

SECTION 11 CATHOUSE FORMATION STANDARDS

Supplement to the T-34 Formation Flying Manual

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INTRODUCTION

Section 11 is intended to supplement the T-34 Formation Flying Manual by providing a base of procedures that all participating Grumman pilots will adhere to, unless briefed otherwise. *This section does not intend to teach formation flight.*

The following procedures are considered "STANDARD" for Grumman aircraft formations, and anything briefed as "standard" will use the formation procedures listed below. Any procedure that is "non-standard" will be fully briefed by the flight lead. These standards do not supercede the T-34 Formation Flying Manual.

(Please substitute he/him/his with she/her as appropriate.)

FORMATION CONCEPTS

Formation Flight

Definition: More than one aircraft which, by prior arrangement between the pilots, operates as a single aircraft with regard to navigation and position reporting. Separation between aircraft within the formation is the responsibility of the flight leader and the pilots of the other aircraft in the flight. This includes transition periods when aircraft within the formation are maneuvering to attain separation from each other to effect individual control and during join-up and breakaway.

The contract between a Flight Lead and his wingmen is fairly simple: the flight lead is responsible for making safe, sound decisions as to the operation of the flight to complete the intended mission. The wingman's primary responsibility is to stay in position, execute the flight lead's directives to the best of his ability, and advise the flight lead when he is unable.

Flight Lead

The biggest part of the flight lead's job is to conduct the flight within the wingmen's capabilities. Any flight lead can lose his wingman; lead's job is to keep them within the formation and safely complete the mission.

The flight lead should acknowledge wingmen's radio calls. If a wingman is directive, the flight lead should immediately execute the wingman's directives, and talk about it later on the ground. The exception would be if the flight lead has complete situational awareness and believes the directive to be in error; in this case the lead should respond to the call as such.

If a flight lead needs or wants to clear a wingman out of the flight, the call is "2, you're cleared off" (or the appropriate position number).

Wingman

The wingman should maintain flight discipline at all times. The wingman also has a responsibility to anticipate the flight lead's directives; this typically comes with experience. Wingmen should acknowledge all flight lead's directives, and in the same manner in which he received them (e.g. radio call – radio call; visual signal – visual signal).

Generally, wingmen should fly at approximately the same altitude as their flight lead (exception: fighting wing). This is especially applicable when flying at low altitudes.

The wingman should notify the flight lead of any unsafe or soon-to-be unsafe situations, like calling traffic. In a critical situation, the primary emphasis is on being *directive* (e.g. "CLIMB NOW") to avoid a possible unsafe situation.

Sometimes a wingman will be out of position. This is to be expected occasionally, and the wingman should fight to get back in position as soon as possible. Breaking out of formation, however, is a conscious choice by the wingman to leave the flight, and is to be taken very seriously. The wingman may not like what the flight lead is doing or how he is doing it, but that is *not* a reason to break out of formation. *Breaking out of formation is a last resort.* There are two times a wingman can (should) break out of formation:

- 1) He directed the flight lead to take some sort of evasive action ("turn hard right") and the flight lead did not, exposing both aircraft to an unsafe situation (typically a mid-air), or
- 2) The flight lead has exceeded the capabilities of the wingman, and the wingman can no longer maintain control and situational awareness of his aircraft.

Should a wingman ever need to break out, the call is "2's breaking out" (or appropriate position number). Once things get settled, the wingman should ask for permission from the flight lead to rejoin the flight.

While the old adage that "wingmen should be seen and not heard" is somewhat extreme, the best wingmen accomplish the mission with the minimum radio talk required.

GENERAL PROCEDURES

All formations flown are to be standard.

One pilot is designated as the flight lead, and he will designate #2, #3, and #4 as appropriate.

Formations with more than 4 aircraft will *not* be briefed as "standard".

All aircraft in the flight are on the same frequency, as designated by the flight lead.

Flight lead will check-in wingmen on all new frequencies. Wingmen should respond with their position number (e.g. "2"), in order. Wingmen should obtain appropriate information (e.g. ATIS) before checking in on the ground and before entering an airport traffic area. **Exception:** After landing all aircraft will switch to appropriate ground frequency rolling clear of the runway without instructions from lead. Lead will not check-in wingmen in on Ground frequency.

Flight lead will make all radio calls to ATC, unicoms, etc. as appropriate.

All aircraft monitor *Beachball* on radio #2, if equipped (except to obtain flight information, e.g. ATIS).

Flight lead squawks for the entire flight. Wingmen squawk stand-by. The squawk will be passed to the new lead during a lead change.

In a 4-ship formation 3 & 4 are considered a *section/element*, and make all formation position changes together.

Each individual flight member is responsible for their own in-flight checks, as appropriate (e.g. level-off, before landing).

Any aircraft experiencing an alert or emergency situation will immediately notify the flight lead (the flight lead will also notify wingmen). At that time, or anytime thereafter, the stricken aircraft can request and receive the lead of the flight, and should determine whether a chase aircraft is desired or not. Chase position will be 500-1000 feet behind and to the side of the stricken aircraft (2-ship only).

Should a wingman or a flight lead lose comm radios (NORDO), his element partner will lead him back. The NORDO pilot will give the visual signal for NORDO. If flight lead loses radios, he should pass the lead to his wingman. The (new) flight lead (with radios) will lead the NORDO back to final approach at the intended destination airport. At approximately 1 mile on final (or sooner/later as weather conditions permit), and when the NORDO aircraft is cleared to land, the flight lead will use the visual signal to pass the lead back to the NORDO aircraft, and assume the chase position. The NORDO aircraft should land normally, pull off the runway, and look for light signals from the tower (if appropriate) (the non-NORDO aircraft should inform tower of the NORDO aircraft's final destination).

GROUND OPERATIONS

After engine start, the flight lead will check-in the flight on *Beachball* before taxiing.

Flight lead will taxi at an appropriate speed which allows his wingmen to maintain position.

Flight lead will taxi on one side of the taxiway, wingmen will stagger (i.e. left, right, left, right).

The flight will line up abreast in the run-up area. Once stopped, each aircraft will perform a thorough pre-takeoff check and run-up.

No flight member will signal ready ("thumbs up") until he has received the signal from the wingman behind him.

Flight lead maintains all radio contact with ATC.

After landing, flight lead will exit the runway and allow flight to reform for taxi.

FORMATION TAKEOFFS

Flight/element lead will position his wingman on the upwind side of runway if there is a crosswind component regardless of direction of intended turn-out after takeoff (See Fig. 1). Wingmen will position themselves well forward of the fingertip line (without being line abreast).

For a 3- or 4-ship formation, #3 lines up on the same side of the runway as lead (offset slightly to either side, if possible). #4 lines up on the same side as #2, in position on #3.

When wingmen are in position and ready for takeoff, they will give a visual head nod to the flight/element lead.

When ready for takeoff, each flight/element lead will give a "run-up" visual signal to the wingman. The element will run up to ~1800 RPM with brakes locked.

The element takeoff is the standard departure method.

Element Takeoff

Element takeoffs will not be done with over 15 knots of crosswind component. Only two aircraft at a time will execute an element takeoff.

The flight lead will indicate brake release by smoothly dropping his head to his chest. Both aircraft release brakes at same time while going to takeoff power.

If wingman falls behind at full power, he states "Lead, give me one." The flight lead will reduce power slightly and continue the takeoff.

If wingman overtakes the flight lead for any reason, during any part of the takeoff roll, he states "2 (or position #) has the lead on the right (or left)" and takes the lead of the flight. Once safely airborne, and at least 500 AGL, the original flight lead will direct as required to resume command of flight.

When in 3- or 4-ship the second element will wait until the first element has lifted off before brake release (either as single ship or element formation).

Initial rejoin (See Fig. 3) and climb speed is ~100 KIAS. Flight/element lead will cross-under wingman to the inside wing during the rejoin. #4 *automatically* performs a cross-under on #3 to the proper side as #3 moves into the fingertip position on #1.

The #3/#4 element (when applicable) always joins in fingertip to the side opposite #2. #4 is always on the outside of #3. (See Fig. 3)

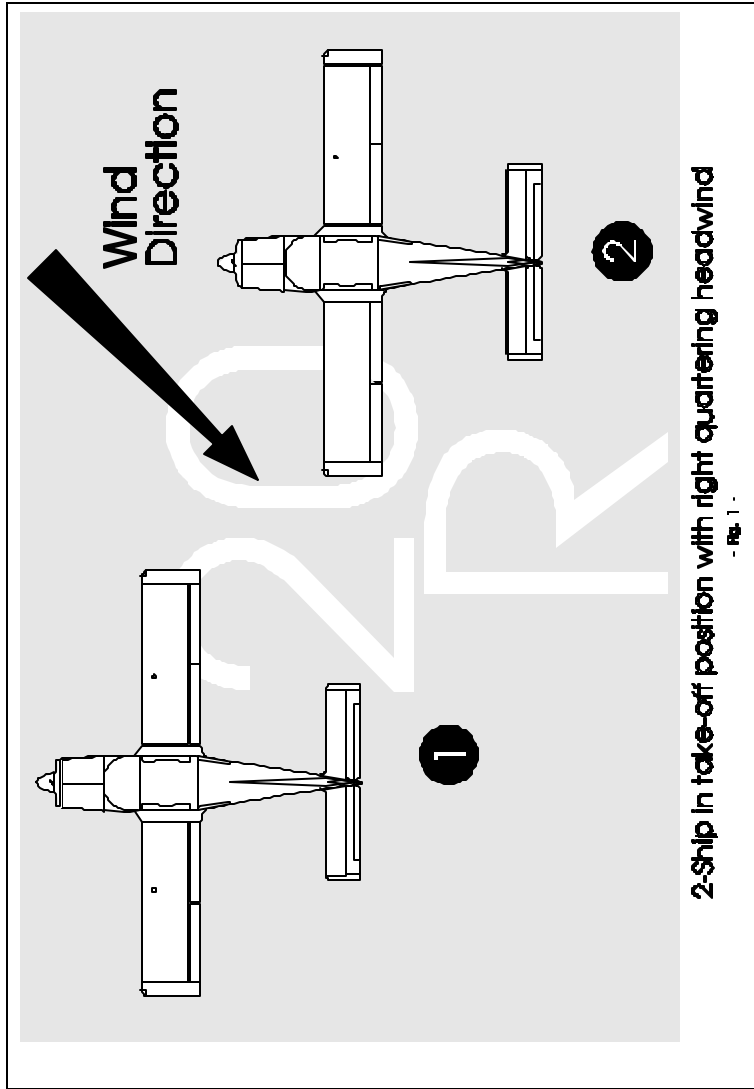
Single-Ship Takeoff

Single-ship takeoffs will be used whenever crosswind component exceeds 15 knots, the runway is less than 50' wide, or briefed by the flight lead.

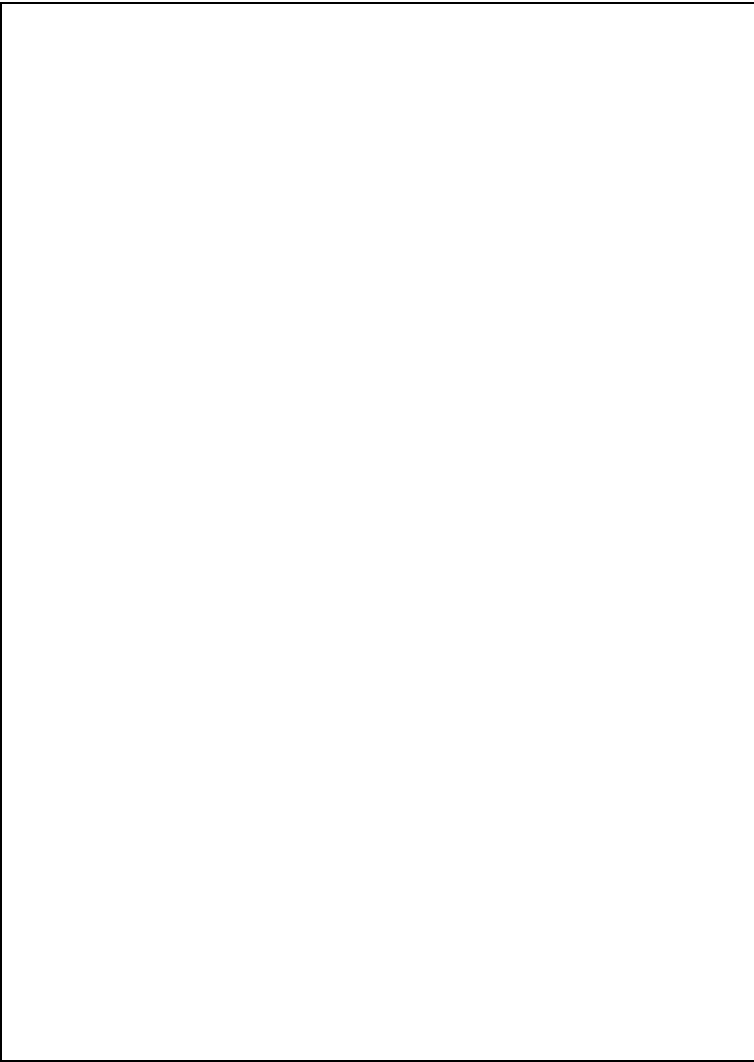
Flight lead takes off single-ship, maintaining relative side of runway.

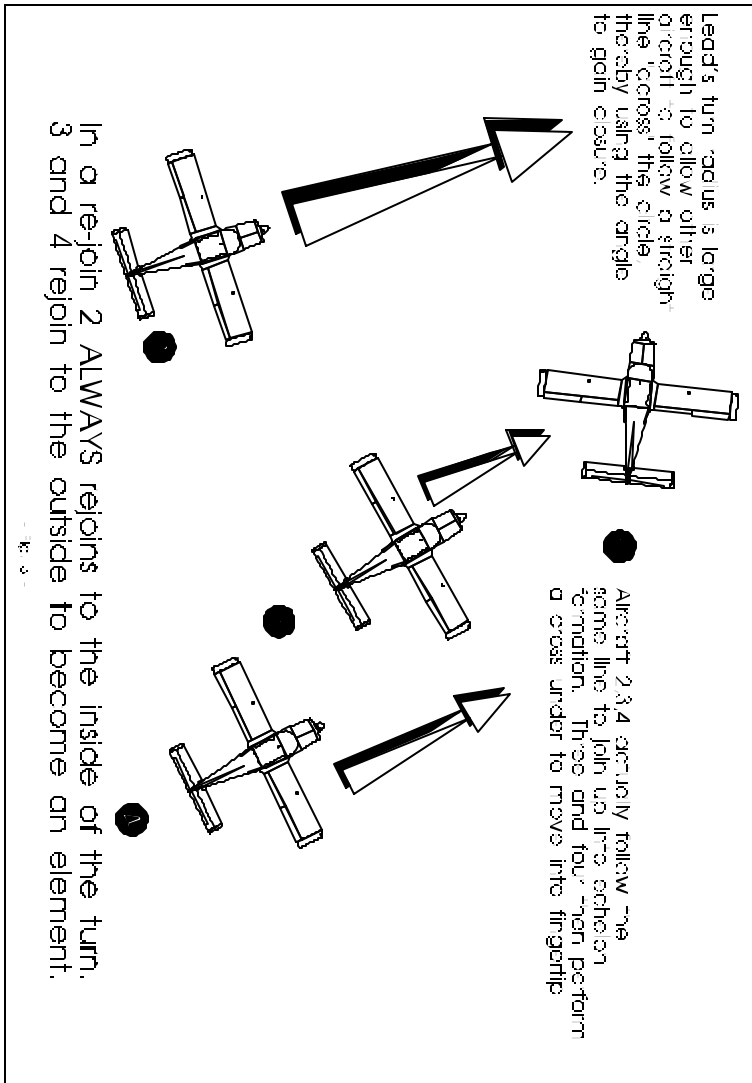
Wingmen release brakes when the aircraft in front has lifted off, maintaining their relative position on the runway.

All joinups out of traffic will be to fingertip. Flight lead holds ~100 KIAS until all wingmen are joined up. #2 *always* joins to the inside of the turn (regardless of position on runway); or if a straight ahead rejoin is executed, to the side positioned on the runway. #3 *always* joins to the outside of the turn (regardless of position on runway); or if a straight ahead rejoin is executed, to the side opposite #2. #4 *always* joins to the outside of #3 (regardless of position on runway). (See Fig. 3) Also, see "Rejoins" on page 11-11.



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LANDINGS

Single-Ship Landings

Overhead Approach (FAA definition) - A series of predetermined maneuvers prescribed for VFR arrival of military aircraft (often in formation) for entry into the VFR traffic pattern and to proceed to a landing. The pattern usually specifies:

- (1) The radio contact required of the pilot.
- (2) The speed to be maintained.
- (3) An initial approach 3 to 5 miles in length.
- (4) Two 180 degree turns with a short downwind in between.
- (5) A break point at which the first 180 degree turn is started.
- (6) The direction of the turns.
- (7) Altitude (at least 500 feet above the conventional pattern).
- (8) A roll-out on final approach not less than 1/4 mile from the landing threshold and not less than 300 feet above the ground.

The overhead approach is the standard landing method for formation flight. Flight lead will enter the pattern at 100-120 KIAS and normal pattern altitude with the formation in echelon. All turns in the overhead pattern are echelon turns.

Flight lead will give the pitchout signal 5-30 seconds before breaking to downwind. Wingmen will take 3 seconds spacing before each aircraft breaks to downwind.

Flight lead lands on either side of the runway (if possible, ~500 feet down the runway for every wingman following), usually on the downwind side of the runway. Wingmen alternate sides of the runway (if possible, ~500 feet down the runway for every wingman following).

Maintain minimum of 500' spacing between aircraft at touchdown. No radio calls are required unless a (potential) problem exists.

Element Landing

Element landings will not be done with over 10 knots of crosswind component, or on a wet runway. Only two aircraft at a time will execute an element landing.

Flight lead will position his wingman on the upwind side of the runway, if there is a crosswind component.

Flight lead will maintain 75-80 KIAS on final until the threshold. Wingman will maintain a position forward of the fingertip line and stacked level, until the threshold. Over the threshold, when safe, the wingman can pull power to idle and land, or stay with lead. At touchdown, wingman will initiate braking to increase separation from the flight lead.

The flight lead and wingman maintain their own side of the runway until a safe taxi speed is reached. The wingman should call "clear" to flight lead, if appropriate, to let lead know it is safe to move over to taxi off the runway.

IN-FLIGHT PROCEDURES

Formation Types

Fingertip - Fore/aft: front of main wheel pant touches rear of nose wheel pant; or rear corner of wingtip on the tip of nose cone (spinner). In/out: 4 feet lateral wingtip spacing. Up/down: wingman should see both bottom and top of lead's wing; or lead's gear on horizon. Used primarily for tight formation (e.g. overhead approaches, IMC) or with more experienced wingmen.



Sweet Spot – A variation of fingertip; slightly more relaxed. The leader's tail ring is superimposed on or around the far trailing wingtip. Wingtip spacing between lead and wingman is ~5 feet. Standards pertaining to Fingertip apply to the Sweet Spot.

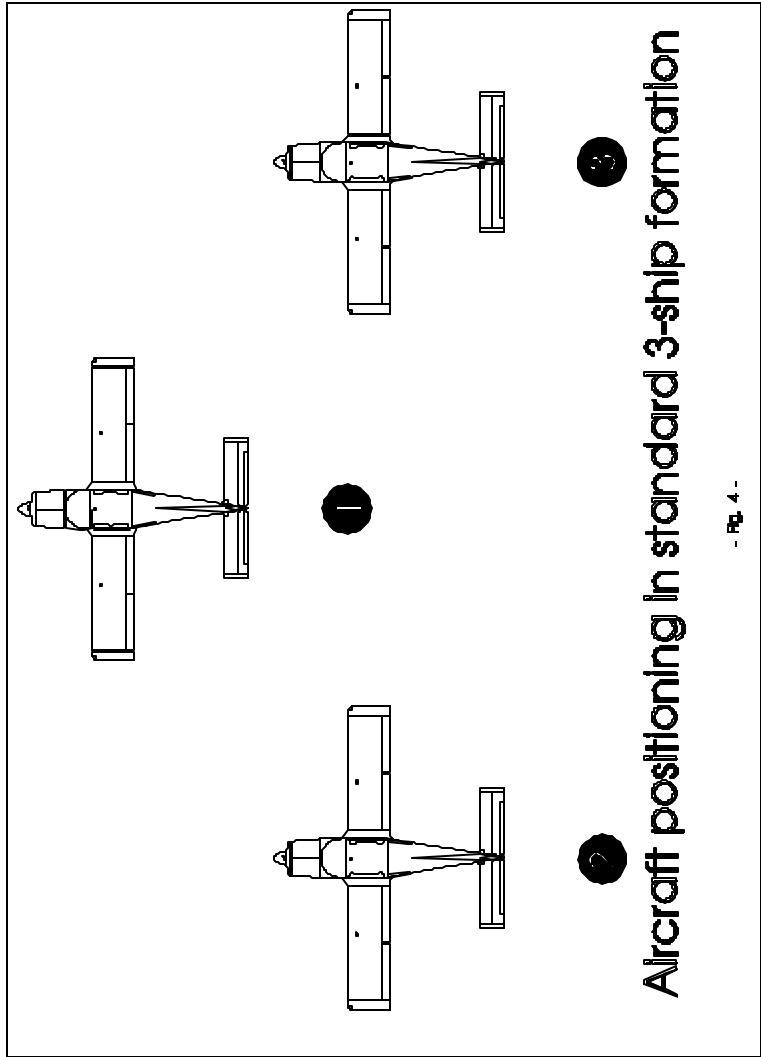


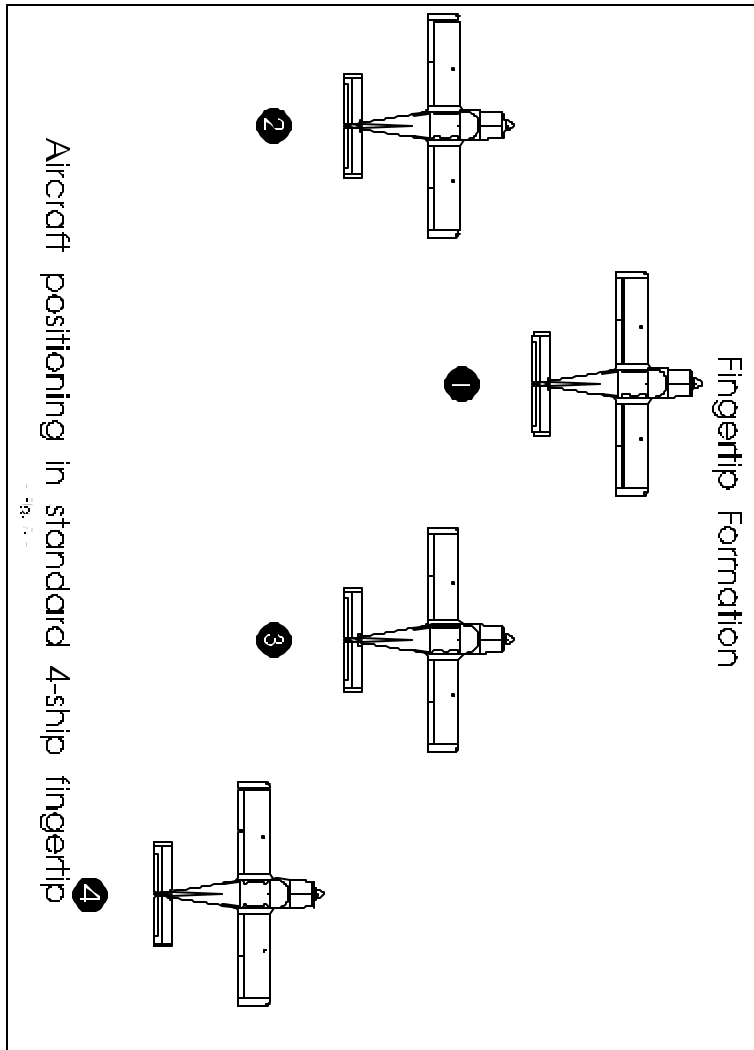
Enroute - Relaxed fingertip, flown out to 1000 feet. Fly a forward position (on or ahead of the fingertip line) where the flight lead can see you. Wingmen on the outside of a turn in enroute formation fly an echelon turn.

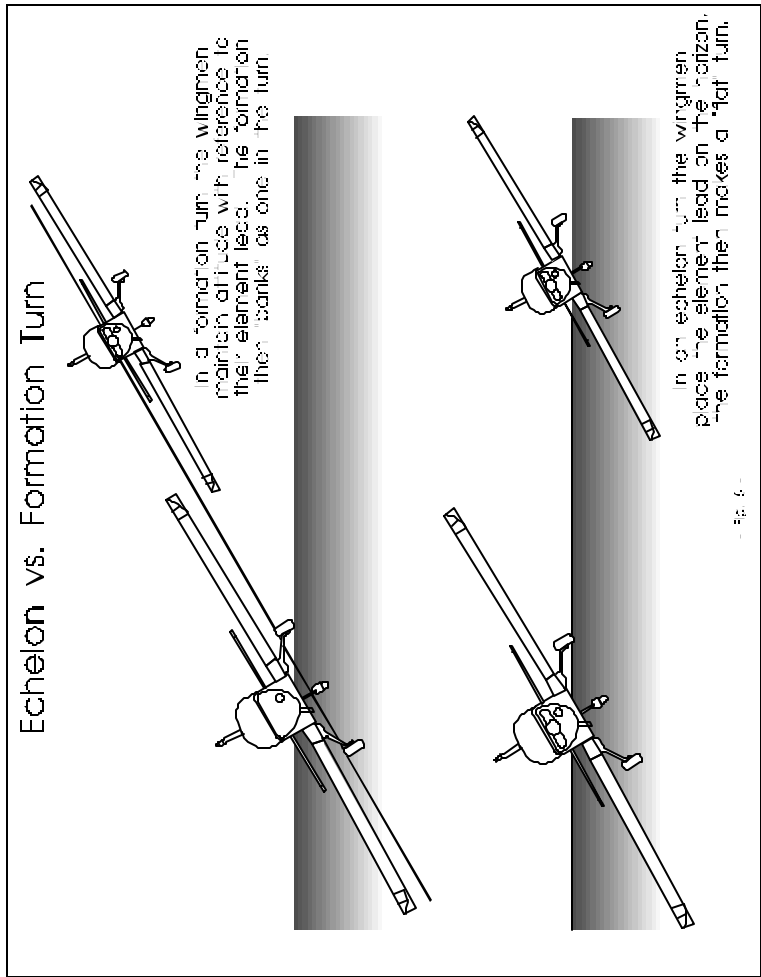
Echelon - All wingmen on the same side of the flight lead. Spacing stays the same as in fingertip or route (depending on formation being flown). All aircraft turn with the flight lead on the horizon. (See Fig. 6)

Fighting Wing - Wingman flies in a "30-45 degree cone" (off the leader's tail) 500-1500 feet out. Power is set and not adjusted by flight lead or wingman. Wingman uses angles and cutoff to maintain spacing. Wingman always attempts to fly in a position where the flight lead can see him.

Rejoin - Lead will hold cruise airspeed except on rejoins out of traffic. Wingmen will rejoin in order, all using the rejoin line off lead. When #3 or #4 gets close to #2, they execute a cross-under to get into position on the high wing.







Lost Wingman Procedures

Lost wingman procedures are only applicable in IMC or for training purposes. These maneuvers will provide adequate clearance between the flight and the lost wingman, while still remaining within protected airspace.

Whenever the wingman loses visual contact with his flight/element lead lost wingman procedures should be IMMEDIATELY executed:

- (1) Execute the required maneuvers (see below)
- (2) Notify the flight lead
- (3) Flight lead will coordinate a separate clearance for the lost flight member. Lost wingmen always maintain the assigned altitude.

Note: #4 always stays with #3, unless #4 goes lost wingman.

While Straight and Level

#2 will alter his heading 15 degrees away from the flight for 15 seconds, then correct back to the original heading.

#3 will perform the same maneuver as #2.

#4 will alter his heading 30 degrees from the flight for 15 seconds, then correct back to the original heading.

The call is "2 (or position number) is lost wingman". Lead will acknowledge with the flight's heading and altitude.

While Turning – Wingman/men on High Wing

Lead continues his turn. #2 will immediately roll level for 15 seconds before turning to the heading that the flight rolls out on.

#3 will perform the same maneuver as #2.

#4 will roll into a standard rate turn away from the flight for 15 seconds, then turn to the heading that the flight rolls out on.

The call is "2 (or position number) is lost wingman rolled out" followed by his current heading.

Lead will respond with the flight's altitude and the target heading of the flight; e.g. "Grumman flight at eight thousand turning to 290".

While Turning – Wingman/men on Low Wing

In this situation making the radio call is the first thing that the lost wingman does. The emphasis is on being directive. The call is "Lead roll out, 2 (or position number) is lost wingman".

Lead will respond by rolling level (the remainder of the flight rolls out with lead), and acknowledges with the flight's altitude and current heading.

#2 will continue the turn for an additional 15 degrees, fly that heading for 15 seconds, then turn to the same heading as the rest of the flight.

#3 will perform the same maneuver as #2.

#4 will steepen his turn away from the flight and turn for an additional 30 degrees, fly that heading for 15 seconds, then turn to the same heading as the rest of the flight.

While Inside Final Approach Fix

If any member of the flight goes lost wingman on an instrument approach inside the final approach fix the lost wingman immediately 1) climbs to FAF altitude and 2) executes the published missed approach procedure upon reaching the MAP.

Visual Signals

Visual signals will be used as much as practical, to hold down radio chatter and to develop better formation skills.

The wingman should respond to a signal by the flight lead in the same manner as the flight lead gave it to him. If the flight lead uses a visual signal, the wingman responds with a visual signal (as appropriate). If lead uses the radio, response (as appropriate) is by radio. If a wingman (or flight lead) misses or does not understand a visual signal, he shakes his head, like saying "no". This says that he did not get the signal, and requests the signal to be sent again.

The flight lead should hold the visual signal so it is prominent to the wingman. One of the best places is over the instrument panel, above the glare shield, on the same side as the wingman.

Lead Change – See T-34 FFM. Original flight lead reduces power to facilitate the lead change. The lead is changed when the wingman acknowledges the signal (or radio call). (See Fig. 7 and 8)

Rejoin/rendezvous – See T-34 FFM. Always indicates a rejoin to fingertip. Rejoins should be executed along the fingertip line.

Enroute/combat spread – See T-34 FFM. This visual signal technically means "loosen the formation", which we define as "enroute" position.

Fighting Wing - With thumb outstretched from fist, move fist over shoulder several times (as in a hitchhiking motion).

Perform Checklist (level-off, before landing, etc.) - Lead makes a "check" signal with the index finger and thumb (90 degree angle). Not normally used for an "Ops Check".

Ops Check – This is a radio call (only) from lead to the wingmen directing them, at their earliest convenience, to check the operations of their aircraft systems; fuel quantity, fuel balance, engine instruments, etc. Wingmen should acknowledge the directive as normal, e.g. "2".

Cross-Under – See T-34 FFM. (Fig 9-10)

Echelon Turn - The index finger and little finger pointing up (like “landing lights on”), moving between vertical and horizontal several times. Note: not needed when in echelon formation (3 or more aircraft); all turns are echelon turns in this situation. (See Fig. 6)

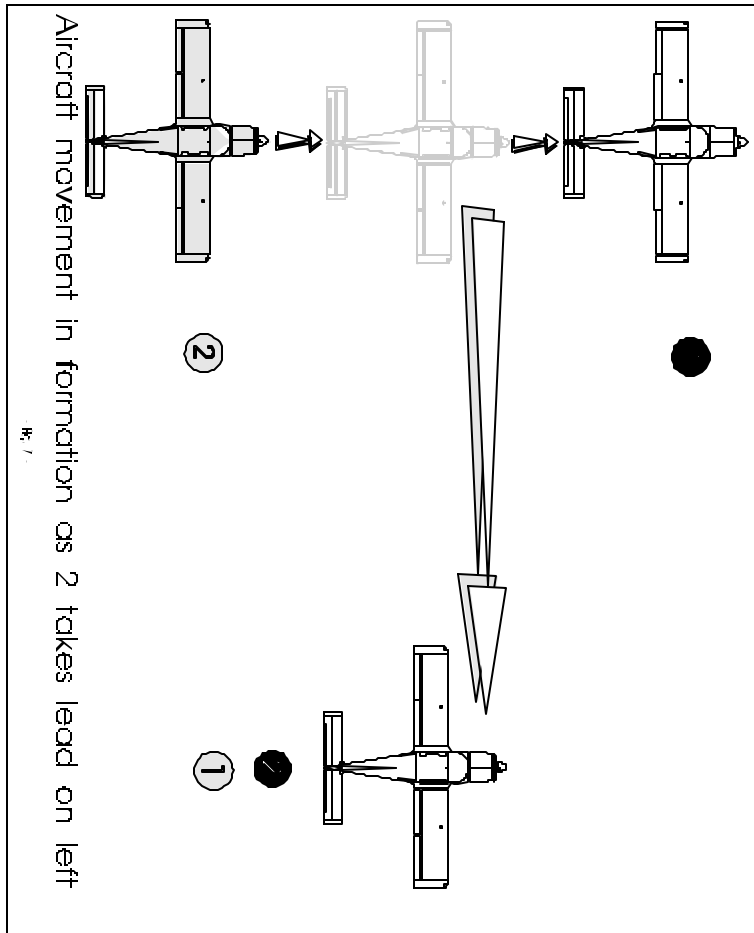
Lost Radios – See T-34 FFM.

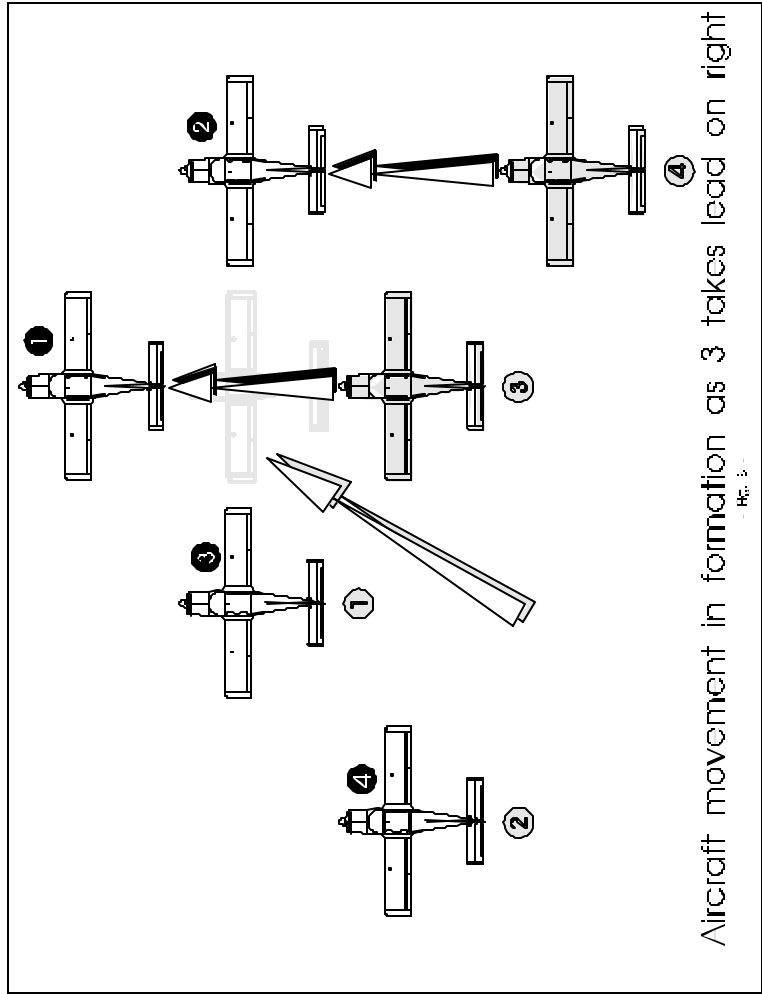
Numbers - See T-34 FFM. All numbers are made with one hand. 1,2,3,4,5 are indicated by using the appropriate number of fingers, holding them straight up. 6,7,8,9 are indicated by holding fingers horizontal, and adding 5. 0 is indicated with a closed fist. Typically used for frequency changes when discretion is wanted.

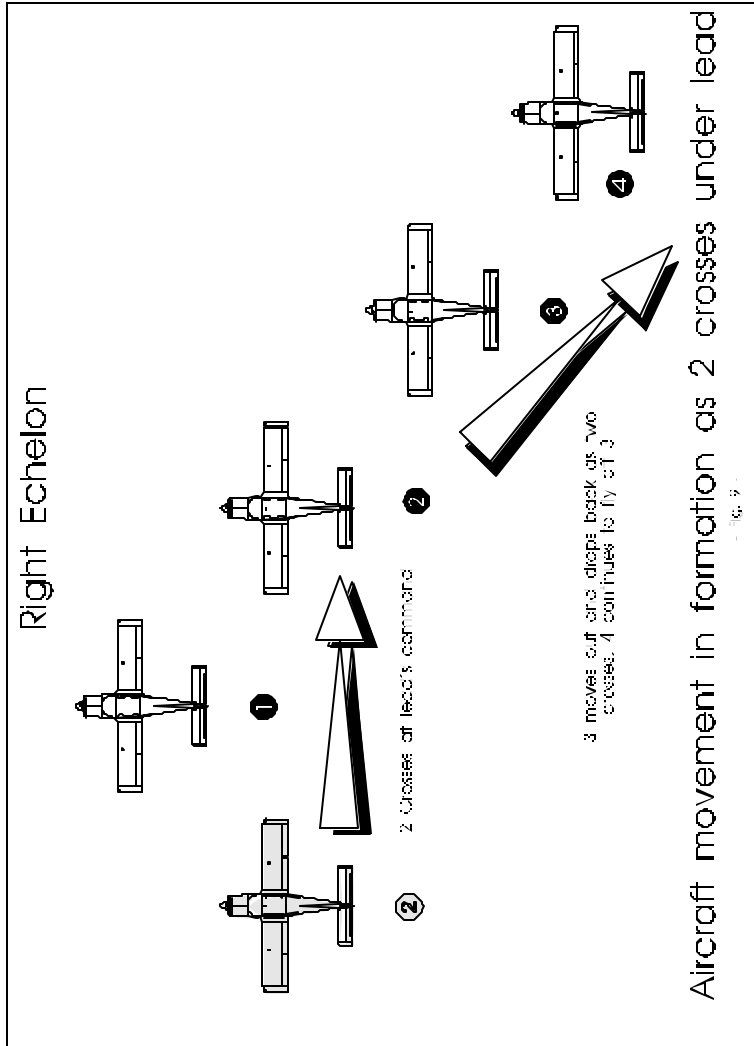
Frequency Change – See T-34 FFM.

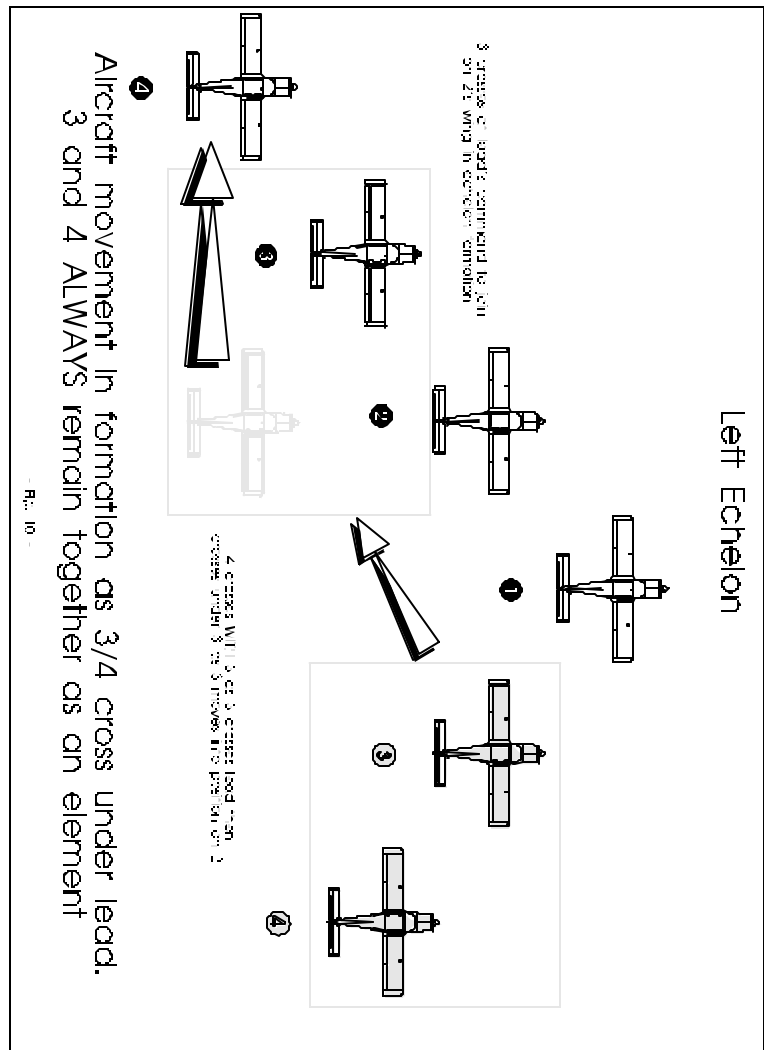
Pitchout/Run-up - See T-34 FFM. Pitchout interval is 3 seconds.

Flaps – See T-34 FFM for hand signal. Flap actuation is in two steps. The first time lead gives the flap signal and head nod, it is for ½ flaps (approximately 3 seconds actuation time). The second signal indicates to the wingman to go to full flaps.









Standard Phraseology/Glossary

Beachball – the radio frequency 123.45.

Bingo - Aircraft has reached a fuel state where any delay in reaching the destination will result in a minimum fuel state.

Blind - I do not see the aircraft (in our flight).

Chase - A position well clear of a stricken aircraft, 500-1000 feet behind and to the side. The chase aircraft acts as safety observer for the stricken aircraft, and is available should he be called upon.

Check-In – the procedure where each aircraft in the flight checks in to Lead with their corresponding position number, in order.

Cross-under – a formation maneuver where a wingman/wingmen will cross under and slightly behind his lead aircraft and take position on Lead's other wing.

Directive - a radio transmission from a member of the flight to another to take action. This should be used to notify any flight member of any unsafe or soon-to-be unsafe situations, like avoiding traffic.

Element/Section - 2 aircraft operating as a unit, as in #1-2 and #3-4. #3 is considered an element lead in a 4-ship (but is not the flight lead).

No Joy - I do not see the aircraft (not in our flight).

NORDO – no radio. A condition where an aircraft has lost use of the communications radios.

Overhead Approach (FAA definition) – A series of predetermined maneuvers prescribed for VFR arrival of military or Grumman aircraft (often in formation) for entry into the VFR traffic pattern and to proceed to a landing.

Sturdy Landing – Alternative to landing on alternating sides. All aircraft land on the centerline. When under control, move to the same side of the runway as the flight lead. Any aircraft that has a problem uses the opposite side of the runway as lead.

Tally (Tally-ho) - I see the aircraft (not in our flight).

Visual - I see the aircraft (in our flight).

Many thanks to the Lunken Cathouse Gang.
In memory of Jon Maestre. May we all fly in formation together again.