

# Formation Flight Safety

Part 2

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**WE KICKED OFF OUR** Formation Flight Safety series last month with a focus on the challenges of the lead position, as well as situational awareness and key collision risk factors. Flying well as a formation leader can be more challenging than flying the wing, and it's important to emphasize that you shouldn't try to tackle the lead position until you have mastered flying on the wing. Even if it's easier than leading, flying wing is still a new skill.

I can still remember my first formation training flight, back in the fall of 1977 (how time flies!). I remember it because I was surprised by my instructor's demonstration of the wing position. We briefed a basic two-ship formation skills mission, with me flying wing. We performed an interval takeoff with about five seconds of spacing behind the lead aircraft, and my instructor demonstrated the takeoff and join-up straight ahead. But it was his technique of flying in close formation ("fingertip" in Air Force lingo) that really surprised me. He was jockeying the throttle back and forth constantly, plus and minus an inch at a pretty high frequency (maybe two cycles per second!), and the same was true with the control stick. He was "stirring" it constantly. Since we were in the old T-37, side-by-side, jet trainer, I had a perfect view of his inputs and resulting position. But what I couldn't figure out was how his inputs were affecting our position on the leader.

I later discovered that I couldn't figure it out because those inputs were not having much if any effect on his position! "Inside" some of those stirring motions were a few inputs that mattered; I just couldn't see which ones they were! After all, the leader was not moving his throttle, and was only moving the stick when he needed to initiate a roll or pitch maneuver. So we probably didn't need to be moving the controls so vigorously! Bottom line, if you're flying the wing well, you'll be making smooth deliberate inputs to maintain position. My instructor was what is known as a "high gain" pilot, one who is constantly moving things, even if the movements don't really matter. His input in one direction was immediately canceled by an input in the other direction—the net result was zero change.

Having said that, flying the wing position does indeed involve making constant corrections back to the "perfect" position relative to lead. But the corrections you make should be small and timely. This requires an ability to anticipate. If you wait too long to make a correction, you will end up farther out of position, necessitating a large correction, which takes longer to have effect, which means another correction will follow, and before long you're oscillating in large variations around the desired position. To learn to anticipate

corrections, and get ahead of them, you need good reference points on the lead aircraft that allow you to "triangulate" your correct position, both laterally and fore-aft. The three legs of the triangle are:

- Your view up the "wing line" toward your leader's head.
- The leader's fuselage line from his cockpit back toward his tail.
- Your view directly abeam, at his tail.

On the ground prior to flight (as we discussed last month) set the two aircraft on the ramp in a desired close formation position. From your wing aircraft cockpit position, look up the wing line of the lead aircraft and find something on the fuselage or cockpit directly behind an item on the wing. For example, does the wingtip light superimpose the canopy leading edge? If so, remember that; it creates your "wing-line" reference. Then look abeam at the tail of the lead aircraft, where are you relative to the rudder hinge, for example. These are your "null" (good) references. All corrections in flight with the stick and throttle are meant to return you to this position. We're looking for our two aircraft to have wingtips about 3 feet apart laterally, and a wingman "stagger" aft of the lead about 30-45 degrees; in other words our cockpit is that angular amount from a perfect side-by-side line.

So on my first formation flight, the instructor gave me the aircraft after his "demonstration," and I had no idea how to make the required corrections. I ended up in that proverbial "yo-yo" adding too much power and overshooting, then pulling off too much and getting behind, banking into lead and getting too close, then banking away too much and getting too far away. Eventually, though, I discovered a very interesting relationship in the "triangulation" necessary



for the correct position, one that you can explore with a simple exercise. The objective of the exercise is for you to learn to recognize when a power change is required to correct back to position versus a bank angle change. Believe it or not these two inputs, power and bank, are very closely coupled in achieving that perfect, stable wing position.

Start out with your instructor stabilizing your aircraft in the proper wing position in wing-level flight on the leader. Then make a very slight bank angle input away from the leader (2-3 degrees of heading change). What you will notice first is an apparent lag behind the leader. If you are not closely monitoring your "triangulation reference," it will appear that you are drifting behind. Your instinct will be to add power. In fact, what has happened is you have increased your lateral spacing on lead, because of the heading change. Since you are on a 30-45 degree staggered wing-line reference, any

move outward along this line also appears to be a move aft. Your intuition is to add power. But all you really need to do is bank back into the leader, and you will come right back up the wing line to the original correct position. Perform this exercise until you instinctively know that you are wide and need to bank toward lead, or that you are truly aft and need to add power. Until you master this "perception" issue, you inevitably find yourself in the power yo-yo moving back and forth about the desired position in large oscillations.

Another common error for pilots learning to fly formation in the close position is their over-fixation on the triangulation references. If you look at only those two reference lines we defined, you miss the big picture. Once you get comfortable, those references will become second nature, and you'll be looking at the whole lead aircraft and seeing movements in relative position at the inch level instead of the foot level. In other words, see the big

picture of where you are relative to lead, and make the correct correction (power or bank) immediately, when it's a matter of a few inches instead of a few feet.

Once you have mastered this concept, then other positions take on the same relative demand. If you want to do a cross-under to move from the right side of leader to the left, reduce power slightly, step back to get to a place where your nose clears leader's tail, then add power to stabilize. Then add a small bank change to the left to move laterally across to the left side. Then once on the left side, add power to move forward to the wingtip position. This maneuver uses all the principles I discussed above.

Spend some time on the basics above and you'll get really comfortable with relative positioning on your leader. Once your corrections are instinctive, you're ready to move to more advanced maneuvers like rejoins and trail formations. A topic for next month! Fly safely out there. *EAA*