**PRIMARY FORMATION**

**INTRODUCTION**

"Section," is a formation of two aircraft, Lead and Wingman**.** Three or four aircraft is a "Division.”

**Lead's Responsibilities:**

1. Be a smooth, stable platform for Wing.

2. Keep the flight within the proper operating area and comply with local course rules.

3. Keep the flight clear of clouds and other aircraft.

4. Always be aware of the position of Wing.

5. Meet the mission objectives in a safe, efficient manner.

**Wing's Responsibilities:**

1. Always maintain the position signaled by Lead (parade, cruise, etc.).

2. Keep Lead in sight.

3. Comply with all signals given by Lead and, be prepared to give a timely response signal.

4. Maintain situational awareness of what is going on and be prepared for upcoming events.

**GROUND PROCEDURES**

During the Prestart Checklist, **navigation lights will be on bright**. **Taxi in a trail position**

**11-Point Inspection:**

1. Prop Out of Feather 7. Flaps Retracted

2. Engine Cowlings Secure 8. All Antennas Secure

3. Canopies Closed and Locked 9. Horizontal and Vertical Stabilizers

4. All Panels Secure 10. No Visible Leaks

5. Proper Extension of Struts 11. Navigation and Strobe Lights On

6. Proper Tire Inflation

**RADIO FREQUENCY CHANGES**

1. Give the command to go to the new frequency (visually or on the radio).

2. Check in Wing on the new frequency.

3. Talk to the new controller (if necessary).

**INTERVAL TAKEOFF**

**Lineup.** Wingman into the wind, with the leading edge of his wing aligned with the trailing edge of Lead's same-side elevator

**Runup and Takeoff.** Lead will pass the runup signal, and wing will acknowledge. Both aircraft will set 500 ft-lbs and check for safety of flight items. When Wing is ready for takeoff, he will do a **quick** visual inspection and pass a thumbs-up (if OK) to Lead. Lead will return the thumbs-up in response, look forward, pass the "kissoff” signal, and proceed with a normal takeoff maintaining his side of the runway. Wing will count five seconds (300 feet of separation) and then proceed with a normal takeoff.

**RUNNING RENDEZVOUS**

Primarily a “power rendezvous” in which aircraft take off in order and effect a join up on departure.

**The Leader.** After takeoff, Lead will fly the departure in accordance with local course rules and concentrate on maintaining a stable platform. Above 300 feet AGL, Lead should retard the power to 850 ft-lbs (max) to allow Wing a closing advantage during the climbout. If a turn is required prior to the Wingman rejoining, then Lead will use no more than 20º of bank. Lead should make all power adjustments at a slow constant rate.

**The Wingman.** Once safely airborne, adjust the angle of bank as necessary to establish the aircraft inside Lead's turn, maintaining Lead slightly above the horizon. Once Lead is rolled out, maneuver to put Lead at the 11 o'clock position with at least 20 feet of stepdown (Lead's wing should initially cover the exhaust stack). Use power (reference airspeed) to control the closure rate. Use about 10 knots difference per T-34C length as a guide, and **do not exceed 170 knots during the Running Rendezvous.** At approximately three plane lengths out (when you can read the "Navy/Marines" on Lead's aircraft), move to and then stabilize beneath the starboard parade position with 20 feet of stepdown. **In the 20 feet of stepdown position, the** “**ventral point**” **will be over the opposite** “**cutout,**” **with the** “**prop arc**” **under the** “**midpoint**” **of the starboard wing, and the trailing edge of the starboard exhaust stack tangent to the leading edge of the starboard wing.** After stabilizing in this position, simultaneously add a small amount of power and back stick pressure to move up into the starboard parade position.

**Underrun.** If the Wingman fails to recognize a rapid closure rate and is unable to stop beneath the parade position, the underrun procedure shall be executed. During the underrun, Wing should maintain adequate stepdown and keep Lead in sight. (**See Section 313 for the underrun procedures).**

**PARADE POSITION**

The parade position is defined as “a fixed position on the 45º bearing line on either the port or starboard side of Lead.” **The parade position is described as approximately 10 feet of stepdown beneath the leader, 20 feet of nose-to-tail clearance, and 4 feet of wingtip separation. If positioned properly for the parade position, the Wingman will see Lead's prop arc bisecting Lead's inboard wing (the** “**midpoint**” **of that wing), the** “**ventral point**” **on the opposite aileron cutout, and the exhaust stack hidden by the wing**. Wing must strive to always “zero out” the relative motion between aircraft.

**RELATIVE MOTION**

Wing's goal is to stop all relative motion between aircraft. Consider Lead as fixed in space and any movement between aircraft is considered as movement of the Wingman in relation to the Leader. **Scan Lead's entire aircraft, don't just use the ventral point, prop arc, and exhaust stacks.** Primarily, elevator controls vertical movement, power controls fore and aft movement, and aileron controls lateral movement.

**FLYING PARADE AS WING, ERROR DETECTION, AND CORRECTION**

Each correction actually requires three separate actions: one to initiate movement toward the desired position, one to arrest the aircraft's momentum once the position has been achieved, and finally one to maintain the desired position. Ideally, error corrections should be frequent and relatively small, requiring only slight stick pressures and minimum PCL movement. It is imperative the aircraft be properly trimmed. **Wing should correct position errors in three distinct phases: first for stepdown, second for bearing, and third for relative closeness.** As proficiency increases, the Wingman will be able to correct for all simultaneously.

1. **Stepdown.** Corrections for stepdown are accomplished primarily by fore and aft stick pressure. If stepdown is insufficient, then the "cutout" will be hidden by the lead aircraft's fuselage and the exhaust stack will be visible above the wing. Insufficient stepdown is a potentially dangerous condition and should be corrected immediately with slight forward stick pressure. If the Wingman's stepdown is excessive, there will be sky visible between the "ventral point" and the "cutout”, and the exhaust stack will be visible under the wing. Use slight back stick pressure to correct for excessive stepdown.

2. **Bearing.** Properly aligning the “ventral point” on the aileron cutout and the prop arc bisecting the inboard wing will line up the wing aircraft on a 45º bearing from Lead. A condition where Wing is incorrectly positioned aft of the bearing is referred to as “sucked.” The condition where Wing is incorrectly positioned forward of the bearing, is referred to as "acute." To correct bearing, first ensure the stepdown is correct and then position the aircraft to the bearing line and stabilize. Once stabilized, utilize a combination of power and aileron to maintain that bearing line while correcting for relative closeness.

3. **Relative Closeness.** Once stepdown is achieved and bearing established, determine relative closeness by scanning Lead's entire aircraft, not just the prop arc over the midpoint. Use aileron and power to move up and down the bearing line to set the proper distance from Lead.

**DEPARTURE**

**Lead.** Lead is responsible for getting the section to and from the area safely. Lead should make all power adjustments at a slow constant rate and use the parade rate of roll for turns. Lead will initiate a smooth level off approximately 200 feet prior to the desired level off altitude and **will smoothly establish 150 KIAS (approximately 630 ft-lbs) entering the working area.**

**Wing.** After takeoff, the Wingman's primary goal is to get into and maintain position as expeditiously and safely as possible. Wing should maintain situational awareness through the departure to help anticipate transitions and maintain position.

**FUEL CHECK**

As a minimum, fuel checks will be accomplished as a section at the following times:

1. On the departure phase, before commencing the area work.

2. At least once during the first parade profile.

3. After the lead change.

4. At least once during the second parade profile.

5. Before commencing the recovery phase.

**Lead**

1. Lead will check Wing in position and pass the fuel check signal.

2. After Lead passes the signal, he will look at Wing for a head nod acknowledgement.

3. Lead will check engine instruments, fuel quantity, and position within the area (IGP).

4. Lead will allow Wing enough time to complete the fuel check before continuing the profile.

**Wing**

1. Wing will acknowledge the fuel check signal with a head nod when Lead looks.

2. Wing will check engine instruments, fuel quantity, and ball centered (IGB). Wing must “time share” his attention between flying formation and cross-checking the instruments.

**THE PARADE SEQUENCE**

1. Fuel Check

2. Parade Turn Exercise (four turns, 180 deg min each)

3. Crossunder (R to L)

4. Parade Turn Exercise (four turns, 180 deg min each)

5. Crossunder (L to R)

6. Fuel Check

7. Breakup and Rendezvous Exercise

8. Cruise Turns (only F4004 and F4005)

9. Lead Change

**Lead**. Lead is responsible for completing the maneuvers in the Sequence and should always consider area management, winds, and weather to develop an efficient flow and minimize any wasted time or extra turns.

**Wing**. Wing's job in the area is to maintain the position commanded by Lead at all times and to execute Lead's commands as safely and expeditiously as possible.

**PARADE TURN EXERCISE**

A series of four turns (minimum of 180º each) per side, in sequence, and in alternating directions.

**Lead.** Lead should hold airspeed throughout and make small, smooth torque adjustments as necessary to maintain airspeed if altitude deviations occur. Lead will utilize the **parade rate of roll (rolling at a rate that achieves 30º angle of bank after 30º of turn)**. Turns can be continuous or "linked" after F4002.

**Wing.** Wing is required to maintain a fixed position in relation to Lead.

**Turns Into Wing**

As Lead rolls into an angle of bank, Wing will match Lead’s angle of bank and **maintain the same parade references as straight and level flight**. The difference is that *the Wingman is on a slightly shorter turn radius than Lead*. To roll about the Lead's longitudinal axis, Wing will initially have to lower the nose slightly while reducing power and matching Lead's roll rate. To roll out, Wing will need to add a small amount of power while pulling the nose up slightly to maintain the parade checkpoints.

**Turns Away From Wing (VMC)**

As Lead rolls into bank, Wing will match Lead's rate of roll and rotate about his own longitudinal axis. Place the underside of Lead's fuselage on the horizon and keep the ventral point over the opposite wing aileron cutout. Once the turn is established, Wing is now on a longer radius of turn than Lead and will have to use a combination of power, aileron, and a small amount of back stick pressure to maintain position. When Lead initiates the rollout, Wing will need to match his roll rate (turning about his own longitudinal axis) and reduce power as necessary. As Lead approaches wings level, focus on reattaching the cutout over the ventral point.

**Forty-Five Degree Angle of Bank Turns**

Lead should use a slow, smooth roll rate. As Wing, the errors will show up a little faster, so deviations and corrections must be more aggressive. The references are exactly the same as the 30º angle of bank turns.

**CROSSUNDER**

**Lead.** Lead will maintain a steady platform during the crossunder.

1. Check Wing is in position and area clear.

2. Pass the Crossunder signal and receive acknowledgement from Wing.

**Wing.** Wing should cross under using straight lines. Keep relative motion slow and controlled.

1. Observe the signal Lead passes and acknowledge with a quick head-nod.

2. Stabilize in the parade position.

3. Increase stepdown to 20 feet by using slight forward stick pressure (reduce power as required) to descend straight down until the trailing edge of the Lead's exhaust "stack" on your side is tangent to the leading edge of that wing and the ventral point is directly over the cutout.

4. Once stabilized with 20 feet of stepdown, make a slight wing dip towards Lead moving slowly to the other side. Adjust power as necessary to ensure you move straight across to the other side WITH 20 feet of NOSE-TO-TAIL CLEARANCE. At no time should Wing's nose be under any part of Lead's aircraft. The crossunder rate should be no faster than a walking pace.

5. Arrest lateral motion with a slight wing dip toward lead approaching the opposite bearing line. Momentarily stabilize with 20 feet of stepdown on the opposite bearing line.

6. Use slight back stick pressure and add a little power to move your aircraft straight up into the parade position on the new side of Lead.

**BREAKUP AND RENDEZVOUS EXERCISE**

**Radius of Turn.** An aircraft's radius of turn is a function of bank angle and airspeed. Higher bank angles have a shorter turn radius and lower bank angles have a larger turn radius. An aircraft at 20º of bank at a high airspeed is going to have a much larger turn radius than one at a slower airspeed.

**Bearing Line.** Bearing line is a coordinate system referenced from Lead's tail. The convention is that Lead's tail is 0º and Lead's nose is 180º.

**Pursuit Curves. I**f Lead is in a turn and the nose of Wing's aircraft is pointed ahead of Lead's aircraft, closure is generated, ultimately resulting in Wing passing in front of Lead; we call this "lead pursuit". If Wing points the nose of the aircraft behind Lead while in a turn, then closure on Lead should slow and Wing should pass behind Lead, this is "lag pursuit". Finally, if Wing points the nose of the aircraft directly at Lead, only a small amount of closure will be created and we call this “pure pursuit".

**Breakup and Rendezvous – Lead:**

1. Set 150 KIAS, check Wing in the proper position, on the appropriate side, and the area clear.

2. Give the break up and rendezvous signal and look for Wing to acknowledge.

3. Give the kiss-off signal.

4. After kissing off Wing, Lead breaks away at 45º AOB for a minimum of 180º (may use more as required for area management) of turn while maintaining airspeed and altitude.

5. Five degrees prior to the desired heading, Lead will roll out sharply to indicate the new heading.

6. Once wings level, correct airspeed (150 KIAS) and altitude if required. After stabilizing, time for a minimum of 20 seconds (more time may be necessary for area management).

7. When timing is complete, Lead will "flash" by banking the wings up to at least 45º AOB in the direction of the rendezvous (either left or right) and then reset the bank angle to 20º. Ideally, Lead will not manipulate power throughout Wing's breakup and rendezvous practice.

8. Monitor Wing during the rendezvous.

**Breakup and Rendezvous - Wing:**

Apply the concepts of radius of turn, bearing lines, and pursuit curves.

1. Respond to Lead's breakup and rendezvous signal with a head-nod.

2. As Lead passes abeam after the kiss-off and break, Wing will break using a maximum of 60º AOB while maintaining 150 KIAS and keeping Lead on or slightly below the horizon.

3. Wing's goal is to establish 800 – 1000 feet of separation and then use pursuit curves to stay there. The further Wing's nose is pointed behind Lead's, the more rapidly his nose-to-tail distance will increase and vice versa.

4. To maintain 800 - 1000 feet of separation once established, Wing shall place Lead at his 11 or 1 o'clock position until rollout.

5. When Lead rolls out of turn, Wing shall maneuver to place lead at his 12 o'clock, slightly below the horizon. At this point, wing must **aggressively** correct to 150 KIAS and ensure a stable power setting prior to Lead's initiation of the rendezvous.

6. When Lead flashes his wings and sets the turn direction, Wing will use 30º of bank to maneuver inside Lead's radius of turn (lead pursuit) **while holding Lead on the horizon**. Hold 30º of bank until you arrive on the 45º bearing line (when Lead's vertical stabilizer **BISECTS** the opposite wing).

7. After arriving on the 45º bearing line, Wing should anticipate intercepting the 60º bearing line by shallowing his AOB towards wings level. He must reduce his AOB prior to reaching the rendezvous bearing to avoid going acute. When Wing arrives on the 60º bearing line, he should begin to align his fuselage with Lead's.

8. Wing now must use the concepts of radius of turn, bearing lines, and pursuit curves to effect closure and complete the rendezvous. The goal for Wing is to hold Lead on the horizon, maneuver on the 60º bearing line until within one wingspan of Lead, and then execute the joinup phase.

Wing will not change power until:

1. The join-up phase begins.

2. An underrun is required.

3. 'Hung" or "stuck" on the bearing line as a result of airspeed deviations.

Wing must hold Lead **on the horizon** throughout the rendezvous. If the horizon is not clear, center Lead's opposite wingtip on the tip of the vertical stabilizer to set altitude. If Wing does not maintain altitude, Wing's airspeed will change, making it more difficult to maintain the bearing line.

Wing must adjust his angle of bank to maintain the 60º bearing line (hold Lead's vertical stabilizer on the opposite wingtip) and create closure towards Lead. The closure should be at a "walking speed." If Wing is acute, there will be space between Lead's wingtip and vertical stabilizer. Wing should correct back to the 60º bearing line by **decreasing** bank angle a small amount. If Wing is sucked, Lead's vertical stabilizer will be inboard of the wingtip. Wing should correct back to the 60º bearing line by **increasing** bank angle a small amount. Wing's should recognize deviations early and make small corrections to altitude and AOB as required. Wing shall not use more than 150 KIAS for the rendezvous unless hung on the bearing.

9. As Wing approaches Lead on the 60º bearing line, Wing should place the fuel cap of the opposite wing above the UHF antenna (dot the UHF antenna with the fuel cap). Monitor closure, because any corrections to AOB will take effect quickly. If Wing becomes “hung” on the bearing line, it is OK to add a 25-50 ft-lbs.

10. The joinup phase begins when a T-34C wingspan will no longer fit between Wing and Lead. The joinup phase should be at a slow and controlled rate of motion. If closure is slightly fast, Wing may need to begin the joinup phase early (two wingspans out). Execute the joinup phase by **simultaneously:**

a. Lowering the nose to establish **20 feet of stepdown** (exhaust stack tangent to leading edge of the near wing).

b. Adjusting power to maintain **20 feet of nose-to-tail distance** (the “VY” in NAVY or the “NES” in MARINES should be underlined with the ventral fin).

c. Adjust angle of bank to **establish the aircraft directly under** the pitot tube. As you approach the joinup position, match Lead's angle of bank in order to **stabilize momentarily** in the joinup position with 20 feet of stepdown, 20 feet of nose-to-tail separation, and directly under either the pitot tube.

d. Once stabilized in the joinup position, move out and up to the turn away position by adjusting angle of bank to cross laterally beneath and behind Lead to the outside of the turn at a slow and controlled pace.

e. Once on the outside of the turn, add power and back stick to move up into the normal turn away reference.

**RENDEZVOUS UNDERRUN**

Wing will initiate an underrun when any of the following situations occur:

1. If Wing becomes **excessively acute** (ahead of the 60º bearing approaching the abeam position of Lead).

2. If Wing gets **acute in close** to Lead and is too close to make angle of bank corrections.

3. If Wing experiences an **excessive closure rate**.

4. Whenever **Wing is uncomfortable** and in his judgment an unsafe situation has developed.

**Underrun Procedure**

If Lead is wings level, underrun by simultaneously executing the following steps:

1. **LOWER** the nose to maintain stepdown.

2. Reduce power to **IDLE** to avoid passing ahead of Lead.

3. Move further to starboard to obtain additional **LATERAL SEPARATION**.

If Lead is in a turn, underrun by simultaneously executing the following steps:

1. **LOWER** the nose to obtain at least 20 feet of stepdown.

2. **LEVEL** your wings and move to a position outside the Lead's radius of turn.

3. Reduce power to **IDLE** to avoid passing ahead of Lead.

4. As you pass Lead's tail, begin to match Lead's angle of bank. When relative motion is controlled, as noted by an absence of closure with Lead, join to the turn away reference.

**LEAD CHANGE PROCEDURE**

If at any time there is confusion about who is in the lead, utilize the radios to identify the leader.

**Lead Change Signal**

1. Lead will establish the section in a location where the lead change has enough room to occur.

2. Lead will check Wing in position on the **right side** and check the area clear.

3. Lead will initiate by patting the **right side** of his helmet three times with his **left hand** while looking forward.

4. Lead will pass the lead by pointing his **left hand** to Wing once.

5. Wing will accept the lead by patting the **left side** of his helmet once with his **left hand** and giving a single chopping motion. If Wing shakes off or does not acknowledge the signal, Lead will maintain lead position and repeat the signal.

**Lead Change Procedure**

1. Establish 20 feet wingtip clearance by using a **slight** wing dip away from the new leader.

2. Arrest lateral motion with a **slight** wing dip toward the new leader.

3. Establish 20 feet of step-down and slide aft in one fluid motion by lowering the nose and reducing power.

4. Arrest descent by raising the nose slightly and continue to slide aft, allowing the pitot tube to slide forward along the bottom edge of the black portion of the engine cowling.

5. Add power to stop with 20 feet of nose-to-tail separation as the angle of attack (AOA) probe intercepts the "prop arc" and the "V" in NAVY appears above the "cutout" (or “N” in MARINES). Place the trailing edge of the port exhaust stack tangent to the leading edge of the wing to ensure 20 feet of stepdown.

6. Make a normal crossunder to the starboard parade position with 20 feet of stepdown.

7. When stable, move up into the starboard parade position.

**Recovery Phase**

1. Fuel Check

2. Obtain Automatic Terminal Information Service (ATIS)

3. Descent and Level Off

4. Homefield Entry

**THE DESCENT**

**Lead**

1. Clear area and give Wing a "fuel check." Descend and intercept course rules VFR.

2. Ensure the formation has the current ATIS information.

3. Lower nose smoothly and accelerate to 200 knots. 5 knots prior, slowly retard the power to 400 ft-lbs.

4. Begin the level off 200 feet prior to the desired altitude and advance power as required for 170 KIAS.

**Wing**

1. Execute the "fuel check" when commanded by Lead.

2. Maintain the position throughout the recovery.

**HOMEFIELD ENTRY**

1. The homefield entry will be conducted in accordance with local course rules.

2. Ensure Wing is properly positioned for the break.

3. Be aware of the reduced maneuverability inherent in a formation flight.

**THE BREAK AND LANDING**

1. Conducted IAW local SOP. Lead will pass Wing the “kiss-off” signal just prior to commencing his break.

2. Once Lead breaks, Wing must quickly resume a VFR scan and will break when abeam Lead.

3. **Lead will fly a no-flap pattern and landing and Wing will fly a full-flap pattern and landing to help build spacing between the aircraft.** Wing is responsible for ensuring at least 1500 feet of separation.

**FORMATION EMERGENCIES**

The emergency aircraft will always **initially** have the lead, and the non-emergency aircraft will assume the Chase position (same as Cruise, but stepped up on Lead) to keep an eye on, provide mutual support for, and not distract Lead. Preferred method to swap lead in an emergency is to use the radios.

**INTERVAL TAKEOFF ABORTS**

**Lead.** If Lead aborts the takeoff, he will remain on his respective side of the runway and immediately transmit “**[tactical call sign], abort, abort, abort**. The Wingman will abort behind Lead, also maintaining his side of the runway.

**Wingman.** If Wing aborts the takeoff, he will remain on his side of the runway and execute the aborting takeoff procedures. Once the Wing has his aircraft under control and Lead is safely airborne, notify Lead via the radio.

**SECTION PEL**

Lead should fly his best possible individual PEL. Lead will maneuver and configure as appropriate prior to High Key while Wing flies the Chase position and matches Lead's configuration.

**UNSAFE LANDING GEAR INDICATIONS**

**Lead or Wing.** The aircraft with the unsafe indication should take the lead and climb to an emergency orbit or delta pattern. Coordinate with your Wingman or a chase aircraft to get an airborne landing gear inspection.

**AIRBORNE LANDING GEAR INSPECTION**

Consider using the VHF radio to establish discreet contact between aircraft at a minimum of 2000 feet AGL.

**AIRBORNE DAMAGED AIRCRAFT**

If damage occurs between Lead and Wing, both aircraft should turn away from each other until adequate separation is achieved.

**UNINTENTIONAL INSTRUMENT FLIGHT / LOST SIGHT PROCEDURES**

If Lead unintentionally enters IMC, he will shift his scan to instruments and fly straight and level for one minute. If necessary, Lead will make a shallow angle of bank turn (15º) for 180º away from Wing to attempt to return to VMC. **Wing will maintain the parade position references during all turns in IMC (welded wing).**

If Wing loses sight of Lead in IMC, then Wing will **simultaneously**:

1. **TRANSITION TO AN INSTRUMENT SCAN**

2. Call “**[tac call sign] two is lost sight**”, while executing the following procedures:

a. **Straight and Level**. Wing will turn away from Lead using 15º of bank for a 30º heading change. Lead will transmit his exact heading and altitude and will direct a rejoin or coordinate for a separate squawk for the Wingman as appropriate.

b. **Turns**. The aircraft on the outside of the turn will roll wings level and transmit his heading and altitude. The aircraft on the inside of the turn will maintain bank angle and continue the turn for a minimum of 30º of heading change. Lead will direct a rejoin or coordinate for separate squawks as appropriate.

c. **Climbs or Descents.** If lost sight is encountered while in a climb or descent, the wingman will level off, while executing the appropriate procedure outlined above. The Lead or Solo Chase will be directive, using the radios, to ensure deconfliction by assigning different altitudes to formation members. If after one minute, positive communication with ATC has not been established, the wingman will resume the last assigned heading and altitude, squawk 7600, and comply with normal IMC lost communication procedures.

**BLIND PROCEDURES**

In the event Wing loses sight of the leader in VMC, Wing will immediately call “[tac call sign]

two is Blind.” The leader will immediately attempt to establish visual contact. If successful,

Lead will use the Wing’s clock position, direct a rejoin. If unsuccessful:

**Lead.** Check the area clear and climb 200 feet **above** the working altitude. Proceed direct to the

prebriefed rendezvous point. Establish a 20º angle of bank, left orbit at 150 knots until the flight is rejoined.

**Wing.** Immediately call “[tac call sign] two is Blind”, check the area clear, and **descend** 200 feet **below** the working altitude. Proceed direct to the pre-briefed. When you call Lead in sight (“[tac call sign] two is Visual”), Lead will direct a rendezvous.

**RADIO FAILURE (NORDO)**

**Section Flights.** The NORDO aircraft will pass the appropriate visual signal and be placed in the lead position to troubleshoot. If radio contact cannot be reestablished, the aircraft with the good radios shall be placed in the lead position to lead the flight home. The good aircraft will inform approach and tower Wing is NORDO and coordinate for ALDIS lamp signals. If Lead experiences a radio failure after the VFR entry point for the runway in use, a lead change will not be conducted. Wing will handle communications, inform tower Lead is NORDO, and coordinate for ALDIS lamp signals. Lead should watch Wing for the break clearance. Wing will point at Lead and give the kiss-off signal when break clearance is received.

**SECTION TAKEOFF**

Wing maintains the Parade bearing line throughout takeoff roll and liftoff.

**Section Takeoff Restrictions**

1. Total crosswind component must be 10 knots or less.

2. Runway must be dry.

3. Ceilings above circling minimums (or 1000 feet/3 where circling minimums do not apply).

4. Minimum 5000 feet runway length available.

**Section Takeoff.**

Wing will line up the leading edge of his wing with the trailing edge of Lead's horizontal stabilizer. When cleared for takeoff:

**Lead**

1. Hold brakes firmly. Pass the runup signal, set 500 ft-lbs., check engine instruments, and reset to 950 ft-lbs.

2. Check Wing's aircraft.

3. Return a thumbs-up to Wing.

4. Raise forearm to vertical and smoothly give the brake release signal (arm forward and down in a chopping motion). As Lead's arm drops below the canopy rail, the flight simultaneously releases the brakes. At 60 KIAS, begin to apply smooth back stick pressure to effect rotation to the takeoff attitude (cowl seam on the horizon) no earlier than 80 kts. Allow 4-5 seconds for complete nose strut extension. Once safely airborne, check the fuel caps, give the gear up signal (lower head with hand on gear handle), check airspeed below 120 (ideally less than 110), and retract the gear (simultaneously raise head up and back and raise gear handle). Verify wing’s gear appears up and locked. Reset power as appropriate for the departure (850 ft-lbs max).

**NOTE:**

1. Depending on the wind, Wing may be in either a left or right Parade. Crossunder above 300 feet AGL.

2. If the crosswind component exceeds 10 knots, an interval takeoff will be made. Use caution during takeoff in gusty conditions. Maintain directional control and ensure aircraft separation.

**Wing**

1. Hold brakes firmly. Acknowledge the runup signal with a head nod, set 500 ft-lbs., check engine instruments, and reset to 1015 ft-lbs.

2. Check Lead's Aircraft

3. Pass Lead a thumbs-up when ready.

4. Release brakes upon Lead's signal and maintain position during takeoff roll. To signal brake release, smoothly “chop” arm down. When your arm is horizontal to the canopy rail, release the brakes. Maintain position down the runway by adjusting power to control bearing and rudder to maintain wingtip separation. Do not “ride” brakes. Wing’s aircraft should lift off at the same time as Lead. Use Lead's nose strut extension to anticipate and match rotation rate and pitch attitude. If aft when Lead rotates, ensure max power selected and delay rotation slightly to accelerate on runway and catch up. If ahead of position nearing rotation, pull power slightly and **slowly** work aft. Retract the gear upon Lead’s signal and move into parade position. Prebrief the pilot-not-flying to check fuel caps. Any gear malfunctions in either aircraft should be announced over the intraflight radio frequency.

**WARNING:**

Any time Wing passes Lead during the takeoff roll, with **excessive** relative motion, Lead aircraft will pass Dash-2 the lead over the radio and transition to the Wing position. The new Lead shall continue with normal section takeoff and departure procedures and must ensure the section remains clear of traffic and obstacles. Once established on departure, the Flight Leader will use the radios to reset the formation as desired.

**SECTION TAKEOFF ABORTS**

If either aircraft aborts the takeoff after brake release, do not cross runway centerline. The

nonaborting aircraft will check max power and execut an individual takeoff. Wing must maintain a minimum of 10 ft of wingtip clearance throughout the takeoff. The aborting aircraft will execute NATOPS abort procedures while maintaining their side of the runway. If section abort required, Lead will transmit “[tac call sign], abort, abort, abort.” Both aircraft will abort, maintaining their own side of the runway.

**IFR PARADE TURN EXERCISE**

IFR parade flying has to be tempered with extreme caution due to several factors:

1. Wing's propeller prevents Wing from getting too close to Lead.

2. Flying through clouds may involve turbulence, which could cause a prop-strike if Wing is flying too close.

3. Wing could potentially lose sight of Lead in IMC, which may be disorienting for Wing.

IFR parade utilizes the "welded wing" concept. Wing's position on Lead remains the same as in level flight, regardless if turning into or away. Wing must aggressively maintain position. If in actual IMC, Dash-2 may not realize he is in a turn unless they cross-reference the attitude gyro. If Wing cannot see Lead's fuselage, or if his prop comes within inches Lead's aircraft, then Wing should separate using lost sight procedures.

**IFR PARADE TURNS AWAY**

In contrast to VFR turns away, the wingman rotates about Lead's longitudinal axis while matching Lead's rate of roll and maintaining parade position. It initially requires more power than the VFR turn away because the Wingman's relative position is above Lead in addition to being outside Lead's radius of turn. If power is not added when entering the turn, Wing will go sucked. Conversely, when the Wingman rolls out, he will initially require a larger power reduction than the roll-out for the VFR turn away.

**NOTES:**

1. IFR parade turns into are flown exactly the same as a VFR parade turns into.

2. Lead will be limited to a maximum of 45° angle of bank for IFR parade turns.

**IMC LOST SIGHT**

Wing may have to combat the classic physiological effects of flying in the clouds, while transitioning from flying off of Lead to flying off of the instruments. If Wing goes lost sight on an instrument approach, the formation will need to be concerned about gaining separation and obstacle clearance. If there is any delay in priority handling by ATC or confusion between the involved aircraft and the controller, then do not hesitate to declare an "emergency" and pick up priority handling.

1. **Outside the Final Approach Fix (FAF) on an Instrument Approach.** Lead and Wing should initially execute the lost sight procedures while maintaining at or above the minimum altitude for that segment of the approach (or MSA/ESA). Once separation is ensured, Lead may continue the approach and should coordinate for a separate clearance for the Wingman.

2. **Inside the FAF on an Instrument approach.** Lead and Wing should initially execute the lost sight procedures. Once separation is established, Wing will immediately execute the missed approach procedure, adding 500 feet to all altitudes. This will provide separation in case Lead has to go missed approach as well. Lead may continue the approach. A separate clearance should be coordinated for the Wingman.

3. **During the Missed Approach.** Lead and Wing should execute the lost sight procedureswhile conducting the missed approach procedure. Lead will fly the altitudes published for the missed approach and Wing will add 500 feet to all altitudes. A separate clearance should be coordinated for the Wingman.

**INSTRUCTOR IFR PARADE POSITION**

Because of the propeller, the suggested IFR parade position (FOR IPs ONLY) is stepped down about 8-10 feet lower and closer to Lead. The new reference is Wing centering his propeller arc below and behind Lead's same side wingtip. Wing should get into IFR parade prior to entering the clouds. Lead should consider splitting the formation for separate approaches.

**SECTION APPROACH**

Used to expedite the recovery of aircraft (two at a time) or for certain emergencies. The preferred configuration is no-flap. Wing will always mirror Lead's configuration.

**Section Approach Restrictions.** Weather must be above circling minimums (or 1000/3 if circling mins don't apply).

**Lead**

1. If operating VFR on top, Lead should consider configuring the section prior to penetrating IMC. If VMC, Lead should intercept the final approach course and pass the gear down signal prior to the final approach fix. If IMC and not already configured, consider using the radios to call for the gear extension. Once both aircraft are configured (no-flap preferred), Lead and Wing will check the landing gear and exchange a thumbs-up.

2. Lead should query Tower for the current winds and position the Wingman on the upwind side. The crossunder shall not be conducted below 300 feet AGL.

3. Lead should set up the formation on the extended runway centerline 1 to 3 miles from the runway, each centered on their own half. If there is any confusion, Wing must request clarification over the radio.

4. Lead should fly a normal final at no less than 100 knots.

**Section Approach as Wing.** Wing will fly Parade position until past the FAF and below the weather.

**Taking Spacing On Final.** The section must take spacing on final and land safely as single aircraft.

**Straight-In Approach.** Once Lead has the runway environment in sight, he should confirm the Wingman is visual with the runway by pointing at his eyes with first and second fingers and then pointing at the runway. Wing should confirm with a head nod. Lead should detach Wing with the “kiss-off” signal or transmitting “[tac call sign] 2 detach.” Lead will fly a no-flap approach and if required may accelerate slightly to build spacing between aircraft. After the kiss-off, Wing should reduce power and establish a minimum of 1500 feet of separation between aircraft. Flaps may be used to aid in gaining separation (avoid overspeed), but once 1500 feet of separation is obtained, use power as required to maintain this distance. Wing should waveoff if he does not have at least 1500 feet of spacing from Lead. Each aircraft should maintain centerline on his half of the runway all the way to touchdown and through the landing rollout. In some cases, Lead may need to cross in front of Wing to clear the runway. In this situation, once both aircraft are under control, Wing will transmit "[tac call sign], cleared to cross".

**Circling Approach.** Once Lead has the runway environment in sight, he should confirm the Wingman is visual with the runway. Lead detaches Wing once he commences circling

**CRUISE FORMATION INTRODUCTION**

Wing on Lead's 45° bearing line, with three ship-widths of lateral separation and 30 feet of stepdown. Can be flown on either side of Lead without directed crossunders. Wing will maintain position primarily by radius-of-turn or pursuit curves instead of power corrections.

**Parade to Cruise**

**Lead**

1. Pass the Cruise signal with an alternating pointing thumb over each shoulder.

2. Smoothly adjust power to 850 ft-lbs.

3. Maintain a stable platform until Wing is established in the Cruise position.

4. Once Wing is in position, Lead may maneuver as required.

**Wing**

1. Acknowledge Lead's Cruise signal with a head nod.

2. Slide out on the 45º bearing into the Cruise position. This will require a small power reduction coordinated with a small aileron input away from Lead.

3. Approaching the Cruise position, reset power to 850 ft-lbs.

**Cruise to Parade**

**Lead**

1. Roll wings level (section can still be in a climb or descent), then signal Wing to move into Parade by gently “porpoising” the aircraft three times.

2. Smoothly adjust power (approximately 630 ft-lbs straight and level.)

3. Provide a stable platform while Wing returns to the parade position.

**Wing**

1. Observe Lead's roll out, and maintain the Cruise position on the side presently established.

2. Note Lead's signal to move into the parade position.

3. Use power and angle of bank as necessary to slide up the 45º bearing into the parade position on the side presently established.

**MAINTAINING THE CRUISE POSITION**

**Lead.** Once Wing is stable in the Cruise position, commence turns in either direction using a max of 45º angle of bank. Execute at least two 360 turns with at least one turn reversal and without torque adjustment.

**Wing.** The Cruise position for Wing is basically an extended position along the 45º bearing; defined by aligning the ventral point over the aileron cutout and the tip of Lead's horizontal stabilizer with the UHF antenna. Wing should also maintain approximately three wingspans of spacing and 30 feet of stepdown. Stepdown is maintained by keeping Lead's horizontal stabilizer tangent to the top, aft section of Lead's canopy.

**Cruise Turns Into.** Wing must maintain stepdown and proper nose-to-tail separation. Wing will initially need to maneuver to Lead's tail momentarily (lag pursuit) to prevent closing on Lead, and then should maneuver to the inside of Lead's turn (lead pursuit) to hold position. Once established in the turn, lead and lag are used as required to maintain position. Too long of a delay in the initial lag can result in the Wingman being "spit out" of the turn. Lead's rate of roll will determine whether a slight lag outside or an expeditious roll to inside of Lead's turn will be required. A good reference for turns-into is to line up Lead's horizontal stabilizer with the red line portion of the star on Lead's fuselage.

**Cruise Turns Away.** When Lead turns away, Wing will need to maintain stepdown and maneuver towards the inside of Lead's turn (lead pursuit) in order to maintain nose-to-tail spacing. Wing should avoid stabilizing directly behind Lead. At no time should the Wingman allow himself to become stepped up on Lead.

**CRUISE CLIMBS AND DESCENTS**

Lead can initiate the climb or descent by maintaining power and raising or lowering the nose (climb no slower than 120 KIAS). The Wingman will adjust the aircraft's nose attitude and power (if necessary) to maintain position. For descents more than 1000 feet, Lead may reduce power to prevent an overspeed. If a power reduction is desired, Lead will direct Wing via the radio to set an appropriate power setting. Approaching the level off altitude, Lead will direct an increase in power via the radio to maintain flight in cruise.

**SECTION CRUISE LEAD CHANGE**

**Lead**

1. Signal Lead change by rocking the wings back and forth with the ailerons three times.

2. Provide a steady platform for Wing.

3. Just prior to Wing passing abeam, give the lead change signal (3 taps on the helmet, then pointing at the Wing). Wait for Wing's acceptance then maneuver to the cruise position.

**Wing**

1. After Lead's wing rock, maneuver from cruise to a position abeam Lead with a maximum of 3 ship-widths separation and on the currently established heading. Coordinate power and back stick inputs to place Lead on the horizon as you pull abeam.

2. Approaching abeam, watch for the lead change signal. Accept the lead (by patting your forehead once followed by chopping motion) when given the signal and reset power to 850ft-lbs.

3. Provide a stable platform until the new Wingman is established in the cruise position.

**PASSING SIGNALS**

Use visual signals to the maximum extent possible. Announce what signal you are going to pass over the ICS before initiating the signal. **When initiating any signal as Lead pass the signal while looking forward, even when on the ground, then pull the signal down and look at Wing for a response (if required).**

All hand signals, except the Lead change, will be given with the hand nearest your Wingman.

**All optional signals do NOT require an acknowledgement.**

**GENERAL SIGNALS**

**MESSAGE TO BE SENT SIGNAL**

1. Affirmative (I understand, ready). Thumbs-up, or head nod.

2. Negative (I do not know, not read). Thumbs-down, or turn head from side to side. (Shake-off signal).

3. Wait. Hand held up with palm outward.

4. Ignore last signal. Hand waved (palm forward) in an erasing motion in front of face.

5. Numerals. With forearm vertical, extend fingers to indicate desired number

from 1 to 5. With forearm horizontal, indicate number which, added to 5, gives the desired number from 6 through 9. A clenched fist indicates zero.

6. “Eyes-on” landing environment. Lead points to eyes with two fingers, then raises forearm

horizontally with fingers extended, palm inward, pointing in direction of runway.

**RADIO COMMUNICATIONS**

**After passing a frequency change signal, Lead should look at Wing to acknowledge with a head nod.**

**MESSAGE TO BE SENT SIGNAL**

1. Shift radio to preset frequency as Tap earphone and indicate by fingers the numerals of the channel

indicated by numerals. to which shifting.

2. Switch to manual frequency. Tap helmet on same side with flat fingers three times, then hold

forearm vertical and make rotating hand motion like you are "screwing in a light bulb." Rotate three times, then give frequency as described in numerals above, one number at a time.

3. I have taken over communications. Tap earphones, followed by patting head and pointing to self.

4. Take over communications. Tap earphones followed by Lead pointing at Wing.

**RUNUP SIGNALS**

**MESSAGE TO BE SENT SIGNAL**

1. Your propeller is in feather. Give thumbs-down and then forearm vertical, hand extended, palm

flat, fingers together, rotate hand back and forth rotating about the wrist (hand stays vertical).

2. Improper lighting configuration. Point index and middle finger at your eyes.

3. Your canopy is open. Give thumbs-down and then use both hands to simulate pushing

the canopy closed (hands over head).

4. Your flaps are down. Give thumbs-down and then raise forearm vertical, bend hand at

wrist and open and close fingers to thumb several times (like

you're hand is "talking").

**TAKEOFF, SECTION TAKEOFF SIGNALS**

**MESSAGE TO BE SENT SIGNAL**

1. My engine instruments check good, Thumbs-up.

your aircraft configuration checks good,

and panels secure with no visible leaks.

2. Signal to release brakes Same side forearm bent vertically, slowly extend to

(section takeoffs only). horizontal in chopping motion. When arm is

parallel with canopy rail, release brakes.

**AIRCRAFT AND ENGINE OPERATION**

**MESSAGE TO BE SENT SIGNAL**

1. Perform gas check. Raise fist with thumb extended in a drinking position.

2. Lower landing gear. **Prep:** Rotate hand in cockpit as if cranking wheels.

**Execute:** One head nod up/back.

3. Raise landing gear. **Prep:** Lead bows head to place chin on his chest.

**Execute:** One head nod up/back.

4. Open or close flaps. **Prep:** Open or close four fingers and thumb very slowly, three times.

**Execute:** One head nod up/back.

**CLIMBOUT, AREA, DESCENT SIGNALS**

**Checking the Wingman in position and the area clear will preface all in-flight signals.** Make these checks with exaggerated head movements to give Wing a warning you're going to give a visual signal. **All optional signals do NOT require an acknowledgement.**

**MESSAGE TO BE SENT SIGNAL (\*\* = OPTIONAL)**

1. I am going to start a climb to With fingers extended, palm down, motion slowly fore and aft with

a higher altitude.\*\* a climbing attitude.

2. I am going to descend.\*\* With fingers extended, palm down, motion slowly fore and aft with

a descending attitude.

3. Level off.\*\* With fingers extended, palm down, motion slowly side-to-side

over the glareshield in a level attitude.

4. I am going to reduce power.\*\* Head tilted backward three times.

5. I am going to add power.\*\* Head tilted forward three times.

6. I am turning right or left.\*\* Head tilted right or left from vertical three times.

7. I am rolling out on this heading.\*\* Lead, with forearm vertical, hand open, and fingers together,

executes a chopping motion forward.

8. Wing crossunder to other wing. Extend forearm vertically with fist clenched.

9. I am offering the lead to you. Lead taps his helmet three times while looking forward and then

points at the Wing.

10. I have the lead. Wing pats forehead once with near hand, gives rollout signal

(chopping motion), and looks forward.

11. I am leaving formation. Hold fist to Wingman's side of helmet (“kiss-off signal”) and

extend all fingers outward.

12. Aircraft indicates who should Lead points at aircraft to leave formation and gives “kiss-off

leave formation. signal.”

13. Breakup and Rendezvous. Raise same side hand, make a fist with two fingers extended, and

make three small circles with fingers.

14. Parade to Cruise. Alternate pointing thumb over each shoulder.

15. Cruise to Parade. Gently porpoise aircraft three times.

16. Cruise Lead Change. Rock the wings back and forth with the ailerons three times.

**EQUIPMENT MALFUNCTION / HEFOE SIGNALS**

**Used only with radio failure.**

**MESSAGE TO BE SENT SIGNAL**

1. Radio receiver or transmitter, Tap microphone or earphone, give thumbs-up or down,

inoperative as appropriate. as appropriate.

2. Ejecting or bailing out. Pull both clenched fists pulled downward across the face to

simulate pulling a face curtain.

3. I am having difficulty (followed by Bend arm across forehead in "weeping" gesture.

one or more of the signals listed below).

a. Hydraulic trouble. Extend one finger upward.

b. Electrical trouble. Extend two fingers upward.

c. Fuel trouble. Extend three fingers upward.

d. Oxygen trouble. Extend four fingers upward.

e. Engine trouble. Extend five fingers upward.