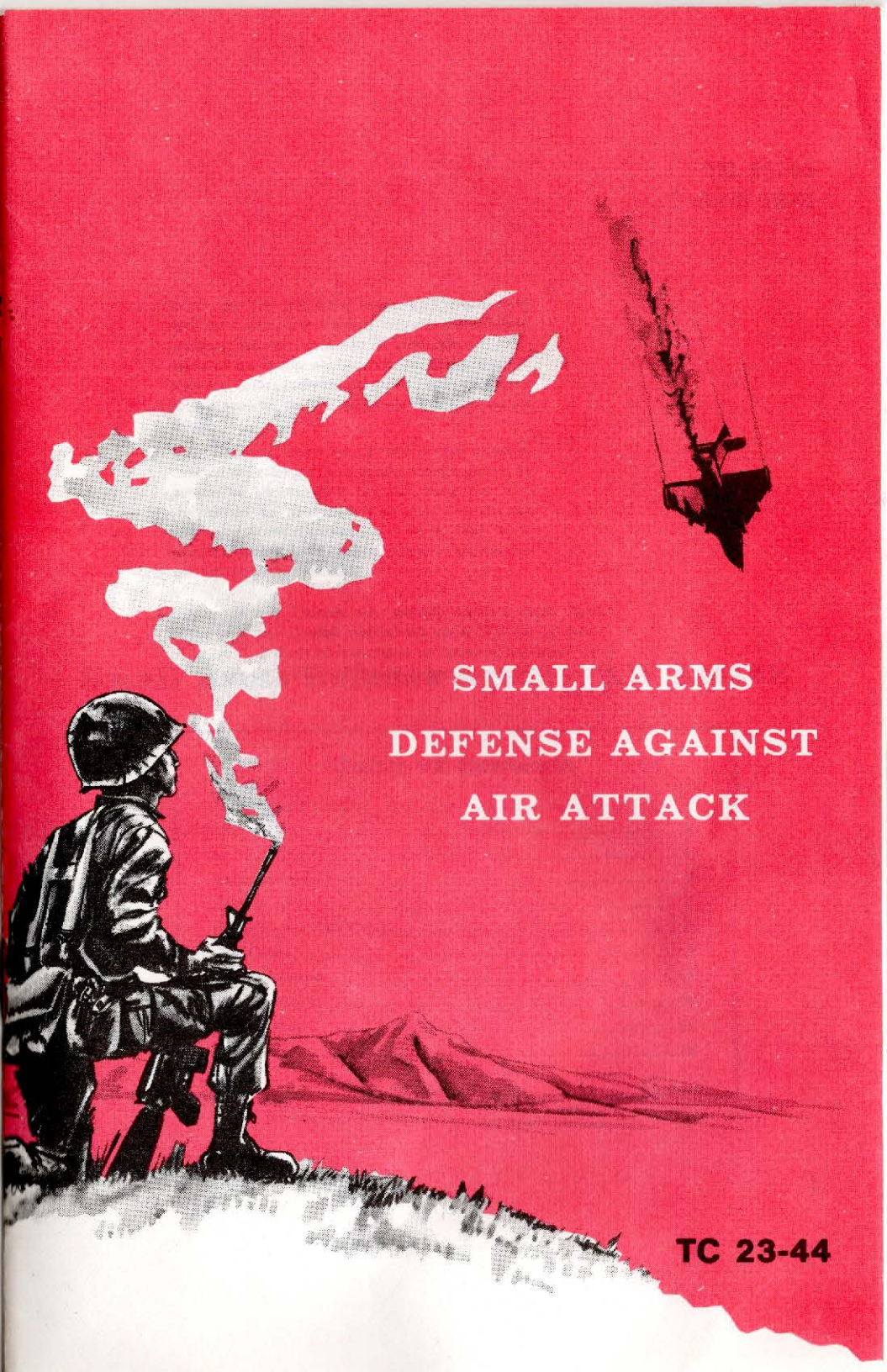


SMALL ARMS DEFENSE AGAINST AIR ATTACK

TC 23-44

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In the past, the US Army fought on the battlefield with little worry about enemy aircraft. And in future conflicts, the Air Force and air defenders will keep many of the enemy airplanes off our backs. But the basic fact is that potential enemy air forces have more aircraft than we do. We *must* train to counter the air threat.

Your unit must know how to take passive measures to avoid detection and how to take active measures to combat air attacks. What can you, the commander and trainer, do to prepare your unit? This circular will show some techniques for firing small arms weapons, suggest some training methods, and discuss application of the techniques.

Small Arms Defense Against Air Attack

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Volume is the Key

Don't think that trying to knock down an attacking airplane with small arms weapons is fruitless—it isn't. In the Korean Conflict, the US Air Force lost 544 aircraft to combined small arms and air defense fire, *almost five times as many as were lost in air-to-air combat.* In South Vietnam, we lost 410 fixed-wing and 2,100 helicopters. And over North Vietnam, small arms contributed to significant losses of our aircraft. During the Middle East War (1973), units on both sides used small arms weapons to drive off, damage, or destroy attacking aircraft.

"ACCURACY IS NOT IMPORTANT—VOLUME IS!"

What's the key to effective small arms fire against aircraft? In one word: **Volume!** One Israeli division commander said it this way: "Put up a large volume of fire with small caliber weapons. Accuracy is not important—volume is!" Another commander stated: "I put up a curtain of fire in front of the aircraft. Accuracy was not important. The idea is to get volume of fire."

All right. Volume is the key. But how do we get that volume in some kind of coordinated, somewhat accurate manner? The best technique is the simplest one. Now there's no doubt that someone could devise elaborate mental calculations for the proper lead. And someone else could place every rifleman and machinegunner according to some formula and their fire could stop a flying tank.

But let's be realistic. What is needed is a way to get volume of fire on a fast-moving target, hoping to at least get his attention away from his job. ***And if you can ruin the pilot's day by putting a lot of bullets near him, you will have given yourself some measure of protection.*** If you don't change his mind, he will turn around and work you over—all day long.

How to Fire

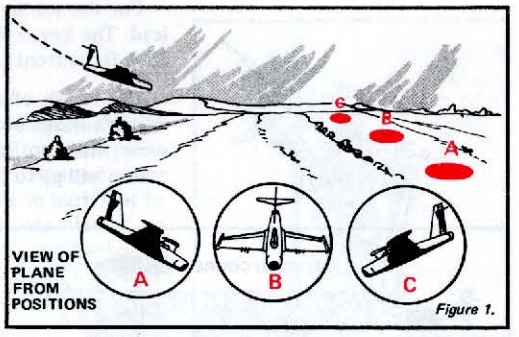


Figure 1.

Let's start by looking at how one man should fire at an aircraft. What will the target look like? Well, if it's attacking, you will probably see a head-on view or crossing view (figure 1). As the plane finishes its firing run, it will climb (figure 2). If it's not attacking, you might see the airplane pass parallel, overhead, or at an angle to your position.

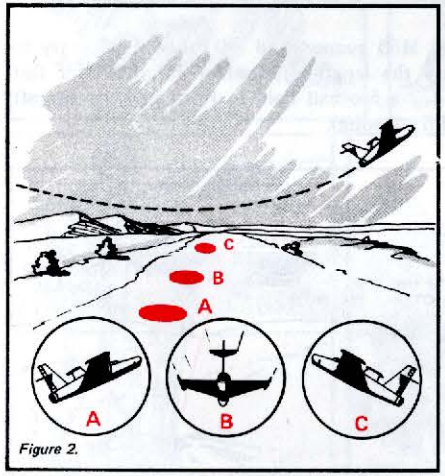


Figure 2.

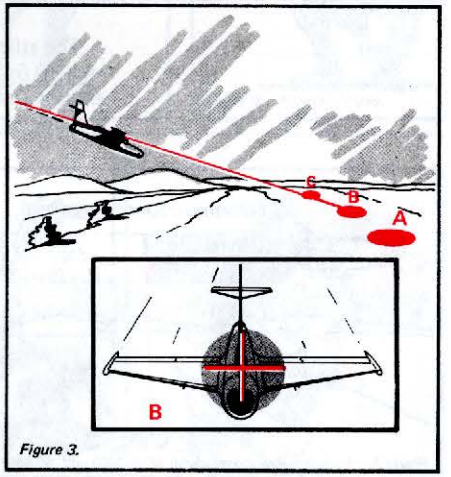


Figure 3.

If the aircraft is attacking, here's some good news and some bad news. The good news is that to fire at a plane coming directly at you, just aim slightly above the nose and fire (figure 3). Now for the bad news—he's really trying to put it to you. ***So you want to pump as much fire into his nose as you can.***

For the soldier who sees a crossing view, he must use a lead. The key is to keep the weapon in front of the aircraft. How far in front? Let's keep it simple.

The length of a football field is used only to trigger the soldier's image of a lead. Some will fire using too much lead; some with too little. But with **everybody shooting**, enough bullets will go to the right spot in front of the aircraft.

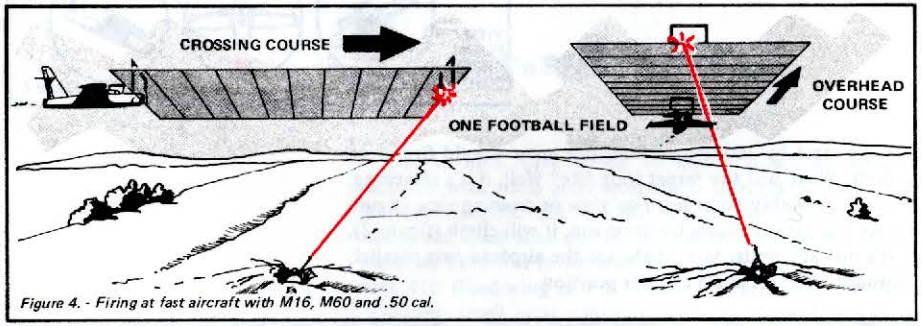


Figure 4. - Firing at fast aircraft with M16, M60 and .50 cal.

The rifleman, M60 gunner, and .50 caliber gunner try to aim in front by the length of one football field for fast aircraft (jets); 1/2 a football field in front of slow aircraft (helicopter and fixed-wing).

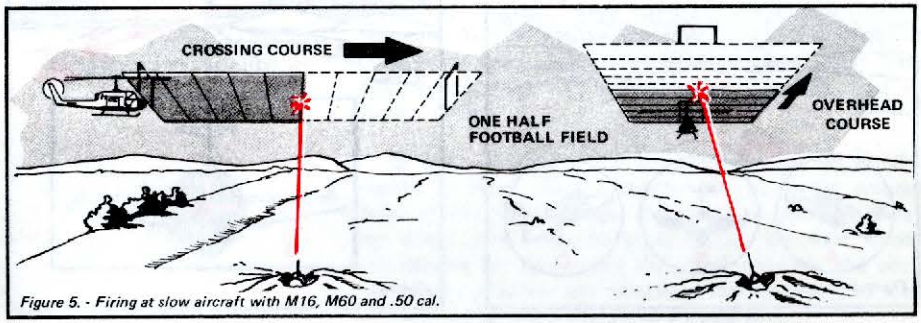
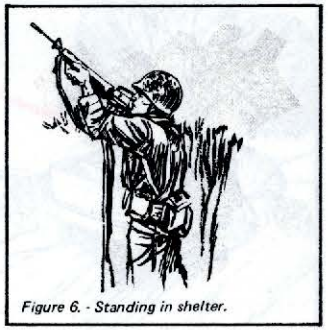


Figure 5. - Firing at slow aircraft with M16, M60 and .50 cal.

So the soldier fires as fast as possible at the nose of an incoming airplane, and leads any other view. But one man firing doesn't do much good. ***Volume means EVERYBODY SHOOTS!*** Even if the soldier forgets to lead, don't let him forget to shoot. Just get a bunch of bullets in the air.

Firing positions

Except for the prone position, the riflemen's basic firing stances stay the same. Firing at aircraft from the prone position means the firer is lying on his back, aiming his rifle into the air. But it won't take the soldier long to learn that he wants to fire from some kind of cover and concealment, no matter how small. If he's in a foxhole, he'll probably fire from a supported standing position. If he's not in a foxhole, he should look for a tree, a large rock, or something to help support the weapon and protect him.


Figure 6. - Standing in shelter.

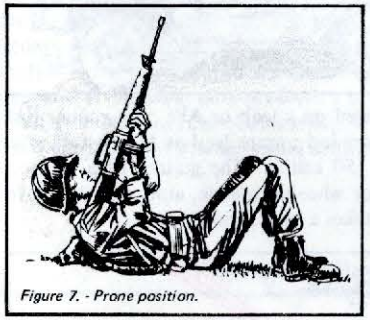

Figure 7. - Prone position.


Figure 8. - Kneeling (high).


Figure 9. - Kneeling (low).


Figure 10. - M16 with bipod


Figure 11. - M60 MG on improvised support.


Figure 12. - Emergency support.

The M60 gunner will also fire from some protected position if possible. He needs to get the weapon up in the air. He can hold it up or use some support for his arms and the weapon. In a real emergency, another soldier can act as a hasty firing support.

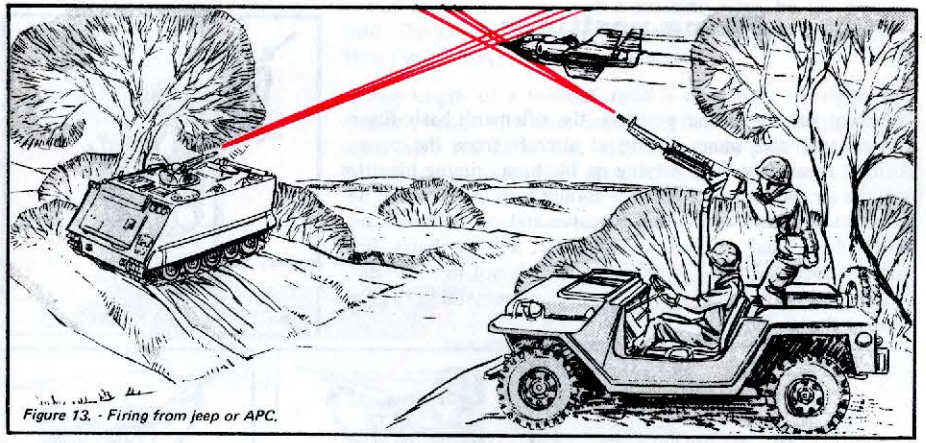


Figure 13. - Firing from jeep or APC.

If the M60 is mounted on a jeep or APC, the gunner just elevates the machinegun and pumps lead at the aircraft. The same is true for the .50 caliber. The gunner of a weapon mounted on an APC or wheeled vehicle, aims slightly above the aircraft's nose (or takes a lead), and fires.

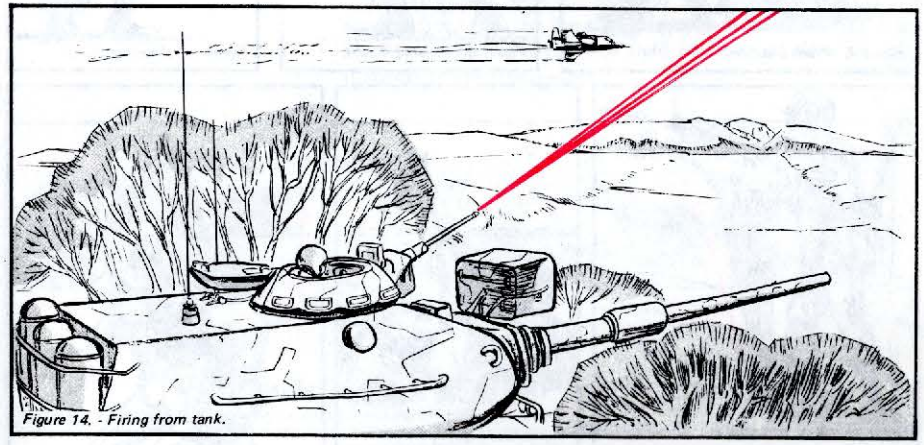


Figure 14. - Firing from tank.

For a tank commander, firing is more difficult. On some tanks, the TC may have a sight with a speed ring for the cupola-mounted .50 caliber. If the aircraft is moving slowly, he may be able to place accurate fire on it. But in the case of a jet, the TC will just elevate, aim slightly above the aircraft's nose (or take a lead), and fire.

Rules of Engagement

With many aircraft in the skies, you don't want to shoot at one of your own. So you need to have some guidelines. The first one is really easy—***if an airplane is attacking your unit, SHOOT***. You don't need to know anything else. Self-defense is an old Army rule of survival.

If the aircraft is not attacking, you (the unit commander) have a decision to make. First, you may not want to fire and disclose your position. Perhaps he didn't even see you. Second, to engage it, you must be able to ***positively identify the airplane as hostile***. Unless you are familiar with aircraft design, this may be difficult. You can get some help from the Redeye gunner, if available, since he has been trained in aircraft recognition. If Vulcan, Chaparral, or Redeye is in the area and is shooting at a plane, it's a sure bet the aircraft belongs to the enemy. **Remember, if you are not being attacked, you must give the order to fire on an aircraft.**

Volume Fire

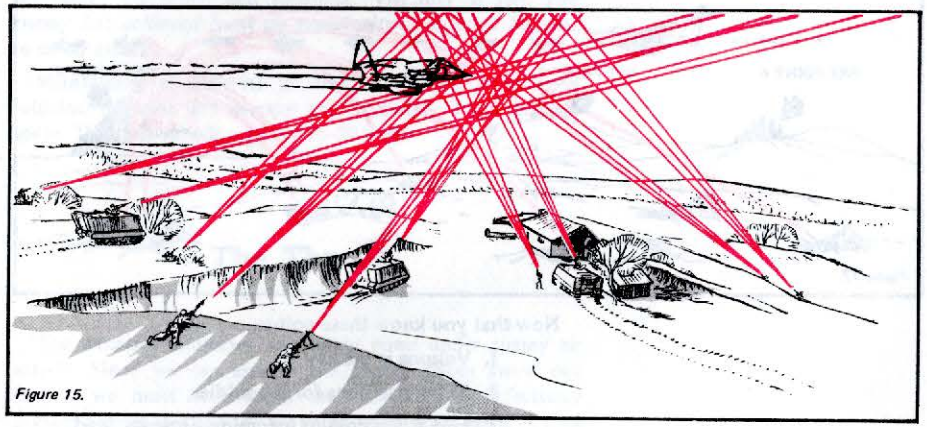


Figure 15.

The best active protection is volume fire. It is effective against low-flying, attacking aircraft. As figure 15 shows, some firers will shoot at the nose of the airplane; others will lead the target. With everybody shooting, a large area can be covered.

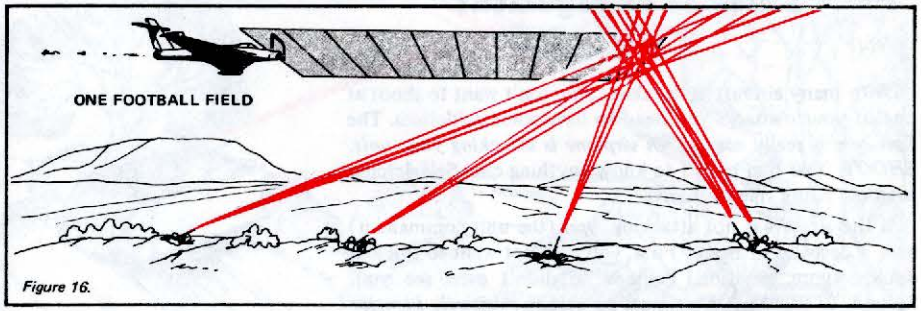


Figure 16.

From a defensive position, you might have time to coordinate firing upon command. The leader orders ***JET, FIRE.*** And everybody shoots as fast as possible until the aircraft passes (figure 16).

Another technique from a defensive posture is to have preselected reference points. The leader alerts his soldiers to get ready. As the aircraft approaches the known reference point, he orders, for example, ***"REFERENCE POINT 2, FIRE."*** All firers point their weapons at the reference point, raise the weapons at a 45° angle, and **SHOOT** (figure 17).

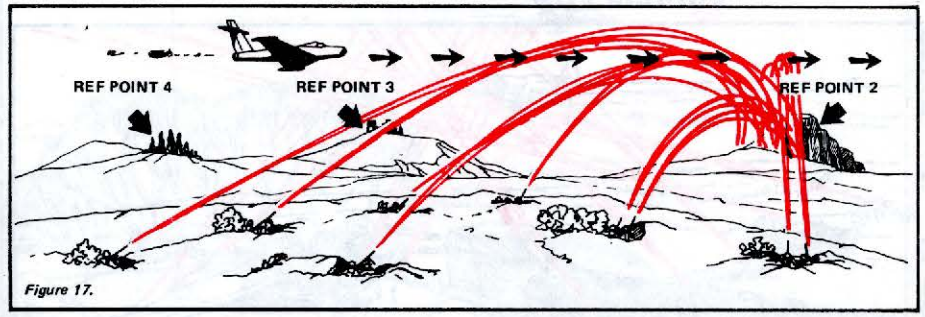


Figure 17.

Now that you know these points:

1. **Volume is the key,**
2. **Firing positions for the soldier,**
3. **Fire at the nose of incoming airplanes; lead crossing views,**
4. **Rules of engagement,**

let's look at a training situation which reflects a realistic possibility. The application of these key points will be illustrated and amplified.

Air Defense for the Convoy

Your unit faces the greatest danger of an air attack while moving in a column. Vehicles strung out along a road are sitting ducks unless action is taken quickly. An air attack must be thought of as a type of ambush. Just as security and immediate action drills are practiced to ward off a ground ambush, the unit must train to detect and counter an air attack.

AN AIR ATTACK IS A TYPE OF AMBUSH

Let's say you are commander of Team Alpha. You have two mech platoons and one tank platoon. The brigade reserve has been committed to securing the FEBA after an enemy penetration. You have been ordered to move from the division reserve to replace the committed brigade reserve. The team must move 10 km along a road (speed is important). The terrain is gently rolling. It is spring and the trees and vegetation are green and plentiful. Visibility is fair. ***The enemy has achieved local air superiority—you must be alert to an air attack.***

Maintaining an interval of about 100 meters between vehicles, the unit will occupy approximately 3 km of road space. The convoy will move at 15-20 mph.

The Threat

The situation indicates you might come under enemy air attack. Since we can assume the enemy pilots know our tactics, we must understand their doctrine to effectively protect against it. Let's say we could be hit by a flight of four aircraft armed with rockets, 1100-lb bombs, cluster bomb units (CBU), and guns (23-mm/37-mm). Hawk units are in the area and Chaparral units can protect some of the route, so the flight will probably stay below 1,000 feet, hoping to attack using a laydown and popup tactic.

Flying in two elements (two aircraft in each element) separated by 1-3 miles, the lead airplanes spot the convoy and notify the second element. The first element then does a popup. This popup is meant to divert attention until the second element attacks with a level, high-speed, low-altitude laydown of CBUs along the length of the convoy (figure 18).

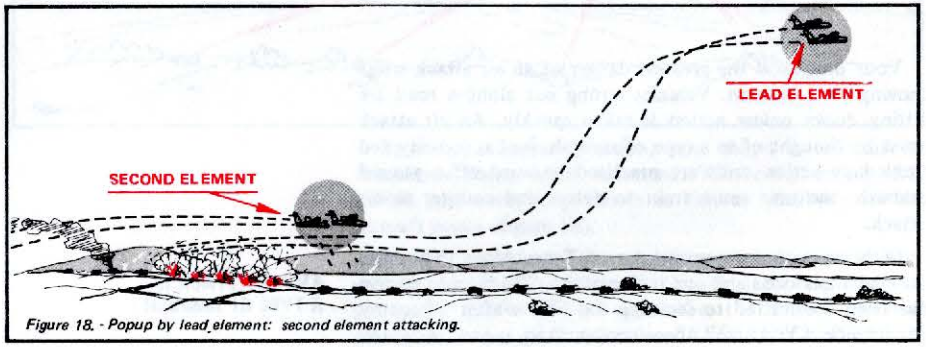


Figure 18. - Popup by lead element: second element attacking.

This tactic provides a double effect: (1) if the convoy is surprised by the popup and doesn't take immediate action, the CBUs will get good results; (2) if the soldiers scramble for cover against the CBUs, the air defense threat to the first element rolling back in for a rocket and gun run will be reduced. From the popup, the first element will have completed a high-G, reversing maneuver to come back over the road, firing rockets or machineguns or divebombing, concentrating on undamaged vehicles (figure 19). ***If the air defense weapons and small arms fires don't do the job, the second element may also return for a machinegun attack at the targets.***

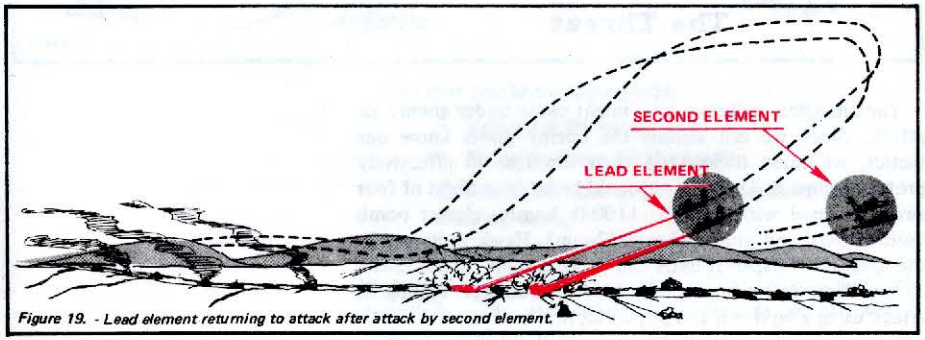


Figure 19. - Lead element returning to attack after attack by second element.

The commander should remember that the enemy pilots:

(1) will try to surprise and divert the attention of the convoy.

(2) will fly at low altitude. If they attack from higher than 350 meters, your small arms won't have much of a chance anyway. If they do go higher, air defense weapons will do a job on them.

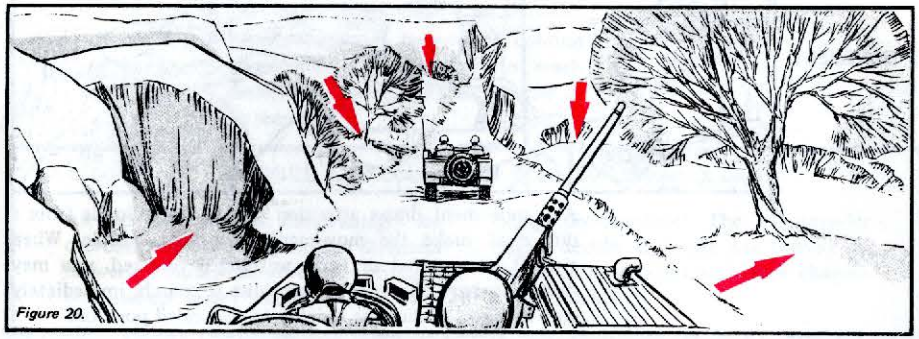
(3) will fly at high speed, using high-G maneuvers, and "jinking" (erratic movement) to make air defense weapons and small arms fire less effective.

Passive Measures

The enemy pilot must first find the convoy. *You must train your soldiers to take steps which make it difficult for the pilot to spot the unit.* The principles of camouflage apply.

SHAPE

There isn't much you can do to change the shape of a vehicle moving down the road. Small bushes, limbs, and leaves help some. Train your drivers to look, as they disperse, for a bush, tree, or some concealment to break the shape as seen from air (figure 20).


Figure 20.

TEXTURE

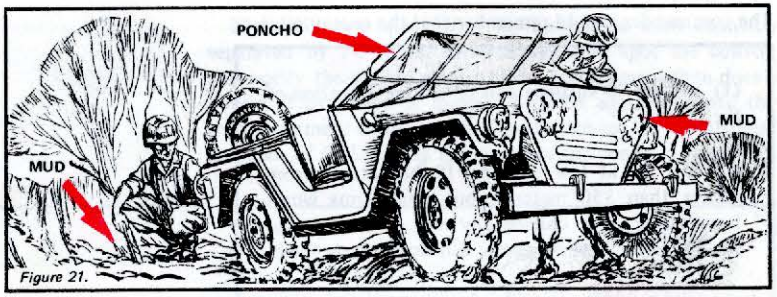


Figure 21.

Smooth surfaces and objects (windshields, helmets, field glasses, etc.) will reflect light and grab the pilot's attention. Camouflage or cover all shiny items before moving out.

COLOR

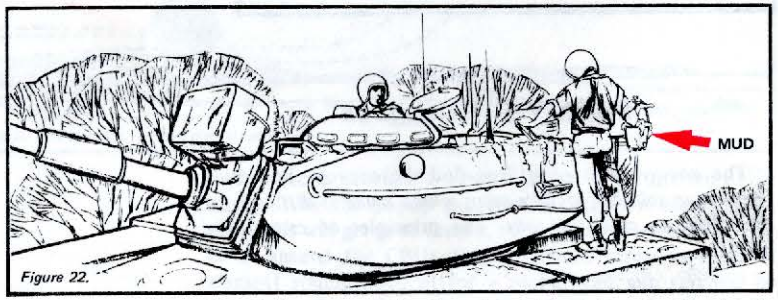
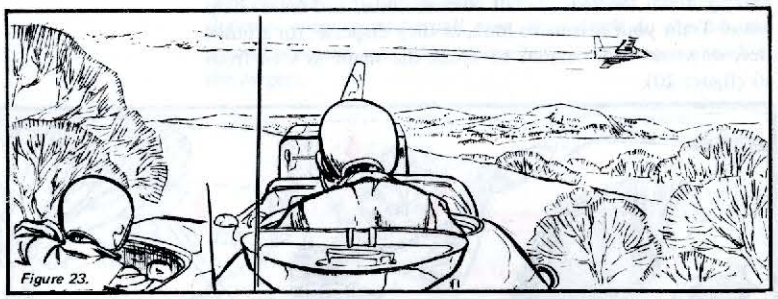


Figure 22.

If vehicles are not already painted in patterns to blend with the terrain and to break the outline, use mud to change the sameness of color.

MOVEMENT


Figure 23.

Any movement draws attention. Rising dust clouds from a dirt road make the movement even more visible. When aircraft are spotted or early warning is received, you may decide to have the convoy continue to march, immediately stop in place, or disperse quickly to concealed positions.

Seeing the enemy first puts the odds in your favor. You then have time to react. Assign airguard duties to specific soldiers. Loaders on tanks will watch for aircraft as part of their normal duties. Other airguards should be located throughout the column and should be given specific search areas. If the road march lasts more than an hour, have the men take turns. Scanning for a long period dulls the ability to spot aircraft *(see FM 23-17 and FM 44-3 for air search and scan procedures).*

The commander must also decide to use either an open or closed column. The distance between vehicles must not be "set in concrete"—choose the distance that will do the job best. Factors influencing selection of the "best" interval include mission, cover and concealment along route, length of road march, type of road surface (dirt, paved), number and type of vehicles (tanks, tracks, wheels) in the convoy, enemy threat (ground and air), convoy control, presence of air defense support, and small arms potential.

OPEN COLUMN (80-100 meters)

ADVANTAGE Probability of fewer vehicles being damaged or destroyed from air-delivered rocket, cannon, 1100-lb bombs, or CBUs because of the spread.

DISADVANTAGES Harder to control in terms of reaction to commander's decision; i.e., stop, continue, disperse and seek concealment, engage aircraft.

- Easier to see from air.
- Less concentrated small arms fire.
- Longer exposure time—open column takes longer for convoy to reach destination, permitting more time to be seen.

CLOSED COLUMN (less than 80 meters)

All the open column disadvantages are overcome somewhat by smaller distances between vehicles. However, presenting a bunched-up target could be the overriding disadvantage. The commander might decide to move his convoy in march units at night to reduce chances of air attack.

Active Measures

Enemy aircraft have been identified heading for your convoy. What do you do now? While deciding, you'll have alerted vehicle commanders of impending attack and they are preparing to engage the aircraft with small arms weapons. Let's look at your options.

STOP

Vehicles go to the shoulders of the road (figure 24).

ADVANTAGES

- Harder for the pilot to see the convoy than if you continued moving.
- Once the threat passes, it's easier and faster to continue the march.
- Volume and density of organic weapons will be greater than if you disperse.

DISADVANTAGE

- A convoy stopped on the road makes a good target. The enemy attack has a better chance of causing great damage to the unit.



Figure 24. - Vehicles moving to positions on road shoulders.

CONTINUE THE MARCH

The mission and/or terrain may dictate that the march continue. Increase speed.

ADVANTAGE

- Moving targets are more difficult to hit than stationary ones.

DISADVANTAGES

- Detection is easier.
- Volume and density of small arms fire are reduced.

DISPERSE AND SEEK CONCEALMENT

(figure 25)

ADVANTAGES

- Scatters the vehicles, making it more difficult for the enemy pilot to get multiple hits.
- Makes it harder for the enemy pilot to detect vehicles once they are dispersed and concealed.

DISADVANTAGES

- Makes it easier for pilot to spot convoy during initial movement.
- Takes longer to reorganize the convoy.
- Reduces volume and density of small arms fire.



Figure 25. - Vehicles dispersed and in concealed positions.

In our situation, the team commander has identified attacking aircraft and ordered the column to disperse. A simple technique is to have, by SOP, each odd-numbered vehicle go to the left and each even-numbered go to the right. Make sure you remind them of the march order in your briefing. The key to dispersion is not to make two straight lines out of what was one long line. ***The vehicles must be staggered.*** But this shouldn't be much of a problem if you have trained the drivers to go to trees, bushes, folds in the ground, etc., that will give concealment. Except for tank crews and vehicular-mounted weapon gunners, the soldiers will dismount and take up firing positions.

Remember: Fire at the nose of directly incoming aircraft; lead crossing aircraft. If you have time to coordinate the massing of fires by shooting on command (JET, FIRE), great. If not, each soldier fires without command. Again, *EVERYBODY SHOOTS.* That's the only way to get volume. Stop firing as the plane begins its climb or when the weapon cannot be kept in front of the aircraft.

Small arms alone will give coverage something like this:

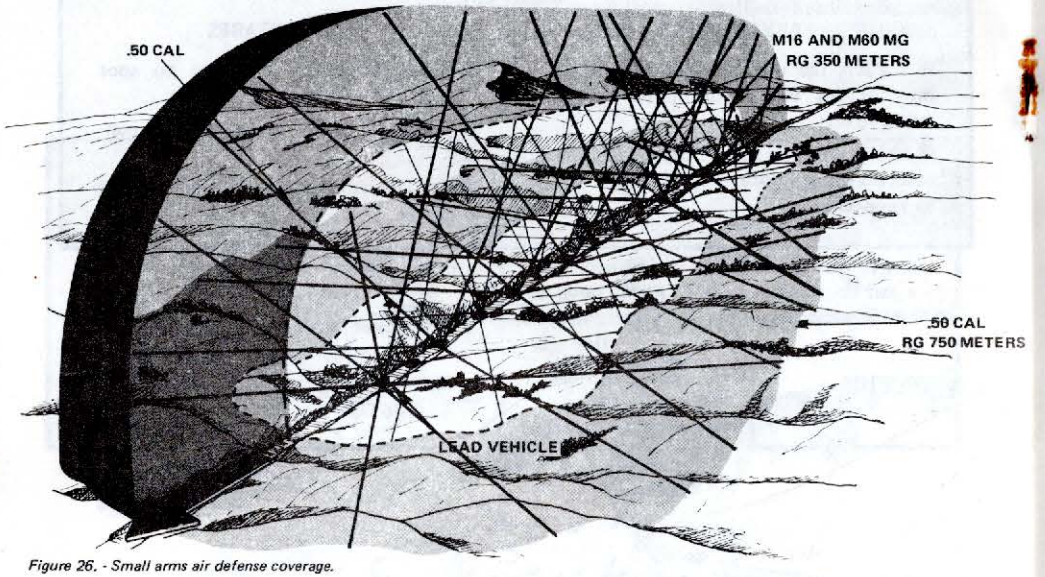


Figure 26. - Small arms air defense coverage.

That basically fills out what you can do with small arms alone. Let's look at some additional factors when air defense support is available.

Take the Redeye, for instance. The Redeye team is trained in aircraft recognition and can advise the commander of a plane's identification. With the team's contact to the **Forward Area Alerting Radar**, it can help give early warning. Our convoy might get one Redeye team to go along.

How will you place the team in the convoy? First, you should split the team: put the team chief near the front and the gunner toward the rear. Splitting does require more "get ready" time, but this will give them a shot at the aircraft as it begins its attack and again as it flies past the column. Since the *Redeye is a tailchase weapon* (the missile locks on the plane's engine exhaust and the gunner fires at the rear of the aircraft), you would lose coverage by putting the team together in the midst of the convoy.

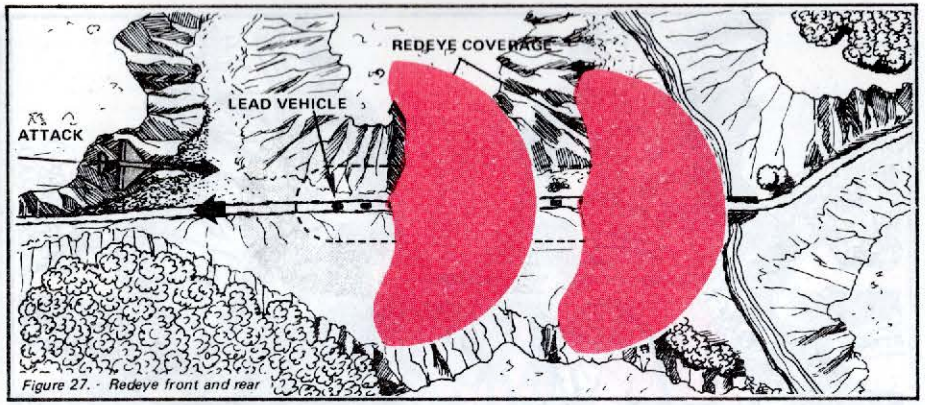


Figure 27. - Redeye front and rear

Because the Redeye team doesn't have its own vehicle, it will have to hitchhike. In our example, the commander's track will put the team chief forward; the gunner could ride on any of the maintenance vehicles near the rear of the convoy.

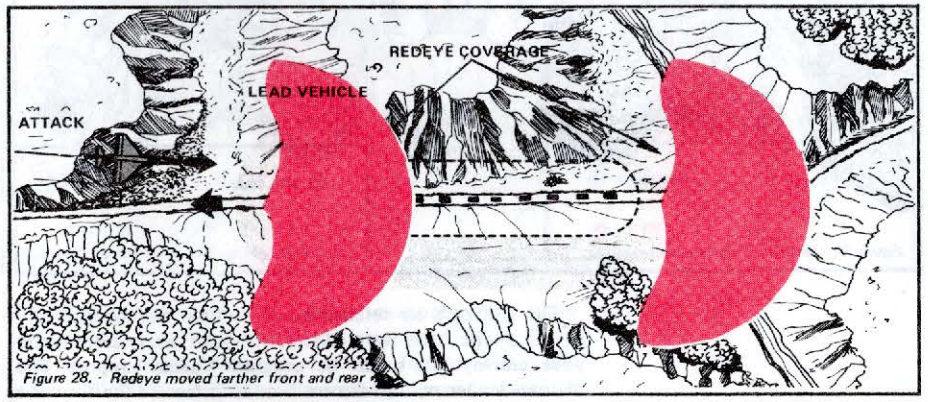


Figure 28. - Redeye moved farther front and rear

The Redeye team may have to dismount to fire at the aircraft. This means the convoy must stop or disperse. When coming to a halt on the road, the team gets off the road and prepares to fire. If the decision is to disperse, the vehicles carrying the Redeye should stop briefly for the team to dismount before seeking concealment. With enough warning, the team would move to the front and rear as far as possible. This improves early engagement capability. The option is to let the Redeye fire from its vehicle, expecting backblast damage.

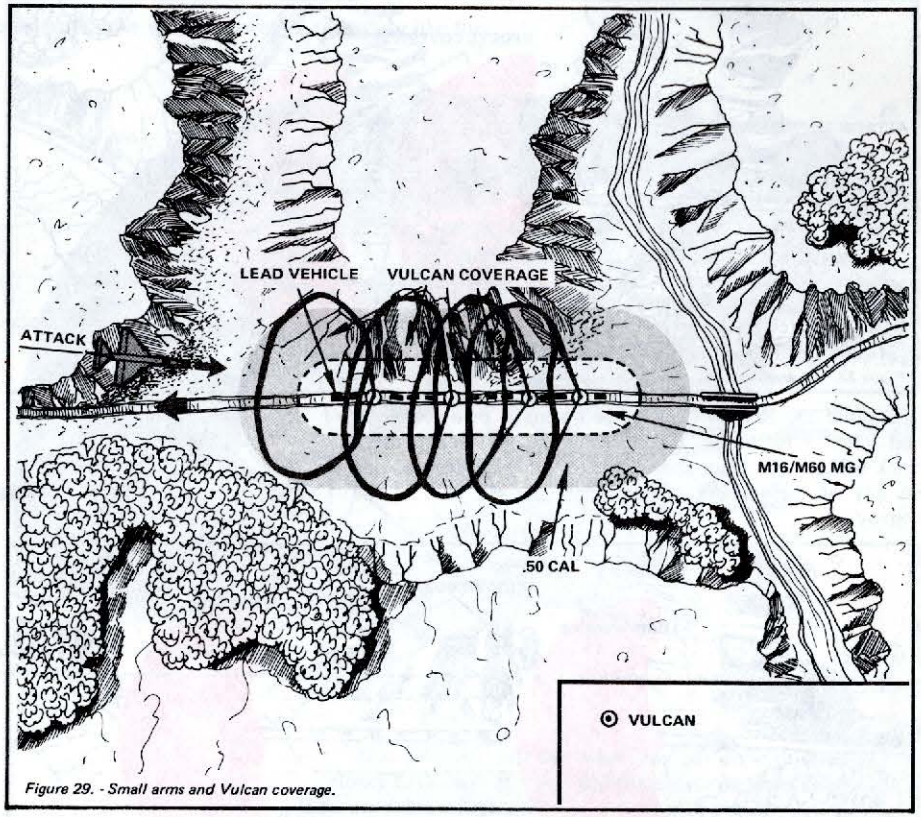


Figure 29. - Small arms and Vulcan coverage.

The convoy's air defense would be increased significantly if Vulcan fire units were added. Although assets are limited, your convoy just might be assigned Vulcan support. The platoon leader will advise on how to integrate the four fire units to get massing fire. Vulcan doctrine says a fire unit should be placed within 100 meters of the front and rear of the column. The remaining fire units are placed to further weight the front and rear. In our example, the first Vulcan should be placed after the second tank (this lets the light section stay together); the second Vulcan would be right behind the commander's track. The rear of the convoy would be weighted in a similar fashion.

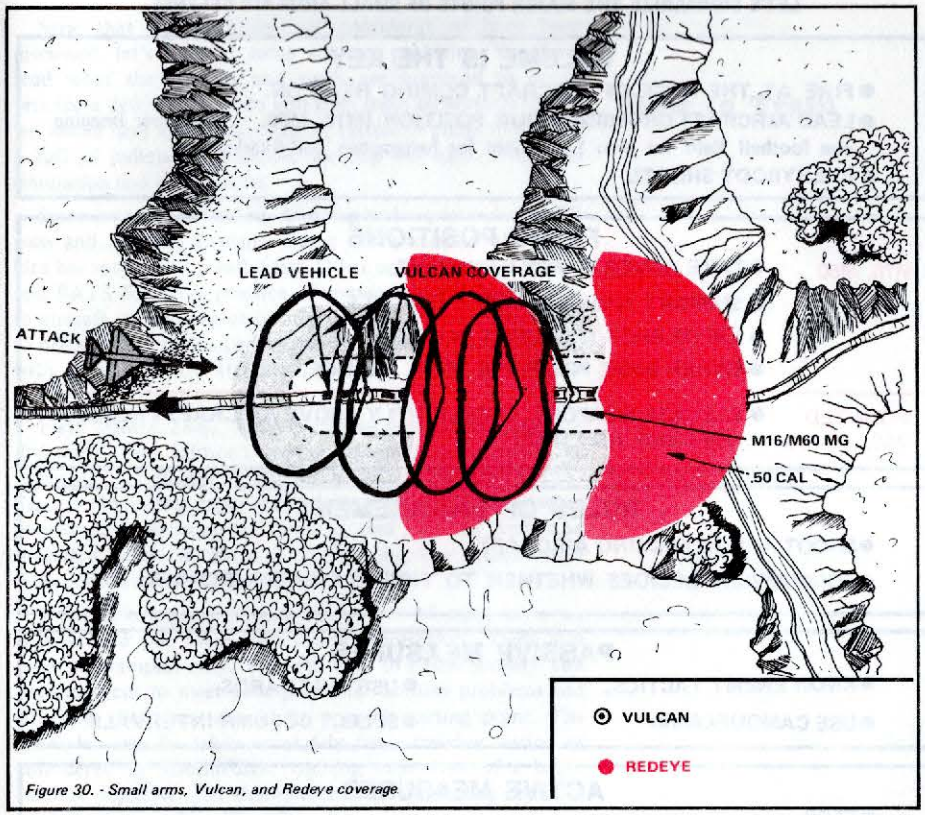


Figure 30. - Small arms, Vulcan, and Redeye coverage.

With Vulcans available, the commander has more considerations for the column interval and more active measures he can take. In an open column, the spread makes it more difficult for Vulcan fire units to provide mass or concentrated fire. Perhaps you will want to specify 80-meter rather than 100-meter intervals. Remember also that Vulcans can shoot on the move, but with reduced effectiveness. It is better for the Vulcan to fire from the halt; that aids the gunner tracking.

The example of Team Alpha shows basic considerations for small arms air defense of a convoy. These factors and the techniques discussed earlier apply also to other situations. The commander must plan for actions against an air attack and train his soldiers to react quickly and correctly.

LET'S SUMMARIZE THE MAJOR POINTS OF SMALL ARMS AIR DEFENSE.

VOLUME IS THE KEY

- FIRE AT THE NOSE OF AIRCRAFT COMING HEAD ON.
- LEAD AIRCRAFT CROSSING YOUR POSITION (M16, M60, - .50 caliber imagine one football field for jets; 1/2 a field for helicopters and fixed-wing).
- EVERYBODY SHOOTS

FIRING POSITIONS

M16, M60
- TAKE COVER IF YOU HAVE TIME.
- SUPPORT YOUR WEAPON IF POSSIBLE.
- LIE ON BACK IF CAUGHT IN OPEN.
- OTHER BASIC POSITIONS DON'T CHANGE.

MOUNTED M60, .50 CAL
- ELEVATE WEAPONS, AIM SLIGHTLY ABOVE AIRCRAFT's NOSE (or take a lead), AND SHOOT.

RULES OF ENGAGEMENT

- SHOOT ANY ATTACKING AIRCRAFT.
- COMMANDER DECIDES WHETHER TO FIRE AT OTHER AIRCRAFT.

PASSIVE MEASURES

- KNOW ENEMY TACTICS.
- USE CAMOUFLAGE.
- USE AIRGUARDS
- SELECT COLUMN INTERVALS

ACTIVE MEASURES

- STOP.
- CONTINUE THE MARCH.
- DISPERSE AND SEEK CONCEALMENT.
- ENGAGE THE AIRCRAFT WITH:
  1. SMALL ARMS - Everybody shoot.
  2. REDEYE - Set up to protect the front and rear of column.
  3. VULCAN - Weight front and rear of column for early engagement and massing of fires.

VOLUME IS THE KEY

How to Train

Now that the doctrine and considerations have been discussed, let's look at some training problems. You have read what the soldiers and units are supposed to do to provide a defense. How do you train them to perform? Since we would have a hard time getting volunteer pilots to fly into a hail of bullets for practice, training will have to rely on simulation and imagination.

Some units have worked on firing techniques by using BB guns and a model airplane sliding down a guide wire. That idea has some good possibilities. Other units have used drones and BATS for firing practice. Commanders who have access to aircraft, or can beg or borrow one, can fly over their units to observe the excellence of passive measures. If you come up with more realistic training situations, please spread the word.

Field Manual 21-6, *"How to Prepare and Conduct Military Training"* (Test Edition), explains the performance-oriented approach to training. The highlights of the approach are ***(1) what is the soldier expected to do in combat, (2) under what conditions is he expected to do it, and (3) how well is he supposed to do it.*** Thus, a training objective consists of a task, conditions, and standards.

We've taken some of the key points of small arms air defense and put them into training objectives. These will serve as examples only. You will have to refine, modify, and expand them to meet your particular training problems and situation. But they should be a good starting point. The examples may be taken separately for a training session or considered as intermediate training objectives of a larger training objective. For example, the overall training objective might look something like this:

Training Objective

TASK: Team Alpha will move in column formation from point A to point B (approximately 10 km),

CONDITIONS: during daylight, over a road through gently rolling terrain with medium vegetation, with enemy having air superiority and little chance of ground attack.

STANDARDS: Unit will take appropriate passive measures to avoid detection and reduce damage possibility, and take active measures to engage attacking aircraft.

If such an overall training objective is used, the following examples would aid training toward that end. They are by no means all the inherent tasks. The commanders will have to analyze all facets of getting the job done and insure his soldiers can perform.

Training Objective

TASK: The rifleman will employ active small arms air defense measures at an attacking aircraft

CONDITIONS: coming straight on, during daylight, using the kneeling position, having been alerted to the attack.

STANDARDS: The rifleman will take available cover (tree, vehicle fender, etc.), providing support for his arm and weapon. He will aim slightly above the nose of the aircraft, fire as fast as possible, and stop firing when the airplane passes directly overhead.

NOTE: Similar objectives would cover the tasks of the M60 and .50 caliber gunners on both straight on and crossing views. If a method of actual firing is possible, training and evaluation would be even better.

Perhaps use of the television trainer (TVT) would be beneficial. The firer would aim the TVT camera instead of a weapon to prove he understood the concept of firing at the nose and leading the aircraft. The trainer could monitor and critique performance.

Training Objective

TASK: Vehicle drivers will take passive measures against air attack,

CONDITIONS: from the column formation, on a road, during daylight, over gently rolling terrain with adequate trees and vegetation.

STANDARDS: Driver will drive to a location to gain concealment from air observation. Vehicular-mounted weapons must be able to fire at aircraft. Observer in aircraft will attempt to spot vehicle within two minutes after order to disperse is given. Vehicles must follow SOP for dispersion against air attack. Vehicles will not be alined with others.

NOTE: Even though it is difficult to attain measurable performance standards for this task, the training is imperative. Subjective judgment and evaluation make a better critique than no criteria at all. Remember that the conditions and standards are altered by your location: snow, jungle, desert, etc.

Training Objective

TASK: Airguards will scan and search for approaching aircraft

CONDITIONS: while riding in a column, observing assigned sector, during daylight.

STANDARDS: Airguards will scan and search according to techniques in FM 23-17 and FM 44-3. Airguards will alert the vehicle commander of any sighting by calling out "Airplane" and point out to the airplane.

NOTE: If possible, have various kinds of aircraft fly over the column from different directions. This training can be preceded or augmented by training with the *Ground Observer Aircraft Recognition* (GOAR) kit. If airguards become proficient in recognition, the alert could include type of aircraft.

TASK: Unit will move in column formation

CONDITIONS: mounted in organic vehicles, 10 km over a road from point A to point B, enemy contact not likely.

STANDARDS: Vehicles will be camouflaged appropriately. Drivers will maintain vehicular interval of approximately 100 meters and a speed of 15-20 mph.

NOTE: It is important that drivers learn to maintain distance and speed without commands from the vehicle commander. When the condition states "enemy contact probable," the standards and techniques of movement will vary.

Training Objective

TASK: Redeye gunners will employ active air defense measures against attacking aircraft

CONDITIONS: in convoy vehicle, during daylight, with M76 tracking head trainer, live aircraft (or model plane) with IR source.

STANDARDS: Gunners will follow procedures prescribed in FM 23-17 to deploy, detect, and fire on attacking aircraft. Gunners must fire while aircraft is in launch envelope.

NOTE: When training resources prohibit actual firing, the TVT can be an invaluable aid to improve gunner skills. See TC 44-7 (Test Edition) for details on installing the TVT on the Redeye training launcher and monitoring gunner performance.

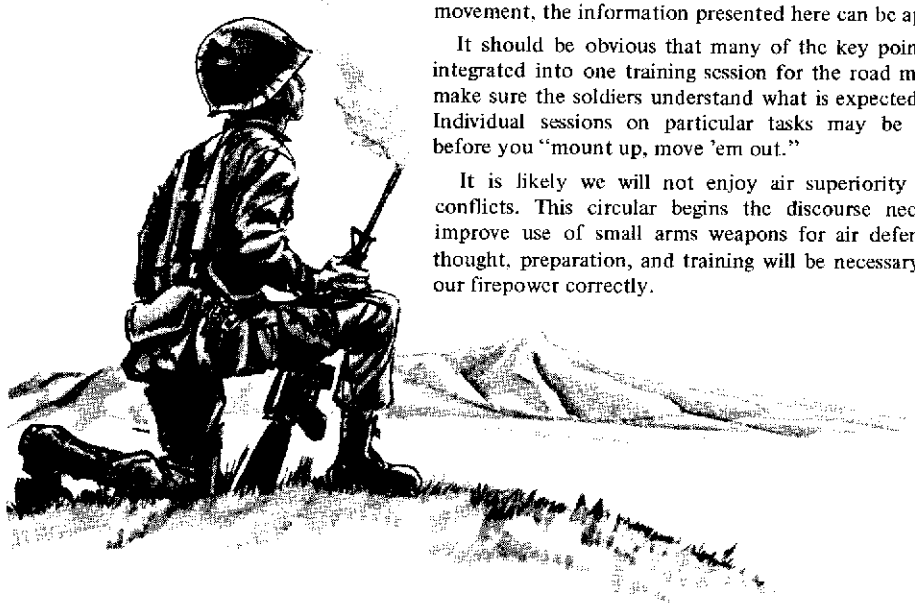


Conclusion

Training for air defense is easily integrated into any tactical training for any type or size unit. Anytime a unit is practicing the road march or some other type battlefield movement, the information presented here can be applied.

It should be obvious that many of the key points can be integrated into one training session for the road march. But make sure the soldiers understand what is expected of them. Individual sessions on particular tasks may be necessary before you "mount up, move 'em out."

It is likely we will not enjoy air superiority in future conflicts. This circular begins the discourse necessary to improve use of small arms weapons for air defense. Much thought, preparation, and training will be necessary to apply our firepower correctly.



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