

NWCG Standards for Airtanker Operations, PMS 514

FEBRUARY 2025

Appendix D – Table of Contents

Appendix D – Standard Operation Practices for Flights	1
Introduction	1
Roles and Responsibilities	1
Standards and Briefing	3
Formation/Flight Positions	4
Overrun	6
Other Emergencies	8
Standard Flight Procedures	8
Speed and Distance Chart	11

Appendix D – Standard Operation Practices for Flights

Introduction

This document establishes a baseline set of procedures otherwise known as a “Standard” for how up to four Single engine air tankers (SEATs) or Scoopers may operate as a team allowing a group of pilots to team up and have a clear understanding of the procedures to follow. The procedures here are the “standard” baseline but variations are expected to deal with local conditions or procedures not covered in this document. Variations should be briefed and clearly understood by all parties prior to execution.

The intent of this document is **NOT** to change how close together we fly. The objective of operating as a flight is to increase efficiency, minimize communication, and establish rules for visual mutual support. This will also provide Aerial Supervisors with a more efficient force packaging option to expedite fire operations when appropriate.

Roles and Responsibilities

Flight Lead

The Flight lead is primarily responsible for visual lookout, navigation, and communication with outside agencies. Unless otherwise briefed, the flight lead owns the wingman’s radios and will direct the wingman to change frequencies. The flight lead should maneuver in a stable and predictable manner and verbalize any upcoming unanticipated maneuvers.

Wingman

The wingman is primarily responsible for maintaining visual and immediately communicating if “blind,” deconflicting from the lead aircraft and maintaining correct formation position. Wingman secondary responsibilities include visually looking out for other aircraft and hazards. In the fire environment the wingman is responsible for being in a position behind and/or above the lead aircraft and visually clearing “through” the lead aircraft. The wingman can also backup the flight lead during periods of busy communication.

Definitions/Policies

Formation flight – A flight consisting of more than one aircraft which, by prior arrangement between the pilots, operates as a single aircraft regarding navigation and position reporting, as well as clearances issued by Air Traffic Control (ATC).

The Federal Aviation Administration (FAA) defines a “standard formation” as one in which a proximity of no more than 1 mile laterally or longitudinally, and within 100 ft vertically from the flight leader is maintained by each wingman. IF receiving ATC service (Instrument Flight Rules [IFR] flight plan or Visual Flight Rules [VFR] flight following) while operating in formation the flight lead must request and receive approval to operate as a non-standard formation.

NWCG Standards for Aerial Supervision, PMS 505 limits formations of SEATs to a maximum of four aircraft. It mandates that formations will not be created within the Fire Traffic Area (FTA). It also prescribes exact communications scripts for FTA check-in as well as recommend scripts for other calls. In the event of a conflict between this document and *NWCG Standards for Aerial Supervision*, PMS 505 the latter should be controlling until clarification can be obtained.

Flight Lead (FL) Responsibilities:

- Be Predictable.
 - Lead a clear brief, know the Standards, then operate in accordance with (IAW) the brief and Standards.
- Fly a stable platform. Maneuvers will be executed with consideration for the wingman's ability to follow and maintain position.
 - Provide smooth and consistent roll and pitch changes.
 - Use good power management, so wing can maintain position.
 - Communicate unplanned or unexpected or abnormal maneuvers.
- Primary Communications.
 - Airport, ATC, FTA Communications.
 - Flight leads will be directive to ensure all flight members are on correct frequencies.
- Navigation to and from the fire.

Wingman (WG) Responsibilities:

- Be Predictable.
 - Comprehend the brief, know the Standards, the operate IAW the brief and Standards.
- Visual: Always keep flight lead and in sight. Immediately communicate "Blind."
- Maintain Formation Position.
 - Spacing $\frac{1}{4}$ to $\frac{1}{2}$ mile spacing behind preceding aircraft.
 - Altitude within 100' of FL when in level flight.
- Be on correct frequency.
- Backup the flight lead.
 - Visually look outside the formation for traffic, hazards.
 - Speak up if FL misses a radio call etc.
- Dispatch and tanker base communication unless otherwise briefed or directed.
- Keep flight lead informed of any changes, problems, emergencies, and dispatch frequency changes.

Standards and Briefing

To ensure an effective formation flight all members must have a shared understanding of rolls, responsibilities, and the actions each pilot will take at all times. All flight members must be predictable. A thorough briefing prior to flight is critical to ensure this is possible. Operating from a known set of written standards such as this document allows the flight lead to begin a briefing from the standard baseline and only cover mission specifics or differences from the published standard.

Briefing Guide:

Here's an example of how a "Flight Lead" should brief a flight:

- T1 will be flight lead.
- T2 will be #2, T3 will be #3, T4 will be #4.
- Interflight Frequency will be XXX.XX
- Everything will be IAW with the SEAT flight standards (this document) unless otherwise briefed.
- Everyone start engines, then report ready to taxi with thumbs up if visual or on ramp frequency.
- Check-in on Common Traffic Advisory Frequency (CTAF) XXX.XX standard.
- T1 (flight lead) will make airport, ATC, and FTA calls.
- T2 (#2) will handle dispatch and communicate with the airtanker base when inbound. (Load and return, hold, positive/negative fuel).
- Takeoff Standard.
- Rejoin standard formation positions.
- Rejoin airspeed.
- Frequency change to fire frequencies and back to ATC frequencies.
- FL directed.
- If missed by wingman auto switch by 15 miles.
- Dropping as a flight.
- Dropping as individuals.
- Rejoin off the drop.
- Airport arrival procedures.
- Landing.
- Taxi bac.
- Emergencies or abnormalities.
- Questions?

Additional requirements beyond the above minimums are at the discretion of the flight lead.

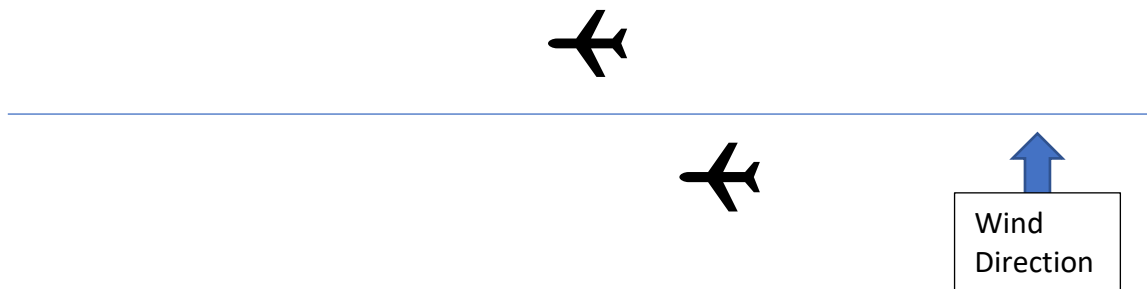
Formation/Flight Positions

Takeoff and Landing:

When taking off or landing as a flight consider the wind direction. On a narrow runway all flight members should takeoff on the runway centerline then offset downwind once airborne at a safe airspeed. On a wide runway the flight lead may line up on the downwind side of the centerline of the runway. This allows the wake turbulence to be blown away from the trailing tankers. The trailing tankers should take off or land upwind of the preceding tanker's centerline. Allow the preceding tanker to become airborne before initiating a takeoff roll. Upon landing each tanker should land and either roll long enough or exit the runway in a manner that allows trailing tankers adequate spacing for a normal landing.

Takeoff / Landing Profile:

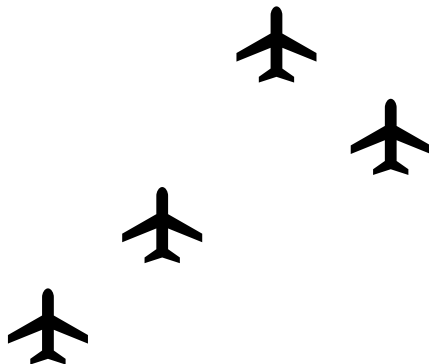
Figure 1: Typical takeoff and landing profiles.



En Route To/from FTA (Staggered Formation):

Maintain a distance of $\frac{1}{4}$ to $\frac{1}{2}$ mile on a 45-degree line and slightly below from preceding aircraft. Typically, number 2 maintains position on the right, however this position is dynamic, and the wingman is allowed to maintain position either side as appropriate. It is important that the number 2 – 4 aircraft maintain a position so that they are visible to the preceding pilot.

Figure 2: Staggered Formation



Inside FTA:

Another position to mention is the "TAC/Trail Position." This positioning should be used once inside the FTA and in the orbit. Aircraft should still maintain the $\frac{1}{4}$ to $\frac{1}{2}$ mile separation while in the orbit. While maneuvering for a drop, tankers should maintain a distance that allows a preceding drop to settle

to the ground, with time for adjustment or a go around before the next drop begins. The reasons for adjusting to a trail position are as follows:

- Allows flight lead to maneuver as needed.
- Allows trailing tankers to maneuver freely to maintain position, using lead/lag.

Figure 3: TAC/Trail Position



Maintain $\frac{1}{4}$ to $\frac{1}{2}$ mile spacing.

Blind/Lost Sight Procedures:

Any operations in formation or as flights of aircraft are predicated on visual deconfliction. The most basic requirement is that the wingman has the responsibility to visually acquire and maneuver to avoid being a conflict for the Flight lead. It is imperative that if the aircraft with responsibility for visual deconfliction ever loses sight of any aircraft they are responsible to communicate that information with the term “Blind.”

A “blind” situation is a potentially impending midair collision. If “blind” is ever communicated all other communication should stop until the blind situation is resolved and communication priority should be as follows:

1. The blind aircraft
2. The aircraft they are “blind” on (the aircraft they have lost sight of)
3. Any other aircraft that has information to ensure separation or can direct aircraft to avoid the midair (someone that sees both aircraft)

If an aircraft with responsibility for visual separation ever loses sight of an aircraft for which they have responsibility for separation the “blind” pilot will communicate blind as follows: his/her callsign, the callsign of the aircraft you are blind on, and your intended actions to ensure initial deconfliction.

Tanker 2: “Tanker 2 is blind on Tanker 1 climbing to 2000.”

If both aircraft are in the FTA orbit the blind aircraft should default to a climb of 500’ as their initial deconfliction action. At other times the blind aircraft should maneuver away from the last know attitude of the aircraft on which they are blind while avoiding the altitudes of other aircraft to the max extend possible.

Tanker 1 should communicate if they are visual or blind on Tanker 2 with the assumption being that normally the flight lead will be blind at this time.

Tanker 1: “Tanker 1 is also blind at 1500’ over the heal of the fire behind B-55.”

If the flight lead is visual the flight lead should communicate “visual” and provide a point-out to the wingman as follows:

Tanker 1: “Tanker 1 is visual Tanker 2. Visual is your 11 o’clock two miles over the heal of the fire.”

Once positive deconfliction is assured (usually with altitude separation) The two aircraft involved should continue to communicate their position until the aircraft with responsibility for separation regains sight and calls “visual.”

Tanker 2: “Tanker 2 is visual Tanker 1 descending back to 1500.”

Tanker 1 should acknowledge this call. Example:

Tanker 1: “Tanker 1 copy.”

Flight leads should be directive to ensure deconfliction and may trump the initial deconfliction plan called by the blind wingman. For example, the flight lead could communicate:

Tanker 1: “Tanker 2 stay at 1500’ Tanker 1 descend to 1000.”

If other aircraft have information to help the blind aircraft reacquire the visual the other pilot should communicate that only after initial deconfliction is assured. If, for example, Tanker 3 is visual both 1 and 2 Tanker 3 should communicate:

Tanker 3: “Tanker 2, Tanker 1 is at your 9 o’clock two miles opposite side of the column.”

Flight Split Due to Poor Visibility:

If a flight of aircraft is operating in areas of reduced visibility and it is becoming difficult to maintain visual formation the wingman will request a flight split and make a positive maneuver away from the lead aircraft normally changing heading and altitude.

Overrun

An overrun is the unintentional imminent or possible passing of the lead aircraft by the trail aircraft usually during a drop pattern. These procedures were developed to provide airtanker and leadplane flight personnel with a standard set of procedures to execute if an overrun situation becomes likely or imminent. The procedures should also be executed if an overrun situation occurs between aircraft operating as a flight or between fixed wing aircraft during sequencing operations.

Overrun Procedures:

1. **Communication:** An overrun, or possible overrun, requires radio communication. If the words “Overrun,” “Bump it Up,” “Push it up,” or “Pick it Up,” or other similar terms are heard over the radio, communication priority shall be given to the aircraft involved in the potential overrun. All other radio transmissions should cease until the situation is resolved.
2. **Attempt to prevent the overrun:** The first step is to attempt to avoid the need to initiate the “Overrun” procedure which is indicated by stating “Bump it Up,” “Push it up,” or “Pick it Up” or similar. If spacing is less than desired or closure rates are greater than desired (too close or closing too fast), the trailing aircraft (normally an airtanker) should use geometry, refer to *Appendix B Proximity Flying/Geometry*, and if conditions permit, an airspeed reduction to stop closure and increase spacing. If these tools are not available or insufficient, the trailing aircraft shall communicate to the leading aircraft to increase speed with the preferred terms “Bump it

Up,” “Pick it up,” or “Push it Up.” An amount to bump it up may be included which gives the lead aircraft an idea of the severity of the issue. For example, “Bump it up 10 knots.”

The lead aircraft will immediately use power and if available a push over to increase airspeed and descend. The lead aircraft will continue to increase airspeed until the trail aircraft communicates that the spacing is good. If spacing is restored and an overrun is not called, the drop pattern may be continued. If this procedure is executed between two airtankers such as in a flight, the lead airtanker should only drop if certain that their retardant will have time to clear the air prior to the second airtanker passing through the drop area.

3. Overrun procedure: If the actions to prevent an overrun are insufficient or are not available due to late recognition, the second aircraft (normally an airtanker) must communicate “Overrun.” Do not wait until passing the lead aircraft to initiate the overrun. If closure rate is high, it may be appropriate to initiate the overrun at approximately at 1000-500’ horizontal separation.

The following actions shall be accomplished when an overrun is communicated:

1. The trailing aircraft shall communicate “Overrun, overrun, overrun” and perform the following actions:
 - a. Do not drop the retardant except to prevent a more serious accident as doing so could potentially cripple the lead aircraft.
 - b. Pitch up to begin a climb and if able reduce airspeed. The objective is to create vertical and horizontal separation.
 - c. If the flight paths or briefed exit is straight out, the trailing airtanker should pass above and to the right of the lead plane/first airtanker hugging the right side of a canyon if restricted by terrain.
 - d. If the flight paths or briefed exit is left or right turn, the airtanker should pass above and to the outside of the leadplane’s /first airtanker’s turn.
 - e. If terrain or visibility prevents utilizing (ii) or (iii) above, the airtanker should pass over the top of the leadplane/first airtanker.
 - f. The trail aircraft should attempt to maintain sight during the procedure, but this may not be possible. As soon as time permits the trail aircraft should communicate if they see the lead aircraft with “visual” or “blind” as well as an altitude. If visual, they should communicate their position in relation to the lead aircraft.
2. The leadplane or first airtanker should execute the following actions:
 - a. If the lead aircraft is an airtanker they shall NOT drop the retardant to prevent blinding the trail aircraft unless to prevent a more serious emergency.
 - b. Increase power and if able pitch down to increase airspeed. The goal is to create horizontal and vertical separation.
 - c. If the flight paths or briefed exit is straight out, the lead aircraft should stay low and to the left side of a canyon if restricted by terrain.
 - d. If the flight paths or briefed exit is a left or right turn the lead aircraft should make a tighter turn hugging the inside of the turn or terrain.
 - e. Continue the above routing until positive deconfliction is assured through communications or visual contact.

Other Emergencies

Minimum spacing of approximately $\frac{1}{4}$ mile is to allow room for an emergency to happen with adequate spacing for all participating tankers. The tanker with the emergency will clearly announce they have an emergency to the other tankers in the flight. The pilot with the emergency will have priority over everything else. The other tankers in the flight will offer support to the tanker in distress. The flight lead and the other tankers will assist with position reporting, ATC/GUARD/AIR GUARD communication, dispatch communications, and anything else that might help an emergency response. It is important for everyone involved to remain calm and communicate clearly, directly, and concisely.

Emergency Emphasis Items

- Assure deconfliction.
- Exit FTA if able or applicable.
- Assess the emergency.
- Declare an emergency through the proper channels.
- Communicate calmly, and clearly. Be direct and concise.
- Return to base and land.

Standard Flight Procedures

The following is the “Standard” procedures for operating as a flight. Flight leads will brief differences or specifics. If changes are required during the flight clear communication is required to ensure common understanding. Flight members will follow guidance in the following order or priority:

1. Real Time Communication (flight lead direction)
2. The Brief
3. These Standard Procedures

Pre-flight Ground Procedures:

- All flight members will start engines set radios to monitor Interflight Common, CTAF/Ground, Ramp Freq, FM to assigned Fire Frequencies or National.
- Flight lead loads and taxis to a position to wait on trailing tankers.
- Flight lead will monitor RAMP frequency to hear trailing tankers leave the loading pit, and ready to taxi.
- Trailing tankers will call when ready to taxi. (2 ready, 3 ready, 4 ready).
- Lead makes appropriate radio calls for taxi to the active runway.
- Trailing tankers will follow preceding tanker at least three tanker lengths to the active runway.
- Wingmen will be assumed ready for departure upon reaching the active runway. Wingman shall speak up if not ready.
- Flight lead should execute a check-in on the runway frequency (Tower (TWR) or CTAF).
- Flight lead should take the active runway normally a centerline takeoff is the safest option.

- Trailing tankers should wait for preceding tanker to become airborne before initiating takeoff roll.

Departure and Join Up:

- Flight lead will fly to allow wingman an advantage to rejoin. For a straight out departure, the Flight lead will use reduced power and a lower than normal climb speed. For a turn on departure the FL will extend upwind then fly a large radius turn to allow wingman to use geometry to rejoin.
- Trailing aircraft will use an airspeed advantage and geometry to gain briefed or standard formation position.
- Standard Enroute formation:
 - 2-Ship is #2 to the right ¼- ½ mile aft 30-60 degrees of the leads tail either side.
 - In a 4-ship #2 on the right #3 on the left.
 - #3 ½ - ¾ aft of lead offset opposite side of #1 as #2 (Standard left of #1).
 - #4 in a cone ¼ - ½ mile aft of #3 on the left.
- Trailing aircraft will communicate on interflight frequency when in position (2 in position, 3 in position, 4 in position).
- #2 will call dispatch and confirm AFF.

Enroute:

- Trailing tankers will maintain position at 45 degrees and slightly lower than the preceding aircraft.

Fire Traffic Area:

- Flight lead will make calls for clearance into the FTA Using *NWCG Standards for Aerial Supervision*, PMS 505 Standard Script.
- Wingman will acknowledge with Scheduled Time of Departure (STD) Script (CS, # in flight).
- Trailing aircraft will fall into “trail/TAC position” and use lead/lag principals to maintain ¼ to ½ mile spacing.
- Trailing aircraft are responsible for avoiding wake turbulence.
- Flight will follow directions from aerial supervision.
- Flight lead will handle communications for the flight.
- Wingmen will acknowledge radios specifically directed at them using their tanker number.
- Flight may be cleared as one unit, or aircraft may be requested to maneuver individually.
- Request clarification before vacating orbit altitude if instructions from aerial supervision is unclear.
- If maneuvering as a flight, maintain spacing to allow preceding drop to fall to the ground completely and adjust or go around if necessary. (A good rule of thumb is if a tanker is turning

final, #2 should be turning base or approximately 15 seconds. Never fly through the retardant cloud. If ever in doubt go around.

- Last tanker should call “Last SEAT off the Drop.”
- Flight should climb back up to maneuvering altitude and exit FTA in a way not to create a collision hazard to other aircraft either in the FTA or inbound.
- If exit instructions are given by aerial supervision, follow their instructions.
- If tankers are dropping individually use the same methods as stated above and rejoin once outbound from the FTA.

Rejoin After the Drop

- If exiting as a flight, flight lead should maintain an airspeed that allows trailing tankers to catch up if needed.
- If tankers dropped individually, flight lead should exit the FTA, hold at a location that does not create a collision hazard to other aircraft and wait for the other tankers to rejoin before departing back to base or return to base as singletons then rejoin back on base.
- Tankers should acquire visual contact then request rejoin.
- Once joined up, tankers should assume their en route positions back to base.

Back to the Base:

- Flight lead makes airport, and ATC calls.
- #2 handles dispatch.
- #2 makes tanker base call with intentions 5 – 10 minutes out.

Airport Traffic Area:

- Flight lead will enter traffic pattern IAW Federal Aviation Regulations (FARs) and local airport procedures, or as directed by ATC.
- At uncontrolled airports flight lead will make traffic pattern entry calls.
- Trailing tankers should call their own base and final.
- Trailing tankers will be responsible for spacing and extending downwind legs as needed.

Ground Procedures Post Flight:

- Flight lead will land and extend ground roll or clear runway to allow trailing tankers to land “clear of the active.”
- Trailing tankers make normal landings and call clear when clear.
- At uncontrolled airports each pilot is responsible for their own taxi to the base.
- At controlled airports tower will issue once clearance for the flight and expects wingman to follow the flight lead using the same taxi routing.
- Each pilot is responsible for their own base ramp clearance.

Speed and Distance Chart

The following chart may be a useful reference for timing, spacing, and closure rates at various speeds. The chart shows common speeds and distances used in the aerial firefighting environment.

	105kts/120 mph	130kts/150 mph	140kts/160 mph	150kts/170 mph	160kts/185 mph	170kts/195 mph
¼ NM (1500ft)	8.5 seconds	7 seconds	6.5 seconds	6 seconds	5.5 seconds	5.3 seconds
½ NM (3000ft)	17 seconds	14 seconds	13 seconds	12 seconds	11 seconds	10.6 seconds
1 NM (6000ft)	34 seconds	28 seconds	26 seconds	24 seconds	22 seconds	21.2 seconds