

MILITARY TRAINING

VOLUME 17

ALL ARMS AIR DEFENCE

(BILINGUAL)

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Original..... 01989-06-01

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FOREWORD

1. B-GL-318-017/PT-000, Military Training, Volume 17, All Arms Air Defence, is issued on authority of the Chief of the Defence Staff.
2. This manual is a new publication. It is effective upon receipt.
3. Comments or recommendations regarding the contents of this manual should be forwarded through normal channels to Headquarters, Mobile Command, Attention: SSO Artillery.

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CHAPTER 1
INTRODUCTION
SECTION 1
GENERAL

AIM

1. The aim of this manual is to provide guidance on the employment of small arms in the air defence (AD) role, and to provide a reference for unit officers and instructors when planning and conducting all arms air defence (AAAD) training.

SCOPE

2. There will never be enough dedicated AD resources to provide immunity from air attack. All elements of the army must, therefore, be capable of self-defence against the air threat, particularly against the armed helicopter. This manual deals with employment techniques, control procedures and training methods for small arms and certain anti-armour weapons in a secondary AD role. A chapter on passive AD measures is also included, since passive AD will be the primary form of AD available to units, see Chapter 2. As the fighter ground attack (FGA) aircraft is the most difficult target to engage with AAAD, it is covered in detail in this manual. Similar principles and techniques are used to counter the helicopter threat.

3. Employment and control procedures for AD artillery weapons are dealt with in B-GL-308-001/FT-001 Interim 1, Air Defence Artillery, Volume 1, Command, Control and Employment.

BACKGROUND

4. No matter how efficient AD weapons assigned to units may be, the enemy will possess sufficient assault helicopters and aircraft to ensure that friendly ground forces come under air attack.

5. Recent history has proven that modern high technology aircraft are vulnerable to small arms, cannon, tank and anti-armour weapons fire when the fire is properly controlled and is present in large volume.

6. During World War II, few aircraft were destroyed by small arms fire as they generally operated at altitudes above the effective ranges of such weapons. Subsequently, improvements in AD weapon systems have forced attacking aircraft to lower altitudes, increasing their vulnerability to small arms. These weapons have been proven effective against low flying aircraft in recent conflicts.

7. In Korea, the United States Air Force lost over 500 aircraft to ground fire, more than five times the number lost in aerial combat. In South Vietnam, over 400 fixed-wing (FW) aircraft and more than 2000 helicopters were destroyed in combat, the majority by small arms. AAAD was also reported to be highly effective in the Middle East and Falkland Island conflicts.

SECTION 2

THE AIR THREAT

ENEMY AIR

1. Enemy air activity of concern to AAAD can be divided into the following types (see Figure 1-2-1):
 - a. FGA;
 - b. reconnaissance (recce);
 - c. armed helicopters; and
 - d. transport aircraft used for para-landing.
2. **FGA.** The Warsaw Pact forces have a large number of aircraft available for ground attack. Many are multi-role AD/FGA/recce fighters. These aircraft are expected to fly at low level in flights of four or eight aircraft using off-set pop up or lay down methods of attack and employing bombs, cluster bomb units (CBUs) air-to-surface missile (ASMs) rockets, napalm and cannon. These methods of attack are discussed in paragraph 8. Typical FGA aircraft used by Warsaw Pact forces are shown in the Figures 1-2-2 to 1-2-6.
3. Two new aircraft in the Soviet inventory are the SU-27 FLANKER and the MIG-29 FULCRUM, see Figure 1-2-7. Designed as air superiority fighters and similar to the F-15 EAGLE in shape and performance, they also have a formidable ground attack capability. Using sophisticated fire control systems, including laser designators and forward looking infra-red radar (FLIR) search and track pods, they can deliver ordnance with pinpoint accuracy.
4. Eighty percent of all daylight reconnaissance missions will be at low level. Aircraft will often be armed and, therefore, capable of attacking opportunity targets. Recce sorties use visual, photographic and infra-red (IR) techniques to gather information. Recce aircraft will not normally be engaged by AAAD unless the unit is attacked by those aircraft. Typical recce aircraft are:

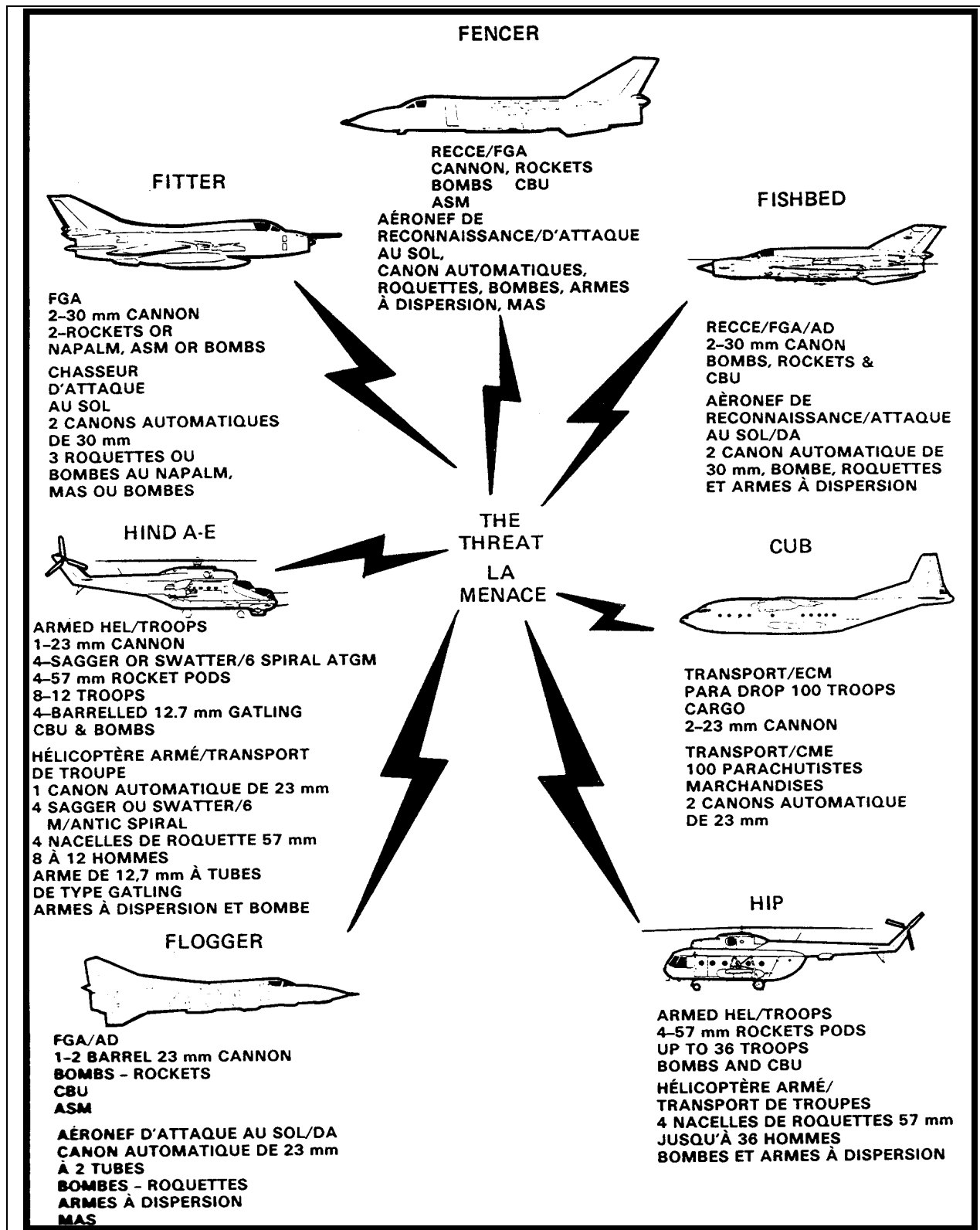


Figure 1-2-1 Threat Aircraft Likely to be Seen Over the Battlefield

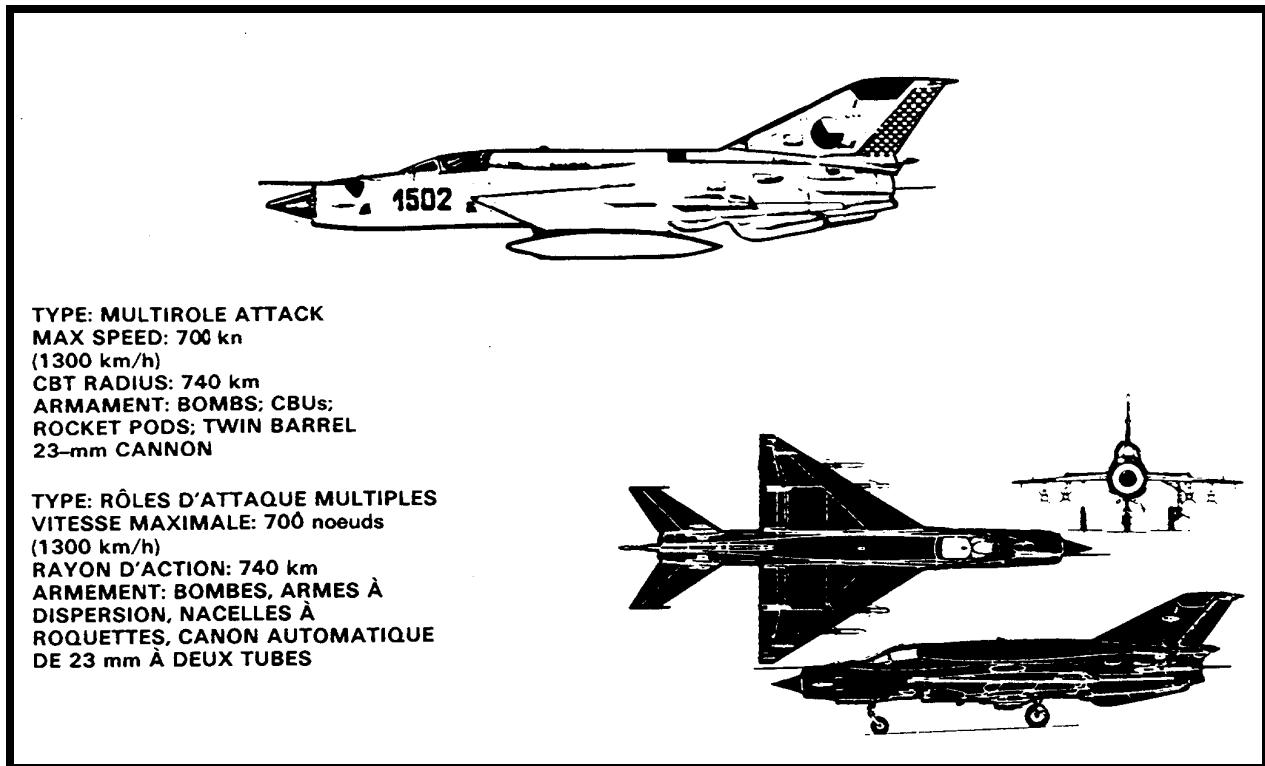


Figure 1-2-2 MIG-21 FISHBED

- a. FISHBED/H;
- b. FITTER H;
- c. FENCER/D; and
- d. FOXBAT B/D.

5. **Armed Helicopters.** The Warsaw Pact forces can be expected to employ large numbers of armed helicopters in any offensive against NATO. Four to eight armed/attack helicopters will normally escort helicopter assault formations of up to 20 aircraft, while formations of up to 16 anti-armour helicopters will work in pairs, threes and fours using anti-tank guided missiles (ATGMs) against friendly armoured formations from standoff ranges of up to 5000 metres. The more important Soviet armed helicopters are shown in Figures 1-2-8 and 1-2-9.

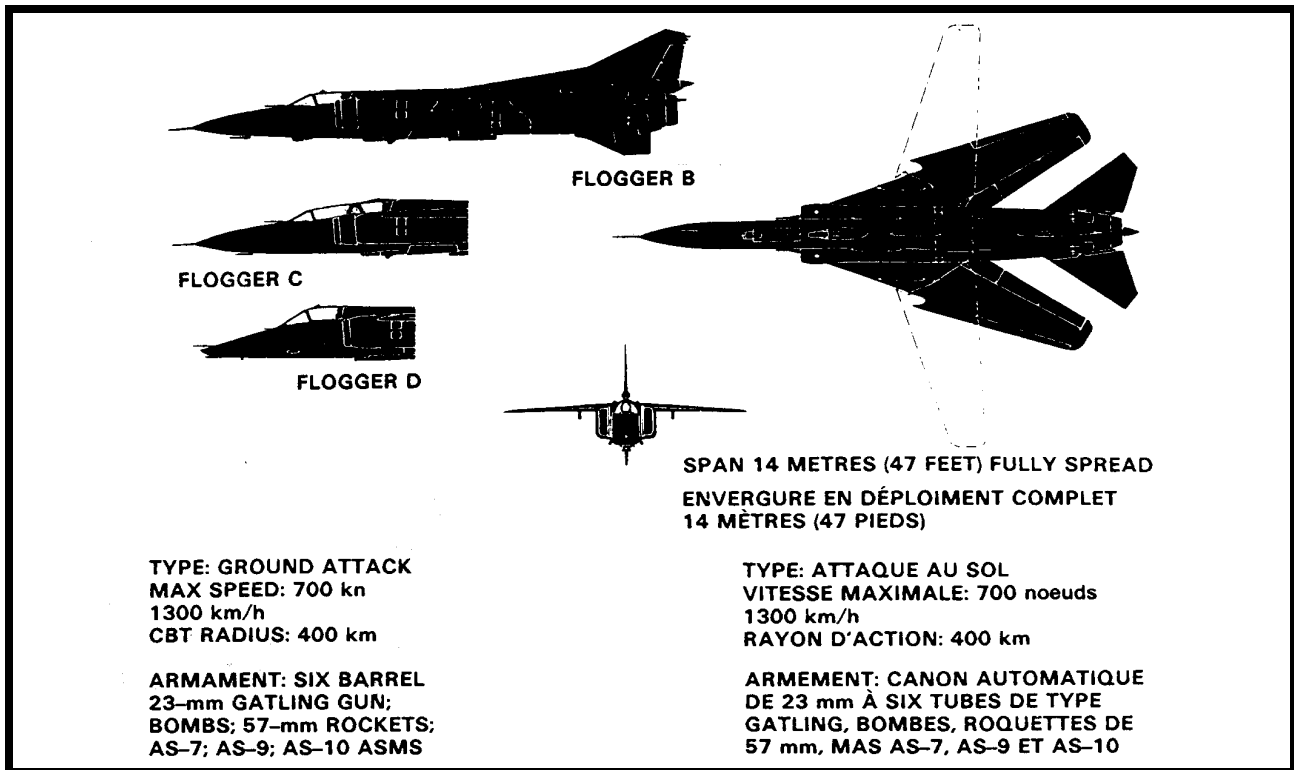


Figure 1-2-3 MIG-23 FLOGGER

6. A new attack helicopter being fielded by the Soviets is the HAVOC, see Figure 1-2-10. Similar in size and shape to the AH-64 APACHE, it carries sophisticated all weather search and tracking devices, the AT-6 SPIRAL and a nose-mounted cannon.

7. **Transport.** Warsaw Pact forces can be expected to use troop lift helicopters escorted by armed helicopter and supported by AD suppression operations to attempt air mobile insertions of company and battalion-sized units up to 50 kilometres ahead of their main thrusts. In addition, they may employ airborne forces. These drops normally take place at night from altitudes of 360 to 600 metres at speeds not exceeding 200 knots. Typical Soviet transport aircraft used in heliborne and airborne operations are shown in Figures 1-2-11 and 1-2-12.

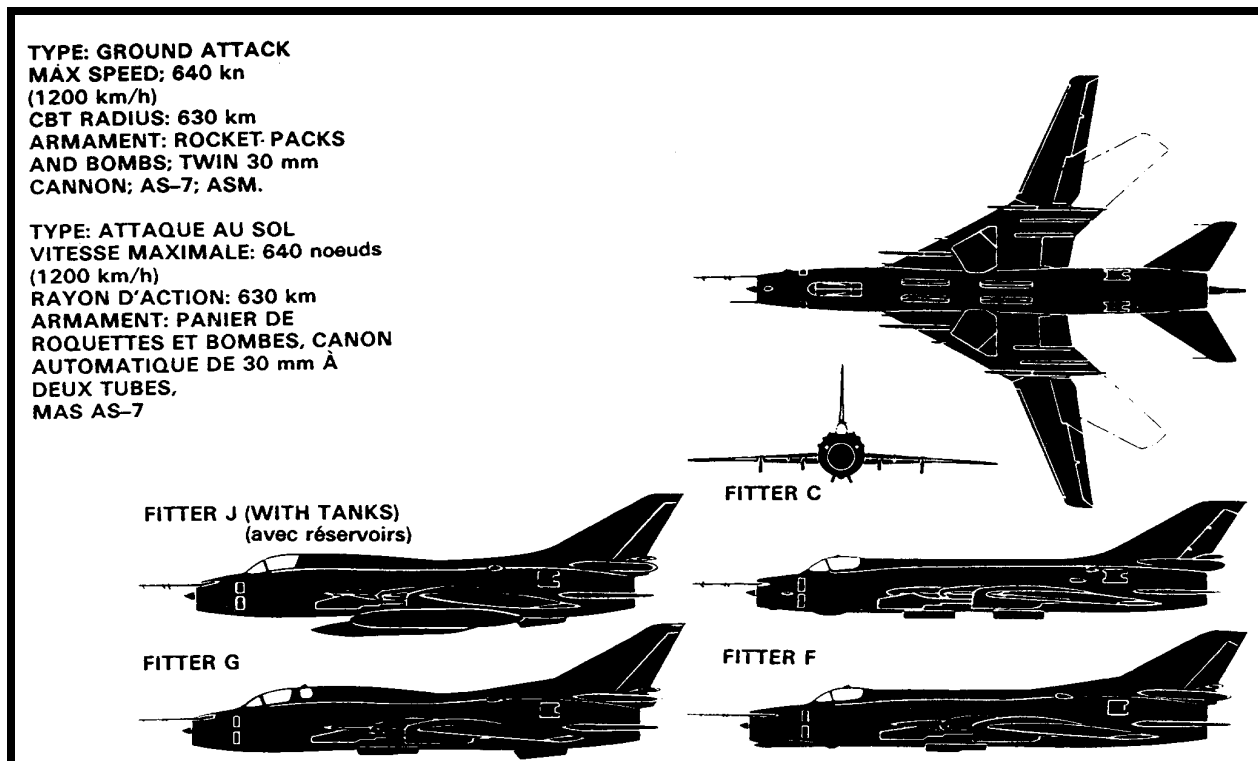


Figure 1-2-4 SU-17/20 FITTER

AIRCRAFT ATTACK PROFILES

8. Threat aircraft will carry out attacks against ground formations and critical assets, attacking at low altitudes in formations of two, four or eight aircraft. Figures 1-2-13 to 1-2-19 illustrate typical aircraft attack profiles while Figure 1-2-20 provides details of various weapons employed by aircraft.

- a. **Bombing Attacks.** Aircraft may approach at very low levels and pop up to deliver bombs in a dive profile, or they may execute a straight-in, low level attack using high-drag ordnance. Conventional iron bombs with a variety of fuzes may be effective against area targets and field defences, while CBU's and ASMs may be used against troops, armour and soft-skinned vehicle concentrations.

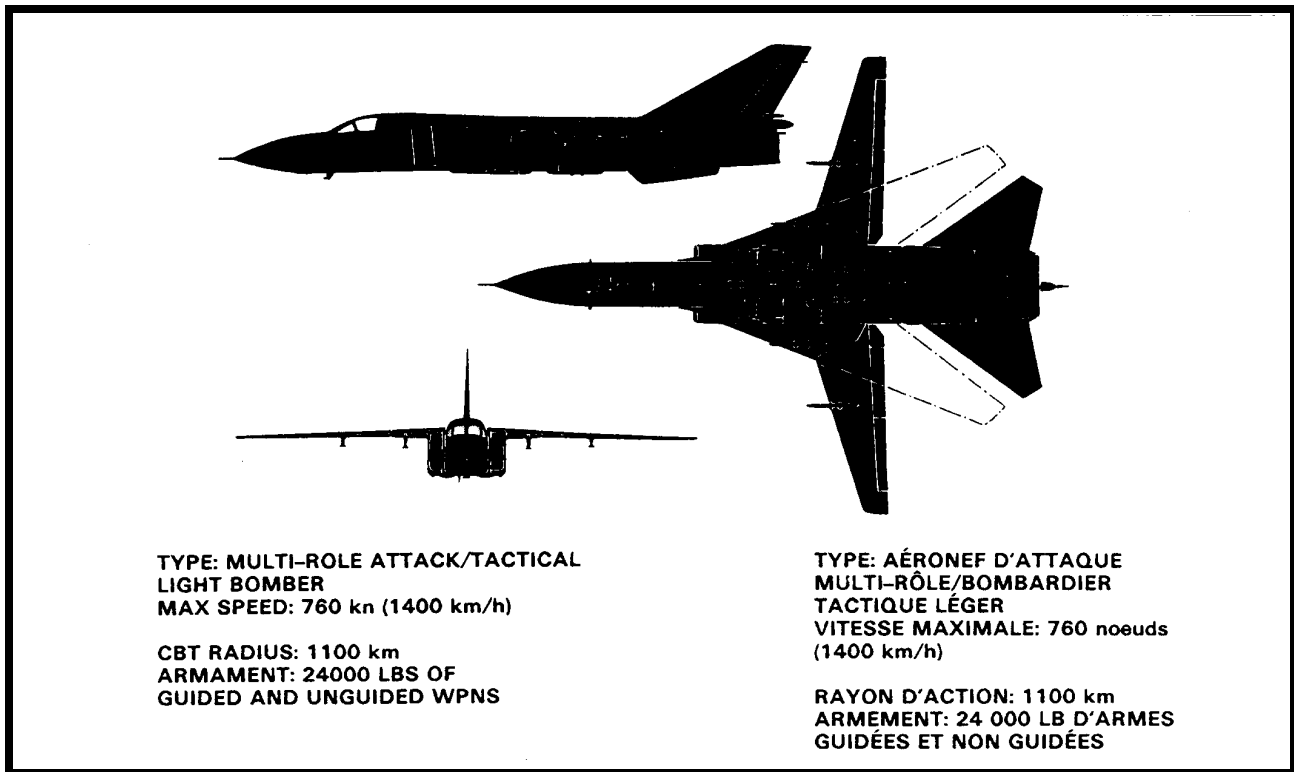


Figure 1-2-5 SU-24 FENCER

- b. **Rocket Attacks.** Aircraft equipped with rockets will approach at low levels and pop up 500 to 1000 metres to deliver rockets in a 10 to 30 degree dive and from a range of 800 to 1500 metres. Rockets are effective against hard targets, armour, dug-in troops, small bridges and soft-skinned vehicles.
- c. **Cannon Attack.** Aircraft will approach the target at low altitude, climb to 500 to 1000 metres and fire at a range of 500 to 1000 metres in a 10 to 30 degree dive. Cannon is effective against troops and vehicles, particularly in convoy formation.

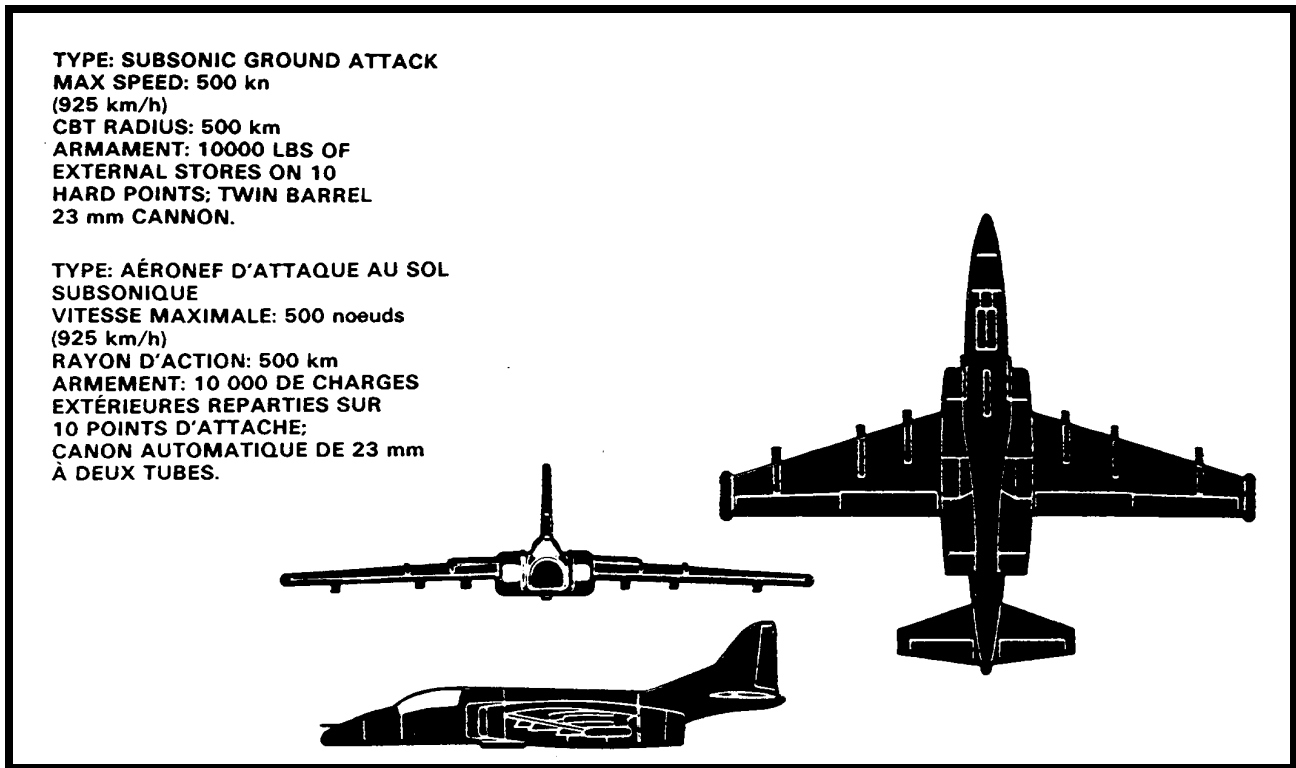


Figure 1-2-6 SU-25 FROGFOOT

- d. **Napalm.** Napalm is delivered at a height of about 1 00 metres at speeds of 300 to 500 km/h. It is effective against all types of targets susceptible to intense heat. Effectiveness is reduced in heavy snow.
- e. **Attack Helicopters.** Armed Soviet helicopters normally execute rocket and ATGM attacks by pulling up to 500 metres altitude, 3000 to 6000 metres from the target and approaching the target in a shallow dive.

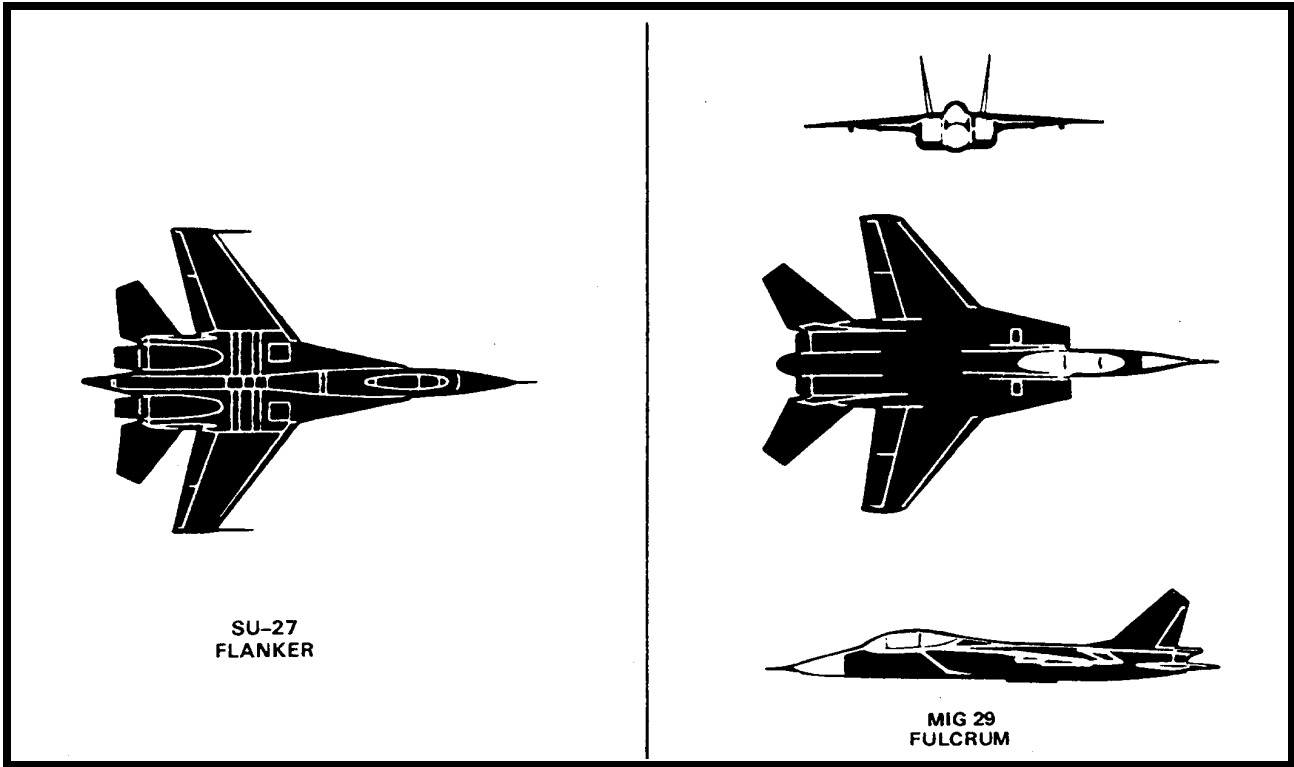


Figure 1-2-7 SU-27 FLANKER MIG-29 FULCRUM

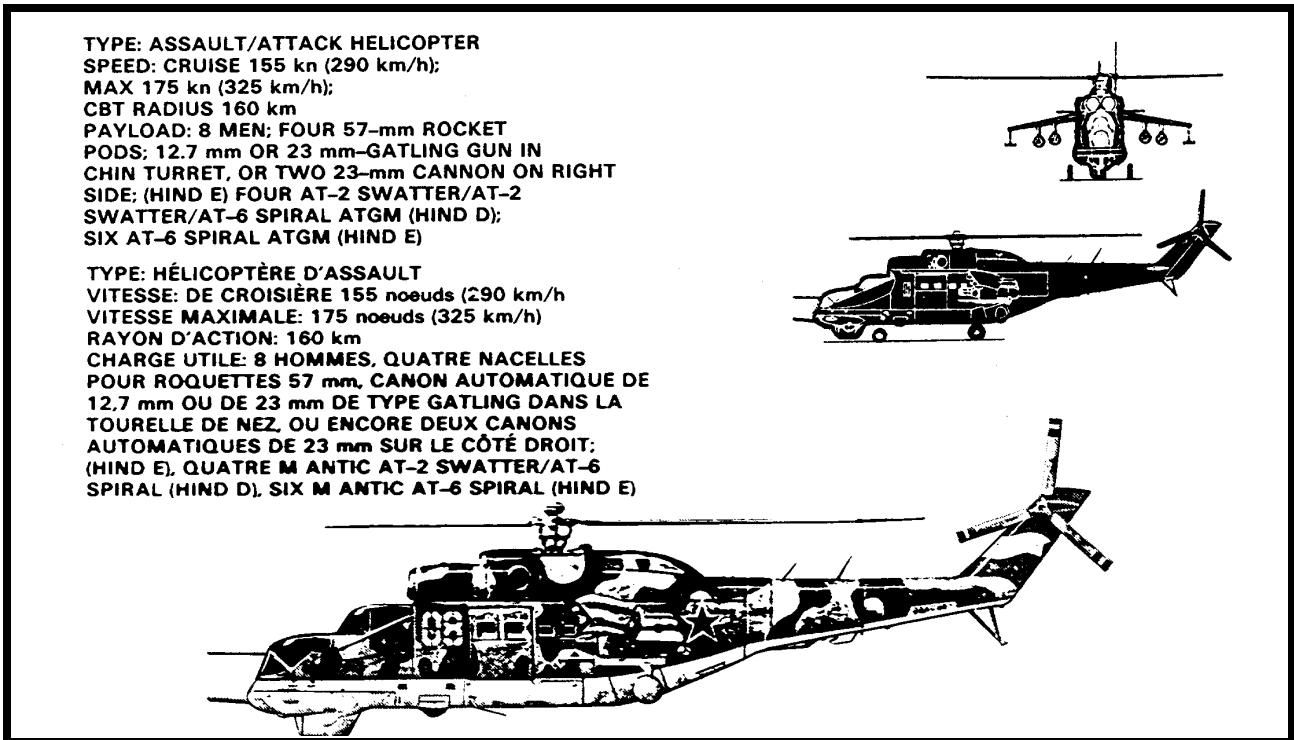


Figure 1-2-8 MI-24 HIND

TYPE: MEDIUM TRANSPORT/ASSAULT
SPEED: 113 kn (210 km/h)
PAYLOAD: 12 TO 20 MEN; SIX 57-mm
ROCKET PODS: FOUR AT-2 SWATTER
ATGM AND A 12.7-mm IN NOSE.

**TYPE: HÉLIOPTÈRE DE TRANSPORT MOYEN/
HÉLIOPTÈRE D'ASSAULT**
VITESSE: 113 noeuds (210 km/h)
CHARGE UTILE: DE 12 À 20 HOMMES,
SIX NACELLES DE ROQUETTES DE 57 mm,
QUATRE M ANTIC AT-2 SWATTER ET UNE
MITRAILLEUSE 12.7 mm MONTÉE DANS LE
NEZ DE L'APPAREIL.

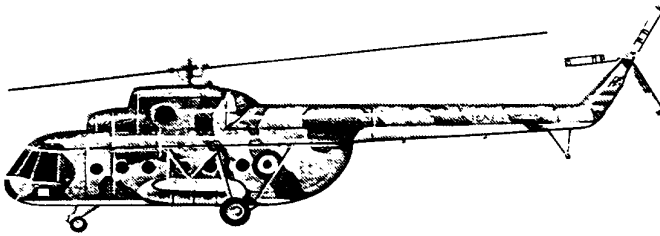
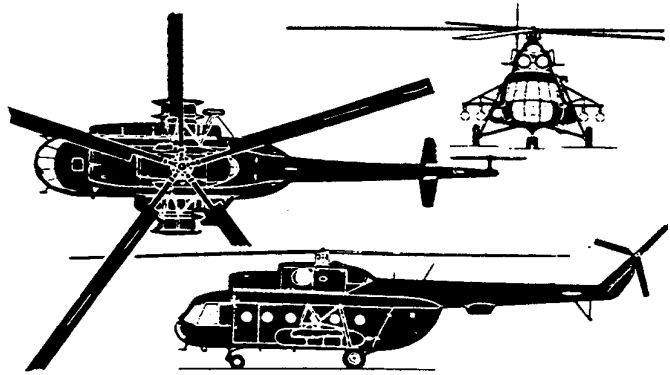


Figure 1-2-9 MI-8 HIP

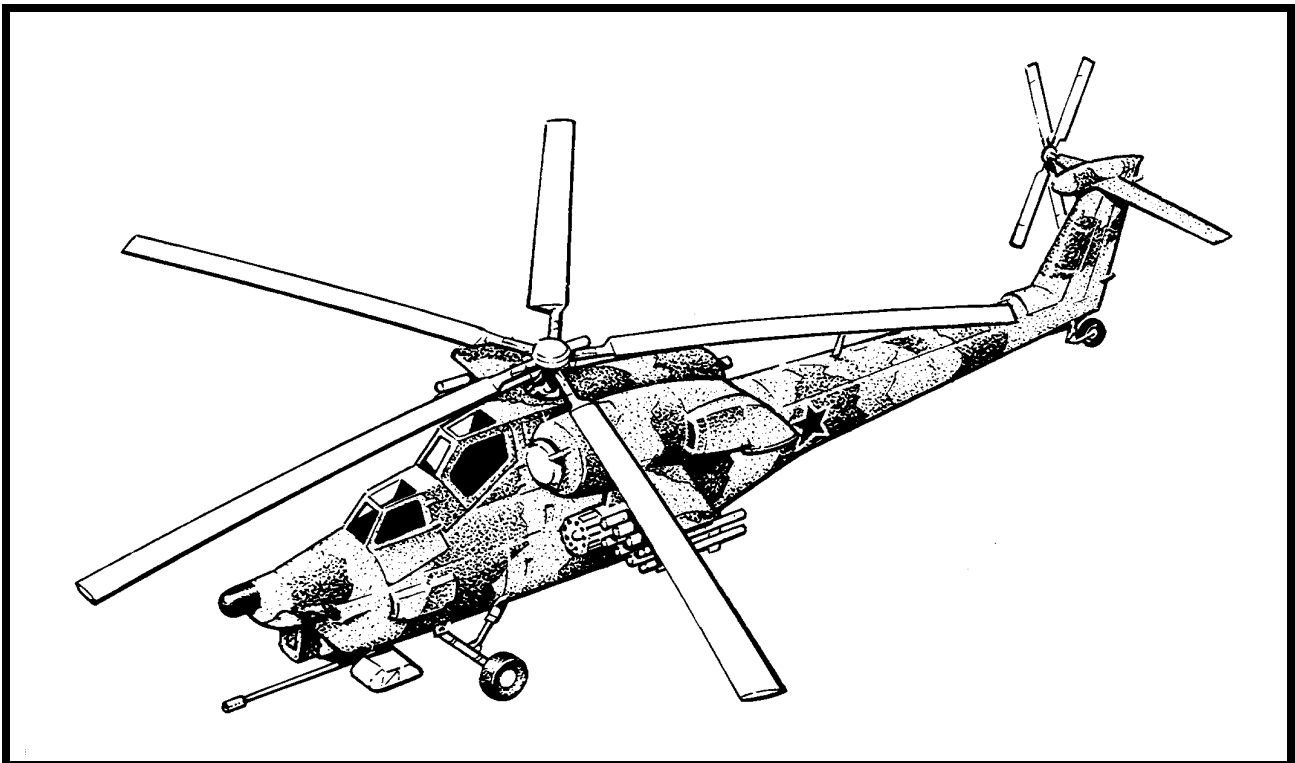


Figure 1-2-10 HAVOC

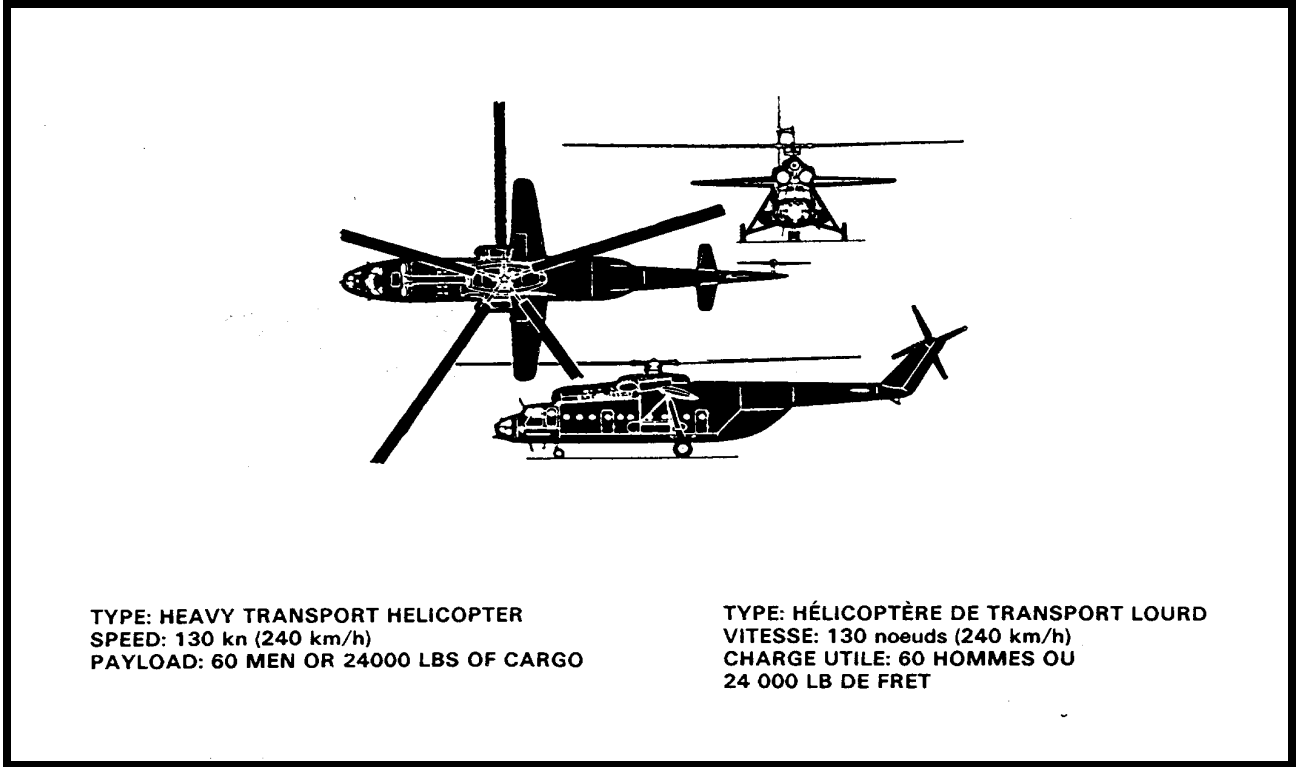


Figure 1-2-11 MI-6 HOOK

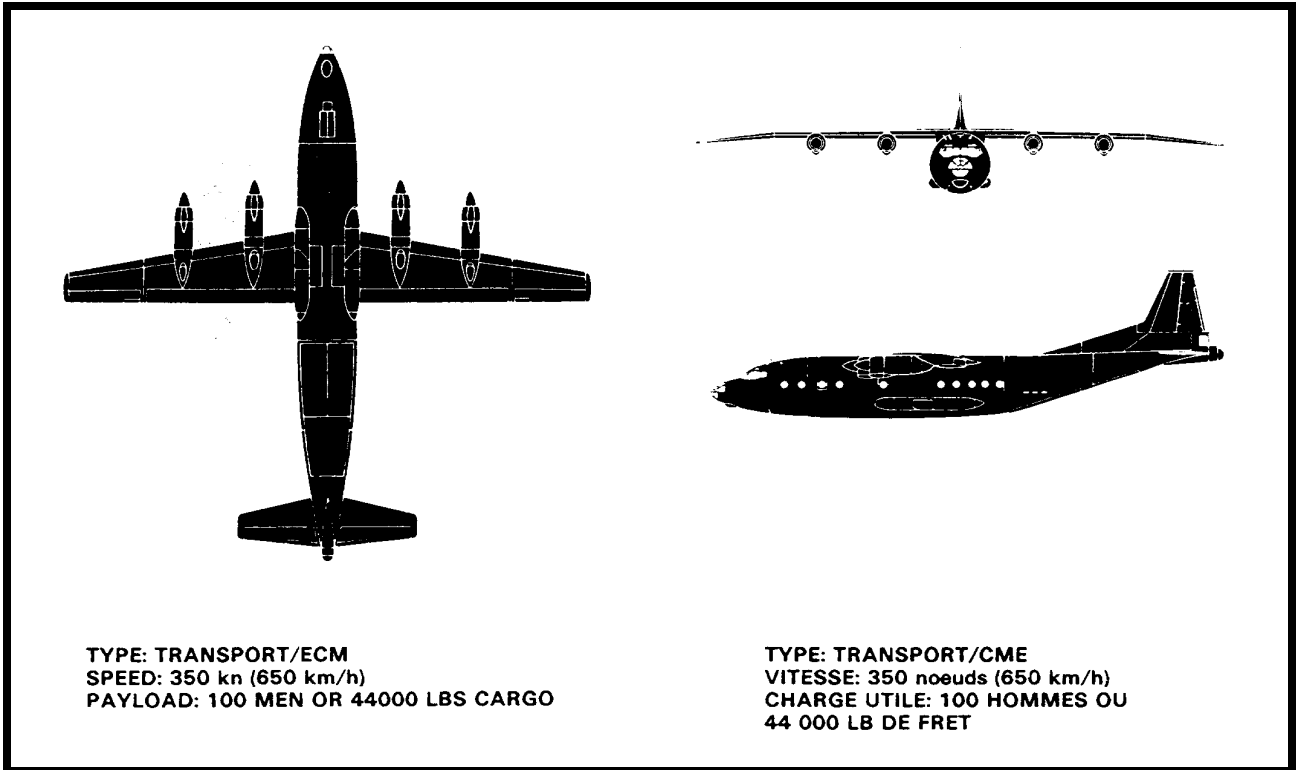


Figure 1-2-12 AN-12 CUB

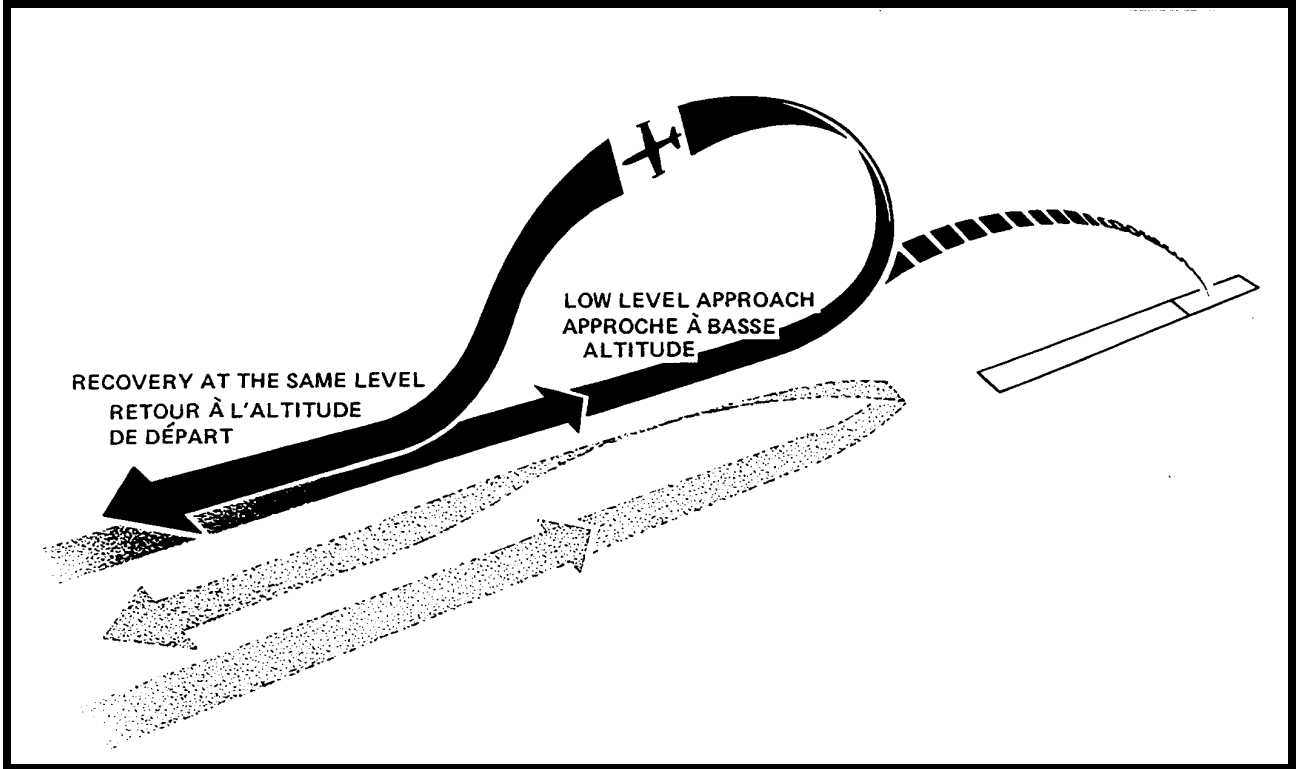


Figure 1-2-13 Low Angle Toss Bombing

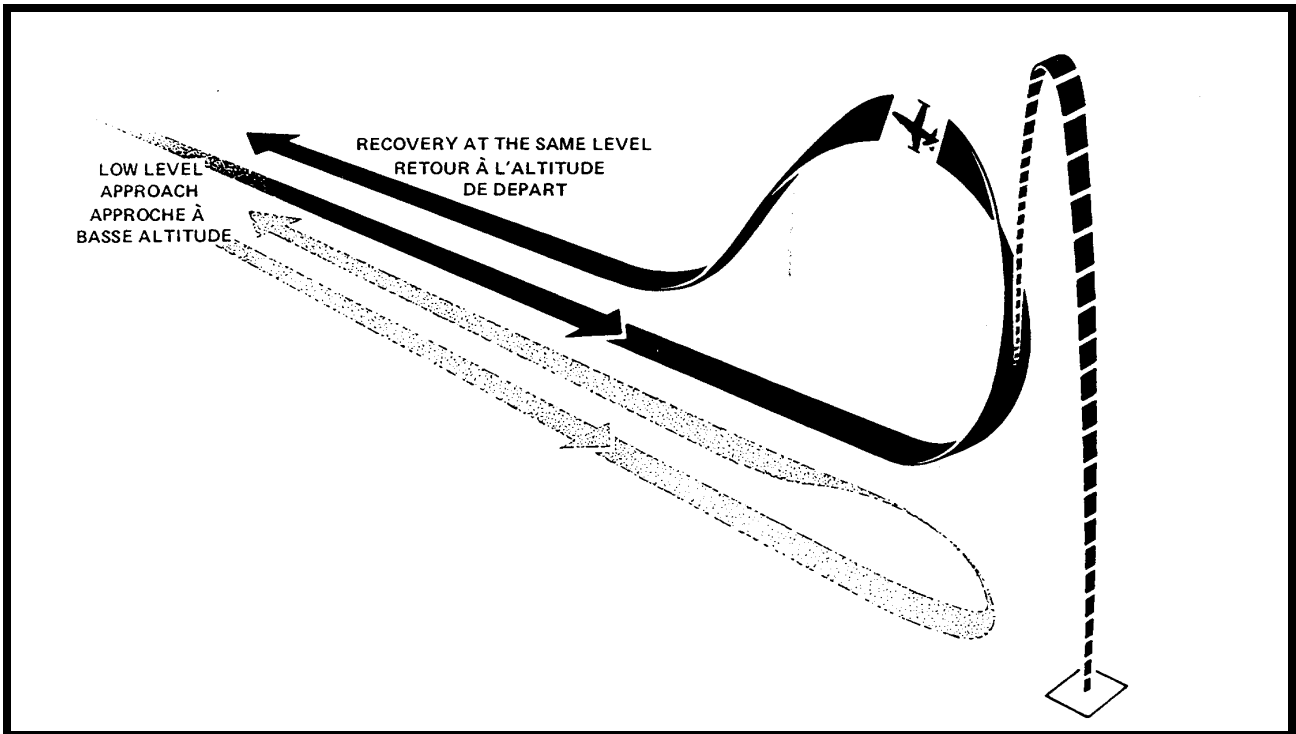


Figure 1-2-14 High Angle Toss Bombing

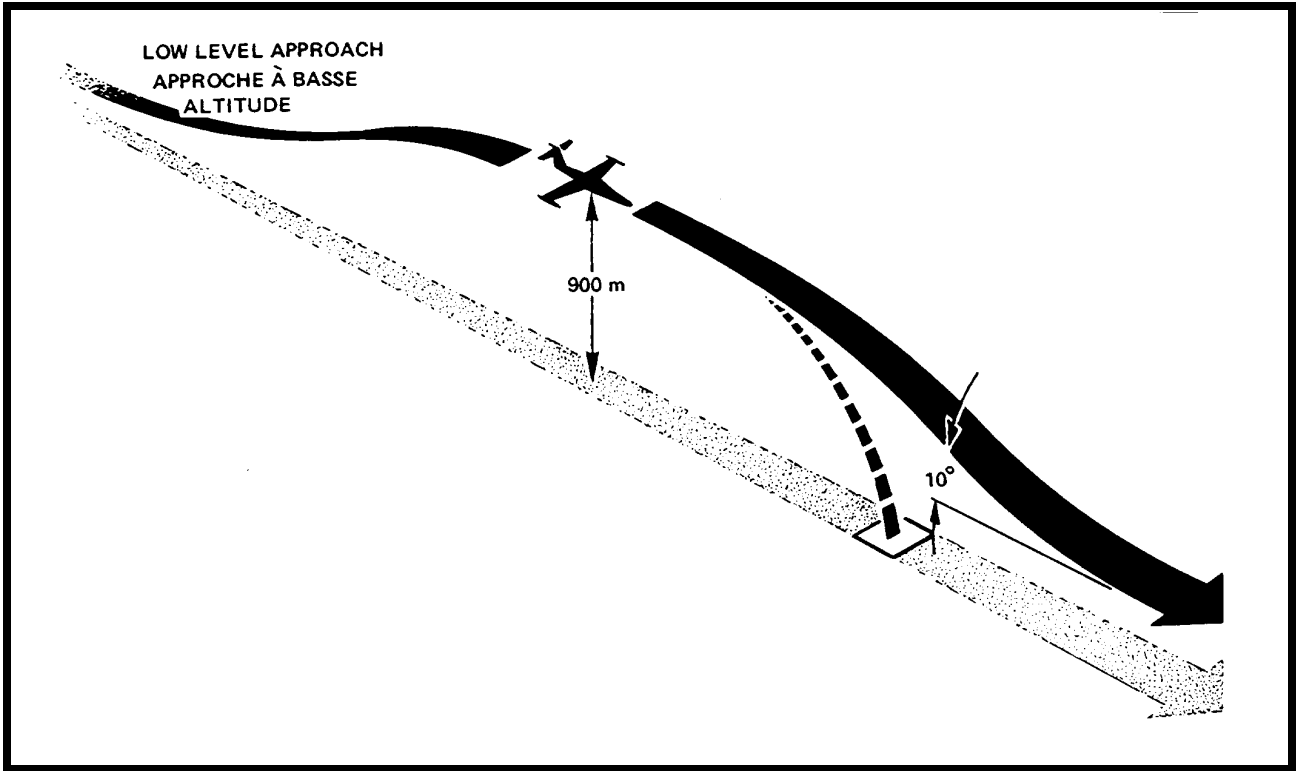


Figure 1-2-15 Rocket and Cannon Attack - 10 Degree Dive

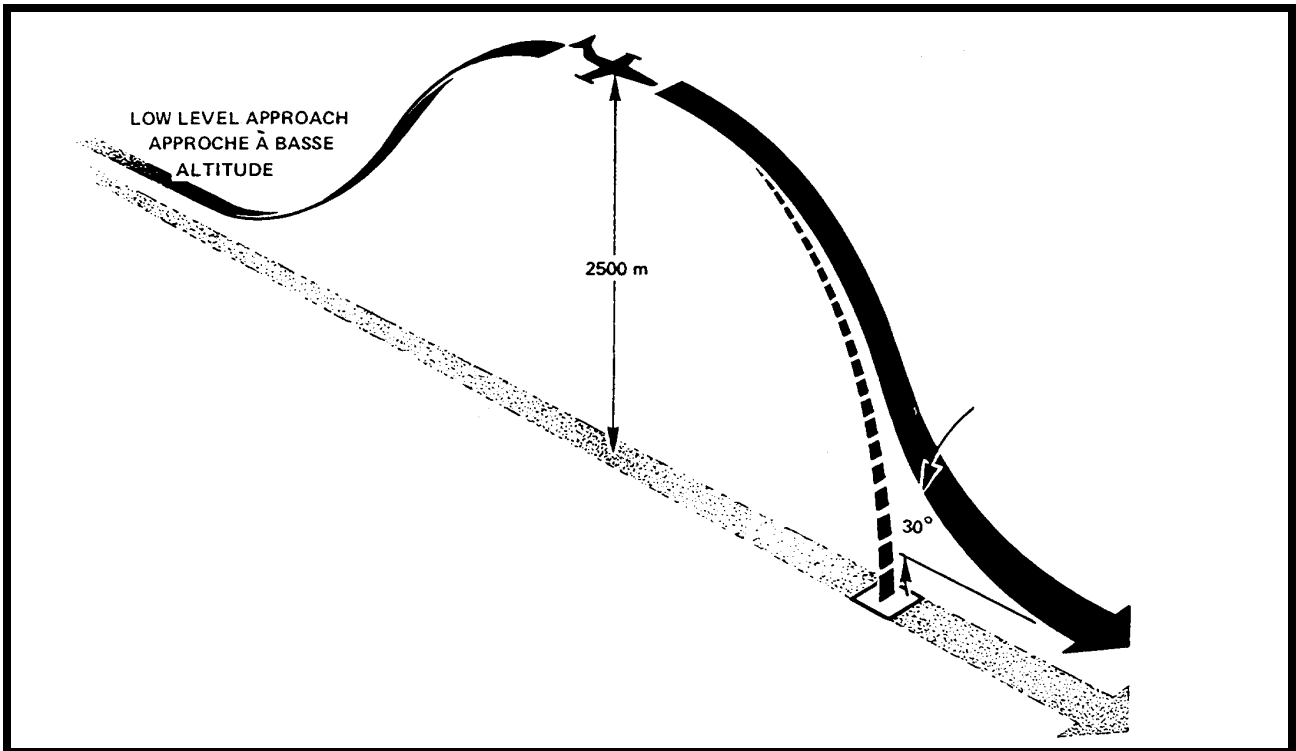


Figure 1-2-16 Rocket and Cannon Attack - 30 Degree Dive

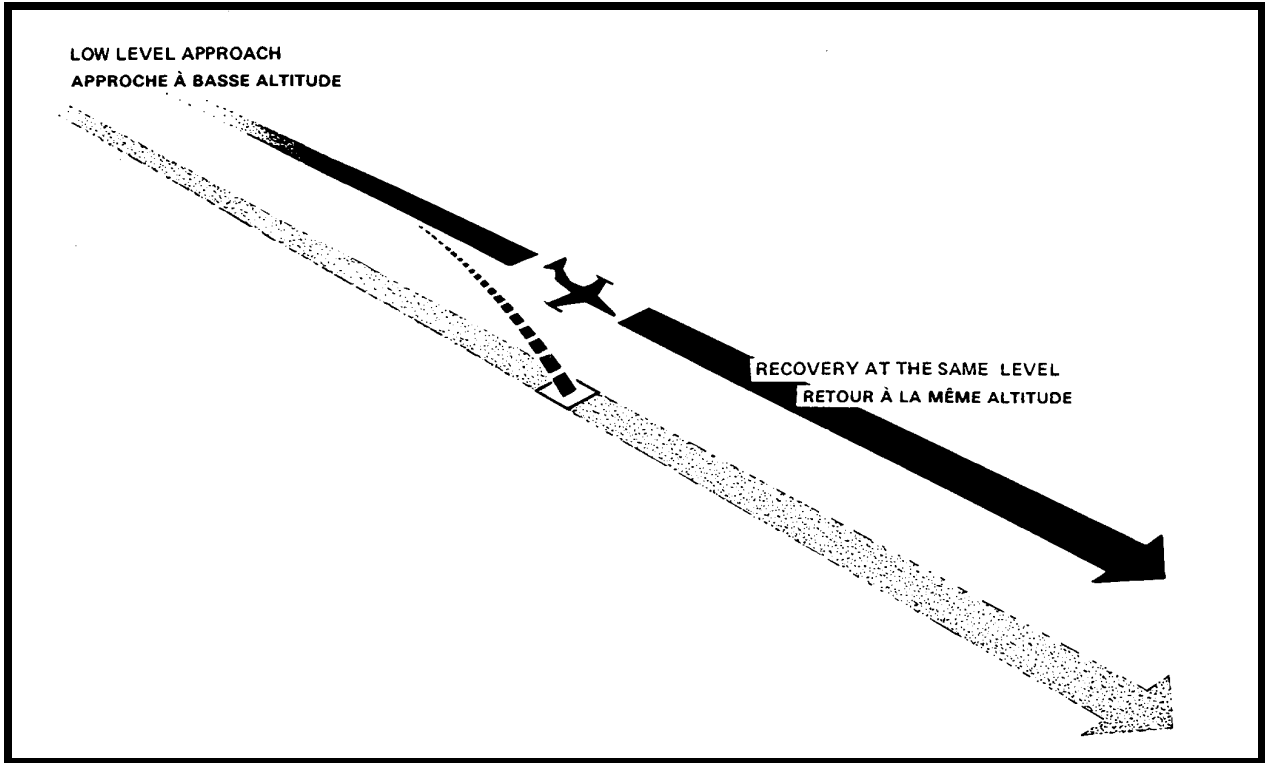


Figure 1-2-17 Straight-in Lay Down Method of Attack - Napalm/High-drag Bombs

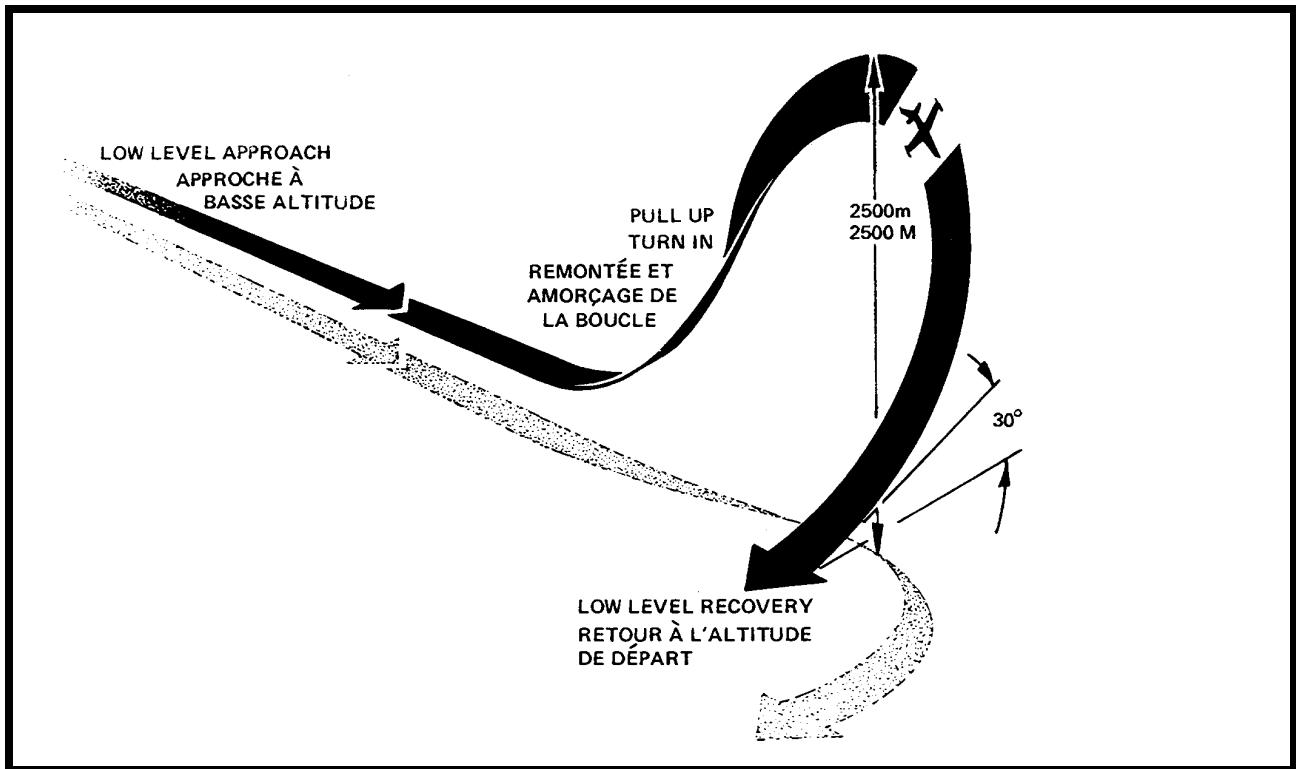


Figure 1-2-18 Off-set Pop Up Attack with 30 Degree Dive

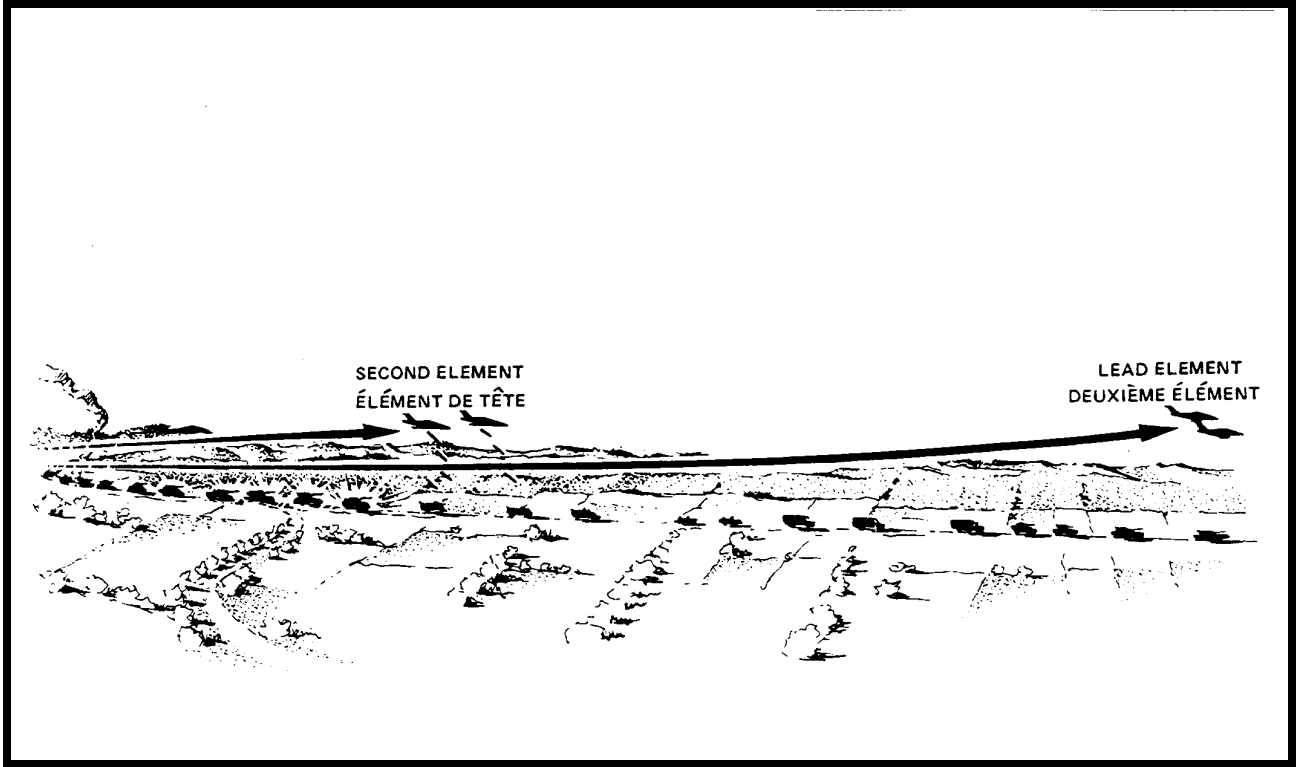


Figure 1-2-19 Aircraft Attacking Along the Line of a Route

Ser	Weapons	Dive angle (degrees)	Starting height (feet)	Height of weapon release (feet)	Aircraft height over Tgt (feet)	Speed of aircraft (knots)	Horizontal ground range to line of weapon release (metres)
1	BOMBS (Free Fall)	30	6,000	3,000	1,600	450-500	1,300
2		20	5,000	2,500	1,600	450-500	1,500
3	ROCKETS	30	3,500	1,500	600	450	850
4		10	1,500	650	500	450	850
5	CANNON	30	3,000	1,500	300	400	500-900
6		5-10	1,000-1,500	200-400	300	to 500	500-900
7	BOMBS (Free Fall) (see Note)	High Angle Toss 'Over the Shoulder' Method	150-200	6,000 to 15,000	-	550	9000 Over target
8	BOMBS (Free Fall)	Low Angle Toss Bombing	150-500	2,500 to 5,000	-	460 reducing to 360 at Apex	3,000-7,000 conventional 5,000-9,000 nuclear
9	NAPALM	0	200	200	200	500	550
10		0	100	100	100	to 400	400
11	CLUSTER BOMB	0	150-500	150-500	150-500	450-500	650-900
12	RETARDED BOMB	0	150-200	150-200	150-200	450-600	650-800
14	ASGW	(Aircraft or Helicopter Launched)				0	Up to 4,000
<p>NOTE: The Toss Bombing is used primarily to deliver nuclear weapons although it may be used for conventional bombs, especially Laser guided bombs.</p>							

Figure 1-2-20 Examples of Air Delivered Weapons

SECTION 3

UNIT RESPONSIBILITIES

GENERAL

1. Every unit or formation has a basic responsibility for self defence against air attack. The two types of AD measures taken are:

- a. passive measures; and
- b. active measures.

PASSIVE MEASURES

2. Passive AD measures are the primary means of defence available to all units. Passive measures are described in Chapter 2.

3. The correct application of passive AD measures will prevent threat aircraft from pin-pointing the location and exact size of a unit. This will hinder the enemy's intelligence gathering and will make successful air attacks more difficult.

ACTIVE MEASURES

4. Active AD measures are designed to destroy attacking enemy aircraft or to deny the aircraft the ability to successfully carry out its mission. Active measures incorporate the use of both AD and non-AD weapons in the AD role. These weapons include:

- a. low level area missiles (LLAMs);
- b. point guns;
- c. point missiles;
- d. small arms (SAs); and
- e. anti-armour weapons used in an emergency AD role.

5. To destroy enemy aircraft while ensuring minimal risk to friendly aircraft, active measures are controlled at the highest level possible. Control procedures governing AD artillery weapons are detailed in B-GL-308-001/FT-001 Interim 1, Air Defence Artillery, Volume 1, Command, Control and Employment.

6. Units, other than dedicated AD units, will use active measures as a last resort, ie, when passive measures fail. The employment of unit small arms and crew served weapons in the AD role is described in Chapter 3.

CHAPTER 2

PASSIVE AIR DEFENCE MEASURES

SECTION 1

GENERAL

INTRODUCTION

1. Passive measures are the primary form of AD available to units and must be emphasized at all levels. Passive measures include:
 - a. siting,
 - b. dispersion,
 - c. concealment,
 - d. control of movement,
 - e. field defences and hardening,
 - f. deception, and
 - g. warning.

SITING

2. Good siting can do much to lessen the likelihood and effect of attack. The air threat should be considered during the recce and siting phase of any operation to ensure that selected positions are, where possible, difficult to attack from the air. They should also avoid conspicuous geographical features that could be used to reference the target.

DISPERSION

3. Dispersion will deny the enemy a worthwhile target both in static locations and during movement. Standing operating procedures (SOPs) should lay down minimum distances between weapon locations and between vehicles, both during movement and while occupying hides. This will ensure that damage will be kept to a minimum.
4. The dispersion of personnel and equipment over too large an area reduces the density of coverage provided by AD units in the area. It also reduces the effectiveness of AAAD fire by reducing its volume.

CONCEALMENT

5. Surveillance devices which use the electromagnetic spectrum can detect targets through camouflage. The use of radar and IR absorbent paints and materials will improve concealment from such devices.
6. Concealment from visual observation is still of vital importance as most air attacks are likely to be mounted by aircraft which require the pilot to visually acquire targets and aim weapons. The selection and concealment of locations should be assessed from the enemy pilot's point of view. Pilots will look for:
 - a. the unusual or the obvious,
 - b. straight edges and lines,
 - c. symmetry,
 - d. reflection,
 - e. shadows, and
 - f. movement.
7. Routes in and out of a location must be carefully selected to avoid giving an indication of the presence of troops.

CONTROL OF MOVEMENT

8. Movement of personnel or vehicles is readily spotted from the air, therefore, the control of movement must be rigidly enforced. Traffic control must endeavour to prevent traffic jams. As well as lessening the likelihood of attack, the control of vehicle movement should ensure that vehicles are sufficiently spaced apart to lessen the effect of any attack that does occur.
9. Units should take maximum advantage of darkness and bad weather conditions to carry out large scale troop movements, as the likelihood of air attack will be less under these conditions.
10. Unit commanders should consider redeployment when:
 - a. there has been recent air reconnaissance of the area;
 - b. the unit has been in action; and
 - c. the unit has occupied the same position for a period of time.

FIELD FORTIFICATIONS AND HARDENING

11. Personnel and equipment dug in are much less likely to be affected by air attack than if they are unprotected. Well developed field defences should survive all but direct hits from air delivered weapons.
12. Protective works increase the chances of detection and, therefore, attack from the air. The use of decoys and dummy positions, if properly designed and coordinated, will make it more difficult for pilots to identify and locate the real position and could, therefore, cause them to drop their weapons on an unoccupied area.
13. Deception plans will normally be coordinated at brigade or higher.

WARNING

14. The use of air sentries will ensure that units have some warning of an air attack and provide sufficient time to take protective action. The training and employment of air sentries is discussed in more detail in Chapter 5.
15. A system for warning personnel of an imminent air attack must be detailed in SOPs and practised. The method of warning will depend on the unit's operational role and the tactical situation, and could include the use of whistles, radios, horns, or in rear areas, sirens.
16. Drills to be adopted when attacked, or warned of an attack are discussed in Chapter 5.

CHAPTER 3

ACTIVE ALL ARMS AIR DEFENCE MEASURES

SECTION 1

GENERAL

ROLE OF AAAD

1. The role of AAAD is to provide unit self-defence against attacking aircraft. This implies that the aircraft must present a direct threat to the unit. In any case, fire should not be opened on an aircraft until it is clear that it is attacking, or about to attack. See Chapter 4, Section 2, paragraphs 4 and 6.
2. The effectiveness of AAAD weapons is limited by the range of the weapon, the weight of the round of ammunition and the burn-out of any tracer ammunition used. Automatic weapons with high rates of fire are the most effective in the AAAD role. They have to be dual role, ie, they are required to engage ground targets as a first priority with AD as a secondary task. Personal small arms employing volume techniques can also be effective in specific circumstances against certain attacking aircraft.
3. Units will not normally have any form of early warning other than air sentries, or possibly ground observation posts (OPs). Target acquisition and tracking will be by the weapon operator. As a result, detection, acquisition and engagement times will be very short. Engagement times are unlikely to exceed four seconds against FGA aircraft.
4. The kill probability of a single AAAD weapon against FGA aircraft is very low, but is somewhat higher against helicopters and transport aircraft. If used in great enough volume, AAAD can be effective. In addition, AAAD has the following benefits:
 - a. **Morale.** The ability to fire back at attacking aircraft increases ground troop's morale.
 - b. **Deterrent Effect.** The possibility of being engaged by ground fire may distract the pilot's attention from the primary mission.
 - c. **Damage.** Damage to the aircraft, even from small arms fire, will increase the repair and logistic problems for the enemy and reduce the availability of the aircraft to carry out subsequent missions.
5. All small arms can be used in the AAAD role but the most effective will be MGs and cannons with a calibre of 12.7 mm or greater. Heavier weapons, such as 20 mm or 25 mm cannon, have armour-piercing (AP) ammunition which is effective against vehicles and aircraft alike, however, limits to elevation and rates of traverse will reduce their effectiveness against high-speed aircraft.

6. Anti-tank guided weapons (ATGWs) will also have some air defence capability, however, their long time of flight may make them effective only against hovering or slow flying helicopters at short ranges. Similarly, tank main armament and field artillery may also be effective against helicopters.

AMMUNITION

7. Ammunition for AAAD should be of common user nature and should not present resupply problems. Use of weapons in a dual role will result in increased expenditure rates.

8. As an aid to aiming, a high tracer mix is desirable. It may even increase the deterrent effect on the pilots of attacking aircraft, particularly helicopters. It must be realized, however, that pilots will not likely see tracer ammunition, except from the flank, during dark or fading light conditions.

9. In each unit those weapons which are provided with AD mounts should carry a certain amount of high tracer mix ammunition as part of their basic load. A high tracer mix can present problems, particularly with barrel weapons.

VOLUME FIRE

10. The key to effective small arms fire is volume and control. Every available weapon is used to put up the largest possible volume of fire into the path, or at the future position of the aircraft. Indiscriminate firing by individuals will produce little effect and merely waste ammunition. The firing must be controlled and must only be initiated by those units/subunits which are being attacked. Engagement procedures are discussed in Section 4. Control of AAAD is discussed in Chapter 4.

SECTION 2

AAAD WEAPONS AND TEAM

AAAD WEAPONS EFFECTIVE RANGES

1. The effective ranges of various weapons when used in the AD role are given in Figure 3-2-1 below:

AAAD TEAM

2. Each combat team or equivalent should have a team of two persons trained in AAAD techniques for each sub-subunit. Each AAAD team should be equipped with:

- a. a general purpose machine-gun (GPMG) or heavy machine-gun (HMG);
- b. an AD mount;
- c. binoculars;
- d. a whistle or noisemaker with which to provide warning of an air attack; and
- e. where possible, a radio.

3. An AAAD team's primary role is AD, however, the team will normally have a secondary role of providing additional direct fire support. Alternatively, if a severe air threat exists, the ground force commander may decide to supplement the AAAD teams by employing additional weapons in an AD role. Separate AD duties within the AAAD team may have to be combined during personnel restrictions.

4. The task of the AAAD team is to provide early warning against air attack as well as initial fire against that attack. An alert AAAD team will allow the remainder of the unit/subunit time to bring all of its weapons to bear.

5. An AAAD team could have an additional air sentry on duty whose sole responsibility is searching for enemy aircraft. The air sentry's tour of duty should not exceed 20 minutes at a time. All air sentries and unit officers should be able to recognize aircraft on the Spotter Class 3 list as a minimum and desirably, on the Spotter Class 1 and 2 lists as well. The Spotter Class lists are issued by FMCHQ and are revised periodically. They contain potentially hostile aircraft as well as friendly aircraft which look similar up to 36 in number.

Serial N ^o	Weapon Armes	Effective AD Range Portée utile
(a)	(b)	(c)
1	GPMG C6 7.62 mm Mitralleuse polyvalente C6 de 7,62 mm	1,000 metres 1,000 mètres
2	LMG C9 5.56 mm Mitralleuse légère C9 de 5,56 mm	1,000 metres 1,000 mètres
3	FN C1 7.62 mm FN C1 7,62 mm	800 metres 800 mètres
4	FN C2 7.62 mm FN C2 7,62 mm	1,000 metres 1,000 mètres
5	M16A2 C7 5.56 mm M16A2 C7 5,56 mm	800 metres 800 mètres
6	Carbine C8 5.56 mm Carabine C8 5,56 mm	1,200 metres 1,200 mètres
7	CANNON, 25 mm CANON, 25 mm	2,000 metres 2,000 mètres
8	MRAAW MRAAW (arme antichar à moyenne portée)	1,000 metres 1,000 mètres
9	LAAAW LRAAW (arme antichar à longue portée)	3,000 metres 3,000 mètres
10	TANK (APDS) CHAR (Obus perforant à sabot détachable)	1,500 metres 1,500 mètres
NOTE: Ranges for opening fire against fast and slow approaching targets are given in Section 4. NOTA: Les distances pour l'ouverture de tir contre des objectifs à approche rapide et lente figurent à la section 4.		

Figure 3-2-1 Table of AAAD Weapons Ranges

6. Air raid warning procedures are dealt with in Chapter 5.

WEAPON MOUNTS

7. The effectiveness of AAAD weapons is increased by mounting them on a stable mounting. Various types of AD mounts are discussed in Annex A.

SECTION 3

SITING FUNDAMENTALS FOR AAAD TEAMS

GENERAL

1. Because of the limited range of AAAD weapons and the fact that the weapons will normally be sited within a unit's perimeter, it is unlikely hits will be achieved before the aircraft's weapons are released, see Figure 3-3-1.

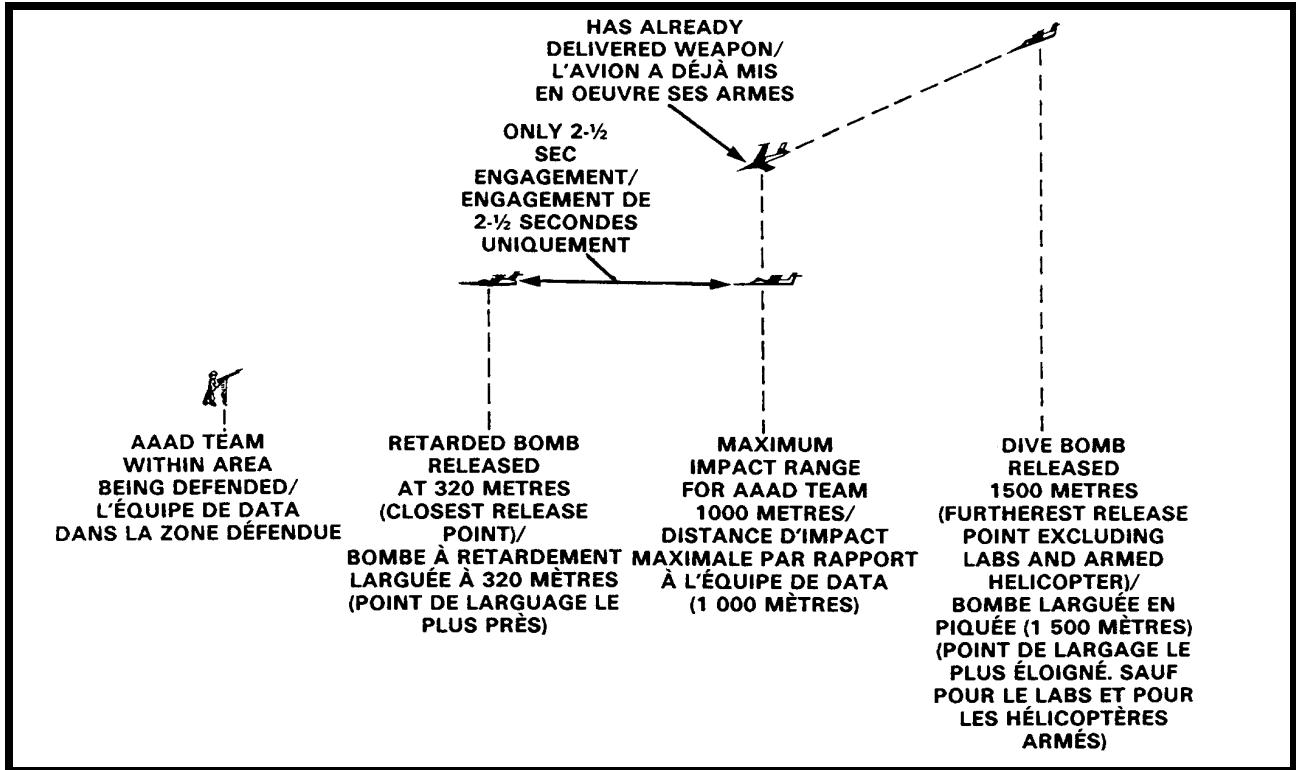


Figure 3-3-1 Limited Engagement for AAAD Team Sited Within Defended Area

2. AAAD weapons should be sited to bring the maximum fire to bear on aircraft overflying the locality which is being defended. This can frequently be achieved by siting one or more weapons facing inwards across the defended locality. Figure 3-3-2 shows three machine-guns (MGs) in the AD role sited within a combat team area, together with one detachment of a blowpipe section. The remaining point missiles are left out for simplicity. The arcs and relative effective ranges of each weapon are also shown.

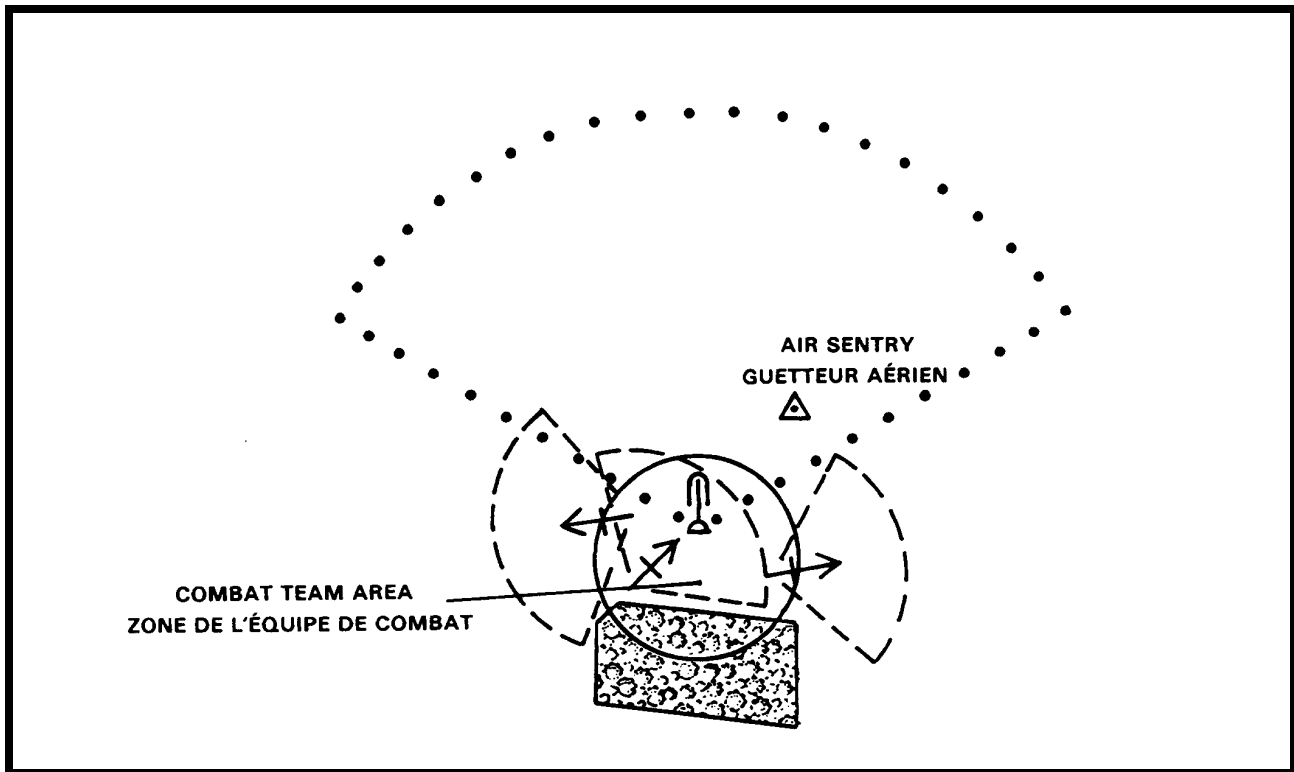


Figure 3-3-2 Weapon Siting, One Weapon Facing Inwards

3. Ideally, weapons should be sited with an engagement arc of 6400 mils and observation to a minimum distance of 3000 metres. An approaching aircraft will need to be seen 3000 metres away to allow for reaction time and a four to five second engagement. Although a 6400 mil arc is desirable, a single observer can only effectively keep watch over an arc of about 2100 mils.

FACTORS AFFECTING WEAPONS SITING

4. Factors affecting weapon siting are:
 - a. locations and arcs of other AD weapons in the area,
 - b. number of weapons available,
 - c. requirement for all-round defence and coordination,
 - d. likely direction of attack,
 - e. need for concealment,
 - f. ground attack threat, and
 - g. local terrain.

5. **Number of Weapons.** The number of weapons allocated to AD within a unit will depend on the primary role in which the unit is engaged and its location with respect to the forward edge of battle area (FEBA). The further back from the forward area that a unit is deployed, the more emphasis can be put on siting GPMGs, etc, with AD as the priority role.
6. **All-Round Defence.** If sufficient weapons are available, AD teams should be deployed to provide all-round defence against air attack. Weapon coverage must be coordinated with adjacent units and the coverage provided by nearby AD weapons, eg, blowpipe. AAAD teams must not be sited closer than 30 metres to blowpipe detachments or other missile systems unless they have protection from the missile's efflux.
7. **Direction of Attack.** It may be possible to determine the likely approach of aircraft after careful map study. To do this, the ground commander must be familiar with the pilot's requirements in planning a ground attack sortie. These requirements are considered in Annex B.
8. **Concealment.** Concealment from ground and air observation will be a factor when siting AAAD teams. The requirements for a well concealed position and a good AAAD site are rarely compatible and a compromise may have to be accepted.
9. **Ground Attack Threat.** The local ground threat will influence a commander's decision on whether AAAD teams can be sited outside a defended locality.
10. **Local Terrain.** The best type of position is on fairly high ground with the minimum amount of terrain screening. Ideally, the position should enable the weapon to engage aircraft approaching from any direction and it should have a minimum field of view of 3 kilometres.

DEFENCE OF VITAL POINTS IN REAR AREAS

11. In forward areas in a defensive battle, AAAD weapons will normally have to be sited within the area they are defending. In rear areas, this may not be necessary. A better defence can be provided if weapons are outside the defended area at the ground range of aircraft weapon release, see Figure 3-3-3. When AAAD weapons are sited at this distance from the area they are defending, they will be able to bring fire to bear for four to five seconds before the pilot releases the weapons and during the crucial phase, when the pilot is siting the weapons.
12. The number of AAAD teams required to provide all-round defence, if deployed in this manner is likely to exceed the number of teams available. Too few teams will have the detrimental effect of reducing crucial volumes of fire. AAAD teams might, however, be sited as shown in Figure 3-3-3, either in conjunction with other AD weapons, eg, point missiles, or concentrated to cover a likely direction of attack. Figure 1-2-20 shows likely ground ranges to the aircraft's line of weapon release. The distance of 900 metres shown in Figure 3-3-3 is a compromise distance since the exact type of attack to be expected is rarely known beforehand.
13. Ideally, AAAD weapons should be sited at the ground range of aircraft weapon release. The reason is:

- a. maximum effectiveness impact range for MGs in an AAAD role is 1000 metres;
- b. a four second engagement of an aircraft before it releases its weapons is desirable. In this time, an aircraft approaching at 450 knots will have flown 920 metres; and
- c. since the distances for a. and b. are approximately equal, MGs deployed in the AAAD role should be sited on the approximate aircraft line of weapon release.

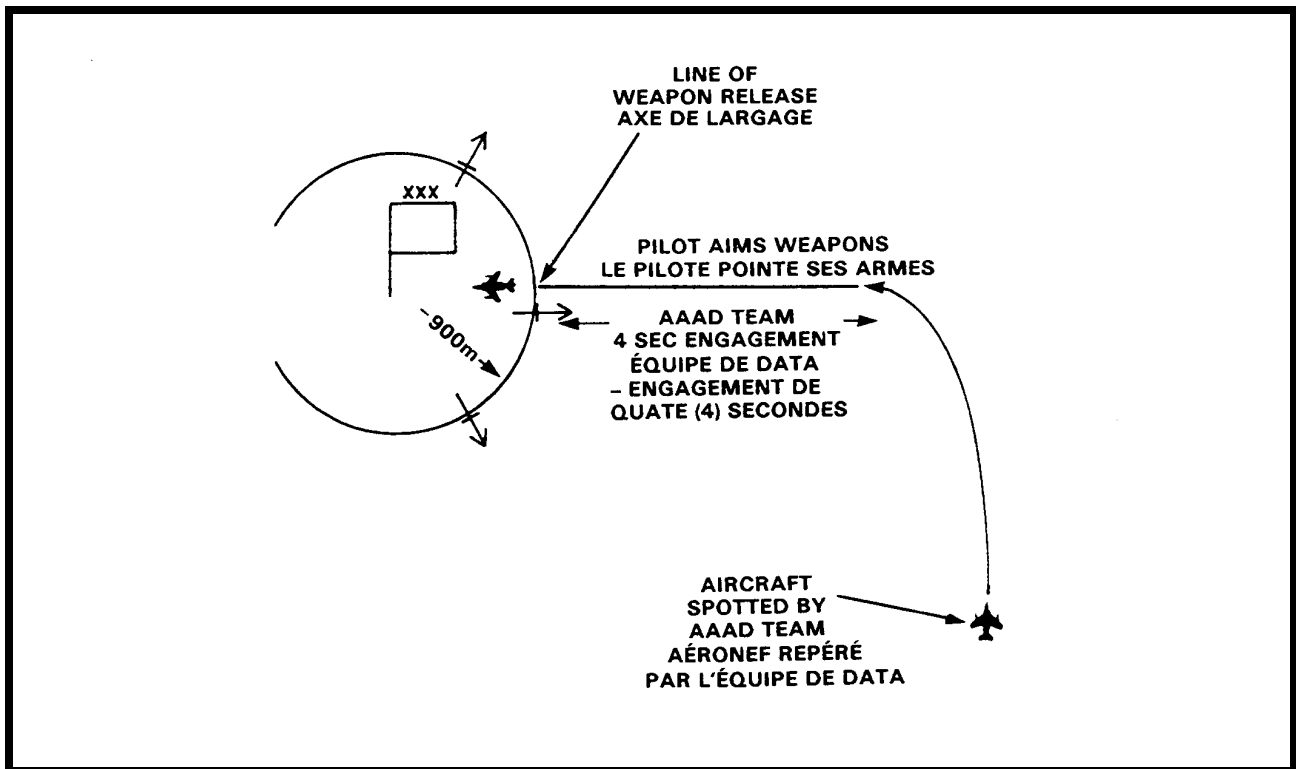


Figure 3-3-3 Rear Area Vital Point Defence

DEFENCE ON THE MOVE

14. For defence on the move, AD weapons should be mounted with an air sentry:
 - a. at the front looking forwards and to the flanks; and
 - b. at the rear looking back and to the flanks.

SECTION 4

ENGAGEMENT PROCEDURES

GENERAL

1. The aim of this section is to detail AD engagement procedures. Rules of engagement are discussed in Chapter 4. Special procedures required when firing at model aircraft targets (MATs) such as the TATs 50 are given in B-GL-304-003/TS-001, Operational Training, Volume 3, Ranges and Training Safety, Chapter 8, Section 3.

SAFETY

2. When engaging low flying aircraft, care must be taken that weapons are not fired so low as to endanger friendly troops. It should also be noted that small arms projectiles fired at high elevations can travel up to 4000 metres; therefore, the danger to adjacent units must be assessed.

ENGAGEMENTS

3. Engagements are subject to current weapon control orders (WCOs) and rules of engagement. The local commander may order the engagement of an attacking aircraft. The engagement orders will be comprised of a warning order, a method of engagement and the order to fire:

- a. **Warning Order.** A warning of an air attack and a reference to the approaching aircraft may be given by either the local commander, an air sentry or anyone who happens to spot the aircraft first, see Chapter 5, Section 2, paragraph 7. Examples:
 - (1) AIR ATTACK, AIRCRAFT FRONT/REAR/LEFT/RIGHT, HIGH/LOW;
 - (2) (SERIES OF LONG WHISTLE BLASTS) AIRCRAFT HALF-RIGHT/LEFT, HIGH/ LOW; and
 - (3) AIR ATTACK, AIRCRAFT, REFERENCE RED BARN, LEFT ONE FIST LOW. The warning AIR ATTACK or a series of long blasts on a whistle or horn is given as soon as the aircraft is spotted or the air warning RED is received from higher headquarters, see Annex E.
- b. **Method of Engagement.** Once the local commander has spotted the attacking aircraft and identified it as hostile, the commander will order a method of engagement, estimate aim-off and order PREPARE TO FIRE, see Section 4, paragraphs 8 and 14. For example: AIR DEFENCE REFERENCE POINT 4, PREPARE TO FIRE.

- c. **Order to Fire.** Once the local commander has determined that aircraft is within the estimated ranges for opening fire, the commander will order FIRE, see Section 4, paragraph 18.
4. During an engagement and before a new target is ordered, the order STOP is to be given; a new direction is then immediately ordered followed by the command FIRE. When the attack is over, the order STOP or CHECK FIRING is given.
5. Two examples of orders for a complete engagement are:
 - a. **Reference Point Method** (see Section 4, paragraph 1 6):

AIR ATTACK

AIRCRAFT HALF-RIGHT, LOW

AIR DEFENCE REFERENCE POINT 2

PREPARE TO FIRE

FIRE

STOP

AIR DEFENCE REFERENCE POINT 4

FIRE

CHECK FIRING (or single long whistle blast).
 - b. **Fixed Aiming Point Method** (see Section 4, paragraph 17):

AIR ATTACK

AIRCRAFT, REFERENCE CHURCH, LEFT ONE FIST, LOW

WATCH THE TRACER, PREPARE TO FIRE

AIR DEFENCE TEAM FIRE (establishes tracer reference)

FIRE (remaining weapons engage, firing at tracer reference)

CHECK FIRING.

6. **To Engage Using the Rifle.** Sights are set at 600. The correct aim-off is applied using one of the methods discussed in Section 4, paragraphs 14 to 17; the aircraft is engaged with rapid fire.

7. The basic flying unit is usually a four aircraft formation composed of two subunits of two aircraft. Where possible, fire should be concentrated on the first aircraft of each pair. These are the leaders and are, therefore, likely to be the most experienced pilots.

ESTIMATION OF AIM-OFF

8. In order to hit an aircraft, fire must be aimed at a point along the apparent flight path.

9. The amount of aim-off applied will depend on aircraft speed and heading, as well as the range of the aircraft and speed of the bullet. Without special sights to compensate for the above factors, a quick and simple method of estimating aim-off or lead is required. It is also important that volume fire be employed, to compensate for those weapons for which too much or too little aim-off is applied, see Figure 3-4-1.

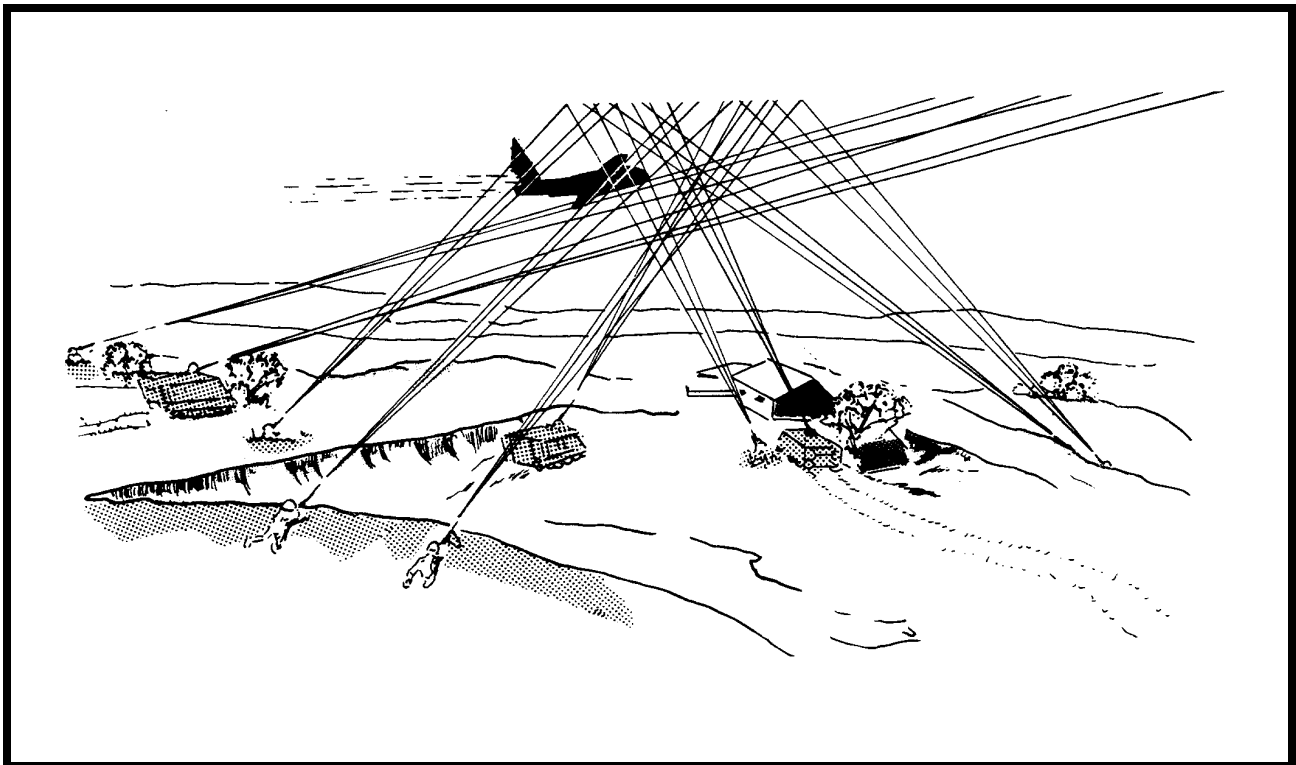


Figure 3-4-1 Volume Fire

10. The following paragraphs provide rules of thumb, which, when applied with the technique of volume fire, will bring effective small arms fire to bear on attacking aircraft. The amount of aim-off applied depends on whether attacking aircraft is:

- a. diving directly at the firer;
- b. approaching at an oblique angle to the firer; or
- c. hovering.

11. **Rule Number 1 - Diving Targets.** When an aircraft is diving directly towards troops on the ground, only the head-on aspect of the aircraft will be seen and none of the fuselage length will be visible. The line of aircraft flight and the line of sight to the target will be coincident. However, the aircraft will pull up immediately after weapon release so the troops being attacked should aim their weapons just above the centre of the target, see Figure 3-4-2.

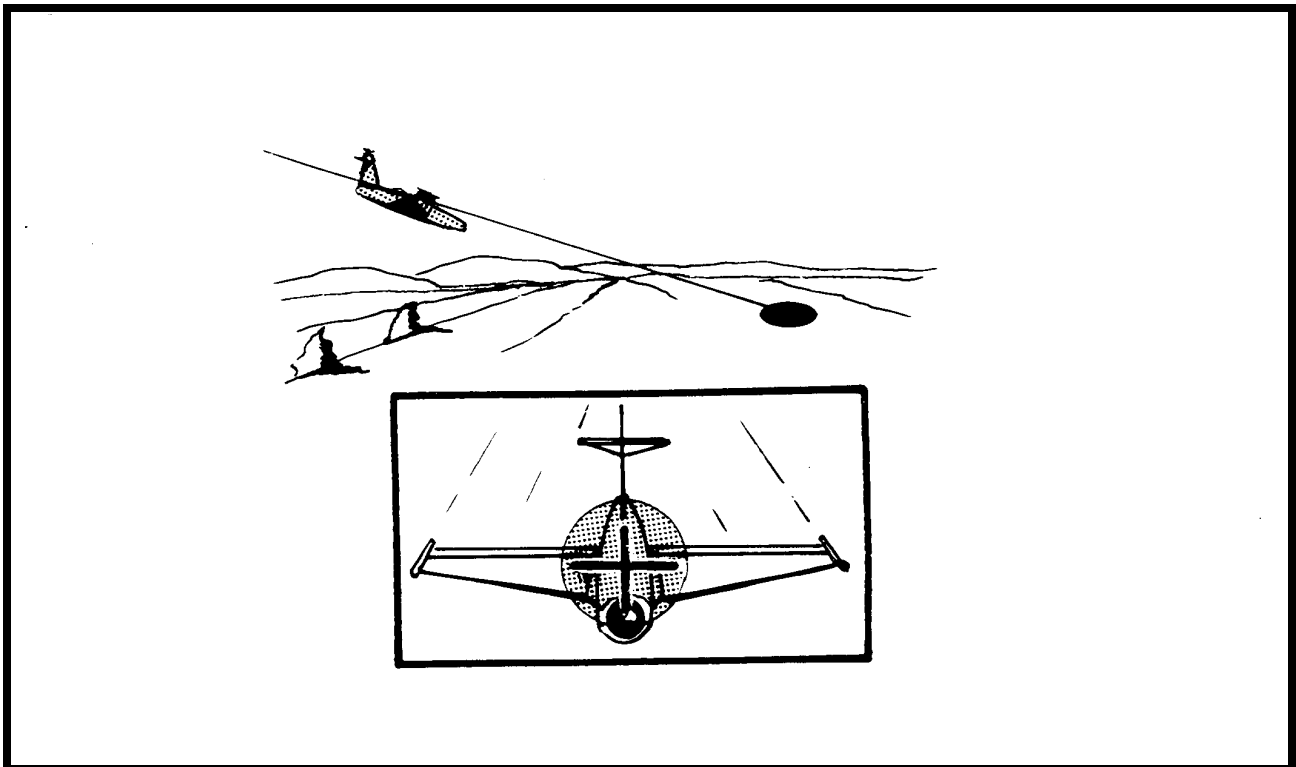


Figure 3-4-2 Point of Aim for Targets Diving Directly at Weapon Position

12. **Rule Number 2 - Oblique Targets.** When the target aircraft is approaching at an oblique angle to the firer, the amount of aim-off to be applied is more difficult to judge. As the amount of lead is fixed according to the speed of the aircraft, it must be easily recalled to mind and visualized by the soldier. For this purpose, a football field (100 metres) is used as the fixed amount and is applied as follows:

- a. **High-speed Aircraft.** The point of aim is four football fields (400 metres) ahead of the aircraft along its apparent line of flight, see Figure 3-4-3.
- b. **Low-speed Aircraft (including helicopters).** The point of aim is half a football field (50 metres) ahead of the aircraft along its apparent line of flight, see Figure 3-4-4.

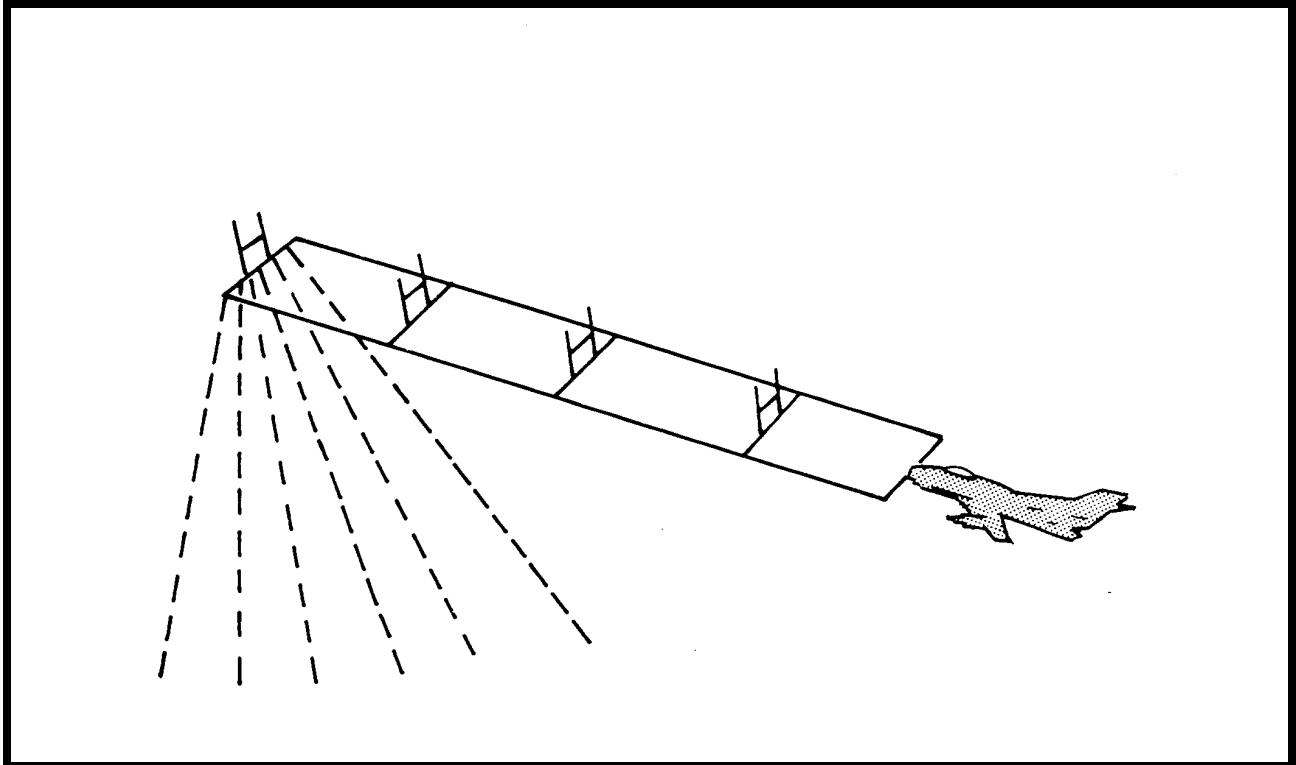


Figure 3-4-3 Point of Aim for Oblique High-speed Targets

13. **Rule Number 3 - Hovering Targets.** Helicopters may, on occasion, hover to fire rockets, missiles and guns, or to dismount troops and supplies. In this case, they are engaged as a stationary ground target. Weapons should be aimed directly at the target, preferably at the cockpit or engine/transmission area, see Figure 3-4-5. The range at which the order for fire is given is dependent on the maximum range of the weapon. Under these circumstances, tank main armament and armour weapons can be used most effectively. Where an enemy helicopter is seen to execute a shallow diving attack at speed, then rule numbers 1 and 3 apply.

ENGAGEMENT PROCEDURES USING AIM-OFF

14. There are three procedures by which AAAD weapons can use aim-off effectively to engage aircraft. They are:

- a. fixed lead procedure,

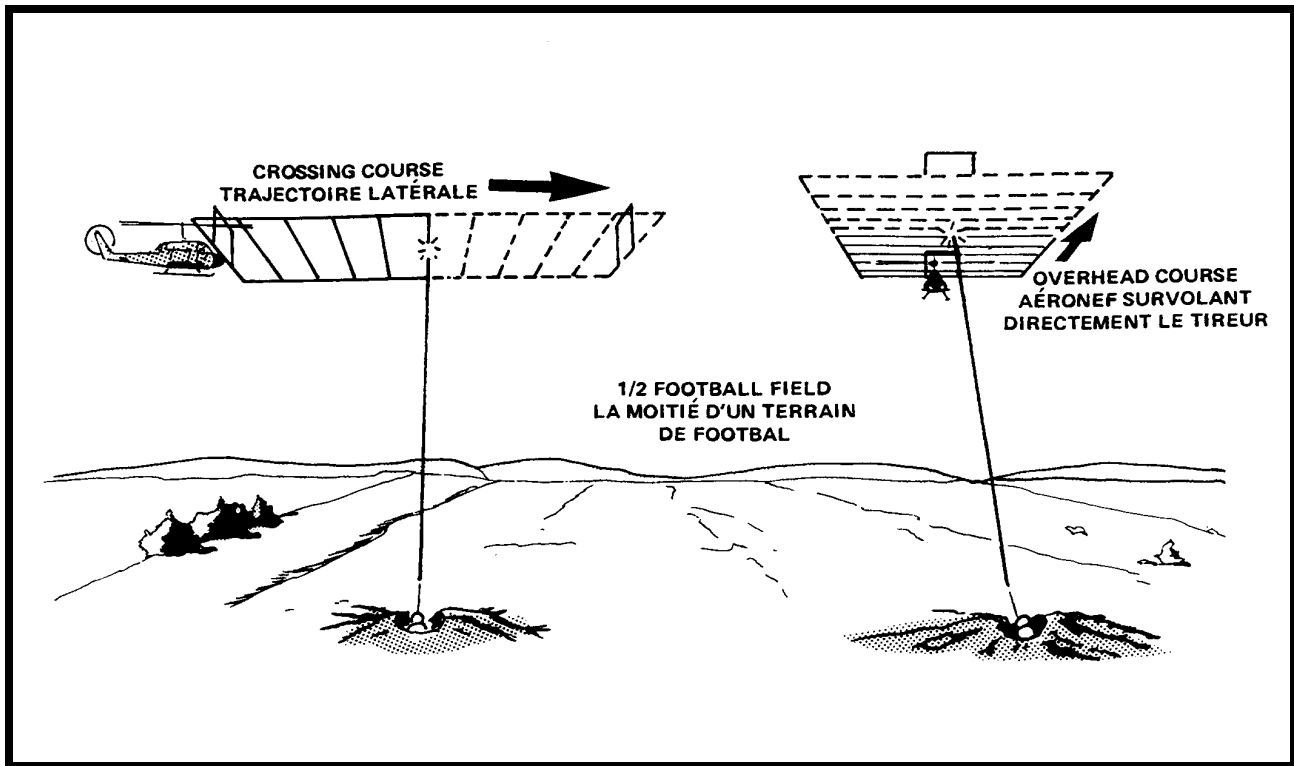


Figure 3-4-4 Point of Aim for Slow Crossing Targets

- b. reference point procedure, and
- c. fixed aiming point procedure.

15. **Fixed Lead Procedure.** With this procedure, the firer maintains a fixed lead in front of the aircraft throughout the engagement. This is the primary method to be used when the weapon is fitted with an AD sight. An example is shown at Figure 3-4-6. It can also be employed where tracer observation is used, see Annex D. Maintaining a fixed lead by tracer observation takes a great deal of training and is relatively ineffective due to the time it takes for corrections, particularly when a tracer-to-ball mix of less than one to one is used. When using the fixed lead procedure the following sequence should be adopted:

- a. Aim the weapon at the aircraft;
- b. Swing the weapon with the aircraft;

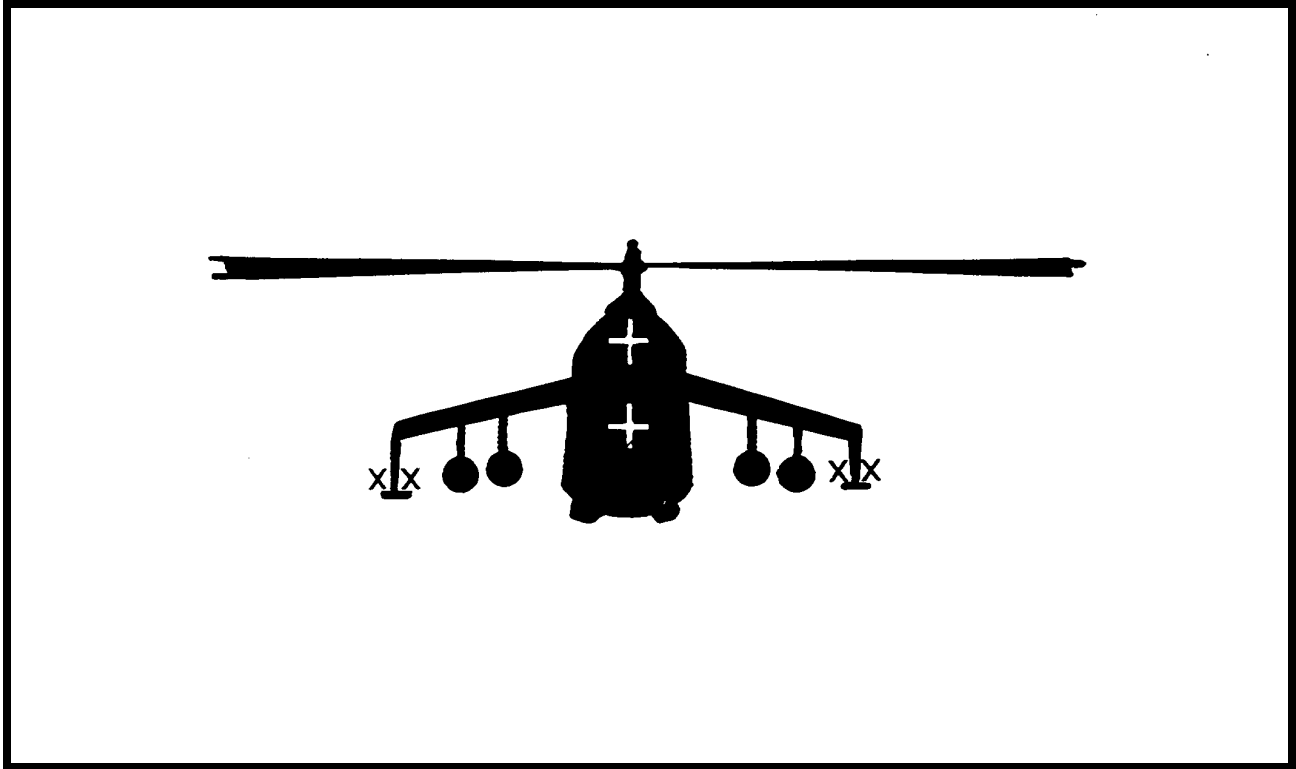


Figure 3-4-5 Point of Aim for Hovering Targets

- c. Apply the correct lead ahead and on the line of flight of the aircraft;
- d. Fire (sustained burst);
- e. Keep firing and keep swinging;
- f. Observe the tracer and correct aim-off.

16. **Reference Point Procedure.** This procedure relies for its effectiveness on the massed fire of at least a section and preferably a platoon. The commander selects a known referencepoint, which should, if the unit's elevated weapons are fired in the general direction of that reference point at the correct time, cause the aircraft to fly through some or all of the fire, see Figure 3-4-7. The procedure is as follows:

- a. The section/platoon commander alerts the soldiers by ordering AIR DEFENCE REFERENCE POINT ... PREPARE TO FIRE.

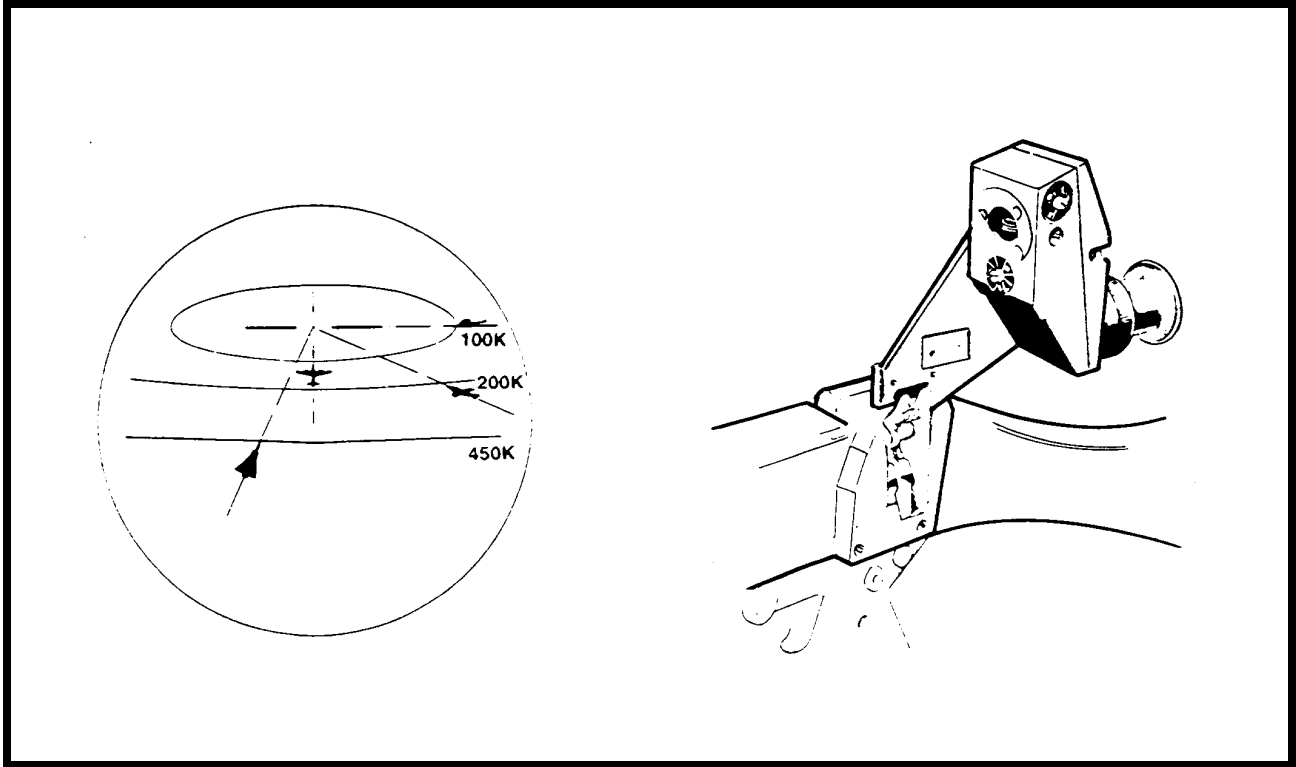


Figure 3-4-6 British AAAD Sight Fitted to FNC1/C2 or GPMG

- b. All firers point their weapons at the reference point ordered and raise their weapons to 45 degrees.
- c. As the aircraft approaches the reference point the section/platoon commander orders REFERENCE POINT ... FIRE.

17. **Fixed Aiming Point Procedure.** A variation of the above procedure is where the section/platoon fires all of its weapons at a fixed point in the sky in front of the aircraft so that it is forced to pass through the fire. In this case, a GPMG with a high tracer-to-ball mix of ammunition fires at a point well in front of the aircraft along its apparent path. The remaining weapons use the tracers as an aiming mark. This procedure works well where it is well established as a unit SOP, see Figure 3-4-8.

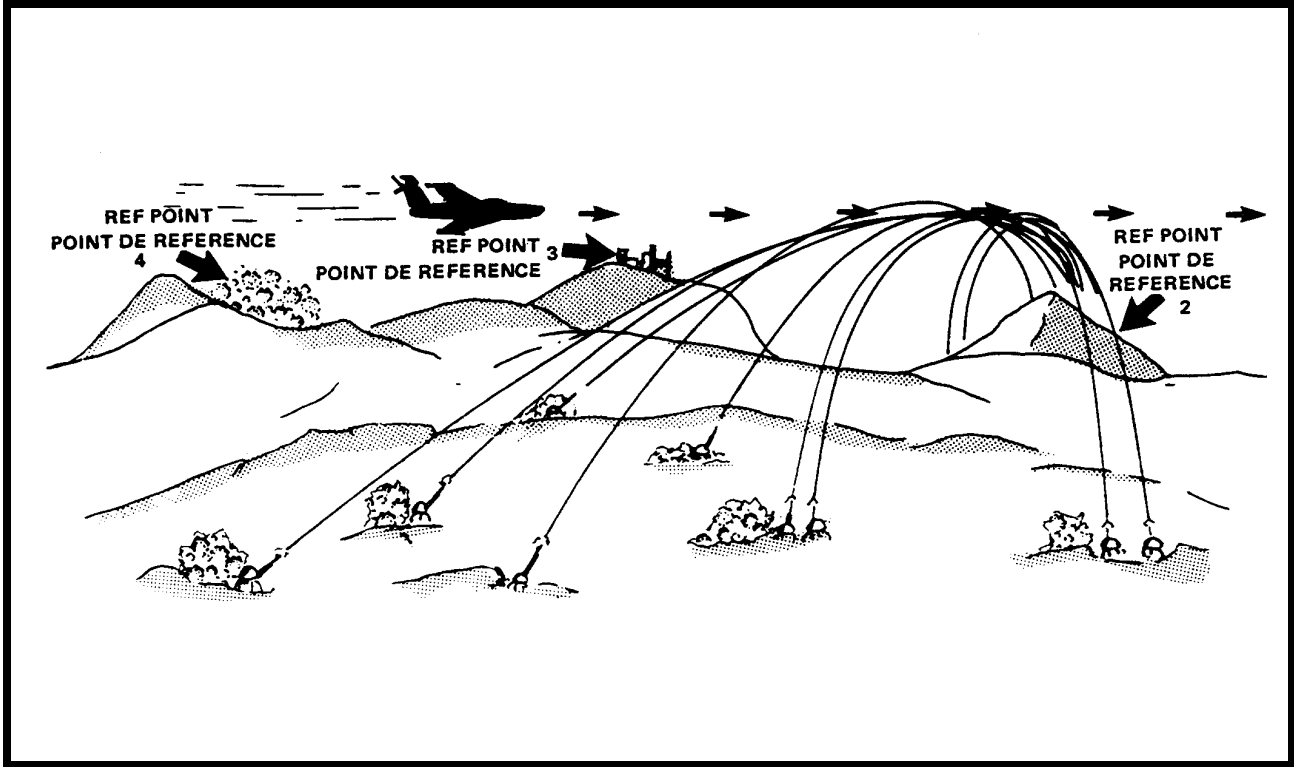


Figure 3-4-7 Reference Point Procedure

TARGET RANGE ESTIMATION

18. Targets should not be engaged unless they are within the estimated ranges for opening fire shown below:

- a. Fast targets (450 km/h) - 1500 metres;
- b. Slow targets (200 km/h) - 1200 metres;
- c. Helicopters (100 km/h) - 1200 metres.

19. The range card normally produced in defensive positions can be used to assist in estimating the opening range to attacking aircraft. However, the position of an aircraft relative to the ground is difficult to judge. Factors affecting this estimation include:

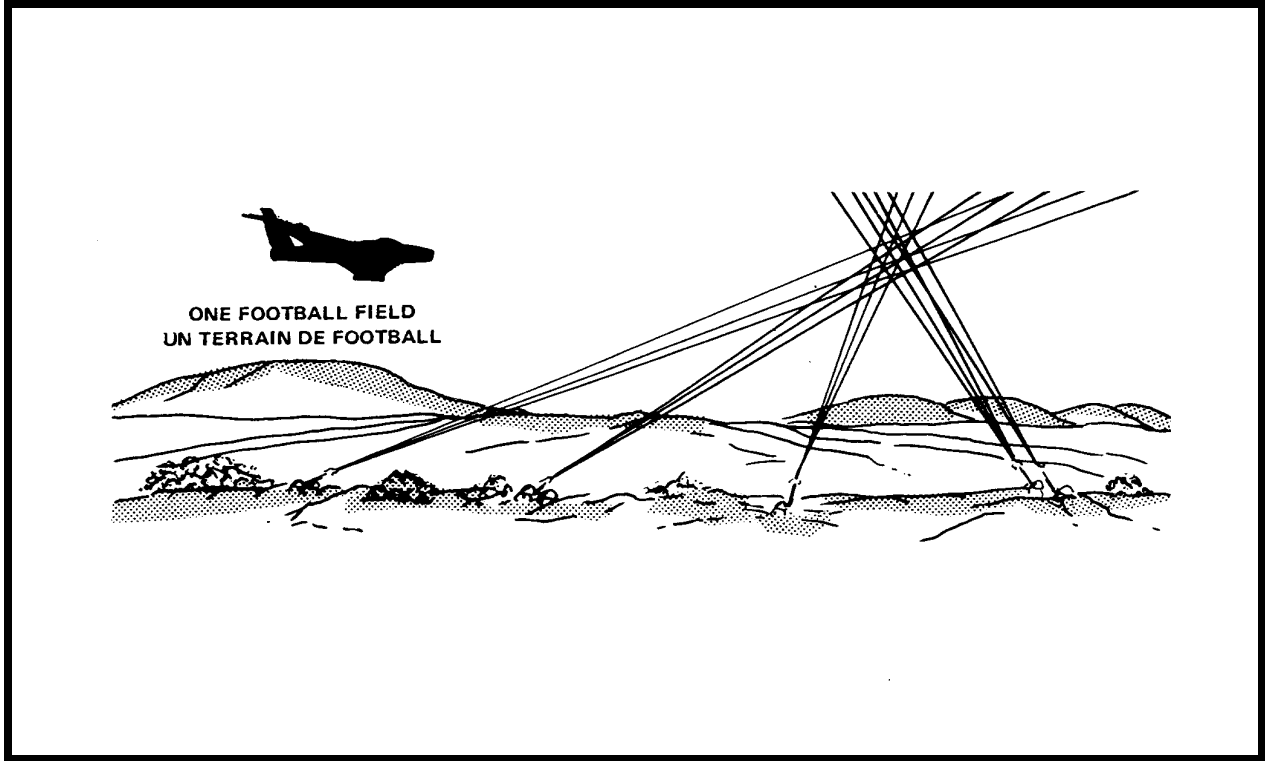


Figure 3-4-8 Fixed Aiming Point Procedure

- a. aircraft speed;
- b. aircraft aspect;
- c. ambient light conditions.

AMMUNITION EXPENDITURE

20. Ammunition expenditure is one of the methods by which a commander controls the fire of unit weapons in the AD role. In order to achieve the effect of volume fire, ammunition expenditure is likely to increase substantially to the point where it could be unnecessarily wasted. Therefore, the amount of ammunition to be fired per weapon in any single engagement must be fixed in formation and unit SOPs.

CHAPTER 4

CONTROL OF AAAD

SECTION 1

GENERAL

INTRODUCTION

1. The control of AD weapons involves the restriction and relaxation of various conditions under which AD weapons will engage an enemy. The control of unit small arms weapons in the AD role will be subject to the directives and restrictions laid down by AD control authorities and formation headquarters.
2. The authority exercising control may not order a weapon to fire, however, restrictions may be applied to prevent the weapon from firing. Conversely, the commander of a unit or subunit may not give the order to fire the weapons unless all restrictions that were imposed by the control authority have been met.
3. To be effective, the control of fire must be simple and flexible. It will be exercised through:
 - a. procedural control, implemented by directives and SOPs; and
 - b. positive control orders passed on existing communications links (normally command nets).
4. Only those control procedures applicable to unit weapons used in the AD role are described in this chapter. A more detailed description of the control of the whole AD system is contained in B-GL-308-001/FT-001, Interim 1, Air Defence Artillery, Volume 1, Command, Control and Employment.

SECTION 2

PROCEDURAL CONTROL

GENERAL

1. Procedural control is pre-arranged, and the necessary information is issued by the formation headquarters, normally in the form of directives and SOPs. These directives and SOPs reflect the policy established by the formation air defence commander (ADC) and are aimed at separating AD weapons and friendly aircraft into areas where each can operate safely and relatively independent of each other. This eliminates as many risks as possible to friendly aircraft from AD weapons and ensures that both aircraft and weapons have maximum freedom of action.
2. Small arms weapons used in the AD role must comply with the relevant aspects of the directives and SOPs applicable to the area in which they are operating. Therefore, unit SOPs must contain those procedures drawn from formation SOPs which are relevant.
3. SOPs will define the conditions under which weapons may engage aircraft. From the aspect of procedural control, SOPs are to include:
 - a. definitions of hostile aircraft;
 - b. definitions of a hostile act;
 - c. rules of engagement;
 - d. the standby WCO;
 - e. air raid warning conditions and transmissions;
 - f. fire orders to be used to engage aircraft and the authority to issue such orders; and
 - g. the maximum amount of ammunition to be expended per weapon for each engagement.

DEFINITION OF HOSTILE AIRCRAFT/HOSTILE ACT

4. Hostile aircraft and hostile acts are defined by the ADC for the theatre of operations and are, therefore, copied directly into formation and unit SOPs. They may include the following examples:
 - a. an aircraft is recognized as hostile by its identification features; or
 - b. it commits a hostile act, that is to say:
 - (1) attacks any friendly unit,

- (2) drops paratroops, where aircraft and troops are visually identified as other than friendly, or
- (3) manoeuvres unmistakably into position to attack friendly forces or facilities.

5. Hostile act criteria is detailed in B-GL-308-001/FT-001.

RULES OF ENGAGEMENT

6. By its very nature, AAAD is defensive. Due to the relatively short range of unit small arms these weapons are most effective engaging aircraft directly attacking the weapon position. ATGWs and tanks, although capable of engaging helicopters at longer ranges, should only do so where there is a lack of other weaponry available to carry out the engagement. This will prevent the misuse of valuable anti-tank (AT) ammunition. With these limitations, it is important that rules of engagement for unit weapons used in an AD role be clearly laid down in formation and unit SOPs.

7. The following rules are of a general nature and may need to be adjusted to suit specific circumstances. Rules of engagement for unit weapons are:

- a. Before declaration of hostilities, AAAD fire is not to be employed except in self-defence on the orders of the local commander. (This rule may need to be modified, eg, made more restrictive, depending on government policy relating to the political situation at the time.)
- b. After declaration of hostilities, an aircraft may be engaged with unit small arms provided it is positively identified as hostile by an officer or non-commissioned officer (NCO), or is seen to commit a hostile act. (If WEAPONS HOLD is in effect, then this rule is limited to acts of self-defence.)
- c. The normal WCO (see Section 3, paragraph 4) will be WEAPONS HOLD. (Certain circumstances may dictate that a less restrictive WCO be put into effect by a higher headquarters. Under no circumstances can a local commander issue a WCO which is less restrictive than the one issued by a higher authority. For example, if placed at WEAPONS HOLD, the local commander cannot put the troops at WEAPONS TIGHT.)
- d. Receding high performance aircraft and aircraft which will not approach closer to the weapon position than the weapon's effective range are not to be engaged. (A rule of thumb is 1000 metres.)
- e. At no time should fire endanger friendly aircraft.

STANDBY WEAPON CONTROL ORDER

8. When communications to the next higher headquarters fail and are not possible to achieve, the standby WCO will automatically be adopted. The standby WCO for unit weapons used in the AD role is WEAPONS HOLD.

SECTION 3

POSITIVE CONTROL

GENERAL

1. Positive control permits AD weapons and Units to respond to the minute-to-minute movements of friendly and hostile aircraft. Because of the speed and flexibility of movement of aircraft, effective positive control requires:

- a. good communications;
- b. reliable real time information on the location and identity of all aircraft;
- c. the ability to process and display the necessary data in real or near-real time; and
- d. close liaison between the agencies controlling friendly aircraft movements and ground formations.

2. Because of the limited range of unit small arms and the inability (and lack of necessity) of units other than AD units to provide the requirements listed above, the only positive control measures applicable to the use of small arms in the AD role are:

- a. WCOs; and
- b. AD warning conditions.

3. WCOs and AD warning conditions are passed down the chain of command using existing formation and unit command nets. They will also be passed down the AD command and early warning nets and subsequently, to units through the local AD commander.

WEAPON CONTROL ORDERS

4. The WCOs used to exercise control of AD weapons are:

- a. **WEAPONS FREE.** An air defence weapon control status meaning weapons may fire at any aircraft not positively identified as friendly, ie, a hostile or unknown.
- b. **WEAPONS TIGHT.** An air defence weapon control status meaning weapons may fire only at aircraft identified as being hostile.
- c. **WEAPONS HOLD.** An air defence weapon control status meaning weapons may fire only in self-defence or in response to a formal order.

5. Local commanders may not lessen the restrictions applied by a higher authority, however, they may impose a more restrictive control order.

AD WARNING CONDITIONS

6. AD warning conditions are designed to indicate the likelihood of air attack. They are initiated by the AD early warning (EW) system and are passed from the formation AD operations centre to the formation headquarters, who will then pass them to units via command nets.
7. The AD warning conditions are:
 - a. **WARNING WHITE.** Attack by enemy aircraft is unlikely.
 - b. **WARNING YELLOW.** Attack by enemy aircraft is probable.
 - c. **WARNING RED.** Attack by enemy aircraft is imminent or in progress.
8. In order to achieve some degree of defence/preparation for an air attack, formation and unit SOPs should state what actions are to be carried out on the receipt of an AD warning. An example is given in Annex E.
9. Passage of **WARNING RED** must take a high priority over other traffic on command nets, as it is likely that most air raid warnings will precede the actual attack by only seconds, if any warning is received at all.

PASSAGE OF WCO AND AD WARNINGS WITHIN THE UNIT

10. Immediately upon receiving an AD warning or WCO, the unit command post (CP) will relay the information to its subunits by the quickest means possible. This will normally be by radio or land line. An example of a transmission is:

CC1 THIS IS 1, WARNING RED, WARNING RED, FOUR AIRCRAFT
APPROACHING FROM NORTH, OVER.

11. At the subunit level, the information must be passed as quickly as possible in order to allow the troops to take appropriate action, including taking cover and preparing to engage the aircraft. There are six methods other than radio, for passing an air raid warning on to the remainder of the subunit. They are:
 - a. whistle;
 - b. other noise makers;
 - c. shouting;
 - d. relay of verbal message;

- e. land line; and
- f. visual alarm signals.

12. The various methods of passing both air raid and nuclear, biological and chemical (NBC) warning information are outlined in Annex E.

CONTROLLING ENGAGEMENTS AT UNIT/SUBUNIT LEVEL

13. Fire orders for AAAAD engagements, method of fire, ammunition expenditure rates and authority levels to order an engagement by small arms in the AD role must be clearly laid down in unit SOPs. Examples of simple engagement orders are found in Chapter 3, Section 4. Others can be found in B-GL-309-003/FT-001, Infantry, Volume 3, Section and Platoon in Battle, Chapter 14.

CHAPTER 5

CONDUCT OF UNIT AIR DEFENCE

SECTION 1

GENERAL

INTRODUCTION

1. Whether on the move or stationary, units must be ready to defend themselves from an air attack. Active measures involving the use of small arms will normally be possible only during daylight hours. Terrain and meteorological (met) conditions, as well as improvements in the technology incorporated in modern aircraft may make it necessary to continue AD measures into the night.
2. Sections 2 and 3 outline the procedures and skills for the AD of a unit, either in a static location or moving on foot. Section 4 outlines the different procedures and skills required for the AD of a unit moving by vehicles.

SECTION 2

AIR SENTRY PROCEDURES

GENERAL

1. The success of unit AD, both passive and active, depends largely on the early detection of enemy aircraft. Units in the combat and communications zones must have air sentries posted throughout daylight hours. Air sentries are responsible for detecting enemy aircraft, and should not have any other task during their periods of duty.

ALLOCATION AND EQUIPPING OF AIR SENTRIES

2. As a rule, each platoon size organization should have an air sentry. The air sentry should be located within the platoon position at a point from which the arc responsibility can best be observed.

3. Each air sentry should be equipped with a pair of binoculars and be trained to the basic level of aircraft recognition, Spotter Class 3. Air sentries should change frequently to prevent excessive eye fatigue.

SEARCH AND SCAN TECHNIQUES

4. Air sentries must employ definite search and scan procedures if they are to be successful in detecting aircraft. Scanning is a step-by-step method of visually searching the ground and sky, and the observer must focus on distinct objects, clouds or terrain features every few seconds. If this is not done, the eyes will relax without the observer being aware of it and distant aircraft will not be detected.

5. Examples of two scanning procedures are given, their use being dependent on the terrain over which the air sentry is observing. The use of these procedures will ensure that the entire airspace within the search arc has been scanned. Rapid scanning over a large arc will detect very little detail. If the search arc is divided into segments, each of which is scanned in short steps, aircraft are more likely to be detected. Air sentries should ensure that they refocus continually.

6. The search and scan procedure for observation over flat terrain is shown in Figure 5-2-1. The search and Scan procedure for observation over hilly terrain is shown in Figure 5-2-2.

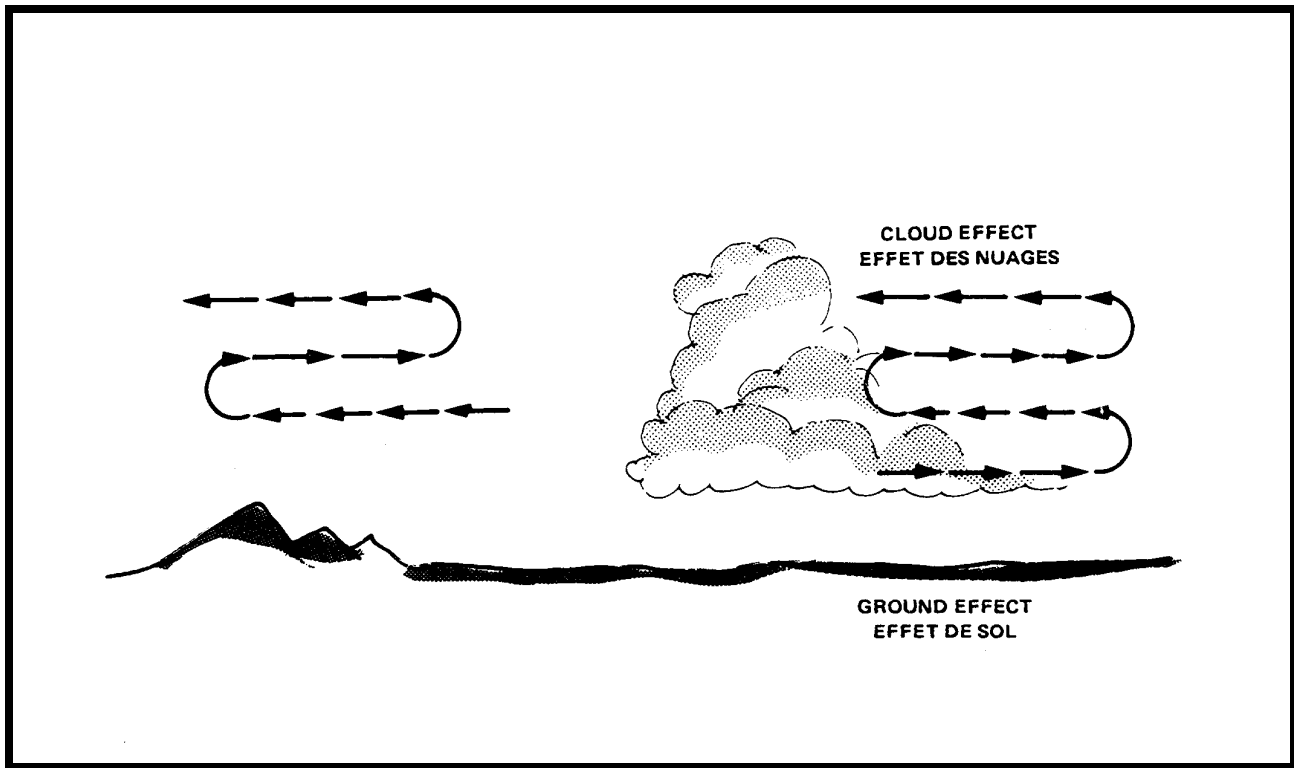


Figure 5-2-1 Scanning Over Flat Terrain

AIRCRAFT TARGET INDICATION

7. Having detected the target, the air sentry must indicate its location to other personnel. Normal methods of target indication are used, eg:

- a. **Reference Point.** AIRCRAFT, REFERENCE CHURCH, RIGHT/LEFT FIST, HIGH/LOW.
- b. **Axis of Advance.** AIRCRAFT, RIGHT FRONT, HIGH/LOW.

8. HIGH or LOW is used to indicate whether the aircraft is above or below 400 mils angle of sight. This will assist personnel in locating the aircraft by reducing the area of sky they need to scan.

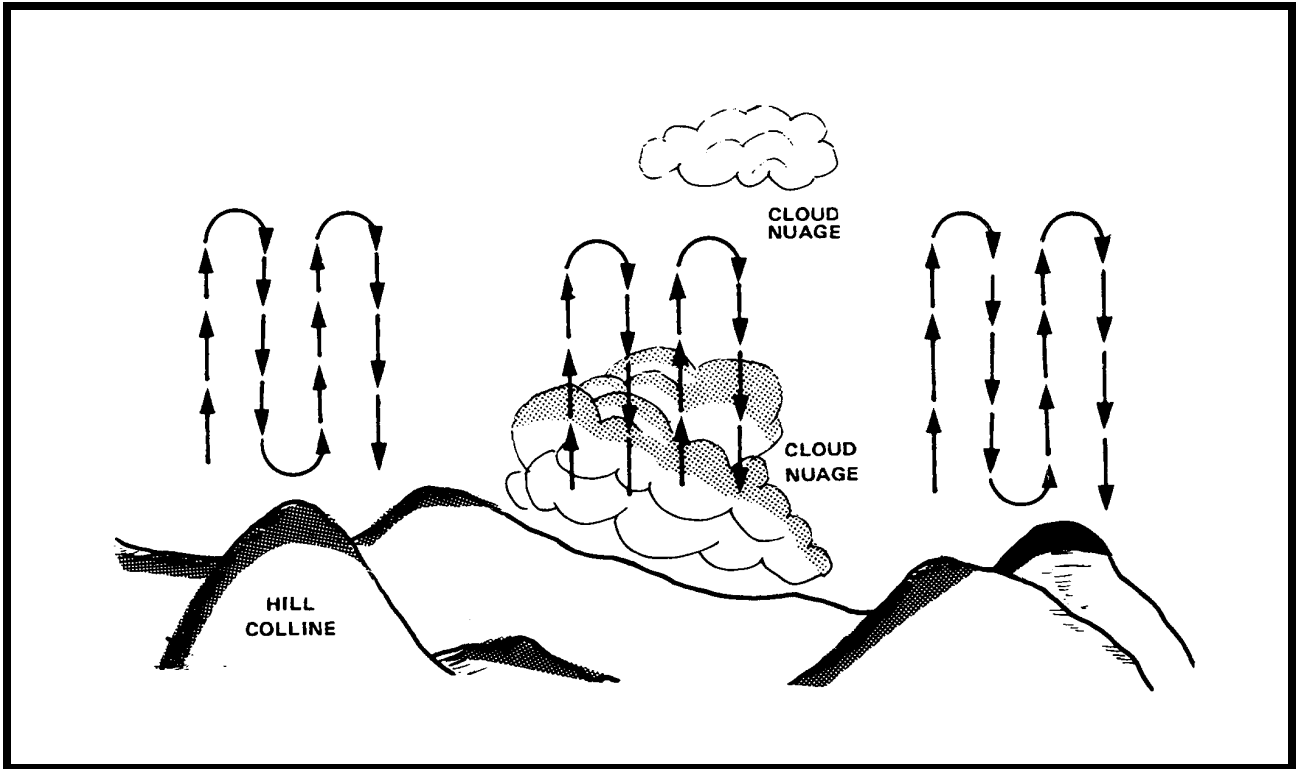


Figure 5-2-2 Scanning Over Hilly Terrain

9. Other examples of air target indication can be found in B-GL-309-003/FT-001, Infantry, Volume 3, Section and Platoon in Battle.

SECTION 3

ENGAGEMENT DRILL

GENERAL

1. When an unidentified or hostile aircraft is sighted or when WARNING RED is received, the alert must be sounded by the method laid down in SOPs, see Chapter 4, Section 3, paragraphs 6 to 12. The unit should take cover and, provided active measures are authorized, personnel should prepare to engage the aircraft with their individual weapons, see Chapter 3, Section 4, paragraph 3. If all personnel have not seen the target, it should be indicated by the air sentry using one of the methods described in Section 2, paragraph 7. Avoid excessive movement which could reveal the unit's location.
2. The local commander at section, platoon or company level must identify the target and assess its range. If the aircraft is attacking the unit position and is at the correct range at which to open the engagement, the local commander may order fire, see Figure 3-2-1.
3. All personnel are to apply the aim-off appropriate to the aspect of the target, and as quickly as possible fire the amount of ammunition detailed in unit SOPs for AD engagements. The engagement should cease when:
 - a. personnel have expended the amount of ammunition authorized;
 - b. the aircraft is receding;
 - c. the aircraft is out of range; or
 - d. the aircraft is destroyed.
4. The engagement and results must be reported to the next highest headquarters, detailing the:
 - a. unit callsign;
 - b. time of engagement;
 - c. number and type of aircraft engaged; and
 - d. visible results.

SECTION 4

TROOPS MOVING BY VEHICLE

GENERAL

1. Units, equipment and personnel are most vulnerable to air attack when moving on fixed routes by vehicle.
2. During daylight movement, each vehicle should have an air sentry in the front of the vehicle in contact with the vehicle commander and/or driver. The air sentry must have his/her head clear of the canopy or cab roof. Within a packet of vehicles, air sentry arcs must be allocated so that all round coverage is ensured. Automatic weapons should be sited throughout the packet to provide an even distribution of firepower. Vehicles travelling singly should have air sentries at the front and rear of the vehicle if possible.
3. When an unidentified or hostile aircraft is sighted, or when WARNING RED is received, a vehicle convoy has three alternatives:
 - a. stop on the sides of the road;
 - b. continue; or
 - c. disperse and seek concealment and protection.
4. The advantages and disadvantages of each alternative are discussed in Annex F. It is important that vehicle commanders and drivers know which alternative is to be used. These are normally advised in formation/unit SOPs and/or at convoy briefings. The procedures for the use of small arms are the same as those described in Chapter 3, Section 4.

CHAPTER 6
UNIT TRAINING
SECTION 1
GENERAL

INTRODUCTION

1. Hostile air attack may occur without warning. It can prove to be an extremely frightening and demoralizing experience causing panic among untrained troops and a great deal of damage and disruption. It is vital, therefore, that all personnel be trained in AAAD measures.
2. Frequent and regular training in the measures and drills to adopt in case of air attack will ensure that all personnel react correctly and instinctively when an air attack occurs.
3. All members of a unit must be trained in:
 - a. passive measures;
 - b. aircraft recognition;
 - c. actions to be taken on air attack (see Annexes E & F); and
 - d. the engagement of aerial targets using small arms.
4. An example of a suggested syllabus for a unit AAAD course is given in Annex G.

PASSIVE MEASURES

5. Units should practise all aspects of passive AD as a matter of routine. These are normal fieldcraft procedures such as:
 - a. careful siting;
 - b. the use of track plans and track discipline for personnel and vehicles;
 - c. camouflage, including:
 - (1) disruptive paint and mud patterns on vehicles and equipment;
 - (2) prevention of shine from vehicle windscreens, bare metal, bare skin, etc;
 - (3) concealment of the spoil from digging; and

- (4) correct use of camouflage nets and natural camouflage materials;
 - d. restrictions on daylight movement and training of units to ensure they are competent at and properly equipped for, night movement, deployment and operations;
 - e. dispersion of men, vehicles and equipment; and
 - f. the disciplined procedure of personnel remaining stationary and not looking up when aircraft pass overhead.
6. Pilots cannot effectively attack what they cannot find. Regular practice of passive measures during training, therefore, will reduce the chance of air attack during operations.

AIRCRAFT RECOGNITION

7. The success of unit AD, both active and passive, will depend largely on the ability of all personnel to detect, recognize and give warning of the approach of enemy aircraft. To achieve this, all personnel should receive training in aircraft recognition.
8. The techniques and methods of teaching aircraft recognition are described in the UK pamphlet Army Code 70748, All Arms Recognition Training. This pamphlet can be ordered through unit/base libraries.
9. Aircraft recognition teaching packages could include the following items:
- a. aviation magazines and journals available through unit/base libraries;
 - b. the Recognition Journal and aircraft recognition handbooks available through unit/base libraries;
 - c. scale model aircraft kits purchased locally; and
 - d. aircraft recognition slide packages (Spotter Class 1-3) available through FMCHQ, SSO Artillery.
10. Further aircraft recognition training can be carried out during field training exercises using simulated attacks by service aircraft.

ACTIVE MEASURES

11. For volume fire to be effective, all personnel must be trained and practised in the techniques of engaging aircraft with unit small arms, see Chapter 3. In particular, the three areas which require emphasis and considerable practice are:
- a. fire orders/methods and control of fire by section/ platoon/company commanders;

- b. estimation of aim-off; and
- c. assessing the range to an aerial target.

12. **Firing Practices.** Live firing practices against aerial targets should be conducted as often as possible. Emphasis should be placed on volume fire techniques and strict control of fire at the section and platoon level. Instructions for the organization, control and conduct of small arms AD practices are contained in B-GL-304-003/TS-001, Operational Training, Volume 3, Ranges and Training Safety; B-GL-317-014/PT-001, Weapons, Volume 14, The Machine Gun .50 cal M2; B-GL-317-012/PT-001 Interim 1, Weapons, Volume 12, The General Purpose Machine Gun 7.62 mm C6; and B-GL-317-019/PT-001, Interim 1, Weapons, Volume 19, The Light Machine Gun 5.56 mm C9.

13. **Targets for Air Defence Training.** Live firing AD practices with small arms should be conducted using aerial targets which are as realistic as possible, yet cost effective. A good example of such a target is a sub-scale radio controlled model aircraft such as the TATS 50, see Figure 6-1-1. Artillery units in Mobile Command have a TATS section with sufficient operations and aircraft to provide each formation with a pool of AAAD targets. Units can request the use of these TATS sections through normal channels.

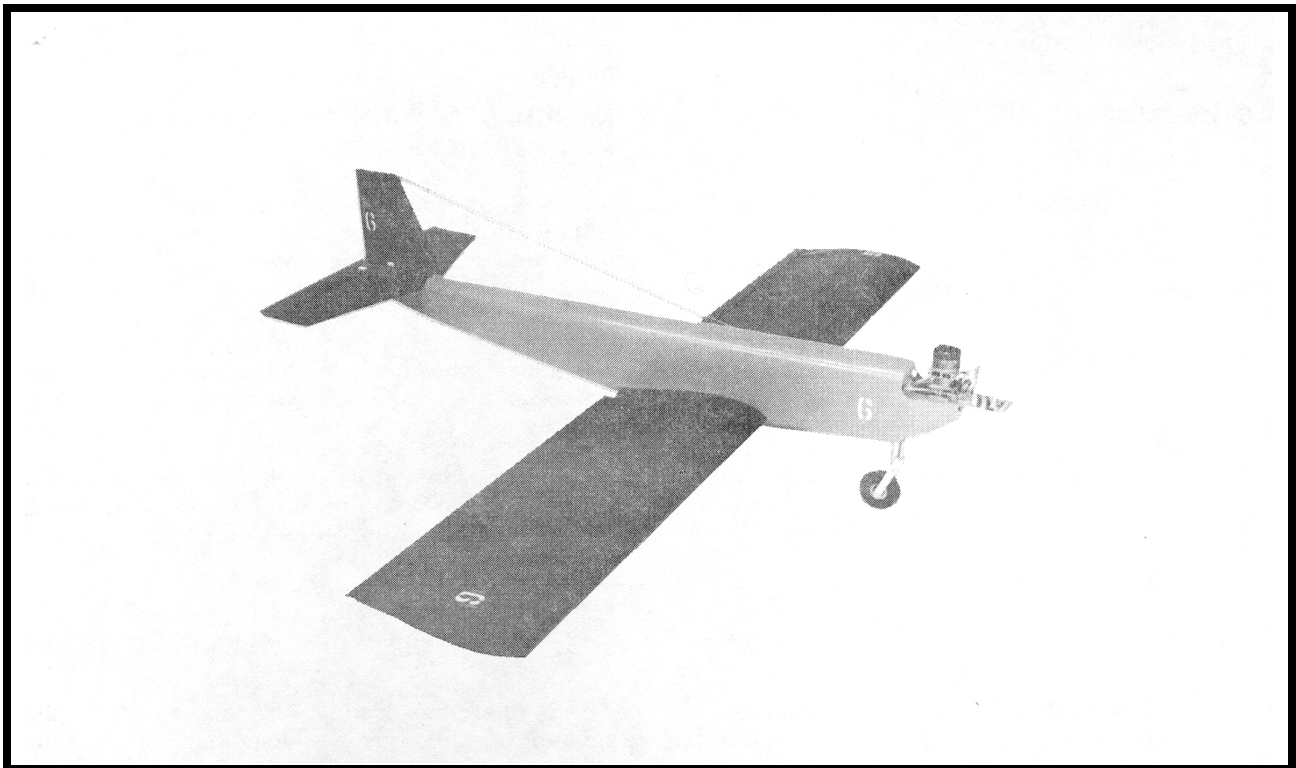


Figure 6-1-1 TATS 50 Target System

14. Should TATS be unavailable, a number of other suitable targets can be used, including:
 - a. helium-filled balloons,
 - b. hand-held parachute flares, and
 - c. mortar and artillery illuminating rounds.

ANNEX A AD WEAPON MOUNTS

GENERAL

1. The effectiveness of AAAD weapons is significantly increased by mounting them on a stable mounting. Although only the M63 mount is currently issued to units, most of the following mounts discussed below can be jury-rigged or manufactured locally:

- a. armoured vehicle mount,
- b. M63 anti-aircraft mount,
- c. logistic vehicle mount,
- d. simple canopy rail air defence mount, and
- e. ground and light vehicle mount.

ARMoured VEHICLE MOUNT

2. Experience has shown that the pintle mount on the M113 is not well suited to the AD role as the machine-gunner is unable to get sufficient elevation to engage a fast approaching target. Difficulty is also found in traversing the weapon when engaging a near-crossing target.

3. The GPMG mount on the LEOPARD tank is more effective in that it allows for more freedom of movement for the weapon.

4. Neither of the above mounts provide vehicle commanders with the means of detecting, acquiring and engaging the target other than with their own senses which are virtually ineffective when closed down in the vehicle. Consequently, these, as well as turret-mounted MGs such as on the GRIZZLY and COUGAR, will be of limited value when used in the AD role under circumstances where the crew are forced to close down.

M63 ANTI-AIRCRAFT MOUNT

5. The M63 mount, see Figure A-11, provides a stable platform for both the GPMG and the HMG. It will also enable the weapon to be used in the direct fire support role, although it is not as effective in this role as the regular tripod mount. Its advantage over the tripod in the AD role is that it provides for much greater movement in elevation.

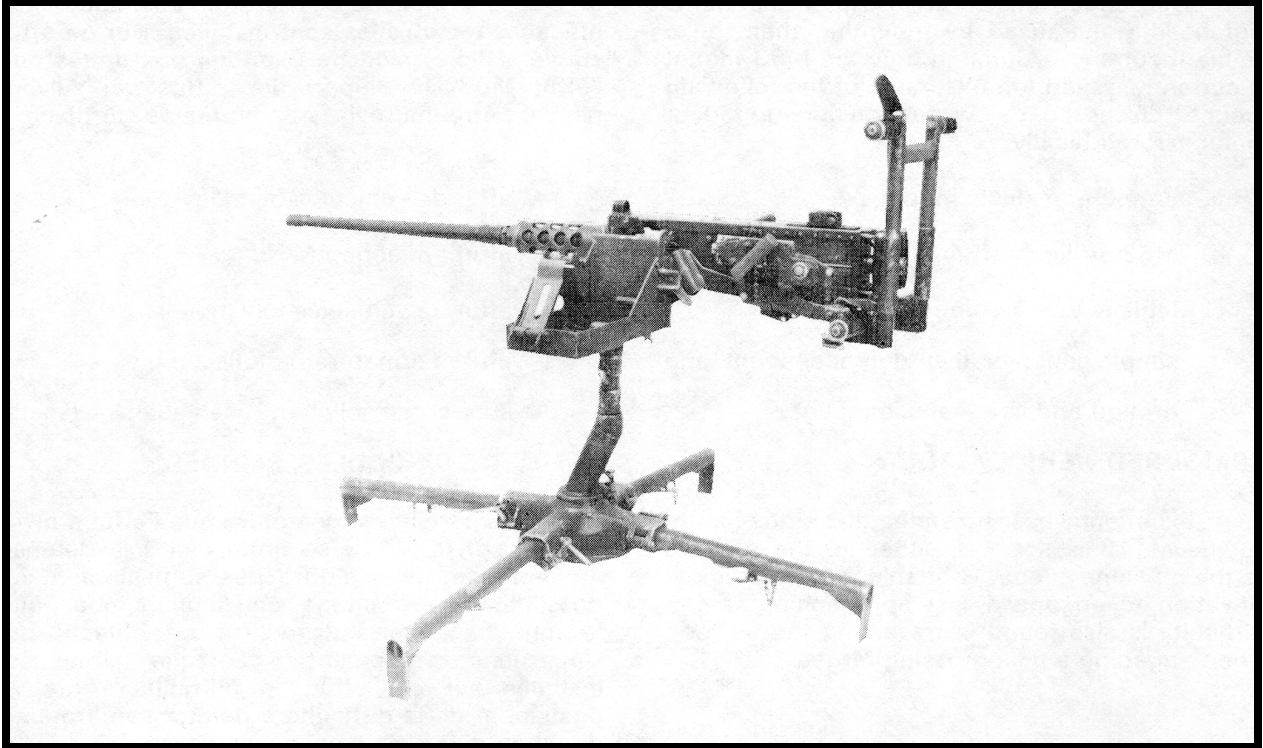


Figure A-1 .50 Cal MG on the M63 Anti-aircraft Mount

LOGISTIC VEHICLE MOUNT

6. A cab mounting for an MG is required on logistic vehicles for protection while moving and when outside the cover of AD weapons. The weapon should be capable of quick and easy removal from the vehicle cab, for use dismounted, eg, in an administrative area. An example of such a mount is the UK B Vehicle Mount, see Figure A-2.

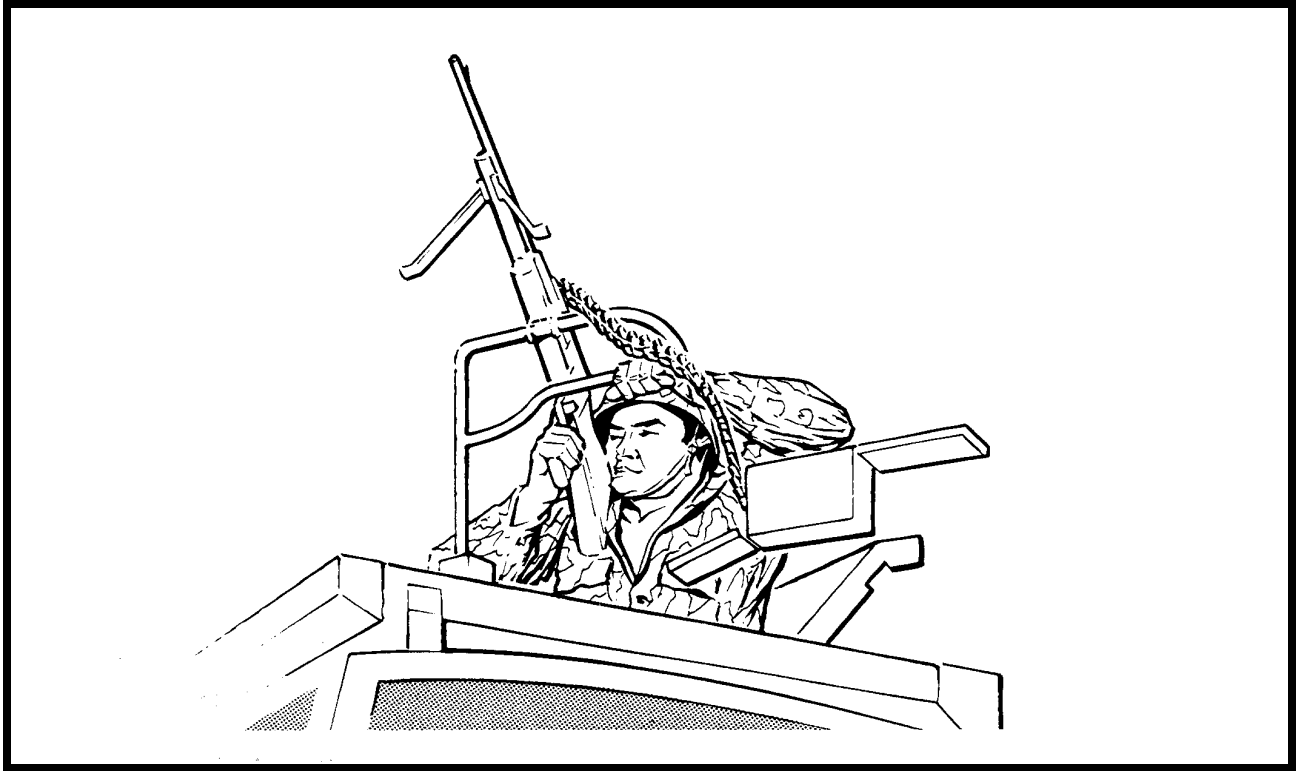


Figure A-2 UK B Vehicle Mount

SIMPLE CANOPY RAIL MOUNT

7. The simple canopy rail mount (SCRAM) is in service with the UK forces as an interim AD mount for logistic vehicles, see Figures A-3 and A-4. It allows a GPMG or LMG to be mounted on the side or rear canopy rails of a 5/4 ton cargo vehicle.

GROUND AND LIGHT VEHICLE MOUNT

8. A simple ground mount is required for use from weapon positions, slit trenches, etc. To allow its use by a gunner standing in the open or in a slit trench, this could consist of a mount on an expanding or segmented pole and a base spike. The same mount should be capable of rapid and easy fitting to a light vehicle for use on the move. An example of such a mount is the UK Ground Mount or Louch Pole which can also be fitted to the Landrover, Volvo BE202E and Snowtrac, see Figures A-5 to A-6.

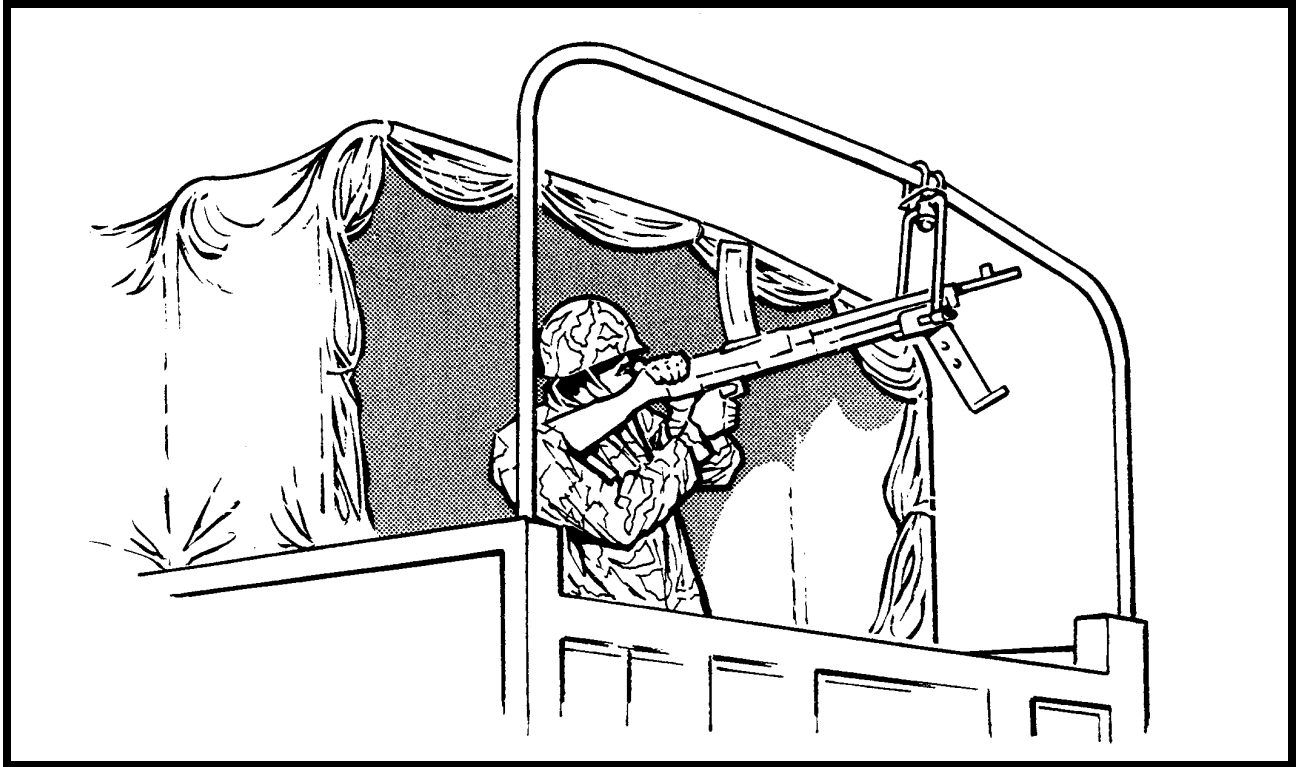


Figure A-3 SCRAM Mounted on a Four Ton Truck

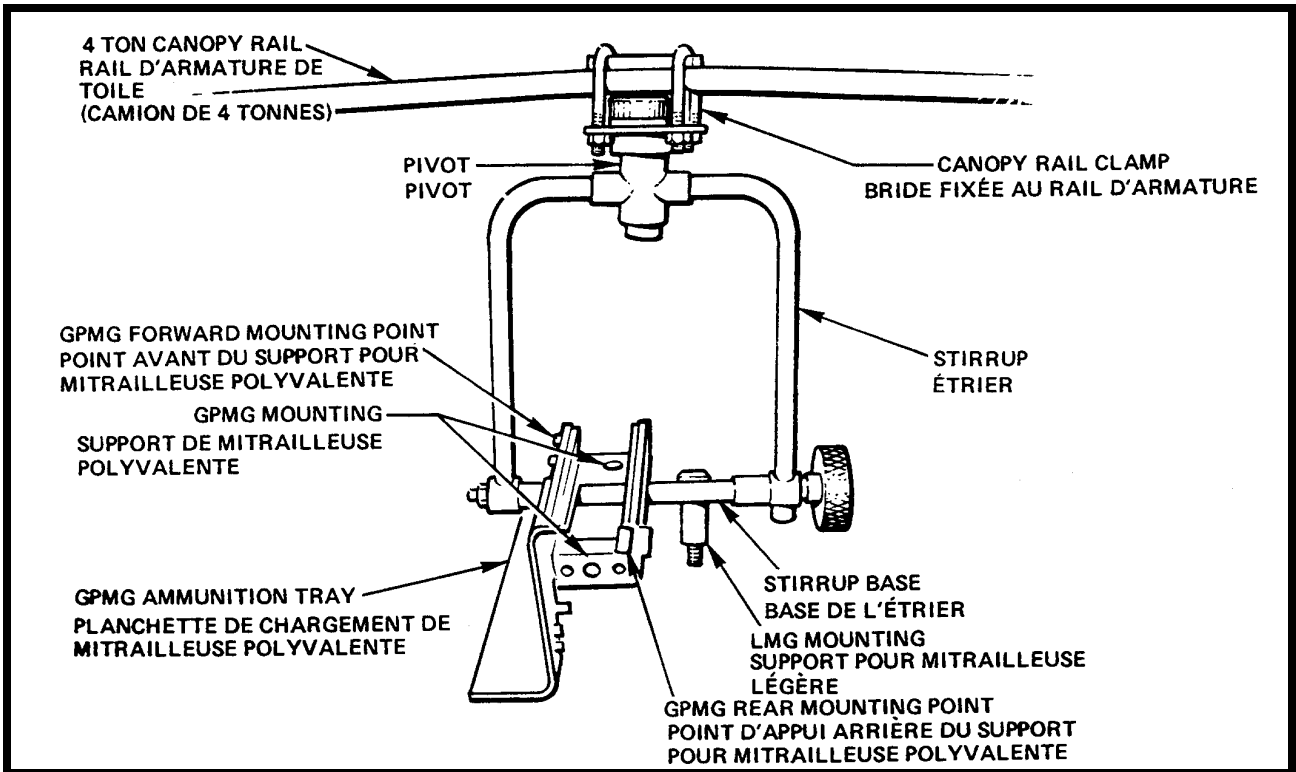


Figure A-4 The SCRAM Mount

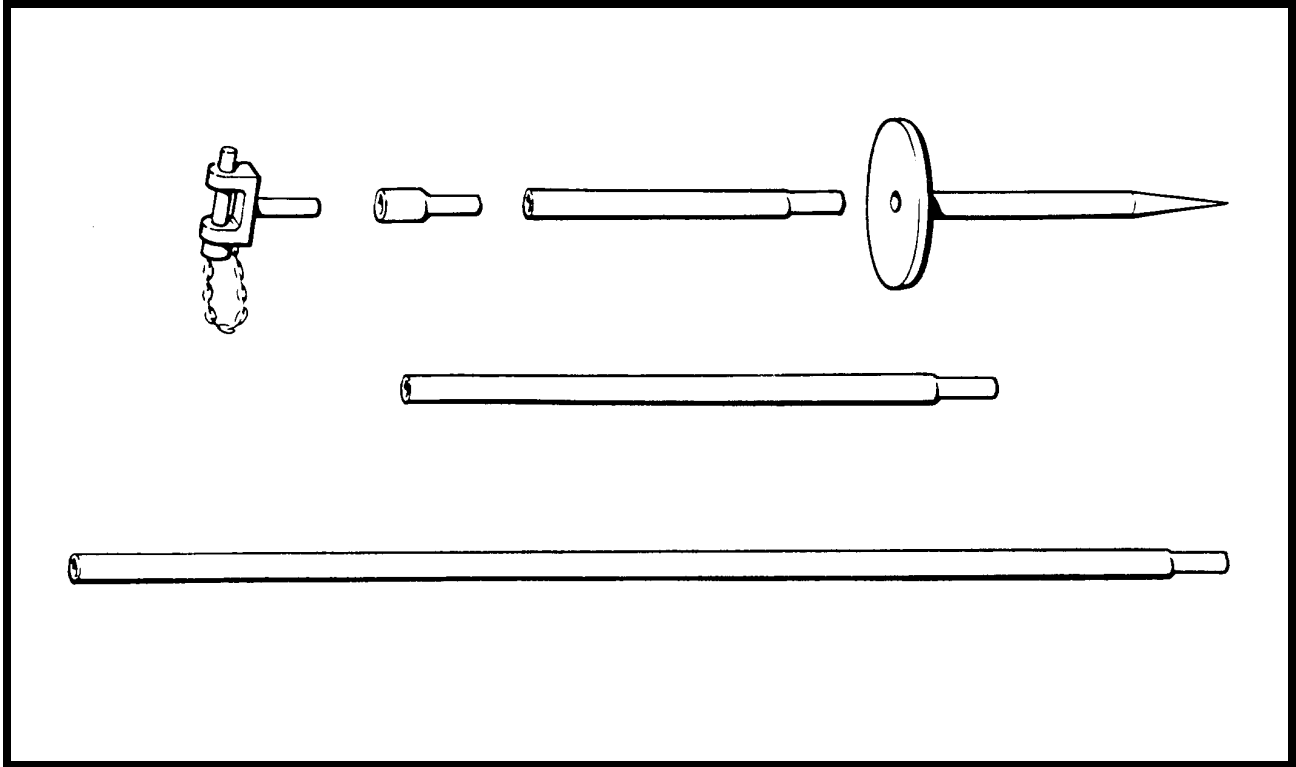


Figure A-5 The Ground Mount Disassembled

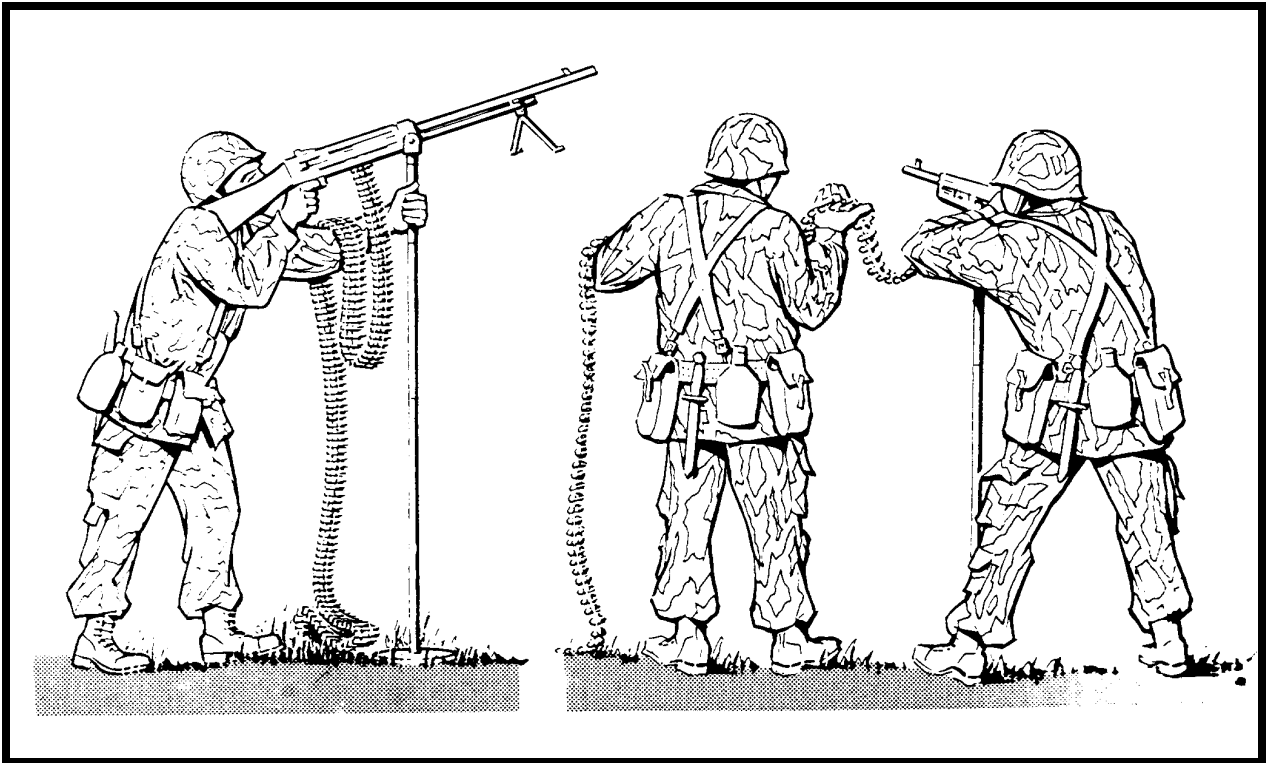


Figure A-6 The Ground Mount in the Normal Ground Role

ANNEX B
THE PILOT'S REQUIREMENTS IN PLANNING AN FGA SORTIE

GENERAL

1. A thorough examination of likely flight paths which might be used in attacks on the asset being defended will aid in planning the efficient use of AAAD resources.

THE PILOT'S REQUIREMENTS

2. Examples of typical attack profiles are discussed in Chapter 1. A pilot who is attacking a target will require a series of clear ground indications to assist with low level navigation, terminating at an initial point (IP). The IP will probably be 10 to 20 kilometres from his target and the route to it will normally be selected in order to keep as low as possible to avoid radar detection for as long as possible.

3. Likely IP features are:

- a. high ground of clear shape, preferably separated from its background;
- b. an unmistakable feature of a building set in a larger background;
- c. towns;
- d. railways with a definite feature such as a bridge or a junction;
- e. rivers with a definite feature such as an easily recognized island;
- f. via ducts and bridges; and
- g. lakes.

4. Unlikely IP features are:

- a. woods;
- b. villages, unless in a thinly populated area;
- c. power lines; and
- d. railways and rivers, unless connected with some definite feature.

5. From the IP, the pilot will either:

- a. commence a timed run to the pull up point (PUP);
 - b. use the IP and a PUP; or
 - c. commence a timed run direct to the target for a napalm, retarded bomb or heliborne attack.
6. The requirements of a PUP are:
- a. the pilot must be able to see and identify the target;
 - b. the line from the PUP to the target should be clear of intermediate features which could make target identification difficult;
 - c. the ground slope to the target must be less than the dive angle of attack;
 - d. the exit route beyond the target must be clear and preferably on the pilot's escape route; and
 - e. the distance from the PUP to the target is normally 3 to 7 kilometres.
7. The following will modify the likely position of the IP and PUP:
- a. The pilot's desire not to fly further into enemy held territory than is necessary. This will be particularly true in the case of a heliborne attack.
 - b. Combat radius of the aircraft.
 - c. **Position of the sun.** The line from the PUP to the target will ideally lie away from the sun to allow easier identification of the target.
 - d. **Wind strength and direction.** The ideal is for the line from the IP to the target for a lay down attack and from the PUP to the target for an off-set pull up attack to be into the wind.

ANNEX C
SOVIET HELICOPTER TACTICS IN EXECUTING AN ARMED SORTIE

GENERAL

1. An understanding of the attack profile of Soviet helicopters in the combat area will provide useful information in planning the effective employment of AAAD. Small arms and ATGW/tank fire will be effective against helicopters if used correctly and in sufficient quantity, even though helicopters such as the HIND are armoured.
2. The attack profile of Soviet helicopters is dependent on the type of helicopter, the weapons used and the need to keep the exposure time to a minimum. The tactics described here are based on the HIND and HIP. The latest Soviet helicopters are beginning to approach Western helicopters in agility and capability, therefore, their tactics will also begin to resemble those of their Western counterparts, ie, creeping around terrain features and popping up from the hover at tree top level for short exposure times.

TACTICS IN THE ARMED ROLE

3. In general, Soviet helicopters are less agile than their Western counterparts although in most cases they are faster. These characteristics make it difficult for them to fly very low, ie, nap of the earth. In order to effect surprise on a ground attack sortie, they fly towards the target at about 150 metres above ground level (AGL) and at some 15 kilometres from the target they descend to a height of 20-50 metres. Maintaining this height and making use of terrain cover until at approximately 4 to 6 kilometres from the target, a rapid climb is made to about 150 metres, the target identified and the attack commenced in a shallow dive, see Figure C-1. ATGMs are fired 3 and 5 kilometres from the target (depending on type) and could be followed by rockets at 1500 metres and cannon at 1000 metres. At 50 metres AGL, a sharp breakaway is made to either side of the target. This type of attack is usually carried out under the direction of a ground or airborne Forward Air Controller (FAC).

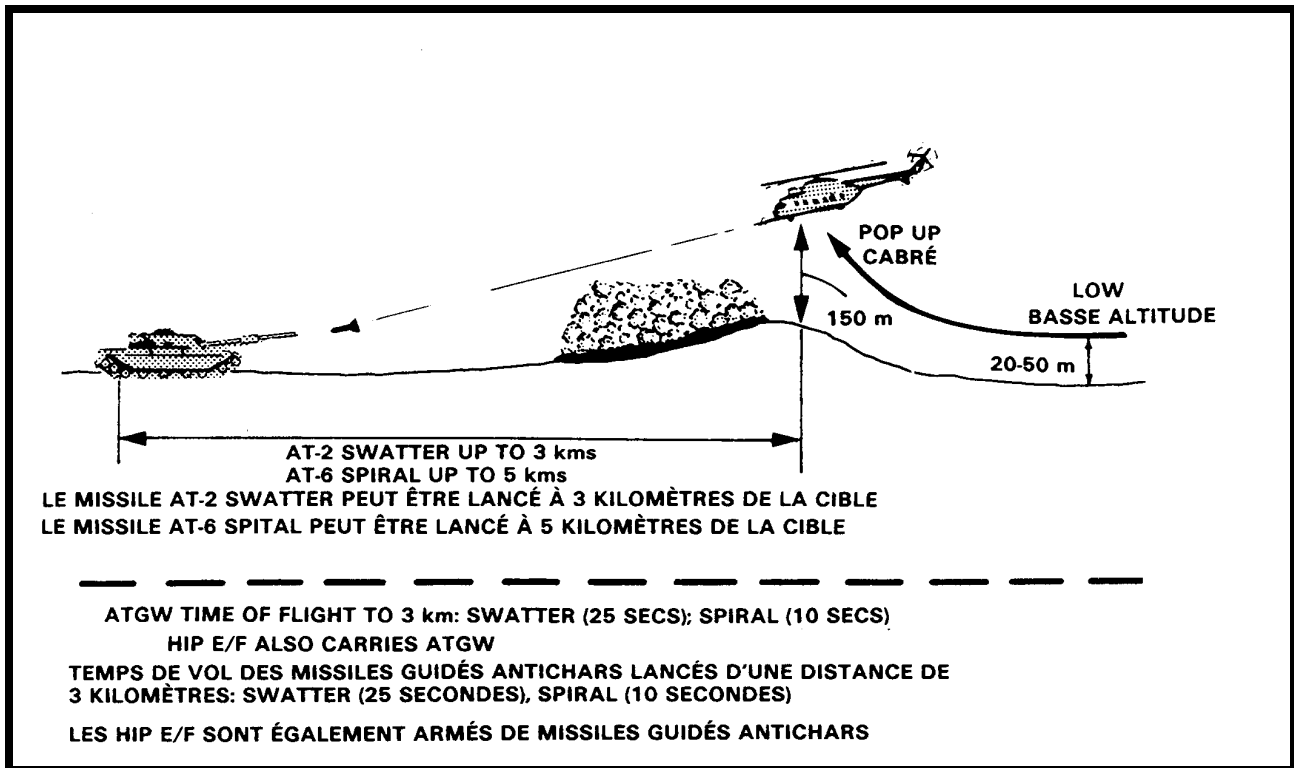


Figure C-1 HIND ATGM Diving Attack from a Pop Up

4. Anti-tank attacks with ATMGs made from ambush, and concealed attacks from a low hover are a possibility and could be made if circumstances favour this, see Figure C-2.

5. Helicopters operating in the armed escort, suppressive fire support or armed transport roles in a airmobile operation deep into enemy territory are likely to adopt largely similar tactics, modified to take into account longer distances to be covered at low level, see Figure C-3. For example, an approach at about 150 metres to within a few kilometres of the FEBA, then a descent to about 50 metres which they will maintain until the assault landing area is reached. The transports will probably go straight in to land, with the armed escorts pulling up to 150 metres and diving down to attack or suppress opposition and act as close air support to the heliborne troops after landing.

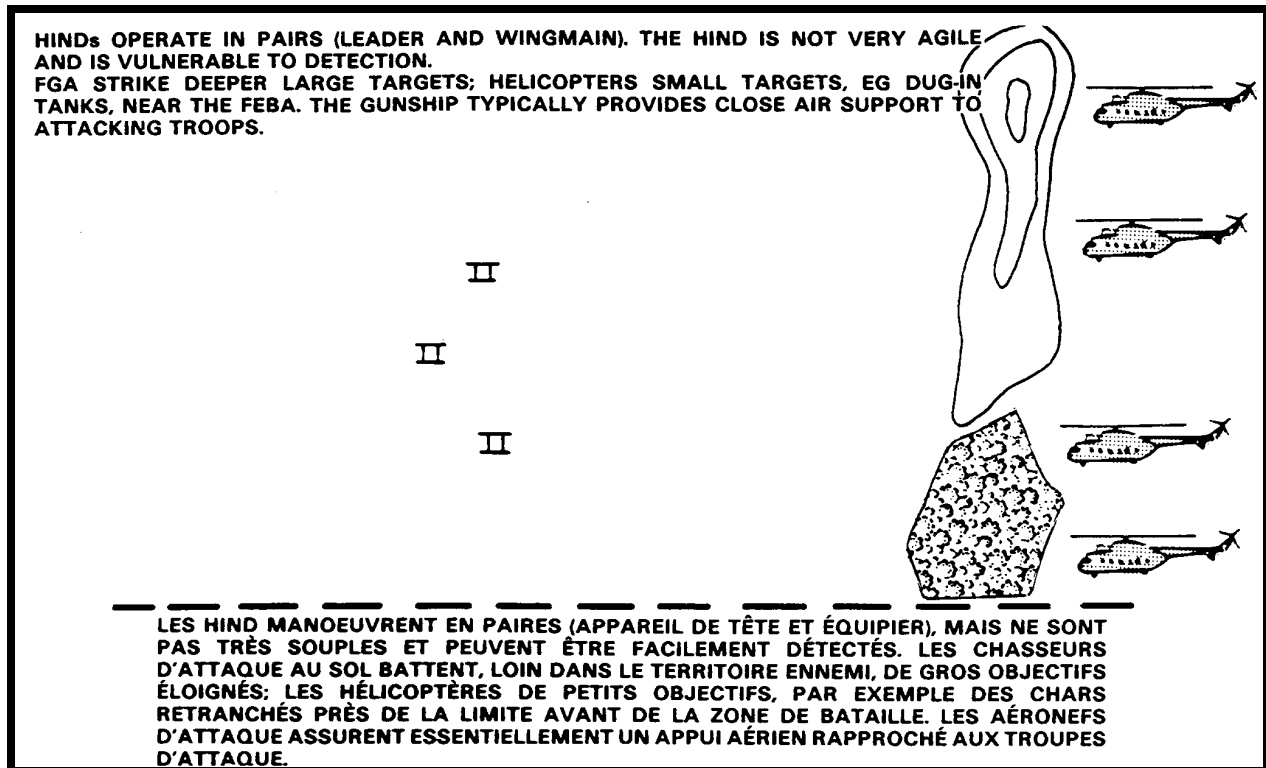


Figure C-2 HIND Attacking Tanks from Ambush Positions

PILOT'S REQUIREMENTS

6. Soviet helicopter pilot's requirements in all of the situations described above will be much the same as those of the FGA pilot shown in Annex B, modified to take account of the helicopter's ability to fly lower and slower than FGA aircraft. For example, helicopters will likely descend to lower altitude at the IP. They will not necessarily have to use timed runs to the PUP or to the target as their on-board equipment, greater manoeuvrability and slower speeds allows them a greater flexibility of operation.

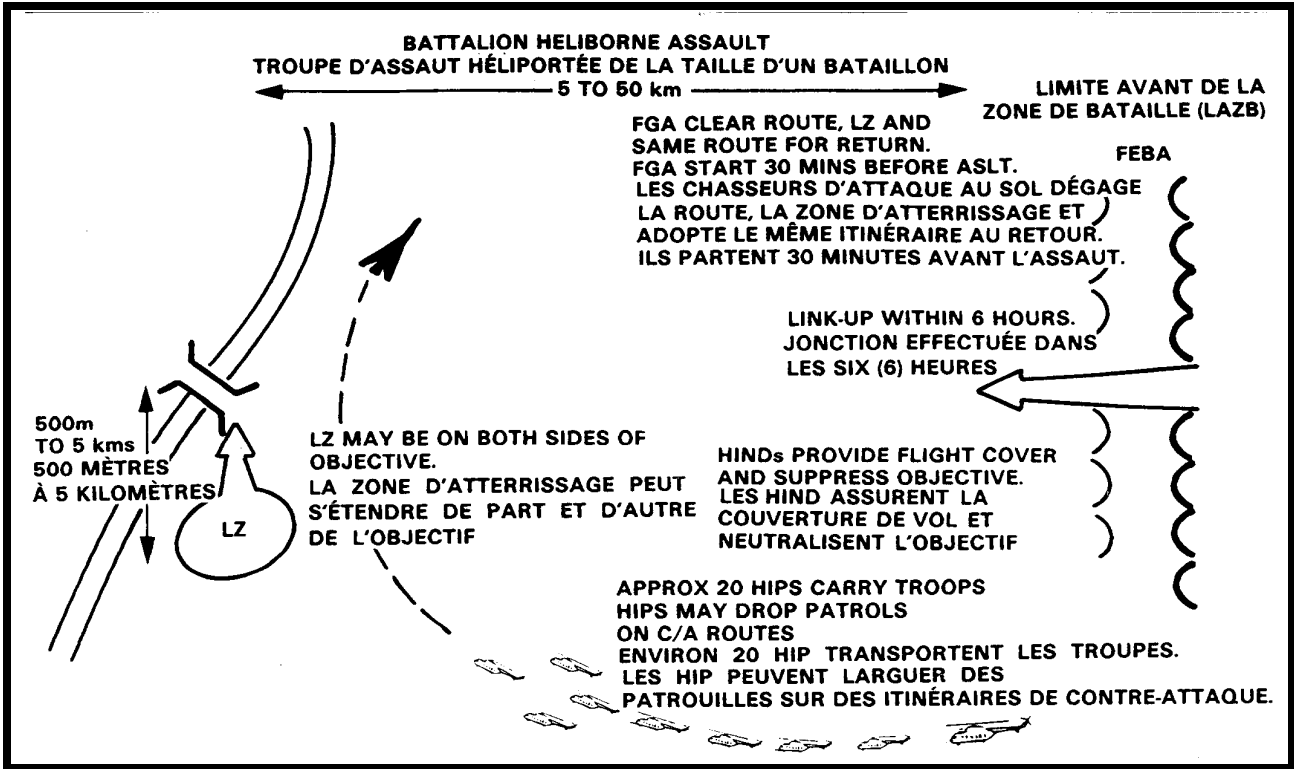


Figure C-3 Battalion-sized Heliborne Assault

ANNEX D
CORRECTION OF AIM-OFF USING TRACER OBSERVATION

INTRODUCTION

1. Tracer observation provides the only practical means of correcting aim-off when attempting to maintain a fixed lead engaging an aircraft with small arms, see Chapter 3, Section 4, paragraph 14.
2. The time of flight for a bullet to reach 1000 metres is approximately two seconds. This, and the fact that the average AAAD engagement will only last four to six seconds means that the time available to correct aim-off by tracer observation is extremely short. Since effective tracer observation requires a great deal of practice, it is recommended that only the more experienced firers attempt this method of engagement. The remainder should concentrate on one of the other two methods of engagement outlined in Chapter 3, Section 4, paragraph 14, particularly when engaging crossing targets.
3. There are two difficulties associated with tracer observation. The first is one of depth perception, ie, it is difficult for the soldier on the ground to determine which is more distant - the tracer or the target. The second is the illusion of lateral curvature of the tracer round when engaging crossing targets. This is caused by sequential shots fired at different bearings as the gunner follows the aircraft with his weapon. In practice, the tracers do not appear as single spots moving directly away from the weapon, but rather as a curved path as shown in Figure D-1. When fired, the bullets move in a straight line away from the weapon. Gravity causes the trajectory to curve downward, but except for the effects of wind or drift, the bullets do not move to the left or right. The illusion of lateral curvature occurs because the gunner is concentrating on a moving reference point, the target, and is not following the tracer from start to finish. The point of maximum apparent curvature is called the tracer hump, see Figure D-1.
4. Using tracer observation correctly and overcoming the above difficulties is accomplished by the following:
 - a. localizing vision around the target;
 - b. superimposing the tracer on the target; and
 - c. reading the tracer and correcting aim-off.

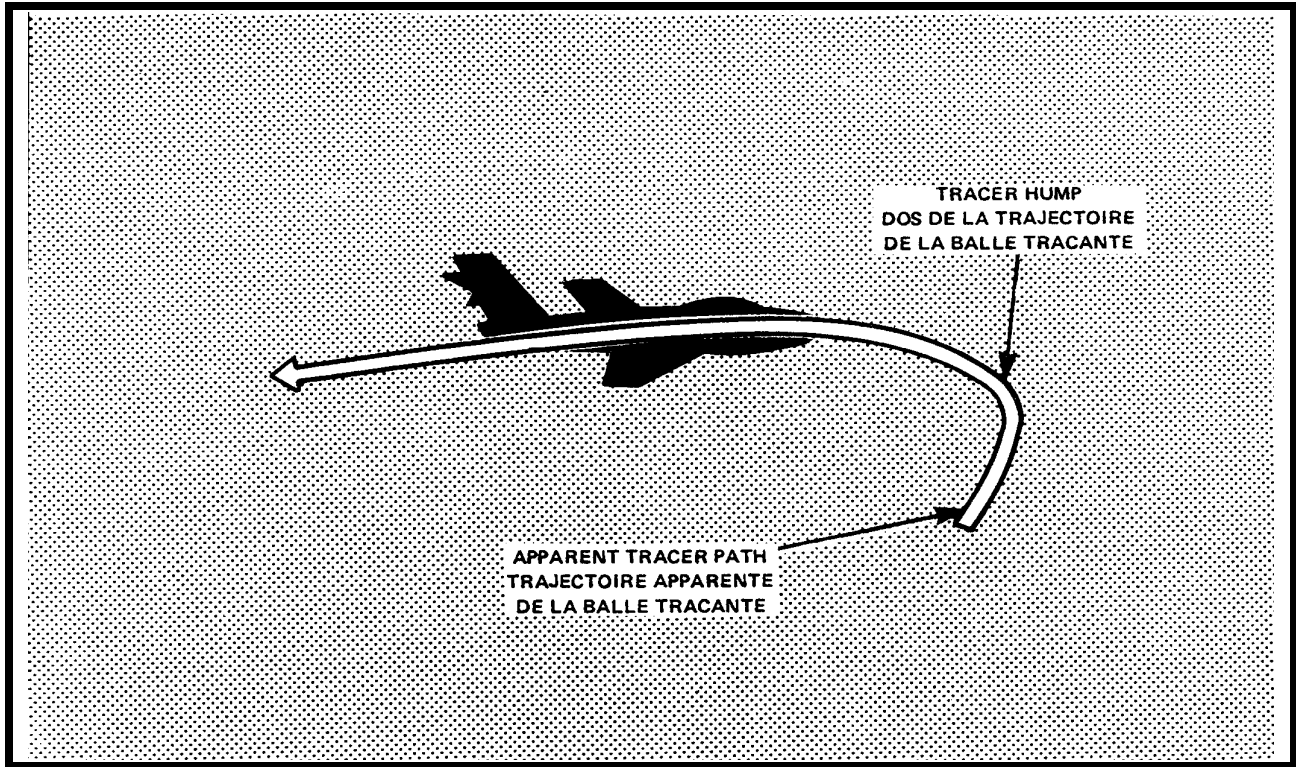


Figure D-1 Illusion of Curvature

LOCALIZING VISION AROUND THE TARGET

5. Gunners must focus their attention in the immediate vicinity of the target, see Figure D-2.

SUPERIMPOSING TRACER ON THE TARGET

6. For a direct approacher, if the tracer path is too far left or right, shift the weapon's aim back towards the aircraft in order to superimpose the tracer path to pass across the aircraft, see Figure D-3.

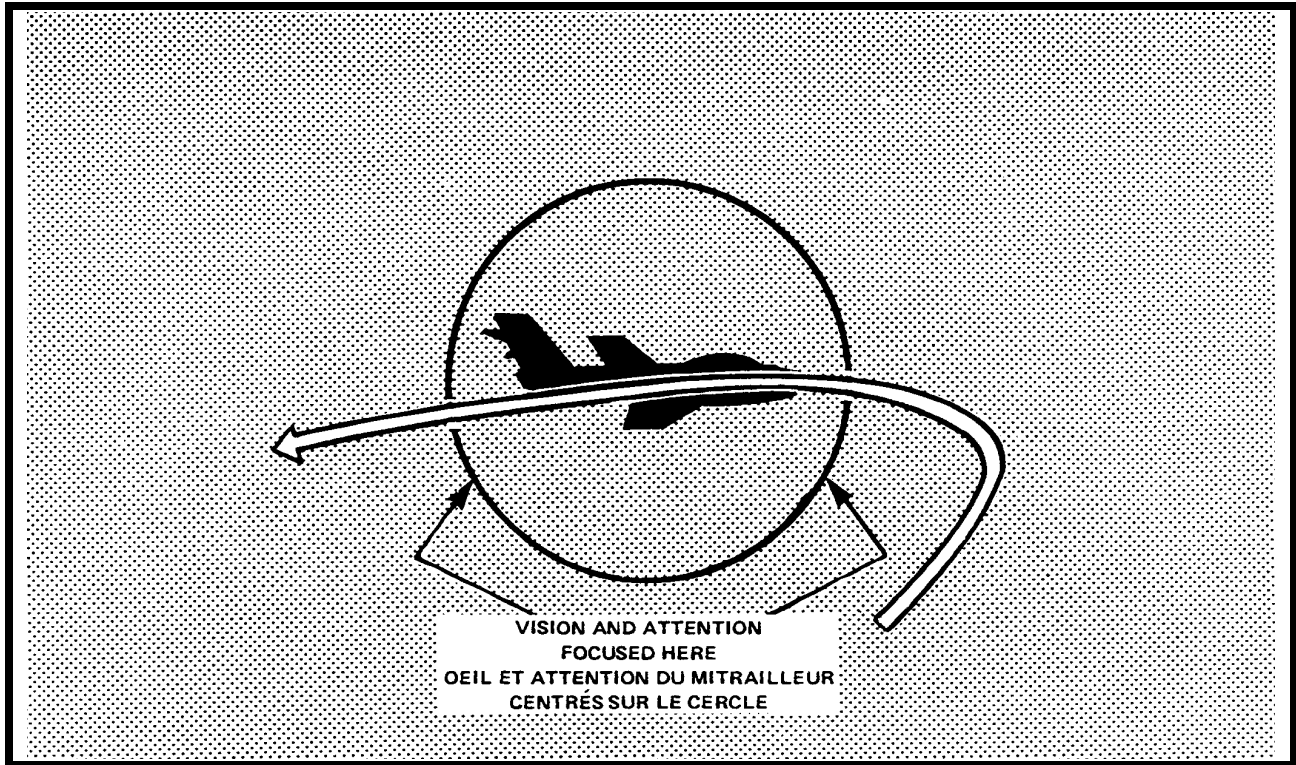


Figure D-2 Localizing Vision

READING THE TRACER AND CORRECTING AIM-OFF

7. Once the tracer has been superimposed over the target, the gunner must quickly read the tracer rounds in the immediate vicinity of the target, see Figure D-4.
 - a. Tracers which pass behind the target, reappearing out the other side are PLUS; aim-off should be decreased.
 - b. Tracers which can be seen against the target are MINUS; aim-off should be increased.
 - c. Tracers which are seen to disappear into the target indicate a hit; aim-off is correct.

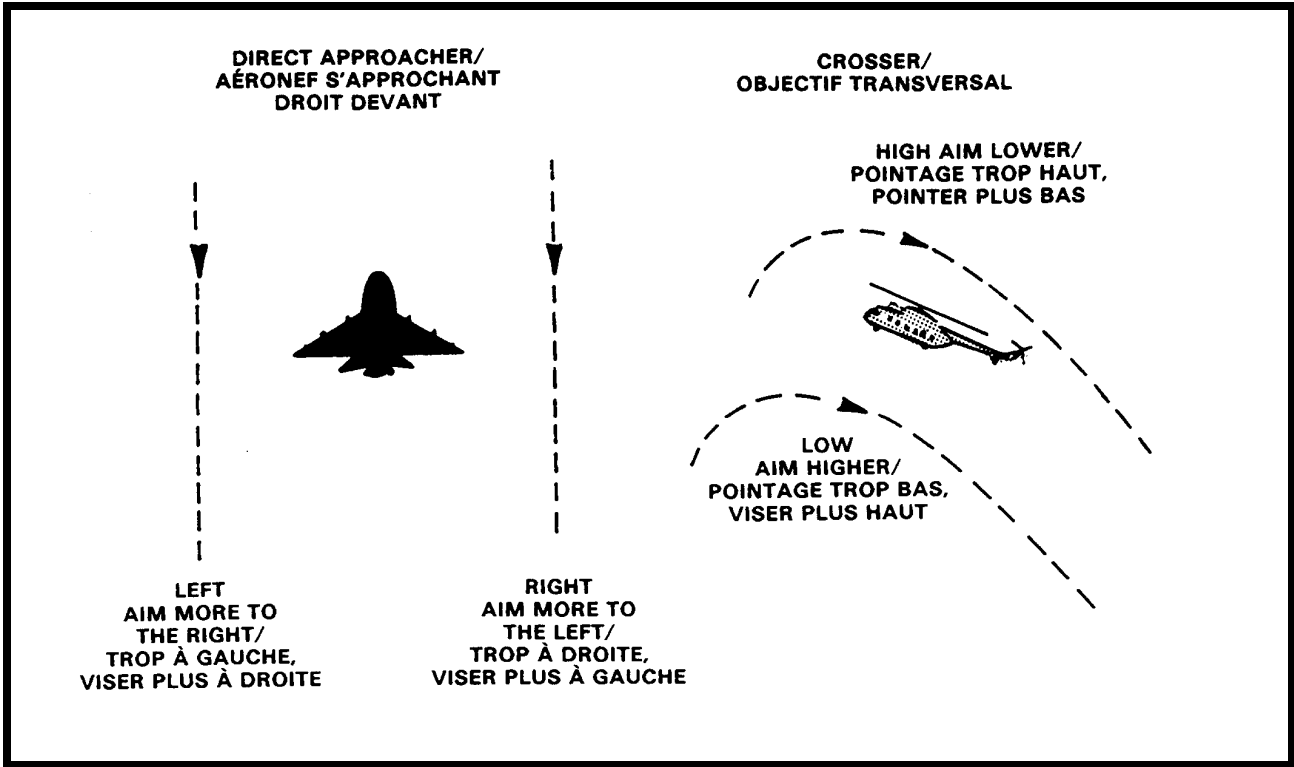
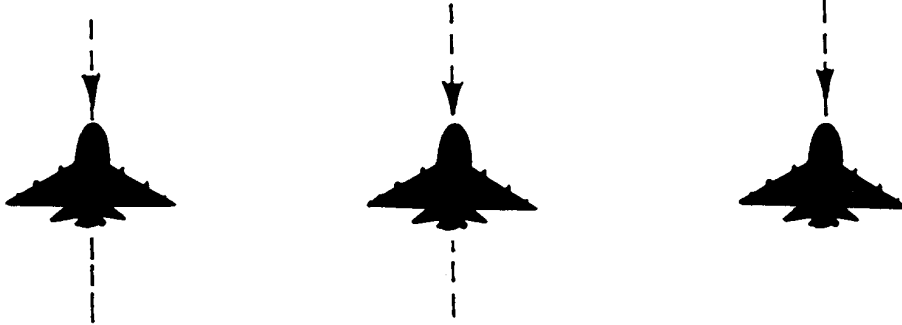
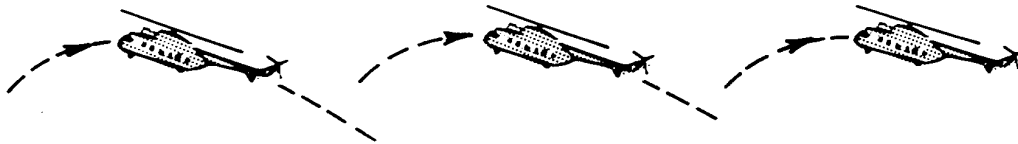


Figure D-3 Superimposing Tracer on the Target

**DIRECT APPROACHER - LINE OF SIGHT ROUNDS/
AÉRONEF S'APPROCHANT DROIT DEVANT -
TRAJECTOIRE DES BALLES TRAÇANTES**



**CROSSER - LINE OF SIGHT ROUNDS/
CIBLE TRANSVERSALE - TRAJECTOIRE
DES BALLES TRAÇANTES**



PLUS

**TRACER PATH OBSCURED
BY TARGET.
TOO MUCH AIM OFF
AT THE MOMENT OF
FIRING.
DEVANT**

**LA BALLE TRAÇANTE
DISPARAÎT DERRIÈRE LA
CIBLE. LA CORRECTION-BUT
EST DEVANT LA CIBLE
AU MOMENT DU TIR**

MINUS

**TRACER PATH SEEN
AGAINST TARGET.
TOO LITTLE AIM OFF AT
THE MOMENT OF FIRING.
DERRIÈRE**

**LA TRAJECTOIRE DE LA
BALLE TRAÇANTE SE DESSINE
LE LONG DE LA CIBLE.
LA CORRECTION-BUT EST
DERRIÈRE LA CIBLE
AU MOMENT DU TIR**

HIT

**TRACER PATH DISAPPEARING
INTO TARGET.
CORRECT AIM OFF AT THE
MOMENT OF FIRING.
COUP AU BUT**

**LA TRAJECTOIRE DE LA
BALLE TRAÇANTE SE
TERMINE SUR LA CIBLE.
LA CORRECTION-BUT
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Figure D-4 Reading the Tracer and Correcting Aim-Off

**ANNEX E
UNIT SOP FOR AIR DEFENCE - EXAMPLE**

SOP 65

UNIT AIR DEFENCE POLICY

GENERAL

65.01. Every unit or formation has a basic responsibility for self-defence against air attack.

POLICY

65.02. Passive measures are the primary means of AD.

65.03. Active AD measures will only be used when passive measures have failed and the unit is under air attack.

65.04. Subunits are to engage attacking aircraft with organic weapons using the volume fire principle, ie, all weapons will engage.

TRAINING

65.05. All unit personnel are to be trained in:

- a. passive measures;
- b. aircraft recognition;
- c. air sentry procedures;
- d. procedures for engaging hostile aircraft; and
- e. AD procedures at unit subunit level.

SOP 66

CONTROL OF UNIT AIR DEFENCE

GENERAL

66.01. Control of unit weapons used in the AD role will be subject to directives and restrictions imposed by formation headquarters.

COMMUNICATIONS

66.02. AD control orders and early warning information will be passed on the unit/subunit command net.

PROCEDURAL CONTROL

66.03. Procedural control may be amended by formation headquarters directives and SOPs which will reflect those of the formation AD Comd.

66.04. **Hostile Aircraft.** An aircraft is recognized as hostile by its identification features or if it commits a hostile act in accordance with SOP 66.05.

66.05 **Hostile Act.** An aircraft commits a hostile act if it:

- a. attacks a friendly unit; or
- b. drops paratroops, where both the aircraft and troops are visually recognized as not being friendly.

66.06. Rules of Engagement for Unit AD

- a. **Rule 1.** Active AD measures are only to be applied when passive measures have failed.
- b. **Rule 2.** Before the declaration of hostilities, aircraft are not to be engaged by unit weapons except in self-defence against an actual attack and then only on the order of the local commander.
- c. **Rule 3.** After declaration of hostilities, an aircraft may be engaged with unit weapons if it is positively identified as hostile by an officer or NCO in accordance with SOP 66.04 and 66.05 and in accordance with the weapon control order in effect at the time.
- d. **Rule 4.** At no time is ground fire to endanger friendly aircraft.
- e. **Rule 5.** Receding high performance aircraft are not to be engaged.
- f. **Rule 6.** An AD engagement will only be ordered by an officer or NCO to whom the authority to order such an engagement has been delegated.

66.07. **Standby Weapon Control Order.** The standby weapon control order is WEAPONS HOLD.

66.08. **Ammunition Expenditure.** Ammunition expenditure for each AD engagement is not to exceed the following:

- a. Magazine-fed weapons - one full magazine; and
- b. Belt-fed weapons - one belt of 100 rounds.

POSITIVE CONTROL

66.09. **Weapon Control Orders.** Weapon control orders for unit AD are:

- a. **WEAPONS HOLD.** Do not open fire at an aircraft except in self-defence.
- b. **WEAPONS TIGHT.** An aircraft can be engaged only if it is positively identified as hostile.
- c. **WEAPONS FREE.** An aircraft can be engaged if it is not identified as friendly.

66.10. Unless otherwise ordered, the weapon control order in effect is WEAPONS HOLD.

66.11. **AD Warning Conditions.** AD warning conditions are:

- a. **Warning WHITE.** Attack by enemy aircraft is improbable.
- b. **Warning YELLOW.** Attack by enemy aircraft is probable.
- c. **Warning RED.** Attack by enemy aircraft is imminent or in progress.

66.12. **Audible Alarms for AD and NBC Warnings.** The following alarm signals are to be used in the event of air or NBC attack:

- a. **RED (AIR):**
 - (1) Succession of long blasts on whistles,
 - (2) Series of continuous long blasts on vehicle horns,
 - (3) Vocal: AIR ATTACK;
- b. **BLACK (NBC).** Succession of short signals, such as:
 - (1) Rapid and continuous beating on any metal object producing a loud noise;
 - (2) Succession of very short blasts on vehicle horn or other suitable device;
- c. **WHITE (ALL CLEAR):**
 - (1) Normally vocal: ALL CLEAR by voice, radio, telephone or loudhailer,

- (2) A sustained signal, such as a steady blast on a vehicle horn or whistle.

NOTE: There should be a distinct difference between the duration of the sound for the warning and that for the ALL CLEAR.

SOP 67

UNIT AIR DEFENCE TACTICS (STATIC LOCATION)

AIR SENTRIES

67.01. At least one air sentry per platoon is to be posted at all times during daylight hours. Arcs of responsibility are to interlock to give the unit/subunit all round observation.

67.02. An air sentry's arc of responsibility is to be no more than 2100 mils and a tour of duty at any one time is not to exceed 20 minutes.

67.03. **Target Indication.** The target will be indicated by the Reference Point Method, eg, AIRCRAFT/HELICOPTER, REFERENCE expressed as either:

- a. **HIGH** - above 400 mils angle of sight; or
- b. **LOW** - below 400 mils angle of sight.

ACTION ON RECEIPT OF AIR RAID WARNINGS

67.04. On receipt of an air raid warning the following actions are to be taken:

- a. **Warning WHITE:**
 - (1) normal activities continue,
 - (2) normal camouflage and movement discipline observed;
- b. **Warning YELLOW:**
 - (1) all personnel to move under cover,
 - (2) continue working under cover,
 - (3) air sentries remain on duty,
 - (4) designated weapons loaded for AD engagement;

c. **Warning RED:**

- (1) all movement to cease,
- (2) all personnel are to prepare for an AD engagement,
- (3) one person in each weapon pit is to observe the ground arcs, the remainder are to scan for the hostile aircraft,
- (4) control for the AD engagement passes to the local subunit commander.

AD ENGAGEMENT REPORT

67.05. Engagement Reports are to be sent to the next higher headquarters as soon as possible after the engagement. The format to be used is as follows:

Serial NE	Elements
(a)	(b)
1	OPENING CALL
2	ENGAGEMENT REPORT
3	A. Unit/Subunit C/S B. Time of Engagement (ZULU) C. Number and Type of Aircraft Engaged D. Visible Results
4	CLOSING CALL

SOP 68

**UNIT AIR DEFENCE TACTICS
(VEHICLE MOVEMENT)**

GENERAL

68.01. This SOP is to be read in conjunction with SOP ... Road Movement.

AIR SENTRIES

68.02. Every vehicle in a packet is to have at least one air sentry positioned with his/her head clear of the canopy or cab roof. This air sentry is to be in voice contact with the vehicle commander and/or driver.

68.03. The size of search arc allocated to each sentry is dependent on the number of vehicles in the packet. Each packet must have all round coverage. This principle also applies to vehicles moving individually.

AUTOMATIC WEAPONS

68.04. On receipt of an air raid warning the following actions will take place:

a. **Warning WHITE:**

- (1) keep moving,
- (2) normal convoy discipline applies;

b. **Warning YELLOW:**

- (1) keep moving,
- (2) normal canopy discipline applies,
- (3) weapons to be loaded for AD engagement.

c. **Warning RED:**

- (1) vehicles to move off the road at right angles on alternate sides commencing with lead vehicle to the left, and move to nearest cover within 100 metres. If off-road movement is not possible, vehicles will halt immediately on the shoulders of the road on alternate sides as above;
- (2) all personnel are to dismount, seek cover and prepare to engage the aircraft; and
- (3) control of the AD engagement passes to the packet commander.

ANNEX F
ACTION BY VEHICLE CONVOYS UNDER AIR ATTACK

GENERAL

1. When moving by vehicle convoy, there are three alternative actions which may be taken when an air alert is received, or an aircraft is seen by an air sentry. They are to:

- a. stop;
- b. continue;
- c. disperse.

STOP

2. Vehicles move to alternate sides of the road and halt on the shoulders, see Figure F-1.

3. **Advantages.** The advantages are:

- a. it is harder for a pilot to see the convoy than if movement were continued;
- b. once the threat has passed, it is easier and faster to continue the move; and
- c. the volume and density of small arms fire will be greater than if vehicles were dispersed.

4. **Disadvantage.** The disadvantage is that a convoy stopped on, or just off a road is a good target and the enemy has a better chance of creating maximum damage.

CONTINUE

5. The convoy continues on the road, increasing speed as much as possible while avoiding bunching.

6. **Advantage.** The advantage of continuing movement is moving targets are more difficult to hit than if they are stationary.

7. **Disadvantages.** The disadvantages are:

- a. detection is easier; and
- b. the volume and density of small arms fire is reduced.



Figure F-1 Vehicles Moving onto the Road Shoulders

DISPERSE AND SEEK CONCEALMENT

8. Drivers should be trained to continuously look for concealment and/or protected positions well off the road to allow quick and positive reaction in the event of an air raid warning or air attack, see Figure F-2.
9. **Advantages.** The advantages are:
 - a. the chance of multiple hits from one strike by the aircraft are reduced; and
 - b. it is more difficult to detect targets once they are dispersed and concealed.
10. **Disadvantages.** The disadvantages are:
 - a. it is easier for a pilot to see a convoy during the initial movement off the road;
 - b. it takes longer to resume convoy movement; and

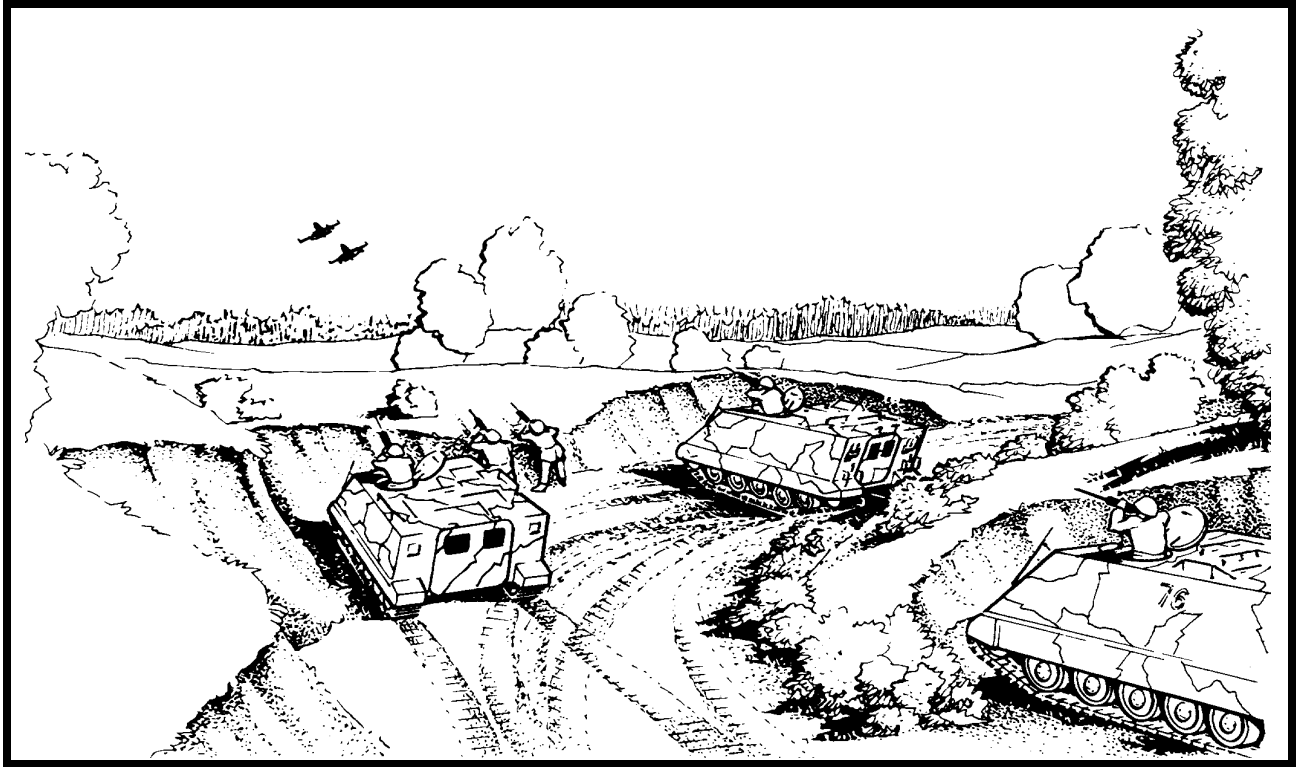


Figure F-2 Vehicles Dispersed and in Concealed Positions

- c. it reduces the volume and density of small arms fire if the convoy becomes too spread out.

11. A simple method pre-arranged control for dispersal and concealment of vehicles is to arrange for odd numbered vehicles to go to the left and even numbered vehicles to go to the right of the road. There should be a minimum spacing of 50 metres between vehicles and commanders should also lay down the minimum and maximum distances off the road that vehicles should move.

**ANNEX G
SUGGESTED SYLLABUS FOR A UNIT AAAD COURSE**

1. An example syllabus for training unit personnel in AAAD procedures is shown below:

Subject	Contents	Number of Periods
Introduction to AAAD	Family of AD weapons. Deployment characteristics of AD weapons. The aim and purpose of AAAD.	1
The Threat	Types of aircraft. Types of weapons. Weapon delivery.	2
AAAD Mounts	Weapon mounts used. Fitting mounts to vehicles.	0.5
Aim-Off	Principles of aim-off. The rules and method of applying aim-off	1
Observation of Tracer	Method of observing tracer and applying correction to aim-off.	1
Command and Control	Control orders. Rules of Engagement.	1
Siting AAAD	Siting principles. Aircraft attack profiles. Soviet helicopter tactics.	1.5
Aircraft Recognition Training	Spotter Class 2 list of aircraft (20 aircraft including the Spotter Class 3 list).	10
Air Sentry Duties	Air sentry procedures. Air raid warnings and method of transmission.	1
Passive AD Measures	Concealment. Dispersion. Protection. Warning system. Redeployment.	1
Methods of Engagement	Engagement drills, orders and procedures.	3
Weapon Training	Revision in .50 Cal, GPMG and LMG handling and stoppages. Range safety procedures.	5
Firing Practice	Section and Platoon engagements of TATS 50 aircraft, including firing from vehicle mounts.	7
	TOTAL	35

2. The unit AAAD course outlined above is five days long, based on seven instructional periods per day of 50 minutes each.

ANNEX H
REFERENCE AND STANDARDIZATION AGREEMENTS

1. The following references are related to and may be used in conjunction with this publication:
 - a. B-GL-308-001/FT-001, Air Defence Artillery, Volume 1, Command, Control and Employment.
 - b. B-GL-309-003/FT-001, Infantry, Volume 3, Section and Platoon in Battle.
 - c. ATP 40 Doctrine and Procedures for Airspace Control in the Combat Zone.
 - d. AAP 6 (P) NATO Glossary of Terms and Definitions for Military Use.
 - e. FM 71-1, Appendix 1 - Air Defence.
 - f. AC70748, All Arms Recognition Training.
 - g. TC23-44, Small Arms Defence Against Air Attack.

2. The following NATO Standardization Agreements have been wholly or partially incorporated into this publication:
 - a. STANAG 2014 Operation Orders and Warning Orders, Edition 5, Amendment 3, 30 Mar 83.
 - b. STANAG 2099 Fire Co-ordination in Support of Land Forces, Edition 3, Amendment 4, Jun 78.

3. The following ABCA Standardization Agreement has been wholly or partially incorporated into this publication:
 - a. QSTAG 337 Glossary of Air Defence Terms, Edition 1, 6 Sep 77.

LIST OF ABBREVIATIONS

AAAD	all arms air defence
AD	air defence
ADA	air defence artillery
ADC	air defence commander
AGL	above ground level
AP	armour-piercing
ASM	air-to-surface missile
AT	anti-tank
ATGM	anti-tank guided missile
ATGW	anti-tank guided weapon
CBU	cluster bomb unit
CO	command post
ECM	electronic countermeasures
EW	early warning; electronic warfare
FAC	Forward Air Controller
FAM	friendly aircraft movement
FEBA	forward edge of battle area
FGA	fighter ground attack
FUR	forward looking infra-red radar
FW	fixed wing
IFF	identification, friend or foe
IP	initial point
IR	infra-red
LAAD	low altitude air defence
LABS	low altitude bombing system
LLAD	low level air defence
LLAM	low level area missile
LLGUN	low level gun
LRAAW	long-range anti-armour weapon
LW	local warning
MAT	model aircraft target
met	meteorological
MG	machine-gun
MRAAW	medium-range anti-armour weapon
NBC	nuclear, biological and chemical
NCO	non-commissioned officer
OP	observation post
PAD	passive air defence
PUP	pull up point
PWR	point of weapon release
recce	reconnaissance
SA	small arms
SAM	surface-to-air missile
SLAR	side looking airborne radar
SOP	standing operating procedure
STOL	short take-off and landing
surv	surveillance
tgt	target
VA	vital area
VLLAD	very low level air defence

WCO

weapon control order