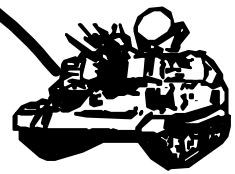
FIRE CONTROL SYSTEM FIELD ARTILLERY AN/GYK-37

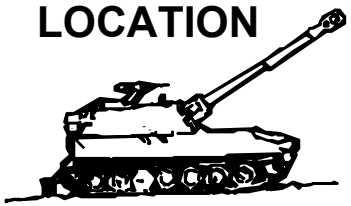
THE BATTERY COMPUTER SYSTEM (BCS)

FIVE REQUIREMENTS FOR ACCURATE PREDICTED FIRE

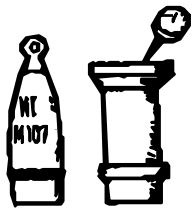
4
ACCURATE MET INFO



2
ACCURATE BATTERY LOCATION



3
ACCURATE AMMO & WPN INFO



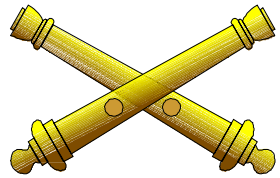
1
ACCURATE TARGET LOCATION AND SIZE

5
ACCURATE COMPUTATIONAL PROCEDURES

USAFAS

GUNNERY DEPARTMENT

Manual Solution vs. BCS Solution



	REQUIREMENT #1	
8 DIGIT GRID	10 DIGIT GRID	
	REQUIREMENT #2	
8 DIGIT GRID	10 DIGIT GRID	
BASE PIECE	IND. PIECE DATA	
	REQUIREMENT #3	
PARALLEL SHEAF	IND. PIECE DATA	U
	REQUIREMENT #4	S
BALLISTIC MET	COMPUTER MET	A
	REQUIREMENT #5	F
PLOTTING GEAR ACCURACY	HIGHLY ACCURATE	A
HUMAN ERROR	GARBAGE IN/OUT	S

BCS COMPUTES INDIVIDUAL PIECE FIRING DATA USING:

- INDIVIDUAL PIECE LOCATION
- INDIVIDUAL PIECE AIMPOINT
- INDIVIDUAL PIECE MVVs and PROPELLANT TEMPERTURES
- INDIVIDUAL PIECE BALLISTIC TRAJECTORIES

MAJOR BCS HARDWARE COMPONENTS

Page 1-1

	QTY
• LIGHTWEIGHT COMPUTER UNIT (LCU)	1
• PRINTER	1
• AC/DC CONVERTER CHARGER	1
• EXTERNAL TACTICAL COMMUNICATIONS INTERFACE MODULE (TCIM)	1
• GUN DISPLAY UNIT (GDU)	1-12

BCS PERFORMANCE CHARACTERISTICS

Page 1-4

- CONDUCT OF AREA FIRE MISSIONS
- LOCATION OF TARGETS USING GRID, POLAR, LASER POLAR, AND SHIFT FROM A KNOWN POINT
- COMPUTATION OF FIRING DATA FOR ALL CURRENT PROJECTILES
- CONDUCTS PRECISION, HB/MPI, AND RADAR REGISTRATION MISSIONS
- CONDUCTS LASER MISSIONS
- CONDUCTS OBSERVER LOCATION PROCESSING (RESECTION, TRILATERATION, AND TRIANGULATION)
- EXECUTES FIRE PLANS
- CORRECTS FOR NON-STANDARD CONDITIONS

BCS PERFORMANCE CHARACTERISTICS

- CONDUCTS TOT MISSIONS AND EXECUTES FIRE PLANS
- PERFORMS ZONE TO ZONE TRANSFORMATION AND REPLOT
- CONDUCTS 10 ACTIVE AND PRIORITY MISSIONS
- OPERATES WITH IFSAS OR AUTONOMOUSLY
- CONDUCTS RELAY OF MESSAGES BETWEEN TWO SUBSCRIBERS
- CONDUCTS/CONTROLS MASSING FOR UP TO 5 OTHER UNITS (BCSs)

BCS CAN STORE

Page 1-4

- 12 HOWITZER LOCATIONS (8 M109A6)
- 120 TARGETS/KNOWN POINTS (MAXIMUM OF 99 KNOWN POINTS)
- 30 OBSERVER LOCATIONS
- FSCMs (EXPANDED FORMATS FOR VER. 11)
- 24 MASKS (MAXIMUM OF 8 PER HOWITZER)
- 8 SETS OF REGISTRATION CORRECTIONS

BCS CAN STORE

- 10 COMPUTER MET MESSAGES, 1 CAAMS, AND 1 CENTER OF SECTOR COMPUTER MET
- 4 FIRE PLANS WITH TOTAL MAXIMUM 78 FIRE PLAN TARGETS
- 100 SUBSCRIBERS
- 27 MVVs PER HOWITZER STORED BY HOWITZER, PROJECTILE FAMILY, AND PROPELLANT TYPE AND LOT,
- BATTERY AMMUNITION STATUS (UP TO 26 PROJECTILES, 9 PROPELLANTS, AND 26 FUZES)
- MAP INFORMATION
- RECEIVED MESSAGES

BCS LIMITATIONS

- ONLY ONE FIRING UNIT AND ONE AZIMUTH OF FIRE ~>

  TECHNICAL FIRE DIRECTION ONLY

- ENVIRONMENTAL CONCERNS

- LANGUAGE/ACCEPTABILITY ~> DOS/WINDOWS 95 VS SCO UNIX

BCS TERMINOLOGY AND DEFINITIONS

BCS UPPER DISPLAY

Page 1-6

DISPLAYS STATUS INFO FOR A MAX OF 3 ACTIVE FIRE MSNS FROM FIRE MISSION BUFFER

FIRE MISSION BUFFER CONTAINS:

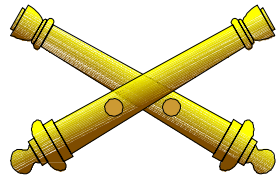
- 10 ACTIVE AND PRIORITY MISSIONS BASED ON HOWITZER MODEL:
- 105 AND 203MM – 9 ACTIVE AND 1 FPF
- 155MM – 6 ACTIVE AND 3 CPH AND 1 FPF OR 4 CPH

KEY	TARGET	OB	MSN	P	PHASE	STATUS	1	2	3	4
1	BN1046	21	AREA		FFE	WR		□		
2	AJ4506	22	REG		TIME	AMC	A			
3	BN1047	71	AREA		ADJ	WR			A	

BCS MIDDLE DISPLAY

DISPLAYS MESSAGE INDICATOR, CURRENT SYSTEM TIME AND DATE, HOWITZER STATUS, DATA BASE FILES STATUS, INPUT QUEUE STATUS, NUMBER OF SYSTEM WARNINGS, AND SYSTEM DISK UNIT (DU) ACCESS

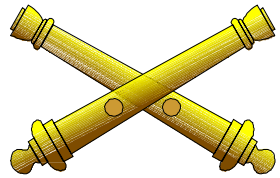
CHK FIRE	DATETIME 14:30:30	DATA/ACK ----------
FIRE MSN	18 JUL 00 20:30:30 Z	POLL/READY ----------
MSG RCVD	SW IQ FP TKP OB FC DU	FIRE/SHOT ----------
	2 3 2 4 5 6	RDS CMPLT ----------



BCS LOWER DISPLAY

DISPLAYS CURRENT INDEX OR MESSAGE FORMAT

_____;P:_;SB:_/_/_/__/___;C:___;SG:__,__;DT:__,__/__/__;ID:____;A:_;_
SPRT;MAP;EAST:____/____;NORTH:____/____;GZ:___;
LATD:_/__/__/__._/__/__/__._;LONGD:_/__/__/__._/__/__/__/__._;
DATCDE:___;DSHIFT:_____/_____/_____; SPHERE:_;MAJX:___._;MINX:___._?
GD:__;



INDEX

Page 1-5

- LIST OF DISPLAY OPTIONS THAT IS PRESENTED BY THE BCS
- USED TO SELECT THE MESSAGE FORMAT OR INDEX TO BE DISPLAYED

SYS;WEAPONS;C:___;
1:155MM/M109A2
2:155MM/M109A3
3:155MM/M109A5
4:155MM/M109A6
5:155MM/M114A2
6:155MM/M198
7:105MM/M101A1

VERSION CB0000 - 11.021
8:105MM/M102
9:105MM/M119
10:8IN/M110A2
11:DATABASE1 __/___/__ __/__/ ___/_____
12:DATABASE2 __/___/__ __/__/ ___/_____
13:FLEXIBLE DISK UNIT DATABASE

SELECT:3_;

BCS MESSAGE FORMATS

ALLOWS THE BCS OPERATOR TO ENTER DATA INTO THE BCS FOR DATABASE OR FIRE MSNS

_____;P:_;SB:_/_/_/__/___;C:___;SG:__,__;DT:__,__/__/__;ID:____;A:_;_
SPRT;MAP;EAST:____/____;NORTH:____/____;GZ:___;
LATD:_/__/__/__._/__/__/__._;LONGD:_/__/__/__._/__/__/__/__._;
DATCDE:___;DSHIFT:_____/_____/_____; SPHERE:_;MAJX:___._;MINX:___._?
GD:__;

FIELD

- LOCATION IN WHICH INFORMATION IS ENTERED OR DISPLAYED
- BEGINS WITH ITS NAME AND ENDS WITH A SEMICOLON (;)

ADDR:_;

SUBFIELD

- DATA ITEM THAT PROVIDES SPECIFIC INFORMATION ABOUT ITS FIELD
- A FIELD MAY HAVE SEVERAL SUBFIELDS SEPARATED BY SLASHES (/)

POLAR:____/____/_____;

ITERATION

- DESCRIBES MULTIPLE ENTRIES OF SIMILAR INFORMATION IN A SINGLE FIELD
- A FIELD MAY HAVE SEVERAL ITERATIONS SEPARATED BY COMMAS (,)

PLOT:_____/_/____,_____/_/____,_____/_/____;

DEFAULT

- A PREDETERMINED VALUE ASSIGNED TO A SPECIFIC FIELD OR SUBFIELD
- IF NO OTHER ENTRY IS MADE IN THE FIELD OR SUBFIELD, THE COMPUTER ASSIGNS THE DEFAULT VALUE

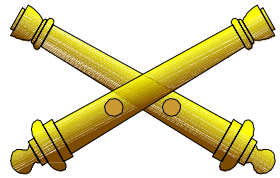
MNEMONIC

- AN ABBREVIATED FORM OF A WORD OR GROUP OF WORDS
- MOST COMMONLY USED FOR AMMUNITION (APPENDIX B)

FIELD ENTRIES

- REQUIRED ENTRY - Describes a data area that requires an entry by the operator for processing to take place
- OPTIONAL ENTRY - Describes a data area that does not require an entry by the operator for processing to take place
- CONDITIONAL ENTRY - Describes a data area where an entry is made or not made, depending on the entry in another data area
- PROTECTED FIELD - A field which is reserved for the BCS, the operator is prevented from making an entry

GUNNERY DEPARTMENT



BCS DATABASE CONSTRUCTION

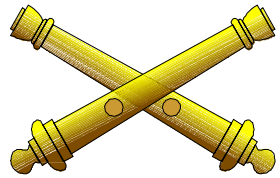
CHAPTER 2

USAFAS

POWER UP PROCEDURES

Page 2-1

- ENSURE ALL ATTACHED PERIPHERALS ARE OFF
- POWER UP AC/DC CONVERTER
- POWER UP AND ADJUST RADIOS AND AMPLIFIER/POWER SUPPLY GROUP
- IF AVAILABLE, POWER UP PRINTER
- IF TO BE USED, POWER UP KY-57 AND COMSEC
- POWER UP TCIM
- ENSURE HARD DISK DRIVE IS INSTALLED PROPERLY AND NO FLOPPY DISK IS INSTALLED
- SET ON/OFF SWITCH ON LCU TO ON



SYSTEM WEAPONS INDEX

Page 2-2

- Used to initialize the system
- Select weapon system to construct a new database or database number/flexible disk to restore a previously saved database

```
SYS;WEAPONS;C:___;                VERSION  CB0000  -  11.021
    1:155MM/M109A2                         8:105MM/M102
    2:155MM/M109A3                         9:105MM/M119
    3:155MM/M109A5                        10:8IN/M110A2
    4:155MM/M109A6                        11:DATABASE1  __/___/__ __/__/    ___/____
    5:155MM/M114A2                        12:DATABASE2  __/___/__ __/__/    ___/____
    6:155MM/M198                          13:FLEXIBLE DISK UNIT DATABASE
    7:105MM/M101A1

SELECT:__;
```

LINKED MESSAGES

- BCS requires the operator to enter the minimum information needed to establish/restore a database
- BCS displays required MSG formats in sequence
- After completion of linked messages the BCS has the minimum amount of information needed to conduct Fire Missions
- New database = linked messages
- Restored database = Three linked messages

AFCS COMPATIBILITY SCREEN

- ESTABLISHES PARAMETERS FOR BCS VERSION 11 SOFTWARE TO COMMUNICATE WITH VERSION 10 AFCS ON M109A6
- USED FOR M109A6 ONLY
- FOR ALL OTHER SYSTEMS ENTER “NO”

SYSTEM SETUP/ SUBSCRIBERS

Used to set BCS operating parameters: Hardware setup, GDU communications, etc.

System Setup/Subscribers

System: BCS Weapon 155MM/M109A5 Version:11.021

- Set Data/Time
- System Setup
- Unit Reference Numbers
- Database/Flexible Disk Access
- Setup Complete
- System Shutdown

SETTING THE DATE AND TIME

Page 2-3

- ESTABLISHES BCS INTERNAL CLOCK
- USED FOR TOT MSNs

System Setup/Subscribers

System: BCS Weapon 155MM/M109A5 Version:11.021

Set Data/Time
System Setup
Unit Reference Numbers
Database/Flexible Disk Access
Setup Complete
System Shutdown

SETTING THE DATE AND TIME

System Date/Time

System: BCS Weapon 155MM/M109A5 Version:11.021

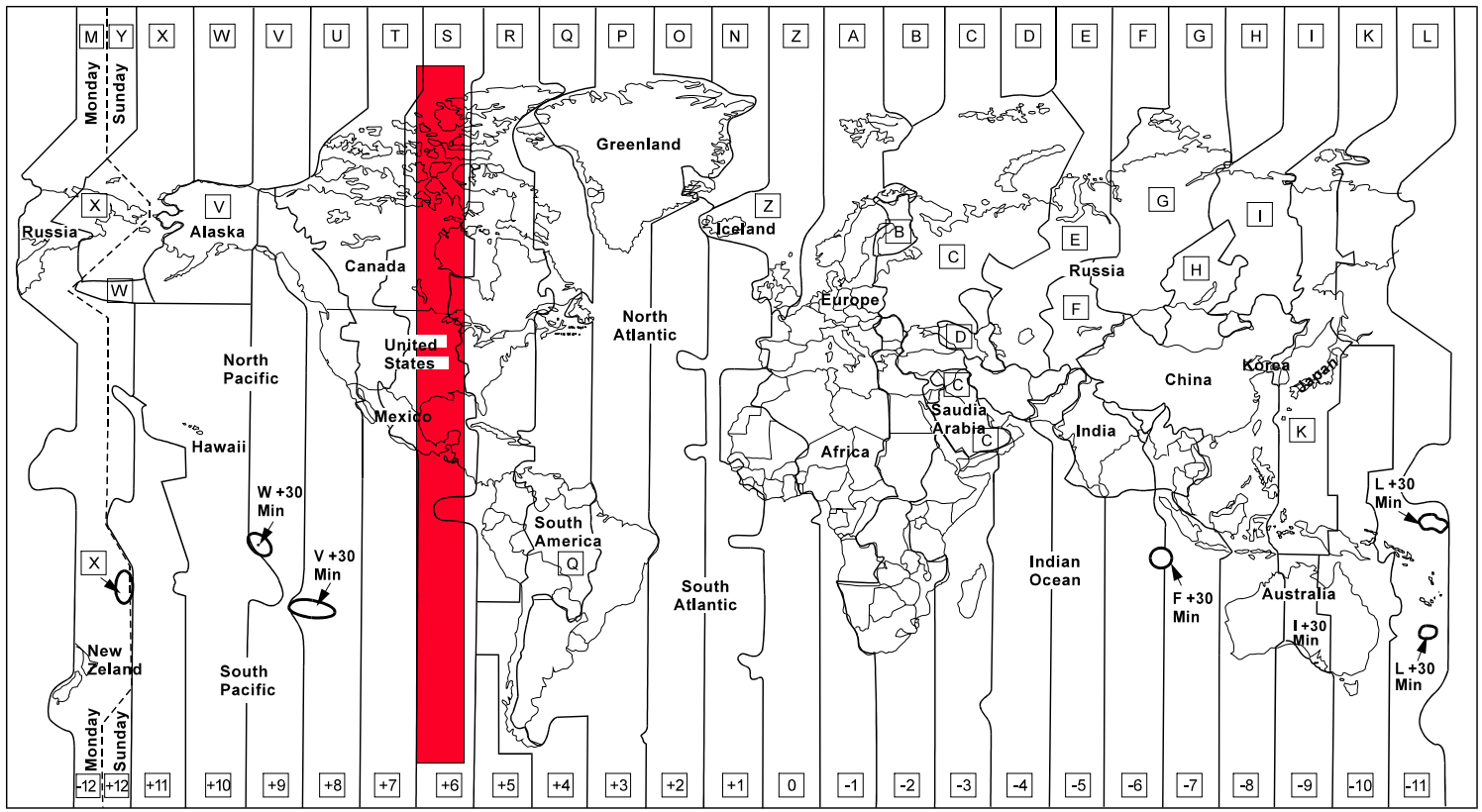
Year: 2000
Month: JUL
Day: 18
Hour: 12
Minute: 30
Second: 45
Time Zone: S
Daylight Savings: 1 Hour Ahead

JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Standard
1/2 Hour Ahead
1 Hour Ahead
2 Hours Ahead

SETTING THE DATE AND TIME

World Time Zones Chart



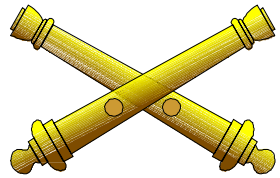
USAFAS

SYSTEM SETUP

System Setup/Subscribers

System: BCS Weapon 155MM/M109A5 Version:11.021

Set Data/Time
System Setup
Unit Reference Numbers
Database/Flexible Disk Access
Setup Complete
System Shutdown



SYSTEM SETUP

System Setup Page 1 of 2

System: BCS Weapon 155MM/M109A5 Version:11.021

Unit Name:_/_/A/1_/22
Unit Reference Number:12345678
TCIM Address: 5
System Status: On
Target Number Block:_____/____
Full Screen: Yes
Keyboard Beep: No
Audible Alarm: Yes
Print Messages on Receipt: No
Print Messages on Transmit: No

0
1
2
3
4
5
6

On
Off

Yes
No

SYSTEM SETUP

System Setup Page 2 of 2

System: BCS Weapon 155MM/M109A5 Version:11.021

Weapon Caliber: 155MM
Weapon Model: M109A5
Datum Code: 131
Met In Use: CAAMS
Met To Update: 1
Met To Delete:
Auto XMIT to Pieces: No
Record MV Data: No
Copperhead Fire Interval: 30
Report Ammo Expenditure:_/_/_/1_/22
XMIT FM MOI To FSO:_/_/_/__/__

Yes
No

1
2
3
4
5
6
7
8
9
10

STANDARD
CAAMS
MIDDLE
1
2
3
4
5
6
7
8
9
10

U
S
A
F
A
S

COMMUNICATION PROTOCOLS

Page 2-7

- PROMPT IS NOT DISPLAYED UNTIL SYSTEM SETUP MESSAGE IS EXECUTED

System Setup/Subscribers

System: BCS Weapon 155MM/M109A5 Version:11.021

Set Data/Time
System Setup
Protocols
Unit Reference Numbers
Database/Flexible Disk Access
Setup Complete
System Shutdown

PROTOCOL INITIALIZATION

Page 2-8

- USED TO CONFIGURE 4 COMMUNICATION CHANNELS
- 5 DIFFERENT PROTOCOLS CAN BE USED

Protocol Initialization

System: BCS Weapon 155MM/M109A5 Version:11.021

Channel 1 -Unassigned
Channel 2 -Unassigned
Channel 3 -Unassigned
Channel 4 -Unassigned
Protocol Init Complete

SELECTING A PROTOCOL

- SELECT A CHANNEL
- THAT CHANNEL'S CONFIGURATION MENU IS AUTOMATICALLY DISPLAYED

Protocol Initialization

System: BCS Weapon 155MM/M109A5 Version:11.021

Channel 1 -Unassigned
Channel 2 -Unassigned
Channel 3 -Unassigned
Channel 4 -Unassigned
Protocol Init Complete

SELECTING A PROTOCOL

- SELECT A PROTOCOL

Channel 1 Configuration

System: BCS Weapon 155MM/M109A5 Version:11.021

Protocol: Unassigned

Unassigned
MIL-STD-188-220
TACFIRE Net
ADDS
MSE
GDU

ADDS

Page 2-9

- **USED WITH EPLRS**

Channel 1 Configuration

System: BCS Weapon 155MM/M109A5 **Version:11.021**

Protocol: ADDS
Modulation: NRZ
Data Rate: 256000
Transmit Clock Source: External
Receive Clock Source: External
Maximum wait Time: 30
Secure: Yes

CDP
FSK 1575/2425 HZ
NRZ

Internal
External

2400
4800
8000
9600
16000
19200
24000
32000
64000
128000
256000

TACFIRE Net

Channel 1 Configuration

System: BCS Weapon 155MM/M109A5 Version:11.021

Protocol: TACFIRE Net
TACFIRE Channel Address: G
Communication Device: SINCGARS
Modulation: FSK1200/2400 HZ
Data rate: 600
Net Access Delay time: 0.5
Preamble Length: 1.4
Block Mode: Single
Net Sensing Override: No
Maximum Wait Time: 10
Secure: Yes

- BASIC FM (MUST USE FOR 12 SERIES RADIOS AND OLDER)

2 Wire
CMSC/KY-57
KY-57
Radio
SINCGARS

FSK1200/2400 HZ
FSK1300/2100 HZ
NRZ

600
1200
2400
4800
16000

TACFIRE Net

System: BCS Weapon 155MM/M109A5 Version:11.021

Protocol: TACFIRE Net
TACFIRE Channel Address: G
Communication Device: SINCGARS
Modulation: FSK1200/2400 HZ
Data rate: 600
Net Access Delay time: 0.5
Preamble Length: 2.1
Block Mode: Double
Net Sensing Override: No
Maximum Wait Time: 10
Secure: Yes

0.2
0.7
1.4
2.1
2.8
4.0

Single
Double

Yes
No

Yes
No

MIL-STD-188-220

Page 2-11

Protocol:MIL-STD-188-220
IP Address: 130.255.255.25
Communication Device: SINCGARS SIP
Modulation: NRZ
Load Defaults: No
Number of Stations: 5
Station Rank: 3
Data Rate: 4800
Net Access delay Method: DAPNAD
EDC Mode: FEC and TDC
Hop Mode: Frequency Hopping
COMSEC Mode: Cipher Text
Net Usage: Data Only
Net Sensing Control: Normal
Maximum Wait Time: 10
Secure: Yes

2 Wire
4 Wire
KY/57
Radio
SINCGARS RT-1439
SINCGARS ICOM RT-1532
SINCGARS SIP

FSK1200/2400 HZ
FSK1300/2100 HZ
NRZ

Yes
No

USAFAS

- UPGRADED DIGITAL SYSTEM (USES VMF-BOM)

MIL-STD-188-220

Protocol:MIL-STD-188-220
IP Address: 130.255.255.25
Communication Device: SINCGARS SIP
Modulation: NRZ
Load Defaults: No
Number of Stations: 5
Station Rank: 3
Data Rate: 4800
Net Access delay Method: HNAD
EDC Mode: Double FEC and TDC Net
Hop Mode: Frequency Hopping
COMSEC Mode: Cipher Text
Net Usage: Data Only
Net Sensing Control: Normal
Maximum Wait Time: 10
Secure: Yes

600
1200
2400
4800
16000
1200N
2400N
4800N
9600N

RNAD
PNAD
HNAD
DAPNAD
ADAPTIVE

No EDC
Scrambling Only
FEC Only
FEC and Scrambling
FEC and TDC
FEC, TDC, and Scrambling
Double FEC and TDC

USAFAS

MIL-STD-188-220

Protocol:MIL-STD-188-220
IP Address: 130.255.255.25
Communication Device: SINCGARS SIP
Modulation: NRZ
Load Defaults: No
Number of Stations: 5
Station Rank: 3
Data Rate: 4800
Net Access delay Method: HNAD
EDC Mode: Double FEC and TDC Net
Hop Mode: Frequency Hopping
COMSEC Mode: Cipher Text
Net Usage: Data Only
Net Sensing Control: Normal
Maximum Wait Time: 10
Secure: Yes

Single Channel
Frequency Hopping

Plain Text
Cipher Text

Data Only
Voice and Data

Normal
Noisy

GDU

System: BCS Weapon 155MM/M109A5 Version:11.021

Protocol: GDU
Communication Device: 2 Wire
Preamble Length: 0.250
Manual Polling: On

2 Wire
4 Wire
CMSC/KY-57
KY-57
Radio
SINCGARS
Two Wire and Radio

0.125
0.250
0.375
0.500
0.625
0.750
0.875

On
Off

- USED FOR COMMUNICATION WITH HOWITZERS

USAFAS

MSE

- PROVIDES UPGRADED VOICE AND DIGITAL COMMUNICATION FOR HIGHER HQs

Channel 3 Configuration

System: BCS Weapon 155MM/M109A5 Version:11.021

Protocol: MSE
Tactical Name Server: No
IP Address:___.___.___.___
Maximum Wait Time: 10
Secure: Yes

PROTOCOL CHANNELS

- YOU CAN ESTABLISH ALL FIVE PROTOCOLS ON CHANNELS 1 AND 3
- CHANNELS 2 AND 4 CANNOT ESTABLISH MSE AND ADDS
- UPON COMPLETION SUBSCRIBERS PROMPT IS ADDED TO THE SYSTEM SETUP MESSAGE
- 12 SERIES RADIOS CAN USE ONLY TACFIRE PROTOCOL

SUBSCRIBERS

System Setup/Subscribers

System: BCS Weapon 155MM/M109A5 Version:11.021

Set Data/Time
System Setup
Protocols
Subscribers
Unit Reference Numbers
Database/Flexible Disk Access
Setup Complete
System Shutdown

SUBSCRIBERS

UTILIZE STEP ACTION DRILLS

- ADDS p. 2-23
- TACFIRE p. 2-26
- MIL-STD-188-220 p. 2-28
- RELAY p. 2-31
- MSE p. 2-34

TACFIRE

- **TO ADD A SUBSCRIBER**

TACFIRE Net Subscribers

System: BCS Weapon 155MM/M109A5 **Version:11.021**

Add **Done**

SELECT ADD

No Entries Found

GUNNERY DEPARTMENT

TO ADD A SUBSCRIBER

- ENTER THE DATA AND EXECUTE THE MESSAGE

Add TACFIRE Net Subscribers

System: BCS Weapon 155MM/M109A5 **Version:11.021**

Channel Number: 2
Device: TFDMD
Subscriber Name: _/F/O/63/__
Unit Reference Number (URN): 20
Status: ON
TACFIRE Channel Address: K
Receive Serial Number: 01
Transmit Serial Number: 01
RLY (Fixed Format TACFIRE Relay):

BCS
FIST DMD
TFDMD
MMS
MDS
ATHS
FOS (FSO/CDR)
FOS (SURVEY)
FOS (FO/FIST)
IDM
RPV
Firefinder Radar
Firefinder Radar (VMF)
IFSAS, Light TACFIRE, AFATDS

USAFAS

TO ADD A SUBSCRIBER

- ADD TACFIRE NET SUBSCRIBER FORMAT IS DISPLAYED
- REPEAT FOR ALL TACFIRE SUBSCRIBERS
- SELECT DONE WHEN COMPLETE
- YOU MAY DELETE OR EDIT SUSCRIBERS AS NEEDED WITH FORMAT

Tacfire Net Subscribers

System: BCS Weapon 155MM/M109A5 Version:11.021

Add Delete Edit Done

CH 2; _/F/O/63/__ ;

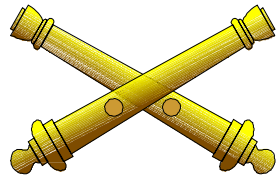
SPRT; MAP

Page 2-37 TO 2-38
GZ (determined from legend of military map fig. A-1)
DATUM (appendix A, table A-1)

- Used to define BCS geographic area of operations (i.e. its an electronic firing chart!)
- If the SPRT; MAP is entered correctly most other coordinates in BCS can be entered as 5 X 5 grids
- Fig. A-5
  - » Inside base GZ & map mod = 5 X 5 coords w/o GZ
  - » Inside base GZ but outside map mod = 6 X 8 coords w/o GZ
  - » Outside base GZ but inside map mod = 5 X 5 coords w/ GZ
  - » Outside base GZ & map mod = 6 X 8 coords w/ G

BCS WILL DETERMINE SPHERE BASED ON DATUM

GUNNERY DEPARTMENT



_____;P:_;SB:_/_/_/__/___;C:___;SG:__,__;DT:__,__/__/__;ID:____;A:_;_
SPRT;MAP;EAST:____/____;NORTH:____/____;GZ:___;
LATD:_/__/__/__._/__/__/__._;LONGD:_/__/__/__._/__/__/__/__._;
DATCDE:___;DSHIFT:_____/_____/_____; SPHERE:_;MAJX:___._;MINX:___._?
GD:__;

USAFAS

AFU; UPDATE

Page 2-38 to 2-39

- Used to store information about the firing unit that is needed by the BCS for technical fire direction
- Also used to update higher elements on unit status

_____;P:_;SB:_/_/_/__/___;C:___;SG:__,__;DT:__,__/__/__;ID:____;A:_;_
AFU;UPDATE;FU:_/_/_/__/___;WPN:155MM;MODEL:M198 ;MSN:___;ZONE:_____;
CORD:_____/_____/_____;GZ:___;DTG:__/__/__;
APL:_/_;WSTR:__ ;AZ:____;RT:_;RS:_;TRAVLR:____/____;
MINRNG:_____;MAXRNG:_/_____,_/_____,_/_____;
READY:_;OUTTIL:__/__/__;
MAXEL:____;ST:_;DF:____;FULAT:___._;
ORSTA:_____/_____/_____;ORSTBGZ:___;
ORSTB:_____/_____/_____;ORSTAGZ:___;

BCS; PIECES

Page 2-40 to 2-41

- Used to store howitzer locations, operational & commo status, groupings and propellant temperature of up to 12 guns
- Applies Requirements #2 and #3
- Howitzers can be located using 1 of 3 methods:
  - Grid coordinates
  - Polar from an aiming circle
  - Polar from another gun (reciprocal laying)
- Azimuth (NOT Deflection) entered for polar data
- Math step (page 2-40, FIGURE 2-67):

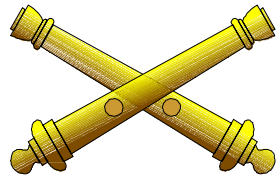
  Azimuth of Lay
  + Final Lay Deflection
  = Azimuth to Howitzer

BCS; PIECES

Page 2-41

- **Key Fields:**
  - GO# (operational status)
    - » Used to determine if gun can fire during mission
    - » Used to determine if BCS can xmit digital messages to gun
    - » Used to track ammunition (page 4-25)
      - Digital Commo = BCS subtracts rounds after GDU response
      - Voice Commo = BCS subtracts rounds after F1 is pressed
    - » Used to select the guns to fire a CPHD mission (“C” or “W”)
    - » Used to delete guns (“D”)
  - GROUP (required entry)
  - GRID (either grid or polar required)
  - FG (defaults to ORSTA)
  - POLAR (Azimuth, Distance, VA [not required])
  - PTMP (propellant temperature in degrees Fahrenheit)

GUNNERY DEPARTMENT



G01;_;GRP:_;CORD:_____/_____/_____;FG:__;POLAR:____/____/_____;PTMP:____;
G02;_;GRP:_;CORD:_____/_____/_____;FG:__;POLAR:____/____/_____;PTMP:____;
G03;_;GRP:_;CORD:_____/_____/_____;FG:__;POLAR:____/____/_____;PTMP:____;
G04;_;GRP:_;CORD:_____/_____/_____;FG:__;POLAR:____/____/_____;PTMP:____;
G05;_;GRP:_;CORD:_____/_____/_____;FG:__;POLAR:____/____/_____;PTMP:____;
G06;_;GRP:_;CORD:_____/_____/_____;FG:__;POLAR:____/____/_____;PTMP:____;
G07;_;GRP:_;CORD:_____/_____/_____;FG:__;POLAR:____/____/_____;PTMP:____;
G08;_;GRP:_;CORD:_____/_____/_____;FG:__;POLAR:____/____/_____;PTMP:____;
G09;_;GRP:_;CORD:_____/_____/_____;FG:__;POLAR:____/____/_____;PTMP:____;
G10;_;GRP:_;CORD:_____/_____/_____;FG:__;POLAR:____/____/_____;PTMP:____;
G11;_;GRP:_;CORD:_____/_____/_____;FG:__;POLAR:____/____/_____;PTMP:____;
G12;_;GRP:_;CORD:_____/_____/_____;FG:__;POLAR:____/____/_____;PTMP:____;

USAFAS

BCS;MVSTBL

- p. 2-42 TO 2-43
- INFORMATION ENTERED ALLOWS BCS TO COMMUNICATE WITH MVS
- ASSISTS FDO IN MAINTAINING ACCOUNTABILITY AND TRACKING MVVS
- KEY ENTRIES (p. 2-43)
  - GO1: X = HOWITZER HAS MVS. MUST ENTER X TO ENTER MEASURED MVV ENTRIES IN AFU;MVV
  - HOW: HOWITZER BUMPER #
  - TUBE: HOWITZER TUBE NUMBER
  - MUST ENTER HOWITZER HAS DIGITAL COMM IN BCS;PIECES

BCS; MVSTBL:
G01:_;HOW:____;TUBE:_____;G02:_;HOW:____;TUBE:_____;
G03:_;HOW:____;TUBE:_____;G04:_;HOW:____;TUBE:_____;
G05:_;HOW:____;TUBE:_____;G06:_;HOW:____;TUBE:_____;
G07:_;HOW:____;TUBE:_____;G08:_;HOW:____;TUBE:_____;
G09:_;HOW:____;TUBE:_____;G10:_;HOW:____;TUBE:_____;
G11:_;HOW:____;TUBE:_____;G12:_;HOW:____;TUBE:_____;

BCS;MVSCMD AND BCS;MVSREQ

- MESSAGE FORMATS FOR INTEROPERABILITY WITH THE MVS ON THE HOWITZERS
- ESTABLISHES PARAMETERS WITH COMMUNICATIONS HARDWARE CURRENTLY NOT FIELDED
- NOT USED-EXECUTE PAST THESE FORMATS

AFU; AMMO

Page 2-43 to 2-45

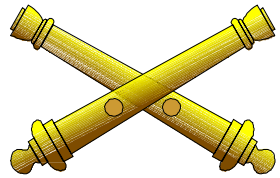
- Used to store information about the firing units ammunition (type, nation of manufacture, lot, weight, & quantity)
- Stored by firing unit <u>not</u> by individual piece
- Updated automatically based on GDU status
- Uses mnemonics (appendix B)
- Stores projectiles by lot identifier and propellants by lot identifier and manufacturers lot

```
AFU;AMMO;_;FU:_/_/_/__/___;DTG:__/__/__;
PROJA:___/_/___._/____/__/___________,___/_/___._/____/__/___________;
PROJB:___/_/___._/____/__/___________,___/_/___._/____/__/___________;
PROJC:___/_/___._/____/__/___________,___/_/___._/____/__/___________;
PLOTA:_________/_/____/__/___________;
PLOTB:_________/_/____/__/___________;
PLOTC:_________/_/____/__/___________;
FZEA:____/____/__,____/____/__,____/____/__;
FZEB:____/____/__,____/____/__,____/____/__;
```

ADDITIONAL DATABASE FORMATS

Page 2-45

- AFU; AMMO ends linked messages
- SYS; INDEX is displayed (BCS MAIN INDEX)
- BCS has minimum information needed to conduct a Fire Mission
- Additional database formats add information to BCS databases that enhance Fire Mission processing
  - Safety Data
  - Fire Support Coordination Measures/Planned TGTS/KN PTS
  - Non-standard conditions/5 RFAPF
- Not every one is required (METT-T dependent)
- Not Linked ~> Must display each message format from Message Skeletons or BCS; DBSUM



BCS MAIN INDEX

Page 2-45

Main point for entering the system

```
SYS;INDEX;C:___ ;
  1:FIRE MISSIONS
  2:INPUT QUEUE
  3:MESSAGE SKELETONS
  4:SYSTEM SETUP/SUBSCRIBERS     __  OF 100
  5:DATA BASE
  6:FIRE PLANS                   __  OF   4
  7:FIRE PLAN GROUP ENTRY
  8:SYSTEM WARNINGS              __  OF  12
  9:SYSTEM SHUTDOWN
  LAST DATA BASE RECORDING     __/___/__  __/__/___ (_)
  TARGET NUMBER BLOCK   AF6601/AF7000     NEXT TARGET NUMBER   AF6601
SELECT:__;
```

MESSAGE SKELETONS

Page 2-46

Allows the operator to select a blank format

SYS;MSGSUM;C: ;

1:FM;CHECK
2:FM;CFF
3:FM;SUBS
4:FM;INTM
5:FM;QF
6:FM;FOCMD
7:FM;OBCO
8:FM;MTO
9:AFU;AMMO
10:AFU;MASK
11:AFU;REG
12:BCS;MVD
13:BCS;COMD
14:SPRT;DATUM
15:SPRT;BGEOM
16:SPRT;ACA
17:SPRT;DISP
18:SPRT;LOC
19:SPRT;MEDVAC
20:SPRT;SCPST
21:SPRT;TPAC
22:NNFP;CFF
23:MET;CM
24:HOW;UPDATE
25:HOW;AMMO
26:HOW;REQUST
27:HOW;MOVE
28:HOW;OBSR
29:ATI;AZR
30:ATI;CDR
31:ATI;SHR
32:SYS;PTM
33:SYS;RING

SELECT: ;

BCS DATABASE SUMMARY

Main point for reviewing or selection for entry of database information

```
BCS;DBSUM;
  1:MAP MOD                                  9:METS                          __ OF  11
  2:SUBSCRIBER DATUMS      ___ OF 100       10:MISSION METS
  3:UPDATE/PIECES/          __ OF  12       11:OBSERVERS                     __ OF  30
  4:MVSTBL                  __ OF  12       12:TARGETS/KNPTS                ___ OF 120
   5:AMMO                                    13:GEOMETRIES                  ___ OF 218
      SHELLS                __ OF  26       14:ICONS                       ___ OF 100
      POWDERS               __ OF   9       15:MVV
     FUZES                  __ OF  26       16:REGISTRATIONS                 __ OF   8
  6:MVSCMD                  __ OF  12       17:SURVEY CONTROL POINTS         __ OF  25
  7:MVVREQ                                   18:OPERATIONS ORDERS             __ OF  10
  8:MASKS                   __ OF  24       19:GEOMETRY CHECK

 SELECT:  ;
```

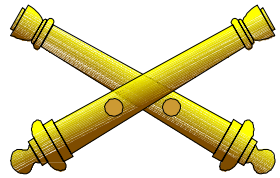
USAFAS

AFU; MASK

Page 2-47 to 2-48

- Similar to XO's MIN QE, Checks to ensure trajectory clears any immediate crests
- Performs check using howitzer's computed trajectory on each set of Firing Data (VT is ARMED VT)
- Warning displayed on BCS if violated, BCS will not stop you from firing the mission!
- 8 per howitzer, 24 total for all howitzers
- Key Fields:
  - MASKA (mask #, L AZ or DF, R AZ or DF, RNG, site to crest)
  - GUN (required entry, only 1 gun per format!)
  - MASK:1/ (AZ or DF, defaults to AZ)

GUNNERY DEPARTMENT



_____;P:_;SB:_/_/_/__/___;C:___;SG:__,__;DT:__,__/__/__;ID:____;A:_;_
AFU;MASK;FU:_/_/_/__/___;DELETE:_;
MASKA:_/____/____/____/_____;
MASKB:_/____/____/____/_____;
MASKC:_/____/____/____/_____;
MASKD:_/____/____/____/_____;
MASKE:_/____/____/____/_____;
MASKF:_/____/____/____/_____;
MASKG:_/____/____/____/_____;
MASKH:_/____/____/____/_____;
GUN:__;MASK:1/__,2/__,3/__,4/__,5/__,6/__,7/__,8/__;

USAFAS

BCS MVV STORAGE

Page 2-50

- BCS stores an individual MVV file for each howitzer, part of Requirement #3
- Up to 12 MVV files in Database
- Gun # in BCS; PIECES = MVV file #
- Storage criteria:
  - By gun #
  - By projectile family
  - By propellant <u>type and lot identifier</u>
  - By charge group combination
- MVVs can be entered as Historical or M90 data
- MVVs are applied to subsequent Fire Mission if application criteria met

BCS; MVD

Page 2-51 to 2-52

- **Used to enter M90 chronograph data into database**
- **Converts M90 Readout AVE into a Calibrated MV based on projectile square weight and prop temp**
- **Calculates MVV based on programmed STD MV**

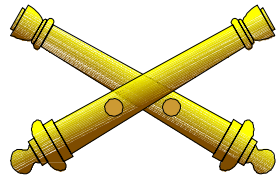
BCS;MVD;GUN:**1** ;CHG:**4**;LOT:**A/G**;FZE:**PDA/_**;PTEMP:**80___**;
M90;MV:**317.6**;

AFU; MVV

Page 2-50 to 2-51

- Used to store MVV data for a specific howitzer or to enter Historical MV data into database
- Can use to enter historical data using blank iterations
- Key Fields:
  - MVV
    - » Projectile Family ~> lists head of family, HEF converted to HEL
    - » Propellant Type/Model
    - » Propellant Lot Identifier ~> Must match lot in AFU;Ammo
    - » Calibrated Charge
    - » Calibrated MV/MVV ~> Stored data = MVV
      Entered data = Calibrated MV or MVV
    - » Type of MVV data ~> M, H, or D

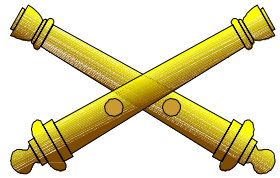
GUNNERY DEPARTMENT



_____;P:_;SB:_/_/_/__/___;C:___;SG:__,__;DT:__,__/__/__;ID:____;A:_;_
AFU;MVV:GUN:_*1*_;FU:_/_/_/__/___;DTG:__/__/__;
1: *HEA/M3A1 __/G/4_/__1.2/M*,__/_____/_/__/___._/_,___/_____/_/__/___._/_;
2: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/___._/_;
3: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/___._/_;
4: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/___._/_;
5: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/___._/_;
6: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/___._/_;
7: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/___._/_;
8: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/___._/_;
9: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/___._/_;

USAFAS

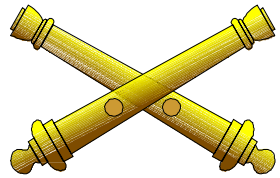
GUNNERY DEPARTMENT



_____;P:_;SB:_/_/_/__/___;C:___;SG:__,__;DT:__,__/__/__;ID:____;A:_;_
AFU;MVV:GUN:_*1*_;FU:_/_/_/__/___;DTG:__/__/__;
1: *HEA/M3A1* __/*G/4*_/__*1.2/M*,__/_____/_/__/___._/_,___/_____/_/__/_
2: *HEF/M3A1* /*G/4* / *-1.8/H*,___/_____/_/__/___._/_,___/_____/_/__/
3: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_
4: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_
5: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_
6: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_
7: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_
8: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_
9: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_

USAFAS

GUNNERY DEPARTMENT



_____;P:_;SB:_/_/_/__/___;C:___;SG:__,__;DT:__,__/__/__;ID:____;A:_;_
AFU;MVV:GUN:_*1*_;FU:_/_/_/__/___;DTG:__/__/__;
1: *HEA/M3A1* __/*G/4*_/__*1.2/M*,*HEL/M3A1*_ /*G/4*_/_*1.8/H*,___/_____/_/__/_
2: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_
3: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_
4: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_
5: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_
6: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_
7: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_
8: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_
9: ___/_____/_/__/___._/_,___/_____/_/__/___._/_,___/_____/_/__/_

USAFAS

BCS MVV APPLICATION

Page 3-11 to 3-12; FM 6-40 Page 4-17

How FDO should apply MVVs:

- (LOGBOOK TO MSN)
- Same gun
- Same proj family
- Same prop lot
- Same charge or to other charges according to an order of preference:
  - » Down 1 chg
  - » Up 1 Chg
  - » Down 2 chgs
  - » Up 2 chgs
  - » To any other prefered chg
  - » From a prefered to a restricted chg

NEVER transfer a restricted chg!

How the BCS will apply MVVs:

- (MSN TO LOGBOOK)
- Same gun
- Same prop type
- Same proj family
- Same prop lot
- Same charge or to other charges according to an order of preference:
  - > Up 1 chg
  - > Down 1 Chg
  - > Up 2 chgs
  - > Down 2 chgs
  - > Up 3 chgs
  - > Down 3 chgs

BCS <u>will</u> transfer a restricted charge!

•If no match is found BCS <u>will</u> transfer from another lot of the same type propellant!

FM; OBCO

Page 2-52 to 2-53

- Used to enter observer information into database
- Helps meet Requirement #1

_____;P:_;SB:_/_/_/__/___;C:___;SG:__,__;DT:__,__/__/__;ID:____;A:_;_
FM;OBCO;CAKKEY:__;OB:__;CLDHT:___;GLLDCO:___;VISIB:__;
CORD:_____/_____/_____;GZ:___;SPHERE:_;DTG:__/__/__
ECRD:_____/_____;EDT:__/___/_;EOB:____;

SPRT; BGEOM

Page 2-54 to 2-56

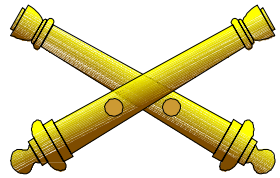
- Used to store an RFA, FLOT, FFA, RFL, FSCL or ZONE in database
- Warning displayed on BCS if violated ~> BCS will not stop you from firing the mission!
- RFA = 1 grid w/radius, FLOT = 2 to 30 grid (L to R), ZONE= 3-30 grid (L to R)

ZONE

Page 2-54

- Use SPRT;BGEOM message format
- Used to store a ZONE of operations in database
- Warning displayed on BCS if violated ~> BCS will not stop you from firing the mission!
- At least 3 points required

GUNNERY DEPARTMENT



_____;P:_;SB:_/_/_/__/___;C:___;SG:__,__;DT:__,__/__/__;ID:____;A:_;_
SPRT;BGEOM;____/_____;DELETE:_;EDTG:__/__/__;_/_/_/__/___;
WIDTH:____;FCORD:_____;RESAMO:_,_,_,_,_,_,_;
MINEFIELD:_____/_____/____/___;TYPE:_____/_____;AP:_;
PTA:__/_____/_____/___, __/_____/_____/___,__/_____/_____/___;
PTB:__/_____/_____/___, __/_____/_____/___,__/_____/_____/___;
PTC:__/_____/_____/___, __/_____/_____/___,__/_____/_____/___;
PTD:__/_____/_____/___, __/_____/_____/___,__/_____/_____/___;
PTE:__/_____/_____/___, __/_____/_____/___,__/_____/_____/___;
PTF:__/_____/_____/___, __/_____/_____/___,__/_____/_____/___;
PTG:__/_____/_____/___, __/_____/_____/___,__/_____/_____/___;
PTH:__/_____/_____/___, __/_____/_____/___,__/_____/_____/___;
PT I:__/_____/_____/___, __/_____/_____/___,__/_____/_____/___;
PTJ:__/_____/_____/___, __/_____/_____/___,__/_____/_____/___;

U
S
A
F
A
S

FM; CFF

Page 2-57 to 2-58

- Used to store a TGT or KN PT in database
- Also used to process Fire Missions!

_____;P:_;SB:_/_/_/__/___;C:___;SG:__,__;DT:__,__/__/__;ID:____;A:_;_
FM;CFF:_;TGT:_____;KNPT:__;CORD:*65500_/42280___/375__*;GZ:___;RV:___;
OB:__;FST:__;DIR:____/__;DIST:____;SHIFT:_/____/_/____/_/____;
LAS:____;TYPE:_____/_____;DOP:_____;SIZE:____/____;ATT:____;
CONT:____/____;ME:____/___;TIME:__/__;MIS:_;PRI:_;PTM:_____;
ASF:___/____;SH:*SMA/*___;FZ:*PDA_/*____;RDS:__;VOL:__;STR:____;
EOM:*X*;RAT:*K;*ASNFPF:_;UFFE:_/_/_/__/___,_/_/_/__/___
LOT:_/_;CHG:_;LOTS:_/_/_/_;CHGS:_/_;FIRINT:___;
PTF:____;SPTF:__/__/__/__;SHTF:_/_/_/_/_/_/_/_;
PFFE:____;SHFFE:_/_/_/_/_/_/_/_;
HOB:____;RG:_____;TOF:___._;MAXORD:_____;
SHEAF:____;VOLCMD:_;CSLOAD:_;RPT:_;

USAFAS

MET; CM

Page 2-58 to 2-60

- Used to store a Computer MET message in database
- Up to 10 MET MSG on file (BCS always has STD MET)
- BCS applies MET data to correct firing data, covers Requirement #4
- Must have number in METUPD to store in DB
- Must perform MET update procedures after entry (page 2-59)
- BCS also stores CAMS (BCS generated MET for midpoint of COB and initial target location)
- MIDDLE: BCS generated, Midpoint of COB and max range along AZoF

MET;CM;Q:_;POSI:_____;DTI:__/__._/_;HGT:___;ATMS:___;
LINEA:__/___/___/___._/____,__/___/___/___._/____,__/___/___/___._/____
LINEB:__/___/___/___._/____,__/___/___/___._/____,__/___/___/___._/____
LINEC:__/___/___/___._/____,__/___/___/___._/____,__/___/___/___._/____
LINED:__/___/___/___._/____,__/___/___/___._/____,__/___/___/___._/____
LINEE:__/___/___/___._/____,__/___/___/___._/____,__/___/___/___._/____

DATABASE RECORDING PROCEDURES

Page 2-59

- Save database immediately after completion
- Display SYSTEM SETUP/SUBSCRIBER Screen
- Select Database/Flexible Unit Access

  Overwrite oldest database on hard drive

  Write to database file #1

  Write to database file #2

  Write to floppy disk(Flexible Disk

POWER DOWN PROCEDURES

Page 2-59 to 2-60

- 3 METHODS MAY BE USED
- GENERALLY-RETURN TO MAIN INDEX AND SELECT “9” (SYSTEM SHUTDOWN)
- FOLLOW INSTRUCTIONS ON BCS SCREEN
- TURN OFF PERIPHERAL EQUIPMENT FIRST
- TURN OFF MAIN BCS POWER SWITCH

CONDUCT OF PE

- Known data HO on page 3 of CCC Phasebook Change
- Blank message formats on page 6
- Follow step-action drills in CH 2 (Minimum keystrokes)
- Highlight default values and required entries
- Work in groups
- Take breaks as needed
- Answer key in back of room
- FT Sill map in back of room
- Save DB before shutdown (you will need it for MP)
- You can leave when you're finished!