A publication of the
National Wildfire Coordinating Group

NWCG Standards for Airtanker Operations

PMS 514 DRAFT 2024

NWCG Standards for Airtanker Operations

DRAFT 2024
PMS 514

The *NWCG Standards for Airtanker Operations* establishes the standards for dispatching, utilizing, and coordinating airtankers on interagency wildland fires. These standards should be used in conjunction with the *NWCG Standards for Aerial Supervision* (*SAS*), PMS 505, https://www.nwcg.gov/publications/pms505, *NWCG Standards for Airtanker Base Operations*, PMS 508 https://www.nwcg.gov/publications/pms508 and any applicable agency plans.

As this is the first edition of these standards, the National Interagency Aviation Committee (NIAC) requests review and input into the 2025 revision. Please use the NWCG Publication Review Form, https://www.nwcg.gov/publications/publication-review-form, to submit constructive input into the next version of these standards.

The National Wildfire Coordinating Group (NWCG) provides national leadership to enable interoperable wildland fire operations among federal, state, tribal, territorial, and local partners. NWCG operations standards are interagency by design; they are developed with the intent of universal adoption by the member agencies. However, the decision to adopt and utilize them is made independently by the individual member agencies and communicated through their respective directives systems.

Table of Contents

Introduction **1**
Management **1**
Airtanker Base Operations **1**
Dispatch and Coordination **1**
Mobilization **1**
Flight Following **2**
National Flight Following Frequency 2
Flight Following Script 3
Airtanker Rotation **3**
Flight Hour and Duty Limitations **3**
Aviation Safety **4**
Hazards 4
Managing Risk 5
Risk Refusal 5
Aerial Supervision 5
Working With a Leadplane 5
Working with Water Scooping Aircraft 5
Operational Procedures **5**
Constructive Airmanship: 5
Airspace 6
Communications 6
Operations in the Fire Traffic Area (FTA) and in Temporary Flight Restrictions (TFRs) 7
TFR Entry Procedures 7
FTA Entry Procedures 7
Initial Point (IP) Procedures 10
Orbit Entry Procedures 10
Responsibility for Separation When Entering the Orbit 11
Spacing and Separation While in the Orbit and When Following a Leadplane or Airtanker for a Drop. 12
Dropping/Flying Behind an Airtanker 12
Sequencing With Other Types of Aircraft or Types of Operations. 12
Orbit Procedures 12
Maneuvering Procedures 13
Approach Pattern Procedures 14
Climb Out Procedures 15
Exit Procedures 16
Routing to and from the Fire 17
Retardant Application 17

Sequencing for Airtankers **19**
Principles of Sequencing 20
Sequencing Terminology 21
Aerial Supervisor's Responsibility During Sequencing. 23
Airtanker's Responsibility During Sequencing. 23
Sequencing Watch Outs 25
Emergency Procedures **25**
Blind/Lost Sight Procedures **25**
Overrun **26**
Overrun Procedures: 26
Proximity Flying/Geometry **27**
Minimum Drop Heights **28**
Operations in Low Light/Adverse Flight Conditions **28**
Retardant Operations During Low Light Conditions. 28
Airtanker Types **28**
Airtankers (Multi-Engine) 29
Very Large Airtankers (VLAT) 29
VLAT Flight Operations Considerations 29
Single Engine Airtankers (SEATs) 29
Forest Service Contracted VLAT and Type 1 & 2 Airtanker Pilot Qualifications **31**
Modular Airborne Firefighting System (MAFFS) **32**
Flights **33**
Flights of Single Engine Airtankers (SEATS): 33
Flights of Cal Fire S-2s 34
Retardant Operations **34**
Loading Retardant 34
Retardant Hot Loading 34
Simultaneous Fueling and Retardant Loading 34
Qualified Products 34
Wildland Fire Chemicals Near Waterways 35
Reporting Requirements: Fire Chemicals into Waterways, Waterway Buffer Areas, and Mapped Avoidance Areas 35
Appendices: https://www.nwcg.gov/publications/pms514

Appendix A – Fixed Wing Scripts
Appendix B– Proximity Flying/Geometry
Appendix C – Flight Procedures and Briefing Requirements
Appendix D –Standard Operating Practices for Flights
Appendix E – S-2 Tactical Flight Procedures
Appendix F – S-2 Flight Comm Scripts

Introduction

This publication is intended to be used in conjunction with other guides or references such as applicable contracts, *NWCG Standards for Airtanker Base Operations (SABO)*, PMS 508, local Airtanker Base Operations Plan (ABOP), the *Interagency Standards for Fire and Fire Aviation Operations* (Red Book) https://www.nifc.gov/standards/guides/red-book, *NWCG Standards for Aerial Supervision (SAS)*, PMS 505, https://www.nwcg.gov/publications/pms505, *NWCG Standards for Water Scooping Operations*, PMS 518, https://www.nwcg.gov/publications/pms518, and other state or local aviation plans or guides. These references together assist in the standardization of common procedures and best practices throughout airtanker operations. This publication identifies the minimum interagency standards for airtanker operations. Much of the content is written for airtanker operators, pilots, and the personnel managing those resources.

Management

All airtankers shall adhere to the specifications set forth in the contract under which they are operating. Any concerns, requests, or proposed deviations to contract specifications shall be vetted through the assigned Contracting Officer (CO) and/or the appropriate Airtanker Program Manager (ATPM) prior to execution. The airtanker program requires Regional/Geographic area management and oversight in addition to national or agency program management.

Airtanker Base Operations

The *SABO* outlines expectations for ground operations. The *SABO* can be found at: https://www.nwcg.gov/publications/pms508.

Dispatch and Coordination

Airtankers shall be dispatched using the *NWCG Aircraft Dispatch Form*, PMS 250, or equivalent. Resource order forms are not an acceptable aircraft dispatch information format.

The following terminology will be used when requesting aircraft through the National Interagency Coordination Center (NICC):

Knots (kts) will be the standard term used to reference airspeed.

Very High Frequency Omni-directional Range (VOR) will be used to reference direction.

Latitude/Longitude must be provided in Degrees Decimal Minutes (DDM), utilizing GPS Datum WGS84 degrees and minutes.

Mobilization

The NICC mobilizes resources based on National Multi-Agency Coordinating Group (NMAC) priorities. NMAC will allocate federal airtankers by positioning them around the country in areas of current or predicted high wildfire danger or activity. Geographic Area Coordination Centers (GACCs) managing these aircraft will make them available for wildfire assignments when ordered by NICC. This will be accomplished by ensuring that all support functions (e.g. airtanker bases and local dispatch centers) that are required for the mobilization of national resources (e.g. airtankers/SEATs, leadplanes, aerial supervision modules, and Type 1 and 2 helicopters) are staffed and maintained to support mobilizations. Host GACCs will check with NICC prior to releasing flight crews/airtankers at the end of

shift. National resources, when not being used within the host area, could be utilized in another GACC for emerging or ongoing fire activity.

When a GACC is utilizing all hosted airtankers, request(s) for additional resources will be placed to NICC. Airtankers shall be used for initial attack across a GACC boundary when the airtanker outside the boundary is the closest resource to the incident. A resource order from the receiving GACC should be placed to NICC who will then place the order with the sending GACC. An *NWCG Aircraft Dispatch Form*, PMS 250, or equivalent, should be sent direct to the sending GACC and dispatch center to launch the airtanker. Reference the *NWCG Aircraft Dispatch Form*, PMS 250, at https://www.nwcg.gov/publications/pms250.

Airtanker mobilization will be coordinated by NICC; the requesting GACC will place order up and NICC will place the order down to the sending GACC (where the airtanker is located). All airtankers will have a resource order or aircraft dispatch form prior to departure. The type of airtanker mobilized will be based on incident needs, resource availability, location in relation to the requesting unit, and aircraft and crew capability.

Prepositioning may require a job code for the flight. The National Fixed Wing Coordinator (FWC) and National Airtanker Program Manager (ATPM) have an assigned prepositioning code for this use. The job code will be provided to a requesting GACC or airtanker base.

Aerial Supervision Modules (ASMs)/leadplanes shall be ordered and mobilized immediately with airtankers that require a leadplane. When leadplanes are co-located with airtankers they should be dispatched together. When airtankers are ordered to a congested area a leadplane/ASM shall be ordered. When airtankers are ordered and a leadplane is available they should be dispatched as well.

See Grant of Exemption No. 392 in the *Interagency Standards for Fire and Fire Aviation Operations* at https://www.nifc.gov/standards/guides/red-book.

Flight Following

Flight following is mandatory for all flights. Refer to the *National Interagency Standards for Resource Mobilization* https://www.nifc.gov/nicc/logistics/reference-documents for specific direction.

Automated Flight Following (AFF) is the preferred method of flight following. If AFF has been confirmed, 15-minute radio checks are not needed. Adding the radio checks clutters the radio for the pilots and can be distracting to the crew. If AFF is not working, operations may continue with the 15-minute radio checks, refer to appropriate agency contract and the *National Interagency Standards for Resource Mobilization*, Chapter 50, https://www.nifc.gov/nicc/logistics/reference-documents.

National Flight Following Frequency

The National Flight Following frequency, (168.6500 MHz, a Continuous Tone-Coded Squelch System (CTCSS) tone of 110.9 must be placed on the transmit and receive sides of the frequency), is used for flight following, dispatch, or redirection of interagency and contract aircraft. No other use is authorized.

Airtankers will establish/terminate flight following and confirm AFF on the National Flight Following frequency. All dispatch centers/offices will monitor the National Flight Following frequency at all times. Refer to the *National Interagency Standards for Resource Mobilization*, Chapter 50, Flight Following Management for detailed flight following procedures and requirements.

Flight Following Script

The following information is required every time a flight is initiated or continued with a dispatch center or airtanker base if approved by local dispatch for close proximity incidents to the airfield.

- Call sign (T-###)
- Departure location
- Number of flight crew on board
- Fuel on board (hours)
- Estimated time en route (ETE)
- Destination
- AFF confirmation

Example flight following radio transmission:

Tanker 4 – "Redding Dispatch, Tanker 4 off Redding, 2 on board, 3 hours fuel, 20 minutes en route to the Rock Fire."

Redding Dispatch – "Tanker 4, Redding, Copy all, Positive AFF."

Airtanker Rotation

Refer to the *Interagency Standards for Fire and Fire Aviation Operations (Red Book)*, Chapter 16 for the most current information regarding airtanker rotation.

https://www.nifc.gov/standards/guides/red-book

Flight Hour and Duty Limitations

(Refer to appropriate agency contract)

For federal airtankers all flight time, regardless of how or where performed, except personal pleasure flying, shall be reported by each flight crew member, and used to administer flight hour and duty time limitations.

Flight time to and from the assigned base as a flight crew member (commuting) shall be reported and counted toward limitations if it is flown on a duty day.

Flight time includes, but is not limited to, military flight time, charter, flight instruction, 14 CFR Part 61.56 flight review, flight examinations by Federal Aviation Administration (FAA) designees, any flight time for which a flight crew member is compensated, or any other flight time of a commercial nature whether compensated or not.

Flight time shall not exceed a total of 8-hours per day (except for point-to-point flights which allows for 10 hours per day for multi-crewed aircraft).

Pilots accumulating 36 or more flight hours in any six consecutive duty days shall be off duty the next day. Flight time shall not exceed a total of 42 hours in any six consecutive days. After any one full off duty day, pilots begin a new six consecutive day duty period, providing during any 14 consecutive day period, each pilot shall have two full days off duty. Days off need not be consecutive.

If these standards are exceeded, the following time off requirements will be followed:

- 11 consecutive hours of rest if the duty day or flight time limitations are exceeded by not more than 30 minutes.
- 12 consecutive hours of rest if the duty day or flight time limitations are exceeded by more than 30 minutes, but not more than 60 minutes.
- 16 consecutive hours of rest if the duty day or flight time limitations are exceeded by more than 60 minutes.
- Notification through the contracting chain of command shall occur and an Aviation Safety Communique (SAFECOM) should be submitted.

Assigned duty of any kind shall not exceed 14 hours in any 24-hour period. Within any 24-hour period, pilots shall have a minimum of ten consecutive hours off duty immediately prior to the beginning of any duty day. Local travel up to a maximum of 30 minutes each way between the work site and place of lodging shall not be considered duty time. When one-way travel exceeds 30 minutes, the total travel time shall be considered as part of the duty day.

Duty includes flight time, ground duty of any kind, standby time, or alert status at any location.

Pilots may be relieved or remove themselves from duty prior to reaching duty limitations for fatigue or other stressors caused by strenuous duty. The Contracting Officer Representative (COR) or other appropriate official should be notified as soon as practicable.

During times of prolonged heavy fire activity, the Government may issue a notice reducing the pilot duty day/flight time and/or increasing off duty days on a geographical or agency-wide basis.

Flights point-to-point (airport-to-airport, etc.) with a pilot and copilot shall be limited to ten flight hours per day. (An aircraft that departs “Airport A,” flies reconnaissance on a fire, and then flies to “Airport B,” is not point-to-point).

When pilots act as a mechanic, mechanic duties in excess of 2 hours shall apply as pilot flight hours on a one-to-one basis toward flight hour limitations.

Relief, additional, or substitute pilots reporting for duty under this contract shall furnish a record of all duty and all flight hours during the previous 14-days. Pilots shall be FAA qualified, FAA current in the aircraft, proficient, and approved in the special mission.

Aviation Safety

Hazards

Aerial firefighting presents many hazards and risks associated with the dynamic nature of operations and the fire environment. Common hazards include, but are not limited to:

1. Airspace congestion or aircraft proximity/co-altitude
2. Low visibility
3. Hazardous/masking terrain
4. Low-level flight profiles
5. Weather, wind shift, or variable wind conditions
6. Insufficient aerial supervision

7. Lack of communication
8. Communication blocking
9. Sense of urgency
10. Mission focus based on unreasonable expectations

This environment demands a significant level of situational awareness (SA). Hazards such as these can overwhelm operators, causing loss of SA, possibly leading to more complex hazards increasing risk and mishap potential.

Managing Risk

Information on aviation safety materials and Safety Management Systems (SMS) can be found in the *NWCG Standards for Aviation Risk Management*, PMS 530, https://www.nwcg.gov/publications/pms530, and the *NWCG Aviation Risk Management Workbook*, PMS 530-1, https://www.nwcg.gov/publications/pms530-1.

Risk Refusal

Every individual has the right to turn down unsafe assignments. When an individual feels an assignment is unsafe, they also have the obligation to identify, to the degree possible, safety alternatives for completing that assignment. *The Incident Response Pocket Guide (IRPG)*, PMS 461 at https://www.nwcg.gov/publications/pms461 contains a process for properly refusing risk.

Aerial Supervision

Refer to the *NWCG Standards for Aerial Supervision*, PMS 505, at https://www.nwcg.gov/publications/pms505 for the most current direction on aerial supervision regarding airtanker operations.

Working With a Leadplane

Refer to the *NWCG Standards for Aerial Supervision*, PMS 505, at https://www.nwcg.gov/publications/pms505 for the most current direction and information on working with a leadplane.

Working with Water Scooping Aircraft

Refer to the *NWCG Standards for Water Scooping Operations*, PMS 518, at https://www.nwcg.gov/publications/pms518 for information that may be useful such as circuits and routes.

Operational Procedures

Constructive Airmanship:

Aerial Firefighters encounter different circumstances (peer skill level, comfort level, weather conditions, familiarity with other pilots, familiarity with other vendors, etc.) during each mission. It is imperative for all pilots, including the flight lead (if applicable), to work together to achieve a safe, effective, and efficient mission while working toward common objectives.

Airspace

Airspace coordination and deconfliction is a shared responsibility among pilots, air traffic controllers, dispatchers, trainers, on scene personnel, and managers of resources, operations, safety, and airspace. The primary focus in airspace coordination is midair collision avoidance. When performing most agency aviation tasks, the pilot's attention will be diverted out of the aircraft toward the ground, conflicting with their primary responsibility to "see and avoid" other aircraft or obstructions. Other users of this airspace may have similar workload distractions. As airspace becomes more complex, effective processes are needed that will identify issues and facilitate coordination efforts. The Fire Traffic Area (FTA) is the primary tool aerial firefighters have to ensure safe separation. Refer to the *NWCG Fire Traffic Area (FTA)*, PMS 505d, at https://www.nwcg.gov/publications/pms505 for more information on FTA requirements.

As always, it is the pilot's responsibility to comply with all FAA rules and regulations for flight through each type of airspace. The final responsibility for collision avoidance rests with the Pilot-in-Command (PIC) to "see and avoid."

Refer to the *NWCG Standards for Airspace Coordination*, PMS 520, at https://www.nwcg.gov/publications/pms520 for more guidance.

Communications

When communicating on firefighting frequencies airtanker pilots will use standard communications procedures in accordance with the *NWCG Standards for Aerial Supervision*, PMS 505, this document, and *Appendix A – Fixed Wing Scripts.* On complex incidents frequency congestion may be a limitation. Airtanker pilots should emphasize communication brevity. If the PMS 505 or the Fixed Wing Scripts dictate a specific script, airtanker pilots should utilize that script.

Communications directed at airtankers that sound like a clearance or are directive should be read back. This includes clearance into the FTA, clearance to maneuver, specific altitudes or routes to fly, or specific exit instructions. Example:

Rock Air Attack: "Tanker 100, Altimeter 2992, You're cleared in 1500, Air Attack is 2500, 1 Copter 500' and below. Hazards are Powerlines."

Tanker 100: "Tanker 100 cleared in 1500, altimeter 2992, copy hazards."

If communication from the aerial supervisor sounds descriptive, airtanker pilots should acknowledge receipt and understanding by transmitting their call sign only. Airtanker pilots should avoid the tendency to read back an entire descriptive radio call if it is clearly understood. Ideally, following a long and complex target description from the aerial supervisor, the response from the airtanker pilot should be "Airtanker (Callsign), I have the target." If an airtanker pilot is unclear on all or part of the communication, the pilot should clearly ask a question to illicit the specific information needed from the aerial supervisor. Example:

Rock Air Attack: "Tanker 73, the heel of the fire is near the house along the paved road. The head is at the top of the hill. The smoke is blowing over the right shoulder. There is a house with a red roof under the smoke off the right shoulder."
Tanker 73: "Tanker 73, I have the target."

Rock Air Attack: "Tanker 73, start on the driveway between the house and the fire and take it down the right flank. Whole load, coverage level 4, left turn on the exit. You are cleared to maneuver."
Tanker 73: "Tanker 73, I don't have the target."

When following a leadplane it is important to acknowledge receipt of radio calls with callsign. Example:

Bravo 12: "Tanker 113, Bravo 12, we're turning base for a live run, crossing this ridge at 1200."
Tanker 113: "Tanker 113"

Operations in the Fire Traffic Area (FTA) and in Temporary Flight Restrictions (TFRs)

Procedures outlined below are derived from *NWCG Standards for Aerial Supervision,* PMS 505, https://www.nwcg.gov/publications/pms505.

TFR Entry Procedures

1. All assigned/ordered aircraft must obtain clearance into the incident TFR by the on-scene aerial supervisor. An Interagency Resource Ordering Capability (IROC) order or aircraft dispatch form is NOT a clearance into a TFR.
2. Pilots should use the communications script for FTA entry detailed below. Pilots must remain outside the TFR until cleared in. If the operations area or the airtanker orbit is near the TFR, boundary pilots should remain outside the 7-mile the orbit area until cleared in by aerial supervision.
3. The first responding aircraft must have reasonable assurance that there are no other aircraft in the TFR by making blind calls on the TFR frequency, other assigned air-to-air frequencies, and double-checking with ground personnel (Incident Commander [IC], Operations, or helibase). This is normally the aerial supervisor. If an airtanker is the first aircraft responding on a given day, they must perform these tasks or hold outside the TFR until the aerial supervisor has accomplished them and taken control of the TFR.
4. There may be multiple aircraft operations areas (AO) or working areas (WO) within a TFR. Arriving airtankers must ensure they understand the location and nature of other operations and should receive or request routing or information to ensure safe separation from other operations.
5. Non-incident aircraft may enter the TFR in accordance with (IAW) FAR 91.137. Airtanker pilots should always be vigilant in looking out for non-incident aircraft or TFR violating aircraft.

FTA Entry Procedures

Airtanker pilots must follow the FTA entry procedures listed below. Variations of these procedures should also be followed for TFR entry IAW the TFR section above and for reporting to an Initial Point (IP) IAW IP section below.

Communication and Clearance into the FTA and/or a TFR

There are three different scenarios requiring slightly different communication procedures when arriving at an incident:

1. Aerial supervision is on scene.
2. Aerial supervision is not on scene, but other aircraft are on scene.
3. There are no aircraft on scene.

Scenario 1: Aerial Supervision is On Scene

- Change to incident frequencies: As soon as possible, change to and monitor incident frequencies.
- 12 Mile call: At 12 miles, make a radio call to aerial supervision. Include the call sign of the aerial supervisor, airtanker's call sign, location, and altitude. If unable to make contact at 12 miles aircraft may continue but must remain outside 7 miles until clearance is received. Example:

Tanker 100: "Rock Air Attack, Tanker 100, 12-miles southwest, 1500"

- Obtain clearance into the FTA: Clearance shall include the airtanker's call sign, altimeter setting, a clearance altitude, altitude of aerial supervisor, other aircraft and their altitudes (and order in sequence and who to follow if required) and known hazards. Example:

Rock Air Attack: "Tanker 100, Rock Air Attack, Altimeter 2992, You're cleared in 1500, Air Attack is 2500, 1 copter 500' and below. Hazards are powerlines. You are number two behind Tanker 89."

  - Read back the clearance (altimeter and altitude cleared in at) and enter the incident airspace, as briefed. Example:

Tanker 100: "Tanker 100, 2992, Cleared in 1500."

Scenario 2: Aerial Supervision is not On Scene, but Other Aircraft are On Scene

- Change to incident frequencies: As soon as possible change to and monitor incident frequencies.
- 12-mile call: At 12 miles, make a radio call to the aircraft on scene. Include the call sign of the on-scene aircraft, airtanker's call sign, location, and altitude. If the call sign of on-scene aircraft is unknown the arriving aircraft should us the term "any aircraft on scene of the (fire name) Fire." If unable to make contact at 12 miles, aircraft may continue but must remain outside 7 miles until clearance is received. Example:

Tanker 100: "Any aircraft on scene the Rock Fire, Tanker 100, 12-miles southwest, 1500."

- Obtain clearance into the FTA. Clearance shall include the airtanker's call sign, altimeter setting, a clearance altitude, other aircraft and their altitudes (and order in sequence and who to follow if required), and known hazards. Non-aerial supervisor aircraft may not be as practiced at providing complete clearance instructions. Arriving pilots should actively solicit required clearance items if not initially provided. Example:

Copter 514: "Tanker 100, Copter 514, Altimeter 2992, you're cleared in 1500, one copter 500 and below. Hazards are powerlines. You are number two behind Tanker 89."

  - Read back the clearance and enter the incident airspace, as briefed.
  - Get status of all on-scene aircraft (location, mission type, etc.).
  - Coordinate separation with all on-scene aircraft.
  - Call IC and get objectives and priorities.

Scenario 3: There Are No Aircraft on Scene

- Change to incident frequencies: As soon as possible, change to and monitor incident frequencies. Use all available information such as Automatic Dependent Surveillance (ADS-B), Traffic

Collision Avoidance System (TCAS), Traffic Collision Avoidance Device (TCAD), radio communication with dispatch, the IC or responding ground personnel, and visual lookout to ensure no other aircraft are on scene.

- 12-mile and 7-mile blind calls: At 12 miles and again at 7 miles make a radio call "in the blind." These calls should be made on the primary and secondary air-to-air frequencies (in California 122.925.) Include the phrase "any aircraft on scene or responding to the (fire name) Fire," airtanker's call sign, location and altitude, and a request that any aircraft respond. Identify the frequency transmitting on.

Example: Tanker 100: "Any aircraft on scene or responding to the Rock Fire, Tanker 100, 12 miles southwest, 1500, please advise on 127.35"

- FTA setup: If an airtanker is the first aircraft on scene they must establish the FTA protocols. Airtanker pilots should enter at 1500' Above Ground Level (AGL), communicated in Mean Sea Level (MSL), unless a higher altitude is required for terrain or hazards. The first on-scene aircraft is then responsible for coordinating with other aircraft using standard communication scripts and FTA protocols in accordance with (IAW) *NWCG Standards for Aerial Supervision,* PMS 505.
    - Scenario 1: Airtanker on scene clearing in Air Attack example:

Tanker 800: "Air Attack 17, Altimeter 2992, cleared in 8000, Tanker 800 is at 7000, two copters at and below 6000, caution power lines south side of the ridge top."

    - Scenario 2: Airtanker On Scene clearing in another airtanker example:

Tanker 800: "Tanker 105, Altimeter 2992, cleared in 7000, Tanker 800 is also at 7000, one copter 6000 and below, caution power lines south side of the ridge top. You are cleared in #2 behind Tanker 800."

    - Scenario 3: Airtanker On Scene clearing in a helicopter example:

Tanker 800: "Copter 514, Altimeter 2992, cleared in 6000 and below, Tanker 800 is at 7000, there is one copter on scene 6000 and below, Copter 2GK, caution power lines south side of ridge top."

- Coordinate with IC. Call the IC/ground personnel on the assigned FM air-to-ground frequency and establish objectives and priorities and provide a fire sizeup. If unable to establish contact or no ground personnel are on scene, notify dispatch of on-scene status and provide a fire sizeup.
- Finding/reporting a new incident: If an airtanker pilot finds what they believe to be a new incident contact dispatch to ensure no aircraft are on scene prior to proceeding within 7 miles. If assured that no aircraft are on scene, make blind calls at 12/7 miles on appropriate frequencies if known, or guard as a last resort. Proceed to the incident. Maintain at least 1,500 feet AGL and watch for other aircraft. Once at scene obtain an accurate lat/long, then contact dispatch with a full fire sizeup.

Hold Outside 7 Miles Until Cleared In:

Pilots that have not yet received a clearance into the FTA must hold outside 7 miles. If holding outside 7 miles, pilots should hold well off the direct course between the fire and reload bases in a location that minimizes the possibility of conflict with other arriving or departing aircraft. The manner and method of holding will be situationally dependent. It is important to practice "see and avoid" and be responsible for your own separation such as right of course in left turns, or orbit in a left-hand turn around the 7-mile

no-communications ring. When holding outside 7 miles, pilots should make blind calls and communicate with other aircraft also holding or arriving in the vicinity.

On Altitude and Airspeed by 7 nm

Prior to crossing inside of 7 miles, pilots must be less than 170 knots and at the assigned orbit altitude.

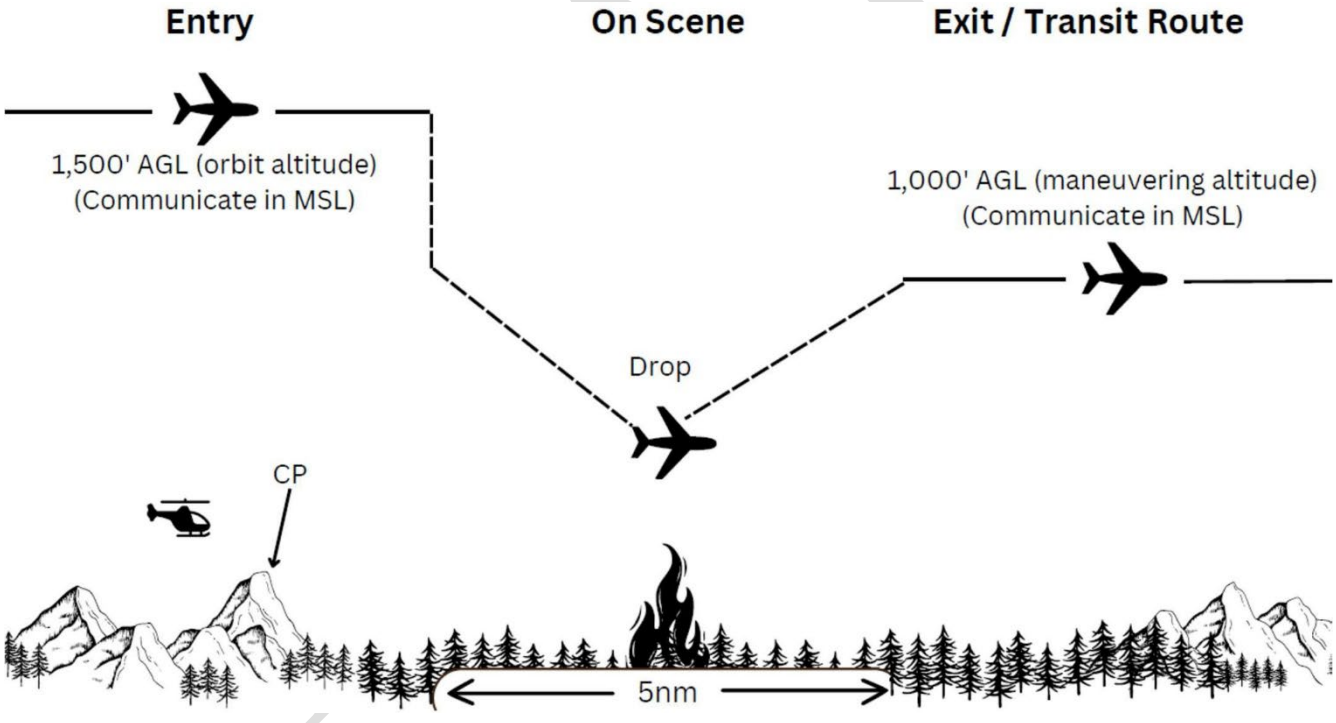
Initial Point (IP) Procedures

If ordered to report to an IP, airtankers should receive an IP name, latitude/longitude, and an altitude for arrival at the IP. On large or complex incidents pilots must understand the geographic relationship between the IP, the FTA or working area, and the TFR boundaries (if applicable). Pilots are expected to avoid flying through the working area en route to the IP. If unsure of the routing to an IP, pilots should request clarification from dispatch or aerial supervision. Pilots are encouraged to make the initial call to aerial supervision 12 miles from the IP and hold outside 7 until clearance is received. Pilots should use the FTA entry script above but use the IP name in lieu of the fire name. If directed to hold at an IP, airtanker pilots should hold in an orbit centered on the IP in left-hand turns.

Example:

Tanker 800: “Rock Air Attack, Tanker 800, 12 miles southwest of Blue Lake IP, 6500.”

Figure 1: Segments of the Airtanker Mission.



Orbit Entry Procedures

Orbit entry procedures apply to the airtanker orbit inside an FTA or the orbit at an aircraft operations area/working area inside a TFR. If entering at an IP that already contains other aircraft, similar concepts apply.

Airtankers enter the orbit in a left-hand turn at 1,500 feet AGL (communicated in MSL). If the assigned orbit altitude is restricted by smoke or terrain, or is otherwise not optimum, airtanker pilots should coordinate with aerial supervision for a different orbit altitude. Leadplanes and ASMs also enter at orbit altitude in a left-hand orbit unless briefed and approved by the on-scene aerial supervisor. Fixed wing water scooping aircraft arriving at scene for the first time normally enter the 1500' left-hand orbit using the same procedures as retardant dropping aircraft and are sequenced in the same as retardant aircraft.

Responsibility for Separation When Entering the Orbit

Aerial firefighting is conducted under visual flight rules (VFR), thus all pilots are responsible to "see and avoid." However, as airtankers arrive on scene, they are responsible to ensure safe separation from all other aircraft already on scene. To accomplish this, the arriving airtanker must meet the following conditions prior to entering the orbit:

1. Have accurate information on the number of other aircraft on scene at orbit altitude. This is normally accomplished by the aerial supervisor including the information in the FTA or TFR clearance. "Tanker 1 you're cleared in at 1500 number 3 behind Tanker 100 and Tanker 800." Pilots should use active listening. ADS-B, and/or TCAS / TCAD information should also be used to assist in acquiring this information.
2. Know the location of the orbit to allow the arriving airtanker to remain clear by initially flying to a position wide and to the right of the orbit. On a large fire or where smoke or terrain is a factor it may be difficult to know the exact location of the orbit. Pilots that are unfamiliar should query the aerial supervisor on the location of the orbit. Pilots should use active listening, ADS-B, and TCAS/TCAD information to assist in acquiring this information.
3. Visually acquire all the aircraft in the orbit prior to entering the orbit or becoming a collision hazard for any other aircraft. ADS-B and TCAS/TCAD information may be useful in assisting. Pilots must recognize the inherent lag and possible failure of these systems. Do not enter an orbit without visual confirmation of all other resources.

All participating flight crew members play an active role in ensuring the FTA arrival process is accomplished safely and efficiently. Airtanker pilots should assist aerial supervisors by requesting or recommending establishment of an IP or route if the pilot believes it may increase safety or efficiency.

Pilots arriving at a complex or large fire for the first time, or who are unsure of the orbit location or routing should inform aerial supervision and request enough information to ensure safe entry.

Airtanker pilots should communicate amongst themselves to establish routing between the fire and the base. Pilots should also communicate any pertinent mission information to help the next arriving aircraft. This communication may be sent on 122.925 (California air-to-air), other inter-flight frequency, or base victor. Example pertinent mission communication:

Tanker 89: "Tanker 100, Tanker 89 on 122.925, the work area is about 5 miles east of where we were working yesterday."

All participants have a responsibility to speak up if an error or miscommunication is determined. Pilots should actively scan to visually acquire arriving aircraft and must speak up prior to a possible conflict. Example (there are already three airtankers established in the orbit and the aerial supervisor incorrectly clears in the 4th tanker number as the 3rd):

Tanker 89: "Rock Air Attack, Tanker 89, There are currently 3 airtankers in the orbit. I believe Tanker 90 should be number 4 not number 3."

Spacing and Separation While in the Orbit and When Following a Leadplane or Airtanker for a Drop.

Consideration should be given for maneuvering in the event of a malfunction, emergency, or loss of directional control. The lead aircraft, or aircraft being overtaken, has the right of way. The following aircraft must maintain appropriate spacing and visual contact with the aircraft they are following at all times. In the event visual contact is lost the following aircraft must immediately communicate "blind" and execute the procedures detailed later in the chapter under Blind Procedures.

Minimum spacing between fixed wing retardant dropping airtankers or between fixed wing retardant dropping airtankers and a leadplane is 1500' (¼ NM). Aircraft will maintain the minimum 1500' separation and should use available tools such as TCAS/TCAD and/or ADS-B information to accomplish this. Momentary unintentional excursions inside 1500' are not considered a policy deviation but shall be corrected as soon as safely possible. Spacing may need to be increased during dynamic maneuvering or when dropping retardant behind another airtanker.

Dropping/Flying Behind an Airtanker

When dropping behind or after an airtanker (in a flight or during sequencing operations) spacing must allow the first airtanker's retardant to completely clear the air and the aerial supervisor time to evaluate the drop, then provide a correction to the second airtanker (if required) or direct a go-around. This is approximately 15 seconds or ½ NM of separation (refer to the speed and distance chart in *Appendix D – Standard Operating Procedures for Flights*) This can normally be accomplished by the second airtanker being on the base leg when the first airtanker is dropping.

When dropping or flying behind an airtanker drop, the second aircraft must plan and fly a pattern that allows the pilot to keep sight of the previous retardant and maneuver to avoid the retardant cloud if it hangs in the air longer than expected. No aircraft should ever fly though retardant that is hanging in the air.

Sequencing With Other Types of Aircraft or Types of Operations.

When working in close proximity to other types of aircraft, it is imperative that airtanker pilots have positive identification of the quantity and type of other aircraft. Airtanker flight crews should also be aware of the other resource's dip/scoop locations, routes, patterns, and altitudes. Aerial supervision may choose to increase SA by referencing helicopter type (1, 2, 3), configuration (bucket or tank), and/or model (Skycrane, Blackhawk, Huey, etc.) as appropriate when briefing resources. Likewise, airtankers should be referred to by make and/or model of aircraft (BAe-146, MD-87, etc.).

Orbit Procedures

- 1500' AGL as assigned left turns: Maintain the assigned altitude (normally 1500' AGL communicated in MSL) in left-hand turns unless briefed and approved by on-scene aerial supervisor.
- Sequence and orbit spacing: Aircraft arriving in the orbit should expect to drop in the order in which they arrive. The first aircraft in the orbit at orbit altitude (the next to maneuver) sets the location, size, and shape of the orbit. Other aircraft in the orbit will follow the aircraft in front of them with the goal of being out of the way and behind the first airtanker. This will provide the first airtanker with maximum freedom to maneuver. Optimum follow location is roughly 1/4 to 1/3rd of the way around the orbit. If the orbit contains three or more aircraft, spacing should be

reduced to position aircraft at the ¼ orbit position to make a large and obvious place for the next airtanker arriving in the orbit. The total diameter of the orbit may also be increased by reducing bank angle if the orbit has more aircraft. Under normal circumstance more than four airtankers in the orbit should be avoided because it reduces safety, effectiveness, and efficiency.

- Maneuver to view previous drop/show me: The first aircraft in the orbit at orbit altitude (the next to maneuver) should maneuver to view the previous drop/show me or to view the drop area while receiving a target description. The first aircraft must remain in left-hand turns and must maneuver predictably with consideration for the other aircraft in the orbit. In an orbit with three or four airtankers the lead airtanker must prioritize separation from other aircraft in the orbit over optimizing the view.
- Tactical briefing: The next up airtanker to maneuver should be prepared to receive a tactical briefing. The tactical briefing should include the drop location, coverage level, exit instructions, and hazards. If the airtanker pilot understands the target, the response should include call sign and "I have the target." If the airtanker pilot does not understand the target or there is any confusion the airtanker pilot should ask for clarification. Questions using standard fire anatomy are an excellent technique.
- Understand the target, the exit, and completely plan the drop pattern prior to low-level operations: Do not accept a clearance to maneuver if unsure of ability to maintain safe separation from all other aircraft. Do not accept a clearance to maneuver if unable to comply with briefed exit instructions. Maneuvering may begin while finalizing the exact drop pattern plan and completing the recon, but do not begin low-level operations without a complete plan. (see approach/drop sections below for further details).

Maneuvering Procedures

- 1,000' AGL/500' below orbit altitude. Maneuvering altitude is normally 1000'AGL but should be flown a minimum of 500' below the orbit altitude as communicated in MSL (if orbit is 4500'MSL maneuvering is 4000' MSL).
- Left-hand patterns are standard.
- Right-hand patterns require approval: If a drop pattern is to be performed from a right-hand pattern the airtanker pilot must request and receive clearance for a right pattern. The pilot must then descend 500' below orbit altitude **prior** to beginning the right turn.
- Clearance to lower altitude: An airtanker desiring to get a closer look at a target or hazards or desiring to get out of a congested orbit may request clearance to the maneuvering altitude. This is NOT a clearance to maneuver for the drop. Example:

Tanker 800: "Rock Air Attack, Tanker 800, request a descent to maneuvering altitude to get a better look at the tower near the start point."
Rock Air Attack: "Tanker 800, Rock Air Attack you are cleared to descend to 4000."

- Cleared to maneuver: Clearance to maneuver is a clearance to descend from the orbit altitude and fly the drop pattern all the way to drop location and altitude but is not a clearance to drop (see drop clearance below). Example:

Rock Air Attack: "Tanker 100, cleared to maneuver."

- Clearance to maneuver and drop behind a leadplane: A leadplane will not normally use the terms "cleared to maneuver" or "cleared to drop" when operating in the lead profile. Phrases such as "if you have me in sight, you can join me on the downwind at 1000'" is clearance to maneuver behind the leadplane. "Start here," and "tie in next to the rocks" are examples of drop clearance when the airtanker is maneuvering behind the leadplane/ASM while in the lead profile.

Approach Pattern Procedures

- Drop patterns should be planned prior to maneuvering. Normally drop patterns are planned based on an exit. Drop patterns are planned from the exit backward to the start point with a level or downhill exit often being the controlling factor. Dropping downhill, into the wind, down sun, and starting at the anchor or existing retardant will result in the most accurate and effective drop.
- Plan the airtanker drop pattern and exit to avoid other aircraft. Airtanker pilots must understand the location of other aircraft, their dip sites, routes, circuits, and checkpoints with enough detail to plan a pattern to avoid the other aircraft. If a fence is in place, airtankers must not cross the fence during the pattern or the exit when below orbit altitude. If unable to plan and fly a pattern that avoids the other aircraft or crosses a fence, the pilot must inform the aerial supervisor and coordinate for alternate deconfliction procedures prior to beginning to maneuver. This can best be accomplished by clearly informing the Air Tactical Group Supervisor (ATGS)/Leadplane Pilot (LPIL) that the pattern or exit will possibly have a conflict and where that conflict will occur. If appropriate, the airtanker pilot should recommend/request an alternate deconfliction plan that will provide safe separation for all aircraft. Example:

Tanker 800: "Rock Air Attack, Tanker 800, on my exit I will need a right turn down the canyon which will cross the fence and overfly the dip. If you hold the copter ¼ NM upstream of the heel while I maneuver that will provide safe separation."

- Fly a predictable drop pattern. On complex fires, airtanker pilots may not be informed of the location of every other operation. Aerial supervisors expect airtanker pilots to fly a predictable pattern. When airtankers are performing drops in the same general location as the previous drop (such as a tag and extend) aerial supervisors expect each pilot to fly roughly the same pattern (same direction or drop, roughly same size and shape (with variation for type of airtanker)) as the previous pilot. If the drop pattern will differ significantly from the previous airtanker's pattern and/or there is any possibility of an airspace conflict, inform the ATGS/LPIL of the planned pattern and ensure no conflict exists.

  Example:

Tanker 110: "Rock Air Attack, Tanker 110, I have the target. I saw the last drop. I will need to drop the opposite direction with a right turn on the exit for terrain. Will that be a conflict for other operations?"

- Maintain Appropriate Spacing: Maintain appropriate spacing behind the leadplane, preceding flight member, or other aircraft during sequencing operations per the spacing section above.
- Call legs (downwind, base, final) when working with Aerial Supervision and time (time to target) with an IC.
- Aerial Supervision Example:

Tanker 89: "Tanker 89, downwind."

- To the max extent possible downwind should be called abeam the target on a reciprocal heading from the planned drop heading. Base should be called 90 degrees to the drop heading. If time allows final should be called wings level on final. This timing of communications allows the Air Attack the ability to use cadence to manage workload as well as confirm that the airtanker is on the desired line. It also allows the air attack pilot to best position the ATGS to observe the drop. If dropping from a right pattern, the airtanker pilot must add "right" to the downwind and base calls. Example:

Tanker 89: "Tanker 89, right base."

IC Example: Tanker 100: "Rock IC Tanker 100 1 minute out from the drop/target"

- SEAT "gate is armed": SEAT pilot will visually confirm gate is armed and make a radio call "Gate is armed" any time prior to the final leg.
- Keep the exit in sight at all times: Flying the drop pattern is a high task loading portion of the mission. Airtanker pilots must execute a composite cross-check/scan. To execute an effective drop, the pilot must acquire and process information from inside the cockpit, the pattern routing, descent path, and the target area (hazards, start point, drift info). Pilots must ensure that the exit is always scanned as part of this process. It is especially important to complete each scan with a look at the exit. A loss of contact with the target or other fixation in the target area must not result in a failure to continue to verify the exit is still viable and the airtanker is on track to be able to fly the exit.
- Drop clearance received by Final. If no drop clearance is received, the airtanker pilots should query the aerial supervisor. If no drop clearance is received the airtanker should go around. When dropping without aerial supervision on scene, the clearance to drop will come from the ground contact.

Climb Out Procedures

- Straight Out is Standard; The standard initial climb out routing is straight out unless otherwise directed or approved as exit instructions.
- Climb to Maneuvering Altitude: The standard altitude on climb out is maneuvering altitude. Pilots. Should climb as expeditiously as the aircraft performance will allow to maneuvering altitude.
    - Split or Start/Stop Drop If the split or start/stop drop is planned in advance, the airtanker pilot should communicate with the aerial supervisor prior to maneuvering for the first portion of the load. Airtanker pilots and aerial supervisors must have a shared understanding regarding the expectation and clearance to maneuver for both drops, one after the other or if the airtanker will return to maneuvering altitude and receive a separate clearance to maneuver for the second drop as would often occur when sequencing with other resources. Examples:

Rock Air Attack: "Tanker 800, Rock Air Attack, I would like you to split your load. Start at the two-track road and stop at the rock outcropping. You are cleared to maneuver."

Tanker 800: "Rock Air Attack, Tanker 800, I have the drop. I would like to do the first half out of a right pattern then a left 270 for the second half."

Rock Air Attack: "Tanker 800, Rock Air Attack, you are cleared to maneuver for both drops and cleared for the right-hand pattern for the first drop." Or:

Rock Air Attack: "Tanker 8400, Rock Air Attack, After the first drop I need you to hold (at maneuvering altitude) while I get the copter in for 1 drop."

- Go-Around: If executing a go-around, airtankers should climb up to maneuvering altitude and follow the briefed exit routing. Pilots should communicate the go-around as soon as practicable and request a new clearance.
- Specific Clearance Required to Circle to Look at Own Drop: Airtanker pilots (especially during training or upgrade) may desire to get a look at their drop. To the max extent possible, airtanker pilots should inform the aerial supervisor of this need prior to maneuvering for the drop. A specific clearance must be received prior to maneuvering back into the target area to look at the drop.

Exit Procedures

- Airtankers must comply with briefed exit instructions: Airtankers may request, and must receive, an alternate clearance if unable to comply with briefed exit instruction. If possible, this should be accomplished prior to maneuvering for the drop.
- Exit Straight Out at Maneuvering Altitude at 150 knots until clear of the FTA is Standard: The standard exit is to fly straight out at maneuvering attitude while maintaining 150kts or less until clear of the FTA. Airtanker pilots must coordinate for alternate instructions if the standard exit will not work for reasons of safety or efficiency. For example, on a small fire if the reload base is on the opposite side of the fire from the direction of exit, airtanker pilots may request a turn prior to 7 miles (such as at 3 miles) to proceed back to the reload.
- Avoid other Working Areas/Areas of Operations (WA/AO): WA/AOs are areas where an identified project or task is being accomplished. Airtankers are required, unless clearance is given, to avoid other WA/AOs. Aerial supervisors should identify exit instructions that provide clearance from other operations, but airtanker pilots should query aerial supervisors if exit instructions are unclear.
- Drop Critique: Aerial supervisors should provide a drop critique. If no drop critique is received, when time and activity permits, airtanker pilots should request a drop critique. The critique should describe where the drop landed in relation to the desired location. Drop critiques should always include feedback on the start point and the line. If the drop is a start/stop or roll-up-to, the feedback should include critique of the end point as well. Example:

Rock Air Attack: "Tanker 79, start was ¼ load late. Line started good, but the last ¼ load drifted into the black."

- Communicate Known Errors: Airtanker pilots should inform aerial supervisors if they made a known error that contributed to a missed drop. This will prevent aerial supervisors from recommending incorrect corrections to the next airtanker. This is especially important when following a leadplane. Errors may include incorrect altitude, airspeed, coverage level, etc. Example:

Tanker 89: "B-55, Tanker 89, I was off your line one wingspan to the left when I dropped."

- Confirm load & return, hold, or release. When an airtanker completes its drop, the pilot needs to confirm with aerial supervision whether they are requested back to the fire, should hold on base, or are released from the fire.
- Confirm reload base or hold/release location. If an airtanker requests to return to a specific location at the end of the duty day this information should be communicated as early as possible. Also communicate the possible consequences of a failure to approve the request. This early communication is especially important if the aircraft will need to cease operations earlier than normal cut-off time so the IC/ATGS may consider ordering a replacement resource.
- Re-establish communications with dispatch, base, and Air Traffic Control (ATC).
- Fly standard Routes and Altitudes: The standard is right of course and VFR altitudes. See Routing to and from the Fire section below for details.

Routing to and from the Fire

When transiting between the airport/reload base and the fire, standard routing is to offset right of the direct course between the airport and the fire/IP/working area. Pilots should fly VFR altitudes. If right of course routing is sub-optimal, often due to the airport traffic pattern entry and runway in use, pilots may coordinate amongst themselves for non-standard left of course routing or coordinate specific routing such as passing on opposite sides of a prominent landmark en route. It is essential that non-standard routing be communicated and understood by all participating aircraft. The routing should be established as soon as possible and communicated between pilots (on 122.92 or other common frequency). The routing should also be communicated to the airtanker base, aerial supervision, and other entities that may be able to relay the information to incoming or newly dispatched airtankers.

Retardant Application

Ten Principles of Retardant Application

- Determine the strategy; direct, parallel, or indirect, based on fire sizeup and resources available.
- Establish an anchor point and work from it.
- Use the proper drop height.
- Apply proper coverage levels.
- Drop downhill, down sun, when feasible.
- Drop into the wind for best accuracy.
- Maintain honest evaluation and effective communication between the ground and air.
- Use direct attack when ground support is available, or it is feasible to extinguish the fire.
- Plan drops so that they can be extended or intersected effectively.
- Monitor effectiveness of retardant and adjust use accordingly.

Specifics on These Principles Are Explained Below.

- Airtanker pilots are responsible for the placement of their retardant/water load. Dropping on people or personnel should be avoided.

- Always drop above minimum drop height. Minimum drop height is delineated in feet above the top of the vegetation. Minimum drop height is predicated on dropping at correct drop speeds. If faster than normal, airtanker pilots must increase drop height or go around.
- Airtanker pilots should fly an offset line to counter crosswind drift. When working with a leadplane, the leadplane pilot will normally fly the drift, but airtanker pilots should query the LPIL if unsure.
- Retardant should lose forward momentum and rain straight down for best coverage. For optimum retardant effectiveness, the forward motion must be completely stopped prior to the top of vegetation. This prevents shadowing where retardant with forward motion coats the front of vegetation or other object creating an area of low or no coverage behind the object.
- Drop at appropriate coverage level. Airtanker pilots should drop at the coverage level requested by aerial supervision. Time permitting, an airtanker pilot that believes the coverage level should be adjusted may query the aerial supervisor or make a recommendation. This is especially appropriate if the pilot plans to drop at a higher-than-normal altitude or airspeed. The coverage level should be based on vegetation/fuel model. Observed fire behavior, terrain, or the effectiveness of the previous retardant drops may dictate changes from the standard coverage levels for given fuel model. In any case if the airtanker drops at a different level than requested, that needs to be communicated to the supervisor.
- Strong Tie In: Airtanker pilots must be familiar with the drop pattern and limitations of the tank system in their aircraft. When an airtanker is directed to "tie in to" or "tag and extend" existing retardant with a specific coverage level, the airtanker pilot is expected to start the drop to provide the proper overlap at the directed start point. For a tag and extend of the existing retardant, the pilot should start their drop to ensure that the retardant line is a continuous line at the requested coverage level. Leadplane pilots will normally communicate the start point as the end of the existing retardant with the understanding that airtanker pilots will push the release button at the correct time to provide proper overlap. A weak tie may be worse than a clear gap as it can be extremely difficult to observe from the air and may not be fixed, resulting in a failure of the retardant line.
- Plan drops so they may be extended or intersected effectively. Airtanker pilots should plan and execute drops so they may be effectively extended/tied into or intersected. The "tail" length and location should be based on the estimated time until the next airtanker drop. For example, if extending the line along the flank of a fire and the next airtanker to drop is already in orbit, the end of the first drop may be very direct as the next drop will occur in a few minutes and before the fire has a chance to significantly grow laterally. If the next airtanker will not be arriving for 20 minutes, the tail must be more indirect so that the fire does not "hook" around the end of the first drop prior to the next airtanker arriving. Similar concepts apply when putting a "vee" across the head of fast-moving fire or when the retardant line will change direction.
- Waterway and Terrestrial Avoidance Area Avoidance: Airtanker pilots must comply with the 2016 Implementation Guide for the Aerial Application of Fire Retardant. Detailed information is contained later in this chapter as well as in *NWCG Standards for Aerial Supervision,*PMS-505. In summary: Under normal circumstances long term chemical fire retardant must not be dropped within 300' of waterways.

Refer to Chapter 12 Suppression Chemicals and Delivery Systems, in the *Interagency Standards for Fire and Aviation Operations* for more information.
(https://www.nifc.gov/standards/guides/red-book).

Recommended Coverage Levels

Coverage Level	Fuel Model Description
CL-1	Short/medium grasses and tundra
CL-2	Conifer with grass, Short-needle closed conifer; summer hardwood, Long-needle conifer; fall hardwood
CL-3	Sagebrush with grass, Sawgrass, and tall grass and Intermediate brush (green) Light slash
CL-4	Short-needle conifer (heavy dead litter)
CL-5	Southern rough Intermediate brush (cured); Alaska Black Spruce
CL-6	California mixed chaparral; high pocosin Medium to heavy slash

Sequencing for Airtankers

The information provided below focuses on sequencing as it relates to Airtankers. For a comprehensive explanation of Sequencing, reference *NWCG Standards for Aerial Supervision*, PMS 505, Sequencing https://www.nwcg.gov/publications/pms505

Sequencing is a technique used to deliver multiple aircraft to a shared target area. Sequencing can be done between fixed-wing and/or rotor-wing aircraft to the same target area and actively managed by an aerial supervisor. The aerial supervisor establishes routes, circuits, and checkpoints, and uses specific language to determine which resource is cleared to the shared target area first, second, third, and so forth. Sequencing is NOT aircraft working in different target areas simultaneously. However, tools such as fences, routes, circuits, and checkpoints are utilized even when sequencing is not needed or appropriate.

Sequencing facilitates safe, effective, and efficient use of all resources. Sequencing is a shared responsibility, and all participants must maintain SA. If there is any doubt, or the situation does not allow positive control, hold resources.

Safe

Establishing known checkpoints, routes, and circuits for helicopters/water scoopers and utilizing the standard airtanker drop pattern (downwind, base, final, and exit) location and standard calls to determine which resource is cleared to the target first, results in predictability. Increased predictability facilitates bringing the resources in closer to the target area, thus each aircraft is easier to see, facilitating everyone's responsibility to "see and avoid." Using standard terminology, everyone involved knows what is expected.

Effective

The aerial supervisor can easily prioritize the correct resource for the needs of the mission, water vs. retardant, large aircraft versus smaller aircraft, aircraft with a long turnaround time vs. aircraft with a short turnaround time, aircraft working directly with ground resources vs aircraft working on a project far away from ground resources.

Efficient

Aircraft, mainly helicopters and water scooping aircraft, operate in close proximity to the target area requiring a close in checkpoint, minimizing hold time at their dip/scoop. The helicopters and water scoopers can transit from their dip/scoop sites to the checkpoint at their own pace, without a clearance. From the checkpoint aircraft are cleared to target as soon as the airtanker is off the drop and exiting.

Because the helicopter/scooper is close in and easy for the airtanker to find, the airtanker can gain situational awareness faster and thus reduce delivery time of retardant.

Note: Sequencing is NOT aircraft working in different target areas simultaneously. However, tools such as fences, routes, circuits, and checkpoints are utilized even when sequencing is not needed. An example would be an easily identifiable road that is designated as a virtual vertical fence. Each type of resource is assigned a side of the fence, i.e. helicopters on one side and scoopers on the other side of the fence, and each cannot cross the fence without a clearance. The helicopter and scooper paths never cross and each continue to work to their respective target area with minimal direction from the aerial supervisor once everyone involved identifies the fence and understands they cannot cross the fence without permission from the aerial supervisor.

Principles of Sequencing

- Checkpoints:
  - Checkpoints are generally used by helicopters and scoopers and should be close to the target area. Aircraft can transit to the target, deliver the water/retardant, and depart the target in route to the dip in a relatively short time.
  - Checkpoints must never be placed in the location of the base leg, final leg, or exit path of the airtanker.
  - Ideal locations for helicopter checkpoints:
    - Inside the airtanker drop pattern abeam the target area. The airtanker can see the helicopter the entire time they are maneuvering to drop and conversely, the helicopter can see the airtanker maneuvering.
    - Abeam the target area, but on the opposite side of the airtanker pattern. The airtanker and helicopter can still see each other throughout the pattern and the helicopter's route does not cross the drop pattern at any point.
    - Checkpoints may not be able to be placed in these locations due to locations of dip sites, terrain, and smoke, thus the next best places are anywhere just outside the drop pattern as long as it is not in the exit path of the airtanker. Since these checkpoints are farther out, it will take the helicopter longer to get from the checkpoint to the target area and then back out.
  - Ideal location for scooper checkpoints:
    - A location that is 2-4 minutes transit time from checkpoint to the target area and not in the exit path of the airtankers. This gives the airtanker plenty of time to drop if at or below maneuvering altitude and conversely, enough time for the scoopers to get in and out of the target area before the airtanker is cleared to maneuver.
- Routes/Circuits:
  - Since the helicopter can transit freely from the dip to the checkpoint without a clearance from the aerial supervisor, the helicopter's route from the dip sight to the checkpoint must not be in a location coincident with the airtanker being at the same altitude/location, i.e. any time the airtanker has descended below maneuvering altitude or is climbing away from the drop area on its exit.

- Water Scooper Circuits must be planned so that the portion from the scoop to the checkpoint will keep the scoopers away from the airtanker pattern since circuit altitudes may coincide with the maneuvering altitude of the airtankers.

- Who gets cleared first to the target area:
  - This is based on where the airtanker is in the drop pattern when the helicopter/scooper calls for clearance at their checkpoint.
    - If the airtanker is anywhere from starting the descent out of the orbit to establishing the downwind, the helicopter, most of the time, will get cleared to the target first.
    - If the airtanker is in the middle of the downwind, the aerial supervisor will have to make a decision on who gets to go first depending on the needs of the fire, the types of aircraft, fuel status, and a myriad of other factors. This is where the airtanker must be the most flexible and willing to extend the downwind or go around.
    - If the airtanker is late in the downwind, on base, on final, or starting the exit, the helicopter/water scooper will be cleared to target number 2 behind the airtanker.
  - This is a starting point and will be adapted to the current situation. There will be times when the airtanker is farther in the drop pattern and will be asked to go around to facilitate a helicopter/scooper drop because of a higher need for that type of support. There will also be times that the airtanker will just be descending out of the orbit and the helicopter will be cleared to target number 2 because there is a higher need for retardant.
  - The main objective is to ensure there is never a time when the airtanker is at the same altitude/location as the helicopter/water scooper.
- Wake turbulence should be considered when working in close proximity with other aircraft.

Sequencing Terminology

- "Call your dips/scoops and drops": A request from the aerial supervisor for the resource to make blind calls when out of the dip/scoop and off the drop. These calls help on-scene aircraft build situational awareness of helicopter/water scooper location. These calls are not acknowledged by the aerial supervisor. Examples:

Helicopter: "Helicopter 3BH off the dip."
Water Scooping Aircraft: "Scooper 200 Flight off the scoop."
Everyone listening immediately knows where that resource is.

- "Call for Clearance at ____ Check": The helicopter/water scooper must get clearance from the aerial supervisor before proceeding past the checkpoint. If the helicopter/water scooper does not receive a clearance, they must not proceed past the checkpoint. Example:

Aerial Supervisor: "Call for Clearance at Rock Check"
Helicopter: "Helicopter 3BH, Rock Check"

- "Cleared to Target": Denotes a helicopter/water scooper is cleared to leave the checkpoint and proceed to the target area. The helicopter/water scooper is Number 1 to the target area. Example:

Aerial Supervisor: "Helicopter 3BH, cleared to target."

- The helicopter can go directly to the target area.
- The drop clearance may come directly from the aerial supervisor if not working for a ground firefighter. If working for a ground firefighter, the drop clearance will come from the ground firefighter.

- "Cleared to Target number 2,3, etc. behind___ (aircraft call sign) on ___ (location of aircraft to follow)": Denotes a helicopter/water scooper is cleared to proceed past the checkpoint number 2, 3, etc. after another aircraft(s) to the target area. Example:

Aerial Supervisor: "Helicopter 3BH, cleared to target number 2 behind T-800 on base."

- The helicopter can leave the checkpoint if it has the airtanker in sight and go to the target area after the airtanker has passed through the target area (the airtanker may or may not make a drop).
- A flight of aircraft or a leadplane working with an airtanker are grouped together. Example:

"Helicopter 3BH, cleared to target number 2 behind a flight of 4 SEATs." "Scooper 200 Flight cleared to target number 2 behind the leadplane and T-100 on base."

- "Cleared to transition": Denotes a helicopter/scooper is cleared through the area (on the way to helispot/sling spot, back to helibase/airport, on a recon, etc.). Example:

Aerial Supervisor: "Helicopter 3BH cleared to transition to H-1"

- Signifies that the aircraft is not delivering water to a target, but rather transiting through the target area to another location.

- "Cleared to transition number 2,3, etc. behind___ (aircraft call sign) on ___ (location of aircraft to follow)": Denotes a helicopter/water scooper is cleared Number 2, 3, etc. to transition the target area after another aircraft(s). Example:

Aerial Supervisor: "Helicopter 3BH, cleared to transition to helibase number 2 behind T-800 on base."

- The helicopter can transit the area if it has the airtanker in sight and goes through the target area after the airtanker has passed through the target area (the airtanker may or may not make a drop).

- "Cleared Unrestricted": Denotes to a helicopter/scooper that the active sequencing has stopped and no longer need to call for clearances at the designated checkpoint. Example:

Aerial Supervisor: "Helicopter 3BH, cleared unrestricted."

- The helicopter/water scooper no longer needs to call for clearance to continue past the checkpoint but, is still expected to make blind calls out of the dip/scoop and off the drop. The helicopter/water scooper is still required to fly the same route/circuit, use the same dip/scoop, drop in the same target area, and adhere to altitude assignments until directed otherwise.
- The checkpoint has been turned off due to lack of need. At any time, the checkpoint can be turned back on.

- "Clear to Drop": On line for target, line is clear, and clear to drop.
  - Clearance that is given to an airtanker when they are Number 1 to the target area. Example:

ATGS: "T-100, Clear to Drop"

Leadplane/ASM: "T-100, turning base live run, we're number 1, helicopter approaching the checkpoint will be number 2 behind us."

- "Cleared to Drop number 2,3, etc behind___ (aircraft call sign) on ___ (location of aircraft to follow)": On line for target, line is clear, and clear to drop number 2,3, etc. after another aircraft(s) to the target area. Example:

ATGS: "T-100, Clear to Drop number 2 behind Helicopter 3BH just coming off the drop."

Leadplane/ASM: "T-100, downwind live run, we're number 2 behind Helicopter 3BH approaching the target."

Responsibilities

Regardless of whether sequencing is being used or not, every aircraft has a responsibility to "see and avoid" all other traffic in the FTA. Here are some additional responsibilities of the airtankers and aerial supervisors when sequencing is being utilized:

Aerial Supervisor's Responsibility During Sequencing.

- Clearly identify and establish routes, checkpoints, fences, and circuits.
- Notify all resources of locations of established routes, checkpoints, fences, and circuits.
- Notify all resources of other resources working in the same Work Area/Area of Operation and target area.
- Adjust routes, checkpoints, fences, and circuits when they no longer are functional for the current situation or when requested by an airtanker/helicopter/water scooping aircraft.
- Establish an order and provide clearance for each aircraft to the target/drop area.
- Use standard verbiage.
- Ensure essential communications are transmitted on both the primary and secondary frequencies.
- Maintain situational awareness of all resources on scene.
- Adjust the tempo/tone of the operation when the situation changes.

Airtanker's Responsibility During Sequencing.

- See and avoid as well as hear and avoid. Airtanker pilots must actively listen to gain awareness that sequencing is occurring as well as to gain an understanding of which aircraft are participating and the location of routes, circuits, and checkpoints. Airtanker pilots must then visually acquire the other traffic, as well as relevant routes, checkpoints, and circuits.
- Understand sequencing procedures, the standard verbiage, and its meaning.
- Locate checkpoints, routes, and circuits. Airtanker pilots must visually locate checkpoints, routes, and circuits of other aircraft that may be a factor to the drop pattern or exit. This may require additional communication. If an airtanker pilot is unsure if a checkpoint, route, or circuit may be a conflict for the airtanker's drop pattern, the pilot must query the aerial supervisor.

- Plan the airtanker drop pattern and exit to avoid aircraft operating on circuits or routes or holding at checkpoints. Aerial supervisors are trained to create checkpoints which reduce conflict with the airtanker drop pattern, but this is not always possible during a dynamic firefighting operation. If unable to plan and fly a pattern that avoids the other aircraft, inform the aerial supervisor and coordinate for alternate deconfliction procedures. This can best be accomplished by clearly informing the ATGS/LPIL that the pattern or exit possibly conflict and where that conflict will occur. If appropriate the airtanker pilot should provide an alternate deconfliction plan that will provide safe separation for all aircraft. Example: Tanker 100: "Rock Air Attack, Tanker 100, my base to final turn will be right over Purple Check where the Red Blackhawk is holding. If you hold them south of the highway while I maneuver that will provide safe separation."
- Fly a predictable drop pattern. On complex fires airtanker pilots may not be informed of the location of every other operation. Aerial supervisors expect airtanker pilots to fly a predictable sized and shaped pattern. When airtankers are performing drops in the same general location as the previous drop aerial supervisors expect each pilot to fly roughly the same pattern (same direction or drop, roughly same size and shape [with variation for type of airtanker]) as the previous pilot. If the drop pattern will differ significantly from the previous airtanker's pattern and/or there is any possibility of an airspace conflict, inform the AA/LPIL of the planned pattern and ensure no conflict exists. Example:
- Tanker 10: "Rock Air Attack, Tanker 100, I have the target. I saw the last drop. I will need to drop the opposite direction with a right turn on the exit for terrain. Will that be a conflict for other operations?"
- Exit as briefed. Straight out at maneuvering altitude unless otherwise directed or approved.
- Go-around per exit instructions and climb to maneuvering altitude: If a go-around is executed, climb back to maneuvering altitude, communicate the go-around as soon as practical, and ask for further instructions.
- Be flexible: Be flexible and prepared to react to a change in sequence or an unpredictable action by another aircraft. Be prepared for another resource to be prioritized first. An airtanker pilot may be asked to extend the downwind to give another resource more time or take an extra turn at maneuvering altitude. An airtanker that accepts a sequencing clearance behind another aircraft must maintain constant visual contact with the other resource. Airtanker pilots should be prepared to vary the size and shape of the pattern to provide sufficient time in the target area for the other resource. If there is ever a doubt about spacing or safe separation the airtanker pilot should execute a go-around and announce the go-around as soon as possible.
- Make comfort calls: Make comfort calls to build situational awareness and let other aircraft know the airtanker has them in sight.
    - "T-800 final, have Helicopter 3BH in sight."
    - "T-100 extending downwind, have 3BH in sight."
    - "T-900 spacing is good, have the exiting helicopter in sight."
- Contribute to the tempo/tone: Airtanker pilots must contribute to the tempo and tone of the operation through professionalism, understanding, and predictability. This includes speaking up if the tempo is too fast. This is especially important when initially arriving at an incident for the first time. It is normal for the tempo to have to moderate when a new participant arrives. Do not enter an FTA if it seems/sounds too congested for your comfort level.

Sequencing Watch Outs

- Setting up sequencing will take time for all participants to understand and perform their roll. It is very important to keep SA up and ensure everyone sees the same mental model.
- Any time new resources arrive on scene, the target area changes, or environmental conditions change, there will be a period where the flow will slow, change, or come to a halt. All resources must recognize this, remain vigilant, be flexible, and facilitate a return to sequencing.

Emergency Procedures

If an aircraft has an emergency in the FTA the pilot should initially clear their own flight path and maneuver to avoid other aircraft. The pilot should then announce their intentions and request assistance or priority handling (such as a specific altitude or routing) while maneuvering to exit the FTA.

Blind/Lost Sight Procedures

The FTA and any operations as flights of aircraft are predicated on visual deconfliction and see and avoid procedures. The most basic requirement is that aft or following aircraft (the airtanker behind a leadplane, the wingman in a flight, or the most recently arrived aircraft in an orbit) has the responsibly to visually acquire and maneuver to avoid a conflict for the aircraft in front of them. 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 potential 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).

The "blind" pilot will communicate blind as follows: the blind aircraft's call sign, the call sign of the aircraft blind on, and intended actions to ensure initial deconfliction. Example:

Tanker 800: "Tanker 800 is blind on Tanker 100 climbing to 2000."

If both aircraft are in blind in the orbit, they should gain lateral and vertical separation between aircraft as their initial deconfliction action. At other times the blind aircraft should maneuver away from the last known attitude of the aircraft on which they are blind while avoiding the altitudes of other aircraft to the max extent possible.

The lead aircraft should communicate if they are visual or blind on the trailing aircraft with the assumption being that normally the leading aircraft will be blind at this time. Example:

Tanker 100: "Tanker 100 is also blind at 1500' over the heal of the fire behind B-55."

If the lead aircraft is visual with the trailing aircraft, the pilot should communicate "visual" and provide a point-out to the lead aircraft. Example:

Tanker 100: “Tanker 100 is visual Tanker 800. Visual is your 11 o’clock two miles over the heel 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.” Example:

Tanker 800: “Tanker 800 is visual Tanker 100 descending back to 1500.”

The lead aircraft should acknowledge this call. Example:

Tanker 100: “Tanker 100 copy.”

Aerial supervisors and flight leads can be directive to ensure deconfliction and may trump the initial deconfliction plan called by the blind aircraft, however this in no way removes the responsibility of each pilot to “see and avoid.” Example:

Rock Air Attack: “Tanker 800 stay at 1500’ Tanker 100 descend to 1000.”

If another aircraft has information to help the blind aircraft reacquire the visual, the other pilot should communicate only after initial deconfliction is assured. Example:

Tanker 95 is visual with both 800 and 110, Tanker 95 should communicate:

Tanker 95: “Tanker 800, Tanker 110 is at your 9 o’clock two miles opposite side of the column.”

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:

- Communication: An overrun, or possible overrun, requires radio communication. If the words “Overrun,” “Bump it Up,” “Push 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.
- Attempt to prevent the overrun: The first step is to attempt to avoid the need to initiate the “Overrun” Procedure. 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, 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” or “Pick 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.

- 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) should communicate "Overrun." Do not wait until passing the lead aircraft to initiate the overrun procedure. 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 if an Overrun is communicated:
    - The trailing aircraft shall Communicate "Overrun" and perform the following actions:
    - Do not drop the retardant except to prevent a more serious accident as doing so could potentially cripple the lead aircraft.
    - Pitch up to begin a climb and if able reduce airspeed. The objective is to create vertical and horizontal separation.
    - If the flight paths or briefed exit is straight out, the trailing airtanker should pass above and to the right of the leadplane/first airtanker hugging the right side of a canyon if restricted by terrain.
    - 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.
    - If terrain or visibility prevents utilizing (ii) or (iii) above, the airtanker should pass over the top of the leadplane/first airtanker.
    - 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.
  - The leadplane or first airtanker should execute the following actions:
    - 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.
    - Increase power and if able pitch down to increase airspeed. The goal is to create horizontal and vertical separation.
    - 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.
    - 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.
    - Continue the above routing until positive deconfliction is assured through communications or visual contact.

Proximity Flying/Geometry

Operating in the FTA requires pilots to understand proximity flying and the use of geometry to follow another aircraft. All pilots should receive ground and flight training on the topics covered in *Appendix B – Proximity Flying and Use of Geometry*.

Minimum Drop Heights

- Very Large Airtanker (VLAT) – the minimum is 250 feet above the top of the vegetation.
- Multi Engine Airtankers (Type 1, 2 or 3) – the minimum is 150 feet above the top of the vegetation.
- Single Engine Airtankers (SEAT) – the minimum is 60 feet above the top of the vegetation.
- It is important for the retardant to "rain" vertically with little or no forward movement.
- Drop heights can be adjusted to achieve the desired coverage level across the drop zone. Drops shall not be conducted below minimum drop heights under any circumstances.
- The airtanker pilot is responsible for maintaining safe drop heights.

Operations in Low Light/Adverse Flight Conditions

Incident aviation operations are often conducted under adverse flight conditions. Congested airspace, reduced visibility, poor weather, and mountainous terrain all add risk and complexity to operations.

Complexity must dictate the level of supervision required to conduct aerial operations safely, effectively and efficiently. Aerial supervision may be provided by a leadplane, ASM, ATGS or Helicopter Coordinator (HLCO). Dispatchers and Airtanker Base Managers (ATBMs) in consultation with aerial supervisors, are mutually responsible for ensuring that policies are applied, and limitations not exceeded.

Retardant Operations During Low Light Conditions.

Refer to *NWCG Standards for Aerial Supervision,* PMS 505 for the most current direction on retardant operations during low light conditions. https://www.nwcg.gov/publications/pms505

Airtanker Types

Airtankers have played a key role in suppressing wildfires. Airtankers deliver fire retardant to wildfires, thereby reducing fire intensity and rate of spread, allowing ground firefighters time to contain and/or control new, emerging, and large fires. The reduced intensity and rate of spread can allow more effective use of hand crews and engines. As fire intensity increases, or as rate of spread increases, they become more difficult to control and costly to extinguish. Accessibility of terrain or the location of a wildfire can delay the deployment of ground resources. Consequently, aerial delivery of fire retardant is often the only available method to slow the growth of wildfires until ground firefighters can establish containment and/or control lines. Multi-engine airtankers are defined as turbine, fixed-wing aircraft converted to function as retardant or water delivery airtankers. Airtankers are defined by Incident Command System (ICS) Typing Standards.

Types of Airtankers

TYPE	CAPACITY GALLONS	EXAMPLES
VLAT	> 8,000	DC-10
1	3,000 – 5,000	BAe-146, RJ85, MD-87, C-130, B-737
2	1,800 – 2,999	Q-400, CV-580, P-3
3	800 to 1,799	S-2T, AT-802F
4	Up to 799	Thrush, M18T

Airtankers (Multi-Engine)

Generally, airtankers are staffed with Initial Attack (IA) rated pilots and do not require aerial supervision. Occasionally when the airtanker is not staffed with an IA rated pilot, they will require a leadplane or ASM.

Generally, type 1-4 airtankers can work out of existing large airtanker (LAT) bases. Occasionally there will be a need for downloading retardant due to density altitude, temperature, and/or runway length. When there is a need for downloading, it must be documented by both the airtanker base and aircrew. Consider utilizing different resources that have different capabilities.

Very Large Airtankers (VLAT)

A VLAT carries 8,000 or more gallons of retardant. Because of their size, weight, and gallons, they will require additional operational and logistical equipment and considerations.

VLAT airtanker base operations will not limit or restrict the capacity of an airtanker base to load Type 1, 2, and 3 airtankers.

VLAT Flight Operations Considerations

Aerial supervision (leadplane or ASM) is required by contract and interagency policy for VLATs while dropping retardant or water.

VLATs require a leadplane/ASM supervision to be on scene prior to arriving on the fire.

Establish flight paths holding areas/altitudes, to avoid creating hazards to other aerial resources within the FTA.

To avoid wake turbulence, aircraft are required to wait a minimum of 3 minutes after the VLAT has dropped to resume aerial operations near the pattern from the drop.

Single Engine Airtankers (SEATs)

SEATs may carry a retardant capacity of up to of 800 gallons or less. Takeoff and landing weight for a single engine airtanker is 16,000 lbs. Refer to applicable agency contract and/or standard operating procedures. For Department of Interior (DOI) contracted SEATs, the pilot must not land the aircraft loaded unless an emergency precludes jettisoning the load.

SEAT Pilot Qualification levels – All SEAT pilots shall be carded or qualified as either a Level I or Level II, based on training, and experience. Refer to the applicable agency aircraft contract. Currently the DOI is the host for the only Federal National on-call SEAT services contract.

https://www.nifc.gov/sites/default/files/blm/aviation/BLMseat/On-CallConformedcontract.pdf

For dispatch purposes it is important to understand the following limitations:

Level II Qualified Pilots - The Level II qualification permits pilot's performance of missions without benefit of aerial supervision in the FTA with the SEAT plus one other aircraft. If more than two aircraft are within the FTA, aerial supervision for the Level II pilot is required.

The Level II restriction only affects operations while within the FTA, this can be mitigated over the fire with communication amongst all operating aircraft.

Level II pilots must make it known to the aerial supervisor prior to entering the FTA of the fact that they are a Level II pilot. When no aerial supervision is on-scene, they must notify the IC. If no aerial

supervisor or IC is present, notify other aircraft on the fire and/or broadcast in the blind that they are a Level II.

Level I Qualified Pilots - The Level I qualification permits the pilot to perform missions in the FTA without aerial supervision at any time and allows them to conduct and coordinate operations in a multiple tactical aircraft environment. This encompasses all missions from initial attack through large fire aerial operations. The Level I qualified pilot will be familiar with and have experience in complex aerial fire suppression methods and, therefore, will be more effective in these types of situations.

SEAT Pilot Mission Evaluations

Requirements for mission evaluations may be found in the applicable agency contract. For DOI, all Level I and Level II recurrent pilots must have a Fire Mission Evaluation every 12 months. The Fire Mission Evaluation must be done by a dedicated agency aerial supervisor.

If the pilot has not been in service in the previous 12 months, the Fire Mission Evaluation must be done within the first five fire missions. Pilots may request the annual Fire Mission Evaluation from the dedicated aerial supervisor for whom they dropped for. The SEAT Pilot Mission evaluation form can be found at https://www.nifc.gov/sites/default/files/blm/aviation/BLMseat/NIFC9400-32SEATEvaluationForm.pdf.

Level II to Level I Upgrades

Level II to level I upgrade requires a flight evaluation and candidate must meet the DOI on-call contract requirements in section B10.5.2.2:
https://www.nifc.gov/sites/default/files/blm/aviation/BLMseat/On-CallConformedcontract.pdf.

Wind and Turbulence Limitations for SEAT Operations

SEAT operations shall cease when the SEAT pilot, aerial supervisor, or leadplane has been notified that there are sustained winds greater than 30 knots at the fire operations area, or that the wind gust spread exceeds 15 knots in the fire operations area. Pilots should take into consideration wind and weather conditions (including crosswinds) at the base of operations prior to accepting a dispatch. This does not prevent a decision to cease operations when any unsafe or inefficient conditions are present. This limitation in no way supersedes any aircraft or pilot operational restrictions.

ASHHE Acronym

SEAT Pilots should brief on the ASHHE acronym (Approach, Speed, Horizontal Separation, Height, Exit). Information on ASHHE can be found at
https://www.nifc.gov/sites/default/files/blm/aviation/BLMsafety/Fodder_ASHEreview.pdf.

The ASHHE visual indicator is located at
https://www.nifc.gov/sites/default/files/blm/aviation/BLMsafety/ASHHE_poster_final-flat.pdf.

Forest Service Contracted VLAT and Type 1 & 2 Airtanker Pilot Qualifications

Airtanker Pilot Qualification levels (Dual Piloted Forest Service [FS] Contracted or utilized) – In a dual piloted aircraft, there will be at a minimum, an Airtanker Co-Pilot (AKC) and an Airtanker Pilot (AKP). In order for the airtanker to be available for initial attack, there must be either an Airtanker Initial Attacked Pilot (AKI), or an Airtanker Training Pilot (AKTP) as one of the two pilots. See definitions and expectations below:

Airtanker Co-Pilot (AKC)-An individual who is fully carded, capable, proficient and current (preferably with a PIC and or Second in Command (SIC) type rating, but regardless, appropriately rated as an SIC in the aircraft) to takeoff, operate, and land the airplane in all approved weather conditions, during day or night, under any emergency circumstance, from the right seat of the aircraft in the instance that the PIC becomes completely incapacitated. They are expected to have a basic knowledge of the FTA and fire communications as well as United States Forest Service (USFS) required flight following requirements and procedures, such that they could depart an FTA, and complete flight following and resource tracking without causing undue burden for other aircraft or dispatch in the event the PIC becomes unable to do so. They should understand basic fire terminology and have an entry level understanding of fire tactics, but there is no expectation that they are capable of dropping retardant or chemicals as the pilot at the controls, other than in their copilot role and duties. An AKC shall not drop water or retardant as the pilot at the controls while operating under this contract.

Airtanker Pilot (AKP)-An individual who is type rated as a PIC in the aircraft and fully carded to conduct drop operations on a fire provided there is a leadplane on scene. They are capable, proficient, and current to takeoff, operate and land the aircraft in any approved weather environment, in day or night conditions, under any emergency circumstance from the left seat of the aircraft with a new, but appropriately rated, copilot in the right seat. A fully carded AKP shall be capable and proficient to drop water and/or retardant with a high degree of accuracy in any fire environment, of any complexity level, with any number of aircraft in the FTA while under the supervision of a federally carded or recognized leadplane pilot with a new but appropriately carded copilot in the right seat. They should have an advanced level of understanding about fire terminology and tactics. It is understood that if the time and situation allow, a show-me run will be given prior to the lead profile (follow me) for the live drop. In extenuating and time critical situations the show-me run may be omitted, but a lead profile (follow me) will be conducted. It is not expected that an AKP conduct a run without a lead profile. An AKP shall not permit an AKC to conduct drops (as the pilot at the controls) from the right seat. All other flight duties may be shared as applicable and appropriate for the aircraft. If two AKPs are crewing the aircraft the standard shall be for the pilot in the left seat to be the PIC and conduct all drop operations as the pilot at the controls. AKPs will announce themselves as "Tanker XX AKP " for all initial communications within the FTA.

Airtanker Pilot Trainee [AKP(T)]-This is the stage that the USFS expects the pilot to begin left seat (pilot at the controls) drop training. An AKP trainee is an individual who is fully type rated as a PIC in the aircraft. They are capable, proficient, and current to takeoff, operate and land the aircraft in any approved weather environment, in day or night conditions, under any emergency circumstance from the left seat of the aircraft. They must have been previously carded as an AKC in the make and model of aircraft, hold a current PIC Type rating and current 61.58 in make and model, and completed the annual simulator requirements of the contract as a PIC. They will be issued an AKP(TRAINEE) card with a trainee designation.

Airtanker Initial Attack (AKI)-An individual who is fully carded and type rated as a PIC in the aircraft. They are capable, proficient, and current to takeoff, operate and land the aircraft in any approved weather environment, in day or night conditions, under any emergency circumstance from the left seat of the aircraft with a new, but appropriately rated copilot in the right seat. A fully carded AKI shall be capable and proficient enough to drop water and/or retardant with a high degree of accuracy in any fire environment, of any complexity level, with a limited number of aircraft in the FTA (as dictated by the *NWCG Standards for Aerial Supervision*, PMS 505) without any additional aerial supervision resources present. They should have an advanced level of understanding of fire terminology, fire tactics, fire behavior, and fire control procedures, techniques, and operations. They will have the ability to conduct all required flight profiles and drop operations with no suggestions or assistance from any other resource safely, effectively, and efficiently. They shall be able to conduct all air-to-air and air-to-ground communications while simultaneously flying the aircraft and maintain situational awareness of the FTA and fire environment. An AKI must have the ability to deconflict/coordinate airspace and create separation of resources. They must also be responsible for obtaining drop and line clearance from the IC or other ground resources. An AKI may not allow an AKC or AKP to conduct drops (as the pilot at the controls) from the right seat. All other flight duties may be shared as applicable and appropriate for the aircraft. If two AKI's, or an AKI and an AKP are crewing the aircraft the AKI in command shall occupy the left seat, be the PIC, and conduct all drop operations as the pilot at the controls. However, at all times, without an AKTP occupying a seat with controls, the qualifications of the pilot sitting in the left seat dictates the supervision requirements. AKIs will announce themselves as "Tanker XX " for all initial communications within the FTA.

Airtanker Training Pilot (AKTP)- An individual who is type rated as a PIC in the aircraft and previously carded as an AKI. They are capable, proficient, and current to conduct any operation the airplane is approved for from either seat of the aircraft with a new but appropriately carded pilot in the other seat. They possess all the appropriate certificates and ratings to teach/instruct any operation that the aircraft is approved for (both basic FAA aircraft operation and fire operations). They shall be capable of conducting operations and teaching/instructing in any fire environment, of any complexity with any number of aircraft, with, or without additional aerial supervision with a high degree of safety, effectiveness, efficiency, and accuracy from either pilot seat.

Airtanker Training Pilot Very Large Airtanker (AKTP_VLAT)-An individual who is fully carded, and type rated as a PIC in the aircraft. They are capable, proficient and current to conduct any operation the airplane is approved for from either seat of the aircraft with a new but appropriately carded pilot in the other seat. They possess all the appropriate certificates and ratings to teach/instruct any operation that the aircraft is approved for (both basic FAA aircraft operation and fire operations). They shall be capable of conducting operations and teaching/instructing in any fire environment, of any complexity with any number of aircraft, with leadplane supervision with a high degree of safety, effectiveness, efficiency, and accuracy from either pilot seat.

Modular Airborne Firefighting System (MAFFS)

MAFFS is a joint Forest Service and Department of Defense (Air Force) program governed by an interagency agreement. The FS provides eight (8) MAFFS retardant delivery units. Three Air National Guard Wings (California, Reno and Wyoming), and one Air Force Reserve Wing (Colorado Springs) provide the C-130H/J aircraft and flight crews.

MAFFS provides surge capability to supplement commercial airtankers on wildland fires. MAFFS are national resources when mobilized by the FS and are used as a reinforcement measure when contract airtankers are committed or not readily available. MAFFS will be made available to assist foreign

governments when requested through Department of State or other diplomatic Memorandum of Understandings (MOU).

GACCs are responsible for assuring all suitable FS contracted airtankers are assigned to wildland fires or committed to initial attack before placing a request for a MAFFS mission to the NICC. For additional information, see the MAFFS Operating Plan.

The NICC is responsible for assuring that all suitable FS contract airtankers nationally are committed to wildland fires, initial attack, or cannot meet timeframes of requesting units. When this occurs, the Coordinator on Duty (COD) will notify the Washington Office (WO) Assistant Director, Operations. The WO Assistant Director, Operations, or his/her acting, or in his/her absence, the WO Assistant Director, Aviation is responsible for initiating a MAFFS mission. Once approval is given, the NICC Manager activates the request through proper Department of Defense (DOD) channels. After the initial contact has been made, the NICC will submit a Request for Assistance (RFA) to the DOD Liaison at NIFC.

The Governors of California, Wyoming, Nevada, may activate their respective Air National Guard MAFFS Wings for State-controlled fires. Approval for use of MAFFS equipment must be obtained from the FS Assistant Director, Operations, prior to this activation.

When National Guard MAFFS are activated by a governor, the FS Regional Office for that State will assign an accounting code for the incident. The Regional Office shall notify the WO Assistant Director, Operations of state MAFFS activations.

Refer to the current MAFFS Operating Plan for specifics
https://www.nifc.gov/nicc/logistics/references/MAFFS_Operations_Plan.pdf

Flights

Flights of Single Engine Airtankers (SEATS):

Single Engine Airtankers may operate in flights of up to four aircraft. Communication procedures will be in accordance with *NWCG Standards for Aerial Supervision,* PMS 505, *Appendix A – Fixed Wing Scripts*, and the brief. Prior to operating as a flight on firefighting missions, pilots will receive, and document ground and flight training covering all the subjects in *Appendix C – Flight Procedures and Briefing Requirements*.

Prior to operating in flights pilots will conduct a general briefing on all the subjects in *Appendix C – Flight Procedures and Briefing Requirements*. Pilots are encouraged to utilize the first opportunity such as arrival at a new base or over the phone with pilots at nearby bases to conduct this briefing. This general briefing does not substitute for the required mission specific briefing. The mission specific briefing should be conducted before flight if possible but may be conducted over the radio while airborne prior to entering the FTA.

Appendix D – Standard Operating Practices for Flights provides SEAT pilots a common framework and baseline set of procedures that pilots can train to and operate by. *Appendix D* is not prescriptive, and pilots are expected to deviate from these procedures to deal with local conditions. All SEAT pilots will be familiar with *Appendix D*. This will allow any group of SEAT pilots to efficiently brief by agreeing to operate in accordance with *Appendix D*.

Flights of Cal Fire S-2s

Cal Fire S-2s may operate as flights in accordance with CAL FIRE Fixed Wing Flight Standards approved training and briefing procedures. Cal Fire S-2s operating as a flight will check into the FTA using the same *NWCG Standards for Aerial Supervision*, PMS 505 communication scripts as flights of SEATS or Scoopers. Aerial supervisors desiring to have the flight maneuver and drop in sequence like a flight of SEATS should use the sequencing language from the PMS 505. Example:

Rock Air Attack: "Tanker 94, cleared to maneuver number 1, Tanker 95 cleared to maneuver #2."

Both S2s will descend to maneuvering altitude and call their legs. Each S-2 expects to receive drop clearance on final. Communications priority should be given to the S-2 on final. The maneuvering procedures and spacing is the same as for a flight of SEATS. *Appendix E – Tactical Flight Procedures* and *Appendix F – Flight Comm Scripts* contain a detailed explanation of Cal Fire S-2 procedures and comm scripts for operating as flights.

Retardant Operations

Loading Retardant

FS contracted airtankers and MAFFS airtankers shall be loaded using a mass flow meter to measure the retardant payload in pounds regardless of which agency owns or manages the airtanker base. An airtanker's payload is restricted by their Interagency Airtanker Board and/or Supplemental Type Certificate authorized amounts. Each airtanker has a metering system on board their aircraft. When loading product onto an airtanker, the loader will monitor the mass flow meter as well as the onboard meter. When either meter shows full, stop loading immediately.

Airtanker's payload will never exceed the authorized Interagency Airtanker Board (IAB) or Supplemental Type Certificate (STC) amount. If more is loaded than authorized, the excess must be removed prior to flight. Each airtanker will be loaded by weight regardless of the product used. Refer to the Airtanker Overfill or Overloading Direction at:
https://www.nwcg.gov/sites/default/files/committee/docs/iabs-airtanker-overfilling-or-overloading-direction.pdf

Retardant Hot Loading

Refer to the *Interagency Standards for Airtanker Base Operations (SABO)*
https://www.nwcg.gov/publications/pms508

Simultaneous Fueling and Retardant Loading

Refer to the *Interagency Standards for Airtanker Base Operations (SABO)*
https://www.nwcg.gov/publications/pms508

Qualified Products

Only approved wildland fire chemicals shall be used. A current list of qualified products and approved uses can be found on the Wildland Fire Chemical Systems (WFCS) website at https://www.fs.usda.gov/rm/fire/wfcs/wildland-fire-chemicals.php.

Wildland Fire Chemicals Near Waterways

Refer to Chapter 12, Suppression Chemicals and Delivery Systems in the *Interagency Standards for Fire and Aviation Operations* for more information (https://www.nifc.gov/standards/guides/red-book).

Reporting Requirements: Fire Chemicals into Waterways, Waterway Buffer Areas, and Mapped Avoidance Areas

Guidance for Pilots - Pilots will avoid all waterways and additional mapped avoidance areas designated by individual agencies. To avoid intrusion in waterways, retardant will not be applied within 300-feet of waterways, or outside of additional mapped avoidance areas.

For more information and reporting procedures have been implemented for the required reporting for intrusions into waterways. All information, including reporting tools and instructions are posted on the website at https://www.fs.usda.gov/rm/fire/wfcs/wildland-fire-chemicals.php

Refer to Chapter 12 Suppression Chemicals and Delivery Systems, in the *Interagency Standards for Fire and Aviation Operations* for more information (https://www.nifc.gov/standards/guides/red-book).

The *NWCG Standards for Airtanker Operations* is developed and maintained by the National Interagency Aviation Committee (NIAC), an entity of the National Wildfire Coordinating Group (NWCG).

Previous editions: First

While they may still contain current or useful information, previous editions are obsolete. The user of this information is responsible for confirming that they have the most up-to-date version. NWCG is the sole source for the publication.

This publication is available electronically at https://www.nwcg.gov/publications/pms514.

Submit comments, questions, and recommendations to the appropriate agency program manager assigned to NIAC using the NWCG Publication Review Form, https://www.nwcg.gov/publications/publication-review-form. View the complete roster at https://www.nwcg.gov/committee/national-interagency-aviation-committee/roster.