

FORMATION FLIGHT, INCORPORATED

SUMMARY OF RECENT CHANGES TO THE FFI FORMATION GUIDE REVIEW AND CLARIFICATION OF COMMON ERRORS AND NON-STANDARD PROCEDURES

JULY 2018

After more than two years of effort by your FFI Board, and a bit of waiting for FAA progress on the 8900.1 update, the revision of our FFI manuals is complete and approved! The current versions of all manuals and aircraft-specific supplements are available at www.ffi.aero, under "[Documents](#)"

This Summary is designed to clarify, in plain language, some areas that are often misunderstood and/or poorly executed in the field. It will also highlight new Policy or Procedure items that we want to ensure get fully disseminated to FFI members.

During this revision cycle we have discovered several examples of FFI pilots conducting formation flights not in accordance with the [FFI Formation Guide](#). This is due to several factors, including:

- Localisms. Regional groups start flying maneuvers in a slightly different way. Eventually they are practiced for so long that the pilots involved believe the way they're doing it is actually the standard.
- Legacy. "We've always flown it this way. Did something change? Why?"
- Flight Lead Technique. Although the Guide allows Leads to brief, utilize and train with slightly different *techniques*, some have exceeded this latitude, and are not in compliance with FFI *procedures*. Techniques that alter Standard Procedure are not authorized.
- Manual Changes. Our standards have evolved, but ensuring everyone in the field receives information about changes has proven a challenge in the past. Great strides are being made to correct that, and this Summary is part of that effort. Additionally, sometimes pilots read the new manual but don't notice the changes; or sometimes they don't read the new manual at all. Manual dissemination has also been hampered by external factors, or delays in regulatory/policy updates.

The scope of this Summary is to highlight recent changes and their causes, to point out non-standard "localisms", to identify differences between techniques and procedures, and to "foot-stomp" (i.e., give the bottom line on) procedures that are often seen executed incorrectly.

As you read through the common errors or clarifications, if you find yourself asking "Who the heck does it THAT way?" please be patient. SOMEONE does, or did, or we wouldn't be discussing it here.

1. Formation Pilot's Knowledge Guide vs. T-34 Manual

The [FFI Formation Guide](#) is the primary reference document for FFI standards and procedures.

The Formation Pilot's Knowledge Guide, published by FAST, has replaced the T-34 Manual as an additional reference document. The T-34 Manual served us well for many years, but it was dated and rather thin on maneuver execution. The FPKG is a comprehensive document, offering in-depth additional information on all things formation.

2. Briefing Guides

Sample briefing cards are now available [online](#).

Standardized briefings for FFI flights are a big step towards our goal of improved performance.

3. Taxi

Why: Correct procedural errors after entering taxi in trail

The FFI Formation Guide states:

- *If Lead taxis on centerline, Wingmen follow close in trail, about 1 plane length between planes.*
- *If Lead staggers to the left or right of centerline, Wingmen will alternately taxi on opposite sides of the taxiway, while maintaining a safe nose to tail clearance. #2 sets the spacing. #3 and #4 line up aircraft centerlines with #1 and #2 in front of them.*
- **To signal a move from stagger to trail, Lead will cycle the elevator up and down repeatedly. Wingmen pass this signal down the line by cycling their elevators in the same manner. Even the last aircraft will cycle his (her) elevator for formation integrity.**

To clarify:

- When Lead taxis on the centerline, Wingmen taxi in trail on the centerline.
- When Lead moves to one side of the taxiway with no signal, Wingmen stagger.
- Once Lead cycles his/her elevator, Wingmen fall in trail, either on or off the centerline, and follow Lead wherever he/she goes, staying in trail.
- Once the elevator signal is given, Wingmen must remain in trail unless an audible directive is received from Lead on the radio.
- An elevator signal *may*, but does not *always* mean return to the centerline. It means to fall in trail with Lead, wherever he/she goes!
- An additional emphasis item for Flight Leads in this area is to plan your taxi well ahead, and communicate your intentions via signals or radio calls. This is especially true when taxiing into the run-up area, to avoid confusion and traffic jams in the run-up area.

4. Run-up

Why: Eliminate unnecessary signaling

No run-up signals are mentioned in the Guide, so pilots should conduct their own run-up checks once they are stopped in the run-up area. In other words, Auto run-up, unless otherwise briefed.

5. Formation Takeoff

Why: Correct common positioning and procedural errors

The correct aircraft lineup on the runway is Wingman's wing leading edge aligned with Lead's wing trailing edge... no further aft than that. Not abeam the N-number. Not abeam the tail. Wingmen that fall behind during the power application should advance power and attempt to regain the correct position.

Although the Guide does not mention it, many pilots believe a "4's IN" call on the runway is required. It is not, but Lead has the option to brief this technique. It can be particularly useful in large formations, or when flying cabin-class planes like Bonanzas and Mooneys with limited visibility. It is a common briefing practice in large formations to have the Lead of the last element, or the last aircraft, call "on" or "in".

Wingmen often forget to nod their heads when ready for an Element Takeoff, leading to delays and confusion on the runway prior to departure. To review:

-When Lead is ready, he (she) looks to Wing. Wing indicates ready with a head nod.

Sometimes Wingman and Lead stare at one another for several seconds. Lead is waiting for Wingman to signal ready. Wingman is waiting for Lead to nod and release brakes. Remember, the Lead gives the run-up signal, and the Wingman nods when ready. Nod your head, Wingmen!

A head-tap by Lead prior to the big head nod and brake release is non-standard, and may confuse Wingmen.

6. Straight Ahead Rejoin

Why: Confirm and clarify standard procedure

Some pilots have believed Lead needed to specify the rejoin side for #2 in all cases. Unless briefed otherwise, #2 will ALWAYS rejoin on Lead's left wing when flying straight ahead.

7. Reform to Fingertip from Close Trail

Why: Confirm and clarify standard procedure

A combination of localisms, legacy, and manual interpretation has led to confusion on this procedure. The "Aircraft Signals" section of the Guide states:

- WING ROCK: Lead uses rapid aileron inputs to mildly rock wings. The flight will rejoin in Fingertip, from Route, Diamond, or Close Trail. If joining from wings level Close Trail, #2 is expected to join on Lead's left wing (or as pre-briefed), and #3 and #4 will always join on the opposite side. If in a turn during the wing rock, #2 would join to Lead's inside wing, #3 and #4 would take the opposite side.

Prior to the change in procedure, wingmen reformed to their previous fingertip position if Lead flew straight and level after the wing rock. This is incorrect. Unless briefed otherwise, #2 ALWAYS reforms to the left side when Lead flies straight ahead. This was done to make the procedures for a straight-ahead reform just like those for a straight-ahead rejoin.

8. Trail

Why: Clarify standard language

This term "Trail" is no longer used to describe FFI flight operations. "Close Trail" and "Extended Trail" are the only proper terms, to avoid confusion. Note that the FAA use of the term "Trail" as defined in 8900.1 most closely matches the FFI definition of Extended Trail.

9. Extended Trail Entry

Why: Confirm and clarify standard procedure, reduce risk of mid-air collision

This procedure has changed significantly.

First, Lead **must** make a radio call to announce that Extended Trail is the next maneuver, and all Wingmen must acknowledge. In the past, upon pitchout, Wingmen had no way of knowing if the follow-on maneuver would be a rejoin or Extended Trail Maneuvering, sometimes creating confusion and resulting in poor positioning. The radio call signal for Extended Trail is intended to foster safety by eliminating confusion, and ensuring everyone in the formation knows what is coming next.

Second, only level turns from Close Trail or level pitchouts from Echelon are approved for Extended Trail entry. Previously, some groups used a pop-up entry from Close Trail, and a mid-air resulted after a Wingman lost sight of the aircraft ahead. Per the FFI Formation Guide, Extended Trail entries from Close Trail must employ a low-energy turn; entries from Echelon must employ a standard pitchout.

For RVs, Lead continues the turn until #4 calls "In", which #4 should make as soon as he/she has achieved 500-1000' separation from 3. For Bonanzas and Mooneys, per their respective supplements, Lead will roll out after 180 degree turn, and 4 calls "in" when they roll out behind the other aircraft in trail. This is due to the limited visibility from the cockpits of these aircraft.

To achieve the desired 500' – 1000' spacing, a 2 second break interval is used for all Extended Trail entries.

10. Pitchout Signal

Why: Eliminate unnecessary signaling

The twirling finger and interval number of seconds are standard, passed from Lead and acknowledged by #2 with a head nod.

The pitchout signal is not passed on to other Wingmen.

Just before Lead breaks, he/she may pass a kiss-off signal to #2.

11. Overshoot

Why: Clarify procedure and reduce risk

The FFI Formation Guide emphasis items are:

- Overshoot safely
- Make an overshooting radio call
- Complete the rejoin when safe to do so.

Common errors seen recently include failure to call "Overshooting", rushing to rejoin following the overshoot, and failure of #3 and #4 to stagnate their rejoin to allow #2 to cross back inside to rejoin.

12. Lead Change

Why: Clarify minor change to standard procedure

The primary change in this procedure is the addition of guidance to allow the old Lead to simultaneously slightly adjust (reduce) power to expedite the position change, as the new Lead moves forward. This ensures there is minimal time with the old Lead looking over his/her shoulder at the new Lead, and facilitates a safe and expeditious move by the new Lead forward of the old Lead's 3/9 line.

This is important, because the old Wingman becomes the new Lead as soon as he/she acknowledges the lead change signal (visually or on the radio), and it means the new Wingman is immediately out of position, and must correct back to position. Safety and smoothness are the primary factors here.

13. Route Position

Why: Correct common positioning errors

(For RVs/Bonanzas/Mooneys) Lead's wingtip on the spinner. 2-4 ship widths.

Route Formation is a defined position, not a casual suggestion.

In the field, it has been noted that Wingmen sometimes fly too close, or too far away, and allow their aircraft to drift around the correct position far too much. On a X-C, a Lead may give Wingmen the latitude to fly a looser "X-C position", but in formation training, check rides, rehearsals and performances, Route should be flown in the defined position.

14. Ops Check

Why: Clarify standard language

The correct radio call is "(Callsign), Ops Check." Wingmen respond to the directive call with position number, then check fuel and instruments. If no problems are noted, no further radio calls are required. "Set 'em up", "4 Hours (of Fuel)", and "Green" are localisms and holdovers, and are not used during FFI flights.

An additional emphasis item here for Leads is to continue on a straight and level flight path after calling for an Ops Check. Don't immediately begin a turn, climb or descent after calling for an Ops Check (take care of your Wingmen).

An additional emphasis item for Wingmen is to maintain a scan of Lead and other Wingmen during an Ops Check. Don't fixate inside the cockpit, as you may miss the build-up of relative motion, and the loss of separation from other aircraft.

15. Overhead Pattern Radio Call

Why: Clarify standard language

To safely integrate Overhead Pattern formation flights with normal VFR traffic at uncontrolled fields, several radio calls have been added to the Guide. The intention is raise situational awareness of other pilots in the pattern, by communicating our intentions clearly. This will not only increase safety, but will prevent confusion, frustration, and irritation by others in the pattern.

All pilots must review this section of the Formation Guide to ensure compliance.

16. Formation Landing

Why: Describe best practice for wingman management, clarify standard language

If the Wingman is on the inside of the base and final turns, he/she can get "jammed", especially if Lead pulls power to idle. In this case, a breakout at low airspeed and low altitude may be the Wingman's only escape option. In addition, placing the Wingman on the inside of the turn means he/she is looking at Lead, but away from the runway, resulting in low SA.

By placing the Wingman on the outside, he/she can see the runway and Lead at the same time, resulting in much higher SA through the final turn. If keeping the Wingman on the outside of the final turn will result in being downwind of Lead at touchdown, a compromise technique is to fly a slightly longer downwind, and use the extra distance on final to cross the Wingman under once on final.

If a Wingman needs to make a radio call on landing roll to allow a preceding aircraft cross in front, the correct call is "X's Cold", not "X's Down and Slow".

After landing, Lead will gather the flight for taxi back as a flight. Wingmen will match Lead's configuration, but a thumbs up is not required or expected prior to taxi.

17. Terminate

Why: Introduce new term and associated procedures

"*Terminate*" is a FAST term a for a "soft" Knock It Off call, to signal termination of maneuvering for training reasons. It was not previously addressed in the FFI Formation Guide, but has been added to standardize terminology between formation groups.

The following text has been added to the Guide:

- *TERMINATE: The term "Terminate" is used to cease the maneuvering of all aircraft in a flight when the learning objectives have been achieved, or are not achievable. In plain language, "Terminate" is a directive call, sometimes used to cease maneuvering for reasons other than safety of flight. However, it is not expected, or desired, that Flight Leads use "Terminate" to end each maneuver during a training or evaluation flight.*

18. Breakout

Why: Introduce new term and associated procedures, reduce risk of mid-air collision

Another FAST term recently adopted by FFI is "Breakout", an immediate maneuver by a wingman to move away from other aircraft to avoid an imminent collision.

The following text has been added to the FFI Formation Guide:

- *BREAK OUT: The purpose of a Break Out is to ensure immediate separation and to avoid a mid-air collision. A Wingman MUST Break Out of a formation if:*

- *They lose sight of their formation reference aircraft*
- *They are unable to rejoin or stay in formation without crossing directly under or in front of Lead*
- *They feel their presence in the formation constitutes a hazard*
- *When directed to do so by Lead*

18. Lost Sight

Why: Confirm and clarify new standard procedures, reduce risk of mid-air collision

Procedures and discussion have been added to clarify maneuvering and radio calls required.

The following text has been added to the FFI Formation Guide:

- LOST SIGHT (Break Out required)

- If a Wingman loses sight of their formation reference aircraft while in a close formation, then a Break Out is required. To Break Out of a formation, immediately find a clear area, and maneuver towards the clear area. This clear area is the safest direction, away from the last known position or flight path of the Lead and other aircraft. In a dynamic situation, it is imperative that a Wingman that has lost sight (aka a "Blind" Wingman) not hunt for their reference aircraft; if a Wingman has lost sight, then an immediate Break Out is required. In most cases, the clear escape area is "above" the pilot, or along the aircraft's pitch axis or lift vector if the formation is not straight and level. Therefore, an "Up and Out" maneuver, away from the formation, would be appropriate. Situational awareness of where Lead and other aircraft are is critical, and formation pilots must always know where their "out" is. Be aware of Wingmen that may be affected by the Break Out; For example, if #3 in a 4-ship fingertip formation must Break Out, they must be mindful of aircraft on their wing.

- Call the Break Out and direction, "**Mustang 2, Breaking Out, up and to the right**"

- If Lead replies with "**Visual**", the Wingman will follow Lead's instructions to rejoin the flight.

- If Lead does not have visual contact with the Wingman, he/she will also call "**Blind**", and will ensure immediate altitude separation, by calling their altitude ("**Mustang Lead is Blind, 4500 feet**"). The Blind Wingman should echo the call with their altitude. Lead will cease maneuvering and put the remainder of the flight in a route position. At this point any aircraft that has the situational awareness to help the flight regain visual can make a call, i.e. "**Mustang Lead, 2 (i.e., the Blind Wingman) is at left 10 o'clock, slightly high**". Once Lead regains visual contact, they will direct the Blind Wingman as necessary to regain visual contact and rejoin the flight.

- If the Flight and the Blind aircraft do not regain visual contact, they will then work towards a common reference point (ground reference point, Waypoint, or Radial/DME) until visual contact is regained. Lead will be directive, and will ensure altitude separation is maintained until the visual contact is regained, or until RTB is directed.

- LOST SIGHT (Break Out not required)

- There may be situations where a Wingman momentarily loses sight of their formation reference aircraft while maneuvering, but a Break Out is not warranted. This occurs when spacing between aircraft is such that a mid air collision is not an immediate concern. Examples would be losing sight during or after rolling out from a pitch-out, during a rejoin, or during fluid maneuvering exercises, such as Extended Trail maneuvering.

- In these situations, when proximity does not warrant an immediate Break Out, the Blind Wingman will call: "**Mustang 2 Blind, 4500 feet**", and lag the last known position of the reference aircraft. Lead will be directive, as described above, to get the flight back together.

- If there is any question to safety of flight then the proper call is: "**Mustang 2 Knock It Off, Blind at 4500 feet**". The flight in turn will cease maneuvering, mimic the KIO call, ensure altitude separation, and remain in a predictable flight path while using the techniques described above to regain visual contact. In all cases Lead will be directive.