MODERN ARCHERY – Chapter 9

THE MECHANICS OF STABILISATION and EVALUATION

In the previous article I explained a little of why we use stabilisation and the hardware we use to improve the performance of our bows. I left out much of the technical stuff, so in this part I will explain some of the mechanics involved and how to carry out a quick evaluation of your set-up.

1 - FORCES ACTING on a BOW at FULL DRAW

The diagram above applies to a bow being held at full draw and not moving. However, when the archer releases the string, the bow is free to move and most particularly to rotate about axes in three planes as shown below:

2 - AXES OF ROTATION OF A BOW

The Longitudinal axis “X-X”, through, or parallel to, the long rod

The Vertical axis “Y-Y”, through, or parallel to, the axis of the bow handle

The Transverse axis “Z-Z”, at right angles to the bow handle

This diagram shows the source and direction of the principal forces acting on a bow at full draw. The magnitude of these forces is not shown as this will vary from situation to situation but as can be seen, they are not symmetrical. The bow however, is held in static equilibrium by the archer. When the archer releases the string, the forces no longer balance each other out and the bow will move. Stabilisation is needed to control the direction and magnitude of movement.
The purpose of stabilisation is to provide control as the bow rotates about its Centre of Gravity (C of G) in each of these planes. The C of G is the point where the total mass of the bow acts, (I will explain how to determine this in a later article). If held at this point the bow would be perfectly balanced and only a small additional weight or push would be needed to make it move in any direction. In adding items to offer this control, we do not want to add too much mass (weight), to the bow, or else it will become too difficult to lift and hold in the aiming phase. So, the principle of, “a little weight at a long distance can be as effective as a large weight at a short distance”, is used. This is often more easily understood as the “lever or seesaw principle”.

For a simple balance system, as required in Phase 1 (see previous article), we need to consider what is called the 1st Moment of Inertia. This is defined as the weight multiplied by the distance it is from its point of action. So for us, a weight of 1oz at 24 ins is as effective as 2 oz at 12 ins or 4 oz at 6 ins. Compared to the end weights, the weight of the rod itself is quite small, therefore the 24ins unit will be lighter than the 12 or 6ins one.

For an aluminium long rod with simple end weight, the balance point is usually around two-thirds along its length, from where it fastens into the bow.

When we look at stabilisation we also normally include vibration control as well. Normal stabilisation components will usually help to reduce vibration in two ways. The first is in their design, for instance, parallel tubular long rods provide a resonant cavity, which can be tuned to absorb specific frequencies. The second way is that they will add mass to the bow, which will lower the natural frequency of vibration, hopefully lower than the one that annoys the archer. The general rule is that a heavier mass will vibrate at a lower frequency. Conversely, a stiffer (or shorter) component will vibrate at a higher frequency than a longer more flexible one.

Adding “rubber.” components can absorb vibration or isolate one component from another to control vibration levels. These are very popular at the moment, seen as lumps of high hysteresis elastomer stuck all over the bow.

3 - STABILISER SET-UP EVALUATION

The methods of evaluating any particular set-up tend to be subjective, needing the archer to determine how the bow feels when shooting one stabiliser system compared to another. The “feel” is likely to be a combination of the weight of the assembly and of how the bow responds on loosing an arrow. The response will be affected by the balance and inertia of the system, as well as by the characteristics of the bow, whether recurve or compound.

A useful method of assessment is to determine how good the bow set up is for aiming, as this can be done quite quickly. However, the stabilisation for good static aiming, may not give good shooting or adequate vibration reduction, under dynamic conditions so, this is only a starting point.

Another popular method is to extend the approach above and to shoot the bow and assess the group size, the best stabilisation set up being the one that gives the smallest group size. The distance you choose to do this will vary with your shooting skill. It needs to be carried out at a distance where you can obtain a reasonably sized group, say 20 yards for beginners or up to 50 yards for improving archers.

This is very plausible, but needs to be done either indoors or in still conditions outdoors. A caution when using this method, a coach standing by his/her elbow can make an archer shoot much better, for a few arrows, than would be shot in a competition.

A longer term method is to select a set up which feels comfortable, record scores on regular rounds, make changes, then see how scores compare with previous ones (taking account of changing weather conditions). By keeping a careful log of all scores and recording the stabiliser set-up and shooting conditions, a “Best Compromise for Me” set-up can be established.

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