Research Product 90-13

Trainer's Guide: Personal Computer (PC) Version of the Basic Rifle Marksmanship Program for the Multipurpose Arcade Combat Simulator (MACS)

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Fort Benning Field Unit
Training Research Laboratory

U.S. Army Research Institute for the Behavioral and Social Sciences

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Technical Director

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COL, IN
Commanding

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The Multipurpose Arcade Combat Simulator (MACS) system is a low-cost, part-task weapons trainer that has been validated as a teaching device with entry-level soldiers. The system may be used for preparatory, basic, sustainment, and remedial training.

The PC Version of MACS requires the following equipment and components: M16 rifle with a light pen attached to the barrel; IBM-AT-compatible computer, keyboard, and high resolution color monitor; PXL-380 high resolution light pen board; EGA color graphics board; and the PC Version of the MACS Basic Rifle Marksmanship (BRM) program.

MACS allows soldiers to practice BRM skills by firing at targets at scaled ranges displayed on the computer screen. Diagnostic feedback is provided on the screen. The PC Version of the BRM program is comparable to the Commodore version of the BRM program. Both are intended to provide part-task training in BRM. (Continued)

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Rifles

19. ABSTRACT (Continued)

The Trainer's Guide for the PC Version of BRM is intended to accompany each MACS PC Version assembly kit. The guide provides instructions for assembly of the MACS system, using the menu, aligning the light pen, and an extensive description of the BRM program.

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Trainer's Guide: Personal Computer (PC) Version of the Basic Rifle Marksmanship Program for the Multipurpose Arcade Combat Simulator (MACS)

Jamie W. Purvis and Ellen W. Wiley
Litton Computer Services

The Personal Computer (PC) Version of the Multipurpose Arcade Combat Simulator (MACS) system was developed to explore the utility of using existing IBM-AT-compatible computers in the field as weapons training devices. Because it requires only the addition of a light pen board and M16 rifle with a light pen attached to the barrel, the PC Version of the MACS system is substantially lower in cost than other available training devices, although equally effective.

The Trainer's Guide for the PC Version of Basic Rifle Marksmanship (BRM) is intended to accompany each MACS PC Version assembly kit. The guide provides instructions for assembling the MACS system, using the menu, and aligning the light pen, and includes an extensive description of the BRM program.

Patented in 1986, MACS is a product of the U.S. Army Research Institute's Fort Benning Field Unit, which conducts research on training and training technology with emphasis on individual and small team skills in the Infantry arena. The research task that supports this mission is titled "Developing Training for Individual and Crew-served Weapons" and is organized under the "Training for Combat Effectiveness" program area. Sponsors for the MACS research program were the U.S. Army Infantry School under a Memorandum of Understanding (9 December 1987) and the U.S. Army Training Support Center under a Training Device Need Statement for MACS approved in 1984. The MACS system hardware and the BRM software described in this report are being distributed by the Training Support Center at Fort Benning, Georgia. A copy of the PC Version of the MACS Trainer's Guide accompanies each system.
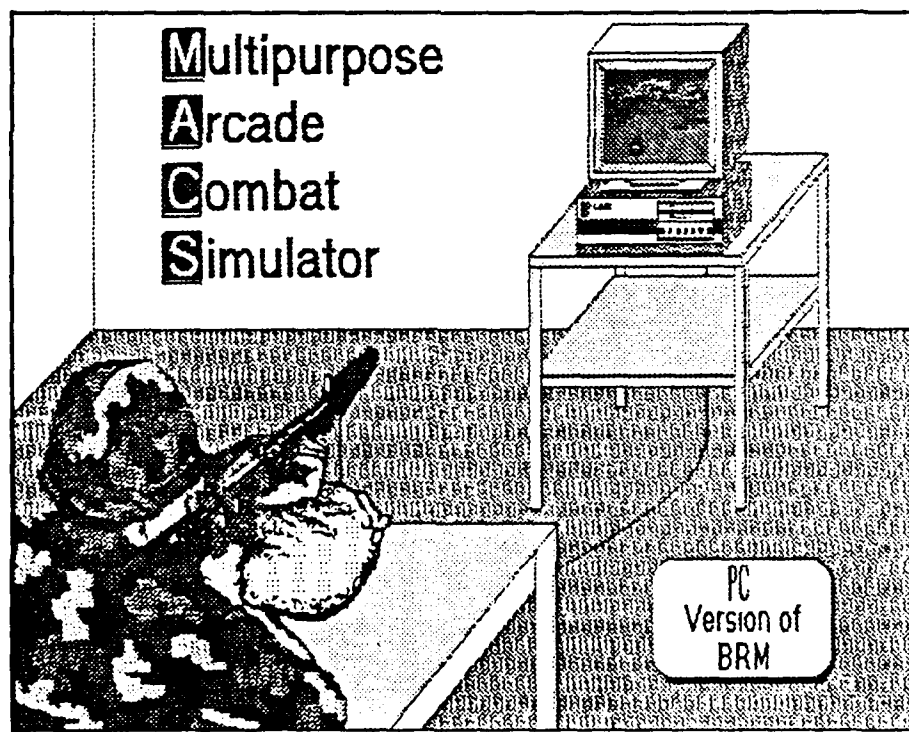
EDGAR M. JOHNSON
Technical Director

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TRAINER'S GUIDE

PC VERSION OF THE BASIC RIFLE MARKSMANSHIP PROGRAM FOR THE MULTIPURPOSE ARCADE COMBAT SIMULATOR
(MACS)

Multipurpose
Arcade
Combat
Simulator

PC
Version of
BRM

1/26/90

OVERVIEW OF THE MACS PC VERSION OF BRM

OVERVIEW OF THE MACS PC VERSION OF BRM

The Multipurpose Arcade Combat Simulator (MACS) system is a low-cost, part-task weapons trainer that has been validated as a teaching device with entry level soldiers. The system may be used for preparatory, basic, sustainment, and remedial training. MACS allows soldiers to practice Basic Rifle Marksmanship (BRM) skills by firing at targets at scaled ranges displayed on the computer screen. Diagnostic feedback is provided on the screen.

Software has been developed for both the Commodore 64 computer (BRM cartridge), and IBM-AT compatible computers (PC Version of BRM). The PC Version is described in this Trainer's Guide.

The PC Version of MACS requires the following equipment and components:

- **M16 rifle with a light pen attached to the barrel**
- **IBM-AT compatible computer, keyboard, and high resolution color monitor**
- **PXL-380 high resolution light pen board**
- **Enhanced graphics adapter (EGA) color graphics board, and**
- **MACS PC Version of the BRM program**

The PC Version of the BRM program is comparable to the Commodore version of the BRM program. Both are intended to provide part-task training in BRM. An initial skill test is followed by a main program which has nine increasingly more difficult levels of training. Stationary targets at ranges between 50 and 300 meters are presented at varying time intervals depending on the level being practiced. Specific performance standards are set for each level and are incorporated into the program. Upon completion of a level, the shooter's performance is evaluated against these standards.

Depending on performance, the shooter may:

- **Advance to the next level**
- **Stay at the same level, or**
- **Be sent back one level**

The MACS BRM program is specifically designed to help the average and below average shooter and does this in two ways:

- First, it provides the shooter with more feedback than can be obtained from live fire on a range.

- Second, because the rifle has no flash, recoil, or cartridge ejection system, it allows the shooter to develop the psycho-motor skills needed to achieve steady position, correct aiming, breath control, and proper trigger control, without having to overcome the instinct to flinch or blink when firing.

The PC Version of the BRM program provides additional flexibility, allowing the instructor to go directly to any level using the MACS Menu. The MACS Menu can be accessed from the BRM program using the escape (ESC) key, except while the shooter is establishing a shot group.

- F1, Select Start/Final Level, allows the instructor to limit the shooter to selected levels.

- New Firer, F2, allows new shooters to establish a shot group without exiting the program.

- The "Call Your Shot" option (F3) allows shooters five seconds to call their bullet strike before a cross hair showing actual shot location appears on the target.

- The light pen may occasionally need to be aligned with the replica rifle. Two indications that the light pen may need to be aligned are the appearance of a purple border around a target screen when the trigger is pulled and difficulty in obtaining an adequate shot group by experienced shooters. Entering F4 starts the light pen alignment program. Section 7 contains a detailed description of the light pen alignment procedures.

· A program designed to teach the fundamentals of aiming the M16A1 and to identify 4 cm shot groups can be accessed from the MACS menu by entering F5.

· F6 (EZ) sets all targets in level 1 to 250 meters, providing the shooter additional practice at the range used to zero the M16A1 rifle in live fire.

· Wind of different speeds and directions may be introduced directly into any of the nine levels using F7.

· F8 allows the user to exit the MACS program and return to the disk operating system (DOS).

The MACS system software is largely self-explanatory, but assumes the presence of an instructor. On-screen diagnostic feedback is provided to the shooter, which helps the instructor in identifying problems and recommending corrective action.

At the first four levels, shot-by-shot feedback is provided:

- **· Steady position**
- **· Aiming**
- **· Breath control**
- **· Trigger squeeze**
- **· Shot location**
- **· Replay of sight picture**

At all levels summary feedback is provided:

- **· Single target shot groups for each range**
- **· Average diagnostic scores or a summary of shots is presented at the end of each level**

The type of feedback provided at each level of difficulty is summarized on page 4-21, and a table summarizing the nine firing levels is found on page 4-22.

The MACS BRM program has incorporated features to enable a single instructor to monitor the progress of several soldiers at the same time (with multiple systems). Standards embedded in the program determine the shooter's progress from level to level.

The color of the screen border changes to draw the instructor's attention to any soldier having difficulty.

The colors of the borders indicate the soldier's status:

> · BLACK - making satisfactory progress
> · RED - refiring some targets at a particular range, or a part of a level
> · BLUE - refiring an entire level
> · YELLOW - has been sent back one level
> · PURPLE - aiming off the screen, or light pen not reading

Information on the soldier's progress is included in the upper left corner of the screen:

> · L - level being shot
> · T - target being shot within a level
> · R - number of refires within a level

Before using the MACS system as a teaching device, the instructor is encouraged to read the entire Trainer's Guide for the PC Version of the BRM program and shoot the entire program several times.

ASSEMBLY INSTRUCTIONS FOR MACS PC VERSION

ASSEMBLY INSTRUCTIONS FOR MACS PC VERSION

PLEASE READ ALL INSTRUCTIONS BEFORE
ATTEMPTING TO ASSEMBLE MACS PC VERSION
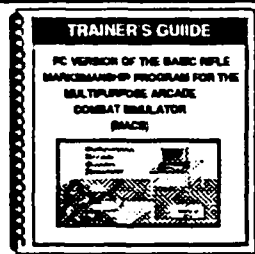SYSTEM

Required equipment and components are listed below:

_____ MACS program disk(s)

_____ PC with an 80286 microprocessor
      (eg., Zenith 248, IBM PC/AT)

_____ 20 MB hard disk

_____ 384 KB of RAM (minimum)

_____ EGA graphics card

_____ EGA color monitor

_____ Keyboard

_____ Light pen card (PXL 380)

_____ M16 rifle with light pen

_____ DOS version 3.1 or higher
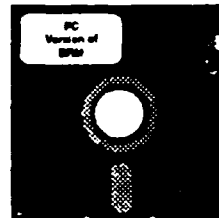
STEP 1 UNPACK MACS PC VERSION ASSEMBLY KIT

CHECK:

THE FOLLOWING SYSTEM COMPONENTS ARE INCLUDED IN THE MACS PC VERSION ASSEMBLY KIT. CHECK OFF EACH ITEM AS YOU UNPACK IT.
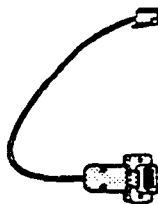
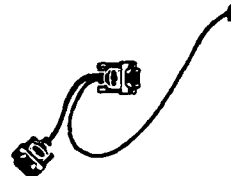| Trainer's Guide: PC Version of BRM for MACS	MACS Program Disk PC Version for BRM
	(Located in pocket inside back cover of manual)

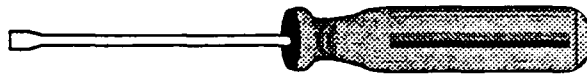| Light Pen Cable	Light Pen Board	Monitor Interface Cable

MACS M16 rifle with light pen and cable
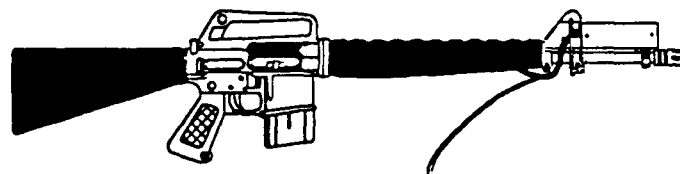
TOOLS REQUIRED FOR MACS PC VERSION SYSTEM ASSEMBLY

Standard Screwdriver

Phillips Screwdriver
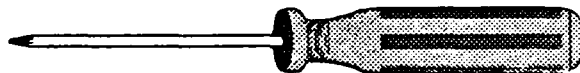
7/64" Allen Wrench

COMPUTER EQUIPMENT NEEDED TO COMPLETE THE MACS SYSTEM

Color Monitor, Computer, and Keyboard

Color Monitor ——

—— Computer

—— Keyboard

Computer Power Cable
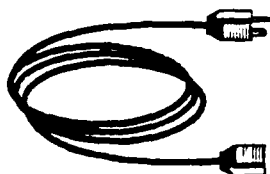
Monitor Power Cable
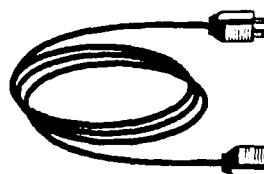
NOTE:

IN THE EVENT OF MISSING ITEMS IN THE MACS PC VERSION
ASSEMBLY KIT CONTACT THE FORT BENNING TRAINING
SUPPORT CENTER (TSC) AV 835-1545.

STEP 2 INSTALL THE LIGHT PEN BOARD

CAUTION:

READ ALL INSTRUCTIONS before attempting to
install the light pen board or DAMAGE TO THE
SYSTEM MAY RESULT.

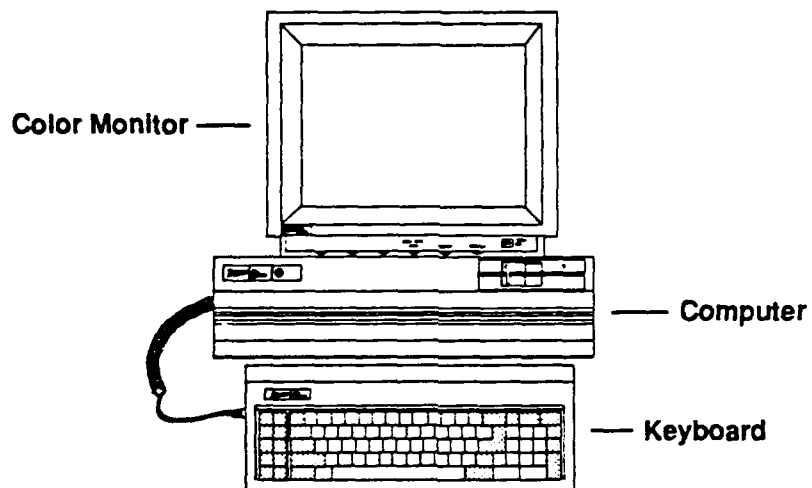The heads of the hard disk MUST BE PARKED before
moving the computer even a short distance. Refer
to your DOS manual for further instructions.

WARNING:

STATIC ELECTRICITY CAN DAMAGE COMPUTER EQUIPMENT!

· Use non-magnetic tools.
· Do not walk on carpeted areas. If unavoidable,
  touch metal before handling computer
  equipment or components.
· Spray area around computer with antistatic
  substance.

STEP 2 INSTALL THE LIGHT PEN BOARD (continued)

Place the computer on a firm work surface:

· Turn off the computer and unplug the power line
from the outlet. The power switch is located on the
rear of the computer.

· If the monitor is connected to the computer,
disconnect the cable and set the monitor aside.

Turn OFF computer	Disconnect monitor cable
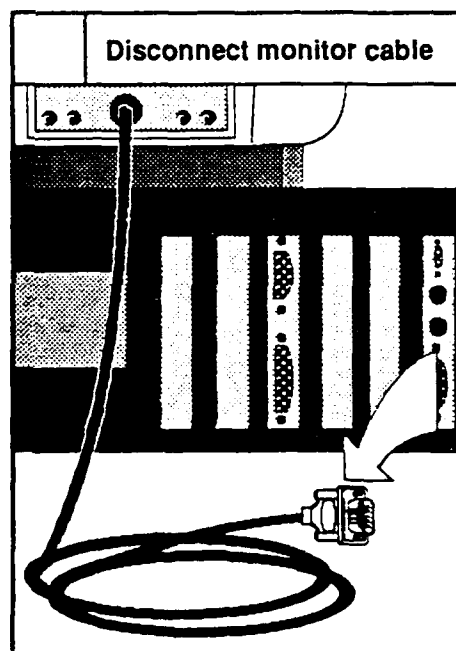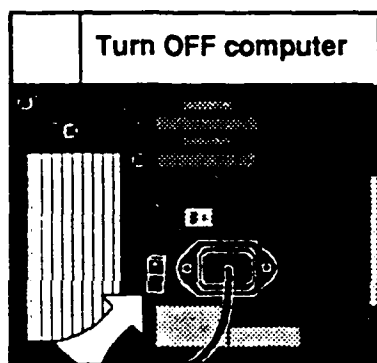
STEP 2 INSTALL THE LIGHT PEN BOARD (continued)

Remove the cover:

· Remove the six screws that secure the cover.

· Remove the cover by sliding forward. The cover will catch at
the halfway point: Continue to slide forward while lifting
slightly. Set the cover aside.
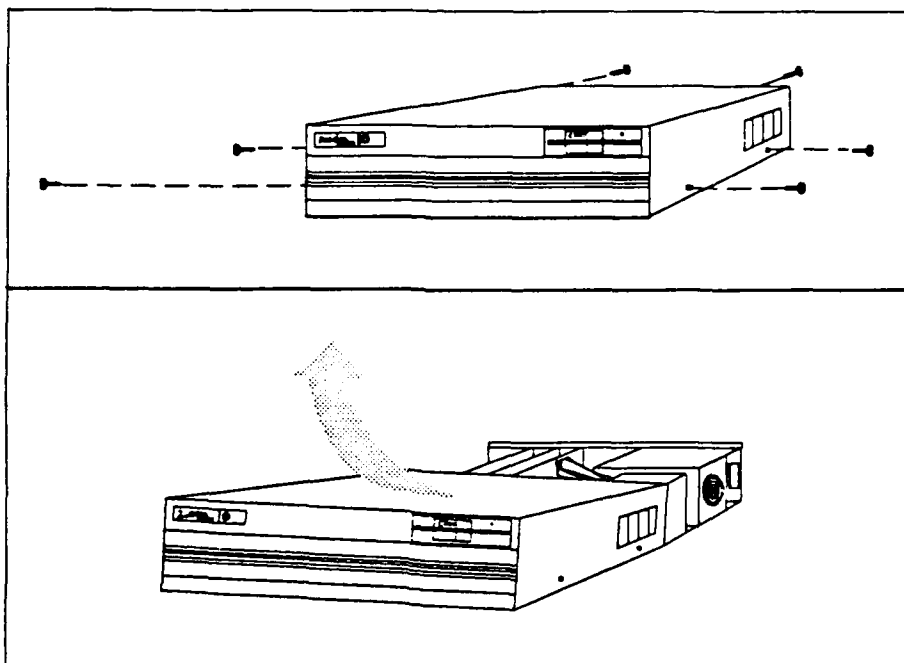
Removing the computer cover.

STEP 2 INSTALL THE LIGHT PEN BOARD (continued)

Look inside the computer:

Notice that boards are placed into slots on the floor of the
computer and held into place at the rear of the computer by
slot holders. The first slot is generally too short to
accommodate most boards. The light pen board may be
installed in any unused slot long enough to accommodate it.

If an empty slot is between two boards, ensure there is
enough space between boards so projections on boards do
not touch each other.

**Slot
too short**

Slot O. K.
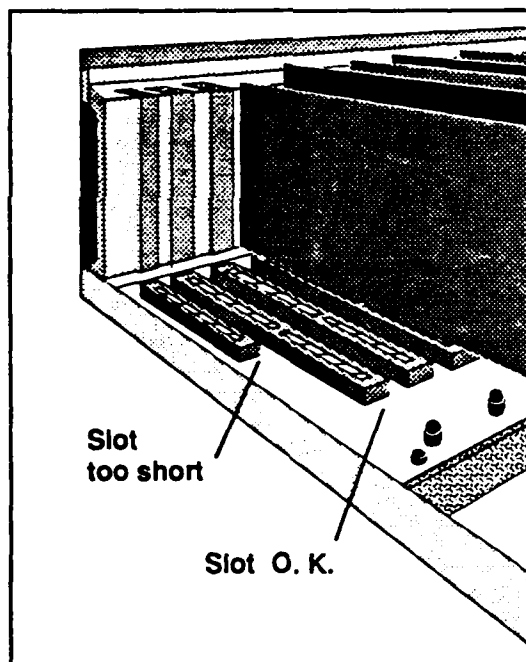
View of slots on the floor of the computer.

Install the light pen board:

· Remove the slot holder from an empty slot. Save the screw
for use with the light pen board.

Removing the slot holder.

Remove the light pen board from its package:

Notice the notch and white border at the bottom of the
board. The slot holder at the rear of the board has cutouts
for three connectors; the lower two will be used.

CAUTION:

COMPUTER BOARDS ARE EASILY DAMAGED WHEN HANDLED INCORRECTLY.

· **Always handle the board by its edges or by the slot
  holder.**
· **Static electricity is harmful to computer boards. Avoid
  walking on carpet or briefly touch metal surface before
  handling board.**

The light pen board.

2-12
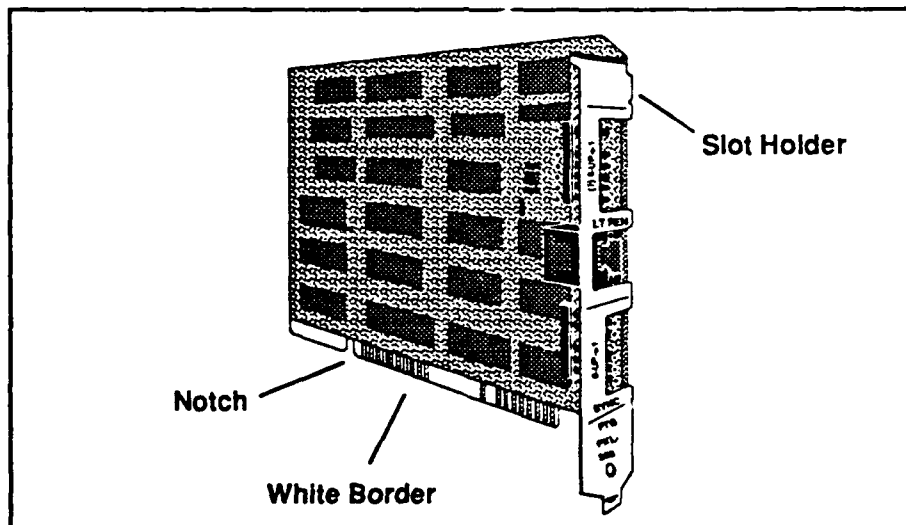
Press light pen board into slot:

· While holding the light pen board by the slot holder and top
  edge, line the board up with the slot holder toward the rear
  of the computer. Press the light pen board firmly into the
  selected slot.
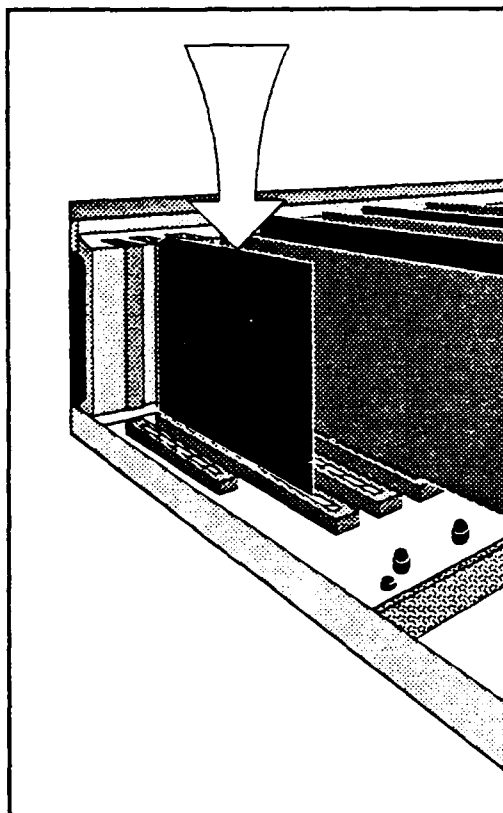
Pressing the light pen board into the slot.

Look at the bottom of the light pen board:

The white border on the bottom of the board must be
completely covered by the edge of the slot.
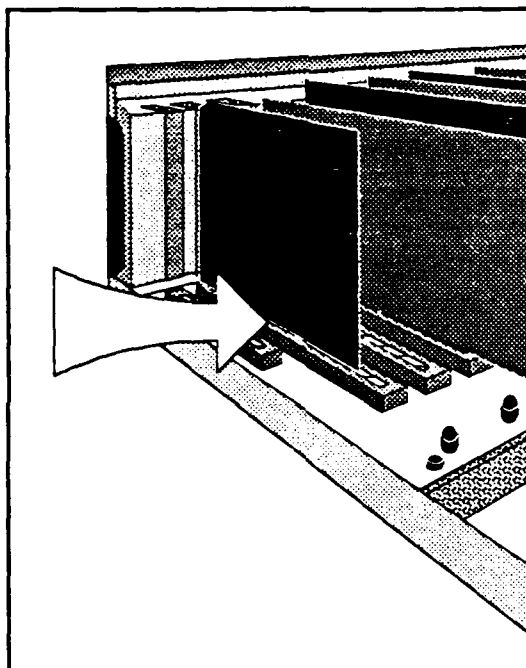
Correct position of light pen board.

STEP 2 INSTALL THE LIGHT PEN BOARD (continued)

Screw the light pen board into place:

· Using the slot holder screw removed earlier, screw the light pen board into place.
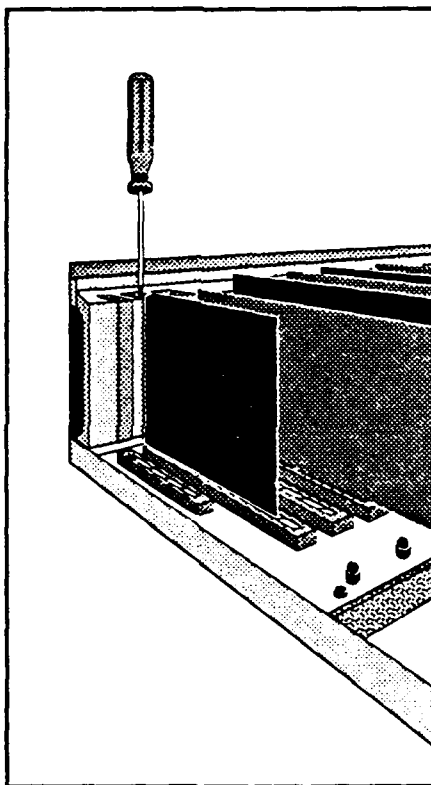
Securing the screw holding the light pen board.

STEP 2 INSTALL THE LIGHT PEN BOARD (continued)

Locate the cables illustrated below:

· These cables plug into the light pen board at the rear of the computer.

Light Pen Cable	Monitor Interface Cable
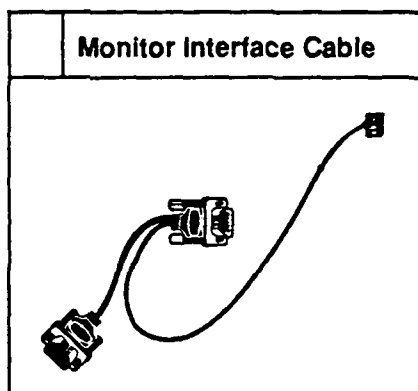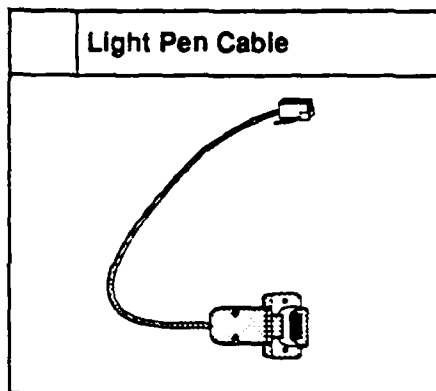
Light pen board cables.

STEP 2 INSTALL THE LIGHT PEN BOARD (continued)

Connect the monitor interface cable to the light pen board:

Match the ↑UP↑ label on the 6-position connector with the label 6-UP-1 on the rear of the board and insert the connector.
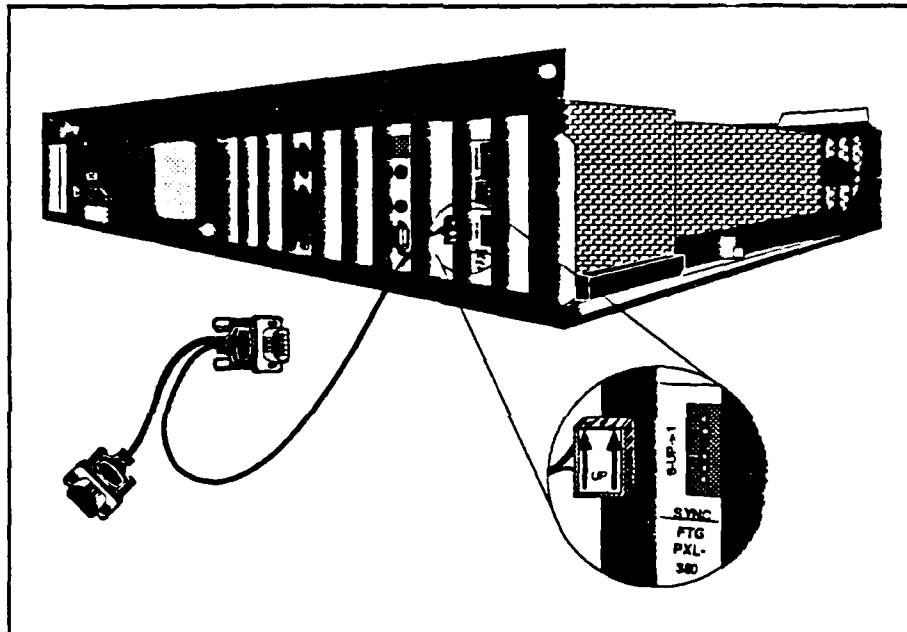
Inserting the 6-pin connector on the monitor interface cable into the light pen board.

Connect the monitor interface cable to the Enhanced Graphics Adapter (EGA) board:

Match the 9-pin male connector to a corresponding female receptacle on the rear of the computer. The location of the female connector may vary depending on which slot the EGA card is installed.
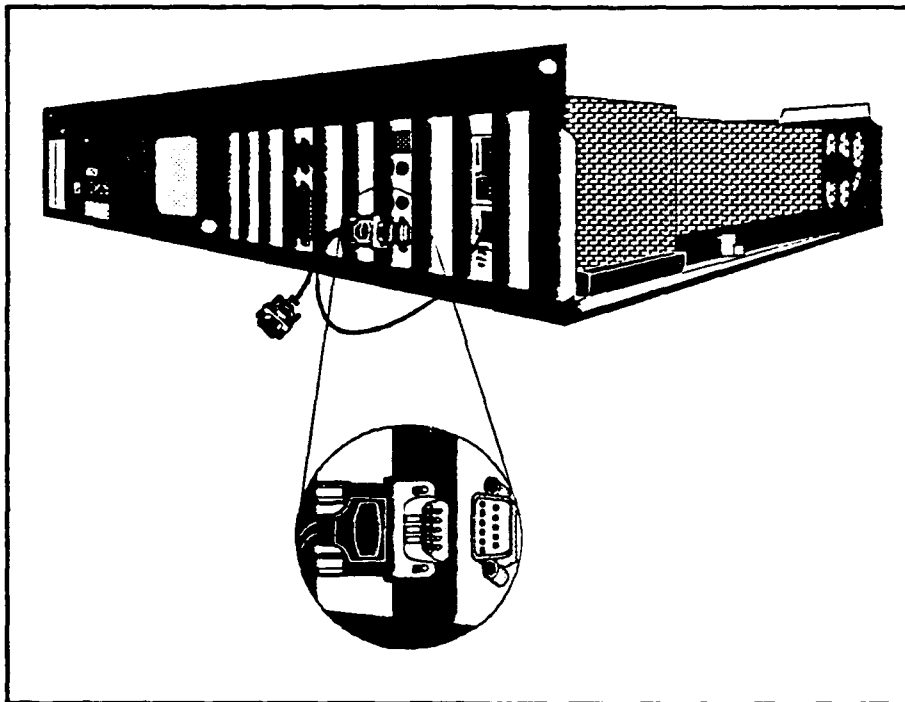
Connecting the 9-pin male connector on the monitor interface cable to the EGA board.

2-18

Connect the telephone jack on the light pen cable to the light pen board:

Insert the telephone jack into the receptacle labeled LT PEN. The jack should click into place.
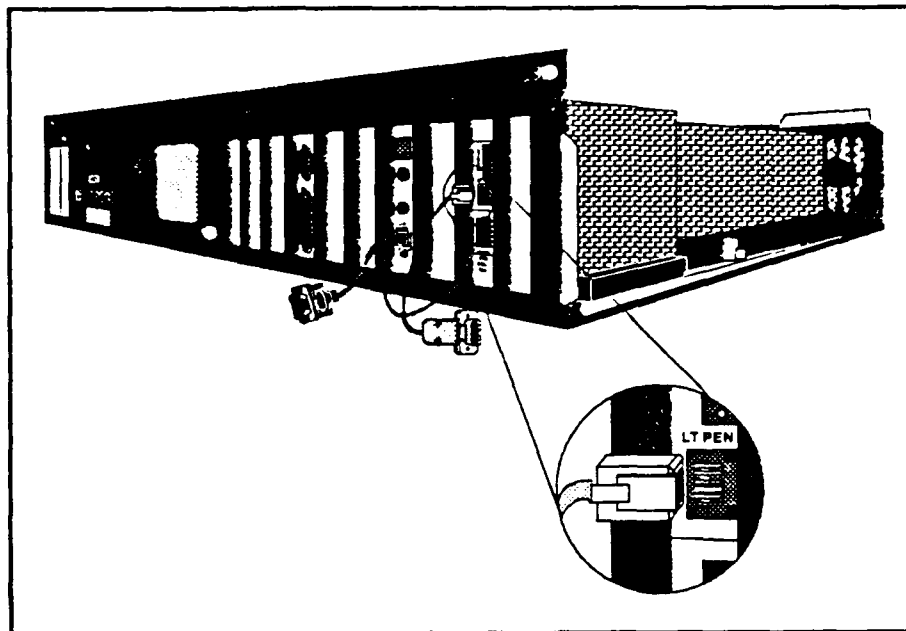
Connecting the telephone jack on the light pen cable
to the light pen board.

STEP 2 INSTALL THE LIGHT PEN BOARD (continued)

Replace the computer cover:

- Replace the cover by sliding the cover to the rear.
- If the ribbon cables are in the way, carefully push them down.
- Replace the six screws which secure the cover to the computer.
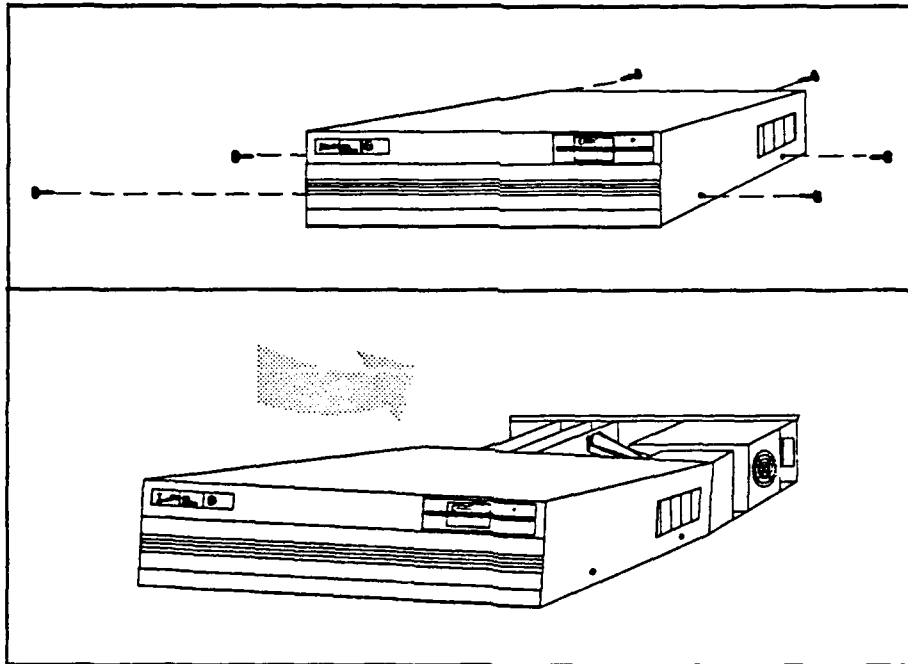
Replacing the computer cover.

STEP 3 PLACEMENT OF THE MACS SYSTEM

CAUTION:

The heads of the hard disk MUST BE PARKED before moving the computer even a short distance. Refer to your DOS manual for further instructions.

Placement of equipment:

- All equipment should be placed on a firm, steady surface within reach of a three-pronged receptacle.
- Point the M16 rifle at the monitor.
- Place the monitor at eye level to the shooter, 7'6" from the tip of the light pen.

MARK THE DISTANCE ON THE CONNECTOR CORD WITH TAPE FOR FUTURE REFERENCE.

· Sandbags are required for supported position.

7'6"
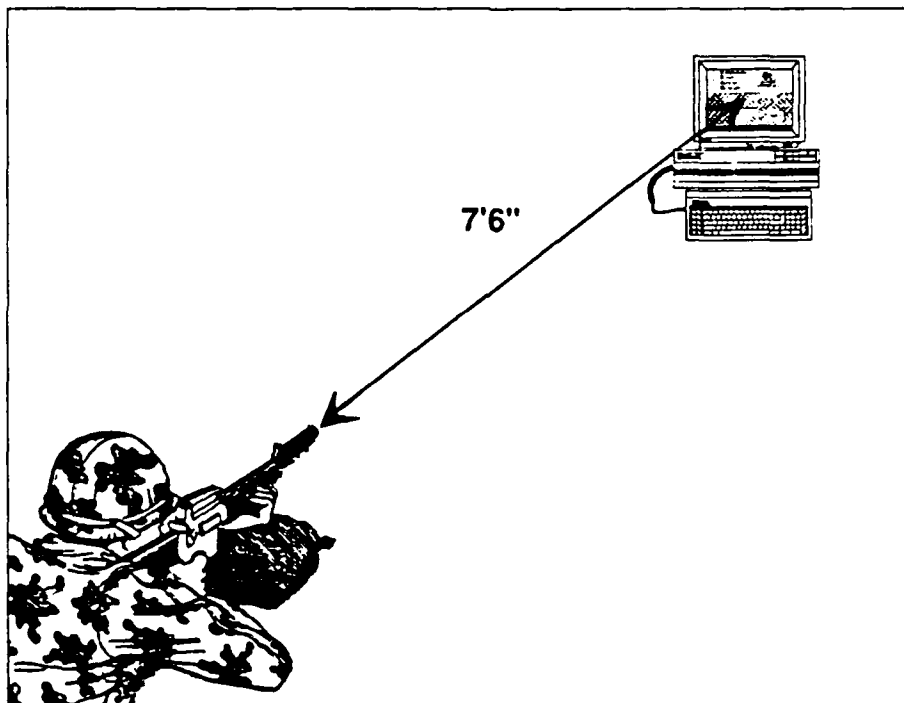
STEP 4 MACS SYSTEM CABLE ATTACHMENT

CAUTION:

TURN the power switch on the computer OFF before attaching cables to avoid damage to the computer.

Connect the keyboard to the back of the computer:
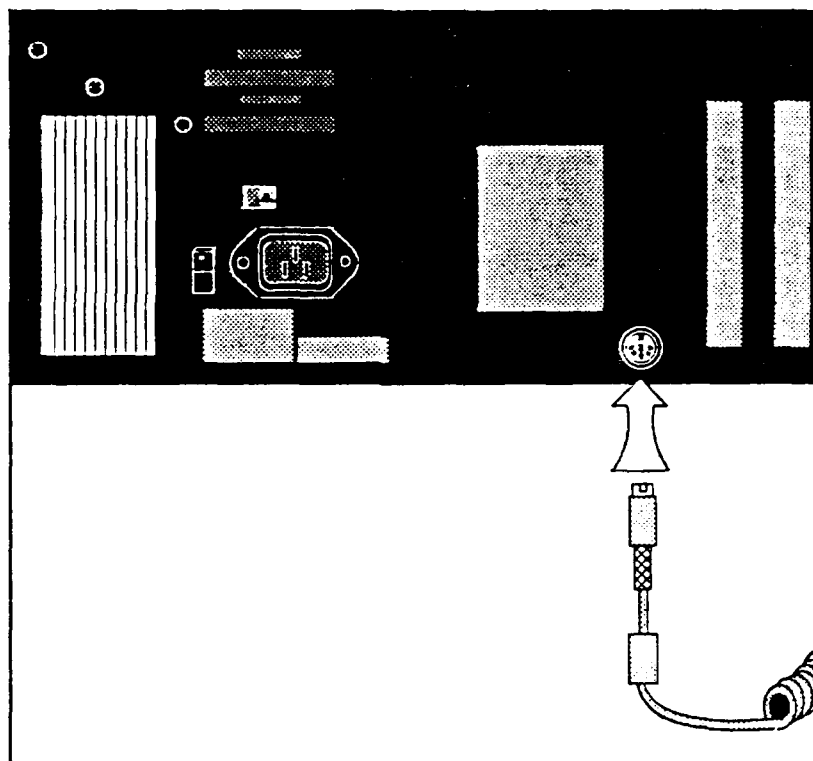
Connecting the keyboard.

STEP 4 MACS SYSTEM CABLE ATTACHMENT (continued)

Connect the computer power cord to the rear of the computer:
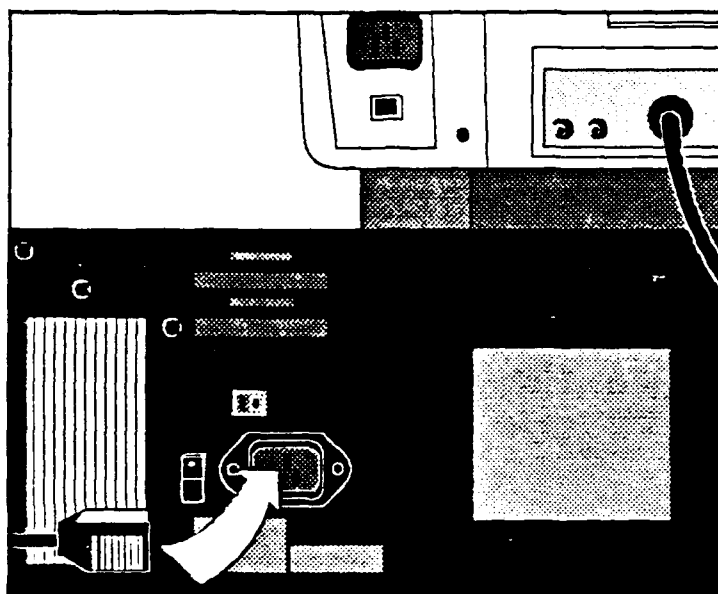
Connecting the computer power cord.

Connect the monitor power cord to the rear of the
monitor:
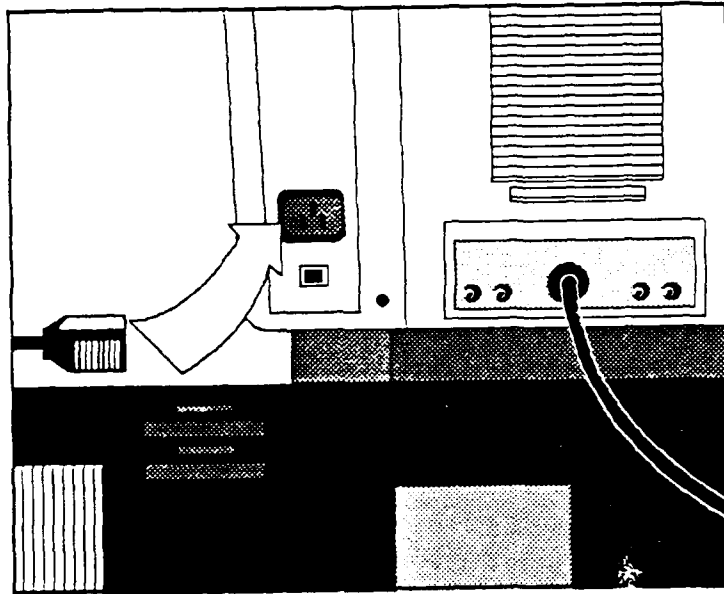
Connecting the monitor power cord.

STEP 4 MACS SYSTEM CABLE ATTACHMENT (continued)

Connect the monitor cable to the monitor interface cable:

· Connect the 9-pin male connector on the monitor cable to the female connector on the monitor interface cable.
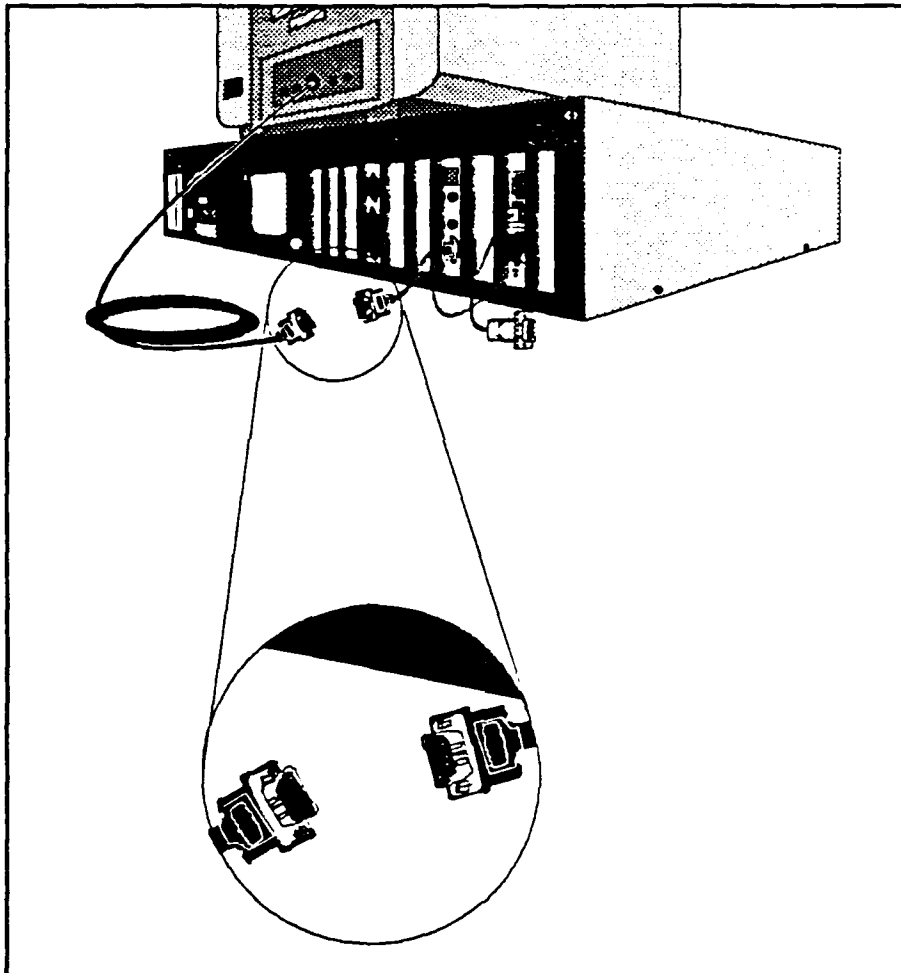
Connecting the monitor cable to the monitor interface cable.

STEP 4 MACS SYSTEM CABLE ATTACHMENT (continued)

Connect the light pen cable to the M16 rifle:

· Connect the 9-pin male connector on the light pen cable to
the female connector at the end of the rifle cable.

To
Rifle
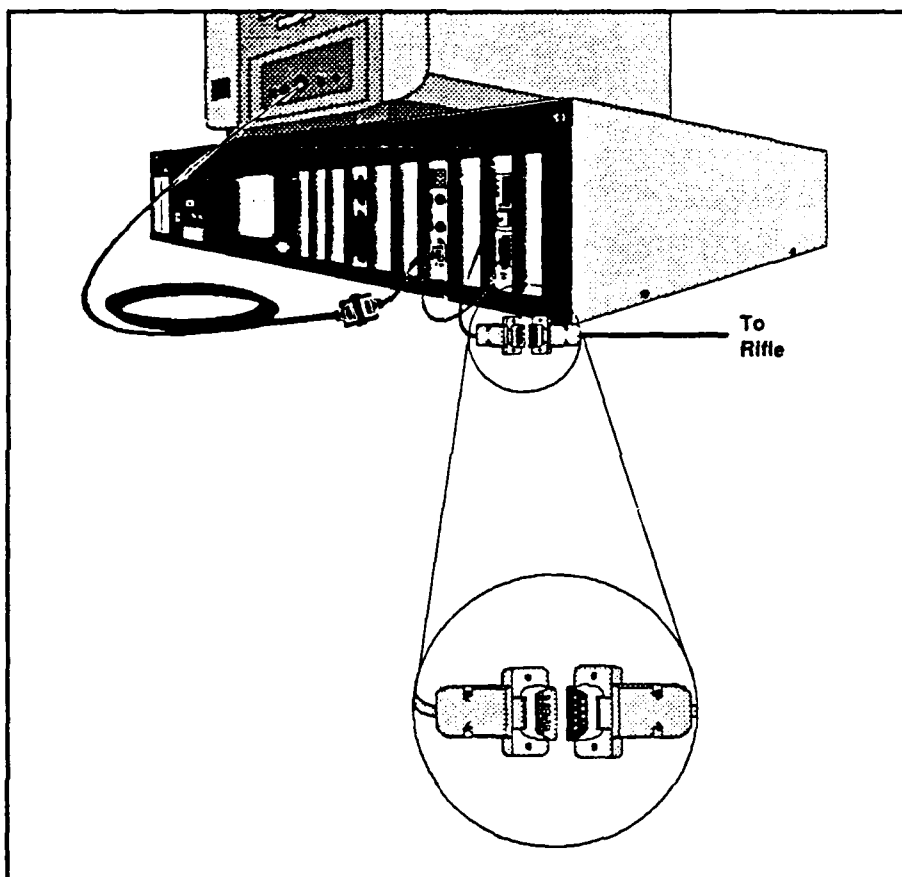
Connecting the light pen cable to the rifle.

Plug computer and monitor power cords into surge protector
then plug surge protector into AC wall outlet.

NOTE: Surge protectors are necessary to prevent damage from
electrical power surges which may occasionally occur. However,
power cords may be plugged directly into AC wall outlet if no surge
protector is available.
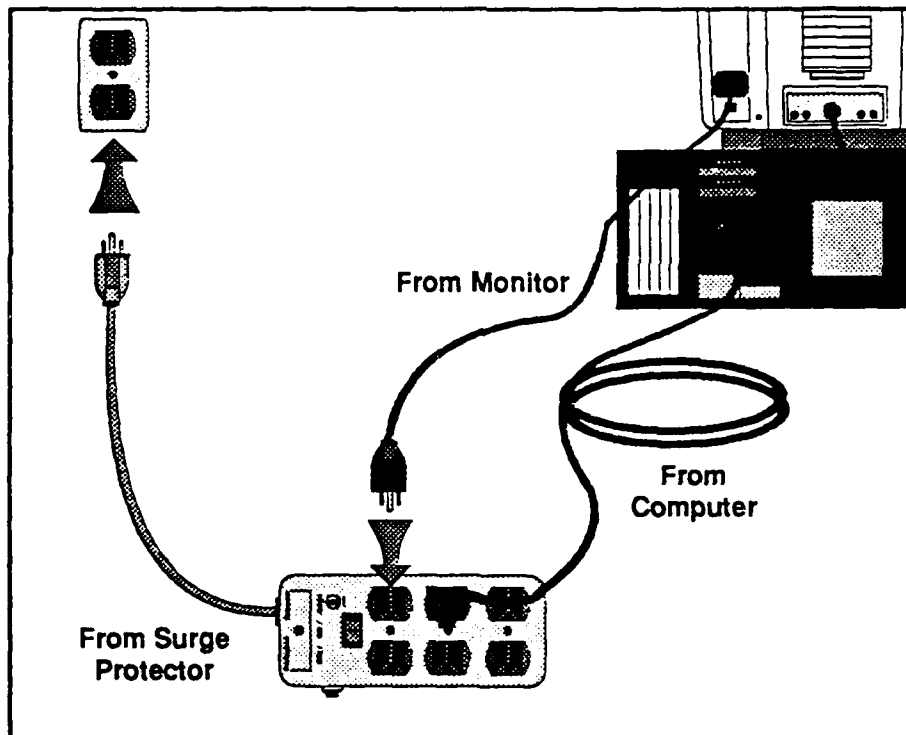
Plugging power cords into surge protector,
then plugging surge protector into outlet.

STEP 4 MACS SYSTEM CABLE ATTACHMENT (continued)

Turn on all the power switches in the the following order:

1 Surge suppressor

2 Computer
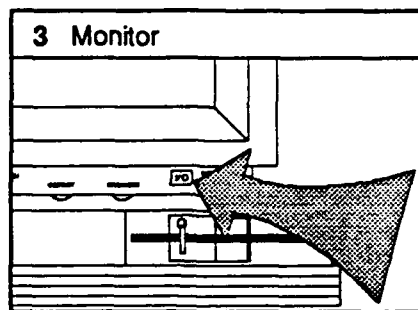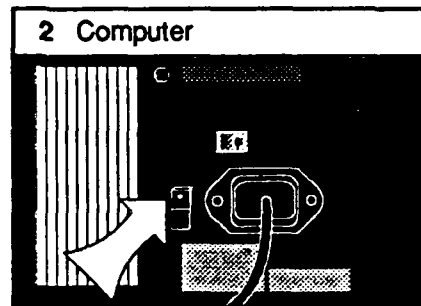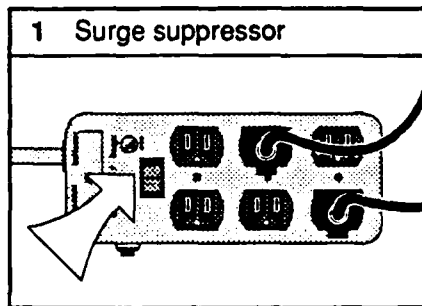
3 Monitor

NOTE:

GO TO DOS. THE MONITOR SCREEN SHOULD DISPLAY THE
FOLLOWING PROMPT...

C:\>_

SEE SECTION 6 "TROUBLESHOOTING" IF THIS PROMPT IS
NOT DISPLAYED

MACS SOFTWARE INSTALLATION PROCEDURES

MACS SOFTWARE INSTALLATION PROCEDURES

PLEASE READ ALL INSTRUCTIONS BEFORE ATTEMPTING TO INSTALL THE MACS PC Version SYSTEM SOFTWARE.

NOTE:

The installation program performs verification routines to determine whether the required components and equipment (listed on page 1-3) are present. If any of these components are missing, a message will be displayed on the monitor. Refer to the "TROUBLESHOOTING" section if an error occurs during the software installation process.

INSTALLING THE MACS PROGRAM ON THE HARD DISK

The MACS installation program checks for hardware and
software problems. The program will not load if any
obstacles are encountered.

Refer to the TROUBLESHOOTING section if any error(s)
occur during the software installation process.

1. Insert the MACS program disk in Drive A (A), then close
   the disk drive door (B).

A Insert disk	B Close disk drive door
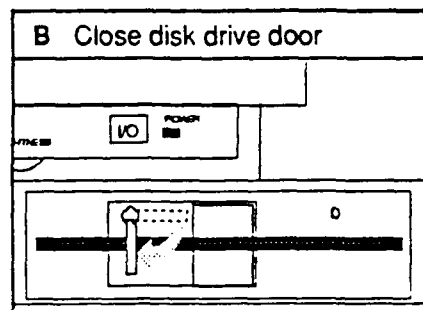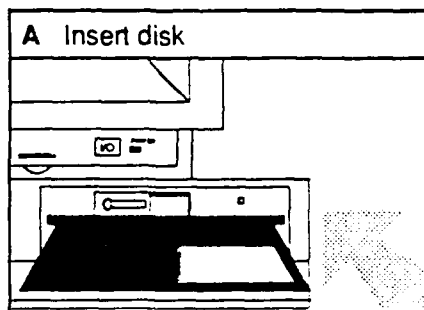
Inserting MACS program disk into Drive A.

2. Type   **A:**   and press the **<ENTER>** key.
   The computer will respond:

   A:\>

3. At the **A:\>** type **INSTALL** and press the **<ENTER>** key.
   The screen should look like this:

   A:\>INSTALL

4. The computer will send many messages on the screen as
   the program is copying the MACS program disk to the
   hard disk. When installation is complete, the message:

   MACS HAS BEEN INSTALLED

   will appear.

STARTING THE MACS PROGRAM AFTER INSTALLATION

1. After the program has loaded, type **C**: and press the
   <ENTER> key. The computer will answer:

   C:\>

2. Type **cd MACS** and press the **<ENTER>** key. The
   computer will answer:

   C:\MACS>

3. Type **MACS** and press the **<ENTER>** key. The
   "Welcome to MACS" program screen will be displayed.
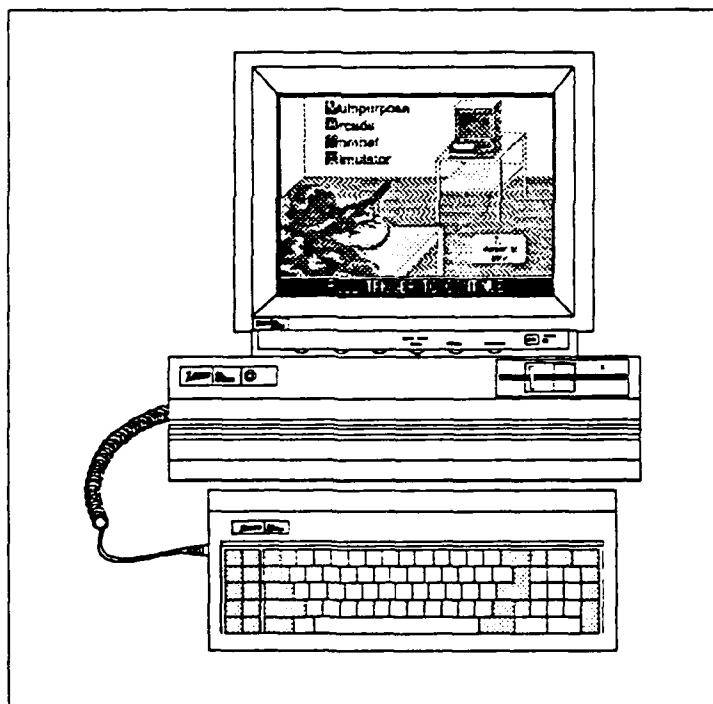
Monitor screen displaying MACS welcome screen.

USING THE MACS PROGRAM

If you have just completed installation of the MACS program, continue on to section 4 after reading these instructions.

The MACS program needs to be installed on the hard disk only one time.

To use the MACS program after it has been installed:

    1. Turn on the computer system and monitor.

    2. Go to the **C:\>** prompt.

When the computer is turned on it may:	Then:
Go directly to **C:\>**	Go to step 3
Go to another prompt such as **D:\>**	Typing **C:** will bring up the **C:\>** prompt from **D:\>**

Display a menu	Find the option **EXIT TO DOS** and follow directions on the screen to exit to **DOS**
	    · If the computer goes to **D:\>** type **C:** to bring up **C:\>**
	    · If the computer goes to **C:\>filename>** type **CD ** to bring up **C:\>**
	    · If the computer goes to **C:\MACS>** go to step 4

    3. At the **C:\>** prompt type **cd MACS** and press the **<ENTER>** key. The computer will answer:

        C:\MACS>

    4. Type **MACS** and press the **<ENTER>** key. The "Welcome to MACS" program screen will be displayed.

To exit the MACS program:

1. Press the escape key (ESC) to access the MACS Menu

2. At the MACS Menu enter **X** to exit to **DOS**

3. At the **C:\MACS>** prompt enter

        **CD **

        or

        CD ..

  and press the **<ENTER>** key

4. The prompt **C:\>** should be displayed.

THE BASIC RIFLE MARKSMANSHIP PROGRAM

Multipurpose
Arcade
Combat
Simulator

Version of
BRM

PULL TRIGGER TO CONTINUE
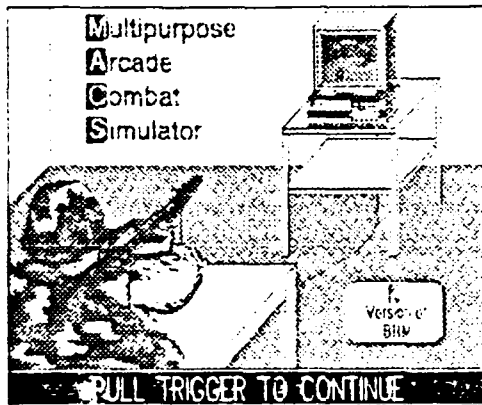
MACS WELCOME SCREEN

· First screen of MACS BRM program.

· Pull trigger to begin program.

or

Press [ESC] key to access

MACS program menu (further details in section 5).

MACS

BASIC RIFLE

MARKSMANSHIP

TRAINING

PULL TRIGGER TO CONTINUE.

FOUR FUNDAMENTALS OF
RIFLE MARKSMANSHIP

· Steady Position
· Aiming
· Breath Control
· Trigger Squeeze

PULL TRIGGER TO CONTINUE
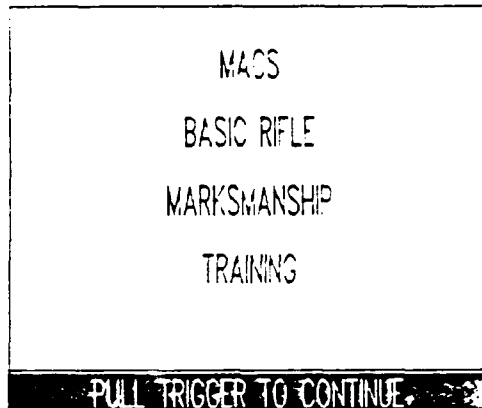
NOTE: Spacebar on keyboard will substitute for trigger pull on screens not showing targets.

ESTABLISH SHOT GROUP

First 3 shots determine shot group.

Aim at center of mass.

Black dot shows center.

PULL TRIGGER TO CONTINUE

- It is important to get a good shot group.

- Targets are at 250 m.

NOTE: Adjustment of brightness or contrast after establishing shot group changes system calibration (firer must rezero).

SHOOTING INSTRUCTIONS

Fire one shot per target.

Targets are untimed.

ASSUME A SUPPORTED POSITION

PULL TRIGGER TO CONTINUE

- The next three shots establish shot group.

NOTE: Pulling rifle trigger sends signal to computer to continue.
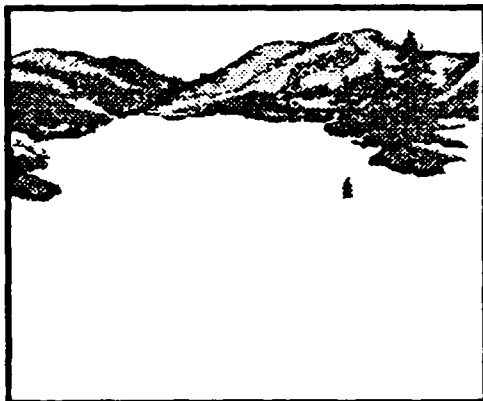
FIRE SHOT GROUP

· Soldier fires one shot at each of three targets.

NOTE: Purple border appears when light pen is not aimed at screen.

```
STEADY POSITION   EXCELLENT
AIMING            EXCELLENT
BREATH CONTROL    OK
TRIGGER SQUEEZE   EXCELLENT
SHOT GROUP        EXCELLENT


PULL TRIGGER TO CONTINUE
```

SHOT GROUP SUMMARY SCREEN

· Shot locations pictured on target.

· Feedback for three shots summarized.

· Good shot group calibrates system.

IF SHOT GROUP IS INVALID:

```
INVALID SHOT GROUP

TRY AGAIN

PULL TRIGGER TO CONTINUE
```
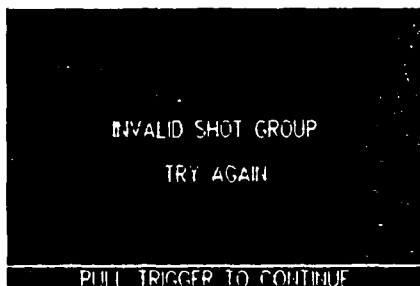
· An invalid shot group is one in which one or more shots hit outside a rectangular area (not seen by the shooter) which is the same size as the light pen alignment rectangle shown on the next page.

4-5

IF SHOT GROUP IS VALID:

```
        SHOT GROUP
     ▪▪▪▮▮▮▮▮▮

           [bottle]

    ▬▬▬                [NO]
Want to try for a tighter shot group?
PULL TRIGGER TO SELECT ANSWER
```

· Pull trigger when selected answer (YES or NO) is enlarged.

· If **YES**:
Refire shot group.

· If **NO**:
Initial skill test criteria determine starting level.

IF SECOND SHOT GROUP IS INVALID:

```
    INVALID SHOT GROUP

          TRY AGAIN
 OR CHECK LIGHT PEN ALIGNMENT
      PRESS ESC THEN F4
   (SEE MANUAL FOR DETAILS)
   PULL TRIGGER TO CONTINUE
```
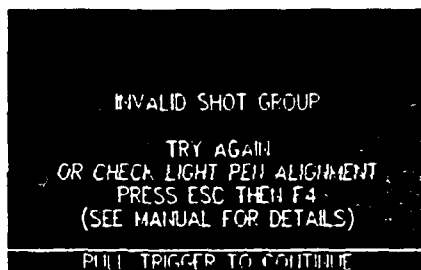
If second shot group is invalid:

· Press ⎡ESC⎤ then ⎛ F4 ⎞ to start light pen mount alignment program.

NOTE: See Section 7 for instructions on aligning the light pen.

```
    AIM AT BLUE CROSS

              |
           ___|___
          |   :   |
          |___:___|
              |
   PULL TRIGGER WHEN READY
```
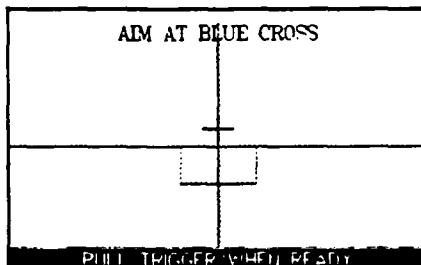
· Follow directions for alignment.

· Following alignment the program will return to WELCOME TO MACS screen.

INITIAL SKILL TEST CRITERIA

To pass each skill test two GOOD ratings and two EXCELLENT ratings must be earned on measures of shot location, steady position, aiming, and trigger squeeze.

IF CRITERIA ARE NOT MET:

Level
1

Introduction/Supported Position

PULL TRIGGER TO CONTINUE
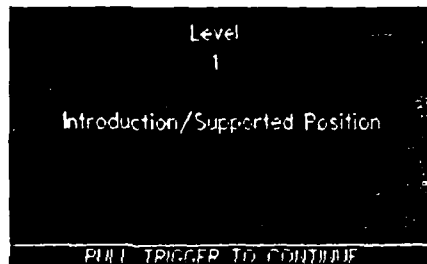
· Program starts at Level 1.
· See page 4-10.

IF CRITERIA ARE MET:

Next 3 shots help decide start level.

ASSUME AN UNSUPPORTED POSITION

PULL TRIGGER TO CONTINUE

Summary

STEADY POSITION	EXCELLENT
AIMING	EXCELLENT
BREATH CONTROL	OK
TRIGGER SQUEEZE	EXCELLENT
SHOT LOCATION	EXCELLENT

PULL TRIGGER TO CONTINUE
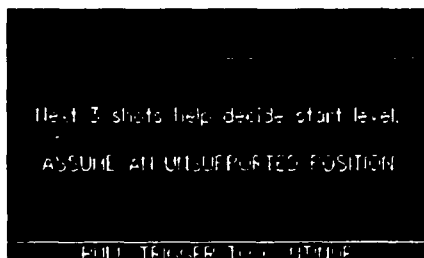
· Skill test is continued.
· Soldier fires one shot as each of three targets is presented from an unsuppported firing position.

IF CRITERIA ARE NOT MET:

Level
2

Introduction/Unsupported Position

PULL TRIGGER TO CONTINUE

· Program starts at Level 2.

IF CRITERIA ARE MET:
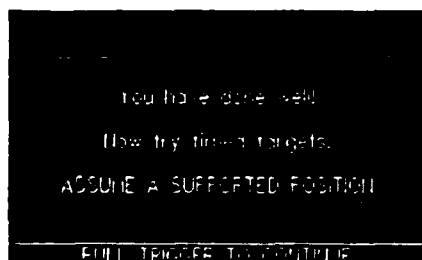
- Skill test is continued.
- 3 shots fired at timed targets in supported position to determine starting level for better shooters.
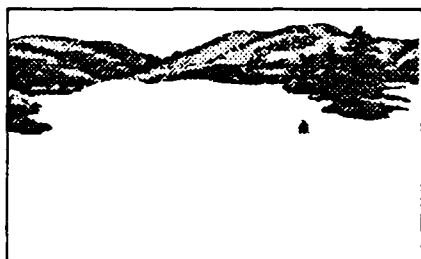
- Timed targets at 100, 250, and 300 m are presented.
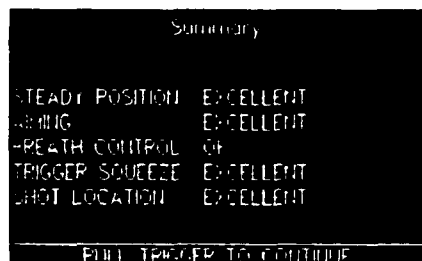
NOTE: If criteria are met, three shots are then fired at timed targets from the unsupported position. Program will begin at Level 4 or Level 5 depending on results of this skill test.

IF CRITERIA ARE NOT MET:

- Program starts at Level 3.

4-9

LEVEL 1

Level
1

Introduction/Supported Position

PULL TRIGGER TO CONTINUE
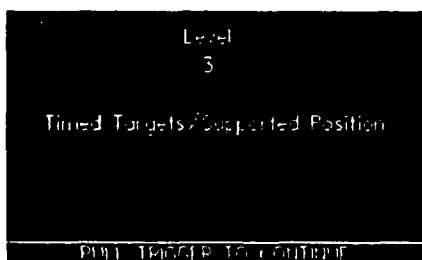
· First firing level in BRM program.

TARGET RANGES

Target Ranges
in meters

300
250
200
150
100
50

PULL TRIGGER TO CONTINUE
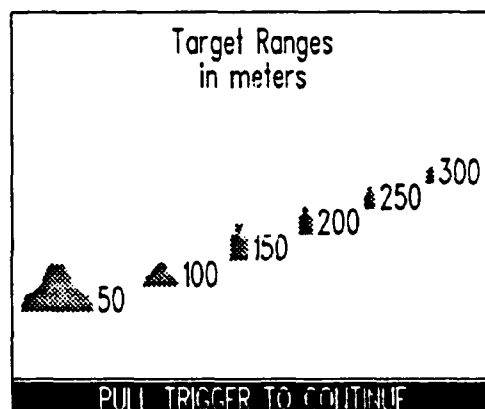
· Targets at each range are illustrated.
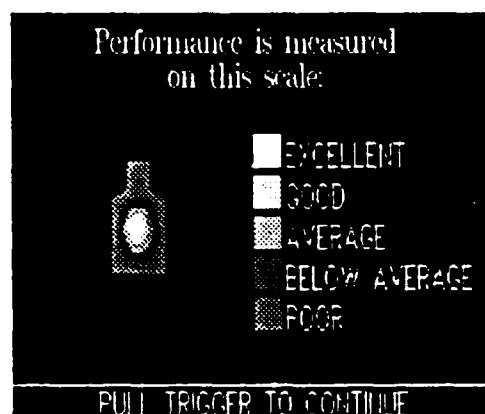
SHOT LOCATION STANDARDS

Performance is measured
on this scale:

EXCELLENT
GOOD
AVERAGE
BELOW AVERAGE
POOR

PULL TRIGGER TO CONTINUE

· The shooter must hit center of mass for shot location to be graded excellent.

4-10

```
The targets are untimed.

STANDARD: Hit 2 of 3

of each distance.

PULL TRIGGER TO CONTINUE
```
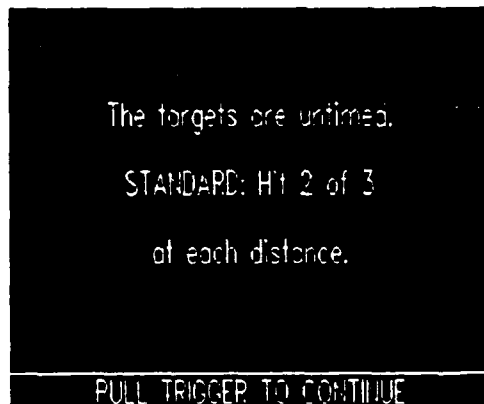
SHOOTING INSTRUCTIONS

· Untimed targets.
· Hit 2 of 3 at each distance.
· Supported position.
· First three targets are at 50 meters.

```
L=1 T=1 R=0
```
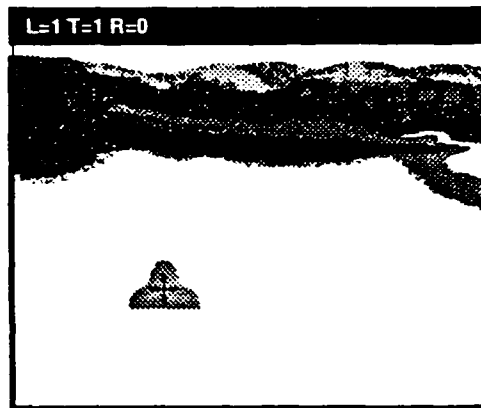
TARGET SCREENS

· Three target screens are presented.

· Feedback screens follow each target presentation.

$-\!\!\mid\!\!-$ indicates bullet strike.

· HIT or MISS appears in lower left corner of screen.

NOTE: In the upper left corner of the screen:
· L=Level being shot.
· T=Target being shot within a level.
· R=Number of refires within a level.

FEEDBACK SCREEN SEQUENCE

correct sight placement (black).

your sight placement (white).

- Each shot is followed by a replay of the sight placement of the shooter compared to the correct sight placement and bullet strike.
- Shooter's sight placement in moments before bullet strike (white) is superimposed over correct sight placement (black).
- The shot can be replayed as many times as necessary.
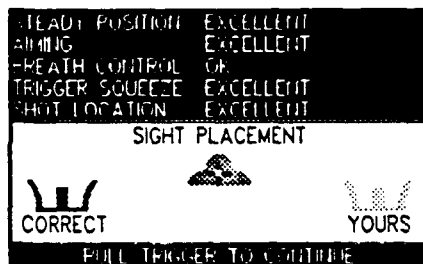
- PULL TRIGGER TO CONTINUE to next target screen.
- Bullet strike is displayed on target.

NOTE: For an explanation of MACS Feedback turn to page 4-21.

4-12

```
YOUR 3 ROUND SHOT GROUP:




          ▲


     50 meters
 PULL TRIGGER TO CONTINUE
```
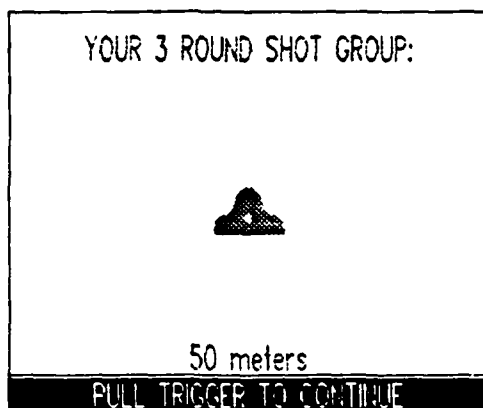
3 ROUND SHOT GROUP

- Target and feedback screens repeated for 100, 150, 200, 250, and 300 m targets.
- Shot group displayed on target at each range.
- These screens can be analyzed as if shots were fired at a known distance (KD) range.
- Must hit 2 of 3 targets to meet standard.

TRAINER'S TIP

Trainer should assist the soldier by performing a shot group analysis and give corrective action. For example, the soldier's shot group at 100 m is centered horizontally, but is too high.

Corrective action: Explain adjusted aiming point.

FAILURE TO MEET STANDARD

```
You did not meet the standard.

     PREPARE TO REFIRE...


    PULL TRIGGER TO CONTINUE
```
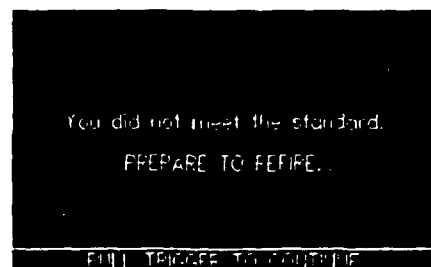
- Repeats presentation of target and feedback screens for each of the 3 shots.
- 3 round shot group is displayed for the range.

NOTE: Red border appears during refire of a range.

Level 1 Summary

```
STEADY POSITION   EXCELLENT
AIMING            EXCELLENT
BREATH CONTROL    OK
TRIGGER SQUEEZE   EXCELLENT
SHOT LOCATION     GOOD
```

PULL TRIGGER TO CONTINUE

LEVEL 1 SUMMARY

· If standard is met the shooter goes on to Level 2.

STANDARD FOR LEVEL 1 NOT MET

```
You are being sent back to level 1
because one of your SUBPART scores
was POOR or BELOW AVERAGE
```

PULL TRIGGER TO CONTINUE

```
FOUR FUNDAMENTALS OF
RIFLE MARKSMANSHIP

        Steady Position
        Aiming
        Breath Control
        Trigger Squeeze
```

PULL TRIGGER TO CONTINUE

· Blue border will appear during refire of a level.

· Yellow border will appear if shooter has regressed from a higher level.

TOP GUN

```
              TOP GUN
    Well done!  Enter your initials.

            [ E ][ W ][ W ]

    A B C D E F G H I J K L M
    N O P Q R S T U V W X Y Z
        [ ERASE ]   [ DONE ]
    AIM AT LETTER AND PRESS TRIGGER
```

- At the end of Level 9, combat fire, high scorers may enter initials for display on high score screen. The high score screen will alternate with the MACS welcome screen until computer is turned off.

```
              TOP GUN

    1. EWW          6.  UWZ
    2. RFG          7.  RFM
    3. QT           8.  QRS
    4. AC           9.  DRQ
    5. ABC         10.  JOY

    PULL TRIGGER TO CONTINUE
```

- Alternates with MACS welcome screen
- Activated after shooter fires high score on Level 9.

```
           CONGRATULATIONS

         You are finished with
    this program. Call instructor




    PULL TRIGGER TO CONTINUE
```

DESCRIPTIVE SUMMARY OF LEVELS

Level 1. Introduction to Supported Position

Summary description
- No time limit.
- Supported position.
- Single-target presentations.
- Eighteen targets presented, three targets at each of six ranges.
- Targets engaged in order of range: 50, 100, 150, 200, 250, and 300 m.

Feedback
- Words **HIT** or **MISS** appear on screen for each shot.
- Cross hair appears on screen to show bullet strike.
- Diagnostics and replay are displayed after each shot.
- Screen shows 3 rounds on single target after each group of three shots.
- Summary screen at end of level shows average diagnostic scores.

Standards
- Two hits out of three shots at each range within level. Failure to meet standard at a given range results in immediate refire of 3 more targets at that range. Refires continue until standard is met.
- Refire of level is required if any score on summary screen is **BELOW AVERAGE** or **POOR**.
- Breath control is rated **OK** or **CHECK**. These ratings are tied to the steady position score.

Level 2. Introduction to Unsupported Position

Identical to Level 1, with these exceptions:

- It is fired from the unsupported position.
- Shooter is regressed a level if any 2 scores on summary screen are **POOR**.

Level 3. Timed Targets in Supported Position

Summary description
- Time limit approximately 1 1/3 times that of record fire.
- Supported position.
- Single target presentations.
- Twenty-four targets in random sequence (four presentations per range).

Feedback
- Cross hair appears on screen to show bullet strike.
- For a hit, target disappears immediately after bullet strike is displayed.
- Diagnostics and replay are displayed after **bad shots** only. Criteria for **bad shot** is a **POOR** for any score or a **BELOW AVERAGE** for shot location.
- Audible tone when target exposure time limit has expired.
- Summary screen at end of level showing average diagnostic scores.
- Summary screens displaying four shots at each range on single targets.

Standards
- Three hits out of four shots at each range within level. For each range at which this standard is not met, a refire of four targets at each of those ranges is required. Refires continue until standard is met.
- Refire of level is required if any score on summary screen is **BELOW AVERAGE or POOR**.
- Shooter is regressed a level if any two scores on summary screen are **POOR**.

4-17

Level 4. Timed Targets in Unsupported Position

Identical to Level 3, with these exceptions:
- Level 4 is firedfrom the unsupported position.
- Standard is lower. Three hits out of four shots at 50, 100, 150, and 200 m, and two hits out of four shots at 250 m and 300 m.

Level 5. Practice Record Fire I

Summary description
- Time limit same as for Record Fire.
- Supported and unsupported positions.
- Single or double presentations.
- Targets presented in random sequence.
- 20 targets fired from supported position, then 20 fired from unsupported position.

Feedback
- Cross hair appears on screen to show bullet strike.
- For a hit, target disappears after bullet strike is displayed.
- Audible tone when target exposure time limit has expired.
- **OUT OF AMMO** appears on screen when 20 shots have been fired.
- Interim summary of performance (hits, misses, and no fires) and shot location score given at end of each position and final summary at end of course of fire.
- Summary screens showing shots at each range on a single target at end of supported position and at end of unsupported position.
- Overall performance is graded Expert (36-40), Sharpshooter (30-35), Marksman (23-29), or Unqualified (0-22).

Standards
- Fifteen hits out of 20 shots in both supported and unsupported positions.
- On double target exposures, a penalty is recorded if furthest target is engaged first (a penalty indicates a tactical error, but does not reduce the total number of hits).
- Regress one level for shot location score of POOR. Stay at same level for mean shot location score of BELOW AVERAGE. Otherwise pass.

4-18

Level 6. Practice Record Fire II

Identical to Level 5, with the exception that the cross hair displaying bullet strike appears only after misses. Target disappears when hit.

Level 7. Record Fire

Summary description
- Time limit same as actual live-fire qualification course.
- Supported and unsupported positions.
- Single or double presentations.
- Targets presented in random sequence.
- 20 targets fired from supported position, then 20 fired from unsupported position.

Feedback
- Targets disappear when hit.
- **OUT OF AMMO** appears on screen when 20 shots have been fired.
- Audible tone when target exposure time limit has expired.
- Cross hairs showing bullet strike for misses on refires only.
- Interim summary of performance (hits, misses, and no fires) and shot location score given at end of each position and final summary at end of course of fire.
- Summary screens displaying shots at each range on a single target at end of supported position and at end of unsupported position.
- Overall performance is graded Expert (36-40), Sharpshooter (30-35), Marksman (23-29), or Unqualified (0-22).

Standards
- Fifteen hits out of 20 shots in both supported and unsupported positions. Refire of position if standard not met.
- On double target exposures, a penalty is recorded if furthest target is engaged first.
- Regress one level for average shot location score of POOR. Stay at same level for mean shot location score of BELOW AVERAGE. Otherwise pass.

4-19

Level 8. Rapid Record Fire

Identical with Level 7, except that the target exposure times are 1/3 less than those used in Record Fire.

Level 9. Combat Fire

Summary description
- Time limits variable, dependent on number of targets presented.
- Supported and unsupported positions.
- Single, double, and multiple presentations.
- Targets are presented in attack/retreat scenarios.
- 40 targets fired from supported position, then 40 fired from unsupported position.

Feedback
- Targets disappear when hit.
- **OUT OF AMMO** appears on screen when 40 shots have been fired.
- Cross hairs displaying bullet strike for misses on refires only.
- Summary of shot location (hits, misses, and no fires) given at end of supported position and at end of unsupported position.
- Summary screens showing shots at each range on a single target at end of supported position and at end of unsupported position.
- Performance graded as Expert (36-40), Sharpshooter (30-35), Marksman (23-29), or Unqualified (0-22).

Standard
- Twenty-three hits out of 40 shots in both supported and unsupported positions. Refire of position if standard not met.

MACS FEEDBACK FOR BRM PROGRAM

LEVEL	SHOT-BY-SHOT DIAGNOSTIC FEEDBACK		ON-SCREEN FEEDBACK DURING SHOOTING						SUMMARY FOLLOWING SHOOTING SEQUENCE		
	Diagnostic feedback at end/replay of each shot.	Hit or miss in lower left corner of screen only.	Crack heard showing bullet entts.	Missile shape is larger than real.	Target disappears not hit within time limit.	Die or ammo in lower right corner of screen.	Penalty for not hitting down.	Shot group displayed on target per fire.	Average disappears on target on target per range.	Summary of hits, misses and no fires.	Qualification rating.
1	X	X						X			
2	X	X						X			
3		X						X	X		
4		X						X	X		
5		X	X	X		X	X		X	X	
6	X*	X	X	X	X	X	X		X	X	X
7	X**	X	X	X	X	X	X		X	X	X
8	X**	X	X	X	X	X	X		X	X	X
9	X**	X	X	X	X	X	X		X	X	X

*FOR MISSES ONLY
**FOR REFIRES ONLY

4-21

MACS BRM PROGRAM SUMMARY TABLE

LEVEL	TITLE	TIME LIMIT	POSITION	TARGET PRESENTATION	TARGET SEQUENCE	NUMBER OF TARGETS	STANDARDS
1	INTRODUCTION TO SUPPORTED POSITION	NONE	SUPPORTED	SINGLE	IN ORDER 50-100-150-200-250-300	18 (3 PER RANGE)	HIT 2 OF 3 TARGETS AT EACH DISTANCE
2	INTRODUCTION TO UNSUPPORTED POSITION	NONE	UNSUPPORTED	SINGLE	IN ORDER 50-100-150-200-250-300	18 (3 PER RANGE)	HIT 2 OF 3 TARGETS AT EACH DISTANCE
3	TIMED TARGETS: SUPPORTED POSITION	1 1/2 TIMES GREATER THAN TIME ALLOWED FOR RECORD FIRE	SUPPORTED	SINGLE	RANDOM	24 (4 PER RANGE)	HIT 3 OF 4 TARGETS AT EACH DISTANCE
4	TIMED TARGETS: UNSUPPORTED POSITION	1 1/2 TIMES GREATER THAN TIME ALLOWED FOR RECORD FIRE	UNSUPPORTED	SINGLE	RANDOM	24 (4 PER RANGE)	HIT 3 OF 4 TARGETS AT 50-100-150-200 HIT 2 OF 4 TARGETS AT 250-300
5	PRACTICE RECORD FIRE I	SAME AS RECORD FIRE	SUPPORTED/ UNSUPPORTED	SINGLE OR DOUBLE	RANDOM	40	HIT 16 OF 20 TARGETS IN EACH POSITION
6	PRACTICE RECORD FIRE II	SAME AS RECORD FIRE	SUPPORTED/ UNSUPPORTED	SINGLE OR DOUBLE	RANDOM	40	HIT 16 OF 20 TARGETS IN EACH POSITION
7	RECORD FIRE	SAME AS ACTUAL LIVE-FIRE QUALIFICATION COURSE	SUPPORTED/ UNSUPPORTED	SINGLE OR DOUBLE	RANDOM	40	HIT 16 OF 20 TARGETS IN EACH POSITION
8	RAPID RECORD FIRE	1/2 LESS THAN TIME ALLOWED FOR RECORD FIRE	SUPPORTED/ UNSUPPORTED	SINGLE OR DOUBLE	RANDOM	40	HIT 16 OF 20 TARGETS IN EACH POSITION
9	COMBAT FIRE	VARIES	SUPPORTED/ UNSUPPORTED	MULTIPLE	ATTACK/ RETREAT	80	HIT 32 OF 40 TARGETS IN EACH POSITION

DESCRIPTION OF THE MACS MENU

MACS MENU INSTRUCTIONS

The MACS Menu provides flexibility for the instructor using the MACS program. To access the MACS program menu from the Welcome screen or Levels 1-9, press the [ESC] key:

· Menu options may be selected from the keyboard using the numeric and function keys.
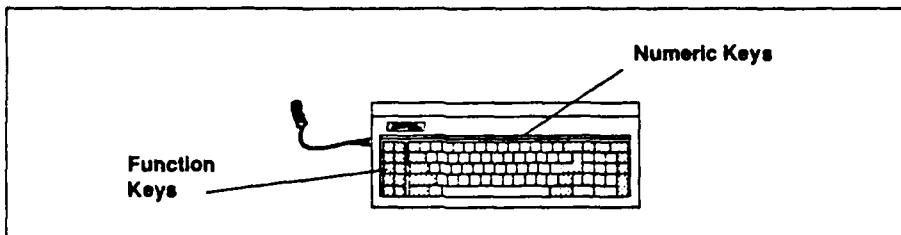

```
Start Level=1  Final Level=9                              Jan 90

1  Introduction/Supported Position
2  Introduction/Unsupported Position
3  Timed Targets/Supported Position
4  Timed Targets/Unsupported Position
5  Practice Record Fire I
6  Practice Record Fire II
7  Record Fire
8  Rapid Record Fire
9  Combat Fire

F1  Select Start/Final Level
F2  New Firer
F3  Turn ON "CALL YOUR SHOT" option
F4  Light pen alignment
F5  Sight alignment, aiming and grouping program
F6  Set Level 1 Targets for 250 meters (EZ)
F7  Set Wind speed and direction
F8  Begin Program

X  Exit to DOS

Select option:
```

LEVEL OPTION

· Permits instructor to set levels to be used in training before students arrive.

Select Option: (F1)

Press (1) - (9) **to select START Level** → (2)

Press (2) - (9) **to select FINAL Level** → (8)

Select Option: (F8)

NEW FIRER OPTION

· Program returns to ESTABLISH SHOT GROUP screen.
· Used when one firer has completed firing and a new firer takes over.

Select Option: (F2)

EZ OPTION

· Sets all targets in Level 1 to 250 m.
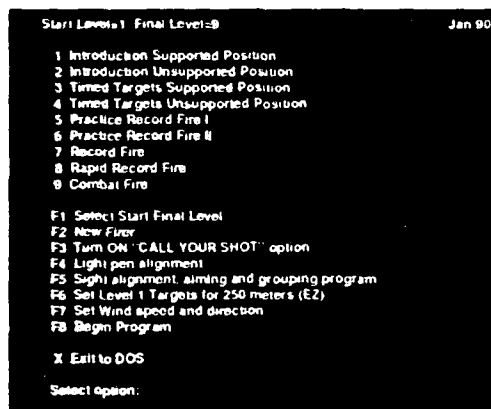
Select Option: (F6)

BEGIN PROGRAM

· MACS Welcome Screen appears.

Select Option: (F8)

EXIT TO DOS

· Program exits to main operating system.

Select Option: (X)
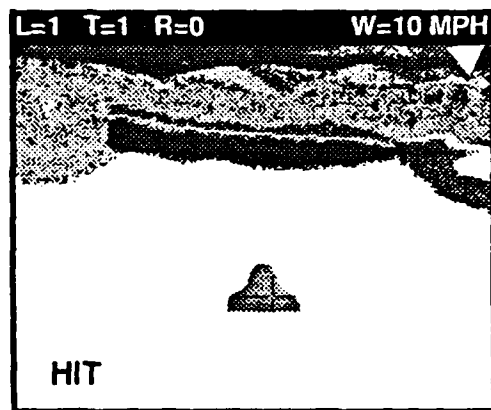
Start Level=1 Final Level=9   Jan 90

1 Introduction Supported Position
2 Introduction Unsupported Position
3 Timed Targets Supported Position
4 Timed Targets Unsupported Position
5 Practice Record Fire I
6 Practice Record Fire II
7 Record Fire
8 Rapid Record Fire
9 Combat Fire

F1 Select Start Final Level
F2 New Firer
F3 Turn ON "CALL YOUR SHOT" option
F4 Light pen alignment
F5 Sight alignment, aiming and grouping program
F6 Set Level 1 Targets for 250 meters (EZ)
F7 Set Wind speed and direction
F8 Begin Program

X Exit to DOS

Select option:

CALL YOUR SHOT

Enter: **F3**

NOTE: The "Call Your Shot" option works with Levels 1 and 2 only.

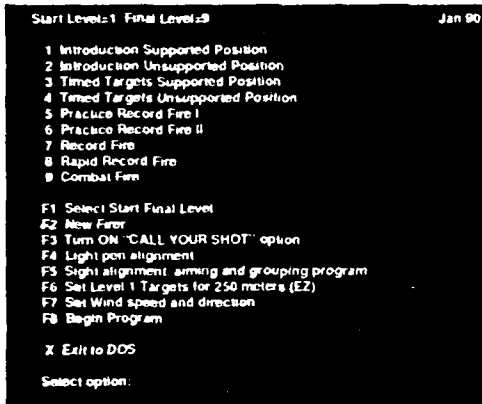

L=1 T=1 R=0   W=10 MPH
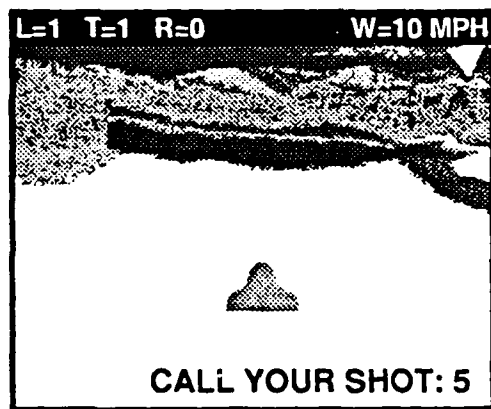
CALL YOUR SHOT: 5

CALL YOUR SHOT

· Firer has 5 seconds to call out shot location after the trigger is pulled.
· CALL YOUR SHOT appears on the bottom of the screen.

L=1 T=1 R=0   W=10 MPH

HIT

· When time expires cross hair appears on target showing shot location.

5-5

1 Introduction Supported Position
2 Introduction Unsupported Position
3 Timed Targets Supported Position
4 Timed Targets Unsupported Position
5 Practice Record Fire I
6 Practice Record Fire II
7 Record Fire
8 Rapid Record Fire
9 Combat Fire

F1 Select Start Final Level
F2 New Firer
F3 Turn ON "CALL YOUR SHOT" option
F4 Light pen alignment
F5 Sight alignment, aiming and grouping program
F6 Set Level 1 Targets for 250 meters (EZ)
F7 Set Wind speed and direction
F8 Begin Program

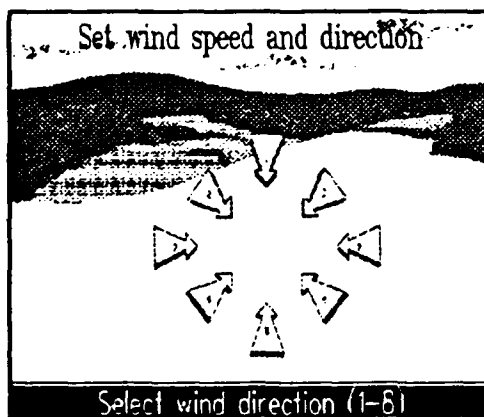X Exit to DOS

Select option:

SET WIND SPEED AND DIRECTION

· Enter **F7** to select wind option.
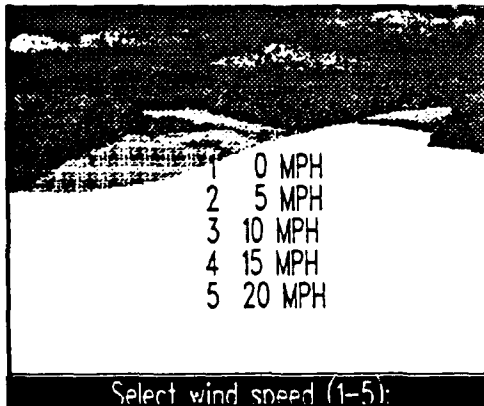
WIND EFFECTS

· Enter **1** to **5**

to select wind speed.

NOTE: There is no wind effect at 0 mph.

```
1   0 MPH
2   5 MPH
3  10 MPH
4  15 MPH
5  20 MPH
```

Select wind speed (1-5):

Set wind speed and direction

Select wind direction (1-8)
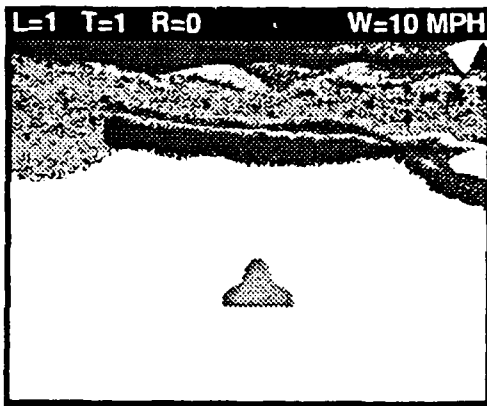
WIND DIRECTION

· Enter **1** to **8**

to select wind direction.

WIND

· The correct offset is illustrated for targets at three distances.
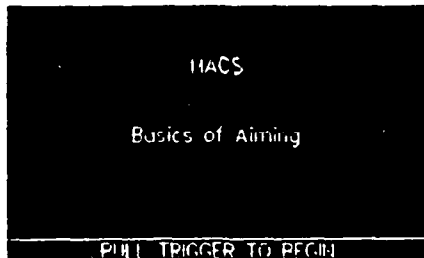· The offset changes with each wind effect.

NOTE: Wind speed and direction will remain in effect unless program is restarted, or new wind speed and direction are entered using the menu.


TARGET SCREEN

· Wind speed and direction are shown in upper right-hand corner of screen.

SIGHT ALIGNMENT, AIMING AND GROUPING

HACS

Basics of Aiming

PULL TRIGGER TO BEGIN

Correct Application of
Sight Alignment
and
Aiming
Improves Marksmanship Skills

PULL TRIGGER TO CONTINUE

HACS

Sight Alignment
and
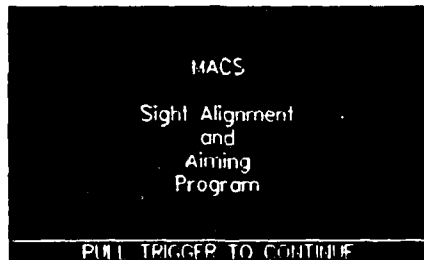Aiming
Program

PULL TRIGGER TO CONTINUE

· Enter [**F5**] to begin program.

· The sight alignment, aiming, and shot grouping program is designed to teach and test the basic skills of sight alignment, aiming, and shot grouping to the novice marksman.
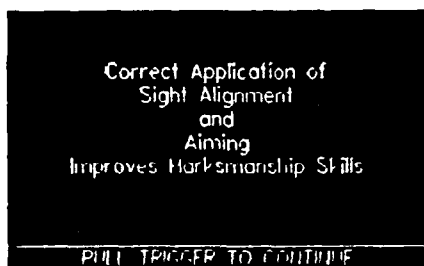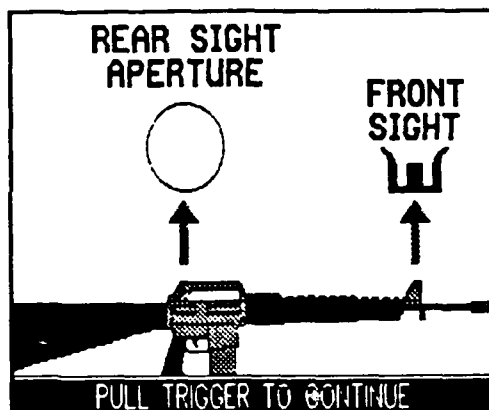
· The sight alignment, aiming, and shot grouping program has three parts:

1. Sight alignment program.
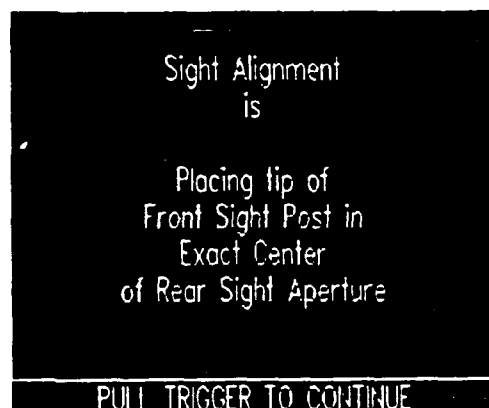2. Aiming program.
3. Grouping program.

LOCATION OF SIGHTS

· Front sight.
· Rear sight aperture.

REAR SIGHT APERTURE

FRONT SIGHT

PULL TRIGGER TO CONTINUE

DEFINITION OF SIGHT ALIGNMENT

Sight Alignment
is

Placing tip of
Front Sight Post in
Exact Center
of Rear Sight Aperture

PULL TRIGGER TO CONTINUE

DEMONSTRATION OF SIGHT ALIGNMENT

Demonstration of Sight Alignment PULL TRIGGER TO BEGIN	**SIGHT ALIGNMENT** **Part 1:** · Tip of front sight post is placed in center of rear sight aperture.
Demonstration of Sight Alignment PULL TRIGGER TO CONTINUE	**Part 2:** · Center of rear sight aperture is designated by the red cross.
Demonstration of Sight Alignment PULL TRIGGER TO CONTINUE	**Part 3:** · Complete demonstration screen. · Sequence returns to Part 1 unless trigger is pulled.

SIGHT ALIGNMENT TEST

TEST INFORMATION SCREEN

· Tests ability to identify correct sight alignment.
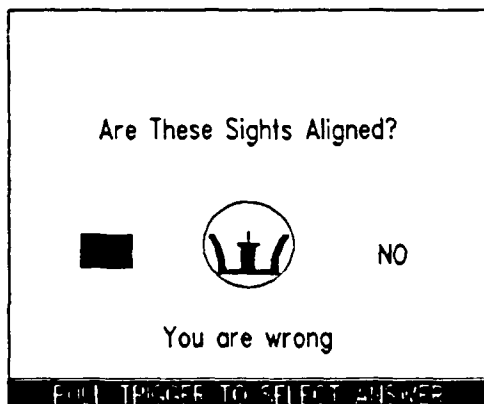· Must correctly identify three sight pictures in a row to pass test.

TEST SCREEN

· Front and rear sights pictured.
· YES and NO alternately appear in large black type.
· Select answer by pulling trigger when choice appears in large (black) type.

SIGHT ALIGNMENT TEST FEEDBACK SCREENS

Are These Sights Aligned?

NO

You are wrong

FULL TRIGGER TO SELECT ANSWER

INCORRECT RESPONSE FEEDBACK

- Red cross designates correct placement of front sight in rear aperture.
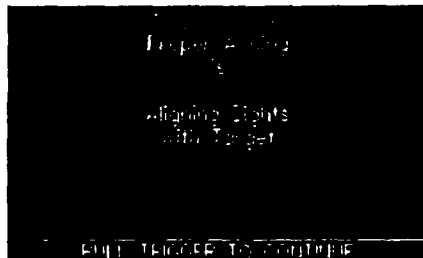- Error is described.

Are These Sights Aligned?

NO

This is Correct
Sight Alignment

FULL TRIGGER TO CONTINUE
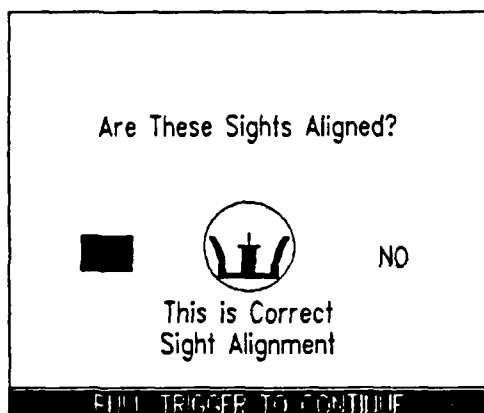
EXAMPLE

- Red cross designates correct placement of front sight in rear aperture.
- Error is described.

Are These Sights Aligned?

YES

You are correct

FULL TRIGGER TO CONTINUE

CORRECT RESPONSE FEEDBACK

- You are correct.

5-12
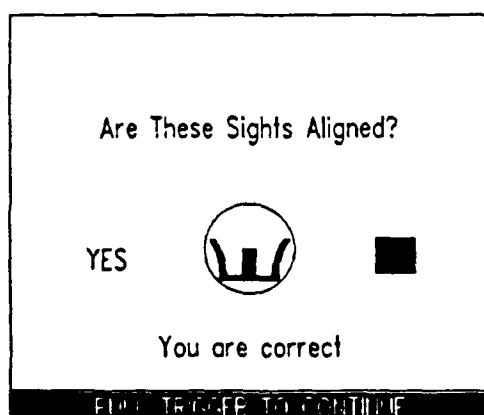
AIMING PROGRAM

Definition

· Proper aiming is aligning sights with target.

FULL TRIGGER TO CONTINUE

DEMONSTRATION OF AIMING

Demonstration of
Proper Aiming

✦

250 meter Target

EXPLANATION

Part 1:
· Cross hairs designate center of
  mass of target.

Demonstration of
Proper Aiming

250 meter Target

Part 2:
· Correct sight alignment is placed at
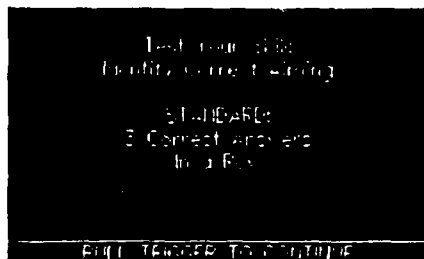 center of mass.

Demonstration of
Proper Aiming

250 meter Target
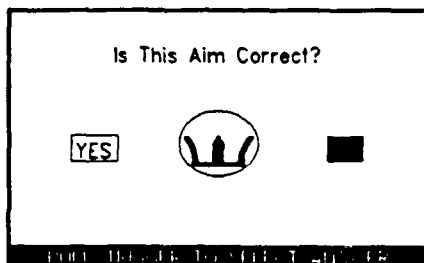
Part 3:
· Cross hairs are removed.
· Correct sight alignment shown at
  center of mass.
· Sequence returns to Part 1 unless
  trigger is pulled.
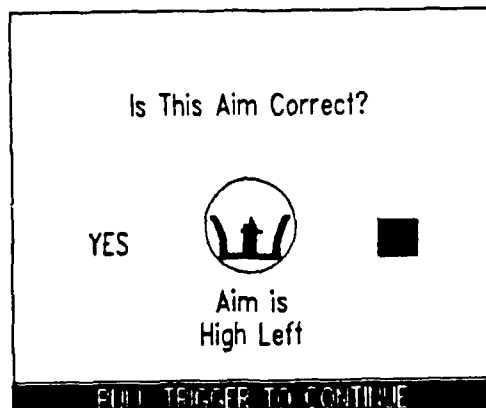
AIMING TEST

AIMING SKILL TEST

· Tests ability to identify correct sight picture.
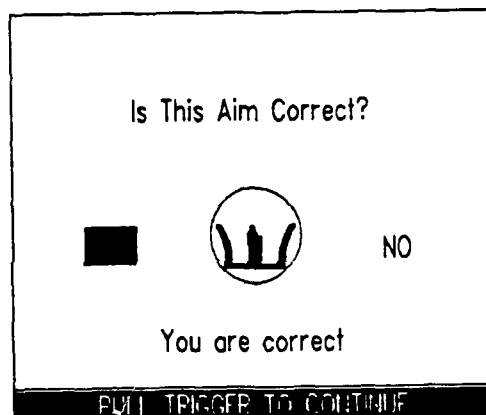· Must correctly identify three sight pictures in a row to pass test.

TEST SCREEN

· YES and NO alternately appear in large black type.
· Select answer by pulling trigger when choice appears in large black type.

Is This Aim Correct?

YES

AIMING TEST FEEDBACK SCREENS

```
Is This Aim Correct?

YES      (crown)    ■

         Aim is
         High Left

FULL TRIGGER TO CONTINUE
```

INCORRECT RESPONSE FEEDBACK

· Red cross designates center of mass of the target.
· Error is described.

```
Is This Aim Correct?

■      (crown)      NO

      You are correct

PULL TRIGGER TO CONTINUE
```

CORRECT RESPONSE FEEDBACK

· You are correct.

```
Very good!

Standards met

Now Try These...

FULL TRIGGER TO CONTINUE
```

AFTER THREE CORRECT RESPONSES IN A ROW:

· Next set of screens tests ability to identify correct sight alignment and sight picture.

ADVANCED AIMING TEST

Is This Aim Correct?

YES (sight picture) ■

ADVANCED AIMING
SKILL TEST

- Tests ability to identify correct sight alignment and sight picture.
- YES and NO alternately appear in large black type.
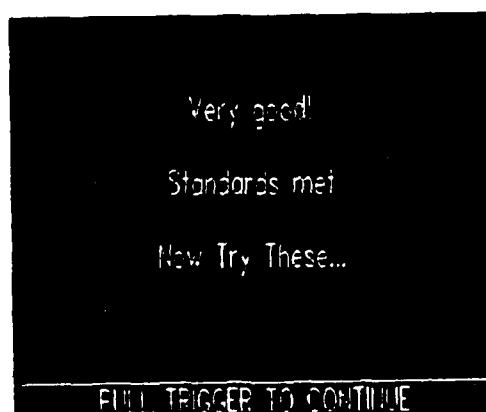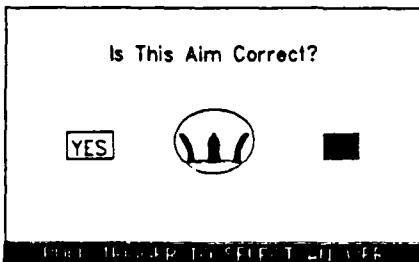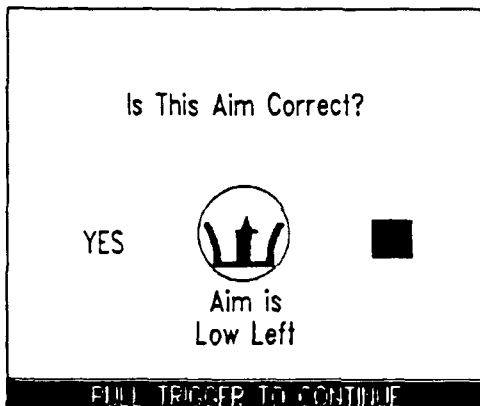- Select answer by pulling trigger when choice appears in large black type.
- Must correctly identify three in a row to exit test.

Is This Aim Correct?

YES (sight picture) ■

Aim is
Low Left

FULL TRIGGER TO CONTINUE

ADVANCED AIMING TEST
FEEDBACK SCREENS

INCORRECT RESPONSE
FEEDBACK

- Red cross designates center of mass of the target.
- Error is described.

Is This Aim Correct?

■ (sight picture) NO

You are correct

FULL TRIGGER TO CONTINUE
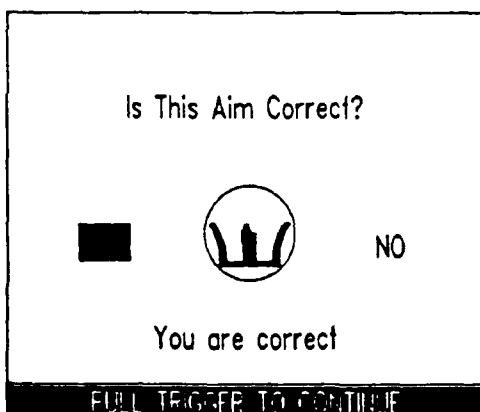
CORRECT RESPONSE
FEEDBACK
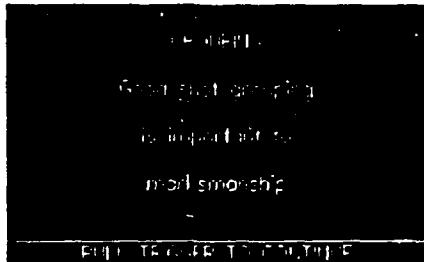
- You are correct.
- Front and rear sights are aligned correctly.
- Front sight is placed on center of mass of target.

5-16

Very good!

Sight Alignment and

Aiming Program Completed

PULL TRIGGER TO CONTINUE

AFTER THREE CORRECT RESPONSES IN A ROW:

· End of Aiming Program.

GROUPING PROGRAM

STATEMENT OF IMPORTANCE

· Tight shot groups indicate correct
application of the four fundamentals
of marksmanship.
- · Steady position
- · Aiming
- · Breath control
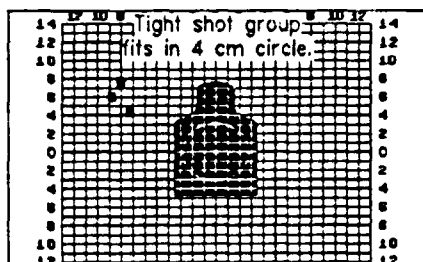- · Trigger squeeze

ILLUSTRATION OF SHOT GROUPS

TIGHT SHOT GROUP
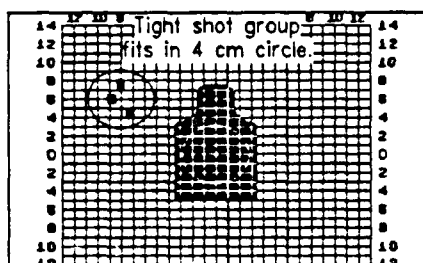
· Shots fit in 4 cm circle.

LARGE SHOT GROUP

· Shots do not fit in 4 cm circle.

TIGHT SHOT GROUP

Tight shot group fits in 4 cm circle.

Part 1:
· 3 shots hit close together.

Tight shot group fits in 4 cm circle.

Part 2:
· Circle appears around shot group.

Tight shot group fits in 4 cm circle.
PULL TRIGGER TO CONTINUE
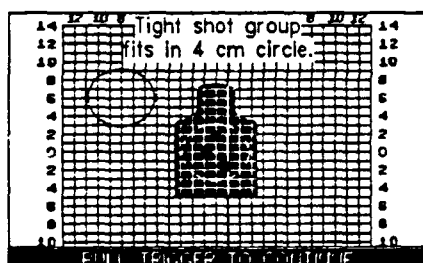
Part3:
· Shot group moves to center of target.

TWO SHOT GROUP

If only 2 shots can be seen fire another shot group.
PULL TRIGGER TO CONTINUE
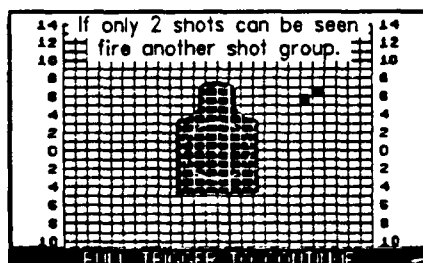
· One shot missed target.
· Fire another shot group.

GROUPING PROGRAM TEST
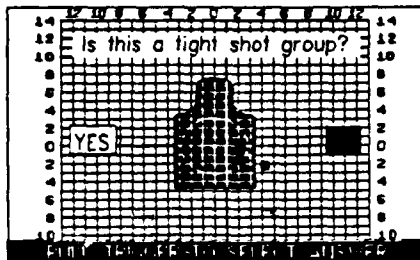
SHOT GROUP SKILL TEST

· Tests recognition of tight shot group.
· YES & NO alternately appear in large black type.
· Select answer by pulling trigger when choice appears in large black type.
· Must correctly identify three in a row to pass test.
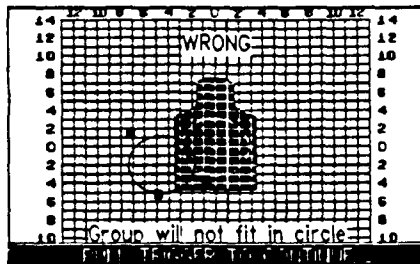
INCORRECT RESPONSE

· Scaled 4 cm circle moves to middle of shot group.
· Error is described.
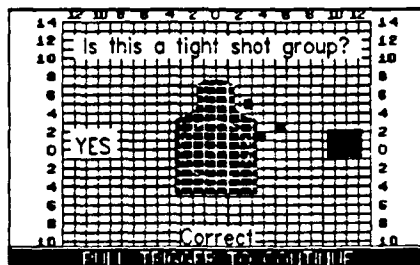
CORRECT RESPONSE

· You are correct.

5-20
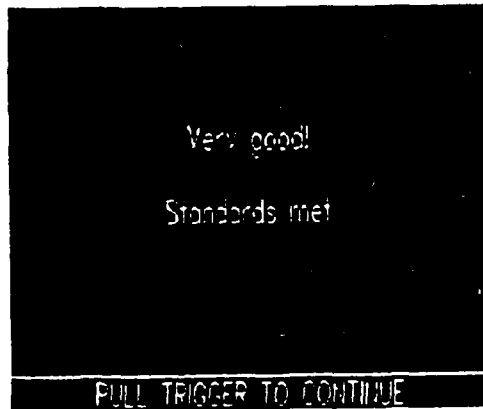
AFTER THREE CORRECT RESPONSES IN A ROW

· Standards met.

```
Very good!

Standards met

PULL TRIGGER TO CONTINUE
```
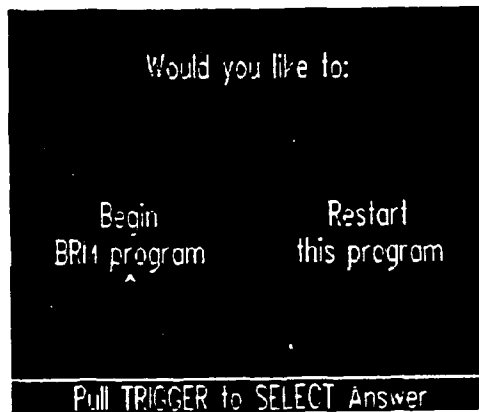
END OF PROGRAM

· Select choice by pulling trigger when arrow points to desired response.

```
Would you like to:


Begin            Restart
BRM program      this program
    ^

Pull TRIGGER to SELECT Answer
```

TROUBLESHOOTING

SPECIAL FUNCTIONS

CTRL-ALT-DEL	Reboots system when it locks up
BACKSPACE	Corrects typing errors
RETURN or ENTER	Begins processing after command is entered
SHIP or PARK	Places heads of hard disk over non-vital area of the disk to protect surface when moving system

HARDWARE PROBLEMS

CONDITION	POSSIBLE CAUSE
Computer does not come on - no beep, no fan noise.	· Power cord not plugged into computer or AC power source · Computer power switch in off position · Surge protector not turned on · Electrical current not reaching wall outlet
Computer beeps and fan comes on but does not boot properly	· Defective battery inside computer
Monitor screen is blank	· Monitor power cord not plugged into monitor or AC power source · Monitor power switch not turned on · Surge protector not turned on · Monitor not connected to EGA card · EGA card improperly installed in expansion slot · Computer is not turned on · Defective monitor
Monitor does not display what has been typed on the keyboard	Keyboard not plugged into computer · Monitor not connected to EGA card · EGA card improperly installed in expansion slot · Monitor power switch not turned on · Key is stuck and needs to be released · Computer not turned on
Monitor displays graphics correctly, but color is poor	· Brightness setting needs adjustment · Contrast setting needs adjustment · Tint or color setting needs adjustment

HARDWARE PROBLEMS

CONDITION	POSSIBLE CAUSE
Monitor display is distorted	· Vertical hold needs adjustment · Horizontal hold needs adjustment · Monitor cable loosely plugged in
Monitor does not display graphics, although text is properly displayed	· Vertical hold needs adjustment · Horizontal hold needs adjustment
Light pen does not work	· M16 rifle not plugged into light pen cable · Light pen cable not plugged into light pen · Light pen card incorrectly installed in expansion slot · Light pen incorrect distance from monitor screen (should be 7'6") · Brightness or contrast settings too high or too low

6-5

SOFTWARE ERROR MESSAGES

CONDITION	POSSIBLE CAUSE
Non-system disk or disk error. Replace and strike key when ready	· Non-system floppy disk inserted into Drive A or Drive B when computer is turned on
Insufficient disk space	· There is not enough memory on the hard disk to run the program
Insufficient memory	· There is not enough memory (RAM) to load the program
File not found	· MACS program not installed correctly on hard disk · Incorrect command entered to access program

SOFTWARE INSTALLATION ERROR MESSAGES

MESSAGE	POSSIBLE CAUSE

>>> HI-RES LIGHT PEN BOARD INTERRUPT not found. <<<
 >>> driver not installed.<<<
 	
 PXL-380 light pen card not found or improperly installed.
 	
 Consult Trainer's Guide for instructions.
 	
 C:\MACS>
	· Light pen board is not installed
	 · Light pen board is incorrectly installed
	 · Light pen board is defective
	 · Light pen board not connected to graphics board
	 · 6-position connector on monitor interface cable is plugged into upper, rather than lower, port on light pen board
	 · Refer to ASSEMBLY INSTRUCTIONS FOR MACS PC VERSION (section 2 of this manual) for instructions on installing the light pen board

MACS requires an EGA graphics card to operate properly. Please consult Trainer's Guide for instructions.	· EGA graphics board is not installed · EGA graphics board is incorrectly installed · EGA graphics board is defective · Monitor cable is not connected to the monitor interface cable · Monitor interface cable is not connected to the EGA board · Refer to ASSEMBLY INSTRUCTIONS FOR MACS PC VERSION (section 2 of this manual) for further information regarding MACS system cable attachment

LIGHT PEN
ALIGNMENT

NOTE:

The MACS system light pen occasionally may need to be realigned. The only tool needed is an allen wrench (9/64" for demilitarized rifle or 7/64" for M16 replica rifle).

Older MACS systems have an adjustable focal ring on the light pen. An incorrect gap is the most frequent and easily corrected problem if the light pen is not reading the computer screen (detected by a purple border). On these systems, always check to ensure the gap between the focal ring and light pen barrel is approximately 5/8", before attempting to adjust the light pen mount.
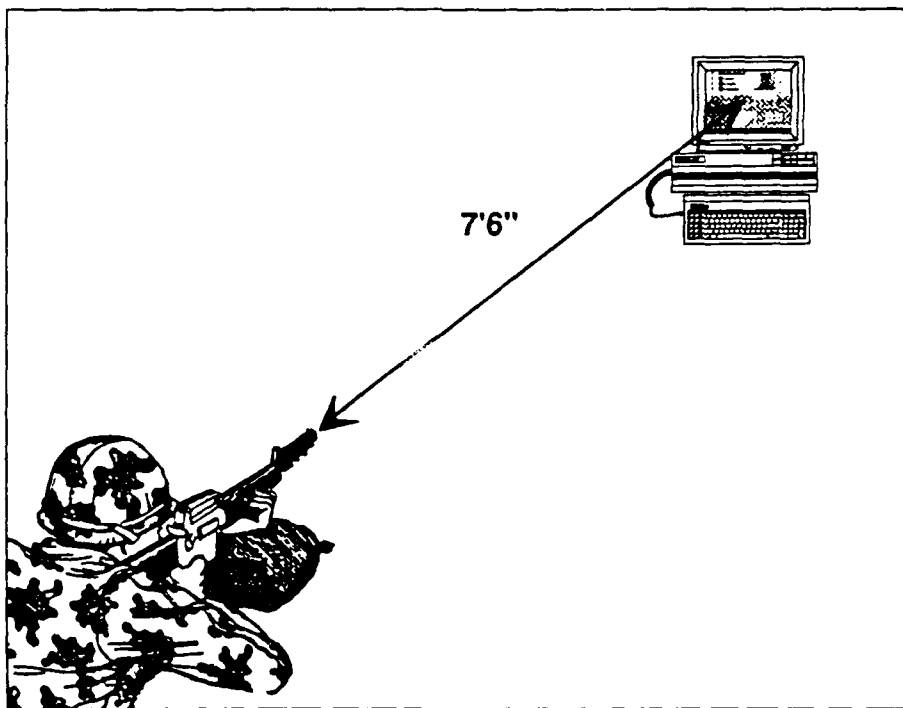
Detailed instructions for adjusting the light pen mount are provided in this section.

ALIGNMENT OF LIGHT PEN (M16 REPLICA RIFLE)
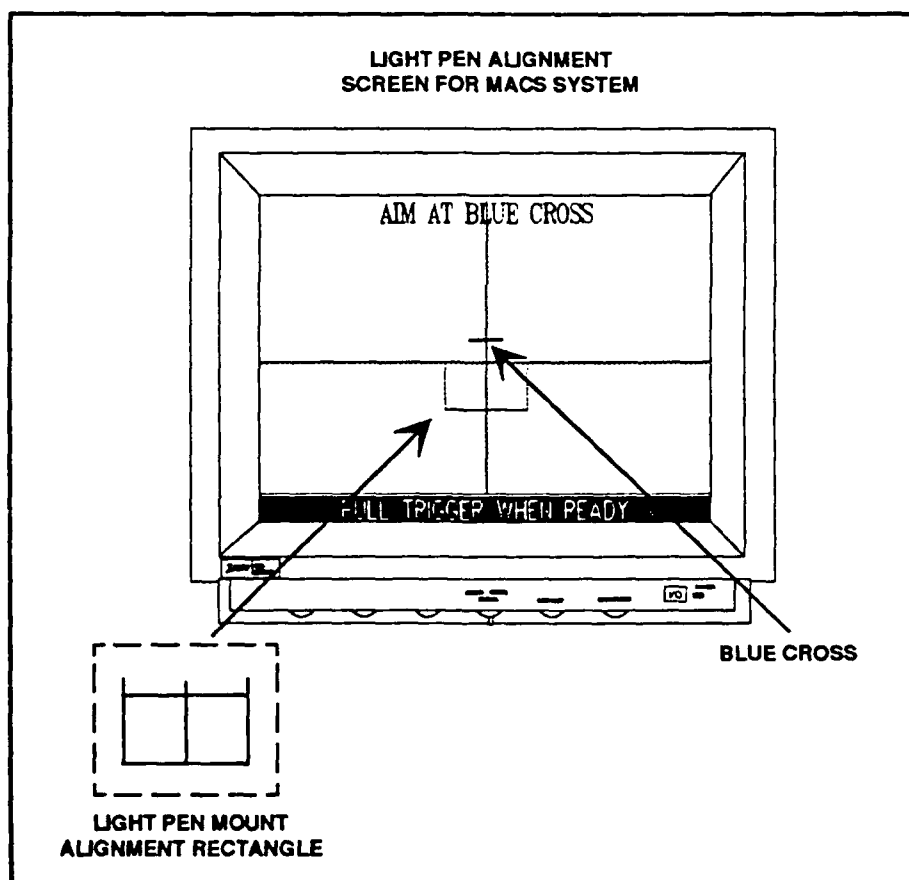
NOTE:

BEFORE PROCEEDING WITH ALIGNMENT OF LIGHT PEN

- Place rifle 7'6" from screen.
- Turn on computer.
- At the C:\> type cd MACS and press the <ENTER> key.
- After the computer answers C:\MACS> type MACS and press the <ENTER> key.
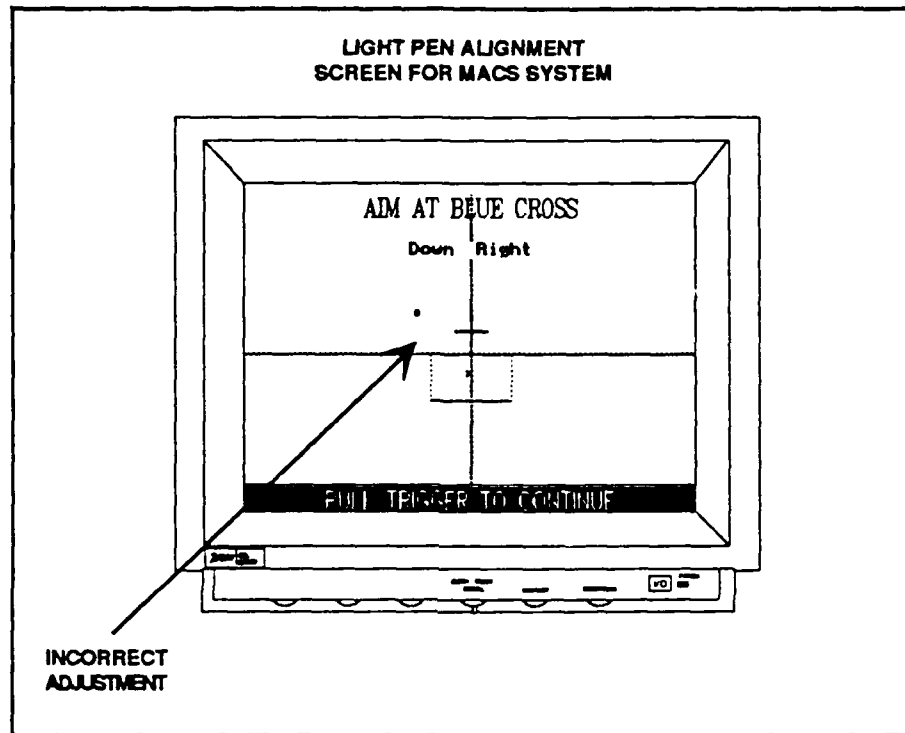- The MACS Welcome Screen will appear.

7'6"

STEP 1 CHECK ALIGNMENT OF THE LIGHT PEN

- · Press [ESC] to enter MACS menu.

- · Press [F4] to start light pen alignment program.

- · Aim at center of blue cross and pull trigger.
- · **While holding rifle steady look over sight.**
    - · If light pen alignment is correct, **O.K.** will appear
      on the screen and black dot will appear in rectangle.
- · Go to **STEP 3.**

**LIGHT PEN ALIGNMENT
SCREEN FOR MACS SYSTEM**

AIM AT BLUE CROSS

PULL TRIGGER WHEN READY

BLUE CROSS

**LIGHT PEN MOUNT
ALIGNMENT RECTANGLE**

7-4

IF BLACK DOT IS NOT IN ALIGNMENT RECTANGLE AND O.K. DOES NOT APPEAR LIGHT PEN MOUNT NEEDS ADJUSTMENT. GO TO STEP 2.

LIGHT PEN ALIGNMENT
SCREEN FOR MACS SYSTEM

AIM AT BLUE CROSS

Down   Right

PULL TRIGGER TO CONTINUE

INCORRECT
ADJUSTMENT

STEP 2 ADJUST THE LIGHT PEN

LIGHT PEN ADJUSTMENT IS REQUIRED ONLY IF THE BLACK DOT DOES NOT APPEAR WITHIN THE ALIGNMENT RECTANGLE WHEN RIFLE IS AIMED AT CENTER OF BLUE CROSS.

NOTE:

For light pen adjustment two people are recommended unless a vise is available to hold rifle securely.

- Holding rifle securely, aim rifle at center of blue cross.
- Adjust light pen mount to move black dot into rectangle and **O.K.** appears.
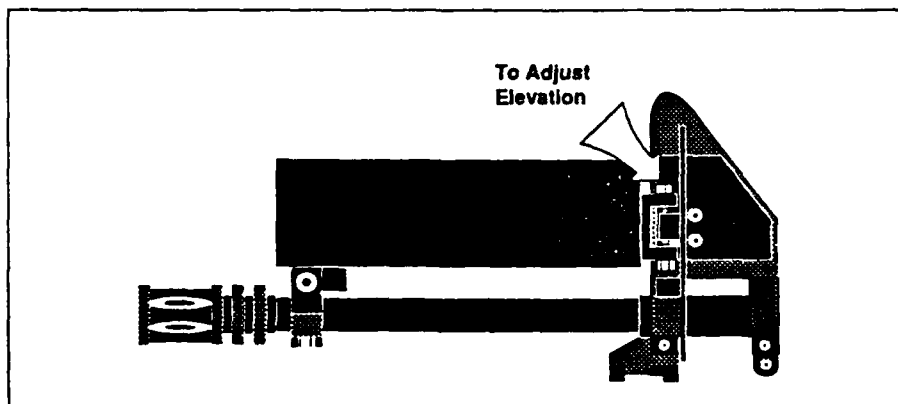
STEP 2 ADJUST THE LIGHT PEN (continued)

To Adjust Windage:

- TIGHTEN screw to move cursor to the LEFT
- LOOSEN screw to move cursor to the RIGHT
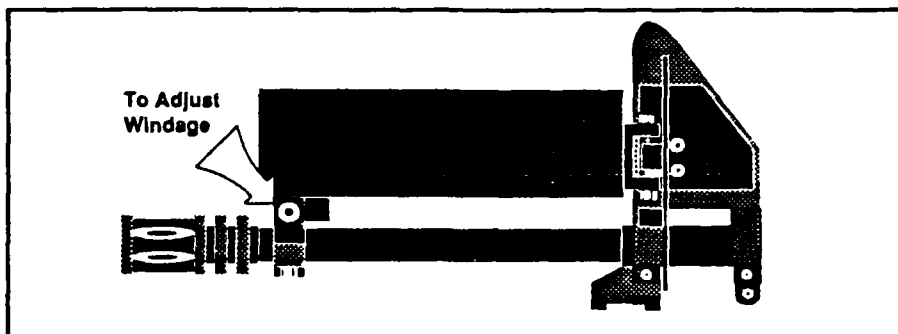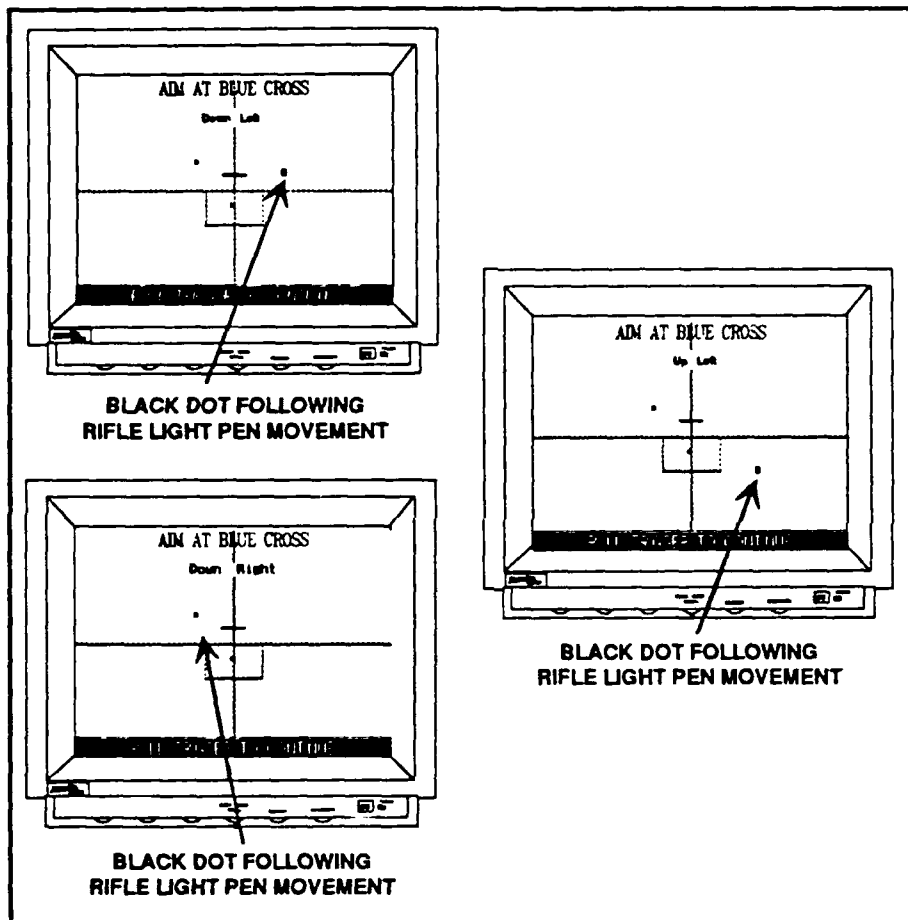
To Adjust
Windage

To Adjust Elevation:

- TIGHTEN screw to move cursor to the UP.
- LOOSEN screw to move cursor to the DOWN.
- Use 7/64" allen wrench to make adjustments.

To Adjust
Elevation

STEP 3 PERFORM THE LIGHT PEN TRACKING TEST

· Look over the rifle sights at the monitor screen.
· Aim rifle toward different points on screen.

**BLACK DOT FOLLOWING
RIFLE LIGHT PEN MOVEMENT**

**BLACK DOT FOLLOWING
RIFLE LIGHT PEN MOVEMENT**

**BLACK DOT FOLLOWING
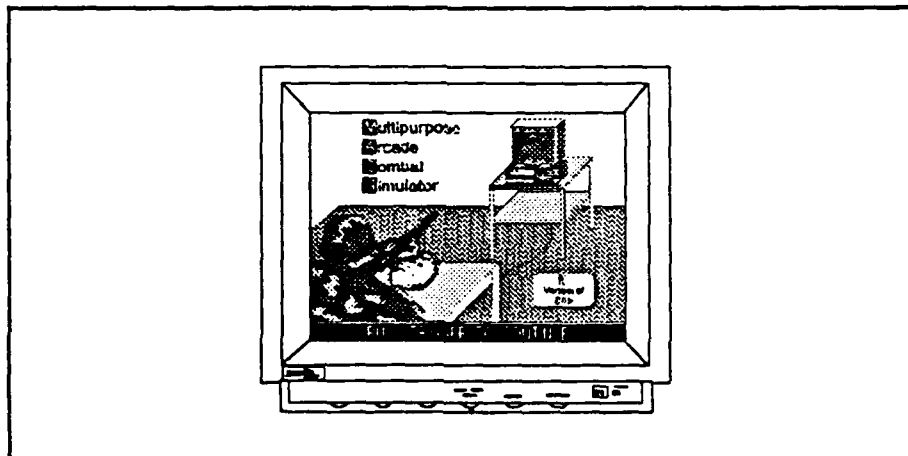RIFLE LIGHT PEN MOVEMENT**

**IF BLACK DOT SMOOTHLY FOLLOWS MOVEMENT OF RIFLE,
LIGHT PEN ALIGNMENT PROCEDURE IS COMPLETE!
OTHERWISE, RETURN TO STEP 2.**

LIGHT PEN ALIGNMENT IS CORRECT WHEN:
- O.K. APPEARS ON SCREEN
- BLACK DOT APPEARS IN RECTANGLE

AIM AT BLUE CROSS

CORRECT
ADJUSTMENT
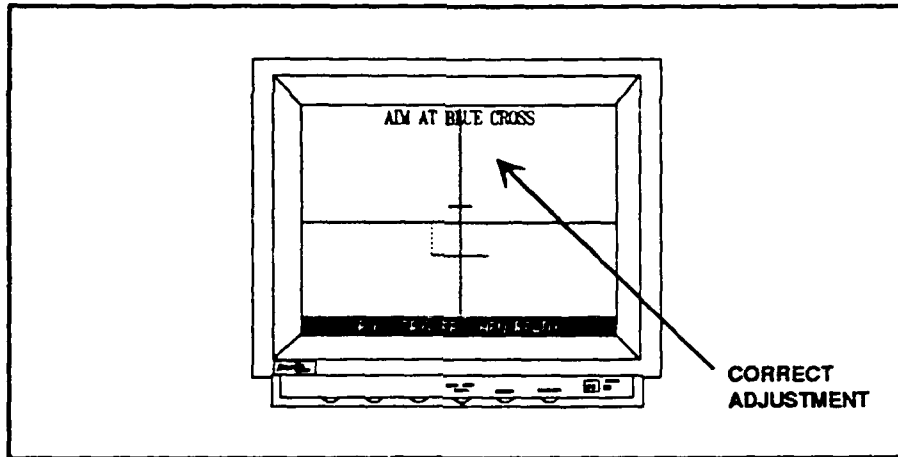
PULL TRIGGER TO RETURN TO MACS WELCOME SCREEN

Multipurpose
Arcade
Combat
Simulator

7-9

REFERENCES

REFERENCES

Broom, J. M., Champion, D. F., Greene, W. H., Martere, R. F., Purvis, J. W. ,& Sills, E. G. (1989). Multipurpose arcade combat simulator (MACS) basic rifle marksmanship (BRM) program. (ARI Research Product 90-01). Alexandria, VA: U. S. Army Research Institute for the Behavioral and Social Sciences.

This research report provides a more detailed discussion of the rationale behind the instructional design, standards, and feedback contained in the MACS BRM program.

Available from the Defense Technical Information Center order number AD-A 214 459.

Evans, K. L. (1988). Development and evaluation of the multipurpose arcade combat simulator: A research summary (ARI Research Report 1488). Alexandria, VA: U. S. Army Research Institute for the Behavioral and Social Sciences.

Available from the Defense Technical Information Center order number AD-B 130 099.

This research report summarizes the results of over 20 developmental hardware tests, training and cost effectiveness evaluations, and informal field investigations conducted since 1982. Benefits associated with MACS training used in conjunction with standard training appear to be increased performance, fewer failures to meet performance standards, significantly lower expenditures of ammunition, improved performance feedback, and greater soldier interest.

Purvis, J. W. & Wiley, E. W. (1989). Trainer's Guide: Multipurpose Arcade Combat Simulator (MACS) Basic Rifle Marksmanship (M16 Rifle). (ARI Research Product 90-03). Alexandria, VA: U. S. Army Research Institute for the Behavioral and Social Sciences. AD-A 217 593

This research product presents information on system assembly and troubleshooting the Commodore version of the MACS system. A comprehensive overview of the MACS Basic Rifle Marksmanship (BRM) program is presented, as well as descriptions of each of the nine levels of difficulty and the types of feedback presented at each level. A pictorial display of many of the program screens accompanied by short narratives is presented to aid the instructor in learning the many features of the MACS BRM program.

REFERENCES

To obtain copies of U. S. Army Research Institute Research Reports and
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