FITA Coach's Manual

COMPOUND BOW

Module

Intermediate Level

FITA Coaching Manual
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Contents

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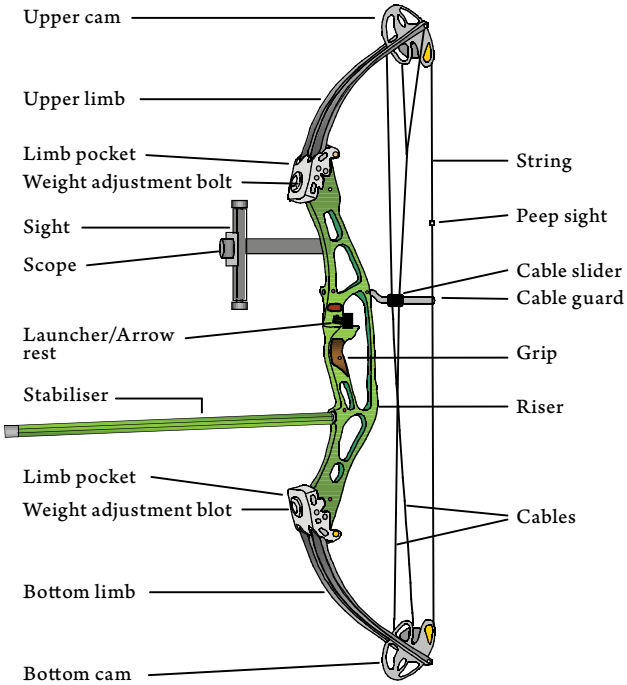
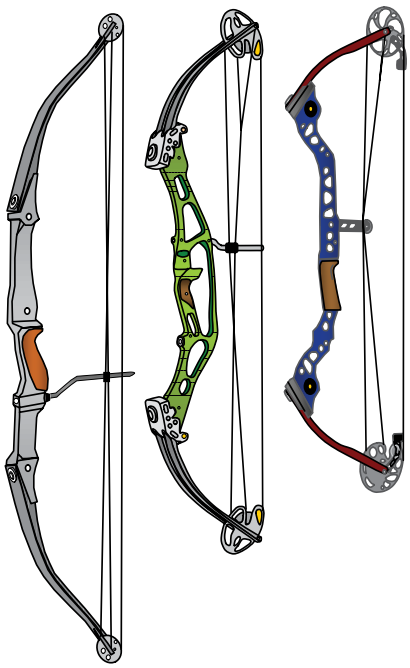


2. The Compound Bow

Axle to axle length

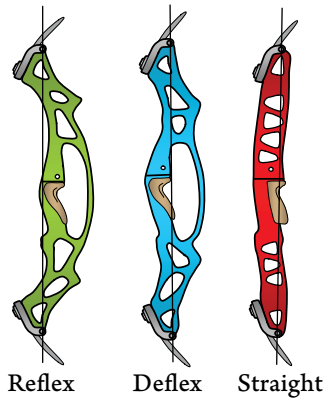
The overall length of a compound bow is measured from axle to axle (the axle is the shaft through the limbs that the cams are mounted on).

Currently compounds range in length from 30″ to 48″ axle to axle. Shorter bows are commonly considered difficult to shoot and not as well suited to target archery as longer bows. Bows with very long lengths, above 45″, are generally forgiving to shoot but tend to be much slower than shorter bows. Most compound target archers shoot a bow with a length between 38″ and 43″ for shooting with a mechanical release.



Riser design

There are three common riser designs: reflex, deflexed and straight. A reflex riser curves rearward with the grip set behind the limb pockets. The deflexed riser curves forward with the grip ahead of the limb pockets, the grip is further from the string than the limb pockets are. As the name implies the straight riser is straight with the grip and the pockets in line, parallel with the string.



The reflex riser is the most widely available. This design typically offers a very balanced feel with good arrow velocities due to the lower brace heights associated with them. The reflex design is more susceptible to problems with hand torque and is considered to be less forgiving than the other two designs.

The deflexed design is available on high end bows, but may be difficult to find in less expensive models. This design is less popular due to its lower speeds that result from higher than average brace heights. This shape is less susceptible to the effects of hand torque. The high brace heights and shape of this design make it the most forgiving design of the three.

The straight riser is of course the average of the other two designs. This is true of not only the shape, but also the features and benefits of the shape. Very few bows are marketed with a perfectly straight riser.

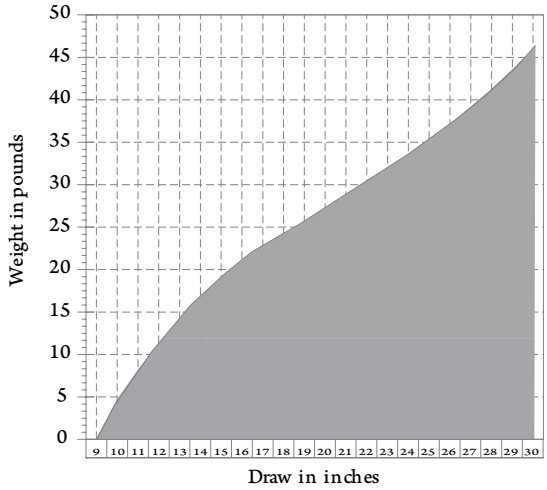
As indicated above the riser design plays a part in the brace height of the bow. Brace height is the distance between the throat of the grip and the string when the bow is in the braced position (not drawn). A lower brace height extends the power stroke of the bow by pushing further forward on the arrow than a higher brace height. By pushing on the arrow for a longer period, more energy, speed, is imparted on the arrow. This increase in speed may be an advantage, however the increased amount of time that the arrow spends on the string, means that there is more time for the archer to make an error, or more time for errors to affect the arrow. Bows used for target archery generally have a minimum of seven inches of brace height. Most target bows' brace height falls between seven and one half inches and nine inches.

Draw force curve

A draw force curve is a curve on a graph that represents the stored energy of a bow. Along the "Y" axis is draw weight, and along the "X" axis is draw length or power stroke of a bow. Power stroke is the distance that the bowstring pushes on the arrow. Power stroke is equal to:

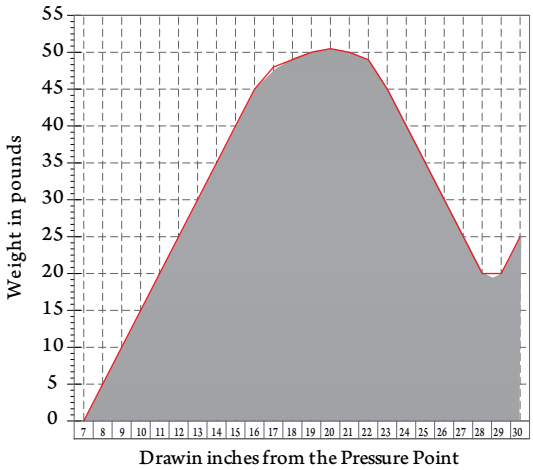
- The draw length minus
- The brace height of a bow and something more (because the arrow leaves the string after the string has passed brace height).

The curve in graph 1 represents the energy stored when a Recurve bow is drawn. The draw weight of this bow continuously increases as the bow is drawn back. The shaded area under the curve represents the amount of energy stored in the bow at full draw.



Graph 1

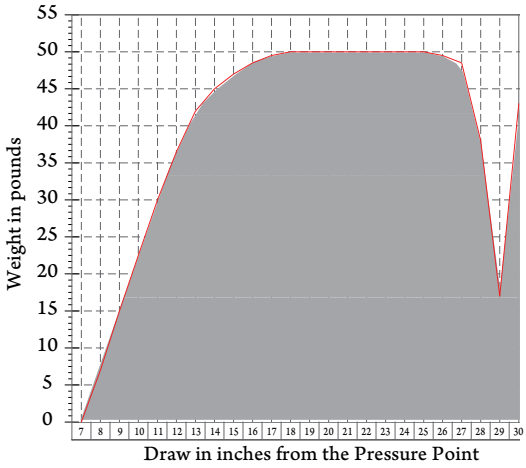
The curve in graph 2 represents the energy stored once a round wheel compound bow is rotated The draw weight of this bow increases as the bow is drawn to peak weight and the lets off to a lighter holding weight when full draw is reached. The shaded area under the curve represents the amount of energy stored in the bow at full draw. Notice that more area is shaded indicating the increased energy stored in a compound bow as compared to a Recurve bow.



Graph 2

The curve in graph 3 represents the energy stored when a hard cam compound bow is drawn. The draw weight of this bow increases quickly as the bow is drawn, remains (dwells) at peak weight for a longer distance and it lets off to a lighter holding weight near the end of the draw. The shaded area under the curve represents the amount of en-

ergy stored in the bow at full draw. Notice that this cam design has the most shaded area indicating the increased energy stored by a hard cam compound bow as compared to the two previous examples.



Graph 3

Increasing the peak weight of a bow or lengthening the draw length/power stroke of a bow increases the amount of shaded area below the curve. This increased shading represents the increase in energy or ultimately arrow velocity that results from these changes.

Eccentrics

There are many eccentric systems on the market. Each style of eccentric offers a different set of features and benefits. The axis of the "Eccentrics" is not suspended centrally but eccentrically to achieve a mechanical advantage. Traditionally Eccentrics have been classified as cams or round wheels. Cams are elliptical in shape, which result in a large amount of stored energy and high arrow velocities. As the name implies, round wheels are round in shape, this results in less stored energy, lower velocities and a smoother pull. There are also several eccentric styles within the cam category. These consist of one cam, Hybrid (cam and one half) and two cam systems. When properly tuned, as outlined in section 9 of this chapter, these cam systems all shoot well.

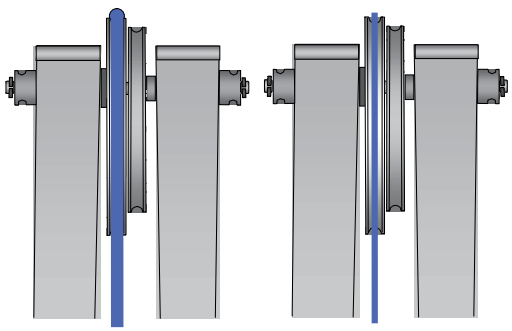
When choosing a bow, keep this in mind. All string and cable assemblies stretch some amount, some more than others. Once the string and cable assembly on any of these eccentric systems stretches, the bow is no longer the same as it was when it was initially set up and tuned (see sections three and nine of this chapter). The draw length, poundage, cam position, brace height, axle to axle length, let-off and nocking point position all change with this stretch. To make the bow shoot as it did when first tuned, small adjustments to the string and cable lengths will be required. On most bows, a few twists to the string and cables will return them to their original length. Consult the bow owner's manual for the optimal "timing" or "cam position" for the eccentric system on your bow.

Let-off refers to the amount of reduction in draw weight that occurs when the eccentrics of a compound bow roll over. This is expressed as a percentage. For example a bow with 75% let-off and 60 pound draw weight will be 15 pounds holding weight after the cams roll over at full draw. Bow manufacturers offer cams with let–off percentages that typically range from 60%to 80%. For shooting with good form and back tension, the increased holding weight found on bows with lower let-off may be desirable.

There are several ways to slightly reduce the let-off on some bows that do not have adjustable let-off. One of these ways is to shorten the string to shorten the draw length and roll the cam position back. The draw length may then be adjusted to its original draw length by replacing or adjusting the draw length module. Another way to reduce let-off is to increase the diameter of the buss cable where it crosses the axle at full draw.

Strings and Cables

Select the number of strands that results in the proper diameter string for the cam groove diameter. The string should fill the cam groove, but not be wedged into the groove.



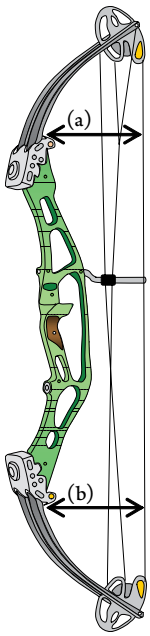
String too thick. String too thin.

Select the diameter of serving material for the center serving providing the proper diameter to fit the nocks on the arrows. The nock of the arrow should snap on the string without any side to side movement, dragging slightly as it slides up and down the string.

3. Initial Set-Up (before tuning)

Tiller

Tiller is the relationship between the base of the bow limbs and the string when the bow is at brace. To measure tiller, use a bow square or ruler held perpendicular to the string to measure the distance between the limb where it enters the limb pocket and the string. The distance measured for the top (a) limb can be compared with the distance measured for the bottom limb (b) to determine the tiller setting of the bow.



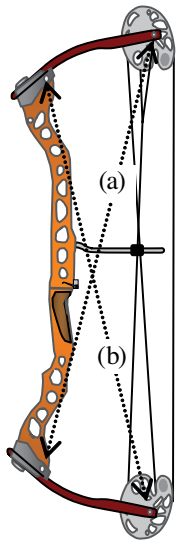
There are many opinions on how the tiller of a compound bow should be adjusted and the effects of such adjustments. If most of the archers strive to get the same distance "base of top limb / string" as the distance "base of the bottom limb / string" some believe that whatever the initial setup of the tiller, as long as the bow is tuned, it doesn't make any difference how the tiller is set on a compound bow.

To adjust the tiller of a compound bow one or both weight adjustment bolts, limb bolts, are turned with one changing position more than the other. Tightening a bolt will decrease the measurement for the end of the bow that the bolt is on. Loosening the bolt increases the measurement. Adjusting the tiller of a compound bow will affect the following items; draw weight, the angle of the riser between the limbs in relation to the string (grip angle), the relationship between the nocking point and arrow rest and brace height. Adjusting the tiller of a compound bow will not effect synchronization of the cams or the strength of the limbs.

There are two methods commonly used to adjust tiller. One method is to measure the tiller and adjust the bolts until both ends are even. The other is to tighten the bolts until the limbs are as tight as they go, then turn the bolts back in even amounts until the desired draw weight is achieved. The second way depends on the precision with which thread of the bolt and the riser had been manufactured. An archer may wish to consult the bow owner's manual for recommended settings.

Many of the newer cam systems have different shaped eccentrics on the top and bottom limbs. As a result the tiller may be uneven when the limbs are adjusted to the same point. These different shaped eccentrics may also cause the tiller measurements to change unevenly when string or cable lengths are adjusted. If an archer wishes to measure tiller and the eccentrics are different in shape, a piece of thread may be tied between the axles that go through the limb tips, and a measurement between this thread and the limb may be used.

To check or adjust the tiller on a bow that has virtually parallel limbs; it may be necessary to measure between the upper limb pocket pivot point and the bottom limb cam axle (a), then compare this to the measurement between the bottom limb pocket pivot point and the upper limb cam axle (b). To make an adjustment the limb bolts can be adjusted as previously mentioned.



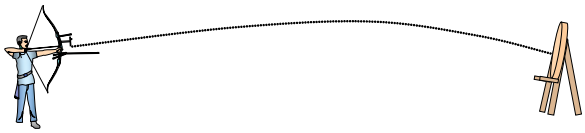
It is advisable to check with the manufacturer for the correct procedure and expected results.

Draw weight

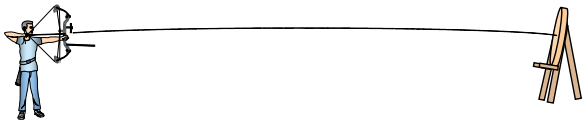
FITA rules limit the draw weight to 60 lbs. Setting draw weight light enough to be easily managed allows an archer to learn to shoot with proper form and develop good hab-

its. When adjusting the draw weight for an archer, make sure the bow is drawn using the muscles of the back. As an archer's strength increases, the weight may be increased. Regardless of what the draw weight is, the archer should be able to shoot a full FITA in one day without excessive fatigue. The archer should have enough strength to execute the last shot with the same proper form as the first shot.

Heavier draw weights make it easier to reach 70 and 90 meters due to a flatter trajectory as well as performing better in the wind. Trajectory is the arc of the arrow.



Higher trajectory when shooting a recurve bow.



Flatter trajectory when shooting a compound bow.

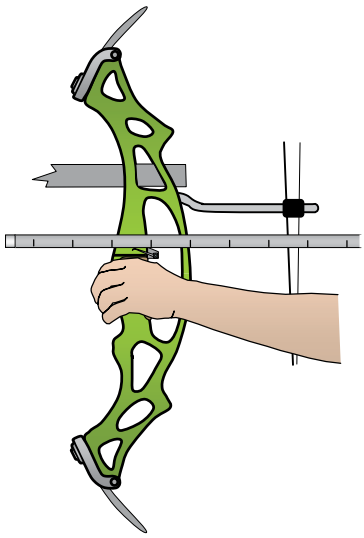
With a lower arc, it is easier to sight in at longer distances without the sight having to be adjusted into the path of the arrow.

Another advantage of a flatter trajectory is the reduction of errors from the miss-estimation of distance. This is particularly beneficial for field archery and other unmarked distance shooting.

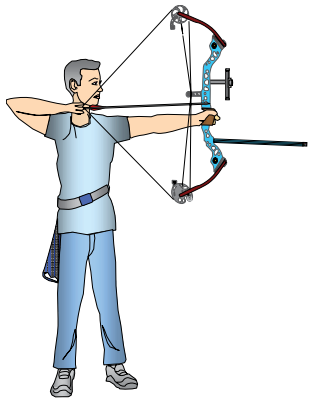
Draw length

A proper length gives leverage and control over the bow as well as leverage to generate back tension. A proper draw also allows for clearance for the string at the chest and bow arm. Set the draw length so the release hand can find a stable spot, for instance: against the jawbone (popular), depression behind the ear... See "Facial marks" from the FORM Chapter. Having the stable release hand helps to steady the bow as well as properly positioning the draw arm. The drawing elbow should be located directly behind or slightly outside the line of the arrow while at full draw. If the elbow is rotated behind the head, the draw length is too long. The drawing elbow should also be held up to or above the line of the arrow.

When measuring a new archer for their draw length, pay close attention to the position of head, anchor point, bow shoulder, bow arm and posture. Archers will naturally try to mold to or fit a compound bow, because it has a pre set stopping point. Archers may lean their head or torso to fit a bow that is too long, or they may hunch to fit a bow that is too short. It is important to fit the bow to the archer not the archer to the bow. An exceptionally light weight Recurve bow, a light draw weight compound bow with no let-off, or an elastic band attached to a bow to represent a light weight draw string may be used in conjunction with a draw length arrow to determine an archers proper draw length. A draw length arrow is one with preprinted marks indicating the length to which the bow is drawn.

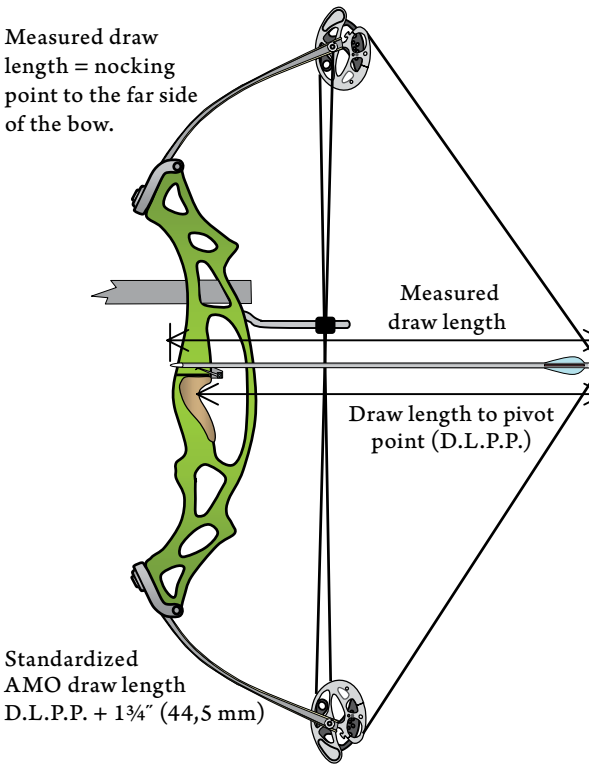


Keep in mind that regardless of the method used to initially determine an archer's draw length, adjustments may need to be made as the archer progresses. A bow with an adjustable draw length may be desirable for beginning archers.



When purchasing/selecting a bow it is important to understand how manufacturers measure draw length of the bow. The ATA, Archery Trade Association, formerly the AMO, Archery Manufacturers Organization, states that the draw length of a bow is one and three quarters of an

inch longer than the distance from the string at full draw to the throat of the grip. Most manufacturers represent the draw length of their bows in this manner.

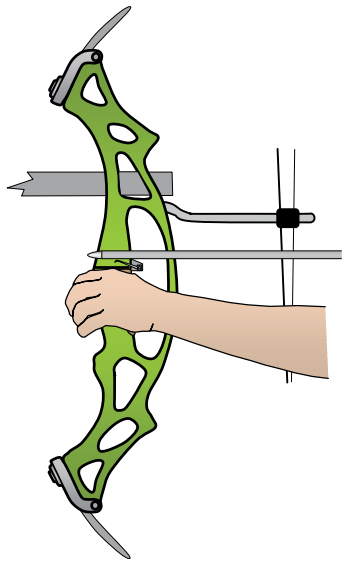


4. Accessories

Rest

An arrow rest should be very solid and consistent. It should also be adjustable enough to make tuning easy. The "Pacesetter" or "lizard tongue" style of arrow rest is easy to tune and forgiving to shoot.. 008″ or. 010″ blade thickness works well with light weight arrows. With these thinner sizes, it is easier for the arrow to "push through" the blade if there is unwanted contact with the arrow. The arrow may fall off of this type of rest during the draw if an archer is not in good physical condition. In this case use a heavier launcher blade. If the arrow repeatedly falls off of the rest, the archer will become fatigued and discouraged.

Fall away arrow rests are gaining in popularity. These arrow rests are designed to move away from the arrow at the point of release, so the fletching does not contact the rest.



As a starting point mount the rest so that there is approximately one inch (25 mm) of the arrow in front of the rest.

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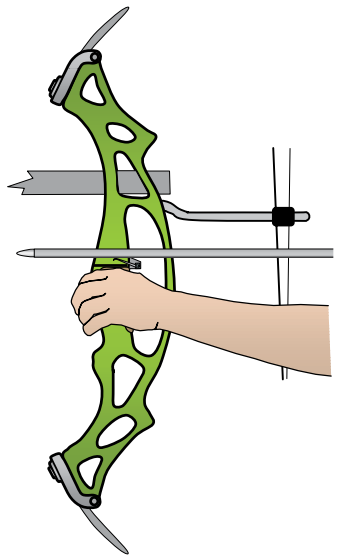
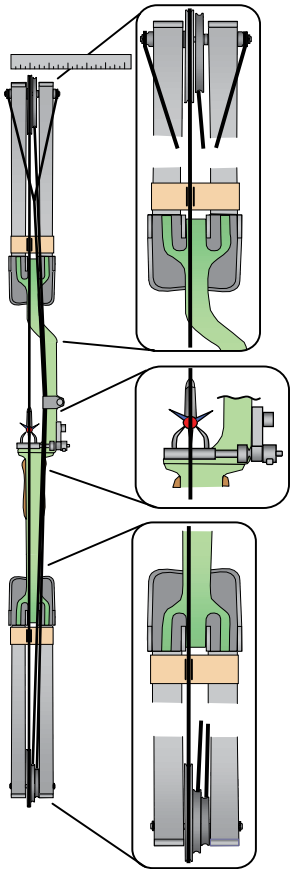


When the rest begins to fall the arrow should have travelled approximately 3 inches (75 mm). If the distance is greater than 3 inches (75 mm), the rest, due to the speed of the arrow, may not clear the fletchings. It is imperative that fletching clearance is confirmed after this adjustment which can be checked by spreading the fletching area with some (foot) powder. Spray the fletching area of the arrow with foot powder, taking care not to disturb the powdered area, shoot the arrow into a firm Butt. Inspect the powdered area of the arrow for marks which may indicate contact problems.

Mount the arrow rest on the bow so that the center of the arrow shaft is at or slightly below the center of the mounting bolt. FITA rules require that the point of the rest that contacts the arrow be no more than six centimeters behind the low point of the throat of the grip. For

maximum forgiveness, the rest should be placed between zero and three centimeters behind this point.

Center shot is the point at which the arrow is directly in line with the path of the string. To adjust center shot, place an arrow on the bow and point the bow away from you. Line a point on the string approximately one inch below the top cam up with the string that is in the groove wrapped around the cam. Without moving, glance down to the center of the string and the arrow. When the bow is in center shot, the string will appear to run right down the center of the arrow.



Limb alignment gauges can be used for this section, but as there are many types of bows and set-ups the following is a suggested method of the procedure:–Measure across the end of the limbs with a rule, find the centre, then measure the distance from this centre point to the centre of the string track on the cam. Stick a piece of masking tape across the limb just at the end of the riser. Find the centre of the limb at this point and put a small mark on the masking tape. From this point add the same distance as the offset of the string and make a mark, then put a heavy pencil mark either side of this point approximately the width of the string.

These two lines can then be used to visually line up the string. If a release aid is to be used, the rest can then be adjusted to move the arrow in or out from the riser to get the string alignment so that the string passes straight along the arrow. If this bow is to be shot off the fingers then the pyle of the arrow needs to be slightly out to the left of the string (known as the archer's paradox). This setting is required to compensate for the interference the releasing fingers have on the string, which in turn affects the initial flight of the arrow.

The drawing shows a right-handed bow set-up.

If limb alignment gauges are used care must be taken that the gauges are close to the top and bottom of the riser and that they are properly attached to the limbs.

It is not imperative that this adjustment be absolutely perfect, as the rest will likely be re-adjusted during the tuning process.

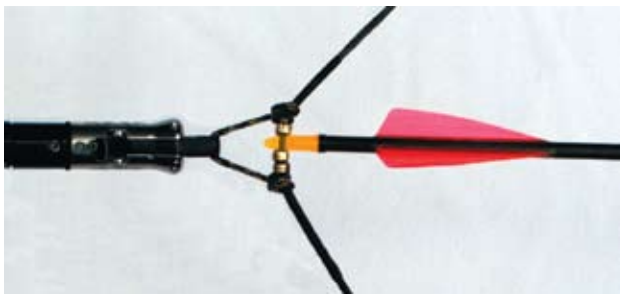
Nocking point/loop

The height of the nocking point on the string should be set so the arrow appears to be level when the bow is held straight up and down. That is the arrow is perpendicular to the string. Once again this setting is not critical, as it too will be moved in the tuning process.

Hand tied nock sets and a rope release work very well. A string loop is also popular. There are three effective ways to tie a string loop. The first is to tie the top and bottom knots equally spaced above and below the arrow.

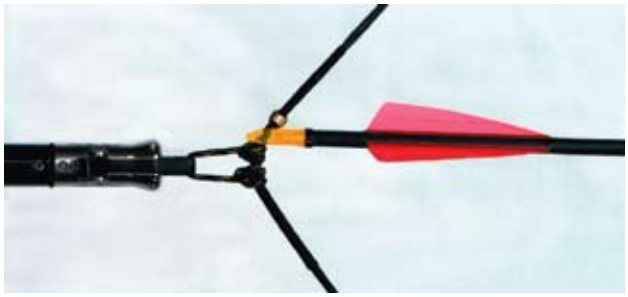
With this loop the release will be pulling from a point slightly above the nock of the arrow. This results in very little pressure from the arrow on the arrow rest. With very little downward pressure, it is somewhat easier for the arrow to fall off of the rest.

The second loop is the same as the first with the addition of a nocking point placed below the arrow inside of the loop.



This brings the pressure of the release down directly behind the nock of the arrow and puts some downward pressure on the rest, thus might be preferable in windy conditions.

The last loop has a nocking point above the arrow and both the top and bottom knots of the loop tied below the arrow.



This loop results in the same pressure on the string and rest as a rope release applies. This loop may be shorter in length, because there is no need to leave room for the arrow nock between the release and the string.

Sight

A sight should be easily and accurately adjusted with a reliable locking system. Having a level on the sight is important for shooting distances beyond 18m. Canting the bow affects the impact of the arrow greatly at longer distances. Level the sight bar and scope with the bow so windage does not change when the elevation is adjusted.

A scope on a compound bow consists of a housing with a single lens and a level.

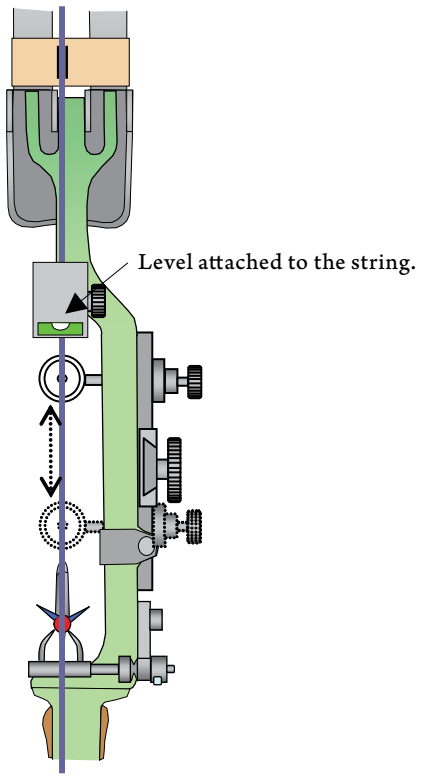
The power, magnification, of the scope lens is based on personal preference. Four and six power lenses are most common. The higher the magnification the lens has the more detail you will see of the target. The higher power not only magnifies the target, but it also magnifies the appearance of the archers wiggle. Seeing too much wiggle may be detrimental. Choose scope housing color, diameter and peep sight size so that it is easy to center the scope accurately in the peep. A black scope, peep and aiming dot is easy to center and focus on. Black is a soft color and easy for the eye to focus on. Choose a peep diameter that allows you to see a narrow ring of light around the outside of the scope housing. This will help to keep the peep centered on the scope. When aiming with a peep sight and a level, the archer should center the peep on the scope and check the level before focusing on the dot in the scope or the target. Once the focus shifts to the dot or target, it should remain there. The peep and the level should not distract the archers aiming.

To install a sight on a compound bow, bolt the sight on the riser and set the sight extension at the length it will be shot at. Pulling the extension in close to the riser will cause the archer to see less detail while aiming as well as less perceived wiggle. Extending the sight shows more detail for finer aiming as well as magnifying the appearance of wiggle. Place the bow so the string is vertical in all directions or plum.

Next place a level against the vertical adjustment bar.

Loosen the screws that hold the bar onto the extension and adjust the bar so that it is level. Re-tighten the screws on the bar. With the level against the vertical bar, loosen the scope on the sight block and adjust it until the level in the scope matches the level on the vertical bar.

Re-tighten the scope on the sight block.



Archers who intend to shoot field archery may then wish to rock the bow forward and back with a level along the string to see if the third axis of the scope needs to be adjusted. If the bubble moves left and right in the scope when the bow is pointed up and down, loosen the third axis adjustment screws and rotate the scope until the level no longer changes when pointed up or down. Consult the owner's manual for the sight to find the proper screws or adjustments for the third axis.

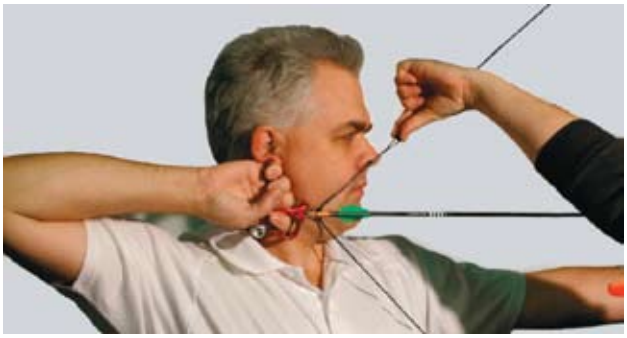
Sights designed for Recurve bows may not withstand the vibration of a compound bow.

Peep Sight

A peep sight is the rear sight on a compound bow. Peep sights are available with and without clarifier lenses. The use of a clarifier lens is a matter of personal preference.

To install the peep, place the bow in an appropriate press and relax the string. Place the peep between the strands of the string approximately four inches above the nocking point and remove the bow from the press. Adjust the scope on the sight to a position that will be correct for 50 or 70 meters for outdoor shooting or 18 meters for indoor shooting. Next the archer draws the bow while another person slides the peep up or down the string to position it in front of the archer's eye.

Safety: when adjusting the peep sight do not have the hands in front of the string – the archer may inadvertently release the string and an injury may be caused. Note the thumb is away from the trigger on the release aid.



The archer may wish to draw and anchor with closed eyes, so the current position of the peep does not influence its final setting. Tie the peep sight into the string so it cannot fly out in the event of a bow breakage or dry fire. The bow string may need to be twisted to make the peep turn properly to see through it.

Stabilizers and weights

A properly weighted bow will have a slow wiggle around the middle of the target. This wiggle will often appear to take the shape of horizontal figure eight on the face of the target. If the bow is too light the sight will wiggle very quickly around the face of the target. If the bow is too heavy the sight will be steady but slowly bounce up and down as it drops out of the bottom of the target while aiming. Keep the weight on the lower part of the bow. A low center of gravity is easier to hold steady.

Stabilizers may also incorporate shock-reducing features such as carbon rods, rubber dampeners, etc. Some of these items are affixed on the bow limbs. They can make the bow more enjoyable to shoot. Shock reducers also help prevent vibration from harming sights, arrow rests and the archer's joints.

5. Arrows

Indoor

For indoor shooting, high quality large diameter arrows are recommended. According to FITA rules the diam-

eter may not exceed 9.3mm. Fletching on indoor arrows ranges from two inch vanes to five inch feathers. Personal preference plays a large part in selecting fletching for indoor arrows.

Outdoor

Smaller diameter aluminum/carbon or carbon arrows are better suited to shooting outdoors. The smaller diameter and lighter weight of these arrows makes it easier to reach 70 and 90 meters, as well as performing better in the wind. Heavy point weight is considered beneficial for shooting long distances. 90 to 125 grain points are common depending on arrow size and weight. One and a half to two inch vanes are most common on outdoor arrows. "Spin Wing" type vanes may be more likely to contact the arrow rest of a compound bow, and are not typically used for this purpose. If an archer wishes to try this type of vane, a fall away style rest may be in order.

In order to produce the most consistent arrows possible, all arrows should be fletched on the same fletching jig. Arrows should be numbered so each arrows performance can be evaluated, and problem arrows can easily be identified.

Length

To determine the proper arrow length use an arrow with a scale on the side of it or use a full length arrow that may be marked. Place the arrow in the bow and draw it back to full draw. It is important to do this with the release that the bow is to be shot with, because a different measurement will result if the bow is drawn with fingers. Once the archer is at full draw, another person may mark the shaft or read the length at a point that is one inch in front of the contact point of the arrow rest. The length the arrows are cut to changes the way they react in regard to stiffness. If the stiffness needs to be changed, this length may be altered somewhat.

Spine

When selecting arrows for indoor or outdoor shooting, it is important to select a shaft with the proper spine, stiffness, for the bow they are to be shot out of. To select the proper spine make note of the draw weight, cam type and proper arrow length. With this information, the arrow manufacturers sizing chart may be referenced to find the appropriate shaft size.

6. Release

Release aid styles and descriptions

There are countless releases on the market. For practical purposes we can group them into three categories: Pure back tension releases, hand held releases with a trigger and wrist strap releases.

Thumb release

Thumb release with wrist strap

Finger release with wrist strap.

Second Finger and wrist pull with finger release.

Activates on increased holding pressure.

Back tension release.

Pure back tension releases are a hand held release that does not rely on a trigger to fire.

These releases fire as a result of changes that occur in the head of the release when the archer pulls with fingers on the release.

Hand held releases with a trigger have a button or trigger that is manipulated to cause the release to fire.

The wrist strap release straps onto the wrist behind the hand.

This allows the bow to be drawn using the wrist and arm leaving the hand relaxed. The wrist strap release also has a trigger which is manipulated which causes it to fire.

Many archers believe that hand held releases are more suitable for executing a surprise release by the use of the muscles located in the archers back and posterior part of the string shoulder, any of these three types of release aids can generate such a "surprise release". Nevertheless archers will find this achievement more or less easy pending the release aid design. This is why a personal research has to be done by testing various release aids.

More about the release technique in "Shot Execution" of the FORM Chapter.

7. Form

Level I Manual

The basic form used to shoot with a compound bow is essentially the same as described in the FITA Level 1 Coaching Manual for shooting a Recurve bow. There are a few exceptions as listed below.

Bow arm/hand

With a low wrist grip, and the pressure at the bottom of the palm, the bones in the wrist support the bow. Using bones to support the bow is more consistent than using muscles, as the bones do not change. The pressure of the bow should be placed at the bottom of the palm between the muscles, on the thumb-side of the lifeline. The pressure on the bow riser should be slightly below the center of the grip with the thumb and index fingers all the way at the top of the grip. This pressure should be focused on the left edge of the riser for right-handed archers. The knuckles of the bow hand should be at a forty-five degree angle from the vertical line of the grip. This angle will result in a space between the little finger side of the palm and the riser. The fingers of the bow hand should be totally relaxed on the front of the grip, but not open. The arm may be bent downward slightly or straight but not locked. The shoulder should be as low as possible

When shooting with the proper bow hand position as described above, the bow may fall out of the hand upon release. A sling is a strap or cord used to prevent the bow from falling. The sling can be permanently mounted on the bow, or may be attached to the fingers or wrist of the bow hand and simply wrapped around the bow while in use. The sling does not hold the bow in the hand, but rather catches the bow when it begins to fall. If the sling is adjusted tightly to hold the bow in place, the sling can impart unwanted torque on the bow. The bow may typically be allowed to fall into the sling a distance about as long as the thumb.

Facial Marks

This technical element was formerly named "anchor point"; it is the position that the drawing hand is consistently placed on the jaw or face of the archer while aiming and executing a shot. Depending on the style of release

aid, it is common to place the thumb or knuckles of the draw hand against the jaw as part of the anchor point. The tip of the nose is typically placed on the string as an additional reference point. Archers wearing eye glasses may not be able to position the tip of the nose on the string and still see properly. In this case the head may be held erect and slightly turned in order to see through the lens. The anchor point is very important, however it is not as critical with a compound bow equipped with a peep sight as it is with a Recurve bow without a peep sight. The peep sight provides consistent aiming by requiring the eye to be properly aligned behind the sight in order to see through it. This results in less reliance on the anchor. The anchor point becomes very consistent as a result of the repetitious nature of practice.

8. Shot Execution (Release)

There are various techniques for executing the shot. Below we will make some comments about some combinations of the following 4 principles:

- 2 will refer to the "intention" of the shot: "Commanded release" and "Surprise release"
- 2 will refer to the part of the body generating the shot: "Finger Triggering" (activate the trigger with a finger) and "Continuous Draw Increase" (Back Tension, body extension / spreading …).

It is useful to know the following methods when teaching the proper use of a release.

Commanded triggering

The name of this technique is self explanative: this is a combination of:

- A triggering action–a finger (suddenly) activates the trigger (*).
- On command (when the visual/aiming references have reached an enough good quality level).

This technique has a limited field of efficient action: when it is very windy.

Otherwise, the mental order that the archer has to send to his finger embeds a perfect follow-through and the shot happens while the archer is no longer aiming. Also a rapid finger motions often disturbs the overall steadiness of the archer. This is why this technique is also known as "Perfect aim and an imperfect shot.

Two classical bad evolutions of this technique are:

- "Punching" the trigger, a technical mistake known as "finger hit" in shooting,
- Target panic.

(*) This technique is also possible when using a release aid without a trigger: the archer suddenly changes the angle of the release hand; as above it is usually not a recommended technique.

Smooth or progressive triggering.

This is a combination of a triggering action (a finger activates the trigger) but so continuously that the string is surprisingly liberated by the trigger. (**)

In this method the bow is aimed at the target and the trigger is continuously squeezed (usually slowly) while maintaining the muscular tension in the archer's back. A proper squeeze on the release should result in a surprise shot when the trigger gets off and the string is released. If implemented this way, it is an excellent method!

There are two common problems with this method.

a) The archers does not provide a continuous squeeze toward the end of the draw, but command the release with some sort of punch as described above, due to:
   - Either some impatience: the archers has a stable sight for a while and the continuous squeeze has not yet allow the triggers to go off;
   - Some fair of the surprise release. The archer is afraid that the trigger will go off when the sight will be out of the target centre.

b) The archer regulates the speed of squeezing according to his aiming quality:
   - Quite fast squeeze when the peep, scope and target are well centered,
   - Slow squeeze (or worst. stop squeezing) when unstable, misaligned or the wiggle is important.

When this "regulation" applies we are very close to the technique of "Commanded triggering" as described above and the mental activity is split on the sighting and squeezing activities. Nevertheless it would not be efficient to continue squeezing the trigger t the same pace, when the sight is really away from the target centre! Hence some "regulation" skill has to be developed in case of abnormal sight wiggling, as long as the archer does not "fall" in the commanded triggering as described above.

(**) This technique is also possible when using a release aid without a trigger through 2 alternatives:

- *The archer progressively changes the angle of the release hand; this alternative is usually not recommended.*

– *The change of angle of the release aid is achieved by activating the muscles of the archer's back and/or posterior part of the string shoulder. This technique is described below.*

Notes about the above Triggering methods (Commanded or Smooth/Progressive):

A huge percentage of Compound archers (probably more than 90%) are learning to shoot by "manipulating" the trigger. The reason they manipulate the trigger is because it is easier to learn and results in instant results, however short term they may be. Among the most frequent negative long term effects of the improper use of releases, we can report:

– Back and shoulders muscles relaxing before the shot is over.
– Target panic

Surprise release generated by a Continuous Draw Increase

According to some experts, this is THE technique. It is a fact that over the last 15 – 20 years, this technique has became quite popular among the elite Compound archers.

This method of shot execution is often called "back tension". With this method the archer aims at the target and increases tension in the back and/or posterior part of the string shoulder, regardless of where the sight goes. Of course the archer always has the option to let the shot down and start over if they do not like where the sight goes. The outcome of this method is a surprise release resulting in perfect form. One of the main advantages of this method is that it keeps the archer's mind away from the trigger and trigger hand, allowing an excellent follow-through (see further down)

Notes about the surprise release (achieved through the 2 latest techniques presented above):

– In order for an archer who may be struggling with concept to experience the feel of a surprise release, the coach may squeeze the trigger of the release while the archer safely aims at a target.
– The sight may not be perfectly centered when the bow goes off. In opposition to the Commanded triggering method, this one can be summarized as "Imperfect aim and a perfect shot", through which the arrow is guaranteed to hit inside the wiggle area of the sight because it is executed with perfect form while the subconscious mind makes the necessary corrections. With practice, the wiggle area gets smaller and these groups get tighter.
– By strong wind, it might be more hazardous to solely use "Surprise release".

Executing the shot

The first order of business when teaching an archer to shoot with a mechanical release is to teach them how to safely draw the bow without prematurely releasing. To accomplish this, the archer should draw with their thumb and fingers off of the trigger of the release aid. For pure back tension releases, the archer may want to brace the release in a direction that will not allow it to fire by placing fingers against the back side of the release while drawing.

Illustration: draw safely with a "pure Back tension" release aid

When learning how to shoot a compound bow with a mechanical release the archer should shoot at short range at a blank bale. The blank bale is also a good place to perfect form and work on form improvements.

Once an arrow is nocked and the release is on the string, raise the bow to rest on the knees or hip. Support the bow by holding it up with the release so the bow hand can be properly set on the riser. Next, raise the bow to the height of the target and draw on target with the arrow as much parallel to the floor as possible. Pause between raising and drawing the bow to allow for a smooth draw and prevent the arrow from falling off of the rest.

Safe Drawing Angle.

Some archers tend to come down with elbow and hand while drawing back to make the draw easier (they instinctively use additional muscles which help them to overcome the peak weight); although the bow hand is kept in the same position the arrow point will then be higher than the nock; if something breaks during that ac-

tion the arrow may fly way over the target and cause accidents; this should be avoided under all circumstances.

Unsafe Drawing Angle.

The sight should be at the center of the target when full draw is reached. The sight will not remain on target during the draw, due to the motion and effort necessary to draw, but it should start and finish on target.

When full draw is achieved, place the draw hand in the proper anchor position and begin the aiming process. Look through the peep sight and center it on the scope housing. Check the level.

At this point, focus on either the sight or the target, but not both. Choose one and be consistent. The eye cannot focus at two distances at the same time; this is why one is chosen. Focusing on only one item also makes it easier to accept the wiggle area of the bow. Do not try to hold the bow still, let it float or wiggle. The subconscious mind will automatically keep the wiggle of the sight centered on the target. "Trying" to hold still will cause more wiggles than simply trying to relax. Consciously trying to force the sight on the target causes unnecessary muscle movement in addition to the movement called for by the subconscious. If the archer chooses to focus on the target, try using a very small dot or a ring on the scope lens that can easily be ignored by the conscious mind. If the archer chooses to focus on the sight, try a large dot on the lens that makes it easier for the conscious mind to ignore the target. To explain this system, compare it to watching television while a bug is flying around the room. If a person is focused on the television program they will not notice the movement of the bug. The bug would only be noticed if it lands on the television screen. This is the same as focusing on the target causes us to accept or not notice the movement of the sight. In the case of focusing on the sight instead of the target, if this person is focused on the bug they cannot watch the television. It is the same principal either way.

When using a pure back tension release (a trigger-less hinge type release), begin to pull at this point. If a release with a trigger is being used, move the thumb or finger onto the trigger while centering the peep and checking the level. Apply approximately one half of the pressure necessary to release the trigger. Once the thumb or finger is properly set on the release, begin to pull with the back and/or posterior string shoulder muscles, as if pulling a bow through the clicker. When the proper muscles of the back are used for this pull, the bicep of the drawing arm is relaxed. The tension in the release hand does not change at all, no increase and no relaxation.

Entry to intermediate level archers holds the bow at full draw with their back and arms and press the trigger with their finger. Many of these archers "creep" as they aim, indicating a decrease in back tension while at full draw.

Once the pull with the back muscles begins, there is absolutely no conscious thought about the release hand whatsoever. After gaining an understanding of this, the draw does not need to be stopped to check peep, level and set thumb. The draw will become a slow constant pull throughout the shot. Again, this pull is the same as pulling through the clicker on a bow.

Changes in the body while pulling will cause the release to fire all by itself. There is no need for thoughts about when or how to shoot the shot ever again. Once the pull is started the archer must be willing to pull forever; aiming and pulling with no expectation that the shot will ever go off.

Although it is important to trust the back tension system to work without using conscious thought to execute the shot, some archers may wish to know what causes the release to fire. Continuing to pull on the release with back tension increases the pressure between the hand and the release because the compound is shot from the wall. The increase in pressure causes the back of the hand to stretch. As the hand stretches the thumb or trigger finger moves rearward at a rate that is faster than the rate that the release moves. The trigger moves with the thumb or finger that it is in contact with. When the trigger moves far enough the string is released. With a quality release this movement, change in relationship between the hand and the release, is not typically visible or felt. Keep in mind that there

is no conscious change in the relationship between the hand and the release.

Calmly talk the archer through this process of execution with each shot as they learn how to execute a proper shot. By doing this the coach is performing the function of the mental program for the archer. Once the proper method is learned and committed to the subconscious, the archer may be taught to use a mental program in order to control the shot the way the coach did.

Follow through

Shooting with back tension results in a "surprise" when the shot goes off; therefore there is no need for conscious thought about follow through. An analogy for this is people playing tug-o-war (pulling on opposite ends of a rope). If the rope were to break while people were pulling on it, there will be a surprise. The people pulling will fall onto their backs, without time to react in any other way. The bow moves straight toward the target that it is aimed at when the release goes off (the rope breaks). At the same moment, the release hand moves straight away along the same line. This occurs before the archer can react in any other way, allowing the arrow to leave the bow while everything is still in perfect line. The result is perfect follow through. There is no need to exaggerate the motion of follow through because the arrow is gone before the archer regains control after the surprise of the release. Again, no thought about follow through is necessary if the release is executed properly using back tension, resulting in a surprise. The perfect follow through is natural. The example of a rope breaking is an explanation used to demonstrate that with a surprise we can not control the follow through until after the arrow leaves and it no longer matters. Just as the people on the rope eventually react to their fall, we also react and re-grip the bow and regain control. This reaction occurs after the arrow has left, because of the element of surprise. A true surprise release ensures that the shot is achieved while the archer is still aiming; hence the bow can propel the arrow away while visual and mental activities of the archers are maintained and unchanged.

Three outcomes of a shot

This section is a short restatement of what must happen when the archer draws the bow. This information is so important that it is necessary it make it stand out from the other aspects of the shot. This is the "Keystone" of shooting properly with a mechanical release.

Three things can occur once the bow is drawn. First, the archer draws, anchors, aims and starts to pull. The pull continues with constant, even motion, never speeding up or slowing down, until the release goes off, surprising the archer and the arrow flies to the target. Second, the archer draws, anchors, aims and starts to pull. The pull continues with constant, even motion, never speeding up or slowing down, until the shot has deteriorated so badly that the arrow will not hit the target if it goes off. In this case the archer lets down and starts the shot over from the beginning. This is still a perfect shot, as the archer still has the opportunity to execute the shot properly. The third occurrence is the archer draws, anchors, aims and starts to pull. The pull continues with constant even motion, never speeding up or slowing down. This pull continues at the constant rate for an eternity. In this third scenario, the archer is standing at full draw for the remainder of his or her life. Of course the third scenario never occurs. Eventually all shots end in one of the first two results listed. If the third scenario never occurs, then why include it? Simply put, in order for the shot to be successful, the archer must intend to do number three every time the bow is drawn back. The archer must have no expectation that the bow will ever go off, this allows the surprise release to occur. With expectation comes anticipation. The archer must have endless patience with every shot.

Breathing

An archer should exhale when exerting the effort to draw a bow. Once at full draw the archer should aim and execute the shot before taking another breath. This time while the lungs are empty is referred to as the natural respiratory pause. It may seem difficult to spend this amount of time without breathing, but consider that we do not draw a breath while talking, and we often talk for periods longer than that required to execute a shot. An alternative to this is to draw a half or full breath after reaching full draw and holding that breath until the shot is completed.

9. Tuning

Basic Tuning

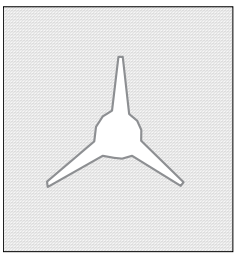
As listed in section three of this chapter, the assembly and set-up of the bow and components is the first step in the tuning process. This step must be performed in order to learn to shoot with proper form. Once an archer has learned how to execute shots with proper form, the tuning process can resume.

Paper tuning

The next step in tuning a compound bow is paper tuning. Stand two yards/meters from a frame with paper stretched tightly across it. Using good form, shoot fletched arrows through the paper and into a target butt. The holes in the paper may then be analyzed to determine adjustments that may be necessary to improve arrow flight. If the arrows make tears in the paper that are vertical or a combination of vertical and horizontal, make adjustments or corrections until the tear is perfect or only horizontal before making adjustments to correct for horizontal tears. Make only one change or adjustment at a time so the effects of the change can be properly measured. Ultimately the arrow will pass through the paper making a perfect hole with three equal length tears from the fletching. There are many resources available that detail other adjustments and considerations for this type of tuning. Easton Archery has produced much informational literature on this subject over the years. See the Easton Tuning Guide that you can download from http://www.easton-archery.com/downloads.asp

Paper tuning should not require a large amount of time or effort. Reasonable results should be achieved in just a few minutes and certainly should not take more than one hour.

- Perfect tuning

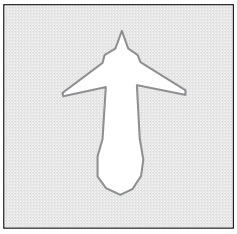


This tear indicates good arrow flight. The point and fletching enter the same hole.

There is no reason to contribute too much time paper tuning, because this is just a starting point for the fine tuning process that will take place when shooting at a target.

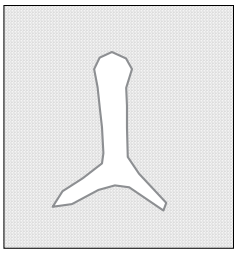
There are many factors affecting the flight of an arrow. Below are several suggestions for correcting arrow flight depending on the direction of the tear in the paper.

- Nock high



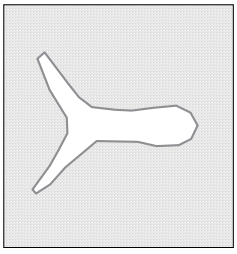
  - Check cam timing/synchronization.
  - Raise rest or lower nocking point.
  - Soften spring tension or launcher blade on rest.
  - Increase speed that fall away rest drops.
  - Check for fletch clearance (spray foot powder on fletching and shoot).
  - For long arrows, shorten arrow until point is approximately one inch in front of rest at full draw.
  - For one cam or cam and a half bows, stiffen arrow (cut shaft, lighten point, larger shaft, reduce poundage).

- Nock low



  - Check cam timing/synchronization.
  - Lower rest or raise nocking point.
  - Stiffen spring tension or launcher blade on rest.
  - Decrease speed that fall away rest drops.
  - For one cam or cam and a half bows, weaken arrow (heavier point, longer shaft, smaller shaft, raise poundage)

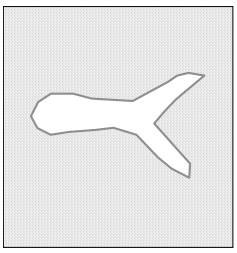
- Nock left (right handed archer)



  - Move arrow rest right.

- Confirm that archer is not torquing bow grip.
- Weaken arrow (heavier point, longer shaft, smaller shaft, raise poundage)
- Check for fletch clearance (spray foot powder on fletching and shoot).
- Check for deflection of bowstring from facial contact (Aim at paper then pull face away from string slightly and execute shot).
- Check for wheel lean/twisted limbs.
- If items listed above do not correct flight, try to move rest left or stiffen arrow.

- Nock right (right handed archer)



  - Move arrow rest left.
  - Confirm that archer is not torquing bow grip.
  - Stiffen arrow (lighten point, cut shaft, larger shaft, lower poundage)
  - Check for fletch clearance (spray foot powder on fletching and shoot).
  - Check for deflection of bowstring from facial contact (Aim at paper then pull face away from string slightly and execute shot).
  - Check for wheel lean/twisted limbs.
  - If items listed above do not correct flight, try to move rest right or weaken arrow.

Fine tuning

This advanced step will be detailed in the level 3 coaching curriculum.

Other tuning/set-up tips

Below are listed several tips for common problems that may be difficult to solve.

Effects of lengthening/shortening the string or the cables. This may be achieved by twisting/untwisting existing string or cables, or by replacement with new ones.

String

- Shorten (twist)
  - Shortens draw length
  - Decreases draw weight
  - Reduces let-off (slightly)
  - Raises brace height (slightly)
  - Increases tension of string and cable assembly in brace position
- Lengthen (untwist)
  - Lengthens draw length
  - Increases draw weight
  - Increases let-off (slightly)
  - Lowers brace height (slightly)
  - Decreases tension of string and cable assembly in brace position

Cables (referred to as bus cables or power cables)

- Shorten (twist)
  - Lengthens draw length
  - Increases draw weight
  - Increases let-off (slightly)
  - Raises brace height (slightly)
  - Adjust timing. On a two cam bow, shortening one cable will cause the cam it is attached to roll over slower. That is the cam will not be drawn back as far.
- Lengthen (untwist)
  - Shortens draw length
  - Reduces draw weight
  - Reduces let-off (slightly)
  - Lowers brace height (slightly)
  - Adjust timing. On a two cam bow, lengthening one cable will cause the cam it is attached to roll over further. That is the cam will be drawn back further.

Methods for correcting improper peep roll.

- Compress bow in press and move strands of string from one side of the peep to the other. An equal number of strands should be on each side of the peep before and after this adjustment.
- Compress bow in press, remove one end of the string from the cam and twist the string one or two turns as needed. Twisting the string from the top cam end will affect the peep position more than from the bottom end.
- If a string loop is used, wax the loop and the bow string serving where the loop is to be tied. This will prevent the loop from spinning on the string. The loop may then be rotated on the string to influence the position of the peep when the bow is drawn.

- If peep is off exactly 180 degrees, compress bow in press, remove peep, and place back in the string without changing any of the strands facing the opposite direction.
- If peep spins more than 180 degrees when bow is drawn, remove center serving of bowstring and reserve wrapping in the opposite direction.
- Install a peep sight with rubber tubing attached to it which is designed to turn the peep when the bow is drawn. If so, the rubber tubing must be regularly checked. For those that shoot regularly under strong sunlight, the tubing breaks a lot faster.

Methods for adjusting bow to sight in at long distances without placing the scope/sight pin in the path of the arrow or fletching.*

- Reduce length of sight extension.
- Install scope with smaller diameter housing.
- Change point of release attachment from below the arrow to a loop attached above and below the arrow. This will cause the peep sight to be adjusted upward.
- Increase poundage/speed of bow within archer's ability.
- Reduce arrow weight within limitation of manufacturer's recommendation and tunability.
- Lower anchor point to increase peep height, which is an unpopular and critical change!

(*) After using any of these methods, adjust sight to the longest distance, place a small amount of lip stick or foot powder on the bottom of the scope or sight pin and shoot the bow. Inspect the arrow and the scope or sight pin for signs of contact after the shot.

10. Maintenance

Maintenance suggestions

Below are several suggestions for the care and maintenance of a compound bow.

Replace string and cables every year or two, or after 15,000 to 20,000 shots. If string or cables show signs of failure, replace immediately. String and cables should be replaced as a set. It is recommended to mark the cams against the limbs at brace position after the bow is set-in (cable and string fully stretched). If any of the marks moves from its original position, the bow must be checked.

Inspect the bow and accessories for wear or damage prior to shooting.

All bolts and screws must be retightened regularly.

Do not expose a compound bow to extreme heat. The string, cables, and limbs in particular can be damaged. This often occurs when a bow is left in a vehicle on a warm day.

After shooting in the rain, the bow should be left to dry under natural environment (in a ventilated and shaded place). Direct heating or sunlight is not recommended. The string and cable shall not be waxed until after moisture in them has evaporated. Waxing the string and cable when they are wet will trap the moisture. Axes and all moving parts (e.g. Arrow rest) should be checked and oiled

Lubricate the axles where they pass through the eccentrics approximately every 1500 to 2000 shots or at least once a month; lubricants should be based on silicone, Teflon or quality grease." with "dry-type Silicon or Teflon lubricants to avoid dirt from sticking to bow parts.

Bow string and cables should be waxed on a regular basis to protect them from abrasion, wear and separation.

Always have a qualified technician use a bow press that supports the riser of the bow in two places if the bow needs pressed.

For bows unused for long periods of time, it is recommended to reduce the draw weight to the minimum.