SIGHTING SYSTEMS
FOR
MILITARY SMALL ARMS

BY

Lt. Colonel (Ret) T. Warren Whittaker, OBE
Life Vice President, British Army Rifle Association

INTRODUCTION

1.1 In the past, it was usual for Military Small Arms to be fitted with iron sights. These sights are inefficient and certainly degraded the performance of the weapons. Telescopic sights were fragile, expensive and unsuitable for use in the CQB role. Modern technology has enabled collimator sights to be manufactured and telescopic sights to be made more compact and robust. With this in mind, it is necessary to re-consider the requirements of sighting systems for Military Small Arms.

1.2 Typical battlefield targets are low contrast, moving or fleeting (or all three !).The sighting system must enable the soldier to engage such targets in the shortest possible time.

1.3 On the battlefield, soldiers armed with the Individual Weapon (Rifle) or the Light Support Weapon (LMG) must be able to engage targets out to the maximum effective range of the weapon in all conditions of weather and light by day and night.

1.4 When selecting sighting systems for battlefield use, it is necessary to consider two types of engagement

Close Quarter Battle (CAB)	0 to 100 metres
Long Range Engagements (LRE)	Beyond 100 metres

The most important difference between these types of engagement is the **TIME** available for a successful engagement. The enemy is most dangerous at close quarters. In order to succeed in a CQB engagement, the soldier must get in a **FIRST ROUND HIT FIRST.** At short ranges, accuracy of aim is not as important as rough alignment of the weapon will ensure a hit. Thus, **SPEED** is more important than accuracy. As range increases, , accuracy becomes more important than speed. The Rifle must be capable of CQB and LRE out to at least 400 metres. The sighting system chosen must have an excellent performance in the CQB role. The most important role for the LMG is LRE out to 800 metres. Thus the sighting system chosen for the LMG must enable the soldier to engage low contrast targets at long ranges.

1.5 The sighting system selected must be easy to use so that training time and ammunition are kept to a minimum.

AIM

2. The aim of this paper is to consider three sighting systems for use on Military Small Arms and make recommendations.

SIGHTING SYSTEMS

3. The three sighting systems to be considered are:

Iron Sights	
Collimator Sights	Unit power, Illuminated graticule for night use.
Telescopic Sights	x 4 magnification.

SIGHT REQUIREMENTS FOR CQB

4. In order to obtain a **FIRST ROUND HIT FIRST**, the soldier must use the sights on his weapon to obtain a rough alignment on his target and fire with a minimum of delay. (Many techniques of firing without the use of sights have been tried. None of them are satisfactory.) The essential features of a CQB engagement are:

-Having located a target, the soldier must be able to align his weapon quickly. Most CQB engagements are from the standing unsupported position. The configuration of the weapon must allow the soldier to look through the sights with his head upright. *1*

He must shoot with both eyes open so as to retain peripheral vision. This will enable him to engage several targets in quick succession.

Due to short ranges of CQB engagements, moving targets require a fast swing. Unit power sights work best in this situation.

1 The sight line on the Enfield Engager with the SUSAT sights is much too low.

SIGHT REQUIREMENTS FOR LRE

5. The engagement of battlefield targets at long ranges requires a sighting system which will enable the soldier to aim accurately without taking his eye off the target, i.e. the graticule or pointer must be in the same focal plane as the target. It must be possible to engage low contrast targets in low light and under battlefield illumination. The graticule or pointer must be illuminated for use at night. Unit magnification is satisfactory out to about 400 metres. Beyond this distance, a magnification of about x4 is desirable.

MAGNIFICATION

6. The relationship between the magnification of a sighting system and its roles illustrated in Figure 1. It is not possible to design a telescopic sight that has a fixed power of magnification which is ideal for all situations.

THE RELATIONSHIP BETWEEN MAGNIFICATION AND ROLE

SIGHT	ROLE	
	CQB	LOW LIGHT &/OR LONG RANGE
NO MAGNIFICATION	GOOD	POOR
x4 MAGNIFICATION	POOR	GOOD

6.2 It is very difficult to shoot with both eyes open when using a telescopic sight because one eye sees the target and surroundings at normal size but the aiming eye sees everything magnified 4 times. If the soldier closes his aiming eye, he has three problems.

- His field of view is reduced and he is blind to anything outside the field of view.

- He must accustom his brain to the sudden change of scale from x 1 to x 4. This takes time.

- The engagement of moving targets at short ranges with a x 4 magnification sight is difficult due to the fact that when swinging onto a target, the background as seen through the sight appears to be moving 4 times faster than it would be with a non magnifying sight. This makes target acquisition difficult and tends to increase the time taken to engage a moving target.

6.3 All these factors combine to increase the time taken to get a hit. This is a very serious matter as one thing the soldier is short of in a CQB situation is **TIME**.

6.4 Big game hunters in the USA/ when after Grizzly Bears in the forest have a similar problem to the soldier in a CQB situation. The grizzly at close quarters, is likely to be moving and is very dangerous. These hunters do **NOT** use x 4 telescopic sights. They use unit power or very low power (x 1.5) optical sights. The sights are mounted so that, when the rifle is brought to the shoulder, the sight is aligned on to the target without the firer having to move his head. Further, he can fire with both eyes open and has no problems with a change of scale due to magnification. All this adds up to speed and accuracy.

CONCLUSION

6.5 It is concluded that the rifle should be equipped with a unit power sight so as to get the best possible performance in the CQB role. It would be an advantage for the LMG to be fitted with a telescopic sight having x 4 magnification so as to get the best performance at long ranges (out to 800 metres).

THE THEORY OF IRON SIGHTS

7.1 Iron sights worked reasonably well on conventional rifles such as the No.4 .303 Enfield rifle. The foresight was about 900mm from the eye. The SLR (FN FAL) foresight was only about 700mm from the eye and accurate aiming was more difficult. However, with a lot of training and practice, acceptable standards could be reached. The foresight on Compact Weapons (Bull Pup configurations such as the Enfield Engager (SA 80) is about 350mm from the eye. This is a very bad solution for the following reason:

- Due to the short sight base, very small alignment errors become very large errors at the target. In order to eliminate sight alignment errors, it is essential that the foresight is in sharp focus in order to centre the tip of the foresight in the rearsight aperture.

7.2 The need to focus the foresight introduces another problem. Once the eye is focussed on the foresight, all distant objects including the target are out of focus. When the foresight is only 350mm from the eye, focussing problems are severe. It is not possible to see the average battlefield target sufficiently clearly to get an acceptable sight picture when the foresight is in focus. See figures 2 and 3.

FOCUSSING PROBLEMS USING THE IRON SIGHT

FORESIGHT IN FOCUS

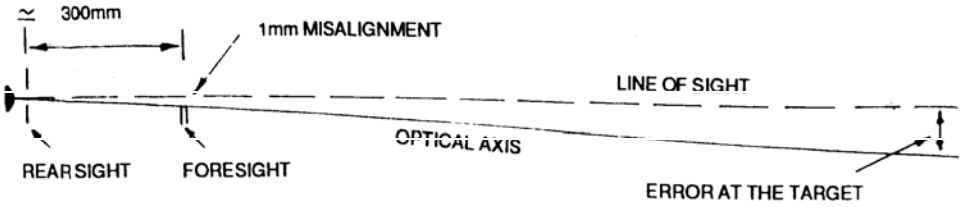

Figure 2. THE EYE FOCUSSED ON THE FORESIGHT. The Acircles of confusion@ at the target are very large. A clear sight picture cannot be obtained.

TARGET IN FOCUS

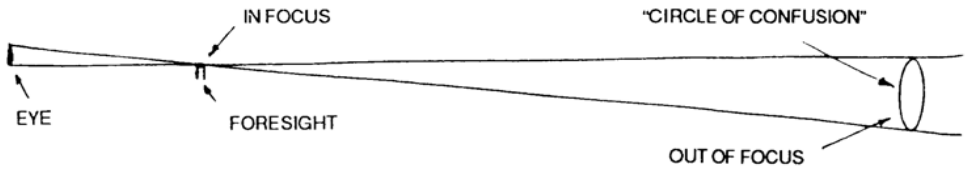

Figure 3. THE EYE FOCUSSED ON THE TARGET. The foresight is out of focus and cannot be aligned accurately in the centre of the rearsight aperture.

Very small errors in centring the foresight in the rear aperture will cause the bullet to miss the target because the error is angular and increases the proportion to the distance to the target. See Figure 4.

SIGHT ALIGNMENT ERROR

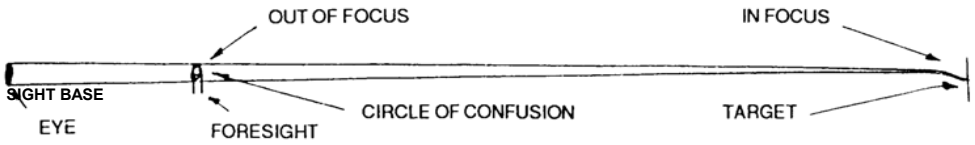

Figure 4. FORESIGHT NOT ALIGNED IN THE CENTRE OF THE REARSIGHT.

- The act of looking through the rearsight aperture reduces the amount of light reaching the eye. This, in turn makes it more difficult to get a sight picture. Accurate engagement of low contrast targets becomes impossible.

The firer is presented with a dilemma:

* If he maintains his focus on the target, he is likely to miss due to faulty alignment.

* If he transfers his focus to the foresight, he is likely to lose the target because it is out of focus.

- A compromise solution is to switch focus rapidly between the foresight and the target. This requires a lot of practice. It was not too difficult with the No.4 Rifle because the foresight was about 900mm from the eye and the change of focus was small. It is much more difficult when the foresight is only 350mm from the eye. This procedure works under range conditions but it is not a practical solution for the battlefield.

- At night, iron sights are, for practical purposes, almost useless because the rearsight is invisible and the foresight cannot be seen sufficiently clearly to make sight alignment possible.

CONCLUSION

7.3 Due to the need to ficus the foresight, it is considered that the iron sight is **not suitable for use on the battlefield in any circumstances.**

COLLIMATOR SIGHTS

8.1 The Collimator sights manufactures by Ring Sights have the following characteristics:

- A solid glass optic is fixed into a robust zeroable mounting.

- The graticule is in the same focal plane as the target and there is negligible parallax and no rear sight, so the need to Aalign@ the sight is eliminated. The only requirement is to place the graticule on the target. Thus, the solider is able to keep the target in focus throughout the engagement and the time required to obtain a good sight picture is much reduced.

- The graticule is illuminated so that the sight can be used in low light and at night.

- The sight has unit magnification so that it can be used with both eyes open. Thus, it will be ideal for CQB and very much better than the Iron Sight at long range.

- The sight is easy to use. Time and ammunition required for training are reduced to a minimum and the soldier gains confidence in his weapon.

- The cost is low in relation to the cost of the weapon.

- For more detailed information see Annex A.

THE COLLIMATOR SIGHT - Diagrammatic

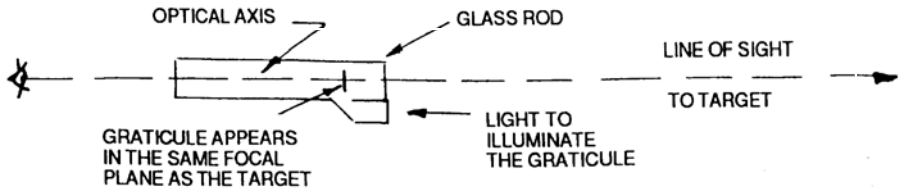

Figure 5. THE RING SIGHT

The Collimator sight is not as good as a x 4 power telescopic sight for the engagement of low contrast targets at long ranges and is no help in the acquisition of targets. Due to the fact that the collimator sight is used with both
eyes open, it is much better than the iron sight for the engagement of low contrast targets at normal combat ranges. (out to 400 metres).

CONCLUSION

8.2 Ring Sights LC-7-40 (and its developments)[2] manufactured by Ring Sights are the best solution for the CQB and meets the requirements of a sighting system for rifles used in the LRE role. The Ring Sight LC-14-46 is a good low cost solution for LMG sights but is not as good as x 4 telescopic sight.

[2] This sight is designed for the M16 rifle. New HC models have been designed for the Enfield Engager (SA 80), the FN ›P90' and other weapons. See Annex ›A=.

TELESCOPIC SIGHTS

9.1 There are many different Telescopic Sights available. The selection will depend on the use to which the system is to be put. The requirements of Telescopic Sights for sniping are outside the scope of this paper. In outline, the requirements are:

- A Telescopic Sight for use on the Rifle or LMG should have about x 4 magnification.

- A Telescopic Sight must have good light gathering powers so that low contrast targets can be acquired and engaged out to the maximum effective range of the weapon.
- The pointer must be in the same focal plane as the target so the target can be kept in focus throughout the engagement.

- Such a sight would enable the LMG to be used with maximum efficiency out to 800 metres.

- For reasons explained in paragraph 6, telescopic sights with a x 4 magnification are not suitable for use in the CQB role.

CONCLUSION

9.2 Due to the poor performance of telescopic sights in the CQB role, they should not be fitted to rifles. Telescopic sights give excellent results when fitted to LMG=s.

RECOMMENDATIONS

10.1 Iron sights are very inefficient and should not be fitted to Military Small Arms.

10.2 The Collimator Sights manufactured by Ring Sights are the best available sighting system for Individual Weapons (Rifles).

10.3 Telescopic Sights are ideal for Lon Range Engagements and are recommended for Light Support Weapons (LMG=s). However, the Ring Sight LC-14-46 is a good alternative at much less cost.

T. W. WHITTAKER

21 June 1989.

Annex A

The Ring Sights referred to are unit power solid glass sights which can have a unique, patented double graticule. One pattern is lit by light from the target; the other , superimposed on the first, is lit by a tritium light source and simultaneously, by light from the sky. This feature enables the firer to choose whichever graticule is best suited to the lighting conditions by day and night. Some of the sights currently available are:-

LC-7-40- specially designed for the M16 rifle
LC-14-46 - designed for pistols and machine guns
HC-10-62 - specially designed for the Enfield Engager (SA 80)
HC-18-80 - specially designed for the FN P 90
LC-40-100 - designed for surface to air MG-s and Cannon

For further details of these sights, sights for other weapons, or specially designed sights, contact:

Ring Sights
PO Box 2108,
Salisbury,
SP2 2BX,
UK

Tel: +44 (0) 8700 422260 Fax: +44 (0) 8700 422261