DON C. THOMSON

DEPARTMENT OF TACTICS
UNITED STATES ARMY AVIATION SCHOOL
FORT RUCKER, ALABAMA

UH-1 IP

GUNNERY QUALIFICATION COURSE

FILE NO. 67-289-40

STUDENT HANDOUT BOOKLET

DEPARTMENT OF TACTICS
UNITED STATES ARMY AVIATION SCHOOL
Fort Rucker, Alabama

August 1969
File No. 67-289-40

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UH-1 IP GUNNERY QUALIFICATION COURSE

DEPARTMENT OF TACTICS
UNITED STATES ARMY AVIATION SCHOOL
Fort Rucker, Alabama

April 1969
File No. 67-468-1

PERFORMANCE OBJECTIVES

INTRODUCTION TO UH-1 GUNNERY

1. KNOWLEDGES: Without the aid of notes or other reference material, the student will be able to—

   a. List two of the three variables of scoring.

   b. List four of the six prerange firing requirements which must be met prior to firing on any range.

   c. List three of the four conditions which must be met prior to arming the weapons subsystem.

2. SKILLS: None.

NOTES

DEPARTMENT OF TACTICS
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Fort Rucker, Alabama

April 1969
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STUDENT OUTLINE

INTRODUCTION TO UH-1 GUNNERY

1. Classroom instruction.

2. Flight instruction.

3. Grading procedure.

4. Range orientation.

a.

b.

c.

d.

e.

f.

g.

5. Range safety.

a.

b.

c.

6. Conduct of a day's firing.

a.

b.

c.

d.

DEPARTMENT OF TACTICS
UNITED STATES ARMY AVIATION SCHOOL
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PERFORMANCE CHECK

INTRODUCTION TO UH-1 GUNNERY

1. What grade must you receive during this course to receive a rating of gunnery instructor pilot?

2. At what point during a firing run is the gun switch placed in the HOT position?

3. What requirements must be met prior to placing the gun switch in the HOT position?

4. What variables should be taken into consideration when grading a student's performance?

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DEPARTMENT OF TACTICS
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April 1969
File Nos. 39-292-1
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PERFORMANCE OBJECTIVES

PRINCIPLES OF AERIAL FIRE BALLISTICS

1. KNOWLEDGES: Without notes or references and without errors, the student will be able to—

   a. List the three phases of ballistics.

   b. List four of the seven ballistic factors common to all weapons systems.

   c. List the two ballistic factors unique to flexible weapons.

   d. List the two methods used for stabilizing projectiles.

   e. List four of the six major ballistic factors affecting rockets.

2. SKILLS: None.

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ADVANCE SHEET

PRINCIPLES OF AERIAL FIRE BALLISTICS

PURPOSE: This conference is designed to provide you with a background knowledge of the ballistic factors that affect projectiles fired from a moving platform so that you will be better able to instruct in ordnance delivery techniques.

SUMMARY: The conference begins with a discussion of the three phases of ballistics. The discussion then moves to a detailed discussion of the external phase with particular emphasis on the ballistic factors affecting flexible-mode firing. These ballistic factors affect all flexible weapons but have more effect on the lower muzzle velocity systems such as the M5. Of course, there is a direct relationship between ballistic factors and aircraft speed/deflection angle. The last portion of this block of instruction is devoted to stowed-weapon ballistics with primary emphasis going to the 2.75-inch folding fin aerial rocket. The discussion will cover all the major ballistic factors as well as minor, unpredictable factors which affect accuracy.

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STUDENT OUTLINE

PRINCIPLES OF AERIAL FIRE BALLISTICS

1. Three phases of ballistics.

   a.

   b.

   c.

2. Ballistic factors common to all weapons systems.

   a.

   b.

   c.

   d.

   e.

   f.

   g.

3. Ballistic factors for flexible weapons systems.

a.

b.

4. Methods for stabilizing projectiles.

a.

b.

5. Ballistic factors for stowed weapons systems.

a.

b.

c.

d.

e.

f.

(1)

(2)

g. Miscellaneous factors.

(1)

(2)

(3)

(4)

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PERFORMANCE CHECK

PRINCIPLES OF AERIAL FIRE BALLISTICS

1. List the three phases of ballistics.

a.

b.

c.

2. List four of the seven ballistic factors common to all weapons systems.

a.

b.

c.

d.

3. List the two ballistic factors unique to flexible weapons.

a.

b.

4. List the two methods used for stabilizing projectiles.

a.

b.

5. List four of the seven major ballistic factors affecting rockets.

a.

b.

c.

d.

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January 1969
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PERFORMANCE OBJECTIVES

ATTACK HELICOPTER EMPLOYMENT, THE CARDINAL RULES

1. KNOWLEDGES: Without the aid of notes, references, and without errors, the student will be able to—

   a. Write from memory the 12 cardinal rules of attack helicopter employment. The rules need not be verbatim.

   b. Write the cardinal rule being violated in four sketches of tactical situations involving attack helicopters.

2. SKILLS: None.

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January 1969
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67-456-1

ADVANCE SHEET

ATTACK HELICOPTER EMPLOYMENT, THE CARDINAL RULES

PURPOSE: This conference is designed to provide you—as future attack (armed observation) helicopter pilots—with several vital rules which will apply to the majority of missions performed by attack (armed observation) helicopter units in the Republic of South Vietnam.

SUMMARY: This period of instruction is concerned with attack (armed observation) helicopter tactics and employment techniques at the fire team (scout team) level. The 12 cardinal rules have been proven in combat from the utilization of the first attack (armed observation) helicopter team in South Vietnam up to the present day. Variations of certain rules due to terrain and situation differences will be mentioned. This period will provide each student with tested guidelines which will enable him to make sound tactical, on-the-spot decisions.

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STUDENT OUTLINE

ATTACK HELICOPTER EMPLOYMENT, THE CARDINAL RULES

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

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PERFORMANCE CHECK

ATTACK HELICOPTER EMPLOYMENT, THE CARDINAL RULES

1. Write from memory the 12 cardinal rules.

   a.

   b.

   c.

   d.

   e.

   f.

   g.

   h.

   i.

   j.

   k.

   l.

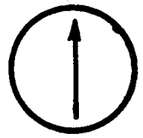
2. Each of the following sketches depicts a typical tactical situation involving attack (armed observation) helicopter employment. Write the rule being violated in the space provided.

NOTE:

PLATOON LEADER

FIRE TEAM LEADER

WINGMAN



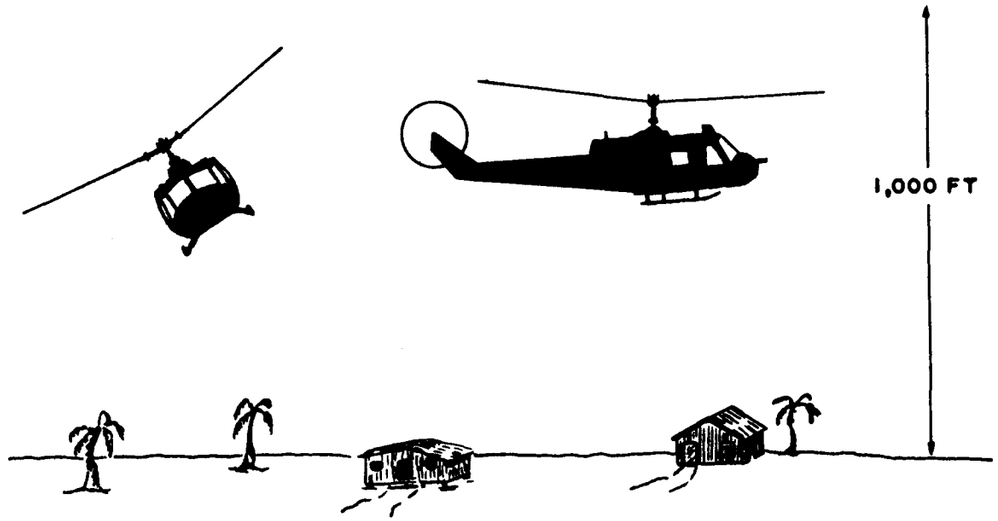
ANTIAIRCRAFT WEAPON

AUTOMATIC WEAPON

No. 1

ANSWER: _____

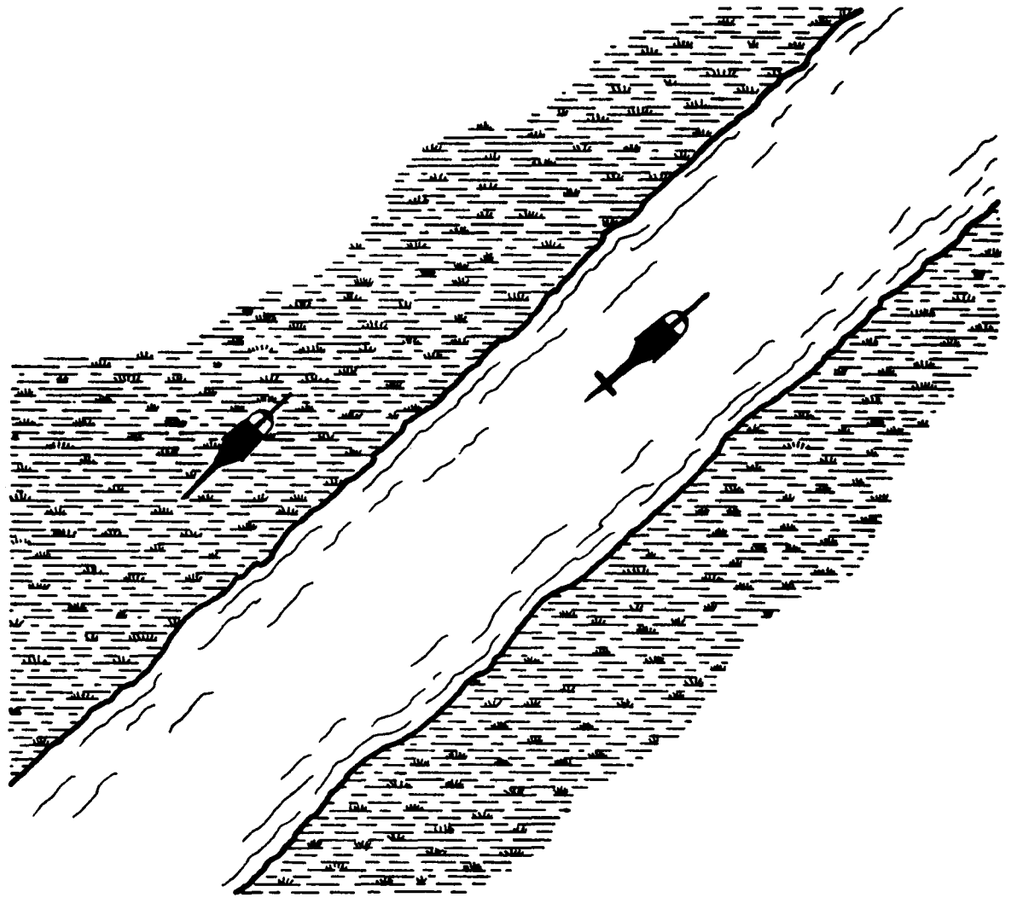
_____



No. 2

ANSWER: _____

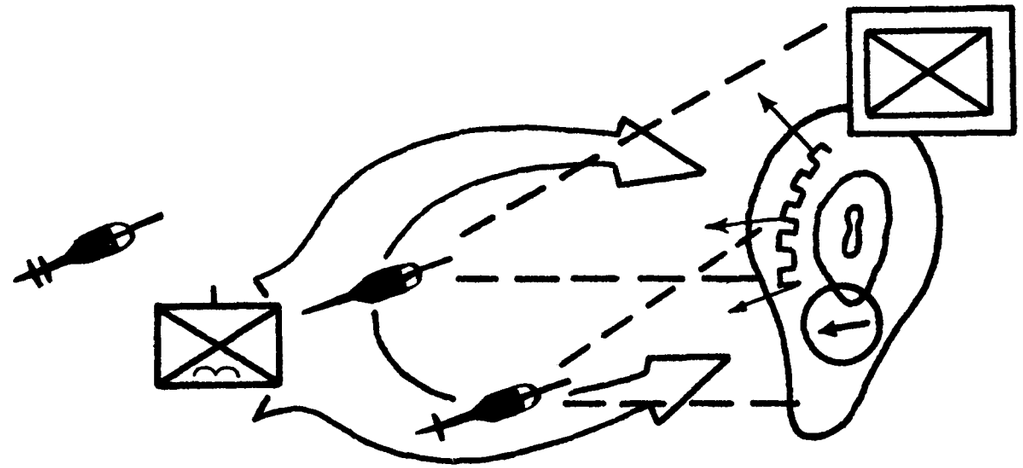
_____



No. 3

ANSWER: _____

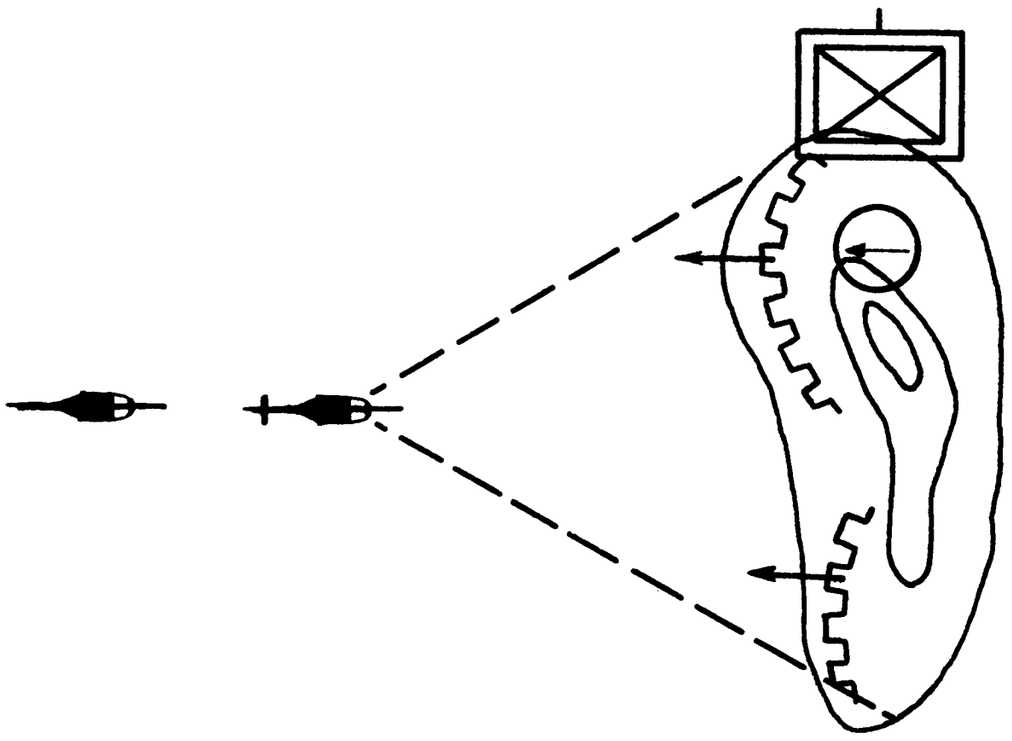
_____



No. 4

ANSWER: _____

_____



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May 1969
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PERFORMANCE OBJECTIVES

ROTARY WING AERIAL FIRE RANGES

1. KNOWLEDGES: Without the aid of notes or references and without errors, the student will be able to—

   a. Name the four major areas in the surface danger area.

   b. State the two minimum range-marking requirements.

   c. State the four basic types of targets used on aerial ranges.

   d. Name four of the range facilities required on an aerial range.

   e. State who has overall responsibility of all operations on an aerial range.

   f. State the four basic terrain considerations common to aerial fire ranges.

2. SKILLS: None.

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May 1969
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ADVANCE SHEET

ROTARY WING AERIAL FIRE RANGES

PURPOSE: This discussion will provide the student with a general understanding of considerations in the planning and use of aerial ranges.

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May 1969
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STUDENT OUTLINE

ROTARY WING AERIAL FIRE RANGES

1. Aerial gunnery range.

   a. Firing lane.

   b. Target lane.

   c. Impact area.

   d. Area "G."

2. Range markings.

a. Minimum required.

b. Coloring.

3. Targets.

a. Types.

b. Uses.

4. Range facilities and operating procedures.

a. Range facilities.

b. Operating procedures.

c. Range references.

5. Supervisory responsibilities.

a. Officer in charge (OIC).

b. Range control officer (RCO).

c. NCOIC.

d. Ammunition NCOIC.

6. Terrain considerations.

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May 1969
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PERFORMANCE CHECK

ROTARY WING AERIAL FIRE RANGES

1. What are the four major areas of the range fan?

2. The senior officer of the unit using the range in active participation is the _____.

3. What are the maximum angular limits that targets may be engaged to the left or right of the range azimuth centerline?

4. What are the two minimum range markers?

5. What are the four basic terrain considerations common to aerial fire ranges?

6. What are the four basic types of targets used on aerial ranges?

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PERFORMANCE OBJECTIVES

TECHNIQUES OF FIRE FOR AERIAL WEAPONS SYSTEMS

1. KNOWLEDGES: Without the aid of notes or references and without errors, the student will be able to—

   a. State three commonly used sighting techniques used in rocket firing, how they are employed, their applications and limitations.

   b. State three methods of range determination and give description of the use of each method to include applications and limitations.

   c. State the flight techniques required of the aviator to place accurate fire, either stowed or flexible, on a target.

   d. State three types of night illumination and explain how firing at night is critical as far as range estimation is concerned.

   e. State the sight picture compensation required when firing rockets in a crosswind.

2. SKILLS: None.

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ADVANCE SHEET

TECHNIQUES OF FIRE FOR AERIAL WEAPONS SYSTEMS

PURPOSE: This instruction is designed to provide the student with a working knowledge of the sighting techniques, range determination, night firing, and special flight techniques associated with firing of aerial weapons systems.

DISCUSSION POINT:

1. SIGHTING TECHNIQUES:

   a. Of the three commonly used sighting techniques for stowed fire, the combat sight setting is the most sound for field use.

   b. The flexible sighting systems for automatic guns are extremely accurate and require little time to become proficient.

2. Range determination must be mastered by the armed helicopter commander in order to place accurate fire on all targets.

3. The nature of the target, the nature of the terrain, visibility conditions, and other factors affect visual range determination.

4. Enfilade, plunging, and diving fire techniques are used in aerial weapons systems.

5. Coordination and control touch are important individual flight techniques when firing aerial weapons systems.

STUDY ASSIGNMENTS: None.

SPECIAL INSTRUCTIONS: None.

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STUDENT OUTLINE

TECHNIQUES OF FIRE FOR AERIAL WEAPONS SYSTEMS

1. Sighting techniques.

   a. Stowed fire.

      (1) AIRCRAFT PLACKARD

      (2) PIPER INTERSECTION - TO MUCH MANUAL & MATHMATICAL MANIPULATION REQUIRED MAKES THIS METHOD TOO INFLEXIBLE

      (3) COMBAT SIGHT SETTING - MOST OFTEN USED 600', 60K 1250 M SLANT RANGE, PIPER ON TARGET, FIRE, ROTATE PIPER TO WHERE THE BURST HIT, FIRE A

   b. Flexible fire.

      (1) M16 and M21. HARMONIZED AT 750 M (TRACER BURN OUT)

      (2) M5. 100', 90K & 1000 M SLANT RANGE

2. Range estimation. (BIGGEST PROBLEM)

   a. Estimation by the eye. MOST COMMONLY USED, FAST & FLEXIBLE BUT LEAST ACCURATE AS EYE IS OFTEN DECEIVED.

   b. Map and photomaps.
      GIVES POINTS OF REFERENCE

   c. Friendly troops.

D. OPTICAL SIGHT

OF TARGETS TO FILL RECTICLE x 100 = DISTANCE (RANGE) TO TARGET.

3. Types of fire.

a. Enfilade fire. PLACING LONG AXIS OF BEATEN ZONE (IMPACT AREA) ALONG LONG AXIS OF TARGET

b. Plunging fire. FIRING INTO A HILLSIDE

c. Diving fire. HIGH ANGLE TO CONCENTRATE BEATEN ZONE

4. Flight techniques and fire control techniques.

a. Coordination.

(1) Stowed fire. OUT OF TRIM CAUSES ROCKET TO VANE INTO THE WIND.

(2) Flexible fire. AFFECTED RELATIVELY LITTLE BY OUT OF TRIM CONDITIONS.

b. Control touch. VERY IMPORTANT. COCKPIT TURBULENCE IS A HANDICAP.

c. Airspeed. 60K HERE

(1) Rockets. ON HELOS BECOME MORE UNSTABLE AS A/S INCREASES

(2) Automatic guns. AT HIGH A/S MUST LEAD MORE. GUNS ARE AS ACCURATE BUT HELO IS LESS STABLE WITH INCREASING A/S.

(3) M5. DIFFICULT TO LEARN

d. Turning error. AIM HIGH AND OPPOSITE DIRECTION OF BANK (TURN) DON'T FIRE ROCKETS IN A TURN OR BANK

e. Crosswind. FLEXIBLE SYSTEMS ARE NOT AFFECTED, ROCKETS ARE AIMED UPWIND 4 MILS FOR EVERY 10 KNOTS ABOVE 10 KNOTS.

f. Night firing. RANGE ESTIMATION IS QUITE DIFFICULT BECAUSE OF A LACK OF A REFERENCE POINT. RULE OF THUMB IS TO ADD ½ TO YOUR BEST ESTIMATE. NIGHT ILLUMINATION MAY HELP SOME. FIREFLY IS BEST NIGHT ILLUM. ALSO HAVE AL FLARES AND ARTILLERY FLARES.

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PERFORMANCE CHECK

TECHNIQUES OF FIRE FOR AERIAL WEAPONS SYSTEMS

1. Describe the three sighting techniques used in rocket firing.

2. Describe the two types of flexible weapons sights and explain which of the two requires more time to become proficient (M21/M16 or M5).

3. Describe the four methods of range determination, stating applications and limitations to each.

4. Briefly describe the three types of fire.

5. Discuss the five special flight techniques as they pertain to aerial weapons.

6. When firing rockets, utilizing the MK8 or XM60 sight, in a 90-degree right cross-wind condition of 20 knots at a target range of 1,250 meters, what sight correction and in what direction would achieve the best results?

7. When in a coordinated right turn, firing any of the aerial weapons systems, what is the proper sight correction?

8. Describe four methods of night illumination.

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July 1969
File Nos. 30-261-1
67-261-1

PERFORMANCE OBJECTIVES

XM3 ORIENTATION

1. KNOWLEDGES: Without the aid of notes or references and without errors, the student will be able to—

   a. List the five components of the launcher system.

   b. List the six components of the fire control system.

   c. State the maximum effective and minimum engagement range of the XM3 subsystem.

   d. State the proper action taken in the event of misfire.

   e. State the weight of the XM3 subsystem (fully loaded) with the 10-pound warhead.

2. SKILLS: None.

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ADVANCE SHEET

XM3 ORIENTATION

PURPOSE: This instruction is designed to provide the student with a working knowledge of the XM3 armament subsystem.

PERFORMANCE OBJECTIVES:

1. Knowledges. Without the aid of notes or references and with no errors, the student will be able to—

   a. List the five components of the launcher system.

   b. List the six components of the fire control system.

   c. State the maximum effective and minimum engagement range of the XM3 subsystem.

   d. State the proper action taken in the event of misfire.

   e. State the weight of the XM3 subsystem (fully loaded) with the 10-pound warhead.

2. Skills: None.

DISCUSSION POINTS:

1. The maximum effective range of the XM3 subsystem is 2,500 meters.

2. The minimum engagement range of the XM3 subsystem is 300 meters.

3. The five components of the launcher system are—

   a. Pod.

   b. Supporting structure.

   c. Crank.

   d. Crossbeam.

   e. Adapter frame.

4. The six components of the fire control system are—

   a. Interconnecting box.

   b. Rocket armament panel.

   c. MK8 sight.

   d. Intensity control panel.

   e. Firing switches and associated circuit breakers.

   f. Cable and harness assembly.

5. The weight of the XM3 subsystem (fully loaded) is approximately 1,439 pounds (10-pound warhead).

6. The rocket pods should be jettisoned in the event of a fire or explosion in a rocket pod or aircraft emergency requiring a forced landing.

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STUDENT OUTLINE

XM3 ORIENTATION

1. Capabilities.

2. Launcher system.

   a. Supporting structure.

   b. Crank and crossbeam.

c. Adapter frame.

d. Launcher pod.

3. Fire control system.

a. Interconnecting box.

b. Rocket armament panel.

c. MK8 sight.

d. Intensity control panel.

e. Firing switches and circuit breakers.

f. External cables and harness assembly.

4. Preflight.

5. Emergency procedures.

a. Jettison.

b. Misfire.

6. Destruction of material.

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PERFORMANCE CHECK

XM3 ORIENTATION

1. List the five components of the launcher system.

   a.

   b.

   c.

   d.

   e.

2. List the six components of the fire control system.

   a.

   b.

   c.

   d.

   e.

   f.

3. State the maximum effective and minimum engagement range of the XM3 subsystem.

a.

b.

4. State proper emergency procedure in event of fire or explosion in a rocket pod.

5. State the proper action taken in the event of misfire.

6. State the weight of the XM3 subsystem (fully loaded) with the 10-pound warhead.

DEPARTMENT OF TACTICS
UNITED STATES ARMY AVIATION SCHOOL
Fort Rucker, Alabama

July 1969
File No. 67-251-1(C)

PERFORMANCE OBJECTIVES

M5 INTRODUCTION

1. KNOWLEDGES: Without the aid of notes or references, the student will be able to write without error—

   a. Four of the six components of the M5 subsystem.

   b. The total weight of the subsystem, including all components and ammunition.

   c. The flexible limits of the turret.

   d. The movement of the gun when the turret control switch on the sighting station is released.

   e. The muzzle velocity of the M384 (HE) projectile.

2. SKILLS: None.

NOTES

DEPARTMENT OF TACTICS
UNITED STATES ARMY AVIATION SCHOOL
Fort Rucker, Alabama

July 1969
File No. 67-251-1(C)

ADVANCE SHEET

M5 INTRODUCTION

WEAPON DATA:	
WEAPON:	One M75 grenade launcher.
AMMUNITION:	
TYPE:	40mm (linked).
AMOUNT:	150 rounds.
RATE OF FIRE:	220 shots per minute.
OPERATION:	
STOWED:	Fired by pilot or copilot.
	Elevation - +15°.
	Depression - -35°.
FLEXIBLE:	Elevation - +15°.
	Depression - -35°.
	Deflection - 60° right or left of centerline of helicopter.
ADD:	Lead angle compensator device.
RANGE:	
MAXIMUM EMPLOYABLE:	1,750 meters.
MAXIMUM EFFECTIVE:	1,200 meters.

1. Components of the M5 subsystem.

a. Turret. The turret is mounted on nose of helicopter and serves as a platform for the M75 grenade launcher.

b. M75 grenade launcher. The M75 is an air-cooled, electric-motor driven, 40mm, rapid-firing weapon capable of launching antipersonnel, fragmentation-type projectiles. It is percussion-fired and metallic link-belt fed.

c. Feed system.

(1) Ammunition booster. The ammunition booster assists the gun in pulling ammunition from the ammunition box through the flexible chuting. The booster is mounted on a shelf inside the electronic equipment compartment.

(2) Ammunition. The ammunition box is of stainless steel construction and is located slightly left of the fore-aft centerline of the helicopter under the troop seat. Maximum capacity of the box is 75 rounds.

(3) Ammunition feed chuting. The ammunition feed chuting consists of two sections of flexible chute. The forward section connects the ammunition feed chute assembly on the turret to the exit end of the ammunition booster. The aft section completes the system from the entrance end of the booster to the ammunition box. Seventy-five rounds of ammunition are contained in the flexible chuting.

d. Turret control panel. The turret control panel is mounted in the lower left corner of the pedestal console. The face of the panel contains the indicators and controls for applying power to the system, for determining rounds remaining in the system, and for selecting the gun elevation for the stow position.

e. Sighting station. The sighting station provides the means for remotely directing and firing the gun. The mounting pivot axis system matches the azimuth and elevation coordinate system used on the turret so that the correct relationship between the gunner's line of sight and the gun line of fire is maintained throughout the field of fire. The sighting station is composed of two major elements—the suspension system and the hand control with sight.

f. Servo-amplifier and junction box. The servo-amplifier and junction box contain two servo-amplifiers and the system relay switching and control circuits. Test jacks are externally mounted to permit troubleshooting without having to remove the box cover. The box is located in the baggage compartment of the helicopter.

2. Ammunition. The M5 armament subsystem uses the 40mm high-explosive (HE) M384 cartridge. The M384 has a muzzle velocity of 790 feet per second. The M384 antipersonnel, fixed-type ammunition cartridge consists of a steel projectile body and a point-detonating fuze.

3. Capabilities. The M5 armament subsystem is designed to fire 40mm grenade projectiles as a direct-fire, or area-fire weapon against troops, lightly armored vehicles, and other soft-materiel targets. It provides an immediately responsive and highly mobile means of delivering volume area nonnuclear fires in support of airmobile and ground maneuver elements.

4. Limitations.

a. The M5 armament subsystem is vulnerable to all types of air defense forces, including small arms.

b. Effectiveness of operation is reduced at night and during periods of low visibility due to limitations in target acquisition and range estimation.

c. Engagement of targets is limited by function of gun-turret range, altitude, airspeed, and helicopter degree of bank as they relate to the subsystem's flexible limitations.

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File No. 67-251-1(C)

STUDENT OUTLINE

M5 INTRODUCTION

1. Components.

a. Turret.

b. M75 grenade launcher.

c. The feed system.

(1) Ammunition booster.

(2) Ammunition box.

(3) Ammunition feed chuting.

d. Turret control panel.

e. Sighting station.

(1) Suspension system.

(2) Hand control.

(3) Lead angle compensator.

f. Servo-amplifier and junction box.

2. Ammunition.

3. Capabilities and limitations.

a. Capabilities.

b. Limitations.

4. New developments.

DEPARTMENT OF TACTICS
UNITED STATES ARMY AVIATION SCHOOL
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July 1969
File No. 67-251-1(C)

PERFORMANCE CHECK

M5 INTRODUCTION

1. List four of the six components of the M5 subsystem.

a.

b.

c.

d.

e.

f.

2. What are the flexible limits of the M5 subsystem?

3. What is the rate of fire of the M75 grenade launcher?

4. What is the total weight of the M5 subsystem, including 150 rounds of ammunition?

5. What is the movement of the gun when the turret control switch on the sighting station is released?

6. What is the maximum employable range of the M5 subsystem?

7. List two capabilities of the M5 subsystem.

   a.

   b.

8. What is one limitation of the M5 subsystem?

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Fort Rucker, Alabama

January 1969
File No. 67-211-1

PERFORMANCE OBJECTIVES

M60C DISASSEMBLY, ASSEMBLY, AND TROUBLESHOOTING

1. KNOWLEDGES: Without the aid of notes or references, the student will be able to—

   a. List, with 80 percent accuracy, the type, operation, feed, weight, rate of fire, and effective range of the M60C machinegun.

   b. Name six of the nine assemblies of the M60C.

   c. State the definition of a malfunction and a stoppage.

   d. State the most common cause of stoppages.

   e. State the immediate action and four of the five subsequent actions available to the gunner.

   f. State the condition that must be met to render the gun safe.

2. SKILLS: When provided with an M60C machinegun, the student will be able to—

   a. Disassemble the M60C machinegun to the user's limit of disassembly within 5 minutes.

   b. Assemble the M60C machinegun correctly within 5 minutes.

NOTES

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ADVANCE SHEET

M60C DISASSEMBLY, ASSEMBLY, AND TROUBLESHOOTING

PURPOSE: This instruction is designed to briefly acquaint the student with the characteristics, nomenclature, troubleshooting procedures, and the basic assembly/disassembly of the M60C machinegun.

DISCUSSION POINTS:

1. Malfunctions and corrective action used to keep the gun in operation.

2. Stoppages and their causes as they relate to the cycle of functioning.

3. Immediate and subsequent action that is available to the gunner to clear stoppages.

4. Safety precautions to be observed when handling the gun.

STUDY ASSIGNMENTS: None.

SPECIAL INSTRUCTIONS:

1. Be prepared to discuss the points listed above.

2. Bring to class the Student Outline and this Advance Sheet.

ADDITIONAL INSTRUCTIONAL MATERIAL: Annex A (Troubleshooting Guide) to Advance Sheet.

NOTES

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ANNEX A (TROUBLESHOOTING GUIDE) TO ADVANCE SHEET

M60C DISASSEMBLY, ASSEMBLY, AND TROUBLESHOOTING

These are the more common malfunctions and stoppages.

Malfunction	Probable causes	Corrective action
Failure to feed.	Insufficient gas pressure.	Clean gas port.
	Feed pawl defective.	Replace defective assembly.
	Feed pawl spring defective.	Replace defective assembly.
	Front and rear cartridge guides defective.	Replace defective assembly.
	Feed lever cam spring defective.	Replace defective assembly.
	Bolt cam actuator roller defective.	Replace defective assembly.
	Lubrication inadequate.	Apply lubricant as required.
	Defective link of ammunition.	Insert new ammunition or link.
	Ammunition belt installed wrong.	Reverse belt with open portion of link down.
	Defective cover latch.	Replace defective assembly.
	Damaged or weakened operating rod spring.	Replace.
	Obstruction by foreign substances or material in receiver.	Remove item blocking movements; clean and lubricate as required.
Failure to chamber.	Ruptured cartridge case.	Remove.
	Caked carbon in gas cylinder.	Remove carbon.
	Caked carbon in receiver.	Remove carbon.

	Damaged round.	Recharge weapon.
Failure to fire.	Broken or damaged firing pin.	Replace. (Check aperture in face of bolt.)
	Broken or damaged firing pin spring.	Replace.
	Faulty ammunition.	Remove ammunition.
	Dirty chamber.	Clear and clean or change barrel.
	Weakened or damaged operating rod spring.	Replace.
Failure to extract.	Broken extractor or spring.	Replace.
	Short recoil.	Clean out gas port with wrench.
	Gas (floating) piston installed backward.	Install properly.
Failure to eject.	Short recoil.	Clean out gas port with wrench.
	Frozen or damaged ejector or ejector spring.	Clean and/or replace.
Failure to cock.	Broken sear.	Replace defective assembly.
	Deformed operating rod sear notch.	Replace defective assembly.
	Obstructions in receiver.	Clean as required.
	Broken, defective, or missing sear plunger and/or spring.	Replace defective assembly.
	Short recoil.	Clean gas port and cylinder.
Uncontrolled fire.	Broken or worn sear.	Replace defective assembly.
	Worn sear notch on operating rod.	Replace defective assembly.

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STUDENT OUTLINE

M60C DISASSEMBLY, ASSEMBLY, AND TROUBLESHOOTING

1. M60C machinegun.

a. Description.

AIR COOLED GAS OPERATED METALLIC BELT FED

b. Weight. 21 LBS.

c. Rate of fire.

d. Effective range.

2. Nine assemblies.

a. BARREL OFF (CONSIDERED SAFE)

b. FEED COVER ASSEMBLY

c. FEED TRAY ASSEMBLY

d. TRIGGER ACTUATOR

e. BACK PLATE

f. BUFFER

g. OPERATING ROD

h. BOLT ASSEMBLY

i. RECEIVER GROUP

3. Disassembly and assembly.

4. Malfunction.

a. Definition.

GUN WORKS BUT IS WORKING INCORRECTLY

b. Sluggish operation.

c. Runaway gun(s).

5. Corrective action.

a. Sluggish operation.

b. Runaway gun(s).

6. Stoppages.

a. Definition.

GUN WILL NOT WORK

b. Failure to feed.

c. Failure to chamber.

d. Failure to lock.

e. Failure to fire.

f. Failure to unlock.

g. Failure to extract.

h. Failure to eject.

i. Failure to cock.

7. Immediate action.

a. Definition.

RECYCLE

b. Application.

8. Subsequent action.

INVESTIGATE CAUSE

CIRCUIT BREAKERS
ELECTRICAL & HYDRAULIC LINES TO WEAPON
V FOR BENT OR JAMMED LINES

1ST STEP OF SUBSEQUENT ACTION IS
① TAKE THE BARREL OFF (QUIT) WHICH MAKES IT SAFE

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PERFORMANCE CHECK

M60C DISASSEMBLY, ASSEMBLY, AND TROUBLESHOOTING

1. The M60C machinegun is _____ cooled, _____ operated, fed by _____ _____ _____ _____ and weighs _____ pounds. It has an effective range of _____ meters with a rate of fire of _____ shots/minute.

2. List the nine assemblies of the M60C machinegun.

a.

b.

c.

d.

e.

f.

g.

h.

i.

3. List the sequence of disassembly.

4. Define malfunction and stoppage.

5. Give the most common cause of stoppages and why.

6. Give the immediate action available to the gunner.

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File Nos. 30-281-2
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PERFORMANCE OBJECTIVES

ATTACK HELICOPTER MISSIONS

1. KNOWLEDGES: Without the aid of notes or other reference material, the student will be able to correctly—

(Period one of two periods)

a. List the five paragraphs and major subparagraphs of the operations order.

b. List the METT planning factors.

c. Write the most important principle in any reconnaissance mission.

d. Name the four types of reconnaissance missions.

e. List three of the five types of security missions.

(Period two of two periods)

f. List the three types of direct fire support delivered by attack helicopters.

g. List the three phases of support for an airmobile escort.

h. List the ideal organization of a convoy escort force.

i. Write the purpose of debriefings as stated in class.

2. SKILLS: None.

NOTES

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ADVANCE SHEET

ATTACK HELICOPTER MISSIONS

PURPOSE: This conference is designed to familiarize you with the variety of missions attack helicopters are capable of performing, the planning which must precede the conduct of the missions, the support required, and the coordination necessary for the success of these missions.

PERFORMANCE OBJECTIVES:

1. KNOWLEDGES: Without the aid of notes or other reference material, the student will be able to correctly—

   (Period one of two periods)

   a. List the five paragraphs and major subparagraphs of the operations order.

   b. List the METT planning factors.

   c. Write the most important principle in any reconnaissance mission.

   d. Name the four types of reconnaissance missions.

   e. List three of the five types of security missions.

   (Period two of two periods)

   f. List the three types of direct fire support delivered by attack helicopters.

   g. List the three phases of support for an airmobile escort.

   h. List the ideal organization of a convoy escort force.

   i. Write the purpose of debriefings as stated in class.

2. SKILLS: None.

DISCUSSION POINTS:

1. Mission planning.

   a. Preplanned. When time and the situation permit, a premission briefing should be conducted, utilizing the Operations Order.

(1) Situation.

(2) Mission.

(3) Execution.

(4) Administration and logistics.

(5) Command and signal.

b. Immediate mission planning. Because of the attack helicopter's ability to change missions rapidly, many situations do not allow time for premission planning. In this situation, the battle-tested factors of METT have proven to be adequate planning factors to be considered by the mission leader prior to the conduct of his mission.

(1) Mission.

(2) Enemy.

(3) Terrain and weather.

(4) Troops available.

2. Reconnaissance/security missions. The attack helicopter extends and augments the ground forces' reconnaissance and security efforts. This is accomplished by the ability to provide rapid information about the enemy and terrain for either purpose; therefore, these missions are classified "Reconnaissance/Security." In addition, the attack helicopter can perform limited independent missions.

NOTE: Attack helicopters are on a continuous reconnaissance.

a. Reconnaissance - the directed effort in the field to collect information about the enemy and area of operation by ground and air means.

(1) Zone reconnaissance is the directed effort to obtain detailed information on all routes, terrain, and enemy forces within a zone defined by specific boundaries.

(2) Area reconnaissance is a detailed reconnaissance of all routes, terrain, and enemy forces within a specific and clearly defined area. The area reconnaissance is normally conducted over a smaller area and with a smaller force than a zone reconnaissance.

(3) Route reconnaissance is the directed effort to obtain information on the route, obstacles, and enemy along a specified route and the terrain adjacent to it which, if occupied by the enemy, would affect movement along the route. Route reconnaissance may be performed independently or as a part of a zone or area reconnaissance.

(4) Reconnaissance by fire is a technique of observation, not necessarily a different type of reconnaissance mission, as it may be used during the other types of reconnaissance.

b. Security - all measures taken to protect the command from espionage, observation, sabotage, annoyance, or surprise.

(1) Advance guard.

(2) Flank guard.

(3) Rear guard.

(4) Screening force.

(5) Rear area security.

3. Direct fire support missions. Attack helicopter fires fall into three general types. The distinction between the three depends upon the desired results.

a. Types of fire.

(1) Neutralization - fire delivered for the purpose of reducing the combat efficiency of the enemy by hampering or interrupting the fire of his weapons, by reducing his freedom of action, by reducing his ability to inflict casualties on friendly troops, and by severely restricting his movement within an area.

(2) Destruction - fire delivered for the sole purpose of destroying material targets.

(3) Combined - due to the capability of attack helicopters to carry more than one type of ordnance. Destruction fires may be conducted simultaneously with neutralization fires.

b. Preplanned fire missions. Time permitting, missions are usually planned prior to takeoff on the mission.

(1) Preplanned area fire missions.

(a) Preparation - a heavy volume of fire to secure a suspected or actual enemy position prior to and during the initiation of an assault.

(b) Diversionary fire - delivered into an area to draw attention and possible enemy forces away from the principal area of operation.

(c) Base of fire - delivering fire that supports the advance or maneuver of friendly forces.

(d) Interdicting fire - the delivery of fire into a designated area to deny the use of that area to the enemy.

(e) Counter-preparation - the delivery of fire into enemy fire-support positions.

(2) Preplanned designated point. Preplanned fire on designated points is delivered with the intent of destroying material targets.

c. Immediate fire missions. Planning is not accomplished prior to departure on the mission. Immediate fire missions are those which become required randomly due to a change in the tactical situation or because unexpected targets present themselves.

(1) Immediate area fire mission - requires that a situation develop for which previous planning was not possible.

(a) Preparation fire.

(b) Base of fire.

(c) Interdicting fire.

(d) Targets of opportunity.

(2) Immediate point target fire missions - delivered on point targets which are acquired in the battle area.

(a) Targets of opportunity.

(b) Counter-measure fire - primarily employed to break contact.

4. Escort missions. An escort mission is the act of providing reconnaissance/security and direct fire to insure the successful transit of an element from one point to another. These missions are defensive in nature but internally offensive; also, reconnaissance/security tasks contribute to the overall conduct of the mission.

a. Escort of airmobile forces. In the accomplishment of this mission, protection and security of the transport helicopter is paramount; this includes the security of the staging area, enroute protection, and neutralization of enemy fire in the landing zone. Attack helicopters are frequently called upon to make a landing zone reconnaissance and/or prestrike prior to the arrival of the transport helicopters.

b. Ground convoy escort. Attack helicopters are ideally suited for this task. It is felt that the attack helicopters should be organized into two elements.

(1) Reconnaissance force precedes the column and reconnoiters the route providing timely and accurate reports on the route, critical terrain adjacent to the route, and likely ambush sites.

(2) Strike force provides protection in the immediate vicinity of the convoy by flying in orbits around the column or making S-turns over the route of advance.

5. Mission debriefings. Normally prepare for next mission; then, debrief.

a. Purpose is to gain intelligence and operational information.

b. Debrief individual flight crews.

c. Debrief flight leaders.

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STUDENT OUTLINE

ATTACK HELICOPTER MISSIONS

1. Mission planning.

a. Preplanned missions.

(1) Situation.

(a)

(b)

(c)

(2) Mission.

(3) Execution.

(a)

(b)

(c)

(d)

1.

2.

3.

4.

5.

(4) Administration and logistics.

(a)

(b)

(c)

(d)

(5) Command and signal.

(a)

(b)

b. Immediate mission planning.

(1) Mission.

(2) Enemy.

(a)

(b)

(c)

(d)

(e)

(3) Terrain and weather.

(4) Troops and equipment available.

2. Reconnaissance/security.

a. Reconnaissance definition.

(1) Principles of reconnaissance.

(2) Types of reconnaissance.

(a) Zone reconnaissance.

(b) Area reconnaissance.

(c) Route reconnaissance.

(d) Special reconnaissance.

(3) Techniques of reconnaissance.

(a) Reconnaissance by fire.

(b) Others.

b. Security definition.

(1) Principles of security.

(a)

(b)

(c)

(d)

(e)

(2) Types of security missions.

(a)

(b)

(c)

(d)

(e)

3. Direct fire support.

a. Types of fire.

(1)

(2)

(3)

b. Preplanned fire missions.

(1) Area fires.

(a)

(b)

(c)

(d)

(e)

(2) Designated point fire.

c. Immediate fire missions.

(1) Area fires.

(a)

(b)

(c)

(d)

(2) Point target fire.

(a)

(b)

4. Escort missions.

a. Airmobile escort.

(1)

(2) Phases of support.

(a)

(b)

(c)

b. Ground convoy escort.

(1)

(2) Organization.

(a)

(b)

c. Other (downed aircraft and crews).

(1) Support.

(2) Recovery.

5. Mission debriefings.

a. Definition.

b. Crew debriefing.

c. Flight leader debriefing.

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PERFORMANCE CHECK

ATTACK HELICOPTER MISSIONS

1. List, in order, the five paragraphs of the operation order.

a.

b.

c.

d.

e.

2. List the METT planning factors.

a.

b.

c.

d.

3. The most important principle in any reconnaissance mission is the _____ _____.

4. List the four major types of reconnaissance.

a.

b.

c.

d.

5. List three of the five types of security missions.

a.

b.

c.

6. List the three types of fire delivered by attack helicopters.

a.

b.

c.

7. List the three phases of support for an airmobile escort.

a.

b.

c.

8. What is the ideal organization of a ground convoy escort force?

9. What is the purpose of debriefings.

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PERFORMANCE OBJECTIVES

M22 ORIENTATION

1. KNOWLEDGES: Without the aid of notes or references and with no errors, the student will be able to list—

   a. The size and weight of the AGM-22B missile.

   b. The number of rounds that are carried on the M22 system.

   c. The maximum and minimum practical ranges and the distance from launch point that the warhead becomes armed.

   d. The four components of the external hardware.

   e. The five major components of the internal hardware.

2. SKILLS: None.

NOTES

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ADVANCE SHEET

M22 ORIENTATION

PURPOSE: This instruction is designed to acquaint the student with the functioning and capabilities of the M22 armament subsystem.

DISCUSSION POINTS:

1. The M22 wire-guided missile armament subsystem is a point-fire, antitank weapon developed by Nord Aviation Company of France. Containing a shaped charge capable of defeating any known armored vehicle in the world today, the M22 missile can also be successfully employed against other hard targets such as fortifications, bunkers, and gun emplacements.

2. The system, as employed by the US, consists of six missiles transported on and fired from the UH-1B helicopter. They are fired and remotely controlled by the copilot/gunner. The guidance commands go out over two wires as they play out from the missile, and missile control devices change the course of the flight.

3. The firing sequence of the AGM-22B is as follows:

   a. Explosive cartridge is detonated.

   b. Gyro is ignited.

   c. Gyro is uncaged. (Missile battery power is applied.)

   d. Flares and booster motor are ignited. (Delay squibs are ignited.)

   e. Sustainer motor ignites. (Guidance is now possible.)

   f. Fuze-detonator is armed.

   g. Impact.

   h. Wires are jettisoned.

4. The external hardware consists of—

   a. Housing assembly.

   b. Launcher support assembly.

   c. Fixed housing.

d. Launcher.

5. The internal hardware consists of—

a. Pilot's sight.

b. Gunner's sights.

c. Gunner's station.

(1) Armrest.

(2) Control stick.

d. Missile selection box.

e. Guidance control unit.

f. Miscellaneous items.

(1) Pilot's electrical jettison switch.

(2) Electrical controls for pilot's sight.

(3) Mechanical jettison lever.

(4) Circuit breakers on upper circuit-breaker panel.

SPECIAL INSTRUCTIONS: None.

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STUDENT OUTLINE

M22 ORIENTATION

1. System background.

a. History.

b. General description.

2. Missile description.

a. Firing sequence.

(1) Explosive cartridge and locking lever.

(2) Ignite gyro.

(3) Uncage gyro.

(4) Ignite booster and flares.

(5) Wings.

(6) Sustainer motor.

(7) Jet deflectors.

(8) Wires.

(9) Detonator arming device.

(10) Impact.

b. Functions of major components.

3. External hardware.

a. Housing assembly.

b. Launcher support assembly

c. Fixed housing.

d. Launcher.

4. Internal hardware.

a. Pilot's sight.

b. Gunner's sights.

c. Control stick.

d. Missile selection box.

e. Guidance control unit.

f. Miscellaneous items.

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PERFORMANCE CHECK

M22 ORIENTATION

1. List the size and weight of the AGM-22B missile.

2. How many missiles are carried on the M22 system?

3. At what distance from launch point does the AGM-22B missile become armed?

4. What is the maximum effective range of the M22?

5. What is the minimum practical range of the M22?

6. List the four components of the external hardware of the M22 subsystem.

a.

b.

c.

d.

7. List the five major components of the internal hardware of the M22 subsystem.

a.

b.

c.

d.

e.

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File Nos. 30-285-1(U)
43-285-1(U)
67-285-1(U)
71-285-1(U)

PERFORMANCE OBJECTIVES

M6/M16 INTRODUCTION

1. KNOWLEDGES: Without the use of notes and without errors, the student will be able to—

   a. List the five major components of the M6.

   b. List ammunition capacity, range, and rate of fire of the M6 subsystem.

   c. Write the function of the cartridge drive motor and charger assembly.

   d. List flexible limits of the M6 subsystem.

   e. Write proper loading procedure for the M6 system.

2. SKILLS: None.

NOTES

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ADVANCE SHEET

M6/M16 INTRODUCTION

PURPOSE: This instruction is designed to acquaint the student with the five major components of the M6 armament system including operation and loading procedures, characteristics, capabilities, and limitations of the various components.

DISCUSSION POINTS:

1. The M6 helicopter armament subsystem was designed and developed by the Emerson Electric Corporation under contract with the United States Army, to provide the helicopter with a suppressive fire capability. It is used against enemy ground troops and soft target installations. There are 22 M6 aircraft in the ROAD Division. Nine are in the Air Cavalry Troop and 13 in the Division Aviation Battalion.

2. The universal mount is the same mount as that used with M3 and M22 systems. This system operates from the aircraft electrical and hydraulic systems. Inside the gun mount assembly are the electrical and hydraulic mechanisms necessary to position the guns as directed by the gunner. Lines are connected to the aircraft electrical and hydraulic systems. The guns will elevate 15° and depress 60°. They will traverse outboard 70° and inboard 12°. Positive mechanical stops are employed at the limits of each axis. The slew rate (rate the guns move) is approximately 64° per second in elevation and depression and 124° per second in deflection. In essence, when the gunner is on target, the guns will be ready to fire. A fire interrupter switch is incorporated into the system. When the guns reach a point 11° inboard, an electrical solenoid closes and prohibits the guns from firing after they reach the 12-degree inboard limit. Immediate action is accomplished through the use of hydraulically operated charger assemblies. In the safe position, the operating rod is held to the rear or out-of-battery position. In the armed position, the operating rod is carried forward, and the bolt is held to the rear. When the trigger switch is depressed, it allows the bolt (and firing pin) to move forward and strike the round.

3. The M60C machineguns used with this system are basically the same as the standard M60 ground-mounted weapons. Certain parts have been removed or replaced, and the gun is supplied with a remote firing capability by replacing the trigger assembly with an electrically actuated trigger solenoid. Each of the four guns will fire 550 rounds per minute for a total combined cyclic rate of fire of 2200 rounds per minute. The M60C has a maximum range of 3200 meters and a maximum effective range of 750 meters.

4. The ammunition feed system consists of ammunition boxes, flexible chuting, and cartridge drives. There are 12 ammunition boxes. These are specifically designed for use in the M6 system. Each box contains 500 rounds of 7.62mm ammunition and is placed within a box tray that is bolted to the floor of the aircraft. Spacers and tiedown straps hold the boxes in place.

5. There are eight sections of flexible chuting, two per gun. One section from the box to the cartridge drive - one section from the drive to the machinegun. The chuting contains 700 rounds of ammunition, making the total ammunition capacity of the system 6700 rounds.

6. Each gun is equipped with a cartridge drive. This drive assists the gun in pulling ammunition from the box to the gun. It is driven by a D.C. electric motor and is activated by trigger switches. A voltage limiter prevents the drive motor from burning itself out in the event of gun stoppage.

7. The circuit control box is mounted in the lower left portion of the pedestal. The off-safe-armed switch is a three-positioned, bat-handled type. The guns cannot be fired until it is placed in the armed position. A switch is used to recycle, or apply immediate action, in the event of gun stoppage. The gunner places the switch from the armed to the safe position, then after allowing 3 to 5 seconds for the recycling process, back to the armed position.

8. The gun selector switch allows the gunner to select the upper guns (one on each side of the aircraft), lower guns, or all four guns.

9. The gunner's sighting station is the primary means of firing this system. It is composed of a suspension linkage and a controller. The suspension linkage is a space parallelogram arrangement and allows the gunner to sight around obstructions in the cockpit without destroying the reference plane of the sight. The controller contains electrical components that send a signal to the circuitry within the gun mount assemblies that move the guns throughout their limits as directed by the gunner.

10. The gunner gains control of the guns by depressing an action switch. This provides the electrical connection and permits control of the guns by means of a control handle. The gunner looks through the sight, which contains a reflected reticle and pip (dot), depresses the action switch, turns the control handle, places the pip on target, then depresses the trigger switch located immediately above the action switch. The guns will not move until the action switch is depressed. When the action switch is released, the guns move back into a fixed or stowed position. The action switch must be depressed before the gunner will be able to fire from the sighting station. The lamp illuminates the reticle image in the sight head and has a rheostat for use in night firing.

11. The secondary capability of the M6 system is the fixed or stowed position. In this mode, the aircraft must be aligned with the target, and the guns are fired by the pilot or copilot/gunner by a trigger switch located on each cyclic stick. A reference mark on the windshield serves as a sight for the fixed position.

12. The M6 system uses standard 7.62mm ammunition which reduces the resupply problem in operational areas. Normal maintenance is accomplished at organizational level. Battle damage is rapidly overcome by replacing major components.

13. The weight of the M6 system fully loaded is approximately 830 pounds. This includes all components and 6700 rounds of ammunition. The system is well within the center-of-gravity range of the helicopter and does not affect the autorotational characteristics.

14. The major components of the M16 are M6 subsystem, the rack assembly, two 2.75-inch FFAR rocket launchers, and the intervalometer.

15. The weight of the M16 fully loaded is approximately 1275 pounds (six warheads).

16. There are three available launchers at this time: The M157 (front loaded, seven launching tubes), the M158 (rear loaded, seven launching tubes), and the M159 (front loaded, 19 launching tubes).

17. There are two available stowed ordnance sighting stations: The MK8 (100-mil reticle) and the M60 reflex infinity sight (80-mil or 50-mil reticle).

18. There are two types of intervalometers with which the system may be equipped. The newest intervalometer incorporates a reset button in place of the pairs-remaining counter. There is also an additional position on the armament selector switch for a 40mm capability.

NOTES

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STUDENT OUTLINE

M6/M16 INTRODUCTION

1. System background.

   a.

   b.

   c.

2. General description.

   a. A FLEX

   b.

c.

d.

e.

f.

3. M60C machineguns.

a.

b.

c.

4. Gun mount assemblies.

a.

b.

c.

d.

e.

f.

g.

h.

i.

5. Sighting station.

a.

b.

c.

6. Circuit control box.

a. ALL 4, UPPER PAIR, OR LOWER PAIR

UPPER GUNS
ALL GUNS
LOWER GUNS

b. IF GUNS MALFUNCTION THE FIRST ACTION SHOULD BE TO RECYCLE BY PLACING SWITCH IN "SAFE" POSITION

ARM
SAFE
OFF

c.

d.

7. Ammunition feed system. (SEPARATE SYSTEM FOR EACH GUN)

a. BOXES

b. CARTRIDGE SHOOT

c. CARTRIDGE DRIVE SYSTEM (ASSISTS GUN IN DRAWING CARTRIDGES FROM AMMO BOXES TO THE WEAPON CHAMBER.

d. LOOK FOR SHORT OR LONG CARTRIDGES AND DIRTY OR CORRODED CARTRIDGES

8. Loading procedures.

a. SINGLE LOOP INWARD
START BELT IN END OF AMMO BOX NEAREST THE WEAPON AND "S TURN" BELTS BACK AND FORTH.

b. YOU'LL PULL WITH THE AMMO BOX FURTHEST FROM THE WEAPON WHEN YOU BEGIN FIRING

9. M16 subsystem.

a.

b.

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PERFORMANCE CHECK

M6/M16 INTRODUCTION

1. List the five major components of the M6 armament subsystem.

a. GUNS

b. MOUNTS

c. SIGHT

d. CONTROL BOX

e. AMMUNITION FEED SYSTEM

2. Describe the proper loading procedure of the M6 system.

METALIC LINK BELT FEED

3. What is the total ammunition capacity of the M6 system?

700 RNDS/IN
6000 " IN AMMO BOXES
(550 RNDS/MIN)

750 M IS MAX. EFFECTIVE RANGE (BECAUSE OF TRACER BURNOUT)

4. What is the function of the cartridge drive?
ASSISTS GUN IN DRAWING CARTRIDGES FROM THE AMMO BOX TO THE WEAPON CHAMBER.

5. What is the function of the charger assembly?
MERELY COCKS THE WEAPON (HYDRAULICALLY OPERATED)

6. What are the elevation, depression, and deflection limits of the M6 system?
15° UP (ELEVATION) AND 60° DN (DEPRESSION)
12° INWARD AND

7. What items are located on the circuit control box?

8. What is the rate of fire of the M60C machinegun? 550RNDS/MIN.

Combined cyclic rate of fire?
2200 RNDS./MIN.

9. What items are located on the control handle of the gunner's sighting station?

10. Describe the function of the action switch.

11. What is the maximum effective range of the M60C machinegun? Why is this so?
750 METERS BECAUSE OF TRACER BURN-OUT.

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PERFORMANCE OBJECTIVES

M21 INTRODUCTION

1. KNOWLEDGES: Without the aid of notes or references and without errors, the student will be able to write correctly–

   a. The names and one function of three of the four rocket launcher components.

   b. The names and functions of the switches on the intervalometer.

   c. The names of the 11 automatic gun components.

   d. A concise description of the loading of the ammunition boxes and crossover drive.

   e. Two of the three functions of the delinking feeder.

   f. The maximum effective range of the M134 automatic guns.

   g. A concise description of the cycle of operation of the M134.

2. SKILLS: None.

NOTES

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ADVANCE SHEET

M21 INTRODUCTION

1. PURPOSE: This period introduces the M21 subsystem which is equipped with two rocket launchers and two M134 automatic guns. The class concentrates on the components that differ from the M16.

2. DISCUSSION: The M21 is capable of launching 2.75-inch rockets and utilizes two high-rate-of-fire automatic guns. The automatic gun has proven to be a devastating weapon in service with the Air Force. Techniques of employment and much of the hardware are similar to the M16. We will concentrate on the automatic gun, its attached hardware, and the safety problems peculiar to the M21. TM 55-1520-211-10 contains a thorough description of the subsystem.

NOTES

- TO FIRE PAIRS OF ROCKETS PUT BOTH STEPPER SWITCHES ON RESET.

- TO FIRE SINGLE ROCKETS, PUT ONE STEPPER SWITCH ON RESET AND ONE ON 13.

- ROCKETS FIRE AT 6 PAIRS PER SECOND AFTER THE FIRST SECOND.

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STUDENT OUTLINE

M21 INTRODUCTION

(Period one of two periods)

1. Rocket launcher components.

   a. Rocket launchers.

   b. Rack and support assembly.

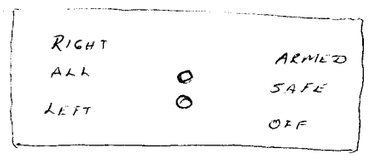
   c. Intervalometer.

   d. M60 reflex infinity sight.

2. Automatic gun components.

   a. Control panel.

   40
   2.75
   7.25



   b. Sighting station.

M 60 REFLEX INFINITY SIGHT

c. Control box.

d. Gun mount assembly.
PROVIDES SUPPORT FOR THE GUNS. NOT INTERCHANGEABLE
HOUSE RECEPTICLES FOR ELECTRICAL AND HYDRAULIC LINES,

e. Ammunition chuting.
LINKS THE CROSSOVER DRIVE

f. Ammunition box assembly.
4 ROWS (3 BOXES PER ROW) (500 RNDS/BOX TO 1500 ROUNDS/ROW)
(6,000 RNDS)

g. Crossover drive.
TO FEED TWO BAYS OR ROWS TO ONE GUN
ELECTRICALLY DRIVEN (24 V DC)

3. Loading.

a. Secondary bay. LOADED FIRST (FEMALE END)
AMMUNITION LOADED TOWARD THE FRONT OF THE A/C

b. Primary bay. LOADED SECONDLY

(Period two of two periods)

4. Automatic gun accessories.

a. Recoil adapters.
MOLDS THE GUNS TO THE MOUNT ASSEMBALY

b. Two-speed drive assembly.
28 V. D.C.
CHANGES

3,400 RNDS./MIN. (FROM 12° INBOARD TO 12° OUTBOARD)
& 4,000 RNDS./MIN.

IF YOU ARE IN BOTH AND ONE GUN HITS THE
INBOARD STOP IT WILL CEASE FIRING AND THE
GUN ON THE OTHER SIDE WILL GO TO 4,000 RNDS.
PER MIN.

c. Delinking feeder.
- STRIPS THE LINKS FROM THE ROUNDS
AND FEEDS ROUNDS TO THE GUN
- TIMING PIN (FOR CRITICAL GUN TIMING - WILL NOT FIRE WITHOUT IT)
IF SET PROPERLY ALIGNES 7 PUSH RODS TO THE 6 BOLTS.

5. Automatic gun M134. (JU-2B/A IS THE AIR FORCE DESIGNATION)

a. General description.
AIR COOLED, ELECTRICALLY DRIVEN, METALIC BELT FED DISCINTIGRATING.
MAX. EFFECTIVE RANGE 1,000 METERS
MAX. RATE OF FIRE = 4,000 RNDS/MIN./GUN
28 V. D.C. 3 H.P. ELECTRIC MOTOR DRIVES IT

b. Gun components. (10) ① HOUSING COVER ② SAFEING SECTOR ③ GUN HOUSING
④ GUIDE BAR ⑤ BARREL SUPPORT ⑥ GUIDE BAR ⑦ REAR GUN SUPPORT

6. Harmonization. ALIGNING THE GUNS TO FIRE WHERE THE SIGHT IS POINTED.

a. Flexible mode.
- MECHANICAL ADJUSTMENTS MADE TO THE PYLON.
- USES A FLEXIBLE SIGHT.
- ALWAYS DO YOUR FLEXIBLE HARMONIZATION FIRST

b. Stowed mode.
- ELECTRICAL ADJUSTMENTS MADE TO THE CONTROL BOX.
- ALWAYS SET STOWED HARMONIZATION AFTER FLEXIBLE
HARMONIZATION HAS BEEN SET.

7. Operation.
FIRE AT LEAST 1 SECOND BURSTS
SAFEING SECTOR LOCKS, COCKS AND FIRES THIS WEAPON

8. Safing.

a. NO PERSONNEL IN FRONT OF GUN

b. ROTATE BARRELS 1" OR ONE BARREL WIDTH OPPOSITE
THE DIRECTION OF ROTATION.

c. REMOVE THE HOUSING COVER AND SAFEING SECTOR
(RENDERS GUN SAFE)

10° UPWARD MOVEMENT
85° DOWNWARD MOVEMENT
12° INWARD MOVEMENT
70° OUTWARD MOVEMENT
> CHECK TO SEE YOU HAVE THIS AFTER SETTING FLEXIBLE HARMONIZATION.

d. ROTATE THE BARRELS IN DIRECTION OF OPERATION

e. CLEAR ANY AMMUNITION THAT MAY BE IN THE WEAPON VISUALLY CHECK EACH CHAMBER AND BARREL SAFE

9. Limitations.

a. FIRE AT LEAST 1 SECOND BURSTS

b. MAINTENANCE IS MORE DIFFICULT THAN ON THE M 60.

c. FIRING INTERRUPTOR AUTOMATICALLY STOPS FIRING AFTER 3 SECONDS. (MAX FIRE IS TWO 3 SECONDS AT A TIME)

d.

- IF THE GUN IS JAMMED THE PROCEDURE IS TO TAKE THE POWER OFF THE ~~M~~ WEAPON BY GOING TO THE SAFE POSITION.

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PERFORMANCE CHECK

M21 INTRODUCTION

1. What is the function of the intervalometer?

2. To fire single rockets, the stepper switches should be set on _____ and _____.

3. When finished loading the crossover, the clutch handle should be in the _____ position to insure the _____ bay feeds first.

4. When one gun reaches the inboard stop, the other gun will fire at _____ rounds per minute, providing the gun selector switch on the control panel is in the _____ position.

5. List the three functions of the delinking feeder.

6. What is the maximum effective range of the M134?

7. Outline the cycle of operation of the M134.

(True or False)

8. Insuring that all personnel are clear of the gun, the next step in clearing the M134 is to remove the safing sector. _____

9. The M134 is considered clear when the safing sector is removed. _____

10. While flying a mission and one gun jams, the power should be removed from the jammed gun. _____

11. The primary job of the crossover drive is to feed two bays to one gun. _____

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PERFORMANCE OBJECTIVES

M134 DISASSEMBLY, ASSEMBLY, AND TROUBLESHOOTING

(Period one of two periods)

1. KNOWLEDGES: Without the aid of notes or references and without errors, the student will be able to—

   a. List the type, operation, feed, weight, rate of fire, and effective range of the M134.

   b. List the 10 basic assemblies of the M134.

2. SKILLS: Given the proper tools and without notes or errors, the student will be able to disassemble the M134.

(Period two of two periods)

1. KNOWLEDGES:

   a. List four of the six common causes of stoppages and corrective action.

   b. List six of the nine basic assemblies and their functions of the MAU-56/A delinking feeder.

   c. List four of the five assemblies which cannot be immersed in cleaning solvent.

2. SKILLS: Given the proper tools and without notes or errors, the student will be able to assemble the M134.

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ADVANCE SHEET

M134 DISASSEMBLY, ASSEMBLY, AND TROUBLESHOOTING

PURPOSE: This instruction is designed to briefly acquaint the student with the characteristics, nomenclature, basic assembly/disassembly of the M134 machinegun, troubleshooting, cleaning, and lubrication procedures.

DISCUSSION POINTS:

1. Description of weapon.
2. Basic assemblies.
3. Disassembly and assembly.
4. Troubleshooting.
5. Cleaning and lubrication.

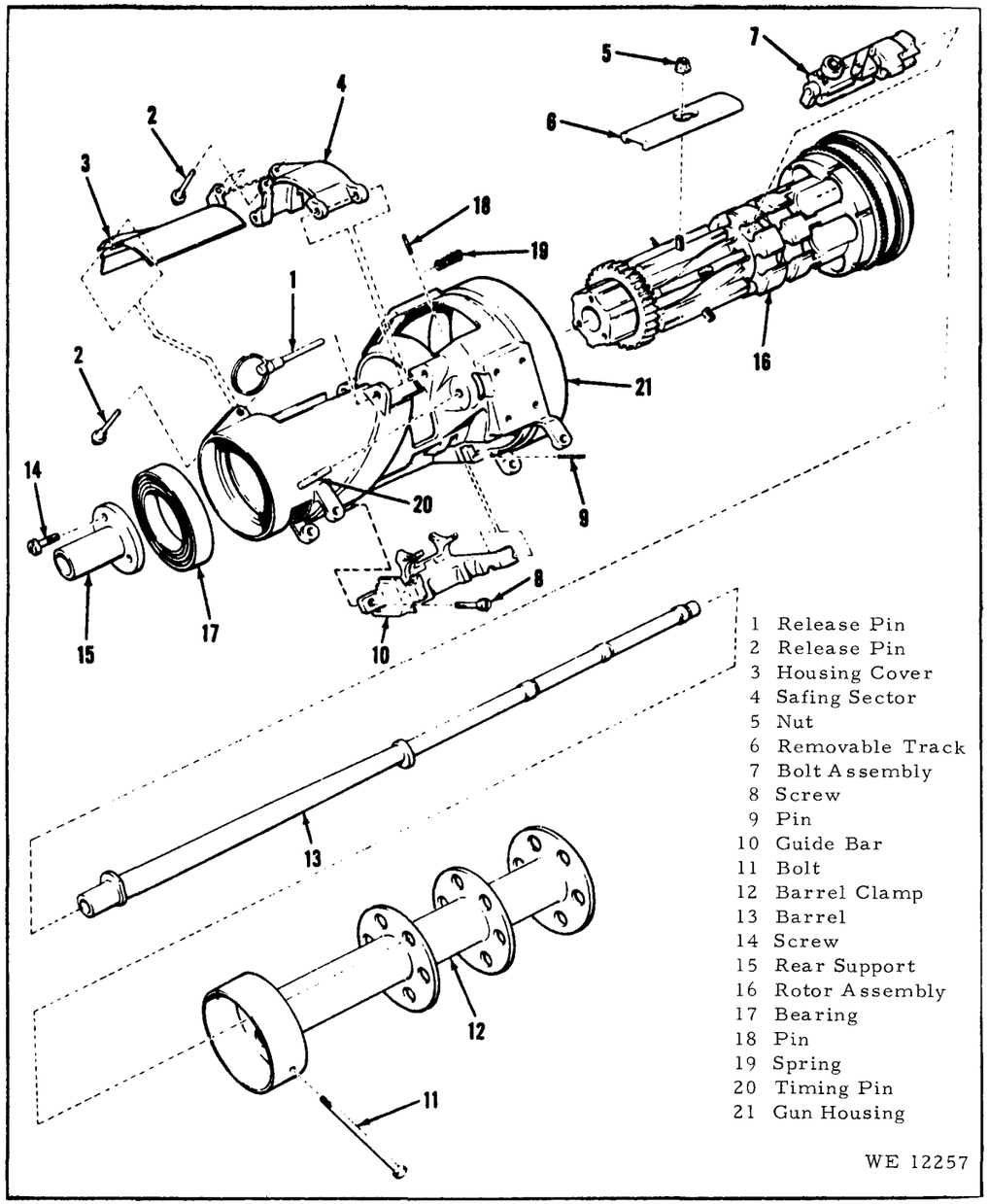
STUDY ASSIGNMENT: None.

SPECIAL INSTRUCTIONS:

1. Be prepared to discuss the points listed above.
2. Bring to class the Student Outline and this Advance Sheet.

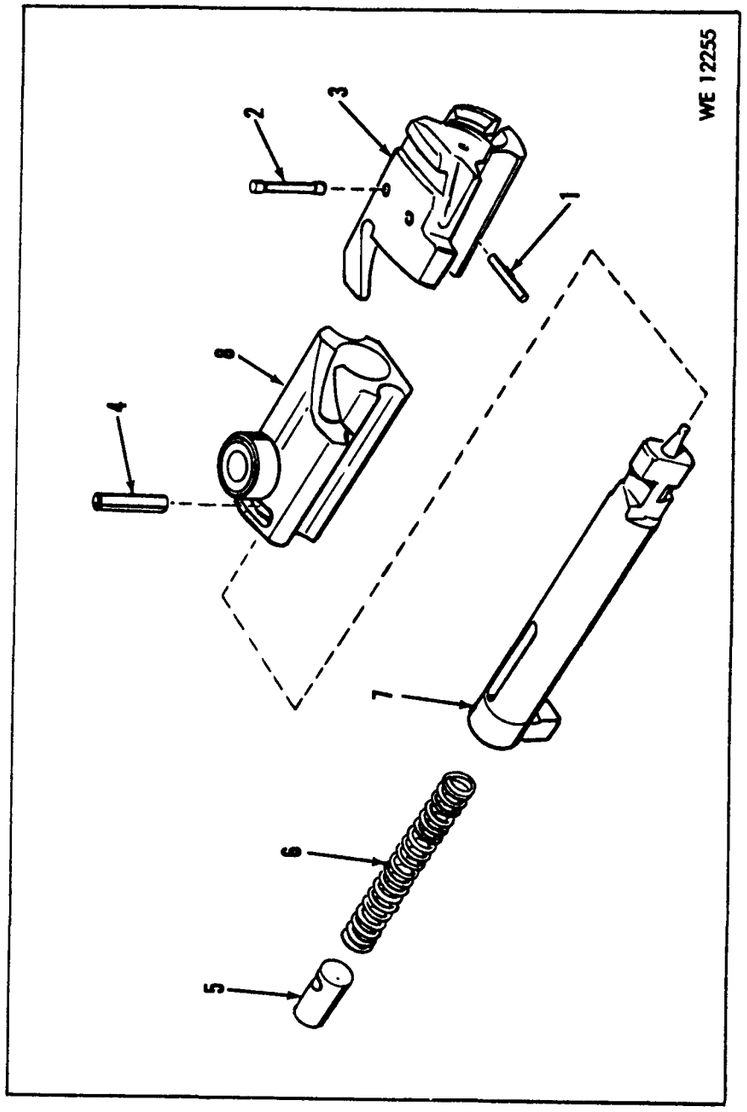
ADDITIONAL INSTRUCTIONAL MATERIAL: Annex A - weapon breakdown and part nomenclature.

ANNEX A

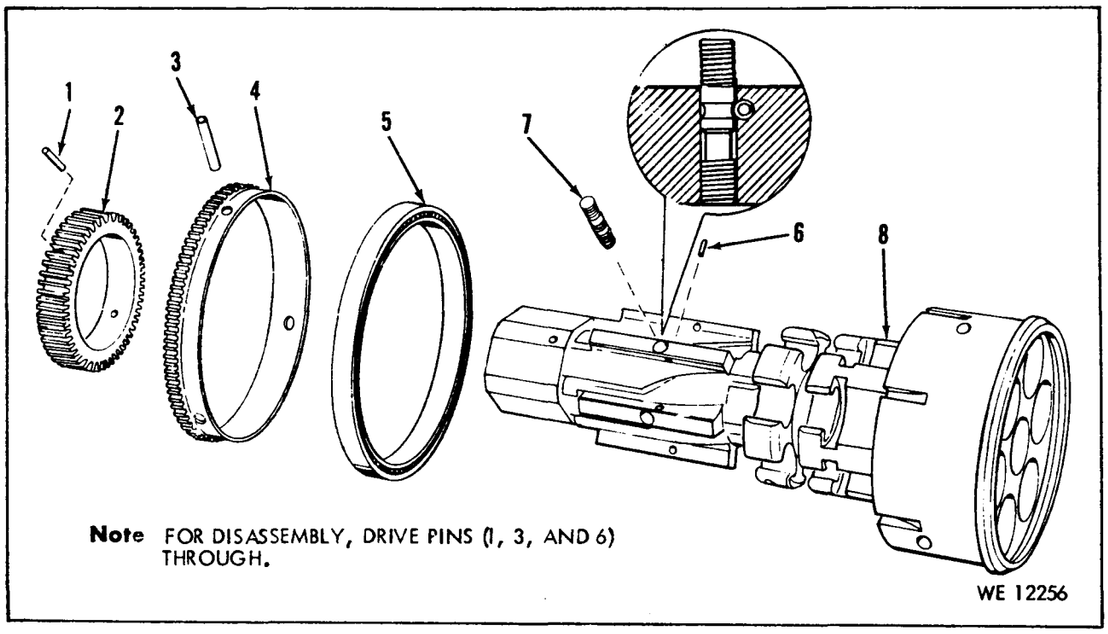


1 Release Pin
2 Release Pin
3 Housing Cover
4 Safing Sector
5 Nut
6 Removable Track
7 Bolt Assembly
8 Screw
9 Pin
10 Guide Bar
11 Bolt
12 Barrel Clamp
13 Barrel
14 Screw
15 Rear Support
16 Rotor Assembly
17 Bearing
18 Pin
19 Spring
20 Timing Pin
21 Gun Housing

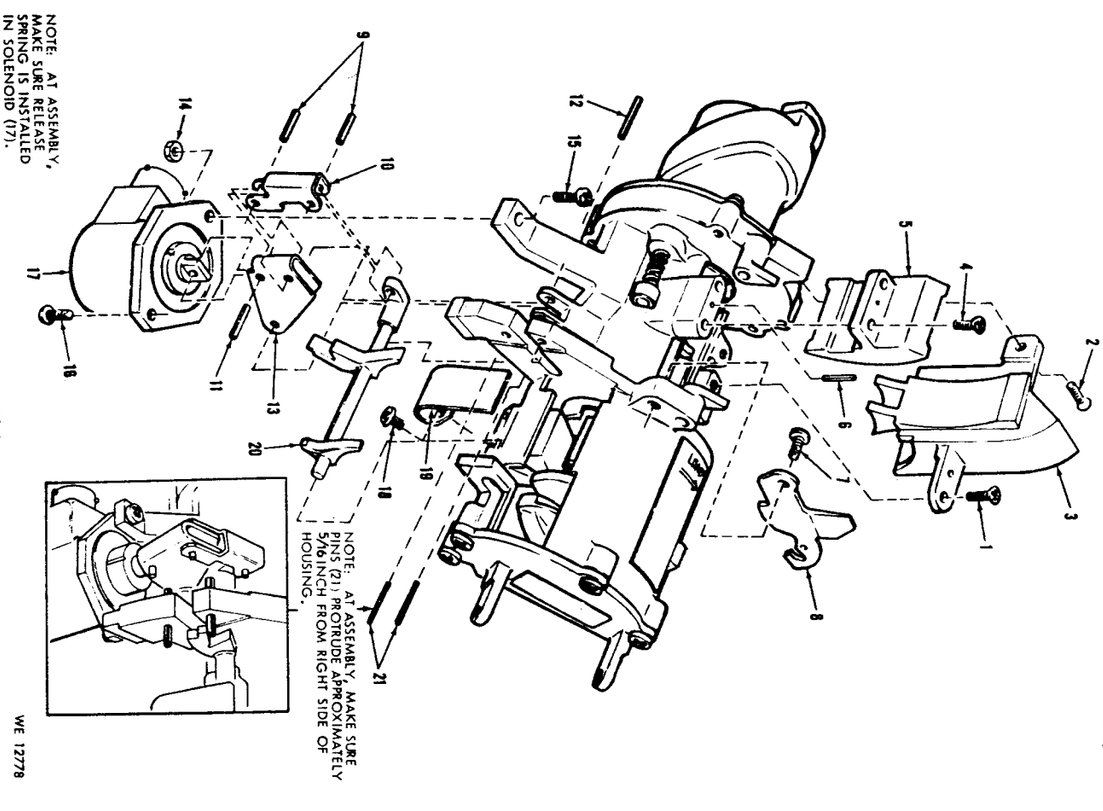
WE 12257



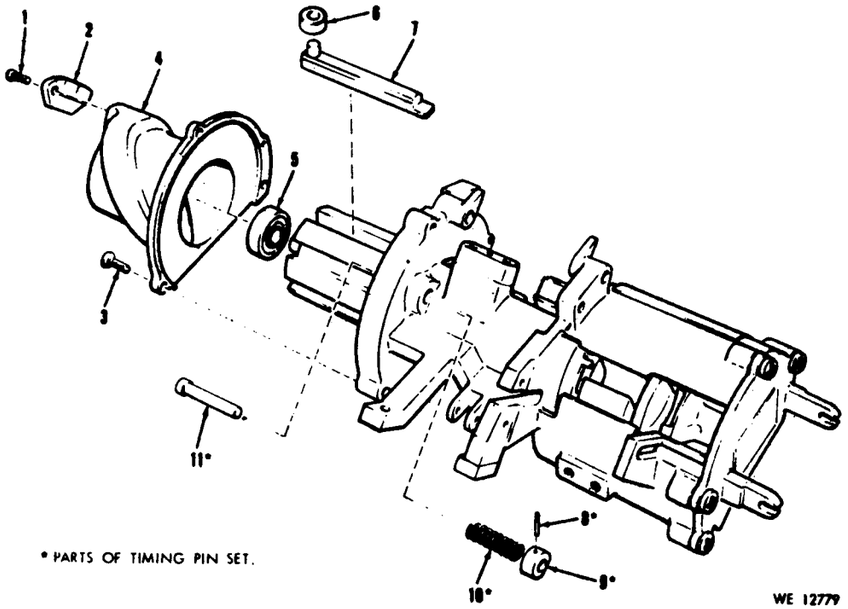
1 Spring Pin
2 Locking Pin
3 Bolt Head
4 Spring Pin
5 Spring Stop
6 Helical Compression Spring
7 Firing Pin
8 Bolt Subassembly



1 Spring Pin
2 Rear Gear
3 Spring Pin
4 Front Gear
5 Ball Bearing
6 Spring Pin
7 Track Stud
8 Rotor



1. Screw
2. Screw
3. Guide
4. Screw
5. Guide
6. Pin
7. Screw
8. Nose Guide
9. Pin
10. Link
11. Pin
12. Pin
13. Arm
14. Nut
15. Screw
16. Screw
17. Solenoid
18. Screw
19. Spring
20. Guide
21. Pin

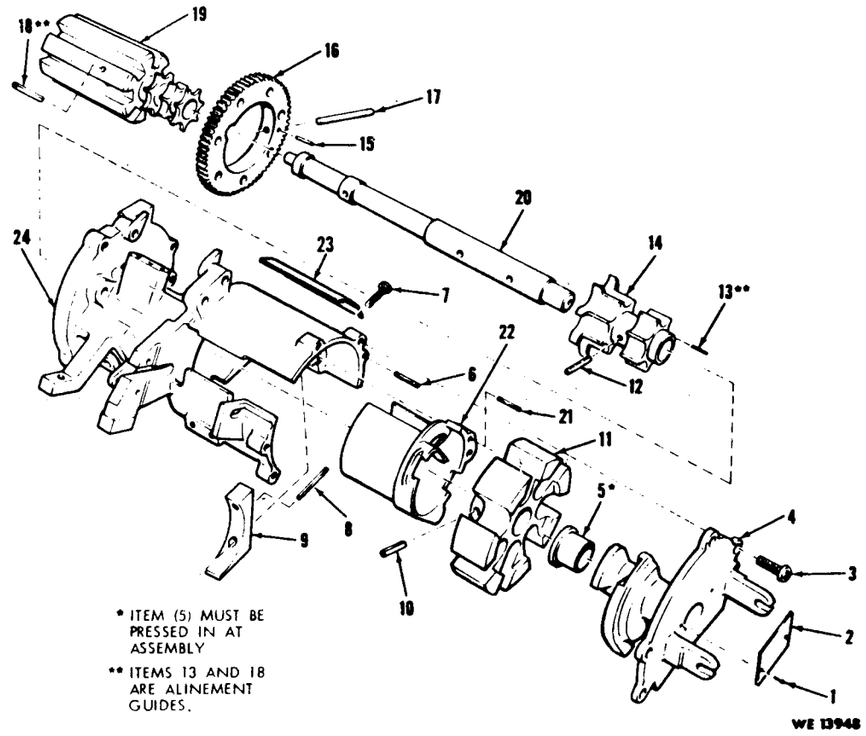


* PARTS OF TIMING PIN SET.

WE 12779

1. Screw
2. Insert
3. Screw
4. Housing
5. Bearing
6. Roller
7. Pushrod
8. Pin
9. Button
10. Spring
11. Pin

1. Screw
2. Plate
3. Screw
4. Nose plate
5. Bearing
6. Pin
7. Screw
8. Pin
9. Guide
10. Pin
11. Sprocket
12. Pin
13. Pin
14. Sleeve
15. Pin
16. Gear
17. Pin
18. Pin
19. Guide Assembly
20. Shaft
21. Pin
22. Guide
23. Housing

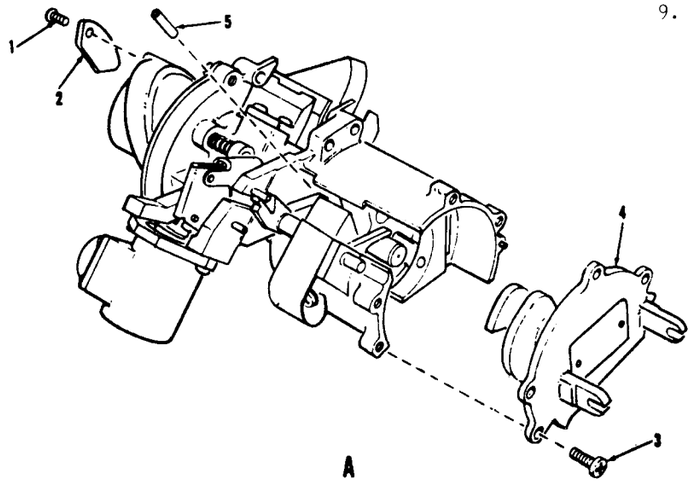


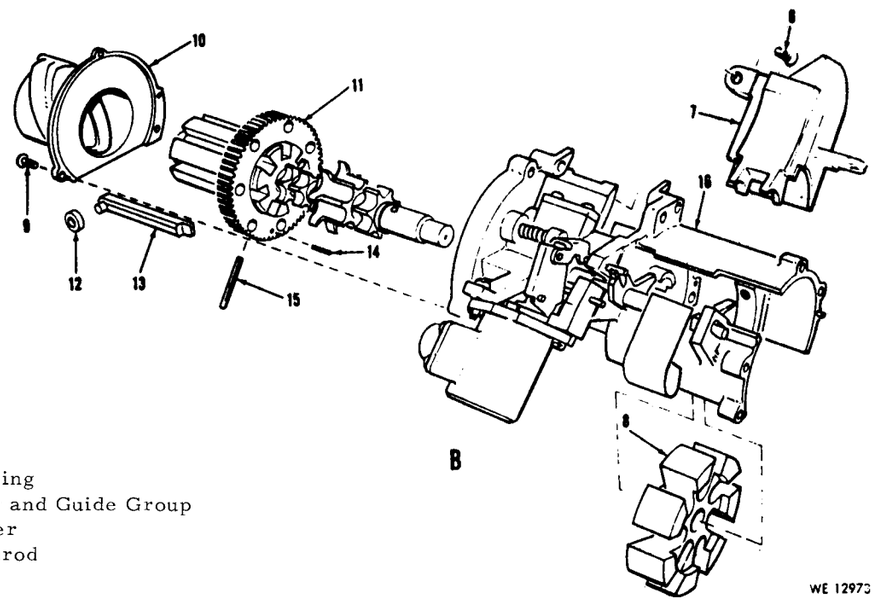
* ITEM (5) MUST BE PRESSED IN AT ASSEMBLY

** ITEMS 13 AND 18 ARE ALINEMENT GUIDES.

WE 13948

1. Screw
2. Insert
3. Screw
4. Plate
5. Pin
6. Screw
7. Guide
8. Sprocket
9. Screw





10. Housing
11. Gear and Guide Group
12. Roller
13. Pushrod
14. Pin
15. Pin
16. Delinking Feeder Group

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STUDENT OUTLINE

M134 DISASSEMBLY, ASSEMBLY, AND TROUBLESHOOTING

1. Description of the M134 automatic gun.

a.

b.

c.

d.

e.

f.

2. Nomenclature of basic assemblies (10).
a. HOUSING COVER
B. SAFEING SECTOR

C. GUN HOUSING ASS.

D. 6 REMOVABLE TRACKS

E. 6 BOLT ASSEMBALIES (INTERCHANGABLE & REMOVABLE

F. ROTOR ASSEMBALY

G. GUIDE BAR (GUIDES FROM DE-LINKER FEEDER INTO GUN AND DUMPS FIRED CARTRIDGES

H. 6 BARRELS

I. 6 BARREL CLAMPS (MUST BE SAFETY WIRED)

J. REAR GUN SUPPORT

3. Practical exercise.

a. Disassembly sequence.

CLEAR WEAPON
(2) REMOVE HOUSING COVER
(3) REMOVE SAFEING SECTOR
(4) REMOVE RECOIL ADAPTER (OUT HERE)
(5) REMOVE MOTOR (OUT HERE)
(6) REMOVE DE-LINKER FEEDER
(7) REMOVE 3 TRACKS
(8) REMOVE ALL 6 BOLTS
(9) REMOVE GUIDE BAR (3 BOLTS)
(10) REMOVE BARREL CLAMPS (SAFETY WIRE SEAL)
(11) REMOVE BARRELS
(12) REMOVE REAR GUN ASSEMBALY
(13) ROTOR ASSEMBALY WILL COME OUT

b. Assembly sequence.

4. Troubleshooting.

a.

b.

c.

d.

e.

f.

5. Cleaning and lubrication.

AVGAS, JP-4, JP-5, OR GUN CLEANING SOLVENT
LSA (LUBRICATION, STANDARD AVIATION?)
LSAT (HAS TEFLON BASE)

6. Delinking feeder MAU-56/A.

a.

b.

c.

d.

e.

f.

g.

h.

i.

j.

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PERFORMANCE CHECK

M134 DISASSEMBLY, ASSEMBLY, AND TROUBLESHOOTING

1. The M21 subsystem will fire (per gun) _____ SPM or _____ SPM.

2. The XM27/27 E1 weapon subsystem will fire _____ SPM or _____ SPM.

3. The M134 is _____ _____ driven.

4. List the 10 basic assemblies.

   a.

   b.

   c.

   d.

   e.

   f.

   g.

h.

i.

j.

5. List the steps in disassembly of the M134 as presented in the practical exercise.

6. List four out of five assemblies of the M134 that cannot be immersed in cleaning solvent.

MOTOR
RECOIL ADAPTERS
BEARINGS
ELECTRICAL FITINGS OR CONNECTIONS
GUN FEED SOLENOID ON DE-LINKER FEEDER

7. List four common causes of stoppages and corrective actions to be taken.

a.

b.

c.

d.

8. Write the function of the gun-feed solenoid.

a. With electrical power.

b. No electrical power.

9. List the names and functions of seven of the 10 delinking feeder parts.

①
②
③ GUIDE & GEAR GROUP
④ DE-LINKER FEEDER
⑤ GUIDE
⑥ NOSE GUIDE
⑦ GUN FEED SOLENOID
⑧ FRONT PLATE

NOTES

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PERFORMANCE OBJECTIVES

XM3 AND M16/21 ALIGNMENT AND CIRCUIT TEST

1. KNOWLEDGES: Without the aid of notes or reference material and without errors, the student will be able to—

   a. Write the three steps in the alignment of the XM3 and M16 subsystems.

   b. Write the two steps in the preparation for alignment.

   c. Write the three steps in the alignment of the infinity sight.

   d. Write the three steps in both methods of pod alignment.

   e. Write the four types of circuit checks performed on the XM3 and M16 subsystems.

   f. Recite the equipment necessary to complete each type of circuit check.

   g. Distinguish between the jettison circuit test on the XM3 and the jettison circuit test on the M16.

2. SKILLS: None.

NOTES

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STUDENT OUTLINE

XM3 AND M16/21 ALIGNMENT AND CIRCUIT TEST

1. Alignment.

   a. Purpose.

   b. Steps in alignment.

      (1) Preparation for alignment.

      (2) Alignment of the infinity sight.

      (3) Alignment of the XM3 pods and the M16 launcher pods.

   c. Preparation.

      (1) Leveling and stabilizing.

      (2) Establishing centerline.

d. Alignment of the infinity sight.

(1) Parallel adjustment.

(2) Cant and elevation adjustment.

(3) Sight reticle check.

e. Pod alignment.

(1) Distant aiming point method.

(a) Pod elevation.

(b) Helicopter-target positioning.

(c) Pod azimuth adjustment.

(2) Parallel line method.

(a) Leveling pods.

(b) Pod azimuth adjustment.

(c) Pod elevation.

2. Circuit test.

a. Purpose.

b. XM3.

(1) Interior electrical.

(2) Firing voltage.

(3) Firing circuit.

(4) Jettison circuit - purpose.

c. M16.

(1) Interior electrical.

(2) Firing voltage.

(3) Firing current.

(4) Jettison circuit.

NOTES

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PERFORMANCE CHECK

XM3 AND M16/21 ALIGNMENT AND CIRCUIT TEST

1. Select your answers from the following list and correctly fill in the blank steps in their proper order:

Level pods
Adjust pod azimuth
Pod elevation
Pod boresight
Helicopter-target positioning

a. Distant aiming point method.

(1)

(2)

(3)

b. Parallel line method.

(1)

(2)

(3)

2. Fill in the blanks.

a. Leveling of the helicopter in preparation from pod alignment is accomplished through the use of a _____ _____ attached in the (left, right) _____ cargo door.

b. The three steps in the alignment of the infinity sight are—

(1)

(2)

(3)

3. Answer true or false.

a. True False The four types of circuit tests performed on the XM3 are— (1) Interior electrical. (2) Firing current. (3) Exterior electrical. (4) Jettison check.

b. True False The multimeter (TS 352/U) is used in the jettison circuit test of the M16.

c. True False It is necessary that rockets be in the tubes during the firing circuit tests on either.

d. True False The ohmmeter is used in the firing circuit check on the M16.

e. True False The primary purpose of the firing circuit check is to isolate the malfunction within two categories.

f. True False Limited use of the XM3 subsystem would be permissible if stray voltage was indicated in the firing voltage check.

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ADVANCE SHEET

XM3 AND M16/21 ALIGNMENT AND CIRCUIT TEST

PURPOSE: This instruction is designed to provide the student with a working knowledge of the tools and procedures for conducting the alignment processes and circuit tests on the XM3 and M16 weapons systems.

DISCUSSION POINTS:

1. We must prepare the aircraft for alignment by selecting proper area and leveling aircraft on jacks.

2. We must establish a centerline to refer to for further measurements.

3. We first adjust the infinity sight to include—

   a. Parallel alignment.

   b. Cant and elevation adjustment.

   c. Sight reticle check.

4. We next align pods utilizing either the—

   a. Distant aiming point method.

   b. Parallel line method.

5. We then conduct circuit tests to include—

   a. Interior electrical.

   b. Firing voltage check.

   c. Firing circuits check.

   d. Jettison circuits check.

SPECIAL INSTRUCTIONS:

1. Be prepared to discuss the points listed above.

2. Bring to class the Student Outline and this Advance Sheet.

ADDITIONAL INSTRUCTIONAL MATERIAL:

1. Annex A - Checkout of Firing Circuits.

2. Annex B - Check of Jettison Circuits.

ANNEX A

CHECKOUT OF FIRING CIRCUITS

STEP	OPERATION AND NORMAL INDICATION	CORRECTIVE ACTION
1	Check the system test box. a. Set the POWER switch on the system test box to ON. The POWER indicator on the test box glows.	Replace the indicator lamps. Replace the indicator.
	b. Press each fire-signal indicator on the test box. Each indicator glows while pressed.	Replace the defective indicator lamps. Replace the defective indicators.
2	Check the subsystem firing circuits. a. Set the selector switch on the rocket-armament panel to 2, and set the arm switch to ARMED. The SAFE indicator goes out and the ARMED indicator glows.	Replace the defective lamp. Replace the defective indicator.
	b. Press and momentarily hold the firing switch on the control stick. Two indicators (Nos. 1 and 2) on the test box glow. The ZERO indicator on the rocket-armament panel goes out.	
	c. Set the selector switch to 3 and press and momentarily hold the firing switch. Three more indicators (Nos. 3, 4, and 5) on the test box glow.	
	d. Set the selector switch to 6 and press and momentarily hold the firing switch. Six more indicators (Nos. 10-15) on the test box glow.	
	e. Set the armed switch on the rocket-armament panel to SAFE. The ARMED indicator goes out and the SAFE indicator glows.	
	f. Press and hold the RESET button on the interconnecting box. The ZERO indicators on the interconnecting box and the rocket-armament panel glow.	

STEP	OPERATION AND NORMAL INDICATION	CORRECTIVE ACTION
	g. Press the counter-reset button on the rocket-armament panel. The counter indicates 000. h. Press the RESET switch on the test box. All 24 indicators on the test box go out. i. Set the selector switch to 24 and press and momentarily hold the firing switch. No indicators on the test glow. j. Set the arm switch on the rocket-armament panel to ARMED. The SAFE indicator goes out and the ARMED indicator glows. k. Press and momentarily hold the firing switch. All 24 indicators on the test box glow in correct sequence (Nos. 1-24). l. Set the arm switch on the rocket-armament panel to SAFE. The ARMED indicator goes out and the SAFE indicator glows. m. Press the RESET button on the interconnecting box. The ZERO indicators on the interconnecting box and the rocket-armament panel glow. n. Press the counter-reset button on the rocket-armament panel. The counter indicates 000. o. Press the RESET switch on the test box. All 24 indicators on the test box go out. p. Set the POWER switch on the test box to OFF. The POWER ON indicator on the test box goes out.	

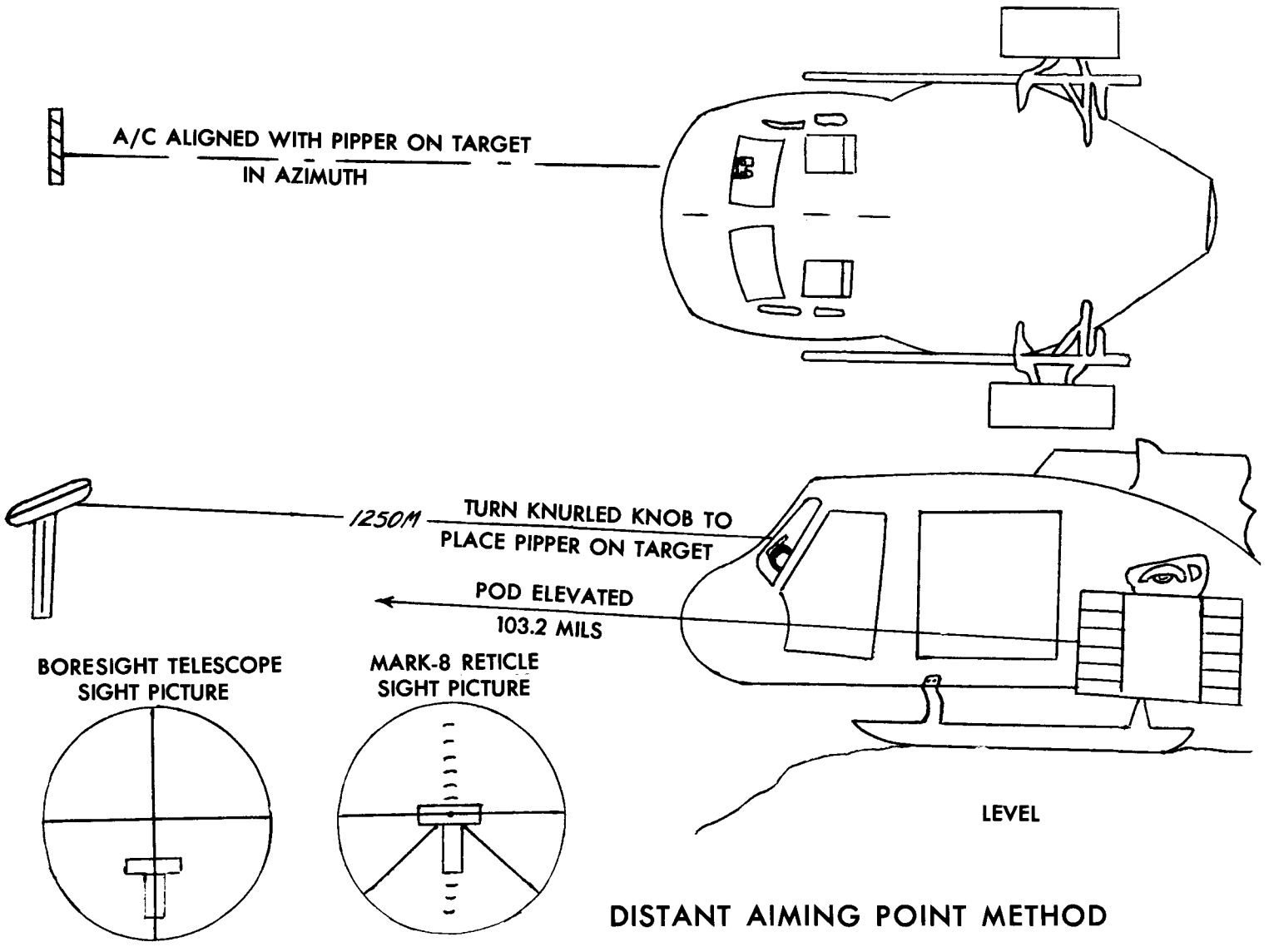
STEP	OPERATION AND NORMAL INDICATION	CORRECTIVE ACTION
	q. Deenergize the subsystem. The SAFE, ZERO, and SYSTEM POWER ON indicators go out. r. Pull out the two rocker-armament circuit breakers (on the overhead panel). The JETTISON POWER ON indicator on the rocket-armament panel goes out. s. Disconnect the test cable (3W1) from P4014 (right) and connect it to P4008 (left). Push in the two rocket-armament circuit breakers. The JETTISON POWER ON indicator on the rocket-armament panel glows. t. Repeat steps 1a through 2r.	

ANNEX B

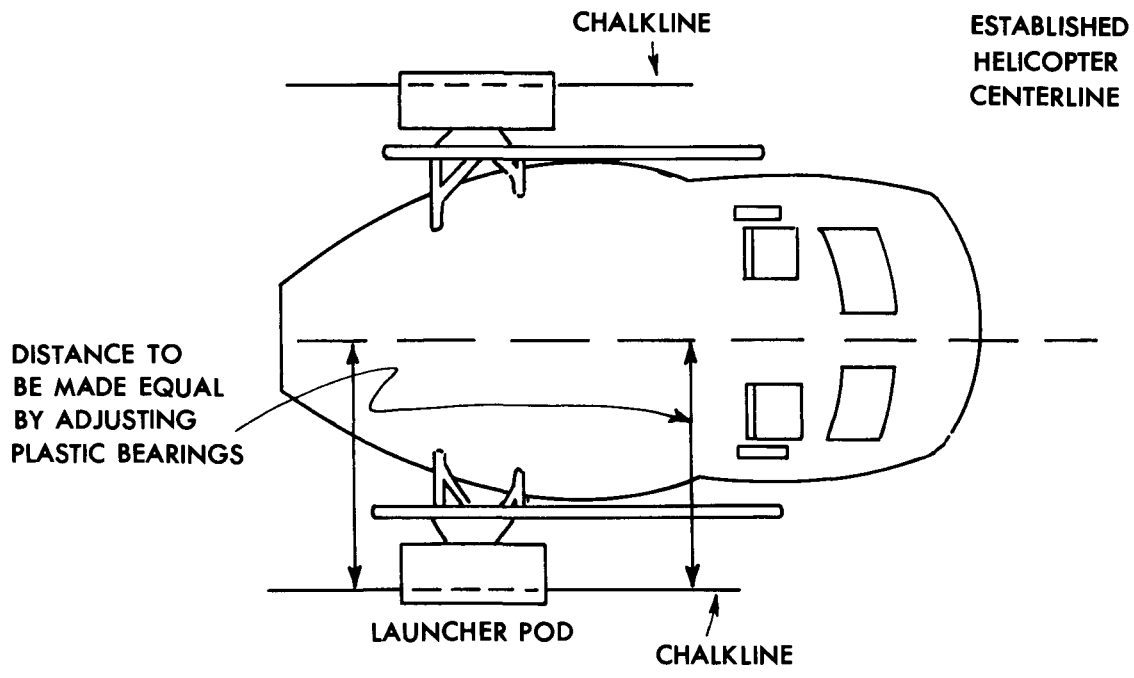
CHECK OF JETTISON CIRCUITS

STEP	OPERATION AND NORMAL INDICATION	CORRECTIVE ACTION
1	Check the jettison circuit to the right-top explosive-bolt connector. a. Connect the voltmeter positive probe to pin B and the negative probe to pin A of connector P34. b. Set the JETTISON switch to the ON (up) position. The meter pointer momentarily deflects, showing some voltage less than 28 volts D.C., and the JETTISON COMPLETE indicator glows. c. Press the RESET button on the interconnecting box. The JETTISON COMPLETE indicator goes out. d. Connect the voltmeter positive probe to pin D and the negative probe to pin C of connector P34. e. Same as b above. Same as b above. f. Same as c above. Same as c above.	
2	Check the jettison circuit to the right-bottom explosive-bolt connector. a. Connect the voltmeter positive probe to pin B and the negative probe to pin A of P35. b. Same as 1b. Same as 1b. c. Same as 1c. Same as 1c. d. Connect the voltmeter positive probe to pin D and the negative probe to pin C of the connector P35.	

STEP	OPERATION AND NORMAL INDICATION	CORRECTIVE ACTION
	e. Same as 1b. Same as 1b. f. Same as 1c. Same as 1c.	
3	Check the jettison circuit to the left-top explosive-bolt connector. a. Connect the voltmeter positive probe to pin C and the negative probe to pin D of connector P36. b. Same as 1b. Same as 1b. c. Same as 1c. Same as 1c. d. Connect the voltmeter positive probe to pin A and the negative probe to pin B of connector P36. e. Same as 1b. Same as 1b. f. Same as 1c. Same as 1c.	
4	Check the jettison circuit to the left-bottom explosive-bolt connector. a. Connect the voltmeter positive probe to pin C and the negative probe to pin D of connector P36. b. Same as 1b. Same as 1b. c. Same as 1c. Same as 1c. d. Connect the voltmeter positive probe to pin A and the negative probe to pin B of connector P37. e. Same as 1b. Same as 1b. f. Same as 1c. Same as 1c.	



DISTANT AIMING POINT METHOD



PARALLEL LINE METHOD

NOTES

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PERFORMANCE OBJECTIVES

2.75" AMMUNITION

1. KNOWLEDGES: Without the aid of notes or reference material, the student will be able to correctly—

   a. Recognize and identify the two major components of the 2.75" FFAR.

   b. State the approximate bursting radius of the 10-pound and 17-pound warheads.

   c. State the minimum employable range, used when firing the 2.75" FFAR 10-pound warhead.

   d. State the loading and unloading sequence of the XM3 and the XM159 systems.

   e. State at least four of the six general safety precautions that must be observed when handling rocket ordnance.

2. SKILLS: None.

NOTES

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ADVANCE SHEET

2.75" AMMUNITION

PURPOSE: This instruction is designed to provide the student with a working knowledge of 2.75" rocket ammunition and general characteristics, with the problems of safety in handling emphasized. The student will also learn the proper procedures to follow in loading and unloading the XM3 and M16/M21 subsystems.

DISCUSSION POINTS:

1. General. Rocket use in warfare had its beginning in the 13th century when the Chinese used them against the Mongols. Further development was stagnant until World War II, when rockets were used rather extensively. Later refinements saw combat in Korea, and further developments are being made every day.

2. 2.75" folding fin aerial rocket.

a. General description. Although the smallest air-to-ground rocket used today, the 2.75" FFAR has the impact of a 105mm howitzer shell. It is a solid-propellant, free-flight, fin/spin stabilized, air-launched, variable-warhead weapon.

b. Fuzes. The various fuzes utilized are acceleration arming.

c. Warheads. The M151 is a high-explosive warhead utilizing composition B. Limited use is made of HEAT round, WP warhead, and a low-explosive colored smoke round. Practice warheads are similar to the high-explosive heads, except that plaster replaces the explosive charge.

d. Motor assembly. The motor tube is 32 inches in length and 2.75 inches in diameter. The propellant is nitrocellulos gelatinized by nitroglycerin. The igniter is a small charge of black powder, manganese powder, and an electric squib. The fins, after launch, are actuated by gas pressure from the motor.

e. Scarfing. Cutting the thrust nozzles imparts a 15-RPS spin to the rocket and increases stability.

3. Safety.

a. Excessive temperatures or pressures, continued exposure to abnormal temperatures, and rough handling are all hazards which exist when handling rockets. Inadvertent electrical ignition is another hazard which cannot be overlooked.

b. When in storage, care must be taken to protect rocket motors and warheads from moisture and high temperatures.

4. Assembly and disassembly of 2.75" FFAR. See Annex A.

5. Loading and unloading XM3/M16/M21 subsystems. See Annex A.

SPECIAL INSTRUCTIONS:

1. Be prepared to discuss the points listed above.

2. Study Annex A attached.

3. Bring this Advance Sheet (with Annex A) and Student Outline to class.

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ANNEX A TO ADVANCE SHEET

2.75" AMMUNITION

Assembly, loading and unloading, and disassembly of the 2.75" FFAR, XM3 and M16/M21 subsystem.

Part I. Assembly of 2.75".

1. Preparation of ammunition. Some motors are dimpled, which is a convex bulge in the forward end of the motor tube which contacts the base of the mounted warhead, helping to keep it tightly mounted. Most late-model motors are undimpled, but the assembly of both is the same, as follows:

a. Remove the fuzed warhead and motor from the container.

CAUTION: When mating the warhead to the rocket motor, make sure that the spacer and rubber gasket are removed in order to prevent separation during flight.

b. Remove the warhead shipping support from the motor. There is a rubber gasket ring under the lip of the head shipping support and a shim between the head shipping support and head closure. Remove the rubber gasket. Leave the shim in the motor against the head closure.

c. Tighten the warhead, by hand, as tightly as possible, without causing the head closure to turn and force the visible lockwire in or out of the motor tube lockwire groove. Movement of the tab within the elongated hole is normal. This tightened pressure should be 55 pounds.

CAUTION: Do not pull the lockwire tab down and out of the elongated hole into the motor tube lockwire groove. The enlarged tab traveling through the lockwire groove will bulge the motor tube, making it unsafe to fire. Any motors with the lockwire tab displaced by turning either in or out of the elongated groove should be discarded as unserviceable. If, after assembly, there is a gap between the forward end of the motor and the warhead, remove the warhead and substitute another.

2. Loading the launcher. The launcher should not be loaded until the preflight check has been accomplished.

WARNING: When loading rockets, have all firing circuits open. Be careful to prevent damage to the fins, motor tube, and fuze. Do not load rockets with damaged fins or motor tubes; damaged motor tubes may cause motor to blow up, and damaged fins will cause erratic flight. Do not remove the fin protector until just before loading the rocket. Do not use rockets which have a gap between the warhead and motor tube. Keep people away from the front and rear of loaded launchers.

WARNING: Helicopters with loaded launchers or launchers being loaded and unloaded should be pointed in a direction which offers the least exposure to personnel or property in event of accidental ignition of rockets.

a. Preloading checks.

(1) Set POWER switch to OFF and pull the two rocket jettison circuit breakers. Pair selector switch set to zero, rocket/gun selector switch to GUN position, arm/safe/OFF switch on circuit control panel in OFF position.

(2) Turn helicopter master battery switch to OFF.

(3) Disconnect the main battery plug.

(4) Ground the helicopter (electrical grounding).

(5) Check JETTISON switch cover for safety wiring with 0.0020 gauge copper break wire.

(6) Check that explosive-bolt squibs are disconnected and shorting caps on (XM3), only.

(7) Check that electrical power cable to pods is disconnected.

b. Loading (XM3).

(1) Swing the firing pin assembly clear of the breech and insert the rocket from the breech end of the tube.

(2) Remove the fin protector from the rocket. Check that the fin retainer and contact button are in place and that the launcher latch retaining groove and contact disc are free of grease and dirt.

(3) Push the rocket into the tube until two snaps are heard; then, grasp a fin (not the fin retainer) and pull the rocket back slightly until the hole in the detent rod is visible and the shear wire can be installed.

(4) Swing the launcher firing pin back over the breech until the assembly snaps forward and seats the firing pin firmly on the center contact disc in the fin retainer assembly.

(5) When all tubes have been loaded, place aluminum shear wire (Stock No. 8932315) in the holes in the detent rods on each launcher tube, bending the wire for positive retention.

(6) Remove and retain the shorting caps from the explosive bolt squibs and attach the four connectors to the squibs, being careful to observe the connector markings for top and bottom.

(7) Connect main battery plug.

(8) Start helicopter.

(9) Connect electric power cable to pod.

(10) Remove electric grounding cable.

3. Unloading the launcher.

WARNING: If there are misfired rockets in the launcher, turn the power switch OFF and wait 10 minutes before unloading rockets.

a. Preparation for unloading.

(1) XM3: Check that the rocket-armament panel counterreads 000, that the ZERO indicator on the panel glows when the power switch is ON, and that the jettison circuit breakers are closed. M16: Pair selector switch set to ZERO, rocket/gun selector switch to GUN position, arm/safe/OFF switch ON, circuit control panel to OFF position.

(2) Shut down helicopter.

(3) Set battery switch to OFF.

(4) XM3: Set power switch to OFF and pull out the two rocket-jettison circuit breakers. M16: Pull one jettison circuit breaker.

(5) Disconnect power cable to pods.

(6) Disconnect explosive-bolt connectors and install shorting caps to explosive-bolt squibs (XM3 only).

(7) Electrically ground the helicopter to an earth ground.

(8) Disconnect the main battery plug from the battery.

b. Unloading (XM3 only).

(1) Swing the firing pin assembly away from the breech.

(2) Remove the shear wire from the detent rod.

(3) Push the rocket forward until it protrudes from the tube. Grasp it at the front end and pull it out of the tube.

4. Disassembly of 2.75" FFAR.

a. Install fin protectors over the fins.

b. Remove warhead and install rubber gasket ring and spacer.

c. Place warhead in container.

d. Place motor in container.

5. Loading and unloading M16.

a. Preloading. Use same preloading check as outlined in previous pages.

b. Loading.

(1) Remove fin protector from rocket. Examine fin retainer and contact button to insure that they are in place and that the launcher latch retaining groove and contact disc are free of grease and dirt.

(2) Align arrows on launcher tube between any tow fins on nozzle fin assembly.

(3) Push rocket into tube until snap is heard; then, grasp warhead and pull forward slightly to insure positive placement in tube.

(4) Check the rear of the launch pod to insure positive contact has been made between firing pin and contact disc.

(5) Connect main battery plug.

(6) Start helicopter.

(7) Connect electrical power cable to pod.

(8) Remove electrical grounding cable.

c. Unloading. A screwdriver must be placed into the tube to override the locking detent; then, rocket is removed in the same manner as in XM3 unloading.

NOTE: Aircraft may be loaded ONLY while running IF all other safety precautions are closely followed and an instructor pilot is present at the aircraft. On M16, the arm/safe/OFF switch may be left in SAFE position to prevent possible boresight drift.

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PRELOAD CHECK

MISFIRE PROCEDURES

2.75" AMMUNITION

1. Student announces failure to fire, verified by instructor pilot. IP checks following:

a. Arm/safe/OFF switch (M6 circuit control box) to ARM position.

b. Rocket/gun switch to ROCKET position.

c. Pair selector to one or more.

d. Reset intervalometer switch to station that failed to fire. (This depends on when, in the firing sequence, misfire had occurred.)

e. Attempt to fire again.

2. If no-fire condition still exists, land (keeping aircraft down range and keeping within range fan). Circuit control switch to safe, rocket/gun switch to guns, pair selector to zero. IP exits aircraft and checks—

a. Fore-and-aft electrical connections.

b. Proper seating of rocket.

c. Electrical contact probe.

d. Stepping switch reflects station to fire. On signal from IP, pilot resets intervalometer while IP observes stepping switch.

e. Connect electrical wire to contact disc and firing probe.

f. IP recovers to aircraft and rearms as outlined previously. Attempt to fire. (Keep aircraft pointed down range.)

3. No fire exists; place switches in safe configuration.

a. Intervalometer switch to zero.

b. Pair selector switch to zero.

c. Rocket/gun switch to guns.

d. Circuit control panel switch to off.

e. Pull system circuit breakers.

4. Wait 10 minutes before unloading; then, following safety and unloading procedures outlined in Annex A (263-1), "2.75" Ammunition," leave rocket downrange and mark it.

5. Call EOD to dispose of the rocket.

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STUDENT OUTLINE

2.75" AMMUNITION

1. General description.

SOLID PROPELLANT FREE FLIGHT FIN-SPIN STABILIZED AIR LAUNCHED

① WARHEAD FUZE SECTION
② MOTOR PROPELLANT FIN SECTION

2. Technical characteristics.

(HVI-51 ROCKET) 52.81" 10# WARHEAD
62.82" 17#
2.75" DIA.
20.56# WITH 10# WARHEAD
27.85# WITH 17# WARHEAD

7,500 METERS (UP TO 9,300 M)
6,300 METERS (17# HEAD)
2,500 METERS (MAX. EFFECTIVE RANGE)
300 METERS (MIN. ENGAGEMENT RANGE FOR 10# HEAD)
-65°F TO +150°F TEMP. RANGE

ELECTRICALLY FIRED 1.5 AMPS MIN. & 3 AMPS RECOMMENDED
HAS A VELOCITY OF 2100 FEET/SEC. (880# THRUST)
NAVY 2.75 ROCKET HAS 1400# THRUST

3. General nomenclature.

a. Fuze.

MARK 4 [redacted] 23 (LINEAR ACCELERATION ARMED AT 13 TO 27 G's)
ARMS IN 42 TO 92 METERS FROM A/C

XM-429
TRANSISTERIZED ELECTORICAL PROXIMITY FUSE
BATTERY PRODUCES 29 VOLTS FOR 30 SECONDS
ARMED AT 13 TO 27 G's
FIRES AT 2 TO 12 FEET (AVERAGE OF 7 FT. OR 9 FT FROM WATER)

b. Warheads.

MARK 1 (6#) 6 METER BURSTING RADIUS COMP (NOT MANUF. SINCE 1953)
ANTI-TANK (6#) PENETRATE 12" OF METAL (NOT MANUF. SINCE 1953)
MARK 151 (H.E.) 2.3# COMP. B, 11,000 PIECES OF SHRAPENEL FOR A 10 METER RADIUS FOR MARKING TARGETS & SETTING FIRES
5# OF COMP B, 22,000 PIECES OF SHRAPENEL FOR 13 METER RADIUS ARMY DESIGNED. IS T

[redacted] WDU-4A "THE NAIL" ANTI PERSONNEL PRESHETTE WARHEAD (A.F. DEVELOPED)
ARMED AT 27 G AND FIRES WHEN G'S DROP TO 11
(ABOUT 600 METERS AT ROCKET MOTOR BURN OUT)
3000' AND 10° ANGLE IS OPTIMUM (COVERS 51 METERS BY 91 METERS)
INCORPORATES TRACERS & DYE

c. Motor assembly. 5.9# NITRO GLYCERINE BASE EXPLOSIVE IN AN 8 POINT PERFORATED STAR SHAPE FOR MORE EVEN AND COMPLETE OXIDATION. BURNS AT 5000° C. IGNITOR HAS 10 GRAMS PROPELLANT BURNS FROM FRONT TO BACK FOR C.G. REASONS BURN TIME .3 TO 1.75 SEC. (AVERAGE IS 1.69 SEC.)

4. Safety.

5. Storage.

INADVERTANT ELECTRICAL CONTACT
EXCESSIVE TEMPERATURES OR PRESSURES
CONTINUED EXPOSURE TO ABNORMAL TEMPERATURES } 4 HAZARDS
ROUGH HANDLING

① NEVER REMOVE FUSE
② KEEP YOUR LAUNCHERS AND ASSEMBLED ROCKETS POINTED IN A SAFE DIRECTION
③ NEVER REMOVE PROPELLANT
④ IF POSSIBLY LOAD & UNLOAD WITH ENGINE SHUT DOWN
⑤ ROCKETS MUST BE FREE OF FOREIGN MATTER PRIOR TO LOADING
⑥ ROCKET EXPOSED TO TEMP EXTREMES SHOULD SIT AT NORMAL TEMP FOR 6 HOURS.

6. Packing container.

7. Assembly of 2.75" FFAR.

8. Preparation for loading (XM3/M16).

9. Loading. IN 7.65 POSITION BECAUSE OF INTERNAL GROUNDING

a. XM3.

b. XM157, M158, XM159 launchers (all series).

10. Preparation for unloading XM3/XM157, M158, XM159 launchers (all series).

11. Unloading.

a. XM3.

b. XM157, M158, and XM159 (all series).

12. Disassembly of 2.75" FFAR.

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PERFORMANCE CHECK

2.75" AMMUNITION

1. List and describe the major components of the 2.75" FFAR.

2. State the bursting radius of the 2.75" FFAR, HE warhead M151.

3. State the minimum employable range when firing the 2.75" FFAR, using the 10-pound warhead.

300 METERS

4. What is the arming distance of the M427 (M423) fuze?

5. What is maximum effective range of the 2.75" FFAR?

7,500 METERS

6. List at least four general safety precautions used when handling or using rocket ordnance.

7. What is the launch weight of the 2.75" FFAR with a 10-pound warhead installed?

20.56 #

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PERFORMANCE OBJECTIVES

PRINCIPLES OF ATTACK HELICOPTER EMPLOYMENT

1. KNOWLEDGES: Without the aid of notes or references and without errors, the student will be able to—

(Period one of three periods)

a. When given a list of the nine principles of war and a list of definitions, match the appropriate items.

b. When given a list of definitions of the principles of target attack, write the name of each principle.

c. Write the factors of METT and, for each factor, a consideration which applies specifically to attack helicopter operations.

(Period two of three periods)

d. Describe attack helicopter organization for combat to include number of aircraft and basis for this number at the fire team and platoon level.

e. List the four members of a UH-1 attack helicopter crew and two duties of each crew's position.

f. Name, diagram, and state an advantage and a disadvantage of the three attack patterns taught in class.

g. When given a list of factors affecting night operations, write two considerations for each which pertain to attack helicopters.

(Period three of three periods)

h. When given a diagram of a tactical situation and a partial operations order, diagram the initial attack plan and outline the execution portion of the operations order.

NOTE: This is a theory class, and no specific diagram can be declared the solution. Therefore, accuracy must be based upon the student's ability to justify each element of his plan with a principle or technique taught in this course.

2. SKILLS: None.

NOTES

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ADVANCE SHEET

PRINCIPLES OF ATTACK HELICOPTER EMPLOYMENT

This block of instruction presents the principles and theories of attacking targets with helicopters. The need for this information is obvious to the attack helicopter student. It is also critical to every aviation commander because of the large role of attack helicopters in nearly every operation. It is equally important to the LOH pilot because his reconnaissance mission often forces him to recommend the employment of attack helicopters.

NOTES

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STUDENT OUTLINE

PRINCIPLES OF ATTACK HELICOPTER EMPLOYMENT

1. Principles of war.

a. Objective. A GOAL OR AIM

b. Offensive. IMPOSING THE COMMANDERS WILL ON THE ENEMY.

c. Simplicity. USE SIMPLE CONCISE PLANS SO ALL THE MEN UP THROUGH THE RANKS CAN UNDERSTAND THEM, THUS GAINING "UNITY OF COMMAND".

d. Unity of command. ~~SUPERIORITY (QUANTITATIVE & QUALITATIVE)~~
UNITY ON ALL LEVELS.

e. Mass. SUPERIORITY OF COMBAT COMMAND (QUAHATIVE & QUANTATIVE).

f. Economy of force. TAKE A SMALL PORTION OF YOUR FORCE TO ATTACK A NON-DECISIVE TARGET SO YOUR MAIN FORCE CAN CONTINUE TO THE DECISIVE TARGET.

g. Maneuver. FLEXIBILITY OF ATTACK HELICOPTERS

h. Surprise. CATCHING THE ENEMY OFF GUARD BY USING DIFFERENT TIMES & TYPES OF ATTACKS.

i. Security. KEEPING THE ENEMY FROM SURPRISING US. (AS G-2 OPERATIONS)(FIREFLY FLIGHTS ETC.)

2. Principles of target attack. (ANALYSIS)

a. CONTROL —

SPEED b. FLEXIBILITY —

c. FIRE & MANEUVER —

d. SURPRISE — USE OTHER PATTERNS THAN JUST THE RACETRACK PATTERN, VARYING GREATELY TIMES & TYPES OF ATTACKS, OPERATIONS ETC.

e. TIMING —

f. FIREPOWER — USING ALL THE FIREPOWER YOU HAVE TO ITS BEST ADVANTAGE. MACHIEN GUN, ROCKETS, GRENADES AND MISSELS

DETERMINATION g. VIOLENCE — PUTING DOWN MAXIMUM FIREPOWER IN A MINIMUM AMOUNT OF TIME TO ACHIEVE A PSYCHOLOGICAL VICTORY OVER THE ENEMY. FIX THE ENEMY & DESTROY HIM

h. EXPLOITATION — TAKING ADVAINTAGE OF THE ENEMIES WEAKNESSES

PRE MISSION PLANNING — COMPLETE MISSION, ENEMY, TERRAIN & WEATHER, TROOPS & EQUIPMENT AVAILABLE
ON TARGET PLANNING — RELIABLE .

(TO PLAN WE MUST THINK IT OUT AND TO DO THIS WE NEED KNOWLEDGE)

3. METT. (ASSURES COMPLETE PRE MISSION PLANNING)

a. Mission.

(1) [redacted] NEUTRALIZATION
REDUCING THE ENEMIES COMBAT EFFECTIVENESS

(2) [redacted] DESTRUCTION

(3) COMBINATION (NEUTRALIZATION & DESTRUCTION)

b. ENEMY

c. TERRAIN & WEATHER — PICK TERRAIN THAT WIN GIVE YOU COVER & ALLOW BEST MISSION ATTACK. STUDY MAPS & PHOTOS POOR VISIBILITY & LOW CEILINGS WILL HINDER A TARGET ATTACK.

d. TROOPS & EQUIPMENT AVAILABLE
AVIATORS, GUNNORS, TROOPS, SPECIAL TEAMS AND THEIR STATE OF REST.

4. Combat organization.

a. Fire team. (LIGHT) A FIRE TEAM LEADER & A WINGMAN (SOLE RESPONSIBILITY IS TO COVER THE FIRE TEAM LEADER). (FIRE TEAM LEADER IS RESPONSIBLE FOR COMPLETING THE MISSION

b. Heavy fire team. (REINFORCED) 3 OR 4 AIRCRAFT

c. Platoon. 8 AIRCRAFT

d. Company.

5. Crew duties.

a. Aircraft commander.

RESPONSIBLE FOR HIS A/C'S FIRE, ~~ARE~~ FOR THE SAFETY OF A/C AND CREW AND FOR THE COMPLETION OF ASSIGNED MISSION.

b. Copilot/gunner.

RESPONSIBLE FOR FIRING FLEXIBLE WEAPONS, NAVIGATION & AIDING THE AIRCRAFT COMMANDER (FLYING, RADIOS, CHECK LISTS ETC.)

c. Crew chief.

MAINTAINING THE A/C & FIRES M 60 MACHINE GUN OUT THE DOOR, AN OBSERVER AND SHOULD BE TRAINED IN FIRST AID.

d. Door gunner.

PRIMARY RESPONSIBILITY IS KEEPING THE WEAPONS SYSTEMS ON THE A/C IN GOOD WORKING CONDITION.
OBSERVER, FIRES M-60 OUT THE DOOR & SHOULD BE TRAINED IN FIRST AID.

e. Special consideration.

ENEMY SITUATION
FRIENDLY SITUATION
MISSION
RULES OF ENGAGEMENT
UNIT S.O.P.

- WEAPONS TO BE CARRIED
- COMMUNICATIONS
- UNBUCKLING (ONLY FOR JAMMED MACHIEN GUN OR FOR FIRST AID)

6. Attack patterns. (BREAK OVER FRIENDLIES)

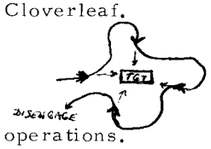
a. Racetrack.

ADVANTAGES: SIMPLE TO RUN & EASY TO CONTROL, CAN USE ANY NUMBER OF A/C
DISADVANTAGE: EASILY STEROTYPED, TENDS TO TIGHTEN UN WITH ONLY 2 A/C IN PATTERN

b. The "L." TO DEVIDE THE ENEMIES FIELD OF FIRE & FIXES THEIR LOCATION

DISADVANTAGES: REQUIRES TWO FIRE TEAMS & TIMING IS CRITICAL.

c. Cloverleaf.



DISADVANTAGE: NOT GOOD FOR USE WHEN THERE ARE FRIENDLIES IN THE TARGET AREAS.

7. Night operations.

a. Target acquisition.

- STROBE LIGHT
- FLAMING ARROW
- RADIO CONTACT
- FIRE FLY
- STARLIGHT SCOPES

b. Range estimation.

ADD 1/3 TO YOUR ESTIMATION

c. Engagement range.

ENGAGE THE ENEMY A LITTLE CLOSER THAN USUAL

d. Control measures.

e. Ordnance selection. DON'T SHOOT STRAIT TRACERS IN THE MINY GUN (FOR BRIGHT). THE ONE TO 4 RATIO WORKS WELL.

f. Illumination.

STAY OUTSIDE CONE OF ILLUMINATION OF FLARES (WATCH FOR FLARE PARACHUTES). FIRE FLY & STARLIGHT SCOPES.

g. Staging areas.

h. Special techniques.

(1) Crew.

(2) Aircraft lighting.

PAINT BOTTOM HALF OF A/C LIGHTS BLACK

8. Target analysis - review.

a. Mission. MOST IMPORTANT FACTOR

b. Enemy. TARGET VULNERABILITY DETERMINES WEAPON SELECTION
17#, FLESHETS, ANTI-TANK, SMOKE (W.P.) REGULAR ROCKETS

c. Terrain and weather. CAN BE USED TO HIDE YOURSELF FRIT ENEMY
CAN DO SAME

9. Practical exercise notes.

DEPARTMENT OF TACTICS
UNITED STATES ARMY AVIATION SCHOOL
Fort Rucker, Alabama

April 1969
File Nos. 43-213-3
61-213-3
67-213-3
71-213-3

PERFORMANCE CHECK

PRINCIPLES OF ATTACK HELICOPTER EMPLOYMENT

1. Match the definition with the correct principle.

a.	Security.	(1)	Superiority of combat power must be attained at the critical time and place for a decisive purpose. This superiority is ideally both qualitative and quantitative.
b.	Economy of force.	(2)	The goal or aim for which the force was constituted and is, therefore, overriding in any operation at any level of command.
c.	Objective.	(3)	Sufficient force must be applied at other than the decisive time and place to permit mass to be applied at the point of decision.
d.	Mass.	(4)	All military resources or combat power must be brought to bear in the accomplishment of the objective.
e.	Surprise.	(5)	Readiness for action of counteraction enhanced greatly by flexibility. Its attainment embraces all measures designed to avoid being surprised or interfered with seriously, and the retention of freedom action.
f.	Maneuver.	(6)	The commander can impose his will on the enemy, set the pace and course of battle, exploit enemy weaknesses, and meet unexpected contingencies.
g.	Unity of command.	(7)	Detailed, simple plans must be adopted in every military operation.
h.	Offensive.	(8)	The establishment of a single authority, insuring unity of effort.
i.	Simplicity.	(9)	Striking the enemy when, where, or in a manner that he is unable to anticipate or counter effectively.

2. To the right of the narrative, write the name of the associated principle of target attack.

   a. Enables the commander to direct his unit. _____

   b. Attack helicopters neutralize the objective while a ground force closes with the enemy. _____

   c. A fire team performing a route reconnaissance receives a change of mission to aid an ambushed patrol. _____

   d. Fires are massed to increase destructive force and to increase demoralization. _____

   e. A riot control agent is delivered close to an enemy antiaircraft gun, and during the resulting confusion a fire team closes with and destroys the weapon. _____

3. The two types of target attack are _____ and _____.

4. Even if bad weather does not cause abortion of a mission, it still affects our capability. What are two considerations when operating with a low ceiling?

   What are two considerations when operating with a reduced visibility?

5. When applying METT, what are two considerations regarding the crew?

6. In most operations, the wingman's primary mission is to _____ _____.

7. The _____ is responsible for all crew actions even though the _____ is charged with navigation.

8. A crewmember may be allowed to unbuckle from his seat strap to perform weapons maintenance or to _____.

9. Why should the commander prohibit "wisecracks" via radio?

10. List the names of three attack patterns and an advantage and a disadvantage of each.

11. What are three means of acquiring targets at night?

12. Write the rule-of-thumb for night range estimation.

13. List three control measures for night operations.

14. When using flares at night, illuminate the _____, being careful not to illuminate _____.

15. When attacking an artificially illuminated target, disengage before entering the _____.

16. List three considerations for operating a night staging area.

17. List two special techniques which increase the effectiveness of night operations.

18. The most important consideration in target analysis is _____ _____.

19. During target analysis target vulnerability should affect _____ _____.

20. Attack pattern selection is affected by _____, and terrain.