Nuclear, Biological, and Chemical Environments

CHAPTER 6

All nuclear, biological, and chemical weapons have an inherent residual effect that presents a hazard to both threat and friendly forces. Nuclear bursts create local contamination of an area around ground zero and may produce radioactive fallout which can contaminate thousands of square kilometers. Some chemical and biological agents create airborne hazards which can be carried downwind for long distances while others create long-term terrain contamination. Areas affected by airborne residual effects are determined primarily by the speed and direction of the wind in the target area and the persistency of the agent used.

It is expected that threat forces will use NBC weapons on the battlefield. Patriot personnel must be able to minimize NBC effects and continue to fight, not only for air defense mission continuity, but also for personnel safety and survival. Failure to prepare for NBC warfare will result in severe losses of men and equipment when threat forces employ NBC weapons. This chapter provides methods used by Patriot personnel to enhance their survivability in an NBC environment.

NUCLEAR

No treaty or international agreement prohibits the use of nuclear weapons in warfare. The threat might use such weapons from the start, or might attack in a conventional manner first, and use nuclear weapons later on. The threat has nuclear weapons and, if they are employed, you must be prepared to fight on a nuclear battlefield.

NUCLEAR WARFARE

Threat forces plan for the use of nuclear weapons in both offensive and defensive operations. According to threat doctrine, nuclear attacks may be combined with conventional fires and air attacks, and exploited rapidly by ground forces. Nuclear weapons can also be used in conjunction with chemical and biological agents.

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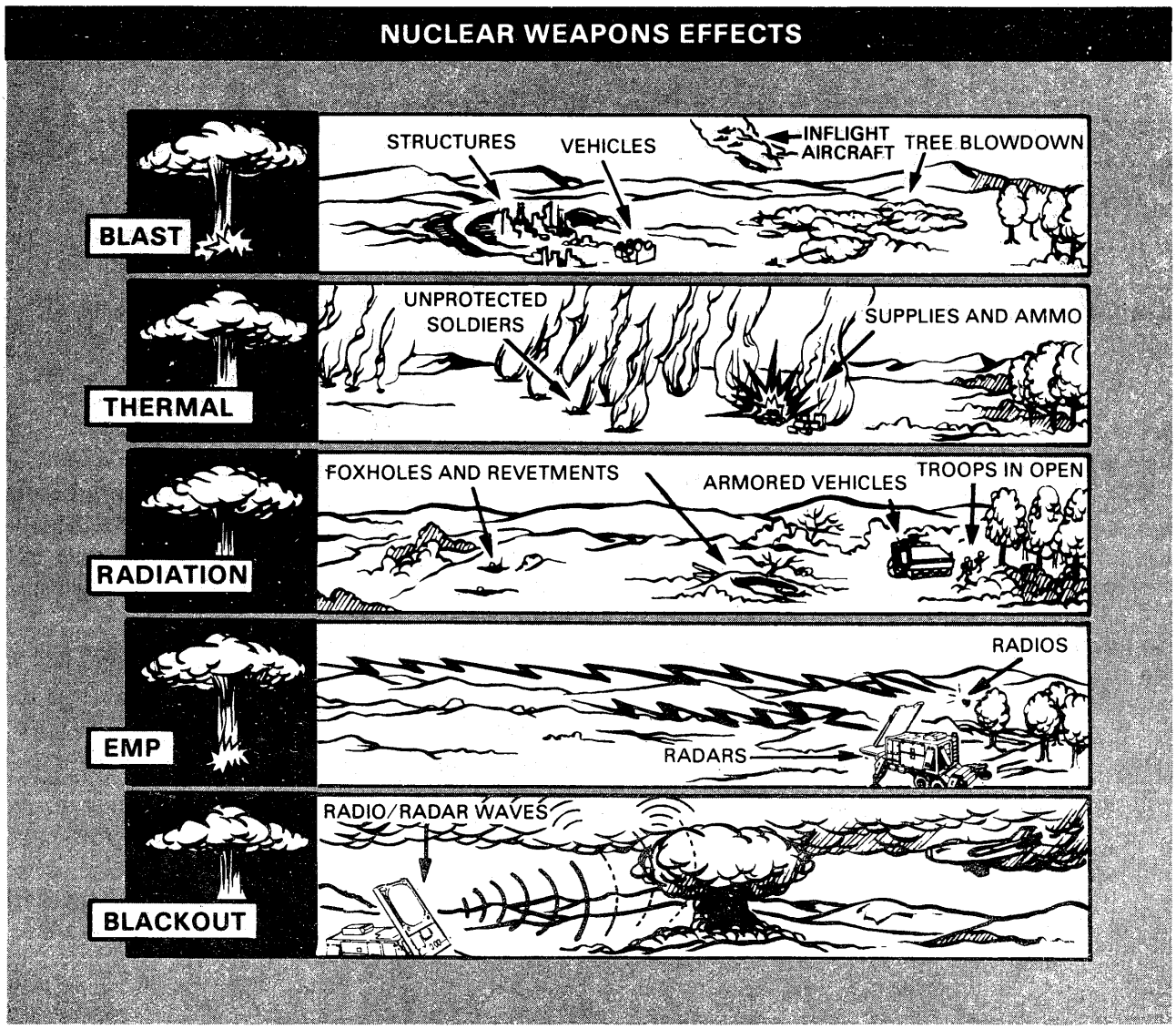
Primary targets for threat attacks are —

- Committed units and reserves.
- Nuclear systems and field artillery.
- Selected command and control elements.

Patriot units in a nuclear environment fight essentially the same as in a conventional environment. Combat service support and communications may be disrupted more than in a conventional environment. The FB may also be isolated for extended periods of time. Otherwise, conventional Patriot tactics are unchanged for use in a nuclear environment.

NUCLEAR WEAPONS EFFECTS

Even when used in low yields, nuclear weapons can quickly and decisively change combat power ratios and the course of a battle. Yield is a term that refers to the energy released when a nuclear weapon explodes. It is measured in terms of kilotons or megatons of TNT needed to produce the same effect. A single KT equals 2,000,000 pounds of TNT and 1 MT equals 2,000,000,000 pounds of TNT.



Nuclear yields are classified by NATO as follows:

- Very low — less then 1 KT.
- Low — 1 to 10 KT.
- Medium — 10 to 50 KT.
- High — over 50 KT.

A 1-KT nuclear weapon has about the same killing power against troops in the open as a single volley of improved conventional munitions from seven artillery battalions. However, a 1-KT weapon is much more effective against troops in individual fighting positions or tanks than conventional artillery. In this case, a 1-KT weapon has 20 to 30 times the lethal area coverage of an artillery volley.

Nuclear weapons achieve such tremendous killing power five ways. The five effects of nuclear weapons are shown in the illustration on page 6-2.

Blast

A fraction of a second after a nuclear detonation, the blast, a high-pressure wave, develops and moves outward from the fireball. This wave causes the most destruction from the nuclear blast. The front of the wave travels quickly away from the fireball, acting like a moving wall of highly compressed air. After the burst, when the fireball is no longer visible, the blast wave is still moving faster than the speed of sound. Strong winds are associated with the blast wave. These winds can have peak velocities of several hundred miles per hour. The overpressure (pressure more than normal air pressure) and the winds are the major causes of blast damage. The crushing overpressure can cause death or injury to unprotected personnel and damage to equipment. High-speed winds can pick up and propel objects such as tree limbs, people, and debris, turning them into lethal missiles.

Thermal Radiation

Thermal radiation consists of extreme heat and a bright light generated from the great amount of energy produced.

Heat. Less than a millionth of a second after a nuclear burst, extreme heat generated by the nuclear fission or fusion process forms the fireball — a hot, bright, round mass of air and nuclear residue. The heat radiated from the fireball adds to the damage of the nuclear burst by igniting buidlings, forests, and fields. These fires spread quickly in the debris produced by the blast. At a distance from ground zero where blast and nuclear radiation are minor, thermal radiation from the fireball can still burn exposed skin. This distance, however, is highly dependent on terrain and weather.

Light. The fireball is also a source of extremely bright light. To an observer 80 kilometers away, the fireball would seem many times brighter than the sun at noon. This light can cause temporary blindness. At night the temporary loss of vision will last longer. Persons looking directly at the fireball will likely suffer permanent blindness caused by burns within the eye itself.

Radiation

Nuclear radiation is also produced with the detonation of a nuclear weapon. It consists of initial and residual radiation.

Initial. Initial nuclear radiation is emitted within the first minute after burst and primarily consists of neutrons and gamma rays. Initial radiation is very hard to protect against because personnel may receive lethal or incapacitating doses before they can take protective actions. Initial radiation effects depend on the amount (dose) of radiation received. The term cGy has replaced the term RAD and has the same value. Centigray is used to express radiation dose levels. For example, an active soldier suddenly exposed to 650 cGys at first shows no symptoms but loses some of his effectiveness in about two hours. He may die in a few weeks. Conversely, exposure in the 100 cGy region has little effect. Other radiation effects based on cGy dose levels are shown in the illustration.

Residual. Residual radiation lasts beyond the first minute following burst. It can be fall-

out, rainout, snowout, or neutron-induced radiation. Fallout is the primary residual hazard. It is produced when material from the earth is drawn into the fireball and vaporized. This material then combines with nuclear wastes and condenses into particles that fall back to earth. The fallout area can be very small or may cover thousands of square kilometers. The fallout dose rate can vary from a minor level to one extremely dangerous for unprotected personnel.

INITIAL RADIATION EFFECTS

DOSE IN cGys	EARLY SYMPTOMS	PERSONNEL EFFECTIVENESS	DEATHS
0 TO 70	LESS THAN 5% OF PERSONNEL WILL SHOW SYMPTOMS.	FULL.	NONE.
150	ABOUT 5% IN 6 HOURS.	REDUCED EFFECTIVENESS, DEPENDING ON TASK. COMPLETELY INEFFECTIVE IF HOSPITALIZED.	NONE.
650	WITHIN 2 HOURS.	SYMPTOMS CONTINUE OFF AND ON FOR NEXT FEW DAYS. EFFECTIVENESS REDUCED SIGNIFICANTLY FOR 2D TO 6TH DAY. HOSPITALIZATION REQUIRED.	MORE THAN HALF AT ABOUT 16 DAYS.
2,000 TO 3,000	100% WITHIN 5 MINUTES.	IMMEDIATE, TEMPORARY INCAPACITATION FOR 30-40 MINUTES, FOLLOWED BY A RECOVERY PERIOD DURING WHICH EFFICIENCY IS IMPAIRED.	100% IN ABOUT 7 DAYS.
8,000	100% WITHIN 5 MINUTES.	IMMEDIATE, PERMANENT INCAPACITATION FOR PERSONNEL PERFORMING PHYSICALLY HARD TASKS. NO PERIOD OF LATENT RECOVERY.	100% IN 1-2 DAYS.
18,000	100% IMMEDIATELY.	PERMANENT INCAPACITATION REGARDLESS OF TASK.	100% IN 24 HOURS.

Note: Symptoms include vomiting, propulsive diarrhea, dry heaving, nausea, lethargy, depression, and mental disorientation. At lower dose levels, incapacitation is a simple slowing down of the rate of performance due to a loss of physical mobility and/or mental disorientation. At the high dose levels shock and coma may be the early symptoms.

Electromagnetic Pulse

The nuclear burst releases gamma rays causing a short-duration radio-frequency EMP. The strength and extent of the EMP field depends on the amount of gamma radiation, nuclear burst height, and atmospheric conditions. EMP does not affect personnel. However, most radio and radar equipment can be damaged by EMP, because its energy is higher than the circuit and component capabilities. The EMP damage can be temporary or permanent. It can range from burned-out fuses, transistors, and coils to the destruction of complete power supplies.

The frequencies generated by the EMP cover most of the usable freuency band. Most EMP engergy is in the HF and VHF ranges.

Based on its EMP vulnerability, Army tactical equipment is divided into four categories, as shown below. This illustration can be used as a general guide.

EQUIPMENT VULNERABILITY CATEGORIES

EQUIPMENT CATEGORIES	PROBABILITY OF DAMAGE	EQUIPMENT INCLUDED IN CATEGORY
I	VERY LOW	ARTILLERY, TACTICAL EQUIPMENT (EXCLUDING COMM EQUIPMENT).
II	LOW	FIRE DIRECTION CONTROL EQUIPMENT, NUCLEAR WARHEADS, MISSILES.
III	MEDIUM	LONG-RANGE COMMUNICATIONS EQUIPMENT (GREATER THAN 100 KM), AIR DEFENSE RADARS.
IV	HIGH	TARGET ACQUISITION RADARS, SHORT-RANGE COMMUNICATIONS EQUIPMENT (LESS THAN 100 KM), COMMAND AND CONTROL EQUIPMENT.

Blackout

Nuclear weapons produce one last phenomenon known as nuclear blackout. Nuclear blackout is the result of the blast fireball and of large dust clouds which may also be created. The effects of nuclear blackout can last from a few seconds to many hours, depending on the

altitude, yield of burst, and the operating frequency of affected equipment.

Blackout affects radio and radar by —

- Refraction (bending of the waves).
- Absorption (consuming waves).
- Scattering (waves scattered in all directions).

These effects result in partial or total loss of voice and data being transmitted or received. For the Patriot radar set, this creates a blind area on the D+C console which prevents the operator from seeing any targets in that airspace.

PROTECTION AGAINST NUCLEAR EFFECTS

Nuclear weapons, although tremendously powerful, are not weapons against which there is no defense. The more individual soldiers know about nuclear weapons, the greater their chances for effectiveness and survival on the nuclear battlefield. *Three* classes of nuclear protective measures are; actions before, during, and after the attack.

Before

Finding shelter and protecting equipment against damage are two things that must be done before a nuclear attack.

The best defense against an attack is to dig in. Unit defensive positions must be prepared whenever possible. These can vary from individual fighting positions to improved defensive positions.

A well-built fighting position gives good protection against both initial and residual radiation. A deep fighting position gives more protection than a shallow one. A fighting position with overhead covering is even better. This reduces the amount of thermal and initial radiation that reaches you and also prevents the entrance of fallout. The fighting position cover should be strong enough to withstand the blast wave.

Tunnels, caves, and storm drains also provide good shelter unless there is a subsurface collapse. Culverts and ditches can be used in an emergency, but they offer only partial protection. Buildings are usually not strong enough to provide effective shelter. However, the basement of a reinforced concrete or steel-framed building provides good protection against all the effects. If taking shelter in a building, avoid the areas around windows and other openings.

Individual clothing, equipment, and other items must be kept in the fighting position or in a separate, covered hole. None of this equipment can be left unsecured because the blast wave will convert it into deadly missiles. Unit supplies, especially explosives and flammables, must be dispersed within the area and protected or shielded. Debris must be kept to a minimum and not be allowed to collect where it could catch fire. Objects such as radios, generators, tools, and fuel cans must always be secured to reduce the danger of casualties from flying objects.

Protective EMP measures taken before a nuclear attack are critical to unit survival. Cables, wires, antenna systems, and metal structures are good electrical conductors; all absorb EMP energy. The term used to describe this process is "coupling." Material that couples electromagnetic energy can absorb enough EMP energy to induce voltage and currents. The key to protection is to develop techniques of equipment installation and operation that reduce EMP coupling.

EMP can enter electrical systems through intentional antennas, unintentional antennas, or direct penetration (see following illustration). Intentional antennas are standard radio and radar antennas. Unintentional antennas can be any device (masts, wiring loops, cables, et cetera) that can act as an antenna even though it is not meant to be one. In direct penetration, internal electronic components act as loop antennas, allowing strong electromagnetic fields to be created inside equipment.

EMP PROTECTIVE MEASURES

FOR INTENTIONAL ANTENNAS—

- Disconnect the antenna.
- Use the highest possible frequency and horizontally polarized antennas.
- Disconnect all antennas, power sources, cables, and wires from spare equipment.

FOR UNINTENTIONAL ANTENNAS—

- Keep cable and wire lengths as short as possible. The amount of energy collected by a cable or wire is directly related to its length.
- Bury all cables and wires at least 18 inches deep.
- Never leave cable or wire, that is connected to equipment, coiled on a reel. The "coil" will pick up more EMP than a straight cable run.
- Use a common ground for all equipment whenever possible.
- Insure that antenna guy lines are properly insulated.
- Never use commercial sources of power. Studies have shown that commercial power sources are extremely susceptible to EMP.

FOR DIRECT PENETRATION—

- Shield all C-E equipment with iron or steel if available, any other metal if not.
- Close all enclosure doors, vents, access panels, and ducts. (Vents that must remain open during equipment operation should be covered with honeycomb metal screens.)
- Line access panels, cabinet walls, enclosure doors, et cetera, with aluminum foil.

During

Threat nuclear attacks can come without warning. The first indication of an attack will be a bright flash of light. Heat and initial radiation arrive with the light and the blast follows in a few seconds. There will be little time; protective actions must be automatic and instinctive. Unit activities will be suspended for a short time while personnel take cover. Personnel out in the open when a nuclear burst occurs must —

- Immediately drop face down flat on the ground or to the bottom of a fighting position. Face away from the fireball. Any depression in the ground will provide some protection if gotten into immediately.
- Close eyes. Protect exposed skin by putting your hands and arms under the body. Keep the helmet on because it will be protection from flying debris.
- Remain down until the blast wave has passed and debris has stopped falling. Remain protected until the negative phase of the blast wave has also passed. As the blast wave passes a position, there is a resulting decrease in air pressure to a point below atmospheric pressure. This creates a vacuum. Air will rush in to fill this volume, causing high winds from the direction opposite that of the direction of travel of the blast wave.
- Stay calm, check for injury and equipment damage, and prepare to continue the mission.
- Count the number of seconds between the flash of light and bang, if possible, for inclusion in an NBC 1 report.

After

After a nuclear attack, secure and organize the equipment, help any casualties, and to protect against fallout, begin to prepare or improve your position. Designated persons will begin radiological monitoring. When warned of fallout, take cover and remain protected until the fallout has stopped or until further orders are received. It may be necessary for the unit to enter and/or remain in an area receiving fallout. If so, quickly dig in, sweep the fallout away from the fighting position, and use a poncho for cover until fallout is complete. If dust particles make breathing difficult, a handkerchief or cloth can be worn over the nose and mouth. The M17 series protective mask cannot be used as a dust respirator. When the dust stops falling, scrape or brush the dust away from the edges of the shelter. Stay in the shelter for at least 24 hours, and then move to a friendly position as fast as possible. If separated from your unit, try to rejoin it or another friendly unit as soon as possible. Upon reaching an area where trees have been blown down, where there is a large crater, or where an area of ground looks glassy, change course and stay away from that area. Keep in mind that radiologically contaminated areas cannot be detected without radiac equipment.

REMEDIAL ACTIONS FOR NUCLEAR BLACKOUT

Nuclear blackout actions are extremely limited and are as shown in the following illustration. Remember, however, that nuclear blackout only affects certain areas and lasts for only a limited time.

NUCLEAR BLACKOUT REMEDIAL ACTIONS

RADAR BLACKOUT

- If the blackout is caused by dust clouds only, it may be possible for the MTI circuitry and CW equipment to "see through" the affected area. This will not be possible if blackout is caused by ionization.
- If the blackout is caused by ionization, it may be possible to maintain coverage through early warning relay from non-affected units.

RADIO BLACKOUT

- Nuclear blackout does not affect wire systems; using wire might be a simple solution. Remember however, that wire systems are extremely susceptible to EMP.
- Alternate routing through a manual relay or retransmission station might be used to bypass the affected region.
- Assigned alternate frequencies might be used. Use higher frequencies if the blackout is caused by ionization. If dust appears to be the problem, use lower frequencies.

FALLOUT PREDICTION

Fallout prediction is used to estimate fallout areas from a nuclear burst before the actual arrival of the fallout. The two types of fallout prediction procedures are detailed and simplified. A detailed fallout prediction is prepared at the major command headquarters. It will be sent to your unit in the NBC 3 report format. Simplified fallout prediction is usually prepared at battery level using the M5A2 radiological fallout area predictor (see FM 3-3 and TM 3-6665-304-10). Fallout predictions are used by commanders to —

- Warn or alert subordinate units of expected fallout.
- Aid in tactical planning.
- Plan radiological surveys.

Units may be ordered to move to less hazardous areas if the radiation doses reach dangerous levels after fallout is complete. However, movement to another area is never based solely on a fallout prediction, because the exact location of fallout cannot be reliably forecast.

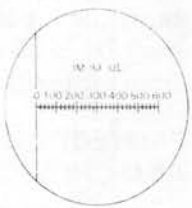
RADIOLOGICAL MONITORING AND SURVEY

Radiation can cause sickness or perhaps death. Radiation cannot be seen, felt, tasted, smelled, or heard. Special instruments must be used to detect it. This detection is known as radiological monitoring and is performed to detect radiation and measure its dose rate. The radiac instruments used in radiological monitoring are shown in the illustration.

RADIAC INSTRUMENTS

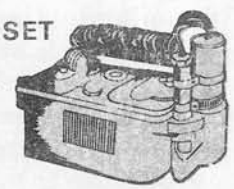
IM-93 ( )/UD DOSIMETER. Pocket size device that measures the total nuclear radiation (gamma) dose received by an individual. It must be recharged using the PP-1578/PD charger at battery Hq, after not more than 2 or 3 days of use and when the total dose reaches or exceeds 500 cGys on the scale.

ACTUAL LENGTH—11.5CM (4½ IN.)

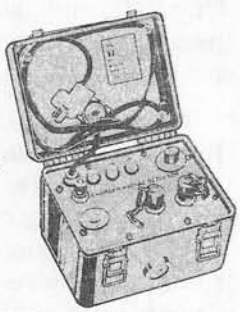


RADIACMETER IM-185 ( )/UD. Pocket size dosimeter for measuring cumulative exposure to X-ray, gamma ray, and neutron radiation. The dosimeter contains a high-vacuum chamber which must be pumped periodically, and an electrometer which must be electrically charged at regular intervals. The IM-185 will replace the IM-93.

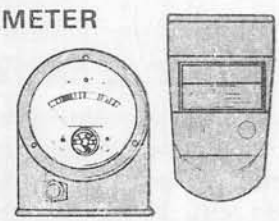
AN/PDR-27 ( ) RADIAC SET Low range dose rate meter used to detect radioactivity on personnel, food, and equipment.



RADIAC DETECTOR CHARGER PP-4370 Charger for the IM-185 ( )/UD. It is lightweight and portable and can be operated from three different power sources: an internal rechargeable battery, a source of 115 v 60-1, 600 Hz ac power, or a vehicular source of 24-vdc power.



IM-174/PD RADIAC METER High range dose rate meter used to detect, measure, and display the dose rate of radioactivity in an area. Gamma readings are indicated in units from 0 to 500 cGys per hour.



The commander is responsible for having his unit's operating area checked for radiation. Battery-size units have at least two trained monitors for each dose rate meter. These personnel use their equipment to detect any radiation and measure the dose rates. The commander then indicates the defensive measures that must be taken. Monitoring techniques, correlation factor data, and recording forms are described in FM 3-3.

Radiac equipment is also used to perform radiological surveys. These surveys are performed to find the extend and degree of radiological contamination. Commanders at all levels are responsible for training survey personnel and performing surveys and resurveys when directed. Detailed guidance is provided in FM 3-3 and STANAG 2112 on how to conduct or request a radiological survey.

FIRST AID FOR NUCLEAR CASUALTIES

First aid measures for nuclear casualties are limited to those for burns caused by thermal radiation and injuries caused by the blast wave. There are no immediate lifesaving measures for radiation sickness or blindness. Detailed procedures for the first aid treatment of specific types of injuries are given in FM 21-11.

EQUIPMENT DECONTAMINATION

Nuclear fallout is solid material and is not absorbed by equipment. The most rapid method of decontaminating vehicles, weapons, and other equiment is by brushing off the loose particles and then washing the equipment. Vehicles can be washed with steam or water and scrubbed with detergent. Decontamination stations may also be made available at battery or battalion level for mass decontamination of vehicles.

BIOLOGICAL AND CHEMICAL

In terms of chemical warfare, the threat is the best-equipped, best-trained, and most heavily armed force in the world. It is fully capable of producing and employing biological agents on a massive scale. Threat forces can operate in either toxic areas imposed on them, or in areas where they themselves have used chemical agents. Their troops are trained and equipped for chemical warfare as if it were inevitable—*so must ours*!

BIOLOGICAL AND CHEMICAL WARFARE

Threat doctrine describes chemical agents as "weapons of mass destruction" and treats their use as a basic part of warfare. It emphasizes the use of chemical weapons in close coordination with conventional and nuclear weapons.

The threat will use chemical strikes to paralyze our defensive capacity and logistical support. Specific areas may be attacked to the point of saturation especially in the rear area. Likely targets will probably include artillery and ADA units, troops in reserve, airfields, and supply depots. In order to maintain their high-speed advance, threat forces will attempt to bypass or cross contaminated areas in sealed tanks and personnel carriers.

The threat may use biological strikes to supplement other types of attacks. Biological agents may also be used to cause death or long-term incapacitation for strategic purposes or may be used to cause casualties at a specific time for tactical purposes.

PROTECTION AGAINST BIOLOGICAL AND CHEMICAL AGENT EFFECTS

Patriot crew members at the FB with the exception of those crew members at the ECSs, may be directly exposed to biological or chemical agents. For those soldiers assigned to operate the ECS, ICC, and CRG, survival chances are based on the environmental control unit. The ECU consists of an air conditioner, a gas-particulate filter, and a collapsible, pressurized, protective entrance for the shelter.

The air conditioning system maintains a higher than atmospheric pressure within the shelter. Air leakage then is from inside to outside preventing contaminated air seepage into the operator compartment from an NBC environment. However, since outside ambient air is drawn in to cool equipment assemblies, crew

members must take precautions when opening closed equipment bay panels in a contaminated environment. The module rack assemblies and other hardware housed behind the closed panels may be contaminated and crew members must don their protective clothing, MOPP 4, before handing the equipment. Protective clothing must be worn until the equipment is decontaminated. As long as the bay doors are closed, they form an airtight seal and present no problem.

In a CB environment, the gas-particulate filter unit mounted on the outside front wall of the shelter is turned on to provide purified air to the crew compartment and the protective entrance. The protective entrance is mounted and sealed over the ECS entry door. It is employed not only as an air lock but also as an air shower to purge incoming personnel of CB agents. The crew enters the lock, receives an air shower, removes protective clothing, changes to sterile clothing, and then enters the ECS through the normal crew access door.

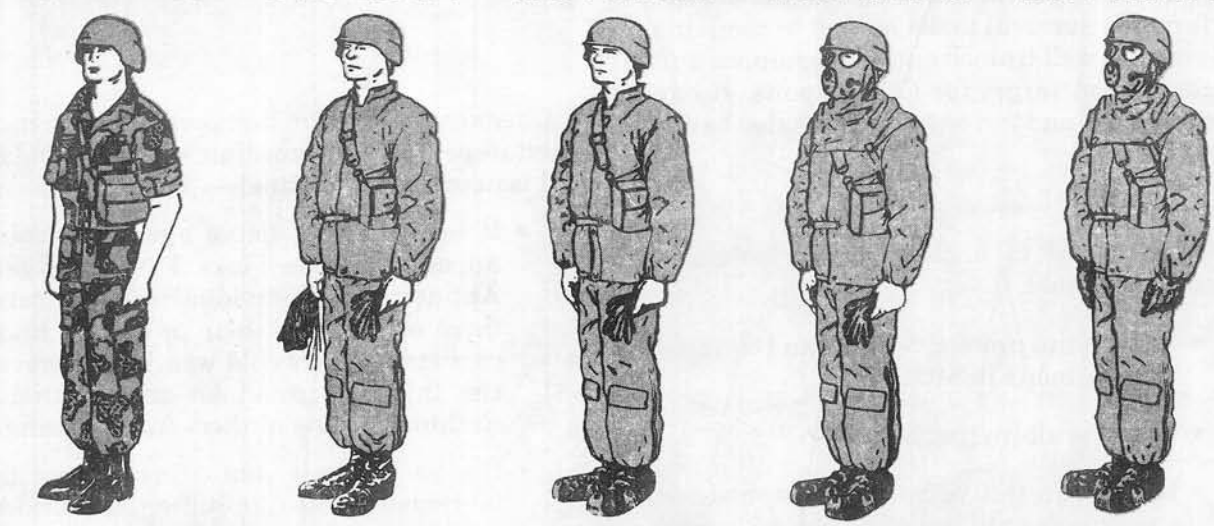
The battalion ICC and CRG are similarly equipped with ECU equipment. Protective actions against biological and chemical agents depend on the threat, mission, situation, and weather.

Before

Unit commanders designate to each unit a mission oriented protective posture. Essentially, each of the MOPP levels tells how much preparation to take for an attack and indicates what protective clothing and equipment to wear (see following illustration). However, if the unit is attacked with CB agents without warning, go immediately to the highest state of preparedness —MOPP 4.

The MOPP balances mission requirements against CB protection requirements and other factors; such as, temperature and work rate. Heavy work-rate activities while wearing protective clothing should be done in the coolest part of the day.

MOPP PROTECTIVE CLOTHING



Equipment and supplies must be protected against liquid agents. Keep them organized and covered with brush, ponchos, shelter halves, or any other covering material. Before sleeping cover equipment and fighting positions. Wear MOPP level 4 while sleeping.

Have an alert and questioning attitude toward any indication of a biological attack. Although respect for biological agents is important, do not have an unreasonable fear of disease. Do not repeat or exaggerate rumors about biological warfare. To reduce the effects of exposure to biological agents —

- Practice good hygiene.
- Clean all wounds and cuts.
- Keep your immunization shots up-to-date.
- Practice area sanitation.
- Maintain physical fitness.

NBC training is the key. Trained soldiers can perform the survival tasks needed to combat a CB strike. A well-trained and well-equipped unit is not a good target for CB weapons. It can survive, fight, and win on a contaminated battlefield.

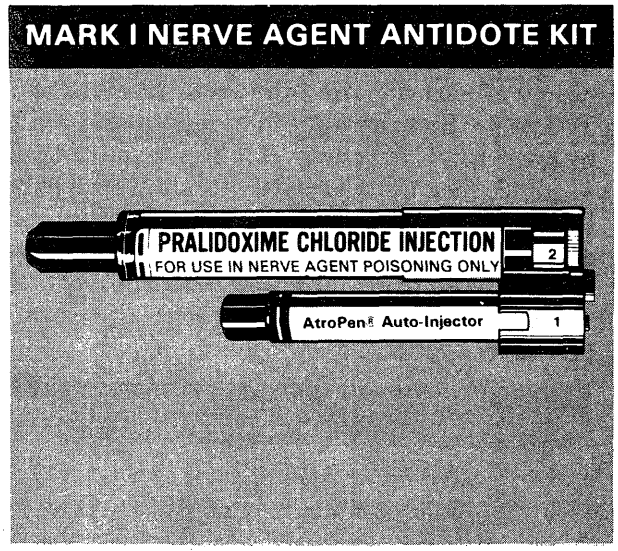
During

When alerted to a chemical or biological attack you should:

- Put on your protective mask and clothing if not already in MOPP.
- Give the alarm (per SOP).
- Keep all protective clothing buttoned and wear mask until the ALL CLEAR signal is given.
- Continue the mission.
- Take cover if the situation permits.

Biological contamination symptoms consist of the onset of unexplained illness. Take biological or toxin casualties to medical treatment facilities as soon as possible.

Chemical casualties present special situations. Symptoms should be readily recognized so proper treatment can be administered. Their primary route of attack upon the body is through the respiratory system or skin. Chemical agents are grouped into *four* major categories — nerve, blister, blood, and choking agents.



Chemical agents are designed to kill or incapacitate personnel. Immediate self-aid or buddy-aid is needed by personnel —

- If symptoms of nerve agent poisoning appear, use the Mark I Nerve Agent Antidote Kit. Individual soldiers carry three of them in their protective mask carriers. In very cold weather, however, the injectors must be carried inside clothing to prevent them from freezing.
- If skin becomes contaminated, use the individual decontamination kit M258A1 on skin and selected personal equipment. Do not use the M258A1 on your protective overgarments.
- If eyes are contaminated, flush them with water from a canteen.

- If the attack is a spray attack, protect body and equipment with a poncho, shelter half, or any other covering material.
- If the agent is identified, follow other first-aid and decontamination actions prescribed for the type of agent used (see illustration below).

MAJOR CHEMICAL AGENTS, SYMPTOMS, FIRST AID, AND DECONTAMINATION

TYPE OF AGENT	SYMBOL/NAME US AGENTS EQUIVALENT	SYMPTOMS IN MAN	INDIVIDUAL	
			FIRST AID	DECONTAM-INATION
NERVE (AEROSOL OR VAPOR)	GA/TABUN CB/SARIN GD/SOMAN	DIFFICULT BREATHING, DROOLING, NAUSEA, VOMITING, CONVULSIONS, AND SOMETIMES DIM VISION.	GIVE 2 PAM. CHLORIDE AND ATROPINE INJECTIONS. ARTIFICIAL RESPIRATION MAY BE NECESSARY.	NONE NEEDED.*
NERVE (LIQUID DROPLETS)	VX THICKENED G-AGENTS			FLUSH EYES WITH WATER. DECONTAMINATE SKIN USING M258A1 KIT.
BLISTER (LIQUID DROPLETS)	HD/MUSTARD HN/NITROGEN MUSTARD L/LEWISITE HL/MUSTARD-LEWISITE CX/PHOSGENE OXIME	MUSTARD: NITROGEN MUSTARD—NO EARLY SYMPTOMS. LEWISITE; MUSTARD-LEWISITE—SEARING OF EYES AND STINGING OF SKIN. PHOSGENE OXIME—IRRITAION OF EYES AND NOSE.	NONE.	FLUSH EYES WITH WATER. DECONTAMINATE SKIN WITH M258A1 KIT OR WASH WITH SOAP AND WATER.
BLOOD (VAPOR-GAS)	AC/HYDROGEN CYANIDE CKk/CYANOGEN CHLORIDE	CONVULSIONS AND COMA.	ARTIFICIAL RESPIRATION MAY BE NECESSARY.	NONE.
CHOKING (VAPOR-GAS)	CG/PHOSGENE	COUGHING, CHOKING, NAUSEA, AND HEADACHE.	FOR SEVERE SYMPTOMS, AVOID MOVEMENT AND KEEP WARM.	NONE.

After

After the attack, remain masked and continue your mission. Give first aid to any casualties in your immediate area and report to your immediate supervisor. If exposed skin was contaminated, decontaminate it immediately. As time permits, check clothing and equipment for possible contamination and decontaminate equipment and replace clothing as required. Do not unmask after an attack until authorized by the unit commander! If no leader is present, follow the unmasking procedures in the SOP. These include the use of a chemical agent detector kit and are also applicable to situations where no such kit is available. How much decontamination you do will depend on the tactical situation and the mission, the decontamination resources available, and how much contamination. As a rule decontaminate only what you need to continue the mission.

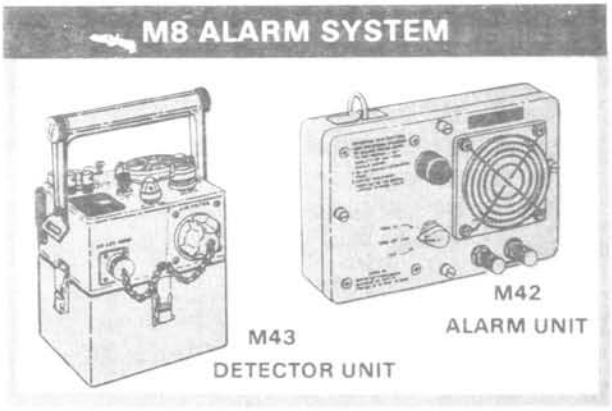
The three types of decontamination that can be done after the attack are basic skills, hasty, and deliberate. The basic skills type of decontamination are simple skills for soldier survival. This type is conducted using supplies and equipment carried by each individual or unit vehicle. Basic skills decontamination calls for skin decontamination and personnel wipedown of equipment such as weapons and protective clothing using the M258A1 decontamination kit, and operator spray down of equipment using the M11/M13 with DS2.

If time permits, the unit could perform a hasty decontamination operation. This type of decontamination calls for MOPP gear exchange, and the mask hand wiped down, individual gear brushed with decontaminant, and complete vehicle wash down by special decontamination teams with power driven decontamination equipment within the battalion.

The third type of decontamination, a deliberate decontamination operation, requires detailed planning, and more manpower and resources than the hasty decontamination. Usually, company size or larger units conduct this type of decontamination which calls for detailed troop and equipment decontamination. All equipment and personnel are thoroughly decontaminated and monitored for contamination. More information on personnel and equipment decontamination can be found in TM 3-5.

EMERGENCY WARNINGS

The United States, along with other NATO nations, has adopted a standard method of disseminating emergency warnings to its land forces. These emergency warnings are listed in FM 3-100 and STANAG 2047.



NBC ALARMS

Vocal, visual, and/or audible alarms are given in all cases as soon as an NBC attack or hazard is detected. These alarms are —

- Rapid and continuous beating on any metal object or any other object which produces a loud noise.
- A succession of short blasts on a vehicle horn or any other suitable device.
- A broken warbling siren; for example, 10 seconds on, 10 seconds off, 10 seconds on, 10 seconds off.
- Sounding of automatic chemical alarms such as the M8 alarm system.
- Shouts of "gas, gas, gas" or "fallout, fallout, fallout" or other sound signals as described in SOP.
- Extending both arms horizontally sideways with doubled fists facing up and rapidly moving fists to the head and back to the horizontal position and repeat this movement at least three times.

EMERGENCY REPORTS

The warning and reporting of threat or unidentified NBC attacks and resulting hazardous areas are made by telephone or message according to the provision of STANAG 2103. NBC reports are as follows:

- NBC 1 Observer's Initial Report, used for giving basic data.
- NBC 2 Report, used for passing evaluated data.
- NBC 3 Report, used for immediate warning of expected contamination.
- NBC 4 Report, used for radiation dose-rate measurements.
- NBC 5 Report, used for areas of contamination.

The following illustrations show STANAG NBC reporting system samples and the meaning of lettered items.

NBC WARNING AND REPORTING SYSTEM

NBC 1 (OBSERVERS) REPORT

TYPE OF REPORT	NUCLEAR	CHEMICAL	BIOLOGICAL
B.	B. TU440810	B. MARBERG	
C.	C. Grid 242 degrees	C. Magnetic 2650 mils	
D.	D. 270400 local	D. 270400 ZULU	D. 270400 local
E.		E. 270410 ZULU	E. 270412 local
F.		F. TI459830 est.	F. OBERG actual
G.		G. Rocket	G. Aerial spray
H.	H. Unknown	H. Nerve	H. Biological
I.		I. 135	
J.	J. 65		
K.			
L.	L. 100 mils		
M.			
S.		S. 270445 ZULU	S. 270430 local

Notes: 1. Items D and H, and either B and C or F, must always be reported; other items are optional.
2. For nuclear reports only —
a. Items B, C, D, H, J, and K are normal for initial reports.
b. Items B, C, D, and H, and either L or M, are normal for follow-up reports.

NBC 2 REPORT (EVALUATED DATA)

TYPE OF REPORT	NUCLEAR	CHEMICAL AND BIOLOGICAL
A.	A. 24	A. 1
D.	D. 270400 local	D. 270400 ZULU
F.	F. TU429950 actual	F. TU465829 actual
G.		G. Rocket
H.	H. Surface	H. Nerve
N.	N. 20	

Notes: 1. Normally based on two or more NBC 1 reports. Items A, D, F, H, and N may be repeated as often as necessary to produce a summary report.
2. Used in conjuntion with the effective downwind message to prepare a simplified fallout prediction.

NBC 3 REPORT (IMMEDIATE WARNING OF EXPECTED CONTAMINATION)

TYPE OF REPORT	NUCLEAR	CHEMICAL AND BIOLOGICAL
A.	A. 54-1	A. 23
D.	D. 270400 local	D. 270400 ZULU
F.	F. LB187486 actual	F. LB206300 actual
P.		P. LB208320 LB210320

NBC 3 REPORT (continued)

	LB206310 LB204310
Y.	Y. 02700310
Z.	Z. 01902505 or 011

Note: Items D, F, and P shown for chemical and biological reports must always be reported; other items are optional.

NBC 4 REPORT (RADIATION DOSE-RATE MEASUREMENTS)

TYPE OF REPORT		NUCLEAR
Q.	Q. LB123987	Q. LB123978
R.	R. 1 initial	R. 27 increasing
S.	S. 201735 local	S. 201750 local
	Q. LB123978	Q. LB123987
	R. 60 peak	R. 41 decreasing
	S. 201805 local	S. 201815 local

Notes: 1. This report is not used for chemical or biological reporting.
2. Items Q, R, and S may be repeated as often as necessary.

NBC 5 REPORT (AREAS OF CONTAMINATION)

TYPE OF REPORT	NUCLEAR	CHEMICAL AND BIOLOGICAL
A.	A. 24	A. 1
O.		
S.		S. 20800 local
T.	T. 201505 local	T. 201045 local
U.		
V.	V. ND651455 ND810510 ND821459 ND651455	
W.	W. ND604718 ND991686 ND114420 ND595007	
X.		X. CHEMICAL ND206991 ND201575 ND200787 ND206991

Notes: 1. This form is best sent by an overlay if time and distance permit.
2. It is not necessary to report all four radiological contours. Four are given to provide flexibility. When a contour closes to form a complete ring, the first coordinate is repeated. [See 300 rad/hr line.]

LETTER ITEMS IN NBC REPORTING

LETTER	NUCLEAR FORMS	CHEMICAL OR BIOLOGICAL FORMS
ALFA	STRIKE SERIAL NUMBER(S).	SAME.
BRAVO	POSITION OF OBSERVER (UTM OR PLACE).	SAME.
CHARLIE	DIRECTION OF ATTACK FROM OBSERVER IN DEGREES OR MILS (STATE WHICH) FROM GRID OR MAGNETIC NORTH (STATE WHICH)	SAME.
DELTA	DATE/TIME OF DETONATION (LOCAL OR ZULU TIME, STATE WHICH).	DATE/TIME ATTACK STARTED (LOCAL OR ZULU TIME, STATE WHICH).
ECHO	ILLUMINATION TIME (DURATION REPORTED IN SECONDS).	DATE/TIME ATTACK ENDED (LOCAL OR ZULU TIME, STATE WHICH).
FOXTROT	LOCATION OF ATTACK (UTM OR PLACE) (ACTUAL OR ESTIMATED, STATE WHICH).	AREA ATTACKED (ACTUAL OR ESTIMATED, STATE WHICH).
GOLF	MEANS OF DELIVERY, IF KNOWN.	MEANS OF DELIVER.
HOTEL	TYPE OF BURST—AIR, SURFACE, OR UNKNOWN (STATE WHICH)—INCLUDING HEIGHT, IF KNOWN.	TYPE OF AGENT, IF KNOWN (CHEMICAL OR BIOLOGICAL). TYPE OF ATTACK (CHEMICAL OR BIOLOGICAL).
INDIA	NA	TYPE AND NUMBER OF MUNITIONS OR AIRCRAFT (STATE WHICH).
JULIET	FLASH-TO-BANG TIME (SECONDS).	NA
KILO	CRATER PRESENT OR ABSENT, AND DIAMETER, IF KNOWN (METERS).	NA
LIMA	CLOUD WIDTH AT H+5 MIN (DEGREES OR MILS, STATE WHICH).	NA
MIKE	CT OR CB ANGLE OR CLOUD HEIGHT, TOP OR BOTTOM (STATE WHICH) AT H+10 MIN. (DEGREES, MILS, METERS, OR FEET).	NA
NOVEMBER	ESTIMATED YIELD (KT).	NA
OSCAR	REFERENCE DATE/TIME FOR ESTIMATED CONTOURS WHEN NOT H+1 HR.	NA
PAPA	FOR RADAR PURPOSES ONLY:	AREA OF EXPECTED CONTAMINATION (UTM).
PA	UTM COORDINATES OF POINTS TO OUTLINE EXTERNAL CONTOURS OF CLOUD.	
PB	WIND DIRECTION (FROM) (DEGREES OR MILS, STATE WHICH).	
QUEBEC	LOCATION OF READING (UTM).	NA

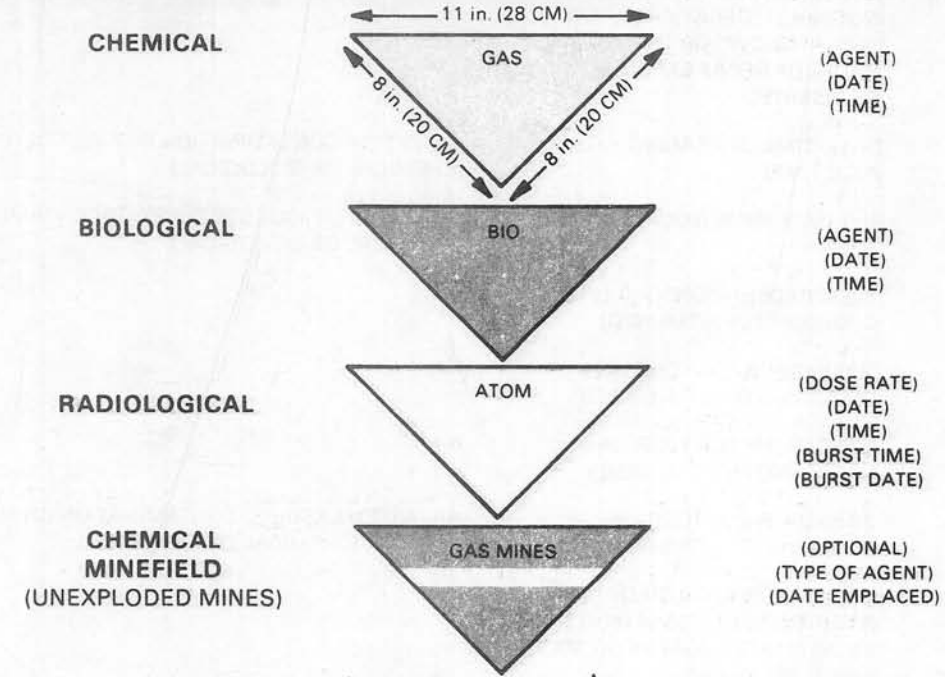
LETTER ITEMS IN NBC REPORTING (continued)

LETTER	NUCLEAR FORMS	CHEMICAL OR BIOLOGICAL FORMS
ROMEO	DOSE-RATE (RAD/HR). THE WORDS "INITIAL," "INCREASING," "PEAK," OR "DECREASING" MAY BE ADDED. WHEN DECAY RATE IS REPORTED, THE WORDS "DECAY NORMAL," "DECAY FAST," OR "DECAY SLOW" OR THE ACTUAL VALUE OF DECAY EXPONENT MAY BE INSERTED.	NA
SIERRA	DATE/TIME OF READING (LOCAL OR ZULU TIME).	DATE/TIME CONTAMINATION INITIALLY DETECTED (CHEMICAL OR BIOLOGICAL).
TANGO	H+1 DATE/TIME (LOCAL OR ZULU TIME).	DATE/TIME OF LATEST SURVEY OF CONTAMINATION (CHEMICAL OR BIOLOGICAL).
UNIFORM	1,000 RAD/HR CONTOUR LINE COORDINATES (UTM) (RED).	NA
VICTOR	300 RAD/HR CONTOUR LINE COORDINATES (UTM) (GREEN).	NA
WHISKEY	100 RAD/HR CONTOUR LINE COORDINATES (UTM) (BLUE).	NA
XRAY	20 RAD/HR CONTOUR LINE COORDINATES (UTM) (BLACK).	AREA OF MEASURED CONTAMINATION (UTM) (YELLOW) (CHEMICAL OR BIOLOGICAL).
YANKEE	BEARING OR AZIMUTH OF LEFT THEN RIGHT RADIAL LINES (4 DIGITS EACH) (STATE DEGREES OR MILS).	NA
ZULU	EFFECTIVE WIND SPEED (KMPH), 3 DIGITS: DOWNWIND DISTANCE OF ZONE 1 (KM), 3 DIGITS; CLOUD RADIUS (KM), 2 DIGITS. (WHEN EFFECTIVE WIND SPEED IS LESS THAN 8 KMPH, 3 DIGITS ONLY FOR RADIAL DISTANCE OF ZONE 1.)	EFFECTIVE WIND SPEED (KMPH).

WARNING SIGNS

Chemically, biologically, and radiologically contaminated areas and chemical minefields are marked by triangular signs as illustrated, unless the area is to be abandoned to threat forces. The nature of the contamination or danger of the considered area is to be indicated by the colors of the signs. The signs will be right-angled, isosceles triangles.

MARKERS OF CONTAMINATED LAND AREAS



DANGER	PRIMARY COLORS	SECONDARY COLORS MARKINGS	SECONDARY COLORS INSCRIPTIONS
RADIOLOGICAL CONTAMINATION	WHITE	NONE	BLACK
BIOLOGICAL CONTAMINATION	BLUE	NONE	RED
CHEMICAL CONTAMINATION	YELLOW	NONE	RED
CHEMICAL MINEFIELDS	RED	YELLOW STRIPE	YELLOW

NBC CONTAMINATED LAND AREAS

As soon as possible following an NBC attack, units mark off areas where contamination is still on the ground, plants, or bushes. Markers indicating the type of contamination are used. These markers are different colored triangles for each type of contamination with ATOM, GAS, or BIO printed in large letters on the front side only. Units indicate on the front (side of marker away from the contaminated area) of GAS and BIO markers the contamination agent and the date and time of contamination, if known. ATOM markers may indicate the dose-rate and the time the dose-rate was measured and, if known, the burst date and time. If you come to one of these signs — STOP! If you can read the information, don't go any further. Conversely, if you do not see any written information on the sign, you have just walked through a contaminated area. Check the other side of the marker to determine the contamination agent, check yourself for contamination and decontaminate yourself.

Training Development

CHAPTER 7

This chapter discusses concepts used by commanders and trainers to establish and conduct a training program. Patriot training is designed to prepare crew members for combat. It emphasizes Patriot missile system procedures that develop and maintain crew proficiency at a high level. A number of training techniques and methods have been developed to support these training requirements. These techniques and methods are summarized in this chapter and, if properly used, can add realism and form a viable training program.

RESPONSIBILITY

The battalion commander has overall responsibility and authority for training his firing batteries. Through his officers, warrant officers, and NCOs, the commander strives to achieve the Army's overall training goal — to develop a combat ready force that is physically and psychologically prepared to fight and win a global war.

ASSESSMENT

Battalion commanders base their assessment of the unit and individual training proficiency on —

- Their Performance on tactical and simulator equipment.
- The Results of tests and exercises.
- His Personal observation.
- Sampling techniques.
- Subordinate input and estimates.

Training assessment is essential to the success of the training program for Patriot crew members. The assessment identifies crew and/or crew member weak points and identifies further training requirements.

EACH INDIVIDUAL'S CURRENT PROFICIENCY

To determine individual proficiency, the battalion commander analyzes —

- SQT scores which serve as the prinicipal means for measuring individual proficiency.

CONTENTS

- The amount of cross-training received on other crew, operator and mechanic positions and proficiency level.
- Crew member and operator-mechanic demonstrated skill level, including any crew and operator-mechanic position training as recorded in the job book for each soldier.
- Crew member and operator-mechanic contributions and performance in crew or unit exercises. These include, but are not limited to, equipment maintenance inspections, field exercises, ARTEPs, and crew drills.

CREW OR UNIT PROFICIENCY

An estimate of crew or unit proficiency may be based on results obtained from —

- ARTEP training; ARTEP training is the principal means of evaluating unit proficiency.
- Other exercises; such as, equipment maintenance inspections, field exercises, and battle drills.
- SQTs; scores may be used to identify deficiencies in specific areas of individual performance.
- Troop proficiency trainer scores.

TRAINING STANDARDS

Compare the proficiency level of crew members with soldier's manual standards. This identifies the need for additional training.

TIME AVAILABLE FOR TRAINING PROFICIENCY

Compare time spent for training with time devoted to unit mission requirements and other obligations.

RESOURCES AVAILABLE

Differences between required and available resources should be reconciled. They affect both the time required for training and the unit's ability to meet required performance standards. Resources to be considered for training are —

- Unit equipment and its readiness.
- Other available resources, such as training devices.
- Any assistance (material and/or person nel) furnished by supporting units and higher headquarters.

PLANNING

Planning is the transition from unit training management to the conducting of the training. To conduct effective performance-oriented training, activities must be planned in accordance with guidance from higher commanders. Plans begin with training objectives which are derived from the unit's mission. These objectives normally are taken from the soldier's manual or the unit's ARTEP. The ARTEP states the task to be done, under what conditions it is to be performed, and the standards, which state how well the task is to be completed. An example of an ARTEP training objective is shown at right.

PROGRAMS

The Patriot training program must consider the primary objective for training — to prepare crew members for combat. Units must train as they expect to fight. Therefore, training conditions must be as close to a realistic combat environment as resources, time, soldier experience and other factors permit. Techniques to simulate a battle situation, such as performing battle drills under blackout conditions, simulating an air-land battlefield (to include nuclear, chemical, electronic warfare, noise, and smoke), and using live-fire exercises, are encouraged. NBC protective measures, including attaching the ICC and ECS environment control unit, donning protective clothing, and practicing individual chemical and biological decontamination actions, should be emphasized.

The training program must also consider Army common military training subjects.

These subjects augment broad mission training and provide a specific individual or collective skill or knowledge. Common military training subjects to be considered are provided in the illustration on page 7-4.

AN ARTEP TRAINING OBJECTIVE

MISSION: Support Combat Operations

ECHELON	TRAINING AND EVALUATION OUTLINE	MISSION
Battalion Headquarters Command Section Patriot Battalion	(TRADOC Reg 310-2)	Support Combat Operations

TASK	CONDITIONS	TRAINING/EVALUATION STANDARDS	REFERENCES	SM TASK NUMBER
Plan, coordinate, and conduct displacements at night or during daylight.	The tactical situation requires the battalion to move in order to continue to provide fire support. General position locations and a specified time by which the unit must be in position ready to fire have been disseminated.	Establish and disseminate the movement control measures necessary for the method of displacement used. Brief key personnel on tactical situation. Unit is in place and ready to operate at the specified time. Insure movement time (SP, HP) are met if specified by higher headquarters. Select and coordinate routes which facilitate movement and maximize defensibility of convoy. Identify battery position areas which provide maximum defensibility while allowing adequate fire support. Identify a battalion CP which optimizes communications capabilities. Coordinate the use of selected positions with the appropriate headquarters. Notify ICC of new position locations to facilitate necessary support activities, if ICC is not collocated with the CP. Reconnoiter (air, ground, map) new positions and routes as time permits. Maintain light and noise discipline. Prepare and disseminate contingency plans appropriate to the tactical situation. Assemble RSOP personnel.	FM 24-1 FM 24-20 FM 25-3 FM 44-1 FM 44-8 FM 44-15 FM 44-18 FM 44-18-1 FM 44-30 FM 55-30	

COMMON MILITARY TRAINING SUBJECTS		
SUBJECT	**AR REFERENCE**	**REMARKS**
Weapons Qualifications	350-4	This training applies to the majority of soldiers. It is conducted on a continuing basis and includes a periodic evaluation for proficiency.
Physical Fitness	600-9	
Benefits of an Honorable Discharge	350-21	This training is classified as refresher training. The type of training will depend on the local situation and the commander's assessment of need. Refresher training reinforces or reviews important skills or knowledge previously taught. It can also be used to develop unit cohesion, discipline, and morale. The frequency of this training is left to the commander's discretion.
Code of Conduct	350-30	
Military Justice	350-212	
Geneva-Hague Conventions	350-216	
Equal Opportunity	600-21	
Alcohol and Drug Abuse	600-85	This training is conducted with other training, to include tasks listed in ARTEP and soldier's manuals. Training effectiveness is measured by how well soldiers perform in SQTs, field training exercises and ARTEPs. These subjects do not usually appear on the training schedule separately unless designated by the commanding officer.
First Aid	40-3	
Heat, Cold, and Hearing Injury Prevention	40-5	
NBC Defense	220-58	
Opposing Force (OPFOR)	350-2	
Survival, Evasion, Resistance	350-30	
Prevention of Motor Vehicle Accidents	385-55	
Operations Security	530-1	

Components of a Patriot training program are individual training, unit training, and training support. These components collectively train crew members in soldier's manual and ARTEP skills, and provide a means to evaluate individual and unit proficiency.

INDIVIDUAL TRAINING

Individual training is an integral part of the battalion's training program. Patriot personnel are taught individual skills not provided during basic or advanced individual training, as well as refresher training to sharpen skills previously learned.

Training managers and trainers are provided guidance in meeting their training responsibilities for soldiers in particular MOSs in the trainer's guide. The TG is a field manual that indicates where the soldier's tasks were initially trained and where additional training is conducted.

NCOs are the principal trainers of individual soldiers. Each NCO must be capable of performing every task required of his immediate subordinates. NCOs must be particularly aware of the importance of job books, SQTs, and soldier's manuals.

Job Books

NCOs identify individual training needs by ensuring that the job books are kept current and complete. Entries are made as soon as the soldier has demonstrated his ability to perform the tasks of his duty position.

Skill Qualification Tests

Results of these annual SQTs provide the basis for remedial training. However, training should not be structured solely to prepare soldiers to pass the SQT. Training must be a continuous, year-round process.

Soldier's Manuals

Soldier common tasks are provided in soldier training publications, for skill levels 1, 2, 3, and 4. Other SMs are developed for critical tasks within specific MOSs. All tasks tested in the SQT are based on both common task and MOS soldier's manuals.

Eventually, Patriot personnel should be able to —

- Proficiently perform the soldier's manual tasks to prescribed standards.
- Cross-train, as much as possible, to effectively perform the duties of other crew positions.
- Develop professionally, consistent with individual duty and unit mission requirements, through available educational and self-study programs such as the Training Extension Course system or through the Army Correspondence Course Program.
- Merge with others into a cohesive combat crew capable of rapid and correct responses to mission requirements.

UNIT TRAINING

Patriot battalion training for field units is primarily centered on ARTEP 44-635. This document establishes training objectives critical to unit survival and performance in combat. It is a training tool used for diagnosing unit strengths and weaknesses. As such, it indicates unit requirements for further training.

Since the battalion ARTEP is divided into section, platoon, battery, and battalion elements, individual portions of the ARTEP may be performed separately. Each level of command trains its units to mission proficiency. The ARTEP is a continuous train, evaluate, train, diagnostic process that allows platoon leaders, battery commanders, and battalion commanders to evaluate their unit's capabilities against certain tasks, conditions, and standards. It determines where the unit is and where they should be. Differences are then translated into training requirements.

Section Training

During section training, each section chief familiarizes himself and his people with all of the MTOE in his section. Using the Patriot ARTEP, TMs, and soldier's manuals provided to the battalion, he familiarizes himself with the missions and tasks which his section must perform. The section chief selects the tasks or mission to be trained and assigns personnel to do them. He monitors their performance

against the standards provided in the ARTEP, soldier's manuals, drill books and TMs. After a particular task or mission is successfully performed, the section chief elects either to repeat the task with personnel of the same MOS performing at different positions or selects another task or mission. His overall goal is to train people of the same MOS to be interchangeable and able to perform all of the tasks and missions required of the section. The following are some of the section-level activities or training that are emphasized:

- Drivers training.
- Conduct of daily checks.
- March order and emplacement of equipment.
- Training in equipment operation.
- Air battle training.
- For support personnel, training in those tasks taught through extension training material courses.

Platoon Training

The platoon leader and platoon sergeant supervise and coordinate platoon training. Examples of training at this level include perimeter defense and, for designated platoon RSOP teams, RSOP considerations.

Battery Training

During battery training, the battery trains as a cohesive unit, emphasizing shared survial tasks. RSOP, reaction force (perimeter defense), and NBC teams are created from personnel within the battery and trained to accomplish their specific tasks. The battery fights as a unit, and trains to perform its mission in a tactical environment. Battery level training may include —

- Battle drill training.
- Battery RSOP training.
- Convoy procedures.
- NBC team training.
- NBC individual training.
- Reaction force training.
- Battery command post training.
- Night deployment.
- Small unit self-defense against air attack.
- Practice of firing phase.

Battalion Training

Patriot battalion training integrates the fire units with HHB and practices information transfer, support operations, and air defense missions (air battles). A battalion FTX determines the unit's combat readiness by evaluating its ability to survive and perform its air defense mission.

BATTALION TRAINING MANAGEMENT SYSTEM

The Battalion Training Management System is an Armywide program designed to improve training within battalions. The BTMS consists of a series of workshops that teaches management techniques to all battalion personnel involved in directing the training effort — from the training manager (battalion commander) down to the individual soldier trainer (NCO). BTMS workshops are scheduled on a regular basis and develop an instructor cadre of BTMS-trained "experts." These personnel, in turn, train other trainers to plan, conduct, and evaluate training.

The BTMS training managers and trainers apply the performance-oriented training concept. Under this concept, training revolves around precise training objectives. Training objectives are developed for individual, crew, or unit tasks. These objectives are furnished in soldier's manuals and in ARTEP 44-635.

By scheduling, planning, and narrowing training efforts to clear-cut, definitive objectives, better and more efficient use is made of limited resources.

SUPPORT

Training support includes developing and providing manuals, audiovisual aids, devices,

ranges, facilities, ammunition, and other resources necessary for good training.

Training literature includes technical and field manuals that provide guidance on tactical, doctrinal, and maintenance procedures. Of special interest to Patriot battalion and battery commanders is FM 44-15, which provides information on the air threat, defense design, structure, and mission of RSOP teams, command and control, combat service support, and other doctrinal and tactical matters.

FM 44-1A(S) is the source document for classified information on Patriot. It benefits the battalion and battery commanders in planning their Patriot defenses based on maximum effective range for the missile and other system capabilities. For personnel assigned to the ECS and ICC, FM 44-1A(S) provides detailed guiddance on engaging aircraft and tactical application of MS1 and MS3 controls and displays.

Technical manuals describe operating procedures and maintenance actions for major end items and associated equipment for the Patriot system. These manuals are listed under References. Other Army field and technical manuals are indexed in DA Pamphlet 310-1.

Training devices are excellent instructor aids and help to make training more realistic and interesting for students. Patriot-peculiar training devices include mock-ups, computer tape programs, and simulators. Those intended for field use are described in chapter 8. Training and audiovisual support centers are also good sources for trainers. They provide audiovisual products and make training devices. They also acquire, loan, issue, and control instructional aids.

A limited number of ranges are available for Patriot training. Careful planning and coordination must be exercised to ensure that maximum benefit is derived from range exercises.

Training Materials

CHAPTER 8

This chapter provides a brief description of the training materials associated with the Patriot system. The training materials described include printed text lessons, films, television tapes, and training devices. Most of the training materials are under development or are projected to be completed later.

TRAINING EXTENSION COURSE

The TEC program is designed to assist individual soldiers to increase job proficiency. The program consists of audiovisual lessons, using audiovisual projectors and cassette tape players; audio-only lessons; and printed text lessons. These TEC lessons provide performance-oriented training on common Army skills, as well as those operations and maintenance skills necessary for the Patriot system. The use of TEC lessons provides flexibility in the training program. It allows the command to concentrate on those skills required by the individual soldiers. TEC lessons can be presented —

- In unit learning centers, classrooms, or in the field.
- To individuals or small groups.
- As self-paced instruction.
- To correct a specific shortcoming.

AUDIOVISUAL

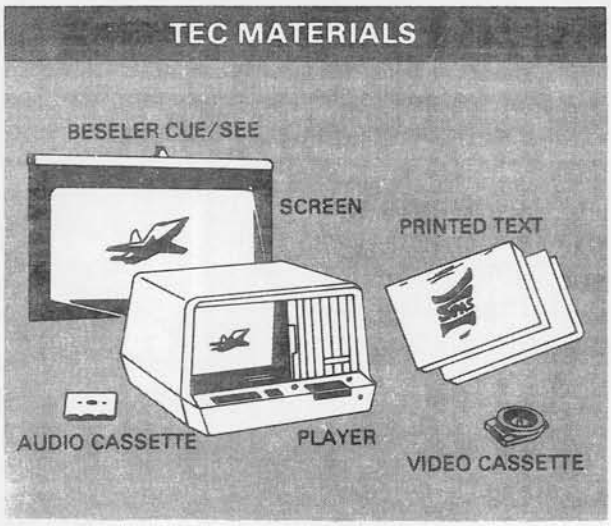
Audiovisual products, such as motion picture films and television tapes, add variety to a Patriot training program. Films and television tapes teach and reinforce key procedures and concepts. Generally speaking, soldiers find the films and television tapes very appealing. Trainers should capitalize on this receptiveness and include training films and television tapes whenever possible in their training programs.

DoD 5040.2-C-1 is an index of Army motion pictures and related audiovisual products. Consult the index for available training films and other audiovisual materials. Films, television tapes, and projection equipment can be obtained from training and audiovisual support centers.

Patriot motion pictures include the following:

- TF 44-6332. Introduction to Patriot System (color-20 min).
- TF 44-6333. Introduction to Patriot Air Defense Phased-Array Radar (color-20 min).

CONTENTS



CORRESPONDENCE COURSES

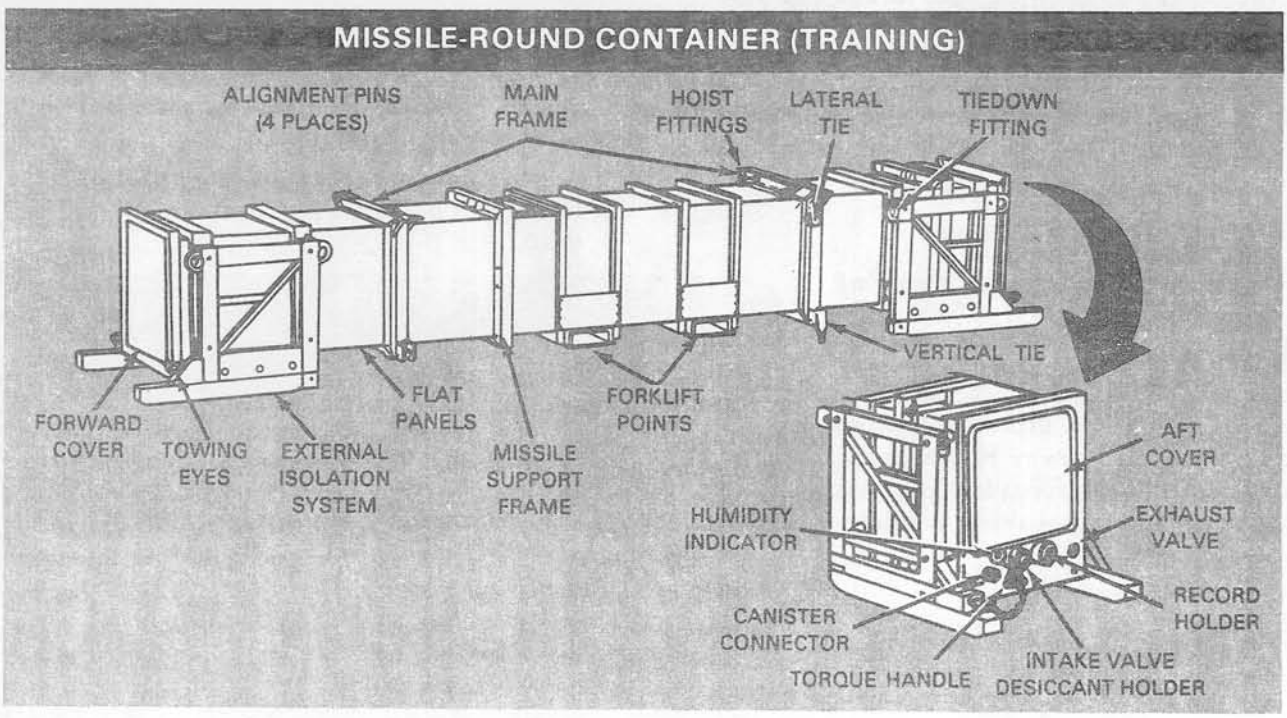
The Army Correspondence Course Program consists of courses of instruction developed by US Army service schools but centrally administered by the Army Institute for Professional Development. They are available to individual soldiers for self-study and allow them to study at their leisure, and choose their study environment. Like TEC lessons, ACCP's are designed to improve the individual's MOS and job proficiency. Promotion points are awarded for couse completion. These points increase promotion potential for soldiers. Army correspondence courses are listed in DA Pam 351-20.

TRAINING DEVICES

Presently, four Patriot-peculiar training devices are projected for Patriot units in the field. Other training devices for the Patriot system include mock-ups and simulator/trainers, but they are available only at the air defense and missile munitions service schools.

MISSILE-ROUND TRAINER

The MRT is a training device that duplicates the external physical features and handling characteristics of the Patriot guided missile canister. The canister ballast is permanently secured inside to simulate a missile-round's weight and center of gravity. It is capable of producing all electrical responses (less launch) and has the mechanical connections of a tactical guided missile. The MRT enables Patriot crew members to transport, handle, load, and reload a Patriot guided missile without the hazards of handling live explosives.



TROOP PROFICIENCY TRAINER

The TPT is a software program used to train new ICC and ECS operators on the MS1 and MS3 consoles. The TPT is also used to evaluate or maintain the proficiency level of current operators.

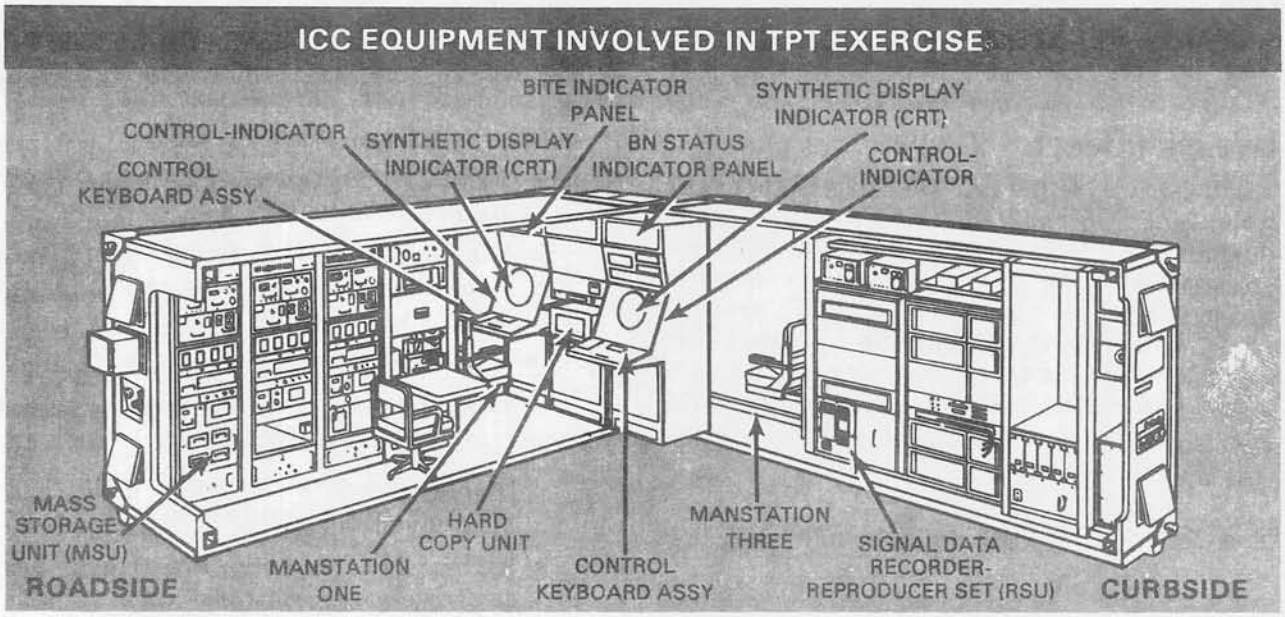
The TPT uses tactical equipment within the ICC and ECS (see illustration). It consists of two tape cartridges that are loaded into the mass storage unit or the signal data recorder-reproducer set of the ECS or ICC. One cartridge serves as a control program while the other provides the scenarios (tactical setting, conditions, and aircraft) for the exercise. During a TPT exercise, the ICC or ECS enters a training mode. As such, tactical communications data transfer and tactical operations are inhibited (non-netted mode).

The TPT uses the computers within the ICC and ECS to present a simulated air defense battle environment for the operator. During an exercise, operators perform actions and tactics as they would during an actual air defense mission. The TPT can be run as a battalion exercise (netted mode) which includes the ICC and ECS, or it can be run by isolating the ICC or ECS (stand-alone mode).

At the ICC, the TPT allows the operator to practice command and coordination of his fire units and communications with adjacent battalions and with brigade. Operators must allocate resources to defend assets under attack by hostile aircraft. To add to the realism, attacking aircraft perform defense suppression and confusion tactics.

At the ECS, the TPT requires the operator to engage aircraft and to defend assigned defended areas and/or vital assets. Included in the simulated environment are friendly and hostile aircraft; electronic countermeasures by hostile aircraft; loss of target tracks because of terrain masking and/or evasive maneuvers; and the destruction of hostile aircraft, defended areas, and/or vital assets.

Scenarios designed to fit some of the battalion's or firing battery's actual positions are available. Because the scenarios are based on the geographic environment peculiar to the area, a realistic battle is shown to the operator. When comparing the operators' performances from different ECSs and ICCs, tactical training officers may choose to run scenarios from areas with which the operators are not familiar. In this case, one operator will not have an advantage over another because he is more familiar with the terrain than another operator.

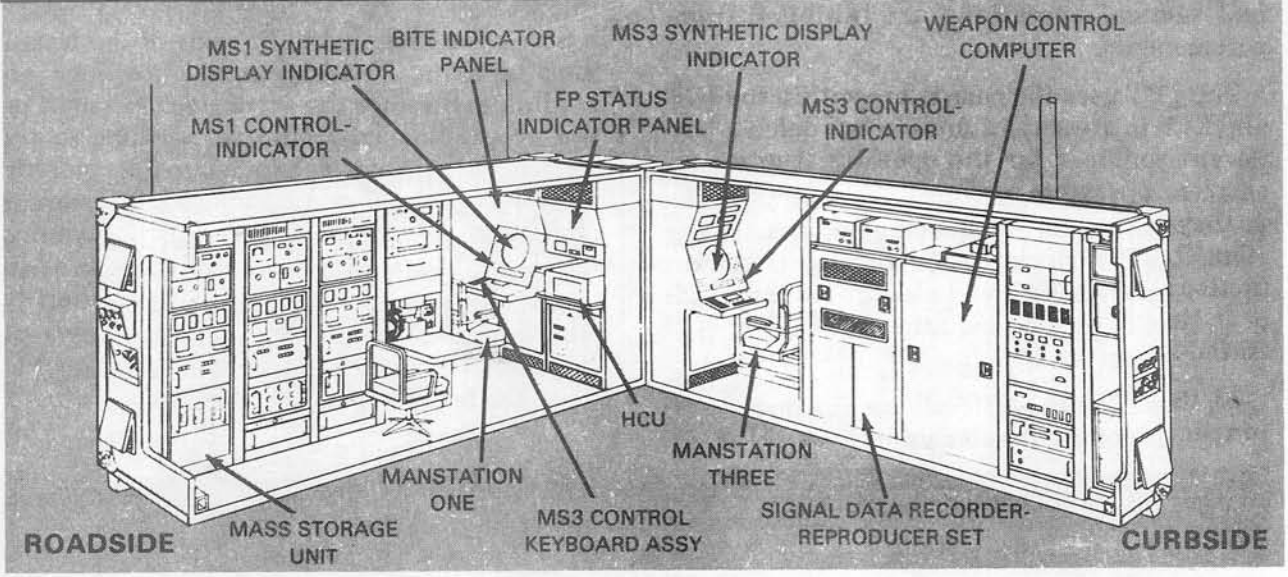


The TPT has the capability of simulating engagements in both automatic and semiautomatic modes. The automatic mode is duplicated in the TPT benchmark exercise mode. In this mode, no operator inputs are used to control the equipment operation. Once initiated in this mode, the program is allowed to run to completion. A final score is then displayed to indicate how well the equipment responded to the simulated air attack. The semiautomatic mode is duplicated by the TPT operator input exercise mode. Operators respond to simulated air attacks using actions and tactics in the same way they would during an actual air defense battle. Once the scenario has been completed, the TPT program computes and displays a final score.

At the completion of the TPT run, a hard copy printout of the exercise may be requested for further analysis. Additionally, the evaluator may replay the entire exercise, allowing him to review all actions taken by the operator during the exercise.

Step-by-step procedures for initiating and conducting a TPT exercise are provided in TM 9-6920-600-14.

ECS EQUIPMENT INVOLVED IN TPT EXERCISE



LIVE AIR TRAINER

The live air trainer is a special cassette available at the ECS and ICC. It is used as a training device to track live targets and simulate their engagement. The training exercise uses a live air trainer, a complete FB, an ICC, and the remaining FBs in the battalion to track and simulate the engagement of live tracks in a simulated battalion air defense battle. The ECS operator employs FB air defense TSOP during this training exercise.

The live air trainer performs the following:

- Replaces the FB operational K7 cassette.
- Displays "TRAINER" on lower right hand corner of CRT.
- Disables MISSILE INVENTORY tab, KILL and NO KILL S/Is, and communications with LSs.
- Inhibits display of PIPs.
- Destroys all targets in formation with a single engagement.
- Displays a confirmed kill, fault alerts and indications, and hot missile count.
- Allows ICC to correlate tracks and receive or send confirmed kills.

PATRIOT CONDUCT OF FIRE TRAINER

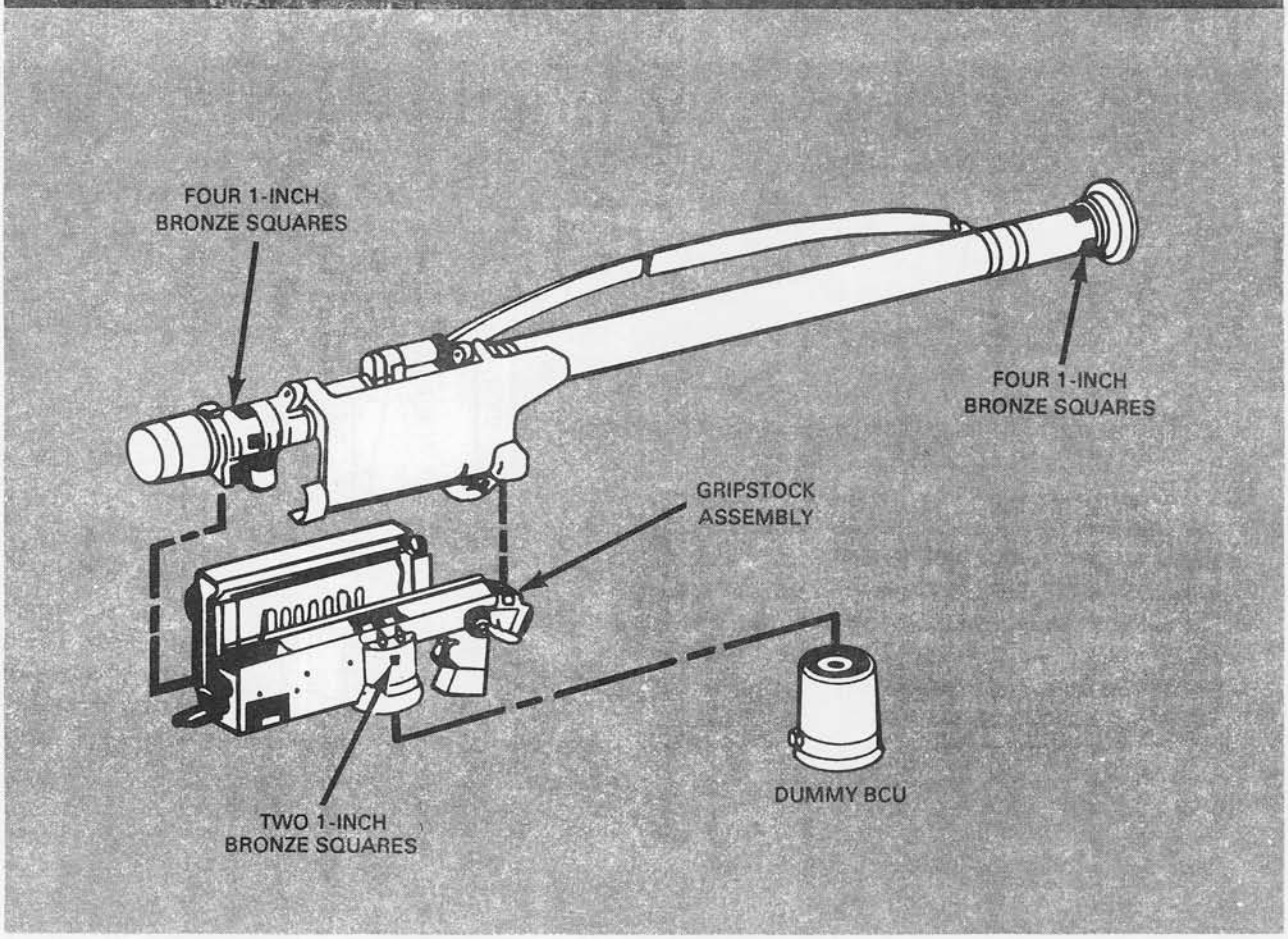
The PCOFT is a computer driven group of student consoles that duplicates the ECS and ICC operator hardware. The PCOFT provides simulations of the Patriot system displays, controls, communications, and data processing systems. The eight student operator consoles are controlled and monitored by the instructor's control group console. The student consoles are designed to allow students to perform all actions related to initialization, automatic and semiautomatic operation, monitoring, the proper use and response to weapon displays, controls, communications, and data processing systems.

STINGER FIELD HANDLING TRAINER

The FHT is used to train Stinger gunners. It is a passive, dummy round that duplicates an actual weapon-round in size, weight, and external appearance. Controls and mechanical operation are the same as the weapon-round except that target acquisition indications are not provided.

Stinger gunners use the FHT to familiarize themselves on basic weapon handling and operation procedures without handling live explosives. Such mechanical actions as mating and removing the gripstock assembly and battery coolant unit can be practiced. FHTs are used to train Stinger gunners on tracking and ranging techniques when live aircraft or radio-controlled miniature aerial targets are available. These FHTs are available at launcher and fire control platoon headquarters.

(FHT) M60 TRAINER



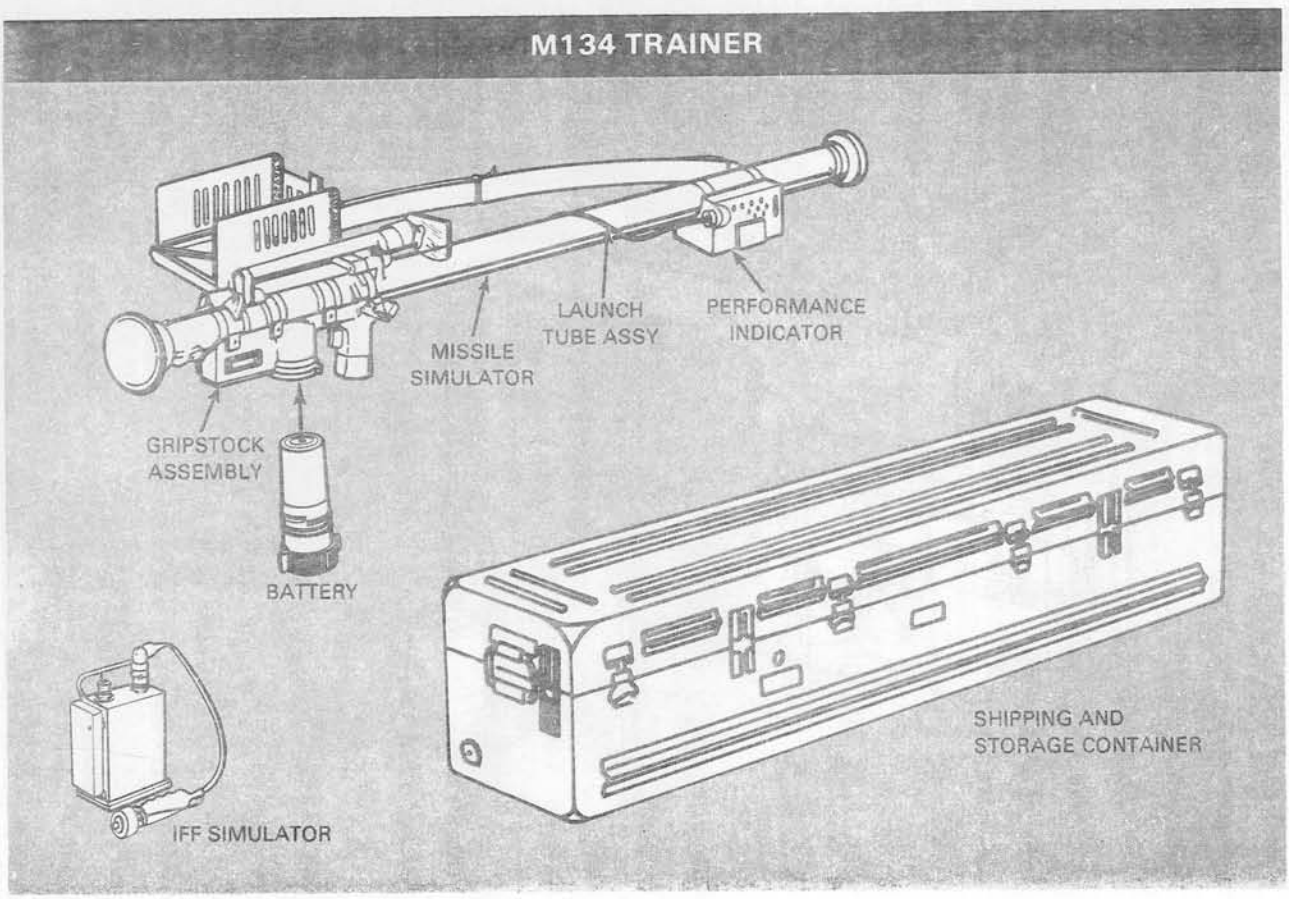
TRAINING SET

The M134 training set consists of a tracking head trainer, five rechargeable batteries, an IFF simulator with cable, and a shipping and storage container (see illustration). This training set is used by the gunner to develop and maintain proficiency in tracking live aircraft and firing procedures for the Stinger weapon. Unlike the FHT, the THT has electrical components that provide the same audiovisual indications as the weapon when acquiring and tracking a target.

The THT has the same general appearance as the weapon-round except that it has an additional performance indicator assembly. This assembly displays the gunner's progress in a simulated engagement. It provides indications that the gunner has —

- Correctly performed the engagement sequence.
- Committed a correctable error — a procedural error than can be corrected prior to squeezing the trigger.
- Committed an uncorrectable error — squeezing the firing trigger out of sequence.
- Allowed the 47-second timer to run down, which shuts down the trainer.

An M134 training set is available at battery headquarters. Additional information on the THT can be found in TM 9-6920-429-12.



Radar Coverage Diagrams

APPENDIX A

How effective you are in defending against air attack depends, naturally enough, on what your radars "see". Blind areas caused by terrain masking are undefended areas. Therefore, to establish an effective defense, it is first necessary to determine the impact of terrain on radar tracking and detection capabilities. This terrain analysis is done by preparing a radar coverage diagram.

This appendix provides detailed procedures for preparing radar coverage diagrams. It presents three methods of preparation (deliberate, hasty, and emergency) and describes the circumstances under which each may be used.

PURPOSE

Radar coverage diagrams are graphic representations of the target detecting and tracking capabilities of a radar positioned at a specific site. A radar coverage diagram shows the altitude and range at which targets become visible to a radar, considering terrain masking and earth curvature. Radar coverage diagrams are prepared for 360° around the radar so that primary and secondary sectors can be evaluated. An example of a radar coverage diagram is shown on the following page.

The radar is located at the center of the diagram. The concentric rings indicate range from the radar and the radial lines indicate azimuth. The outer plot (- -) shows the range at which a target flying 300 meters above the terrain will first unmask and become visible to the radar. The middle plot (— —) shows the range at which a target flying 150 meters above the terrain would unmask, and the inner plot (—) shows the range targets unmask which are flying 50 meters above the terrain.

CONTENTS

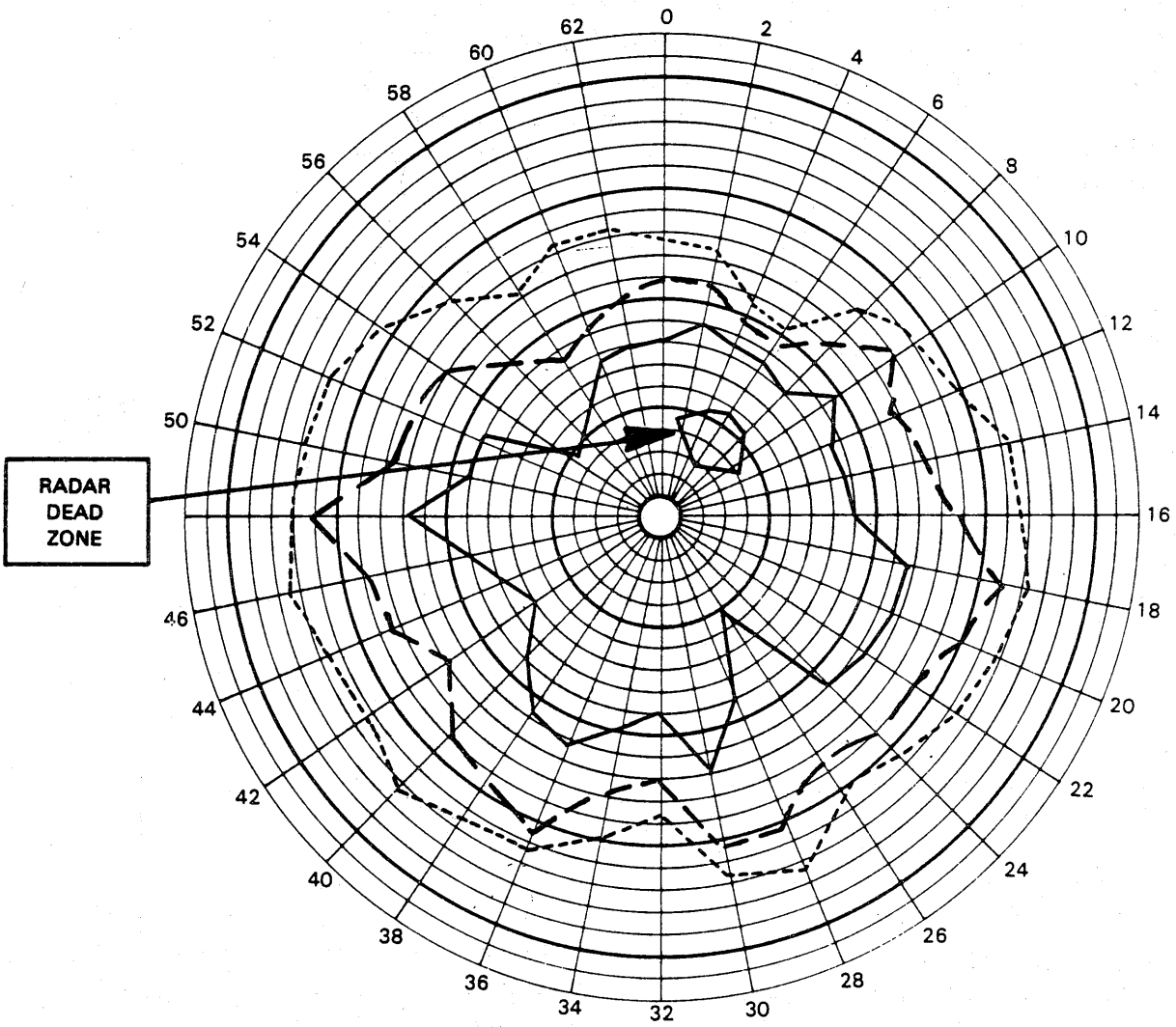
RADAR COVERAGE DIAGRAM

CLASSIFICATION

RADAR COVERAGE DIAGRAM WORKSHEET

Battalion _____ Battery _____ Date _____

Coordinates 020780 Site Altitude 275m Map Sheet _____



SCALE

Patriot — 5 kilometers = 1 ring

	ALTITUDE CODING	TARGET ALTITUDE	
———		50	Meters Above ~~MSL~~/Terrain
— —		150	Meters Above ~~MSL~~/Terrain
- - - -		300	Meters Above ~~MSL~~/Terrain

CLASSIFICATION

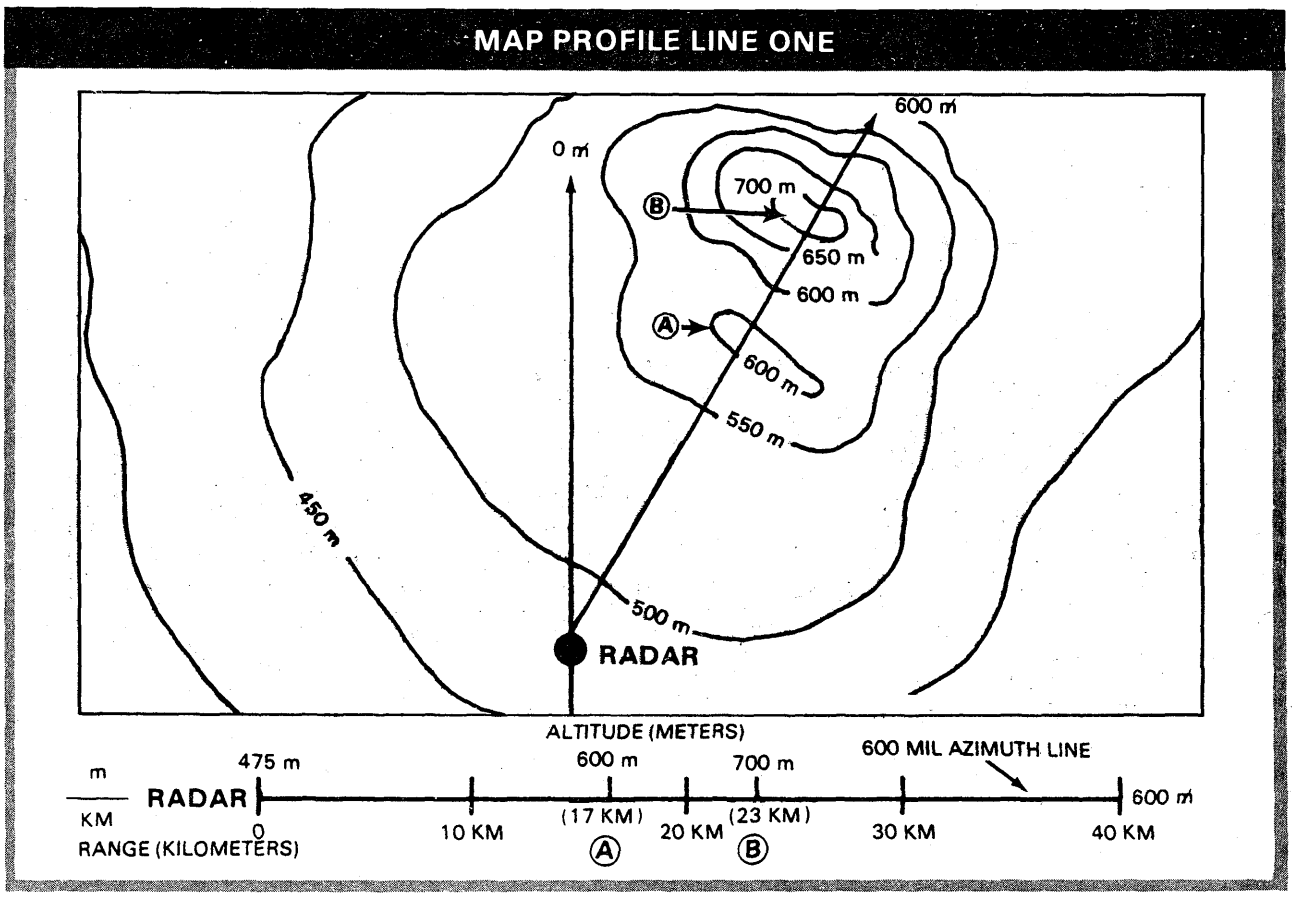
MATERIALS

To prepare a radar coverage diagram you need maps, map profile lines, worksheets, and nomograms. You will also need pencils, blank sheets of paper, a protractor, and a straightedge.

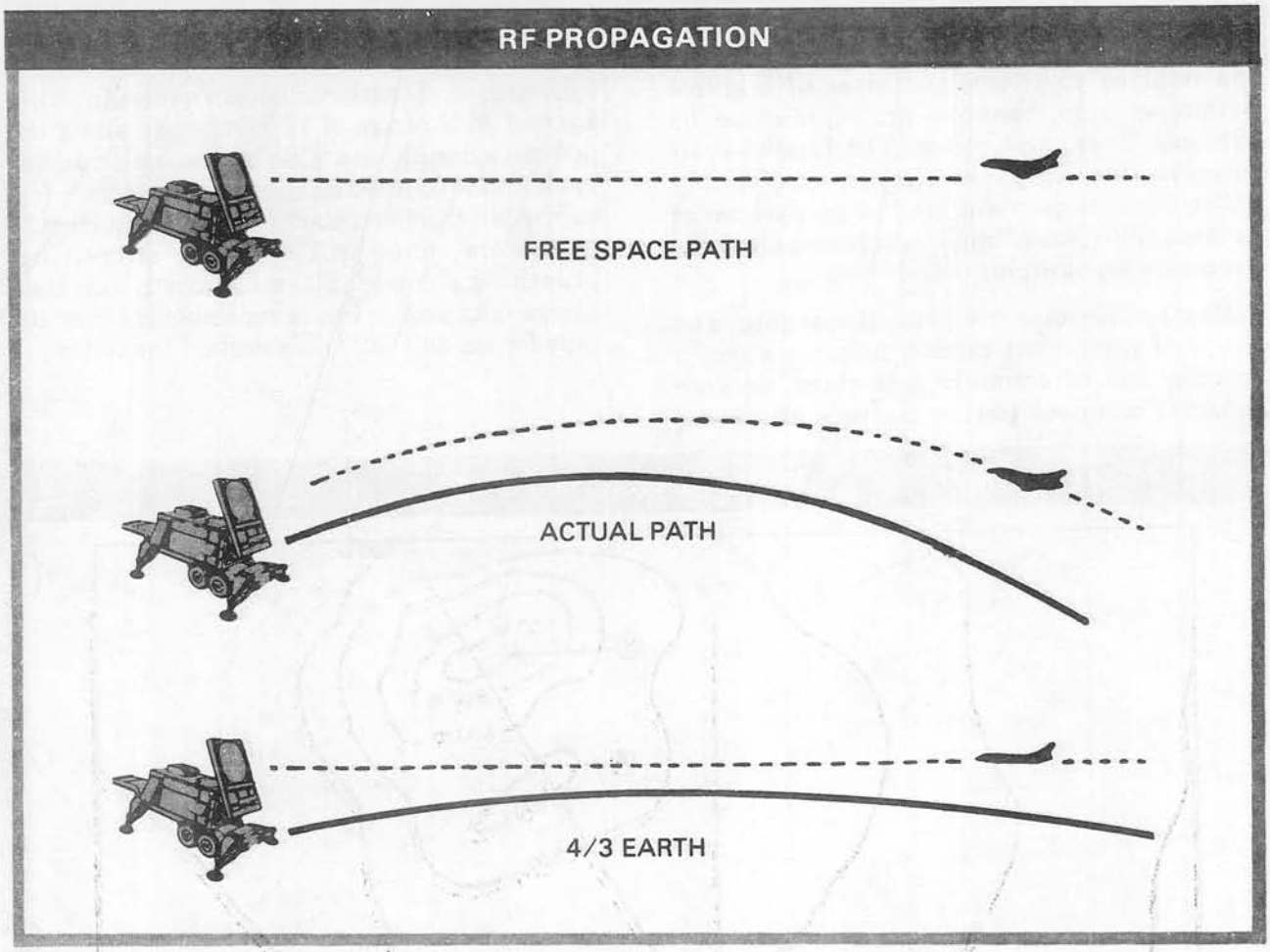
A *map* is a graphic representation of natural and manmade features on the earth's surface. It is usually drawn to a specific scale and shows the relative positions and sizes of features within an area. Features are represented by symbols, lines, and colors. The largest scale topographic maps available (preferably 1:250,000 or larger) are used to prepare radar coverage diagrams. Smaller scale maps lack the necessary topographic detail.

Map profile lines are plots of elevation and range of prominent terrain features along a specific line of azimuth that starts at your radar. (Prominent terrain features are mountains, hills, valleys, buildings, or any other physical object that can mask a target from the radar.) Elevation is determined by using the contour lines, and range is measured using the scale in the map margin.

The accompanying illustration shows a map profile line for an azimuth of 600 mils. The radar is sited at an elevation of 475 meters. A small hill, with an elevation of 600 meters (point A), is located at a range of 17 kilometers along the 600-mil azimuth line. This hill can mask an aircraft and is counted as a prominent terrain feature. Also, the 700 meter high hill (point B) at 23 kilometers range will mask an aircraft approaching along the 600-mil azimuth line. Usually, a map profile line is constructed every 200 mils for the full 6400 mils around the radar.



The *modified 4/3 earth curvature diagram worksheet* is a graphic representation of the curve of the earth's surface. It is modified to reflect the propagation characteristics of RF energy. In free space, RF energy travels in a straight line. In the earth's atmosphere, however, the energy is refracted slightly by air and travels in a slightly curved path. Due to this beam curvature, a radar detects targets as if they were flying above an earth having a radius one-third larger than it actually has. This is called "4/3 earth curvature."



When filled in, as illustrated, a 4/3 earth curvature diagram represents the profile of the earth's surface along a specific azimuth from the radar. Terrain features (heights and depressions) are plotted on the diagram in terms of range and altitude. Also plotted are:

① Radar location.

② Radar base line.

③ Radar line of sight.

④ Target course line.

⑤ Radar dead zones.

⑥ Target detection range.

⑦ Radar mask angle.

COMPLETED 4/3 EARTH CURVATURE DIAGRAM

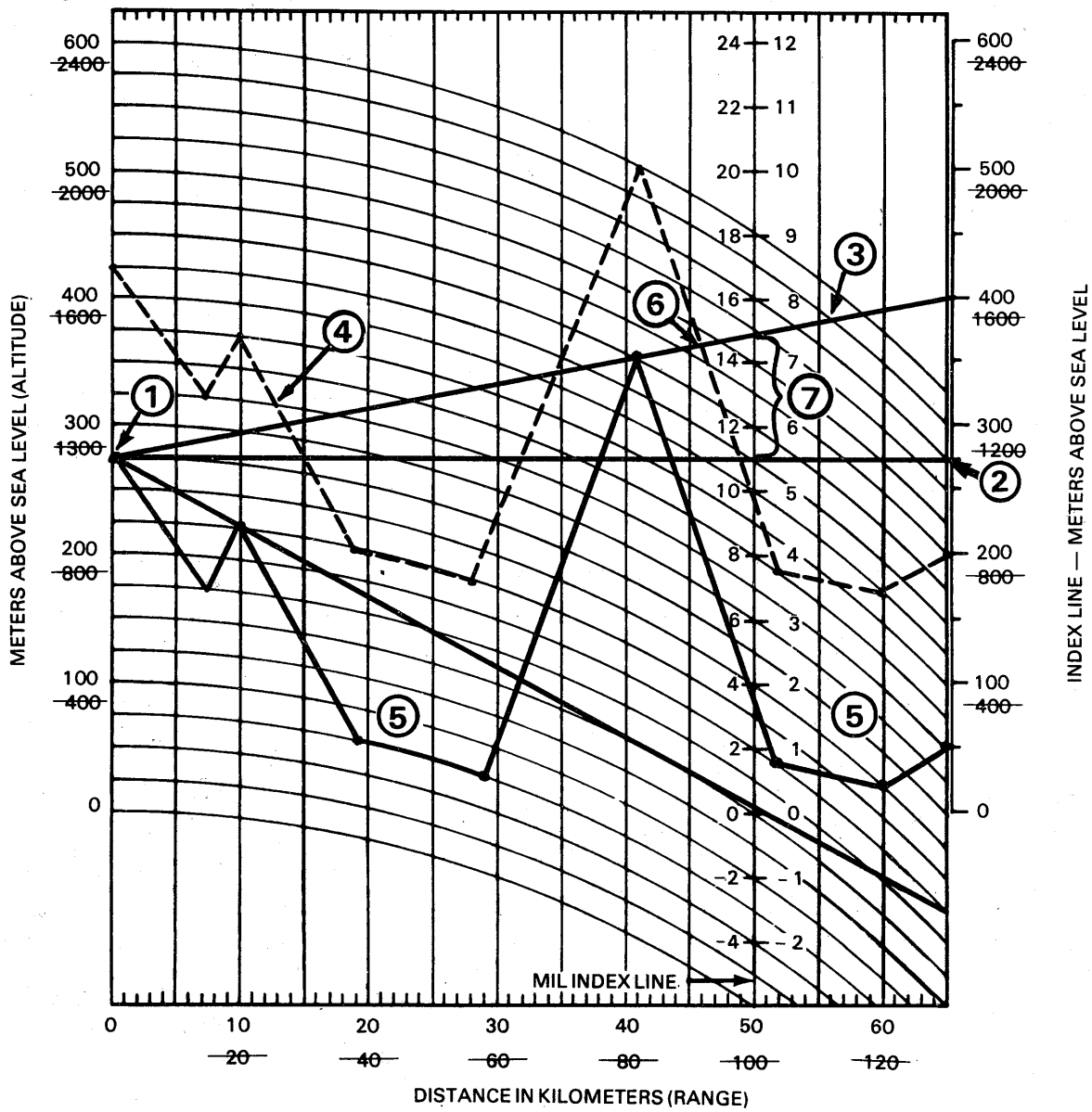
CLASSIFICATION

MODIFIED 4/3 EARTH CURVATURE DIAGRAM WORKSHEET

Unit _____ Date _____ Az 600 mils

Coordinates 020780 Map No. MI 12-T Scale 1:250,000

Target Altitude 150 m Above Terrain



CLASSIFICATION

These terms are explained on the following pages.

The *radar coverage diagram worksheet* is a polar coordinate chart. When filled in, this worksheet becomes the radar coverage diagram. The radial lines represent 6400 mils of azimuth in 200-mil increments. For Patriot use, the concentric circles show a 110-kilometer range in 5-kilometer increments.

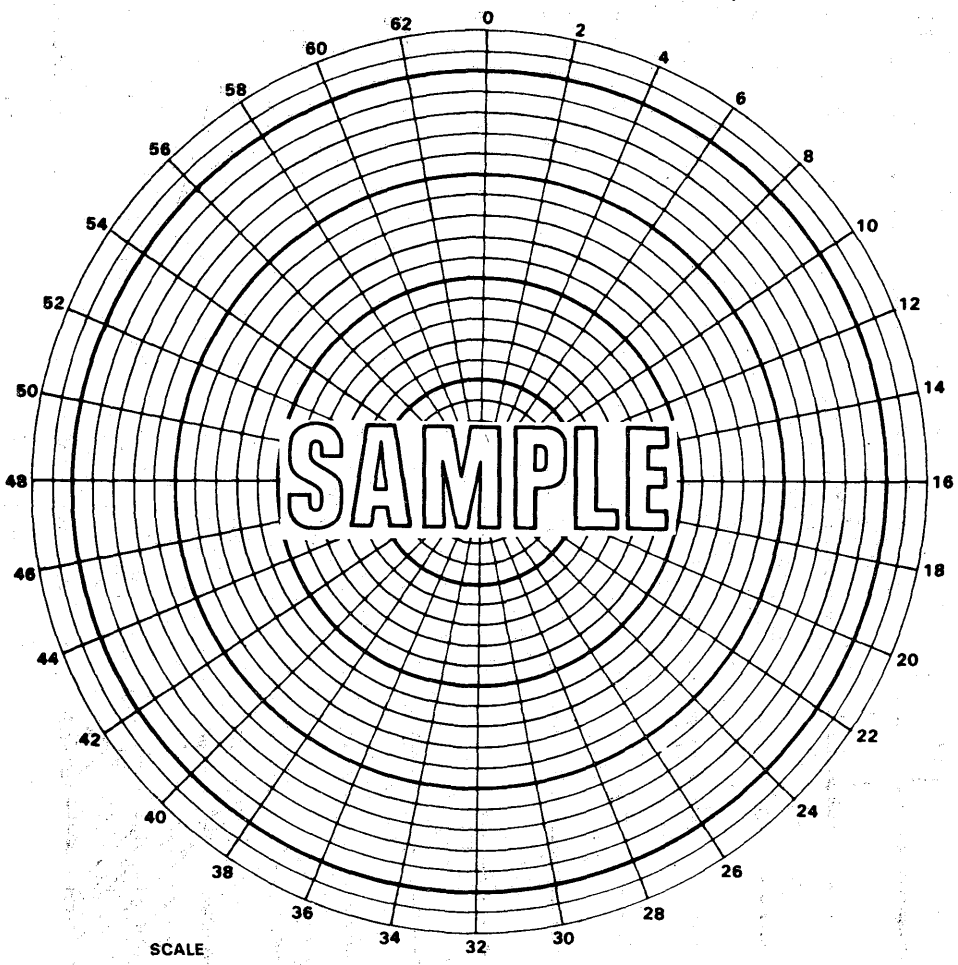
RADAR COVERAGE DIAGRAM WORKSHEET

CLASSIFICATION

RADAR COVERAGE DIAGRAM WORKSHEET

Battalion _____ Battery _____ Date _____

Coordinates _____ Site Altitude _____ Map Sheet _____



SCALE

Patriot — 5 kilometers = 1 [illegible]g

ALTITUDE CODING	TARGET ALTITUDE	
_____	_____	Meters Above MSL/Terrain
_____	_____	Meters Above MSL/Terrain
_____	_____	Meters Above MSL/Terrain

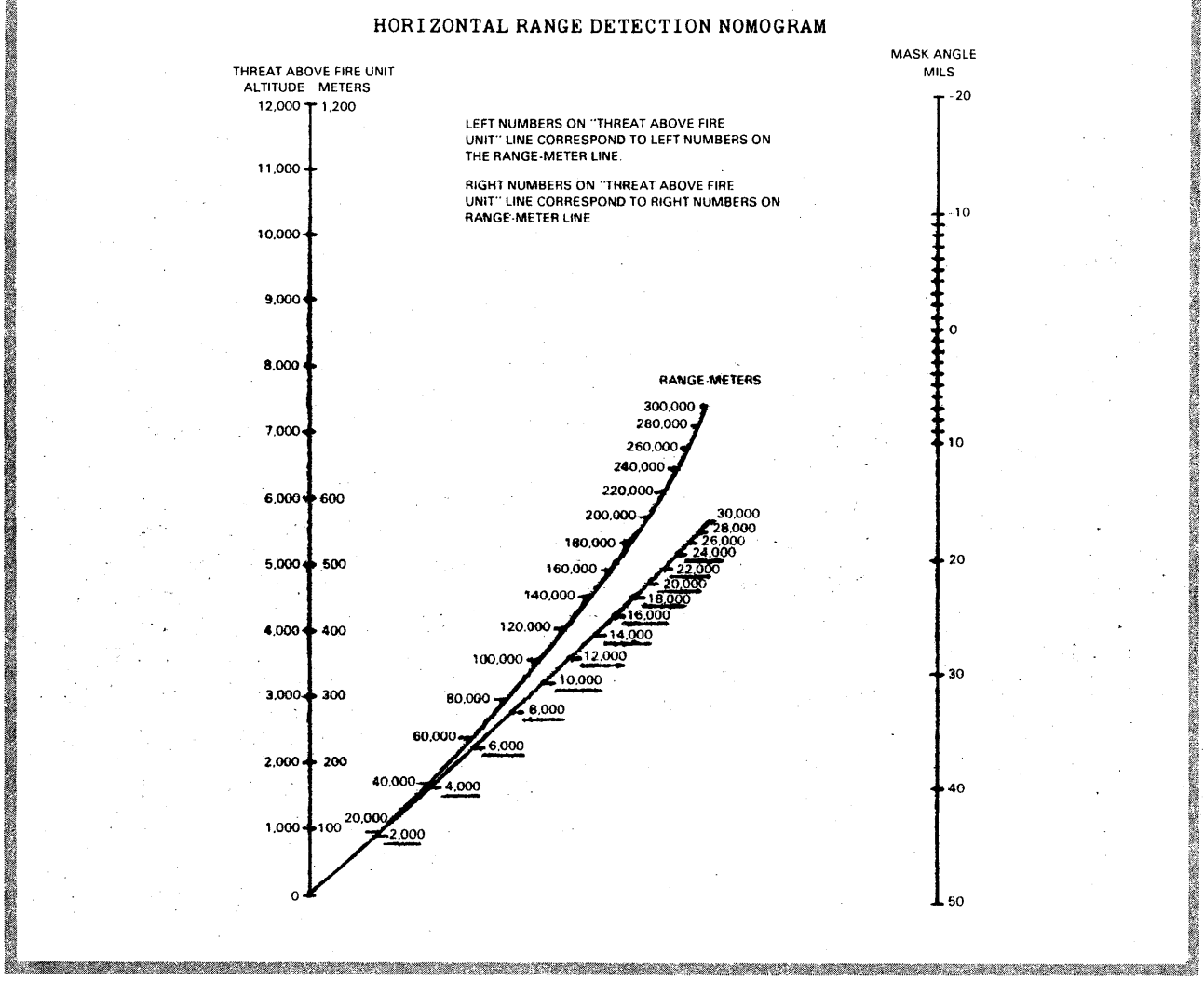
CLASSIFICATION

The *horizontal range detection nomogram* is used only with the hasty method of coverage diagram preparation. It approximates target detection range. Target threat altitude and radar mask angle must be known to use the nomogram. Target threat altitude is listed in your TSOP. It will usually be 50, 150, or 300 meters above terrain. Mask angle is found by using an aiming circle.

The left side of the nomogram shows target threat altitude. It has two scales: 0 to 12,000 meters in 1,000-meter increments, and 0 to 1,200 meters in 100-meter increments. The right side of the nomogram shows mask angle. It is scaled from +50 mils to -20 mils. The center lines on the nomogram show target detection range in meters and have two scales: 0 to 300,000 meters, and 0 to 30,000 meters.

To use the nomogram, lay a straightedge from the target threat altitude on the left to the mask angle on the right. Read the detection range from the center range line. (If using the 0 to 12,000-meter threat altitude scale, read range from the 0 to 300,000-meter range line. If using the 0 to 1,200-meter altitude scale, read range from the 0 to 30,000-meter range line.) An example of how to use the nomogram is illustrated later in this appendix.

HORIZONTAL RANGE DETECTION NOMOGRAM



PREPARING DIAGRAMS

The three methods of preparing radar coverage diagrams are the deliberate method, hasty method, and emergency method. These methods differ in the accuracy of the final product and time used in preparation.

Listed below are step-by-step procedures showing how to prepare radar coverage diagrams using each method.

DELIBERATE METHOD

The deliberate method is used to evaluate a potential position prior to occupying that position. It is as accurate as the maps of the area allow. It cannot account for close-in masking caused by trees, buildings, or other features not included on the map. The deliberate method is used primarily by the S3 section in planning defenses.

Step 1

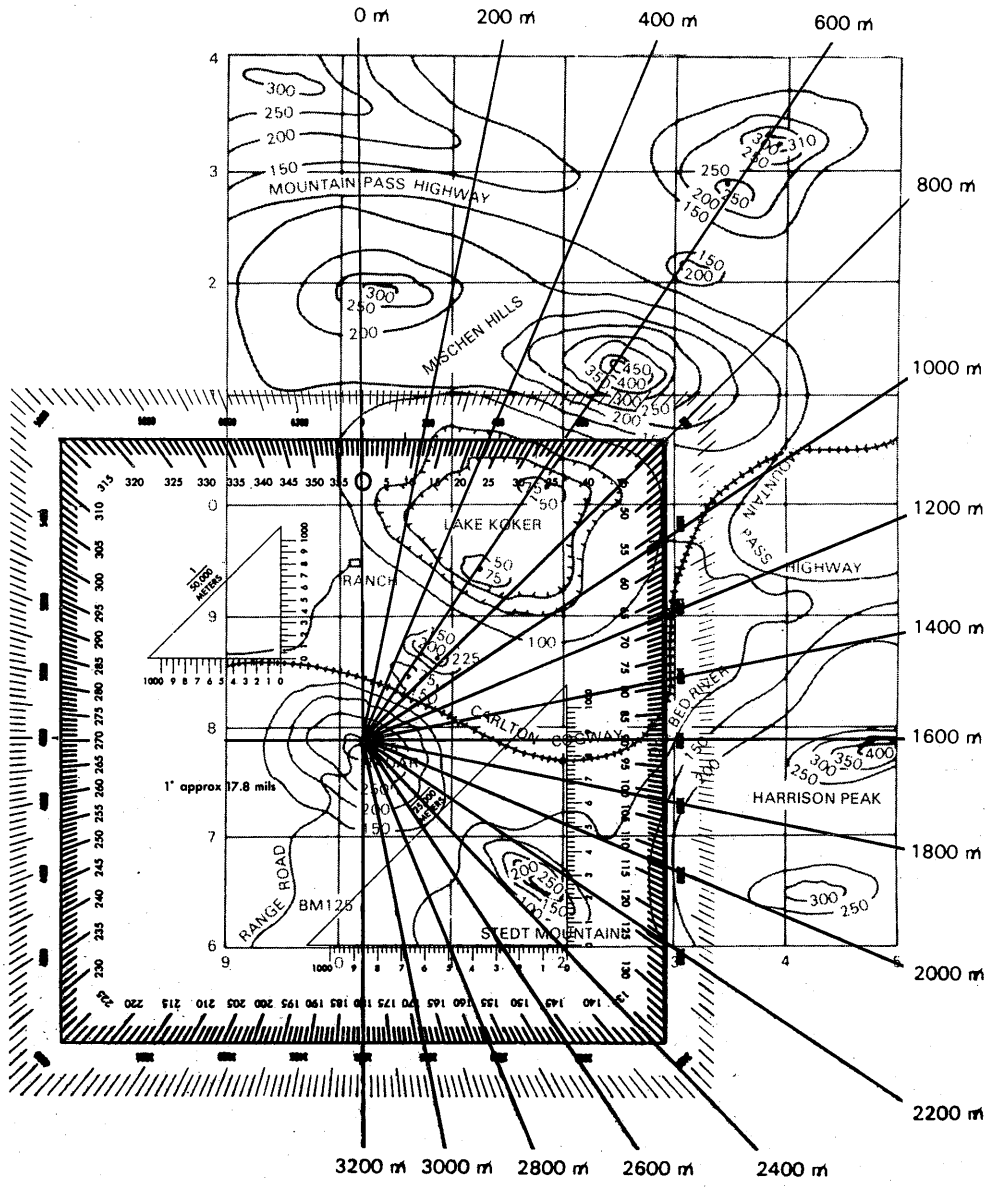
Assemble the necessary materials:

- Map of the area (scale of 1:250,000 or larger).
- Modified 4/3 earth curvatrure diagrams (one for each azimuth line to be plotted, usually 32).
- Radar coverage diagram worksheet.
- Pencils, paper, straightedge, and protractor (graduated in mils).

Step 2

Prepare the map as illustrated. Reading "right and up" plot the radar's site on the map. For this example, the coordinates of the proposed site are 020780. Using a protractor, orient on north (grid or true, as specified in your TSOP) and place a pencil dot every 200 mils around the radar. Next, use a straightedge to draw radial lines from the radar through each dot. Label each radial line with its azimuth in mils (for example, north is 0 mils, the next line clockwise is 200 mils, and so forth.

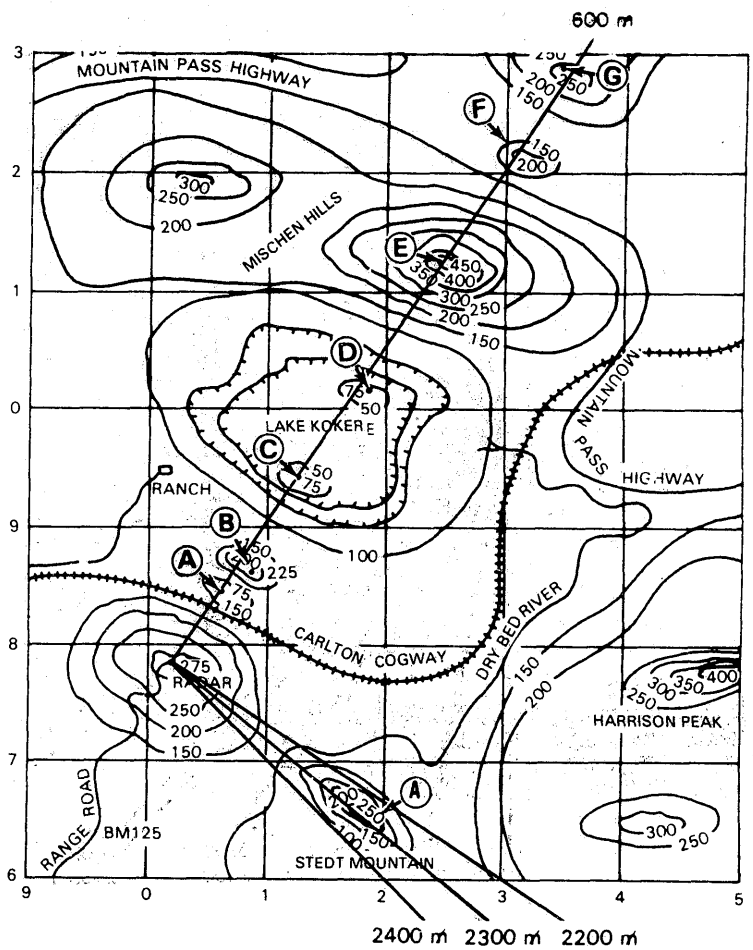
MAP OF THE AREA



Step 3

Identify the prominent terrain features. Look for high and low points along each radial line. Draw a circle around each prominent terrain feature you identify, and label them with a letter (A, B, C, et cetera) beginning with the circle nearest to the radar. If a prominent terrain feature is missed by a normal radial line, draw an additional radial line to intersect that feature. (An additional radial line had to be drawn at 2300 mils to include Stedt mountain in the following illustration.)

PROMINENT TERRAIN FEATURES



Step 4

Prepare a map profile line for each radial line drawn on the map. Use a blank sheet of paper for each radial line drawn on the map, a straightedge, and a pencil. Label each sheet of paper with the azimuth of the radial line it represents. (In this exercise, the 600-mil radial line is used.)

Label the map profile line with the data you are going to plot (range in kilometers below the line, altitude in meters above the line).

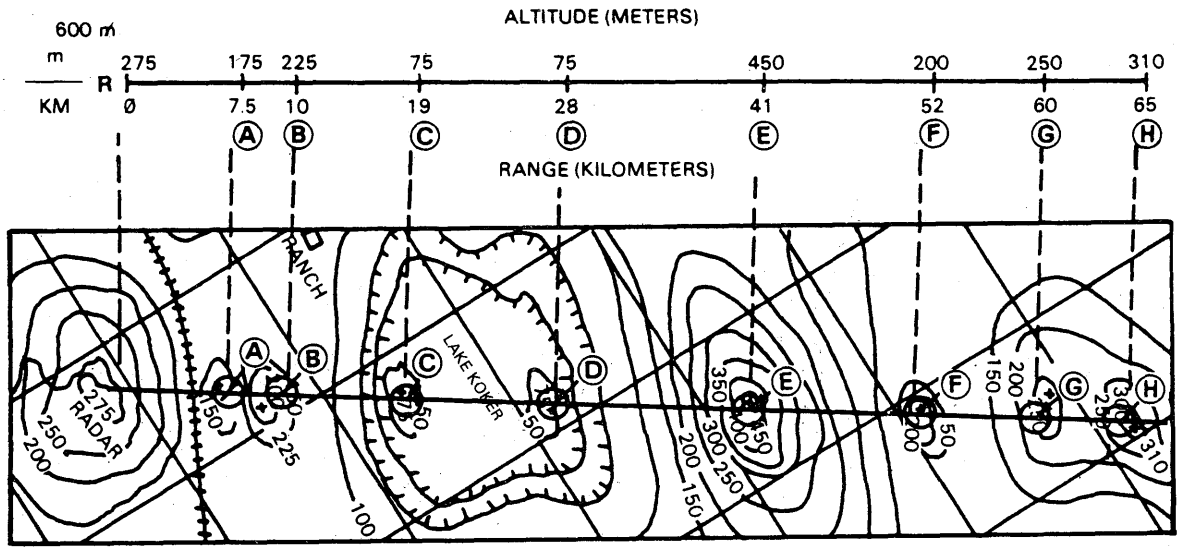
Determine the altitude of the radar from the map contour lines. Label the left end of the map profile line R for radar, and enter the radar altitude above the line.

Measure the range from the radar to the first prominent terrain feature circled on the 600-mil line, using the distance scale in the map margin. Make a tick mark on the map profile line and label it with the range and the letter of the terrain feature "A".

Determine the altitude of the same terrain feature (again using the map contour lines) and enter it above the first range tick mark.

Repeat these procedures for each prominent terrain feature circled on the radial line. When you finish, the map profile line should look like the illustration below.

MAP PROFILE LINE



Next, construct a map profile line for each radial line drawn on the map, using the same procedure. Keep each sheet for future use.

Step 5

Construct a 4/3 curvature diagram, as illustrated, for each map profile line prepared in step 4. Obtain a blank modified 4/3 earth curvature diagram worksheet for each of the map profile lines you prepared. Look at the form and notice that —

- Two sets of numbers are along the vertical line at the left side of the form. These numbers show the altitude of the radar above sea level in two scales: 0 to 600 meters and 0 to 2,400 meters.
- Two sets of numbers are along the horizontal line at the bottom of the form. These numbers show range in two scales: 0 to 60 kilometers and 0 to 120 kilometers. (Always use the smaller set of numbers on the range and altitude scales whenever possible, as this represents the primary area of interest. However, whichever set of numbers you use for one scale must be used for the other scale. In other words, if you use small numbers on one scale, you must use small numbers on the other scale.)
- At the 50/100 kilometer range mark is a vertical line labeled "Mil Index Line". It has two mil scales, -4 mils to 24 mils and -2 mils to 12 mils. This scale is used to determine mask angle. Use the same set of numbers (large or small) as previously selected for altitude and range.
- A vertical line is at the right side of the form labeled "Index Line-Meters Above Sea Level." The divisions of this index line have the same scale of those used for the "Meters Above Sea Level" line on the other side of the form. Depending on which altitude scale you select (small or large numbers), each index division, on the right-hand scale, shows either 50 or 200 meters above sea level.

Fill in the heading of each form with the required information. Next, assemble all the map profile line sheets you prepared earlier. Put them in numerical order, working clockwise from 0 mils azimuth (0 mils, 200 mils, 400 mils, et cetera).

Decide which set of scales (small or large numbers) to use on the 4/3 earth curvature diagram. If it is necessary to plot altitudes over 600 meters or ranges over 65 kilometers, use the large set of numbers. If not, use the small set of numbers. (In this example, the small set of numbers is used.) Mark through the numbers not used with a dash.

Plot the radar on the 4/3 earth curvature diagram as follows (look back to the map profile line sheet):

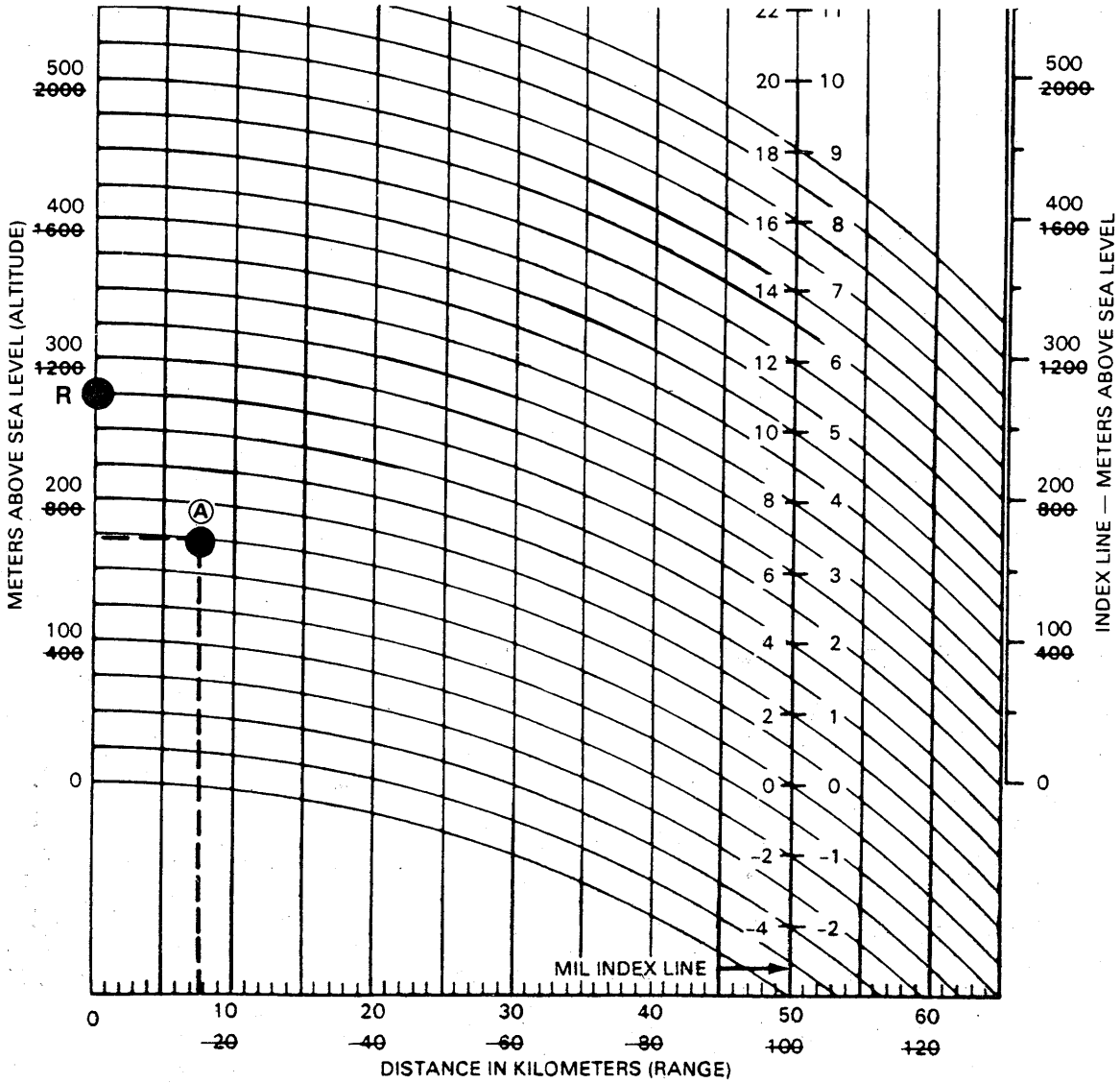
- The radar is the starting point, so its range will always be 0 kilometers.
- Read the radar's altitude (in this case, 275 meters).
- Find the point on your 4/3 earth curvature diagram that corresponds to the 0-kilometer range and the 275 meters altitude. Label this point R for radar.

After you have plotted the radar, plot the position of each terrain feature recorded on the map profile line. (Look again at the 600-mil profile line.)

The first prominent terrain feature, A, is at 7.5-kilometers range and 175-meters altitude.

Find the point corresponding to this altitude and range on the 4/3 earth curvature diagram. Mark it with a dot. (See following illustration)

4/3 EARTH CURVATURE DIAGRAM ONE



In the same way, mark and label the remainder of the prominent terrain features from the map profile line to the 4/3 earth curvature diagram.

Next use a straightedge to draw a line connecting all of your points in sequence (R to A, A to B. B to C, et cetera); (see illustration.)

Construct a radar base line by drawing a line from R (275) meters on the Meters Above Sea Level (Altitude line) to 275 on the Index Line —Meters Above Sea Level lines. Label this line Z.

Using R as a pivot point, rotate your straightedge clockwise until you cross the highest terrain feature visible from the radar (terrain feature E). Draw a line from R to this first terrain feature and extend it through the "Index-Line-Meters Above Sea Level. The line you have just drawn represents the radar's line of sight.

The distance between the points where the radar base line (RZ) and the radar line of sight cross the "Mil Index Line " is read as the mask angle. To determine the mask angle in miles, measure the same distance along the Mil Index Line using zero mils as the starting point. If the radar's line of sight is above the base line, the mask angle is positive (+). (In the example the mask angle is + 1.8.)

RADAR BASE LINE, LINE OF SIGHT, AND MASK ANGLE

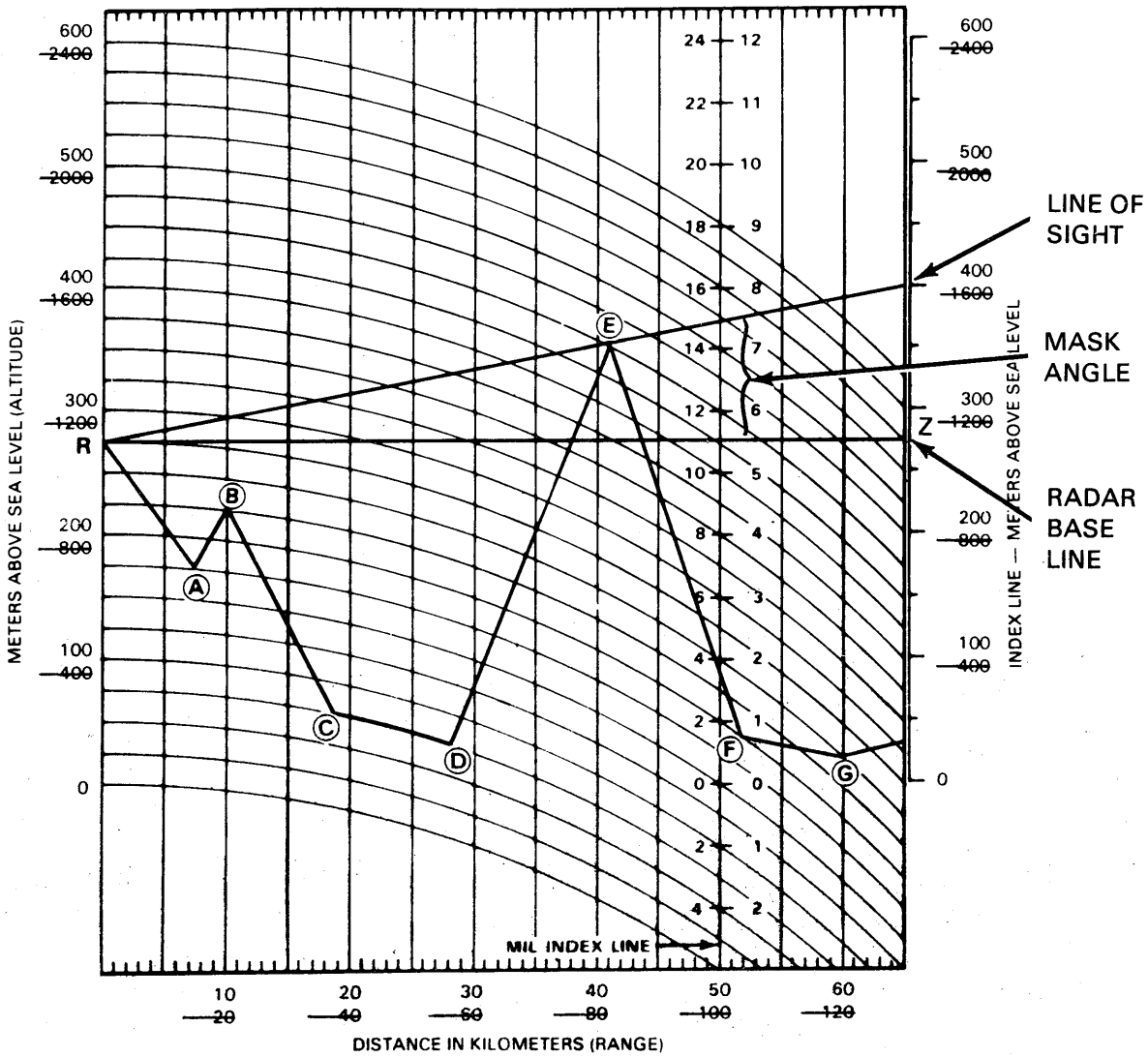
CLASSIFICATION

MODIFIED 4/3 EARTH CURVATURE DIAGRAM WORKSHEET

Unit _____ Date _____ Az 600 mil

Coordinates 020780 Map No. MI 12-7 Scale 1:250,000

Target Altitude _____ Above MSL/Terrain



CLASSIFICATION

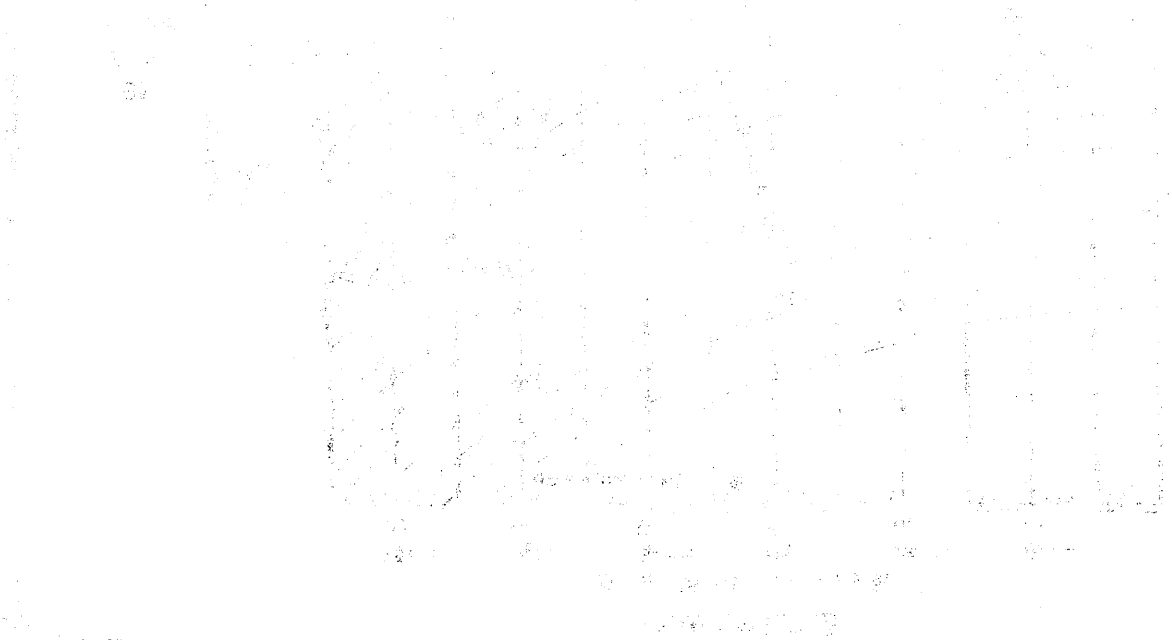
Now you will construct target course lines. First, determine the target altitudes for which your coverage diagrams are to be drawn. As stated before, target altitudes are usually 50, 150, and 300 meters. These altitudes can be stated as above mean sea level or as above ground level. (This example uses altitudes of 50, 150, and 300 meters AGL.)

On the Meters Above Sea Level line on the left of the chart, locate the point corresponding to target altitude. Assume, for example, an altitude of 50 meters AGL. Assume, for example, an altitude of 50 meters AGL. Target altitude is then 50 meters above the radar R or, in this case, 325 meters above MSL (275 + 50 = 325 meters).

Mark the target's altitude with a tick mark above each of the prominent terrain features. In this case, add 50 to the altitudes of each of the lettered points to get each target altitude.

Using a straightedge, connect each of the tick marks in sequence with a dashed line. This is your first target course line. It represents an aircraft flying at a constant altitude above terrain (50 meters AGL) on a constant heading (in this example, 600 mils). (See illustration.)

Next, draw target course lines for each target altitude to be shown. The 150 and 300 meter target altitude course lines can be drawn on the same diagram as the 50 meter AGL line as long as the same altitude scale can be used. The 300 meter target altitude course line is drawn on a separate diagram. Because of the nature of the terrain, the target course line was too high to be plotted using the smaller scale.



50 AND 150 METER TARGET COURSE LINE

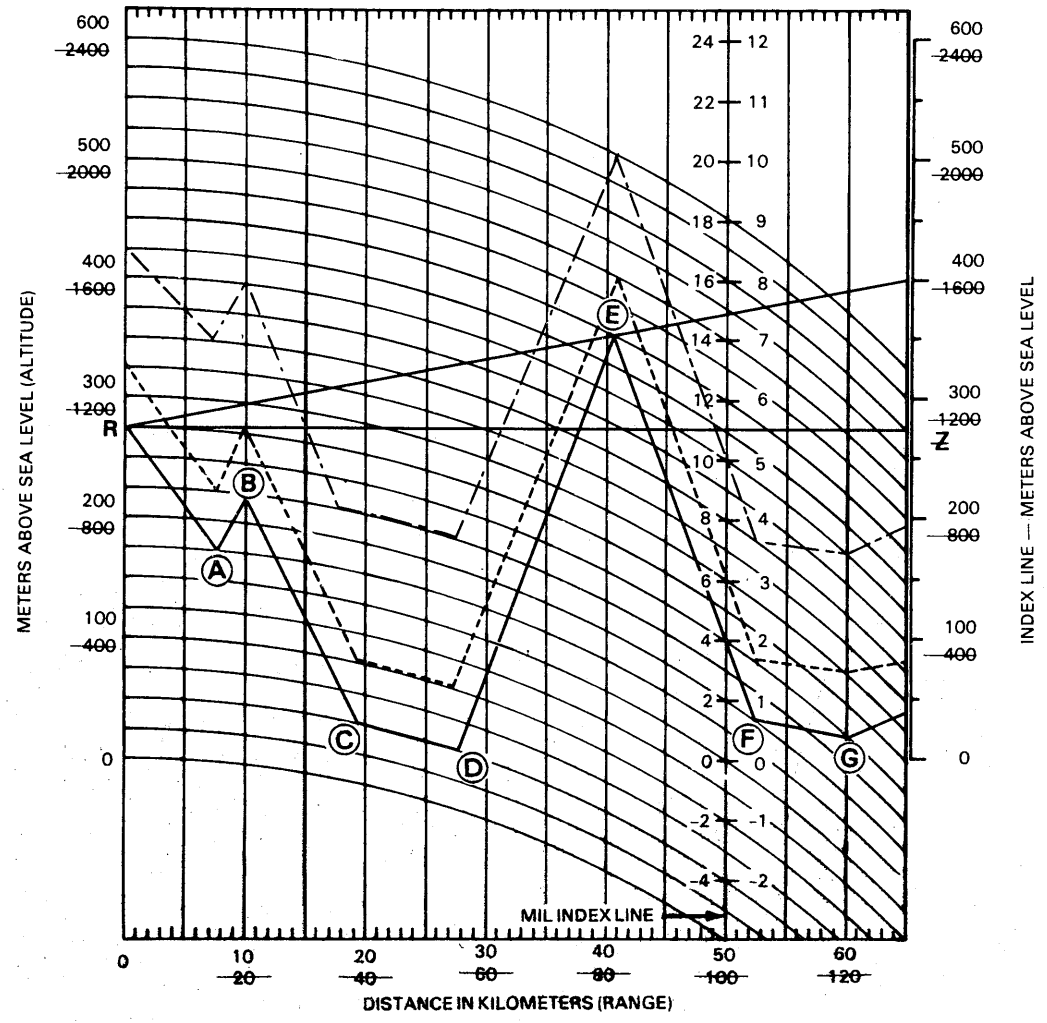
CLASSIFICATION

MODIFIED 4/3 EARTH CURVATURE DIAGRAM WORKSHEET

Unit _____ Date _____ Az 600 m

Coordinates 020780 Map No. MI 12-7 Scale 1:250,000

Target Altitude _____ Above ~~MSL~~/Terrain _____



_ _ _ _ _ _ _ 50 METERS

_ _ _ _ _ _ _ 150 METERS

CLASSIFICATION

300 METER THREAT ALTITUDE COURSE LINES

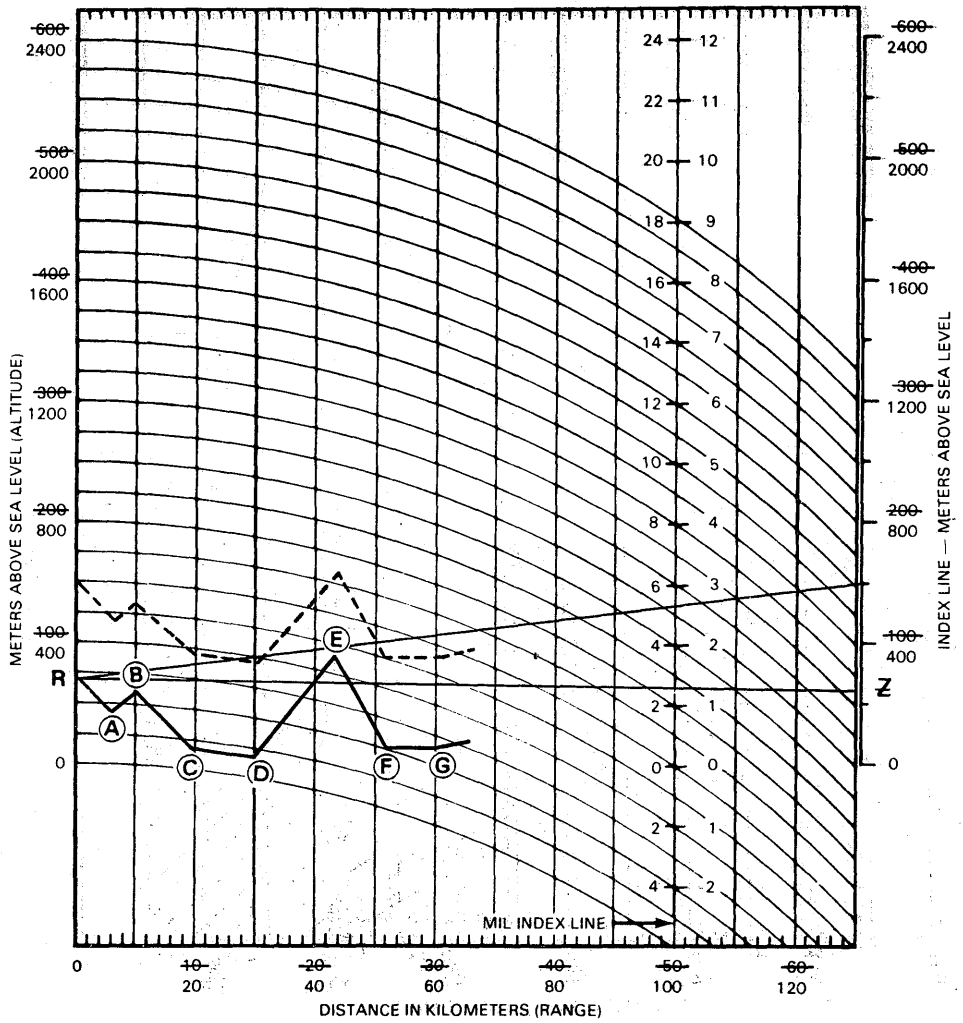
CLASSIFICATION

MODIFIED 4/3 EARTH CURVATURE DIAGRAM WORKSHEET

Unit _____ Date _____ Az 600 mils

Coordinates 020780 Map No. MI 12-7 Scale 1:250,000

Target Altitude _____ Above ~~MSL~~/Terrain



CLASSIFICATION

_ _ _ _ _ 300 METERS

The previous examples have shown target course lines for aircraft flying at fixed altitudes above terrain, or constant AGL. How would you draw target course lines for an aircraft flying at fixed altitudes above mean sea level or constant MSL? In this case, the target course line is the curved line on the 4/3 earth curvature diagram at the altitude of the target. In the illustration below, the target is flying at 550 meters MSL.

550 METER MISSILE TARGET COURSE LINE

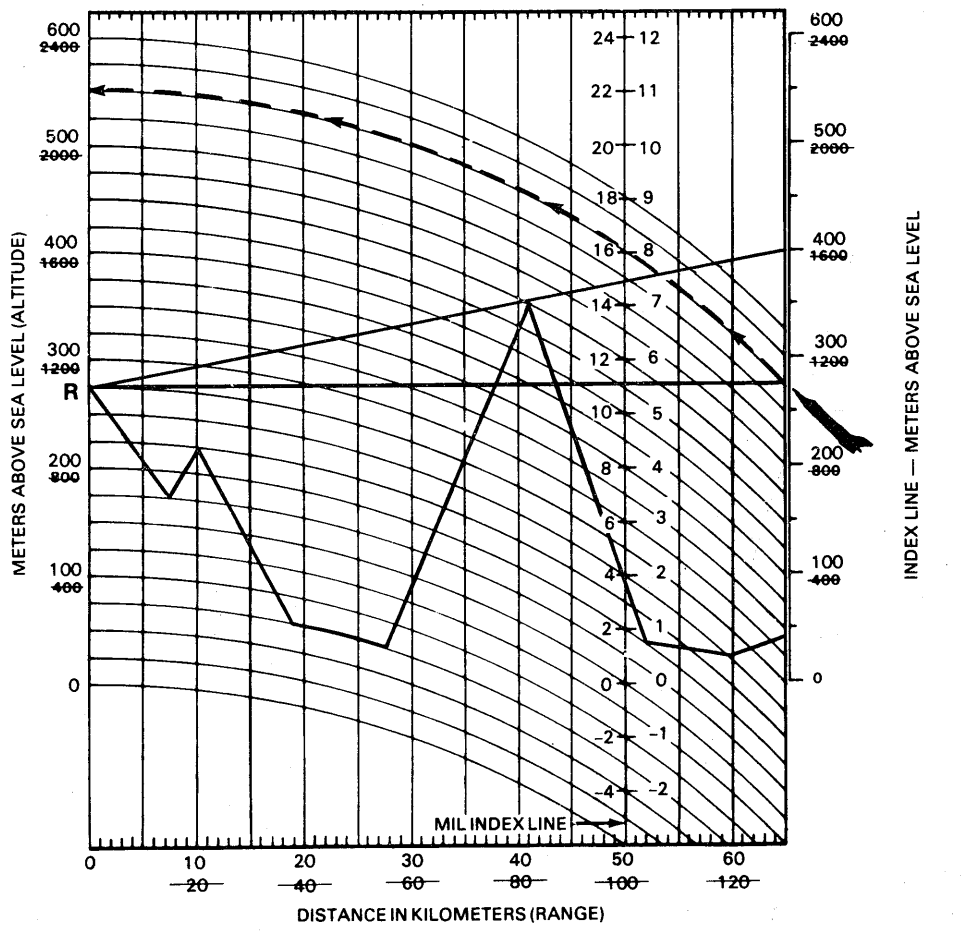
CLASSIFICATION

MODIFIED 4/3 EARTH CURVATURE DIAGRAM WORKSHEET

Unit _____ Date _____ Az 600 M

Coordinates 020180 Map No. NI 12-7 Scale 1:250,000

Target Altitude _____ Above MSL/~~Terrain~~



CLASSIFICATION

After drawing the target course lines, you are able to determine the target acquisition range.

Find the point on the 4/3 earth curvature diagram where the radar line of sight crosses the target course line.

Read the acquisition range from the range scale at the bottom of the chart (remember to use the correct scale of numbers). This is the acquisition range for a target flying at a specific altitude, either AGL or MSL, on the fixed heading (for the 600-mil azimuth example). At 50 meters AGL the target acquisition range is 43 kilometers, and at 150 meters AGL, 47 kilometers. Acquisition at 300 meters AGL is 52 kilometers, and 550-meters MSL, on the same heading, target acquisition is at 54 kilometers.

TARGET ACQUISITION RANGE

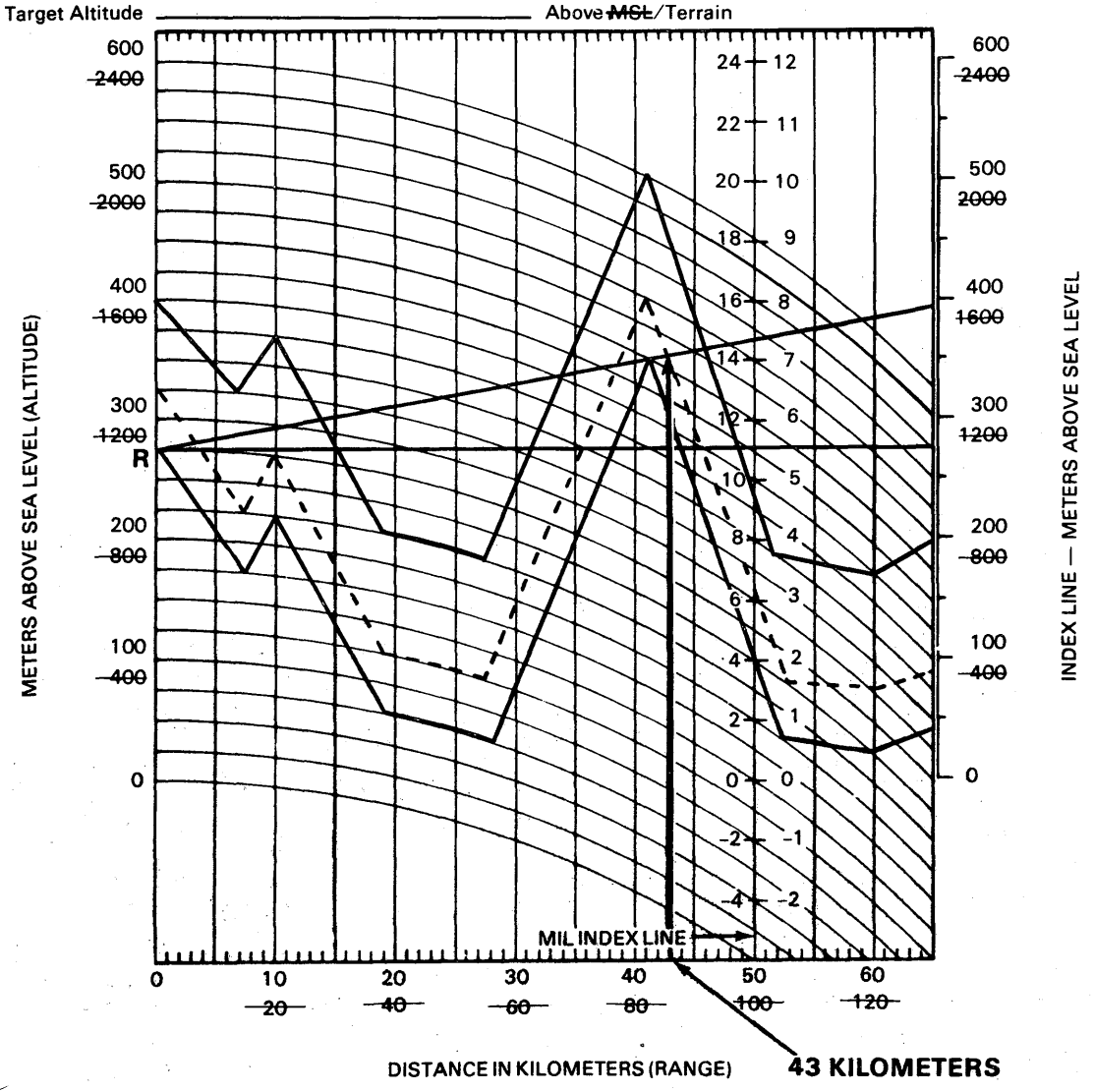
CLASSIFICATION

MODIFIED 4/3 EARTH CURVATURE DIAGRAM WORKSHEET

Unit _____ Date _____ Az 600 M

Coordinates 020780 Map No. M1 12-7 Scale 1:250,000

Target Altitude _____ Above ~~MSL~~/Terrain



CLASSIFICATION

The last procedure you must perform in using the deliberate method, prior to constructing the coverage diagram itself, is to identify radar dead zones. Radar dead zones are volumes of airspace which are masked from the radar's view by terrain features. Here is how they are determined.

Aircraft flying at 50 meters AGL are hidden from the radar's view by terrain feature E at ranges beyond 43 kilometers, or beyond the target acquisition range.

Next, using R as a pivot point, pivot a straightedge clockwise from the radar line of sight until it intersects the next terrain feature (point B). Draw a line from this terrain feature to point R and extend it to the right side of the chart.

Repeat this procedure for all other prominent terrain features along the azimuth line. Shade in the areas hidden from the radar's view. These shaded areas represent radar dead zones produced by terrain features along a particular azimuth line.

Read the range scale at the bottom of the chart to find the ranges at which the target will be lost and then reacquired. In the following illustration (600-mils azimuth, 50-meters AGL), the aircraft will first be detected at 43 kilometers as it clears feature E. It will remain visible until it enters the radar dead zone caused by feature B at 29 kilometers. It will not be visible until it emerges from this dead zone at 14 kilometers, but will then remain visible until it crosses over the radar's site.

Finally, repeat this entire process for each of the 4/3 earth curvature diagrams (representing each of the azimuths originally plotted).

TERRAIN MASKING AND RANGE

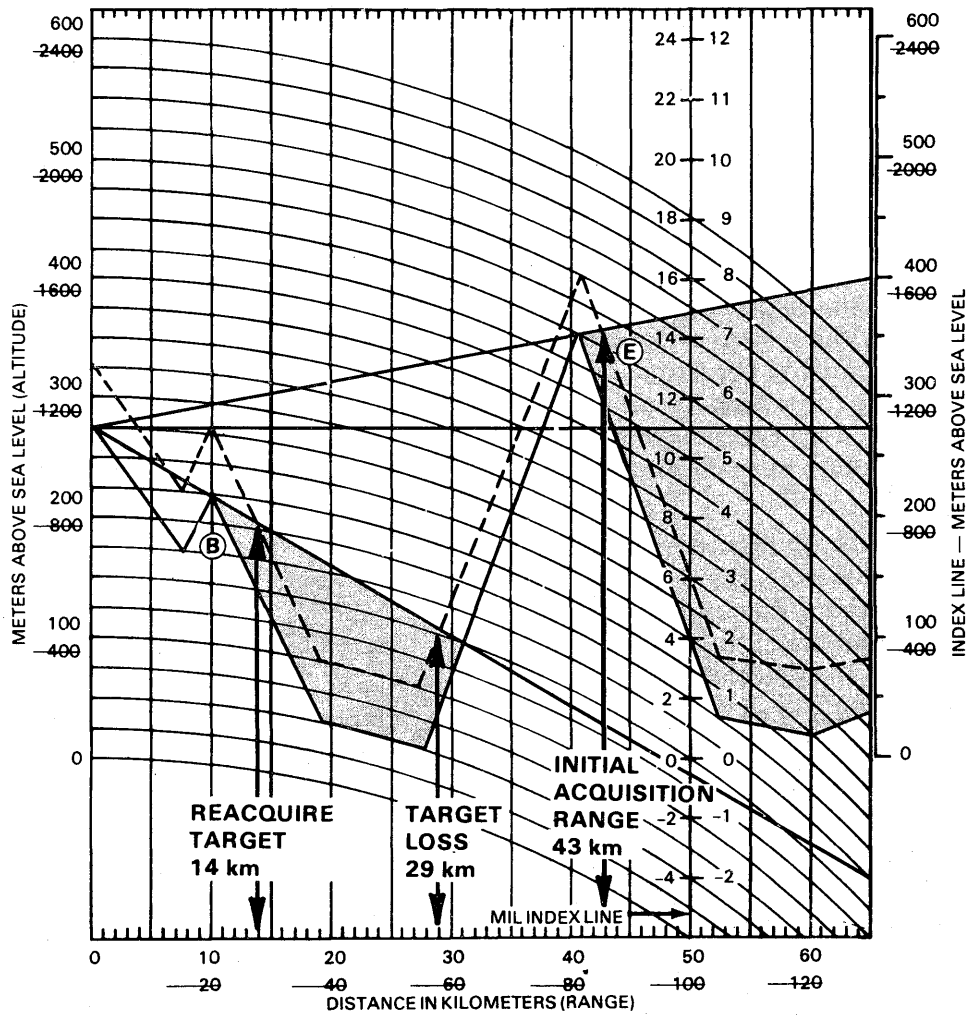
CLASSIFICATION

MODIFIED 4/3 EARTH CURVATURE DIAGRAM WORKSHEET

Unit _____ Date _____ Az 600 mil

Coordinates 020780 Map No. MI 12-7 Scale 1:250,000

Target Altitude _____ Above ~~MSL~~/Terrain



CLASSIFICATION

Step 6

Construct the radar coverage diagram. Now that you have completed all of the previous steps, you are ready to perform the last step of the deliberate method — constructing the coverage diagram itself. First, obtain a blank radar coverage diagram worksheet and fill in the heading. Next, select a method of distinguishing different target altitudes on the diagram. For instance, plot 50-meter AGL targets in red, 150-meter targets in black, and 300-meter targets in blue.

Determine the maximum acquisition range of the system based on system performance against the threat. This information can be found in FM 44-1A(S). The system performance range should be compared to the range found for each azimuth using the 4/3 earth curvature diagram. The smaller of the two ranges should be plotted at each azimuth as explained in the following paragraphs.

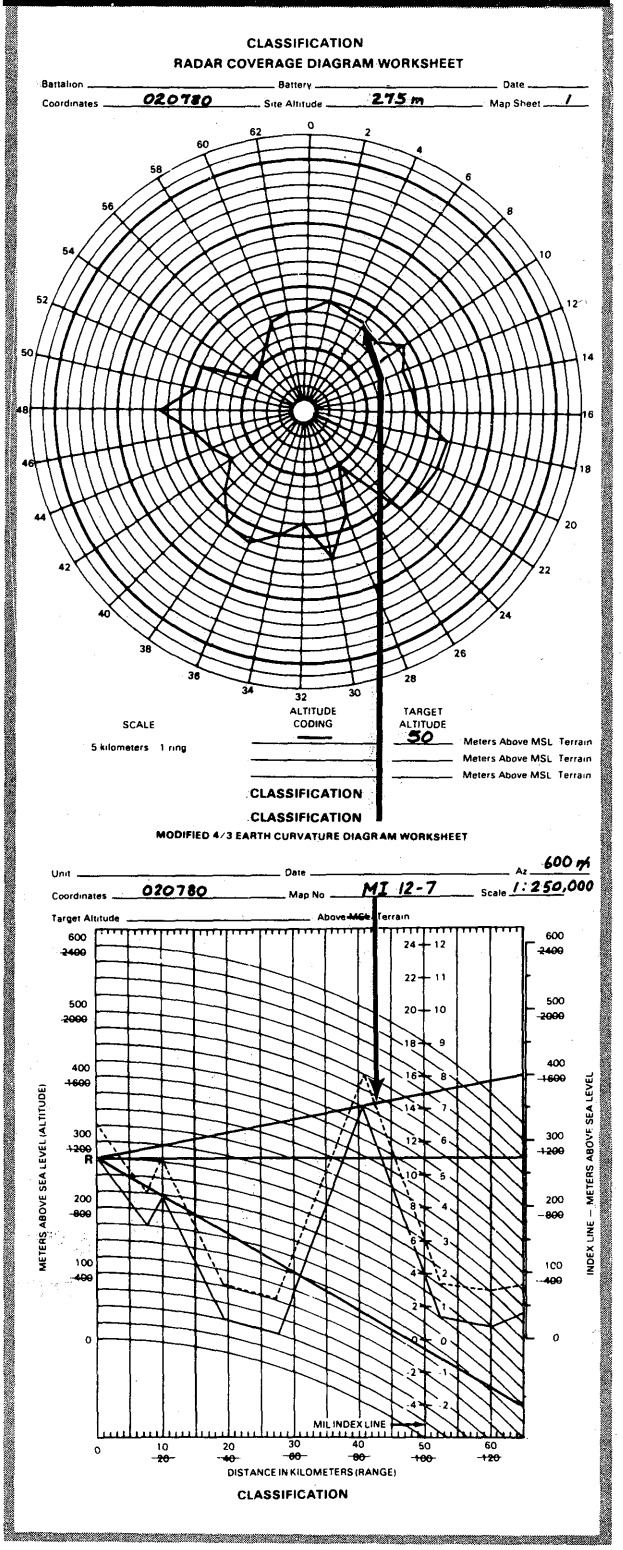
Beginning with the 0 mil azimuth line, transfer the information from each 4/3 earth curvature diagram to the radar coverage diagram worksheet. (The 600-mil azimuth line is again used as an example in the illustration.)

Start with the 50-meter AGL target course line. Read the initial target acquisition range from the 4/3 earth curvature diagram and record it on the appropriate azimuth line of the radar coverage diagram worksheet (43 kilometers at 600-mil azimuth).

Repeat this process until the initial target acquisition range for each of the 4/3 earth curvature diagram has been transferred to the radar coverage diagram worksheet.

Using a straightedge, sequentially connect all the points plotted. The resulting graph now shows the initial target acquisition range for a 50-meter AGL target approaching from all azimuths.

CONSTRUCTING THE RANGE DIAGRAM



Next, plot the radar dead zones caused by terrain masks inside the initial acquisition range, on the radar dead zones illustration.

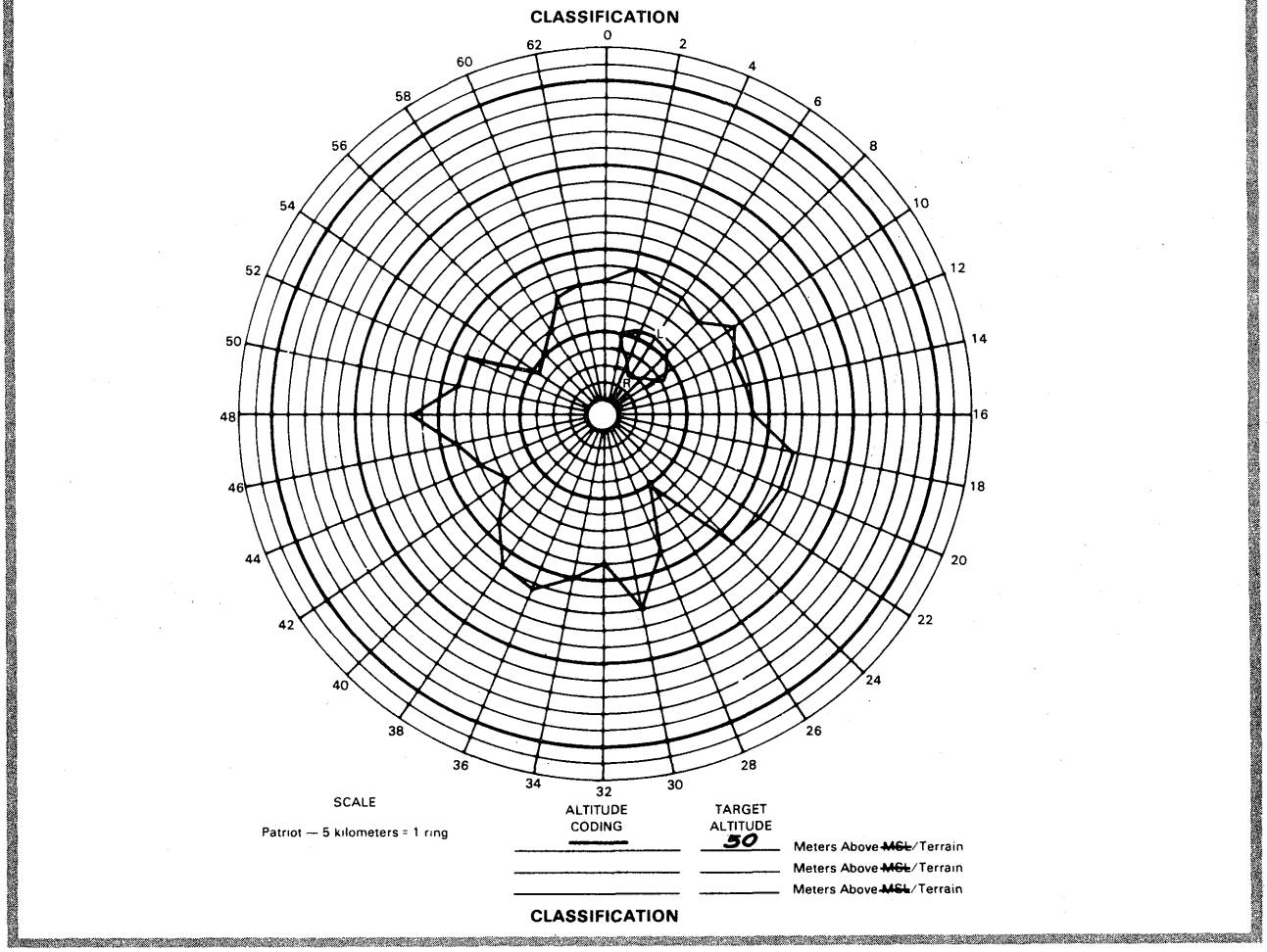
From each 4/3 earth curvature diagram, find the range at which the target is lost behind a mask (20 kilometers in the 600-mil example). Plot this "target lost" range on the appropriate azimuth line on the radar coverage diagram worksheet. Label these plots L to identify them as spots where the target is lost.

Perform this same process to plot the ranges at which the target is reacquired as it clears the masking terrain. Label these points R.

Connect the L and R points for the same terrain feature. (It may be helpful at this step to refer back to the topographic map to identify the particular terrain feature.) The L and R lines should intersect. The enclosed area is the radar dead zone caused by a particular terrain feature.

Repeat this process for each target altitude to be included on the radar coverage diagram. The end product will be a radar's ability to detect, acquire, and track targets flying at selected altitudes of interest. (See illustration.) Finally, determine the security classification of the complete radar coverage diagram, stamp it, and handle it according to applicable regulations.

RADAR DEAD ZONES



HASTY METHOD

The hasty method of radar coverage diagram construction is used by the unit reconnaissance party. It is the normal method used by Patriot firing batteries. The hasty method provides the most accurate on-site evaluation of terrain masking. However, it should be used with the deliberate method when considering a nap-of-the-earth threat, because the hasty method does not alone depict radar dead zones. Hasty coverage diagrams are forwarded by messenger to the battalion S3 section to update and validate that section's deliberate coverage diagrams for defense planning purposes.

Step 1

Obtain the following materials:

- M2 aiming circle.
- Horizontal range detection nomogram.
- Hasty coverage recording worksheet.
- Pencils, paper, and a straightedge.

Step 2

Emplace the aiming circle on the site selected for the radar. Orient the aiming circle to the north reference. FM 6-2 provides instructions on the use of the aiming circle.

Sight through the telescope and, using the elevation micrometer knob, adjust the aiming circle in elevation until the telescope crosshairs intersect at the top of the highest terrain feature visible at that azimuth.

Read and record the mask angle, as shown on the aiming cirlce's elevation scale. Repeat this measuring process every 200 mils for the full 6400 mils around the radar. A sample recording worksheet is shown below. As with the deliberate method, if a high terrain feature is missed by your normal 200-mil terrain measurements, shoot another azimuth to intersect this point.

HASTY COVERAGE RECORDING WORKSHEET

HASTY COVERAGE RECORDING WORKSHEET

Battalion _____ Battery _____ Date _____

Coordinates 020780 Site Altitude 275 m Map Sheet 1

AXIMUTH	MASK ANGLE	UNMASK ANGLE
0	1	55,000
200	2	53,000
400	2.5	47,000
600	2.5	46,000
800	0	56,000

Determine the unmask range for each 200-mil azimuth line.

Determine the target altitude(s) to be used to construct the coverage diagram. (This example used 150 meters.)

Mark the target altitude (150 meters) on the "Threat Above Fire Unit" line of the horizontal range detection nomogram below. (Zero on this line represents the altitude of the radar.)

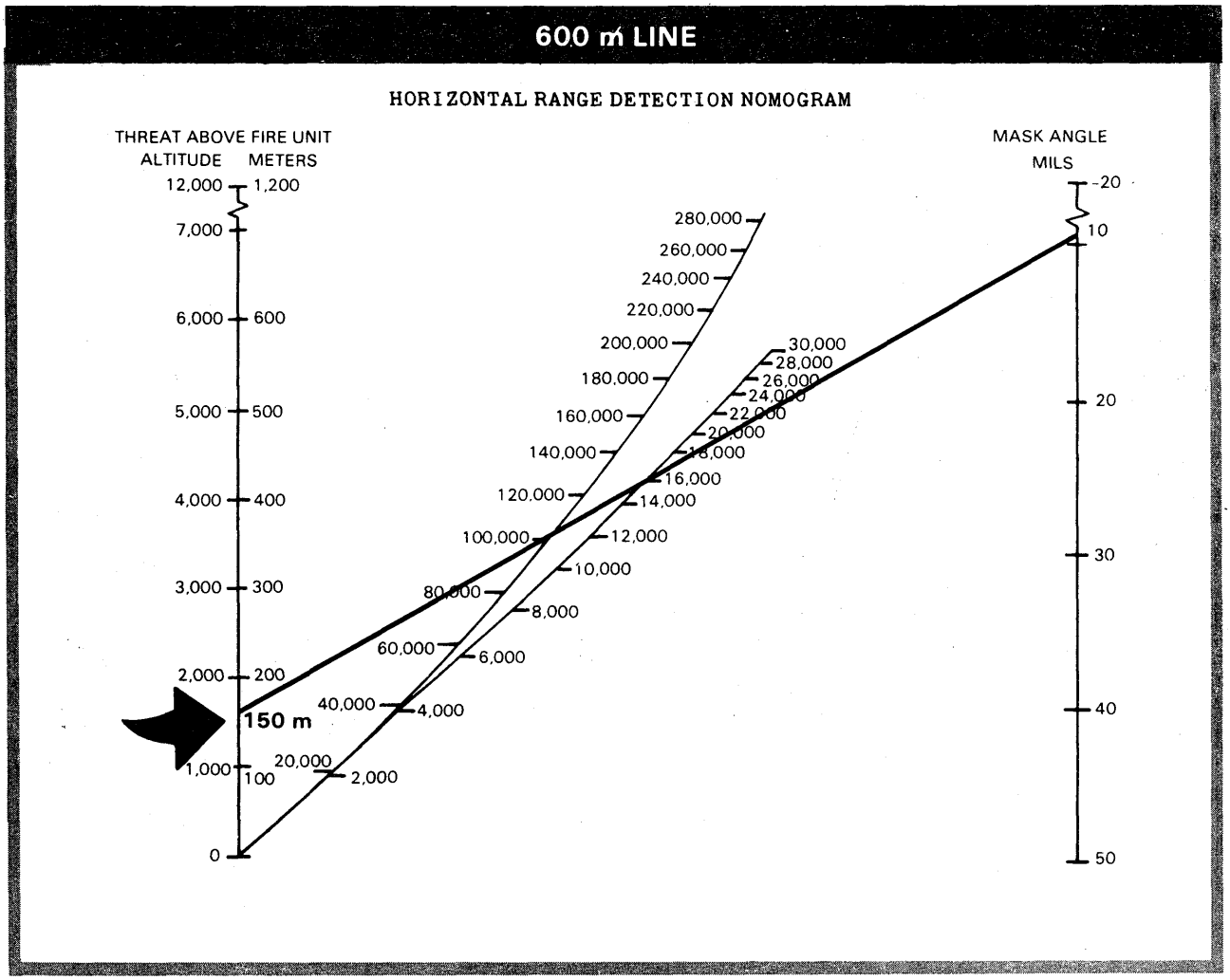
Mark the measured mask angle for the appropriate azimuth on the "Mask Angle" line of the nomogram. (This illustration uses the 600-mil azimuth line, for which the determined angle is 2.5 mils.)

Draw a line connecting the target altitude and mask angle marks using a straightedge.

Read the target unmask range from the "Range-Meters" scale in the center of the nomogram. Be sure to use the correct set of numbers (small or large) for all recordings and plottings. For this example, the target unmask range is 16,000 meters.

Repeat this process for each 200-mil azimuth line and record the unmask angles on the recording worksheet. If different target altitudes must be considered, the process must again be repeated for those different altitudes.

600 mil LINE



Complete the radar coverage diagram with information from the recording worksheet.

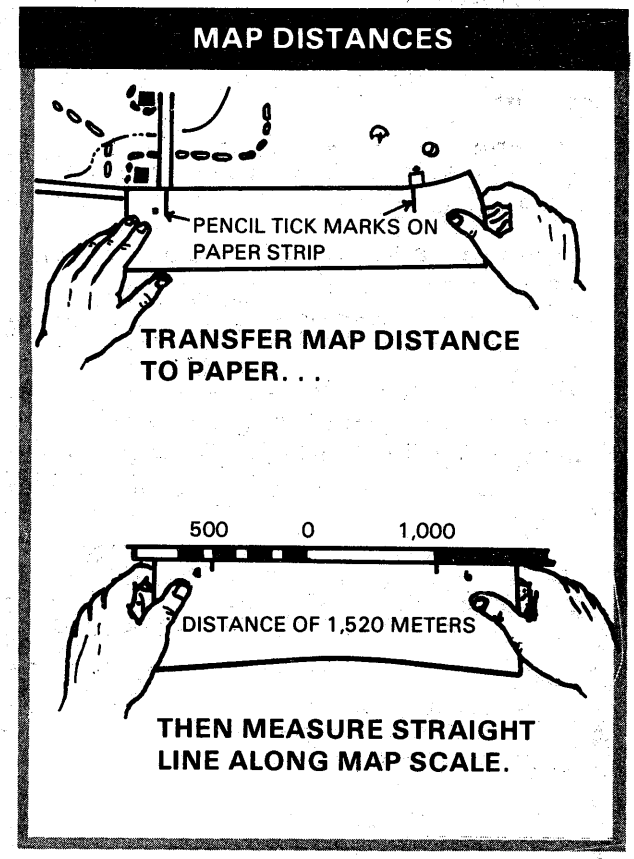
Fill in the radar coverage diagram worksheet heading.

Determine the maximum acquisition range of the system based on system performance against the threat. This information can be found in FM 44-1A(S). The system performance range should be compared to the range found for each azimuth using the 4/3 earth curvature diagram. The smaller of the two ranges should be plotted at each azimuth as explained below.

Mark the determined unmask range with a dot for each azimuth.

Sequentially connect the dots using a straightedge. The resulting graph is the radar coverage for the target altitude being considered.

Repeat the process for each target altitude to be graphed on the radar coverage diagram. Determine the complete diagram's security classification, stamp it, and handle it according to applicable regulations.



EMERGENCY METHOD

The emergency method is by far the least accurate and least time consuming. It is used only when time and the situation demand an immediate evaluation of a position. This method provides an estimated radar detection range in all directions from the radar for a target flying at 50 meters AGL. The results are an approximation of radar coverage and should be replaced with diagrams arrived at by the hasty method as soon as possible.

Step 1

Assemble the following materials:

- A large-scale (1:250,000 or larger) topographic map of the area.
- Radar coverage diagram worksheet.
- Pencils, paper, straightedge, and a protractor graduated in mils.

Step 2

Identify prominent terrain features.

Plot your radar's location on the map.

Inspect the map and identify and mark prominent terrain features that could mask an approaching aircraft from the radar.

Step 3

Measure the azimuth and range of each marked terrain feature.

Draw a line from the radar to each marked terrain feature using a straightedge.

Measure and record the azimuth of each terrain feature radar line on the map using a protractor.

Measure the range from the radar to each terrain feature using the map scale. Add three kilometers to each measured range and record. This will give you the approximate initial acquisition range (see illustration).

Step 4

Construct the coverage diagram.

Transfer the information just obtained to the radar coverage diagram worksheet by placing a dot at the appropriate location on the azimuth line.

Sequentially connect the dots with a straight line using a straightedge.

Determine the security classification of the completed radar coverage diagram, stamp it, and handle it according to applicable regulations.

Glossary

G

ABBREVIATIONS AND ACRONYMS

ac	alternating current
ACCP	Army correspondence course program
ADA	air defense artillery
ADJ	adjacent
ADL	automatic data link
admin	administrative
AGL	above ground level
AMG	antenna mast group
ant (ANT)	antenna
ARTEP	army training and evaluation program
ASL	authorized stockage list
ATC	asset threat category
ADTL-1	Army tactical data link-1
ATOM	radiological
aux (AUX)	auxiliary
az (AZ)	azimuth
BATI	battalion initialization
BCU	battery coolant unit
BIO	biological
BITE	built-in test equipment
bn (BN)	battalion
BOT	bottom
BRNG	bearing
BRU	battery replacement unit
BRU	battery replacement unit
BSME	battalion supply and maintenance equipment
BTACOPS	battalion tactical operations
BTOC	battalion tactical operations center
BTMS	battalion training management system
btry (BTRY)	battery
CANCL	cancel
CANT	cannot
CB	cloud bottom
CCC	command control computer
ccw (CCW)	counterclockwise
C-E	communications-electronics
CEOI	communications-electronics operation instructions
cGy	centigray
CH	channel
CHNG	change
ckt (CKT)	circuit
CM	centimeter
CMUP	clutter map update
comm (COMM) (COMMO)	communications
COMSEC	communications security

CONT	control
CP	command post
CPP	communications patching panel
CRG	communications relay group
CRT	cathode ray tube
CT	cloud top
CURR	current
cw	clockwise
DA	Department of the Army
DAM	display-aided maintenance
DECOR	decorrelation
DLRP	data link reference point
DLT	data link terminal
DoD	Department of Defense
DS	direct support
ECCM	electronic counter-countermeasures
ECM	electronic counter-measures
ECS	engagement control station
ECU	environment control unit
EL (ELEV)	elevation
E/MI	engagement/missile inventory
EMP	electromagnetic pulse
ENG	engagement
ENGST	engagement status
EPP	electric power plant
EPU	elecric power unit
ESTAT	engagement status
ext (EXT)	external
FB	firing battery
FHT	field handling trainer
FM	field manual; frequency modulated
FP	firing platoon
FPn	firing platoon number
FRND	friend
FTACOPS	firing battery tactical operations
FTX	field training exercise
FU	fire unit
gas	chemical
GM	guided missile
GMT	guided missile transporter
HCU	hard copy unit
HEMTT	heavy expanded mobility tactical truck
HEU	higher echelon unit
HF	high frequency
HHB	headquarters and head-quarters battery

HIMAD	high- to medium-altitude air defense
HIS	history
HP	halt point
HR	hour
Hz	hertz
ICC	information and coordination central
ID (ident)	identification
IFF	identification, friend or foe
in	inch
ISE	intermediate support elements
ISLB	initial search lower bounds
KM	kilometer
KMPH	kilometers per hour
KOK	cryptographic operating key
KT	kiloton
LL	lower left
LLCP	landline communications panel
LNIP	launch-now-intercept-point
LOG	logistical
LOS	line of sight
LR	lower right
LRPT	large repair parts transporter
LS	launching station
m	meter
MA	mask angle
MANPAD	man-portable air defense
MC	maintenance center
MCHAN	multichannel
MHz	megahertz
MI	missile inventory
min	minute
MIR	mirror
MOF	method of fire
MOPP	mission-oriented protective posture
MOS	military occupational specialty
MRCTS	missile-round cable test set
MRT	missile round trainer
MS1 (2, or 3)	manstation one (two, or three)
MSE	multiple simultaneous engagement
MSK	masked
MSL	mean sea level
MT	megaton
MTOE	modification table of organization and equipment
MULT	multiple
NA	nonapplicable
NATO	North Atlantic Treaty Organization
NBC	nuclear, biological, chemical
NCO	noncommissioned officer

NO.	number
NORM	normal
NREF	north reference
OPFOR	opposing forces
OPNS	operations
OPSEC	operations security
OSLB	operational search lower bounds
PADIL	Patriot language
PADS	position and azimuth determining system
pam	pamphlet
PAT	Patriot
PCOFT	Patriot conduct of fire trainer
PDU	power distribution unit
PFASC	Patriot field army support center
PFE	process for engagement
PIP	predicted intercept point
PL	party line
PLL	prescribed load list
Plt	platoon
PMF	Patriot maintenance facility
PPU	prime power unit
PRI	priority
PTL	primary target line
pty (PTY)	party
pvt (PVT)	private
RAD	radiation absorbed dose
RATT	radio teletypewriter
RCVD	received
RDR	radar
RECOR	recorrelation
reg	regulation
RF	radio frequency
RIP	ripple
RLRIU	routing logic radio interface unit
RMT	remote
RPSTL	repair parts and special tools list
RRT	radio relay terminal
RS	radar set
RSOP	reconnaissance, selection, and occupation of position
R/WCIU	radar/weapon control interface unit
S1	administrative
S2	intelligence
S3	operations
S4	supply
SCC	system center coordinate
SCI	special control instruction
S/I	switch indicator
SIF	selective identification feature
SLC	side lobe canceller
SM	soldier's manual

SOP	standing operating procedure
SP	start point
SRPT	small repair parts transporter
SQT	skill qualification test
SSI	secondary skill indicator
STANAG	Standardization agreement
STL	secondary target line
SU	single user
SWBD	switchboard
sys	system
SZ	size
tab	tabular display
TAC	tactical
TACI	tactical initialization
TACOPS	tactical operations
TADIL-B (TADILB)	Joint Service Tactical Digital Link-B
TBE	to be engaged
TBEQ	to-be-engaged queue
TCA	tactical control assistant
TCO	tactical control officer
TD	tactical director
TDA	tactical director assistant
TEC	Training Extension Course
TF	training film
TG	trainer's guide
TGO	time to go
tgt	target
TGTNO	target number
TH	threat
THRESH	threshold
THRT	threat
THT	tracking head trainer
TLL	time-to-last-launch
TLR	time to launch release
TM	technical manual
TNT	trinitrotoluene
TOC	tactical operations center
TOE	table(s) of organization and equipment
TOS	tactical operations system
TPT	troop proficiency trainer
trk (TRK)	track
TSEC	telecommunications security
TSOP	tactical standing operating procedure
TTFL	time-to-first launch
TTI	time-to-intercept
TVM	track-via-missile
TY	type
UHF	ultrahigh frequency
UL	upper left
UR	upper right
USAADASCH	US Army Air Defense Artillery School
UTM	universal transverse mercator (grid)
V	volts
vdc	volts direct current

VHF	very high frequency
WC	weapons control
WCC	weapons control computer
WL	with (restrictive) language

TERMS

Air Defense — all measures designed to nullify or reduce the effectiveness of attack by hostile aircraft or guided missiles after they are airborne.

Air Defense Artillery — ground-based surface-to-air weapons, including guns and surface-to-air missile and support equipment for engaging air targets from the ground.

Electromagnetic Interference (EMI) — disruption of electronic data transmission due to jamming of other electronic equipment or (primarily) nuclear detonation in the proximity of the equipment shielded against EMP.

Electromagnetic Pulse (EMP) — an "electronic wave" generated by a nuclear detonation which induces a current in any electrical conductor. EMP can temporarily disrupt or overload and damage components of electronic equipment if improperly protected.

Fire Control Orders — Commands which are used to control air defense engagements on a case-by-case basis, regardless of the prevailing weapons control status. These commands are most often used by higher control echelons when monitoring the decentralized operations of subordinate units.

HIMAD Systems — high- to medium-altitude air defense systems (currently includes Hawk and Patriot weapon systems).

Hook — a process by which a target is selected through operator console action initiated either by (a) moving a joystick-directed cursor over a target video, (b) typing in the track number on the keyboard, or (c) performing sequential designation of target through successive pushbutton actions. This selection of track allows the operator to execute a number of specific actions on that track (for example, assign weapon control conditions, assign/change identity, or initiate engagement, display track, et cetera).

Mission Oriented Protective Posture (MOPP) — a flexible system for protection against a chemical attack, devised to maximize the unit's ability to accomplish its mission in a toxic environment. This posture requires personnel to wear individual protective clothing and equipment consistent with the chemical threat, work rate imposed by their mission, temperature, and humidity without excessive mission degradation.

Operator Input Parameters — those initialization values which the console operator(s) at the ECS (or ICC) are allowed to enter into the WCC (or CCC) memory through keyboard entry. These values, when combined with constants entered during initialization, make up the data base which configures the computer software for tactical operations.

Operations Security (OPSEC) — those actions that are necessary and appropriate to deny the enemy information about planned, ongoing, and completed operations.

Patriot — acronym for phase array tracking to intercept of target.

Position — the exact area within the operating area for the employment of ADA fire units.

Restricted Area — an airspace of defined dimensions above the land areas or territorial waters of the state within which the flight of aircraft is restricted in accordance with certain specified conditions. May also refer to land or sea areas to which access is restricted (JCS Pub. 1, NATO).

SHORAD Systems — short range air defense systems. Currently includes all MANPAD (Redeye, Stinger), Vulcan, Roland, and Chaparral systems.

Site — the placement of individual items of equipment on selected spots within the position.

Tab — an abbreviation for the tabular displays which appear on the ICC or ECS consoles (manstations). Some of the tabs are used only in initialization, some only in TACOPS, and some of the tabs are common to both.

References

R

REQUIRED PUBLICATIONS

Required publications are sources that users must read in order to understand this publication.

ARMY TRAINING AND EVALUATION PROGRAM

44-635	Air Defense Artillery Battalion, Patriot
44-635-11 Drill	Patriot Battle Drills for Electric Power Unit (EPU), Electric Power Plant (EPP), and Antenna Mast Group (AMG)
44-635-12 Drill	Patriot Battle Drills for Information and Coordination Central (ICC) and Communications Relay Group (CRG)
44-635-13 Drill	Patriot Battle Drills for Engagement Control Station (ECS) and Radar Set (RS)
44-635-14 Drill	Patriot Battle Drills for Launching Station (LS) and Missile Reload

FIELD MANUALS

44-1A	(S) Air Defense Artillery Operational Planning (U)
44-15 (HTF)	Patriot Battalion Operations (How to Fight)

TECHNICAL MANUALS

5-6115-602-14&P	Operator's Manual, Electric Power Plant II, AN/MJQ-24
9-1425-602-12	Patriot Software User Guide
9-1430-600-10-1	Operator's Manual, Engagement Control Station, Guided Missile, Truck Mounted, AN/MSQ-104
9-1430-601-10-1	Operator's Manual, Radar Set, Semitrailer Mounted, AN/MPQ-53
9-1430-602-10-1	Operator's Manual, Information and Coordination Central, Guided Missile System, Truck Mounted, AN/MSQ-116
9-1430-603-10	Operator's Manual, Antenna Mast Group, OA-9054(V)4/G
9-1440-600-10	Operator's Manual, Launching Station, Guided Missile, Semitrailer Mounted, M901
9-6920-600-14	Troop Proficiency Trainer/Operator Training Instructions

RELATED PUBLICATIONS

Related publications are sources of additional information. They are not required in order to understand this publication.

ARMY REGULATIONS

40-3	Medical, Dental, and Veterinary Care
40-5	Preventive Maintenance
220-58	Organization and Training for Nuclear, Biological, and Chemical Defense
350-1	Army Training
350-2	Opposing Force Program
350-4	Qualification and Instructional Firing with Weapons and Weapons Systems
350-21	Instruction in Benefits of an Honorable Discharge
350-30	Code of Conduct/Survival, Evasion, Resistance, and Escape (SERE) Training
350-212	Military Justice
350-216	The Geneva Convention of 1949 and Hague Convention No. IV of 1907
380-40	(C) Policy for Safeguarding and Controlling COMSEC Information (U)
385-55	Prevention of Motor Vehicle Accidents
530-1	Operations Security (OPSEC)
600-9	The Army Weight Control Program
600-21	Equal Opportunity in the Army
600-85	Alcohol and Drug Abuse Prevention and Control Program

DEPARTMENT OF DEFENSE

DoD 5040.2-C-1	Catalog of Audiovisual Productions

DEPARTMENT OF THE ARMY PAMPHLETS

351-20	Army Correspondence Course Program Catalog

FIELD MANUALS

3-3	NBC Contamination Avoidance
3-4	NBC Protection
3-5	NBC Decontamination
3-100	NBC Operations
5-36	Route Reconnaissance and Classification
6-2	Field Artillery Survey
6-50	The Field Artillery Cannon Battery
21-11	First Aid for Soldiers
24-1	Combat Communications

24-20	Tactical Wire and Cable Techniques
25-3	Training in Units
44-1 (HTF)	US Army Air Defense Artillery Employment (How to Fight)
44-8	Small Unit Self-defense Against Air Attack
44-18 (HTF)	Air Defense Artillery Employment, Stinger (How to Fight)
44-18-1	Stinger Team Operations
44-30	Visual Aircraft Recognition
55-30	Army Motor Transport Units and Operations
101-5	Staff Organizations and Operations

NATO STANAGs

2002	Warning Signs for the Marking of Contaminated or Dangerous Land Areas, Complete Equipment, Supplies, and Stores
2047	Emergency Alarms of Hazard of Attack (NBC and Air Attack Only)
2103	Reporting Nuclear Detonations, Biological and Chemical Attacks, and Predicting and Warning of Associated Hazards and Hazard Areas
2112	Radiological Surveys
2889	The Marking of Hazardous Areas and Routes Through Them

TABLES OF ORGANIZATION AND EQUIPMENT

44-635L	Air Defense Artillery Battalion, Patriot
44-636L	HQ and HQ Battery, ADA Battalion, Patriot
44-637L	Air Defense Artillery Battery, Patriot

TECHNICAL MANUALS

3-216	Technical Aspects of Biological Defense
3-4230-216-10	Operator's Manual for Decontamination Kit, Skin, M358A1
3-4240-285-20 & P	Organizational Maintenance Manual, including RPSTL, for Collective Protection Equipment, Guided Missile System, Patriot
3-6665-225-12	Operator's and Organizational Maintenance Manual: Alarm, Chemical Agent, Automatic
3-6665-304-10	Operator's Manual: Area Predictor, Radiological Fallout, ABC-M5A2
5-6115-599-14 & P	Operator's Organizational Direct Support and General Support Manual, including RPSTL, for Electric Power Unit, AN/MJQ-21
9-1425-429-12	Operator's and Organizational Maintenance Manual for Stinger Air Defense Guided Missile System
9-1425-600-12	Patriot System Description

9-1425-601-14	Operator's Organizational and Intermediate Maintenance Manual for Patriot Painting and Marking Instructions
9-1430-600-10-2	Operator's Manual for Display Aided Maintenance, Engagement Control Station
9-1430-600-20-1	Organizational Maintenance Manual for Engagement Control Station
9-1430-602-20-1	Organizational Maintenance Manual for Information and Coordination Central
9-1440-600-20-1	Organizational Maintenance Manual for Launching Station
9-6920-429-12	Operator's and Organizational Maintenance Manual for Training Set, Stinger Guided Missile
11-5810-256-12	Operating Instructions TSEC/KY-57
11-5820-540-12	Operator's and Organizational Maintenance Manual, including RPSTL, for Radio Set AN/GRC-103
11-5820-540-12	Operator's Manual, Radio Set AN/GRC-103
43-0002-23	Destruction to Prevent Enemy Use Instruction, Patriot System

TRAINING FILMS

44-6332	Introduction to Patriot System
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By Order of the Secretary of the Army:

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The Adjutant General

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