



National  
Defence

Défense  
nationale

B-GL-385-015/PT-001

**LAND FORCE**

**INFANTRY**

# **INSTRUMENTS FOR CALCULATING MORTAR FIRING DATA**

**(ENGLISH)**

**(Supersedes B-GL-317-009/PT-Z01, 1989-10-13)**

**WARNING**

ALTHOUGH NOT CLASSIFIED, THIS PUBLICATION, OR ANY PART OF IT, MAY BE EXEMPT FROM DISCLOSURE TO THE PUBLIC UNDER THE ACCESS TO INFORMATION ACT. ALL ELEMENTS OF INFORMATION CONTAINED HEREIN MUST BE CLOSELY SCRUTINIZED TO ASCERTAIN WHETHER OR NOT THE PUBLICATION OR ANY PART OF IT MAY BE RELEASED.

**Issued on the Authority of the Chief of the Land Staff**

**Canada**





National Défense  
Defence nationale

B-GL-385-015/PT-001

**LAND FORCE**

**INFANTRY**

# **INSTRUMENTS FOR CALCULATING MORTAR FIRING DATA**

**(ENGLISH)**

**(Supersedes B-GL-317-009/PT-Z01, 1989-10-13)**

**WARNING**

ALTHOUGH NOT CLASSIFIED, THIS PUBLICATION, OR ANY PART OF IT, MAY BE EXEMPT FROM DISCLOSURE TO THE PUBLIC UNDER THE ACCESS TO INFORMATION ACT. ALL ELEMENTS OF INFORMATION CONTAINED HEREIN MUST BE CLOSELY SCRUTINIZED TO ASCERTAIN WHETHER OR NOT THE PUBLICATION OR ANY PART OF IT MAY BE RELEASED.

**Issued on the Authority of the Chief of the Land Staff**

**OPI: DAD 4-2**

**2001-10-30**

**Canada**



**FOREWORD**

1. B-GL-385-015/PT-001 *Instruments for Calculating Mortar Firing Data* is issued on the authority of the Chief of Land Staff.
2. B-GL-385-015/PT-001 *Instruments for Calculating Mortar Firing Data* is effective upon receipt. B-GL-385-015/PT-001 *Instruments for Calculating Mortar Firing Data* supercedes B-GL-317-009/PT-Z01 dated Oct 89.
3. The French version of this publication is B-GL-385-015/PT-002 *Instruments pour calculer les données de tir des mortiers*.
4. Comments and suggestions for changes may be forwarded through the usual channels to Land Forces Doctrine and Training System, Directorate of Army Doctrine, Attention DAD 4-2.
5. Unless otherwise noted, masculine pronouns appearing herein refer to both genders.

**© 2001 MDN Canada**



## PREFACE

### AIM

1. This publication has been issued for personnel who use and teach the use of the plotter and the Mortar Fire Data Calculator (MFDC).

### SCOPE

2. The purpose of this publication is to combine parts of the following two publications:

- a. B-GL-317-009/PT-000 *The Mortar in Battle*; and
- b. B-GL-317-009/PT-Z01 *Mortar Computers*.

### FORMAT

3. The content is given in the form of lesson plans to facilitate training and to ensure standard procedures for using instruments. Thus, units shall not alter or change procedures set out in this publication. Further, all instructors shall master the contents of the lessons and familiarise themselves with the instruments.

### SAFETY

4. The mortar and ammunition used can cause death or serious injuries to soldiers. It is important, therefore, that methods described in this publication always be applied exactly as given.

5. For safe use of the plotter, refer also to B-GL-304-003/TS-001 *Operational Training, Volume 3, Ranges and Training Safety*.





**TABLE OF CONTENTS**

**FOREWORD**..... I

**PREFACE**

    Aim..... iii

    Scope..... iii

    Format..... iii

    Safety..... iii

**CHAPTER 1 MORTAR FIRE DATA CALCULATOR**

**LESSON 1 COMPONENTS OF THE MORTAR FIRE DATA CALCULATOR**

        Enabling Objective ..... 1

        Main Teaching Points..... 1

        Preparation..... 1

        Conduct of the Lesson ..... 2

        Conclusion..... 13

**LESSON 2 THE MORTAR FIRE DATA CALCULATOR PROGRAM**

        Enabling Objective ..... 14

        Main Teaching Points..... 14

        Preparation..... 14

        Conduct of the Lesson..... 15

        Conclusion..... 23

**LESSON 3 PREPARE THE MORTAR FIRE DATA CALCULATOR FOR FIRING**

        Enabling Objective ..... 24

        Main Teaching Points..... 24

        Preparation..... 24

        Conduct of the Lesson..... 25

        Conclusion..... 29

**LESSON 4 PRODUCE FIRE DATA FOR A SIMPLE FIRE MISSION**

Enabling Objective ..... 30  
Main Teaching Points..... 30  
Preparation..... 30  
Conduct of the Lesson..... 31  
Conclusion..... 39

**LESSON 5 PREPARING THE MORTAR FIRE DATA CALCULATOR FOR SAFETY**

Enabling Objective ..... 40  
Main Teaching Points..... 40  
Preparation..... 40  
Conduct of the Lesson..... 41  
Conclusion..... 50

**LESSON 6 CHANGE PROCEDURES I AND II**

Enabling Objective ..... 51  
Main Teaching Points..... 51  
Preparation..... 51  
Conduct of the Lesson..... 52  
Conclusion..... 62

**LESSON 7 CANCELLATION PROCEDURES AND ADJUSTING AN ERRING MORTAR**

Enabling Objective ..... 63  
Main Teaching Points..... 63  
Preparation..... 63  
Conduct of the Lesson..... 64  
Conclusion..... 67

LESSON 8	PRODUCE FIRE CONTROL DATA WITH THE MORTAR FIRE DATA CALCULATOR (MFDC)	
	Enabling Objective .....	68
	Main Teaching Points .....	68
	Preparation .....	68
	Conduct of the Lesson .....	69
	Conclusion .....	73
LESSON 9	PRODUCE POLAR FIRE MISSION DATA	
	Enabling Objective .....	74
	Main Teaching Points .....	74
	Preparation .....	74
	Conduct of the Lesson .....	75
	Conclusion .....	79
LESSON 10	ILLUMINATION AND CO-ORDINATED ILLUMINATION	
	Enabling Objective .....	80
	Main Teaching Points .....	80
	Preparation .....	80
	Conduct of the Lesson .....	81
	Conclusion .....	91
LESSON 11	REGISTER TARGETS AND OBSERVATION POSTS	
	Enabling Objective .....	92
	Main Teaching Points .....	92
	Preparation .....	92
	Conduct of the Lesson .....	93
	Conclusion .....	100
LESSON 12	ADJUST A GROUP OF TARGETS	
	Enabling Objective .....	101

Main Teaching Points.....	101
Preparation.....	101
Conduct of the Lesson.....	102
Conclusion.....	107
LESSON 13 LINEAR HE	
Enabling Objective.....	108
Main Teaching Points.....	108
Preparation.....	108
Conduct of the Lesson.....	109
Conclusion.....	115
LESSON 14 LINEAR SMOKE FIRE MISSIONS	
Enabling Objective.....	116
Main Teaching Points.....	116
Preparation.....	116
Conduct of the Lesson.....	117
Conclusion.....	120
LESSON 15 PRODUCE PLATOON LINEAR FIRE DATA WITH HE OR SMOKE	
Enabling Objective.....	121
Main Teaching Points.....	121
Preparation.....	121
Conduct of the Lesson.....	122
Conclusion.....	128
LESSON 16 RECORDING AND EXTRACTING DATA USING THE CARD READER	
Enabling Objective.....	129
Main Teaching Points.....	129
Preparation.....	129
Conduct of the Lesson.....	130

Conclusion .....	137
<b>LESSON 17 ENTER METEOROLOGICAL MESSAGES</b>	
Enabling Objective .....	138
Main Teaching Points .....	138
Preparation.....	138
Conduct of the Lesson .....	139
Conclusion.....	147
<b>LESSON 18 PRODUCE SURVEY DATA WITH THE MORTAR FIRE DATA CALCULATOR</b>	
Enabling Objective .....	148
Main Teaching Points .....	148
Preparation.....	148
Conduct of the Lesson .....	148
Conclusion.....	151
<b>CHAPTER 2 PLOTTER</b>	
<b>LESSON 1 PREPARE THE PLOTTER FOR FIRING</b>	
Enabling Objective .....	153
Main Teaching Points .....	153
Preparation.....	153
Conduct of the Lesson .....	154
Conclusion.....	160
<b>LESSON 2 BALLISTIC FIRING TABLES CONTENTS AND USE</b>	
Enabling Objective .....	161
Main Teaching Points .....	161
Preparation.....	161
Conduct of the Lesson .....	162
Conclusion.....	164

LESSON 3 THE PIVOT METHOD

Enabling Objective ..... 165  
Main Teaching Points..... 165  
Preparation..... 165  
Conduct of the Lesson..... 166  
Conclusion..... 174

LESSON 4 ALTERNATIVE METHOD

Enabling Objective ..... 175  
Main Teaching Points..... 175  
Preparation..... 175  
Conduct of the Lesson..... 176  
Conclusion..... 182

LESSON 5 CONVERGE FIRE MISSION

Enabling Objective ..... 183  
Main Teaching Points..... 183  
Procedure..... 183  
Conduct of the Lesson..... 184  
Conclusion..... 187

LESSON 6 ADJUST AN ERRING MORTAR

Enabling Objective ..... 188  
Main Teaching Points..... 188  
Preparation..... 188  
Conduct of the Lesson..... 189  
Conclusion..... 192

LESSON 7 ENGAGE TWO TARGETS AT THE  
SAME TIME

Enabling Objective ..... 193  
Main Teaching Points..... 193  
Preparation..... 193

Conduct of the Lesson .....	194
Conclusion .....	195
<b>LESSON 8 POLAR FIRE MISSION</b>	
Enabling Objective .....	196
Main Teaching Points .....	196
Preparation .....	196
Conduct of the Lesson .....	197
Conclusion .....	203
<b>LESSON 9 ILLUMINATION MISSION</b>	
Enabling Objective .....	204
Main Teaching Points .....	204
Preparation .....	204
Conduct of the Lesson .....	205
Conclusion .....	209
<b>LESSON 10 COORDINATED ILLUMINATION MISSION</b>	
Enabling Objective .....	210
Main Teaching Points .....	210
Preparation .....	210
Conduct of the Lesson .....	211
Conclusion .....	213
<b>LESSON 11 ADJUST A GROUP OF TARGETS</b>	
Enabling Objective .....	214
Main Teaching Points .....	214
Preparation .....	214
Conduct of the Lesson .....	215
Conclusion .....	220
<b>LESSON 12 LINEAR HE FIRE MISSION</b>	
Enabling Objective .....	221

Main Teaching Points.....	221
Preparation.....	221
Conduct of the Lesson.....	222
Conclusion.....	229
<b>LESSON 13 LINEAR SMOKE FIRE MISSIONS</b>	
Enabling Objective.....	231
Main Teaching Points.....	231
Preparation.....	231
Conduct of the Lesson.....	232
Conclusion.....	237
<b>LESSON 14 PLATOON FIRE MISSIONS (FM)</b>	
Enabling Objective.....	238
Main Teaching Points.....	238
Preparation.....	238
Conduct of the Lesson.....	239
Conclusion.....	243
<b>LESSON 15 PRODUCE SURVEY DATA USING THE PLOTTER</b>	
Enabling Objective.....	244
Main Teaching Points.....	244
Preparation.....	244
Conduct of the Lesson.....	245
Conclusion.....	248



**LIST OF FIGURES**

Figure 1-1: HP 41CV Calculator with Overlay ..... 4

Figure 1-2: HHP-16K EPROM Module..... 5

Figure 1-3: Accessories..... 9

Figure 1-4a: Met Messages (Front)..... 143

Figure 1-4b: Met Messages (Back)..... 143

Figure 2-1: The Plotter..... 156

Figure 2-2: Preparation of the Plotter—Pivot Method..... 159

Figure 2-3: Production of Fire Control Data Using  
the Pivot Method ..... 168

Figure 2-4: Note the Bearing of the Target. .... 171

Figure 2-5: Alternative Method ..... 178

Figure 2-6: Alternative Method ..... 178

Figure 2-7: Converge Table ..... 185

Figure 2-8: Polar Fire Mission—Pivot Method. .... 198

Figure 2-9: Polar Fire Mission—Pivot Method ..... 199

Figure 2-10: Range Spread..... 206

Figure 2-11: Lateral Spread ..... 207

Figure 2-12: Diamond Illumination ..... 208

Figure 2-13: Target List Form..... 216



**CHAPTER 1**  
**MORTAR FIRE DATA CALCULATOR**  
**LESSON 1**  
**COMPONENTS OF THE MORTAR FIRE DATA**  
**CALCULATOR**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. Components of the MFDC:
  - a. components of the MFDC; and
  - b. maintaining the MFDC.

**PREPARATION**

3. **Time Required.** One 40-minute period.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete, one per student; and
  - b. 24 volt system.
7. **Training Aids:**
  - a. chalkboard; and

- b. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. **Introduction:**

- a. **Review.** As required.
- b. **What.** You will learn its components and how to maintain the MFDC.
- c. **Why.** As a control post operator (CPO) you must know the components of the MFDC and how to maintain it.
- d. **Where.** During the course, on training and in battle.

### 9. **Stage 1—Components:**

- a. The primary means of producing fire and survey data for mortars is the Hewlett-Packard (HP) 41CV manually operated programmable calculator. It is more accurate and faster than manual plotters; however, its efficiency depends on operator skill. When the operator knows how to use the calculator and makes correct entries using proper procedures, mistakes are avoided, particularly when operating without a printer, with no paper proof of calculator data; and
- b. The MFDC consists of the following major components:
  - (1) HP 41CV Calculator;
  - (2) HHP-16K Erasable Programmable Read Only Memory (EPROM) Module; and
  - (3) HP Printer.

10. **Confirmation of Stage I:**
  - a. questions from the class; and
  - b. questions to the class.
  
11. **Stage II—HP 41CV Calculator:**
  - a. The liquid crystal display shows up to 10 figures with decimal and  $\pm$  indicators. It operates from  $0^{\circ}$  C to  $45^{\circ}$  C. The indicators across the bottom enable a quick check of calculator status. They light up when engaged.
  - b. BAT—indicates batteries are low.
  - c. USER—indicates calculator is electronically disengaged from the emulator and is in the calculator mode.
  - d. GRAD/RAD—when the Erasable Programmable Read Only Memory (EPROM) is connected, the word GRAD appears. RAD is a function that does not apply at this time.
  - e. SHIFT—indicates shift key pressed to use secondary key functions.
  - f. 01234 FLAG STATUS—these characters should appear when the program is working; they show the position of data calculated in the EPROM, TGT I (target 1) or TGT II.
  - g. PRGM—indicates that data is being calculated or withdrawn from EPROM.
  - h. ALPHA—this is another mode indicator used to tell the user that these coloured letters or figures are being used.
  - i. Accessory input/output ports are located at the top of the calculator.

Instruments for Calculating Mortar Firing Data

- j. Power is supplied by one or more of:
  - (1) four disposable batteries (Ever-ready E90 or Mallory MN 9100 type);
  - (2) rechargeable battery pack;
  - (3) a 24 volt system using Inverter Power Statics; and
  - (4) 110 volt system or 220 volt system using the re-charger.
  
- k. The battery holder or rechargeable battery pack is inserted into the rear of the calculator. The calculator must be turned off to do this. If any of the batteries are inserted incorrectly the calculator may not turn on.

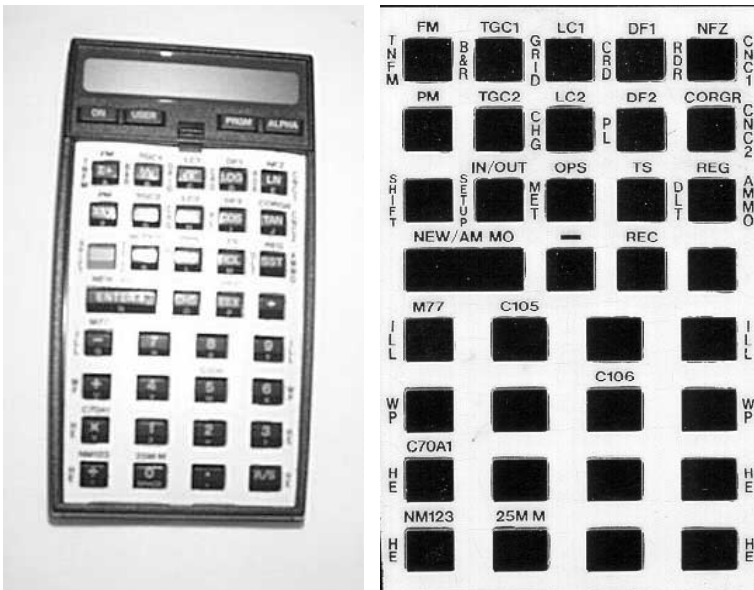


Figure 1-1: HP 41CV Calculator with Overlay

12. Confirmation of Stage II:

- a. questions from the class; and
  - b. questions to the class.
13. **Stage III—Connecting Components:**
- a. The HHP 16K EPROM module has three chips that contain the 81 mm mortar program. The program name, modifications and date of chip production are marked on the exterior. Ensure the calculator is turned off and insert the connector only into port number 3.
  - b. The printer is designed for use with the HP-41CV and provides a written copy of all data and functions. Ensure the calculator and printer are turned off before inserting the connector into port number 4.

### CAUTION

Always turn the MFDC off before connecting or disconnecting components. Failure to do so could damage both the calculator and the components.



**Figure 1-2: HHP-16K EPROM Module**

14. **Confirmation of Stage III:**

- a. questions from the class; and
- b. questions to the class.

15. **Stage IV—HP Printer Switches/Keys:**

- a. “ON/OFF”—power switch.
- b. “PRINT MODE”—there are three printing modes: “MANUAL”, “NORMAL” and “TRACE.” The recommended mode is “NORMAL” and the auxiliary mode is “TRACE”.
- c. “PRINT INTENSITY”—five positions that control print quality.
- d. “PRINT”—prints specific contents in the system for non-81 mm mortar applications. For 81 mm mortar fire data, the “ALPHA” function is used.
- e. “PAPER ADVANCE”—paper advances continuously until key is released.
- f. “LIGHTS”.
- g. “POWER”—indicates power is on.
- h. “BATTERY”—indicates battery power is low with 10-15 minutes operating time left.
- i. “BATTERIES”—The rechargeable batteries supply power for sustained portable printing with time of operation dependent on battery condition. Ensure the printer is switched off and the AC adapter/re-charger is disconnected prior to replacing batteries. Continued printing with the battery light on will damage the rechargeable batteries.
- j. Replacing the batteries:



- (1) ensure printer is turned off and adapter is unplugged;
- (2) turn printer over, push legs of battery holder toward the centre;
- (3) place your hand over the opening, turn printer over, and remove batteries and tongue;
- (4) insert new batteries, aligning them with springs in the compartment; and
- (5) insert door hinge in the battery compartment slot, close the tongue and latch by pushing legs outwards.

16. **Confirmation of Stage IV:**

- a. questions from the class; and
- b. questions to the class.

17. **Stage V—Thermal Paper:**

- a. This is a special heat-sensitive paper in 80-foot rolls. A blue marking appears as a warning that the end of the roll is near. The roll generally has enough paper left for finishing the mission. It is chemically treated on one side only.
- b. To load paper into the printer:
  - (1) Turn printer on, open cover and remove the empty core from the paper well.
  - (2) Remove the first 2 turns from the new roll to ensure the paper is neither torn nor ragged. It is important that the leading edge is straight.
  - (3) Place the roll in the cover and push the leading edge into the slot at the bottom of the well, as far as it will go.

## Instruments for Calculating Mortar Firing Data

- (4) Press the paper advance key and hold down until the paper passes the top of the clear plastic tear-bar.
- (5) Close the cover and press R/S or PRINT key. If it is feeding but not printing, the paper is inverted and the roll must be re-inserted.

### CAUTION

To avoid damage to the printer, ensure that the charging unit is plugged into the printer before plugging in the adapter.

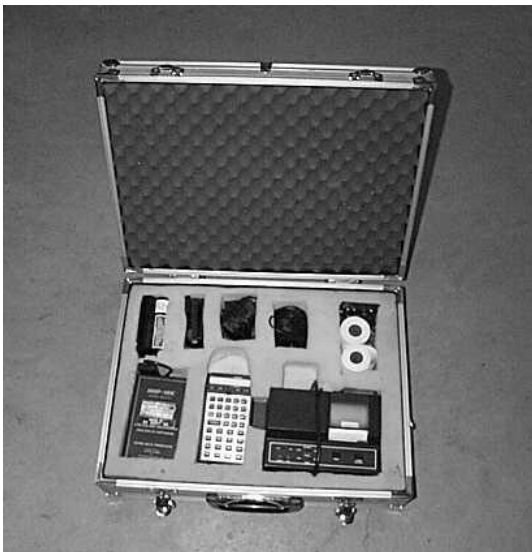
#### 18. **Confirmation of Stage V:**

- a. questions from the class; and
- b. questions to the class.

#### 19. **Stage VI—Accessories:**

- a. **Rechargeable Battery Charging Unit.** This source of electricity enables using the calculator without plugging it in and the time available depends on the state of the batteries.
- b. **Reserve Battery Charging Unit.** When the power indicator light is on the unit is charging a battery. The unit will fully charge a printer battery in 14 to 16 hours.
- c. **AC Re-charger Adapter.**
- d. The above units are used to charge rechargeable batteries for the calculator and the printer. They can provide power to both components simultaneously.
- e. The universal plug fits the calculator, printer and reserve battery charging unit.

- f. The Calculator can operate on 110 volts in Canada and 220 volts in Europe.
- g. **Card Reader.** This component will write or read data stored on magnetic cards. It plugs into port number 4 of the calculator. The card reader is used to transfer information quickly and will be dealt with in greater detail in a subsequent lesson. The printer must be disconnected when the card reader is in use.
- h. **Blank Magnetic Cards with Holders.** These cards are used to store information such as target lists. Care must be taken not to foul the surface with fingerprints, dirt, etc. A card designed to clean the card reader is provided. This subject will be covered in greater detail during the lesson on the card reader.
- i. **Vinyl Case.** The case is designed to protect the calculator when it is not in the travel case.
- j. **Travel Case.** All components are carried in an aluminium case with two locking latches and fitted foam interior. The travel case has a carrying handle and detachable shoulder strap.



**Figure 1-3: Accessories**

20. **Confirmation of Stage VI:**

- a. questions from the class; and
- b. questions to the class.

21. **Stage VII—Maintenance:**

- a. Care and maintenance of the calculator.
- b. Recharge or replace batteries when the BAT indicator appears in the display.
- c. Protective cap should be placed on unused input or output ports so that no dust can penetrate and contaminate the terminals, resulting in poor functioning of the instrument.
- d. The contact area of all plug-in extensions must be kept free of obstructions. The plug-in extensions may be cleaned by brushing or blowing dirt out of the contact area. Do not use any liquid to clean them.

**CAUTION**

Be careful to avoid putting your fingers or any other object in any port. To do so could alter the continuous memory or damage the calculator. Only HP-41CV accessories are designed for plugging into the ports.

- e. Extensions must be stored in a clean, dry place.
- f. Do not place plug-in extensions in a pocket unless they are protected. Static electricity could damage the extensions.
- g. To avoid damage to the calculator it must be turned off before inserting or removing any plug-in extension.

- h. Disposable batteries delivered with the calculator are not rechargeable, only the battery pack can be recharged.
- i. All information put into the calculator can be retained for 30-60 seconds by ensuring that the calculator is shut off when removing the batteries or battery pack. This is intended to provide ample time to change the batteries.
- j. If, after changing batteries, the calculator will not turn on, immediately remove the battery holder. Check the batteries for correct polarity and re-insert the battery holder. The calculator cannot be damaged by incorrect polarity; it simply will not function.
- k. When recharging the rechargeable battery pack, allow 14 to 16 hours for a full charge. The battery pack should be fully discharged before recharging. BAT will appear on the display to indicate that state. Premature recharging greatly reduces overall battery life and can be avoided by carrying a set of disposable batteries in a battery holder. If this condition occurs during a fire mission, the disposable batteries can be inserted quickly to maintain fire.
- l. The calculator is designed to withstand a number of disruptions. If a disruption does occur the most common symptom is a loss of keyboard control. To remedy that problem, remove the battery pack and re-insert it immediately. That will reset the calculator without causing MEMORY LOST (unless the cause was serious enough to produce that condition). If after several attempts the problem is not rectified, proceed as follows:
  - (1) Ensure batteries are fresh, contacts are clean and properly installed, and ensure that all connections are fully inserted.

## Instruments for Calculating Mortar Firing Data

- (2) Turn calculator off then back on. If there is no response continue as follows.
- (3) Carry out the MEMORY LOST procedure. If it does not respond, continue as follows.
- (4) Remove batteries and allow the continuous memory to fully discharge for four to six hours. If, after reinstalling the batteries the display shows MEMORY LOST when the calculator is turned on, the calculator has been cleared and is ready for use.
- (5) If the calculator still does not respond, turn it in for repair.

## 22. **Printer Care and Maintenance:**

- a. Keep the contact area of the printer plug free of obstructions. Should the contact area become dirty, carefully brush or blow the dirt out of it. Do not use any liquid to clean the printer contacts.
- b. As for the calculator, store the printer in a clean dry place.

### **CAUTION**

Always ensure that the calculator and printer are turned off before connecting or disconnecting the printer plug. Failure to do so could damage both components.

- c. If the printer seems to be operating correctly except for printing, check the following:
  - (1) Ensure that the printer is in normal mode.
  - (2) Ensure the printer and EPROM module plugs are inserted fully in the ports and that both printer and calculator are turned on.

- (3) Check the power indicators on both the calculator and printer to ensure there is enough power. If either one has inadequate power, the printer will not operate.
- (4) Check the calculator display for “OUT OF PAPER” message. If the printer runs out of paper it will stop printing.
- (5) Press PRINT then PAPER ADVANCE on the printer. If the paper advances, the printer is operating correctly.
- (6) If the paper is jammed, clear it by grasping the tape and pulling it forward or backward through the mechanism. Never insert tools or other objects into the mechanism.
- (7) If the problem persists, connect the printer to another calculator and a different printer to your calculator to determine which device needs repair. Turn in the malfunctioning device for repair.

23. **Confirmation of Stage VII:**

- a. questions from the class; and
- b. questions to the class.

24. **Final Confirmation:**

- a. questions from the class; and
- b. questions to the class.

**CONCLUSION**

25. During this lesson you have learned the components of the calculator. As a CPO you must know how the components operate and carry out necessary maintenance to effectively produce fire data.

26. The next lesson will be ...

**LESSON 2**  
**THE MORTAR FIRE DATA CALCULATOR PROGRAM**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. The MFDC program:
  - a. “MASTER CLEAR” procedure;
  - b. key function identification;
  - c. overlay explanation; and
  - d. determining program validity date.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student; and
  - b. 24 volt system.
7. **Training Aids:**
  - a. chalkboard; and



- b. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. **Introduction:**

- a. **Review.** As required.
- b. **What.** You will learn the description and explanation for the 81 mm mortar program.
- c. **Why.** As a future control post operator (CPO), you will need to have the necessary knowledge to retrieve fire data for neutralising and/or destroying the objective.
- d. **Where.** During dry training, live firing and on the battlefield.

### 9. **Stage I—“MASTER CLEAR” Procedure:**

- a. It is often necessary to clear the calculator’s memory of all data entered such as base plate positions, fire missions, target lists, observation posts, no fire areas, etc. To clear the memory, proceed as follows:
  - (1) Turn the MFDC off.
  - (2) Press and hold the CLEAR key (identified by the arrow pointing to the left).
  - (3) Turn the MFDC on and release the CLEAR key.
  - (4) The MFDC will display “MASTER CLEAR”. All data entered into the MFDC by the user has been cleared. The mortar program in the EPROM module is retained and cannot be erased.

10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

11. **Stage II—Identification of Key Functions:**

- a. We shall now see what happens with each key when the calculator is attached to the 81 mm EPROM. This is important because if we wish to carry out an exact function, for example fire missions, we must press the appropriate key on the calculator. We can see the effect of the keys in the following two ways:

- (1) Turn the calculator on and hold each key down. The function will appear in the display window.
- (2) The second method is to have the MFDC print out each key location and its function. Proceed as follows:
  - (a) connect the EPROM module to the calculator (port 3);
  - (b) connect the printer to the calculator (port 4);
  - (c) turn the MFDC and printer ON;
  - (d) turn the USER key on the calculator to OFF and press XEQ;
  - (e) press the ALPHA key to ON (shows “ALPHA” in display);
  - (f) use the blue letters on the key pad and spell PRKEYS;

- (g) press the ALPHA key to OFF (“ALPHA” leaves the displays); and
  - (h) the MFDC will now print the location and function of each key.
- b. A number shows the location of a key, for example: 11 XROM “FM” indicates the first key in the higher row. There are eight rows of keys numbered 1 through 8 vertically and 1 through 4 or 5 horizontally.

12. The printout of functions shows the following:

**NOTE**

When a minus sign appears the shift key must be pressed before the required key.

11 XROM “FM”	33 XROM “OPS”
-11 XROM “TNFM”	-33 XROM “MET”
12 XROM “TGCI”	34 XROM “TS”
-12 XROM “BNG/RGE”	35 XROM “REG”
13 XROM “LC1”	-35 XROM “DLT AMMO”
-13 XROM “GRID”	43 XROM “REC”
14 XROM “DF 1”	-51 XROM “M77”
-14 XROM “CRD RDR”	-52 XROM “C105”
15 XROM “NFZ”	-63 XROM “C106”
-15 XROM “CNC1”	71 XROM “C70A1”

Instruments for Calculating Mortar Firing Data

21 XROM "PM"	-81 XROM "NM123"
22 XROM "TGC2"	-82 XROM "25MM"
23 XROM "LC2"	
-23 XROM "CHG DATA"	
24 XROM "DF2"	
-24 XROM "PL"	
25 XROM "COR GRID"	
-25 XROM "CNC2"	
32 XROM "IN/OUT"	
-32 XROM "SETUP"	

13. When printing out the functions, it is very important to set the calculator to the USER position.

14. **Confirmation of Stage II:**

- a. questions from the class; and
- b. questions to the class.

15. **Stage III—Overlay Explanation:**

- a. The MFDC has a removable plastic overlay that shows the operations for each specific key when the MFDC is attached to the mortar EPROM. When the function is written to the side of the key, SHIFT must be pressed first, to input that operation.
- b. "ON"—used to turn the MFDC on or off. Press for on then press again for off.
- c. "USER"—electronically disconnects the EPROM to perform calculator operations. It will show as an

- indicator when another instrument is connected to the calculator and disappears when the other instrument is disconnected.
- d. “PRGM”—shows in view window when using the program.
  - e. “ALPHA”—used to spell out words using the blue letters on the MFDC and also appears as an indicator when switched on.
  - f. “FM” (Fire Mission)—used to enter FMs into the MFDC. Two targets can be engaged at one time under this key. TGT 1 (Target 1) and TGT 2 produce fire data from FM data for the selected target.
  - g. -11 “TNFM” (Target Number Fire Mission)—used to gain fire data from pre-recorded targets stored in the MFDC.
  - h. “TGC1” (Target Grid Corrections 1)—used to input target grid corrections into the MFDC as normally sent (Left, Right, Add, Drop). Produces fire data after corrections are input for TGT 1.
  - i. -12 “BNG/RGE” (Bearings and Ranges)—used to obtain bearings and ranges to grid references from a known grid.
  - j. “LC1” (Laser Corrections 1)—used to input laser corrections under Polar Missions TGT 1.
  - k. -13 “GRID” (Grid)—used to gain 10 figure grid references by doing resections from one or two reference points.
  - l. “DF1” (Distribution of Fire TGT 1)—used to input the distribution of fire to TGT 1, for example: LINEAR, HE (high explosive), WP (white phosphorous), Smoke, Converge, Circle, etc.

## Instruments for Calculating Mortar Firing Data

- m. -14 “CRD RDR” (Card Reader)—used to perform all Card Reader functions with the MFDC.
- n. “NFZ” ( No Fire Zones) — used to input No Fire Areas and No Fire Lines.
- o. -15 “CNC1”—used to cancel wrong corrections entered into TGT 1, will show what was cancelled.
- p. “PM” ( Polar Missions)—used to input Polar Missions. Two targets can be engaged at one time.
- q. “TGC2” (Target Grid Correction 2)—for correcting TGT 2.
- r. “LC2” (Laser Corrections 2)—used to input laser corrections for TGT 2.
- s. -23 “CHG DATA” (Change Data)—used to change adjusting mortar or direction during FMs.
- t. “DF2”—Distribution of fire for TGT 2.
- u. -24 “PL”—used to engage PLATOON SHOOTs under distribution of fire.
- v. “COR GRID” (Corrected Grid)—used to gain 10 figure Corrected Grid of targets.
- w. -25 “CNC2” (Cancel 2)—as for CNC1 except applied to TGT 2.
- x. “SHIFT” (gold colour)—enables using secondary functions found on the side of the calculator; for example: depress SHIFT and TNFM.
- y. “IN/OUT”—used to put mortars in and out of action, for example if number 4 mortar is out, data is not computed for that mortar. The loss of the mortar’s data is compensated for.

- z. -32 “SETUP” (Set up)—used to input Base Plate location in 6, 8 or 10 figure grids in the calculator memory; ARCS OF FIRE, ATTITUDE and SPREAD.
- aa. “OPS” (Observation posts)—used to store up to 10 Observation Post locations in 6, 8 or 10 figure grids in the calculator memory.
- ab. -33 “MET” (Meteorology)—used to input ballistic meteorological messages.
- ac. “TS” (Target Storage)—used to store up to 39 targets in 6, 8 or 10 figure grid in the calculator memory.
- ad. “REG” (Registration)—used to adjust fire data.
- ae. “DLT AMMO” (Delete Ammunition)—used to cancel ammunition.
- af. “CHS” (Change Sign)—used to enter minus signs used for target co-ordinate corrections or laser corrections and to put in left or drop corrections.
- ag. “REC” (Record)—used to record targets in calculator memory.
- ah. “<”—used to clear view window or to go back one figure at a time to correct errors.
- ai. Remaining keys are assigned to ammunition types as indicated on an overlay. Press SHIFT to access.
- aj. “R/S” ( Run/Stop)—used to impose a pause in the print-out during operations or to respond Yes or No to questions asked by MFDC; for example to answer No, press R/S once. To answer Yes, press any positive number first then R/S , for example 3 R/S.

16. **Confirmation of Stage III:**

- a. questions from the class; and
- b. questions to the class.

17. **Stage IV—Determining Program Validity Date:**

- a. The mortar program stored in the EPROM module can be updated; therefore, there must be a means of verifying that the correct program is being used. There are two methods:
  - (1) The data and program are recorded on a plastic shield attached to the EPROM box and must match the current program data.
  - (2) If the plastic shield is missing, the program EPROM module burn dates can be retrieved as follows:
    - (a) Turn MFDC off and disconnect the printer.
    - (b) Turn MFDC on.
    - (c) Press SHIFT and ENTER. “CAT” will appear on the viewer.
    - (d) In sequence, rapidly press key number 2 and R/S. The date the program was burnt onto the chips will appear on the viewer, for example the date for MODE is 22 Sep 1993.

**NOTE**

If keys 2 and R/S are not pressed quickly enough the date will remain on the screen for less than one second.



18. **Confirmation of Stage IV:**
  - a. questions from the class; and
  - b. questions to the class.
19. **Final Confirmation:**
  - a. questions from the class; and
  - b. questions to the class.

## **CONCLUSION**

20. During this lesson you have learned “MASTER CLEAR” procedure, seen key functions, explanation for the overlay and program validity. During use of the calculator (MFDC), you must know this and be able to operate the MFDC without the overlay, should it become lost or damaged.
21. The next lesson will be ...

**LESSON 3**  
**PREPARE THE MORTAR FIRE DATA CALCULATOR**  
**FOR FIRING**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC)

**MAIN TEACHING POINTS**

2. Prepare the MFDC for firing:
  - a. set up for a Quick Fire Mission;
  - b. set up using attitude line; and
  - c. set up using layout.

**PREPARATION**

3. **Time Required.** One 40-minute period.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student; and
  - b. firing tables.
7. **Training Aids:**
  - a. chalkboard; and
  - b. computer with PowerPoint®.

**CONDUCT OF THE LESSON****8. Introduction:**

- a. **Review.** As required.
- b. Carry out MEMORY LOST procedure.
- c. **What.** You will learn to prepare your MFDC for quick fire missions by using attitude line and layout methods.
- d. **Why.** During training and especially in battle, the mortar platoon must occupy mortar positions in different types of situations and must be able to react quickly to all fire requests. As a control post operator (CPO) you must be competent in using the three methods for preparing your MFDC.
- e. **Where.** During dry training, live firing and in battle.

**9. Stage I—Set Up for Quick Fire Missions (Crash Action):**

- a. In plotter operations, the CPO is required to set up the plotter to correspond to CPO base plate positions and to follow a set method for calculating accurate fire data. The same applies to the MFDC. The CPO must carry out set up procedures before accurate fire data can be produced.
- b. The first drill in set up, is for quick fire missions (FMs). This drill enhances the ability to produce fire data quickly when engaging targets of opportunity. Using this procedure, all data is based on the centre of the base plate position. This drill is particularly useful for crash action situations.
- c. The method is as follows: Turn the MFDC on using MEMORY LOST procedure. If you are using a printer, ensure that it is turned on. Proceed as follows:

Instruments for Calculating Mortar Firing Data

STAGE	KEY	DISPLAY	REMARKS
1.	SHIFT/ SET	“FIGS?”	Will accept grid in 6, 8 or 10 figures.
2.	6 R/S	“CHECK MET” “BP GRID 6”	CHECK MET is prompt only. Enter 6 figure grid 004723.
3.	004 723 R/S	“SAFE ARC?”	You can depart set up and go to FM’s now.
4.	FM	“TGT 2”	End of sequence.

**NOTE**

The “CHECK MET” display is a visual and audio reminder of meteorological conditions.

10. Using the above procedure, all data are based on the centre of the base plate position.

11. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

12. **Stage II—Set Up Using Attitude Line:**

- a. The attitude is the bearing from number 1 and number 4 mortars. Attitude provides greater accuracy when firing fire missions. The MFDC will prompt “ATTITUDE”. It will also prompt “SPREAD?”; if R/S is pressed, it will plot 30 metres between mortars. If the spread is greater or less than 30 metres, you enter the correct distance.

**NOTE**

The automatic 30 metres is called a default.

- b. Prepare MFDC using the following data.
- c. Carry out MEMORY LOST procedure:

<b>BP GRID</b>	<b>ATT</b>	<b>SPREAD</b>
010 731	5700	Normal

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
1.	SHIFT/SET	“FIGS?”	Enter the number 6
2.	6 R/S	“BP GRID 6”	Enter 6 figure grid 010731
3.	010731 R/S	“SAFE ARCS?”	No
4.	R/S	“LAYOUT”	No
5.	R/S	“ATTITUDE?”	Enter 5700
6.	5700 R/S	“SPREAD?”	Normal 30 metres, thus no entry required.
7.	R/S	“NEXT DATA?”	End of sequence.

13. **Confirmation of Stage II:**

- a. questions from the class; and
- b. questions to the class.

14. **Stage III—Set Up Using Layout:**

- a. This procedure is used when mortars are set up in other than a straight line, for example a dispersed gun position. It provides correct distribution of fire during fire missions. Enter the group centre as the BP GR (Base Plate, Grid Reference), then enter the bearing and the distance each mortar is from group centre.

Instruments for Calculating Mortar Firing Data

- b. The following example illustrates the set up using layout procedure.
- c. Carry out MEMORY LOST procedure then enter the following data:

**BP GRID (GROUP SURVEY POINT (GSP)) 006 737**

LAYOUT	#1	#2	#3	#4
Bearing	3200	4800	6400	1600
Distance	30	30	30	30

STAGE	KEY	DISPLAY	REMARKS
1.	SHIFT/ SET	“FIGS?”	Enter the number 6
2.	6 R/S	“BP GRID 6”	Enter 6 figure grid 006737
3.	006 737 R/S	“SAFE ARC?”	No
4.	R/S	“LAYOUT?”	Yes
5.	3 R/S	“#1 BEARING?”	3200 mils
6.	3200 R/S	“DIST?”	30 metres
7.	30 R/S	“#2 BEARING?”	4800 mils
8.	4800 R/S	“DIST?”	30 metres
9.	30 R/S	“#3 BEARING?”	6400 mils
10.	6400 R/S	“DIST?”	30 metres
11.	30 R/S	“#4 BEARING?”	1600 mils
12.	1600 R/S	“DIST?”	30 metres
13.	30 R/S		End of sequence

- d. Post-crash Action Procedures (quick fire missions). The MFDC is extremely flexible. It is especially fast during crash action drills. The CPO, therefore, does not interrupt the procedure. Once the crash action drill is complete, and if the base plate position

is to remain occupied, the complete set up procedure must be used to produce more accurate fire.

15. **Confirmation of Stage III:**
  - a. questions from the class; and
  - b. questions to the class.
16. **Final Confirmation:**
  - a. questions from the class; and
  - b. questions to the class.

## **CONCLUSION**

17. In this lesson you have seen how to prepare your MFDC for quick fire missions using attitude, line and layout methods. As CPO you must be able to carry out these operations using different methods, so as to effectively and quickly engage any target.
18. The next lesson will be ...

**LESSON 4**  
**PRODUCE FIRE DATA FOR A SIMPLE FIRE MISSION**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. Produce fire data for a simple fire mission:
  - a. fire data for engagement of simple fire missions (FMs);
  - b. conversion of fire data from target grid corrections;
  - c. fire data for circular fall of shot;
  - d. fire data when smoke is used in adjust;
  - e. fire data when HE is used in adjust; and
  - f. fire data for the 25 mm.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student; and
  - b. fire mission proforma.



7. **Training Aids:**

- a. chalkboard; and
- b. computer with PowerPoint®.

**CONDUCT OF THE LESSON**8. **Introduction:**

- a. **Review.** Review set up procedure:

<b>BP GRID</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
004 723	5300	30 metres	C 70 A1

- b. **What.** You will learn how to produce fire data for engaging a target using HE and smoke rounds.
- c. **Why.** As a control post operator (CPO) you must be able to produce all types of fire data because different types of ammunition can be used in adjust. You should be able to change ammunition and produce correct data to quickly engage a target.
- d. **Where.** During the course, at your unit and in battle.

9. **Stage I—Fire Data for Engagement of Simple Fire Missions:**

- a. The target data sent by the Fire Controller (FC) must be processed to produce the fire data required for the mortar to put rounds on or near the target. Although the procedure differs from the plotter, the resulting information is the same.
- b. Producing initial fire data with the MFDC is quick and simple with its key-in procedure:

FM 4 MOR  
GR 010737  
DIR 5600  
MG  
3 RDS  
3 AF

Instruments for Calculating Mortar Firing Data

STAGE	KEY	DISPLAY	REMARKS
1.	FM	“TGT NO 2?”	FM can be fired under TGT 1 or 2; if TGT 2 go NO, if TGT 1 go YES.
2.	R/S	“TGT 1 GRID 6”	Note: Continues to prompt for 6 figures.
3.	010737 R/S	“SELECT AMMO”	Go SHIFT then the AMMO KEY.
4.	C70A1	“TGT 2 AMMO?”	NO unless on TGT 2; if 1 go YES.
5.	R/S	“TGT 1 AJMOR?”	Enter the adjusting mortar for example mortar number 3.
6.	3 R/S	“SLCT CHARGE?” “MAP RANGE 1522”	The MFDC selects the most central “SLCT CHARGE?” charge with elevation near 1100 mils (or enter charge required).
7.	R/S	“CHG 3 NO 3 BNG 0422 ELEV 1238 RANGE 1522 TOF 29.9”	MFDC now prints Fire Data. (TOF is Time of Flight)

**NOTE**

If the operator has already selected an ammunition type for the target, the MFDC then asks “FIRE DATA?”. If the operator presses R/S, a prompt to select an ammunition type for the target will appear. If the operator responds YES, the MFDC selects the best charge for the actual range and produces fire data.

10. **Confirmation of Stage I:**
- a. questions from the class; and
  - b. questions to the class.

11. **Stage II—Conversion of Fire Data From Target Grid Correction:**

- a. The MFDC has produced sufficient fire data to place mortar rounds in the target area. The adjustment procedures are designed to place rounds on the target. The key procedure uses the same target grid corrections as the plotter.
- b. Set up as follows:

<b>BP GRID</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
103 765	2220	Normal	C70A1

FM 4 MOR	<b>FIRE DATA</b>
GR 097 754	NO 2
DIR 3685	CHG 2
SECT DUG IN	B 3697
4 RDS	E 1313
2 AF	R 1255
	TOF 30.6

- c. Corrections to target data for this exercise are: RIGHT 150, ADD 400, DROP 200, ADD 100, RIGHT 25.
- d. For training purposes do one correction at a time.

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
1.	TGC 1	“DIRECTION”	If target number 2 press TGC 2.
2.	3685 R/S	“TGC 1 R/L”	If RIGHT, enter correction and R/S. If left, enter correction the CHS (CHANGE SIGN) then R/S. If no correction R/S. For our example enter 150 RIGHT.

Instruments for Calculating Mortar Firing Data

STAGE	KEY	DISPLAY	REMARKS
3.	150 R/S	“TGC 1 A/D”	If ADD enter correction and R/S. If DROP enter correction, CHS then R/S, if no correction R/S.
4.	R/S	“NO 2 CHG 3 B 3818 E 1310 R1265”	Prints fire data then goes back to “TGC 1 R/L” carry on with corrections or exit program.
5.		“TGC 1 R/L”	No correction.
6.	R/S	“TGC 1 A/D”	ADD 400, enter 400.
7.	400 R/S	“CHG 3 B 3786 E 1195 R 1663”	Prints fire data, and gives an audio and a visual warning when changing charge.
8.		“TGC 1 R/L”	No correction.
9.	R/S	“TGC 1 A/D”	DROP 200, enter -200 CHS.
10.	-200 CHS R/S	“B 3799 E 1174 R 1464”	
11.		“TGC 1 R/L”	No correction.
12.	R/S	“TGC 1 A/D”	ADD 100, enter 100.
13.	100 R/S	“B 3792 E 1226 R 1563 TGC 1 R/L”	RIGHT 25, enter 25.
14.	25 R/S	“TGC 1 R/L”	No correction.
15.	R/S	“B 3808 E 1225 R 1566”	Final correction now Fire for Effect (FFE).

**NOTE**

1. This completes the established procedure for setting up and adjusting a simple fire mission and finally destroying the target.
2. If a change of charge is required after major corrections, the MFDC sounds an audio warning and displays “CHANGING CHG”.

12. **Confirmation of Stage II:**

- a. questions from the class; and
- b. questions to the class.

13. **Stage III—Produce Fire Data for Circular Fall of Shot:****NOTE**

Keep the same FM and site.

- a. To produce a circular mission, the mortar line must be established using either attitude, line or layout methods.
- b. Under the distribution of fire (DF) key is a prompt for circle. When you answer YES, the MFDC will ask for “RADIUS?”. At that time you should enter the dimension asked by the FC or answer NO. The MFDC will then automatically produce circular fire data.

STAGE	KEY	DISPLAY	REMARKS
1.	DF 1	“MORS R=1/L=2”	Number 4 mortar
2.	R/S	“TGT1 AMMO C70A1”	
3.	R/S	“LIN HE?”	No
4.	R/S	“LIN WP?”	No

Instruments for Calculating Mortar Firing Data

STAGE	KEY	DISPLAY	REMARKS
5.	R/S	“CONVRG?”	No
6.	R/S	“CIRCLE?”	Yes
7.	3 R/S	“RADIUS?”	If answer NO to radius, the MFDC allows an automatic distance of 40 metres. If larger is required, enter manually.
8.	R/S		

14. Fire for effect data produced all CHG 3:

MORTAR	1	2	3	4
BRG	3803	3787	3813	3868
ELEV	1235	1232	1215	1217
RANGE	1723	1734	1788	1776

15. **Confirmation of Stage III:**

- a. questions from the class; and
- b. questions to the class.

16. **Stage IV—Produce Fire Data Using Smoke for Adjustment:**

- a. It is very easy to produce initial fire data for a smoke target when smoke is used for adjustment. We proceed exactly the same way as for HE targets except, of course, we select C-106 ammunition. Carry out the following FM:

BP GR	ATT	SPREAD	AMMO
008 725	2100	Normal	SMK C 106

FM 4 MOR  
GR 013 743  
  
DIR 1900  
SCREEN  
SMK 5 RDS  
2 AF

**FIRE DATA**  
TGT 1  
CHG 2  
B 0284  
E 1219  
R 1865  
TOF 32.7

- b. The production of fire data when smoke is used for adjusting is handled in the same way as a simple fire mission. It is a quick and effective method for quickly answering the fire controller’s fire orders.

17. **Confirmation of Stage IV:**

- a. questions from the class; and
- b. questions to the class.

18. **Stage V—Production of Fire Data Using HE Shells for Adjusting:**

- a. There is no problem in carrying out a smoke mission if HE shells are used for adjusting. This operation is handled in the usual manner but smoke ammunition is used for effective fire. However, if there are different type of ammunition on the line, for example C70A1 HE ammunition and C106 SMK, and the HE shells are used for adjusting, we would then have a problem. The method that we teach is quicker, using a MFDC key for the target number. It is important that the key for the second target is free for other targets, especially during fire planning:

(1) Adjust as follows:

<b>BP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
103 765	2220	Normal	HE C70A1 SMK C106

FM 4 MOR  
GR 097 754  
DIR 1600  
BLINDING  
SMOKE  
10 RDS  
2 AF

**INITIAL FIRE DATA**  
CHG 3  
NO 2  
B 3697  
E 1313  
R 1255  
TOF 30.6

Instruments for Calculating Mortar Firing Data

**CORRECTIONS**

LEFT 200

CHG 3  
NO 2  
B 3785  
E 1357  
R1082

UP 200

CHG 3  
B 3611  
E 1380  
R 0988

- b. The fire controller provides data for effective fire and converts that data into data for smoke ammunition:

STAGE	KEY	DISPLAY	REMARKS
1.	SHIFT, C106	“TGT 2 AMMO?”	
2.	R/S	“AJMOR 2?”	Map range 0988
3.	R/S	“SLCT CHARGE?”	
4.	R/S		Fire Data appears.

**FIRE DATA FOR C 106:**

TGT 1  
CHG 1  
NO 2  
B 3611  
E 1303  
R 0988  
TOF 26.7

19. **Confirmation of Stage V:**

- a. questions from the class; and  
b. questions to the class.



20. **Stage VI—Produce Fire Data for 25 mm Ammunition.**

The MFDC can produce fire data for the 25-mm sabot. The CPO task does not change, the base plate position is converted to 1/10 and the rest remains the same.

**NOTE**

It should be noted that the distance to the target is in centimetres and not in metres.

21. **Final Confirmation:**

- a. questions from the class; and
- b. questions to the class.

**CONCLUSION**

22. During this lesson you have learned how to produce fire data for smoke shells when HE ammunition is used for adjusting. Remember that when smoke is used for adjusting the data is calculated the same way as for a simple fire mission. However, if HE ammunition is employed for adjusting, the data should be converted as for smoke ammunition being used. We have taught you the method that enables you to obtain the quickest fire data and provide maximum flexibility.

23. If the CPO must make a left or drop correction, he shall press the CHS key after entering the figures. You should always know the number of the target you are engaging. Ensure that all data are entered correctly because when the printer is disconnected there is no copy of the information. The choice of charge is a priority manual operation when there are restrictions to the charge. Your MFDC will select a charge where elevation will be mostly around 1100 mils.

24. The next lesson will be ...

**LESSON 5**  
**PREPARING THE MORTAR FIRE DATA CALCULATOR**  
**FOR SAFETY**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. Prepare the MFDC for safety:
  - a. setting arcs of fire and maximum range;
  - b. setting no-fire areas (NFA);
  - c. setting base plate position safety;
  - d. setting no-fire lines; and
  - e. viewing and deleting no-fire lines (NFL)/no-fire zones (NFZ).

**PREPARATION**

3. **Time Required.** Three 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student; and
  - b. firing table for C70A1 ammunition.

7. **Training Aids:**
- a. chalkboard; and
  - b. computer with PowerPoint®.

## CONDUCT OF THE LESSON

8. **Introduction:**
- a. **Review.** As required.
  - b. **What.** You will learn how to prepare MFDC for safety.
  - c. **Why.** Control post operators (CPOs) must be able to set arcs of fire and NFAs in the MFDC to ensure the safety of forward troops and observation posts (OPs). Safety limits depend on the operation and type of ammunition used. It is essential to enter all OPs and mortar sites, as NFAs.
  - d. **Where.** During the course, at your unit and in battle.
9. **Stage I—Arcs of Fire and Maximum Range:**
- a. **Safety Arcs.** When the safety prompt appears, enter the left arc, then the right arc and finally the maximum range, inserting the four figures for each if required. Adjust using techniques already taught, stopping at safety arc:

BP GR	ATT	SPREAD	L OF ARC 4925	MAX RANGE	RANGE	AMMO
030 737	3200	Normal	R OF ARC 6230	CHG 4	4397 m	C70A1

- b. The Range Safety Officer calculates arcs of fire in the usual manner. Note that the maximum charge to be fired for this example is Charge 4. Refer to firing tables and note that the maximum range for

Instruments for Calculating Mortar Firing Data

Charge 4 is 3225 metres. Record as maximum range.

- c. First, answer YES to the question “SAFE ARCS?”, give left arc and then enter 4925 metres, then 6230 for the right arc and 4397 metres for maximum range. That will complete that part of the exercise. During firing, the MFDC checks to ensure that all targets are inside the area. If a target is outside the area, the MFDC sounds an audio warning tone, prints the arcs then the map bearing (or maximum range to indicate outside safety). It then prompts “CONTINUE?”.
- d. The CPO can override safety by pressing 3 (YES) R/S and the MFDC will print the fire data. Safety has been disabled for this portion only. As the CPO carries on with corrections or a new mission, safety continues to be checked. Below is an example for a Target Outside Left of Arc and Beyond Maximum Range.

**C70A1 AMMUNITION**

FM 4 MOR:  
GR 004 740  
DIR 4080  
MG

3 RDS  
2 AF

Fire Date  
TGT 1  
CHG 4  
B 4911  
E 1105  
R 2616  
TOF 33.8

**NOTE**

The MFDC indicates data outside the left of arc (DIR 4080 compared to the L OF ARC 4925). Press 3 R/S and it indicates data is outside the MAXIMUM RANGE.

PRESS “3 R/S”

- e. Set NFAs with MFDC.

**NOTE**

The MFDC maintains safety with a high degree of accuracy, producing fire with minimum delay.

- f. The MFDC plots and maintains ten NFAs in its memory. These are viewed, printed or deleted with key operations, already taught. To increase this distance to 390 metres (normal peacetime safety), enter the grid reference for the observation post as a 780 metres safety area and another for the mortar base plate position. The width of the line must be added to that distance.
- g. All fire data plotted and entered is checked to ensure that it is not in these zones. To shorten execution time, the fire zones are represented as squares and not as circles. If data plotted is in an NFA or on the wrong side of the fire line, the MFDC sounds a tone and prints a warning message for the operator. The operator can then cancel the fire mission or ask the MFDC to print fire data.
- h. “SAFETY OFF?” When the operator presses the NFA key, the MFDC prompts “SAFETY OFF?”. The MFDC is asking the operator if the safety check is to be suppressed. If the operator presses R/S, the safety check is left on. If he answers yes and presses 3 R/S, the safety check is removed. When the safety check is removed a small O will appear at the bottom of the screen to provide visual warning that the safety check is not being performed. With the safety check removed, fire data processing time is greatly reduced.
- i. Specific areas can be made and kept safe by the MFDC (such as OPs) by inserting the OP grid as an NFA. The area can be as wide as desired. First

Instruments for Calculating Mortar Firing Data

follow the normal technique and adjustments except that there is an OP at 011 750 that must be kept safe.

KEY	DISPLAY	REMARKS
NFZ	“SAFETY OFF?”	No
R/S	“INPUT?”	Yes
3 R/S	“NFL-1/NFA-2”	NFA-2
2 R/S	“NFA NO?”	Number 1
1 R/S	“NFA GRD-6”	Input Grid
011750 R/S	“WIDTH?” “NFA NO?”	This represents the diameter of the circle of the area to be kept safe. Normal peace time safety is 780 metres so for full safety we must enter 780 metres
780 R/S		Now depart this routine

**NOTE**

1. A hazard exists with NFAs as the MFDC will plot grids beyond the NFA, thus allowing overhead fire of the NFA. An independent safety check is required at all times.
2. A small O will appear at the bottom of the viewing screen to provide visual warning for the safety check. If there is no indicator, the safety check is at OFF and you are asked if you want to “CONTINUE”.

10. **Confirmation of Stage I:**
  - a. questions from the class; and
  - b. questions to the class.
11. **Stage II—Baseplate Position Safety:**

- a. The MFDC will automatically enter a minimum of 400 metres safety for other ammunition. However, if the mortar line is prepared as a scattered position and if you enter the centre of the mortar position and the normal safety distance as an NFA of 780 metres, this will not cover mortars outside the position. Thus, to ensure complete safety for all mortars you must determine the width of the position and add to the 780 metres distance (safety diameter).
- b. **Example:**
  - (1) Width of position:  $90 + 780 = 870$  metres safety.
  - (2) That distance will be entered as NFA when the “WIDTH” appears.

**NOTE**

Remember that for safety you use the grid for the centre of the mortar emplacement and not the reference of the group survey point.

12. **No Fire Lines (NFL):**

- a. NFLs were designed to protect friendly troops and are usually used in conjunction with the Forward Edge of the Battle Area (FEBA). These are lines to indicate where no indirect fire unit can fire short of without approval from the supported arms commander. The MFDC can plot and maintain safety for up to 3 NFLs and will give the visual and audio warning if data is plotted short of the line or lines.

**NOTE**

If projectiles are about to be fired between the lines and the base plate the MFDC sounds a tone and prints a warning message.

- b. **Procedure.** NFLs are input, viewed and deleted in the same manner as NFAs. When entering the NFLs, the MFDC prompts the CPO for the starting and end points of the line. The starting point of the line must be entered as the lower numerical grid (west). If the operator enters the higher numerical grid first, the MFDC re-prompts for the end point grid.
- c. Enter the following NFLs:

<b>BP GR</b>	<b>ATT</b>	<b>SPREAD</b>
0063 7187	4200	40

NFL 1	Start	GR 0008 7222
	End	GR 0044 7242

NFL 2	Start	GR 0044 7242
	End	GR 0076 7241

NFL 3	Start	GR 0076 7241
	End	GR 0090 7216

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
1.	NFZ	“SAFETY OFF?”	No R/S
2.	R/S	“INPUT?”	Yes 3 R/S
3.	3 R/S	“NFL-1 NFA-2”	NFL-1
4.	1 R/S	“NFL NO?”	Number 1
5.	1	“START GR”	Enter first grid NFL 1
6.	0008 7222 R/S	“END GR”	Enter end grid NFL 1
7.	0044 7242 R/S	“NFL NO?”	NFL 2



STAGE	KEY	DISPLAY	REMARKS
8.	2 R/S	“START GR”	Enter first grid NFL 2
9.	0044 7242 R/S	“END GR”	Enter last grid NFL 2
10.	0076 7241 R/S	“NFL NO?”	NFL 3
11.	3 R/S	“START GR”	Enter first grid NFL 3
12.	0076 7241 R/S	“END GR”	Enter last grid NFL 3
13.	0090 7216 R/S	“NFL NO?”	Proceed with FM

### NOTE

NFLs can be used alone, in pairs or as in this example, in groups of three.

#### 13. Confirmation of Stage II:

- a. questions from the class; and
- b. questions to the class.

#### 14. Stage III—Viewing and Deleting NFL/NFA:

- a. You may wish to see the data you have entered for example to ensure that they have been entered correctly or because the safety officer may ask you for a copy and you must extract it. Proceed as follows:

STAGE	KEY	DISPLAY	REMARKS
1.	NFZ	“SAFETY OFF?”	No
2.	R/S	“INPUT?”	No
3.	R/S	“VIEW?”	Yes
4.	3 R/S	“VIEW ALL?”	Yes
5.	3 R/S	“NFL=1/NFA=2”	If you wish to see the NFLs, press 1 R/S. If you wish to see the NFA, press 2 R/S. Press 1 R/S now.

Instruments for Calculating Mortar Firing Data

STAGE	KEY	DISPLAY	REMARKS
6.	1 R/S	“SORT NFLS?”	The MFDC produces 10 figure grid references in numerical order because you answered yes to “SORT NFLS?”
7.	3 R/S	“DO NOT PRESS R/S WHILE SORTING NFLS”  “NFL NO 0001 START GRD 00080 72220 END GRD 00440 72420”  “NFL NO 0002 START GRD 00080 72220 END GRD 00440 72420”	If you want to see the NFL again, answer NO R/S to the question “SORT NFLS?”. That will save a lot of time because the MFDC already has them in numerical order.

- b. To view only some NFL or NFA the method is the same if you answer NO R/S to the question “VIEW ALL?”.

STAGE	KEY	DISPLAY	REMARKS
1.		“VIEW ALL”	No
2.	R/S	“NFL=1/NFA=2”	Press the number of the NFL you want to view.
3.	1 R/S	“START NFL NO”	If asked from what number you want to check. Enter 1
4.	1 R/S	“END NFL NO”	Asking to what number you want to see, if you want to see only to number 1, press R/S

STAGE	KEY	DISPLAY	REMARKS
5.	R/S	“NFL NO 0001 START GRD 00080 72220 END GRD 00440 72420”	It displays NFL No 0001

c. **Cancelling.** The reasons for cancelling NFL/NFA are as follows:

- (1) an observation post is no longer occupied;
- (2) the mortar group changes positions; or
- (3) troop movements to the front have changed.

d. Procedures are as follows:

STAGE	KEY	DISPLAY	REMARKS
1.	“NFZ”	“SAFETY OFF”	No
2.	R/S	“INPUT?”	No
3.	R/S	“VIEW?”	No
4.	R/S	“DELETE?”	Yes
5.	3 R/S	“NFL=1/NFA=2”	If you want to cancel an NFL, press 1 R/S. If you want to cancel an NFA press 2 R/S. Press 1 R/S.
6.	1 R/S	“START NFL NO”	Press the number of the NFL that you want to cancel
7.	1 R/S	“END NFL NO”	Press R/S if you want to cancel only line 1 or enter the end number of the NFL you want to cancel
8.	R/S	“START NFL NO”	

15. **Final Confirmation:**

- a. questions from the class; and

- b. questions to the class.

## CONCLUSION

16. Safety regulations must be respected at all times. The MFDC accepts 10 safety areas. The CPO must however, remember that the instrument can carry out overhead fire and he must ensure that that type of mission is not fired during peacetime. The safety distance established for combat positions is 200 metres and the CPO must enter those positions as safety areas in order to preserve the applicable safety distance. The MFDC provides for 3 safety lines and the furthest co-ordinate west must always be entered first. Safety lines are displayed or cancelled in the usual way. They are useful for tactical matters and are issued by the supporting fire co-ordination centre. They cannot replace safety regulations at the mortar line and must not be established by the commander of the CPO group. The MFDC cannot automatically foresee the safety of the location because locations vary according to the extent and type of deployment.

17. The next lesson will be ...

## **LESSON 6 CHANGE PROCEDURES I AND II**

### **ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC)

### **MAIN TEACHING POINTS**

2. Change procedures I and II:
  - a. changing direction;
  - b. changing adjusting mortar;
  - c. deleting ammunition;
  - d. changing charge;
  - e. producing fire data for converge targets;
  - f. gaining corrected grid;
  - g. recording targets;
  - h. procedure to put mortars in/out of action;
  - i. change 6 figure grid references to 8 or 10 figure grid references; and
  - j. produce fire data for a maximum range target.

### **PREPARATION**

3. **Time Required.** Three 40-minute periods.
4. **Method.** Theoretical and practical.

## Instruments for Calculating Mortar Firing Data

5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student;
  - b. fire mission proforma; and
  - c. firing table.
7. **Training Aids:**
  - a. chalkboard; and
  - b. computer with PowerPoint®.

## CONDUCT OF THE LESSON

8. **Introduction:**
  - a. **Review.** As required.
  - b. **What.** You will learn Change Procedures I and II.
  - c. **Why.** For various reasons the Fire Controller (FC) or control post operator (CPO) may change the mortar adjustment, its direction or change or delete ammunition. Also, the CPO must be able to register targets, obtain corrected GR, put the mortars out of action and produce fire data for converge targets.
  - d. **Where.** During the course, at your unit or in battle.
9. **Stage I—Changing Direction and the Adjusting Mortar; Deleting Ammunition and Maximum Range Targets:**
  - a. During the adjustment or engagement of targets it may be necessary to change direction of the adjusting mortar. For example, a mortar may be put out of line because of a defect or the fire controller may change observation posts during adjustment. Further, if a type of ammunition is brought to the mortar line which is not part of the pre-programmed data, the CPO must still be able to process the fire mission.

- b. **Changing Direction.** When the FC changes position, he must send a new direction to be entered into the MFDC to produce correct data. Carry out MASTER CLEAR and the following set up:

<b>BP</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
006 723	4700	30	C 70 A1

FM 4 MOR	<b>FIRE DATA</b>
GR 005 740	CHG 4
DIR 4800	B 6367
BMP IN OPEN	E 1316
2 RDS	R 1705
4 AF	TOF 36.1
Fire control orders LEFT 100	
	NO 4
	B 6365
	E 1335

The fire controller changes positions and gives the following corrections

DIRECTION 5300, ADD 100

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
1.	SHIFT CNG	“CNG ADJ MOR?”	No
2.	R/S	“CNG DIR?”	Yes
3.	3 R/S	“CNG 2 DIR?”	No
4.	R/S	“1 DIR?”	Enter new direction now
5.	5300 R/S	“NEXT DATA”	Continue with TGC 1 ADD 100
6.		Final data: “TGT 1 CHG 4 B 6312 E 1325 R 1658”	

Instruments for Calculating Mortar Firing Data

- c. **Changing the Charge.** To change the charge, press for AMMO and enter the desired charge.

STAGE	KEY	DISPLAY	REMARKS
1.	SHIFT, AMMO	“TGT 2?”	No
2.	R/S	“ADJ MOR?”	No
3.	R/S	“SLCT CHARGE?”	Yes, enter 4
4.	4 R/S		Fire Data is produced

**FIRE DATA**

CHG 3  
 B 6312  
 E 1196  
 R 1658  
 TOF 29.5

- d. **Changing Adjusting Mortar.** To change the adjusting mortar, the FC will use the following procedure with the same location and ammunition (C70A1):

**SAME LOCATION AND C70A1 AMMO**

FM 4 MOR	<b>FIRE DATA</b>
GR 011 742	TGT 1
	CHG 4
DIR 0850	NO 1
	B 0240
SEC DUG IN	E 1267
3 RDS	R 1949
1 AF	TOF 35.6

**FIRE CONTROLLER ORDER: LEFT 100, CANCEL 1 AF, 2AF**

STAGE	KEY	DISPLAY	REMARKS
1.	SHIFT CHG	“CHG ADJ MOR?”	Yes
2.	3 R/S	“TGT 2?”	No
3.	R/S	“TGT 1 MOR?”	Enter the new ADJMOR now.
4.	2 R/S	“NEXT DATA”	Continue with TGC1 LEFT 100.



**FIRE DATA**

NO 2

B 0240

E 1253

R 2016

- e. **Change Grid.** To change co-ordinates from 6 to 8 or 10 figures, when your position is a 10 figure reference and your target is 6 or 8 figures, you must follow this procedure:

STAGE	KEY	DISPLAY	REMARKS
1.	SHIFT/SET	"FIG 6"	Enter figure 8 or 10
2.	8 or 10 R/S		The MFDC will accept 8 or 10 figures only. Continue operation. To return to 6 figures, follow the same procedure.

- f. **Deleting Ammunition.** This procedure is used to calculate bearing and range when ammunition is brought to the line which is not part of the pre-programmed data. This information is used in conjunction with the firing tables provided with the new type of ammunition. Then you execute the following sequences and when you have received the distance you will be able to find the elevation from the ammunition firing tables.

- (1) Prepare your MFDC with a base plate:

BP GR	ATT	SPREAD	AMMO
0000 9999	4700	Normal	C 70 A1

Execute: FM 4 MOR

GR 0350 9999

DIR 1600

2 AF

CHG 6

B 1600

E 1174

R 3485

TOF 43.0

Instruments for Calculating Mortar Firing Data

STAGE	KEY	DISPLAY	REMARKS
1.	SHIFT/DLT	“TGT 2?”	No
2.	R/S	“DLT AMMO 1”	Yes
3.	3 R/S	“NEXT DATA”	
4.	TGC 1	“DIRECTION”	1600
5.	TGC 1	“TGC 1 R/L”	No
6.	R/S	“TGC 1 A/D”	No
7.	R/S		The MFDC now calculates the following data for you:  TGT 1 NO 2 B 1600 R 3485

- (2) If you have to produce different types of fire, for example, linear fire, simply press the DF 1 (Distribution of Fire) or DF 2 keys and carry on as for a normal mission. The data applies only to the bearing and range for each mortar.

g. **Maximum Range Target:**

- (1) To produce data for a maximum range target, you must:

BP	ATT	SPREAD	AMMO
104 762	1600	Normal	C 70 A1

- (2) You have received a mortar target (MT) and the MFDC tells you that it is out of range. Thus it gives you the maximum range for the ammunition and the target. To be able to engage at maximum range for the ammunition, proceed as follows:

- (a) enter DLT AMMUNITION and execute the MT; you will then receive the bearing and range; and
- (b) enter the bearing as direction and the correction “DOWN 1” of the maximum range, to bring the target into range.

<b>Example: maximum range</b>	<b>Range requested 4700 metres</b>
4699 metres	
Difference: 1 metre	Press ammo C 70 A1

- (3) You received the same bearing and a different range. Replace the ammunition and you will be given complete data.

10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

11. **Stage II—Production of Fire Data for Converged Targets, Corrected Grid, Registered Targets and Procedures for Mortar In/Out of Action:**

a. **Producing Fire Data for Converged Targets:**

- (1) To do a converge mission, the mortar line must be established either by an attitude line or by doing lay out data.
- (2) Under the DF key is a prompt for converge. When this prompt is answered, the MFDC automatically produces fire data to converge all weapons in action onto the target.

<b>BP</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
008 725	5300	Normal	C 70 A1

**FIRE DATA**

FM 4 MOR	TGT 1
GR 013 743	CHG 4
DIR 1900	NO 2
5 RDS CONVERGE	B 0268
2 AF	E 1283
	R 1871
	TOF 35.8

- (3) Once the target has been set and the order to converge has been received, the CPO presses DF 1 key. The MFDC will display the following data:

STAGE	KEY	DISPLAY	REMARKS
1.	DF 1	“MOR R-1/L-2”	No
2.	R/S	“TGT 1?”	
3.		“AMMO C 70 A1”	
4.	R/S	“LIN HE?”	No
5.	R/S	“LIN WP?”	No
6.	R/S	“CONVRG?”	Yes
7.	3 R/S	“FIRE DATA”	

	# 1	# 2	# 3	# 4
CHG	4	4	4	4
B	0252	0268	0284	0300
E	1282	1283	1285	1286
R	1878	1871	1865	1859

**NOTE**

The MFDC cannot produce converge data when set up for crash action. It will give you the same data as for the adjusting mortar.

- b. **Gaining Corrected Grids.** The COR GRID (Corrected Grid) key enables the operator to view the corrected grid of any target at any time. The operator has the choice of three corrected grids and can select TGT 1 or TGT 2 from the current fire missions or select a target in the target record

registers. If the operator does not select a target number the corrected grid for TGT 1 is produced. The MFDC prints the corrected grid of the selected target in ten figures. Set up as follows:

<b>BP</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
103 765	2220	Normal	C 70 A1

FM 4 MOR  
GR 097 754  
DIR 3685  
SEC DUG IN  
RDS FOR EFFECT  
2 AF

**CORRECTIONS**  
RIGHT 150, ADD 400  
DROP 200  
RIGHT 25, ADD 100

### **FINAL FIRE DATA**

TGT 1  
CHG 3  
B 3808  
E 1225  
R 1566

- c. **Gaining Corrected Grids.** The CPO can obtain 10 figure grids at any time for a target being engaged, simply by pressing the COR GR key. That GR comes from the last mission used:

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
1.	COR GR	“TGT 1?”	YES, if it is not then enter R/S and R/S target number 2
2.	3 R/S	“0940775214”	Note: The MFDC always displays 10 figure grids

- d. **Recording Targets:**

- (1) “TGT 2?” The MFDC prompts the CPO for the target whose data is to be recorded. If the operator responds YES, the MFDC records the data for TGT 2 otherwise, the data for TGT 1 is recorded.

Instruments for Calculating Mortar Firing Data

- (2) "TGT NO?" The MFDC prompts the CPO for the target number the data is to be stored under, from the target record registers. The map and corrected grids for the specified target are then stored in the target record registers. The MFDC gives a visual and audio warning if target numbers in the storage area are duplicated.

BP	ATT	SPREAD	AMMO
008 725	2100	Normal	C 70 A1

FM 4 MOR  
GR 013 743  
DIR 1900  
5 RDS  
2 AF

**FIRE DATA**  
TGT 1  
CHG 4  
NO 2  
B 0284  
E 1285  
R 1865  
TOF 35.8

- (3) FC sends "Record as ZM1001": To record the previous mission, press the REC Key.

STAGE	KEY	DISPLAY	REMARKS
1.	REC	"TGT 2?"	No
2.	R/S	"TGT NO?"	1001
3.	1001 R/S	"NEXT DATA"	Target data has been stored in memory.

e. **Mortars In/Out of Action:**

- (1) When the plotter is used for HE linear missions or for deliberate smoke missions and a mortar is out of action for one reason or another, the linear mission is less effective. The CPO must then spend more time to readjust. The MFDC enables automatic compensation for out of action mortars.

**NOTE**

It is very important for the CPO to realise that the MFDC programs have been made for a group of four mortars. If the group contains only three mortars the CPO must tell the MFDC to place mortar number four out of action. The MFDC can then continue producing accurate fire for different fire missions.

- (2) IN/OUT key operation.
  - (3) **Mortar Out.** When the CPO presses the IN/OUT key the MFDC will prompt “MORTAR OUT?”. If the response is YES the MFDC will prompt “MORTAR NO?”. The CPO then presses the key to match the number of the mortar that is out of action.
  - (4) **Mortar In.** If the CPO does not respond YES to the prompt “MORTAR OUT?”, the MFDC will prompt “MORTAR IN?”. To put a mortar back in, the CPO must respond YES. The operator then presses the key to match the mortar number that is to be put back in.
12. **Confirmation of Stage II:**
- a. questions from the class; and
  - b. questions to the class.
13. **Final Confirmation:**
- a. questions from the class; and
  - b. questions to the class.

## **CONCLUSION**

14. Remember that the MFDC is flexible enough to produce adjusting procedures with much greater accuracy than the plotter, even when the adjusting mortar is changed, the fire controller changes direction or different ammunition is used, than that programmed into the data. It is important that the CPO practices on his own to ensure effective and safe work. Any error, regardless of complexity or importance, can result in the loss of human lives for own troops. If you have any doubt about the data, obtain confirmation by a method other than firing.

15. The next lesson will be ...



**LESSON 7**  
**CANCELLATION PROCEDURES AND ADJUSTING AN**  
**ERRING MORTAR**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. Cancellation procedures and adjusting an erring mortar.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student;
  - b. fire mission proforma; and
  - c. firing table.
7. **Training Aids:**
  - a. chalk board; and
  - b. computer with PowerPoint®.

**CONDUCT OF THE LESSON**

8. **Introduction:**

- a. **Review.** As required.
- b. **What.** You will learn how to adjust an erring mortar.
- c. **Why.** As a control post operator (CPO) you must know the procedure for correcting fire lines for an adjustment.
- d. **Where.** During the course, in your unit and in battle.

9. **Stage I—Adjust an Erring Mortar by Cancelling a Previous Correction.** Occasionally during firing, the line of fire may spread out. The CPO must be able to adjust an erring mortar after receiving adjusted lines of fire from the fire controller (FC); the CPO must know how to cancel previous corrections.

<b>BP</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
104 762	1600	Normal	C70A1

**FIRE DATA**

FM 4 MOR	NO 2
GR 104 732	CHG 6
DIR 3040	B 3195
BMP	E 1250
5 RDS	R 3000
2 AF	TOF 44.0

**CORRECTIONS:**

LEFT 50	B 3180
DROP 50	E 1258
	R 2943

10. **Cancelling Corrections.** If target grid corrections are not required for this target, remove the LEFT 50, DROP 50 from the MFDC or any correction made to the last adjustment. Now to remove

LEFT 50, DROP 50 from the MFDC, press the CANCEL 1 or 2 key.  
Proceed as follows:

STAGE	KEY	DISPLAY	REMARKS
1.	SHIFT, CANCEL 1	“CNC1”	Note the last entered correction was removed
2.		“R/L - 50”	
3.		“A/D - 50”	
4.		“CANCELLED”	
5.		“NEXT DATA”	

### NOTE

To check that the last correction was cancelled note the initial fire data shown and proceed as indicated below.

STAGE	KEY	DISPLAY	REMARKS
1.	TGC 1	“TGC R/L”	No
2.	R/S	“TGC A”	No
3.		“CHG 6 BNG 3195 ELEV 1250” RANGE 3000”	Original task data is displayed

#### 11. Confirmation of Stage I:

- a. questions from the class; and
- b. questions to the class.

#### 12. Stage II—Adjust an Erring Mortar by Regular Grid Correction.

- a. To adjust the line of fire for an erring mortar, the FC must send an individual correction for that mortar.

BP GR	ATT	SPREAD	AMMO
104 762	1600	Normal	C-70 A1

Instruments for Calculating Mortar Firing Data

**FIRE DATA**

FM 4 MOR	N0 2
GR104 732	CHG 5
DIR 3040	B 3195
BMP	E 1250
5 RDS	R 3000
2 AF	TOF 44.0

- b. Order from fire controller/right group adjust fire:
- (1) The number 4 fires out of phase and the FC sends individual corrections to adjust the line of fire. The most effective method consists of introducing the correction as a regular grid correction. The fire controller sends the following message to CPO: number 4, adjust lines of fire LEFT 50, DROP 50.
  - (2) Fire data for mortar number 4 is: B 3180, E 1258, R 2943.
  - (3) When mortar number 4 has provided the data, CPO orders adjustment of line of fire on bearing 3195. The number 4 then carried out the operations and when completed, reports “Line of fire adjust on B 3195”.
  - (4) The CPO then reports to FC: “Lines of fire adjusted”. If further target grid corrections are requested on this target, use the CANCEL key as described in the cancelling correction paragraph.

13. **Confirmation of Stage II:**

- a. questions from the class; and
- b. questions to the class.

14. **Final Confirmation:**
  - a. questions from the class; and
  - b. questions to the class.

## **CONCLUSION**

15. This lesson provides a quick method for adjusting erring mortars, cancelling last corrections introduced in the MFDC and ensuring that appropriate fire is directed on the target area.
16. The next lesson will be ...

**LESSON 8**  
**PRODUCE FIRE CONTROL DATA WITH THE MORTAR**  
**FIRE DATA CALCULATOR (MFDC)**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. Engage two targets simultaneously:
  - a. produce fire data for executing two fire missions simultaneously; and
  - b. produce fire data from target grid corrections.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student; and
  - b. fire mission proforma.
7. **Training Aids:**
  - a. chalkboard; and
  - b. computer with PowerPoint®.

**CONDUCT OF THE LESSON****8. Introduction:**

- a. **Review.** As required.
- b. **What.** You will be taught how to produce fire data for engaging two targets simultaneously.
- c. **Why.** As the control post operator (CPO) you must be able to produce fire data on two targets simultaneously.
- d. **Where.** During the course, at your unit and in battle.

**9. Stage I—Produce Fire Data for Executing Two Fire Missions Simultaneously:**

- a. As we have seen we must process information received from the fire controller (FC) to produce fire data enabling the mortars to hit their target. We will now see how to handle two targets simultaneously.
- b. Fire data for executing two simple fire missions simultaneously:

<b>BP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
999 722	5851	20	C 70 A1

- c. Tasks:

FM R SECT  
GR 023725  
DIR 0670  
1 SECT IN THE OPEN  
5 RDS  
2 AF

Instruments for Calculating Mortar Firing Data

FM L SECT:  
 GR 009738  
 DIR 0170  
 MG NEST  
 5 RDS  
 3 AF

d. Complete the task as already taught for target 1 (TGT 1).

e. Give TGT 1 data:

NO 2  
 CHG 5  
 B1469  
 E1271  
 R 2415  
 TOF 45.5

f. Produce data for the second task on TGT 2:

STAGE	KEY	DISPLAY	REMARKS
1.	FM	“TGT 2?”	Carry out second task on target 2
2.	3 R/S	“TGT 2 GRD 6”	Continue in 6 figures
3.	009738 R/S	“SELECT AMMO”	Press shift and ammunition
4.	SHIFT – C 70 A1	“TGT 2 AMMO?”	Answer yes
5.	3 - R/S	“TGT 2 AJMOR?”	Enter adjusting mortar, number 3
6.	3 - R/S	“SLCT CHG”	If R/S, the MFDC chooses the charge closest to 1100 mils elevation or, enter the required charge
7.	R/S	“TGT 2 CHG4 NO3 B 0574 E 1281 R 1882 TOF 35.8”	The MFDC now prints fire data



- g. If the operator has already chosen the type of ammunition for target number 2, the MFDC then asks “FIRE DATA?”.

10. **Confirmation of Stage I:**

- a. questions from the class; and  
b. questions to the class.

11. **Stage II—Produce Fire Data From Target Grid**

**Corrections:**

- a. The MFDC can adjust two targets simultaneously. The procedure is similar to the one already seen for one target but requires special attention so as not to interchange corrections received from the FC:

<b>BP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
904 508	4520	Normal	C 70 A1

- b. Carry out the following fire missions:

FM L SECT	<b>FIRE DATA</b>
GR 924531	TGT 1
DIR 6080	NO 3
1 SECT IN THE OPEN	CHG 6
5 RDS	B 0732
3 AF	E 1241
	R 3061
	TOF 43.9
FM R SECT	<b>FIRE DATA</b>
GR 918539	TGT 2
DIR 5880	NO1
	CHG 6
1 STATIONARY BMP	B 0422
5 RDS	E 1193
1 AF	R 3373
	TOF 43.2

Instruments for Calculating Mortar Firing Data

c. You receive the following corrections:

Number 3 RIGHT50, ADD 200	“TGC 1”
Number 1 LEFT 100, DROP 200	“TGC 2”
Number 3 DROP 100	“TGC 1”
Number 1 ADD 100	“TGC 2”
Number 3 ADD 50, FFE	“TGC 1”
Number 1 RIGHT 25, ADD 50, FFE	“TGC 2”

**NOTE**

Do one correction at a time for lesson purposes.

STAGE	KEY	DISPLAY	REMARKS
1.	TGC 1	“DIRECTION”	Enter direction 6080. If already done, MFDC goes to next stage
2.	6080—R/S	“TGC 1 R/L”	Right 50
3.	50—R/S	“TGC 1 A/D”	Add 200
4.	200—R/S	“NO 3 CHG 6 B 0685 E 1218”	Proceed with correction to L Section, Number 1
5.	TGC 2	“DIRECTION”	Enter direction 5880
6.	5880—R/S	“TGC 2 R/L”	Left 100
7.	- 100— CHS—R/S	“TGC 2 A/D”	Drop 200
8.	- 200-CHS- R/S	“NO 1 CHG 6 B 0454 E 1224”	Proceed with correction to L Section, Number 3
9.	TGC 1	“TGC 1 R/L”	No correction
10.	R/S	“TGC 1 A/D”	Drop 100
11.	- 100— DHS—R/S	“NO 3 CHG 6 B 0712 E 1227”	Proceed with correction number 1

STAGE	KEY	DISPLAY	REMARKS
12.	TGC 2	“TGC 2 R/L”	No correction
13.	R/S	“TGC 2 A/D”	Add 100
14.	100—R/S	“NO 1 CHG 6 B 0428 E 1215”	Proceed with correction number 3
15.	TGC 1	“TGC 1 R/L”	No correction
16.	R/S	“TGC 1 A/D”	Add 50, FFE
17.	50 - R/S	“NO 3 CHG 6 B 0699 E 1223”	Final data for L Section. Proceed correction R Section, Number 1
18.	TGC 2	“TGC 2 R/L”	Right 25
19.	25 - R/S	“TGC 2 A/D”	Add 50, FFE
20.	50 - R/S	“NO 1 CHG 6 B 0420 E 1207”	Final data for R Section

12. **Confirmation of Stage II:**

- a. questions from the class; and
- b. questions to the class.

13. **Final Confirmation:**

- a. questions from the class; and
- b. questions to the class.

**CONCLUSION**

14. During this lesson you have learned to produce fire data for two targets simultaneously. Remember the importance of making corrections for the correct target.

15. The next lesson will be ...

**LESSON 9**  
**PRODUCE POLAR FIRE MISSION DATA**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. Produce polar fire mission data:
  - a. polar fire missions;
  - b. polar fire missions with laser corrections; and
  - c. polar fire missions with target grid corrections.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student; and
  - b. fire mission proforma.
7. **Training Aids:**
  - a. chalk board; and
  - b. computer with PowerPoint®.

**CONDUCT OF THE LESSON****8. Introduction:**

- a. **Review.** As required.
- b. **What.** You will learn to carry out a polar fire mission with laser and target grid corrections.
- c. **Why.** When used in conjunction with the laser range finder and C5 prismatic compass, the MFDC is the fastest means available to us for accurately engaging targets, within the scope of polar fire missions. The second shot usually hits the target.
- d. **Where.** During the course, at your unit and in combat.

**9. Stage I—Polar Fire Missions with Laser Corrections on Targets.**

<b>BP GR</b>	<b>OP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
109 763	099 751	2100	Normal	C 70 A1

- a. Carry out the following fire mission:

FM 4 MOR  
DIR 2700  
R 2400  
3 RDS  
2 AF

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
1.	PM	“TGT 2?”	No
2.	R/S	“TGT 1 OP C/S” “C 70 A1” “LIN HE?”	If OP is registered, give C/S. Otherwise enter OP C/S and OP grid
3.	51 R/S	“OP GRID 6”	Enter OP grid
4.	099 751 R/S	“TGT 1 DIR?”	Enter direction to target

Instruments for Calculating Mortar Firing Data

STAGE	KEY	DISPLAY	REMARKS
5.	2700 R/S	“TGT DIST?”	Enter distance to target
6.	2400 R/S	“SELECT AMMO”	C 70A1
7.	SHIFT C70A1	“TGT 2 AMMO?”	No
8.	R/S	“TGT 1 AJMOR?”	Number 2
9.	2 R/S	“SLCT CHARGE?”	No
10.	R/S	“TGT 1 CHG 6 NO 2 B 3156 E 1200 R 3327 TOF 43.3”	

b. The above is the procedure for producing polar fire mission data.

c. **Target Adjustment.** Polar fire missions with laser corrections (LC) are our best tool because they usually enable us to hit the target with only one correction.

d. The CPO receives the fire mission from the fire controller:

FM 4 MOR:	<b>FIRE DATA</b>
DIR 2940	NO 2
	CHG 5
R 2000	B 3355
BMP	E 1125
5 RDS	R 3179
2 AF	TOF 44.0

e. The fire controller shall now adjust the target and sends the following corrections: Direction 3000 and Range 2150, representing the distance from which the adjusted shell will fall. Let us now see key LC-1 or LC-2:

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
1.	LC 1	“LC 1 DIR?”	3000 represents the direction from the OP to the shell burst
2.	3000 R/S	“LC 1 DIST 1?”	2150 represents the distance from the OP to the shell burst
3.	2150 R/S	“TGT 1 CHG 6 B 3335 E 1202 LC 1 DIR?”	Continue corrections as ordered

**NOTE**

This program uses only one laser correction. That correction must always be cancelled if a second laser correction is applied.

PRESS “SHIFT CANCEL”  
DIR 2800  
DIST 2000

**FIRE DATA**

TGT 1  
CHG 5  
B 3430  
E 1094  
R 3314

**NOTE**

This method cannot be used with illuminating ammunition. The MFDC will sound an alarm and leave the program.

10. **Confirmation of Stage I:**
- a. questions from the class; and
  - b. questions to the class.

11. **Stage II—Polar Fire Mission Using Target Grid**

**Correction:**

- a. Data can be presented in two different ways. The first involves target grid corrections. Since you already know this method, you will be given the following fire mission from the fire controller (OP, GR 099 751):

LFM 4 MOR	<b>FIRE DATA</b>
DIR 2700	TGT 1
	CHG 6
R 1800	B 3241
MG	E 1277
4 RDS	R 2811
1 AF	TOF 44.4

- b. Polar fire missions with target grid corrections are faster than the classic method. Controllers can actually carry out their work in less time. The technique used with the MFDC is simple and target grid corrections are calculated in the usual fashion. Remember that the direction fed into the MFDC will be the target observation factor, in this case 2700 mils:

<b>CORRECTIONS</b>	<b>FINAL FIRE DATA</b>
LEFT 100, ADD 400	TGT 1
	CHG 6
DROP 200	B 3168
ADD 100	E 1252
DROP 50, FFE	R 2984
	FFE

12. **Confirmation of Stage II:**

- a. questions from the class; and
- b. questions to the class.

13. **Final Confirmation:**

- a. questions from the class; and



- b. questions to the class.

## **CONCLUSION**

14. The MFDC, employed together with the laser range finder enables carrying out fire missions quickly and very accurately. Our potential for producing fire on the battlefield is thus considerably increased.

15. The next lesson will be ...

**LESSON 10**  
**ILLUMINATION AND CO-ORDINATED ILLUMINATION**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. Illumination and co-ordinated illumination:
  - a. point;
  - b. diamond;
  - c. lateral spread;
  - d. range spread; and
  - e. co-ordinated illumination.

**PREPARATION**

3. **Time Required.** Three 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student; and
  - b. fire mission proforma.

7. **Training Aids:**
- a. chalkboard; and
  - b. computer with PowerPoint®.

## CONDUCT OF THE LESSON

8. **Introduction:**
- a. **Review.** As required.
  - b. **What.** You will learn how to produce illuminating and co-ordinated illumination fire data.
  - c. **Why.** One of the methods for illuminating the battlefield at night is provided by illuminating rounds using the mortar and by co-ordinated illumination using HE, to neutralise a target. As control post operator (CPO) you must be entirely familiar with all of these procedures.
  - d. **Where.** During the course, at your unit and in battle.
9. **Stage I—Point Illumination:**
- a. Illumination is an important part of the modern battlefield. The MFDC can produce the needed fire data quickly for point illumination, range spread, lateral spread, diamond and co-ordinated illumination with HE.
  - b. **Point Illumination.** Illumination fire missions are calculated in the same manner as a simple HE mission, differences are that we use the TGC (Target Grid Correction) and DF (Distribution of Fire) keys. During this lesson data used for all illuminating fire missions are as follows:

BP GR	ATT	SPREAD	AMMO
1045 7652	2080	Normal	C105

Instruments for Calculating Mortar Firing Data

FM 1 MOR  
 GR 0980 7490  
 DIR 3465  
 ILLUM 5 RDS  
 2 AF

c. Point illumination is calculated as follows:

STAGE	KEY	DISPLAY	REMARKS
1.	FM	“TGT 2?”	No
2.	R/S	“TGT 1 GRD 8”	Enter Grid
3.	0980 7490 R/S	“SELECT AMMO”	C 105
4.	SHIFT C 105	“TGT 2 AMMO?”	No
5.	R/S	“TGT 1 AJMOR?”	2
6.	2 R/S	“MAP GR 1747” “SLCT CHARGE?”	No
7.	R/S	“CHG 2 NO 2 B 3580 E 1217 R 1747 FUZE 30.4”	

d. You have now prepared the initial illuminating fire mission. Please note that fuze adjustment rather than time of flight is used.

e. Proceed as follows when getting corrections for illuminations. Continue the mission:

STAGE	KEY	DISPLAY	REMARKS
1.	TGC 1	“DIRECTION?”	3465
2.	3465 R/S	“TGC 1 R/L”	LEFT 50
3.	50 R/S	“TGC 1 A/D”	ADD 200
4.	200 R/S	“TGC 1 UP/DN”	UP 100

STAGE	KEY	DISPLAY	REMARKS
5.	100 R/S	“TGT 1 CHG 2 NO 2 B 3542 E 1156 R 1941 FUZE 28.7 TGC 1 R/L”	Continue corrections until desired fire is obtained

#### NOTE

1. The calculator keeps all height corrections in memory (higher or lower).
  2. The MFDC will not accept an up or down (UP/DN) correction less than 50 metres.
  3. Down corrections are input as for left or drop corrections.
  4. The MFDC will not accept an up correction exceeding 900 metres. Thus, projectiles cannot explode before reaching the highest point of their trajectory.
- f. When the fire controller orders fire for effect, the last corrections given are to be used.
  - g. When two mortar are assigned to the same illumination point, proceed as follows while preserving the indications from the preceding mission.

Instruments for Calculating Mortar Firing Data

STAGE	KEY	DISPLAY	REMARKS			
1.	DF 1	“MOR R-1/L-2”	“MOR R-1” applies to the right section  The term “L-2” applies to the left section. Use the right section			
2.	1 R/S	“TGT 1?”  “AMMO C 105”  “RANGE?”	This question concerns range; when not applicable, press 3 R/S key			
3.	3 R/S	“SPREAD?”	Concerns distance between projectiles. If the fire controller does not wish a 600 metre spread, he must specify or the default of 600 metres will be used. In this example use 600 metres.			
4.	R/S	“TGT 1”				
	MOR NO	CHG	B	E	R	TOF
	1	2	3530	1030	2246	27.2
	2	2	3541	1247	1641	29.7

**NOTE**

This data will put one round on the illumination point and one past it.

10. **Confirmation of Stage I:**
- a. questions from the class; and
  - b. questions to the class.

11. **Stage II—Range Spread:**

- a. When we wish to produce illumination in depth in enemy territory, we must resort to range spread. This procedure is very helpful for tanks and anti-armour supporting fire. Proceed as follows (use point fire mission):

STAGE	KEY	DISPLAY	REMARKS			
1.	DF 1	“MOR R-1/L-2”	No			
2.	R/S	“TGT 1?” “AMMO C105 DMND” “RANGE?”	No  Yes			
3.	3 R/S	“SPREAD?”	Use normal 600 metre spread for this example			
4.	R/S	“TGT 1”				
	MOR NO	CHG	B	E	R	TOF
	1	5	3534	1281	2845	43.7
	2	5	3543	1359	2241	44.8
	3	5	3559	1428	1638	45.8
	4	5	3594	1491	1035	46.6

**NOTE**

The MFDC prints the fire data for the range spread with number 1 firing at the farthest point and number 4 firing at the closest point.

12. **Confirmation of Stage II:**

- a. questions from the class; and  
b. questions to the class.

13. **Stage III—Lateral and Diamond Spread:**

Instruments for Calculating Mortar Firing Data

- a. When we wish to illuminate a company in depth, we use lateral spread. Using the same illuminating point as that given in paragraph 10, proceed as follows:

STAGE	KEY	DISPLAY	REMARKS																														
1.	DF 1	“MOR R-1/L-2”	No																														
2.	R/S	“TGT 1?” “AMMO C 105 DMND”	No																														
3.	R/S	“RANGE?”	No																														
4.	R/S	“LAT?”	Yes																														
5.	3 R/S	“SPREAD?”	Use Normal 600 metre spread																														
6.	R/S	“TGT 1”																															
<table border="1"> <thead> <tr> <th>MOR NO</th> <th>CHG</th> <th>B</th> <th>E</th> <th>R</th> <th>TOF</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>5</td> <td>3972</td> <td>1373</td> <td>2125</td> <td>45</td> </tr> <tr> <td>2</td> <td>5</td> <td>3698</td> <td>1392</td> <td>1962</td> <td>45.3</td> </tr> <tr> <td>3</td> <td>5</td> <td>3401</td> <td>1392</td> <td>1958</td> <td>45.3</td> </tr> <tr> <td>4</td> <td>5</td> <td>3126</td> <td>1374</td> <td>2114</td> <td>45</td> </tr> </tbody> </table>				MOR NO	CHG	B	E	R	TOF	1	5	3972	1373	2125	45	2	5	3698	1392	1962	45.3	3	5	3401	1392	1958	45.3	4	5	3126	1374	2114	45
MOR NO	CHG	B	E	R	TOF																												
1	5	3972	1373	2125	45																												
2	5	3698	1392	1962	45.3																												
3	5	3401	1392	1958	45.3																												
4	5	3126	1374	2114	45																												

**NOTE**

Lateral spread is thus 1800 metres from the left mortar to the right mortar.

**14. Confirmation of Stage III:**

- a. questions from the class; and
- b. questions to the class.

**15. Stage IV—Diamond:**

- a. We are frequently required to illuminate a large circular area rather than a linear target. To accomplish this, the diamond formation is used. Using data from paragraph 10, apply the following procedure:



STAGE	KEY	DISPLAY	REMARKS		
1.	DF 1	“MOR R-1/L-2”	No		
2.	R/S	“TGT 1?” “AMMO C 105 DMND”	Yes		
3.	R/S	“SPREAD?”	Normal		
4.	R/S	“TGT 1”			
MOR NO	CHG	B	E	R	TOF
1	5	3530	1358	2246	44.8
2	5	3698	1392	1962	45.3
3	5	3559	1428	1638	45.8
4	5	3416	1393	1950	45.3

### NOTE

Note on which point each mortar fire is directed. Although trajectories can cross occasionally, the differences in heights eliminates the probability of problems. Further, each projectile will burst 300 metres from the point to be illuminated with normal 600 metre spread between projectiles. In the case of the present mission, the rounds will reach 300 metres from the point to be illuminated, that is to say that the projectiles will fall 600 metres one from the other.

#### 16. Confirmation of Stage IV:

- a. questions from the class; and
- b. questions to the class.

#### 17. Stage V—Coordinated Illumination with High Explosive (HE):

- a. When the Fire Controller (FC) adjusts a target at night for HE, the FC must be able to see where the rounds impact. Therefore, co-ordination of firing an HE round with illumination is required.
- b. For this example, the position is located at the following grid and illuminating point is adjusted:

Instruments for Calculating Mortar Firing Data

<b>BP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
104 766	1725	Normal	C 70 A1 C105

FM 4 MOR	<b>FIRE DATA</b>
GR 090 759	TGT 1
DIR 5600	CHG 3
	NO 1
MINE LAYING DETACHMENT	B 4311
NO 1 ILLUM 8 RDS	E 1366
DELAY IN EFFECT 3 RDS	R 1528
1 AF	FUZE 37.5

**NOTE**

Enter the same mission into Target 2 but use the HE ammunition instead of illumination and use number 2 mortar for adjustment. Fire details are shown below.

AMMO C70 A1

TGT 2  
CHG 2  
B 4322  
E 1277  
R 1553  
TOF 31.0

- c. The CPO applies corrections as ordered.

**NOTE**

The illumination will be adjusted first, then the HE.

**INITIAL FIRE DATA:**

ADJUST 1	TGT 1
DIR 5600	CHG 2
	NO 1
LEFT 100	B 4408
ADD 200	E 1233
UP 500	R 1691
	FUZE 25.5

- d. FC now orders **CO-ORDINATED ILLUMINATION 15 SECONDS, 2 ADJUST FIRE**. Apply these corrections:

	<b>FIRE DATA:</b>
ADJUST 2	TGT 2
LEFT 100	CHG 3
	NO 2
ADD 400	B 4520
	E 1146
	R 1806

	<b>FIRE DATA:</b>
DROP 200	B 4417
	E 1177
	R 1717

	<b>FIRE DATA:</b>
ADD 100	B 4470
	E 1162
	R 1760

	<b>FIRE DATA:</b>
DROP 50	B 4444
	E 1170
	R 1738

	<b>FIRE DATA:</b>
DROP 25	B 4430
CANCEL COORD ILLUM	E 1173
CONVERGE	
FFE	R 1728

- e. The CPO now has all mortars fire at the target (except number 1 who puts on the HE fire data and then fires the effect ammunition). Remember that the CPO must be sure which mortar produces illuminating fire and what other mortar fires HE. If distribution of fire (DF) is required, calculate data using the appropriate DF key. The data from the last fire mission is used but the order is given to fire for effect with convergence.

Instruments for Calculating Mortar Firing Data

STAGE	KEY	DISPLAY	REMARKS	
1.	DF 2	“MOR R-1/L-2”	No	
2.	R/S	“TGT 2?” “AMMO C 70 A1” “LIN HE?”	No	
3.	R/S	“LIN WP?”	No	
4.	R/S	“CONVRG?”	Yes	
5.	3 R/S	“TGT #2”		
MOR NO	CHG	B	E	R
1	3	4422	1182	1701
2	3	4430	1173	1728
3	3	4438	1164	1754
4	3	4446	1155	1781

**NOTE**

Important—co-ordinated illumination:

- a. On the command **FIRE FOR EFFECT**, press the DF 1 or 2 key depending on the target you have, FM HE and make a circle using 4 mortars or any other figure requested.
- b. If the command is **CONTINUED ILLUMINATION, FIRE FOR EFFECT**, you proceed as follows:
  - (1) place the illuminating adjusting mortar out of action; and
  - (2) press DF for the requested figure but only for 3 mortars.

18. **Confirmation of Stage III:**

- a. questions from the class; and
- b. questions to the class.

19. **Final Confirmation:**

- a. questions from the class; and
- b. questions to the class.

## **CONCLUSION**

20. We have studied the procedure for producing quick and simple illumination. Do not forget during illuminating co-ordinated fire missions, you must ensure that the right corrections are applied to the right targets.
21. The next lesson will be...

**LESSON 11**  
**REGISTER TARGETS AND OBSERVATION POSTS**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. Register targets and observation posts (OPs).
  - a. input, view and delete OP lists; and
  - b. input, view and delete target lists.

**PREPARATION**

3. **Time Required.** One 40-minute period.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student; and
  - b. fire mission proforma.
7. **Training Aids:**
  - a. chalkboard; and
  - b. computer with PowerPoint®.

**CONDUCT OF THE LESSON****8. Introduction:**

- a. **Review.** As required.
- b. **What.** You will learn how to record targets and OPs in the MFDC.
- c. **Why.** As control post operator (CPO) you must be able to register OP, and target lists for future use, such as for a fire plan or future engagement.
- d. **Where.** During the course, at your unit and in battle.

**9. Stage I—View and Delete OP Lists:**

- a. The MFDC has the capacity to store 39 targets and 10 OPs in its continuous memory program. The targets can be stored by map grid or by polar coordinates so that pre-planned or adjusted targets can be stored and instantly recalled for fire data production under Target Number Fire Missions (TNFMs). All OPs in the area of operations can be stored and recalled for use when occupied by the Fire Controller (FC) (particularly when engaging laser missions). Regarding the list of OPs, the key OPS has three main calls:
  - (1) data input;
  - (2) view, and
  - (3) delete.
- b. The OP program can store up to 10 OP locations in 6, 8 or 10 figure grids. The CPO can input, view or delete OPs in the program.
- c. 8 figure grids:

Instruments for Calculating Mortar Firing Data

<b>BP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
0350 7110	1600	Normal	C 70 A1

d. Use the following OPs:

GR 0044 7202
GR 0045 7202
GR 0108 7258
GR 0210 7214
GR 0249 7282
GR 0346 7341
GR 0042 7576
GR 0137 7602
GR 0221 7540
GR 0246 7641
GR 9980 7334

e. OPs input procedure:

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
1.	OPS	“INPUT?”	Yes
2.	3 R/S	“OP C/S”	Accept up to four digit number
3.	1 R/S	“OP GRD 8”	Insert OP grid now
4.	0044 7202 R/S	“OP C/S?”	Continue until all OPs entered; exit program anytime by pressing any other function key

**NOTE**

If the operator inputs a number which already has been stored, the MFDC warns “DUPLICATIONS” and prompts for a correct number.

10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.



11. **Stage II—View Op Storage:**

- a. To view OPs in storage, the CPO must key OPS, R/S. The calculator asks “VIEW?”. Answer YES. If we answer NO, the calculator asks “DELETE?”.

- b. Viewing all Ops:

STAGE	KEY	DISPLAY	REMARKS
1.	OPS	“INPUT?”	No
2.	R/S	“VIEW?”	Yes
3.	3 R/S	“VIEW ALL?”	Yes
4.	3 R/S	“SORT OPS”	Sorts into numerical order
5.	R/S	“OP C/S”	Prints all OP
6.		“OP GRID”	Shows grid in the program

- c. To the question “VIEW?” (one OP), answer YES to the question “VIEW ALL?” (all OPs) answer NO.
- (1) To view just one OP, enter OP C/S and press R/S; the MFDC then prints the data and returns to start “OP C/S”.
- (2) When sorting, do not press R/S as errors can occur. Sorting OPs or targets can cause delay of operations up to 30 seconds.

- d. View one OP:

STAGE	KEY	DISPLAY	REMARKS
1.	OPS	“INPUT?”	No
2.	R/S	“VIEW?”	Yes
3.	3 R/S	“VIEW ALL?”	No
4.	R/S	“START OP C/S”	Give C/S
5.	1 R/S	“END OP C/S”	To view just one OP enter OP number, press R/S; show data and it goes back to start “OP C/S”.

- e. To delete a number of OPs in numerical sequence enter the lowest number first (“START OP C/S”)

Instruments for Calculating Mortar Firing Data

and the highest number last (“END OP C/S”) and all will be deleted.

f. Deleting OPs :

STAGE	KEY	DISPLAY	REMARKS
1.	OPS	“INPUT?”	No
2.	R/S	“VIEW?”	No
3.	R/S	“DELETE?”	Yes
4.	3 R/S	“START OP C/S”	Enter lowest number to be deleted
5.	R/S	“END OP C/S”	Enter highest number, if it is the only one to be deleted press R/S
6.	10 R/S	“START OP C/S”	MFDC returns to start “OP C/S”

12. Confirmation of Stage II:

- a. questions from the class; and
- b. questions to the class.

13. Stage III—Input, Viewing and Deleting Target Lists:

- a. Targets can be stored by map grid or by polar co-ordinates. For the list of target co-ordinates, key TS (Target Storage).
- b. Input target lists:
  - (1) “POLAR COORD?” (polar co-ordinates), or
  - (2) “MAP COORD?” (grid co-ordinates).
- c. Input target grid co-ordinates. Use the following ten targets:

<b>TGT NO</b>	<b>GRID</b>	<b>TGT NO</b>	<b>GRID</b>
1001	0120 7314	1006	0250 7274
1002	0139 7342	1007	0083 7548
1003	0046 7400	1008	0083 7492
1004	0106 7421	1009	0283 7500
1005	0165 7502	1010	0253 7574

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
1.	TS	“INPUT?”	Yes
2.	3 R/S	“POLAR COORD?”	No
3.	R/S	“MAP COORD?”	Yes
4.	3 R/S	“TGT NO?”	Input target number now
5.	1001 R/S	“TGR GRD 8”	Input target grid now
6.	0120 7314 R/S	“TGT NO?”	Continue to input all targets as above

### NOTE

1. The calculator can memorize a list of 39 targets. If the operator enters a number already used, the calculator warns “DUPLICATIONS” and ask the question “TGT NO?”.

2. To depart this routine, press any other function key, for example FM.

d. Input targets with polar co-ordinates. Example data is: **OP NUMBER 15: GR 0250 7259**

<b>TARGET NUMBER</b>	<b>DIRECTION</b>	<b>DISTANCE</b>
1111	1625	1000
1112	1800	2000
1113	1500	1500
1115	1200	1200

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
--------------	------------	----------------	----------------

Instruments for Calculating Mortar Firing Data

STAGE	KEY	DISPLAY	REMARKS
1.	TS	“INPUT?”	Yes
2.	3 R/S	“POLAR COORD?”	Yes
3.	3 R/S	“OP C/S?”	Input OP C/S. If not in storage, asks for OP Grid
4.	1 R/S	“OP GRD 8”	Enter grid now
5.	0250 7259 R/S	“TGT NO?”	Asks for target number.
6.	1111 R/S	“DIR?”	Enter the direction now
7.	1625 R/S	“DIST?”	Enter the distance now
8.	1000 R/S	“TGT NO?”	Continue to enter all targets in the same manner.

- e. **Viewing Targets.** To view one or more targets from the memory, press on TS, when calculator asks “INPUT?” press R/S. When calculator asks “VIEW?” answer YES. If we answer R/S (no), the calculator asks “DELETE?”. Now you can view one or all targets.

STAGE	KEY	DISPLAY	REMARKS
1.	TS	“INPUT?”	No
2.	R/S	“VIEW?”	Asks to view the targets; respond yes.
3.	3 R/S	“VIEW ALL?”	If just one target, no; if all, say yes.
4.	R/S	“MAP GRID?”	If yes gives map grid; if no gives corrected grid.
5.	3 R/S	“START TGT NO”	To view just one target, press R/S, displays data and goes back to start target number

STAGE	KEY	DISPLAY	REMARKS
6.	1111 R/S	“END TGT NO”	
7.	R/S	“TGT NO 1111”	
8.		“MAP GRID”	
9.		“03499 72566”	

f. Now view all targets:

STAGE	KEY	DISPLAY	REMARKS
1.	TS	“INPUT?”	No
2.	R/S	“VIEW?”	Yes
3.	3 R/S	“VIEW ALL?”	Yes
4.	3 R/S	“MAP GRID?”	Yes
5.	3 R/S	“SORT TGT?”	Asks if you want to see all targets in numerical order; answer YES.
6.	3 R/S	“DO NOT PRESS R/S WHILE SORTING TGTS”	Warning if R/S is pressed, error in computing data can occur.

g. **Deleting Targets.** As indicated, targets can be deleted from memory when they are obsolete. Following is the procedure:

STAGE	KEY	DISPLAY	REMARKS
1.	TS	“INPUT?”	No
2.	R/S	“VIEW?”	No
3.	R/S	“DELETE?”	Yes
4.	3 R/S	“START TGT NO”	Input the lowest target number to be deleted.

## Instruments for Calculating Mortar Firing Data

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
5.	1111 R/S	“END TGT NO”	This is only one to be deleted so press R/S.
6.	R/S	“START TGT NO”	If other targets are to be deleted, continue; if not, exit program.

### **NOTE**

To delete a number of targets in numerical sequence, enter the lowest number first at “START TGT NO” and the highest number last at “END TGT NO”. All targets in between, including the numbers given, will be deleted.

14. **Confirmation of Stage III:**
- a. questions from the class; and
  - b. questions to the class.
15. **Final Confirmation:**
- a. questions from the class; and
  - b. questions to the class.

## **CONCLUSION**

16. Thirty-nine targets can be kept in the calculator’s memory and recalled for obtaining fire data. Ten observation posts can be memorised and recalled when engaging polar missions, thus accelerating CPO reaction for engaging targets quickly.
17. The next lesson will be ...

## **LESSON 12**

### **ADJUST A GROUP OF TARGETS**

#### **ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC) .

#### **MAIN TEACHING POINTS**

2. Adjust a group of targets:
  - a. silent registration;
  - b. registration by fire; and
  - c. adjusting fire data.

#### **PREPARATION**

3. **Time Required.** One 40-minute period.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student; and
  - b. fire mission proforma.
7. **Training Aids:**
  - a. chalkboard; and
  - b. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. **Introduction:**

- a. **Review.** As required.
- b. **What.** Produce fire data by silent registration, registering by fire and adjusting fire data.
- c. **Why.** To respond quickly to calls for fire on previously designated targets, the control post operator (CPO) must pre-compute and produce fire data for the targets. The CPO must also be able to register targets when fire is authorised.
- d. **Where.** During the course, at your unit and in battle.

### 9. **Stage I—Silent Registration:**

- a. This method allows the operator to prepare all data for targets on the target list passed by radio (encoded) or by hand (written list or card reader card). Altitude is not used for the 81 mm program.

#### **NOTE**

Go MEMORY LOST then do the steps below.

#### **TARGET LIST “GOOSE CHASE”**

1001	0120 7314
1002	0139 7342
1003	0046 7400 FINAL PROTECTIVE FIRE
1004	0106 7421
1005	0165 7502
1006	0250 7274
1007	0083 7492
1008	0083 7548
1009	0283 7500
1010	0253 7574



<b>BP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
9980 7334	6400	Normal	C 70 A1

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
1.	TNFM	“TGT 2?”	No
2.	R/S	“TGT NO?”	Select target to be engaged (i.e., FPF 1003)
3.	1003 R/S	“SELECT AMMO”	Input desired ammunition here.
4.	C70 A1	“TGT 2 AMMO?”	
5.	R/S	“TGT AJMOR?”	Select ADJ MOR (In this example number 0)
6.	R/S	“MAP RG 0944” “SLCT CHARGE?”	No
7.	R/S	“TGT 1 CHG2 NO 0 B 0800 E 1314 R 0933 TOF 26.3 NEXT DATA”	
8.	Use this procedure for the remaining targets to finish silent registration. Although each target must be computed individually, it is still much faster than the manual methods. These targets have not been adjusted by fire so accurate fire still cannot be guaranteed.		

10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

Instruments for Calculating Mortar Firing Data

11. **Stage II—Registration by Fire:**

- a. In this operation, the Fire Controller (FC) either adjusts each target individually or, as a more practical method to conserve ammunition and maintain security, adjusts one target (or witness point) and uses the data to adjust the other targets.
- b. To adjust a witness point, do the following procedure using the GOOSECHASE Target List.
- c. Produce fire data for the following fire mission (ammunition C70 A1):

FM 4 MOR  
TGT NO 1005

DIR 6315  
ADJ REG PT  
1 AF

CORRECTIONS:

LEFT 75  
ADD 100  
DROP 50  
ADD 25

DATA FROM ZM 1001 TO  
ZM 1010

REF TGT: N0 1  
CHG 5  
B 0793  
E 1253  
R 2519

STAGE	KEY	DISPLAY	REMARKS
1.	REC	“AF DATA?”	No, this will be covered later.
2.	R/S	“TGT 1?”	Yes. Use the fire data in TGT 1 (1005) to adjust the other targets.
3.	3 R/S	“LEFT 0081” “ADD 0068” “START TGT NO”	This is the adjustment made to move the fire. This is for the lowest numbered target to adjust (1001).

STAGE	KEY	DISPLAY	REMARKS
4.	1001 R/S	“END TGT NO?”	Highest numbered target to be adjusted and will include all between (1010).
5.	1010 R/S	“1001” “1002 (...to 1010”	This shows that it is making the adjustment and shows each target as they are done. When it is finished, it will return to “NEXT DATA”.

- d. To view everything, key TS (Target Storage) and at the question “MAP GRID?”, answer NO. The calculator will display corrected data, indicating corrections.
- e. The new adjustments cancel the old and if we wish to cancel all adjustments we must:

STAGE	KEY	DISPLAY	REMARKS
1.	REG	“AF DATA?”	Yes, AF (Adjust Fire)
2.	3 R/S	“R/L AFD”	AFD (Adjust Fire Data) Right/Left Corrections
3.	R/S	“A/D AFD”	Add/Drop Corrections
4.	R/S	“RIGHT 0000 ADD 0000”	All targets return to target grid

12. **Confirmation of Stage II:**
- questions from the class; and
  - questions to the class.
13. **Stage III—Adjusting Fire Data:**

Instruments for Calculating Mortar Firing Data

- a. During defensive operations the FC must frequently authorise fire corrections or engage a target of opportunity. To do this, he must move to an alternate position in order to protect the security of the main position. When the mission is ended, the collected fire data are calculated as previously explained. To learn how to adjust fire data obtained from another group mission, use RIGHT 125, ADD 100 and proceed as follows:

STAGE	KEY	DISPLAY	REMARKS
1.	REG	“AF DATA?”	Yes, adjust fire data is from another position
2.	3 R/S	“R/L AFD?”	Right/Left Correction
3.	125 R/S	“A/D AFD?”	Add/Drop Correction
4.	100 R/S	“RIGHT 125” “ADD 100” “START TGT NO”	Restates full correction for confirmation. State the lowest numbered target (1001)
5.	1001 R/S	“END TGT NO”	State the highest numbered target (1010) and all targets in between will be adjusted.
6.	As the MFDC adjusts each target, it will display which target is being adjusted at that time		

**NOTES**

1. If the user keys REG and answers no to the question “AF DATA?”, he must choose “TGT 1” or “TGT 2”. If he chooses “TGT NO?”, the displayed data will appear to him as having been corrected but it will not have been;
2. To verify if fire data have been corrected, press the key TS and use “VIEW ALL?”; press the R/S key after “MAP GRID” causing corrected grids for all targets to be displayed.

14. **Confirmation of Stage III:**
  - a. questions from the class; and
  - b. questions to the class.
15. **Final Confirmation:**
  - a. questions from the class; and
  - b. questions to the class.

## **CONCLUSION**

16. In this lesson you have seen registration by fire and adjusting fire data.
17. The next lesson will be...

**LESSON 13**  
**LINEAR HE**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. Linear HE:
  - a. linear HE 2 mortar (left/right sections);
  - b. linear HE 4 mortars; and
  - c. linear HE alternative method.

**PREPARATION**

3. **Time Required.** One 40-minute period.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student.
  - b. fire mission proforma.
7. **Training Aids:**
  - a. chalkboard; and
  - b. computer with PowerPoint®.

**CONDUCT OF THE LESSON****8. Introduction:**

- a. **Review.** As required.
- b. **What.** Produce linear HE data with section, group and alternative method.
- c. **Why.** Enemy lines of advance or defensive positions are seldom parallel to our belts of fire; therefore, we must be prepared to match the belts of fire to a linear occupation of the ground so as to deliver the most effective fire possible on the target.
- d. **Where.** During the course, at your unit and in battle.

**9. Stage I—Linear HE 2 Mortars (Left/Right Sections):**

- a. You have learned how to lay out linear HE so as to extract data with the plotter. Using the procedure for producing simple linear HE, you can enter the same data in the calculator. We begin with left/right sections fire missions (FMs) for 2 mortars. Explain and demonstrate:

<b>BP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
006 725	0100	Normal	C 70 A1

FM LEFT SECT  
GR 015 754  
DIR 1700  
COY IN THE OPEN  
RDS  
LINEAR 200  
ATT 5300  
3 AF

- b. Carry out the FM program as taught. Fire data are as follows:

Instruments for Calculating Mortar Firing Data

TGT 1  
 CHG 6  
 NO 3  
 B 0308  
 E 1247  
 R 3022  
 TOF 44.0

- c. The fire controller orders fire for effect. Press key DF 1 (Distribution of Fire) (repeat). The calculator displays as follows:

STAGE	KEY	DISPLAY	REMARKS
1.	DF 1	“MORS R-1/L-2”	This refers to Right Section (R-1) or mortars 1 and 2. L-2 refers to Left Section or mortars 3 and 4. We want 3 and 4 so enter 2 R/S.
2.	2 R/S	“TGT 1 AMMO C70A1” “LIN HE?”	It then asks “LIN HE?” Responds yes.
3.	3 R/S	“ALT METHOD?”	No
4.	R/S	“LENGTH?”	200
5.	200 R/S	“ATTITUDE?”	0100
6.	0100 R/S	“TGT 1 CHG 6 NO 3 B 0301 E 1252 R 3120” “TGT 1 CHG 6 NO 4 B 0317 E 1265 R 2895”	Data is then produced for mortars 3 and 4.



FM RIGHT SECT  
 GR 011 747  
 DIR 1745  
 PL IN THE OPEN  
 5 RDS  
 LIN 100  
 ATT 0700  
 1 AF

**FIRE DATA:**

TGT 1  
 CHG 5  
 NO 1  
 B 0225  
 E 1289  
 R 2301  
 TOF 45.7

**FIRE DATA:**

TGT 1	TGT 1
CHG 6	CHG 5
NO 1	NO 2
B 0235	B 0217
E 1282	E 1301
R 2346	R 2226

10. **Confirmation of Stage I:**

- questions from the class; and
- questions to the class.

11. **Stage II—Linear, 4 Mortars (Group):**

- The exercise using the left or right section is complete. We now progress to group linear fire. Press key R/S display is “MOR L/R” and go directly to display “LIN HE?” and proceed as before:

FM 4 MOR  
 GR 018 745  
 DIR 1050  
 COY IN THE OPEN  
 5 RDS  
 LINEAR 200  
 ATT 6400  
 2 AF

Instruments for Calculating Mortar Firing Data

**INITIAL FIRE DATA:**

TGT 1  
CHG 5  
NO 2  
B 0548  
E 1282  
R 2346  
TOF 45.6

- b. Then press key DF 1 until “LIN HE?” is displayed and input requested data according to FM. The linear HE fire data are as follows:

<b>MORTAR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
B	0521	0540	0561	0584
E	1263	1277	1291	1304
R	2460	2375	2290	2207

**NOTE**

Press key “MEMORY LOST”.

<b>BP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
006 722	5250	Normal	C 70 A1

FM 4 MOR  
GR 012 744  
DIR 5780  
PL IN THE OPEN  
5 RDS  
LINEAR 200  
ATT 0800  
4 AF

**INITIAL FIRE DATA:**

TGT 1  
CHG 5  
NO 4  
B 0291  
E 1294  
R 2273  
TOF 45.7

**LINEAR HE FIRE DATA:**

<b>MORTAR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
B	0273	0272	0270	0269
E	1277	1287	1298	1308
R	2375	2312	2249	2186

12. **Confirmation of Stage II:**

- a. questions from the class; and
- b. questions to the class.

13. **Stage III—Linear HE Alternative Method:**

- a. When the CPO has selected the linear HE pattern, the MFDC prompts for the alternative method. If the FC presses on R/S, the calculator executes the program by asking “LENGTH?”. Through the alternative method, the MFDC produced fire data for a linear pattern along the line between target 1 and target 2 by computing the length and attitude from the grid references of both targets. In this event, target engagement corresponds only to ammunition constants that were used to calculate fire data. For example if you asked for smoke ammunition, your calculated data corresponds to smoke.

**NOTE**

Enter key “MEMORY LOST”.

- b. To compute the linear HE alternative method, the FC must adjust both edges of the linear as target 1 and target 2. The CPO then proceeds with Linear HE alternative method under DF1, answering YES to “LIN HE?” and “ALT METHOD?”. Do the following exercise:

<b>BP GR</b>	<b>OP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
107766	115 764	2210	Normal	C 70 A1

Instruments for Calculating Mortar Firing Data

FM 4 MOR  
GR 085 732  
DIR 3800  
MOR #1 R 200, ADD 100  
MOR #4 L 200, DROP 100  
VEHICLE CONVOY  
4 RDS  
LINEAR  
AMC 1 AND 4 AF

- (1) First compute initial fire data for mortar 1, target 1. **Do not forget to apply correction:**

TGT 1  
CHG 6  
NO1  
B 3823  
E 1045  
R 4151  
TOF 41.1

- (2) FC for control post operator (CPO) mortar 1 register as right extremity.
- (3) Then calculate fire data for mortar 4 for target 2. **Do not forget to apply correction:**

TGT 2  
CHG 6  
NO4  
B 3745  
E 1087  
R 3955  
TOF 40.5

- (4) FC for CPO mortar 1 as extreme left.
- (5) Press key DF1 and answer YES to “LIN HE?” and “ALT METHOD?”:

STAGE	KEY	DISPLAY	REMARKS
1.	DF 1	“MORS R-1/L-2”	No
2.	R/S	“TGT 1 AMMO C70 LIN HE?”	Yes
3.	3 R/S	“ALT METHOD?”	Yes
4.	3 R/S		

MORTAR	1	2	3	4
B	3823	3798	3772	3745
E	1045	1060	1074	1087
R	4151	4083	4017	3955

14. **Confirmation of Stage III:**

- a. questions from the class; and
- b. questions to the class.

15. **Final Confirmation:**

- a. questions from the class; and
- b. questions to the class.

## CONCLUSION

16. Note that the enemy does not always deploy so that HE fire produces a target that is parallel to the line of the mortars. Consequently, we must be able to obtain the fire data taking into account other attitudes than that of the group. Thanks to the calculator, our options are greatly increased and we can quickly obtain more accurate fire data.

17. In this lesson you will have seen how to produce of linear HE fire data with section, group and alternative methods.

18. The next lesson will be...

**LESSON 14**  
**LINEAR SMOKE FIRE MISSIONS**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. Linear Smoke Fire Missions (FM):
  - a. linear smoke 2 mortars (left/right sections); and
  - b. linear smoke 4 mortars (group).

**PREPARATION**

3. **Time Required.** One 40-minute period.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student; and
  - b. fire mission proforma.
7. **Training Aids:**
  - a. chalk board; and
  - b. computer with PowerPoint®.

**CONDUCT OF THE LESSON****8. Introduction:**

- a. **Review.** As required.
- b. **What.** Produce linear smoke fire data with the MFDC using section, group and alternative methods.
- c. **Why.** When the smoke pattern is selected, the MFDC distributes fire evenly on a line along the attitude input by the control post operator (CPO), beginning at the target grid. The distance between rounds is equal to the length less 200 metres divided by the number of mortars in action. If there is only one mortar in action the MFDC fires the round on the adjusted point of origin.
- d. **Where.** During the course, at your unit and in battle.

**9. Stage I—Linear Smoke Fire, 2 Mortars (Left/Right Sections):****NOTE**

One mortar can smoke off an area of 200 metres. The largest linear WP a 4-mortar group can cover is 800 metres. Usually one HE round is used to adjust fire and the controller adjusts fire to the point of origin. The following set-up procedure is used to obtain linear smoke fire data:

<b>BP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
006 722	5220	Normal	C 70 A1 C 106

Instruments for Calculating Mortar Firing Data

FM SECT/LEFT	<b>INITIAL FIRE DATA:</b>
GR 011 741	CHG 4
DIR 0270	NO3
PL POSN TO SCREEN	B 0270
SMOKE 5 RDS	E 1265
LINEAR 200	R 1962
ATT 5400	TOF 35.6
3 AF	

**CORRECTIONS**

ADD 100	DROP 50
B 0270	B 0270
E 1243	E 1254
R 2062	R 2012
FFE	

- a. Change ammunition to C106 and extract data;
- b. Key on DF 1 (Distribution of Fire) then on R/S until "LIN WP?" is displayed. Answer YES by keying on 3 R/S; then enter length 200 R/S and attitude 5400 R/S. Smoke data are:

NO 3	NO 4
CHG 3	CHG 3
B 0270	B 0191
E 1297	E 1286
R 2012	R 2078

- c. Linear smoke FM (group):

FM 4 MOR	<b>HE FIRE DATA</b>
GR 004 700	CHG 5
DIR 4600	B 3273
SCREEN	E 1302
SMK 10 RDS	R 2224
LINEAR 800	TOF 45.8
ATT 0200	
4 AF	

- d. Change ammunition for C106, extract data.



- e. Fire controller orders FFE (fire for effect). Now press DF 1 key and R/S until “LIN SMK?” appears. Answer YES and enter length 800 R/S and attitude 0200 R/S. Following are linear smoke data:

<b>MORTAR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
CHG	3	3	3	3
B	3312	3285	3250	3202
E	1264	1310	1353	1393
R	2195	1939	1685	1433

- f. Linear smoke fire mission (group):

FM 4 MOR  
 GR 028 750  
 DIR 6400  
 BLIND  
 SMK 10 RDS  
 LIN 600  
 ATT 4000  
 1 AF

**HE FIRE DATA**

CHG 6  
 NO 1  
 B 0666  
 E 1163  
 R 3550  
 TOF 42.8

- g. The fire controller orders fire for effect:

**LINEAR WP FIRE DATA:**

<b>MORTAR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
CHG	6	6	6	6
B	0666	0667	0668	0669
E	1234	1259	1282	1305
R	3550	3359	3168	2977

**NOTE**

1. The mortar fire data calculator will recover data for four mortars even if the linear is 600 metres. If we wish to introduce only 1 to 3 mortars, we must resort to the sub-program IN/OUT (mortars out of action) and suppress mortar number 4 to obtain correct dispersion for the other three. Obviously, mortar number 4 must be re-introduced when the mission is completed.

2. Mortars can be put in action (IN) or out of action (OUT) according to the length of the line of fire. The procedure for introducing data is simple and quickly gives linear smoke fire.

10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

11. **Final Confirmation:**

- a. questions from the class; and
- b. questions to the class.

**CONCLUSION**

12. The enemy does not always deploy to present a parallel objective to the base plate. Thus, to produce effective fire we must modify the belts of fire. Thanks to the MFDC it is much easier to obtain effective mortar fire where we take into account the enemy's linear occupation of the ground.

13. The next lesson will be...

**LESSON 15**  
**PRODUCE PLATOON LINEAR FIRE DATA WITH HE OR SMOKE**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. Produce platoon linear fire data with HE or smoke:
  - a. platoon linear HE fire; and
  - b. platoon linear smoke fire.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student, and
  - b. fire mission proforma.
7. **Training Aids:**
  - a. chalkboard; and
  - b. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. **Introduction:**

- a. **Review.** As required.
- b. **What.** You will learn to produce platoon fire data for linear HE and Smoke Fire Missions (FM).
- c. **Why.** As a control post operator (CPO), you must be able to produce linear fire data for HE and smoke at the platoon level because sometimes the belt of fire from a group of mortars will not be sufficient to neutralise the target. For that reason the platoon is required.
- d. **Where.** During the course, at your unit and in battle.

### 9. **Stage I—Platoon Linear High Explosive Fire:**

- a. Platoon linear shoots are used when engaging targets that are longer than the belts of fire of a group of mortars. These shoots require close co-ordination between two mortar groups.
- b. Platoon linear HE is processed under the PL key and performs both senior and junior group duties. When PL is pressed, the MFDC prompts if fire data is to be produced as the junior group. If the CPO presses the R/S key, the calculator produces fire data for the senior group.
- c. The CPO has chosen a linear FM (LIN HE). The calculator then asks the length of the fire line.
- d. Platoon linear missions using the plotter are time consuming and can be confusing for the CPO. Using the MFDC the task is much faster and easier. The program is started with the key PL and the MFDC produces data for senior and junior groups.

<b>BP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
006 722	5150	Normal	C 70 A1

**THE TWO GROUPS MUST ENTER THE FM:**

FM PL  
 GR 017 745  
 DIR 1600  
 COY IN THE OPEN  
 LINEAR 1600  
 ATT 1000  
 5 RDS  
 4 AF

**INITIAL DATA:**

CHG 5  
 NO4  
 B 0472  
 E 1247  
 R 2555  
 TOF 45.3

**NOTE**

1. The junior group does not require corrections, the senior group requires the following corrections: LEFT 25, ADD 25.

**FIRE DATA:**

NO 4  
 CHG 5  
 B 0477  
 E 1241  
 R 2588.

2. As soon as possible the senior group produces the corrected grid it is sent to the junior group.

- e. Following is the procedure for a senior group linear fire.

STAGE	KEY	DISPLAY	REMARKS
1.	Shift PL	“JUNIOR?”	No
2.	R/S	“TGT 2?”	No
3.	R/S	“TGT 1?” “AMMO C 70A1”	Prompt only
4.		“LIN HE?”	Yes
5.	3 R/S	“LENGTH?”	1600
6.	1600 R/S	“ATTITUDE?”	1000
7.	1000	“CHANGING	

Instruments for Calculating Mortar Firing Data

STAGE	KEY	DISPLAY	REMARKS
7.	1000	“CHANGING CHG”	
		MAP GR 3288 and prints fire data	

**FIRE DATA FOR SENIOR GROUP:**

MORTAR	1	2	3	4
CHG	5	5	5	5
B	0571	0544	0513	0477
E	1100	1153	1199	1241
R	3288	3052	2818	2588

GR 01725 74525
Attitude: 1000

- (1) The senior group shall send this target data to the junior group.

GR 01725 74525
Attitude: 1000

- (2) Return to the PL key and answer YES to the "JUNIOR?".

STAGE	KEY	DISPLAY	REMARKS
1.	SHIFT PL	“JUNIOR?”	Yes
2.	3 R/S	“TGT GRD 1?”	As for target data from senior group
3.	01725 74525 R/S	“TGT 2 AMMO?”	No
4.	R/S	“TGT 1 C70 A1” “LIN HE?”	Yes
5.	3 R/S	“LENGTH?”	1600
6.	1600 R/S	“ATTITUDE?”	1000
7.	1000		Prints fire data

- (3) Junior group fire data:

<b>MORTAR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
CHG	5	5	5	5
B	0441	0394	0337	0268
E	1243	1280	1315	1346
R	2578	2356	2140	1932

- f. Now that you have studied the procedure for linear fire with one base plate, the following is the method for other positions. The two groups shall record the FM:

<b>FM PL</b>	<b>SENIOR</b>	<b>JUNIOR</b>	<b>TARGET</b>
BP GR	006 722	024 722	GR 017 745
ATT	5140	4500	DIR 0460
SPREAD	NORMAL	NORMAL	COY DIGGING IN
AMMO	C70A1	C70A1	10 RDS LIN 1600 ATT 1000 4 AF

**INITIAL FIRE DATA:**

Senior Group

CHG 5

NO 4

B 0472

E 1247

R 2555

TOF 45.3

**CORRECTIONS: LEFT 25, ADD 75**

**THE JUNIOR GROUP IS NOT REQUIRED TO ENTER  
CORRECTIONS.**

Senior Group

CHG 5

B 0462

E 1234

R 2630

**INITIAL FIRE DATA:**

Junior GR

CHG 5

NO 4

B 6118

E 1272

R 2405

Instruments for Calculating Mortar Firing Data

	SENIOR				JUNIOR			
MOR	1	2	3	4	1	2	3	4
CHG	5	5	5	5	5	5	5	5
B	0558	0531	0499	0462	6094	5998	5898	5796
E	1092	1145	1191	1234	1260	1271	1278	1282
R	3325	3090	2585	2630	2476	2410	2367	2348
COORD	01710 74578							

10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

11. **Stage II—Platoon Linear With Smoke Shell:**

- a. When the CPO has selected “LIN WP?”, the MFDC then prompts the CPO for the distance between rounds along the line of fire. SPREAD is used so rounds from two different groups will not cover the same area on the ground. The formula used for distance between shells is:

$\text{Linear} = \frac{\text{Distance}}{9.5}$ For Example $\text{Linear} = \frac{600}{9.5} = 63 \text{ metres}$
---

BP GR	ATT	SPREAD	AMMO
006722	0125	Normal	C 106

BP GR  
 GR 014734  
 DIR 4800  
 SCREEN  
 SMK 10 RDS  
 LIN 1400  
 ATT 5400  
 1 AF

**FIRE DATA**  
 NO1  
 CHG 2  
 B 0585  
 E 1312  
 R 1483  
 TOF 33.7

- b. Proceed as for a smoke linear fire mission until the SPREAD stage. Enter distance 147 metres (1400/9.5) and attitude.



<b>FIRE DATA FOR SENIOR GROUP</b>				
MORTAR	1	2	3	4
CHG	2	2	2	2
B	0585	0458	0331	0207
E	1312	1315	1312	1305
R	1483	1470	1480	1513
Data for target GR 00748 73836 Attitude 5400				

- c. Now calculate for the junior group: data for the target are: GR 00748 73836, attitude 5400. Press PL, answer the question “JUNIOR?”, and enter the 10-figure grid. Press on R/S for question “TGT 2 AMMO?” and “LIN HE?”. Answer yes to “LIN WP?”. To the question “SPREAD?”, enter 147 and enter attitude 5400 at “ATTITUDE?”.

<b>DATA FOR PLATOON LINEAR FIRE FOR JUNIOR GROUP</b>				
MORTAR	1	2	3	4
CHG	2	2	2	2
B	0093	6392	6301	6218
E	1264	1246	1223	1196

12. **Confirmation of Stage II:**
- questions from the class; and
  - questions to the class.
13. **Final Confirmation:**
- questions from the class; and
  - questions to the class.

**CONCLUSION**

14. With the use of the MFDC you are now able to rapidly produce accurate fire data to engage linear targets with high explosive or smoke shells. This increases your ability to support friendly troops in battle.

15. The next lesson will be...

**LESSON 16**  
**RECORDING AND EXTRACTING DATA USING THE CARD**  
**READER**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. Recording and extracting data using the card reader:
  - a. description and maintenance of the card reader;
  - b. writing data cards;
  - c. reading data cards; and
  - d. erasing data cards.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student; and
  - b. fire mission proforma.
7. **Training Aids:**
  - a. chalkboard; and

- b. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. Introduction:

- a. **Review.** As required.
- b. **What.** You will learn how to write, read and delete the contents of cards.
- c. **Why.** During all phases of war, lists must be passed quickly and accurately. The calculator is provided with an accessory that can be used for this purpose. The card reader enables lists to be used swiftly and securely with the MFDC. It also enables the rapid storage of information in the calculator.
- d. **Where.** During the course, at your unit and in battle.

### 9. Stage I—Description:

- a. The card reader is an accessory specifically designed for use with the MFDC. It provides virtually unlimited data and program storage through the use of small magnetic cards.
- b. It has an automatic power checking system to prevent operation if battery power is low. When “LOW BAT” appears on the display while operating the card reader, remove the card then replace the batteries. The MFDC has a heavy power requirement when the card reader is used.

### CAUTION

Always ensure calculator and printer are turned off when connecting or disconnecting any accessories. Failure to do so could damage the equipment and alter or erase stored data.

- c. When plugging in the card reader to port number 4, ensure the calculator is turned off.
- d. When removing the card reader grasp the body of the card reader with thumb and forefinger over the tabs on either side. Press on the tabs then pull the card reader straight back until the connector is free of the port.
- e. **Magnetic Cards:**
- (1) Information in the calculator can be magnetically recorded onto these cards then read back when needed. Each card has two tracks on the back (dark) and front (light) side that can be used to record what has been stored on the card, for example a target list. Lead pencils only should be used to identify the use. Permanent markers must be avoided.
  - (2) The recorded information can be kept as a permanent list by clipping the appropriate corner.
  - (3) The following is a guide to what can be stored on the cards:

TARGET LISTS	OBSERVATION POST LISTS	SAFETY ZONES
10 targets per 1 card	10 OP on 1 card	10 NFZ and 3 NFL on 1½ cards (3 tracks)
20 targets on 2 cards		
30 targets on 3 cards		
39 targets on 4 cards		

- f. **Calculator Display.** The following is shown on the calculator display when using the card reader. Press SHIFT then CARD RDR without attaching the card reader.

## Instruments for Calculating Mortar Firing Data

	<b>DISPLAY</b>	<b>FUNCTION</b>
(1)	“NO CRD RDR”	Indicates that the card reader is not attached. Attach the card reader, press again. Ensure calculator is switched OFF when plugging in.
(2)	“TGT LIST?”	MFDC asks if this is a target list procedure. If no, press R/S.
(2)	“OP LIST?”	MFDC asks if this is for OP lists. If no, press R/S.
(3)	“NFZ?”	MFDC asks if this is for no fire zones (NFZ). If no, press R/S.
(4)	“AMMO?”	Disregard as this particular function has been eliminated from the program. If R/S is keyed, the calculator returns to “TGT LIST?”.

If you answered yes to question (2) or (3) or (4), the MFDC goes to:

(5)	“WRITE DATA?”	MFDC asks if information is to be written. If yes, it will advance to:
(6)	“CLIPPED CARD?”	MFDC asks if it is to write over a clipped card. If yes, operator can write over the recorded data on the card. If no, press R/S.
(7)	“EMPTY CARD”	MFDC prompts for an empty card and when R/S is pressed, it will show which card and how many are needed , for example Card 1 of 8 Cards.
(8)	“READ DATA?”	The calculator asks if one or more cards are to be read. If yes it displays “CARD”. Otherwise it remains at the function

<b>DISPLAY</b>	<b>FUNCTION</b>
	“WRITE DATA?”.
(9) “CARD”	This will show “TGT OP” or “NFZ” in front of “CARD” to show which list it is ready to read.
(10) “CARD ERROR”	Indicates that the card is blank.
(11) “CHECKSUM ERR”	Indicates the card is damaged or dirty.
(12) “MALFUNCTION”	This indicates that the card reader is not working correctly.
<b>10.</b>	<b>Confirmation of Stage I:</b>
a.	questions from the class; and
b.	questions to the class.
<b>11.</b>	<b>Stage II—Maintenance:</b>
a.	Keep contact area of the card reader plug free of obstructions. Should the contents become dirty, carefully blow out the dirt. Do not use any liquid to clear the contacts or the card reader.
b.	Store the card reader in a clean dry place; static electricity could damage it.
c.	Magnetic card maintenance:
(1)	Keep cards clean and free of oil, grease and dirt. If “CHECK SUM ERROR” is displayed, clean the card by rubbing the dark side gently against clean dry paper then re-enter. If the cards are extremely dirty, they may be cleaned with alcohol and a clean, soft cloth. Ensure the cards are dry before inserting.

## Instruments for Calculating Mortar Firing Data

- (2) The card reader has a recording head similar to a tape recorder. The card pack contains an abrasive cleaning card. If the head is dirty, the reading and recording of cards is not correct “MALFUNCTION” will appear on the display. If this occurs, use the cleaning card by running it through the card reader as indicated on the card.

### CAUTION

Use of the cleaning card when the head is not dirty will reduce the useful life of the card reader since a minute layer will be removed from the head itself after each cleaning.

- d. Improper card reader operation is checked as follows:
  - (1) Ensure calculator is correctly assembled and ready for operation.
  - (2) If display shows “LOW BAT” when a card is inserted, the batteries do not have enough power. Replace batteries or use an external power source.
  - (3) If “MALFUNCTION” repeatedly shows, use the cleaning card to clean the head.
  - (4) If this does not rectify it, use another card. If the difficulty persists, turn the card reader in for repair.
- e. “MALFUNCTION” will show if the card reader is operated outside the operating temperature specifications of 10° C to 45° C.
- f. Always insert the card firmly into the card reader. Cards must move freely past the heads. If a card is held back or bumped after the drive mechanism is engaged, the data could be misread or written incorrectly.



12. **Confirmation of Stage II:**
- questions from the class; and
  - questions to the class.

13. **Stage III—Writing Data Cards:**

- To record a target list proceed as follows:

<b>BP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
0099 7315	1600	Normal	C 70 A1

<b>TARGET LIST</b>	<b>OP LIST</b>
1001 GR 0120 7314	1 GR 0045 7202
1002 GR 0139 7342	2 GR 0108 7258
1003 GR 0046 7400	3 GR 0210 7214
1004 GR 0106 7421	4 GR 0249 7282
1005 GR 0165 7502	5 GR 0346 7341
1006 GR 0250 7274	6 GR 0042 7576
1007 GR 0083 7492	7 GR 0137 7602
1008 GR 0083 7548	8 GR 0221 7540
1009 GR 0283 7500	9 GR 0246 7641
1010 GR 0253 7574	10 GR 9980 7334

- Attach the card reader to the calculator and turn the power on. Proceed as follows to register target lists:

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
1.	SHIFT CARD RDR	“TGT LIST?”	Yes
2.	3 R/S	“WRITE DATA?”	Yes
3.	3 R/S	“CLIPPED CARD?”	No
4.	R/S	“EMPTY CARD?”	No
5.	R/S	“CARD”	Insert card
6.		“RDY OF ”	

- Continue until all cards and tracks are completed. If you are using only one track of a card or less than eight cards, press R/S twice. This will return the

Instruments for Calculating Mortar Firing Data

MFDC automatically to “NEXT DATA”. The target lists are recorded.

- d. To record OP lists or NFZs, follow the same steps. To retain a list permanently, clip the appropriate corner from the card.

14. **Confirmation of Stage III:**

- a. questions from the class; and
- b. questions to the class.

15. **Stage IV—Reading Data Cards:**

- a. The following steps will enable you to register information in the calculator:

STAGE	KEY	DISPLAY	REMARKS
1.	SHIFT CARD RDR	“TGT LIST?”	Yes
2.	3 R/S	“WRITE DATA?”	No
3.	R/S	“READ DATA?”	Yes
4.	3 R/S	“TGT CARD”	Yes
5.	R/S	“CARD”	Insert first card
6.		“RDY OF ”	

- b. Continue to insert each track and card until all are read. If there are less than eight cards to read, press R/S twice to return to “NEXT DATA”.
- c. To ensure all data have been entered correctly, attach the printer and go to “VIEW ALL?” on the TS (Target Storage) key to get a written copy of the target list.
- d. OP and NFZ lists are done in this same manner. Ask all students to read the information on their cards (the list and initial targets apply).

16. **Confirmation of Stage IV:**

- a. questions from the class; and
  - b. questions to the class.
17. **Stage V—Erasing Data Cards:**
- a. To prevent new and outdated data from becoming mixed or for security purposes, the cards may have to be erased. The following steps are to be followed:
    - (1) Attach card reader.
    - (2) Do MASTER CLEAR.
    - (3) Follow the same steps as for writing data. With MASTER CLEAR the MFDC will erase rather than write.
  - b. Ask candidates to erase information contained on cards. For verification purposes, cover the same steps as for reading data and have a list made of data on the cards.
18. **Confirmation of Stage V:**
- a. questions from the class; and
  - b. questions to the class.
19. **Final Confirmation:**
- a. questions from the class; and
  - b. questions to the class.

## CONCLUSION

20. In this lesson you have learned how to enter and erase data using the card reader.
21. The next lesson will be...

**LESSON 17**  
**ENTER METEOROLOGICAL MESSAGES**

**ENABLING OBJECTIVE**

1. Produce fire control data with the Mortar Fire Data Calculator (MFDC).

**MAIN TEACHING POINTS**

2. Enter meteorological (met) messages:
  - a. know the effects of met conditions;
  - b. interpret met messages;
  - c. enter met messages in the MFDC; and
  - d. enter a new met message and return to standard met.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. MFDC complete one per student; and
  - b. fire mission proforma.
7. **Training Aids:**
  - a. chalkboard; and

- b. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. Introduction:

- a. **Review.** As required.
- b. **What.** You will learn how to enter and interpret the met message.
- c. **Why.** As a control post operator (CPO) you must be able to enter and delete met messages. While firing, the weather affects the fired round. To produce effective data with a minimum of shells, you must use the met message procedure.
- d. **Where.** During the course, at your unit and in battle.

### 9. Stage I—Introduction:

- a. The data contained in firing tables are based on the atmospheric structure used by International Civil Aviation Organisation (ICAO). The firing tables are arranged in sequence and formatted to coincide with the NATO met message. The NATO met message is usually transmitted using Form **CF 82 (6/76)**, Canadian Forces Artillery Meteorological Message.
- b. We don't usually consider the effects of weather in our capacity as mortar crew. Fire is simply adjusted to comply with changes in the weather. Following is an example demonstrating the effects of meteorological conditions and the amount of adjustments required for a target located at 3000 metres. At that distance the normal height of a mortar shell is 2700 metres. If you do not take a 27 knot tail wind into account for example, the round would be 196 metres out of the target area. By introducing data from a met message into the

## Instruments for Calculating Mortar Firing Data

calculator, we can compensate for unusual conditions and obtain effective fire data. For example, for a fire table, ammunition Charge 6 and 3000 metres (correction factors established) you subtract 5.4 m per knot if there is a tail wind. Consequently, if the wind is blowing at 27 knots, you multiply 27 by 5.4 and subtract the product from the initial distance.

- c. **Interpreting Met Messages.** Met messages are received and read back on the mortar radio net. For an inexperienced person all of these figures mean very little or nothing. However, each set of figures in a message has a specific ballistic meteorological meaning. Following is an example of a physical ballistic met message:

MET B3 4 458 664 21 030 4 005 002

1	00	34	03	990	012
2	01	36	15	994	010
3	02	39	20	004	001
4	03	42	25	016	992
5	04	48	27	019	989
6	05	48	27	019	000
7	06	50	28	019	000
8	07	50	28	019	000

### NOTE

Sending the MET message format:

- d. **Explanation of message:**
- MET** - indicates that the transmission is a met message;
  - B** - indicates that the message is a ballistic met message;
  - 3** - indicates message is for surface to surface fire;
  - 4** - indicates the octant of the globe that the message applies to;

- 458** - is the latitude of the centre of the area of applicability (nearest tenth of a degree);
  - 664** - is the longitude of the centre of area of applicability;
  - 21** - is the day of the month;
  - 030** - is the nearest tenth of an hour in Greenwich Mean Time (GMT) (the hour the period of validity begins).
  - 4** - is the duration of validity in hours;
  - 005** - is the altitude in tens of metres of the met stations above mean sea level (MSL); and
  - 002** - is the atmospheric pressure at MSL.
- e. Note that the following line of the message begins with 00. When the CPO receives a met message, that line is always included but the line must start with 01 when we use a MFDC;
- f. Each group of numbers between the line 00 and 07 represent a height;
- g. Line 00 34 03 990 012:
- 00** - represents the standard height above ground
  - 01** - 200 m
  - 02** - 500 m
  - 03**- 1000 m
  - 04**- 1500 m
  - 05**- 2000 m
  - 06**- 3000 m
  - 07** - 4000 m
  - 34** - is the direction in hundreds of mils from which the ballistic wind is blowing.
  - 03** - ballistic wind speed to the nearest knot (3 knots).
  - 990** - ballistic air temperature to the nearest 0.1 percent of standard.

Instruments for Calculating Mortar Firing Data

**012** - ballistic air density to the nearest 0.1 percent of the standard.





**ARTILLERY METEOROLOGICAL MESSAGE  
MESSAGE METEOROLOGIQUE D'ARTILLERIE**

TYPE OF/DE MESSAGE		OCTANT	CENTRE OF APPLICABILITY CENTRE DE LA ZONE DE VALIDITE		DATE	VALID PERIOD PERIODE DE VALIDITE	MDP - PRMS	
Anti-aircraft Anti-avion	METB2		L <sub>a</sub> L <sub>n</sub> L <sub>n</sub> L <sub>o</sub> L <sub>o</sub> L <sub>o</sub>		Begins Début	Duration Durée	In - En déca- mètres	PPP (METB2)
Surface-to-Surface Sol-Sol	METB3		OR					PPP (METB2)
Computer Calculateur	METCM	Q	XXXXXX		YY	G <sub>o</sub> G <sub>o</sub> G <sub>o</sub>	hhh	P <sub>d</sub> P <sub>d</sub> P <sub>d</sub> (METCM)
MET								
ZONE HEIGHTS (METRES) HAUTEUR DES ZONES (METRES)		LINE LIGNE	WIND - VENT DIRECTION SPEED DIRECTION VITESSE		TEMPERATUR E TEMPÉRATUR E	DENSITY OR PRESSURE - MASSE SPEC. OU PRESSION	WIND DIRECTION DU VENT	REMARKS - OBSERVATIONS
BALLISTIC MESSAGE MESSAGE BALISTIQUE		Line No Ligne N°	100's mils en 100m	Knots En noeuds	Percentage of Standard Pourcentage du standard			
COMPUTER MESSAGE MESSAGE DESTINÉ AU CALCULATEUR		Zone No N° de Zone	10's mils En 10m	Knots En noeuds	1/10° K	In - En millibars	degrees degrés	
Surface En Surface		00			TTT	Δ Δ Δ	Do not transmit Ne pas transmettre	
200	200	01						
500	500	02						
1000	1000	03						
1500	1500	04						
2000	2000	05						
3000	2500	06						
4000	3000	07						
5000	3500	08						
6000	4000	09						
8000	4500	10						
10000	5000	11						
12000	6000	12						
14000	7000	13						
16000	8000	14						
18000	9000	15						
Serial: N° :	10000	16						
	11000	17						
	12000	18						
	13000	19						
	14000	20						
Date :	15000	21						
	16000	22						
	17000	23						
Time: Heure :	18000	24						
	19000	25						
	20000	26						
Sent by: Transmis par :		99999 or 9 METCM only/seulement						
Recv by: Reçu par :		CHECKWORD CODE DE VERIFICATION						
TO: A:		99999						
								For abbreviations/codes See REVERSE side Pour abréviations et codes voir endos

Figure 1-4a: Met Messages (Front)

Instruments for Calculating Mortar Firing Data

	<u>Octant</u>	
	Latitude	Longitude
	0 - North	0° - 90° W
	1 - North	90° - 180° W
	2 - North	180° - 90° E
	3 - North	90° - 0° E
	4 -	
	5 - South	0° - 90° W
	6 - South	90° - 180° W
	7 - South	180° - 90° E
	8 - South	90° - 0° E
	9 - Use with XXXXXX	
L <sub>a</sub> L <sub>a</sub> L <sub>a</sub>	<u>Latitude</u> , to 0.1°	
L <sub>o</sub> L <sub>o</sub> L <sub>o</sub>	<u>Longitude</u> , to 0.1°	
XXXXXXX	<u>Location</u> , clear or code	
YY	<u>Date of Month</u> (GMT), referred to by G <sub>o</sub> G <sub>o</sub> G <sub>o</sub>	
G <sub>o</sub> G <sub>o</sub> G <sub>o</sub>	<u>Time Valid Period Begins</u> to 0.1 hours (GMT)	
G	<u>Valid Period Duration</u>	
	0 - duration unspecified	
	1 - 1 hour	
	2 - hours etc.	
	8 - 8 hours	
	9 - 12 hours	
MDP	Mean Datum Plain	
hhh	<u>MDP Height</u> , decametres	
PPP	<u>MDP Pressure</u> , to 0.1% of standard	
P <sub>d</sub> P <sub>d</sub> P <sub>d</sub>	<u>MDP Pressure</u> , millibars	
ZZ	<u>Ballistic Line Number</u>	
Z <sub>n</sub> Z <sub>n</sub>	<u>Zone Number</u>	
dd	<u>Ballistic Wind Direction</u> , to nearest 100 mils	
ddd	<u>Zone Mean Wind Direction</u> , to nearest 10 mils	
FF	<u>Ballistic Wind Speed</u> , knots	
FFF	<u>Zone Mean Wind Speed</u> , knots	
TTT	<u>Ballistic Temperature</u> , to 0.1% of standard	
TTTT	<u>Zone Mean Virtual Temperature</u> , to 0.1° K	
Δ Δ Δ	<u>Ballistic Density</u> , to 0.1% of standard	
PPPP	<u>Zone Mid-Height Pressure</u> , in millibars	

Figure 1-4b: Met Messages (Back)

10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

11. **Stage II—Entering a Met Message in the Calculator:**

<b>BP GR</b>	<b>ATT</b>	<b>SPREAD</b>	<b>AMMO</b>
030 737	1600	Normal	C 70 A1

- a. Enter the following fire missions:

<b>TARGET NO. 1</b>	<b>DATA WITHOUT MET</b>	<b>TARGET NO. 2</b>	<b>DATA WITHOUT MET</b>
FM 4 MOR GR 004 740 DIR 6400 PL 3 RDS 1 AT	NO 1 CHG 5 B 4919 E 1244 R 2573 TOF 45.2	FM 4 MOR GR 026 761 DIR 0550 VEH ON ROAD 3 RDS 2 AF	NO 2 CHG 5 B 6238 E 1268 R 2431 TOF 45.5

- b. Entering a met message in the calculator. We first enter the line.

LINE 01 R/S 36 15 994 010 R/S
LINE 02 R/S 39 20 004 001 R/S
LINE 03 R/S 42 25 016 992 R/S
LINE 04 R/S 48 27 019 989 R/S
LINE 05 R/S 48 27 019 000 R/S
LINE 06 R/S 50 28 019 000 R/S
LINE 07 R/S 50 28 019 000 R/S

<b>STAGE</b>	<b>KEY</b>	<b>DISPLAY</b>	<b>REMARKS</b>
1.	MET	“MET MESSAGE?”	Yes
2.	3 R/S	“MET LINE NO?”	Enter 1
3.	1 R/S	“01 DD FF TTT PPP”	Enter line 01 from above
4.	36159 94010 R/S	“MET LINE NO?”	

Instruments for Calculating Mortar Firing Data

STAGE	KEY	DISPLAY	REMARKS
5.	2 R/S	“02 DD FF TTT PPP”	Continue until all lines have been entered and go to TGC 1 and 2 to receive FM data

- c. The preceding table represents fire on a target number 1 in a head wind and on target number 2 in a crosswind. This example illustrates the effect of weather under unusual conditions. Enter the last two fire missions, taking into account weather data and note the difference.

TARGET NO. 1	DATA WITH MET	TARGET NO. 2	DATA WITH MET
FM 4 MOR GR 004 740 DIR 6400 PL 3 RDS 1 AF	NO 1 CHG 5 B 4924 E 1219 R 2710	FM 4 MOR GR 026 761 DIR 0550 VEH ON ROAD 3 RDS 2 AF	NO 2 CHG 5 B 6283 E 1264 R 2452 TOF 45.5

**NOTE**

From one to seven message lines can be entered into the calculator.

12. **Confirmation of Stage II:**

- a. questions from the class; and
- b. questions to the class.

13. **Stage III—Entering New Met Message and Returning to Standard Met:**

- a. **Standard Met.** Weather conditions seldom remain stable for extended periods of time, so the CPO must

be able to change met information entered in the MFDC. There are three methods of changing the met:

- (1) Input a new met message, which automatically cancels the previous information.
- (2) To return to standard met, press SHIFT then MET, MFDC will display "MET MESSAGE?" Respond NO by pressing R/S; MFDC will show "NEXT DATA". Met has been removed from the program. All other data is then processed with standard met.
- (3) The last method for deleting a met message is to do the MEMORY LOST. This method must not be used if all other data in the MFDC must be maintained.

14. **Confirmation of Stage III:**

- a. questions from the class; and
- b. questions to the class.

15. **Final Confirmation:**

- a. questions from the class; and
- b. questions to the class.

**CONCLUSION**

16. This lesson covered the procedures to enter ballistic met messages in the MFDC. Additional time spent with these calculations results in economy of ammunition and time because fewer adjustments to fire are required.

17. The next lesson will be...

**LESSON 18**  
**PRODUCE SURVEY DATA WITH THE MORTAR FIRE DATA**  
**CALCULATOR**

**ENABLING OBJECTIVE**

1. Survey a base plate position.

**MAIN TEACHING POINTS**

2. Produce survey data with the Mortar Fire Data Calculator (MFDC) to include:
  - a. produce bearing and range;
  - b. resection with two reference points; and
  - c. grid with one reference point.

**PREPARATION**

3. **Time Required.** Three 40-minute periods.
4. **Method.** Demonstration/Performance.
5. **Administration.**
6. **Stores:** MFDC complete one per student.
7. **Training Aids:**
  - a. chalkboard; and
  - b. computer with PowerPoint®.

**CONDUCT OF THE LESSON**

8. **Introduction:**
  - a. **Review.** As required.

- b. **What.** To teach production of survey data.
- c. **Why.** As a control post operator (CPO) you must be able to use the survey program to produce data to accurately plot your location. As a Group Commander you must be able to accurately gain survey data for the production of fire.
- d. **Where.** During the course, in the unit and in battle.
9. **Stage I—To Determine the Bearing and Range:**
- a. **Introduction.** In order to make the best use of the MFDC’s accuracy, the Group Commander must ensure that the base plate grid is as accurate as possible. To aid him, the MFDC has the ability to determine the bearing and range between two points and the grid of a point from one or two known locations.
- b. **Bearing and Range.** When it is necessary to determine the bearing and range between two known points follow the sequence as shown below:

STAGE	KEY	DISPLAY	REMARKS
1.	SHIFT, B&R	“FIGS?”	This shows if it has not received previous instructions. Use 8 figures for this example.
2.	8 R/S	“REF P GRD 8”	Enter the grid of first reference point.
3.	00477204 R/S	“TGT GRD 8”	Input the other grid.
4.	01727400 R/S	“BNG 0578” “RGE 2325” “TGT GRD 8”	This is for other targets or points from the same reference point in Step 2.

10. **Confirmation Stage I:**
- a. questions from the class; and
- b. questions to the class.

11. **Stage II—Grid With One or Two References Points:**

a. **Grid.** When determining exact locations working directly on a map has many built in possibilities for error ( pencil thickness, inaccurate plotting on a map, etc). The MFDC can reduce or eliminate them.

b. Enter grid:

(1) Point 1 GR 1601 3955 DIR 2870.

(2) Point 2 GR 1624 5213 DIR 1575.

STAGE	KEY	DISPLAY	REMARKS
1.	SHIFT, GRID	“2 REF PTS?”	Are two reference points being used? (For this example yes).
2.	3 R/S	“FIGS?”	Shows if not already indicated (use eight figure for the example).
3.	8 R/S	“REF 1 GRD 8”	Enter grid of first reference point. Note: This must always be the most westerly point.
4.	16013955 R/S	“REF 2 GRD 8”	Enter grid of second reference point.
5.	16245213 R/S	“REF 1 DIR”	Enter direction to first reference point.
6.	2870 R/S	“REF 2 DIR?”	Enter direction to second reference point.
7.	1575 R/S	“TGT GRID1182252022” “RGE 1 13156” “RGE 2 4419”	Gives a ten figure grid of location and the distance to reference points 1 and 2.



- c. To do the same for one reference point, do the following procedure:

- (1) grid of the reference point GR 01187314, DIR 3882.

STAGE	KEY	DISPLAY	REMARKS
1.	SHIFT, GRID	“2 REF PTS?”	No, to this question.
2.	R/S	“FIGS?”	
3.	8 R/S	“REF P GRD 8”	Enter the grid of the reference point.
4.	01187314 R/S	“DIR?”	Enter bearing from reference point to you or to the target (back bearing if you are determining your location).
5.	3882 R/S	“DIST?”	
6.	1275 R/S	“TGT GRD” “00389 72140”	This is the location of the target or your location.

12. **Confirmation Stage II:**
- questions from the class; and
  - questions to the class.
13. **Final Confirmation:**
- questions from the class; and
  - questions to the class.

## CONCLUSION

14. Effective mortar fire depends largely on the accuracy of the base plate, target and observation post locations. The MFDC can greatly aid with these calculations.

15. Your next lesson will be ...



**CHAPTER 2  
PLOTTER**

**LESSON 1  
PREPARE THE PLOTTER FOR FIRING**

**ENABLING OBJECTIVE**

1. Produce fire control data with the plotter.

**MAIN TEACHING POINTS**

2. Prepare the plotter for firing:
  - a. description;
  - b. maintenance;
  - c. preparation for the pivot method; and
  - d. preparation for the alternative method.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;
  - b. firing tables; and
  - c. cleaning materials.

7. **Training Aids:**

- a. chalkboard;
- b. large-scale plotter;
- c. firing tables; and
- d. computer with PowerPoint®.

**CONDUCT OF THE LESSON**

8. **Introduction:**

- a. **Review.** As required.
- b. **What.** You will learn the preparation of the plotter for firing.
- c. **Why.** So that, as a control post operator (CPO), you can perform your work correctly and produce accurate fire control data.
- d. **Where.** On the course, at your unit and in combat.

9. **Stage I—Description:**

- a. **Description.** As has already been seen, there is a clear difference between the fire orders given to the CPO by the fire controller (FC) and passed to the CPO and those given to the mortar by the CPO. The orders have to be converted by the CPO with the mortar computer or the plotter. As the mortar computer is a machine, it is liable to mechanical breakdowns. As CPO, you must therefore know all aspects of producing fire control data using the plotter.
- b. With the mortar, the plotter is used to calculate fire control data and convert the fire controller's orders into:

CHARGE
BEARING
ELEVATION

- c. **Components.** The plotter includes five main parts:
- (1) **The Bag.** It is mounted in a bag with a strap and containing pockets for maps, papers, firing fans and registration table.
  - (2) **The Base.** The base represents 1000 metre plotting grids subdivided into 100 metre squares. A line, which goes from the centre point to the top of the base, is called the indicator line. This line is numbered from 1 to 6 to indicate the distance from the position of the pivot point.
  - (3) **The Rotating Disk.** The rotating disk turns on the base by means of a pivot. The outside edge of the disk is graduated in mils from 0 - 6400 mils, numbered every 100 mils and marked every 10 mils.
  - (4) **Firing Fans.** These are various types of fans depending on the ammunition you use. Their usefulness is to determine the charge and elevation for the various firing ranges.
  - (5) **Registration Table.** Allows the CPO to register target data and have them within reach.

## Instruments for Calculating Mortar Firing Data

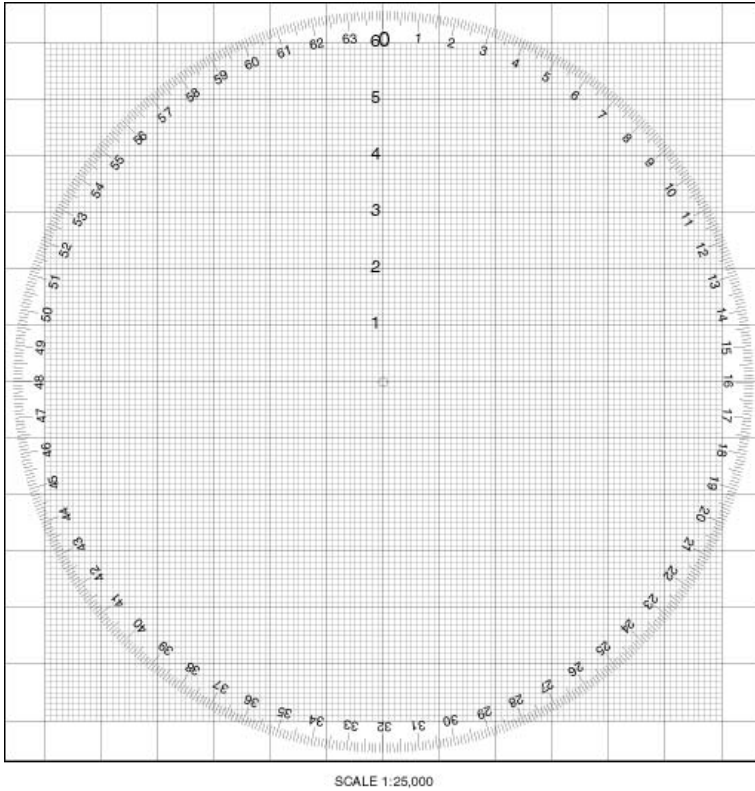


Figure 2-1: The Plotter

### 10. Confirmation of Stage I:

- a. questions from the class; and
- b. questions to the class.

11. **Stage II—Maintenance.** The plotter is made of plastic and scratches easily, especially underneath the disk. If dirt is allowed to accumulate on the plotter, it very quickly becomes unusable. The CPO must make sure to follow these instructions:

- a. **Before Use.** The plotter must be clean and free of dirt, especially sand. The disk must be removed and carefully cleaned. Typewriter cleaners are suitable

for removing marks, but liquid silicon may be used. Dry it with a flannel cloth or paper towel.

- b. **During Use.** Only graphite, omnichrome or fine point pencils erasable with water are recommended for use. To erase, do not use material such as rubber to erase ink but only silicon. When the plotter is not being used for a short period of time, make sure it is placed in a safe place so no one sits or walks on it.
- c. **After Use.** Clean it properly and dry it thoroughly before putting it away. Always put it away flat in a cool, dry and protected place. Do not expose it to the sun or place it near the heater of a vehicle.

12. **Confirmation of Stage II:**

- a. questions from the class; and
- b. questions to the class.

13. **Stage III—Preparation of the Plotter:**

- a. **Introduction.** There are two methods of preparing the plotter, the pivot method and the alternative method.
- b. **The Pivot Method.** The pivot method consists of making the grid lines of the base correspond to the grid lines on the map, so that the position of the mortars corresponds to the pivot. You must proceed as follows:
  - (1) Determine the position of the mortars on the map with a six-figure grid reference, for example 150 650.
  - (2) Make the pivot of the plotter coincide with the map (grid reference) (see Figure 2-2).
  - (3) Note the easting at the top of the indicator line, for example 150.

## Instruments for Calculating Mortar Firing Data

- (4) Note the northing facing the line 1600-4800 for example, 650.
- (5) Once the starting point has been entered on the plotter as indicated above, number the other lines.
- (6) Easting: move towards the east from 150 - 160, 170, 180, etc. and vice versa towards the west -140, 130, 120, etc.
- (7) Northing: move towards the north from 650 - 660, 670, 680, etc. and vice versa towards the south, - 640, 630, 620, etc.
- (8) Later, the CPO can enter on the disk data such as safety limits in future periods, arcs of fire, etc.
- (9) The CPO must then install the appropriate firing fan, if applicable. The practice base plate will be:

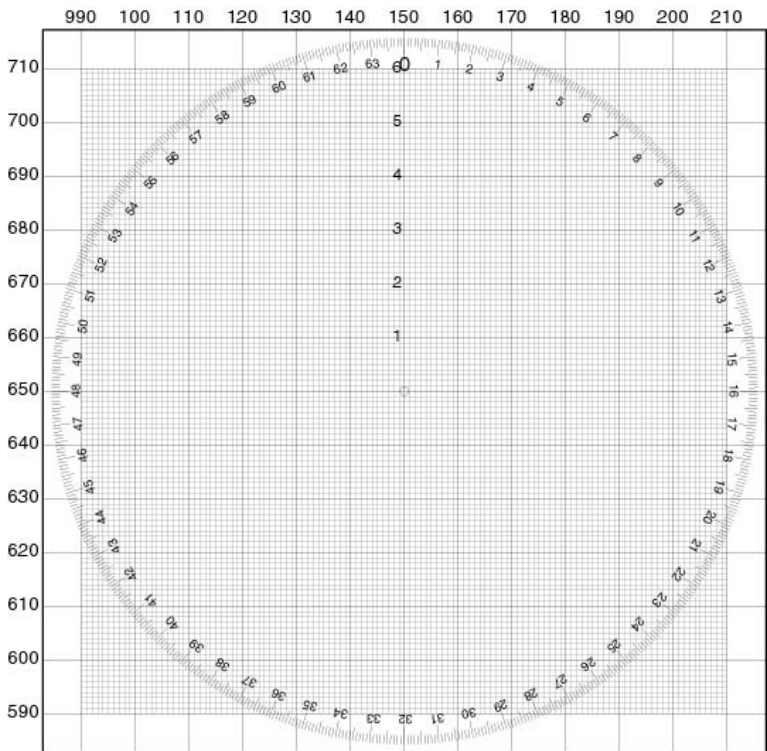
114 506
998 107
123 124

- c. **Alternative Method.** When the mortars must be moved large distances, the pivot method cannot be used because it takes too much time. Then proceed as follows:

- (1) In choosing the grid references to determined the starting point, the firing CPO must allot 3000 metres to the area not covered by the disk, otherwise the line of departure would not be covered. To do this, it suffices to add or subtract 3000 metres to or from the place on the map where the mortar was originally.



- (2) Determine the position of the mortar and assign it a six-figure grid reference. Mark it on the plotter as one would do on a map and draw a mortar symbol. The point of the symbol indicates the exact position.
  
- (3) Once the above preparation has been completed, it is no longer necessary to change the numbering of the grid lines during the operation. You have only to erase the former mortar positions and trace the new ones as on a map.



**Figure 2-2: Preparation of the Plotter—Pivot Method**

**14. Confirmation of Stage II:**

- a. questions from the class; and

## Instruments for Calculating Mortar Firing Data

b. questions to the class.

### 15. **Final Confirmation:**

a. questions from the class; and

b. questions to the class.

## **CONCLUSION**

16. You have just learned how to describe and maintain the plotter and also how to prepare for firing using the pivot and alternative methods.

17. The next lesson will be...

## LESSON 2 BALLISTIC FIRING TABLES CONTENTS AND USE

### ENABLING OBJECTIVE

1. Produce fire control data with the plotter.

### MAIN TEACHING POINTS

2. Ballistic Firing Tables contents and use:
  - a. elevation;
  - b. time of flight;
  - c. adjustment of fuzes; and
  - d. weather data.

### PREPARATION

3. **Time Required.** One 40-minute period.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;
  - b. firing tables; and
  - c. cleaning materials.
7. **Training Aids:**
  - a. chalkboard;

## Instruments for Calculating Mortar Firing Data

- b. large-scale plotter;
- c. firing tables; and
- d. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. **Introduction:**

- a. **Review.** As required.
- b. **What.** You will learn how to use the ballistic firing tables.
- c. **Why.** As a control post operator (CPO), on certain occasions it will be impossible for you to use the fan, due to: the type of ammunition or the information on the weather or on the beaten zone requested by the FC or for reasons of safety. The CPO must be able to extract the information from these tables to produce fire for effect (FFE).
- d. **Where.** On the course, at your unit and in combat.

9. **Stage I—Ballistic Firing Tables.** Modern artillery and mortar ammunition was developed with variable propulsion systems (charges) for accuracy and to reduce the risk of detection by radar. During the development of the ammunition, firing trials were conducted to find what range a round could reach with various charges and elevations. This information and other relevant information, such as the effects of the weather, are compiled in booklet form called Ballistics Firing Tables:

- a. The firing tables are prepared in a standard format containing introduction, body and appendices.
- b. **Introduction.** Contains a list of conversion factors, symbols and abbreviations. It also gives a basic description and technical data by which the fire control data are produced.

- c. **Body.** The main part of the firing tables, containing all the information the CPO needs to produce fire for effect, namely:
- (1) At the top of the page, there are the firing table number, the type of ammunition, the muzzle velocity (MV) and the charge number.
  - (2) The rest of the page is divided into columns. The number of columns varies according to the firing tables:
    - (a) column I—the range;
    - (b) column II—the elevation for this charge at the given range;
    - (c) column III—indicates the time of flight for the charge and range;
    - (d) column IV—the maximum altitude (maximum northing); and
    - (e) column V—contains the probable error calculated for various ranges.
  - (3) One can also find the information on the corrections for increasing the range.
  - (4) **Additional Data.** The additional data that firing tables contain are the probable errors and information on the trajectory. As in the basic firing tables, column I indicates the range in a sequence of numbers, indicating the functions then the content based on the type of ammunition and its nationality.
- d. **Appendices.** These are usually found in American firing tables and follow the body. They provide the information for determining the altitude of the trajectory with various charges and ranges.

**NOTE**

When selecting the charge, one must take the one which is as close as possible to an elevation of 1100 mils.

- e. **Adjustment of the Fuze.** When firing illumination you must determine the adjustment of the fuze, which is found under the column FUZE SETTING of the illumination ammunition table. This adjustment is written in seconds and tenths of seconds, corresponding to the marking on the fuze on the round.
- f. **Meteorological Data.** These are contained in the firing tables and take into account the atmospheric structure, atmospheric pressure, air temperature, etc. These data will be useful when you use the mortar computer.

10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

11. **Final Confirmation:**

- a. questions from the class; and
- b. questions to the class.

**CONCLUSION**

12. During this lesson you have seen firing tables. As CPO it is important to be able to read and interpret firing tables. Remember, in choosing your charge, think about the elevation which must be as close as possible to 1100 mils. Do not forget that the Time of Flight (TOF) is only sent for the first round and in seconds.

13. The next lesson will be...

## LESSON 3 THE PIVOT METHOD

### ENABLING OBJECTIVE

1. Produce fire control data with the plotter.

### MAIN TEACHING POINTS

2. The pivot method:
  - a. produce the fire control data for simple fire missions; and
  - b. conversion of fire control data using target grid correction.

### PREPARATION

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;
  - b. firing tables; and
  - c. cleaning materials.
7. **Training Aids:**
  - a. chalkboard;
  - b. large-scale plotter;

Instruments for Calculating Mortar Firing Data

- c. firing tables; and
- d. computer with PowerPoint®.

**CONDUCT OF THE LESSON**

8. **Introduction:**

- a. **Review.** As required.
- b. **What.** You will learn how to produce bearings and elevations using the pivot method.
- c. **Why.** As a control post operator (CPO), you must be able to place a target grid reference correctly and to find its bearing and the range to produce initial fire control data.
- d. **Where.** On the course, at your unit and in combat.

9. **Stage I—Produce Fire Control Data:**

- a. Having completed the preparation of the plotter, the CPO must have a grid reference and a direction in conjunction with a fire mission (FM). Before engaging a target he must transfer the data onto the plotter and convert them into fire control data for the mortar line.

**PRODUCTION OF FIRE CONTROL DATA USING THE PIVOT METHOD**

BP GR PIVOT
150 650

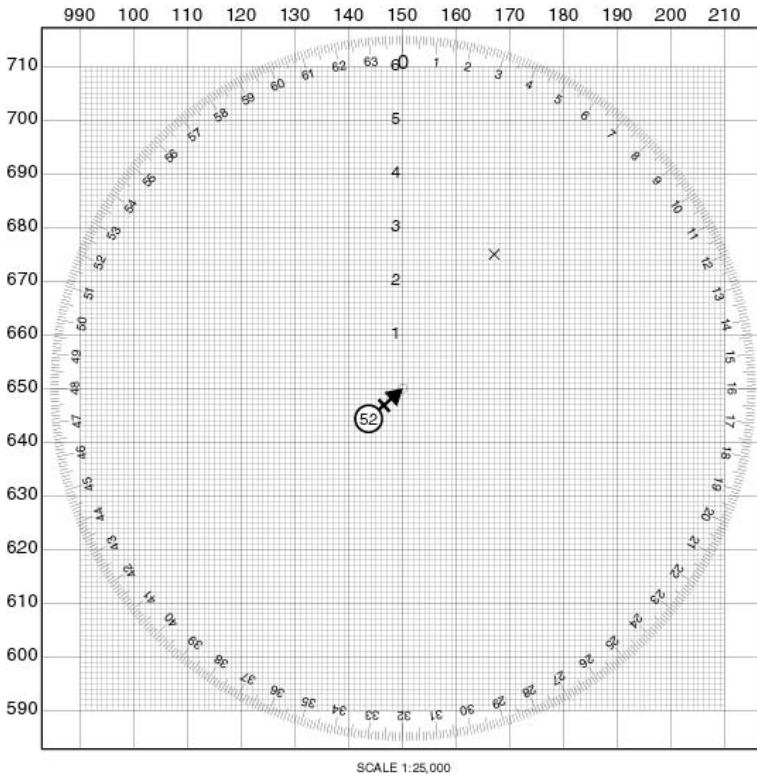


**THE FIRE CONTROLLER (FC) SENDS THE FOLLOWING FM:**

FM 4 MOR  
GR 167 675  
DIR 1220  
SECTION DUG IN  
5 ROUNDS  
AF

- b. The procedure is as follows:
- (1) Turn the disk until the O is directly above the indicator line.
  - (2) Reading the base as you would do for a map, locate the target grid reference and mark a small + on the disk directly above the grid reference. This is the fall of shot of the first round; enter a small "1".
  - (3) Turn the disk until the + (the target) is on the indicator line. Count the distance in metres from the pivot to the target; you now have the range from the target.
  - (4) The + is on the indicator line. Note the bearing of the target according to the graduation in mils on the disk.
  - (5) Turn the disk until you can read the direction against the indicator line at the top of the plotter. Extend the graduation line in mils up to the matt surface of the disk and enter the direction D.
  - (6) The data for the first target is now placed on the plotter.

## Instruments for Calculating Mortar Firing Data



**Figure 2-3: Production of Fire Control Data Using the Pivot Method**

### 10. Confirmation of Stage I:

- a. questions from the class;
- b. questions to the class; and
- c. important points:
  - (1) make sure that the O is right on the indicator line;
  - (2) mark the target as small as possible and mark it using a figure (+); and
  - (3) check your work.

11. **Stage II—Conversion of Fire Control Data.**

- a. We have determined the bearing and range of the target. Now, to find the rest of the data, you must use the firing tables:

<b>BP GR PIVOT</b>	<b>AMMUNITION</b>
150 650	C 70 A1

FM 4 MOR	FM 4 MOR
GR 177 676	3 ROUNDS
DIR 1020	CHG 6
SEC DUG IN	BNG 0819
3 ROUNDS	ELEVATION 1131
	RANGE 3750
AF	COMDT 4 AF

- b. Using the above data, go to the firing tables, find the range you have placed and find the elevation closest to 1100 mils. In this case, the elevation is 1090 mils, charge 6. The CPO can also at this time find the time of flight (37 seconds) and the  $PE_r$  (probable error:  $30 \times 10$ ). He writes his data on the fire control data form and gives it to the mortar line (except the Time of Flight and  $PE_r$ ).

**NOTE**

The firing tables are graduated in 25-metre increments. You must take the average to give yourself an even more accurate elevation.

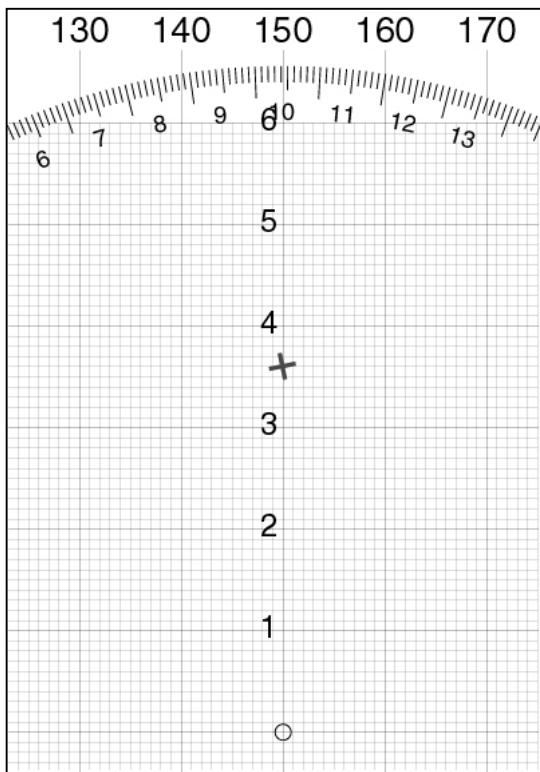
- c. For the fire control data of a simple smoke fire mission (FM) you do the same as for HE. Do the following FM:

Instruments for Calculating Mortar Firing Data

BP GR PIVOT	AMMUNITION
150 650	C106

FM 4 MOR  
GR 164 665  
DIR 0430  
BLINDING  
SMOKE 2 ROUNDS  
AF

- d. **The Firing Fan.** When British L19 A3/A4 and L15 A3/A4 ammunition is used, the CPO can use the associated firing fan. The procedure is the following:
- (1) turn the fan until one of the charges intercepts the targets;
  - (2) select the charge to have the greatest flexibility;
  - (3) to find the bearing, look directly above the fan and read the bearing;
  - (4) to find the elevation, read where the mark + comes into contact with one of the lines of the charge chosen on the fan; and
  - (5) for the time of flight (TOF) and the other data, the firing tables must be used.



**Figure 2-4: Note the Bearing of the Target**

BP GR PIVOT	AMMUNITION
150 650	C 70 A1

FM 4 MOR:	FM 4 MOR
GR 172 680	3 ROUNDS
DIR 2910	CHG 6
SEC DUG IN	BNG 0645
3 ROUNDS	ELEVATION 1135
AF	(RANGE 3725)

12. **Confirmation of Stage II:**

- a. questions from the class; and

Instruments for Calculating Mortar Firing Data

- b. questions to the class.

13. **Stage III—Target Grid Corrections:**

- a. Now you have received the initial fire control data of the shot on or near the target. However, due to certain factors, the shot will need to be adjusted. The corrections come from the FC and are as follows:

**LEFT, RIGHT, ADD, DROP, UP, DOWN**

<b>BP GR PIVOT</b>	<b>AMMUNITION</b>
150 650	C 70 A1

FM 4 MOR	FM 4 MOR
GR 158 674	3 ROUNDS
DIR 6300	CHG 4
SEC IN OPEN	BNG 0328
3 ROUNDS	ELEVATION 1132
	(RANGE 2525)
AF	AF

- b. Now here is the procedure:
  - (1) The direction which was sent in the initial order will be marked on the side of the disk with an arrow and the letter D, then turn the disk to the indicator line.
  - (2) All corrections are made from the direction and last target marked.

**THE FC SENDS THE FOLLOWING CORRECTIONS:**

LEFT 100
ADD 400

- (3) Proceed as follows:

- (a) make sure the direction is on the indicator line;
- (b) from the initial target + , count the number of squares to find the range LEFT 100 and ADD 400, mark it with a +, then mark a small 2; and
- (c) check for accuracy.

**NOTE**

Use the vertical and horizontal lines to help you and proceed in the same way as with the initial round to find the data.

**THE FIRE CONTROL DATA ARE: C70 A1**

CHG 4  
 BNG 0237  
 ELEVATION 1026  
 RANGE 2875

**THE FC SENDS THE FOLLOWING CORRECTIONS:**

RIGHT 50  
 DROP 200

**THE FIRE CONTROL DATA ARE AS FOLLOWS:**

CHG 4  
 BNG 0280  
 ELEVATION 1083  
 RANGE 2700

**NOTE**

When you select the charge and the elevation, stay with the same charge as that of the original FM. Do not go to another charge if it is near 1100 mils, for example CHG 4, and for smoke ammunition, corrections are done in the same way as for HE.

14. **Confirmation of Stage III:**
  - a. questions from the class; and
  - b. questions to the class.
15. **Final Confirmation:**
  - a. questions from the class; and
  - b. questions to the class.

**CONCLUSION**

16. During this lesson, you have learned how to produce and convert fire control data using the pivot method. Do not forget it is very important for all problems to be checked for accuracy of fire control data.
17. The next lesson will be ...



## LESSON 4 ALTERNATIVE METHOD

### ENABLING OBJECTIVE

1. Produce fire control data with the plotter.

### MAIN TEACHING POINTS

2. Alternative method:
  - a. produce fire control data for simple fire missions (FMs); and
  - b. convert fire control data from target grid corrections.

### PREPARATION

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;
  - b. firing tables; and
  - c. cleaning materials.
7. **Training Aids:**
  - a. large-scale plotter; and
  - b. computer with PowerPoint®.

**CONDUCT OF THE LESSON**

8. **Introduction:**

- a. **Review.** As required.
- b. **What.** In this lecture you will learn how to produce fire control data using the alternative method and report for simple HE and smoke FM.
- c. **Why.** As a control post operator (CPO) you must be able to place a target grid reference correctly and find its bearing and range to produce fire control data.
- d. **Where.** During the course, at your unit or in combat.

9. **Stage I—Produce Fire Control Data:**

- a. Having completed the preparation of the plotter, the CPO is ready to receive a fire mission. Before engaging the target the CPO must convert the target grid reference into firing data.

ALTERNATIVE BP GR	DIRECTION	AMMUNITION
150650	NE	C-70 A1

- b. Production of alternative method fire control data:

**THE FIRE CONTROLLER (FC) SENDS THE FOLLOWING FIRE MISSION:**

FM 4 MOR  
GR 167675  
DIR 1220  
SEC DUG IN  
5 ROUNDS  
AF

- c. Sequence to follow:
- (1) place the ZERO of the rotating disk on the indicator line;
  - (2) reading the base, locate the target grid and place an X;
  - (3) enter 1 for the first round;
  - (4) turn the disk until the target and the position of the mortar are equidistant from the indicator line;
  - (5) read the bearing on the indicator line;
  - (6) find the range by counting the 100 metre lines to the target;
  - (7) convert the range into charge and elevation using the firing table;
  - (8) gather the data and pass the fire order to the mortar line; and
  - (9) mark the direction of the fire mission and place it on the indicator line.

# Instruments for Calculating Mortar Firing Data

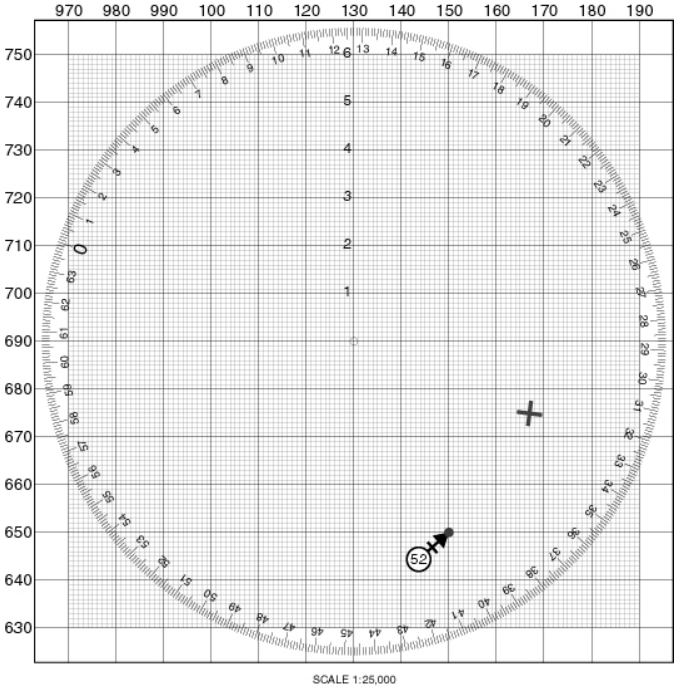


Figure 2-5: Alternative Method

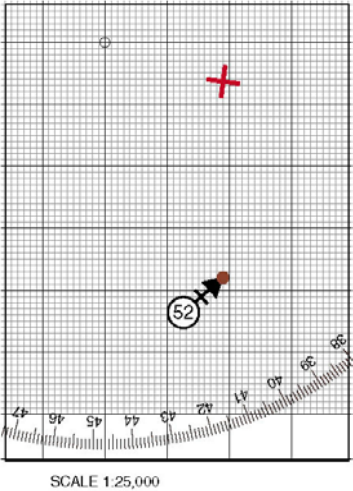


Figure 2-6: Alternative Method (Close-up)

**NOTE**

To read the bearing and the range, the position of the mortars must be always at the bottom of the rotating disk. To read the corrected GR, you bring the ZERO of the disk onto the indicator line.

FM 4 MOR  
 GR 167675  
 DIR 1220  
 SEC DUG IN  
 5 ROUNDS  
 AF

**FIRE CONTROL DATA:**

FM 4 MOR  
 5 ROUNDS  
 CHG 5  
 BNG 0609  
 ELEVATION 1159  
 (RANGE 3025)  
 3 AF

- d. Production of alternative method fire control data (enter), sequence to follow based on the alternative method:
- (1) A simpler method consists of keeping the bearing of the target on the indicator line.
  - (2) Enter the range from the target on the indicator line based on the pivot.
  - (3) You may use the firing fan because you will be working with the pivot method.
  - (4) All corrections will be entered according to the pivot method.

Instruments for Calculating Mortar Firing Data

- (5) To find the corrected GR, you must place the direction on the indicator line, count the distance which separates the last shot and the first shot and enter this information based on the first shot of the alternative method.
- (6) Place the ZERO of the disk on the indicator line and read the corrected GR.

10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

11. **Stage II—Conversion of Fire Control Data:**

- a. You have received all the fire control data but the shot does not hit the target and it must be corrected.

**TARGET GRID CORRECTIONS, ALTERNATIVE METHOD.**

<b>BP GR ALTERNATIVE</b>	<b>DIRECTION</b>	<b>AMMUNITIO N</b>
200680	NW	C106

FM 4 MOR  
GR 199 702  
DIR 0300  
SEC IN OPEN  
SMOKE 3 ROUNDS  
3 AF

FM 4 MOR  
SMOKE 3 ROUNDS  
CHG 2  
BNG 6354  
ELEVATION 1124  
(RANGE 2200)  
3 AF

- b. Sequence to follow:

- (1) bring the direction onto the indicator line;

- (2) the FC sends you a correction:

LEFT 400
ADD 100

- (3) based on round 1, you count the distance given to the left and up;
- (4) mark the round X 2;
- (5) turn the disk until shot number 2 and the position of the mortars are equidistant from the indicator line;
- (6) read the bearing on the indicator line;
- (7) count the distance to the shot and find the charge and elevation:

CHG 2  
BNG 6211  
ELEVATION 1035  
(RANGE 2450)

- (8) place the direction on the indicator line.

- c. Target grid references, alternative method 2 (enter):

- (1) the corrections are applied in the same manner as for the alternative method, except that you use the indicator line according to the pivot method; and
- (2) the firing fan can be used if it corresponds to the type of ammunition.

## 12. **Confirmation of Stage II:**

- a. questions from the class; and
- b. questions to the class.

Instruments for Calculating Mortar Firing Data

13. **Final Confirmation:**
- a. questions from the class; and
  - b. questions to the class.

**CONCLUSION**

14. During this lesson, you have learned how to produce fire control data with alternative methods I and II.
15. The next lesson will be...



## LESSON 5 CONVERGE FIRE MISSION

### ENABLING OBJECTIVE

1. Produce fire control data with the plotter.

### MAIN TEACHING POINTS

2. Converge fire mission:
  - a. converge tables; and
  - b. converge procedure.

### PROCEDURE

3. **Time Required.** One 40-minute period.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;
  - b. firing tables; and
  - c. cleaning materials.
7. **Training Aids:**
  - a. chalkboard;
  - b. large-scale plotter;
  - c. firing tables; and

- d. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. **Introduction:**

- a. **Review.** As required.
- b. **What.** Obtain fire control data for a converge mission.
- c. **Why.** In order to be able to engage a target requiring a heavy volume of fire on a relatively small area.
- d. **Where.** On the course, at your unit and in combat.

### 9. **Stage I—Converge Tables:**

- a. The fire controller (FC) often finds himself in the presence of small targets, requiring a heavy volume of fire. To do this, he must concentrate all his mortars on the beaten zone of one mortar. That is, he must converge his mortars on the adjustment point when firing for effect.
- b. **Converge Table.** The converge table has been designed to be able to converge up to 4 mortars on the same target. As you know, there are usually 30 metres between mortars for a total of 90 metres of front for 1 group. Look at your firing table and you will notice on the left the ranges of 500 to 5600 metres. Also, the amount of mils which you will have to remove or add in order to converge.
- c. Each column represents a mortar from 1 to 3 over 90 metres of space. The adjustment mortar is 0.
- d. On the same table there is 20 metre distance between mortars which is used in the same manner as the 30 metre table.

MOR #	1		2		3		MOR #	1		2		3	
	METRES	20	30	40	60	60		90	METRES	20	30	40	60
500	40	60	80	120	120	180	3100	6	10	12	20	18	30
600	33	50	66	100	99	150	3200	6	9	12	18	18	27
700	29	43	58	86	87	129	3300	6	9	12	18	18	27
800	25	38	50	76	75	114	3400	6	9	12	18	18	27
900	22	33	44	66	66	99	3500	6	9	12	18	18	27
1000	20	30	40	60	60	90	3600	6	8	12	16	18	24
1100	18	27	36	54	54	81	3700	5	8	10	16	15	24
1200	17	25	34	50	51	75	3800	5	8	10	16	15	24
1300	15	23	30	46	45	69	3900	5	8	10	16	15	24
1400	14	21	28	42	42	63	4000	5	8	10	16	15	24
1500	13	20	26	40	39	60	4100	5	7	10	14	15	21
1600	13	18	26	36	39	54	4200	5	7	10	14	15	21
1700	12	17	24	34	36	51	4300	5	7	10	14	15	21
1800	11	17	22	34	33	51	4400	5	7	10	14	15	21
1900	11	15	22	30	33	45	4500	4	7	8	14	12	21
2000	10	15	20	30	30	45	4600	4	7	8	14	12	21
2100	10	14	20	28	30	42	4700	4	6	8	12	12	18
2200	9	13	18	26	27	39	4800	4	6	8	12	12	18
2300	9	13	18	26	27	39	4900	4	6	8	12	12	18
2400	8	13	16	26	24	39	5000	4	6	8	12	12	18
2500	8	12	16	24	24	36	5100	4	6	8	12	12	18
2600	8	12	16	24	24	36	5200	4	6	8	12	12	18
2700	7	11	14	22	21	33	5300	4	6	8	12	12	18
2800	7	10	14	20	21	30	5400	4	5	8	10	12	15
2900	7	10	14	20	21	30	5500	4	5	8	10	12	15
3000	7	10	14	20	21	30	5600	5	5	8	10	12	15

**Figure 2-7: Converge Table**

10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

11. **Stage II—Produce Fire Control Data for Converged Fire:**

- a. Procedure. On the order “CONVERGE”, the control post operator (CPO) acknowledges receipt. Using the bearing and distance from the adjustment mortar he finds the bearing for the other mortars using the converge table.

**NOTE**

- 1. The charge and elevation for all mortars remains the same. (Give the individual bearings for each mortar).
- 2. The mortars to the left of the adjustment mortar—you add—the tubes move to the right.
- 3. The mortars to the right of the adjustment mortar—you subtract—the tubes move to the left.

- b. Sequence to follow:

- (1) the order “CONVERGE” is given to a group of 4 mortars, (reference: review fire mission);
- (2) the adjustment mortar is number 3, its bearing is 0071 mils and the range is 3050 metres, rounded to 3100 metres; and
- (3) calculate the bearings using the Converge Table beginning with number 1:

True bearing Number 3 = 0071 mils,
Range = 3100 metres, and
Movement = 10 mils for 30 metres

Bearing Number 1: $0071 - 20 = 0051$ mils
Bearing Number 2: $0071 - 10 = 0061$ mils
Bearing Number 4: $0071 + 10 = 0081$ mils.

12. **Confirmation of Stage II:**
- questions from the class; and
  - questions to the class.

13. **Final Confirmation:**
- questions from the class; and
  - questions to the class.

## CONCLUSION

14. You have seen the converge tables and the converge procedure. You must always remember that:
- the left mortars—you add;
  - the right mortars—you subtract; and
  - the bearing of the adjustment mortar does not change.
15. The next lesson will be...

**LESSON 6**  
**ADJUST AN ERRING MORTAR**

**ENABLING OBJECTIVE**

1. Produce fire control data with the plotter.

**MAIN TEACHING POINTS**

2. Adjust an erring mortar:
  - a. adjust an erring mortar—control post operator (CPO); and
  - b. adjust an erring mortar—using mortar number 1.

**PREPARATION**

3. **Time Required.** One 40-minute period.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;
  - b. firing tables; and
  - c. cleaning materials.
7. **Training Aids:**
  - a. chalkboard;
  - b. large-scale plotter;
  - c. firing tables; and

- d. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. **Introduction:**

- a. **Review.** As required.
- b. **What.** You will learn how to adjust an erring mortar.
- c. **Why.** As a CPO, you must know the procedure for adjusting the line of fire of an erring mortar. This procedure is quick and accurate and removes the possibility of placing a mortar out.
- d. **Where.** On the course, at your unit and in combat, you must know this procedure which can save human lives.

### 9. **Stage I—Adjustment of an Erring Mortar:**

- a. It happens that during firing, the belt of fire becomes convergent, in other words not parallel. The lines of fire must be parallel for fire for effect (FFE) to be produced. When the fire controller (FC) notices that one of his mortars is erring, he could correct it individually and thus make the rounds explode at the intended place in the belt of fire. That mortar would then have fire control data different from the others, which must absolutely be avoided. If it is a directional aiming error, it could be corrected by making sure that all mortars had the same fire bearing in their sights, in which case not only would their parallel lines of fire be reestablished but maintained.
- b. Communication Procedure with Respect to the FC and the Mortar to be Adjusted. Produce the fire control data for adjusting an erring mortar from the FC to the CPO:

Instruments for Calculating Mortar Firing Data

1.	FC—mortar number 1 erring, number 1 LEFT 100 - 1 AF
	CPO—say again word for word
	Result: "Fire is good"
	FC—right group AF (to confirm firing)
	CPO—say again word for word
	FC number 1, adjusted line of fire
	CPO—say again word for word
2.	From the CPO to mortar number 1:
	CPO—adjusted line of fire on bearing
	No 1—say again word for word
	No 1—line of fire adjusted on bearing
	CPO—say again word for word
3.	From the CPO to the FC:
	CPO—line of fire adjusted
	FC—say again word for word

- c. After the target adjustment has been completed, the FC must check the belt of fire before engaging with FFE.
- d. After completing 1 round FFE, the FC determines that this belt of fire is not parallel. Then he will order individual conduct for that mortar:
  - (1) order by the FC: **NUMBER 1 MORTAR ERRING, NUMBER 1 LEFT 100 OVER.**  
The CPO must:
    - (a) make sure that the direction is on the proofline;
    - (b) place the correction left 100; and
    - (c) obtain the fire control data and fire the round.

BEARING 0169
CHARGE 4
ELEVATION 1090



- e. If additional corrections are necessary, the CPO will make them in the normal manner and will fire the round. In that case, the FC is satisfied and will give the following order: **ADJUSTED LINE OF FIRE**. The CPO must then:
- (1) repeat the order;
  - (2) give the order to the number 1 **ADJUSTED LINE OF FIRE ON BEARING 0196**; and
  - (3) erase the adjustments for that mortar.

f. **Action on the Mortar Line.** After number 1 has received the order **ADJUSTED LINE OF FIRE** on bearing 0196, he must proceed as follows:

- (1) Check the aiming of his mortar and make the necessary corrections.
- (2) Without changing the aiming of his mortar, loosen the screw of the large and small reading scales. He will adjust these so that the bearing given is aligned with the index of the bearings and will tighten the screw again and read the new reading.
- (3) He thus gives the reading on the sight of a deviation corresponding to the difference between the former bearing and the new one:

Former: 0196
After adjustment: 0169
27 mils, change of reading

- (4) If the new reading is lower than the former one, he will increase the difference of the readings from all other sight checks. If the new one is higher, he will subtract.
- (5) When all these corrections are complete, he will report to the CPO **MORTAR**

**NUMBER\_\_ , LINE OF FIRE  
ADJUSTED ON BEARING \_\_\_\_.**

10. **Confirmation of Stage I:**
- a. questions from the class; and
  - b. questions to the class.

11. **Final Confirmation:**
- a. questions from the class; and
  - b. questions to the class.

**NOTE**

If the new bearing is higher than the preceding one, the reading will be smaller and vice versa.

**CONCLUSION**

12. You have seen the procedure by the CPO and the number 1 for adjusting an erring mortar. As CPO you must know these procedures to make sure of having a proper line of fire.
13. The next lesson will be...

**LESSON 7**  
**ENGAGE TWO TARGETS AT THE SAME TIME**

**ENABLING OBJECTIVE**

1. Produce fire control data with the plotter.

**MAIN TEACHING POINTS**

2. Engage two targets at the same time.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;
  - b. firing tables; and
  - c. cleaning materials.
7. **Training Aids:**
  - a. chalkboard;
  - b. large-scale plotter;
  - c. firing tables; and
  - d. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. **Introduction:**

- a. **Review.** As required.
- b. **What.** In this lesson, you will learn to engage two targets at the same time.
- c. **Why.** During the course, it will be necessary to produce fire control data for engaging more than one target and as control post operator (CPO) you must be able to carry out this task with accuracy.
- d. **Where.** On the course, at your unit and in combat.

### 9. **Stage I—Engaging Two Targets:**

- a. The engagement of several targets by a group of mortars will take place especially during registration fire or a fire plan.
- b. The procedure to follow is simple except that the CPO must be very vigilant in producing fire control data because poor data for a target can result in loss of life.
- c. With the plotter, it is possible for a single group to engage several targets at once.
- d. When producing fire data, it is important to identify each target properly, either by:
  - (1) using different colours; or
  - (2) writing the target numbers.
- e. For the engagement of the targets to be effective, it is necessary to have proper fire control. The FC will use the order **AT MY COMMAND**.
- f. Targets may be registered beforehand by:

- (1) using the list of targets;
  - (2) during previous fire when care has been taken to name the target; or
  - (3) again during immediate fire.
- g. The production of fire control data does not change according to the methods already taught.

#### **NOTE**

You may adjust on a target and make the corrections on your list of targets.

10. **Confirmation of Stage I:**
  - a. questions from the class;
  - b. questions to the class.
11. **Final Confirmation:**
  - a. questions from the class; and
  - b. questions to the class.

#### **CONCLUSION**

12. In this lesson, you have seen how to engage several targets with the plotter. As CPO you must be able to produce fire control data for several targets.
13. The next lesson will be...

**LESSON 8**  
**POLAR FIRE MISSION**

**ENABLING OBJECTIVE**

1. Produce fire control data with the plotter.

**MAIN TEACHING POINTS**

2. Polar fire mission.
  - a. pivot method;
  - b. laser corrections;
  - c. target grid corrections; and
  - d. alternative method.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;
  - b. firing tables; and
  - c. cleaning materials.
7. **Training Aids:**
  - a. chalkboard;
  - b. large-scale plotter;

- c. firing tables; and
- d. computer with PowerPoint®.

**CONDUCT OF THE LESSON**

8. **Introduction:**

- a. **Review.** As required.
- b. **What.** You will learn how to produce fire control data for a polar fire mission.
- c. **Why.** As a control post operator (CPO), you must be in a position to produce these fire control data quickly. If everything is correct, a polar mission is more accurate and saves time and ammunition.
- d. **Where.** During the course, at your unit and in combat.

9. **Stage I—Pivot Method:**

- a. The use of laser and the plotter produces a more accurate fire in a shorter time, using less ammunition. To do this, the bearing of the location and the observation post (OP) must be extremely accurate.
- b. Before the CPO can produce the fire control data for a polar fire mission, he must know and mark the location of the OP. In this case, the OP is at GR 009 741. Carry out the following fire mission:

<b>BP GR PIVOT</b>	<b>OP</b>	<b>AMMUNITION</b>
993 725	009 741	C 70 A1

FM 4 MOR  
 DIR 0600  
 RANGE 1400  
 SEC DUG IN  
 2 ROUNDS  
 AF

Instruments for Calculating Mortar Firing Data

c. Proceed as follows:

- (1) make sure the OP is properly marked;
- (2) place the direction (0600) on the indicator line;
- (3) from the OP, find the range (1400) in a straight line;
- (4) place your target on the indicator line and read your bearing (0724); and
- (5) find the distance (3646) between the target and the pivot and use the fan or the firing tables to determine the elevation and the charge.

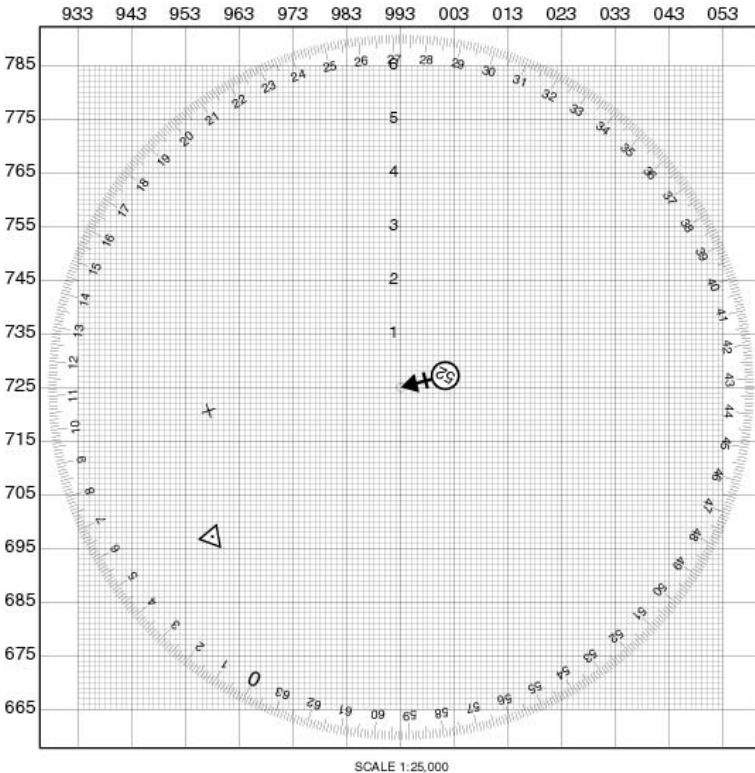
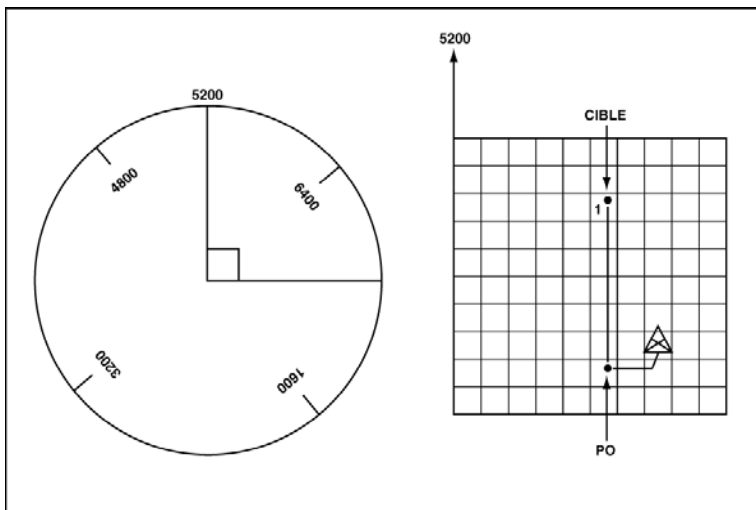


Figure 2-8: Polar Fire Mission—Pivot Method





**Figure 2-9: Polar Fire Mission—Pivot Method**

CHG 6  
 BNG 0724  
 ELEVATION 1148  
 RANGE: 3650

**NOTE**

Check your work for accuracy.

- d. **Laser Corrections.** If the round does not hit the target, the FC will fire the laser at the explosion and send a correction and a range from the shot:

Direction 0440
Range 1550

- e. Proceed as follows:
- (1) Place the direction 0440 on the indicator line.
  - (2) Count the distance 1550 from the OP and mark with a dot.

Instruments for Calculating Mortar Firing Data

- (3) Turn the disk so that the initial mark and the second mark are in line horizontally.
- (4) Count the distance between the 2 marks.
- (5) Move the second mark to the opposite side of the first, counting the same distance, and erase the second mark.

**THE FIRE CONTROL DATA ARE:**

CHG 6  
BNG 0797  
ELEVATION 1166  
RANGE 3550

- (6) This correction method will only be used with the polar fire mission (FM). For other FMs the FC must use target grid corrections. To go to the target grid corrections, mark the original direction (0600) and make the normal corrections to the first mark made on the plotter:

**LEFT 50**  
CHG 6  
BNG 0783  
ELEVATION 1166  
RANGE 3550

10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

11. **Stage II—Alternative Method:**

- a. As CPO, you must be in a position to produce fire control data using the alternative method. You may be called on to produce data based on an alternative position (in defence) or during mobile operations:

<b>ALTERNATIVE BP GR</b>	<b>OP</b>	<b>DIRECTIO N</b>	<b>AMMUNITION</b>
023 695	005 696	NW	C 70 A1

FM 4 MOR  
 DIR 5650  
 RANGE 1800  
 PL IN TRENCH  
 5 ROUNDS MIXED FUZE  
 1 AF

- b. To apply the initial fire control data, proceed as follows:
- (1) make sure the position of the OP is properly marked;
  - (2) turn the disk until the direction (5650) can be read on the indicator line;
  - (3) from the OP, count the range (1800 metres) upward and mark the target;
  - (4) turn the disk to align the location of the mortars and the target making sure that the mortars are towards the bottom;
  - (5) read the bearing on the indicator line; and
  - (6) count the distance from the mortars to the target and find the charge and the elevation.

FM 4 MOR  
 5 ROUNDS MIXED FUZE  
 CHG 6  
 BNG 5253  
 ELEVATION 1202  
 RANGE 3325  
 1 AF

Instruments for Calculating Mortar Firing Data

- c. **Laser Corrections.** The FC will fire the laser onto the explosion and send the following corrections:

DIR 5600
RANGE 1700

- d. Proceed as follows:

- (1) Turn the disk until the direction (5600 mils) can be read on the indicator line.
- (2) From the OP, count the distance (1700 metres) and mark it as 2.
- (3) Turn the disk and align the initial mark and the second mark horizontally. Use the grid references to help you.
- (4) Count the distance between the 2 marks and enter the second at the same distance on the opposite side, in line with the initial mark. Erase the second mark.
- (5) Turn the disk to align the position of the mortars and the mark, read the bearing on the indicator line.
- (6) Count the distance between the mortars and the second mark and find the charge and elevation.
- (7) Check your work and send your data to the mortar line.
- (8) If there are other target grid corrections, they must be sent using the target grid references:

CHG 6  
BNG 5288  
ELEVATION 1190  
RANGE 3400

RIGHT 50

BNG 5304

ADD 25

ELEVATION 1190

FFE

RANGE 3400

Corrected GR: 9931 7112

12. **Confirmation of Stage II:**
  - a. questions from the class; and
  - b. questions to the class.
13. **Final Confirmation:**
  - a. questions from the class; and
  - b. questions to the class.

## CONCLUSION

14. In this lesson, you have learned how to produce fire control data for a polar fire mission with the pivot method and the alternative method. As CPO, you must know the proper procedure to be in a position to engage targets quickly and effectively.
15. The next lesson will be...

**LESSON 9**  
**ILLUMINATION MISSION**

**ENABLING OBJECTIVE**

1. Produce fire control data with the plotter.

**MAIN TEACHING POINTS**

2. Illumination mission:
  - a. point;
  - b. diamond;
  - c. lateral spread; and
  - d. range spread.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;
  - b. firing tables; and
  - c. cleaning materials.
7. **Training Aids:**
  - a. chalkboard;

- b. large-scale plotter;
- c. firing tables; and
- d. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. **Introduction:**

- a. **Review.** As required.
- b. **What.** You will learn how to produce the fire control data for point, diamond, lateral spread and range spread illumination fire missions (FMs).
- c. **Why.** As a control post operator (CPO), you may have to produce fire control data in order to illuminate an area in certain situations.
- d. **Where.** On the course, at your unit and in combat.

### 9. **Stage I—Point Illumination:**

- a. point illumination is done in the same manner as a simple HE and smoke FM, except that you will have a fuze to adjust so that the illumination is produced at the right height;
- b. each time you will have an up or down 100 metre correction, you remove or add 1 second; for each 50 metre correction this will be .5 seconds;
- c. if you have a down correction, you have to add;
- d. if you have an up correction, you have to subtract;
- e. corrections of more than 200 metres and less than 50 metres in height are not effective; and
- f. you must monitor the seconds on the ups and downs to fire for effect.

10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

11. **Stage II—Range Spread.** The CPO carries out the normal adjustment then, on the order **FIRE FOR EFFECT**, brings his adjustment point to the indicator line and traces 4 dots from the adjustment point up and down, one at 300 and the other at 600 from the first:

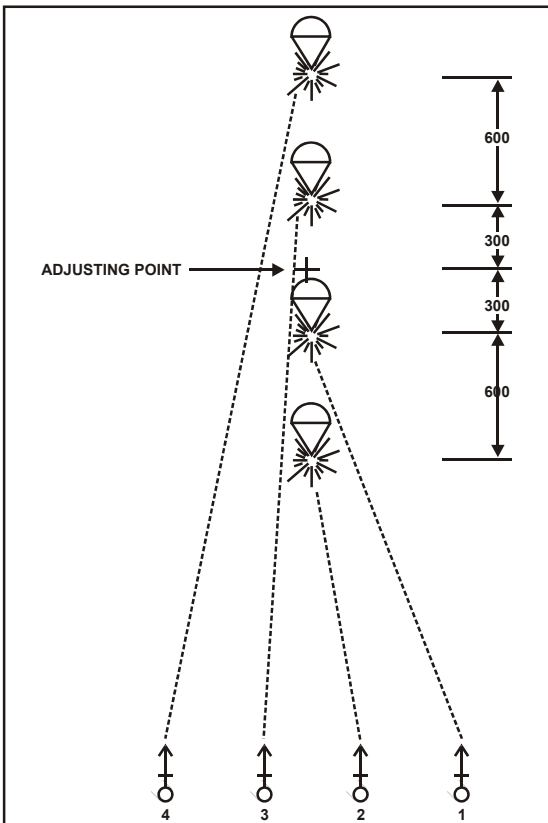


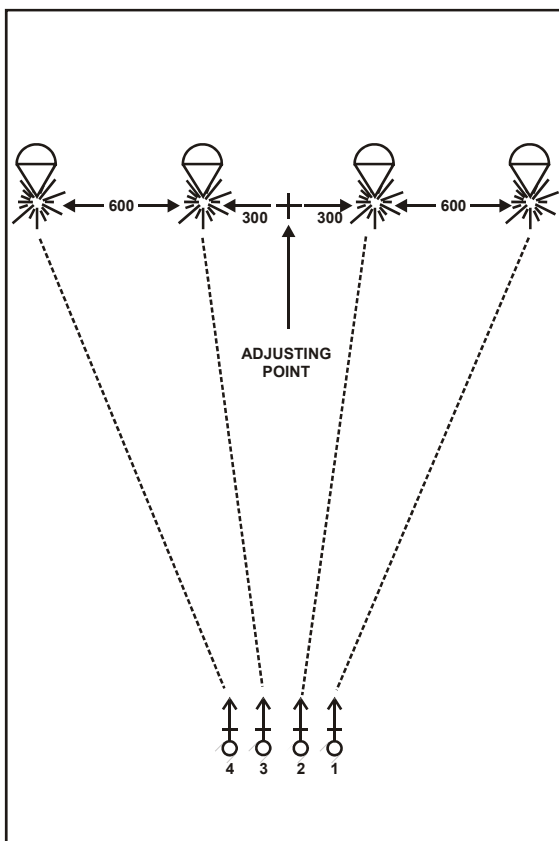
Figure 2-10: Range Spread

12. **Confirmation of Stage II:**



- a. questions from the class; and
- b. questions to the class.

13. **Stage III—Lateral Spread.** The CPO begins with a normal adjustment then, on receiving the order **FIRE FOR EFFECT**, makes his trace on the indicator line and places two dots 300 metres from the adjustment point and two other dots 600 metres from the first two dots in order to have 600 metres between each two rounds.



**Figure 2-11: Lateral Spread**

14. **Confirmation of Stage III:**

Instruments for Calculating Mortar Firing Data

- a. questions from the class; and
- b. questions to the class.

15. **Stage IV—Diamond Illumination.** The CPO carries out the normal adjustment then, on the order **FIRE FOR EFFECT**, brings his adjustment point to the indicator line and traces 4 dots up and down, to the left and to the right, 300 metres from the adjustment point:

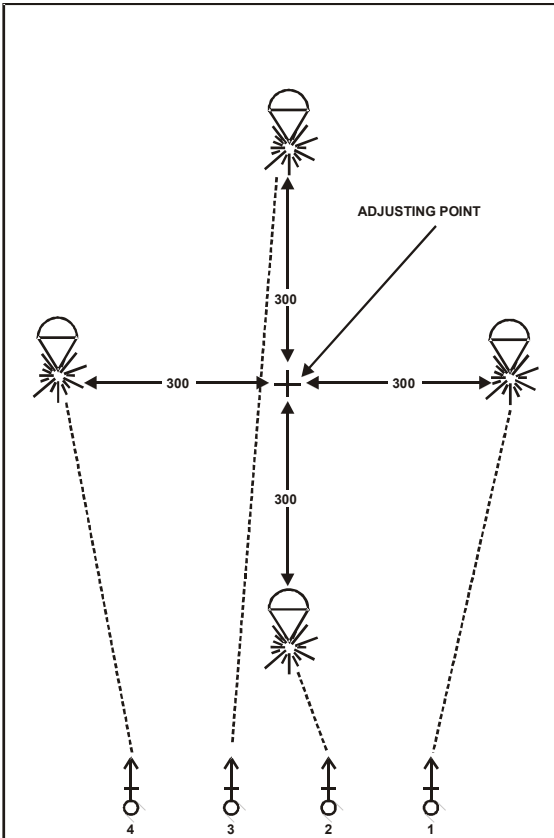


Figure 2-12: Diamond Illumination

16. **Confirmation of Stage IV:**

- a. questions from the class; and

- b. questions to the class.
17. **Final Confirmation:**
- a. questions from the class; and
  - b. questions to the class.

## CONCLUSION

18. During this lesson, you have seen point illumination, diamond spread, range spread and lateral spread. Remember that the initial mark is from the adjustment point. For length and width, there are 600 metres between mortars.
19. The next lesson will be...

**LESSON 10**  
**COORDINATED ILLUMINATION MISSION**

**ENABLING OBJECTIVE**

1. Produce fire control data with the plotter.

**MAIN TEACHING POINTS**

2. Coordinated illumination mission:
  - a. conventions; and
  - b. co-ordinated illumination procedure.

**PREPARATION**

3. **Time Required.** Three 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;
  - b. firing tables; and
  - c. cleaning materials.
7. **Training Aids:**
  - a. chalkboard;
  - b. large-scale plotter;
  - c. firing tables; and

- d. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. Introduction:

- a. **Review.** As required.
- b. **What.** You will learn how to produce fire control data for a co-ordinated illumination fire mission (FM).
- c. **Why.** In order to illuminate a sector so that the fire controller (FC) can adjust with HE onto a target.
- d. **Where.** During the course, at your unit and in combat.

### 9. Stage I—Convention:

- a. Co-ordinated illumination is point illumination combined with a target for HE or smoke rounds. The illuminating is adjusted first, followed by the HE on the target.
- b. Once the illuminating has been adjusted, the FC will give the order **CO-ORDINATED ILLUMINATION \_\_ SECONDS**, the point illumination is marked with a circle and the mortar number, for example +2 and the fire control data for the adjustment of the HE are calculated.

#### NOTE

The grid reference becomes the adjustment point for the HE and the correction the adjustment point for the illuminating.

- c. The adjustment is now carried out on the target. The interval sent in the order is the time of illumination of the adjustment round from beginning until it is

Instruments for Calculating Mortar Firing Data

effective on the terrain. Thus, the interval must be compared with the illuminating fuze and the time of flight (TOF) of the HE round. For example:

Fuze:	36.7 seconds
HE TOF:	39.0 seconds
Interval:	15.0 seconds

- (1) add the interval ordered by the FC to the time of the fuze; and
- (2) subtract the smaller of the two times, HE or fuze of the other, to obtain the firing interval for the HE round.

36.7 (Fuze time)	51.7 (+15)	12.7 seconds after firing the illuminating round you fire the HE round.
+ 15.0 (Interval)	- 39.0 (Smaller number, that is the HE TOF)	
=51.7 (+15)	=12.7 (Difference)	

Fuze	28.5seconds
HE TOF:	41.0seconds
Interval:	10.0seconds

28.5 (Fuze)	41.0 (HE TOF)	The HE round will be fired 2.5 seconds before the illuminating one.
+ 10.0 (Interval)	- 38.5 (Smaller number, fuze plus the interval)	
= 38.5 (+10)	= 2.5 (Difference)	

10. **Confirmation of Stage I:**
- a. questions from the class; and
  - b. questions to the class.

11. **Final Confirmation:**
  - a. questions from the class; and
  - b. questions to the class.

## CONCLUSION

12. During these two periods, you have learned co-ordinated illumination. Remember on the adjustment of the illuminating to raise, you reduce the time of the fuze, and to lower, you increase your fuze time. To obtain the interval between the illuminating and the HE, it is the difference, (which must be positive) of either:
  - a. illumination fuze time plus the interval required, minus the HE TOF; or
  - b. HE TOF minus illumination fuze time plus the interval required.
13. The next lesson will be...

**LESSON 11**  
**ADJUST A GROUP OF TARGETS**

**ENABLING OBJECTIVE**

1. Produce fire control data with the plotter.

**MAIN TEACHING POINTS**

2. Adjust a group of targets:
  - a. adjustment procedure by target grid;
  - b. adjustment procedures by polar grid references;
  - c. silent registration; and
  - d. registration by fire.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;
  - b. firing tables; and
  - c. cleaning materials.
7. **Training Aids:**
  - a. chalkboard;
  - b. large-scale plotter;
  - c. firing tables; and



- d. computer with PowerPoint®.

**CONDUCT OF THE LESSON**

8. **Introduction:**

- a. **What.** You will learn how to use the various adjustment procedures as well as registration methods.
- b. **Why.** As a control post operator (CPO), you can prepare the fire control data for a list of targets for combat manoeuvres.
- c. **Where.** During the course, at your unit, and in combat.

9. **Stage I—Silent Registration.** This method is used when it is essential for reasons of safety, economy of ammunition or for surprise effect. Here is how to proceed based on the mortar position:

- a. The fire controller FC sends a messenger to carry a list of targets to the CPO or the order group or transmits it by radio. If by radio, all the grid references must be transmitted in code or with a secure transmission system. For example by radio:

53A this is 51 C
List of targets—over
GR (coupled)
GR (coupled)
GR (coupled) FINAL PROTECTIVE FIRE
GR (coupled)
Register in sequence/or from ZM 1001 to ZM 1004—over
53 A—Say again and end with wait—over.

- b. On receipt, the CPO decodes the grid references. Then in the normal manner he finds the charge, bearing and elevation for each target, notes this information and assigns them a number on the

Instruments for Calculating Mortar Firing Data

registration list. Then he transmits the target numbers to the FC as follows:

51C this is 53A
Targets registered in sequence
from ZM 1001 to ZM 1004 - over

**NOTE**

If it is a final defensive fire target, the CPO must first decode it, find the data, give them to the mortar line and then decode the others.

1.	LIST OF TARGET NOS/NAMES: _____						
2.	FC C/S _____ LOCATION _____						
3.	WEF _____ TO _____						
4.	SHEET _____ OF _____ _____ SHEET _____						
SER	TARGET NO	FIRE UNIT	LOCATION	CHARGE	BEARING	ELEVATION	REMARKS
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

**Figure 2-13: Target List Form**

10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

11. **Stage II—Registration by Fire:**

- a. For registration by fire, the CPO carries out the fire mission in the normal manner. The use of the word “registration” notifies him that corrections may apply to targets registered silently. When the FC has completed the adjustment, he will give the order **ADJUST FIRE CONTROL DATA**. Concerning a series of specific targets, the registration point must not be more than 1000 metres from the targets.

<b>BP GR PIVOT</b>	<b>OP</b>	<b>AMMUNITION</b>
943 667	963 667	C 70 A1

FC 53A this is 51C FM 1 MOR GR 952 696 DIR 1050 OVER REGISTRATION POINT AF	CPO CHG: 5 BNG: 0307 ELEVATION: 1159 RANGE: 3025
---	--

CORRECTION	CHG: 5
RIGHT 100	BNG: 0309
DROP 100	ELEVATION: 1184
ADJUST FIRE CONTROL DATA FROM ZM 1001 TO ZM 1005	RANGE: 2900

- b. To apply the adjustment of the data to the targets registered silently, the CPO must proceed as follows:

## Instruments for Calculating Mortar Firing Data

- (1) place the disk at zero on the centre line;
- (2) note the relationship between the final correction and the initial grid references, for example if the total correction is left 35, reduce 135;

### NOTE

Never erase or lose the grid references of the initial targets.

- (3) prepare the data for the **FINAL DEFENSIVE FIRE** first and make sure always to have 10 rounds ready;
- (4) without moving the disk, apply the correction left 35, reduce 135, to all targets;
- (5) note the grid corrections for each target;
- (6) find the data; and
- (7) inform the FC and the fire support co-ordination centre (FSCC) when the data have been adjusted.

## 12. **Confirmation of Stage II:**

- a. questions from the class; and
- b. questions to the class.

## 13. **Stage III—Adjustment Procedure with Polar GR:**

- a. When the adjustment procedure with polar GR is used, it is more accurate and takes much less time for the adjustment.
- b. Procedure:

- (1) mark the OP and the target in the normal manner for the polar corrections;
- (2) mark the normal corrections; and
- (3) as soon as the point is registered as a GR, place the O on the centre line and record or note the corrections which apply to every target. List of targets:

<b>BP GR PIVOT</b>	<b>OP</b>	<b>AMMUNITION</b>
458 162	482 174	C 70 A1

Ser	Tgt No	Fire Unit	Location of Targets	Chg	Bearing	Elevation	Range	Remarks
1.	1100	53	DIR 0400 RANGE:1000	6	0936	1174	3500	
2.	1101	53	DIR: 2000 RANGE: 1200	6	1388	1161	3575	
3.	1102	53	DIR: 5550 RANGE: 2000	4	0353	1083	2700	Final defensive fire
4.	1103	53	DIR 6180 RANGE:1350	5	0710	1105	3275	Defensive Fire

14. **Confirmation of Stage III:**

- a. questions from the class; and
- b. questions to the class.

15. **Final Confirmation:**

- a. questions from the class; and
- b. questions to the class.

**CONCLUSION**

16. In this lesson you have seen the procedures of silent registration and registration by fire, and the adjustment procedure with polar GR.

17. The next lesson will be...

## LESSON 12 LINEAR HE FIRE MISSION

### ENABLING OBJECTIVE

1. Produce fire control data with the plotter.

### MAIN TEACHING POINTS

2. Linear HE fire mission:
  - a. linear HE with the target grid:
    - (1) with 2 or 4 mortars;
    - (2) pivot method; and
    - (3) alternative method.
  - b. linear HE with polar GR:
    - (1) with 2 or 4 mortars;
    - (2) pivot method; and
    - (3) alternative method.

### PREPARATION

3. **Time Required.** Three 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;

Instruments for Calculating Mortar Firing Data

- b. firing tables; and
- c. cleaning materials.

7. **Training Aids:**

- a. chalkboard;
- b. large-scale plotter;
- c. firing tables; and
- d. computer with PowerPoint®.

**CONDUCT OF THE LESSON**

8. **Introduction:**

- a. **What.** Use the plotter for a linear HE target.
- b. **Why.** In order to be able to engage a target which is on the ground at a different angle than the mortars.
- c. **Where.** On the course, to the unit and in combat.

9. **Stage I—Engaging a Linear Target:**

- a. **Introduction.** To engage a linear target, in his initial order the control post operator (CPO) will be given the orientation, size and linear order. The orientation of the target can be sent in both directions, because the adjustment is made to the centre of the target. The CPO will obtain all the data in the normal manner for adjustment. When he receives the order **FIRE FOR EFFECT**, (FFE) he will proceed as follows:

<b>BP GR PIVOT</b>	<b>AMMUNITION</b>
993 725	C 70 A1



FM 4 MOR  
 GR 003748  
 DIR 0320  
 SEC DUG IN  
 5 ROUNDS  
  
 LIN 200  
 ORIEN 5420  
 1 AF

FM 4 MOR  
 5 ROUNDS  
 CHG 4  
 BNG 0418  
 ELEVATION 1137  
 RANGE 2508  
 1 AF

**CORRECTION**

RIGHT 100                      BNG 0458  
    ELEVATION 1133  
    RANGE 2520

DROP 50, FFE                      BNG 0461  
    ELEVATION 1147  
    RANGE 2470  
    FFE

<b>MORTAR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
CHG	4	4	4	4
BNG	0502	0474	0447	0420
ELEVATION	1152	1146	1146	1139
RANGE	2450	2475	2475	2500

b. The procedure for engaging with 2 and 4 mortars is:

- (1) Pivot the disk in the direction representing the orientation. Based on the adjustment point, trace the lower and higher dots by taking half, and distributing the other mortars in the interval.
  
- (2) Let us take a linear target 200 x 100 metres. The CPO must mark 100 metres above and 100 metres below the adjustment point,

Instruments for Calculating Mortar Firing Data

place the other mortars in the interval, pivot the disk until the dots are oriented in the direction of firing and number the mortars from right to left. Then he must prepare and transmit the fire control data to the mortar line.

- (3) To obtain the bearings of each mortar, the CPO will calculate the bearings of mortars number 1 and 4 according to the plotter and will divide the difference by the number of mortars minus one, then will add the result obtained to each mortar starting from the left, for example:

Bearing Number 1	= 0420
Bearing Number 4	= 0502
Difference	= 82
Divided by 3	= 27 mils

- (4) Adding 27 mils to mortar number 1, we obtain the bearing of number 2, namely 0447, and by doing the same with mortar number 2 we obtain the bearing of number 3, namely 474 mils.

NO 1	BNG 0420
NO 2	BNG 0447
NO 3	BNG 0474
NO 4	BNG 0502

- (5) To calculate the elevation, the CPO can follow the following method, for example:

Elevation Number 1	= 1146
Elevation Number 4	= 1158
Difference	=12
Divided by 3	=4 mils

NO 1	ELEVATION 1146
NO 2	ELEVATION 1150
NO 3	ELEVATION 1154
NO 4	ELEVATION 1158

### NOTE

You can also use the plotter to find the bearings and elevations.

#### 10. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

11. **Stage II—Alternative Method of Adjustment.** When the fire controller (FC) cannot determine the exact length and/or orientation of a linear target, the adjustment must be performed as follows:

- a. The FC adjusts the fire with number 1 and gives the order **REGISTER AS RIGHT EDGE**.
- b. The FC adjusts with number 4 and gives the order “Register as left edge”, this can be done at the same time.
- c. The FC gives the order **FIRE FOR EFFECT** (FFE).
- d. The CPO pivots the disk until the dots are oriented in the direction and arranges numbers 1 and 4, and calculates their bearings and elevations.
- e. If the FC asks for the orientation of the target, the CPO can give it to him by referring to the plotter by aligning the right and left edges vertically. The orientation can be read on the indicator line.

Instruments for Calculating Mortar Firing Data

Calculating the distance between the 2 flanks gives us the length of the linear.

<b>BP GR PIVOT</b>	<b>AMMUNITION</b>
993 725	C 70 A1

FM 4 MOR	FM 4 MOR
GR 984 745	10 ROUNDS
DIR 0200	CHG 4
NO 4 G 300	BNG 5869
COY DUG IN	ELEVATION 1211
	RANGE 2193
10 ROUNDS	AMC 1 AF (at my command)
LINEAR	
AMC 1 AND 4 AF	

**CORRECTION NUMBER 4:**

RIGHT 100	BNG 5898
	ELEVATION 1182
	RANGE 2325

DROP 50, **REGISTER AS LEFT EDGE.**

**NOTE**

The CPO will fire a shot.

BNG 5883  
ELEVATION 1194  
RANGE 2275

**CORRECTION NUMBER 1:**

CHG 4  
BNG 5969  
ELEVATION 1211  
RANGE 2200

**RIGHT 300**

CHG 4  
 BNG 6092  
 ELEVATION 1249  
 RANGE 2025

**LEFT 50**

CHG 4  
 BNG 6070  
 ELEVATION 1244  
 RANGE 2050

**DROP 50, “REGISTER AS RIGHT EDGE”:**

CHG 4  
 BNG 6058  
 ELEVATION 1249  
 RANGE 2025

**FFE 10 ROUNDS**

<b>MORTAR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
CHG	4	4	4	4
BNG	6058	5999	5941	5883
ELEVATION	1249	1230	1212	1194
RANGE	2025	3000	2175	2275

12. **Confirmation of Stage II:**
- a. questions from the class; and
  - b. questions to the class.

Instruments for Calculating Mortar Firing Data

13. **Stage III—Polar Procedure.** Polar procedure with the pivot method and the alternative method, for a linear HE are detailed below:

a. pivot method:

<b>BP GR PIVOT</b>	<b>OP</b>	<b>AMMUNITION</b>
993 725	016 742	C 70 A1

FM 4 MOR	FM 4 MOR
DIR 1600	10 ROUNDS
RANGE 0900	CHG 6
COY DUG IN	BNG 1103
10 ROUNDS	ELEVATION 1153
	RANGE 3625
LIN 600	1 AF
ORIEN 0200	
1 AF	

**CORRECTIONS:**

DIR 1650	BNG 1061
RANGE 1100	ELEVATION 1178
FFE	RANGE 3475

<b>MORTAR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
CHG	6	6	6	6
BNG	1131	1087	1043	0999
ELEVATION	1210	1188	1166	1144
RANGE	3285	3411	3543	3682

b. alternative method:

FM 4 MOR	FM 4 MOR
DIR 5700	5 ROUNDS
RANGE 1000	CHG 5
PL DUG IN	NO 1BNG 0613
NO 4 LEFT 100	ELEVATION 1149
	RANGE 3075
NO 1 RIGHT 100	
5 ROUNDS	NO 4
LIN	BNG 0594
AMC 1 and 4 AF	ELEVATION 1188
	RANGE 2875

**NUMBER 4 REGISTER AS LEFT EDGE.  
NUMBER 1 REGISTER AS RIGHT EDGE, FIRE FOR EFFECT.**

<b>MORTAR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
CHG	5	5	5	5
BNG	0613	0608	0601	0594
ELEVATION	1149	1162	1175	1188
RANGE	2975	2950	2925	2875

14. **Confirmation of Stage IV:**
- a. questions from the class; and
  - b. questions to the class.

15. **Final Confirmation:**
- a. questions from the class; and
  - b. questions to the class.

**CONCLUSION**

16. During this lesson, you have seen how to produce the fire control data for a linear HE with the grid and polar procedure, using the pivot and alternative methods.

Instruments for Calculating Mortar Firing Data

17. Remember that the order **LINEAR FFE** must be given by the FC before applying the procedure.
18. The next lesson will be...



## LESSON 13 LINEAR SMOKE FIRE MISSIONS

### ENABLING OBJECTIVE

1. Produce fire control data with the plotter.

### MAIN TEACHING POINTS

2. Linear smoke fire missions:
  - a. linear smoke with the target grid, including:
    - (1) 2 or 4 mortars;
    - (2) pivot method; and
    - (3) alternative method.
  - b. linear smoke with polar grid references, including:
    - (1) 2 or 4 mortars;
    - (2) pivot method; and
    - (3) alternative method.

### PREPARATION

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;

## Instruments for Calculating Mortar Firing Data

- b. firing tables; and
- c. cleaning materials.

### 7. **Training Aids:**

- a. chalkboard;
- b. large-scale plotter;
- c. firing tables; and
- d. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. **Introduction:**

- a. **Review.** As required.
- b. **What.** You will learn to produce fire control data for a linear smoke fire mission (FM) with the pivot method and the alternative method, for polar FMs and with target grid.
- c. **Why.** When you act as a control post operator (CPO), you must be in a position to carry out a linear smoke FM with the proper fire control data in order to engage a linear target.
- d. **Where.** During the course, at your unit and in combat.

9. **Stage I—Pivot Method.** This method is used to provide a smokescreen for the infantry. The adjustment point differs from the one for linear HE. The fire controller (FC) makes the adjustment on a starting point and gives the order **FIRE FOR EFFECT** (FFE). At that point, the CPO always marks upward in the direction of the orientation. A group of mortars can produce a screen effective up to 800 metres. We will carry out a smoke fire mission using the pivot method (C106 ammunition):

<b>BP GR PIVOT</b>	<b>AMMUNITION</b>
143 515	C 106

FM 4 MOR	FM 4 MOR
GR 158 529	SMOKE 4 ROUNDS
DIR 6000	CHG 2
BLINDING	BNG 0835
SMOKE 4 ROUNDS	ELEVATION 1167
	RANGE 2052
LIN 600	4 AF
ORIEN 3200	
4 AF	

**FFE INTERVAL 25 SECONDS.**

<b>MORTAR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
CHG	2	2	2	2
BNG	1101	1001	0913	0835
ELEVATION	1260	1235	1204	1167
RANGE	1700	1803	1921	2052

10. The procedure for a linear smokescreen is:
- a. the CPO receives from the FC **\_\_\_ QUICK ROUNDS FOLLOWED BY \_\_\_ ROUNDS FFE, INTERVAL 25 SECONDS;**
  - b. the CPO must then follow the following procedure:
    - (1) on receiving the FFE, the CPO will order **AMC \_\_\_ QUICK ROUNDS, FOLLOWED BY \_\_\_ ROUNDS FFE, INTERVAL 25 SECONDS;**
    - (2) before that, the CPO turns the disk on the orientation and spaces the 200 metre dots upwards;
    - (3) turns the disk in the direction of firing; and

Instruments for Calculating Mortar Firing Data

- (4) prepares the fire control data and communicates them to the line, for example:

MOR 1	BNG 6075
	ELEVATION 1069
MOR 2	BNG 6050
	ELEVATION 1107
MOR 3	BNG 6025
	ELEVATION 1145
MOR 4	BNG 6001
	ELEVATION 1184

11. **Confirmation of Stage I:**

- a. questions from the class; and
- b. questions to the class.

**NOTE**

The orientation of a linear smoke will be determined in relation to the wind direction, our troops on the ground, and the part to be screened/blinded.

12. **Stage II—Alternative Method.** The alternative method is carried out with the same rules as the pivot method:

<b>BP GR ALTERNATIVE</b>	<b>DIRECTION</b>	<b>AMMUNITION</b>
173 545	SW	C-106

FM 4 MOR  
 GR 153 534  
 DIR 4300  
 BLINDING  
 SMOKE 10 ROUNDS  
  
 LIN 600  
 ORIEN 0800  
 1 AF

FM 4 MOR  
 SMOKE 10 ROUNDS  
 CHG 2  
 BNG 4288  
 ELEVATION 1100  
 RANGE 2275  
 1 AF

**LEFT 100  
 FFE, 25 SECONDS**

<b>MORTAR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
CHG	2	2	2	2
BNG	4343	4294	4266	4328
ELEVATION	1100	1210	1154	1260
RANGE	2286	1900	2100	1709

13. **Confirmation of Stage II:**

- a. questions from the class; and
- b. questions to the class.

14. **Stage III—Polar Procedure:**

- a. Pivot method when used with the polar grid references is carried out with the same rules.

<b>BP GR PIVOT</b>	<b>OP</b>	<b>AMMUNITION</b>
143 515	153 520	C106

FM 4 MOR  
 DIR 6400  
 RANGE 1500  
 BLINDING  
 SMOKE 5 ROUNDS  
  
 LIN 800  
 ORIEN 4800  
 1 RT

FM 4 MOR  
 SMOKE 5 ROUNDS  
 CHG 2  
 BNG 0472  
 ELEVATION 1116  
 RANGE 2225  
 1 AF

Instruments for Calculating Mortar Firing Data

**FFE, 10 SECONDS**

<b>MORTAR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
CHG	2	2	2	2
BNG	0472	0358	0233	0102
ELEVATION	1116	1147	1164	1183
RANGE	2225	2125	2050	2000

b. Alternative method:

<b>BP GR ALTERNATIVE</b>	<b>OP</b>	<b>DIRECTIO N</b>	<b>AMMUNITIO N</b>
143 515	153 520	SW	C-106

FM 4 MOR  
DIR 2130  
RANGE 1400  
BLINDING  
SMOKE 3 ROUNDS

FM 4 MOR  
SMOKE 3 ROUNDS  
CHG 3  
BNG 1690  
ELEVATION 1258  
RANGE 2225

LIN 800

4 AF

ORIEN 2050

4 AF

**FFE, 25 SECONDS**

<b>MORTAR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
CHG	3	3	3	3
BNG	1784	1759	1728	1690
ELEVATION	1096	1157	1210	1258
RANGE	2975	2725	2475	2225

15. **Final Confirmation:**

- a. questions from the class; and
- b. questions to the class.

**CONCLUSION**

16. During this lesson, you have seen the pivot method and the alternative method used for linear smoke with grid and polar FMs. It is very important of know these procedures when HE and smoke rounds are used.
17. The next lesson will be...

**LESSON 14**  
**PLATOON FIRE MISSIONS (FM)**

**ENABLING OBJECTIVE**

1. Produce fire control data with the plotter.

**MAIN TEACHING POINTS**

2. Platoon fire missions (FM) to include:
  - a. coordinated fire; and
  - b. linear with HE rounds and smoke rounds.

**PREPARATION**

3. **Time Required.** Two 40-minute periods.
4. **Method.** Theoretical and practical.
5. **Administration.**
6. **Stores:**
  - a. one plotter per candidate;
  - b. firing tables; and
  - c. cleaning materials.
7. **Training Aids:**
  - a. chalkboard;
  - b. large-scale plotter;
  - c. firing tables; and



- d. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. Introduction:

- a. **Review.** As required.
- b. **What.** You will learn to produce fire control data for coordinated and linear platoon FMs.
- c. **Why.** As a control post operator (CPO), you must know and correctly apply the procedures for producing the fire control data for various platoon shoots.
- d. **Where.** During the course, at your unit, and in combat.

### 9. Stage I—Platoon Coordinated Fire Mission:

- a. All platoon FMs will be asked for in passing by the fire support co-ordination centre (FSCC). If the two groups are in direct support, the fire controller (FC) may ask the mortar groups directly for his platoon FM.
- b. The first group which receives and answers the FC becomes the senior group. The group which joins to complete the platoon FM becomes the junior group.
- c. The senior group adjusts the target in the normal manner. As soon as the adjustment has been completed, it sends the junior group the grid references corrected to 8 figures, and the junior group finds the fire control data for its group.
- d. As soon as the 2 groups report that they are ready, the FC gives both groups the fire order.
- e. Do the problem on the plotter and in solving it, make the two groups different.

Instruments for Calculating Mortar Firing Data

<b>BP GR 52</b>	<b>BP GR 53</b>	<b>AMMUNITION</b>
123 456	126 459	C70A1

52A, 53A this is 51C

PL FM  
GR 142 474  
DIR 1780

COY DUG IN  
10 ROUNDS  
52A 4 AF

CPO

CHG 4  
BNG 0833  
ELEVATION 1211  
RANGE 2200  
4 AF

**CORRECTIONS:**

ADD 200

CHG 4  
BNG 0903  
ELEVATION 1182  
RANGE 2325

DROP 100

BNG 0869  
ELEVATION 1200  
RANGE 2250

ADD 50

BNG 0886  
ELEVATION 1194  
RANGE 2275

- f. As soon as the FC has finished his adjustment, he will send at my command (AMC), fire for effect (FFE).
- g. The CPO of the senior group (53A) sends the Corrected GR of the last correction at that time. The corrected GR are sent in 8 figures:
  - (1) 53A this is 52A
  - (2) Corrected GR: 1434 4737

- (3) The CPO of 52A then produces the fire control data and sends them to his group:

CHG 4  
 BNG 0873  
 ELEVATION 1083  
 RANGE 2709

- h. As soon as both groups are ready, the CPO reports to the FC.

10. **Confirmation of Stage I:**

- a. questions from the class; and  
 b. questions to the class.

11. **Stage II—Platoon Linear HE Fire Mission:**

- a. **Sequence.** The FC asks for his fire mission from the CPO of call sign (c/s) 52A. Call sign 52A becomes senior, c/s 53 junior, for example:

FC (51B)	CPO (52A)	CPO (53A)	FSCC
52A-53A this is 51B PL FM OVER	52A PL FM OUT	53A RECEIVED OUT	
GR 123 456 DIR 1450 OVER	52A GR 123 456 DIR 1450 OUT	53A RECEIVED OUT	
PL DUG IN LINEAR 1000 ORIENTATION 0700 5 ROUNDS 52A, 1 AF OVER	52A PL DUG IN LINEAR 1000 ORIENTATION 0700 5 ROUNDS 1 AF OUT	53A RECEIVED OUT	51 RECEIVED OUT

- b. Call sign 52A, the senior group, acknowledges receipt of the whole fire mission.  
 c. Call sign 53A and c/s 51 acknowledge receipt by: “c/s\_\_ received, out”.

## Instruments for Calculating Mortar Firing Data

- d. The FC will adjust firing to the centre of the target with the number 1 of c/s 52 and will give the order **AMC FIRE FOR EFFECT**.
- e. The CPO c/s 52A will transmit the corrected grid reference to c/s 53A in 8 figures.
- f. The two CPOs will produce their data as follows using the linear HE method:
  - (1) the senior group will take 500 metres above the adjustment point;
  - (2) the junior group will take 500 metres below; and
  - (3) when the two groups have reported READY, the FC will give the order: **FIRE**.

## 12. Confirmation of Stage II:

- a. questions from the class; and
- b. questions to the class.

## 13. Stage III—Platoon Linear Smoke Fire Mission:

- a. Deliberate smoke is used when the area to be covered has a wide front which you cannot be cover with a section or a group using the quick procedure.
- b. The procedure for conducting a deliberate engagement is similar to the one used for a quick engagement except that the FC must say so in his fire distribution order (senior group and junior group). This is given in his fire order.
- c. **Adjustment.** The FC adds the point about the wind direction for the screen. There is no need to be accurate because the screen will cover the distance and the whole front to be covered. The adjustment usually will be made with instantaneous HE

ammunition to save the smoke as a surprise and make it possible to smoke off the sector.

- d. **Tester.** A tester smoke round will only be used if the wind direction and strength cannot readily be defined. This use must be in accordance with the supported troops commander because there will no longer be any tactical surprise. The order to test with a smoke round is: **SMOKE IN ADJUST.**
- e. Linear smoke differs from linear HE in that the length is divided by 7 (as there are 8 mortars total) with the junior group marking the corrected GR, dividing the length by 7 and marking the senior group, then marking its group above, using the calculation for the spacing between each two mortars.

14. **Confirmation of Stage III:**

- a. questions from the class; and
- b. questions to the class.

15. **Final Confirmation:**

- a. questions from the class; and
- b. questions to the class.

**CONCLUSION**

16. You have learned to produce fire control data for platoon FMs. This is very useful, especially in fire plans.

17. The next lesson will be...

**LESSON 15**  
**PRODUCE SURVEY DATA USING THE PLOTTER**

**ENABLING OBJECTIVE**

1. Survey a base plate position.

**MAIN TEACHING POINTS**

2. Produce survey data using the plotter to include:
  - a. prepare plotter for survey; and
  - b. sequence.

**PREPARATION**

3. **Time Required.** Two 40-minute lessons.
4. **Method.** Demonstration/performance.
5. **Administration.**
6. **Stores:**
  - a. plotter;
  - b. protractor;
  - c. pens; and
  - d. survey data.
7. **Training Aids:**
  - a. blackboard;
  - b. large scale plotter; and

- c. computer with PowerPoint®.

## CONDUCT OF THE LESSON

### 8. **Introduction:**

- a. **Review.** As required.
- b. **What.** During these periods, you will learn how to produce survey data with the plotter.
- c. **Why.** If your Mortar Fire Data Calculator (MFDC) breaks down, you'll have to produce accurate survey data of the base plate position for the control post operator (CPO). The only way to accurately do it is by using the plotter.
- d. **Where.** During your reconnaissance and preparation of the base plate position before day or night firing. You will use the skills taught in this lecture during this course, back in your home unit, and ultimately in an operational theatre.

### 9. **Stage I—Set Up The Plotter:**

- a. In order to produce survey data with the plotter you have to convert your plotter to read 100 and 10 metres instead of the usual 1,000 and 100 metres.
- b. To do so, you have to change the numbers representing 100 metres in your grid reference, instead of changing the numbers representing 1,000 metres as is done when you set up your plotter for firing, for example with GR 352 068:
  - (1) at the top of your plotter you should write: 352, 353, 354, etc from Left to Right, and on the side it should be: 068, 069, 070, etc. from bottom to top;

## Instruments for Calculating Mortar Firing Data

- (2) check your map to see what will be your general direction of survey.
- c. Write your grids and place your Recorded Survey Point (RSP) in such a way that the direction you will proceed will not take you outside of your plotter. If you do get a distance/direction that takes you outside of your plotter, you must note the GR of your last surveyed point, clean your plotter, remark the grids on it, re-plot the noted GR and then continue. You can plot your RSP at + or - 1 metre by judging the last number in the small square. Ensure plotter is set on a bearing of 0 mils on the center line whenever plotting or reading GR's. For example the RSP GR is at 12345 67890. You will be proceeding in a westerly direction. Pivot point should be GR 123 678.
- d. You are now ready to start your survey.

### 10. **Confirm Stage I:**

- a. questions from the class; and
- b. questions to the class.

### 11. **Stage II—Sequence to Follow:**

- a. Once you have set up your plotter and plotted your RSP, it is time to commence plotting of survey data. Point Number 1—Direction 1700 mils, Distance 180 metres. Place the direction (1700 mils) on the center line of the plotter, and going up, calculate the distance and mark a small dot exactly vertical of the RSP point, 180 metres up. Your protractor can be used as a guide to ensure your plot is exactly vertical. To determine the 10 figure GR of that point, turn the plotter wheel so the center line reads 0 mils, and read the GR: 23635 78883.

#### **NOTE**

Remember that the squares represent 100 and 10 metres.



- b. To carry on the survey to the second point, your data will be calculated from the last point plotted, NOT from the RSP. For example: Direction 0200 mils, Distance 120 metres.
- c. Turn the plotter wheel until the direction (0200 mils) is read on the center line. As before, 120 metres directly vertical from your last point plotted, will be your new point. Plot it and determine the 10 figure GR.
- d. Then to get the data for the 4 mortars proceed as follows:
  - (1) First, the exact bearing and distance to all 4 mortars must be known, whether it is taken from 2 or more points. The 4 mortars must be plotted on the plotter.
  - (2) From that point, you will determine the bearing and distance to each mortar. Since the bearing is from the Group Surveyed Point (GSP) to the mortar (not the record), align your number 1 mortar and the GSP, so that the number 1 mortar is directly vertical over the GSP plot.
  - (3) Note the bearing indicated on the centerline of the plotter wheel. Measure the distance from the GSP to the number 1 mortar.

**NOTE**

You now have the datas for all 4 mortars.

- (4) Repeat the same operation for all mortars.
  - (a) number 1 mortar direction—  
1390 mils—distance—180 metres  
GR 23726 79218;

## Instruments for Calculating Mortar Firing Data

- (b) number 2 mortar direction—  
1600 mils, distance—130 metres  
GR 23680 79181;
- (c) number 3 mortar direction—  
1950 mils, distance—90 metres  
GR 23635 79151;
- (d) number 4 mortar direction—  
2650 mils, distance—75 metres  
GR 23589 79117.

### 12. **Confirm Stage II:**

- a. questions from the class; and
- b. questions to the class.

### 13. **Final Confirmation:**

- a. questions from the class; and
- b. questions to the class.

## **CONCLUSION**

14. In this lecture you have learned how to determine survey data with the plotter in case of the MFDC malfunction.

15. The next lesson will be...