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FM 6-3-2

DEPARTMENT OF THE ARMY FIELD MANUAL

OPERATION OF THE GUN DIRECTION COMPUTER M18 ROCKET APPLICATION

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HEADQUARTERS, DEPARTMENT OF THE ARMY
OCTOBER 1967

TAGO 7384A

FIELD MANUAL
No. 6-3-2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *19 October 1967*

OPERATION OF THE GUN DIRECTION COMPUTER M18 ROCKET APPLICATION

CHAPTER 1

GENERAL

Section I. PURPOSE AND SCOPE

1. Purpose

This manual is a guide to assist commanders in training artillery personnel in the operation and maintenance of the gun direction computer M18 (FADAC).

2. Scope

a. This manual covers the operation of the gun direction computer M18 in the rocket application.

b. The material presented herein is applicable, without modification, to both nuclear and nonnuclear warfare.

c. Related publications are listed in appendix A.

3. Changes

Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded to the Commandant, U.S. Army Artillery and Missile School, Fort Sill, Oklahoma 73503.

Section II. GENERAL

4. General

The gun direction computer M18 is authorized for issue to each rocket firing battery and the headquarters and headquarters battery or the headquarters, headquarters and service battery of each rocket battalion.

5. Personnel

The assigned personnel in both the battalion and the battery fire direction centers operate the computer and the auxiliary equipment. The minimum number of personnel required in sustained operations is four: two computer operators and two generator operators.

6. General Duties of Personnel

a. Computer Operator. The computer operator is responsible for the emplacement, march order, operation, and operator maintenance of the computer and its associated equipment. His duties are to—

(1) Insure that the proper procedures are followed in setting up the computer and the associated equipment.

(2) Insure that correct procedures are followed in the operation and maintenance of the equipment.

(3) Transmit and record data in accordance with the unit standing operating procedures.

(4) Report discrepancies in computer or associated equipment maintenance.

(5) Perform operator maintenance at regular intervals. Perform only the maintenance authorized in the maintenance allocation charts in TM 9-1220-221-20/1. For other details, see TM 9-1220-221-10 and FM 6-3.

b. Generator Operator. The duties of the generator operator are normally performed as additional duties by a member of the fire direction center. In addition to his regular duties, the person assigned the duties of the generator operator is responsible for—

(1) The proper emplacement of the generator.
(2) Starting, stopping, and monitoring the operation of the generator on a standby basis.
(3) Insuring that the generator is providing the proper current.
(4) Performing operator maintenance and reporting discrepancies in maintenance to the chief of section.
(5) Maintaining the prescribed records on generator operation.

CHAPTER 2

EQUIPMENT

Section I. DESCRIPTION

7. General

a. The gun direction computer M18 (fig. 1) is a general purpose, solid state, nonvolatile digital computer. It is designed to solve the gunnery problem by computing accurate firing data for rockets or cannons; however, it will perform any computational task for which a program has been written and inserted into memory. It is limited only by the size of the rotating magnetic disk memory of 8,192 words. Using the Honest John or Little John rocket program, it will solve the ballistic problem and display the firing data; it will store the firing data and all associated information for 10

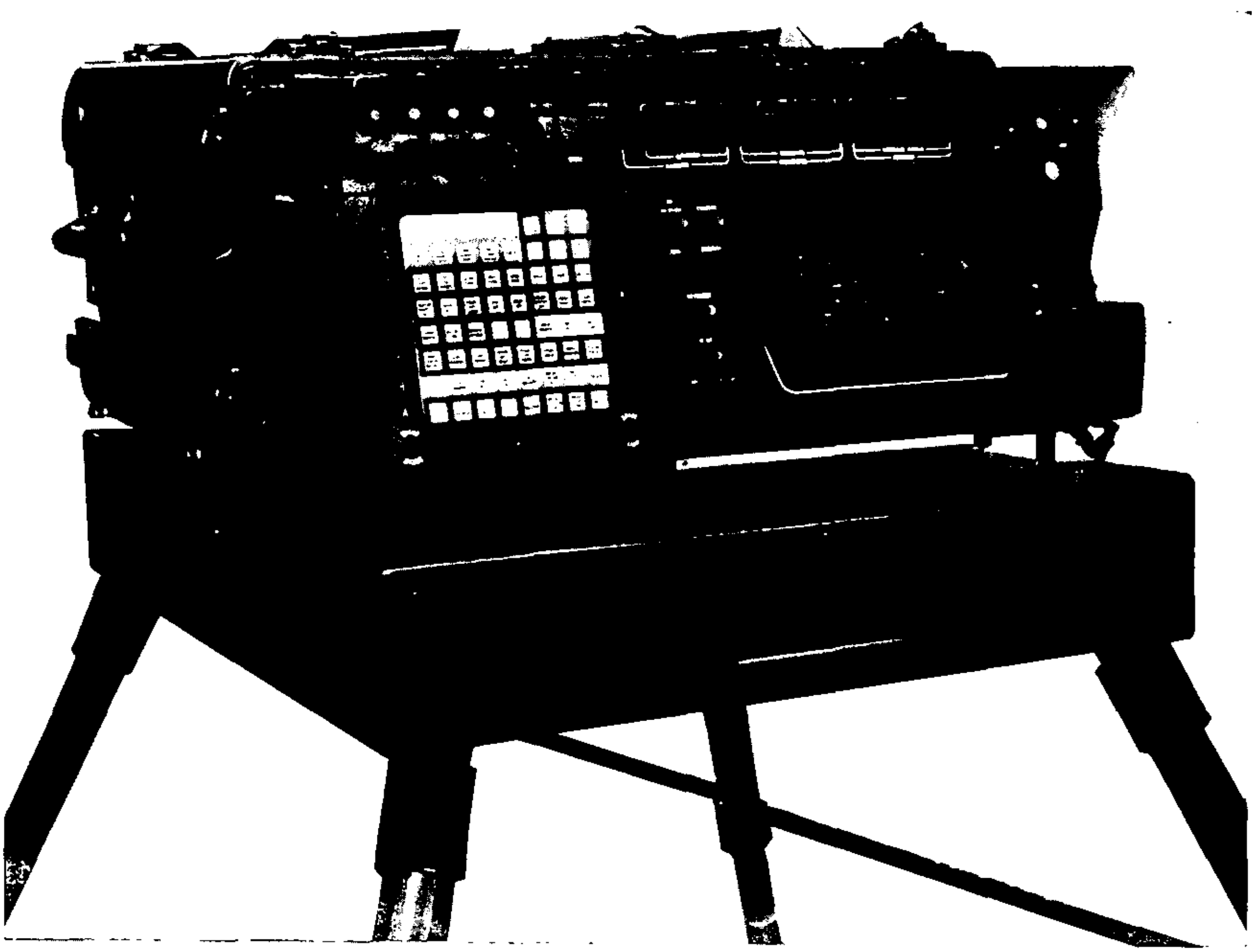


Figure 1. Gun direction computer M18.

separate missions. It will store the coordinates and altitudes of 32 targets and 16 firing points. It will compute traverse and intersection type survey problems, and using a teletypewriter, it will print out comprehensive firing data in addition to all the parameters pertinent to a specific mission. It will also print out the coordinates and altitudes of the targets and firing points stored in memory.

b. Programs are coded on punched paper tape and are inserted into memory by using the signal data reproducer. After the program is loaded into the computer, the program will not be changed by normal operation. Information required for solving problems is entered by the operator using the input selection matrix, the keyboard, and the mechanical tape reader.

8. Components and Associated Equipment

a. The computer is of modular construction, consisting of four major categories of components: the power supply chassis, the magnetic disk memory, the control panel assembly, and the circuit boards. The computer is housed in a watertight case with removable front and rear covers. Computer parts are cooled by two blowers which draw air through replaceable filters and exhaust it through louvers in the rear of the computer.

b. Associated equipment consists of a teletypewriter; a computer table with an integral power connection panel; a power cable and reel assembly; and a 3-KW, 120/208-volt, 400-cycle, 3-phase, 4-wire generator.

c. Auxiliary equipment consists of the signal data reproducer (SDR) AN/GSQ–64 and the computer logic unit test set (CLUT) AN/GSM–70.

d. Detailed nomenclature, technical characteristics, and other operational information are discussed in detail in the references listed in appendix C.

Section II. PREPARATION FOR OPERATION AND MARCH ORDER

9. General

A minimum of four men are required to set up and prepare for operation or to march order the equipment. The computer weighs approximately 210 pounds and should be handled with care to prevent damage to the equipment or injury to personnel. The computer table weighs 58 pounds, and at least two men are required to set up or march order it.

10. Preparation for Operation

a. The computer is prepared for operation as follows:

(1) Turn the field table upside down and release the screw-lock fasteners on the legs.

(2) Unfold and extend each leg so that the height for the operator is comfortable and the top is level.

(3) Secure each leg in position by tightening the leg locking ring and place the table in an upright position.

(4) Have two men place the computer on the table.

(5) Depress the core of the pressure release valve and allow the pressure in the case to equalize.

(6) Remove the front and rear covers.

(7) Fasten the four latches on the table over the four hooks on the computer case.

(8) Remove the cap from receptable J11 and connect cable P11 from the table to receptacle J11.

(9) Connect the power cable to receptacle J5 on the table and insure that the circuit breaker is in the OFF position.

(10) Start the generator and insure that it is producing the correct voltage.

(11) Check the air intake for obstructions.

(12) Place the circuit breaker in the ON position.

(13) Turn the POWER switch on the power panel to the POWER ON position. When the POWER READY indicator lights, the computer is ready to operate.

b. When the computer is semipermanently mounted in a vehicle, the procedures in (5) through (13) above are applicable.

c. For further details in handling the equipment, see TM 9-1220-221-10.

11. March Order

a. The computer is prepared for traveling as follows:

(1) Move the POWER switch and the circuit breakers to their OFF positions.

(2) Stop the generator and disconnect the power cables, replace the cable on the cable and reel assembly.

(3) Disconnect all cables from the computer and replace the front and rear covers.

(4) Remove the computer from the table and secure the plug of the computer power cable to the clamp under the table.

(5) Turn the table upside down.

(6) Release the telescoping portion of each leg by turning the leg locking ring counterclockwise.

(7) Retract and fold the legs.

(8) Place the computer, the field table, and the cable and reel assembly in the transport vehicle.

b. To march order equipment that is semipermanently mounted in a vehicle, perform (1) and (3) above.

Section III. OPERATOR CONTROLS

12. General

The M18 gun direction computer is controlled through the use of buttons, switches, and keys. The controls and indicators are located on the front of the computer or near the front panel within easy reach of the operator.

13. Control Panel

The computer control panel (fig. 2) consists of seven sections. Each section may be considered a functional area and is identified by its principal use as follows:

a. Power Panel. The power panel, on the upper right section of the control panel, has a toggle switch to control two night lights, a toggle switch to turn the computer on and off, a POWER READY indicator, and an elapsed time meter to indicate the cumulative hours of operation.

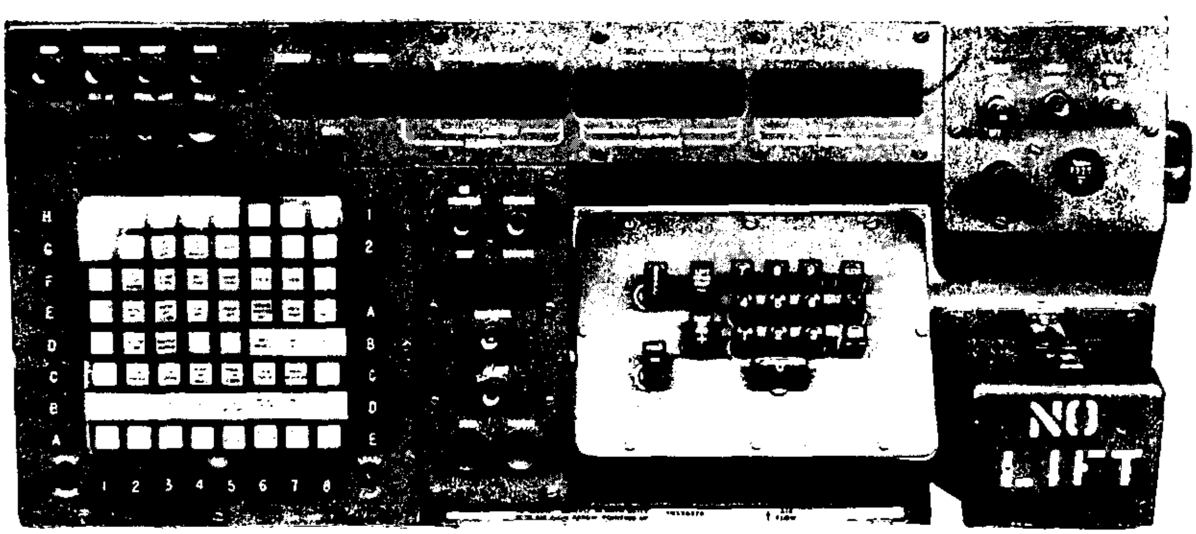


Figure 2. Control panel.

b. Trouble Indicator Panel. The trouble indicator panel has four trouble indicators, a night light, and three buttons: SET UP, PROG TEST, and RESET. This panel is in the upper left corner of the control panel.

c. Operator Panel. The operator panel, in the center of the control panel, has four indicators and four buttons. The four indicators show the operator when the computer is in the compute mode or input-output mode or a NO SOLUTION is indicated. The four buttons—TRIG, COMPUTE, SEND, and RECEIVE—are used for initiating a problem solution or for sending and receiving information from another computer or input device.

d. Matrix Panel. The matrix, on the left side of the control panel, is a selection device which allows the operator to control the elements of data that are entered, recalled, or computed in the solution of a problem. Details describing the use of this panel, as it applies to a particular program are contained in table 1.

e. Keyboard. The keyboard, on the right of the operator panel, is used to manually enter numerical data into the computer.

f. Mechanical Tape Reader. The mechanical tape reader, in the lower right portion of the control panel, is a mechanical device capable of reading five-hole punched paper tape as input data. Its primary function is to read the meteorological message from paper tape.

g. Display Panel. The display panel (fig. 2) consists of 18 Nixie tube indicators, which provide numerical, sign, and designation information as it is entered in the computer or as an output display of the solution to a problem. In most instances, the data entered through the keyboard are displayed on this panel and erased when the ENTER key is depressed. The panel is divided into six windows which display the following data:

(1) The first window, BATTERY, indicates which lettered mission association button, A through E, is depressed.

(2) The second window, SIGN, displays the algebraic sign (+ or −) associated with a numerical input or output.

(3) The third window, CHARGE, indicates the security classification of the program entered and displays certain entry flags.

(4) The fourth window has five indicators and is labeled DEFLECTION, AZIMUTH, and EASTING. It displays the input or output data for the matrix position selected. When the coordinates are entered in the normal sequence, the easting is displayed in this window, the northing is displayed in the next window, and the altitude in the last window. When the northing or altitude is recalled separately, it will be displayed in this window, or other information, such as MOTOR EMPTY WT, or LAT.

(5) The fifth window has five indicators and is labeled FUZE SETTING, TIME OF FLIGHT, DISTANCE, and NORTHING. The display data depend on the matrix position selected and whether the data are input data or output data resulting from the solution of a problem or the recall of data.

(6) The last window has five indicators and is labeled QUADRANT, VERTICAL ANGLE, and ALTITUDE. It displays the input or output data for the matrix position selected. In some cases, the entry flag is displayed in this window when the ENTER key is depressed. The NO SOLUTION flags are displayed on the last two indicators of this window.

14. Functions of Controls and Indicators

The function of each control and indicator on the computer control panel (fig. 2) is described below:

a. POWER ON-OFF Switch. The POWER ON-OFF switch is a momentary contact, center-return switch. In the ON position, the power supply, blowers, and memory are energized. In the OFF position, the computer is deenergized.

b. POWER READY Indicator. The POWER READY indicator lights approximately 20 seconds after the computer is energized. The indicator blinks when the computer is in the marginal test mode or when the lower blower motor is not operating. This indicator will blink when the back cover is installed for cold weather operations. If the indicator blinks when the back cover has been removed and the MARGINAL TEST switch is off, a malfunction of the lower blower is indicated.

c. LIGHTS ON-OFF Switch. The LIGHTS ON-OFF switch lights the panel lamps for night operation.

d. Elapsed Time Meter. The time meter records the cumulative hours the computer has been in operation.

e. TEMP Indicator. The TEMP indicator lights when the internal operating temperature is correct. The indicator blinks when the operating temperature is not correct.

f. TRANSIENT Indicator. The TRANSIENT indicator lights when the line voltage is correct. The indicator blinks when the power supply voltages fluctuate or approach the operating limits.

g. PARITY Indicator. The PARITY indicator is normally lighted. It blinks when an error occurs in internal data transfer or when incorrect data are transferred from an input device to the memory or from the memory to an output device.

h. ERROR Indicator. The ERROR indicator is normally lighted. It blinks when there is an internal overflow or an error verification. Blinking may also be caused by entering a number too large for the computer.

i. SET UP Button. The SET UP button is not used with the rocket programs.

j. PROG TEST Button. When the PROG TEST button is momentarily depressed, and a numbered key is then depressed, the computation of a stored test begins and the COMPUTE indicator lights during the solution of the test. When the test problem is completed, the COMPUTE indicator light goes out.

k. RESET Button. The RESET button is depressed to terminate the mode that is to clear the computations in progress or to clear an error indicated by a blinking PARITY, TRANSIENT, or ERROR indicator. Depressing the RESET button will stop the blinking provided the malfunction is not recurring.

l. NO SOLUTION Indicator. The NO SOLUTION indicator is normally lighted and blinks if the data entered for a particular problem produces no solution. A numerical display defines the cause, such as *out of range or input parameter omitted.*

m. COMPUTE Indicator. The COMPUTE indicator lights while the computer is in the compute mode.

n. TRIG Button. The TRIG button is not used with the rocket programs.

o. COMPUTE Button. The COMPUTE button, when depressed, causes the computer to compute the trajectory for the ballistic problem.

p. KEYBOARD Indicator. The KEYBOARD indicator lights when the computer requires information which must be entered through the keyboard.

q. IN/OUT Indicator. The IN/OUT indicator lights when information is being transferred to or from an input-output device. This indicator, as well as the KEYBOARD indicator, must light to allow input through the keyboard.

r. SEND Button. The SEND button, when depressed, causes information to be transmitted to a second computer or other output equipment.

s. RECEIVE Button. The RECEIVE button, when depressed, causes the computer to receive information from another computer or other input equipment.

15. Keyboard Assembly

a. Sample Matrix and RECALL Keys. The SM (sample matrix) key, when depressed, causes the computer to follow the commands in that portion of the program selected by the matrix position. Normally these commands will require a keyboard entry therefore the keyboard indicator will light. The RECALL key is used to recall from memory the data indicated by the matrix position selected.

b. LEFT, DOWN, DROP, – Key. The LEFT, DOWN, DROP, – key, when depressed, causes a negative sign to be associated with the numerical value entered through the keyboard.

c. Right, UP, ADD, + Key. The RIGHT, UP, ADD, + key, when depressed, causes a positive sign to be associated with the numerical value entered through the keyboard.

d. Numerical Keys 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and . (decimal point). The numerical keys and decimal point are used to enter a numerical value including the decimal point. The keys are interlocked so that an error cannot be made by depressing two keys simultaneously. The numerical value is displayed as each numerical key is depressed.

e. CLEAR and ENTER Keys. The CLEAR key is used to erase an erroneous input. After the CLEAR key has been depressed, the correct information can be entered without depressing the SM key again. The ENTER key is used to enter the information displayed in the memory of the computer. An entry error that is discovered after the ENTER key has been depressed may be corrected by reselect-

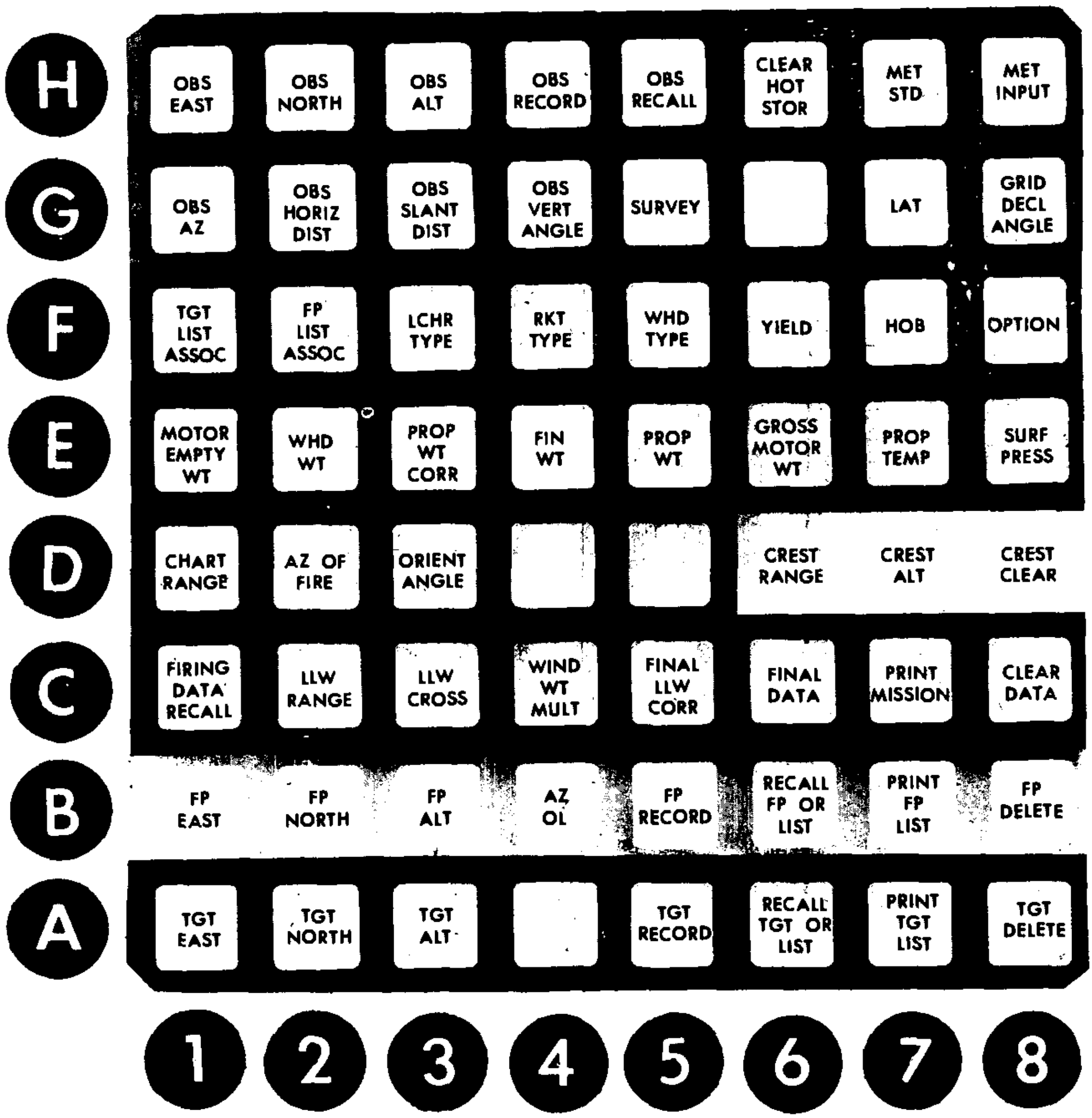


Figure 3. Input selection matrix.

ing the input matrix function, depressing the SM key, and typing in the correct data on the keyboard.

16. Matrix

a. The input selection matrix consists of 64 windows. The desired input location on the matrix is selected by depressing two buttons, one numerical button (1–8) in the row below the matrix windows and one lettered button (A–H) in the column on the left side of the matrix. The use of the input selection matrix (fig. 3) is explained in detail for each matrix position in table 1.

b. The input selection matrix has seven sections. Each section is color coded for ease in identification. The operator may use any section without regard to sequence. The seven sections are color coded as follows:

(1) The target information in row A is colored blue.

(2) The firing point information in row B is colored yellow.

(3) The information on firing data recall, low-level wind, print mission, and clearance data in row C is colored green.

(4) Miscellaneous information on the rocket, warhead, ballistic, and orienting data in the left portion of row D and in rows E and F is colored red.

(5) The crest clearance information in the right portion of row D is colored white.

(6) The observer and survey information in the left portion of rows G and H is colored gray. One window in row H, CLEAR HOT STORAGE, is colored red.

(7) The meteorological, latitude, and grid declination information in the right portion of rows G and R is colored green.

17. Program Tapes

a. Each program tape for either the Honest John or the Little John rocket contains instructions for the solution of the rocket gunnery problem and two types of survey problems.

b. The specific program entered in the computer's memory is verified during the procedure (para 21). The computer displays the identification of the program entered in memory by displaying the security classification and the size of the rocket (762-mm or 318-mm) on the display panel (fig. 4).

18. Numbered and Lettered Mission Association Buttons

There are two numbered buttons, 1 and 2, and five lettered buttons, A through E, on the right side of the matrix panel. These buttons are used to associate specific mission data. By depressing both a numbered button and a lettered button at the same time (e.g., A1, B1, ... E1, E2) ten independent sets of firing data can be computed separately and stored in ten separate memory locations. Targets normally are planned to be fired upon from a designated firing point; therefore, all the orienting information, the rocket and warhead data, and the other ballistic information pertaining to that specific firing point-target combination is referred to as being mission associated. Each of the ten possible missions is identified by its letter and number combination.

Section IV. TESTS

19. General

The computer operator should perform the marginal test and the program test to insure the computer is operating properly. These tests are made when the computer is first set up for operation, when there is a loss of power, or when there is a reason to believe the equipment is not operating properly. The rocket program must be entered in the computer memory. The battalion radio mechanic is responsible for entering the program by using the signal data reproducer AN/GSQ–64.

20. The Marginal Test

a. The marginal test is built in the M18 computer and provides a means of performing a limited check of the computer's operation when intermittent malfunctioning is suspected. The test assures the operator the computer will operate under normal conditions.

b. The test procedure is as follows:

(1) When the POWER READY indicator is on, turn the MARGINAL TEST switch to the 1 position.

(2) Depress the PROG TEST button and the 1 key on the keyboard. If the PARITY or ERROR indicator blinks, there is an indication of a malfunction. If there is no indication, turn the switch to test position 2, and again depress the PROG TEST button and the 1 key on the keyboard. If the PARITY or ERROR indicator blinks, there is an indication of a malfunction.

(3) Continue through positions 3, 4, and 5 depressing the PROG TEST button and the 1 key on the keyboard. If the indicators fail to blink in any of the five positions, the computer is functioning properly under this test.

c. Any of the five test positions will cause the POWER READY indicator to blink. This does not indicate a malfunction. In normal operation the MARGINAL TEST switch should be in the OFF position. Then the POWER READY indicator light will be steady and nonblinking.

d. If the PARITY indicator blinks when the MARGINAL TEST switch is rotated from one position to another, depress the RESET button. The malfunction indication should cease.

21. Program Tests

a. The program tests should be conducted when the program is to be entered into memory, when the computer is first set up and turned on, or whenever there is a loss of power.

b. There are two parts to the program test, the first part is a test of permanent storage (test 1) and the second part is a test of working storage (hot storage), (test 2).

c. The procedure for testing permanent storage is as follows:

(1) Depress the PROG TEST button. The KEYBOARD indicator will light and one of the following displays (fig. 4) will appear:

A x 2 xxxxx xxx00 00762 (for the Honest John program), or

A x 2 xxxxx xxx00 00318 (for the Little John program).

x—indicates a Nixie not lit.

A—indicates a letter—A, B, C, D, or E—lettered for the mission association button depressed.

(2) Check the display, the Nixies tubes in the window labeled DEFLECTION and the first three Nixie tubes in the window labeled FUZE SETTING will not light. The number displayed in the CHARGE window indicates the security classification of the program, and the number 762 or 318 indicates the specific rocket program entered.

(3) Depress the 1 key on the keyboard and the computer will automatically test the permanent storage. If the test is successful, one of the following displays (fig. 4) will appear:

A x 2 00000 00000 00762 (for the Honest John program), or

A x 2 00000 00000 00318 (for the Little John program).

If the test is not successful, the NO SOLUTION indicator will blink, and a different set of numbers will be displayed.

(4) Repeat the test if the first attempt is not successful. It may be successful on the second or third try, since aging parts in the computer may cause the test to fail on the first attempt and succeed on the second or third attempt. If this occurs, maintenance checks should be performed as soon as possible.

d. The procedure for testing the working storage is as follows:

(1) Depress the PROG TEST button, the keyboard indicator will light and one of the displays shown in *c*(1) above will appear.

(2) Depress the 2 key on the keyboard. If the test is successful, the number 136 will appear in the right three Nixie tubes of the display panel. If the test is not successful, the

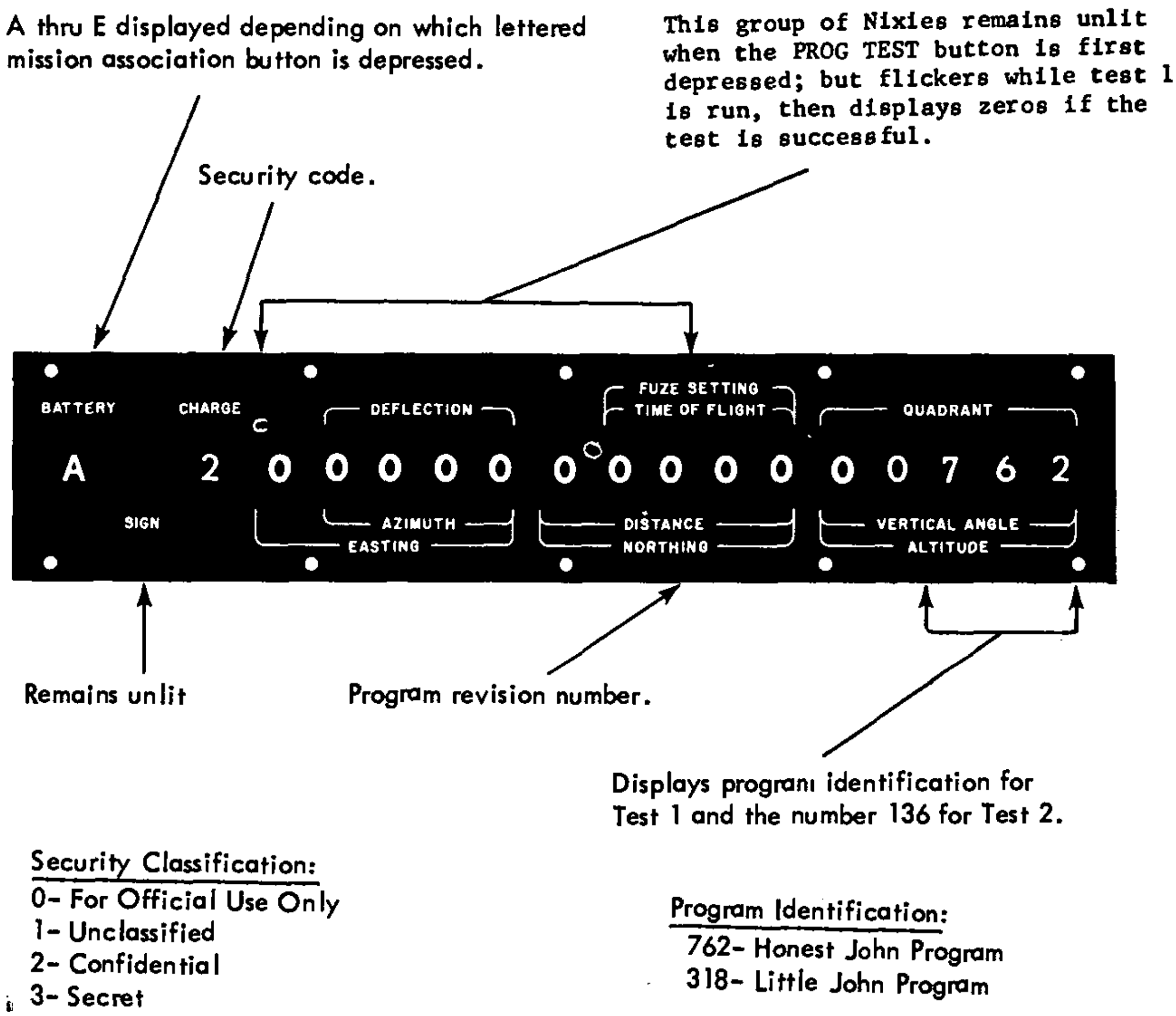


Figure 4. Test display.

PARITY indicator will flicker, and the number of the channel in working memory in which the error occurred will appear. The incorrect data must then be cleared from the channel indicated, and the data reentered. To clear the memory channel, use the procedures described in paragraph 28 and table 1, matrix position H–6 (CLEAR HOT STORAGE). After the channel has been cleared, repeat the test. Refer to the memory map in figure 8 to determine which data to reenter.

e. A third program test, which insures proper computer operation, is to cause the computer to solve a sample problem for which the answer is known. This test may be performed during lulls in firing or during maintenance periods.

22. General

The most accurate information available must be used for best results. Unless data has been mission associated it will remain in memory until new data is entered. Standard met is entered when the program is loaded and the computer will use these values unless the current met data is entered, then it will automatically use current met. Care must be taken to prevent inadvertantly using old met or other invalid data previously stored in memory.

23. Five-Digit Coordinates Requirement

Each coordinate must be entered in five digits (nearest meter), or the program will halt and the NO SOLUTION indicator will flicker. The display will retain the erroneous coordinate as entered. To correct the error—

a. Depress the SM key. The display will extinguish and the KEYBOARD indicator will light.

b. On the keyboard, type in the correct coordinate in five digits by adding zeros if necessary.

c. Depress the ENTER key.

24. Functions Demanding a Signed Input

Several numerical inputs require that a plus or minus (±) sign precede the numerical entry. The plus and minus keys on the keyboard are used to input these signs. The following inputs require a sign:

Input	*Matrix designation*	*Matrix location*
Latitude	LAT	G–7
Grid declination angle	GRID DECL ANGLE.	G–8
Propellant weight correction	PROP WT CORR.	E–8
Propellant temperature	PROP TEMP	E–7
Low-level wind, range (+, head; –, tail).	LLW RANGE	C–2
Low-level wind, cross (+, right; –, left).	LLW CROSS	
Observer vertical angle	OBS VERT ANGLE.	G–4

25. Enabling Procedure

The enabling procedure is designed to act as a safeguard against operator error, and the operator can activate or cancel a function as desired. In each case where the enabling procedure is used, a keyboard entry of 0 enables the routine for computation, and an entry of 9 cancels the proposed input and terminates the mode. In the case of using function H–7 (MET STD), the entry of 9 tells the computer not to set the met to standard but to use the current met message. The inputs that require an enabling procedure are listed below:

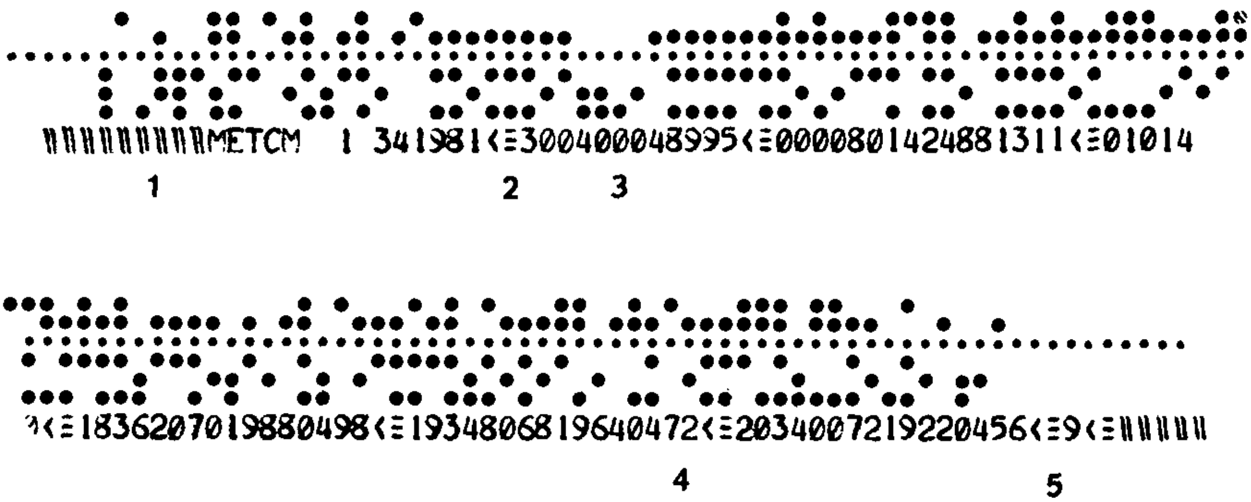
Input	*Matrix designation*	*Matrix location*
Target deletion	TGT DELETE	A–8
Firing point deletion	FP DELETE	B–8
Clear mission data	CLEAR DATA	C–8
Setting met to standard	MET STD	H–7

26. Function Values Reset

When matrix functions A–8 (TGT DELETE), and B–8 (FP DELETE), C–8 (CLEAR DATA), and F–8 (OPTION) are used, the data contained in certain complementary functions are destroyed; for example, the specified target of firing point coordinates, the specified mission data, and in the case of the height of burst option, the data entered by using function F–7 (HOB). The data in these complementary locations are set to an unrecognizable form which, when recalled, will be displayed as a series of zeros preceded by a minus sign. This is a safety feature which prevents an error as the result of a failure to make complete entries. For example, TGT DELETE sets the data stored in the specified target memory location to an unrecognizable form; and, if the operator enters only the easting and the altitude of a new target and fails to enter the northing, the computer will not use the old target northing but will require the entry of a new northing, before it will compute the mission.

27. Entry Procedures for Meteorological Message Tape

Meteorological message tapes are prepared by a radio teletypewriter, such as the teletypewriter reperforator-transmitter TT–76/GGC, which is a component of the radio teletypewriter set AN/GRC–46. Running the length of the tape are small offcenter sprocket holes, which allow the wide side of the tape to contain as many as three punched holes and the narrow side to contain as many as two. If



1. Tape Advance Symbol at Front of Tape.
2. Line Feed Carriage Return Symbol.
3. Identification line.
4. Last line of meteorological message.
5. Line Feed Carriage Return, Stop Code (9) symbols.

Figure 5. Meteorological message tape.

the tape is cut by the TT–76/GGC, there will be a printout of the met data along the margin on the wide side of the tape (fig. 5).

a. The procedure for entering the met message tape in the mechanical tape reader is outlined below:

(1) Determine the front of the tape by placing the tape in the tape reader with the wide side toward the computer and the printed side up (fig. 6).

(2) Open the armature clamp that keeps the tape in place.

(3) Place the tape in the track with the wide side (three holes) toward the computer.

(4) Insure that the message section of the tape is to the left of the read head; the read head is under the armature clamp.

(5) Place the tape under the clamp, engage the tape under the clamp, engage the tape in the sprocket holes, and fasten the armature clamp (fig. 7).

(6) Turn the sprocket knob on the reader to insure that the tape is properly engaged.

(7) If the tape does not move freely, open the clamp and insure that the sprocket holes in the tape are engaged on the sprocket and that the tape is properly threaded between the read head and the sprocket. Close the clamp and turn the sprocket knob again.

b. The procedure for causing the computer to read the tape is as follows:

(1) Depress matrix buttons H–8 (MET INPUT).

(2) Depress the SM key, KEYBOARD indicator lights.

(3) On the keyboard, type in 2, the flag indicating an entry with the mechanical reader.

(4) Depress the ENTER key. The reader will start reading the tape in a clockwise direction. Insure that the tape does not tangle or hang up while

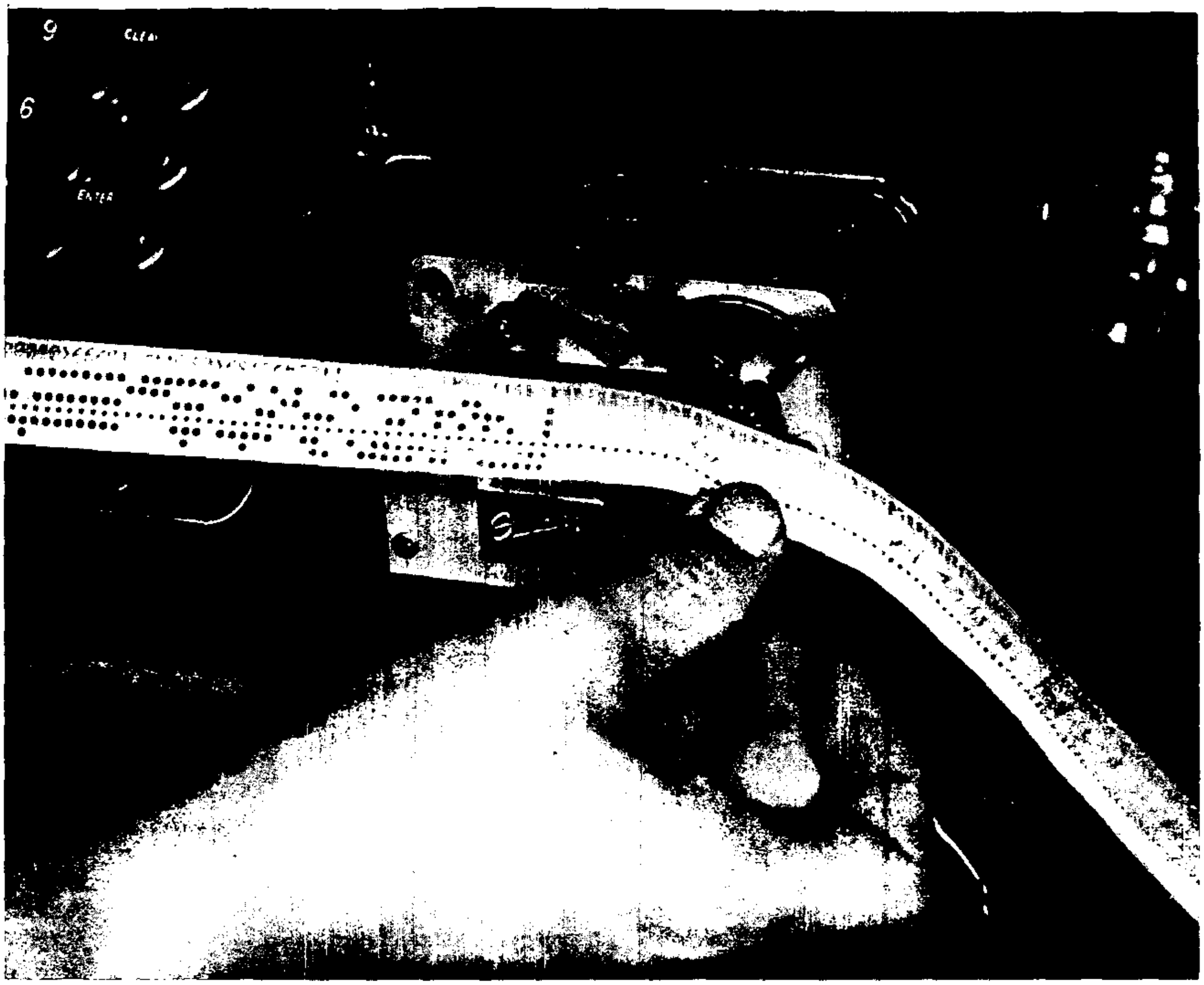


Figure 6. Determining the front of the meteorological message tape.

reading. The reader will stop automatically at the end of the tape; however, if the message contains less than 26 lines, the ENTER key must be depressed tc terminate the input mode.

c. If the maximum ordinate of the trajectory is higher than the altitude of the last line of a new met message, function H–6 (CLEAR HOT STOR) should be used to clear channel 76 of the old met data and replace it with standard met data. When a new met message is entered, the previously entered met message is erased only to the last line number of the new met message. This procedure will insure that the old met data are not used above the last line of the new met being entered.

28. Detailed Matrix Functions

a. Table 1 contains detailed instructions on using each of the input selection matrix functions for the entry or recall of data. A description of the information shown in table 1 is as follows:

(1) The "Input function" column includes the name of each function as it appears on the input selection matrix.

(2) The "Matrix location" column gives the location of each function by the row (A–H) and column (1–8) in

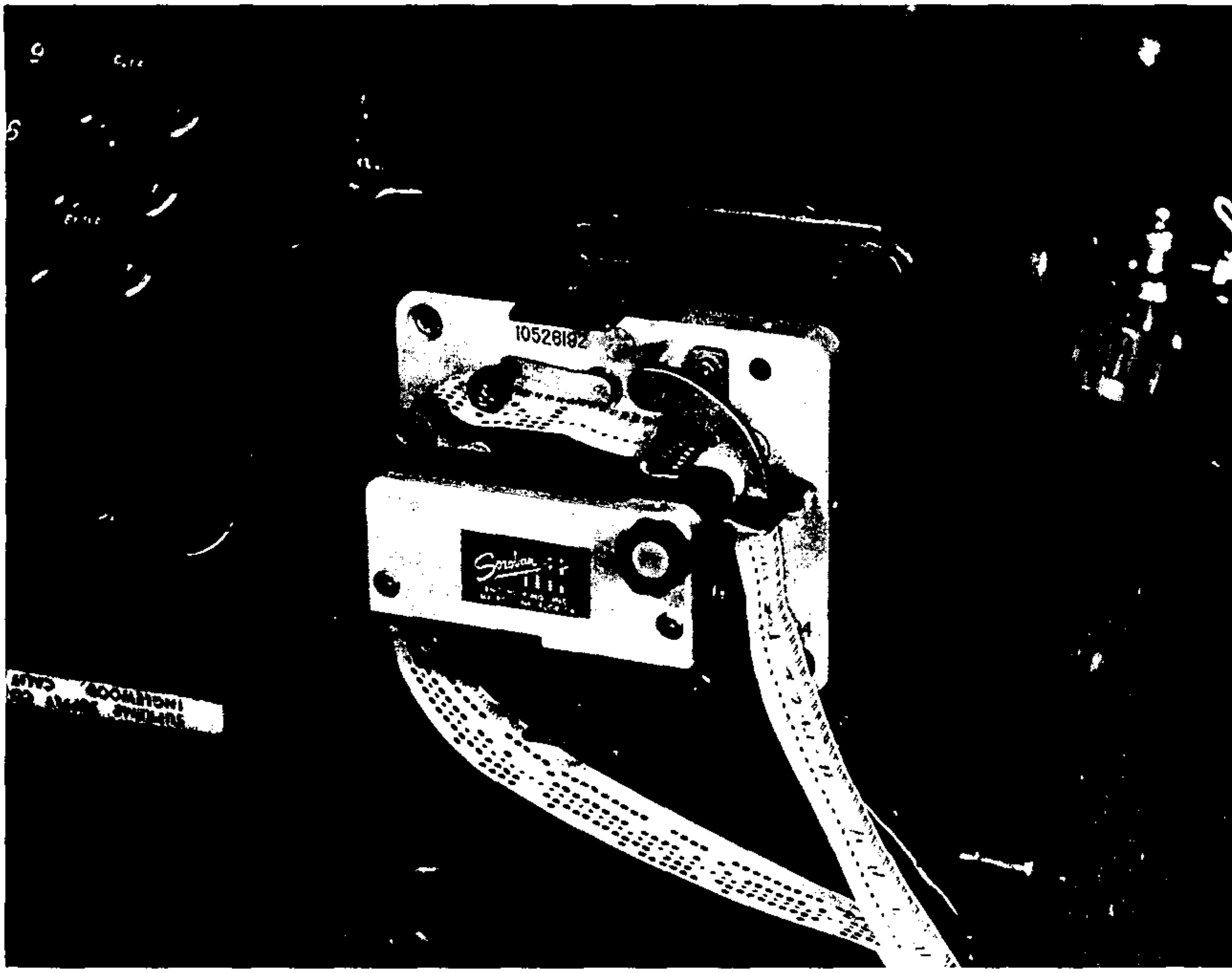


Figure 7. Meteorological message tape in reader, armature closed.

which it is found. The input functions are listed in table 1 in alphabetical and numerical order from A–1 to H–8.

(3) The "Mission associated" column designates whether or not a function is mission associated. If the word "Yes" appear in the column, the input must be associated with a specific firing point and target combination by depressing the appropriate mission association buttons. If the word "No" appears in the column, it does not matter which of these numbered and lettered buttons are depressed. However, in all cases at least one of the lettered buttons, A through E, must be depressed.

(4) The "Entry procedure" column gives detailed instructions for entering a specific function or causing the computer to solve the problem presented by that function. Some matrix locations such as SURVEY or FINAL LLW CORR, require the entry of more than one function. Unless specifically noted, these data may be entered in any sequence.

(5) The "Recall procedure" column gives detailed instructions for recalling information from memory for certain matrix locations. Not all the input

functions are recallable.

(6) The "Remarks" column contains information about the function pertinent to its use.

b. A graphic illustration of the location in memory of input data is shown in figure 8. If data need to be reentered after the CLEAR HOT STORAGE function (H-6) has been used, the operator should refer to figure 8, to determine the data that have been cleared. See details in table 1 after function H-6 (CLEAR HOT STORAGE).

Channel number	Working storage locations					
70	Missions A-1 data	Mission A-2 data	Mission B-1 data	Mission B-2 data		
72	Mission C-1 data	Mission C-2 data	Mission D-1 data	Mission D-2 data		
74	Mission E-1 data	Mission E-2 data	Observers data	Lat	Df	Survey data *
76	Current meteorological data	Decl	Survey data *			
110	Target list	Clear				
112	Firing point list	Azimuth OL	Clear			
114	Standard meteorological data dependent on matrix H-7 entry					
116	Clear	Fuze data *	Clear			
130	Clear					
132	Clear					
134	Clear					
136	Clear	Azimuth of fire *		QE*		

Note: Octal base system, only even numbers used.

* Temporary storage, need not be reentered

Figure 8. Memory map, rocket program.

Table 1. Honest John-Little John Matrix

Input function	*Matrix location*	*Mission associated*	*Entry procedure*	*Recall procedure*	*Remarks*
TGT EAST	A–1	No	1. Depress matrix buttons A–1. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. Enter target easting to nearest meter. (Target easting is displayed.) 4. Depress ENTER key. (Display does not extinguish.)	See matrix position A-6 (RECALL TGT OR LIST) procedures.	1. Used to enter target easting. 2. Five digits must be entered or NO SOLUTION indicator flickers and the display remains. (For corrective action, reinitiate entry procedure and enter value correctly.)
TGT NORTH	A–2	No	1. Depress matrix buttons A–2. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. Enter target northing to nearest meter. (Target northing is displayed.) 4. Depress ENTER key. (Display does not extinguish.)	See matrix position A–6 (RECALL TGT OR LIST) procedures.	1. Used to enter target northing. 2. Five digits must be entered or NO SOLUTION indicator flickers and the display remains. (For corrective action, reinitiate entry procedure and enter value correctly.)
TGT ALT	A–3	No	1. Depress matrix buttons A–3. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. Enter target altitude to nearest meter. (Target altitude is displayed.) 4. Depress ENTER key. (Display does not extinguish.)	See matrix position A–6 (RECALL TGT OR LIST) procedures.	1. Used to enter target altitude. 2. A maximum of four digits may be entered.
TGT RECORD	A–5	No	1. Enter target easting, northing, and altitude using TGT EAST (A–1), TGT NORTH (A–2), and TGT ALT (A–3), respectively. 2. Depress matrix buttons A–5. (Matrix window lights.) 3. Depress SM key. KEYBOARD indicator lights.) 4. On the keyboard, type in the target list number. 5. Depress ENTER key. (Target northing, easting, and altitude are displayed and are stored	NA ------------------------------	1. Used to record a target on the target list in the memory of the computer. 2. Values must be entered for A–1, A–2, and A–3, or the NO SOLUTION indicator flickers and . . . . 3 is displayed. 3. Target may be stored as any one of 32 targets on target list. 4. The computer will accept any target number from 1 to 32.

Table 1. Honest John-Little John Matrix—Continued

Input function	Matrix location	Mission associated	Entry procedure	Recall procedure	Remarks
			on the target list. Operator must wait until display appears before changing the matrix position.)		
RECALL TGT OR LIST	A–6	Only if recalling mission associated target; otherwise not mission associated.	NA	1. To recall a target(s) from the target list: a. Depress matrix buttons A–6. (Matrix window lights). b. Depress SM key. (KEYBOARD indicator lights.) c. Type in target number to obtain display of a specific target. (A vacancy on the list will cause a display of –00000.) The NO SOLUTION indicator will flicker. d. Depress ENTER key. 2. To recall a mission associated target: a. Make desired alphanumeric selection of mission. b. Depress matrix buttons A-6. (Matrix window lights.) c. Depress RECALL key. (Target coordinates are displayed.)	1. Used to obtain the display of a specific target on the list or a mission associated target. 2. Display will include target easting, northing, and altitude. 3. Using this matrix location, each target on the target list be recalled separately.
PRINT TGT LIST	A–7	No	1. Depress matrix buttons A–7. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. To obtain printout of the entire target list, type in 0 and depress ENTER key. For printout of a single target, type in target number and depress ENTER key.	NA	1. Used to print the numbers and coordinates of all targets on the target list or the number and coordinates of a single target. 2. When the target list is to be printed for less than 32 targets the RESET button may be depressed to terminate the list at any point.
TGT DELETE	A–8	No	1. Depress matrix buttons A–8. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.)	NA	1. Used to delete target coordinates and altitude on target list. Replace data with unrecognizable figures.

			3. On the keyboard, type in the number of target to be deleted. 4. Depress ENTER key. 5. On the keyboard, type 0 to delete target or 9 to dismiss the command. 6. Depress ENTER key. (Target is either retained or destroyed, depending on the entry.)		2. To insure against accidental deletion of a target, the enabling entry of 0 is used to affirm deletion and 9 is used to dismiss this command.
FP EAST	B–1	No	1. Depress matrix buttons B–1. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the firing point easting to the nearest meter. (Firing point easting is displayed.) 4. Depress ENTER key. (Display does not extinguish.)	1. See matrix position B–6 (RECALL FP OR LIST.)	1. Used to enter firing point easting. 2. Five digits mut be entered, or NO SOLUTION indicator flickers and the display remains.
FP NORTH	B–2	No	1. Depress matrix buttons B–2. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the firing point northing to nearest meter. (Firing point northing is displayed.) 4. Depress ENTER key. (Display does not extinguish.	See matrix position B–6 (RECALL FP OR LIST) or B–7 (PRINT FP LIST).	1. Used to enter firing point northing. 2. Five digits must be entered or NO SOLUTION indicator flickers and display remains.
FP ALT	B–3	No	1. Depress matrix buttons B–3. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the firing point altitude to nearest meter. (Firing point altitude is displayed.) 4. Depress ENTER key. (Display does not extinguish.)	See matrix position B–6 (RECALL FP OR LIST.)	1. Used to enter firing point altitude. 2. A maximum of four digits may be entered.
AZ OL	B–4	No	1. Depress matrix buttons B–4. 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the grid azimuth of orienting line to nearest mil. (Azimuth is	1. Can be typed out as part of firing point coordinates by allowing procedure for matrix position B–7 (PRINT FP LIST). 2. To recall when firing points have been mission associated—	1. Used to enter the grid azimuth of the orienting line of any firing point. 2. A maximum of 6,400 mils may be entered. 3. Matrix position B–8 (FP DE–

Table 1. Honest John-Little John Matrix—Continued

Input function	*Matrix location*	*Mission associated*	*Entry procedure*	*Recall procedure*	*Remarks*
			displayed.) 4. Depress ENTER key. (Display extinguishes.) 5. For firing point line association, see matrix position B–5 (FP RECORD).	a. Depress B–4. b. Depress mission buttons. c. Depress RECALL key.	LETE) sets these data to an unrecognizable value. 4. Can only be recalled by using RECALL key when firing point has been mission associated.
FP RECORD	B–5	No	1. Enter firing point easting, northing, altitude, and azimuth orienting line (if available) by performing the entry procedures for FP EAST (B–1), FP NORTH (B–2), FP ALT (B–3), and AZ OL (B–4). 2. Depress matrix buttons B–5. (Matrix window lights.) 3. Depress SM key. (KEYBOARD indicator lights.) 4. On the keyboard, type in the firing point list number. (Number is displayed.) 5. Depress ENTER key. Firing point easting, northing, and altitude are displayed.	NA ----------------------------	1. Used to record a firing point on the firing point list in the memory of the computer. 2. Values must be entered in B–1, B–2, and B–3, or NO SOLUTION indicator flickers and a . . . . . . 3 will be displayed. 3. The computer will accept firing point numbers from 1 to 16 only on the firing point list. 4. After depressing ENTER key, firing point information to include azimuth of orienting line (if entered) is stored on firing point list. Operator must wait until display appears before changing matrix position.
RECALL FP OR LIST	B–6	Only if recalling mission associated FP; otherwise not mission associated.	NA ----------------------------	1. To recall a firing point from the firing point list— a. Depress matrix buttons B–6. b. Depress SM key. (KEYBOARD indicator lights.) c. On the keyboard, type in firing point number to obtain display of a specific firing point. d. Depress ENTER key. (Firing point coordinates are displayed.) or a vacancy on the list will cause the NO SOLUTION indicator to blink and a display of zeroes. 2. To recall a mission associated firing point—	1. Used to obtain the display of a specific firing point on list or a mission associated firing point. 2. Display for firing point will include the firing point easting, northing, and altitude. Display for mission associated firing points will include alphabetical association, easting, northing, and altitude. 3. Using this matrix position, each firing point on the firing point list may be recalled separately.

				a. Make desired alphanumeric selection of mission. b. Depress matrix buttons B–6. c. Depress RECALL key. (Firing point coordinates are displayed.)	
PRINT FP LIST	B–7	No	1. Depress matrix buttons B–7. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. To obtain a printout of entire firing point list, type in 0 on the keyboard and depress ENTER key. For printout of a single firing point, type in number of firing point and depress ENTER key.	NA ----------------------------	1. This function causes the computer to print out the firing point numbers, coordinates of firing points, and azimuths of the orienting lines of the firing points on the entire list or of a single firing point on the list. 2. Depress the RESET button to terminate the printout mode when the printout of less than the complete list is desired.
FP DELETE	B–8	No	1. Depress matrix buttons B–8. (Matrix window lights.) 2. Depress SM key. KEYBOARD indicator lights.) 3. On the keyboard, type in the number of firing point to be deleted. 4. Depress ENTER key. 5. On the keyboard, type 0 to delete firing point or 9 to dismiss the command. 6. Depress ENTER key. (Firing point is either retained or deleted depending on last step.)	NA ----------------------------	1. Used to delete the firing point coordinates, altitude, and azimuth of orienting line (if entered) from the firing point list. Replaces data with unrecognizable values. 2. To insure against accidental deletion of a firing point, the enabling entry of 0 is used to affirm deletion and a 9 is used to dismiss the command.
FIRING DATA RECALL	C–1	Yes	NA ----------------------------	1. Depress the appropriate alphanumeric mission association buttons. 2. Depress matrix buttons C–1. (Matrix window lights.) 3. Depress SM key. (Firing data are displayed if they have been computer; if not, the NO SOLUTION indicator flickers.)	1. Used to recall and display the previously compute deflection, time of flight, and quadrant elevation for a particular mission before using matrix positions C–2 through C–7. 2. The data displayed will be the result of the latest ballistic computation. Low-level wind corrections for this mission may now be applied by following the procedures outlined for

Table 1. Honest John-Little John Matrix—Continued

Input function	*Matrix location*	*Mission associated*	*Entry procedure*	*Recall procedure*	*Remarks*
					LLW RANGE (C–2), LLW CROSS (C–3), WIND WT MULT (C–4) and FINAL LLW CORR (C–5).
LLW RANGE	C–2	Yes	1. Depress matrix buttons C–2. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. Depress the key with a plus (+) sign for a head wind or the key with a minus (−) sign for a tailwind. 4. On the keyboard, type in the range wind component value to the nearest mile per hour. 5. Depress ENTER key.	1. Depress matrix buttons C–2. (Matrix window lights.) 2. Depress RECALL key. (Low-level range wind is displayed.)	1. This function is used to input the low-level range wind component in miles per hour with the appropriate sign. 2. The computer will accept any value for component wind speed from +50 mph head to −50 mph tail. 3. This function must be used prior to applying low-level wind correction. 4. If the pilot balloon or line 00 of the met message is used to determine low-level winds, see remarks under C–4 (WIND WT MULT). 5. Set to −00000 by C–8 (CLEAR DATA).
LLW CROSS	C–3	Yes	1. Depress matrix buttons C–3. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. Depress either the RIGHT or LEFT key, depending on the direction of the crosswind component. 4. On the keyboard, type in the value of the crosswind component to the nearest mile per hour. 5. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons C–3. (Matrix window lights.) 2. Depress RECALL key. (Low-level crosswind is displayed.)	1. This function is used to input the low-level crosswind component in miles per hour. 2. The computer will accept any value for component wind speed from right +50 mph to left −50 mph. 3. This function must be used prior to applying the low-level wind correction. 4. If the pilot balloon or line 00 of the met message is used to determine low-level winds, see remarks under C–4 (WIND WT MULT). 5. Set to −00000 by C–8 (CLEAR DATA).
WIND WT MULT	C–4	Yes	1. Depress matrix buttons C–4. (Matrix window lights.) 2. Depress SM key. (KEYBOARD	1. The value of the input is recallable only from the time of its input until either an-	1. This function is used to enter the wind weighting factors to be applied to the windset read-

			indicator lights.) 3. On the keyboard, type in the applicable flag (digit): a 1 if the low-level winds were determined with the wind set during all other than nighttime conditions, a 2 if the low-level winds were determined from the 00 line of the met message or from the pilot balloon. 4. Depress ENTER key. (Display extinguishes.)	other value is entered or matrix location C-8, CLEAR DATA, is used. To recall the wind weight multiplier— a. Depress matrix buttons C-4. (Matrix window lights.) b. Depress RECALL key (Flag is displayed.)	ings. 2. Nighttime conditions exist from 1 hour before sunset to 1 hour after sunrise, with clear skies or few clouds and component winds less than 10 mph. 3. Use all other than nighttime conditions when any of the above conditions do not exist. 4. If the pilot balloon method is used, the wind components are determined as indicated in FM 6-40-1. 5. If the 00 line of the met message is used, the wind velocity must be converted from knots/hr to miles/hr (multiply by 1.1508). Then the wind components may be determined in the appropriate firing table, before using matrix positions C-2 (LLW RANGE) and C-3 (LLW CROSS). 6. Set to −00000 by C-8 (CLEAR DATA).
FINAL LLW CORR	C-5	Yes	1. Depress matrix buttons C-5. (Matrix window lights.) 2. Depress SM key. (The low-level wind correction for deflection is displayed in the DEFLECTION window, and the low-level wind correction for the quadrant elevation is displayed in the QUADRANT window. In the TIME OF FLIGHT window, a correction of zero is displayed.)	NA ------------------------------	1. This function causes the computer to multiply the values of range wind and crosswind by the appropriate profile factors and to display the results as corrections to deflection and quadrant elevation. 2. Entries must have been made for LLW RANGE (C-2), LLW CROSS (C-3), and WIND WT MULT (C-4), or NO SOLUTION indicator will flicker and . . . . . . 7 will be displayed. 3. The NO SOLUTION indicator will flicker and a . . . . . 7 will be displayed when the low-level wind corrections are computed before the firing data are computed. 4. A plus (+) sign in the SIGN

Table 1. Honest John-Little John Matrix—Continued

Input function	*Matrix location*	*Mission associated*	*Entry procedure*	*Recall procedure*	*Remarks*
					window indicates a left deflection correction. A minus (−) sign in the SIGN window indicates a right deflection correction. 5. The final LLW corrections must be displayed before they are applied to the firing data. To determine the final data, see matrix location C–6. 6. A 9 in the first indicator of the quadrant window indicates a tailwind correction, and nothing in this location represents a headwind correction. 7. Functions C–2, C–3, and C–4 need not be entered in order. 8. Set to −00000 by C–8 (CLEAR DATA).
FINAL DATA	C–6	Yes	1. This function is used immediately after FINAL LLW CORR (C–5). 2. Depress matrix buttons C–6. (Matrix window lights.) 3. Depress SM key. (Final firing data are displayed.)		1. This function causes the computer to algebraically apply the low-level wind corrections to the previously computed met corrected deflection and to the quadrant elevation. 2. Display of final firing data includes deflection, time of flight, and quadrant elevation. 3. The computer rounds off the values it displays but applies decimals in its computations; therefore, the final data may not match the firing data recalled plus the LLW corrections.
PRINT MISSION	C–7	Yes	1. Depress matrix buttons C–7. (Matrix window lights.) 2. Depress SM key. (Computer starts printing mission and stops after identification line of met message. Depress ENTER key to continue the typeout of the body of the	NA ----------------------------	1. This function is used immediately after C–6, FINAL DATA, and causes the computer to type out data used in the mission. (See table 3, for typeout format.) 2. Use of this matrix position, C–7 (PRINT MISSION), should

			met message or type in a period to terminate the mode.		follow C-6 (FINAL DATA), since the information may be lost when other operations are performed. 3. The standard met message cannot be typed out unless a met identification line has been entered. 4. Prior to printing duplicate copies of the mission, low-level wind data must be reentered, computed, and applied.
CLEAR DATA	C-8	Yes	1. Depress the appropriate mission associated buttons. 2. Depress matrix buttons C-8. (Matrix window lights.) 3. Depress SM key. (KEYBOARD indicator lights.) 4. Enter 0 to clear data or 9 to dismiss the clear command.		1. This function clears all data stored for a mission. C-1, C-2, C-3, C-4, D-1, D-2, D-3, E-1, E-2, E-3, E-4, E-5, E-6, E-7, E-8, F-3, F-4, F-5, F-6, F-7, and F-8. 2. This function incorporates an enabling entry of 0 to clear data or a 9 to dismiss the clear command (numbers 1 through 8 will produce a NO SOLUTION indication and an error display of . . . . . 9.
CHART RANGE	D-1	Yes	1. Depress the appropriate mission associated buttons. 2. Depress matrix buttons D-1. (Matrix window lights.) 3. Depress SM key. (Chart range is computed and displayed.)	1. Depress the appropriate mission associated buttons. 2. Depress RECALL key. (Chart range is displayed if it has been computed; if not, NO SOLUTION indicator flickers and –00000 is displayed.)	1. Used to compute the horizontal range from the firing point to the target. 2. Coordinates of firing point and target must have been entered and mission associated, or NO SOLUTION indicator will flicker and . . . . 5 is displayed. 3. Matrix location C-8 (CLEAR DATA) sets this function to –00000.
AZ OF FIRE	D-2	Yes	1. Insure that firing point and target coordinates have been entered and mission associated. 2. Depress matrix buttons D-2. (Matrix window lights.) 3. Depress SM key. (Azimuth of fire is computed and displayed.)	1. Depress the appropriate mission associated buttons. 2. Depress RECALL key. (Azimuth of fire is displayed if it has been computed; if not, NO SOLUTION indicator flickers and –00000 is displayed.)	1. Used to compute the azimuth from the firing point to the target. 2. Coordinates of firing point and target must have been entered and mission associated, or NO SOLUTION indicator will flicker and . . . . . 7 is displayed.

Input function	*Matrix location*	*Mission associated*	*Entry procedure*	*Recall procedure*	*Remarks*
					3. Matrix location C–8 (CLEAR DATA) sets this function to −00000.
ORIENT ANGLE	D–3	Yes	1. Depress appropriate mission associated buttons. 2. Depress matrix buttons D–3. (Matrix window lights.) 3. Depress SM key. (Computer computes and displays the orienting angle.)	1. Depress appropriate mission associated buttons. 2. Depress matrix buttons D–3. (Matrix window lights.) 3. Depress RECALL key. (If an orienting angle has been computed for this mission, it will be displayed; if no orienting angle has been computed, the NO SOLUTION indicator will flicker and −00000 will be displayed.	1. Used to compute the orienting angle for mission. 2. Target and firing point coordinates and the azimuth of the orienting line must have been entered and mission associated prior to using this function. 3. Matrix location C–8 (CLEAR DATA) destroys this value.
CREST RANGE	D–6	Yes	1. Depress matrix buttons D–6. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the range to crest in meters, five digits maximum. (Range is displayed.) See remark 2. 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons D–6. (Matrix window lights.) 2. Depress RECALL key. (Last crest range entered is displayed.)	1. This function is used to enter the range from the firing point to a crest. 2. Use manual calculations for ranges less than 5,000 meters (FM 6–40–1).
CREST RANGE	D–7	Yes	1. Depress matrix buttons D–7. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the crest altitude in meters—four digits maximum. (Altitude is displayed.) 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons D–7. (Matrix window lights.) 2. Depress RECALL key. (Last crest altitude entered is displayed.)	This function is used to enter the altitude of the crest.
CREST CLEAR	D–8	Yes	1. Depress matrix buttons D–8. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the appropriate flag. (See re-	NA ----------------------------	1. A ballistic trajectory for the mission must have been computed prior to using this function. 2. The range and altitude of the crest must have been entered

			marks for flags and meaning.) 4. Depress ENTER key. (Computer computes crest clearance; displays crest range, crest altitude, and number of probable errors by which the trajectory will clear the crest; and displays the probability as a percentage.)		by using matrix locations D–6 (CREST RANGE) and D–7 (CREST ALT) prior to using this function. 3. Flags designating the type of crest clearance computation are as follows a. Flag 1, the computer computes the clearance of a crest occupied by friendly troops. b. Flag 2, the computer computes the clearance of a crest in enemy territory. c. Flag 3, the computer computes the clearance of a crest in enemy territory for classified ammunition. See FM 6–3–2A. 4. PE display will be either PE_H or PE_R depending on which value results in the lower probability of clearance.
MOTOR EMPTY WT	E–1	Yes	1. Depress matrix buttons E–1. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the motor empty weight to the nearest pound—four digits maximum—if the stenciled motor empty weight is known. If not known (with MGR–1A rocket), enter 0. (Entry is displayed.) 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons E–1. (Matrix window lights.) 2. Depress RECALL key. (Entered weight will be displayed.)	1. This function is used to input the motor empty weight of the MGR–1A, MGR–1B, or MGR–3A rocket motor. 2. The computer will accept values for this function from 1,200 to 2,700 pounds for the *Honest John* and from 200 to 350 pounds for the Little John.
WHD WT	E–2	Yes	1. Depress matrix buttons E–2. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the stenciled warhead weight to the nearest pound. (Warhead weight is displayed.)	1. Depress matrix buttons E–2. (Matrix window lights.) 2. Depress RECALL key. (Entered warhead weight is displayed.)	1. This function is used to enter the stenciled warhead weight (MGR–1A, MGR–1B, or MGR–3A) rocket. 2. The computer will accept any value for this function from 1,185 to 1,650 pounds for the *Honest John* and from 200 to

Table 1. Honest John-Little John Matrix—Continued

Input function	*Matrix location*	*Mission associated*	*Entry procedure*	*Recall procedure*	*Remarks*
			4. Depress ENTER key. (Display extinguishes.)		400 pounds for the Little John.
PROP WT CORR	E–3	Yes	1. Depress matrix buttons E–3. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in propellant weight correction to the nearest tenth of a pound. Include the sign (+ or −) and decimal point. 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons E–3. (Matrix window lights.) 2. Depress RECALL key. (Entered propellant weight correction is displayed.)	1. This function is used to enter the propellant weight correction stenciled on the MGR–1B or MGR–3A rocket motor. 2. This function is used for only the MGR–1B and MGR–3A rockets and must include the *sign* (+ or −). 3. This function must be entered with a sign, even if zero (± 0). 4. The computer will accept any value for this function from +50 to −50 pounds.
FIN WT	E–4	Yes	1. Depress matrix buttons E–4. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in fin weight to the nearest pound. (Fin weight is displayed.) 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons E–4. (Matrix window lights.) 2. Depress RECALL key. (Fin weight is displayed.)	1. Used with Honest John program for MGR–1A rocket only. 2. Used with Honest John program only. MGR–1A fin weights are— *Fin* — *Weight* M136A1 — 166 pounds M136A2 — 166 pounds M136A2B1 — 172 pounds 3. MGR–1B fin weight is included in stenciled motor empty weight.
PROP WT	E–5	Yes	1. Depress matrix buttons E–5. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the stenciled propellant weight for MGR–1A rocket, to the nearest pound. (Propellant weight is displayed.) 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons E–5. (Matrix window lights.) 2. Depress RECALL key. (Propellant weight is displayed.)	1. Used with Honest John program for MGR–1A rocket only. 2. This function is used to input the propellant weight. (This value is stenciled on the MGR–1A rocket motor.) 3. Computer accepts any value for this function from 1,500 to 2,200 pounds.
GROSS MOTOR WT	E–6	Yes	1. Depress matrix buttons E–6. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.)	1. Depress matrix buttons E–6. (Matrix window lights.) 2. Depress RECALL key. (Gross motor weight is displayed.)	1. Used only with Honest John program. 2. This function is used to enter the stenciled gross motor

			3. On the keyboard, type in the gross motor weight to the nearest pound. (Gross motor weight is displayed.) 4. Depress ENTER key. (Display extinguishes.)		weight for the MGR-1A rocket only. 3. This function is used only when MOTOR EMPTY WT is not known and the propellant and fin weight are known and entered. 4. If this function is used, a zero must be entered in matrix location E-1 (MOTOR EMPTY WT). 5. The computer will accept values for this function from 3,400 to 4,900 pounds.
PROP TEMP	E-7	Yes	1. Depress matrix buttons E-7. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the sign (+ or −) and the propellant temperature to nearest degree Fahrenheit. (Propellant temperature and sign are displayed.) 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons E-7. (Matrix window lights.) 2. Depress RECALL key. (Propellant temperature is displayed.)	1. This function is used to enter the propellant temperature for the MGR-1A, MGR-1B, or MGR-3A rocket. 2. Input must be signed (+ or −). 3. The computer will accept temperatures between −30° and +130° F.
SURF PRESS	E-8	Yes	1. Depress matrix buttons E-8. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in surface pressure to nearest millibar or a 0 to cause the computer to use the met surface pressure in the met identification line. (Entry is displaced.) 4. Depress the ENTER key. (Display extinguishes.)	1. Depress matrix buttons E-8. (Matrix window lights.) 2. Depress RECALL key. (Entered surface pressure is displayed.)	1. This function is used to enter the surface pressure in millibars or to cause the computer to use the met surface pressure in the identification line of the met message. 2. The met surface pressure in the identification line is corrected by FADAC for the difference in altitude between the launcher and the mean datum plane (MDP). 3. The computer will accept data on pressure input between 650 and 1,100 millibars.
TGT LIST ASSOC	F-1	Yes	1. Depress the appropriate mission association buttons. 2. Depress matrix buttons F-1. (Matrix window lights.)	NA ----------------------------	1. This function is used to mission associate a target previously stored on the target list. 2. The target henceforth will be

Table 1. Honest John-Little John Matrix—Continued

Input function	*Matrix location*	*Mission associated*	*Entry procedure*	*Recall procedure*	*Remarks*
			3. Depress SM key. (KEYBOARD indicator lights.) 4. On the keyboard, type in the number of the target on the target list to be mission associated. (Number is displayed). 5. Depress ENTER key. (Target coordinates and altitude are displayed and mission associated.)		associated with this mission for all computations. 3. If a target number which has not been entered on the target list is mission associated, the error display is . . . . 4. 4. Target will be mission associated when display appears.
FP LIST ASSOC	F–2	Yes	1. Depress the appropriate mission association buttons. 2. Depress matrix button F–2. (Matrix window lights.) 3. Depress SM key. (KEYBOARD indicator lights.) 4. On the keyboard, type in the number of the firing point on the firing point list to be mission associated. (Number is displayed). 5. Depress ENTER key. (Firing point coordinates, altitude, and azimuth of the orienting line are mission associated.) and the coordinates and altitude of the firing point are displayed.	NA	1. This function is used to mission associate a firing point previously stored on the firing point list. 2. The firing point will be associated with this mission for all computations. 3. If a firing point number which has not been entered on the firing point list is mission associated, the error display is . . . . 4. 4. Firing point will be mission associated when display appears.
LCHR TYPE	F–3	Yes	1. Depress matrix buttons F–3. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in (launcher type) 386, 33, or 34 (number is displayed.) 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons F–3. (Matrix window lights.) 2. Depress RECALL key. (Launcher type number is displayed.)	1. This function is used to enter the launcher type from which the rocket will be fired—M386, M33, or M34. 2. Deflection 2800 is associated with M34 and M386; deflection 1600 is associated with M33.
RKT TYPE	F–4	Yes	1. Depress matrix buttons F–4. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in flag	1. Depress matrix buttons F–4. (Matrix window lights.) 2. Depress RECALL key. (Warhead flag is displayed.)	This function is used to input the rocket type to be fired— *Rocket* — *Flag* MGR–1A — 31 MGR–1B — 50 MGR–3A — 51

			for rocket type. (See remarks.) 4. Depress ENTER key. (Display extinguishes.)		
WHD TYPE	F–5	Yes	1. Depress matrix buttons F–5. (Matrix window lights.) 2. Depress SM key. KEYBOARD indicator lights.) 3. On the keyboard, type in flag for warhead type. (See remarks.) (Flag is displayed.) 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons F–5. (Matrix window lights.) 2. Depress RECALL key. (Warhead flag is displayed.)	This function is used to input the warhead type flag designations. See table 5.
YIELD	F–6				See FM 6–3–2A and table 5.
HOB	F–7	Yes	1. Depress matrix buttons F–7. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in height of burst above target in meters. (Height of burst is displayed.) 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons F–7. (Matrix window lights.) 2. Depress RECALL key. (Height of burst is displayed.)	1. Their first function is used to enter the height of burst above target. 2. See FM 6–3–2A for special instructions. 3. The computer will accept any value from 0 to 9999. 4. When matrix function F–8 (OPTION) is used, the value entered in this function is set to an unrecognizable form. 5. See table 5.
OPTION	F–8	Yes	1. Depress matrix buttons F–8. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the HOB option flag. (Flags is displayed.) 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons F–8. (Matrix window lights.) 2. Depress RECALL key. (HOB option flag is displayed.)	1. This function is used to input the HOB option, if it is required by the mission. 2. See FM 6–3–2A for instructions.
OBS AZ	G–1	No	1. Entered at the appropriate point in the traverse or intersection procedure in G–5 (SURVEY). 2. Depress matrix buttons G–1. (Matrix window lights.) 3. Depress SM key. (KEYBOARD indicator lights.) Number of the observer for whom azimuth is being entered appears on right Nixie of quadrant window.)	1. Depress matrix buttons G–1. (Matrix window lights.) 2. Depress RECALL key. (Last value entered for observer azimuth is displayed.)	This function is used to enter the azimuth in survey. (See matrix function G–5 (SURVEY). Azimuth must be entered to nearest mil but may be entered to nearest 0.01 mil.

Table 1. Honest John-Little John Matrix—Continued

Input function	*Matrix location*	*Mission associated*	*Entry procedure*	*Recall procedure*	*Remarks*
			4. On the keyboard, type in the observer grid azimuth in mils. (Azimuth is displaced.) 5. Depress ENTER key. (Display extinguishes.)		
OBS HORIZ DIST	G–2	No	1. Depress matrix buttons G–2. (Matrix window lights.) 2. Depress SM key. (KEYBOARD *indicator* lights.) 3. On the keyboard, type in the observer horizontal distance in meters. (Horizontal distance is displayed.) 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons G–2. (Matrix window lights.) 2. Depress RECALL key. (Last horizontal distance entered is displayed on Nixies.)	1. Either the horizontal distance or the slant distance (but not both) must be entered when computing locations from an observer location. 2. Set to −00000 during computation. 3. Horizontal distance must be entered to nearest meter but may be entered to the nearest 0.01 meter. Seven digits maximum.
OBS SLANT DIST	G–3	No	1. Depress matrix buttons G–3. (Matrix window lights.) 2. Depress SM key. (Keyboard indicator lights.) 3. On the keyboard, type in the observer slant distance in meters. (Slant distance is displayed.) 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons G–3. (Matrix window lights.) 2. Depress RECALL key. (Last slant distance entered is displayed on Nixies.)	1. Either the slant distance or the horizontal distance (but not both) must be entered when computing locations from an observer location. 2. Set to −00000 during computation. 3. Slant distance must be entered to nearest meter but may be entered to nearest 0.01 meter. Seven digits maximum.
OBS VERT ANGLE	G–4	No	1. Depress matrix buttons G–4. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in a + or − sign and observer vertical angle to the nearest mil. (Sign and angle are displayed.) 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons G–4. (Matrix window lights.) 2. Depress RECALL key. (Sign and angle are displayed on Nixies.)	1. A plus or minus sign must precede the entry. 2. Set to −00000 during computation. 3. Used with matrix function G–5 (SURVEY). Must be entered to nearest mil but may be entered to nearest 0.01 mil. 4. Horizontal is zero.
SURVEY	G–5	No	1. To solve a traverse problem: a. Using matrix position H–5 (OBS RECALL), recall the coordinates and alti-	1. Azimuth, distance, and vertical angle cannot be recalled after the computation of the forward station has been made.	1. This function is used to solve traverse and intersection survey problems. 2. Flag 1 is entered for traverse

tude of the first station, or enter the coordinates and altitude of the first station, using matrix positions H–1 through H–3.

b. Using matrix positions G–1 through G–4, enter the traverse data to the forward station; grid azimuth (mils), horizontal or slant distance (meters), and vertical angle (mils).

c. Depress matrix buttons G–5 (SURVEY).

d. Depress SM key. (KEYBOARD indicator lights.)

e. On the keyboard, type in the digit 1. Flag 1 is displayed.

f. Depress the ENTER key. The coordinates of the forward station will be computed and displayed. These new coordinates automatically become the first station for the next leg of the traverse.

2. To solve an intersection problem:

a. Using matrix position H–5 (OBS RECALL), recall the coordinates of the first observer.

b. Using matrix positions G–1 (OBS AZ) and G–4 (OBS VERT ANGLE), enter the azimuth and vertical angle from this observer to the point of intersection.

c. Using matrix position H–5 (OBS RECALL), recall the coordinates of the second observer.

d. Using matrix position G–1 (OBS AZ), enter the azimuth of the second observer to the point of intersection.

e. Using matrix position G–5 (SURVEY), depress matrix buttons.

f. Depress SM key, type in the digit 2, then depress the ENTER key. The intersected point coordinates will be displayed.

2. Any one of the four observer locations may be recalled to initiate the traverse or any two may be recalled to solve an intersection survey problem. Use matrix position H–5 (OBS RECALL).

solution and flag 2 is entered for intersection solution.

3. Display of coordinates and altitude of the surveyed location to the nearest 0.01 meter may be accomplished by using recall procedure for matrix positions H–1 (OBS EAST), H–2 (OBS NORTH), and H–3 (OBS ALT), successively.

Table 1. Honest John-Little John Matrix—Continued

Input function	*Matrix location*	*Mission associated*	*Entry procedure*	*Recall procedure*	*Remarks*
			muth from this observer to the point of intersection. (Only one vertical angle need be entered; it may be from either station.) e. Depress matrix buttons G–5. (Matrix window lights.) f. Depress SM key. KEYBOARD indicator lights.) g. On the keyboard, type in the digit 2. Flag 2 is displayed. h. Depress the ENTER key, and the coordinates and altitude of the point of intersection are computed and displayed. A traverse leg may be computed with this point as the first station by using the procedure starting in 1b above.		
LAT	G–7	No	1. Depress matrix buttons G–7. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the latitude of unit to the nearest degree. Must be signed + for Northern Hemisphere, – for Southern Hemisphere) 0 to ± 90°. (Latitude and sign are displayed.) 4. Depress ENTER key. (Display extinguishes.)	1. Depress matrix buttons G–7. (Matrix window lights.) 2. Depress RECALL key. (Latitude is displayed with sign.)	1. This function is used to enter the latitude of the region in which the unit is operating so that applicable corrections can be made to gunnery solution. 2. The computer will accept values from +90° to –90°.
GRID DECL ANGLE	G–8	No	1. Depress matrix buttons G–8. (Matrix window lights.) 2. Depress SM key. (KEYBOARD Indicator lights.) 3. On the keyboard, type in the sign (+ or –) and the numerical value of the grid declination angle to the near-	1. Depress matrix buttons G–8. (Matrix window lights.) 2. Depress RECALL key. (Grid declination angle and sign are displayed.)	1. This function is used to convert met wind direction from true north reference to grid north reference. If grid north is to the right of true north, sign is plus. If grid north is to the left of true north, sign is minus. 2. The computer will accept values

			est mil. (Grid declination angle and sign are displayed.) 4. Depress ENTER key. (Display extinguishes.)		from +64 to −64 mils.
OBS EAST	H–1	No	1. Depress matrix buttons H–1. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the observer easting. (Easting is displayed.) 4. Depress ENTER key. (Display extinguishes.)	See matrix position H–5 (OBS RECALL).	1. This function is used to enter observer easting for use in the survey routine. 2. At least five digits must be entered or NO SOLUTION indicator will flicker, and display will remain on Nixes. (For corrective action, reinitiate the entry procedure and enter observer easting correctly.) 3. Entry may be made to nearest 0.01 meters, seven digits.
OBS NORTH	H–2	No	1. Depress matrix buttons H–2. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the observer northing. (Northing is displayed.) 4. Depress ENTER key.	See procedures for matrix position H–5 (OBS RECALL).	1. This function is used to enter observer northing for use in the survey routine. 2. At least five digits must be entered or NO SOLUTION indicator will flicker, and display will remain on Nixies. (For corrective action, reinitiate entry procedures and enter correctly.) 3. Entry may be made to nearest 0.01 meters, seven digits.
OBS ALT	H–3	No	1. Depress matrix buttons H–3. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the altitude to the nearest meter. (Altitude is displayed.) 4. Depress ENTER key.	See procedures for matrix position H–5 (OBS RECALL).	1. This function is used to enter the observer altitude for use in the survey routine. 2. Entry must be to the nearest meter but may be made to the nearest 0.01 meter.
OBS RECORD	H–4	No	1. Perform after data have been entered in matrix locations H–1, H–2, H–3. 2. Depress matrix buttons H–4. (Matrix window lights.) 3. Depress SM key (KEYBOARD indicator lights.) 4. On the keyboard, type in the number 1 through 4 to iden-	See procedures for matrix position H–5 (OBS RECALL.)	1. This function is used to store the easting, northing, and altitude of an observer. 2. Values must have been entered in matrix locations H–1, H–2, and H–3 or NO SOLUTION indicator flickers. 3. Each observer location must be assigned a number from 1 to 4.

Table 1. Honest John-Little John Matrix—Continued

Input function	*Matrix location*	*Mission associated*	*Entry procedure*	*Recall procedure*	*Remarks*
			tify the observer location (OP). 5. Depress ENTER key. (Coordinates are stored and displayed.)		
OBS RECALL	H–5	No	See recall procedure.	1. Depress matrix buttons H–5. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights). 3. Enter the number of the observer location (OP) being recalled. (Number is displayed.) 4. Depress ENTER key. (The easting, northing, and altitude of the observer location (OP) are displayed.)	1. This function is used to recall to computational mode the coordinates of any of the four observer locations previously recorded. 2. Observer location must have been stored by using procedure outlined for matrix position H–4 (OBS RECORD).
CLEAR HOT STORAGE	H–6	Any	1. Test working storage by following the program test procedures. (Computer displays the channel of memory in which the parity error has occurred.) 2. Place the appropriate section of the hot storage tape in the mechanical tape reader. This section may be determined by comparing the number at the beginning of the tape section with the line number displayed by the computer in step 1. 3. Depress matrix buttons H–6. (Matrix window lights.) 4. Depress SM key. (KEYBOARD indicator lights.) 5. On the keyboard, type in the line number displayed by the computer as a result of the working storage test. (Computer reads in the proper section of tape through the mechanical tape reader. This restores the	NA ----------------------------	1. This function is used to clear and restore a selected line of working storage to the same condition it was in after the program was entered. The need for using this function is shown by the flickering of the PARITY indicator which indicates an alteration of improper reading from memory. 2. If the program test of working storage is successful (136 displayed) and the parity error persists, the trouble is not in the working storage, and the program should be reloaded, using the signal data reproducer AN/GSQ–64. 3. To prevent undue delay in computing firing data, step 7 of the entry procedure, may be omitted until a lull in firing, provided the data are not required for the mission. 4. Clear hot storage tape consists of section of tape for each line

			line number entered to the same condition it was in after the program was entered with the signal data reproducer AN/GSO-64.) 6. Refer to map of working storage (fig. 8) to determine which data were stored in the cleared line. 7. Reenter data in cleared line by following the normal entry procedure. 8. Initiate program test 2. 9. Repeat 1 through 8 above, until test of working storage is successful.		of memory. At the beginning of each section of tape, the number of the channel of memory is printed. The computer will accept only the correct section of the tape according to the keyboard input. 5. The entry procedures for the clear hot storage tape is identical to that for the met tape.
MET STD	H–7	Yes	1. Depress matrix buttons H–7. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in a 0 to use standard conditions or a 9 to dismiss this command. 4. Depress ENTER key. (Standard met will be used in the problem solution if a 0 has been entered.)	1. Depress matrix buttons H–7. (Matrix window lights.) 2. Depress RECALL key. (A 0 or a 9 will be displayed.)	1. This function is used to direct the computer to use standard met conditions in the problem solution. 2. Incorporates an enabling entry of 0 to permit use of standard met or a 9 to dismiss the command. 3. Computer automatically uses current met data for a mission unless H–7 (MET STD) has been used. When this function has been used with an 0 entry, and a met message has subsequently been entered, it must be dismissed with a 9 entry if the current met data are to be used in the ballistic solution.
MET INPUT	H–8	No	1. Depress matrix buttons H–8. (Matrix window lights.) 2. Depress SM key. (KEYBOARD indicator lights.) 3. On the keyboard, type in the input code: 0—keyboard entry or 2—tape reader If 0 is entered, the computer will demand the identification line by an 88 display. Enter identification line and com-	1. Depress matrix buttons H–8. (Matrix window lights.) 2. Depress RECALL key. (Identification line of met message is displayed.)	1. Used to enter met data for solution of the gunnery problem. 2. Format for entry of met data, using Code 0 (keyboard entry). a. To enter the identification line— (1) Perform steps 1, 2, and 3 of entry procedure (2) Type the date-type group, six digits. (3) Type the MDP (to 10 meters) three digits.

Table 1. *Honest John-Little John Matrix*—Continued

Input function	*Matrix location*	*Mission associated*	*Entry procedure*	*Recall procedure*	*Remarks*
			puter will demand each line, in turn, by displaying its number (00, 01, 02). To terminate the input, enter a 9 when the line after the last line is demanded. The mode is automatically terminated after line 26 is entered. (See remarks for format.) 4. If code 2 is entered, the computer reads the prepared paper tape. See paragraph 27 for method of entering tape in mechanical reader. 5. When less than 26 lines of met data are entered using the tape, depress the ENTER key after the tape stops, the input mode will terminate.		(4) Type the percent of met surface pressure (three digits.) (5) Depress ENTER key. b. Upon demand for each line, type in— (1) Line number, two digits. (2) Wind direction (to nearest 10 mils), three digits. (3) Wind speed to nearest knot, three digits. (4) Temperature to 0.1° K, four digits. (5) Density to nearest 1 gm/m^3, four digits. 3. See paragraph 27 for details on tape entry. 4. If the maximum ordinate of the trajectory is higher than the altitude of the last line of a new met message, function H-6 (CLEAR HOT STOR) should be used to clear line 76 of old met data and replace it with standard met data. When a new met message is entered, the previously entered met is erased only to the last line number of the new met message; therefore, this procedure will insure that old met data are not used above the last line of the new met being entered.

Section VI. COMPUTER OUTPUT

29. General

a. The output of data for the rocket program is through the display panel described in paragraph 13, and through a teletypewriter connected to the M18 gun direction computer.

b. The teletypewriter printout formats including an explanation of the abbreviations used in the printouts are shown in table 3.

30. No Solution Display Indications

In the rocket program when an input item has been entered by using an erroneous procedure or when the item is incorrect, the NO SOLUTION indicator blinks and a number is displayed on the Nixie display panel to identify the error. This number is shown in table 2 and on the flag for the particular rocket program. For example, if the target is at a range greater than the rocket can achieve, the NO SOLUTION indicator will blink and 23 appears in the Nixie display. This number is the flag identifying the error as "out of range."

Table 2. No Solution Indication Displays Description of Error, and Corrective Actions

Display	Description of error	Corrective actions
1	Magnitude of the input has exceeded the limits of the computer.	Reenter the input function within the correct limits.
3	One or more of the inputs (easting, northing, and altitude) which define the firing point or the target were not entered before the FP DATA STORE or TGT DATA STORE was attempted.	Recall inputs to determine which ones were not entered, and enter the missing data.
4	A firing point or target which is not on the list has been mission associated.	Insure that the firing point and the target being used for the mission have been entered on the lists.
5	One or more of the inputs needed to compute the data below have not been entered: (1) Chart range. (2) Azimuth of fire. (3) Orienting angle.	Insure that the firing point and the target have been mission associated.
6	A crest clearance computation has been attempted for a mission that has not been computed.	Compute the firing data (except the low-level wind corrections) before attempting to compute the crest clearance.
7	A low-level wind computation has been attempted for a mission that has not been computed. Low-level range wind, low-level crosswind, or wind weight multiplier has not been entered.	Compute the mission before computing the low-level wind corrections, and enter the appropriate data before depressing C–5. (FINAL LLW CORR.)
8	FINAL DATA initiated before the low-level wind computations were completed.	Compute the low-level wind corrections before depressing C–6. (FINAL DATA.)
9	Incorrect enable or dismiss code used for— (1) TGT DELETE. (2) FP DELETE. (3) CLEAR DATA. (4) MET STD.	Use the correct enable or dismiss code.
10	1. PRINT MISSION was attempted without computing the mission. 2. Mission buttons not depressed for mission associated item.	1. Compute the mission before depressing C–7. (PRINT MISSION.) 2. Depress appropriate mission associated buttons.
11	Matrix buttons or mission buttons were changed after the sample matrix or compute buttons were depressed.	Depress the correct matrix or mission buttons and depress COMPUTE button. If not successful, reenter appropriate data and depress COMPUTE button.
15	Crest range or crest altitude or both were not entered before the CREST CLEAR calculation was attempted.	Enter appropriate data.
16	Mission was changed during crest clearance computations.	Perform correct computation-sequence.

Table 2.—Continued

Display	*Description of error*	*Corrective actions*
17	Crest range is greater than the target range.	Not applicable.
18	Trajectory intersects the crest.	Not applicable.
XY	Improper or incomplete matrix position entry. (X is the lettered row on the matrix panel containing the error, and Y is the numbered column containing the error. For example, ...53 indicates an error in the PROP WT CORR entry.	Correct entry procedure.
−00000 is displayed	Recalling an input which has been entered or recalling a previously noncomputed value or a value set to an unrecognizable form.	Enter or compute desired value.
NSL blinks and input display remains in Nixies.	Failure to enter five digits for an input which requires a five-digit entry.	Enter proper number of digits.
NSL blinks and no display	1. A parameter has been recalled which is not recallable. 2. The magnitude of the quadrant elevation is out of range of the system (rocket and launcher). 3. Matrix buttons have not been depressed when executing SM (sample matrix) or RECALL. 4. A blank matrix window has been used. 5. Lettered button is not depressed for mission associated items. 6. Depressing an unused button; i.e., SET UP, SEND, TRIG, or RECEIVE. 7. An incorrect meteorological message entry has been made. 8. A decimal point has been entered for an item not requiring a fractional input.	Review and correct entry or entry procedure.
21	No vertical angle or an acceptable vertical has been entered.	Recheck entry. Angle entered must be between +1600 mils and −1600 mils.
22	Azimuth has not been entered (traverse).	Recheck entry. Azimuth must not be greater than 6,400 mils.
23	Out of range.	Compute a leg greater than 100,000 meters by another method (manually).
24	Azimuth has not been entered (intersection).	Recheck entry. Azimuth must not be greater than 6,400 mils.
25	Two vertical angles have been entered for an intersection problem.	Recheck entry and use vertical angle pertaining to the problem.
26	A zero horizontal range has been entered.	Recheck entry and enter and acceptable value.
27	A horizontal or slant range has not been entered.	Make appropriate entry.

31. Teletypewriter Printout

a. A printout of the fire mission, the firing point list, or the target list may be obtained if the teletypewriter is connected to the computer. Matrix positions A–7, B–7, and C–7 are used, respectively.

b. Table 3 illustrates the format obtained with these printout functions.

Table 3. Printout Formats, Rocket Program.

Firing Point List Format

	Firing point record number	*Firing point easting (5 digits)*	*Firing point northing (5 digits)*	*Firing point altitude (3–4 digits)*	*Azimuth of orienting (4 digits)*
Printout format		FPE	FPN	FPA	AOL
	1	00000	00000	000	0000
	2	00000	00000	000	0000
	3	00000	00000	000	0000
	4	00000	00000	000	0000
	–	–	–	–	–
	–	–	–	–	–
	16	00000	00000	000	0000

Target List Format

	Target number	*Target easting (5 digits)* TGE	*Target northing (5 digits)* TGN	*Target altitude (3–4 digits)* TGA
Printout format	1	00000	00000	0000
	2	00000	00000	0000
	3	00000	00000	0000
	4	00000	00000	0000
	–	–	–	–
	–	–	–	–
	–	–	–	–
	32	00000	00000	0000

Fire Mission Format

Printout format — *Symbol printed*	*Number of digits printed*	*Explanation of symbols and data*
DEF	4	Deflection.
FZS	3	Fuze setting.
QEL	4	Quadrant elevation.
TGE	5	Target easting.
TGN	5	Target northing.
TGA	3–4	Target altitude above sea level.
FPE	5	Firing point easting.
FPN	5	Firing point northing.
FPA	3–4	Firing point altitude.
AZF	4	Azimuth of fire.
RNG	4–5	Range.
HOB	3	Height of burst above target.
LCH	2–3	Flag (code) for launcher type.
RKT	2	Flag for rocket type.
WHT	1	Flag for warhead type.
OPT	1	Flag for height of burst option.
YLD	1	Flag for yield.
AOL	4	Azimuth of the orienting line.
ORA	4	Orienting angle.
WWT	4	Warhead weight.
MEW	4	Motor empty weight.
PWC	5	Propellant weight correction for MGR–1B rocket.
PWT	4	Propellant weight for M31 rocket.
FWT	3	Fin weight for M31 only.
GWT	4	Gross motor weight. Alternate stenciling on M31 in lieu of MEW.
PRT	2	Propellant temperature.
SPR	3–4	Surface pressure.
LLR	1–3	Low-level range wind.
LLX	1–3	Low-level crosswind.
RCF	1	Range wind correction factor.
XCF	1	Crosswind correction factor.
DQE	1–2	Final low-level wind corrections to quadrant elevation.
DDF	1–3	Final low-level wind corrections to deflection.
LAT	2	Latitude of the firing point.
MET	14	Met identification line only.
	16	Each line of the met message.

Values printed are positive unless preceeded by a minus sign.

32. How FADAC Computes

a. The computer solves the gunnery problem for the rocket in three phases:

(1) Range, azimuth, and initial firing data selection.

(2) Data computation for powered flight.

(3) Trajectory computations for free flight.

b. The series of computations made by the computer are depicted in figures 9 through 12. The six steps are explained below:

(1) *Steps 1 through 3.* Using the coordinates of the firing position and the target, FADAC mathematically calculates the range and azimuth of fire. Then, using the other initial data entered, it calculates the height of burst relative to the launcher. From this information, the computer selects a trial quadrant elevation based upon the empirical data entered in its memory.

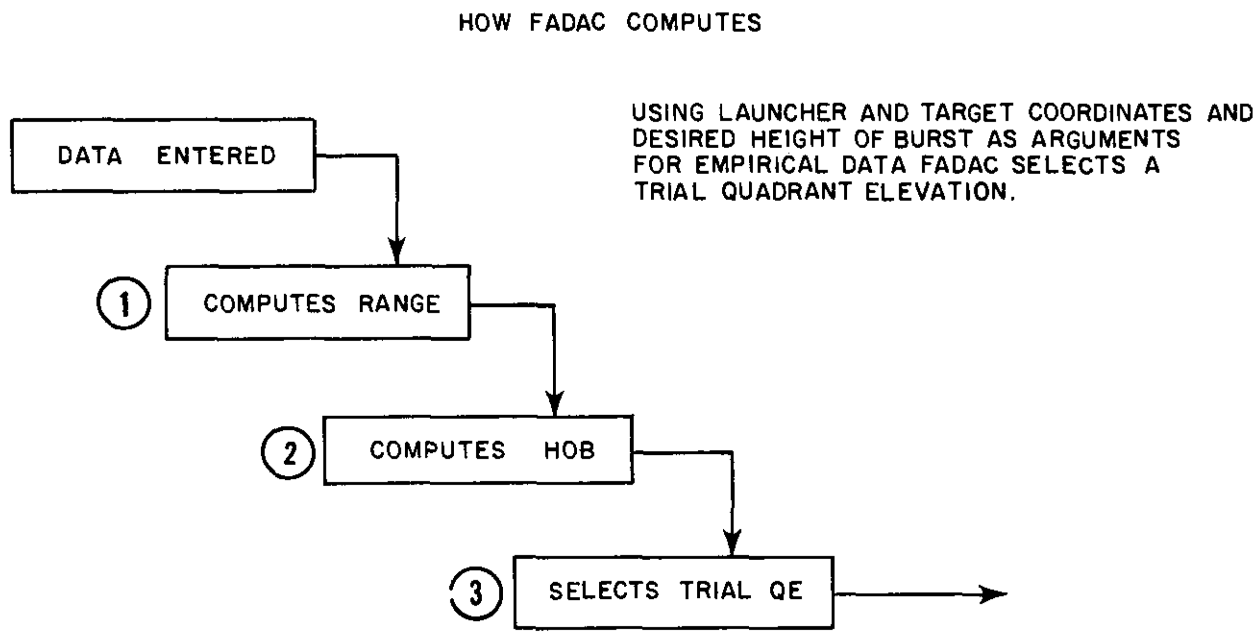


Figure 9. Steps 1 through 3 of computation.

(2) *Step 4.* The trial quadrant elevation is used as an argument to enter a table of empirical data stored in the computer's memory to determine the position of the rocket at motor burnout, in range (X) and height (Y) and angle of travel (Ø) along a hypothetical trajectory.

(3) *Step 5.* After motor burnout, considering the velocity and angle of travel at this point, the computer simulates the flight of the rocket through the existing conditions of weather, using data on the rocket's known aerodynamic performance and the known ballistic effects of rotation of the earth and gravity, by numerically integrating the equations of motion for a projectile in flight. At each integration, the nonstandard conditions are applied to the equations of motion to determine a new velocity. Acceleration is integrated to find the velocity. The velocity of the rocket is further integrated to determine its displacement in horizontal distance (X) and vertical distance (Y).

(4) USING THE TRIAL QE AS AN ARGUMENT TO EMPIRICAL DATA FADAC SOLVES FOR THE POSITION OF THE ROCKET AT MOTOR BURNOUT:

X RANGE
Y HEIGHT
Φ ANGLE OF TRAVEL

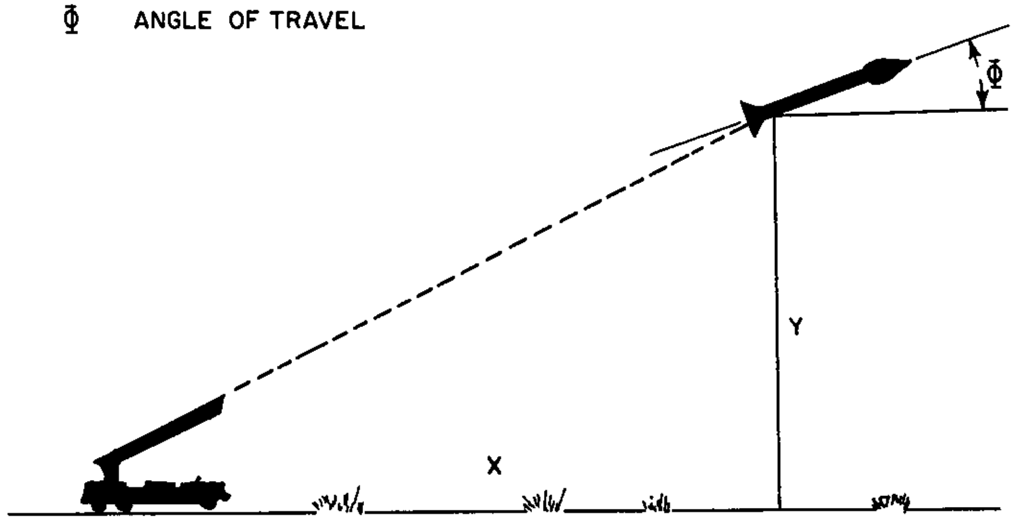


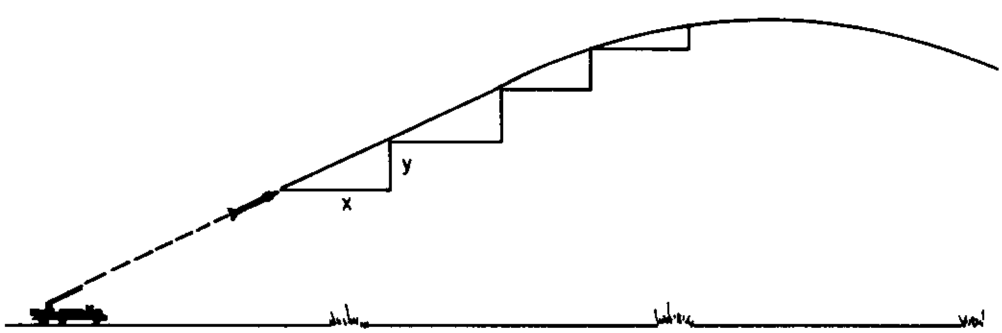
Figure 10. Step 4 of computation.

(5) AFTER MOTOR BURNOUT, APPLYING ALL KNOW CONDITIONS AFFECTING ROCKET FLIGHT, IN THE EQUATIONS OF MOTION FADAC COMPUTES:

X Range = f (Velocity, Cos $\measuredangle$ Travel, Wt, Drag, Weather)

Y Height = f (Velocity Sin $\measuredangle$ Travel, Wt, Drag, Weather, Gravity)

For a TIME INTERVAL



INTEGRATING ACCELERATION TO OBTAIN VELOCITY,
THEN: With a new velocity, angle of travel and considering weather and other effects at this time, COMPUTES: (X) RANGE and (Y) HEIGHT and so on........

Figure 11. Step 5 of computation.

(4) *Step 6.* At the completion of each velocity integration, the altitude of the rocket is compared with the target altitude. When the computed altitude of the rocket is equal to or less than the altitude of the target, the integration stops and a miss distance is computed by comparing the location of the rocket with that of the target. If the miss distance is less than 30 meters, a correction is applied, and the firing data are displayed. If the miss distance is 30 meters or greater, the initial quadrant elevation is corrected in step 3 and the trajectory is recomputed. This comparison continues until the miss distance is reduced to less than 30 meters.

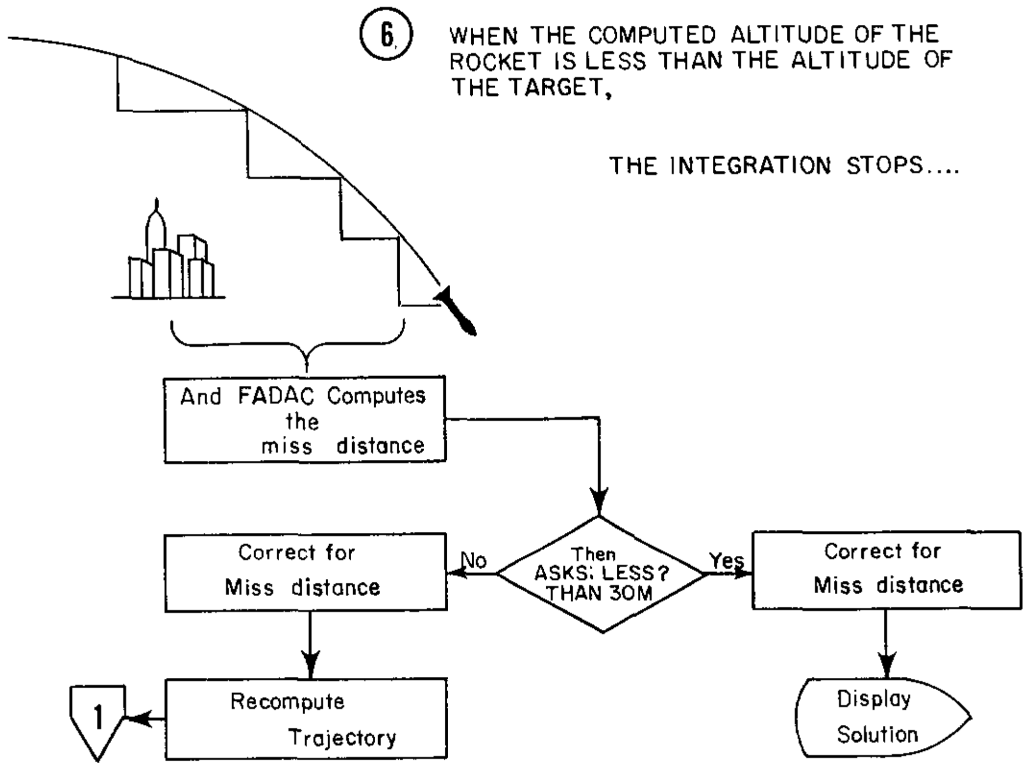


Figure 12. Step 6 of computation.

c. The integration method also applies corrections to deflection for earth curvature, rotation of the earth, and ballistic crosswind. When the computation is completed, the initial deflection, fuze setting, and quadrant elevation are displayed. Data for low-level winds are then entered, and corrections are computed and applied to the initial deflection and quadrant elevation. Then final firing data are displayed.

d. The computer solves the gunnery problem by using the nonstandard conditions entered by the operator, including the current meteorological data unless the meteorological standard command has been entered.

e. FADAC computes the crest clearance probabilities for any crest at a range greater than 5,000 meters and less than the range to the target. The solution displayed for this problem is the probability of clearing the crest expressed as a number of probable errors and as a percentage. A crest or piece mask at a range less than 5,000 meters is considered as a special problem, and manual methods and special tables are used to determine the clearance criteria (as described in FM 6–40–1.)

The computer solves the crest clearance problem, as follows:

(1) The computer determines three points on the trajectory, two of which have the same altitude as the crest, one on the ascending leg and one on the descending leg of the trajectory and the third point is at the same range as the crest.

(2) The computer then determines the distance from the top of the crest to each of these three points. For the first two, this distance is horizontal; and for the third, the distance is vertical.

(3) Dividing these distances by the value of the appropriate probable error, the computer determines the number of probable errors by which the trajectory will clear the crest at each of these points taking into account an additional safety factor if the crest is occupied by friendly forces. The smallest value is used.

(4) Entering a standard probability table stored in the memory, the computer, determines the assurance of clearing the crest in percentage.

(5) The display shows range, altitude, number of probable errors, and percentage assurance.

33. Operator's Steps in Solving Problem

a. Firing data are computed using the mission association buttons of the rocket program. The buttons numbered 1 and 2 and lettered A through E on the right side of the matrix panel are depressed to designate ten separate missions, i. e., A1, A2 . . . E1, E2.

b. The steps in solving a problem are performed in the sequence in (1) through (14) below. This sequence is only a guide, and it may be altered to fit the available data in a given situation. These steps provide an efficient and fast solution to the gunnery problem.

(1) Select the mission by depressing the appropriate number (1 or 2) and letter (A through E) buttons.

(2) Clear the mission location by using function C–8 (CLEAR DATA).

(3) Using matrix function F–1 (TGT LIST ASSOC), select the target by number from the target list. Targets must be stored on the list before they can be mission associated.

(4) Using matrix function F–2 (FP LIST ASSOC), select the firing point from the firing point list. Firing points must be stored on the list before they can be mission associated.

(5) Enter the metro message, grid declination angle, and latitude by using matrix functions H–8, G–7, and G–8. If this information has already been entered, it will be applied to the mission without any action by the operator.

(6) Enter the known data pertaining to the rocket type, launcher type, warhead type, propellant weight, gross and motor weight, etc., by using the red matrix buttons.

(7) Compute the azimuth of fire and the orienting angle and, if required, the chart range by using matrix functions D–1, D–2, and D–3.

(8) Compute the initial deflection, the fuze setting or time of flight, and the quadrant elevation by depressing the COMPUTE button.

(9) Using matrix functions D–6, D–7, and D–8, compute the crest clearance information required.

(10) Approximately 2 minutes prior to firing the mission, enter low-level wind data by using matrix functions C–2, C–3, and C–4. Using matrix functions C–5 and C–6, compute and apply low-level wind corrections to obtain final data.

(11) Mission data may be precomputed and stored by using the procedure in (1) through (8) above. When new meteorological messages are received or a change in other input data has occurred, the mission should be updated as follows:

(*a*) Depress the appropriate mission association buttons and, using matrix function C–1, recall the mission.

(*b*) Use matrix function H–7 and dismiss the met standard. This must be done if the met standard has been used to compute the mission.

(*c*) Using matrix function H–8, enter the latest met message.

(*d*) Using the appropriate matrix functions, enter any new data pertinent to the mission. These functions are color coded red.

(12) After the final data have been computed, in (10) above, a printout of the mission may be obtained by using matrix function C–7 and a teletypewriter connected to the M18 computer.

(13) Printout of the firing points and targets may also be obtained by using matrix functions A–7 and B–7.

(14) When a particular mission set of data is no longer needed, the data may be cleared from the "hot storage" section of memory by using matrix function C–8 (CLEAR DATA).

CHAPTER 3

DESTRUCTION OF EQUIPMENT

34. General

a. When it becomes necessary to abandon equipment during combat, the M18 computer and its auxiliary equipment must be destroyed to prevent its use by the enemy.

b. The destruction of any equipment subject to capture will be ordered only upon authority delegated by a division or higher commander.

35. Principles

Plans must be prepared for destroying the computer and its auxiliary equipment. The principles to be applied in planning are as follows:

a. Destruction methods must be easy to implement.

b. Destruction must be thorough.

c. Priorities must be established so that the more essential parts are destroyed first.

d. The same essential parts on all like units must be destroyed to prevent the enemy from constructing a unit from salvaged parts.

e. Spare parts and accessories must be destroyed with the same priorities given the same parts installed on the equipment.

36. Methods

a. The methods employed in the destruction of the computer will be specified in the destruction plan. The use of firearms, grenades, or TNT or other types of explosive or the destruction of some parts by burning or striking with an ax, sledge hammer, or similar instrument are typical methods that should be considered in formulating a plan of destruction for the unit standing operating procedures.

b. The essential parts of the M18 computer are the circuit boards, the magnetic disk memory, and the control panel assembly. If time permits, the chassis can be removed from the case and can be destroyed by smashing with a sledge hammer. Each circuit board should be smashed. The computer may also be rendered useless by placing it on a pile of combustible material and pouring gasoline, oil, or other similar liquid over it and igniting a fire. A hot fire is required. For further details on destruction means, refer to TM 9–1200–221–10.

APPENDIX A

REFERENCES

1. Field Manuals

FM 5–25	Explosives and Demolitions.
(S) FM 6–3–2A	Operation of Gun Direction Computer M18, Free Rocket Application with Nuclear Ammunition (U).
FM 6–40	Field Artillery Cannon Gunnery.
FM 6–40–1	Field Artillery Honest John/Little John Rocket Gunnery.
(S) FM 6–40–1A	Field Artillery Honest John/Little John Rocket Gunnery (U).
FM 6–40–3	Field Artillery Gun Direction Computer M18, Gunnery.
FM 6–125	Qualification Tests for Specialists, Field Artillery.

2. Technical Manuals

TM 5–6115–211–10	Operator's Manual: Generator Set, Gasoline Engine: 3KW, AC, 120V, 1 and 3 Phase, 120/240V, Single Phase, 120/208V, 3 Phase, 400 Cycle, Skid Mounted.
TM 5–6115–211–20	Organizational Maintenance: Generator Set, Gasoline Engine: 3 KW, AC, 120V, 1 and 3 Phase, 120/240V, Single Phase, 120/208V, 3 Phase, 400 Cycle, Skid Mounted.
TM 5–6115–211–20P	Organizational Maintenance Repair Parts and Special Tool Lists. Generator Set, Gasoline Engine: 3 KW, AC, 120V, 1 and 3 Phase, 120/240V, Single Phase, 120/208V, 3 Phase, 400 Cycle, Skid Mounted.
TM 5–6115–271–15	Operator and Organizational Maintenance Manual Generator set, gasoline engine: 3 KW, less engine, 3 kw, ac, 400 cycle (Military model HF 3.0 MD) FSN 6115–075–1638 and FSN 6115–012–1933, 3 kw, ac, 60 cycle (Military model SF 3.0 MD) FSN 6115–075–1640 and FSN 6115–913–9290; 3 kw, dc, 28V (Military model DC 3.0 MD/28) FSN 6115–012–1997.
TM 9–1220–221–10	Operator's Manual: Computer, Gun Direction, M18.
TM 9–1220–221–20/1	Organizational Maintenance Manual: Computer, Gun Direction, M18.
TM 9–1220–221–20/2	Organizational Maintenance Manual: Computer, Gun Direction, M18 (Composite Test Tape Program Printout).
TM 9–1220–221–20P	Organizational Maintenance Repair Parts and Special Tool Lists: Computer, Gun Direction, M18.
TM 9–1340–202–12	Operator and Organizational Maintenance Manual 762-mm Rockets MGR–1A and MGR–1B series (Honest John rocket system).
TM 9–1340–204–12	Operator and Organizational Maintenance Manual: 318-mm Rocket MGR–3A (M51).

TM 9–4931–204–12/2	Operator and Organizational Maintenance Manual: Test Set, Computer Logic Unit AN/GSM–70 (Composite Test Tape A Program Printout).

3. Miscellaneous

AR 611–201	Enlisted Military Occupational Specialties.
ATP 6–100	Field Artillery Cannon Units.
ATP 6–302	Field Artillery Rocket Units, Honest John and Little John Rockets.
DA Pam 310-series	Index of Military Publications.

APPENDIX B

ROCKET REFERENCE DATA

1. The rocket programs compute weight information based upon the type rocket, warhead, and launcher being used; therefore, manual computations are unnecessary. Table 4 shows the matrix input function for weight data applicable to the rocket types.

Table 4. Rocket Weight Data

Matrix location	*Applicable to rocket types*	*Remarks*
E-1 (MOTOR EMPTY WT)	MGR-1A, -1B, and -3A	Weight stenciled on motor.
E-2 (WHD WT)	MGR-1A, -1B, and -3A	Weight stenciled on warhead.
E-3 (PROP WT CORR)	MGR-1B and -3A	Weight stenciled on motor.
E-4 (FIN WT)	MGR-1A only	166 pounds or 172 pounds according to fin type.
E-5 (PROP WT)	MGR-1A only	Weight stenciled on motor. Use only when E-1 is not used.

2. The use of matrix input functions F-6 (YIELD), F-7 (HOB), and F-8 (OPTION) depends on the type of warhead being fired. Rocket and warhead combinations and fuzing information are shown in table 5 and the appropriate input functions are indicated. For additional information, see table 1, or FM 6-3-2A.

Table 5. Rocket Warhead Data

Warhead type	*Flag*	*Applicable matrix entry locations*	*Remarks*
Nuclear M27, M47, M48	1	F-6 (YIELD) F-7 (HOB) F-8 (OPTION)	See FM 6-3-2A.
High-explosive M57	2	F-7 (HOB)	Enter 0 height of burst. Set time fuze for safety time of flight minus 5 seconds. Used only with the MGR-1A rocket.
*Chemical M190 (E19R2)	3	F-8 (OPTION) only	Enter one of the following flags: 1—low airburst. 2—high airburst.
Flash-smoke M38	4	F-7 (HOB) only	Enter height of burst above target in meters.
Flash-smoke XM4	5	F-7 (HOB) only	Used only with the MGR-1A rocket.
High-explosive M6E1	6	F-8 (OPTION) only	Used only with the MGR-1A rocket. Enter one of the following flags: 1—low airburst. 2—high airburst.
High-explosive M44	7	F-8 (OPTION) only	Enter one of the following flags: 1—low airburst. 2—high airburst.

Table 6. Rocket Warhead Data

Warhead type	*Flag*	*Applicable matrix entry locations*	*Remarks*
Nuclear M50, M78	1	F-6 (YIELD) F-8 (OPTION)	See (S) FM 6-3-2A (U).
*Chemical M206 (E20)	2	F-8 (OPTION) only	Enter one of the two following flags: 1—low airburst. 2—high airburst.
Flash-smoke M8 and M8E1	3	F-7 (HOB) only	Enter the height of burst above the target in meters.
High explosive M146	4	F-8 (OPTION)	Enter flag 1 indicating a low airburst.

3. For details on fuze models applicable to the various warheads, see TM 9-1340-202-12 for the Honest John Rocket and TM 9-1340-204-12 for the Little John Rocket.

*Not programmed in initial program tapes.

APPENDIX C

COMPUTER METEROLOGICAL MESSAGE TAPE PREPARATION

1. Met message perforated tapes should be prepared for training operators when using the sample problems in appendixes D and E. In actual operations it is the function of the met section at a higher echelon to prepare and transmit the met message for use at unit level; however, tapes used for training may be prepared as outlined below:

2. The gun direction computer M18 (FADAC) uses a special computer met message in its computations. This met message allows the computer to use weather data as it actually exists. It is different from the met message used in the manual computation of firing data where the effects of one layer of atmosphere are weighted against the effects of lower layers or zones and then grouped together.

3. The entry of data into FADAC is a function of the computer program; therefore, the met message must be in a format which conforms to the input portion of that program and the perforated tape must be in a specific format to be acceptable for input. Any deviation from the procedure for cutting the tape will cause the computer to reject the tape message.

4. The tape may be prepared by using the teletypewriter reperforator-transmitter TT76/GGC in the AN/GRC–46, AN/GRC–122, or AN/GRC–142 radio teletypewriter set.

5. The procedures for cutting a training met message tape are outlined below:

a. Advance the tape 4 to 5 inches by using the tape advance lever on the TT–76.

b. Cut the test of the message; e.g., the identification lines, and then cut the met data lines of the computer met message, using –6 digits for each data line. Use only *one carriage return* and *one line feed* instruction at the end of each line.

c. After cutting the last line of available met data, cut the digit *9* and one carriage return instruction. (The digit 9 is a stop instruction to FADAC.)

d. Advance the tape 3 to 4 inches, using the BLANK key or the tape advance lever on the TT–76.

Table 7. Computer Meteorological Message Tape Preparation Procedures

Message parts	*Met Message Text*	*Machine functions*	*Remarks* *CR—carriage return* *LF—line feed*
		Advance the tape 4 to 5 inches, using the BLANK key on the TT–76 teletypewriter.	Blank tape is used to thread the tape into the FADAC mechanical tape reader.
Introduction:	METCM 1 361320	1 CR, 1 LF	ID line
Date-time	270400036970	1 CR, 1 LF	
Body:	0002000526621122	1CR, 1LF	The carriage return code causes FADAC to store the previous 16 digits.
	0102601026281110	1CR, 1LF	
	0203002026021084	1CR, 1LF	
	0305102225881062	1CR, 1LF	
	* * *	* * *	
	1018205025100743	1 CR, 1 LF	
	9	1 CR	The 9 code is a halt.
		Advance the tape 3 to 4 inches, using the BLANK key on the TT–76 teletypewriter.	

APPENDIX D

SAMPLE PROBLEMS FOR 762-MM ROCKET, HONEST JOHN

Section I. GENERAL

1. General

a. This appendix contains a series of sample problems which may be used for operator training on the M18 gun direction computer, FADAC. The problems illustrate the computation of firing data for the Honest John rocket. The solutions are those displayed using the 762-mm rocket program tape with the following identification number:

Ax2 xxxxx xxxxx 00762. This identification number is displayed when the program test is initiated.

b. In the tactical and training situations in the problems in this appendix, it is assumed that an Honest John battalion, part of an infantry division artillery, has occupied a position area, selected firing points, established communications, and completed survey.

2. Operator Checks and Tests

a. After setting up the computer, the operator must run the program tests to insure the computer is operating properly and that the program has been correctly entered in memory.

b. The operator performs the following actions:

(1) Depress the PROG TEST button. Ax2 xxxxx xxxxx 00762 is displayed.

(2) Depress the 1 key on the keyboard to test the permanent storage section of the program in memory. The Nixie lights will flicker during this test. When the test is complete, the following display should appear: Ax2 00-000 00000 00762.

Note. The letter "x" denotes an unlit Nixie and the letter "A" denotes the display of one of the five letters, A through E, for the mission association button depressed.

(3) Depress the PROG TEST button again.

(4) Depress the 2 key on the keyboard to test the working storage section (hot storage). If the test is successful, the number 136 will appear in the right three Nixie indicators of the display panel.

3. Sequence of Events in Processing a Fire Mission

a. In most tactical situations the sequence of events in processing a fire mission is as follows:

(1) The battalion fire direction center will receive a fire mission from higher headquarters which will include such data as the number of launchers; the target number; the coordinates and altitude; the firing point number; the height of burst, the yield, and option; the rocket and warhead types; the number of rockets; and the time on target (FM 6–40–1).

(2) The battalion S3 then issues a fire order and designates the mission association number; i.e., the firing point-target association (A1, A2 . . . B5), the launcher number, and the firing point number.

(3) Based on the information received in the fire mission and in the fire order, the fire direction center issues a warning order to the battery designated to fire the mission. This order indicates the launcher number; the firing point number; the type of rocket and of warhead; the height

of burst, yield, and option, if applicable; the number or rockets; and the time on target data.

(4) The launcher platoon designated to fire the mission reports the rocket weight and the propellant temperature and surface pressure to the fire direction center before moving to the firing point.

(5) The fire direction center enters all available data including the latest meteorological message into the FADAC. Then, the initial firing data, the crest clearance, the azimuth of fire, and the orienting angle are computed. The orienting angle and the azimuth of fire are sent to the firing platoon as soon as possible.

(6) When the firing platoon reaches the firing position, the surface pressure and propellant temperature are measured again. These data and the referred deflection are sent to the fire direction center.

(7) Using the latest meteorological message, the fire direction center recomputes the firing data and sends the fire commands to the platoon. (The firing deflection is obtained by algebraically adding the difference between the computer displayed deflection and 2,800 mils to the referred deflection. For example, when the computer displayed deflection is 2808, and the referred deflection is 2653 (2653+8=2661), the deflection sent to the firing point as a command is 2661.)

(8) Two minutes prior to firing, the low-level wind data are measured and sent to the fire direction center.

(9) The fire direction center computes the final data and sends the final deflection and quadrant elevation to the platoon.

(10) The final countdown is conducted for a time on target mission, and the rocket is fired.

b. The sequence of events in *a* above may vary with the situation. In some cases, firing may take place from the position area which would eliminate the need for the actions described in *a*(6) above.

Section II. MISSION 1

4. Computation of Traverse Survey

a. Situation. A field training exercise is being conducted in a theater of operations during which service ammunition will be fired to add realism to the training. You are a member of the fire direction center participating in this exercise.

b. Given. From the data determined by the battalion survey section the following field notes are delivered to the fire direction center:

Survey control point coordinates
26963.61-21694.50 altitude 418.8

Traverse	*Azimuth (mils)*	*Distance (meters)*	*Verticle Angle (mils)*
SCP to TS 1	5598.1	918.06	−2.6
TS 1 to TS 2	692.5	1121.87	−4.4
TS 2 to TS 3	5858.7	995.08	−3.3
TS 3 to FP 1	5008.3	1120.62	−2.5

c. Requirement. The operator is directed to compute the coordinates of each traverse station and the firing point.

d. Solution of Traverse Station 1. The operator performs the following actions:

(1) Depress matrix buttons H–1 (OBS EAST).

(2) Depress the SM key KEYBOARD indicator lights.

(3) On the keyboard, type in the easting coordinates of the SCP to the nearest 0.01 meter, *26963.61*. Display appears in the easting window, and the decimal fraction appears in the northing window.

(4) Depress the ENTER key. Display extinguishes.

(5) Depress matrix buttons H–2 (OBS NORTH).

(6) Depress the SM key. KEYBOARD indicator lights.

(7) On the keyboard, type in the northing coordinates of the SCP to the nearest 0.01, *21692.50*. Digits are dis-

played in the easting window, and the decimal fraction is displayed in the northing window.

(8) Depress the ENTER key. The display extinguishes.

(9) Depress matrix buttons H–3 (OBS ALT).

(10) Depress the SM key. KEYBOARD indicator lights.

(11) On the keyboard, type in the altitude of the SCP to the nearest 0.01 meter, *418.80*. Digits will be displayed in the easting window.

(12) Depress the ENTER key. Display extinguishes.

(13) Depress matrix buttons G–1 (OBS AZ).

(14) Depress the SM key. KEYBOARD indicator lights.

(15) On the keyboard, type in the azimuth from the SCP to TS 1 to the nearest 0.01 mil, *5598.10*. Check the display.

(16) Depress the ENTER key. Display extinguishes.

(17) Depress matrix buttons G–2 (OBS HORIZ DIST).

(18) Depress the SM key. KEYBOARD indicator lights.

(19) On the keyboard, type in the distance from the SCP to TS 1 to the nearest 0.01 meter, *918.06*. Check the display.

(20) Depress the ENTER key. Display extinguishes.

(21) Depress matrix buttons G–4 (OBS VERT ANGLE).

(22) Depress the SM key. KEYBOARD indicator lights.

(23) On the keyboard, type in the vertical angle to the nearest 0.1 mil SCP to TS preceded by a sign, *−2.6*.

(24) Depress the ENTER key.

(25) Depress matrix buttons G–5 (SURVEY).

(26) Depress the SM key. KEYBOARD indicator lights.

(27) On the keyboard, type in *1*, the flag to compute the traverse.

(28) Depress the ENTER KEY. Coordinates and altitude of TS 1 are displayed: *26313 22342 417*.

(29) If a record of the coordinates of the traverse station is required to the nearest 0.01 meter, the operator should temporarily store these data by using the following procedure:

(*a*) Depress matrix buttons H–4 (OBS RECORD).

(*b*) Depress the SM key.

(*c*) On the keyboard, type in 1 to identify TS 1.

(*d*) Depress the ENTER key.

(*e*) Depress matrix buttons H–5 (OBS RECALL).

(*f*) Depress the SM key.

(*g*) On the keyboard, type 1 and depress the ENTER key. Coordinates and altitude of TS 1 will be displayed.

(*h*) To recall the easting to the nearest 0.01, depress matrix buttons H–1 (OBS EAST), depress the RECALL key. Easting will be displayed to the nearest 0.01 of a meter. The northing and altitude may be recalled in a similar manner. (See table 1 for recall procedure.)

e. Solution of Traverse Station 2. The operator performs the following actions:

(1) Depress matrix buttons G–1 (OBS AZ).

(2) Depress the SM key.

(3) On the keyboard, type in the azimuth from TS 1 to TS 2 to the nearest 0.1 mil, *692.5*.

(4) Depress the ENTER key.

(5) Depress matrix buttons G–2 (OBS HORIZ DIST).

(6) Depress the SM key.

(7) On the keyboard, type in the distance from TS 1 to TS 2 to the nearest 0.01 meter, *1121.87*.

(8) Depress the ENTER key.

(9) Depress matrix buttons G–4 (OBS VERT ANGLE).

(10) Depress the SM key.

(11) On the keyboard, type in the vertical angle from TS 1 to TS 2 preceded by a sign and to the nearest 0.1 mil, *−4.4*.

(12) Depress the ENTER key.
(13) Depress matrix buttons G–5 (SURVEY).
(14) On the keyboard, type in *1*.
(15) Depress the ENTER key. Coordinates of TS 2 are displayed: *27019 23215 412*.

f. Solution of Traverse Station 3. The operator performs the following actions:

(1) Depress matrix buttons G–1 (OBS AZ).
(2) Depress the SM key.
(3) On the keyboard, type in the azimuth from TS 2 to TS 3 to the nearest 0.1 mil, *5858.7*.
(4) Depress the ENTER key.
(5) Depress matrix buttons G–2 (OBS HORIZ DIST).
(6) Depress the SM key.
(7) On the keyboard, type in the distance from TS 2 to TS 3 to the nearest 0.01 meter, *995.08*.
(8) Depress the ENTER key.
(9) Depress matrix buttons G–4 (OBS VERT ANGLE).
(10) Depress the SM key.
(11) On the keyboard, type in the vertical angle from TS 2 to TS 3 preceded by a sign and to the nearest 0.1 mil, *–3.3*.
(12) Depress the ENTER key.
(13) Depress matrix buttons G–4 (SURVEY).
(14) Depress the SM key.
(15) On the keyboard, type in *1*.
(16) Depress the ENTER key. Coordinates and altitude of TS 3 are displayed: *26514 24073 409*.

g. Solution of Firing Point 1. The operator performs the following actions:

(1) Depress matrix buttons G–1 (OBS AZ).
(2) Depress the SM key.
(3) On the keyboard, type in the azimuth from TS 3 to the FP to the nearest 0.1 mil, *5008.3*.
(4) Depress the ENTER key.
(5) Depress matrix buttons G–2 (OBS HORIZ DIST).
(6) Depress the SM key.
(7) On the keyboard, type in the distance from TS 3 to the FP to the nearest 0.01 meter, *1120.62*.
(8) Depress the ENTER key.
(9) Depress matrix buttons G–4 (OBS VERT ANGLE).
(10) Depress the SM key.
(11) On the keyboard, type in the vertical angle from TS 3 to the firing point, preceded by a sign and to the nearest 0.1 mil, *–2.5*.
(12) Depress the ENTER key.
(13) Depress matrix buttons G–4 (SURVEY).
(14) Depress the SM key.
(15) On the keyboard, type in *1*.
(16) Depress the ENTER key, coordinates and altitude of FP 1 are displayed: *25417 24300 406*.

5. Entry of Surveyed Firing Points

a. Situation Continued. The battalion survey section submitted traverse field notes for three other firing points and the coordinates and altitudes have been computed.

b. Given.

Firing point number	*Coordinates*	*Altitude*	*Azimuth of orienting line*
1	25417 24300	406	2615
2	27943 22917	366	2052
3	31899 22696	370	1322
4	33925 21098	359	2801

c. Requirement. The operator is directed to store the list of firing points in the computer.

d. Solution. The operator performs the following actions:

(1) Depress matrix buttons B–1 (FP EAST).
(2) Depress the SM key. KEYBOARD indicator lights.
(3) On the keyboard, type in the firing point easting *25417*.
(4) Depress the ENTER key.
(5) Depress matrix buttons B–2 (FP NORTH).
(6) Depress the SM key. KEYBOARD indicator lights.
(7) On the keyboard, type in the northing of the firing point, *24300*.
(8) Depress the ENTER key.
(9) Depress the matrix buttons B–3 (FP ALT).

(10) Depress the SM key. KEYBOARD indicator lights.
(11) On the keyboard, type in the altitude of the firing point, *406*.
(12) Depress the ENTER key.
(13) Depress matrix buttons B–4 (AZ OL).
(14) Depress the SM key. KEYBOARD indicator lights.
(15) On the keyboard, type in the azimuth of the orienting line, *2615*.
(16) Depress the ENTER key.
(17) Depress matrix buttons B–5 (FP RECORD).
(18) Depress the SM key. KEYBOARD indicator lights.
(19) On the keyboard, type in *1*.
(20) Depress the ENTER key.

Note. This firing point is now stored in memory as firing point number 1 and may be recalled from memory, using matrix locations B–6 (RECALL FP OR LIST) or B–7 (PRINT FP LIST).

e. Solution Continued. The operator stores the three additional firing point coordinates and altitude and the azimuths of their orienting lines by performing the procedures in *d* above and using the applicable data.

6. Entry of Targets on Target List

a. Situation Continued. The following list of preplanned targets for the training exercise has been received at the battalion fire direction center. The target numbers assigned by the higher headquarters identify these targets as being planned for simulated nuclear attack.

b. Given.

Target	*Coordinates*		*Altitude*	*Target list number*
NA2122	2340	3065	429	1
NA1313	2853	3642	385	2
NA1412	34660	31730	446	3
NA2000	39060	33020	394	4
NX3000	30140	29000	400	5
NX5000	26700	34550	395	6
NX1000	28820	32430	400	7

c. Requirement. The operator is directed to enter these targets on the target list.

d. Solution. The operator performs the following actions:

(1) Depress matrix buttons A–1 (TGT EAST).
(2) Depress the SM key.
(3) On the keyboard, type in the target easting, *entering five digits.* Zeros are added, when required. For target 1, type *23400*.
(4) Depress the ENTER key.
(5) Depress matrix buttons A–2 (TGT NORTH).
(6) Depress the SM key.
(7) On the keyboard, type in the northing coordinate of the target, entering five digits. For target number 1, type *30650*.
(8) Depress the ENTER key.
(9) Depress matrix button A–3 (TGT ALT.)
(10) Depress SM key.
(11) On the keyboard, type in the altitude of the target. For target number 1, type *429*.
(12) Depress the ENTER key.
(13) Depress matrix buttons A–5 (TGT RECORD).
(14) Depress the SM key.
(15) On the keyboard, type *1*.
(16) Depress the ENTER key. Target NA 2122 is now stored in memory on the target list as target number 1.
(17) Repeat (1) through (16) above for each target listed in *b* above.

7. Entry of Grid Declination and Latitude

a. Given. The grid declination angle at the meteorological station is known to be +51 mils. The latitude of the area is 34° north.

b. Requirement. The operator is directed to enter these data.

c. Solution. The operator performs the following actions:

(1) Depress matrix buttons G–8 (GRID DECL ANGLE).
(2) Depress the SM key.
(3) On the keyboard, type in *+51*. (The + sign indicates that grid north is right of true north.)
(4) Depress the ENTER key.
(5) Depress matrix buttons G–7 (LAT).
(6) Depress the SM key.
(7) On the keyboard, type in *+34*. (The sign indicates north latitude.)
(8) Depress the ENTER key.

8. Entry of the Meteorological Message

a. Situation Continued. A meteorological message has been received in the fire direction center. Entry of the most recent meteorological data is vital to the determination of accurate firing data. As soon as a computer met message is received it should be entered in the computer.

b. Given.

Computer Met Message

Introduction

Identification	*Octant*	*Location*	*Date-time*	*Station height (10's m)*	*MDP pressure (% of STD)*
METCM	1	341981	261620	036	974

Body

Line number	*Wind direction (10's mils)*	*Wind speed (knots)*	*Temperature (1/10° K)*	*Density (gm/m³)*
00	010	011	2693	1277
01	048	019	2679	1266
02	032	014	2673	1243
03	056	037	2617	1195
04	014	015	2672	1093
05	540	014	2718	1016
06	512	022	2707	0953
07	516	033	2672	0903
08	504	060	2672	0846
09	492	070	2657	0802
10	491	065	2616	0763
11	490	060	2580	0725
12	485	050	2542	0665
13	475	055	2483	2596
14	480	052	2410	0533
15	490	055	2327	0478
16	500	060	2248	0427
17	550	058	2192	0375
18	601	036	2141	0328
19	614	035	2106	0284
20	587	032	2119	0237

c. Requirement. The operator is directed to enter the meteorological message.

d. Solution. The operator performs the following actions to enter the met message manually.

(1) Depress matrix buttons H–8 (MET INPUT).

(2) Depress the SM key. KEYBOARD indicator lights.

(3) On the keyboard, type in *0* (flag indicating manual entry).

(4) Depress the ENTER key. The number 88 is displayed.

(5) On the keyboard, type in the identification line of the message, starting with the date-time group: *261620 036974*.

(6) Depress the ENTER key, 00 is displayed.

(7) On the keyboard, type in the 00 line of the message: *00 010 011 2693 1277*.

(8) Depress the ENTER key, 01 is displayed.

(9) On the keyboard, type in the 01 line of the message: *01 048 019 2679 1266*.

(10) Depress the ENTER key, 02 is displayed.

(11) The data on each line are entered by the methods in (7) and (8) above until the last line has been entered. Then the input mode is terminated by typing *9* on the keyboard and depress the ENTER key.

e. Mechanical Tape Reader. The operator performs the following actions to enter the met message tape through the mechanical tape reader:

(1) Load the tape in the mechanical tape reader with the wide side toward the computer and with the printed side up.

(2) Turn the sprocket knob to insure that the tape is properly engaged on the sprocket.

(3) Depress matrix buttons H–8 (MET INPUT).

(4) Depress the SM key. KEYBOARD indicator lights.

(5) On the keyboard, type in *2*.

(6) Depress the ENTER key. The tape reader will automatically start and will stop at the end of the tape. When the tape stops, depress the ENTER key to terminate the mode.

9. Call for Fire Format

a. The call for fire from higher headquarters will follow a specific format. Only the items applicable to a specific mission will be received.

b. The following mission in the standard format, has been received in the fire direction center.

Item	Call for fire
(1) Identification	BLUE LIGHT 18, THIS IS FIREPOWER 9,
(2) Warning order	FIRE MISSION,
(a) Size of unit to engage	(omitted)
(b) Firing points	FIRING POINT 2
(3) Number and location of target	TARGET NA2122, GRID NS23403065, ALTITUDE 429,
(4) Description of target	(omitted)
(5) Method of engagement	HONEST JOHN ROCKET MGR-1A,
(a) Type warhead	WARHEAD M38,
(b) HOB or option	HEIGHT OF BURST 400 METERS,
(c) Number of rockets	ONE ROCKET,
(6) Control	TIME ON TARGET,
(a) Time on target	1800Z,
(b) Latest time on target	2000Z,
(7) Remarks or special instructions	DO NOT OCCUPLY FIRING POINT PRIOR TO 1700Z.

10. Computation of Firing Data for Mission 1

a. Situation Continued. The S3 notes that target NA 2122 is on the target list (target number 1) and designates the mission association number as A1 and issued the fire order:

MISSION A1,
LAUNCHER NUMBER 2,
FIRING POINT NUMBER 2,
TARGET NUMBER 1.

b. Requirement. The operator is directed to compute the initial laying data for inclusion in the warning order.

c. Solution. The operator performs the following actions:

(1) Depress mission association buttons A and 1.

(2) Depress matrix buttons C–8 (CLEAR DATA).

(3) Depress the SM key.

(4) On the keyboard, type in 0.

(5) Depress the ENTER key.

(6) Depress matrix buttons F–1 (TGT LIST ASSOC).

(7) Depress the SM key.

(8) On the keyboard, type 1 (target number).

(9) Depress the ENTER key. Wait for the display to appear: 23400 30650 429.

(10) Depress matrix buttons F–2 (FP LIST ASSOC).

(11) Depress the SM key.

(12) On the keyboard, type 2 (firing point number).

(13) Depress the ENTER key. Wait for the display to appear: 27943 22917 366.

Note. Firing point number 2 and target number 1 are now mission associated. Data entered in the computer which are applicable to this mission should be entered with mission association buttons A and 1 depress and with the matrix positions colored red.

(14) Depress matrix buttons D–2 (AZ OF FIRE).

(15) Depress the SM key. Azimuth of fire is displayed: *5,859* (mils).

(16) Depress matrix buttons D–3 (ORIENT ANGLE).

(17) Depress the SM key. Orienting angle is displayed: *2,593* (mils).

d. Warning Order. The following warning order is issued to Battery B:

LAUNCHER NUMBER 2,
FIRING POINT NUMBER 2,
ROCKET MGR–1A.
WARHEAD M38,
ONE ROUND AT MY COMMAND,
HEIGHT OF BURST 400,
TIME ON TARGET 1800,
AZIMUTH OF ORIENTING LINE 2052,
AZIMUTH OF FIRE 5859,
ORIENTING ANGLE 2593.

e. Situation Continued. The following data are received from the launcher platoon designated to fire the mission:

Launcher type	M386
Motor empty weight	2,010 lb
Warhead weight	1,620 lb
Fin weight	166 lb
Propellant weight	2054 lb
Propellant temperature	+63° F
Surface pressure	966 mb.

f. Solution Continued. To compute the initial firing data and crest clearance data, after insuring that the mission association buttons A and 1 are depressed, the operator performs the following actions:

(1) Depress matrix buttons F–3 (LCHR TYPE).

(2) Depress the SM key.

(3) On the keyboard, type in *386*.

(4) Depress the ENTER key.

(5) Depress matrix buttons F–4 (RKT TYPE).

(6) Depress the SM key.

(7) On the keyboard, type *31*.

(8) Depress the ENTER key.

(9) Depress matrix buttons F–5 (WHD TYPE).

(10) Depress the SM key.

(11) On the keyboard, type in *4* (flag identifying M38 warhead).

(12) Depress the ENTER key.

Note. Position F–6 (YIELD) is omitted from this training mission; see FM 6–3–2A.

(13) Depress matrix buttons F–7 (HOB).

(14) Depress the SM key.

(15) On the keyboard, type in the height of burst, *400*.

(16) Depress the ENTER key.

Note. Position F–8 (OPTION) is omitted from this mission; see FM 6–3–2A.

(17) Depress matrix buttons E–1 (MOTOR EMPTY WEIGHT).

(18) Depress the SM key.

(19) On the keyboard, type in *2010*.

(20) Depress the ENTER key.

(21) Depress matrix buttons E–2 (WHD WT).

(22) Depress the SM key.

(23) On the keyboard, type in *1620*.

(24) Depress the ENTER key.

Note. Position E–3 (PROP WT CORR) is not used with the MGR–1A rocket.

(25) Depress matrix buttons E–4 (FIN WT). (Used only with the MGR–1A rocket.)

(26) Depress the SM key.

(27) On the keyboard, type in *166*.

(28) Depress the ENTER key.

(29) Depress matrix buttons E–5 (PROP WT). (Used only with the MGR–1A rocket.)

(30) Depress the SM key.

(31) On the keyboard, type in 2054.

(32) Depress the ENTER key.

Note. Position E–6 (GROSS MOTOR WT) is omitted when position E–1 (MOTOR EMPTY WT) is used.

(33) Depress matrix buttons E–7 (PROP TEMP).

(34) Depress the SM key.

(35) On the keyboard, type in *+63*.

(36) Depress the ENTER key.

(37) Depress matrix buttons E–8 (SURF PRESS).

(38) Depress the SM key.

(39) On the keyboard, type in *966*.

(40) Depress the ENTER key.

(41) All the necessary data have been entered to compute the initial firing data. Depress the COMPUTE button. The computation begins and lasts about 17 seconds and the following data are displayed:

Deflection *2798*,
Fuze setting *17.4*,
Quadrant elevation *294.7*.

Note. It is not necessary to send these data to the firing platoon; however, the ballistic solution must be computed before the crest clearance data are computed.

11. Computation of Crest Clearance Data

a. Situation Continued. From an inspection along the azimuth of fire on the situation, the S3 notes that the trajectory will pass over a crest occupied by friendly troops.

b. Given. The altitude of the crest is 520 meters. It is 6,000 meters from the firing point.

c. Requirement. The operator is directed to compute the crest clearance data.

d. Solution. The operator performs the following actions:

(1) Depress matrix buttons D–6 (CREST RANGE).

(2) Depress the SM key.

(3) On the keyboard, type in *6,000*.

(4) Depress the ENTER key.

(5) Depress matrix buttons D–7 (CREST ALT).

(6) Depress the SM key.

(7) On the keyboard, type in *520*.

(8) Depress the ENTER key.

(9) Depress matrix buttons D–8 (CREST CLEAR).

(10) Depress the SM key.

(11) On the keyboard, type in 1 (the flag indicating that the crest is occupied by friendly troops).

(12) Depress the ENTER key and the following data are displayed: 6000 520 6xx99. Therefore, 6 (PE's) 99 (percent).

e. Discussion. There is a 99 percent probability that the rocket will clear the crest by 60 or more meters. The maximum percent displayed is 99; therefore, the probability is also shown as a number of probable errors. The 6 PE's in this situation are considered as 100 percent.

12. Computation of Final Data

a. Situation Continued. The firing platoon has arrived at the firing point, and the launcher has been positioned and laid.

b. Given. The following given information is sent to the fire direction center:

Referred deflection	386~~4~~
Propellant temperature	+66° F
Surface pressure	968 mb

c. Requirement. The operator is directed to enter the latest data.

d. Solution. The operator performs the following actions:

(1) Depress matrix buttons E–7 (PROP TEMP).

(2) Depress the SM key.

(3) On the keyboard, type in *+66*.

(4) Depress the ENTER key.

(5) Depress matrix buttons E–8 (SURF PRESS).

(6) Depress the SM key.

(7) On the keyboard, type in *968*.

(8) Depress the ENTER key.

(9) The operator depresses the COMPUTE button, and the following data are displayed at the termination of computation:

Deflection *2798*,
Fuze setting *17.4*,
Quadrant elevation *294.2*.

e. Situation Continued.

(1) The following commands are sent to the firing point:

DEFLECTION *384* (*386* + (*−2*)),
FIRE SETTING *17.5*,
QUADRANT ELEVATION *29-4.3*.

Note. The difference between the displayed deflection and 2,800 mils is added algebraically to the referred deflection to obtain the firing deflection.

(2) Two minutes before firing time, the platoon reports low-level wind data measured with the wind measuring set. Conditions are all other than nighttime.

Range wind component: Tail (–) 5 mph.
Crosswind component: Left 2 mph.

f. Solution Continued. The operator performs the following actions to compute the final data:

(1) Insure that mission association buttons A and 1 are depressed.

(2) Depress matrix buttons C–2 (LLW RANGE).

(3) Depress the SM key.

(4) On the keyboard, type in *−5*.

(5) Depress the ENTER key.

(6) Depress matrix buttons C–3 (LLW CROSS).

(7) Depress the SM key.

(8) On the keyboard, type in *LEFT 2*.

(9) Depress the ENTER key.

(10) Depress matrix buttons C–4 (WIND WT MULT).

(11) Depress the SM key.

(12) On the keyboard, type in *1* (the flag indicating all other than nighttime conditions).

(13) Depress the ENTER key.

(14) Depress matrix buttons C–5 (FINAL LLW CORR).

(15) Depress the SM key. Computation begins and ends with the display: +9 0.0 9 04.9. This means that the deflection correction is LEFT 9, and the quadrant elevation correction is −4.9 mils. The time correction is always zero.

(16) Depress matrix buttons C–6 (FINAL DATA).

(17) Depress the SM key. The final data are computed and displayed:

Deflection *2807*,
Fuze setting *17.4* (*not sent*),
Quadrant elevation *289.2*.

g. Situation Continued. The following commands are sent to the firing point:

DEFLECTION *393* (*386* + *7*),
QUADRANT ELEVATION *289.4*.

13. Printing the Mission

a. Situation Continued. A record of each mission is required by unit standing operating procedure. The teletypewriter is connected to the computer.

b. Requirement. The operator is directed to print the mission.

c. Solution. The operator performs the following actions:

(1) Depress matrix buttons C–7 (PRINT MISSION).

(2) Position the typewriter paper.

(3) Depress the SM key. This action starts the printout.

Note. The printout will stop when the identification line of the met message has been typed. If the ENTER key is depressed, the entire message will be printed.

(4) Depress the PERIOD key to terminate the mode after the identification line has been printed. See table 3 for the printout format.

14. Printing the Firing Point and the Target Lists

a. Situation Continued. A printout of the firing point list and the target list may be obtained with the teletypewriter.

b. Requirement. The S3 directs the operator to print the firing point and target lists.

c. Solution. The operator performs the following actions:

(1) Depress matrix buttons B–7 (PRINT FP LIST).

(2) Depress the SM key.

(3) Position the typewriter paper.

(4) On the keyboard, type *0* (flag indicating the entire list).

(5) Depress the ENTER key, and the entire list of 16 firing points will be printed. If a firing point has not been entered, only the number will be printed. See table 3 for the printout format. To print a single firing point, type in the number of that point in (4) above. The printout may be terminated at any time by depressing the RESET button.

d. Solution Continued. The operator performs the following actions to print the target list:

(1) Depress matrix buttons A–7 (PRINT TGT LIST).

(2) Depress the SM key.

(3) Position the typewriter paper.

(4) On the keyboard, type in *0*, flag indicating the entire list.

(5) Depress the ENTER key and the entire list of 32 targets will be printed. If a target has not been entered, only the number will be printed. See table 3 for the printout format. To print a single target, type in the target number in (4) above. The printout may be terminated at any time by depressing the RESET button.

15. Location of the Impact Point by Intersection Survey

a. Situation Continued. The battalion has established two OP's for the purpose of locating the impact points of rockets fired during the training exercise. Mission A1 has been fired, and the data available from survey and observation are as follows:

Observer	*Coordinates*	*Altitude*	*Azimuth measured to impact point*	*Vertical angle*
01	23560 29584	452	6230	−25
02	24325 29750	440	5578	Not measured

b. Requirement. The operator is directed to compute the location of the impact point.

c. Solution. The operator performs the following actions:

(1) Depress matrix buttons H–1 (OBS EAST).

(2) Depress the SM key.

(3) On the keyboard, type in the easting coordinate of the 01 observer, *23560*.

(4) Depress the ENTER key.

(5) Depress matrix buttons H–2 (OBS NORTH).

(6) Depress the SM key.

(7) On the keyboard, type in the northing coordinate of the 01 observer, *29584*.

(8) Depress the ENTER key.

(9) Depress matrix huttons H–3 (OBS ALT).

(10) Depress the SM key.

(11) On the keyboard, type in the altitude of the 01 observer, *452*.

(12) Depress the ENTER key.

(13) Depress matrix buttons H–4 (OBS RECORD).

(14) Depress the SM key.

(15) On the keyboard, type in *1*.

(16) Depress the ENTER key.

(17) Repeat (1) through (16) above, entering the 02 observer data.

(18) Depress matrix buttons H–5 (OBS RECALL).

(19) Depress the SM key.

(20) On the keyboard, type in *1*.

(21) Depress the ENTER key. The coordinates and altitude of 01 are displayed.

(22) Depress matrix buttons G–1 (OBS AZ).

(23) Depress the SM key.

(24) On the keyboard, type in the azimuth from 01 to the impact point, *6320*.

(25) Depress the ENTER key.

(26) Depress matrix buttons G–4 (OBS VERT ANGLE).

(27) Depress the SM key.

(28) On the keyboard, type in the measured vertical angle from 01 to the impact point, *−25*.

(29) Depress the ENTER key.

(30) Depress matrix buttons H–5 (OBS RECALL).

(31) Depress the SM key.

(32) On the keyboard, type in *2*.

(33) Depress the ENTER key. The coordinates and altitude of 02 are displayed.

(34) Depress matrix buttons G–1 (OBS AZ).

(35) Depress the SM key.

(36) On the keyboard, type in the azimuth from 02 to the impact point, *5578*.

(37) Depress the ENTER key.

(38) Depress matrix buttons G–5 (SURVEY).

(39) Depress SM key.

(40) On the keyboard, type in *2* (the flag indicating an intersection type survey).

(41) Depress the ENTER key. The coordinates and altitude of the impact point are computed and displayed: *23379 30656 438*.

16. Deletion of Targets and Firing Points from the Lists

a. Situation Continued. The S3 decides to delete target number 1 and firing point number 2 from the lists, as they are no longer required.

b. Requirement. The operator is directed to delete target number 1 from memory.

c. Solution. The operator performs the following actions to delete target number 1 from memory.

(1) Depress matrix buttons A–8 (TGT DELETE).

(2) Depress the SM key.

(3) On the keyboard, type in *1* (the number of the target to be deleted).

(4) Depress the ENTER key, the KEYBOARD indicator remains lit.

(5) On the keyboard, type in *0* (the flag indicating *yes* for the enabling procedure for this function).

(6) Depress the ENTER key.

d. Solution Continued. The operator performs the following actions to delete firing point number 2 from memory:

(1) Depress matrix buttons B–8 (FP DELETE).

(2) Depress the SM key.

(3) On the keyboard, type in *2* (the number of the firing point to be deleted).

(4) Depress the ENTER key. The KEYBOARD indicator remains lit.

(5) On the keyboard, type in 0 (the flag indicating *yes* for the enabling procedure for this function).

(6) Depress the ENTER key.

e. Discussion. Target number 1 and firing point number 2 have been deleted from memory.

17. Clearing Mission Data

a. Situation Continued. The S3 decides to clear mission A1 from memory. This location in memory may then be used to store data for a new mission.

b. Requirement. The operator is directed to clear mission A1 data from memory.

c. Solution. The operator performs the following actions:

(1) Depress mission association buttons A and 1.

(2) Depress matrix buttons C–8 (CLEAR DATA).

(3) Depress the SM key.

(4) On the keyboard, type in *0*.

d. Discussion. All data associated with mission A1 have been cleared from memory.

18. Summary of Input Data for Mission 1

Matrix function	*Input data* [1]	*Remarks*
A–1 (TGT EAST)	23400	Zero added to enter five digits.
A–2 (TGT NORTH)	30650	Zero added to enter five digits.
A–3 (TGT ALT)	429	
A–5 (TGT RECORD)	1	Target list number assigned.
B–1 (FP EAST)	27943	
B–2 (FP NORTH)	22917	
B–3 (FP ALT)	366	
B–4 (AZ OL)	2052	Must be entered before using function B–5 (FP RECORD).
B–5 (FP RECORD)	2	Firing point list number assigned.
F–1 (TGT LIST ASSOC)	1	Target list number.
F–2 (FP LIST ASSOC)	2	Firing point list number.

Matrix function	Input data[1]	Remarks
F-3 (LCHR TYPE)	386	Flag for M386 launcher.
F-4 (RKT TYPE)	31	Flag for MGR 1-A rocket.
F-5 (WHD TYPE)	4	Flag for M38 warhead.
F-7 (HOB)	400	Value in meters.
E-1 (MOTOR EMPTY WT)	2010	Value in pounds.
E-2 (WHD WT)	1620	Value in pounds.
E-4 (FIN WT)	166	Value in pounds depending on type of fins.
E-5 (PROP WT)	2054	Value in pounds.
E-7 (PROP TEMP)	+63 (+66)	Signed value in degrees Fahrenheit.
E-8 (SURF PRESS)	966 (968)	Value in millibars.
G-7 (LAT)	+34	Signed value. The + sign indicates north latitude.
G-8 (GRID DECL ANGLE)	+51	Signed value. The + sign indicates that grid north is right of true north.
H-8 (MET INPUT)	261620 (036974)	Identification line of met message entered.
C-2 (LLW RANGE)	-5	The sign indicates a tailwind factor. Signed value in miles per hour from wind measuring set.
C-3 (LLW CROSS)	LEFT 2	LEFT indicates that correction will be added to deflection.
C-4 (WIND WT MULT)	1	Flag indicating all other than nighttime conditions.
D-6 (CREST RANGE)	6000	Value in meters.
D-7 (CREST ALT)	520	Value in meters.
D-8 (CREST CLEAR)	1	Flag indicating that the crest is in friendly territory and is occupied.
H-1 (OBS EAST)	23560 (24325)	
H-2 (OBS NORTH)	29584 (29750)	
H-3 (OBS ALT)	452 (440)	
H-4 (OBS RECORD)	1 (2)	Numbers assigned to 01 and 02.
H-5 (OBS RECALL)	1 (2)	Numbers of 01 and 02 recalled in sequence for intersection survey.
G-1 (OBS AZ)	6230 (5578)	Value in mils.
G-4 (OBS VERT ANGLE)	-25	Signed value in mils.
G-5 (SURVEY)	2	Flag indicating intersection type survey.
A-8 (TGT DELETE)	1 (0)	Target number. ( ) indicates enabling flag entered.
C-8 (CLEAR DATA)	0	Flag indicating enable *yes*.

[1] A second entry is shown in parentheses.

Section III. MISSION NUMBER 2

19. Entry of Firing Points, Targets, Grid Declination Angle, and Latitude

a. Situation. The Honest John battalion has just occupied a position area, survey has been completed, and traverse data have been computed by using FADAC. Nuclear weapons *have not* been used in this combat situation; therefore, the battalion is equipped with high-explosive warhead M144, and MGR-1B rockets. The battalion is equipped with the M386 launcher.

b. Given. The following data are available in the fire direction center:

Firing Point List—

Firing point number	Coordinates		Altitude	Azimuth of orienting line
1	35417	44300	406	2615
2	37943	42917	366	2052
3	41899	42696	360	1322
4	43925	41098	359	2801
5	44540	40810	400	4022

Grid Declination and Latitude—

Grid declination + 42

Latitude 34° north

Target List—

Target Number	Coordinates		Altitude
1	3290	5065	500
2	3853	5642	385
3	4466	5173	446
4	4906	5302	394

Target Number	*Coordinates*		*Altitude*
5	4014	4900	400
6	3670	5455	395
7	3882	5243	400
8	3910	5800	420
9	4005	6050	500
10	3640	6230	420

c. Requirement. The operator is directed to enter the firing points on the firing point list.

d. Solution. The operator performs the following actions:

(1) Depress matrix buttons B–1 (FP EAST).

(2) Depress the SM key.

(3) On the keyboard, type in the firing point easting, *35417*.

(4) Depress the ENTER key.

(5) Depress matrix buttons B–2 (FP NORTH).

(6) Depress the SM key.

(7) On the keyboard, type in the firing point northing, *44300*.

(8) Depress the ENTER key.

(9) Depress matrix buttons B–3 (FP ALT).

(10) Depress the SM key.

(11) On the keyboard, type in the altitude of the firing point, *406*.

(12) Depress the ENTER key.

(13) Depress matrix buttons B–4 (AZ OL).

(14) Depress the SM key.

(15) On the keyboard, type in the azimuth of the orienting line, *2615*.

(16) Depress the ENTER key.

(17) Depress matrix buttons B–5 (FP RECORD).

(18) Depress the SM key.

(19) On the keyboard, type in *1*.

(20) Depress the ENTER key.

Note. The operator performs the procedures in (1) through (20) above, and enters the appropriate data for each of the five firing points on the list.

e. Requirement Continued. The operator is directed to enter the targets on the target list.

f. Solution Continued. The operator performs the following actions:

(1) Depress matrix buttons A–1 (TGT EAST).

(2) Depress the SM key.

(3) On the keyboard, type in the target easting, *32900* (entering five digits).

(4) Depress the ENTER key.

(5) Depress matrix buttons A–2 (TGT NORTH).

(6) Depress the SM key.

(7) On the keyboard, type in the target northing, *50650* (entering five diits).

(8) Depress the ENTER key.

(9) Depress matrix buttons A–3 (TGT ALT).

(10) Depress the SM key.

(11) On the keyboard, type in the target altitude, *500*.

(12) Depress the ENTER key.

(13) Depress matrix buttons A–5 (TGT RECORD).

(14) Depress the SM key.

(15) On the keyboard, type in *1*.

(16) Depress the ENTER key. The target is stored in memory as target number 1.

Note. The operator performs the procedures in (1) through (16) above, and enters the appropriate data for each target on the target list.

g. Requirement Continued. The operator is directed to enter the grid declination angle and the latitude.

h. Solution Continued. The operator performs the following actions:

(1) Depress matrix buttons G–7 (LAT).

(2) Depress the SM key.

(3) On the keyboard, type in *+34*. (The + sign indicates north latitude.)

(4) Depress the ENTER key.

(5) Depress matrix buttons G–8 (GRID DECL ANGLE).

(6) Depress the SM key.

(7) On the keyboard, type in *+42* (+ sign indicates that grid north is right of true north).

(8) Depress the ENTER key.

20. Entry of the Meteorological Message

a. Given. The following meteorological message has been received and must be entered in the computer:

Identification	*Octant*	*Location*	*Date-time*	*Station height (10's m)*	*MDP pressure (% of std)*
METCM	1	341981	300406	048	995

Line number	*Wind direction (10's mils)*	*Wind speed (knots)*	*Temperature (1/10° K)*	*Density (gm/m³)*
00	008	014	2488	1311
01	014	022	2484	1298
02	033	019	2468	1269
03	018	030	2470	1230
04	046	045	2413	1190
05	020	012	2399	1146
06	630	038	2356	1008
07	580	050	2322	0988
08	560	062	2309	0956
09	548	045	2296	0924
10	524	042	2286	0901
11	536	048	2236	0856
12	480	060	2202	0802
13	442	055	2166	0766
14	420	042	2138	0737
15	500	020	2111	0672
16	450	030	2048	0632
17	380	015	2028	0590
18	362	070	1988	0498
19	348	068	1964	0472
20	340	072	1922	0456

Note. See appendix C for instructions on preparing tape.

b. Requirement. The operator is directed to enter the meteorological message.

c. Solution. The operator performs the following actions to enter the met message manually:

(1) Depress matrix buttons H–8 (MET INPUT).

(2) Depress the SM key.

(3) On the keyboard, type in 0 (flag indicating manual entry).

(4) Depress the ENTER key. The number 88 is displayed.

(5) On the keyboard, type in the identification line starting with the date-time group; *300406 048995.*

(6) Depress the ENTER key. The number 88 is displayed.

(7) On the keyboard, type in the 00 line of the message: *00 008 014 2488 1311.*

(8) Depress the ENTER key, 01 is displayed.

(9) On the keyboard, type in the 01 line of the message: *01 014 022 2484 1298.*

(10) Depress the ENTER key, 02 is displayed.

Note. The data on each line are entered until the last line of the message has been entered. Then the input mode is terminated by typing 9 on the keyboard and depressing the ENTER key.

d. Mechanical Tape Reader. The operator performs the following actions to enter the met message tape through the mechanical tape reader:

(1) Load the tape in the mechanical tape reader with the wide side of the tape toward the computer and with the printed side up.

(2) Turn the sprocket knob to insure that the tape is properly engaged on the sprocket and depress matrix buttons H–8 (MET INPUT).

(3) Depress the SM key.

(4) On the keyboard, type in 2 (flag indicating mechanical tape reader input).

(5) Depress the ENTER key. The tape reader will automatically start and will stop at the end of the tape. Terminate the mode by depressing the ENTER key.

21. Call for Fire

a. Situation Continued. The following call for fire has been received from higher headquarters:

BLUE LIGHT 18, THIS IS FIREPOWER 9, FIRE MISSION,
FIRING POINT 4,
TARGET NA2011,
GRID NS4370 5761,
ALTITUDE 426,
HONEST JOHN MGR–1B ROCKET,
WARHEAD M144,

HEIGHT OF BURST OPTION HIGH AIR,
ONE ROCKET,
TIME ON TARGET 0900Z.

b. Requirement. The S3 notes that this target is *not* on the target list and directs the operator to enter it as target number 11.

c. Solution. The operator performs the following actions to enter the target on the list:

(1) Depress matrix buttons A–1 (TGT EAST).

(2) Depress the SM key.

(3) On the keyboard, type in the target easting, *43700* (entering five digits).

(4) Depress the ENTER key.

(5) Depress matrix buttons A–2 (TGT NORTH).

(6) Depress the SM key.

(7) On the keyboard type in the target northing, *57610* (entering five digits).

(8) Depress the ENTER key.

(9) Depress matrix buttons A–3 (TGT ALT).

(10) Depress the SM key.

(11) On the keyboard, type in the target altitude, *426*.

(12) Depress the ENTER key.

(13) Depress matrix buttons A–5 (TGT RECORD).

(14) Depress the SM key.

(15) On the keyboard, type in the number 11 (target number assigned by the S3).

(16) Depress the ENTER key. The target is now stored on the list.

22. Computation of Firing Data

a. Situation Continued. The S3 issues a fire order based upon the information in the call for fire from higher headquarters and his knowledge of the situation. The fire order is as follows:

MISSION A2, BATTERY BRAVO,
LAUNCHER NUMBER 1,
FIRING POINT NUMBER 4,
TARGET NUMBER 11.

b. Requirement. The operator is directed to compute the initial laying data for inclusion in the warning order.

c. Solution. The operator performs the following actions:

(1) Depress mission association buttons *A and 2*.

(2) Depress matrix buttons C–8 (CLEAR DATA).

(3) Depress the SM key.

(4) On the keyboard, type in *0*.

(5) Depress the ENTER key.

(6) Depress matrix buttons F–1 (TGT LIST ASSOC).

(7) Depress the SM key.

(8) On the keyboard, type *11*.

(9) Depress the ENTER key. Wait for the display to appear: *43700 57610 426*.

(10) Depress matrix buttons F–2 (FP LIST ASSOC).

(11) Depress the SM key.

(12) On the keyboard, type *4*.

(13) Depress the ENTER key. Wait for the display to appear: *43925 41098 359*.

Note. Firing point number 4 and target number 11 are mission associated as mission A2. All data pertinent to the mission must be entered with mission association buttons A2 and depressed.

(14) Depress matrix buttons D–2 (AZ OF FIRE).

(15) Depress the SM key. The computer determines and displays the azimuth from firing point 4 to target 11: 6386.

(16) Depress matrix buttons D–3 (ORIENT ANGLE).

(17) Depress the SM key. The orienting angle is computed and displayed: 2814.88 (to the nearest 0.01 mil).

d. Warning Order. The following warning order is issued to the battery designated to fire:

LAUNCHER NUMBER 1,
FIRING POINT NUMBER 4,

ROCKET MGR–1B,
WARHEAD M144,
ONE ROUND AT MY COMMAND,
HEIGHT OF BURST OPTION HIGH AIR,
TIME ON TARGET 0900Z,
AZIMUTH OF ORIENTING LINE 2801,
AZIMUTH OF FIRE 6386,
ORIENTING ANGLE 2815.

e. Situation Continued. The following data are received from the launcher platoon:

Motor empty weight	1,400 lb
Warhead weight	1,620 lb
Propellant weight correction	−2.1 lb
Propellant temperature	+62° F
Surface pressure	1,010 mb.

f. Solution Continued. To compute the initial firing data and crest clearance data, after insuring that the mission association buttons A and 2 are depressed, the operator performs the following actions:

(1) Depress matrix buttons F–3 (LCHR TYPE).

(2) Depress the SM key.

(3) On the keyboard, type in *386,* the launcher type.

(4) Depress the ENTER key.

(5) Depress matrix buttons F–4 (RKT TYPE).

(6) Depress the SM key.

(7) On the keyboard, type in 50 (flag indicating the rocket type).

(8) Depress the ENTER key.

(9) Depress matrix buttons F–5 (WHD TYPE).

(10) Depress the SM key.

(11) On the keyboard, type in 7 (flag indicating the warhead type).

(12) Depress the ENTER key.

Note. Positions F–6 and F–7 are not used with this warhead.

(13) Depress matrix buttons F–8 (OPTION).

(14) Depress the SM key.

(15) On the keyboard, type in 2 (flag indicating high airburst).

(16) Depress the ENTER key.

(17) Depress matrix buttons E–1 (MOTOR EMPTY WT).

(18) Depress the SM key.

(19) On the keyboard, type in *1400.*

(20) Depress the ENTER key.

(21) Depress matrix buttons D–2 (WHD WT).

(22) Depress the SM key.

(23) On the keyboard, type in *1620.*

(24) Depress the ENTER key.

(25) Depress matrix buttons E–3 (PROP WT CORR).

(26) Depress the SM key.

(27) On the keyboard, type in *−2.1.*

(28) Depress the ENTER key.

Note. Matrix positions E–4, E–5, and E–6 are not used with this rocket (table 1).

(29) Depress matrix buttons E–7 (PROP TEMP).

(30) Depress the SM key.

(31) On the keyboard, type in *+62.*

(32) Depress the ENTER key.

(33) Depress matrix buttons E–8 (SURF PRESS).

(34) Depress the SM key.

(35) On the keyboard, type in *1010.*

(36) Depress the ENTER key.

(37) When all the necessary data have been entered to compute initial firing data, depress the COMPUTE button. When the compute mode is terminated, the following data are displayed:

Deflection *2790,*
Fuze setting *29.4,*
Quadrant elevation *304.8.*

Note. It is necessary to compute the firing data *before* the crest clearance data are computed.

23. Computation of Crest Clearance Data

a. Situation Continued. Inspecting a map along the direction of fire, the S3 notes that the rocket will pass over a crest occupied by friendly troops. The altitude of the crest is

980 meters. It is 5,000 meters from the firing point.

b. Requirement. The S3 directs the operator to compute the crest clearance data.

c. Solution. The operator performs the following actions:

(1) Depress matrix buttons D–6 (CREST RANGE).
(2) Depress the SM key.
(3) On the keyboard, type in *5000*.
(4) Depress the ENTER key.
(5) Depress matrix buttons D–7 (CREST ALT).
(6) Depress the SM key.
(7) On the keyboard, type in *980*.
(8) Depress the ENTER key.
(9) Depress matrix buttons D–8 (CREST CLEAR).
(10) Depress the SM key.
(11) On the keyboard, type in *1* (the flag indicating that the crest is occupied and in friendly territory).
(12) Depress the ENTER key and the following display will appear: *05000 00920 2xx90*. Therefore, *2* (PE's) *90* (percent).

d. Discussion. This means there is only a 90 percent probability that the rocket will clear the crest. This probability, expressed as *2* probable errors, does not meet the minimum assurance criteria of 6 PE's (99 percent).

24. Computation of Data After Changing Firing Points

a. Situation Continued. Since the crest cannot be cleared with a 99 percent assurance, it is necessary to change firing points. The firing platoon has not yet reached firing point 4 and may easily be directed to another point. Firing point 3 is selected.

b. Requirement. The operator is directed to compute data for firing point 3 instead of firing point 4.

c. Solution. The operator performs the following actions:

(1) Insure the mission association buttons A and 2 are depressed.
(2) Depress matrix buttons F–2 (FP LIST ASSOC).
(3) Depress the SM key.
(4) On the keyboard, type *3*.
(5) Depress the ENTER key. Wait for the coordinates and altitude to be displayed: *41899 42696 360*.
(6) Depress matrix buttons D–1 (CHART RANGE).
(7) Depress the SM key and the following range is displayed: *15022* (meters).
(8) Depress matrix buttons D–2 (AZ OF FIRE).
(9) Depress the SM key and the following is displayed: *122* (mils).
(10) Depress matrix buttons D–3 (ORIENT ANGLE).
(11) Depress the SM key and the following is displayed: *1199.59* (mils).

d. Situation Continued. The following message is sent to the firing platoon:

LAUNCHER NUMBER 1,
FIRING POINT NUMBER 3,
AZIMUTH OF ORIENTING LINE 1322,
AZIMUTH OF FIRE *122*,
ORIENTING ANGLE *1200*.

e. Situation Continued. The S3 reexamines the map and notes a crest along the new direction of fire at a range of 14,500 meters. This crest is in enemy territory. Its altitude is 580 meters.

f. Requirement. The S3 directs the operator to compute the crest clearance.

g. Solution. The operator performs the following actions to compute crest clearance:

(1) Depress the COMPUTE button. At the termination of the compute mode the following data are displayed: (Ballistic solution must be computed before the crest clearance is computed.)
    Deflection *2794*,
    Time *25.3*,
    Quadrant elevation *277.8*.
(2) Depress matrix buttons D–6 (CREST RANGE).
(3) Depress the SM key.
(4) On the keyboard, type in *14500*.

(5) Depress the ENTER key.

(6) Depress matrix buttons D–7 (CREST ALT).

(7) Depress the SM key.

(8) On the keyboard, type in *580*.

(9) Depress the ENTER key.

(10) Depress matrix buttons D–8 (CREST CLEAR).

(11) Depress the SM key.

(12) On the keyboard, type in 2 (the flag indicating that the crest is in enemy territory for this type of ammunition (table 1)).

(13) Depress the ENTER key and the following display appears: *14500 00580 6xx99*. Therefore, 6 (PE's) 99 (percent).

25. Updating Mission Using the Latest Meteorological Message

a. Given. The following meteorological message has been received in the fire direction center.

Identification	*Octant*	*Location*	*Date-time*	*Station height (10's m)*	*MDP pressure (% of std)*
METCM	1	341981	200810	048	992

Line number	*Wind direction (10's mils)*	*Wind speed (knots)*	*Temperature (1/10° K)*	*Density (gm/m)*
00	010	011	2504	1292
01	638	005	2490	1269
02	620	020	2466	1258
03	618	024	2432	1221
04	590	030	2387	1202
05	584	011	2366	1169
06	600	028	2343	1144
07	610	050	2308	1088
08	560	062	2274	1023
09	524	040	2238	0999
10	502	024	2200	0986
11	486	010	2179	0976
12	460	030	2106	0966
13	380	048	2066	0892
14	365	060	1998	0836
15	320	040	1936	0749
16	396	020	1912	0688
17	429	036	1855	0624
18	440	058	1814	0589
19	439	047	1799	0578
20	486	060	1722	0542
21	438	022	1689	0520
22	500	010	1644	0489
23	560	042	1620	0466

b. Requirement. The operator is directed to update mission A2 and to enter the meteorological message.

c. Solution. The operator performs the following actions to enter the met message manually:

(1) Depress matrix buttons H–8 (MET INPUT).

(2) Depress the SM key.

(3) On the keyboard, type in 0 (the flag indicating manual entry).

(4) Depress the ENTER KEY. The number 88 will appear.

(5) On the keyboard, type in the identification line of the message starting with the date-time group: *300810 048992*.

(6) Depress the ENTER key, 00 is displayed.

(7) On the keyboard, type in the 00 line of the message: *00010011 25041292*.

(8) Depress the ENTER key, 01 is displayed.

(9) On the keyboard, type in the 01 line of the message: *01638005 24901269*.

(10) Depress the ENTER key, 02 is displayed.

(11) The data on each line are entered by the procedures in (8) and (9) above until the last line of the message has been entered. Then the input mode is terminated by typing 9 on the keyboard and depressing the ENTER key.

d. Mechanical Tape Reader. The operator performs the following actions to enter the met message tape through the mechanical tape reader:

(1) Load the message tape in the mechanical reader with the wide side toward the computer and with the printed side up.

(2) Turn the sprocket knob to insure that the tape is properly engaged on the sprocket.

(3) Insure mission association buttons A and 2 are still depressed.

(4) Depress matrix buttons H–8 (MET INPUT).

(5) Depress the SM key.

(6) On the keyboard, type in *2*.

(7) Depress the ENTER key. The tape reader will automatically start and will stop at the end of the tape. If less than 26 lines are entered, the input mode must be terminated by depressing the ENTER key.

Note. Crest clearance data may be recomputed to insure that the weather effects have not degraded clearance probability by the procedures outlined in paragraph 24*g*.

26. Computation of Final Data

a. Situation Continued. The firing platoon has arrived at the firing point and the launcher has been positioned and laid for direction. The following report is received at the fire direction center:

Barometer is inoperative.
Propellant temperature is +62° F.
Referred deflection is 2664.

b. Requirement. The S3 directs that the identification line of the meteorological message be used to determine the pressure data and that the operator convert the percentage figure to pressure in millibars and correct for the difference in altitude between the firing point and the mean datum plane (MDP).

c. Solution. The computer uses the percent pressure figure in the identification line of the met message when a 0 is entered in matrix function E–8 (SURF PRESS). Printout of the mission will show 0.0 as having been entered; however, the computer uses a value comparable to an entry of 1,019 mb in this mission.

d. Solution Continued. The operator performs the following actions to enter the latest pressure and propellant temperature:

(1) Depress matrix buttons E–8 (SURF PRESS).

(2) Depress the SM key.

(3) On the keyboard, type in *1019*.

(4) Depress the ENTER key.

(5) Since the propellant temperature has not changed, a new entry is not required. The operator can check the temperature by depressing matrix buttons E–7 (PROP TEMP) and then depressing the RECALL key; ±*62* is displayed.

(6) Depress the COMPUTE button, and at the termination of the compute mode, the following data will be displayed:

Deflection *2802*,
Fuze setting *25.1*,
Quadrant elevation *276.1*.

e. Situation Continued. The following fire commands are transmitted to the firing platoon:

DEFLECTION *2666*,
TIME *25.1*,
QUADRANT ELEVATION *276.1*.

Note. The difference between the displayed deflection and 2,800 mils is adedd algebraically to the referred deflection to obtain the deflection seat to the firing point; e.g., 2802 − 2800 = +2,2664 + 2 = 2666.

f. Situatioon Continued. Two minutes before firing time the platoon reports low-level wind data measured with the wind measuring set. Conditions are all other than nighttime.

Range wind component ________ Head + 11 mph.
Crosswind component ________ 0.

g. Solution Continued. The operator performs the following actions to compute the final data:

(1) Depress matrix buttons C–2 (LLW RANGE).

(2) Depress the SM key.

(3) On the keyboard, type in +*11*.

(4) Depress the ENTER key.

(5) Depress matrix buttons C–3 (LLW CROSS).

(6) Depress the SM key.

(7) On the keyboard, type in + *or* − *0*.
Note. The zero must be preceded by a sign.

(8) Depress the ENTER key.

(9) Depress matrix buttons C–4 (WIND WT MULT).

(10) Depress the SM key.

(11) On the keyboard, type in *1*, the flag

indicating all other than nighttime conditions.

(12) Depress the ENTER key.

(13) Depress matrix buttons C–5 (FINAL LLW CORR).

(14) Depress the SM key. Computation terminates with the following display: *0 0.0 6.6*. This means that the deflection correction is 0, and the quadrant elevation correction is +6.6 mils. The time correction is always zero.

(15) Depress matrix buttons C–6 (FINAL DATA).

(16) Depress the SM key. The final data are computed and displayed:

Deflection 2802,
Fuze time 25.1 (not sent to the FP),
Quadrant elevation 282.7.

h. Situation Continued. The following commands are sent to the firing point:

DEFLECTION 2666 (2664+2),
QUADRANT ELEVATION 282.7.

27. Printout Mission, Firing Point List, and Target List

a. Requirement. The S3 directs that a hard copy record be made of all missions.

b. Solution. The operator performs the actions described in paragraphs 13 and 14.

28. Summary of Input Data for Mission 2

Matrix function	*Input data* [1]	*Remarks*
A–1 (TGT EAST)	43700	Zero added to enter five digits.
A–2 (TGT NORTH)	57610	Zero added to enter five digits.
A–3 (TGT ALT)	426	
A–5 (TFT RECORD)	11	Target list number assigned.
B–1 (FP EAST)	43925 (41899)	
B–2 (FP NORTH)	21098 (42696)	
B–3 (FP ALT)	359 (360)	
B–4 (AZ OL)	2801 (1322)	Must be entered before using function B–5 (FP RECORD).
B–5 (FP RECORD)	4 (3)	Firing point list number assigned.
F–1 (TGT LIST ASSOC)	11	Target list number.
F–2 (FP LIST ASSOC)	4 (3)	Firing point list number.
F–3 (LCHR TYPE)	386	
F–4 (RKT TYPE)	50	Flag for rocket MGR–1B.
F–5 (WHD TYPE)	7	Flag for M144 warhead.
F–8 (OPTION)	2	Flag for high airburst.
E–1 (MOTOR EMPTY WT)	1400	Value in pounds.
E–2 (WHD WT)	1620	Value in pounds.
E–3 (PROP WT CORR)	−2.1	Signed value in pounds.
E–7 (PROP TEMP)	+62 (nc)	Signed value.
E–8 (SURF PRESS)	966 (o)	Value in millibars.
G–7 (LAT)	+34	Signed value. The + sign indicates north latitude.
G–8 (GRID DECL ANGLE)	+42	Signed value. The + sign indicates that grid north is right of true north.
H–8 (MET INPUT)	300406 048 995 (300810 048 996)	Identification line of met message entered.
C–2 (LLW RANGE)	+11	Signed value. The + sign indicates a head wind correction.
C–3 (LLW CROSS)	+ or −0	Zero must be entered and must be preceded by a + or − sign.
C–4 (WIND WT MULT)	1	Flag indicating all other than nighttime conditions.
D–6 (CREST RANGE)	4000 (12000)	Value in meters.
D–7 (CREST ALT)	820 (580)	Value in meters.
D–8 (CREST CLEAR)	1 (2)	Flag indicates that the crest is in friendly territory and occupied. Flag 2 indicates that the crest is in enemy territory.

[1] A second entry is shown in parentheses.

Section IV. MISSION NUMBER 3

29. General

a. Situation. The Honest John battalion fire direction center has occupied position and established communications. The M18 computer has been set up and program tests 1 and 2 have been run successfully.

b. Given.

(1) The following targets and firing points have been entered into memory.

Target list

Number	*Coordinates*		*Altitude*
1	3290	5065	500
2	3853	5642	385
3	4466	5173	446
4	4906	5302	394
5	4014	2900	400
6	3670	5455	395
7	3882	5243	400
8	3910	5800	420
9	4005	6050	500
10	3640	6230	420

Firing point list

Number	*Coordinates*		*Altitude*	*Azimuth of orienting line*
1	35417	44300	406	2615
2	37943	42917	366	2052
3	41899	42696	360	1322
4	43925	41098	359	2801
5	44540	40810	400	4022

Note. The targets and firing points are the same as those used in mission 2 and need not be reentered. If this mission is used as a separate problem, these data must be entered by following the procedures in paragraph 19.

(2) The following data are available:
Latitude 40° north
Grid declination +25 mils.

c. Requirement. The operator is directed to enter the grid declination and latitude.

d. Solution. The operator performs the following actions:

(1) Depress matrix buttons G–7 (LAT).

(2) Depress the SM key.

(3) On the keyboard, type in +*40*.

(4) Depress the ENTER key.

(5) Depress matrix buttons G–8 (GRID DECL ANGLE).

(6) Depress the SM key.

(7) On the keyboard, type in +*25*.

(8) Depress the ENTER key.

e. Situation Continued. The following call for fire has been received:

BLUE LIGHT 18, THIS IS THUNDERBIRD 9,
FIRE MISSION,
FIRING POINT 1,
TARGET NUMBER 1000,
GRID NK364623,
ALTITUDE 420,
HONEST JOHN MGR–1A ROCKET,
WARHEAD M57,
IMPACT BURST,
ONE ROUND, TIME ON TARGET 1200Z.

30. Computation of Firing Data for Mission 3

a. Situation Continued. The S3 notes that the target is on the target list and has been entered in memory. Based upon his knowledge of the situation and the information in the call for fire, he issues the following fire order:

MISSION B1,
BATTERY ALFA,
LAUNCHER NUMBER 1,
FIRING POINT NUMBER 1,
TARGET NUMBER 10.

b. Requirement. The operator is directed to compute the initial laying data for the warning order.

c. Solution. The operator performs the following actions:

(1) Depress mission association buttons *B and 1*.

(2) Depress matrix buttons C–8 (CLEAR DATA).

(3) Depress the SM key.

(4) On the keyboard, type in *0*.

(5) Depress the ENTER key.

(6) Depress matrix buttons F–1 (TGT LIST ASSOC).

(7) Depress the SM key.

(8) On the keyboard, type in *10*.

(9) Depress the ENTER key. Wait for the following display to appear: *36400 62300 420*.

(10) Depress matrix buttons F–2 (FP LIST ASSOC).

(11) Depress the SM key.

(12) On the keyboard, type in *1*.

(13) Depress the ENTER key. Wait for the following display to appear: *35417 44300 406*.

Note. Firing point number 1 and target number 10 are now mission associated.

(14) Depress matrix buttons D–2 (AZ OF FIRE).

(15) Depress the SM key. The azimuth from firing point 1 to target 10 is computed and displayed: *56*.

(16) Depress matrix buttons D–3 (ORIENT ANGLE).

(17) Depress the SM key. The orienting angle is computed and displayed: 2559.43 (to the nearest 0.01 mil).

Note. Range may also be computed by using function D–1 (CHART RANGE). If so, the range displayed is *18027 m*.

d. Situation Continued.

(1) The following warning order is issued to Battery A:

LAUNCHER NUMBER 2,
FIRING POINT NUMBER 1,
ROCKET MGR–1A,
WARHEAD M57 HIGH EXPLOSIVE,
ONE ROUND AT MY COMMAND,
TIME ON TARGET 1200Z,
AZIMUTH OF ORIENTING LINE 2615,
AZIMUTH OF FIRE *56*,
ORIENTING ANGLE *2559*.

(2) The battalion has not received a meteorological message in the past 24 hours. The S3 decides to compute data using the standard met.

e. Requirement. The S3 directs the operator to use standard met.

f. Solution. The operator performs the following actions:

(1) Depress matrix buttons H–7 (MET STD).

(2) Depress the SM key.

(3) On the keyboard, type in *0*.

(4) Depress the ENTER key.

g. Situation Continued. The following information is received from the launcher platoon designated to fire the mission:

Gross motor weight	4,060 lb
Warhead weight	1,592 lb
Fin weight	172 lb
Propellant weight	2,036 lb
Propellant temperature	+55° F
Surface pressure	990 mb.

h. Requirement. The operator is directed to compute initial data.

i. Solution. The operator performs the following actions:

(1) Insure that mission association buttons B and 1 are depressed.

(2) Depress matrix buttons F–3 (LCHR TYPE).

(3) Depress the SM key.

(4) On the keyboard, type in *386*.

(5) Depress the ENTER key.

(6) Depress matrix buttons F–4 (RKT TYPE).

(7) Depress the SM key.

(8) On the keyboard, type in *31*.

(9) Depress the ENTER key.

(10) Depress matrix buttons F–5 (WHD TYPE).

(11) Depress the SM key.

(12) On the keyboard, type in 2 (flag indicating the M57 high-explosive warhead).

(13) Depress the ENTER key.

(14) Depress the matrix buttons F–7 (HOB).

(15) Depress the SM key.

(16) On the keyboard, type in *0*. (Zero height of burst must be entered for this type warhead. See table 5.)

(17) Depress the ENTER key.

(18) Depress matrix buttons E–1 (MOTOR EMPTY WT).

(19) Depress the SM key.

(20) On the keyboard, type in *0*. (A zero is entered in function E–1 when motor gross weight is to be entered.)

(21) Depress the ENTER key.

(22) Depress matrix buttons E–2 (WHD WT).

(23) Depress the SM key.

(24) On the keyboard, type in *1592*.

(25) Depress the ENTER key.

(26) Depress matrix buttons E–4 (FIN WT).

(27) Depress the SM key.

(28) On the keyboard, type in *172*.

(29) Depress the ENTER key.

(30) Depress matrix buttons E–5 (PROP WT).

(31) Depress the SM key.

(32) On the keyboard, type in *2036*.

(33) Depress the ENTER key.

(34) Depress matrix buttons E–6 (GROSS MOTOR WT).

(35) Depress the SM key.

(36) On the keyboard type in *4060*.

(37) Depress the ENTER key.

(38) Depress matrix buttons E–7 (PROP TEMP).

(39) Depress the SM key.

(40) On the keyboard, type in *+55*.

(41) Depress the ENTER key.

(42) Depress matrix buttons E–8 (SURF PRESS).

(43) Depress the SM key.

(44) On the keyboard, type in *990*.

(45) Depress the ENTER key.

(46) All the necessary data have now been entered to compute the initial firing data, using standard met data. The operator depresses the COMPUTE button, and when the compute mode is terminated, the following data are displayed:

Deflection *2801*,
Time of flight *46.2*,
Quadrant elevation *496.7*.

j. Discussion. The trajectory must be computed before the crest clearance data are computed.

31. Computation of Crest Clearance

a. Situation Continued. The firing platoon has arrived at the firing point. While examining a map, the S3 notes that the trajectory will pass over a crest occupied by friendly troops, which it must clear with 99 percent assurance.

b. Given.

Range to crest is 5,000 meters.
Altitude of the crest is 466 meters.

c. Requirement. The operator is directed to compute the crest clearance data.

d. Solution. The operator performs the following actionos:

(1) Depress matrix buttons D–6 (CREST RANGE).

(2) Depress the SM key.

(3) On the keyboard, type in *5000*.

(4) Depress the ENTER key.

(5) Depress matrix buttons D–7 (CREST ALT).

(6) Depress the SM key.

(7) On the keyboard, type in *466*.

(8) Depress the ENTER key.

(9) Depress matrix buttons D–8 (CREST CLEAR).

(10) Depress the SM key.

(11) On the keyboard, type in 1 (flag indicating that the crest is occupied and in friendly territory).

(12) Depress the ENTER key. The following data are displayed: 5000 466 6 99. Therefore, 6 (PE's) 99 (percent).

e. Discussion. This probability meets the minimum criteria for clearance.

32. Updating Mission with the Latest Meteorological Message

a. Situation Continued. The fire direction center has received a new met message.

b. Given. The meteorological message is as follows:

Identification	*Octant*	*Location*	*Date-time*	*Station height (10's m)*	*MDP pressure (% of std)*
METCM	1	341981	311014	036	998

Line number	*Wind direction (10's mils)*	*Wind speed (knots)*	*Temperature (1/10° K)*	*Density (gm/m)*
00	480	015	2568	1302
01	460	020	2526	1288
02	500	022	2513	1273
03	510	018	2520	1262
04	520	032	2501	1244
05	620	040	2497	1232
06	580	028	2489	1212
07	020	038	2477	1200
08	060	045	2465	1189
09	001	040	2444	1178
10	030	055	2437	1134
11	042	060	2405	1073
12	038	026	2369	1040
13	022	039	2320	1001
14	034	020	2294	0962
15	043	040	2224	0958
16	123	050	2202	0932
17	128	042	2188	0865
18	253	070	2156	0834
19	385	054	2089	0719
20	320	038	2077	0699

c. Requirement. The S3 directs that the mission be updated, using this met message.

d. Solution. The operator first performs the following actions to dismiss the standard met.

(1) Depress matrix buttons H–7 (MET STD).

(2) Depress the SM key.

(3) On the keyboard type in *9*.

(4) Depress the ENTER key.

e. Solution Continued. The operator performs the following actions to enter the meteorological message manually:

(1) Depress matrix buttons H–8 (MET INPUT).

(2) Depress the SM key.

(3) On the keyboard, type in *0*.

(4) Depress the ENTER key, 88 is displayed.

(5) On the keyboard, type in the identification line starting with the date-time group: *311014 036988*.

(6) Depress the ENTER key, 00 is displayed.

(7) On the keyboard, type in the 00 line of the message: *00480015 25681302*.

(8) Depress the ENTER key, 01 is displayed.

(9) On the keyboard, type in the 01 line of the message: *01460020 25261288*.

(10) Depress the ENTER key, 02 is displayed.

(11) Continue to enter each line and terminate the input mode after the last line has been entered by typing a *9* and depressing the ENTER key.

f. Mechanical Tape Reader. The operator forms the following actions to enter the met message tape through the mechanical tape reader:

(1) Load the tape in the mechanical tape reader with the wide side toward the computer and with the printed side up.

(2) Turn the sprocket knob to insure that the tape is properly engaged on the sprocket and close the clamp.

(3) Depress matrix buttons H–8 (MET INPUT).

(4) Depress the SM key. Keyboard light lights.

(5) On the keyboard, type in *2*.

(6) Depress the ENTER key. The tape reader will automatically start and will stop at the end of the tape. Terminate the input mode by depressing the ENTER key.

g. Solution Continued. The operator performs the following actions to compute data, using the latest met message:

(1) Depress the COMPUTE button. The following data are displayed:

Deflection *2800*,
Time of flight *59.8*,
Quadrant elevation *666.3*.

(2) Recompute the crest clearance data by the procedure in paragraph 31*d* to insure that the minimum probability has not changed as a result of considering the weather.

33. Computation of Final Data

a. Situation Continued. The firing platoon reports the following data from the firing point:

Propellant temperature	+58° F
Surface pressure	1,000 mb
Referred deflection	2,884 mils

b. Requirement. The operator is directed to enter the latest propellant temperature and surface pressure:

c. Solution. The operator performs the following actions:

(1) Depress matrix buttons E–7 (PROP TEMP).

(2) Depress the SM key.

(3) On the keyboard, type in *+58*.

(4) Depress the ENTER key.

(5) Depress matrix buttons E–8 (SURF PRESS).

(6) Depress the SM key.

(7) On the keyboard, type in *1000*.

(8) Depress the ENTER key.

(9) Depress the COMPUTE button and the following firing data will be computed and displayed:
Deflection *2800*,
Time of flight *59.8*,
Quadrant elevation *665.7*.

d. Situation Continued. The following fire commands are transmitted to the firing platoon:

Deflection *2884*
Fuze time *54.8*
Quadrant elevation *665.7*

(1) The difference between the displayed deflection and 2,800 mils is added algebraically to the referred deflection, in this case zero.

(2) Time of flight is −5 seconds.

e. Situation Continued. Low-level wind components have been determined by the fire direction center, using the 00 line of the met message, as follows:

Wind direction	4800
Wind speed	15 knots.

Knots are converted to miles per hour:
15 x 1.1508 = 17 mph.

Azimuth of the wind	4800
Minus azimuth of fire	56
Chart direction =	4744

Correction factors for low-level winds:
T 0.01 and R 0.99.
Tail 2 mph (T 0.10 x 17).
Right 17 mph (R 0.99 x 17).

f. Solution Continued. The operator performs the following actions to enter low-level wind components and compute the final data.

(1) Depress matrix buttons C–2 (LLW RANGE).

(2) Depress the SM key.

(3) On the keyboard, type in *−2*.

(4) Depress the ENTER key.

(5) Depress matrix buttons C–3 (LLW CROSS).

(6) Depress the SM key.

(7) On the keyboard, type in *RIGHT 17*.

(8) Depress the ENTER key.

(9) Depress matrix buttons C–4 (WIND WT MULT).

(10) Depress the SM key.

(11) On the keyboard, type in *3* (flag indicating use of the 00 line of the met message).

(12) Depress the ENTER key.

(13) Depress matrix buttons C–5 (FINAL LLW CORR).

(14) Depress the SM key. This action puts the computer in the compute mode which terminates with the following display: *−91 0.0 905.0*.

Note. This display means deflection correction (RIGHT) 91 mils, quadrant −5.0 mils.

(15) Depress matrix buttons C–6 (FINAL DATA)

(16) Depress the SM key. The final data are computed and displayed:

Deflection *2709*,
Time of flight *59.8* (not sent),
Quadrant elevation *660.7*.

g. Situation Continued. The following fire commands are sent to the firing point:

DEFLECTION *2793* (2884 −91)
QUADRANT ELEVATION *660.7*.

Note. The difference between the displayed deflection and 2,800 mils is added algebraically to the referred deflection, in this case −91 mils.

34. Printout Mission, Firing Point List, and Target List

a. Requirement. The S3 directs that a hard copy record be made of this mission and of the firing points and target lists.

b. Solution. The operator performs the procedures outlined in paragraphs 13 and 14 of this appendix.

35. Summary of Input Data for Mission 3

Matrix function	*Input data* [1]	*Remarks*
A-1 (TGT EAST)	36400	Zero added to enter five digits.
A-2 (TGT NORTH)	62300	Zero added to enter five digits.
A-3 (TGT ALT)	420	
A-5 (TGT RECORD)	10	Target list number assigned.
B-1 (FP EAST)	35417	
B-2 (FP NORTH)	44300	
B-3 (FP ALT)	406	
B-4 (AZ OL)	2615	Entered prior to using B-5 (FP RECORD).
B-5 (FP RECORD)	1	Firing point list number assigned.
F-1 (TGT LIST ASSOC)	10	Target list number.
F-2 (FP LIST ASSOC)	1	Firing point list number.
F-3 (LCHR TYPE)	386	
F-4 (RKT TYPE)	31	Flag for MGR 1A rocket.
F-5 (WHD TYPE)	2	Flag for M57 warhead.
F-7 (HOB)	0	Zero must be entered for impact data.
E-1 (MOTOR EMPTY WT)	0	A zero must be entered for this function when GROSS MOTOR WT is entered.
E-2 (WHD WT)	1592	Value in pounds.
E-4 (FIN WT)	172	Value from type of fin in pounds.
E-5 (PROP WT)	2036	Value in pounds.
E-6 (GROSS MOTOR WT)	4060	Value in pounds used only when motor empty weight is not known and only for rocket MGR-1A.
E-7 (PROP TEMP)	+55 (+58)	Signed value.
E-8 (SURF PRESS)	990 (1000)	Value in millibars.
D-6 (CREST RANGE)	5000	
D-7 (CREST ALT)	466	
D-8 (CREST CLEAR)	1	Flag *1* indicates that crest is in friendly territory and occupied.
G-7 (LAT)	+40	Signed value. A + sign indicates north latitude.
G-8 (GRID DECL ANGLE)	+25	Signed value. A + sign indicates that grid north is right of true north.
H-7 (MET STD)	0 (9)	The 9 is an enabling entry which means *dismiss*.
H-8 (MET INPUT)	311014 (036998)	After entering the identification line of the met message, all lines are entered, manually or mechanically.
C-2 (LLW RANGE)	−2	Signed value. A − sign indicates a wind correction factor.
C-3 (LLW CROSS)	+17	Signed value. A + sign indicates a left correction factor.
C-4 (WIND WT MULT)	3	Flag indicating 00 line of met message used.

[1] A second entry is shown in parentheses.

APPENDIX E

SAMPLE PROBLEMS FOR 318-MM ROCKET, LITTLE JOHN

Section I. GENERAL

1. General

a. This appendix contains a series of sample problems which may be used for operator training on the M18 gun direction computer, FADAC. The problems illustrate the computation of firing data for the Little John rocket. The solutions are those displayed using the 318-mm rocket program tape with the following identification number:

A X 2 XXXXX XXXXX 00318. This identification number is displayed when the program test is initiated.

b. In the tactical and training situations in the problems in this appendix, it is assumed that a Little John battalion has occupied a position area, established communications, and completed survey.

2. Operator Checks and Tests

a. After setting up the computer, the operator must run the program tests to insure that the computer is operating properly and that the program has been correctly inserted into memory.

b. The operator performs the following actions:

(1) Depress the PROG TEST button. A X 2 XXXXX XXX00 00318 is displayed.

(2) Depress the 1 key on the keyboard to test the permanent storage section of the memory. The Nixie lights will flicker during this test. When the test is complete, the following display appears: A X 2 00000 00000 00318.

Note. The letter "X" denotes an unlit Nixie tube, and the letter "A" denotes the display of one of the five letters, A through E, for the mission association button depressed.

(3) Depress the PROG TEST button again. Then depress the 2 key on the keyboard to test the working storage section (hot storage). If the test is successful, the number 136 will appear in the right three Nixie indicators of the display panel.

3. Sequence of Events in Processing a Fire Mission

a. In most tactical situations the sequence of events in processing a fire mission is as follows:

(1) The battalion fire direction center will receive a call for fire from higher headquarters which will include such data as the number of launchers; the target number; the coordinates and altitude; the firing point number; the height of burst, yield, and option; the rocket and warhead types; the number of rockets; and the time on target, (FM 6-40-1).

(2) The battalion S3 then issues a fire order and designates the mission association number; i.e. firing point-target association (A1, A2, . . . B5), the launcher number, and the firing point number.

(3) Based on the information received in the fire mission and in the fire order, the fire direction center issues a warning order to the battery designated to fire the mission. This order indicates the launcher number; the firing point number; the type of

rocket and of warhead; the height of burst, yield, and option, if applicable; the number of rockets; and the time on target data.

(4) The launcher platoon designated to fire the mission reports rocket weights and the propellant temperature and surface pressure to the fire direction center before moving to the firing point.

(5) The fire direction center enters all available data including the latest meteorological message into the FADAC. Then, the initial firing data, the crest clearance, the aximuth of fire, and the orienting angle are computed. The orienting angle and the azimuth of fire are sent to the firing platoon as soon as possible.

(6) When the firing platoon reaches the firing position, the surface pressure and propellant temperature are measured again. These data and the referred deflection are sent to the fire direction center.

(7) Using the latest meteorological message, the fire direction center recomputes the firing data and sends the fire commands to the platoon. (The firing deflection is obtained by algebraically adding the difference between the computer displayed deflection and 2,800 mils to the referred deflection. For example, when the computer displayed deflection is 2808, and the referred deflection is 2653 (2653+8=2661), the deflection sent to the firing point as a command is 2661.

(8) Two minutes prior to firing the low-level wind data are measured and sent to the fire direction center.

(9) The fire direction center computes the final data and sends the final deflection and quadrant elevation to the platoon.

(10) The final countdown is conducted for a time on target mission, and the rocket is fired.

b. The sequence of events in *a* above may vary with the situation. In some cases firing may take place from the position area which would eliminate the need for actions described in (6) above.

Section II. MISSION 1

4. Computation of Traverse Survey

a. Situation. A field training exercise is being conducted in a theater of operations during which service ammunition will be fired to add realism to the training. You are a member of the fire direction center participating in this exercise.

b. Given. From the data determined by the battalion survey section, the following field notes are delivered to the fire direction center:

Survey control point coordinates 26963.61–21694.50, altitude 418.8—

Traverse	*Azimuth (mils)*	*Distance (meters)*	*Vertical angle (mils)*
SCP to TS 1	5598.1	918.06	−2.6
TS 1 to TS 2	692.5	1121.87	−4.4
TS 2 to TS 3	5858.7	995.08	−3.3
TS 3 to FP 1	5008.3	1120.62	−2.5

c. Requirement. The operator is directed to compute the coordinates of each traverse station and the firing point.

d. Solution of Traverse Station 1. The operator performs the following actions:

(1) Depress matrix buttons H–1 (OBS EAST).

(2) Depress the SM key. KEYBOARD indicator lights.

(3) On the keyboard, type in the easting coordinates of the SCP to the nearest 0.01 meter, *26963.61*. Display will appear in the easting window and the decimal fraction will appear in the northing window.

(4) Depress the ENTER key. Display extinguishes.

(5) Depress the matrix buttons H–2 (OBS NORTH).

(6) Depress the SM key. KEYBOARD indicator lights.

(7) On the keyboard, type in the northing coordinates of the SCP to the nearest 0.01, *21692.50*. Digits are displayed in the easting window, and the decimal fraction in the northing window.

(8) Depress the ENTER key. The display extinguishes.

(9) Depress matrix buttons H–3 (OBS ALT).

(10) Depress the SM key. KEYBOARD indicator lights.

(11) On the keyboard, type in the altitude of the SCP to the nearest 0.01 meter, *418.80*. Digits will be displayed in the easting window.

(12) Depress the ENTER key. Display extinguishes.

(13) Depress matrix buttons G–1 (OBS AZ).

(14) Depress the SM key. KEYBOARD indicator lights.

(15) On the keyboard, type in the azimuth from the SCP to TS 1 to the nearest 0.01 mil, *5598.10*. Check the display.

(16) Depress the ENTER key. Display extinguishes.

(17) Depress matrix buttons G–2 (OBS HORIZ DIST).

(18) Depress the SM key. KEYBOARD indicator lights.

(19) On the keyboard, type in the distance from the SCP to TS 1 to the nearest 0.01 meter, *918.06*. Check the display.

(20) Depress the ENTER key. Display extinguishes.

(21) Depress matrix buttons G–4 (OBS (VERT ANGLE).

(22) Depress the SM key. KEYBOARD indicator lights.

(23) On the keyboard, type in the vertical angle to the nearest 0.1 mil from the SCP to TS 1 preceded by a sign, *—2.6*.

(24) Depress the ENTER key.

(25) Depress matrix buttons G–5 (SURVEY).

(26) Depress the SM key. KEYBOARD indicator lights.

(27) On the keyboard, type in *1*, the flag to compute the traverse.

(28) Depress the ENTER key. Coordinates and altitude of TS 1 are displayed: 26313 22342 417.

(29) If a record of the coordinates of the traverse station is required to the nearest 0.01 meter, the operator should temporarily store these data by using the following procedure:

(*a*) Depress matrix buttons H–4 (OBS RECORD).

(*b*) Depress the SM key.

(*c*) On the keyboard, type in 1 to identify TS 1.

(*d*) Depress the ENTER key.

(*e*) Depress matrix buttons H–5 (OBS recall).

(*f*) Depress the SM key.

(*g*) On the keyboard, type 1 and depress the ENTER key. Coordinates and altitude of TS 1 will be displayed.

(*h*) To recall the easting to the nearest 0.01, depress matrix buttons H–1 (OBS EAST), depress the RECALL key. Easting will be displayed to the nearest 0.01 of a meter. The northing and altitude may be recalled in a similar manner. (See table 1 for recall procedure.)

e. Solution of Traverse Station 2. The operator performs the following actions:

(1) Depress matrix buttons G–1 (OBS AX).

(2) Depress the SM key.

(3) On the keyboard type in the azimuth from TS 1 to TS 2 to the nearest 0.1 mil, *692.5*.

(4) Depress the ENTER key.

(5) Depress matrix buttons G–2 (OBS HORIZ DIST).

(6) Depress the SM key.

(7) On the keyboard, type in the distance from TS 1 to TS 2 to the nearest 0.01 meter, *1121.87*.

(8) Depress the ENTER key.

(9) Depress matrix buttons G–4 (OBS VERT ANGLE).

(10) Depress the SM key.

(11) On the keyboard, type in the vertical angle from TS 1 to TS 2 preceded by a sign and to the nearest 0.1 mil, *−4.4*.

(12) Depress the ENTER key.

(13) Depress the matrix buttons G–5 (SURVEY).

(14) On the keyboard, type in *1*.

(15) Depress the ENTER key. Coordinates of TS 2 are displayed: *27019 23215 412*.

f. Solution of Traverse Station 3. The operator performs the following actions:

(1) Depress matrix buttons G–1 (OBS AZ).

(2) Depress the SM key.

(3) On the keyboard, type in the azimuth from TS 2 to TS 3 to the nearest 0.1 mil, *5858.7*.

(4) Depress the ENTER key.

(5) Depress matrix buttons G–2 (OBS HORIZ DIST).

(6) Depress the SM key.

(7) On the keyboard, type in the distance from TS 2 to TS 3 to the nearest 0.01 meter, *995.08*.

(8) Depress the ENTER key.

(9) Depress matrix buttons G–4 (OBS VERT ANGLE).

(10) Depress the SM key.

(11) On the keyboard, type in the vertical angle from TS 2 to TS 3 preceded by a sign and to the nearest 0.1 mil, *−3.3*.

(12) Depress the ENTER key.

(13) Depress matrix buttons G–5 (SURVEY).

(14) Depress the SM key.

(15) On the keyboard, type in *1*.

(16) Depress the ENTER key. Coordinates and altitude of TS 3 are displayed: 26514 24073 409.

g. Solution of Firing Point 1. The operator performs the following actions:

(1) Depress matrix buttons G–1 (OBS AZ).

(2) Depress the SM key.

(3) On the keyboard, type in the azimuth from TS 3 to the FP to the nearest 0.1 mil, *5008.3*.

(4) Depress the ENTER key.

(5) Depress matrix buttons G–2 (OBS HORIZ DIST).

(6) Depress the SM key.

(7) On the keyboard, type in the distance from TS 3 to the FP to the nearest 0.01 meter, *1120.62*.

(8) Depress the ENTER key.

(9) Depress matrix buttons G–4 (OBS VERT ANGLE).

(10) Depress the SM key.

(11) On the keyboard, type in the vertical angle from TS 3 to the firing point, preceded by a sign and to the nearest 0.1 mil, *−2.5*.

(12) Depress the ENTER key.

(13) Depress matrix buttons G–5 (SURVEY).

(14) Depress the SM key.

(15) On the keyboard, type in *1*.

(16) Depress the ENTER key, coordinates and altitude of FP 1 are displayed: 25417 24300 406.

5. Entry of Surveyed Firing Points

a. Situation Continued. The battalion survey section submitted traverse field notes for three other firing points and the coordinates and altitudes have been computed.

b. Given.

Firing point number	Coordinates		Altitude	Azimuth of orienting line
1	25417	24300	406	2615
2	27943	22917	366	2052
3	31899	22696	370	1322
4	33925	21098	359	2801

c. Solution. The operator performs the following actions:

(1) Depress matrix buttons B–1 (FP EAST).

(2) Depress the SM key. KEYBOARD indicator lights.

(3) On the keyboard, type in the firing point easting *25417*.

(4) Depress the ENTER key.

(5) Depress matrix buttons B–2 (FP NORTH).

(6) Depress the SM key. KEYBOARD indicator lights.

(7) On the keyboard, type in the northing of the firing point, *24300*.

(8) Depress the ENTER key.

(9) Depress the matrix buttons B–3 (FP ALT).

(10) Depress the SM key. KEYBOARD indicator lights.

(11) On the keyboard, type in the altitude of the firing point, *406*.

(12) Depress the ENTER key.

(13) Depress the matrix buttons B–4 (AZ OL).

(14) Depress the SM key. KEYBOARD indicator lights.

(15) On the keyboard, type in the azimuth of the orienting line, *2615*.

(16) Depress the ENTER key.

(17) Depress matrix buttons B–5 (FP RECORD).

(18) Depress the SM key. KEYBOARD indicator lights.

(19) On the keyboard, type in *1*.

(20) Depress the ENTER key.

Note. This firing point is now stored in memory as firing point number 1 and may be recalled from memory, using matrix locations B–6 (RECALL FP OR LIST) or B–7 (PRINT FP LIST).

d. Solution Continued. The operator stores the three additional firing point coordinates and altitude and the azimuths of their orienting lines by performing the procedures in *c* above and using the applicable data.

6. Entry of Targets on Target List

a. Situation Continued. The following list of preplanned targets for the training exercise has been received at the battalion fire direction center. The target numbers assigned by the higher headquarters identify these targets as being planned for simulated nuclear attack.

b. Given.

Target	Coordinates		Altitude	Target list number
NA2122	2340	3065	429	1
NA1313	2853	3642	385	2
NA1412	34660	31730	446	3
NA2000	39060	33020	394	4
NX3000	30140	29000	400	5
NX5000	26700	34550	395	6
NX1000	28820	32430	400	7

c. Requirement. The operator is directed to enter these targets on the target list.

d. Solution. The operator performs the following actions:

(1) Depress matrix buttons A–1 (TGT EAST).

(2) Depress the SM key.

(3) On the keyboard, type in the target easting, *entering five digits.* Zeros are added, when required. For target 1, type *23400*.

(4) Depress the ENTER key.

(5) Depress matrix buttons A–2 (TGT NORTH).

(6) Depress the SM key.

(7) On the keyboard, type in the northing coordinate of the target, entering five digits. For target number 1, type *30650*.

(8) Depress the ENTER key.

(9) Depress matrix buttons A–3 (TGT ALT).

(10) Depress the SM key.

(11) On the keyboard, type in the altitude of the target. For target number 1, type *429*.

(12) Depress the ENTER key.

(13) Depress the matrix buttons A–5 (TGT RECORD).

(14) Depress the SM key.

(15) On the keyboard, type *1*.

(16) Depress the ENTER key. Target NA2122 is now stored in memory on the target list as target number 1.

(17) Repeat (1) through (16) above, for each target listed in *b* above.

7. Entry of Grid Declination and Latitude

a. Given. The grid declination angle at the meteorological station is known to be +51 mils. The latitude of the area is 34° north.

b. Requirement. The operator is directed to enter these data.

c. Solution. The operator performs the following actions:

(1) Depress matrix buttons G–8 (GRID DECL ANGLE).

(2) Depress the SM key.

(3) On the keyboard, type in *+51*. (The + sign indicates that grid north is right of true north.)

(4) Depress the ENTER key.

(5) Depress matrix buttons G–7 (LAT).

(6) Depress the SM key.

(7) On the keyboard, type in *+34*. (The + sign indicates north latitude.)

(8) Depress the ENTER key.

8. Entry of the Meteorological Message

a. Situation Continued. A meteorological message has been received in the fire direction center. Entry of the most recent meteorological data is vital to the determination of accurate firing data. As soon as a computer met message is received it should be entered in the computer.

b. Given

Computer Met Message

Identification	*Octant*	*Location*	*Date-time*	*Station height (10's m)*	*MDP pressure (% of std)*
METCM	1	341981	261620	036	974

Body Line number	*Wind direction (10's mils)*	*Wind speed (knots)*	*Temperature (1/10° K)*	*Density (gm/m³)*
00	010	011	2693	1277
01	048	019	2679	1266
02	032	014	2673	1243
03	056	037	2617	1195
04	014	015	2672	1093
05	540	014	2718	1016
06	512	022	2707	0953
07	516	033	2672	0903
08	504	060	2672	0846
09	492	070	2657	0802
10	491	065	2616	0763
11	490	060	2580	0725
12	485	050	2542	0665
13	475	055	2483	0596
14	480	052	2410	0533
15	490	055	2327	0478
16	500	060	2248	0427
17	550	058	2192	0375
18	601	036	2141	0328
19	614	035	2106	0284
20	587	032	2119	0237

c. Requirement. The operator is directed to enter the meteorological message.

d. Solution. The operator performs the following actions to enter the met message manually:

(1) Depress matrix buttons H–8 (MET INPUT).

(2) Depress the SM key. KEYBOARD indicator lights.

(3) On the keyboard, type in *0* (flag indicating manual entry).

(4) Depress the ENTER key. The number 88 is displayed.

(5) On the keyboard, type in the identification line of the message, starting with the date-time group: *261620 036974*.

(6) Depress the ENTER key, 00 is displayed.

(7) On the keyboard, type in the 00 line of the message: *00 010 011 2693 1277*.

(8) Depress the ENTER key, 01 is displayed.

(9) On the keyboard, type in the 01 line of the message: *01 048 019 2679 1266*.

(10) Depress the ENTER key, 02 is displayed.

(11) The data on each line are entered by the procedures listed in (8) and (9) above until the last line has been entered. Then the input mode is terminated by typing *9* on the keyboard and depressing the ENTER key.

e. Mechanical Tape Reader. The operator performs the following actions to enter the met message tape through the mechanical tape reader:

(1) Load the tape in the mechanical tape reader with the wide side toward the computer and with the printed side up.

(2) Turn the sprocket knob to insure that the tape is properly engaged on the sprocket.

(3) Depress matrix buttons H–8 (MET INPUT).

(4) Depress the SM key. KEYBOARD indicator lights.

(5) On the keyboard, type in *2*.

(6) Depress the ENTER key. The tape reader will automatically start and will stop at the end of the tape. When the tape stops, depress the ENTER KEY to terminate the mode.

9. Call for Fire Format

a. The call for fire from higher headquarters will follow a specific format. Only items applicable to a specific mission will be received.

Note. The standard format used in the problems contained in this appendix is shown in *b* below:

b. The following mission has been received in the fire direction center in the standard format:

Format item	*Call for fire*
(1) Identification	BLUE LIGHT 18, THIS IS FIRE POWER 9,
(2) Warning order	FIRE MISSION,
	(omitted)
(*a*) Size of unit to engage	FIRING POINT 2,
(*b*) Firing points	TARGET NA2122
(3) Number and location of target	GRID NS23403065,
(4) Description of target	ALTITUDE 429,
	(omitted)
(5) Method of engagement	LITTLE JOHN ROCKET MGR–3A,
(6) Type warhead	WARHEAD M8,
HOB or Option	HEIGHT OF BURST 200 METERS,
Number of rockets	ONE ROCKET
(7) Control	TIME ON TARGET
Time on target	1800Z
Latest time on target	2000Z
(8) Remarks or special instructions	DO NOT OCCUPY FIRING POINT PRIOR TO 1700Z.

10. Computation of Firing Data for Mission 1

a. Situation Continued. The S3 notes that target NA2122 is on the target list (target number 1) and designates the mission association number as A1. He issues the following fire order:

MISSION A1
LAUNCHER NUMBER 2,
FIRING POINT NUMBER 2,
TARGET NUMBER 1.

b. Requirement. The operator is directed to compute the initial laying data for inclusion in the warning order.

c. Solution. The operator performs the following actions:

(1) Depress mission association buttons A and 1.

(2) Depress matrix buttons C–8 (CLEAR DATA).

(3) Depress the SM key.

(4) On the keyboard, type in *0*.

(5) Depress the ENTER key.

(6) Depress matrix buttons F–1 (TGT LIST ASSOC).

(7) Depress the SM key.

(8) On the keyboard, type in *1*, the target number.

(9) Depress the ENTER key. Wait for display to appear: *23400 30650 429.*

(10) Depress matrix buttons F–2 (FP LIST ASSOC).

(11) Depress the SM key.

(12) On the keyboard, type in *2* (the firing point number).

(13) Depress the ENTER key. Wait for display to appear: *27943 22917 366.*

Note. Firing point number 2 and target number 1 are now mission associated. Data entered in the computer which are applicable to this mission are entered with mission association buttons A and 1 depressed.

(14) Depress matrix buttons D–2 (AZ OF FIRE).

(15) Depress the SM key, the azimuth of fire is displayed: *5859.*

(16) Depress matrix buttons D–3 (ORIENT ANGLE).

(17) Depress the SM key. The orienting angle is displayed: *2593.04* (to the nearest 0.01 mil).

d. Warning Order. The following warning order is issued to Battery B:

LAUNCHER NUMBER 2,
FIRING POINT NUMBER 2,
ROCKET MGR–3A,
WARHEAD M8,
ONE ROUND AT MY COMMAND,
TIME ON TARGET 1800Z,
AZIMUTH OF ORIENTING LINE 2052,
AZIMUTH OF FIRE 5859,
ORIENTING ANGLE 2593.

e. Situation Continued. To compute the initial firing data and crest clearance data, the operator performs the following actions:

(1) Insure that mission association buttons A and 1 are depressed.

(2) Depress matrix buttons F–3 (LCHR TYPE).

(3) Depress the SM key.

(4) On the keyboard, type in *34* (flag indicating the launcher type).

(5) Depress the ENTER key.

(6) Depress matrix buttons F–4 (RKT TYPE).

(7) Depress the SM key.

(8) On the keyboard, type in *51* (flag indicating the rocket type).

(9) Depress the ENTER key.

(10) Depress matrix buttons F–5 (WHD TYPE).

(11) Depress the SM key.

(12) On the keyboard, type in 3 (the flag indicating the warhead type).

(13) Depress the ENTER key.

Note. Position F–3 (YIELD) is omitted from this training mission.

(14) Depress matrix buttons F–7 (HOB).

(15) Depress the SM key.

(16) On the keyboard, type in *200*, the desired height of burst.

(17) Depress the ENTER key.

Note. Position F–8 (OPTION) is omitted from this mission, see FM 6–3–2A.

(18) Depress matrix buttons E–1 (MOTOR EMPTY WT).

(19) Depress the SM key.

(20) On the keyboard, type in *279.*

(21) Depress the ENTER key.

(22) Depress matrix buttons E–2 (WHD WT).

(23) Depress the SM key.

(24) On the keyboard, type in *260.*

(25) Depress the ENTER key.

(26) Depress matrix buttons E–3 (PROP WT CORR).

(27) Depress the SM key.

(28) On the keyboard, type in *–2.0.*

(29) Depress the ENTER key.

Note. Positions E–4 (FIN WT), E–5 (PROP WT) and E–6 (GROSS MOTOR WT), are not used with this rocket, (table 4).

(30) Depress matrix buttons E–7 (PROP TEMP).

(31) Depress the SM key.

(32) On the keyboard, type in *+63.*

(33) Depress the ENTER key.

(34) Depress matrix buttons E–8 (SURF PRESS).

(35) Depress the SM key.

(36) On the keyboard, type in *966*.

(37) Depress the ENTER key.

(38) All the necessary data have been entered to compute the initial firing data. Depress the COMPUTE button. The computation begins and lasts about 17 seconds and the following data are displayed: Deflection 2796, Fuze setting 18.1, Quadrant elevation 201.0.

Note. It is not necessary to send these data to the firing platoon; however, the ballistic solution must be computed before the crest clearance data are computed.

11. Computation of Crest Clearance Data

a. Situation Continued. From an inspection along the azimuth of fire on the situation map, the S3 notes that the trajectory will pass over a crest occupied by friendly troops.

b. Given. The altitude of this crest is 520 meters. It is 6,000 meters from the firing point.

c. Requirement. The operator is directed to compute the crest clearance data.

d. Solution. The operator performs the following actions:

(1) Depress matrix buttons D–6 (CREST RANGE).

(2) Depress the SM key.

(3) On the keyboard, type in *6000*.

(4) Depress the ENTER key.

(5) Depress matrix buttons D–7 (CREST ALT).

(6) Depress the SM key.

(7) On the keyboard, type in *520*.

(8) Depress the ENTER key.

(9) Depress matrix buttons D–8 (CREST CLEAR).

(10) Depress the SM key.

(11) On the keyboard, type in *1* (the flag indicating that the crest is occupied by friendly troops).

(12) Depress the ENTER key and the following solution is displayed: *600 520 6 99*.

e. Discussion. There is a 99 percent probability that the rocket will clear the crest by 60 or more meters. The maximum percent displayed is 99; therefore, the probability is also shown as a number of probable errors. The 6 PE's in this situation are considered as 100 percent.

12. Computation of Final Data

a. Situation Continued. The firing platoon has arrived at the firing point and the launcher has been positioned and laid.

b. Given. The following information is sent to the fire direction center:

Referred deflection 386,
Propellant temperature +66° F.,
Surface pressure 968 mb.

c. Requirement. The operator is directed to enter the latest data.

d. Solution. The operator performs the following actions:

(1) Depress matrix buttons E–7 (PROP TEMP).

(2) Depress the SM key.

(3) On the keyboard, type in *+66*.

(4) Depress the ENTER key.

(5) Depress matrix buttons E–8 (SURF PRESS).

(6) Depress the SM key.

(7) On the keyboard, type in *968*.

(8) Depress the ENTER key.

(9) The operator depresses the COMPUTE button, and the following data are displayed at the termination of computation:

Deflection 2796,
Fuze setting 18.1,
Quadrant elevation 200.8.

e. Situation Continued.

(1) The following commands are sent to the firing point:

DEFLECTION 382 (386+ (−4))

FUZE SETTING 18.1
QUADRANT ELEVATION
200.8

Note. The difference between the displayed deflection and 2,800 mils is added algebraically to the referred deflection to obtain the firing deflection.

(2) Two minutes before firing time, the platoon reports low-level wind data measured with the wind measuring set. Conditions are all other than nighttime conditions.

Range wind
component: Tail (–) 5 mph
Crosswind
component: Left 2 mph

f. Solution Continued. The operator performs the following actions to compute the final data:

(1) Insure that mission association buttons A and 1 are depressed.
(2) Depress matrix buttons C–2 (LLW RANGE).
(3) Depress the SM key.
(4) On the keyboard, type in *–5*.
(5) Depress the ENTER key.
(6) Depress matrix buttons C–3 (LLW CROSS).
(7) Depress the SM key.
(8) On the keyboard, type in *LEFT 2*.
(9) Depress the ENTER key.
(10) Depress matrix buttons C–4 (WIND WT MULT).
(11) Depress the SM key.
(12) On the keyboard, type in *1* (the flag indicating all other than nighttime conditions).
(13) Depress the ENTER key.
(14) Depress matrix buttons C–5 (FINAL LLW CORR).
(15) Depress the SM key. Computation begins and ends with the following display: *+2 0.0 9 00.9*. This means that the deflection correction is LEFT 2 (LARS) and the quadrant elevation correction is –0.9 mil. The time correction is always zero.
(16) Depress matrix buttons C–6 (FINAL DATA).
(17) Depress the SM key. The final data are computed and displayed:
Deflection 2799,
Fuze setting 18.1,
Quadrant elevation 199.9.

g. Situation Continued. The following commands are sent to the firing point:

DEFLECTION 385 (386 + (–1)),
QUADRANT ELEVATION 199.9.

13. Printing the Mission

a. Situation Continued. A record of each mission is required by unit standing operating procedure. The teletypewriter is connected to the computer.

b. Requirement. The operator is directed to print the mission.

c. Solution. The operator performs the following actions.

(1) Depress matrix buttons C–7 (PRINT MISSION).
(2) Position the typewriter paper.
(3) Depress the SM key. This action starts the printout.

Note. The printout will stop when the identification line of the met message has been typed. If the ENTER key is depressed, the entire message will be printed.

(4) Depress the PERIOD key to terminate the mode after the identification line has been printed. See table 3 for the printout format.

14. Printing The Firing Point and the Target Lists

a. Situation Continued. A printout of the firing point list and the target list may be obtained with the teletypewriter.

b. Requirement. The S3 directs the operator to print the firing point and target lists.

c. Solution. The operator performs the following actions:

(1) Depress matrix buttons B–7 (PRINT FP LIST).
(2) Depress the SM key.

(3) Position the typewriter paper.

(4) On the keyboard, type *0* (flag indicating the entire list).

(5) Depress the ENTER key, and the entire list of 16 firing points will be printed. If a firing point has not been entered, only the number will be printed. See table 3 for the printout format. To print a single firing point, type in the number of that point in (4) above. The printout may be terminated at any time by depressing the RESET button.

d. Solution Continued. The operator performs the following actions to print the target list:

(1) Depress matrix buttons A–7 (PRINT TGT LIST).

(2) Depress the SM key.

(3) Position the typewriter paper.

(4) On the keyboard, type in *0* (flag indicating the entire list.)

(5) Depress the ENTER key and the entire list of 32 targets will be printed. If a target has not been entered, only the number will be printed. See table 3 for the printout format. To print a single target, type in the target number in (4) above. The printout may be terminated at any time by depressing the RESET button.

15. Location of the Impact Point by Intersection Survey

a. Situation Continued. The battalion has established two OP's for the purpose of locating the impact points of rockets fired during the training exercise. Mission A1 has been fired, and the data available from survey and observation are as follows:

Observer	*Coordinates*		*Altitude*	*Azimuth measured to impact point*	*Vertical angle*
01	23560	29584	452	6230	−25
02	24325	29750	440	5578	Not measured.

b. Requirement. The operator is directed to compute the location of the impact point.

c. Solution. The operator performs the following actions:

(1) Depress matrix buttons H–1 (OBS EAST).

(2) Depress the SM key.

(3) On the keyboard, type in the easting coordinate of the 01 observer, *23560.*

(4) Depress the ENTER key.

(5) Depress matrix buttons H–2 (OBS NORTH).

(6) Depress the SM key.

(7) On the keyboard, type in the northing coordinate of the 01 observer, *29584.*

(8) Depress the ENTER key.

(9) Depress matrix buttons H–3 (OBS ALT).

(10) Depress the SM key.

(11) On the keyboard, type in the altitude of the 01 observer, *452.*

(12) Depress the ENTER key.

(13) Depress matrix buttons H–4 (OBS RECORD).

(14) Depress the SM key.

(15) On the keyboard, type in *1.*

(16) Depress the ENTER key.

(17) Repeat (1) through (16) above, entering 02 observer data.

(18) Depress matrix buttons H–5 (OBS RECALL).

(19) Depress the SM key.

(20) On the keyboard, type in *1.*

(21) Depress the ENTER key. The coordinates and altitude of 01 are displayed.

(22) Depress matrix buttons G–1 (OBS AZ).

(23) Depress the SM key.

(24) On the keyboard, type in the azimuth from 01 to the impact point, *6320.*

(25) Depress the ENTER key.

(26) Depress matrix buttons G–4 (OBS VERT ANGLE).

(27) Depress the SM key.

(28) On the keyboard, type in the meas-

ured vertical angle from 01 to the impact point, *-25*.

(29) Depress the ENTER key.

(30) Depress matrix buttons H-5 (OBS RECALL).

(31) Depress the SM key.

(32) On the keyboard, type in *2*.

(33) Depress the ENTER key. The coordinates and altitude of 02 are displayed.

(34) Depress matrix buttons G-1 (OBS AZ).

(35) Depress the SM key.

(36) On the keyboard, type in the azimuth from 02 to the impact point, *5578*.

(37) Depress the ENTER key.

(38) Depress matrix buttons G-5 (SURVEY).

(39) Depress the SM key.

(40) On the keyboard, type in *2* (the flag indicating an intersection type survey).

(41) Depress the ENTER key. The coordinates and altitude of the impact point are computed and displayed: *23379 30656 425*.

16. Deletion of Targets and Firing Points From the Lists

a. Situation Continued. The S3 decides to delete target number 1 and firing point number 2 from the lists, as they are no longer required.

b. Requirement. The operator is directed to delete target 1 from memory.

c. Solution. The operator performs the following actions to delete target number 1 from memory:

(1) Depress matrix buttons A-8 (TGT DELETE).

(2) Depress the SM key.

(3) On the keyboard, type in *1* (the number of the target to be deleted).

(4) Depress the ENTER key, the KEYBOARD indicator remains lit.

(5) On the keyboard, type in *0* (the flag indicating YES for the enabling procedure for this function).

(6) Depress the ENTER key.

d. Solution Continued. The operator performs the following actions to delete firing point number 2 from memory:

(1) Depress matrix buttons B-8 (FP DELETE).

(2) Depress the SM key.

(3) On the keyboard, type in *2* (the number of the firing point to be deleted).

(4) Depress the ENTER key. The KEYBOARD indicator remains lit.

(5) On the keyboard, type in *0* (the flag indicating YES for the enabling procedure for this function).

(6) Depress the ENTER key.

e. Discussion. Target number 1 and firing point number 2 have been deleted from memory.

17. Clearing Mission Data

a. Situation Continued. The S3 decides to clear mission A1 from memory. This location in memory may then be used to store data for a new mission.

b. Requirement. The operator is directed to clear mission A1 data from memory.

c. Solution. The operator performs the following actions:

(1) Depress mission association buttons A and 1.

(2) Depress matrix buttons C-8 (CLEAR DATA).

(3) Depress the SM key.

(4) On the keyboard, type in *0*.

d. Discussion. All data associated with mission A1 have been cleared from memory.

18. Summary of Input Data for Mission 1

Matrix function	Input data[1]	Remarks
A–1 (TGT EAST)	23400	Zero added to enter five digits.
A–2 (TGT NORTH)	30650	Zero added to enter five digits.
A–3 (TGT ALT)	429	
A–5 (TGT RECORD)	1	Target list number assigned.
B–1 (FP EAST)	27943	
B–2 (FP NORTH)	33917	
B–3 (FP ALT)	366	
B–4 (AZ OL)	2052	Must be entered prior to using function B–5 (FP RECORD).
B–5 (FP RECORD)	2	Firing point list number.
F–1 (TGT LIST ASSOC)	1	Target list number.
F–2 (FP LIST ASSOC)	2	Firing point list number.
F–3 (LCHR TYPE)	34	Flag for launcher.
F–4 (RKT TYPE)	51	Flag for MGR–1A rocket.
F–5 (WHD TYPE)	3	Flag for M8 practice warhead.
F–7 (HOB)	200	Value in meters.
E–1 (MOTOR EMPTY WT)	2010	Value in pounds.
E–2 (WHD WT)	1620	Value in pounds.
E–3 (PROP WT CORR)		Signed value in pounds.
E–7 (PROP TEMP)	+63 (+66)	Signed value.
E–8 (SURF PRESS)	966 (968)	Value in millibars.
G–7 (LAT)	+34	Signed value. The + sign indicates north latitude.
G–8 (GRID DECL)	+51	Signed value. The + sign indicates grid north is right of true north.
H–8 (MET INPUT)	261620 (036974)	Identification line of the met message entered.
C–2 (LLW RANGE)	–5	Signed value. The – sign indicates a tail wind.
C–3 (LLW CROSS)	LEFT 2	Signed value. LEFT IS (+) correction.
C–4 (WIND WT MULT)	1	Flag 1 indicating all other than nighttime conditions.
D–6 (CREST RANGE)	6000	
D–7 (CREST ALT)	520	
D–8 (CREST CLEAR)	1	Flag 1 indicating crest is occupied by friendly troops.

[1] A second entry is shown in parentheses.

Section III. MISSION NUMBER 2

19. Entry of Firing Points, Grid Declination Angle and Latitude

a. Situation. The Little John Battalion has just occupied a position area, survey has been completed, and traverse data have been computed by using FADAC. Nuclear weapons have not been used in this combat situation. The battalion is equipped with high-explosive warhead M146, MGR–3A rockets and the M34 launcher.

b. Given. The following data are available in the fire direction center:
Firing Point List

Firing point	Coordinates	Altitude	Azimuth of orienting line
1	25417 34300	306	1615
2	37943 32917	266	1052
3	31899 32696	260	322
4	33925 31098	259	1801

Grid Declination and Latitude
Grid declination +25
Latitude 40° north
Target List

Target number	Coordinates	Altitude
1	2290 4065	400
2	2853 4642	285
3	3466 4173	346
4	3906 4302	294
5	3014 3900	300
6	2670 4455	295
7	2882 4243	300
8	2910 4800	420
9	3005 5050	400
10	2640 4930	320

c. Requirement. The operator is directed to enter the firing point list.

d. Solution. The operator performs the following actions:

(1) Depress matrix buttons B–1 (FP EAST).

(2) Depress the SM key.

(3) On the keyboard, type in the firing point easting, *25417*.

(4) Depress the ENTER key.

(5) Depress matrix buttons B–2 (FP NORTH).

(6) Depress the SM key.

(7) On the keyboard, type in the firing point northing, *34300*.

(8) Depress the ENTER key.

(9) Depress matrix buttons B–3 (FP ALT).

(10) Depress the SM key.

(11) On the keyboard, type in the firing point altitude, *306*.

(12) Depress the ENTER key.

(13) Depress matrix buttons B–4 (AZ OL).

(14) Depress the SM key.

(15) On the keyboard, type in the azimuth of the orienting line, *1615*.

(16) Depress the ENTER key.

(17) Depress matrix buttons B–5 (FP RECORD).

(18) Depress the SM key.

(19) On the keyboard, type in *1*, the number of the firing point.

(20) Depress the ENTER key.

Note. The operator performs the procedures in (1) through (20) above, and enters the appropriate data for each of the four firing points on the list.

e. Requirement Continued. The operator is directed to enter the targets on the target list.

f. Solution. The operator performs the following actions:

(1) Depress matrix buttons A–1 (TGT EAST).

(2) Depress the SM key.

(3) On the keyboard, type in the target easting, *32900* (adding zeros to enter five digits).

(4) Depress the ENTER key.

(5) Depress matrix buttons A–2 (TGT NORTH).

(6) Depress the SM key.

(7) On the keyboard, type in the target northing, *40650* (adding zeros to enter five digits).

(8) Depress the ENTER key.

(9) Depress matrix buttons A–3 (TGT ALT).

(10) Depress the SM key.

(11) On the keyboard, type in the target altitude, *400*.

(12) Depress the ENTER key.

(13) Depress matrix buttons A–5 (TGT RECORD).

(14) Depress the SM key.

(15) On the keyboard, type in the target list number, *1*.

(16) Depress the ENTER key.

Note. The operator performs the procedures in (1) through (16) above, for each target on the target list.

g. Requirement Continued. The operator is directed to enter the grid declination angle and the latitude.

h. Solution Continued. The operator performs the following actions:

(1) Depress matrix buttons G–7 (LAT).

(2) Depress the SM key.

(3) On the keyboard, type in *+40* (the + sign indicates north latitude).

(4) Depress the ENTER key.

(5) Depress matrix buttons G–8 (GRID DECL ANGLE).

(6) Depress the SM key.

(7) On the keyboard, type in *+25* (the + sign indicates grid north is right of true north).

(8) Depress the ENTER key.

20. Entry of the Meteorological Message

a. Given. The following meteorological message has been received and the operator is directed to enter it in the computer:

Identification	Octant	Location	Date-time	Station height (10's m)	MDP pressure (% of std)
METCM	1	341981	300406	048	995

Line number	Wind direction (10's mils)	Wind speed (knots)	Temperature (1/10° K)	Density (gm/m³)
00	008	014	2488	1311
01	014	022	2484	1298
02	033	019	2468	1269
03	018	030	2470	1230
04	046	045	2413	1190
05	020	012	2399	1146
06	630	038	2356	1008
07	580	050	2322	0988
08	560	062	2309	0956
09	548	045	2296	0924
10	524	042	2286	0901
11	536	048	2236	0856
12	480	060	2202	0802
13	442	055	2166	0766
14	420	042	2138	0737
15	500	020	2111	0672
16	450	030	2048	0632
17	380	015	2028	0590
18	362	070	1988	0498
19	348	068	1964	0472
20	340	072	1922	0456

Note. See appendix C for instructions on preparing tape.

b. Requirement. The operator is directed to enter the meteorological message.

c. Solution. The operator performs the following actions to enter the met message mechanically:

(1) Depress matrix buttons H–8 (MET INPUT).

(2) Depress the SM key.

(3) On the keyboard, type in *0* (flag indicating manual entry).

(4) Depress the ENTER key. The number 88 is displayed.

(5) On the keyboard, type in the identification line starting with the date-time group: *300406 048995.*

(6) Depress the ENTER key, 00 is displayed.

(7) On the keyboard, type in the 00 line of the message: *00 008 014 2488 1311.*

(8) Depress the ENTER key, 01 is displayed.

(9) On the keyboard, type in the 01 line of the message: *01 014 022 2484 1298.*

(10) Depress the ENTER key, 02 is displayed.

Note. The data on each line are entered until the last line of the message has been entered. The operator terminates the mode by typing in a *9* on the keyboard and depressing the ENTER key.

d. Mechanical Tape Reader. The operator performs the following actions to enter the met message tape through the mechanical tape reader:

(1) Load the tape in the mechanical tape reader with the printed side up and with the wide side toward the computer.

(2) Turn the sprocket knob to insure that the tape is properly engaged on the sprocket.

(3) Depress matrix buttons H–8 (MET INPUT).

(4) Depress the SM key.

(5) On the keyboard, type in *2* (the flag indicating mechanical tape reader input).

(6) Depress the ENTER key. The tape reader will automatically start reading the tape. It will stop automatically at the end of the tape.

(7) Depress the ENTER key to terminate the mode.

21. Call for Fire

a. Situation Continued. The following call for fire has been received from higher headquarters:

BLUE LIGHT 18, THIS IS FIREPOWER 9,
FIRE MISSION,
FIRING POINT 4,
TARGET NS1220,
GRID NS 3370 4761,
ALTITUDE 326,
LITTLE JOHN MGR–3A ROCKET,
WARHEAD M146,
HEIGHT OF BURST OPTION HIGH AIR,
ONE ROCKET,
TIME ON TARGET 0900Z.

b. Requirement. The S3 notes that this target is *not* on the target list and directs the operator to enter it as target number 11.

c. Solution. The operator performs the following actions to enter the target on the list:

(1) Depress matrix buttons A–1 (TGT EAST).

(2) Depress the SM key.

(3) On the keyboard, type in the target easting: *33700* (adding a zero to enter five digits).

(4) Depress the ENTER key.

(5) Depress matrix buttons A–2 (TGT NORTH).

(6) Depress the SM key.

(7) On the keyboard, type in the target northing: *47610* (adding a zero to enter five digits).

(8) Depress the ENTER key.

(9) Depress matrix buttons A–3 (TGT ALT).

(10) Depress the SM key.

(11) On the keyboard, type in the target altitude, *326*.

(12) Depress the ENTER key.

(13) Depress matrix buttons A–5 (TGT RECORD).

(14) Depress the SM key.

(15) On the keyboard, type in the target number, *11*.

(16) Depress the ENTER key.

22. Computation of Firing Data for Mission 2

a. Situation Continued. The S3 issues a fire order based upon the information in the call for fire and his knowledge of the situation. He assigns mission association number A2 to this mission. The fire order is as follows:

MISSION A2,
LAUNCHER NUMBER 1,
FIRING POINT NUMBER 4,
TARGET NUMBER 11.

b. Requirement. The operator is directed to compute the initial laying data for inclusion in the warning order.

c. Solution. The operator performs the following actions:

(1) Depress mission association buttons *A* and *2*.

(2) Depress matrix buttons C–8 (CLEAR DATA).

(3) Depress the SM key.

(4) On the keyboard, type in *0*.

(5) Depress the ENTER key.

(6) Depress matrix buttons F–1 (TGT LIST ASSOC).

(7) Depress the SM key.

(8) On the keyboard, type in *11*.

(9) Depress the ENTER key. Wait for the coordinate display to appear: *33700 47610 326*.

(10) Depress matrix buttons F–2 (FP LIST ASSOC).

(11) Depress the SM key.

(12) On the keyboard, type in *4*.

(13) Depress the ENTER key. Wait for the coordinate display to appear: *33925 31098 259*.

Note. Firing point number 4 and target number 11 are mission associated, and all data pertinent to this mission must be entered with mission association buttons A and 2 depressed.

(14) Depress matrix buttons D–2 (AZ OF FIRE).

(15) Depress the SM key. The computer determines and displays the azimuth from firing point 4 to target 11: *6386*.

(16) Depress matrix buttons D–3 (ORIENT ANGLE).

(17) Depress the SM key. The computer determines and displays the orienting angle: 1814.88 (to the nearst .01 mil).

d. Warning Order. The following warning order is issued to the battery designated to fire:

LAUCHER NUMBER 1,
FIRING POINT NUMBER 4,
ROCKET MGR–3A,
WARHEAD M146,
ONE ROUND AT MY COMMAND,

HEIGHT OF BURST OPTION HIGH AIR,
TIME ON TARGET 0900Z,
AZIMUTH OF ORIENTING LINE 1801,
AZIMUTH OF FIRE 6386,
ORIENTING ANGLE 1815.

e. *Situation Continued.* The following data are received from the launcher platoon:

Motor empty weight	280 lb
Warhead weight	262 lb
Propellant weight correction	+1.8 lb
Propellant temperature	+62° F
Surface pressure	1010 mb.

f. Solution Continued. To compute the initial firing data and crest clearance data, the operator performs the following actions:

(1) Depress matrix buttons F–3 (LCHR TYPE).

(2) Depress the SM key.

(3) On the keyboard, type in *34* (flag indicating launcher type).

(4) Depress the ENTER key.

(5) Depress matrix buttons F–4 (RKT TYPE).

(6) Depress the SM key.

(7) On the keyboard, type in *51* (flag indicating the rocket type).

(8) Depress the ENTER key.

(9) Depress matrix buttons F–5 (WHD TYPE).

(10) Depress the SM key.

(11) On the keyboard, type in *4* (flag indicating the warhead type).

(12) Depress the ENTER key.

Note. Position F–6 and F–7 are not used with this warhead.

(13) Depress matrix buttons F–8 (OPTION).

(14) Depress the SM key.

(15) On the keyboard, type in *2* (flag indicating high airburst).

(16) Depress the ENTER key.

(17) Depress matrix buttons E–1 (MOTOR EMPTY WT).

(18) Depress the SM key.

(19) On the keyboard, type in *280*.

(20) Depress the ENTER key.

(21) Depress matrix buttons E–2 (WHD WT).

(22) Depress the SM key.

(23) On the keyboard, type in *262*.

(24) Depress the ENTER key.

(25) Depress matrix buttons E–3 (PROP WT CORR).

(26) Depress the SM key.

(27) On the keyboard, type in *+1.8*.

(28) Depress the ENTER key.

Note. Position E–4, E–5, and E–6 are not used with this rocket.

(29) Depress matrix buttons E–7 (PROP TEMP).

(30) Depress the SM key.

(31) On the keyboard, type in *+62*.

(32) Depress the ENTER key.

(33) Depress matrix buttons E–8 (SURF PRESS).

(34) Depress the SM key.

(35) On the keyboard, type in *1010*.

(36) Depress the ENTER key.

(37) When all the necessary data have been entered to compute the initial firing data, depress the COMPUTE button. When the compute mode ends, the following data will be displayed:
Deflection 2815,
Fuze setting 50.2,
Quadrant elevation 542.3.

Note. It is necessary to compute the firing data *before* the crest clearance can be computed.

23. Computation of Crest Clearance Data

a. Situation Continued. Inspecting a map along the direction of fire, the S3 notes that the rocket will pass over a crest occupied by friendly troops. The altitude of the crest is 1,600 meters. It is 3,000 meters from the firing point.

b. Requirement. The S3 directs the operator to compute crest clearance data.

c. Solution. The operator performs the following actions:

(1) Depress matrix buttons D–6 (CREST RANGE).

(2) Depress the SM key.

(3) On the keyboard, type in 3000.

(4) Depress the ENTER key.

(5) Depress matrix buttons D–7 (CREST ALT).

(6) Depress the SM key.

(7) On the keyboard, type in *1600*.

(8) Depress the ENTER key.

(9) Depress matrix buttons D–8 (CREST CLEAR).

(10) Depress the SM key.

(11) On the keyboard, type in *1* (the flag indicating a crest occupied by friendly troops).

(12) Depress the ENTER key. When the complete mode ends, the following display will appear: *03000 01600 2xx90.*

d. Situation Continued. This means there is only a *90* percent probability that the rocket will clear the crest. This probability, expressed as *2* probable errors, fails to meet the minimum assurance criteria of 6 PE's and 99 percent (FADAC does not indicate 100 percent).

24. Computation of Data After Changing Firing Points

a. Situation Continued. Since the crest cannot be cleared with the minimum assurance, it is necessary to change firing points. The firing platoon has not yet reached firing point 4 and may easily be diverted to another point. Firing point 3 is selected.

b. Requirement. The operator is directed to compute data for firing point 3 instead of firing point 4.

c. Solution. The operator performs the following actions:

(1) Insure that mission association buttons A and 2 are depressed.

(2) Depress matrix buttons F–2 (FP LIST ASSOC).

(3) Depress the SM key.

(4) On the keyboard, type in *3*.

(5) Depress the ENTER key, wait for the coordinates and altitude to be displayed; *31899 32696 260.*

(6) Depress matrix buttons D–1 (CHART RANGE).

(7) Depress the SM key and the following range is displayed: *15022.*

(8) Depress matrix buttons D–2 (AC OF FIRE).

(9) Depress the SM key and the following azimuth is displayed: *122.*

(10) Depress matrix buttons D–3 (ORIENT ANGLE).

(11) Depress the SM key and the following orienting angle is displayed: *199.59* (to the nearest 0.01 mil).

d. Situation Continued. The following message is sent to the firing platoon:

LAUNCHER NUMBER *1*,
FIRING POINT NUMBER *3*,
AZIMUTH OF ORIENTING LINE *322*,
AZIMUTH OF FIRE *122*,
ORIENTING ANGLE *200*.

e. Situation Continued. The S3 reexamines the map and notes a crest along the new azimuth of fire. The range to this crest is 12,000 meters, and its altitude is 580 meters. The crest is in enemy territory.

f. Requirement. The S3 directs the operator to compute the crest clearance data.

g. Solution. The operator performs the following actions to compute the crest clearance:

(1) Depress the COMPUTE button. At the termination of the compute mode the following data are displayed: (Ballistic solution must be computed before the crest clearance is computed.)

Deflection 2801,
Fuze setting 40.8,
Quadrant elevation 433.6.

(2) Depress matrix buttons D–6 (CREST RANGE).

(3) Depress the SM key.

(4) On the keyboard, type in *12000*.

(5) Depress the ENTER key.

(6) Depress matrix buttons D–7 (CREST ALT).

(7) Depress the SM key.

(8) On the keyboard, type in *580*.

(9) Depress the ENTER key.

(10) Depress matrix buttons D–8 (CREST CLEAR).

(11) Depress the SM key.

(12) On the keyboard type in *2*, (the flag indicating that the crest is in enemy territory (table 1)).

(13) Depress the ENTER key and the following display appears: *12000 00580 6xx99*. Therefore, 6 (PE's), 99 (percent).

25. Updating Mission Using the Latest Meterological Message

a. Given. The following meteorological message has been received in the fire direction center.

Identification	*Octant*	*Location*	*Date-time*	*Station height (10's m)*	*MDP pressure (% of std)*
METCM	1	341981	300810	048	992

Line number	*Wind direction (10's mils)*	*Wind speed (knots)*	*Temperature (1/10° K)*	*Density (gm's/m³)*
00	010	011	2504	1292
01	638	005	2490	1269
02	620	020	2466	1258
03	618	024	2432	1221
04	590	030	2387	1202
05	584	011	2366	1169
06	600	028	2343	1144
07	610	050	2308	1088
08	560	062	2274	1023
09	524	040	2238	0999
10	502	024	2200	0986
11	486	010	2179	0976
12	460	030	2106	0966
13	380	048	2066	0892
14	365	060	1998	0836
15	320	040	1936	0749
16	396	020	1912	0688
17	429	036	1855	0624
18	440	058	1814	0589
19	439	047	1799	0578
20	486	060	1722	0542

Note. See appendix C for instructions on preparing tape.

b. Requirement. The operator is directed to update mission A2 and to enter the meteorological message.

c. Solution. The operator performs the following actions to enter the met message manually:

(1) Depress matrix buttons H–8 (MET INPUT).

(2) Depress the SM key.

(3) On the keyboard type in *0*.

(4) Depress the ENTER key. The number 88 is displayed.

(5) On the keyboard, type in the identification line of the message starting with the date-time group L *300406 048995*.

(6) Depress the ENTER key, 00 is displayed.

(7) On the keyboard, type in the 00 line of the message: *00 008 014 2488 1311*.

(8) Depress the ENTER key, 01 is displayed.

(9) On the keyboard, type in the 01 line of the message: *01 014 022 2484 1298*.

(10) Depress the ENTER key, 02 is displayed.

(11) The data on each line are entered by (8) and (9) above until the last line has been entered. Then the input mode is terminated by typing 9 on the keyboard and depressing the ENTER key.

d. Mechanical Tape Reader. The operator performs the following actions to enter the met message tape through the mechanical tape reader:

(1) Load the message tape in the mechanical reader with the printed side up and the wide side toward the computer.

(2) Turn the sprocket knob to insure that the tape is properly engaged on the sprocket.

(3) Depress matrix buttons H–8 (MET INPUT).

(4) Depress the SM key.

(5) On the keyboard, type in *2*.

(6) Depress the ENTER key. The tape reader will automatically start and will stop at the end of the tape.

(7) Depress the ENTER key to terminate the mode.

Note. Crest clearance data may be recomputed to insure that the weather effects have not degraded clearance probability by the steps outlined in paragraph 24*g*.

26. Computation of Final Data

a. Situation Continued. The firing platoon has arrived at the firing point and the launcher has been positioned and laid for direction. The following report is received at the fire direction center:

Barometer is in operation.
Propellant temperature is *+62*.
Referred deflection is *2664*.

b. Requirement. The S3 directs that the identification line of the meteorological message be used to determine the pressure data and that the operator convert the percentage figure to pressure in millibars and correct for the difference in altitude between the firing point and the mean datum plane.

c. Solution. The operator determines the following pressure data (FM 6–40–3):

Altitude of the MDP ________________ 480
Altitude of the FP ________________ 359

$\frac{359 - 480}{100} \times -1.2 = -1.2 \times -1.2 = +1.4$ percent.

Met message pressure	= 99.2	
Corrections factor	+ 1.4	
Corrected pressure	= 100.6	Converted to mb* = 1,019 mb.

*Use table C, FTR 318.

d. Solution Continued. The operator performs the following actions to enter the latest pressure and propellant temperature:

(1) Depress matrix buttons E–8 (SURF PRESS).

(2) Depress the SM key.

(3) On the keyboard, type in *0*.

(4) Depress the ENTER key.

(5) Since the propellant temperature has not changed, a new entry is not required. The operator can check the temperature by depressing matrix buttons E–7 (PROP TEMP) and then depressing the recall key; +62 is displayed.

(6) Depress the COMPUTE button, and at the termination of the compute mode, the following data will be displayed:

Deflection 2810,
Fuze setting 41.2,
Quadrant elevation 439.0.

e. Situation Continued. The following fire commands are transmitted to the firing point:

DEFLECTION *2674* (*2664* + (*+10*))
FUZE SETTING *41.2*
QUADRANT ELEVATION *439.0*

Note. The difference between the displayed deflection and 2,800 mils is added algebraically to the referred deflection to obtain the deflection sent to the firing point; e.g., 2810 − 2800 = +10; then the +10 to the referred deflection 2664 + (+10) = 2674.

f. Situation Continued: Two minutes before firing time the platoon reports low-level wind data measured with the wind measuring set. Conditions are all other than nighttime.

Range wind component ________ Head +11 mph.
Cross wind component ________ 0 mph

g. Solution Continued. The operator performs the following actions to compute the final data.

(1) Depress matrix buttons C–2 (LLW RANGE).

(2) Depress the SM key.

(3) On the keyboard, type in *+11*.

(4) Depress the ENTER key.

(5) Depress matrix buttons C–3 (LLW CROSS).

(6) Depress the SM key.

(7) On the keyboard, type in + or −0.

Note. The zero must be preceded by a sign.

(8) Depress the ENTER key.

(9) Depress matrix buttons C–4 (WIND WT MULT).

(10) Depress the SM key.

(11) On the keyboard, type in *1*, the flag indicating all other than nighttime conditions.

(12) Depress the ENTER key.

(13) Depress matrix buttons C–5 (FINAL LLW CORR).

(14) Depress the SM key. Computation terminates with the following display: *0 0.0 +6.9*. This means that the deflection correction is 0, and the quadrant elevation correction is +6.9 mils.

(15) Depress matrix buttons C–6 (FINAL DATA).

(16) Depress the SM key. The final data are computed and displayed:

Deflection 2810,

Fuze time 41.2 (not sent to the FP),

Quadrant elevation 446.6.

h. Situation Continued. The following commands are sent to the firing point:

Deflection 2674 (2664 + (+10)),

Quadrant elevation 446.6.

27. Printout Mission, Firing Point List, and Target List

a. Requirement. The S3 directs that a hard copy record be made of all missions and the current firing point and target lists.

b. Solution. The operator performs the actions described in paragraphs 13 and 14.

28. Summary of Input Data for Mission 2

Matrix function	*Input data* [1]	*Remarks*
A–1 (TGT EAST)	33700	Zero added to enter five digits.
A–2 (TGT NORTH)	47610	Zero added to enter five digits.
A–3 (TGT ALT)	326	
A–5 (TGT RECORD)	11	Target list number assigned.
B–1 (FP EAST)	33925 (31899)	
B–2 (FP NORTH)	31098 (32696)	
B–3 (FP ALT)	259 (260)	
B–4 (AZ OL)	1801 (322)	
B–5 (FP RECORD)	4 (3)	
F–1 (TGT LIST ASSOC)	11	Target list number.
F–2 (FP LIST ASSOC)	4 (3)	Firing point list number.
F–3 (LCHR TYPE)	34	Flag for M34 launcher.
F–4 (RKT TYPE)	51	Flag for MGR–3A rocket.
F–5 (WHD TYPE)	4	Flag for M146 warhead.
F–6 (YIELD)	NA	Not used with M146 warhead.
F–7 (HOB)	NA	Not used with M146 warhead.
F–8 (OPTION)	2	Flag for a high airburst.
E–1 (MOTOR EMPTY WT)	280	Value in pounds.
E–2 (WHD WT)	262	Value in pounds.
E–3 (PROP WT CORR)	+1.8	Signed value in pounds.
E–7 (PROP TEMP)	+62	Signed value in degrees Fahrenheit.
E–8 (SURF PRESS)	1010 (0)	Value in millibars.
G–7 (LAT)	+40	Signed value. The + sign indicate north latitude.
G–8 (GRID DECL ANGLE)	+25	Signed value. The + sign indicates that grid north is right of true north.
H–8 (MET INPUT)	300406 048995 (300810) 048996)	Identification line of the met message entered.
C–2 (LLW RANGE)	+11	Signed value. The + sign indicates a head wind correction.
C–3 (LLW CROSS)	+ or – 0	Signed value. A zero must be entered and must be preceded by a + or – sign.
C–4 (WIND WT MULT)	1	Flag indicating all other than nighttime conditions.
D–6 (CREST RANGE)	3000 (12000)	
D–7 (CREST ALT)	1600 (580)	
D–8 (CREST CLEAR)	1 (2)	Flag 1 indicates that the crest is occupied by friendly troops; flag 2, by enemy troops.

[1] A second entry is shown in parentheses.

29. Entry of Firing Points, Grid Declination Angle, and Latitude

a. Situation. Your Little John battalion fire direction center has occupied position, established communications, and the M18 computer has been set up. Program tests 1 and 2 have been run successfully.

b. Given.

(1) The following target list and firing point list have been entered into memory.

Target list

Number	*Coordinates*	*Altitude*
1	2290 4065	400
2	2853 4642	285
3	3466 4173	346
4	3906 4302	294
5	3014 3900	300
6	2670 4455	295
7	2882 4243	300
8	2910 4800	420
9	3005 5050	400
10	2640 4930	320

Firing point list

Number	*Coordinates*	*Altitude*	*Azimuth of orienting line*
1	25417 34300	306	1615
2	27943 32917	266	1052
3	31899 32696	260	322
4	33925 31098	259	1801

Note. The targets and firing points are identical to those used in mission 2 and need not be reentered.

(2) The latitude of the battalion is 40° north, and the grid declination angle is 25 mils.

c. Requirement. The operator is directed to enter the grid declination angle and the latitude.

d. Solution. The operator performs the following actions:

(1) Depress matrix buttons G–7 (LAT).

(2) Depress the SM key.

(3) On the keyboard, type in *+40*.

(4) Depress the ENTER key.

(5) Depress matrix buttons G–8 (GRID DECL ANGLE).

(6) Depress the SM key.

(7) On the keyboard, type in *+25*.

(8) Depress the ENTER key.

e. Situation Continued. The Little John battalion is located in a training area and has been authorized to fire the M8 flash-smoke warhead. The following call for fire has been received:

FIREBALL 18, THIS IS THUNDERBIRD 9,
FIRE MISSION,
FIRING POINT 1,
TARGET NUMBER 10,
GRID NK264493,
ALTITUDE 320,
LITTLE JOHN MGR–3A ROCKET,
FLASH-SMOKE WARHEAD M8,
HEIGHT OF BURST 200 METERS,
ONE ROUND, TIME ON TARGET 1200Z.

30. Computation of Firing Data for Mission 3

a. Situation Continued. The S3 notes that the target is on the target list and has been entered into memory as target number 10. Based upon his knowledge of the situation and the information in the call for fire, he issues the following fire order:

MISSION B2
ALFA, BATTERY
LAUNCHER NUMBER 2,
FIRING POINT NUMBER 1,
TARGET NUMBER 10.

b. Requirement. The operator is directed to compute the initial laying data for the warning order.

c. Solution. The operator performs the following actions:

(1) Depress mission association buttons *B and 2.*

(2) Depress matrix buttons C–8 (CLEAR DATA).

(3) Depress the SM key.

(4) On the keyboard, type in *0.*

(5) Depress the ENTER key.

(6) Depress matrix buttons F–1 (TGT LIST ASSOC).

(7) Depress the SM key.

(8) On the keyboard, type in *10.*

(9) Depress the ENTER key. Wait for the following display to appear: *26400 49300 320.*

(10) Depress matrix buttons F–2 (FP LIST ASSOC).

(11) Depress the SM key.

(12) On the keyboard, type in *1.*

(13) Depress the ENTER key. Wait for the following display to appear: *25417 34300 306.*

Note. Firing point number 1 and target number 10 are now mission associated.

(14) Depress matrix buttons D–2 (AZ OF FIRE).

(15) Depress the SM key. The azimuth from firing point number 1 to target number 10 is computed and displayed: *67.*

(16) Depress matrix buttons D–3 (ORIENT ANGLE).

(17) Depress the SM key. The orienting angle is computed and displayed: *1548.34.*

Note. Range may also be computed by using function D–1 (CHART RANGE). If so, the range displayed is *15032.*

d. Situation Continued.

(1) The following warning order is issued to Battery A:

LAUNCHER NUMBER 2,
FIRING POINT NUMBER 1,
ROCKET MGR–3A,
WARHEAD FLASH-SMOKE M8,
ONE ROUND AT MY COMMAND,
TIME ON TARGET *1200Z,*
AZIMUTH OF ORIENTING LINE *1615,*
AZIMUTH OF FIRE *67,*
ORIENTING ANGLE *1548.*

(2) The battalion has not received a meteorological message in the past 24 hours. The S3 decides to compute data using the standard met.

e. Requirement. The S3 directs the operator to use the standard met.

f. Solution. The operator performs the following actions:

(1) Depress matrix buttons H–7 (MET STD).

(2) Depress the SM key.

(3) On the keyboard, type in *0.*

(4) Depress the ENTER key.

g. Situation Continued. The following information is received from the launcher platoon designated to fire the mission:

Motor empty weight	+1.5 lb
Warhead weight	275 lb
Propellant weight correction	265 lb
Propellant temperature	+60° F
Surface pressure:	990 mb.

h. Requirement. The operator is directed to compute initial firing data.

i. Solution. The operator performs the following actions:

(1) Insure that mission association buttons B and 2 are depressed.

(2) Depress matrix buttons F–3 (LCHR TYPE).

(3) Depress the SM key.

(4) On the keyboard, type in *34.*

(5) Depress the ENTER key.

(6) Depress matrix buttons F–4 (RKT TYPE).

(7) Depress the SM key.

(8) On the keyboard, type in *51.*

(9) Depress the ENTER key.

(10) Depress matrix buttons F–5 (WHD TYPE).

(11) Depress the SM key.

(12) On the keyboard type in *3* (flag indicating the M8 flash-smoke warhead).

(13) Depress the ENTER key.

Note. Position F–6 is not used with this warhead.

(14) Depress matrix buttons F–7 (HOB).

(15) Depress the SM key.

(16) On the keyboard, type in *200*.

(17) Depress the ENTER key.

Note. Position F–8 is not used with this warhead.

(18) Depress matrix buttons E–1 (MOTOR EMPTY WEIGHT).

(19) Depress the SM key.

(20) On the keyboard, type in *275*.

(21) Depress the ENTER key.

(22) Depress matrix buttons E–2 (WHD WT).

(23) Depress the SM key.

(24) On the keyboard, type in *265*.

(25) Depress the ENTER key.

(26) Depress matrix buttons E–3 (PROP WT CORR).

(27) Depress the SM key.

(28) On the keyboard, type in *+1.5*.

(29) Depress the ENTER key.

Note. Position E–4, E–5, and E–6 are not used with this rocket.

(30) Depress matrix buttons E–7 (PROP TEMP).

(31) Depress the SM key.

(32) On the keyboard, type in *+60*.

(33) Depress the ENTER key.

(34) Depress matrix buttons E–8 (SURF PRESS).

(35) Depress the SM key.

(36) On the keyboard, type in *990*.

(37) Depress the ENTER key.

(38) All the necessary data have now been entered to compute the initial firing data, using standard met data. The operator depresses the COMPUTE button and the following firing data are computed and displayed:

Deflection 2801,
Fuze setting 28.8,
Quadrant elevation 383.0.

j. Discussion. The initial data must be computed before the crest clearance data are computed.

31. Computation of Crest Clearance

a. Situation Continued. The firing platoon has arrived at the firing point and is preparing to fire. While examining a map, the S3 notes that the trajectory will pass over a crest occupied by friendly troops, which must be cleared by 6 PE's, with 99 percent assurance.

b. Given.

Range to crest is 3,000 meters
Altitude of the crest is 520 meters.

c. Requirement. The operator is directed to compute the crest clearance data.

d. Solution. The operator performs the following actions:

(1) Depress matrix buttons D–6 (CREST RANGE).

(2) Depress the SM key.

(3) On the keyboard, type in *3000*.

(4) Depress the ENTER key.

(5) Depress matrix buttons D–7 (CREST ALT).

(6) Depress the SM key.

(7) On the keyboard, type in *520*.

(8) Depress the ENTER key.

(9) Depress matrix buttons D–8 (CREST CLEAR).

(10) Depress the SM key.

(11) On the keyboard, type in *1* (flag indicating that the crest is occupied by friendly troops).

(12) Depress the ENTER key and the following data are displayed: 03000 520

6 99. Therefore, 6 (PE's) 99 (percent).

e. Discussion. This probability meets the minimum criteria for clearing the crest.

32. Updating Mission with the Latest Meteorological Message

a. Situation Continued. The fire direction center has received a new met message.

b. Given. The meteorological message is as follows:

Identification	*Octant*	*Location*	*Date-time*	*Station height (10's/m)*	*MDP pressure (% of std)*
METCM	1	341981	311014	036	988

Line number	*Wind direction (10's mils)*	*Wind speed (knots)*	*Temperature (1/10° K)*	*Density (gm's/m³)*
00	480	015	2568	1302
01	460	020	2526	1288
02	500	022	2513	1273
03	510	018	2520	1262
04	520	032	2501	1244
05	620	040	2497	1232
06	580	028	2489	1212
07	020	038	2477	1200
08	060	045	2465	1189
09	001	040	2444	1178
10	030	055	2437	1134
11	042	060	2405	1073
12	038	026	2369	1040
13	022	039	2320	1001
14	034	020	2294	0962
15	043	040	2224	0958
16	123	050	2202	0932
17	128	042	2188	0865
18	253	070	2156	0834
19	385	054	2089	0719
20	320	038	2077	0699

c. Requirement. The S3 directs that the mission be updated, using this met message.

d. Solution. The operator first performs the following actions to dismiss the standard met.

(1) Depress matrix buttons H–7 (MET STD).

(2) Depress the SM key.

(3) On the keyboard, type in *9*.

(4) Depress the ENTER key.

e. Solution Continued. The operator performs the following actions to enter the meteorological message manually:

(1) Depress matrix buttons H–8 (MET INPUT).

(2) Depress the SM key.

(3) On the keyboard, type in *0*.

(4) Depress the ENTER key, 88 is displayed.

(5) On the keyboard, type in the identification line starting with the date-time group: *311014 036988*.

(6) Depress the ENTER key, 00 is displayed.

(7) On the keyboard, type in the 00 line of the message: *00480015 25681302*.

(8) Depress the ENTER key, 01 is displayed.

(9) On the keyboard, type in the 01 line of the message: *01460020 25261288*.

(10) Depress the ENTER key, 02 is displayed:

(11) Continue to enter each line and terminate the input mode after the last line has been entered by typing a *9* and depressing the ENTER key.

f. Mechanical Tape Reader: The operator performs the following actions to enter the met message tape through the mechanical tape reader:

(1) Load the tape in the mechanical tape reader with the wide side toward the computer and with the printed side up.

(2) Turn the sprocket knob to insure that the tape is properly engaged on the sprocket.

(3) Depress matrix buttons H–8 (MET INPUT).

(4) Depress the SM key. Keyboard light lights.

(5) On the keyboard type in *2*.

(6) Depress the ENTER key. The tape reader will automatically start and will stop at the end of the tape. Terminate the input mode by depressing the ENTER key.

g. Solution Continued. The operator performs the following actions to compute data, using the latest met message:

(1) Depress the COMPUTE button. The following solution is displayed:
    Deflection 2811,
    Fuze time 45.2,
    Quadrant elevation 463.5.

(2) Recompute the crest clearance data by the procedure in paragraph 31 to insure that the minimum probability has not changed as a result of considering the weather.

33. Computation of Final Data

a. Situation Continued. The firing platoon reports the following data from the firing point:

Propellant temperature	+58° F
Surface pressure	1,000 mb
Referred deflection	2,884 mils

b. Requirement. The operator is directed to enter the latest propellant temperature and surface pressure:

c. Solution. The operator performs the following actions:

(1) Depress matrix buttons E–7 (PROP TEMP).

(2) Depress the SM key.

(3) On the keyboard, type in *+58*.

(4) Depress the ENTER key.

(5) Depress matrix buttons E–8 (SURF PRESS).

(6) Depress the SM key.

(7) On the keyboard, type in *1000*.

(8) Depress the ENTER key.

(9) Depress the COMPUTE button and the following firing data will be computed and displayed:
    Deflection 2811,
    Fuze setting 45.3,
    Quadrant elevation 464.9.

d. Situation Continued.

(1) The following fire commands are transmitted to the platoon:
    Deflection 2895 (2884 + (+11)),
    Fuze time 45.3,
    Quadrant elevation 464.9.

Note. The difference between the displayed deflection and 2,800 mils is added algebraically to the referred deflection to obtain the firing deflection.

(2) Low-level wind components have been determined by the fire direction center, using the 00 line of the met message, as follows:

Wind direction	4800
Wind speed	15 knots.

Knots are converted to miles per hour, $15 \times 1.1508 = 17$ mph.

(3) Azimuth of the wind 4800
    Azimuth of fire −56
    Chart direction 4744

(4) Correction factors for chart direction: T 0.10 and R 0.99 (from firing tables).
    Tail 2 mph (17 x T 0.1).
    Right 17 mph (17 x R 0.99).

e. Solution Continued. The operator performs the following actions to enter the low-level wind components and compute the corrections and final data.

(1) Depress matrix buttons C–2 (LLW RANGE).

(2) Depress the SM key.

(3) On the keyboard, type in *−2*.

(4) Depress the ENTER key.

(5) Depress matrix buttons C–3 (LLW CROSS).

(6) Depress the SM key.

(7) On the keyboard, type in *RIGHT 17*.

(8) Depress the ENTER key.

(9) Depress matrix buttons C–4 (WIND WT MULT).

(10) Depress the SM key.

(11) On the keyboard, type in *3* (the flag indicating use of the 00 line of the met message).

(12) Depress the ENTER key.

(13) Depress matrix buttons C–5 (FINAL LLW CORR).

(14) Depress the SM key. The computer will compute and display and low-level wind corrections as follows: *−23 0.0 9 01.0*.

(15) Depress matrix buttons C–6 (FINAL DATA).

(16) Depress the SM key. The corrections

will be applied to the firing data, and the following solution will be displayed:

Deflection 2788,
Fuze setting 45.3 (not sent to the firing point),
Quadrant elevation 463.9.

f. Situation Continued. The following fire commands are sent to the platoon:

DEFLECTION 2872 (2884 + (−12)),
QUADRANT ELEVATION 463.9.

Note. The difference between the displayed deflection and 2,800 mils is added algebraically to the referred deflection to obtain the firing deflection.

34. Printout Mission, Firing Point List, and Target List

a. Requirement. The S3 directs that a hard copy record be made of this mission and of the firing points and targets.

b. Solution. The operator performs the procedures outlined in paragraphs 13 and 14 of this appendix.

35. Summary of Input Data for Mission 3

Matrix function	*Input data* [1]	*Remarks*
A–1 (TGT EAST)	26400	Zero added to enter five digits.
A–2 (TGT NORTH)	49300	Zero added to enter five digits.
A–3 (TGT ALT)	320	
A–5 (TGT RECORD)	10	Target list number assigned.
B–1 (FP EAST)	25417	
B–2 (FP NORTH)	34300	
B–3 (FP ALT)	306	
B–4 (AZ OL)	1615	Must be entered before using B–5 (FP RECORD).
B–5 (FP RECORD)	1	Firing point list number.
F–1 (TGT LIST ASSOC)	10	Target list number.
F–2 (FP LIST ASSOC)	1	Firing point list number.
F–3 (LCHR TYPE)	34	Flag for M34 launcher.
F–4 (RKT TYPE)	51	Flag for MGR–3A rocket.
F–5 (WHD TYPE)	3	Flag for M8 warhead. See flag card.
F–7 (HOB)	200	Value in meters.
E–1 (MOTOR EMPTY WT)	275	Known value.
E–2 (WHD WT)	265	Known value.
E–3 (PROP WT CORR)	+1.5	Signed value.
E–7 (PROP TEMP)	+60 (+58)	Signed value.
E–8 (SURF PRESS)	990 (1000)	
D–6 (CREST RANGE)	3000	
D–7 (CREST ALT)	520	
D–8 (CREST CLEAR)	1	Flag indicating that the crest is occupied by friendly troops.
C–7 (LAT)	+40	Signed value.
C–8 (GRID DECL ANGLE)	+25	Signed value.
H–7 (MET STD)	0 (9)	The 9 is the second entry which is used to dismiss the standard met.
H–8 (MET INPUT)	311014 036998	Identification line of the met message entered.
C–2 (LLW RANGE)	−2	Signed value. The − sign indicates a tail wind correction.
C–3 (LLW CROSS)	+17	Signed value. The + sign indicates wind correction.
C–4 (WIND WT MULT)	3	Flag indicating 00 line of met message used.

[1] A second entry is shown in parentheses.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
KENNETH G. WICKHAM,
Major General, United States Army,
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USMA (1)
Svc Colleges (2)
Br Svc Sch (2) except
USATC (2) except USATC FA (5)
Units org under fol TOE:
6–175 (10)
6–525 (10)
6–565 (10)
6–567 (5)

NG: None.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

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