

FIELD MANUAL

**PROCEDURES AND DRILLS  
FOR  
HAWK MISSILE BATTERY (IMPROVED)**

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HEADQUARTERS, DEPARTMENT OF THE ARMY

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MISSILE BATTERY (IMPROVED)

		Paragraph	Page
<b>PART ONE</b>	<b>INTRODUCTION</b>		
<b>CHAPTER</b>	<b>1. GENERAL</b> .....	1-1-1-4	3
	<b>2. DESCRIPTION OF EQUIPMENT</b> .....	2-1-2-5	5
	<b>3. SYSTEM OPERATION</b> .....	3-1-3-4	9
	<b>4. SAFETY</b> .....	4-1-4-10	13
<b>PART TWO</b>	<b>EMPLACEMENT AND MARCH ORDER</b>		
<b>CHAPTER</b>	<b>5. COMMAND AND ACQUISITION SECTION</b>		
<b>Section</b>	<b>I. Preparation</b> .....	5-1-5-3	16
	<b>II. Information and coordination central</b> .....	5-4-5-6	16
	<b>III. Improved battery control central</b> .....	5-7-5-9	18
	<b>IV. Improved pulse acquisition radar</b> .....	5-10-5-12	20
	<b>V. Improved continuous-wave acquisition radar</b> .....	5-13-5-15	24
	<b>VI. Improved range-only radar</b> .....	5-16-5-18	26
	<b>VII. Improved platoon command post</b> .....	5-19-5-21	28
	<b>VIII. Trailer-mounted 60-kw or 45-kw generator set</b> .....	5-22-5-24	30
<b>CHAPTER</b>	<b>6. FIRING SECTIONS</b>		
<b>Section</b>	<b>I. Preparation</b> .....	6-1-6-3	32
	<b>II. Improved high-powered illuminator radar</b> .....	6-4-6-6	32
	<b>III. Improved zero-length launcher</b> .....	6-7-6-9	34
	<b>IV. Trailer-mounted pallet</b> .....	6-10-6-12	38
	<b>V. Loader-transporter</b> .....	6-13-6-15	39
	<b>VI. Improved missiles</b> .....	6-16-6-18	40
<b>CHAPTER</b>	<b>7. ORIENTATION AND ALINEMENT</b>		
<b>Section</b>	<b>I. Improved battery</b> .....	7-1-7-9	43
	<b>II. Improved assault fire unit and assault fire section</b> .....	7-10-7-15	52
<b>CHAPTER</b>	<b>8. CHECKOUT PROCEDURES</b> .....	8-1-8-3	55
<b>PART THREE</b>	<b>OPERATIONS</b>		
<b>CHAPTER</b>	<b>9. STATES OF READINESS, ALERT PROCEDURES, AND ENGAGEMENTS USING THE AUTOMATIC DATA PROCESSOR (ADP)</b>		
<b>Section</b>	<b>I. States of readiness</b> .....	9-1-9-4	56
	<b>II. Alert procedures</b> .....	9-5-9-6	56
	<b>III. Engagements using the ADP</b> .....	9-7-9-9	66
<b>CHAPTER</b>	<b>10. EMERGENCY PROCEDURES</b> .....	10-1-10-3	69
	<b>11. ECM ENVIRONMENT</b> .....	11-1-11-7	71
<b>APPENDIX</b>	<b>A. REFERENCES</b> .....		76
	<b>B. ABBREVIATIONS</b> .....		78
<b>INDEX</b>	.....		79

**PART ONE**  
**INTRODUCTION**  
**CHAPTER 1**  
**GENERAL**

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**1-1. Purpose and Scope**

*a.* This manual is a *guide* for use in training personnel formed into crews to expeditiously emplace, march order, and fire the Improved Hawk guided missile system. Users of this manual should have completed an Improved Hawk system-oriented course of instruction either in the US Army Air Defense School, or The Air Defense Artillery Training Brigade, or had adequate on-the-job training paralleling such courses of instruction. The subject matter is specifically applicable to Improved Hawk missile batteries organized and equipped under the mobile sections of TOE 44-247. The subject matter is also applicable in large part to semimobile batteries organized and equipped under this TOE.

*b.* Part one contains introductory material including brief descriptions of equipment, system operation, and safety precautions. Drills for emplacement and march order of Improved Hawk equipment are included in part two as well as orientation, alinement, and checkout procedures. Personnel actions required to progress from a 15-minute state of alert to the conduct of fire are contained in part three. Emergency procedures and effects of an electronic countermeasures (ECM) environment are also presented in part three.

*c.* The material contained herein is applicable to both nuclear and nonnuclear warfare.

**1-2. Recommended Changes and Comments**

Users are encouraged to submit recommended changes and comments to improve this manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be prepared on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to Commandant, US Army Air Defense School, ATTN. (ATSA-CTD-TL, Fort Bliss, Texas 79916.

**1-3. Improved Hawk Missile Battery Organization**

The Improved Hawk missile battery consists of a headquarters section, communications section, assembly, service, and maintenance section, firing platoon, security section, and motor maintenance section. When authorized by Department of the Army, the battery may be augmented with equipment and personnel required to form an improved assault fire unit (IAFU). The battery may also be augmented with an assault fire section (AFS) capable of performing independent missions.

*a. Headquarters Section.* This section is authorized the personnel and equipment required to exercise the usual command, administrative, supply, and mess functions for the entire battery.

*b. Communications Section.* This section is authorized the personnel and equipment required to perform organizational maintenance on all wire and radio equipment issued to the battery. It is also authorized the personnel and equipment required to operate the battery message center and lay field wire.

*c. Assembly, Service, and Maintenance Section.* This section is authorized the personnel and equipment required to perform organizational maintenance on all items of Improved Hawk peculiar, ancillary, and support equipment. It is also authorized the personnel required to draw missiles from the ammunition supply point, decan them, test their safety and arming devices (SAD), assemble them, and load them on storage pallets.

*d. Firing Platoon.* The firing platoon includes a platoon headquarters, command and acquisition section, and two identical firing sections. The platoon is authorized the personnel and equipment required to search for, detect, identify, lock on, track, and engage targets on a 24-hour per day basis. It is also authorized the personnel and equipment required to transfer missiles from storage pallets to launchers during emplacement,

and from launchers to storage pallets during march order. In normal operations, the platoon can engage two separate targets simultaneously.

*e. Security Section.* This section is authorized military police personnel and equipment required to help maintain security of the battery tactical areas, particularly at night. It is authorized trained dog handlers and sentry dogs as an aid in this effort.

*f. Motor Maintenance Section.* This section is authorized the personnel and equipment required to perform organizational maintenance on all wheeled and tracked automotive vehicles. It is also authorized personnel and equipment needed to operate the battery motor pool, evacuate disabled vehicles, and prepare field positions for Improved Hawk equipment in the firing platoon.

*g. Improved Assault Fire Unit (IAFU).* This unit may be formed when the battery is augmented with an improved platoon command post. The improved continuous-wave radar in the command and acquisition section and all of the Improved

Hawk equipment in one of the firing sections are used in its formation. Personnel from both sections are detailed to man and operate the unit. It is capable of carrying out independent tactical missions and can engage one target at a time. When this unit is formed and deployed on a separate mission, the remainder of the firing platoon can also engage only one target at a time.

*h. Assault Fire Section (AFS).* This section is authorized the personnel and equipment required to provide the battery with a third fire unit. Its personnel, equipment, and capabilities are identical to those of the IAFU. When authorized to the battery, the basic capability of the rest of the battery to engage two targets simultaneously is unchanged.

#### 1-4. Appendixes

Appendix A lists publications used as references in preparing this manual. Appendix B lists some of the abbreviations and their meanings as used in this manual.

## CHAPTER 2

## DESCRIPTION OF EQUIPMENT

## 2-1. General

This chapter contains functional descriptions of Improved Hawk equipment issued to the command and acquisition, firing, and assembly, service and maintenance sections in the Improved Hawk missile battery. Descriptions of the communications equipment used in the battery during field operations are also included.

## 2-2. Command and Acquisition Section Equipment

The Improved Hawk equipment issued to the command and acquisition section is used to control the fire of the battery. It provides the means for acquiring, evaluating, designating, and firing at targets. Major items are the improved pulse acquisition radar (IPAR), improved continuous-wave acquisition radar (ICWAR), improved range-only radar (IROR), improved battery control central (IBCC), information and coordination central (ICC), improved platoon command post (IPCP), and generator sets.

*a. Improved Pulse Acquisition Radar.* The trailer-mounted IPAR detects aircraft up to medium altitudes by means of conventional pulse techniques. Identification, friend or foe (IFF) equipment, mounted in the ICC, is used in conjunction with the IPAR, ICWAR, and automatic data processor (ADP) in the ICC to aid in discriminating between friendly and hostile aircraft. The IPAR is capable of operating in an ECM environment. This capability is provided by built-in electronic counter-countermeasures (ECCM) circuits. Most of these circuits require an omnidirectional antenna mounted on top of the IPAR antenna reflector for operation. The IPAR is operated by remote control from the IBCC except during operation and maintenance checks when the IPAR must be in local control. When on surveillance, the IPAR provides target data to the IBCC and ICC. For a complete description of the IPAR, refer to TM 9-1430-534-12-1.

*b. Improved Continuous-Wave Acquisition Radar.* The trailer-mounted ICWAR is normally used in conjunction with the IPAR to detect targets. It is particularly capable of detecting targets at very low altitudes where radiofrequency (RF) reflections from objects on the ground (ground clutter) make detection difficult for the

IPAR. The capability for detecting targets in the midst of ground clutter is due to the use of continuous-wave (CW) transmission. Because this radar transmits continuously, two antennas housed in a single assembly are provided, one for transmitting, the other for receiving. The ICWAR is operated by remote control from the IBCC or IPCP except during operating and maintenance checks. When controlled from the IBCC, it is oriented and synchronized with the IPAR. When controlled from the IPCP, it is oriented on a known reference point (KRP). Built-in test equipment (BITE) is provided, some of which automatically tests certain critical circuits periodically. Failure of the critical circuits is indicated by red lights on the control panel of the ICWAR and in the IBCC or IPCP. The ICWAR provides target data to the IBCC and ICC, or IPCP when on surveillance, and is equipped with built-in ECCM circuits. For a complete description of the ICWAR, refer to TM 9-1430-528-12-1.

*c. Improved Range-Only Radar.* The trailer-mounted IROR uses pulse techniques to provide range data on call to either of the improved high-powered illuminator radars (IHIPIR) (para 2-3 a) only when they operate under control from the IBCC. The range data is provided automatically when an IHIPIR experiences ECM of sufficient intensity and duration while attempting to lock on and track a target or while tracking a target. For a complete description of the IROR, refer to TM 9-1430-529-12-1.

*d. Improved Battery Control Central.* The truck-mounted IBCC houses the electronic equipment needed to monitor and control firing operations of the battery. Information from the Army air defense command post (AADCP), radars, launchers, and missiles is displayed on one or more consoles in the IBCC. Some of the displays are used in evaluating target data to determine which target poses the greatest threat to the defended area. Means are provided for determining missile status, designating a target to be engaged, and evaluating the results of engagements. Numerous indicator lamps are provided to alert operators when major items of the Improved Hawk system fail. Controls are provided to operate the system in one of three modes; automatic, normal (semiautomatic), and manual. Refer to chapter 3 for brief descriptions of

the three modes of operation. For a complete description of the IBCC and the three modes of operation, refer to TM 9-1430-526-12-1.

*e. Information Coordination Central.* The trailer-mounted ICC houses the electronic equipment required for data processing when the Improved Hawk system is operated in the automatic or normal modes from the IBCC. It also houses the electronic equipment required for IFF interrogation and tactical communications during all three modes of system operation. In the automatic and normal modes of operation, an automatic data processor (ADP) receives a target data from the system radars along with battery status information from the IBCC. These data are used by the ADP to threat order targets in a preselected defense sector. The ADP then generates signals to provide indications of the most threatening targets to the IBCC and selects a firing section to engage each target. Under certain conditions in the automatic mode, the ADP generates a fire command at the appropriate time to fire one missile without the necessity of tactical control officer (TCO) acceptance (CEASE FIRE/RESUME FIRE switch at RESUME FIRE); if required, additional missiles must be fired manually. In the normal mode, application of the ADP fire command is always withheld until the decision of the ADP is accepted by the TCO. Indicator lamps on each major item of equipment alert operators locally and in the IBCC when failure occurs. For a complete description of the ICC, refer to TM 9-1430-527-12-1.

*f. Improved Platoon Command Post.* The trailer-mounted IPCP houses the electronic equipment needed to monitor and control firing operations of the IAFU or AFS. Information from the AADCP, radars, launchers, and missiles is displayed on a tactical display and engagement control console (TDECC). The target information displayed is evaluated to determine which target to engage. An IFF interrogator set, tactical communications equipment, and a modified ADP are among the major items installed in the IPCP. Hence, it functions essentially as described in *d* and *e* above for the IBCC and ICC, except that only one target can be engaged at a time. For a complete description of the IPCP and the three modes of operation, refer to \*TM 9-1430-535-12/1.

*g. IFF Equipment.* Interrogator Set AN/TPX-46(V)1 is the IFF equipment that is installed in both the ICC and IPCP. It is capable of operation in five different modes. Prospective

targets can be challenged manually in the ICC or IBCC (controls are on the tactical control assistant's (TCA) operating panel) in the full firing battery or in the battery less a firing section; targets also can be challenged by the TCO with controls on the TDECC in the IPCP. In the automatic and normal modes of fire, prospective targets are challenged automatically by a signal generated in the ADP at the appropriate time. Challenging results in the display of symbols on the tactical control console plan position indicator (TCC PPI) in the IBCC and on the modified TDECC PPI in the IPCP that indicate those prospective targets that are probably friendly aircraft. For a complete description of Interrogator Set AN/TPX-46(V)1 and the five modes of operation, refer to TM 11-5895-532-12.

*h. Generator Sets.* Trailer-mounted alternating current (ac) generator sets provide the electrical power required to operate the Improved Hawk equipment. The generators are driven by diesel engines and are rated at 3-phase, 400-hertz (Hz), 120/208 or 240/416 volts, ac, 45 or 60 kilowatts of power output. Four 3-phase electric receptacles are mounted on each set for connecting the output to equipment.

### 2-3. Firing Section Equipment

The Improved Hawk equipment issued to each of the two firing sections in the firing platoon is used to search for, detect, lock on, track, and fire at targets. In addition to the generator sets described in paragraph 2-2 *h*, each firing section is issued an IHIPIR, three improved zero-length launchers (ILCHR), an improved launching section control box (ILSCB), six truck- and trailer-mounted pallets, and a loader-transporter.

*a. Improved High-Powered Illuminator Radar.* The trailer-mounted IHIPIR is a CW radar used to search for, detect, lock on, and track a designated target. The basic purpose of the IHIPIR is to continuously direct RF energy at a target so that missiles can home on the energy reflected from the target. After the IHIPIR locks on and starts tracking a target, it analyzes the RF energy reflected from the target. The analysis produces target information for use in the IBCC and ICC, or IPCP, ILCHR, and missiles. The IHIPIR is controlled from either the IBCC, ICC, or IPCP during firing. It is equipped with BITE, some of which automatically tests certain critical circuits periodically. Failure of the critical circuits is indicated by red lamps locally and in the IBCC or IPCP. This radar is equipped with built-in ECCM circuits. For a complete description of the IHIPIR, refer to TM 9-1430-533-12-1.

\*To be published.

*b. Improved Zero-Length Launcher.* The towable ILCHR is used to support from one to three missiles in a ready-to-fire attitude when the battery is at BATTLE STATIONS. Up to three ILCHR may be connected through the ILSCB to one IHIPIR. After the IHIPIR locks on a target and the target gets within effective range of the missile, a fire command is generated either automatically or manually. This causes an ILCHR to be selected and activated and to slew to point the missiles at the target, both in azimuth and elevation, and to track the target along with the IHIPIR. At the same time, an appropriate missile message is sent to a selected missile. This results in activation of the missile which acquires rear reference lock on the IHIPIR. The selected ILCHR then repositions itself to firing azimuth and firing elevation. If the ILCHR is pointed in an obstructed area, built-in shoot-around circuits automatically reposition the ILCHR so that the selected missile can be launched. The ILCHR then generates a signal that ignites the rocket motor of the activated missile. As soon as the missile is launched, the ILCHR re-slaves itself to the IHIPIR and tracks the target with it. If additional missiles are not fired within 40 seconds of the first launch, the ILCHR returns to the standby mode of operation. Each time a missile is launched the 40-second delay in returning to the standby mode of operation restarts. During operation, the status of ILCHR and missiles is indicated by lamps at the ILSCB and in the IBCC or IPCP. For a complete description of the ILCHR, refer to TM 9-1440-531-12-1.

*c. Improved Launching Section Control Box.* The ILSCB is used to distribute command signals and ILCHR and missile status signals between the IHIPIR, IBCC and ICC, or IPCP, and the three ILCHR in a firing section. It is equipped with safety switches that are used during maintenance, and missile loading and unloading procedures. When the OPERATE / SAFE switches are set at SAFE, they interrupt control of the ILCHR from the IBCC, ICC or IPCP. The ILSCB is equipped with indicator lamps that reflect the status of each ILCHR and missile. The results of certain missile tests are also indicated by lamps. Space is provided to store a telephone headset and a safety-and-arming test aid (SATA). For a complete description of the ILSCB, refer to TM 9-1440-531-12-1.

*d. Pallets.* The truck- and trailer-mounted pallets are used as mobile supports for up to three assembled missiles each. They provide storage space prior to loading missiles on an ILCHR, after unloading from the ILCHR, and during battery

movement. If desired, the pallets may be dismounted and placed on the ground by using a loader-transporter after missiles have been removed and the pallets are unfastened from the vehicle. For a complete description of the pallet, refer to TM 9-1440-531-12-1.

*e. Loader-Transporter.* The loader-transporter is a full-tracked vehicle used to load and unload missiles on pallets and launchers. It can handle up to three missiles at one time. Because its maximum speed is not more than 12 miles per hour, the loader-transporter is usually carried in the bed of an extra-long wheelbase 2½-ton truck when the battery moves. For a complete description of the loader-transporter, refer to TM 9-1450-500-20.

#### 2-4. Assembly, Service, and Maintenance Section Equipment

The Improved Hawk equipment issued to the assembly, service, and maintenance section is used to maintain all of the Improved Hawk peculiar equipment in the battery, and to assemble and store missiles. The equipment includes a loader-transporter described in 2-3 *e* above. The section is also issued Improved Hawk missiles in containers. The loader-transporter issued to this section is used primarily to transfer missile bodies from missile containers to an assembly stand, and assembled missiles from the assembly stand to pallets.

*a. Improved Missile.* The improved missile is dart-shaped with control surfaces at the rear of the wings to enable quick maneuver while in flight. It is propelled by a solid-propellant rocket motor and computes its own flight and burst commands. The improved missile was developed under the certified round concept; therefore, detailed checkout or maintenance is not required by the user. For a complete description of the Improved Hawk missile and the missile container described in *b* below, refer to TM 9-1410-530-14.

*b. Missile Container.* A single, pressurized, steel chamber is used to transport and store the improved missile until it is prepared for use in the battery. To conserve space, the improved missile body and the wing assemblies are stored on two separate loading frames which are roller-mounted on rails to permit easy withdrawal from the container. A humidity indicator, a two-way valve for pressurizing and depressurizing the container, and a waterproof compartment for storage of records are provided in the cover of the missile container.

#### 2-5. Communications Equipment

Three general means of communication are provided for an Improved Hawk missile battery, a wire net built in the cabling system, field wire, and truck-mounted radio sets. The built-in wire net

provides headset hot loops for use primarily during orientation, alignment, and system checkout procedures. Field wire is used to establish a telephone net from a switchboard to the battery command post, the firing platoon and all sections, and to battalion headquarters when time permits. Field wire is also used in a hot loop between all elements of the local security force. This hot loop is connected through the battery switchboard. The radio sets provide the primary means of communication to battalion headquarters and for internal command and control when the battery is in convoy. (Detailed descriptions of communications facilities in the Improved Hawk missile system are in TM 9-1425-525-1.) Following are descriptions of the radio sets issued to Improved Hawk missile batteries:

a. *AN/GRC-106*. The *AN/GRC-106* is designed to transmit and receive single sideband AM and frequency shift teletype signals over a frequency range of 2-30 MHz. It operates on a standard vehicular 24-volt dc power source when used for AM operation alone. For teletype operation, the set requires an auxiliary generator capable of delivering 100 amperes at 24 volts dc. This radio set may be operated by remote control for voice transmission with radio set control group *AN/GRA-74* or by the remote device built inside the ICC.

b. *AN/TRC-145*. The *AN/TRC-145* is designed to transmit and receive voice and pulse code FM signals over a frequency range of 220-404.5 MHz. The security device *TSES/KG-27* will be used to provide a secure radio link. The *AN/TRC-145* provides multichannel tactical communications including the automatic data link (ADL) required between the ICC and the battalion operation center (Bn OC) and between the IPCP and Bn OC. Two receiver-transmitter (RT) units are provided, each capable of operating in up to 12 channels simultaneously. (Pending availability of the *AN/TRC-145* for issue to air defense units, an *AN/MRC-69(V)* may be issued as a substitute.)

c. *AN/VRC-46*. The *AN/VRC-46* is designed to transmit and receive FM signals over a frequency range of 30-76 MHz. It has one receiver-transmitter (RT) unit and operates on a standard vehicular 24-volt dc power source. This radio set may be operated by remote control for voice transmission with radio set control group *AN/GRA-39*.

d. *AN/VRC-47*. The *AN/VRC-47* has one RT unit and an additional receiver. It has the same operating characteristics and power requirements as the *AN/VRC-46*.

## CHAPTER 3

### SYSTEM OPERATION

#### 3-1. General

The number of persons required to man a firing element varies in an Improved Hawk missile battery. Depending on the tactical mission, the firing element may be the normal firing platoon composed of a command and acquisition section and two firing sections, an IAFU or AFS, or a firing platoon less one firing section and the ICWAR. The method of operation and communications nets used depends on the organization of the firing elements.

#### 3-2. Personnel Requirements for Firing Operations

In addition to Improved Hawk-trained operator

and maintenance personnel, certain communications, engineer, and missile resupply personnel are required to support firing operations in each firing element crew. The minimum number of personnel required for each crew is shown in table 3-1. For sustained firing operations over long periods of time (e.g., 24 hours per day, day after day) each firing element should be comprised of at least two crews. TOE 44-247 authorizes sufficient personnel with appropriate MOS to form at least two crews as shown for each firing element.

*Table 3-1. Minimum Personnel Required for Firing Operations*

	Battery	IAFU and AFS	Battery less one firing section and ICWAR
<b>Fire Control Area:</b>			
Tactical control officer .....	1	1	1
Tactical control assistant .....	1	1	1
Fire control operators .....	3	2	2
Azimuth-speed indicator operator .....	1	0	0
Power generator operator / mechanic .....	1	1	1
<b>Firing Area:</b>			
Section chiefs .....	2	1	1
Launcher crewmen .....	4	2	2
Assistant launcher crewman .....	2	1	1
Power generator operator: mechanic .....	2	1	1
<b>Assembly, Service, and Maintenance Area:</b>			
Launcher crewman .....	2	0	2
Assembly crewman .....	1	0	1
Assistant launcher crewman .....	1	0	1
Loader operator * .....	1	0	1
Firing section mechanics .....	2	1	1
ICWAR—ICC mechanic .....	1	1	1
Fire control mechanic .....	1	0	1
<b>Communications Area:</b>			
Radio operator .....	1	1	1
Radio relay attendant .....	1	1	1
Switchboard operator .....	1	1	1
Totals .....	29	15	21

\* At least one qualified as a loader operator, except in the battery configuration which requires two, one in each of the firing sections.

#### 3-3. Communications

The communications nets described below are the minimum number used by a battery when operating in the field. Additional nets may be required, depending on the battery's mission.

##### a. Inrattery.

(1) *Radio net.* The AN / VRC-series of radio sets provide the battery commander with the means for exercising command and control while moving and upon initial occupation of a field position.

These sets are also used to maintain contact with battalion headquarters under these conditions.

(2) *Wire nets.*

(a) *General.* As soon as possible after a position has been occupied, the communications section lays field wire to establish the administrative and local security nets. Individual lines are laid from the switchboard to the battery command post, each section, and firing platoon headquarters. A hot loop is laid connecting all weapon sites in the local security force through the switchboard.

(b) *Intracabling wire nets.*

1. *Acquisition loop.* This hot loop connects the ICC to the IBCC, IPAR, ICWAR, and IROR.

2. *Firing section loops.* Each of the two firing consoles in the IBCC is connected to its associated IHIPIR, ILSCB, and ILCHR with a hot loop.

3. *Communications modules.* Modules installed in the IBCC and ICC are equipped with controls required to interconnect any or all of the communication facilities available in the battery.

b. *Tactical Communications.* Upon completion of emplacement, multichannel tactical communication between the ICC and Bn OC, and between the IPCP and Bn OC is achieved using radio terminal set AN/TRC-145 or AN/MRC-69. The terminal set interfaces with the ICC and IPCP to provide the following facilities:

(1) *Automatic data link (ADL).* This two-way net is used to exchange digital data between the Bn OC and the ICC, and Bn OC and IPCP with respect to the air situation, target engagements, and battery status. The data passes through data converter AN/GSA-77 which is installed in the ICC and IPCP. The converter decodes data from the Bn OC and converts it into signals displayed on the TCC in the IBCC. It also encodes data from the ICC and IPCP and transmits it in digital form to the Bn OC. Voice transmission is not possible over the ADL.

(2) *Air defense control net (hot loop).* This two-way net is used by the TCO to talk with personnel in the Bn OC on matters concerning operational control that cannot be transmitted in code over the ADL net.

(3) *Intelligence radar reporting (IRR) net.* This two-way net is used by the TCA to talk with personnel in the Bn OC on intelligence matters respecting potential targets detected by the ICWAR and IPAR that cannot be transmitted in code over the ADL net. This net is also used to receive early warning data from higher headquarters.

(4) *Command and administrative net.* This

two-way voice net carries traffic on administrative, logistical, and maintenance matters. This net is usually patched into the battery switchboard so that pertinent traffic can originate in any platoon or section of the battery.

c. *Backup Communications.* If the AN/TRC-145 or AN/MRC-69(V) is disabled, the single sideband radio sets organic to the battery may be used to establish required communications except the ADL. When time and the tactical situation permit, the radio nets should be backed up by wire laid between the battery and battalion. This may be accomplished in part by entering the Army area communications system.

d. *IAFU and AFS.* The IPCP contains communications equipment that provides facilities similar to those described above for the battery.

### 3-4. Methods of Operation

a. *Normal Firing Platoon.*

(1) *Automatic mode.* In this mode of operation, under specific conditions, the Improved Hawk guided missile system is completely controlled by the ADP in the ICC. IPAR, ICWAR, and IFF data with respect to certain categories of targets that enter a preselected defense sector are monitored by the ADP. These data are evaluated by the computer, and the targets are sorted out as to their relative threat to the battery area. Signals are then developed in the ADP which result in either one of two symbols (or both) being displayed on the TCC in the IBCC. If either one or both symbols are flashing, a priority I target is indicated with a minimum time to last launch available. However, if the symbol(s) is (are) not flashing, a priority II target is (are) indicated with a greater amount of time to last launch available. Status and command data from the IBCC are also processed by the ADP. These data are used by the ADP to automatically select and assign a firing section to engage the most threatening target. When a firing section is assigned to a target, its associated IHIPIR automatically slews to the azimuth of the target and enters a high, medium, or low search pattern. After the IHIPIR locks on and starts tracking, target data developed in the IHIPIR is monitored by the ADP. An ADP fire command is generated when the fire unit is assigned to the target; however, the command is held up until in-range calculations are smoothed. An ILCHR is then automatically selected, becomes fully activated, and slews to the azimuth and elevation of the IHIPIR. Simultaneously, a missile is activated electrically and hydraulically, and acquires rear reference lock on the IHIPIR. The ILCHR then requests lead angle from the IHIPIR to position

itself to firing azimuth and firing elevation. When the ILCHR is so positioned, it generates a signal which ignites the rocket motor of the activated missile, thereby launching the first missile. If additional missiles are required to destroy the target, they must be fired manually at the appropriate fire control console (FCC) as directed by the TCO. Throughout this mode of operation, personnel in the IBCC monitor the displays and evaluate data on targets not capable of being processed by the ADP. When necessary, manual control of the system is implemented and engagement is effected as described in (3) below. The TCO may preempt control of the system at any time during the automatic mode of operation before the fire command is generated by setting the CEASE FIRE/RESUME FIRE switch at CEASE FIRE.

(2) *Normal mode.* In this mode of operation, the Improved Hawk guided missile system is partially under the control of the ADP. IPAR, ICWAR, and IFF data with respect to the same categories of targets as in the automatic mode as well as status and command data from the IBCC are processed in the ADP as described in (1) above, resulting in selection of a target to be engaged. A firing section is selected and assigned, and the associated IHIPIR slews to the azimuth of the target, searches, locks on, and starts tracking. When the target is within effective range of the missile, the ADP generates a fire command which is interrupted at the TCC until the TCO accepts the assign request from the ADP. If he accepts the ADP assign request, the automatic sequence continues until one missile is fired. Again, if additional missiles must be fired to destroy the target, the procedure is performed manually at the appropriate FCC.

(3) *Manual mode.*

(a) Four electronic consoles in the IBCC are used to detect, identify, track, and engage targets. The TCC displays target information from the IPAR, ICWAR, and ICC, and track symbols from the AADCP. The continuous-wave target detection console (CWTDC) displays target information from the ICWAR. It is equipped with controls with which the operator can operate the ICWAR and alert the TCO when very low-altitude targets are detected. The two FCC display target information from the IPAR and ICWAR. Each displays the azimuth at which its associated IHIPIR is pointing. The FCC are equipped with controls which permit each FCO to operate the ASSOCIATED IHIPIR and launchers, to point the IHIPIR at an assigned target, and to select a launcher from which a missile will be fired. In-

range and launch computations are provided by the ADP.

(b) The officer and four enlisted men who operate the IBCC during an engagement are the TCO, TCA, two FCO, and an azimuth-speed operator (ASO) who operates the CWTDC. The TCO and TCA monitor the displays on the TCC to determine the presence of targets. They may be indicated by AADCP symbols, IPAR, ICWAR, or ICC information, or by IPAR and ICWAR information simultaneously at the same azimuth. When targets are first detected by the ASO, he presses a pushbutton on the CWTDC which results in a display on the TCC that alerts the TCO and TCA to target presence. Within the rules for engagement laid down in the battery's tactical SOP, or as directed from the AADCP, the TCO selects a target for engagement. He designates which FCC is to fire by pressing the appropriate ASSIGN LOW/ASSIGN HIGH pushbutton on the TCC. The FCO then uses the controls provided on the FCC to accept the assignment and point the IHIPIR at the target. When the IHIPIR locks on the target, both the TCO and FCO receive a lock indication. The FCO then selects a launcher (if necessary) and, when all conditions for firing have been met to include the TCO having set the CEASE FIRE/RESUME FIRE switch at RESUME FIRE, presses the FIRE pushbutton. The selected ILCHR becomes fully activated and slews to the azimuth and elevation of the IHIPIR. Simultaneously, a missile is activated electrically and hydraulically, and acquires rear reference lock on the IHIPIR. The ILCHR then requests lead angle from the IHIPIR to reposition itself to firing azimuth and firing elevation. When the ILCHR is so positioned, it generates a signal which ignites the rocket motor of the activated missile, thereby launching it. After the missile has lifted off, the FCO continues to monitor the engagement to determine its effectiveness. If the target is destroyed, the FCO immediately presses the KILL pushbutton. If the target is not destroyed, the FCO announces NO KILL to the TCO who reevaluates the air situation, decides whether to fire additional missiles at the same target, change targets, or take other action as required by the attack environment. The FCO reacts according to the TCO's directions and, if additional missiles are fired, evaluates the results of each. If directed to do so, the FCO momentarily presses the NO KILL pushbutton. Pressing either the KILL or NO KILL pushbutton automatically relays the results of the engagement to the AADCP and breaks down the engagement. When several targets are in the

assigned defense sector, two of them may be engaged at the same time.

(4) *Casualty mode.* This mode of operation is used when the ADP is inoperative (para 10-3). All targets must be manually evaluated, threat ordered, and assigned to a fire section by the TCO. Operation in this mode is as described in (3) above except that in-range and launch computations are provided by the IHIPIR.

*b. Firing Platoon Less One Firing Section and ICWAR.* In this firing element, operational capabilities are curtailed because one firing section and the ICWAR are deployed as part of an IAFU. Consequently, one FCC and the CWTDC are not functional in the IBCC and the ADP has no ICWAR target data input. As a result, very low-altitude targets are difficult to detect, and only one target can be engaged at a time. Otherwise, the modes of operation are the same as those in the normal firing platoon.

*c. IAFU and AFS:*

(1) *Automatic mode.* In this mode of operation, the IAFU or AFS is completely controlled by the modified ADP in the IPCP, provided that the TCO has set the CEASE FIRE/RESUME FIRE switch at RESUME FIRE. Operation is essentially the same as that described for the normal firing platoon in a (1) above with the following exceptions:

(a) There is no IPAR target data input to the IPCP.

(b) All target information required for visual evaluation of the air situation is displayed on a single electronic console, the TDECC.

(c) All of the controls required to operate the individual items of equipment and engage a target are contained in or on the TDECC.

(d) The IHIPIR may be used in a search mode of operation to detect targets at medium altitudes to a limited extent.

(e) Since only one firing section is connected to the IPCP, the modified ADP does not select one for an engagement.

(2) *Normal mode.* Operation in this mode is essentially the same as that described in a (2) above for the normal firing platoon. The exceptions in c (1) (a) through (e) above also apply to this mode of operation.

(3) *Manual mode.*

(a) The TDECC in the IPCP is used to detect, identify, track, and engage targets. Target information from the ICWAR and ADP, and track symbols from the AADCP, are displayed on a modified plan position indicator (PPI) in the tactical control panel. The azimuth at which the IHIPIR is pointing is also displayed on the PPI. When the IHIPIR is locked on a target, its doppler spectrum is displayed on the radar control panel on a cathode-ray tube using a type A presentation. Controls are provided so that personnel can operate the ICWAR, IHIPIR, and ILCHR remotely.

(b) One officer and two enlisted men operate the IPCP during an engagement. They are a TCO, and TCA, and a communications operator. The TCO and TCA monitor the displays on the TDECC to determine the presence of hostile targets. They may be indicated by AADCP symbols, ICWAR information supplemented with IFF interrogation, flight parameters, evasive action, or their use of ECM. If the IHIPIR is used in a search mode, it will display target data only after it has locked on. In this case, determination as to whether the target is hostile may be effected by using IFF interrogation, correlation with AADCP symbology, etc. The TCO selects a target for engagement based on rules laid down in the tactical SOP or as directed from the AADCP. It should normally be the target posing the greatest threat to the defended vital area. The TCO designates the selected target to the TCA for engagement. Unless the target was detected by the IHIPIR, the TCO positions the azimuth cursor over the target and momentarily presses the MANUAL ASSIGN pushbutton. When the IHIPIR locks on, the FCO monitors the doppler displayed and listens to the associated audio signal to determine the approximate number and types of aircraft being tracked. He reports the number of aircraft to the AADCP by momentarily pressing the appropriate pushbutton (ONE, FEW, MANY) on the tactical control panel. When the target gets within effective range of the missile, the TCO selects an ILCHR (if necessary) and momentarily presses the FIRE pushbutton. The rest of the firing sequence events are identical to those described in a (3) (b) above for the normal firing platoon down to determining the effectiveness of the engagement and reporting to the AADCP.

## CHAPTER 4

## SAFETY

## 4-1. General

a. The hazards to personnel and equipment in the Improved Hawk system are so numerous that extensive protective measures are necessary. Many built-in safety devices are used throughout the system to prevent accidents. However, operators and maintenance personnel must recognize those hazards for which there are no built-in safety devices and take necessary precautions.

b. The following hazards in the IMPROVED Hawk system are discussed in this chapter:

- (1) Electrical.
- (2) Mechanical.
- (3) High explosives and flammable liquids.
- (4) High-pressure hydraulic fluid.
- (5) High-pressure air.
- (6) Fire.
- (7) RF radiation.
- (8) Radioactive material radiation.

## 4-2. Electrical

a. Almost every component of the Improved Hawk system is electrically powered or generates electrical power. All electrical power should be considered dangerous. Shocks, even from common 115-volt electrical power, may be fatal under certain conditions. Contact with, or proximity to, high-voltage potentials can produce a painful burn or death. A secondary effect of electrical shock is the muscular reflex action of the shocked person, often causing severe injury or even death.

b. The following precautions will minimize the danger of injury or damage from electrical sources:

- (1) Ground all equipment provided with grounding stakes or systems.
- (2) Do not work alone on electrical equipment. First aid is required immediately if you suffer electric shock.
- (3) Only qualified personnel should perform tests and adjustments or operate test equipment.
- (4) Interlocks must be kept in good condition and visibly tagged when overridden.
- (5) Never override interlocks unnecessarily. Make it a habit to keep panels and doors closed.
- (6) Whenever possible, turn power off before servicing equipment. Always turn power off before disconnecting or connecting power cables.
- (7) Insure that personnel are clear of equipment when power is applied.

(8) Check that safety devices are operating properly.

(9) Cables and connections should be protected from moisture and vehicular traffic.

(10) Perform periodic inspections to insure compliance with safety rules.

(11) During electrical storms, evacuate personnel from all areas in which missiles are stored.

## 4-3. Mechanical

a. The radars, ILCHR, loader-transporters, and associated equipment present many hazards which may result in falls or entanglement with moving mechanical parts.

b. Observance of the following precautions will minimize the chances of accident due to mechanical sources:

- (1) Wipe up dripped or spilled liquids immediately.
- (2) Do not wear loose clothing when working in the vicinity of equipment with moving components.
- (3) Set the SAFE / OPERATE switch at SAFE when working on radar antennas.
- (4) Use both hands when climbing. Discourage personnel from climbing up to antennas except when necessary.
- (5) Stowlock radar antennas during motor marches.
- (6) Clear the equipment area before the equipment is placed in remote control.
- (7) Do not jump from the tops of radars; use the ladders provided.
- (8) Remove all obstacles from the rotation path of the antenna reflectors.
- (9) Do not try to lift equipment which normally requires movement by more than one person.
- (10) Set the SAFE / OPERATE switch on the ILSCB at SAFE before working on an ILCHR. This prevents the ILCHR from being activated from the IBCC or IPCP.
- (11) When operating the loader-transporter, insure that all equipment being towed, lifted, or carried is properly secured before moving the loader-transporter.
- (12) Wear ear protection devices when working in the vicinity of operating radars, air

conditioners, and generators to prevent hearing loss.

#### 4-4. High Explosives and Flammable Liquids

a. High-explosive components are used in Hawk missiles. Gasoline and other flammable liquids are used with such items of Improved Hawk equipment as the generators and loader-transporters.

b. Observance of the following precautions will minimize the chances of an explosion occurring:

(1) Handle missiles with care; avoid rough handling such as dropping, shaking, or jolting.

(2) Do not attempt to disassemble missile bodies or remove factory-installed components from them.

(3) Make sure that the SAFE / ARM levers are always set at SAFE on all missiles except those about to be launched.

(4) Do not smoke within 100 feet of any area where gasoline, diesel fuel, lubricants, or explosives are stored.

(5) Do not use matches or other spark-producing devices within 60 feet of the missile or containers with explosives, ILCHR, or loader-transporters when missiles are being moved.

(6) Store ammunition and missiles as prescribed in TM 9-1300-206.

#### 4-5. High-Pressure Hydraulic Fluid

a. Hydraulic fluid under high pressure is used for loader-transporter operation, and for raising and lowering launchers. Body contact with escaping hydraulic fluid can cause severe injury.

b. Observance of the following precautions will minimize injury from hydraulic fluid escaping under high pressure:

(1) Remain clear of equipment charged with high-pressure hydraulic fluid whenever possible.

(2) All lines, hoses, valves, and connections must be secured before hydraulic pressure is applied.

(3) All lines and hoses must be kept free of kinks, twists, sharp turns, and protected from sharp corners and such outside pressures as are caused by doors and vehicles.

(4) Hydraulic lines and hoses must be depressurized before disconnection.

#### 4-6. High-Pressure Air

a. High-pressure air systems are used in missile and launcher accumulators. Careless or improper handling of these systems can result in serious injury or death.

b. The following precautions will minimize the probability of an accident occurring:

(1) Always relieve pressure by opening appropriate bleeder valves before making repairs.

(2) Never loosen a connection to relieve pressure.

(3) Never stand in front of a hand valve when opening it to pressurize a system.

(4) When pressurizing a system, open the hand valve slowly to prevent sudden shock loading of the system.

(5) When closing the hand valve in a pressurized system, use only enough hand force to seat the valve firmly.

(6) Never use a wrench or other tool to close a valve.

(7) Use only those lubricants specified in the lubrication order.

(8) Never expose air hoses to vehicular traffic, pulling, twisting, kinking, or other abuse.

#### 4-7. Fire

a. The presence of high-explosive and flammable materials in the battery area presents a continuous fire hazard. Fires may be started by merely bringing certain materials close to each other.

b. The probability of fire or fire damage can be reduced by observing the following precautions:

(1) *Engine-driven equipment.*

(a) Never refuel while the engine is running.

(b) Do not refuel while the engine manifold is hot.

(c) Ground fueling nozzles during refueling.

(d) Wipe up any spilled fuel or lubricant immediately.

(e) Inspect fuel lines frequently for leaks or breaks.

(f) Do not store fuel or lubricants in the immediate vicinity of engine-driven equipment.

(g) Make sure that fire extinguishers are available for immediate use and that they are inspected frequently for serviceability and proper charge.

(2) *Explosive components.* Explosive components must be inspected frequently and disposed of when deterioration of the explosive is detected.

c. If a fire breaks out in or close to the battery area, every effort must be made to extinguish it before it reaches equipment and areas in which explosives and flammable liquids (e.g., missiles, small arms ammunition, vehicular fuels and lubricants, etc.) are stored or used. Should the fire get out of control where it is about to engulf areas in which explosives and flammable liquids are stored and used, or if the fire originates in such areas, evacuate personnel from the areas immediately. After the initial explosions subside, every effort must be made to extinguish any residual fires to prevent loss of or damage to remaining materiel.

#### 4-8. RF Radiation

a. RF radiation from radar antennas and associated equipment is a potential hazard to personnel. It heats body tissues and, when the intensity is high enough, will damage some tissues permanently. The damage is not always immediately apparent. An averaged incident power density of 10 milliwatts per square centimeter has been established by the surgeon generals (AR 40-583) as the permissible exposure limit for humans. This value provides a conservative safety factor and is substantially below that at which biologically significant heating effects occur. It is used to determine the distance from radiating antennas beyond which it is certain that personnel will be safe from RF radiation.

b. The probability of injury from RF radiation can be minimized by observing the following precautions:

(1) Personnel should not be permitted to enter areas where densities above 10 milliwatts per square centimeter exist continuously. Densities higher than the permissible value are continuously present in the main beams of Improved Hawk radar transmitting antennas out to the distances tabulated below:

IHIPIR .....	108 meters
ICWAR .....	18 meters (nonscanning)
IPAR .....	15 meters (nonscanning)
IROR .....	44 meters

(2) Before starting checks on the IHIPIR or IROR that require transmitter power to be on, elevate the antenna assembly a minimum of 50 mils above the horizontal plane.

(3) Turn the transmitter power off before starting work on antenna reflectors and waveguide assemblies.

(4) When the IPAR or ICWAR is transmitting and nonscanning, insure that personnel are not positioned in the main beam of the transmitting antenna within the distances tabulated in

(1) above.

#### 4-9. Radioactive Material Radiation

a. Many electroic components in Improved Hawk equipment contain radioactive tubes. Although danger exists only when a person comes in contact with the radioactive material inside the tubes, all personnel must be aware of the existence and location of these tubes in case they are broken.

b. The probability of injury from radioactive material radiation can be minimized by observing the following precautions:

(1) Check pertinent technical manuals for designation and location of radioactive tubes.

(2) Never touch damaged or broken radioactive tubes with bare hands. Wear gloves and goggles.

(3) Periodically check assemblies containing radioactive tubes.

(4) If personnel suffer a wound involved with radioactive materials, observe the following special first aid procedures:

(a) Apply a tourniquet if the wound is located where a tourniquet will be effective.

(b) Stimulate mild bleeding by manual pressure about the wound or with a suction bulb.

(c) Wash the wound with soap and flush with plenty of clear water.

(d) If the wound is of the puncture type or the opening is quite small, make an incision to promote bleeding and to facilitate cleaning and flushing of the wound.

**Warning:** Do not suck the wound by mouth.

#### 4-10. Minimum Safety Distances

a. Unless they are properly revetted, ILCHR must not be emplaced within 61 meters of any other equipment or of any building.

b. During firing, personnel must not approach within a radius of 61 meters from the launcher.

c. To protect cables from rocket-motor exhaust, the first 10 meters of cable from the ILCHR must be covered by at least 0.6 meter of earth.

**PART TWO**  
**EMPLACEMENT AND MARCH ORDER**  
**CHAPTER 5**  
**COMMAND AND ACQUISITION SECTION**

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**Section I. PREPARATION**

**5-1. General**

This chapter describes step-by-step drills for emplacing and march ordering the Improved Hawk fire control equipment issued to the command and acquisition section. Repeated use of these drills will produce effective teamwork which will result in the unit being able to become operational or move to a new field position in minimum time.

**5-2. Equipment**

Fire control equipment that is emplaced and march

ordered includes the ICC, IBCC, IPAR, ICWAR, IROR, IPCP, and generator sets.

**5-3. Personnel**

TOE 44-247 authorizes 17 enlisted men in the command and acquisition section. A minimum of 21 men are needed to *simultaneously* emplace or march order all of the fire control equipment required to become fully operational or move in minimum time. The assembly, service, and maintenance section will provide the additional men required for these purposes.

**Section II. INFORMATION AND COORDINATION CENTRAL**

**5-4. General**

The trailer-mounted ICC is parked so that the IFF antenna is directly over the stake driven into the ground to mark its site during reconnaissance and selection of position. The ICC must be positioned so that its door faces away from the IPAR (or any other source of high-power energy such as Nike Hercules HIPAR, LOPAR, AAR, etc.) to prevent dumping of the ADP memory when the door is opened. Also, the ICC air conditioner should not face the ICWAR to prevent false targets from appearing on the CWTDC azimuth-speed indicator (ASI). Emplacement and march order of the ICC require three FC crewmen.

**5-5. Emplacement**

*a. Step 1.*

(1) FC crewman 1 sets the handbrakes at the front of the trailer, removes the intervehicular cable connector from the receptacle at the rear of the truck and installs it in the bracket provided on the drawbar, closes the service coupling shutoff cock, removes the air line connector and installs it in the receptacle provided on the drawbar, removes the safety chain hooks and installs them on the U-bolts provided on the drawbar, takes the driver's seat,

starts the engine, and waits for instructions from FC crewman 2.

(2) FC crewman 2 supports the front support jack with the jack handle while FC crewman 3 pulls upward on the spring-loaded frame handle; both men lower the jack to the down position insuring that the ends of the spring-loaded frame handle engage the holes in the bracket and spindle assembly. They then disengage the jack crank from the storage clip, and lower the retractable portion of the jack by turning the jack crank clockwise until the wheels are firmly on the ground.

(3) FC crewmen 2 and 3 each remove a leveling jack crank from storage at the rear center of the trailer.

(4) FC crewmen 2 and 3 install cranks on the rear leveling jacks, and push forward and hold the horizontal lock levers. They then rotate the jacks into position for vertical movement, release the horizontal lock levers, and pull up and hold the vertical lock levers. Next they rotate the jacks into the vertical position, release the vertical lock levers, and lower the retractable portion of each jack by turning the jack crank clockwise until the pads are about 3 inches from the ground.

(5) FC crewman 2 removes the pintle hook

FM 44-101 (Exec.)

Ch. 7, 8

para 3-4 (pg. 10)

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TM 9-1430-526-12-1

Table 3-17

Pg. 3-52

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TM 9-1425-525-12-1

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lock pin and opens the pintle hook at the rear of the truck.

(6) FC crewman 3 lowers the retractable portion of the front support jack until the lunette is raised off the pintle hook.

(7) FC crewman 1 drives the truck forward to clear the pintle hook from the lunette when directed by FC crewman 2, stops the truck, dismounts, moves to the rear of the truck, closes the pintle hook, and replaces the pintle hook lock pin.

*b. Step 2.*

(1) FC crewmen 2 and 3 push forward and hold the horizontal lock lever at the front leveling jack, rotate the jack into position for vertical movement, and release the horizontal lock lever. They then pull up and hold the vertical lock lever, rotate the jack into the vertical position, and release the vertical lock lever.

(2) FC crewman 1 removes the jack crank from the A-FRAME at the front of the trailer, installs the crank on the front leveling jack, and lowers the retractable portion of the jack until the pad is firmly on the ground.

(3) FC crewmen 1, 2, and 3 simultaneously lower the retractable portions of the three leveling jacks until the trailer tires are approximately 2 inches off the ground.

*c. Step 3.*

(1) FC crewman 1 mounts to the roof of the ICC shelter, checks that the ANT SAFE / OPERATE switch is set at ANT SAFE and that the AZ DRIVE SAFE OFF / ON switch is set at SAFE OFF, and releases the two stow bolt assembly handknobs that secure the antenna pedestal in the travel position. He then eases the antenna and pedestal (under spring tension) to the operating position, positions and tightens the stow bolt assembly handknobs to secure the antenna pedestal in the operating position, and takes post near the spirit levels mounted on the pedestal assembly.

(2) FC crewman 1 directs the raising or lowering of the leveling jacks by FC crewmen 2 and 3 until the spirit levels indicate that the antenna is level, opens the two ADP air exhaust vents on the ICC roof, and descends to the ground.

(3) FC crewman 2 removes the ground rod and strap from storage at the front of the ICC, drives the ground rod into the earth near the ground cable connector on the trailer, and connects the ground cable to the ground rod and trailer.

(4) FC crewman 3 opens the ADP air intake vents at the rear and side of the ICC, releases and lowers the stairs, opens the pressure air vent, removes ground strap 9166696-2 from the storage

cabinet in the ICC, and connects it between the ICC and IBCC ground rods.

(5) FC crewmen 1, 2, and 3 lay the data cables to the IBCC, the power cable to the generator, and connect all cable ends to the receptacles in the cable entry panel on the ICC.

*Note.* The ICC is now ready for performance of procedures prior to application of power, positioning of controls prior to application of power, and energizing procedures as described in TM 9-1430-527-12-1. If remote operation of the IFF antenna is required, refer to TM 9-1425-525-12-1 for procedures to be used.

**5-6. March Order**

The ICC must be placed in local control, deenergized, and prepared for march order in accordance with information in TM 9-1430-527-12-1.

*a. Step 1.*

(1) FC crewman 1 mounts to the roof of the ICC, sets the ANT SAFE / OPERATE switch at SAFE and the AZ DRIVE SAFE OFF / ON switch at SAFE OFF and rotates the IFF antenna to the traveling position. He then releases the two stow bolt assembly handknobs that secure the antenna in the operating position, lowers the antenna pedestal to the travel position, and positions and tightens the two stow bolt assembly handknobs to secure the antenna pedestal in the travel position. He next closes the two ADP air exhaust vents on the ICC roof and descends to the ground.

(2) FC crewmen 2 and 3 disconnect the power and data cables from the receptacles at the cable entry panel and replace the dust covers on the cable ends and receptacles. They then raise the retractable portion of the front leveling jack to its upper limit, pull up and hold the vertical lock lever, rotate the jack to the horizontal position, release the vertical lock lever, push and hold the horizontal lock lever, rotate the jack under the trailer, release the horizontal lock lever, and remove and store the jack crank.

*b. Step 2.*

(1) FC crewmen 2 and 3 raise the retractable portions of the rear leveling jacks until both tires are firmly on the ground and the pads are about 3 inches off the ground.

(2) FC crewman 1 disconnects the ground cable from the ground rod and trailer, removes the ground rod from the earth, stores the ground rod and cable, removes and stores ground strap 9166696-2, closes the ADP air intakes at the rear and side of the ICC, closes the pressure air vent and door, and raises and secures the stairs.

*c. Step 3.*

(1) FC crewman 1 gets in the truck and starts the engine.

(2) FC crewman 2 guides FC crewman 1 in backing the truck until the pintle hook is within a few inches of the trailer lunette, removes the pintle hook lock pin, and opens the pintle hook.

(3) FC crewman 3, directed by FC crewman 2, raises or lowers the retractable portion of the front support jack until the trailer lunette is at the proper level for coupling with the pintle hook.

(4) FC crewman 1 backs the truck as directed by FC crewman 2 until the pintle hook is in position to engage the lunette.

(5) FC crewman 2 directs FC crewman 3 to raise the retractable portion of the front support jack until the lunette rests on the lower half of the pintle hook, closes the pintle hook, and replaces the pintle hook lock pin.

(6) FC crewman 1 dismounts from the truck cab, moves to the rear of the truck, removes the intervehicular cable connector from its bracket on the trailer drawbar, and installs it in the receptacle on the truck. He then removes the air line connector from the dummy receptacle on the trailer drawbar and installs it in the receptacle on the truck, and opens the service shutoff cock. Next he removes the safety chain hooks from the U-bolts on the drawbar, engages the safety chain hooks on the

bars provided on the truck, and releases the trailer handbrakes.

(7) FC crewmen 2 and 3 raise the retractable portions of the rear leveling jacks to their upper limits, pull up and hold the vertical lock levers, and rotate the jacks to the horizontal positions. They then release the vertical lock levers, push and hold the horizontal lock levers, rotate the jacks under the trailer, and release the horizontal lock levers.

(8) FC crewmen 2 and 3 raise the retractable portion of the front support jack to its upper limit and store the jack crank in its storage clip. They then pull out the spring-loaded frame handle and, using the jack handle, rotate the jack rearward and upward until the spring-loaded frame handle engages the holes in the top of the lunette mounting bracket.

(9) FC crewmen 1, 2, and 3 retrieve the data and power cables and load them on the truck.

(10) FC crewman 1 checks that the load in the truck is properly secured and, assisted by FC crewmen 2 and 3, checks that running lights, blackout lights, turn signal indicators, trailer brakes, etc. are functioning properly before moving out in column.

### Section III. IMPROVED BATTERY CONTROL CENTRAL

#### 5-7. General

The vehicle which transports the IBCC also tows the trailer-mounted generator set that provides power to the command and acquisition section equipment. Emplacement of the IBCC takes place after the generator set has been uncoupled and the IBCC site has been reached. Since the IBCC remains on the truck, to prepare it for operation only two men are required, a fire control (FC) crewman (MOS 16E) and an FC mechanic (MOS 24E). Except for mounting the siren and connecting power and data cables, each man works independently of the other.

#### 5-8. Emplacement

##### a. FC Crewman.

(1) Lowers the truck tailgate, mounts to the bed of the truck, opens the IBCC door, opens the air vent covers on the inside and outside of the IBCC door, and proceeds to the right side of the TCA's chair.

(2) Removes the bolts holding the siren to the floor, using a 7/16-inch, open-end wrench.

(3) Removes the siren and passes it up to the FC mechanic on top of the IBCC.

(4) Replaces the bolts that hold the siren to the floor.

(5) Unstraps the chair from the floor in front of the TCA control panel as follows:

(a) At the tiedown device, releases the strap-buckle catch.

(b) Disengages the buckle from the hook.

(c) Pushes the straps and buckles through the two handles on the chair.

(d) Using a screwdriver, sets the screwdriver adjustment at OPEN.

(e) Releases the strap brass plug.

(f) Using a screwdriver, sets the screwdriver adjustment at PLUG.

(g) Stores the chair tiedown kit.

(6) Repeats steps (5) (a) through (g) above for each chair, in turn, at the TCC control panel, CWTDC, and FCC A and B.

(7) Unstraps the telephone tiedown.

(8) Removes five headsets from the storage box, installs two on the TCC, and one each on FCC A, FCC B, and the CWTDC.

(9) Removes and stores the two TCC supports as follows:

(a) Removes the upper locking pin from the right support bracket and disengages the support from the bracket.

(b) Removes the lower locking pin from the clamp and reduces the length of the support.

(c) Stores the support in the storage clamp.

(d) Repeats (a) through (c) above for the left support.

(10) Assists the FC mechanic in connecting the power and all data cables.

*Note.* The IBCC is now ready for performance of procedures prior to application of power, positioning of controls prior to application of power, and energizing procedures as described in TM 9-1430-526-12-1.

#### *b. FC Mechanic.*

(1) Mounts the IBCC, using the footholds provided at the rear right corner of the IBCC.

(2) Receives the siren from the FC crewman.

(3) Removes the bolts from the siren mount plate, using a 7/16-inch open-end wrench.

(4) Places attach holes on the siren over the holes in the plate.

(5) Places the bolts through the attach holes and secures the siren to the siren mount plate.

(6) Opens the siren receptacle on the side of the IBCC and connects the siren cable to it.

(7) Raises the condenser air discharge door on the air conditioner.

(8) Dismounts the IBCC, using the footholds provided.

(9) Removes the ground rod and cable from under FCC B and the CWTDC in the IBCC.

(10) Connects the ground cable to the IBCC ground-cable connector.

(11) Drives the ground rod into the earth near the IBCC ground-cable connector.

(12) Connects the ground cable to the ground rod.

(13) Rolls out the power cable to the generator.

(14) Connects the power and all data cables at the IBCC cable entry panel with assistance of the FC crewman as they are brought from other items of equipment.

#### **5-9. March Order**

All equipment controlled by the IBCC must be in local control, the IBCC deenergized, and power removed at the generator before march order is performed.

##### *a. FC Crewman.*

(1) Assists the FC mechanic in disconnecting the power and all data cables, and in rolling the power cable on its reel.

(2) Straps the telephone tiedown.

(3) Removes the five headsets from the five consoles and stores them in the storage box.

(4) Straps the chair to the floor in front of the FCC A as follows:

(a) At the tiedown device, uses a screwdriver to set the screwdriver adjustment at OPEN.

(b) Inserts the strap brass plug into the hole provided in the tiedown device.

(c) Sets the screwdriver adjustment at LOCK.

(d) Inserts the two straps and buckles through the two handles on the chair and engages the buckles with the hook.

(e) Pulls the two straps through the two buckles until equal tension is applied.

(5) Repeats steps (a) through (e) above for chairs at FCC B, CWTDC, TCC control panel, and TCA control panel, in turn.

(6) Installs the two TCC supports as follows:

(a) Disengages the right support from the storage clamp.

(b) Extends the support, engages it with the support bracket, and inserts the upper locking pin.

(c) Inserts the lower locking pin in the clamp.

(d) Repeats (a) through (c) above for the left support.

(7) Closes and secures the air vents on the front and rear sides of the IBCC shelter door.

(8) Receives the siren from the FC mechanic.

(9) Removes the siren-attaching bolts from the floor at the right side of the TCA's chair, using a 7/16-inch, open-end wrench.

(10) Places attach holes on the siren over the holes in the floor.

(11) Inserts bolts through the attach holes and secures the siren to the floor.

##### *b. FC Mechanic.*

(1) Disconnects the power and all data cables and caps connectors and receptacles with protective caps and rolls the power cable on its reel with assistance of FC crewman.

(2) Disconnects the ground cable from the IBCC ground cable connector and ground rod and removes the ground rod from the earth.

(3) Stores the ground rod and cable in the clamps provided under FCC B and CWTDC in the IBCC.

(4) Disconnects the siren cable connector and replaces the receptacle cap.

(5) Mounts the IBCC, using the footholds provided at the rear right corner of the IBCC.

(6) Removes the bolts holding the siren to the top of the IBCC, using a 7/16-inch, open-end wrench.

(7) Removes the siren and hands it to the FC crewman.

(8) Replaces the bolts in the siren mount plate.

(9) Closes the condenser air discharge door on the air conditioner.

(10) Descends from the top of the IBCC.

(11) Closes and secures the IBCC shelter door when the FC crewman has secured the siren.

(12) Raises and secures the truck tailgate.

(13) FC crewman gets in, starts the engine, and drives the truck to the area where the generator

it tows is emplaced and couples to it as described in paragraph 5-24.

(14) FC crewman, assisted by the generator operator checks that running lights, blackout lights, turn signal indicators, trailer brakes, etc. are functioning properly before moving out.

## Section IV. IMPROVED PULSE ACQUISITION RADAR

### 5-10. General

The trailer-mounted IPAR is parked so that the antenna pedestal is directly over the reference stake driven into the ground during reconnaissance and selection of position. Emplacement and march order require five men, one FC mechanic, and four FC crewmen.

### 5-11. Emplacement

(1) FC crewman 1 sets the handbrakes at the front of the trailer and then joins the FC mechanic at the front support jack.

(2) The FC mechanic supports the front support jack with the jack handle while FC crewman 1 pulls upward on the spring-loaded frame handle. Both men lower the jack to the down position insuring that the ends of the spring-loaded frame handle engage the holes in the bracket and spindle assembly. They then disengage the jack crank from the storage clip and lower the retractable portion of the jack by turning the jack crank clockwise until the wheels are firmly on the ground.

(3) FC crewmen 2 and 3 each removes leveling jack cranks from storage at the center rear of the trailer.

(4) FC crewmen 2 and 3 install the cranks on the rear leveling jacks and push forward and hold the horizontal lock levers. They then rotate the jacks into position for vertical movement, release the horizontal lock levers, pull up and hold the vertical lock levers, and rotate the jacks into the vertical position. Next they release the vertical lock levers, and lower the retractable portion of each jack by turning the jack crank clockwise until the pads are about 3 inches from the ground.

(5) FC crewman 4 removes the intervehicular cable connector from the receptacle at the rear of the truck and installs it in the bracket provided on the drawbar. He then closes the service coupling shutoff cock, removes the air line connector, and installs it in the receptacle provided on the drawbar. Next he removes the safety chain hooks and installs them on the handgrip bars provided on the drawbar, mounts the truck cab to the driver's seat, and waits for instructions from the FC mechanic.

### b. Step 2.

(1) The FC mechanic removes the pintle hook lock pin and opens the pintle hook at the rear of the truck.

(2) FC crewman 1 lowers the retractable portion of the front support jack until the lunette is raised off the pintle hook.

(3) FC crewman 4 drives the truck forward to clear the pintle hook from the lunette when directed by the FC mechanic, stops the truck, dismounts, moves to the rear of the truck, closes the pintle hook, and replaces the pintle hook lock pin.

(4) FC crewmen 1 through 4 unload all equipment from the bed of the truck under direction of the FC mechanic.

*Note.* Substeps (3) and (4) above may be modified to leave the antenna reflector containers on the truck and to park the truck about 1 meter away on the curbside of the IPAR trailer. This will facilitate handling the antenna reflectors during the emplacement procedures. If the containers are off-loaded, they may be used as stands for the same purpose and to support test equipment during the time that the position is occupied. Off-loading the containers will free the truck for other usage while the position is occupied until needed for march order.

### c. Step 3.

(1) FC crewman 2 checks that the antenna SAFE / OPERATE switch is set at SAFE, climbs to the top of the IPAR, and checks that the ANTENNA STOWLOCK is set at ENGAGED.

(2) The FC mechanic and FC crewman 1 pull up and hold the horizontal lock lever at the front center leveling jack and rotate the jack in position for vertical movement. They then release the horizontal lock lever, pull up and hold the vertical lock lever and rotate the jack to a vertical position, and release the vertical lock lever.

(3) FC crewman 1 removes the jack crank from the A-frame at the front of the trailer, installs the crank on the front center leveling jack, and lowers the retractable portion of the jack until the pad is firmly on the ground.

(4) The FC mechanic at the front center leveling jack and FC crewmen 1 and 3 at the rear leveling jacks lower the retractable portion of each jack until the trailer wheels are approximately 2 inches off the ground.

(5) FC crewman 2 directs the raising or lowering of the front center and rear leveling jacks by the FC mechanic and FC crewmen 1 and 3 until the bubble rests in the center of the bull's-eye level at the base of the antenna pedestal.

(6) The FC mechanic and FC crewman 1 pull up and hold the vertical lock levers at the front corner stabilizing jacks. They then rotate the jacks to the vertical position, release the vertical lock levers, install the jack cranks, and lower the retractable portion of each jack until the pads just clear the ground.

*d. Step 4.*

(1) FC crewman 3 climbs to the top of the IPAR to join FC crewman 2, and disengages the azimuth stowlock.

(2) FC crewman 2 removes the hexagon-head capscrew wrench from the bracket at the antenna pedestal and hands it down to the FC mechanic.

(3) The FC mechanic and FC crewmen 1 and 4 at antenna reflector containers No. 9192545 remove the four hexagon-head capscrews, flat washers, and lockwashers from the attach holes. They then hand the capscrew wrench, capscrews, flat washers, and lockwashers to FC crewman 2 and remove the center section of the antenna reflector and hand it up to FC crewman 2 and 3.

(4) FC crewmen 2 and 3 place the center section of the antenna reflector on the antenna reflector support and secure it with the capscrews, flat washers, and lockwashers, and store the hexagon-head capscrew wrench in its bracket on the antenna pedestal.

(5) The FC mechanic and FC crewmen 1 and 4 release the four captive fasteners on antenna reflector containers Nos. 9180247 and 10672192 and remove the tops of the containers.

(6) FC crewman 3 removes the antenna reflector spanner wrench from its bracket on the antenna pedestal for use when securing the rest of the antenna reflector sections.

(7) At container 10672192, FC crewmen 1 and 4 loosen and disengage the five joint nuts from the joint studs; remove the left inner section of the antenna reflector from the container, and hand it up to FC crewmen 2 and 3.

(8) FC crewmen 2 and 3 position the left inner section of the antenna reflector on the five joint studs on the left side of the center section of the antenna reflector and secure it by tightening the joint nuts onto the joint studs.

(9) At container 9180247, FC crewmen 1 and 4 repeat the actions described in (7) above for the right inner section of the antenna reflector.

(10) FC crewmen 2 and 3 repeat the actions

described in (8) above for installation of the right inner section of the antenna reflector.

(11) At container No. 10672192, FC crewmen 1 and 4 loosen and disengage the five joint nuts from the joint studs, remove the left outer section of the antenna reflector, and hand it up to FC crewmen 2 and 3.

(12) FC crewmen 2 and 3 position the left outer section of the antenna reflector on the left side of the inner section and secure it by tightening the joint nuts onto the joint studs.

(13) At container No. 9180247, FC crewmen 1 and 4 repeat the actions described in (11) above for the right outer section of the antenna reflector.

(14) FC crewmen 2 and 3 repeat the actions described in (12) above for installation of the right outer section of the antenna reflector.

(15) At container 10672192, FC crewmen 1 and 4 remove the omnidirectional antenna as follows:

(a) Loosen the three wingnuts that secure the small rubber-lined bar and slide the bar up.

(b) Loosen the three wingnuts that secure the base adjustable bracket and slide the bracket down.

(c) Loosen the two wingnuts that secure the adjustable bracket and slide away from the stationary bracket.

(d) Lift the omnidirectional antenna out of the stationary bracket and hand it up to FC crewmen 2 and 3.

(16) FC crewmen 2 and 3 install the omnidirectional antenna as follows:

(a) Align the antenna on the antenna mount and secure it with the four captive screws.

(b) Disconnect the antenna cable from the two dummy receptacles.

(c) Pass one end of the antenna cable through the antenna and connect it to the connector adapter.

(d) Connect the other end of the antenna cable to the receptacle on the amplifier-cooler group.

(e) Remove the two cable clamps from the main antenna center section support, insert the cable in them, and reinstall the clamps on the support.

(17) FC crewmen 2 and 3 manually rotate the antenna until the reflector rests over the receiver-transmitter group.

*Note.* The procedures in (18) through (21) below are omitted if the feedhorn has not been removed during march order.

(18) FC crewmen 2 and 3 prepare the an-

tenna reflector support for installation of the feedhorn as follows:

(a) Remove the two hexagon-head bolts securing the waveguide support bracket to the waveguide cover plate.

(b) Remove the four hexagon-head nuts and capscrews, lockwashers and flat washers securing the waveguide support bracket to the antenna reflector support. Retain the small hardware for use as described in (21) (a) below.

(c) Remove the 10 hexagon-head nuts and capscrews, lockwashers, and flat washers securing the waveguide cover plate to the waveguide twist flange. Retain the small hardware for use as described in (21) (b) below.

(d) Hand the waveguide support bracket, waveguide cover plate, and the two bolts removed as described in (a) above to FC crewmen 1 and 4.

(19) At container No. 9180247, FC crewmen 1 and 4 loosen the four wing-type screws and four wingnuts that secure the adjustable clamps to the feedhorn and turn the clamps; remove the feedhorn from the container and hand it up to FC crewmen 2 and 3; and receive the waveguide support bracket, waveguide cover plate, and two hexagon-head bolts from FC crewmen 2 and 3.

(20) At container No. 9180247, FC crewmen 1 and 4 place the waveguide cover plate on the feedhorn flange plate, position the four clamps over the cover plate and secure by tightening the four wingnuts; and place the waveguide support bracket on the waveguide cover plate and secure using the two hexagon-head bolts.

(21) FC crewmen 2 and 3 install the feedhorn on the antenna reflector support as follows:

(a) Secure the feedhorn bracket on the antenna support using the small hardware removed as described in (18) (b) above. Do not completely tighten the nuts.

(b) Secure the feedhorn flange to the waveguide twist flange using the small hardware removed as described in (18) (c) above. Tighten the small hardware used to secure the feedhorn bracket to the antenna support as described in (a) above.

(c) Remove the cover from the feedhorn receptacle, remove the RF cable from the dummy receptacle, and connect it to the feedhorn receptacle.

(22) FC crewman 2 stores the antenna reflector spanner wrench in the bracket provided on the antenna pedestal.

(23) FC crewmen 2 and 3 descend to the ground.

*e. Step 5.*

(1) The FC mechanic and FC crewman 1

remove the ground rod and cable from storage between the receiver-transmitter group cabinet and the antenna pedestal, drive the ground rod into the earth near the ground rod cable connector on the IPAR trailer, and connect the ground cable to the ground rod and trailer.

(2) FC crewmen 1 and 2 connect the power cable and lay it out to the generator.

(3) FC crewmen 3 and 4 connect the data cables and lay them to the IBCC.

*Note.* The IPAR is now ready for performance of procedures prior to application of power, positioning of controls prior to application of power, and energizing procedures as described in TM 9-1430-534-12-1.

**5-12. March Order**

The IPAR must be placed in local control, deenergized, and prepared for march order in accordance with instructions contained in TM 9-1430-534-12-1.

*Note.* If the antenna reflector containers were not off-loaded during emplacement (see note following para 5-11 b(4)), the truck must initially be parked about 1 meter away on the curbside of the IPAR trailer to facilitate handling the antenna reflectors.

*a. Step 1.*

(1) FC crewmen 1 and 2 disconnect the power cable and roll it on its reel.

(2) FC crewmen 3 and 4 disconnect the data cables and roll them on their reels.

(3) The FC mechanic and FC crewman 1 disconnect the ground cable, remove the ground rod from the earth, and store the cable and rod between the receiver-transmitter group and the antenna pedestal.

*b. Step 2.*

*Note.* The procedures described in (1) through (5) below are omitted unless low obstructions on the route of march will damage the feedhorn. It should be determined during route reconnaissance whether the feedhorn must be removed.

(1) FC crewmen 2 and 3 climb to the top of the IPAR, insure that the antenna stow lock is disengaged, and manually rotate the antenna until the reflector rests over the receiver-transmitter group cabinet.

(2) FC crewmen 2 and 3 remove the feedhorn from the antenna reflector support as follows:

(a) Disconnect the RF cable from the feedhorn receptacle, secure the cable to the dummy receptacle on the antenna support, and place the protective cap over the feedhorn receptacle.

(b) Remove the 10 hexagon-head nuts and capscrews, lockwashers, and flat washers that secure the feedhorn flange to the waveguide twist flange. Retain the small hardware for use as described in (4) below.

(c) Remove the four hexagon-head nuts and capscrews, lockwashers, and flat washers that secure the feedhorn bracket to the antenna support. Retain the small hardware for use as described in (4) below.

(d) Remove the feedhorn and hand it down to FC crewmen 1 and 4 and receive the waveguide cover plate, waveguide support bracket, and two hexagon-head bolts from FC crewmen 1 and 4.

(3) At container No. 9180247, FC crewmen 1 and 4 remove the two hexagon-head bolts that secure the waveguide support bracket on the waveguide cover plate. They then remove the waveguide support bracket from the container; hand up the waveguide support bracket, waveguide cover plate, and the two hexagon-head bolts to FC crewmen 2 and 3; and receive the feedhorn from FC crewmen 2 and 3.

(4) FC crewmen 2 and 3 secure the waveguide cover plate to the waveguide twist flange, using the small hardware removed as described in (2)(b) above. They then secure the waveguide support bracket to the antenna reflector support, using the small hardware removed as described in (2)(c) above; and secure the waveguide support bracket to the waveguide cover plate, using the two hexagon-head bolts.

(5) At container No. 9180247, FC crewmen 1 and 4 position the feedhorn on the feedhorn flange plate and support, set the adjustable clamps; secure the feedhorn by hand tightening the four wing-type screws and four wingnuts.

(6) FC crewmen 2 and 3 manually rotate the antenna until the antenna support bracket rests over the receiver-transmitter group cabinet.

(7) FC crewmen 2 and 3 disassemble the omnidirectional antenna as follows:

a) Remove the two clamps that secure the antenna cable to the main center section support.

(b) Separate the cable from the clamps and reinstall the clamps on the support.

(c) Disconnect the cable from the receptacle on the amplifier-cooler group and connect it to one of the two dummy receptacles provided on the center antenna reflector section.

(d) Disconnect the cable from the connector adapter, pull the cable through the antenna, and connect it to the other dummy receptacle.

(e) Release the four captive screws, remove the antenna from the antenna mount, and hand it down to FC crewmen 1 and 4.

(8) At container 10672192, FC crewmen 1 and 4 install and secure the omnidirectional antenna as follows:

(a) Place the base of the antenna in the stationary bracket.

(b) Slide the adjustable bracket toward the stationary bracket until the top of the antenna rests on the lip of the adjustable bracket, and tighten the two wingnuts.

(c) Slide the small rubber-lined bar down until it presses snugly against the antenna, and tighten the three wingnuts.

(d) Slide the base adjustable bracket up until it fits snugly against the base of the antenna, and tighten the three wingnuts.

(9) FC crewman 2 removes the antenna reflector spanner wrench from its bracket on the antenna pedestal for use in removing the outer and inner sections of the antenna reflector.

(10) FC crewmen 2 and 3 loosen and disengage the five joint nuts from the joint studs on the right outer section of the antenna reflector, remove the outer section, and hand it down to FC crewmen 1 and 4.

(11) FC crewmen 1 and 4 store the right outer section of the antenna reflector in container No. 9180247 by positioning the five joint nuts over the joint studs on the container and hand tightening the joint nuts onto the joint studs.

(12) FC crewmen 2 and 3 repeat the actions described in (10) above for removing the left outer section of the antenna reflector.

(13) FC crewmen 1 and 4 repeat the actions described in (11) above for storing the left outer section of the antenna reflector in container No. 10672192.

(14) FC crewmen 2 and 3 repeat the action described in (10) above for removing the right inner section of the antenna reflector.

(15) FC crewmen 1 and 4 repeat the actions described in (11) above for storing the right inner section of the antenna reflector in container No. 9180247; position the container top in place, and secure it with the four captive fasteners.

(16) FC crewmen 2 and 3 repeat the actions described in (10) above for removing the left inner section of the antenna reflector.

(17) FC crewmen 1 and 4 repeat the actions described in (11) above for storing the left inner section of the antenna reflector in container No. 10672192; position the container top in place, and secure it with the four captive fasteners.

(18) FC crewman 2 stores the antenna reflector spanner wrench on its bracket while FC crewman 3 removes the hexagon-head capscrew wrench from its bracket.

(19) FC crewmen 2 and 3 remove the four hexagon-head capscrews, flat washers, and lockwashers which hold the center section of the antenna reflector in place. They then remove the center section and hand it to the FC mechanic and

FC crewmen 1 and 4 below; hand the wrench, capscrews, and washers to the FC mechanic below; manually rotate the antenna until the antenna support bracket rests over the receiver-transmitter group cabinet; and engage the antenna stow lock.

(20) The FC mechanic and FC crewmen 1 and 4 turn the center section of the antenna reflector face down, place it in its container, check that the top crossmember of the center section rests on the supports provided, and secure the center section with the four capscrews and washers.

(21) The FC mechanic hands the hexagon-head capscrew wrench to FC crewman 2 who stores it in its bracket.

(22) FC crewmen 2 and 3 descend to the ground.

*c. Step 3.*

(1) FC crewmen 1, 2, 3, and 4 load all equipment into the truck bed under the direction of the FC mechanic.

(2) FC crewman 4 gets in the truck and starts the engine.

(3) The FC mechanic guides FC crewman 4 in backing the truck until the pintle hook is within a few inches of the trailer-lunette, removes the pintle hook lock pin, and opens the pintle hook.

(4) FC crewman 1 removes the jack crank from the trailer A-frame and FC crewman 2 removes the jack cranks from the rear center of the trailer.

(5) The FC mechanic and FC crewman 1 raise the retractable portion of the center leveling jack to its upper limit and pull up and hold the vertical lock lever. They then rotate the jack to the horizontal position, release the vertical lock lever, push and hold the horizontal lock lever, rotate the jack under the trailer, and release the horizontal lock lever.

(6) The FC mechanic and FC crewman 1 at the front corner stabilizing jacks and FC crewmen 2 and 3 at the rear leveling jacks, install the jack cranks and raise the retractable portions of the jacks until the tires touch the ground.

(7) The FC mechanic and FC crewman 1 raise the retractable portions of the front corner stabilizing jacks to their upper limits, pull up and hold the vertical lock levers, rotate the jacks to their horizontal positions, and release the vertical lock levers.

(8) FC crewmen 2 and 3 raise the retractable

portions of the rear leveling jacks until the jack pads are about 3 inches off the ground.

(9) FC crewman 1, directed by the FC mechanic, raises or lowers the retractable portion of the front support jack until the trailer lunette is at the proper level for coupling with the pintle hook.

(10) FC crewman 4 backs the truck, as directed by the FC mechanic, until the pintle hook is in position to engage the lunette.

(11) The FC mechanic directs FC crewman 1 to raise the retractable portion of the front support jack until the lunette rests on the lower half of the pintle hook, closes the pintle hook, and replaces the pintle hook lock pin.

(12) FC crewman 4 dismounts, moves to the rear of the truck, removes the intervehicular cable connector from its bracket on the trailer drawbar and installs it in the receptacle on the truck. He then removes the air line connector from its bracket on the trailer drawbar and installs it in the receptacle on the truck. Next he opens the service coupling shutoff cock, removes the safety chain hooks from the handgrip bars on the drawbar, and engages the safety chain hooks on the bars provided on the truck.

(13) FC crewmen 2 and 3 raise the retractable portions of the rear leveling jacks to their upper limits and pull up and hold the vertical lock levers. They then rotate the jacks to the horizontal positions, release the vertical lock levers, push and hold the horizontal lock levers, rotate the jacks under the trailer, and release the horizontal lock levers.

(14) FC crewman 1 checks to insure that the trailer handbrakes are released.

(15) The FC mechanic and FC crewman 1 raise the retractable portion of the front support jack to its upper limit and store the jack crank in its storage clip. They then pull out the spring-loaded frame handle and, using the jack handle, rotate the jack rearward and upward until the spring-loaded frame handle engages the holes in the top of the lunette mounting bracket.

(16) FC crewman 4 checks that the load on the truck is properly secured, and, assisted by FC crewmen 2 and 3, checks that running lights, blackout lights, turn signal indicators, trailer brakes, etc. are functioning properly before moving out.

## Section V. IMPROVED CONTINUOUS-WAVE ACQUISITION RADAR

### 5-13. General

The trailer-mounted ICWAR is parked so that the

antenna pedestal is directly over the stake driven into the ground to mark its emplacement site

during reconnaissance and selection of position. Emplacement and march order require three men, one ICWAR-ICC mechanic and two FC crewmen.

#### 5-14. Emplacement

##### a. Step 1.

(1) The ICWAR-ICC mechanic and FC crewman 1 set the handbrakes at the front of the trailer frame.

(2) FC crewman 2 removes a leveling jack crank from the left fender well of the trailer.

(3) FC crewmen 1 and 2 install the leveling jack crank on the rear leveling jack crankshaft, turn the crank counterclockwise until tension on the staybars is relieved, remove the staybars; pull out and hold the two spring-loaded retaining pins, and rotate the leveling jack downwards, using the handgrip provided. They then release the retaining pins, turn the leveling jack crank clockwise until the leveling jack pad is about 2 inches from the ground, and cross the staybars over the rear leveling jack support frame.

(4) FC crewmen 1 and 2 remove the straps securing the front leveling jacks to the pads and strap assemblies, pull out and hold the two spring-loaded retaining pins, rotate the leveling jacks to the down position, using the handgrips, and release the retaining pins.

(5) FC crewman 2 removes two additional leveling jack cranks from the left rear fender well.

(6) FC crewmen 1 and 2 install the leveling jack cranks, turn the leveling jack cranks clockwise until the front leveling jack pads rest firmly on the ground, remove the two safety chains from the lifting shackles at the rear of the truck, and store them on the trailer frame lifting handles.

(7) FC crewman 2 closes the service coupling shutoff cock at the right rear of the truck, disconnects the airbrake hose and stores it in the bracket on the right side of the lunette support, gets in the truck cab, and starts the engine.

(8) FC crewman 1 removes the intervehicular cable from the receptacle at the left rear of the truck and stores it in the bracket on the left side of the lunette support.

(9) The ICWAR-ICC mechanic removes the pintle hook locking pin at the rear of the truck and opens the pintle hook.

(10) The ICWAR-ICC mechanic and FC crewman 1 turns the front leveling jack cranks clockwise until the trailer lunette is free from the pintle hook.

(11) FC crewman 2, when directed by the ICWAR-ICC mechanic, drives the truck forward until the pintle hook is cleared, stops the truck, and dismounts.

(12) THE ICWAR-ICC mechanic closes the pintle hook and replaces the pintle hook locking pin.

(13) FC crewman 1 turns the rear leveling jack crank clockwise until the jack pad is firmly on the ground.

##### b. Step 2.

(1) The ICWAR-ICC mechanic and FC crewman 1 untie the antenna protective cover cords, remove the cover, and store it in a protected area near the ICWAR.

(2) FC crewman 1 releases the antenna azimuth stow lock.

(3) FC crewman 1 removes the ground rod from the ground rod stow brackets and cable from the left rear fender well, drives the ground rod into the ground at the right rear of the trailer, and connects the ground cable to the trailer and ground rod.

(4) FC crewmen 1 and 2 lay the power cable to the generator and the ICWAR-ICC mechanic connects the power cable to the power receptacle at the cable entry panel.

(5) FC crewmen 1 and 2 lay the data cable to the ICC or IPCP and the ICWAR-ICC mechanic connects the data cable to the receptacle at the cable entry panel.

(6) The ICWAR-ICC mechanic and FC crewmen 1 and 2 turn the leveling jack cranks clockwise until the trailer tires are at least 1 inch off the ground.

(7) The ICWAR-ICC mechanic mounts the ICWAR, opens and secures the receiver-transmitter cabinet cover, and directs FC crewmen 1 and 2 to raise or lower appropriate leveling jacks until the spirit level bubbles in the cabinet are centered. He then rotates the antenna 1,600 mils in azimuth, checks that the bubbles are still centered, and dismounts from the ICWAR.

(8) FC crewmen 1 and 2 remove the leveling jack cranks and store them in the rear left fender well.

*Note.* The ICWAR is now ready for performance of procedures prior to application of power, positioning of controls prior to application of power, and energizing procedures as described in TM 9-1430-528-12-1.

#### 5-15. March Order

The ICWAR must be placed in local control, deenergized, power shut off at the generator, and prepared for march order in accordance with information contained in TM 9-1430-528-12-1 and TM 9-1425-525-12-1.

##### a. Step 1.

(1) FC crewmen 1 and 2 disconnect the power cable from the receptacle at the cable entry panel and roll it on its reel.

(2) FC crewmen 1 and 2 disconnect the data cable from the receptacle at the cable entry panel and roll it on its reel.

(3) The ICWAR-ICC mechanic disconnects the ground cable from the trailer and ground rod, removes the ground rod from the earth, and stores the ground rod and cable.

*b. Step 2.*

(1) FC crewman 2 removes the leveling jack cranks from the left fender well and installs a crank on each jack. He then gets in the truck, starts the engine, and backs the truck, under the direction of the ICWAR-ICC mechanic, until the pintle hook is within a few inches of the lunette.

(2) FC crewman 1 turns the rear leveling jack crank counterclockwise until the jack pad is clear of the ground.

(3) The ICWAR-ICC mechanic removes the pintle hook locking pin, opens the pintle hook at the rear of the truck, and directs FC crewman 1 to raise or lower the front leveling jacks until the lunette is in position to be engaged by the pintle hook.

(4) The ICWAR-ICC mechanic directs FC crewman 2 to back the truck until the pintle is in position to engage the lunette.

(5) The ICWAR-ICC mechanic and FC crewman 1 retract the front leveling jacks until the lunette rests on the lower half of the pintle hook.

(6) The ICWAR-ICC mechanic closes the pintle hook and replaces the pintle hook locking pin.

*c. Step 3.*

(1) FC crewman 2 removes the airbrake hose from the bracket on the right side of the lunette support, connects it to the airbrake hose coupling on the truck, and opens the service coupling shutoff cock.

(2) FC crewman 1 removes the intervehicular

cable from the bracket on the left side of the lunette support and connects it to the receptacle on the truck.

(3) FC crewmen 1 and 2 remove the two safety chain hooks from the trailer frame lifting handles and hook them on the lifting shackles at the rear of the truck.

(4) FC crewmen 1 and 2 retract the front leveling jacks by turning the cranks counterclockwise, remove the leveling jack cranks, and store them in the left fender well.

(5) FC crewmen 1 and 2 at each of the front leveling jacks pull out and hold the two spring-loaded retaining pins, rotate the jack upward, position the jack on the pad and strap assembly, release the retaining pins, and secure the jack with the strap.

(6) FC crewmen 1 and 2 pull out and hold the two spring-loaded retaining pins at the rear leveling jack, rotate the jack to the vertical position, release the retaining pins, position the staybars, and turn the jack crank clockwise until the staybars are tight.

(7) FC crewman 2 removes the jack crank and stores it in the left fender well.

(8) The ICWAR-ICC mechanic and FC crewman 1 replace the antenna protective cover, rotate the antenna in azimuth until it faces roadside, and engage the azimuth stow lock while FC crewman 2 checks that the trailer handbrakes are released.

(9) FC crewman 2 checks that the load on the truck is properly secured, and, assisted by FC crewman 1 and the ICWAR-ICC mechanic checks that running lights, blackout lights, turn signal indicators, trailer brakes, etc. are functioning properly before moving out.

## Section VI. IMPROVED RANGE-ONLY RADAR

### 5-16. General

The trailer-mounted IROR is parked so that the antenna pedestal is directly over the stake driven into the ground to mark its emplacement site during reconnaissance and selection of position. Emplacement and march order require three men; one FC mechanic and two FC crewmen.

### 5-17. Emplacement

*a. Step 1.*

(1) The FC mechanic and FC crewman 1 set the handbrakes at the front of the trailer frame.

(2) FC crewman 2 removes a leveling jack crank from the left fender well of the trailer.

(3) FC crewmen 1 and 2 install the leveling jack crank on the rear leveling jack crankshaft, turn the crank counterclockwise until tension on the staybars is relieved, and remove the staybars. They then pull out and hold the two spring-loaded retaining pins and rotate the leveling jack downwards, using the handgrip provided. They next release the retaining pins, turn the leveling jack crank clockwise until the leveling jack pad is about 2 inches from the ground, and cross the staybars over the rear leveling jack support frame.

(4) The FC mechanic mounts the IROR, disengages the elevation stow lock, and manually elevates the antenna to 1,600 mils. He then

disconnects the securing straps from the back of the antenna, removes the antenna protective cover taking care not to damage the waveguide assembly, dismounts from the IROR, and stores the cover in a protected area.

(5) FC crewmen 1 and 2 remove the straps securing the front leveling jacks to the pad and strap assemblies; pull out and hold the two spring-loaded retaining pins; rotate the leveling jacks to the down position, using the handgrips; and release the retaining pins.

(6) FC crewman 2 removes two additional leveling jack cranks from the left rear fender well.

(7) FC crewmen 1 and 2 install the leveling jack cranks and turn the leveling jack cranks clockwise until the front leveling jack pads rest firmly on the ground. They then remove the two safety chains from the lifting shackles at the rear of the truck and store them on the trailer frame lifting handles.

(8) FC crewman 2 closes the service coupling shutoff cock at the right rear of the truck, disconnects the airbrake hose and stores it in the bracket on the right side of the lunette support, gets in the truck and starts the engine.

(9) FC crewman 1 removes the intervehicular cable from the receptacle at the left rear of the truck and stores it in the bracket on the left side of the lunette support.

(10) The FC mechanic removes the pintle hook locking pin at the rear of the truck and opens the pintle hook.

(11) The FC mechanic and FC crewman 1 turn the front leveling jack cranks clockwise until the trailer lunette is free from the pintle hook.

(12) FC crewman 2, when directed by the FC mechanic, drives the truck forward until the pintle hook is cleared, stops the truck, and dismounts.

(13) The FC mechanic closes the pintle hook and replaces the pintle hook locking pin.

(14) FC crewman 1 turn the rear leveling jack crank clockwise until the jack pad is firmly on the ground.

*b. Step 2.*

(1) FC crewman 1 removes the ground rod from the ground rod stow brackets and cable from the rear left fender well, drives the ground rod into the ground at the right rear of the trailer, and connects the ground cable to the trailer and ground rod.

(2) FC crewmen 1 and 2 lay the power cable to the generator.

(3) The FC mechanic connects the power cable to the power receptacle at the cable entry panel.

(4) FC crewmen 1 and 2 lay the data cables to the IBCC.

(5) The FC mechanic connects the data cables to the receptacles at the cable entry panel.

(6) The FC mechanic and FC crewmen 1 and 2 turn the leveling jack cranks clockwise until the trailer tires are at least 1 inch off the ground.

(7) The FC mechanic mounts the IROR, uncovers the two spirit levels, and directs FC crewmen 1 and 2 to raise or lower appropriate jacks until the bubbles are centered in the spirit levels. He then releases the azimuth stow lock, manually rotates the antenna 1,600 mils clockwise, and checks the levels.

(8) FC crewmen 1 and 2 remove the leveling jack cranks and store them in the rear left fender well.

*Note.* The IROR is now ready for performance of procedures prior to application of power, positioning of controls prior to application of power, and energizing procedures as described in TM 9-1430-529-12-1.

### 5-18. March Order

The IROR must be placed in local control, deenergized, and prepared for march order in accordance with information in TM 9-1430-529-12-1.

*a. Step 1.*

(1) FC crewmen 1 and 2 disconnect the power cable from the receptacle at the cable entry panel and roll it up on its reel.

(2) FC crewmen 1 and 2 disconnect the data cables from the receptacles at the cable entry panel and roll them up on their reels.

(3) The FC mechanic disconnects the ground cable from the trailer and ground rod, removes the ground rod from the earth, and stores the ground rod in the ground rod stow brackets and cable in the rear left fender well.

(4) The FC mechanic retrieves the antenna protective cover, mounts the IROR, elevates the antenna to 1,600 mils, mounts the cover on the antenna and secures it. He then depresses the antenna to 0 mils elevation and engages the elevation stow lock, turns the antenna in azimuth so that it faces curbside, engages the azimuth stow lock, and dismounts from the IROR.

*b. Step 2.*

(1) FC crewman 2 removes the leveling jack cranks from the left fender well, and installs a crank on each jack. He then gets in the truck, starts the engine, and backs the truck under the direction of the FC mechanic until the pintle hook is within a few inches of the lunette.

(2) FC crewman 1 turns the rear leveling jack crank counterclockwise until the jack pad is clear of the ground.

(3) The FC mechanic removes the pintle hook locking pin and opens the pintle hook at the rear of

the truck and directs FC crewman 1 to raise or lower the front leveling jacks until the lunette is in position to be engaged by the pintle hook.

(4) The FC mechanic directs FC crewman 2 to back the truck until the pintle hook is in position to engage the lunette.

(5) The FC mechanic and FC crewman 1 retract the front leveling jacks until the lunette rests on the lower half of the pintle hook.

(6) The FC mechanic closes the pintle hook and replaces the pintle hook locking pin.

*c. Step 3.*

(1) FC crewman 2 removes the airbrake hose from the bracket on the right side of the lunette support, connects it to the airbrake hose coupling on the truck, and opens the service coupling shutoff cock.

(2) FC crewman 1 removes the intervehicular cable from the bracket on the left side of the lunette support and connects it to the receptacle on the truck.

(3) FC crewmen 1 and 2 remove the two safety chain hooks from the trailer frame lifting handles and hook them on the lifting shackles at the rear of the truck.

(4) FC crewmen 1 and 2 retract the front

leveling jacks by turning the cranks counterclockwise, remove the leveling jack cranks, and store them in the left fender well.

(5) FC crewmen 1 and 2, at each of the front leveling jacks, pull out and hold the two spring-loaded retaining pins; rotate the jack upward; position the jack on the pad and strap assembly; release the retaining pins; and secure the jack with the strap.

(6) FC crewmen 1 and 2 pull out and hold the two spring-loaded retaining pins at the rear leveling jack, rotate the jack to the vertical position, release the retaining pins, position the staybars, and turn the jack crank clockwise until the staybars are tight.

(7) FC crewman 2 removes the jack crank and stores it in the left fender well.

(8) FC mechanic checks that the trailer handbrakes are released.

(9) FC crewman 2 checks that the load on the truck is properly secured and, assisted by the FC mechanic and FC crewman 1, checks that running lights, blackout lights, turn signal indicators, trailer brakes, etc., are functioning properly before moving out.

## Section VII. IMPROVED PLATOON COMMAND POST

### 5-19. General

The trailer-mounted IPCP is parked so that the IFF antenna is directly over the stake driven into the ground to mark its site during reconnaissance and selection of position. Emplacement and march order of the IPCP require three FC crewmen.

### 5-20. Emplacement

*a. Step 1.*

(1) FC crewman 1 sets the handbrakes at the front of the trailer, removes the intervehicular cable connector from the receptacle at the rear of the truck, and installs it in the bracket provided on the drawbar. He then closes the service coupling shutoff cock, removes the air line connector, and installs it in the receptacle provided on the drawbar. He next removes the safety chain hooks and installs them on the U-bolts provided on the drawbar, gets in the truck, starts the engine, and waits for instructions from FC crewman 2.

(2) FC crewman 2 supports the front support jack with the jack handle while FC crewman 3 pulls upward on the spring-loaded frame handle. Then both men lower the jack to the down position insuring that the ends of the spring-loaded frame handle engage the holes in the bracket and spindle

assembly. They next disengage the jack crank from the storage clip and lower the retractable portion of the jack by turning the jack crank clockwise until the wheels are firmly on the ground.

(3) FC crewmen 2 and 3 each remove a leveling jack crank from storage at the rear center of the trailer.

(4) FC crewmen 2 and 3 install cranks on the rear leveling jacks, push forward and hold the horizontal lock levers, and rotate the jacks into position for vertical movement. They then release the horizontal lock levers, pull up and hold the vertical lock levers, and rotate the jacks into the vertical position. Next they release the vertical lock levers and lower the retractable portion of each jack by turning the jack crank clockwise until the pads are about 3 inches from the ground.

(5) FC crewman 2 removes the pintle hook lockpin and opens the pintle hook at the rear of the truck.

(6) FC crewman 3 lowers the retractable portion of the front support jack until the lunette is raised off the pintle hook.

(7) FC crewman 1 drives the truck forward to clear the pintle hook from the lunette when directed by FC crewman 2, stops the truck, dismounts,

moves to the rear of the truck, closes the pintle hook, and replaces the pintle hook lockpin.

*b. Step 2.*

(1) FC crewmen 2 and 3 pull up and hold the horizontal lock lever at the front leveling jack, and rotate the jack into position for vertical movement. They then release the horizontal lock lever, pull up and hold the vertical lock lever, rotate the jack into the vertical position, and release the vertical lock lever.

(2) FC crewman 1 removes the jack crank from the A-frame at the front of the trailer, installs the crank on the front leveling jack, and lowers the retractable portion of the jack until the pad is firmly on the ground.

(3) FC crewman 1, 2, and 3 simultaneously lower the retractable portions of the three leveling jacks until the trailer tires are approximately 2 inches off the ground.

*c. Step 3.*

(1) FC crewman 1 mounts to the roof of the IPCP shelter, checks that the ANT SAFE / OPERATE switch is set at ANT SAFE and that the AZ DRIVE SAFE OFF / ON switch is set at SAFE OFF, and releases the two stow bolt assembly handknobs that secure the antenna pedestal in the travel position. He then pushes in the spring-loaded locking pin and raises the handle, releases the locking pin, raises the antenna pedestal to the operating position, and positions and tightens the stow bolt assembly handknobs to secure the antenna pedestal in the operating position. Next he pushes in the springloaded locking pin, lowers the handle and releases the locking pin, and takes post near the spirit levels mounted on the antenna.

(2) FC crewman 1 directs the raising or lowering of the leveling jacks by FC crewmen 2 and 3 until the spirit levels indicate that the antenna is level. He then disengages and secures the azimuth stow lock, rotates the antenna 1,600 mils in azimuth, rechecks antenna level, and descends to the ground.

(3) FC crewman 1 releases and lowers the stairs and opens the air vent and shelter door. He then removes the ground rod and ground cable from storage, drives the ground rod into the earth near the ground cable connector on the trailer, and connects the ground cable to the ground rod and trailer. Next he removes the two 0.9 meter cables from storage in the IPCP and connects one cable between J12 and JO12 and the other cable between J14 and JO14 at the cable entry panel.

(4) FC crewmen 1, 2, and 3 lay the power cable to the generator, connect its end to the cable entry panel, and connect all the data cable ends to

the cable entry panel as they are brought up from the ICWAR and IHIPR.

*Note.* The IPCP is now ready for performance of procedures prior to application of power, positioning of controls prior to application of power, and energizing procedures as described in TM 9-1430-535-12-1.

**5-21. March Order**

All equipment controlled by the IPCP must be in local control, the IPCP deenergized, and power removed at the generator before march order is performed.

*a. Step 1.*

(1) FC crewman 1 mounts to the roof of the IPCP, sets the ANT SAFE / OPERATE switch at SAFE and the AZ DRIVE SAFE OFF / ON switch at SAFE OFF, and rotates the IFF antenna to the traveling position. He then locks the azimuth stow lock, releases the two stow bolt assembly handknobs that secure the antenna in the operating position, and pushes in the spring-loaded locking pin and raises the handle. Next he releases the locking pin, lowers the antenna pedestal to the travel position, and positions and tightens the two stow bolt assembly handknobs to secure the antenna pedestal in the travel position. He then pushes in the spring-loaded locking pin, lowers the handle and releases the locking pin, and descends to the ground.

(2) FC crewmen 2 and 3 disconnect the power and data cables from the receptacles at the cable entry panel and replace the dust covers on the cable ends and receptacles. They then raise the retractable portion of the front leveling jack to its upper limit, pull up and hold the vertical lock lever, and rotate the jack to the horizontal position. Next they release the vertical lock lever, push and hold the horizontal lock lever, rotate the jack under the trailer, release the horizontal lock lever, remove and store the jack crank.

*b. Step 2.*

(1) FC crewmen 2 and 3 raise the retractable portions of the rear leveling jacks until both tires are firmly on the ground and the pads are about 3 inches off the ground.

(2) FC crewman 1 disconnects the ground cable from the rod and trailer, removes the ground rod from the earth, and stores the ground rod and cable. He then removes the two 0.9 meter cables from the receptacles on the cable entry panel and stores them in the IPCP, closes the air vent and door, and raises and secures the stairs.

*c. Step 3.*

(1) FC crewman 1 gets in the truck and starts the engine.

(2) FC crewman 2 guides FC crewman 1 in

backing the truck until the pintle hook is within a few inches of the trailer lunette, removes the pintle hook lockpin, and opens the pintle hook.

(3) FC crewman 3, directed by FC crewman 2, raises or lowers the retractable portion of the front support jack until the trailer lunette is at the proper level for coupling with the pintle hook.

(4) FC crewman 1 backs the truck as directed by FC crewman 2 until the pintle hook is in position to engage the lunette.

(5) FC crewman 2 directs FC crewman 3 to raise the retractable portion of the jack until the lunette rests on the lower half of the pintle hook, closes the pintle hook, then replaces the pintle hook lockpin.

(6) FC crewman 1 dismounts from the truck cab, moves to the rear of the truck, removes the intervehicular cable connector from its bracket on the trailer drawbar and installs it in the receptacle on the truck. He then removes the air line connector from the dummy receptacle on the trailer drawbar and installs it in the receptacle on the truck. He

next opens the service shutoff cock, removes the safety chain hooks from the U-bolts on the drawbar, engages the safety chain hooks on the bars provided on the truck, and releases the trailer handbrakes.

(7) FC crewmen 2 and 3 raise the retractable portions of the rear leveling jacks to their upper limits, pull up and hold the vertical lock levers, and rotate the jacks to the horizontal positions. They then release the vertical lock levers, push and hold the horizontal lock levers, rotate the jacks under the trailer, and release the horizontal lock levers.

(8) FC crewman 2 and 3 raise the retractable portion of the front support jack to its upper limit, and store the jack crank in the storage clip. They then pull out the spring-loaded frame handle and, using the jack handle, rotate the jack rearward and upward until the spring-loaded frame handle engages the holes in the top of the lunette mounting bracket.

(9) FC crewmen 1, 2, and 3 retrieve the power cable and load it on the truck.

## Section VIII. TRAILER-MOUNTED 60-KW OR 45-KW GENERATION SET

### 5-22. General

The drills presented in this section for emplacement and march order of the trailer-mounted 60-kw or 45-kw generator set are also applicable to the firing sections. Emplacement and march order of the generator set require two power generator operators/mechanics, hereafter referred to as operators.

### 5-23. Emplacement

#### a. Step 1.

(1) Operator 1 on the left and operator 2 on the right set the trailer handbrakes.

(2) Operators 1 and 2 support the front support jack, remove the support locking pin, allow the support frame to swing down, and lower the support jack to the vertical position. They then raise the support frame until the locking holes coincide with the locking holes on the front support jack and secure the jack and frame with the support locking pin.

(3) Operator 1 turns the front support jack crank clockwise until the front support jack pad rests firmly on the ground.

(4) Operator 2 closes the service coupling shutoff cock, disconnects the two airbrake hoses from the truck and stores them in the receptacles on the sides of the A-frame, and disconnects the safety chains from the truck and stores them on the A-frame.

(5) Operator 1 disconnects the intervehicular cable from the receptacle on the rear of the truck and stores it in the storage bracket on the A-frame. He then removes the pintle hook locking pin and opens the pintle hook, gets in the truck, starts the engine, and waits for instructions from operator 2.

(6) Operator 2 turns the front support jack crank clockwise until the lunette is free of the pintle hook and directs operator 1 to drive the truck forward.

(7) Operator 1 drives the truck forward until the pintle hook is clear of the lunette, stops the truck, dismounts, closes the pintle hook, and replaces the pintle hook locking pin.

#### b. Step 2.

(1) Operators 1 and 2 remove the ground rod and cable from the trailer, drive the ground rod into the earth near the right rear of the trailer, and connect the ground cable to the trailer, and ground rod.

(2) Operator 1 opens the screen backing door beside the cable entry panel and the rear panel.

(3) Operator 2 opens the side panels.

(4) Operator 1 performs the before-operation checks listed in the operator and organizational maintenance technical manual applicable to the particular generator set issued to the section.

(5) Operator 2 connects the power cables to the generator set as their free ends are brought up by the FC and missile-launcher (ML) crewmen.

**5-24. March Order**

Before the trailer-mounted generator set is march ordered, all equipment to which it supplies power must be deenergized, the engine stopped, and the after-operation checks performed as listed in the applicable technical manual.

**a. Step 1.**

(1) Operator 2 disconnects the power cables and closes the screen backing door beside the cable entry panel and the rear panel.

(2) Operator 1 closes and secures the side panels.

(3) Operators 1 and 2 disconnect the ground cable from the trailer and ground rod, remove the ground rod from the earth, and store the ground rod and cable on the trailer.

(4) Operator 1 gets in the truck; starts the engine; and backs the truck, guided by operator 2, until the pintle hook is within a few inches of the lunette.

(5) Operator 2 removes the pintle hook locking pin and opens the pintle hook.

**b. Step 2.**

(1) Operator 2 raises or lowers the trailer front support jack until the lunette is in position to be engaged by the pintle hook.

(2) Operator 1, guided by operator 2, backs the truck until the pintle is in position to receive the lunette, stops the truck, and dismounts.

(3) Operator 1 raises the front support jack until the lunette rests on the lower half of the pintle

hook, closes the hook, and replaces the pintle hook locking pin.

(4) Operator 1 turns the front support jack crank counterclockwise until the jack is fully retracted.

(5) Operator 2 removes the intervehicular cable from the storage bracket on the A-frame and connects it to the receptacle at the rear of the truck.

(6) Operator 1 removes the two airbrake hoses from the receptacles on the sides of the A-frame, connects them to the couplings on the rear of the truck, and opens the service coupling shutoff cocks.

(7) Operators 1 and 2 remove the support locking pin securing the front support frame to the front support jack and let the support frame swing down. They then swing the front support jack toward the rear, swing the support frame toward the front with the front support jack resting on top of it until the locking holes align with the locking holes on the front support jack, and replace the support locking pin.

(8) Operator 1 on the left and operator 2 on the right remove the safety chain hooks from stowage on the A-frame, connect them to the lifting bars on the truck, and release the trailer handbrakes.

(9) Operator 1 checks that the load on the truck is properly secured and, assisted by operator 2, checks that running lights, blackout lights, turn signal indicators, trailer brakes, etc. are functioning properly before moving out.

## CHAPTER 6

### FIRING SECTIONS

#### Section I. PREPARATION

##### 6-1. General

This chapter describes step-by-step drills for emplacing and march ordering the Improved Hawk firing equipment issued to the firing sections. Repeated use of these drills will produce effective teamwork which will result in the unit being able to become operational or move to a new field position in minimum time.

##### 6-2. Equipment

Firing equipment that is emplaced and march ordered includes the IHIPIR, ILSCB, ILCHR, trailer-mounted pallets, loader-transporter, im-

proved missiles, and generator sets. The generator sets are emplaced and march ordered as described in paragraphs 5-23 and 5-24.

##### 6-3. Personnel

TOE 44-247 authorizes 16 enlisted men in each firing section. A minimum of 23 men are needed to *simultaneously* emplace or march order all of the firing equipment required to become fully operational or move in minimum time. The assembly, service, and maintenance section will provide the additional men required for these purposes.

#### Section II. IMPROVED HIGH-POWERED ILLUMINATOR RADAR

##### 6-4. General

The trailer-mounted, IHIPIR is parked so that the antenna pedestal is directly over the reference stake driven into the ground to mark its emplacement site during reconnaissance and selection of position. Emplacement and march order require three FC crewmen.

##### 6-5. Emplacement

###### a. Step 1.

(1) FC crewman 1 sets the handbrakes at the front of the trailer, removes the intervehicular cable connector from the receptacle at the rear of the truck, and installs it in the bracket provided on the drawbar. He then closes the service coupling shutoff cock, removes the air line connector, and installs it in the receptacle provided on the drawbar. Next he removes the safety chain hooks and uses the turnbuckles to install them on the U-bolts provided on the drawbar, gets in the truck, starts the engine, and waits for instructions from FC crewman 2.

(2) FC crewman 2 supports the front support jack with the jack handle while FC crewman 3 pulls upward on the spring-loaded frame handle. Then both men lower the jack to the down position insuring that the ends of the spring-loaded frame handle engage the holes in the bracket and spindle assembly. Next they disengage the jack crank from the stowage clip and lower the retractable portion

of the jack by turning the jack crank clockwise until the wheels are firmly on the ground.

(3) FC crewmen 2 and 3 each remove a leveling jack crank from storage at the rear center of the trailer.

(4) FC crewmen 2 and 3 install cranks on the rear leveling jacks, push forward and hold the horizontal lock levers, and rotate the jacks into position for vertical movement. They then release the horizontal lock levers, pull up and hold the vertical lock levers, and rotate the jacks into the vertical position. Next they release the vertical lock levers and lower the retractable portion of each jack by turning the jack crank clockwise until the pads are about 3 inches from the ground.

(5) FC crewman 2 removes the pintle hook lockpin and opens the pintle hook at the rear of the truck.

(6) FC crewman 3 lowers the retractable portion of the front support jack until the lunette is raised off the pintle hook.

(7) FC crewman 1 drives the truck forward to clear the pintle hook from the lunette when directed by FC crewman 2, stops the truck, dismounts, moves to the rear of the truck, closes the pintle hook, and replaces the pintle hook lockpin.

###### b. Step 2.

(1) FC crewman 3 lowers the steps on the roadside of the trailer and mounts the IHIPIR, sets the antenna PEDESTAL SAFETY switch at

SAFE, removes the antenna covers, and releases the elevation stow lock by turning it counterclockwise. He then manually elevates the antenna to 1,600 mils, takes post near the spirit levels at the rear of the elevation head, and uncovers the spirit levels.

(2) FC crewmen 1 and 2 push rearward and hold the horizontal lock lever at the front center leveling jack, and rotate the jack in position for vertical movement. They then release the horizontal lock lever, pull up and hold the vertical lock lever and rotate the jack into the vertical position. Next they release the vertical lock lever, again push and hold the horizontal lock lever and complete rotating the jack outward and release the horizontal lock lever.

(3) FC crewman 1 removes the jack crank from the A-frame at the front of the trailer, installs the crank on the front center leveling jack, and lowers the retractable portion of the jack until the pad is firmly on the ground.

(4) FC crewmen 1 and 2 lower the retractable portions of the front center and rear leveling jacks equal amounts until the trailer tires are approximately 2 inches off the ground.

(5) FC crewman 3 directs the raising or lowering of the front center and rear leveling jacks by FC crewmen 1 and 2 until the spirit levels indicate that the antenna is level. He then disengages the azimuth stow lock, rotates the antenna 1,600 mils, rechecks antenna, and descends to the ground.

(6) FC crewmen 2 and 3 pull up and hold the vertical lock levers at the front corner stabilizing jacks and rotate the jacks in the vertical position, release the vertical lock levers, install the jack cranks, and lower the retractable portion of each jack until the pads barely touch the ground.

*c. Step 3.*

(1) FC crewman 1 removes the ground rod and cable from the wall behind the transmitter cabinet, drives the ground rod into the earth near the ground rod cable connector on the trailer, and connects the ground cable to the ground rod and trailer. He then removes the ILSCB from the truck, places it at the site selected for it during reconnaissance and selection of position, drives a ground rod into the earth adjacent to the grounding stud on the ILSCB, and connects a ground strap between the grounding stud and the ground rod.

(2) FC crewmen 2 and 3 lay the power cable to the generator and connect it to the IHIPIR on the main power distribution box.

(3) FC crewmen 2 and 3 lay the data cables to the IBCC or IPCP and connect them to the

IHIPIR; then lay and connect the data cable to the ILSCB and IHIPIR.

*Note.* The IHIPIR is now ready for performance operations prior to application of power, positioning of controls prior to application of power, and energizing procedures as described in TM 9-1430-533-12-1.

**6-6. March Order**

The IHIPIR must be placed in local control, deenergized, power shut off at the generator, and prepared for march order in accordance with instructions in TM 9-1430-533-12-1.

*a. Step 1.*

(1) FC crewmen 2 and 3 disconnect the power cable and roll it up on its reel.

(2) FC crewmen 2 and 3 disconnect the IBCC or IPCP and ILSCB data cables and roll them up on their reels.

(3) FC crewman 1 disconnects the ground cable from the ground rod and trailer, removes the ground rod from the earth, stores the rod and cable in the wall behind the transmitter cabinet, and recovers the ILSCB and stores it in the truck bed. He then mounts the IHIPIR, manually positions the antenna so that it faces the trailer curbside, engages the azimuth STOW lock by turning the handle clockwise, and manually positions the antenna in elevation to -180 mils. Next he engages the elevation STOW lock by turning the handle clockwise, mounts the antenna covers and secures them, dismounts from the IHIPIR, and stores the steps on the roadside of the trailer.

*b. Step 2.*

(1) FC crewman 1 gets in the truck and starts the engine.

(2) FC crewman 2 guides FC crewman 1 in backing the truck until the pintle hook is within a few inches of the trailer lunette, removes the pintle hook lockpin, and opens the pintle hook.

(3) FC crewman 2 removes the jack crank from the trailer A-frame and FC crewman 3 removes the jack cranks from the rear center of the trailer.

(4) FC crewmen 2 and 3 raise the retractable portion of the center leveling jack to its upper limit, pull up and hold the vertical lock lever, and rotate the jack to the horizontal position. Next they release the vertical lock lever, push and hold the horizontal lock lever, rotate the jack under the trailer, and release the horizontal lock lever.

(5) FC crewmen 2 and 3 raise the front corner stabilizing and rear leveling jacks by equal amounts until the trailer tires touch the ground.

(6) FC crewmen 2 and 3 raise the retractable portions of the front corner, stabilizing jacks to their upper limits, pull up and hold the vertical lock

levers, rotate the jacks to their horizontal positions, and release the vertical lock levers.

(7) FC crewmen 2 and 3 raise the retractable portions of the rear leveling jacks until the jack pads are about 3 inches off the ground.

(8) FC crewman 3, directed by FC crewman 2, raises or lowers the retractable portion of the front support jack until the trailer lunette is at the proper level for coupling with the pintle hook.

(9) FC crewman 1 backs the truck, as directed by FC crewman 2, until the pintle hook is in position to engage the lunette.

(10) FC crewman 2 directs FC crewman 3 to raise the retractable portion of the front support jack until the lunette rests on the lower half of the pintle hook, closes the pintle hook and replaces the pintle hook lockpin.

(11) FC crewman 1 dismounts from the truck cab, moves to the rear of the truck, removes the intervehicular cable connector from its bracket on the trailer drawbar, and installs it in the receptacle on the truck. He then removes the air line connector from its bracket on the trailer drawbar and installs it in the receptacle on the truck and opens the service coupling shutoff cock. Next he removes the safety chain hooks from the U-bolts on the

drawbar, and engages the safety chain hooks on the bars provided on the truck.

(12) FC crewmen 2 and 3 raise the retractable portions of the rear leveling jacks to their upper limits, pull up and hold the vertical lock levers, and rotate the jacks to the horizontal positions. They then release the vertical lock levers, push and hold the horizontal lock levers, rotate the jacks under the trailer, and release the horizontal lock levers.

(13) FC crewman 1 checks to insure that the trailer handbrakes are released.

(14) FC crewmen 2 and 3 raise the retractable portion of the front support jack to its upper limit and store the jack crank in its stowage clip. Next they pull out the spring-loaded frame handle and, using the jack handle, rotate the jack rearward and upward until the spring-loaded frame handle engages the holes in the top of the lunette mounting bracket.

(15) FC crewman 1 checks that the load on the truck is properly secured and, assisted by FC crewmen 2 and 3, checks that running lights, blackout lights, turn signal indicators, trailer brakes, etc. are functioning properly before moving out.

### Section III. IMPROVED ZERO-LENGTH LAUNCHER

#### 6-7. General

The ILCHR are towed to the positions selected for them as marked during reconnaissance and selection of position. Emplacement and march order of each ILCHR require three missile-launcher (ML) crewmen.

#### 6-8. Emplacement

##### a. Step 1.

(1) ML crewman 1 on the left and ML crewman 2 on the right set the ILCHR handbrakes.

(2) ML crewman 1 at the left rear and ML crewman 2 at the right rear of the truck close the service coupling shut-off cocks and disconnect the airbrake hoses and store them in the clamps on the front of the launcher base. They then unhook the safety chains from the lifting shackles on the truck and unhook the safety chain from the launcher outriggers.

(3) ML crewman 3 disconnects the intervehicular cable at the rear of the truck.

(4) ML crewmen 1 and 2 turn the crank on the front support jack clockwise to free the jack pad from the lunette crossbar then counterclockwise until the pad is free of the lunette crossbar. They

then rotate the front support jack downward to a vertical position, remove the quick-release pin at the launcher base, and push the jack against the launcher base. Next they replace the quick-release pin, remove the quick-release pin from the jack pad, rotate the pad to the horizontal position, replace the quick-release pin, and turn the crank clockwise until the pad rests firmly on the ground.

(5) ML crewman 3 removes the pintle hook locking pin at the rear of the truck and opens the pintle hook.

(6) ML crewman 1 turns the crank clockwise at the front support jack until the lunette is free from the pintle hook.

(7) ML crewman 2 drives the truck forward until the pintle hook is clear of the lunette, dismounts and moves to the rear of the truck, closes the pintle hook, and replaces the pintle hook locking pin.

(8) ML crewmen 1, 2, and 3 unload all equipment from the truck.

##### b. Step 2.

(1) ML crewman 3 disconnects the intervehicular cable at the launcher base and stores it in the front compartment.

(2) ML crewman 2 at the left front leveling

cylinder and ML crewman 3 at the right front leveling cylinder remove the quick-release pins, rotate the leveling cylinders to the side of the launcher base, and replace the quick-release pins.

(3) ML crewman 1 removes the front compartment cover.

(4) ML crewman 1 depresses the lunette detent, turns the hand knob counterclockwise to loosen the lunette, and removes the lunette.

(5) ML crewmen 1 and 2 support the left front outrigger, remove the towing brace quick-release pin at the upper left corner of the launcher base, lower the outrigger, replace the quick-release pin, unscrew the T-handle ball socket, and remove the left front towing brace.

(6) ML crewmen 1 and 3 repeat (5) above to remove the right front towing brace.

(7) ML crewman 1 removes a sway brace from the storage compartment. ML crewmen 1 and 2 rotate the left front outrigger outward, secure the sway brace to the launcher base and outrigger with quick-release pins, remove an outrigger pad from the side of the ILCHR, and place it on the ground under the outer end of the outrigger. They then insert the outrigger in the outrigger pad socket slide with the socket spring toward the trailer, remove the hand pump handle from the front compartment and connect it to the hand pump, and open the left front cylinder leveling valve. Next they close all other valves, align the leveling cylinder with the outrigger socket, actuate the hand pump until the piston collar on the leveling cylinder engages the outrigger socket, and close the left front cylinder leveling valve.

(8) ML crewmen 1 and 3 repeat (7) above to emplace the right front outrigger using the right front cylinder leveling valve.

(9) ML crewmen 1, 2, and 3 emplace the rear outrigger as follows:

(a) ML crewman 3 supports the leveling cylinder and ML crewman 2 supports the outrigger.

(b) ML crewman 3 removes the quick-release pin and lowers the leveling cylinder.

(c) ML crewman 2 lowers the outrigger.

(d) ML crewman 1 removes an outrigger pad from the side of the ILCHR, places it on the ground under the outer end of the outrigger, and inserts the outrigger in the outrigger pad socket slide with the socket spring toward the trailer.

(e) ML crewman 3 aligns the leveling cylinder.

(f) ML crewman 1 opens the rear cylinder leveling valve at the base hydraulic panel, actuates the hand pump until the piston collar on the

leveling cylinder engages the outrigger socket, and then closes the rear cylinder leveling valve.

(10) ML crewmen 2 and 3 lock out each wheel suspension system by rotating the lockout assembly handles to an upright position, so that the spring-loaded detents are engaged.

(11) ML crewman 2, directed by ML crewman 1, opens the two front cylinder leveling valves, and actuates the hand pump to raise the tires 1 inch off the ground. He then closes the two front leveling valves, opens the rear cylinder leveling valve, and actuates the hand pump until the launcher base appears to be level.

(12) ML crewman 1 removes the protective cap from the bull's-eye level on the right side of the launcher turntable and observes the position of the bubble. He then directs ML crewman 2 in manipulating appropriate values and actuating the pump handle to extend the leveling cylinders until the launcher base is level. Next he then replaces the protective cover on the level.

(13) ML crewman 2 at the left front leveling cylinder and ML crewman 3 at the right front and rear leveling cylinders screw down the locking sleeves.

(14) ML crewman 1 opens all leveling valves at the base hydraulic panel and removes and stores the hand pump handle in the front compartment.

(15) ML crewman 2 turns the crank counterclockwise at the front support jack until the jack pad clears the ground.

(16) ML crewmen 2 and 3 remove the ground rod and strap from the front compartment, drive the ground rod into the earth at the right rear of the launcher base to a depth of at least 3 feet, and connect the ground strap to the trailer and ground rod.

(17) ML crewman 1 removes the launcher control (LC) from the front compartment and emplaces it on its tripod at a safe distance to the rear of the launcher base. He then checks that the REMOTE / LOCAL switch is set at LOCAL and that all other switches are set at off (down), removes the headset from the front compartment, and connects the headset lead to the LC communications module.

(18) ML crewman 2 removes the LC cable from the front compartment and connects it between the LC and the LOCAL CONTROL receptacle on the launcher base.

(19) ML crewman 3 removes the rear compartment cover and checks that all switches are set at off at the base distribution box.

(20) ML crewman 1 stores the lunette and towing braces in the front compartment, closes and

secures the front compartment cover, loosens the finger grip knobs on the azimuth lock, lifts and rotates the azimuth lock 3,200 mils, and tightens the finger grip knobs.

(21) ML crewmen 2 and 3 open the air vents at the left and right sides of the launcher base.

(22) ML crewmen 2 and 3 lay the power cable to the generator and connect it to the launcher base.

(23) ML crewmen 2 and 3 lay the data cable to the ILSCB and connect it to the ILSCB and to the launcher base.

(24) ML crewmen 1, 2, and 3 each remove sufficient spades from the storage racks on the sides of the launcher base and drive them into the ground through the spade slots in the outrigger pads. The number of spades required depends on the type of soil at the emplacement site.

*Note.* The ILCHR is now ready for performance of procedures prior to application of power, positioning of controls prior to application of power, and energizing procedures as described in TM 9-1440-531-12-1. When the missiles are emplaced on the ILCHR and the ILCHR is energized, safety and arming test aid (SATA) checks are performed on the missiles as described in TM 9-1410-530-14 and on the ILCHR umbilicals as described in TM 9-1440-531-12-1.

### 6-9. March Order

Before the launchers are march ordered, all missiles must be transferred to the truck and trailer-mounted pallets as described in paragraph 6-18. In addition, each launcher must be deenergized and prepared for march order in accordance with information in TM 9-1440-531-12-1.

#### a. Step 1.

(1) ML crewmen 1, 2, and 3 disconnect the control, power, and data cables as follows:

(a) ML crewman 2 removes the rear compartment cover and sets all circuit breakers at off.

(b) ML crewman 1 removes the front compartment cover.

(c) ML crewman 3 disconnects the power cable after power has been removed by the generator operator and caps the cable end and launcher power receptacle.

(d) ML crewman 1 disconnects the data cable at the ILSCB and ILCHR, and caps the cable end and data receptacle on the ILSCB and ILCHR.

(e) ML crewman 1 disconnects the cable from the LC and caps the cable the cable end and receptacle on the LC.

(f) ML crewman 2 disconnects the LC cable from the ILCHR and caps the cable end and LOCAL CONTROL receptacle on the ILCHR.

(2) ML crewmen 1, 2, and 3 roll the power and data cables on their reels.

(3) ML crewmen 1, 2, and 3 load the power and data cables into the truck.

(4) ML crewmen 2 and 3 disconnect the ground strap from the trailer and ground rod, and remove the ground rod from the earth.

(5) ML crewmen 1, 2, and 3 remove the outrigger pad spades from the earth and store them on the storage racks on each side of the launcher base.

#### b. Step 2.

(1) ML crewmen 2 and 3 close the air vents on the right and left sides of the trailer.

(2) ML crewman 2 opens the control panel door, opens the manual azimuth movement valve at the boom support hydraulic control panel by turning it counterclockwise, and manually rotates the launcher boom support to the travel position with the aid of ML crewman 3. He then loosens the finger grip knobs on the azimuth lock, lifts and rotates the azimuth lock 3,200 mils, and engages the azimuth lock lug in the slot in the turntable. Next he tightens the finger grip knobs, closes the manual azimuth movement valve by turning it clockwise, and closes the control panel door.

(3) ML crewman 1 disconnects the headset leads from the LC and temporarily moves the headset and LC out of the way.

(4) ML crewman 1 checks that the front support jack is locked in the down position with the jack pad just clear of the ground.

(5) ML crewmen 1, 2, and 3 lower the launcher until the tires and front support jack are on the ground as follows:

(a) ML crewman 1 closes bleed valve No. 5 and system selector valve No. 4 at the base hydraulic unit and checks that cylinder valves Nos. 1, 2, and 3 are open. He then removes the hand pump handle from the front compartment and installs it on the hand pump, and actuates the hand pump until the locking sleeves loosen from their piston collars.

(b) ML crewman 3 unscrews the right and left front locking sleeves as far as possible.

(c) ML crewman 2 unscrews the rear locking sleeve as far as possible.

(d) ML crewmen 1 and 3 check that the right and left handbrakes are set.

(e) ML crewman 1 slowly opens bleed valve No. 5 until the wheels and front support jack are firmly on the ground.

(f) ML crewmen 2 and 3 unlock each wheel suspension system by rotating the lockout assembly handles downwards.

#### c. Step 3.

(1) ML crewman 2 at the left outrigger and ML crewman 3 at the right outrigger lift and hold

the outriggers, retract the leveling cylinders, and announce, CLOSE VALVES NOS. 1 AND 3, to ML crewman 1.

(2) ML crewman 1 closes valves Nos. 1 and 3 when directed by ML crewmen 2 and 3.

(3) ML crewmen 2 and 3 support the leveling cylinder, lower the outriggers, raise the leveling cylinders, and lay them back against the launcher base. Next they remove the quick-release pins from the outrigger sway brace locking brackets and outriggers and store the sway braces in the front compartment.

(4) ML crewman 1 removes the two front towing braces from the front compartment.

(5) ML crewmen 2 and 3 insert the T-handle ball socket end of the towing braces at the front outriggers and turn the T-handles in about three fourths of their thread lengths.

(6) ML crewmen 1 and 2 raise and swing the left front outrigger to the towing position and secure the towing brace with a quick-release pin at the towing brace bracket.

(7) ML crewmen 1 and 3 repeat (6) above with the right outrigger and towing brace.

(8) ML crewmen 1, 2, and 3 install the lunette as follows:

(a) ML crewman 1 removes the lunette assembly from the front compartment.

(b) ML crewmen 2 and 3 center and hold the outrigger steady.

(c) ML crewman 1 inserts the lunette lugs in the slots on the outriggers, lifts up on the drawbar end of the lunette, and positions the lunette clamp on the ball projections on top of the outriggers. He then depresses the detent at the top of the lunette assembly, rotates the hand knob clockwise to tighten the lunette, adjusts the hand knob to seat the detent in its notch, and releases the detent.

(9) ML crewmen 2 and 3 tighten the T-handles at the outrigger towing braces.

(10) ML crewmen 1, 2, and 3 position the rear outrigger for travel as follows:

(a) ML crewman 2 raises and holds the outrigger.

(b) ML crewman 3 lifts and holds the leveling cylinder and announces, CLOSE VALVE NO. 2, to ML crewman 1.

(c) ML crewman 1 closes valve No. 2.

(d) ML crewman 2 lowers the outrigger.

(e) ML crewman 3 lowers the leveling cylinder.

(f) ML crewman 2 raises and lays the outrigger against the launcher base.

(g) ML crewman 3 raises the leveling cylinder and aligns the fittings.

(h) ML crewman 2 secures the leveling cylinder and outrigger at the outrigger clevis fitting with a quick-release pin.

(11) ML crewman 1 removes the intervehicular cable from the front storage compartment and connects it to the receptacle at the right front corner of the launcher base. He then stores the three outrigger pads on the side of the ILCHR; removes the handle from the hand pump; stores the hand pump handle, ground rod and cable, LC and its cable, and headset in front compartment; and replaces and secures the front compartment cover.

(12) ML crewman 2 at the left front leveling cylinder and ML crewman 3 at the right front leveling cylinder remove the quick-release pins from the leveling cylinder brackets, align the leveling cylinders with the fittings, and replace the quick-release pins.

#### d. Step 4.

(1) ML crewman 2 gets in the truck, starts the engine, and, under the direction of ML crewman 1, backs the truck until the pintle hook is within a few inches of the lunette.

(2) ML crewman 1 removes the pintle hook locking pin, opens the pintle hook at the rear of the truck, and directs ML crewman 3 to raise or lower the support jack until the lunette is in position to be engaged by the pintle hook.

(3) ML crewman 1 directs ML crewman 2 to back the truck until the pintle hook is in position to engage the lunette. He then directs ML crewman 3 to raise the retractable portion of the front support jack until the lunette rests on the lower half of the pintle hook, closes the pintle hook, and replaces the pintle hook locking pin.

(4) ML crewman 1 turns the front support jack crank counterclockwise until the jack is fully retracted, removes the quick-release pin from the front support jack pad, and removes the quick-release pin from the front support jack at the launcher base.

(5) ML crewmen 1 and 2 rotate the front support jack to the horizontal position with the jack pad on top and replace the quick-release pin in the jack pad. They then rotate the jack crank clockwise until the hooks on the jack pad rest on the crossbars of the lunette and replace the quick-release pin at the launcher base.

(6) ML crewman 2 connects the intervehicular cable to the receptacle on the rear of the truck.

(7) ML crewman 1 at the left rear and ML crewman 2 at the right rear of the truck connect the airhoses to the truck and open the service coupling shutoff cocks.

(8) ML crewman 3 connects the safety chains to the lifting shackles at the rear of the truck and to the ILCHR outriggers.

(9) ML crewman 1 on the left side of the launcher base and ML crewman 2 on the right side release the handbrakes.

(10) ML crewman 2 checks that the load on the truck is properly secured and, assisted by ML crewmen 2 and 3, checks that running lights, blackout lights, turn signal indicators, ILCHR brakes, etc. are functioning properly before moving out.

## Section IV. TRAILER-MOUNTED PALLET

### 6-10. General

The trailer-mounted pallets are parked in areas selected during reconnaissance and selection of position that meet the minimum safety-distance requirements for storage of explosives. Emplacement and march order require two ML crewmen for each pallet.

### 6-11. Emplacement

a. ML crewman 1 sets the handbrakes at the front of the trailer, removes the intervehicular cable connector from the receptacle at the rear of the truck and installs it in the bracket provided on the drawbar. Next he removes the safety chain hooks and installs them on the handgrip provided on the drawbar.

b. FC crewman 1 supports the front support jack with the jack handle while FC crewman 2 pulls upward on the spring-loaded frame handle. Both men lower the jack to the down position insuring that the ends of the spring-loaded frame handle engage the holes in the bracket and spindle assembly. They then disengage the jack crank from the storage clip and lower the retractable portion of the jack by turning jack crank clockwise until the wheels are firmly on the ground.

c. ML crewman 1 removes the pintle hook lock-pin and opens the pintle hook at the rear of the truck, closes the service coupling shutoff cock, and removes the air line connector from the receptacle on the truck and installs it in the bracket on the trailer drawbar.

d. ML crewman 2 lowers the retractable portion of the front support jack until the lunette is raised off the pintle hook.

e. ML crewman 1 gets in the truck, starts the engine, drives the truck forward to clear the pintle hook from the lunette, stops the truck, dismounts, moves to the rear of the truck, closes the pintle hook, and replaces the pintle hook lockpin.

f. ML crewman 2 removes the leveling jack cranks from storage at the rear center of the trailer and installs them on the rear leveling jacks.

g. ML crewmen 1 and 2 push forward and hold the horizontal lock levers on the rear leveling jacks and rotate the jacks into the position for vertical

lock levers. They then rotate the jacks into the vertical position, release the vertical lock levers, and lower the retractable portion of each jack until the jack pads are firmly on the ground.

h. ML crewmen 1 and 2 push forward and hold the horizontal lock lever at the front center leveling jack and rotate the jack in position for vertical movement. They then release the horizontal lock lever, pull up and hold the vertical lock lever, rotate the jack into the vertical position, and release the vertical lock lever.

i. ML crewman 1 removes the jack crank from the A-frame at the front of the trailer, installs the crank on the front center leveling jack, and lowers the retractable portion of the jack until the jack pad is firmly on the ground.

j. ML crewmen 1 and 2 lower the retractable portions of the front center and rear leveling jacks equal amounts until the trailer tires are approximately 2 inches off the ground.

k. ML crewman 1 drives the ground rod into the earth and connects the ground cable to the ground rod and trailer.

### 6-12. March Order

a. ML crewmen 1 and 2 raise the retractable portions of the front center and rear leveling jacks to their upper limits and pull up and hold the vertical lock levers. They then rotate the jacks to their horizontal positions, release the vertical lock levers, push and hold the horizontal lock levers, rotate the jacks under the trailer, and release the horizontal lock levers.

b. ML crewman 1 gets in the truck; starts the engine; and, guided by ML crewman 2, backs the truck until the pintle hook is within a few inches of the trailer lunette.

c. ML crewman 2 removes the pintle hook lock-pin, opens the pintle hook, and raises or lowers the retractable portion of the front support jack until the lunette is at the correct level to engage the pintle hook. He then directs ML crewman 1 in backing the truck until the pintle hook is in position to engage the lunette. Next he raises the retractable portion of the front support jack until the lunette rests on the lower half of the pintle hook.

d. FC crewmen 1 and 2 raise the retractable portion of the front support jack to its upper limit and store the jack crank in its storage clip. They then pull out the spring-loaded frame handle and, using the jack handle, rotate the jack rearward and upward until the spring-loaded frame handle engages the holes in the top of the lunette mounting bracket.

e. ML crewman 1 removes the intervehicular cable connector from its bracket on the trailer drawbar and installs it in the receptacle on the truck. He then removes the safety chain hooks from the handgrip bars on the drawbar and engages the safety chain hooks on the bars provided on the

truck. Next he checks that the trailer handbrakes are released. ML crewman 2 removes the ground cable and rod and stores them on the trailer.

f. ML crewman 2 removes the air line connector from its bracket on the drawbar and installs it in the receptacle on the truck, and opens the service coupling shutoff cock.

g. ML crewman 1 checks that the loads on the pallet and truck are properly secured and, assisted by ML crewman 2, checks that running lights, blackout lights, turn signal indicators, trailer brakes, etc. are functioning properly before moving out.

## Section V. LOADER-TRANSPORTER

### 6-13. General

Emplacement of the loader-transporter consists of unloading it from the truck in which it is transported and preparing it for operation. Conversely, march order of the loader-transporter consists of preparing it for travel and loading it into the truck. Three ML crewmen are required to perform either action. The drill presented in this section is applicable both in the firing sections and the assembly, service, and maintenance section.

### 6-14. Emplacement

a. ML crewmen 1, 2, and 3 release the loading ramp tiedown ropes, lower the truck tailgate, and slide the loading ramps out of the truck bed. They then secure the scuff plates on the forward end of each ramp, attach the forward ends of the loading ramps to the rear of the truck bed using quick-release pins, and insure that the ramps are parallel both to the sides of the truck and to each other.

b. ML crewmen 1, 2, and 3 disconnect the loader-transporter web strap tiedown assemblies.

c. ML crewman 1 removes the two quick-release pins from the transfer arms and yoke assembly, takes the driver's seat, performs the engine before-operation checks, and starts the engine. He then raises the index boom off the missile support frame, releases the brakes, drives the loader-transporter down the ramps (guided by ML crewman 2) until the loader-transporter is clear of the ramps. Next he pulls back and locks the steering levers, disengages the suspension lockout system, detaches the operator's protective device, and positions it out over the left fender.

d. ML crewman 1 disconnects the azimuth cylinder piston rod from the main support assembly by removing the quick-release pin. ML crewmen 2 and 3 manually rotate the superstructure clockwise

3,200 mils in azimuth and ML crewman 1 reconnects the azimuth cylinder piston rod to the main support assembly with the quick-release pin.

e. ML crewman 1 disconnects the electrical jumper cable from the dummy receptacle on top of the distribution box, removes the protective cap from the receptacle on the index boom, and connects the cable.

f. ML crewmen 2 and 3 remove the quick-release pins from the missile support frame and safety bar, raise the safety bar high enough to allow the center missile support to be raised, and secure the support to the missile support frame. Next they secure the safety bar to the missile support frame with a quick-release pin and raise and secure the outboard missile supports with quick-release pins.

g. ML crewmen 2 and 3 remove the scuff plates from the forward ends of the ramps and disconnect the ramps by removing the quick-release pins. Next they store the scuff plates and ramps in the truck bed and raise and secure the truck tailgate. ML crewman 1 positions the operator's protective device to the operating position and performs the loader-transporter before-operation daily checks.

### 6-15. March Order

a. ML crewmen 2 and 3 lower the truck tailgate and remove the loading ramps and scuff plates from the bed of the truck. They then secure the scuff plates on the forward end of each ramp, attach the forward ends of the loading ramps to the rear of the truck, using quick-release pins, and insure that the ramps are parallel to the sides of the truck, and to each other.

b. ML crewman 1 performs the engine before-operation checks, starts the engine, and positions the superstructure in the missile transport position

(i.e., extension cylinder retracted, centered in roll and azimuth, fully raised in elevation).

c. ML crewman 1 detaches the operator's protective device and rotates it beyond its normal storage position out over the left fender. ML crewmen 2 and 3 lower the center missile support to its stored position, place and secure the safety bar in the lower position, and lower and secure the outboard missile supports.

d. ML crewman 1 disconnects the electrical jumper cable from the end of the index boom and connects it to the dummy receptacle on top of the distribution box. He then installs the protective cap on the receptacle on the index boom.

e. ML crewman 1 disconnects the azimuth cylinder piston rod from the main support assembly by removing the quick-release pin. ML crewmen 2 and 3 manually rotate the superstructure counterclockwise 3,200 mils in azimuth. ML crewman 1 reconnects the azimuth cylinder piston rod to the main support assembly with the quick-release pin.

f. ML crewman 1 places and secures the operator's protective device in the normal storage position, engages the suspension lockout system, and backs the loader-transporter up the ramps

guided by ML crewman 2. He then drives toward the front of the truck until the ends of the rear fenders are alined with the second stake pocket from the front of the truck. Next he places the drive selector in the N position, sets the brakes, and inserts two quick-release pins through the yoke assembly and transfer arms to prevent movement of the assembly.

g. ML crewmen 2 and 3 remove the scuff plates from the forward ends of the ramps, disconnect the ramps by removing the quick-release pins, store the scuff plates and ramps in the truck bed under the loader-transporter, and raise and secure the truck tailgate.

h. ML crewman 1 places the extension control lever in the retract position and the elevation control lever in the boom down position and allows the boom to lower until it comes in firm contact with the missile support frame. He then returns the extension control lever to neutral but leaves the elevation control lever in the boom down position, shuts the engine down, and performs the engine after-operation daily checks.

i. ML crewmen 1, 2, and 3 secure the loader-transporter with the web strap tiedown assemblies.

## Section VI. IMPROVED MISSILES

### 6-16. General

Emplacement of the missiles consists of transferring them from pallets to ILCHR's using the loader-transporter; conversely, march order of the missiles consists of transferring the missiles to pallets from the ILCHR's using the loader-transporter. When transferring missiles to or from trailer-mounted and ground-mounted pallets, no special problems are encountered. However when performing either operation with truck-mounted pallets, a special problem is encountered. If the truck and loader-transporter are on level ground, the index boom cannot be raised high enough to be indexed to the pallet. To enable indexing of the loader-transporter to a truck-mounted pallet, the front wheels of the truck must be raised at least 18 inches higher than the rear wheels. This may be accomplished by driving the front wheels of the truck up on locally-made chocks or filled sandbags, or by selecting suitable terrain. Two ML crewmen are required to emplace and march order each load of three missiles.

### 6-17. Emplacement

#### a. Step 1.

(1) ML crewman 1 checks the yoke assembly on the loader-transporter to insure that the quick-

release pins at the transfer arms are inserted in the tactical position and the balancing weight is in the "place weight here for tactical missile" position on the left side of the yoke assembly. He then rotates the stop to the tactical position at the striker plates on the forward ends of the two transfer arms.

(2) ML crewman 1 starts the loader-transporter engine, places the drive selector lever in the HILLY position, drives the loader-transporter directly toward the front of the pallet, and stops about 3.5 meters from the pallet.

*Note.* ML crewman 2 checks that the SAFE / ARM lever is still turned to SAFE and that the shorting plugs are still installed in the umbilical plug connectors as required in paragraph 6-18.

(3) ML crewman 1 sets the handbrakes, places the drive selector lever at N, adjusts the hand throttle until the engine is running at 2,000 revolutions per minute (rpm), and checks that the hydraulic pressure is at 3,000 pounds per square inch (psi).

(4) ML crewman 1 raises the transfer arms to the vertical position with the extension control lever and, guided by ML crewman 2, roughly alines the index points to the pallet with elevation and roll control levers. He then positions the drive selector lever to D.

(5) ML crewman 1, under continuous guidance from ML crewman 2, drives the loader-transporter slowly forward and adjusts the index points in azimuth, elevation, and roll until the index forks are in position to engage the pins in the index fittings on the pallet. He then lowers the index points until the index forks are firmly seated on the pins and then continues to lower the index points until the front road wheels are about 2 inches off the ground.

(6) ML crewman 1 sets the handbrakes and places the drive selector lever to N.

(7) ML crewman 1 checks that the three red missile release lamps light and then releases the handbrakes.

(8) ML crewman 1 extends the transfer arms until the missile suspension arms rest on the missiles and the missile locking latches are aligned with the missile lifting holes. ML crewman 2 applies latching force on the center latch control handle when the hoisting beam forward latch seats in the missile.

(9) ML crewman 2 engages the missile latches in the two outboard missiles. ML crewman 1 checks that the three green missile latched lamps light and that the three red missile unlatched lamps go out.

(10) ML crewman 2 releases the missiles from the pallet by unscrewing the two missile anchoring studs equipped with jam nuts from each missile, removing the quick-release pins at each pallet latch housing, and pulling the latch handles down.

**Caution.** When removing the missile anchoring studs, be sure to follow the procedure exactly as described in TM 9-1425-525-12-1 to avoid untorquing the associated wing bolts.

(11) ML crewman 1 retracts the transfer arms until the missiles are approximately 2 feet above the missile support pads and raises the index forks just enough to clear the index fittings on the pallet. He then positions the drive selector lever to R; releases the handbrakes; slowly backs away from the pallet; stops, pulls back, and locks the steering brake levers; and positions the drive selector lever to N.

(12) ML crewman 1 centers the index boom in roll and raises the index boom to its upper limit. He then aligns the missiles in azimuth with missile supports on the loader-transporter, lowers the missiles on the missile supports, retracts the index boom, releases the brakes, and drives to the designated ILCHR.

**b. Step 2.**

(1) ML crewman 2 sets the REMOTE/LOCAL switch at LOCAL and all

other switches on the LC at off (down). He then opens the manual azimuth movement valve at the ILCHR and disengages the azimuth stow lock. Next he rotates the boom until the index fittings on the ILCHR are turned toward the loader-transporter, and checks that all forward rotating sectors are latched on the boom support arms and that all forward latch levers are up.

(2) ML crewmen 1 and 2 index the loader-transporter to the ILCHR as described in step 1 (a) (2)-(6) above.

(3) ML crewman 1 extends the transfer arms until the missiles contact the stops on the cradles of the ILCHR. ML crewman 2 holds the missile nose cones down to prevent possible damage to the tail cones by contact with the ILCHR rear retaining studs.

**Caution.** When placing missiles on the pallet or ILCHR, to prevent overloading the structures during final seating of the missile against the rear hooks (pallet or ILCHR), it is important to avoid over-extending the extension cylinder.

(4) ML crewman 2 pulls down on the latch levers at the forward rotating sectors.

(5) ML crewman 1 releases the missiles from the suspension arms, using the missile release switch on the distribution box, and checks that the three green missile latched lamps go out and the three red missile unlatched lamps light.

(6) ML crewman 1 retracts the transfer arms to the vertical position and raises the index forks to break index.

(7) ML crewman 1 slowly backs the loader-transporter until clear of the ILCHR and missiles, stops the loader-transporter, sets the handbrakes, and places the drive selector lever to N.

(8) ML crewman 1 raises the index boom, centers it in roll and azimuth, and retracts it.

## 6-18. March Order

Before the missiles are march ordered, the SAFE/ARM lever must be turned to SAFE at each missile, the umbilical plug connectors disconnected, and the shorting plugs installed in the missiles.

**a. Step 1.**

(1) ML crewman 1 checks that the loader-transporter is prepared to transfer tactical missiles as described in paragraph 6-17 a (1).

(2) ML crewman 1 checks that the launcher is prepared for missile transfer as described in pertinent parts of paragraph 6-17 b (1).

(3) ML crewman 1 and 2 position the loader-transporter and index it to the launcher as described in paragraph 6-17 a (2)-(6).

(4) ML crewmen 1 and 2 prepare to transfer the missiles as described in paragraph 6-17a (7)-(9).

(5) ML crewman 2 releases the missiles from the launcher by pushing up the latch levers on the rotating sectors.

(6) ML crewman 1 removes the missiles from the launcher and transports them to the designated pallet as described in paragraph 6-17A (11) and (12). While ML crewman 1 removes the missiles from the ILCHR, ML crewman 2 holds the missile nose cones down to prevent possible damage to the tail cones by contact with the ILCHR rear retaining studs.

*b. Step 2.*

(1) ML crewmen 1 and 2 position the loader-transporter and index it to the pallet as described in paragraph 6-17a (2)-(6).

(2) ML crewman 1 extends the transfer arms

until the missile stops in the rear cradles of the missile support arms engage the recesses in the missiles.

(3) ML crewman 2 pushes the missile latch handles up, engages the quick-release pins, and checks that the ends of missile stops are down.

(4) ML crewman 1 releases the missiles from the suspension arms, breaks index, backs away from the pallet, and prepares the loader-transporter for travel as described in paragraph 6-17b (5)-(8).

(5) ML crewman 2 secures each missile to the pallet with two missile anchoring studs equipped with jam nuts.

**CAUTION.** When securing the missiles to the pallet with the anchoring studs and jam nuts, be sure to follow the procedure exactly as described in TM 9-1425-525-12-1 to avoid damaging the threads on the anchoring stud, associated wingnut, or both.

## CHAPTER 7

## ORIENTATION AND ALINEMENT

## Section I. IMPROVED BATTERY

## 7-1. General

a. Orientation and alinement procedures are usually performed as soon as the Improved Hawk equipment is emplaced in the field and each item of equipment is energized. Although several techniques may be used to perform these procedures, only the optimum procedures are presented in this chapter. They are based on each item of equipment having line-of-sight to any other item of equipment with which it must be alined. This condition should exist if reconnaissance and selection of position have been performed properly. If this condition does not exist because of terrain difficulties, refer to TM 9-1425-525-12-1 for other techniques that may be used. To insure that correct procedures are followed, responsibility for the performance of the procedures at each item of equipment is normally delegated to personnel as follows:

IBCC—TCO  
 IPAR—TCA  
 ICC (IFF)—Senior FC crewman  
 IROR—TCA  
 IHIPIR A—FCO A  
 IHIPIR B—FCO B  
 ICWAR—ASO  
 ILCHR's—Senior ML crewmen

b. The orientation and alinement procedures must be performed with precision to insure effective use of the ADP, accurate interchange of ADL information with the Bn OC, and to maximize the chances of successful engagements. They are directed by the TCO from his station in the IBCC and consist of the following general steps performed in the indicated sequence:

(1) Orient the IPAR on a known reference point (KRP) whose azimuth from true north (0 mils) is known and aline with the displays in the IBCC.

(2) Aline the IHIPIR's with the IPAR.  
 (3) Aline the IFF antenna with the IPAR.  
 (4) Aline the ICWAR with the IPAR.

(5) Aline the ILCHR's with their associated IHIPIR.

(6) Aline the IROR with each IHIPIR.

c. The TCO checks that the IBCC power supply

group is energized, the power switches on all consoles are set at ON, communications are established with each major component, and the following switches are in the stated positions:

(1) SCAN MODE switch at NORMAL.

(2) OPERATE / TEST ROTATE switch at OPERATE.

(3) IROR—ON / OFF switch at ON.

## 7-2. Improved Pulse Acquisition Radar

a. Set the following switches as indicated:

(1) SYSTEM CONTROL at LOCAL.

(2) ANTENNA ROTATE at OFF.

(3) SAFE / OPERATE at SAFE.

b. Energize the IPAR to standby condition.

d. Check the radar level.

d. Remove the telescope from the radar set group and install it on the mounting bracket.

e. Make a communications check with the IBCC.

f. Release the azimuth stow lock and turn the antenna until the telescope vertical crosshair is centered on the KRP.

g. Secure the antenna by tightening the azimuth stow lock, adjust the mil ring indicator to the azimuth to the KRP, release the antenna azimuth stow lock, and turn the antenna until 0 mils is indicated on the mil ring indicator; then retighten the azimuth stow lock.

h. Set the SYSTEM CONTROL LOCAL / REMOTE switch to REMOTE and press and hold the ANTENNA CT ZERO INDICATOR switch. Release and rotate the TRAILER POSITION COMPENSATOR ADJUSTMENT knob until a fine null (zero) is obtained on the ANTENNA CT ZERO INDICATOR meter. Release the ANTENNA CT ZERO INDICATOR switch.

i. Lock the TRAILER POSITION COMPENSATOR ADJUSTMENT knob and recheck the null indication on the ANTENNA CT ZERO INDICATOR meter by pressing and holding the ANTENNA CT ZERO INDICATOR switch. Release the ANTENNA CT ZERO INDICATOR switch.

j. Report PULSE RADAR AZIMUTH ZERO

MILS to the IBCC crewman and wait for further instructions. When requested to do so, press and hold the REMOTE SCOPE pushbutton and check that the PPI sweep is positioned at 0 mils; release the pushbutton and report the result to the IBCC crewman. Wait until the IBCC crewman verifies azimuth.

k. When notified by the IBCC crewman that azimuth has been verified, remove the telescope, reinstall it so that it will backsight on the other radars when alining with them, and turn the SYSTEM CONTROL—LOCAL / REMOTE switch to LOCAL.

l. Release the azimuth stow lock and turn the antenna to backsight as directed by the IBCC crewman on an IHIPIR, IFF antenna, or ICWAR. In each case, both radar antennas will be pointing in the same direction since the IHIPIR, IFF, or ICWAR antenna will be frontsighted.

m. Turn the SYSTEM CONTROL—LOCAL / REMOTE switch to REMOTE when directed to do so by the IBCC crewman.

### 7-3. Identification, Friend or FOE, Antenna (ICC)

a. At the ICC, set the following switches as indicated:

- (1) ANT SYNC EXT / INT at EXT.
- (2) ANT SAFE / OPERATE at ANT SAFE.
- (3) AZ DRIVE SAFE OFF / ON at SAFE OFF.

b. Energize the ICC in remote status.

c. Check the level of the IFF antenna.

d. Install the telescope and mounting bracket assembly in the telescope mount on the IFF antenna.

e. Make a communications check with the IBCC.

f. Frontsight the IFF telescope on the IPAR telescope.

g. Request the azimuth of the IPAR from the IBCC crewman and set the azimuth mil ring on the IFF antenna to that value.

h. Request the ICC crewman in the shelter perform the IFF nulling procedure and wait for his report.

i. When the AZIMUTH ERROR NULLED report is received, report, IFF ANTENNA FRONTSIGHTED ON IPAR AND AZIMUTH ERROR NULLED, to the IBCC crewman and wait for instructions from him.

j. When requested to continue the alinement procedures, set the AZ DRIVE SAFE OFF / ON switch at ON and the ANT SAFE / OPERATE switch at OPERATE.

k. Check that the IFF antenna remains front-

sighted on the IPAR antenna and report the result to the IBCC crewman and wait.

l. When notified by the IBCC crewman that alinement is verified, set the ANT SAFE / OPERATE switch at ANT SAFE and the AZ DRIVE SAFE OFF / ON switch at SAFE OFF.

m. Adjust the tilt of the IFF antenna as determined by the angular elevation to the horizon, if required. Use the highest point at the horizon within the sector of interest as a reference. If this point is less than  $10^\circ$ , use it as the tilt angle; if the point is  $10^\circ$  or more, use  $10^\circ$  as the tilt angle.

n. Set the AZ DRIVE SAFE OFF / ON switch at ON and the ANT SAFE / OPERATE switch at OPERATE.

*Note.* As soon as possible, interrogate a target of opportunity and observe whether the IFF replies appear at the same azimuth as IPAR targets. If they do not appear at the same azimuth, further adjustment of the AZ ADJ control is necessary. Any further adjustment required must be made by an ICWAR-ICC mechanic.

### 7-4. Improved Continuous-Wave Acquisition Radar

a. Set the following switches as indicated:

- (1) LOCAL / REMOTE at LOCAL.
- (2) Antenna SAFETY SWITCH at SAFE.

b. Energize the ICWAR to false radiate status.

c. Turn the operating mode switch located on the control-indicator panel to PULSE SLAVE.

d. Make a communications check with the IBCC.

e. Remove the telescope from storage and install it on the mounting bracket.

f. Open the receiver-transmitter cabinet and check the spirit levels for radar level; close the receiver-transmitter cabinet.

g. Manually rotate the antennas until the telescope is front-sighted on the IPAR telescope; hold the antenna in place until the alinement procedure is completed.

h. Open the right access door on the pedestal and record the setting of the BORESIGHT SHIFT COMPENSATOR ADJUST knob.

i. Turn the BORESIGHT SHIFT COMPENSATOR ADJUST knob to zero.

j. Open the rear access door on the pedestal and unlock the SYNCHRO CLUSTER ORIENT adjust knob, turn the servo BITE switch to position 6, push the knob down, and rotate it until a null (zero) is obtained on the servo BITE meter.

k. Turn the servo BITE switch to position 7 and rotate the SYNCHRO CLUSTER ORIENT adjust knob to obtain a fine null on the servo BITE meter.

l. Release the SYNCHRO CLUSTER

ORIENT adjust knob, lock the knob, check that the servo BITE meter still indicates a null, turn the servo BITE switch to OPR, set the LOCAL/REMOTE switch at REMOTE, and report, ICWAR FRONTSIGHTED AND ALINED ON IPAR, to the IBCC crewman; wait for instructions from him.

m. When requested by the IBCC crewman to resume the alinement procedure, set the AZIMUTH AMPLIDYNE circuit breaker at ON, the ANTENNA SAFETY switch at OPERATE, and check that the antenna does not move; set the ANTENNA SAFETY switch at SAFE.

n. Close the rear access door, return the BORESIGHT SHIFT COMPENSATOR ADJUST knob to the setting recorded in *h* above, close the right access door, and remove and store the telescope.

o. Request the azimuth reading of the IPAR from the IBCC crewman and set the azimuth mil ring to that azimuth; report, ICWAR READY FOR SYNCHRONISM CHECK, to the IBCC crewman and wait for instructions.

p. If requested by the IBCC crewman to perform the COMPENSATION adjustment, open the azimuth control and power supply drawer, connect an ac voltmeter across R1 in the azimuth control amplifier, adjust R36 for a null on the voltmeter (not more than 0.5 volt), remove the voltmeter and close the drawer. (This adjustment is required only if the ICWAR antenna is leading or lagging the IPAR antenna.)

q. Report, COMPENSATION ADJUSTMENT COMPLETED, to the IBCC crewman and wait for verification of alinement.

#### 7-5. Improved High-Powered Illuminator Radars

##### a. Alinement with IPAR.

(1) Set the following switches as indicated:  
(a) LOCAL/REMOTE switch at LOCAL.

(b) Antenna SAFETY SWITCH at SAFE

(2) Energize the IHIPIR to false radiate status and set the antenna SAFETY SWITCH at OPERATE.

(3) Make a communications check with the IBCC.

(4) Using the azimuth handwheel, position the IHIPIR antenna to frontsight on the IPAR, and set the antenna SAFETY SWITCH at SAFE.

(5) Install the telescope, check the radar level, and request the IPAR crewman backsight on the IHIPIR telescope.

(6) Manually rotate the IHIPIR antenna to sight on the IPAR telescope; report, IHIPIR

FRONTSIGHTED ON IPAR, to the IBCC crewman.

(7) Request the azimuth of the IPAR from the IBCC crewman; set the IHIPIR azimuth mil ring to this azimuth and report accomplishment to him.

(8) When requested by the IBCC crewman to continue the alinement procedure, set the LOCAL/REMOTE switch at REMOTE; check that the IHIPIR telescope is still frontsighted on the IPAR telescope.

(9) Open the pedestal access door, unlock and press the SYNCHRO CLUSTER ORIENT ADJUST knob; rotate the knob until a null (zero) is obtained on the nulling meter.

(10) Press and hold fine null switch S1, and simultaneously rotate the SYNCHRO CLUSTER ORIENT ADJUST knob until a fine null is obtained.

(11) Release S1 and the SYNCHRO CLUSTER ORIENT ADJUST knob, lock the knob, and check that the nulling meter indicates zero by pressing S1 again. Report, IHIPIR NULLED, to the IBCC crewman and wait for further instructions.

(12) When requested to do so, set the MOTOR GENERATOR circuit breaker at ON; set the antenna SAFETY SWITCH at OPERATE and report when accomplished to the IBCC crewman. Check that the antenna does not slew 3,200 mils. If it does, repeat (1), (4), and (6) through (12) above.

(13) Report, IHIPIR ALINED TO THE IPAR, to the IBCC crewman; wait until he verifies the alinement.

(14) When the IBCC crewman verifies the alinement, close the pedestal access door; stand by to aline with the ILCHR's and the IROR.

##### b. Alinement with the ILCHR's.

(1) Set the LOCAL/REMOTE switch at LOCAL.

(2) Set the antenna SAFETY SWITCH at SAFE.

(3) Position the antenna to 0 mils in elevation and engage the elevation STOW lock.

(4) When requested to do so, perform the following in the sequence shown:

(a) Frontsight the IHIPIR telescope on the end of the telescope support bar on the ILCHR and hold the antenna in place.

*Note.* The IHIPIR telescope must remain frontsighted on the end of the telescope support bar until the request to frontsight on the ILCHR boom telescope is received.

(b) Frontsight the IHIPIR telescope on the ILCHR boom telescope and hold the antenna in

place. (This step is part of a rough check performed in conjunction with paragraph 7-6 *w* to insure that the alinement telescope has remained locked in place during performance of the actions described in paragraph 7-6 *q* and *r*.)

(c) Position the antenna —

1. To the primary target line.
2. To 0 mils azimuth.
3. To the left and right limits of any

sector in which fire has been ordered cut out.

(5) When alinement with the ILCHR's is completed, set the minimum elevation control for the stowed synchro 40 mils *higher* than the highest elevation lever setting as reported by the ILCHR crewman.

**Warning.** Do not set the minimum elevation control to less than 150 mils under any circumstances.

c. *Alinement with IROR.*

(1) Check that the conditions stated in *b*(1), (2), and (3) above still exist.

(2) Frontsight the IHIPIR telescope on the IROR telescope and hold the antenna in place until alinement is verified.

(3) When requested to do so, set the IHIPIR LOCAL / REMOTE switch at REMOTE.

(4) After the procedures in *a*, *b*, and *c* above have been performed, remove and store the alinement telescope.

#### 7-6. Improved Zero-Length Launchers

Alinement of an ILCHR with its associated IHIPIR requires using the alinement telescope and fire cutout assembly mounted on at least one of the rear corners of the ILCHR. The alinement procedure for each ILCHR is identical, but varies slightly depending on the configuration of the terrain surrounding the ILCHR site and the position of the ILCHR relative to the IHIPIR. The surrounding terrain must be observed to determine whether there are obstructions with masks greater than 90 mils in elevation at ranges less than 2 kilometers. If so, some of the fire cutout switches must be set outward on the fire cutout assembly before the ILCHR is alined to the IHIPIR. Meeting the terrain criteria for emplacement of the ILCHR may result in either both rear corners of the ILCHR chassis having line-of-sight to the IHIPIR or only one rear corner having such line-of-sight. In the former case, it does not matter at which corner the telescope and fire cutout assembly is first mounted; in the latter case, the assembly must first be mounted at the corner that does *not* have line-of-sight to the IHIPIR, provided obstructions exist on that side of the ILCHR chassis. The alinement and fire cutout procedure below is

based on the worst case; i.e., masks exceeding 90 mils in elevation at ranges less than 2 kilometers exist on both sides of the ILCHR chassis and only one rear corner has line-of-sight to the IHIPIR. Procedures listed below that may be modified or omitted are determined by local conditions.

a. Check that the OPERATE / SAFE switch on the ILSCB is set at SAFE for the ILCHR being alined.

b. At the LC, set the REMOTE / LOCAL switch at LOCAL, and the MAIN POWER / OFF switch at OFF; then remove the LC and install it on its tripod away from the ILCHR.

c. Disconnect any unbilical cables that are connected to missiles on the ILCHR before applying power. Install the shorting plugs in the missile.

d. Check the level of the ILCHR and adjust it, if necessary.

e. Obtain the telescope support bar from storage and install it on the rear corner of the ILCHR chassis that *does not* have line-of-sight to the IHIPIR; then tighten the mounting lock. Obtain the boom telescope and install it on the ILCHR so that it can be backsighted on the IHIPIR.

f. Remove the alinement telescope and fire cutout assembly from the ILCHR rear compartment and install it on the telescope support bar; then tighten the mounting lock.

g. Place all the fire cutout switches to the inward position.

h. Set the telescope to 90 mils on the elevation angle scale and tighten the elevation locknut; scan the horizon clockwise and observe for any obstructions above the horizontal crosshair. Whenever an obstruction is observed (other than the superstructure of the ILCHR), set the vertical crosshair on its left edge, then set the fire cutout switch indicated by the obstruction indicator arrow to the outward position; reposition the telescope so that the vertical crosshair is on the right edge of the obstruction, again set the fire cutout switch indicated by the obstruction indicator arrow to the outward position. If this results in two switches, not immediately adjacent to each other, being set to the outward position, set all the intervening switches that lie in the direction of the obstruction to the outward position.

i. Scan the horizon and set the telescope horizontal crosshair at the top of the highest obstruction regardless of how wide it is; read and record the indication of the elevation angle scale.

j. Inspect the fire cutout switches. If five or more adjacent switches are positioned outward in one or more obstructed sectors, measure and record the

elevation angle to the top of the highest of these obstructions.

k. Remove the telescope support bar (including the alinement telescope and fire cutout assembly) and reinstall it on the other rear corner of the ILCHR.

l. Repeat *h*, *i*, and *j* above for obstructions in the sector that was obscured by the ILCHR superstructure while the alinement and fire cutout assembly was first mounted on the other rear corner of the ILCHR.

*Note.* The procedures in *m* and *n* below are based on the requirement to set the azimuth override lever and minimum elevation lever on the shoot-around console and the elevation fire interrupter lever on the ILCHR boom to some 50-mil increment value (100, 150, 200, and so forth).

*m.* Add 100 mils to the elevation angle measured to the top of the highest obstruction in *i* or *l* above, regardless of the obstruction's width. If this results in a 50-mil increment value, set the azimuth override lever to that value. For instance, if the angle is 450 mils, adding 100 mils results in 550 mils which can be set. If the addition results in other than a 50-mil increment value, set the lever to the next *lower* 50-mil increment value. For instance, if the angle is 370 mils, adding 100 mils results in 470 mils which can not be set. Set the lever to 450 mils which is the next lower 50-mil increment.

*n.* Subtract 150 mils from the elevation angle measured to the top of the highest five (or more)-switch obstruction in *i* or *l* above. If this results in a 50-mil increment value, set both elevation levers to that value. For instance, if the angle is 400 mils, subtracting 150 mils results in 250 mils which can be set. If the subtraction results in other than a 50-mil increment value, set the levers to the next *higher* 50-mil increment. For instance, if the angle is 430 mils, subtracting 150 mils results in 280 mils which cannot be set. Set the levers to 300 mils which is the next higher 50-mil increment.

**Warning.** Do not set the elevation levers higher than 400 mils or lower than 100 mils.

*o.* Examine the settings of the azimuth override lever and elevation levers; determine if there is a difference of 250 mils or more between the settings. If so, there is a possibility of a misfire occurring if the ILCHR is aimed to fire toward any of the five (or more)-switch obstructed sectors. In this case, record the azimuths of the left and right limits of each five (or more)-switch obstructed sector (as indicated by the switches on the fire cutout assembly) for use as described in *ac* below.

*p.* Request the IHIPIR crewman frontsight the IHIPIR telescope on the end of the telescope support bar.

*Note.* The IHIPIR must remain frontsighted on the end of the telescope support bar until the request to frontsight on the ILCHR boom telescope is received as indicated in *v* below.

*q.* Sight the alinement telescope so that the vertical crosshair is centered on the IHIPIR telescope; lock the alinement telescope in place.

*r.* Remove the alinement telescope and fire cutout assembly from the telescope support bar and install it in the ILCHR rear compartment; connect plug P9 to connector J2 and plug P10 to connector J1.

*s.* Use nulling procedures as follows:

(1) Set the ALINE / OPERATE switch on the shoot-around console control panel at ALINE.

(2) Set and hold the ALINE NULL / COARSE / FINE switch at ALINE NULL and rotate the COARSE ADJUST control on the control panel until a null is indicated on the ALINE meter.

(3) Release the ALINE NULL / COARSE / FINE switch, check that it returns to the COARSE position, and again rotate the COARSE ADJUST control *clockwise only* until another null is indicated on the ALINE meter.

(4) Set and hold the ALINE NULL / COARSE / FINE switch at FINE and rotate the COARSE ADJUST control a *small amount in either direction* until a fine null is obtained.

(5) Release the ALINE NULL / COARSE / FINE switch and check that it returns to the COARSE position.

*t.* Remove and store the telescope support bar; set the ALINE / OPERATE switch at OPERATE.

*u.* At the LC, set the MAIN POWER / OFF switch at MAIN POWER and the HYD PRESS / OFF switch at HYD PRESS.

*v.* When the hydraulic system activates, set the ALINE / OFF switch on the LC at ALINE; request the IHIPIR crewman frontsight the IHIPIR telescope on the ILCHR boom telescope and hold the antenna in place.

*w.* Backsight through the ILCHR boom telescope to verify the alinement; check that the elevation indicator on the front of the elevation actuating cylinder indicates  $0 \pm 40$  mils. Record the azimuth mil reading below the red indicator on the ILCHR and the azimuth mil reading of the IHIPIR for use in periodic alinement checks.

**Warning.** The ILCHR superstructure will turn in azimuth during the next three steps.

*x.* Request the IHIPIR crewman to position the IHIPIR antenna to the primary target line. When the ILCHR superstructure stops turning, record the azimuth mil indication of the red indicator and

rotate the azimuth handwheel on the LC until the same azimuth is indicated. This is the setting of the day for the ILCHR.

y. Request the IHIPIR crewman to position the IHIPIR antenna to 0 mils azimuth; when the ILCHR superstructure stops turning, record the azimuth mil indication of the red indicator for use in *ac* below, when required. Since the mil indication is true north, it is also used during daily alinement checks.

z. Set the ALINE / OFF switch at OFF; check that the ILCHR superstructure slews to the setting on the LC azimuth indicator.

aa. Repeat *a* through *z* above for the remaining ILCHRs; report the highest of the elevation lever settings to the IHIPIR crewman.

ab. If a sector of fire is ordered cutout, proceed as follows:

(1) Perform the procedures described in *a* through *aa* above except for setting the azimuth override levers; set them at 1,250 mils.

(2) After the procedure described in *y* above has been performed at each ILCHR, request the IHIPIR crewman to position the IHIPIR antenna to the left limit of the sector to be cut out; record the azimuth indicated by the red indicator on the ILCHR.

(3) Request the IHIPIR crewman to position the IHIPIR antenna to the right limit of the sector to be cut out; record the ILCHR azimuth.

(4) On the fire cutout assembly, set outward the two fire cutout switches that correspond to the azimuths of the left and right limits of the cutout sector; set outward all the intervening switches that lie in the direction of the cutout sector.

ac. If the possibility of misfire exists (see *o* above) in any sector(s), the true azimuths to the left and right limits of the sector(s) must be determined. As an example; assume that the indication recorded in *y* above was 500 mils ILCHR azimuth (0 mils true azimuth), and that the left and right limits of a possible misfire sector recorded in *o* above are 900 and 1,600 mils ILCHR azimuth, respectively. Subtract 500 from both 900 and 1,600 to determine the true azimuths which, in this example, are 400 and 1,100 mils, respectively.

ad. Report the true azimuths of the left and right limits of each possible misfire sector to the IBCC crewman.

*Note.* The IBCC crewman uses a color code to indicate possible misfire sectors on the FC console PPI for each ILCHR. The color code is used in selecting an ILCHR, when required, during firing exercises. The TCO also uses a color code on the TCC PPI to indicate possible misfire sectors for use in selecting a fire unit during firing exercise.

## 7-7. Improved Range-Only Radar

The IBCC crewman notifies the IROR crewman when the IHIPIR's are ready to be alined. Alinement with both IHIPIR's is identical; however, IHIPIR A must be alined first if both IHIPIR's are operational. Each IHIPIR must be in local control at the beginning of the procedure.

a. Set the following switches on the IROR as indicated:

(1) LOCAL / REMOTE switch at LOCAL.

(2) RADIATE / STANDBY switch at STANDBY.

(3) Antenna SAFETY SWITCH at SAFE.

(4) SERVO FIL circuit breaker at OFF.

b. Measure and record the horizontal distance to the nearest meter between—

(1) IHIPIR A pedestal center and the IROR pedestal center.

(2) IHIPIR B pedestal center and the IROR pedestal center.

c. Install the alinement telescope so that it can be backsighted on the IHIPIR telescope and check that the IROR is level.

d. Request the IHIPIR crewman to position and stow lock the IHIPIR antenna at 0 mils in elevation, to manually front sight the IHIPIR telescope on the IROR telescope, and set the IHIPIR LOCAL / REMOTE switch at REMOTE.

e. Manually position the IROR antenna until the telescope vertical crosshair bisects the IHIPIR telescope; request the IHIPIR azimuth mil reading from the IBCC crewman and set the IROR azimuth mil ring to the same value.

*Note.* The IROR antenna must be held in place until alinement is completed. Do not reset the IROR azimuth mil ring when alining with IHIPIR B. Request the azimuth reading of IHIPIR B from the IBCC crewman and check that the reading is indicated on the IROR azimuth mil ring.

f. Turn the DISTANCE TO ILLUM handwheel for IHIPIR A (or B) until the adjacent meter indicates 0 and set the SERVO FIL circuit breaker at ON.

g. Set the LOCAL / REMOTE switch at REMOTE and request the IBCC crewman to place firing console A (or B) in manual call.

h. Turn the CLUSTER ADJUST handwheel for IHIPIR A (or B) on the computer control panel so that the azimuth parallax computer indicates zero.

i. Open the access cover above the SAFETY SWITCH, raise the lock lever, press and adjust the CLUSTER ORIENT ILLUMINATOR No. 1 (or

No. 2) control for a null (zero) indication on the nulling meter.

j. Press and hold the null meter sensitivity switch, press and carefully adjust CLUSTER ORIENT ILLUMINATOR No. 1 (or No. 2) control for a fine null on the nulling meter, and release the control before releasing the sensitivity switch.

k. Turn the locking lever to the original position and set the SAFETY SWITCH at OPERATE.

*Note.* If the antenna rotates 3,200 mils, a false null has been obtained. Repeat procedure in *d* through *k* above.

l. Verify alinement by checking the reading on the azimuth mil ring to insure that it is still set at the value established in *e* above and that the elevation vernier indicates 0 mils. Notify the IBCC crewman that alinement is verified.

m. Set the SAFETY SWITCH at SAFE: turn DISTANCE TO ILLUM handwheel for IHIPIR A (or B) until the adjacent meter indicates the distance recorded in *b* above; close the access cover after IHIPIR B has been alined; remove and store the telescope.

n. Set the SAFETY SWITCH at OPERATE and notify the IBCC crewman that IROR alinement is complete.

#### 7-8. Improved Battery Control Central

a. When the IPAR crewman reports, PULSE RADAR AZIMUTH ZERO MILS, it is verified as follows:

(1) Set the SCAN MODE switch on the CWTDC at NORMAL.

(2) Turn the OPERATE / TEST ROTATE switch on the scan servo-amplifier to OPERATE.

(3) Turn the correlation cursor handwheel on the TCC until the CORRELATION CURSOR (MILS) indicator indicates 0 mils.

*Note.* Procedures in (1) through (3) above must be accomplished after the procedure in paragraph 7-2j above is performed.

(4) Check that the IPAR sweep on the TCC PPI coincides with the position of the correlation cursor, and that the sweep and cursor are positioned at 0 mils. Request the IPAR crewman to press and hold the REMOTE SCOPE pushbutton and check the local PPI sweep; wait for his report.

*Note.* If in the first part of this step the sweep and cursor are more than 10 mils apart, request the IPAR crewman to repeat the nulling procedure. If they still remain more than 10 mils apart, call a fire control mechanic to effect necessary repairs or adjustments.

(5) Request the ICC crewman in the shelter to perform the IPAR check procedure and wait for his report on the ACQ readout.

(6) If the ACQ readout lies between 6393 and 0007 mils, notify the IPAR crewman that alinement is verified.

b. When the ICC crewman alining the IFF antenna requests the azimuth of the IPAR, perform the following:

(1) Adjust the correlation cursor handwheel until the correlation cursor is coincident with the sweep on the TCC PPI.

(2) Record the indication of the CORRELATION CURSOR (MILS) counter and give him the value indicated. Wait for his next report.

(3) When the report, IFF ANTENNA FRONTSIGHTED ON IPAR AND AZIMUTH ERROR NULLED, is received, request the ICC crewman in the shelter to start performing the IFF check procedures. Wait until he reports the IPAR ACQ azimuth readout.

(4) When the IPAR ACQ azimuth readout is received, set the SCAN MODE switch on the CWTDC at CW, request the ICC crewman in the shelter to continue the IFF check procedure, and wait for his next report.

(5) When the CASUALTY AZIMUTH INDICATION READOUT OKAY report is received, adjust the correlation cursor handwheel until the correlation cursor is coincident with the sweep on the TCC PPI.

(6) Check that the CORRELATION CURSOR (MILS) counter indicates within  $\pm 10$  mils of the value recorded in (2) above.

(7) Request the ICC crewman in the shelter to continue the IFF check procedures and wait for his next report.

(8) When the IFF IN CW ROTATE AND ANTSYNC SWITCH AT EXT is received, set the SCAN MODE switch at NORMAL and notify the ICC crewman in the shelter that the IFF check procedures are complete.

(9) Request the ICC crewman who is alining the IFF antenna to continue the alinement procedure. Wait until he reports again.

(10) When he reports that the antenna is still front sighted on the IPAR antenna, notify him that alinement is verified.

c. When the ICWAR crewman reports, ICWAR FRONTSIGHTED AND ALINED ON IPAR, the alinement is verified as follows:

(1) Check that the OPERATE / TEST ROTATE switch on the scan servo-amplifier is turned to OPERATE and that the CASUALTY / CW ROTATE switch in the ICC IS SET AT CW ROTATE.

(2) Set the SCAN MODE switch from CW to

NORMAL and check that the sweeps on the CWTDC and TCC do not move.

(3) If the sweeps move more than  $\pm 2$  mils, request the ICWAR crewman to repeat the alinement procedure.

(4) Request the ICC crewman in the shelter to start performing the ICWAR check procedures and wait until he reports the IPAR AZIMUTH readout.

(5) When the report IPAR AZIMUTH READOUT RECORDED is received, set the SCAN MODE switch to CW: request the ICC crewman to continue the ICWAR check procedures and wait for his next report.

(6) When the ICC crewman reports, AZIMUTH CHECK OKAY AND DATA INPUT SWITCH SET TO ALL ZEROS, request the ICWAR crewman to resume the alinement procedure and wait until he requests the IPAR azimuth.

(7) When the ICWAR crewman requests IPAR azimuth, give him the value indicated on the TCC CORRELATION CURSOR (MILS) counter and wait until he reports, ICWAR READY FOR SYNCHRONISM CHECK.

(8) When the ICWAR crewman reports as stated in (7) above, check that the IPAR SYSTEM CONTROL switch is set at REMOTE: request the IPAR crewman to set the SAFE/OPERATE switch at OPERATE, then momentarily press the RADIATE pushbutton on the IPAR control.

(9) Check that the ICWAR and IPAR antennas rotate in synchronism; if they do not (i.e., the ICWAR sweep is not an elongation of the IPAR sweep), request the ICWAR crewman to perform the COMPENSATION adjustment.

(10) When the report COMPENSATION ADJUSTMENT COMPLETED is received, check that the ICWAR and IPAR antennas are rotating to synchronism; verify alinement to the ICWAR crewman.

d. When the IHIPIR crewman reports, IHIPIR FRONTSIGHTED ON IPAR, and requests the IPAR azimuth, perform the following:

(1) Check that the SCAN MODE switch on the CWTDC is set at NORMAL.

(2) Turn the SYSTEM ACCURACY TEST switch on the FC console to ON; turn the OPERATE/TEST ROTATE switch on the scan servo-amplifier to TEST ROTATE; check that the azimuth repeatback mark on the FC console PPI coincides with the azimuth cursor.

(3) Turn the SYSTEM ACCURACY TEST switch to OFF and the OPERATE/TEST ROTATE switch to OPERATE. Position the

azimuth cursor to coincide with the sweep on the FC console PPI.

(4) Turn the MANUAL ELEVATION control on the FC console to 0 mils; momentarily press the ELEVATION MANUAL pushbutton.

(5) Turn the correlation handwheel on the TCC until the correlation cursor coincides with the IPAR sweep. Give the value indicated on the CORRELATION CURSOR (MILS) to the IHIPIR crewman when requested by him, and wait until he reports that the azimuth mil ring has been set.

(6) Turn the OPERATE/TEST ROTATE switch to TEST ROTATE and turn the azimuth cursor handwheel on the FC console until the azimuth cursor coincides with the IPAR sweep. Request the IHIPIR crewman to place the IHIPIR in remove and to continue the alinement procedure.

(7) When the IHIPIR crewman reports, IHIPIR NULLED, turn the OPERATE/TEST ROTATE switch to TEST ROTATE and check that the IHIPIR repeatback mark coincides with both the correlation cursor on the TCC and the azimuth cursor on the FC console; if necessary, request the IHIPIR crewman to repeat the aline procedure.

(8) Request the IHIPIR crewman to set the MOTOR GENERATOR circuit breaker at ON and antenna SAFETY SWITCH at OPERATE and wait until he reports accomplishment. When he does, check that the azimuth repeatback mark on the FC console is positioned at the same azimuth cursor. Wait until the IHIPIR crewman reports, IHIPIR ALINED TO THE IPAR.

(9) When the report is received, request the ICC crewman in the shelter to perform the IHIPIR check procedure and wait for his ACQ AZ readout report.

(10) When the ACQ AZ readout report is received, check that it is within  $\pm 7$  mils of the IHIPIR repeatback mark azimuth.

(11) Inform the IHIPIR crewman that alinement is verified.

e. After the IHIPIR's have been alined with the IPAR, notify the IROR crewman that the IHIPIR's are ready to be alined with the IROR. Assist in the procedures as follows:

(1) When the IROR crewman requests the azimuth of the IHIPIR, position the correlation cursor on the TCC so that it coincides with the IHIPIR azimuth repeatback mark; give the value indicated on the CORRELATION CURSOR (MILS) counter to the IROR crewman.

(2) Momentarily press the CALL pushbutton

on the FC console (A or B) when requested to do so by the IROR crewman.

### 7-9. Information and Coordination Central (ADP)

The ADP in the ICC is used to check alinement of the radars to insure that it is processing data within the tolerances required for successful engagements in the automatic and normal modes of firing. The sequence in which the radars are checked is directed from the IBCC by the TCO. To perform the checks, the operational program must be loaded into the ADP in accordance with TM 9-1430-527-12-1 and the READER POWER ON/OFF switch set at ON.

a. When requested to perform the IPAR check procedures, proceed as follows:

(1) Turn the INSTRUCTION INPUT switches on the CPU panel to 06044042.

(2) Press the EXECUTE pushbutton one time. Check that the tape advances to the battery check portion of the tape and stops.

(3) Turn the DATA INPUT switches on the CPU panel to 40000101.

(4) Press the DTO MANUAL RESET pushbutton.

(5) Press the CPU RESET pushbutton.

(6) Set the LOCAL/REMOTE switch at REMOTE.

(7) Press the DISPLAY ENABLE pushbutton.

(8) Press the START/STEP/PULSE pushbutton two times. Check that the remaining portion of the operational program is loaded and that the printer readout is ACQ 6393 to 0007 MILS. Report the result to the IBCC crewman.

b. When requested to perform the IFF nulling procedures, lift and turn the METER selector switch to AZ COARSE on the coder-decoder group antenna control panel; open the AZ ADJ LOCK control cover and adjust the control for a null on the PWR SUP TEST/NULL meter; lift the selector switch and turn it to AZ FINE; and adjust the AZ ADJ control for a minimum indication on the meter. Report, AZIMUTH ERROR NULLED, to the ICC crewman who is alining the IFF antenna.

c. When requested to start performing the IFF check procedures, proceed as follows:

(1) Press the SINGLE INSTRUCTION pushbutton.

(2) Press the DTO MANUAL RESET pushbutton.

(3) Press the CPU RESET pushbutton.

(4) Press the DISPLAY ENABLE pushbutton.

(5) Press the START/STEP/PULSE push-

button two times. Record the IPAR ACQ azimuth readout, report its value to the IBCC crewman and wait for further instructions.

(6) When requested to continue the IFF check procedures, momentarily press the CASUALTY/CW ROTATE pushbutton for a CASUALTY indication.

(7) Set the ANT SYNC EXT/INT switch at INT.

(8) Press the SINGLE INSTRUCTION pushbutton.

(9) Press the DTO MANUAL RESET pushbutton.

(10) Press the CPU RESET pushbutton.

(11) Press the DISPLAY ENABLE pushbutton.

(12) Press the START/STEP/PULSE pushbutton two times.

Check that the printer readout is within  $\pm 14$  mils of the azimuth recorded in c(5) above; report, CASUALTY AZIMUTH INDICATION READOUT OKAY, to the IBCC crewman and wait for further instructions.

(13) When requested to continue the IFF check procedures, momentarily press the CASUALTY/CW ROTATE pushbutton for a CW ROTATE indication.

(14) Set the ANT SYNC EXT/INT switch at EXT.

(15) Report, IFF IN CW ROTATE AND ANT SYNC SWITCH AT EXT, and wait.

(16) When notified that the IFF check procedures are completed, tighten the AZ ADJ LOCK and close the AZ ADJ access cover. Tighten the cover securely.

d. When requested to start performing the ICWAR check procedures, proceed as follows:

(1) Press the DTO MANUAL RESET pushbutton.

(2) Press the CPU RESET pushbutton.

(3) Press the DISPLAY ENABLE pushbutton.

(4) Press the START/STEP/PULSE pushbutton two times. Record the printer IPAR AZIMUTH readout and report IPAR AZIMUTH READOUT RECORDED, to the IBCC crewman and wait for further instructions.

(5) When requested to continue the ICWAR check procedures, press the DTO MANUAL RESET pushbutton.

(6) Press the CPU RESET pushbutton.

(7) Press the DISPLAY ENABLE pushbutton.

(8) Press the START/STEP/PULSE pushbutton two times.

Check that the printer readout indicates within  $\pm 7$  mils of the azimuth recorded in (4) above.

(9) Turn the DATA INPUT switches to 00000000. Report, AZIMUTH CHECK OKAY AND DATA INPUT SWITCH SET TO ALL ZEROS, to the IBCC crewman.

e. When requested to perform the IHIPIR check procedures, proceed as follows:

- (1) Press the DTO MANUAL RESET pushbutton.
- (2) Press the CPU RESET pushbutton.
- (3) Press the DISPLAY ENABLE pushbutton.
- (4) Press the START / STEP / PULSE pushbutton two times.
- (5) Report the ACQ AZ readout to the IBCC crewman.

## Section II. IMPROVED ASSAULT FIRE UNIT AND ASSAULT FIRE SECTION

### 7-10. General

a. Orientation and alinement procedures are usually performed as soon as the IAFU or AFS Improved Hawk equipment is emplaced in the field and each item of equipment is energized. Procedures for using the ADP during orientation and alinement are currently being developed and will be incorporated in a future change to this manual. To insure that correct procedures are followed, responsibility for the performance of the procedures at each item of equipment is normally delegated to personnel as follows:

IPCP (IFF) .....	TCO
ICWAR .....	Senior FC crewman
IHIPIR .....	FCO
ILCHR's .....	Senior ML crewman

b. The procedures are directed by the TCO from his station in the IPCP and consist of the following general steps:

- (1) Orient the ICWAR on the KRP and aline the ICWAR sweep with the display on the TDECC in the IPCP.
- (2) Aline the IFF with the ICWAR.
- (3) Aline the IHIPIR with the ICWAR.
- (4) Aline the ILCHR's with the IHIPIR.

### 7-11. Improved Continuous-Wave Acquisition Radar

a. Set the following switches as indicated:

- (1) Antenna SAFETY SWITCH at SAFE.
- (2) LOCAL / REMOTE switch at LOCAL.
- (3) Operating mode switch at LOCAL SYNCHRO.

b. Check that the ICWAR is level and install the alinement telescope on the antenna so that it can be frontsighted on the KRP.

c. Manually position the antenna until the vertical crosshair in the telescope is sighted on the KRP; hold the antenna in place and set the azimuth mil ring to the known azimuth to the KRP.

d. Manually position the antenna until the azimuth mil ring indicates 0 mils; hold the antenna

in place until alinement is verified; and set the azimuth handwheel on the fuse and control panel to 0 mils.

e. Open the right access door on the pedestal and record the setting of the BORESIGHT SHIFT COMPENSATOR ADJUST knob; and turn the knob to zero.

f. Open the rear access door on the pedestal and unlock the SYNCHRO CLUSTER ORIENT adjust knob, turn the servo BITE switch to position 6, and push the knob down and rotate it until a null is obtained on the servo BITE meter.

g. Turn the servo BITE switch to position 7 and rotate the SYNCHRO CLUSTER ORIENT adjust knob to obtain a fine null on the servo BITE meter.

h. Release the SYNCHRO CLUSTER ORIENT adjust knob, lock the knob, check that the servo BITE meter still indicates a null, and turn the servo BITE switch to OPR.

i. Set the LOCAL / REMOTE switch at REMOTE, and report, ICWAR ORIENTED AND ALINED, to the PCP crewman; wait for verification.

j. When the IPCP crewman verifies alinement, return the BORESIGHT SHIFT COMPENSATOR ADJUST knob to the setting recorded in e above, close and secure the right and rear access doors; remove the alinement telescope and reinstall it so that it can be used to backsight on the IFF and IHIPIR antennas.

k. When alining with the IFF and IHIPIR, insure that the ICWAR alinement telescope remains backsighted on the IFF and IHIPIR alinement telescopes until the alinement is verified.

l. When the IFF and IHIPIR antennas have been alined, remove and store the ICWAR alinement telescope.

### 7-12. Identification, Friend or Foe (IPCP)

a. Set the following switches as indicated:

- (1) ANT SYNC EXT / INT at EXT.

(2) ANT SAFE / OPERATE AT ANT SAFE.

(3) AZ DRIVE SAFE OFF / ON at SAFE ON.

b. Energize the IFF equipment as described in TM 9-1430-535-12-1.

c. Check the level of the IFF antenna and install the alinement telescope and mounting bracket in the telescope mount on the IFF antenna.

d. Request the ICWAR crewman to backsight the ICWAR alinement telescope on the IFF antenna alinement telescope; position the IFF antenna until the telescope vertical crosshair is centered on the ICWAR telescope; and hold the IFF antenna in place until alinement is complete.

e. Open the AZ ADJ LOCK control cover and unlock the AZ ADJ control; adjust the control for a coarse and fine null on the meter on the synchronizer assembly.

f. Adjust the AZIMUTH handwheel on the TDECC control panel until the azimuth cursor coincides with the IFF sweep on the TDECC PPI; record the reading of the AZIMUTH counter.

g. Momentarily press the CASUALTY / CW ROTATE pushbutton on the front panel of the auxiliary box for a CASUALTY indication; set the ANT SYNC EXT / INT switch at INT.

h. Adjust the AZIMUTH handwheel until the azimuth cursor coincides with the sweep on the TDECC PPI; check that the AZIMUTH counter indicates within  $\pm 10$  mils of the indication recorded in g above.

i. Momentarily press the CASUALTY / CW ROTATE pushbutton for a CW ROTATE indication; set the ANT SYNC EXT / INT switch at EXT; tighten the AZ ADJ LOCK; close and secure the AZ ADJ LOCK cover.

j. Adjust the tilt of the IFF antenna as determined by the angular elevation to the horizon, if required.

*Note.* Use the highest point at the horizon within the sector of interest as a reference. If this point is less than  $10^\circ$ , use it as the tilt angle; if this point is  $10^\circ$ , or greater, use  $10^\circ$  as the tilt angle.

k. Set the AZ DRIVE SAFE OFF / ON switch at ON and the ANT SAFE / OPERATE switch at OPERATE.

*Note.* As soon as possible, interrogate a target of opportunity and observe whether the IFF replies appear at the same azimuth as ICWAR targets. If they do not appear at the same azimuth, further adjustment of the AZ ADJ control is necessary.

### 7-13. Improved High-Powered Illuminator Radar

#### a. Alinement with ICWAR.

(1) Set the following switches as indicated:

(a) LOCAL / REMOTE switch at LOCAL.

(b) Antenna SAFETY SWITCH at SAFE.

(2) Energize the IHIPIR to false radiate status.

(3) Check that the IHIPIR is level and install the alinement telescope on the IHIPIR antenna.

(4) Request the ICWAR crewman to backsight the ICWAR telescope on the IHIPIR telescope and to hold the ICWAR antenna in place; frontsight the IHIPIR telescope on the ICWAR telescope.

(5) Report, IHIPIR FRONTSIGHTED ON ICWAR, to the IPCP crewman and wait for instructions from him.

(6) When requested by the IPCP crewman to do so, set the LOCAL / REMOTE switch at REMOTE and continue the alinement procedure; check that the telescope is still frontsighted on the ICWAR telescope.

(7) Open the pedestal access door, unlock and press the SYNCHRO CLUSTER ORIENT ADJUST knob, and rotate the knob until a null (zero) is obtained on the nulling meter.

(8) Press and hold fine null switch S1, and simultaneously rotate the SYNCHRO CLUSTER ORIENT ADJUST knob until a fine null is obtained.

(9) Release S1 and the SYNCHRO CLUSTER ORIENT ADJUST knob, lock the knob, and check that the nulling meter indicates zero by pressing S1 again; report, IHIPIR ALINED WITH THE ICWAR, to the IPCP crewman; wait for further instructions from him.

**Warning.** Insure that all personnel are clear of the IHIPIR antenna before performing the following step.

(10) When requested by the IPCP crewman to do so, set the MOTOR GENERATOR circuit breaker on the main fuse panel at ON, and the antenna SAFETY SWITCH at OPERATE.

(11) Check that the IHIPIR antenna remains stationary and is positioned to 0 mils elevation. If the antenna slews 3,200 mils, a false null was obtained; repeat (7) through (9) above.

(12) Set the LOCAL / REMOTE switch at LOCAL; adjust the azimuth handwheel on the control indicator panel until the AZIMUTH dial indicates 0 mils; adjust the elevation handwheel until the ELEVATION dial indicates + 200 mils; and set the antenna SAFETY SWITCH at SAFE.

(13) Adjust the IHIPIR azimuth mil ring so that the vernier indicates 0 mils, being careful not to disturb the antenna position.

b. Alinement with ILCHR's. Alinement of the IHIPIR with the ILCHR's is performed as

described in paragraph 7-5 *b* for the improved battery.

**7-14. Improved Zero-Length Launchers**

Alinement of the ILCHR's with the IHIPIR is performed as described in paragraph 7-6 for the improved battery, except that possible misfire sectors are reported to the IPCP crewman instead of the IBCC crewman. He uses a color code for the same purpose as described for the IBCC crewman, but applies the code to the TDECC PPI instead of the FCC PPI.

**7-15. Improved Platoon Command Post**

*a.* When the ICWAR crewman reports, ICWAR ORIENTED AND ALINED, perform the following:

(1) Verify the alinement by rotating the AZIMUTH handwheel on the TDECC control panel until the counter indicates 0 mils. Check that the ICWAR sweep on the TDECC PPI is positioned at 0 mils. If the sweep is positioned at 3,200 mils, a false null was obtained. Request the ICWAR crewman to repeat the procedures in paragraph 7-11 *f* through *h*.

(2) Inform the ICWAR crewman that alinement is verified and request him to backsight

on the IFF antenna telescope or the IHIPIR antenna telescope, whichever is ready first.

*b.* When the IHIPIR crewman reports, IHIPIR FRONTSIGHTED ON ICWAR, perform the following:

(1) Adjust the AZIMUTH handwheel on the TDECC control panel until the azimuth cursor coincides with the sweep on the TDECC PPI.

(2) Set the ELEVATION thumbwheel on the TDECC control panel to 0 mils; request the IHIPIR crewman to set the IHIPIR LOCAL/REMOTE switch at REMOTE and to continue the alinement procedure.

*c.* When the IHIPIR crewman reports, IHIPIR ALINED WITH THE ICWAR, perform the following:

(1) Turn the mode switch on the status panel to HPI; check that the azimuth cursor passes through the center of the IHIPIR symbol on the TDECC PPI; turn the mode switch to ADP.

(2) Inform the IHIPIR crewman that alinement is verified and request him to set the MOTOR GENERATOR circuit breaker at ON and the antenna SAFETY SWITCH at OPERATE.

## CHAPTER 8

## CHECKOUT PROCEDURES

**8-1. General**

As soon as possible after completion of the emplacement, preenergizing, energizing, orientation, and alinement procedures, certain checks must be performed to insure that the integrated Improved Hawk system is operating properly. These checks are directed by the TCO at the IBCC in the improved battery, and at the IPCP in the IAFU or AFS.

**8-2. Improved Battery**

Details as to how to perform the following checks are contained in TM 9-1430-526-12-1.

**a. IPAR.**

- (1) Set control panel lamps.
- (2) Remote standby operation.
- (3) Remote radiate operation.
- (4) Moving target indicator video.
- (5) Back bias dicke fix.
- (6) Sector of interest.
- (7) Gated moving target indicator video.
- (8) Video integration.
- (9) Side-lobe blanking.
- (10) Identification, friend or foe.

**b. ICWAR.**

- (1) Remote standby operation.
- (2) Local / remote switching.
- (3) Target video presentation.
- (4) Jamming strobe.

**c. IHIPIR.**

- (1) Remote standby operation.
- (2) Remote radiate operation.
- (3) System test.
- (4) Destruct and recycle functions.
- (5) Low search.
- (6) High search.
- (7) Transmitter frequency.
- (8) Target doppler plus AM.
- (9) Interfering target.
- (10) Special lock.
- (11) AFC hold.
- (12) Battery routine.

(13) Auto pilot.

*d. Target Acquisition function—Normal Mode.*

*e. Launcher preparation.*

*f. Frequency and Message Commands.*

**8-3. Improved Assault Fire Unit and Assault Fire Section**

The following checks are those required in the IAFU and AFS. Details as to how to perform the checks are contained in \*TM 9-1430-535-12-1.

*a. ADP Loop Test.*

*b. Platoon Display and Alinement and Loop Test.*

*c. ICWAR.*

- (1) Remote standby operation.
- (2) Remote radiate operation.
- (3) Local / remote switching.
- (4) PSI display presentation.
- (5) Jamming strobe.

*d. IHIPIR.*

- (1) Remote standby operation.
- (2) Remote radiate operation.
- (3) System test.
- (4) Destruct and recycle functions.
- (5) Manual azimuth positioning.
- (6) Manual elevation positioning.
- (7) Low search.
- (8) High search.
- (9) Azimuth narrow search.
- (10) Azimuth wide search.
- (11) Azimuth rotate search.
- (12) Transmitter frequency.
- (13) Target doppler plus AM.
- (14) Interfering target 2.
- (15) Special lock.
- (16) AFC hold.

*e. ADP / IHIPIR / TDECC Interface.*

*f. Target Assignment Function and Normal Mode Operation.*

*g. Launcher Preparation.*

\* To be published.

## PART THREE

## OPERATIONS

## CHAPTER 9

STATES OF READINESS, ALERT PROCEDURES,  
AND ENGAGEMENTS USING THE AUTOMATIC  
DATA PROCESSOR (ADP)

## Section I. STATES OF READINESS

## 9-1. General

Operations in Improved Hawk missile batteries vary between major commands because of different tactical situations. However, basic operating procedures are the same regardless of the theater of operations. The defense readiness condition is dictated by the imminence of hostilities and the state of alert is dictated by the current air defense warning.

## 9-2. Defense Readiness Conditions

Defense readiness conditions (DEFCON) are specific requirements to bring units up to a state of preparedness compatible with the imminence of hostilities. Because of security classification, these conditions are omitted from this manual. They usually are described in local command directives, including the battery SOP.

## 9-3. Air Defense Warnings

An air defense warning is an indication of the probability of attack expressed as—

- a. **WARNING RED.** Attack by hostile aircraft or missiles is imminent or in progress.
- b. **WARNING YELLOW.** Attack by hostile aircraft or missiles is probable but not imminent.
- c. **WARNING WHITE.** Attack by hostile aircraft or missiles is not probable.

## 9-4. States of Alert

- a. A state of alert establishes the period of time

within which firing elements must be able to open fire. Air defense commanders establish states of alert in consonance with the defense readiness condition and alert status imposed by higher headquarters. Subordinate commanders may order their units to a higher, but never to a lower, state of alert than that imposed by higher headquarters. When a prescribed state of alert cannot be assumed for any reason (e.g., equipment malfunction) higher headquarters must be notified immediately.

b. The states of alert that *may* be established are 3-hour, 1-hour, 15-minute, or BATTLE STATIONS, the highest state of alert. An Improved Hawk firing element at BATTLE STATIONS has all of its equipment energized and manned by required personnel and is ready to fire. Firing elements ordered to BATTLE STATIONS are usually returned to a lower state of alert as soon as the threat has passed. Firing element commanders will order their units to BATTLE STATIONS under any of the following conditions:

- (1) Air defense WARNING RED has been received.
- (2) Known or suspected hostile aircraft (missiles) have been detected.
- (3) Pop-up targets meet established criteria for engagement, and BATTLE STATIONS has not been ordered previously.

## Section II. ALERT PROCEDURES

## 9-5. General

This paragraph describes readiness conditions that *may be* required for each state of alert, except BATTLE STATIONS, with respect to manning,

equipment, and missiles. The readiness conditions described for BATTLE STATIONS *must be* achieved. The actual readiness conditions required for each state of alert vary between major com-

mands. Unit tactical SOP reflect the variations as determined by enemy capabilities, particularly in the areas of electronic countermeasures (ECM and antiradiation missiles (ARM).

*a. 3-Hour and 1-Hour Alert Statuses.*

(1) Duty stations are not manned. However, manning crews are available so that BATTLE STATIONS may be reached within the prescribed time (3 hours or 1 hour).

(2) Communications to the AADCP are monitored.

(3) Equipment may be deenergized.

(4) All missile SAFE / ARM levers are turned to SAFE; umbilical cables are *disconnected* and umbilical shorting plugs in missiles.

*b. 30-Minute Alert Status.*

(1) Manning crews must be in the general vicinity of their duty stations so that BATTLE STATIONS can be reached within 30 minutes.

(2) Communications to the AADCP are monitored.

(3) All fire control equipment is energized; radars are in standby and local control; ILCHR's are in local control and off; the OPERATE / SAFE switches at the ILSCB are set at SAFE.

(4) All missile SAFE / ARM levers are turned to SAFE; umbilical cables are *disconnected* and umbilical shorting plugs in missiles.

*c. 15-Minute Alert Status.*

(1) Manning crews must be in the immediate vicinity of their duty stations so that BATTLE STATIONS can be reached within 15 minutes.

(2) Communications with the AADCP are monitored and internal communications manned.

(3) All fire control equipment is energized; ICC is in remote status and operational program is running; radars are in local standby status; ILCHR's are in local off status; OPERATE / SAFE switches at the ILSCB are set at SAFE.

(4) All missile SAFE / ARM levers are turned to SAFE; umbilical cables are *connected*.

*d. BATTLE STATIONS.*

(1) All equipment and communications are manned.

(2) All equipment is energized, ILCHR's and radars in remote control status, radars in radiate condition, acquisition radars on surveillance, and OPERATE / SAFE switches at the ILSCB set at OPERATE.

(3) All missiles are ready to fire (SAFE / ARM levers turned to ARM).

**9-6. 15-Minute Alert Drill Training**

This paragraph contains step-by-step procedures for use in drill training in a non-ECM environment to achieve the proficiency required to progress from a 15-minute alert status to BATTLE STATIONS when operating in the manual ADP assist mode. Modifications required in the procedures when operating in an ECM environment are contained in TM 9-1425-525-12-3. With minor changes, if any, the procedures can be adapted to suit any tactical situation. During crew drill training, the command, BLAZING SKIES, is used instead of BATTLE STATIONS. The procedures are designed primarily for use by newly activated units undergoing the formal phases of training in an ATP, by individuals undergoing advanced individual training in other than a tactical unit, and are predicated on three assumptions. First, the readiness conditions described in paragraph 9-5 c have been achieved; second, the firing element has completed a system integrated check prior to assuming the 15-minute alert status and periodically repeats the check while in this status; and third, malfunctions have not occurred and will not occur during the drill. A unit in training may modify the procedures to conform to the tactical SOP and to suit current conditions. As an example of the latter, if the launching section crewmen assigned to manning detail happen to be working in the vicinity of the ILCHR's, they would not receive the order BATTLE STATIONS or BLAZING SKIES directly from the crew chief as shown in c below. They would immediately check with the crew chief by headset to determine which status has been ordered before continuing with the drill. All crewmen must be instructed that any malfunction discovered during drill must be reported promptly and corrected as soon as the training or tactical situation permits.

*a. IBCC Detection, Identification, and Threat Evaluation Phase.* The duties of personnel in the IBCC, when ordered to BATTLE STATIONS (BLAZING SKIES) and conducting the detection, identification, and threat evaluation phase of an engagement, are described in table 9-1. With obvious deletions, these duties are also applicable to the battery minus the IAFU.

Table 9-1. IBCC Detection, Identification, and Threat Evaluation Procedures

TCO	TCA	ASO	FCO A and B
<p>1. Sounds siren, monitors communications net, orders <b>BLAZING SKIES</b> or <b>BATTLE STATIONS</b>.</p> <p>2. ....</p> <p>3. ....</p> <p>a. Checks that all consoles in IBCC are energized; performs lamp test, and checks fuses at TCC; sets the controls on the TCO/TCA communications unit to the desired positions.</p> <p>b. Checks that power distribution controls are in the required or desired positions. Observes whether any <b>FAIL IND</b> or <b>UNIT FAILURE</b> lamps are flashing.</p> <p>c. When the TCA reports that the IPAR is ready for remote operation, directs him to place it in remote. Checks that the <b>STANDBY</b> lamp on the IPAR set control lights and immediately presses the <b>RADIATE</b> pushbutton; checks that the <b>RADIATE</b> lamp lights.</p> <p>d. When the TCA reports that the IROR is ready for remote operation, directs him to place it in remote. Checks that the <b>RADIATE</b> lamp lights on the IROR electronic control amplifier.</p>	<p>1. ....</p> <p>2. Proceeds to IPAR.</p> <p>3. ....</p> <p>a. Checks that <b>CRYSTAL CURRENT</b> meter indicates red line with the <b>OFF/COHO/SIG</b> switch in the <b>COHO</b> and <b>SIG</b> positions.</p> <p>b. Turns the <b>TEST TRANSFER</b> switch on the signal comparator to <b>SIGNAL MONITOR</b>. Checks for red line indication on the test meter with the <b>SIGNAL MONITOR</b> switch in the <b>COHO LEVEL</b> and <b>OSCILLATOR LEVEL</b> positions. Turns the <b>TEST TRANSFER</b> switch to <b>OPERATE</b>.</p> <p>c. Informs TCO by headset that checks are completed and that the IPAR is ready for remote operation. When directed, turns the <b>SYSTEM CONTROL — LOCAL/REMOTE</b> switch to <b>REMOTE</b>.</p> <p>d. Proceeds to IROR, positions antenna to point in direction of known ground clutter, energizes IROR to radiate status, checks display for presence of normal clutter. Informs TCO by headset that the IROR is ready for remote operation. When directed, sets the <b>LOCAL/REMOTE</b> switch at <b>REMOTE</b>.</p>	<p>1. ....</p> <p>2. Proceeds to ICWAR.</p> <p>3. Presses <b>RADIATE</b> pushbutton, waits 20 to 35 seconds and performs the following:</p> <p>a. Checks that <b>MAG UNDER CURRENT</b> lamp goes out and <b>HIGH VOLTAGE ON</b> lamp lights.</p> <p>b. Checks that <b>MAGNETRON PLATE VOLTAGE</b> and <b>PLATE CURRENT</b> meter indications are within tolerances.</p> <p>c. ....</p> <p>d. Checks that antenna is clear and sets <b>SAFETY SWITCH</b> at <b>OPERATE</b>.</p> <p>e. Sets <b>AZ AMPLIDYNE</b> circuit breaker at <b>ON</b>.</p>	<p>1. Announces <b>BLAZING SKIES</b> or <b>BATTLE STATIONS</b> by headset to launching section crew chief.</p> <p>2. Proceeds to <b>IHIPER</b>.</p> <p>3. Presses <b>RADIATE</b> pushbutton and performs the following:</p> <p>a. Checks that <b>RADIATE READY</b> lamp goes out and <b>RADIATE</b> lamp lights.</p> <p>b. Checks that <b>FORWARD RF POWER</b>, <b>REGULATOR VOLTS</b>, <b>BEAM VOLTAGE</b>, and <b>BEAM AMPERE</b> meter indications are within tolerances.</p> <p>c. Turns <b>DEGENERATION FUNCTION SELECTOR</b> switch to all positions and checks that <b>MONITOR</b> meter indications are in correct color coded areas.</p> <p>d. Checks that <b>AM</b> noise does not exceed 6 and <b>FM</b> noise does not exceed 20 on the transmitter noise meter.</p> <p>e. Turns <b>RECEIVER FUNCTIONS</b> switch to all positions and checks <b>RECEIVER FUNCTIONS</b> meter for correct indications.</p>

Table 9-1. IBCC Detection, Identification, and Threat Evaluation Procedures—Continued

TCO	TCA	ASO	FCO A and B
<p><i>g.</i> When ASO reports that the ICWAR is ready for remote operation, directs him to place it in remote. Checks that the RADIATE lamp lights on the CWTDC control panel.</p> <p><i>h.</i> When FCO A (B) reports that the IHIPIR is ready for remote operation, directs him to place it in remote. Checks that the FIRE SECTION ACTIVE lamp lights on FCC A (B).</p> <p>4. ....</p> <p><i>a.</i> Checks that CEASE FIRE/RESUME FIRE switches are set at CEASE FIRE and that the FIRE MODE switch is set at NORMAL.</p> <p><i>b.</i> Checks ECCM fixes; selects and adjusts best video; checks that assigned defense sector and IPAR range window have been properly set in the ADP; turns the video selector switch to GATE.</p> <p>5. Insures that firing element has assumed increased status; notifies AADCP if required.</p> <p>6. Monitors communications nets, symbology, TCC indicator, and IBCC status indicator.</p> <p>7. For BLAZING SKIES, directs FCO to set FIRE UNIT ACTIVE switch at READY 2.5 or 5 minutes after the launching section is declared CLEAR AND SIMULATED READY, depending on position of MSL COUNT DELAY switch on ILSCB.</p>	<p>.....</p> <p>.....</p> <p>4. Returns to IBCC and performs the following: <i>a.</i> Presses IPAR RADIATE pushbutton.</p> <p><i>b.</i> Adjusts TCC, early warning plotting board lamps, blackout switches, and curtains.</p> <p>5. Orally announces equipment ready status.</p> <p>6. Monitors communications nets, symbology, and IBCC status indicator. Plots early warning information on plotting board. Begins surveillance of TCC indicator.</p> <p>7. Marks successive target positions on EW plotting board AND reflective plotter. Continues surveillance for other possible threats.</p>	<p><i>f.</i> Turns operating mode switch to PULSE SLAVE.</p> <p><i>g.</i> Informs TCO by headset that checks are completed and that the ICWAR is ready for remote operation. Sets LOCAL/REMOTE switch at REMOTE when directed.</p> <p>.....</p> <p>4. Returns to IBC and performs the following: <i>a.</i> Performs lamp test and checks fuses.</p> <p><i>b.</i> Adjusts lamps, doppler, and video.</p> <p>5. Orally announces equipment ready status.</p> <p>6. Begins visual surveillance for approaching targets and audio surveillance for receding targets.</p> <p>7. Continues surveillance, concentrates on locating known threat.</p>	<p><i>f.</i> Checks that antenna is clear and sets SAFETY SWITCH at OPERATE.</p> <p><i>g.</i> Sets MOTOR GENERATOR circuit breakers at ON.</p> <p><i>h.</i> Informs TCO by headset that checks are completed and that the IHIPIR is ready for remote operation. Sets LOCAL/REMOTE switch at REMOTE when directed.</p> <p>4. Returns to IBCC and performs the following: <i>a.</i> Performs lamp test and checks fuses.</p> <p><i>b.</i> Adjusts lamps, doppler, video, sweep, symbols, and system accuracy; checks that headset is connected under the FCC, not to the communications module.</p> <p>5. Orally announces equipment ready status over intrabattery communications. Checks that IHIPIR is in active status (radiate) and positions antenna to primary target line, if necessary.</p> <p>6. Begins search of assigned sectors, pretracks possible targets with cursor, and monitors ASSIGN lable.</p> <p>7. For BATTLE STATIONS, when the launcher section is declared CLEAR AND READY, waits until at least one missile present lamp is lit, then sets FIRE UNIT ACTIVE switch at READY. For BLAZING SKIES, sets FIRE UNIT ACTIVE switch at READY on direction of TCO.</p>

Table 9-1. IBCC Detection, Identification, and Threat Evaluation Procedures—Continued

TCO	TCA	ASO	FCO A and B
<p>8. Correlates targets with early warning data and symbology. Notifies AADCP if required.</p> <p>9. Same as step 8 above.</p> <p>10. ....</p>	<p>8. If the known threat is acquired or a new target is detected, challenges it according to procedures in the unit tactical SOP, tracks it by positioning the correlation cursor over it, and notifies TCO.</p> <p>9. When the CW CONFIRM pushbutton begins flashing, examines PSI for location of target. Places correlation cursor over designated target. Presses CW CONFIRM pushbutton.</p> <p>a. If the target can be correlated with a PPI target, marks it accordingly and notifies TCO.</p> <p>b. If the target cannot be correlated with a PPI target, challenges it according to procedures in unit tactical SOP, tracks it by positioning correlation cursor over it, and notifies TCO verbally.</p> <p>10. Keeps track of target and continues to perform procedures in step 6 and 7 above.</p>	<p>8. ....</p> <p>9. If a target is detected, tracks it manually by positioning the cursor over it and slewing the display if necessary. Presses TCC ALERT pushbutton to notify TCA / TCO. Estimates range (close in, far out) and announces it to TCO.</p> <p>10. When the TCC ALERT pushbutton goes out, continues to mark target location with a grease pencil, if required, and begins searching for new targets.</p>	<p>8. ....</p> <p>9. ....</p> <p>10. ....</p>

*b. IBCC Engagement Phase.* The duties of personnel in the IBCC when engaging a target are described in table 9-2. To enable realistic simulation of missile present lights on the FCC's

during drill training, radar target simulation station AN / TPQ-29 must be connected to the IBCC or miniature missile simulators must be installed on the ILCHR's.

Table 9-2. IBCC Engagement Procedures

TCO	TCA	ASO	FCO A and B
<p>1. After detection, identification, and evaluation of the threat, a target is selected for engagement. The TCO places the tracking symbol over the target, presses ASSIGN HIGH (or LOW) pushbutton of fire unit A (or B), and checks that CEASE FIRE/RESUME FIRE switch is set at CEASE FIRE.</p>	<p>.....</p>	<p>.....</p>	<p>1. When the tracking symbol appears over the target and the ASSIGN label and HIGH (or LOW) pushbutton begins flashing, presses BREAK LOCK pushbutton, turns azimuth handwheel until cursor is over the symbol, then releases BREAK LOCK pushbutton.</p>
<p>2. Observes the fire unit lock-on sequence on the IBCC status indicator.</p>	<p>2. ....</p>	<p>2. ....</p>	<p>2. ....</p>
<p>3. At illuminator lock.</p>	<p>3. ....</p>	<p>3. ....</p>	<p>a. After the repeat-back mark is coincident with the cursor, accepts the assignment by pressing HIGH (or LOW) pushbutton, and checks that:</p> <ul style="list-style-type: none"> <li>(1) SEARCH lamp is flashing.</li> <li>(2) FIRE SECTION ACTIVE lamp is lit.</li> </ul> <p>b. Tracks the target manually in azimuth, using the handwheel, until the illuminator locks on. Changes elevation search modes if necessary to achieve lock.</p> <p>3. At illuminator lock, checks that:</p> <ul style="list-style-type: none"> <li>a. LOCK label lights, SEARCH label goes out, and spectrum analyzer indicates a valid lock.</li> <li>b. Altitude, speed, and signal strength meters are lit and are registering; relays this information to the TCO if required.</li> <li>c. Range strobe moves to the range of the target within <math>\pm 10</math> percent.</li> </ul>
<p>c. Observes the illuminator repeat-back mark and range strobe on TCC indicator to insure that illuminator is locked on the assigned target.</p>	<p>.....</p>	<p>.....</p>	

Table 9-2. IBCC Engagement Procedures—Continued

TCO	TCA	ASO	FCO A and B
<p>4. ....</p> <p>5. If a new target is determined to be a greater threat or if the illuminator is locked on the wrong target, repositions tracking symbol, presses CHANGE TARGETS and ASSIGN HIGH (or LOW) push-buttons, and sets CEASE FIRE/RESUME FIRE switch at CEASE FIRE.</p> <p>6. Observes which of the raid-size labels are lit and makes decision as to how many missiles will be fired.</p> <p>7. If necessary, notifies FCO's which launcher will be used.</p> <p>8. Once assured that the illuminator is locked on the correct target, sets CEASE FIRE/RESUME FIRE switch at RESUME FIRE.</p> <p>9. If notified of hangfire, decides whether to fire again from same launcher or select another launcher.</p>	<p>4. ....</p> <p>5. Examines PSI for location of new target. Presses CW CONFIRM pushbutton and notifies TCO.</p> <p>6. ....</p> <p>7. ....</p> <p>8. ....</p> <p>9. ....</p>	<p>4. ....</p> <p>5. If a new higher priority target appears, repeats procedures necessary to alert TCA / TCO.</p> <p>6. ....</p> <p>7. ....</p> <p>8. ....</p> <p>9. ....</p>	<p>4. If the LOCK label goes out and the COAST label is lit, the illuminator has lost target lock. The illuminator will coast in azimuth for 10 seconds at the same rate it had at the moment lock was lost. If the illuminator does not automatically regain lock, the FCO tracks the target manually in azimuth, changing elevation search modes if necessary, until the illuminator regains lock. If lock is not achieved, tries using manual speed.</p> <p>5. If CHANGE TARGET and ASSIGN labels begin flashing, or if FCO has determined that he is locked on the wrong target, takes the following action:</p> <p>a. Presses BREAK LOCK pushbutton.</p> <p>b. Turns azimuth handwheel until cursor and repeat-back mark are placed over proper target.</p> <p>c. Repeats steps 1-3 above.</p> <p>6. Listens to doppler and monitors spectrum analyzer to determine raid size. Presses ONE, FEW, or MANY pushbutton as appropriate.</p> <p>7. Launcher 1 is automatically selected at assign; if another launcher is to be used for engagement, it is selected manually by pressing its associated pushbutton.</p> <p>8. Normally presses FIRE pushbutton (after it is lit) in accordance with unit tactical SOP. If the HANGFIRE lamp starts flashing and all three missile present lamps to out, selects another launcher and continues the engagement. (See note below this table.)</p> <p>9. Checks that one missile present lamp of selected launcher goes out. If HANGFIRE label starts flashing, notifies TCO.</p>

Table 9-2. IBCC Engagement Procedures—Continued

TCO	TCA	ASO	FCO A and B
10. ....	10. ....	10. ....	10. If there has been a hangfire and TCO desires to fire from same launcher, presses FIRE pushbutton after it is lit.
11. If required to <i>weapons hold</i> (or <i>hold fire</i> ), sets CEASE FIRE RESUME FIRE switch at CEASE FIRE. If a missile is on the way, presses DESTROY pushbutton and holds for 5 seconds. Gives verbal <i>weapons hold</i> (or <i>hold fire</i> ) order to FCO.	11. ....	11. ....	11. CEASE FIRE label is lit; FIRE pushbutton is disabled and goes out. DESTROY label is lit. Presses DESTROY pushbutton and holds for 5 seconds.
12. ....	12. ....	12. ....	12. Prepares to continue engagement or change targets.
13. If required to <i>cease fire</i> , sets CEASE FIRE/RESUME FIRE switch at CEASE FIRE.	13. ....	13. ....	13. CEASE FIRE label is lit; FIRE pushbutton is disabled and goes out. <i>Missiles that have been launched are allowed to continue to intercept.</i>
14. ....	14. ....	14. ....	14. Continues to track the target. If no missiles have been fired, presses NO KILL pushbutton. If missiles are in flight proceeds to step 15 and 16 below.
15. ....	15. ....	15. ....	15. Continues to monitor indicator while missile is in flight and monitors audio for tone burst.
16. Observes battery status indicator for a KILL indication. If such is observed, engages the next most threatening target. If NO KILL report is received from the FCO, decides whether to fire more missiles at the same target, change targets, etc., depending on the air situation, directions from AADCP, and content of unit tactical SOP. Directs the actions of the FCO in consonance with his decisions.	.....	.....	16. Observes for burst on PPI, loss of target lock, diminishing audio signal, drop in signal strength and target speed, and decrease in target altitude. Determines KILL or NO KILL from these indications. If a KILL is indicated, momentarily presses the KILL pushbutton; if a NO KILL is indicated, reports NO KILL to the TCO. Takes action as directed by the TCO. Monitors effectiveness of each missile fired. If directed to do so by the TCO, momentarily presses the NO KILL pushbutton.

Note. If a launcher loaded with two or three missiles fails to fire as indicated by all missile present lamps going out and the HANGFIRE lamp flashing, the trouble lies in the launcher. If a launcher loaded with only one missile produces the same symptoms, treat it as if it were a hangfire although it may turn out to be only a misfire. This note is also applicable to the launchers in the IAFU and AFS, except that the MISFIRE lamp flashes on the TDECC.

*c. Arming of Missiles.* The final arming procedures are predicated on three ILCHR's being connected to an IHIPIR with three safe-armed missiles onboard each ILCHR. The duties are applicable to all Improved Hawk firing elements. The crew chief usually remains at the ILSCB to monitor the headset, manipulate the OPERATE / SAFE switches, and observe the actions of the crewmen at the ILCHR's. When the siren sounds, he receives the order BATTLE STATIONS or BLAZING SKIES from the FCO and relays it to the launching section crewmen. Actions to be taken are as follows:

(1) *Launching section crewmen.* One launching section crewman proceeds to each ILCHR, reports to the crew chief by headset upon arrival at the ILCHR and, if BATTLE STATIONS has been ordered, proceeds as follows:

- (a) Checks that the ILCHR is:
1. Positioned to the setting of the day.
  2. In local off status.

**WARNING.** If BLAZING SKIES has been ordered, the actions described in (b) through (d) below are simulated.

(b) Mounts the ILCHR, insures that the umbilical cables are properly connected, and turns the SAFE / ARM levers on the missiles to ARM.

(c) Discmounts from the ILCHR and sets the MAIN POWER / OFF switch on the LC at MAIN POWER.

(d) Sets the LOCAL / REMOTE switch on the LC at REMOTE.

(e) Reports by headset to the crew chief, ILCHR 1 (2 or 3) READY or SIMULATED READY.

(f) Stores the headset.

(g) Returns to ILSCB.

(2) *Launching section crew chief.*

(a) Checks that the OPERATE / SAFE switches on the ILSCB are set at SAFE and sets the

MSL COUNT DELAY switch to the appropriate position depending on ambient temperature (above or below 65° F).

(b) Receives reports from the launching section crewmen as each arrives at and departs from his assigned ILCHR.

(c) As each launching section crewman arrives at the ILSCB, sets the appropriate OPERATE / SAFE switch at OPERATE, provided BATTLE STATIONS has been ordered. If BLAZING SKIES has been ordered, simulates setting the OPERATE / SAFE switches at OPERATE. When the last launching section crewman arrives at the ILSCB, reports, LAUNCHING SECTION A (B) CLEAR AND READY (or SIMULATED READY) to FCO A (B) in the IBCC.

*d. IPCP.*

(1) *Detection, identification, and threat evaluation phase.* The duties of personnel in the IPCP (TCO and TCA), when ordered to BATTLE STATIONS (BLAZING SKIES) and conducting the detection, identification, and threat evaluation phase of an engagement, are described in table 9-4. An FCO stationed at the ICWAR and another stationed at the IHIPIR are required to prepare the radars for remote operation as described in table 9-1 for the ASO and FCO A (B). A communications operator (CMO) stationed in the IPCP is required to monitor and operate the communications equipment.

(2) *Engagement phase.* The duties of personnel in the IPCP when engaging a target are described in table 9-4. To enable realistic simulation of missile present lights on the TDECC during drill training, radar target simulation station AN / TPQ-29 must be connected to the IPCP or miniature missile simulators must be installed on the ILCHR's.

Table 9-3. IPCP Detection, Identification, and Threat Evaluation Procedures

TCO	TCA
<p>1. Sounds siren, orders, <b>BLAZING SKIES</b>, or <b>BATTLE STATIONS</b>; Performs firing circuits test and ADP loop test.</p>	<p>1. Relays <b>BLAZING SKIES</b> (<b>BATTLE STATIONS</b>) to ICWAR and IHIPIR crewmen and to launching section crew chief by headset.</p>
<p>2. Checks that the AADCP REMOTE and ADP lamps are lit; verifies that the MISSILE COUNT switch is turned to <b>NORMAL</b> and that the <b>NORMAL MODE</b> pushbutton lamp is lit; checks that the <b>SYMBOL DISPLAY</b> switch is turned to the position as directed in unit tactical SOP; checks that the proper code and mode are set on the IFF control panel and that the set is turned on.</p>	<p>2. Performs lamp test. Coordinates remoting of ICWAR and IHIPIR for operation from the TDECC; verifies that the HPI <b>ACTIVATE</b> and ICWAR <b>RADIATE</b> pushbutton lamps remain lit; momentarily presses the <b>ASI APPROACH</b> and <b>CW ROTATE</b> pushbuttons and checks that their associated lamps light.</p>
<p>3. Checks PPI display and adjusts appropriate intensity controls, if necessary.</p>	<p>3. Checks spectrum analyzer display and adjusts appropriate intensity controls, if necessary.</p>
<p>4. Momentarily presses <b>SYSTEM READY</b> pushbutton, performs <b>PLATOON TEST</b> and <b>MISSILE COUNT TEST</b>; checks that associated lamps light.</p>	<p>4. Assists TCO in observing for proper indications.</p>
<p>5. Checks that sector of interest is properly positioned and that the <b>VITAL AREA</b> is properly positioned by momentarily pressing the <b>VITAL AREA CALL</b> pushbutton.</p>	<p>5. Observes the ICWAR, IFF, ADP, DISPLAY, HVPS, LVPS FAILURE lamps and verifies that none are lit.</p>
<p>6. Performs the IFF <b>SYSTEMS OPERATION TEST</b>; checks that <b>CEASE FIRE</b> pushbutton lamp is lit.</p>	<p>6. Assists TCO in observing for proper indications during <b>IPP SYSTEMS OPERATION TEST</b>; verifies that ICWAR video changes position radially scan-to-scan; estimates range (close in, midrange, far out) to possible targets.</p>
<p>7. Receives report, <b>LAUNCHING SECTION CLEAR AND READY</b> (or <b>SIMULATED READY</b>), from launching section crew chief. If <b>BATTLE STATIONS</b> has been ordered, waits until at least one missile present lamp lights and immediately reports <b>BATTLE STATIONS</b> to the AADCP. If <b>BLAZING SKIES</b> has been ordered, waits 2.5 or 5 minutes (depending on the position of the <b>MSL COUNT DELAY</b> switch at the ILSCB), then reports at <b>BLAZING SKIES</b> to the AADCP.</p>	<p>7. Starts visually observing the sector of interest for possible non-ADP processed targets. Turns the <b>VOICE/VOICE HPI/VOICE ICWAR</b> switch on the communications module to <b>VOICE/ICWAR</b> and listens for receding target doppler.</p>
<p>8. Observes PSI for target video; when present, challenges with IFF equipment and observes for presence of a series of IFF returns at azimuth(s) of target(s); if one or more targets do not respond, resumes challenging in the various modes as directed in unit tactical SOP; evaluates results of challenging. (See note 1 below.)</p>	<p>8. When target(s) doppler audio is (are) heard, observes PSI for its (their) location(s) and alerts TCO to its (their) presence, if necessary. Assists TCO in evaluating the results of challenging. (See note 1 below.)</p>
<p>9. Based on evaluation of challenging and AADCP data, if available, tentatively selects a target for engagement, designates it to FCO by positioning the azimuth cursor over the target video and pressing the <b>MANUAL ASSIGN</b> pushbutton momentarily; checks that the <b>MANUAL ASSIGN</b> lamp lights.</p>	<p>9. When <b>ASSIGNED</b> indicator lamp lights, presses <b>BREAK LOCK</b> pushbutton; momentarily presses <b>ELEVATION LOW</b> pushbutton and checks that the associated lamp lights; release <b>BREAK LOCK</b> pushbutton. Performs any one or all of the following to obtain target lock, if necessary: uses azimuth handwheel to keep cursor over target video; turns <b>VOICE/VOICE HPI/VOICE ICWAR</b> switch to <b>VOICE HPI</b>; momentarily presses <b>ELEVATION HIGH</b> pushbutton and checks that its associated lamp lights.</p>
<p>10. Checks that FCO locks on right target; if locked on wrong target, redesignates target to FCO. When locked on right target, reads <b>GROUND SPEED</b> and <b>ALTITUDE</b> meters; checks raid size as indicated by the lighted <b>ONE</b>, <b>FEW</b>, or <b>MANY</b> indicator.</p>	<p>10. At target lock, estimates raid size by listening to doppler audio and observing the spectrum analyzer and <b>SIGNAL STRENGTH</b> meter; presses either the <b>ONE</b>, <b>FEW</b>, or <b>MANY</b> pushbutton and checks that its associated lamp lights. Analyzes the doppler spectrum display. If target return indicates requirement to do so, uses manual speed and manual range controls to maintain lock. (See note 2 below.)</p>
<p>11. Challenges the target again; reevaluates target based on IFF response, if any, readouts stated in step 10 above, rules of engagement, AADCP data, if available, decides whether to engage or resume search and evaluation of the air situation. If decision is to engage, proceeds as described in table 9-4 below. If decision is to resume search and evaluation of the air situation, notifies FCO and momentarily presses <b>TERMINATE ENGAGE</b> pushbutton. Repeats procedures as described in this table beginning with step 8 above.</p>	<p>11. If TCO decides to engage, proceeds as described in table 9-4. If TCO decides to resume search and evaluation of the air situation, presses <b>BREAK LOCK</b> pushbutton until IHIPIR track symbol coincides with azimuth cursor. Repeats procedures as described in this table beginning with step 7.</p>

## Notes.

1. If no target video is displayed, the TCO may direct the FCO to search with the IHIPIR and repeat the procedures in steps 10 and 11.

He must designate the search mode, azimuth, and elevation settings to be used. The FCO presses the BREAK LOCK pushbutton; momentarily presses the designated search pushbutton and checks that its associated lamp lights; positions the azimuth handwheel and elevation thumbwheel to the designated settings; releases the BREAK LOCK pushbutton; turns the VOICE / VOICE HPI / VOICE ICWAR switch to VOICE HPI; repeats the procedures described in steps 10 and 11. The procedures described in this note may also be used if a high-priority target beyond the range of the ICWAR but within the range of the IHIPIR is designated for engagement by the AADCP.

2. If, after lock, the IHIPIR loses lock and goes into COAST, the FCO sets the azimuth cursor and MANUAL ELEVATION MILS indicator to the azimuth and elevation at which lock was lost. If automatic lock is not regained within 10 seconds, he attempts to regain lock manually or as described in step 9 if target video reappears.

Table 9-4. IPCP Engagement Procedures

TCO

TCA

1. After the air situation has been evaluated and decision to engage has been reached (step 11, table 9-3 above) determines number of missiles to be fired as prescribed in unit tactical SOP; momentarily presses the RESUME FIRE pushbutton; checks that CEASE FIRE lamp goes out and RESUME FIRE lamp lights.

2. When IN RANGE and FIRE lamps are lit, gives 5-second countdown, if required; presses FIRE pushbutton momentarily; checks that FIRING lamp lights and FIRE lamp goes out. Fires additional missiles each time the FIRE lamp relights, if required. If MISFIRE lamp lights, selects another launcher, if necessary, and resumes firing. (See note at the end of table 9-2.)

Note. Misfires must be handled in accordance with procedure in paragraph 10-2, after the engagement is complete.

3. If AADCP HOLD FIRE lamp lights, presses and holds DESTROY pushbutton for 5 seconds; momentarily presses the CEASE FIRE pushbutton; checks that the RESUME FIRE lamp goes out and the CEASE FIRE lamp lights.

4. If the AADCP CEASE FIRE lamp lights, momentarily presses the CEASE FIRE pushbutton; checks that RESUME FIRE lamp goes out and the CEASE FIRE lamp lights. If missiles have been fired, allows them to continue to intercept.

5. Monitors same TDECC indications as does FCO. Assists FCO in evaluating results for each missile fired. If result is NO KILL, decides whether to resume firing, change targets, or resume evaluation of the air situation. Directs actions of FCO accordingly. If result is KILL, momentarily presses TERMINATE ENGAGE pushbutton.

1. Evaluates target azimuth and direction of travel with respect to launcher fire cutout areas and selects launcher to fire, if necessary; checks that HPI ACTIVATE lamp is still lit.

2. Begins to monitor and evaluate results of firing.

3. Presses the BREAK LOCK pushbutton; momentarily presses NO KILL pushbutton and checks that its associated lamp lights; prepares to continue engagement, if required.

4. Continues to track target. If missiles have been fired, evaluates results as described in step 5 below.

5. Monitors doppler audio listening for tone burst which occurs 5 seconds before intercept. Observes TDECC indications of KILL as evidenced by: target ground speed, doppler audio, and signal strength drop to zero; IN RANGE lamp goes out and altitude meter deactivates; target video disappears. Momentarily presses KILL pushbutton and checks that associated lamp lights. If result of first missile is no kill, reports, NO KILL, to TCO and takes directions from him. If TCO fires additional missiles, evaluates the results for each missile fired. If directed to do so, momentarily presses the NO KILL pushbutton and checks that the associated lamp lights.

### Section III. ENGAGEMENTS USING THE ADP

#### 9-7. General

a. When any one of the firing elements has reached BATTLE STATIONS or BLAZING SKIES as described in tables 9-1 and 9-3, the TCO and TCA begin observing the displays on the TCC or TDECC for target video, particularly in the sector of interest. Each tentative target not processed by the ADP must be evaluated manually as to the probability of its being friendly or hostile. The TCO must threat order all manually detected

hostile targets to determine the sequence in which he will take them under attack. If ADP-processed target symbols are displayed, he must determine whether the targets are greater threats than the manually detected hostile targets. If he decides they are not greater threats, he engages targets in the manual ADP assist mode as described in tables 9-2 and 9-4. On the other hand, if he decides that the ADP-processed targets are greater threats than the manually detected hostile targets, he engages the

ADP-processed targets in either the automatic or normal mode of fire under rules contained in the unit tactical SOP.

*b.* ADP-processed targets are indicated by the appearance of either the priority I or priority II symbol (or both) on the TCC PPI and on the PPI portion of the modified TDECC PPI. When they appear on the TCC PPI, the corresponding lamps light on the TCC control panel for the selected firing sections. For a priority I target, both the symbol on the PPI and its associated lamp flash. For a priority II target, only the lamp flashes. Priority I symbols appearing on the TDECC PPI indicate targets that are threats to the offsite vital area being defended, whereas priority II symbols indicate that the targets are platoon (IAFU or AFS) threats. Only one of each can appear at the same time. Either symbol not flashing indicates that it is a category II target and there is maximum time remaining to fire.

### 9-8. ADP Engagements in the IBCC

*a. Automatic.* In this mode, the TCO sets the FIRE MODE switch at AUTO FIRE and checks that the AUTO FIRE lamp lights on the TCC. He observes that the IHIPIR azimuth repeatback mark of the selected firing section slews toward the designated target, that the appropriate LOCK lamp lights on the IBCC status indicator when the IHIPIR locks on the target, and that the AUTO ASSIGN lamp on the TCC lights. He then sets the appropriate RESUME FIRE / CEASE FIRE switch to RESUME FIRE and checks that the corresponding CEASE FIRE lamp goes out on the IBCC status indicator. When the target gets within range and all data is smooth, the ADP fires one missile. The TCO observes that the appropriate HE FIRED lamp lights on the IBCC status indicator and monitors the results of the firing. If necessary, he uses the RESUME FIRE / CEASE FIRE switch to direct the FCO to fire additional missiles or to cease firing. The FCO is alerted that the TCO has elected to use the ADP for engagement by observing that the AUTO and ASSIGNED lamps light on the FCC, the IHIPIR azimuth repeatback mark slews away from the azimuth cursor toward the target, that the SEARCH lamp lights when the IHIPIR goes into box search, and that the CEASE FIRE lamp on the FCC goes out. When the IHIPIR achieves lock, he estimates the raid size as described in table 9-2 and presses the appropriate pushbutton. He notes when a missile has been fired by observing that one missile present lamp goes out on the selected ILCHR. He then observes the results of the firing as in the manual mode described in table 9-2. If the result is a kill, he

momentarily presses the KILL pushbutton. If the result is not a kill, he informs the TCO and takes directions from him. If more missiles are fired, he monitors the result of each and reacts according to the result. He momentarily presses the NO KILL pushbutton only when directed to do so by the TCO.

*b. Normal.* In this mode, since the FIRE MODE switch is already set at NORMAL, the TCO merely presses the flashing priority pushbutton to permit the engagement to continue. He makes the same observations and takes the same actions as described in *a* above. The indications to the FCO that the TCO has elected to engage in the normal mode are the same as those for the automatic mode. He makes the same observations and performs the same actions as described in *a* above.

### 9-9. ADP Engagements in the IPCP

*a. Automatic.* In this mode, the TCO momentarily presses the AUTO FIRE pushbutton and checks that the associated lamp lights and that the NORMAL lamp goes out. When the ADP designates a target, the ADP REQUEST ACCEPT lamp flashes and the AUTO AND ASSIGNED lamps light. The IHIPIR tracking symbol slews away from the azimuth cursor and, when it reaches the vicinity of the target, goes into box search. When the IHIPIR achieves lock, the predicted intercept vector appears on the tracking symbol to indicate the heading of the target. If time permits, the TCO uses the IFF equipment to challenge in the other modes to verify that it is a hostile target. He also uses criteria in the unit tactical SOP for verification. If he decides that the target is friendly, he manipulates the tracking lever to place the hook symbol over the target and momentarily presses the FRIEND pushbutton. This action discontinues the engagement and places the target in the ADP friend file for future threat ordering. If the ADP determines that the target is friendly, the threat symbol disappears from the PPI and the FRIENDLY TARGET lamp lights for 6 seconds. If the target is hostile, the engagement continues. The TCO momentarily presses the RESUME FIRE pushbutton and checks that its associated lamp lights. When the target is in range, the IN RANGE lamp lights. The ADP then sets the firing schedule and the OK FIRE lamp lights steadily. When the optimum time for firing exists, the OK FIRE lamp flashes, a missile is fired, the FIRE pushbutton flashes momentarily, and the FIRING lamp lights. The TCO then monitors the results of the firing. If the engagement is ineffective, he fires additional missiles until the target is either

destroyed, out of range, or reaches a position where it is impossible to fire. The TCA is alerted that the TCO has elected to use the ADP for engagement by observing that the AUTO and ASSIGNED lamps light. When the IHIPIR achieves lock, he estimates the raid size as described in table 9-4 and then presses the appropriate pushbutton (ONE, FEW, MANY). He notes when a missile is fired by observing that one missile present lamp goes out on the selected ILCHR. He then observes the result of the firing as in the manual mode described in table 9-4. If the result is a kill, he momentarily presses the KILL pushbutton and then presses the TERMINATE ENGAGE pushbutton. If the result is not a kill, he informs the TCO and takes directions from him. If more missiles are fired, the TCA monitors the result of each and reacts according to the result. He momentarily presses the NO KILL pushbutton only when directed to do so by the TCO.

*b. Normal.* In this mode, when a category I target is designated, the TCO observes the ADP REQUEST ACCEPT lamp and priority symbol flash, and that the AUTO AND ASSIGNED lamps light. The engagement progresses as described in *a* above to the point at which the OK FIRE lamp is flashing and halts. When a category II target is designated, only the ADP REQUEST ACCEPT lamp flashes. If the TCO decides to accept the request, he momentarily presses the ADP REQUEST ACCEPT pushbutton. He notes that the AUTO and ASSIGNED lamps light and the engagement progresses to the point at which the

OK Fire lamp flashes and halts. If the TCO decides not to accept the request for either a category I or category II target, he momentarily presses the REFUSE pushbutton to allow the next target in the ADP file to be processed. If the TCO decides to engage a target other than the one designated by the ADP, he manipulates the tracking lever to place the hook symbol over it and then presses the ENGAGE OTHER pushbutton. To continue the engagement of the ADP designated target, the TCO presses the FIRE pushbutton. He observes that the FIRE pushbutton lamp flickers momentarily and the FIRING lamp lights when a missile is fired. He then monitors the result of the firing, makes the same observations, and takes the same actions as described in *a* above. The TCA is alerted that an ADP processed target is about to be engaged in this mode by noting that the AUTO and ASSIGNED lamps light and that the engagement progresses until the OK FIRE lamp is flashing. He makes the same observations and takes the same actions as described in *a* above up to IHIPIR lock. When the TCO presses the FIRE pushbutton and a missile is fired, he evaluates the result of the engagement and reacts as described in *a* above.

*c.* If the engagement must be terminated in either mode of fire after missiles have been fired and before intercept, the TCO presses the CHANGE TARGET pushbutton. The IHIPIR breaks lock as indicated by the tracking symbol slewing away from the target until it coincides with the azimuth cursor. Missiles in flight are destroyed by this action.

## CHAPTER 10

### EMERGENCY PROCEDURES

#### 10-1. General

Malfunctions of the Improved Hawk guided missile system are to be expected from equipment failures, accidents, or enemy action. Failure of certain items of equipment will reduce the firing element's capability to deliver maximum fire. Whatever the failure, it should be corrected as soon as possible. If the nature of the failure is such that it cannot be corrected within a reasonable time, field expedients may be implemented to use the firing element to a limited degree. Some expedients are described in paragraph 10-3.

#### 10-2. Missile Misfires and Hangfires

A misfire is failure of the missile to leave the ILCHR, after the firing sequence has been initiated. This may be caused by faulty electronic components in the firing circuit, ILCHR, or missile, or by faulty propelling components in the missile. A hangfire is a *delay* in functioning of electronic components in the firing circuit, ILCHR, missile, or of propelling components in the missile, but results in eventual launching of the missile. The delay may last from a split second up to several minutes. Initially, a misfire cannot be distinguished from a hangfire; therefore, a mandatory time interval must elapse (minimum of 30 minutes) in order to determine which has occurred. During the mandatory time interval, personnel must not approach the ILCHR to avoid injury or death should the missile motor ignite during a lengthy hangfire. At the end of the mandatory time interval, it may be assumed that a misfire has occurred, not a hangfire. Depending upon the cause of the misfire, a dangerous situation may exist in the vicinity of the ILCHR. Therefore, nobody should approach the ILCHR until directed to do so by the TCO.

a. In peacetime, if the missile fails to leave the ILCHR at the proper time after the firing sequence has been initiated, the actions described in (1) through (4) below should be taken immediately.

(1) At the ILSCB, note which FAILED TO FIRE and which MISSILE READY lamps are lit; set the appropriate OPERATE / SAFE switch at SAFE.

(2) Turn off all radars.

(3) Disconnect the data cable to the affected ILCHR at the ILSCB.

(4) Turn the main power circuit breaker off at the generator set delivering power to the affected

ILCHR and disconnect the appropriate power cable.

*Warning.* Wait the mandatory time interval specified in unit SOP (if none is specified, wait a minimum of 30 minutes) after the missile fails to leave the ILCHR before investigating the cause of the misfire.

(5) Approach the missiles from their left sides observing for any unusual condition such as smoke and listening for unusual noises. If any unusual condition is noted, wait at a safe distance until it has cleared up. When all is clear, proceed to the ILCHR and mount it.

(6) Set the SAFE / ARM lever at SAFE on the affected missile, disconnect the umbilical cable, and install the umbilical shorting plug.

(7) On the LC, set the MAIN POWER / OFF switch at OFF, and the LOCAL / REMOVE switch at LOCAL.

(8) Repeat the actions described in (6) above for the other missiles on the ILCHR.

(9) To determine whether the fault lies in the missile or in the circuits back of the umbilical cable connector, proceed as follows:

(a) Install a miniature guided-missile simulator on the arm on which the affected missile is supported.

(b) Reconnect the power cable at the generator set and turn the main power circuit breaker on.

(c) Perform a firing function check. If the check is successful, the fault lies in the missile. Turn the ILCHR off, clear the area of personnel, and request assistance from the supporting explosive ordnance disposal (EOD) team. If the check is unsuccessful, the fault lies in the circuits back of the umbilical cable connector. Assigned maintenance personnel then perform the procedures required to isolate the fault and correct it.

b. The procedure described in a above will result in the firing element being out of action more than 20 minutes. In war-time, therefore, the TCO may modify the procedure to conform with tactical requirements with due regard to the safety of personnel.

#### 10-3. Inoperative Equipment

This paragraph contains expedients that may be used for maximum efficiency in operation when certain items of equipment become inoperative.

a. *Inoperative ADP.* With the ADP inoperative, all targets must be processed manually. However, the IHIPIR's must be conditioned to provide in-range information to the IBCC and firing azimuth and elevation to the ILCHR's. To do so, the ADP/HPI/TEST switches on the firing interlock assemblies for both FCC must be turned to HPI.

b. *Inoperative IPAR.* The TCO may designate one or both of the IHIPIR's to be placed in the automatic search EL HIGH mode to search a sector in the direction of probable attack. When the IHIPIR locks on an airborne object, the object may be evaluated using AADCP symbology, ICWAR video, and IFF video displayed on the TCC PPI.

c. *Inoperative ICWAR.* The TCO may designate one or both of the IHIPIR's to be placed in the automatic search EL LOW mode to search a sector in the direction of probable attack. When the IHIPIR locks on an airborne object, the object may be evaluated using AADCP symbology and IFF video displayed on the TCC PPI.

d. *Inoperative FCC.* If the battery is augmented with an IPCP and an IAFU has not been deployed, the TCO may direct that the IHIPIR associated with the Inoperative FCC be disconnected from the IBCC and connected to the IPCP. The IPCP may then be used as in an IAFU to conduct fire. A telephone line should be laid from the IPCP to the IBCC to facilitate control of fire.

## CHAPTER 11

## ECM ENVIRONMENT

## 11-1. General

ECM are positive actions taken to impair effective operation of an enemy radar system. Two types are in general use, deception and jamming. Deception is the introduction of signals into a radar for the purpose of either deceiving the enemy radar operator or pulling a tracking radar off target. Jamming is the introduction of signals into a radar system to obscure actual target returns. Either deception or jamming may be accomplished by the reflection or transmission of RF energy. Both deception and jamming techniques may be used at the same time.

## 11-2. Detection of ECM

In most cases, ECM are detectable by the radar operator. However, the presence of enemy ECM activities is normally determined and verified by electronic intelligence units (ELINT) or electronic security units (ELSEC) in the field. On orders, these units perform electronic reconnaissance operations in a specified area. Using spectrum ferreting and analysis of the enemy's transmissions, these units determine what ECCM should be taken. Their equipment includes such devices as sensitive and accurately calibrated receiving equipment, panoramic indicators, calibrated oscillators, directional antennas, and spectrum analyzers. By intercepting ECM transmissions, it is possible to determine the number and location of jammers, frequencies used, pulse repetition rates, and pulse widths.

## 11-3. Reflection Deception

Reflection deception is accomplished by the use of mechanical devices that reflect radar transmissions. The intended result is to cause a radar indication similar to an actual target echo. In many instances, the return from the reflector is stronger than that from an actual target.

*a. Window.* Window is the least expensive and the easiest to use of the various reflection deception devices. Although more often used for jamming, it is also effective as a deception device. Window consists of pieces of metallic reflecting material packaged into a bundle. The bundle is normally dropped from an aircraft and opens as it drops. The metallic material then spreads out and causes a large radar echo on the display. The window may remain in an area for as long as 30 minutes,

depending on wind conditions. The radar operator may become confused by the window return and not observe the target pull away from the window. Tracking radars may lock on the stronger returns from the window instead of the target. Against acquisition radars, bundles of window are dropped periodically to produce many false target indications. The two common types of window are chaff and straws. Chaff consists of small pieces of reflecting material used against high-frequency radars. Straws are long pieces of reflecting material used against low-frequency radars.

*b. Angels.* Angels, another type of reflection deception device, are also known as confusion reflectors. These are large reflectors dropped from an aircraft which descend slowly with a fluttering motion and drift with the wind currents. The name is derived from the fluttering indication they produce on the IPAR PPI. The four major types of angels are rope, corner reflectors, dipoles, and decoy missiles.

(1) *Rope.* Rope usually consists of a number of small reflectors placed end to end and held together by suitable supporting material. One end of the rope is connected to a small parachute. The rope unwinds as it is dropped from an aircraft and the parachute opens. Rope used in quantity is intended to appear on the radar display as a formation of aircraft. Rope is usually used against low-frequency or search radars, and is seldom used against high-frequency radars or automatic tracking radars.

(2) *Corner reflectors.* Corner reflectors are made up of a number of plane surfaces or rigid reflecting material. The pieces are fastened together to form three-dimensional reflectors with a number of facets or faces. These reflectors are designed to reflect intercepted radar energy directly back toward the source, regardless of the orientation of the reflector. Because of efficiency of design, relatively small corner reflectors return as much RF energy as a much larger actual target. Against search radars, corner reflectors are used in the same manner as rope. They are very effective against automatic tracking radars, producing an effect known as glint if they are mounted on the wingtips, nose and tail assembly of a large aircraft. The tracking radar hunts from one reflector to another, since the signal return varies from each reflector. If

the hunting becomes excessive, the tracking radar slews off target.

(3) *Dipoles*. Dipoles are deception devices sized to produce maximum reflection at a specific radar frequency. They are actually dipole antennas, and are used in the same manner as corner reflectors. Mounted dipoles also may be made to rotate or oscillate, producing reflected signals of varying phases to confuse radars that employ moving target indicator systems.

(4) *Decoy missiles*. Decoy missiles are the most significant threat to a radar. The missiles are small and generally have corner reflectors mounted in the nose, wing, or tail assemblies. Each decoy simulates the size, speed, altitude, and operational characteristics of the aircraft which is the actual target. It is possible for one target to fly in formation with a great number of decoy missiles. Decoys can also carry jammers.

#### 11-4. Transmission Deception

a. Transmission deception is the generation and transmission of RF energy to deceive the radar operator, or confuse the automatic tracking circuits of a radar. Transmission deception that produces false targets on a radar display is known as "spoofing." Spoofing is usually directed against acquisition radars. The spoofer transmits a number of false-target indications to the acquisition radar, confusing the radar operator by indicating a large attacking force where none exists. In pulse radars the spoofer presents false targets at different ranges; in CW radars it may also present false targets at different speeds.

b. Fixed- and swept-frequency repeaters are particularly useful against CW tracking radars. The fixed-frequency repeater intercepts the radar signal, shifts the frequency a specific amount, amplifies the new signal, then transmits it back to the radar, introducing false doppler signals. The swept-frequency repeater functions in the same manner, with one exception. Instead of shifting the radar signal frequency a specific amount, it continually sweeps it through a limited range of frequencies. When the signal is received at the radar, the varying frequency shift confuses the automatic tracking circuits.

#### 11-5. Reflection Jamming

Reflection jamming, though not the most effective type of jamming, is the most economical, and is therefore used extensively. The jamming devices usually are made of inexpensive lightweight materials. As their only function is to reflect the transmission of the radar being jammed, they require no self-contained power. The effectiveness of reflection jamming is limited. However, by using

reflecting devices of the correct physical dimensions, signals can be reflected that are strong enough to cause radarscope saturation in a given area. To be successful, a reflection jamming mission must employ jamming devices of the proper size, and must use these devices in considerable quantity. Window and angles are the primary materials used for reflection jamming and, generally, both types are used together. The combination produces reflected signals that are steadier and stronger than those produced using either material alone. Generally, these devices are used in combination jamming and deception operations.

#### 11-6. Transmission Jamming

Transmission jammers radiate newly generated RF energy toward the radar to be jammed instead of reflecting back the energy generated by the radar. The jammer transmitter must be tuned at, or close to, the operating frequency of the radar and, to be effective, must have considerable power. The two major types of transmission jamming are CW and modulated.

a. *CW Jamming*. CW jamming is accomplished by the transmission of unmodulated RF signals at, or close to, the frequency of the radar to be jammed. Since each CW jamming signal is radiated at either a single frequency or multiple frequencies within a very narrow band, all the transmitted power is concentrated at one spot in the radar spectrum. Because of this concentration of power, CW jamming is very effective for blocking the radar receiver. The four techniques of CW jamming are spot, barrage, swept, and lock-on.

(1) *Spot*. Spot jamming is the most common type of CW jamming. In a spot-jamming operation, the CW jammer is aimed at one specific radar. The jamming signal is meant to interfere with that one radar only, and is not intended to affect other radars in the area.

(2) *Barrage*. Barrage jamming is accomplished either by the use of a single jammer capable of high power over a wide band of frequencies or by the simultaneous use of a number of CW jamming units, each tuned to closely adjacent frequencies in the radar band. The combined output of the jammers, therefore, covers a band of radar frequencies and affects any radars using frequencies within this band. Because barrage jamming requires a considerable amount of equipment, it is not used to any great extent. The same amount of equipment may be used to greater advantage as individual spot jammers.

(3) *Swept-frequency*. Swept-frequency CW jamming is similar to frequency-modulated jamming. The jammer employs a single transmitter

that sweeps continually through a wide band of radar frequencies. In this manner, a single jammer can be used with some degree of effectiveness against a number of radars operating at different frequencies. The frequency band covered in swept-frequency CW jamming is much greater than that covered by frequency-modulated jamming.

(4) *Lock-on.* Lock-on jamming is essentially a very accurate method of spot jamming. Any variations in the radar transmitter frequency are automatically followed by a lock-on jammer. Therefore, the effective jamming power is generally greater than in spot jamming.

*b. Modulated Jamming.* Modulated jamming is accomplished by the transmission of RF signals modulated to increase the band-width of the jamming signal. Many different signal types may be used to modulate the jamming carrier, each type producing individual and characteristic display presentations. Modulated jamming is generally effective over a wider band of radar frequencies than unswept CW jamming, since modulation produces RF sidebands in addition to the carrier frequency. Additional space in the frequency spectrum, therefore, is occupied by the transmitted signal and the bandwidth coverage of the jamming signal is increased. As the frequency coverage increases, the maximum unmodulated signal power is dispersed over a wider portion of the frequency spectrum, and the maximum jamming signal power decreases. Because of this reduction of the jamming signal power there is a limit to the bandwidth that can be effectively covered. Beyond this limit a band width increase decreases jamming effectiveness.

(1) *FM jamming.* FM jamming is accomplished by varying the frequency of the jamming signal in accordance with the frequency and amplitude of the modulation. Frequency modulation is well-suited for jamming, since it produces jamming signals with some of the characteristics of both CW and AM jamming. Normally the carrier center frequency of the jamming signal is set at approximately the same frequency as the radar output. When FM is applied, the carrier frequency varies about the center frequency. Thus, the jamming signal covers a band in the radar frequency spectrum. In this way, more than one radar may be affected by the jamming signal. On CW radars using FM modulation, modification of the modulation by the jammer produces erroneous intelligence. A combination of an AM carrier, swept in frequency by additional frequency modulation, is generally considered one of the most effective types of jamming.

(2) *AM jamming.* AM jamming is produced by varying the amplitude of the RF jamming signal in accordance with the amplitude and frequency of the modulation. On CW radars using AM techniques, modification of the modulation by the jammer produces erroneous intelligence. In a pulse radar, when the frequency of the modulating signal is the same as the pulse repetition frequency (PRF) of the radar being jammed, or some whole multiple of the PRF, the jammer is synchronized. Synchronized jamming produces a definite constant pattern on the radar display of the jammed radar. The type of pattern depends on the type of signal modulating the jamming signal. It is generally more difficult to detect target information on the radar display affected by a synchronized jamming signal. The five most common types of periodic modulation are sine wave, square wave, keyed CW, sawtooth, and pulse.

(a) *Sine wave modulation.* Sine wave modulation is produced by modulating the carrier frequency with an essentially pure sine wave. The lack of complexity of the modulating signal, however, produces a jamming signal that covers only a relatively narrow band of frequencies.

(b) *Square wave modulation.* Square wave modulation produces a jamming signal that occupies a wider portion of the frequency spectrum than sine wave modulation. Theoretically, a square wave is made up of a fundamental sine wave and an infinite number of harmonics of the sine wave frequency. The signal resulting from square wave modulation is similar to one which results from modulation by a very complex combination of sine wave. Square wave modulation, therefore, produces a very effective jamming signal. However, high-powered transmission levels are required to compensate for the wide frequency coverage and the resulting power dispersion. Square wave modulation may be produced by a continuously cycling square wave or by a pulse repeated at either a set or a varying repetition rate.

(c) *Keyed CW modulation.* Keyed CW jamming is produced by manually keying a transmitter that is tuned to the frequency of a radar to be jammed. The resulting jamming signal has basically the same characteristics as a square wave modulated jamming signal. The jamming characteristics vary with the rate of speed at which the transmitter is keyed.

(d) *Sawtooth modulation.* A sawtooth waveform may be used in the modulation of jamming signals in the same way that sine waves and square waves are used.

(e) *Pulse modulation.* Pulse modulation of

jamming signals, although very similar to square wave modulation, is still more effective and efficient. In pulse modulation, a high-powered pulse is transmitted with the expenditure of relatively low levels of average power. A pulse-modulated jamming signal covers a wider portion of the frequency spectrum than sine wave, sawtooth, or square wave modulation.

(3) *Noise-modulated jamming.* Noise modulation of jamming signals is one of the most effective types of modulated jamming. The modulating noise signal is composed of sharp, narrow signal peaks of random frequency, phase, and amplitude. This type of modulation produces a wide-band jamming signal with a high peak-to-average power ratio. Such a jamming signal is very difficult to counter. Noise-modulated jamming signals are usually used for spot, barrage, swept-frequency, or lock-on jamming of particular radars. Modulation is then limited so that transmitter power is concentrated in a band of frequencies just wide enough to cover the radar receiver bandpass. In barrage jamming, either a number of noise-modulated spot jammers are operated at frequencies close to one another to cover a wide band of radar frequencies, or a single jammer is used which is capable of relatively high-power levels over a wide band of radar frequencies. Noise-modulated, swept-frequency jamming is produced by a combination of jamming signals. The jamming carrier is swept through a portion of the radar spectrum, while wide-band noise modulation is applied to the sweeping carrier. This type of jamming produces, at relatively high-power levels, a jamming signal that covers an extremely wide portion of the radar frequency spectrum. It is effective against large operations using a great variety of radars.

### 11-7. ECCM Fundamentals

*a. Operator Technique.* ECCM are methods used to reduce or eliminate the effectiveness of enemy ECM. How effective these methods are depends upon the radar operators as well as materiel. Assuming that the available ECCM equipment is sufficient to minimize the effects of ECM, the equipment is useless in the hands of untrained personnel. Surprise and panic are the greatest threats. Only through constant training and drill can confidence be achieved and the full capability of the equipment be realized.

(1) *Self-training.* The radar operator must recognize that an ECM environment will be the normal operating condition in wartime. He must also recognize that some forms of ECM are contrived to simulate equipment malfunction. Proper

maintenance schedules and the operator's confidence that his equipment is operating at peak performance, will help him recognize and defeat this type of deception. The operator must be thoroughly familiar with all ECM techniques, and which ECCM to use to combat a given situation. He must develop judgment so that only those measures necessary to overcome the threat are taken. He must also learn to differentiate between actual ECM and interference of an accidental or malfunctioning nature. Close coordination between the operator and the maintenance mechanic can result in maximum efficiency of operation in any environment.

(2) *Unit training.* A planned and continuing training program should be established by the unit through which the operator may keep abreast of the state of the art. Of particular value for this purpose are FM 32-20 and TM 9-1425-525-12-3. Simulator station AN/TPQ-29 is provided as a training device for the Improved Hawk guided missile system. By producing typical target signals as they would appear in various ECM environments, it serves to simulate jamming engagements.

#### *b. ECCM Equipment.*

(1) *General.* ECCM equipment includes those circuits and devices designed to minimize the effect of ECM. Such equipment is either operator controlled or automatic. The ECCM function is accomplished in many ways, such as automatic selective gain control, filtering, gating, back-biasing, and using the jamming signal itself to provide target information. The equipment is usually designed to counter a specific type of ECM.

#### (2) *Basic equipment design characteristics.*

(a) The prime objective of ECCM circuit design is to detect the unwanted signal as soon as possible after it has entered the radar system, and to successively offset its effects as the target signal progresses through the system to display. In addition the equipment must be able to operate across a relatively broad band of the frequency spectrum, since a radar system capable of operation at one fixed frequency would be extremely vulnerable to ECM.

(b) RF section design includes the use of tunable oscillators, detunable local oscillators, automatic frequency control (AFC), and balanced mixers. In some cases, transmissions can be momentarily interrupted; in others, side-lobe cancellation proves effective.

(c) Intermediate frequency (IF) sections use either manual or automatic gain control

(AGC), noise suppression, sensitivity time control (STC), variable bandwidths, wide-band limiting (dicke fix), and log amplification (dicke fix-fix) in the IF amplifiers.

(d) Detector and video sections are augmented by back-biasing (BB) techniques, video integration, automatic noise limiting, filtering, and the use of balanced amplification. Under some conditions, successive scans are delayed and synchronously added, allowing the target indication on the display screen to appear brighter than the jamming background.

c. *ECCM in the Improved Hawk Guided Missile System.* Each radar in the Improved Hawk guided missile system contains ECCM capabilities which, along with correct operator technique, permit satisfactory operation of the system in an ECM environment. ECM used against the system is usually directed against the individual radars. The vulnerability to ECM differs for each radar so

that, in general, different ECCM capabilities are built into each radar. For example, the tracking circuits in the IHPIR are subject to deceptive ECM that could cause the antenna system to lose lock on a target. However, the IPAR and ICWAR antennas rotate continuously, and are not subject to such deception. But, in both the acquisition and tracking radars, the receiving and indicating circuits are equally vulnerable. This vulnerability is considered more harmful to the acquisition radars, since jamming the receiving and indicating circuits could obscure the radarscope display and make it impossible to detect targets. The vulnerability of a radar also depends on the type of RF signal transmitted. For example, pulse radars are more vulnerable to synchronized modulated jamming than CW radars. For detailed descriptions of the Improved Hawk ECCM circuits that operate automatically or are available for operator use, refer to TM 9-1425-525-12-3.

## APPENDIX A

### REFERENCES

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#### A-1. General

Department of the Army pamphlets of the 310- series should be consulted for latest changes or revisions of references given in this appendix and for new publications relating to materiel covered in this manual.

#### A-2. Army Regulations (AR).

40-583	Control of Potential Hazards to Health from Microwave Energy.
310-25	Dictionary of United States Army Terms.
310-50	Authorized Abbreviations and Brevity Codes.
385-62	Firing Guided Missiles and Heavy Rockets for Training, Target Practice and Combat.
385-63	Regulations for Firing Ammunition for Training, Target Practice, and Combat.
611-201	Enlisted Military Occupational Specialties.

#### A-3. Department of the Army Field Manuals (FM).

5-25	Explosives and Demolitions.
21-11	First Aid for Soldiers.
(C) 32-30	Electronic Warfare (U).
44-1	US Army Air Defense Artillery Employment.
44-20	Service Practice for Air Defense Artillery Missile Units.
44-96	Air Defense Artillery Employment, Hawk.

#### A-4. Department of the Army Pamphlets (DA Pam).

310-series	Military publications indexes.
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#### A-5. Department of the Army Technical Manuals (TM).

9-1300-206	Ammunition and Explosive Standards.
9-1410-530-14	Operator, Organizational, direct support and General Support Maintenance Manual: Intercept—Aerial, Guided Missile MIM-23B-1, MIM-23B-2, and MTM-23B (Improved Hawk Air Defense Guided Missile System).
(C) 9-1425-525-1	Description of Improved Hawk Air Defense Guided Missile System (U).
(S) 9-1425-525-2	Description of Improved Hawk Air Defense Guided Missile System (U).
9-1425-525-12-1	Operator and Organizational Maintenance Manual: Emplacement of Hawk Air Defense Guided Missile System.
(S) 9-1425-525-12-3	Operator and Organizational Maintenance Manual: Electronic Countermeasures and Counter-Countermeasures (U).
9-1430-526-12-1	Operator and Organizational Maintenance Manual: Improved Guided Missile Battery Control Central AN / TSW-8 (XO-1).
9-1430-527-12-1	Operator and Organizational Maintenance Manual: Guided Missile Information and Coordination Central AN / MSQ-95 (XO-1), (XO-2).
9-1430-528-12-1	Operator and Organizational Maintenance Manual: Radar Set AN / MPQ-48 XO-1).
9-1430-529-12-1	Operator and Organizational Maintenance for Improved Range-Only Radar Set AN / MPQ-51 (XO-1).

9-1430-533-12 / 1	Operator and Organizational Maintenance for Improved High-Powered Illuminator Radar Set AN / MPQ-46 (XO-1).
9-1430-534-12-1	Operator and Organizational Maintenance Manual: Radar Set AN / MPQ-50 (XO-1).
*9-1430-535-12 / 1	Operator and Organizational Maintenance for Trailer-Mounted Improved Platoon Command Post AN / MSW-(XO).
9-1440-531-12-1	Operator and Organizational Maintenance Manual: Improved Guided Missile Zero-Length Launcher XM192E1, Guided Missile Loading and Storage Pallet XM1E1, and Improved Guided Missile Launching Section Control Box AN / GSA 132 (XO-1).
9-1450-500-10	Operators Manual for Loader-Transporter, Guided Missile: XM501E2 (1450-768-7046) XM501E3 (1450-066-8873).
9-1450-500-20	Organizational Maintenance Manual for Loader-Transporter, Guided Missile: XM501E2 (1450-768-7046) and XM501E3 (1450-066-8873).
11-5895-532-12	Operator and Organizational Maintenance Manual: Interrogator Set AN / TPX-46(V) 1, 2, 3, 4, and 6.

#### A-6. Table of Organization and Equipment (TOE).

44-247

Air Defense Artillery Battery, Improved Hawk.

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\* To be published.

## APPENDIX B

### ABBREVIATIONS

#### B-1. General

The tabulation in paragraph B-2 contains some abbreviations peculiar to the Improved Hawk Guided Missile System (not contained in AR 310-50) and their meanings as used in this manual. The tabulation also includes some abbreviations contained in AR 310-50. They are included for clarity because they either have multiple meanings or completely different meanings from those stated in AR 310-50. Following are some examples of the latter types of abbreviations:

ARM ..... antiradiation missile; Army Ready Materiel.  
 TCO ..... termination contract officer; test control officer.  
 ASO ..... area supply officer.  
 CT ..... combat team; confirmatory test.

#### B-2. Abbreviations

ac .....	Alternating current.	FC .....	Fire control.
ACQ .....	Acquisition.	FCC .....	Fire control console.
ADJ .....	Adjustment.	FCO .....	Fire control operator.
AFS .....	Assault fire section.	FIL .....	Filament.
ANT .....	Antenna.	FM .....	Frequency modulated.
ARM .....	Antiradiation missile.	HPI .....	High-powered illuminator.
ASI .....	Azimuth speed indicator.	HYD .....	Hydraulic.
ASO .....	Azimuth speed operator.	HVPS .....	High-voltage power supply.
ATP .....	Army training program.	IAFU .....	Improved assault fire unit.
AZ .....	Azimuth.	IBCC .....	Improved battery control central.
BB .....	Back bias.	ICC .....	Information and coordination central.
BITE .....	Built-in test equipment.	IHIPR ...	Improved high-powered illuminator radar.
Bn OC ....	Battalion operations central.	ILCHR ...	Improved launcher.
CMO .....	Communications operator.	ILSCB ....	Improved launching section control box.
CPU .....	Central processing unit.	INT .....	Internal.
CT .....	Control transformer.	IPAR .....	Improved pulse acquisition radar.
CWTDC ..	Continuous-wave target detection console.	IPCP .....	Improved platoon command post.
dc .....	Direct current.	IROR .....	Improved range-only radar.
DTO .....	Data take-off.	KRP .....	Known reference point.
EXT .....	External.	kw .....	Kilowatts.
		LVPS .....	Low-voltage power supply.
		MAG .....	Magnetron.
		ML .....	Missile-launcher.
		OPR .....	Operate.
		PWR .....	Power.
		RF .....	Radiofrequency.
		RT .....	Receiver-transmitter.
		SATA .....	Safety and arming test aid.
		SUP .....	Supply.
		SYNC .....	Synchronize.
		TCA .....	Tactical control assistant.
		TCC .....	Tactical control console.
		TCO .....	Tactical control officer.
		TDECC ...	Target detection and engagement control console.

## INDEX

	Paragraph	Page		Paragraph	Page
Abbreviations .....	app B	78	Communications:		
Air defense warnings .....	9-3	56	Back-up .....	3-3 c	10
Alert procedures .....	9-5	56	In improved assault fire unit and assault fire section .....	3-3 d	10
Alert statuses .....	9-4	56	Intrabattery:		
Alinement:			Radio net .....	3-3 a (1)	9
Identification, friend or foe, antenna (IPCP) .....	7-3	44	Tactical .....	3-3 b	10
Identification, friend or foe, antenna (IC) .....	7-12	52	Wire nets .....	3-3 a (2)	10
Improved continuous-wave acquisition radar with:			Communications equipment:		
Improved platoon command post .....	7-11	52	Descriptions:		
Improved pulse acquisition radar .....	7-4	44	AN / GRC-106 .....	2-5 a	8
Improved high-powered illuminator radar with:			AN / TRC-145 .....	2-5 b	8
Improved continuous-wave radar .....	7-13	53	AN / VRC-46 .....	2-5 c	8
Improved pulse acquisition radar .....	7-5 a	45	AN / VRC-47 .....	2-5 d	8
Improved range-only radar .....	7-5 c	46	General .....	2-5	7
Improved zero-length launcher .....	7-5 b	45	Checkout procedures:		
Improved pulse acquisition radar .....	7-2	43	General .....	8-1	55
Improved range-only radar .....	7-7	48	Improved assault fire unit and assault fire section .....	8-3	55
Improved zero-length launcher .....	7-6,7-14	46,54	Improved battery .....	8-2	55
Alinement checks using the automatic data processor for:			Defense readiness conditions (DEFCON) .....	9-2	56
Identification, friend or foe, antenna (ICC) .....	7-9 b,c	51	Description of equipment, general .....	2-1	5
Improved continuous-wave acquisition radar .....	7-9 d	51	Drill training (15-minute alert to battle stations):		
Improved high-powered illuminator radar .....	7-9 e	52	Arming of missiles .....	9-6 c	64
Improved pulse acquisition radar .....	7-9 a	51	Improved battery control central, manual mode:		
Arming of missiles .....	9-6 c	64	Detection, identification, and threat evaluation phase .....	9-6 a	57
Assembly, service, and maintenance section equipment:			Engagement phase .....	9-6 b	60
Descriptions:			Improved platoon command post, manual mode:		
Improved missile .....	2-4 a	7	Detection, identification, and threat evaluation phase .....	9-6 d (1)	64
Loader-transporter .....	2-3 e	7	Engagement phase .....	9-6 d (2)	64
Missile container .....	2-4 b	7	Drills, emplacement and march order:		
Command and acquisition section equipment:			Command and acquisition section:		
Descriptions:			Equipment .....	5-2	16
Generator sets .....	2-2 h	6	General .....	5-1	16
Identification, friend or foe, equipment .....	2-2 g	6	Personnel .....	5-3	16
Improved battery control central .....	2-2 d	5	Improved battery control central:		
Improved continuous-wave acquisition radar .....	2-2 b	5	Emplacement .....	5-8	18
Improved platoon command post .....	2-2 f	6	General .....	5-7	18
Improved pulse acquisition radar .....	2-2 a	5	March order .....	5-9	19
Improved range-only radar .....	2-2 c	5	Improved continuous-wave acquisition radar:		
Information and coordination central .....	2-2 e	6	Emplacement .....	5-14	25
			General .....	5-13	24
			March order .....	5-15	25
			Improved platoon command post:		
			Emplacement .....	5-20	28
			General .....	5-19	28
			March order .....	5-21	29
			Improved pulse acquisition radar:		
			Emplacement .....	5-11	20
			General .....	5-10	20

	Paragraph	Page
<b>Drills, emplacement and march order—Continued</b>		
March order .....	5-12	22
<b>Improved range-only radar:</b>		
Emplacement .....	5-17	26
General .....	5-16	26
March order .....	5-18	26
<b>Information and coordination central:</b>		
Emplacement .....	5-5	16
General .....	5-4	16
March order .....	5-6	17
<b>Trailer-mounted 60-kw or 45-kw generator set:</b>		
Emplacement .....	5-23	30
General .....	5-22	30
March order .....	5-24	31
<b>Firing sections:</b>		
Equipment .....	6-2	32
General .....	6-1	32
Personnel .....	6-3	32
<b>Improved high-powered illuminator radar:</b>		
Emplacement .....	6-5	32
General .....	6-4	32
March order .....	6-6	33
<b>Improved missiles:</b>		
Emplacement .....	6-17	40
General .....	6-16	40
March order .....	6-18	41
<b>Improved zero-length Launcher:</b>		
Emplacement .....	6-8	34
General .....	6-7	34
March order .....	6-9	36
<b>Loader-transporter:</b>		
Emplacement .....	6-14	39
General .....	6-13	39
March order .....	6-15	39
<b>Trailer-mounted pallet:</b>		
Emplacement .....	6-11	38
General .....	6-10	38
March order .....	6-12	38
<b>Electronic countermeasures (ECM):</b>		
Angels .....	11-3b	71
Continuous-wave (CW) jamming .....	11-6a	72
Detection of .....	11-2	71
General .....	11-1	71
Modulated jamming .....	11-6b	73
Reflection deception .....	11-3	71
Reflection jamming .....	11-5	72
Transmission deception .....	11-4	72
Transmission jamming .....	11-6	72
Window .....	11-3a	71
<b>Electronic counter-countermeasures:</b>		
Equipment .....	11-7b	74
In the Improved Hawk guided missile system .....	11-7c	74
Operator technique .....	11-7a	74
<b>Emergency procedures:</b>		
General .....	10-1	69
Inoperative equipment .....	10-3	69
Missile misfires and hangfires .....	10-2	69
<b>Emplacement:</b>		
Improved battery control central .....	5-8	18
Improved continuous-wave acquisition radar .....	5-14	25

	Paragraph	Page
<b>Emplacement—Continued</b>		
<b>Improved high-powered illuminator radar</b>		
radar .....	6-5	32
Improved missiles .....	6-17	40
<b>Improved platoon command post</b>		
post .....	5-20	28
<b>Improved pulse acquisition radar</b>		
radar .....	5-11	20
Improved range-only radar .....	5-17	26
Improved zero-length launcher .....	6-8	34
<b>Information and coordination central</b>		
central .....	5-5	16
Loader-transporter .....	6-14	39
<b>Trailer-mounted 60-kw or 45-kw generator set</b>		
generator set .....	5-23	30
Trailer-mounted pallet .....	6-11	38
<b>Engagements using the automatic data processor:</b>		
General .....	9-7	66
<b>In the improved battery control central:</b>		
Automatic mode .....	9-8a	67
Normal mode .....	9-8b	67
<b>In the improved platoon command post:</b>		
Automatic mode .....	9-9a	67
Normal mode .....	9-9b	68
<b>Fire cutout determinations and settings</b>		
settings .....	7-6	46
Firing elements .....	3-1	9
<b>Firing section equipment:</b>		
<b>Descriptions:</b>		
<b>Improved high-powered illuminator radar</b>		
illuminator radar .....	2-3a	6
<b>Improved launching section control box</b>		
control box .....	2-3c	7
<b>Improved zero-length launcher</b>		
launcher .....	2-3b	7
<b>Loader-transporter</b>		
loader-transporter .....	2-3e	7
<b>Pallets</b>		
pallets .....	2-3d	7
<b>Generator set, 60-kw or 45-kw, trailer-mounted:</b>		
Description .....	2-2h	6
Emplacement .....	5-23	30
March order .....	5-24	31
<b>Hazards:</b>		
Electrical .....	4-2	13
Fire .....	4-7	14
General .....	4-1a	13
<b>High explosives and flammable liquids</b>		
liquids .....	4-4	14
<b>High-pressure air</b>		
high-pressure air .....	4-6	14
<b>High-pressure hydraulic fluid</b>		
fluid .....	4-5	14
<b>Mechanical</b>		
mechanical .....	4-3	13
<b>Radioactive material radiation</b>		
radioactive material radiation .....	4-9	15
<b>RF radiation</b>		
RF radiation .....	4-8	15
<b>IFF:</b>		
Antenna (ICC) .....	7-3	44
Description .....	2-2g	6
<b>Verification of alinement from IBCC</b>		
IBCC .....	7-8b	49
<b>Improved battery control central:</b>		
Alinement .....	7-8	49

	Paragraph	Page
<b>Improved battery control central—Continued</b>		
Description .....	2-2 <i>d</i>	5
Duties of personnel .....	9-6 <i>a,b</i>	57,60
Emplacement .....	5-8	18
March order .....	5-9	19
<b>Improved continuous-wave acquisition radar:</b>		
Alinement .....	7-11,7-4	52,44
Description .....	2-2 <i>b</i>	5
Emplacement .....	5-14	25
March order .....	5-15	25
Orientation .....	7-11	52
<b>Improved high-powered illuminator radar:</b>		
Alinement .....	7-13	53
Description .....	2-3 <i>a</i>	6
Emplacement .....	6-5	32
March order .....	6-6	32
<b>Improved launching section control box:</b>		
Description .....	2-3 <i>c</i>	7
Emplacement .....	6-5 <i>c</i>	33
March order .....	6-6 <i>a</i> (3)	33
<b>Improved missile:</b>		
Arming .....	9-6 <i>c</i>	64
Description .....	2-4 <i>a</i>	7
Emplacement .....	6-17	40
March order .....	6-18	41
Misfires and hangfires .....	10-2	69
<b>Improved platoon command post:</b>		
Alinement .....	7-11	52
Description .....	2-2 <i>f</i>	6
Emplacement .....	5-20	28
March order .....	5-21	28
<b>Improved pulse acquisition radar:</b>		
Alinement .....	7-2	43
Description .....	2-2 <i>a</i>	5
Emplacement .....	5-11	20
March order .....	5-12	22
Orientation .....	7-2	43
<b>Improved range-only radar:</b>		
Alinement .....	7-5 <i>c</i>	46
Description .....	2-2 <i>c</i>	5
Emplacement .....	5-17	26
March order .....	5-18	26
<b>Improved zero-length launcher:</b>		
Alinement .....	7-6	46
Description .....	2-3 <i>b</i>	7
Emplacement .....	6-8	34
March order .....	6-9	36
<b>Information and coordination central:</b>		
Alinement checks .....	7-9	51
Description .....	2-2 <i>e</i>	6
Emplacement .....	5-5	16
March order .....	5-6	17
<b>Loader-transporter:</b>		
Description .....	2-3 <i>e</i>	7
Emplacement .....	6-14	39
March order .....	6-15	39
<b>March order:</b>		
Improved battery control central .....	5-9	19

	Paragraph	Page
<b>March order—Continued</b>		
Improved continuous-wave acquisition radar .....	5-15	25
Improved high-powered illuminator radar .....	6-6	33
Improved missiles .....	6-18	41
Improved platoon command post .....	5-21	29
Improved pulse acquisition radar .....	5-12	22
Improved range-only radar .....	5-18	27
Improved zero-length launcher .....	6-9	36
<b>Information and coordination central:</b>		
Loader-transporter .....	6-15	39
Trailer-mounted 60-kw or 45-kw generator set .....	5-24	31
Trailer-mounted pallet .....	6-12	38
<b>Methods of operation:</b>		
<b>Firing platoon less one firing section and improved continuous-wave acquisition radar .....</b>		
Improved assault fire unit and assault fire section:		
Automatic mode .....	3-4 <i>c</i> (1)	12
Manual mode .....	3-4 <i>c</i> (3)	12
Normal mode .....	3-4 <i>c</i> (2)	12
<b>Normal firing platoon:</b>		
Automatic mode .....	3-4 <i>a</i> (1)	10
Casualty mode .....	3-4 <i>a</i> (4)	12
Manual mode .....	3-4 <i>a</i> (3)	11
Normal mode .....	3-4 <i>a</i> (2)	11
Minimum safety distances .....	4-10	15
Missile container (description) .....	2-4 <i>b</i>	7
<b>Organization, Improved Hawk missile battery:</b>		
Assault fire section .....	1-3 <i>h</i>	4
Assembly, service, and maintenance section .....	1-3 <i>c</i>	3
Communications section .....	1-3 <i>b</i>	3
Firing platoon .....	1-3 <i>d</i>	3
Headquarters section .....	1-3 <i>a</i>	3
Improved assault fire unit .....	1-3 <i>g</i>	4
Motor maintenance section .....	1-3 <i>f</i>	4
Security section .....	1-3 <i>e</i>	4
<b>Orientation:</b>		
Improved continuous-wave acquisition radar .....	7-11	52
Improved pulse acquisition radar .....	7-2	43
<b>Orientation and alinement:</b>		
Improved assault fire unit and assault fire section .....	7-10—7-14	52
Improved battery .....	7-1—7-9	43
<b>Personnel requirements for firing operations .....</b>		
operations .....	3-2	9
<b>Precautions against hazards:</b>		
Electrical .....	4-2	13
Fire .....	4-7	14
General .....	4-1 <i>a</i>	13
<b>High explosives and flammable liquids .....</b>		
liquids .....	4-4	14
High-pressure air .....	4-6	14

	Paragraph	Page
<b>Precautions against hazards—Continued</b>		
High-pressure hydraulic fluid .....	4-5	14
Mechanical .....	4-3	13
Radioactive material radiation .....	4-9	15
RF radiation .....	4-8	15
Purpose and scope .....	1-1	3
Recommended changes and comments .....	1-2	3
References .....	app A	76
Safety .....	4-1—4-10	13
States of alert .....	9-4	56
States of readiness, general .....	9-1	56
System operation, general .....	3-1	9
<b>Trailer-mounted 60-kw or 45-kw generator set:</b>		
Description .....	2-2 <i>h</i>	6
Emplacement .....	5-23	30
March order .....	5-24	31
<b>Trailer-mounted pallet:</b>		
Description .....	2-3 <i>d</i>	7

	Paragraph	Page
<b>Trailer-mounted pallet—Continued</b>		
Emplacement .....	6-11	38
March order .....	6-12	38
<b>Verification of alinement from:</b>		
Improved battery control central:		
Identification, friend or foe, antenna .....	7-8 <i>b</i>	49
Improved continuous-wave acquisition radar .....	7-8 <i>c</i>	49
Improved high-powered illuminator radar .....	7-8 <i>d</i>	50
Improved pulse acquisition radar .....	7-8 <i>a</i>	49
Improved platoon command post:		
Improved continuous-wave acquisition radar .....	7-15 <i>a</i>	54
Improved high-powered illuminator radar .....	7-15 <i>b,c</i>	54
Warnings, air defense .....	9-3-56	

By Order of the Secretary of the Army:

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