Cadet Target Rifle Coaching Course

COURSE FOLDER CONTENTS

SECTION 1

SAFETY

Reference:

A. Army Code No. 71751, Cadet Training Ranges 2016.

B. JSP 535 Cadet Training Safety Precautions.

General

0101. Target rifle shooting, like any other type of shooting, is potentially a very dangerous sport. However, it has a much better safety record than many other seemingly 'safe' sports because those involved are so aware of the potential dangers and regard safety as of paramount importance.

0102. The normal rules for range safety apply as set out in Reference A and, for cadet organisations, in Reference B. The purpose of this note is to add information particular to target rifle shooting.

0103. It is necessary to emphasise the safety rules to cadets and their responsibility since, if they progress to local rifle meetings, the Imperial Meeting at Bisley or Team Tours, they will be expected to check their own safety and that of fellow competitors without their coach beside them all the time.

0104. Full details of the NRA Rules can be found in the NRA Rules for Shooting (the 'NRA Bible') under 'Conduct of Shooting' in rules 270 – 277.

0105. The following is a summary of the Safety Rules:

a) When handing over or receiving a rifle ALWAYS open the breech and check that it is unloaded.

b) NEVER, for any reason, point a firearm at anyone.

c) NEVER load any firearm other than on the firing point under the instruction of the Range Officer.

d) On the Range:

- Obey the instructions of the Range Conducting Officer or his/her assistants.
- Do not load until instructed.

e) Always keep a loaded firearm pointed towards the target (this means that generally the bolt should not be closed until the rifle is in the shoulder, though NRA rules permit closing the bolt with the rifle horizontal on the ground, before it is lifted into the shoulder).

f) Check that your firearm is unloaded before leaving the firing point and that either a breech flag is inserted or the bolt removed. When firing under NRA conditions in pairs or threes, check that your partner's rifle is also safe. (Your signature on the squadding card confirms that you have done this. If, later, your partner's rifle is found to be unsafe, you (as well as he) will be in trouble).

g) Ensure that the breech of your rifle is open at all times except when it is:

- Loaded before firing.
- Stored in its case or the armoury.

h) Do not move forward to the firing point when firing is in progress without permission from the Range Officer.

i) Pick up all empty cases, check that there are no live rounds and put the empties in the box provided. Live rounds (e.g. converted sighters) are handed to the range officer.

j) NEVER have live rounds and drill cartridges in the same place

k) NEVER 'dry fire' behind the firing point. When adopting an aim position to check sights, sling etc, always do it on the firing point with the rifle pointed towards the butt in the normal way.

Dry Firing

0106. Dry firing for cadets in a classroom should always be carried out under supervision. The supervisor is to check Any Drill Cartridges Carefully Before They Are Issued.

Ear Defenders

0107. Ear defenders must be worn by all firers, coaches and supervisors on the firing point and by all waiting details and spectators within 5 meters behind the point.

0108. Ear muffs are the most popular type of ear defender and they should be in a serviceable condition. Normal ear plugs alone are not good enough but may be worn with muffs as extra protection.

Misfires

0109. Misfires are thankfully rare with commercial ammunition but any failure to fire must be treated as a misfire. The rifle is to be held in the shoulder, pointed at the target, for at least 30 seconds. Inform the range officer and prepare to open the bolt. Ensure no-one is standing behind you. Carefully take the rifle out of the shoulder and turn it (still pointing at the butts) so that if the case ruptures as you open the bolt, the fragments will go into the ground. Then, using fingertips on the end of the bolt handle (so that if the bolt flies back the fingers are not in the way), open the bolt and extract the misfire. Wrap it in something like a towel, for later disposal by an armourer. REMEMBER, SUCH HAPPENINGS ARE RARE. It is more usually due to a firer not having reloaded or having put in an empty case.

Security

0110. All firearms and ammunition must be safeguarded at all times. Firearms kept at home or in a clubhouse must be in an approved safe or armoury with bolts stored separately.

0111. When being transported in a car, the bolt should be carried in a separate box and all should be out of sight. While waiting at the back of the range (e.g. when you go for a coffee or a chat with you friends on another range) they must be in someone's care. In the clubhouse during the day they should be similarly in someone's care or locked up.

Legislation

0112. If you are going to be involved with coaching or administration with civilian firearms, you need to be up-to-date with the Firearms Legislation operating in your area at the time. Likewise with military issue firearms, you need to know the rules for safety and security.

SECTION 2

INTRODUCTION TO THE L81A2 CADET TARGET RIFLE

Reference:

A. The National Rifle Association (NRA) Rules for Shooting
B. Army Code 71847 The L81A2 Cadet Target Rifle Pamphlet 2007 Edition

General

0201. Full-bore target rifle shooting in the cadet movement is a civilian sport governed by the rules of the National Rifle Association (NRA), set out in Reference A.

0202. All coaches should be familiar with reference B which sets out the procedures for using the L81A2 Cadet Target Rifle (CTR) including rifle handling lessons, the Rifle Handling Test, maintenance and a complete list of the components of the L81A2 CTR system.

0203. The key information below is extracted from Reference B.

Characteristics and Description of the L81a2 Cadet Target Rifle

0204. The 7.62 mm L81A2 Cadet Target Rifle is a single shot, bolt action rifle, based on the L81A1 Cadet Target Rifle and originally developed from the Parker Hale 1200 TX Target Rifle and the M82 Sniper Rifle. The rifle is made up of five main assemblies:

- Stock
- Barrel
- Body
- Bolt
- Sights.

0205. ***The Stock***. The one piece stock is prepared from hardwood with a hard wearing polyurethane finish. The registered Serial Number is embossed on the underside of the small of the butt. A rubber butt pad and three wooden spacers secured by two screws are fitted to the butt. An adjustable hand stop is fitted on the underside of the stock. Two sling swivels are provided. The front sling swivel is incorporated into the hand stop and the rear swivel is screwed into the stock forward of the trigger guard.

0206. ***The Barrel***. The 7.62 mm "free floating" barrel is screwed into the body (action). A foresight block is mounted at the front end of the barrel and can be re-positioned for left or right hand use. Repositioning must only be carried out by the nominated contractor authorised by CSE IPT. The foresight block carries a detachable foresight.

0207. ***The Body (Action)***. The body (action) forms a robust housing for the bolt. The top face of the body (action) provides mounting points for the rear sight mounting bracket. The left side of the body (action) has a gas escape hole at its forward end. The right side of the body (action) is cut away to provide for ejection of the bulleted round or empty case. The trigger mechanism assembly and the trigger guard are secured to the underside of the body (action) by two tamper proof screws. The trigger is of the single stage type and is adjustable for pull-off. (Note: The user is not permitted to carry out any adjustments to the trigger.) The safety catch, which is part of the trigger assembly, is not to be used as it may cause damage. It can

only be applied when the rifle is cocked. When applied it locks the sear, trigger and bolt. The registered Serial Number and proof marks are engraved on the left side of the body (action).

0208. ***The Bolt.*** The Mauser type bolt is cast and machined to locate and lock into the guideways and lugs in the body (action). The bolt is drilled internally to house the striker and striker spring. The bolt face has a hole drilled centrally to allow the striker to protrude and fire the round. The extractor is attached to the bolt by a rotating collar. At the rear of the bolt is the cocking piece to which is attached the striker and striker pin. The bent is located on the underside of the cocking piece. The registered Serial Number is engraved on the bolt handle.

0209. ***The Sights.*** A ring (aperture) foresight is fitted into a removable tunnel housing. The rifle is fitted with a Parker-Hale (twin zero) rear sight which is adjustable for windage and elevation and has a variable aperture eye piece.

0210. ***The Bipod.*** The simple bipod is fitted onto the hand stop rail and secured by tightening the screw. The bipod must always be fitted when the rifle is first removed from its bag.

Technical Details

0211. The technical details for the rifle, extracted from Reference A, are given below.

a) Ammunition Calibre 7.62mm

b) Firing Mode - Single Shot

c) Method of Operation - Bolt Action

d) Locking - Mauser type bolt is machined to locate and lock into the guideways and locking lugs in the body.

e) Feed - Single round placed in the bolt way.

f) Muzzle Velocity - 870 m/s (2850 ft/s)

g) Number of barrel grooves – 4

h) Twist of Rifling - RH 1 in 14 (1 in 355mm)

i) Barrel Length - 660mm (26 in)

j) Sighting Type - Parker-Hale

Rear – Adjustable eyepiece 0.8 to 2.0 mm

Front – Foresight block with sight elements 3.0 to 4.0 mm

k) Weight - with Rear Sight = 5.2 kg (11 lbs 8 oz)

- without Rear Sight = 4.8 kg (10 lbs 10 oz)

l) Overall length - Maximum = 1194 mm (47 in)

Minimum = 1156 mm (45.5 in)

m) Trigger Pull – 0.90 to 2.25 kg (2 to 5 lbs)

Limitations

0212. The L81A2 Cadet Target Rifle is subject to the following limitations:

a) Only Commission Internationale Permanente (CIP) approved ammunition may be fired. This includes Service issue ammunition.

b) It is to be used exclusively for target shooting in the prone position on approved MOD ranges in the UK.

c) It is only to be used by appropriately trained personnel.

d) Inspections and repairs are to be carried out only by contractors specifically appointed to maintain the CTR.

Safe Range Procedures and Use of the Safety Catch

0213. The CTR is fired in accordance with Reference A. Handling drills for Target Rifles may at times appear to be in conflict with some common safety procedures; however those aspects of safety are built into the handling drills which are taught in Reference B.

a) An example occurs on Loading. Placing a round into the rifle with the butt out of the shoulder appears contrary to the requirement for Load, Unload.

b) Stoppage drills and inspections to be carried out with the barrel pointed *horizontally* at the target / stop butt. However a target rifle is not "loaded" until the bolt is closed. Under NRA rules the bolt must never be closed or opened with a live round in the chamber unless the butt is in the shoulder and the barrel horizontal, pointing at the target.

c) Aspects of safety, which would normally be covered by the use of the Safety Catch on a service rifle, are built into the handling drills and covered in the NRA rules. Although **the Safety Catch on this rifle is never used**, cadets are to be taught how it functions so that they do not inadvertently damage the rifle.

Serial Numbers

0214. Bolts are not to be swapped between rifles. Before inserting and removing the bolt it is essential to check that the bolt has the same Serial Number as the body (action). Use of the wrong bolt may result in an unsafe headspace. Firing the rifle in this condition might result in a breech explosion with the high risk of injury to the firer.

Operators Do's and Don'ts

0215. The following lists, taken from Reference B, summarise the main points to ensure safe user handling and promote a more reliable rifle system:

0216. ***Do:***

a) Always carry out Normal Safety Precautions (NSPs) before handling the rifle.

b) Check that the bolt and stock numbers match the Serial Number on the body/action.

c) Adjust the butt length to suit the firer.

d) Correctly prepare and clean the rifle prior to firing.

e) Ensure the bipod is fitted to the rifle before you mount the Rearsight.

f) Always ensure the detachable front sling swivel is kept with the rifle.

g) Use only CIP recognised ammunition.

h) Record all rounds fired in the User Log Book.

i) Carry out routine user maintenance.

j) Report and record any defects found on the rifle.

0217. **Do Not:**

a) Un-bed the body and barrel from the stock.

b) Adjust the trigger.

c) Exchange and fit bolts between rifles.

d) Use unauthorised cleaning compounds, oils and lubricants.

e) Use the cleaning rod before placing the rod guide into the chamber.

f) Use oils or solvents to clean the stock.

g) Use hand loaded ammunition.

h) Paint, stamp, etch, engrave or deface the stock in any way for quick identification purposes.

i) Tighten or unscrew by hand the rearsight eyepiece.

j) Mount the rearsight to the rifle before fitting the bipod.

k) Place the rifle in the gun slip with the sights fitted.

SECTION 3

RIFLE MAINTENANCE, PREPARATION & CLEANING

0301. ***Maintenance***

a) When a rifle is issued to a cadet it is their responsibility to maintain it in a serviceable condition at all times.

b) In order to achieve this, it is essential that the coach and cadet knows how to clean and care for the rifle.

c) Cadets are taught to put on the bipod, to insert and remove the bolt and how to fit and remove the sights.

d) The rifle must never be stripped further than taught.

e) Any defects noted during cleaning/inspection must be reported for subsequent attention by an armourer.

f) Assembly and stripping causes wear and should be carried out with care. It must never be done as a race.

0302. ***Care and Cleaning the Rifle System***

a) The greatest enemy of a rifle is neglect. Treat the rifle with the care and respect you would give any other fine precision instrument and it will reward you with a lifetime of safe, accurate and reliable service.

b) The rifle bag must be kept clean and free of grass and other moisture containing items. The rifle should never be stored in a wet bag to avoid the metal rusting.

c) Before cleaning the rifle NSPs are to be carried out.

0303. ***The Cleaning Tool Kit.*** The rifle is to be kept clean and serviceable using the following tools and materials. The small items are contained in the cleaning kit box:

a) A cleaning rod.

b) A chamber rod guide.

c) Jag J30.

d) Phosphor bronze bore brush and/or Nylon bore brush.

e) Refillable oil bottle.

f) A nylon brush for removing external fouling.

g) SA1 breech cleaning stick.

h) Flannelette patches.

0304. ***Maintenance Tools***. The following tools are provided for maintenance and are contained in the sight box:

a) Wrench key 3/16 in AF (for butt adjustment).

b) Wrench key 2mm (for slipping of vernier scales).

c) Wrench key 2.5 mm (for tightening rear sight).

d) "C" type spanner (for fixing eye-piece to rear sight).

0305. ***Lubricants and Preservatives***. Lubricants and preservatives are provided to reduce friction and wear of mechanical parts, to reduce or absorb heat, to clean and prevent corrosion. The following lubricants and preservatives are provided:

a) Oil, OX-24 for all purposes.

b) M-Pro7 Gun Cleaning System (M-Pro7 Gun Cleaner and/or M-Pro7 Bore Cleaning Gel).

c) PX-11 for long term storage.

Note: No substances save those listed above may be used on any part of the rifle. Although small arms lubricants and preservatives OX-24, PX-11 and M-Pro7 are not considered to be hazardous, basic precautions normally associated with the handling of Petroleum, Oils & Lubricants, such as avoidance of continuous contact with the skin and splashing in the eyes are to be observed. Care should be taken to prevent M-Pro7 coming in contact with the wooden parts of the Rifle.

0306. ***Cleaning the Rifle.*** It is important to use only the tools and brushes provided, listed above. When using the cleaning rod, the rod guide must always be placed into the breech. This will centralise the cleaning rod and prevent damage to the barrel lead and bore. Flannelette and Brushes must always be passed completely through the barrel and removed at the muzzle end.

0307. ***Normal Daily Cleaning*** (maintenance of stored rifles):

a) Carry out Normal Safety Precautions. If fitted, remove the bolt.

b) Using the nylon brush remove any loose fouling or debris from the rifle and its components.

c) Use the rod guide, rod, jag and a piece of flannelette 100 x 35mm (4 x 1½ inches) to clean the barrel. Change the patches as often as necessary until the patch comes out clean.

d) Fit a piece of flannelette 100 x 35mm (4 x 1½ inches) to the breech cleaning stick and clean the chamber.

e) Carefully inspect the barrel and chamber and then re-oil if appropriate.

i. Oil the barrel with a piece of flannelette 100 x 35mm (4 x 1½ inches) fitted to the jag on the cleaning rod.

ii. Lightly oil the chamber using a piece of oiled flannelette 100 x 35mm (4 x 1½ inches) on the breech stick.

f) With a piece of lightly oiled flannelette clean the bolt including the bolt face and external metal parts of the rifle.

g) If necessary the stock can be wiped clean with a damp cloth. Do not use oil or solvents as this could damage the polyurethane finish.

0308. ***Cleaning before firing***. Normal daily cleaning should be carried out leaving the bore and chamber dry. Lightly oil the bolt but take care to dry the face of the bolt, as this can affect chamber pressure. Check that the gas escape hole is clear.

0309. ***Cleaning after firing***. Cleaning must be undertaken at the end of every day's firing to maintain the long term accuracy of the rifle. After firing, unload, carry out the normal safety precautions, strip the rifle and clean using the materials provided. The rifle is easier to clean immediately after firing while it is still warm. Cleaning is carried out as follows:

a) Apply M-Pro 7 cleaner or bore gel to the nylon bristle brush on a cleaning rod. Using the rod guide, run the brush through the barrel several times and make sure that the bore is completely coated. Take care that no drops of solvent are allowed to drop into the area of the trigger.

Notes:

1) As an alternative to M-Pro 7 cleaner or gel, OX-24 oil may be used.

2) As an alternative to the nylon bristle bore brush, a flannelette patch 100x35 mm (4 x 1½ inches) may be used on a jag. Ensure that the jag is taken off the patch at the muzzle end.

b) Wait 1-5 minutes depending on the severity of the fouling.

c) In the case of a heavily fouled barrel, use a cleaning rod and rod guide to run a nylon bristle bore brush or, with great care a phosphor bronze brush, through the full length of the barrel 3 or 4 times. Each time the brush must be passed completely through the barrel and removed at the muzzle end. Take care to avoid any excess scrubbing action.

d) Dry the barrel. Apply a dry flannelette patch 100x50 mm (4 x 2 inches) to a jag on a cleaning rod and, using a rod guide, run the flannelette through the barrel and remove it at the muzzle end. Repeat until the flannelette patch emerges clean.

e) If necessary repeat steps a. – d. until the bore is spotless and the patches are white. Even after 8 times, the patch may come out a very light grey. If there is no visible fouling, no further cleaning is necessary. The light grey material is microscopic carbon deposits being pulled out of the pores of the metal and does not have a significant impact on accuracy. In addition, it will be removed in subsequent cleaning until a point is achieved where steps a. – d. will be repeated approximately 4 times and the patches will come out white.

f) Clean the remainder of the rifle as for daily cleaning.

g) Inspect the rifle then lubricate. (If the rifle is to be used again within 24 hours the barrel and chamber should be left dry.)

0310. ***Periodic Cleaning***

a) <u>After 250 Rounds</u>. After each 250 rounds have been fired the phosphor bronze brush dipped in OX-24 should be used at the beginning of the cleaning cycle. Insert the brush from the breech end and push through the barrel in one direction only. Remove the brush from the rod at the muzzle end and repeat. Reversing the phosphor bronze brush through the barrel may cause uneven wear and rapidly impair accuracy.

b) One Week after Firing. One week after firing the rifle should be dried out, cleaned and oiled as after firing to prevent corrosion caused by 'sweating'.

c) At the End of the Shooting Season. At the end of the shooting season, clean the rifle as after 250 rounds but re-oil using PX-11 instead of OX-24.

*0311. **Annual Inspections and Repairs***

a) The complete rifle system for the Cadet Target Rifle 7.62mm L81A2 is solely managed on a Contractor Logistic Support (CLS) basis.

b) Annual and periodic inspections, repairs and replacement of worn or damaged components of the complete rifle system are the prime responsibility of the nominated contractor.

c) Under no circumstances must any military or civilian user, technician or armourer strip, repair or replace components of the rifle system beyond that described and permitted in Army Equipment Support Publication (AESP) 1005-L-105-201 Operating Information.

d) Any unauthorised repairs, modifications or adjustments found will render the rifle system unserviceable and the contractor is instructed to automatically report such findings to CSE IPT (Lt Wpns).

e) Observations of broken or worn components and poor functioning or accuracy are to be reported in accordance with the Equipment Support Policy Directives.

SECTION 4

CLOTHING and EQUIPMENT

Clothing

0401. The regulations on dress and aids to shooting are in the NRA Rules & Regulations ('The Bible'). In cadet matches, cadet dress rules will apply.

0402. The firer needs the following essentials:

a) *Shooting Jacket*. In cadet matches this may be restricted to the issued combat jacket. In civilian matches, purpose made shooting jackets are available but any comfortable jacket will do provided it has padding for the butt, upper arm under the sling and elbows. Strap-on elbow pads may be used. Ideally the jacket would be waterproof.

b) *Hat.* A hat is essential to afford adequate shade and shelter for the eyes and rearsight.

c) *Wet Weather Clothing.* A cape or similar if the jacket is not waterproof and waterproof trousers.

d) *Glove.* A glove may be worn to protect the forward hand from the sling and/or forward sling swivel.

e) *Sling.* A single or double point sling may be used and all cadets must be trained in its proper use. A hook or button may be worn on the shooting jacket or combat jacket to keep the sling in place. Slings are issued with the L81A2 cadet target rifle.

0403. Undergarments will depend upon the individual but comfort and consistency of thickness on the shoulder and sling arm is essential.

Equipment

0404. In addition to the maintenance and cleaning equipment issued with the rifle and referred to earlier, the coach will require a box or bag in which to carry the miscellaneous items of equipment required. What is required is a compromise between capacity, weight and ability to apply wet weather drill.

0405. The following items will be required:

a) Telescope & stand
b) Spare foresight elements
c) Scorebook and score cards
d) Pencil and spare pencil
e) Pencil sharpener & rubber
f) Wind calculator
g) Groundsheet
h) Ear defenders
i) Screwdrivers
j) Ammunition case or rack
k) Wash leather and towels for wet weather
l) A cocktail stick or toothpick for cleaning sight apertures
m) Flannelette

SECTION 5

WET WEATHER DRILLS

Introduction

0501. In the UK we normally carry on shooting in the rain, unless safety would be compromised e.g. bad visibility hides a danger area. In some other countries their rain storms are such that continuing is impossible.

0502. Good wet weather drill will minimise the firer's discomfort and help to maintain scores, giving you an advantage over the many people who do not prepare for rain.

The Effect Of Wet Ammunition

0503. Water stops the bullet properly gripping the side of the chamber and this increases the chamber pressure on the face of the bolt which affects the jump of the barrel and, therefore, the fall of the shot which may land high.

0504. To combat this, ensure that rounds are introduced to the chamber completely dry.

Keeping The Ammunition Dry

0505. Bullets must be kept dry by using a pocket, a towel, a waterproof bag or a box.

0506. To ensure loading a dry round, adopt the following drill.

a. Wipe all rain-water off the breech area of the rifle with a wash leather or towel. The leather should be kept over the action when not actually firing or reloading.

b. Eject the empty case.

c. Dry the fingers on a piece of towelling and load the next round with the action of the rifle sheltered by the body. If this is done immediately after firing, any residual dampness may be dried out by the heat of the chamber. On the other hand, the round will warm up. If it is possible to reload dry, it should be done just before firing the next shot.

Dress And Equipment

0507. The minimum needed is waterproof trousers and boots. If wearing wellingtons, the trousers are best worn outside the boots.

0508. A shooting hat is an asset in wet weather to keep the rain off the face and the rearsight.

0509. A thin waterproof jacket can be worn under the combat jacket but a waterproof jacket is not suitable outside as it allows the butt to slide.

0510. An old syle groundsheet can be used as a cape. A groundsheet/poncho can also be used to cover kit while waiting behind the firing point and then used to cover the shooting box/bag on the firing point. It should definitely NOT be used to lie on in wet weather – it acts like a pond liner and leaves the firer lying in a puddle!

0511. A plastic bag with a towel inside (e.g. bar towel or old terry nappy) should be used to store the ammunition. Another towel or chamois leather can be draped over the action so that water does not get in when it is opened.

0512. Very useful is a set of **wet weather score sheets**, which can be written in soft pencil even under water. (Remember to transfer the score when you have dried everything out.

0513. To protect the score sheet and the register card, 'Weather-Writers' are a very useful aid but expensive. If one is not available, the register keeper should be supplied with a plastic bag to protect the register card.

0514. Plastic covers are available to fit over the action to keep rain out but allow easy loading. These are not too difficult to make yourself.

0515. Waterproof rifle covers are available. Great care needs to be taken with the rifle case of the L81 A2 cadet target rifle. It should not be brought out in the wet as the rifle has to be stored in it and rusting will be the result. Grass and similar vegetation should also be kept out as it will produce moisture in a closed bag with similar results.

0516. After a wet shoot, the rifle and ancillaries need to be perfectly dry when put away

0517. ***The Telescope***. Telescope lenses tend to fog in wet weather. When this happens inside there is nothing that can be done about it. Actions to protect the telescope:

- A soft dry cloth should be kept handy to wipe the outside of the lenses.
- When it is new, put tape around the joints.
- Make a plastic tube to slip over scope, from an old bleach bottle or plastic drainpipe.
- Dry telescope off as soon as possible. DO NOT leave somewhere hot.

After The Shoot

0518. Remove the wet clothing first, otherwise water continues to drip on rifles. Towels should then be used to soak up as much water as possible from the outside of both rifle and telescope. Only then should the rifle be cleaned and all metal parts carefully oiled. The rifle should then be left in a dry, airy preferably warm but not hot, place until it is properly dry before putting into a carrying bag.

0519. Telescope caps should stay off until it has dried in a warm airy place. If it 'fogs' it will take longer. Telescopes should only be dismantled by someone who knows something of optical instruments.

0520. Remember to transfer any records done on waterproof sheets, to paper sheets.

SECTION 6

INTRODUCTION TO TARGET RIFLE COACHING

What Is Coaching?

0601. The term 'coaching' means different things to different people but in the cadet organisations there are fundamentally two types of coaching: coaching the experienced shot in a team competition and coaching the beginner.

0602. The coach to a civilian club/county/national target rifle team checks the firer's sights for elevation and tells the firer what to set on the sights for wind. The coach may not do the score sheet and the graphs – there may be a plotter to do it so that the coach spends as much time as possible looking at the wind. The administration such as dealing with squadding cards and ammunition is done by a separate adjutant.

0603. The cadet coach is likely to do all the team administration as well as probably teaching the cadets everything they need to know.

0604. Coaching is an art. A good shot is not necessarily a good coach and a good coach may not necessarily be a particularly good shot but the coach needs to be a competent shot so as to understand what the cadet is expected to do.

Coaching Requirements

0605. The Art of Coaching is to:

a) Give advice when needed
b) Spot & correct faults as early as possible
c) Center the group
d) Assess wind & adjust sights
e) Encourage the cadet
f) Gain further knowledge to improve own coaching standards

0606. The Successful Coach should:

a) Be a competent shot
b) Be enthusiastic
c) Have a sound knowledge of shooting
d) Understand the principles of instruction

0607. The Expert Coach will have a thorough knowledge and understanding of:

a) The marksmanship principles
b) The capabilities of the rifle and the ammunition
c) Zeroing
d) Theory of a Group
e) Elevation

f) Effect of wind and how to judge it

g) Causes of bad shooting and how to rectify them

h) How to use a score card to best effect

SECTION 7

MARKSMANSHIP PRINCIPLES

Introduction

0701 Cadets will achieve the best results if they understand and apply the **4 Marksmanship Principles.** These are best remembered using the key word **SPAR**:

a) **S**upport & Position

b) **P**ointing (Natural Alignment)

c) **A**iming (Sight Alignment)

d) **R**elease of Shot & Follow Through

0702 ***Support & Position*** - the firing position must be comfortable and the hold firm enough to support the rifle – with a sling.

a) Chest as flat on the ground as possible.
b) Left elbow almost under rifle.
c) Left wrist straight.
d) Right elbow out a little from the body.
e) Rifle across palm of hand, not base of fingers.
f) Left hand at point of balance of rifle.
g) If sandbag is used - it supports left wrist or forearm, NOT back of hand.

0703 ***Pointing (Natural Alignment)*** - the rifle must point naturally at the target without any physical effort or strain. The body position must be adjusted until this state is achieved.

a) Shoulder and arm muscles must be relaxed - let the rifle point where it wants to.
b) To move rifle up or down, move stomach and feet back or forward.
c) To move rifle left or right, move feet and stomach right or left.
d) Only small movements are needed.

0704 ***Aiming (Sight Alignment)*** – the aim or sight alignment must be correct and the aim picture consistent.

a) The head must be as upright as possible
b) Look through the center of the rear sight, line up front sight with target.

c) Focus on the front sight, NOT the target - a sharp front sight and blurred target is acceptable.

d) Unacceptable - a sharp target and blurred foresight.

0705 ***Release of Shot*** – the shot must be released and followed through without disturbing the position or aim.

a) The first pressure (if applicable) is taken up while settling down.

b) The trigger is squeezed GENTLY through the second pressure without ‘pull’ or ‘tug’.

c) ‘Follow through’ means that, when the bullet has fired, there is no further movement for a second or so.

d) Breathing must be controlled for a steady shot to be released.

SUPPORT & POSITION - The first marksmanship principle

0706. The position must be comfortable and the hold firm enough to support the rifle – with a sling.

0707. The position must enable the rifle to be supported by the bone structure, thus allowing the muscles to be as relaxed as possible.

0708. The position must be EXACTLY the same for every shot.

0709. Adopting the position on the firing point must not cause disturbance to other competitors.

The Sling

0710. The sling is the most important aid to the target rifle shooter in the prone position. It may be of single or two-point design. Almost all small-bore shooters use the single-point sling, since that is what the modern continental-made rifles are designed to use. Most fullbore shooters also now use single point as many start on small-bore, but some of our best marksmen use double point. A double point sling has the advantage of being more stable in a buffeting wind.

0711. The sling supplied with the L81A2 cadet target rifle is a good example of a simple, sturdy, non-stretch sling. If other slings are being purchased for use with small-bore or privately purchased target rifles, they should be of similar design. Leather slings of similar design are available but leather tends to stretch with time

0712. Whichever type is used, it must be in exactly the same place and at exactly the same tension for every shot.

0713. The sling must be placed high up on the upper arm to minimise the pulse beat and support the weight of the rifle. Commercial shooting jackets have sling keepers to do this. A good alternative with a combat jacket is to use the epaulet buttoned up again to its normal position at the neck. (This may look odd when standing up but will usually be found to be just right when lying down. Well fitting, older pattern combat jackets are therefore needed). Some people use the epaulet buttoned to the pocket on the sleeve, or hooks attached to the epaulet, but both of these are usually too low on the arm when in the prone position.

Firing Positions

Note: Left-handed shooters should read the opposite hand where appropriate.

0714. There are two basic firing positions.

0715. The Military Position. In this position, the body is at an angle of approximately 45° to the line of fire. The legs are straight, either closed or, more often, spread apart. This position may be useful for small cadets.

0716. The Alternative Position. This is the normal position used in target rifle shooting, using a single-point sling. In this position the body is only at an angle of 5° to 15° to the line of fire with the right knee drawn up to approximately 45° to the line of the spine. The left leg is straight and parallel to the spine.

The Right Leg

0717. The right leg is drawn up slightly, with lower part parallel to line of spine and in line with barrel. Toes point outwards, heel on ground. This reduces pressure on abdomen and chest giving easier breathing and reduced pulse.

The Left Leg

0718. The left leg is parallel to line of spine, the foot is vertical above the toe, or the toe is turned inwards. The whole leg is relaxed.

The Left Hand And Arm

0719. The left hand and wrist must be in a straight line with the left arm, with the fore-end of the rifle resting on the heel of the hand (NOT across the base of the fingers). The fingers and thumb should be relaxed, clear of the stock and must not be in contact with the barrel of the rifle as this can influence the 'jump' of the rifle.

0720. The sling should be high on the upper arm to minimise the pulse beat and support the weight of the rifle. The upper arm supports the weight of the body and the lower arm enables the hand to support the rifle.

The Left Elbow

0721. The left elbow should be almost under the rifle, so that the wrist remains straight. This may be checked by opening the left hand so that it is not gripping the stock and removing the right hand from the rifle. If the rifle remains steady and pointed at the target, the elbow is correctly positioned. If the rifle attempts to fall to one side and muscle power is needed to bring it upright again; the elbow must be moved until muscles are not needed.

0722. The most common fault is to have the elbow too far left. It is sometimes gradually pushed left by beginners, to realise the tension of the sling. This may have the effect of throwing shots laterally across the target.

0723. The left elbow should be reasonably far forward if the position is not to collapse or be illegally low.

The Right Elbow & Hand

0724. The right elbow should be reasonably far away from the body. The weight should not be taken on the bone at the tip of the elbow. Instead, the inner side of the elbow should be in contact with the ground.

0725. Beginners sometimes roll the rifle over the left elbow by rolling the body to the left and pulling the right elbow close to the body. Instead, the right elbow should be placed to the right and the left brought in to compensate. The correct right elbow position is usually achieved by placing the right hand on the stock (after the butt is placed in the shoulder) and then setting the right elbow on the ground.

0726. To ensure the right elbow is in the correct position, place the right hand on the stock (after the butt is placed in the shoulder) and then set the right elbow on the ground.

0727. The right hand should not influence the direction in which the rifle is pointing.

The Butt

0728. The butt plate should be located in the pocket of the shoulder to ensure that it is in exactly the same place for every shot. It should be lifted into position by placing the thumb behind the butt plate and locating it in the shoulder.

The Head

0729. The head should be as upright as possible, with the correct eye relief: thus the cheek placement must also be exactly the same for each shot. The butt of the rifle supports the weight of the head.

POINTING (NATURAL ALIGNMENT) – The second marksmanship principle

0730. The rifle must point naturally at the target without any physical effort or strain.

0731. Any attempt to force the rifle on to the target using the muscles of the arms and shoulders is to be avoided. Once in position, the firer must adjust the position so that the rifle is naturally aligned on the target as follows:

- Shoulder and arm muscles must be relaxed - let the rifle point where it wants to.
- To move rifle up, move stomach and feet backward.
- To move rifle down, move stomach and feet forward.
- To move rifle left, move feet and stomach right.
- To move rifle, move feet and stomach left.
- Only minor movements are needed and these are sometimes referred to a **minor positional adjustments or MPAs**.

The Spotting Telescope

0732. When a firer is self-coaching, the position of the scope is critical. It must be placed so that only a slight movement of the head is necessary to bring the eye to the lens.

Firing Point Drill

0733. Always adopt the following procedure.

a) Place the telescope in position (it should be at least one third of the way across your allocated space to make sure that your feet do not encroach into the next space, or, on a small-bore firing bench, do not hang off the edge).

b) Check that the sling is in the correct position on the arm.

c) Place the left hand comfortably behind the handstop.

d) Place the left elbow in the correct position.

e) Place the right thumb behind the butt of the rifle and use this to place the butt in the same position in the shoulder every time.

f) Grasp the rifle with the right hand and lower the elbow to the ground.

g) Lower the cheek to the butt.

h) Check that you are correctly aligned. The sights should settle on the target when you stop at the end of an out breath. If alignment is not correct, move feet and stomach to pivot the body about the left elbow until it is correct. (Stomach/feet moved back brings rifle up; moved forward brings rifle down; moved left brings rifle right; moved right brings rifle left).

i) The newer you are to marksmanship, the more you will have to think about pointing (natural alignment). For a beginner it is often helpful to take aim, close the eyes, take two or three breaths, breathe out and open the eyes. The chances are that the rifle will not now be pointed at the target and some minor positional adjustments will have to be made. With eyes open there is a tendency to use some muscle power to point the rifle; closing the eyes allows the rifle to point naturally.

j) When correct alignment has been attained, breathe again while placing the finger on the trigger (single stage trigger) or taking up the first pressure (two-stage trigger). Move eyes away from the sight for a second, or blink (to rest the eye), breathe out, stop, final check on alignment and squeeze the trigger.

k) Follow through. Do not move anything until the rifle has come back to rest. It should come back to the same place each time, preferably to the point of aim. If it does not, this can give some idea where a misplaced shot may have gone.

AIMING (SIGHT ALIGNMENT) - the third marksmanship principle

0734. The aim or sight alignment must be correct and the aim picture consistent.

0735. Aiming means aligning the eye, the rear sight and the foresight on the aiming mark. Consistent aiming is essential and is one of the first skills taught to the beginner. Consistent aiming is essential to accurate placement of the shot.

0736. Efficient aiming depends on three things:

- Correct use of the eyes, including spectacles or lenses.
- Precise alignment of the eye, rear sight and foresight.
- Completion of the sight picture and co-ordination of the breathing and aiming process.

The Eyes

0737. Everyone's eyes are different, even those who have perfect vision. A sighting set-up which gives a good sight picture for one firer, may not necessarily work for another. Each individual has to select the components of the sighting system which best suit themselves.

0738. ***Proper use of the eyes*****.** It is necessary to make the best possible use of the eyesight, though many shooters have less than perfect eyesight. Most vision defects can be corrected by a number of means:

0739. ***Spectacles.*** Most beginners, (including most members of Cadet Forces), who need correction, will be dependent on normal spectacles, though these are not ideal. The lenses are made so that when standing, we look through the centre of the lens and at right angles to the lens. When in the prone position we do not look forward through the centre part of the lens but through the top and at an angle. Ordinary spectacles have to be kept well up the nose and not allowed to sit in different positions for each shot.

0740. ***Shooting Spectacles*****.** Special shooting spectacles can be bought and are often the best answer but usually have to wait until the shooter is earning a reasonable salary! They are expensive and can be a nuisance in wet weather. A Chamois leather or old towel should be kept in the shooting box, to dry lenses if necessary. If shooting under UIT rules is contemplated, shooting spectacles may have to be used, as rear sight lenses are not permitted. The position of the lens is normally moveable to ensure that it can be placed at right angles to the eye and with the correct distance from eye to lens.

0741. ***Rear Sight Lens*****.** This is a popular method of sight correction as it is permitted under both National Rifle Association (NRA) and National Small-bore Rifle Association (NSRA) rules. Prolonged wet weather can affect these lenses also. If the lens is used to correct astigmatism, care must be taken to see that it is kept upright. Such lenses usually have a mark that has to be kept at 12 o'clock. It takes very little movement of a cylindrical lens to affect the zero. Such lenses are also designed for a particular eye-relief.

0742. ***Contact Lenses*****.** These are a good method of correcting defects, but only for those who can wear them all the time. Some users find them better for outdoors than indoors.

0743. ***Focussing*****.** Ideally the foresight and target would both be in focus but this is impossible. A young firer with good eyesight may be able to accommodate both i.e. quickly flick from one to the other, but this ability decreases with age. Use of a small rear aperture increases the depth of field and helps to compensate. It is most important to <u>focus on the foresight</u> and make do with a blurred target if necessary. A large foresight element helps if a blurred target is to be centred in a sharp foresight.

0744. When correction is required, it is considered that the point of focus should be about 2.5 meters (about 8 feet) from the eye.

0745. The position of the head is also important for correct use of the eyes. The head should be as upright as possible, since, if it is not, the balance system will try to straighten it. The sight picture may also be distorted.

0746. It is also desirable to keep both eyes open. The eyes are meant to work together, so closing one puts a strain on the other. Most people will need some sort of eye-blind so that the unused eye cannot actually see anything. This blind should be light in colour and a little distance from the eye so that a similar amount of light enters both eyes. Shooting spectacles can have a purpose made blind mounted on them; a piece of light coloured plastic can be attached to the rearsight to disrupt the view of unused eye; or a piece of light coloured card can be held to the forehead with a sweat band, with just enough of the corner in front of the eye to disrupt the view. If the card is properly placed, this eye can still be used to look through the telescope, especially if an angled eyepiece telescope is used. DO NOT be tempted to use a dark eye patch, which covers the eye completely.

0747. Staring should be avoided as an image can be 'burned in' on the retina and a small movement off aim may not be noticed. When correct aim is achieved, blinking or moving them away from the sight for a second (without moving the head) can rest the eyes. As the breath is exhaled in preparation for firing, the eyes are moved back to the rear sight.

0748. ***Filters.*** Under NRA Rules, tinted spectacles or filters may be used, but the filter must be between the rear aperture and the eye. Filters must be of good optical quality or the sight picture will be distorted. All filters decrease the amount of light entering the eye, so there are occasions when it is better not to use a filter. Some are of the opinion that pink filters help those with astigmatism. A yellow filter will give greater contrast and is useful on dull or misty days. Pale blue, green or smoked filters are useful in very bright conditions. Plastic-type foresight elements may also be tinted.

0749. ***Eagle Eyes.*** Eagle Eye lenses are now allowed in NRA competitions although not in NSRA, UIT disciplines or in cadet competitions. The Eagle Eye lens is a low positive powered spherical lens, which is fitted to the foresight tunnel. It is usually of 0.25 or 0.50 dioptres power, 0.50 currently being the highest power allowed under NRA rules.

- Advantages of the Eagle Eye:
  - It makes the aiming mark appear bigger.
  - It makes it easier to read target numbers at long range (900 and 1000yards)
- Disadvantages of the Eagle Eye:
  - It makes the aiming mark appear slightly blurred, the higher the Eagle Eye power the greater the blurring.
  - It will require the use of a larger foresight element as it does not increase the size of the element.
  - It can be rendered useless in heavy rain.

0750. ***Eye Relief.*** This is the distance from the eye to the rear sight. It has to be far enough so that the eye is not hit by the sight but should not be too far. About 10 cm is the average but it can depend on the eyesight. A long-sighted person can use more eye relief than a short-sighted person, to give the same sight picture.

The Rear Sight

0751. The rear sight must be rugged and firmly attached to the rifle. It should not be too heavy, especially on a fullbore rifle, where the recoil will cause it to shake loose.

0752. The rear sight must be capable of fine adjustment – quarter minute clicks are normal in fullbore though some sights may now be eighths. Half-minute clicks may be found on some old sights, usually ex -.303 sights; a few sights may have thirds. Small-bore sights may be sixths, eighths or twelfths.

0753. The sight should not have any 'backlash' i.e. each 'click' should move the sight the required distance. This can be checked by clicking the sight on by a fairly large number of clicks, say, 10 minutes, then clicking 10 minutes back. It should end up back at the reading where it started. Depending on the design, backlash may or may not be removable. If a sight has backlash which cannot be corrected, a new sight is needed.

0754. The wind arm should be at 90^0 to the elevation arm. If it is not, a change to wind will also cause a change to the elevation and vice versa. This is usually not a problem, unless the rifle has been dropped on the sight.

0755. ***Six-Hole Eyepiece.*** The rear sight should have an adjustable aperture. The most common is the six-hole eyepiece. A good one will be centrally bored, so that when a new aperture is chosen, the zero does not change. Care needs to be taken that the six-hole eyepiece is clicked properly into position when a new aperture is chosen, or the next shot will be seriously high left or low right.

0756. ***Iris Eyepiece.*** A more expensive eyepiece, an iris, is supplied with the L81A2. Irises need to be carefully made so that the aperture is perfectly circular and the adjustment needs to be tight enough so that it does not open or close in response ton the recoil during the shoot. Iris eyepieces also need to be looked after as they are easily damaged.

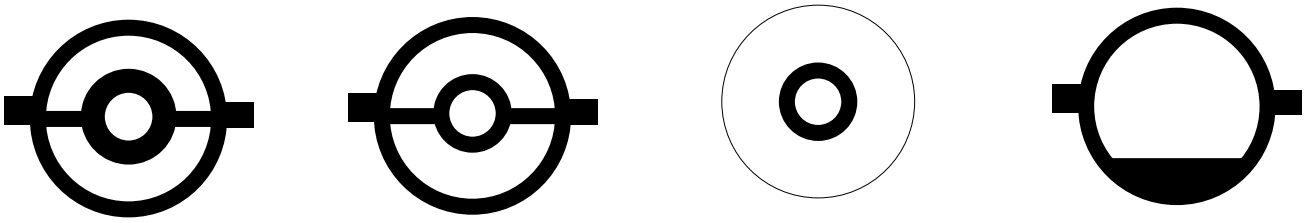
0757. ***Setting-Up the Rear-sight Aperture.*** The rear sight aperture should be small rather than large. The smaller the aperture, the greater the depth of field. However, be careful not to use too small a rear sight aperture as this can cause a false sight picture due to diffraction of light. Those who normally use a very small aperture need to be careful of this in bad light. The following procedure should be used to find the correct aperture (and may have to be used if light conditions change):

- Open the aperture fully and look at the target
- Close the aperture until the foresight is seen clearly **or**
- Close the aperture until it is too far closed, then open it a little (one hole on a six-hole eyepiece).

The Foresight.

0758. There are two main types of foresight, the ring and the blade, though some recommend cross-hairs for long range.

0759. ***Ring Foresight***. This is by far the most popular. The element can be a metal element or a plastic disc. A variety of thicknesses of metal elements can be found, but if too-thick an element is chosen, it reduces the amount of light passing through the foresight tunnel. Metal elements should be held on horizon bars to assist in holding the rifle upright. Older metal elements may be held on a post, but are best avoided. Plastic discs will usually need separate horizon bars.



0760. Plastic elements come in a variety of colours, or colourless. The Russians have tried various types of element and have concluded that a rose-pink plastic element is the best choice of all. A plastic element needs to be of good quality so that it does not introduce optical distortion. They have the disadvantage of not having a horizon bar, but one may be fitted.

0761. Iris foresights are becoming more popular but are expensive and need to be protected from damage. Their advantage is that they avoid the possibility of changing zero if a replacement element is not centrally bored

0762. ***Choice of Element***. Left to themselves to choose an element, most beginners will choose a small one, believing that they will get the most accurate sight picture if the aiming mark fills the foresight aperture. This has been proved to be untrue. A small black disc can be more accurately positioned in a large white circle than in a small white circle.

a) Ideally the foresight element should be 2 to 2.5 times the apparent size of the aiming mark.

b) The exact size will depend on the sight base

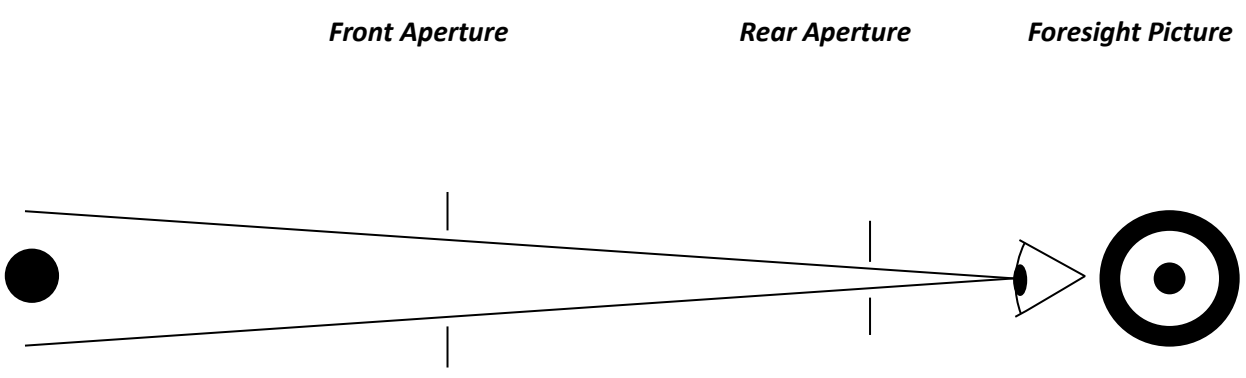
c) In general, for someone with <u>very good</u> eyesight, the foresight should not be less than:

- 3.4 mm at 300 and 500 yards
- 3.2 mm at 600 yards
- 2.5 mm at 900 and 1000 yards.

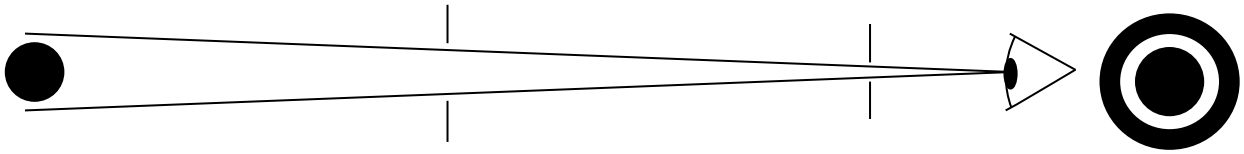
d) The poorer the eyesight or the lower the light, the larger the element needed and it is quite common to find firers with normal eyesight using 3.8 to 4.0 mm at 300 yards and 3.6 mm at 900 yards.

e) Users of civilian target rifles such as those supplied by CCRS to Athelings should increase these <u>minimum</u> sizes by about 0.2 mm, as their barrels are 28 or 30 inches long whereas the L81A2 has a 26 inch barrel.

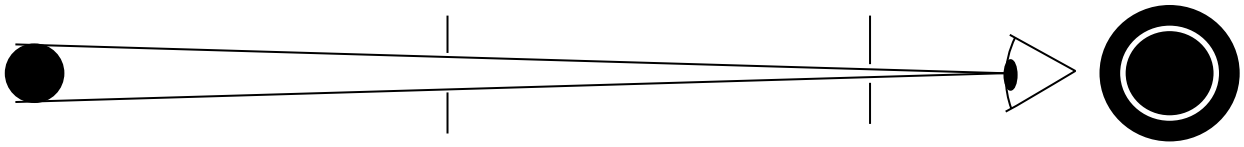
f) If too small a foresight element is chosen, a false sight picture will be seen. In the diagram, the element is smaller than the apparent size of the aiming mark, so you might think the aiming mark would fill the foresight element. However, the firer will see a sight picture with a thin white ring around the aiming mark, due to diffraction of the light.



Correct Relationship

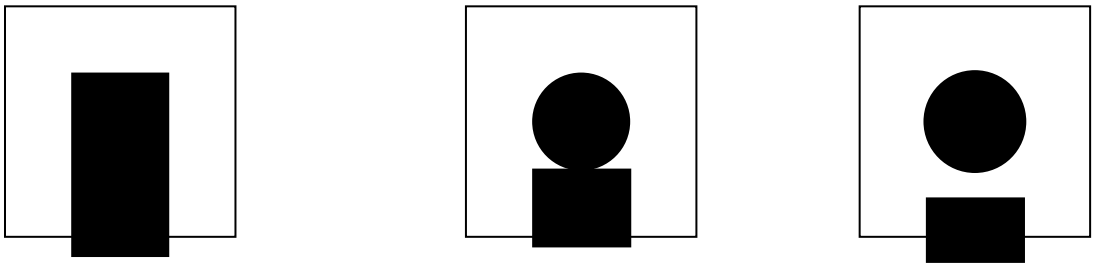


Minimum Acceptable Relationship

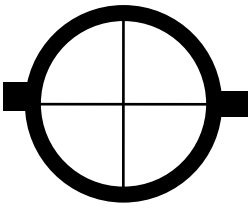


Impossible – *yet light still appears to be visible around the aiming mark*

0763. ***Blade Foresight***. These are not much used now, but they can have a use. With failing eyesight, it may be necessary to use the whole target as an aiming mark. The usual way to do this is to leave an equal line of white at the top and sides of the target. This could also be useful in very bad visibility, but it would be advisable to know the new zero, as it could be 4 - 7 minutes down at long range. With a blade the aiming mark may also be treated like a lollipop, or the blade may be placed with a line of white below the aiming mark.



0764. ***Cross-hairs.***

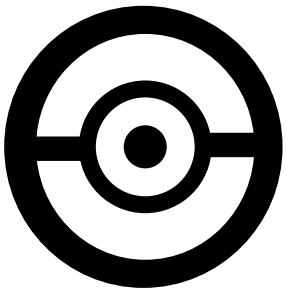


Rear-Sight / Foresight Relationship

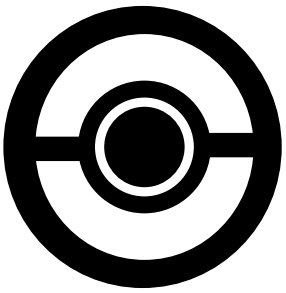
0765. As has already been stated, the foresight should be reasonably small, to give a fairly large area of white around the aiming mark. The reverse is desirable between the foresight tunnel and the rear sight. The foresight tunnel should nearly fill the rearsight aperture.

0766. ***Focus***. Ideally, both foresight and aiming mark should be in focus, but in practice this is impossible. Young eyes may be able to accommodate both i.e. they can quickly move from one to the other, but older eyes or those with defective eyesight, cannot do this. It is important to have the foresight in focus and if necessary make do with a blurred target. It is only then necessary to centre the blur in the foresight. The bigger the foresight, the easier this is to do. Focussing the foresight minimises aiming errors. This can be quite difficult to teach beginners, as the natural thing to do is to focus on the target, but if the target is in focus and the foresight blurred, slight aiming errors will be magnified.

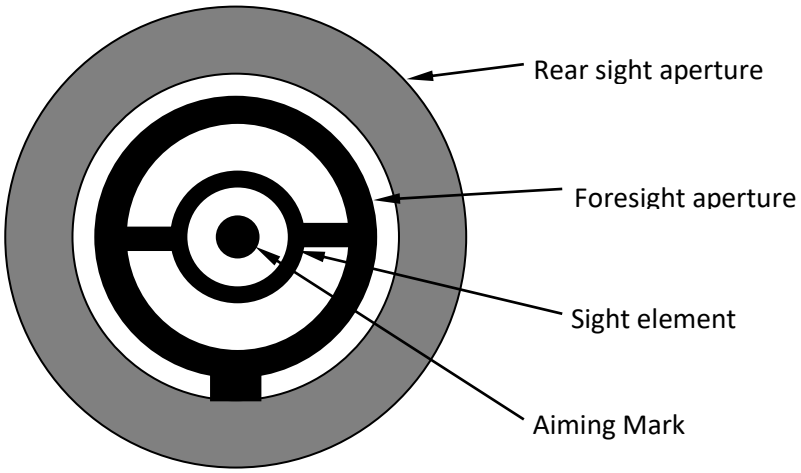
Foresight / Aiming Mark Relationship



CORRECT



INCORRECT
Foresight too small



Aiming Drills

0767. The act of aiming is divided into 3 parts:

a) Getting the sights perfectly upright – cant can be disastrous in fullbore shooting.

b) Aligning the sights: i.e. precise alignment of the eye, rear sight and foresight.

c) Completing the sight picture – i.e. maintaining perfect alignment while bringing the foresight on to the aiming mark.

0768. It is important that the time spent in aiming is not too long, for several reasons. The eye rapidly tires and the picture can 'burn in' on the retina. The sights may have moved but the eye is seeing the original picture. Also, the longer aiming takes, the more opportunity the wind has to change! If the process is not completed in 4 – 6 seconds, then the firer must return to the breathing cycle and start the process over again.

0769. The following sequence should be followed:

a) If using a two-stage trigger, take up the first pressure while settling down.

b) Check alignment – check that the rifle is naturally pointed at the target at the end of a normal out breath. (If necessary, close the eyes for a couple of breaths). If not, realign using feet and stomach.

c) Once alignment is correct, take another breath or two.

d) When ready to fire, rest the eyes either by blinking or by moving the eyes to one side and back, while breathing out.

e) Release the shot.

RELEASE OF SHOT (TRIGGER CONTROL) – the fourth marksmanship principle

0771. The shot must be released and followed through without disturbing the position or aim.

0772. When a beginner starts shooting, (s)he has to consciously direct the finger to press the trigger, but, with training, this becomes a conditioned reflex action. (S)he also has to suppress some unconditioned reflexes.

0773. Errors in trigger control can lose a firer many points, especially at short range. Slight errors in trigger control cause more misplaced shots than slight errors in any of the other marksmanship principles.

Types Of Trigger

0774. There are two basic types of trigger in use on target rifles:

0775. ***Two Stage Trigger.*** This is the normal type of trigger found on most military rifles and still on many target rifles.

a) It is essential that there are two distinct pressures and that they are operated separately i.e not pressing through both pressures at once.

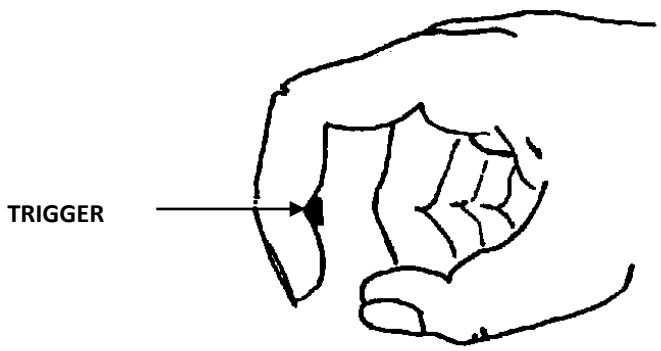
b) The release of the trigger at the end of the second pressure should be crisp and with no creep. A two-stage trigger can have an advantage. It can be set up to have maximum weight on the first stage and only a light pull on the second stage, thus minimising the movement of the rifle when the trigger is pressed,

0776. ***Single Stage Trigger***. This is the usual type of trigger on newer smallbore rifles and is now being fitted to fullbore rifles. The L81A2 cadet target rifle has a single stage trigger. Theoretically this type should be more easily controlled as there is no travel and no alteration of plane when the second pressure is taken up.

Trigger Finger

0777. It is important that the grip of the right hand (or left hand for left-handed firers) does not interfere with the trigger operation. The only part of the trigger finger that should be in contact with the rifle is the part which is on the trigger.

0778. Placement of the trigger finger is important. The pad of the first joint is favoured, so that the bend of the first joint is just touching the right side of the trigger (or left side for a left handed firer). This gives the most efficient use of the finger flexing muscles. However, it may depend on the length of the finger. Those with very long fingers may need to use the second joint.



Trigger Operation

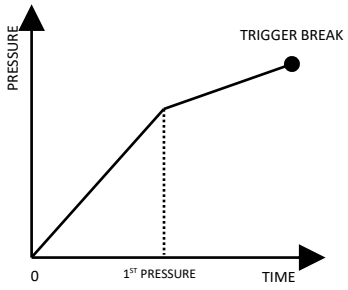
0779. Consistency is very important to trigger operation. The trigger should operate in the same way each time and go at the same pressure.

0780. The trigger is operated by application of enough force to disengage the sear. Muscles must be trained to apply the force in the correct direction and manner each time.

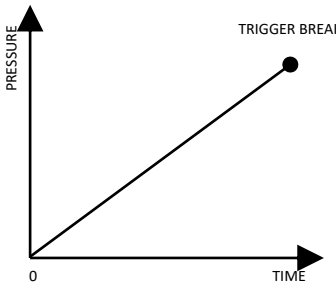
0781. With the ***two-stage trigger***, the first pressure is taken up while settling into position. There are then two ways of continuing:

a) When ready, the second pressure is gradually increased while alignment is seen to be correct, until the shot is fired. Theoretically, if alignment is disturbed, the process can be halted until alignment is correct again and then continued. In practice, this requires very sensitive fingers and very great control.

b) Alternatively, as soon as a clear sight picture is seen, the second pressure is operated smoothly in one movement.



0782. With a **single stage trigger**, the operation is the same as for the second stage of a two-stage trigger.



Follow Through

0783. It is possible for the firer to respond to trigger action while the bullet is still in the barrel and this can cause the shot to be misplaced. It is essential that the shot is followed through i.e. there must be no movement until the recoil movement comes to rest. The rifle should come to rest back on the point of aim. If it does not, this can give some idea where a misplaced shot may have gone.

0784. Responses to the noise of the shot, such as flinching or blinking, are natural reflexes and these must be controlled. This requires a lot of concentration on the part of the firer.

Breathing

0785. In the prone position, as we breathe, the rifle moves up and down. This must be controlled long enough for a steady shot to be released.

0786. Breathing is essential for life, so we cannot hold the breath for long. The eyes are amongst the first organs to notice a lack of oxygen. Also, as the carbon dioxide builds up in the lungs, it triggers a breathing response. Therefore the longer we stop breathing, the more strain builds up in the system. The mind is now focussed on the need to breathe and is no longer entirely on the aiming process or on trigger control.

0787. Breathing is a natural function so we do not normally need to think about how we breathe: however, if we consider what happens we see that there are three points to consider:

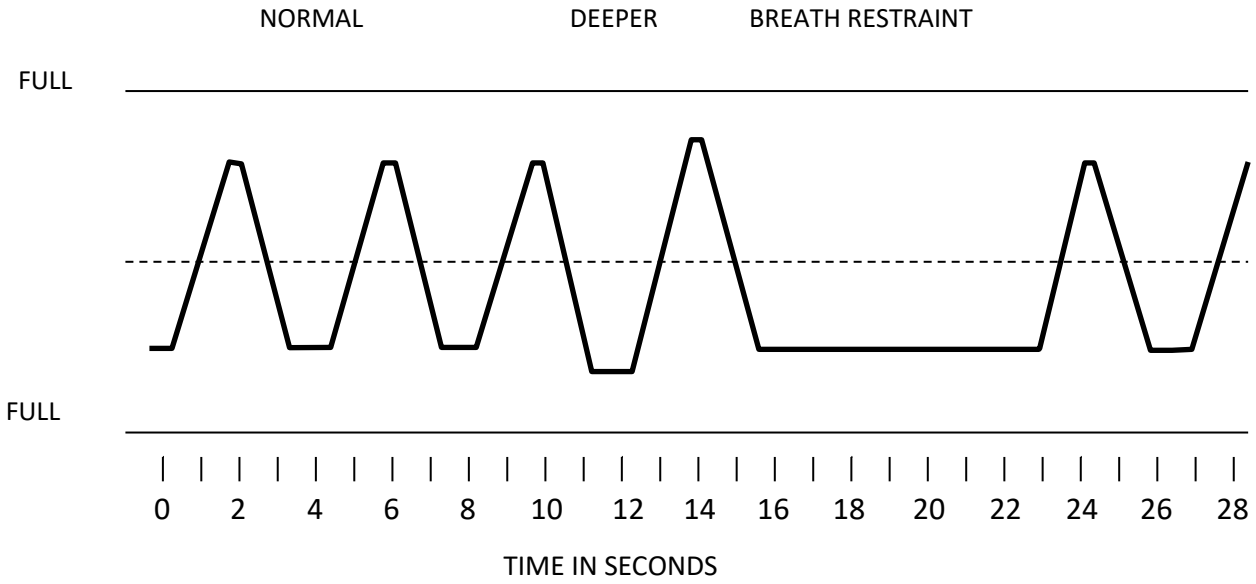
a) At rest, we neither breathe fully in, nor do we completely empty the lungs.

b) After breathing out, there is a natural pause of about a second.

c) The whole breathing cycle lasts about 6 seconds.

0788. Since the body is used to a pause at the end of the normal breathing cycle, this would seem to be the best place to fire the shot with the least strain. The pause needs to be lengthened to 4-6 seconds to allow for proper trigger release, but should not be any longer. After this time, concentration drops off as the natural impulse to breathe asserts itself.

0789. If the shot has not been fired in 4-6 seconds, the breathing and aiming process must be started again.



Note that this shot goes in about 20 seconds. In Individual Competition,

45 seconds are allowed. This pattern gives time to correct errors

0790. Some instructors have been heard to instruct cadets to release the shot when they ‘breathe half out’. What they really mean is to release at the end of a normal ‘out’ breath at which the lungs are

half empty but confused cadets try to stop half way to the end of a normal breath. It is better therefore to refer to a 'normal out breath'.

Sequence Of Breathing & Trigger Release

0791. Adopt the following sequence.

a) Take a few deeper breaths while settling down and placing the finger on the trigger.

b) Return breathing to normal.

c) Breathe out to the end of a normal 'out' breath.

d) Pause, check the aim and press the trigger.

Note: Take care not to breathe out more than normal. Also, if, for some reason, the shot is not released within the time, the breathing cycle should be started again, avoid the temptation to 'get rid of the shot'.

Staring At The Target

0792. Avoid staring at the target for a long time. The image can become imprinted on the retina, just as the image of a light can still be seen if you stare at it and then close your eyes. If this happens, you can move off aim but not notice.

0793. Eventually, co-ordinated control of breathing and release of shot will become a reflex action, but you need to ensure that the reflex happens correctly.

Calling The Shot

0794. A firer needs to be able to 'call the shot'. i.e. (s)he must be able to say if a shot has been misplaced and predict where it may go.

0795. On the follow through, if the rifle does not come to rest on the point of aim, the position where it does come to rest may give some indication of the direction in which the shot is misplaced. The smaller the firer, the more likely it is that the rifle will not come to rest on the point of aim.

0796. The next best thing is that it should always come to rest in the same place each time. If it comes to rest at a different point each time, the group is likely to be large and other factors need to be examined e.g. position, sling or hold.

CANT

What Is Cant?

0797. Canting is the term used when the rifle is held so that the sights are not perfectly upright when the shot is fired. Rifles may be canted either to the right or left. Some small-bore shooters cant, especially when shooting in the standing position. They therefore need a spirit level on the front sight to make sure the cant is constant.

0798. Canting does no harm if it is consistent and there is no wind but fullbore shooters are discouraged from canting as making wind changes also causes elevation changes.

What Causes Cant?

0799. The most common causes of involuntary canting are gripping the fore-end too tightly or having too tight a sling. Having the rifle incorrectly positioned on the forward hand can also cause canting.

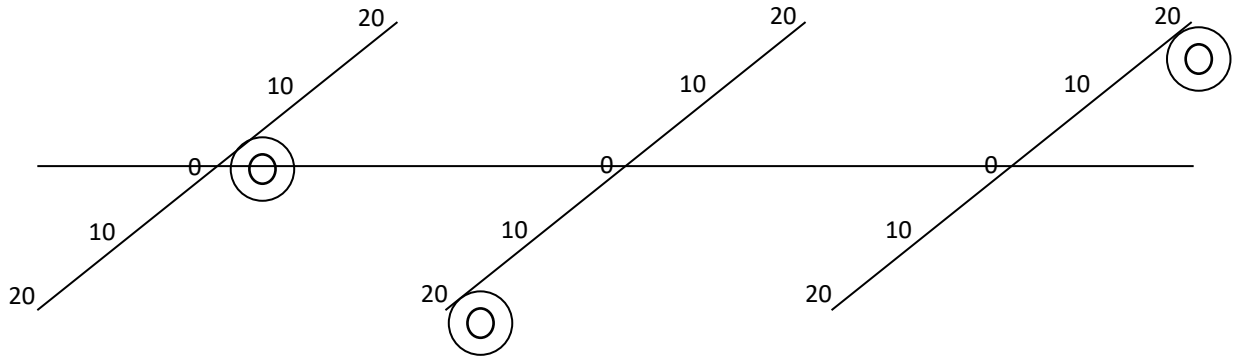
The Effects

07100. At short range the effects are mainly lateral but at long range it can also cause elevation changes. If a rifle is canted to the right, the shot will go right and vice versa. At short range the effect may not be enough to put the shot out of the bull but at long range it can be much more serious. The following table shows the effect of a 6° cant (which is a very small cant).

RANGE (m)	LATERAL ERROR (mins)	DISTANCE ON TARGET (cms)
300	0.6	3.75
600	1.5	22.5
900	3.6	90.0

07101. Assume the first shot is fired with the rifle upright and the second with a 6° cant. At 300m the canted shot will still be in the bull (provided the MPI is central and there is no wind change) but at 900m it will be nearly a meter right of the first - a magpie at best.

07102. The following diagram shows how making a wind change can affect the elevation.



NO WIND | 20 mins left wind | 20 mins right wind

L cant + L wind | L cant + R wind

SECTION 8

THEORY OF A GROUP

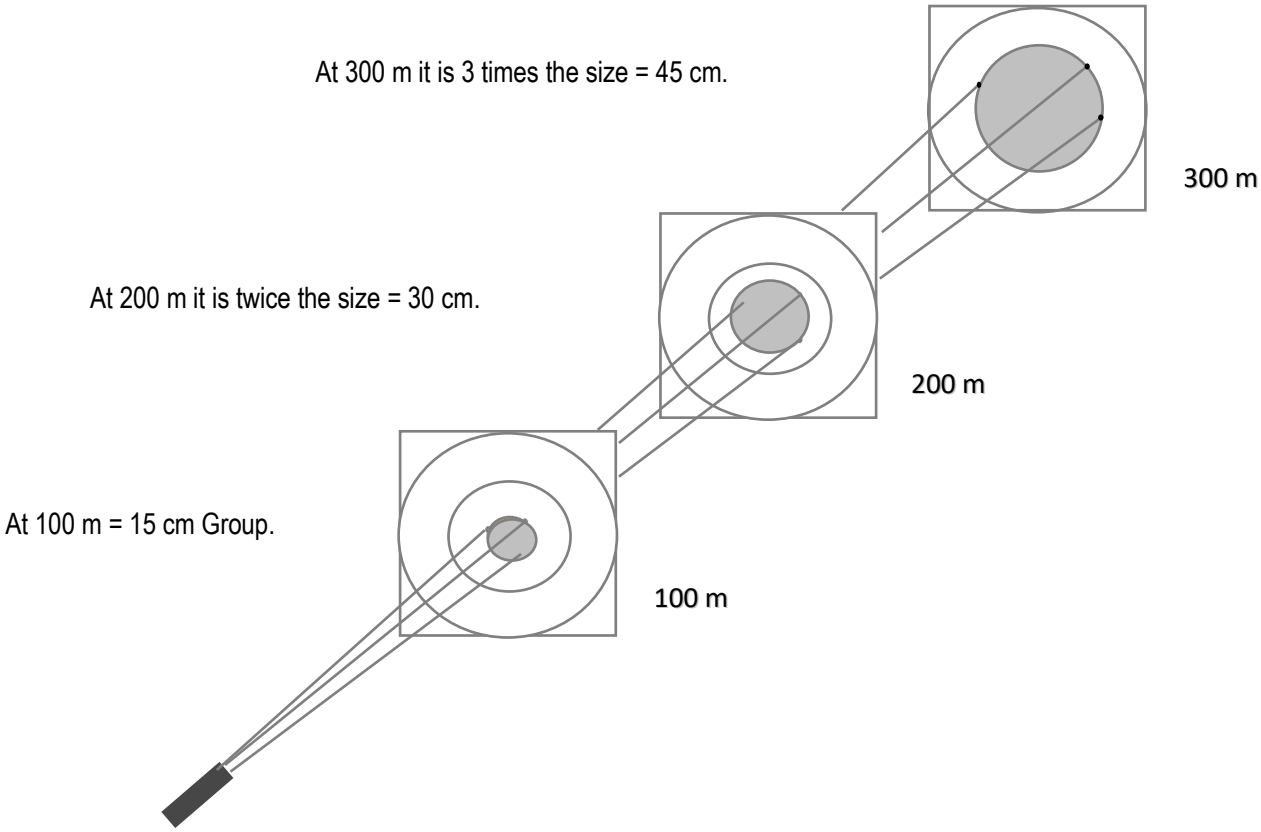
Introduction

0801. A series of shots will not hit exactly the same spot – they form a group. The size of the group is affected by: the ammunition; the rifle; the firer (see later).

0802. A group consists of at least three shots fired at the target under the same conditions i.e. same firer, same rifle, same ammunition, same distance, same wind, same position etc.

0803. The group size will tell you a lot about the ability of the firer, the quality of the rifle, or the quality of the ammunition.

0804. The size of the group varies in direct proportion to the distance from which it is fired.



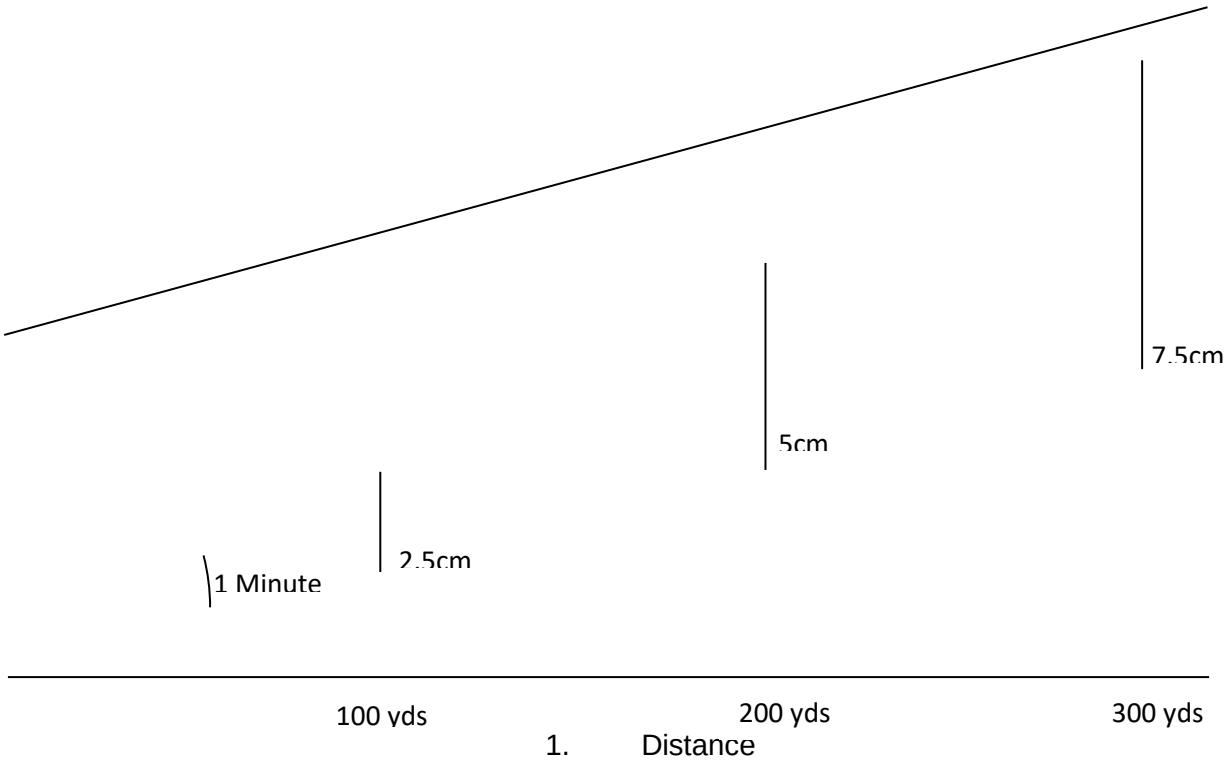
Minutes Of Angle

0805. The group size is measured in minutes of angle. There are 60 minutes in a degree and there are 360 degrees in a circle. An easy way to remember is that (almost):

0806. Useful measure: 1 minute will give 1 inch (2.5 cm) for every 100 yards. i.e. if you draw two lines at an angle of 1 minute to each other, by the time they reach 100 yards they will be 1 inch (2.5 cm) apart. Therefore:

1 minute gives 2 inches (5 cm) at 200 yards

1 minute gives 3 inches (7.5 cm) at 300 yards etc



1.

Grouping

0807. Every beginner should start by firing a number of groups. For fullbore target rifle, preferably at short range such as 25 m or 100 yds.

a) These groups should be no less than 5 rounds (for the reason see below).

b) It does not matter where on the target the group falls, it is the size that matters, so sights need not be altered at first unless some of the shots might miss the target.

c) The group size should be 2.5 cm or less at 25 m and 10 cm or less at 100 yds before zeroing or scoring is attempted.

Anatomy Of A Group

0808. 5-Shot and 20-shot groups are chosen for good reason. When a firer begins firing, the next shot fired is more likely to fall outside the group already formed than inside, thus making the group larger. As the number of shots increases, the chances of the next round landing inside the group increases and the number falling outside gets smaller. The group attains its maximum size when an

infinite number of shots have been fired. Less than an infinite number of shots will give a group of some percentage of the size of the final group.

NUMBER OF SHOTS	PERCENTAGE
2	22%
3	42%
5	64%
10	86%
15	94%
20	97%
Infinite	100%

0809. The first group size that is likely to be useful is therefore of 5 shots. 20 shot groups are used when zeroing under ideal conditions and for testing batches of ammunition for accuracy.

Note: In fullbore target rifle shooting, we have two sighters, which do not constitute a group!

Factors Affecting Size Of The Group

0810. *Ammunition* **- Most of our ammunition is mass-produced and will have imperfections and variations in the cartridge, the bullet and the charge. Good target quality ammunition should be capable of grouping to less than 2 minutes of angle i.e. the ammunition is capable of putting every shot in the bull and therefor giving us highest possible scores! In practice, most of the commercial ammunition available to us is better than this, though some commercial ammunition abroad may not be as reliable. Match Rifle and F Class Shooters and Target Shooters in some other countries can load their own bullets. They can take more time and care in getting the rounds as alike as possible.**

0811. *The Rifle* **– The rifle will have its own effect on the group, usually enlarging it over and above what the ammunition is capable of. Both barrel and action have their effects but, with the modern stiff action rifles, the barrel is the main factor.**

0812. *The Firer* **- Few people can group to better than half a minute of angle. Errors in aim or 'let-off' further increase the size of the ammunition or rifle group. Group size sometimes has an element of luck. Good luck is when the shot you pulled a little low would have been the high shot of the group; bad luck is when you pulled that shot high.**

Centering The Group

0813. The bullets we are given for a shoot would have their own particular characteristic group if fired from a bench rest, but the order in which we fire them is a matter of luck. We might

think that, if the sighters are very close together we are well on the way to a good shoot. However, the sighters we fire might be the high shots of the group or they might be the low shots of the group or we might be lucky and find that they are the extreme shots of the group – we have no way of knowing. We therefore need to know how to centre the group with what sighters we have.

0814. The following procedure is advised:

a) If the first sighter falls far away from where it is expected to fall, make a half correction (after checking that everything else is as it should be). e.g. if the sighter falls 2 minutes left, make a 1 minute correction, then fire the second sighter.

b) If the first sighter falls close to where it is expected to be, make no correction and fire the second sighter.

c) If the second sighter is some distance from the first, decide on the MPI and make a full correction.

d) If the two sighters are very close together and the MPI is not central, decide on the MPI but only make a half correction – they might both be from the same area of the group.

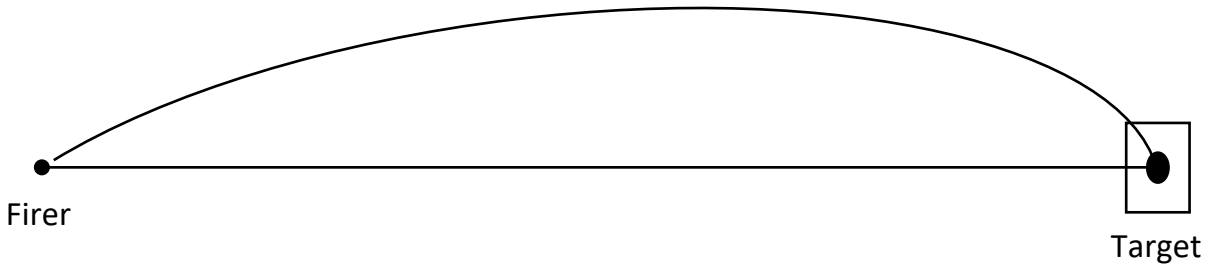
e) As scoring shots are fired, adjust the MPI and make corrections as necessary.

SECTION 9

ELEVATION

Trajectory

0901. Any object aimed at a distant target has to be propelled upwards, as the force of gravity will pull it downwards again. It therefore follows a curved path, called a trajectory.

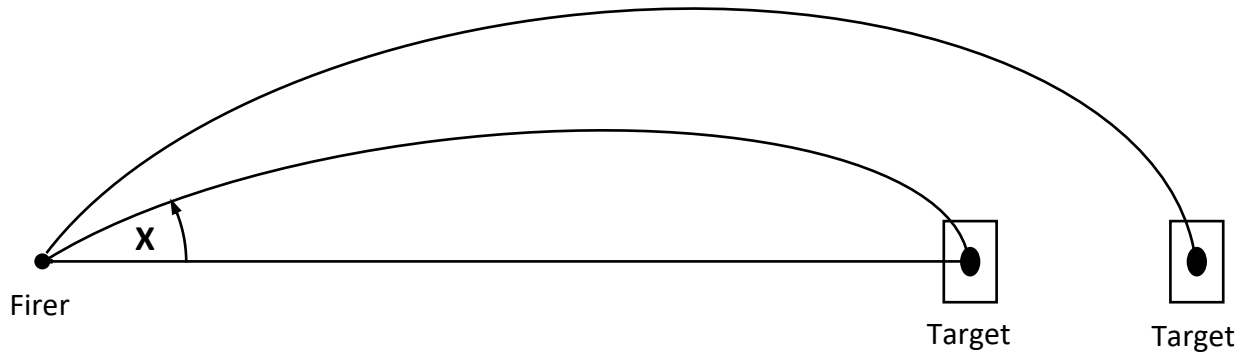


0902. The greater the distance between the firer and the target (or the slower the missile), the greater is the angle required.

a) This angle is called the 'elevation'.

b) The further away the target, the more we need to point the rifle upwards.

c) A scale on the rear sight measures the angle of elevation.



0903. The basic measurement of angle is the degree:

- 360 degrees in a circle
- 60 minutes in a degree.

0904. In target rifle shooting, the elevation and changes in elevation needed to move the distances involved is small and is measured in minutes of angle.

0905. A good rear sight will be capable of setting both the elevation change and the wind change to ¼ of a minute. Score card diagrams are marked out in 1-minute squares so that the sight changes needed, can be easily determined.

0906. The increase in elevation as the target gets further away is not constant. The farther the bullet travels, the slower it gets so the relatively greater the elevation has to be.

Elevation Table

Change (yards)	Rise (minutes)
100 - 200	2.0
200 – 300	2.5
300 – 400	3.0
400 – 500	3.5
500 - 600	4.0

0907. An elevation table assists with setting the sights of an unfamiliar rifle to approximately the correct elevation, once they have been zeroed. Thereafter, the firer will use previous values for that rifle at each distance to set the sights.

From	Rise to: (in minutes of angle)					
	300 yds	500 yds	600 yds	800 yds	900 yds	1000 yds
200 yds	2.5	9	13	22	28.5	35.5
300 yds		6.5	10.5	19.5	26	33
500 yds			4	13	19.5	26.5
600 yds				9	15.5	22.5
800 yds					5.5	12.5
900 yds						7

Factors Affecting Elevation

0908. ***Ammunition*** - Different bullet weights and muzzle velocities will need different elevations. A cadet who uses issued ammunition (144 grains weight) for ISCRM and then goes on to fire the Imperial Meeting with the same rifle will probably find a slight difference in the elevations required as the competition ammunition is 155 grains weight.

0909. ***Temperature*** - Change of temperature also changes the density of the air. In hot weather, less elevation will be needed. There may, therefore, be a slight difference in winter and summer settings. It is not advisable to keep an unfired round in a hot chamber for a long time e.g. if there is a delay on the target. A 'cooked' round may go a little low. It is best (and safest) to close the bolt just as the target begins to rise.

0910. ***Altitude*** - At higher altitude the air is less dense so less elevation is needed. However, most cadets need not worry about this, as there has to be a great difference in altitude to make it noticeable.

0911. **Wet and dirt** - Oil, water or dirt in the chamber decreases the grip of the bullet on the chamber walls, increases the chamber pressure and gives high shots. Proper cleaning and maintenance is essential. Even stainless steel barrels, which do not need cleaning as often, should have the chamber cleaned with a breech stick and flannelette at least one a day.

0912. ***Variation in sight picture*** - Variations in sight picture will cause elevation changes. This may be caused by inconsistent head position or by variations in firing point contours – some ranges have flat firing points, some have the older sloped version.

Factors Affecting the Elevation Rise between Range Distances

0913. Ammunition, temperature and altitude will also affect the rise needed between distances, as will the sight base (the distance between front and rear sights). All other things being equal, the longer the sight base, the greater the rise necessary.

0914. After a rifle has been used by its firer a few times, a set of elevations for given distances will be known and should be used instead of elevation tables. However it may need to be stressed to cadets that a set of elevations they know for one rifle are not likely to apply if they pick up a different rifle.

SECTION 10

VERNIER SCALES

1001. ***What is a Vernier Scale?*** A Vernier scale is a way of accurately reading a scale, which would have divisions too small to be easily read by the naked eye. The vernier was originally invented by a Frenchman, Pierre Vernier (1580 – 1637). Initially his invention was of little interest, until it was applied to the classic vernier calliper measuring instrument.

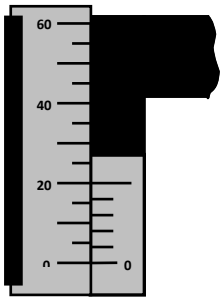
1002. ***How does a Vernier Scale work?*** Since the change in elevation needed on rifle sights is a very small angle, any measurement on a sight would be difficult to read. The smallest graduations which could be easily read would be about 5 minutes, but we need to be able to read to ¼ of a minute.

1003. A vernier scale has two components – a moving scale and a fixed scale. The moving scale has five divisions on it, to every four on the main scale.

The Elevation Vernier

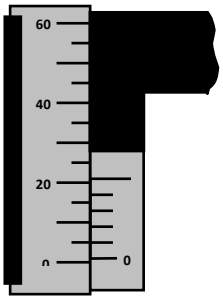
1004. Figure 1 shows the elevation vernier reading zero – both '0's are aligned.

Figure 1



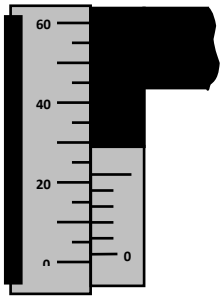
1005. Figure 2. If the top screw is turned clockwise four clicks (1 minute), the '0' on the Vernier scale is no longer aligned with another mark but the next line up is aligned with one on the main scale – i.e. the reading is 0 + 1, or 1 minute.

Figure 2



1006. Figure 3. If the top screw is turned another four clicks clockwise (another 1 minute), we will have to count to the second line above zero on the vernier to find two aligned, giving a reading of 0 + 2,

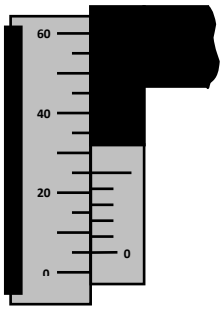
Figure 3



or 2 minutes.

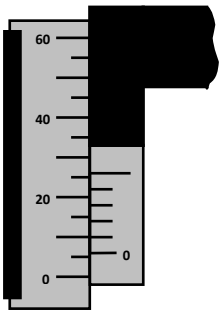
1007. Figure 4. The '0' on the vernier is aligned with '5' on the main scale, giving a reading of 5 minutes.

Figure 4



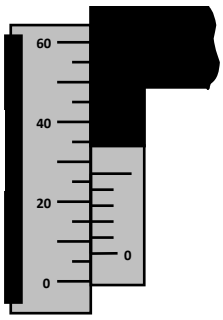
1008. Figure 5. Here the alignment comes above '5' on the main scale and one up from the '0' on the vernier scale, giving a reading of '5 + 1', or 6 minutes.

Figure 5



1009. Figure 6. It should now be easy to read this as 7 minutes.

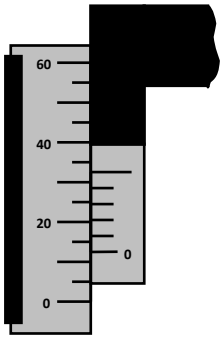
Figure 6



1010. Figure 7. Here, there are no alignments, but two lines on the vernier scale are between two on the main scale. In this case, the reading is above 10 and it is the second and third which are between alignments i.e. '10 + 2.5', or 12.5 minutes.

1011. If the exact reading was difficult to see, the sight could be clicked to see how many it took to bring it to the nearest whole number. For half a minute it will take two clicks. Quarters are best judged by the clicking method, remembering to click back once the reading is obtained.

Figure 7



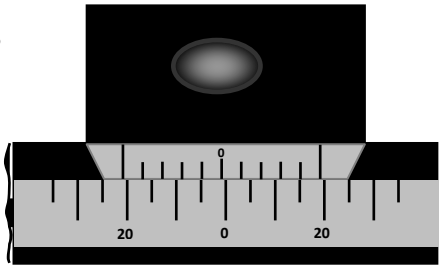
The Wind Vernier

1012. Reading the wind vernier is similar to the elevation vernier but wind can be either left or right.

Note: On the L81A2 sights, unlike on other sights, the main scale is fixed and the vernier scale moves, therefore left wind is read off to the right of zero and right wind is read to the left of zero.

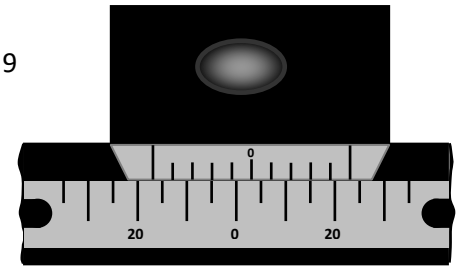
1013. Figure 8 shows 1 minute of right wind.

Figure 8



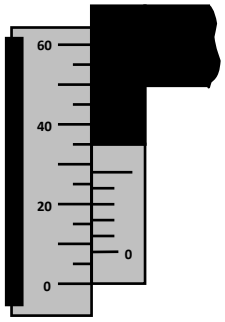
1014. Figure 9 shows 3 minutes of left wind.

Figure 9



1015. ***Exercises*** - Read the following scales

1) Elevation Scales



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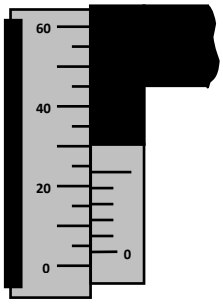

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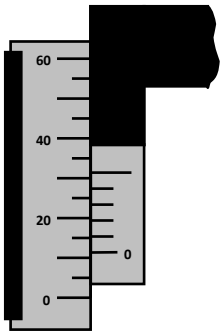

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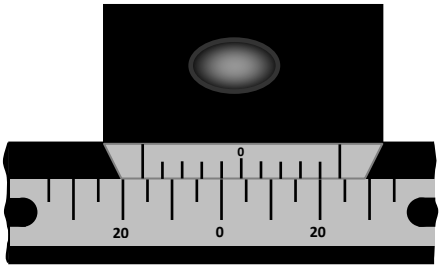
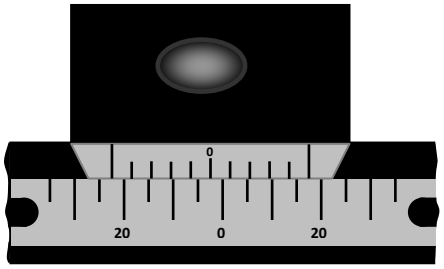
2) Wind Scales



a



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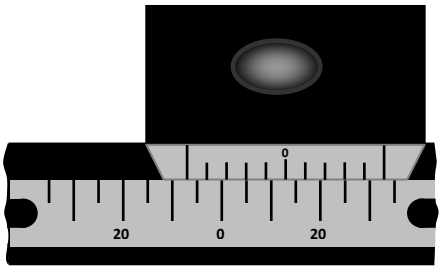

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SECTION 11

ZEROING

1101. In theory, a correctly zeroed rifle should, in nil wind conditions, deliver a good shot to the centre of the target at a known elevation set on the rear sight scale and zero set on the wind scale.

1102. When zeroing in nil wind conditions, the wind vernier should be set to read zero, once the group is central.

1103. However, the elevation vernier should not read zero. It should be set to some small positive value at the shortest distance you are likely to use e.g. 5 minutes at 300 yds. This means that, on another day, using a different batch of ammunition or in different weather conditions, or on a different range, you can bring the group down without going into negative elevation.

1104. A correct **wind zero** is essential, especially for coached shoots and it is vital for shooting in 'fish-tail' winds.

1105. ***Methods of Zeroing*** - The range on which you zero is a matter of what is available but Ideally one should zero at 25 or 100 yards, where the wind has no effect on the bullet.

1106. ***Zeroing at 25 yards (meters) -*** A small-bore 25-yard aiming mark is suitable for this. Ideally a vertical line should be drawn on the card and a plumb line used to ensure that the target is vertical. (The Bisley zeroing range is just under this distance - see below). The sights should be set so as not to disrupt the aiming mark – i.e. set them so that the shots land above it.

a) ***Wind Zero*** - Fire shots and move sights left or right until the group is centred on the vertical line. The screws on the wind vernier can then be loosened and the scale slipped so that it reads zero.

b) ***Elevation*** - Now the elevation can be adjusted. The sights are approximately set for 300 yards when the group is about half way between the centre and the top of the aiming mark and for 200 yards when the group is just below centre. Note the reading on the vertical scale, or loosen the screws and set it to whatever reading you wish. (This may not get you in the bull but will be near enough for two sighters to get you in). A good elevation setting for 300 yards is 5 minutes. Do not be tempted to set the sights to zero at 300 yards as you might some day want to fire at 200 yards or you might come across a batch of ammunition which groups higher on the target. If you deal with a number of rifles e.g. a cadet team or a number of club rifles, it is a good idea to have them all reading approximately the same at 300 yards. An unfamiliar user can then be sure that the first sighter should at least be in the black!

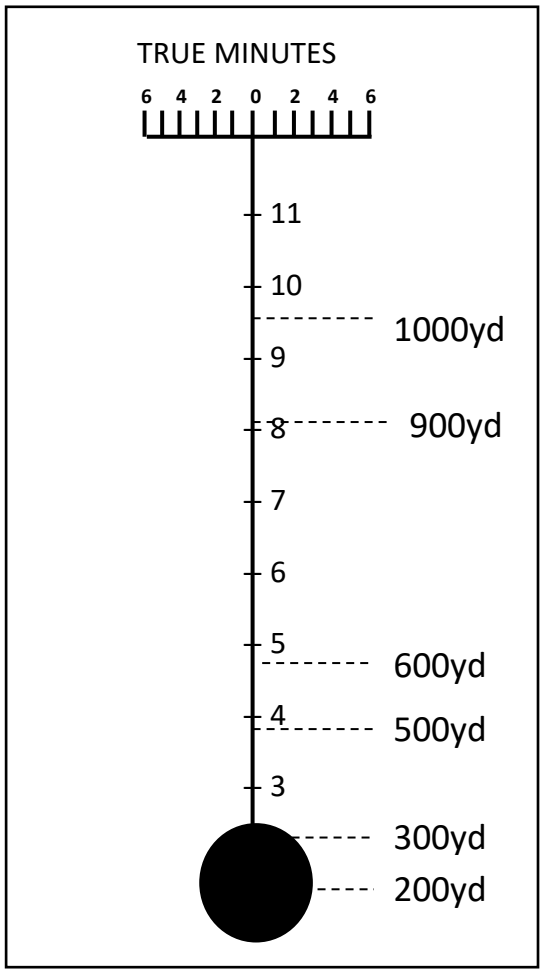
1107. ***Zeroing at 100 yards (meters)*** - A small-bore 100-yard target is a suitable aiming mark. Since this is a bigger aiming mark, groups can be fired at it directly and then centred. The wind vernier is then zeroed as before. The elevation reading is then noted. The 300-yard setting will be about 4.5 minutes above this, so, if an elevation reading of 5 at 300 yards is needed, the sights should be set to 0.5 minutes at 100 yards. (Fine adjustment to the reading might be necessary after a few shoots).

1108. ***Zeroing at other distances*** - Most often a new or refurbished rifle is first used at the distance which happens to be available on that day. Set the sights to a reasonable elevation and get someone to spot through a telescope for the first few shots, in case they miss. Adjust on the fall of shot until the group is centred on the target and adjust the

elevation scale to the reading you want. Take a number of opinions on the mean wind from experienced shots and adjust the windage accordingly. Again, some fine adjustments will have to be made after a few shoots.

1109. ***Bisley Zero Range*** - The Bisley zeroing range is just under 25m, with special targets for the purpose, already marked out or with a master card so that you can mark your own card with distances.

a) The sights should be set so as not to disrupt the aiming mark – i.e. set them so that the shots land above the aiming mark. Fire shots and move sights left or right until the group is centred on the vertical line. The screws on the wind vernier can then be loosened and the scale slipped so that it reads zero. Now the elevation can be adjusted. The sights are approximately set for 300 yards when the group is about half way between the centre and the top of the aiming mark and for 200 yards when the group is just below centre. Note the reading on the vertical scale, or loosen the screws and set it to whatever reading you wish



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Bisley Zeroing Target

SECTION 12

TARGET RIFLE BUTT MARKING & TELEPHONE MESSAGES

1201. ***Safety.*** The same safety rules apply as to butt marking for other shooting disciplines.

1202. ***Equipment.*** The following are required and are normally available on any range used for target rifle practices. It is advisable, however, to check the details on the range recce.

a) Targets for each distance, with spare faces.

b) Patches

c) Paste

d) Spotting discs (small for 200 yds and 300 yds, large for further back)

e) Value marking panels

f) Communication (phone or radio) and back-up

1203. ***Make-do's.*** Some ranges do not have value panels. A possible alternative is to use a large spotting disc with black patches stuck on the white side and small holes punched along the bottom of the target. (The old marking poles give a difficulty with marking V-bulls and 1s as these should be marked in red but if nothing else was available, some other system could be worked out with the range officer).

1204. ***Procedure***

a) Before the start of the shoot, check that the target has no shot holes, spotting discs or value panels on it. Patch out any holes found.

b) The marker must watch the butt-stop behind the target, not the target itself. When a strike is seen, take the target down, locate the shot-hole, put in a red spotting disc of the correct size and inset the value panel at the correct position, with the correct colour showing (See Annexe A) Put target back up. Watch again for the next shot. Take target down, move spotting disc to the new shot-hole and patch out the old one. Move the value panel as necessary. There is therefore only one hole in the target at a time.

c) At the end of the shoot, patch out the last hole and set the spotting discs and value panel ready for the next detail.

d) If a shot cuts a line, the shooter gets the higher value.

e) Do not hold on to the target or frame during shooting – if the frame is loose you may move it as it is being fired at.

f) If the value of a shot is challenged, the target must be checked by the butt officer or assistant.

g) If a shot misses the target, patch out the old shot hole, remove spotting disc and value panel. (However, check the old hole and the spotting disc carefully to ensure that the shot has not gone through them).

h) If two shots strike the target, put spotting discs in both and signal the higher value.

i) If a shot strikes the spotting disc, it is supposed to be discarded and a new one used. However, many military ranges do not have enough for this so the shot hole should be patched if possible, even if this has to be a white patch on red.

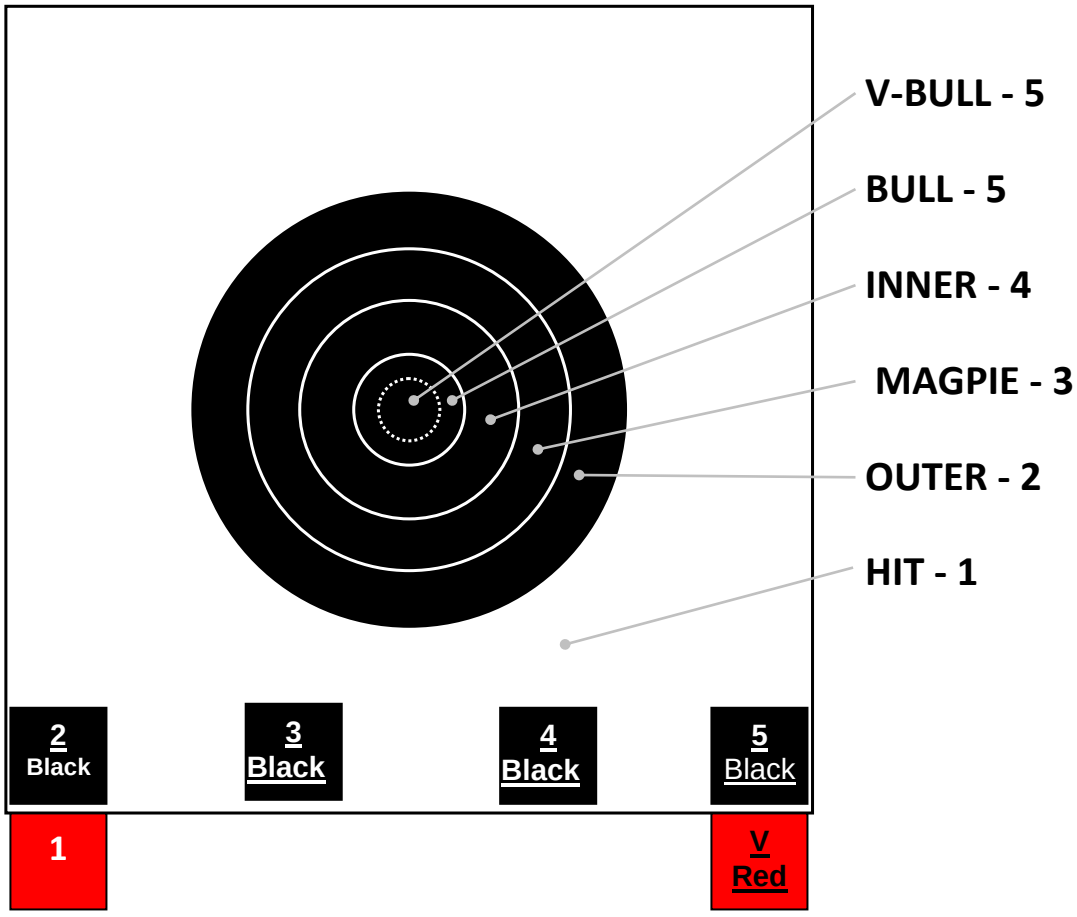
1205. **Telephone Messages.** Communications between firing point & butts must be brief and concise – a series of standard messages is used internationally (See Annexe B).

Annex A

to Section 12

Target Rifle Butt Marking & Tele Messages

SHOT VALUES



Annex B

to Section 12

Target Rifle Butt Marking & Tele Messages

TELEPHONE MESSAGES

Communications between firing point & butts must be brief and concise – a series of messages is used internationally:

Message 0	Raise sighting targets
Message 1	Firing about to commence.
Message 2	No spotting disc visible.
Message 3	Spotting disc unmistakably disagrees with signalled value. Check that spotting disc shows the LAST shot and signal its correct value*. The Range Officer is to view the target before passing the message.
Message 4	A shot has been fired but no signal has been made. Examine target carefully and signal the shot, if found, or a miss*.
Message 5	Firer has challenged for a higher value for their shot. Examine the whole target and signal the correct value*.
Message 6	It is suspected that there is a second shot on the target. Inspect the target for a second shot. If found mark and signal both shots. If not leave the spotting disc in the original hole*.
Message 7	A miss has been signalled but firer has challenged for a scoring shot. Re-examine the target carefully and signal the shot, if found, or a miss*.
Message 8	The spotting disc appears not to have moved. Butts Officer is to consult marker and confirm that the spotting disc is in the latest shot hole. If successive shots have been very close to each other, the RO is to be advised accordingly.*
Message 9	Marking/Shooting appears to be unduly slow. Butt/Range Conducting Officer to check and correct where necessary.
Message 10	Stand Easy. Half-mast targets.
Message 11	Blow-off shots are about to be fired. Ensure that all, or the specified, targets are fully lowered until message 1 is given.
Message 12	Stand easy. Lower target, patch out and put target back up.

***** The result must also be confirmed by radio.

Every communication should be clear and short, giving the Target No. followed by the Message No.

Example: "*Target 15, Message 4*"

SECTION 13

WIND AND AIDS TO WIND JUDGEMENT

Preliminaries

1301. You should arrive on the range at least 15 minutes before you are due to shoot. This gives you time to get ready at a leisurely pace, but it also gives you time to observe the surroundings and the wind flags.

1302. Try to identify any wind channels and obstacles e.g. on Ballykinler No 3 range, the left-hand targets are mostly sheltered from a left wind by trees until about the 200 yard point. On Century, at Bisley, especially at 500 yards and 600 yards, range 11 is sheltered from left wind, also by trees. Range 18 and 19 can be difficult in left wind as it can hit the trees and bounce back, giving unexpected left shots. On Stickledown, the left hand targets – at the bottom of the hill – are sheltered from left winds by the trees whereas those at the top of the hill are not.

Wind Components

1303. There are three wind components to be considered when calculating wind allowance.

a) The strength of the wind

b) The direction from which the wind is blowing

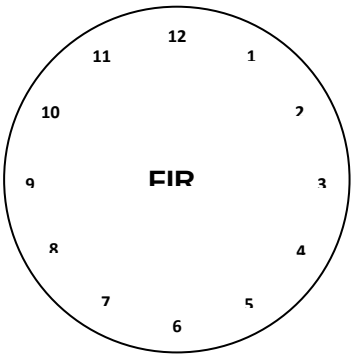
c) The distance the bullet has to travel

1304. Each component can be given a 'factor' number, according to how much effect it has on the bullet. The factors can then be used to construct wind tables. There is no need for most of us to learn these factors and their use, but they may be of some interest.

1305. ***The Strength of the Wind***. For simplicity, the wind strength is considered in multiples of 4 mph. These strengths can be seen on the angle of the flag.

WIND SPEED	4	8	12	16	20
Description	Gentle	Moderate	Fresh	Strong	Very Strong
Factor	1	2	3	4	6

1306. *The Direction from which the wind is Blowing*. **This is described by imagining the firer at the centre of a clock face with the target at 12 o'clock.**



1307. **Wind blowing straight across the range has most effect on the bullet, while a head or tail wind has almost no effect. A wind from 1,5,7 or 11 o'clock has half the effect of a 3 o'clock wind. The direction factors are as follows:**

DIRECTION (o'clock)	1,5,7,11	2,4,8,10	3,9
Factor	2	3	4

1308. ***The Distance the Bullet Has to Travel***. The further the bullet travels in the wind, the more the deflection. Also, as the bullet slows down, the wind has more effect. The factors applied are as follows:

DISTANCE (yds)	200	300	400	500	600	800	900	1000
FACTOR	1.5	2	3	4	5	7.25	8.5	10

Wind Tables

1309. The above factors are used in the following equation to construct Wind Allowance Tables, giving the correction in minutes of angle:

$$\frac{\text{Strength Factor x Direction Factor x Distance Factor}}{10}$$

1310. Tables of wind allowances come in many forms. One of these is usually found in the form of a diagram on the score sheet; another is a table constructed using the above formula; another is a circular calculator.

1311. It is essential that a beginner takes note of one of these at least at the beginning of the shoot. It is advisable to use the table along with flags or other indicators, for a period of time before the shoot, to try to find the probable maximum and minimum wind conditions.

1312. The wind closer to the firer has more effect on the bullet than the wind nearer the target. This can be explained by the following examples. The diagrams show firers at 1000 yds. In Fig 1, there is still air in the first half of the range and a 9 o'clock wind in the second half. In Fig 2 the situation is reversed, with the bullet first experiencing wind and then still air.

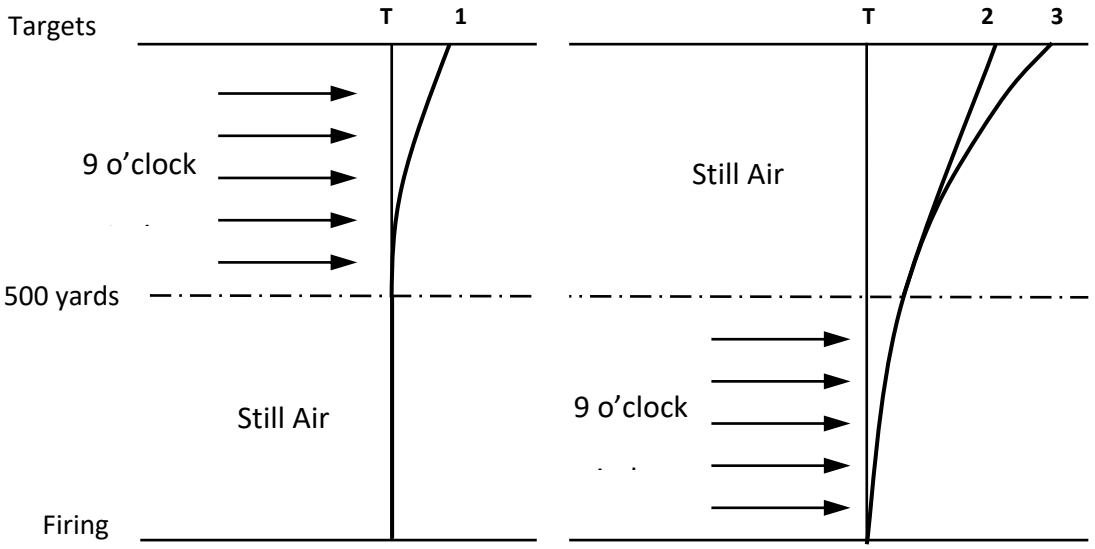


Fig 1 Fig 2

1313. **'T'** shows where the shot would fall if there were no wind. In Fig 1, deflection of the bullet starts at 500 yds and the bullet actually falls at position **1.** In Fig 2, deflection starts at the firer. When the air becomes still, the bullet does not then turn and proceed straight down the range (**2**). Its axis has already become been deflected so it continues in this deflected direction and actually lands at **3.**

Wind Flags

1314. Flags may vary in shape and size but at major ranges such as Bisley, they are made to a definite pattern so that their behaviour can be predicted. Most wind tables are based on 'Bisley' flags.

1315. In considering the information provided by flags, the following should be considered:

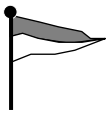
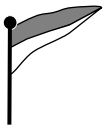
a) ***Material***. Natural fibres such as cotton, linen or jute absorb water, so are heavier when wet. Artificial fibres behave much the same whether wet or dry. Artificial fibres are often lighter in weight and lightweight flags do not show strength accurately in high winds.

b) ***Position***. Upwind flags are more useful, as this is the wind that is coming to you. Flags blowing across the firers vision are best for assessing speed, while those upwind are best for showing direction.

c) ***Size.*** Big flags are sluggish in light winds, small ones are useless in high winds.

d) ***Height.*** The height of the flag above the bullet flight path is important. A very high flag could be showing a strong wind while the bullet flight path is sheltered by low trees.

e) ***Movement.*** In very light winds flags move sluggishly and may not indicate the correct speed or direction. Mirage is more useful under these conditions. In very high winds, quite large changes may have little affect on the appearance of the flag. In this case, the speed at which the flag ripples or flutters is a good indication of wind speed.

Wind Description	Gentle	Moderate	Fresh	Strong	Very Strong
Speed mph	4	8	12	16	20
Appearance of Flag					

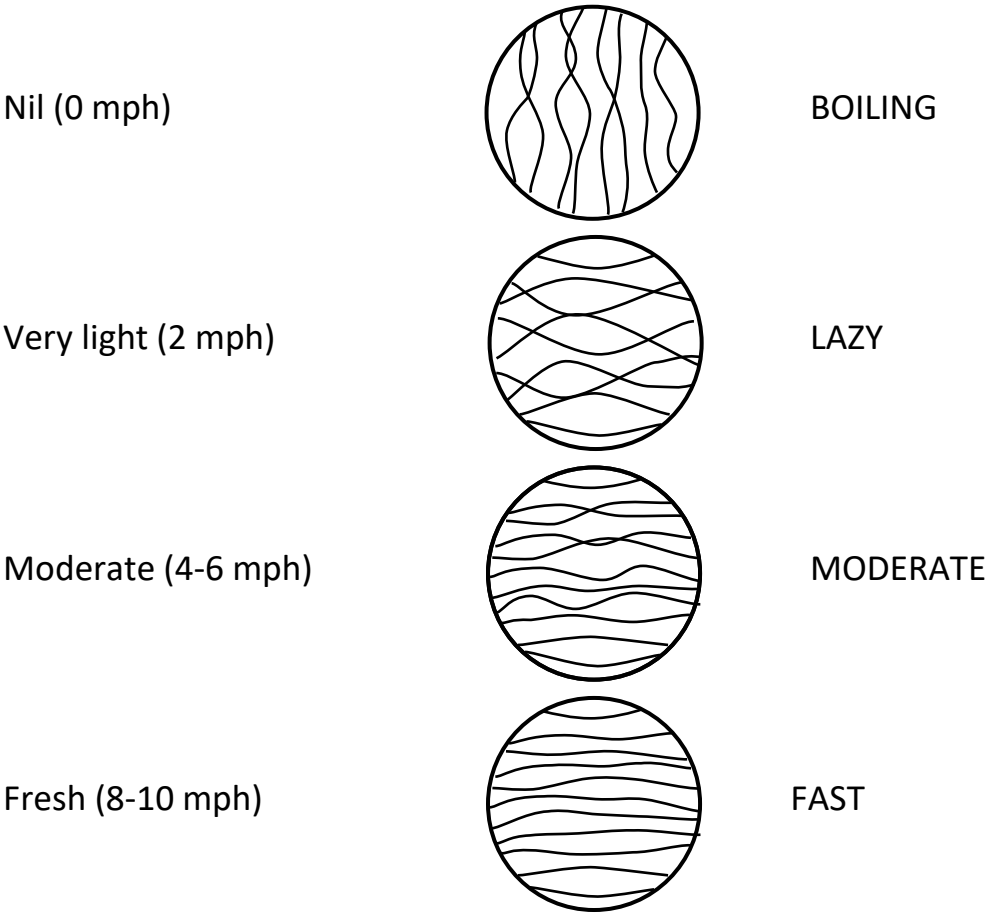
Mirage

1316. Mirage is the best way of judging very light winds, provided the weather is warm enough to produce mirage. It is particularly suitable in fishtail winds as the mirage often turns before flags.

1317. On a warm day, when the ground heats up, it transfers heat to the layer of air above it. This causes the air to become less dense and rises through denser air, causing turbulence. This can be seen through the telescope on a warm sunny day.

1318. In still conditions, the mirage rises straight up and has the appearance of water heating in a saucepan. This is known as 'boiling'. If there is a head or tail wind, the mirage will 'boil' more rapidly.

1319. A side wind will disturb the mirage, first obliquely then horizontally with increasing speed. In a very light wind the mirage may be described 'lazy'. Stronger winds may be 'fast' or 'running'. Mirage is only useful for judging speed up to about 8mph.



1320. A good telescope is needed to see mirage on a cooler day. Since wind in the first half of the range is more important than wind near the target the spotting scope must be focussed at a point nearer the firer than the target. If this is done carefully, the spotting disc can still be seen, even if slightly blurred.

Other Methods Of Judging Wind

1321. Some ranges do not have flags and mirage only appears on warm days so other ways of judging the wind must be considered.

a) If the grass is long, look at the direction it is blowing, or throw a tuft of grass in the air.

b) Look for smoke e.g. from a bonfire or from the muzzles of other rifles

c) In wet weather, look for the direction of the rain drops

d) Be aware of wind on the face

e) Sometimes a sudden change of wind is shown when a line of targets come up with shots in the same place, showing that a number of firers have been 'caught'. However, altering your sights on someone else's shots can be dangerous – you do not know what they had set on their sights.

Be Decisive

1322. Most beginners are too cautious. If you think you see a wind change, do something. If you see a change at long range (900 or 1000 yds) it is a least 1 minute.

1323. Once wind has been set, the shot needs to be let off a few seconds later, so that the wind has little time to change.

1324. Wind judgement is not an exact science. It is usually calculated guesswork and experience.

Annex A

to Section 13

Wind and Aids to Wind Judgement

WIND AND AIDS TO WIND JUDGEMENT - AIDE MEMOIRE

1. Successful wind judgement depends on:

   a) the common-sense application of a few simple rules

   b) background knowledge of cause and effect

   c) logical interpretation of the behaviour of wind indicators.

2. Use all the information available: if there is a great deal of it, discard that which does not agree with the results achieved.

3. For crosswinds , flags are likely to be the best indicators, except in very light winds.

4. For fishtail winds, mirage provides the best answer except in very strong winds.

5. The wind in the first half of the range is more important.

6. Local conditions can have significant effects on the behaviour of the wind.

7. Make adequate records. They will be useful in the future.

8. Look at conditions before the shooting, watch others shoot.

9. Be decisive and fairly quick when shooting.

10. Trust your own judgement and make your own decisions, except when being coached.

11. Preliminary observation:

   a) Investigate range and surroundings.

   b) Identify wind channels and obstacles.

   c) Study the aids available.

   d) Select the aids most likely to prove useful.

12. Before shooting:

   a) Watch flags/mirage for a short period.

   b) Decide which aids will be most useful.

   c) Estimate the maximum and minimum correction likely to be required.

   d) Halve this bracket for sighters

13. During shooting:

   a) Observe conditions before each shot.

   b) Decide if correction is required, apply it and fire the shot.

   c) Check conditions to see if they have changed while on aim.

d) Record firing data, results of shot and relevant remarks in scorebook. In variable conditions plot the wind graph on score card.

14. After shooting:

a) Analyse wind correction graph.

b) Identify possible errors in methods or estimation or use of aids.

SECTION 14

THE SCORE CARD

Introduction

1401. Since the target is a long way from the firer, the only means of seeing the shot hole is to have a spotting disc put into it and the disc is observed through a telescope. Also, to avoid confusion, old shot holes are patched out so that only the most recent shot appears on the target. To record all of the shot positions, it is necessary, therefore, to use a diagram of the target and this is part of the 'score card' on which the positions of the shots are plotted.

1402. There are several reasons for completing a score card during a shoot and then keeping it:

a) To keep a true record of: the value and position of each shot; the weather; the rifle used and the ammunition used.

b) To help determine the correct wind allowance.

c) To keep track of the elevation.

d) To find the MPI as early as possible in the shoot and indicate any sight correction needed.

e) To build up a history of the firer and the rifle, so that any changes can be spotted quickly.

f) To have a record to show Team Captains who are doing team selections as they often like to see more than just scores.

Types of Score Card

1403. Most people use single score sheets rather than score books. These are then kept in loose-leaf folders. Sometimes it may be best to take to the range only the sheets required and not the full folder, in case of rain. The sheets can be held on a piece of board with rubber bands or clips. There are many designs of score sheet now available and many people now design their own.

1404. Some are available which only show the bull and inner at short range. These are not very useful for the average cadet as they usually stray a little further out in their earlier shoots. Senior cadets, doing the Imperial Meeting or Athelings Selection may wish to use them.

1405. Also available are wet weather score sheets which can be filled in with a soft lead pencil, even under water, but the score must be transferred to a paper sheet at the end of the shoot.

1406. A score sheet must have:

a) A diagram of the target on which to record the position of the shots.

b) A facility to record elevation, estimated wind, calls of shot and score. Some versions also have a facility to record true wind and flag direction.

c) Graph areas to draw wind and elevation graphs.

d) A wind table to help with initial judgement of wind.

e) A facility to record details such as the rifle and its components and the weather.

Pre-Requisites.

1407. The rifle should be zeroed to the individual using it, though with cadet or 'club' rifles this may not be possible.

1408. The grouping capacity of the firer should be known (the Expected Scoring Area).

1409. The elevation needed for the particular shoot should be known.

Before The Shoot

1410. Well before the shoot, several pieces of information should be entered on the score sheet (some might even be done the night before): the event, date, rifle, the sight settings, and the target. (Remember to set the sight settings on the rifle also).

1411. As early as possible, enter the time, weather and ammunition batch.

1412. You should be at the range at least fifteen minutes before the shoot. This gives time to assess the wind but wind is not entered until a shot has been fired, in case a sudden change has to be made at the last minute.

During The Shoot

1413. The position of a shot is shown by one symbol only, placed in the position as indicated by the spotting disc. The sighters are shown by A and B, the scoring shots by 1, 2 etc. Do not use Xs, dots or 'spider's legs' – one symbol only is necessary for each shot hole.

1414. The elevation for each shot is written down as soon as it is decided, before the shot is fired.

1415. The wind used is written down immediately after the shot is fired (if there is a wind change when on aim, a quick change has to be made).

1416. Be careful to enter the elevation and wind for the correct shot. It is a common mistake with beginners to write them in for a previous.

1417. If a bad shot is fired, it must be 'called' before the target comes up again and a symbol to indicate what may have gone wrong, put in the 'call' box.

1418. If no change is made to elevation or wind settings, the box should be left empty – this indicates that whatever was in the previous box still applies.

1419. As soon as the sighters are fired, the wind and elevation graphs should be started (see later sections).

1420. Use the evidence of all good shots fired to decide on the elevation needed and adjust the sights AS SOON AS IT IS OBVIOUS WHAT CHANGE IS NEEDED. Avoid the tendency of some beginners to 'just fire another one to confirm'. If, say, two shots fired so far are low, the next one is likely to be low as well unless something is done about it. Avoid also the temptation to change on only the last shot and NEVER alter on a bad shot.

1421. If a bad shot is fired, it is plotted but a circle is put around it and it is <u>not</u> used it to decide the MPI.

After The Shoot

1422. Record any unusual items in the 'remarks' box which might explain anomalies noticed later e.g. 'sloped firing point' or 'erratic marking'

1423. At the end of the shoot, the average elevation is worked out and noted for the next shoot at that distance.

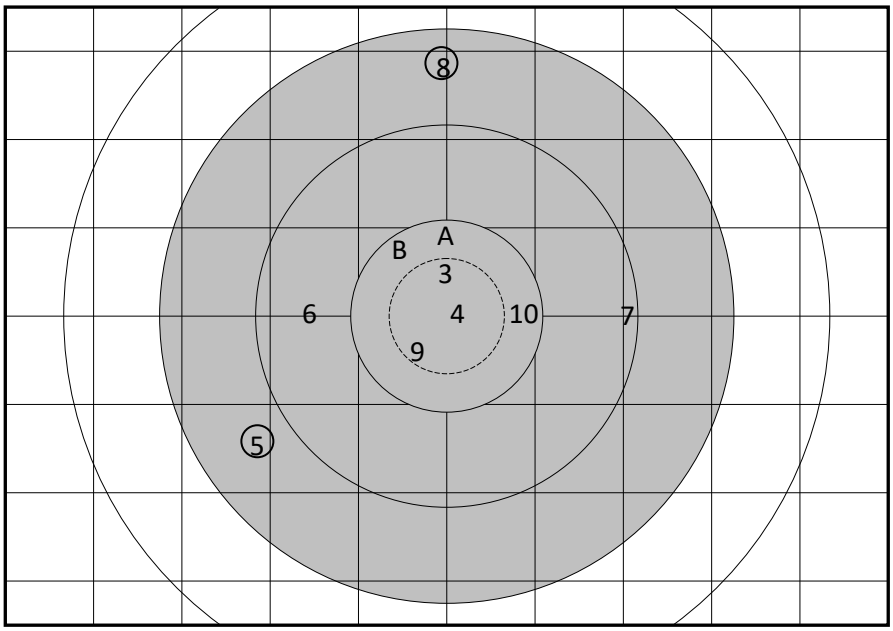
1424. Periodically, review all score sheets to try to discover any problems e.g. always under-calling the wind: gradually increasing group size (is the barrel wearing out?).

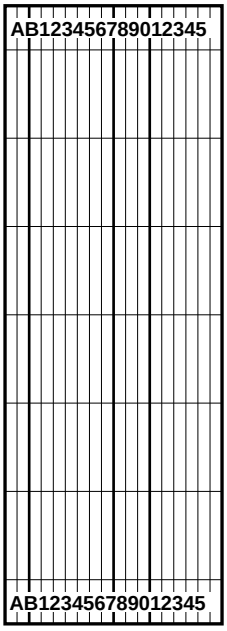
1425. A score sheet is easy to use under normal NRA conditions, when there are two or three firers sharing a target: there is time to do paperwork. When coaching a cadet, the coach has to be fast and efficient if (s)he is to get the paperwork completed, watch the wind, watch the cadet for faults and, in a competition, keep an eye on the register-keeper!

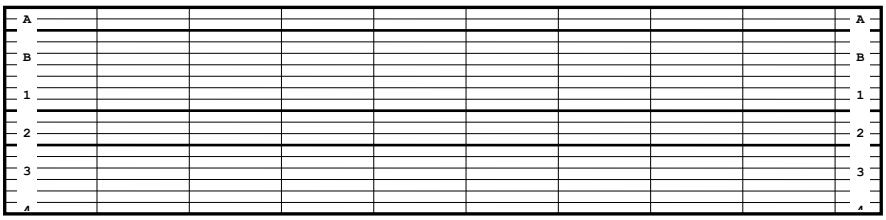
1426. An example of a properly completed score sheet:

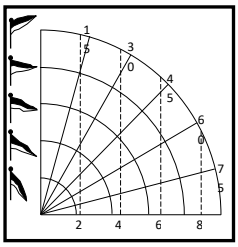
EVENT		DATE	TIME
RANGE	TARGET	WEATHER	LIGHT
RIFLE	AMMN	FORESIGHT	REARSIGHT

600 yard









SHOT	ELEV	WIND L	WIND R	CALL	SCORE
A	15	4			5
B					5
1					5
2					5
3	14½	3			V
4	14				V
5				↙	5
6					4
7		1			4
8		0		↑	4
9					V
0			1		5
1					
2					
3					
4					
5					
PREVIOUS RANGES				TOT	45.03
				AGG	

THE SCORE CARD - GRAPHS

Elevation Graph

1427. The quickest way to find the average elevation as early as possible in the shoot is to draw an elevation graph. It is often called a 'corrected elevation graph' as the graph shows the group, taking out the fact that elevation changes have been made on the sight.

1428. At the end of the shoot, it shows the elevation spread of the shots and what the average elevation was for that shoot. This is the elevation which that firer should use next time with that rifle at that distance.

1429. Unless the firer is very experienced and using a very familiar rifle, it is usually best to start the elevation graph after the sighters have been fired.

1430. The graph lines for the elevation graph are at the right-hand side of the score sheet. The following is the procedure to be followed:

a) Choose a sight setting which will be approximately in the middle of the group and put this on the mid-line. Add the other values above and below at 1 minute intervals BUT UPSIDE-DOWN.

b) Look at the elevation that was on the sight when the shot was fired and identify that line.

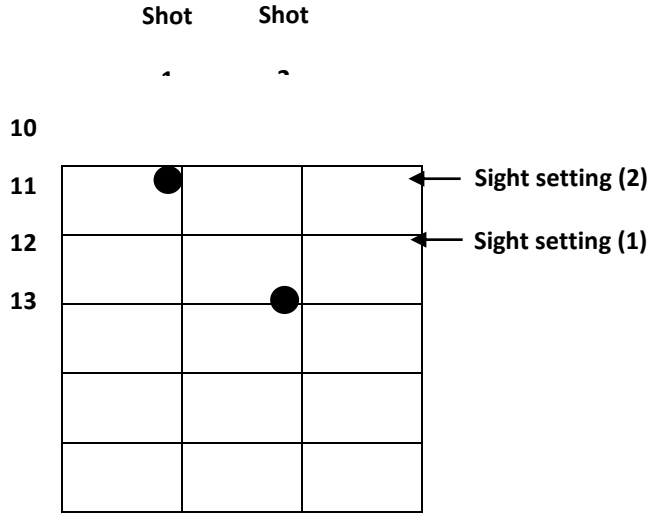
c) Look at the position of the shot, at where it is relative to the centre line of the target.

d) Plot it on the graph in that relative position i.e. if it is high, plot it high and if it is low, plot it low, by the appropriate number of minutes.

1431. Examples.

a) Shot 1 was fired with the elevation set at 12 minutes and the shot fell one minute high. It is therefore plotted 1 minute above the 12 line i.e. on the 11 line.

b) Shot 2 was fired with the elevation set at 11 minutes and the shot fell 2 minutes low. It is therefore plotted two minutes below the 11 line i.e. on the 13 line.



Wind Graph

1432. The wind graph lines on the score card are located below the diagram.

1433. The principles for drawing the wind graph are the same but it might have to go in both directions if the wind is close to zero. However, usually it will have either left wind or right wind and on a day of high wind, zero will not appear.

1434. The following is the procedure to be followed:

a) Choose a wind which is close to the average wind and put this on the mid-line. Next, put an 'R' at the left end of the graph scale and an 'L' at the right end of the scale, as a reminder that right wind increases to the left and left wind increases to the right for the purposes of a corrected wind graph.

b) Identify the line for the wind reading that was on the sight when the shot was fired.

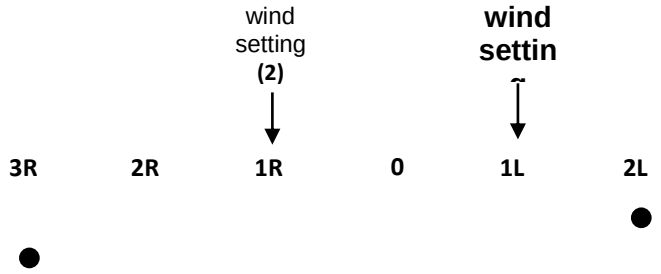
c) Look at the position of the shot, relative to the centre of the target.

d) Plot it on the graph, relative to the wind setting i.e. if it landed right of the wind call, plot it right; if it fell left of the wind call, plot it left.

1435. Examples.

a) Shot 1 was fired with the wind sights set on 1 minute of left wind and falls 1 minute to the right of centre. It is therefore plotted one minute to the right of the '1 left' line.

b) Shot 2 was fired with the wind sights set on 1 minute of right wind and falls 2 minutes left of the centre of the target.



SECTION 15

COACHING THE TARGET RIFLE BEGINNER

Introduction

1501. It is well known that shooting is the most popular activity in the Amy Cadet Force and that it provides many opportunities for cadets to take part in shooting competitions in different disciplines including target rifle.

1502. For cadet target rifle beginners to reach their full potential and to enjoy their shooting experience it is vital that they receive competent instruction and coaching from an enthusiastic well trained adult coach.

Progress of Coaching

1503. After being taught the principles of safety, the beginner needs to be gradually taught the basic skills. It is probably best to teach trigger squeeze first as this may be done using a sand bag or rest. Faulty trigger operation is one of the most common causes of bad grouping, so getting that out of the way before bad habits set in will allow the coach to see the grouping capacity of their cadet. Breathing, follow through, aiming and alignment can then follow.

1504. The beginner needs to be individually coached at first and given confidence by progression and improvement. As with the learning of any skill, the beginner needs frequent reminders of these topics. They need to be aware that each score WII not be better than the last but the average should increase over a period of time. The next step is for the coach to gradually allow the cadet to coach themselves, when they have gained sufficient knowledge and confidence.

1505. The beginner also needs to understand that grouping is the foundation of good shooting. The group size is a measure of the consistency of the firer. Unless the firer can maintain a tight group, they will not be able to get a good score. A good group is achieved by eliminating errors.

Knowledge

1506. The coach needs to have the knowledge detailed in Section 6 and the ability to transfer that knowledge to cadets.

Causes of Bad Shooting

1507. The coach must understand the causes of bad shooting.

- Failure to apply the marksmanship principles
- Poor rifle preparation
- Rifle badly zeroed
- Rifle badly fitted to cadet
- Bad eyes or bad health
- BAD COACHING

1508. It is important that the coach identifies the causes of any bad shooting and rectifies them quickly.

Failure to Apply the Marksmanship Principles

1509. The beginner will almost certainly fail to apply properly the marksmanship principles and the coach must spot the mistakes and rectify them quickly. Common mistakes are:

a) Firing Position. The coach must check the cadet's position, including use of the sling, hand stop and butt placement and ensure that correct alignment is adopted.

b) Faults in Aiming. The beginner needs to be observed by the coach while on aim. Watch for dwelling on aim too long, altering eye relief, squinting and flinching.

c) Breathing. Watch for the cadet who fails to control breathing. It is useful to watch the movement of the barrel. Another common mistake is excessive restraint of breathing — the breath is held so long that the shot is released to 'get rid of it'.

d) Trigger Control. The location of the finger on the trigger must be consistent and the trigger operation needs to be observed in case it is snatched.

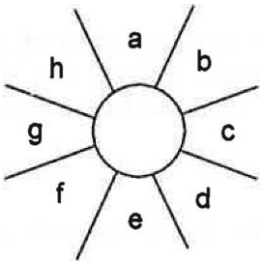
e) Flinching. This is a bad habit which can be difficult to cure, once developed.

f) Follow-through. Many beginners need to be reminded to follow through.

1510. Watch the firer! A common mistake made by inexperienced coaches is to spend too long looking through the telescope and not watching the cadet. The coach needs only look through the telescope as the target comes up. The only exception to this is a cadet is getting unexplained misses and it can then be useful to watch through the telescope to spot the fall of shot.

Misplaced Shots & Possible Causes

1511. The following diagram and notes show some of the possible causes of misplaced shots.



a) High Shots
   1) Looking through the top of the aperture
   2) Aim acquired by dropping the left hand
   3) Butt too low in the shoulder
   4) Failure to relax the left am

b) High Right Shots
   1) Loose sling
   2) Looking through the right side of the aperture
   3) Len hand too far back
   4) Applying pressure across the trigger instead of straight back

c) Right Shots
   1) Loose sling
   2) Faulty positioning of the left elbow
   3) Side of finger on trigger
   4) Left hand pushing right

d) Low Right Shots
   1) Loose sling
   2) Right elbow slipping 3) Sights canted to the right
   4) Trigger snatching

Low Shots

1) Loose sling
2) Aim corrected by raising left hand
3) Foresight low in the aperture
4) Finger too low on the trigger

Low Left Shots

1) Sling too tight
2) Sights canted to left
3) Finger incorrectly positioned on trigger
4) Pushing with right shoulder

g) Left Shots

1) Left hand pulling left
2) Side of finger on trigger
3) Sling too tight

h) High Left Shots

1) Sling too loose
2) Flinching
3) Excessive pressure of cheek on butt

Procedure — Coaching Checklist

1512. Coaching starts when the firer arrives on the range and finishes only when a de-brief on the shoot has been held, the rifle is cleaned and put away.

1513. Each and every shoot must be a learning experience for both the cadet firer and coach. To achieve this, the following procedure should be adopted.

1514. Before Firing— behind the firing point

a) Check that the cadet is property dressed.
b) Check the rifle & equipment — rear aperture, foresight element, elevation setting, the sling, butt length, hand-stop and eye relief.
c) Examine the score book history.
d) Discuss any points to remember
e) Consider the wind.

1515. Before Firing— on the firing point

a) Ensure that the cadet's firing position and natural alignment is correct.
b) Ensure the sight settings are correct.
c) Check that the correct target is engaged.
d) The cadet takes one or two dry shots to show up any obvious faults which can be corrected before shooting starts.
e) Consider the Mind.

1516. During Firing. During firing the coach's emphasis must be on quiet encouragement and the removal of any cause for anxiety. The coach must:

a) Watch the cadet to spot and correct faults; to correct a fault tell the cadet to stop and come out of the aim then say what has to be said and let him start again.

b) Ensure the firer declares all shots; declarations should be made before the target reappears.

c) Watch & adjust for wind.

d) Use the score card to centre the group.

e) Ensure there are no distractions — do not talk to the firer whilst on aim.

D Give the cadet some indication of progress without necessarily spelling out the exact position and value of each shot.

g) Give encouragement.

1517. After Firing— on the firing point The coach must:

a) Ensure that all safety and range procedures are correctly followed.

b) Quickly clear the firing point.

1518. After Firing — behind the firing point The coach needs to:

a) Analyse and discuss the shoot the firer as soon as time allows. This should NOT be done shot-by-shot during the shoot or loudly on the firing point during someone else's shooting time.

b) Bring out any lessons learned.

c) Highlight any apparent faults in technique to identify smart further training/practice is required.

d) Give encouragement.

Conclusions

1519. The good coach will be knowledgeable, enthusiastic, firm and understanding.

1520. Coaches must keep their knowledge up-to-date.

1521 . The success of the coach is measured by the success of the cadets.

SECTION 16 - CADET TARGET RIFLE COACHING: AIDE MEMOIRE

COACHING = Two Types.

1. Teaching an inexperienced cadet
2. Helping an experienced cadet in a team / competition.

ART OF COACHING

1. Give advice when needed
2. Spot & correct faults as early as possible (Marksmanship Principles)
3. Centre the group
4. Assess wind & adjust sights
5. Encourage the cadet
6. Gain further knowledge to improve own coaching standards.

KNOWLEDGE

1. Marksmanship Principles.
2. Capabilities of the rite and ammunition
3. Zeroing.
4. Theory of a Group.
5. Elevation.
6. Effects of wind and how to judge it
7. How to use a scorecard.
8. Causes of bad shooting and how to rectify them.

COACHING GROUND RULES

1 . Watch conditions for a few minutes before the shoot
2. Make good use of a scorecard
3. Do not let the cadet dwell in the aim
4. During the shoot — watch the firer
5. Never alter sights on a declared bad shot
6. Do not chase errors
7. Do not waste time between shots - keep a good rhythm going

CAUSES OF BAD SHOOTING

1 . Failure to apply the marksmanship principles
2. Poor rifle preparation
3. Rifle badly zeroed
4. Rifle badly fitted to cadet
5. Bad eyes or bad health

6. BAD COACHING

COACHING CHECKLIST

Before - Behind Firing Point	1 . Check cadet is properly dressed 2. Check rile & equipment — rear aperture, foresight element, elevation setting, 3. Examine scorebook history 4. Discuss any to remember 5. Consider the wind
Before - Prep On Firing Point	1 . Ensure the cadet's position & alignment is correct. 2. Sight settings 3. Correct target 4. Dry firing 5. Consider wind
During the Shoot.	1 . Watch the firer to spot & correct faults 2 Ensure the cadet declares all shots 3. Watch and adjust for wind 4. Use the score card to centre the group 5. Ensure no distractions — don't talk to the firer while on aim 6. Give encouragement
After On Firing Point.	1 . Safety! 2. Clear firing point quickly
After - Behind Firing Point.	1 . Analyse and discuss the shoot with the cadet 2. Bring out any lessons learned 3. Identify any further practice or instruction 4. Give encouragement