

# GROUPS AND HOW TO CENTRE THEM

2<sup>nd</sup> Edition – April, 2021

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## The Purpose of this Paper:

Hopefully after reading this paper the new and less experienced shooter will have a better understanding of how each shot in a series of shots establishes a pattern on the target (the “Group”) and how best to adjust their sights to ensure that the centre of the group is positioned over the middle of the target so as to maximise the score.

## The Objective of Target Rifle Shooting as a Sport:

Every time we go to the firing mound it is our intention to fire a series of shots with all of *them falling within the bullseye so that our score is greater than all the other competitors!* Preferably we would like to put each shot through the “Pin Hole” at the dead centre of the target. “Pin Hole”? – A compass is used to scribe the black lines on the white target face and the hole that the pivot pin leaves in the dead centre is the “Pin Hole”. Hitting the “Pin Hole” with every shot may be our intention but we seldom achieve that goal. Why? Obviously there are several factors which come into play to impact upon our score in any string of shots. Those factors include our own shooting skills, our ability to control nervous anxiety, the weather conditions and the grouping capability of our rifle and ammunition.

I want to concentrate this discussion paper on groups and group centring by adjusting our rifle sight to achieve the best possible outcome regardless of the other factors at play during our shoot.

## What is a Group?

**A “group” is the pattern a series of shots forms on the target.**

**Rule #1: ONE SHOT DOES NOT A GROUP MAKE!**

However, two shots do make a group and every subsequent shot in the series adds to the pattern which we collectively call a “group”. The picture below is of a nicely centred group.



### Measuring Group Size:

A term you will hear often in shooting is “Minute of Angle” (MOA). A minute of angle for the purposes of our discussion is (in historical imperial terms) 1 inch per 100 yards. For those of you more metrically minded that’s 25.4mm per 100 yards (now there’s a measurement mixture for you). To make it easier, let’s just say 25mm per 100 yards!

The Minute of Angle is also often referred to on the range as simply a “Minute” or “Point”, eg, “I needed a point (or, “I needed a minute”) more for that shot to be a Central Bullseye”.

One inch per 100 yards (and therefore one MOA) = 3 inches at 300 yards, 4 inches at 400 yards, 5 inches at 500 yards and so on.

A good rifle and ammunition combination (without human error influences) should be able to produce a group of at least ½ MOA! That’s ½ an inch (12.7mm) per 100 yards.

### Target Dimensions:

The dimensions of our bullseye are set out on the attached extract from Chapter 13 in the NRAA Standard Shooting Rules (SSR’s) which can be downloaded from the NRAA website. **The SSRs should be studied by every shooter – ignorance of the rules of our sport is no excuse!**

#### BULLSEYE DIMENSIONS AT EACH DISTANCE

Distance in Yards	Bullseye Size in mm	MOA	Central Bullseye in mm	MOA	Super V in mm	MOA
300	130	1.7	65	0.9	32	0.4
400	173	1.7	86	0.9	43	0.4
500	260	2.0	130	1.0	65	0.5
600	290	1.9	145	1.0	72	0.5
700	320	1.8	160	0.9	80	0.4
800	510	2.5	255	1.3	127	0.6
900	510	2.2	255	1.1	127	0.6
1000	510	2.0	255	1.0	127	0.5

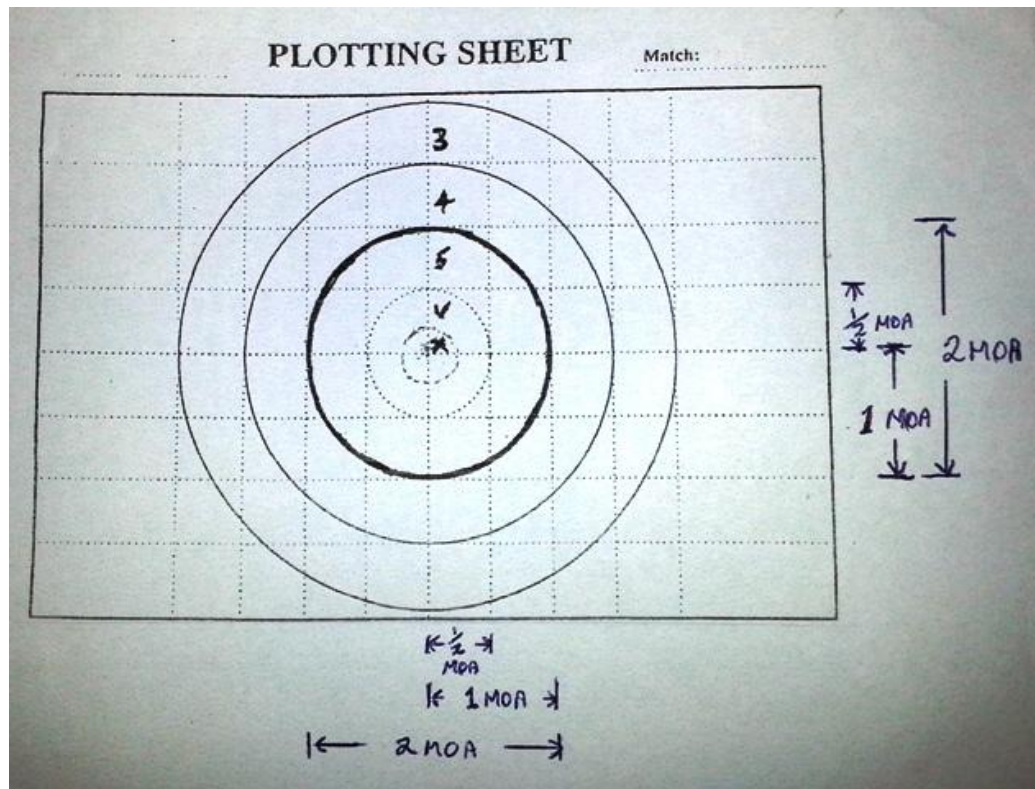
Fig. 2

This table shows that the bullseye size at each distance is, for our discussion purposes, approximately 2 minutes of angle and that rule of thumb can be used to help us understand the size of our group in relation to the size of the bullseye.

The table also reinforces the need to centre our groups when contemplating that the Central Bullseye (scoring 6 for F-Class) is half the size of the bullseye and the Super V is one quarter the size of the Bullseye!

**Rule #2: ALWAYS MOVE TOWARDS THE CENTRE OF THE TARGET**

Look at this Plotting Sheet.



**The solid dark line is the Bullseye circle (5) with the inner dotted lines being the Central Bull(V) and inside that, the Super Centre (X).**

In this Plotting Sheet each of the dotted horizontal and dotted vertical lines are ½ MOA apart. From this we can then appreciate that the Bullseye is 2MOA, the Central Bull 1 MOA and the Super Centre ½ MOA. In this Plotting Sheet the Inner 4 ring is 1MOA bigger than the Bullseye but importantly from the point of view of our discussion, it is ½ MOA from the edge of the Bullseye. The “Magpie” or “Bird” ring is similarly spaced in this diagram.

While this Plotting Sheet is simplistic by today’s target scoring ring dimensions it is a very helpful tool when we are on the firing mound and trying to estimate the distance from our last shot position as indicated to the centre of the Super Centre (“The Pin Hole”).

Now we can see that if our last bullet fired passed through the Bullseye line at the 12 o’clock position we need to move our sights down ONE FULL minute to hit the Pin Hole. If the shot was at 3 o’clock we need to move our sights left ONE FULL minute, if at 6 o’clock we need to move our sights up ONE FULL minute, or if at 9 o’clock we need to move our sights right ONE FULL minute.

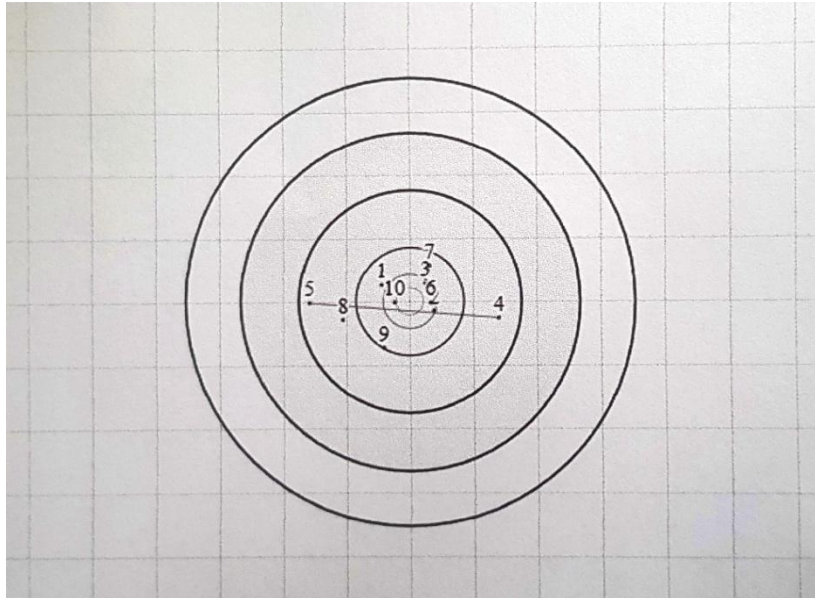
If the shot had cut the Inner-4 ring at 4.30 o’clock the move to the Pin-Hole is 1/2 minute up and 1+3/4 minute left.

It is important to be confident and make the move in full – it is better to have made the bold move than leave the sight untouched – “I’m glad I made that move” not “I wish I had gone the full minute”!

**Rule #2: ALWAYS MOVE TOWARDS THE CENTRE OF THE TARGET**

**Hexa Target System** – We who shoot on the Duncan Range at Belmont in Brisbane, Queensland are fortunate to have the excellent Hexa electronic targets. The photo below is from a Hexa monitor.

**Important Note** – The Hexa monitors have lines indicating 1 MOA horizontally and vertically relative to each shooting distance. **This is a valuable tool that provides the information that the shooter needs to determine the distance from the last shot to the Pin-Hole.**



### Question Time!

From the above image determine how far you would need to move the sight after shot 4 to place the next shot through the Pin-Hole.

Rule #2: **ALWAYS MOVE TOWARDS THE CENTRE OF THE TARGET**

### Using our Sighting Shots:

We only have two sighting shots to help us maximise the chances of hitting the “Pin-Hole” with every subsequent scoring shot.

**Arguably, our sighters are the two most important shots we will fire in any match.**

Perfectly fired sighters give us the opportunity to adjust our sights to maximise the value of the subsequent scoring shots in the string. Our sighters also indicate to us how well we are reading the wind conditions and they enable us to adjust our mental calculations for the following scoring string. Poorly executed sighters can mislead us in our thinking and wrongly influence decisions later in the string. If our first sighter is a Central Bullseye and the second sighter is an Inner 4 or worse, human nature will almost certainly lead us to believe that the Central Bullseye was the best shot when subsequent shots in the scoring string may well prove that we were misled by that shot!

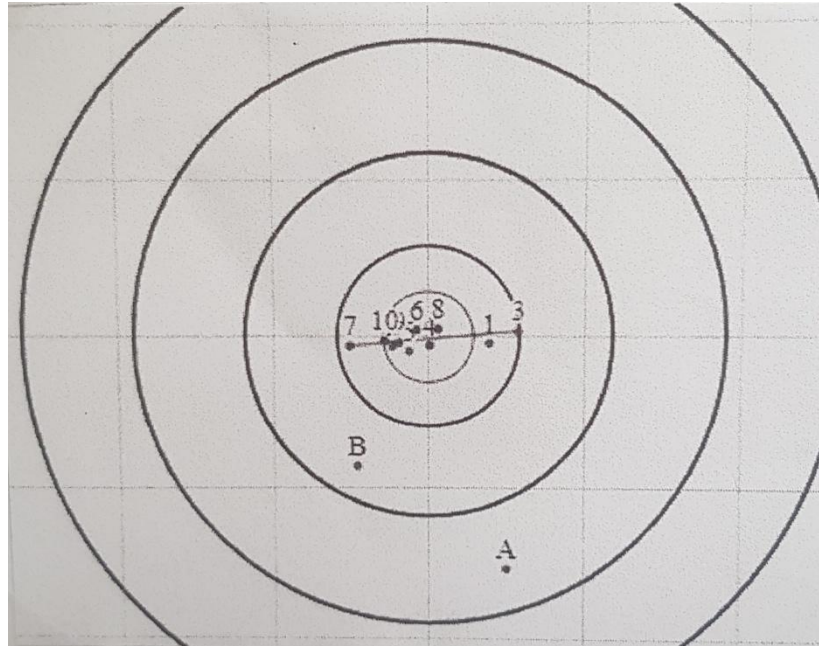
Rule #3: **FIRE PERFECT SIGHTERS!**

Remember Rule #1: **ONE SHOT DOES NOT A GROUP MAKE.**

When we fire our first sighter we do not know where that sighter lies in relation to the group that will be formed by the subsequent shots. It may well be proved that the sighter was perfectly placed in the middle of the group but, equally it might be found to have been on

the fringe of the group at any point of the compass! At the extremes, its position may be completely unrelated to the eventual group!

Having fired our first sighter, the position it holds in the subsequently formed group can only be determined by firing more shots! **BUT, we only get two sighters!!!**



In this image the shooter has made good use of his sighters to centre the group on the “colour line”\*.

Remember Rule #3: **FIRE PERFECT SIGHTERS!**

(\* “Colour Line” – In very early days of target shooting the target was black on the top half and orange or white on the bottom half. The horizontal line where the two colours met passed through the centre of the Bullseye, hence the still often used term “Colour Line” to indicate a flat group formed horizontally along the imaginary line splitting the Bullseye in two equal halves, top and bottom).

### **Recognising Shots Outside the Group:**

After the first few shots in a scoring string we begin to recognise the group formation and where it lies in relation to the centre of the target.

Remember Rule #2: **ALWAYS MOVE TOWARDS THE CENTRE OF THE TARGET**

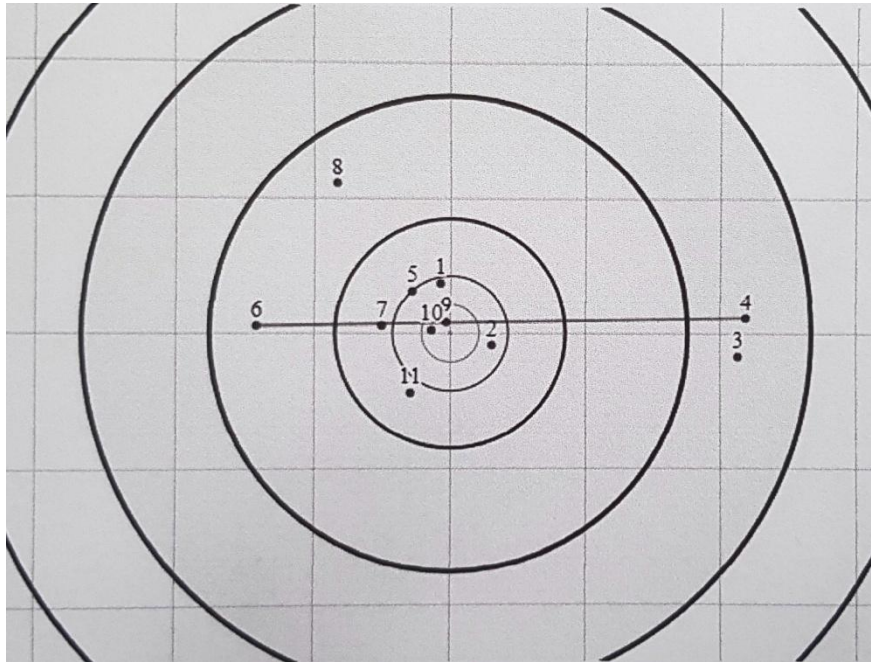
Occasionally we recognise that we have fired a less than a perfect shot and its spotter appears in a position on the target quite unrelated to the previous shots. **That’s a shot outside the group!**

Rule #4: **IGNORE SHOTS OUTSIDE THE GROUP!**

As hard as it may be, shots that appear in a position completely unrelated to the others in the string that have gone before it should be ignored.

In the image below the shooter has fired shot 8 and, realising that it is outside the group, has ignored it and placed subsequent shots 9 and 10 right back into the middle of his substantive

group. Had the shooter altered on shot 8 it is doubtful that he would have scored central bullseyes 9 and 10.



**Rule #5: NEVER ADJUST YOUR SIGHTS ON A BAD SHOT:**

### **The Perfectly Centred Group:**

**Definition of a perfectly centred group** - one in which the pattern of shots in a string has the “Pin Hole” in the middle of the group. A group of shots, however large or small, where the “Pin Hole” is not in the middle is not a centred group!

A perfectly centred group does not necessarily have to be so small that all of the shots fall inside the Super Centre, the Central Bull or even the Bullseye.

Remember the factors mentioned in the opening paragraph that impact upon our score - our own shooting skills, our ability to control nervous anxiety, the weather conditions and the grouping capability of our rifle and ammunition.

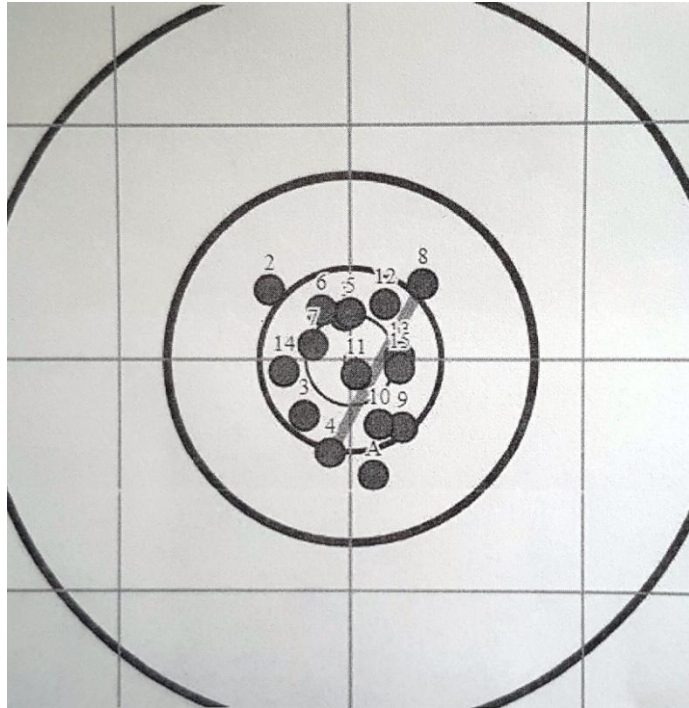
**Rule #6: PLOT YOUR SHOTS TO HELP YOU RECOGNISE THE CENTRE OF THE GROUP:**

A possible score of 50 with no central bulls can be a perfectly centred group provided the “Pin Hole” is in the middle of that group. Equally, a score made up of “Inner” fours, “Magpie” threes or “Outer” twos can also be a perfectly centred group provided the “Pin Hole” is at the middle of the group.

A perfectly centred group does not necessarily have to be circular in shape but can be oblong in shape in any direction but, hopefully for our egos, it is horizontal having been influenced by wind changes rather than poorly executed shots!

For example, in very tricky wind conditions an oblong group may be formed from one side of the target to the other but nevertheless be on the “Colour Line”\* and well centred.

For example, a score of 50.0 achieved where all the shots are in one sector of the Bullseye is not a centred group. It is almost certain that the firer was very lucky that at least one or more of the shots did not fall outside the Bullseye leading to loss of points. Equally, if the group had been properly centred it is certain that some Central Bullseyes would have been scored.



Remember the **Definition of a Perfectly Centred Group** - one in which the pattern of shots in a string has the "Pin Hole" in the middle of the group just like the group in the image above.

Similarly, a score of 50.10 achieved where all the shots are, say, in the bottom of the Central Bull is not a centred group (see the group in the image below). It is almost certain that the firer was very lucky that shot 2 did not fall outside the Central Bull depriving him/her of the perfect possible. Similarly, the shooter could have scored another super-x if the group was centred properly.

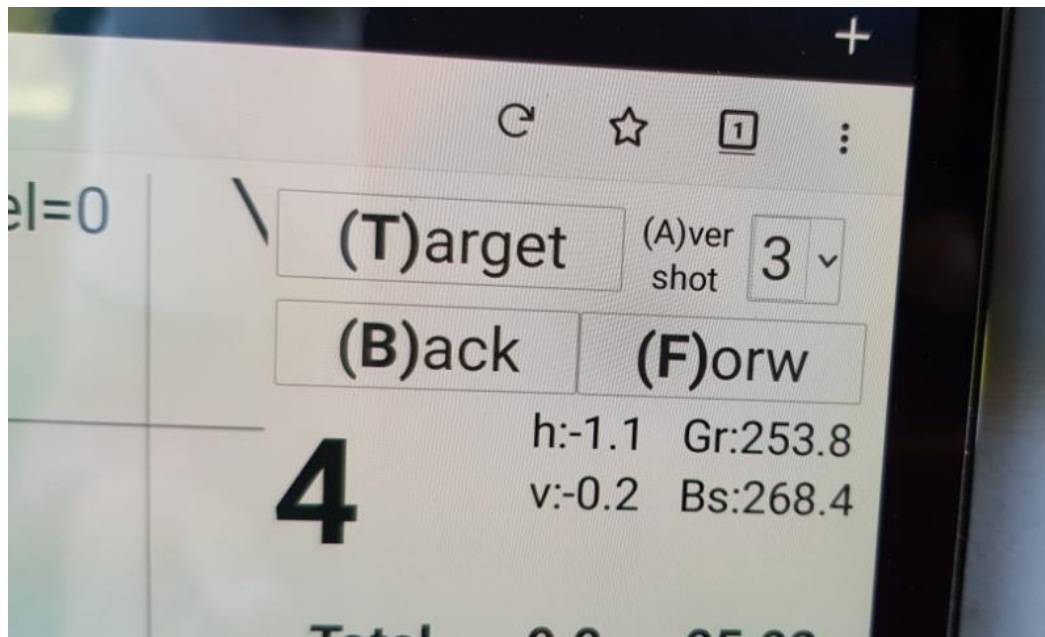


**Rule #7: CENTRE YOUR GROUP OVER THE PIN HOLE!**

**Hexta monitors can help you centre your group.** In the top right hand corner of both the shooter and scorer monitor screens is a little box which allows you to select a number of shots just fired (say, the last 3 shots) and the monitor will display a small X to indicate where the vertical centre of your group is. **Use this important feature!**

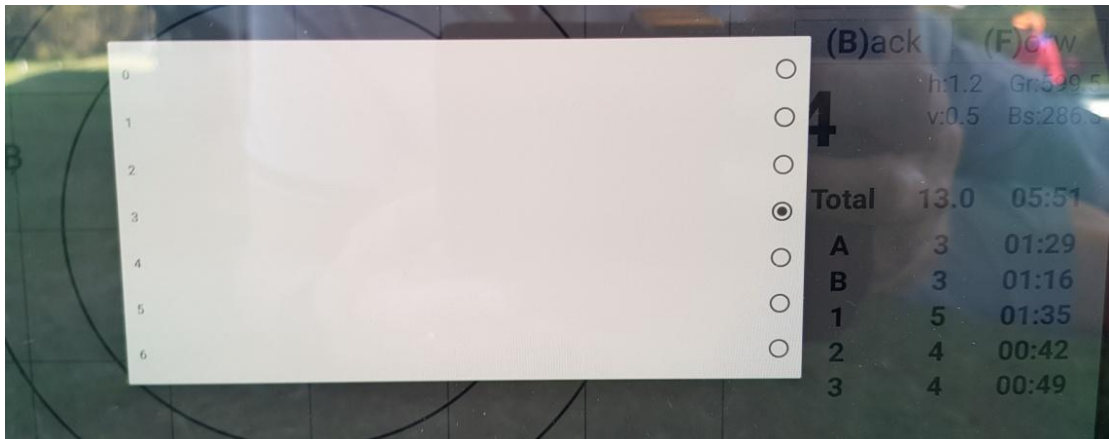


The above photo indicates the location of the Average Shot Position Indicator (ASPI) on the Scorer's monitor. Click on the drop-down box and select the number of shots to be included.

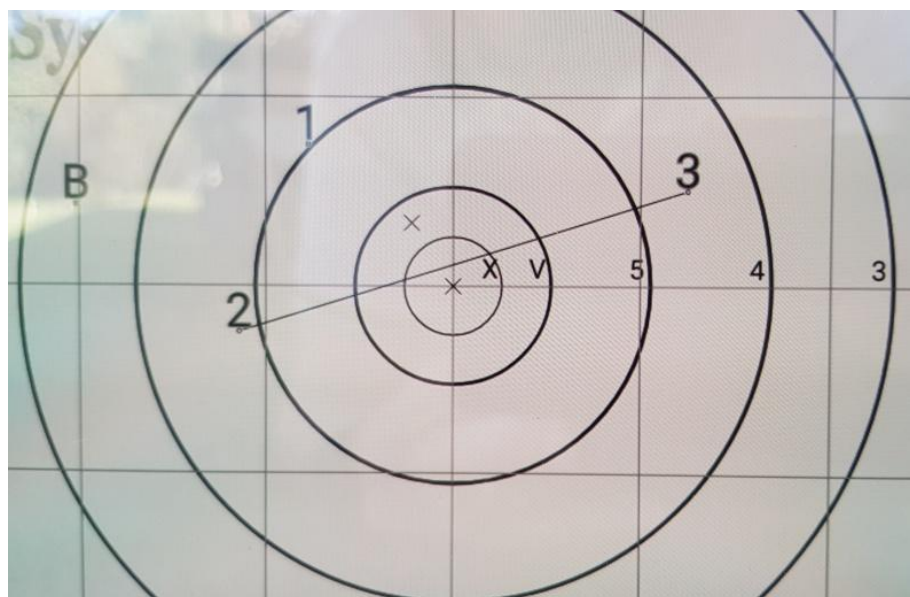


In the above photo three shots have been selected by the scorer to be included in the ASPI. The use of the ASPI function on the scorer's monitor is for the interest of the scorer only and does not impact on the display of the shooter on his monitor.

The shooter selects the ASPI function by touching the icon on the top right corner of his screen.



This is the display of the ASPI selection panel on the shooter's monitor.  
Touch the circle button for the required number of shots to be included in the ASPI.



In the above photo the ASPI appears as small cross at 11 o'clock in the V Bull indicating the vertical centre of the shooter's group averaging shots 1, 2 and 3. The cross indicates that the vertical centre of the group is between a quarter and half minute too high!

Note the value of the scoring rings is displayed on the scorer's monitor but NOT on the shooter's monitor.

**Target Dimensions:**

(Refer SSR's Chapter 13)

There are three Classes of Targets:

- (a) Third Class 1200mm x 1200mm square (48 inches square) (300 and 400 yards)
- (b) Second Class 1800mm x 1800mm square (72 inches Square) (500, 600 and 700 yards)
- (c) First Class 2400mm x 1800mm (96 inches wide x 72 inches high) (800, 900 and 1000 yards)

	Height						Width					
	Full Height			Edge to "Pin Hole"			Full Width			Edge to "Pin Hole"		
	Inches	mm	MOA	Inches	mm	MOA	Inches	mm	MOA	Inches	mm	MOA
<b>(a) Third Class</b>				(Half the full height)						(Half the full width)		
300 Yards	48	1200	<b>16</b>	24	1200	<b>8</b>	48	1200	<b>16</b>	24	1200	<b>8</b>
400 Yards	48	1200	<b>12</b>	24	1200	<b>6</b>	48	1200	<b>12</b>	24	1200	<b>6</b>
<b>(b) Second Class</b>												
500 Yards	72	1800	<b>14.4</b>	36	1800	<b>7.2</b>	72	1800	<b>14.4</b>	36	1800	<b>7.2</b>
600 Yards	72	1800	<b>12</b>	36	1800	<b>6</b>	72	1800	<b>12</b>	36	1800	<b>6</b>
700 Yards	72	1800	<b>10.3</b>	36	1800	<b>5.1</b>	72	1800	<b>10.3</b>	36	1800	<b>5.1</b>
<b>(c) First Class</b>												
800 Yards	72	1800	<b>9</b>	36	1800	<b>4.5</b>	96	2400	<b>12</b>	48	2400	<b>6</b>
900 Yards	72	1800	<b>8</b>	36	1800	<b>4</b>	96	2400	<b>10.7</b>	48	2400	<b>5.3</b>
1000 Yards	72	1800	<b>7.2</b>	36	1800	<b>3.6</b>	96	2400	<b>9.6</b>	48	2400	<b>4.8</b>

## Target Rifle Sights:

Regardless of whether you are a Target Rifle (TR) or F-Class shooter it's possible that you will have a rifle sight that alters in movement increments that are different to the person next to you! That's because different sight manufacturers over time have developed their own system of sight adjustments. Vive la difference'

### Iron Sights:

Those of you who are shooting Target Rifle (TR) will be using a peep sight with wind and elevation adjustments, albeit in several different "click" movement measurements.

For example: Your elevation and windage adjustments may be one of the following:

0.25 MOA 4 clicks to the minute (4 clicks from the edge of the Bullseye to the Pinhole)

0.5 MOA 2 clicks to the minute (2 clicks from the edge of the Bullseye to the Pinhole)

0.3 MOA 3 clicks to the minute (3 clicks from the edge of the Bullseye to the Pinhole)

**Your sight may have different movement increments for windage and elevation.**

The last, (0.3MOA) while popular for a while in the 1990's, has largely disappeared in favour of an elevation adjustment of 0.25MOA and windage adjustment of 0.5MOA (this in a large way due to people like Natives Club member, Tom Canty, who are skilled in making all sorts of things fit our individual needs!). In the past if you wanted to make a quarter minute change it was necessary to sit the sight on "The Hump", ie, moving the sight so that it sat half way between machined half minute increments, hence, sitting on "The Hump".

### Know Your Iron Sight:

You **MUST** understand the value of incremental movements in your sight, both in elevation and windage (remember they may be different). You **MUST** practice moving your sight in each and every direction so that alterations become automatic. The best way to do this is to sit at home in the quiet of your own personal space and practice adjusting the sight until it is an automatic reflex action. Only then can you be confident that while on the firing mound under the pressures of a competition shoot (aren't all shoots of that variety?) will you feel confident of making the correct adjustments.

### Telescopic Sights:

Those of you who are shooting in one of the various 'scope classes (F-Class Standard, F-Class Open or F-TR) will have telescopic sights that may be different to the sights of other competitors around you.

For example: Your elevation and windage adjustments may be one of the following:

0.125 MOA 8 clicks to the minute (8 clicks from the edge of the Bullseye to the Pinhole)

0.25 MOA 4 clicks to the minute (4 clicks from the edge of the Bullseye to the Pinhole)

0.5 MOA 2 clicks to the minute (2 clicks from the edge of the Bullseye to the Pinhole)

With telescopic sights it is unlikely that you will have different movement increments for windage and elevation.

### Know Your Telescopic Sight:

Just like TR shooters you **MUST** know your sight. Practice often and long to ensure you can adjust the sight automatically. During the pressure of a competitive shoot your hand must move automatically, **without conscious thought**, to adjust the sight.

**The only way to achieve this is with constant practice.**

## WHAT HAVE WE LEARNT?

### **Bullseye and Other Scoring Rings in MOA:**

- MOA from the edge of the Bullseye to the “Pin Hole” - approximately 1 MOA!
- Target sizes in MOA – learn the three different target sizes and how that knowledge can help you measure the distance from your last shot to the “Pin Hole”.

### **Your sighters are very important – make them good shots!**

- Sighters – one shot does not a group make, **BUT**, if you know the idiosyncrasies of you barrel when clean or dirty at the first shot, **MAKE** the adjustment. Second shot establishes a group so; **CENTRE THE GROUP OVER “PIN HOLE”**.

### **Plot your shots or use the Hexta ASPI feature to look for the centre of your group:**

#### **Split your concentration -**

- **pull good shots.**
- **watch the weather changes.**
- **watch the shape and formation of your group.**
- **watch the centre of you group in relation to the “Pin Hole”.**

### **The Hexta Target System can help you centre your groups!**

- The ASPI feature of the Hexta monitor can help you to determine the vertical centre of your group.
- Each of the vertical and horizontal lines on the Hexta monitor is one minute apart for each range distance. Use these lines to calculate your next sight adjustment.

## **REMEMBER, REMEMBER and REMEMBER!!!**

- **Remember - Plot your shots** on a plotting sheet which will help you recognise where your group is forming. Alternatively, where available use the Hexta ASPI feature.
- **Remember - Always move your group to the centre!**
- **Remember - 1.0 MOA from the Bullseye line to the “Pin Hole”.**
- **Remember - 0.5 MOA from the Central Bull line to the “Pin Hole”.**
- **Remember - 1.5 MOA from the “Inner” four line to the “Pin Hole”.**

## **ADJUST, ADJUST, ADJUST, ADJUST, ADJUST, ADJUST, ADJUST!!!!!!**

**Better to be positive and move and maybe lose a point rather than fail to move and still lose a point (or 2)!!!**

## **WAYNES' RULES:**

- 1. ONE SHOT DOES NOT A GROUP MAKE!**
- 2. ALWAYS MOVE TOWARDS THE CENTRE OF THE TARGET!**
- 3. FIRE PERFECT SIGHTERS!**
- 4. IGNORE SHOTS OUTSIDE THE GROUP!**
- 5. NEVER ADJUST YOUR SIGHTS ON A BAD SHOT!**
- 6. PLOT YOUR SHOTS OR USE THE HEXTA ASPI FEATURE TO HELP YOU RECOGNISE THE CENTRE OF THE GROUP!**
- 7. CENTRE YOUR GROUP OVER THE PIN HOLE!**
- 8. START AGAIN AT RULE 1!**

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