



FIGHTER FORMATION FUNDAMENTALS



BASIC FIGHTER MANEUVERS 101

Welcome to another addition of the Fighter Formation Fundamentals newsletter. As in the past, this letter is a forum for information that hopefully will be of some use to you while flying your fighter this airshow season. Before we get into ant training aspects of the discussion, I would like to bring everyone up to date on recent changes to our formation program. The correct wording might be lack of changes, fortunately. We have been under some pressure over the last couple of years to roll all formation operations under one umbrella, notably FAST. We resisted this due to some fundamental differences in how the two programs are run. Mr. Ed Robinson (FAA Chief of Airshow Operations) has pushed for the one formation program for some time, however, he is the one who approved our program from the beginning and has been very impressed with it. With the help of Mr. Robinson, Connie Bowlin and Vlado Lenocho, we have reached an agreement to become a signatory of the FAST program. This will be finalized at Oshkosh this year. What does this mean for us? Fortunately, it will not change anything about the way we do business. We will operate exactly as we did prior to this event. January 1, 2000 we will issue new formation cards with a FAST sticker applied to it. Nothing else will be required. A small one-time fee will be required to print new cards with the FAST sticker.

Each formation qualified pilot will be required to possess the Fighter Formation Fundamentals manual and carry the card in order to fly formation in shows. As for the remainder of this year your current formation card is still valid. Mr. Robinson will issue a letter to this effect shortly. I will send everyone a copy to carry with you in case some overzealous inspector has nor gotten the word. This event should finally close the door on the formation debacle. Everyone is happy and will operate no differently than before.

This year has brought about a significant change In Mustang owners especially. I have heard several comments recently about the inability of some of our guys to stay correctly spaced in trail airshow events. Armed with this information, I decided to break down some of the more basic fighter maneuvers to possibly help explain some of the geometry involved in making trail formation work more smoothly. This discussion will not delve into vertical maneuvers in any detail, since these are generally not performed at airshows and there is not much need to fly them.

Essentially, the ability to remain in position during these maneuvers involves some knowledge of pursuit curves. In other words, the ability to use geometry to solve closure or acute spacing problems. We generally assume that these pursuit curves are used without changing power settings after trail formation is set. The key to staying in position is early recognition of your movement out of position. We generally are always following airplanes of the same type or if not, the relative size is similar. For trail demonstrations as we describe in the manual, you should sight your leading fighter at 2.5-3 inches wingspan on your windshield. It might even help you at first to mark two small vertical lines on your windshield of that width to help you quickly identify a problem. Another technique is to use a grease pencil and while in cruise level flight prior to the show, place a "piper" on the center of your windshield where the horizon bisects the windscreen. Draw a circle around the piper approximately 2 inches in diameter. The sloping windshield will distort the circle into an oval, which can be used to help estimate distances based on target wingspan. For ground attack demonstrations, depending on the number of aircraft in the pattern, may not necessitate such close attention to position, but and understanding of pursuit curves will make you more comfortable and ultimately safer. In the discussion that follows, we will discuss pursuit curves in a little more detail to help you understand how to use geometry. Remember in the discussion that we are not interested in shooting down an adversary in our operations, but the mechanics are useful for airshow operations.

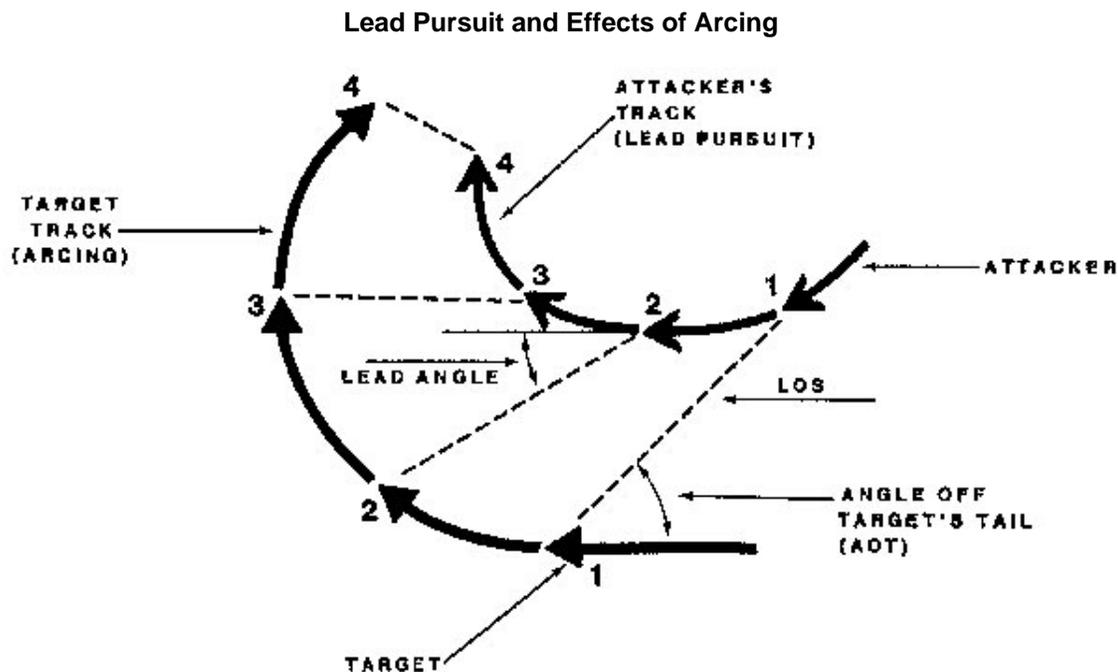
"flying fighters is not a matter of life or death - it's much more important than that"

PURSUIT CURVES

The three forms of pursuit: lead, pure and lag – are technically defined by the orientation of the attacking aircraft's velocity vector ahead of, directly toward, or behind the target aircraft, respectively. Since the fighter pilot does not always have a precise indication of the direction of his velocity vector, his nose position is usually substituted as a reference. In maneuvering situations, these two references (velocity vector and nose position) vary by the amount of the attacker's angle of attack and sideslip, which are generally not great enough to be of importance. So, what is called "pure pursuit", for instance, may actually involve a small amount of lag.

LEAD PURSUIT

A lead pursuit path is followed by positioning the aircraft's nose ahead of the target fighter. The purpose of lead pursuit is primarily to increase closure on the target fighter by use of geometry. The ideal lead angle for greatest closure depends on relative aircraft positions, relative speed and target maneuver. By moving your nose inside the target's turn circle, closure is increased and you will notice the wingspan of your target getting larger as previously discussed. The more lead you pull the more closure you will generate. If you get behind, increase the lead pursuit instead of adding power. Remember, that when you induce more lead, and thus closure, you will have to kill the closure rate when you have achieved position. Note the example to follow:



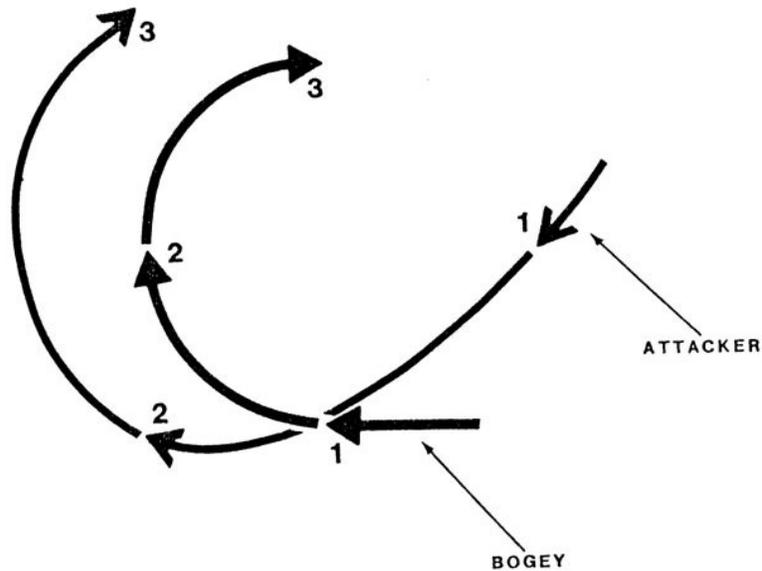
PURE PURSUIT

Holding your nose directly on the target also provides some closure, unless the target has a significant speed advantage and the angle off the tail is very small. Although pure pursuit does not generate as much closure as lead pursuit in most cases, it is very useful in holding a relative position behind the target when maneuvering is remaining fairly constant.

LAG PURSUIT

In lag pursuit, you will place your nose at an angle behind your target fighter. This tactic is useful in slowing or stopping closure to maintain a desired separation from the target while simultaneously maintaining or decreasing the angle off the tail. **Using lag pursuit, even a faster fighter can maintain a position in the rear hemisphere of a maneuvering target aircraft, for instance, Mustangs in the racetrack with Thunderbolts, etc.** Using lag pursuit is the answer. Avoid having to pull the power off to stay in position, and using flaps should never be considered.

Lag Pursuit (Note Attacker is you)



As you can see, pursuit curves can be used with impunity to control any closure problem in trail formations. You can practice these curves with a willing leader. Brief it up thoroughly and practice moving the airplane in and out of the leaders turn circle and become proficient using the curves to remain in position.

I hope the following discussion has been of some help. To those oldheads, I apologize for the basics. We're all in this together, and together we can all learn to be better fighter pilots. In conclusion, I would like to welcome new members of our team: Dan Martin, Al Schiffer, Joe Thibodeau, Gene Mallette and Chuck Hall. Chuck is our newest Check Pilot in the west coast region. Chuck brings a lot of experience to the program and we are glad to have all of our new members on board. Until the next issue.

Fly Safe,

Bradley C. Hood
Fighter Formation Qualification Program