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National Wildfire Coordinating Group

NWCG Standards for Water Scooping Operations

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The *NWCG Standards for Water Scooping Operations* establishes the standards for dispatching, utilizing, and coordinating water scooping aircraft 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/505, and any local, state, or geographic/regional water scooping plans.

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

This publication is intended to be used in conjunction with other guides or references such as applicable contracts, 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/505, and other state, or local aviation plans or guides. These references together assist in the standardization of common procedures and best practices throughout water scooping operations.

This publication identifies the minimum interagency standards for water scooping aircraft operations.

Water Scooper Capabilities

The CL-215T and CL-415 are multi-engine, turboprop, fixed-wing, Amphibious Water Scooping Aircraft (AWSA). Fire Boss aircraft (AT-802F), a single engine turbine, provides an additional AWSA platform.

Maximum water load of the CL-415 is 1,621 US gallons and 1,421 US gallons for the CL-215T. Cruising speed for both aircraft types is 170-180 knots with a max speed 190 knots. Normal fuel cycles of four (4) hours on station are the standard and can be adjusted as needed for scooping operations at lakes up to 8,000' density altitude. Ferry flights of up to six (6) hours for repositioning are possible. Fire Boss aircraft have a hopper capacity of up to 800 gallons, however typical water loads are 500-750 gallons depending how much fuel is on board. Max cruise speed at 16,000 lbs. is 150 knots. Normal fuel cycles can be three to four (3-4) hours.

Amphibious water scoopers are most effective when used in multiples of two and are normally managed as an operational pair. They are extremely effective as an early initial attack (IA), direct attack suppression tool particularly when grouped together with additional AWSA. AWSA are extremely flexible and can also be used to support other aerial resource activity when needed. Aerial supervision may be required depending upon incident complexity and aerial supervision guidelines. All flight crews are capable of working independently and directly with a ground contact and have multiple FM radios for air-to-ground communications. Some AWSA are also equipped with infrared displays.

AWSA follow all local and national aquatic invasive species (AIS) guidelines and have decontamination procedures that exceed those guidelines as well as having the equipment and trained personnel to do so timely when lake source use changes unexpectedly.

Dispatch

To increase effectiveness, water scooping aircraft should be dispatched in pairs (or more).

Fire Boss aircraft are capable of (and prefer) being ground-loaded before departure. The CL-215T/ CL-415 can be ground-loaded if requested. In the absence of ground-loading, flight crews should pick up water en route to the incident.

Water Source Selection

Upon receiving dispatch, the flight crews will determine closest suitable water source. Coordination between the aircraft manager, flight crews, and local dispatch will vary dependent upon regional water source access protocol. Water source selection may occur en route depending on the geographic area of operations such as Alaska, Washington, Minnesota, etc. Areas of high recreation or restrictive water

access should have prior water source coordination setup, and appropriate notifications will be made by the water scooping aircraft manager.

The water scooping pilot-in-command (PIC) shall coordinate separation with aerial supervision and/or other responding air resources depending on the scenario. The transition through or around the Fire Traffic Area (FTA) to the water source shall be approved or coordinated with standard FTA communication protocol.

Upon reaching the water source, the PIC is responsible to survey the water and surrounding area for suitability. The PIC will assess winds, water conditions, length, width, depth, terrain, ingress, egress, natural and human-made hazards, recreation use, and AIS status.

Winds

Water scoopers typically pick up into the wind. Surrounding terrain and vegetation will impact mechanical turbulence and should be considered for the approach, pickup, and climb out. Wind direction, velocity, gusts, and downdrafts are visible from above during the water source survey and while on the water. Wind indicators such as white caps, streaks, and cat's-paws, give excellent cues on the expected conditions.

Water Conditions

Factors impacting water conditions include wind direction, velocity, and length of water source. Fetch is known as the distance the wind travels over the water, and will influence wind-driven chop, creating swells given enough length and velocity. Larger water sources are susceptible to larger wave height and possibly swells depending upon the conditions. Smaller water sources with higher winds will not usually develop swells. Narrow water sources may dictate pickups with a crosswind component. Water sources with glassy or smooth water have a higher drag component than water sources with wind-driven chop and will yield a longer scooping run.

Length

Distance needed for pickup is calculated per aircraft performance charts and is impacted by aircraft weight, water conditions, winds, density altitude, and available engine power. Length of water source may be estimated by recording the time flown from one shore to another. For example, a 30 second run at 120 knots of ground speed on the Global Position System (GPS) will be approximately one nautical mile. Water sources with higher density altitude will produce a longer scooping run due to reduced lift, propeller efficiency, and possibly lower power settings. Higher aircraft weights require a faster liftoff speed and will also increase takeoff distance.

Width

Selection of a narrow water source should be made with consideration given to directional control that may be impacted by crosswinds, poor technique, or mechanical malfunction. Width may also determine if water scoopers will pick up in trail of aircraft or offset (to avoid wake vortices).

Depth

There are several ways to determine water depth, but the most effective is to survey the water source and surrounding terrain. Water clarity, wave action, vegetation, sun angle, cloud cover, and time of day are a few factors that can enhance or impact ability to judge depth.

Additional resources such as water mapping tools, electronic marine charts, and local knowledge can assist with depth and suitability determination. Visual clues such as boat docks, types of boats moored or operating, vegetation, and wildlife activity can also assist with depth determination. The PIC will consider adequate depth in the event the water scooping aircraft needs to reject a takeoff and settle into displacement taxi. Fire Bosses typically require a minimum of four feet of depth and CL-215T/CL-415 require six feet.

Terrain

Ingress and egress will be dependent upon terrain and obstacles surrounding the water source. Terrain will also impact local wind conditions and may render a water source unusable in certain circumstances.

Hazards

Natural hazards include but are not limited to daily tidal changes, shallow areas, rocks, stumps, debris, and birds. Examples of human-made hazards include, but are not limited to, towers, power lines, buoys, watercraft, bridges, surrounding structures, and proximity of airports.

Aquatic Invasive Species (AIS)

Water scooping aircraft adhere to specific AIS protocol determined by agency contracts, operator mitigation plans, and local unit determination. The Water Scooper PIC shall record the water source used and coordinate with manager and ensure proper inspection and/or decontamination protocol depending upon regional concerns or specific AIS status of the water source. *Guide to Preventing Aquatic Invasive Species Transport by Wildland Fire Operations*, PMS 444, provides more information on preventing AIS transport.

Water Pick Up

Depending upon individual operator's standard operating procedures, the PIC will complete a pre-pickup checklist or flow to determine proper aircraft configuration and water pickup system settings. After pickup, the PIC will climb to an appropriate altitude for transition, considering drop altitude, terrain, and other traffic.

Helicopter and Airport Awareness

When a water source or circuit is near a helibase or airport, flight crews shall monitor assigned frequencies and make position reports as necessary. An effort shall be made to avoid overflying helibases and give consideration for impacts on traffic patterns at airports.

Water scooping aircraft crews should anticipate helicopter routes to and from the incident to the helibase and share any communication protocol to incoming scooper flights or relief aerial supervision.

Helibases and local airports may be outside the FTA or Temporary Flight Restrictions (TFR). Flight crews should recognize that these entities may be outside the span of control of the aerial supervisor. Flight leads should consider delegating helibase or local airport position reports to the second aircraft in the flight to share workload.

Water Scooper Routes and Patterns (Circuits)

The pattern for water pickup, route to the drop area, and pattern for the drop may collectively be referred to as a circuit. Circuit shape may vary depending on distance to the water source, winds, and desired drop patterns. Water scooper circuits are generally into the wind at the water source and form an oval, racetrack, Figure 8, U shaped, parallel, or concentric shape, depending upon terrain, aircraft deconflictions, and drop patterns.

Typical Oval Circuit: Can be flown with right or left traffic.

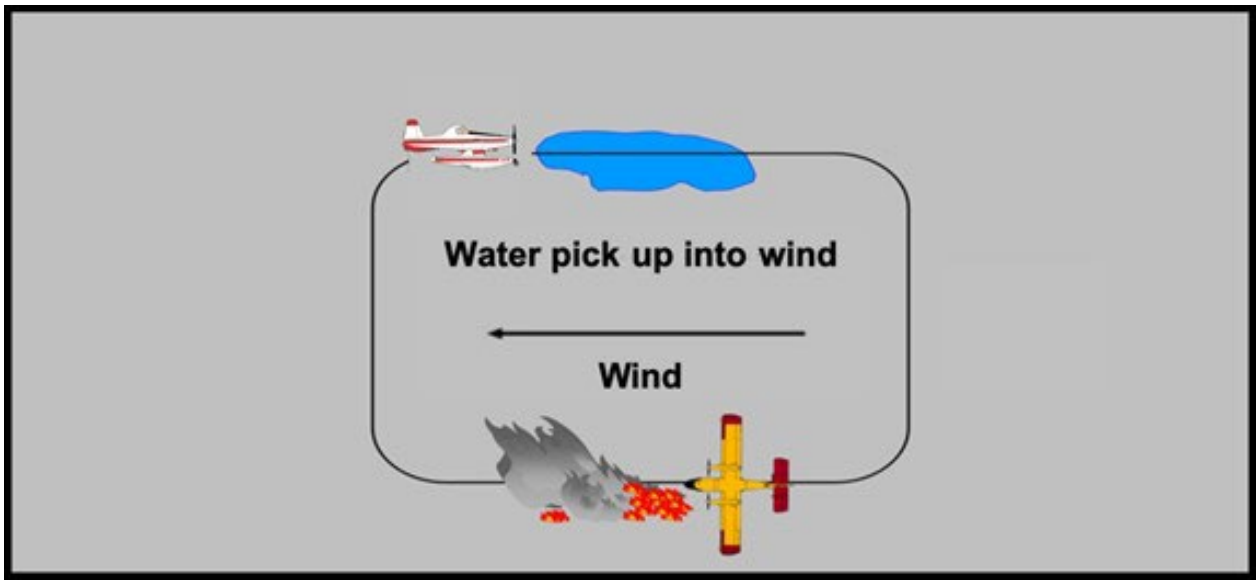
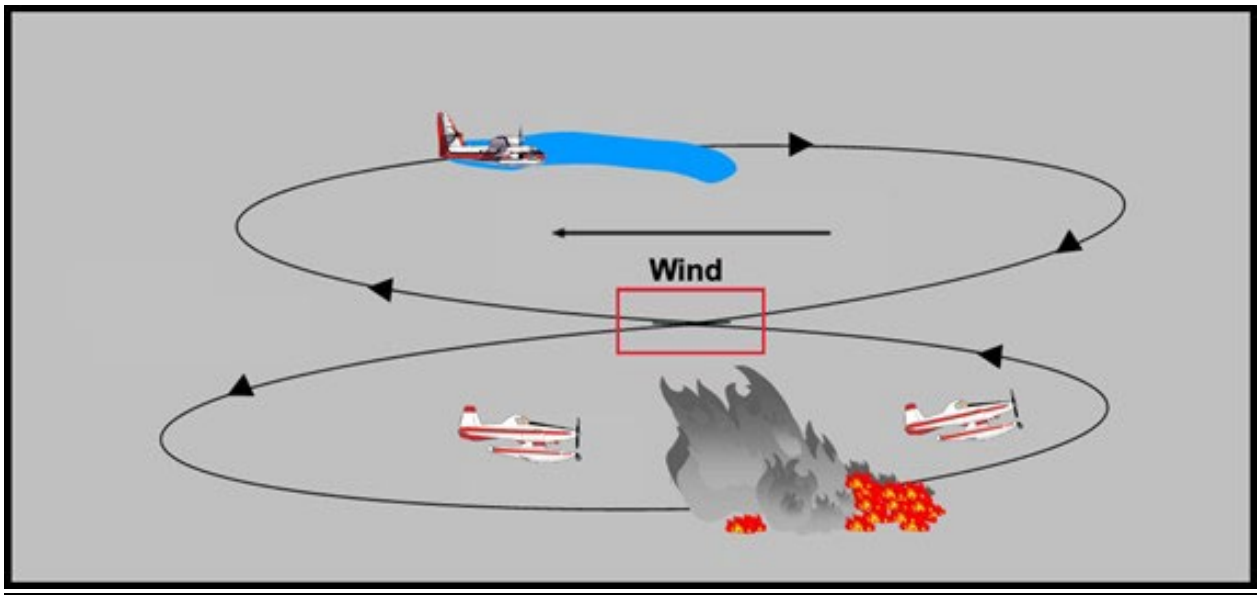
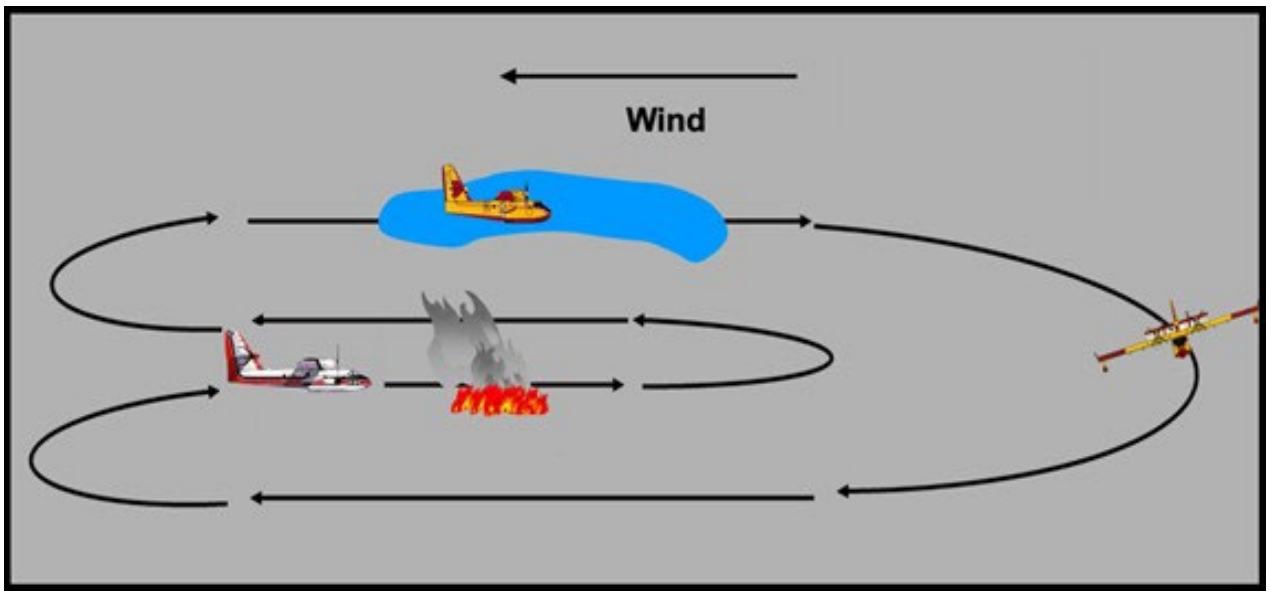


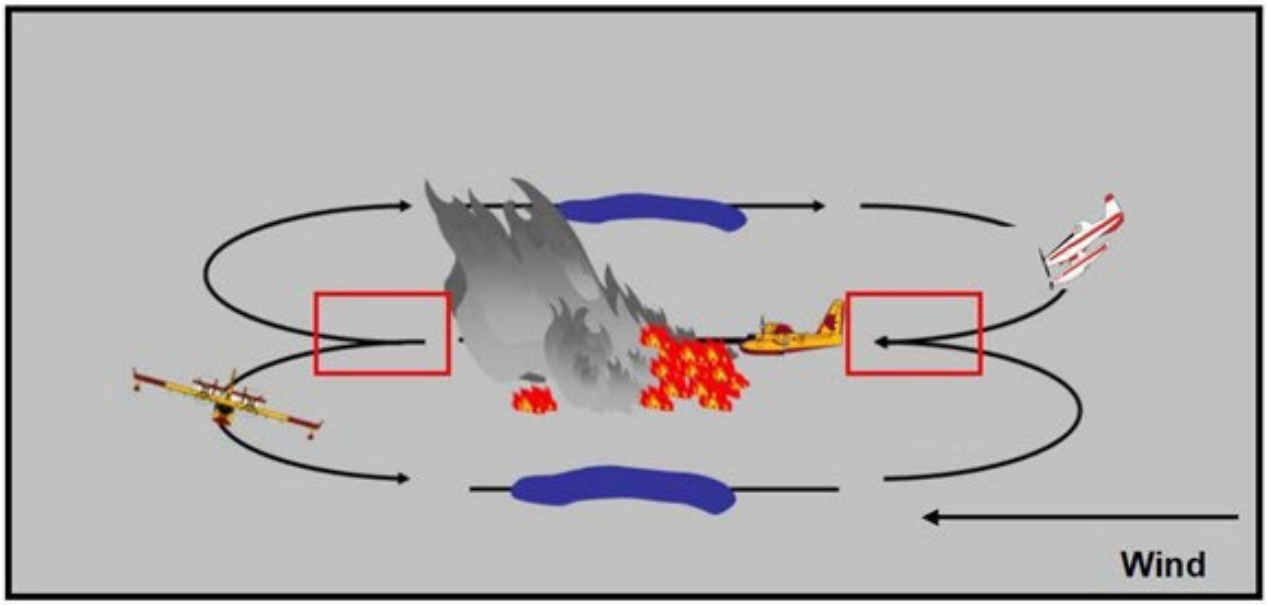
Figure 8 Circuit: Pickup and drop into the wind. Note conflict area and increased maneuvering.



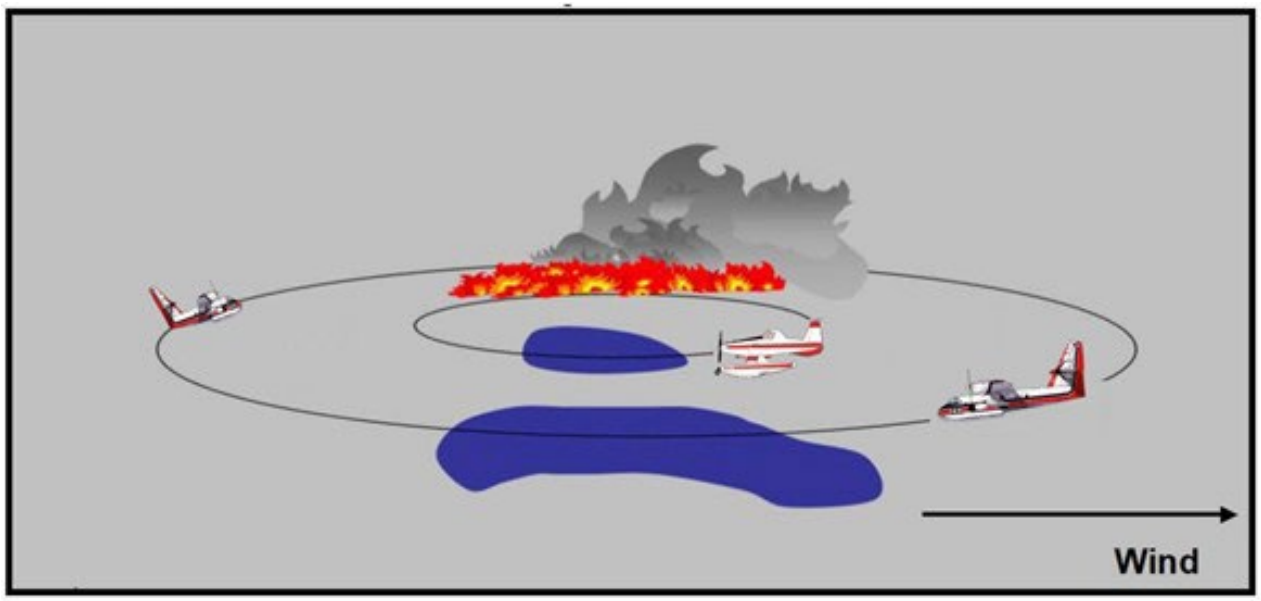
U Shaped Circuit: Pickup and drop into the wind. Note increased maneuvering.



Parallel Circuit: Example of different water sources. Note conflict areas.



Concentric Circuit: Example of different water sources.



Circuit Spacing and Separation

A safe separation distance should always be maintained within the circuit. This pertains to both air and water operations. In the event spacing decreases, the faster aircraft should adjust (power or other flight variables) to return the circuit to appropriate spacing. Consideration should be given for maneuvering in the event of a malfunction, rejected pickup, emergency, or loss of directional control. The lead aircraft, or aircraft being overtaken, has the right of way.

The flight lead aircraft should consider width of water source, obstacles, watercraft, terrain, wind, and trail aircraft when choosing a scooping lane. If possible, the lead aircraft should attempt to leave clean air for the trail aircraft. Subsequently, the trail aircraft should scoop upwind of the lead aircraft to avoid wake vortices.

If multiple flights are operating within the circuit, it is each flight lead's responsibility to ensure good separation and communication protocols. All aircraft within the flight or flights are expected to operate predictably and advise other aircraft of any non-standard patterns, orbits, or holding procedures.

Flight leads should consider the impact and potential complexity of multiple flights on aerial supervision. It may be advisable for different water scooper types to join as a single flight to facilitate sequencing with other resources. This may assist aerial supervision when simultaneous retardant, helicopter, or smokejumper operations are being conducted in the same target or geographic area. Per the *NWCG Standards for Aerial Supervision* (*SAS*), PMS 505, flights of Fire Bosses are limited to four aircraft.

Circuit altitude is the maximum altitude a water scooping aircraft will fly throughout the circuit. Circuit altitude and route should be established and communicated to assist in vertical and horizontal separation.

The PIC shall coordinate the circuit altitude with aerial supervision and ensure the route and altitude does not conflict with helicopter or airtanker traffic.

When working in proximity, it is imperative that water scooping aircraft and helicopter pilots have positive identification of the quantity and type of aircraft. The flight crews should also be aware of the other resource's dip/scoop locations, routes, patterns, and altitudes. Aerial supervision may increase

situational awareness by referencing helicopter type (1, 2, 3), configuration (bucket or tank), and/or model (Skycrane, Chinook, Vertol, S-61, Blackhawk, Huey, 205, A-Star, 407, etc.), as appropriate, when briefing resources. Likewise, water scooping aircraft should be referred to as Fire Boss or Scooper (CL-415/CL-215T) to help positively identify traffic.

Communication and separation protocol will vary depending upon the location of the water source relative to the fire and target area.

Water sources within the FTA will yield very fast turn-around times. In that case, an effective practice is to give water scoopers a geographic area and overall objective, and only provide further instruction as necessary.

Water sources outside the FTA may necessitate the use of a checkpoint if working with (or sequencing with) other aircraft. Checkpoints help to establish timing and are best used approximately 4 miles from target which is generally about two minutes out. The aerial supervisor should ask water scooping aircraft to call off the scoop, last aircraft off the drop, and call for clearance at the checkpoint. The flight lead and trail aircraft should make passive (blind) and active calls on the radio to enhance situational awareness of all aircraft. If not assigned a checkpoint by aerial supervision, the flight lead should suggest one to assist with control measures, situational awareness, and position reporting.

Examples

Passive calls: "Scooper 262 flight off the scoop," or "Last Fire Boss is off the drop."

Active calls: "Fire Boss 209 flight is ridge check." (Expect a clearance from aerial supervision)

They would then receive a clearance: "Fire Boss 209, flight cleared to target number two behind a Skycrane on the drop," or "Scooper 281, no other traffic, you are cleared unrestricted."

Flights

Aircraft in flights follow Federal Aviation Administration (FAA) guidance. When operating in support of wildland fires and all risk incidents, aircraft in flights shall follow NWCG FTA standard procedure found in the *NWCG Standards for Aerial Supervision* (*SAS*), PMS 505 https://www.nwcg.gov/publications/501.

Water scooping aircraft typically operate in flights of two or more aircraft operating in close proximity to one another with a common objective. A flight lead may be determined prior to the dispatch in some operations. Each aircraft PIC should communicate with other aircraft in their respective flights to coordinate routing, altitude, and speeds en route to the water source.

Further direction on flights and FTA can be found in the *NWCG Standards for Aerial Supervision* (*SAS*), PMS 505.

During the initial transmission to the FTA, the lead aircraft will identify themselves with their scooper/fire boss number or tanker number for flight of Single Engine Air Tankers (SEATs), followed by the phrase "flight of" and then the total number of aircraft in the flight (i.e., "Fire Boss 209 flight of three, with 211, and 212, twelve miles west"). Aerial supervision will then communicate FTA clearance to the flight lead. The flight lead should confirm the clearance and each trail aircraft will acknowledge the clearance by transmitting their call sign and respective order in the flight (i.e., "212 #2"). This protocol ensures all aircraft understand the clearance and serves as a radio confirmation for all aircraft in the flight.

Further communications will be given to the flight lead unless specific instructions need to be given to other aircraft. If the same directions are given to each aircraft in the flight, such as tag, and extend from the existing target, each aircraft in the flight can acknowledge by transmitting their call sign in the flight as appropriate. If directions are unclear to any aircraft in the flight, the pilot should seek clarification prior to the drop.

Any change in flight status shall be communicated to aerial supervision utilizing call signs.

Examples

Aircraft added to the flight: "Flight of three is now flight of four, Scooper 281 is joining circuit."

Aircraft returning for fuel: "Flight of three is now a flight of two, Fire Boss 232 departing for fuel."

Flight Lead Considerations

- Brief mission to flight members. This will be done prior to the mission if aircraft are co-located or can be completed in flight during a join up utilizing a standard briefing:
  - Dispatch specifics / dispatch form.
  - Water source name / scooping location.
  - Water source specifics / hazards / AIS status.
  - Number of aircraft in flight / type / call signs.
  - Routes / patterns / altitude (circuit) if known ahead of time.
  - Drop target specific hazards and considerations.
- Monitor separation for the flight and other resources (consider length and width of flight).
- Manage flight variables (power, speed, angles) to allow trail aircraft to maintain flight integrity.
- Manage radio communications for the flight with aerial supervision and/or ground contact(s) unless directed otherwise.
- Conduct and communicate pre-scoop checklist for the flight for single pilot operations (Fire Boss).
- Conduct and communicate hazard briefings prior to scooping and dropping for any new/additional aircraft that join the flight, or if additional flights join the circuit.

Spacing in Flights

Trailing aircraft must not fly so close as to create a hazard to the aircraft they are following or themselves, whether en route, at the water pickup, and within the FTA. At the water source the lead aircraft should determine a scooping lane considering trail aircraft. For wide water sources with crosswind conditions, the lead aircraft should choose a scooping lane that allows clean air for trail aircraft.

Trail aircraft should scoop on a line upwind of the previous aircraft. For narrow water sources, additional spacing between aircraft may be necessary for wake vortices consideration. The lead aircraft should adjust power settings and patterns to allow trail aircraft to stay with the lead.

Coordination between the trail aircraft and lead aircraft assists in facilitating safe and efficient scooping operations. Larger flights will require additional vigilance of the lead aircraft, and efficient communications within the flight to keep the flight together.

A general rule of thumb is one-quarter (¼) mile of separation or approximately 10 to 15 second intervals between drops. Spacing shall not be so close that a rejected scoop or drop of the aircraft ahead would cause aggressive maneuvering or possibility of collision. There must be enough distance between aircraft to allow aerial supervision to convey updated directions considering the preceding drop or a change in objectives. [See *NWCG Standards for Aerial Supervision* (*SAS*), PMS 505, Chapter 8.]

Trailing aircraft must be close enough to the aircraft they are following to have and maintain visual contact with that aircraft and be responsible for separation. In the event visual contact is lost, it is the PIC's responsibility to communicate position, heading, altitude, and coordinate deconfliction.

Multiple Flights

- Adhere to FTA standard operating procedures concerning radio calls, airspeeds, and sequencing.
- Choose an appropriate water source; survey hazards, ingress/egress, terrain, etc.
    - When using the same pickup area or joining a circuit, fly over water source above established pattern (minimum of 500 ft.) to survey and confirm pickup area and communicate join up.
- Consider other aircraft routes and advise aerial supervision and other aircraft as necessary.
- Confirm the number of helicopters, and the locations of dip sites, helibases, and helispots.
- Commence operations as directed by the aerial supervisor or Incident Commander (IC) or at the discretion of the initial-attack-rated PIC if first resource on scene.
- Advise non-standard patterns.
- Make blind calls (such as "Fire Boss 221 off the lake" and "last Fire Boss off the drop") to maximize situational awareness.
- Call for clearance at the checkpoint as directed.
- Incoming flight should attempt to join existing circuit, however, should not hesitate to suggest alternate sources or circuits as conditions may have changed.

Water Scooper Types

On a short turn-around the CL-215T, CL-415, and Fire Boss operate at similar speeds, therefore spacing can generally be maintained between aircraft in the circuit. Coordination is necessary to ensure no conflicts during the pickup leg and drop leg.

On longer turnarounds the CL-215T and CL-415 will outpace the Fire Boss. The aircraft that is being overtaken has the right of way and the PIC of the overtaking aircraft should give way to the other aircraft by altering the heading to the right. The water scooping aircraft crew shall advise the slower aircraft and aerial supervisors (as appropriate) of the overtaking maneuver. Any overtaking maneuver must be coordinated among flight crews. Overtaking should not occur on the drop leg nor the pickup leg of the circuit. Operational complexity, phase of flight, and assurance of appropriate spacing must be considered prior to a coordinated overtaking maneuver.

On occasion, experience, and comfort levels of each aircraft's PIC may dictate the use of different water sources. This may result in multiple circuits and multiple flights. This is achievable, and at times more efficient and should be briefed with participating flight crews and aerial supervision.

Operational Considerations

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, to work together to achieve a safe and effective mission while working toward common objectives.

Frequency / Radio Management

Water scoopers have historically used a separate frequency to coordinate at the water source and within the flight to minimize impact on the tactical frequency. Pilots should consider the workload and phase of flight of other resources when making radio transmissions. The assigned incident air operations frequency must be monitored.

- Requesting an additional frequency would further aid in removing potential congestion.
    - Utilize a scooper frequency for circuit coordination, flight communications, and to keep tactical frequencies less congested.

Hosting Unit

An agency aircraft manager will be assigned to water scooping aircraft or group. Plans should be made and communicated to flight crews and agency managers prior to arrival to determine:

- Placement of aircraft – at airtanker base or nearby fixed-base operation (FBO) or elsewhere.
- Integration into daily operations – briefings and debriefings at airtanker base or elsewhere.

Fuel: The CL-215T/CL-415 (Single Point refueling preferred) and Fire Boss require Jet A fuel. Fuel demand could be 750-1,800 gallons a day depending on what type and how many aircraft are assigned. The CL-215T/CL-415 will burn approximately 1,500 lbs. or 220 gallons an hour ferry flight and 2000 lbs. or 292 gallons an hour during water dropping missions. A Fire Boss will hold 380 gallons of fuel and burn approximately 90 gallons or 612 lbs. per hour.

Fuel pumping considerations should be 50 gallons per minute (GPM), fuel hose length of 50’ for a fuel truck and 100’ for an island.

Ramp Space: CL-215T/CL-415s (94’ wingspan 68’ long and 29.5’ tall) and an Air Tactical Group Supervisor (ATGS) platform require approximately a 400’ by 400’ ramp area. Vendors usually travel with one support truck and large trailer per aircraft.

The Fire Boss requires the same space as a SEAT (60’wingspan 36’ long 17’ tall) and may come with a support truck and mixing trailer (consult the contract).

Running water with hoses should be in close proximity to parking for wash down purposes for possible invasive species or in the case of having hauled retardant (Fire Boss).

Cooperator Canadian aircraft will travel with support equipment that will have to be offloaded with forklifts or scissor lifts. Work with host unit and/or airport to identify needs and logistical support.

The *NWCG Standards for Water Scooping Operations* is developed and maintained by the Interagency Water Scooper Subcommittee (IWSS), under the National Interagency Aviation Committee (NIAC), an entity of the National Wildfire Coordinating Group (NWCG).

Previous editions: 2022, 2021.

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/518.

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