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SHOOTING AT MOVING TARGETS

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Note for Readers
This document has not been updated since 2011 and while the main body regarding moving target technique and equipment setup is still very valid other sections, particularly those quoting regulatory matters, may now be out of date.

About the author:

Bob Maddison is the British National Coach for Moving Target Shooting. He was appointed to that post in 1988 and, for several years, shared those duties and responsibilities with the late Michael Baxter. Bob also holds a Class "A" ISSF Judges Licence for this discipline. By profession Bob was a physicist, now retired, and his scientific approach to shooting is apparent in this book. This book brings together much of the coaching material that he has used in developing the discipline and in introducing it to others already within shooting sport as well as total newcomers to shooting.

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DEDICATION

This book is dedicated to the memory of the late Michael Baxter who, until his death in 1992, did so much to promote the Moving Target disciplines both in Great Britain and throughout the world. It was a great privilege to have shared the duties and responsibilities of British National Coach for this discipline with Michael, and to learn so much from his lengthy experience of the sport.

ACKNOWLEDGEMENTS

I am indebted to the support given me by my wife Joan in my coaching activities connected with this shooting discipline and in preparing this manuscript. Although not a shooter herself, she was drawn into an involvement with the sport to the extent that in 1992 she qualified as an ISSF Judge for the event.

I am also indebted to the members of the British National Squad, the 'Training Squad', members of the British Sporting Rifle Club and all those shooters and potential shooters who allowed me to develop the training material that forms the basis of this book.

My thanks to Bill Murray, the one time Great Britain Target Shooting Federation Director of Coaching who has done so much to promote a professional attitude to shooting coaching in Britain. Thanks also to my fellow Coaches Don Thurlow and John Anthony, both sadly now deceased, who were my predecessors in the discipline, and to the Coaches in all shooting disciplines from whom I have learned so much.

FOREWORD

In writing this book my objective has been to provide a textbook for all levels of skill in these Moving Target disciplines. It is not necessary to have any prior experience of the discipline in order to benefit from the book, nor even to have any shooting experience in any discipline. At the same time, this book is intended to be of help to experienced shooters who wish to improve their skill in this discipline, as well as a sourcebook for their coaches and instructors. As a coach, it is my belief that good instruction is important to beginners in any sport if they are to receive the maximum enjoyment from participation in it. That initial instruction should form the base upon which all future instruction is built. At no stage should it be necessary to 'unlearn' anything. Thus it is an important principal that shooters at all stages of their development should be able to benefit from the training methods and the experiences of the top international shooters. Throughout, this book concentrates on the 10m Running Target discipline. Whilst it is possible to enjoy shooting 50m Running Boar and 100m Running Deer without ever having shot at a 10m Running Target, it is unlikely that the necessary skills to compete effectively at international level can ever be fully developed without that air rifle background. It is also easy, for a variety of reasons, to develop an inadequate technique by learning the technically easier 50 and 100m disciplines first. Thus precedence is given to 10m shooting. In dealing with 50 and 100m shooting I have described how the equipment and techniques differ from those for 10m. To benefit from this text the shooter who is interested only in the Running Deer event must necessarily study the sections on 10m shooting. However, those who have no interest in Running Boar or Running Deer shooting may skip those sections. This approach is not unique to the Moving Target disciplines. The foundation for skill in all ISSF rifle and pistol shooting today lies in air rifle and air pistol shooting

Although this book is all about Moving Target shooting, most if not all of Part 6 (Improving Performance) and Part 7 (Shooting at International Level) have much that is common to all shooting disciplines. I would hope that other shooters will find much to help them in those sections and that they will go on to read the rest of the book too.

Throughout this book I have used the masculine 'he' or 'his' unless referring specifically to the ladies events. This is only to avoid the use of the cumbersome 'he or she' and 'his or her', and has no other implication. Similarly, I do not differentiate between 'junior' and 'senior' events. It is usual for these to be shot concurrently rather than separately. Likewise, when I refer to right or left hand, foot or eye, I am thinking of the right handed shooter. I intend no disrespect to left handed shooters but only to avoid the cumbersome use of words. The left handed shooter should reverse the sense when appropriate. The special problems of the left handed shooter in the Running Deer events will be dealt with in the text.

In describing range equipment and techniques I have given precedence to the older “paper” targets with manual marking. Many ranges throughout Europe including Bisley in the UK now have Electronic Scoring Targets (ESTs) which offer numerous advantages. However, the ISSF and NSR Rules are based firmly on the use of paper targets. This is partially because around the world, such ranges are more common and EST ranges vary significantly in their operation. The differences in procedure necessary are noted in the text. Apart from the 10m range made by Sius-Ascor, the ISSF has not given generic approval for other makes and types of electronic scoring range. Currently, although the ISSF recognises the Sius-Ascor 10m Electronic Scoring Running Target range, there is no equivalent specification for a Running Boar or Running Deer range although such ranges do exist such as at Bisley.

Throughout this book, there appears to be some repetition between chapters and occasionally between sub chapters. This is inevitable in such a comprehensive book which is intended to be used as a manual for selective study rather than to be read from cover to cover. I have an aversion to textbooks that only make sense if you look up their extensive cross references. Thus each chapter and sub chapter is an entity; only rarely will it be necessary to make a cross reference. This is also a product of the origins of this text which started in a series of articles in the now defunct magazine "Target Sports" and which were followed up in the bi-monthly Newsletter of the British Sporting Rifle Club. It is not possible to deal with shooting techniques without some reference to equipment; and to some extent, shooting technique is determined by the equipment available. Therefore both must be considered together. Nor is it possible to deal effectively with Mental Training without some reference to Training Plans and Motivation, both of which are the subject of their own chapters. Thus, in order to minimise the use of cross references there has been some necessary repetition. Hopefully this has been minimised consistent with the book being easy to read, chapter by chapter.

INTRODUCTION

Moving Target Shooting, included in the programme of the International Shooting Sport Federation (ISSF), formerly known as the International Shooting Union (ISU / UIT), is one of the oldest of the target shooting disciplines. All target shooting, like many of our Olympic Sports had its origins in the chase or on the battlefield, and the need to improve those essential skills. When hunting became a sport and no longer a necessity, it was not considered to be good etiquette to shoot at a moving target and so the targets used for practice were also required to stand still. However, remembering our ancestral skills as hunter/gatherers, the moving target still has a place in our sport. With the popular trend towards 'practical' shooting events, this is even more pertinent. Moving Target Shooting is the original 'Practical Rifle' discipline. The Running Deer has a particular significance in some of the Scandinavian countries where competence in this, or similar events, is an important feature of the compulsory tests for would be hunters.

In 1862 the British National Rifle Association (NRA) commissioned Sir Edwin Landseer to design a target in the form of a Running Deer. From that design a pair of cast iron targets was made and installed at the NRA ranges on Wimbledon Common on the outskirts of London. Those targets stand today outside the present headquarters of the NRA at Bisley Camp in Surrey. There was a Wild Boar competition in the Paris Olympic Games in 1900. Running Deer events were shot in the Olympic Games in 1908, 1912, 1920, 1924, 1952 and 1956. The 50m Running Boar event, much as we know it today, was introduced to the Olympic Games in Munich in 1972 and remained in the programme until 1992 when it was replaced by the 10m Running Target event. The Olympic Games in Athens, 2004 were the last in which this most traditional of our shooting sports was included. One reason for its exclusion is the low level of support for the event in terms of the limited number of competitors and countries taking part in the event internationally. The reason for this is the difficulty of the event, perceived or real, which has discouraged the beginner from advancing in the sport. Nevertheless, the 10m Running Target and 50m Running Boar events remain in the ISSF's programme and are included in the World Championships and in the regular Championships organised by the European Shooting Union (ESU) and other Continental Championships.

It is both apt and unfortunate that the words "to shoot at a moving target" have become synonymous with something that is difficult, almost impossible. The Moving Target disciplines are difficult to master, and as a result are less popular than they deserve. They need a highly developed intuitive attitude to shooting coupled with the skill and coordination needed to achieve the precision required. In this they have much in common with Rapid Fire Pistol shooting. They share the need for gun 'fit' so that the rifle or pistol becomes one with the hands, arms, body and mind of the shooter, and the need to supplement that with a precise aim and carefully judged release of the shot. Superficially they have much in common with the ISSF Clay Target disciplines, however, that similarity remains superficial and is largely confined to the need for a perfect match between the shooter and his gun. Those shooters experienced in the “static” rifle disciplines will have the greatest difficulty in adapting to shooting at moving targets: they are conditioned to shoot only when the target is perfectly framed by their sight and is free from all discernible movement. The Moving Target shooter must accept an “area aim” when his sight is never still on the target!

The International Shooting Sport Federation (ISSF) came in for some criticism when, in 1988, in deference to the environmental lobby of the International Olympic Committee, it decided to make the 10m Running Target event the premier Olympic Moving Target event. The newly designed 10m target was 'neutral' with no hint of the origins of the sport in the hunt for game for

the pot. Except for the scoring rings, it severed all connections with the earlier 10m Running Boar target, a scaled down version of the 50m target. As usual, the most vociferous criticism came from those who were not themselves involved in the sport. The Moving Target shooters were more concerned with mastering the skills demanded of them. This change of target and the move to air rifle shooting in the premier Olympic event has had a profound effect on the discipline in general. Although the 50m Running Boar event remains unchanged in the ISSF programme, all the emphasis is on the 10m event. The 10m targets are relatively more difficult to shoot at, and the low velocity and longer time between the release of the trigger and the pellet exiting the barrel of the air rifle punishes any small error of technique. Thus the event has become even more demanding on the shooters. Fortunately, it is easier to find a suitable range facility and, with inexpensive ammunition and targets, easier to train extensively. The net result has been increased International participation accompanied by a dramatic improvement in standards world wide. This has been reciprocated in the 50m Running Boar event. The move to the' neutral' target has also removed any ethical objections to shooting at an animal shaped target and this too has led to an increased international participation, particularly from the Arab countries and in the Ladies events. As international standards have improved, so British standards have been forced up too, perhaps not so rapidly as we would like. Since its exclusion from the Olympic programme after 2004, there has been a noticeable decrease in Moving Target shooting in international events. This is despite the efforts of the ISSF Moving Target Committee which has gone out its way to promote the events.

The 100m Running Deer discipline is no longer in the ISSF programme; it is a unique feature of the Nordic Shooting Region (Great Britain and the Scandinavian countries). Alas, too, 2004 has probably seen the end of the Nordic Shooting Region Championships as we have known them, and hence the end of the only major international 100m Running Deer event. *[This was a very big competition with up to 72 separate event shot over less than a week. The costs of running it were high and much of the cost was borne by the host country. Ultimately the event became a victim of its own success.]* Throughout this book, whenever the ISSF Rules are referred to then it should be taken to include, if relevant, the 100m Running Deer Rules of the Nordic Shooting Region. Those rules are based on the ISSF Moving Target Rules. In my terminology I refer to Moving Target shooting as a generic description of the discipline; the term Running Target shooting is confined to the 10m air rifle event. The Running Boar is shot exclusively at 50m with a rimfire rifle and Running Deer at 100m with a centre fire rifle. Internationally there are numerous variants on the Running Deer event. These include the Running Moose or Elk in Scandinavia, sometimes at 80 m rather than 100m. In some countries a variant of the Running Boar reverts to the earlier rules and is shot with a centre fire rifle

The ISSF reintroduced a Ladies and Junior Ladies 10m Running Target event in 1993. Otherwise the Moving Target disciplines have been essentially a male event in the ISSF and Nordic programmes. There are junior events at both 10m and 50m, but the 100m Running Deer event is an 'open' event. Thus shooters who are technically 'juniors' (i.e. under the age of 21 throughout the whole of the calendar year in question) may take part. However, it is not recommended that any young person should undertake the intensive training with a centre fire rifle required for participation in the 100m Running Deer events until they are able to withstand the recoil without damage to developing bones. It is generally accepted that this will not be before the 14th birthday has passed although slightly built juniors may need to confine their shooting to the 10m Running Target and 50m Running Boar for longer.

Any shooter who intends to take this discipline seriously should have a copy of the ISSF and Nordic Shooting Region rules in his possession. For convenience, a summary of the rules pertaining on1 January 2009 is given in Appendix 2.

Part 1 Getting Started

Many of those reading this book will already be moving target shooters. They will need little in the way of an introduction the sport. But for those who are new to this sport, especially those who are not already shooters, some introduction is needed. Ideally, this initiation should be given by a qualified Instructor or Coach, on a person to person basis. However, any book like this would not be complete without some information on getting started in the sport.

The best way to get started in Moving Target shooting is to join a club that has suitable facilities, and which can offer skilled instruction.

No-one need be put off Moving Target shooting because they think that they will need an expensive specialist rifle and sight. Any rifle or air rifle, of the appropriate calibre and which, for competition, complies with the ISSF Rules, can be used. For the absolute novice, strict compliance with the ISSF Rules is not essential provided that the discrepancy is minor and does not give him an advantage. However, he should "get legal" as soon as practicable otherwise his progress in and enjoyment of the sport will be limited.

Chapter 1 Safety

Shooting sport has an excellent safety record. It has one of the lowest rates for insurance of any sport. *[The biggest contribution to insurance cost is the considerable value of the (mostly) silver trophies!]* The reason for this is that shooters recognise that their sport has a considerable potential to cause injury or even death if they act irresponsibly. Consequently, safety regulation within the sport itself is of the highest standard.

In the 10m Running Target event, safety is mainly common sense. Although the potential for serious injury is limited, careless gun handling could suggest that a shooter might be equally careless with his Running Boar or Running Deer rifle and is dealt with seriously in any respectable shooting club.

In Running Boar and particularly in Running Deer shooting, there is a great potential for a serious accident if safe handling procedures are not followed. Whilst in the 'ready' position an accidental discharge can 'sky' a shot and, if it is a centre fire Running Deer rifle, that shot can travel a very long way. The primary safety factor comes from the Range Safety Certificate which, in the UK, was formerly issued by the MoD but is now issued by one of the two National Governing Bodies (NRA and NSRA) for civilian shooting. Firearms Certificates, unless they are issued for hunting, are endorsed to prohibit any shooting except on a range with a relevant Range Safety Certificate. However, the MoD criteria, which are based on many years of experience with both civilian and military ranges, are still used. In Britain there are three types of Certificate:

The ‘No Danger Area Range’. This relies on engineered features to contain any shot fired. It is often a fully enclosed pistol range or small bore rifle range. It may have a bullet and ricochet proof roof; without a substantial bullet proof roof, the walls, particularly behind the target line and on its flanks are high enough to stop any carelessly discharged shot. Overhead baffles might be used to reinforce safety. If it is a fully enclosed building, its construction must not only prevent a projectile leaving the premises, it must also ensure that ricochets within the building cannot cause injury or damage. It is possible to construct an indoor No Danger Area Running Boar range. However, this would require a minimum area of 60 x 20 m: the roof must be self supporting (no roof pillars) as well as being bullet proof and the walls and roof would have to be adequately baffled to prevent or restrain ricochets. Any such building would be expensive and it would be very difficult to adapt an existing building. There are two indoor Running Boar ranges as part of the purpose built “Finals Hall” of the Munich Olympic Shooting Centre, but such an indoor range is the exception.

The 'Gallery Range'. The primary protection is a physical barrier such as a stop butt which may not be high enough to stop a bullet fired high hence it is combined with a safe area behind the targets. The Range Safety Certificate for a 'Gallery Range' must take into account the possible line of fire following an accidental discharge and the probability of such a shot going over the top of the stop butt. Because the range is not enclosed, safety on a Gallery Range relies on good range management and a program of sound shooter training and discipline. On a Gallery Range, shooting is confined to strict shooting lanes: each firing point has its own target; cross shooting is not allowed and there is a strict limit on how much the muzzle of a loaded rifle can be raised above the horizontal.

The 'Field Firing Range'. The Range Safety Certificate relies on having an extensive safe area behind the targets and to either side, although this safe area may not be large enough to guarantee that no projectile travels beyond range limits. Although there might be a stop butt, this is for convenience only and is not mandatory; its only specification is that it must not itself, be the cause of a dangerous ricochet. Its safety is dependent on good range management and safe disciplined shooting by its users. Shooting is through a defined arc of fire rather than in discrete lanes. A Field Firing Range is the usual requirement for a 50 or 100m Moving Target range.

There is also the 'Full Danger Area Range'. This type of range is only available for military shooting. The danger area is so great that projectiles cannot travel beyond its limits. It requires a considerable area of land especially for centre fire rifle shooting and will often be part of a simulated 'Battle Range' designated for use by heavy artillery.

The Range Safety Certificate will specify which calibres are permitted and any other restrictions. It is reinforced by Range Safety Regulations which specifies how shooting is to be conducted so as to ensure that every shot (including ricochets) will remain within the safe area. The Range Officer, appointed by the club using the range, who is directly responsible for range safety whilst shooting is taking place, must ensure compliance with the Range Safety Regulations. The Range Officer will often be a qualified "Range Conducting Officer", trained to exacting MoD standards.

Although the arrangements for other countries are different and different terminology may be used, the general principles are the same as in Britain.

Important safety points include:

Only suitably experienced persons are allowed to shoot unless they are under the close supervision of an experienced shooter.

Guns are only loaded when it is safe to do so and on the Range Officer's command.

Guns are never 'pointed', aimed or 'snapped' in a direction where they could not be fired safely.

Every shooter has a duty to be aware of potentially unsafe practices by himself and by other shooters, and to take whatever action is needed to ensure safety.

Every shooter must be aware of the danger associated with a shot fired high that might travel outside the designated danger area.

Every shooter should be aware of the signs of overpressure or incipient damage to his gun or ammunition.

No gun should leave the firing point unless the action is open preferably with the bolt removed and / or the action open with a 'Breech Flag' in place, it has been verified by a second person (usually an appointed Range Officer) to be unloaded and with any magazine removed or proven to be empty.

Although the more serious accidents are always uppermost in shooter's minds, some of the more common 'incidents' are concerned with gun or ammunition malfunctions. A misfired gun is still a loaded gun until it can be made safe and proved to be safe. The cause of the misfire can be either the rifle (a 'light strike' by the firing pin) or a faulty primer. *[Although it is a rare occurrence, it has been known for a primer that has been given a light strike by the firing pin to detonate several seconds late (a "hang fire").]* All Running Deer shooters should be aware of the signs of potentially dangerous ammunition, whether it is home or factory loaded. These include malformed or pierced primers, raised or cratered primers, case bulges or splits or difficult spent case extraction. These all indicate excess pressure in the rifle chamber. Whilst the obvious cause of excess pressure is a cartridge which has been overloaded with powder, there are other causes of high pressure. These include the use of a cartridge case which is too long for the rifle

chamber, a bullet which is too heavy for the powder charge, a bullet which is a tight fit in the chamber or a badly fouled barrel or chamber.

Overloaded or incorrectly loaded ammunition is dangerous, and every home loader is responsible for his own safety and the safety of those nearby. Underloaded ammunition (i.e. with no or too little propellant in the case) can lead to a barrel blockage and severe damage if any attempt is made to fire a subsequent shot such as in the Running Deer Doubles. Other important points are that the rifle must be fitted with the correct bolt and loaded with the correct ammunition. Sometimes a bolt which is too short, from a similar rifle of different calibre, can be fitted. If the action is one in which the bolt's locking lugs are at the rear; it can be fired with the cartridge supported only on the extractor. When the rifle is fired, part of the cartridge case is unsupported and the case will burst. It is also possible in some circumstances to attempt to fire the 'wrong' calibre of ammunition with possible dangerous consequences.

Whilst the Running Boar shooter should not have to face the same potential problems of dangerous ammunition, he should be aware that even .22RF cases do sometimes split. The consequences are usually minor, but the cause should not be ignored. Case rims have been known to split, releasing hot gases. This is more likely with high velocity 'hunting' ammunition. A weakness of any .22RF rifle lies in the area of the extractor groove. The case has minimal support in this area, and wear from long usage can weaken the remaining metal to the extent that a bulge is formed in the fired case at this point. This suggests that failure may occur soon. All shooters should occasionally examine their spent cases for signs of incipient failure, especially when high velocity ammunition is used.

Most ranges insist that cartridge rifles are demonstrably safe when they are taken from the firing point. This is more difficult with some air rifles. The obvious way to deal with a cartridge rifle is to remove the bolt, but this may not be easy when a high cheekpiece is fitted. An alternative is to use one of the 'Breech Flags' which are now available or which can easily be improvised and which leave no-one in any doubt that the rifle cannot be fired; however, they can conceal a cartridge inside the magazine. The bolt and 'scope should always be removed for air travel otherwise the bolt will act as a fulcrum resulting in a broken stock, or the 'scope will be damaged should the gun case be dropped. Without its 'scope, the rifle looks less 'threatening' during the routine airport checks by airport security staff which are carried out before any gun can be accepted as baggage.

Instruction in safety is part of the training given to any shooter when they first join a club and this is often embodied in the legislation governing club membership. Normally they are not allowed to shoot unless closely supervised, until they have successfully passed a probationary period. The Range Officer must be satisfied that they understand and will comply with the Range Safety Regulations. Currently, in the UK, no-one is allowed to shoot anything other than a Small Bore manually reloaded Rifle on any Military Range (which includes Bisley where the Range danger Area is shared with the nearby Military Pirbright ranges) without a recognised "Certificate of Competence" issued by the National Governing Body or by the chairman of his club, unless they are under close supervision by a qualified person.

Chapter 2 The Basics of Moving Target Shooting

2.1 The 10m Running Target Match

Running Target Shooting is shot at a distance of 10m using a 4.5 mm (.177") calibre air rifle equipped with a telescope sight. The sight magnification must not exceed 4x, a variable power 'scope is not allowed even if it is adjusted to 4x. The overall weight of the rifle and sight must not exceed 5.5 kg. There are no restrictions on the trigger pull.

When paper targets are used this consists of two scoring diagrams 140 mm apart with a central black 'aiming' mark which is 15.5 mm diameter. The scoring diagrams use the same ring dimensions as the static air rifle target, and the same size of 'black', but the rings are scored differently, with the conventional '9' ring scoring '10' etc. It is the TRAILING diagram that is shot every time. The ISSF Rules now recognise the use of an 'Electronic Scoring Target'. The arrival of the shot at the target plane is detected by a series of microphones and a microprocessor is used to determine the co-ordinates of the virtual shot hole. There are no scoring rings on the target face itself. Because there is only one set of electronics, a central scoring area is flanked by two 'aiming' marks the centres of which are 70 mm either side of the centre of the scoring area. Both types of target are permitted in ISSF championships, but the convenience of the electronic targets has made them the norm for major events, and for those clubs which take the event seriously. For the shooter, despite the obvious target differences, the technique is no different on paper or electronic targets.

The target starts on the right. The shooter is allowed four sighting shots, two in each direction. For the sighting shots and the first shot of a match series, the shooter adopts the 'ready' position and, when he has prepared himself, calls 'READY' and the target is released immediately. When the target appears, and not before, he raises the rifle to his shoulder, aims (a little ahead of the scoring diagram), and fires. The target has a 'run' of 2 metres as perceived by the shooter, and in the 'slow' runs this takes 5.0 - 5.2 seconds. For subsequent runs, the shooter does not call 'ready' but the target is released about 2 seconds after the shooter is seen to be in the 'ready' position by the range operator. The course of fire is 30 shots (20 shots for the ladies match), 15 (10) in each direction. This is followed by a similar course of fire, the 'fast' runs, in which the run time is 2.5 - 2.6 seconds.

Taking the 'slow' runs first, if he is using a simple telescope sight, when he raises the rifle to his shoulder, the shooter must first 'find' a view through the sight and then align it with the target. The area of aim is about 20 - 25 mm ahead of the centre of the scoring diagram, roughly in the '3' ring. He must 'follow' the target until he is satisfied with his aim and then release the shot. In the 'fast' runs everything is the same but done in half the time, the 'lead' is about 40 -50 mm that is midway between the black of the scoring diagram and the black of the 'aiming' mark. This point of aim is not easy to identify but in practice, the shooter has to do so much work to follow the target that the precise point of aim is academic until he is shooting quite high scores. More sophisticated sights are available to overcome this problem and they will be described later. It is much more important to gain some real experience in shooting this match. Too many shooters are deterred from taking up Moving Target shooting because they think that a state-of-the-art rifle and 'scope are essential, whereas such equipment demands extensive experience before its benefits are measurable. Indeed, a novice shooter confronted by advanced equipment will be at a disadvantage. As always in shooting sport, a rifle and sight you are comfortable with is better than a technically correct rifle that just doesn't feel right!

There is also a Mixed Runs match in which the shooter does not know if the target will run slow or fast. The ISSF Rules require an equal number of slow and fast runs right and left, in two series of 20 shots, each preceded by two slow and two fast runs as sighting shots.

2.2 The 50m Running Boar Match

Until 1988, Running Boar was the Olympic Moving Target event. As the name implies, the target is in the form of a Wild Boar. It is shot at 50m using a 0.22" Rimfire (.22RF) rifle having a minimum trigger pull of 500 g. The scoring rings are (relatively) larger than for the air rifle match. There is no restriction on the dimensions and magnification of the sight used, although there is still an all-up weight limit of 5.5 kg. Telescope sights of 20x magnification are not uncommon amongst the experts, but these require considerable skill to use them because of the very limited field of view.

The course of fire is identical to that for the 10m Running Target event. There are slow runs (5 - 5.2 seconds), fast runs (2.5 - 2.6 seconds) and mixed runs. The crossing distance is 10m. In the 'slow' runs, if subsonic ‘match’ ammunition such as Eley TENEX or CLUB is used, an aiming point of the eye, or just below it is very easy to identify with a cross hair 'scope. However, in the 'fast' runs, the aiming point would be >100 mm in front of the nose, an impossible aim as it is off the card. If High Velocity (hunting) ammunition is used, then an aim on the tip of the nose for the ‘fast’ runs is about right. If this ammunition is used for the 'slow' runs, the aim is in the jowl which is less easy to identify. It is not unusual for different ammunition to be used for the different speeds. Like the 10m match, a specialised 'scope allows a choice of aiming point and makes a change of ammunition irrelevant.

There is also a 50m Mixed Runs match.

2.3 The 100m Running Deer Matches

This is quite a different event. It is shot at 100m using a centre fire, manually loaded rifle. Most shooters use a sporting rifle, although match type rifles are available in a suitable calibre. The target is in the form of a Red Deer; the run is 23 metres in about 4.3 seconds. Instead of fast and slow runs, there are separate matches for 'Singles' and 'Doubles' when TWO shots must be taken with each run of the target. Although any centre fire calibre (up to 8 mm depending on the range safety certificate) is permitted, ammunition with adequate velocity (>900 m/sec) and minimal recoil (for the 'Doubles' match) is needed. The most popular calibre is .222REM, and with this, at about 950m/sec (3100 ft/sec) the aiming point is a little in front of the chest and directly below the eye. Many shooters zero their rifle to shoot about 0.5 m low so that they can aim on, or a little below the eye. This aim is encouraged by the fact that before the target appears, the antlers can be seen above a screening wall. Although the target is still accelerating, this 'antler run' is essential in the 'Doubles' as it enables the shooter to have his sight lined up on the point of aim before the whole target (i.e. the scoring zone) appears.

The Running Deer matches are immensely enjoyable despite the high cost of ammunition. Most regular shooters reload their ammunition to keep costs down.

2.4 Relationship between the Scores

The maximum score from one shot at the Running Deer is 5 not 10 as on the Running Boar and Running Targets. From the angular dispersion and allowing for the size of the gauged shot hole, a shot which will score a '4' on the 100m Running Deer will score '7' on the 50m Running Boar and only ' 4' on the 10m Running Target.

There is an approximate relationship between 50m Running Boar and 10m Running Target scores. This is:

$$[\text{Score10}] = ([\text{Score50}] \times 1.25) - 165$$

This relationship has been calculated using statistical probability based on the angular spread of the shot holes on the target and has been validated against scores recorded in events where the same shooters compete in both 10m and 50m events. Because the spread of scores is much greater for a novice or a 'club' level shooter than for an expert, this relationship is less reliable for the lower scoring competitors. There is no similar relationship available for the 100m Running Deer because the 1 and 2 scoring areas have an irregular shape.

Chapter 3 Equipping Yourself

Anyone who wishes to take up Moving Target shooting should not think about buying any equipment until he has had the opportunity to try the event for himself using borrowed, hired or 'club' equipment. He should also have the benefit of some formal instruction before attempting to shoot at any moving target.

For 10m Running Target shooting, there are several clubs throughout Europe including Great Britain, and most other Countries with a tradition of target shooting, who have equipped themselves with a suitable range. The best way to try this discipline is to join a suitable club where a qualified instructor and suitable equipment should be available. If you do not know of a suitably equipped club in your locality, then you should contact your National Federation who will provide you with information. Appropriate information is provided in Appendix 3 for potential Moving Target shooters in Great Britain.

For the 10m event, there is no need to use a special Running Target Air Rifle. Any 4.5 mm calibre (.177") air rifle fitted with a telescope sight can be used. The sight should not exceed a fixed 4x magnification, but at this stage this is not important unless you intend to take part in competitive shooting. Although variable power ‘scopes are prohibited, the beginner should not be deterred if he can set his ‘scope to 4x. Most sporting air rifles can be used and may be much easier for a young or inexperienced shooter to handle than the heavy match rifle. There is no need to think about buying any special equipment, just use what is readily available. Likewise for the 50m and 100m events (but there is no restriction on ‘scope magnification), however, as the rifles used in these events are classified as 'firearms' in most countries (air rifles are usually not), a suitable rifle might not be so readily available. Most clubs where these events are shot will have a suitable rifle and appropriate ammunition for loan to members who do not possess their own.

As your standard improves, you will want to acquire your own Moving Target Rifle(s) or to modify and adapt an existing rifle, and to learn the techniques needed to become a competent Moving Target shooter.

Now read on:

Part 2 The Course Of Fire

This part of the book gives a general description of the course of fire for the different events. The ISSF Rules for the Moving Target events are summarised in Appendix 2 which should be read in conjunction with this part of the book. Every shooter who has any intention of taking his sport seriously must have access to a copy of the current ISSF General Technical Rules and the Special Technical Rules and be familiar with their contents.

Chapter 4 10m Running Target Shooting

This event is shot, from the standing position, with a 4.5 mm (0.177") calibre air rifle. The propellant gas may be compressed air or carbon dioxide CO_2. The projectiles must be made from lead or other soft (i.e. readily deformable) material. Although the ISSF Rules permit any shape of projectile, the use of match quality 'wadcutter' ammunition is universal and makes accurate scoring easier. Also, with a match quality air rifle, this ammunition is significantly more accurate at 10 m than pellets designed for vermin shooting at longer ranges. As the name implies, the shooting distance is 10 m. The target crossing distance is 2 m.

The principle behind the 10m Running Target match is no different to the other Moving Target events. The shooter prepares himself, adopts the 'ready' position (see the Chapter on 'The Ready Position') and then he calls 'READY'. The target appears immediately, from the right. The shooter raises the rifle, which is fitted with a telescope sight, to his shoulder, find his aim and then fire the shot, this is at the trailing (i.e. right) scoring area. The target then disappears behind the 'wall'. The value of the shot is then signalled using a mechanical or electrical system. Unless Electronic Targets are being used, the value of the shot will only be an estimate at this stage; a gauge is not used. It is usual to have a Closed Circuit Television (CCTV) so that the shooter can observe the shot and make any necessary adjustment to his sights or to his aim. He reloads and comes to the 'ready' position again and when he is ready, he calls 'READY'. The target next appears from the left and he shoots at the trailing scoring area, now on the left.

The shooter is allowed four sighting shots on a specially marked target, calling 'READY' for each shot, and then he must begin his match. The procedure is the same, but he calls 'READY' only for the first match shot. He may not raise the rifle from the 'ready' position until the target has appeared from behind the 'wall'. After the first shot, the target is released about two seconds after he comes into the ready position. The rhythm of shooting is such that there should be not more than 20 seconds after the completion of the previous run before the target starts again. Only two shots are fired on each target, one on each scoring area, after which the target is changed. The course of fire is for four sighting shots then 30 shots to count on the slow runs when the target must cross the 2 m gap between the 'walls' in 5.0 - 5.2 seconds. After every competitor has completed his slow runs, the process is repeated with the fast runs when the crossing time is 2.5 - 2.6 seconds.

In the Ladies Match, the procedure is identical except that the course of fire is for four sighting shots and then 20 shots slow runs followed by four sighting shots and 20 shots fast runs. Most ladies will opt to shoot the full 60 shot course of fire during training or in local matches.

Whist the firer is shooting his series, the next shooter on the programme to shoot on that range is allowed to 'dry fire' a full series. For this he stands to the left of the shooter, separated from him by a screen. 'Dry firing' means releasing the trigger of an unloaded rifle without releasing a bullet or propellant gas. This is an important part of the final match preparation for the shooter.

In a major match, targets are changed for formal scoring and, if necessary gauging, after every pair (L & R) of runs. In a club match or when training, it is usual to fire five shots on each diagram before the target is changed.

The foregoing procedure applies when paper targets are being used. When an Electronic Scoring Target is used, there is only a single central scoring area which is flanked by two aiming marks. As far as the shooter is concerned, the procedure is identical as what he sees in his sight is the

same. However, the shot position and value are shown on the computer monitor as well as the total for each ten shot series. Because targets do not have to be changed between runs, the whole procedure is usually much quicker and it is usual for the shooter to come into the Ready position in much less than the maximum permitted 20 seconds.

For the Mixed Runs match the course of fire consists of two series, each of which has four sighting shots (two slow and two fast runs) followed by 20 scoring shots. In the Mixed Runs match the shooter does not know in advance if the target will emerge slow or fast. There must be an equal number of slow and fast runs from each side in each series, and no more than five consecutive runs at the same speed.

Chapter 5 50m Running Boar Shooting

This is shot with a 5.6 mm rimfire rifle (0.22LR): only one cartridge may be loaded for each run of the target. It follows that the rifle should be capable of being loaded singly. The use of 5.6 mm Centre Fire calibres or a rifle chambered for 0.22" magnum ammunition is prohibited. Although the ISSF Rules do not specifically prohibit the use of tracer ammunition, local rules probably do.

The course of fire and general range procedure is the same for the 50m Running Boar events as the corresponding 10m Running Target events. Apart from the difference of scale, (50 m range and 10 m crossing distance), there are some differences in range administration which are important to the shooter.

When paper targets are being used, separate targets are used for the right and left runs of the target. At the completion of each run, the targets are changed over using a simple mechanism on the target frame. Because the target is so much larger, 15 shots plus two sighting shots are fired at each target (10 +2 for the Mixed Runs event). After signalling the estimated score, which may include the use of Closed Circuit Television equipment, the shot holes are patched. The sighting shot holes are covered with a black patch; the scoring shot holes with a transparent patch. The last scoring shot hole on each diagram is left unpatched. (When there are several transparent patched shot holes on the target face, it will be helpful if the marker points to the last hole with a pen that can be clearly seen on the monitor before he patches it. The targets can then be taken to the scoring office where the final value of each shot can be assessed. The transparent patches used can be carefully removed if necessary to permit the use of a gauge. To aid the scorers, any misses are noted by affixing the appropriate patch to the target outside the scoring area.

Because targets do not have to be changed each time, and because reloading involves less physical effort than an air rifle, the natural shooting rhythm is usually faster and so the time allowance between runs is up to 18 seconds.

In all but a major match, it is usual to set up two targets 'back to back' rather than using separate targets. This then makes for less work in the target pit. The shooter fires at the leading target which must appear nose first. This is different to the 10m event (on paper targets) in which the shooter fires at the trailing target. Part targets are used to 'repair' a full target. These are printed with only the scoring rings and the 'nose' of the Boar. These are less costly than the full target. For training, only the scoring rings need to be replaced, but the repair centres must then be very carefully aligned with the rest of the target which has the aiming area.

Electronic Scoring Targets are also available for this event and may use a variety of different target arrangements. The simplest is a two headed target so that a common scoring area can be used. Other systems use two separate target faces but with a mechanism that interchanges them between left and right facing runs so that only one set of electronics are needed. Such a mechanism must be very precise so as to maintain the relationship between the aiming area and the centre of the scoring area. At the firing Point the shooter can see his shot(s) displayed on a representation of the target on a computer screen. The shot value, the cumulative score and the average shot value are also displayed. At the present time, Electronic Scoring Targets are not approved for ISSF Championships in the 50m Running Boar event but are being used increasingly for Club level and even National level events. Most Electronic ranges can also be used with paper targets when necessary. The basic ISSF requirement is that when Electronic Scoring Targets are used, their accuracy and score reproducibility should not be worse that the

equivalent paper target. As the visible aiming point does not coincide with the unseen point of impact of the projectile, this is not as easy to achieve as it might seem.

Chapter 6 100m Running Deer Shooting

This is shot with a Centre Fire rifle. The Nordic Shooting Region rules specify that the calibre must not exceed 8 mm. The rifle may only be reloaded manually after each shot. Automatic, semiautomatic and double barrelled guns are prohibited. Local laws may prohibit or restrict the use of certain types of rifle (such as a 'pump' action rifle). The use of tracer, incendiary and explosive bullets is prohibited. The Range Safety Certificate (or its equivalent) may further limit the calibres or type of ammunition that may be used.

Although there is much in common with the techniques used in the 10m and 50m events, the course of fire for the Running Deer event is quite different. The range is 100m and the target crossing distance ~23 m. However, after the target leaves the pit area, the 'antlers' can be seen over the top of a wall for 1 - 2 seconds before the full target appears. During this period the target mechanism accelerates and it must reach its full speed at least 0.5 seconds before the full target emerges. As soon as the antlers appear, the shooter may raise the rifle to his shoulder. This 'antler run' can be very helpful to the shooter in the Doubles event.

The crossing time between the walls when the target is fully exposed is 4.3 ± 0.2 seconds. All target runs are at the same speed; there are no slow and fast runs. Because of the size of the target, a pair of targets is invariably used 'back to back' (sometimes with a common central scoring area). The shooter fires at the leading target that appears nose first. All scoring is done from the pits and shot holes are gauged and patched before the target runs again. A register keeper is responsible for an independent record of the score that can be used to verify the score signalled. Because of the size of the target, it is not practicable to use a Closed Circuit Television system to indicate shot position to the shooter. A simple mechanical signalling system is normally used. Electronic Scoring Targets are being used increasingly.

In the Running Deer Singles, one shot is fired at each run of the target. The course of fire is for two series each consisting of four sighting shots and then 20 shots to count. Because ammunition is expensive, a shooter will sometimes not take all of his sighting shots. In domestic shooting, he will usually tell the range officer how many sighting shots will be taken, who will in turn inform the marking pit and the number of runs of the target will be adjusted. In a domestic match, 'convertible' sighting shots are sometimes allowed to save on ammunition costs. The shooter opts for the value of his sighting shots to be counted in place of the first shots of the match.

In the Running Deer Doubles the procedure is the same except that the shooter fires up to two shots on each run of the target. Reloading between shots must be 'manual' i.e. by means of a bolt, lever or 'pump' action rifle. Semiautomatic rifles are not allowed. (Note that in Great Britain, a semiautomatic or pump action centre fire rifle is classed as a prohibited weapon and cannot be used legally for this competition.) Again the match is in two series of 20 shots, (i.e. ten runs of the target), preceded by up to eight sighting shots (i.e. four runs of the target). During the sighting runs, the shooter may opt to take fewer than eight shots. Again, in domestic matches, the shooter may ask for fewer sighting runs of the target or he may 'convert' his sighting shots into scoring shots.

Like the 50m and 10m disciplines, Electronic Scoring Targets are sometimes used. At the firing Point the shooter can see his shot(s) displayed on a representation of the target on a computer screen. The shot value, the cumulative score and the average shot value are also displayed.

Part 3 Equipment For Moving Target Shooting

There is no necessity for anyone taking up Moving Target Shooting to feel that he needs to buy expensive equipment. Although the equipment such as the rifle, sight, jacket and boots used by a top International Shooter may be expensive, they are not essential for a novice or even an experienced 'club' shooter. This is emphasised throughout this book. Provided that the requirements of the ISSF Rules are met, a lot can be done with existing or relatively inexpensive equipment to help the recreational shooter enjoy his sport. Even equipment that does not meet the exact requirements of the ISSF Rules can be used to enjoy the sport provided that the shooter is aware of the limitations of the use of his equipment and understands that he cannot use it to take part in formal competitions.

There is a great tendency amongst all shooters to believe that technically excellent equipment will necessarily improve scores. At the bottom line, the rifle, 'scope and clothing are tools. They have a job to do; provided that they do the job efficiently, no more need be asked of them. It may satisfy some ego to know that the rifle is built to 'Rolls Royce' standards, that the 'scope is optically perfect and that the shooting jacket is the most expensive available. Unless these actually improve the score, the extra money would have been better spent on more ammunition for training.

As a Coach, I am often asked to recommend the purchase of some item of equipment. My usual answer to the question is to say that "If you need to ask, then you are not ready to change your present equipment". I also remind the questioner that any change to his equipment, no matter how desirable in the long term, will set back his immediate performance until he has fully integrated it with his own technique and style of shooting.

Chapter 7 The Rifle

Although specialist rifles are made for all the Moving Target disciplines, no-one need be deterred from taking up Moving Target shooting for lack of an expensive rifle. Apart from complying with relevant ISSF Rules, the demands of the disciplines are minimal. The rifle should be capable of adequate accuracy, in relation to the target, over a typical course of fire (e.g. 30+ shots); it should have a satisfactory trigger mechanism and must be capable of accepting a suitable telescope sight. Whilst many other features are desirable, and are built in to the specialist rifles, it is not difficult to adapt most rifles to handle and shoot almost as well as any of them.

All shooters, most of all those using a Sporting Rifle of any sort, have an intense pride in their rifle and other equipment. Sometimes this can cause them to choose a rifle simply because it is a new or innovative design rather than because it is suitable for their discipline. They will spend several thousand pounds on a hand built rifle just because it is expensive and therefore “it must be good”. On the other hand, others will pride themselves on using a rifle long since out of production simply because it fits them well and shoots well. Most rifles have an action and barrel that are accurate enough for Moving Target shooting, how well it fits you is more important; how it looks is immaterial. The words “fit for purpose” come to mind. One well known British Moving Target shooter used rifles (and pistols) that had the appearance of being held together with “binder twine and creosote”. Needless to say, in his hands they shot superbly well!

The key to good Moving target shooting is a rifle which 'feels right' to the shooter. Pin sharp accuracy from the test bench is immaterial if the rifle does not come up to the shoulder easily and 'point' well at the target. An experienced shooter knows immediately if a rifle feels right, and he will go to much trouble to adapt even a specialist rifle to fit his own physique and to feel exactly right for him. Some Centre Fire sporting rifles are incapable of putting 30 shots into a small group on the target in under 10 minutes: the point of impact changes as the rifle barrel warms up. Otherwise almost any rifle that complies with the ISSF Rules for the discipline will be capable of the required accuracy. The 'bull's eye' for all these events is quite large in relation to the static shooting disciplines and even a relatively inexpensive rifle, if it can satisfy the ISSF Rules and accept a 'scope sight, can be made suitable. In the next part of this book I will describe how to adapt a rifle to make it more suitable for Moving Target shooting. In the following sections of this chapter I will describe the attributes that are needed.

In all of the Moving Target disciplines, the rifle must be of a suitable calibre and type. The calibres are:

10m Running Target 4.5 mm (.177") air or CO_2 rifle
50m Running Boar 5.6 mm Rim Fire (.22LR) rifle
100m Running Deer any Centre Fire calibre up to 8.0 mm.

The overall length of the barrel and action must not exceed 1.00 m measured from the rear of the mechanism of the air rifle or the closed bolt of the cartridge rifle.

The overall weight (including sight) must not exceed 5.50 kg.

The buttplate may be adjustable but must not be longer than 150 mm and the depth of curvature must not exceed 20 mm. No part of the buttplate, in its lowest position, may be more than 200 mm below the centre line of the barrel.

The centre line of the sight may not be more than 75 mm above the centre line of the barrel.

A barrel extension is permitted but no part of it may be more than 60 mm from a line drawn through the centre of the barrel.

For the Running Boar and Running Deer rifles, the trigger pull must be greater than 500 grams.

For the Running Target and Running Boar, the rifle MUST be capable of being loaded easily with a single projectile even if a magazine, integral or detachable, is fitted.

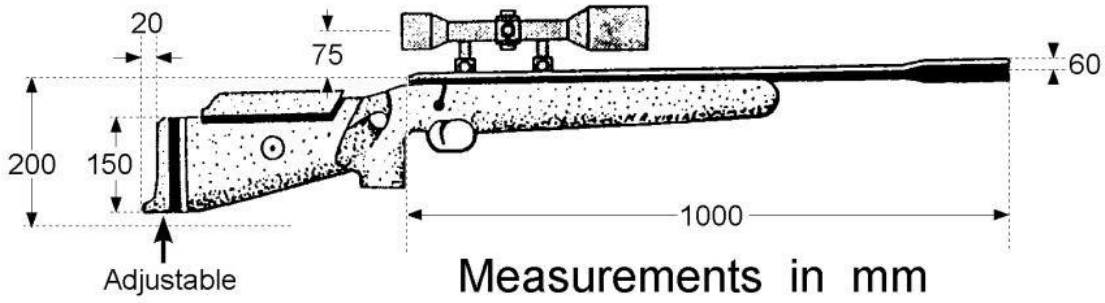


Fig. 7.0.1 The Moving Target Rifle

Note: Up until 2010 there was an overall length limit to the 'scope used on the 10m RT Air Rifle. This no longer applies and there is now no overall length limit for the 'scope on a rifle used in any Moving Target discipline. However, the magnification of the Air Rifle 'scope must not exceed 4x.

7.1 The 10m Air Rifle

Specialist air rifles are currently made by several manufacturers including Feinwerkbau, Walther and Anschutz. Until recently, most rifles were of either the single stroke pneumatic type or were pre-charged with CO_2. The latter were never successful as the action was chilled with every shot fired and the relatively rapid rate of fire did not allow recovery: hence inconsistent pellet velocity. More recently, there has been a move towards rifles which are pre charged with compressed air which do not suffer the problems of CO_2. These use a special valve and regulator to ensure that pellet velocity remains constant as the air pressure in the reservoir falls. All are available for a left handed or right handed shooter. Older specialist rifles include the earlier Feinwerkbau 300 models and the Walther LGR. The former is a spring operated rifle, the latter a single stroke pneumatic.

The pros and cons of the different types of specialist air rifle are worth considering:

The spring operated rifles are very robust but, despite the suppressed recoil of a ‘match’ rifle, they do suffer from some vibration on firing. The 'lock time' of these rifles is very long because of the inertia of the piston and its spring. However, because the pellet is given a long slow 'push' from the air compressed by the spring, they have a reputation for being able to digest almost any pellets, even badly distorted ones, without significant loss of accuracy. They are also very insensitive to temperature and air pressure (i.e. altitude) variations.

The later pneumatic air rifles are virtually vibration free and give a very consistent performance. Their 'lock time' is very short and, coupled with a short true barrel, give the effect of the pellet seeming to leave the barrel immediately the trigger is pulled, almost like a centre fire rifle. The earlier pneumatic rifles such as the Walther LGR, because of the design of their valve mechanism, were very much slower in this respect. They require the shooter to anticipate the release of the shot and then to 'follow through' meticulously. Most of the match quality air rifles of the 1980's were of this type. A long cocking lever is drawn back fully and then forward again to compress a charge of air into the reservoir, often with considerable effort on the part of the shooter. (There is a knack to this and each rifle is different; with experience you seldom notice the effort needed to charge these air rifles!) When the trigger is operated, this air is released to drive the pellet through the barrel. All of the pneumatic air rifles can be sensitive to pellet skirt size. The sudden release of the highly compressed air gives a sharp impulse to the pellet and does not give time for it to form itself into the rifling in the way it does in a spring operated air rifle. Thus the pellet manufactures now offer a range of skirt diameters so that the shooter can choose the optimum pellets for his rifle. (Most now optimise at 4.49 or 4.50 mm skirt diameter.) Not that the cheaper, unsized, pellets are poor performers: it is just that these pneumatic rifles are capable of such extreme accuracy when correctly fed. Their one drawback is that the single stroke pneumatic air rifles are sensitive to temperature and to air pressure, and may give a reduced velocity at high altitude. However, they are consistent performers under any given ambient conditions. Pre charged pneumatic air rifles do not suffer in this respect.

The later versions of these air rifles used a pre charged cylinder of compressed air. A valve and regulator system ensures that the pressure and volume of air used form shot to shot is consistent. The popularity of the pre charged pneumatic air rifles stemmed initially from their lack of effort to load and their almost complete absence of vibration when firing. However, the later designs have a lighter action and use a short true barrel (with a long extension) to optimise the pellet's velocity. This gives the designer, and user, more freedom to balance the weight of the rifle to achieve near perfect handling. Current pre charged pneumatic air rifles are significantly lighter and better balanced that their single stroke charged predecessors.

The air cylinder on a modern pre charged air rifle is normally filled to a maximum working pressure of 200 bar and most Air Rifles will work with a pressure down to about 60 bar. This usually means up to two full match series, although most shooters will recharge their cylinders after each full series. They should preferably be charged from a storage cylinder containing high pressure "Breathing Quality" clean, dry, oil free, compressed air. They can also be recharged with a small electric compressor or with a simple hand pump. Neither is recommended on a regular basis as it admits some moisture which could ultimately lead to corrosion of the delicate valve and regulator mechanism. If a storage cylinder is used it can either be the type used by divers which can be charged at a ‘diving station’ up to <300 bar, or be the type used by emergency services on dry land which is usually charged to <230 bar. Whilst the former has a much longer time before a refill is needed, they must be subjected to more frequent pressure tests and inspections than the latter. A club might choose to install a high pressure compressor. However, this must include provision for drying the air. A large compressor cannot be used to charge small rifle cylinders directly but must have a large capacity buffer cylinder. The compressor is only used to keep this cylinder topped up. The whole charging system is subject to regular statutory

pressure testing and examination which can be an expensive overhead. If there is a diving station within easy reach, a 15 l gas cylinder will last even an active club several months between refills.

Air rifles powered by CO_2 became popular in the 1980's. As CO_2 is not a gas but a vapour, under compression it liquefies and so a very simple valve mechanism can be used to release a constant volume of the gas at a constant pressure. The CO_2 rifles are very similar in many respects to the pre charged pneumatic air rifles. One real drawback is that CO_2 being a vapour and not a true gas, is very much more sensitive to ambient temperature than air. Under pressure it is a liquid at normal ambient temperatures; at about 32 deg. C it becomes a gas and the pressure can take a sudden upward boost. Not only that, but when the vapour expands on release, it has a marked chilling effect on the valve and transfer port. The energy needed to convert liquid to vapour is taken from the rifle's action i.e. the valve mechanism. When compressed air expands it too chills its surroundings but to a very much lesser extent and the valve mechanism compensates for any change in temperature. With CO_2 the vapour is held at a constant pressure dependent only on its temperature: the effect of cooling the action is to reduce the temperature and hence pressure of the chamber for the next shot to be fired! Because of this chilling effect, it is necessary with a CO_2 rifle, to pre-cool the mechanism by discharging a few charges of gas before the important match. The static rifle shooters with unlimited sighting shots have no problem. The Running Target shooters with only four sighting shots cannot afford to waste them and so must chill their rifles on a nearby static 'test' range before going onto the firing point. Also, because the Running Target event demands a fairly high rate of fire compared to the Match Air Rifle events this exacerbates the chilling effect. This; coupled with the fact that CO_2 rifles are less consistent than their pneumatic equivalents and the need to find a supply of refill gas, has made them much less popular. Many of the match quality CO_2 air rifles and pistols that were used up until the early 1990's have been converted by their manufacturers to use compressed air and they are seldom seen on the international ranges in their earlier CO_2 form. The cost of conversion is high and so it would not be advisable to buy one of these CO_2 powered air rifles with conversion in mind.

An important feature of both the pre charged pneumatic air rifles and those powered by CO_2 is that they have a facility for Dry Firing. This is an important part of the shooting procedure in the Moving Target events. This Dry Fire facility works as follows: the loading tap is opened in the usual way and this cocks the trigger mechanism. No pellet is loaded and the loading tap is left open. When the trigger is pressed, it appears to operate in the normal way but no gas is released. This is most important as release of gas would contravene the ISSF Rules. However, it gives the shooter all the mechanics of firing an actual shot and he can prepare himself both mentally and physiologically for his match.

It is important to note that charged cylinders of neither air nor CO_2 can be carried on any aircraft so that a reliable supply of gas at the match venue is important if travelling overseas. Most match organisers arrange a suitable supply of compressed air for competitors. This is often provided as a free service for competitors by the air rifle manufacturers. Unless it is a very big match involving many Match Air Rifle or Air Pistol shooters, CO_2 is unlikely to be provided nowadays.

Whilst it is certainly possible to use almost any air rifle for Running Target shooting, there is a distinct advantage in using a recoilless or suppressed recoil rifle. It is technically not possible to design a totally 'recoilless' air rifle. However, at typical air rifle velocities, most of the modern target air rifles have negligible perceived recoil. The earlier air rifles give a noticeable vibration on firing, but this occurs after the pellet has left the barrel. Most of the air rifles designed for the static 10m air rifle match can be adapted for Running Target shooting. However, for some like the Feinwerkbau 600 series, the toggle loading tap can interfere with the sight unless it is mounted very high. (For the Running Target version, the tap has been redesigned.) It would be pointless to buy a modern, but non specialist air rifle, specifically to adapt, but a shooter who

already owns a Target Air Rifle could use it for the Running Target event too. One exception would appear to be the air rifles marketed by Air Arms, These were originally designed for Field Target shooting but are now being made in a Match form. This is a relatively inexpensive pre charged pneumatic 'match' air rifle which can easily be equipped with a telescope sight and preferably a barrel extension, ready for Running Target shooting. Many of the earlier generation Target Air Rifles are readily available second hand, and are still in regular use by many club shooters. Their cost is a fraction of that of a modern specialist air rifle (but about the same as the Air Arms rifle mentioned above) and mostly, they are easily adapted. The Feinwerkbau 300 series, the various Anschutz models, the Walther LGR and the OriginalDiana Mod.75 can all form an excellent basis for a Running Target Air Rifle. Specialist Air Rifles designed for Field Target Shooting may be more difficult to adapt. They usually have a very short barrel with the weight concentrated over the action. Also, they tend to be made to deliver very high muzzle energy, and this could increase the perceived recoil compared with that of a Match Air Rifle as well as reducing the life of target back stops and Electronic Scoring Target pellet catchers.

Coming down the scale, the relatively inexpensive 'sporting' air rifles can also be used. The recoil and vibration of the spring guns is less of a disadvantage than might be supposed, except that it makes 'follow through' more difficult. Most of the disturbance occurs when the piston reaches the end of its travel which is after the pellet has left the barrel. Their main disadvantage is that many have a very heavy and imprecise trigger mechanism compared to a good match air rifle. Even the inexpensive 'break barrel' air rifles can be used. However, they impose limitations for adaptation because it is undesirable to add too much extra weight to the front of the barrel. Also, the stock is usually too short to allow a correct hold on the forend. The underlever or side lever air rifles with their fixed barrel are better in this respect. I can see little point in anyone purposely buying a sporting air rifle for Running Target shooting. However, if such a rifle is already available much can be done to adapt it and allow it to be used up to quite a high level of performance.

A newcomer to Running Target Shooting sometimes mistakenly thinks that there will be an advantage in having a rifle which has a high muzzle velocity. The only possible advantage would be that of a very slightly quicker "barrel time". However, this advantage is negligible compared to the overall time between the trigger releasing the mechanism to the pellet leaving the muzzle. The sometimes claimed advantage of shorter 'lead' distance is a myth. The emphasis should be on consistency rather than on achieving a particular muzzle velocity. The typical muzzle velocity of a modern match air rifle is about 185 m/sec. (~600 ft/sec). The performance of any air rifle is limited by the speed of sound in air (about 330 m/sec for compressed air and about 260 m/sec for CO_2). Although it is theoretically possible to exceed sound velocity, this could only be achieved if the gas is released at a very high pressure indeed, or if it is pre heated to quite a high temperature. Even at sub sonic velocities, as the muzzle velocity increases, the energy conversion efficiency of the air rifle decreases. Thus for a modest increase in velocity, the effort needed to cock the rifle, or the gas consumption of a pre-charged air or CO_2 rifle, will increase markedly. As shooting is done at a fixed distance, and at a target moving at a predetermined velocity, there is no significant advantage in having a higher than normal muzzle velocity, and there are some distinct disadvantages.

Modern air rifles, especially the 'match' rifles that may be used for extensive training and practice, are very reliable and need little maintenance. They need to be reliable as a typical international shooter can easily fire 25,000 shots in a year during training; this represents only one match series every day which is probably the minimum a serious Running Target shooter will need in training. For him, reliability, or easy access to an accredited repairer is an essential feature when choosing a new Air Rifle. The major manufacturers all provide a comprehensive repair and maintenance service at every major international event. This is usually free to competitors.

Looking after any air rifle is fairly straightforward. It is rare for a barrel to need cleaning and then, it is usually sufficient to shoot a few of the felt cleaning 'pellets' through it. More vigorous cleaning is best done with a 'pull through' although suitable cleaning rods are available. Modern air rifles are fitted with PTFE seals that need infrequent lubrication and then only with a silicone based oil or grease used sparingly. However, the manufacturer's recommendations must be followed as some synthetic lubricants can have an adverse effect on piston seals. The mechanical linkages need occasional lubrication. Because some lubricant may find its way into the air cylinder, this is best done with a recommended oil or grease too. Oil and grease should be kept away from sensitive trigger mechanisms unless the manufacturer advises otherwise. For an air rifle in frequent use, an annual overhaul by the manufacture or his accredited agent is well worth while. Dismantling by an 'amateur' should be avoided unless he has access to a supply of the necessary spare parts such as seals.

7.2 The 50m Small Bore Rifle

Currently, there is no specialist Running Boar rifle in production. However, the rifles made by Anschutz are still fully serviceable as their actions are still used in other products. It is just that, due to low demand, the specialist stocks are no longer made. The most recent Anschutz Running Boar rifle was fitted with a stock which is very similar to their current air rifle, and had an action based on their current small bore target rifles. There are many of the earlier Anschutz and Walther Running Boar rifles still in regular use and available second hand. These are all excellent for Running Boar shooting. All are bolt action rifles, and are single shot loading.

There are many small bore rifles target rifles available which can be adapted for the event. Rifles in the 'Free Rifle' class are too heavy and would need to be restocked completely, but the older ISSF "Standard" Rifles are excellent. The Anschutz 1407 / 1807 and their earlier versions are typical. The specialist prone rifles are less easily adapted, many of them have a very heavy barrel and would have a poor balance for Running Boar shooting and with no latitude for changing the balance. The main problem of adapting any of these rifles is the trigger. The typical trigger weight of 100 - 200 g must be increased to at least 500 g by the use of an additional spring. The trigger fitted as standard to the Anschutz 1407 and 1807 rifles can be easily adjusted up to the necessary 500 grams.

Sporting .22 rifles are very common and inexpensive. Most can be adapted but such a rifle should not be bought specially for this purpose and should only be used if already available. The best are those based on the same manufacturer's target rifles and which often share the same action but with a lighter barrel. Those which share their general design with a centre fire rifle are also usually quite good. Anschutz list a good range of 'sporting' .22's which are designed for different forms of sport shooting ranging from Biathlon through Silhouette Shooting to .22 Bench Rest shooting. They are most based around a simplified match rifle action and can obviously be adapted for the Running Boar. However, they are not cheap to buy and a second hand specialist rifle or match rifle would be a better buy. A bolt action is always preferable; a semiautomatic or lever action, although permitted under ISSF Rules, is rarely successful because these rifles are usually too light, badly balanced and often poorly made. They may not be permitted in some countries. To comply with ISSF Rules, they must be loaded singly rather than from a large capacity magazine. Some magazine fed rifles can only be loaded from the magazine and it impracticable to charge the magazine with a single cartridge for every run: they are thus unsuitable for Running Boar shooting. Semi automatic rifles with a tubular magazine under the barrel are poorly balanced and are difficult to adapt to the needs of Moving Target shooting. Because they too are difficult to load singly, they are not permitted under ISSF Rules. More

importantly, it may be very difficult to satisfy a range officer that the magazine is truly empty before leaving the range.

Although I would not recommend the purchase of a sporting rifle specifically for Running Boar shooting, an existing rifle can, and should be used. Certainly any beginner can learn the techniques and get a feel for the sport without committing himself to any major expenditure. Whilst minor deviations from the ISSF Rules can be permitted under local (club) rules, anyone using such a rifle must acknowledge that his scores could be disallowed in any major championship, if he is allowed to use it at all.

Apart from cleaning, little maintenance is needed on a small bore rifle. The need to clean the barrel and the frequency is controversial. Some Small Bore shooters never clean their rifle; others clean it often, even during a match between series, although this is never seen at an international match! Much seems to depend on the intensity of use of the rifle. A rifle that is in use daily may need cleaning only once a year. A rifle that is used once a month may seem to foul up quickly and must be cleaned more often. Fouling left in the barrel will oxidise and become harder and more abrasive; lead deposits oxidize over a few days or weeks to a harder more abrasive compound. A rifle with a stainless steel barrel is less likely to pick up fouling and will need less cleaning but only after it has been 'run in' and the bore polished. Such barrels are rare in a specialist Running Boar rifle. The general rule would seem to be that the barrel should be cleaned after use if the rifle is not to be used again for some time. Excellent advice on small bore rifle cleaning can be had on www.hps-tr.com/guidance/smallbore_clean.asp. My own preference is for the sparing use of a PTFE (Teflon) based cleaning fluid is an excellent way to preventing corrosion, removing fouling and discouraging further fouling. The chamber and bolt should be cleaned regularly to remove any build up of bullet lubricant. The bolt should also be kept very lightly oiled or greased; the modern PTFE (Teflon) based lubricants used sparingly on the locking lugs will ensure smooth functioning. Oil should be kept away from sensitive trigger mechanisms. All .22 target shooters know that most rifles with a carbon steel barrel will put the first one or two shots high on the target whether clean or fouled. Thus they need to be warmed up on the nearby test range before firing the first sighting shot. The use of a PTFE (Teflon) based lubricant / cleaner seems to minimise the problem which is much less with a stainless steel barrel.

7.3 The 100m Centre Fire Rifle

Very few specialist rifles have ever been made for this minority discipline. One current exception is by Tikka which unfortunately has a long throw action which is a disadvantage in the 'doubles'. However, some makers such as Weihrauch can supply a suitable action fitted into the stock of their ISSF "Standard Rifle", a centre fire rifle, intended for 3P shooting at 300 metres. One of the most successful rifles, specifically designed for the event, is the Husqvarna / Karl Gustav rifle from Sweden, alas no longer made in a suitable calibre. Because ISSF Centre Fire shooting is also a minority interest, suitable ISSF "Standard Rifles" in the centre fire calibres are not common either. Those that are available are often not in the most suitable calibre. A Long Range Match or Target Rifle can be used if it complies with the 5.5 kg weight limit. Although readily available and inexpensive second hand, they are not always easy to fit with a suitable telescope sight. They are usually in .308WIN (7.62 mm Military) which is definitely not the most suitable calibre, especially for the Doubles event. They are often too heavy to comply with the Nordic Rules. The availability of inexpensive military surplus ammunition makes the .223REM calibre seem attractive. However, the equivalent 5.56 x 45 mm calibre ex military ammunition is designed for use in an automatic or semi automatic assault rifle with 'fast' rifling and can be inaccurate in a typical bolt action rifle.

Most shooters choose to use an adapted sporting centre fire rifle. There are many suitable rifles available; some are more suitable than others, particularly for the Running Deer Doubles. It is calibre more than anything, which determines the suitability of a rifle. Although ammunition will be discussed in a later chapter, the discipline calls for a rifle with minimal recoil yet with adequate velocity to keep the point of aim somewhere within the target frame. The dominant calibre is the .222REM. The .223 (5.56 mm Military) is also suitable, but the choice of appropriate rifles has been limited. *[Note that although these calibres are notionally equivalent, they are not identical. Because of the availability of ex military ammunition, most rifles in .223REM caliber are actually chambered for 5.56 x 45 military ammunition and will safely accept both calibres. The converse is not true.]* Many of the other .22 Centre Fire calibres can also be used if they have sufficient velocity. A muzzle velocity of 800 - 1000 m/sec is needed. In the UK there are minimum calibre / muzzle energy requirements for shooting live deer. The most popular hunting calibre in Britain is the .243WIN and similar 6 mm calibres. With a light bullet and powder load, this can be used successfully for the Running Deer events, even in the Doubles.

Another important factor is the suitability of the rifle for the Doubles event. Almost any centre fire calibre (up to 8 mm) can be used for the Singles, but the recoil of a heavy calibre can make reloading for the second shot almost impossible. The bolt design is also important. A rifle in which the handle of the closed bolt lies close to the stock, such as with some Steyr Mannlicher rifles, is very difficult to reload quickly. Reloading must be easy, smooth and reliable. Some of the Tikka rifles, although otherwise excellent, are spoilt by some unreliability in ejection and feeding. Many of the less expensive sporting rifles come in only a single length of action for all available calibres. When the chosen calibre is .222REM, the long throw action designed to accommodate .30/06 calibre can make life very difficult, although some of these rifles have a 'stop' to limit the bolt movement. Another feature that can be important is the ejector mechanism. The extractor must hold the spent case securely until it is clear of the action and then it must be ejected smartly upwards and to the right. There are two types of ejector. The most common is one in which the ejector is part of the bolt and in which spring pressure is maintained on the case as it is withdrawn until the case mouth is clear of the action when it is thrown clear. In this system the extractor must hold the case very securely otherwise the ejector can release it prematurely. In the second type, the ejector is part of the action and only operates when the bolt is fully withdrawn. To work properly, the bolt must be withdrawn fully and fairly sharply. If it is pulled back slowly, the extractor may release the case prematurely or it will fail to eject it and it then stays within the action.

A rifle with a "straight pull" bolt is best avoided. In this design, the bolt is locked using an internal rotating action rather than by turning it externally. Whilst this concept seems a good idea, in practice the bolt shows a marked resistance to operation, whereas the more conventional 'turn bolt' action can be smooth and light to operate. This is an instance where technical innovation is counterproductive.

The wear and tear on a centre fire rifle is considerable, especially if extensive practice is undertaken. Many Long Range Match and Target rifle shooters will have their rifle rebarrelled after as little as 1000 shots if it is a mild steel barrel, perhaps 2500 if it is of stainless steel. Many Running Deer shooters, if in training for a match, will shoot more than this in one season. The use of the smaller calibres such as .222REM certainly helps, more so if powder charges are kept below the maximum and the barrel is regularly cleaned. Barrel fouling is cumulative; propellant residues are abrasive, becoming worse of left for a few days; cuprous bullet jacket material can build up resulting in a 'tight' barrel which will shoot inconsistently Excellent advice on cleaning centre fire rifles is available from www.hps-tr.com/guidance/fullbore_clean.asp. Whilst, for most shooters, barrel wear is a long term problem, it is important that the barrel is capable of shooting a full course of fire without a significant change in the point of impact. This is difficult to predict.

Whilst a heavy barrel should be better (it absorbs the heat better), this is to little avail if there are built in stresses that show themselves when the barrel warms up. Fluted barrels, if supplied as original equipment and fully stress relieved, however, a barrel that is fluted as an afterthought might not shoot too well. However, the 'bull's eye' is 150 mm (6") diameter and, at 100m, most rifles should be able to keep all their shots well within that circle over the full course of fire and beyond. Before buying a rifle, it is worth checking this by firing not less than 30 shots at a rate of at least 5 shots per minute. Acceptable consistency over up to 28 shots in under six minutes is much more important than the ability to shoot a single tiny three shot group.

As with the Running Target and Running Boar rifles, it is handling which is usually more important than absolute accuracy. Again, most rifles can be adapted without too much difficulty. Some of the more popular rifles are those like the Sako range that not only have a short action for the .222REM calibre, but come in a heavy barrel 'varmint' version with a stock with a broad 'beaver tail' forend that comes close to the ideal balance and weight.

As with the other Moving Target events, it is better to shoot with what is available than to debate the ideal rifle indefinitely. Most centre fire sporting rifles can be used to shoot the Singles event successfully and can at least be used for the Doubles.

In common with all centre fire rifles, regular barrel cleaning is essential for accuracy and long life. The modern PTFE (Teflon) based cleaning and lubricating fluids such as “Break Free CLP” or “Tri-Flow” are excellent for removing fouling including copper deposits in the barrel from the bullet jacket, and from the headspace area in the face of the bolt. They also inhibit pick up of fouling from subsequent shots. Only one or two drops are needed on each 'patch' and when the patches emerge 'clean', the barrel can be dry patched. It is not necessary to leave the barrel 'wet' with lubricant during storage as the PTFE forms a protective film and thus there is no danger of excess oil reaching the bedding or trigger mechanism. With their regular use, it is rarely necessary to resort to the use of an abrasive phosphor bronze cleaning brush. Once a year the barrel should be cleaned with a mildly abrasive compound. Various proprietary compounds are available, but 'Solvol Autosol', a cleaner for chromium plating on automobiles or 'T-Cut', a mildly abrasive car body polish, work well. Any cleaning compound should be removed with a cleaning rod and patch or felt wad and then the borer very lightly oiled before the rifle is stored. Another excellent product which is non abrasive is 'Forest Foam'. This is an aerosol cleaner which is sprayed into the rifle bore and forms foam. After 15 minutes it is patched out leaving the bore clean and resistant to future residue build up. However, it is water based and the barrel should be lightly oiled after cleaning unless it is to be used again very soon afterwards.

7.4 Rifle Bedding

The way in which the rifle action is attached to the stock can affect the point of impact of the projectile. Traditional wooden stocks are prone to moisture absorption, even if not exposed to wet conditions they can absorb moisture from the atmosphere. Changes in the moisture content of the wood will affect the stresses placed on the action by the stock that can affect the way the rifle recoils and hence the point of impact. Many modern hunting rifles are being made with synthetic stocks to overcome this problem. Even with a wood stocked rifle, the problems are minimised by careful design, particularly of the way in which the action is attached to the stock. Most rifles now have a fully floating barrel, in which the barrel is attached only to the action and has no direct contact with the woodwork. This may be checked by slipping a strip of thin card between the barrel and forend of the rifle.

A number of gunsmiths are able to carry out a specialist service on many rifles to ensure that the bedding surfaces between the action and the stock are very carefully matched to ensure that uniform, reproducible pressure is applied between action and stock at all times. This supplements the work done by the rifle's manufacturer. Whilst such treatment is important for a Target rifle intended to be used for precision shooting, it is seldom necessary for a Moving Target rifle. However, it is important that the shooter understands the purpose of the epoxy resin or bedding compound that has been applied to the wood under the bearing surfaces of the action. Oil and cleaning fluids must be kept well away from these bedding surfaces. If the action is removed from the stock for any reason, it must be reassembled carefully so as not to damage those surfaces. The bolts must be tightened carefully to avoid placing any stress on the action.
They should never be overtightened, a normal screwdriver or hexagon wrench should be sufficient; extended spanners or wrenches must be avoided. Anschutz fit special compressible washers under the bolts of their rifles and can supply a torque wrench which ensures that the correct torque is applied. This is typically about 4.5 Newton metres (Nm) on the front bedding screw and about 3 Nm on the rear screw. Some rifles use “pillar bedding” in which the mounting stress is taken by metal inserts rather than directly on the wood. Because the bedding screws work metal to metal, there is no resilience and it is most important that they are correctly tightened and regularly checked. This method is often used on a synthetic stock.

An air rifle should not suffer from any bedding problems, but the security of the bedding bolts should be checked from time to time. A small bore rifle can be sensitive to the bedding of the action. Any otherwise unexplained enlargement of the group size can sometimes be attributed to loose, or over tightened bedding bolts which put a stress on the action. The centre fire Running Deer rifle is not usually too critical of its bedding, but it is subjected to considerable stress with every shot. This may loosen the bolts which should be checked for security every time the rifle has been used.

In some designs of rifle, the trigger adjusting screws are mounted in the stock or the trigger guard rather than in the trigger frame. This means that in the bedding screws become loose, or are over tightened, the trigger stop or first stage travel could be affected

7.5 Choosing a Rifle

For the novice, especially one who has no experience of any form of shooting, the use of a club rifle is mandatory. No-one should go out and buy a rifle without some experience and guidance as to what he is looking for. Any newcomer to this sport should make use of any possible opportunity to inspect the rifles owned by fellow club members. With the owner’s permission and legal requirements permitting, they should at least hold them to get their 'feel' if it is not possible to actually shoot with them. They should seek opinions and ideas from other shooters; however, they should be wary of putting too much importance on the owner's opinion of his rifle. Shooters opinions are often subjective and they tend to see things in 'black and white'. They either believe that their rifle is ideal, or else they are unhappy with it and have little good to say about it. They may tell a different story if they are trying to sell the rifle!

Every rifle will feel different. To a novice, a rifle that is near the full weight permitted by the ISSF will feel impossibly heavy, and he might feel more at home with a lightweight sporting rifle. As he gains experience, a sporting rifle will feel too light and difficult to hold steady on the target. It is only with experience and knowledge of the biomechanics of Moving Target shooting that he will be able to choose a rifle with confidence.

It is not uncommon for a more advanced shooter to become dissatisfied with his present rifle. Sometimes a change will lead to a significant improvement in his performance, not because the new rifle is necessarily any better, but because he has a new confidence in his equipment. In making his choice, he should be wary of over reacting to his perception of his present rifle. His choice should not be subjective but based on a sound technical judgement.

For the more advanced shooter, reliability and maintainability should be an important consideration in choosing a rifle. A shooter preparing for a major international competition can easily shoot 25,000 pellets through his air rifle in one year. This puts a heavy demand on the reliability of the mechanism and on the effectiveness of the sealing rings. If vulnerable components are easily changed and readily available, this is not a problem. If repairs have to be carried out professionally and are needed frequently, that rifle may not be the best choice for such a demanding shooter. This is one good reason for choosing a rifle from a maker whose products are in common use and who provides a good after sales service.

The barrel of a new rifle should be carefully cleaned to remove any oil, grease or preservative wax before the first shot is fired. Particular attention should be paid to cleaning the new rifle after it has first been used. Microscopic marks on the steel pick up lead or copper until they have been polished out by firing. After a first shot from a new barrel, particularly one made from stainless steel, it picks up excessive fouling and this not only accelerates wear but slows down the ‘running in process. To optimise this process, the barrel should be cleaned after that first shot and the cycle one shot / clean repeated, only gradually increasing the number of shots fired between cleaning. Any new barrel will take several hundred shots before it is fully 'run in' and attains its optimum accuracy but it is the very early shots that are critical. There are recognised procedures for ‘running in’ a new rifle barrel. A good gunsmith can advise. There is some helpful advice on the internet such as at www.hps-tr.com/guidance/barrel_runningIn.asp

Chapter 8 Ammunition

8.1 Air Rifle Ammunition

Although any lead pellets of 4.5 mm (.177") calibre can be used, only 'match' wadcutter pellets should be considered. Not only are these accurate, they punch a clean hole in the target that makes scoring easier and more accurate. The principal makes of pellet are RWS and H&N, both from Germany. Other brands do appear from time to time but have little price advantage and may be of poorer quality. 'BB' pellets, which are made from hard metal such as steel, are not permitted under the ISSF Rules and are very dangerous when fired against normal pellet back stops.

For Running Target shooting the standard tins of 500 pellets are adequate. These are usually very lightly lubricated and this helps prevent undue surface oxidation. Tins of pellets are available from the major manufacturers that have been selected for skirt size. This is stated on a label on the bottom of the tin. In the absence of such a label, the pellets usually have a skirt diameter fractionally over 4.50 mm to ensure that they are a firm fit in the rifle barrel. However, the shooter should not stray from 4.49 - 4.51 mm unless he has properly tested those pellets in his own rifle and verified their suitability. A few years ago selected pellets were available individually packed in boxes of 100. Whist this seemed like a good idea, they were difficult to protect from oxidation (they weren't lubricated) and acquired a hard surface that made them inconsistent unless used soon after manufacture. The pellets in a normal tin, provided that the sealing tape is replaced after shooting, seem to maintain their accuracy for several years if necessary. Pellets in a full tin are unlikely to suffer damage during normal handling. Packs that hold up to 100 pellets in separate compartments are available and can be filled easily from a tin. These sound a good idea but offer no real advantage over a tin except to count the shots fired: not always a good idea. They should not be used for long term pellet storage as it is difficult to prevent oxidation. Pellet sizing and seating devices are available, but these are not recommended unless you have little choice but to use poor quality pellets.

The modern pneumatic and CO_2 Air Rifles are much more sensitive to their ammunition requirements than the older spring operated Air Rifles, and prefer pellets with a nominal skirt size of at least 4.49 mm. The spring operated FWB300 and Original-Diana 75 seem to be able to digest almost any pellet, including pellets with a distorted skirt. This arises from the fact that in the spring guns, the driving pressure rises slowly and the pellet accelerates slowly down the barrel giving it time to expand and form its skirt into the rifling without significant leakage of air. The pneumatic rifles have a very rapid rise of driving pressure when the release valve is opened. Any slight imperfection in the seal between pellet and barrel can lead to a significant loss of pressure before the pellet skirt is fully expanded. This will lead to a significant loss of velocity.

Most 'match' pellets weigh about 0.50 - 0.55 grams. Lightweight pellets weighing about 0.45 - 0.50 grams are available. They are intended for use in an air pistol with its lower power and might not always perform as expected in an air rifle. Although they will give a higher muzzle velocity, they are probably best avoided. The skirt of these light weight pellets is thinner and they are more easily damaged, thus they are less consistent than normal weight pellets. Again, there is no advantage in having a slightly faster pellet (the difference really is small). The important factor is consistency. Conversely, heavier than normal pellets have no advantage when shooting in a normal indoor range and may also be less consistent.
Both of the major manufacturers offer 'hyper accurate' pellets such a "Finale Match" variant. They are carefully selected for weight and size and are more expensive than the standard pellets.

They are intended for the static 10m Air Rifle match, particularly the 'final' when shots are scored to one tenth of a point. The improvement in consistency over the standard pellets is small and is not needed in the Running Target event. Their use is a needless expense.

8.2 50m Running Boar Ammunition

When a twin reticle telescope sight is in use, or for the slow runs with a cross hair reticle, normal subsonic 'match' type ammunition (~320 m/sec, ~ 1030 ft/sec) is all that is needed. Even with a cross hair reticle the aiming point is just under and behind the eye of the boar. (On the target the eye is a little higher than the horizontal centre line of the target.) When a cross hair reticle is used in the fast runs, supersonic ammunition (~400 m/sec, 1300 ft/sec) will be needed to keep the point of aim on the target board. The usual point of aim with high velocity ammunition is the point of the nose. If high velocity ammunition is used, then the bullet must remain supersonic under all normal match conditions until it has passed through the target. Subsonic ammunition that has a muzzle velocity very close to the speed of sound can sometimes go supersonic, especially in very cold weather during a period of low atmospheric pressure. The instability caused by the bullet going through sonic speed (up or down) as it nears the target is not acceptable. RWS make a Biathlon variant which is designed for shooting under these conditions, but which should not be needed!

The usual range of 'match' ammunition such as Eley TENEX or RWS R50 is normally satisfactory if expensive. The equivalent Eley CLUB or RWS STANDARD ammunition is almost as accurate but half of the cost. Other makers such as Lapua, Winchester and CCI offer a similar range of subsonic ammunition. High velocity ammunition is specially made for the Running Boar event. This is ballistically similar to the high velocity 'hunting' ammunition from the same manufacturer which is very much cheaper and seems no less accurate. 'Hyper Velocity' ammunition, such as CCI 'Stinger' offers no significant advantage and is notoriously inconsistent. It should not be considered by the serious Running Boar Shooter.

Running Target shooters should be aware that small velocity changes can affect their point of impact in two ways. The first is the normal change of elevation as the bullet inevitably falls towards the ground in flight; the second is the change in 'lead' needed especially in the fast runs. Having said that, ammunition which is consistent in velocity to within 1% should keep the shots well within the ten ring. The small bore static rifle shooters place much value on batch tested ammunition. Whilst it is good to know that your rifle is capable of shooting a tiny one hole group at 50 m, the central ten ring of the Running Boar target is 60 mm diameter and such accuracy is not needed, nor is it within the skill of most shooters from the standing position especially when the target is moving. The additional expense of batch testing and the need to buy a large quantity of the selected batch is difficult to justify. Most 'match' ammunition should be within that 1% consistency. However, whatever the ammunition chosen, the same batch, preferably ammunition from the same box should be used throughout a course of fire in a competition. Different batches can give a slightly different point of impact from the same rifle; different types of ammunition even from the same maker certainly will.

Currently both Eley TENEX and MATCH ammunition are made with a semi ‘wad cutter’ shape topped by a tiny ‘pip’. Whilst this design has been shown to improve accuracy, that tiny ‘pip’ is fragile and if damaged, and can reduce accuracy thus negating the advantages. When used against an Electronic Scoring Target, the wad cutter design causes excessive damage to the rubber diaphragm that is essential to the correct operation of the electronic scoring system and this ammunition is not popular on such ranges!

Premium quality 'Match' ammunition is usually coated in a thin layer of a wax lubricant. Sometimes the amount is excessive with droplets of wax on the surface of the bullet rather than a thin film. Although this does not seem to affect accuracy, there is a tendency for the excess wax to build up on the mouth of the chamber and on the bolt face resulting in a misfire. Small bore ammunition should be inspected before use and any excess wax removed with a dry cloth or a clean tissue. Care should be taken to prevent any wax from reaching the case wall which should always be 'dry'. The middle and lower quality ammunition from the same manufacturer often uses a very slightly oily or dry lubricant and does not suffer from this problem. Some 'hunting' .22LR ammunition is supplied lubricant free on the grounds that it might be carried loose in a pocket and must not be allowed to pick up grit!

8.3 100m Running Deer Ammunition

The ammunition calibre will have been decided in the choice of rifle. The majority of shooters will opt to load most, if not all, of their ammunition themselves. For a given calibre, there are many factors that affect the accuracy and reproducibility of the shot. With a cross hair reticle in the 'scope sight, it will be necessary to have a muzzle velocity of at least 800 m/sec in order to keep the point of aim on the target frame. For an 'eye' aim, a velocity of about 950 m/sec will be needed although at ~800 m/sec the aim would be on or near the nose. To achieve 950 m/sec consistently, it will usually be necessary to use a fairly light bullet. This is also compatible with the need to keep recoil low for the Doubles event. It is very important to comply with any range restrictions. In Britain this is normally a maximum muzzle velocity of 1000 m/sec, 3275 ft/sec. Muzzle energy restrictions (i.e. 4500 J in the UK) must also be complied with although these are usually not significant if a small calibre light weight bullet is used.

The factors which affect bullet consistency are the rifling of the barrel used, the bullet weight and length, the powder type and weight, and the dimensions of the cartridge case in relation to the rifle chamber dimensions. As the rifling and chamber are, for most shooters, fixed, it will be necessary to optimise the other variables if maximum accuracy is to be achieved. The objective should be to load ammunition that is as insensitive as practicable to any errors on loading, rather than to achieve 'bench rest' accuracy. The .222REM calibre is easy to load to these criteria and is very forgiving. No specific recommendation will be given, but for the .222REM cartridge, the following guidance will be found to be helpful: The favoured bullet weight is 50 - 52 grains (3.2 grams), cases should be neck sized for a perfect fit in the rifle chamber and long case life, and the powder load (from the manufacturer's loading data) should be about 95% of the maximum. Extremes such as matched cases and hand turned case necks are not necessary for the Running Deer event. The powder chosen is a matter of personal preference. It is better to avoid the faster burning powders that tend to give sharper recoil than the slower burning powders. The very slow burning powders are not suitable for a high velocity light bullet as they do not burn consistently under the low chamber pressure generated.

Choice of bullet type is also a matter of personal preference. It is important to choose a bullet shape that encourages easy feeding from the magazine for the Doubles event. Most bullet makers such as Sako, Sierra, Speer, RWS, Nossler and Hornady offer a range of suitable bullets. In Britain, the use of soft or hollow point "expanding" bullets is prohibited for target shooting. However, "match" bullets that have a vestigial hollow point are legal as they are not designed to "expand" on impact. Bullet length and weight must be matched to the rate of twist of the rifling in the barrel. A short twist is needed to stabilise the heavier, and thus longer, bullets. Poor accuracy may sometimes be cured by a change in bullet weight. Although lead bullets can be used, without a hard jacket they can only be used at low velocity (<500 m/sec) and are thus

unsuitable for the Running Deer event. Military bullets intended for use in a .223 semi automatic assault rifle are inexpensive but are very inaccurate when fired from a sporting rifle.

Having decided on a bullet and powder load, a small batch of ammunition should be tested from the bench, if possible over a chronograph. If the load is satisfactory then you should stick with it. It is tempting to try to develop a 'perfect' load, but this only detracts from the real business of shooting at moving targets. Even with the typical 0.5 m 'lead' needed for this event, a 3% spread of velocity, which is easily attained, is the equivalent of only 15 mm which will keep the bullets within a 25 mm group on the target. This is well within the central scoring ring.

There has been some controversy over the use of MoS_2 coated (or plated) bullets. It is claimed that these have a higher muzzle velocity than the same uncoated bullets and that they are more consistent. However, extensive testing by Norma has shown that muzzle velocity is actually reduced simply because the bullet accelerates faster thus transferring less energy from the propellant charge. Some of the coating is left behind in the barrel and is effectively amalgamated with the steel and hence is very difficult to remove completely. Although it would appear that a 'Moly' coated barrel will shoot accurately for longer without cleaning, there is also evidence that it could accelerate stress related micro cracking of the metal surface thus reducing the overall barrel life. Any benefits from using MoS_2 coated bullets are unlikely to manifest themselves in a rifle used for the Running Deer competition and are probably not worth the extra cost. Whilst it is possible to save money by using a do-it-yourself 'coating', this is NOT the same as a commercially 'plated' bullet and the coating may not be consistent. One thing however is certain and all agree on: Moly coated bullets should never be used in a new barrel until it has been fully run in and fired several hundred shots.

Similar claims and counter claims have been made for the PTFE (Teflon) loaded cleaning fluids such as "Break Free CLP" or "Tri-Flow" which leave a minute film of PTFE in the barrel. This undoubtedly reduces the need for cleaning and reduces barrel wear without any change in muzzle velocity. They are used extensively in military weapons of all types. Technically its ultimate breakdown product is fluorine which is very reactive chemically; but the amount involved is microscopic, does not build up in the barrel and has no history of causing long term damage. Unlike MoS_2 it cannot react metallurgically with the steel and is most unlikely to cause any harm. I have found that these lubricants when used for cleaning not only remove fouling very efficiently, but that they do make subsequent cleaning much easier.

In the UK legal considerations affect the choice of bullet used for the Running Deer competition. So called "expanding bullets" *i.e. bullets that deform in a predictable manner on impact*, are prohibited for any form of competitive shooting on artificial targets. This would exclude most soft or hollow point bullets that, ironically, are mandatory for shooting live deer in the UK. *[Some High Velocity .22LR ammunition used for vermin shooting also has a hollow point and hence is prohibited for Running Boar competitions. High velocity solid .22LR ammunition is available but is often difficult to find.]* Some "match" bullets do have a tiny hollow point but this is to aid ballistics and NOT to help it deform on impact. This is an unfortunate state of affairs as soft or hollow point ammunition in the common hunting calibres is much more readily available than a full metal jacket alternative. Thus the would-be Running Deer shooter is restricted in his choice of calibre. Fortunately there is a ready supply of suitable loaded ammunition and Full Metal Jacket bullets for reloading in the most popular calibres .222REM, .223WIN (5.56 mm Military) and the .308WIN (7.62 mm Military). One of these calibres should be the obvious choice in the UK. Full Metal Jacket ammunition in the .243WIN calibre is difficult if not impossible to find and the shooter using this calibre has little choice but to load his own ammunition. However, anyone bringing a rifle into Great Britain to take part in a Running Deer competition must be

made aware of this limitation otherwise he might face having his ammunition impounded at the point of entry into the country.

Chapter 9 Telescope Sights

Although any type of optical sight is permitted by the ISSF Rules, the only type that has proved to be practicable is the Telescope (or 'scope) sight. Other types that have been tried without success include the 'Red Dot' sight, but unless this includes a magnifying system, is not precise enough for Moving Target shooting. The ISSF Rules do not prohibit the use of a Laser sighting system, but it is unlikely to have any advantages over a conventional 'scope and significantly adds to the weight and affects the balance of the rifle.

'Iron' sights can be used for Moving Target shooting. Indeed there was a move within the ISSF in 1986 to prohibit the use of an optical sight in the 10m Running Target events. However, when the practical difficulties of using an 'iron' sight, whether an open sight or an aperture sight, were pointed out, that proposal was dropped. The primary advantage of an optical sight is that the shooter does not have to align the two components of any 'iron' sight. The alignment is carried out within the telescope if has been set up correctly. If setting up has not been carried out correctly, there is a possibility that the reticle and the target will go out of alignment as the shooter's head moves as his body is moved with the target. The procedure for setting up a 'scope will be described in a later Chapter.

The ISSF Rules specify a maximum magnification of 4x (with a +0.4x tolerance) for the 10m Running Target events. For the Running Boar and Running Deer there is no such limitation and there is a wide range of sighting systems available, but not all of them are suitable. The centre of the sight must not be more than 75 mm above the centre line of the barrel and this does prevent a 'scope with a very large objective lens from being used.

Telescope sights have a number of optical properties that may make then more or less suitable for Moving Target shooting. After the magnification, the objective lens diameter is most important. Thus a 4x32 'scope has a magnification of 4x and an objective lens diameter of 32 mm. Another important property is derived from these figures; that is the exit pupil diameter. This is equal to the objective lens diameter divided by the magnification. Thus in the 4x32 'scope, the exit pupil is 8 mm diameter. This determines the amount of light which can be transmitted to the eye. However, the entrance pupil of the human eye cannot exceed about 7 - 8 mm diameter thus an exit pupil of greater than 8 mm cannot give the shooter a brighter image. The entrance pupil diameter of the human eye is about 4 mm in diameter under normal range lighting hence a ‘scope with and exit pupil of 4 mm should normally be adequate.

A large exit pupil does have one advantage, provided that the entrance pupil of the shooter's eye remains within the exit pupil of the sight, there is some latitude for head movement compared with a smaller 'scope. Any head movement when a 'scope such as a 4x16 is used will result in some blacking out of the image. The disadvantage of using a 'scope with a very large exit pupil is that, like a camera lens at wide aperture, the depth of field is limited and the 'scope is more critical of being focused correctly. At the same time, any head movement against an incorrectly focused 'scope will result in an apparent movement of the reticle against the target and this will be worse with a ‘scope with a large exit pupil. This is called 'parallax' and will be dealt with later in the Chapter on 'Setting up a Telescope Sight'.

Thus the specification for a telescope sight is quite important. For most shooters, a magnification of between 4 and 8x is adequate, and a 6x40 'scope is a good proposition. For the 10m Running Target event which is limited to a 4x magnification, the 4x32 'scope is a good choice. The inexpensive 4x16 or 4x20 'scopes with a 19 or 22 mm diameter body tube are not recommended.

For the Running Boar and Running Deer events, the very large 'scopes such as 8x56 might look impressive on the rifle but are not needed and may affect the balance of the rifle. With experience and training, it should be possible to use a 10x or even 16x 'scope. With higher magnification the field of view becomes smaller and the positioning of the eye more critical. This makes it more difficult to identify the chosen aiming point quickly. The higher magnification will emphasis any instability in the hold and may be distracting. It is unlikely that many shooters can hold a moving target rifle steadily enough to justify using a 'scope of more than 20x magnification and for most shooters, 10x is a practical limit.

The 'eye relief' of the 'scope is also important. Unlike a spotting telescope or binoculars, the shooter's eye must not be in contact with the eyepiece of his 'scope. It is clearly essential that the eye should not be too close to the eyepiece of the 'scope otherwise the recoil could cause injury. With most 'scopes suitable for Moving Target shooting there is about 50 – 100 mm of eye relief between the rear of the eyepiece lens and the optimal eye position. The 'eyebrow' relief will be much smaller! Ideally, the eye should be placed in exactly in this position. However, there must always be some latitude. If the eye is placed too close to the 'scope, then part or all of the image suffers from 'greyout' when an unpredictable part of the image seems to disappear behind an opaque grey film. If the eye is too far away, all that will happen is that the extremes of the field of view will be lost. Thus it is usual to err on the side of locating the eye a few millimetres further away from the 'scope than is ideal. The longer the eye relief, the more latitude there is for positioning the eye but the narrower the field of view. Also, the lower the magnification, the more latitude there is for positioning the eye.

The field of view of a 'scope is determined by three main factors: magnification, eye relief and the diameter of the eyepiece lens. There are practical limits to the maximum eyepiece diameter and so, for a wide field of view, it is usually the eye relief that must be shortened. Not only does this bring the eye closer to the 'scope, which could be hazardous with a centre fire rifle, but it makes it more important to locate the eye correctly every time. When the eye relief is short (i.e. 50 - 70 mm), as in a 'wide angle' 'scope, the field of view decreases very quickly as the eye is moved further from the ideal position. With a longer eye relief (i.e. 70 - 100mm) the actual field of view is much less sensitive to eye position. Thus, in practice, the field of view through a 'wide angle' 'scope could be less than that through its 'normal' counterpart. Also, in a 'wide angle' 'scope, the quality of the image at the extremes of the field of view can be very poor. Some manufacturers get around this by masking off the top and bottom of the image giving a rectangular “TV” field of view. There seems little justification for this. Overall, the 'wide angle' 'scopes are best avoided and are not necessary for the Moving Target events. Some 'scopes have been made with a flattened eyepiece and objective surround to enable a large 'scope to be mounted low on the rifle. These are expensive and difficult to focus accurately. They serve little purpose for Moving Target shooting and should be avoided, especially if the rifle is to be 'canted' at all.

Variable power 'scopes are often used. They are not allowed in the 10m Running Target event even if adjusted to 4x or less. They have some application in the Running Boar and Running Deer events, but also some limitations. Like a camera 'zoom' lens, the optical quality and light transmission can never be quite as good as a fixed magnification 'scope. When the magnification is changed, the length of the eye relief may also be changed a little. Thus, if the magnification is changed, the position of the 'scope on the rifle may also need to be changed. For most purposes, the magnification should remain fixed or changed only within very narrow limits. These 'scopes are particularly useful with a multiple dot reticle. Careful use of the variable magnification can make a three dot 'scope almost as useful as a specialist multiple reticle 'scope. In many variable power ‘scopes, changing the magnification will change the scale of the reticle against the target, thus changing the spacing of the dots. In theory, if the shooter is prepared to use 8x magnification for the slow runs and 4x magnification for the fast runs, he will double the dot spacing thus

making his 'scope very versatile. However the size of the dots will also change relative to the target, the eye relief may change and it is not easy to get used to such a large change in magnification so this is seldom a practical option.

Because the 'scope will be used at only one distance, the helical focusing objective lens fitted to some hunting 'scopes has limited application and just adds to its weight. While this would not rule out the use of such a 'scope, it is not a feature that is worth paying extra for. It is certainly convenient whilst setting up the 'scope, but thereafter is just one more thing to check each time the rifle is used. If the rifle is to be used for some other purpose too, such as a centre fire hunting rifle, the focusing objective is more useful. Other features of many modern 'scopes such as a 'bullet drop compensator' have no application in Moving Target shooting.

Telescope sights come with one of two types of adjustment. In some of the older 'scopes and the modern twin post 'scopes, the reticle is placed at the point where the image of the target is formed by the objective lens. The adjusters operate directly on the reticle. Thus the reticle is seen to move within the field of the telescope. This type of 'scope may require the use of adjustable mounts giving a coarse windage adjustment if the reticle is to be kept in the centre of the field of view.

In most modern single reticle 'scopes, the reticle is placed further back and is viewed directly by the eyepiece lens. In this system, it is the image of the target that is moved and the reticle itself is fixed so that the reticle always appears to be centred in the field of view. The reticle is sometimes an etched glass disc and so a wide variety of different designs can be accommodated easily. It is placed at the point where the image of the target is formed by a lens inside the telescope which inverts the already upside down image formed by the objective lens. Instead of operating on the reticle itself, the adjusters operate on the inverter lens. In effect, the inverter lens acts as a prism, if it is pivoted a little, the image of the target is moved too. Because of the optical advantage, only a very small movement of the sleeve is needed to effect a considerable movement of the image of the target. The inverter lens is contained in a sleeve that is carefully pivoted and can be controlled by the adjusters. This type of 'scope is convenient because the reticle will always be centred in the field of the telescope. However, it is important that the reticle is carefully aligned with the plane of the adjusters during manufacture otherwise changing the elevation may make a small change to the windage too. This is not normally important if the rifle is sighted to shoot to the point of aim, but if the sight is set up for another point of aim, such as the eye aim on the Running Deer, it might be significant.

9.1 Conventional, Single Reticle 'Scopes

Conventional telescope sights are fitted with a variety of reticles. Many different reticles are available but the most common are the simple cross hair and the duplex reticle that has cross hairs between thickened posts. The simple cross hairs are preferable; the duplex system is useful when hunting in poor light but is less useful for Moving Target shooting as the thickened posts tend to mask a significant area of the target. They do have two advantages over the simple cross hairs: the thickened posts stand out well against the target, especially the 50m Running Boar and, if the shooter can ignore the central cross hairs, the thickened posts give him a large area of aim. This is especially helpful for a less experienced shooter during the fast runs.

A single post reticle is sometimes used. This usually has a fine horizontal cross hair in addition to the vertical post. Such a cross hair is essential because the shooter uses it to help set his sight 'square' to the target, important if the rifle is canted at all. The cross hair is not necessarily on the

tip of the post, especially if it has a point rather than a flat top. This can give rise to some uncertainty in the aim. Another problem is that the post is sometimes fairly thick and as a result, if the tip is focused correctly, the cross hair is slightly out of focus. This is more an annoyance than a real problem. The post reticle does require some experience to use it correctly and unless the shooter is already familiar with its use, such as on a hunting rifle, it is better avoided. There is a tendency for a post reticle to give vertically elongated groups.

In some ways the single dot reticle is near to the ideal. The dot is supported on a fine horizontal cross hair which again helps to 'square' the rifle to the target. The dot should be nearly as large as the area of aim, perhaps about 10 mm diameter at 10 metres or 50 mm at 50 metres. A variant on this is a small dot at the centre of a pair of fine cross hairs.

The multiple (three) dot reticle was popular at one time for the Running Boar event, but is a poor substitute for the specialist multiple reticle 'scopes that will be described later. The dot spacing is determined when the 'scope is built and cannot be adjusted if the 'lead' varies. However, if used on a variable power 'scope (not permitted in the 10m Running Target events) changing the magnification will normally only affect the image of the target, not the reticle. Thus a change of magnification will change the dot spacing relative to the target. On many of these 'scopes, the dots are too small to be very useful and are difficult to see against the target, especially the 50m Running Boar. The excellent Pecar ‘scopes (alas no longer made) were excellent as it was a relatively easy matter to change or modify the reticle. However, it not too difficult nor too expensive to have a special reticle fitted to some popular 'scopes to your own specification. Many of the special reticles are in the form of a thin, optically flat disc engraved with the reticle. Other complex reticle 'scopes are also available. Some of these have been designed for Field Target Shooting where it is necessary to compensate for the drop of the air rifle pellet at the different (long) ranges used. Others have so called 'range finder' reticles. These are all unnecessarily complex and only serve to confuse the shooter in the Moving Target events. The simpler the reticle, the easier it is to use the 'scope effectively.

9.2 Multiple Reticle 'Scopes

Most 10m Running Target and 50m Running Boar shooters eventually opt for one of the specialist multiple reticle 'scopes. The most common are the twin post 'scopes made by the Nickell division of Hertel and Reuss in Germany. Similar twin post 'scopes have been made in the USSR but are now difficult to find. At least one model of twin post ‘scope has been made in Japan. Dick Thomas (Premier Reticles) in the USA has built a range of specialist three reticle 'scopes by adapting various conventional 'scopes such as those made by Leupold and Bushnell (Bausch and Lomb). They have been very popular for the 50m Running Boar event. However, the business no longer exists and, as all of their ‘scopes were individually made to order, are very difficult to find even second hand.

The twin post 'scopes have, as their name suggests, a pair of independently adjusted post reticles. They are in the form of thick, vertical posts. The 'scopes are characterised externally by having four adjusters. The principle behind them is that each post is adjusted so that, when on the selected aim the point of impact of the bullet is the centre of the scoring rings. One post is used for the left runs and one for the right runs of the target. The spacing of the posts is adjusted between slow and fast runs, depending on the chosen point of aim and the amount of ‘lead’ needed. Many different points of aim can be selected, and the 'scope can be set up so that either the leading or the trailing post is used on each run. The posts are usually quite thick (i.e. almost as wide as the central aiming mark on the 10m target) and this makes the sight picture easier to pick up and encourages a good area aim. The adjustments are also quite coarse on some models

(2 mm/click at 10 m, 10 mm/click at 50 m), and this can be an annoyance to an inexperienced shooter until he learns to accept that he is unable to hold the rifle anything like as accurately as that on a moving target. The main drawback of these 'scopes is that, until the shooter is experienced in their use, it is easier to align the sight with the target horizontally than vertically, resulting in vertically elongated groups.

The reticle design means that they must be moved whilst the image of the target remains fixed. Thus, to be used effectively, they must be equipped with adjustable mounts so that the top of the posts is roughly in the centre of the field of view. This is particularly important in the 10m Running Target event where the usual point of aim is the aiming mark on the target. For the fast runs the posts come fairly close together. The design will not allow either post to cross the centre of the field of view nor to approach each other too closely. Thus there is very little latitude for adjustment in this configuration. Nickell did make a variant of this 'scope for the 10m event, but it is no longer made. It had only three adjusters and the posts are adjustable individually only for 'lead' on the target, not elevation. A single central adjuster is used for elevation and this moved the image relative to the reticles. There is no adjuster underneath the 'scope body, thus this 'scope is particularly suited for fitting to the FWB600 series of Air Rifles where the loading tap can foul the lower adjuster on the more conventional twin post 'scopes. One drawback of this 'scope is that it is important to mount it so that the posts are vertical when the rifle is in the shoulder. Any 'cant' of the rifle will change the point of impact on one side or the other. However, this design of 'scope is easy to set up and does not need adjustable mounts because the posts, free from the need for vertical adjustment, can now move across the centre of the field of view if necessary. Adjustable mounts are often used as it is still desirable to have the reticle roughly central, but this is no longer as important and any vertical adjustment needed can easily be accommodated by shimming a mount.

The Dick Thomas 'scopes were quite different. They were built on an existing 'scope made by a variety of manufacturers and the modification consists of adding a pair of independently adjustable reticles. They look impressive with their six adjusters. The original 'scope reticle is retained but it is usually in the form of a single vertical line with a small central dot. This is an 'image moving' system thus the dot is always central and the rifle is set up to shoot with it on the point of impact. With this design, the difficulty sometimes experienced in sighting in a twin post 'scope has been overcome. The additional reticles are independent of this central reticle and are adjusted to give the appropriate 'lead' either side of it. The most popular reticle is the 'twin loop'. These consist of a pair of rings each supported by fine wires running to 45^0 at either side. The diameter of the rings is specified by the user and, for the 50m Running Boar, usually fills the area between tusk and nose at a specified magnification. With a variable power 'scope, the shooter can then adjust the relative size of ring and target to suit his own technique. Any such adjustment also changes the relative spacing between the rings and so must be accompanied by some adjustment of the ring position.

The loops demand to be placed precisely on the right area of the target. Thus it can be more difficult to accept a large area of aim with this type of 'scope, neither is it easy to 'aim off' for fine adjustment such as in the Mixed Runs events. These problems are unimportant in the 50m Running Boar events where the area of the target used for the aim is itself diffuse (see the Chapter on 'Aiming'), but can cause difficulties in the 10m Running Target events. When the 10m Running Target events were introduced in their present form in 1988 the twin loop concept seemed at first ideal. However, apart from the difficulties already mentioned, if the loops are large enough to sit comfortably around the aiming mark, then they are too large to be brought close enough together for the fast runs. Similarly, if the scoring area is chosen as the aiming mark, in the slow runs, the loops must be made very small and fit inside the 'black' of the target (not ideal) otherwise again they cannot be brought close enough together. Thus most shooters

using these 'scopes have opted for them to be fitted with posts or some other form of reticle. Dick Thomas (later Premier Reticles) also supplied a wide range of custom fixed reticles such as the multi dot type, and could fit them to most 'scopes.

For the Running Deer events the conventional cross hairs 'scope can be adjusted so that the rifle shoots about 0.5 m below the point of aim. With the choice of a suitable calibre rifle and ammunition, the point of aim will then be somewhere on the head near the eye. This is such an easy point of aim to identify that the use of a specialist 'scope is not necessary. Different target running speed and ammunition velocity are easily accommodated by shifting the point of aim across the head of the deer. Some shooters do use a twin post or twin loop 'scope for the Running Deer events to give them a point of aim on the nose of the deer. The main advantage of using a twin post 'scope is that the large posts are very clearly defined and encourage a good area aim rather than the too fine aim using cross hairs. They also allow some adjustment of aim to accommodate different target running speeds and muzzle velocities.

9.3 Special Requirements of the 10m Running Target Discipline?

There is a popular belief that it is impossible to shoot the 10m Running Target well with a single reticle ‘scope. This is a **myth**. Certainly a Twin Post ‘scope makes it easier to identify the small area of aim needed to achieve scores in the high 500s, but under 500, the major factor is the inability to ‘hold’ a small area of aim rather than being able to identify it on the target. The fact is that if the shooter can keep a cross hair scope inside an area equal in diameter to the width of the four rings ‘in the white’ in front of the black of the scoring area, then he should be able to score at least an 8 every time. Even on the Fast Runs, to keep his shots ‘in the black’ he only needs to hold an area of aim 30 mm in diameter; this is bigger than half the distance between the edge of the scoring black and the black aiming mark. This would give an average shot value of at least 6, to give a total of well over 400 (ex 600) which, at ‘club’ level would be a respectable score. Yet too many shooters think that because they cannot identify a ’10 ring aim’ then this is the reason for their poor scores. Certainly, a good ‘scope is important to the International Shooter, but for most at club level, the ability to hold a practicably small area of aim is far more important. Anyone who doubts this should try firing at a conventional Air Rifle target at 10 m using a 5.0 second or 2.5 seconds ‘snap’ timing. This will indicate the area of aim he is capable of holding under ideal conditions. With a target “on the move”, the group will be bigger.

9.4 Illuminated Reticle ‘Scopes

Nickell make a 4x35 Twin Reticle ‘scope for 10m Running Target Shooting that uses illuminated reticles. These can be useful when the contrast of the normal black reticle against the target is not ideal. The reticle can be adjusted from black (off) to bright red which shows up well against any target. The illuminated reticle is one more complication in the shooter’s equipment: something else to go wrong, and with properly controlled range lighting and target contrast, it seems to be an unnecessary luxury. Whilst this ‘scope has the potential to give the shooter more control over the perceived image, it is much more expensive than its conventional equivalent and should not rank high on his “wish list”. A bigger ‘scope more suited to the 50m Running Boar or 100m Running Deer might be more useful in combating variable lighting levels outdoors, and there are modestly priced illuminated single reticle‘ scopes available. However, these are necessarily heavier that their conventional equivalents and may make the rifle more difficult to balance without adding excessive additional weights to the muzzle.

Chapter 10 Clothing and Personal Equipment

Unlike the other ISSF rifle and pistol disciplines, there are no rigid rules (2009 ISSF Rules) for the clothing and general equipment permitted to be used in the Moving Target disciplines. However, the ISSF Rules explicitly prohibit wearing any form of camouflage clothing in any shooting discipline. Thus if you use your camouflage Hunting Jacket for target shooting, you will need to find an alternative for any formal competition. The practical limitations set by the discipline dictate their own rules. Clothing that could be construed in other disciplines as giving an unfair advantage a shooter would, in these disciplines almost certainly have major disadvantages. However, the ISSF keeps all developments in clothing and equipment under review and, should developments warrant it, appropriate regulations will be introduced to bring them under control.

Much of the clothing worn by Moving Target shooters has been adapted from everyday clothing or the specialist clothing designed for another shooting discipline or even a different sport. Moving Target shooters are the most innovative of all shooters, and this is helped by a liberal attitude by the ISSF. However, whatever the origins of their equipment, most shooters find it advantageous to reserve their 'special' clothing for use in this discipline. There is a physical advantage in wearing the same clothing in every match and training session; there is also a psychological advantage in that it identifies the shooter with the event. The act of donning special clothing can be most important as an aid to achieving a relaxed state of mind before the match. However, it will only work if the same clothing is used during training and for the match, and the same routine used for changing clothing.

In all areas of business, technology and sport, it has been shown that the Pareto Principle (the "80/20" rule) applies. This means that 80% of the result can be obtained with only 20% of the effort or cost. After that it is hard work to affect any improvement. This is also relevant to shooting where it is too easy to be fooled into believing that "if only I had - - - -, my scores would improve". Most improvement is the result of hard work not the purchase of expensive new equipment. All that are needed for the beginner or even the advanced club shooter are a sweatshirt, a pair of old jeans and a comfortable pair of 'trainers'. When their 10m Running Target scores regularly exceed 80% (or 90% in the Running Boar), then they can think seriously about some of the specialist clothing that might add a few more points to their average. Even then, they must be prepared for an initial drop in their scores. Some of the specialist clothing, although technically 'correct', is not the most comfortable to wear. Initially the discomfort of a stiff jacket or boots will outweigh their technical advantages, and it may take a lot of training before their benefits can be exploited as better scores. For the novice or club shooter, comfort should take precedence over technical superiority.

10.1 The Shooting Jacket

A look at the jackets worn by the participants in any major Moving Target match will show that the majority can be traced back to the German firm of Mouche, and that most are bespoke: designed and made to the individual's requirements. Whilst other makers have tried to emulate Mouche, that company has the great advantage that its owner and manager is also an International Running Target shooter and her designs are based on the requirements of the German Moving Target Team. Mouche also offer a limited range of ‘off the peg’ jackets if you can't wait the few weeks needed to have one made to measure. How different to just a few years ago when every

Moving Target shooter had a different jacket, mostly made to their own specifications by some local small manufacturer.

Undoubtedly a good shooting jacket will help produce better scores. Ideally it should be stiff enough to provide support for the weight of the rifle. At the same time it must also constrain movement of the trunk to encourage a proper 'swing' of the whole body. However, it must also be flexible enough not to inhibit the 'raise' of the rifle from the 'ready' position. There must be no folds or creases formed, particularly near the right shoulder, as the rifle is raised. Unfortunately, the more support the jacket gives, the better it must fit. A jacket designed for the static rifle disciplines is unlikely to be satisfactory for Moving Target shooting. An obvious modification is to add the adjustable fastenings that are permitted under ISSF Rules for the MT events but prohibited for the other rifle events, and to incorporate flexible or elasticated elbows.

As a compromise, some shooters favour a sleeveless shooting 'vest' such as are used by the shotgun shooters. Both Mouche and Sauer make suitable Moving Target shooting vests in leather or heavy gauge canvas. The vests have adjustable straps for fastening, and the Sauer jacket has additional straps across the back designed to ensure a snug fit. They have the advantage over a full jacket in that the movement of the arms cannot create folds or creases as the gun is raised. However, they provide no support for the shooter's arms. Some of the shotgunner's jackets on the market are unsuitable, being too loose a fit and designed for a style of shooting in which the gun is fitted to the shoulder rather than being raised from a 'ready' position. Many are made from quilted material and do not give the positive gun location at the shoulder that is needed. A sleeveless vest designed for skeet shooting is most likely to be satisfactory. Most of those on the market can be improved by removing the usual thick, spongy shoulder pad and sewing on a wide flap of soft, thick leather. Ideally, this should extend from the shoulder down to the waist so as not to interfere with the 'raise' of the rifle from the 'ready' position. Some experimentation may be needed to establish the optimum amount of stitching and its position.

For many Moving Target shooters, the expense of a specialised shooting jacket cannot be justified. The real benefits of a specialised jacket come only at the top end of performance. I would not put such a jacket very high on the list of priorities for a beginner or even an experienced 'club' shooter. Indeed, quite a few club shooters have spent a lot of money on a state of the art jacket only to find that they shoot better without it! It is not unusual to see participants in National Championships wearing a sweatshirt rather than a specialist shooting jacket. For most shooters, this is a good compromise if it fits well enough so that it does not 'ruck' across the chest or upper arms. This is essential wear under a sleeveless shooting vest. Another good compromise is a close fitting 'blouson' of the type with a suede or leather front and close fitting knitted back and sleeves. There are many other possibilities too. Military surplus clothing can often be adapted (if it is not made from camouflage material), or some normal street wear such as a leather casual jacket. It is important that there are no pockets, 'tabs' or buttons which will interfere with the smooth 'raise' of the rifle to the shoulder from the 'ready' position. A heavily quilted or padded jacket should also be avoided. Under ISSF Rules, any pockets must be empty when you are shooting.

The same shooting 'jacket' is normally worn when shooting the 10m Running Target, 50m Running Boar and the 100m Running Deer events. However, the 10m event is shot indoors whereas the 50m and 100m events are normally shot outdoors, albeit from a covered firing point. Thus the jackets worn by those shooters who shoot only those outdoor events tend to be more compatible with the cold and wet conditions of a typical Moving Target range. It is not unusual to see a shooter wearing his Deer Stalking clothing on the Running Deer range. The ubiquitous Waxed Cotton jacket is quite common and, if it is a close fit, makes quite a good shooting jacket for these conditions. Another consideration is that the target on the 100m Running Deer range

moves through a much greater angle, as seen by the shooter than the Running Target or Running Boar. This means that the shooter has to be able to 'swing' through a greater angle. Thus many experienced shooters wear a leather jacket for 10m and 50m and a softer Skeet vest for 100m.

The one thing that every shooting 'jacket' must have is a mark to indicate the waist line in the 'ready' position. Until the target appears, the lower tip of the buttplate must be level with or below this mark. The ISSF rules require that the mark is placed on the jacket so that the upper edge is not higher than the lowest point of the elbow when the arm is held against the body, finger tips on the shoulder. The mark must be 30 mm wide and 250 mm long, parallel with the ground and permanently attached to the jacket. It should be a distinctive yellow colour with a black border. For major competitions, only the mark supplied by the ISSF is acceptable. It is the responsibility of the shooter to ensure that his jacket is correctly marked, although this will be checked by equipment control before a major match. Exactly what constitutes "permanently attached" is open to interpretation, but Equipment Control may stick a seal over the mark. In any case, the Range Jury has the right to check that the mark is correctly placed. A temporary mark is easiest made with a strip of surgical tape 1" (25 mm) wide which sticks well to most jacket materials. It can be removed, albeit with difficulty, and leaves little residue. If the mark is sewn on, it should be readily removable if the Equipment Control Officer at a major match is not satisfied with its positioning!

Fig. 10.2.1 Marking the Shooting Jacket

10.3 Trousers

The stiff trousers worn by the static air rifle and three positional rifle shooters are of little value. Good, comfortable, loose fitting casual trousers or track suit bottoms are adequate. The waist should not be tight and a tight belt should be avoided. Braces ("suspenders") used to hold up the trousers, are not a good idea as the straps will be felt against the pressure of the rifle's butt plate

on the shoulder. Also, any buckles or clip fasteners over the front of the chest can snag the buttplate of the rifle as it is raised from the 'ready' position, even under a jacket. The Mouche jackets open from the left and have adjustable fasteners that are well clear of the right chest wall.

10.4 Footwear

Like a shooting jacket, there are undoubted advantages to be had from wearing appropriate footwear. Many of the top international shooters wear boots that were designed for three positional rifle shooting. These mostly incorporate some features that are unnecessary for Moving Target shooting, and some which are undesirable. The stiffened sole, the extended squared off toe and the lacing down the back of the boot, all of which are designed to help the shooter in the kneeling position are unnecessary. Although ankle support is important, the usual shooting boots can be too rigid and do not permit the free 'swinging' from the ankles that is so important in Moving Target shooting unless the upper lacing hooks or eyelets are left unfastened. The lower 'shoes' now available that are designed to comply with the ISSF Rules for Pistol Shooting are becoming popular but offer no ankle support.

Probably the most important feature of any shooting footwear is comfort. The boots (or shoes) should be high enough to provide some ankle support yet still allow some flexibility. The sole material should be flexible but not so soft as to be 'spongy'. A good internal arch support or footbed is beneficial. It is also important that the heel is raised some 20 mm above the ball of the foot if painful tendons are not to result. In this the Moving Target shooter does not have to comply with the same constraints on design imposed on the static rifle shooter.

Whilst there is at present no purpose design of footwear for the discipline, finding a satisfactory compromise is not difficult. Many international shooters do wear 'rifle' shooting boots (or shoes), but mostly the less expensive boots without some of the more specialist features. If these boots are worn, the importance of a comfortable fit must be emphasised. Walking boots are not uncommon and the former 50m Olympic Running Boar Champion wears his (Norwegian) Army boots. Heavy and very stiff Ski Boots are not advised nor are the very heavy climbing boots designed for snow and ice climbing. Thick cleated soles are unnecessary and probably undesirable especially on an indoor 10m range, but some of the modern lightweight walking boots can be very good. Some of the older style of Langlauf (Cross Country Skiing) boots may be suitable. Boxing or weight lifting boots have been considered but are usually without a raised heel and are too flexible. Skating boots (roller or ice) without the skates might be considered.

For most shooters, the obvious compromise is to wear a comfortable pair of training shoes, or preferable boots with a higher top. The soles must not be too soft or too thick as this can cause instability. It is also important that the heel is slightly raised. Fortunately there is a wide choice of suitable sports boots readily available and not too expensive. It must be stressed that such footwear should be reserved for use in Moving Target shooting and not used for everyday wear. An unevenly worn sole or worn out uppers with limited ankle support will not be conducive to good shooting however comfortable.

Although Rubber 'Wellington' Boots are far from ideal, in very bad conditions they are not unknown on the outdoor Running Boar and Running Deer ranges. Even in very wet conditions, it is usually possible to change the Rubber Boots for the footwear normally used on the 10m range on the Running Deer firing point. Invariably some mud does find its way inside and so some shooters prefer to wear different footwear for the Running Boar and Running Deer events.

On the Running Deer ranges, it is not unusual to see the high leather boots sold as 'stalking boots' worn. Provided they are comfortable, these are not out of place in the usual range conditions.

10.5 Hearing Protection

Although hearing protection is not necessary in the 10m Running Target event, many shooters opt for the use of some form of sound reducing device as an aid to concentration. This also preserves the link with the 50m and 100m events.

Conventional Ear Muffs may cause a problem when the rifle is raised to the shoulder if the bottom of the muff should hit the top of the cheekpiece. In the air rifle match, the wearing of ear muffs should not be allowed to dictate the height of the cheekpiece when this is unnecessary. Thus the use of foam Ear Plugs or Ear Valves may be better. The latter only remove the peak sound levels and do not inhibit hearing range commands, etc. Some shooters prefer to be able to cut themselves off completely from extraneous sounds and the foam ear plugs do this fairly well. Fortunately, in the Moving Target events it is not essential to be able to hear routine range commands except in the “Olympic” final.

The ISSF Rules specifically prohibit the use of ear protection containing any "sound producing device". Only "sound reducing devices" may be used. It is now generally accepted that this can include electronic devices designed to reduce sound or certain types of sound. It does not permit the use of a radio receiver nor any device that replays recorded sounds. This applies to all ISSF events and, by implication, events governed by the Nordic Shooting Region (NSR) Rules. Thus the 'Electronic Ear Muffs' that reduce excessive sound but allow the shooter to hear normal range command via a microphone and amplifier are permitted. However, any such electronic hearing protection will be scrutinised to ensure that it does not contain either a radio receiver or a music player. The reason is to prevent a shooter from using a personal radio or tape player in lieu of proper Ear Muffs. Although they might possibly provide adequate protection, he would be totally unable to hear normal range commands particularly an emergency STOP or CEASE FIRING. Another reason is to prevent the use of a radio receiver for illicit 'coaching' on the firing line. Electronic Ear Muffs are particularly useful for Range Officials who need to be able to communicate with Competitors and other Officials whilst also protecting their hearing. They are also particularly helpful in the pistol shooting events where the shooter must be able to react to routine range commands.

For the Running Boar event some hearing protection is essential. If only subsonic ammunition is being used, such as Eley TENEX or CLUB, Ear Valves which reduce only the noise peaks are adequate, although foam Ear Plugs have greater overall sound attenuation. If High Velocity ammunition is being used then the foam plugs are a minimum requirement and full Ear Muffs desirable. The problem of the muff hitting the cheekpiece can be overcome by cutting away part of the cheekpiece to accommodate the muff. Otherwise, the cheekpiece, if adjustable, may have to be set lower that is otherwise required.

Full Ear Muffs are essential for the Running Deer event, and these should be designed for maximum sound attenuation. Some of the cheaper industrial hearing protection devices do not make good firm contact around the ears and should be limited to occasional use in an emergency such as for casual visitors to the range. In the confines of a covered firing point the noise from a centre fire rifle is very damaging to hearing. Muffs and Ear Valves or Plugs are often worn together. If a typical sporting rifle is being used, there should be no problem of the muffs touching the comb, but if a raised cheekpiece is fitted, some wood may have to be removed

10.6 Corrective Spectacles

In 1995, the athletes attending an Olympic Training Camp in Florida were given eye tests. 27% of those tested were found to be competing with impaired vision. 9% of athletes admitted to never having had an eye test but were identified as being in need of urgent visual correction. Whilst in some sports, the need for eyesight correction may not be important; in all shooting sports it is essential.

Corrective spectacles are a 'must' for most Moving Target shooters. Whilst spherical correction (i.e. long or short sight) to the vision can be made by careful focusing of the telescope sight, the only way that astigmatism can be corrected is by the use of properly prescribed lenses. Contact lenses are not recommended for shooting; the degree of correction possible for astigmatism is not as great as with conventional spectacles, and they provide no eye protection. There are many potential eye defects that can affect a shooter and it is most important that he visits his optician for regular eye checks. If two shooters both believe that they have 'normal' vision, then they should be able to use each others' 'scope without further adjustment. A sure sign of a potential problem is that if when a shooter picks up another's rifle and looks through the sight, the sight picture appears blurred. The other shooter should repeat the exercise with the first shooter's rifle. If both shooters can see a better image with their own 'scope, then one or other of them is in need of eyesight correction. If either can see a better image with the other's 'scope, then he may need to adjust the focus of his own 'scope.

The most common eyesight defect that will affect a moving target shooter is astigmatism. In this, the eye appears to be seeing through a distorting (aspheric) lens and parts of his field of view are out of focus. The lens shape is elliptical rather than spherical. This can mean that an aperture sight on a target rifle seems to be oval rather than round. Most people suffer from some degree of astigmatism. Often this is minor, and their brain automatically corrects for the slight distortion it can induce, especially when both eyes are used together. When vision through one eye must dominate, such as through the telescope sight, the brain becomes more conscious of any astigmatism. This usually manifests itself in either horizontal or vertical lines (such as the cross hairs of the sight) being slightly 'out-of-focus', or sometimes a blurred band at an angle across the target. Many of the complaints I have heard about poor telescope optics have been caused by the lack of corrective spectacles, often associated with a badly focused sight. No telescope, however expensive, can correct the distortion caused by astigmatism of the eye of the shooter.

Other eye defects which may otherwise go unnoticed can be important when using a telescope or 'scope sight. One example is an early cataract which can easily go unnoticed but which can create a blind spot through a 'scope. Another example is strabismus in which both eyes do not focus together. If pronounced, this can make it difficult for the shooter to see through his 'scope and to align it easily with the target. It can be corrected with suitable lenses. Thus if any shooter has difficulty in using a 'scope, he should visit his optician for a check-up.

It is also important that the unaided eye can see the target as well as possible. Thus, although a 'short-sighted' shooter can adjust his telescope sight to give him a perfect image, this is of little use if he cannot clearly see the target as it emerges without the aid of the sight. When the optician carries out a standard eye test, he or she usually prescribes lenses that are a compromise. If the vision is reasonable acute from near objects to distant ones without the use of spectacles, then you may be told that spectacles are unnecessary. It is most important for the optician to be told that you need to have excellent distant vision free from astigmatism. The spectacles prescribed

may not be necessary for everyday activities, in which case they can be reserved for shooting. Bifocal, Trifocal and Varifocal lenses can cause problems unless you can be sure to be using only the 'distance' part of the lenses. If you normally wear such lenses, you should consider having a special pair of spectacles made with single focus lenses corrected only for distant vision which you use when shooting.

There may be a particular problem if you are right handed and your left eye is your leading eye. You can check which is your leading eye by holding a finger at arm's length and 'sighting' some nearby object with both eyes open. Then close each eye in turn. If your finger remains aligned with the 'target' when your left eye is closed but appears to move when your right eye is closed, then your right eye is dominant. A few people have their dominant eye on the opposite side to their dominant hand, often as a result of an injury or illness. They must decide whether to shoot 'wrong handed' or with the 'wrong' eye. If the latter, then some help can be available from your optician who can prescribe a darkened lens for the dominant eye to suppress its vision. A temporary solution may be had by putting a 'blinder' (which must comply with ISSF Rules) over the non-sighting eye to suppress its central vision. However, full stereoscopic vision is very important in Moving Target shooting and such a 'blinder' must allow the shooter some binocular vision of the emerging target whilst he is in the ready position. It is better to use a dark tinted lens for the non aiming eye which merely reduces the reliance on that eye rather than suppress it altogether. It is not a good idea to close the non-sighting eye or to 'squint', the resulting tension in the facial muscles will impede vision through the sighting eye too.

Ideally, for shooting, the spectacles should have their optical centres moved high and to the left so that the eye looks through the optical centre of the lens whilst on aim (rather like the spectacles worn by some snooker players). This would compromise their use to observe the emerging target. Unless the correction is considerable, this is probably unimportant. Any change in head position could nullify the benefits of such specially fitted lenses. It is important though, that the lenses are large enough (or located close enough to the eye) so that vision is not impeded by the frame whilst on aim. Most opticians can supply suitable frames and will fit the lenses correctly if the problems are explained to them. It can help to take the rifle to the optician so that he better understands the problems. Better still, consult an optician who is himself a shooter or who specialises in prescribing spectacles for shooters or other sportsmen.

The type of tinted spectacles used by some Clay Target shooters are not recommended, although neutral photochromic lenses, or sunglasses in bright outdoor conditions, should not cause any difficulty. If the spectacles are to be used only for shooting then the use of plastic or toughened glass lenses should be considered. Normal industrial safety spectacles use polycarbonate lenses. These offer more protection to the eyes for 50m and 100m shooting than normal glass lenses but are very easily scratched although any plastic lenses (unless specially coated) can be scratched easily if not carefully handled and cleaned.

Even if prescription spectacles are not worn, some form of eye protection should be worn for the 100m Running Deer event and are recommended for the 50m Running Boar. At the worst, a split case can cause severe injuries, but even a 'blown' primer can release hot gasses possibly accompanied by tiny fragments of metal. Although the design of the rifle action and bolt should provide some protection from the hot gasses released if a primer 'blows' the eyes are very vulnerable. A left handed shooter is especially vulnerable if he is using a rifle with a right handed action; the gasses will vent towards, rather than away from, his face. Even the Running Boar shooter is not free from risk. It is not unknown for a cartridge rim to split releasing some hot gas, especially when High Velocity ammunition is being used. Also, in some rifle actions, the chamber wall is very thin (or worn away) where the extractor groove is cut, and this can lead to case failure when High Velocity ammunition is being used. Although toughened glass or plastic

lenses are better, normal prescription spectacles with glass lenses will provide some protection. Ideally, the spectacle frames should provide some side protection too. Specialist frames designed for shooting are available, heavy industrial safety spectacles can be used but may be uncomfortable to wear.

The special spectacle frames used by rifle and pistol shooters, such as those made by Champion or Knobloch, can be used, but offer little eye protection in cartridge rifle shooting. The small lens, whilst it can be adjusted for optimum use through the sight, may be wrongly placed for target observation. The cost of these frames is high and the money would be better spent on a conventional spectacle frame that allows for large lenses. Some frames are available that are specially selected to be suitable for shooters of all disciplines. Care should also be taken to ensure that the lens for the shooting eye is prescribed for distant vision, not +0.5D or +1.0D often prescribed for the static disciplines to aid sight alignment.

Chapter 11 Targets

The targets used in the Moving Target events are those approved by the ISSF or Nordic Shooting Region. Most of the 10m and 50m targets are printed by Edelmann, but other printers also supply them. The specialist target faces used in the 10m Running Target events are normally supplied by the Electronic Scoring Target range manufacturer. Running Deer targets are obtained from various sources, mainly in Scandinavia. The description of the 10m and 50m targets is given in full in the ISSF General Technical Rules and will be summarised here.

When paper targets are used, it is most important that the paper or thin card is suitable. Most normal paper is made to be reasonably durable under normal office conditions. This means that it is made from a cellulose base with long fibres to resist tearing. However, when struck by a bullet it gives a jagged hole, often with much damage to the surrounding paper, which makes scoring difficult and the target short lived. Short Staple paper gives a clean shot hole helping precise scoring. Such paper is not in common use and is often available only in bulk for the specialist printing industry; hence do it yourself paper targets are seldom successful. However, larger targets from a different discipline (i.e. used 50 m Rifle Targets) are a useful source and can be printed on the reverse side. Care must be taken to ensure that the print contrast is adequate.

11.1 10m Running Target

This is printed on a card 260 x 150mm. It has two scoring diagrams 50.5 mm diameter whose centres are 140 mm apart. Between them on the same centre line there is a black, 15.5 mm diameter aiming mark. From 1 January 1997, the central aiming spot has rings corresponding to the 10, 9 and 8 rings of the normal target. The '10' ring of the scoring target is 5.5 mm diameter, the same as the '9' ring on the static air rifle target. The other rings increase in diameter by 5 mm for each point. The black centre of the scoring rings is 30.5 mm diameter. Thus the target is the same as the static air rifle target but with one 'extra' ring. Because the shot holes can be seen through the 'scope whilst shooting, it is helpful not to have the pellet stop too light coloured in order to minimise this distraction especially if more than one shot is fired at each diagram during training.

Most major international 10m Running Target events now use an 'Electronic' Scoring Target, and these are being used increasingly in local and club ranges around the world. The 'scoring" area is a circular black area corresponding to the 'black' of the normal target. There are no scoring rings, nor are there any scoring rings in the 'white'. The score is recorded electronically and the target does not need to be replaced each time it is used. The aiming spots placed either side of the scoring area also has rings corresponding to the 10, 9 and 8 rings of the normal paper target. Thus, to the shooter, seeing the target through his 'scope at 4x magnification, there are important differences. If he uses the centre of the aiming mark as his aim, then this final target will look very similar to a normal target. However, if he uses an aim in the scoring area which has no rings but is a plain black disc, he may find it more difficult to shoot this event. It is important that he trains for the use of Electronic Scoring Targets even though he does not have access to such a range for training. However, it is not difficult to make up a simulated Electronic Scoring Target or to modify a conventional paper target for training purposes.

Because of the need to transport a heavier target system, the range equipment used with the Electronic Scoring Targets needs to be more robust than that used with paper targets. The SiusAscor ranges incorporate a pellet stop in the mechanism rather than using a separate stop

across the whole range area. A set of Electronic Scoring Targets and their associated range equipment is owned by the ISSF and based in Munich. It is available, at cost, to organisers of major championships. However, it may also be necessary to 'hire' the skilled staff needed to set it up and operate it. Although there are undoubted advantages of using Electronic Scoring Targets in any major event, their use can create possible divisions between competition in a major International Championship and competition at National and Club level.

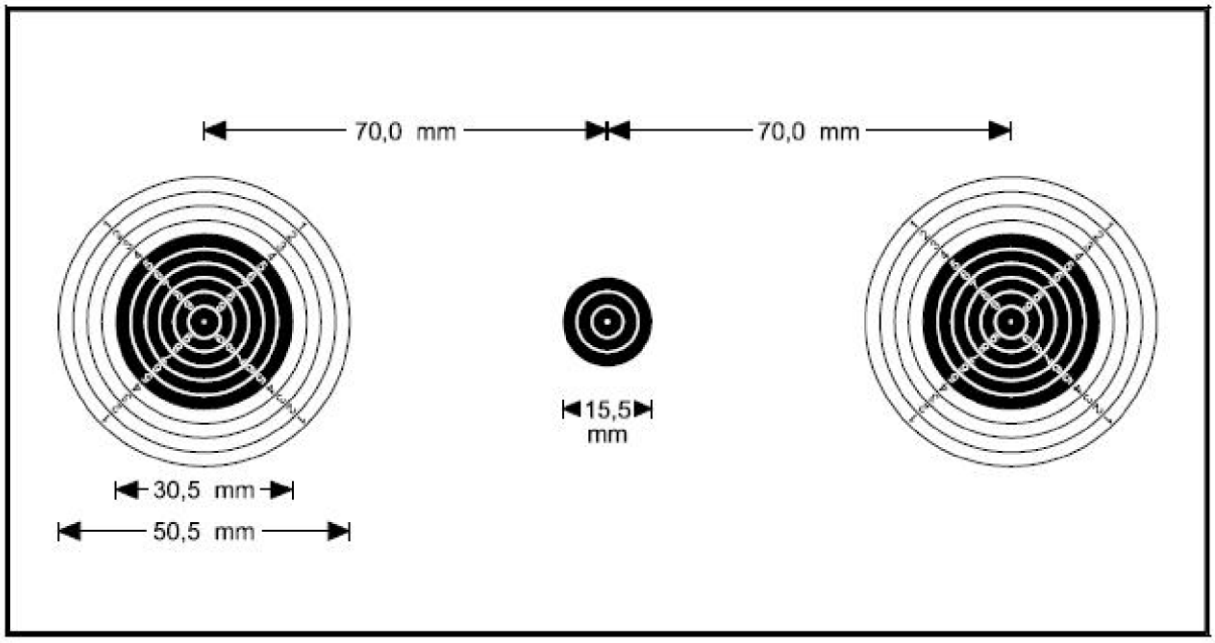


Fig. 11.1.1 The normal 10m Running Target as seen by the shooter

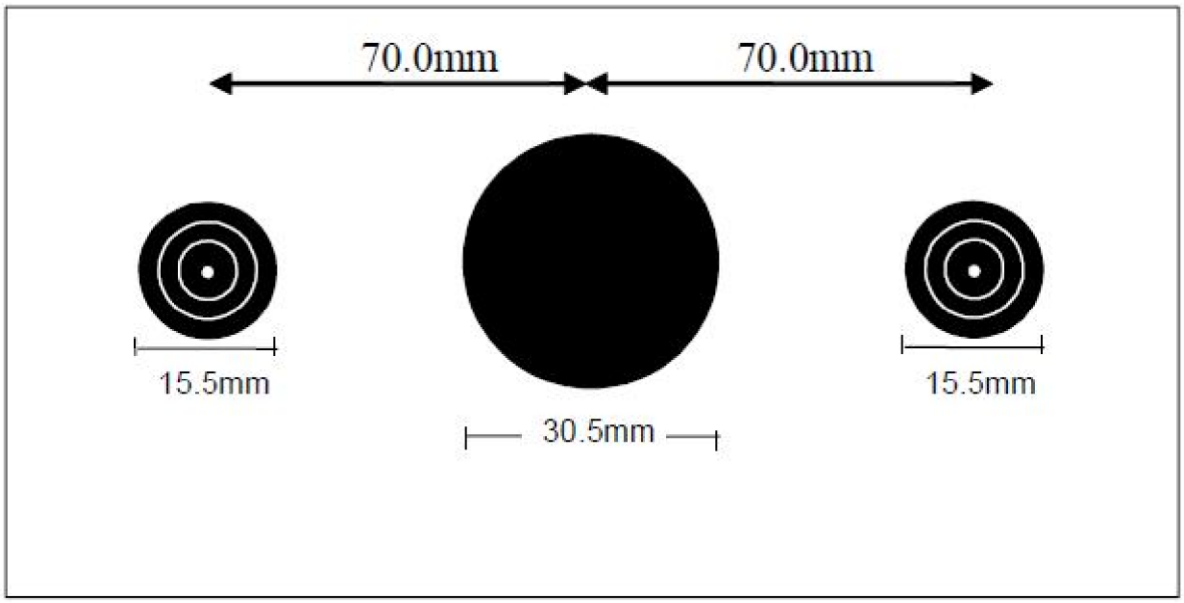


Fig. 11.1.2 The Electronic 10m Running Target as seen by the shooter (Not to scale)

11.2 50m Running Boar

This is printed as a European Wild Boar, black on an off white card. The scoring rings, marked in white, are centred on a horizontal line 500 mm from the tip of the nose. The '10' ring is 60 mm diameter, the other rings increase in diameter by 34 mm for each point. The '1' ring is 366 mm diameter. These targets are very expensive, and the use of half targets and repair centres is common. Half targets that include the nose (i.e. the aiming area) must be used for major events, but simple repair centres are used for training. There are alignment marks on the targets and repair centres. These targets must be properly printed. It is critical that the detail on the target such as the scoring rings, the jowl, eye and tusk of the boar, and the grass in the foreground are printed in accordance with ISSF requirements. These features can all be seen through the 'scope whilst shooting and it is these features that are used to identify the point of aim.

Electronic Scoring Targets are also available for this event and may use a variety of different target arrangements. The simplest is a two headed target so that a common scoring area can be used. Other systems use two separate target faces but with a mechanism that interchanges them between left and right facing runs so that only one set of electronics are needed. At the present time, there is no generic approval for Electronic Scoring Targets for ISSF Championships in the 50m Running Boar event but are being used increasingly for Club level and even National level events. Most Electronic ranges can also be used with paper targets when necessary. If Electronic Scoring Targets are used, then it is most important that the scoring accuracy is not less than that obtainable with paper targets.

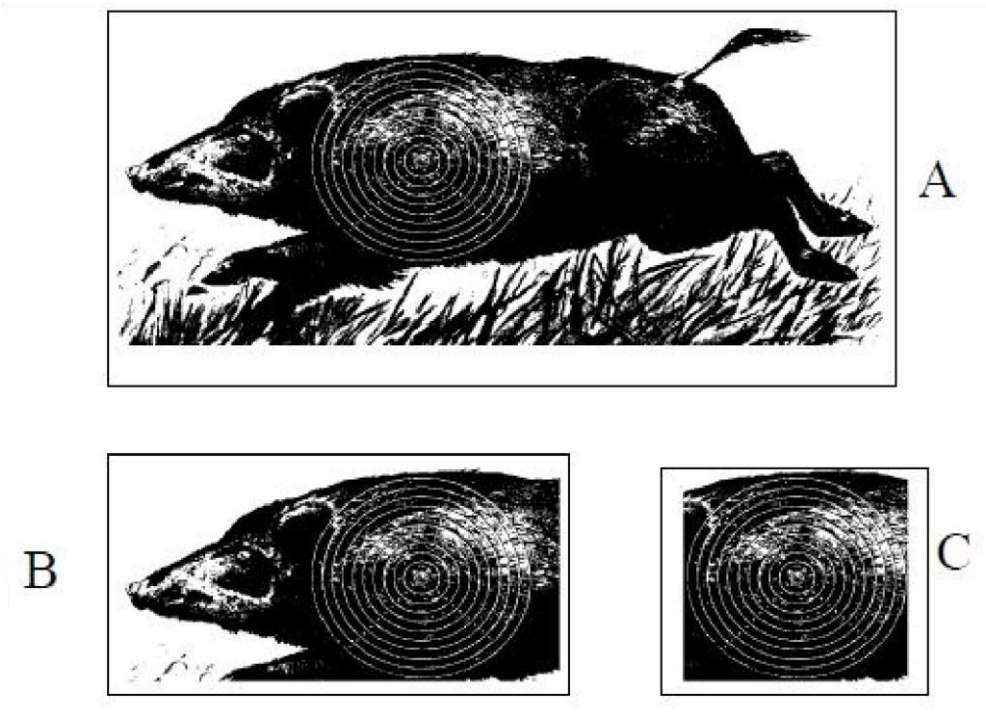


Fig. 11.2.1 The 50m Running Boar Target

A full target (A), Half Targets (B) or repair centres (C) may be used. There are location marks to ensure the correct location of the half targets and repair centres on the full target.

11.3 100m Running Deer

This is a full size picture of a Red Deer, printed in brown on an off white background. The central scoring ring is 150 mm diameter and scores 5 points. It is located over what purports to be the heart/lung area. The '4' and '3' rings are 300 and 450 mm diameter. The '2' ring is an irregularly shaped area covering the neck, chest and trunk. The '1' area is the rump, but as targets are invariably 'siamesed' the rump area is usually omitted to keep the target size as compact as possible. The scoring rings cannot be seen whilst shooting, and there is very little detail on the target to assist in finding the point of aim other than the head area. Because of the advantage offered by using the 'antler run', most shooters opt for an eye aim. This also gives a very positive aim using a cross hair 'scope sight. The aim is about 500- 600 mm ahead and above the centre of the scoring area, a 500 mm lead is about right with ammunition with a velocity of 950m/sec. However, because the head of the deer is detailed and well defined, it is very easy to adjust the point of aim to suit ammunition velocity and target speed. The targets are printed in several sections on very thin paper and are very large. They tend to stretch if not handled carefully when wet with paste. It is very important that the sections are correctly aligned and correctly located within the target frame. Any slight misalignment can result in a group which is not centred over the '5' ring. It can be useful if the shooter has the opportunity to inspect the target and use a tape measure before the match; especially it is to be held on an unfamiliar range. The critical dimensions involve the relationship between the eye and the scoring centre of the target. It is a major task and expensive to replace a target face and so it is usual to repeatedly patch the targets until the supporting board is unusable. Thus it is important in a major match that scores are confirmed by a second person and that an accurate score register is kept to validate the scores that are signalled to the firing point.

Electronic Scoring Targets (ESTs) are becoming increasingly common for the Running Deer, although the Nordic Shooting Region Rules do not refer to them. As a general rule, an EST must allow for accuracy that is not significantly less than would normally be found with paper targets. However, to keep the size and weight of the target mechanism down, it is usual to use back to back targets with a common scoring area. Because the areas scoring 1 or 2 points are an irregular shape, it is possible to have an EST using a virtual ‘rump’ area that the shooter cannot actually see but which can be scored.

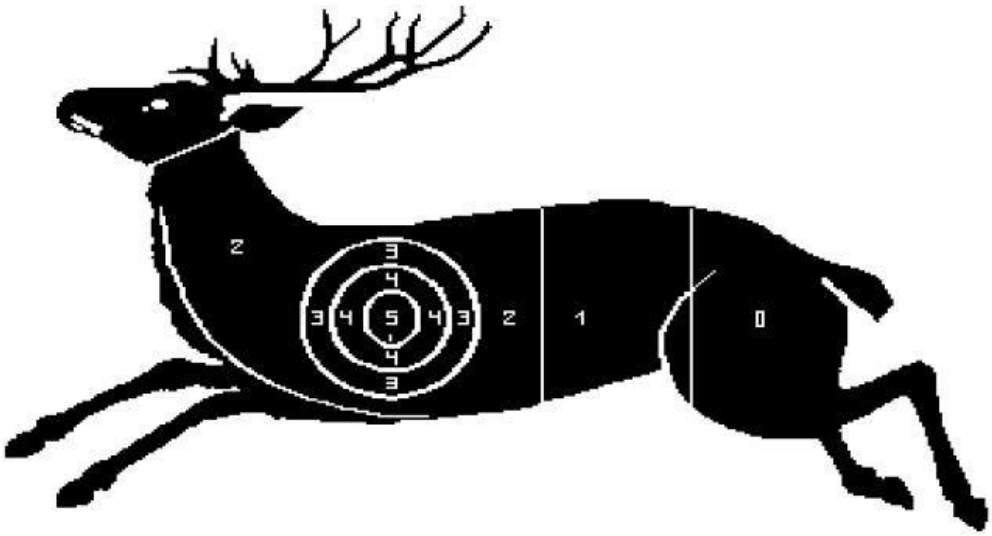


Fig. 11.3.1 The 100m Running Deer Target

Chapter 12 The Shooting Range

All of the range equipment used for Moving Target shooting is demanding in its design, construction and operation. If an existing range is not conveniently located, it is tempting to try to make one yourself. These are rarely successful and often cost more than it would to purchase a commercially available range facility. Many shooting clubs have tried, unsuccessfully, to build a 10m, 50m or even a 100m range. Their attempts are often seen as a derelict structure now left to rot. Whilst any Moving Target practice is better than none, a shooter who is only able to practice regularly on a range which runs inconsistently or at the wrong speed will be at a great disadvantage in a match on a properly timed range. Certainly he should not expend any money on an ad hoc range which is inadequate, but would be better advised to spend that money on the additional expense needed to travel to a range which is properly equipped and maintained.

Apart from the fact that the shooter is limited in his training by a less than adequate range, there is also an inertia when it comes to visiting another, properly equipped, range for a competition. He perceives that his own training range is inadequate and that he will be disadvantaged. Therefore he will not enter the competition. Clearly he is unlikely to advance in the sport; but even worse, such ranges often devolve into a fun range and the money spent is largely wasted. Worse still, the range is then underused and quickly becomes unusable and thence derelict.

12.1 The 10m Running Target Range

This is the simplest range to build. Commercial ranges are available from a number of manufacturers. As a rough guide, a range, without 'extras' such as CCTV equipment, can cost as much as three times the cost of a typical Running target Rifle. The fairly basic range once made by RX Products (later trading under the name MilTec) cost rather less than the cost of a rifle but it worked well. Alas, these ranges are no longer made but there are many lying unused at clubs around the UK. It may be necessary to provide your own pellet stop and of course, locate it at the correct height in a safe position. For the pellet stop a steel plate is ideal, either vertical or sloping, but an improvised pellet stop can be made using a wooden frame to support old telephone directories that can be replaced regularly. It would be wise to back these up in the central strip with a 2 - 3 mm steel plate and to inspect and replace the directories regularly. The pellet stop should be painted a dark neutral colour such as grey. If it is too light, the pellet holes can be seen through the target and this distracts the shooter from completing a good follow through. Instead of painting the pellet stop, it can be covered with sheets of dark cloth or card separated from the pellet stop by a few centimetres. The card or cloth allow the pellet to penetrate and can be replaced occasionally.

The range equipment should be supported so that the centre of the target is 1.40 ± 0.05 m. Any deviation from this will cause the shooter considerable problems in determining the elevation of the rifle, and may need some adjustment to his hold and/or to the way the rifle is set up. Whilst a range at the wrong height can be accommodated by most shooter, they would be at a major disadvantage if shooting on a fully compliant range.

The need to provide protection for the shooter against gusts of wind and driving rain makes an indoor range a necessity. The minimum space needed to accommodate a range is a room 12.5 metres long and 3.5 metres wide. 15 x 4 metres is better. It must be uniformly lit to a level of at least 300 lux (500 lux is recommended), with a minimum of 1000 lux on the target itself. As a rough guide, at 300 lux, it should be possible to take photographs at 1/30 second with a lens

aperture of f2.8 on 100 ISO film (or its digital equivalent). Many 'club' air gun ranges have adequate light over the targets but have poor general lighting. As a result, a shooter who has trained on such a range will find that the targets seem too dark on a correctly lit range. Although the ISSF Rules specify minimum lighting levels, it is more important to maintain the correct lighting contrast between the general range lighting, especially at the firing point, and the target itself. An outdoor range, although feasible, would severely limit practice to daylight hours and to times of good weather; even a modest wind can severely deflect the low velocity pellet. Although an outdoor or semi outdoor range, or one relying on natural lighting, is certainly better than no range at all, a shooter who intends take this event seriously should have regular access to a properly equipped range.

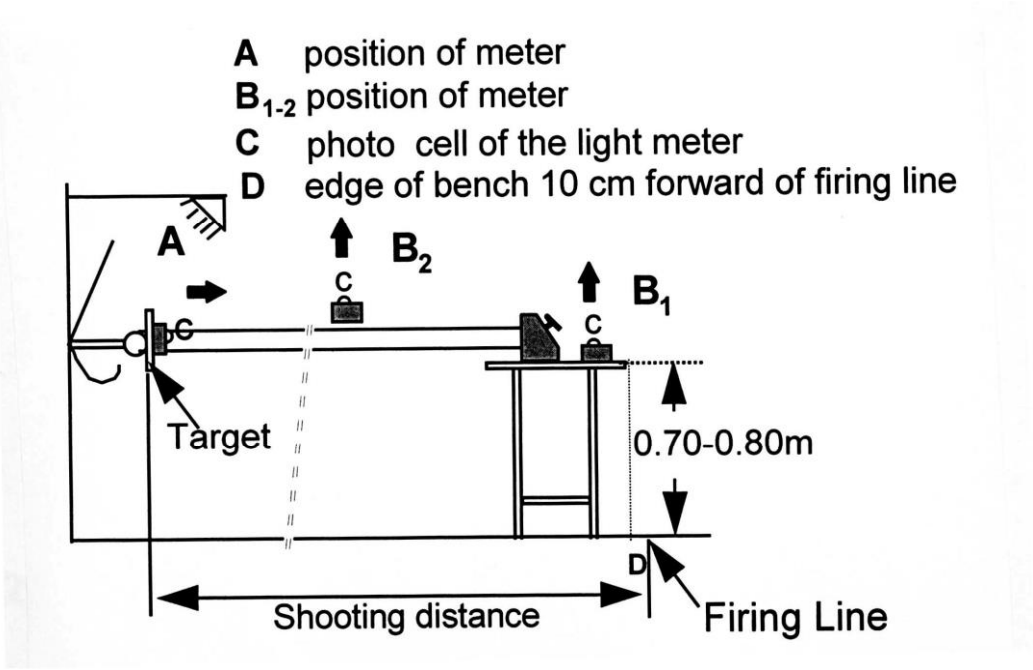
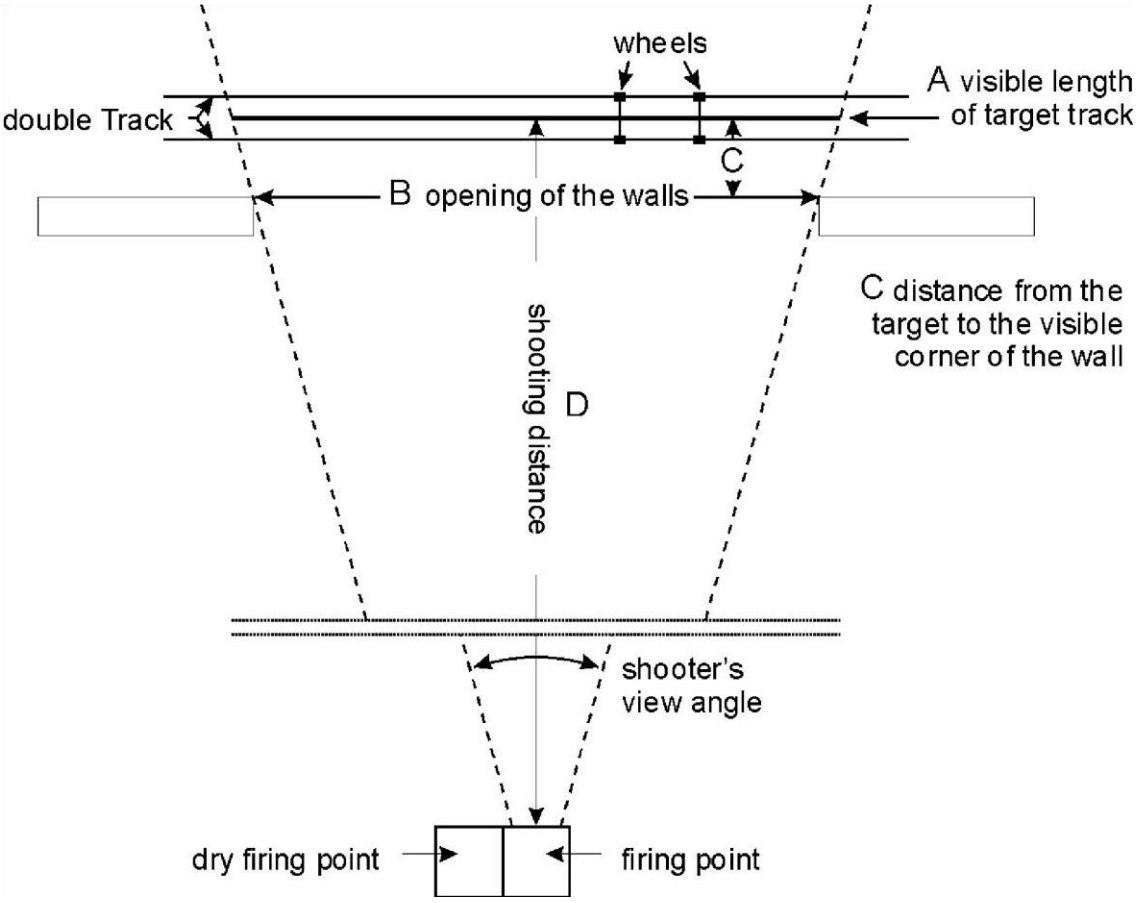


Fig. 12.1.1 Measuring the Range Lighting Levels

Although the ISSF rules specify general range lighting of at least 300 lux, this is important only over the firing point (B_1). Even on a correctly lit range, the shooter's perception of the lighting over the range floor area (B_2) will be determined more by the colour and reflectivity of the range floor than by the level of illumination!

For a homemade facility, it is important to remember that it must be able to run at the correct speeds and consistently. This probably means using a regulated power supply and a motor which is rather more powerful than might at first be thought to be necessary. An ad hoc range can be made using an OO or HO gauge model locomotive, a length of track with 'isolating' sections at both ends and a polarity change-over switch. This can cope with the slow runs well if a regulated power supply is used, but it is difficult to get enough acceleration (and deceleration) to cope with the fast runs. A major problem is wheel spin on the track. This is typical of the problem which might be encountered with any home made range. A positive drive system is needed. Drive cords must be taught, preferably over a large diameter pulley, otherwise they can slip. This in turn demands a good motor with a suitable front bearing to take the stress. A Direct Current (DC) motor lends itself to fine tuning of the speed using the regulated adjustable power supply. The modern trend is to use a linear stepping motor driven by a precise pulse generator. This can only work properly with a very positive drive system free from slippage.

Of course the Rolls Royce of ranges is proper Electronic Scoring Target range. The most frequently used range system is made by Sius-Ascor in Switzerland, although other systems are made. Not only are the shots scored electronically, but the heavy target system is driven by a very powerful and reliable motor. The target crossing time is monitored for every run and the result displayed on the operator's console. The time seldom varies by more than one hundredth of a second. However, such ranges are expensive; nevertheless they have replaced the mechanical systems with paper targets at all of the major international matches.



A visible length of target track
B opening of the wall between visible corners
C distance from the target to the visible corner of the wall
D shooting distance
Formula for **determining the opening: B = A x (D – C) / D**

Example (50 m):
C= 0.20 m
B = 10.00 m x (50.00 m – 0.20 m) / 50.00 m
B = 10.00 m x 49.80 / 50.00 = 10.00 m x 0.996
B = 9.96 m

Example (10 m):
C= 0.15 m
B = 2.00 m x (10.00 m – 0.15 m) / 10.00 m
B = 2.00 m x 9.85 / 10.00 = 2.00 m x 0.985
B = 1.97 m

Fig.12.1.2 How the Target Run Width is to be Calculated

12.2 The 50m Running Boar Range

This is a major step up in scale. Safety is important and a good back stop with a large range safety area behind is essential. There must be adequate provision for the safety of markers in the butts and possibly for safe access to the butts whilst shooting is taking place too. The motor and electrical system must be protected from the weather. There must be an effective system for signalling the value of each shot. Most ranges are outdoors with a covered firing point to protect the shooter from wind and rain. Indoor ranges are not unknown and can get around many of the safety problems of an outdoor range but are expensive. However, an indoor range must comply with the ISSF lighting requirements (i.e. as specified for the 10m Running Target event) and this could be expensive to implement.

Local safety requirements should be ascertained before any commitment is made. In the UK the range must comply with the MoD criteria although Safety Certification will be through the NRA or NSRA. In the UK it is unlikely that a Range Safety Certificate will be granted for a range otherwise authorised for 50m static rifle shooting as the safe area will be too small. In case anyone is tempted to bypass the process of licensing, the standard British Firearms Certificate prohibits a target rifle being used except on a range approved for the purpose by the relevant authority.

There are few commercially made range systems still on the market. Although a home made system is possible, unless suitable motors, gearboxes and drive systems are already available, the cost of building such a range is not inconsiderable. The target frame is big and heavy and may need a three phase electrical supply to provide enough power for the fast runs. The target must be accelerated to 4 m/sec (14.4 km/hr) in the space of only about 2 metres. For a target frame weighing perhaps 50 kg, this needs lots of power. The drive must be robust and a >5 mm steel cable is usual, it must be positively coupled to the motor, usually via a large driving drum. Speed changing can be through a gear box or may be done electrically if a three phase motor is used. Fine adjustment of the speed is best achieved by some form of adjustable drive pulley. The drive system must also include a braking mechanism (which can be an electrical regenerative brake) if the target trolley is not to damage itself by crashing against a 'stop'.

Like the 10m range, the height of the centre of the target is important and should be 1.40 ± 0.20 m. Thus the range should be built over level ground. If necessary, the height of the firing point can be altered to bring the perceived target height within specification.

Most 50m Running Boar ranges will be outdoors. A covered firing point is necessary to protect the shooter from wind and rain. If possible the range should face in the same direction as the prevailing wind but should not face the into the sun: ideally the sun should be directly behind the firing point at midday. Some screening is helpful at either side to minimise the effect of wind. However, a screen on one side only can cause a problem with wind buffeting when the wind is blowing from the opposite side, making the flight of the bullet unpredictable.

Sius-Ascor also make a 50m Running Boar Electronic Scoring Target system, but do not supply the drive mechanism. Häring can supply a complete range system. The target system is necessarily heavy and this needs an even bigger drive motor than would a paper target system. If you chose to use a twin target system with some form of switchable target so that the same electronic system can be used for both the left and right facing runs, this will require a lot of space under the rails supporting it, and an even bigger motor drive.

12.3 The 100m Running Deer Range

If the Running Boar Range sounds difficult to build, then the Running Deer Range must be nearly impossible. The range safety demands are formidable unless it can be located in a deep quarry or against a cliff face. Even then, ricochet protection is essential. Because the rifle must be raised to the shoulder from the 'ready' position, there is always the danger of an uncontrolled shot being sent skywards, or a shot being fired well outside the bounds of the target "run". The range of a free flying centre fire bullet will be several kilometres and the authority giving approval to the range construction must be satisfied that there is no danger to shooters or the public. In the UK the safety criteria take account not only of a bullet being "skied" but also the risk of a ricochet.

A three phase supply is essential to power a motor requiring several kilowatts (HP). The Target Frame will weigh, typically, 100 kg, and it must be accelerated to about 5 m/sec (18 km/hr). The 'antler run' does provide some space for acceleration and deceleration of the target, and this is essential. The drive system is usually a scaled up version of that used for the Running Boar

A 100m Running Deer range will always be outdoors. The shooter should be protected from wind and rain under a covered firing point. Although the effect of wind on the bullet will be small, wind blowing into the firing point can cause the shooter some problems with the stability of his position.

It should be obvious from the foregoing that it will always be difficult and expensive to set up a satisfactory Running Deer or even a Running Boar range. This is one reason why, many years ago the ISSF changed from using Centre Fire to Small Bore rifles for the Running Boar event; and why the more recent change to the Air Rifle for the (then) premier 50m Running Boar Olympic event was made. Whilst homemade 10m ranges are not recommended, the cost of a commercial range is not prohibitive. A suitable building to house it may be more expensive. However, for anyone who wishes to shoot Moving Targets seriously, the 10m Air Rifle event must be the way forward. The lessons learnt from winter training indoors at 10m can be 'converted' to the 50m and 100m events during the warmer, dryer months.

Häring can supply a complete range system using Electronic Targets. Rather than using a mechanical brake this uses electrical (regenerative) braking.

PART 4 SETTING UP THE EQUIPMENT

Most shooting equipment needs to be set up in accordance with the needs of the individual shooter. Like the shotgun disciplines, the rifle needs to be fitted to the shooter in order that he can get the best use from it. Like a shotgun, the rifle must be pointing at the target and following its run as soon as it comes into the shoulder. It is at that point that the shooter acquires his perfect aim through the ‘scope sight. The telescope sight must also be correctly adjusted to the needs of the discipline. This part of the book shows how the equipment can be optimised to match the shooter's requirements.

It is most important that any changes to the fit of the rifle, the position of the 'scope and the shooting position, must be correlated. Any change to one must usually be accompanied by changes to the others. It is particularly important to be aware of the 'ratchet' effect in which one seemingly small change leads to others which then eventually lead to further changes in the original parameter. (This is an example of the “Law of Unintended Consequences”!) A good philosophy is the make any changes slowly. It is too easy to be forced into an uncomfortable shooting position because of lack of attention to detail in the initial setting up process. Thus it is always helpful to review the fit and 'feel' of the equipment from time to time, preferably with the help of a qualified Coach or Instructor, or another experienced shooter.

Before significant changes are made to the fit of the rifle and the position of the 'scope, it is most important the shooter should verify that his shooting position is satisfactory. Only after this should he adjust the fit of the rifle to match his shooting position and then finally, adjust the position of the 'scope so that no head movement is needed when the rifle is first raised to the shoulder.

No matter how good the equipment, unless it has been set up to match the needs and physiology of the shooter, he will never realise his potential.

For most Moving Target shooters, relatively inexpensive equipment can be adapted to perform almost as well as the more expensive specialist equipment. Even the specialist equipment often needs some adaptation to suit it to the needs of the shooter.

It is suggested that the initial setting up procedure should follow the order of this text; especially Chapters 14 – 17. These factors are strongly interrelated and when the rifle has been set up, the ‘scope finally fitted and the rifle balance adjusted, the process should be repeated. Particular care should be taken to ensure that any subsequent changes made are convergent i.e. the amount of any change should decrease each time. If a change is made at any other time to one of these factors, then the whole process should be reviewed. Remember the “Law of Unintended Consequences”! Zeroing (Ch.19) should only be done after the rifle and ‘scope have been set up, but a spot check can be made at any time. Adjusting the trigger (Ch. 18), apart from changing its reach, is independent of any other adjustment. Setting up the ‘scope sight (Ch. 13) should only need to be done once but if any change is made to the focusing of the objective lens (Ch. 19) i.e. for a different shooting distance, then rifle zeroing MUST be repeated (If the ‘scope has a helical

focusing mount and/or it has a variable magnification, re zeroing should not be necessary but it is worth verifying the zero).

Chapter 13 Setting Up a Telescope Sight

When a new 'scope is first taken from its box it must be set up before it can be used. There are two adjustments to be made. It is important to understand the function of those adjustments.

The eyepiece adjustment is made for the sole purpose of obtaining the best possible image of the reticle NOT the target. It may vary slightly with the user. However, any significant difference between users would suggest that one or more of them are in need of corrective spectacles.

The objective lens adjustment is made to place the image of the target in the same position within the 'scope as the reticle. It will vary with target distance. If this is incorrect, any movement of the shooter's head from side to side or vertically will cause the image of the target to move in relation to the image of the reticle and this will result in a displacement of the point of impact.

If the objective lens adjustment is made correctly, and the reticle has been focused properly using the eyepiece adjustment, then both reticle and target must be in focus together.

If both adjustments have been made correctly and either the reticle or the target does not appear to be acceptably sharp, then the most probable cause is uncorrected astigmatism in the eyesight of the user.

13.1 Eyepiece Adjustment

This is made by rotating the eyepiece of the telescope. Some ‘scopes like those made by Nickell have a very coarse adjuster that requires only 180^0 of movement to cover its full span. There is usually a crude scale to help reset the adjustment should it be changed. Other 'scopes have a fine adjustment, with several turns of the whole eyepiece needed to make a significant change. In this type, the eyepiece can be locked in position with a threaded sleeve after the adjustment has been completed. There are many variants of each type.

Whatever the type, the eyepiece should first be unscrewed (i.e. to make the telescope slightly longer) until the reticle appears blurred. Take care not to unscrew the eyepiece completely.

The 'scope should now be rested on a firm support that allows you to look through it at a comfortable distance and to be able to move your head away and back again easily. The 'scope should be pointing at a well lit but neutral background. A blank sky is good, but a well-lit white card is better. It is important that there is no distracting detail in the field of view of the 'scope. When you move your head away, it should be possible to look at a well-defined object at a distance of at least five metres. Ideally this object should be at the same distance as the target. The difference between 5 metres and infinity is probably unimportant. This is what your eye must be focused on immediately before you look through the 'scope. If you need corrective spectacles for distant vision they must be worn. This is most important. Whilst shooting, your eyes should be in their most relaxed state which, for 'normal' vision, is when they are focused at infinity. Your eyes will quickly adjust to an image that is not at infinity, but not quickly enough for shooting at a moving target.

It is important that the image of the reticle that you see through the 'scope appears to be at the same distance as the actual target. If not, then it will be difficult for you to maintain the binocular vision that is so important for balance whilst aiming. Closing one eye will also cause strain in

your facial muscles which will, in turn, lead to strain in your aiming eye. Any difficulty in using binocular vision whilst aiming can often be traced back to failure to wear corrective spectacles and/or incorrect adjustment of the 'scope eyepiece.

Focus both eyes on the distant object for at least ten seconds without 'staring' at it. Now look through the 'scope. It is your first response that is important. After five seconds or so your eye will adjust itself to focus on almost anything! Is the reticle blurred? If not, unscrew the eyepiece lens further. Now look at the distant object again for ten seconds and try again.

Make a small adjustment to the eyepiece by screwing it in (to shorten the telescope slightly). After resting your eye again, look through the 'scope again. Is the reticle less blurred?

Repeat this process until the reticle appears sharp and further adjustment makes it blurred again. Come back to the point where it is sharpest. If there is any doubt, unscrew the eyepiece slightly and try again. When you have a perfectly sharp reticle, lock up the eyepiece or note the scale reading and go away for a cup of tea. It will be helpful to make a mark (use white correcting fluid: it is easily removed) on the eyepiece and the body of the 'scope so that you easily return to this setting. After a ten minute break, look again. Is the reticle still sharp. Remember that it is your first impression that is important. There will always be some slight uncertainty. The final setting should always err on the side of the eyepiece being unscrewed very slightly anticlockwise (i.e. with the telescope slightly longer).

Now check that the reticle is uniformly sharp and that vertical and horizontal lines look the same. If not, rotate the 'scope and see if the less sharp line rotates with it. If it does, then the reticle is not perfectly flat. In this case the eyepiece should be readjusted until the best compromise is reached. This is not a fault in the 'scope, it is not always possible to have every part of a complex reticle in the same plane. In some of the Nickell twin post scopes the two posts will always be in a slightly different plane. If, when you rotate the 'scope, the less sharp part of the image is always in the same part of the field of view in relation to your eye (i.e. vertical or horizontal), you are suffering from uncorrected astigmatism and should visit your optician.

Now that the eyepiece has been correctly focused and not before, you can focus the objective lens.

13.2 Focusing the Objective Lens

Set the telescope up on a firm rest and pointing at a well-defined object such as a target that is at the intended shooting distance. This must be carefully measured especially for a 'scope to be used at 10 metres. Ideally the shooting range should be used. The 'scope may be attached to a rifle but appropriate safety precautions must be observed.

If the 'scope has a calibrated focusing head, set this at the appropriate distance. It is most important that you verify this calibration, they are seldom perfect. If the 'scope does not have an easily adjustable head, then you must investigate the system for adjusting the objective lens. Some are accessible after removing a threaded ring, others use a locking sleeve. A 'C' spanner may be needed to adjust the lens, or a two point watchmaker’s watch back removing tool. With care, a large screwdriver can be used to rotate the mount of the lens to adjust it. A useful tool can be made by carefully grinding the measuring tips of an inexpensive steel calliper to fit the notches in the lens mount and locking rings. However, it is very easy to damage the lens if any such tool should slip. The mounts are usually very well greased and this tends to harden making it difficult

to achieve the first movement. If this is the case, a minute drop of light oil on the threads and allowed to work overnight sometimes works.

Now look through the 'scope at your target. Does it look sharp whilst the reticle is also sharp? Move your head slightly from side to side or up and down. Observe carefully the relationship between the reticle and the target. If the reticle seems to change its position in relation to the target, the objective lens must be refocused. Most 'scopes are set by their manufacture for a range of either 100 m or 30 m. To focus on a target that is closer than this, the objective lens must be unscrewed a little. Unscrew the objective lens one turn and re-check. Does the reticle move more or less than it did before when you move your head? If the relative movement changes its direction, then the lens has been moved too far. The objective lens should be adjusted until however much you move your head, the target and the reticle remain perfectly aligned. This is known as "Parallax Focusing"; it uses the parallax effect between the image of the target and the reticle to verify that both are in the same plane within the 'scope. Although any uncorrected parallax will cause problems if your eye is not placed central to the 'scope, it is more important to remember that any parallax means that the target has not been correctly focused by the objective lens.

Now look at the target for about ten seconds and then bring your eye quickly to the 'scope. Do both the reticle and target appear to be equally sharp? If not, you must go back to the beginning and refocus the eyepiece. If this still does not work, then the following procedure should be used but only after the procedure already described has been carried out.

13.3 An Alternative Procedure

With some 'scopes such as the Twin Post 'scopes, the reticle is not flat; in others, the reticle isn't perfectly perpendicular to the 'scope axis. Some designs use fine needles or wires. It is the outline of the reticle that is important when shooting. Whilst shooting, the eye tends to concentrate on the target and so it is only the outline of the reticle that the shooter is aware of. However, whilst focusing, when only the reticle should be clearly seen, the eye tends to be drawn to its detail such as the thickened body of the posts.

In other designs, the two posts are made from flat metal strips but, because of the independent adjustment mechanism, they are not in exactly the same plane within the 'scope. It is difficult to decide which post to focus on and there must be a compromise. With this type of 'scope, there will always be some residual parallax whilst focusing the objective lens. The lens should be focused until the parallax of both posts is minimal with both showing a similar amount of movement when the eye is moved, but in opposite directions. This means that the image of the target is equidistant between the two posts. It must be emphasised that the difference is small and it is only because the method is very sensitive that there is any problem at all. Whilst shooting, the shooter's eye tends to be drawn to the fine detail in the target and he is not aware of the small out of focus effect of the bold reticle.

With either design, or if similar problems occur with other 'scopes; fine adjustments to the eyepiece may be made, but only after the objective lens has been focused correctly. Because the target is flat and has considerable fine detail, it is sometimes easier to adjust the eyepiece to focus on the target rather than on the reticle. If this method is to work, it is essential that there is minimal parallax between target and reticle and that the target distance is correct before any attempt is made to focus on the target using the eyepiece adjustment. The eyepiece should be focused to give the sharpest image of the target, with the knowledge that the image of the target within the

'scope is coincident with the reticle. The reticle should then also be in sharp focus, or as near to sharp focus as the design permits. If the whole of the reticle(s) cannot be brought to a sharp focus, it is the part of the reticle that is aligned with the target that is most critical. Small adjustments should then be made to the eyepiece to bring the fine detail of the target into sharp focus. It is again most important to look away from the 'scope every few seconds and to focus the eye on the target before looking through the 'scope again.

Finally, replace any locking rings or sleeves, taking care not to disturb any adjustments that you have made. If the 'scope has an adjustable focusing head, make a note of any scale readings or mark the head so that you can easily return to this setting.

The 'scope is now ready for use.

Chapter 14 Fitting the Sight

The position and height of the sight are dependent on the length of the rifle stock, the height of the cheekpiece and the position of the buttplate. A change to any of these must be reciprocated in the others. Other chapters deal with these adjustments in more detail.

It is also most important that an inexperienced shooter does not fit the sight to accommodate a poor shooting position or badly fitting stock. The priority must be given to shooting position, then rifle fit and ideally, only then should the sight be fitted. However it is to set up the rifle's cheekpiece unless the 'scope has been fitted to the rifle. The critical matter is the 'scope height: thus the 'scope can be fitted to the rifle temporarily using its intended mounts to allow initial rifle fitting and cheekpiece and buttplate adjustment. Only when the rifle has been fitted to the shooter should the final position of the 'scope be determined. Thus you will find it beneficial to return to the 'scope position as the other adjustments (i.e. stock length, cheekpiece and buttplate) are altered.

14.1 'Scope Mounts

There are many different mounting systems available. Most, intended for an air rifle or small bore rifle, make use the dovetail mount machined into the top of the rifle's receiver. The mounts usually hold the 'scope body in a close fitting clamp. To cope with the recoil, the mounts intended for a centre fire rifle are more rigidly attached to the rifle and sometimes to the 'scope too. Before attempting to fit any mounts to a 'scope it is essential to ensure that they are compatible. Many of the older 'scope bodies (mostly German made) were 26 mm diameter whereas most of the modern 'scopes are 1" or 25.4 mm diameter. 26 mm mounts can be fitted to a 25.4 mm 'scope but only by using suitable shims (sometimes supplied with the mounts). Any attempt to fit 25.4 mm mounts to a 26 mm 'scope will result in damage to the 'scope. Whatever the relative sizes, it is most important that the 'scope rings are a snug fit around the 'scope body: there should be the maximum metal to metal contact without any assistance from the mounting screws.

Mounts come in varying qualities. Price is not always the best guide to quality. Many of the less expensive mounts are made from an aluminium alloy. Their only weakness is that sometimes the steel screws used can damage the threads if overtightened or removed and refitted too often: these should be avoided. Some mounts split vertically and cannot be removed from the rifle and replaced exactly. Some of the more expensive mounts have a facility for some horizontal adjustment. This type of mount is almost mandatory if a twin post 'scope is used to make sure that the posts appear in the centre of the field of view. With some adjustable mounts, it is easy to lose the adjustment if the 'mounts are removed from the rifle for instance for air travel. If non adjustable mounts are used, then it may be necessary to shim the mounts. Thin aluminium strips between the 'scope and its mount may be used to correct the position of offset posts. Suitable shims can be made from the thin aluminium used for soft drink cans. PVC tape is unsuitable because it 'creeps' under load and can cause a shift of zero, but metallic (aluminium) adhesive tape can be used. Some care is needed when shimming a mount. If overdone, the shims can put excessive strain on the 'scope body.

The mounts should be fitted as far apart as the 'scope and the rifle allow. When fitting 'scope mounts to a dovetail on a rifle, it is most important that the mounts are fully seated on the dovetail before either clamp is tightened. The mounts should be a matched pair and the screws tightened progressively to ensure that no strain is placed on the 'scope. One piece mounts are available that

make various claims as to their rigidity. They are unsuitable for most cartridge rifles and some air rifles because they can make loading difficult. Although some one piece mounts are undoubtedly very secure, they need to be matched to the rifle dovetail and carefully fitted. They are only really necessary for a recoiling air rifle.

For the Feinwerkbau 600 series air rifles, the position and size of the loading port mean that it will sometimes be necessary to use a special front mount. This needs to fit over the larger front 'bell' of the sight rather than over its body. Appell in Germany did make special mounts to accommodate at least one of the Nickell 'scopes, but they are now only made to special order. Most shooters using this most popular air rifle have made up their own front mount. The later P70 series air rifles have a better dovetail base for sight mounting. An alternative is to use raising blocks with a rearward extension on the front block over the loading port. With this rifle it is essential to use high mounts (or raising blocks) in order to provide sufficient clearance for the loading tap. This is particularly important if a conventional twin post 'scope is used which has an adjuster underneath the 'scope body. However, care must be taken to make sure that the sight is not too high to contravene the ISSF Rules.

Some air rifles have mounting rails that are a different width and / or height at the front (on the rifle barrel), and at the rear (on the action). This can mean that the mounts are slightly misaligned. If the 'scope uses an 'image moving' system of adjustment, it should be possible to compensate by normal 'scope adjustment. If it is the reticle that is moved, it may be necessary to shim the mount or to make up an offset mount to compensate if the correction is too great to be accommodated by the usual adjustable mounts.

Shims under the rear mount may be needed for the 10m Running Target event, especially if high mounts are used. There may not be enough adjustment to compensate for the height of the sight above the barrel. This is particularly important if a Twin Post 'scope is used which has limited movement of the posts. It is important that the shooter should be able to use the posts to keep his rifle 'square' with the target. This needs a good view of both posts and so the top of the posts should not be too far below the centre of the field of view

Some shooters have tried using mounts that are offset to the left. Although they permit a better, unstrained, head position, they have never been successful. The rifle no longer ‘points’ naturally and sight tends to go out of alignment as the shooter swings whilst he follows the target. However, a very small offset can be beneficial. When the mounts are fitted to the rifle using a conventional dovetail system (common on the 10m Air Rifle and 50m Running Boar Rifle), it is worth noting that the dovetail width does vary. Most mounts will accommodate the usual range of dovetail width. This does mean that the centre of the ‘scope isn’t necessarily directly over the centre of the barrel. The offset, 1 – 2 mm at most is not important. However, it can be exploited because by turning the mounts through 180^0 the offset can be reversed. This can be exploited to achieve a better head position if the slight offset is leftwards.

The height of the mounts is important. It dictates the height of the cheekpiece and the position of the buttplate; high mounts also lower the shooter's left arm thus reducing strain and making for a more comfortable hold. For hunting, most shooters prefer a low mounted 'scope that is more comfortable to use in different shooting positions, especially the prone position. A low mounted 'scope is less likely to snag on vegetation whilst stalking. These factors are unimportant for Moving Target shooting when shooting takes place only from a standing position and the target is at a fixed distance. When shooting at Moving Targets, a high 'scope encourages a more upright head position that is more comfortable and improves balance. The ISSF Rules permit the centre line to be up to 75 mm above the centre line of the barrel. A high sight line allows the recoil to act more in line with the supporting shoulder thus reducing the climb of the rifle muzzle. A high

mounted sight also leaves more room for loading a bolt action rifle. However, a high sight line makes the rifle more sensitive to 'cant'. In the Running Deer events, if an eye aim is used, this has a similar effect to using a very high sight line. For some air rifles, notably the Feinwerkbau 600 series, a high sight line is necessary so that the 'scope can clear the loading port. For the Running Deer events, a conventional 'scope mounted low over the action must allow sufficient clearance for the spent cases to be thrown clear reliably after the first shot of each Doubles run. If a twin post 'scope is used, the bottom adjuster can easily be struck by the case and be damaged or cause the case to fall back into the action thus preventing reloading the second cartridge. Raising blocks can be used, within the ISSF / NSR Rules, to increase the height of the 'scope.

When the mounts are fitted to the rifle, or the 'scope is fitted into its mounts, the screws should be tightened progressively to avoid unnecessary strain on the mounts and 'scope. The screws should be firm but not overtightened to avoid damage to screw threads. If the mounts are a good fit to the 'scope there will be no distortion of the mount when the screws are tightened firmly.

14.2 Fitting the Mounts to the Rifle

It is most important that your eye is perfectly aligned with the sight as soon as you raise the rifle to your shoulder, and that it remains in alignment as you swing to follow the target. Any change in your stance or head position must be accompanied by the necessary change in 'scope position. It is also most important that your head position is as relaxed as possible and not dictated by the way the rifle and sight have been set up.

The mounts should be attached to the rifle (without the ‘scope) in approximately the position they will be used with the 'scope. If the rifle is then raised to the shoulder, the height of the cheekpiece and position of the buttplate should be adjusted until you can see centrally through the open mounts without having to adjust your head. An earlier chapter dealt with cheekpiece and buttplate adjustments and this should be consulted.

Now stick a strip of paper or 'masking tape' along the top of the cheekpiece. Raise the rifle to your shoulder into the shooting position and get an assistant to make a mark on the tape directly below the front of your eyeball. Do this several times until the mark is consistent with your stance.

Fit the 'scope to the mounts but do not tighten the screws fully yet. Place a bright, well diffused light in front of the 'scope. A well diffused 40 watt incandescent bulb is suitable. Now place a piece of white card behind the eyepiece and locate the bright image of the objective lens on the card. This should be 50 - 100 mm behind the eyepiece ring. You are looking for a crisp round image of the front of the 'scope, not of the lamp! Now adjust the position of the 'scope until this sharp image will be about 3 - 5 mm in front of the position of your eyeball marked on the cheekpiece. This is the optimum position for the 'scope. Check that the 'scope is square, and that the reticle is vertical when the rifle is in the shoulder. You may need to take account of any cant you use. Now tighten the mounts firmly but not too tight. The screws holding the mounts to the rifle need to be secure and must not permit any sight movement under recoil. Relatively small screws are used to secure the ‘scope within its rings and it is important that these are tightened firmly but not so tight so as to cause the screws to stretch. If the rings are a good fit around the ‘scope body, then a firm fit can be achieved without any risk of over tightening. As several screws are used on each ring, they should be tightened progressively.

If you raise the rifle to your shoulder, your eye should be perfectly aligned with the 'scope without any need to move your head in any direction. If not, some adjustment to the cheekpiece and/or the buttplate may be needed. This is the natural position for your head. If you subsequently find that you need to move your head, you must move the sight, cheekpiece and buttplate too. Any change in the length of the stock must also be accompanied by other changes too.

It can be helpful to mark the position of one of the 'scope mounts on the rifle so that, if the 'scope has to be removed such as for air travel, it can be replaced quickly in exactly the same position as before. A stop can be fitted to the rifle, made from a spare mount or a sight raising block, that will ensure that the 'scope is always returned to the same position. It should not be necessary to fit expensive 'roll off' 'scope mounts. A light mark on the ‘scope body will also tell you if the ‘scope has moved in its rings.

14.3 Verifying the Sight Position

It is only too common to see even an experienced shooter move his head slightly after he has raised the rifle to his shoulder. If the rifle and 'scope are correctly fitted to the shooter, this should not be necessary. A small movement of the head downwards as the rifle is raised to the shoulder, to increase the pressure on the cheekpiece, is acceptable. This movement should be no more than a few millimetres and should be done consistently. After it has been fitted, the position of the sight should be verified. The Shooter should adopt the ready position and then raise the rifle to his shoulder in the normal way. His eye should be correctly aligned with the 'scope. His eye should be centred with the eyepiece, as seen by an independent observer, and he should be able to see a correctly centred disc of light in the mask of the eyepiece mount of the 'scope. If he has to move his head laterally or upwards, then some corrective action is needed. Any lateral or vertical misalignment can be corrected by adjusting the fit of the rifle. Vertical misalignment can also be corrected by using different sight mounts or sight raising blocks.

If, on looking through the sight, there is some restriction of the field of view, then the 'scope is too far from his eye (or vice versa) and should be corrected. Ideally, the disc of light should just fill the mask of the eyepiece mount. A slight restriction of the field of view is of minor importance compared to the problem of the eye being too close to the sight. In this case, 'greyout' will occur. Part of the image will be obscured by a grey veil. The reason for this is that all of the image forming light rays are not being allowed to converge on the lens of the shooter's eye. This must be corrected, either the 'scope must be moved further forward, or the shooter's head must be moved further back by altering the fit of the rifle. Simply changing the head position is not usually satisfactory unless accompanied by some change to the fit of the rifle. Any tendency to 'greyout' will be emphasised if there is any movement of the head relative to the rifle whilst the target is followed in the sight. This will lead to a change in the position and the extent of the 'greyout' which will make it very difficult to shoot effectively. If in doubt, the eye should always be a little further from the 'scope than too close.

If any subsequent changes are made to the fit of the rifle, it is important that the sight position is verified in this way and corrected if necessary. It is most important that the fitting of the 'scope is carefully coordinated with the fit of the rifle. It is also important that, from time to time, the shooter carries out an objective assessment of the way he is looking through his 'scope. It is only too easy to adjust the head position subconsciously and then adjust the fit of the rifle to reinforce this poor position.

14.4 Final Fitting of the Rifle

It is very easy for the shooter to adjust his position, particularly his head position, to suit the rifle. However, if he strays from the 'natural' position, then when he is under stress in an important match, he will not be able to reproduce that position and will find himself having to move his head after he has raised the rifle to his shoulder. It is also very easy, whilst adjusting the fit of the rifle, to make changes that demand undesirable accompanying changes in another parameter. This 'ratchet' effect can lead to a totally unacceptable configuration. The following sequence of changes is suggested which, if followed whilst fitting the rifle, should prevent such an effect. The same sequence should also be followed if subsequent changes are needed.

(i) Without a sight fitted to the rifle, adjust the length of the stock to achieve the most comfortable shooting position with the chosen arm height. It will be necessary to make a temporary adjustment to the height of the buttplate during this operation.

(ii) Fit the sight mounts to the rifle, but without a 'scope. These determine the height of the 'scope. Now raise the rifle to the shooting position and adjust the height of the cheekpiece until the shooting eye naturally aligns itself with the pair of mounts. Again, make any temporary adjustment needed to the buttplate height.

(iii) Make a mark on the cheekpiece directly below the eyeball. Now fit the 'scope with the eye relief corresponding to this position, as described in the Chapter on 'Fitting the Sight in this part of the book.

(iv) Make fine adjustments to the position of the sight and the height of the cheekpiece to ensure that the shooting eye is perfectly aligned with the sight immediately the rifle is brought to the shoulder.

(v) Finally, adjust the height of the buttplate to ensure a snug fit in the shoulder.

If any change is made to the length of the stock or to the height of the 'scope, then the process should be started again from (i).

With considerable Moving Target shooting experience, a shooter may want to make vary small adjustments to the fit of the rifle and/ or the 'scope. Such adjustments should not be made without that experience and always in the knowledge that consequential adjustments might also have to be made to other parameters.

Chapter 15 Fit of the Stock

The fit of the rifle stock is dependent on the position and height of the sight. A change to the length of the stock (i.e. from butt plate to trigger) must be reciprocated in the location of the sight. This is dealt with in another chapter in more detail.

Rifle fit and shooting position are interlinked. It is important that no attempt is made by an inexperienced shooter to adapt the fit of the stock to a poor shooting position. The stock must be adapted to a well developed shooting position. In this it is most important that a novice is guided by a qualified Coach or Instructor. In the absence of such guidance, it may be helpful to borrow a rifle from an experienced shooter of similar build. It might seem an easy way out to adapt the shooting position to a poorly fitting rifle. This can never work as the shooter will be disadvantaged from the beginning. Whilst some concessions can be made, there will always be a problem if the shooter has different rifles for the different Moving Target disciplines. Every effort should be made to ensure that all three rifles are compatible with each other and that the basic shooting position remains constant.

Despite the need to adjust the fit of the rifle to suit the physiology and the stance of the shooter, time and again it has happened that a rifle that fits one shooter perfectly will also fit many other shooters with only minor adjustment. However, someone who has regularly used a badly fitted rifle will have adjusted his position to accommodate it and will find that other rifle uncomfortable to use.

15.1 The Pistol Grip

The traditional shape of the sporting rifle derives from its shot gun origins which dictate that it must be capable of being used at almost any angle from nearly vertical to below the horizontal. A Moving Target rifle, like a Target Rifle, is only used in the horizontal position and benefits from having a square pistol grip that is almost vertical. The ISSF Rules make no stipulations about the shape of the grip and so a palm shelf can be added if this is deemed helpful. This shape of grip helps to locate the right hand in a consistent position with little or no tension in the wrist. Because the pull must be straight back into the shoulder, the square grip also helps in holding the rifle into the shoulder. The accompanying straight pull backwards of the trigger is less likely to affect the stability of the rifle. It will also be helpful if some of the weight of the rifle is taken on the top of the middle finger rather than relying on grip pressure alone. This may require the stock immediately behind the trigger guard to be built up a little.

It is not difficult to modify a sporting rifle pistol grip using Epoxy filler. It need not be made a permanent feature if it is applied and shaped over a thin polythene film. A modified grip like this can also be made which will place the index finger on the trigger in the optimum position. When it is finally shaped, it can be attached using 'tacky' glue or double sided adhesive tape so that it can easily be removed. 'Blu-Tac' works well if moulded very thinly over the grip before it is pressed firmly into place.

Although many specialist Moving Target rifles have a 'Thumbhole' stock design, the use of the thumbhole is going out of favour. It gives a very secure feeling in the 'ready' position and is very effective in locating the right hand. Current designs allow the thumb to be placed gently around the grip, with a spur above the thumb to locate the web between thumb and first finger. Some shooters favour removing this spur to allow them to place the thumb high on the woodwork at

the rear of the action. This is claimed to give them better trigger control and also makes for a quicker reloading in the Running Deer Doubles event.

15.2 Stock Length

Before the stock length is adjusted, it is important that you are comfortable with the pistol grip and the trigger reach. If the trigger blade is fixed, it might be necessary to rebuild the grip to ensure that the trigger blade is within comfortable reach (see later). This is obviously easier if there is some adjustment to the trigger blade position such as is normal on a match rifle.

The length of the stock, as measured from the centre of the butt plate to the trigger, determines the pressure with which the rifle is drawn back into the shoulder. It is also related to the stance adopted by the shooter. If the stock is too short, the right shoulder must be pushed forward, or the whole body must be turned so that the shooter faces the target more squarely. If it is too long, the right shoulder is pushed back or the shooter must adopt a more oblique stance. Thus the length of the rifle stock is directly related to the shooter's stance.

The arm position adopted by the shooter also determines the stock length. If the shooter keeps his right elbow high ($<30^0$ above the horizontal), he will need a slightly longer (10 - 20 mm) stock than if he keeps his elbow low (See the Chapter on 'The Shooting Position' in Part 5 of this book.)

Not only must the length of the stock be adapted to suit the shooter's stance, it must be adjusted to fit his physique. It will also depend on the shape and to a lesser extent on the weight and balance of the rifle. The 'length' is normally measured between the trigger blade and the centre of the buttplate. However, a sporting rifle with a shotgun grip for the right hand will often need a longer stock than a target rifle with a squared off pistol grip. The objective is to achieve a comfortable, relaxed stance with the right elbow making an angle of about 60^0. For the Running Deer Doubles, if the stock is too short, the bolt will lie too far back for its comfortable operation, but this will depend somewhat on rifle design.

The traditional way to decide stock length is as follows. Hold the rifle normally but using the right hand only. Place the buttplate in the bend of the elbow with the upper arm against the chest wall. The pistol grip should feel comfortable and without strain; the trigger should still be within comfortable reach. This method gives a good starting point for deciding the stock length. If the rifle is a traditional sporting design with a fixed trigger blade, the relationship between the position of the right hand and the trigger blade can be changed by moving the hand further up or down the sloping grip. With a square pistol grip, this distance is fixed and the position of the trigger blade must be adjusted. The advantage of this method lies in the fact that the position of the hand on the pistol grip is taken into account. With a target rifle design, the length of the stock can be adjusted by adding or removing butt spacers. With a sporting rifle design it may be necessary to shorten the stock by cutting it, or to lengthen it using an additional butt pad or by adding a butt spacer. In determining the length of the stock, it is important to remember that the rifle must be able to come up from the 'ready' position smoothly without unduly complex movements. If the stock is too long, it will dictate the 'ready' position and the way the rifle is raised to the shoulder. It is not uncommon to see even an experienced shooter raise his rifle across his chest and then to push it away from his body before pulling it back into his shoulder. This is wasteful of effort and slows down the raise and is a sure sign that the stock is too long. For the Running Deer events, it is also important that the bolt should be within easy reach whilst the rifle is in the shoulder. This will sometimes dictate a slightly shorter stock than is otherwise 'correct'.

Accessory adjustable buttplates are available. The slip on butt ‘shoe’ sold for shotguns is also worth considering if the stock is too short. The type made of smooth leather, rather than moulded rubber, is best if a little more expensive.

15.3 The Forend

The forend should not be too shallow, its depth determines the height of the left hand and arm. If the forend is shallow, the arm must be raised so that the muzzle of the rifle is kept at target height. The slim forend of a typical sporting rifle is shallow and this can mean that the left arm must be kept unnaturally high. Some packing under the forend can be helpful to raise the rifle. If the forend is too deep, it will become more difficult to keep the rifle upright, placing more strain on the left wrist. It is suggested that, for comfort, the depth of the forend should not exceed about 50 mm measured from the underside of the barrel. A broad forend will also help in keeping the rifle upright.

A specialist Moving Target rifle has a deep, broad forend shaped to give a positive grip for the left hand. There is no problem in modifying the slim forend of a typical sporting rifle. It can be built up with wood and Epoxy filler much like the Pistol Grip or, if it is not too slim (such as an ISSF “Standard Rifle”), by gluing on strips of cork or leather. Such modifications need not be permanent but can be attached using double sided adhesive tape that can easily be removed later. A cork or leather covering for the surface makes for a very secure grip without needing too much pressure and is a useful addition to even a specialist rifle.

15.4 Anatomical Grips

Moving Target shooters are innovative when it comes to modifying their rifles. This is encouraged by the ISSF Rules. Some shooters have chosen to mould anatomical grips for both their right and left hands using Epoxy filler. Whilst this does give very positive location of the fingers, it does not permit any small variation, and the way the rifle is held is now fixed. A further disadvantage is that if the finger grips fit the shooter's hand too well, a change in ambient temperature can make the grip feel uncomfortable. Whilst some positive location is desirable, it should leave some flexibility. A nominal palm shelf on the pistol grip and a drawing pin stuck in the forend to guide in locating the fingers may be all that is needed. Some rifles have a deep recess in the stock at the rear of the trigger guard leaving a gap above the right middle finger. A ‘filler’ can easily be made which will help to locate the index finger on the trigger blade. Again this can be attached securely with ‘Blu-Tac’ The front sling swivel (a sling can be fitted to the rifle but must not be used to support it) often found on a sporting rifle can, if it is correctly placed, be a useful aid in locating the leading hand. The swivel can be located between first and second (or second and third) fingers.

15.5 Stock Finish

Although modern materials such as plastics are being used for some rifle stocks, most Moving Target rifles will use wood. Traditionally, surfaces that are to be held have chequering cut into the wood surface. The less expensive rifles have the chequering pressed into the wood. A more satisfactory finish is that of 'stippling' with the wood finely cut over the whole holding surface. The current specialist rifles tend to be made from a wood laminate which is much stronger than

traditional wood and the surface is mostly left in an 'unfinished' condition. With wide holding surfaces, the wood fills the hand of the shooter and is very comfortable to hold, and is very secure even with minimal grip pressure. A chequered finish, although excellent for hunting, is unnecessary for target shooting and can be painful to the hand after 30 shots.

With a wooden rifle stock, it is important that the wood does not absorb moisture that would make it dimensionally unstable and apply stress to the action it supports. The wood is treated in various ways to make it more or less weather resistant. This should not be a problem for a Moving Target rifle which is unlikely to spend any significant time in wet conditions. The traditional finish for a rifle stock is either a hard varnish or else the wood is given an oiled finish. The latter has an excellent nonslip 'feel' to it. The modern specialist rifles tend to use a synthetic matt finish that is more practical for a Moving Target rifle. A glossy surface tends to exaggerate the effect of perspiration and is not ideal. It is not difficult to remove any high gloss varnish from the wood under the hands, or even to roughen it with abrasive paper, leaving behind a good nonslip finish. Alternatively, the wood can be given a coat of matt varnish or paint. Another treatment is to 'polish' the wood occasionally with one of the matt wax polishes such as “Grippo” (sold for bowling) that are available that leave the surface very slightly sticky. Thin sheets of rubber with a self adhesive backing are available and are very effective but sometimes have a surface that is a little too rough. Probably the most satisfactory finish of all is to glue a thin sheet of leather over the forend of the rifle leaving a nonslip surface that is pleasant to hold. The cheekpiece can benefit from similar treatment but this is not recommended for the Running Deer rifle when the recoil can cause bruising to the cheek bone if the cheekpiece is too 'sticky'. The pistol grip is best left as plain wood, although if a sporting rifle is used, the raked grip does benefit from a nonslip finish such as the traditional chequering.

The wood of the stock should be cleaned with a vegetable oil such as linseed, or one of the proprietary 'stock oils' occasionally. The oil should be used sparingly and kept away from bedding surfaces. A varnished or polished stock responds well to beeswax or one of the special wax polishes. The wax based polish such as 'Grippo' used by bowls players and permitted under ISSF rules for the Moving Target events (but NOT the static rifle events) leaves a very satisfactory surface finish.

Chapter 16 The Cheekpiece and Buttplate

The height of the cheekpiece is dependent on the position and height of the sight and the height and the position of the buttplate. A change to any of these must be reciprocated in the others. The position and height of the sight is dealt with in another chapter in more detail.

The way the rifle 'points' at the target with respect to its height is determined by the cheekpiece and, to a lesser extent by the position of the buttplate. The ISSF Rules make no stipulation regarding the cheekpiece. The buttplate, defined as the part of the rifle that is in contact with the shoulder, must not exceed 150 mm long. If it is concave, the depth of curvature must not exceed 20 mm. The position of the buttplate is adjustable but the overall length of 150 mm sets a practical limit to the amount of adjustment possible. The lowest part of the buttplate must not be more than 200 mm below the centre line of the barrel.

It is also most important that any adjustments to the fit of the rifle are only made with respect to a sound shooting position. The guidance of a qualified Coach or instructor should be sought before any significant alterations are made. Care should be taken not to adjust the rifle to reinforce a poor shooting position, thus making it very difficult to correct in the future.

16.1 The Cheekpiece

For a shooter used only to using a sporting rifle with a fixed cheekpiece, the adjustment of the cheekpiece on a specialist Moving Target rifle is a mystery. However, its correct adjustment is most important to being able to consistently bring the rifle into the aim every time, without any need to adjust the head position. The height and attitude of the cheekpiece can only be determined with the ‘scope fitted to the rifle as this determines the height of the cheekpiece.

On a specialist Moving Target rifle this is adjustable for height and sometimes it can be swiveled or canted too. Because the rifle stock is in line with the sight, the shooter's head must lean over to the right to bring it in line with the sight. The height and shape of the cheekpiece limit the amount of movement of his head. Thus the cheekpiece is important in providing a location for the shooter's head. However, the cheekpiece also serves as another point of contact between the shooter and his rifle, and to help to stabilise his position.

With only a light pressure on the cheekpiece, the weight of the rifle is supported only by the arms and by pressure into the shoulder. The height of the rifle is then determined by the buttplate which may be curved slightly to fit the shoulder better. When the rifle is raised from the 'ready' position to the shoulder, it is the cheekpiece that acts as a 'stop' to the movement. Firm pressure on the cheekpiece ensures that the final position is achieved quickly without any necessity to make fine adjustments. If the cheekpiece is pressed hard onto the shooter's cheek, this opposes some of the pressure exerted by the right hand of the shooter and thus tends to stabilise the rifle. Without that balance of force between hand and cheek the shooter's right hand and wrist will have more work to do to steady the rifle, making precise trigger control more difficult.

If the rifle has a front heavy balance, part of its weight, which tends to force the muzzle down, can be taken up by increasing the downwards pressure on the cheekpiece. This will also tend to raise the height of the rifle on the target which may be increased further by raising the cheekpiece a little. Raising the cheekpiece will also apply more pressure on the rifle from the left, thus any increase in downwards pressure must be accompanied by a reduction in sideways pressure by a

change in its shape to allow the head to be placed further to the right. Any experienced shotgun shooter will be very familiar with this aspect of gun fitting. When adjusting the position or altering the shape of a cheekpiece, it is important to remember that only a little material added or removed from the side will make a significant change in cheek pressure. It may take the removal of much more material to effect a similar change to its height. The balance between sideways and downward pressure is a matter for personal preference. The rifle should be raised to the shoulder and 'pointed' at a target at the correct height. If this raise is done with the eyes closed, when they are opened the shooter will see if the rifle is at the correct height. The height of the rifle should be noted and the cheekpiece and possibly the position of the left (leading) hand adjusted to bring the rifle to target height. Care should be taken not to be confused by the effects of fatigue if the rifle is held to the shoulder for more than a few seconds.

With too much pressure on the cheekpiece, unnecessary force must be used by the right arm, and the pressure of the rifle on the cheek will feel uncomfortable. There may also be a tendency for the head to be placed too high thus resulting in a loss of vision through the sight. Thus, as cheekpiece pressure is increased, it makes the rifle progressively more stable until it becomes uncomfortable and progressively more difficult to place the head correctly.

Another factor is that of reproducibility. Except with a recoilless air rifle, the cheekpiece pressure will influence the way in which the rifle responds to recoil. The cheekpiece pressure should be sufficient to ensure that it is reproducible. If it is too light or too heavy, it will not be consistent from shot to shot. Any pistol shooter knows that unless his grip on the pistol is consistent from shot to shot he cannot shoot small groups. Cheekpiece pressure is the Moving Target shooter's equivalent. Curiously, it is the 50m Running Boar rifle that is most sensitive to cheekpiece pressure and this is because a significant part of the recoil effect takes place before the bullet leaves the barrel. This is minimized by having a short true barrel with a long extension. On the 100m Running Deer rifle, although the overall recoil is much greater, the much higher velocity of the bullet ensures that it acts for only a very short time before the bullet is in free flight!

Two factors influence the cheekpiece pressure; its height and its shape. Ideally the cheekpiece should provide for maximum contact area between the rifle and shooter. It may be shaped to match the contours of the cheek (e.g. the Monte Carlo Cheekpiece of some sporting rifles). However, if the cheekpiece is in contact with the face directly over bone where there is less flesh, it will feel uncomfortable, especially under recoil. Thus the principal area of contact should be in the area between cheekbone and jawbone. The fixed cheekpiece of a sporting rifle can be built up using Epoxy Filler, cork, wood or leather, or combinations of these. There should be no obvious seam in contact with the face, between the original cheekpiece and any additional material. A covering of leather will make the cheekpiece feel comfortable and free from the problems of perspiration which a plain wooden cheekpiece suffers, but unless it has a very smooth surface, it can lead to bruising under the recoil of the Running Deer rifle.

A straight cheekpiece that can move against the cheek during recoil will be more comfortable than one that is contoured and, even with a small bore or air rifle, result in more predictable recoil. The shape of the cheekpiece is determined by the need for the shooter to get his head over to the right behind his sight. Thus it is normally well rounded at the top. The amount of curvature must be determined by the shape of the shooter's cheekbone which should rest comfortably on top of the cheekpiece. If the cheekbone is prominent, or if there is little flesh between bone and wood, careful adjustment will be needed if discomfort is to be avoided. If the shooter has a fleshy cheek, this will act as a cushion between himself and the rifle and makes adjustment less critical. The cheekpiece supplied with some specialist Moving Target rifles has a square profile with the intention that it will be shaped to match the shooter's physiology. Understandably, some shooters are reluctant to reshape their new rifle. However, as supplied, the cheekpiece could be

uncomfortable. There should be no difficulty in making a new cheekpiece and so leaving the original untouched. Such cheekpieces are usually comprehensively adjustable for position, and often a good fit can be achieved without any need to reshape it.

The cheekpiece should be no longer than it needs to be to locate and support the rifle. If it is too long and high, it will make it difficult to remove the bolt from a cartridge rifle. If necessary the front of the cheekpiece can be cut away at the top to make bolt removal easier without the need to remove the cheekpiece. Simple spacers or a gauge piece can be made which will allow a removable cheekpiece to be replaced exactly. *[Note that this might necessitate a visit to 'equipment control' every time it is replaced.]* It may also be necessary to cut away part of the cheekpiece to accommodate the ear muffs worn whilst shooting the 50m and especially the 100m events.

16.2 The Buttplate

Although the ISSF Rules specify a maximum length for the buttplate of 150 mm and do allow curvature or even a small butt hook, many shooters prefer a straight buttplate. If the shooter wears a jacket made from stiff material, any hook tends to catch on the leather under the arm where it is folded. If the height of the rifle is determined by the cheekpiece, the hook is unnecessary. However, if only a light pressure on the cheekpiece is preferred, the hook can be useful, especially if only a soft jacket or a sweatshirt is worn.

The concave buttplate seen on most non specialist rifles is unsuitable. This type of buttplate is intended to be pulled firmly into the shoulder and does provide a positive location. However, the top of the buttplate will foul on the jacket when the rifle is raised from the 'ready' position. This means that the shooter must adopt a technique of raising his rifle that requires him to first push it away from his body and then make an exaggerated movement to pull it back in to his shoulder. Needless to say, this should be avoided. Thus, even if a 'straight' buttplate is used, its top end should be well rounded to facilitate a smooth raise.

The best material for a buttplate is undoubtedly wood. Rubber buttplates are designed not to slip once in position, but this is contrary to the requirements of Moving Target shooting. If a rubber pad is needed to help absorb the recoil of a Running Deer rifle, it should have a smooth surface and be nearly straight. Carefully covering a rubber butt pad with “Gaffa Tape” can help even a coat of varnish will help!

As the buttplate should rest comfortably in the very convenient groove formed in the shoulder when in the shooting position, it should not be too wide. The buttplate should be carefully shaped so that it gives the maximum contact area with this shoulder groove. Depending on the physiology of the shooter, some 'rake' (forwards or backwards) may be useful. Unless the rifle is canted, the most effective position for most shooters is with the buttplate turned anti clockwise a little, as seen by the shooter. However, with the buttplate skewed like this, it may interfere with the raise of the rifle from the ready position and so a compromise may be needed. It may be easier to reshape the buttplate rather than move it. Any shaping should take account of the shooting jacket. Again, there should be no difficulty in making a new wooden buttplate if there is any reluctance to modify the buttplate supplied with the rifle. This also gives an opportunity to lengthen or shorten the stock if this is not adjustable. If the rifle is canted towards the shooter's eye, the normal position of the buttplate, parallel to the stock, is usually close to the optimum.

The height of the buttplate should be adjusted to match the height of the sight. Again, maximum contact with the shoulder is essential. If a sporting rifle is used, the buttplate will be fixed and designed for use with a low mounted 'scope, probably from a prone position with the head low. Once the 'scope has been fitted, and the height of the cheekpiece adjusted, it should not be difficult to refit such a buttplate, or to make and fit a new one, so that it gives maximum support to the rifle.

Another important factor is that, in the ready position, the lower part of the buttplate must be level with or below the mark on the shooter's jacket. Thus the shooter can gain a slight advantage if the buttplate is close to it maximum permitted length of 150 mm and is as low as good fit and the ISSF Rules (<200 mm below the centre line of the barrel) allows. Too many shooters use a short buttplate on the grounds that only some 100 mm of it is in contact with the shoulder. They are penalising themselves in the ready position.

Chapter 17 Balance of the Rifle

17.1 Rifle Weight

To the novice, the rifle, even a lightweight sporting rifle, is perceived to be intolerably heavy. This perception is influenced by his lack of training and experience. When he has learned to hold the rifle correctly and he becomes more familiar with it, he begins to appreciate the value of a heavy rifle. The ISSF Rules allow for a maximum weight, including the sight, of 5.5 kg. This compares with a typical sporting rifle that can weigh as little as 3 kg. There is a significant advantage in using a heavy rifle. It is less sensitive to the effects of recoil, and less sensitive to any muscle tremors of the shooter, but if it is too heavy, the likelihood of tremor is increased. Most experienced shooters prefer a rifle that has a weight near to the maximum permitted by the ISSF Rules.

Nevertheless it is the distribution of the weight that is more important. The position of the centre of gravity is very important to the way in which the shooter perceives the rifle weight, and in the amount of energy needed to hold it steady. A well balanced rifle feels lighter than one that is muzzle heavy or light. With the centre of gravity over the leading hand, there is minimal strain on that hand and thus the rifle will feel lighter. Just try holding a heavy length of timber with one hand – it is much easier if it is held near the point of balance! For a given rifle weight and position of the centre of gravity, the distribution of the weight about its length affects the way in which it responds when the shooter swings his body to follow the target.

17.2 Centre of Gravity

Ideally, the centre of gravity should be over or just a little behind the supporting left hand In this position there is no tendency for the rifle to pivot, and the hand and arm do no more than support its weight. If the centre of gravity is not over the supporting hand, the tendons of the wrist will be strained in trying to keep the rifle pointing at the right height. The position of the supporting hand is determined by the need to keep the arm at such an angle that it has the maximum mechanical advantage. This is dealt with in the Chapter on the 'Shooting Position'.

The need to place the supporting hand under the centre of gravity is modified by the way that pressure is taken on the cheekpiece, the pressure of the buttplate on the shoulder, and the support given by the right arm and hand. However, as little of this distributed support is available in the 'ready' position, it remains important that the centre of gravity is near to the supporting hand.

The weight of the rifle, and its balance, determine the way in which it is raised from the 'ready' to the 'shooting' position. A well balanced rifle needs little effort to raise it, but at the same time, it builds up momentum which carries through to following the movement of the target. If the point of balance is well behind the support hand, then more physical effort will be needed to move the rifle. Likewise, if the rifle is too light, more effort will be needed to move it and the subsequent movement of the rifle to follow the target will be dependent on the strength of the shooter rather than on the momentum imparted to the rifle itself.

Recently, some shooters have been bringing their support hand further back so that the centre of balance is well forward of the support hand. This allows the weight of the rifle to do even more of the work in raising it to the shoulder and following the target. However, there is a tendency for the muzzle of the rifle to drop. This is compensated for this by using more downwards

pressure on the cheekpiece. This technique seems to work for some shooters but is clearly an unnatural position which is uncomfortable and would need much training in its use if it is to be adopted.

17.3 Rifle Balance

The ISSF Rules permit the use of a barrel extension. The length of the extended barrel must not exceed 1.00 m measured from the back of the closed bolt or the rear of the air rifle mechanism. Compensating weights must be contained within a radius of 60 mm of the centre line of the barrel. The extended barrel, if correctly balanced, has the effect of damping out minor movements such as the release of the trigger, as the rifle is swung with the target. The principal is derived from the laws of mechanics; the long barrel increases the moment of inertia of the rifle which thus needs more effort to move it. At the same time it needs more effort to swing such an extended rifle and it is more difficult to make any small corrections to the aim. A rifle with a long barrel will be affected more by any wind on the firing point in the 50 and 100m events. The barrel extension normally carries additional weights. The general principle is that, for the same overall weight, a compensating weight at the end of a long barrel will have a more beneficial effect than the same weight drawn back nearer to the rifle' action.

Although such an extended rifle may be heavier, if the centre of gravity is kept over the supporting hand, then it will be no more difficult to use. However, to be effective, the technique must be so good that as the rifle is raised to the shoulder, it points correctly at the target. Not only must the technique be good, but the rifle must be a perfect fit so that when it comes into the shoulder, it is always in the right place. Thus the use of an extended barrel and compensating weights are best avoided by a novice and left to the more experienced shooter

To some novice shooters the short 'Stutzen' rifle may seem attractive as a Moving Target rifle. These rifles are designed for hunting in dense woodland where the conventional long barrelled rifle may be a hindrance. Because it is short, such a rifle seems to be more willing to point where the shooter wants it to. However, this is only because the shooter must force it onto his aim rather than achieving a good aim by sound technique in raising the rifle. The low inertia of these rifles means that they need more energy and finer control to keep them on the target. Once the correct technique of swinging with the target has been learned, the advantages of the long rifle with its inertia should become apparent.

The current specialist Moving Target rifles have been designed with a barrel extension in mind. Many of then have a shortened true barrel to reduce the weight nearer the action and so allow more of the weight to be placed forward. If an ISSF "Standard Rifle", Match Air Rifle or sporting rifle is to be fitted with an extension tube, it would not be advisable to shorten its true barrel. Unless this is done professionally and the barrel properly 'crowned' some accuracy will be lost. The normal barrel is designed so that there is the maximum energy transfer to the projectile. If the barrel is shortened, the bullet will leave the barrel at a different velocity (it could be faster or slower). Although a shorter barrel can be an advantage, most normal barrels can be fitted with a suitable extension tube successfully. The tube fitted to a cartridge rifle usually benefits by having some holes drilled near to the real muzzle of the rifle. These, and muzzle brakes, are prohibited for the ISSF Static Rifle events but are allowed in the Moving Target events. Without some ventilation like this, the gases leaving the barrel behind the bullet will overtake it and can cause some instability. The vent holes allow the gas pressure to reduce quickly without disturbing the bullet. A muzzle brake uses the gases emerging behind the bullet to counteract the tendency for the muzzle of the rifle to rise during recoil. It would give little or no advantage to the 50m

Running Boar shooter but may have some use in the 100m Running Deer event, especially the Doubles. However, a muzzle brake will direct the gases back towards the shooter and others on the firing point and will exaggerate the noise of firing.
Contrary to this, a sound moderator (silencer) if permitted by local legislation, can make an effective muzzle weight and make life more comfortable for others on or near the firing point in the Running Deer events. In the UK there is no restriction on buying a sound moderator and fitting it to an air rifle, but if it is to be fitted to a cartridge rifle, it must be authorized on the owner's Firearms Certificate. However there is no restriction on a plain tube used as a balance weight (but not a "flash concealer") or a muzzle brake.

Some care should be taken to make sure that the extension tube has a large enough internal diameter. Under recoil, or whilst the rifle is being swung with the target, it is possible for the projectile to touch the wall of the tube. With a supersonic bullet, even approaching the wall of the tube will be sufficient to make it unstable. The bullet does have some sideways motion as it leaves the real barrel and thus compensates for some of the effect of the movement of the extended barrel. However, any irregular movement such as 'snatch' can bring the tube into contact with the projectile. It is worth while examining the bore of any extension tube occasionally for scratch marks or other evidence of contact. This could explain the occasional bad shot!

There are various ways of attaching an extension tube which range from having a screw thread cut on the outside of the barrel, to using clamps and screws. The fixing should be secure as the tube must carry any extra weights. With an air rifle, it may be sufficient to use a friction fit such as over rubber 'O' rings to hold the extension tube in place.

A 'Break Barrel' air rifle cannot easily be fitted with an extension tube. The additional leverage on the barrel will affect the alignment between the barrel and the air cylinder. The use of a light weight tube may be feasible and, with such a light weight rifle, sufficient.

17.4 Changing the Rifle Weight and Balance

Optimising the weight distribution of the rifle is a matter of trial and error. A small weight at the end of the barrel or its extension will be more effective in damping minor movements than a larger weight fitted near to the action. Even though the overall weight change is small, the centre of gravity may move and thus the 'feel' of the rifle will be quite different. A long barrel with its weight towards the muzzle may be very stable but this is to no avail if it needs much more effort from the shooter to use it.

Most compensating weights are cylindrical and fitted concentrically over the barrel extension. However, eccentric weights are not uncommon. Some shooters have chosen to fit weights symmetrically either side of the barrel. These tend to stabilise the rifle in a vertical plane (i.e. cant). However, with the limit of 60 mm radially from the centre line of the barrel set by the ISSF Rules, their value is very limited. This rule also precludes the use of a separate balancing rail as used on an ISSF "Free" Rifle.

Some of the earlier air rifles such as the Walther LGR had a heavy action and a slim barrel. There is very little scope for additional weights within the ISSF Rules. Even so the difference in handling with an extension tube, although the standard barrel weight must be discarded, is significant. With such a rifle it is tempting to think of removing some surplus weight from elsewhere. The obvious place on the LGR is to discard the threaded pillar used for fine adjustment to the height of the cheekpiece. The cheekpiece is also held on two posts by means

of a screw. Those pillars are of steel and can be replaced by aluminium or a thin walled tube. Some ISSF "Standard Rifles" or Match Air Rifles are fitted with weights inside the hollow stock. These may be removed and replaced with equivalent weights near the muzzle. The removal of some wood from places where it is not important is not difficult. Although often seen, the saving in weight by removing surplus wood from the rifle stock is very small indeed, and can weaken the stock significantly. However, even a small amount of wood removed will allow the equivalent weight to be added at the front of the rifle that may have a significant effect on its balance.

The specialist Moving Target rifles come with a selection of weights that can be used in different positions to affect the feel of the rifle. Most shooters find that the best place for them is always at the end of the barrel. Although most shooters favour using a full length extension, some prefer to use a slightly shorter extension tube. This could be important if the tube itself is heavy but, as most tubes are made from light alloy, the same effect can be achieved by moving any weights back a short distance. The main advantage of a slightly shorter tube may be in the 50m and 100m events where, although the firing point is under cover, the shooter may be exposed to any head or side winds which can affect his hold on a very long rifle.

In the early 1980's the French Moving Target shooters experimented with the extended balancing arms used in Archery. These gave a very smooth swing with the target and made it very easy to keep the rifle upright. They were quickly banned by the ISSF who introduced the rule that barrel extensions must be contained within a 60 mm radius from the centre line of the bore. Nevertheless some shooters use steel rods on either side, parallel to the barrel and within the 60 mm radius to achieve a similar, but lesser, effect.

Some Centre Fire sporting rifles can benefit from the use of vibration damping weights (i.e. the Browning BOSS system). With a relatively slim barrel, the position of the weights can be used to modify the vibration mode of the barrel thus improving accuracy. However, such weights might be incompatible with the need for good balance and it will be better to accept slightly less accuracy for better handling.

Chapter 18 The Trigger

The weight and 'feel' of the trigger is a matter for personal preference and is closely related to the trigger technique used. The ISSF and Nordic Rules specify a minimum trigger pull of 500 g for the Running Boar and Running Deer rifles. There is no limit on trigger pull in the 10m Running Target events, but the use of a 'set trigger' is not allowed. With such a trigger, part of the trigger weight can be taken by the presetting mechanism resulting in a very light final release. However, setting the trigger will also reduce the sear engagement making the rifle liable to accidental discharge it is given even a light knock. Although the use of a 'set trigger' is not specifically prohibited in the 50m Running Boar and 100m Running Deer events, if the specified 500 g pull is to be obtained this would preclude the use of most 'set triggers'. A ‘set trigger’ might be prohibited by local rules whatever its final release weight. Thus it would be advisable to adjust a rifle fitted with a 'set trigger' so that the presetting mechanism is inoperative, or to ensure that the setting lever is visibly blocked. A 'set trigger' is most likely to be encountered in the centre fire rifles used in the 100m Running Deer events.

The trigger technique used will depend to some extent on what other forms of shooting, if any, are practised by the shooter. A pistol or shotgun shooter will be happy with a rifle with a crisp, single stage, trigger. A small bore rifle shooter will be used to using a two stage trigger. This is suited to a technique whereby the shooter takes up the weight of the trigger progressively as he raises the rifle to his shoulder. If he takes up the trigger pressure in one continuous movement only when he has the correct sight picture, then a single stage trigger may be preferred. The single stage trigger is more suited to the cartridge rifle events but in the air rifle events, where the trigger pull is 'free', the lower trigger pull permitted can be made more controllable by the use of a trigger having two distinct stages in its operation. However, if the shooter takes part in the 50m or 100m events as well as the 10m events, he may prefer to use a similar trigger technique and trigger pull for all. Most sporting rifles and many specialist Moving Target rifles have a either a single stage trigger or a two stage trigger in which the first stage movement can be eliminated, and this is preferred by many shooters. A notable exception is the Anschutz trigger in which, for safety reasons, it is not possible to eliminate the first stage travel entirely.

If the trigger is adjustable for after travel, then this too is a matter for personal preference. A long after travel is usually more compatible with a two stage trigger with a long first stage travel. A minimal after travel is more compatible with a single stage trigger. If the after travel is adjustable, then it should not be set so close so that there is a possibility that it will not release at all. It is usual to find the point at which the trigger will not release, and then back off the adjusting screw by about ¼ turn.

Most shooters prefer the sear to be adjusted to give a crisp release without any 'creep'. However, if the sear is too crisp, safety may be compromised. The manufacturer's instructions should be followed. It is usual practice to ensure that the sear adjusting screw has at least ¼ turn of adjustment left before the sear fails to engage, but this will vary with the trigger. Some shooters prefer a long 'roll over' release. This is most appropriate to a trigger pull that is well above the minimum 500 g for the Running Boar and Running Deer events. In many trigger mechanisms the adjustments are complex and interrelated. Each design of trigger has its own peculiarities. It is important to know if making one adjustment to the trigger will affect any other adjustment, particularly the first stage movement and after travel. These should be rechecked, if necessary, after making any other adjustment such as for trigger weight. It can be embarrassing to find that, after adjusting the trigger weight, it will not release! In most trigger mechanisms, the sear

engagement is not affected by any other adjustment. In the Anschutz trigger, although the sear and first stage travel are linked, minimum sear engagement is always maintained.

In some rifle designs, some of the trigger adjustments are dependent on the fit of the action in the stock. To reduce bulk and hence keep the rifle action low in the stock, the trigger mechanism does not have its own frame. Some of the adjusting screws are located in the stock or trigger guard, and bear on the trigger blade or a lever connected to it. If the action bedding screws are allowed to become loose, or are overtightened, the trigger can be affected. With this design, the trigger adjustment should always be checked after the action has been removed from the stock and refitted.

Trigger adjustment should only be attempted under the guidance of the manufacturer's instructions or by an experienced person. The more complex the trigger, the easier it is to 'lose' a setting. A trigger like that on the Anschutz rifles, is capable of very fine adjustment to suit almost any shooter, but the various adjustment are interrelated and tempt the unwary to experiment. The most common “professional” maintenance task on Anschutz rifles is that of trigger adjustment! Oil and cleaning fluids should be kept well away from the trigger mechanism. Some, particularly those in an inexpensive sporting air rifle, depend to some extent on friction for their safe functioning. Oil on the sear can result in a very light or unpredictable trigger.

One problem with the more sophisticated trigger mechanisms is that there is a tendency to continually seek to “improve” its adjustment. This should be resisted and adjustments only made when they really are needed or to try out a different ‘feel’. If practicable, any such adjustment should only be made during the non competitive season and the trigger left severely alone when a match is in the offing.

18.1 Trigger Reach

There are no hard and fast rules as to how the finger is to be placed on the trigger blade. Consistency is more important than the use of any particular method. It may be more important that the forefinger 'points' naturally at the target than that the trigger is used in any particular way. The pad of the forefinger is normally used when the trigger is light and sensitive, but the end joint may be used for a heavier trigger. The correct placement of the forefinger on the trigger blade is determined by the 'reach' of the trigger blade from the natural hand position. This can depend on how bulky the rifle grip is under the right hand as well as on the size of the shooter's hand. Most specialist rifles have a trigger which is adjustable for reach. The blade can be moved along a rail on the trigger mechanism. In some designs, the blade can also be swivelled to achieve the most comfortable position for the finger. If the trigger blade is not adjustable, then it may be possible to improve the trigger action by modifying the rifle grip. Wood can be removed from the pistol grip, or epoxy resin used to build it up so that the trigger blade falls more naturally under the forefinger. A trigger “shoe” can sometime be used the change the ‘feel’ of the trigger especially of a heavy trigger, but this will also increase the trigger reach. Although not the subject if an ISSF Rule, many range authorities rightly frown upon a trigger shoe that extends beyond the trigger guard. Again, a trigger guard is not compulsory but it would be very confident competitor who defies a Range Officer’s ruling on this!

The trigger 'reach' on a sporting rifle can be changed by altering the way the right hand is placed on the rifle stock. On a specialist rifle, with a square pistol grip, this is not possible. On such a rifle, if neither the trigger blade nor the grip can be adjusted, then the shooter must learn to place his finger on the trigger in, what for him, may be a less than ideal position. The way that the

trigger finger accesses the trigger can be controlled by careful modification of the pistol grip to locate the right hand more consistently.

18.2 The Air Rifle Trigger

Most 'match' air rifles have a finely adjustable trigger and most shooters can find a suitable setting. Most are of the two stage design. In some two stage triggers, the first stage is only the free movement of the trigger blade against a light spring. The sear engagement is not affected by this first stage movement. In other designs, such as the Anschutz, the whole of the trigger movement changes the sear engagement. Both systems have their advantages and disadvantages. Many sporting Air Rifles have a very simple direct acting trigger mechanism with only a limited range of adjustments. The Anschutz air rifles share the trigger design with their cartridge rifle equivalents. That trigger can be altered internally to give two adjustment ranges. However, the 'feel' of the heavier range is not as good as the lighter range. Although a lighter trigger is permitted in the air rifle events, most shooters who also shoot the 50m event prefer to use a trigger pull of only a little under 500 g for their air rifle. If a sporting air rifle is used, the trigger will have a smaller range of adjustment. In many, the sole adjustment is the pressure on a single spring that affects the whole of the trigger action, both first and second stage if it is a two stage trigger. Many sporting air rifles are let down by their heavy, insensitive trigger. A competent gunsmith can sometimes 'tune' the mechanism to improve the trigger without compromising safety.

18.3 The Running Boar Rifle Trigger

For the 50m events, if a specialist Running Boar rifle is used, the trigger will be adjustable to achieve the minimum 500 g pull specified whilst retaining most of the features of their prone or free rifle equivalents. If a modified ISSF “Standard Rifle” is used, it may not be possible to obtain a 500 g trigger pull. Although modified springs can be fitted internally, one simple solution is to fit an external spring behind the trigger blade. A coil spring or a leaf spring can be attached to the rear of the trigger blade, or to the back of the trigger guard. The final trigger pull will then be dependent on the position of the trigger blade. It is possible to arrange it so that the additional spring only comes into operation after the initial movement of the first stage of a two stage trigger, or so that the tension of the additional spring is felt throughout the whole of the trigger movement. If a sporting rifle is used, the trigger pull is usually well in excess of 500 g across the whole of its range of adjustment. If the trigger feels too heavy, a wide trigger 'shoe' will change the 'feel' of the trigger considerably.

18.4 The Running Deer Rifle Trigger

As the Running Deer rifle is often based on a sporting rifle, the trigger should always have a pull of at least 500 g. Some shooters prefer the trigger pull to be significantly heavier to be compatible with the trigger of their hunting rifles. The range of adjustment of the trigger of some sporting rifles is limited. When a more sophisticated trigger is fitted, it may be a 'match' type trigger but it is often a 'set trigger'. In this design, most of the trigger pressure can be taken up by operating a presetting lever. This may be a separate lever or a second trigger blade, or the normal trigger blade must be pushed forward to 'set' the trigger. Once the trigger is 'set' it can be released with very little pressure indeed. Although the use of a rifle with a 'set trigger' is not specifically prohibited for the Running Deer events, the setting mechanism must not be used if the pull is to

be more than 500 g. However, even though the ‘set’ trigger might comply with the NSR pull weight, a ‘set trigger’ is usually held on the tiniest amount of sear engagement and is sensitive to even light knock and local rules will often prohibit their use.

Chapter 19 Sighting In and Testing

Before the rifle and its sight are used in competition or for serious training, they must be sighted in or "zeroed". If the 'scope sight used has a simple cross hair reticle, then this should be a straightforward process. It can be much more complex when a twin reticle 'scope is used, or if, as in the Running Deer events, the rifle is sighted in to shoot well below the point of aim.

The 'sighting shots' allowed at the beginning of a competition offer no more than an opportunity to verify that the rifle is shooting roughly in the right place and should perhaps be renamed "test shots". Any major correction must be made before the competition using the nearby static sighting in position. During the competition itself, the 50m Running Boar shooter has the advantage of being able to see his groups forming on the target. Each shot hole is covered with a transparent patch that allows the hole to be seen on the CCTV monitor. The 10m Running Target shooter using paper targets has only one shot on each scoring diagram and so must try to remember the position of individual shots to build up a picture of his groups. This is not easy under the stress of competition. However, when Electronic Scoring Targets are in use, the full series of shots is displayed on the monitor screen albeit sometimes without differentiating between left and right running targets. Unless he has the benefit of an Electronic Scoring Target, the Running Deer shooter has only the signalled score to work with. There is no CCTV and the shot holes are patched before the next run. It can be disheartening to learn, after the last shot, that you have shot perfect groups but in the 'wrong' place!

19.1 The Single Reticle Sight

The rifle should shoot to point of aim. For the air rifle, the pellet should be on, or very near, the target, however the sight has been set up before sighting in, and it should not be difficult to adjust it to shoot to a true zero. For the cartridge rifle, unless the aim is approximately correct, it may be difficult to ensure that the first bullets hit the target card. It is not difficult to 'bore sight' any bolt action rifle. With care this can be done to within 50 mm at a distance of 50m. Although optical and laser bore sighting devices are available, these are not essential for shooting at the short distances involved in Moving Target shooting. If the rifle barrel is aligned visually with a mark on the target, then at 50m the sight should be aligned with the same point or a little lower. This should ensure that the first shot lies within 50 mm of the aiming mark.

Testing should be done from a firm, but not hard, rest such as a sandbag, or from the prone position. As the recoil characteristics of the rifle will be different from the shoulder, any sight settings should be confirmed after sighting in by firing a group from the normal firing position. This is most likely to affect the 50m Running Boar shooter. The ammunition used should be the same as that expected to be used in competition. The shooting distance should be that used in the appropriate event. The target used should have a definite aiming mark, large enough to see clearly in the sight, but not so large that the sight cannot be accurately centred over it. It should also have some strong horizontal and vertical lines, checked against a plumb line, to aid alignment. These lines help to ensure that the rifle is not canted or that any cant is consistent, during testing.

Although 'click' adjustment is referred to, not all 'scopes have 'click' adjusters. If not, then a protractor should be made up from thick white card and marked off in 50 or 100 segments. This should have a prominent alignment mark so that when it is placed over the adjuster turret, the mark points along the barrel of the rifle. A mark should now be made on the adjuster itself that can be used as a cursor against the protractor. This protractor can be very helpful with any 'scope when adjusting the sight on the Running Deer rifle from point of aim shooting to an eye aim.

The first two or three shots from a cold barrel should be disregarded. After that, a five shot group should be fired and the distance of the centre of that group from the centre of the point of aim estimated. The sight is then adjusted and further groups shot until the group is centred over the point of aim. When the sight is adjusted, unless you already know that it is free from backlash, make sure that the final movement of the adjusters is always in the same direction (i.e. up and right). Thus if you wish to move the sight down 5 'clicks', move it down 8 'clicks' and then up three.

As with any sight, it will be helpful to know exactly how much each 'click' of the adjusters move the point of impact, and how much backlash there is in the adjustment mechanism. Once the rifle is sighted in, shoot a record group of ten shots, preferably with the rifle rested on a firm, but not hard, support. Take care to align the reticle against the vertical and horizontal lines of the target as well as with the aiming mark itself. Then move the sights ten 'clicks' up and shoot another group. Repeat this, moving the sight a further 10 'clicks' up. Now move the sight down ten 'clicks'. Do NOT set the backlash, the movement should be ten 'clicks', no more and no less. Shoot another group. Now repeat this until the sight is back at its original setting and then shoot a final group.

[Note: Ten 'clicks' between groups is suggested. If the adjustment is very fine, 20 or even 40 'clicks' might be more appropriate. The groups should be separated by at least four times their diameter.]

The centre of the first and fifth groups and the second and fourth groups should coincide. If not, there is backlash in the adjusters that must be taken into account every time the rifle is used. Most 'scopes have little or no backlash but this must always be checked. If there is backlash, the simple ploy of always making the final adjustment in one direction is usually sufficient. This test should now be repeated but moving the point of impact to the right and then back again rather than vertically.

The difference in group centre from group 1 to 2 to 3 will tell you exactly how much each 'click' of the adjustment moves the point of impact of the projectile. This can differ between the vertical and horizontal planes. It will be helpful if you stick a small label on the sight with the relevant information. The results of these tests should also be used to confirm that the sight adjustment mechanism operates in the same planes as the 'scope reticle. If not, a small correction may be applied by rotating the 'scope slightly in its mounts. Although this can be the result of internal misalignment, it is more often the result of failure to align the reticle of the 'scope whilst fitting it to the rifle. Should there be any difference, it is more important that the vertical adjustment is correct than the horizontal adjustment. Any effect of misalignment will be small when shooting to point of aim at normal shooting distances when the barrel line and sight line are nearly parallel. However, when the eye aim is used for the Running Deer events, any misalignment can be significant.

If the rifle is deliberately canted, the 'scope should be turned within its mounts so that vertical lines in the reticle are truly vertical on the target. In this case, because the axis of the 'scope is not directly above the barrel axis, there will always be some horizontal displacement of the point

of impact when the sight is adjusted vertically. Some small bore rifles, and some air rifles, do have a separate barrel sleeve that carries the sight mounting rail. This can be rotated so that the 'scope is vertically above the rifle bore line. This ensures the independence of the vertical and horizontal movements of the 'scope's adjustments when the rifle is canted.

The rifle should be sighted in again if the objective lens is refocused for any reason. This is most important. The reason is that the optical and geometrical centres of the objective lens seldom correspond. Thus, as the lens is rotated, instead of all the shots lying within a small group, they describe a circle, sometimes quite large. If the 'scope has a calibrated focusing objective, then the lens itself does not rotate as the focusing ring is turned and so this should not be a problem. Nevertheless you should confirm that changing the focus does not alter the point of impact. Also, if the 'scope has variable power, it will be helpful to confirm that a change of magnification dosed not change the point of impact.

19.2 The Running Deer Rifle

If the eye aim is used for the Running Deer event, then the rifle must be sighted in to shoot about 600 mm low at 100m. The exact difference is a matter for personal preference. Many shooters prefer not to aim at the eye but just below it, in which case, the rifle may be sighted in to shoot 500 mm low. It is essential that this sighting in is carried out at exactly the right shooting distance otherwise a correction will be necessary. If the zeroing distance is shorter than the shooting distance then the rifle must be set up to shoot proportionately higher. Because the typical Running Deer target is printed over several sheets of paper, these are not necessarily correctly aligned. Thus a rifle that shoots well on one target might be shooting a little low or high on another. This is something that the shooter has little control over and he must be prepared to adjust either his aim or his sight if necessary.

The rifle should first be sighted in to shoot to the point of aim. With the cost of centre fire ammunition, groups of five rather than ten shots might be acceptable. Now from your knowledge of the distance the shot moves for each 'click' of the adjuster, move the point of impact down by half of the required amount. Shoot a group on a target large enough to accommodate the lower point of impact. A single shot may be sufficient. Use this group to confirm your calibration. Now move the sight the remaining distance and confirm your point of impact which should be the chosen distance between the point of aim and the centre line of the target.

You must also confirm that the point of impact is vertically below the point of aim. Thus it is important that there are some strong vertical and horizontal lines on the zeroing target which should be used to align the reticle. The target should be checked against a plumb line. If the sight is not perfectly 'square' on the rifle, the sight adjustment mechanism is not perfectly aligned with the reticle, or if the rifle is canted, there will be a significant change in the horizontal position of this final group. In this case, the 'scope should be rotated slightly in its mounts until the elevation adjustment gives a truly vertical movement. It is inevitable that this group will be larger than the group shot to the point of aim. The effect of canting the rifle even a small amount whilst shooting a group can have a significant effect on the point of impact. It may be helpful having shot such a group, to fire a shot with the rifle deliberately canted and see just how much the point of impact moves!

It is very important that you make a note of the exact number of 'clicks' the sight has been changed. It is relatively easy to return to point of aim shooting, but much more difficult to sight

in for an eye aim. As the adjustment is considerable, a simple protractor fitted over the turret may be better than counting up to 100 'clicks'.

19.3 The Multi Reticle 'Scope

The principle behind sighting in these 'scopes is the same as for a single reticle 'scope, but more complex in practice. The best way is to make up a white card with marks corresponding to your normal point of aim and the expected point of impact on the stationary target. Thus instead of shooting to point of aim you will shoot to an offset point of impact.

The alternative, is to bring the reticles together in the centre of the 'scope, adjusting the elevation too if necessary, until you can shoot to the point of aim. With a twin post 'scope, this will be just above the pair of reticles. It may be necessary to adjust the 'scope mounts or to shim the 'scope until the reticles are truly central. If the reticles are not truly centred, then one of them can be offset until the point of impact corresponds to the point of aim midway between them. This should not be more than a few 'clicks' off centre otherwise establishing a mid point will be difficult. When the rifle is shooting to point of aim, the reticles can then be adjusted the appropriate amount to give the required 'lead' on the moving target. When high mounts are used, the posts may need to be set near to the bottom of the field of view, especially on an air rifle used at 10m. Although this is not necessarily a problem, it may be aesthetically unacceptable and can be corrected by raising the rear mount 0.5 - 1.0 mm using shims although this might place some strain on the ‘scope body.

It is most important that any sighting in of a multi reticle 'scope is confirmed by shooting at a moving target. During a competition, this will be carried out during the main training session on the day before the event.

The twin loop 'scopes made by Dick Thomas can be sighted in to point of aim using the central dot reticle. The loops (or posts) are then moved to the appropriate position either side of this central dot reticle. The relationship between the loops (or posts) and the central dot should be worked out in advance.

The adjusters on most multi reticle 'scopes have a resettable calibrated scale. It is usual to adjust the mounts for these 'scopes so that they shoot to the point of aim when the posts are moved to their central position and at their 'shooting height'. The scales should be reset to '0' in this condition. A note should then be kept of how much movement is needed for the slow and the fast runs series. The scales on the adjusters on the traditional Nickell Twin Post 'scopes consist of a sleeve which is only a friction fit. These scales should not be relied on. However, if they are set to zero as described above, this condition that can always be returned to and the scales quickly reset if necessary. This gives a convenient reference for zeroing the rifle. For the 10m Running Target event, there is very little latitude for adjustment of the traditional Twin Post 'scope from this central reference position. Either the slow runs or the fast runs aim will require the posts to be set very close to this central position, leaving little latitude for fine adjustment. Thus it is important that the posts are centralised in this way. With the Twin Post 'scopes from Nickell, designed with the 10m event in mind, it is less important provided that the shooter can accept that the posts are not central in his field of view. Although the posts can be adjusted past the centre of the field of view there is a limit as to how close they may be brought together. In the 50m Running Boar event this is less important. For this, the posts are normally well separated for most points of aim on the target, and it is not unusual for a shooter to have both his posts well off centre although this cannot be recommended.

19.4 Checking the Zero

Having sighted in the rifle, it will be helpful if you can set up a simple system for re-checking the zero without having the return to the range. Not every shooter has easy access to a suitable sighting in range. However, a different distance may be readily available, such as 25 m rather than 100 m. If so, after setting up the rifle and its sight, it will be useful to shoot a group at this shorter range for reference. Parallax error will be a problem in the out of focus 'scope. This can be minimised by using a mask for the objective lens cut from a 10m target that will restrict the objective lens to about 8 - 10 mm diameter. Although the resultant image will be dark, the effect of head movement permitted will be small and the image will be sharper.

An easy alternative is to bore sight the rifle on some convenient object. This can be done at home. If the same object can be used, and at the same distance each time, this will act as a convenient reference for any future checks. Again, as the distance may be small, it will be necessary to use a lens mask over the objective lens to limit the amount of parallax error. A careful record should be made of the results so that it can be repeated if the 'scope is removed from the rifle or its adjusters moved. When a rifle is checked in this way there is sometimes a surprising result when two similar rifles are compared. If both barrels are aligned with the same object, their 'scopes can appear to be aligned differently. This comes about because a rifle barrel is seldom perfectly straight. Thus the line of sight through the barrel may not be exactly the same as the line of flight of a bullet. This should not affect the rifle's accuracy significantly, but it will affect the way it responds to bore sighting. The bore sighting should be consistent and give reproducible results if the rifle is correctly sighted in. In this, the bore sighting devices are better because they align with only the last few centimetres of the muzzle end of the barrel, not along its full length.

Checking the sighting in when you arrive at the match venue is also important. Before the match starts there will be an opportunity to sight in the rifle at the correct distance. This is important in case the 'scope has been disturbed during transportation, or if it has been removed from the rifle for safety during air travel. A shooter should not go onto the range, even for training, unless he is confident that his rifle is shooting where he expects it to shoot. Every shooter needs to know how to check zero quickly and to recognise if there is any significant change. This opportunity is necessarily limited: other shooters need to use the range too. Thus it is important that you know the relationship between the point of aim and the point of impact, particularly when using a multi reticle 'scope. Immediately before the match starts there will be a further opportunity to check the rifle, but the real value of this time is as a preparation for the match, not for adjusting your sight. The Electronic Scoring Targets used for the 10m Running Target event are helpful here because the monitor displays the position of the overall group centre and its coordinates (in millimetres). However, it does not differentiate between the left and right running targets. Thus if you want to check your point of impact, you should fire a ten shot group with the target moving only in one direction. Do not shoot on the return run. The group centre displayed will then be for that direction of travel.

Any change in zero should be investigated. If the 'scope has been removed from the rifle, such as for air travel, then a small shift of zero is to be expected. This should be no more than one or two clicks in any direction. If the 'scope has remained attached to the rifle and the same type and batch of ammunition are used, a change in zero could suggest damage to the scope, the rifle or to the 'scope mounts. Any failure to maintain the expected small group could mean a fault in the 'scope or its mounting. It is most important that when a mounting dovetail is used, both mounts are fully seated on the dovetail before either mount is tightened and that they are tightened progressively.

19.5 Rifle and Ammunition Testing

It is always useful to know how well (or otherwise) your rifle and ammunition can perform. The same procedure should be followed as used for shooting test groups whilst sighting in a rifle. Test groups should be of at least ten shots, any less can be misleading. If a reliable 'chronograph' is available, it can be used for checking the consistency of projectile velocity. Unless the rifle and ammunition combination is capable of giving consistent velocity, shots are unlikely to lie within a small group on the target. The converse is not always true, consistent velocity may not necessarily be associated with small group size. On the target, the group size should be measured by measuring the coordinates of the centre of each shot hole with respect to some arbitrary datum, and then calculating a mean and standard deviation of each set of coordinates using a pocket calculator with scientific functions. This is much more meaningful than just measuring the extremes of group 'size'.

The effect of firing a first shot from a cold barrel should be evaluated: this is especially important for a .22RF Running Boar rifle. This may be useful sometime, if the first sighting shot must be fired from a cold barrel. To know exactly where the second shot will go may be important. For the Running Deer shooters, it will be helpful to know that every shot from the first to the last, as the barrel warms up will lie in the same small group. The best way to check this is the shoot a test group, then immediately shoot a competition series, and then another test group. The two test groups should be the same size and in the same place. If not, then your rifle may not be ideal for shooting this event although perfectly adequate for stalking live deer!

Part 5 Shooting Technique

There is no 'correct' technique. Each shooter has his own preferred technique that works best for him. In this part of the book, the techniques are described and often recommendations made. It is up to each shooter, with the help of a qualified Coach or Instructor, to work out for himself which techniques are best for him. Without that freedom there can be no progress. The recommendations given in this book should be taken to be a good starting point. At the same time, some of the pitfalls are described that can trap the unwary or the novice. It is most important that a good shooting position and a sound technique should be acquired from the beginning. Bad habits learnt early are difficult to lose. Once a sound technique has been acquired, then the fit of the rifle and the position of the 'scope should be adjusted to match it. The shooter and his Coach should always be aware of the danger of adjusting the rifle or its sight to accommodate a poor shooting position or technique.

Some shooters believe that all their problems can be solved if only they had better equipment. That belief is at best misleading, at worst wrong. The best equipment is useless, worthless, unless it is used by a shooter with a sound technique. Once a sound technique has been developed, better equipment may then add a few more points to his score.

The basis for all good Moving Target shooting is economy of effort. The rifle is supported by the skeleton of the shooter, using its own weight to stabilise it. The shooter's technique is wrong if he has to use excessive muscular effort to support, aim and fire the rifle.

Tradition governs many of the techniques used in shooting, as well as determining the ISSF Rules. Thus, by tradition, the trigger is released by the forefinger of the right hand. There is no reason why the trigger should not be released by the middle finger and this would only require minimal changes to the design of the pistol grip. Such a change would release the forefinger to do what it does best; to point in the direction of the target. However, it would be a brave shooter to use such an innovative technique in an important match. A poor score would inevitably be blamed on the new technique, whereas an exceptionally good score would see everyone adopting it. Every shooter should be prepared to consider such 'unlikely' techniques; it is only by someone trying something different that the sport can progress. However, the days or even weeks before an important match is not the time for such experimentation. This needs to be carried out outside of the match 'season'.

Chapter 20 Preparing to Shoot

It is important that each shooter has a well-rehearsed routine he uses every time he arrives at the range and prepares to shoot. The routine may vary depending on whether he is shooting at his familiar training range or at a distant, and perhaps unfamiliar, venue.

20.1 Are You Ready to Shoot?

Although many of the items should be second nature, it may be helpful if you comply a simple check list. The items to be checked should include:

Are the rifle's bedding screws properly tightened?
Are the buttplate and cheekpiece in their correct positions and screws tight?
Is the 'scope correctly attached to the rifle and screws firm (but not overtight)?
Is the rifle shooting to the expected zero?
Is there sufficient ammunition of the correct type available?
Has the planned mental and physical training programme been completed?
Is a snack or drink needed?
Are the shooting jacket and boots comfortable?

20.2 Psyching Down

When arriving at the range, every shooter will be to some extent, in a state of agitation. If there has been a long journey, it may take some time to psyche down from the stress of driving. Even just the effort of carrying shooting gear from the car park will raise arousal levels. If the journey was short and the range familiar, just the act of putting on the shooting jacket and lacing up the boots may be sufficient to restore a calm mind. These actions should not be hurried. Otherwise a rest in quiet corner applying some of the Mental Training techniques learned in training, or reading a good book, may be called for.

20.3 Warming Up

A few simple stretching exercises are not amiss here. These can be used to promote an alert but not over aroused state. After this, the most effective exercises can be carried out on the range with the rifle.

Although covered in more detail in the Chapter on 'Match Preparation' in Part 7 on Shooting at National and International Level' there is a need for a reminder here. Before going onto the firing point, the shooter should take every opportunity available to him to sight in his rifle and shoot some warm up groups. This is important not only to get muscles working after the journey, but to settle his mind into a state ready to shoot well. Even if he cannot gain access to the sighting in range, much can be done by simply holding and aiming the rifle at a safe mark downrange.

This should not be overdone to the point where he becomes tired or bored. The timing of this shooting should be carefully managed as part of the preparation for shooting.

Chapter 21 Dry Firing

Dry firing is a unique feature of the Moving Target events. The shooter has the opportunity to dry fire a complete series immediately before he goes onto the firing point to shoot. He will dry fire from a specially marked area to the left of the preceding shooter. The first shooter in the competition will have an opportunity to dry fire whilst another shooter, not a competitor, shoots a dummy match. A screen separates the two, usually with a vertical slot so that the dry firer can see when the actual shooter raises his rifle from the bench into the ready position and thus when the target might appear.

It is most important that the shooter makes full use of this opportunity, and he can only do so if he has included dry firing in his match preparation. This is amplified in the Chapter on 'Match Preparation in Part 7 on shooting at 'National and International Level'.

Although the maximum use should be made of dry firing, it is also important that it does not cause fatigue or boredom. The shooter must use the opportunity to dry fire only as a means to preparing himself fully for the competition ahead. Thus, if necessary, he should plan breaks in his dry firing, sitting down and resting occasionally. It is not unusual for a shooter to take a break of a few runs near the end of the series, dry firing the last two or four runs to complete his preparation. It is too late to discover, on the firing point, that dry firing has made you exhausted.

During the dry firing, the shooter should concentrate on making sure that his rhythm is correct. He should be able to pick up the correct view of the target through his sight and see that when he releases the trigger there is no disturbance to the sight picture.

Whilst dry firing on the Running Deer Singles, it is not unusual to see a shooter dry firing the Doubles. Likewise he will dry fire 'triples' during the Doubles. This 'extra' training helps sharpen up reflexes for the match, and helps to prevent any tendency to hang on to a shot for too long.

The modern pre charged pneumatic air rifles have a facility for cocking the trigger mechanism without charging the air cylinder. Others can be modified by adding a lever to actuate the trigger mechanism. Most CO_2 rifles offer a similar facility. There must be no possibility that gas is released during dry firing in contravention of the ISSF Rules.

Some cartridge rifles have a facility for dry firing in which, if the bolt is closed but not locked, when the trigger is released, the bolt will drop into the locked position. There is a satisfactory 'clunk' that simulates the disturbance as the small bore rifle is fired. There should be no ammunition exposed on the bench in front of the dry firing shooter. If your rifle appears not to have this facility then check that the bolt, particularly the locking lugs, is properly lubricated. It will not work with a dry and unlubricated bolt! The sparing use of a PTFE (Teflon) based gun grease on the bolt locking lugs is helpful. In the genuine absence of this facility the bolt can be fully closed on an empty chamber. The release of the firing pin on the empty chamber should not cause any damage as most come to a stop against a reinforced shoulder, unlike some shot guns where excessive dry firing can lead to damage to the firing pin

Chapter 22 Stance

It is most important that the correct stance is adopted from the beginning. Even a novice will have some difficulty in shooting if he adopts an incorrect stance, and may then lose interest in Moving Target shooting. The stance sets the angle of the body to the target, and thus dictates the length of the rifle stock and hence the 'fit' of the rifle.

Although the basic position is described in some detail, it must be emphasised that it should be adjusted to suit the needs of each shooter. It is most important to understand the reason for the suggested basic stance, and to rationalise any changes you might want to make.

22.1 Foot Position

The basic stance is as follows: The right foot is placed parallel to the target track, perhaps turned towards it a little. The left foot is than placed so that a line through both heels will be at an angle of about 45^0 pointing beyond the left end of the target track. The centre of the heels should be about 200 - 250 mm apart. The feet should be at an angle of about 60^0. Thus the left foot will point to a position to the right of the target track. This is the foot position that would be used if the shooter is standing talking to someone. It is relaxed: the legs are not under tension. *[For the experienced ISSF pistol shooter, this stance approximates to the stance used by a left handed pistol shooter.]*

By placing the heels at an angle of 45^0 to the target, this means that the shoulders are naturally at 45^0 too. As the supporting left arm lies most comfortably at about 30 - 45^0 to the line of the shoulders, this ensures that the rifle will 'point' naturally at about the centre of the target run.

If the heels are too far apart, the position will feel stable but the natural 'swing' of the shooter's body to follow the moving target will be inhibited. It is most important that he is free to 'swing' from the ankles upwards. Because the length of the run of the Running Deer is relatively longer especially when the 'antler run' is used, the heels may be placed a little closer together than would be the case for the Running Target and Running Boar events. However, the recoil of the rifle tends to encourage a wider stance. If the heels are too close together, the position will feel unstable.

Some shooters move their feet slightly between left and right runs of the target. The left foot is turned to point more towards the target for the left runs and to be more nearly parallel to the right foot for the right runs. Although this results in the body turning more naturally in the appropriate direction, it introduces some tension whilst in the ready position waiting for the target to appear. To be effective, the movement of the feet must be made consistently throughout the course of fire which may not be possible whilst under stress in a competition. Thus it is not recommended for most shooters. The maximum benefit from this technique may be found in the Running Deer events with their much longer target run.

After the position has been taken up, the shooter should verify that the rifle 'points' naturally at the centre of the target run. He should then 'swing' his body a few times across the whole of the run to ensure that there is no tension in his position that will make his 'swing' unsteady. A small change of foot position may then be made to correct any potential bias.

22.2 The Shoulders

There is a natural tendency for a novice who has not used a rifle before to stand facing the target. In this position he will find that it is a very long reach with his right arm to place his right index finger on the trigger, and that his left arm cannot be placed under the centre of gravity of the rifle. Conversely, someone who is accustomed to shooting a target rifle from the standing position will take up a stance that is very oblique so that a line through his shoulders points towards the target. From this position he will be unable to 'swing' towards the left end of the target run.

Neither of these extremes can be correct. The recommended foot position should ensure that the shoulders are in the optimum position for comfortable, unstrained support of the rifle. Although the final position preferred by an individual shooter may differ, any change should only be made with experience, and must be accompanied by changes to the fit of the rifle. Any tendency to push the right shoulder forward should be corrected at an early stage in the shooter's development. If the shoulders are not naturally in line, undue physical effort will be needed to support the weight of the rifle.

A novice shooter, particularly a lady novice, often tends to push the right shoulder forward thus leading to a complaint that the rifle is too long. This tendency must be corrected at the earliest possible stage otherwise the novice will be put off Moving Target shooting altogether. A novice who has used a shotgun will naturally adopt a “crouch” stance. This too must be corrected:
the correct stance is upright!

22.3 The Hands

Although 'stance' should refer only to the positioning of the body and feet, this chapter also includes the basic hand positions whilst holding the rifle.

The most 'natural' position for the hands may be found by 'pointing' an imaginary rifle towards the target and noting the position of the hands and fingers. Although an ideal position, it may not be possible to realise this in practice because of the constraints of the shape of the stock and the weight and balance of the rifle. There must also be some compromise between the ideal hand position in the ready position and in the shooting position.

As well as supporting the weight of the rifle and guiding it, the hands also exert pressure to bring the rifle securely into the shoulder. Not only does this pressure help support the weight of the rifle, but it also counteracts the effects of recoil. The effort of pulling the rifle back into the shoulder must be shared between the two hands. There is a natural balance between the upward force needed to hold the weight of the rifle, and the rearward pressure that transfers some of that effort into the shoulder. The balance will be determined by the weight, balance and 'fit' of the rifle. Most of the pressure will be taken with the right hand and arm which also has the trigger finger. Excessive pressure exerted by the right arm will result in muscle tension and hence tremor. This will cause a jerky hold and a poor trigger release. Clearly the effect of recoil is negligible in the case of the Air Rifle, and can be significant for the Centre Fire Rifle. However, the effects of an inconsistent hold will be most apparent with the Small Bore Rifle. The high velocity of the Centre Fire bullet helps to minimise any disturbance of the point of impact as a result of recoil. In practice, the shoulder pressure will be similar in all three disciplines, sufficient to help support the rifle without causing tremor. Even in the Running Deer events, this should be sufficient to minimise the discomfort of recoil, especially if a calibre such as the .222REM is

used. If any additional shoulder pressure is needed, this is best achieved by slightly increasing the pressure exerted by the left hand and arm rather than with the trigger hand.

22.4 The Inner Position

In shooting, the term 'Inner Position' is used to denote the level of tension in the individual muscles as well as the degree to which ligaments are stretched and the relationship between the different parts of the body. The Inner Position is something that only the shooter himself can know. In order for anyone to shoot well, in any discipline, the level of muscular tension must be minimal. Because of the dynamic nature of Moving Target shooting, the Inner Position must also be dynamic. There must be some change in the level of tension in the different muscle groups as the shooter carries out the various actions needed to raise the rifle, take aim, and follow the target and fire. The Inner Position is best experienced throughout these actions by shooting with an imaginary rifle. Although it is possible to mentally rehearse the whole process whilst sitting in a relaxed position, it is more effective, to use such an imaginary rifle and adopt the stance that would be used whilst actually shooting, to rehearse each shot.

With such rehearsal, the mind and body are trained to accept this idealised position as normal, and to use it when actually shooting. Clearly the weight and balance of the rifle must be imagined too, and this will only be possible with regular training on the range. It is always helpful to return to this imaginary rifle and to observe how much the actual technique differs from this imagined technique. Any deviation from the idealised technique should only be made with good reason.

Chapter 23 Loading

Most accidental discharges occur whilst the rifle action is being closed. Apart from a faulty mechanism, with a cartridge rifle this may be because the shooter's hand accidentally touches the trigger as he closes the bolt. With an air rifle with a light trigger, it has been known for a sear, set too finely, to release under the shock as the cocking lever is closed. Most single stroke cocking pneumatic air rifles now open the loading gate as the action is cocked and the mechanism is blocked until the gate is closed manually. With the pre charged pneumatic air rifles, very little force is needed for any part of the act of loading. Nevertheless, with any rifle, it is good safe practice to close the action only when the rifle is pointing downrange in a safe direction.

Reloading the rifle between shots in the Running Deer Doubles event will be discussed in the Chapter on 'Follow Through' where it seems more appropriate.

Reloading should be carried out as soon as the target has come to rest. When an Electronic Scoring Target or a CCTV is in use, the position of the shot hole can be seen at a glance and then the shooters attention given to the matter of preparing for the next run. When no monitor is being used, such as on many 100m Running Deer ranges, there will a short delay before the shot value is signalled. The shooter should reload during this delay rather than wait for the shot to be signalled before reloading. He then has an opportunity to take a brief rest before the next target run. Whilst some shooters are able to shoot quickly, not all are able to maintain a rapid rate of fire for a full 30 shot half course of fire. It is important to be able to keep up a steady rhythm. The rules state that the target must be ready to run less than 12 seconds after the target has completed its previous run and the shooter ready for the next run not more than 18 seconds (18 seconds and 20 seconds respectively in the 10m Running Target events). If marking takes place only on the right side of the Running Deer or Running Boar range rather than on both sides, it may not always be possible for the range to operate to this routine. Likewise, if target changing is slow in the 10m Running Target events, there may be an unequal rest period. (In particular, one range design brought the target back to the operator to be changed which added a significant delay to the range timings every second run. These ranges are no longer approved for ISSF Competitions.) When Electronic Scoring Targets are in use the target will be ready for its next run almost immediately. It is up to the shooter to assess this range rhythm and to pace himself to make best use of the time he has. In an International Match, he will do this during training on the day before the match. It is most important that the shooter himself is ready for the target within the time limits, even though the target is not ready to run. He should not raise his rifle to the Ready position until marking and any target changing is seen to be complete

Loading a single stroke cocking pneumatic air rifle demands significant physical effort, reloading is an opportunity for the shooter to take an essential rest between target runs and to relax his position (hence the additional two seconds allowed between runs in the 10m RT events). It is advisable to place the rifle on the bench, or at least to rest the muzzle or butt of the rifle on the bench, at some time in the reloading sequence. This allows him to relax his grip on the rifle and thus prevent fatigue. It is possible to load even such an air rifle without using the bench, but some shooters prefer to rest the butt on the bench with the muzzle up whilst charging it. However, in the interest of safety, the rifle should be pointed down range whilst the action is closed.

There have been two schools of thought in the matter of reloading. Most rifles, both air and cartridge, have been designed so that the right handed shooter reloads with his right hand. His left hand supports the rifle during reloading, maintaining its position on the forend. One result of this is that the left hand is never relaxed; its grip may even tighten on the forend throughout the

course of fire. This is a particular problem with a pneumatic or spring operated air rifle where the left hand must resist the force of charging the action. Some manufacturers recognised this by fitting a single stroke cocking pneumatic action designed to be cocked with the left hand. This simply changed the problem around; the shooter's right hand became progressively more tense. Whilst the idea of maintaining the grip is a sound one, it is counterproductive unless the hand can remain in a relaxed state throughout.

The answer for many shooters is to share the work of reloading between the hands. If the right hand is used to operate the bolt, loading tap or charging lever, the left hand is used to insert the pellet or cartridge. This gives both hands an opportunity to relax fully, but means that they must be relocated correctly on the rifle before adopting the ready position. Whatever the method used, it is important to break the grip on the rifle with both hands at sometime during the loading operation. Failure to do so will result in the unrelaxed hand becoming progressively more tense, often causing pain.

In the 10m Running Target and 50m Running Boar events, the ISSF Rules permit only one pellet or cartridge to be loaded for each run. Hence any magazine of a .22RF rifle can only be used as a loading platform for a single cartridge. This can cause a problem for a shooter who uses a .22RF rifle that can only be loaded from the magazine especially if this must be removed from the rifle to recharge it. In the Running Deer events, where a magazine fed rifle is the norm, only sufficient ammunition should be inserted into the magazine for the next run. The temptation to fill the magazine with four or more cartridges should be resisted as this negates the opportunity to relax between runs. Thus only one cartridge should be loaded for each run of the Singles, and only two inserted for each run of the Doubles.

It is usual for reloading to be carried as soon as practicable after the previous shot has been fired although the action might not be closed until just before the rifle is raised to the 'ready' position. This allows the maximum time for recovery before the shooter adopts the Ready Position for the next shot. The rules state that the shooter must be ready for the target to run not more than 18 seconds after the completion of the previous run. The time is increased to 20 seconds for the 10m Running Target events; despite that fact that most shooters in any major competition now use a pre charged pneumatic air rifle. This is in recognition that loading an air rifle takes more effort and also the assumption that it takes longer to change a 10m target than to patch and signal the score on a 50m or 100m target. With the universal use of an Electronic Scoring Target or at least a Closed Circuit Television (CCTV) system in the 10m events, no other signalling is necessary and this latter assumption is no longer valid. In the 50m events, because targets are patched between shots rather than changed, some additional mechanical or electrical signalling system is likely to be in use even when a CCTV system is installed. A CCTV system is not practicable in the 100m Running Deer events. Thus, in practice, target changing is usually very quickly carried out on the 10m range and will often be quicker than the patching and signalling on a 50m or 100m range.

After the rifle has been reloaded, there is a brief opportunity for the shooter to rest. At one time there was a tendency, in all shooting events, to encourage shooters to use all the time available. This was on the grounds that this would maximise the physical recovery between shots. This ignored the effect of mental fatigue. Modern thinking is that each shooter should find his own natural rhythm, dictated by his subconscious, and not try to force himself into taking longer between shots than he really needs. As a result, the average time taken to complete a course of fire in the precision shooting events such as Air Rifle or Air Pistol has been reduced, allowing the time permitted in the ISSF rules to be reduced too. A shooter who is adequately trained and physically fit should have no need for more than a few seconds after reloading to recover from the effort needed. In the Moving Target events, the actual time between target runs is likely to

be much less than the maximum allowed (range operations permitting). Not only does this give the shooter an opportunity for a brief physical rest, but it can give him an opportunity to visualise the actions needed to fire his next shot successfully. This focuses his mind on the task before him and helps his concentration. It is a very powerful technique, one of a series of visualisation techniques which will be described more fully in the chapter on Mental Training. However, this technique is mentally demanding and, if overdone, or if it has not been properly prepared for in training, can increase mental fatigue. It is also most important the he is able to carry out this visualisation exercise well within the allocated time. Reloading, noting the position of the previous shot and mental preparation for the next shot need not take longer than 12 - 15 seconds. If the shooter has trained himself to take the maximum permitted time, it is most unlikely that he can maintain this under the stress of competition and he risks a warning or a penalty.

Whilst actually reloading, the shooters mind concentrates on the task in hand. Once the physical act of reloading is completed, the shooters mind must be kept occupied if distracting or negative thoughts are not to take their toll on performance. It is at this time that he is most likely to become aware of distracting sounds or movements nearby. Distracting thoughts are more likely under stress in a match than under the idealised conditions when training. The use of visualisation techniques can isolate him from these thoughts for a few seconds but only if carried out consistently. The result, if his mind is distracted in any way, or is allowed to go ‘blank’, is that he may lose concentration and become careless, releasing his shot when the sight picture and tracking of the target are not ideal. It would be better to adopt a faster shooting rhythm than to allow oneself to be mentally distracted.

Under stress, such as in a match, or when mentally fatigued, a shooter will sometimes underestimate the passage of time. Under stress he will find it more difficult to carry out a shot visualisation that was no problem in training. Thus it is most important that he should ensure during training that he leaves an adequate margin for such errors. If he does exceed the time allowance, the shooter will first be given a warning. He will be penalised 2 points for each subsequent offence. There is also a possibility that the operator will release the target after 18 (20) seconds even if the shooter has not yet come into the Ready Position. None of these will help the shooter improve his performance and the situation should clearly be avoided. During any major international match, the Range Officers and Jury will watch the shooters carefully during formal training for any sign of a delay in adopting the ready position. Any shooter seen to be close to the time limit will be watched very carefully during the competition.

Chapter 24 The Ready Position

The 'ready' position is the starting point for all Moving Target shooting. If it is incorrect, the rifle cannot be raised to the shoulder quickly and efficiently. The ISSF Rules specify that, in the ready position, the rifle must be held with the lower part of the buttplate level with or below the line on the waist of the shooting jacket. Earlier ISSF Rules required that the buttplate actually touched the mark, but this is no longer required except notionally under NSR Rules for the Running Deer events. In the 'ready' position, it is normal for the rifle muzzle to be elevated $30 - 50^0$ from the horizontal. However, on some ranges there may be a limit as to how much the muzzle may be elevated and so all Moving Target shooters should be prepared to adopt a lower "ready" position if necessary.

It can be very tempting for a novice shooter to want to hold the rifle in his shoulder whilst waiting for the target to appear. Not only is this contrary to the ISSF Rules, but it will make it almost impossible to 'find' and subsequently follow the target in the sight. This tendency is most evident in slightly built shooters who perceive that the rifle is too heavy and that the stock is too long. Experienced shooters of a similar build do not suffer the same problems. Other shooters lack confidence to subsequently raise the rifle to their shoulder thinking that this will take too long and that they will be unable to fire before the target disappears. It is most important that this tendency is corrected from the beginning. Exceptionally, if a novice has difficulty in raising the rifle from the ready position quickly, it is better to let him shoot with a shortened light weight rifle rather than adopt an incorrect position. A novice should be encouraged to raise the rifle to the shoulder from the ready position repeatedly until he can do it confidently under stress i.e. when shooting at a target. It is important that a novice is taught that a precise raise is much better than a fast raise if this is going to be inconsistent.

It may be desirable for a very inexperienced or nervous shooter to start with the rifle held parallel to the ground i.e. pointing towards the target. In this position, should he accidentally fire the rifle whilst he is raising it to his shoulder, there should be no damage or injury caused. This might be mandatory on some ranges or, on the Running Deer range, with some rifle ammunition. Although a more experienced shooter might think that this would slow down the raise, there is little evidence that this is significant. When I am shooting on the Running Deer range, I adopt this position if I am using a large calibre rifle such as the .308WIN rather than my regular .223REM which has a more limited ultimate range.

24.1 The Body Position

The body must be upright and relaxed. The legs must be straight. The skeleton must be used to support the rifle not muscle power. This can only be done if the body is kept upright. Once knee and hip joints are bent or the spine allowed to bend: tension in the muscles is needed to maintain this position. There is a natural tendency amongst novices to seek to emulate the shotgun shooters with their crouching stance. This is designed to cope with a target moving in three dimensions when to follow it, some muscle power is needed. As the target moves only in one plane, this stance is inefficient; the only movement needed is a twisting one from the ankles upwards. Ideally, the body's weight should be distributed equally between both legs. This can be achieved by leaning very slightly forward or backward, but this should not be overdone lest the position becomes unstable. It is more important that the whole body is able to swing freely with the target and this is easiest with an upright stance.

The whole body must be turned slightly from the natural position facing the centre of the target track until it is facing the point where the target will emerge. The slight tension this introduces in the position will be cancelled naturally as the body is swung with the moving target.

24.2 The Head Position

The head must be upright, the neck free from tension. The shotgun shooter's 'crouch' with the head bent forward is not only unnecessary but wrong. Some forward movement of the head is allowed but only during the raise, and this must be consistent. However, with a typical Sporting Rifle and low mounted ‘scope, some lowering of the head is inevitable. This must be minimised. Ideally, the rifle should be fitted to the shooter with his head nearly upright, rather than the shooter adapting his head position to match a badly fitted rifle and ‘scope.

24.3 The Right Hand

The right hand holds the rifle in its natural position on the pistol grip. Because the butt of the rifle is lower, the right wrist is bent upwards at a slight angle. It is in this position that some support for the web of the hand between thumb and forefinger is helpful. A design favoured at one time by many shooters and permitted by the ISSF Rules is the Thumbhole stock. The modern equivalent is a spur above the thumb which provides some location for the hand. Some shooters have favoured a 'thumb up' hold. This gives better trigger control but can be uncomfortable and feel insecure in the ready position.

Because the right hand also has to operate the trigger, it is important that there is not too much tension and that it feels comfortable. The natural relaxed condition of the hand is that the fingers are gently curved so that the tip of the index (trigger) finger almost touches the tip of the thumb. The fingers are parallel. If the operation of the trigger is not to disturb the rifle, it is important that this natural position is preserved as closely as possible. It is also important that the hand, including the relaxed index finger, 'points' naturally towards the target. If necessary, the shape and size of the rifle stock and it pistol grip should be changed to allow this most comfortable hold. It will be helpful if some of the weight of the rifle is taken upon the top of the third finger rather than relying on grip pressure alone. This may necessitate adding a filler behind the trigger guard. This should be deep enough to ensure that when pulling the trigger straight back, the trigger finger remains parallel to the middle finger. The sensitive tip of the finger should be used to operate the light air rifle trigger, but the heavier trigger of the .22 and particularly the centre fire rifle may make it better to use the first joint. The length of reach to the trigger should be such as to ensure that the trigger finger preserves its natural curve when it is placed on the trigger. It must be recognised that the placement of the finger on the trigger should be determined more by the need for a comfortable relaxed hold than any dogma concerning the part of the finger to use.

To some extent the way the right hand is placed will be related to the trigger weight. Although the trigger weight is 'free' for the Air Rifle events, a very light trigger can only be effective with a light grip pressure. Most shooters prefer a trigger weight near to that of the 500 grams specified for the 50m and 100m events. Because there is a natural tendency to increase the pressure of the rifle into the shoulder in the 100m events, many shooters prefer the trigger weight of their Centre Fire rifle to be rather higher than the minimum 500 grams.

24.4 The Trigger Finger

The trigger finger should not take any of the weight of the trigger in the ready position. During the raise, there is a danger that the pressure may increase subconsciously resulting in an early shot which will be scored as a miss. Depending on range construction / location, a shot accidentally released whilst in the ready position could be dangerous. Such accidents are rare but the novice shooter must be taught to keep his trigger finger outside of the trigger guard while he is in the ready position. A more experienced shooter may place his finger inside the guard but well clear of the trigger blade. It may be moved into light contact with the trigger blade only when the rifle is pointing in the general direction of the target.

24.5 The Left Hand

It is the left hand that determines the height of the rifle muzzle whilst in the ready position. The stock should be held firmly but gently with the left hand. It is placed under the forend of the rifle as in the shooting position. The wrist should be as straight as possible. It is important that the rifle rests naturally on the heel of the hand on the inside of the wrist, and at the base of the forefinger. If the rifle is only rested in the web between thumb and forefinger it will twist the wrist too much and make shooting uncomfortable. The left forefinger may be kept straight, pointing in the direction of the target, or curled upwards over the forend if the stock is short. Alternatively, the forefinger may be curled under the stock with the other fingers.

The stock should be held firmly but gently with the left hand. Its main purpose is to guide and support the rifle, not to pull it back into the shoulder. However, some rearward pressure, which can only be achieved by lightly gripping the rifle, will help reduce the load on the right (i.e. trigger) hand, and will also help to stabilise the movement of the left arm. It is important that the rifle rests naturally on the heel of the hand, on the inside of the wrist, and at the base of the forefinger. Any attempt to rest in the web between thumb and forefinger, as if shooting in the prone position, will twist the wrist too much and make shooting uncomfortable. In the ready position, the wrist will be straight but bent back about 30^0 in the shooting position.

There are three principle ways of placing the left hand:

(a) The hand may be kept 'open' without any attempt to grip the stock;
(b) The stock may be lightly held between the thumb and fingers; or
(c) The left forefinger may be kept straight, pointing along the stock.

The latter position (c), with the forefinger pointing along the stock, is probably the most natural, but any holding pressure can then only be exerted by the remaining three fingers and is thus limited. Consequently most of the pressure into the shoulder must be exerted with the right hand and arm. If the stock is short, or the arm is held outstretched, the forefinger may curl upwards over the front of the forend. In the first position (a) where the rifle merely rests on the left hand, all the pressure into the shoulder must be taken with the right arm. The second position (b), with all four fingers wrapped under the stock and the rifle gripped between thumb and fingers allows more pressure into the shoulder to be taken by the left arm. However, this requires that the left wrist be twisted to the right and can become uncomfortable unless this hold is broken between shots, i.e. during reloading. The grip should be firm, but gentle. Any excessive grip pressure will quickly cause fatigue in the left hand unless it is fully relaxed between shots.

It is helpful to have some feature on the stock to mark the position of the hand, such as under the tip of the forefinger so that the position can easily be identified when coming to the ready position. A drawing pin can be used if the shooter does not want to make a more permanent mark such as with a drill. If a sling swivel is fitted *[Note: a sling may be fitted to the rifle but it may not be used to help support it]* it can be used to locate the left hand.

24.6 The Position of the Rifle

Until the target appears, the rifle must be held so the lower tip of the buttplate is level with or below the mark made on the jacket in accordance with the ISSF Rules (see the chapter on Clothing). At one time the favoured position was to hold the rifle at about 45^0 with the left hand held fairly high. The position favoured by most shooters now is with the muzzle of the rifle held much lower so that the rifle is at an angle of 30^0 or even less. This is compatible with the modern long barrel or barrel extension and allows the shooter to see the target emerge just above the muzzle of his rifle. The higher position was natural for the older shorter barrel and it was usual for the left hand to act only as a pivot with all the work of raising the rifle done with the right arm. In the lower position, the work of raising the rifle to the shoulder is shared between the arms with the right arm taking 25 - 30% of the effort. This is a more natural and less strained position and the rifle comes up into the shooting position more quickly. More importantly, by sharing the effort between the arms, there is less tendency for the rifle to "overswing" when it is raised, which is what can happen if the left hand is used only as a pivot. The older 'high' position also reduced the blood flow to the left arm and hand and could cause early fatigue. The modern lower position is much less tiring and also has the left wrist straighter and thus less strained than the older 'high' position.

With inexperienced shooters, particularly on the Running Deer range, the rifle should be held out of the shoulder but kept parallel to the ground until the target appears. This will minimise the effect of a negligent discharge. In this instance, the ISSF / NSR Rule that the lower tip of the buttplate should be level with the mark on the jacket might be difficult to comply with unless the rifle is held very low, and may be disregarded when a novice is involved. The novice must also be taught to keep his finger well clear of the trigger until the rifle is pointing at the target.

24.7 Taking up the Ready Position

It is important that the shooter does not come into the ready position (nor call "ready") until he really is ready. Lifting the rifle from the bench should be a decisive action giving a clear signal to the line officer that he is ready for the target to appear. This will be about two seconds after the rifle is lifted to the ready position. The shooter is not allowed to 'aim' nor 'sight' his rifle after lifting it and before adopting the ready position. Some shooters have been known to lift the rifle with the muzzle aligned with the centre of the target run and then to swing it across to the normal position awaiting the target's emergence. This is not "illegal" but the target could be released before the shooter gets into his final position. Any shuffling or fidgeting position shows an unpreparedness to shoot and may confuse the line officer. This will make it difficult for him to have empathy with the shooter's rhythm and will not help the shooter and could earn him a formal "warning". As a general rule, the line officer will start his 2 seconds count down as the shooter raises the rifle from the bench after reloading. If the shooter takes up a different foot position for the left and right runs, this should be done before the rifle is lifted from the bench after reloading. Sometimes the target takes longer to appear from one side than from the other. Although the

shooter needs to be aware of this it is usually compensated for by the operator starting the target earlier on one side. The formal training session the day before a major match will allow the shooter to become accustomed to such variables, and the operators to become accustomed to the shooter's foibles!

24.8 Breathing

Both inhaling and exhaling cause some movement of the chest and hence the rifle. Thus it is important that breathing is under control. Although it is possible to hold one's breath for some 12 - 15 seconds, after only a few seconds some strain is felt. The static rifle and pistol shooters are able to optimise their breathing to ensure that the gun is a stable as possible at the moment the shot is fired. Except in the Olympic Final, described in a later chapter, the Moving Target shooter has less control over the moment of release and so he must exercise control over his breathing for several seconds. This must start as the rifle is raised to the ready position. The strain on the chest is minimal when the lungs are partially inflated during the process of inflation. The lungs should be emptied of air just before the rifle is raised from the bench. This does not mean totally empty, but at the bottom of a normal breathing cycle. As the action of lifting the rifle from the bench tends to inflate the lungs, the shooter should complete the normal intake of air as he comes into the ready position. Whilst waiting for the target to appear, he should slowly deflate his lungs until the target appears. With training, it should be possible to reach this point with the lungs about half inflated, in which condition it is not difficult to hold one's breath for up to five seconds until the shot has been released and the follow through completed. If the lungs are overfilled, or are empty, the strain will be so great that there will be a temptation to fire before the sights are fully aligned with the target in order to relieve that strain. There is no place for any degree of hyperventilation during any part of the shooting cycle.

Training will help the shooter to achieve an optimum breathing routine. The objective should be to achieve a natural rhythm that is in tune with the usual range operation. Clearly there can be a significant difference in breathing routine between the slow and the fast runs. This is more difficult in the mixed runs matches. In the Running Deer Doubles match, a rapid partial exhalation and reflation of the lungs can be achieved during the reload. Whilst training on the range is clearly important, it must be remembered that not all range operators will start the target at the same time after the rifle is first raised to the ready position. Thus it is important, before a match, to use every opportunity to become attuned to the local conditions. During private training, it is normal to use an automatic timer to start the target at preset intervals between runs. Unfortunately it is not easy to anticipate these accurately and so the duration of the ready position will vary. An electronic device to start the target a preset time after the rifle is lifted from the bench is better. It will help if the range can be operated manually by an experienced operator from time to time, and that he tries to simulate the probable range of timings likely to be experienced during a match. Mental Training techniques that involve controlled breathing and aerobic Physical Training to increase lung capacity are both very important. These will be described in their own chapters in the next section of this book.

24.9 Checking the Ready Position

During a competition, the range officers and jury will always look for a ready position that is within the ISSF Rules. Most shooters have a tendency to raise the rifle butt slightly under stress and when they become tired towards the end of a course of fire. If the position is near to the legal limit, it is only too easy to attract a warning from an official during a match. This should be

avoided at all costs and should be corrected during training with an observer checking regularly that the position is legal. No shooter should be allowed to become careless in this respect. It will also help if the length and position of the buttplate are as low as the ISSF Rules and good rifle fit allow. It is surprising just how many shooters do not use all the latitude allowed them in this matter and have a ready position unnecessarily near the limit.

Chapter 25 The Raise

The raise is the key to good Moving Target shooting. This in turn depends on a well balanced rifle, properly fitted to the shooter's physiology and style of shooting. Any misfit will lead to an indecisive raise and the loss of valuable tenths of a second. Nor must the shooter hurry the raise to the extent that the rifle 'overshoots' the final position, which is pointing at the correct aiming point on the target and moving with it. An efficient raise will bring the rifle to this position quickly and with minimal effort. The swing to follow the target begins as the shooter starts to raise the rifle. The action of raising the rifle to the shoulder can be practised during training and rehearsed again during 'dry firing' prior to shooting the match. Some top international shooters have a slow deliberate raise even for the fast runs, whilst others have a very fast raise. What matters is not how fast the rifle is raised to the shoulder, but how long it takes to settle into a good aim on the moving target. The words “more haste – less speed” come to mind.

For the four sighting runs and the first competition run, when he is in the ready position and is comfortable, the shooter calls "ready" and the line officer immediately operates the mechanism to release the target. As soon as the target appears, the shooter may raise the rifle to his shoulder. After the first competition run, the target is released about two seconds after the shooter has clearly been seen to come into the ready position.

The ISSF Rules are ambiguous about exactly when the target should be released, and simply say that the target will be released when the shooter is in the ready position. However, for the sighting shots, the Rules do say that the target must be released not more than four seconds after the shooter has called “ready”. In practice, for the sighting runs, the target is released immediately the shooter calls “ready”. For the competition runs it has become the norm for the target to be released about two seconds after the shooter is perceived to be in the ready position. *[Contrast the ISSF Rules for Trap and Skeet that say that the target is released immediately the shooter calls “pull” (Trap) and after a variable delay of up to three seconds (Skeet).]*

The ISSF Rules state that, in the 10m Running Target competitions, signalling and target changing will be completed and the target ready to run in not more than 18 seconds. The shooter must be ready for the target to be released in not more than 20 seconds. The timings are 12 and 18 seconds for the 50m Running Boar and 100m Running Deer competitions where targets are not changed between runs. However, the interval may be longer in the Running Deer Doubles because of the additional time taken to signal the value of the shots.

Whilst the rifle must not be raised from the 'ready' position until the target appears, the raise must be completed quickly and efficiently. The rifle must not overshoot the final position but come to a halt in the shoulder with the cheekpiece and buttplate correctly located and the eye aligned with the 'scope, and the 'scope aligned with the target. If the 'high' (45^0) ready position has been adopted and the buttplate is correctly positioned level with the mark on the waist, the left hand is held high and most of the work of raising the rifle to the shoulder is done by the right hand and arm. The rifle pivots about the left hand which remains still, but some strain is felt on the left wrist. In this 'high' position, the shooter looks towards the target past the forend of his rifle which could, if it is a thick forend, obstruct his view.

Most shooters now favour the lower position for the rifle, holding it at about 30^0 or less. The shooter now looks towards the target past the unobtrusive muzzle of his rifle. With both eyes open, the obstruction of vision by the rifle is minimal. The left hand is much lower and this position is much less strained. The rifle can be held comfortably in this position for a long time

if necessary (such as during dry firing). Although much of the work of raising the rifle is now still done by the right arm and hand, the left arm takes some share. One result of this is that, with both arms sharing the work, the raise is much less strained and the rifle comes very quickly and naturally to a positive stop in the correct position. A properly fitted rifle, with respect to the cheekpiece, is essential here. It is the cheekpiece that brings the upward movement of the rifle butt to a halt with the rifle correctly aligned with the centre of the target's run.

A smooth and efficient raise is facilitated by a using heavy, well balanced rifle. With the left hand at or near to the point of balance, minimal effort is needed to hold it in the ready position and to raise it to the shoulder, but in doing so, the inertia of the rifle is overcome and the momentum it acquires is carried forward into the 'swing' to follow the target. If a novice is allowed to start with the rifle in his shoulder, he loses this initial 'start' and must expend more energy in accelerating the rifle to follow the target. The effect can best be compared with using a hammer to drive in a nail. With a well balanced heavy hammer, the effort needed is minimal, but if the hammer is too light, the nail can only be driven in by muscle power.

25.1 The Trigger Finger

As the rifle is raised, the trigger finger should be moved until it is in light contact with the trigger blade. If a two stage trigger is used, the first stage movement may be taken up at this time, but this will need careful practice if it is never to result in an early shot. It is most important that the shooter trains to ensure that, even under competition stress, he never applies pressure to the trigger until the rifle is pointing in a safe direction.

25.2 Facing the Target

The shooter is naturally looking for the emergence of the target from behind the wall. Both eyes should be open for stereo vision. The rifle should point above the target track in such a position that it is pointing naturally at the target immediately it comes into the shoulder. In the fast runs, the rifle will point nearer the centre of the run than for the slow runs. The exact position must depend on the speed of the shooter's reaction when he first sees the target emerge, and the speed of his raise. It is important that the shooter's swing should commence as soon as he starts to raise the rifle from the ready position. When the rifle comes into the shoulder it must already be following the movement of the target. This can only be achieved through training and experience. It is a characteristic of a novice shooter that his swing does not start until the rifle has been raised into his shoulder.

For the Running Deer, as the antler run is so useful to the shooter, the usual position for the rifle in the ready position is with it pointing over the wall from which the target will finally come into full view. Because all runs are at the same speed, the Singles and Doubles are treated in the same way. The antler run lasts from 1 – 2 seconds, and the target must reach full speed at least 0.5 seconds before the head of the deer emerges into full view. The antler run does allow the shooter to make some adjustment to the position of the rifle before it is in full view. His objective must still be to have the aiming area of the target in his sight immediately the rifle comes into the shoulder, even though the target is not yet fully in view. This is where adopting an 'eye' aim is helpful. However, the purpose of the antler run is to allow the target to accelerate to full speed and the shooter must be able to match his swing to this acceleration phase. This is unlike the Running Boar when the target emerges at its full speed.

25.3 The Response of the Shooter

The lower tip of the buttplate of the rifle must remain level with or below the line on shooter's waist until the target has appeared. Some shooters tend to anticipate the emergence of the target perhaps by watching the CCTV monitor. On some ranges, when the line officer presses the starting button the CCTV monitor is blanked out and then there is a delay of about two seconds before the target appears. Some shooters may try to use this fixed delay to gain a few milliseconds in their response. It is just as likely to lead to a warning for raising the rifle too quickly if he miscalculates.

A typical time for the raise is about 0.5 - 0.7 seconds. There should be no perceivable difference in the raise time between the slow and the fast runs, nor between the Running Deer Singles and Doubles. As the rifle is raised, the shooter's body must be swinging with the target. In the fast runs the shooter should be swinging his body much faster. He must watch the target as he raises the rifle and it is his observation of the target that determines his swing speed, particularly in the mixed runs event. When the rifle comes up to his shoulder, the aiming point should be close to the reticle of the sight, and his swing should be following the target perfectly. Only a small correction to the aim should be needed. It is this coordination between raising the rifle and swinging the whole body that determines how well he will shoot. Any significant adjustment of the aim will result in an erratic movement and a bad shot. Only a well trained shooter with a well fitted rifle will be able to concentrate on the target whilst the rifle is raised to the shooting position.

There is some danger of the shooter trying too hard to force the rifle onto the target as he raises it to his shoulder. This is a real problem for a novice but sometimes an experienced shooter will have difficulty in 'finding' the target quickly, especially in the fast runs. The problem is always made worse if the shooter has not learned to shoot with both eyes open, it is the non aiming eye that should be directing the rifle towards the target as the rifle is raised. Although difficult to do, it is instructive to try to raise the rifle whilst closing only the aiming eye, keeping the non aiming eye open. Sometimes the problem is a result of a poor foot position, calling for additional body stress to find and follow the target. One secret is to learn to raise the rifle instinctively so that it points naturally at the target as soon as it comes up to the shoulder. This needs training and practice before it can be achieved every time. It will come about more quickly if the shooter can stop himself trying to force the rifle onto the target. Dry firing exercises in which the rifle is raised whilst the eyes are closed at the start of the raise, only opening them when the rifle is in the shoulder, will help.

Chapter 26 The Shooting Position

The shooting position, like the 'ready' position, is upright with the weight of the rifle supported through the skeleton rather than by muscle power. As the shooter must track the target whilst it moves through an arc of about 12^0 (~18^0 in the Running Deer events), it is most important that he is able to 'swing' freely as he follows the target.

The importance of adopting an efficient shooting position cannot be over emphasised. This can only be achieved under the guidance of a qualified Coach or Instructor. In the absence of such guidance, a novice shooter may acquire a shooting position which will mar his enjoyment of the sport and will be very difficult to correct later. If the rifle feels uncomfortable, or if the sight picture cannot be found easily or is easily 'lost', the first thing to check is the shooting position, then the fit of the stock and only then the position of the 'scope. Although every shooter must discover for himself what is the 'best' position, he must take cognisance of the position adopted by the worlds' leading Moving Target Shooters, and that variations from the 'norm' to suit individual physiques are small. A shooter who wishes to try a new or unconventional shooting position must only do so with the benefit of experience in the more conventional position.

26.1 The Head Position

The head may be allowed to move forward a little, but this must be done during the raise; NEVER after the rifle is in the shoulder. It is important that the eye is placed exactly the same distance from the 'eyepiece of the 'scope every time the rifle is brought to the shoulder. This is helped by the pressure of the cheekpiece of the rifle against the cheek. The most reproducible head position is an upright or almost upright one. The 'scope must be fitted to the rifle so that the shooter's eye is naturally aligned with the eyepiece.

With a low mounted 'scope, the head must be lowered and the neck bent forward unless the buttplate and the cheekpiece of the rifle are also lowered. If a sporting rifle is used, a low mounted sight is normal and, with limited adjustments practicable to the unmodified rifle, a low head position must be adopted.

26.2 The Swing

As the target runs, the shooter must be able to follow it in his sight. With a rifle held firmly in both hands, there should be no tendency to twist the shoulders. Any such movement will be characterised by misalignment of the head against the 'scope. This will result in a loss of vision through it. There is a natural tendency amongst novices to twist their body from the waist and hips. This is encouraged if the heels are placed too far apart. Some movement of the body from the waist and hips is permitted but only as part of the total movement that should start at the ankles. The relative movement between legs, hips and waist is governed by the amount of tension placed on them. Because the legs are held apart, they act as a wide, flat spring. Thus the tension in the legs is determined by the placement of the heels. Any tension in the hips and waist is controlled mainly by muscle power that must be minimised to achieve a relaxed stance.

The shooter should be able to swing his whole body consistently. The natural pivot for his swing is an imaginary line that goes through his spine and is locked in the ground between his heels. However, the human body, whilst supporting an object like a rifle, has complex articulation.

Because the rifle is not supported directly on the spine, about which the shooter tends to swing, but at the shoulder, the offset can cause a significant change in the attitude of the rifle as it is swung across the target run. If the velocity of the muzzle is measured as the rifle is swung, it will be seen that it is not consistent across the run, will vary from one shooter to another, and may not be reproducible. This can be important in the 10m Running Target events. This is because of the nature of the articulated pivot formed by the shooter's physiology and stance.

As the projectile leaves the barrel of the rifle, it has a component of velocity in the same direction as the movement of the target caused by the swing of the rifle. This tends to reduce the lead needed to hit the moving target. With a rifle length of 1 m (excluding any barrel extension), and assuming an average air rifle pellet velocity of 170 m/sec, the reduction in lead is as much as 5 mm for the fast runs. With a shorter true barrel such as is found on the newer air rifles, this reduction in lead will be much less. However, a careful inspection of the articulation of a shooter's right shoulder as he swings will show that the centre of the swing of the rifle barrel is not a point, but a line, somewhere behind his shoulder. Thus the velocity of the true muzzle of the rifle is even greater than expected and will vary across the swing, resulting in an even smaller lead but one which is inconsistent. The effect is much less important in the 50m Running Boar events because, although the sideways component of velocity is the same, the target is running five times faster and the bullet is also travelling faster. Thus whilst the change in lead for the air rifle in the example quoted is 10%, the corresponding change for the .22 calibre rifle (with sub sonic ammunition) is only about 3%. This is only just significant in relation to the size of the scoring rings. The effect on the Running Deer is negligible.

By adopting a good shooting position, this eccentric motion will be minimised. To minimise any possible inconsistency, the pivot line for the shooter's swing should ideally be a line from his right shoulder to the ground between his heels. This can be achieved by his leaning slightly to the left as he swings, placing a little more weight on the left leg. This is not unnatural as it tends to compensate for the weight of the rifle, but should not be overdone as it can lead to some loss of balance. The body should remain upright, the pronounced lean adopted by some shotgun shooters is not recommended.

26.3 The Shoulders

There is a natural tendency for a novice who has not used a rifle before to stand facing the target. In this position he will find that it is a very long reach with his right arm to place his right index finger on the trigger, and that his left arm cannot be placed under the centre of gravity of the rifle. Conversely, someone who is accustomed to shooting a target rifle from the standing position will take up a stance that is very oblique so that a line through his shoulders points towards the target. From this position he will be unable to 'swing' towards the left end of the target run.

Neither of these extremes can be correct. The recommended foot position should ensure that the shoulders are in the optimum position for comfortable, unstrained support of the rifle. Although the final position preferred by an individual shooter may differ, any change should only be made with experience, and must be accompanied by changes to the fit of the rifle. Any tendency to push the right shoulder forward should be corrected at an early stage in the shooter's development. If the shoulders are not naturally in line, undue physical effort will be needed to support the weight of the rifle.

If the initial foot position adopted in the ready position is correct, the body will face naturally at an angle of about 45^0 from a line drawn from the shooter to the centre of the target 'run'. The

shoulders must be straight and perpendicular to this natural line. If the right shoulder is pushed too far forward, as many novices tend to do, it will not be possible to place the hands on the rifle so as to minimise the effort required to hold it steadily and follow the target smoothly. This is one reason why many novices perceive that the rifle stock is too long. Rather than shorten the stock, the Coach or instructor should help the novice to correct this tendency.

26.4 The Left Arm

The partly outstretched left arm must support most of the weight of the rifle. The most comfortable position for the left arm, if that were all it had to do would be with the upper arm on the chest wall and the elbow bent sharply upwards. This is the position used by the static air rifle shooters or three positional rifle shooters in the standing position. The ISSF Rules state that the rifle must be held supported by the arms only (including in the ready position), and that the left arm must not be supported on the hip or chest wall. The Moving Target shooter also has to guide the rifle as he swings with the target. He can only exercise full control over the rifle if his left arm is outstretched, much as would a pistol shooter. Thus the position must be a compromise. For optimum holding power and control, the elbow should be bent at an angle of about 90^0. The actual angle will depend a little on the position of the centre of gravity of the rifle. It will also depend on how much of the weight of the rifle is taken up by pressure back into the shoulder, and downward pressure on the cheekpiece. The balance of the rifle should be adjusted so that the centre of gravity is over the left hand, or a little behind it, in this suggested 'best' position.

The position of the left hand will also determine, to some extent, the height of the rifle on the target. If the rifle is raised to the shoulder with the shooting eye closed, the 'natural' height of the muzzle can be determined. The shooting eye should be closed until the rifle is settled in the shoulder otherwise it will direct the rifle to the 'correct' height. It is important not to hold the rifle too long whilst settling into position because, with the onset of fatigue, the weight of the rifle will tend to pull the muzzle down. If the rifle consistently points below the target when it is first raised to the shoulder then, in theory, the left hand should be moved back a little on the forend to raise the muzzle. However, if the left elbow is already bent at the optimum angle of about 90^0, then any movement of the hand will put the arm at a mechanical disadvantage. In addition, if the rifle has already been set up so that the centre of balance is above the leading hand, then if the hand is moved from that position there will be a significant twisting moment on the left wrist, again increasing the load on the arm. In fact, if the left hand is brought back to raise the rifle, the rifle muzzle will now try to turn down, thus counteracting the repositioning of the hand. Whilst the rifle could be rebalanced, this is not always practicable. The amount of adjustment possible by moving the left hand is very limited and should not lead to adopting an uncomfortable position. Thus if the rifle will not point naturally at the target height, other actions may be more effective. These could include adjusting the height of the cheekpiece or increasing the depth of the forend of the rifle. In practice, shooter comfort should be the most important consideration. With a comfortable arm position, he will naturally compensate for any small error in rifle height without significantly increasing the stress on his support arm.

The left wrist will be bent back about 30^0, but should not be twisted sideways. The rifle should be held firmly but without strain, between thumb and fingers. The forefinger may curl around the stock with the other fingers, or it may be outstretched towards the target. If it curls around the stock, it will dictate the amount of pressure applied and this may become excessive, resulting in pain in the left hand. If the left forefinger is outstretched, then it should point naturally along the line of the rifle towards the target. If the stock is short, or the arm is held outstretched, the forefinger may curl upwards over the front of the forend.

The basic stance determines the position of the shoulders which should align naturally at an angle of about 45^0 to the left of a line drawn from the shooter to the target. The whole arm should be moved across the body about 30^0 so that a line from the right shoulder through the left hand points to the target. If this position is adopted, the forearm will make an angle of about 45^0 from the vertical as seen by the shooter. This is the best compromise between supporting the rifle and being able to 'swing' with the target. The position of the left arm and hand should be the same as if an imaginary gun is 'aimed' at the target without the need to support any weight.

26.5 The Right Arm

The right elbow should form an angle of about 60^0. At this angle, muscles are relaxed and the maximum force is available to pull the rifle back into the shoulder with minimum strain. The right arm must not in any way trap the butt of the rifle thus the elbow must be raised. The angle can vary from about 60^0 below to as much as 30^0 above the horizontal. With the elbow at 45^0 below the horizontal, the arm can apply the maximum pressure to pull the rifle back into the shoulder. As the elbow is raised, so the pocket formed by the shoulder deepens and the rifle is located more positively. At the same time the sensitivity of the trigger finger is increased. However, more muscle energy is needed to maintain the same shoulder pressure. The angle used is a matter for personal preference and may differ with the different events, the greater recoil of the Running Deer rifle favouring the lower elbow position. When ordering a bespoke shooting jacket, a competent maker will take account of the position of the right arm and design it to offer maximum support in the chosen position.

The arm height is related to the length of the stock. If the stock is too long, the right shoulder will be pushed back and the rifle will feel unstable and the swing will be erratic. If it is too short, it will be difficult to apply sufficient pressure into the shoulder and too much of the work will be done with the left arm. The higher arm position is more critical of stock length and will need a slightly longer stock (10 - 20 mm) than a lower position. If the stock is too short, the high arm position will feel uncomfortable with some tension in the right wrist and shoulder and the position will be inconsistent. The trigger action may also be adversely affected. If the stock is too long, the arm will tire quickly during a match.

26.6 The Right Hand and Trigger Finger

Advice on trigger finger placement varies widely. One school of thought suggests that only the pad of the forefinger should rest on the trigger blade and should be at right angles to the line of sight. Another school of thought suggests that the first joint should be used, especially when the trigger pressure is high such as on the cartridge rifles. What is perhaps more important is that the trigger finger should point naturally at the target. This position can be found if the shooter takes up an imaginary rifle and 'aims' it at the target. The attitude of his right hand should be observed. The best hand and trigger finger position will probably be the same as he used for this imaginary rifle. In this position he will naturally pull straight back on the trigger parallel with the line of the barrel. The position of the finger on the trigger will then be determined by how thick the pistol grip is. The position of the trigger, if adjustable, should then allow the pad of the forefinger to be placed on the trigger at a right angle to the line of sight. If the trigger 'reach' is short, it will be better to use the first joint of the forefinger rather the pad if this would mean that the first joint is bent past a right angle.

26.7 Vision

Both eyes will be needed to observe the first movement of the target and should be kept open at all times whilst shooting. The left, non aiming eye can see the target and helps the shooter subconsciously to align his aiming eye with the target through the sight. The question of binocular vision will be dealt with in the Chapter in this part of the book dealing with 'Aiming'.

26.8 Rifle Height

When the rifle is raised to the shooting position, it is the shooter's left arm that must support most of its weight and establish the height of the sight line. This does need some muscle power. If the arm is kept high, the muscles of the arm and shoulder are at a disadvantage and there is a natural tendency for the muzzle to drop.

There are several things that can be done to make it easier to support the rifle. The most important is to make sure that the balance of the rifle is correct (see the Chapter on 'The Fit of the Stock'). A badly balanced rifle, whatever its weight, will be more difficult to hold. The next thing is to make sure that the left arm is working to its best mechanical advantage, with the elbow at 90^0 and the forearm at about 45^0 across the body. Even a small deviation from this position can affect the ability to hold the rifle comfortably.

A small gain in height can be obtained by bringing the left hand back a little along the forend. This can be worth trying, but the change in position must be kept small (less than 20 mm) and the shooter must be aware that any gain in height can be cancelled out by the increased effort needed. The effort needed to support the rifle with the left arm can be reduced a little if more of the weight is taken up by downward pressure on the cheekpiece. If the cheekpiece is raised a few millimetres, then more pressure must be applied to bring the eye back into the correct position against the 'scope. Whilst this tends to raise the muzzle of the rifle, that downward pressure must be resisted by the arms and so any gain could be cancelled out. However, if the cheek pressure is already low, a small increase by raising the cheekpiece can be beneficial.

If the rifle is fitted with low sight mounts, higher mounts (within the ISSF Rules) will lower the rifle thus lowering the left arm and increasing the mechanical advantage. This is a worthwhile gain with few disadvantages and several other advantages such as an improved head position. It is also possible to make the rifle forend deeper by building it up with wood or Epoxy resin. Any gain in height in this way can be beneficial, but there is a practical limit. If the forend is too deep, the rifle will tend to twist about a vertical axis and it will be more difficult to keep it upright or to maintain a given degree of cant.

26.9 Cant

If the rifle is canted over to the left, to bring the 'scope nearer to the shooter's face, and then his head will be able to take up a more comfortable position. No longer will it be necessary for him to twist his head to the right, his aiming eye will no longer be directed upwards and towards his nose. By canting the rifle it will be possible to lower the cheekpiece or move it further to the right. Even without reshaping the cheekpiece, it will have a larger area of contact with his face and thus make for a more stable hold. The contact area will be with the fleshy part of his cheek and there will be less pressure from his bonier chin. This will also help achieve a more comfortable position.

However, there are drawbacks. If the 'scope has a cross hair reticle and is sighted in to shoot to point of aim, the rifle barrel will be pointing a little above that point of aim. This is because the projectile will fall under gravity from the time it leaves the barrel until it reaches the target. The approximate fall is about 20 mm for the air rifle pellet, 120 mm for the 50m small bore bullet and 80 mm for the 100m centre fire bullet. Thus if he were to fire a series of shots as the rifle was rotated, maintaining the same point of aim, the bullet holes would form a circle with a radius equal to the projectile drop and with its centre at the point of aim. If the point of aim is lower that the point of impact, such as with a 6 o'clock aim on the 10m target, then the circle will increase its radius by that same amount. If the point of aim is higher than the point of impact by a distance equal to the bullet drop, the circle will be reduced to a single small group. The rifle is least sensitive to cant, for any normal point of aim, if it is not canted.

Ideally, the point of aim should coincide with the point at which a line drawn through the barrel (the extended barrel line) meets the target. Because of bullet drop this will be above the point of impact of the projectile. In this condition, rotating the rifle will not change the point of impact. Fortunately, in the 50m Running Boar events, the natural point of aim with a cross hair 'scope and subsonic ammunition, is on or just under the eye for the slow runs. The rifle is zeroed to shoot a little low. This makes the 50m Running Boar rifle with a cross hair 'scope insensitive to cant.

The further from the extended barrel line the point of aim is, the more sensitive the rifle will be to cant. When a multiple reticle 'scope such as a twin post 'scope is used (see the Chapter on 'Aiming'), the point of aim is offset from the point of impact (i.e. on a stationary target). It then becomes very sensitive to any cant. Rotating the rifle around one of the posts will produce a circle of shots well offset to one side. A small variation in the angle of cant can make a big difference in the point of impact. This is something the user of such a 'scope must live with, the problem is inherent in the concept of the multiple reticle 'scope and is made worse by canting the rifle. It is particularly important that the rifle is canted around the point of impact and not around the top of one of the posts.

Thus, by canting the rifle, although it may feel more comfortable, three things become important:

The sight is no longer directly above the barrel but is offset to the left;
The point of impact will move up and to the right;
The sights are no longer adjusted in truly vertical and horizontal planes.

As the sight adjusters no longer work in truly vertical and horizontal planes, any adjustment of the lead between slow and fast runs must be accompanied by a change in elevation. To overcome this, the 'scope must be realigned in its mounts so that the reticle is 'square' to the target. This not only ensures that the sight adjusters will operate truly vertically and horizontally again but it will allow the shooter to use his reticle to control the degree of cant. However, the sight is still not directly above the barrel. Some of the modern rifles overcome this problem by fitting the sight mounting rail on a rotating sleeve around the action. If the rifle is canted, the sleeve is rotated to keep the 'scope directly above the barrel thus minimising its sensitivity to cant. This feature has been applied by Steyr in their CO_2 rifles and is starting to appear in some small bore target rifles. It will no doubt be seen in some other Moving Target rifles eventually.

It is also important to recognise that the more the rifle is canted the more sensitive it becomes to the angle of cant. Furthermore, the more the rifle is canted, the more difficult it becomes to reproduce that cant. Whilst the reticle itself can be used against the target as a visual levelling gauge, this is no substitute for the natural inclination to keep the rifle vertical.

Thus, if the rifle is canted, the cant should be no more than is necessary to obtain a comfortable head position. Each shooter must work out what is best for himself. Fortunately, with a high sight position, the angle of cant needed to achieve a comfortable head position is proportionately less than it would be with a low mounted sight.

In the 100m Running Deer events, if an 'eye' aim is used, the 'scope will be pointing some 500 mm above the point of impact. Thus if a series of shots is fired as the rifle is rotated, the bullet holes will form a circle which has a radius of 500 mm. Because a long lead (about 500 mm) is needed, any small variation in the degree of cant will have a significant effect on the point of impact. Thus a Running Deer rifle sighted in for an 'eye' aim will be very sensitive indeed to any change in cant and should preferably not be canted if this aim is used. Anyone using the eye aim must be aware that a shot that lies inexplicably to the right or left could be caused by a small variation in the ‘cant’ of the rifle even when it is supposedly held ‘square’ to the target.

The overall advice is that some cant is an advantage for the serious shooter who has a technique that is good enough to be able to reproduce the cant every time. A novice should be taught to hold his rifle vertically without cant until he has learnt the basic techniques thoroughly and can reproduce his position consistently. A typical angle of cant is about 5 - 10^0, 15^0 would be extreme. If the 'scope has been realigned in its mounts it is not difficult to keep it 'square' to the target, especially if it has a horizontal line in the reticle. With a twin post 'scope, it is important that the posts are not too low in the field of view nor should the chosen aim make them too far apart. This is necessary in order that the shooter can see as much of the posts in the centre of his field of view as practicable and thus make the best use of them to regulate his angle of cant.

If the rifle is to be canted, then particular attention should be paid to its fit and to the shooting position to ensure that the cant is most effective. It may be necessary to raise the sight; it is easier and more consistent to cant a rifle with a high sight line because less cant will be needed to achieve the same improvement in the position. It may also be necessary to move, or alter the shape of, the buttplate. However, for most shooters, canting the rifle to the left ensures a better fit for the buttplate if it is already in the standard vertical position. The right elbow should be fairly high to give adequate clearance for the rifle stock which is now moved out to the right. Most of these changes will be small, but it is important that they are made and that the overall shooting position and fit of the rifle are reviewed after any change like this.

26.10 Dealing with the Mixed Runs Match

Some shooters face the Mixed Runs with some trepidation. In fact it is usually one of the more interesting of the Moving Target events to shoot. A look at scores from major matches shows that, pro rata, there is very little difference between the normal runs and the mixed runs. One reason for this is that many shooters treat it as a 'fun' shoot, relax and so shoot better.

The secret of shooting the mixed runs is to treat every run as if it were fast, and then if it turns out to be slow, there is plenty of time to adjust the swing and timing. There should be no significant difference between the raise for the fast and slow runs in any case. There will be some differences in aim if a multi reticle 'scope is used. These will be dealt with in the Chapter on 'Aiming'.

Chapter 27 Aiming

27.1 Vision

For most novices, the left eye closes naturally the better to see the image of the target through the 'scope with the right eye. This might be necessary when using an astronomical telescope to view the stars when the light transmission of the telescope is very small. With a telescope sight, the image seen through the 'scope should be almost as bright as with the unaided eye and there is no excuse for closing the left eye. Another excuse for closing the left eye is that when the right eye is not correctly aligned with the 'scope resulting in some image cut off or 'grey out', the shooter tends to see the target only with his non aiming eye. As soon as possible, a novice must be encouraged to shoot with both eyes open. The action of closing one eye results in tension in the facial muscles that leads to strain in the other eye which must be avoided. Binocular vision is the normal state and closing one eye will result in some loss of balance that is so important in Moving Target shooting. It is most important to remember that it is the non shooting eye that directs the rifle to the target during the 'raise' (the shooting eye's vision is partially blocked by the rifle). It is only when the rifle is actually in the shoulder that the aiming eye is required to take over the task of holding the rifle on the target and perfecting the aim. In effect, until the rifle is in the shoulder and actually tracking the target, the aiming process owes much to the instinctive aim of the shot gun shooter. This requires the use of both eyes.

If the shooter is right handed but his left eye is dominant, then he may be able to suppress the dominant eye by wearing a dark lens over that eye. This should leave sufficient vision through the left eye to maintain binocular vision. The lens should suppress the vision enough to counteract any tendency for the view of the target through the left eye to dominate that through the 'scope with the right eye. Closing the left eye or fitting a 'blinder' is not recommended for Moving Target Shooting. If a blinder is thought to be necessary, it must be as small as practicable and comply with ISSF Rules.

A shooter who experiences real difficulty in keeping both eyes open whilst shooting may be suffering from some incipient problem of vision such as poor alignment of his eyes. Another potential problem is that he is short sighted and tends to look at, rather than through, the sight. In either case an optician should be able to provide appropriate spectacles corrected for distance viewing.

If the 'scope is correctly focused, and the shooter's vision is 'normal', with the aid of prescription spectacles if necessary, then he should see the image of the target, and the 'scope reticle, in the same plane as the actual target as seen with his non shooting eye. There should be no conflict between the images seen by the two eyes; the view by the non shooting eye will be suppressed. If he suffers from strabismus (i.e. non convergent vision), spectacles fitted with prisms may be needed to bring the eyes back into convergence. If the 'scope has not been correctly focused, or the shooter needs to wear corrective spectacles but does not, then such a conflict may occur. The image seen through the 'scope and the image seen by the non shooting eye will not be in the same plane and the brain will not be able to decide which is correct. This will also lead to early 'eye strain' possibly even to extent of causing blurred vision before he has reached the end of the series of shots.

27.2 The Area Aim

Anyone who does not have a scientific or engineering background tends to think in ‘absolutes’. The scientist (or engineer) is trained to accept that nothing can be measured precisely: every process has its errors, including those controlled by a person. In no shooting discipline is it possible to achieve a perfect shot not even when shooting from a rested position “off the bench”. Although most of the rifles that are likely to be used for Moving Target shooting are capable of shooting a very small group, even from a rigid bench there will always be some small deviation of each shot. More importantly, very few shooters could hope to hold their rifle still enough to match its performance. Even using a 4x 'scope in the 10m Running Target event, the shooter is aware of the slight tremor in his hold. It is most important that every shooter accepts that he cannot achieve a perfect aim. He must decide for himself what is acceptable. For many 'club' shooters, if the sight is aligned within an area of the target that will give him a score of '9', that may be more than adequate in the slow runs, or '7' in the fast runs. If he tries to achieve a better aim, then his muscles will tire more quickly and this will accelerate the onset of the wobble. This is especially so if he holds on to his aim too long, trying to make a certain '9' into a '10'.

If the muscles, including the eye muscles, are fatigued by being asked to hold too small an aiming area, the additional effort needed to release the shot cleanly is often just too much and the aim relaxes at the moment of squeezing the trigger. Instead of a certain '9', the shot is a '7' or worse. If he had accepted a bigger area aim, then the shot could have been fired earlier and would have resulted in a '9' or '10'. The static shooters, both rifle and pistol, are able to relax their aim if it is not acceptable, even to the extent of being able to lower their gun. Often, however, it will mean only a relaxation of the aim, allowing the eye muscles to rest for a few seconds. Not so in Moving Target shooting where the shooter is committed once he has adopted the ready position.

This problem is made even worse if a high powered 'scope is used for the Running Boar or Running Deer events. Not only is it more difficult to 'find' the aiming area (or even find the target at all), but any wobble in the aim is more apparent, increasing uncertainty and hesitation. Thus a novice is well advised to stick with a 4x or 6x 'scope even in the 50m and 100m events where high magnification 'scopes are permitted.

Although it is difficult, every Moving Target shooter must learn to accept an area aim that is large enough to be compatible with his present ability. Performance can only improve if the shooter is able to accept such an imprecise aim and then concentrate his efforts into achieving a clean release of the shot. It is made easier if a thick reticle is used. This is especially important when a twin post reticle is used; the posts should be about half the width as the central aiming mark on the 10m Running Target. They should be about the width of the eye for the 50m and 100m events. It is important to know that errors on the target are NOT additive, but are summed quadratically. *[This means that when there are several sources of error, the overall error is much less than the simple sum of the contributions. Moreover, the largest error(s) will dominate the whole to an extent that is out of proportion to their relative magnitude. As an example if there are two errors of 3 and 4, their sum is NOT 7 but 5.]*

27.3 10m Running Target

It is the TRAILING diagram that is shot at when paper targets are used. When Electronic Scoring Targets are used, there is only one scoring area.

Because the target is moving, the aim must be in front of the intended point of impact. For the slow runs, the lead is about 20 - 23 mm. For the fast runs the lead is about 40 - 45 mm. The actual

lead will be determined by the pellet velocity, the barrel length and the way the shooter swings his rifle with the target. (See the Chapter on 'The Shooting Position'.)
When a single reticle 'scope, such as one with cross hairs, is used, a lead of 21 mm places the reticle on the outer edge of the '3' ring. This point of aim is not difficult to identify. A lead of 42 mm for the fast runs places the point of aim roughly midway between the edge of the black aiming mark and the black of the scoring rings. Because the two marks are different diameters (15.5 mm and 30.5 mm), it is not easy to bisect the zone between them. However, a larger area of aim is acceptable for the fast runs and this factor is much less important than many shooters think!

When a multi reticle 'scope such as one with a twin post is used, the shooter has a choice of aiming points:

(i) Central aim. The trailing post is placed over the centre of the '10' ring. This can work well but may have a disadvantage during training where more than one shot will be fired on each target. This can also be an advantage in that it encourages a good follow through as the shooter watches through his 'scope as the pellet strikes the target. With the aiming point being progressively shot way, the group tends to wander. A further disadvantage of this aim is that, in the fast runs, the point of impact is so far in front of the point of aim that there is a possibility of shooting late, not being aware that the centre of the target will pass behind the wall of the range before the projectile reaches it.

(ii) 6 o'clock aim under the scoring rings. The trailing post is placed under the scoring rings at 6 o'clock, a typical pistol aim. To be effective this needs the use of very wide posts. The point of aim will be affected by any variation in the amount of white card seen under the black of the scoring rings and this is determined by the height of the target seen above the front board of the range.

[With the use of a trailing reticle of any type, there is always a possibility that the shooter is not aware that his point of impact has moved behind the wall of the range and so he will score a miss. This is a problem with a central aim in the 10m Running Target events and needs to be guarded against. When the aiming mark is used, if it can be seen, then if a shot is fired, it should hit the scoring area!]

(iii) Aim at the centre of the aiming mark. The leading post is placed over the centre of the aiming mark; which of course leads the scoring rings. This is helped by wide posts perceived to be a similar width as the aiming mark (15.5 mm). Because the aiming mark and the posts are black, there can be difficulties in finding the centre of the aiming mark. With normal range lighting this has not proved to be a problem. As the leading post is used for both fast and slow runs, the aiming point moves behind the wall of the range before the moment of impact. Thus the shooter has good warning that he is about to shoot late.

(iv) 6 o'clock aim under the aiming mark. The leading post is placed at 6 o'clock under the aiming mark. Again a wide post, the same width as the aiming mark is preferred. There is a tendency to shoot vertically stretched groups due to uncertainty in the amount of 'white' to leave under the aiming mark. This may be affected by the height of the target centre above the front board of the range which may vary from range to range.

Most shooters use a leading post in the centre of the aiming mark (iii), with the remainder divided between an aim in the centre of the scoring rings (i) and a 6 o'clock aim under the aiming mark (iv). In practice, a shooter adopting (iii) or (iv) above will probably finish up with a compromise

aim with the tip of the post low down in the aiming mark. (ii) is not a good aiming point as there is too much uncertainty and the aim will wander.

One very important factor in deciding on an aiming point is that if Electronic Scoring Targets are used, then there are no scoring rings on the target centre. Thus there are no features on the main scoring area to help identify the centre or other point of aim. For some shooters this could be an advantage as it does encourage him to accept a large area aim i.e. anywhere in the central ‘black’ area. However, on the aiming mark, there are now rings equivalent to the 10, 9 and 8 rings of the normal target. With this in mind, most shooters will opt to use the aiming mark rather than the scoring area for their aim.

In deciding on a suitable aiming point, it is important to remember that the further the aiming point is from the point of impact (on a stationary target) the more sensitive the rifle will be to any small changes in the angle of cant (see the Chapter on the 'Shooting Position'). Thus the posts should be kept as close together as practicable. If a 6 o'clock aim is used, whether under the aiming mark or under the scoring rings, the rifle will be more sensitive to cant than if the posts are placed across the centre of the target. It is also important that the posts are high in the field of view; certainly they should not be significantly below the centre. This is to ensure that the best use can be made of them to keep the 'scope 'square' to the target and so minimise any variations in the cant of the rifle.

In the accompanying illustrations, the aiming point for a 'scope with a cross hair reticle and the relative position of the two posts as shown in these diagrams is only approximate. It will depend on the velocity of the pellet, the target speed, the length of the barrel and the way the shooter swings his rifle. The positioning of the second post will be determined by the target run in the opposite direction.

Because the target is seen by the shooter in plain black on white, with very well defined features, it is much more difficult to 'aim off' with a twin post 'scope than on the 50m Running Boar target. Aiming off is sometimes needed in the normal runs to make a fine correction to the aim during a match rather than pausing to adjust the reticles of the 'scope, and is necessary in some form or other in the Mixed Runs match.

For the Mixed Runs match, the shooter with a single reticle 'scope shoots as he would in the normal runs. The shooter with a twin post 'scope, who must adjust his posts between slow and fast runs, has to decide whether to concentrate his technique on the slow or the fast runs. It will be necessary to 'aim off' for either the slow or the fast runs of the target. The consensus is that it is better to choose a fast runs aim and then to 'aim off' if the run should turn out to be slow. The alternative view, that it is better to get the slow runs right and to aim off for the fast runs has some credence, but the argument that there is more time to adjust the aim on the slow runs seems to be more acceptable. One successful compromise that has been tried is to use an aim with the leading post across the centre of the aiming mark for the fast runs, and then use an aim in the scoring rings, usually a little behind the centre, for the slow runs. Although not perfect, this is very close to a true point of aim for the slow runs and any adjustment by 'aiming off' is very small and not difficult to estimate. The alternative method is to set up the posts for a slow runs aim with the trailing post across the centre of the scoring rings. For the fast runs, the leading post must then be placed near the edge of the aiming mark. The success of either of these compromise methods will depend on the actual lead required.

Another method that could be used is to adjust the posts until they are close together in the centre of the field of view. The 'scope is then used in much the same way as a 'scope with a cross hairs reticle.

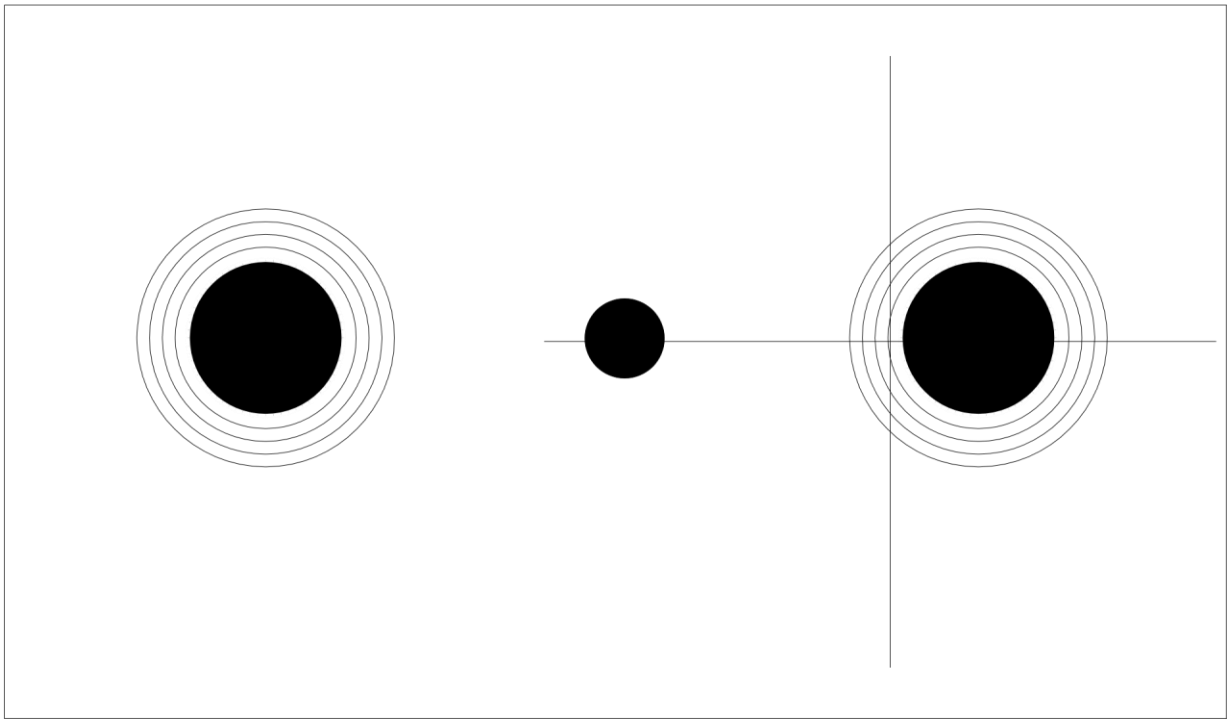


Fig. 27.3.1 10m Running Target (Paper), Cross Hair Reticle: slow runs aim ←

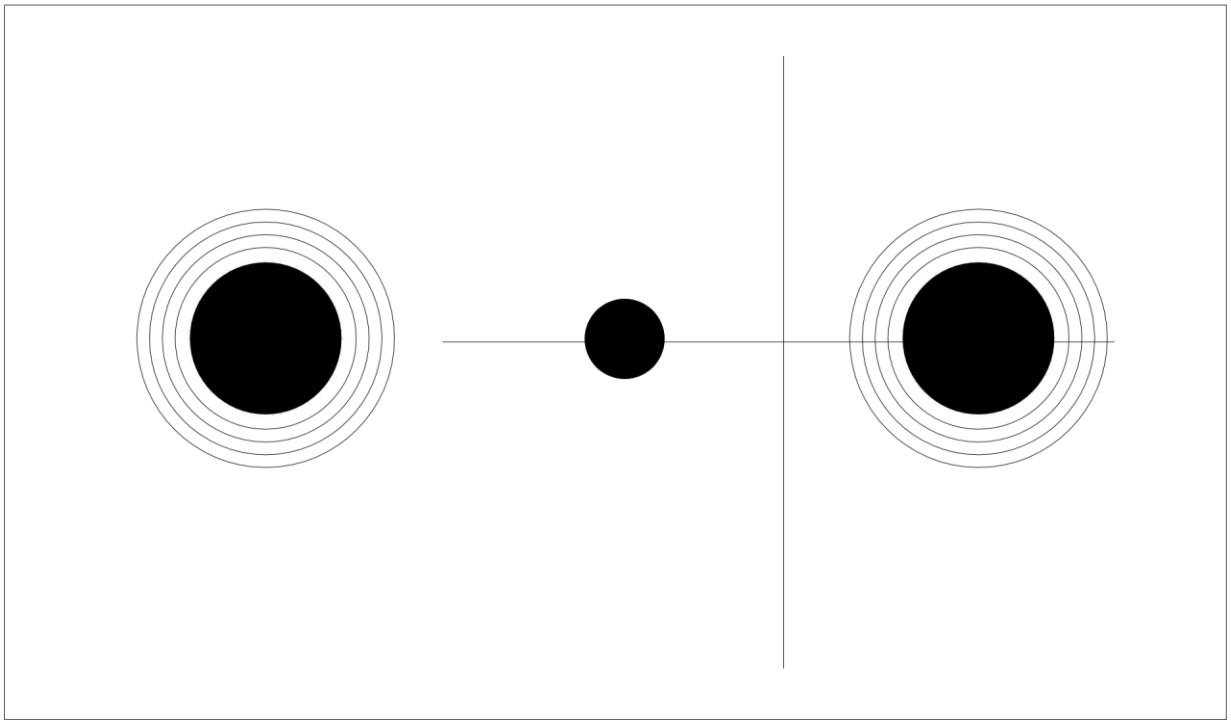


Fig. 27.3.2 10m Running Target (Paper), Cross Hair Reticle: fast runs aim ←

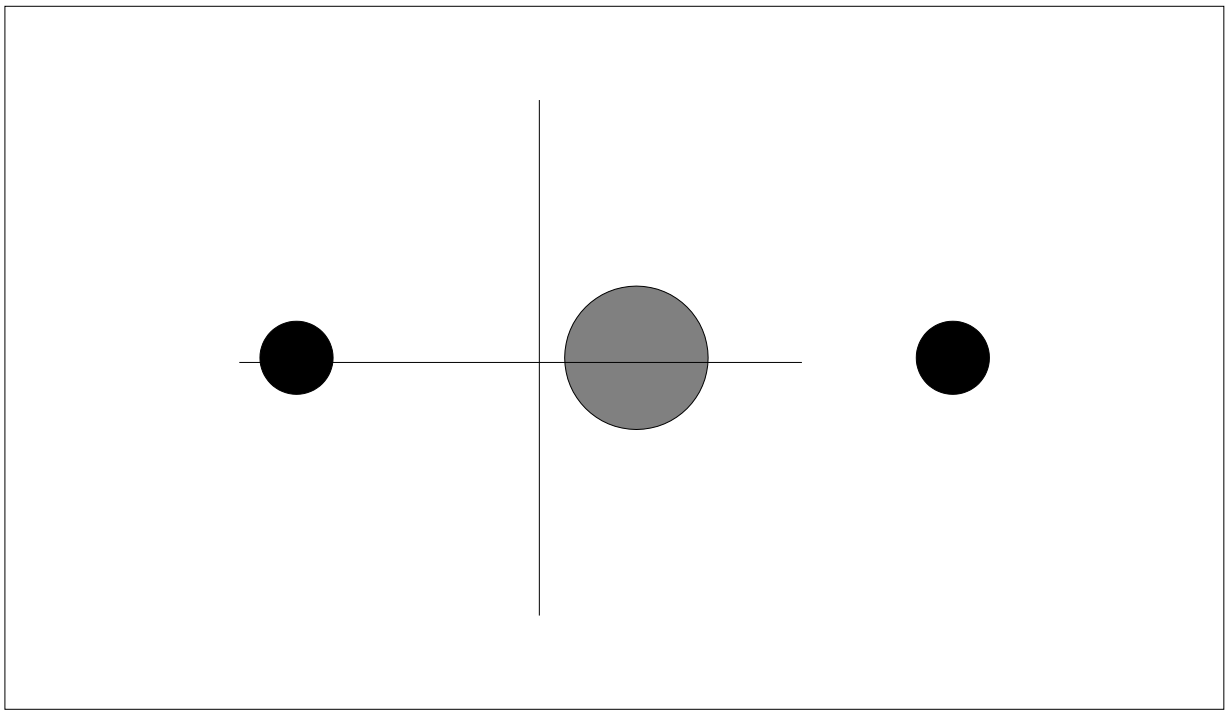


Fig. 27.3.3 10m Running Target (EST), Cross Hair Reticle: slow runs aim ←

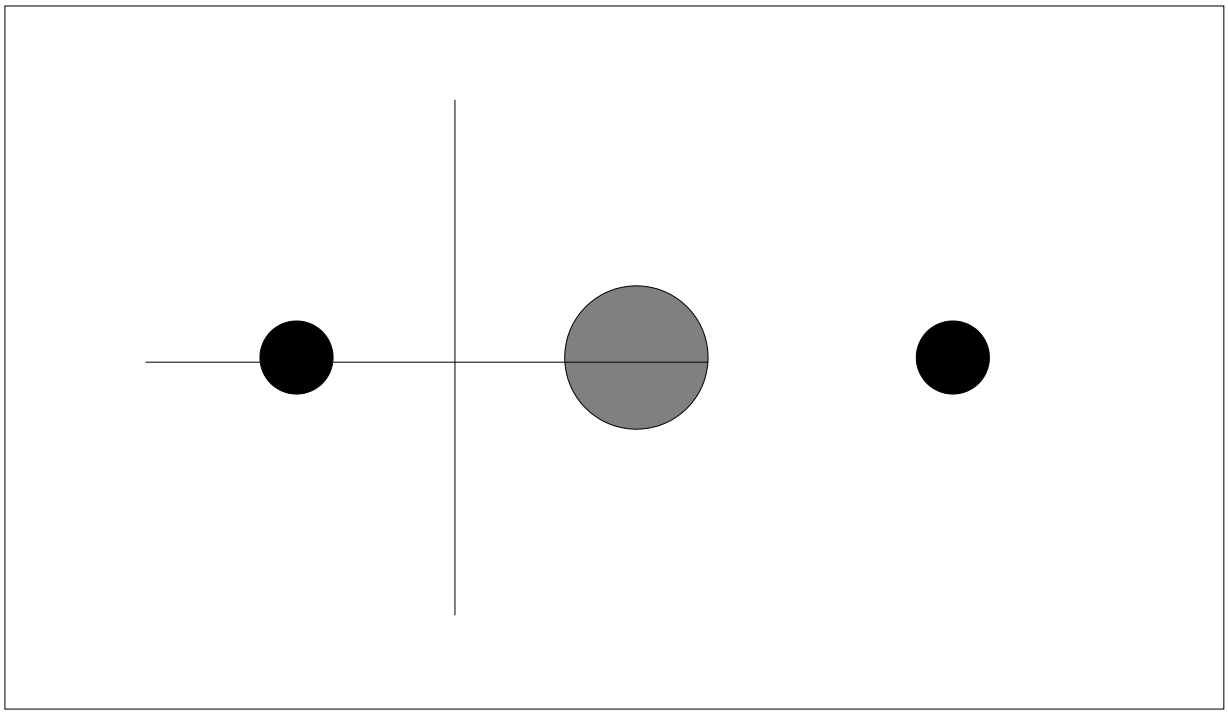


Fig. 27.3.4 10m Running Target (EST), Cross Hair Reticle: fast runs aim ←

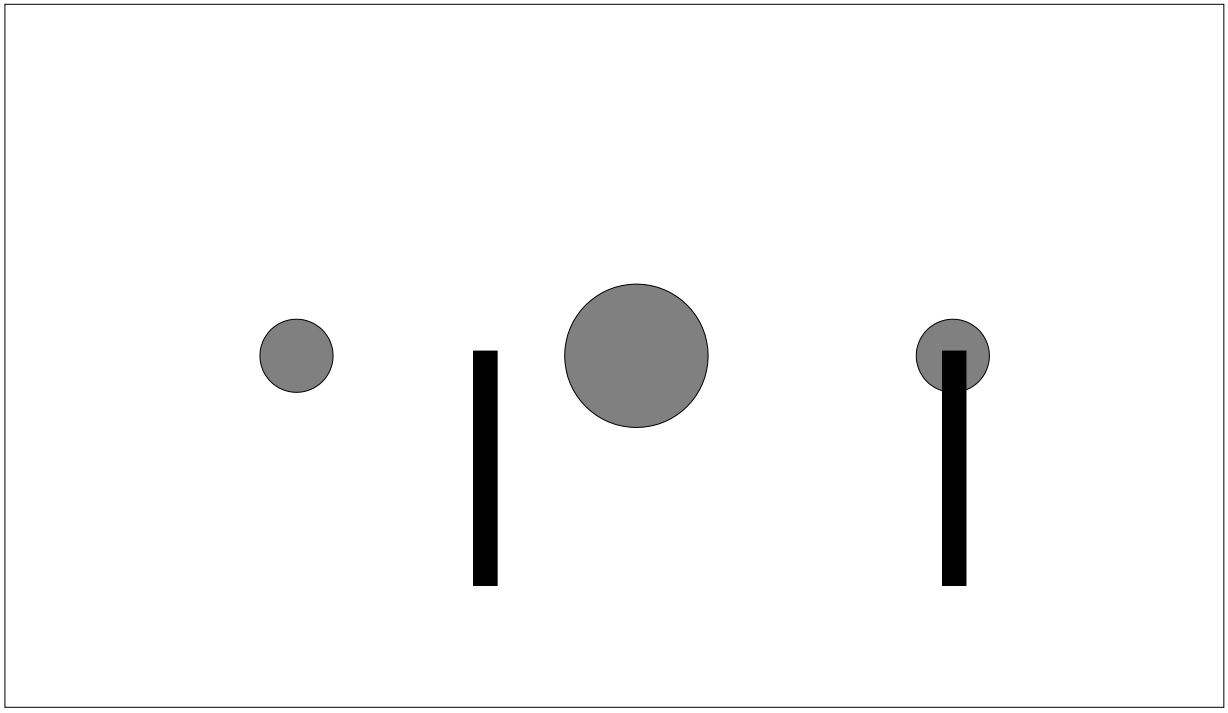
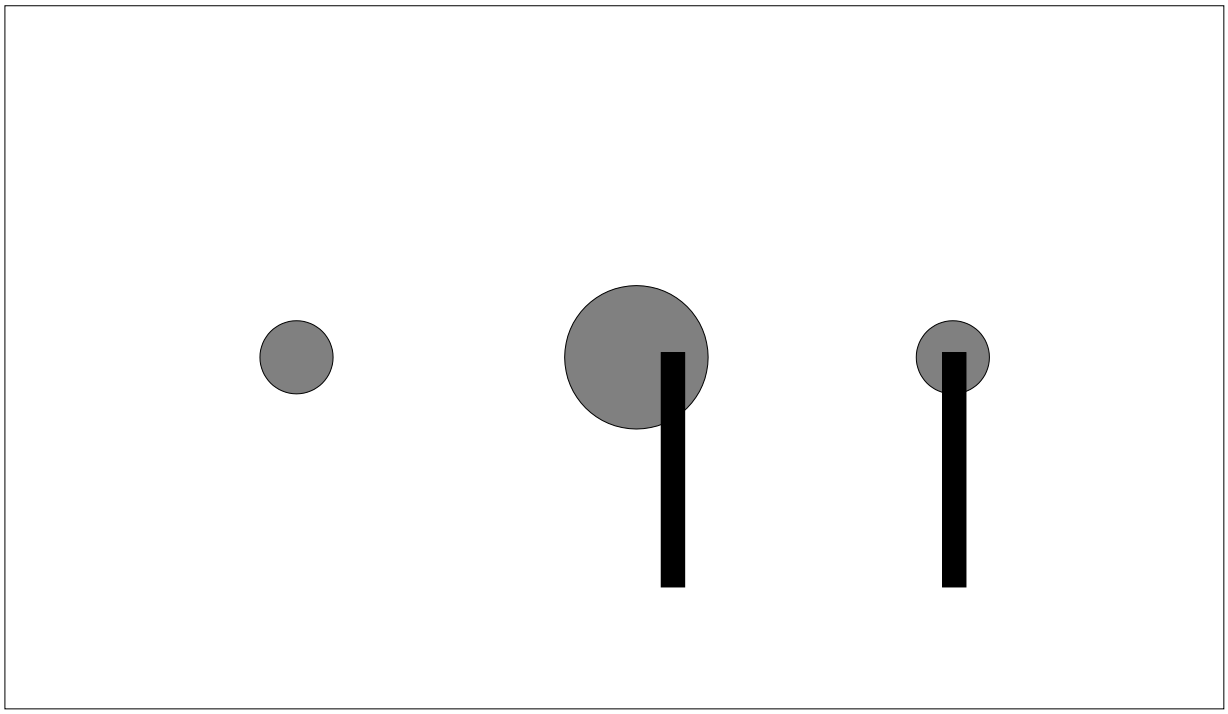


Fig. 27.3.5 10m Running Target (EST), Twin Post Reticle: slow runs aim with the leading post across the centre of the aiming mark →



Fig, 27.3.6 10m Running Target (EST), Twin Post Reticle: fast runs aim with the leading post across the centre of the aiming mark →

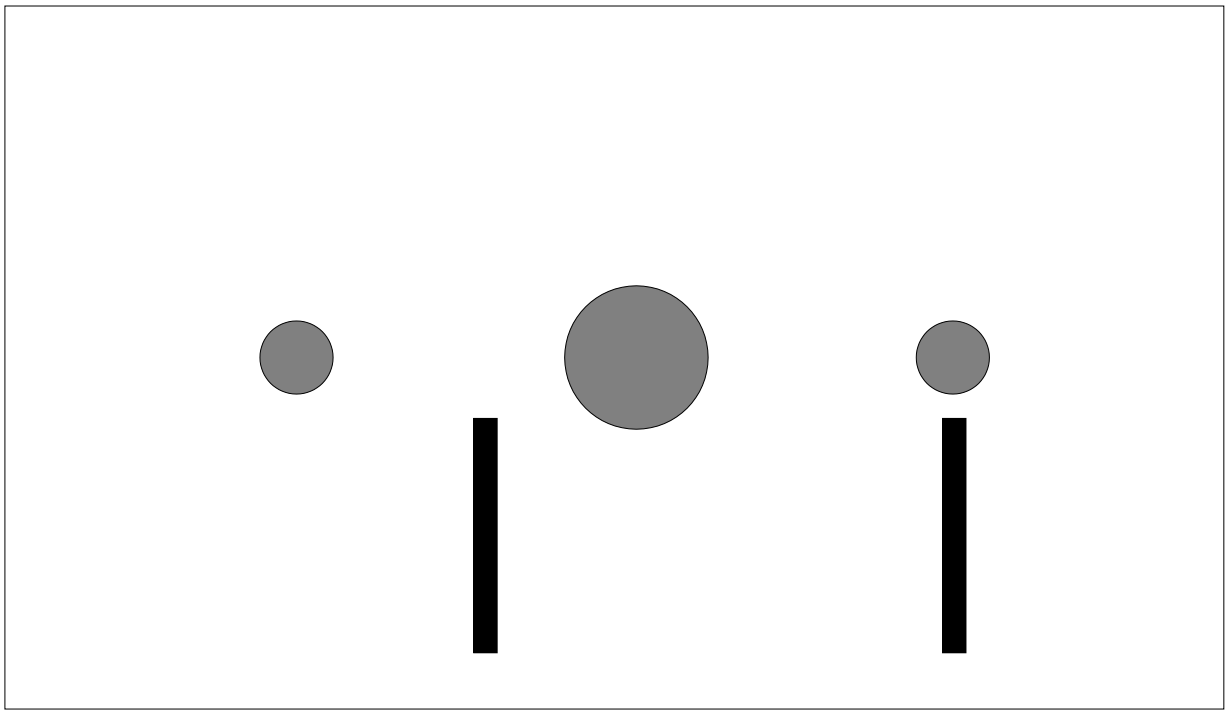


Fig. 27.3.7 10m Running Target (EST), Twin Post Reticle: slow runs aim with the leading post at 6 o'clock under the aiming mark →

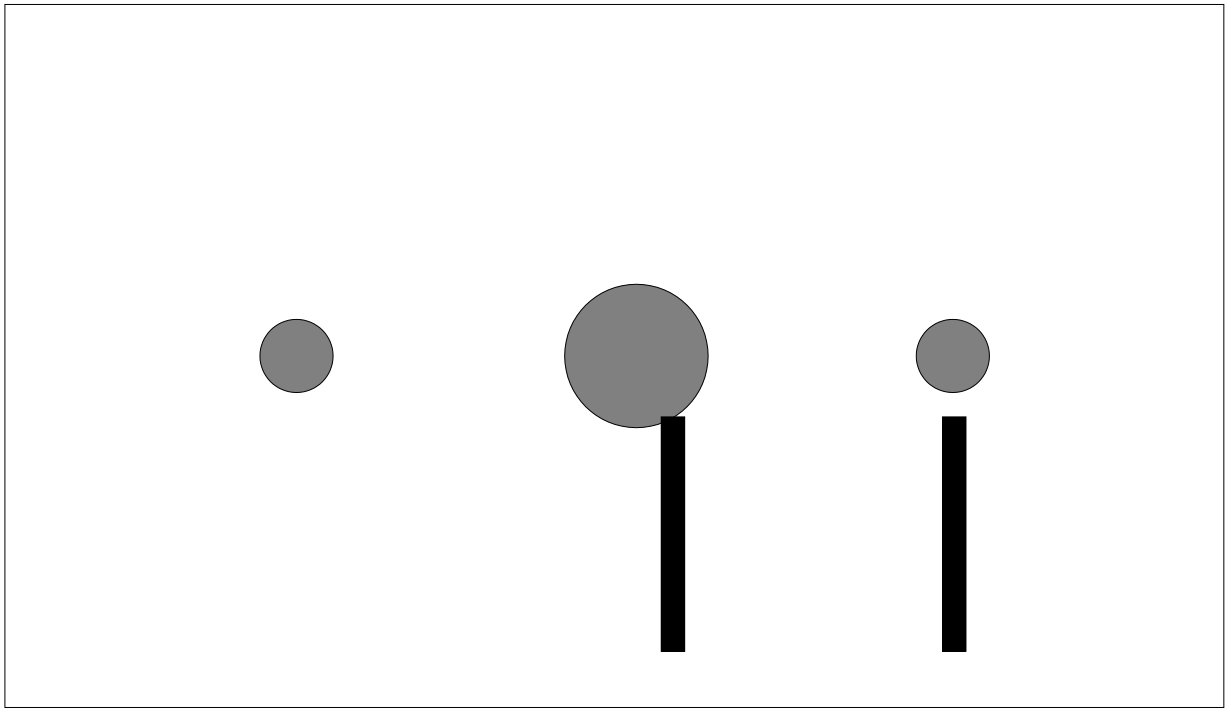


Fig. 27.3.8 10m Running Target (EST), Twin Post Reticle: fast runs aim with the leading post at 6 o'clock under the aiming mark →

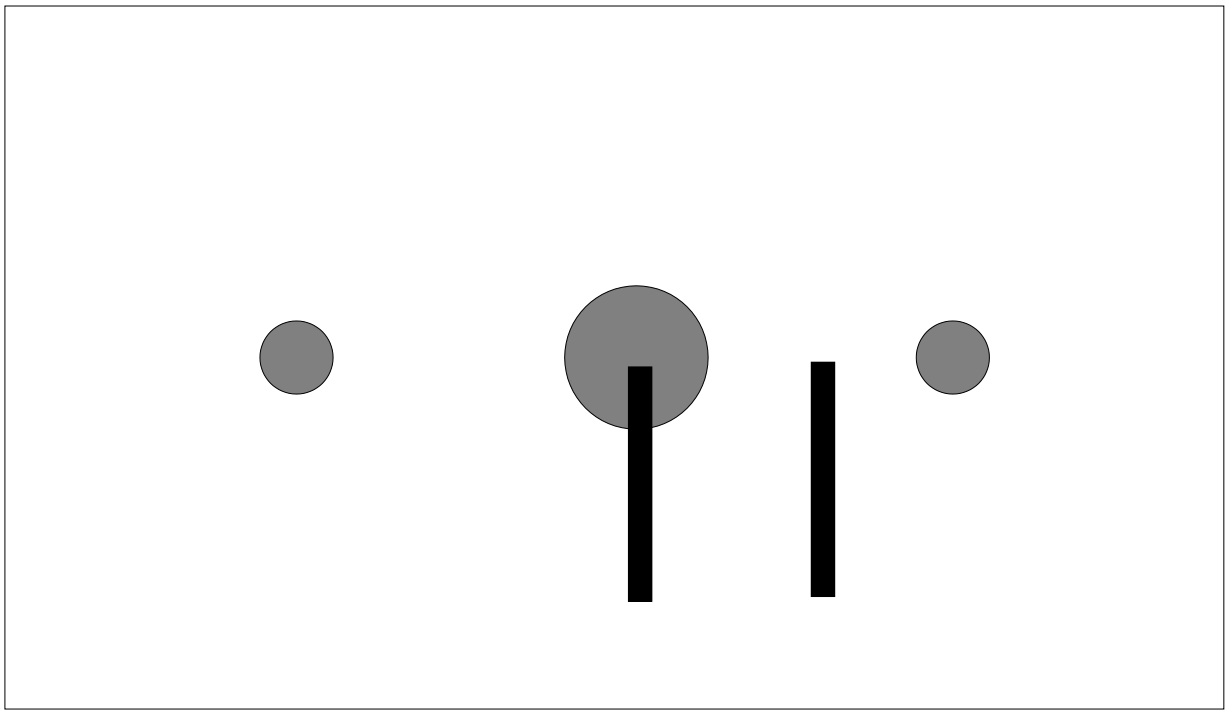


Fig. 27.3.9 10m Running Target (EST), Twin Post Reticle: slow runs aim with the trailing post across the centre of the scoring rings→

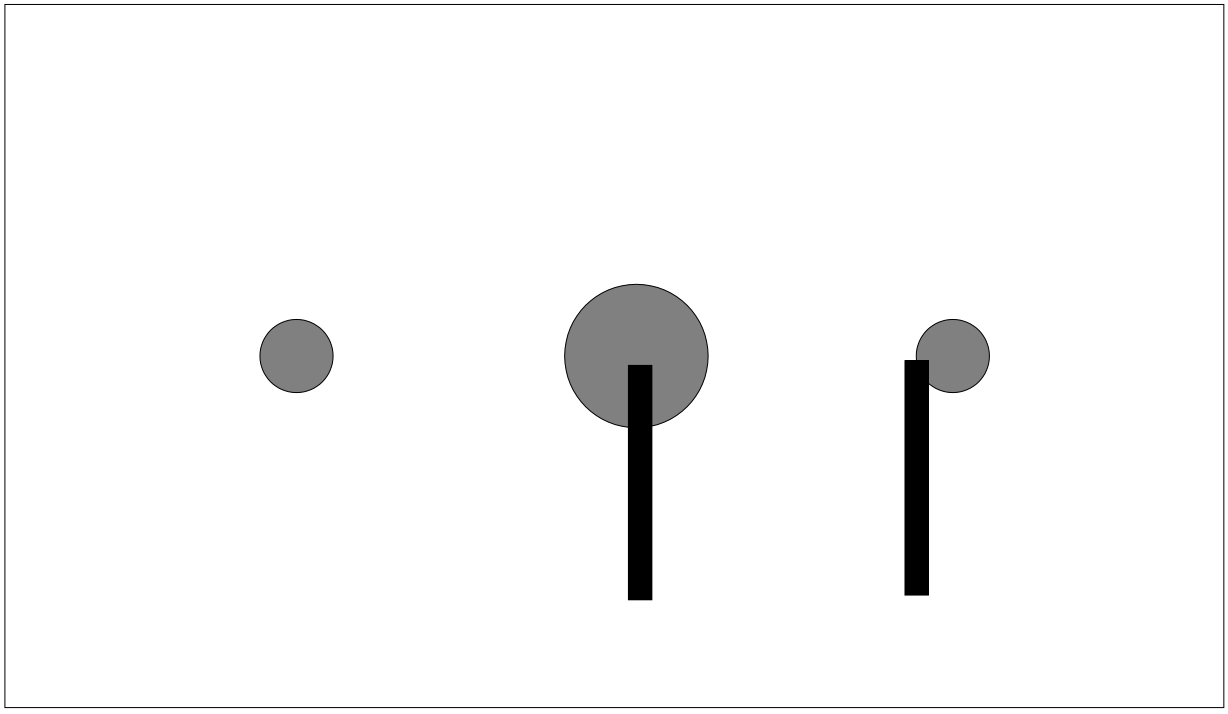


Fig. 27.3.10 10m Running Target (EST), Twin Post Reticle: fast runs aim with the trailing post across the centre of the scoring rings →

27.4 50m Running Boar

The lead required with normal subsonic ammunition (~320 m/sec) is about 300 mm for the slow runs and 600 mm for the fast runs. With high velocity supersonic (hunting) ammunition (~400 m/sec), the leads are about 250 and 500 mm respectively.

With a single reticle 'scope and subsonic ammunition the ideal aiming point in the slow runs is thus on or just below and slightly behind, the eye. Fortuitously, an aim on the eye is least sensitive to the effect of canting the rifle and is thus an excellent aim for a novice. However, for the fast runs, the aiming point would be >100 mm in front of the target, an almost impossible aim. With supersonic ammunition the slow runs aim is in the cheek of the boar, and the fast runs aim is on the tip of the nose. Thus for the fast runs, supersonic ammunition is best; for the slow runs, then subsonic ammunition should be used. There is a difference in the elevation of the shot between the two types of ammunition of about 30 mm. Because the eye is above the height of the target centre, if the rifle shoots to point of aim with supersonic ammunition, the point of aim for the slow runs with subsonic ammunition will be just below the eye without any need to readjust the sight. However, it would be prudent to check the sighting in of the rifle when changing ammunition. If not, then certainly fire one or two fouling shots to clear any residues from the earlier ammunition left in the barrel.

With a multi reticle 'scope such as a twin post or twin loop, the universal aiming point is the area of the snout of the boar between the tip of the nose and the tusk. With subsonic ammunition, the leading reticle is used for the slow runs and the trailing reticle for the fast runs. Only a very small adjustment of the reticles should be needed, if any, between the slow and the fast runs. This is fortuitous. If a twin loop reticle is used and it just fits into the triangle between nose and tusk, then with most match ammunition such as Eley TENEX or CLUB or RWS R50, no sight adjustment is needed between slow and fast runs. When a twin post 'scope is used, the usual aiming point is just under the nose where there is a convenient notch on the target that fits the top of a post well. Because this is not quite midway between the slow and fast runs lead, a small adjustment, usually only one or two 'clicks' is needed for the two speeds.

For the mixed runs match, the shooter with a single reticle 'scope has little option but to use supersonic ammunition. His slow runs aim will be in the cheek of the boar. This is not ideal, but works well in practice. With a twin loop 'scope, the shooter just takes his normal aim. Any 'aiming off' needed is very small and this makes it much easier to shoot the 50m Mixed Runs than the 10m event. If he is using a twin post 'scope and subsonic ammunition, then the aim should be in the snout midway between tusk and nose. He will use the leading post for the slow runs and the trailing post for the fast runs. If he uses the aiming point just under the nose, then he should set up for the fast runs with the trailing post, and use the leading post under the tusk for the slow runs.

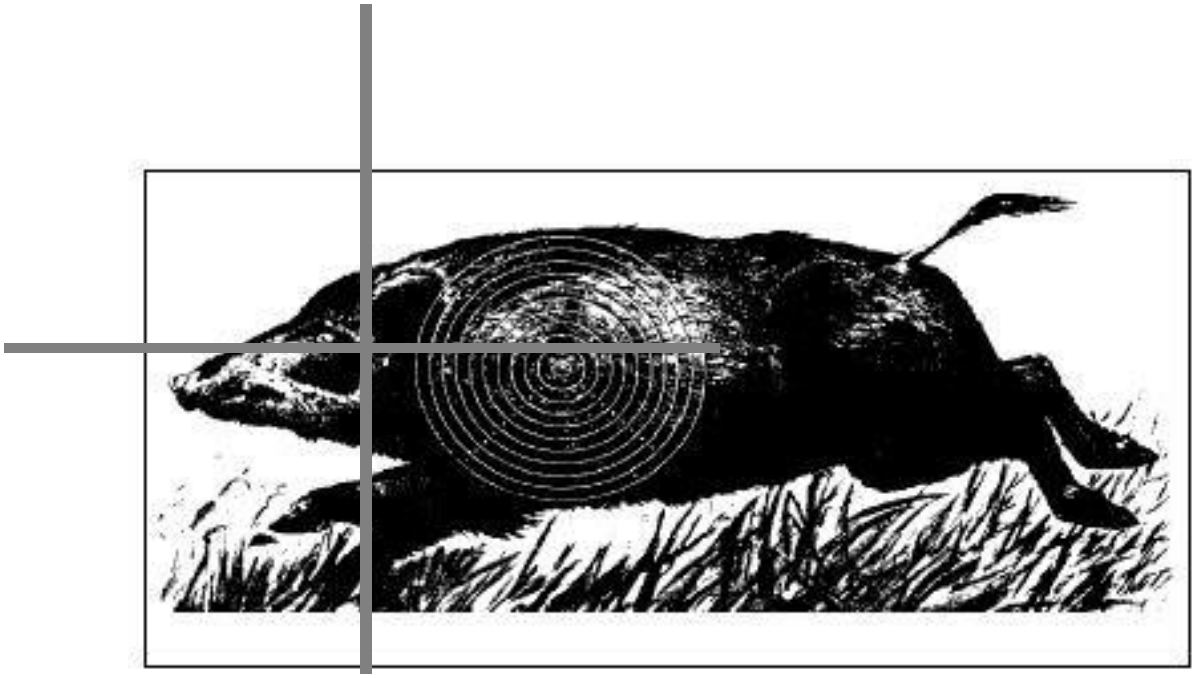


Fig.27.4.1 50m Running Boar, Slow Runs Aiming Area: Sub Sonic (Match) Ammunition

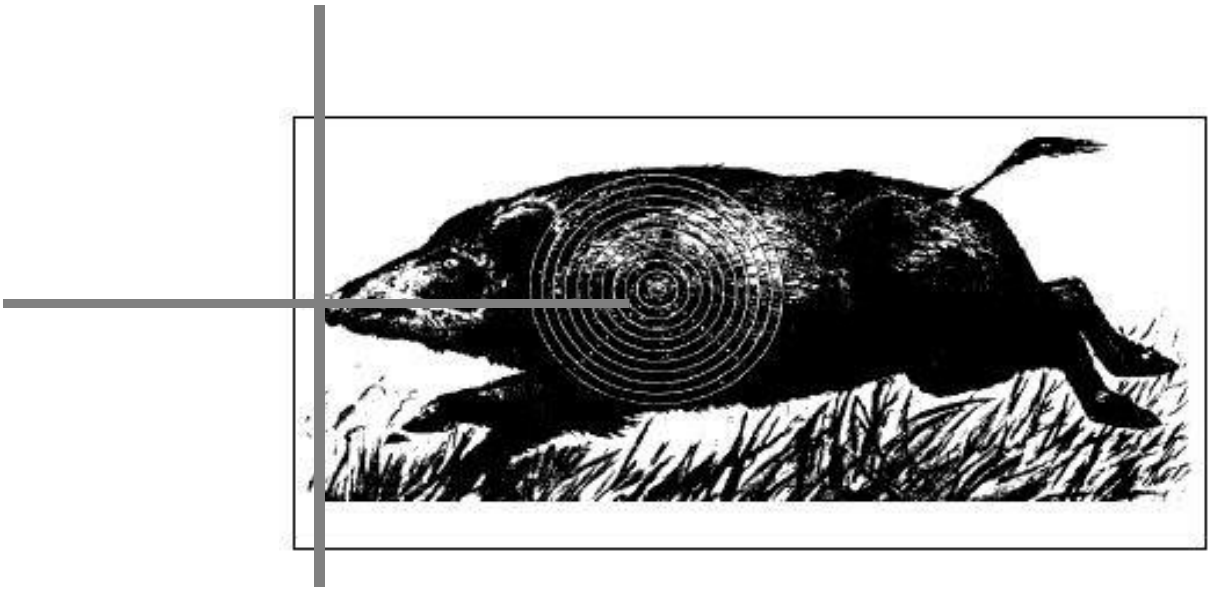


Fig. 27.4.2 50m Running Boar, Fast Runs Aiming Area: High Velocity Ammunition

The ‘scope is not adjusted between the Slow and the Fast Runs.

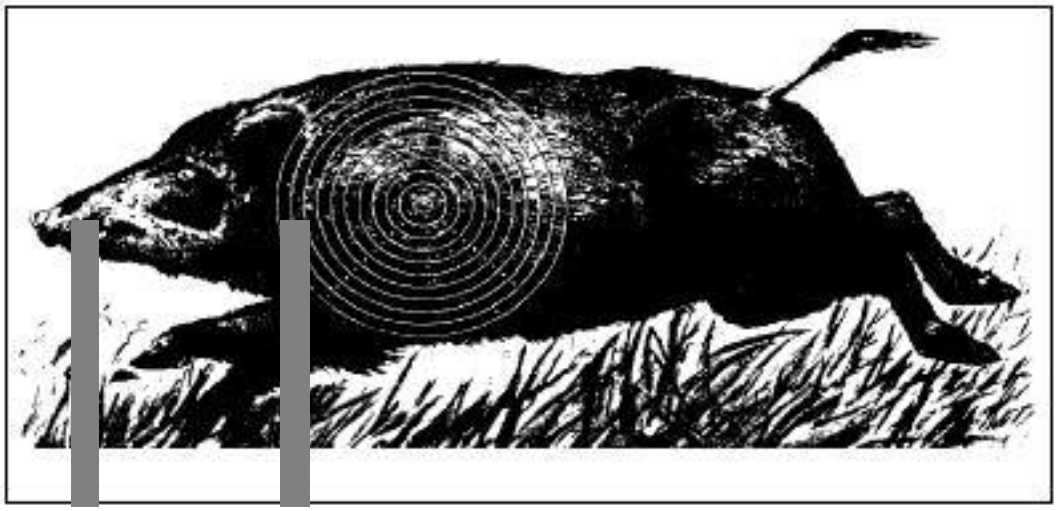


Fig. 27.4.3 50m Running Boar, Typical Slow Runs Aiming Area: Twin Post 'Scope, Sub Sonic (Match) Ammunition

Fig. 27.4.4 50m Running Boar, Typical Fast Runs Aiming Area: Twin Post 'Scope, Sub Sonic (Match) Ammunition

The 'scope is not adjusted between the Slow and the Fast Runs.

27.5 100m Running Deer

The lead will depend entirely on the velocity of the ammunition used. Most commercial centre fire ammunition in the most popular calibres has a velocity in the range 850 - 990 m/sec (2800 - 3250 ft/sec). With a velocity of about 950m/sec (3150 ft/sec) the lead will be about 500 mm.

Thus, with a single reticle 'scope, if the rifle is sighted in to shoot to point of aim, the aim will be just in front of the chest of the deer. This is not very easy to identify, but is feasible. The edge of the target board usually helps to determine the lead necessary, but it can be very difficult to determine the height of the target centre unless it has been well patched after other shooters have fired on it. (The shooter can easily see the 'shot out' central area of the Electronic Target which is not patched.) The eye of the deer target is about 600 mm above the centre of the scoring rings. Many shooters choose to sight in their rifle to shoot 500 - 600 mm low and aim at the head at the level of or just below the eye. This allows them to take advantage of the antler run during which they can align their sight using the antlers of the deer visible over the wall for at least 1.5 seconds before the full target appears. If there is any change in the velocity of the ammunition, or in the speed of the target, it is easy to make a small change in the point of aim without any significant loss of precision.

If a multi reticle 'scope is used then the usual aiming point is on the nose of the deer with a leading post. The reticles can be adjusted to cope with any change in ammunition velocity or the speed of the target. However, because the head is not very large in relation to the minimum separation between typical 'scope reticles, it may then be an advantage to use ammunition with a higher velocity (i.e. 990 m/sec (3250 ft/sec) to be certain of keeping within the range of the adjustments. Because the posts must necessarily be close together, it is important that adjustable mounts are used (or shims in the mounts) to make sure that all the adjustment needed is available and to centralise the reticles in the field of view.

The aiming point for the Running Deer Doubles is the same as for the Singles. However, in the Doubles, it is most important that full use is made of the antler run. Thus it is more difficult to shoot the Doubles using a rifle with a single reticle 'scope sighted in to shoot to point of aim. An eye aim is a distinct advantage for the Doubles.

Because of the long lead needed (~500 mm) the point of impact will be very sensitive to any small variation in the degree of cant. This is exaggerated if an eye aim is used. Thus it is recommended that no cant is used in the Running Deer events, particularly if an eye aim is used.

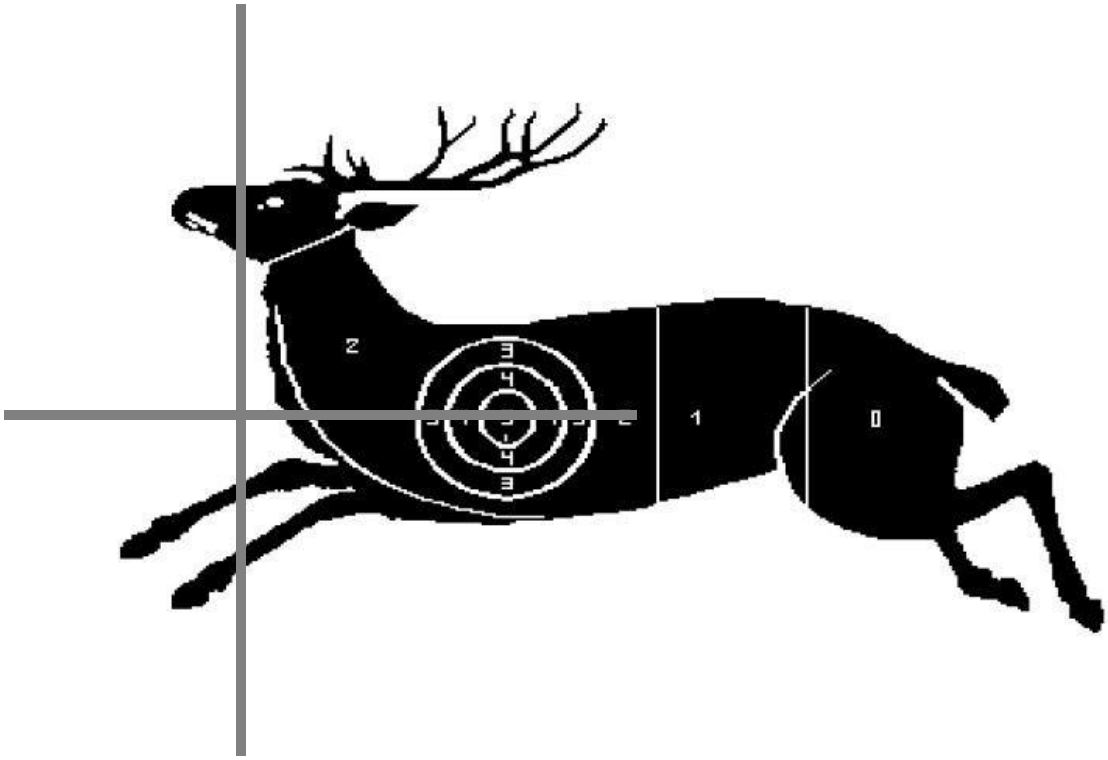


Fig. 27.5.1 100m Running Deer, Typical Chest Aim with Rifle Sighted to Shoot to Point of Aim

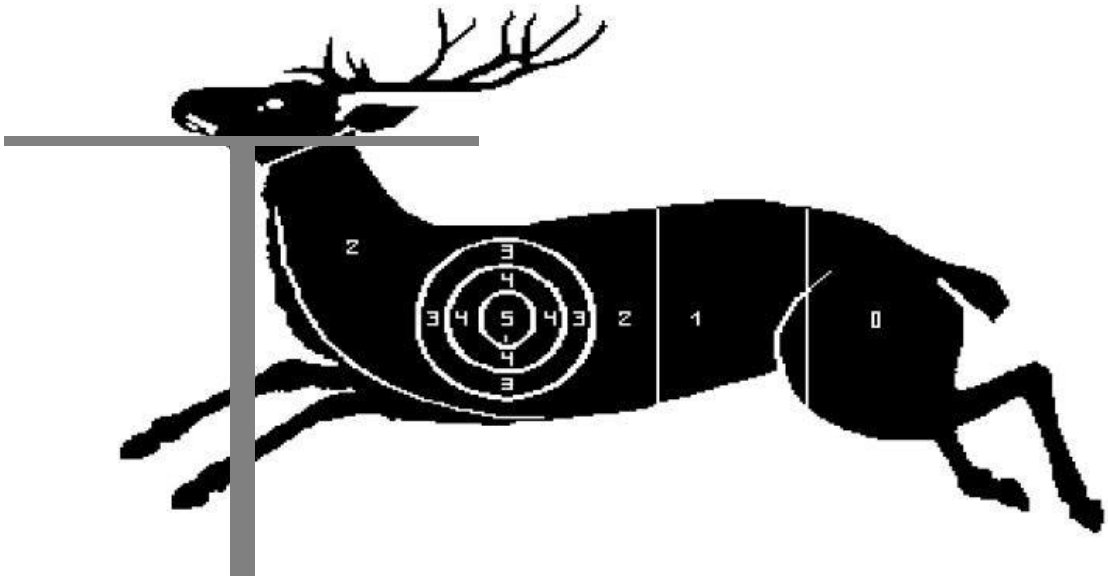


Fig.27.5.2 100m Running Deer, Typical Eye Aim with Rifle Sighted to Shoot ~500 mm Low, Typical Single Post Reticle

Note that the actual aiming point whilst near the eye can be adjusted to centralise the group in the centre of the scoring rings. It is easy to pick out any aiming point in the head area to suit the bullet velocity.

27.6 The Effect of Wind

Any wind will affect the flight of the projectile. If the wind is directly from the front or from behind the shooter, the effect will be to slow down or speed up its flight. For all practical purposes this is negligible. However, a wind from the right or left can have a significant effect on the point of impact.

The air rifle pellet can be so badly affected by any wind that it is not considered to be an option to build an outdoor 10m Running target range for serious shooting. A subsonic .22LR bullet fired from a Running Boar rifle will be deflected some 60 mm by a strong wind (30 km/hr, 20 mph) from the right or left. *[When supersonic ammunition is being used, the wind deflection is even greater and much of the bullet's flight is in the 'transonic' velocity region where it is more susceptible to external effects.]* With such a wind blowing, gusts may easily reach double that speed. Even a modest breeze can move the point of impact 25 mm. It is usual for there to be some form of screening at either side of the 50m Running Boar range to minimise the effect of the wind. However, the effects of such a screen are not predictable and in some circumstances it can actually cause an apparent reversal of wind direction due to buffeting. The Running Boar shooter must be prepared to adjust his sights for the effect of any wind. However, it is difficult to give any direct guidance as to what allowance must be made because this will depend on the range construction. The effect of the wind on the shooter himself, particular if it is a head wind blowing onto the firing point, must also be taken into account. Probably the best way to assess the effect of wind is to shoot a group from a rest, on the range in question, using a rifle of known zero, under as many different wind conditions as possible.

With a centre fire rifle on the 100m Running Deer range, even a strong wind blowing from either side should not deflect the bullet outside the central '5' ring of the target. Again, the effect is best established by trial and error. The most important effect of the wind is on the shooter himself. It has been known for a shooter to be so concerned about keeping his body stable in the wind that he has gone into 'auto pilot' and actually shot better.

Chapter 28 Tracking

The shooter, having raised the rifle to his shoulder and identified the selected aiming area through his 'scope, must now track the target. If his raise was correct, his sight will already be on, or very close to, the chosen aiming point. He must now follow the target with his rifle, keeping his 'scope reticle aligned within the area aim.

28.1 Following the Target

It is necessary to track the target, adjusting his aim until he is satisfied, and then release the shot. Like the follow through, this period of tracking the target can be very short, but it must be done. This is where a heavy rifle with the weight well forward to add inertia is so useful. The action of raising the rifle to the shoulder imparts momentum to the rifle and this is used to track the target with minimal effort. However, this is only effective if the rifle is tracking the target satisfactorily as soon as it comes into the shoulder. [*This is why a novice, who hasn't mastered the raise, might find a heavy well balanced rifle more difficult to shoot with.]* A lightweight rifle cannot track smoothly, even though it needs less effort to hold. Anyone who shoots only with a lightweight rifle should try tracking the target and dry firing with a well balance heavy rifle. The difference, even to an inexperienced shooter, can be significant. This is discussed in full in the Chapter on the 'Balance of the Rifle' in Part 4 on 'Setting Up the Equipment'. Almost any sporting rifle can be improved at little cost.

28.2 Waylaying the Target

It is wrong to think that the target can be waylaid as some novices will try to do. This includes coming up fast from behind or waiting until the target catches up with the rifle. Anyone who does either will be disadvantaged when using a heavy well balanced rifle. If the rifle is tracking the target from behind, it is most important to remember that when the shot is released, it must be fired early, especially in the 10m Running Target events. Equally, if the target is catching up with the rifle, the shot must also be released early.

There are two reasons for this. The first is that there is a small but finite time between releasing the trigger and the projectile leaving the barrel. This is most apparent with some of the older spring and pneumatic air rifle such as the FWB300 and the Walther LGR. However, the other reason concerns the way that the speed at which the rifle muzzle is swung affects the amount of lead needed. This is discussed fully in the Chapter dealing with 'The Shooting Position'. Whilst both of these effects are small, the chance of hitting a perfect '10' is negligible unless the rifle is following the target perfectly. Thus a smooth swing is a prerequisite for good shooting.

28.3 The Effect of Holding On Too Long

The target should not be followed for any longer than is necessary to ensure a good shot. It is very tempting to hold on to a good aim, trying to make it a perfect aim, only to develop some instability and finally release a bad shot in panic.

When the 10m Running Target match was first introduced in its present form, the first major match (the European Air Gun Championships in Copenhagen in 1989) produced some unusual

results. A very high proportion of shooters had a better score in the fast runs than they did in the slow runs. Technically, this should not be possible. Previously, with the old 10m Running Boar target, and with the 50m Running Boar, it was usual to expect that any shooter would lose twice as many points in the fast runs as he would in the slow runs. With the new target, this just did not appear to be happening.

One reason was undoubtedly psychological. With a poor score in the slow runs, the shooter gives up mentally, relaxes, and proceeds to shoot a better fast runs. However, this cannot be the whole explanation. The most likely reason is that, with the more precise aim possible on the new targets, the shooters were holding on to a good aim for too long. Although things have been a little better since 1989, it is still normal to find a few shooters in any match with better scores fast than slow. Careful observation shows that in the slow runs, most of the late shots are bad shots; most of the very early shots are good shots.

It seems quite clear that no shooter can hold the rifle perfectly steady in the moving target shooting position for more than about 2 - 2.5 seconds. The level of instability that occurs will be dependent on his level of fitness, but is nevertheless inevitable. Thus having raised his rifle and found his initial aim, which takes a little over 0.5 second, he still has more than four seconds left in the slow runs, and he is tempted to use it all. When he becomes unstable just after the target has gone half way across the range, he must try very hard to get his sight back onto the point of aim again. If he were shooting the fast runs, the target would have disappeared from his sight long before this happened. Thus the obvious approach should be that the target should not be tracked any longer that is necessary. This is helped by using a large enough area aim (see the Chapter on 'Aiming' in this part of the book).

The situation is very different for a novice shooter. When he brings the rifle to his shoulder, it will take him longer than the expert, and he will be unlikely to have his sight correctly aligned with the point of aim. His tracking will be erratic, with his sight alternately moving ahead and falling behind the target. Thus he needs the extra time to settle into the target before he is ready to release the shot. As his competence increases, so he will find that he is trying to make every '10' into an '11'. This is where points can be lost through carelessness.

Thus each shooter must learn to recognise a good, if not perfect, sight picture, to know that he is tracking the target smoothly and to release the shot before his aim becomes unstable. A certain '9' is always better than a potential '10' that turned into a '7'.

28.4 The Running Deer Doubles

The effects of tracking the target efficiently are most apparent in the Running Deer Doubles match. If the antler run is used, then the sight will be on the point of aim as soon as the head of the deer appears. After allowing for the acceleration of the target, the swing can be adjusted during the antler run so that it is possible to release a perfect shot before the actual scoring rings have appeared from behind the wall. This then leaves the shooter with up to four seconds to reload his rifle, settle it back into his shoulder and take the second shot. The expert will continue tracking the target, albeit unseen, whilst he reloads for the second shot! If he is used to shooting like this, then there is no reason why he should not shoot the Singles in the same way, shooting very quickly as soon as the head of the deer appears.

Chapter 29 Releasing the Shot

29.1 Trigger Techniques

The trigger technique used will depend to some extent on the trigger mechanism fitted to the rifle and how it is adjusted. The Chapter on 'The Trigger' should be referred to.

The traditional method of releasing the shot with the forefinger, used by the static rifle and pistol shooters, is to take up the trigger pressure progressively as the gun stabilises on the aim. When the shot is released it almost takes the shooter by surprise. Some Moving Target shooters have been able to use a similar method. The first stage of the two stage trigger is taken up as the rifle comes to the shoulder. The pressure is increased as the aim becomes more certain. As the target is tracked, the trigger is released almost without the shooter being aware of the actual moment. Unfortunately, this method of trigger release implies that the shooter is able to hold his aim for a significant time whilst the target is tracked. This is seldom possible even for an experienced shooter.

The modification of this method is that the trigger pressure is rapidly increased in a series of 'taps' as the sight comes on and off the ideal aim. The intensity of the each 'tap' is cut short if the aim becomes less certain, and increased as it stabilises. There is a danger with this method of trigger release that, under match pressure, the shot could be released prematurely, or that it may not be released at all.

The third method of trigger release is shared with the Rapid Fire Pistol shooters and is used by most Moving Target shooters. The trigger is pulled through quickly and smoothly when the aim is perceived to be correct. It is not a 'snatch' because it is completely under control. However, under pressure, or without adequate practice, it can easily become a snatch. If the trigger is of the two stage design, the pressure needed to take up the weight of the first stage indicates to the shooter how much more pressure is needed to release the second stage smoothly. If the trigger has only a single stage, the shooter should take up part of the pressure as he comes onto aim, rapidly increasing the pressure as his aim becomes more certain. When part of the trigger weight is taken up early, there is some risk that the pressure will be too great resulting in an early, unintended shot.

29.2 Controlling the Trigger Release

Whatever the method of trigger release, there will always be less danger of a snatched release if the pressure is taken directly back towards the supporting shoulder. The placement of the index finger on the trigger blade, already discussed in the Chapter on 'The Shooting Position', is important in preventing any movement of the rifle when the trigger is released. Some experimentation may be worthwhile. Any problems with trigger release can often be resolved by extensive shooting at a stationary target or by dry firing. It may also be helpful to dry fire the rifle with the eyes closed, the better to visualise the feel of the trigger.

If the trigger is adjustable for after travel, this is a matter for the preference of the shooter. The trigger with a long after travel is less likely to allow the rifle to be disturbed by an uncontrolled snatch. However, such a trigger is more likely to encourage such a snatch. When there is little or no after travel, the trigger movement is halted immediately the sear is released. This usually accompanies a short first stage movement and a crisp trigger release with very little 'creep'.

The trigger weight is 'free' for the 10m Air Rifle events, and must have a minimum weight of 500 grams for the 50m and 100m events. The very light trigger permitted for the Air Rifle can only be effective if the right hand and arm are unstrained and with a light grip pressure. Most shooters prefer a trigger weight for the Air Rifle near to that of the 500 grams specified for the Small Bore and Centre Fire rifles and often significantly greater than 500 grams permitted when using a Centre Fire rifle.

29.3 Using Different Rifles

If more than one of the Moving Target disciplines is shot regularly, then there may be some advantage in having similar trigger characteristics on all the rifles used. This is often not possible. If one discipline is given priority, then it is most important that some attention is given to the others immediately before a match. As the feel of the rifle and of its trigger are most significant, this refamiliarisation can be achieved by shooting at a static target and by dry firing, and any opportunity to do so before a competition should be taken. However, apart from differences in the 'feel' of the trigger, there are some important differences between the mechanisms of the different types of rifle that must be taken into account too.

29.4 The Effect of Lock and Barrel Time

When the target is continuously moving in the sight, choosing the precise moment for releasing the shot will be influenced by the time taken from releasing the trigger mechanism until the projectile leaves the barrel. There are two factors: the lock time and the barrel time.

The lock time is the time it takes from the release of the sear until the projectile starts to move down the barrel. The barrel time is the time the projectile takes to travel down the barrel. The lock and barrel time together can vary from about 4 milliseconds to perhaps 20 milliseconds. Obviously the barrel time will be very short (1 - 1.5 msec.) for a centre fire rifle whose bullet leaves the barrel at 900 m/sec, and much longer (5 - 8 msec.) for an air rifle whose velocity is only 170 m/sec. Even longer times are associated with the spring operated air rifles where the acceleration of the piston is very slow. Some of the early single stroke cocking pneumatic air rifles have a long lock time because of the design of the valve mechanism, whereas the current generation of pre charged pneumatic air rifles are much faster. Also, as the true barrels of the modern air rifles are very short, barrel time is correspondingly reduced, typically about 3 msec. The lock time of a bolt action rifle can vary significantly and will depend on the strength of the spring driving the firing pin as well as the weight of the firing pin (i.e. its inertia) and the distance it has to travel. Because more force is needed to ignite the primer of a centre fire cartridge does not mean that it will necessarily have a shorter lock time than the equivalent small bore rifle. The extra force might be generated by giving the heavier firing pin a longer travel thus increasing the lock time.

The lock time of the rifle and the barrel time may be anticipated by the shooter. A shooter who has trained well with a given rifle will eventually find himself subconsciously anticipating the delay in releasing the projectile. He tends to squeeze the trigger just before the target comes into perfect alignment. This was very obvious in the late 1980s when the current generation of air rifles began to replace the earlier air rifles such as the Walther LGR which is single stroke cocking pneumatic air rifle and the Feinwerkbau spring operated rifle. Most shooters became aware that a subtle change in technique was needed. The difference of even only a few

milliseconds was significant, and they commented that the newer rifles shot more like their small bore rifles. Those shooters who also shoot the Running Deer events know that their rifles are usually faster still and that a further change in technique is needed. This is why many shooters who are experienced in the 50m and 100m disciplines usually have so much difficulty in adapting to the air rifle events.

Because there are such differences between the different disciplines, the fact that there may be a different trigger mechanism may not be so important. If the trigger of the air rifle and the small bore rifle were to feel identical, the shooter must always remind himself that the trigger technique must be slightly different. When the mechanisms are already different, such a reminder is less necessary.

Chapter 30 Follow Through

As in all forms of shooting, a good follow through is essential for consistency. The purpose of the follow through is to ensure that the shooter does not destroy his carefully prepared aim in his hurry to prepare for the next shot. If he shoots too quickly then there is a danger that he will simply fail to follow through at all. However, the most difficult time will be when he has waited too long to shoot and stress has built up so that he has difficulty in holding the rifle steady. This often means a snatched shot with poor trigger control. The relief at firing the shot will sometimes let him allow the rifle to come off aim too quickly, thus giving him a worse shot than he deserves. The use of a larger area aim, helped by a thick 'scope reticle, will help prevent him waiting too long to fire the shot.

Another cause of poor follow through is when difficulty is experienced in 'finding' the target and the point of aim when the rifle is first raised to the shoulder. Apart from poor technique, this can be brought about by the use of a 'scope with too high a magnification. It is most important that the rifle is on, or very close to, the point of aim immediately it is brought up to the shoulder and that it is following the target accurately.

The follow through does not have to be for a long time, just sufficient to ensure that the projectile has left the barrel before the aim is relaxed. More importantly, a good follow through will guarantee that the rifle is pulled off aim before the shot is fired! Many expert shooters have the ability to shoot very quickly and yet they appear not to follow through. Very careful study shows that they do follow through but for just long enough. Each type of rifle used in Moving Target shooting has its own influence on the follow through.

30.1 The Air Rifle

The modern pneumatic air rifles are as close to being totally recoilless as any gun can be. There must be some reaction to the motion of the pellet, but there is no other sensation. Thus the shooter can follow through in the classical way by maintaining his aim after the shot has been fired. Unless the point of aim is the centre of the scoring rings, there is a possible distraction in that the shooter may be tempted to watch the pellet strikes the target rather than maintain his aim. The most recent air rifles even use a compensator that counteracts the tiny amount of reaction to the movement of the pellet.

The other 'recoilless' (or suppressed recoil) air rifles can behave in a similar manner but may suffer more disturbance as the shot is fired. Their important feature is that any additional disturbance occurs after the pellet has left the barrel. The FWB300 series of spring operated rifles are different in that the whole of the rifle action, including the barrel and any balancing weights, moves back towards the shooter about 10 mm when the rifle is fired. This can be disconcerting at first, but with experience, the sight picture can be re-established after the shot is fired. Notwithstanding the movement, the rifle itself remains still.

If a recoiling air rifle is used there will be substantial movement as the piston reaches the end of the air cylinder. This should only be after the pellet has left the barrel, thus the recoil should not affect the accuracy of the shot. However, the shooter will need to make a conscious effort to regain his sight picture for an effective follow through. However, it is always worth their reminding themselves that the ‘recoil’ that disturbs their follow through will not affect the point

of impact of the pellet. These air rifles feel like a centre fire rifle to shoot, and can be useful as a training aid for the Running Deer events.

30.2 The Small Bore Rifle

There is a noticeable reaction as the rifle is fired. It is normally a very gentle 'lift' of the muzzle. However, because the bullet has a very considerable initial acceleration, this recoil starts as soon as it begins to move. Thus there is a small amount of movement of the rifle before the bullet has left the barrel. This is a strong argument for using a short true barrel and long extension that reduces the time taken by the bullet to travel down the barrel. The amount of disturbance is small but may be significant if the rifle is not held on aim whilst the bullet travels the length of the barrel. It is relatively easy to allow the rifle to drop back into onto the aim after it has been fired, and to continue to track the target. Notwithstanding the recoil, the rifle should be allowed to continue to track with the target after the shot has been fired.

The effect of recoil may be observed by shooting a test group from a well-supported prone position, and then a second group from a rigid ‘hard’ support without using the left arm to steady the rifle. There will be a noticeable change in the position of the groups showing that the recoil does affect the point of impact. This exercise will also demonstrate the importance of having a consistent hold on the rifle throughout.

30.3 The Centre Fire Rifle

Perceived recoil can be extreme. The rifle must be held firmly in the shoulder otherwise the recoil can cause injury. Because of the higher velocity of the bullet, there is relatively little disturbance to its point of impact from the recoil. Test groups shot from a rigid support and from the shoulder are usually in almost the same place on the target. However, the effect of the recoil is to take the rifle well off aim after the bullet has left the barrel, and makes recovery difficult. Thus follow through is more a matter of intent than it is of achievement.

30.4 The Running Deer Doubles

In the Doubles event, the rifle must be reloaded immediately the first shot has been fired ready for the second. Nevertheless there must be a definite pause and follow through after the trigger has been released for the first shot before the right hand is moved to the bolt to reload. Any undue haste will result in a 'pulled' shot. Follow through must be a deliberate planned action. The ideal rhythm will be to take the right hand from the grip as the rifle recovers from its recoil, but not before. There is no need to recover the sight picture.

Reloading after the first shot should be a definite action. Most 'malfunctions' which occur during the Doubles are as a result of either failing to bring the bolt back fully, or of failing to pause momentarily with the bolt fully open. It takes a finite time for the extractor to release the case and for the ejector to throw it clear of the action. It also takes a finite time for the magazine to push the new cartridge into position to be picked up by the bolt. If the shooter is too quick with his attempted reload, he may find that he fails. It is tempting to blame the rifle. One sure proof is to attempt to eject a spent case slowly and deliberately, and to reload a fresh case. The action seldom fails to operate correctly. Thus the shooter must cultivate the habit of reloading as a deliberate act, pausing for long enough to ensure that the spent case is ejected and a new cartridge

picked up. If full use is made of the antler run and the first shot is fired just as the target emerges from the wall, there is more than enough time to reload and fire the second shot.

The reload is carried out with the rifle still in the shoulder. To do this successfully a long bolt handle with a positive grip for the hand is essential. The bolt must also be able to move freely with no sign of stickiness. If a short cartridge such as .222REM is used, a rifle with a matching short action will make reloading easier; many makers supply an identical action (and bolt) for a wide range of calibres and this isn't helpful but some makers offer different length actions to suit the different calibres. A dry lubricant such as PTFE, MoS_2 or graphite on the bolt will also help. During training, to save on ammunition costs, it can be helpful to load and fire only one shot but to operate the bolt and take the second shot 'dry'.

The left handed shooter will have particular difficulties with the Doubles. True left handed centre fire rifles are very rare, and the bolt is usually designed to be operated with the right hand. It is possible, with practice, to achieve the appropriate manual dexterity and there are some competent left handed Doubles shooters. Although it is possible to have an extension welded onto the bolt to make it operable with the left hand, the eccentric leverage makes it tend to 'stick' and its operation is very slow. This is not a practicable solution. A rifle with a lever action will be easier to manage, but such rifles have not a good reputation for reliable feeding and may need special 'scope mounts or a 'scope with a very long eye relief. Lever action rifles are not common in the appropriate rifle calibres, and most have a stock design and balance that makes them unsuitable for the event. Until they were prohibited in the UK in 1988, 'pump' action rifles could be used, and these too were ambidextrous. However, whilst an 'ambidextrous' rifle might seem to be the answer, such a rifle stock must compromise gun fit and is seldom successful for the Running Deer events.

Many shooters who can handle the Singles competently are unable to cope with the Doubles. Successful Doubles shooting is built upon a sound technique in the Singles. A shooter who is used to using most of the target run for his Singles shots will not be able to get his first Doubles shot off quickly enough. Thus the Singles event should be treated as being the first shot of the Doubles and practised accordingly. A novice would be ill advised to attempt the Doubles event until he is able to fire his Singles shots well before the target has run half way across the range. When he does shoot the Doubles event for the first time, the best advice is that he should fire the first shot as he would the Singles and then, if he has sufficient time, reload and take the second shot. Too many novices try too hard for the second shot and as a result score two misses. As he gains experience, the novice will be able to make full use of the 'antler run' and fire that first shot just after the target appears fully from behind the wall. He will then leave himself nearly four seconds to reload, aim and fire the second shot. Experienced shooters can score almost the same in the Doubles as in the Singles. Another competition is available that comes midway between the Singles and the Doubles. It is sometimes called the "Swedish Test" from its origins. In this, the target is driven out and stopped just in full view. The shooter fires his first shot whereupon the target is started and the shooter must reload and take the second shot 'on the move'. Because the target takes a finite time to accelerate, the overall time between shots can be a little longer than the normal run time. This makes the event attractive to the user of a large calibre stalking rifle. However, it is also an important training aid for the would-be 'Doubles' shooter. Running Deer experts have problems with this event as they are able to reload and acquire the target in their sight long before it has reached full speed; hence their second shot is sometimes given too much lead!

30.5 Some Practical Considerations

Whilst the need to follow through is well recognised, the reality of being able to do so consistently is never very easy. In the Moving Target events, the basic hold is unstable, depending on strength and hence muscle tension, especially in the leading arm, to support the rifle. Throughout the target run, the rifle is perceived to become progressively heavier. This tendency to drop is counterbalanced by increased strain in the leading arm. When the shot is finally released, one of two things can happen: either the shooter is so relieved not to have to support the rifle anymore that he allows the muzzle to drop; or else the tension developing in his arm takes over and he lifts the muzzle (this actually reduces the strain on the leading arm). Sometimes both can happen throughout a series. Neither is any problem unless the shooter, subconsciously anticipates the shot's release and the muzzle starts to fall (or rise) before the projectile has left the barrel.

Obviously physical fitness and meticulous attention to follow through can help prevent this. A sound training programme will help eliminate the effect. However, when the shooter is tired, perhaps towards the end of a series when the rifle may be perceived to be heavier than it was at the beginning, then this problem will occur. One way to prevent it is to adopt an initial point of aim slightly higher than normal, allowing the muzzle to drop slightly as the target is tracked so that it is at the correct height at the moment the trigger is finally released. The extra height needed is small: not more than one, or at most two, ring widths at 10m and a corresponding amount at 50 and 100m. This is a natural movement as the muzzle is already being lowered when it is brought from the ready position into the aim. All that is needed is to slow down the "raise" slightly early rather than stopping it altogether at the correct height. *[The alternative method of bringing the sights up into the point of aim is equally effective and may work better for some shooters, although the technique of allowing the muzzle to 'fall' into the aim is easier to acquire. This alternative method would allow the muzzle to 'overshoot' the point of aim and as this is a less smooth movement, it may be more difficult to make the final adjustment to the aim.]* Similar methods are used by some Air Pistol and 50m “Free” Pistol shooters whose hold is equally unstable and is also dependent on muscle tension in the arm. The overall objective is to have the sights correctly aligned laterally but 'on the move' vertically. Such a dynamic hold is more stable than any attempt to hold the gun perfectly still.

Whilst the purists will argue that the sight should be perfectly aligned with the target for a measurable time before the shot is fired, the reality is that even the best shooters actually release the shot 'on the move'. There is always some pseudo random movement of the muzzle. By introducing a controlled amount of movement, the amount of uncontrolled random movement can be minimised without strain. The best evidence for this technique comes from comparing group sizes on the moving target with those shot on a stationary target. For the top shooters there is very little difference and if there is, the moving target groups are often smaller. However, the technique will be of little value to a shooter who is already having difficulty in aligning the rifle with the moving target. It is not for novices!

Whilst the foregoing is easy to apply on the 10m and 50m slow runs, the fast runs demand a more instinctive technique. This will be acquired naturally if the technique is first used consciously for the slow runs and then the fast runs allowed to look after themselves. Most shooters finds themselves 'conditioned' to accept that the fast runs are the same as the slow runs but carried out in half the time!

Chapter 31 Control of Breathing

The control of breathing is important in all forms of shooting. Breathing is controlled by expansion and contraction of the chest cavity, and by movement of the diaphragm. 'Diaphragm' breathing is the norm whilst resting, and this is supplemented by chest breathing when greater demands are made on the oxygen carrying capacity of the blood. Either form of breathing will cause some movement of the arms and shoulders although this is small if only the diaphragm is used. Thus the act of taking fresh air into the lungs and expelling air depleted in oxygen and enriched in carbon dioxide will have an effect on the aim. The natural relaxed condition is with the lungs about 25 -30% filled with air, if more, the chest is expanded, if less, the chest must be forcibly contracted. If the lungs are filled with air, any relaxation of the tension in the chest muscles or diaphragm will cause the lungs to become slightly pressurised and there will be an overpowering urge to exhale and relieve the pressure. Similarly, it is difficult to keep the lungs fully deflated for very long. Thus the ideal time to fire the shot is when the lungs are partially empty of air. It is possible, in deliberate shooting events, to time the firing of the shoot to coincide with the optimum part of the breathing cycle, minimising the time during which it is necessary to stop the breathing process (i.e. hold the breath). In Moving Target shooting as in Rapid Fire pistol shooting, the timing is determined by the operation of the range. Thus the management of breathing must involve an element of anticipation.

In the natural breathing cycle most people, whilst at rest, take between 12 and 18 breaths each minute. The breathing rate speeds up and breathing becomes deeper when additional demands are made on the oxygen supply carried by the blood and carbon dioxide builds up. (The breathing reflex is controlled by the presence of carbon dioxide in the blood rather than by the absence of oxygen.) If this cycle is disturbed by, for example, holding the breath, the body compensates immediately normal breathing is restored by increasing the depth and frequency of breathing. In shooting, the cycle is thus one of holding the breath and then, when the shot has been fired, compensating by breathing faster or more deeply than normal. For the moving Target shooter, this cycle is less than 30 seconds. The only time that the chest must be still is during the actual aim until the shot is fired, no more than five seconds.

Thus, immediately the shot has been fired, and after a brief 'follow through', the shooter will oxygenate his lungs and drive out excess carbon dioxide by taking a few deep breaths. This is a natural process and happens subconsciously while reloading. However, this 'natural' reaction is in response to a minor imbalance between oxygen and carbon dioxide, and does nothing to prepare him for the increased demand he is about to experience whilst he takes his next shot. The shooter should accelerate the process of recovery and prepare himself for the next shot by deliberately breathing deeply and quickly. It is most important that he does not 'hyperventilate' or 'overbreathe'. This can reduce the carbon dioxide level in the blood too much, causing the blood pressure to fall, the pulse rate to rise and lead to momentary dizziness.

When reloading is complete, the shooter should take two or three full breaths, finally exhaling before he raises the rifle from the bench to the ready position. When he raises his rifle, the movement of his arms tends to expand the chest naturally and thus draw in extra air and it is natural for him to enhance this by subconsciously breathing in. This should not be full breath and should preferably involve only the diaphragm and not the chest muscles. As it is difficult to hold the breath with the lungs even partially filled, some of this air should be gently exhaled whilst waiting for the target to appear until the chest muscles and diaphragm are relaxed. This is much easier during the sighting runs as the act of calling "ready" partially empties the lungs immediately before the target appears. During the competition runs, he is dependent on the

rhythm set by the range operator. If this is erratic, the shooter can find himself with the rifle at his shoulder and with his lungs too full of air, or holding his breath for too long.

When the target appears and the shooter raises the rifle to his shoulder, the process of exhaling should cease. It is not necessary to hold the breath for more than five seconds and this should be no problem for any shooter. However, if he is suffering from any bronchial infection such as a common cold, his ability to inhale sufficient oxygen during normal breathing and to hold his breath will be impaired. A severe cold can cost a lot of points. A shooter suffering from asthma has special problems, especially as the stress of shooting can initiate an attack.

Having fired the shot, there is a desire to resume normal breathing again as soon as possible. This must be made part of the 'follow through', any premature inhalation or exhalation will make the rifle muzzle move down or up respectively. In the Running Deer Doubles, the reload is an opportunity for a quick partial reflation and deflation of the lungs, but it is most important that the lungs are only partially filled before the aim is resumed for the second shot.

Although the process of breathing described is a natural process, this only applies to the recovery from the shot already fired. The shooter must intervene if he is to prepare himself for the next shot. During the stress of a match, he sometimes inadvertently interferes with nature. It is not unusual for him to hold his breath throughout the whole of the time from when he first raises the rifle to the 'ready' position until the shot is fired. This is a natural reaction to the demands of a complex task and will become less likely with training and experience. However, under match stress, he may revert to holding his breath for long periods unnecessarily, and with his lungs too full of air. Not only is this wrong of itself, but as he attempts to recover after firing the shot, he will take 'panic' breaths which only make the problem worse. Thus it is important for him to understand the breathing process in order that he can detect any deviation from it. Attention to breathing control during training should help to avoid this problem. Practising deep controlled breathing as part of the mental training programme can also be helpful because it helps him to associate deep steady breathing, something he can do at any time, with a relaxed state of mind. This is dealt with in the Chapter on 'Mental Training'.

Chapter 32 The 'Olympic' Final

In 1988 the ISSF introduced the concept of the 'Olympic Final' to the Olympic shooting events. This was designed to provide a short, exciting climax to the match for the benefit of the television cameras and the spectators. An important feature is that scores recorded in the “qualification” match are carried forward to the final and added to the decimal scores recorded therein. However, in the 10m Running Target event, the procedure was very similar to that required prior to 1988 to determine the leading rankings if there were tied scores. Thus, whilst the 'Olympic Final' is only relevant to the 10m Running Target match, the procedure is almost identical to that already in use at both 10 and 50 metres, including the Mixed Runs match, to break a tie. The procedure for settling a tie in the Running Deer events is also very similar. The only major change introduced in 1988 was that in the 10m Running Target match, the 'final' is now shot as a matter of course in all major competitions, and in training events for shooters who might take part in a major match. In 2004, 10m Running Target was dropped from the Olympic Programme to be replaced later with a side by side, shot by shot, ‘duelling’ final. This demands the use of at least two adjacent ranges; not easy to set up for many National Championships. Although the original Olympic Final is no longer in the rule book, it remains on the programme of all but major championships. It can be shot by the competitors in sequence (lowest ranked first) on only one range if necessary whereas the ‘duelling’ final only works when two shooters compete side by side on adjacent ranges..

In a major match, there will be two or three ranges in use. Three ranges is the norm and all three ranges are used for the final event. The leading six competitors shoot in two relays of three shooters. They shoot in reverse order, if there are tied scores, the shooting order is determined by (a) comparing the highest score in the last ten shot series; and (b) by counting the number of 'inner tens'. If a tie for the order of shooting still cannot be broken, it will be determined by drawing lots. A feature is that the targets run simultaneously on all the ranges for the first sighting shot and for all competition shots. In a minor match where there may only be one range in use. For tie breaking in the 50m and 100m events, the procedure is similar except that only one competitor shoots at a time.

The course of fire is four sighting shots followed by ten final competition shots. All the runs are fast runs. The targets are scored to one tenth of a point and this makes the use of Electronic Scoring Targets more or less mandatory as scoring paper targets to this precision, although possible, is time consuming.

The competitor(s) is allowed one minute preparation time. He is not allowed to dry fire whilst the previous competitor is shooting. The Range Officer then gives the command:

"FOR THE FIRST SIGHTING SHOT - LOAD"

After a pause for the competitors to load their rifles, the Range Officer gives the command:

"ATTENTION! 3 - 2 - 1- START"

At the command **"START"** the target is released. The shooter may not raise his rifle to his shoulder until the target appears. Subsequent sighting shots are taken in the normal manner with the competitor calling **"READY"** before the target is released.

A competitor who loads his rifle before the command **'LOAD'** will be penalised after a warning has been given.

After the target(s) have been changed if necessary, the Range Officer gives the command:

"FOR THE FIRST (NEXT) COMPETITION SHOT - LOAD"

After a pause for the competitors to load their rifles, the Range Officer gives the command:

"ATTENTION 3 - 2 - 1 - START"

This is repeated for all ten runs of the target. The targets are scored after each pair of runs and the scores announced. Paper targets are scored to one tenth of a point using special gauges..

If a tie remains, each tied competitor fire two more sighting shots and then two shots to count. If necessary (and this is virtually unknown) a second or third series of two runs will be shot. If, after three series a tie remains, the competitors are given equal places.

An 'Olympic Final' event like this is obviously exciting and the competitors can be very nervous. It is this that makes it so attractive to the spectators and for the television cameras. This is why it is so important to train for such an event, where the 'Olympic Final' is the norm in all major competitions. There has been some criticism of these finals especially where they change the final ranking of the competitors. However, as experience has grown, they have become more acceptable, and if there is a change in ranking, it is usually only when the two competitors were very close together initially. Although some shooters inevitably succumb to nerves, others find the final to be a challenge.

In some ways it is easier to shoot well in an 'Olympic Final' than in the normal runs. Because the target is started on command, the shooter can anticipate its release. Although he is not allowed to raise his rifle until the target appears, he can be fully alert and ready as soon as the command **"START"** is given. As the start of the target is no longer subject to minor variations in technique by the Range Officer, he is able to control his breathing better and shoot more consistently. Thus it is usual for him to raise his rifle to the 'ready' position between the count of 'three' and 'two', breathing in as he does so. He then breathes out partially until the command **"START"** is given. Thus he has removed at least one of the variables from his match. As the targets are scored to one tenth of a point, 'good' shots are repaid well, but a careless shot that just creeps into the '10' ring is punished.

Whilst the value of the 'Olympic Final' will continue to be debated, those shooters who accept it as a fact and train accordingly will benefit from the extra demands it makes on them. Those shooters who continue to ignore it will probably never experience such an 'Olympic Final' in a match.

In 2008, because Moving Target shooting was no longer in the Olympic programme, the ISSF agreed to abandon the Olympic final in favour of a special Running Target "Medal Match". This involves four shooters going head-to-head in pairs in a sudden death shoot out. It requires two ranges to be used side by side: the older Olympic Final could be shot, if necessary, using only one range but the "Medal Match" loses its impact if only one range is available. Scores from the earlier qualification match are NOT carried forward and so the ranking of the leading four shooters is determined only by this attenuated "match". In particular, this "Medal Match" is counter to the normal shooting ethic that shooting is a non confrontational sport. It was devised more as a sop to the media and spectators than in the interest of the

shooters and may have harmed the sport by discouraging all but the very best shooters from taking part in an international match. At national and club level, if there is to be any form of "Final", then it is likely to be under the old Olympic Final Rules where the scores from the qualification match are carried forward.

Chapter 33 Assessing the Shots

At the end of each run, the value of the shot(s) will be signalled. For the 10m Running Target events, the signalling will either be the monitor for an Electronic Scoring Target or a Closed Circuit Television (CCTV) system directed at the scoring rings. Even with a small monitor, the shooter can see the position and value of each shot hole clearly. For the 50m Running Boar events, a mechanical or electrical signalling system will be used which indicates the estimated shot value and it position. This will often be supplemented by a CCTV system. For the Running Deer events, only an electrical or mechanical signalling system will be used, a CCTV system is impracticable because of the small size of the shot holes in a large scoring area and the fact that targets are patched out until the backing board is unusable. Many Moving Target ranges are now equipped with Electronic Scoring Targets (ESTs) where the position and value of the shot hole is displayed instantly on a computer monitor screen, along with the previous shots, thus allowing the firer to assess his groups. In a competition, the shooter is allowed to have to monitor within his line of sight turned off, but if he does, he must understand that no alternative method of signalling will be used.

During a training session, it may not be possible to signal the value of each shot. This can be an advantage as it will give the shooter an excuse to concentrate on technique. The novice, understandably, wants to see where every shot lies on the target. The expert will train for long periods without even inspecting the target. The point of impact of individual shots is much less important than the position and size of the overall group.

33.1 Calling the Shots

As he releases the shot, the shooter should estimate where it will strike the target. The signalled shots should agree with his estimate. Although it would be good to be able to say that every shot called wrongly should be investigated to find out its cause, this is not easy to do, especially during a competition. However, the exercise of calling the shots is valuable in its own right. It is an indication of a confident shooter that he can 'call' most of his shots correctly and that he is never surprised by the value or position of the shot signalled. When a shooter can 'call' most of his shots correctly, it is a sign of maturity and that he will benefit from applying some of the more advanced techniques. This need not mean that all of his shots are in the '10' ring, but the fact that he knows where they will hit the target is the starting point for improving his technique so that they do.

Whilst shooting the 50m Running Boar events, the position of the group can be clearly seen on the CCTV (if used) as it forms. This allows the shooter to adjust his sight to bring the group into the centre of the target. With an Electronic Scoring Target, things are even better. The monitor shows the position of the group centre and its coordinates, albeit on some ranges with runs in both directions grouped together. Even then, the fact that the monitor shows the elevation of the group centre is helpful to the shooter. For the 10m Running Target events, when paper targets are used, with only one shot on each scoring diagram, and the 100m Running Deer events where shot holes are patched out after each run, this is not so easy. It is not advisable for the shooter to attempt to build up a mental picture of every shot on the target. For most shooters this is a distraction and will result in a loss of concentration and consequent poor shots. Thus if his groups are not centred over the centre of the scoring rings, he may not know it. His only indication is that his shots are consistently different from their called position. Thus it is most important that he has full confidence that his rifle is shooting to its intended zero.

33.2 Plotting the Shots

During training, the shooter will have full access to his targets and can make a full assessment afterwards. With Electronic Scoring Targets it is even better; the plot can be printed out at the end of a series. On the Sius-Ascor 10m range, if the shooter should need to differentiate between shots on left and right running targets, this information can be extracted from the range computer and transferred to a Personal Computer to separate the runs. The shooter should never be tempted to keep his own 'plot' (or overall score) whilst he is shooting. This can only distract his attention from the real business of firing a perfect shot every time. ***The only shot that matters is the one you are about to fire!*** With paper targets on the 10m Running Target events, he can take an overview of his shots by marking the position of the centre of each shot hole through the target onto the back of a clean target. In this way he can see exactly how his group has formed and can assess the effect of any sight adjustments he may have made. To do this for the 50m Running Boar and 100m Running Deer events will need the assistance of a coach or other observer to plot the shots as they are signalled. Although the groups are clearly visible on the shot targets in the 50m events, there is no record of when each shot was fired unless an EST is used. The observer can record this information. During training for the 100m events, it can be helpful if individual shots are not patched immediately (or are patched with transparent patches), so that the whole group may be inspected.

The 'plot' can be recorded on a sketch on a piece of plain paper, or a pro forma can be used. The central scoring ring, '10' (or '5') should be much larger than the other rings; hopefully it will have to contain more information. The observer marks the position of each shot and numbers them. At the same time he notes any very late or very early shots and any other unusual features. The occurrence of a malfunction or any other interruption should also be recorded.

Immediately after the competition or training session, the shooter should review his 'plots' for any lessons that might be useful for the future. If a qualified Instructor or Coach has watched him shoot, then he should be involved in this review. This is the time, if he can remember, to assess if he is correctly “calling” his shots.

33.3 Faults in Technique

Many texts on shooting will go to some lengths in describing possible faults and their correction. In Moving Target shooting, this is not profitable. The numbers and type of fault that can occur is too great. Many faults are the result of inadequate training and / or experience. In some instances, the shooter will know exactly what he has done wrong at the moment he fires the shot, often because the rifle was not correctly aimed at the moment of release. In most instances a poor shot can be directly attributed to lack of concentration; a moment's inattention. He should not dwell on individual poor shots except to learn not to repeat the error!

It can be more instructive to look at the way the shots group on the target. For this it is helpful to fire at least 50 shots on a pair of Running Boar or Running Deer targets. This would be uninformative on the 10m Running Target and it will be better to shoot no more than five shots on each diagram, unless of course an Electronic Scoring Target is used. The shots will group on the target in one of four ways:

A small, well centred group

A large but well centred group
Two identifiable groups each with its own centre
A small well centred group with another larger group superimposed.

If there appears to be two identifiable groups, one of which may be larger than the other. This would imply some repetitive error of technique. One possibility is an intermittent failure to follow through adequately when the rifle is 'pulled' away early. Another possibility is an inconsistent hold, particularly on the small bore rifle. However, these faults may not be obvious from an inspection of the target which will show more evidence of an overall random spread. When there appear to be two concentric groups, usually a tight group with a few (too many) scattered shots around it, this is a sure sign of lack of concentration. He is making a series of errors which follow no particular pattern. Clearly, if the groups are large and random, the real answer is more, or better quality, training.

It is more important to identify and correct any repetitive errors that can lose a shooter many points in his score. However, these errors are often transient and are not repeated from day to day. Sometimes the form of the error, and its effect, can change even during a training session. Most errors in technique are best identified by a skilled Coach (see the later Chapter on 'Coaching'). If this book has been studied by both Coach and shooter, the reason for most repetitive errors should be obvious.

Chapter 34 Dealing with Malfunctions and Interruptions

Because it is important that the shooter is able to keep up a constant rhythm, any malfunction of his rifle or ammunition can be significant. Unlike a prone rifle shooter, a misfired round cannot simply be ignored.

Malfunctions are rare in the 10m Running Target events but if they do occur, usually mean that there has been some major failure of the rifle or its sight. However, it is possible for a shooter using a pre charged pneumatic rifle or a CO_2 rifle equipped with a 'dry fire' device to operate this rather than cock the rifle fully; i.e. to simply fail to close the tap fully! Malfunctions are not uncommon in the 50m Running Boar event and are sometimes caused by insufficient or poorly distributed priming compound in the .22LR cartridge. If this is the case, the misfired cartridge will show a good firing pin strike.

[Note: There should be no attempt to fire any cartridge that has malfunctioned and has a significant marking on the primer; the primer may be weakened by the first strike of the firing pin and vent gas if it should fire on the second strike.]

Another common cause of malfunctions is a 'light strike' of the firing pin. Whilst this can be the result of a weak firing pin spring, it is more usually caused by a build up around the mouth of the chamber of the wax used to lubricate the .22 Rim Fire bullets. This 'padding' will soften the blow of the firing pin. The solution to this is to ensure that excess lubricant is removed from the ammunition before it is used, and to clean at least the mouth of the chamber and the extractor groove of the rifle regularly. With the centre fire rifle and ammunition used in the 100m Running Deer event, similar malfunctions are uncommon and are usually caused by a poorly seated primer. This is potentially dangerous as there is a possibility that the primer could be 'pinched' by the bolt face and fire whilst the cartridge is being chambered. The shooter should also be aware of the possibility that home loaded ammunition may sometimes be faulty. The absence (or insufficiency) of propellant powder can cause a bullet to jam in the barrel with possible serious consequences if any attempt is made to fire a second shot. If you experience an apparent misfire but the case is extracted in a fired condition, you MUST check that the barrel is free from obstruction before loading another round. However, the most usual cause of malfunctions in the Running Deer is in the Doubles event when the shooter fails to operate the action fully for the second shot of the pair.

Whatever the cause of the malfunction, incorrect procedure could lead to the unnecessary loss of valuable points from the score. If an “allowable” malfunction is to be claimed, the malfunction procedure described fully in the ISSF Rules must be followed. If the shooter suffers a malfunction which he believes to be' allowable', it is important that he places his rifle on the shooting bench and informs the Range Officer. He must not touch the rifle further except with a centre fire Running Deer rifle to support the butt in case of a 'hangfire'. For the malfunction to be allowable, it must be shown that it was not the fault of the shooter. In most cases, this will mean that a cartridge must have been loaded correctly and the trigger operated. The range officer will first examine the rifle to check that the action is closed. He will then attempt to fire it once in a safe direction. If the trigger has clearly been pulled, he will open the action to see if a cartridge has been loaded and that it has a clear imprint of the firing pin on the primer. If not, then the firing pin may be damaged and a repair necessary. If there is a mark on the primer and the cartridge is clearly still unfired, then it may be assumed that the ammunition was faulty and the shooter will be allowed to repeat the run. *[It is important that everyone concerned can recognise the situation where and unfired case is extracted leaving the bullet behind in the throat of the barrel. This is*

usually the result of the bullet being "seated out" in the cartridge and only shows itself when an unfired cartridge is extracted from the action.]

Note: If a malfunction occurs in the 100m Running Deer events, because of the danger from the firing of an unsupported rifle, the shooter should support the rifle on his shoulder whilst pointing it down range, or with a firm hold on the butt if it has been placed on the bench, until the Range Officer has been called. Because there is a risk of 'hangfire', at least 30 seconds should elapse before any attempt is made to open the rifle action, and this should then only be done using the finger tips and whilst the butt is restrained. Because of the force exerted by the firing pin when opening the rifle action there is a risk that the cartridge could fire. The shooter and Range Officer must avert their faces when the action is opened.

If a cartridge had not been loaded, the action not fully closed or the trigger not pulled, then the shooter is at fault and the run will not be repeated but counted as a miss.

In the 100m Running Deer events, if the ammunition was loaded by the shooter rather than being 'factory' made, then the malfunction can be deemed to be under the control of the shooter. A misfired cartridge might not then be classed as an allowable malfunction. Much will depend on circumstances. In the Running Deer Doubles, the most usual cause of a malfunction is that the shooter fails to operate the rifle action fully. This is indicated by there being a fired cartridge case, or no case at all, in the action and would not be an allowable misfire. It does sometimes happen that a cartridge case is not thrown clear of the action before the action is closed. This is usually obvious and the malfunction is allowable.

Even though a malfunction is allowable a re-occurrence may lead the Range officer to order the rifle to be repaired (or replaced) or ammunition to be replaced. An astute Range Officer or Jury Member will be aware of any safety implications of a malfunction, and may require evidence that the rifle or ammunition is safe before the shooter is allowed to continue. The ISSF Rules specify that if a repair cannot be effected within five minutes, the next shooter will be called. The shooter who suffered the malfunction may then continue to shoot from the point of the interruption when he has repaired or replaced his equipment. He will not be allowed any additional sighting shots unless the interruption was more than five minutes when sighting shots (two additional target runs) will be allowed.

Other malfunctions are clearly the fault of the shooter, such as a loose sight mount, and he will not be allowed to repeat the shot(s). Others may be beyond his control, such as a damaged sight and are allowable. It should be noted that if the shooter opts to carry on shooting when he suspects that his rifle or ammunition is faulty, he will be allowed to repeat only the shot when he claimed a malfunction (if allowable). Such a claim cannot be retrospective.

The series may be interrupted by a Range Official under circumstances beyond any control of the shooter, such as a range breakdown, or a safety related incident. If the interruption is for more than five minutes, the shooter will be allowed an additional two sighting shots (four in the Mixed Runs and Running Deer Doubles events).

The shooter should also know that if the target emerges backwards (tail first), from the wrong side or at the wrong speed, the run must be cancelled and repeated even if the shooter has fired. This could occur in the Mixed Runs events. It would be a very confident shooter who refused to shoot at a run of the target because he believed that the programme of runs was not in accordance with the ISSF Rules. It might be said that he is not concentrating fully on his shooting! When Electronic Scoring Targets are used, a target malfunction such as the black paper strip behind the

front target face failing to move correctly is not uncommon. The shooter may claim a malfunction and a repeat shot or shots according to the circumstances and will be decided by the Jury.

Part 6 Improving Performance

Shooters of all disciplines can be placed in one of three classes: the ‘plinkers’ (or fun shooters) who enjoy firing a few shots, probably from a rifle rested on a bench; the ‘recreational shooters’ such as the typical “club” shooter who enjoys occasional competitive shooting; and the serious shooter who aspires to represent his country in International Competition. The ‘plinkers’ will have little interest in the following section, but it is hoped that by reading the foregoing sections of this book they might have been inspired to become more serious recreational shooters. Hopefully the recreational shooters who are already hooked on Moving Target Shooting will want to improve their technique to the point where serious International Competition beckons; then the following chapters might inspire them.

Having learned the techniques of Moving Target shooting, the novice shooter may wish to learn some more advanced techniques and thus improve his performance. This part of the book deals with some of the more important methods that may be used to improve technique. Whilst the guidance of a trained and experienced Instructor is essential for the novice shooter, the guidance of a qualified Coach is equally valuable for the more experience shooter who wishes to improve his performance. This part of the book is intended as much for use by the Coach as by the shooter himself.

This part also deals with the abuse of drugs in shooting and warns against the dangers in proprietary medicines, many of which contain substances that are prohibited to sportsmen and women.

There is no substitute for a properly planned training programme, conscientiously carried out, for improving performance. Although natural talent is important, it is worth nothing at all without careful development.

Mental training, including a positive mental attitude, is the key to success in any sport. However, such mental training cannot be a substitute for physical fitness and training in the technical aspects of shooting. Mental, physical and technical training are complimentary.

Chapter 35 Coaching

"Tell me and I forget.
Show me and I remember.
Involve me and I learn."

Benjamin Franklin

Throughout this book there are frequent references to consulting a Coach or Instructor. The word 'Coach' is a title, and a Coach, in Great Britain often an unpaid volunteer, deserves the respect such a title gives him. Although the meaning of the term 'Instructor' is clear enough, there are some misconceptions about what a Coach can, or should, do. The traditional view is that the Coach watches his charges shoot and then tells them what is wrong with their technique. This is no longer acceptable. While such actions may be called for when novice shooters are under instruction, the modern view is that the more experienced shooter must find out for himself where he is going wrong and make his own judgement on how best to correct it. The Coach's task is to help a shooter to work out his own destiny rather than to decide it for him.

It is a common mistake amongst all athletes to rely on their Coach to tell them what they are doing wrong. My own response to the question "You are the Coach, what am I doing wrong?" is "What you are doing wrong is to ask me what you are doing wrong!" The real fault lies in believing that a single item of equipment or a technique holds the key to instant success. This is wrong. The 'loose' shots during a match usually have a spectrum of different causes. If the shooter, or his Coach, concentrate on only one or two possible causes, then by focusing attention this will often exaggerate the problem. Most problems can be solved by careful planned training which allows the shooter to develop his skills overall. However, this should include exercises designed to improve specific aspects of technique, but not in direct response to a supposed 'fault'. Often, as a result of overtraining, a shooter will identify a 'fault' in technique, typically a poor trigger action; or in his equipment, typically a badly fitting grip. Very often these are only a symptom of his shooting badly, seldom the cause. It is up to the Coach to help the shooter to learn to ignore these supposed faults and to concentrate on systematic training and preparation. This may involve a rest from shooting, or a training programme in which the shooter goes back to the fundamentals of his technique and equipment and learns to shoot all over again.

There are of course specific examples of how the Coach, as an independent observer, can identify faults in technique that the shooter may well not be aware of. The role of the Coach as an observer will be dealt with in a later chapter. Clearly, the Coach or Instructor will try to take action to correct any obvious faults but this will seldom be done ostentatiously by shouted comments to the shooter on the range. Corrective action is more likely to be in the form of discussion and analysis with the shooter himself playing a major part in the process. Even an experienced Coach will not have an answer for everything, but he will be expected to have access to other Coaches, Instructors and experts, perhaps from another discipline or even another sport, who do.

35.1 The Coach

As yet, there is no satisfactory dictionary definition of a 'Coach'. Each sport seems to have its own definition. However, in the Olympic sports, there is now a consensus that a Coach should be professionally qualified in the knowledge and application of his sport. This is certainly the view of the ISSF who have started to hold their own Coach training courses leading to the award of an ISSF Coach’s Licence. This approach is compatible with the approach to coaching by some

member countries, including Great Britain, who have established their own Coach training scheme. Ultimately those training schemes will be integrated with the ISSF scheme, allowing individual countries to provide suitable courses leading to a qualification recognised fully by the ISSF. Throughout this book, the word Coach is given a capital 'C' in recognition of the fact that Coaches are qualified, experienced and appointed.

A Coach should be trained, qualified and experienced in the Moving Target events and in coaching methods generally. He should also have some training in sports psychology and physiology and in Team Management. He is usually appointed by his National or Regional Governing Body and is given specific responsibilities. He should be able to take a lead in developing new techniques and will probably bear considerable responsibility for the routine administration of shooting within his discipline. However, his main task is to help the shooters in his charge to develop their own potential.

An important function of any Coach is to provide suitable coaching material for the Instructors working at club level in the discipline. He will also be responsible for the training and qualification of Instructors. A Coach should himself be able to instruct shooters at all levels of performance from the novice to the expert shot. He should be able to take over responsibility for the development of any shooter who shows the potential to become a competent International Competitor.

It should go without saying that a Coach should be thoroughly familiar with the ISSF Rules as they affect his discipline. Most Coaches will hold an ISSF Judges Licence for their discipline. It should also go without saying that a Coach should be familiar with the safety rules governing the use of the shooting range where he is coaching. In the UK it is usual for a Coach to hold a Range Conducting Officer (RCO) qualification that allows him to be responsible for the safe conduct of all firing on that range. He should also be thoroughly familiar with the rules on drugs abuse and the drugs testing procedures. He owes that to his shooters.

35.2 The Instructor

It is important that every novice taking up shooting sport, in any discipline, should have the benefit of sound instruction. Techniques learned at this formative stage of their experience are long remembered, whether they are good or bad. Every shooting club should have at least one Instructor, appointed by the club, who is thoroughly familiar with the discipline(s) and can instruct and guide novices and 'club' shooters, and help them improve their performance. Ideally, the Instructor should be trained and qualified for his work, although there are many good Instructors who have received no formal training but rely on their experience in the discipline. There is however a danger in this that old bad habits may be taught to new shooters. All Instructors should be supervised by a more senior Coach or Instructor to ensure a uniform high standard.

An Instructor should be familiar with the ISSF Rules as they affect his discipline. Although an Instructor would not be expected to take a lead in developing new techniques, he would be expected to assist a senior Coach in this work. His primary responsibility must be to instruct novices and club members in sound shooting techniques, and to advise on the purchase and use of their equipment.

35.3 The Personal Coach

The personal coach is someone who provides direct support for a shooter. He or she need not have any direct experience or qualification in shooting, but should be understanding and have empathy with the shooter and his aspirations. A family member, friend or fellow club member can act as a personal coach even for a shooter who is regularly competing at a high international level. It is often of benefit to a shooter to be able to discuss his problems with someone who is not themselves involved in the sport. Such an independent opinion can sometimes get to the root of a problem better than a qualified and experienced Coach or Instructor with preconceived ideas.

Any personal coach should be guided by a senior Coach who has overall responsibility for that shooter. Although a personal coach is not expected to be qualified formally, many are themselves Coaches or Instructors, sometimes in another discipline or even in another sport. Probably one of the best ways for a personal coach to help a Moving Target shooter is for him to observe the shooter during training, or whilst competing in a match, and to report his observations to the shooter. This can be of great help to the shooter in helping him to perceive his actions accurately. The shooter may himself ask the observer to note certain features of his technique, such as the way he raises the rifle to his shoulder, or how well he 'follows through' after firing a shot. The use of a Video Recorder can be helpful, but its use must not interfere in any way with the running of the range. Ideally the subject should not be aware it is being used, although this is inevitable in a training session. When a Video Recorder is used in training, the shooter should be discouraged from having a lengthy analysis of his shooting: it is more important for the Coach to pick out particular aspects of technique that he could draw attention to. A long catalogue of potential faults cannot be helpful except as a record for posterity.

35.4 Getting it Right

All Coaches are sometimes asked "What am I doing wrong?" Whilst there is sometimes an answer that they can give to the relative newcomer to the sport, mostly they cannot give a specific answer to that question. Bad shots can be the result of so many different contributory factors that it is impossible to pin down any one fault. More importantly, there seldom seems to be any consistent reason for poor shooting. The simple answer to this question is that you should ask yourself "What am I doing right for the other shots?" By trying to find a specific fault, you are just looking for a crutch lean on. If there really is a problem, the answer is often to be found in the mind of the shooter and this will not be obvious to an external observer. It is sometimes only too easy to suggest a solution to a problem that does not exist

The fact is that most bad shots are the result of two things: mental and physical fatigue. This can manifest itself in many different ways, but dealing with the symptoms is no substitute for dealing with the root problem. We all know the situation when we have fired a shot knowing full well that the rifle simply was not 'on target'. Equally there are many occasions when we are only too glad to 'get rid of the shot' so that we can put the rifle down and start again after a brief rest. The former is a sign of mental tiredness and lack of concentration, the latter is a sign of physical tiredness and lack of fitness. In both instances, proper training can delay the onset of the inevitable symptoms. What really matters is that the symptoms do not show until after the last shot of the match has been fired! In the Moving Target disciplines, once you have come to the 'ready' position, a train of events is started that cannot be stopped until you have fired the shot. There is also a strict time limit between shots. You cannot take a long rest to recover between shots, hoping to make up time later, nor can you put the rifle down if you think things are not

quite right. This is in contrast to the other rifle shooting disciplines where there is an opportunity to rest and to time your shots according to your perception of your present physical state.

Obviously, regular time spent on the range cannot be bad! However, if this is overdone, then mental stagnation and boredom may nullify the effects of the training. Such training must not be exclusive. There are many other forms of training that you can use that will help you to make the best use of range time. One excellent method is to just pick up the rifle and hold it on a spot on the wall. This should be at eye level or at target height 1.35 - 1.45 m (this may be adjusted for very short or very tall shooter if the wall is significantly closer than the normal shooting distance!). When the rifle comes into the shoulder, the sight should be perfectly aligned with that spot and the shooter should be able be able to hold it for at least five seconds. The size of the spot will depend on the distance available, but should be adjusted according to the shooter's ability, maybe starting out as large as the "black", then no larger than the aiming spot, finally the 9 and then the 10 ring. Another excellent exercise is to mark a horizontal line on the wall and to 'track' this in the sight. It will be helpful to have a tape recording of six "pips" at one second intervals (the BBC time pips) to help time the 5 seconds, but this not essential. The image in the 'scope will probably be blurred, especially if training at a relatively short range. A big improvement can be made if part of the 'scope's objective lens is masked with a card mask or even insulating tape. This reduces the lens aperture and thus increases the depth of focus. The shape of the aperture does not matter too much, but a hole near the centre of about 5 mm diameter will be about right. This will darken the image and make eye alignment very critical - not a bad thing in itself for training!

When training like this, the greatest of care must be taken not to overdo it. The exercise must be terminated before boredom sets in as this will result in a loss of concentration. It must also be terminated before physical fatigue makes it impossible to hold the rifle on target. The objective should be to improve concentration and physical fitness to the level where 100 shots can be fired in two hours (i.e. a match including sighting shots and dry firing) without undue fatigue or loss of concentration. Initially it will be necessary to stop long before this. Regular training day after day, even if it is only for a short time, is much more effective that a 'blitz' once a month or even once a week, and will gradually build up mental and physical stamina.

Some shooters believe that a change in technique or equipment is the answer to all their problems; this is (mostly) not true. Most rifles will outshoot their owners by a very big margin. Undoubtedly a change from a sporting rifle to one designed for the Moving Target disciplines will make a big difference, but that difference is most obvious at the top end of performance and might be counter productive for a novice!. Using a good jacket instead of a loose fitting sweater will also make a difference, but not if you are uncomfortable in it. Changes in technique will certainly help if things really are wrong, but most shooter's techniques are well within the accepted limits. Often the real problem is that the shooter has simply not spent enough time in training to perfect his existing technique before he tries to change it yet again. Yur'Yev in his book "Competitive Shooting" analysed hundreds of shooters in all disciplines and found that every one had a different stance / hold / technique, and that there was no right or wrong method in any discipline. Physiology did play a part, but between physically similar shooters there were big differences in technique even at the very top. The fact is that too many shooters use a change in technique, or more often, a change in equipment, as they would an aspirin to cure toothache. Yes it helps, but the effect wears off and they are soon back to where they started and are looking for a better aspirin. The effect is mainly in the mind: by being forced to concentrate on something different they are less prone to boredom and loss of concentration. This effect is always short lived. There are many prone, air rifle and air pistol shooters who regard a change of gun once a year as essential to maintaining performance. In reality, they spend the next few months just familiarising themselves with their new 'toy' instead of using that time (and their old gun) for

meaningful training. The initial supposed improvement soon wears off and their performance drops back to where it was originally and can only be brought back again by systematic training: something they never actually achieve. Undoubtedly there are often advantages in using equipment that incorporates the latest developments, but this does have its price as anyone going over to a twin post 'scope from cross hairs usually finds to their cost! Very often the 'improvements' are mainly cosmetic. Even proven technical improvements, such as the modern pre charged air rifles, are not necessarily such a big improvement on the older manual charged rifles in the short term. A different weight distribution and a very short "lock time" may necessitate some changes in technique in order to make best use of them. New equipment; new techniques, are no substitute for systematic training!

Chapter 36 Technical Training Methods

The term 'training' embraces all those actions that contribute to the process of conditioning a shooter to perform well. It includes Psychological and Physical training as well as Technical Training and Practice. This chapter will deal only with Technical Training methods.

For too many shooters, 'training' means no more than regular visits to the shooting range and firing so many match series. For anyone who takes his shooting seriously, this is inadequate. Such 'practice', while valuable, should be only one part of a comprehensive training programme. The real purpose of training is to learn. Simply shooting endless series is, after a certain time, not teaching the shooter anything new and he becomes stale. This form of training is common amongst those shooters who do not have the commitment to their sport to train properly. It is an excuse for their own inadequacy.

36.1 Understanding the Basics

The first stage in any programme of training is to break down the whole process into its component parts. This should include taking up the stance, raising the rifle to the shoulder, taking aim, firing the shot and following it through. From the shooter's own knowledge of himself, perhaps with the aid of a Coach, personal coach or fellow shooter as an observer, he should then decide which parts of that process are most important to his current performance. He must then assign priorities to the actions needed to improve his performance and prepare a training plan to deal with them. He must also carry out regular reviews of his progress and revise his plan accordingly.

For much of the training, the shooter will not need access to a Moving Target range. For some of it he may not even need to fire the rifle. Much of the Technical Training needed for the Running Boar and Running Deer events can be achieved on the 10m Running Target range. A spring operated air rifle, which recoils when the piston reaches the end of its stroke, can be useful as a training aid for the Running Deer events.

36.2 Training Objectives

It is helpful to have stated objectives in all training activities, and to monitor progress against those objectives. During training, every effort should be made to avoid 'score training'. This only distracts attention away from the true objectives. To avoid 'score training' it is better to shoot many shots on a single target, or to cut away the target centre so that only the worst shots can be observed. The objective should be to keep every shot within the '9' ring. In this case, on the 10m Targets, if the '7' ring is cut out; almost every shot that does not mark the remaining target will be a 9. By taking attention away from 'scores' it is easier to concentrate on the real business of improving performance. During training (and during competitions) a useful objective is to endeavour to fire as many shots as practicable without any “loose” shots. If you can fire a full course of fire without and stray shots then your score MUST improve and your group sizes reduce. It will be necessary from time to time to measure progress by shooting a score. This will be dealt with in the Chapter on 'Practice'.

36.3 The Use of Static Targets

Many Moving Target shooters are unaware of the benefits to be had to their technique of shooting at a stationary target. A group of ten shoots fired at a stationary target (at the normal shooting distance and without any time limit) is very revealing. It is usually much larger than the shooter expects it to be, yet he hopes to be able to shoot smaller groups when that target is moving. If the group is shot in 5 or 2.5 seconds, timed by an observer with a stop watch, the group will be even larger. The benefits to be had from static shooting like this are considerable. The 'ready' position can be adopted and the rifle raised to the shoulder at a signal. The shot must be fired before a second signal is given. It is not difficult to record an audio tape, perhaps a short continuous loop of tape to the type that used to be used in some older telephone answering machines, to give appropriate signals at about 20 second intervals. This training technique does not require access to a Moving Target range, and will be referred to later in the Chapter dealing with 'Match Preparation' in Part 7 of this book.

36.4 Dry Firing

Although the Moving Target shooter is allowed only a limited number of sighting shots, he does have the opportunity to 'dry fire' a full series whilst the preceding shooter shoots his course of fire. Whilst dry firing, he is allowed to carry out all the actions he would do whilst live firing except that the rifle must not be loaded, nor must he discharge any propellant gas. The dry firing is carried out from a special position to the left of the shooter and screened from him. In a match, the value of being able to dry fire is obvious. However, to make best use of it, the shooter must include dry firing in his normal training programme. A full series fired 'dry' followed by a series fired 'live' demands considerable stamina, and some care must be taken to ensure that the dry firing does not leave the shooter fatigued when he goes onto the firing point. Thus some dry firing should be included in the normal training programme. Dry firing also tends to be more boring than live firing and this too limits its use just before the match. Some shooters take planned breaks during dry firing to ensure that they gain maximum benefit from it.

During dry firing the shooter is able to rehearse all the things he will do in the match except that there is no recoil and no response from the target to say where his 'shot' might have struck. One limitation with dry firing before a match is that the target is started when the other shooter is ready, not the dry firing shooter. He has only a limited view of when the other shooter raises his rifle from the bench thus he has only limited warning of when the target might run. This helps sharpen reflexes. (There is usually a slot in the screen so that the dry firer can see when the shooter raises his rifle to the ready position.) Dry firing is especially valuable in the 50m Running Boar and 100m Running Deer events where the saving in the cost of ammunition is significant. For a shooter who has trained extensively at 10m, dry firing is an excellent way to experience the weight and feel of the cartridge rifle. It is possible to dry fire the cartridge rifle on the 10m range if the 'scope sight can be refocused for the shorter distance. This is often not practicable nor desirable because of the need to re-zero the rifle afterwards. It can be facilitated if a circular mask is placed over the objective lens with a small (i.e. 5 - 8 mm) diameter hole cut in the centre. A section of 10m target with the '10' ring cut out is convenient. This has the effect of reducing the effective aperture of the 'scope and thus increasing the depth of field and so sharpening up the out of focus image. It also darkens the image and at the same time makes it more critical where the eye is placed.

For the 100m Running Deer events, it is not unusual to see a shooter dry fire a Doubles series whilst the Singles is being shot and a 'triples' series whilst the Doubles is being shot. The fact

that this is possible indicates that there is more than enough time to shoot the normal Doubles event.

Because there is no recoil, one important feature of dry firing is that the shooter can assess his follow through. There should be no movement of the rifle after the trigger is released, and no tendency to snatch the rifle off aim.

36.5 The Role of the Coach as an Observer

During training, whilst firing normally at a moving target, there is an excellent opportunity for a Coach, personal coach or a fellow shooter to observe and criticise the techniques used. The first thing to look for is that the 'ready' position is in accordance with the ISSF Rules. During a match there is a tendency for the butt to rise very slightly throughout the series so that what started as a legal 'ready' position ends up illegal. This is something to watch very carefully in training. The observer should then have no hesitation in pointing it out to the shooter immediately. If it occurs in a match, a Range Officer or Jury member will point it out accompanied by Yellow Card.

The second thing for the observer to look for is the timing and consistency of the shooter's actions. Although a stop watch can help, it is not really needed by the observer to see how consistently the shooter raises the rifle when the target appears, follows the target and then shoots. On the 10m range this process is made much easier, if the range allows, if the pellet stop is freshly painted or a new backing card installed. The position of the shot holes throughout the target run tells the shooter a lot about his consistency. Although a long horizontal 'group' is expected, the shorter it is the more consistent the shooter. It is the isolated shots well out of group that are the most telling. With careful observation, it should be possible to link those early or late shots with the score they made. The use of an Electronic Scoring Target can be even more telling.

The work of the observer can be made very much easier on the 10m range with the use of a small visible laser attached to the rifle barrel. The lasers that are most convenient are those designed to be used as a screen pointer. They weigh only 30 grams or so and can be attached to the rifle with adhesive tape. They are now very inexpensive. With practice, it is surprising how easy it is to direct the laser beam accurately. The ideal location is about 200 - 300 mm below the centre of aim on the front board of a 10m range. The shooter cannot see the beam of the laser and is scarcely aware that it has been fitted. It is easy for the observer to follow the swing of the rifle, to note any erratic movement and to check for any movement immediately the rifle is fired. Much more sophisticated devices using photo electric equipment are available for the static shooters. Unfortunately, all of those currently available need electrical connections to a photo target near the actual target and this is not easy to arrange when it is moving.

The observer also has a role during a match. If the same observer who watched the shooter in training can be present at an important match, he should be able to identify any important differences in technique. In the stress of a match, the shooter sometimes does things differently to the 'ideal' way he developed in training. If these differences can be identified, then it will be possible either to concentrate on them in training or to change the technique so that the 'match' technique is the one which is trained. It will often be better to accept a less than ideal technique in order to achieve consistency.

36.6 Improving Hand - Eye - Mind Coordination

Success in Moving Target Shooting demands a high degree of hand - eye - mind coordination. Whilst much of this will come about through normal training and practice, there are other ways to improve coordination. Playing sports such as Squash, Badminton, Tennis and Table Tennis is an obvious example. Other less vigorous sports such as Darts, Archery, Golf, Bowls and Ten Pin Bowling also demand a high degree of coordination and can be a valuable part of any training programme. Shotgun shooting is also valuable in training but should not be overdone if incompatible habits are not to be learned. A simple way to assess the degree of coordination is to take a normal carpenters hammer and try to hammer home a nail into a block of wood. The nail should be 'started', but there should be no attempt to 'aim' the hammer, just a single blow struck without preamble. With a well balanced hammer, most competent shooters can hit the nail hard and square every time. If not, then there is a problem. If the exercise is repeated with a poorly balanced hammer such as a heavy 'lump hammer' or an engineer's ball-pein hammer the subject should soon learn to adjust his stroke to be accurate every time. However, he will be aware that the hammer he is using is not ideal for the task. Likewise with a poorly balanced rifle, the shooter can adjust to its poor balance but will always be aware of its inadequacy.

Exercises such as hammering in a nail, or throwing Darts or playing Bowls (for someone not already familiar with such games) can be helpful to an instructor in assessing the potential of a novice shooter. However, most experienced Coaches and Instructors can assess a novice correctly within a few minutes of him first picking up a rifle, often before he has fired a shot.

36.7 Sensory Deprivation Techniques

The shooter should go into a darkened room with as much extraneous sound as practicable eliminated. To enhance the effect he should wear ear muffs and foam plugs, and dark eye shades. With all audio and visual stimulation removed, he will be in a very sensitive state to accept and learn sensory stimulation from other receptors. Thus, if he should now sit in a comfortable position with his (unloaded) rifle and dry fire the trigger mechanism. After half an hour of such training the trigger will feel quite different. This is an excellent way to cure snatch or trigger shyness. If, at the end of such a session, he is unhappy about the trigger adjustment, this is the time to make changes. However, he must return to the dark room to repeat the exercise before he tries to use the rifle normally.

This is a powerful training technique and can be used during a pre match preparation period (eyes closed, ear muffs on) to retrain the trigger finger. This should only be done in the official 'warm up' area, not in the changing room!

The technique need not be confined to trigger training but can also be used to practise the raise. There will be no feedback from his eyes and so he must learn to 'feel' his hold and mounting of the rifle. This can be combined with the trigger technique. However, after a short period of training like this it will be necessary to return to the range to verify that the rifle is being held at the correct height. A few blind raises with the shooting eye closed, opening it only when the rifle is in the shoulder, will quickly confirm the position.

36.8 The Application of Technology

Other high technology equipment is also available for the static shooters that can be used by the Moving Target shooters. Probably the most useful is a trigger pressure sensor that records the weight taken on the trigger throughout the firing sequence. Whilst this is most useful when used in conjunction with other training equipment such as the 'NOPTEL' or 'SCAT', which is not readily applicable to moving target shooting, nevertheless it does have some value. It can be used to identify and correct trigger snatch.

Another device that has been useful to the static shooters is the force platform. This locates the centre of gravity on a platform which the shooter is standing on. It tells him a lot about the tiny changes of balance that take place throughout a series. For the moving target shooter there are obvious limitations as his weight is constantly shifting as he swings with the target. What will be more useful are a pair of bathroom scales, one for each foot. An observer can note the weight distribution between the feet as the shooter takes up his stance. The older mechanical scales are probably better for this than the modern digital scales whose fast response makes them difficult to read unless everything is stationary.

High Speed Ciné or Video equipment is also useful if available. Such equipment is expensive and needs a high lighting level to be used at its best. An ordinary Video Recorder has its uses too and these often have a good low light capability. However, the amount of information that can be accumulated by any of these systems is often beyond the resources of most shooters to be able to deal with effectively. Ideally, digital video images can be displayed and manipulated on a computer. It is consistency that should be looked for and this needs an input from many shots to be useful. A compact digital camera with a “video” function can be almost as good as an ordinary Video Camera; even a Mobile Phone can be used although many have only a limited memory. Often still camera images are useful too and the quality of the images is often much better than can be had with the Video. A still digital camera is particularly useful if it can be set up to record at ~5 frames per second for several seconds. The location of readily identifiable points on the rifle or the shooting jacket can be plotted for instance during the raise. In either case, it will be helpful to have some prominent marks on the shooting jacket and rifle to act as a reference on the records.

One drawback of any Hi-Tec equipment is that its novelty can be a distraction. Unless it can be used regularly over a long period of time, its application is limited.

36.9 The Effect of Overtraining

In all sports, overtraining is counterproductive. It is when the shooter gets into a rut (or thinks that he is in a rut) with his training that there is the greatest danger of overtraining. There is always a tendency to think 'only once more and I will get it right'. In some sports such unplanned overtraining can lead to physical injury, in shooting this is less likely, but the effects are more subtle. The worst effect is boredom, driving the shooter deeper into his rut!

Overtraining can only be avoided by means of a comprehensive Training Plan. All training should be meaningful, and to be meaningful, training must be planned. When the training appears to be having no effect, or even a negative effect on performance, it is time to review it and revise the plan. For anyone seeking to represent his nation at International level, a comprehensive Training Plan is mandatory, and its application subject to monitoring.

Particular care should be taken to ensure that any programme of physical training is not overdone. Any energetic activity, no matter how 'good' it is supposed to be, can lead to fatigue and possible injury. Their onset can be difficult to spot. As a general rule, any such exercise in moderation will be good, but constant repetition can less to stress injuries. Again, a well managed Training Plan should help avoid the worst excesses.

36.10 Rest Periods

All the evidence suggests that adequate rest periods are essential for any athlete if he is not to become stale. Short rest periods, such as a holiday, will occur naturally, but it is helpful to plan at least one break from shooting of at least four weeks in each year. These might well be planned around a holiday break. During the rest period, the shooter should refrain from any training specific to his discipline, such as training on the range. However, he should continue his general fitness training programme and his mental training, perhaps in a modified form.

Following a rest period, a shooter should return to full training only after a review of his techniques. He will then find it helpful to rebuild his technique completely. This need not take very long, but he should review every detail of his old technique and assess if anything needs to be changed. His training for the next few weeks must concentrate on the elements of his technique from stance and hold to trigger release and follow through. This also a time to review equipment, particularly its fit and suitability for the shooter's stance and hold.

Chapter 37 Practice

Practice is a specialised form of training. It is the process of rehearsing actions that are already familiar and which are an integral part of the shooting technique needed to complete a match successfully. The actions to be practised may be some, perhaps only one, of those that together constitute a match, or they may a complete match. Practice cannot teach us anything new, only reinforce what we already know and can achieve. For the skilled shooter who has trained systematically, practice might well consist of bringing together all those actions that constitute a full match course of fire. Careful analysis will show where future training efforts should be concentrated. The less skilled shooter might best avoid shooting a match course too often until his skill in executing the individual actions can take such intensive training. Too much match practice can lead to mental confusion arising from the different lessons to be learnt from different actions. For the novice, the temptation to spend a lot of time in match practice is great; he is keen to see his "scores" improve. He would be better advised to resist this temptation and to restrict his limited training time to practising individual points of technique.

Unfortunately, many shooters, especially recreational shooters or those shooting at club level, only ever practice; they never get beyond practice to systematic training. Practice, no matter how well intentioned, is no substitute for systematic, planned training. Unfortunately, many shooters who have aspirations to shoot well perceive that practice is more important than technical training. Usually this is because although they have aspirations they lack the commitment to train regularly. They believe that the little time they can make available for training should be spent in practising. This is wrong. The less time there is available the more important it is to use it wisely. Although practice must always be an element of training, it must not lead to the neglect of other forms of technical training that are not specific to the discipline.

37.1 The Objective of Practice

Practice takes two forms. In the first instance it can be used to rehearse those actions or parts of a technique that are weak; this presupposes that they will actually respond to such a specialist form of training. First, however, the weak areas of technique must be identified and evaluated. Typical areas that will always benefit from practice are the raise, the aim, the trigger release and the follow through. Progress must be reviewed regularly if effort is not to be wasted in trying to achieve the (almost) impossible.

The second objective of practice, and the one that is unfortunately too common, is to shoot for a score. Such practice is undoubtedly an important part of any shooter's training. If it is done under match conditions, it will hopefully remind the shooter of how much work is still to be done to achieve his overall objectives. If on the contrary it shows that those objectives are being achieved, then it demonstrates that it is time that they were revised. Such practice carries with it the implication that the sum of all techniques is near to the ideal, a presumption which few will achieve. Nevertheless, properly planned training needs a significant element of feedback to help the shooter concentrate effort on those shortcomings of his technique that will most benefit from further training. However, another valuable feature of practice is that it should encourage the shooter to rehearse everything that will be required of him in a major match. This should include checking the sighting in of the rifle, warming up, dry firing and then finally shooting the match. It is most important to simulate, as closely as possible, actual match conditions during such a practice session. Whilst it is impossible to reproduce the causes of match 'nerves' nevertheless other match conditions can be reproduced. In particular, practice should not be hurried but should

use the same rhythm that would be forced upon the shooter during a match. If the training has been properly planned and conscientiously carried out, this should be its logical conclusion. If training is haphazard and lacking planning, there will be pressure from within to go straight into shooting a 'score' and to omit the other important match elements. The subject of Training Plans is dealt with in Part 7 on Shooting at National and International Level.

37.2 When to Practice

The timing and frequency of practice are important. It is best to concentrate on training rather than practice in the week or so leading up to an important match. This is dealt with in the Chapter on 'Match Preparation' in Part 7 on 'Shooting at National and International Level'. At other times it must be related to the volume of training. To shoot one practice match each week would not be unreasonable for a shooter who is training regularly on five days a week. This should be supplemented by perhaps an additional two to four matches each month. If there are regular minor competitions available for instance within a club, then these can count as practice.

37.3 Over Practice

Over practice, as with all forms of training, can lead to a loss of performance. In the more physical sports the effects of over practice are only too obvious with fatigue and even physical injury the cause of ever deteriorating performance. The principal problems for the shooter are boredom and complacency and these are not so easy to identify. If practice is properly integrated into a training plan, then boredom should not be a problem. The training plan should ensure that any one technique is only practised in short but effective sessions to avoid such boredom. Subsequent training sessions are then used to reinforce the lessons already learnt. When the only form of training is in fact match practice, boredom is almost guaranteed unless such training is very limited indeed! Incipient boredom should be recognised and the training plan revised to counteract it. One sign of boredom is that there is a tendency to shoot too quickly during practice. If this happens it needs to be corrected at once because it is no longer simulating match conditions and hence is of limited value. Complacency is more difficult to recognise and to deal with.

Because it is difficult to simulate match pressure during practice, it leaves the shooter ill prepared for pressure during the actual match. It is quite usual for remarkable scores to be registered during training sessions without match pressure. Thus the shooter is lulled into a false sense of achievement, believing that he can beat anyone. As a result, his training plan may be neglected and he fails to train systematically. When he comes to the match, that lack of training shows. Although he blames match pressure, what is sometimes forgotten is that one of the best ways to combat it is the knowledge that his technique and his preparation for the match are beyond reproach. "Match pressure" is sometimes a sign of a guilty conscience. If practice scores show that objectives are being achieved, then it is time for him to consider reducing the amount of practice and to concentrate even more on technical training.

Throughout all the major sports, there has come a recognition that it is the quality of practice that is more important than its quantity. Meaningless shooting at a moving target in a half dozy state, the result of boredom from too much practice, may be harmful. Every practice session should be carried out with a stated goal and the session evaluated against that goal.

37.4 The Use of an Observer

During practice, as well as during a match, it is helpful to have an observer watch the shooting technique and position. The obvious thing an observer should watch for is the legality of the 'ready' position. However, seemingly minor points of technique can change from time to time, particularly between practice sessions and the actual match. It is most important that these changes are identified and fully understood. One reason why scores can be worse in a match than they were in practice is that the techniques used may differ. Whatever the ideal technique, it is of little value if it cannot be used instinctively during the important match whilst the shooter is under pressure. Extensive training and practice can condition the shooter's reflexes to adopt the idealised technique even under pressure. However, if the technique or position adopted is not 'natural' then, under stress, there is always a tendency to revert to the more natural technique or position.

Thus an observer such as a Coach or a fellow shooter can be of great help in identifying those small nuances of technique or position which may have changed from those practised. It is then up to the shooter to decide whether to concentrate on those matters in training, in the hope of conditioning himself to accept them as normal or to accept that his concept of the ideal technique is wrong. In this case, he must train using the technique which he will adopt under stress. In making this decision, it will be helpful to revert to the 'Inner Position' described in the Chapter on 'Stance' in the part of the book on 'Shooting Technique'. In many instances, this Inner Position will be nearer to that adopted during the match under stress than the position (or technique) used in practice when there is no mental pressure.

Chapter 38 Mental Training

Shooting, along with Archery, Golf (Stroke Play only, not Match Play) and to some extent Field Athletics, is different from most other sports in several ways. Most importantly, competition is essentially within the shooter himself. He can only strive to realise his own best performance; it should not be influenced in any way by the performance of another competitor. It is important for the future of shooting sport that this should continue: the introduction of a 'conflict' element will only reinforce the attitude of the anti shooting fraternity.

Because the ISSF has strict rules governing range construction and conditions, there should be minimal influence of weather, lighting, etc, especially in the air gun events. This contrasts with track athletics in which the prospect of a new World Record time will be enhanced by the fierceness of the competition as well as by the weather. Because he is not interacting with the other shooters in the competition he is not constantly trying to outwit their tactics and thus he is very much 'alone' on the firing point. He must work hard to remain alert for the whole course of fire. Shooting and Archery share another unique characteristic: they are the only sports where there is a strict limit on the maximum score. The ISSF recognizes this by stipulating that a tie between shooters with perfect scores will not be broken; equal awards will be made. Perfect scores are still such a rare event that this causes no problems. Unlike the field athletic events when there is always a real possibility or throwing just a little further or jumping a little higher that anyone else ever has! In Modern Pentathlon Pistol Shooting is unique in the five events because it has a finite score. *[Even in Golf where a perfect round is possible, the possibility of completing 18 holes with only 18 strokes is so remote that it can be discounted.]* These two factors have a significant influence of the mental makeup of a typical shooter. Many professional Sports Psychologists fail to understand this and treat shooters like any other athlete!

Even within shooting sport there are major differences between the mental makeup of those participating in the different disciplines. I once had the greatest difficulty in convincing a Sports Psychologist that in some forms of shooting, rapid reactions are a major asset. His only experience was with prone rifle shooters! The Moving Target shooter, along with the Rapid Fire Pistol shooter and the Clay Target shooter has other special problems. Once he goes onto the firing point, he cannot take a break if all is not going well. Nor does he have an unlimited number of sighting shots to settle himself into the competition. Thus he must be in the correct mental state before he is called to the firing point and be able to maintain it throughout the course of fire.

The novice shooter has no such problems. He is so intent on putting into practice all that he has recently been taught that he puts any distracting thoughts out of his mind. This applies particularly to younger shooters who appear to have 'no nerves' in competition. It is only with training and experience that distracting thoughts, negative thoughts and lack of concentration start to have their effect on performance. Throughout the world, in shooting clubs of all kinds, there are many shooters who are content to attend regularly but who have no aspirations to shoot in International, National nor even Regional championships. For them shooting is a recreation, something that helps them to relax. To introduce a competitive element would be to destroy the recreational aspect of the sport. Yet their performance is often as good, or better, than their fellow club members who are more competitive. One purpose of mental training is to allow a shooter to participate in competition whilst preventing the negative influence of the competitive element detracting from the recreational aspect of his sport and thus hindering performance.

Much work has been done in recent years on behalf of all sports on the way in which mental training can be used to improve performance. Strictly, the wording should be 'to realise potential'. Much of this work is a direct consequence of the work being done to improve performance in business and commerce. Mental training methods alone cannot improve performance unless the potential is already there, and it must be used to complement a comprehensive programme of technical training. A number of books have been written on this subject and the details will not be repeated. A qualified shooting Coach should have received some training in Sports Psychology and can advise the shooters whom he coaches. National Governing Bodies can refer individual shooters to a qualified Sports Psychologist for further help when needed.

Although it would be wrong to suggest that mental training methods are of little or no value to a novice or 'club' shooter, nevertheless its benefits will be found most for the advanced shooter. Certainly, even the novice can learn the techniques that will be of most benefit when his performance improves, but he must not be fooled into thinking that 'it is all in the mind'. The skills needed to fire a good shot must first be acquired and developed. It is only when he is able to 'call' his shots with confidence that he will get the maximum benefit from mental training.

In this chapter, mental training is referred to in the context of match preparation. This is only because it is in that context that a shooter is most aware of his need for such training. Under the relaxed conditions of normal training, there may seem little need for mental training. However, that is the time when it must be used and integrated with other forms of training if it is to be of benefit during the important match. Mental training must be an integral part of any training plan when it can be used effectively to reinforce the technical and physical training in that programme.

38.1 The Need for Mental Training

The need for mental training is evidenced by the fact that most shooters have found that it is easier to achieve a good score whilst training than in the important match. The stress caused by match pressure results in carelessly dropped points. The inherent ability of the shooter is evidenced by the fact that he is able to perform better whilst not under such match stress.

Recent research in the USA has suggested that when a new task is being learned, a special part of the brain is used. As the learning process is completed, the 'stored' learning is transferred to the operational part of the brain where it is used under automatic control The research has suggested that if the subject concentrates too hard on carrying out a task, then the brain switches over to the learning part, bypassing the automatic responses that have already been learned. Thus by concentrating too hard on any aspect of shooting, it is probable that performance will be worse. This research also confirms the value of technical training. Probably most shooters will agree with its conclusions. The effect is rather like 'exam nerves' when, although the student has done all the work, he 'freezes' in the examination room and cannot remember anything that he has learnt. Likewise 'stage fright' when the actor forgets his words on stage. There is a little rhyme which goes:

"Centipede who was happy quite until a frog in fun
Said "Pray which leg comes after which?"
Which set his mind in quite a pitch
He lay distracted in a ditch
Figuring how to run.

Once a technique has been learned, it resides in a part of the brain where it is under automatic control. However, under stress, if he tries too hard, control of those automatic actions reverts to the 'learning' part of the brain where control is not so precise. Having carried out his training, the shooter needs to be able to relax, confident that he is capable of achieving his objectives. Mental training can help the shooter to gain self confidence and to relax in quiet confidence of his ability.

Preliminary results from similar research in the UK carried out on shooters has shown that motor responses are at their peak when all of the brain's resources are devoted to them. When the shooter is 'thinking', some of those resources are diverted to that additional task with the inevitable result of a poor shot. In other words, the shooter must learn to be single minded and bring no mental baggage with him to the match.

Mental training has several important elements. The most significant is that it can be used not only to reduce stress and tension before a match, but the same techniques can be used to prevent that stress from arising in the first instance. However, other elements of mental training must not be ignored. These include using mental training techniques to reinforce the effects of technical training by improving the receptiveness of the mind. They can also be used as a substitute for technical training during injury or illness, or if access to the range is curtailed for whatever reason. There is no single programme of mental training that can help every shooter. Apart from differences between the shooting sub disciplines, each shooter has his own needs and responds differently to mental training. A technique that works for some shooters may have only a negative effect with another. Thus each shooter must work out for himself, guided by a qualified coach, a programme of mental training that is tuned to his own needs. That programme must be regularly reviewed and modified as needs change.

38.2 Mental Training; the Key to Realising Potential

Every shooter has some potential: an immediate potential, a medium term potential and a long term potential, which he must ultimately work towards. It is the immediate potential that is most important, this is the performance he is capable of now. It is determined by the inherent motor skills and coordination of the shooter, and is represented by the score he would make if he were to shoot under ideal conditions. This must include an ideal state of mind. The attitude taken by some shooters is that, as they have at sometime scored a central '10', every shot is potentially a central '10'. For them, mental training is the magic formula that will convert every shot into a central '10' and this becomes the focus of their training. They only need to recreate their mental state when they scored that ‘10’ to be able to make every shot a ‘10’. They have not taken into account the fact that there is a significant random element in the way they hold, aim and fire the rifle, and that this can only be minimised by improving their motor skills by training on the range. As a result, they feel let down when they do not see the central 10's every time they shoot. Mental training cannot make up for deficiencies of technique.

Mental training has long, medium and short term elements. In the long term it involves adopting the right attitude to competitive shooting. In the short term it means having the resources to be able to tackle mental problems as they arise; this will only be possible if there is an on going programme of mental training. There are no quick, easy fixes for mental problems.

38.3 Goal Setting

The key to most forms of mental training lies in the goals and objectives we set ourselves. Setting realistic, attainable goals in every aspect of training and competition can realise the potential of any shooter. We all have 'dream goals', maybe it is winning a Gold Medal in the World or European Championships, or perhaps setting a new world record score. For most shooters, these will remain dream goals, and their subconscious recognises that they can never be attained and so they are ignored. What sometimes happens is that those dream goals are turned into real goals and the shooter finds himself trying to achieve, what for him, is the impossible. The value of goal setting is thus lost. Unrealistic goals lead to disillusionment and failure.

To be effective, goals must have the following attributes:

They must stretch the shooter to better his current performance;
They must be attainable without reference to the performance of another shooter;
They must be attainable within the present physical skill of the shooter;
They must be continually revised as performance improves; They may be short, medium or long term.

In the chapter on 'Training Plans' in the next part of this book on 'Shooting at National and International Level' I will suggest ways of setting score goals. However, scores are not the only goal that can be set. A sensible goal would be to achieve and maintain a given level of physical fitness, or even to do a prescribed amount of training each week. Some care should be taken when setting such quantitative goals not to ignore the quality of the training. For the novice, one goal would be to keep every shot 'in the black'. Every aspect of training can have its own goals.

38.4 Positive Thinking

One important part of mental training is the adoption of a positive attitude towards the sport and life generally. This is the long term part of the training and is for life. Positive thinking is much talked about but often misunderstood. In essence it means that a shooter should always try to find the good in everything that happens and to emphasise that good. Positive thinking should not be confused with the philosophy of 'optimism' that insists that, whatever happens, it is all to the good. That philosophy leads to complacency and was lampooned by Voltaire in his novel “Candide”. Nor must it be confused with what was once called "reframing" and is now popularly known as "spin", which seems to mean closing the mind to anything you don't like! Positive thinking demands action to show that the shooter is in control. It does not mean that he should ignore the less welcome aspects, but that he should learn from them, turning them into good. This can only be beneficial if it is practicable. If it goes beyond reason, then his mind will reject it as being deceitful. Thus, it is of no value if he thinks only of scoring tens, when he knows that he is not capable of scoring a highest possible score of 600 points. Such thinking would be false positive thinking. It would be much better to think of not scoring less than an eight! To some shooters, this would be negative thinking. That view is wrong, it is positive thinking. Negative thinking means always expecting at least one seven or worse.

Positive thinking must be related to the shooter's goals and objectives, it does not mean that he must always 'think to win'. Such an attitude might be acceptable for a 'conflict' sport such as tennis but in shooting, his performance can be measured independently of that of other competitors. To think only of winning is to make his achievements dependent on the achievements of other shooters and so making himself a hostage to fortune. His positive thoughts

should be directed to what he can achieve by his own efforts such as attaining a specified score. Even then there is a potential problem: if he sets himself a goal of 570, then after the Slow Runs his score is 285, he knows that he must score 285 on the Fast Runs. After a few poor shots, he knows that his chances of achieving his goal are diminishing and so he stops trying, thus negating the purpose of setting such a goal. As always, the only shot that matters is the shot you are about to fire, and this concept should dominate goal setting.

If the shooter is to be able to make the best of a potentially bad situation and use it to his own advantage, then it is necessary for him to be able to anticipate the bad situations and to have a contingency plan to deal with them. A strong wind and heavy driving rain might be seen by one shooter as a recipe for a poor score on the 50m Running Boar range. Another shooter will accept these conditions as a challenge and, having prepared himself for poor weather, shoot better for it knowing everyone else is suffering too. The weather, which is something he can cope with, can be used to divert his worries away from the internal conflicts that can badly affect his performance.

The shooter who thinks positively is the one who can recover from the first poor shot, takes it as a challenge, and makes sure that there isn't a second. The negative thinker sees the bad shot as a disaster and immediately gives up and abandons the match. That bad shot is followed by a second, sometimes even worse, shot.

If the shooter can adopt a positive attitude of mind, he will have gone a long way towards overcoming the mental problems that can inhibit his achievements in shooting. Nevertheless, specific problems will remain, and these demand special techniques to overcome them.

38.5 Self Esteem and Confidence Building

Closely related to Positive Thinking is the matter of self esteem. A shooter who has little self esteem cannot, and does not, expect to succeed. Self esteem can be improved by careful goal setting: it may be better for a developing shooter to be highly placed in a minor match than to take part and come near the bottom of the list in a major championship. Although participating may be good experience, the trauma of being low placed can be detrimental to his future performance. Thus careful management of the shooter's match commitments can do much to improve his self esteem. Equally his self esteem can be lowered if he is not given due credit for his performance, even when it is not perhaps his best. A dressing down for poor performance is a good way to lower his self esteem and guarantee poor performance in future. Thus a positive attitude is needed from everyone around him, Coach, family, friends, as well as from the shooter himself. Whilst some pressure to perform well can be a good thing, too much pressure will be counterproductive. This does not only apply to shooting. An insensitive manager at work can destroy any self esteem and this will rub off onto his shooting performance. Nevertheless, in applying this principle, the Coach must be meticulously honest in his comments otherwise the shooter will reject his praise entirely.

Although it is primarily a matter for the shooter himself to build up self esteem and self confidence, he needs external assistance because he is too involved. A Coach or member of his family can do much by just applying common sense to help him build up that self confidence and counter the negative influences that make for a performance which is less than his potential.

38.6 Motivation

No matter how competent a shooter is technically, unless he is motivated to train and to perform well, his performance can never be realised. Motivation varies from shooter to shooter; and even in the same shooter from time to time. A well motivated shooter will have a comprehensive, up to date, training plan and will go out of his way to ensure that it is implemented. A poorly motivated shooter will use any excuse to defer serious training. For him, training is a bore, to be subjugated to other demands on his time. This attitude may be reinforced if his training is repetitive and boring, and without clear objectives.

A shooter who has a well organised lifestyle will be better motivated to shoot well. Even though there may be pressure to do other things, such as work or family matters, rather than train, if he is well organised, then time will be found to train and to take part in local matches.
If he is not well organised, other matters will be allowed to take precedence until shooting is squeezed out altogether.

Many shooters in clubs throughout the world have no aspirations to perform well at national or international level. Shooting for them is a hobby, something to distract their mind from work and family problems. For others, shooting is a way to prove themselves to their fellow club members, and even outside the club. They take their sport more seriously and are more likely to shoot well than their less well motivated colleagues. This is not a reflection on the ability of the less well motivated shooters; it simply recognises the fact that without such motivation, their shooting will always remain a 'hobby'.

Once the initial motivation to succeed in shooting is present, many things can affect that motivation. Tiredness, minor illness, pressure of work, distracting thoughts, family and domestic commitments can all reduce the motivation of any shooter. This can lead to a reduced performance which in turn leads to despondency and reduces motivation even further. Sometimes, if these pressures build up too much, then it is better for him to take a short break from shooting altogether, returning to it with fresh mind after these problems have been overcome.

A Coach can help a shooter to increase his motivation, however, a close friend or family member can help even more in encouraging him during those times when he feels slightly 'down'. Motivation is encouraged by a positive attitude to the sport. This process can be further aided by the setting of adequate achievable goals and objectives. If goals are not being attained, then they should be set lower thus giving him a mental boost. It might be better for him to shoot in a minor match which he can be highly placed rather than a major championship where his score may be near the bottom of the list. There is always a danger of attempts to motivate a shooter turning into pressure and thus being counterproductive.

38.7 Dealing with Mental Problems

There are a number of mental factors that can influence the shooter. Some of these are positive, most are negative. Some shooters have a natural resilience to being adversely influenced by factors which, for another shooter, would be a disaster. The mental problems that may occur and which prevent his true potential from being realised include the following:

Over or under excitement or arousal;
Lack of concentration;

Distracting thoughts;
Negative thoughts about losing (or winning); External pressure.

a) Arousal Level

Arousal level can be conveniently "measured" by measuring the pulse rate and / or blood pressure. That is a simplistic view, as many of the factors are complex, but it is practicable. It is governed by the amount of natural adrenaline flowing and can vary from hyperactive to drowsy. Everyone has an optimum arousal level for carrying out any task. Most people will run faster if they are 'psyched up' such as running away from danger ('flight or fight'), and will concentrate better on a mentally demanding task if they are 'psyched down'. Someone who is 'psyched up' has a short attention span. The typical 'extrovert' is normally under aroused and needs to be aroused mentally just to live his normal life. He needs to be at the centre of the crowd. Leave him on his own and his arousal falls to a level where he becomes soporific and unable to function. The 'introvert', on the other hand, is easily over aroused and needs to be left alone to be at his best for many tasks. He needs to avoid contact with other people who simply arouse him further and raise his pulse rate and blood pressure either of which are detrimental to good performance. Most, but not all, of the world's top shooters are introverts.

Each shooter has an arousal level that corresponds to his best performance. For many, this is the arousal level that pertains whilst he is practising on a familiar range. Most shooters are at their best when their pulse rate is 20 - 40 % above their 'resting' rate. Each shooting discipline will have a different requirement which to some extent will depend on the duration of a typical course of fire. Each shooter will be different too. No generalisations can be made. If he takes part in another sport, such as Squash, then his optimum arousal level for that sport may be different. The journey to a match, the strange surroundings, meeting and talking to strange people and old friends, all serve to raise the arousal level and reduce performance. Once that additional adrenaline is flowing through his system it is difficult to remove. It is more difficult to reduce arousal level than to raise it. There are a number of mental techniques that can be used to lower the level of arousal and to help isolate the shooter from those factors that caused it to be raised in the first instance. Some methods are very simple, thus some shooters hide themselves in a corner with a book before the match.

Under arousal results in a 'sleepy' feeling and it is hard to concentrate on the techniques needed for shooting well. Most shooters have had the experience of firing a shot when they knew that the sight picture was wrong and knew that it would be a bad shot. They had ample time to correct it and yet found themselves firing anyway; they could not stop themselves. Part of this is a result of over training; part is a result of boredom. Mental exercises can be used to improve concentration. Some mild anaerobic exercises can be used to increase alertness without increasing arousal.

Before undertaking any mental training, it is as well to understand some of the causes of stress and mental arousal. One cause of stress is often neglected: it is the act of talking to another shooter. The conversation inevitably turns to scores, equipment or personalities and, however hard they try, sooner or later their minds start to become involved and pulse rates rise. This is why so many shooters subconsciously try to shut themselves off from their fellow shooters and team officials in the hours before a match. Another cause of stress is that tiny questions start to enter their minds at the wrong moment. "Did I lock the door before I left home?" "Did I bring enough ammunition?" "Is my rifle shooting to zero?" Many of these questions can be avoided by

a systematic approach to the final preparations for a match, which should start before leaving home! Another cause of stress is the setting of too high a goal. Unattainable goals are self defeating. In the Chapter on 'Training Plans' in Part 7 on 'Shooting at National and International Level', I will describe a method of setting demanding but attainable score goals.

While much can be done by common sense to minimise those things that raise the level of arousal too high, it is important that, when the common sense approach is inadequate, there is a technique ready to deal with them.

b) Concentration

Lack of concentration is a prime cause of those isolated bad shots. Causes of poor concentration include boredom, fatigue and distracting thoughts. Boredom is the prime enemy of shooters. A badly managed Training Plan (or lack of a formal plan) can result in too much repetitive training without apparently achieving much. A more immediate cause of boredom before an important match is the fact that the shooter may be away from home, away from the 'distractions' of family and work. Some theorists believe that the absence of such distractions helps focus the mind on performance; in practice their absence can lead to boredom. In preparing for a match, the shooter must take this into account and make plans to avoid boredom. A good book and a 'walkman' (or IPod or MP3 Player) will help. Some activities intended to relieve boredom, such as a sports and games, can also raise the level of arousal too high and should be avoided on the day of the match.

This in turn is often the result of over arousal caused by being in a strange country or city and living in a hotel rather than the familiar surroundings of home. If sleeplessness is a real problem, the Medical Officer of the Governing Body must be consulted before taking sleep inducing drugs. A dose of Whisky as a night cap might help, if permitted, (but see the next Chapter on the 'Misuse of Drugs'). Long term mental training such as the use of Autogenic Training or Self Hypnosis is a better solution. These techniques will be described later.

One possible cause of loss of concentration is fatigue. Fatigue may be the result of lack of sleep, or the result of recent physical or mental exertion. However, for most shooters, their sport is an opportunity to relax after a day's work, and their performance is better then than when they are relaxed at a weekend or when they take part in a match! Thus, to the purist, fatigue is a bad thing, whereas in practice, some fatigue can be helpful to minimise distractions. Another cause of fatigue is that brought on by travel. Whilst "jet lag" has been much talked about, just travelling by air to a match on continental Europe can involve 12 hours of travel door to door. Fatigue can also result from physical stress brought about by misguided physical training. Any programme of physical training should be carefully matched to the shooting programme if it is not to interfere with shooting performance. Whilst an early morning jog on the morning of an important match can be beneficial, it will be detrimental if it is not an integral part of the shooter's normal training pattern. Fatigue may also result from the physical stress of the match itself. One of the causes of this is insufficient match preparation and training. There is no point in going to a match in which the full course of fire of 30 + 30 shots is to be fired if, in his normal training, he only shoots a total of 40 shots. His Training Plan should prepare him fully for the match.

c) Distracting Thoughts

Distracting thoughts are an important cause of poor concentration. Some shooters can leave home for the match and leave all thoughts of home and work behind them. Those shooters are rare.

Many have learnt to be able to put those distracting thoughts in a 'pending' bin using visualisation techniques. These techniques will be described later. Some shooters are able to use shooting as an excuse to be able to forget those problems, just like the 'recreational' shooter. This will only be practicable when there are no negative thoughts about the match itself. One common distracting thought is that of 'keeping a score'. The shooter mentally adds up his score, telling himself "I only need tens for the last five shots and I will achieve a personal best score". That is a recipe for a poor shot! He concentrates so much on the score that he is distracted from using the best technique. It helps if, from a very early stage in the shooter's career, he is able to avoid this trap. The only shot that matters is the one about to be fired. The shot he has just fired can have no effect on the next one unless he allows it to do so.

d) Negative Thoughts

Negative thoughts can create internal stress and thus raise arousal level, reduce concentration and thus reduce performance. The most significant negative thoughts arise if there is too much pressure from within the shooter or from external sources to achieve a given performance. Simply setting an unrealistic goal can create this pressure. Team members, family, or 'selectors' can also place pressure on the shooter which guarantees poor performance. Worries about equipment ("Am I about to run out of air?"), the range conditions ("I never shoot well on this range!"), or the range officials ("I don't like being watched!"), can all influence performance.
Not only are they distracting thoughts, but those worries raise the pulse rate and blood pressure and thus affect performance. For some shooters, negative thoughts are their escape route. They need something to blame for poor performance and they 'find' it before the match, ready to produce it as an excuse afterwards. In fact, it is the presence of that negative thought that so easily reduces concentration and thus becomes self fulfilling.

Equally negative, although sometimes thought of wrongly as positive thoughts, is the problem of trying too hard. After an indifferent shot, the shooter "tries harder" for his next shot. As a result his brain is overloaded and he is unable to go onto "auto pilot", thus resulting in an even worse shot.

Another manifestation of negative thinking is the "crutch" syndrome. After an indifferent shoot, the shooter tries to apportion blame, often to his equipment such as rifle or ammunition; maybe to marginally adverse conditions on the range such as distracting noises or unaccustomed poor (or good!) lighting; maybe to the absence of some ineffective "mascot" or fetish. After a match, it may help the shooter's ego to think that his poor performance was the result of some external problem over which he has no control. A typical example is that the shooter is distracted because the score signalling system or CCTV on the 50m range is "different", or that the target changing on the 10m range is slow, or that he has never shot on paper targets before, thus disrupting his ‘perfect’ rhythm. However, the reality is often quite different and that external problem is merely a crutch to lean on and to take comfort from. Once this has happened, although his ego might remain intact, he has not dealt with the real problem which is often inadequate training and preparation. An early symptom of this problem that can be identified in training is an obsessive desire to apportion blame or fault for every poor shot. Most poor shots have no single cause but are a result of loss of concentration, itself caused by over reaction to the previous bad shot! By trying to blame poor trigger technique or an erratic 'swing', he is trying to distract himself from the real cause which is lack of skill or poor preparation.

e) External Pressure

There are many sources of external pressure that can distract the shooter. The most important are those that are trying to force him to shoot well. Although internal pressure like this ("I can do it!") are significant, when there is added to this pressure from a Team Manager or a Coach, or perhaps the Governing Body ("Unless you shoot well you will not be selected again!"), the pressure starts to have its negative effect on performance. There is a big difference between the effects of encouragement and pressure, and sometimes one is confused with the other. All those who are in any way connected with a shooter, especially before an important match, should know the effect that pressure to shoot well may have in making him shoot worse. Again this is an example of trying too hard!

The shooter can easily be subjected to external pressure by the unrealistic objectives determined by the aspirations of others. Family, friends and fellow club members can apply unrealistic pressure, having convinced themselves that he is capable of a performance which he knows to be impossible. This can only be prevented by education. Probably the worst kind of external pressure is that on junior shooters from their parents, mostly well intentioned. How often have we seen media reports about a junior (in any sport) who is "certain" to be selected for next year's Olympic Games, ignoring the fact that they are not yet even in the National Squad! Many promising junior shooters are lost to the sport because they ultimately rebel against this kind of pressure.

38.8 Mental Training Techniques

Most mental training techniques are long term and need to be worked at over a long period of time to be effective. Short term techniques are available but most are only effective if they are supported by a long term mental training programme. Although the "bottom line" is to achieve the optimum state of arousal for shooting, most experienced shooters will agree that this is best achieved by first relaxing and then gently lifting the state of arousal to the desired level.

38.9 Mental Training Techniques to Help Control Stress

For most shooters, because of stress, their state of arousal tends to be too high immediately before and during the match. The overall objective of applying these techniques should be to attain the optimum state of arousal and to improve concentration. A state of relaxation is normally achieved first and then the level of arousal raised, by physical or by mental means until it is at the optimum level. I will not describe the techniques in great detail. They are best learned by being taught by an experienced Coach or counsellor. The techniques include Autogenic Training, Self Hypnosis, Meditation, Yoga and some of the Oriental 'Soft' Martial Arts such as Chi Kung and T'ai Chi Chuan. Other techniques such as Visualisation, Perception and Deep Breathing are more easily acquired. An important feature of many of these techniques is that they demand total concentration in order to use them at all. It is probably this factor that accounts for some of their success. By demanding total concentration, the subject is able to put aside all distracting thoughts and thus more easily control his level of arousal and prepare himself to shoot.

Whilst it is understandable that many shooters see the control of stress and arousal levels as being of the greatest importance in any programme of mental training, mental training has other benefits for the shooter too. Although many of the following techniques can be used to help control stress, and to remove its causes, those other benefits should also be considered. It should

be obvious from the brief description of each technique what those benefits are. These effects should all be taken into account in when putting together a programme of mental training.

Over arousal will result in a faster heart rate and raised blood pressure. Thus it should be possible to monitor the level of arousal by regularly measuring these parameters. If it can be established during training what is the arousal level (i.e. heart rate or blood pressure) needed for optimum performance, then it should be possible to aim at achieving that level during match. Unfortunately this is not quite as easy as it sounds. Unless it is done regularly, taking the pulse rate or measuring blood pressure will, of itself, actually affect those parameters. Inexpensive monitors are available which can measure the pulse rate electronically, giving a direct readout in beats per second. Digital wrist watches are available which have facilities for measuring both heart rate and blood pressure. These devices may not have absolute accuracy but are usually consistent and thus effective. Such instruments can make routine measurements much easier and thus make the use of these parameters more practicable. However, just knowing that a shooter is over (or under) aroused is of little value unless it is possible to change the arousal level and to achieve the optimum and keep it there during a match and the preparations for it.

a) Autogenic Training

As part of an on going training programme, various equipment is available which monitors a range of the body's involuntary autonomic responses. Such things as pulse or breathing rate are obvious; less obvious are the electric signals generated by the brain whilst it is carrying out various tasks. Used properly, the shooter can learn, by careful rehearsal, to control some of these autonomic responses. However, whilst such equipment, if available, can be a valuable part of the shooter's training resource; they are too specialised for general use and cannot be used at all during a match. Autogenic training is a way to do this without access to expensive hi-tec. equipment.

Autogenic Training, or Biofeedback, was introduced by Dr. J W Schultz, a German Neurologist, in 1932. The technique has been subject to considerable refinement since and is very popular with many sportsmen and women, particularly in Continental Europe. Several books have been published on the subject but, for maximum benefit, it should be taught on a one to one basis by someone, such as a Coach, who has been trained in the technique. Some people cannot use the technique because it creates disturbing brain signals. Others should not use it because, unless it is done under medical control, it can affect such conditions as diabetes or heart disease. The technique has been used effectively to control both of these medical conditions.

The technique consists of taking over some control of the body's autonomic functions such as heart rate, breathing or body temperature, and using this control to 'manage' stress. At the end of a session, which may last about 15 minutes, the subject is usually in a state of complete relaxation and the Autogenic condition must be 'cancelled' by a simple stretching exercise. Once the ability to induce a relaxed condition has been established, it is possible to go quickly into that state by means of simple trigger actions that are built into the programme.

Whilst in an autogenic state, the subject is not only relaxed but is very receptive to positive imagery. For the shooter this can be the perfect lift of the rifle into the shoulder, the perfect sight picture, the optimum trigger release etc. However this part of the technique only comes with long experience. Autogenic Training is not a short term solution to a problem but must be worked at. The late Malcolm Cooper, World and Olympic Rifle Champion, used Autogenic Training to control his heart beat. He demonstrated on UK Television (“Tomorrow’s World”) that he could actually suspend his heart beat for several seconds so as to minimise any disturbance whilst he fired the shot.

Caution. Autogenic Training is a very powerful psychological tool when used correctly. To be effective, the techniques must be learned gradually without any attempt to rush the learning process. Many people have been put off from using it because their early experiences led to some psychological disturbance such as vivid 'nightmare' images. This is often the result of trying too much too quickly. If such disturbances are experienced, Autogenic Training should be stopped and only resumed from a very low level, if at all. Autogenic Training can also be used to control such autonomic functions as heart rate and blood pressure. Its use in this way should not be attempted except with expert guidance or under medical supervision.

b) Self Hypnosis

This is another established technique that can be used to induce a feeling of freedom from stress and to isolate the mind from distracting or disturbing thoughts. Whilst in the hypnotic state, the subject's mind is open to suggestion. The effects of Autogenic Training and Self Hypnosis are, in many ways, very similar. However, a state of Self Hypnosis can be induced by using an audio tape, whereas Autogenic Training must be totally under the control of the subject. A number of different audio tapes are available commercially for use in a 'walkman' to deal with relaxation, overeating, giving up smoking etc. These can be very effective but should only be used as part of a long term programme of mental training. They can be particularly helpful in inducing restful sleep when the subject is in an excited state, and this specific application is probably where they are most useful.

Caution. Self Hypnosis, as described, is probably harmless and can be effective for its intended purpose. Hypnosis by a second party can be harmful if misused and should be avoided unless the practitioner is fully qualified and registered.

c) Yoga

This is another long term training aid. Many people are put off Yoga because of its origins in the mystic religions of the East. Most of the standard textbooks use language that reflects those origins. There are many forms of Yoga available that combine meditation with some basic anaerobic exercises. However, if you look below the surface, Yoga has much to recommend it as part of a mental training programme. It is the meditation that is probably of most value. If the religious connotations are taken away, what is left is a sound series of mental exercises that both relax the mind and improve concentration.

Meditation alone is a form of visualisation that itself can be a valuable part of a training programme.

d) The 'Soft' Martial Arts

These include such techniques as Chi Kung and T'ai Chi Chuan. They consist of gentle exercises involving controlled breathing and deliberate movement and postures. Because they are mentally demanding, they help the subject to remove from his mind the negative and distracting thoughts that can have such a negative effect on his performance, and help him to relax. Although these techniques should be taught by a skilled practitioner, many books are available which can be used by a novice to gain some insight into their possibilities.

e) Deep Breathing

Although this does form an important part of some forms of Yoga, it has a value in its own right. To help you to relax, take a series of slow, deep breaths, concentrating on using only the stomach muscles and diaphragm rather than the chest. This is even more effective if you can also visualise the breath as it leaves the mouth and nose thus making it a form of meditation too. Steady deep breathing is very effective in reducing stress and promoting a relaxed state of mind. It is a psycho-physical technique that takes little effort to master and can be used at almost any time, and there is little danger of becoming over relaxed. It works in two different ways. The first is physiological. Deep slow breathing like this ensures that the blood is supplied with plenty of oxygen but, if done only from the diaphragm or stomach muscles, does not drive out all the carbon dioxide. The raised carbon dioxide level in the blood has a slightly sedative effect. The second effect is psychological. Breathing, like the heart beat, is an autonomic function, but one of the few autonomic functions which the conscious system can easily take over. Because the chest muscles are used by the body to take in 'emergency' supplies of air when stressed, using only the diaphragm is a strong positive statement that we are relaxed. Like many other techniques, this needs concentration and it tends to divert our mind from any immediate worries. At the same time it demonstrates to yourself that you can control your own autonomic functions. Because this form of deep breathing has a close analogy with the deep breathing associated with relaxed sleep, the calming effect is marked. It is particularly useful before a match but only if it has been practised beforehand. After a session of such a breathing exercise, a few full breaths (but not 'hyperventilation') should be taken quickly to purge the lungs of excess carbon dioxide which can cause slight drowsiness.

Deep breathing can be useful during the match itself to counter any last minute nervousness. It is also useful to counter any tendency to lose concentration. However, this should be full deep breathing using the chest muscles as well as the diaphragm. A yawn is a subconscious form of deep breathing or hyperventilation that the body makes in response to a carbon dioxide level that is too high. Immediately after firing a shot, after the breath has been held for a few seconds, the shooter will take a few deep breaths to purge out the carbon dioxide and replace it with oxygen, almost without thinking. If deep breathing has been used as a training aid, this enforced deep breathing during the match should be carried out deliberately when it will be associated with a state of 'relaxed alertness' rather than a state of anxiety.

Deep breathing can be made combined with a simple meditation exercise. Most forms of meditation, when stripped of their religious significance, are a means of inducing a relaxed state of mind. Because they are demanding mentally, they can also help improve concentration. One simple exercise in meditation is the Breath Counting Meditation.

Sit comfortably and close your eyes. Take deep breaths, counting down with each breath starting with any number above ten.

Inhale Exhale 10
Inhale Exhale 9
Inhale Exhale 8 etc.

The breathing should be from the diaphragm and, whilst doing so, try to visualise each breath. If you lose count, start again. Eventually you may want to start from 20 or even 100. When you reach zero or want to stop, the exercise, clench your fists, stretch your arms, take a deep breath in, open your eyes and breathe out.

Deep breathing should not be confused with 'hyperventilation'. In hyperventilation a very deep breath is taken, using both the diaphragm and chest muscles, followed by full exhalation. Whilst this ensures that the oxygen supply to the blood is replenished, it also reduces the carbon dioxide

level in the blood too much. If the carbon dioxide level is too low, the blood pressure will fall and pulse rate rise. This can cause momentary dizziness or even lead to a 'faint'. Although probably not dangerous, there are probably no beneficial effects either, and clearly any dizziness would be very undesirable during a competition. Thus hyperventilation should be avoided.

f) Exposure to Stress

There can be no doubting that match experience is worth a lot in improving performance. It is regular exposure to match stress that can help the shooter most in combating its effects. Unfortunately, very few shooters can get sufficient match exposure and it is important that they take every opportunity offered to them. This may come from taking part in some other shooting discipline or even some other sport. To be effective, the shooter must have the right attitude of mind to this form of training. He must compete at a level that is compatible with his own performance standard so that each competition is a real challenge to him. It can be most helpful to be able to compete with another shooter or sportsman who has a similar performance, thus making each encounter a challenge. If shoulder to shoulder matches cannot be arranged, it is often possible to arrange a 'postal' match. In shooting, as in most sports, too many shooters are afraid of match stress, or rather, they are afraid of losing or of performing badly. This is why so many 'club' shooters avoid taking part in the more important National or Regional championships. The shooter who wants to succeed will deliberately seek out or even create stressful situations in order to immunise himself to its effects in the important match. He will also try to understand the effects of stress on his performance and seek the means to counteract them.

On a purely practical note, anyone working in a stressful job may well find that shooting is a relaxation. Even the stress of major competition, if he approaches it in the right state of mind, can be a relaxing experience.

g) The Use of Music

One neglected technique is the use of the appropriate mood setting music. The 'walkman' (IPod or MP3 Player) has made this easier, but much of the music used has been chosen to act as a distraction rather than as part of any systematic mental training programme. Music can be used on its own or as an integral part of some other technique. Apart from the pure pleasure of listening to a favourite piece of music, there are three distinct types that can be helpful.

There is the music that is totally demanding. This is the type of music that conjures up vivid mental images. It may be sad music or joyful, or the type of music with unpredictable changes of mood or rhythm that demand your full attention. Most people have their own favourites that they use to mask their worries and thoughts, and to isolate themselves from their environment. Such music can be helpful on the day or evening before the match to help create a personal environment conducive to good performance the next day. The choice of this type of music is a matter for each shooter. The music that is effective for one shooter may not be suitable for another. Along with this type of music are the tapes using the spoken word: comedy or perhaps drama such as the 'speaking books' that are available. Because any audio tape in this class is totally demanding, it is not possible to read a book whilst listening, and so the visual receptors in the brain are not fully isolated from the surroundings unless the eyes are kept closed.

The second type is mood setting music, usually with a steady predictable rhythm. It is the 'Musak' often used in the Dentist's waiting room to calm your nerves. Much of the orchestral and instrumental music of Mozart comes into this class, so does much of the music written as

incidental music for film and television such as that composed by Ennio Morricone. Carefully chosen to suit your own musical preferences, it can be invaluable in calming you down and helping reduce your state of arousal before a match. Several audio tapes of music specially chosen to aid relaxation are also available, and the music is sometimes combined with the spoken word to reinforce its effect. Care should be taken that the effect is not too relaxing and causes drowsiness.

The third type is the strident music with a definite 'beat' that makes you want to tap your feet. It has a predictable theme, the type of music you want to whistle. It should not be demanding to listen to, rather the type of music you can work with in the background. This can help to increase your alertness during the final stages of preparing for a match.

It must be emphasised that the ISSF Rules do not permit the use of "receiving devices" whilst shooting, and these can be taken to include any sound producing device!

h) A Good Book

The value of a good book has already been mentioned. Unless you have a favourite book that you want to read again, or a favourite author, a book can be unpredictable. The book needs to be demanding to read, but not so demanding that you cannot read it whilst you have something else on your mind, such as the match ahead. It must not be so demanding that you cannot put it down and forget it easily. Sometimes the articles in a hobby magazine, because they are short, are good to read. It can be helpful to combine reading with an audio tape of suitable music. In this way both the audio and visual senses can be isolated from unwanted distractions.

38.10 Cancelling Out a State of Relaxation

Many of the techniques described are good at reducing stress and the level of arousal. However, most will, too easily, reduce it too far, and the shooter will not be sufficiently alert to shoot well. Before he shoots, he must bring his state of arousal and alertness back up to that necessary for him to shoot well. This is much easier than reducing it! It is best done by purely physical means if there is not to be a danger of introducing conflicting or distracting thoughts. Simple muscle tensioning and stretching exercises, such as fist clenching and arm stretching, along with rapid deep breathing (but not too deep) will all raise the level of arousal quickly. This should always be done after any deep relaxation exercises to bring yourself into a fit state to shoot. Finding a nearby (solid) wall and try to push it over usually works well.

38.11 Other Mental Training Techniques

The following techniques will be found helpful to most Moving Target shooters. Again they should be incorporated into a formal training programme along with the techniques described in the earlier sections of this chapter.

a) Improving Concentration

Apart from removing some of the causes of poor concentration, there is much that can be done to improve it. A simple mental task such as the following can help. The following are random numbers between 100 and 999. Time how long it takes you to write them down in the correct sequence:

434	863	203	347	284	447	798	350	549	172	159	992	177
575	139	153	937	908	673	862	935	503	174	629	180	997
893	773	502	819	636	324	383	173	438	434	371	815	402
682	894	799	820	549	761	478	404	977	349	817	492	445
858	531	599	173	471	186	444	397	653	438	815	277	114

Can you improve on 8 minutes?

Another simple exercise is to concentrate your mind for about one minute on a simple object in front of you such as a pencil. Now close your eyes and time how long you can hold the recall of the image of that object. Can you hold the image for 30 seconds?

Another very helpful exercise is as follows: Sit in a comfortable position, eyes closed. Now breathe deeply and slowly, counting each breath. When you have reached ten, start again at one. Use a stop watch to time yourself. How long can you keep it up without 'losing count'? This exercise is very subtle. Controlled deep breathing like this is an excellent way to relax. However, the need to keep an accurate count demands that you must remain alert. Thus, to be effective, the rate and depth of breathing is adjusted subconsciously to optimise these two conflicting needs. Such a balance between the needs to be both relaxed and alert is exactly what is needed when you are shooting

b) Visualisation

Visualisation is the name given to a series of techniques which can be used to improve performance in any sport. One important feature of all visualisation techniques is that they demand total concentration. Thus, although they have a value in themselves, they have a secondary value in that they force the subject to put aside the distracting and negative thoughts that can adversely affect his performance. Visualisation techniques can be a good way to relax, even though they can be hard work to master.

Probably the most powerful technique is a form of mental rehearsal. All the actions need to prepare for and fire a shot are visualised. The shot should be a good one, within his normal 'area aim' (see the chapter on 'The Aim'), but not necessarily perfect. It should be compatible with the shooter's physical and technical ability (see the earlier section on Goal Setting). Many shooters make the mistake of trying to visualise only perfect central 10's knowing that they can never hope have such a perfect aim every time. No shooter, in any recognised discipline, is capable of firing only perfect shots, in the ultimate he is limited by his equipment, ammunition and range conditions. In practice he is also limited by his ability to hold and release a good shot. Thus the way in which he visualises a 'good' shot should be compatible with his actual ability. For all practical purposes, if he can keep every shot in a 10m Running Target match inside the '9' ring, then he will eventually equal the current world record score. For many 'club' shooters an area aim equal in size to the '8' ring is the limit of their ability, even larger for the fast runs, and this should be reflected in their visualisation of a 'good' shot.

It is difficult at first to visualise one shot, but with practice it can be done for a whole series of 30 shots. Not only does this exercise help improve concentration, but it can only be done whilst in a relaxed state. This encourages the shooter to relax in order to achieve his objective of visualising the series.

In many sports there has recently been a realisation that this form of 'mental rehearsal' can give many of the benefits of 'live' training without the risk of injury. In fact some injured athletes have continued to 'train' mentally although they have been unable to work on the track or field because of injury. As a result, when eventually declared fit, they have been able to resume full normal training and competition with little loss of performance. However, it must be emphasised that the potential was already there and had been fully developed, waiting to be realised through mental training.

Another way in which mental rehearsal is invaluable is to rehearse each shot immediately before the rifle is brought to the ready position. This can be part of the shooter's preparation for every shot. It also helps him to pace his shots and ensure adequate rest after reloading. The main benefit is that it helps him focus his mind on the immediate task, which is to execute a good shot, and it helps to improve his powers of concentration. However, it must be done within the time limits allowed.

Visualisation techniques can also be used to improve concentration and to induce a positive attitude to shooting. In its broadest sense it is used to think through every possible contingency and to make plans to deal with any that arise. The next stage is to use visualisation to convert an adverse situation into a beneficial one. If the range is wet and cold, visualising a dry warm range can help overcome the conditions. In the extreme, the shooter can mentally transport himself during a match, back to his familiar training range in ideal conditions, thus giving himself a 'home' advantage.

Visualisation may also be used to combat directly those worries that affect the shooter before the match. If you sit comfortably, hands on knees and imagine you are sitting at a desk with paper and pencil in front of you. Now write down an imaginary list of all those worries that you have and which you know will emerge as you complete your final preparations for the competition. Now take the paper and fold it in two; then place it in an imaginary 'pending' file. After the competition, you must repeat the exercise but this time remove the paper and see which of those worries are still important to you. This final review of your worries is an important part of the process that must not be omitted.

Visualisation is also an important component of such techniques as Self Hypnosis where it can be used to recreate a vision of a relaxing situation and help reduce tension. Another way in which it can be used to promote a state of relaxation is as follows. Sit in a comfortable position, hands on knees, head forward and eyes closed. Now start with your right foot. Can you 'feel' your toes? Do this for about a minute and then go to your left foot. Now work up through your body with calves, knees, thighs, stomach, chest, neck, arms and hands. With practice, you can even feel your heartbeat and measure your pulse rate this way. Finally, clench both fists hard for a few seconds. When you unclench the fists the feeling of complete relaxation is instant. This technique works for many shooters who are uncomfortable with Autogenic Training or Self Hypnosis. It can be used immediately before a match to quell those last minute worries.

c) Perception

Perception is how you interpret and act upon the information provided by your senses. It is closely related to visualisation. During routine training, take up the shooting position and, with your eyes closed or in a darkened room, take time to try to perceive mentally every part of your position and the actions needed to release a good shot. The position of your feet; your 'swing'; the way you place your hands on the rifle; the pressure you use to hold it and to pull it into your shoulder; the feel of the trigger. Under stress, you may suddenly become aware of these feelings

and, if you have not experienced them before, under controlled conditions, they will feel 'wrong'. If this process is taken further, then it verges on the philosophy of Zen that includes the total awareness of the body.

Every shooter has a perception of his rifle. The more experienced he is in using it, the more positive that perception becomes. His perception may be either good or bad and may change from time to time; it is seldom neutral. Thus if his perception of his rifle is bad, this will influence his performance with that rifle, almost any other rifle will be perceived to be good and he will seek to change his equipment. If his perception of his rifle is good, then he will be biased against different rifles and will find difficulty in shooting with a different rifle. Thus, if he changes his rifle, for whatever reason, the way in which he adjusts to the new rifle will be determined by his perception of the old and the new rifles. This may have very little to do with their technical merits. This is why some shooters seem to change their rifle, or other equipment, frequently. What they are doing, subconsciously, is to use their equipment as a scapegoat for their own inadequacy as a shooter. This should not be condemned, it does sometimes work and by offloading all their problems onto one item of equipment, their performance does improve significantly.

The one item that causes every shooter more problems of perception than any other is that of the feel of the trigger. So often, if a shooter has a poor result, he will blame the trigger of his rifle. The more sophisticated the trigger mechanism, the less happy he is with it; he is never able to adjust it to his satisfaction. The answer to most of these problems lies with his perception of the trigger. If he perceives the trigger to feel differently to what it really is, then it will always be 'wrong'. When everything is going well, the release of the trigger is automatic. The shooter is not even aware of having felt it. When things go wrong and he is looking for something to blame, he suddenly becomes aware of the trigger. The problem is more likely to lie with the way he operates the trigger than with the mechanism itself. To understand the trigger better try releasing the trigger of the unloaded rifle in a quiet, darkened room. Ear muffs and eye shields should be used to cut out all auditory and visual stimulation. Deprived of such stimuli, your mind is now concentrated on the sense of touch which is now much more important to you. Thus the feel of the trigger is now learned more quickly and is not forgotten easily. When this feels satisfactory, support the rifle on a firm rest and 'shoot' the unloaded rifle at a stationary target. Finally, dry fire the rifle at a moving target. Dry firing is an important training technique under any circumstances, but if there are problems with trigger release, this exercise will help reassure you that the trigger is smooth, and that it can be released without disturbing the aim. The same method can be applied to perceiving the weight and balance of the rifle which the shooter only becomes aware of when under stress and everything seems to be going wrong. The method can also be applied to any part of the process of raising the rifle, aiming and firing the shot. This sensory deprivation technique can be invaluable when transferring from one rifle to another such as when more than one sub discipline is to be shot during an event. It is the best and quickest way, short of an extended period of re-training, to adapt to the different feel of the rifle, trigger etc.

One reason why some shooters have problems with their perception of the actions necessary to fire a successful shot is that they have undertaken too much meaningless practice. The actions that are necessary should be rehearsed until they are carried out automatically without any need to think about them. However, the shooter must always remain in full control. When he goes into full 'autopilot' he is no longer benefiting from his practice and his training programme should be adjusted accordingly. If he persists in such meaningless practice, then he will find that, under the stress of a match, he is suddenly aware of his actions and they are unfamiliar to him. This is when he becomes dissatisfied with his trigger action or the 'feel' of the rifle.

Another very important matter for a Moving Target shooter is the perception of time. The Running Target or Running Boar must 'run' across the range in a time of 5.0 - 5.2 or 2.5 - 2.6 seconds. Would you be aware if it ran in 5.3 or 2.4 seconds? A most effective way to improve your perception of time is as follows: Take a stop watch in your hand. Without looking at it, start it and then stop it again when you think 5.0 seconds has elapsed. How close were you? It should not take very long until you can estimate 5.0 seconds within one tenth of a second. Now try to estimate 2.5 seconds in the same manner. The same technique can of course be used for the 4.3 seconds timing of the Running Deer range. Until the novice shooter has learned to perceive the timing of the run in this way, his progress will be slow because it governs much of the way a Moving Target shooter responds to the movement of the target. A simple extension of this technique is that every time you need to look at your watch, first estimate what time it is. It is surprising how accurately you can learn to estimate the time correctly even over a few hours!

The next step is to visualise the target's run as you time yourself, thus integrating this exercise with the visualisation exercises described earlier. Whilst mentally conjuring up an image of the target running across the opening, try to estimate the time of the run and 'make' the target run at the correct speed. This requires both a good sense of timing and considerable power of concentration, but the end result is the development of a rhythm that is almost independent of the shooter's observation of the target's run. Relating the visualisation process to a real time in this way enhances its effect.

d) Sleep

It is important that a shooter is able to have a normal night's sleep before any important event. What is considered to be normal will vary from shooter to shooter. Pre-match nerves, excitement, a mind filled with new images of new places, a strange bedroom and the unaccustomed presence of a fellow shooter as room mate can combine to prevent restful sleep.

Most of the techniques used to induce a calm mind before a match can also be used. However, sometimes stronger measures may be needed. It is better, if practicable; to give in to wakefulness rather than to fight it if this can lead to negative feelings. To sit quietly for an hour, listening to some calming music and reading a good book is better that spending two hours lying awake restlessly. A warm milky drink, if practicable, immediately before going to bed will also help. A small measure of spirits, unless prohibited by local rules, may also help. Any effect may be short lived. However, this is unlikely to be of any value unless the shooter is normally a light drinker.

38.12 What is the mental make-up of a successful shooter?

In general, the same as the mental make-up of any successful athlete or business person. A study carried out a few years ago in the USA has given us some helpful guidance. A number of sports Coaches were asked to complete a questionnaire on the mental attitude of both a successful athlete and one whom they deemed to be a failure. The results from all the Coaches were combined. They showed that the successful athlete was more likely to work hard in training, was more likely to blame himself for a poor performance, was more likely to adopt changes suggested by his Coach. He learned well, would focus his mind on the next event and tended to deliver a more consistent performance. The under achieving athlete was lazy, would find excuses for a poor performance, tended to make excuses for not following the Coach’s guidance, was a slow learner, tended to think more about his ultimate performance (i.e. becoming World Champion) rather than his performance in the next match, and his performance was more erratic. There were

other differences too, such as the fact that the successful athlete was more likely to be a well rounded individual who integrated well with other people and had a good sense of humour.

Now, whilst it is clear that some of the factors could be seen to have a direct affect on performance, it is not at all clear that some of the factors might not themselves have been as a result of good (or indifferent) performance. However, such a study does suggest ways in which the Coach might identify the probable successful shooter from the probable under achiever, and is worth considering. The results are reported in a book "Sports and Psychology" by Frank Ryan.

38.13 Gamesmanship

Of all sports, shooters are probably the most supportive of each other, none more than the Moving Target shooters. This comes directly from the nature of the competition. Each shooter is alone on the firing point; his conflict is only with himself. He accepts that if he can put up a personal best performance, then the fact that he was still beaten is unimportant. Many Coaches and Psychologists used to dealing with other sports where the athletes are in direct conflict with their fellow competitors have difficulty in understanding this unique feature of the target sports.

Thus it is normal for a shooter to congratulate another on a good performance even though he himself has yet to shoot. This is almost unheard of in most other sports. However, some shooters prefer not to look at the scoreboard until after they themselves have shot, thus isolating themselves from any negative thoughts that may be generated by this knowledge. This is a little different from other rifle shooting disciplines where all the competitors shoot together and thus don’t know how their rivals have performed until later.

Likewise, if any shooter is having technical problems with his equipment, offers of help can overwhelm him, even from close rivals. Most shooters, in all disciplines, are more concerned with improving standards overall than with their own performance, provided that it meets their own goals. Moving Target shooters will frequently comment to each other on nuances of technique or equipment. They are free with information on new techniques or equipment that has helped them improve their own performance.

However, such comments can work in two radically different ways. A rhetorical question like "That technique is different?" could be taken in two ways. It could be seen as an innocent and well intentioned query; or it could be seen as an attempt to undermine the confidence of the other shooter. Thus, immediately before a match, shooters tend to 'clam up' shutting themselves into a sealed cell, oblivious of such comments from around them. The camaraderie of the previous day when they arrived at the match venue and first inspected the range has gone and has been replaced by sullenness. After the match, when the results have been announced, the good humour returns and the party begins!

Although there will always be some good natured 'gamesmanship', hopefully in shooting this will never reach the depths reached in some other 'sports'. All shooters should be aware of the kind of seemingly innocent comment that could lose them confidence in their techniques or equipment. Many of the mental training techniques dealt with in this chapter will help them to overcome such negative thoughts. The best way to combat them is through comprehensive and well planned training which gives the shooter confidence in both his techniques and equipment, leaving nothing to chance and negative thoughts.

At the same time shooters should be aware that they themselves could, unknowingly, undermine the confidence and hence the performance of another shooter. This is most often in their own team, perhaps in another discipline. Team managers and officials are usually aware of such negative influences and will try to prevent them.

Chapter 39 Physical Training

Shooting is considered by many athletes to be a very sedentary 'sport'. It is true that it has a lot more to do with fine motor skills than with speed or power. Nevertheless, just to load a rifle and then to raise it to the shoulder more than 60 times during a competition does require the shooter to be fit. To this must be added the training and dry firing exercises needed before that competition. There can be no doubt that a good level of general physical fitness is important. It is more difficult to decide what type of physical training and how much should be undertaken. In this book there is insufficient space to go into details of possible physical training programmes; nor would it be appropriate. There are many books on the subject already, and each shooter has his own special needs. However, it is appropriate to give some general guidance on the needs of the shooter so that he can decide his own programme.

During the 1980's, the British Broadcasting Corporation (BBC) broadcast a series of programmes called 'The Superstars' and 'The Superteams'. In these, leading sportsmen and women, from a wide range of sports, were asked to choose six out of eight 'new' sports and to compete against their fellow sportsmen in front of an audience of millions. The winners would be the Superstar or Superteam of the year. One of the sports was always a 'target' sport such as shooting or archery. During the final three years of the series, the programme producer was persuaded to include 10m Running Target shooting. The event used the older 10m Running Boar target, reprinted with bolder scoring rings to make it more 'photogenic'.

For those of us involved in making these programmes, it was an interesting exercise in coaching. Most of the athletes had previously never fired a rifle at all. We were given less than 10 minutes to instruct them in the technicalities of Moving Target shooting. They then had to shoot two sighting shots and ten shots to count in front of the cameras. It was also interesting to observe how the different groups of athletes, supposedly amongst the fittest persons in the world, coped with this different event. It was the boxers and footballers who were least able to cope. It was interesting to discover why this should be so. By observing them shooting, we saw that they showed all the external signs of extroversion and even tended to be hyperactive. Their ability to concentrate was limited, they were constantly 'twitching' and trying to be ever on the move. Others, such as the more muscular athletes tended to use their strength to 'control' the rifle rather than just support it.

In the very last programme, Lynn Davies, a former Olympic Gold Medallist in the Long Jump, and reigning 'Superstar', declined to take part in the shooting even though he had shot very well in previous competitions. When asked "why?" He said that he was unable to cope with the weight of the rifle. Yet he usually won the weightlifting event in the ‘Superstars’ by lifting well over his own body weight. He demonstrated by showing us that when he held the rifle, he could not hold it steady. It was soon obvious why. Almost every muscle in his body was locked rigid. He perceived that the rifle was 'heavy', and he used every ounce of his strength to hold it. The result was that he induced tremor, and the rifle would not stay still. In fact, the rifle should be supported by the skeleton and not by muscle power. It needs only minimal strength to guide it and to hold it on the target. When I challenged Lynn and asked him how well he would jump if his arm and shoulder muscles were as tensed up as much as his leg muscles were just to hold the rifle; he said: “I need to think about that”. I met him again several months later when he said: “If I was still jumping you have put half a metre onto my distance”!

The athletes who coped best with the shooting were those whose own sports included a high level of motor skill and coordination such as the racquet players. An outstanding performer was the

then World Karate champion. The conclusion at the end of making the series was that whilst physical fitness is an asset to a shooter; 'super fitness' is not. Physical training, like all forms of training, is a means to an end and must be related to its objectives. In other words, the shooter must be 'fit for purpose'. Overdeveloped muscles are less able to cope with the fine motor skills needed to execute an accurate shot, especially when one group of muscles dominates. There is also a danger from over training in that, if the training is not maintained, those muscles will lose their flexibility and the end result may be worse than no training at all. There is much evidence from other sports of the 'muscle bound' athletes whose condition has deteriorated rapidly after they gave up active sport.

39.1 The Need for Physical Fitness

There are three basic needs; firstly to achieve a good general level of fitness; secondly to improve stamina and thirdly to ensure that the stresses to the body caused by shooting are do not cause harm.

Any physical activity is potentially harmful if carried out to excess, without proper preparation or without the use of suitable protective clothing. The stress to the body, particularly the spine, caused by repeatedly lifting the weight of a gun and supporting it can be considerable. However, the ability of the body to withstand such stress is increased by regular training and practice. Undoubtedly, the most effective physical training for Moving Target shooters is that provided by shooting at moving targets. This rehearses all the muscles that are likely to be called upon during a competition. Most shooters are aware of how, after even a short period of not shooting, they feel tired even after a shortened course of fire. Unfortunately, this form of physical training is only one part of the story. Injury is more likely to occur following a period of intense training after a period of inactivity. Injury is also more likely if one group of muscles is stressed whilst other associated muscles remain under used. Fortunately, in shooting, the actions needed to load and mount the rifle largely complement those used to hold and shoot it thus helping prevent injury. The enforced break whilst reloading also helps. However, there is significant stress on the leg muscles whilst standing still for perhaps 15 minutes at a time without any opportunity to move and thus relieve that stress.

In any shooting discipline, the most effective form of physical exercise is that which is based on the physical demands of the discipline. In other words, physical exercise should be an extension of range training and complement it. Dry firing exercises, the action of raising the rifle to the shoulder and tracking a moving target for five seconds, or even 'snap shooting' at a mark on a wall, is effective physical training for a Moving Target shooter. Should the shooter be unable to attend his training range regularly, then these lifting and holding exercises will ensure that his muscles do not stagnate but remain supple and active. There is a case for using a rifle that is rather heavier than normal thus enhancing the muscle power needed in the match. However, any attempt to add weights to the rifle will also change its balance significantly and so this form of training is not recommended.

If Moving Target shooting were to be the only form of physical training the shooter used, and he concentrated much of his time to training 'on the range', he would soon become bored and performance would suffer. This was dealt with earlier in the chapter on 'Practice'. This boredom from over training is a major factor in inhibiting the performance of any shooter. Another important factor is that concentrating on only a few muscle groups in this way will lead to a significant muscle imbalance that could have long term detrimental effects on the shooter's general well being. A programme of physical training that compliments the natural training

provided by shooting is beneficial, and will prevent the injuries that excessive development of a limited group of muscles can cause.

39.2 Stamina Training

This is where general physical fitness is important. Any programme of general fitness training should include exercises to improve stamina. Walking is a good general exercise for this purpose, so are jogging, cycling and swimming. All of these, even walking if done briskly, are aerobic and help increase the capacity of the lungs and heart to carry and use oxygen efficiently. However, there is a danger in over exercise, jogging in particular. Repeated impact of the heels on hard ground can damage bones (stress fracture), and injure the knee joints and achilles tendons. It is essential that well fitting footwear is worn which has been designed for jogging. Not all athletic shoes are suitable.

There is also a hidden danger in any form of endurance training. After a while, an activity such as jogging, swimming or cycling can cause the body to produce substances called endorphins. These are naturally occurring anaesthetic agents which help neutralise the pain caused by repetitive training (i.e. the 'pain barrier'). These substances circulating in the body try to disconnect the brain from the sensory receptors, something definitely not recommended for a shooter. Their effect can last a long time, certainly several hours and even days, and when they are eventually used up, the athlete can suffer from withdrawal symptoms. They are addictive. Thus any form of endurance training should be confined to activities that are relatively gentle and which do not overstress the body. The more stressful physical training must be broken up by periods of rest e.g. 'circuit training'.

39.3 Aerobic Training

Aerobic sports and games are also valuable, but also in moderation. Games such as tennis, badminton, squash and volleyball can be good, but shooters should be aware of the danger from sports injuries. The eyes are particularly vulnerable when playing squash and protective spectacles should be worn. An over vigorous approach to these games could also result in damaged ligaments or even broken bones. The more violent 'contact' sports such as Rugby Football are best avoided altogether.

Not only will an appropriate programme of aerobic training improve general fitness, but it will help increase lung capacity. This can be important in helping the shooter achieve the best conditions to release his shot with his lungs partially inflated and stable. During training, the pulse rate should be allowed to rise to at least 50% above normal with a corresponding rise in the breathing rate. You should feel slightly out of breath. However, older or unfit shooters should take professional advice before subjecting themselves to any greater load than this.

Research with track and field athletes (BBC2 'On the Line' July 1993) has shown that training, if carried to excess, can lead to an increased susceptibility to illness. It would appear that the stress of intensive physical training or competition can lead to a reduced immune response. As a result, many athletes have reduced the volume and/or the intensity of their training but increased its quality. This has benefited their overall performance by reducing the incidence of unspecified 'virus' infections. One recommendation resulting from this study is that no intensive physical training should be undertaken if the athlete has any of the precursors of a cold or influenza such as a sore throat or raised temperature. The natural immune response will often cope with these

early symptoms unless it is depressed by physical stress. The already lowered immune response caused by such an incipient viral infection should not be lowered even further by intensive physical training. Under these circumstances, the shooter should be careful not to persist in a physical training programme. Particular care should be taken to avoid exacerbating any minor injury such as muscle strain. Undoubtedly some exercise can assist the natural healing process, but inappropriate exercise can make the injury worse.

39.4 Anaerobic Training

Anaerobic exercise is also valuable. Weight lifting, 'circuit training' and the facilities of a 'power gym' all have their place but again in moderation. As was illustrated by the 'Superstars' exercise, overdeveloped muscles can lose some of their ability to exercise fine control. Other less demanding anaerobic exercise in which muscles are stressed to about 60% of their maximum workload may be more useful. These include 'sit ups' and 'press ups' and simple stretching and flexing exercises such as the following:

(i) Stand upright in the shooting position. Raise the upper arms level with the shoulders; elbows bent, finger tips on the shoulders. Swing your body through 90^0 in either direction several times.

(ii) Lie flat on your back on the ground, hands by your side, palms down. Raise your neck and shoulders from the ground, followed by your legs. Raise your legs until they are vertical. Hold this position for a few seconds and then repeat several times.

(iii) Kneel on the ground, your body upright and with your weight supported by your knees and the tips of your toes. Place your hands on the back of your thighs. Allow your head to fall forward; now stretch backwards until your spine is slightly arched but steadied by your hands on your thighs. Hold this position for a few seconds then repeat several times.

(iv) Sit on the ground with your legs parallel in front of you, body upright and supported by your hands flat on the ground near your buttocks. Allow your head to fall forward. Now bring your head back, leaning back with your body supported by your hands. Now raise your whole body with knees bent at a right angle thus forming a flat 'table' supported by your arms and lower legs. After a few seconds, relax and lower your body. Repeat the exercise several times.

(v) Lie on the ground face down. Place your hands near your shoulders and slowly raise your body clear of the ground supported only by your arms and the tips of your toes. Next raise your buttocks and draw your feet and hands a little closer together so that your whole body forms an inverted V' with feet and hands flat on the floor. After a few seconds, relax and lower your body. Repeat the exercise several times.

Again, some care should be used in carrying out these exercises if there are any minor injuries or pain such as back pain. For additional anaerobic exercises then it is suggested that reference is made to almost any book on Skiing that includes a suggested programme of pre-ski exercises. Most of these are designed to improve muscle tone and are suitable for inclusion in a shooter's training plan. Some shooters find a 'grip' exerciser or a soft rubber ball to be useful. The Keep Fit Instructor at the local gym may be able to advise on exercises which will help your shooting. Unfortunately, not all Instructors are qualified, nor do they understand the special requirements of a shooter. Such advice should be treated with caution.

Except for exercise 1, these and the aerobic exercises are not recommended immediately before shooting but only as part of a general fitness programme. Simple tensioning and stretching exercises that do not increase the pulse rate may be used before a match to help achieve a good muscle tone and create a state of alertness ready for the match. These can include neck rolls, arm swings, fist clenching and general stretching. One useful exercise is to 'try' to push over the nearest (solid) wall. Not only do these exercises improve muscle tone, but they relieve mental stress and improve concentration.

39.5 Over Exercise

As the primary objective of a shooter in carrying out any programme of physical training is to improve his shooting, he must be wary of over training and thus inducing fatigue. The dangers of endurance training have already been emphasised. There is also a danger in over doing any physical training before an important match or trial. Physical training should be carefully matched to technical and mental training and minimised, especially any demanding aerobic training, before a match. The balance between the three aspects of training must be carefully managed in a comprehensive Training Plan. In that Plan, the physical training should be concentrated on the periods when the demands of shooting are minimal.

Chapter 40 Diet

The normal rules for a sound diet should be followed. The emphasis should be on balance. Anyone who, through choice or necessity, must have a special diet, such as a vegetarian, must take care to ensure that their diet contains all the nutrients needed to maintain performance. This is especially so when visiting a foreign country where vegetarianism may be the exception. The range of balanced vegetarian foods readily available in Great Britain and North America are not easily found in some countries. Vegans, who avoid the use of all animal products, have special problems of which, no doubt, they are already aware. In countries where a vegetarian diet is the norm, such as in a Buddhist country, the food is often unpalatable to the unaccustomed western palate and the usual alternative "western" diet, even a "Big Mac", may be more acceptable.

The timing, quantity and quality of meals are factors that need to be taken into account when preparing for an important match. Normal eating patterns may be disturbed by the match programme. This will be dealt with in the Chapter on 'Match Preparation' in Part 7 on 'Shooting at National and International Level'.

There are some foods that are best avoided or consumed in moderation. These include the following:

40.1 Caffeine

Caffeine is in the stimulant class of drugs and is one of many naturally occurring substances that lie between "foodstuffs" and "drugs". Until recently it was prohibited if detected above a specified lower threshold in a blood or urine sample taken in the drugs testing program. It is found naturally in a number of foodstuffs such as tea, coffee and 'cola' drinks. Some so called energy drinks, notably "Red Bull" achieve their effect by a large dose of caffeine. Two or more cups of strong coffee could, under the older rules, exceed the permitted level and thus lead to sanctions against an athlete. [*Theobromine is a chemically related alkaloid. It is found in chocolate and is very toxic to some animals including horses and dogs but only mildly toxic in large dosage in humans. It is prohibited for race horses as even in small dosage it will adversely affect a horse's performance. In humans, its stimulant effect is much less than that of caffeine and because chocolate is considered to be a food rather than a medication it is not prohibited nor tested for in the anti doping programme.]* Caffeine is no longer prohibited to athletes but there are conditions and limits attached to its use which is closely monitored. As a stimulant, it encourages the production of adrenaline which in turn raises the pulse rate and blood pressure and the arousal level of the subject. Hence it could be used in some sports to improve alertness and thus performance. However, it diminishes the motor skills needed for good performance particularly in shooting sport. Any benefit, even in the 'action' shooting sports such as Moving Target, Rapid Fire Pistol and Skeet shooting, is negated by its over stimulation of the nervous system giving rise to the "Shakes". Although this negative effect is short lived (a few hours), many shooters elect not to use such stimulant drinks before shooting or indeed if ever. An alternative for many is the use of decaffeinated tea or coffee. Additional problems may be caused by the mild diuretic effect of tea and coffee which can exacerbate the effects of dehydration.

Needless to say, caffeine in the form of a "pep pill" should never be taken. It might be tempting to use a large dose of caffeine this way if you are suffering from sleep deprivation or jet lag just before the match, but a large dose of caffeine will destroy any chance of shooting well even the next day!

40.2 Food Additives

Many modern foodstuffs contain a range of additives such as preservatives, colourings and flavour enhancers. There has been some consumer backlash against the use of unnecessary additives. Some additives, in particular, have been criticised for leading to hyperactivity. Although not yet fully proven, this appears to be an allergic reaction to certain additives such as the synthetic yellow dye tartrazine (E102) that is used to enhance the colour of orange drinks. Because the reaction is allergic, not everyone will be affected at all, but for those who are sensitive the adverse effects may be observed with only very small doses. Many fruit drinks are now being sold 'additive free'. Most shooters are aware of the effects, if any, of these additives, and avoid them. However, away from home it may be more difficult to know what is acceptable and what soft drinks contain unacceptable additives. As a rule, a shooter should stick with internationally recognised brands and avoid any drinks that are very highly coloured. Some persons are allergic to certain foodstuffs or additives. Most are fully aware of the problem, but an allergic reaction can be triggered at any time, even in someone who has no previous history of allergy. Before an important match, a shooter should avoid, if possible, any strange or highly flavoured foods. Even in very "foreign" places, there is usually sufficient 'bland' food such as rice or cereal based products and fresh fruit for the needs of most shooters over a few days.

40.3 Food Supplements

There are a large number of food supplements available that make various claims for 'body building' or to increase power or speed. While most of these contain fairly harmless proteins, vitamins and minerals, sometimes these are supplemented by substances that come into the class of drugs. There is sometimes a very fine line between food and drugs. In most of Europe and North America, strict rules apply, this is not so everywhere, and sometimes small quantities of prohibited drugs such as stimulants may be added to 'boost' their effect. This also applies to some 'natural' or 'herbal' foods or drinks. Unless he can be sure of the source, then these food supplements should be avoided by a shooter. "Ginseng" purchased abroad has acquired a bad reputation and should be avoided! Be particularly wary about any food supplements bought over the Internet especially if they are not available 'over the counter' in your own country.

There has been some publicity given recently to the use of 'creatine' by athletes. Creatine is a naturally occurring enzyme found in red meat that stimulates the muscles to work harder, faster and longer. It is a naturally occurring substance which is absorbed quickly by the body. The creatine taken by the athletes is a synthetic form which, in effect, simulates a high meat diet. The results have been significant on their performance, particularly for those who were vegetarians or on a low meat diet. The use of this substance for shooters has not yet been evaluated, but there is little doubt that it could improve stamina to support the rifle throughout a match. The creatine preparations are expensive, and work is still being done to evaluate the best way to use them. The recommended intake is 20 grams (the equivalent of 4 kg of beef steak) per day for five days, possibly followed by a much lower 'maintenance' dose; the effects will still be felt one month later. However, there is as yet no information on its long term side effects. Thus it should be used only with caution, and care should be taken that the preparation used does not contain other, less useful or possibly harmful or prohibited substances.

40.4 Vitamins and Mineral Supplements

There is a wide range of vitamin and mineral preparations available. Most of these are innocuous but unnecessary for anyone eating a balanced diet. The specialist pure vitamins are usually beyond reproach, as well as the multi vitamin formulations from reputable suppliers, likewise some of the mineral supplements. However, sometimes vitamins are sold mixed with other food supplements and thus the same precautions should be taken as with all food supplements. The two vitamins which shooters will find most valuable are Vitamin C (ascorbic acid) which is found in fresh fruit and vegetables and Vitamin A (beta carotene) found in liver and yellow or orange fruit and vegetable such as carrots. Vitamin C helps the body resist infection and Vitamin A is important for good vision. Whilst Vitamin C has few side effects if taken in excess, Vitamin A is absorbed by the liver and excessive dosage is harmful. Thus Vitamin A concentrate should only be taken with care.

40.5 Sugar and High Energy Foods

One reason why many people sometimes feel lethargic is that they have allowed their blood sugar level to fall too low. The answer is often to eat a 'snack'. Many of the snack foods that are widely advertised are high in sugar content. The refined sugar is absorbed very quickly into the blood stream and gives an instant energy boost. Unfortunately, the body responds by increasing the secretion of insulin that metabolises the sugar. When the sugar has been used up, insulin secretion continues. Thus the overall effect is that blood sugar levels quickly fall to below where they were before the snack. For a moving target shooter, a sugary snack would not cause any problem if eaten just before going onto the firing point. However, after as little as 15 minutes he would feel the need for another similar snack. Thus, if a snack is needed, sugar or high energy foods should be avoided and instead something like muesli, nuts or complex carbohydrates such as bread or starchy fruit should be eaten. Bananas are a very popular snack for many athletes. These are digested only slowly and while they do allow the blood sugar level to rise, this is a slow process that matches the rate at which it can be metabolised.

40.6 Fluid Intake

Most people are aware that dehydration is bad for them. Research on behalf of some of the more 'active' sports has shown that a 2% weight loss due to dehydration leads to a 20% loss in performance. One effect of dehydration is a general feeling of malaise accompanied by a headache and sometimes nausea. This is often accompanied by some loss of appetite. *[Many of these symptoms are often ascribed to "foreign food or drink" whereas the reality is simply the onset of dehydration.]* Whilst such effects are clearly very significant to an athlete, even for a more sedentary shooter, dehydration can be an important factor that affects his performance. Whilst it is not too difficult to maintain an adequate fluid intake during normal training at home, travelling to a match (particularly air travel), an overheated Hotel room, a hot and humid range and thick, heavy clothing can all lead to excessive fluid loss through perspiration. This is made worse by the probability of expensive drinks in the Hotel or on the range, sometimes a dubious drinking water supply and additional fluid loses through urination driven by nervousness. Thirst is not a reliable guide to fluid needs. A more reliable guide is the quantity and colour of the urine. However, this is long term and may well tell the shooter what he already knows: that he is dehydrated.

It is too easy to say that more fluid should be drunk. If plain water is drunk, possibly after filtration or sterilisation by boiling or with a chemical sterilant, it is absorbed rapidly by the stomach lining and joins the fluid circulating in the blood/lymph system. However, if this has been depleted of essential electrolytes by perspiration, ingestion of plain water will dilute the body fluid even further and can cause muscular cramps and stomach pains. The traditional 'salt tablets' provide a short term answer as does eating very salty food. However, too much salt tends to leave a feeling of being thirsty resulting in the intake of more water than is really needed. This perpetuates the problem. Also, whilst salt will alleviate the symptoms of acute dehydration, the longer term chronic effects are more subtle. Our bodies need to maintain a balanced solution of electrolytes other than sodium chloride, magnesium is one such mineral that is important, and there are others even if needed only in trace quantities. If a lot of water is drunk quickly when the body is already overheated, much of it is lost by excessive perspiration as the body tries to cool itself. This will often result in overcooling and the accompanying discomfort. If a concentrated drink such as fruit juice is drunk, the body accepts this as a 'food' rather than as a simple fluid and it tends to try to dilute itself by drawing fluid from the circulatory system into the stomach and can cause a 'bloated' feeling and nausea. The fluid is only released again when the sugar in the fruit juice has been metabolised. Thus, not only is it difficult to drink enough fruit juice to ensure that the fluid in the circulatory system is replenished quickly, such concentrated sugary drinks tend to make the effects of dehydration worse in the short term. Although fruit drinks do contain some essential minerals, there is not enough to adequately replace the minerals lost through perspiration. A dilute fruit drink such as fruit 'squash' or well diluted fruit juice taken in small sips at frequent intervals is much more effective.

[Note: If a shooter is called to take a drugs test he is offered sealed bottled drinks to help him produce a sample of urine. Fruit drinks should be avoided as these again tend to stay in the stomach too long. Bottled mineral water is the preferred drink if the shooter needs to give his sample quickly in order that he may take his place on the victory podium without delay.]

For emergency rehydration, oral rehydration solutions are available. However, these are formulated to help someone who is acutely, and seriously, ill and are of little value for the more chronic dehydration likely to be suffered by an athlete or shooter. Recently a number of electrolyte drinks, drink powders and effervescent tablets have been developed specifically for the benefit of athletes and others who may suffer from mild dehydration in hot conditions or when doing a lot of physical work. Drinks such as 'Isostar' or 'Gatoraid' replace the lost minerals quickly and effectively. They are called 'isotonic' drinks because they are formulated to be in equilibrium with body fluids. They are designed to be absorbed quickly and to replace the essential minerals lost through perspiration, maintaining the correct mineral balance in the body fluids. These should not be confused with so called "energy" drinks some of which claim to be 'isotonic'. These are not only high in sugar but also in protein for longer term 'body building. Some of these drinks are very dubious in relation to prohibited drugs and must be avoided.

Most of the isotonic drinks readily available have been formulated to benefit the more active sports and contain much sugar, usually as glucose, fructose or dextrose. The sugar is necessary to help the fluid to be taken up into the body fluids at the optimum rate. It replaces lost energy and is of value to a track athlete who does a lot of physical work, but is of less benefit to a more sedentary shooter. When this extra sugar is not needed it is less desirable. *[See the section on sugar and high energy foods.]* Thus it could be helpful to a shooter to use an isotonic drink that has low sugar content if it can be found but, by definition, any such drink would not be truly isotonic. It is important that when any of the isotonic drinks are used, that the powder is dissolved in water in the correct proportion. This is essential to their proper functioning. Although these isotonic drinks do not have a particularly good taste, being rather like a slightly salty dilute fruit squash, their value in combating and preventing dehydration is remarkable. Mineral supplements

are also readily available, often in the form of an effervescing tablet. Unlike the Isotonic drinks, they contain little or no sugar and don't give an energy boost. They can be very effective in counteracting the long term effects of dehydration, but the formulary and the source of the supplement should be beyond reproach. One such drink is ZERO Hydration Therapy which comes in the form of an effervescent tablet to be dissolved in water. As they are easily carried, there is no excuse to rely on local supplies at the match venue! They can be bought (in the UK) in some Health Food shops and Supermarkets as well as in some pharmacies and via the Internet.

Alcoholic drinks should be used with some care. Apart from the effects of alcohol as a drug [see the next Chapter on 'The Misuse of Drugs'], it also needs a large intake of water to process it through the kidneys. 'Spirits' high in alcohol content are particularly harmful and should be used sparingly. Most of the effects of a 'hangover' are caused by dehydration. Beer or lager with a low alcohol content (<4%) will be less harmful and do have a high mineral content which is why they can be refreshing in very hot conditions. No alcoholic drink should be consumed within several hours before shooting.

In hot conditions when dehydration is likely to be a problem, it can be beneficial to plan the intake of fluid throughout the day. Regular small drinks will be most beneficial, but it will also help to ensure that the body is thoroughly rehydrated immediately on waking. A lot of fluid can be lost during sleep or through the normal action of the kidneys and this should be replaced. An intake of more than one litre of fluid before or with breakfast would not be out of place unless you are shooting early in the day. Thereafter, regular small drinks (100 - 200 ml) throughout the day should be taken to 'top up' body fluids. The "camel" drink containers carried on the back and fitted with a long plastic tube favored by some joggers are unnecessary and can be a nuisance. If fluid is carried in any sort of refillable bottle it is essential that it is kept sterile by the regular use of a water sterilizing tablet dissolved in water in the container and allowed to stand for several hours. Best to stick with sealed bottles of water even if they are expensive! *[Note: bottled water is not above suspicion. Make sure that it is fresh (i.e. within the use-by date) and that there is no sign of algal growth in the bottle. Some local water supplies (and some bottled water) have a high mineral content that could lead to a minor stomach upset; if it tastes odd, be wary.]*

Chapter 41 The Misuse of Drugs

This chapter is included in this part of the book on Improving Performance for one very good reason: the best way to use drugs to improve performance is not to take them! Regrettably, some athletes, including shooters, have used drugs or related processes in the hope of improving their performance. Ethical considerations, and their presumed value in other sports apart, the use of drugs, prohibited or permitted, in shooting is most likely to impair not improve performance.

Drug abuse in sport has received widespread publicity. While the instances that have made media headlines have mostly been concerned with deliberate misuse, the matter that concerns most sportsmen and women more is the possibility of their inadvertent use. In shooting sport, almost all the drugs that are prohibited would, if taken, make performance worse. So why ban their use at all?

41.1 Controlling Drugs Abuse

Until 2003, the control of drugs abuse in sport was mostly the province of the International Olympic Committee (IOC) who listed the types of drug and allied substances and processes that they consider would give an unfair advantage to a competitor. International and National Sports Governing Bodies generally applied the IOC rules to their own sport, and this was mandatory if the sport was included in the Olympic Games. From 2004, the responsibility for managing the misuse of drugs in sport has been handed over to a new organisation the World Anti Doping Agency (WADA). This was to ensure that all sports, not only the Olympic Sports, are subject to a consistent set of rules. Almost all recognized sports (including some most unlikely sports) and International Sports Federations and Nations have now signed up to observe the WADA protocols.

It can be argued that if the 'prohibited' drugs are available to everyone, then their use is not unfair! Most of the drugs that are prohibited are harmful if taken without a good clinical reason, especially when taken in the dosage needed to enhance performance. Hence one objective of the anti doping rules is to prevent athletes from deliberately harming themselves by overuse of substances to achieve a boost to performance. For some drugs, like the anabolic steroids, the harmful effects might not manifest themselves until many years after the athlete has retired from competitive sport. These prohibited drugs include those drugs which could be used to mask the effect of some other drug or which WADA considered could be harmful to the competitor. Most of the 'social' drugs of abuse such as cocaine, heroin, cannabis and amphetamines are also prohibited because they are harmful without noticeably improving performance. Some drugs are prohibited merely because they cannot easily be differentiated from other prohibited drugs or because they are metabolized into another prohibited substance. Advances in analytical chemistry are gradually eliminating these drugs from the prohibited list or permitting them under specified circumstances. In listing the prohibited drugs, WADA does not normally differentiate between their effects on different sports, nor does it differentiate between the effect on male and female athletes, but has created a blanket ban. There are supplementary lists that are sport specific. Gender differences can be accommodated by the use of Therapeutic Use Exemptions (TUEs).

With the introduction of the WADA Rules things are not yet perfect but the rules are much more logical than in the past. For instance several drugs are subject to a threshold limit rather than just the limit of detection. This is important as a number of prohibited substances can occur naturally

in the body albeit in very low concentration. Also, the limits of detection are continually being pushed down to detect these minute traces, and techniques are being developed to differentiate between substances that can occur naturally in the body and those similar substances that are taken artificially. Another change is that as a result of better, more sensitive, analytical techniques, some innocent substances which could have been confused with a prohibited substance; are now permitted. It is also important to know that WADA now distinguishes between substances that are prohibited both and out of competition and those substances which have only a short lived effect that are prohibited only if used in competition. This has not only freed up analytical resources, but has often made it unnecessary to apply for a TUE.

One of the WADA protocols is that any dispute over analytical findings or the consequences of a positive finding will be settled only in the Court of Arbitration in Sport, based in Lausanne in Switzerland and it is usual in International Sport that all participants are required to agree to this protocol. This ensures that an aggrieved athlete cannot pick and choose a court to hear his dispute.

41.2 Therapeutic Use Exemption

Another change is that WADA does recognise that many prohibited drugs may be prescribed therapeutically and so they have set up a formal system whereby an athlete can apply to his International Sports Anti Doping unit for an exemption certificate. This must take account of the reason for using the drug, its dosage and the sports involved, and are not granted easily and then only with medical support. For instance the ISSF insists that a Therapeutic Use Exemption (TUE) will not be granted for Beta Blockers to be used by shooters. WADA has also identified some drugs such as Salbutamol and Salmetrol that are commonly used to treat or prevent asthma attacks may be used by specified administration routes with minimum formalities (i.e. a Declaration of Use which does not require prior approval). *[From January 2011 even a formal Declaration of Use is not required for a Salbutamol inhaler.]* Hydrocortisone preparations applied externally and which are used to treat eczema can also be used. The important thing to recognise is that if a therapeutic Use Exemption Certificate is required then it MUST be applied for in advance. Even where a formal Certificate is not required but where there are restrictions on use, the substance must be declared at the time of a drugs test. For those not taking part in international competition a 'national' exemption certificate will be available through the sport's National Governing Body. As international competition is not involved, these might be more easily obtained than an international exemption certificate and probably for a wider range of drugs. The WADA rules are continually evolving and the latest restrictions should be consulted (through the WADA Web Site (www.wada-ama.org), or through the National Governing Body) if there is any doubt. There is also a drugs data base (www.globadro.com) set up jointly by the GB, US and Canadian anti doping administrations but which is in global use and which can be used to check on the legality of a specific drug or related process in any given sport. This data base is kept up to data and is an invaluable resource.

41.3 Minimum Penalties for Drugs Abuse

WADA have also laid down guidelines for minimum penalties for drugs misuse. This is particularly helpful as it should ensure consistent standards throughout the world and from sport to sport. They also differentiate between in and out of competition testing for many drugs. For some drugs, the Governing Bodies are allowed to make their own rules regarding this distinction. Also Governing Bodies are allowed to introduce their own prohibitions for specified substances. Hence, although Beta Blockers (which control the heart rhythms) are generally prohibited, they

might be allowed for therapeutic use in some sports, but are strictly prohibited in shooting, both in and out of competition, and some other sports. Alcohol is prohibited in some sports or is subject to a lower limit. These sports include fencing and archery, but not, strangely, shooting. However, the ISSF Rules allow a Range Official to expel anyone from the range whom they think has drunk too much alcohol. This is strictly enforced to the extent of complete prohibition on some ranges.

It is also most important to know that possession of a prohibited substance will earn the same sanctions as it you had taken it. Moreover, anyone supplying a prohibited substance to another shooter may be punished even more severely. The rules about possession and supplying also apply to a Coach or Team Official. Although not specific in the ISSF Rules, there is a clear implication that anyone convicted or even given a police warning for possession of a substance that is prohibited in or out of competition will also be punished. Thus a warming for possessing a small amount of cannabis MUST be declared to the ISSF through the National Governing Body who will consider the circumstances very carefully. Failure to declare it in a timely manner could increase the penalty if the offence subsequently comes to light (i.e. a "concealed" violation which will be punished more severely than an "open" violation).

41.4 "No Fault or Negligence"

Another major change is that WADA recognises formally that some prohibited substances could be administered without fault or negligence on the part of the subject. Whilst maintaining the principle that the athlete has an absolute responsibility for what he takes, WADA recognises that under some circumstances it might be out of his direct control. This does not mean that it is a good 'excuse' to say that someone put something in a drink with ill intent. This can only be accepted if there is actual proof. In which case, the subject might be spared a ban, but will have any results from the competition where the drug was detected nullified. If the drug was administered by the athlete's Coach or a family member, then the athlete will also still held to be totally liable as he should have been more careful.

WADA also recognises that under some circumstances the athlete ingested a prohibited substance that he had only a limited probability of knowing what it really was. Thus the excuse that the drugs was a contaminant in say a food supplement might qualify for the "no significant fault or negligence" action if he can prove that, for instance, he had used the same supplement before and it was acceptable then, if not now. His absolute liability remains. If "no significant fault or negligence" can be proven, then the athlete may have a reduced ban imposed, typically half the mandatory minimum ban that would have been imposed for deliberate use. This will be possible if the quantity of the substance detected is very small and compatible with the alleged route for its ingestion. If he has already been punished or warned for a doping offence, it is unlikely that a reduced penalty will even be considered.

41.5 Applicability

One consequence of the WADA Rules is that National Governments are now under strong pressure to ensure that all sports fall into line with the WADA programme for controlling the misuse of drugs and at all levels within the sport. Thus most International and National Governing Bodies as well as National Government Sports Agencies such as UK Sport have signed the WADA protocol. A consequence of this is that any sports organisation that receives a

UK Sport grant or Lottery Funding will be expected to demonstrate that they have an effective anti doping programme.

41.6 What Drugs are Prohibited?

It is most important to remember that the WADA list of prohibited substances, like the IOC list previously, is not specifically of named substances but of drug types. The list might be qualified by listing examples of each type of prohibited drug, but the absence of a drug from that list does not necessarily mean that it is permitted. It contains the words "and related substances" or a similar qualification. One exception is the narcotic class of drugs in which specific drugs are identified. A narcotic not on the list is permitted, but note that some drugs, including narcotics, come under more than one class of substance. Thus advice should be sought from the Governing Body, or a Physician appointed by them, who has a knowledge of the WADA and ISSF requirements. The family doctor or the local pharmacist is unlikely to be familiar with those requirements. There is a Web Site (www.globaldro.com) that allows you to look up any substance and obtain a definitive ruling on its legality. Many Physicians are now aware of this data base and make good use of it.

41.7 Drugs that Some Think Might Help Performance

a) Alcohol

Alcohol (Ethanol) is widely used as a social drug. It is one of the few drugs that may, under some circumstances, appear to have an enhancing effect on shooting performance. At one time, some Rapid Fire Pistol Shooters were known to drink half a glass of red wine before going onto the firing point! Its use is not specifically prohibited by the ISSF. Because of its widespread social use, and because it exists in many foodstuffs and is formed in the stomach during digestion, it would be difficult to apply any overall total ban. Any ban would have to specify a threshold limit. Nevertheless, the use of alcohol has been banned in competition by some National Sports Federations and by some International Governing Bodies. The justification for such a ban is safety and although the ISSF has not prohibited the use of alcohol, its use can lead to anyone being excluded from the shooting range by a Range Official on the grounds of safety.

Although alcohol is widely thought of as a stimulant, it is really a depressant. The apparent initial stimulant effect is illusory and quickly wears off and the central nervous system becomes depressed. Thus a short delay in starting a Rapid Fire Pistol series could prove disastrous to anyone having just drunk his dose of red wine! As a depressant, it removes inhibitions and helps the subject to forget or ignore any worries or distractions hence he might perceive it as a stimulant. The only way any supposed stimulant effect can be maintained is by taking frequent repeated doses. In large doses its toxic effects are well known. As a depressant, it could have some role to play in shooting by helping the shooter to forget the worries that might otherwise interfere with his concentration on the range. However, the depressant effect causes a significant reduction in the motor skills and coordination that are needed to execute a good shot. Overall the shooter perceives himself to be able to shoot well but is unable to perform with the precision required.

Probably the best use for alcohol in shooting sport is in moderation for celebrating after the competition. Its use should be avoided for several hours before shooting. Even moderate consumption on the day before the competition can leave the shooter 'hung over' (i.e. dehydrated)

and unable to perform well. Alcohol needs an increased intake of water to process it through the kidneys. Thus the more concentrated 'spirits' should only be used sparingly.

b) Sedatives

At present, most hypnotics (sleep inducing drugs) and tranquillisers such as 'Valium' are not prohibited by the ISSF or WADA. This could change. Any shooter who may have the occasional need to take such drugs on medical advice should check them carefully with the Medical Officer of the Governing Body or through www.globaldro.com at least three weeks before the event. Their use must be declared to the team manager well before the event. Many of these drugs are physically or psychologically addictive and have long term effects. It is too late to suddenly stop their use the night before the competition! They should only be used with extreme caution. It might be tempting to use a sleep inducing medicine to ensure a good night's sleep before a major event. However, it is not advisable to take any medicine within eight hours of shooting, and the effect of any sleep inducing drug should be checked out beforehand. Whilst some are short lived, some can have undesirable after effects. The day of the match is the wrong time to find out!

Other drugs such as anti depressants may be permitted (but check!). However, anyone who needs to use a drug such as Prozac regularly should not be shooting anyway, certainly not in major competition

c) The Beta Blockers

Of all the drugs that are prohibited by the ISSF and WADA only one group, the beta blockers such as oxprenolol and propranolol are believed to have any enhancing effect on shooting performance. These drugs are used to regulate the heart beat in some forms of heart disease and as a treatment for hypertension. Antal and Good reported in "The Practitioner" in 1980 on tests carried on a small group of pistol shooters which showed an apparent slight enhancement. This only applied to the precision shooters; the Rapid Fire shooters did not show the same enhancement. However, the sample was a small one and the tests very limited in scope. For most similar clinical trials a much larger scale trial would then have been conducted: however the ISSF banned the use of Beta Blockers before any more comprehensive study could be undertaken and it is most unlikely that any further research will ever be carried out on shooters! These drugs are only available on the prescription of a physician. The use of this class of drugs would normally only be in the long term. Anyone prescribed such drugs is unlikely to be taking part in International competitions. If so he would be most unwise to stop using the drugs, even temporarily, in order to compete. However, the Beta Blockers are only one group of drugs having a similar therapeutic effect and any shooter prescribed Beta Blocker should ask their physician if an alternative is suitable.

41.8 Prohibited Drugs that Might be Taken Inadvertently

It is important to question the physician about any drugs he prescribes. However, the greatest danger to any shooter from drugs is that many of the prohibited drugs are readily available without prescription, and in a variety of guises. All shooters should be wary of 'remedies' offered by a well intentioned friend or relative. They must take personal responsibility for any drug that they take and politely reject anything which they cannot themselves confirm as being permitted. The substances most likely to be encountered are ephedrine and its derivatives. Inhaled medications are a special case.

a) Ephedrine and its derivatives

The stimulant class of drugs is prohibited in general in competition but not out of competition. Ephedrine and related substances, such as pseudoephedrine, phenylephrine or phenylpropanolamine are stimulants and stimulate the endocrine system to produce adrenaline to counteract an allergic reaction. They act as vaso-constrictors to relieve congestion and are widely used in decongestants such as 'Cold Cure' remedies. The adrenaline acts as a stimulant. Its effect on the shooter is extreme. Even the use of a nasal spray containing ephedrine will increase the heart rate. The raised heart rate and blood pressure from any use of ephedrine or its derivatives would make accurate shooting difficult. It is commonly found mixed with a permitted anti histamine in some proprietary drugs used to relieve the symptoms of hay fever, in decongestants (including nasal sprays), or sometimes, in small quantities, as a stimulant to enhance the effect of some 'tonics' and herbal 'remedies', usually bought from a dubious source.

Ephedrine and methylephedrine are prohibited only in competition but are subject to a lower threshold of 10 micrograms per millilitre of urine. Pseudoephedrine is subject to a much higher threshold limit of 150 micrograms per millilitre of urine which roughly equates to the level expected from normal clinical dosage for a person of average weight and build. This means that if it is used in normal dosage, there might not be a problem if it was only taken more than 24 hours prior to testing. Nevertheless it should not have been taken at all! In the UK it is only available on prescription and there are alternatives available that are not prohibited. Anyone prescribed a prohibited stimulant would not be able to shoot well if at all! Phenylephedrine is not prohibited but could be returned to the prohibited list if there is evidence of abuse. Ephedrine and methylephedrine are, in effect, prohibited. Whilst technically permitted, the lower threshold is so low that almost any effective dose taken within 24 hours would give a positive result. These substances could be used legitimately as a decongestant by topical application (i.e. nasal spray) but not within 24 hours before shooting. The thresholds are such that the recent use of many 'Cold Cure' remedies would result in a positive test.

Anyone visiting parts of South America should be wary about the widespread (legal or tolerated) use of Coca Leaf as treatment for altitude sickness (La Soroche). Coca leaf is the source of cocaine and if taken, in the form of 'tea', it could result in a positive test for the latter. It was the original 'secret' constituent of Coca Cola and although no longer used in most countries, it might still be found in the local version. The countries where it is likely to be encountered are Bolivia and Peru, but it can also be found in Columbia, Northern Chile and Ecuador where its use is ‘tolerated’ rather than being ‘legal’.

b) Inhaled medications

A wide range of medications may be given by inhalation. Some of these are prohibited; others are permitted only by prior approval under a Therapeutic Use Exemption (TUE) certificate and some may require a formal Declaration of Use. Other inhaled medication such as some nasal decongestant sprays (see “Ephedrine and its derivatives” above) have a lower threshold and are only prohibited in competition. A complication arises when some medications are acceptable by inhalation but not if given by any other route. Currently some of the Beta-2 agonists which are used to control asthma are permitted only by inhalation and by declaration of use. Other Beta-2 agonists are prohibited in any form.

One well known shooter used a (then) prohibited decongestant spray after he left the firing point thinking that he would not be tested. He was given a two year ban. He had been offered the spray

by another shooter, who, under current rules, would also have been given a ban. It is as well to remember that "in competition" means from 12 hours before shooting commences until all shooting in that event has been completed, final results declared and drugs control cards handed to the leading competitors!

c) Corticosteroids

The corticosteroids are prohibited if used orally, by rectal administration or intravenous injection, but may be permitted with prior approval as nose drops, skin creams or local (i.e. intramuscular) injection.

d) Note on the use of codeine

Until recently, the use of codeine, a narcotic analgesic, was prohibited. However, WADA and the ISSF now permit its use, along with some other related morphine derivatives. Morphine itself along with several other narcotic agents remains prohibited. The specific list of prohibited narcotic agents is published by WADA. This is a helpful development as codeine in particular is a valuable medicament as an anti diarrhoeal and anti tussive (cough suppressant), as well as a general painkiller. Codeine by itself is only available in the UK on a physician's prescription but it is an ingredient in low dosage, in a number of proprietary medicines. However, whilst codeine is a useful drug, it may lead to drowsiness and have a negative effect on performance. It is addictive and should be used with caution even in low dosage. Other permitted narcotic analgesics are diphenoxylate and loperamide (constituents of Lomotil and Imodium respectively) which are very effective in the treatment of diarrhoea but again, must be used with caution as they too can adversely affect performance.

[Note: Although permitted in sport, Codeine is a prohibited substance in many countries such as in the Middle East and Singapore. Because of its abuse, New Zealand has been considering a total ban. Anyone travelling to or through these countries and who needs to use Codeine should carry a copy of their Doctor's prescription.]

Although codeine is a 'prescription only' medicine in the UK, it is available 'over the counter' in a pharmacy in combination with paracetamol or aspirin. The codeine content of these medicines is very low (8 mg) and unlikely to cause dependence if taken for even a few days. Even in low dosage it can be effective in suppressing diarrhoea and is preferable to either Lomotil or Imodium for treating mild diarrhoea. *[Note: no 'treatment' for diarrhoea should be given unless essential i.e. for travel or in order to compete. Diarrhoea is the body's own method of removing toxins; suppressing it can prolong the real problem.]*

The complication with the use of codeine and similar narcotic analgesics is that they work because they are metabolised into morphine, which remains prohibited. However, if codeine has been used, the morphine / codeine ration should remain in balance within narrow limits. Thus it is essential that if codeine has been taken recently, it is declared at the time of any drugs test.

e) Drugs administered during emergency treatment

It is important to recognise that if a physician is called upon to treat an athlete, he is more concerned with treating the patient than about any consequences to that patient in his participation in sport. If an athlete receives emergency medical treatment, or even dental treatment, a prohibited substance could be administered without his direct knowledge or consent. Although an unconscious patient may not have any control over what was given to him, he does

have the right to be told afterwards. It is most important that he makes a record of what was given him and that he consults the National Governing Body's medical adviser if he is due to take part in a major competition during the next few weeks or is subject to out of competition testing. Fortunately if it is necessary to administer a prohibited drug in this way it is most unlikely that the patient will be fit to take part in serious competition immediately afterwards! However, it could be important if he is subject to out of competition testing.

41.9 Drugs in 'Food'

Shooters should also be aware that some so called foods or food supplements can contain prohibited substances. There are a large number of food supplements available that make various claims for 'body building' or to increase power or speed. While most of these contain fairly harmless proteins, vitamins and minerals, these can be supplemented by substances that come into the class of drugs and these are not always listed on the container. There is sometimes a very fine line between food and drugs. In most of Europe and North America, strict rules apply. This is not so everywhere and sometimes small quantities of prohibited drugs such as stimulants may be added to 'boost' their effect. This also applies to some 'natural' or 'herbal' foods or drinks. Any 'food' claiming to have properties more akin to a medicine than a foodstuff should be avoided, especially if it is not on general sale in your home country. Unless he can be sure of the source and composition, then any food supplements should be avoided by a shooter. Any that are used should be declared to the Governing Body and at any drugs test. Although the concentration may be very small and the effects on performance negligible, nevertheless any drugs test cannot differentiate between a small dose taken recently and a large dose taken a few days earlier. The athlete will be penalised as if he had deliberately taken the drug in order to cheat. However, the lower penalty of a minimum of three months suspension from competition may be imposed if there is reasonable evidence that the drug had been taken inadvertently and that dosage was very small and unlikely to have affected performance.

The recent more enlightened attitude of WADA and the ISSF in permitting small concentrations of some drugs, notably the ephedrine related stimulants, has done much to minimise this problem.

41.10 Drugs Testing

The drugs testing procedure is fully described in the ISSF General Rules and is very similar to the procedure used by the IOC and many National Sports Organisations. It will not be repeated here, but every shooter competing at National or International level and every Coach and Team Manager should be familiar with the procedures. As part of the test procedure, the competitors will be asked to declare any medicines (including herbal remedies) which may have been taken during the last seven days. This must include anti malarial drugs. It is as well to remember that many drugs can be absorbed through the skin or mucous membranes and that even the use of an antiseptic cream should be declared. This also applies to insect repellents and to any skin creams that appear to have ‘magical’ properties. It is usual for the leading three or four competitors in each major competition, plus at least one other competitor chosen at random, to be asked to submit to testing. The randomly selected competitor will normally be handed a doping control card as he leaves the firing point. Failure to attend within the specified time will be treated as a major doping offence. The onus is upon the shooter not to ignore that card given to him as he leaves the firing point! The leading competitors (i.e. medal or award winners) who are liable to testing may not know until everyone in that event has finished shooting and the final results are known. Thus it is very important, if you have had a good score, not to leave the range until the

results are known. It is also most important that if you need to take medication that is permitted only out of competition, you ascertain from a range official, preferably from the Range Jury, that you are no longer likely to be tested before doing so.

In the UK, testing for prohibited drugs in shooters is not normally carried out below National or Regional level competitions. However the WADA protocol does not rule it out even down to "club" level, and indeed in some sports testing is carried out at all levels. Anyone taking part in any form of International Match, even an inter club friendly match, should know that they could be subject to testing unless the organisers can give an assurance otherwise. Because testing is directed at those shooters who might represent their nation in a major International Match, events at home that might be used for selection could well be targeted by the testing agency. Thus any shooter taking his sport at all seriously should consider himself liable to drugs testing.

Analytical Chemistry is making very rapid progress and today, trace levels of drugs are being quantified from very small samples which could not even be detected five years ago. It is not a matter of if, but of when the drugs given to animals will be detected in those who have eaten them. *[In a recent (2010) case, an athlete claimed that the substance (an anabolic agent) detected in his urine sample, came from the local beef he had eaten before his competition. The case is ongoing.]* Many of the prohibited drugs occur naturally in plants, sometimes in microscopic amounts either naturally or by cross contamination. Again it is only a matter of time before they are detected in those who have eaten those plant products. WADA is already specifying lower thresholds for some drugs, and this must ultimately be extended to some of those prohibited drugs that might be found in natural foods. Some of these lower thresholds are set simply to guard against a very low level "false positive" result. Meanwhile, it is important to know that many drugs can still be detected in the body a week or more after they were last taken. Although some drugs are destroyed within the body, most are only removed by excretion and the rate of removal follows an exponential law. Some drugs show up as very long lived physiological changes within the body which could not occur naturally. The diuretic class of drugs, which could be used to hasten the excretion of a prohibited substance, are themselves prohibited. Thus, for anyone involved in International Sport, it is important to make sure that they never take any substance that could lead to a positive test and subsequent disqualification from competition even long after the last dose was taken.

At the moment there is little reason to undertake a major programme of out-of-competition testing of shooters. None of the drugs that have a long term effect on performance such as the anabolic steroids appear to have any enhancing effect on shooting performance. It is to be hoped that, if such a programme is introduced, testing will be confined to specified drugs rather than the full range of drugs tested for during competition. Anyone who might be subject to out of competition testing will be notified that he is in the testing "pool". British Shooting and many other Governing Bodies have made a point of ensuring that anyone who might represent their nation in a major international shooting event will be tested well before the event to ensure that he is "clean".

It is normal practice for athletes who are selected for international competition to be asked to declare any medication they may be taking, or have taken recently, to their team manager or to the National Governing Body. This declaration could be important if there should be a positive test, in deciding if the use of the prohibited substance was deliberate or inadvertent. This could determine the scale of any penalty. It is important that this declaration is comprehensive so that advice can be sought on any dubious medicines. The declaration must include the use any substance for which a Therapeutic Use Exemption certificate has been granted and that certificate MUST be produced at the time a urine sample is taken. The ISSF now requires that all

competitors in ISSF sponsored events sign a declaration that they understand the ISSF anti doping regulations and penalties, and that they will submit to drugs testing if requested.

When the urine sample is taken, the athlete will be asked to list any drugs he has taken recently. It will be helpful to have this list ready and that it should be comprehensive. Even if he has knowingly taken a prohibited drug, it should be declared; he will not be penalised unless it is detected in the sample. It is a general principle in the ISSF Shooting Rules that concealed infringements will be punished more severely that 'open' violations. Thus if he has used something illegal, even a few weeks ago, his chances of escaping a penalty will be reduced if there is no obvious attempt to cover it up. Likewise, if the drug has been taken unknowingly, he should cooperate fully with the authorities to try to establish how and why. Full cooperation will help reduce any penalty.

At some competitions, female competitors may also be asked to submit to a Femininity Test. After a positive test during a major competition, a Certificate may be issued. The possession of a valid certificate should exempt the competitor from further testing. The testing method is not foolproof and if the test should turn out to be negative, the shooter may be asked to submit to further tests. The results of the Femininity Tests are confidential to the shooter and the ISSF Medical Committee.

41.11 Blood Doping

Blood doping is the practice of giving the subject an injection of blood or blood products designed to increase the concentration of red blood cells. This will increase the oxygen carrying capacity of the blood. Sometimes it involves removing blood from the subject and then replacing it after his red cell concentration has returned to normal. It is difficult to see how this could be of any benefit to a shooter. The administration of blood or blood products, except as part of a legitimate medical treatment, is prohibited. The same effect can be achieved legitimately by the 'high altitude training' that is now part of the training programme for many athletes a few weeks before an important event. The only benefit of Blood Doping or ‘high altitude training’ for a shooter is that it could be used as a form of accelerated acclimatisation before a match at high altitude such as in Mexico City or Colorado.

41.12 Permitted Drugs

No recommendations will be made in this text for any currently permitted drugs that could be prohibited tomorrow. The Drugs Information Database Web Site (www.globaldro.com) is very helpful and should be up to date although the usual disclaimer is made! The best advice is that if in doubt, never trust the uninformed opinion of a General Practitioner or Pharmacist but consult the National Governing Body who will, if necessary, refer you to an expert in the field. Many proprietary medicines contain a mixture of substances some of which are permitted by the IOC and some of which are prohibited. Many of those formulations change regularly and a medicine that is safe to use today may contain a prohibited substance tomorrow. It is also common sense to make sure that if medicines are needed, you insist on those containing only single pharmaceutical substances (such as the 'generic medicines'), rather than proprietary mixtures, whenever possible.

Apart from the Drugs Information Database Web Site, the Internet itself is valuable source of information particularly on the possible side effects of permitted medication. Some of these side

effects could adversely affect shooting performance and such medication is best avoided before a competition if this is practicable.

Note: The Anabolic Agents

Understandably, these have received a lot of attention in the media. Because some of these prohibited substances (i.e. testosterone) occur naturally in the body, the testing procedures are different. Some prohibited substances are metabolites of testosterone and release it within the body and the testing procedures are designed to recognise this. The purpose of the testing procedures purpose is to distinguish between what might occur naturally and what might be the result of the use of a prohibited substance.

The much publicised Diane Modahl affair drew attention to the technical problems concerned with testing for the anabolic steroids. Not only were there questions about the way that samples were handled in the testing laboratory, but the whole question of what is 'natural' and what is not came under scrutiny. As a result, if apparently excess testosterone is detected, additional tests will now be carried out to determine if it is the result of a normal physiological condition. Because testosterone (T) occurs naturally in conjunction with the related epitestosterone (E), the basis for a positive test is that the T/E ratio exceeds 6. Even then, further tests must be carried out, such as continued measurements of the T/E ratio over an extended period, as a high T/E ratio could be the result of a natural process such as an abnormally low rate of production of epitestosterone or of its destruction by other processes within the body. Diane Modahl was eventually acquitted of any doping offence but only at considerable financial cost to herself and to the British Athletics Federation.

Part 7 Shooting At National And International Level

Not all shooters will wish to rise the top levels of their sport. Those who do must have a real commitment to the sport both in the use of their time and their money. Shooting is still mainly an amateur sport, some shooters are luckier than others when it comes to sponsorship and financial support. But the most important resource is the dedication of the shooter.

A shooter who aspires to reach the top in his sport must have commitment and dedication. This is shown by his willingness to train and by his ability to use every possible opportunity to improve his performance.

For those shooters who do not aspire to International honours, this part of the book is still worth reading. Most of its content is still applicable to them, but perhaps to a lesser degree. For the beginner, reading this part of the book may be a discouragement. However, they should remember that in Moving Target Shooting, as in all sports, the road to the top is a hard one. There is no 'quick fix', no magic formula for success. Hopefully, those who do aspire to International honours will continue to enjoy their sport, if not then they have lost part of the purpose of taking part.

Anyone seeking to represent his nation in an International shooting event must have an ISSF Shooter ID Number. This can only be obtained through your National Governing Body. On the application form you are required to sign a declaration that you will submit to doping control tests and that in the event of any dispute with the ISSF, you will only continue the dispute through the Court of Arbitration for Sport based in Switzerland. Hopefully this will avoid the need for pointless and expensive (for both parties) litigation.

Chapter 42 Motivation and Commitment

42.1 Motivation

When the novice shooter has learned the basic skills of the discipline, he may decide that he has no potential as an International Shooter but that he will continue to shoot only for recreation. Some shooters will however, aspire to National and International honours. Their motivation may be for personal glory, as a result of some nationalistic fervour, or merely because they see Moving Target shooting as a challenge, as a part of their personal philosophy of life.

Whatever their motivation, it must be capable of being sustained through good and ill. In shooting sport, as well as any other sport, high honours do not come easily nor without cost. The willingness to pay that cost is a measure of the shooter's commitment and dedication.

It is always better to try to avoid any form of external motivation. A Team Manager might say "If you score xx I will buy you a drink afterwards!" In many instances this is harmless, but in some circumstances the shooter may over respond to such pressure, try too hard and fail. There is no place in shooting for the 'bully boy' tactics of the professional coaches found in some team sports. Quiet encouragement is a better motivator for any shooter. The worst form of external motivation often comes from parents to a junior shooter. There is a fine line to be drawn between encouragement and pressure, but their effects can be very different

42.2 Commitment

Any shooter who aspires to National Honours must prove that he or she is the best in their own discipline. This is one instance where, in absolute terms, any achievement will be dependent on the quality of any opposition rather than on their own performance. When he has reached the top nationally, he may be considered as a candidate to represent his country in international competition. *[For instance, in the Olympic shooting events, a maximum of two shooters may represent their country in any event. Thus to compete in the Olympics you must be at least Number 2 in your own country as well as satisfying the very demanding ISSF qualifying procedure.]*

From that point on, motivation alone is insufficient to drive the shooter to achieve the performance necessary to succeed. To be the best shooter nationally means nothing if his standard internationally can only put him in the lower quartile or even worse, on the "also shot" supplementary list. Being the best at home will often lead to complacency and mediocrity. To remain in the National Squad he must be able to demonstrate his commitment by a willingness to train systematically; to give up leisure time daily to train and practice; to give up his family holidays to attend matches; and to be willing to contribute much of his income in support of his sport. This he can only do with the full support and understanding of his family.

Whatever his natural talent, however 'good' he is, National Governing Bodies are, understandably, unwilling to support a shooter by selecting him for international competition unless he can demonstrate his commitment to the sport. They will require evidence of performance and lay down minimum standards to be reached before he can be considered for membership of a National Squad. Higher standards will be required before selection for a representative match. He must then attend regular assessment trials, squad training camps and other events. He must also compete in most, if not all, the National and Regional competitions.

The ISSF has laid down minimum qualifying scores (to be recorded in specified matches) for each shooter to be even considered for participation in the Olympic Games. However, he must also 'win' a start place in the Games by winning a place for his country in specified matches such as the World Cup series, Continental and World Championships. Thus there must be a commitment to attend those matches, and Governing Bodies are unlikely to send a shooter unless he shows reasonable promise of being able to deliver the requisite performance.

As well as being able to achieve the requisite score in a trial, further evidence of commitment must come from the shooter having a formal Training Plan and some proof that he is following it. While the Training Plan must concentrate on quality rather than quantity, the willingness of a shooter to devote a large amount of time to his sport is prime evidence of commitment. In discussions with a number of senior Coaches from a wide range of Olympic Sports, the consensus was that any international athlete should expect to spend at least 20 hours each week in training or other activities directly related to his sport. That time should increase to about 35 - 40 hours in the weeks preceding an important competition. Whilst that time could include the time necessarily spent in travelling to the training venue or match, it does not include all the time spent away from home and family.

The athlete also has to earn his living. Sponsorship of the kind that allows the athlete to dedicate his whole time to his sport is limited to very few athletes, least of all to shooters. Even should he decide to train on a full time basis, he must still consider the fact that there must be a life after he is no longer at the top in his chosen sport. Probably the most valuable form of sponsorship is a sympathetic employer who is willing to allow special leave of absence, often at short notice, for international participation.

The aspiring international shooter must also be prepared to commit himself financially to his sport. The initial cost of suitable equipment is high, but the more significant cost is often the cost of travel and accommodation. An international Running Target shooter might easily use 30,000 air rifle pellets each year. This cost is not insignificant. If he shoots Running Boar or Running Deer, the annual cost of ammunition would be about that of a new rifle, even if did reload his centre fire ammunition. This serves to emphasise the benefits to be gained from even the specialist Running Deer shooters training with the air rifle. Although much of the cost of attending an international representative match is sometimes met either from National Governing Body funds or from a personal grant from the National Sports organisation: the shooter himself will be asked to make a significant contribution. He might be given financial assistance by his club. The opportunities to attend representative matches will be dependent on the shooter achieving the necessary performance. He cannot do this without some experience in international competition. Thus he will find it necessary to attend non representative matches at his own expense, initially to gain the experience necessary for selection, later to maintain his performance.

International competition is not for the casual shooter.

Chapter 43 Training Plans

Throughout this book, frequent reference has been made to Training Plans. Many shooters claim to have a training plan but, when questioned, this is either kept in their mind, or it is so insubstantial that it is valueless. Any shooter who intends to compete seriously at National level should have a comprehensive Training Plan. Many National Governing Bodies require that shooters who represent their country in International competition have a Training Plan approved by themselves.

An International Shooter, in common with all International Athletes, should expect to spend a significant amount of time in training each week throughout the year. This will increase during the preparations for a match, and reduce during a scheduled holiday. As 'training' covers everything that makes a positive contribution to shooting performance, it is unlikely ever to fall to zero. Most, if not all International Shooters also have a normal job to do and home and family responsibilities. The busier they are, the more important it is that they should have a comprehensive Training Plan. Time is their most valuable asset and must be managed well if they are to progress as a shooter without detriment to their work and family life. If their Training Plan is inadequate, there is a danger that training will be missed if other commitments become more demanding.

Like a Business Plan, a Training Plan helps to concentrate the mind on the more important matters and prevents the shooter being diverted into training that is not achieving specified objectives. It also provides a standard against which progress can be measured. As an example, the natural inclination is to spend as much of the training time as possible working at the range. If the Moving Target range is some distance from home, it might be better to make fewer but longer visits and to concentrate on other forms of training nearer home.

43.1 Objectives

Before a Training Plan can be prepared, there must be clear objectives. These can be related to performance (i.e. scores), or achieving a stated level of fitness. They may also relate to simply carrying out a specified amount of training or to the 'quality' of that training. When setting out objectives it is most important that these are attainable and that they are not dependent on the performance or actions of some other person. Whilst it might be a long term dream to win an Olympic Gold Medal, for most shooters this is an impossible dream. Even the objective of winning the next match may be impossible and is certainly not a sound objective because it is dependent on the performance of the other competitors. In setting objectives, shooting has an advantage because the score is such an obvious way to quantify performance.

There are some potential pit falls in using a specified score as an objective. Shooting is, in scientific terms, a random process. There can be no certainty about where a projectile will strike the target even under idealised conditions. This is why scores vary from match to match. If conditions are poor, such as a strong wind and rain on the 50m Running Boar range, the variation may be greater than expected. The way that scores vary is subject to the laws of chance. When the variation is small and the shooter's scores are consistent, then it is easier to confidently predict future performance. Even when scores are erratic, they are governed by strict mathematical laws of random distribution. Thus, rather than setting a particular score as an objective, it is better to specify a minimum score. The objective easiest to understand is that the score should always be

better than the most recent average. This must be achieved at least half of the time if the average is not to fall. If it can be achieved more than half of the time, that average must inevitably rise.

It is also possible to set objectives in terms of the Standard Deviation of those scores. The Standard Deviation is a mathematical measure of the way scores vary about the average. Two out of three scores should lie within one Standard Deviation of the average, nine out ten within two Standard Deviations. If they do not then some external influence is implied, such as very poor conditions or the shooter is out of condition. A good overall objective is to have a score that is one Standard Deviation above the average and never to have a score more than one Standard Deviation below the average. Without going into details, Standard Deviation can be calculated easily using almost any pocket calculator that has a range of scientific functions.

43.2 Key Points

It is very important to identify the key points of the shooting programme in the Training Plan. A match is one key point, so are selection trials. Holidays are another key point that must be planned. All known key points must be identified before any Training Plan can be written. Very often it is these key points that dictate the Training Programme. Any changes to those key points such as non-selection for a match affect the Programme and call for a review and possible revision. Such things as school or college examinations, known demands of work, etc. are also key points.

Other important key points are those times when the shooter can identify in advance that he might have to make a major change to the Plan itself. These would include selection trials for instance. When such uncertainty is introduced into the Training Plan, it should be possible to have a back up plan ready should his main Plan be thwarted.

It is also important to plan for adequate periods of rest from technical training. These rest periods are another key point in any Training Plan and should be properly planned in advance. They should never be just allowed to 'happen'. General training such as fitness or mental training must not be neglected during these rest periods, but it will always be helpful to overall performance if at least one period of at least four weeks is planned in each year with no specific shooting training. The 50m and 100m disciplines are mainly summertime events whereas the 10m disciplines nowadays are all year round. However, for any shooter who chooses to use the 10m discipline as a training discipline for the others, it is important to have an adequate rest between summer and winter activities. A shooter involved in all of the disciplines must plan his rest periods as best he can, but they must not be neglected. Following any such rest period, it will be helpful if the shooter goes 'back to basics' in his training rather than taking anything for granted. He should examine his stance and hold on the rifle very carefully, and rebuild his technique as if he were a novice. By including this in his Training Plan he will ensure that he is made aware of any errors that may have crept into his technique.

There should be a careful balance between the elements of training such as technical, physical and mental. Ideally, physical training should be concentrated in periods of a light load in the shooting programme. When technical training is stepped up, physical training should be reduced to a maintenance level. This will avoid fatigue. Likewise, mental training should be matched to the shooting programme with clear differentiation between trying out new techniques and using then to maintain and enhance performance during a match period.

43.3 Contents of the Training Plan

The Training Plan should include everything that makes a contribution to shooting performance. Travel to the training venue and to matches must be included and planned. This is where the Plan can show up the weaknesses of uncontrolled training. Physical Training, and Mental Training, which should not need to be carried out at the shooting range, can be fitted in between work commitments, etc. If he also shoots another discipline he must decide what contribution that makes to his Moving Target shooting and include it in his Training Plan. Perhaps he is planning a week's holiday skiing. Will that make a useful contribution to his training? If so, it is included in the Plan. The game of golf complements all forms of shooting, and a regular round of golf could feature in a Training Plan.

The Training Plan must make proper provision for the final preparations for a match. His training must be properly managed so as to leave him in the best physical and mental condition for that match.

43.4 Changes in Technique or Equipment

The Training Plan should also include provision for reassessing techniques and equipment. The best time to make a major change is usually immediately after a natural break in the programme such as after a holiday. Smaller changes can be introduced at other times but it would be unwise to make a significant change shortly before a major match. Any change needs time for it to be assimilated and assessed. Sometimes the immediate effect of a change is an apparent improvement in performance, but this is often illusory. The new equipment or a different technique distracts attention from the issues that were hindering good performance such as a lack of concentration. In other instances, the change results in an immediate loss of performance and only time and training will restore it. It is better to assess any new equipment or technique in a controlled manner when there is no immediate pressure to improve performance.

If smaller changes must be introduced during the main training programme, the Training Plan must be amended to allow them to be integrated into the overall technique. It is important to remember that one change may need others if they are to give the maximum benefit.

43.5 Writing a Training Plan

Every Training Plan is unique. Although it is possible to copy the style of the Training Plan of some other shooter, it is not possible to copy its contents. Many different styles have been used by different shooters. One popular style is to use a large 'Year Planner' format with everything set out for six months or a year on one large sheet. This and similar formats have the disadvantage that they are difficult to revise when changes become necessary. With this technique, it is possible to prepare detailed plans for the immediate future, turning into more general plans for perhaps three to six months ahead and only an outline plan for a year ahead. Another method, and one that is very effective, is to create a series of training modules of a week in duration. Each module covers a typical form of training such as during the aftermath of a match, the non shooting season or the transition from 10m Air Rifle to 50m and 100m Cartridge Rifle shooting. With this format, the special planning needed in the weeks immediately before a match can easily be accommodated. With this approach a shooter will also need to have an overall annual Plan to show, in outline, how the modules are put together to form a comprehensive Plan.

Training Plans must be comprehensive but not too detailed. It is better to plan for so many hours of Physical Training during a particular week than to say that he will do 30 minutes each day. This is an advantage of having a modular plan.

Whilst a Training Plan should be discussed with his Coach or Instructor, and he should have some input to it, nevertheless, it should be the 'property' of the shooter. It should not be possible for anyone to dictate the contents of a Training Plan to him. Only if it is his own property is he likely to follow it and thus benefit from it. It would not be unrealistic for him to spend about a week out of his training time to write an initial Training Plan. Such time will be well spent.

43.6 Following the Training Plan

A Training Plan is valueless unless it is followed. That is not to say that it must be followed to the letter, but over a few weeks it should, on average, be followed. If it is too rigid, it will lose some of its value; there must be some flexibility in it. Thus it is useful if, once a week (or thereabouts) the shooter reviews the way he has followed the Plan and of how he has met its objectives. It is important that the results of this review are written down, in the shooter's log. If it becomes clear that the Training Plan was too ambitious or too optimistic, then it must be revised. If he has failed to follow it, the reasons should be recorded. They may be genuine, such as illness or an unexpected business trip away from home, or they may be excuses because he did not have enough commitment. Three or four times a year it will be helpful to carry out a more thorough review of progress. This should include looking back over the records of the regular reviews. This is also the time to revise the objectives.

Some National Governing Bodies require that Training Plans are approved by them and that their shooters demonstrate that their Training Plans are being followed. Membership of the National Team is conditional on following those approved Plans. If this is a requirement, then the shooter must make the appropriate provision for independent verification. A second opinion is always helpful anyway and applies just enough pressure on him to make him stick with it. Even if he reviews progress himself, the format of the Plan can make its verification easier. If it is only on one large sheet it will be more difficult to check off the individual items on it. A modular Plan with separate sheets for each week will be easier to follow and to verify.

43.7 Reviewing the Training Plan

A Training Plan, like a Business Plan, must be reviewed regularly. The review dates should be included in the Plan. Certainly an annual review is important, and this should be supplemented by monthly or quarterly reviews. Additional reviews should be carried out if circumstances change or if it becomes clear that objectives are unrealistic. A review after each major match can be helpful. A review does not necessarily mean that the Plan must be revised. The review may simply confirm that the Plan is satisfactory and should continue to be followed.

Some shooters hesitate to prepare a comprehensive Training Plan saying that it would be a waste of time as it would always be changing. While this is true to some extent, they miss the point. Like a Business Plan, much of its value lies in disciplining himself to write it. If it is carefully prepared, it will include some provision for contingency, such as non selection for a match or illness, and changing the plan will be only a formality. The Training Plan is a living document that must not be allowed to die. If it was carefully prepared in the first instance, revision should not need any great effort.

Chapter 44 The Shooter's Log

Every shooter should keep some sort of log or journal of his shooting activities. This is most important if he aspires to shoot at National or International level. The log should record everything directly connected with his shooting and many other matters which may have an indirect bearing on his performance.

In the first instance the log should form a complete record of all training and competitions. It should record the times spent and some detail of what was actually done. Needless to say, it should include scores. It should also record the match conditions and the shooter's impressions of the opposition. Any ideas he may have gleaned from watching other shooters or talking with them should also be placed on record.

The log should also contain such matter-of-fact information as details of ammunition loads and performance. It might be useful in future to know that before he could shoot a particular match, he had to make a significant adjustment to the sight on his rifle. He may not need to know why at the time, but it could be important to investigate later.

Most of all he should be recording his own feelings. If he has trained after a hard day at work or after a domestic upset, he should say so and how it affected the quality of his training. If he did not feel like shooting at all but did so, how did he feel afterwards? If he did not train at all but felt that he ought to, then this should be recorded.

The form of the log is unimportant. It is best not to use a printed 'diary'; a shooter needs freedom to express himself. A standard bound notebook is better than loose papers unless they are meticulously filed in a proper folder. A Computer or Word Processor can be a good way to keep a log.

The log is private property, but should be reviewed from time to time to see what lessons can be learnt. A comprehensive log can help to identify the precursors to a successful competition and enable you to repeat them on another occasion. If written evidence is need that the Training Plan has been carried out, it will be better to keep, in addition, a more formalised 'diary' which contains only the salient points from the log.

Chapter 45 Match Preparation

Competing in a match is a major disruption to training. Even attending a Domestic Match will involve travel and possibly an overnight stay. It may take eight hours or more of the shooter's time just to shoot one match. If it is an International Match it is likely to be spread over most of one week, longer if it involves inter continental travel. The shooter is away from his normal training facilities for all of that time and only has minimal facilities available to him for training on a range. He is cut off from his family and home life and must find something to do to fill in his time to avoid boredom. There may be problems of jet lag to overcome, and if the match is in a hot location, life can become very uncomfortable. Even when he returns home after the match, there are small jobs to be done and correspondence to deal with which may prevent an early return to his normal training routine.

Thus preparing for any match is an important part of any Training Plan. It is most important that a shooter sets himself a clear objective for the match. This may be to better a specified score, but should not be 'to win'. Because participation in a match raises a number of special issues, preparation for it is dealt with separately, but it is an important component of the Training Plan. The best place to start is at the end; the match itself. Unless it is a Domestic Match, it is likely to be spread over at least three days. On the first day some training will be allowed, usually only ten or fifteen minutes. The slow runs (or Running Deer Singles) will be shot on the second day and the fast runs (or Running Deer Doubles) on the third day. If there is a mixed runs match it will be on the fourth day with, usually, an opportunity for a few minutes training on the range on the previous day. There will sometimes be a supplementary Running Boar match in addition to the main Running Target match.

No-one should be afraid of a break in training for a few days before a match. There is a tendency amongst inadequately prepared shooters to have a rush of training immediately before the match. This does improve the technical ability of the shooter but it also increases fatigue and boredom. Thus his performance will initially appear to improve but then fall away. If he starts the match fatigued, then he will be at a disadvantage. Experience from other sports has shown that if pre match training is properly planned, the athlete will reach a peak and maintain it for 5 - 8 days without further technical training. His training will taper off in the days before the match. In the same way, any physical training should be tapered off before the match to avoid muscle fatigue. This will usually coincide with travel arrangements and the limited training facilities for training at the match venue. Even if unlimited training facilities are available, the shooter must plan his use of them very carefully if he is not to start his match at a disadvantage. He must also be prepared to resist the unsympathetic comments of an ill-informed Team Manager who may apply pressure to train unnecessarily.

45.1 Before Leaving Home

The inexperienced shooter will increase the amount of time spent training on the range immediately before he goes to a match. This is often not a good thing. Certainly, training should be increased, but the objective should be to make the match, the travelling, and the waiting, a part of the planned training. From what has been said before, it should be clear that going to a match needs careful planning, the more so when it involves a long trip away from the home base. Thus, for a match that involves a week or more away from home, the preparation should start two or three weeks before the planned day of travel. Careful attention should be paid to any identified shortcomings in techniques, but major changes should be avoided. Equipment should

be checked and made ready. Make sure that any tools and cleaning equipment that may be needed are available. There should be a 'legal' mark on the waist of the shooting jacket and buttons and straps should be securely sewn on.

Remembering that the possibility for training on the range will be very limited when he reaches the match venue, the shooter needs to plan and prepare for the alternatives. Thus his training plan should include shooting at a static target and various dry firing exercises.

If there is an opportunity to shoot a minor match, or even an arranged 'friendly' match a few weeks before travelling this can be helpful. However, any match is an intrusion into the training programme and must be demonstrably beneficial.

The period immediately before an important match is not the best time to make changes to equipment or techniques. Experimentation is best carried out at a time that is well separated from any match commitment.

45.2 Arriving at the Match Venue

If his journey crossed several time zones it is probable that the shooter will arrive a few days before the match is due to start. Even on short continental journeys, one rest day is normal. Some rest is needed to recover from travel fatigue and to allow muscles strained by carrying a heavy suitcase and gun case to recuperate fully. This time is well spent in Physical Training as a continuation of the normal programme. Unless he does jog regularly, he should not plan to start now, but a good walk will work wonders.

Jet Lag and Travel Fatigue need careful planning if they are to be combated. The next chapter deals with this problem in more detail. However, their effects can be minimised if you arrive at your destination Hotel in the early evening. After a light meal, to bed and let sleep do its work.

For very hot venues like Atlanta, Barcelona and Sydney, the temptation is to arrive early to acclimatise to the heat. All the evidence suggests that no-one can ever acclimatise to it and that after the initial shock of the exposure to high temperatures they simply become more drained of energy each day. Many of the worst effects of high temperatures and humidity are caused by dehydration and the depletion of essential minerals in body fluids. These effects can be minimised by using 'Isotonic' drinks. (See the Chapter on 'Diet'.) For some venues, such as Guatemala, there is a strong probability of acquiring a dose of the local diarrhoea or similar stomach upset. It is as well to remember that the longer the exposure to the local 'bugs' the higher the probability that you will succumb. Thus too long a time spent in 'acclimatising' might not be a good thing. Suitable medication should be taken but, as many of these such as Imodium or Lomotil are in fact (permitted) narcotic agents; their effect on performance could be negative. This too needs forethought and careful planning.

Wherever he is, a shooter will be keen to get to the range and to get back into training. This is not always possible and non range training must be substituted. Any unproductive time spent in the days before the match can be detrimental to his performance, as much of the time as practicable should be productive. For a shooter who has been practising regularly before he travelled to the match, the sudden deprivation of training can affect his performance. If he has planned things properly, he will be able to substitute other forms of training. It should be possible to carry out extensive dry firing, even if only at a static target. At some locations, rifles, including Air Rifles, must be kept in an 'armoury' and so dry firing is only possible at the range complex

and usually under some form of supervision. Nevertheless it should be possible. However, to be of benefit, this form of dry firing should also be an integral part of the normal training programme.

One important thing that must be done is to check all equipment, particularly the rifle and 'scope, for possible damage in transit. It is best if the 'scope is removed from the rifle whilst travelling by air to minimise the possibility of damage. At the earliest opportunity the 'scope should be refitted and the 'zero' of the rifle checked. Make sure that mounting screws are firm but not overtightened.

There will always be some opportunity to undertake some Physical Training. It would be unwise to suddenly start a programme of Physical Training after he arrives at the match venue if this is not already part of the shooter's normal training programme. The exercises, aerobic or anaerobic should be planned in advance as much as prior knowledge of the programme permits.

At many International Matches it will be possible to have rifles overhauled and serviced by the manufacturers. A shooter should make sure that he makes time for this. It is usually easier during training and before the matches start, but this could deprive him of his rifle for a few hours when he needs it. There is usually a great rush to the manufacture's workshops after the early matches finish. This needs to be planned in advance.

45.3 The Day before the Match

For a Domestic Match, it is probable that a shooter will go straight into the match soon after his arrival at the venue. There will be only limited provision for training, but any opportunity should be used. There may be an opportunity to shoot an informal competition with local shooters or other competitors on the day before formal training commences. This is an excellent opportunity to familiarise himself with range conditions and should be used. Otherwise he should make the best possible use of whatever static sighting in facilities are available. He must not be tempted, if opportunity presents itself, to overdo this last minute training. His training should have been completed at home before he goes to the match venue and this last minute training should be used only to familiarise himself with range conditions.

For an overseas match the training facilities will vary with the match and its location. For most matches, access to the Moving Target range will be limited to no more than 15 minutes on the day before the match. Sometimes additional ad hoc training may be possible but this is not to be relied upon. The shooter must never succumb to the temptation to overtrain if such facilities are available, but to conserve his energy, physical and mental, for the match itself. For major matches like the Olympic Games the range may be available for several days before the match but often with strictly limited availability on each day. The order of shooting during training is usually the same as it will be during the slow runs, and there will be no opportunity for ad hoc training on the range. Thus it is most important that plans are made to make the best possible use of the facilities that are available.

It is best to treat this training as a dress rehearsal for the match itself. Thus the shooter should prepare to shoot in the same way as he would normally, checking out his rifle, warming up on the sighting in range and then dry firing. Because of the limited time, he may not be able to shoot a full course of fire. It is his decision how he splits the time between slow and fast runs or Singles and Doubles. (During training for the Mixed Runs match, he can ask for all slow or all fast runs

rather than mixed runs if he prefers.) During training, it is usual to fire five shots on each diagram of the 10m Running Targets rather than one shot per diagram.

After training, it is important for the shooter to relax. Sightseeing or shopping is the usual activity, but a long walk might be better. What he should try to do is to make sure that he forgets the match the following day. While a good night's sleep is desirable on the night before the match, it is as well not to try to go to bed too early and then wake up in the early hours of the match day unable to get back to sleep. It is best to follow the normal pattern as much as possible.

45.4 The Day of the Match

Throughout the time between breakfast and standing on the firing point to shoot the match, the shooter's mental training should be put to good use. He should have a routine worked out for calming himself down after the journey, and for quelling the nerves and avoiding the negative thoughts as he waits his turn to shoot. A good book and a 'walkman' (or IPod or MP3 Player) may be all he needs, but his training should prepare him for this phase of the match.

He should have some idea before hand what time he will be shooting. This information should be used to plan his programme for the day. He will know whether he shoots best on an empty stomach or if he needs some food beforehand. It will be as well for him not to skip breakfast altogether, but if the match is early in the day, a very light meal, avoiding tea and coffee, is suggested. If he is not likely to shoot until later in the day, a late breakfast may be in order. If not, he should make some provision for a snack about an hour before he shoots. A snack high in carbohydrate is good, but high energy sugary foods should be avoided. He should keep away from the greasy foods that are usually provided by the range snack bar until after the match. It is important to avoid dehydration but at the same time avoiding drinking excess fluid which may want to come out at an inopportune moment or cause excessive perspiration. 'Isotonic' drinks are good in this respect as they are quickly absorbed and thus used better by the body. Carbonated drinks should be avoided as well as alcohol; this may be prohibited before shooting under local rules. Although the Moving Target matches are relatively short, the shooter may be present on the range for some time whilst waiting his turn to shoot. Thus he should plan to have a suitable snack available to top up his energy reserves if shooting is delayed for any reason, and adequate fluid to drink. It is important to maintain fluid intake at a uniform level whilst waiting to shoot, rather than having a large drink only when the effects of dehydration start to be felt.

If he has to travel to the range, the shooter will need to make his plans around the availability of transport. If he is travelling by private car and arrives late, this is entirely his own responsibility. Although the ISSF Rules make provision for late arrival, it will incur a two point penalty and will be mentally disturbing. If transport is provided by the organisers, it is still the shooter's responsibility to be at the range on time even if the penalty is waived. Thus adequate time should be allowed, including some contingency time as 'buses have been known to be late or not turn up at all. At the same time, it is unwise to arrive at the range too early. Waiting around to shoot is a good way to raise a shooter's anxiety level, and the facilities for quiet contemplation are usually very limited at the range. The sounds of shooting are usually too good a reminder of what he is about to be called upon to do. This is the time when a well-chosen book and a 'walkman' are invaluable.

On arrival at the range, the time for shooting should be confirmed. The 'start list' does not usually give times but only an order of shooting. The actual timing depends very much on the range organisation. As a rough guide, allow 13 minutes per shooter for the slow runs, 12 minutes for

the fast runs and 9 minutes for the mixed runs and Running Deer events. If Electronic Scoring Targets are in use on the 10m range, times will be a little shorter; perhaps a little longer if paper targets are used. It is usually possible to make a better estimate of timing during formal training. It is a requirement of the ISSF Rules that static firing points are made available near to the range so that shooters can have the opportunity to sight in their rifle and warm up their barrel or action before the match. Technically this is a function firing range without targets, but in the Moving Target events this is usually interpreted as permitting blank targets on one with a few aiming spots". This is also an opportunity for some training in holding the rifle steady. Most shooters go well beyond this basic requirement and use this time to settle themselves into the match atmosphere, using the time much as the static shooters do with their unlimited sighting shots. Some will spend 30 minutes or more in this way, using it as an opportunity to get themselves into the right frame of mind for shooting.

How long each shooter spends in this warming up exercise depends on himself. His objective should be to complete the exercise a few minutes before he dry fires. This facility for static shooting can be invaluable if properly used. It is usual to see three or more shooters using each firing point in this way, each shooting at a different point on a marked up target. It is unwritten range etiquette that the shooters who are about to dry fire will be given priority on this static range.

Because of the limited facility for training and practice, it is important that the maximum use is made of the opportunity to dry fire immediately before the match. This can only be used effectively if dry firing is a part of normal training before the match. During training he may not feel the need for dry firing (nor for shooting at a static target), but this is an essential part of his match preparation. Again, this form of training must be prepared for properly; it can be fatiguing if the shooter has not included it in his normal Training Plan. It should be considered to be as much a part of the match as the shooting itself and prepared for in the same way. Properly planned breaks during dry firing are needed to ensure that the shooter is not too fatigued when he goes onto the firing point.

When the shooter goes onto the firing point, all of his training should come together for a personal best performance. If it has been carried out thoroughly and conscientiously, he should be able to achieve his objectives set for the match.

45.5 Debriefing

After the match it is as well for every shooter to reflect on how he performed. There is no point in bemoaning the mistakes and saying "if only". This debriefing is to find out what lessons can be learned for the future. Immediately after the match, amidst the euphoria or disappointment, is not usually the best time for this. The next day is often better. Ideally, a Coach should have watched him shoot and he should be able to share the debriefing. He may be able to tell his shooters more about their performance during the match than they can remember themselves.

When he returns home, the shooter must settle back into his normal training routine again. There will be jobs to do, extra time spent at work to catch up on what he missed and he will be disinclined to get back into training again. This is where his match preparation and Training Plan come in, disciplining himself to get back into his routine again. Those first few days after the match are important. Probably the best way is to use some of the time to review the Training Plan and objectives.

Chapter 46 Travel Fatigue

Although travelling to a match even within the home country can be tiring, that does not compare with the fatigue that can so easily become part of an International Match. Travel across Continental Europe by road is tiring and time consuming but, is really an extension of travel within the UK. Air travel, particularly Inter Continental 'Long Haul' travel has it own unique problems. Travel fatigue covers not only the tiredness and fatigue that can affect any traveller, but it also includes what is known as 'Jet Lag'. Understandably, the latter has been given a lot of attention by those concerned with sports team management. Various strategies have been worked out for combating it; few with any success. Drugs that claim to combat Jet Lag have been used by aircrew and their passengers alike, with varying results and side effects. One reason for this unpredictability is that so often, Jet Lag is treated in isolation from the greater problem of Travel Fatigue that embraces all of the problems the International Traveller might experience.

46.1 Jet Lag

Jet Lag occurs when our body and its surroundings is on a different time clock to our mind. Our clock is set by our perception of our surroundings. When it is dark we go to sleep, when it is light we wake up. When we cross several time zones, our clock is normalised to the time and conditions of the place of departure. At our destination, when our mind knows that it should be time to go to sleep, the locals are just waking up and as a result we are confused. One manifestation of the problem is that our physical strength and mental alertness are keyed to our body clock. Thus in mid morning, our mind is at its best, whereas our body performs demanding tasks better in the afternoon. With such a time shift, these in-built reactions are totally confused. Like many such problems, time and sleep are the great healers. It is generally reckoned that it takes a full day to recover from every hour of time zone shift. Thus a journey to the Antipodes should be followed by at least ten days of rest before your performance is 'normal' again. This is not always practicable as was explained in the earlier chapter on Match Preparation.

If Jet Lag itself were not bad enough, differences in 'daylight saving' time and local habits might exacerbate the problem. Thus, if we fly to Portugal, we must advance our watches by one hour. Yet Portugal is further west than anywhere in the British Isles and so the sun is actually nearly an hour behind London time! Add to this the local custom of rising late and going to bed even later, and of taking a very late evening meal, and we can see that our body clock could be as much as four hours adrift!

Another factor that can make the problem of Jet Lag seem worse is the change in daylight hours if there is a big north / south shift too. Even flying form the North of Scotland to London in June can involve the loss of two or three hours of daylight. From Southern Europe to Scandinavia in winter can be real shock, apart from the temperature change. This daylight shift must be taken into account when Shooters or team Officials are planning their travel.

Jet Lag is worse flying west to east, i.e. against the travel of the sun. Flying west, you experience a long day. Flying east it is a short day with not enough time to sleep. Thus on a flight to Australia, it is better to fly via the USA than via Singapore. Cost and convenience might dictate otherwise.

We now know that an enzyme, Melatonin, is important in to our body clocks. Melatonin is produced naturally by the pineal gland and is destroyed when our body is exposed to strong light. Melatonin extracted from animal glands has been used to counteract Jet Lag. It is taken to

advance the natural time for sleeping. What is now known is that whilst there is some effect, the exact timing of a dose is critical. Get it even slightly wrong and the end result could be even worse! Perhaps the greatest disincentive for using Melatonin is that its source, an animal gland, makes it susceptible to carrying unknown diseases. Remember BSE?

One matter is generally agreed, it is that alcohol and tea or coffee should be used only in moderation, if at all, during the journey, but otherwise lots of liquids to prevent dehydration. Alcohol and caffeine, like Melatonin, disturb your normal sleep pattern and unless very carefully managed, can make things worse. In addition, alcohol dehydrates and caffeine is a mild diuretic and will exacerbate the problem of dehydration.

46.2 Journey Time

What is often ignored is the effect of a long journey. It is not just the time in the aeroplane that matters but the total journey time. As a rule of thumb, the journey starts one hour before you leave home and ends one hour after reaching you destination accommodation having registered and completed all formalities. In other words, it begins and ends when your time is now your own.

For instance, if it is two hours travelling time to the Airport, you must allow for delays (one hour) such as the rush hour traffic on the M25, and for parking the car (one hour). With guns, you must allow a minimum of three hours to check in, four hours for an Intercontinental flight. With that hour before leaving home, it is at least nine hours until you are on the 'plane. Time can be saved if you can get a lift to the Airport, but if you have to use public transport, this will usually take longer. At the other end, allow at least an hour to clear customs, longer with guns. Then travel to the Hotel. Assuming it is near the Airport it is still an hour. Booking in takes time and you will be fortunate if you can call your time your own four hours after the 'plane landed! Thus you must add at least thirteen hours to the actual flight time! The whole thing is made even worse if your flight is early in the morning. This could mean leaving home soon after midnight. Staying at an Hotel near the airport only saves about an hour and a half in the example above, and might still mean a very early start.

Whatever the Jet Lag problem, you will be fatigued. On a long journey south to say South Africa or South America, the time zone shift is small compared with the overall journey time. Even to New Zealand with a 12 hour time shift, the 24 hour flight (plus eleven hours!) may have almost as great an effect on your performance.

46.3 Combating Travel Fatigue

Time and sleep are both great healers. Make good use of them to combat travel fatigue. There are a few rules to optimise them and to help you minimise the effects of travel fatigue:

Firstly: use alcohol and caffeine sparingly during the journey and afterwards. The use of either, although it might seem a good thing at the time, will affect your ability to recover naturally from travel fatigue. Although they can be used to modify your sleep patterns, unless very carefully controlled, this is usually for the worse!

Secondly: make the travel arrangements figure prominently in your Training Plans. Work back from the point where you wish to finish. If travel arrangements dictate a long break when you

arrive at your destination before you can start 'serious' training again, then plan for this. Have a strategy for an alternative training regime. Sound planning is a good way to minimise the effects of Travel Fatigue. If Jet Lag or 'culture change' are likely to be major factors then, if practicable, try to adjust your lifestyle gradually over the week or so before you travel. Adjust your meal times and sleeping times to bring them nearer to those at your destination. Daylight hours, a major factor in the Jet Lag effect, may dictate how you can do this. However, even a one hour shift can be helpful.

Thirdly: set your watch to local time and try to adjust to it as quickly as possible. It is best to reset your watch when you first board the 'plane. You will be tired when you arrive at your destination hotel. Try to avoid taking a nap; if you do, restrict it to no longer than two hours; you should be fully awake at least four hours before your new bedtime. There is no problem with taking a nap on the 'plane. Even sitting with your eyes closed can help reduce fatigue. Such 'sleep' is usually superficial and often disturbed and so does not interfere with your normal sleep pattern later.

Fourthly: as far as practicable, try to arrive at you journey's end in the early evening. This means that after a light meal you can go to bed and sleep; after all this is what your body most wants to do! For a journey from the UK to Europe, a morning flight achieves this naturally. Unfortunately, most flights from Europe to Australia seem to arrive in the early hours of the morning. Likewise for the return journey. This means that you must resist the temptation to dose off during the day. Exposure to strong sunlight helps; stay outdoors.

Fifthly: plan for your resumption of normal training when you arrive at your destination. Team officials, understandably, want to make sure that their shooters are not affected by Jet Lag. At one extreme, they want to see the shooters go straight into a full training regime; at the other extreme, they want their shooters to rest up until fully recovered. Whilst Jet Lag can be a problem, so is boredom. Thus as the shooters recover from Jet Lag, so they can become bored and thus start to lose concentration. Even a programme of sightseeing or other 'diversions' cannot avoid this; it can only delay its onset. Whatever they do, the thought of the match is always in the background, and negative thoughts and worries start to creep in. These negative thoughts can be circumvented if good training facilities are available to help restore confidence in one's ability. With experience, each shooter should know his own needs in this respect, and should try to arrange their travel to match their needs.

46.4 Getting the Right Balance

Balancing the need to recover from Travel Fatigue and the need to getting back into full training is a real problem. Much will depend on the availability of good training facilities. Alas, these are usually minimal for the Moving Target Shooter. Often the range is not available until the minimum of one day before competition. One way round this is to stop over at some location where Jet Lag to the final destination is minimal but where good training and recuperation facilities exist. You must remember that the final journey to the match venue will also be fatiguing, and that you must allow for recovery from this stage of your journey too. For the more energetic sports, full muscle power and speed are not available until the body had adjusted to the new time zone. Shooting is a more mental sport and this may not be quite so important. Thus the shooters, if it is a mixed sports team, should try to ensure that their needs are not subjugated to those of the rest of the team.

Chapter 47 Travelling with Firearms and Ammunition

Travelling with firearms and/or ammunition can be complex and this chapter can only touch on the subject. Firearms law varies from country to country and even within some countries. Some countries have a permit system for air guns as well as cartridge firearms. Therefore it is most important that anyone taking a gun to a foreign country checks most carefully the local requirements. This must also include any country through which you might pass on your journey. In some countries the possession of a spent cartridge is a serious offence. Some countries even prohibit overflying if the aircraft is carrying any firearm or explosive substance (such as ammunition). Thus you will also need to consult any proposed carrier such as an airline: each carrier has its own rules. For instance whilst most of the major National Airlines will accept rifles and ammunition as checked hold baggage; many of the budget airlines will not even accept an air rifle. Some airlines will carry 'sporting equipment' free of charge (within specified weight limits); other make a supplementary charge for more than one item of checked baggage. Most airlines require at least 72 hours prior notice if you are carrying firearms or ammunition. There are travel companies in many countries which specialize in group or sports travel. These can sometime get concessions from airlines for firearms or other bulky sporting items. Normally, if you are travelling to a major championship to represent your nation, the National Governing Body will make the travel arrangements through one of these companies.

If you are carrying firearms or ammunition across Europe by road or rail, you MUST have a license for each country you might pass through. In many instances this can be obtained at the border point of entry, in others it must be obtained in advance. In the past, competitors travelling from a World Cup match in Munich to the next match in Milan by rail have had problems when entering Italy from Austria because they did not declare their guns at the German - Austrian border.

Some countries insist on a local "sponsor" before they will allow you to import firearms or ammunition. If it is a major match you are attending, the match organisers will normally act as sponsors and arrange this well in advance but will require notification of all the details. Last minute changes (i.e. a new rifle) might not be possible. If you are travelling alone or to a minor match things might be more difficult.

Some countries have special restrictions on certain classes of firearms or ammunition. In the UK there is a ban on the private possession of handguns which will be impounded on entry if you are travelling from the USA to Europe via London. *[Special arrangements can be made, well in advance, for pistols in transit.]* There is also a ban on the use of soft or hollow point ammunition for any form of target shooting; this includes some types of .22LR ammunition. France has restrictions on the possession of "military" calibre rifles and ammunition. Some countries have restrictions on "Hunting Rifles" and this could be construed as including a Running Boar rifle.

Possession of a valid European Firearms Pass, whilst essential for European Citizens travelling throughout Europe, is NOT a substitute for a local Firearms License. The European Firearms Pass is merely a formal statement by your own licensing authority that you are entitled to possess specified firearms and ammunition in your home country and to purchase them whilst abroad. It is a prerequisite for obtaining a License in the country you are visiting.

Whatever you are carrying and wherever you are travelling there are some universal rules that MUST be observed:

In these days of heightened security risk you must anticipate that at any time and anywhere (including in your home country), you could be subject to a random security check. Not only will you be required to show that you are authorised to possess firearms and ammunition, but you will also have to demonstrate that your rifles are safe. A rifle found with a bolt in place and closed could cause a problem even though it was in a case. It will be assumed by the security authorities to be loaded! An uncased firearm being carried by you or on display in a vehicle may initiate a security alert.

No firearms or ammunition may be carried in hand baggage on an aircraft nor on the person i.e. in the aircraft cabin. *[It is a general rule that "All sporting firearms are carried in the hold; only weapons of war are carried in the cabin!"]*

Firearms carried on an aircraft must be cased or boxed; the case must NOT contain any ammunition which must be carried in a separate item of luggage. A rigid rifle case is recommended: soft cases no matter how well padded, will not withstand the attacks of an airport baggage handler! Currently IATA Rules allow a maximum ammunition weight of 5.0 kg per luggage item and this must either be in the maker's box or in a container with separators to prevent any risk of accidental detonation. This is not normally a problem for rifle or pistol shooters, but the shotgun shooters may have to arrange for a supply of ammunition to be delivered to the match venue.

Firearms must be demonstrably safe: not only unloaded but with the action open, any magazine removed and the bolt removed (leaving a bolt in a rifle is recipe for a broken stock). Rifle bolts are best carried with the ammunition in a suitcase. A breech flag is advisable. Firearms are normally inspected by airport security before being checked in, and gun cases will be clearly marked as containing an unloaded firearm. Telescope sights are best carried separately but some countries have strict rules about telescope sights (associated with sniping rifles!) and some airlines will not allow them to be carried in hand baggage (a 'component part of a firearm'?). A suitcase containing ammunition MUST NOT bear any 'explosives' markings.

If travelling by air, it is important to know that it is prohibited to carry compressed gas in an aircraft. Air Rifle gas cylinders should be fully discharged before travelling. The competition organizers usually make a supply of refill air or CO_2 at the match venue, often through one of the major Air Rifle makers. Bulk gas cylinders may be prohibited or require special authorisation on a sea ferry or through the Channel Tunnel and some road tunnels.

At your destination the gun cases are often unloaded from the aircraft separately and will be subject to a further inspection by airport security who will also verify that you are authorised to import firearms.

If travelling as a group, it is helpful for the group leader to have multiple copies of a manifest listing against names, European Firearms Pass and your local Firearms License Numbers, full details of firearms (serial numbers) and ammunition carried. Before leaving the UK this will be endorsed as a formal record of what was taken out of the country and expedites their return. It can also hasten the issue of any local licenses at your destination if it confirms the arrangements already made. If travelling alone, the equivalent of a manifest, although not essential, will usually simplify formalities.

At the match venue, firearms storage arrangements will vary. Many venues insist that all firearms (including air guns) are kept in a central armoury when not in use on the range.

This can cause problems if you have an early morning departure and may mean that you have to make arrangements to take your rifles to your accommodation over that last night! The match organiser will normally arrange to have the armoury open early but it can mean a very early departure from your hotel! This also means that when competing, you MUST get to the armoury in good time to draw your rifles in good time. There is always a long queue!

At any major match there is always a formal equipment check. You MUST have a validated control card before you can shoot the match, and it is usual to pass through equipment control before formal training starts. As the same equipment control centre often covers all the shooting events at the match venue, there can be some very long queues and it is worth consulting the overall match program before attending so that you can choose a likely quieter time. Note that if you make ANY modifications after passing equipment control, you MUST submit it to retest. Equipment may be subject to a random retest on the firing point and this is the norm for all competitors in the Moving Target events. A Running Boar or Running Deer rifle trigger that no longer passes the weight test (500 g) could mean disqualification if it is tested after the competition. Any sign of alteration to the mark on a shooting jacket (or a seal placed thereon by equipment control) will also mean disqualification.

Be sure to check if there are any special procedures to be observed before taking a rifle onto the firing point or removing it after the match. Some ranges insist on the rifle being cased except when on the firing point. The ISSF Rules say very little about range safety presuming that competitors will be briefed on local range safety arrangements which override any ISSF Rules. There is usually a "Technical Meeting" before competitions start when any special requirements are made known.

When leaving the venue for home, some countries will carry out a check to ensure that any firearms brought into the country are being taken out and that they are carried safely. You might also expect to have to account for any ammunition used to make sure that you haven't given any away or sold it. If the venue is a major match, then this is usually only a formality.

When returning to your home country it is important to have all the necessary documentation to hand that will prove your right to possess firearms and ammunition. A manifest, endorsed by airport security before leaving, will usually expedite things. If you have acquired a new rifle or a "component part" whilst abroad, you must have the necessary authority. In the UK, HM Customs and Revenue have the authority to enter a newly acquired rifle onto your Firearms Certificate but only if you have an appropriate variation to acquire it. If not, it will be impounded and only released on production of a Firearms Certificate with an appropriate variation. This could be a very long and expensive procedure.

APPENDIX 1 Suggested Further Reading

The following books are suggested reading for anyone who would seek to improve his performance in Moving Target shooting. With the exception of the first four books listed, none of these books deals specifically with Moving Target shooting. All will be found to provide some helpful background material. The first reference, "Competitive Shooting" covers all aspects of rifle and pistol shooting. While it is now out of date, the author's systematic analytical approach has much to commend it and it makes excellent background reading for any shooter. The second reference, "Practical Rifle Shooting" although is its language is very 'dated', is a classic in its own right. Many of the techniques recommended are still pertinent today.

Note. The inclusion of a reference in this bibliography does not imply endorsement by the author.

"Competitive Shooting", A A Yur' Yev. Published in Russian in 1973. Translated and published by the National Rifle Association of America 1985.

"Practical Rifle Shooting", Walter Winans. Published by G P Putnams Sons 1906; Reprinted 1995 The Border Press, Brecon.

"International Running Target Guide", The United States Army Marksmanship Unit.

"Target Rifle Shooting", David Parish & John Anthony. Published by EP Publishing Ltd. Wakefield, W. Yorkshire, England 1981.

"Practical Rifle Marksmanship", Pete Bloom. Published by P J Bloom, Exeter 1993.

"On the Training of Shooters", Vol. I & II, Heinz Reinkemeier. English version published by NSRA 1992/93. A German version is also available.

"Ways of the Rifle", Gaby Bühlmann, Heinz Reinkemeir, Maik Eckhardt. English version translated by Bill Murray and published by MEC, Dortmund 2002.

"Olympic Target Rifle Shooting, Techniques, Tactics and Training", Ralf Horneber. English and German versions published by F C Mayer Verlag, München 1993.

"Competitive Pistol Shooting" Dr. L C Antal. A & C Black, London 1983/89.

"Mental Training for Shooting Success", Richard L Domey. Published by College Hill Communications, Washington 1988.

"Sporting Body, Sporting Mind", John Syer & Christopher Connolly. Published by Simon & Schuster, London 1984/87

"Think to Win", John Syer & Christopher Connolly. Published by Simon & Schuster, London 1991.

"The Inner Game of Tennis", W Timothy Gallwey. Published by Jonathan Cape and Pan Books 1975/86.

"Autogenic Training", Dr Kai Kermani. Published by Harper Collins, London 1990.

"Zen in the Art of Archery", Eugen Herrigel. Published by Arkana, London 1953/85.

"The Way of Harmony - A Guide to the Soft Martial Arts", Howard Reid, Published by Unwin (Gaia Books), London 1988

"Sports and Psychology", Frank Ryan. Published by Prentice-Hall, New Jersey 1981

"Mental Training Programme", Four Tapes plus Text, "Mental Rehearsal", "Goal Setting", "Concentration Training" and "Anxiety Control", Dr Lew Hardy & Dr John Fazey, Published by National Coaching Foundation, Leeds 1990.

"Fit for Life", Daley Thompson & Sally Ann Voak. Published by Hodder and Stoughton 1983.

"Know the Game - Keeping Fit", Published by EP Publishing Ltd., Wakefield, W. Yorkshire, England, Reprinted regularly.

APPENDIX 2 Moving Target Shooting Rules and Regulations

Every sport needs a set of rules if those participating are to gain the maximum benefit and enjoyment from it. All mainstream shooting is governed by the International Shooting Sport Federation (ISSF).

Although strict compliance with the rules isn't necessary to enjoy the sport, if the shooting procedure and the competitor's equipment do not comply with the ISSF Rules, then participants are must be confined to shooting on their own range. They are at a disadvantage if they ever want to compete side by side with other enthusiasts. The ISSF Rules are designed to ensure that range conditions should, as far as practicable, be the same at every location, and that shooting equipment and procedures are also compatible such that no-one can be seen to have an unfair advantage over any other competitor. The overall objective is that any skilled and experienced shooter should be able to shoot on any range without being aware that it is any different from the range he normally shoots on. There are inevitable small differences between ranges, especially outdoor ranges where wind and lighting conditions can be quite different. One reason for the growing popularity of the 10m Air Gun events, including 10m Running Target, is that they are shot on an indoor range where these factors are not present. When shooting at club level, many of the matters covered by the rules may not be too important overall as long as those using the range are neither advantaged nor disadvantaged by them. For that reason the ISSF Rules are as generous as practicable in allowing some freedom for local interpretation. However, when it comes to major international and even national events, compliance with the rules to the letter is mandatory.

At a major competitive event a qualified independent Jury supervises the shooting and verifies that the ranges and shooting equipment all comply with the rules. A new World, Continental, National or even Regional record will only be recognized if those rules are complied with by all competitors and that the level of independent supervision is appropriate to the event. Thus if shooters are to compete with others outside their own club, it is important that the rules are complied as far as practicable.

When it comes to shooting procedures and personal equipment it is also important that novices are not allowed to adopt techniques or to use equipment that will hinder their subsequent progression in the sport! This requires more than a superficial understanding of the discipline by the Coach, Instructor or Club Official. For instance, strict compliance with the way that the shooting jacket is marked in unimportant in a club match: what does matter is that the shooter's "ready" position is correct – with or without the mark! Again a violation of the rules concerning the rifle design such as a rifle that is too heavy may not be important in a club event but the owner must be made aware that he will not be allowed to use it in a match elsewhere, nor even in a 'postal' match with other clubs.

The following is a summary of the International Rules governing Moving Target Shooting which applied at 1 January 2009. They are fully revised every four years after the Olympic Games, but there are regular updates in the intervening years. In domestic shooting, variations to these rules are permitted, such as the course of fire or the participation of Ladies and Juniors in the 50m and 100m events. Any such variations should be clearly stated in the rules of the competition.

1 MOVING TARGET RULES

There are seven competitions:

10m (air rifle) Running Target Normal Runs (Senior and Junior Men)
10m (air rifle) Running Target Mixed Runs (Senior and Junior Men)
10m (air rifle) Running Target Normal Runs (Senior and Junior Ladies)
50m (small bore rifle) Running Boar Normal Runs (Senior and Junior Men)
50m (small bore rifle) Running Boar Mixed Runs (Senior and Junior Men)
100m (centre fire rifle) Running Deer Singles (Senior Men)
100m (centre fire rifle) Running Deer Doubles (Senior Men)

The rules for these competitions can be found in the ISSF "General Technical Rules" and "Special Technical Rules for Running Target 50 metres and 10 metres" and in the rules of the NORDIC Shooting Region for the Running Deer events. These ISSF and Nordic Rules are concerned with all Moving Target events included in regional, national and international championships. An extract of the major items follows.

2 RIFLE

Any rifle is permitted which meets the following standards:

2.1 The weight of the rifle and sight must not exceed 5.5 kg.

2.2 An adjustable buttplate is permitted. The curvature of the buttplate must not exceed a depth of 20 mm, nor a length of 150 mm measured across the arc. No part of the buttplate, in its lowest position, may be more than 200 mm below the centre line of the barrel. The use of a sling to support the rifle is not permitted.

2.3 All types of sight are permitted in the 50m Running Boar and 100m Running Deer events. The centre line of the sight must not be more than 75 mm above the centre line of the barrel.

All types of sight are permitted in the 10m Running Target events but if an optical sight is used it must be of fixed magnification not exceeding 4x. The centre line of the sight must not be more than 75 mm above the centre line of the barrel.

2.4 Compensating weights are part of the total rifle weight and must not be added or removed after equipment control. Such additions to the rifle must not exceed a radial measurement of 60 mm from the centre-line of the bore of the barrel.

2.5 In the 10 metre Running Target events only air or CO_2 rifles of 4.5 mm (.177") may be used. The trigger weight is unlimited but a set trigger may not be used.

2.6 In the 50 metre Running Boar events only rifles chambered for rimfire .22" Long Rifle (5.6 mm) may be used. The trigger weight must not be less than 500 grams.

2.7 In the 100 metre Running Deer events only manually reloaded single barrelled rifles chambered for centre fire cartridges not exceeding 8.0 mm calibre may be used. The trigger weight must not be less than 500 grams. A set trigger may not be used.

2.8 The length of the system measured from the rear of the mechanism in the discharged condition, or air cylinder, to the end of the system, including any extension (whether part of the barrel or not), must not exceed one metre.

3 RANGE AND TARGET STANDARDS

3.1 Targets must be of a design approved by the ISSF or the NORDIC Shooting Region.

3.2 Shooting distance:

Running Target	10.0 ± 0.05 m
Running Boar	50.0 ± 0.20 m
Running Deer	99.5 - 101.0 m

3.3 Horizontal variation of the position of the firing point either side of a line perpendicular to the centre of the target track:

Running Target	0.40 m
Running Boar	2.00 m
Running Deer	4.00 m

3.4 Height of target centre (measured above ground level at the firing point):

Running Target	1.40 ± 0.05 m
Running Boar	1.40 ± 0.20 m
Running Deer	-4.00 - + 4.00 m

3.5 Target run as seen by the shooter:

Running Target	2.00 - 2.02 m
Running Boar	10.00 - 10.05 m
Running Deer	23.0 ± 0.25 m

4 CLOTHING

The shooting jacket must be marked to allow range officials to see the position of the rifle stock below the shooter's trailing arm whilst in the "ready" position. The shooter must bend his trigger arm into the fully closed position with the upper arm touching his body. The mark, 250 mm long and 30 mm wide, must be permanently attached so that it is below the point of the shooter's elbow. The official ISSF mark is yellow with a black border.

The use of Ear Defenders is recommended to all shooters and persons near the firing line. Shooters are not permitted to use Ear Defenders containing a receiving device.

5 SHOOTING POSITION

5.1 The shooting position is standing without support. The rifle must be held against the body and supported only with both hands. The leading arm must not rest on the hip or chest.

The shooter must take a position in relation to the bench, table or wall in such a way that it is clearly visible that they give him no support. The use of a sling is not permitted.

5.2 Until the moment when any part of the target becomes visible in the opening, the shooter must assume the ready position, holding the rifle with both hands in such a way that the lower tip of the buttplate touches the mark on the shooting jacket. This mark must be visible to the Range Officer or a member of the Jury while the shooter is in the ready position.

6 COURSE OF FIRE

6.1 In the 10m Running Target and 50m Running Boar events, 60 shots in two series of 30 shots:

15 target runs in each direction at the 'slow' speed of 5.0 - 5.2 seconds;
15 target runs in each direction at the 'fast' speed of 2.5 - 2.6 seconds.

One shot may be fired at each run of the target. Prior to each series the shooter is permitted four sighting runs.

6.2 In the 10m Running Target Ladies event, 40 shots in two series of 20 shots:

10 target runs in each direction at the 'slow' speed of 5.0 - 5.2 seconds;
10 target runs in each direction at the 'fast' speed of 2.5 - 2.6 seconds.

One shot may be fired at each run of the target. Prior to each series the shooter is permitted four sighting runs.

6.3 In the 10m Running Target and 50m Running Boar Mixed Runs events, 40 shots in two series of 20 shots:

Each series will consist of five 'slow' runs and five 'fast' runs in each direction. The target will run at random so that the shooter cannot anticipate whether it will be a 'slow' or a 'fast' run. There must not be more than five consecutive runs of the target at the same speed.

One shot may be fired at each run of the target. Prior to each series the shooter is permitted four sighting runs, one at the 'slow' speed and one at the 'fast' speed from each side.

6.4 In the 100m Running Deer Singles event, 40 shots in two series of 20 shots:

10 shots in each direction at a crossing time of 4.3 ± 0.2 seconds. One shot may be fired at each run of the target. The rifle may be raised to the shoulder during the 'antler run 'prior to the 23 m run when the whole target is exposed.

Prior to each series the shooter is permitted four sighting runs.

6.5 In the 100m Running Deer Doubles event, 40 shots in two series of 20 shots:

10 shots in each direction at a crossing time of 4.3 ± 0.2 seconds. Up to two shots may be fired at each run of the target. The rifle may be raised to the shoulder during the 'antler run' prior to the 23 m run when the whole target is exposed.

Prior to each series the shooter is permitted four sighting runs.

6.6 In the 10m Running Target events, one target, which has two scoring diagrams, will be used for each pair of shots left and right running. It is the trailing diagram that is fired at. A separate specially marked target, will be used for the sighting runs.

6.7 In the 50m Running Boar events, one pair of targets will be used for each series, either full targets, half targets or full targets with 'repair centres'. The same pair of targets will be used for the sighting runs. The sighting shots will be covered with black patches before the competition shots are fired.

6.8 In the 100m Running Deer events, shots will be covered with a patch of suitable colour after each shot or pair of shots, and after the value of the shots has been entered into a register kept in the butts.

7 COMPETITION RULES

7.1 Facilities should be provided near to the Moving Target range, to allow shooters to warm up and zero their rifles on a stationary target before they shoot the competition.

7.2 Before the start of the competition, the first shooter must be given the opportunity to dry fire a full series in the event being shot. Dry Firing means the release of the cocked trigger mechanism of an unloaded rifle or the release of the trigger mechanism of a rifle fitted with a device which enables the trigger to be operated without discharging the rifle. Dry Firing must not allow the release of propellant gas from an air or CO_2 Rifle.

7.3 Only the next shooter in succession may dry fire at a specially marked point on the firing line.

7.4 The competition series always starts with a run from right to left.

7.5 Except in the 100m Running Deer Doubles Competition, only one shot may be fired on each run.

7.6 Sighting shots are not compulsory. In the 50m Running Boar events, if they are not fired the equivalent number of black patches must be stuck on the target outside of the scoring area.

7.7 Bullet holes on the 50m Running Boar targets must be covered with transparent adhesive patches before the target runs again. The last hit on each target must remain unpatched. In the event that a shot is not fired or fails to hit the target, the equivalent transparent patch will be stuck on the target outside of the scoring rings.

7.8 After the shooter is called to the firing line he must be granted a maximum time of two minutes for preparation.

7.9 When the shooter has finished his preparation on the range he must call "READY" for each sighting run and for the first run of each series. The Range Officer must start the target immediately. If the target is started before the shooter has called "READY" he should refrain from shooting. However, if he shoots the result must be scored.

7.10 There must be no contact or communication between the shooter and any trainer or team official after the call is given for the first sighting run.

7.11 After completion of the sighting runs the shooter may pause for up to 60 seconds to adjust his sight.

7.12 After each run, the score and location of each shot hole must be shown for at least four seconds. The end of the indication is the signal to the shooter for the continuation of the series. It is necessary to set a constant rhythm in the time taken to indicate the score, and the start of the target run.

7.13 In 10m Running Target events, following the completion of a run, the signalling must be completed in not more than 18 seconds. The next run must be started about 2 - 4 seconds after the shooter comes to the ready position The target must be started not more than 20 seconds after the completion of the previous run.

7.14 In 50m Running Boar events, following the completion of a run, the signalling must be completed in not more than 12 seconds. The next run must be started about 2 - 4 seconds after the shooter comes to the ready position The target must be started not more than 18 seconds after the completion of the previous run.

7.15 In 100m Running Deer events, following the completion of a run, the signalling must be completed in a timely manner. The next run must be started about 2 - 4 seconds after the shooter comes to the ready position.

7.16 If the target is started from the wrong side or tail first, the run must be cancelled and repeated, even if the shooter has fired.

7.17 Should anything occur which might be dangerous, disturb the shooter or otherwise interfere with the competition the Range Officer must stop the shooting. Should the shooter fire at the moment of the command he is entitled to have the run cancelled if he requests it.

7.18 If a series is interrupted for more than five minutes the shooter may ask for two additional sighting runs (four in the Mixed Runs events).

7.19 If a shooter should be unable to fire during a run a miss will be scored unless the cause is outside his control, e.g. a misfire or broken firing-pin etc.

7.20 Gauges. If gauging should be necessary, the shot hole gauges specified in the ISSF General Technical Rules for the 10m Running Target and 50m Running Boar events will be used. In the 100m Running Deer events an 8.00 mm diameter plug gauge will be used.

8 MALFUNCTIONS

8.1 If the shooter experiences technical problems with his rifle or ammunition making it impossible to continue to shoot, the rifle must be placed on the bench or table without further

touching it. The Range Officer must be called and shown the malfunction or rifle defect. The Range Officer must interrupt the series of target runs and start a timer to determine the length of the interruption. The Range Officer should be familiar with the current ISSF Rules which give guidance as to whether or not the malfunction was the fault of the shooter.

In the 100m Running Deer events, no attempt may be made to open the action of the rifle until at least one minute has elapsed since the trigger was last operated. Shooters and range officials must be aware of the possibility of the apparently misfired cartridge being fired when the action is opened and take suitable precautions. These include the use of safety spectacles, averting the eyes and face and keeping the rifle pointing in a safe direction with the butt supported.

8.2 A run is repeated if the Range Officer determines that the malfunction was not caused by the shooter.

8.3 A miss is scored if the Range Officer determines that the malfunction was caused by the shooter.

8.4 In the 100m Running Deer Doubles event, if the shooter fails to operate the rifle action correctly and thus is unable to fire the second shot, a miss will be scored.

8.5 In the 100m Running Deer events, technical problems with the ammunition may be deemed to be the fault of the shooter unless it can be shown that factory loaded ammunition was in use at the time.

9 TIE BREAKING

9.1 Should there be two or more shooters with equal scores tying for places 1 - 3, they will fire an additional 2 shots (Running Deer 10 shots) under arrangements made by the Jury. For all the 10m Running Target and 50m Running Boar events these will be fast runs. For the 100m Running Deer events, the runs will be Singles or Doubles as appropriate. Up to three tie breaking shoots are allowed after which equal awards will be given.

9.2 In the 10m Running Target and 50m Running Boar events, should there be two or more shooters with equal scores tying for places 4 - 10, the tie will be broken by inspecting successive lowest value shots recorded by each shooter. The shooter with the lowest value shot is the loser. If a tie remains, it will be broken by counting the number of 'inner tens'. On the 10m Running Target, this is the central 0.5 mm diameter spot. On the 50m Running Boar target, this corresponds to a ring 30 mm diameter.

9.3 In the 100m Running Deer events, ties below 3rd place will not be broken.

9.4 In the 10m Running Target event (normal runs) the ISSF Rules specify an additional 'Olympic Final' for the leading six competitors. This consists of 4 sighting shots fast runs followed by 10 shots to count. These shots are scored to one tenth of a point using special gauges. The shooting procedure, which is unique to this final event, is described in the ISSF General Technical Rules. In the event of a tie after the final event, all shooters with equal scores after two sighting shots (fast runs) will each fire two shots in turn until the tie is broken.

10 PENALTIES, APPEALS AND PROTESTS

10.1 Infringements of the rules will incur a penalty. For a minor technical infringement the shooter may be shown a Yellow Card with the word "WARNING". For a repeated offence he will be shown a Green Card with the word "PENALTY" and two points deducted from his score. For a third technical offence, or an infringement of the Safety Rules he will be shown a Red Card with the word "DISQUALIFICATION" and disqualified from the competition.

10.2 A shooter may appeal against any penalty. The ISSF Rules describe the appeals procedure.

10.3 A shooter or team official may protest against a score or against the actions of a range official or another competitor. The ISSF and NORDIC Rules describe the protest procedure.

11 10m RUNNING TARGET SHOOTING, THE 'OLYMPIC' FINAL

In 1988 the ISSF introduced the concept of the 'Olympic Final' to the Olympic shooting events. This was designed to provide a short, exciting climax to the match for the benefit of the television cameras and the spectators. However, in the 10m Running Target event, the procedure was very similar to that required prior to 1988 to determine the leading rankings if there were tied scores. Thus, whilst the 'Olympic Final' is only relevant to the 10m Running Target match, the procedure is almost identical to that already in use at both 10 and 50 metres, including the Mixed Runs match, to break a tie. The procedure for settling a tie in the Running Deer events is also very similar. The only major change introduced in 1988 was that in the 10m Running Target match, the 'final' is now shot as a matter of course in all major competitions, and in training events for shooters who might take part in a major match. In 2004, 10m Running Target was dropped from the Olympic Programme to be replaced later with a side by side, shot by shot, 'duelling' final. This demands the use of at least two adjacent ranges; not easy to set up for many National Championships. Although the original Olympic Final is no longer in the rule book, it remains on the programme of all but major championships. It can be shot by the competitors in sequence (lowest ranked first) on only one range if necessary.

The course of fire is four sighting shots followed by ten final competition shots. All the runs are fast runs The targets are scored to one tenth of a point and this makes the use of Electronic Scoring Targets more or less mandatory as scoring paper targets to this precision, although possible, is time consuming.

The competitor(s) is allowed one minute preparation time. He is not allowed to dry fire whilst the previous competitor is shooting. The Range Officer then gives the command:

"FOR THE FIRST SIGHTING SHOT - LOAD"

After a pause for the competitors to load their rifles, the Range Officer gives the command:

"ATTENTION! 3 - 2 - 1- START"

*At the command **"START"** the target is released. The shooter may not raise his rifle to his shoulder until the target appears. Subsequent sighting shots are taken in the normal manner with the competitor calling **"READY"** before the target is released.*

*A competitor who loads his rifle before the command **'LOAD'** will be penalised after a warning has been given.*

After the target(s) have been changed if necessary, the Range Officer gives the command:

"FOR THE FIRST (NEXT) COMPETITION SHOT - LOAD"

After a pause for the competitors to load their rifles, the Range Officer gives the command:

"ATTENTION 3 - 2 - 1 - START"

This is repeated for all ten runs of the target. The targets are scored after each pair of runs and the scores announced. Paper targets are scored to one tenth of a point using special gauges..

If a tie remains, each tied competitor fire two more sighting shots and then two shots to count. If necessary (and this is virtually unknown) a second or third series of two runs will be shot. If, after three series a tie remains, the competitors are given equal places.

APPENDIX 3 Useful Addresses

International Governing Body

The International Governing Body for 10m Running Target and 50m Running Boar shooting is the International Shooting Union. Their address is:

ISSF Headquarters
Bavariaring 21
80336 Munich, Germany

Phone: +49 89 544 355 0
Fax: +49 89 544 355 44

The Nordic Shooting Region has no permanent administration but management is rotated for a four year period between the relevant governing bodies of the participant nation.

British Governing Bodies

The Governing Body for 10m Running Target and 50m Running Boar shooting in Great Britain is the National Small-Bore Rifle Association (NSRA). They may be found at:

National Small-bore Rifle Association
Lord Roberts Centre
Bisley Camp
Brookwood, Woking
Surrey, GU24 0PB

Phone: 01483 485502/485503
Fax: 01483 476392

The Governing Body for 100m Running Deer shooting in Great Britain is the National Rifle Association (NRA). They may be found at:

NRA Bisley
Bisley Camp
Brookwood, Woking
Surrey, GU24 0PB

Phone: 01483 797777

Both NSRA and NRA have delegated much of the day-to-day administration of 50m Running Boar and 100m Running Deer shooting to the British Sporting Rifle Club who may be contacted through the National Rifle Association (NRA) at the above address. The Great Britain Target Shooting Federation coordinates all the International activities of the British governing bodies may be contacted through the NSRA.

UK Sport is a government funded body and is responsible for promoting sport in Britain. Separate Sports Councils exist for Scotland, Wales and Northern Ireland.

UK Sport
21 Bloomsbury Street,
London,
WC1B 3HF

Phone: +44 (0) 20 7211 5100

The British Olympic Association is an independent association and represents Great Britain in the International Olympic Committee and is responsible for British participation in the Olympic Games.

The British Olympic Association
60 Charlotte Street
London W1T 2NU

Phone: +44(0) 207 842 5700

APPENDIX 4 Moving Target Shooting in Great Britain

10m Running Target

Although some air gun clubs have facilities for 10m Running Target shooting, these are not very common. There is an excellent 10m Electronic Moving Target range at the British Sporting Rifle Club (BSRC) at Bisley where the British 10m Running Target Championship is held each year.

50m Running Boar and 100m Running Deer

The principal Running Boar and Running Deer ranges in Great Britain are situated at Bisley which is 7 miles (12 km) north of Guildford. The ranges are owned by the British Sporting Rifle Club and are used by the club on about two Sundays each month throughout the year and on numerous other days. Affiliated clubs have access to the ranges at other times. The BSRC will always welcome potential new members at its match or training days although there are legal restrictions on participation. Club rifles are available for each event and instruction and supervision for beginners. If you want to use your own rifle, any sporting rifle (or match rifle) of the appropriate calibre and fitted with a telescope sight can be used.

Probably the easiest way to try 50m Running Boar or 100m Running Deer is to enter the "unlimiteds" during the NSRA Rifle Meeting in August or during the NRA Full Bore Meeting in July each year. In both instances the shooting is organised by the British Sporting Rifle Club. In addition, the NRA organises two "Open Days" each year in which a wide range of shooting activities can be sampled. These include the Running Boar and Running Deer which are hosted by the BSRC.

APPENDIX 5 Setting up a Twin Post 'Scope

When shooting at a moving target it is necessary to give a 'lead' to the aim to compensate for the target's movement. With a conventional 'scope this means 'aiming off'. With a Twin Post 'Scope you can avoid this by using the position of the posts to compensate for the movement.
Two posts are needed because the compensation is in different directions as the target moves R - L and L- R. In its most basic set up, you simply place the trailing post across the centre of the scoring rings and set it up so that the actual point of impact, on a stationary target, would correspond to the required 'lead'. Most shooter choose to use the aiming marks provided on the ISSF Targets, paper or electronic, and this allows the leading post to be used and for the point of aim to be chosen rather than dictated.

This note describes in some detail the procedure that should be used to set up a Twin Post 'Scope for 10m Running Target Shooting. The procedure for the 50m Running Boar events is similar but, because there are many more variables, it is much more complicated to describe.

With the ISSF 10m Running Target, the amount of 'lead' is determined primarily by the relative velocities of pellet and target. With a mean pellet velocity of 160 m/sec [Note: this will be lower than the muzzle velocity!] the theoretical 'lead' will be 25 mm for the Slow Runs and 50 mm for the Fast Runs. However, the actual 'lead' needed will be less. The movement of the rifle's muzzle as you 'track' the target imparts a significant horizontal movement to the pellet. This effect, which depends on the (true) barrel length and the way you articulate your body and shoulder as you 'track' the target will both affect the amount of compensation. The actual 'lead' needed will vary from 20 - 25 mm for the Slow Runs and 40 – 50 mm for the Fast Runs. I will assume that it will be the minimum value 20 and 40 mm respectively in he following discussion. However, these figures might need to be adjusted for individual circumstances. On the 50m Running Boar, the effect is small, and negligible on the 100m Running Deer.

The big problem with using a Twin Post 'Scope is that initially, the shooter has to get used to the whole concept of using two reticles. Even experienced shooters sometimes set up their 'scope incorrectly and this may not be obvious until several shots have been fired, if at all! When paper targets are used the target is changed after every pair of shots and the shooter must build up a mental picture of his groups. When electronic targets are used, although the shots are all displayed on the monitor, this does not distinguish between L and R Runs of the target, and the group centre displayed on the monitor is the overall group centre. Thus, it can be difficult to "see" exactly where your groups are in order to correct your sights. To avoid this problem in a match, it is necessary to ensure that your sights are correctly set up on a static target before you shoot at a moving target. The following steps are recommended when setting up a new 'scope on a rifle:

1 If you normally cant your rifle, make sure that you move the 'scope in its mounts so that the posts are always vertical. This will mean that the tops of the posts should always be level however they are moved!

2 Bring the posts together in the centre of the field of view. Be very careful not to force the adjusters as the reticles could be damaged. The tops of the posts should be level and also central. Now fire a shot on a static target from the bench, at the correct shooting distance. The shot hole should lie mid way between the posts, or just above them if you have chosen to use a 'six o clock' aim rather than a central aim.

3 Adjust the post height if necessary. This can be important at 10m where the 'scope is 50 mm or so above the bore line. If the posts are too low in the field of view you may have to raise the rear of the 'scope by shimming it in the mounts. For shims, the best material is strips of aluminium cut from an empty "Coke" can. Another good material is self adhesive aluminium foil such as used on window breakage security sensors. DO NOT use PVC tape as this will creep under load.

4 When the post height is satisfactory, adjust the mounts for windage, or use shims so that the point of impact is midway between the posts. This is usually a coarse adjustment. Remember that you must always move the 'scope, or the reticule, towards the point of impact.

5 Make any fine adjustment to the point of impact by moving ONE post only, this will be the post nearest to the present point of impact, assuming this is somewhere between the two posts. You have very little latitude in this because, for the Fast Runs, the posts will lie very close together anyway. Note the indicator scale readings for this setting. This is your zero setting. Be very wary about relying on the scales on the adjusters. Most of these are just a friction fit and can easily 'slip'.

6 Now you can set up the posts for the Slow Runs. As the centre of the aiming mark is 70 mm from the centre of the scoring rings, with a 'lead' of 20 mm (25 mm), your point of impact should be 70 - 20 mm = 50 mm (45 mm) from the post. Thus the posts should be 100 mm (90 mm) apart as seen on the target. (This refers to the centre of the post.) Set up one post first, counting how many clicks you moved it. When you are satisfied, move the other post by the same number of clicks before checking it too. If you are using a 10m Running Target, with the post across the centre of the aiming mark, the point of impact should be across the "3" ring on the target.

7 Now you can set up the posts for the Fast Runs. As the centre of the aiming mark is 70 mm from the centre of the scoring rings, with a 'lead' of 40 mm (50 mm), your point of impact should be 70 - 40 mm = 30 mm (20 mm) from the post. This is the centre of the white area between the aiming mark and the black of the scoring rings. The posts should be 60 mm (40 mm) apart as seen on the target. Set up one post first, counting the number of clicks you need to move from the Slow Runs position. When you are satisfied, move the other post by the same number of clicks and check it too.

8 It is most important that you know exactly haw many clicks you need to move the adjusters between Slow and Fast Runs settings. It is also most helpful to know exactly how much your point of impact will shift for each click. You should also check if there is any backlash in the adjustments. You can do this by firing a group then moving a post 10 clicks and firing another group, then another 10 clicks and another group. Now move back 10 clicks and 10 again. Is your last group in the same place as your first. When moving, make sure that you move the adjuster only in one direction. If there is any backlash, you can compensate by always making your final movement of the adjuster in the same direction. As an example: to move L two clicks, first move R three clicks and then L five clicks; to move R two clicks first move R five clicks and then L three clicks. Thus the final movement is always to the Left. This can be tedious in practice and it is better to have no backlash! Fortunately you can watch the movement of the posts as you move the adjusters and this helps minimise the problem.

9 An alternative to moving the posts between the Slow and the Fast Runs is to use the Slow Runs setting and to place the trailing post inside the scoring area for the Fast Runs. With a 20 / 40 mm lead, this means that if the posts are set up to place the leading post in the aiming area

for the Slow Runs, then for the Fast Runs, the trailing post must be about 10 mm behind the centre of the scoring area. With a 25 / 50 mm lead, this means that if the posts are set up to place the leading post in the aiming area for the Slow Runs, then for the Fast Runs, the trailing post must be about 5 mm ahead of the centre of the scoring area. For most shooters, this will mean that the trailing post should simply be placed somewhere near the centre of the scoring area. This will obviously be a little more difficult if a 'six o clock' aim is used. This is the method commonly used for the Mixed Runs event when it is not possible to move the posts between the Slow and the Fast Runs.

10 Your final adjustment should be made by actually shooting at the Running Target. Remember that if your group is large, you may not be able to distinguish less than a few clicks movement with any certainty! However, if you are finally satisfied, make a record of your zero settings by firing a few shots on the static target. You can then come back to this point quickly in future.

Post width is a matter for personal choice. Most shooters prefer posts that are seen on target to be about half the width of the aiming mark i.e. ~8 mm. Wide posts encourage a generous area of aim. However, even slim posts can be used effectively provided that they stand out clearly against the target. Other reticle forms have been used such as the Twin Loop concept of Dick Thomas. In this 'scope design, the conventional central reticle is retained and can be used for zeroing the rifle. The Twin Loops are independent of that reticle. Although loops are popular, these independent reticles can take almost any form and size the user specifies as these 'scopes are only made to order. The Twin Loop concept seems ideal for the 10m event but the size of the loops needed to circle the aiming mark means that they cannot come close enough together for the Fast Runs aim, thus a lot of shooters have had these fitted with post reticles.

Exactly the same setting up procedure applies if you choose to use a different point of aim. The same procedure is also used on the 50m Running Boar, but in this case, there is a wide choice of aiming points and it is too complicated to describe in detail, but the same principles apply. However, if you choose to use the centre of the triangle formed between nose and tusk as a point of aim, with sub sonic 'match' ammunition it is only necessary to switch from using the leading post for the Slow Runs and using the trailing post for the Fast Runs. Any fine tuning of this aim can be made by adjusting the position of the post within the triangle. However, because the 50m Running Boar target is full of fine detail, almost any area of the target can be chosen as a point of aim. However, it is only when an aiming point in the nose area is used that the posts can be used interchangeably for the Slow and Fast runs without further adjustment.