The Nuts&Bolts of Archery

A Guide to Tuning and Shooting Compound Bows

My most sincere thanks go out to everyone that contributed to this “guide” with special thanks to Alan, a.k.a. nuts&bolts, for the contributions he made. Without Alan’s contributions, this document simply would not be what it is as the VAST majority of what is contained in it is taken directly from his responses on Archery Talk.

Chapter 1 Initial Bow Setup

Finding and Setting Initial Nock Point

The nock point locates your nock on the center serving and locks in the amount of bowstring ABOVE the arrow nock and locks in the amount of bowstring BELOW the arrow nock.

To set the initial nock point, put your bow into a bow vise, if you have one. While the bow is in the vise, ensure your string is plumb and set your arrow at 90 degrees to the string (this can be accomplished with a string and arrow level) with the arrow shaft running through the centerline of the two arrow rest holes (also known as Berger holes).

Adjust your arrow rest to support the arrow as it runs through the centerline of the Berger holes.

If you don't have access to a bow vise, hold the bow riser vertical, making the bowstring plumb, and set the initial nock point so the arrow is dead level to the naked eye and the arrow shaft is running through the centerline of the Berger holes.

This is a good starting point.

Peep Sight Location and the Nock Sitting on the Side of Your Face

We want the nock to land on the SAME EXACT spot along the side of your face for each and every shot. We also want the forward/backward tilt angle of your HEAD to be the same tilt angle for each and every shot. Ideally, ZERO forward tilt for your head and ZERO backward tilt for your head.

Setting the peep sight position on the bowstring helps you do both of these things. It helps keep your head level (zero forward tilt, and zero backward tilt).

RAISE the release hand up or down (do NOT tilt your head to see THROUGH the peep sight). ONLY RAISE YOUR RELEASE HAND so you can CENTER the peep sight and CENTER the round plastic ring around your pins (pin guard). If you CANNOT SEE the bottom part of the round plastic ring around your pins, RAISE YOUR RELEASE HAND and do not tilt your head down to see the entire round plastic ring around your pins when you cannot see the bottom part of your sight ring around the pins.

KEEP YOUR NECK FROZEN SOLID; NEVER TILT your head forward or backward to "see through your peep sight".

You RAISE or LOWER your release hand so the NOCK is sliding UP your face so you can see through the peep sight, or, the NOCK is sliding DOWN your face so you can see through the peep sight. You have ADJUSTED where the nock lands on the side of your face so you can see through the peep sight WHILE YOUR NECK WAS FROZEN SOLID (no tilting your head forwards or backwards...zero neck bending) and now you have to ask yourself if this is a comfortable position for the nock to land on your face.

If the answer is no; if the answer is you do not have any facial anchor touch points, MOVE the peep to a different location on the bowstring and RAISE THE NOCK touching position on the side of your face, or, LOWER THE NOCK touching position on the side of your face WHILE your NECK is frozen (zero bending of the neck).

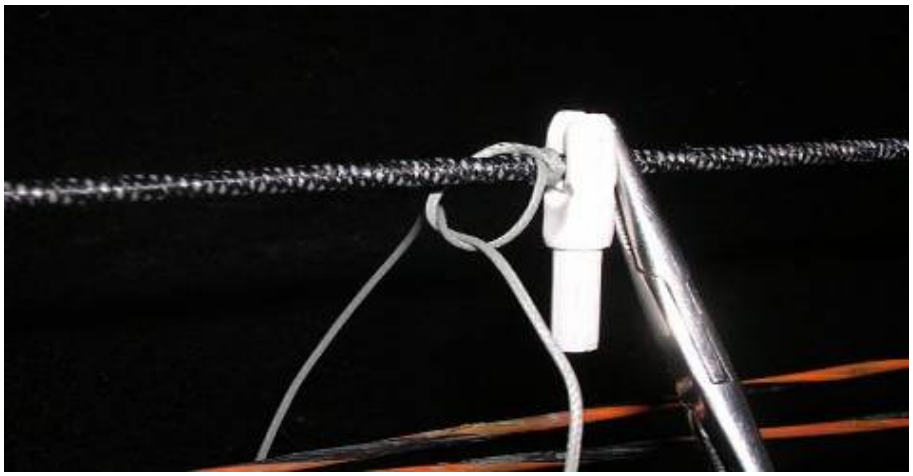
Tying in Nock Sets (by Deezlin)

I always use serving nock sets in conjunction with D-loops. I feel this is the best of both worlds. On my hunting bows, I use a serving nock set on top of the nock only and an eliminator cushion or small electrical grommet under the nock.

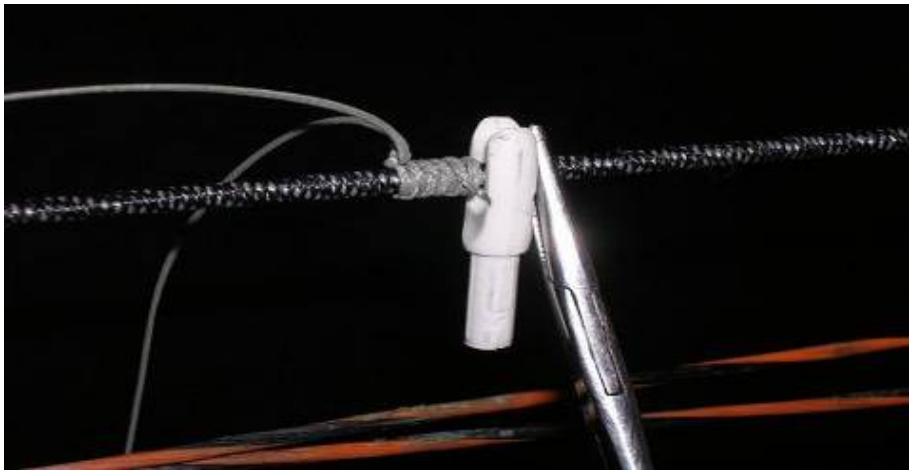
My center serving is .022 Brownell Diamondback. I use .026 Brownell Crown serving for my nock sets. In addition to position the arrow's nocking point, nock sets can be use for a number of other things, such as tying in kisser buttons, rest pull ropes on drop-aways and peep sight slip collars.

In this picture I have already determined the nock position. I have clamped a set of hemostats to the string to hold the position of the nock. I start the nock set by wrapping the serving around the string and crossing like the beginning of a square knot and then tighten.

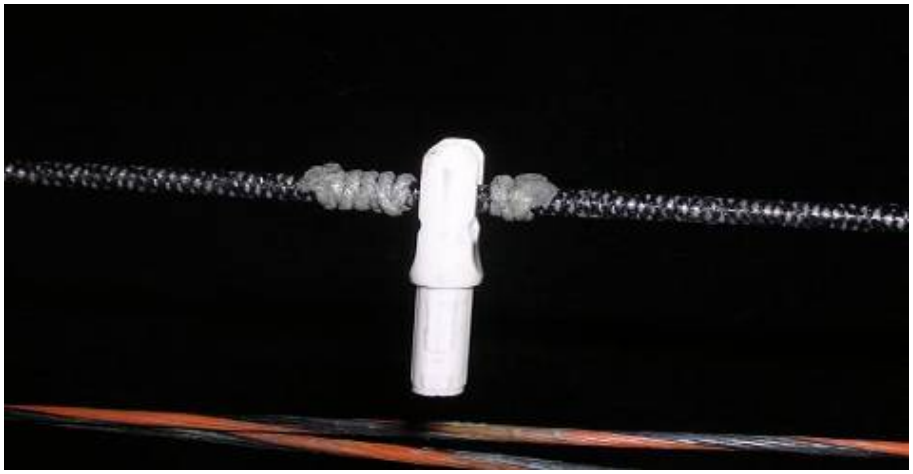
After the first knot is positioned and tightened. I wrap the loose ends around the string and cross and then tighten the next knot opposite to the first. I will do this for 10 times to the lower end of the nock set and then 4 times to the top.



After I have completed 10 knots, terminated the lower set by tying a square knot and then will cut off the ends and melt the end and knot together.

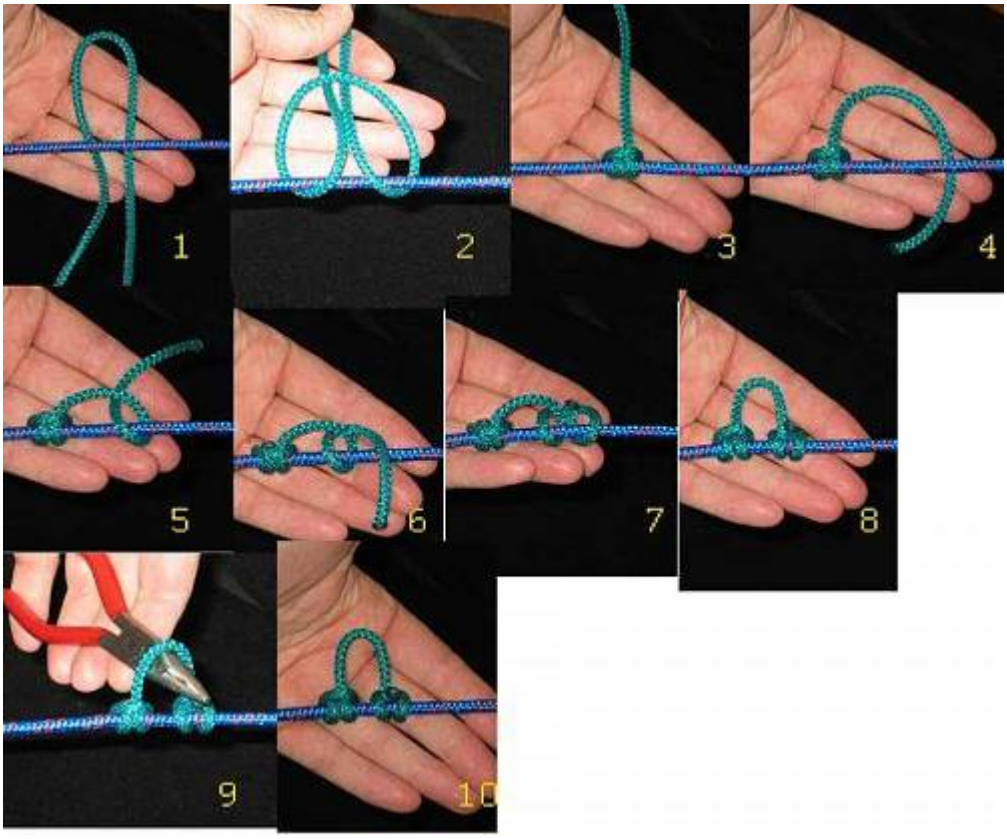


I remove the hemostats and complete the top serving nock set. I allow about a total of 1/32 to maybe a 1/16 of clearance between the nock sets and the nock. This avoids nock pinch at full draw and does not seem to hurt accuracy. This is the completed upper and lower nock sets:



Tying a D-Loop

First, a few pictures showing you how to tie a D-Loop:

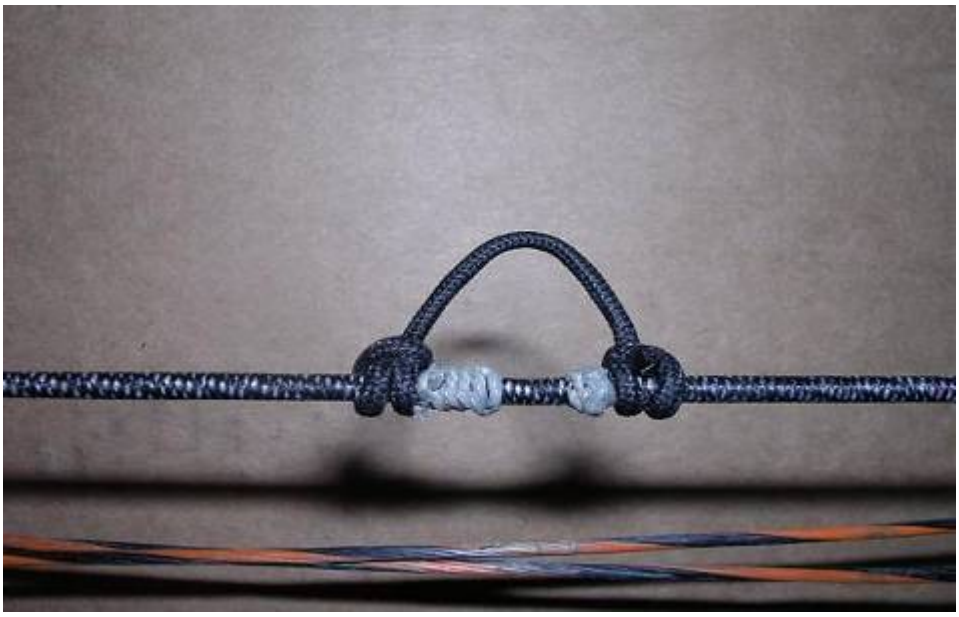


I have completed tying in my D-loop. I melt the first ball on the rope and then wax the rope before beginning. I am left handed and if the loop looks backwards too you, it probably is. I do not hold my release tilted too much and I can see little importance as to which is tied which way. But, it is important to tie the knots opposite of each other.

To take up slack in the D-loop and tighten it, I insert a pair of needle nose pliers to open the loop. (There are pliers available that are designed to assist in the tightening of a D-Loop)

Then I open the pliers with both hands to tighten the D-loop.

This is the completed D-loop. Now, many people feel the nock set should be equal is size so the release will be behind the nock. However, in actuality, you are pulling slightly up on the D-loop at full draw. IMO, the release is more behind the nock here than if the nock sets had been equal.



Note: I use micro-adjustable rests. With a drop-away, I set the nock square to the rest. With a blade rest or other standard non- drop-away rests, I usually set the nock about 1/8" high. I very rarely move the nock sets once they are tied. Normally, I make tuning adjustments at the cables or rest for elevation.

If you need to move the tied in nock set, you can try threading them up or down the center serving (like a nut on a bolt); sometimes this works. (Originally posted on Archery Talk by deezlin)

Q: What's the reasoning behind doing more knots at the bottom vs. the top?

A: It changes the center of force for the d-loop. The hook on your release will always find the "middle point" of the d-loop by itself. If the bottom knot is a little bigger, it will put the nock of the arrow slightly above the "middle point" of the d-loop. This results in a slight "down" pressure on the arrow against the arrow rest.

Folks who do the larger knot on the bottom of the nock inside a d-loop also feel that it helps the shooter to apply the pulling force more directly behind the arrow.

The above nock set is called a tied nocking set or tied nocking point. After they are tied, just coat them with some superglue.

The tied nocking points form a series of “grooves" that mesh with the "grooves" in the center serving just like a nut going up and down a bolt. No slipping and they spin up and down the center serving.

Tied nock points, or, tied nock sets, allow for very fine adjustment to the nock point of your arrow. (Original answer posted by nuts&bolts on Archery Talk)

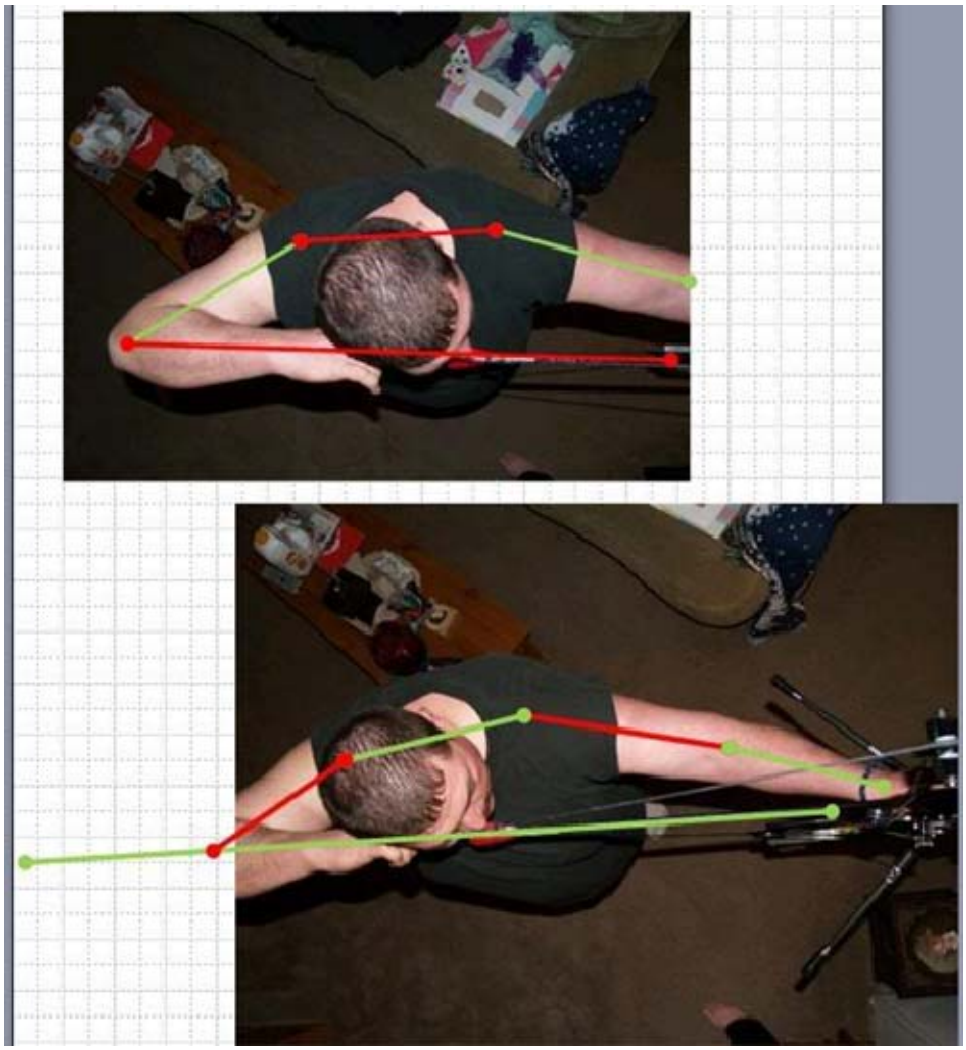
Finding and Setting Correct Draw Length

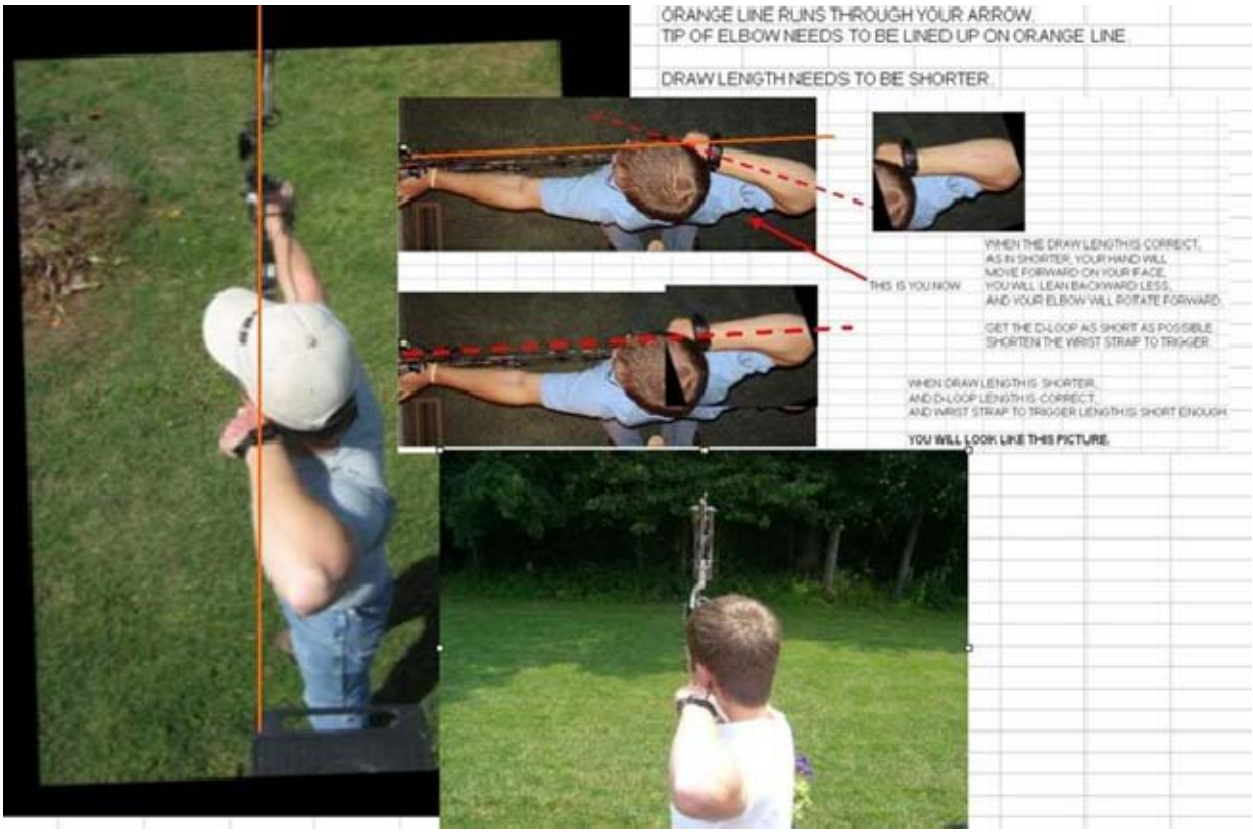
The short answer: the best draw length setting on the bow gets *you* the BEST arrow groups.

The medium length answer: the best draw length for YOU, is where the "float" for your sight pin or scope dot/circle is not too fast (tight pattern, but herky-jerky) and not too slow (large float pattern, and slow like molasses).

The longer length answer:

You want the release side elbow and the release side forearm LINED UP directly behind the arrow.



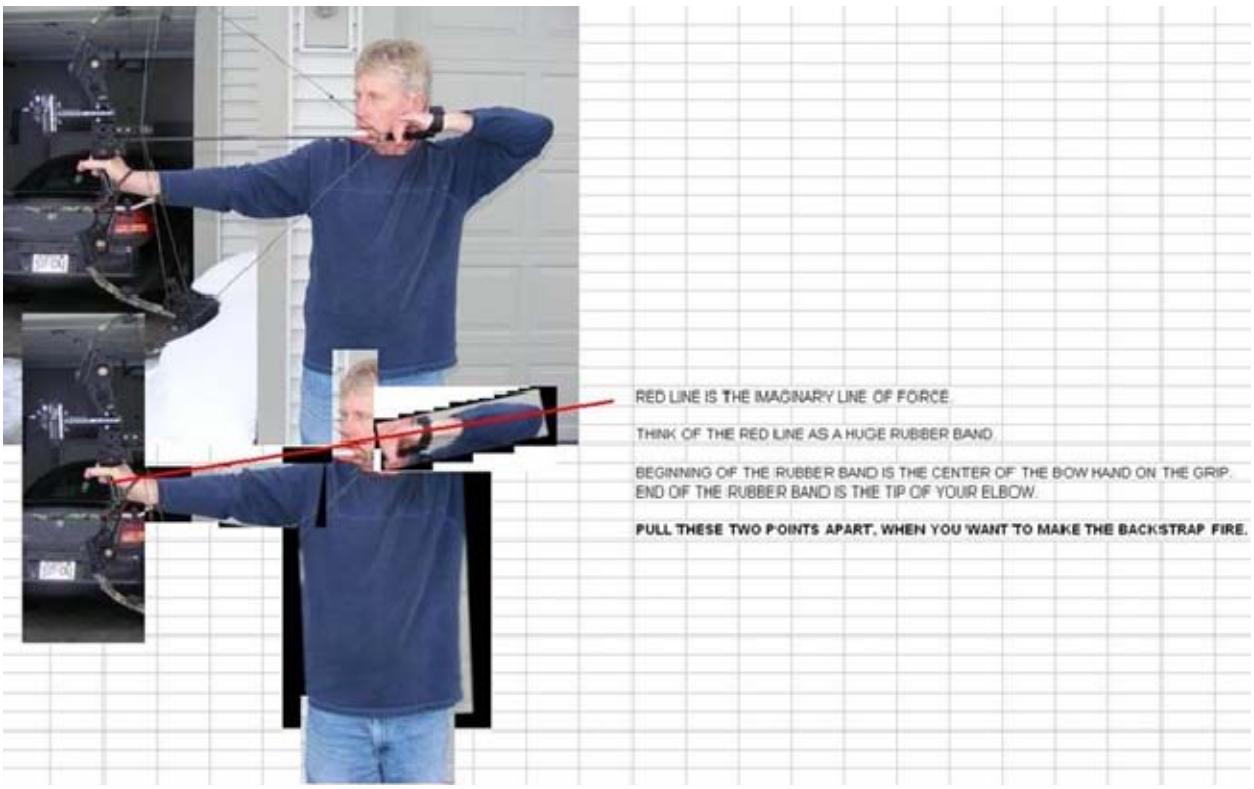


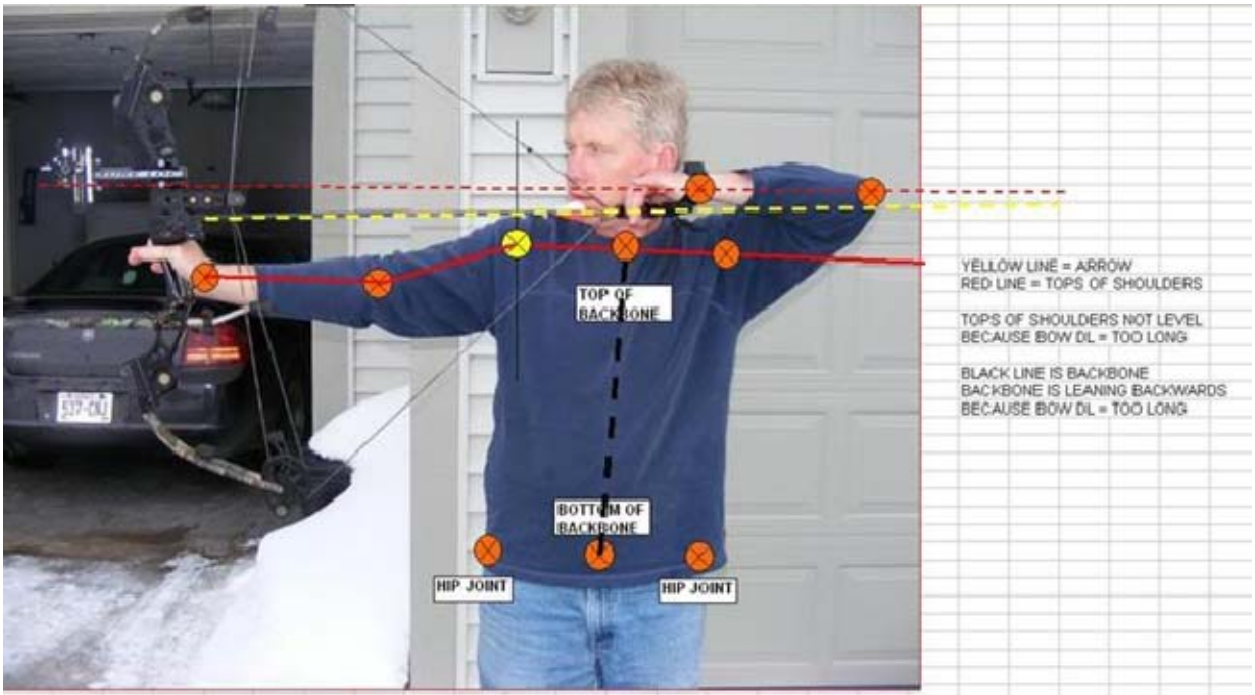
The BEST for YOU bow draw length setting will allow YOU to get to full draw AND be in a "balanced" upper and lower body posture.

Excellent full draw position.

There is room for some improvement in the picture on the left. The picture on the right is an excellent full draw position.

The upper body is leaning backwards which is causing extra weight on the rear foot so the hips are more forwards towards the target. This is no problem when shooting on level ground and is a big problem shooting downhill from a tree stand and when trying uphill shots (NFAA field archery, for example).





BOW ARM = BROKEN WING STYLE
BROKEN WING STYLE IS UNSTABLE

WHEN PULLING THROUGH THE SHOT
THE BOW ELBOW IS LOWER THAN THE BOW SHOULDER

GOTTA USE BOW SHOULDER MUSCLES TO PULL THE BOW SHOULDER DOWN
EXTREMELY EASY TO ALLOW THE BOW SHOULDER TO POP UP (COLLAPSE) WHEN USING THE BROKEN WING STYLE
IF BOW SHOULDER POPS UP.... **BACKSTRAP RELEASE WILL NOT FIRE.**

The fellow on the left can get away with this style of posture when shooting indoors, on a level floor, but, he will have trouble on uneven ground, severe downhill shots, and uphill shots.

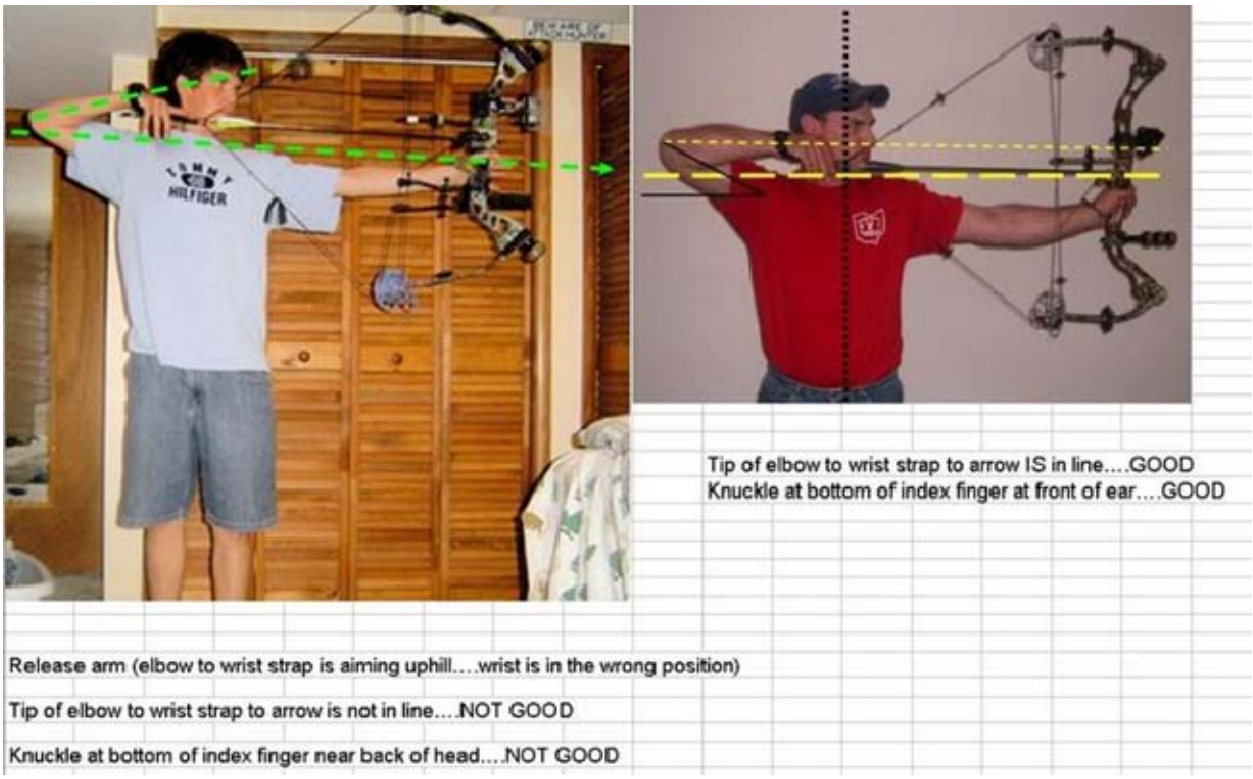
The fellow on the right, has an excellent full draw position.

Whenever you see that the release side forearm is NOT in line with the arrow (in this example, the "high" wrist, instead of a flat, straight wrist), the holding tension will be ENTIRELY in the upper arm muscles, and VERY LITTLE tension in the larger, stronger BACK muscles. The "HIGH" wrist, is also a tell-tale sign that the bow DRAW LENGTH setting is too long.

Draw Length Setting and Posture Clues

The release arm wrist is up high, the wrist is not in line with the arrow. The wrist is up high, AND release side elbow is down low; tell-tale sign that the bow's draw length setting is TOO LONG.

Another example of wrist too high and release side elbow too low which basically means the release arm is NOT in line directly behind the arrow:



Draw Length Before and After Stories

BEFORE PHOTO

The subject's posture is out of whack. The upper body is shifted/leaning backwards and there is too much emphasis on the rear leg/half of the body. When the legs are NOT vertical an imbalance/unstable condition is created in the structure of the hip joints due to the angle of the leg bones in the upper leg.

Photo analysis and recommendations (doctored up photo).

BEFORE PHOTO

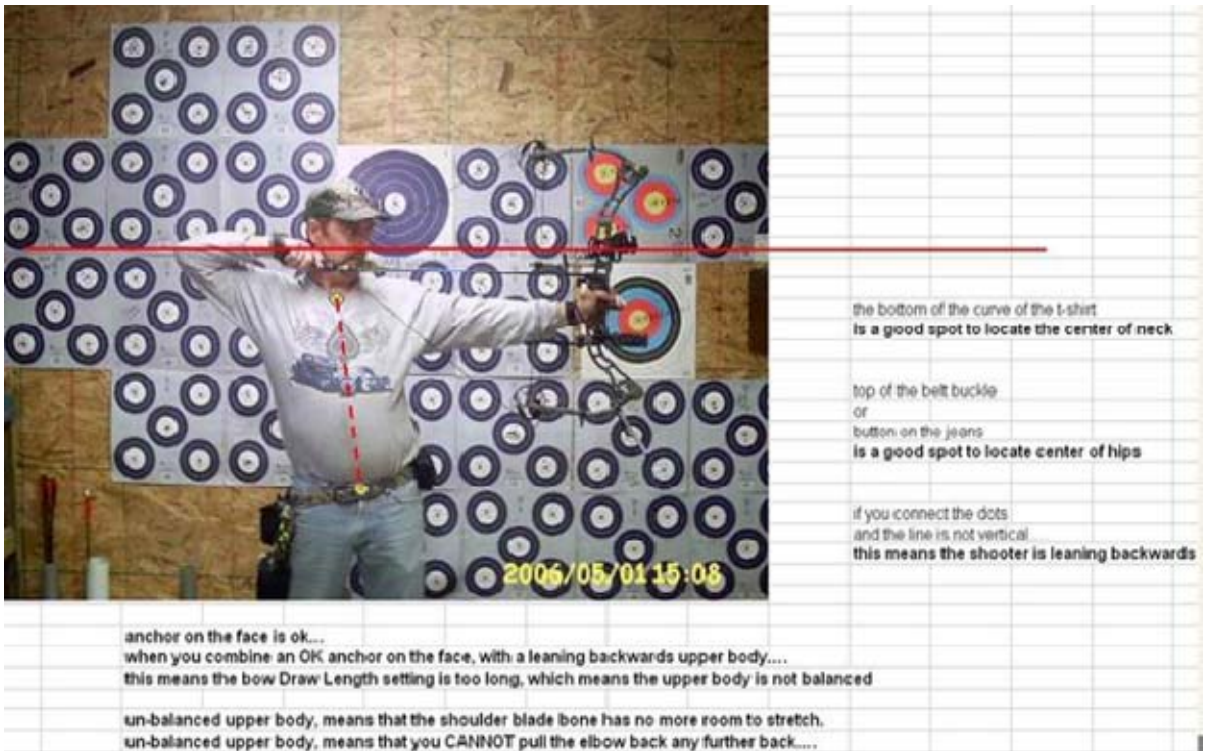
AFTER PHOTO

She is much happier with her shooting and beats her hubby on occasion at the 3D shoots.

THAT'S how you know that the "new" draw length setting works for you. Try out the NEW draw length setting for 30 days and if your average scores get better, you are on the right track.

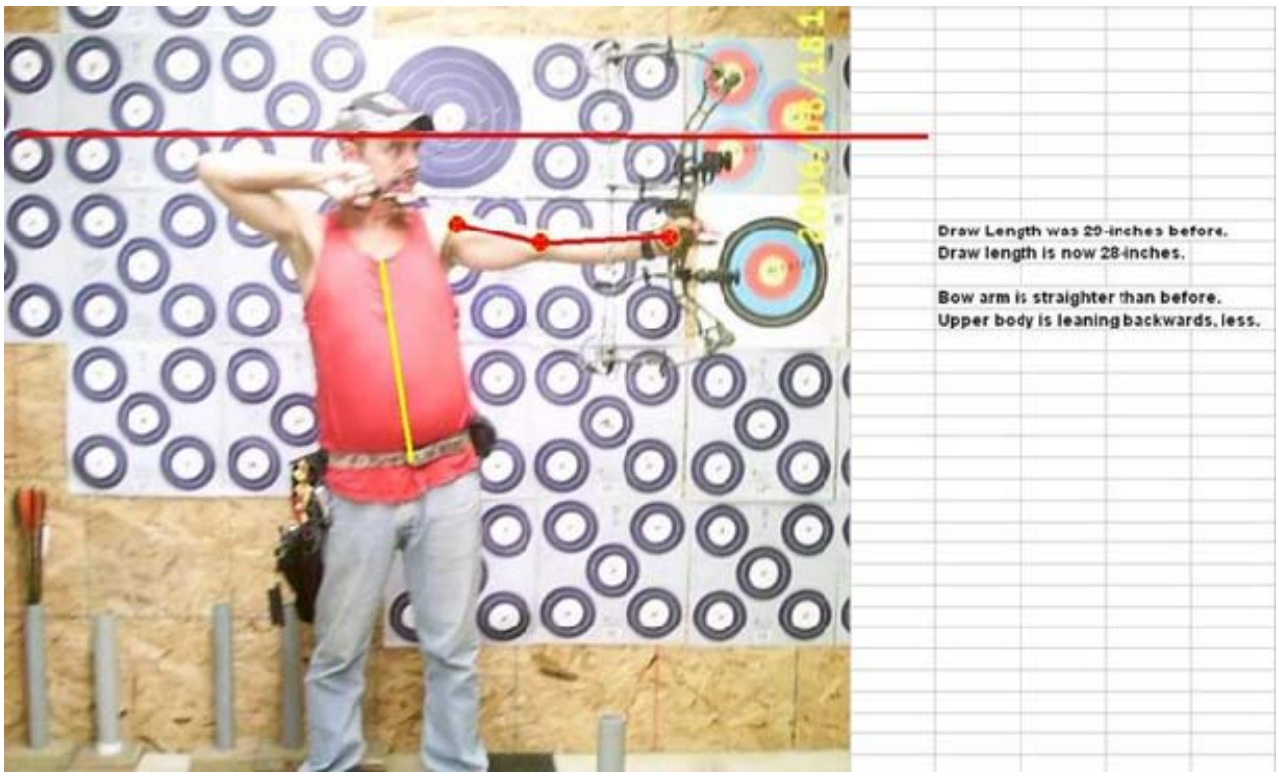
Another BEFORE and AFTER story.

He shot for YEARS at 29-inch DL. One day, he decided to explore and see if he could get higher average scores and decided to post up a picture and ask for advice on AT.



Dropped an inch OFF the draw length (went shorter).

Still at 28-inches of DL (one-inch shorter, but is now trying a handle release).



After about 9 months of experimenting and letting things settle down and a bit of advice here and there...

Over the 9-month period of experimenting his draw length dropped NEARLY 2-inches shorter and he has been shooting just fine.

When you are shooting the BEST scores of your life, then, if you want to experiment further, you experiment with DL changes 1 twist or 2 twists at a time in the bowstring. At this stage, you are trying to find that BEST float pattern to increase your x-ring average on a 3/4-inch circle at 18 meters (about 20 yards). At this stage, a 1/16th inch draw length adjustment is SIGNIFICANT.

DO realize that when shopping for bows, the GRIP ANGLE will change what draw length setting works BEST FOR YOU. If bow #1 has a very low wrist grip and a 28.0-inch DL works great for bow #1 and you go shopping for bow #2 and bow #2 has a medium wrist grip angle then the DL setting that works BEST for you may be 1/4-inch or so different.

NEVER believe the sticker on the bottom limb when it comes to the DL setting. ALWAYS put the bow onto a draw board and whip out the TAPE MEASURE and get a real world measurement, the measurement where the pivot point (deepest part of the curve on the grip) to the nock groove touching the center serving measures 1.75-inches LESS than the DL number on the label.

Sometimes, most times (?), the TAPE MEASURE reading will be on the LONG SIDE. 28.0-DL setting on the bow SHOULD give you a TAPE MEASURE reading of 26.25-inches when the bow is on the draw board.

Posture, Back, Neck, and Shoulder Conditions

All of the prior examples ASSUME zero conditions for neck, shoulders, upper/mid/lower back, elbows, and wrists (etc.).

ALWAYS listen to your body and WORK with your body range of motion. If you have a back condition, OF COURSE, do what you can so that you find what works FOR YOU.

I have worked with folks who could not lift their bow hand to shoulder height as a result of repeated shoulder separations which resulted in limited range of motion. So, we adapt, and find a "more comfortable" lower anchor point for this shooter.

Sometimes folks have limited neck rotation flexibility; could be herniated discs (say C1 or C2). Have the shooter rotate their neck to a comfortable position and work around that.

If you are a RH shooter and you have discomfort/limited range of motion and to be truly upright you find a bias towards the draw arm side more comfortable (slight lean backwards), I would work with you to find a spacing for your feet and find a hip position/pelvis position where we try to shift the center of your lower body (think belly button) a bit more towards your rear foot (right foot).

Keep the shoes parallel to each other because this orients the hip joint into the hip socket and into a more stable configuration.

A little LESS FLEX in the left (forward) knee and slightly MORE FLEX in the right (rear) knee.

The key to "feeling" balanced with your weight on the left and right foot lies in the shifting of your belly button (hip shift) either a skosh more towards or away from the target (sideways shift towards the target or away from the target with the lower body) which gets the forward leg more vertical or less vertical.

Experiment with this sideways shifting of the lower body to find what "feels" most balanced so that your "upper body" lean is comfortable and you "FEEL CENTERED".

Chapter 2 How to Grip Your Bow

Bow Hand/Bow Hand Thumb Placement

http://en.wikipedia.org/wiki/Flight_dynamics

That is a link to an animated .gif pattern for the three ways a plane can move through the air.

This helps for understanding

*ROLL (wing tips go higher and lower)

*PITCH (nose of plane goes higher and lower)

and

*YAW

ROLL is when a plane uses its flaps on the wing TIPS. The left wing will TIP up or the left wing will TIP down.

PITCH is when the nose of the plane goes straight up or when the nose of the plane goes straight down.

YAW is when the plane is sitting on the ground at the airport and the plane makes a FLAT left turn (wings stay level) or when the plane makes a FLAT right turn (wings stay level).

Make a fist with your bow hand and place your bow hand on a table. Your bow hand is the airplane; the table is the ground at the airport.

Grab a pencil or pen and make a fist around the pen. Keep the pen pointed straight up.

POINT your thumb due north (straight ahead) and keep your thumb level, parallel to the table.

Now POINT your thumb north east (thumb is pointed off to the right of the target) while the pen is still pointed straight up.

These are adjustments to YAW, or, adjustments to your thumb pointing direction, while keeping the pen in your fist pointed straight up.

With the pen pointed straight up and with your fist still wrapped around the pen, I would like to see that your thumb is pointed forward in the same direction you want the arrow.

Now, with your thumb still pointed FORWARD (due north, let's call it), I would like you to TILT the pen in your fist sideways until you can get a 45 degree TILT on your knuckles AND your thumb is still pointed forward (due north).

When you tilt the pen in your fist SIDEWAYS, you are making a ROLL change in the airplane.

I cheated and rotated the picture and the two pictures show the thumb pointed "straight ahead".

By rotating the picture, I made a ROLL change to increase the angle on the knuckles.

When you make a ROLL change to increase or decrease the angle of the knuckles, you change where the lifeline of your palm contacts the LEFT EDGE of the grip.

With the thumb pointed forwards (same direction as the arrow flight path), you can rotate or ROLL the hand clockwise and the lifeline will rotate AWAY from the left edge of the riser/grip or you can

rotate or ROLL the hand counter-clockwise and the lifeline will rotate TOWARDS the left edge of the riser/grip.


Get A Grip
01:19
03:27
HD


Get A Grip
01:23
03:27
HD

This is a nice video clip by Larry Wise. http://www.bowtube.com/media/6/Get_A_Grip/

Experiment with different degrees of ROLL rotation angle. Use whatever angle works BEST for you. Just remember to keep the thenar eminence (meaty part of the thumb muscle) as relaxed and cushy as you can.

High Wrist, Medium Wrist, Low Wrist and Grip Angles

These are pictures of the Shrewd Low Wrist Grip and the Shrewd High Wrist Grip for a Mathews bow.

"LOW WRIST" means that the grip angle is darn near vertical; your wrist is very low, closer to the ground due to the near vertical angle of the grip which is close to straight up.

"HIGH WRIST" means that the grip angle is farther away from vertical; your wrist is higher, farther away from the ground due to the grip angle.

Custom grips are available in a wide range of shapes and a wide range of "angles".

Try to have a fully relaxed hand with your fingers naturally curling and zero tension in the fingers. The meaty part of the thumb muscle as cushy as a down pillow and you can feel the bow sinking into the thumb muscle AFTER you get to full draw (because the hand is NOT relaxed, while GETTING to full draw). You must CONSCIOUSLY relax the bow hand thumb muscle in the beginning to let the thumb muscle get mushy.

Allow the bow hand to mold around the grip and get evenly distributed pressure across the top of your palm, across the middle of your palm/top of meaty part of thumb muscle, and across the bottom of your palm/bottom corner of the meaty part of the thumb muscle.

The bottom of the lifeline of the palm should be just off the left edge of the RH grip.

Chapter 3 Arrow Selection

Proper Arrow Selection

Everybody has their favorite arrow for the type of shooting that they do.

Let's talk about using low weight arrows to get to the bow's maximum speed.

General rule of thumb is do NOT go any lower than 5 grains of total arrow weight per pound of bow draw weight. If you have a 60 lb. draw weight bow, the PROPERLY SPINED, total arrow weight should be at least 300 grains.

To design a PROPERLY SPINED arrow for a 60 lb draw weight bow that is LONG enough to fit past your arrow rest and only weight 300 grains total arrow weight is possible, but very difficult to do.

For 3D

Some folks are using fatter arrows in order to "cut lines". Some folks are use super short, super skinny, arrows to get that ultra-lightweight arrow; the 300 grain total arrow weight arrow for a 60 lb. draw weight bow.

For Field Archery

For field archery you need a versatile arrow; something that shoots well for you at 10 yards AND shoots equally as well for you at 80 yards.

Some folks are fans of the "properly spined" skinny carbon arrows and other folks like the fat carbon "line cutter" style arrows which also happen to be crazy stiff.

In terms of the "properly spined" skinny arrows, you have a choice of an all carbon arrow or you can go to the carbon/aluminum core arrows like the Easton ACC or Easton ACE or even the Easton X10/Protour arrows.

The fat carbon "line cutter" arrows, for example, would be the GoldTip Series 22 or the GoldTip X-Cutter arrows. These fat carbon arrows are NOT meant to be shot at "proper spine". These arrows are designed to be shot at normal draw weights or even low draw weights. Typically, you cut the carbon tube length so that you have about 1/2-inch past the arrow rest and use a 90 grain or 100 grain glue in target point. These GoldTip Series 22 arrows or the even stiffer GoldTip X-Cutter arrows will be "off the charts" stiff.

In order to shoot these ultra-stiff, fat carbon line-cutting arrows accurately, your cam timing must be PERFECT, your arrow rest center shot must also be dialed in PERFECT, and your shooting technique must be very, very consistent.

If you can do these three things, the crazy stiff carbon target arrows will shoot very well all the way out to 80 yards.

Maybe the properly spined skinny carbon arrows will shoot better for you on a field archery course.

Maybe the crazy stiff, fat carbon line cutter style arrows will gain you a few extra points.

The only one way to find out is to take a chance and purchase both styles of arrows and see what works best for you.

For Indoor Shooting

You have two choices of arrow for indoor shooting: crazy fat aluminum arrows for the Vegas shoot (all the way up to the Easton 2712s) or crazy fat carbon arrows for the Vegas shoot (an example would be the GoldTip XXX carbon arrows).

If you are going to shoot a FITA indoor shoot, you are limited to a maximum diameter of 23/64ths, making an aluminum 2315 the maximum allowable aluminum arrow size.

Let's assume we are talking Vegas style indoor shooting.

Some folks shoot their crazy large aluminum arrows full length (Easton 2712 at 34.5-inches) with lower point weights at the front end.

Some folks shoot their crazy large aluminum arrows "shorter" and use crazy heavy point weights like 300 grain Pro Points or even heavier.

The best way to figure out what works for you is to experiment with, say, 2 dozen arrows and a variety of point weights.

You can try, say, 6 arrows full length and try all kinds of point weights (yep, this means buying multiple dozens of points).

You can take another 3 arrows and start whacking off 1-inch at a time and try, say, the 300 grain points.

Some folks swear by the larger feathers, some folks swear by Quick Spins, other folks swear by their favorite vanes.

Again, you have to experiment and see what works BEST for you.

For Indoor Spots

For indoor spots, some folks swear by the properly spined "skinny" carbon arrows. People try all kinds of things when chasing the x-ring count.

You can improve your x-ring average with small changes in stabilization (I'm working on some experiments as we speak).

You can improve your x-ring average, possibly, with some "shoot thru" conversions to your buss cable.

A custom grip may help reduce your left-right misses.

For some folks, the "properly spined" skinny carbon arrows, just work better for them.

I must say that the "skinny", properly spined, carbon arrows seem to be MORE forgiving of shot execution mistakes.

The super fat, crazy stiff, carbon arrows are definitely NOT forgiving of shot execution mistakes.

Arrow Spine

There is so much lingo when it comes to arrows and there are so many choices of arrows available that when you finally have your bow tuned and you have finally selected the "proper" arrow for YOU and when you point your bow, and the arrow goes where YOU want...ahhhhhhh....

The goal is to find a perfect match between the power generated by your bow, getting the arrow rest pointed in the correct direction, and finding the "proper" arrow to match the horsepower for your bow. We're not talking horsepower rating (IBO ratings), we are talking real world horsepower, AFTER you have the bow adjusted to work for YOU.

The limb bolts may be a bit less than maximum because it tunes the best this way. The arrow rest has been tweaked up and down (a skosh) and the arrow rest has been tweaked left and right (a skosh). You have tweaked the twists in the cables (maybe a little more...maybe a little less) and the top metal thingy and the bottom metal thingy are all at the "correct for YOU" starting rotation positions. Now you try and find the best arrow for YOUR setup.

Spine Rating

Spine Rating is simply the STIFFNESS rating for the arrow. Aluminum arrows are rated by outside diameter. 19XX series, so could be a Easton 1916 arrow. This means that the aluminum arrow has a 19/64ths outside diameter and the aluminum tubing thickness is 16/1000ths.

If we are talking the brand new "logs" that Easton is selling, we are talking the 27XX series, so this is the Easton 2712 arrow. This means that the aluminum arrow has a 27/64ths outside diameter. Folks, this is ALMOST 7/16ths in diameter! The Easton 2712 aluminum arrow has an aluminum wall thickness = 12/1000ths.

Generally speaking, when the outside diameter of a tube gets LARGER the stiffness of the arrow also gets MORE STIFF. All arrow companies use a stiffness testing machine with a standard weight and with the supports separated 28-inches apart and the test weight = 1.94 lbs.

Let's say we are talking about an Easton Fat Boy 400 carbon arrow. The "400" is the SPINE RATING. All this means is that the Easton Fat Boy BENDS 0.400 inches in the stiffness testing machine.

If we are talking the Easton Axis 340 carbon arrow, this hunting arrow bends 0.340 inches in the stiffness testing machine.

So, when the amount of bending is LESS, we have a STIFFER ARROW.

These are just STIFFNESS RATINGS and a STIFFNESS RATING is not the same as the ACTUAL STIFFNES after you cut the arrow.

A GoldTip XT Hunter 7595 arrow, is just the model name. A GoldTip XT Hunter 7595 arrow does NOT mean this is for a 75 lb to 95 lb draw weight bow. A GoldTip XT Hunter 7595 arrow has a STIFFNESS RATING of 0.340 inches; this arrow BENDS 0.340 inches in the stiffness testing machine.

What about ACTUAL STIFFNESS? Well, if you take a GoldTip XT Hunter 7595 arrow and you cut the carbon tube down to 25-inches for a shorter draw length shooter, you have a CRAZY STIFF arrow that I could nearly use it as rebar for reinforced concrete. This would be a very short building, but you get the idea.

The GoldTip XT Hunter 7595 arrow comes in 32-inches uncut. if you have a long draw hunter and they use the GoldTip XT Hunter 7595 full length, at 32-inches, you can see how the 32-inch full length arrow has an ACTUAL STIFFNESS which is much less than the 25-inch long GoldTip XT Hunter 7595 arrow. The LENGTH of the arrow changes the actual stiffness of the arrow.

So if we are talking a particular arrow, the GoldTip XT Hunter 7595 for example, LONGER arrow tube length makes this arrow shaft LESS STIFF and SHORTER arrow tube length makes this arrow shaft MORE STIFF. A HEAVIER broad head makes this arrow behave LESS STIFF and a LIGHTER broad head makes this arrow behave MORE STIFF.

LIGHTER WEIGHT feathers make this arrow behave LESS STIFF and LONGER, HEAVIER VANES make this arrow behave MORE STIFF. NO ARROW WRAP makes this arrow behave LESS STIFF. ADDING AN ARROW WRAP makes this arrow behave MORE STIFF. A STANDARD NOCK makes this arrow behave LESS STIFF and USING A LIGHTED NOCK (these are heavy) makes this arrow behave MORE STIFF. A MORE STIFF arrow, needs HIGHER draw weight, to make the arrow perform at its best. A LESS STIFF arrow needs a LOWER draw weight to make the arrow perform at its best.

Luckily, there is computer software that can help you figure out this stuff and so you can save money and buy your arrows only one time and have your arrows cut to the "correct" length to get the stiffness just right to work with YOUR broad heads.

Arrow Spine Testing Machine

The arrow spine testing machine has two supports spaced 28-inches apart. The test weight = 1.94 lbs. (not sure how and why this weight).

RAM makes a nice testing machine, but it is rather pricey.

The dial indicator reads bending accurate to 0.0005 inches (5/10,000ths).

Arrow Front of Center (FOC) Balance and Why We Should Care

FOC (arrow front of center balance) will have a "best for you" depending on what kind of shooting you do.

If you take a rock and tie a long string so that the long string acts as a tail and you spin it around and around (holding the end of the tail of the string) and let go, the rock ALWAYS leads during flight and the string ALWAYS follows behind the rock.

The same is true with a BROAD HEAD and a lightweight arrow tube.

For anything that GLIDES through the arrow (no rocket motors in back or front), we NEED the heavier part of the arrow in FRONT of the middle of the unguided, zero motor missile (projectile). We must have a FRONT HEAVIER balance point.

The FRONT HALF of the unguided, zero motor missile, will ALWAYS LEAD during flight.

The HEAVIER we make the FRONT HALF of our arrow, the more directionally stable our arrow will be. We aim it. It hits where we want it to hit.

MORE is BETTER, right? Only up to a point.

If we make the FRONT HALF of the arrow TOO HEAVY, it will drop like a rock, and not go very far. We have to find a BALANCE (hehehehe).

If we are shooting a broad head, a balance somewhere around the 15% FOC range is quite nice. It could be 16%, could be 17% and you are still just fine.

FOC is kind of a side effect of picking the TOTAL PACKAGE STIFFNESS which is much more important to getting your broad head arrows to tune well for you. Broad heads come 75 grain, 90

grain, 100 grain or 125 grain and sometimes heavier. Based on what broad head you happen to have, you go to that computer software and select your favorite arrow shaft company and you see that the arrows only come 400 spine rating (0.400 inch bending) or come 340 spine rating (0.340 inch bending) or come 300 spine rating (0.300 inch bending) for most hunting arrows.

So, you pick a stiff rating for your hunting setup and then you ask the computer software program how long should you cut the arrow tube to match up with the POWER generated by your hunting setup. IF the correct arrow tube length is SHORTER than your draw length, start again on the computer software program and select the NEXT STIFFER arrow rating (LOWER NUMBER) and try again to figure out what arrow tube length you need to work with the broad heads YOU HAVE and to work with the POWER from your bow setup (draw weight and draw length).

Back to FOC...

How to Figure Out FOC?

Take a pencil and lay it on the table. Balance your arrow on top of the pencil. Let's say the "ARROW LENGTH" is 30-inches.

Folks disagree on how to measure "ARROW LENGTH", but, Easton says "ARROW LENGTH" is measured from the bottom of the nock groove to the end of the ARROW TUBE. Arrow length does NOT include the field point length, arrow length does NOT include the broad head length, and arrow length does NOT include the tiny bit of the insert sticking out.

We have an "ARROW LENGTH" = 30-inches. The "MIDDLE" of the arrow is 15-inches away from the end of the arrow tube or you could say the "MIDDLE" of the arrow is 15-inches away from the nock groove. Now, find the balance point.

Let's say the BALANCE POINT is exactly 4.5-inches away from the "MIDDLE" of the arrow and the arrow is 30-inches (end of tube to nock groove on the arrow) long. 4.5-inches (distance from center of arrow shaft to balance point) divided into 30-inches (length of arrow from nock groove to end of arrow shaft) give us a 15 PERCENT FOC (4.5/30 = 15%).

This picture of how to figure out FOC comes from the Easton Tuning Guide:

F.O.C. Recommendations

Aluminum Target Arrows	7-9 %
A/C/C Target Arrows	9-11 %
A/C/E Target Arrows	11-16 %
Hunting Arrows	10-15 %

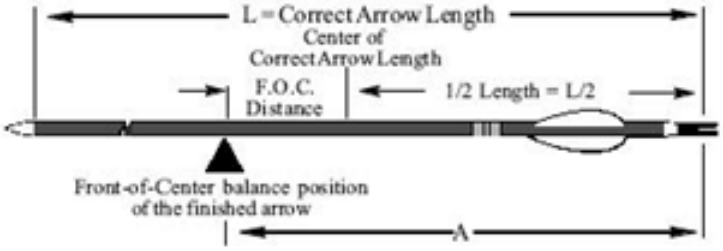
Use the following formula to calculate the exact F.O.C. of an arrow.

Determining F.O.C.%

AMO-Standard F.O.C. balance formula

$$\text{F.O.C.\%} = \frac{100 \times (A - L/2)}{L}$$

L = Correct Arrow Length—Distance from bottom of nock groove to end of shaft
A = Distance from bottom of nock groove to finished arrow balance position (includes weight of point [+ insert], nock system and fletching)



Chapter 4 Bowstring and Cable Tuning/Adjusting

What Does Adding or Removing 4 Twists or Less to the Bowstring Do to the Draw Weight of Your Bow?

Answer: You will barely notice any measurable change to the draw weight of the bow.

Answer: Adding or removing 4 twists to the bowstring, or say 6 twists to the bowstring may help you tighten up or loosen up the "float" pattern of your sight pin/scope dot/ scope circle.

Answer: You can twist up a bowstring enough to SHORTEN the bow draw length setting by about ¼"

Answer: You can usually untwist a bowstring enough to LENGTHEN the bow draw length setting by about ¼".

Answer: Building a CUSTOM bowstring one-inch shorter than the factory spec length, or MORE than two-inches shorter than the factory spec length, etc., is called "SHORT-STRINGING". "SHORT-STRINGING" is a technique (a last resort technique) that was concocted to reduce the bow draw length setting to beyond (read: shorter than) factory settings.

Say you bought a fixed draw length bow for a great price on Ebay and the factory draw length setting is 29". You NEED a 28" draw length bow. Since this is an out of production bow you cannot easily get a 28" draw length cam for this bow.

The answer is to build a custom bowstring that is SHORT enough to bring the draw length down 1" shorter than the factory intended or the cam(s) allows. The Bowstring might need to be ¼" shorter than factory spec; the bowstring might need to be 2.9" shorter than factory spec. These are all guesswork and try-and-try again scenarios intended to get the bow draw length setting DOWN to the draw length setting you want.

When you SHORT-STRING a bow, you:

a) Make the bow draw length setting shorter (obviously)

b) Cause the holding weight (let off) to go UP and the draw weight goes DOWN noticeably.

What Does Adding or Removing Twists to/from Your String Do to the ATA of Your Bow?

ADDING or REMOVING 1, 2, 3, or, 4 twists to the BOWSTRING will have very LITTLE effect on the bow's ATA.

ADDING about 20 twists to the bowstring will drop or add maybe 1/4-inch to your bow draw length setting; it depends on the existing number of twists in the bowstring.

ADDING or REMOVING 1, 2, 3, or 4 twists to the cables will have a VERY noticeable effect on bow ATA. IF your ATA is not quite correct, ADD or REMOVE twists to the cables (keeping in mind you may adjust draw weight when doing so).

ADDING 1, 2, 3, or 4 twists to the bowstring is PRIMARILY for fine tuning the draw length of the bow in order to tweak how "tight" or “loose” the sight pattern looks.

(The "sight pattern" is how fast and herky-jerky the pin dances around when you are holding on the target bull’s-eye)

ADD 1, 2, 3, or 4 twists to the bowstring and the sight pattern will dance around pretty quickly in a tight pattern about half the size of the bull’s-eye at 20 yards.

REMOVE 1, 2, 3, or 4 twists from the bowstring and the sight pattern will swing and slosh around like stirring molasses. It may present itself in a loose wavy pattern about the size of the bull’s-eye at 20 yards or even slightly larger (this presumes you are an advanced shooter and have your draw length bow setting dialed in very well).

How Many Twists to the Bowstring or Cables In or Out Constitute Too Many?

The rule of thumb is a MAXIMUM of 1 twist per inch (for example: a 60-inch bowstring would have 60 twists) for bowstrings and cables.

Most string makers will make a bowstring or cable with 1 twist for every 1.5-inches of bowstring or cable length (60” string will have 40 twists total).

Some string makers will make a bowstring or cable with 1 twist for every 2.0 inches of bowstring or cable length (60” string would have 30 twists total).

When ADDING twists to your bowstring or cable, DO NOT go beyond the 1 twist per inch of finished bowstring or cable length (60 total twists in a 60” string) rule.

What Does Adding or Removing Twists from Your Cables Do to Draw weight? ATA?

The cables on a bow are used to bend the bow limbs while the bow is at rest.

ATA is the "axle to axle" measurement which is another way of quickly checking the amount of "limb bending" present when the bow is at rest.

Example 1:

You have a 70 pound (draw) bow and you have the limb bolts fully tightened (maxed out). You hook up the scale and find the peak draw weight is only 67 lbs.

If you have the correct bowstring length (meets factory spec) then you have a simple case of the bow limbs being NOT BENT ENOUGH while the bow is at rest.

To remedy this, ADD twists to the cables to shorten the ATA (which is another way of saying we are going to INCREASE the bend in the limbs while the bow is at rest).

Retest the bow with the scale and keep ADDING TWISTS to the cables until you reach the correct maximum peak draw weight; 70 pounds for this example.

Example 2:

Same bow with a max poundage rating (draw) for the bow is 70. You test the peak draw weight with the limb bolts fully tightened (maxed out) and discover that the bow is drawing at 75 lbs of draw weight.

This is NOT good.

You must confirm that you have the bowstring length at factory spec and take twists OUT of the cables which will INCREASE the ATA (which is another way of saying we are going to REDUCE the amount of limb bending while the bow is at rest).

How Does Adding or Removing Twists in Your String in Conjunction with Adding or Removing twists in Your Cable(s) Affect Your Bow?

The bowstring and the cables are like cousins. They are related but not exactly closely related. If you ADD 5 twists to the bowstring will the ATA shorten? YES, but not that much. If you ADD 5 twists to the cables will the ATA shorten? YES. This time the ATA will shorten enough that you can see the difference. It might be 1/16th inch or so depending on how many twists are already in the cables.

If you add 5 twists to the bowstring, will you feel the change in the draw length? Probably. Will you be able to measure the change in the bow draw length setting from adding twists to the bowstring? Yes.

If you add 5 twists to the cables, will you feel the change in draw length? Maybe. The change in draw length from adding a particular number of twists to the cables is a very fine adjustment which is harder to notice; kind of like a low volume adjustment.

The change in draw length from adding a particular number of twists to the bowstring has a more DIRECT effect on draw length which is easier to notice; kind of like a medium volume adjustment.

You can change the bow draw length setting with cable twists or with bowstring twists; it just depends on how large of a (fine) tuning adjustment you want to make.

We are talking adjusting the draw length setting by 1/16th to 1/8th inch when we make Draw Length changes with TWISTS to cables or bowstring.

If you need to make 1/2-inch draw length changes, you need to adjust the adjustable draw length module or you need to swap in a replacement draw length module or you need to replace the fixed length cam with another fixed length cam (expensive...and may need new cables and bowstring).

What Effect Does Adding Twists to Your Cables or String Have on Your Brace Height and Draw Length?

(ballison90)
I am nowhere close to having the knowledge that nuts&bolts has but I think I can answer this one.

If you add twists to a string or cable it changes the deflection of the limbs at rest ever so slightly, which will move the string closer to or further away from the riser, depending on weather you added or removed twists. To magnify this effect for clarification purposes: Think of your bow without a string on it; the limbs go straight out. Now hold a string across the cams without deflecting the limbs. Measure your brace height. When you put the string back on the bow, you compress the limbs, moving the string back from the riser. Essentially, adding or removing twists has the same effect, just on a much smaller scale. I claim to be no expert tuner and am actually pretty new to tuning. I am pretty sure I explained this effect correctly, if not, I hope someone more experienced will correct me.

(nuts&bolts)

Brace Height is used as a quick check method to figure out if the Cam Starting Rotation Position is correct.

Now, the cables and the bowstring are related like second cousins; related, but not really close relatives. If you add 5 twists to the cables ONLY (one cable for the solo cam bow...two cables for the twin cam or hybrid cam systems) you will affect the cam starting rotation position a LOT.

If you add 5 twists to the bowstring ONLY, you will affect the cam starting rotation position a LITTLE.

If brace height is what you want to get back into spec you would twist up the cables (or remove twists).

If draw length is what you want to tweak, then you would twist up the bowstring (or remove twists).

So, back to the second cousins thing...

If you ADD or REMOVE 5 TWISTS to the bowstring you affect the DL noticeably (say 1/16" adjustment) and you affect the Brace Height a teeny tiny itsy bitsy amount (maybe 1/50" or about 1/3 less).

If you ADD or REMOVE 5 TWISTS to the cables, lets say you adjust the Brace Height by 1/16", then the draw length will be adjusted by a very teeny amount.

You can also use this to your ADVANTAGE when tuning or "super-tuning" your draw length.

Use MODULES to adjust your draw length to within ½" of your PERFECT draw length (PERFECT draw length for YOU is where you get max accuracy). Now you are within ½" of your MAX POTENTIAL accuracy (groups are getting better than before and you have tried 2 or 3 different module sizes).

Now you twist or untwist the bowstring to get the DL between module sizes (you can adjust the BOW DL setting by a max of ¼" SHORTER or ¼" LONGER with twists to the bowstring).

You are shooting now shooting the BEST scores of your LIFE and you want to see if you can get a few extra points on your tournament average. ADD or REMOVE a half twist or a FULL TWIST on the cables. This will make a very FINE adjustment to your bow DL. Not measureable but it will CHANGE the FEEL of your back tension (hinge) release.

Tiny changes in the DL setting SHORTER will make a hinge release fire slightly FASTER with slightly LESS EFFORT. Tiny changes in the DL setting SHORTER will make your sight pin/circle/dot float a little TIGHTER, float a little FASTER.

So, try TWISTS in the bowstring to make small changes to the bow DL setting; all in the search for higher average scores. Then try TWISTS in the cables to make super duper fine changes to the bow DL setting; all in the search to get to that NEXT LEVEL of shooting. Maybe you will add that one LAST X-RING...maybe.

More on Draw Length

(big jerry)

From an earlier post, I read the draw length is made with the cams, or did I read wrong? If so, what about a single cam bow?

I've got an older Buckmaster with a single cam at 30". When I bought the bow the length was good but since then I've started wearing glasses and I need the length shortened because my glasses frames are right in the way. There used to be an adjustable stop on the cam but I lost it (loosened itself and fell off, I guess). It is a 70-80# draw weight. I have no problem drawing at 80#, but it seems awfully loud. If it is backed off to 70# would I lose a lot of performance?

(nuts&bolts)

Draw Length can be set with fixed length cams. Each draw length would require a different size cam. Draw Length can be set with modules on a base cam. Swap out modules and change the draw length. Each draw length requires a different module.

Draw Length can be set with an adjustable module where you move a screw into one of several holes to adjust draw length.

Draw Length can be set with a "draw stop" which means the cam has a slot and you put a pin somewhere in the slot. You can tighten down the pin at either end of the slot in the cam or pick a

position somewhere within the slot to adjust the draw length. The pin rotates with the cam and eventually stops the cam rotation early by having the pin contact the face of the bottom limb. To set the draw stop ¼" shorter, adjust the draw stop so the cam stops rotation about ¼" (perimeter-wise) shorter than full rotation.

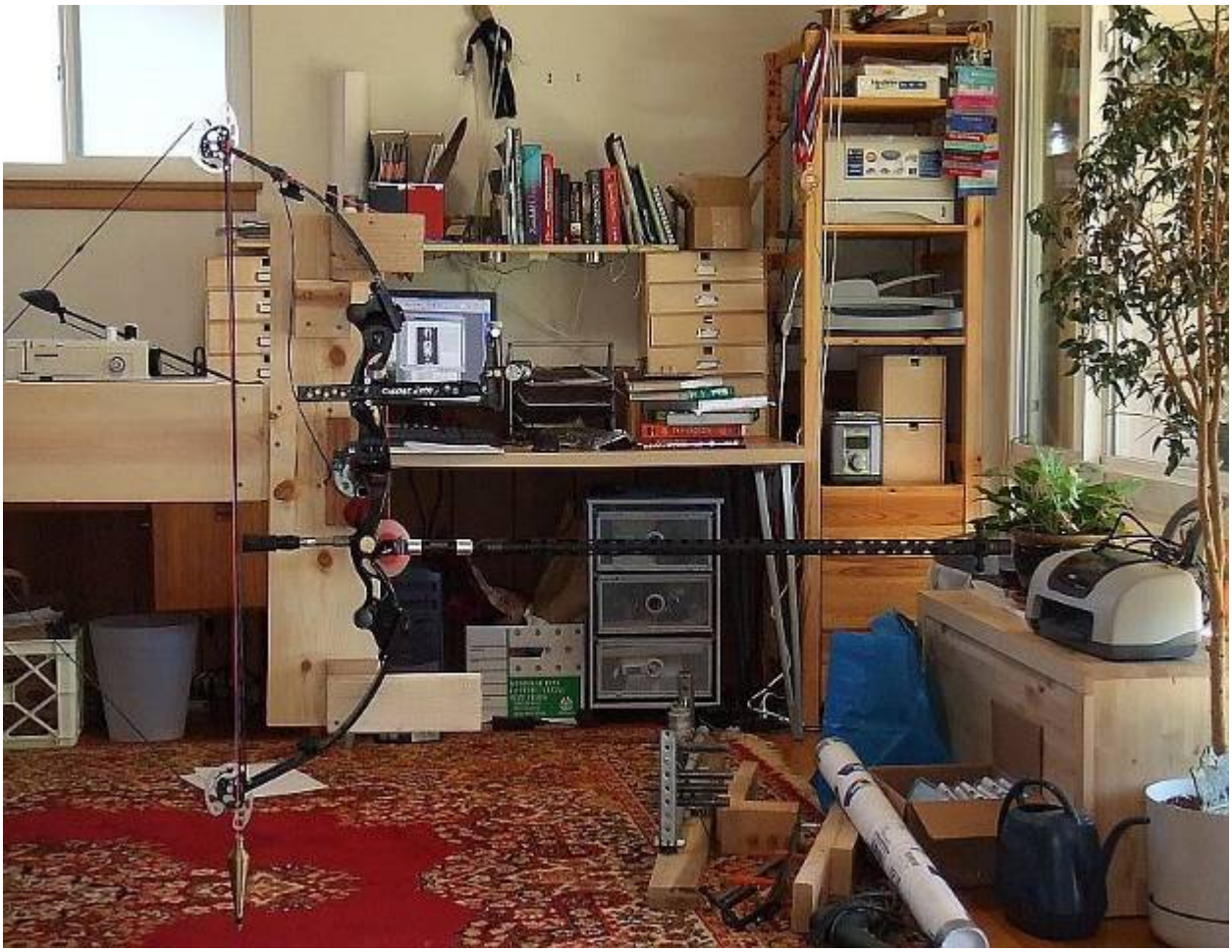
Chapter 5 Bow Tuning

On a Dual Cam Bow, How Do You Advance/Retard the Cams to Gain Proper Position and Timing?

At the basic level, the cables control the starting rotation position of the cams and the relative lengths of the cables affect the ending rotation position of the cams.

Let's start with a twin cam bow.

The top and bottom cam are mirror images of each other. A good example of this would be the Martin Archery Nitrous cam or the Martin Archery Furious cam. The top cam is identical to the bottom cam; bottom cam is just flipped upside down.



For tuning purposes, a GOOD starting point is to have the FLAT section of the modules hitting the cables at the SAME TIME. This gives you a SOLID WALL which stops the rotation of the cams and defines "FULL DRAW".

For "advanced tuning" you may want to experiment with having the cams NOT HIT THE CABLES at exactly the same moment, ON PURPOSE. More on that later.....

Notice that the physical center of the riser is about where the deepest part of the curve is located on the grip. Therefore, the arrow (which most folks have running past the two Berger holes...arrow rest mounting holes) is actually located ABOVE the physical center of the bow riser (height-wise).

Find the cable end loop that attaches to a peg (post) located on the SIDE of the top cam, along the perimeter.

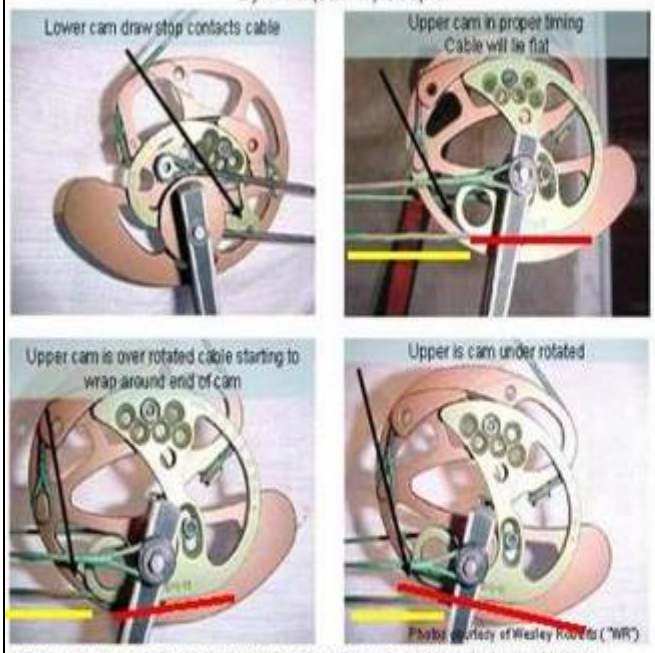
If you ADD twists to this cable end loop on the top cam then you are SHORTENING this cable and you will have the top cam hit the cable later than the bottom cam.

If you REMOVE twists to the cable end loop on the top cam then you are LENGTHENING this cable and you will have the top cam hit the cable before the bottom cam.

If you want to "advance or retard" a cam you are looking for a gap of approximately 1/16th inch between the cable and the flat section of the module.

Here is a write up by JAVI about Hoyt Draw Stop Timing:

Hoyt Cam & ½ Draw Stop Timing
By Mike (Javi...) Cooper



Adjustments are made by twisting/untwisting either the control cable or the buss cable (yoke attached). If the top cam is under rotated (lower right photo) you can either untwist the control cable or twist the buss cable. Which you choose to do is determined by the Axle to Axle measurement and the target draw weight of the bow. Make any changes in small increments (one twist at a time) a little goes a long way. Twisting the control cable will decrease draw length and bow weight, and twisting the buss cable will increase draw length and bow weight. This is only one step to properly tuning a hybrid cam equipped bow, the cams must also be in synchronization.

Yellow line angle is still horizontal in the picture.
Red line angle is slightly uphill in the picture. **Not good.**

The cable is not bent, because the string angle matches the angle of the flat part of the metal module.

The yellow line angle is parallel to the red line angle = straight line.

Yellow line is angle of the string.
Red line is the angle of the flat part of the metal module.
You want the string angle = angle of the flat metal part.

Lower right corner picture.

Yellow line angle is still horizontal in the lower right corner picture.
Red line angle is now slightly downhill in the picture. **Not good.**
Red line is angle of the flat part of the metal module.

On a Single Cam Bow, How Do You Advance/Retard the Cam to Gain Proper Position and Timing?

For a single cam bow, you have a very long bowstring and you have a cable. The metal thingy on the bottom is the cam. The metal thingy on the top is an idler wheel.

Some folks say a single cam has "no timing" because there is only ONE CAM. Ok.

Let's talk about the starting rotation position for the metal thingy on the bottom. It is the same procedure.

Find the cable end loop that attaches to a peg (or post) on the side/perimeter of the cam (metal thingy on the bottom) and ADD twists to this cable end loop or REMOVE twists to this cable end loop and you will adjust the starting rotation position for the metal thingy on the bottom of a solo cam bow.

To achieve the level nock travel that the bow designer intended there is definitely a range of "correct" starting positions for the cam.

The Difference Between Synchronizing and Timing a Cam

The terminology can be very confusing.

When folks get picky about "synchronizing" and "timing", they are especially talking about the Hoyt Cam.5 system and actually are talking about hybrid cam systems in general, and, really all cam systems very loosely.

We want the FLAT section of the modules to hit the cables at the same time. Top and bottom metal thingies in mirror image to each other.

Let's say we twist up the cables 10-inches shorter than factory spec and we get the flat section of the modules (top and bottom) to both contact the cables at the same time. This is good and this is bad.

The good part is we have a super solid wall when at full draw.

The bad part is the cables are nowhere near the correct length. The cams final rotation position is nowhere near where the cam designer intended. This is an EXTREME example but you get the idea.

We want the cable lengths near the "perfect" length so that we get the final cam rotation position correct. We want the flat section of the modules to contact the cables at the same time.

One condition is called "synchronization" and the other condition is called "timing".

To synchronize means to move together exactly; synchronized swimming, for example.

To synchronize two cams means to adjust the cables so that the two cams' or the top metal thingy and the bottom metal thingy, are moving together in unison and as exact mirror images of each other. If we tweak the cables so that the top and bottom metal thingies have the flat section of the cam/module BOTH hit the cables at exactly the same instant we have synchronization and we have a very SOLID feeling wall.

BUT, if we did this and we have the cables, say, 10-INCHES too short, the cams are moving together in EXACT mirror images of each other (NOTE: this is an EXTREME example, to just make the concepts easy to understand); we have EXACT mirror images (synchronization), BUT, the final rotation position is nowhere near what the cam designer had in mind.

When we have too little available cable length we also have TOO LITTLE rotation available. This means when the cable lengths are WAY WAY TOO SHORT, the cams will rotate but not nearly enough. The FINAL ROTATION position will be way out of whack.

With cables, say, 10-INCHES too short, if the cams are starting their rotation at 12-o'clock and the cables are WAY too short, maybe the cams rotate up to 1-o'clock when the cams need to start rotation at 12-o'clock and need to finish rotation, say, at 10-o'clock.

Starting rotation position and final rotation position is "TIMING". To get to the final rotation position PROPERLY, we need the correct cable lengths.

How a String Should Come Off a Cam at Rest

How a string should come off a cam "at rest" differs depending on the cam.

"Under-Rotated"

Let's say we are talking about the top cam.

You are using a draw board and you are slowly approaching full draw. Bottom cam hits "full draw" first. There usually is a flat section on the module where this FLAT section contacts the cable.
Since the FLAT section of the module has fully contacted the cable on the bottom cam, we may have a condition where the TOP CAM flat section of the module has NOT YET contacted the cable. We have a gap up on the top cam.

I get my forwards/backwards and up/down confused.

Let's just call this the "...we have a gap on the top cam..." at full draw condition.

The OTHER CONDITION is going to be the "...we have a gap on the bottom cam..." at full draw condition.

If the FLAT section of the module on the TOP CAM contacts the cable first, that also means we have a gap on the FLAT section of the module, on the BOTTOM CAM. The wall will feel kind of mushy.

If you continue pulling into the wall so that BOTH FLAT sections of the modules (top and bottom) are fully in contact with the cables, you could say the TOP CAM has to rotate MORE than "normal" in order to close the gap on the bottom cam where the FLAT section of the module and the cable want to meet.

What is Yoke Tuning? How is it Accomplished? Why is it Needed?

If your bow uses a yoke cable where the yoke legs attach to the ends of the axle you want to pay particular attention to the lean angles for the top metal thingy (idler in this example).

The top metal thingy might be a cam or an idler wheel, either way we want the top cam, or idler, to be dead vertical when the bow is at full draw.

To test this you will need a draw board to hold your bow safely at full draw while you hold a carbon arrow TIGHT against the side of the top cam/idler and rotate the arrow down next to the bowstring.

With the bow at full draw, look at the edge of the arrow and look at the edge of the bowstring. Is the gap parallel? If so, the top cam or idler wheel lean angle is PERFECT.

If the gap between the arrow and the bowstring gets more and more narrow, you need to put the bow into a (portable) bow press and add twists to the yoke cable leg that is too long.

If the gap gets wider and wider between the arrow and the bowstring, you need to put the bow into a (portable) bow press and add twists to the yoke cable leg that is too long.

Keep adjusting the yoke cable leg length until you have the bow at full draw in a draw board and the gap between the edge of the arrow and the edge of the bowstring is perfectly parallel.

Why is this adjustment important? It is important because when you have a top cam or an idler wheel lean, you will drive yourself CRAZY trying to get field points and broad heads to group together.

If you only shoot target arrows your groups will not reach their MAX potential accuracy if this adjustment is not dead on.

Correcting Cam Lean on a Single Cam Bow

On the single cam bow the idler wheel is on top and the legs of the yoke cable are on either side of the top axle.

If the IDLER WHEEL is leaning, adjust the legs of the yoke cable until the IDLER WHEEL has zero lean while the bow is being checked while at FULL DRAW on a draw board.

All idler wheels **will have some lean while the bow is at rest** because the cable guard pulls the cables out of the way causing the top axle/idler to dip down, or lean, to one side.

To check for idler lean, put the bow on a draw board and get the bow safely to full draw. Once at full draw, use the carbon arrow ruler trick (hold the arrow TIGHT against the side of the idler wheel, and look at the gap between the edge of the arrow and the edge of the bowstring). You want a parallel gap between the arrow and the bowstring.

If you have a short ATA (axle to axle) bow, you may notice that the cam on the bottom is leaning sideways and you may also notice that you do NOT have a yoke cable on the bottom axle.

The cable terminates in an end loop which attaches to a peg (or post) on the side of the cam on the bottom of the bow.

The cam lean angle on a single cam bow is not adjustable; at least not easily adjustable. One way to remedy cam lean on a single cam bow is to swap the order of the precision shims between the bearings on the cam and the edges of the limb fork, but this is not recommended.

Correcting Cam Lean on a Dual Cam Bow

A twin cam bow with two cables will have two split-yoke cables (for this example); two yoke cable legs attached to the top axle and two yoke cable legs attached to the bottom axle.

If the cam lean angle is not correct (you checked at full draw, while the bow was on a draw board, you used the carbon arrow ruler trick, with the carbon arrow held TIGHT against the side of the cam, and, you confirmed that the gap between the edge of the arrow and the edge of the bowstring is DEAD PARALLEL) then put the bow into your (portable) bow press and adjust the length of the yoke cable leg that is TOO LONG.

Binary Cam Tuning Simplified (by Dave Nowlin)

Syncing cams, setting draw length, setting let off, and determining exact point of rollover to deliver most mechanical advantage (reflected as speed).

There's way more to this than you realize. As you add twists to a cable you add more degrees of rotation, thus more draw length. This has to be corrected with the string and the limb pre-load (A to A) can't change as that would increase or decrease draw weight. Of course, if you increase draw weight or poundage you will gain speed. We're looking for the perfect sweet spot in the cam.

I talked with Michael last night and he spent 8 1/2 hours doing this to his personal bow. With the right tools this time can be greatly decreased. This is why I personally recommend the E.L.P. press designed by Larry Asford who is a PSE Pro Staffer. It has a built in timing machine (vertical draw board). This is a tremendous help, to be able to use the same machine to press my bow and adjust strings and cables and checking draw length and synching cams and setting the draw stop.

I don't pay any attention to the numbers on the scale on the adjustable draw stop as once the cams are properly synched and the bow is timed for optimum rollover then I simply use a digital scale. To determine draw stop setting if I'm looking for less than 80% let off, or a direct measurement if I'm looking for maximum let off, which may not always be exactly 80%, (it may be 77% or 78% or whatever) it is the setting which yields the highest let off and longest valley.

Now that I've said all that, do you know how or more importantly do you have the tools. You'll need a press, draw board of some sort, chrono & digital scale as a minimum to do this right.

I'm more than a little amused that BowTech says you can set up one of these bows by simply showing a certain number of dots outside the limb face. Let me endeavor to explain a few things.

First, the cams on these bows are indeed mirror images of one another but you don't draw from the true center of the string. That alone will negate the idea of tuning perfectly by utilizing the dots. The problem doesn't stop here, however, as the limbs are graded by deflection numbers; in simple terms their strength or resistance to bending. There are plus or minus specs as regarding these limbs, just as there are for A to A and brace height.

Now this is getting more complicated.

What do you think the chances are of you getting two perfectly matched limbs on your bow? Do you have any idea what the quality control costs would be in perfectly matching limbs? You wouldn't pay it.

Now let's look at the bow. One of several things is true. The upper limb is on the plus side of the spec and the lower is on the minus or possibly the reverse of this scenario. Then again maybe both limbs are on the positive side but not perfectly matched or maybe they're both on the negative side and not matched. All of these are possibilities.

Have you wondered why in looking at the birth certificate of a 70# bow some may be right at 70# and some as high as 71.5#? Think about this. If you insist on setting each of these bows up at the

same A to A the differences in strengths of the limbs causes these differences in peak draw weight. How many of you have really thought about that before?

Now to synching the cams.

The cams are in sync when the draw stops on the modules of each cam contact the cables at the same time at full draw. If one draw stop makes contact before the other it begins to bend that cable back toward you until the other finally hits the cable. This, in effect, shortens the cable which had first contact. This will shorten your valley when the bow is at maximum let off and reduce the maximum let off which can be achieved.

You're not through yet.

To achieve maximum let off you must set the adjustable draw stop so that it hits the limb face with about a 1/16" gap between the draw stops on the modules and the cables. Why? It's simple.

Observe the adjustable draw stop. You will see that it is covered by a piece of heat shrink tubing with a bulge in the middle. This bulge is caused by an O ring. When you draw hard into the wall this O ring is compressed. If you set the adjustable draw stop up in a way that allows the draw stops on the modules to make contact when the adjustable draw stop first touches the limb, you will distort the cables back toward you as the cam rolls over further and you compress the O-ring. When you do this you shorten your valley and reduce your let off.

Now, finding the perfect point of rollover on your cam involves making adjustments in the exact point of rollover to get the greatest speed without changing draw weight or draw length. This is done with the help of a chrono which is the sole judge of your results. When you find this perfect point of rollover, I like to scribe my cams on each side of the limb with a machinists scribe for future reference.

Now for the fun part: Your reference point here is the limb face. Should you somehow have a limb failure and replace one or both limbs with limbs which aren't absolutely identical to the ones removed, your reference points are no longer valid and you will have to rediscover the perfect point of rollover. Take heart in the fact that it won't be too far away from the original marks you made; it just won't be in the same place.

Level Nock Travel

The nock point locates your nock on the center serving which means you have locked in the amount of bowstring ABOVE the arrow nock and you have locked in the amount of bowstring BELOW the arrow nock.

Unfortunately, there are several other things that must be set to get level nock travel.

Q: What is level nock travel?

A: If you are at full draw and the arrow is DEAD LEVEL, upon release, the arrow is pushed forward by the bow in a DEAD LEVEL flight path.

For DEAD LEVEL nock travel and arrow flight path to occur, the top cam and the bottom cam (twin cams/binary systems/hybrid systems), or, the idler wheel on top and the cam on the bottom MUST work together in unison.

This means the top cam starting (rotation) position must be correct and the bottom cam starting (rotation) position must be correct on a twin/binary cam bow, the cable length must be correct on a single cam bow, and the control/buss cable's lengths must be correct on hybrid cam bows.

Think of the top cam as a fishing reel and the fishing reel has to "reel in" the bowstring (upper portion) back to the starting length (at rest position).

Think of the bottom cam as a fishing reel and the fishing reel has to "reel in" the bowstring (lower portion) back to the starting length (at rest position).

Without a high speed video camera we rely on several methods to figure out YES OR NO whether a) the arrows are flying DEAD LEVEL b) the arrows are flying TAIL HIGH c) the arrows are flying TAIL LOW.

Bare shaft tuning is one way to ascertain this information, paper tuning is another. Both methods of tuning, bare shaft tuning and paper tuning require very consistent shooting form.

If you cannot group bare shafts then do not try bare shaft tuning because the poor end result will be due to form errors.

Same goes for paper tuning. If you cannot group arrows at 20 yards then the weird paper tears COULD be form errors and COULD be bow tuning problems.

On to field testing…

Shoot some arrows for grouping and see if you are happy with the arrow group size. Then experiment with the cable lengths (add or remove a twist) and see if the size of your arrow groups improve or not.

Be sure to pick a comfortable distance and only judge the "good arrows". Pull the "bad arrows"; the ones on which you know your shot execution was not your best and then evaluate the group size/shape.

Adding a single half twist or maybe a full twist to a cable goes a long way for tuning the accuracy of your arrow groups when your shooting technique gets advanced enough.

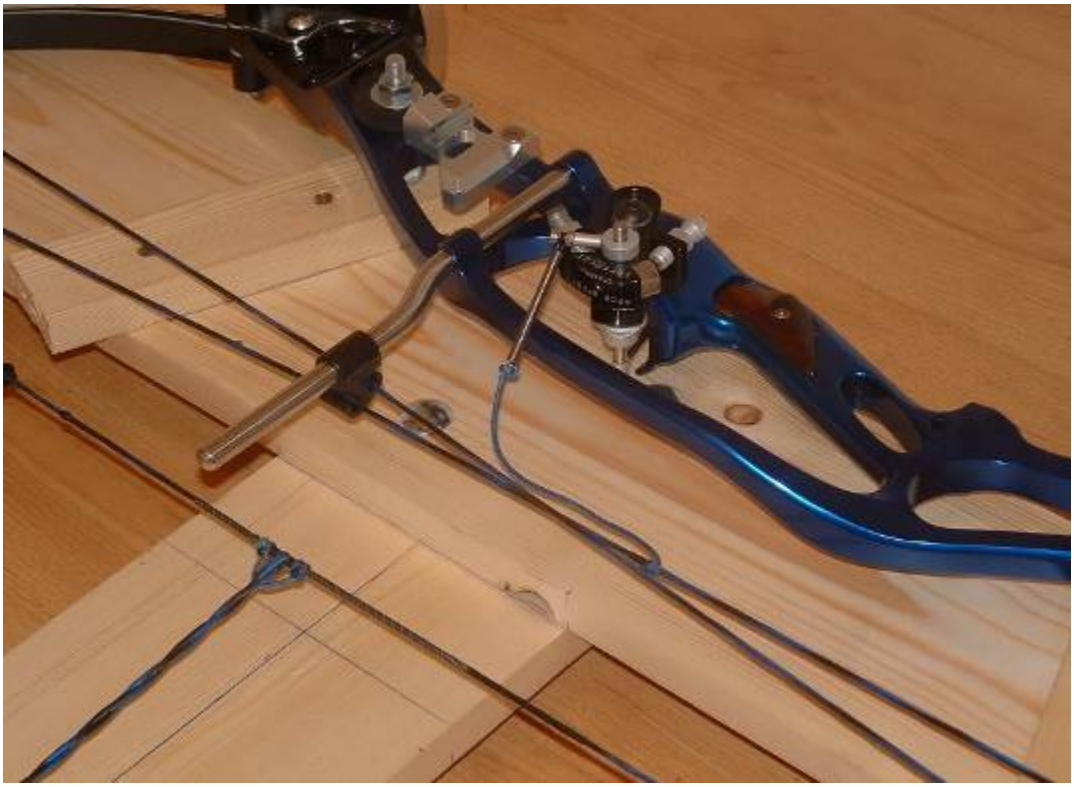
Let's say we are working on the cable end loop that attaches to the peg (post) on the perimeter of the top cam. Adding a twist obviously shortens the cable going to the top cam and this will slow down the top cam, or, realistically, leaves a gap between the flat section of the top cam (part that contacts the cable) when the bottom cam is in full contact with the cable.

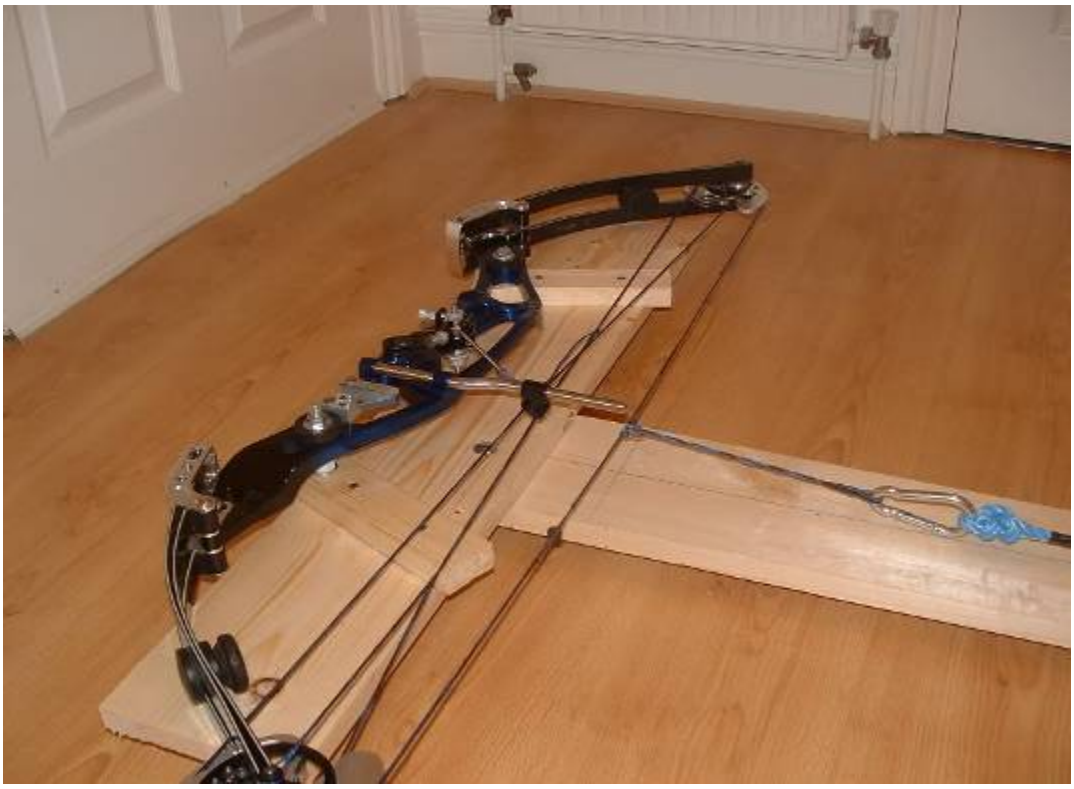
Removing a twist obviously lengthens the cable going to the top cam and this will "speed up the top cam", or, realistically, allows the top cam to contact the cable first which means that when the top cam is in contact with the cable the bottom cam will have a slight gap.

So, why wouldn't we want BOTH cams to contact the cables at precisely the same time? On some bows, it improves your group size/accuracy. What works for you works for you.

Experiment and see.

Here are two examples of Vertical Nock Travel Recording Devices:





The first example was constructed by Old Buck. The second example was built by a fellow down under, in Australia.

If you would like your own, build a long, long wooden cross or Capital Letter “T”.

Add shims and 1x4 pieces of wood to keep the bow limbs perpendicular to your work table.

Solidly Bolt down the riser above the grip and below the grip because you want absolutely ZERO movement on the riser.

A nock travel device is REALLY measuring the rate of upper and lower limb bending per inch of d-loop movement and how the top cam or idler wheel is allowing bowstring to “unreel” (remember the fishing reel example?) inches of bowstring payout for every inch of d-loop movement and how the bottom cam is allowing bowstring to “unreel” inches of bowstring payout for every inch of d-loop movement.

What if the upper limb is bending faster? What if the lower limb is bending faster?

If we ASSUME that the top cam and the bottom cam both go through 1.8 complete revolutions to get to full draw and since the d-loop is NOT in the physical center of the bowstring (most of the time, the d-loop is physically CLOSER to the top cam) and the bottom cam must payout more bowstring to get level nock travel and the top cam must payout less bowstring to get level nock travel...

Whew...so much work. So much math for the bow designer to figure out how to get the upper limb bending rate / upper cam bowstring payout to work with the lower limb bending rate / lower cam bowstring payout.

Tiller Tuning

Tiller tuning is another method to try to get to "level nock travel".

Tiller is the measure of "bending" of the limb while the bow is at rest.

When we get our bows, we ASSUME that IF we max out the limb bolts the top limb and the bottom limb are a PERFECT MATCH for stiffness.

We talk about arrow spine (arrow stiffness rating) and we talk about arrow spine consistency (we ASSUME that all of our arrows are exactly the same stiffness).

We also ASSUME that the top limb and the bottom limb are EXACTLY the same stiffness. Well, the proof is in the pudding.

Just because we max out BOTH limb bolts does NOT necessarily mean that both limbs will provide EXACTLY the same amount of return energy when we fire the arrow.

If the top limb is pulling HARDER, even by a little bit, and if the bottom limb is pulled LESS HARD, even by a little bit, the TOP limb is working harder. This means that the arrow nock will start to CLIMB immediately after the release fires.

So, the arrow is moving forward AND the arrow is travelling horizontally (assuming the arrow started dead horizontal at full draw), mostly.

BUT, the arrow nock (back end) is also slowly climbing because the TOP LIMB TIP is moving up and forward FASTER than the BOTTOM LIMB TIP is moving down and forward.

(NOTE: this is an example that does not take into account string payout and takeup rates, based on cam rotation starting positions, etc...a very simple example only, but you folks get the idea about tiller tuning)

So, the bowstring is moving the arrow nock FORWARD, but, the arrow nock is CLIMBING slightly. This makes MORE WORK for the vanes to try and correct the steering.

The end result? We get a tall arrow group; some arrows hit higher, some arrows hit lower.

If you look at the end of a long front stabilizer, look for the reaction of the tip of the long front stabilizer. Look for the follow through immediately before and after the shot.

When the shooter just pulls into full draw, you will see the stabilizer tip bob DOWN and the shooter will struggle to settle down the end of the stabilizer (TOP LIMB is heavier; too heavy, so the shooter is struggling to hold steady in the vertical direction).

(HINT: You can also diagnose a HEAVY [too heavy] TOP LIMB by analyzing the shape of the d-loop. If you see that the POINT of the d-loop is angled UPWARDS....then, the TOP limb is acting too heavy.)

So, the fix is to take say 1/4 turn OFF the TOP LIMB BOLT and, at the same time, ADD 1/4 turn to the BOTTOM LIMB BOLT. Eventually, the end of your front stabilizer no longer FIGHTS with you and you draw smoothly back to full draw and the dot/pin/circle on your sight just stays on target.

Tiller Tuning, the Nitty Gritty Details.

So, you are now experimenting with turning your LIMB BOLTs in opposite directions. A little goes a long way. Start with 1/4-turn adjustments. If you take off 1/4-turn on the TOP limb bolt, then, at the same time, you ADD 1/4-turn to the BOTTOM limb bolt.

One more thing. To be TRUE tiller tuning, you have to make sure that your peep sight height is still the same.

So, back to the draw board. Use the draw board to hold the bow at full draw (AFTER you make the limb bolt adjustments) and measure the vertical gap between peep sight centerline and arrow shaft centerline.

You have to MOVE the peep sight up or down the bowstring to get back to the original peep sight height above the arrow shaft. You need to do this to make sure your anchor is exactly the same as before.

So, Why Level Nock Travel? Why Tiller Tune? Why Advance/Retard a Cam on Purpose?

Excellent questions.

When you tiller tune, you will have your bow holding much more steady in the vertical direction; the end of your front stabilizer will no longer fight you.

When you find the tiller that works best for you, the correct TOP LIMB BOLT position and the correct BOTTOM LIMB BOLT position (remember, to adjust in opposition directions by 1/4 turn, and then by 1/8th turn), ultimately, you get better groups.

When you do find a TOP and BOTTOM limb bolt combo that works best for YOU, check your cam timing because you will probably need tiny adjustments.

I would only tiller tune AFTER running experiments with draw length and fine tuning of the draw length.

If you can shoot lights out at 80 yards (max distance for NFAA field archery) and you can shoot lights out at 90 meters (about 100 yards max distance for men's FITA tournaments) and you want to go to Vegas and scare a few of the men's pro shooters....then...a) you have a goal b) you spent hundreds of hours "blindly" trying this tuning method and that tuning method to figure out the premium bow settings, and bouncing back and forth between whether the bow is tuned to the MAX or whether your shooting execution is tuned to the MAX or your arrow specs are tuned to the MAX.

Software programs are available to help you tune your arrow specs to the MAX. Before the archery software for arrows I would spend way too much time experimenting with different arrow setups for myself and for my students. Now, with OnTarget2 and other software programs, figuring out the perfect arrow specs takes minutes.

Getting your shot execution near perfect, however, means you have access to pro level coaching and you have access to lots of advice here on AT and you have access to a growing wealth of books and DVDs from famous authors/coaches.

This only leaves figuring out if your bow is adjusted to the maximum level of "forgiveness" so you have an edge.

There are lots of tuning methods: paper tuning, walk back tuning, French Tuning (as described by John Dudley), Modified French Tuning (my version, which only fixes horizontal misses), group tuning, tiller tuning...

All these methods can be used to tune your bow so you can reach your MAX potential for accuracy and group size.

Just like a draw board gives you an edge to get you close to the correct cam starting rotation position and gives you an edge to get super accurate measurements for draw length, peep radius, peep height, a nock travel device lets you see and record how close you are to perfectly level nock travel.

The theory is that when you find the correct combination of bow settings (tiller and cam starting rotation position and cable lengths) then, when the riser is dead vertical, then, the arrow nock will travel in a perfectly level horizontal line.

All tuning techniques are TOOLS. If you prefer paper tuning, go out to the practice range and shoot 10 yards and shoot 40 yards and shoot 60 yards.

If your arrow rest center shot is perfect and if your sight pins windage is perfect, your 10 yard groups will be centered on the bull's-eye and your 40 yard groups will be centered on the bull's-eye and your 60 yard groups will be centered on the bull's-eye.

You are now finished fixing the arrow rest center shot and you are finished fixing the sight pins windage.

If your 10 yard groups are centered perfectly, but, you notice that your 50 yard and 60 yard groups are NOT centered perfectly, you still have some more adjusting to do.

You can double check the paper tuning results, you can try modified French tuning, you can try bare shaft tuning, and you can try group tuning. You can try whatever method of tuning you like.

The goal here is to use whatever tuning method you favor most that will help you get your arrow groups CENTERED on the bull's-eye at short range distances, at medium range distances, and especially at long range distances.

Try multiple methods of tuning and find the method that works for you; the one that gets YOU real world results.

Don't worry about messing up that perfect bullet hole.

Keep tweaking your form and keep tweaking your bow setup until you get arrow grouping results you are completely satisfied with.

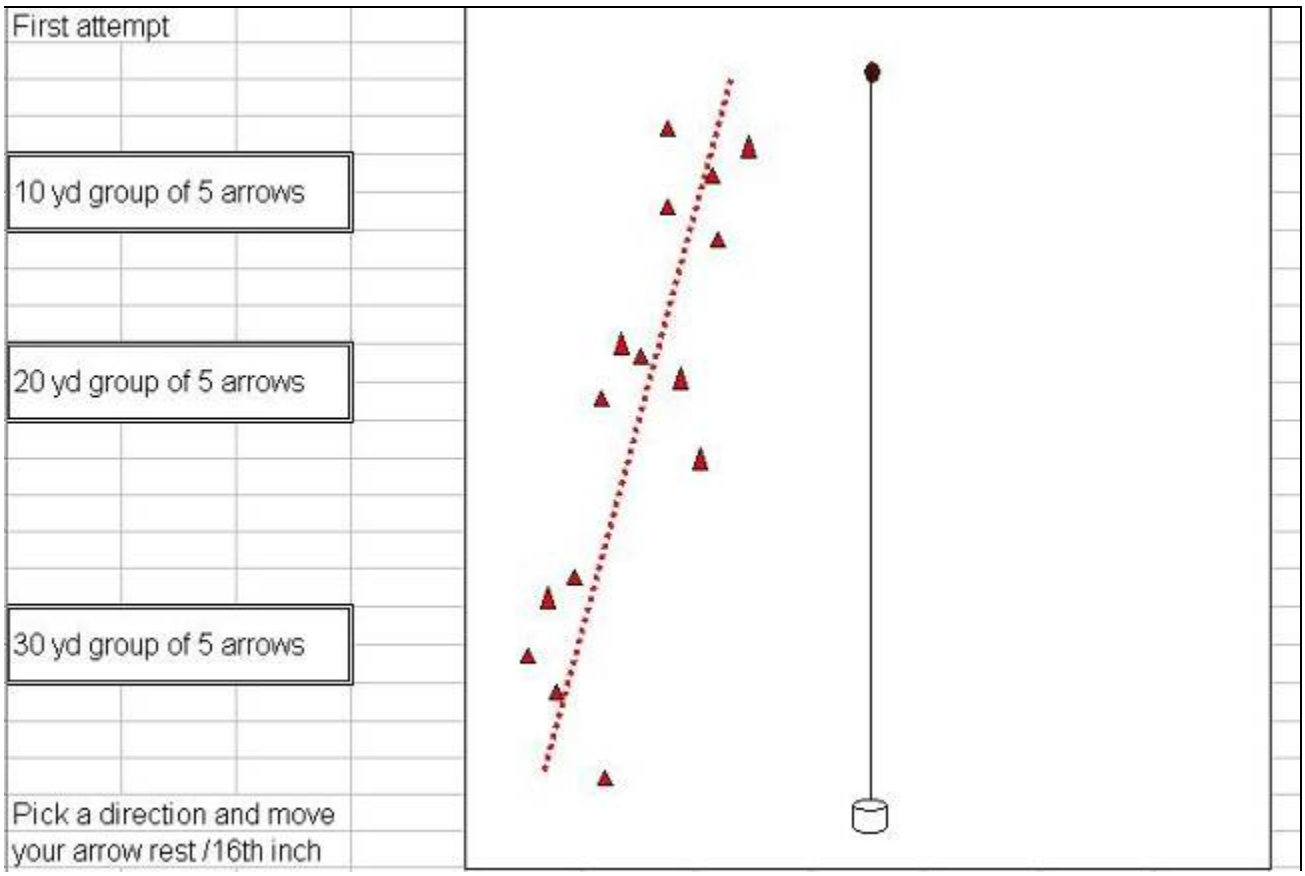
Chapter 6 Shot Tuning

Walk Back Tuning.

Hang a weighted string from a nail on a target. Place a round sticker on the target face so that the string splits the sticker. Use your existing 20-yd pin, step back 20-yards from the target and fire one arrow at the sticker. Don't worry about where the arrow hits.

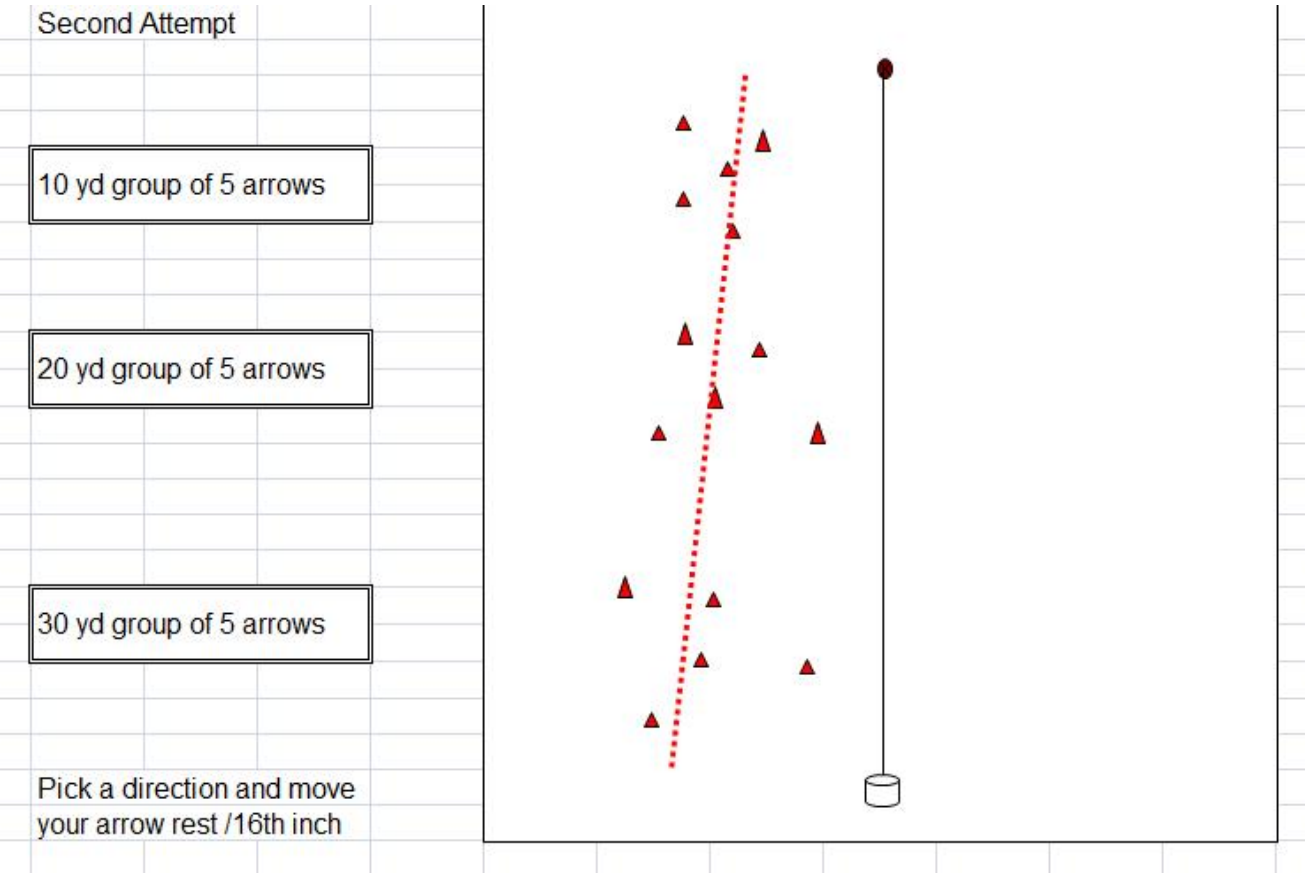
Walk straight back to 30 yds, and using the same 20-yd pin setting, fire one arrow at the sticker. Repeat at 35yds and 40 yds, using the 20-yd pin and firing one arrow at the sticker.

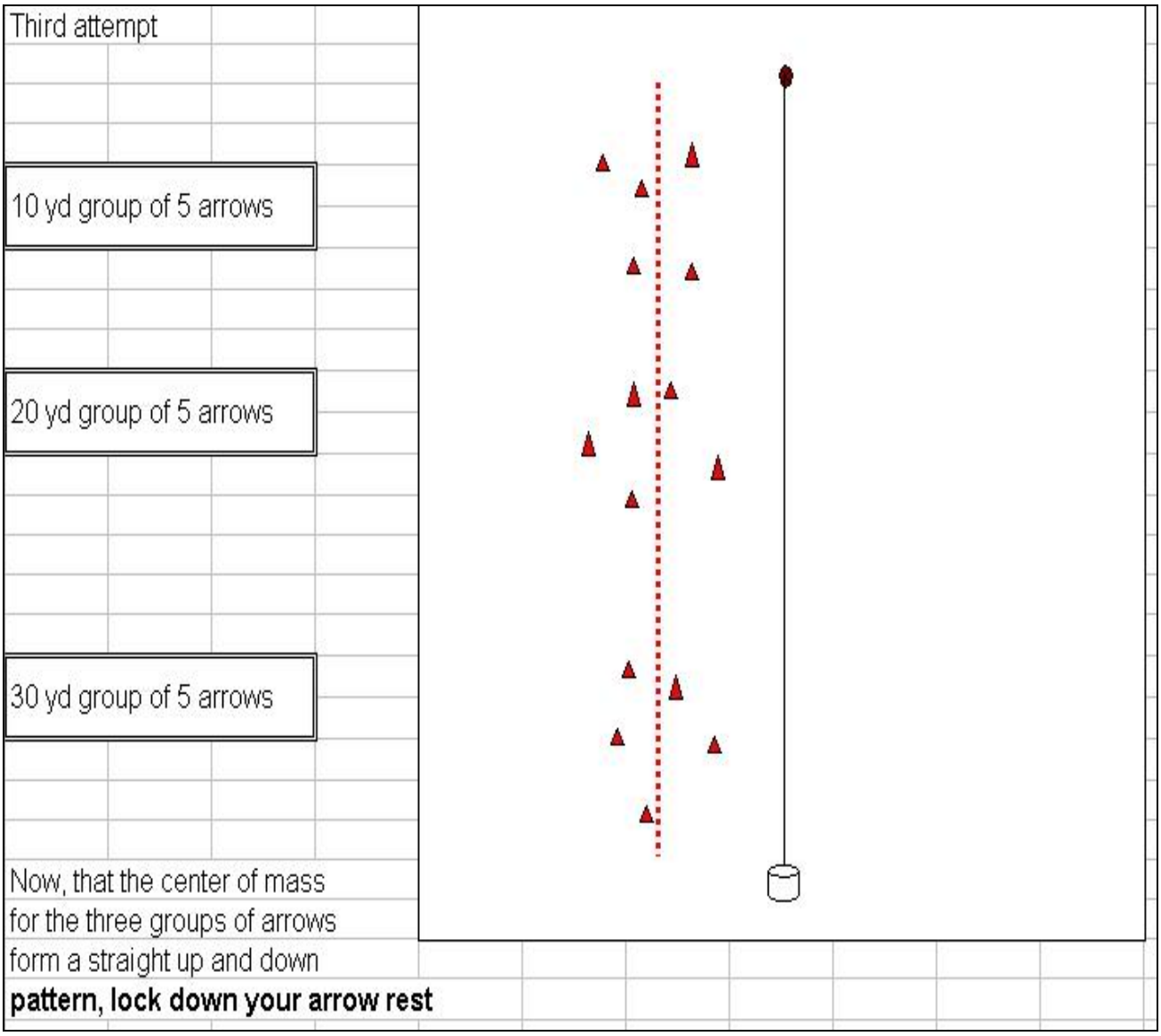
If your arrows look like this pattern " / " or "\",
then pick a direction and move your arrow rest 1/16th inch.



If the pattern gets straighter (more vertical), then that is great. Keep adjusting in that direction.

If the pattern gets more crooked, adjust your rest in the other direction. Keep firing arrows and adjusting the arrow rest position until you get a vertical pattern of arrows.





Eventually, your arrows will hit in the target is a straight up and down line like this " | ". When this happens, LOCK down the arrow rest setting. Your center shot is perfect.

The vertical pattern of arrows may be on one side of the string. Let's say the arrows are hitting 6-inches to the left of the weighted string. Pick a direction to adjust your sight ring windage. Adjust the sight ring windage 1/16th of an inch ad repeat the test. Typically, you will adjust your sight windage left if your arrows are impacting left. Remember, when setting your sight, you follow the arrow. If you are shooting high and left, move your sight pins up and to the left; CHASE THE ARROW.

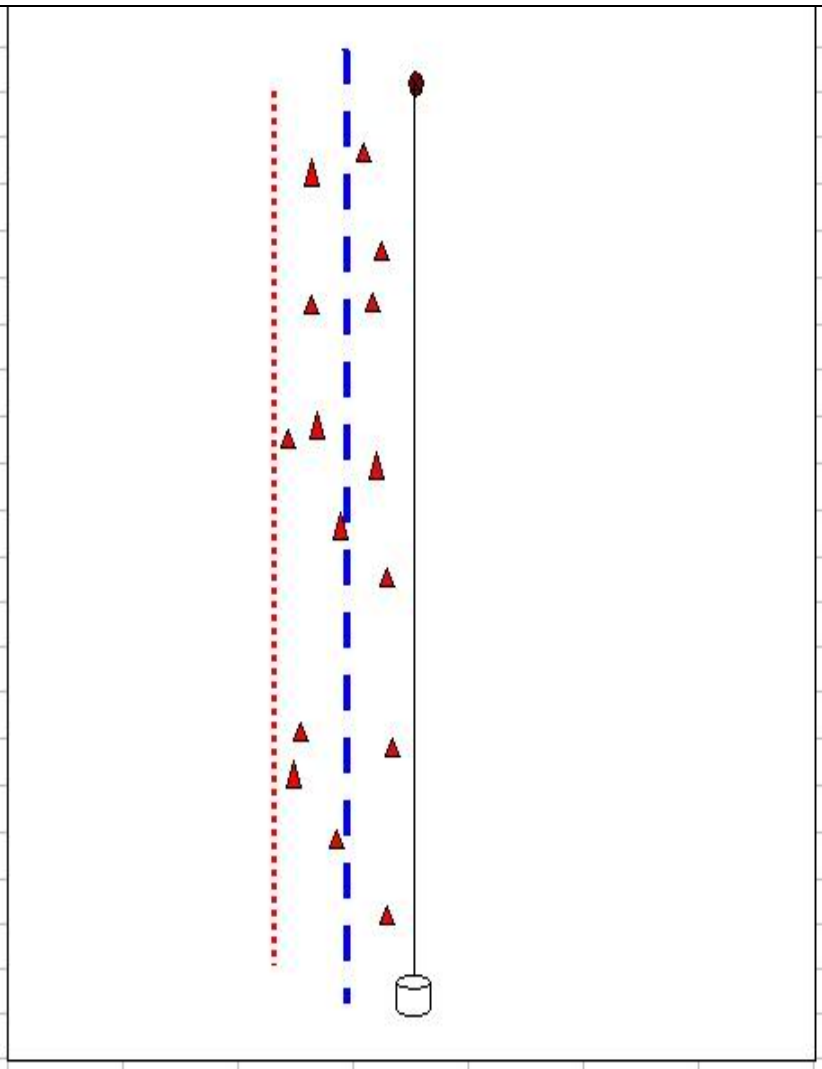
Fire arrows at least 3 distances and see if the vertical pattern of arrows gets closer to the string like in the picture below.

Fourth step:
adjust windage for sight ring
move sight ring 1/16th inch

10 yd group of 5 arrows

20 yd group of 5 arrows

30 yd group of 5 arrows

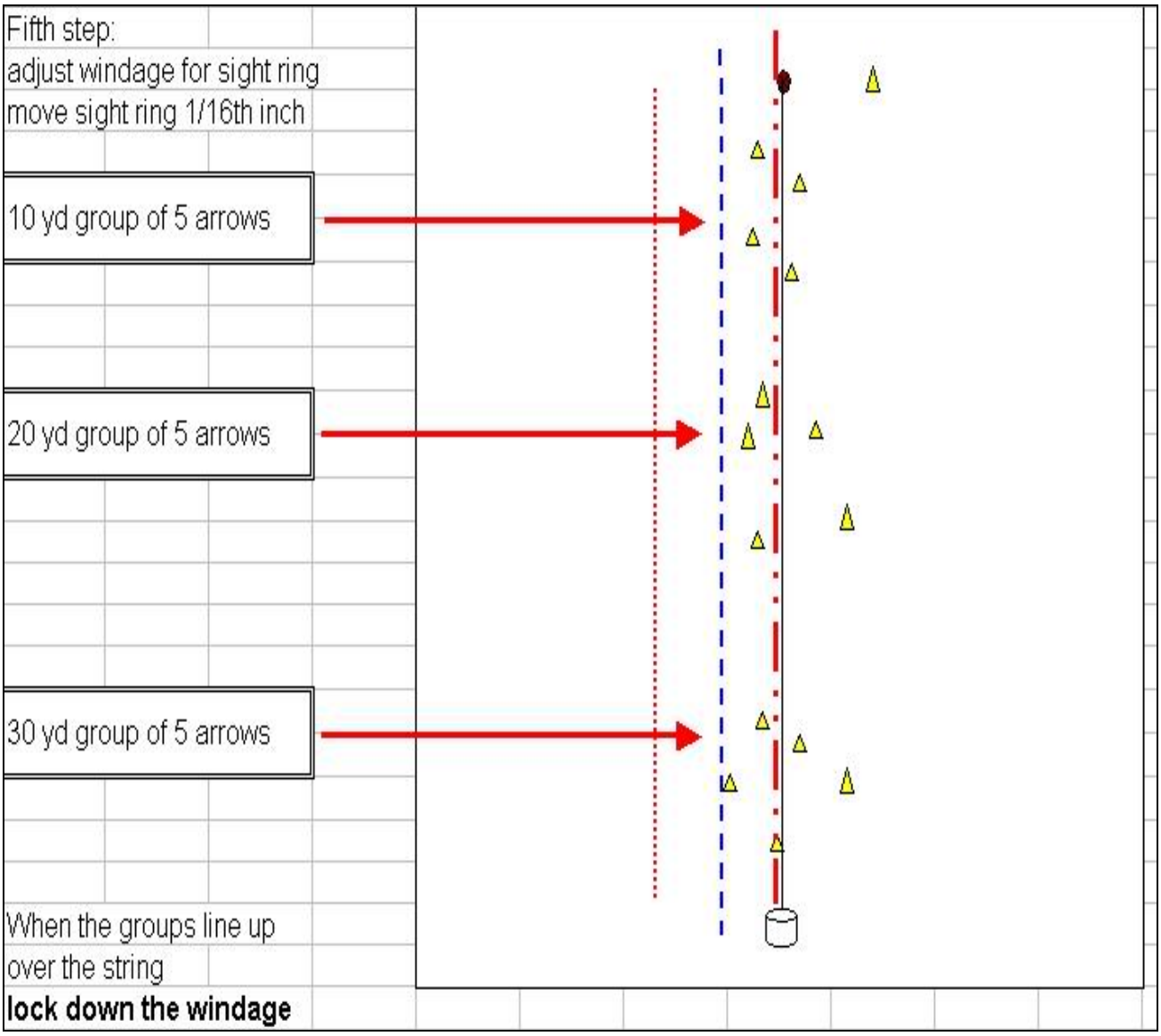


Pick a direction, any direction.
Adjust sight ring 1/16th inch
if that direction works, great.
if not, go the other way.

If the vertical pattern of arrows is getting closer to the string, keep adjusting windage in the same direction until your arrows are impacting ON the string.

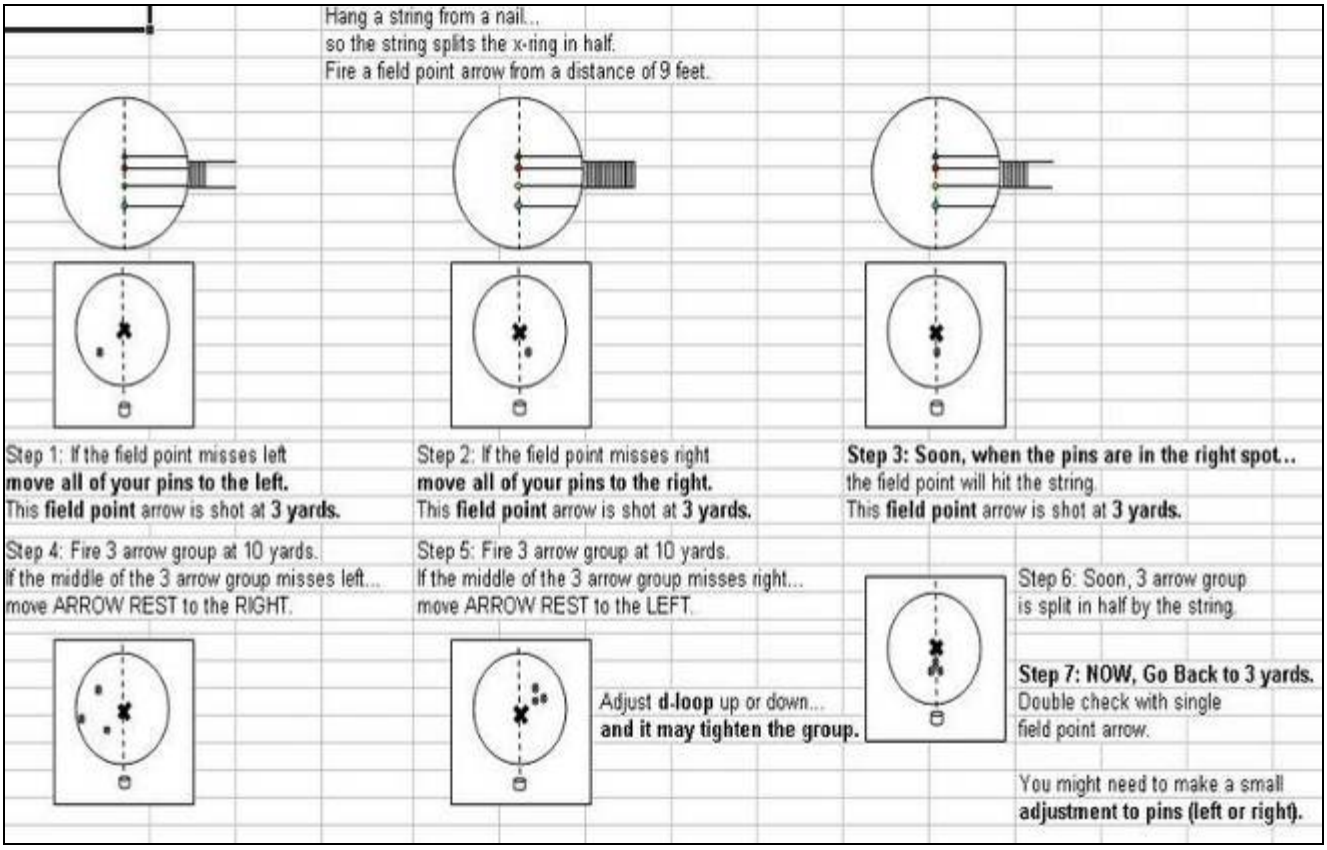
If the vertical pattern of arrows is getting farther away, adjust windage in the opposite direction. Again, the objective is that your arrows impact ON the string.

Eventually, you ***will*** have a vertical pattern of arrows right on top of the string. It will just take time and patience.



Lock down the windage and lock down the arrow rest. Windage and center shot are now perfect.

Modified French Tuning



There is a little known secret called MODIFIED FRENCH TUNING (illustrated above) which does what walk back tuning does, but it is much MUCH easier to do.

The purpose is to get your arrow rest and sight pins (scope pin/scope dot/scope circle, etc) horizontal position perfect.

Hang a target face so the bull's-eye is at your shoulder height. Put a nail at the top and hang a weighted string so the string splits the bull's-eye in half.

Starting at 9 feet, yes, just 9 feet, fire a field point arrow at the string splitting the bull's-eye. If the field point arrow misses the string to the left, make a left windage gang adjustment (move all the pins to the left; adjust the entire sight housing left).

If the field point arrow misses to the string to the right, make a right windage gang adjustment (move all the pins to the right; adjust the entire sight housing right).

The goal is to nail the string perfectly. You want your field point arrow to be exactly below the center of the bull's-eye.

Now go back to 10 yards (or any LONGER distance) and fire a 3 arrow group and find the center of the arrow group. If the center of the arrow group is to the left of the string, move the arrow rest to the right (1/16" at a time). If the center of the arrow group is to the right of the string, move the

arrow rest to the left (1/16" at a time). The goal here is to have the hanging string split your arrow group in half.

Now go back to 9 feet and fire a field point arrow. If the field point arrow does not exactly nail the hanging string, adjust all of your pins to the left or right until the arrow is dead center under the exact center of the bull's-eye.

Now go back to 10 yards (or any LONGER distance) and adjust the arrow rest in tiny amounts until the hanging string splits your 3 arrow group in half.

When you are done you can fire a field point arrow from 9 feet and it will be exactly underneath the center of the bull's-eye. Your 3 arrow group from 10 yards will also be split in half by the hanging string.

Now, your center shot (arrow rest) and your windage (pins) will be perfect.

Q: During 'Modified French Tuning', are you using your 20 yard pin for all shots?

A: Any pin will do.

The intent of Modified French Tuning is only intended to adjust for left to right misses.

When shooting at 6 feet or any close range distance use any pin and shoot at a string with a weight on the end or simply fold a piece of paper in half so you get a vertical edge. Fire at the vertical edge with any pin at close range and see if you can get half the arrow onto the piece of paper and half the arrow off the edge of the piece of paper.

Something like this:

If you miss left when shooting from 6 feet or less (point blank range), move your **Sight Pin** to the right and shoot at that vertical edge again and see if you can split the edge with your arrow.

If you miss right when shooting from 6 feet or less (point blank range), move your **Sight Pin** to the left and shoot at that same vertical edge again and see if you can split the edge with your arrow.

Keep trying and eventually you will hit the edge of the folded piece of paper DEAD CENTER, when shooting at POINT BLANK RANGE, after you have made the corrections to your SIGHT PIN windage settings (horizontal adjustments to your pins or scope dot/circle/ring).

If you have 20 yards in your backyard, use your 20 yard pin and shoot arrow groups at a bull's eye. If you miss left or right at 20 yards then move your **ARROW REST** (move the arrow rest to compensate for left/right misses when shooting longer distances than 9 feet even if that distance is only a few more yards, or, say, 20 ft.) By doing this, you are correcting your **ARROW REST** centershot when shooting longer distance.

You can shoot any convenient longer distance; whatever you have available. It doesn't have to be 20 yards. It could be 20 feet, 25 feet, or even 15 feet. Again, whatever you have available that is convenient.

Tweak the **ARROW REST** centershot until you have the arrow group CENTERED on the bull's-eye when shooting at longer distances.

Once you have accomplished the goal of setting your longer distance **ARROW REST CENTERSHOT**, go back to 5 to 6 feet and shoot ONE ARROW at that folded piece of paper's vertical edge and tweak the SIGHT PIN WINDAGE to get the arrow perfectly centered.

**********short distance shooting (6 feet or so).....adjust SIGHT PIN WINDAGE*
**********move the sight pins left or right (small adjustments) to hit a vertical edge of paper*

*********ANY longer distance (whatever is convenient).....adjust ARROW REST CENTERSHOT*
*********move the arrow rest to center your arrow groups when shooting long range*

Each time you do the full cycle of point blank shooting (super short distance) and longer distance shooting the adjustments get smaller and smaller.

Pretty soon the longer distance shooting at a bull's-eye will have the arrow group CENTERED on the bull's-eye and the single arrow at super short distance will also be centered on the vertical edge of paper.

When you don't have to make any more adjustments, you should have minimal left-right misses at all distance, short, medium and long range and all arrow groups should be centered on the bull's-eye.

All this is done with the assumption you are shooting a bow with the proper draw weight and arrow spine (stiffness).

Pulling Too Hard Into the Wall

How many of us miss sideways (horizontal misses) at 20 yards while indoor spot shooting or at longer range shots like 3D shoots or field archery?

If you are spot on at shorter distances and you are CONSISTENTLY missing left at the longer ranges, this is a center shot problem and tweaking the arrow rest in tiny amounts should get your arrow groups centered at short, medium, and LONG RANGE.

WHAT IF, when shooting spots at 20 yards, you are DEAD CENTER sometimes and you are missing LEFT sometimes and you are missing RIGHT sometimes?

It drives you nuts because you can chase your own tail trying to tune this with the "standard" bow settings.

ONE POSSIBILITY is bow riser TWIST that comes about when we pull HARDER into the wall than normal.

You are shooting indoor league and you are about to break your personal best score but the nerves are biting at you...nipping at your heels...

1) you get to full draw,

2) you pull HARD into the wall trying to steady up the dot/circle/pin and, 3) POW...surprise shot. DANG, missed right.

Shot felt good. Follow through on the bow arm/hand was good. Release side follow through was text book.

HINT: Look at STEP 2

You thought you pulled HARD into the wall and actually, you were pulling your GUTS OUT! You pulled REALLY REALLY HARD into the wall!! You pulled SO HARD into the wall you actually had the riser twist like a pretzel just a tiny, teeny amount. When you PULL THIS HARD into the wall, the riser actually rotates a tiny, itsy bitsy amount CLOCKWISE, or, off to the right for a RH shooter.

So, since the sight picture has twisted off to the right (you see the right side of the target), you rotate your body off to the left but, you don't realize that you have twisted the riser 10 degrees clockwise (this is an extreme example). Because the arrow rest support is forward of the sight mount, the arrow is only rotated 2 degrees (again, an extreme example).

The main thing is, when we pull HARD, no, WAY TOO HARD into the wall, the arrow and the riser are no longer parallel and we end up missing left when we pull too hard into the wall.

So, what is the fix?

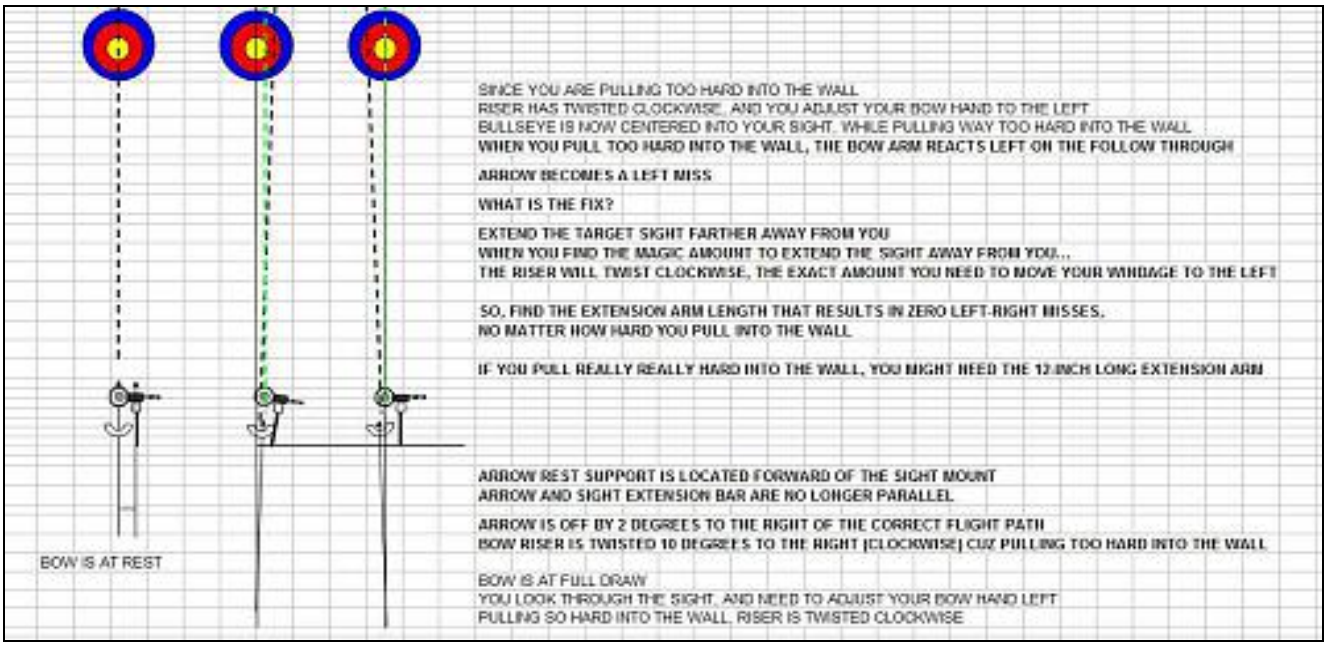
The fix is to extend the sight extension arm farther away from our face and keep experimenting to find the "perfect" extension arm amount so that when we do end up TWISTING the riser, because

we pull TOO HARD into the wall, the sight is twisted to the right the exact amount that we need to change the windage to get back onto target.

Experiment with more and more sight extension until you can pull SUPER HARD into the wall, and hit the bull's-eye and when you pull NORMALLY into the wall you STILL HIT THE BULL'S EYE.

If you pull REALLY HARD into the wall you might need a 12-inch long extension arm.

You will find that as you extend the sight farther and farther and you pull HARD into the wall, the left-right misses get smaller and smaller until...



Explosive Follow Through Motion - Bow Hand and Riser Jumps FOWARD in a Straight Line

Is another possibility for these unexpected left misses a result of not pulling hard enough into the wall (not creeping) causing the bow arm to apply more pressure during final set up thus driving the arrow to the left when loosed?

Let's assuming we are talking a right hand shooter.

There are lots and lots of possible causes for a "left" miss. Assuming the following:

1) The bow and center shot are adjusted close to perfect.
2) We have the "proper" arrow spine.
3) Top cam lean has been adjusted with twists to the yoke cable legs (twin cam or hybrid cam or solo cam bow with a buss cable).
4) The shooter has fairly good posture (stands up straight, no leaning back).
5) The shooter has the bow adjusted to close to his/her perfect bow DRAW LENGTH setting.
6) The shooter is using a bow sling or a finger sling.

7) The shooter is shooting a bow with a front stabilizer (could be 12", could be longer).

Assuming items 1 through 7 above are ALL true and correct, a LEFT miss (for a RH shooter) could be:

a) mis-alignment of the release arm forearm bones (elbow was rotated too far back behind shooter's head) even when the draw length on the bow is correct (nock lands on the "correct" spot on the side of your face).

The elbow on the release side can pivot forward of your body which is out of alignment with the arrow, pivot directly BEHIND the arrow, or, pivot BEHIND your body which is out of alignment with the arrow

When the elbow (release side) pivots BEHIND your body (for a RH shooter), the arrow will react with a left miss.

b) the bow hand thumb MAY NOT be pointed in the direction that you want the arrow to fly. Generally, the bow hand thumb should be pointed FORWARDS in the direction you want the arrow to fly.

Many times, I will see a shooter FORGET to position the bow hand thumb and "under-rotate" so the bow hand thumb is pointed off to the right of the target (probably a shooter who has been hitting his arm and is trying to compensate).

So, a LEFT miss can be due to incorrect/poor bow hand thumb position (bow hand thumb tip is pointed to the right of the arrow flight path

c) a LEFT miss can also be caused by a very TENSE bow hand thumb muscle.

When the bow hand thumb muscle is VERY tense, the curvature of the bow hand thumb muscle will be inconsistent shot to shot. The CURVATURE of the bow hand thumb muscle (when your fingers are stretched forward like a PITCHFORK) will cause a RH bow to usually react by swinging left at the instant the arrow takes off.

d) FINALLY, we have TWO STYLES of maintaining FULL DRAW.

1) DEAD BOW ARM. Think 2x4. The bow arm is PASSIVE; the bow hand is fully RELAXED.

2) PUSH-PULL. The BOW ARM IS PUSHING and the RELEASE ARM IS PULLING (trying to RIP THE BOW APART into TWO PIECES; shooting the bow like you are MAD at IT).

The PUSH-PULL technique is very difficult to master and the PUSH SIDE HALF of your body (bow arm side) must be perfectly balanced with the PULL SIDE HALF of your body (release arm side).

Posture must be DEAD VERTICAL (release side forearm bones must be DEAD STRAIGHT behind the arrow).

Release side forearm follow through should be short and precise, hard and fast. The follow through motion of the release side elbow should be like a RIFLE BOLT.

Bow arm follow through motion should be natural AND directed at the target/arrow flight path.

If you are shooting a LONG ATA target style bow with long straight limbs, the bow riser will JUMP FORWARD out of your RELAXED bow hand and the bow riser will JUMP into the finger sling or the bow riser will JUMP forward until the bow sling hits your wrist.

This will happen IF you have mastered the PUSH and PULL forces EQUALLY and you have mastered the "power triangle" body posture/alignment and you have mastered the "relaxed" bow hand wrist, forward flip movement (HINT...look for more recent youtube video clips of Dave Cousins)

Explosive Follow Through Motion - Bow Hand/Bow Arm ROTATES LEFT for RH shooter.

This is another variation of the PUSH-PULL technique.

Target Shooter is at full draw. Bow arm is PUSHING like crazy. Release arm is PULLING like crazy.

The shooter has been taught to PULL the BOW APART into TWO PIECES. RIP IT; SHOOT your bow like you are MAD at it and you want to TEAR it into TWO.

This is the AGGRESSIVE and ACTIVE bow arm.
The bow arm elbow is also probably within 99% of full extension rotation. The bow arm is near 99% of full extension...very little room to extend further.

NOTE: Discussing how "straight" a bow arm is not really useful because all of us have different amounts of rotation/flexion capability. Hyper-extended elbows will rotate beyond 180 degrees (double-jointed folks) so I will discuss PERCENT of ELBOW ROTATION capacity.

Back to the AGGRESSIVE, push-pull shooter who is at 99% of bow arm extension and at 99% of bow arm elbow rotation capacity...

When this shooter fires his/her bow, the release side elbow flies backwards AND flies in a WIDE CIRCLE and the release side elbow ends up way, way, way back BEHIND the body.
The bow hand, AT FIRST, extends forward and uses up the remaining 1% of extension RAPIDLY and then starts SWINGING in a WIDE CIRCLE BEHIND his/her body.

If the PUSH-PULL balance is not EXACTLY balanced, you will get LEFT misses or you will get RIGHT misses.

The EXPLOSIVE, WILDLY swinging follow through reactions for the bow hand and for the release side elbow are very difficult to master.

I am a much bigger fan of teaching the body posture where the bow reaction follow through is straight towards the target, along the arrow flight path.

1) The bow arm is passive.
2) The release side forearm bones are lined up DIRECTLY behind the arrow.
3) The bow hand thumb muscles are SUPER RELAXED.
4) The bow hand thumb is pointed directly at the target/arrow flight path.

If you are working with a target shooter with a long front stabilizer attached to his/her bow, just watch the reaction of the tip of the long front stabilizer and see if it moves forward or swings left after the shot (for a RH shooter). This will tell you (the coach) if the shooter was "in alignment" or not.

If you are training by yourself, work with a video camera.

Is there a happy medium between the two styles of release action you listed above? Or, does having a bit of both styles just tell you the shooter is not consistent therefore shows a mix of the two reactions upon release?

Push-Pull is a very difficult style to master. Try and see if you like it.

Passive Bow Arm.

With a super relaxed bow hand (thumb muscle as cushy as a down pillow), just have the bow arm bones (forearm and upper arm bones) in a line with the bow arm elbow at say 95% of rotation capacity and then pull into the wall.

Keep the release side elbow in DIRECT LINE behind the arrow (HINT: work with a friend and have the friend confirm your release arm alignment is truly directly behind the arrow), focus on the bull's-eye (no negative thoughts, no stray thoughts, just empty your mind and see ONLY the bull's-eye), go into automatic mode and execute your shot routine and let the shot happen.

Even with a "passive" bow arm there is a tiny amount of muscle involvement. You are relying on the bones in the forearm, in the upper arm, to simply RESIST the bow riser; just trying to keep the bow riser from flying back into your face.

Try the "PULL ONLY" style with the help of a friend and see how this works for you. If you see left or right misses, experiment with bow DL settings.

Follow Through - Release Side

Here is a sequence of photos of Dave Cousins at the Nime Tournament in 2009.

This is precise, exact, in line behind the arrow.

Here is a recent video (2009) of Dave Cousins at the Nime tournament.

http://www.youtube.com/watch?v=er7qm...eature=related

The first shot in the video clip is a very nice example of the release side elbow follow through. Short, precise, directly in line behind the arrow.

You especially notice the "angle" formed by the upper arm and the forearm. While at full draw, the angle is medium "small" between the upper arm and the forearm on the release side.

After the release side elbow follow through, the forearm moves straight back, like a rifle bolt and you can see at the "end" of the short follow through reaction. When the release side elbow has finished the follow through reaction, the "angle" is now VERY small between the upper arm and the forearm.

Bare Shaft Tuning and Level Nock Travel

An arrow is no different than a missile. Generally, they are long and skinny, fly very fast, and both are trying to hit a target. You add fins at the back end of the missile to help make the missile flight more directionally stable.

The same holds true for an arrow.

The vanes or the feathers at the back end of an arrow provide a TREMENDOUS amount of steering correction. If we take OFF the steering correction (vanes/feathers) what happens?

When you shoot an arrow with ZERO steering correction, the "bare shaft" (arrow with no vanes and no feathers) will EXAGGERATE any shooting technique problems and will EXAGGERATE any bow mal-adjustment problems.

There is an old saying, "you can tune only as well as you shoot". A nicer way of saying this is "when tuning, ignore the bad shots, and only look at the good shots".

If you choose to shoot a few bare shafts and this is the first time you are trying this out, start very very close to your target (say 5 yards away) and see if you can get the bare shafts to group. I always suggest that you shoot bare shafts at a bull's eye set at YOUR exact shoulder height because this forces you to raise up the bow hand HIGH enough so that the bare shaft is near DEAD LEVEL when you are at full draw.

We want the bare shaft to start at DEAD LEVEL prior to launch so we can judge any nock high or nock low conditions when you hit your target. The target should be a layered foam block or a solid foam target.

If you are shooting a bag target, the bag could cause the bare shaft to have weird angles (nock high or low) from the uneven stuffing material.

So, you are firing your bare shafts (say a total of 3) into your foam/layered foam block target or at the indoor range and you have two bare shafts that group together and 1 flier. Ignore the flier and pull it out. The two bare shafts that grouped together are both in the bull's eye, BUT, we have a nock high condition which means that the point is lower to the ground than the nock (point of the bare shaft are in the bull's eye) and the nock is higher off the ground than the points.

This means that the TOP HALF of the bow is working harder, pulling harder, and this means that the BOTTOM HALF of the bow is working less hard, pulling less hard.

We do not have "level nock travel" (the official term). Let's assume a few basic things:

a) the arrow rest is set so that the center of the arrow passes through the center of the two arrow rest holes (berger holes), while the bow is at rest.

b) the d-loop is set so that the arrow forms a 90 degree angle or

c) the d-loop is set so that the arrow is 1/8th inch above the spot where the arrow forms a 90 degree angle with the bowstring (arrow is pointing ever so slightly downhill)

Either style is perfectly fine. 90 degrees is ok; slightly above 90 degrees is ok.

So, what does it REALLY mean when we say the TOP HALF of the bow is working HARDER and the BOTTOM HALF of the bow is working less HARD?

Well, the TOP HALF of the bow is really no different than a fishing reel and the BOTTOM HALF of the bow is also really no different than a fishing reel.

The TOP FISHING REEL is pulling in "line" (actually bowstring) a tiny bit TOO FAST and the BOTTOM FISHING REEL is pulling in "line" (actually bowstring) a tiny bit TOO SLOW.

For the really technical folks: since the TOP metal thingy and since the BOTTOM metal thingy all go through the same amount of partial revolutions, the TOP METAL THINGY pulls in TOO MUCH bowstring and the BOTTOM METAL THINGY pulls in NOT ENOUGH bowstring.

This is actually what it means when you shoot a bare shaft (actually, several bare shafts) into a bull's eye at YOUR exact shoulder height and the nock end of the bare shafts are HIGHER than the pointy end of the bare shafts which are all in the bull's eye.

How do we get the nock end of the bare shafts to be at the same height above the ground (level bare shaft flight) and all in the bull's eye? We have a "talk" with the BOTTOM half of the bow and with the TOP half of the bow and get them to work together.

If the TOP HALF of the bow is "reeling in" too much bowstring this means that TOO MUCH bowstring unwrapped from the TOP METAL thingy when we reached full draw. Try finding the cable end loop that ends on a peg attached to the TOP METAL THINGY and LENGTHEN this cable by REMOVING twists from this cable end loop that attaches to the TOP METAL THINGY.

Just try REMOVING 1/2 twist and see what happens. A little adjustment usually goes a LONG WAY towards cleaning up bare shaft arrow flight.

You may or may not need to repeat this procedure (untwist the cable end loop that attaches to the TOP METAL THINGY).

Chapter 7 All About Sights and Scopes

Adjusting Your Pin Sight

Install the sight mount (usually two screws), look in your owner's manual, and move all the pins so the ends are dead center and form a vertical line.

You want your holographic dots or your vertical pins or your horizontal pins all dead center.

Now all your pins are dead center and form a vertical line splitting the pin guard (round plastic/metal ring) into two half circles.

IF YOU WANT the top pin, to be a 20 yard pin, go find a target at the practice range that is 20 yards away from the shooting line.

The FIRST adjustment made when shooting at any distance longer than point blank range is to the arrow REST. Fire a group of say 3 arrows at the 20 yard bull's eye at the practice range.

ALL ARROWS ARE missing to the left (the amount of sideways miss is not important, we observe that ALL the arrows are missing LEFT). FIX: MOVE the ARROW REST a tiny amount to the RIGHT. Fire another group of arrows at the 20 yards bull's eye.

Now ALL the arrows are missing to the right. FIX: MOVE the ARROW REST an even SMALLER amount to the LEFT.

Keep adjusting the ARROW REST, when shooting your arrow groups at the 20 yard target until ALL your arrows are centered around the bull's eye. (WE are ONLY fixing the horizontal position of the arrow group).

OK, the ARROW GROUP is CENTERED horizontally on the bull's eye, BUT, the ARROW GROUP is centered horizontally and it is also 3-inches on the LOW SIDE. Look into your OWNER's MANUAL and figure out how to move the 20 yard pin (your TOP PIN) in the DOWN DIRECTION a tiny bit.

You moved the TOP PIN in the DOWN DIRECTION and you fired a group of 3 arrows and the arrow group is STILL CENTERED horizontally, BUT, now the 3 arrows are ALL HITTING HIGH; your arrows are now hitting ABOVE the 20 yard bull's eye. Now, you have to move the 20 yard pin in the UP DIRECTION and you must move the 20 yard pin in the UP DIRECTION a very very, tiny amount.

Repeat these steps for ALL of your pins.

OK, you have adjusted the UP-DOWN adjustments for ALL your pins and you are done.

Well, not just yet...

Now you go to a target and fold a piece of paper in half and pin the piece of paper to the target bale so that the edge of the piece of paper is DEAD VERTICAL. You then step by back to 6 feet and fire a field point arrow at the vertical edge of paper using any pin you like.

Your goal is to make a perfect arrow hole with HALF the arrow hole off the vertical edge and HALF the arrow hole on the vertical edge of paper. ADJUST YOUR GANG WINDAGE (move the ENTIRE ROUND plastic/metal ring and ALL the pins) to the left or right until you can get the arrow hole centered on top of the vertical edge of paper. Keep tweaking the GANG WINDAGE (horizontal adjustment for ALL the pins) until you get a perfect hole when shooting at 6 FEET.

LONG RANGE. Adjust your arrow rest to get the arrow group centered on the bull's eye.
POINT BLANK RANGE. (really really short shooting distance, like 6 feet) Adjust the GANG WINDAGE on your sight (pins ALWAYS remain centered). ADJUST PINS UP the CENTER, when you miss above the bull's eye and ADJUST PINS DOWN the CENTER, when you miss low below the bull's eye.

Pin Gap Spacing and the Distance Between Your Eye and Your Pins

When you move your sight pins to the maximum distance away from your face, the round pin guard appears smaller through your peep sight and you will see MORE daylight around the outside edge of pin guard.

Another side effect will be that your pin gaps grow larger; the space between your 20 yard pin and your 30 yard pin GROWS; the space between your 30 yard pin and your 40 yard pin also GROWS.

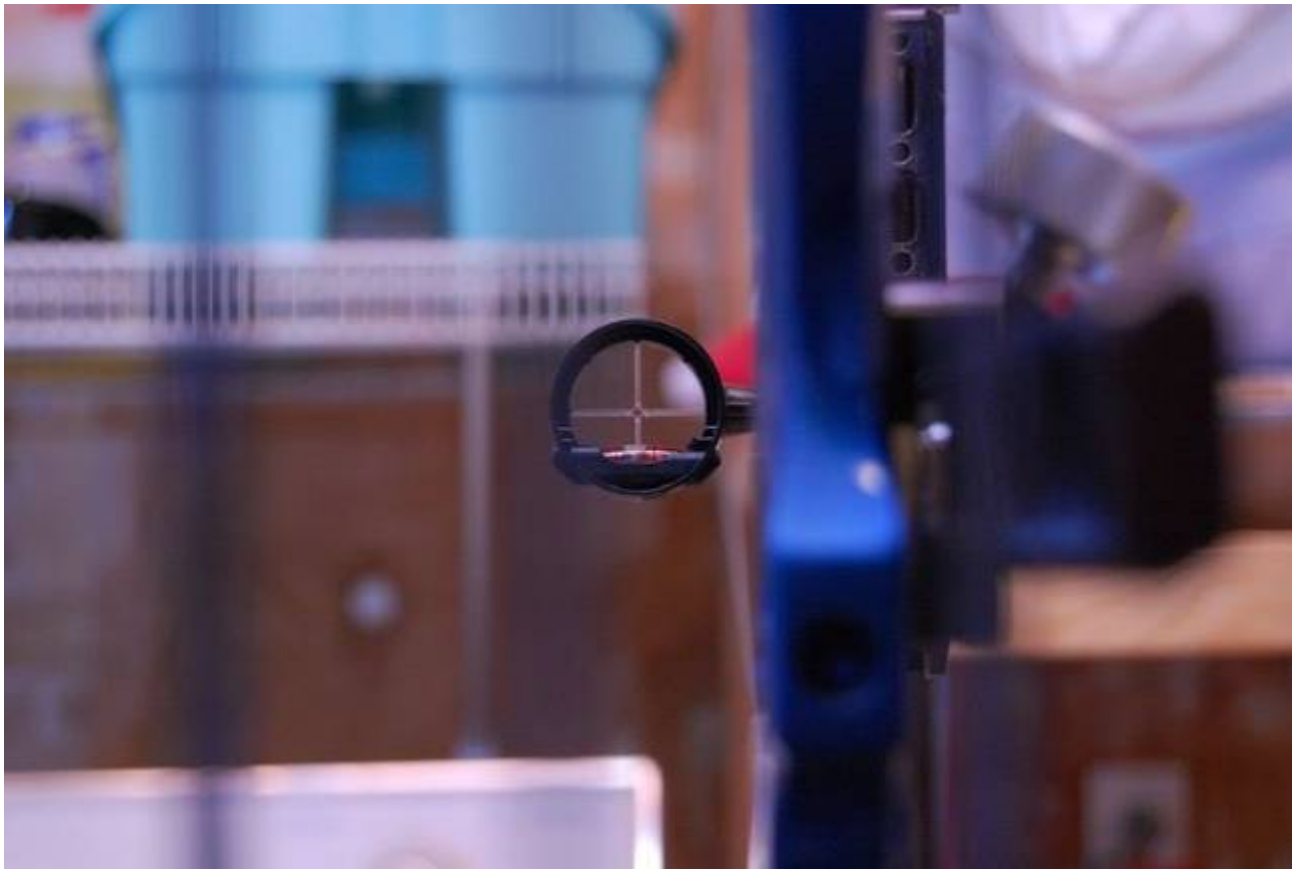
Some folks feel with a WIDER pin gap spacing they can shoot more accurately.

2nd Axis

All target sights and some hunting sights have something called a 2nd axis adjustment. If your sight has a bubble level you can use the bubble level as a reference check to make sure that you are consistent when it comes to the tilt angle of the bow riser.

Basically, just before you make the shot, you confirm that the bubble is DEAD CENTER between the lines on the bubble level. Does this mean that the bow riser is dead VERTICAL? Yes and no.

It all depends how YOU like to hold the bow riser and what bow riser sideways tilt angle is comfortable for YOUR bow hand wrist.



The bubble is centered in the level in the picture above. The sight will usually have two screws that allow you to adjust the threaded rod for the scope housing until you can get the bubble centered. This is called ADJUSTING 2nd AXIS.

If you have ZERO problems with range of motion in your wrist and you WANT to have your bow riser vertical when you shoot arrows, we go to the home made bow vise (any bow holding device will do)...

Whoops...need to adjust the bow riser tilt angle until our trusty 24-inch carpenter's level is vertical.

We hold the carpenter's level tight against the limb pockets, along the sides of the pockets, and

adjust the sideways tilt angle of the bow until the carpenters level bubble is DEAD CENTER.

Use the socket wrench to snug up the bolt on the home made bow holding device to keep the bow riser vertical.

Following the instructions in your owner's manual, adjust the sight's bubble level until the sight's bubble is DEAD CENTER. DONE. 2nd axis adjustment is complete.

Wait a minute...wait just one minute. What if you have broken your wrist in the past and rotating your wrist ENOUGH so that the bow riser is VERTICAL is painful or not even possible for YOU?

No worries.

See the pictures below. They are of Gene Leuck's sight mounted on his bow to allow for the cant he liked to shoot.

This is a Right Handed riser that belongs to "Old Pro". Old Pro prefers to tilt the top of his bow off to his right. As long as the vertical slide of the target sight is DEAD VERTICAL, your sight marks will be just fine.

IF the vertical slide of the target sight is VERTICAL the scope threaded rod is also DEAD HORIZONTAL and the scope housing will be adjusted VERTICALLY UP in a straight line (plumb) and the scope housing will be adjusted VERTICALLY DOWN in a straight line (plumb).

So, if YOU want to tilt your bow sideways (also called canting your bow sideways), go right ahead.

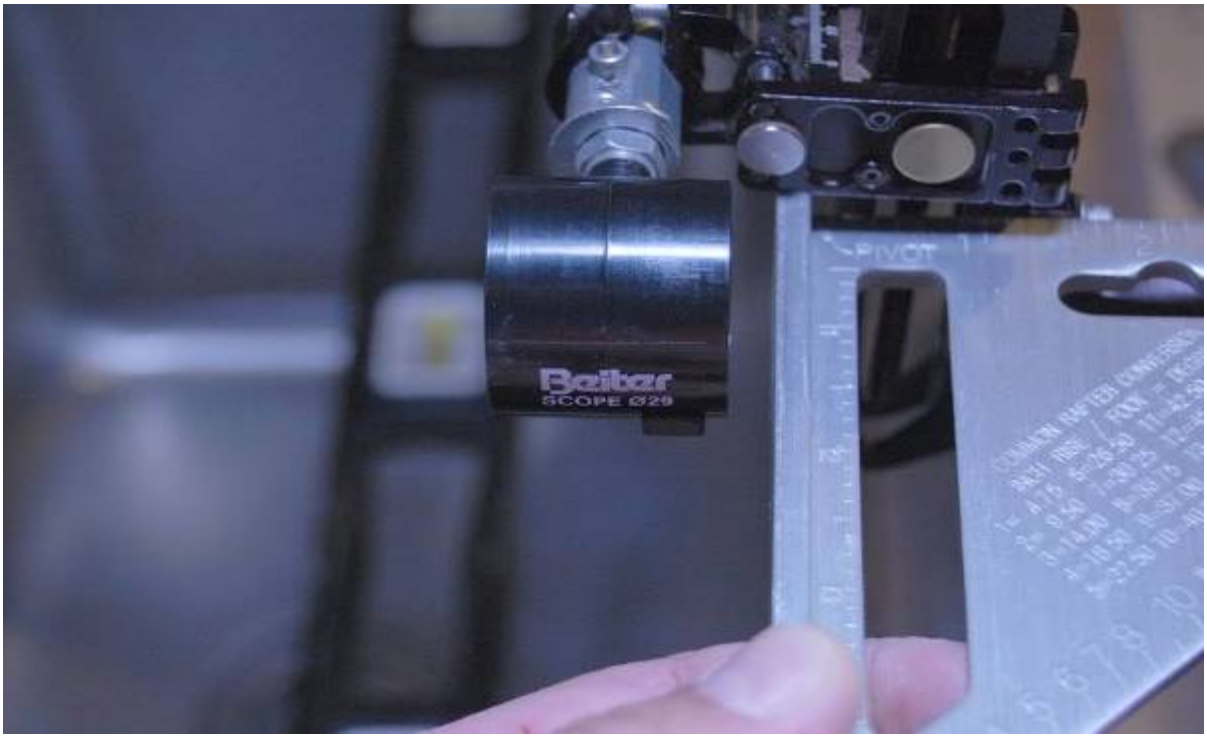
The only thing we need to do to cant the sight to our liking is adjust the bottom sight mount screw by adding shims. Most target sights have a slotted screw hole that allows you to "cant" the vertical slide a small amount. If the adjustment for tilting the vertical slide sideways is not enough, then we have to add shims under one of the sight mount screws.

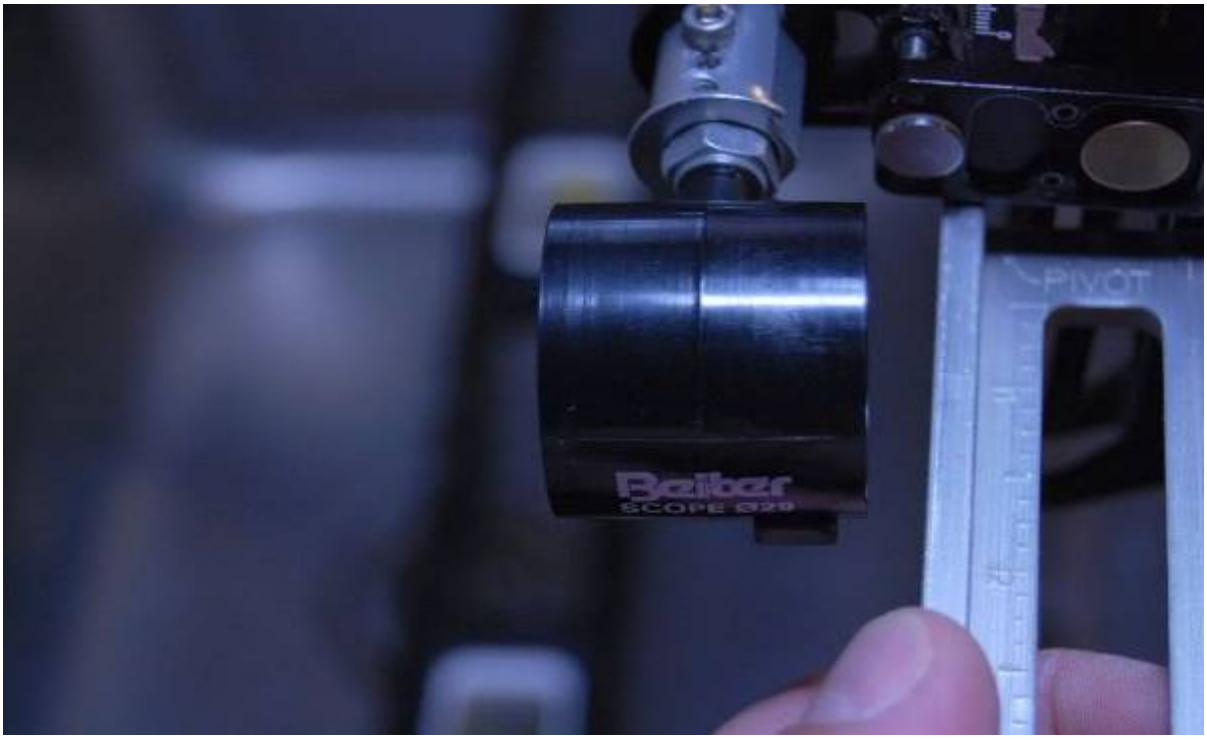
To accomplish this, you can cut an aluminum soda can into rectangular strips and punch a hole in those strips and use them as very precise thickness shims.

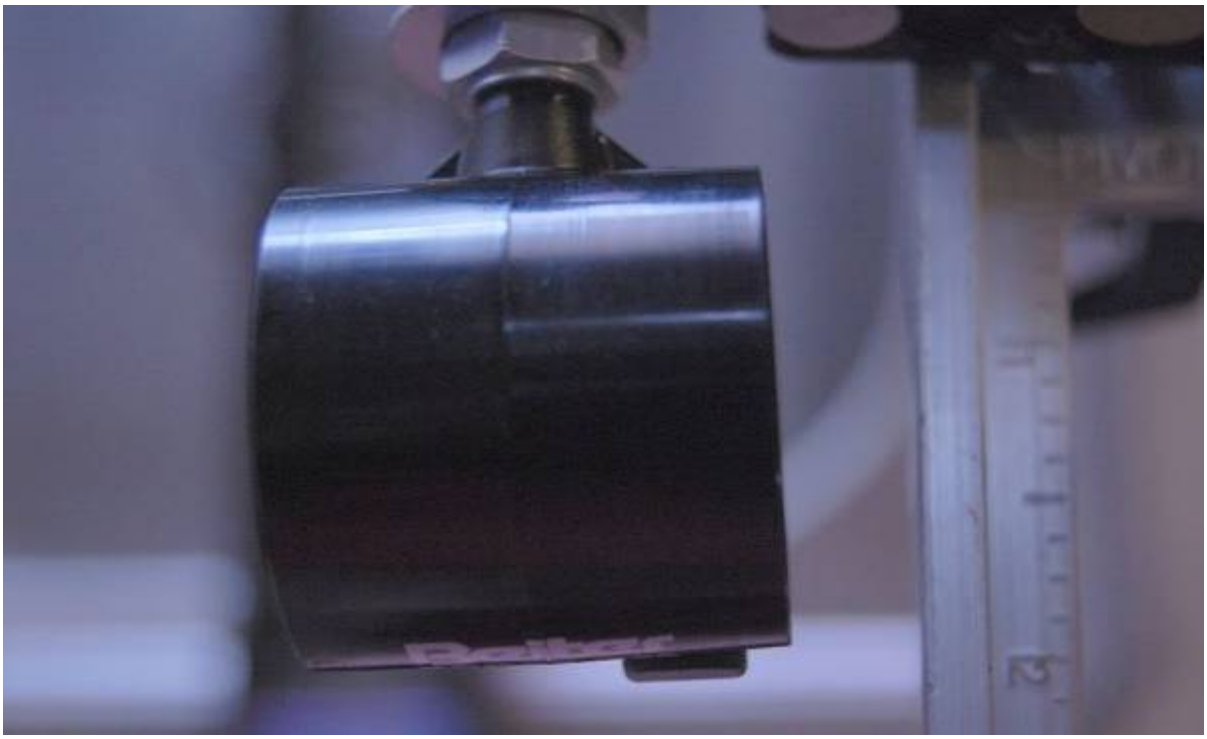
3rd Axis

Some target sights and some hunting sights have what is called "3rd Axis Adjustment". What is 3rd axis? I like to call 3rd axis the "door swing angle" adjustment feature.

Let's go back to the scope housing.





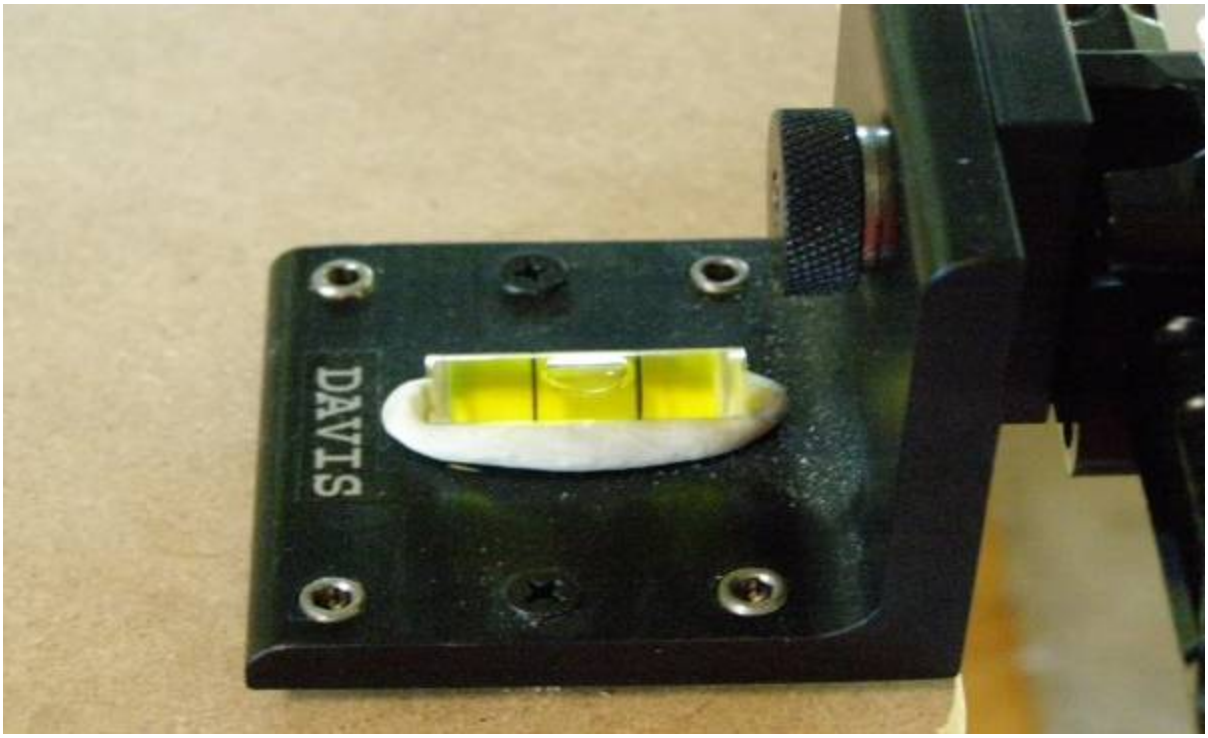


Let's say we are out shooting a 3D course and we are not paying attention and we SLAM our scope housing into the trunk of a tree. Nothing is permanently damaged, the lens is just fine, BUT, the scope housing just ROTATED towards us kind of like OPENING a DOOR towards us (assume the door OPENS IN).

The bubble still is reading DEAD CENTER when we have the arrow level which means the 2nd AXIS is still OK, BUT, when we rotate the bow forward for that steep downhill shot the bubble goes PLUMB CRAZY and screams over to the edge of the bubble level and we cannot even see the bubble. This is because the "door swing angle", 3rd axis adjustment, is way, way, waaaay out of whack.

The same thing happens when we raise the bow to pretend to take a steep uphill shot; the bubble level on the sight goes PLUMB CRAZY and the bubble screams over to the other edge of the bubble level and we cannot even see the bubble.

So, how do we fix this? Well, you COULD use a leveling jig which is just a piece of heavy aluminum angle iron with a large bubble level attached to the horizontal arm of the angle.



The jig has 4 leveling screws that you adjust until the jig is level. Once the jig is level, attach your sight mount and attach you sight to the jig.

Set the arm of your sight to horizontal and double check that the sight bubble reads DEAD CENTER.

Now, loosen the jig knob and rotate the sight arm to a severe uphill angle.

If the "door swing angle" is out of whack, then the sight bubble level will NOT stay in the center even though the jig bubble level is DEAD CENTER.

"Houston.....we have a situation"

So we break out the owner's manual for our sight and we loosen a screw or two and we adjust the "door swing angle", 3rd axis, and we try "swinging the door swing angle" either away from our face, or towards our face and eventually, finally: the sight arm is aimed "UPHILL" and the sight bubble STAYS dead center; the sight arm is aimed "DOWNHILL" and the sight bubble STAYS dead center; the sight arm is aimed "HORIZONTAL" and the sight bubble STAYS dead center. Your 3rd axis is now set correctly.

If you have NEVER checked your sight's 3rd axis (hunting pin sight or target sight with a scope) and you have wondered why your longer range shots would miss to the right and you have wondered why your shorter range shots (same day) would miss left and you wondered why your medium range shots were dead on, check the 3rd axis.

CLARIFIERS

If you shoot a target sight with a scope and your eyes are older than 40 years or so, the image you see inside the scope lens may not be quite as sharp, in focus, as you remember for last year's indoor season. Your eyes have become kind of like an autofocus camera that has forgotten how to autofocus.

The human eyeball also has a lens and this lens gets less and less flexible over time. When a shooter's eyeball lenses are no longer flexible enough to focus on close range images, (reading a

book or newspaper) this same shooter may also have trouble getting his/her scope image to be nice and sharp (in focus) like it used to be.

One trick you can try is to use the "pinhole" camera trick; try a smaller and smaller peep sight opening size (aperture). You can purchase peep sights with the opening as small as: 1/32”, 3/64”, 1/16”, 3/32”, and 1/8”.

Now, as the peep sight opening gets smaller and smaller, the image you see will get more and more in focus and the image will also be darker. Everything has advantages and disadvantages.

Sooner or later, older shooters will eventually go to a CLARIFIER peep sight insert. This is a peep sight with a teeny tiny lens in it (like a tiny pair of reading glasses in the peep sight).

Specialty Archery makes the peep sight housings, peep sight inserts with no lens, and peep sight inserts with a lens (clarifier peep sight inserts).

Now, to be clear (pun intended), the clarifier peep sights are for use with target scope housings with a LENS and the clarifier lens only clears up the TARGET IMAGE (which is 20 yards away for indoor ranges) or the TARGET IMAGE could be up to 80 yards away on a field archery course.

The Target Scope’s Lens is similar to the large OBJECTIVE lens on the end of a pair of binoculars. The Clarifier Lens is similar to the EYEPIECE on the other end of a pair of binoculars. Both lenses work together to clear up the target picture.

Clarifier Lenses come in 3 strengths (low, medium and high). The threads on the side of the Clarifier Lens Insert are color coded with a dot of paint; Yellow Code is the weak strength, Green Code is the medium strength; Red Code is the high strength.

If you have a pin sight and you have trouble seeing the PINS on your sight a Clarifier Peep sight insert will not help you.

#1 Clarifier #2 Clarifier #3 Clarifier

Chapter 8 Holding Steady: Rig Weight, Holding Weight, Let Off, and Stabilizers

We all want the best possible accuracy. If we can hold just a bit more steady, our accuracy should go up, right? Yes, but that's only part of the answer.

The size of your arrow groups depends on how TIGHT your bow stays aimed at your target.

If the bow is tuned well, the cams are timed, the arrow rest center shot is near perfect, and the arrows are near the perfect stiffness, the arrow should go to the center of the target you are aiming at.

So, let's assume that the arrows are the correct stiffness, and that the cams are timed perfectly. Why do we still miss?

a) a sideways gust of wind, right when you release the shot and/or

b) shooter is almost, but not quite lined up correctly (release side arm/elbow) and/or

c) bow hand is almost, but not quite lined up correctly (too little or too much hand in the grip area)

All of these things, and a few other possibilities, result in a bow follow through reaction that is NOT aimed directly at the target.

The bow wants to twist away from the best possible arrow path. The bow might want to twist to the left, away from the best arrow path, the bow might want to twist to the right. The bottom of bow might want to kick up (e.g., too much heel on the bow hand), the top of bow might want to kick down (e.g., too much pressure at web of bow hand).

So, a stabilizer system should make the bow resist making twisting motions (left-right twisting motions or up-down twisting motions).

Stabilizer Systems and Twisting Motions

A stabilizer system helps to resist horizontal twisting motions and vertical twisting motions.

A long stick with a light weight on the end of it is very resistant to making a quick movement.

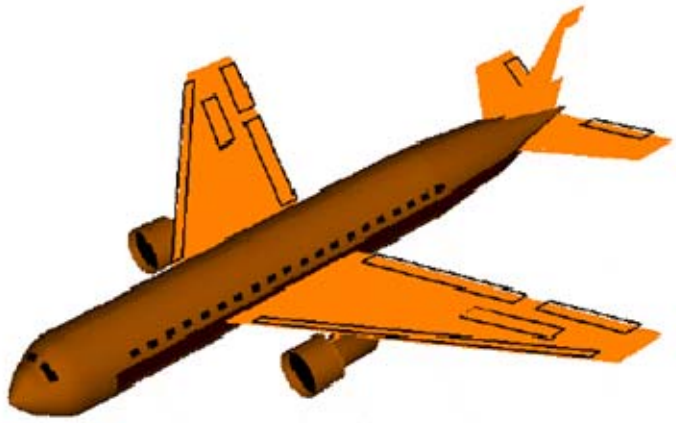
When you fire an arrow, IF the bow is going to make any kind of twisting away movement, it will be a quick, very short, movement that will try to throw your arrow off the best possible flight path.

So, seems like a simple answer. Just use a really really long stick and put a light weight on the end.

If the really really long stick is kind of flexible, the really really long stick has to STOP BENDING before you gain any "stabilizing" effect.

So, let's go over what the various pieces of a stabilizer are BEST at doing.

Front stabilizers are VERY GOOD at resisting left and right twists where the front stabilizer stays horizontal.



Imagine that the airplane is your bow.

The front stabilizer is very good at resisting a "flat" left turn or a "flat" right turn. If your bow stays vertical and the bow tries to "torque" left or "torque" right, the front stabilizer will resist this kind of twist.

What about these target-style rear facing SIDE RODS?

Side RODS are shorter stabilizers, say about 12-inches, and are used with offset knuckle joints or v-bars. These SIDE RODS are called SIDE RODS because these short stabilizers stick out to the (yup, you guessed it)...SIDE. Some folks use just one side rod, some folks use two side rods. A SIDE ROD stabilizer fights against a SIDEWAYS tilt motion.

Short, Medium, Long, and Super Long Stabilizers

Should we use short, medium, long, or super long stabilizers?

Well, to get the same amount of stabilizer power (resistance to a twisting motion), the shorter your stabilizer the MORE weight you need to use on the end.

If you want a LOT of stabilizer power, you need a LOT of weight on the end of a 12-inch stick.

If you want a LOT of stabilizer power, you need only a LITTLE bit of weight at the end of a 30-inch stick.

Who cares about a little bit of weight? Well, we ALL get fatigue, it's just a matter of time. More fatigue = less energy = less accuracy.

Use the longest stabilizers you can and use the least amount of weight on the ends you need to help you steady out your form errors.

ADD weight in small amounts close to the riser to increase riser stability.

Experiment, experiment, experiment.

Find the FOC of your stabilizer system that helps YOU get your best groups.

You know what they say; expert tennis players really don't care what racket they use, they can play well with darn near anything. Expert golfers really don't care what brand of club they use, they can play well with darn near anything.

So, near expert archers CAN shoot well with darn near anything, stabilizer-wise. We are lucky to have soooo many choices for front and side stabilizer systems.

Your choice in stabilizers is nearly limitless; carbon, super stiff carbon, skinny carbon, medium size carbon, fat carbon, slotted aluminum, aluminum/carbon cores, long ones, short ones, medium size ones, inexpensive, expensive, and every color of the rainbow. Irrespective of your stabilizer choice, all stabilizers are still just a stick with a weight on the end.

Total Shooting Rig Weight

A HEAVY shooting rig will shoot super steady and will be hard to lift up and hold steady for very long. Some shooting systems (bow, stabilizers, sight, riser weights, and stabilizer weights) can weigh as much as 10 lbs. or more.

If you are shooting a heavy rig (say 10+ lbs.), make sure that your holding weight is in the 20 lb. range (easier to do with 65 percent letoff cams).

If your cam system has a hard draw stop peg (peg against the limb face), letoff is not as important because you can pull into the wall as much as you like. Just set your release to fire heavy.

Find the FOC that works BEST for you the good old fashioned, experimental way. Add weight close to the riser to get the max shooting system total weight that you can comfortably handle, set the holding weight as high as you can shoot comfortably and/or set your release to fire heavy and your shooting system will be as stable as can be.

Chapter 9 Bow And String Maintenance

Installing A Center Serving

So you just happen to have a spool of your favorite center serving lying around and you purchased an inexpensive serving tool...

(The Spigarelli serving tool is on the left and the Cavalier tool is on the right)

...and it just so happens that your d-loop is worn out, the center serving is really worn out, and the area under the d-loop knots has separated. You are almost ready to try out installing a CENTER SERVING for the very first time.

Me, myself and I, because I like building bow strings, have a device called a string stretcher. A string stretcher is really just two heavy duty ANGLE BRACKETS and threaded hooks.

These Heavy Duty Angle Brackets are designed to be mounted on electrical channel sometimes called “UniStrut” and sometimes called “SuperStrut”. The electrical channel is "U" shaped and you can use special rectangular nuts that allow you to quickly slide the angle brackets any where along the 10-foot piece of channel.

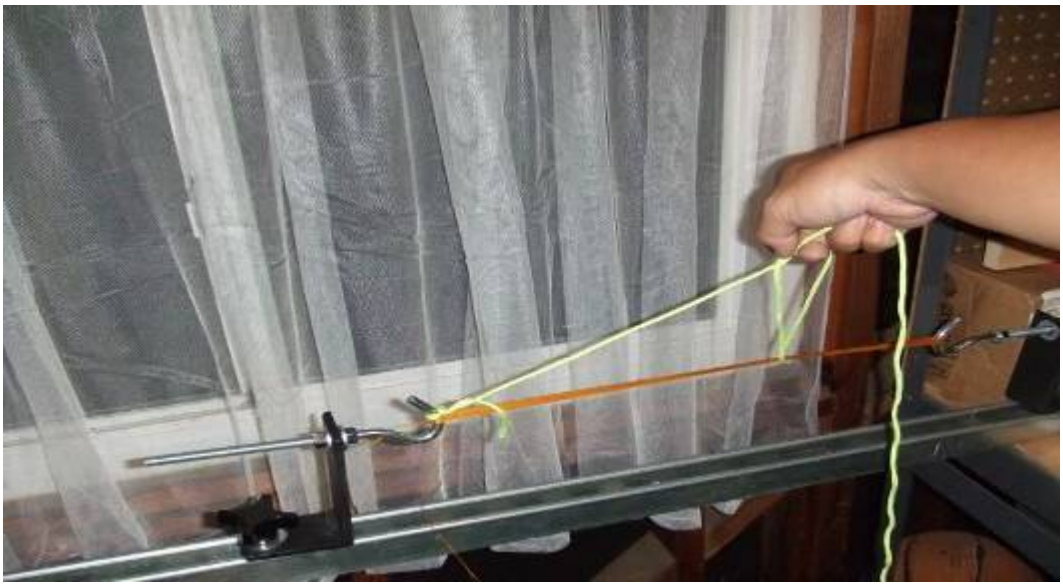
Once you lock down the Angle Brackets (because the threaded section of the hooks are about 3-4-inch long) you can put as much as 300 lbs of tension on the bowstring or cable and the Heavy Angle Brackets will hold up to the stretching pressure.

If you have taken your bowstring off the bow and attached it to the sturdy stretching device you built, take the serving thread and tie it off on the hook on the left hand side.

If you are installing a new center serving while the bowstring is on the bow, find some place handy on the left side of the bow to tie off the end of the serving thread coming off the serving tool.

Pull out enough serving thread to get to the right hand edge of where you want the center serving to begin/end.

At this point, form a circle around the bowstring with the serving tool and run the serving tool through the circle.



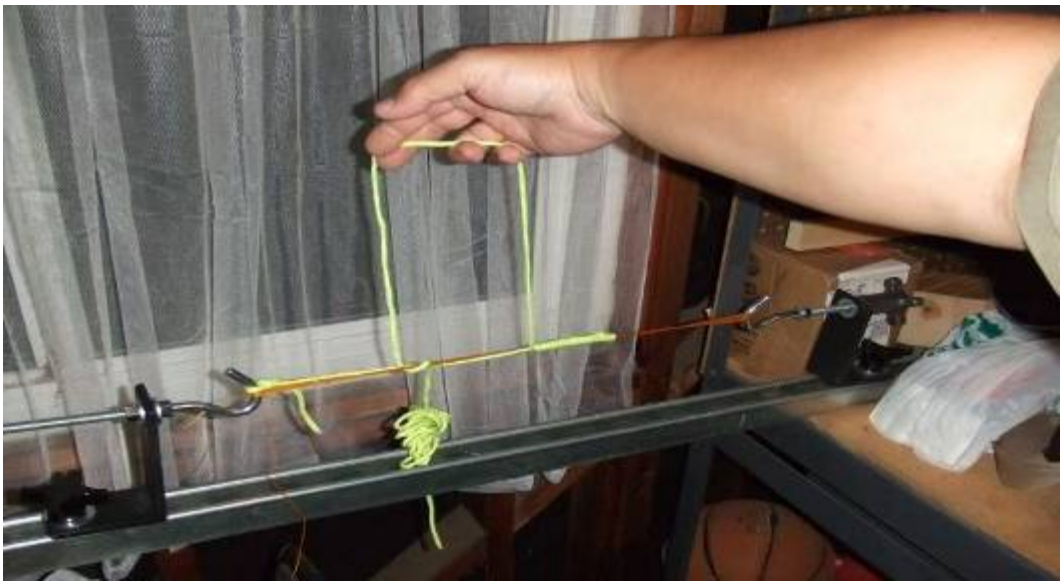
Now pull tight to take out the slack.

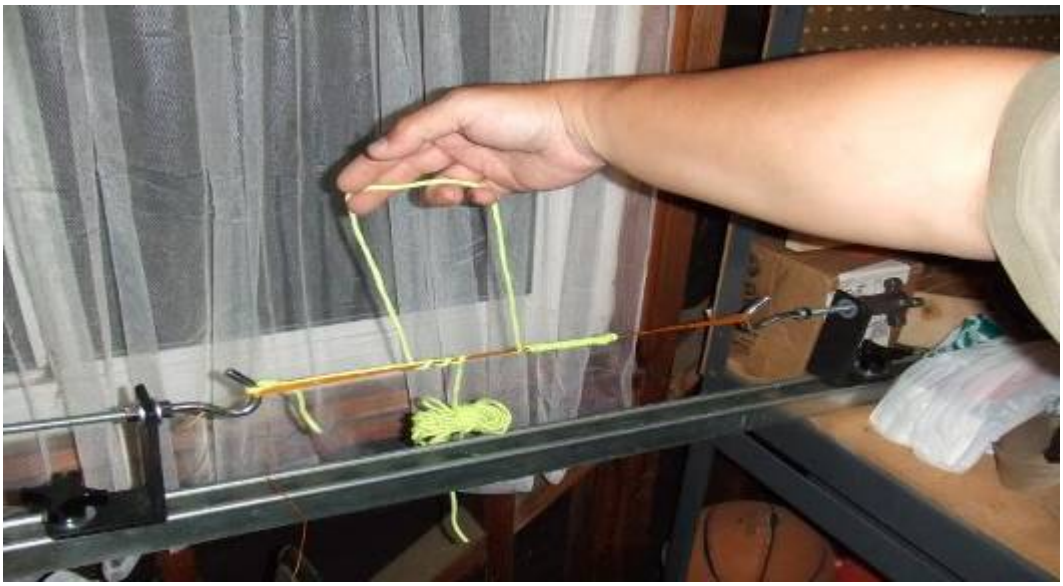
Now use your serving tool and start serving from your right side and around and around and around and around and around and around and MAKE SURE that your serving tool is travelling towards your left where you tied off the end of the thread along the left side of your bow.

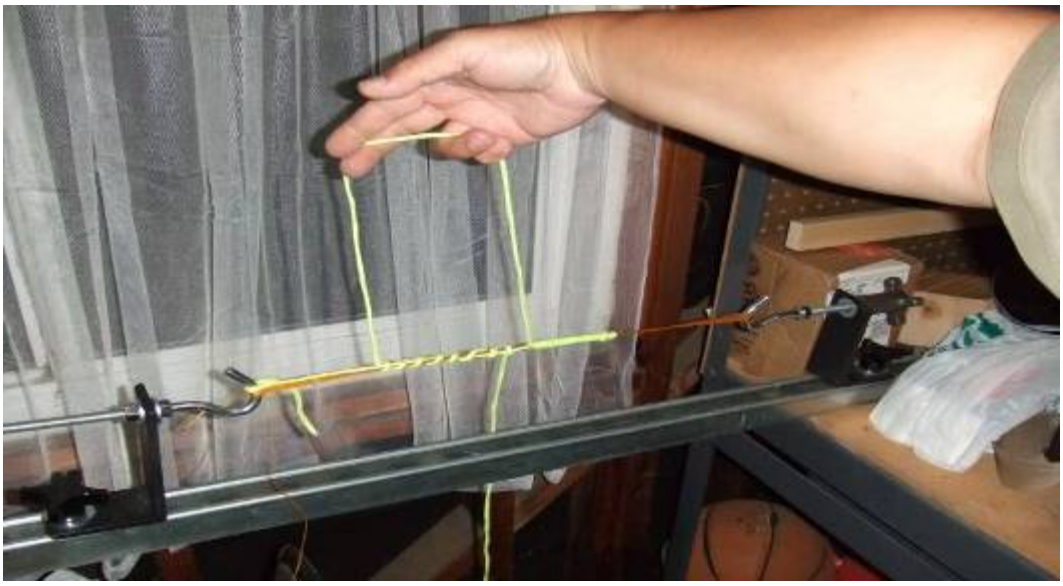
Let's say we are installing a 5” long center serving. Whip out your ruler and confirm you have arrived at the 5” length mark. Once the 5” mark is confirmed, UNWIND the serving tool about 12 wraps (go backwards 12 times, undoing about 12 wraps). Next, PULL OUT 12-inches of SLACK and FORM a HORSESHOE (large loop).

In the photos above, the wraps go down towards the floor, then they go up between my body and the bowstring, then they go back down between the window and the bowstring.

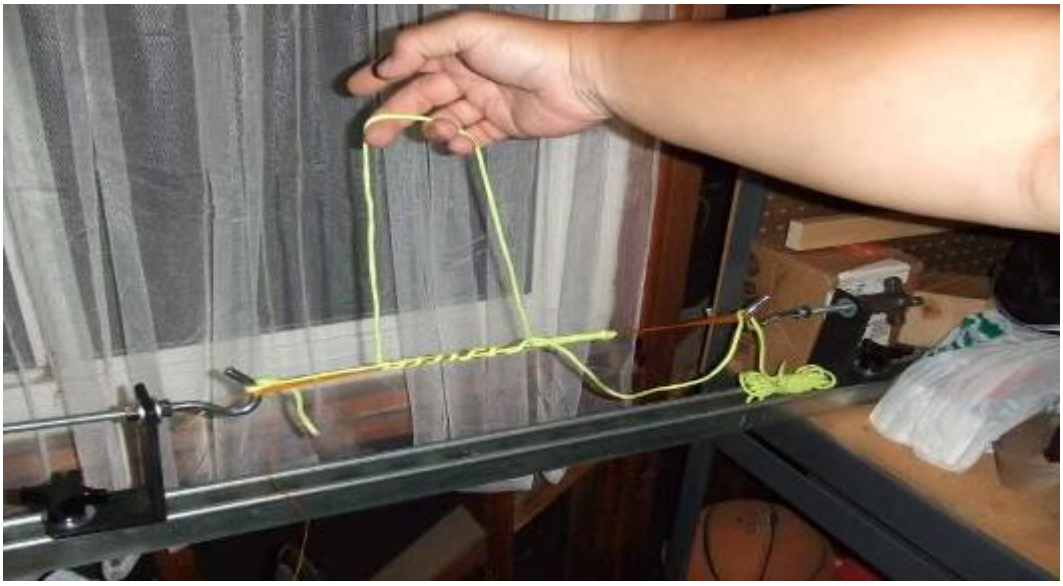
Now we are going to run the serving tool UNDER the HORSESHOE and AROUND the BOWSTRING and UNDER the HORSESHOE and AROUND the BOWSTRING. You are going to run the serving tool UNDER and THROUGH the horseshoe 12 times; the serving tool is now travelling TO YOUR RIGHT.







Now I have pulled out some slack and placed the "serving tool" around the right hand hook.

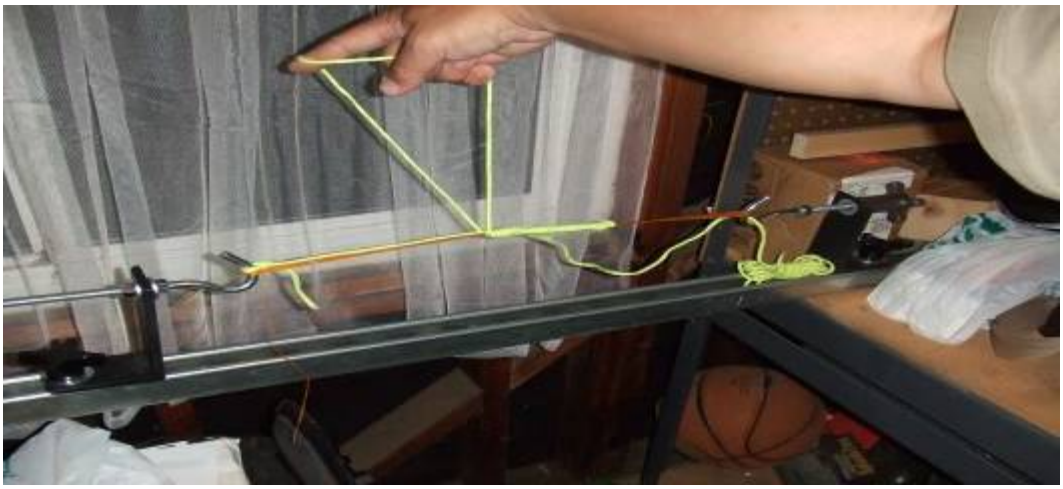


If you are installing your center serving with the bowstring on the bow, just pull out some slack from the serving tool and place the serving tool anywhere that is handy, say, wrapped around the axle to your right.

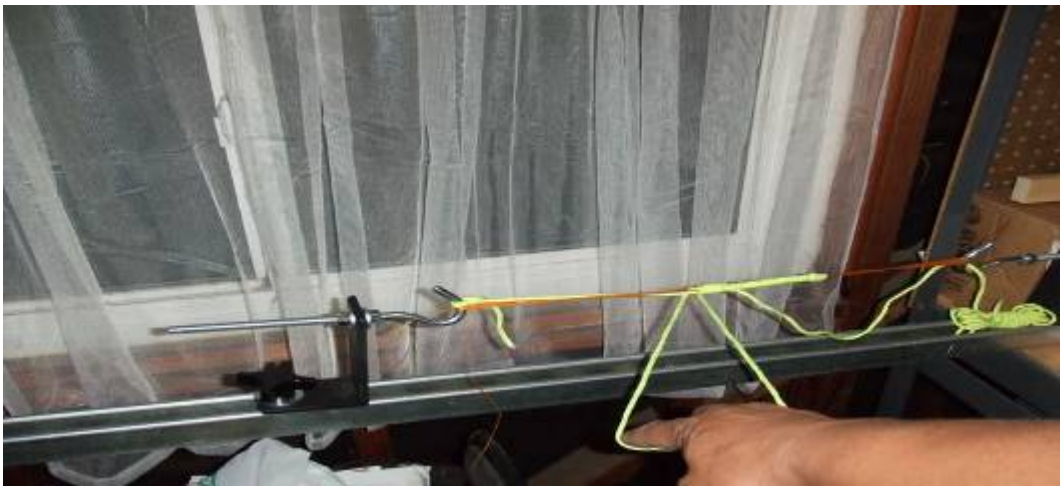
You will need to keep one hand around the peak of the horseshoe to keep the horseshoe open.

Grab the horseshoe and keep wrapping the horseshoe in the same direction you have been going all along. For this example, the HORSESHOE wraps DOWN towards the floor then wraps UP between my body and the bowstring then wraps DOWN between the window and the bowstring again and again and again; a total of 12 times for this example.

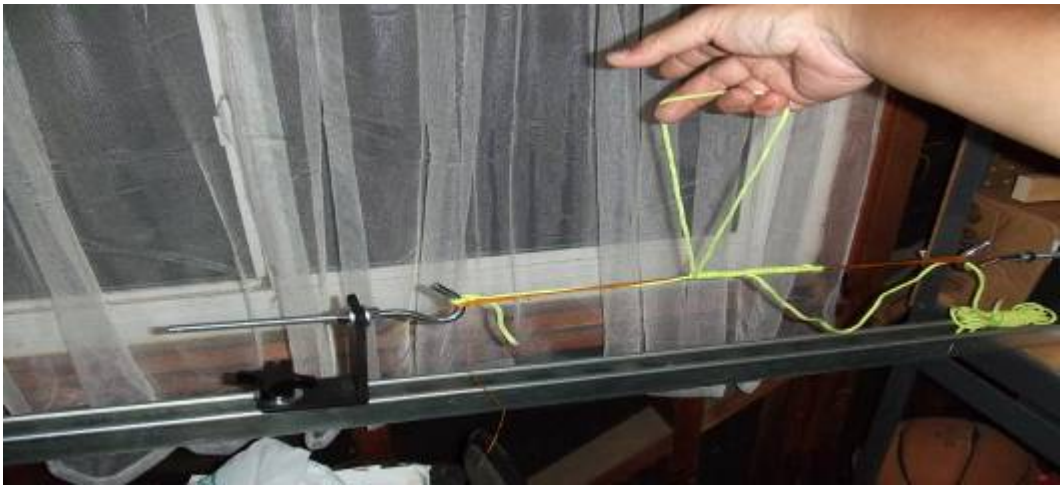
When you do this a total of 12 times, you have arrived here:



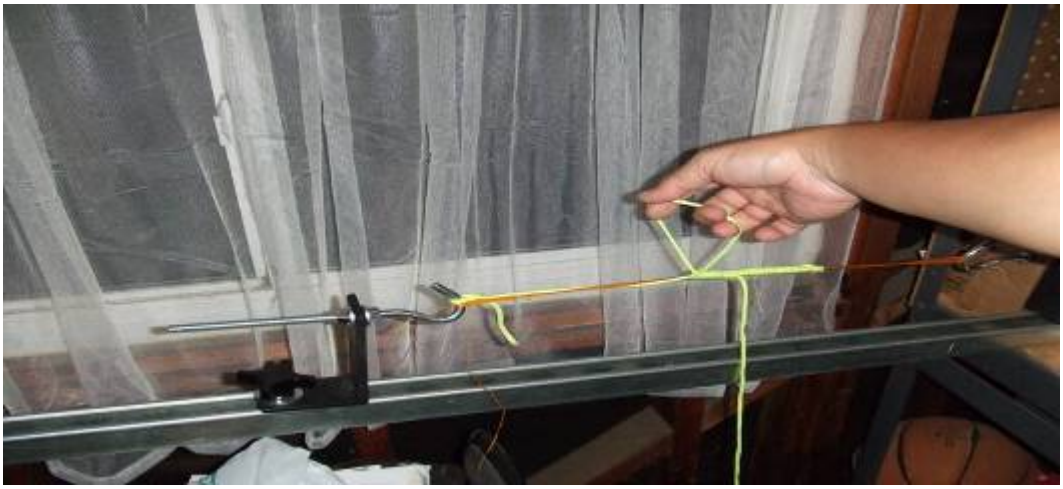
When all the wraps "INSIDE the horseshoe" are gone, the bottom of the horseshoe gets narrower and narrower until it forms a sharp triangle.



Just about gone....

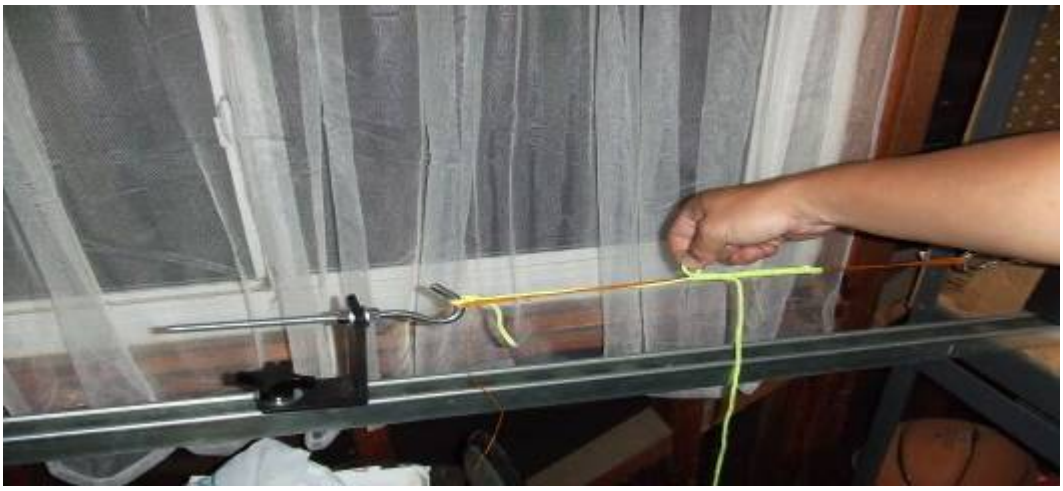


Now go back to the serving tool and start pulling on the serving tool and the "TRIANGLE" shaped horseshoe starts getting smaller and smaller...



Smaller and smaller...

Smaller and smaller...



Now, PULL on the serving tool REALLY HARD and you have now locked down your center serving.

The finished product should look like this.

Now, wasn't that easy? You have just tied your first CENTER SERVING!

After a Dry Fire or Drop from a Tree Stand

A dry fire happens when a bow has been fired with no arrow loaded. Therefore, all the kinetic energy has not been transferred to an arrow. That means all of that kinetic energy has to be absorbed by the bow.

In a "best case" scenario, nothing happens to the bow and there are many things to check. At a minimum, the bowstring will pop some strands. If enough strands rupture, the bowstring will completely break through. The worst thing to happen to a bowstring is BROKEN strands UNDER the center serving. You cannot see this, but the peep will rotate like mad due to uneven strand tension in the string bundle.

In the event of a dry fire, you MUST:

a) Completely disassemble the bow and check that the cam axles (both top and bottom) are still straight. This can be accomplished with a reference quality straight edge. Shine a light and look for a gap.

b) Confirm that both axles have all the e-clips (should be a total of 4)

c) With the bow dis-assembled, confirm that the cams and/or the idler wheel are all still FLAT. A bent cam is another common result of a dry fire.

d) Go over all the servings (center and end servings) and look for damage/unraveling.

e) Take the limbs OUT of the LIMB POCKETS and look for a fracture line along the edge of the limbs (part hidden by the limb pocket) and look at the ends; the part normally under the limb bolts.

f) Check for fracture lines on all the visible, exposed portions of the limbs (portions of the limb not hidden by the limb pocket).

g) Look for fine fracture lines where the axles come through the limb tips (this area is a particular weak spot for dry fires).

h) Look for fine fracture lines throughout the riser, especially at the grip area. Also, look just under the limb pocket areas (requires removing the limb pocket from the riser) for any visible cracks/damage.

If your bow is dropped to the ground, say, from a tree stand, you need to:

a) Look for scratches in the film finish (camouflage dipped risers)

b) Check for gouges in the rim of the cams (use a Q-Tip and see if the cotton fibers catch on anything along the perimeter of the cam).

If you believe you have a splintered limb as a result of either of the above, contact the manufacturer/factory to discuss your options. You will probably have to deliver the bow to a local dealer/pro shop and the pro shop will then ship the bow to the factory for inspection/repair/replacement. DO NOT SHOOT THE BOW IF YOU BELIEVE IT IS DAMAGED IN ANY WAY.

I would turn the limb bolts down to the minimum as set by your owner's manual.

Pressing Your Compound Bow

*****Please exercise EXTREME caution if/when you press a bow in any kind of bow press. Only use a bow press suitable for the bow you are pressing. Contact your bow's manufacturer for presses approved for pressing your bow. An improperly pressed/secured bow press can cause severe injury.*****

The riser of your bow is the most precise and most expensive to manufacture part of your bow. The riser is dead straight and has zero twist and the limb pockets are exactly at the correct angle and distance from each other.

There are portable bow presses like Bowmaster or Ratchet Loc, where the hard parts (metal adapters) only touch the limbs and the limbs are the only thing bent during the pressing process.

Trailer jack style presses with the metal fingers also only push on the limb tips during the pressing process.

Finally, there are old style T-BAR presses with the huge rubber boat rollers where the boat rollers push on the ends of the riser. I prefer to use the other newer style bow presses which ONLY have contact with the limbs and have ZERO contact with the riser.

At the indoor range I have an Ultra Press which is a telescoping tubing press with the metal arms and 4 skinny metal pins (rubber tubing over the pins). Two pins trap the top limb and two pins trap the bottom limb and when you pump the hydraulic jack, it pushes up on the metal cable and the two arms pivot up like a draw bridge.

I built a $20 bow press, using a Pipe Clamp, and "wooden" fingers.

http://www.archerytalk.com/vb/showth...ferrerid=22477

When I am at the indoor range, I use this press all the time. 3/4-inch black gas pipe is cheap, so I can press short bows and really long ATA bows.

If you are pressing at the tips of the limbs, there is no need to take turns off the limb bolts because pushing on the tips of the limbs is the same action as pulling your bow string. Besides, if you are using a bow press that ONLY pushes on the limb tips (like the $20.00 bow press made from a pipe clamp) you only need to compress the limb tips 1/2-inch or less to get the string and cables loose.

*****Please exercise EXTREME caution if/when you press a bow in any kind of bow press. Only use a bow press suitable for the bow you are pressing. Contact your bow's manufacturer for presses approved for pressing your bow. An improperly pressed/secured bow press can cause severe injury.*****