By Larry Wise

Getting in Balance with Stabilizers

It happens in the "blink" of an eye! In fact, it happens in half that time, the bowstring traverses its 20 inch power stroke toward the target in a mere .015 seconds. The arrow gets off the bowstring and is launched to the target so quick that the human eye cannot see it.

Although it takes only .015 of a second much is happening. While the arrow is propelled toward the target by the bowstring the limbs and cams are also moving. Unseen, the bow handle is going in the opposite direction from the arrow and compressing into the archer's bow hand.

LAW OF PHYSICS:

FOR EVERY ACTION THERE IS AN EQUAL AND OPPOSITE REACTION.

How the handle performs during this "blink" of time is one of the major determining factors in where the arrow lands and the consistency with which it does so. In other words, both accuracy and precision depend on the bow handle action – dynamic performance - during the brief time the limbs and bowstring are driving the arrow out of the bow and toward the target. Once the arrow separates from the bowstring neither the handle, bowstring, limbs or bow hand can have an effect on the arrow.

Once the arrow is in "free flight" the archer has no more effect on the landing of the arrow. Therefore, great care must be taken to properly and consistently optimize the conditions of the launch and ensure that the arrow impacts the desired target. Those conditions include the following:

The aimed direction of the bow and arrow system.

The placement of the bow hand.

The consistency of the release technique.

The physical balance of the bow.

The arrow's dynamic spine and flight characteristics.

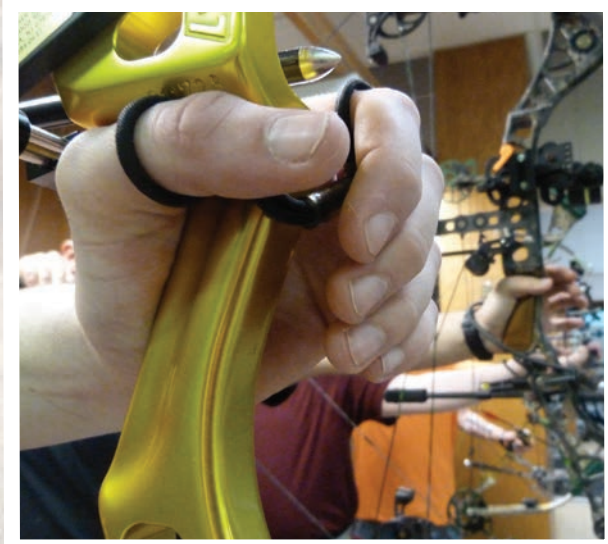
Please notice that all of these are within the direct control of the archer. ALL OF THEM! Good form takes care of the first three while good bow tuning and arrow building take care of the last two. This article is about number four.

THE PROBLEM: BOW SYSTEM DYNAMIC PERFORMANCE

What is or should be the bow handle action as it presses back into the bow hand during that critical .015 of a second? That's the big question we have to deal with when we want to begin balancing the bow with stabilizers.

Here are some facts that we know and have to deal with regarding the compound bow systems we are currently shooting:

The bow hand pressure point in the grip is below center.



The bow hand must be correctly placed and relaxed if you are going to take full advantage of any stabilizer system you place on your bow. The knuckles must be at a 45 degree angle to the bow and the fingers and thumb must be relaxed so as to equal zero tension. When correct and relaxed the thumb points to the target and the bow is free from any hand control or torque.

The nocking point on the bowstring is above center.

The top and bottom halves of the handle are unequal in weight.

Only a few handles are left-right weight equal, most are not.

The bow sight and arrow rest add weight to only one side of the handle.

The top and bottom cams are unequal in weight on most bows.

Wow, while making this list I just realized how unbalanced the whole bow system is before we put any stabilizers on it. Maybe the rare shoot-through handles really do help a little by balancing the left and right sides, I'll have to get one and give it a try. Regardless, when the sight is installed the bow is weighted to that side and balance has to be imposed on the system by using stabilizers.

BOW HAND: When the bow hand pressures into the grip section of the bow handle it is doing so below the vertical center. Most of today's bows have the vertical center at or near the arrow shelf. This means that the hand is exerting a force on the lower half of the handle trying to rotate that handle about its center resulting in the top limb rotating toward the archer.

NOCKING POINT: The nocking point of most bows is above the vertical center of the bowstring. At full draw this force is also trying to rotate the bow handle about its center by pulling the top limb toward the archer. The ideal bow would have the grip at the center, the bow hand at the center, the nocking point at the center and the arrow also traveling through the center - a piercingly painful experience to the bow hand and, therefore, not practical. So we compromise in the bow design by moving those points a short distance away from the center.

HANDLE DESIGN: The top and bottom halves of any handle are unequal in mass (weight), some more than others. During the launch of the arrow this unequal mass plays a role in the attitude of the handle as it comes back into your bow hand.

HANDLE WEIGHTING: Most handles are weighted to one side. A few of the more expensive handles have shoot-through risers that do a better job of left-right weight balance. These risers are also less prone to three-dimensional flexing during the draw and power strokes.

BOW SIGHT: Any sighting device that is attached to one side of the bow handle adds weight to that side. The heavier the bow sight the more off-balance the bow handle becomes and the more counter weighting must be used to establish a left-right neutral balance. The arrow rest also adds weight to one side.

CAM WEIGHT: Most bows today have asymmetrical cam systems. In other words, the top and bottom cams (wheels) have different shapes and mass (weight). The exception to this is the "Binary" system employed by BowTech and a few other companies. The two-wheel bows of the 1970s and 1980s were also symmetric. These cams/wheels are thrust into motion when the bowstring is released giving them momentum and if these wheels are of different weights they will have different amounts of momentum. Although this may be a relatively small matter it does enter the dynamic bow balancing equation.

These are some of the facts that we know regarding our bow-limbs-cams system. They are out of balance and when brought into relative balance the system can and usually does perform more consistently. The bottom line is this: An optimally balanced system shoots better arrow groups in the target.

My old friend, former Olympic coach and mentor, Bud Fowkes, always said, "Don't put anything on the bow unless it improves the arrow groups in the target!" As a dealer, do you consider this when you take a bow out of the box and start assembling it for a customer? Some people lose touch with Bud's Rule and go way overboard with accessories and stabilizers forgetting to determine if it all improves the groups. I follow Bud's rule all of the time!

If the bow's purpose is to accurately and consistently launch the arrow to the target-center then we would expect the bow handle to remain in its vertical attitude during the power stroke. That means that during the .015 of a second that the bowstring is propelling the arrow forward the handle should remain vertically oriented and move only horizontally a micro amount into the bow hand. In other words, the handle-top neither tips forward nor backward, doesn't tip left or right and the handle does not rotate (torque) on its vertical axis - it does shift back into the bow hand a microscopic amount during the power stroke. Following that, the entire bow system thrusts toward the target during a "rebound" reaction. But the arrow is gone by this time and unaffected by such reaction.

STABILIZER PURPOSE

The job of the stabilizer is to dampen or eliminate all handle movement other than the horizontal movement into the bow hand. The stabilizer(s) must dampen any handle tipping and any torque rotation so that the arrow can be aimed and launched accurately and consistently to the target. In other words, the wasted energy of the power stroke (about 25 percent of the stored energy) and unwanted bow hand torque must be dampened or dissipated by the stabilizers during both the aiming phase and power stroke. The law of physics at work here is: An object at rest tends to stay at rest unless acted on by a force.

A weight suspended at some distance resists movement more effectively than a weight attached directly to the bow handle – hence, the stabilizer extension rod.

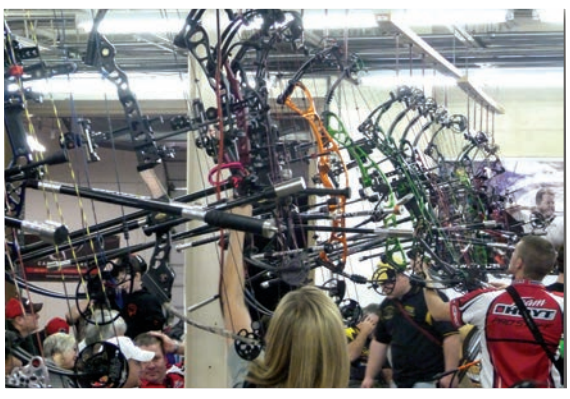
STABILIZER CONSTRUCTION

The shape and the materials of the stabilizer(s) are very important to how well they do their job. Weight suspended at a distance and how it resists movement is one of the important features of the design process. The material of the stabilizer rod also contributes greatly to the energy damping process.

In order to gain some insight into how a stabilizer is constructed I interviewed Todd Reich of Beaver Springs, Pennsylvania. Todd lives over just one mountain from me here in central Pennsylvania so we're neighbors. He builds and sells stabilizers under the business name of Dead Center Archery Products.

Todd has been involved as a major partner in a machine shop business, Top Notch CNC Machining, Beavertown, Pennsylvania, for many years. That,

This target is from Reo Wilde's qualifying effort at the recent Lancaster Archery Classic tournament. He makes this happen regularly by using proper bow hand form, superior release technique, good bow tuning and optimum stabilizer balancing. He has the whole package working!



The bows at the 2012 Lancaster Classic demonstrate how many different stabilizers are in use today. There are at least 10 manufacturers and 30 different styles of rods represented but they all use the same principle: suspending weight at a distance to resist movement from a stationary position.

coupled with his interest in archery, led to the development of a line of aluminum stabilizers a few years ago. Through the prompting of some of his friends he expanded his line to include carbon rod stabilizers. Now the carbon line is his major focus.

The carbon rods Todd uses are pultruded tubes. The diameter and wall thickness give it strength and rigidity. The high modulus carbon fibers that run linearly (lengthwise end to end) oscillate at a high frequency as they dissipate the vibrations that are transferred to it from the bow system. The end-caps are machined aluminum as are the add-on weights and the quick disconnect adjustable arms.

Using the proper adhesives and preparation processes are critical to making a lasting product. Notice that the glossy surface of the carbon has to be scuffed by a sanding operation so the adhesive makes a good bond. The end-caps are outserts that cover the end of the carbon fibers rather than inserting inside the tube which could cause splitting.

Todd Reich, owner and inventor of Dead Center Stabilizers is shown here assembling stabilizers while preparing an order for shipment. A key ingredient is the adhesive used to hold the end caps in place as well as the carbon rod preparation process. Order numbers indicate that he could add 50 percent or more to his 2011 volume by year's end.

TARGET STABILIZER SETUP

If we understand the purpose of the stabilizer system then we know that we must establish a starting point for attaching and balancing the stabilizers we use. This initial combination may not be the combination that gives the best arrow groups in the target so we will also need to establish a tuning process that will move us from the initial combination to the "optimum" combination.

The initial stabilizer combination that Todd and I both recommend begins with the use of the "Pro Balancer" that Todd manufactures or a similar device. This device attaches to a work bench via screws or a "C" clamp and holds the bow at the grip section. The balancer allows the bow to rotate on two sets of pivots so that it can tilt freely in two planes; one pivot allows the long stabilizer to tip up and down in the vertical plane while the other pivot allows the handle-top to tilt left and right. It's simple and very effective, I wish I would have had one back in the 1980s!

Testing various pultruded rod diameters and wall thicknesses helped Dead Center Archery determine the optimum rod dimensions for bow stabilizing. The colored end caps, weights, quick disconnects and angled connectors are all machined at the Top Notch CNC Machining shop in Beavertown, Pennsylvania.

At the start, the bow must be ready to shoot except for the stabilizers to be added. All of the accessories you intend to use must be installed and should include the bow sight, arrow rest, peep sight, nocking point and string dampeners.

STEP I: PLACE THE BOW IN THE BALANCER. Attach the handle to the balancer at the grip section trying to duplicate your bow hand position as closely as possible. Keep in mind that no machine can duplicate exactly how the human

hand holds the bow and that this is a starting point of a process that ends with a fine tuning shooting test.

STEP II: INSTALL THE LONG ROD Place the long stabilizer rod to the back (target side) of the bow with one small weight attached to the end. The length of the rod is a personal choice but keep in mind that the effectiveness of the stabilizer is directly related to the mathematical product of the mass weight at the rod's end and the rod length (mass X length). This product is a measure of how well the stabilizer weighted-end resists movement generated at the bow-end of the rod.

STEP III: INSTALL A SHORT ROD TO THE SIDE OPPOSITE THE BOW SIGHT. To balance the left-right weight of the bow system you must install a short rod with an attached weight to counter-balance the weight of the bow sight. Once again the length of the rod multiplied by the end-weight is a measure of the stabilizer's effectiveness. The offset arm can also be adjusted so the stabilizer rotates further outboard from the bow handle – use this in the final balancing process while the bow is in the balancer.

STEP IV: ESTABLISH A BEGINNING BALANCE BETWEEN THE LONG ROD AND THE SHORT ROD. Balancing the bow so the handle and bowstring are vertical at this point is not the objective. Remember, the bow is not "working" when it is in the balancer unit and having an equal "static" (still or inactive) balance does not mean that the system will be optimally balanced when you have the bow at full draw and also when the bow is "working" during its power stroke. The "dynamic" balance must be found by shoot-testing for arrow groups; therefore, the starting point for the bow held in the balancer unit is arbitrary. In my own personal bows I find that the long-rod tips down when the bow is held in the balancer. Todd finds the same with the overwhelming majority of client bows he balances.

LEFT-RIGHT BALANCE: I recommend that you begin with the left-right balance set equal so the handle is in the vertical plane. The Pro Balancer unit can be locked to prevent the long rod tipping down while you add weight to the counterbalance rod and also rotate it further or nearer to the bow handle using the offset bar. On my own bow I had to increase the rod length from 8 inches to 12 inches, add 6 ounces of weight and increase the offset bar length from 3 to 4 inches. A small rotation change got the bow in perfect left-right balance.

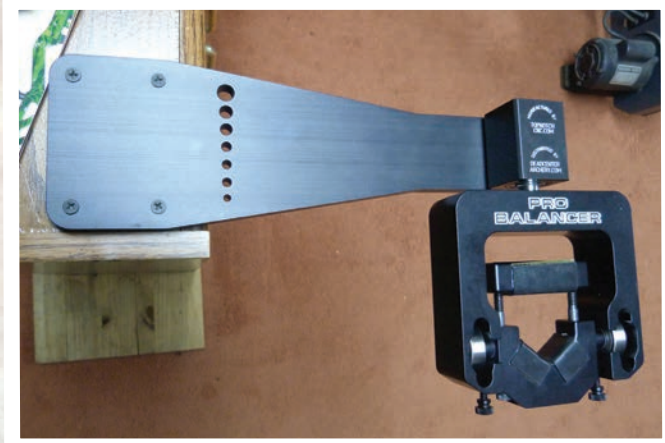
FRONT-BACK BALANCE: Begin with the front-back balance set so the long-rod tips down slightly. Once again it's all about the weight multiplied by its distance from the bow handle. In this static position my long rod tipped down at a 30 degree angle but when the bow is "working" during the power stroke the long rod tip stays level instead of instantly tipping up while the arrow is leaving the bow.

STEP V: SHOOT TESTING FOR GROUPS

Test the initial stabilizer setup by paper testing from 5 to 8 yards. There has been much written about this topic so I won't repeat it here. Check the July 2008 issue of *ArrowTrade* online to read more about Powder and Paper Tuning. (Find that back issue on-line at arrowtrademag.com if you don't still have your print copy.)

Choose some long distance from which to test the arrow groupings from your bow. I always prefer 60 yards, anything more than 40 is good.

Begin by recording your "ZERO" or starting combination of balance weights. Next, add a 1 or 2 ounce weight to either the target-side long-rod or



The Dead Center Archery Pro Balancer is a great way to get started with bow balancing. The device holds any bow at the grip section and allows it to pivot freely in two planes separately or in both simultaneously. The owner/inventor Todd Reich and I both like setting the left-right balance before setting the long rod tip-down balance. Fine tuning from long range will help you optimize the long rod tip weight to get the best groups.

to the shooter-side counter weight rod; record it and shoot test for arrow groups. Add a second weight and repeat the testing.

Remove those two weights and add one weight to the opposite stabilizer. Test for groups then add a second weight and retest. Record each weight combination you test and the resulting arrow groups.

Add a third weight into your process if you like or try a longer or shorter counter balance rod. Warning: I see some really long counter balance rods that negatively affect shooting form. When the rod extends back into your gut so far that you have to bend out over the bow while nocking the arrow then proper posture is jeopardized – you are creating extra work for yourself and you may not reestablish proper body position at full draw. Body position has to be top priority so add weights to a shorter rod or offset that rod further from the bow to get the same balance.

Finish your tuning by resetting the weights to the setting that produced the best groups. Don't forget to retest periodically.

I have to confess that I haven't shot my bow as much as I should have this past year. Nor did I work on my stabilizer package so my left-handed bow was severely out of balance when we first put it into the Balancer. Notice it is tipped far to the sight-side. To get it better balanced we increased the back-rod from 8 to 12 inches and added more weight. To bring it closer into balance we increased the offset bar from 3 to 4 inches and after a slight rotation inboard the bow balance was vertically perfect. Next we changed the tip weights on the long rod to get the desired tip-down position that will get me started with my long distance tuning (as soon as the weather warms a little). I can tell from only a few arrows that the bow aims extremely well at 20 yards already.

BALANCING HUNTING BOWS

My hunting bow is an entirely different animal from my target bow. My hunting bow is designed to do a ONE-SHOT job, at least that's the plan I always have! My hunting bow doesn't have to shoot multiple arrows at long distances either – one shot at 20 yards is the game.

My own hunting bow is very lopsided because of the two-piece bow quiver attached to the same side as the bow sight. It's still better balanced than the one-piece quivers I've used. I use a short 8 inch stabilizer on the target side with no counter balance on the side opposite the quiver. I'm satisfied with how it handles but I don't use a reflex handle like most hunters, mine is a straight-line handle, neither deflex or reflex. When I did use a reflex handle I had to install a counter balance to the quiver and sight.

My hunting bow has to "carry" well and "hold" comfortably while I'm in the treestand. I spend a lot of time with my bow in my hand while waiting for that elusive buck to show himself, particularly in heavy cover areas around my home.

It also has to shoot well on the first shot. I tune my hunting bow so it does that and if I need more weight on the rod-tip I put it on. Pin point accuracy isn't my interest but hitting a paper plate within 30 yards near the middle on the first shot with a broadhead is. I spend enough time adjusting my one stabilizer to make that happen.

I've added weights to the left side of my hunting bow to counter balance the sight and quiver but the whole system weighed too much to carry comfortably so I go without a side weight and balance for a slightly tip-down effect and for carrying comfort.

SURVEY OF STABILIZERS

Following are some of the many stabilizers I saw at the 2012 ATA Show. As you'll see, there are a wide variety of ways to implement this concept of bow balancing and energy damping.

VIPER (viper.com): Viper Products is manufacturing a line of hunting stabilizers to compliment their line of bow sights as arranged above by my long time friend Diane Botjer. The Quad Rod utilizes four energy absorbing carbon rods and is available in both the 6 inch and 9 inch versions. The Viper Stabilizer comes in three versions: the short 4 inch, the 6 inch and the 9 inch.

STOKERIZED (stokerized.com): Kyle Stoker of Annville, Pennsylvania, below shows off his latest assortment of

short stabilizers mounted on his position-adjustable side mount. He also has a selection of balance weights.

VIBRACHECK (pse-archery.com): The full line of Vibracheck products was on display at the PSE Archery booth. The newest addition is the Black Magic Series. These carbon stabilizers below are available in short and long versions and attach to the bow by the HD Coupler.

ROBINHOOD (robinhoodvideos.com): The new Lite Hawk thin-wall stabilizer is designed with a .042 inch wall-thickness to reduce the shaft weight.

Shown above, Owner and Designer Bernie Pellerite from Blacklick, Ohio prefers more weight to be placed at the end where it can do a better job of resisting the torque movement emanating from the bow handle. These

stabilizers are available in 25, 30 and 35 inches weighing in at 3.1, 3.4 and 3.9 ounces respectively. Robinhood also has a V-bar attachment featuring Gator Grip adjustable angled connections.

SHREWD ARCHERY (shrewdarchery.com): Shrewd is a division of Damon Company of Salem, Virginia, represented by Sam Newson at the ATA Show. Their impressive large display shows off the wide variety of long stabilizer lengths in both black and silver carbon finishes. As you can see Shrewd also offers a full selection of short counter balance and hunting stabilizers. New are the external end-caps and internal dampeners that come as standard equipment. They also offer a full selection of external weights to custom adjust the balance of any bow.

HOYT FUSE (hoyt.com): The Fuse stabilizer system by Hoyt (below) offers the very popular Carbon Blade system to not only allow bow stabilization but to reduce side-wind resistance. The cross-section shape is elliptical, that is it is wide horizontal and thin vertical to allow for steadier aiming in a cross wind.

SPECIALTY ARCHERY PRODUCTS (specialtyarch.com): in the photo above right, Michael Anderson proudly displays the updated Pro Stix stabilizers produced by Specialty Archery of Spencer, Iowa. They also offer the Elite Stix and Ultra Lite series of carbon stabilizers in a wide variety of lengths with a full complement of add-on weights for custom balancing. The adjustable V-bar system allows for three-dimensional angle adjustment to suit the needs of every target archer and bow hunter.

KTECH DESIGNS (ktechdesigns.com): The ATA new products display area offered me a look at the innovative stabilizer line of Ktech out of Davison, Michigan. The designers at Ktech have installed weighted harmonic dampeners in various hunting length stabilizers and string dampeners. Several of these great looking and effective models allow for position adjustments for the weighted dampeners.

CONCLUSION

Shooting archery is a fantastic way to measure yourself against yourself. To do it well requires that you prepare thoroughly and that means covering all the bases in personal form and in equipment preparation. All too often the balance of the bow is over-looked or misapplied so help your customers build the proper bow balance by adopting a systematic method like the one outlined in this article. Install a bow balancing device so you can find "exactly" the weights a given bow needs and where to locate them. Be a little more scientific and your customers will reap the rewards.

Keep well. Shoot straight!

Larry

EDITOR'S NOTE: Larry Wise is also available to conduct one and two day CoreArchery Academies on shooting form.

Larry has completed his new DVD titled Core Archery BackTension: Defined and Demonstrated. The DVD is available at www.larrywise.com for $19.95.

Check out past articles by Larry Wise at the twin web sites of *ArrowTrade*. High speed internet users can find more than three years of complete back issues at arrowtrademag.com. If you're using a dial-up connection with slower speeds, you can still download all of Larry's coaching and tuning articles as pdf files at the alternate web site, arrowtrademagazine.com.

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