	7,672,354	7,687,729	7,703,104	7,718,479	7,733,854	7,749,229	7,764,604	7,779,979	7,795,354	7,810,729	7,826,104	7,841,479	7,856,854	7,872,229	7,887,604	7,902,979	7,918,354	7,933,729	7,949,104	7,964,479	7,979,854	7,995,229	8,010,604	8,025,979	8,041,354	8,056,729	8,072,104	8,087,479	8,102,854	8,118,229	8,133,604	8,148,979	8,164,354	8,179,729	8,195,104	8,210,479	8,225,854	8,241,229	8,256,604	8,271,979	8,287,354	8,302,729	8,318,104	8,333,479	8,348,854	8,364,229	8,379,604	8,394,979	8,410,354	8,425,729	8,441,104	8,456,479	8,471,854	8,487,229	8,502,604	8,517,979	8,533,354	8,548,729	8,564,104	8,579,479	8,594,854	8,610,229	8,625,604	8,640,979	8,656,354	8,671,729	8,687,104	8,702,479	8,717,854	8,733,229	8,748,604	8,763,979	8,779,354	8,794,729	8,810,104	8,825,479	8,840,854	8,856,229	8,871,604	8,886,979	8,902,354	8,917,729	8,933,104	8,948,479	8,963,854	8,979,229	8,994,604	9,009,979	9,025,354	9,040,729	9,056,104	9,071,479	9,086,854	9,102,229	9,117,604	9,132,979	9,148,354	9,163,729	9,179,104	9,194,479	9,209,854	9,225,229	9,240,604	9,255,979	9,271,354	9,286,729	9,302,104	9,317,479	9,332,854	9,348,229	9,363,604	9,378,979	9,394,354	9,409,729	9,425,104	9,440,479	9,455,854	9,471,229	9,486,604	9,501,979	9,517,354	9,532,729	9,548,104	9,563,479	9,578,854	9,594,229	9,609,604	9,624,979	9,640,354	9,655,729	9,671,104	9,686,479	9,701,854	9,717,229	9,732,604	9,747,979	9,763,354	9,778,729	9,794,104	9,809,479	9,824,854	9,840,229	9,855,604	9,870,979	9,886,354	9,901,729	9,917,104	9,932,479	9,947,854	9,963,229	9,978,604	9,993,979	10,009,354	10,024,729	10,040,104	10,055,479	10,070,854	10,086,229	10,101,604	10,116,979	10,132,354	10,147,729	10,163,104	10,178,479	10,193,854	10,209,229	10,224,604	10,239,979	10,255,354	10,270,729	10,286,104	10,301,479	10,316,854	10,332,229	10,347,604	10,362,979	10,378,354	10,393,729	10,409,104	10,424,479	10,439,854	10,455,229	10,470,604	10,485,979	10,501,354	10,516,729	10,532,104	10,547,479	10,562,854	10,578,229	10,593,604	10,608,979	10,624,354	10,639,729	10,655,104	10,670,479	10,685,854	10,701,229	10,716,604	10,731,979	10,747,354	10,762,729	10,778,104	10,793,479	10,808,854	10,824,229	10,839,604	10,854,979	10,870,354	10,885,729	10,901,104	10,916,479	10,931,854	10,947,229	10,962,604	10,977,979	10,993,354	11,008,729	11,024,104	11,039,479	11,054,854	11,070,229	11,085,604	11,100,979	11,116,354	11,131,729	11,147,104	11,162,479	11,177,854	11,193,229	11,208,604	11,223,979	11,239,354	11,254,729	11,270,104	11,285,479	11,300,854	11,316,229	11,331,604	11,346,979	11,362,354	11,377,729	11,393,104	11,408,479	11,423,854	11,439,229	11,454,604	11,469,979	11,485,354	11,500,729	11,516,104	11,531,479	11,546,854	11,562,229	11,577,604	11,592,979	11,608,354	11,623,729	11,639,104	11,654,479	11,669,854	11,685,229	11,700,604	11,715,979	11,731,354	11,746,729	11,762,104	11,777,479	11,792,854	11,808,229	11,823,604	11,838,979	11,854,354	11,869,729	11,885,104	11,900,479	11,915,854	11,930,229	11,945,604	11,960,979	11,976,354	11,991,729	12,007,104	12,022,479	12,037,854	12,052,229	12,067,604	12,082,979	12,098,354	12,113,729	12,129,104	12,144,479	12,159,854	12,175,229	12,190,604	12,205,979	12,221,354	12,236,729	12,252,104	12,267,479	12,282,854	12,298,229	12,313,604	12,328,979	12,344,354	12,359,729	12,375,104	12,390,479	12,405,854	12,421,229	12,436,604	12,451,979	12,467,354	12,482,729	12,498,104	12,513,479	12,528,854	12,544,229	12,559,604	12,574,979	12,590,354	12,605,729	12,621,104	12,636,479	12,651,854	12,667,229	12,682,604	12,697,979	12,713,354	12,728,729	12,744,104	12,759,479	12,774,854	12,790,229	12,805,604	12,820,979	12,836,354	12,851,729	12,867,104	12,882,479	12,897,854	12,913,229	12,928,604	12,943,979	12,959,354	12,974,729	12,990,104	13,005,479	13,020,854	13,036,229	13,051,604	13,066,979	13,082,354	13,097,729	13,113,104	13,128,479	13,143,854	13,159,229	13,174,604	13,189,979	13,205,354	13,220,729	13,236,104	13,251,479	13,266,854	13,282,229	13,297,604	13,312,979	13,328,354	13,343,729	13,359,104	13,374,479	13,389,854	13,405,229	13,420,604	13,435,979	13,451,354	13,466,72
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12,500	32,500	35,000	3100,000	3275,000	320,000	1,000
12,750	32,750	35,250	3125,000	3300,000	175,000	2,000
13,000	33,000	35,500	3150,000	3375,000	250,000	3,000
13,250	33,250	35,750	3175,000	3450,000	325,000	4,000
13,500	33,500	36,000	3200,000	3525,000	400,000	5,000
13,750	33,750	36,250	3225,000	3600,000	475,000	6,000
14,000	34,000	36,500	3250,000	3675,000	550,000	7,000
14,250	34,250	36,750	3275,000	3750,000	625,000	8,000
14,500	34,500	37,000	3300,000	3825,000	700,000	9,000
14,750	34,750	37,250	3325,000	3900,000	775,000	10,000
15,000	35,000	37,500	3350,000	3975,000	850,000	11,000
15,250	35,250	37,750	3375,000	4050,000	925,000	12,000
15,500	35,500	38,000	3400,000	4125,000	1,000,000	13,000
15,750	35,750	38,250	3425,000	4200,000	1,075,000	14,000
16,000	36,000	38,500	3450,000	4275,000	1,150,000	15,000
16,250	36,250	38,750	3475,000	4350,000	1,225,000	16,000
16,500	36,500	39,000	3500,000	4425,000	1,300,000	17,000
16,750	36,750	39,250	3525,000	4500,000	1,375,000	18,000
17,000	37,000	39,500	3550,000	4575,000	1,450,000	19,000
17,250	37,250	39,750	3575,000	4650,000	1,525,000	20,000
17,500	37,500	40,000	3600,000	4725,000	1,600,000	21,000
17,750	37,750	40,250	3625,000	4800,000	1,675,000	22,000
18,000	38,000	40,500	3650,000	4875,000	1,750,000	23,000
18,250	38,250	40,750	3675,000	4950,000	1,825,000	24,000
18,500	38,500	41,000	3700,000	5025,000	1,900,000	25,000
18,750	38,750	41,250	3725,000	5100,000	1,975,000	26,000
19,000	39,000	41,500	3750,000	5175,000	2,050,000	27,000
19,250	39,250	41,750	3775,000	5250,000	2,125,000	28,000
19,500	39,500	42,000	3800,000	5325,000	2,200,000	29,000
19,750	39,750	42,250	3825,000	5400,000	2,275,000	30,000
20,000	40,000	42,500	3850,000	5475,000	2,350,000	31,000
20,250	40,250	42,750	3875,000	5550,000	2,425,000	32,000
20,500	40,500	43,000	3900,000	5625,000	2,500,000	33,000
20,750	40,750	43,250	3925,000	5700,000	2,575,000	34,000
21,000	41,000	43,500	3950,000	5775,000	2,650,000	35,000
21,250	41,250	43,750	3975,000	5850,000	2,725,000	36,000
21,500	41,500	44,000	4000,000	5925,000	2,800,000	37,000
21,750	41,750	44,250	4025,000	6000,000	2,875,000	38,000
22,000	42,000	44,500	4050,000	6075,000	2,950,000	39,000
22,250	42,250	44,750	4075,000	6150,000	3,025,000	40,000
22,500	42,500	45,000	4100,000	6225,000	3,100,000	41,000
22,750	42,750	45,250	4125,000	6300,000	3,175,000	42,000
23,000	43,000	45,500	4150,000	6375,000	3,250,000	43,000
23,250	43,250	45,750	4175,000	6450,000	3,325,000	44,000
23,500	43,500	46,000	4200,000	6525,000	3,400,000	45,000
23,750	43,750	46,250	4225,000	6600,000	3,475,000	46,000
24,000	44,000	46,500	4250,000	6675,000	3,550,000	47,000
24,250	44,250	46,750	4275,000	6750,000	3,625,000	48,000
24,500	44,500	47,000	4300,000	6825,000	3,700,000	49,000
24,750	44,750	47,250	4325,000	6900,000	3,775,000	50,000
25,000	45,000	47,500	4350,000	6975,000	3,850,000	51,000
25,250	45,250	47,750	4375,000	7050,000	3,925,000	52,000
25,500	45,500	48,000	4400,000	7125,000	4,000,000	53,000
25,750	45,750	48,250	4425,000	7200,000	4,075,000	54,000
26,000	46,000	48,500	4450,000	7275,000	4,150,000	55,000
26,250	46,250	48,750	4475,000	7350,000	4,225,000	56,000
26,500	46,500	49,000	4500,000	7425,000	4,300,000	57,000
26,750	46,750	49,250	4525,000	7500,000	4,375,000	58,000
27,000	47,000	49,500	4550,000	7575,000	4,450,000	59,000
27,250	47,250	49,750	4575,000	7650,000	4,525,000	60,000
27,500	47,500	50,000	4600,000	7725,000	4,600,000	61,000
27,750	47,750	50,250	4625,000	7800,000	4,675,000	62,000
28,000	48,000	50,500	4650,000	7875,000	4,750,000	63,000
28,250	48,250	50,750	4675,000	7950,000	4,825,000	64,000
28,500	48,500	51,000	4700,000	8025,000	4,900,000	65,000
28,750	48,750	51,250	4725,000	8100,000	4,975,000	66,000
29,000	49,000	51,500	4750,000	8175,000	5,050,000	67,000
29,250	49,250	51,750	4775,000	8250,000	5,125,000	68,000
29,500	49,500	52,000	4800,000	8325,000	5,200,000	69,000
29,750	49,750	52,250	4825,000	8400,000	5,275,000	70,000
30,000	50,000	52,500	4850,000	8475,000	5,350,000	71,000
30,250	50,250	52,750	4875,000	8550,000	5,425,000	72,000
30,500	50,500	53,000	4900,000	8625,000	5,500,000	73,000
30,750	50,750	53,250	4925,000	8700,000	5,575,000	74,000
31,000	51,000	53,500	4950,000	8775,000	5,650,000	75,000
31,250	51,250	53,750	4975,000	8850,000	5,725,000	76,000
31,500	51,500	54,000	5000,000	8925,000	5,800,000	77,000
31,750	51,750	54,250	5025,000	9000,000	5,875,000	78,000
32,000	52,000	54,500	5050,000	9075,000	5,950,000	79,000
32,250	52,250	54,750	5075,000	9150,000	6,025,000	80,000
32,500	52,500	55,000	5100,000	9225,000	6,100,000	81,000
32,750	52,750	55,250	5125,000	9300,000	6,175,000	82,000
33,000	53,000	55,500	5150,000	9375,000	6,250,000	83,000
33,250	53,250	55,750	5175,000	9450,000	6,325,000	84,000
33,500	53,500	56,000	5200,000	9525,000	6,400,000	85,000
33,750	53,750	56,250	5225,000	9600,000	6,475,000	86,000
34,000	54,000	56,500	5250,000	9675,000	6,550,000	87,000
34,250	54,250	56,750	5275,000	9750,000	6,625,000	88,000
34,500	54,500	57,000	5300,000	9825,000	6,700,000	89,000
34,750	54,750	57,250	5325,000	9900,000	6,775,000	90,000
35,000	55,000	57,500	5350,000	9975,000	6,850,000	91,000
35,250	55,250	57,750	5375,000	10050,000	6,925,000	92,000
35,500	55,500	58,000	5400,000	10125,000	7,000,000	93,000
35,750	55,750	58,250	5425,000	10200,000	7,075,000	94,000
36,000	56,000	58,500	5450,000	10275,000	7,150,000	95,000
36,250	56,250	58,750	5475,000	10350,000	7,225,000	96,000
36,500	56,500	59,000	5500,000	10425,000	7,300,000	97,000
36,750	56,750	59,250	5525,000	10500,000	7,375,000	98,000
37,000	57,000	59,500	5550,000	10575,000	7,450,000	99,000
37,250	57,250	59,750	5575,000	10650,000	7,525,000	100,000
37,500	57,500	60,000	5600,000	10725,000	7,600,000	101,000
37,750	57,750	60,250	5625,000	10800,000	7,675,000	102,000
38,000	58,000	60,500	5650,000	10875,000	7,750,000	103,000
38,250	58,250	60,750	5675,000	10950,000	7,825,000	104,000
38,500	58,500	61,000	5700,000	11025,000	7,900,000	105,000
38,750	58,750	61,250	5725,000	11100,000	7,975,000	106,000
39,000	59,000	61,500	5750,000	11175,000	8,050,000	107,000
39,250	59,250	61,750	5775,000	11250,000	8,125,000	108,000
39,500	59,500	62,000	5800,000	11325,000	8,200,000	109,000
39,750	59,750	62,250	5825,000	11400,000	8,275,000	110,000
40,000	60,000	62,500	5850,000	11475,000	8,350,000	111,000
40,250	60,250	62,750	5875,000	11550,000	8,425,000	112,000
40,500	60,500	63,000	5900,000	11625,000	8,500,000	113,000
40,750	60,750	63,250	5925,000	11700,000	8,575,000	114,000
41,000	61,000	63,500	5950,000	11775,000	8,650,000	115,000
41,250	61,250	63,750	5975,000	11850,000	8,725,000	116,000
41,500	61,500	64,000	6000,000	11925,000	8,800,000	117,000
41,750	61,750	64,250	6025,000	12000,000	8,875,000	118,000
42,000	62,000	64,500	6050,000	12075,000	8,950,000	119,000
42,250	62,250	64,750	6075,000	12150,000	9,025,000	120,000
42,500	62,500	65,000	6100,000	12225,000	9,100,000	121,000
42,750	62,750	65,250	6125,000	12300,000	9,175,000	122,000
43,000	63,000	65,500	6150,000	12375,000	9,250,000	123,000
43,250	63,250	65,750	6175,000	12450,000	9,325,000	124,000
43,500	63,500	66,000	6200,000	12525,000	9,400,000	125,000
43,750	63,750	66,250	6225,000	12600,000	9,475,000	126,000
44,000	64,000	66,500	6250,000	12675,000	9,550,000	127,000
44,250	64,250	66,750	6275,000	12750,000	9,625,000	128,000
44,500	64,500	67,000	6300,000	12825,000	9,700,000	129,000
44,750	64,750	67,250	6325,000	12900,000	9,775,000	130,000
45,000	65,000	67,500	6350,000	12975,000	9,850,000	131,000
45,250	65,250	67,750	6375,000	13050,000	9,925,000	132,000
45,500	65,500	68,000	6400,000	13125,000	10,000,000	133,000
45,750	65,750	68,250	6425,000	13200,000	10,075,000	134,000
46,000	66,000	68,500	6450,000	13275,000	10,150,000	135,000
46,250	66,250	68,750	6475,000	13350,000	10,225,000	136,000
46,500	66,500	69,000	6500,000	13425,000	10,300,000	137,000
46,750	66,750	69,250	6525,000	13500,000	10,375,000	138,000
47,000						

APPENDIX K
SAMPLE TTY & BATCH RESULTS

Section K-1

PROJECTILE 0 INCH W106
HEIGHT CALCULATION REQUESTED
PLOT REQUESTED
STABILITY CALCULATION NOT REQUESTED

34 BODY TYPE

0 FINS

0 FTN PIECES

0 KNOWN TYPE

4 OGIVES

1 COPIES OUTPUT REQUESTED

0 DATA CHANGES

PROJECTILE A INCH M106
INPUT DATA FOR BODY OF SHELL

NO.	IDENTIFICATION	D1	C2	LENGTH	DENSITY	REFERENCE
1	OBODY1	7.9800	7.9800	7.8300	.2810	19.2800
2	OBODY2	7.9800	7.9800	1.8000	.2810	29.3200
3	OBODY3	7.9800	6.7600	4.0000	.2830	31.1200
4	OBODY4	7.9800	7.9800	.7800	.2830	18.5000
5	OBODY5	7.9800	7.9800	.4000	.2810	18.1000
6	OBODY6	7.9100	7.9100	.1000	.2810	28.1200
7	OBODY7	7.9100	7.9800	.1000	.2810	28.7200
8	OBODY1	6.4700	6.4700	6.0000	.2210	18.1000
9	OBODY2	4.8600	4.8600	1.8200	.2230	31.1100
10	OBODY3	5.8000	5.8000	2.5000	.2230	28.5800
11	OBODY7	4.8600	4.8600	2.1100	.2230	29.0000
12	OBODY4	6.3000	6.0700	1.2000	.2230	25.3000
13	OBODY5	6.4700	6.4700	1.2000	.2230	24.1800
14	OBODY6	6.0000	6.0000	.1200	0.0000	35.0000
15	OBODYA	1.6000	1.6000	.1000	0.0000	3.7500
16	OBODYC	1.6000	2.0000	.1000	0.0000	3.8500
17	OBODYC	2.0000	1.6000	.1000	0.0000	3.9500
18	OBODYE	1.6000	2.0000	.1000	0.0000	4.0500
19	OBODYF	2.0000	1.6000	.1000	0.0000	4.1500
20	OBODYG	1.6000	2.0000	.1000	0.0000	4.2500
21	OBODYH	2.0000	1.6000	.1000	0.0000	4.3500
22	OBODYI	1.6000	2.0000	.1000	0.0000	4.4500
23	OBODYJ	2.0000	1.6000	.1000	0.0000	4.5500
24	OBODYK	1.6000	2.0000	.1000	0.0000	4.6500
25	OBODYL	2.0000	1.6000	.1000	0.0000	4.7500
26	OBODYM	1.6000	1.6000	1.1500	.0400	4.8500
27	OBODYA	8.0500	8.1400	1.0000	.2830	27.1200
28	OBODYB	8.0500	8.0800	.2000	.2830	28.1200
29	OBODYC	8.1400	8.1400	.1500	.2830	28.3200
30	OBODYC	8.1400	8.2800	.2000	.2830	28.4700
31	OBODYF	8.2800	8.2800	.1000	.2830	28.7700
32	OBODYF	7.9100	7.9100	.1500	.2830	28.7700
33	OBODYE	8.1200	8.1200	.0800	.2830	28.9200
34	OBODYH	8.1200	7.9800	.1200	.2830	29.0000
35	OBODYA	7.5100	7.5100	2.0000	-0.0000	27.1200

INPUT DATA FOR OGIVAL TIPS

NO.	IDENTIFICATION	A	6	LENGTH	DENSITY	REFERENCE	RADIUS
1	OGGIVE	-18.9000	60.0000	14.3500	.2830	3.7500	64.1000
2	OGGIVE	-17.9800	60.0000	13.2500	.2230	4.8500	61.4000
3	OGGIVE	-18.5000	60.0000	3.7500	.1000	0.0000	61.0000
4	OCURVE	-0.0000	-1.2600	1.0000	.2230	37.5200	1.0000

PROJECTILE 8 INCH WIDE

PROPERTIES OF BODY ITEMS

NO.	IDENTIFICATION	WEIGHT	POLAR I	TRANSVERSE I	CG TO REF	VOLUME
1	PRODT1	189.9439	149.9439	531.9728	21.1956	388.8764
2	PRODT2	25.4374	202.4012	4.8769	30.2200	90.0261
3	PRODT3	48.3188	33.5554	63.8746	13.8606	170.8661
4	PRODT4	18.0676	88.1218	54.11	18.9800	19.1051
5	PRODT5	5.0851	44.1723	0.747	18.3007	19.8054
6	PRODT6	1.3907	10.4766	0.012	20.1769	2.9151
7	PRODT7	1.4830	11.0708	0.012	20.1769	2.9151
8	PRODT8	-43.9901	-230.1430	-131.9702	21.1000	197.2649
9	PRODT9	-5.4445	-15.1428	-9.204	31.8034	24.5939
10	PRODT10	-14.6654	-61.6193	-7.0185	27.7090	65.7839
11	PRODT11	-9.9286	-33.5127	-3.6646	30.0114	44.5230
12	PRODT12	-9.9489	-30.4320	-5.646	25.8924	36.0579
13	PRODT13	-8.3684	-43.4401	-1.0241	28.4254	38.8254
14	PRODT14	0.0000	0.0000	0.0000	35.0600	3.3929
15	PRODT15	0.0000	0.0000	0.0000	3.8000	.2011
16	PRODT16	0.0000	0.0000	0.0000	3.9037	.2555
17	PRODT17	0.0000	0.0000	0.0000	3.9963	.2555
18	PRODT18	0.0000	0.0000	0.0000	4.1037	.2555
19	PRODT19	0.0000	0.0000	0.0000	4.1863	.2555
20	PRODT20	0.0000	0.0000	0.0000	4.3037	.2555
21	PRODT21	0.0000	0.0000	0.0000	4.3963	.2555
22	PRODT22	0.0000	0.0000	0.0000	4.5037	.2555
23	PRODT23	0.0000	0.0000	0.0000	4.5963	.2555
24	PRODT24	0.0000	0.0000	0.0000	4.7037	.2555
25	PRODT25	0.0000	0.0000	0.0000	4.7963	.2555
26	PRODT26	.0025	.0296	.0102	5.4250	2.3122
27	PRODT27	14.5651	119.1110	1.2137	27.6219	51.4669
28	PRODT28	2.5914	23.5091	.0096	28.2201	10.2171
29	PRODT29	2.2091	19.2468	.0041	28.3950	7.8060
30	PRODT30	2.9964	25.2495	.0100	28.5706	10.5081
31	PRODT31	1.5238	13.6449	.0073	28.7200	5.3846
32	PRODT32	2.0460	16.1149	.0039	28.8450	7.3711
33	PRODT33	1.1724	9.6627	.0066	28.9600	4.1428
34	PRODT34	1.7285	14.0029	.0021	29.0597	6.1076
35	PRODT35	0.0000	0.0000	0.0000	29.1200	89.0656

PROPERTIES OF ORGVAL ITEMS

NO.	IDENTIFICATION	WEIGHT	POLAR I	TRANSVERSE I	CG TO REF	VOLUME
1	ORGVAL1	113.4678	421.7408	1461.2430	12.9176	400.9463
2	ORGVAL2	-52.3258	-149.6640	-540.4681	13.5105	234.6444
3	ORGVAL3	-2.7777	-6.3749	-5799	2.6028	1.7767
4	ORGVAL4	-2.4653	-6.5343	-5799	2.6028	1.7767

PROJECTILE 8 INCH W104

PROPERTIES OF ENTIRE SHELL

WEIGHT= 200.8185 POUNDS

CG TO REF= 27.7413 INCHES

POLAR INERTIA= 1800.5168 POUND INCH SQUARE

TRANSVERSE INERTIA= 15062.7227 POUND INCH SQUARE

OUTER VOLUME= 1270.1004 CURIC INCHES

Section K-2

WEIGHT CALCULATION REQUESTED
PICT REQUESTED
CYBILITY CALCULATION NOT REQUESTED

WEIGHT TYPE

WEIGHT

WEIGHT TYPE

WEIGHT TYPE

WEIGHT TYPE

WEIGHT TYPE

WEIGHT TYPE

DEFECTIVE & IN- WMS

INPUT DATA FOR BODY OF SHELL

NO	IDENTIFICATION	D1	D2	LENGTH	VELOCITY	DEFLECT
1	100001	7.0000	7.0000	1.8000	2.8000	18.0000
2	100002	7.0000	7.0000	1.8000	2.8000	18.0000
3	100003	7.0000	7.0000	1.8000	2.8000	18.0000
4	100004	7.0000	7.0000	1.8000	2.8000	18.0000
5	100005	7.0000	7.0000	1.8000	2.8000	18.0000
6	100006	7.0000	7.0000	1.8000	2.8000	18.0000
7	100007	7.0000	7.0000	1.8000	2.8000	18.0000
8	100008	7.0000	7.0000	1.8000	2.8000	18.0000
9	100009	7.0000	7.0000	1.8000	2.8000	18.0000
10	100010	7.0000	7.0000	1.8000	2.8000	18.0000
11	100011	7.0000	7.0000	1.8000	2.8000	18.0000
12	100012	7.0000	7.0000	1.8000	2.8000	18.0000
13	100013	7.0000	7.0000	1.8000	2.8000	18.0000
14	100014	7.0000	7.0000	1.8000	2.8000	18.0000
15	100015	7.0000	7.0000	1.8000	2.8000	18.0000
16	100016	7.0000	7.0000	1.8000	2.8000	18.0000
17	100017	7.0000	7.0000	1.8000	2.8000	18.0000
18	100018	7.0000	7.0000	1.8000	2.8000	18.0000
19	100019	7.0000	7.0000	1.8000	2.8000	18.0000
20	100020	7.0000	7.0000	1.8000	2.8000	18.0000
21	100021	7.0000	7.0000	1.8000	2.8000	18.0000
22	100022	7.0000	7.0000	1.8000	2.8000	18.0000
23	100023	7.0000	7.0000	1.8000	2.8000	18.0000
24	100024	7.0000	7.0000	1.8000	2.8000	18.0000
25	100025	7.0000	7.0000	1.8000	2.8000	18.0000
26	100026	7.0000	7.0000	1.8000	2.8000	18.0000
27	100027	7.0000	7.0000	1.8000	2.8000	18.0000
28	100028	7.0000	7.0000	1.8000	2.8000	18.0000
29	100029	7.0000	7.0000	1.8000	2.8000	18.0000
30	100030	7.0000	7.0000	1.8000	2.8000	18.0000
31	100031	7.0000	7.0000	1.8000	2.8000	18.0000
32	100032	7.0000	7.0000	1.8000	2.8000	18.0000
33	100033	7.0000	7.0000	1.8000	2.8000	18.0000
34	100034	7.0000	7.0000	1.8000	2.8000	18.0000
35	100035	7.0000	7.0000	1.8000	2.8000	18.0000

INPUT DATA FOR RETAIL ITEM

NO	IDENTIFICATION	D1	D2	LENGTH	VELOCITY	DEFLECT	WAVE
1	100001	7.0000	7.0000	1.8000	2.8000	18.0000	64.1000
2	100002	7.0000	7.0000	1.8000	2.8000	18.0000	64.1000
3	100003	7.0000	7.0000	1.8000	2.8000	18.0000	64.1000

OBJECTIVE & INCH WING
PROPERTIES OF BODY ITEMS

NO.	IDENTIFICATION	WEIGHT	ON AC I	TRANSVERSE I	CG TO REF	VOLUME
1	ABOVY	100.0000	0.0000	0.0000	0.0000	0.0000
2	ABOVY	25.4774	0.0000	0.0000	0.0000	0.0000
3	ABOVY	41.2410	0.0000	0.0000	0.0000	0.0000
4	ABOVY	11.2410	0.0000	0.0000	0.0000	0.0000
5	ABOVY	5.6647	0.0000	0.0000	0.0000	0.0000
6	ABOVY	1.5007	0.0000	0.0000	0.0000	0.0000
7	ABOVY	1.4800	0.0000	0.0000	0.0000	0.0000
8	ABOVY	4.1000	0.0000	0.0000	0.0000	0.0000
9	ABOVY	25.4774	0.0000	0.0000	0.0000	0.0000
10	ABOVY	41.2410	0.0000	0.0000	0.0000	0.0000
11	ABOVY	11.2410	0.0000	0.0000	0.0000	0.0000
12	ABOVY	5.6647	0.0000	0.0000	0.0000	0.0000
13	ABOVY	1.5007	0.0000	0.0000	0.0000	0.0000
14	ABOVY	1.4800	0.0000	0.0000	0.0000	0.0000
15	ABOVY	4.1000	0.0000	0.0000	0.0000	0.0000
16	ABOVY	25.4774	0.0000	0.0000	0.0000	0.0000
17	ABOVY	41.2410	0.0000	0.0000	0.0000	0.0000
18	ABOVY	11.2410	0.0000	0.0000	0.0000	0.0000
19	ABOVY	5.6647	0.0000	0.0000	0.0000	0.0000
20	ABOVY	1.5007	0.0000	0.0000	0.0000	0.0000
21	ABOVY	1.4800	0.0000	0.0000	0.0000	0.0000
22	ABOVY	4.1000	0.0000	0.0000	0.0000	0.0000
23	ABOVY	25.4774	0.0000	0.0000	0.0000	0.0000
24	ABOVY	41.2410	0.0000	0.0000	0.0000	0.0000
25	ABOVY	11.2410	0.0000	0.0000	0.0000	0.0000
26	ABOVY	5.6647	0.0000	0.0000	0.0000	0.0000
27	ABOVY	1.5007	0.0000	0.0000	0.0000	0.0000
28	ABOVY	1.4800	0.0000	0.0000	0.0000	0.0000
29	ABOVY	4.1000	0.0000	0.0000	0.0000	0.0000
30	ABOVY	25.4774	0.0000	0.0000	0.0000	0.0000
31	ABOVY	41.2410	0.0000	0.0000	0.0000	0.0000
32	ABOVY	11.2410	0.0000	0.0000	0.0000	0.0000
33	ABOVY	5.6647	0.0000	0.0000	0.0000	0.0000
34	ABOVY	1.5007	0.0000	0.0000	0.0000	0.0000
35	ABOVY	1.4800	0.0000	0.0000	0.0000	0.0000

PROPERTIES OF NATAL ITEMS

NO.	IDENTIFICATION	WEIGHT	ON AC I	TRANSVERSE I	CG TO REF	VOLUME
1	ABOVY	112.4674	0.0000	0.0000	0.0000	0.0000
2	ABOVY	52.9254	0.0000	0.0000	0.0000	0.0000
3	ABOVY	3.7777	0.0000	0.0000	0.0000	0.0000

* DOG RECTILE 8 INCH WING

PROPERTIES OF FATIGUE SHELL

WEIGHT = 206.6078 POUNDS

CG TO REF = 21.0325 INCHES

POLAR INERTIA = 1824.0678 POUND INCH SQUARE

TRANSVERSE INERTIA = 15678.5157 POUND INCH SQUARE

UNITED VOLUME = 1370.1004 CUBIC INCHES

Section K-3

AERONAUTICS BRANCH
 ENGINEERING SCIENCES LABORATORY

AERODYNAMIC COEFFICIENTS

MACH	CCY	CMA	CMA	CPM	CYP	CG	DIAMETER	AXIAL TRANSVERSE	WEIGHT	TURN	BOOM
							INCHES	LB IN 50	LB IN 50	CAL/TURN	LENGTH
0.010	0.222	1.981	5.572	0.822	0.840	2.478	0.241	3.207	1.070	0.010	1.691-11.523
0.010	0.354	2.000	5.202	0.899	0.783	2.549	0.201	3.243	1.237	0.009	1.783-2.736
0.010	0.393	2.122	5.106	1.057	0.744	2.620	0.180	3.258	1.022	0.009	1.817-1.808
0.010	0.393	2.184	5.106	1.162	0.666	2.690	0.151	3.273	1.099	0.009	1.845-1.264
0.010	0.383	2.269	4.990	1.301	0.572	2.797	0.121	3.288	1.274	0.009	1.888-0.862
0.010	0.361	2.355	4.900	1.385	0.517	2.903	0.102	3.302	1.052	0.009	1.892-0.894
0.010	0.344	2.473	4.921	1.510	0.454	3.044	0.076	3.332	0.804	0.009	1.914-0.367
0.010	0.322	2.609	4.870	1.633	0.439	3.165	0.074	3.332	0.610	0.009	1.935-0.291
0.010	0.297	2.726	4.807	1.707	0.439	3.165	0.074	3.332	0.434	0.009	1.920-0.656
0.010	0.267	2.860	4.747	1.840	0.439	3.165	0.074	3.332	0.260	0.009	1.904-0.887
0.010	0.235	2.930	4.674	1.985	0.439	3.165	0.074	3.332	0.084	0.009	1.888-0.704
0.010	0.197	2.981	4.768	2.077	0.439	3.165	0.074	3.332	0.007	0.007	1.868-0.216
0.010	0.174	2.837	4.703	1.862	0.439	3.165	0.074	3.332	0.007	0.007	1.803-0.713

(PD/VI) IS USED FOR ALL SPIN DEPENDENT COEFFICIENTS

AFROMALLISTICS BRANCH
ENGINEERING SCIENCES LABORATORY

STABILITY ANALYSIS

TOTAL LENGTH		NOSE LENGTH	POSTAL LENGTH	CG (FM NOSE)	DIAMETER INCHES	AXIAL LB IN SQ	TRANSVERSE LB IN SQ	WEIGHT LBS	INST CAL/TURN	ROOM LENGTH
4.315		2.273	.503	3.500	7.990	1928.000	19504.000	700.000	20.000	0.000
MACH	QYDO	SIGMA	RATE	SPIN	W1	W2	L1	L2	L1*	L2*
.01	2.193	.738	5.622	5.3	.54	.08	.000067	-.000248	-.000177	-.000005
.05	2.145	.731	5.423	314.1	72.25	5.02	.000103	-.000255	-.000142	-.000010
.10	1.993	.706	4.799	621.4	42.39	7.31	.000272	-.000327	-.000059	-.000035
.20	1.826	.673	4.108	474.1	44.76	9.15	.000331	-.000353	-.000040	-.000019
.35	1.691	.639	3.543	500.4	48.37	10.65	.000500	-.000432	.000065	.000003
.50	1.783	.663	3.931	524.8	51.65	10.47	.000574	-.000373	.000192	.000009
.75	1.817	.670	4.069	553.1	54.48	10.75	.000530	-.000300	.000201	.000029
1.10	1.845	.677	4.187	579.4	57.29	11.05	.000451	-.000212	.000184	.000054
1.20	1.808	.686	4.365	632.1	62.84	11.71	.000368	-.000109	.000167	.000021
1.35	1.892	.687	4.381	711.1	70.72	13.14	.000298	-.000040	.000158	.000100
1.50	1.914	.691	4.475	796.1	78.80	14.39	.000217	.000038	.000149	.000125
1.75	1.935	.695	4.559	921.8	92.14	16.58	.000205	.000087	.000156	.000136
2.00	1.928	.694	4.530	1053.5	105.22	19.03	.000213	.000095	.000164	.000144
2.50	1.984	.704	4.764	1316.9	132.35	22.96	.000221	.000105	.000172	.000153
3.00	2.014	.710	4.893	1580.3	159.33	27.04	.000224	.000110	.000176	.000158
4.00	2.001	.707	4.832	2107.1	212.13	36.37	.000220	.000108	.000172	.000157
5.00	2.003	.708	4.841	2633.8	245.21	45.41	.000216	.000104	.000168	.000152

Section K-4

THE FOLLOWING IS INPUT DATA FOR IDENTIFY NO.

ACFT	PCON	NTWST	KT	W	NUAT	JN	AJD	FAITE	ESPA	TA	NATUS	ACOM
WARR	1	2	1	2	2	0	1	0	2	0	0	0

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THE FOLLOWING TAG IS INPUT DATA FOR TRAJECTORY NO. 1

AGRY	NTHOST	M	NUNIT	JN	AJR	IATYC	ISPIN	TA	NATMS	NCDN
1	7	2	2	R	1	0	2	0	n	C

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Page 2 of 2

END OF TRAJECTORY NO.

1000

54100433F 801 412-ADUHHH112

[illegible]

[illegible]

ENGINEERING SCIENCE LABORATORY
EXPERIMENTAL PHYSICS DEPARTMENT

NO.	SUMMARY OF TRAJECTORIES									
	INIT TIME	INIT ANGLE	INIT COIN	INIT ELEV	INIT RANGE	INIT ALT	INIT VEL	FINAL TIME	FINAL ANGLE	FINAL ALT
	INIT TIME	INIT ANGLE	INIT COIN	INIT ELEV	INIT RANGE	INIT ALT	INIT VEL	FINAL TIME	FINAL ANGLE	FINAL ALT
	INIT TIME	INIT ANGLE	INIT COIN	INIT ELEV	INIT RANGE	INIT ALT	INIT VEL	FINAL TIME	FINAL ANGLE	FINAL ALT
1	0.000	28.000	1148.797	0.000	0.000	0.000	716.240	0.000	28.000	0.000
	0.000	-17.010	1100.797	0.000	15140.069	0.000	117.211	0.000	-17.010	0.000
	0.000	200.000	200.000	0.000	0.000	0.000	7.500	0.000	200.000	0.000

Section K-5

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PRECEDING PAGE BLANK NOT FILLED

PROJECTILE A INCH M106

3.5433
155.0000
300.0000
50500.0000
12.6500
9.0000
17.0000
0.0000

PROJECTILE B INCH M106

3.5433
155.0000
300.0000
50500.0000
12.6500
9.0000
17.0000
0.0000

D = CALIBER
XL = LENGTH OF PROJECTILE TRAVEL
VA = CHARGE VOLUME
P = MAX PRESSURE
M = PROJECTILE WEIGHT
C = PROPellant WEIGHT
K = PROPellant TYPE
V = Muzzle Velocity

INTERIOR BALLISTICS
PROJECTILE 8 INCH M16A

D = 3.5433
KL = 155.0000
V0 = 100.0000
P = 10000.00
XM = 12.65
C = 0.00
K = 17
K = 0.00

FOR PROPELLANT M17

F = .43600E+07, GFC = .10290E+04
TRAVEL AT MUZZLE = 10.505
TRAVEL AT BURST = 4.217

VELOCITY AT MUZZLE EQUALS 3073.07 FT/SEC

INTERIOR BALLISTICS
PROJECTILE 8 INCH M10A

O = 3.5433
XL = 155.0000
VB = 108.0000
P = 4500.00
SM = 12.65
C = 0.00
K = 17
V = 0.00

C/V0 IS GREATER THAN 0.0271. HENCE PROPELLANT MAY NOT BURN SMOOTHLY
FOR PROPELLANT M1

F = 43600E+07, SEC = .74220F+04
TRAVEL AT MUZZLE = 11.658
TRAVEL AT BURNOUT = 6.508

VELOCITY AT MUZZLE EQUALS 4054.62 FT/SEC

Section K-6

LA MOD2 R IN PROCTYLE	0.000	0.000	37
17	1000.000	0.000	
5905			
0.0000	878.0000	897.0000	1118.0000
2232.0000	3340.0000	5580.0000	10044.0000
LA MIN FILE			
END REGIN			
0.000	1.787	5.408	8.740
24.741	28.906	33.335	37.663
53.598	58.845	63.919	69.605
85.576	89.201	92.974	96.286
119.568	124.115	129.781	136.082
167.788	174.720	180.600	
28.000	1658.519	1658.798	257.835
0.4	1.4	.5	0.0
NUMBER OF RADII IN FIRST LINEAR REGION IS	2.		
000.5	1236.3	9952.7	0.0
NUMBER OF RADII IN LOGARITHMIC REGION IS	100.		
0.0	989.2	2388.7	0.0
NUMBER OF RADII IN SECOND LINEAR REGION IS	100.		
28.000	47.000		
888.9	8277.8	12352.0	0.0
6.096	47.000		
82.6	765.2	1146.6	0.0

LA MOD2 A IN PROJECTILE	0.000	17
72	1000.000	
25905		
6.0000	678.0000	887.0000 1116.0000 1319.0000 1562.0000 1786.0000
2232.0000	3348.0000	5580.000010044.0000
2		
LA WIN PILF		
END BEGIN		
0.000	1.787	5.205
8.748	12.880	17.067
20.548		
24.741	28.990	33.135
37.603	43.132	47.405
49.483		
53.598	58.445	63.919
69.405	75.099	79.455
82.575		
85.576	89.201	96.974
94.486	100.748	107.170
113.567		
119.568	124.115	129.781
136.082	144.639	152.591
159.907		
167.788	176.320	180.000
25.000	1650.419	1856.330
257.825		
0.9	2.3	1.0
0.0		
NUMBER OF RADII IN FIRST LINEAR REGION IS	2.	
0.0		
NUMBER OF RADII IN LOGARITHMIC REGION IS	100.	
0.0		
NUMBER OF RADII IN SECOND LINEAR REGION IS	100.	
0.0		
25.000	42.080	
943.0	7844.8	11016.6
0.0		
7.620	42.080	
87.7	728.8	1023.5
0.0		

A MOD. 2. B IN PER FETILE		A MOD. 2. B IN PER FETILE	
002122	47.000	0.000	0.000
1000.000	0.000	1.250	2150.0000
1.0000	2.5000	0.000	2364.6470
0.0000	0.0000	5.0000	2575.0000
2.5000	7.5000	10.0000	2575.0000
1.0000	0.0000	15.0000	2725.0000
1.0000	12.5000	20.0000	2850.0000
1.0000	17.5000	25.0000	3100.0000
1.0000	22.5000	30.0000	3275.0000
1.0000	27.5000	35.0000	3450.0000
1.0000	32.5000	40.0000	3625.0000
1.0000	37.5000	45.0000	3800.0000
1.0000	42.5000	50.0000	4000.0000
1.0000	47.5000	55.0000	4200.0000
1.0000	52.5000	60.0000	4400.0000
1.0000	57.5000	65.0000	4600.0000
1.0000	62.5000	70.0000	4800.0000
1.0000	67.5000	75.0000	5000.0000
1.0000	72.5000	80.0000	5200.0000
1.0000	77.5000	85.0000	5400.0000
1.0000	82.5000	90.0000	5600.0000
1.0000	87.5000	95.0000	5800.0000
1.0000	92.5000	100.0000	6000.0000
1.0000	97.5000	105.0000	6200.0000
1.0000	102.5000	110.0000	6400.0000
1.0000	107.5000	115.0000	6600.0000
1.0000	112.5000	120.0000	6800.0000
1.0000	117.5000	125.0000	7000.0000
1.0000	122.5000	130.0000	7200.0000
1.0000	127.5000	135.0000	7400.0000
1.0000	132.5000	140.0000	7600.0000
1.0000	137.5000	145.0000	7800.0000
1.0000	142.5000	150.0000	8000.0000
1.0000	147.5000	155.0000	8200.0000
1.0000	152.5000	160.0000	8400.0000
1.0000	157.5000	165.0000	8600.0000
1.0000	162.5000	170.0000	8800.0000
1.0000	167.5000	175.0000	9000.0000
1.0000	172.5000	180.0000	9200.0000
1.0000	177.5000	185.0000	9400.0000
1.0000	182.5000	190.0000	9600.0000
1.0000	187.5000	195.0000	9800.0000
1.0000	192.5000	200.0000	10000.0000
1.0000	197.5000	205.0000	10200.0000
1.0000	202.5000	210.0000	10400.0000
1.0000	207.5000	215.0000	10600.0000
1.0000	212.5000	220.0000	10800.0000
1.0000	217.5000	225.0000	11000.0000
1.0000	222.5000	230.0000	11200.0000
1.0000	227.5000	235.0000	11400.0000
1.0000	232.5000	240.0000	11600.0000
1.0000	237.5000	245.0000	11800.0000
1.0000	242.5000	250.0000	12000.0000
1.0000	247.5000	255.0000	12200.0000
1.0000	252.5000	260.0000	12400.0000
1.0000	257.5000	265.0000	12600.0000
1.0000	262.5000	270.0000	12800.0000
1.0000	267.5000	275.0000	13000.0000
1.0000	272.5000	280.0000	13200.0000
1.0000	277.5000	285.0000	13400.0000
1.0000	282.5000	290.0000	13600.0000
1.0000	287.5000	295.0000	13800.0000
1.0000	292.5000	300.0000	14000.0000
1.0000	297.5000	305.0000	14200.0000
1.0000	302.5000	310.0000	14400.0000
1.0000	307.5000	315.0000	14600.0000
1.0000	312.5000	320.0000	14800.0000
1.0000	317.5000	325.0000	15000.0000
1.0000	322.5000	330.0000	15200.0000
1.0000	327.5000	335.0000	15400.0000
1.0000	332.5000	340.0000	15600.0000
1.0000	337.5000	345.0000	15800.0000
1.0000	342.5000	350	

87,5000	92,5000	98,0000	4500,0000	4425,0000	4500,0000	4500,0000	15,0000
1,530	1,670	3,160	7,1430	17,4330	17,4530	29,0000	29,0000
46,5070	55,2000	87,4300	120,1200	102,1030	300,1600	651,3330	
1213,2130							
417,2700	9,4870	85,2040	28,4510	18,9740	29,4510	37,9480	
9,4870	37,9480	8,4870	8,4870	8,4870	8,4870	37,9480	
9,4870							
97,5000	97,5000	95,0000	4425,0000	3050,0000	4350,0000	22,0000	
1,1030	1,4070	3,4760	6,6070	13,1430	18,0160	20,0000	
30,6560	41,8120	51,3720	65,0720	77,6700	84,1630	91,3300	
108,0570	129,1200	170,3330	243,3700	420,2090	610,0000	1303,7230	
386,6870							
369,6870	47,1040	37,9170	9,4790	47,3960	10,9580	9,4790	
47,3960	75,4330	9,4790	10,9580	9,4790	9,4790	9,4790	
20,4300	6,4790	20,4300	10,9580	10,9580	56,8750	47,3960	
20,4300							
97,5000	102,5000	100,0000	3050,0000	3425,0000	3350,0000	24,0000	
1,1030	1,5300	3,5110	6,7980	6,7980	11,4900	17,3200	
22,0170	30,3770	43,5190	66,0970	70,4230	87,3360	95,0000	
100,2740	120,4340	170,1110	225,0560	267,1460	350,1780	446,2770	
750,0330	1485,7040	4115,7340					
767,6560	123,1770	132,7750	104,1000	9,3940	37,9930	37,9930	
20,3950	50,7490	47,3910	37,9930	20,3950	10,9960	37,9930	
37,9930	10,9960	85,3040	37,9930	47,3910	85,3040	10,9960	
50,7490	66,1070	75,7060					
102,5000	107,5000	105,0000	3425,0000	3200,0000	3500,0000	14,0000	
2,220	1,4020	2,6430	7,1260	9,8110	11,7330	15,7060	
20,4370	30,6400	54,2550	77,6590	192,1020	471,4710	500,5110	
265,2540	9,4500	9,4500	9,4500	9,4500	20,4370	9,4500	
9,4500	110,0000	3200,0000	2725,0000	2900,0000	7,0000		
107,5000	112,5000	110,0000	3200,0000	2725,0000	2900,0000	7,0000	
123,1770	9,4500	10,9570	37,9540	37,9540	54,2550	200,2010	
112,5000	117,5000	115,0000	2725,0000	2550,0000	2550,0000	7,0000	
85,1320	1,3240	11,2190	20,5000	70,0000	241,2400	711,1640	
117,5000	122,5000	120,0000	2550,0000	2650,0000	2550,0000	7,0000	
50,6370	6,4300	9,4700	9,4700	11,2010	25,4070	327,3270	
122,5000	127,5000	125,0000	2650,0000	2750,0000	2750,0000	7,0000	
151,6000	18,6040	9,5740	9,5740	9,5740	9,5740	210,2100	
127,5000	132,5000	130,0000	2750,0000	2825,0000	2750,0000	13,0000	
35,2760	97,4100	131,1320	150,1590	290,2970	426,4260	31,4320	
600,7590	66,5100	9,4200	20,3500	20,3500	9,4200	9,4200	
132,5000	137,5000	135,0000	2825,0000	2825,0000	2825,0000	9,0000	
296,2970	500,5110	611,0250	54,7730	10,4000	16,6160	20,3210	
611,0250	54,7730	9,1130	9,1130	9,1130	9,1130	18,2260	
6,1130	6,1130						
137,5000	142,5000	140,0000	2825,0000	2625,0000	2750,0000	10,0000	
2,7430	2,7430	102,1020	7,6370	10,2400	21,0540	34,8740	
89,0410	90,1400	30,4210	7,3040	7,0040	15,7400	7,0040	
543,7370	30,4210	7,0040					
142,5000	147,5000	145,0000	2625,0000	2525,0000	2500,0000	4,0000	
552,1300	32,4710	10,7100	13,1610				
147,5000	152,5000	150,0000	2525,0000	2550,0000	2550,0000	5,0000	
345,9760	21,4740	16,2200	2,5790	19,2000	5,4060	5,4060	
152,5000	157,5000	155,0000	2500,0000	2600,0000	2550,0000	8,0000	
2,4330	1,4740	3,1030	6,7060	12,2300	32,4530	136,1350	

Section K-7

PROJECTILE A INCH W100

3.433

195.0000

300.0000

4500.0000

12.6500

9.5000

17.0000

0.0000

D = CALIBER
XL = LENGTH OF PROJECTILE TRAVEL

VO = CHARGED VOLUME

P = MAX. PRESSURE

WM = PROJECTILE WEIGHT

C = PROPELLANT WEIGHT

K = PROPELLANT TYPE

V = Muzzle VELOCITY

INTERIOR BALLISTICS
PROJECTILE 8 INCH M104

D = 3.5431
XL = 155.0000
V0 = 100.0000
P = 50.00.00
AM = 12.65
C = 1.58
K = 17
V = 0.00

C/V0 IS GREATER THAN 0.0271. HENCE PROPELLANT MAY NOT BURN SMOOTHLY
FOR PROPELLANT #17

F = .43680E+07. SEC = .34220E+04
TRAVEL AT MUZZLE = 11.141
TRAVEL AT BURNOUT = 5.330

VELOCITY AT MUZZLE EQUALS 4071.20 FT/SEC

Section K-8

INPUT DATA									
.01000	.28700	40000.00000	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000
24.00000	7415.70000	7415.70000	7415.70000	7415.70000	7415.70000	7415.70000	7415.70000	7415.70000	7415.70000
.00100	.00100	1000.00000	1000.00000	1000.00000	1000.00000	1000.00000	1000.00000	1000.00000	1000.00000
4.50000	0.00000	1000.00000	1000.00000	1000.00000	1000.00000	1000.00000	1000.00000	1000.00000	1000.00000
77.00000									
OMAX1	TOP	TPI	MAX	MAX	MAX	MAX	MAX	MAX	MAX
5000.00000	.08510	.11523	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000
ORCLP	ORCLP	ORCLC	ORCLC	ORCLC	ORCLC	ORCLC	ORCLC	ORCLC	ORCLC
4.44473	110.02444	.20827	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000
ORCP	ORCLC	ORCLC	ORCLC	ORCLC	ORCLC	ORCLC	ORCLC	ORCLC	ORCLC
3.34555	.15946	5.84620	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000
TOP	TOP	TOP	TOP	TOP	TOP	TOP	TOP	TOP	TOP
1.00100	143.01900	4444.00324	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000	100000.00000

5.135	0.75	0.617	5	4.167	4.056	4.25	5.266
8.64	1.25	1.1147	1.075	1.0944	1.5	1.737	1.3666
1.75	1.6147	1.5946	2	1.8647	1.8646	2.25	2.1147
2.0246	2.5	2.3647	2.3466	2.75	2.6147	2.5966	3
2.8247	2.8246	1.25	3.1147	3.0944	3.5	3.347	3.3466
3.75	3.6147	3.5966	4	3.8647	3.8466	4.25	4.1147
4.0946	4.5	4.3647	4.3466	4.75	4.6147	4.5966	5
4.8447	4.8466	5.25	5.1147	5.0944	5.5	5.347	5.3466
5.75	5.6147	5.5966	6	5.8647	5.8466	5.8647	5.8466
2.5	5.625	1.625	4.3990	4.5	4.5	2.5	82100
5	7.25	1.125	112500	4.5	4.5	1.625	152000
5.5	9	4.25	197100	5	9.5	4.75	231100
5.5	10	4.75	244400	6	11.425	5.875	351300
26.0000	16.5000	7635.700032520.0000	2780	10.3600	2460	.0578	
77.0000	8.0010	8020	0.001	2.0000	5000.0000	11.2500	
77.0000	8.0010	8020	2.0000	60.0000	1.5000	45.0000	
77.0000	1.0000	1.0000	1200.0000	0	1	0	
26.0000	16.5000	7635.700032520.0000	2780	10.3600	2460	.0578	
77.0000	8.0010	8020	0.001	2.0000	5000.0000	11.2500	
77.0000	8.0010	8020	2.0000	60.0000	1.5000	45.0000	
77.0000	1.0000	1.0000	1200.0000	0	1	0	
26.0000	16.5000	7635.700032520.0000	2780	10.3600	2460	.0578	
77.0000	8.0010	8020	0.001	2.0000	5000.0000	11.2500	
77.0000	8.0010	8020	2.0000	60.0000	1.5000	45.0000	
77.0000	1.0000	1.0000	1200.0000	0	1	0	

Section K-9

IN 443 SPINER ALL DLF RHY

1.0100	1.6000	1.2000	1.5000	1.8000	1.1000	1.4000	1.3000
1.2000	1.3500	1.5000	1.7500	2.0000	1.2500	1.5000	1.7500
5.0000	5.7000	6.4000	7.1000	7.8000	5.0000	5.7000	6.4000
0.0000	57.3000						

1.7022	1.7044	1.7079	1.7105	1.7130	1.7155	1.7180	1.7205
2.3584	2.4447	2.5490	2.7124	2.8244	2.9584	3.0642	2.9974
2.0313							

0.0100	0.6000	0.8000	0.9000	0.9500	1.0000	1.0500	1.1000
1.2000	1.3500	1.5000	1.7500	2.0000	2.5000	3.0000	4.0000
5.0000	57.3000						
0.0000	57.3000						
5.1000	5.9000	7.4000	9.2000	11.4000	14.0000	15.4000	15.5671
15.6014	15.7054	16.0736	16.2517	16.4750	16.7040	16.9221	16.7080
16.5040							
5.1000	5.9000	7.4000	9.2000	11.4000	14.0000	15.4000	15.5671
15.6014	15.7054	16.0736	16.2517	16.4750	16.7040	16.9221	16.7080
16.5040							

0.0100	0.6000	0.8000	0.9000	0.9500	1.0000	1.0500	1.1000
1.2000	1.3500	1.5000	1.7500	2.0000	2.5000	3.0000	4.0000
5.0000	57.3000						
0.0000	57.3000						
1.9617	1.8894	1.7363	1.6952	1.7337	1.1884	1.7500	1.4604
1.5521	1.6647	1.8054	1.9584	2.0654	2.2092	2.2744	2.2504
2.2150							
1.9617	1.8894	1.7363	1.6952	1.7337	1.1884	1.7500	1.4604
1.5521	1.6647	1.8054	1.9584	2.0654	2.2092	2.2744	2.2504
2.2150							

0.0100	0.6000	0.8000	0.9000	0.9500	1.0000	1.0500	1.1000
1.2000	1.3500	1.5000	1.7500	2.0000	2.5000	3.0000	4.0000
5.0000	57.3000						
0.0000	57.3000						

IN 407 SPINNER ALL DATA ONLY

MISSILE INPUT DATA FOR SIX DEGREE OF FREEDOM TRAJECTORY

ROCKETED DOCKET DATA

LONGITUDE DEGREES ** 276.000
LATITUDE DEGREES ** 0.000
LATERAL ORIENTATION DEGREES ** 0.000
QUADRANT ELEVATION DEGREES ** 11.250

BURNING RATE LBS/SEC ** 0.0000
SPECIFIC IMPULSE LBS-SEC/LB ** 0.000
NOSE DIAMETER INCHES ** 0.000
THRUST MULTIPLIER ** 0.000

AXIAL MISSILE VELOCITY FT/SEC ** 875.100
MISSILE SPIN RATE RADIANS/SEC ** 632.610
MISSILE PITCH RATE RADIANS/SEC ** 0.0000
MISSILE YAW RATE RADIANS/SEC ** 0.0000

AXIAL THRUST MALALIGNMENT ANGLE DEGREES ** 0.000
LATERAL THRUST MALALIGNMENT ANGLE DEGREES ** 0.000
THRUST MALALIGNMENT DISTANCE INCHES ** 0.000
THRUST MALALIGNMENT DISTANCE INCHES ** 0.000
THRUST MALALIGNMENT DISTANCE INCHES ** 0.000
TORQUE MOMENT INCH-LBS ** 0.000
SEPARATION THRUST LBS ** 0.000

DIAMETER INCHES ** 6.092
WEIGHT LBS ** 103.400
CENTER OF GRAVITY FROM NOSE INCHES ** 22.478
AXIAL MOMENT OF INERTIA LBS-SQ. IN. ** 515.000
TRANSVERSE MOMENT OF INERTIA LBS-SQ. IN. ** 6356.000

DENSITY MULTIPLIER ** 1.00000
V₀ MISSILE FT/SEC ** 0.0000
FINAL CENTER OF GRAVITY FROM NOSE INCHES ** 22.478
FINAL TRANSVERSE MOMENT OF INERTIA LBS-SQ. IN. ** 515.000
FINAL TRANSVERSE MOMENT OF INERTIA LBS-SQ. IN. ** 6356.000

CROSS WIND IF CONSTANT FT/SEC ** 0.000
CUT OFF ALTITUDE FEET ** 328.000

DANGF WIND IF CONSTANT FT/SEC ** 0.000
VERTICAL WIND IF CONSTANT FT/SEC ** 0.000

	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7
FORM FACTOR	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PRINT-OUT RATE	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ITERATION RATE	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
PHASE (C.O.) TIME	0.000	0.000	0.000	0.000	0.000	0.000	0.000

RANGE, ALTITUDE AND REFLECTION ARE IN METERS

RAILISTIC COEFFICIENTS AND FORCE CENTERS

NORMAL FORCE COEFFICIENTS

MACH NOS.	0.165	0.400	0.600	0.800	0.900	1.000	1.050	1.100
ANGLES	1.200	1.350	1.500	1.750	2.000	2.500	3.000	4.000
OF	5.000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
ATTACK								
0.00	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
57.30	-0.0023	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	2.3564	2.4447	2.5494	2.7174	2.8246	2.9583	3.1242	3.3371
	2.9717	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
-0.00	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
-0.00	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
-0.00	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000

YAW DAMPING COEFFICIENTS

MACH NOS.	0.165	0.400	0.600	0.800	0.900	1.000	1.050	1.100
ANGLES	1.200	1.350	1.500	1.750	2.000	2.500	3.000	4.000
OF	5.000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
ATTACK								
0.00	5.1865	5.9850	7.4480	9.2012	11.4606	14.8824	15.4572	15.5473
	15.1865	15.7950	16.0000	16.2517	16.4709	16.7080	16.8671	16.9466
	15.2049	15.0000	14.0000	13.0000	12.0000	11.0000	10.0000	9.0000
57.30	5.1865	5.9850	7.4480	9.2012	11.4606	14.8824	15.4572	15.5473
	15.1865	15.7950	16.0000	16.2517	16.4709	16.7080	16.8671	16.9466
	15.2049	15.0000	14.0000	13.0000	12.0000	11.0000	10.0000	9.0000
-0.00	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
-0.00	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
-0.00	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000

SPIN REFLECTION COEFFICIENTS

[illegible]

AXIAL DEAC COEFFICIENTS

210

SIX-DEGREE OF FREEDOM MISSILE TRAJECTORY

TIME	PHASE SEVEN				PHASE EIGHT				PHASE NINE				PHASE TEN				PHASE ELEVEN			
	RANGE VZ-FRONT COLL-CODE	DEFLECTION VZ-FRONT PITCH-DATE	ALTITUDE VZ-FRONT YAW-DATE	VE-MISSILE MASS PC1	VE-MISSILE THRU THETA	VZ-MISSILE MASS PC1	VZ-MISSILE THRU THETA	VZ-MISSILE TOTAL DRAG	VZ-MISSILE TOTAL DRAG	VZ-MISSILE TOTAL DRAG	VZ-MISSILE TOTAL DRAG	VZ-MISSILE TOTAL DRAG	VZ-MISSILE TOTAL DRAG	VZ-MISSILE TOTAL DRAG	VZ-MISSILE TOTAL DRAG	VZ-MISSILE TOTAL DRAG	VZ-MISSILE TOTAL DRAG	VZ-MISSILE TOTAL DRAG	VZ-MISSILE TOTAL DRAG	
0.0000	0. 05434792E+01 05434792E+01	0. 0. 0.	0. 0. 0.	975.100 3.21377 0.000	0.000 0.000 0.000	975.100 3.21377 0.000	0.000 0.000 0.000	0.000 0.000 0.000	0.000 0.000 0.000	0.000 0.000 0.000	0.000 0.000 0.000	0.000 0.000 0.000	0.000 0.000 0.000	0.000 0.000 0.000	0.000 0.000 0.000	0.000 0.000 0.000	0.000 0.000 0.000	0.000 0.000 0.000	0.000 0.000 0.000	
1.0112	05294525E+01 05294525E+01	-0.61975072E-01 -0.61975072E-01	05294525E+01 05294525E+01	957.343 3.21377 0.000	-24.004 0.000 0.000	957.343 3.21377 0.000	-24.004 0.000 0.000	36.474 0.000 0.000	36.474 0.000 0.000	36.474 0.000 0.000	36.474 0.000 0.000	36.474 0.000 0.000	36.474 0.000 0.000	36.474 0.000 0.000	36.474 0.000 0.000	36.474 0.000 0.000	36.474 0.000 0.000	36.474 0.000 0.000	36.474 0.000 0.000	
2.0401	05309525E+01 05309525E+01	-0.61975072E-01 -0.61975072E-01	05309525E+01 05309525E+01	941.111 3.21377 0.000	-34.446 0.000 0.000	941.111 3.21377 0.000	-34.446 0.000 0.000	4.216 0.000 0.000	4.216 0.000 0.000	4.216 0.000 0.000	4.216 0.000 0.000	4.216 0.000 0.000	4.216 0.000 0.000	4.216 0.000 0.000	4.216 0.000 0.000	4.216 0.000 0.000	4.216 0.000 0.000	4.216 0.000 0.000	4.216 0.000 0.000	
3.0728	05313380E+01 05313380E+01	-0.58242470E-01 -0.58242470E-01	05313380E+01 05313380E+01	926.056 3.21377 0.000	5.000 0.000 0.000	926.056 3.21377 0.000	5.000 0.000 0.000	12.093 0.000 0.000	12.093 0.000 0.000	12.093 0.000 0.000	12.093 0.000 0.000	12.093 0.000 0.000	12.093 0.000 0.000	12.093 0.000 0.000	12.093 0.000 0.000	12.093 0.000 0.000	12.093 0.000 0.000	12.093 0.000 0.000	12.093 0.000 0.000	
4.0808	05316040E+01 05316040E+01	-0.57863104E-01 -0.57863104E-01	05316040E+01 05316040E+01	914.442 3.21377 0.000	20.766 0.000 0.000	914.442 3.21377 0.000	20.766 0.000 0.000	30.512 0.000 0.000	30.512 0.000 0.000	30.512 0.000 0.000	30.512 0.000 0.000	30.512 0.000 0.000	30.512 0.000 0.000	30.512 0.000 0.000	30.512 0.000 0.000	30.512 0.000 0.000	30.512 0.000 0.000	30.512 0.000 0.000	30.512 0.000 0.000	
5.0821	05318447E+01 05318447E+01	-0.57863104E-01 -0.57863104E-01	05318447E+01 05318447E+01	903.856 3.21377 0.000	-12.012 0.000 0.000	903.856 3.21377 0.000	-12.012 0.000 0.000	16.419 0.000 0.000	16.419 0.000 0.000	16.419 0.000 0.000	16.419 0.000 0.000	16.419 0.000 0.000	16.419 0.000 0.000	16.419 0.000 0.000	16.419 0.000 0.000	16.419 0.000 0.000	16.419 0.000 0.000	16.419 0.000 0.000	16.419 0.000 0.000	
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9.2829	05330906E+01 05330906E+01	-0.57863104E-01 -0.57863104E-01	05330906E+01 05330906E+01	873.890 3.21377 0.000	-32.259 0.000 0.000	873.890 3.21377 0.000	-32.259 0.000 0.000	7.095 0.000 0.000	7.095 0.000 0.000	7.095 0.000 0.000	7.095 0.000 0.000	7.095 0.000 0.000	7.095 0.000 0.000	7.095 0.000 0.000	7.095 0.000 0.000	7.095 0.000 0.000	7.095 0.000 0.000	7.095 0.000 0.000	7.095 0.000 0.000	

RANGE IN METERS = 2599.12
 MAXIMUM ALTITUDE IN METERS = 164.29
 END OF TRAJECTORY
 SUMMARY OF DESTINANT DATA
 DATE NO. TYPE C.F. MAX RANGE MAX ALT DEFLECTION IMPACT VEL TIME IN AIR TIME T-F-TA

Section K-10

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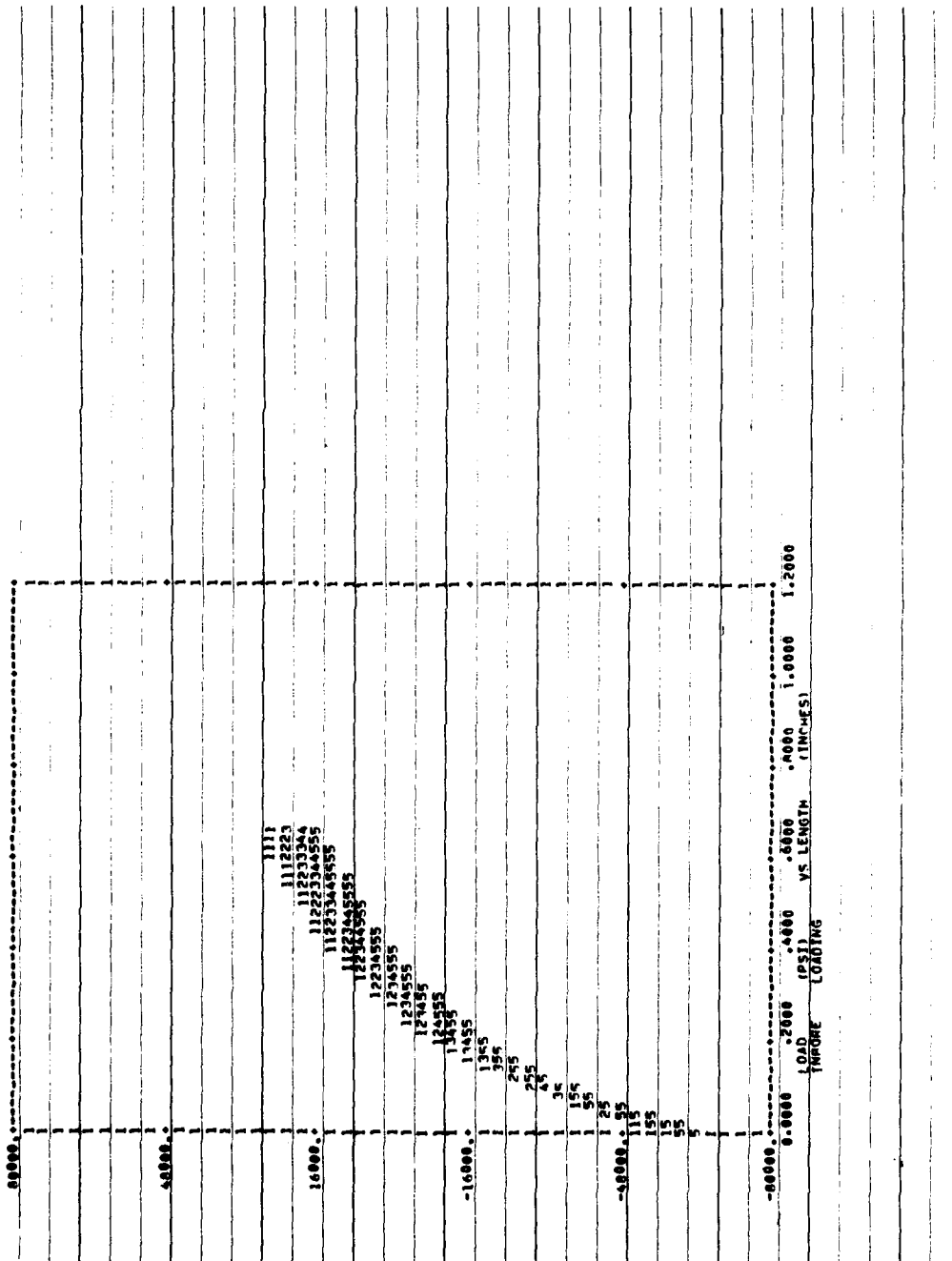
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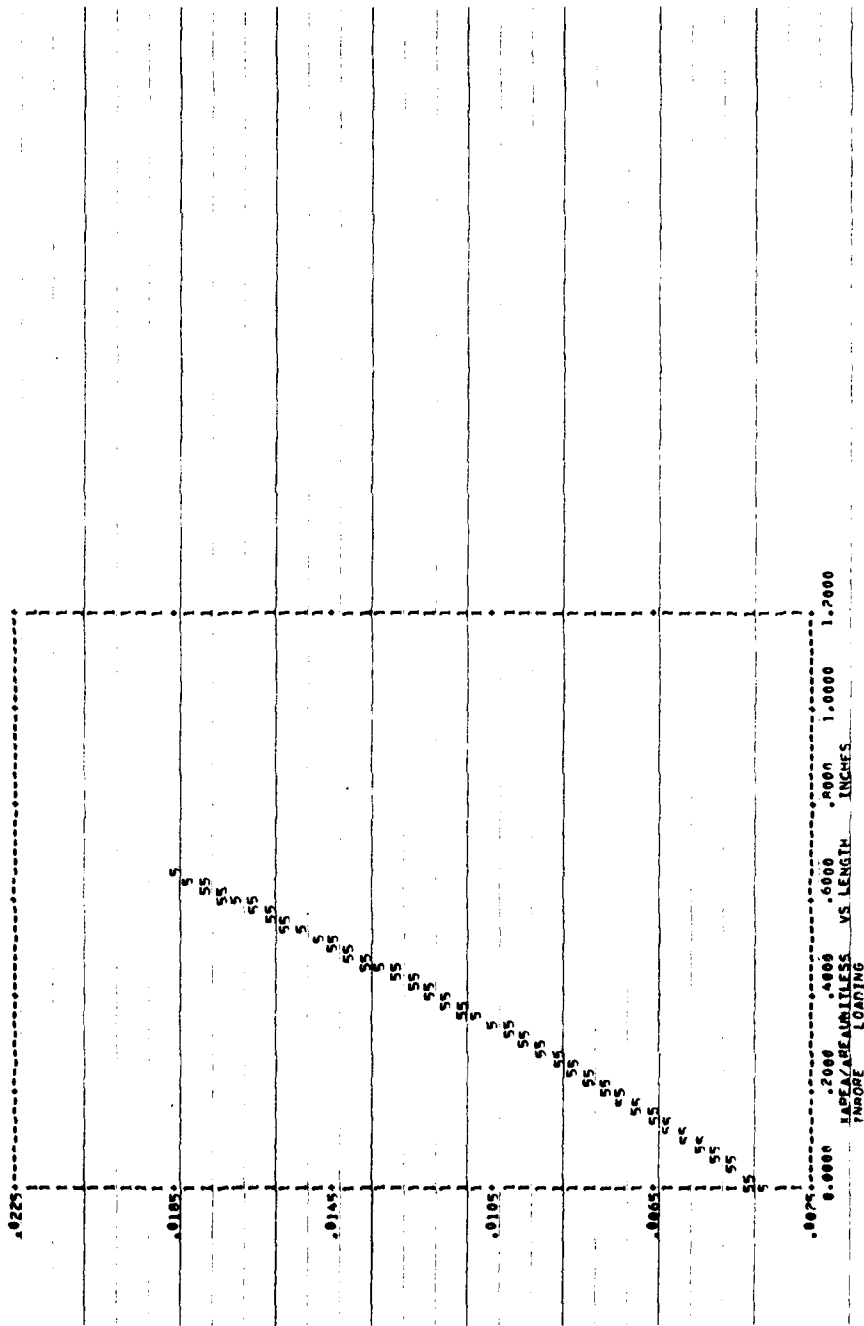
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-411.097248	548.454149	493.481829					
ROE AREA= .0404 IN-2 STRESS=	6646.0025	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0107 IN-2	FRICITION COEF=	.0082 106
-411.078238	545.089075	498.388838					
ROE AREA= .0404 IN-2 STRESS=	6864.6795	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0107 IN-2	FRICITION COEF=	.0082 107
-412.047122	571.759066	503.295311					
ROE AREA= .0404 IN-2 STRESS=	7240.3770	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0108 IN-2	FRICITION COEF=	.0082 108
-413.091852	578.464571	508.203501					
ROE AREA= .0404 IN-2 STRESS=	7563.1432	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0109 IN-2	FRICITION COEF=	.0082 109
-415.526344	585.286948	513.112455					
ROE AREA= .0404 IN-2 STRESS=	8147.843095	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0110 IN-2	FRICITION COEF=	.0082 110
-415.340525	591.983959	518.027057					
ROE AREA= .0404 IN-2 STRESS=	8140.0700	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0110 IN-2	FRICITION COEF=	.0082 111
-416.140322	598.798777	522.034933					
ROE AREA= .0404 IN-2 STRESS=	8454.3220	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0111 IN-2	FRICITION COEF=	.0082 112
-416.027461	605.650981	527.848048					
ROE AREA= .0404 IN-2 STRESS=	8722.762757	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0112 IN-2	FRICITION COEF=	.0082 113
-417.090467	612.541858	532.762757					
ROE AREA= .0404 IN-2 STRESS=	9074.6252	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0113 IN-2	FRICITION COEF=	.0082 114
-418.040667	619.469505	537.677815					
ROE AREA= .0404 IN-2 STRESS=	9720.7422	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0113 IN-2	FRICITION COEF=	.0082 115
-419.174188	626.436825	542.594377					
ROE AREA= .0404 IN-2 STRESS=	9604.2787	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0114 IN-2	FRICITION COEF=	.0082 116
-419.090955	633.443532	547.511999					
ROE AREA= .0404 IN-2 STRESS=	9845.2154	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0115 IN-2	FRICITION COEF=	.0082 117
-420.598095	640.490145	552.430435					
ROE AREA= .0404 IN-2 STRESS=	10163.0121	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0116 IN-2	FRICITION COEF=	.0082 118
-421.271934	647.572196	557.350241					
ROE AREA= .0404 IN-2 STRESS=	10470.5062	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0117 IN-2	FRICITION COEF=	.0082 119
-421.939908	654.705223	562.270773					
ROE AREA= .0404 IN-2 STRESS=	10712.9419	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0117 IN-2	FRICITION COEF=	.0082 120
-422.589813	661.874776	567.192184					
ROE AREA= .0404 IN-2 STRESS=	10943.9507	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0118 IN-2	FRICITION COEF=	.0082 121
-423.228986	669.046411	572.114431					
ROE AREA= .0404 IN-2 STRESS=	11262.5715	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0119 IN-2	FRICITION COEF=	.0082 122
-423.935603	676.360697	577.037468					
ROE AREA= .0404 IN-2 STRESS=	11518.8404	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0119 IN-2	FRICITION COEF=	.0082 123
-424.433028	683.632212	582.962561					
ROE AREA= .0404 IN-2 STRESS=	11782.7927	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0120 IN-2	FRICITION COEF=	.0082 124
-425.081313	689.978555	586.882715					
ROE AREA= .0404 IN-2 STRESS=	12044.4431	APFA DATTIN-2=	.1002 IN	X-SEC APFA=	.0121 IN-2	FRICITION COEF=	.0082 125
-425.573777	698.365244	591.818875					

ROPE AREA = .0404 IN-2 STRESS =	12103.8856	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0122 IN-2	FRICTION COEF =	.0082 126
-420.17051	745.790849	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0123 IN-2	FRICTION COEF =	.0082 127
ROPE AREA = .0404 IN-2 STRESS =	12541.0916	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0124 IN-2	FRICTION COEF =	.0082 128
-420.04456	713.272455	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0125 IN-2	FRICTION COEF =	.0082 129
ROPE AREA = .0404 IN-2 STRESS =	12810.1194	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0126 IN-2	FRICTION COEF =	.0082 130
-427.158531	729.795131	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0127 IN-2	FRICTION COEF =	.0082 131
ROPE AREA = .0404 IN-2 STRESS =	13015.0752	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0128 IN-2	FRICTION COEF =	.0082 132
-427.650787	729.364719	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0129 IN-2	FRICTION COEF =	.0082 133
ROPE AREA = .0404 IN-2 STRESS =	13319.7529	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0130 IN-2	FRICTION COEF =	.0082 134
-428.124558	715.981871	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0131 IN-2	FRICTION COEF =	.0082 135
ROPE AREA = .0404 IN-2 STRESS =	13540.4728	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0132 IN-2	FRICTION COEF =	.0082 136
-428.581068	753.647253	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0133 IN-2	FRICTION COEF =	.0082 137
ROPE AREA = .0404 IN-2 STRESS =	13815.0752	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0134 IN-2	FRICTION COEF =	.0082 138
-429.020545	751.361540	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0135 IN-2	FRICTION COEF =	.0082 139
ROPE AREA = .0404 IN-2 STRESS =	14059.6198	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0136 IN-2	FRICTION COEF =	.0082 140
-429.441213	755.125420	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0137 IN-2	FRICTION COEF =	.0082 141
ROPE AREA = .0404 IN-2 STRESS =	14302.2058	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0138 IN-2	FRICTION COEF =	.0082 142
-429.863888	765.935556	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0139 IN-2	FRICTION COEF =	.0082 143
ROPE AREA = .0404 IN-2 STRESS =	14542.8215	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0140 IN-2	FRICTION COEF =	.0082 144
-430.228232	774.864780	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0141 IN-2	FRICTION COEF =	.0082 145
ROPE AREA = .0404 IN-2 STRESS =	14781.4052	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0142 IN-2	FRICTION COEF =	.0082 146
-430.594434	782.721700	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0143 IN-2	FRICTION COEF =	.0082 147
ROPE AREA = .0404 IN-2 STRESS =	15018.2542	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0144 IN-2	FRICTION COEF =	.0082 148
-431.042324	790.691896	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0145 IN-2	FRICTION COEF =	.0082 149
ROPE AREA = .0404 IN-2 STRESS =	15255.1255	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0146 IN-2	FRICTION COEF =	.0082 150
-431.271856	798.713722	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0147 IN-2	FRICTION COEF =	.0082 151
ROPE AREA = .0404 IN-2 STRESS =	15496.1756	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0148 IN-2	FRICTION COEF =	.0082 152
-431.592928	806.700346	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0149 IN-2	FRICTION COEF =	.0082 153
ROPE AREA = .0404 IN-2 STRESS =	15717.3106	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0150 IN-2	FRICTION COEF =	.0082 154
-431.875476	814.921750	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0151 IN-2	FRICTION COEF =	.0082 155
ROPE AREA = .0404 IN-2 STRESS =	15946.6758	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0152 IN-2	FRICTION COEF =	.0082 156
-432.149426	823.108732	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0153 IN-2	FRICTION COEF =	.0082 157
ROPE AREA = .0404 IN-2 STRESS =	16174.2564	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0154 IN-2	FRICTION COEF =	.0082 158
-432.404784	831.352183	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0155 IN-2	FRICTION COEF =	.0082 159
ROPE AREA = .0404 IN-2 STRESS =	16400.0769	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0156 IN-2	FRICTION COEF =	.0082 160
-432.641236	839.652691	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0157 IN-2	FRICTION COEF =	.0082 161
ROPE AREA = .0404 IN-2 STRESS =	16626.1616	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0158 IN-2	FRICTION COEF =	.0082 162
-432.858948	848.011338	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0159 IN-2	FRICTION COEF =	.0082 163
ROPE AREA = .0404 IN-2 STRESS =	16846.5740	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0160 IN-2	FRICTION COEF =	.0082 164
-433.057768	856.428904	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0161 IN-2	FRICTION COEF =	.0082 165
ROPE AREA = .0404 IN-2 STRESS =	17067.2176	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0162 IN-2	FRICTION COEF =	.0082 166
-433.237628	864.986265	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0163 IN-2	FRICTION COEF =	.0082 167
ROPE AREA = .0404 IN-2 STRESS =	17286.2741	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0164 IN-2	FRICTION COEF =	.0082 168
-433.398432	873.444312	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0165 IN-2	FRICTION COEF =	.0082 169
ROPE AREA = .0404 IN-2 STRESS =	17503.6891	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0166 IN-2	FRICTION COEF =	.0082 170
-433.540129	882.043955	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0167 IN-2	FRICTION COEF =	.0082 171
ROPE AREA = .0404 IN-2 STRESS =	17719.3615	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0168 IN-2	FRICTION COEF =	.0082 172
-433.662638	890.766122	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0169 IN-2	FRICTION COEF =	.0082 173
ROPE AREA = .0404 IN-2 STRESS =	17933.5142	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0170 IN-2	FRICTION COEF =	.0082 174
-433.765884	899.431748	AREA RATIO-2 =	.1002 IN	X-SEC AREA =	.0171 IN-2	FRICTION COEF =	.0082 175

ROPE AREA= .0404	IN-2	STRESS=	10146.0444	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0143	IN-2	FRICTION COEF=	.0082	151
ROPE AREA= .0404	IN-2	STRESS=	-27.384356	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0143	IN-2	FRICTION COEF=	.0082	152
ROPE AREA= .0404	IN-2	STRESS=	-27.101591050	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0144	IN-2	FRICTION COEF=	.0082	153
ROPE AREA= .0404	IN-2	STRESS=	-27.105065446	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0145	IN-2	FRICTION COEF=	.0082	154
ROPE AREA= .0404	IN-2	STRESS=	-27.1051110	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0146	IN-2	FRICTION COEF=	.0082	155
ROPE AREA= .0404	IN-2	STRESS=	-28.100410132	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0147	IN-2	FRICTION COEF=	.0082	156
ROPE AREA= .0404	IN-2	STRESS=	-28.101040017	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0148	IN-2	FRICTION COEF=	.0082	157
ROPE AREA= .0404	IN-2	STRESS=	-29.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0149	IN-2	FRICTION COEF=	.0082	158
ROPE AREA= .0404	IN-2	STRESS=	-29.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0150	IN-2	FRICTION COEF=	.0082	159
ROPE AREA= .0404	IN-2	STRESS=	-30.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0151	IN-2	FRICTION COEF=	.0082	160
ROPE AREA= .0404	IN-2	STRESS=	-30.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0152	IN-2	FRICTION COEF=	.0082	161
ROPE AREA= .0404	IN-2	STRESS=	-30.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0153	IN-2	FRICTION COEF=	.0082	162
ROPE AREA= .0404	IN-2	STRESS=	-31.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0154	IN-2	FRICTION COEF=	.0082	163
ROPE AREA= .0404	IN-2	STRESS=	-31.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0155	IN-2	FRICTION COEF=	.0082	164
ROPE AREA= .0404	IN-2	STRESS=	-31.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0156	IN-2	FRICTION COEF=	.0082	165
ROPE AREA= .0404	IN-2	STRESS=	-32.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0157	IN-2	FRICTION COEF=	.0082	166
ROPE AREA= .0404	IN-2	STRESS=	-32.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0158	IN-2	FRICTION COEF=	.0082	167
ROPE AREA= .0404	IN-2	STRESS=	-32.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0159	IN-2	FRICTION COEF=	.0082	168
ROPE AREA= .0404	IN-2	STRESS=	-33.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0160	IN-2	FRICTION COEF=	.0082	169
ROPE AREA= .0404	IN-2	STRESS=	-33.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0161	IN-2	FRICTION COEF=	.0082	170
ROPE AREA= .0404	IN-2	STRESS=	-34.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0162	IN-2	FRICTION COEF=	.0082	171
ROPE AREA= .0404	IN-2	STRESS=	-34.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0163	IN-2	FRICTION COEF=	.0082	172
ROPE AREA= .0404	IN-2	STRESS=	-35.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0164	IN-2	FRICTION COEF=	.0082	173
ROPE AREA= .0404	IN-2	STRESS=	-35.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0165	IN-2	FRICTION COEF=	.0082	174
ROPE AREA= .0404	IN-2	STRESS=	-36.10001161	AREA RATIO=2=	.1002	IN	X-SEC AREA=	.0166	IN-2	FRICTION COEF=	.0082	175





Section K-11

EXPERIMENT 14

50400.0 4250.0 1.0 1.0
100.000 13.010 2150.00 100.000 12.500 1.21502000.0000.000000 1.000
117.10000 1.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000

PROGRAM NUMBER 2.00

INTERPOL STATISTICS
MILITARY-GRANULATION

NOTED AUGUST 1970 FOR IBM 360 SYSTEM

MATERIAL TESTING DIRECTORATE
ARMED SERVICES DIVISION, WASHINGTON, MARYLAND

(CONVERTED TO CDC 4500
PILATINNY ARCADE, NEWER, NJ
C10 OFENSTEIN, EXTENSION 2367
MARCH 10, 1973)

INTERIOR BALLISTICS

PROBANT IN

POW NUMBER 1 72519-000

PEAK PRESSURE, PSI = 5000.0
 MUZZLE VELOCITY, FPS = 4850.0
 NUMBER OF BURNS = 1
 NUMBER OF LINES BETWEEN TYPEOUT = 1
 CHARGE VOLUME, CU IN. = 195.000
 CROSS SECTION OF BORE, SQ IN. = 13.010
 FLIGHT OF GUN AND DECOILING PTS. LR = 2350.00
 DISTANCE TRAVEL ALONG TUBE, IN. = 128.000
 PROJECTILE WEIGHT, LB = 12.400
 CHARGE ENERGY, BTU = 1.290
 INITIAL PRESSURE, PSI = 2000.00
 ADJUSTMENT FACTOR FOR Q = 0.000
 ADJUSTMENT FACTOR FOR R = 0.000
 PRESSURE FACTOR = 1.000

PROPELLANT DATA

TYPE NAME WT, LB WEP, IN.
 1 7-DEBF, CVL 12.10000 1.00000
 COMPUTED Q AND R .074510 8.735197
 TOTAL LOADING DENSITY FOR ALL CHARGES .047919

Section K-12

APPROXIMATE BRANCH
TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

PROJECTILE 8 INCH #106

NEXT	KDCON	NTHRST	K1	W	MUNIT	JM	NJR	TAUTO	ISPIN	IA	NATUC	NORM
0001	1	2	1	2	3	0	1	0	2	0	0	0
CORR TABLE FOR PHASES TWO AND FOUR												
WACH	.010	.000	.000	.000	.000	.050	1.000	1.050	1.100	1.200	1.350	
	1.500	1.750	2.000	2.500	3.000	3.000	-0.000	-0.000	-0.000	-0.000	-0.000	
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
CM	.135	.135	.140	.177	.227	.335	.360	.361	.360	.344	.328	
	.313	.260	.263	.220	.200	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
THDEG	0.000	2500.000	200.000	7.990	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
THRUST	0.0000	DOTM	BWGT	THR2	DOTM2	CANCEL	BIAS					
		0.000	0.000	780.5000	4.130	0.000	0.000					
YMT(1)	0.000	YMT(2)	YMT(3)	YMT(4)	CKO	FACT	Y					
		7.000	10.000	6000.000	0.000	1.000	0.000					
DELTY(1)	0.000	DELTY(2)	DELTY(3)	DELTY(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)				
		.005	.005	.005	0.000	1.000	1.000	40.000				
SPIN	0.000	TKT(1)	TKT(2)	TKT(3)	TKT(4)	TKTST	INITIAL TURNS PREVST					
		0.000	0.000	0.000	0.000	20.000	-0.000					

AERONAUTICS BRANCH													
TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY													
PROF-PLANT OF 4444-5400													
TIME	WING	ALTITUDE	VELOCITY	IN-DRIV	IN-DRIV	IN-DRIV	IN-DRIV	IN-DRIV	IN-DRIV	IN-DRIV	IN-DRIV	IN-DRIV	IN-DRIV
	X-DEIV	Y-DEIV	V-DEIV	W-DEIV	W-DEIV	W-DEIV	W-DEIV	W-DEIV	W-DEIV	W-DEIV	W-DEIV	W-DEIV	W-DEIV
	SPIN RATE	GYRO STAR	DYNAMIC	W-DEIV	W-DEIV	W-DEIV	W-DEIV	W-DEIV	W-DEIV	W-DEIV	W-DEIV	W-DEIV	W-DEIV
TOTAL TIMES													
0.000	0.000	0.000	762.000	10.000	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
650.011	341.000	-36.132	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
1170.072	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
-0.000													
40.000	10387.074	3321.496	710.376	-23.807	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
240.140	-125.360	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
1170.072	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
7540.487													
57.023	20727.030	0.000	129.820	-40.105	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
260.100	-125.360	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
1170.072	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
10700.280													
END OF TRAJECTORY MD.													

ENGINEERING SCIENCE LABORATORY
AERONAUTICS BRANCH

PROJECTILE 8 INCH W108

SUMMARY OF TRAJECTORIES

NO.	INIT TIME		INIT ANGLE		INIT SPIN		INIT GYRO		INIT RANGE		INIT ALT		INIT VELO	
	FINAL TIME	FINAL ANGLE	FINAL WGT	FINAL WGT	FINAL WGT	FINAL WGT	FINAL WGT	FINAL WGT	FINAL WGT	FINAL WGT	FINAL WGT	FINAL WGT	FINAL WGT	FINAL WGT
1	0.888	38.888	1179.572	1179.572	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	762.000	762.000
	57.421	-48.185	200.000	200.000	0.000	0.000	0.000	0.000	26727.034	26727.034	0.000	0.000	329.829	329.829
	48.888	200.000	200.000	200.000	0.000	0.000	0.000	0.000	16393.874	16393.874	3321.496	3321.496	7.990	7.990

AERONAUTICALS BRANCH													
TRAJECTORY DATA - TRAJECTORY													
POSITION OF MISSILE													
TIME	RANGE	ALTITUDE	VELOCITY	ANGLE	INCLINATION	PROJECTION	WEIGHT	IN	YAW	TEMP	TEMP	TEMP	TEMP
	X-POS	Y-POS	Z-POS	YAW	ROLL	PRE HALF	THROUST	DEAG	SPIN	WIND	WIND	WIND	WIND
	SPIN RATE	SPIN RATE	SPIN RATE	SPIN RATE	SPIN RATE	SPIN RATE	SPIN RATE	SPIN RATE	SPIN RATE	SPIN RATE	SPIN RATE	SPIN RATE	SPIN RATE
TOTAL TIME													
0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.2393	0.2543	0.000	0.000	0.000	0.000	0.000
	650.011	101.000	-37.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1170.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	-0.000												
0.000	1000.104	1100.700	107.907	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	270.261	-128.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1170.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	7500.487												
50.000	2020.045	0.000	327.902	-40.136	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	270.261	-128.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1170.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	10037.140												
END OF TRAJECTORY NO. 1													

ENGINEERING SCIENCE LABORATORY
 BALLISTICS WAREHOUSE

PROJECTILE 8 INCH 480R

SUMMARY OF TRAJECTORIES

NO.	INITIAL TIME		INITIAL ANGLE		INITIAL SPIN		INITIAL GYRO		INITIAL RANGE		INITIAL VEL	
	FINAL TIME	MAX ALT	FINAL ANGLE	INITIAL	FINAL SPIN	INITIAL	FINAL GYRO	INITIAL	FINAL RANGE	INITIAL	FINAL VEL	INITIAL
1	8.800	54.400	-40.136	30.000	1170.572	0.000	0.000	0.000	20205.945	0.000	762.000	327.992
	48.800	286.000	286.000	286.000	286.000	0.000	0.000	18026.788	3185.788	0.000	7.990	

REPERALISTICS MARCH TWO-DIMENSIONAL, TWO-STAGE POCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

PROJECTILE R INCH H104

APRT	MOON	NTMST	KT	M	MUNIT	JN	NJR	IAUTO	TSPIN	TA	NATIS	MOON
001	1	2	1	2	3	0	1	0	2	0	0	0
CORRECTION TABLE FOR PHASES TWO AND FOUR												
WACH	.010	.000	.000	.000	.000	.050	1.000	1.000	1.100	1.200	1.350	
	1.500	1.750	2.000	2.250	2.500	2.750	3.000	3.250	3.500	3.750	4.000	
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
CM	.130	.135	.140	.145	.150	.155	.160	.165	.170	.175	.180	
	.210	.215	.220	.225	.230	.235	.240	.245	.250	.255	.260	
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
THUG	12.000	2500.000	200.000	7.900	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
THRUST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
YIM(1)	YIM(2)	YIM(3)	YIM(4)	YIM(5)	YIM(6)	YIM(7)	YIM(8)	YIM(9)	YIM(10)	YIM(11)	YIM(12)	YIM(13)
0.000	7.000	10.000	10.000	6000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DELTI(1)	DELTI(2)	DELTI(3)	DELTI(4)	DELTI(5)	DELTI(6)	DELTI(7)	DELTI(8)	DELTI(9)	DELTI(10)	DELTI(11)	DELTI(12)	DELTI(13)
0.000	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
SPIN	YK(1)	YK(2)	YK(3)	YK(4)	YK(5)	YK(6)	YK(7)	YK(8)	YK(9)	YK(10)	YK(11)	YK(12)
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
INITIAL TURNS FORECAST												

REGIONALISTICS BRANCH
TWO-DIMENSIONAL TRAJECTORY

PROPORTION OF MAIN STAGE

TIME	RANGE	ALTITUDE	VELOCITY	THETA	WINDITION	PERFECT	WEIGHT	COG	YAW	SPIN	TEMPERATURE
	X-REF	Y-REF	V-REF	TH-REF	NU-REF	PDF-REF					
	4TH DIV	6TH DIV	DYNAMIC	REFLECT	NU-REF	PDF-REF					
	TOTAL T-0-5										
0.000	0.000	0.000	762.000	12.000	XXXX	XXXX	2.2393	2461	XXXX	XXXX	0.000
	644.213	403.760	-36.825	-1.425	XXXX	XXXX	0.0000	632.887	XXXX	XXXX	288.160
	1170.572	XXXX	XXXX	XXXX	XXXX	XXXX	200.000	31.225	187.735	XXXX	2.769F-03
	-0.000										
40.000	16316.884	3977.388	307.982	-21.885	XXXX	XXXX	0.9879	7285	XXXX	XXXX	16947.889
	285.740	-114.786	.517	-1.603	XXXX	XXXX	0.0000	64.015	XXXX	XXXX	262.648
	1170.572	XXXX	XXXX	XXXX	XXXX	XXXX	200.000	7.139	187.735	XXXX	1.8020F-03
	7500.387										
60.452	21250.120	0.000	331.522	-50.321	XXXX	XXXX	0.9742	2793	XXXX	XXXX	21250.120
	285.740	-114.786	.517	-1.603	XXXX	XXXX	0.0000	135.785	XXXX	XXXX	262.648
	1170.572	XXXX	XXXX	XXXX	XXXX	XXXX	200.000	21.009	187.735	XXXX	2.769F-03
	1136.036										

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
AERONAUTICS BRANCH

PROJECT 8 INCH WING

SUMMARY OF TRAJECTORIES

NO.	INIT TIME		INIT ANGLE		INIT SPIN		INIT CYRO		INIT RANGE		INIT ALT		INIT WFLG	
	FINAL TIME	INIT WGT	FINAL ANGLE	INIT WGT	FINAL SPIN	INIT WGT	FINAL CYRO	INIT WGT	FINAL RANGE	INIT WGT	FINAL ALT	INIT WGT	FINAL WFLG	INIT WGT
1	6.800	32.000	-50.921	1174.572	0.000	0.000	0.000	0.000	2125.120	0.000	0.000	0.000	742.000	331.522
	68.452	200.000		700.000					16115.847		7027.388		7.940	

AFORAL: ISTRIC BEHPT
TWO-DIMENSIONAL, TWO-STAGE SOCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

PROJECTILE A INCH M10A

ACCT KOCN MT M NUTT JN AJR IATC ISPIN TA NATC NCM
PRM 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

LONG TARTY TWO DIMES TWO DIM FOUR

WAC 0.010 0.600 0.800 0.950 1.000 1.000 1.000 1.200 1.200 1.350
1.500 1.750 2.000 2.500 3.000 3.500 4.000 4.500 5.000 5.500
0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
0.100 0.150 0.200 0.250 0.300 0.350 0.400 0.450 0.500 0.550
0.600 0.650 0.700 0.750 0.800 0.850 0.900 0.950 1.000 1.050
0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

YDRES 10.000 2550.000 200.000 7.500 0.000 0.000 0.000 0.000 0.000 0.000
T-DLST 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

AFORALISTICS BRANCH
TWO-DIMENSIONAL, TEN-STATE ROCKET TRAJECTORY

REPORT OF MAIN STAGE

TIME	RANGE H-M-DIV	ALTITUDE V-REFIV	VELOCITY V-REFIV	THETA TH-REFIV	ROTATION NU-HALF	PRECESSION PDE HALF	WACH THOUST	TP CRAG	VIEW FREQ VW FREQ	START DIST TEMPERATURE
	SPIN RATE TOTAL TURNS	GYRO STAR	DYNAMIC	REFIDCAL	NU FREQ	PDE FREQ	WEIGHT	THRU/WECS	SPIN OPS	DENSITY
0.000	0.000	0.000	777.240	30.000	XXXX	XXXX	2.2440	.2431	XXXX	0.000
	1271.110	388.020	-36.980	-.828	XXXX	XXXX	0.0000	652.181	XXXX	288.180
	1200.161	XXXX	XXXX	XXXX	XXXX	XXXX	200.000	32.077	101.489	2.1769E-03
	-7.400									
50.000	1895.397	391.531	311.348	773.028	XXXX	XXXX	.0000	.2342	XXXX	14951.005
	284.534	-171.793	.342	-1.661	XXXX	XXXX	0.0000	71.265	XXXX	265.413
	1200.161	XXXX	XXXX	XXXX	XXXX	XXXX	200.000	1.896	101.489	1.6750E-03
	7650.574									
58.379	21254.497	0.000	330.345	-48.709	XXXX	XXXX	.0708	.2719	XXXX	21256.497
	284.534	-171.793	.342	-1.661	XXXX	XXXX	0.0000	172.181	XXXX	265.180
	1200.161	XXXX	XXXX	XXXX	XXXX	XXXX	200.000	21.258	101.489	2.3769E-03
	11174.057									

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
 REPOBILITATION WORK

PROJECT 8-1000-1000

SUMMARY OF TRAJECTORIES

NO	INIT TIME		INIT ANGLE		INIT SPIN		INIT GYRO		INIT RANGE		INIT ALT		INIT VELO	
	FINAL TIME	INIT TIME	FINAL ANGLE	INIT ANGLE	FINAL SPIN	INIT SPIN	FINAL GYRO	INIT GYRO	FINAL RANGE	INIT RANGE	FINAL ALT	INIT ALT	FINAL VELO	INIT VELO
1	54.574	54.574	-48.109	38.000	1203.163	1203.163	0.000	0.000	21256.497	0.000	0.000	0.000	777.240	777.240
	55.000	55.000	200.000	200.000	200.000	200.000	0.000	0.000	14585.497	14585.497	0.000	0.000	777.240	777.240

Section K-13

1940

FOR THE YEAR 1904.

ENGINEERING SCIENCE LABORATORY
SPRINT TESTER REPORT

SPRINT TESTER REPORT

SUMMARY OF TEST RESULTS

ID	INITIAL TIME		INITIAL ANGLE		INITIAL CIRC		INITIAL DANCE		INITIAL VELC	
	INIT TIME	FINAL TIME	INIT ANGLE	FINAL ANGLE	INIT CIRC	FINAL CIRC	INIT DANCE	FINAL DANCE	INIT VELC	FINAL VELC
1	0.000	20.000	-30.000	100.000	0.000	0.000	0.000	0.000	0.000	0.000
	10.000	30.000	0.000	100.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	20.000	-30.000	100.000	0.000	0.000	0.000	0.000	0.000	0.000

Section K-14

Section K-15

TWO-DIMENSIONAL : TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO.

POC HCT 115 2 1424 4194

[illegible]

AFORALISTICS BRANCH													
TWO-DIMENSIONAL TWO-STATE BODY TRAJECTORY													
PERCENTAGE OF BODY SIZE													
TIME	ORANGE	ALTITUDE	VELOCITY	THREAT	MUTATION	DEFLECTION	WIND	THROUST	CR	YAW	TRNG	SLANT	WIND
	X-REF	Y-REF	U-REF	U-REF	U-REF	U-REF	U-REF	U-REF	U-REF	U-REF	U-REF	U-REF	U-REF
	SPIN	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE
	TOTAL	TIME	TIME	TIME	TIME	TIME	TIME	TIME	TIME	TIME	TIME	TIME	TIME
0.000	0.000	0.000	763.000	763.000	763.000	763.000	763.000	763.000	763.000	763.000	763.000	763.000	763.000
	650.011	391.000	-36.172	-36.172	-36.172	-36.172	-36.172	-36.172	-36.172	-36.172	-36.172	-36.172	-36.172
	1170.572	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
	-0.000												
20.000	1834.274	1351.806	110.576	-21.007	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
	284.140	-125.760	542	-1.455	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
	1170.572	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
	7500.187												
57.423	20727.030	0.000	320.829	-68.185	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
	284.140	-125.760	542	-1.455	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
	1170.572	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
	10700.200												
END OF TRAJECTORY NO. 1													

ENGINEERING SCIENCE LABORATORY
SPONTANEOUS COMBUSTION

PERIODIC REPORT

SUMMARY OF VALUES

JOB	TIME		ANGLE		COIN		CORN		RANGE		ALT		VELC	
	INIT	FINL	INIT	FINL	INIT	FINL	INIT	FINL	INIT	FINL	INIT	FINL	INIT	FINL
	TIME	TIME	DEG	DEG	SEC	SEC	SEC	SEC	DEG	DEG	FT	FT	FT/SEC	FT/SEC
1	1.500	5.523	30.000	-40.118	1170.572	1170.572	0.000	0.000	0.000	20727.030	0.000	0.000	742.000	729.829
	40.000		200.000		200.000		0.000	0.000	1.000	1.000	1121.400		7.000	

THE FOLLOWING IS INDENT DATA FOR THE FACTORY NO.

DOUGHERTY & LACHANCE

265

FEDERAL TYPE BRANCH

1954-1955

END OF TRAJECTORY NO.

ENGINEERING SCIENCE LABORATORY
AERONAUTICS BRANCH

WINDTUNNEL WIND METER

SUMMARY OF TRAJECTORIES

NO.	INITIAL DATA			INITIAL DATA			INITIAL DATA			INITIAL DATA		
	INIT TIME	INIT ANGLE	INIT VEL	INIT CYC	INIT CYC	INIT RANGE	INIT ALT	INIT ALT	INIT VEL	INIT VEL	INIT VEL	
	FINAL TIME	FINAL ANGLE	FINAL VEL	FINAL CYC	FINAL CYC	FINAL RANGE	FINAL ALT	FINAL ALT	FINAL VEL	FINAL VEL	FINAL VEL	
	MAX ALT	MAX ALT	MAX ALT	MAX ALT	MAX ALT	MAX ALT	MAX ALT	MAX ALT	MAX ALT	MAX ALT	MAX ALT	
1	0.000	18.000	1170.572	0.000	0.000	0.000	0.000	0.000	0.000	0.000	762.000	
	54.560	-48.174	1170.572	0.000	0.000	20205.945	0.000	0.000	0.000	0.000	327.992	
	40.000	200.000	200.000	0.000	0.000	10025.164	0.000	0.000	0.000	0.000	7.990	

INVESTMENT - TWO-STAGE ROCKET

INVESTMENT - TWO-STAGE ROCKET

THE FOLLOWING IS LISTED FOR YOUR INFORMATION AND

DOUGLASSVILLE A TOWN WITH A FUTURE

KEY	KNOCK	NIMOST	KI	M	MUNIT	JN	KJR	TAUTO	ISPIN	IA	NATUS	ICOM
1	1	2	1	3	3	4	1	0	2	0	0	0

Calligraphy of the 19th century

[illegible]

YANGKE	V	WCF	CYA	X	Y
12,000	2500,000	200,000	7,900	0,000	0,000

THRUST	DOTM	RGCT	THRT	DOTM2	CANCEL	BIAS
0.0000	0.000	0.000	786.5000	4.130	2.0	0.000

YMW(1)	YMW(2)	YMW(3)	YMW(4)	CRD	FAC1	VF
0.000	7.000	10.000	6000.000	0.000	1.000	0.0000

DELTT(1)	DELTT(2)	DELTT(3)	DELTT(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)
0.000	0.000	0.000	0.000	0.000	1.000	1.000	0.000

CPIN	YR(1)	YR(2)	YR(3)	YR(4)	TWIST	TOTAL TURNS THEVST
0.000	0.000	0.000	0.000	0.000	20.000	-0.000

AFONPALLI TCTTCS APANCH

PLAN OF TRAJECTORY NO.

ENGINEERING SCIENCE LABORATORY
 BALLISTICS BRANCH

WINDMILL WINDMILL

SUMMARY OF TRAJECTORIES

NO	TIME		ANGLE		SPIN		CYRO		RANGE		ALT		VELO	
	INIT	FINL	INIT	FINL	INIT	FINL	INIT	FINL	INIT	FINL	INIT	FINL	INIT	FINL
	TIME	TIME	DEG	DEG	REV	REV	REV	REV	FEET	FEET	FEET	FEET	FT/SEC	FT/SEC
1	0.000	32.000	1170.572	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	762.000	762.000
	60.000	-50.121	1170.572	0.000	0.000	0.000	0.000	21250.120	0.000	0.000	0.000	0.000	331.522	331.522
	40.000	200.000	200.000	0.000	0.000	0.000	0.000	10115.843	0.000	0.000	0.000	0.000	7.990	7.990

ACCOMPLISHES BRANCH
FINAL TWO-STAGE BRACKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRANSFORM NO.

DECEMBER 5 1964

[illegible]

2002 JAN 23 PM 4 23 BY A 2864

[illegible]

Year	Y	WCT	PIA	X	Y	Y
1980	250.000	200.000	7.990	0.000	0.000	0.000
1981	250.000	200.000	7.990	0.000	0.000	0.000

TRUST	DATA	PLGT	TRST	DATA	CANCEL	BIAS
0.0000	0.000	0.000	0.0000	4.130	2.0	0.000

TIME(1)	TIME(2)	TIME(3)	TIME(4)	CAD	FACT	VF
0.000	7.000	10.000	6000.000	0.000	1.000	0.000

CELYT(1)	CELYT(2)	CELYT(3)	CELYT(4)	DMAT(1)	DMAT(2)	DMAT(3)	DMAT(4)
0.000	0.005	0.005	0.005	0.000	1.000	1.000	0.000

	YR(1)	YR(2)	YR(3)	YR(4)	TWIST	TOTAL TURNS REVEALED
SPIN	0.000	0.000	0.000	0.000	>0.000	-0.000

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END OF TRAJECTORY NO.

מחלקת המחקר והפיתוח

SYMPTOMS OF TUBERCULOSIS

273

APPENDIX L
UNABBREVIATED OUTPUT AT THE TELETYPE

Unabbreviated Output at the Teletype

Normal usage of IPSSM at the teletype involves batching the job to a central computer site, where the full output can later be retrieved, and/or asking for an abbreviated set of results to be recallable at the same teletype terminal. At Picatinny Arsenal a routine DISPLAYOUTPUT is available to allow the full unabbreviated output of an IPSSM run to be examined at the teletype. Specific instructions follow.

Before typing IPSM at the start of the teletype run, enter:

ATTACH,DISPLAY,DISPLAYOUTPUT,CY=1,ID=MISDSEAD.

Then proceed normally, but when ready to batch your program, enter:

BATCH,JOB,INPUT,HERE.

A name will then be assigned to your job; wait until the job has executed and is in the output queue, then enter:

BATCH,(JOBNAME),LOCAL

DISPLAY,(JOBNAME)

The system response will be

PAGE NUMBER = 1 TOTAL PAGES OF OUTPUT = N

PAGE NUMBER = --- (RIGHT JUSTIFIED)

The page number to be examined is now entered in right-justified format (i.e., the third page would be designated as 003).

Upon completion of examination at the teletype terminal, PAGE 999 is entered to terminate this routine. You may then logout or use the DISPOSE facility to send a permanent record of the unabbreviated results to batch terminal. To dispose your output to a specific terminal, enter the following statement:

DISPOSE,OUTPUT,(TERMINAL CODE)

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