Generalized Tuning Instructions

(for two bladed boomerangs)

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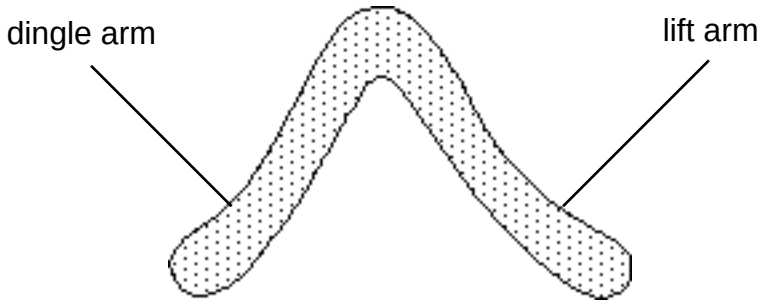
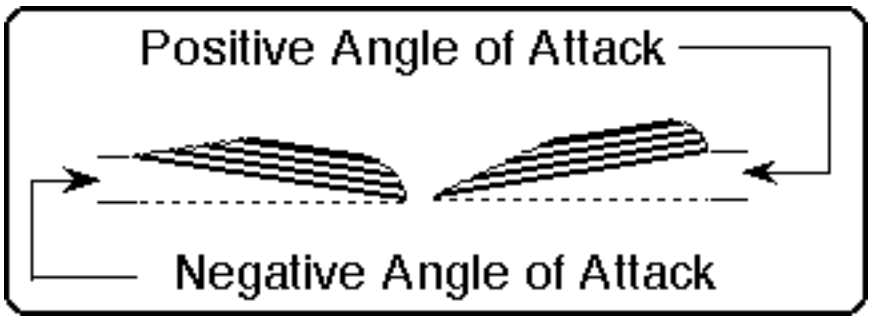
Nomenclature for a right handed boomerang:
(Use mirror image for left handed boomerang)

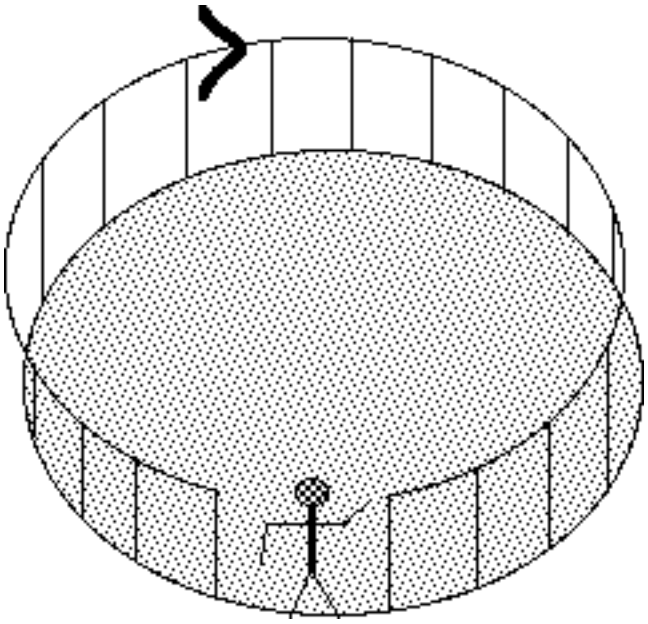


dingle arm is also called "trailing arm"
lift arm is also called "lead arm"

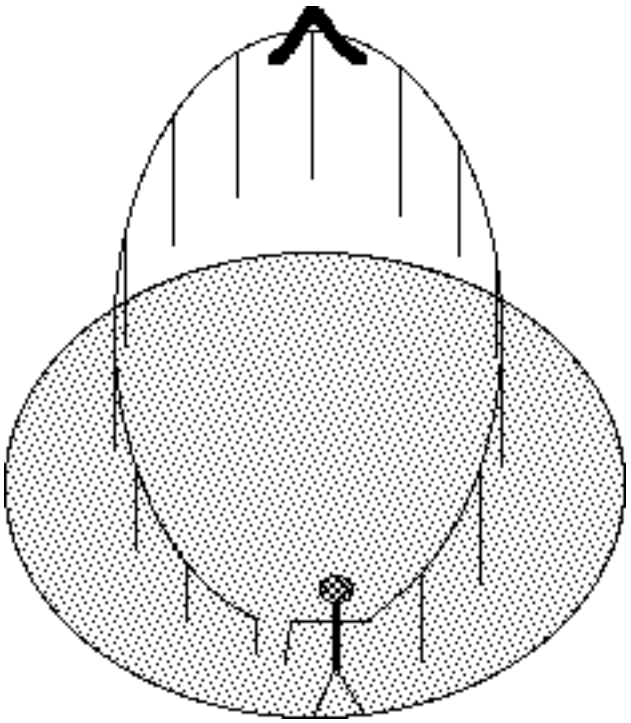


negative angle of attack is also called "washout"

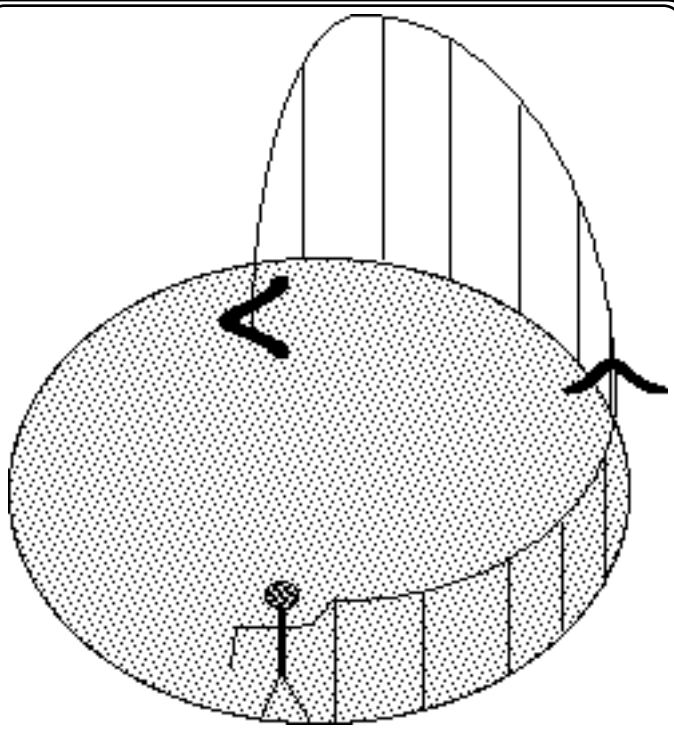
Factors That Affect Layover and Flight Circularity



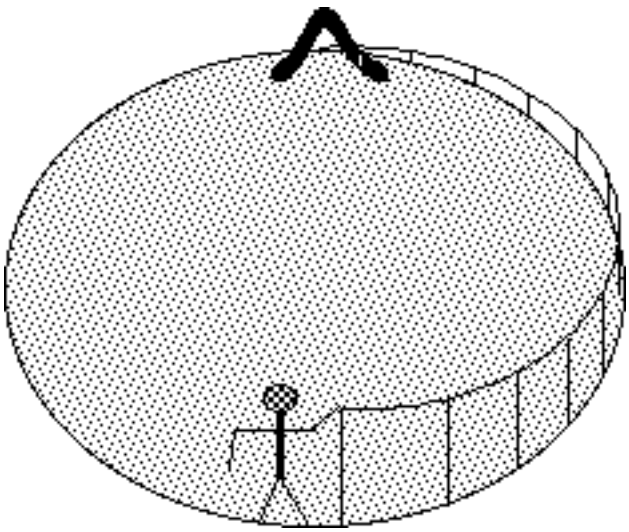
Perfect circular flight, as in a perfectly tuned Fast Catch boomerang. Low, very circular flight is usually achieved by adding positive angle of attack to both arms and reducing the dihedral on both arms to a flat or slightly negative downward bend.



Highly elliptical flight with extended range and/or increased height at maximum range. This flight profile is usually achieved by adding washout (negative angle of attack) to both arms with the possible addition of dihedral for increased height.

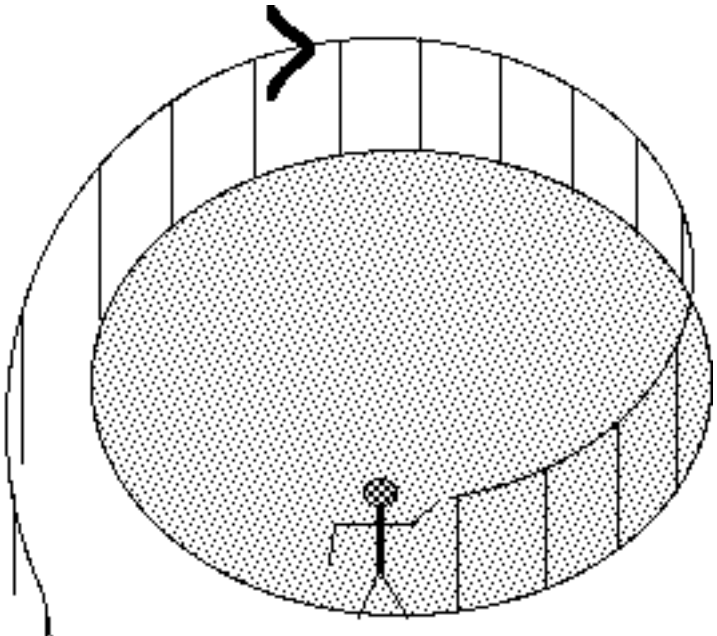


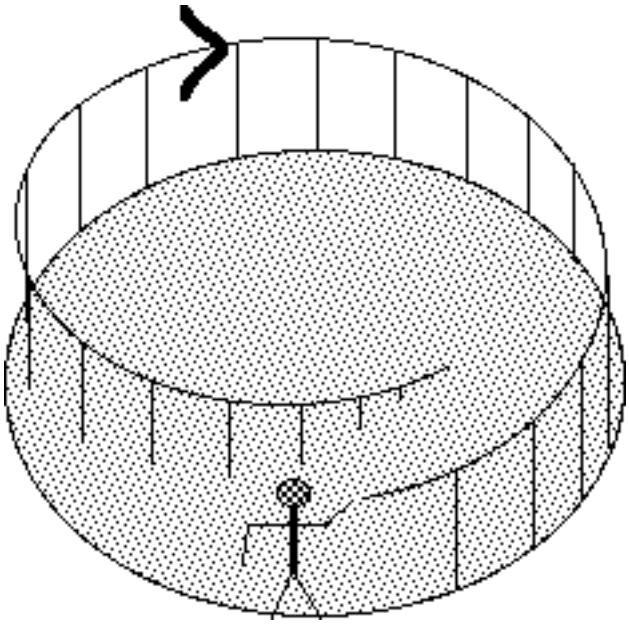
Fault: boomerang lays over too quickly and climbs high at mid-point. It then crashes hard and fast in front of thrower. Correction: reduce washout/add positive angle of attack to lift arm, especially near the elbow.



Fault: boomerang does not lay over and hits the ground mid-way around because of failure to generate sufficient lift to combat gravity. Remedy: reduce angle of attack on lift arm, especially near elbow section. Supplement with a small amount of increased dihedral on lift arm if needed.

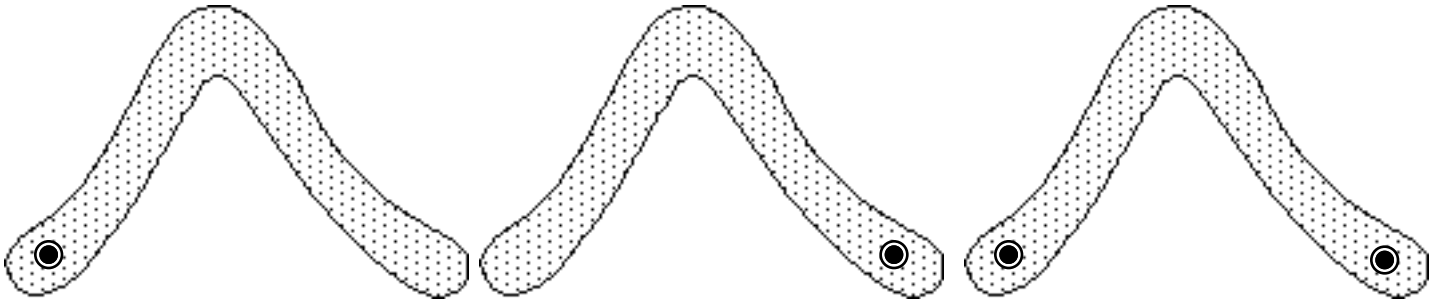
Factors That Affect Layover and Flight Circularity





Excessive changes to flight radius can usually be corrected by modifying the angle of attack on the dingle arm. In the above left figure, the flight radius increases at the end of the flight with possible reverse curvature ("S"ing out) at the very end of the flight. In the figure to the upper right, the flight radius decreases at the end of the flight with the boomerang landing in front of the thrower. You can decrease the terminal flight radius (from left figure to right figure) by adding positive angle of attack to the dingle arm. If your Fast Catch boomerang continually cuts in front of you during low wind conditions, you can correct the problem by adding washout (reducing angle of attack) to the dingle arm.

Adding Weights to Boomerangs



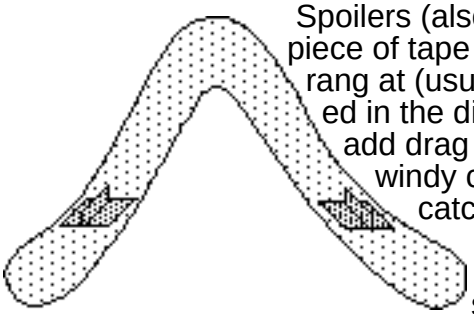
Adding a weight to the dingle arm tip shifts the center of mass towards the dingle arm, resulting in more lift on the lift arm. This reduces the range of the flight.

Adding a weight to the lift arm tip shifts the center of mass towards the lift arm, resulting in less lift on the lift arm. This increases the range of the flight.

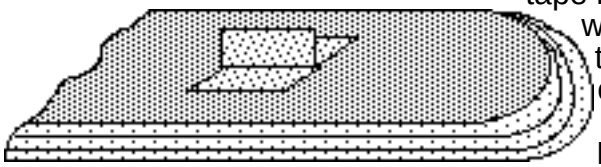
Adding weights to both tips reduces the lift on both arms and increases the moment of inertia substantially. This is usful for combined long distance and wind resistance.

Adding weights to both tips and the elbow can significantly increase the moment of inertia for wind resistance with only a moderate increase in range. Adding extra weight to the elbow such that the center of mass remains unchanged is the ideal case. You can locate the center of mass by suspending the boomerang at each tip and dropping a plumb line straight down with gravity. Where these two lines cross is the center of mass/rotation. Avoid adding so much mass to the tips that the distance from the center of mass to the tips is less than the distance from the center of mass to the elbow.

Adding Spoilers: With & Without Weights



Spoilers (also called flaps) are made by crimping the middle section of a piece of tape to form an inverted "T" and then attaching it to your boomerang at (usually) right angles to the axis of the boomerang arm as depicted in the diagrams to the left. The usual reason for adding flaps is to add drag which reduces spin rate. This can be especially effective in windy conditions or when you want a boomerang to die in trick catching, juggling or doubling.



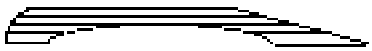
Most throwers tend to use heavy duct tape because of the strong adhesion of this tape to a smooth surface. Masking tape in a 1" width is preferable as it is light and easy to work with without the use of scissors or a knife. It is also easier to modify and remove without leaving gum residue all over the booemrang's surface.

Many throwers add the weight of a penny or a nickel by placing the coin under the tape and wrapping the tape completely around the arm several times. Weight added to the lift arm increases range. Weight added to the dingle arm reduces range. Adding weight to the upper surface usually results in a higher flight profile as in the addition of dihedral. Weight added to the under surface lowers the flight profile in a similar manner as reducing dihedral.

Some throwers use lead tape to add weight to a boomerang wing, with or without flaps. Lead tape is available through most golf shops for the purpose of balancing clubs. Lead is toxic! You can touch it to put it on, but don't put it where you will be continually contacting it with your hand during the throw unless you cover the lead with another kind of tape.

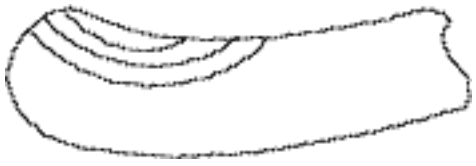
Undercutting & Beveling

underside contour view



end view

Undercutting has a small effect in increasing drag and decreasing lift. The big effect of undercutting is reduced mass and moment of inertia. The effects of reduced moment of inertia with a negligible change in lift is to speed up the boomerang as in a Fast Catch. You can get the same effect by making the same boomerang out of a lighter material. You can also get the same effect by increasing overall lift by adding a blade; such as in the Tri-blader Fast Catch. Undercutting at the tips only has the effect of reducing range in addition to speeding up the boomerang. Beware of making the arms too thin or they may break.



underside contour view

end view

Beveling of the underside of the leading edge is a technology commonly employed on Fast Catch boomerangs. Leading edge beveling permanently builds in positive angle of attack and moves the center of mass away from the tip. This technique is often used in combination with undercutting on the early two bladed Fast Catch boomerang designs. undercutting should be avioded unless the designer cannot produce enough positive angle of attack through twisting. Beveling on the underside of the trailing edge does not have as strong an effect as negative angle of attack. Trailing edge beveling usually results in an increase in the spin rate of the overall boomerang system.