

# Formation Flight Safety

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**WITH AIRVENTURE APPROACHING**, many of us are practicing our formation flying skills in preparation for our annual trek to Oshkosh. Formation ranks up there among the most enjoyable flying we do, but it demands greater preparation, training, and some unique safety measures. The simplest rule we all follow is “don’t hit the other guy!” Unfortunately just recently a midair collision occurred between a vintage warbird Hawker Sea Fury and a Cessna 210. Both aircraft were en route to Eagles Nest Airport from Half Moon Bay Airport near San Francisco. It is too early to know a lot of detail, including whether or not the flight was a planned formation, but the National Transportation Safety Board reported the midair collision occurred when the pilot of the Sea Fury pulled up to the left side of the Cessna 210. The 210 crashed into the bay, killing the pilot, while the Sea Fury managed to make it to Eagles Nest.

This is an all too sobering reminder of what can go wrong when airplanes operate close together. If you’re contemplating formation flying for the first time, be sure to find someone with good experience to give you the proper training. You don’t need a CFI for that, but the individual who instructs formation should have a commanding knowledge of formation flight and experience in the types of aircraft involved. One of the best sources I’ve seen for formation training was written by the Formation and Safety Team (FAST) at [www.FlyFast.org](http://www.FlyFast.org) where you can find a comprehensive guide to this type of flying.

You might think the most challenging part of flying formation is mastering a stable position on the wing, but I’ve found that flying well as the formation leader is far more challenging. The leader has to plan,

think, and maneuver for two (or more) aircraft. A good leader will make the job of flying the wing position much easier. When I’ve conducted formation training with students in both aircraft, I can readily determine from the wing position whether it is the student or instructor on the controls in the lead aircraft. The experienced lead provides a predictable stable platform. Turns changes in power, climbs and descents, and configuration changes all require the leader to plan well ahead so the wingman is ready for the change and can respond promptly to maintain position. For example, when I begin a turn as leader, I roll in smoothly, with initially a low-roll rate but steadily increase it to a normal-roll rate for the aircraft, to get to the desired bank angle. Common mistakes are to roll too quickly, surprising the wingman, or to roll too slowly, causing the wingman to “stutter” his roll inputs in anticipation of the normal roll rate that the lead never gets to. Finding the right balance takes a lot of thinking ahead, and practice.

An extremely important concept for both the lead and wingman is what we call situation awareness (SA). Many failures in formation flying can be attributed to one or more pilots in the flight having lost SA, leading to confusion and errors in the cockpit. FAST defines SA as “the continuous observation of current conditions and, along with the integration of previous knowledge, the ability to quickly form a coherent mental picture to anticipate future needs and direct future actions. Strong SA allows the formation pilot to absorb information from several different sources near simultaneously, such as the aircraft engine and navigation instruments, radio chatter, traffic analysis, etc., and anticipate what actions are needed over time.”

In many regards, flying a general aviation aircraft in formation can be much more challenging than flying the military jets. Propeller aircraft have a narrower operating speed range, slower response to power changes, and often slower roll rates, all of



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which make the job of the leader even more challenging. This is most challenging if the aircraft in the flight are not all the same type. A technique I've used during preflight is to place the formation aircraft side by side on the ramp in the relative position desired for close-aboard formation in flight. Typically, this puts the number two aircraft on about a 30 to 45 degree bearing line behind the lead with at least 3-foot spacing of the wingtips. Use this arrangement to select sight-line references from the pilot seats that you can later use in flight, with the one minor adjustment that you will step down lower, vertically, by 3 feet or so, which of course can't be pre-arranged on the ramp. The wingman steps down vertically from the lead to provide separation margins (enhanced collision avoidance!) for turns performed by the leader into the direction of the wing aircraft.

There are several specific collision risk factors that must be taken into account in formation flight. These include maintaining sight, proper monitoring of the wingman's

position by the leader, appropriate lateral and vertical spacing, overtake speeds during maneuvering rejoins and position changes, consideration of wingtip vortices, and prop wash. Each of these should play a significant role in the way you plan, brief, and execute a formation flight. An absolute must for every formation flight is to have a "lost sight" plan. My favorite is easy to remember: If either aircraft loses sight with the other, call it immediately on the radio. If the other also responds "lost sight," you must immediately execute the lost sight plan. The simplest is to use altitude separation. Lead (aircraft No. 1) is an odd-numbered position and goes to an odd altitude in thousands. The wingman (No. 2) goes to an even-numbered altitude. Neither crosses the altitude where the other was last seen to achieve this. In other words the lead chooses to climb or descend to an odd altitude based on whether the last wingman position was below or above the leader. Once safely established at dissimilar altitudes, radioing each other's relative

position over ground references can get you back together.

Every successful formation flight is created during the briefing. The pilots of each aircraft must discuss each phase of flight from engine start through post-flight engine shutdown in great detail. Expected position of each aircraft for each phase of flight must be well-understood, and the protocols for use of the radios must be unambiguous. A plan also must be established for abnormal and emergency procedures. My general rule of thumb is anytime a wingman aircraft experiences an emergency, that aircraft is offered the lead position and the other aircraft takes the wing position to offer support and coordination with ATC as needed by the emergency aircraft. The support another aircraft can provide in an emergency is one of the most beneficial aspects of formation flying. If the preflight briefing is thought out and executed well, formation flying can be a significant enhancement to overall flight safety. Fly safely out there! *EAA*