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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.

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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

Multi engine scoopers such as the CL-215T and CL-415 are fixed-wing, turboprop, Amphibious Water Scooping Aircraft (AWSA), and are categorized as a type 3 scooper. The maximum water load of the CL-415 is 1,621 US gallons and 1,412 US gallons for the CL-215T. Cruising speed for both aircraft types is 170-180 nautical miles per hour (knots) with a max speed of 190 knots. Normal fuel cycles of four (4) hours are the standard and can be adjusted as needed for long distance dispatches or scooping operations up to 8,000' pressure altitude. Ferry flights of up to six (6) hours for repositioning are possible.

Single engine AWSA such as the AT-802F, are fixed-wing, turbo prop aircraft with amphibious floats and are categorized as a type 4 scooper.

Single engine scoopers have a hopper capacity of up to 800 gallons, however typical water loads are 500-750 gallons depending on fuel load. Maximum cruise speed at maximum gross weight is 140 knots. Normal fuel cycles can be three to four (3-4) hours. Single engine scoopers may be equipped with water enhancer mixing systems. Refer to specific agency policy on use.

Amphibious water scoopers are most effective when used in multiples of two or more and are administratively supervised as a pair by an agency aircraft manager. They are an effective early initial attack (IA) tool, using direct attack tactics. They are also useful for large fire support and can be used to support other aerial resources as needed. Aerial supervision may be required depending upon incident complexity, pilot qualification level, and aerial supervision guidelines. Flight crews are capable of working independently and directly with a ground contact. Some aircraft are equipped with two (2) FM radios for simultaneous air-to-air and air-to-ground communications as needed. Some aircraft are also equipped with infrared displays for better target acquisition.

AWSA follow all local and national aquatic invasive species (AIS) guidelines and have decontamination procedures, equipment, and trained personnel to mitigate the concern as different water sources are used.

Dispatch

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

Single engine scoopers are capable of (and prefer) being ground loaded before departure. Multi engine scoopers can be ground loaded if requested. In the absence of ground loading, flight crews will fill at a water source close to the incident.

Water Source Selection

Upon receiving a dispatch, the flight crews will determine the 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 for surveying 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.

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

Winds

Water scoopers typically scoop into the wind. Surrounding terrain and vegetation will impact mechanical turbulence and should be considered for the approach, scoop, 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 scooping 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 scooping is calculated per aircraft performance charts and is impacted by aircraft weight, water conditions, winds, density altitude, and available engine power. The length of the 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. The actual length may be measured using the Foreflight satellite view layer and distance tool. 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

For narrow water sources, flight crews should consider directional control contingencies that may be impacted by crosswinds, poor technique, or mechanical malfunction. Width may also determine if aircraft will scoop in trail of aircraft or offset (to avoid wake vortices and prop wash).

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 the 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. Single engine scoopers typically require a minimum of four feet of depth and multi engine scoopers 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, shallow areas, rocks, stumps, debris, birds, and tidal changes for saltwater operations. 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 the manager and ensure the proper inspection and/or decontamination protocol depending upon regional concerns or specific water source AIS status. The *Guide to Preventing Aquatic Invasive Species Transport by Wildland Fire Operations*, PMS 444, provides more information on preventing AIS transport.

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. Avoid overflying helibases and give consideration for impacts on traffic patterns at airports.

Scooper flight 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 Circuits (Routes and Patterns)

The pattern for scooping, route to/from the drop area, and pattern for the drop may be collectively referred to as a circuit. Circuit shape may vary depending on terrain, distance, winds, and desired drop patterns, and aircraft deconfliction. Scooper circuits are generally into the wind at the water source and form an Oval, Figure 8, U shape, Parallel, or Concentric shape as needed.

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

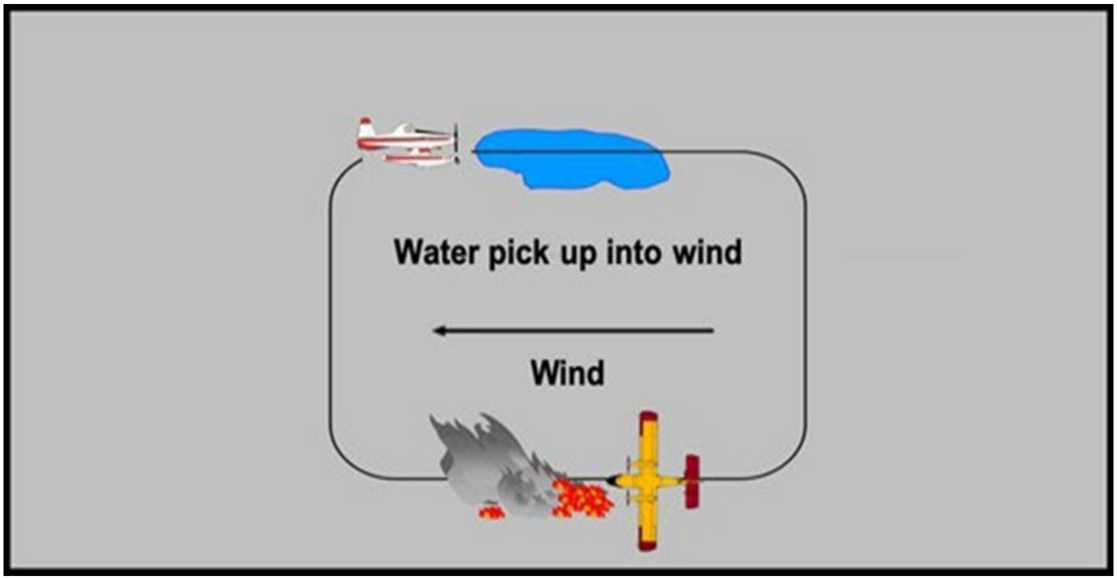
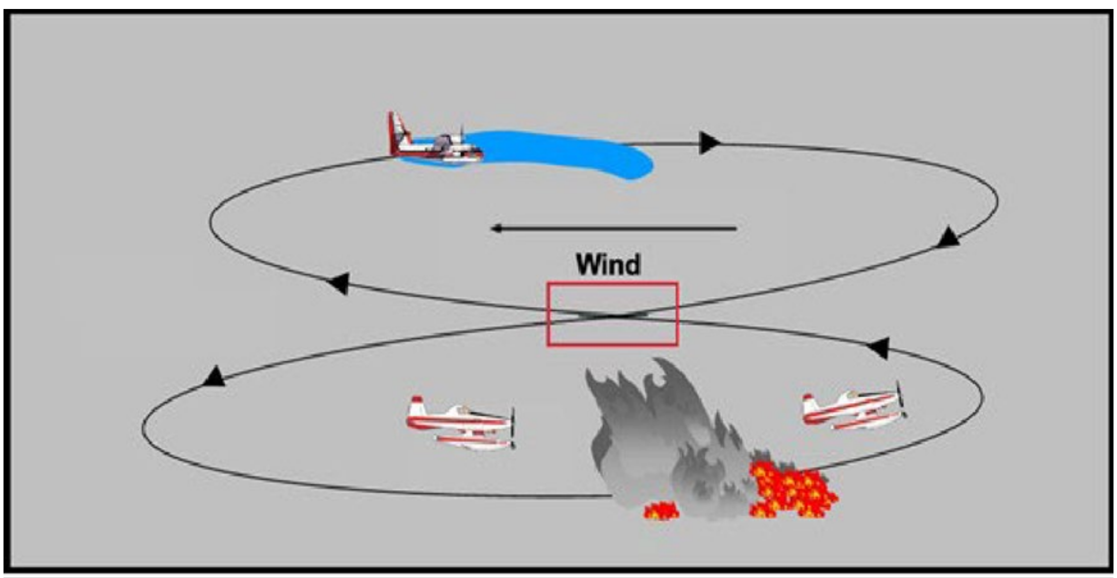
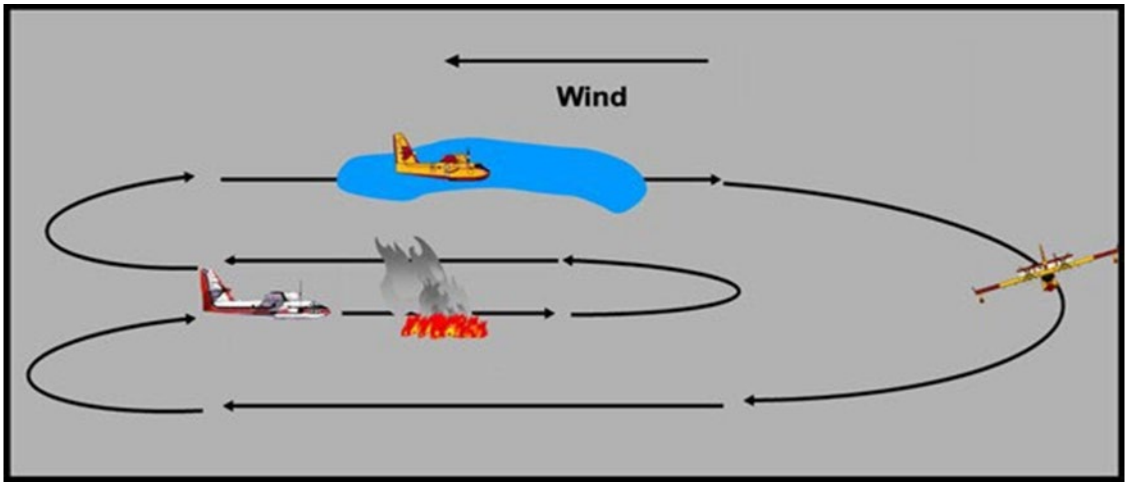


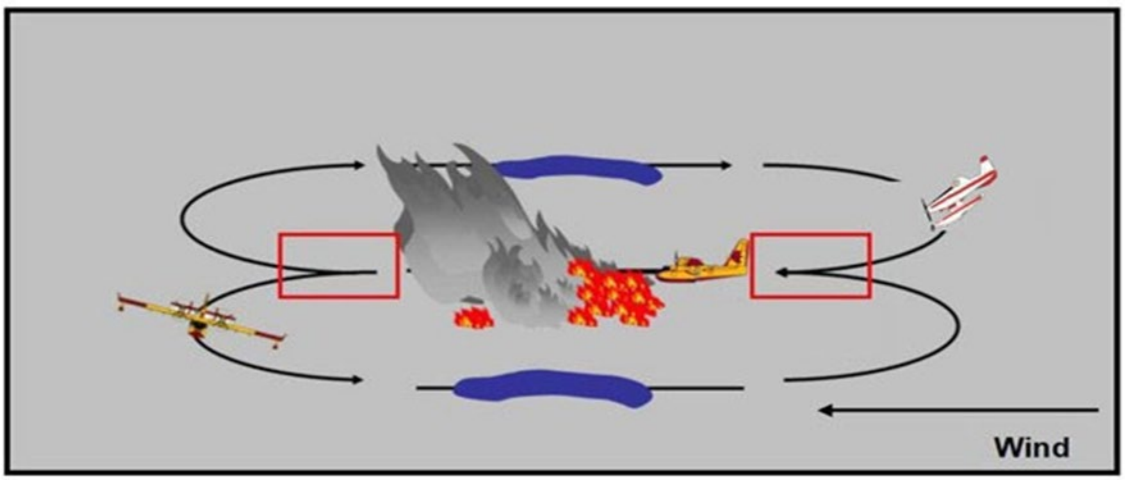
Figure 8 Circuit: Pickup and drop into the wind. Note conflict area and increased maneuvering.



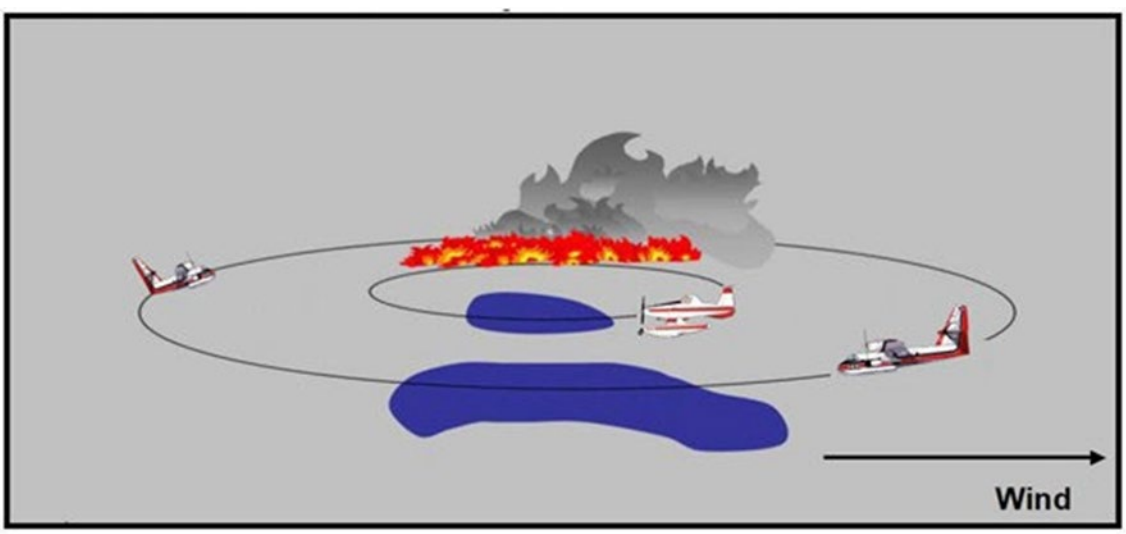
U Shaped Circuit: Pickup and drop into the wind. Note increased maneuvering.



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



Concentric Circuit: Example of different water sources.



Circuit Spacing, Separation, and Sequencing

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 geometry) to return the circuit to appropriate spacing. Consideration should be given for maneuvering in the event of a malfunction, rejected scoop, emergency, or loss of directional control. The lead aircraft has the right of way and trail aircraft have responsibility for separation.

The flight lead 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 when crosswind conditions prevail. Subsequently, the trail aircraft should scoop upwind of the lead aircraft to avoid drifting wake vortices and prop wash.

If multiple flights are operating within the circuit, it is each flight lead's responsibility to ensure good separation and communication protocols. All aircraft are expected to operate predictably and advise of any non-standard patterns, orbits, or holding procedures. Flight leads should consider the impact and potential complexity of multiple flights on aerial supervision. Flight leads must coordinate with aerial supervision when simultaneous retardant, helicopter, or smokejumper operations are being conducted in the same target or geographic area. The aerial supervisor will advise if the flights should operate separately within the circuit, or if the flights should operate in daisy chain. When a flight operates behind another flight, each flight lead should still make appropriate radio calls in the circuit and may be advised to drop on different targets than the preceding flight.

Per the *NWCG Standards for Aerial Supervision (SAS)*, PMS 505, flights of single engine scoopers are limited to four (4) aircraft.

Circuit altitude is the maximum altitude a water scooping aircraft will fly throughout the circuit. The 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 close proximity, it is imperative that scooper 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 single engine scooper or multi engine scooper 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.

<u>Water sources within the FTA</u> — Will yield very fast turn-around times. Aerial Supervisors should assign scoopers a geographic area and overall objective, and only provide further instruction as necessary. The flight lead will call "2xx flight off the scoop" and expect clearance to target if active sequencing with other air resources. A checkpoint may be used as necessary depending on circuit shape.

<u>Water sources outside the FTA</u> — Aerial Supervisors and the flight lead will establish a checkpoint if working in close proximity or sequencing with other aircraft. Checkpoints help to establish timing and are best used approximately four (4) miles from target which is generally about two minutes out. The aerial supervisor should ask scoopers 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 radio calls as needed 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.

Checkpoints

Checkpoints are reporting locations clearly marked by the aerial supervisor. Checkpoints may be geographic points (landmarks: ridge check, meadow check, creek check, etc.), or distance from target in miles (4-mile check) if no obvious landmark exists.

Checkpoints are used to:

1. Route aircraft to and from assignments. (Helicopters to and from Helibase/target/drop point etc., water scooping aircraft to and from the water source as needed, or when outside of the FTA).
2. Provide a location for aircraft to receive a sequencing clearance.

Checkpoints used for sequencing Helicopters and Water Scooping aircraft should:

1. Be Safe (not in the flight path of other aircraft).
2. Be in a location that the pilot being sequenced can see the other aircraft.
3. Be close to the target to minimize the time from receiving the "cleared to target" clearance and clear of the target, (Helicopter checkpoints are usually within 1 mile of the target area, whereas water scooping aircraft checkpoints are usually 4 miles to enable maneuvering if requested to hold at the checkpoint).

Cleared to target – A clearance to target, or unrestricted clearance is not necessarily a clearance to drop. The specific communication and separation protocol is determined at mission commencement, and updated with all additions of water scooping aircraft, aerial supervision relief, helicopters, and ground forces. The drop clearance will be determined based on the specific scenario:

- Scooper assigned a ground contact. PIC receives drop clearance directly from the ground contact.
- Aerial Supervisor clears each specific drop. Air Tactical Group Supervisor (ATGS) confirms line clearance from the ground contact and clears the scooper (flight) to drop. Clearance is prompted by scooper checkpoint or pattern position calls "Scooper 2XX downwind/base/final" as appropriate.
- Water Scooping Aircraft pilot confirms with aerial supervisor that the line is unstaffed and determines geographic drop clearance limits. Subsequent drop clearances are unnecessary as no one is on the ground.

Script Examples

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

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

The flight would then receive a clearance: "Scooper 209 flight, cleared to target number two behind a Skycrane on the drop," or "Scooper 281 flight, 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/505.

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 and target area.

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 flight lead will identify themselves with their scooper number, followed by the phrase "flight of" and then the total number of aircraft in the flight (i.e., "Scooper 209 flight of three single engine scoopers, 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 previous drop," 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, Scooper 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 / location / specific scooping area / hazards / AIS status.
    - Number of flights in the circuit, aircraft in each flight / type / call signs.
    - Routes / patterns / altitude (circuit) if known ahead of time.
    - Target area specific hazards and considerations.
- Monitor separation for the flight and other resources (consider length and width of flight).
- Manage flight variables (power, speed, geometry) 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 (single engine scoopers).
- 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 scoop site, and within the FTA. The lead aircraft should adjust power settings, geometry, 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 flight lead, and efficient communications within the flight to maintain flight integrity.

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 necessitate aggressive maneuvering or increase the possibility of a 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 scoop area or joining a circuit, fly over water source above established pattern (minimum of 500 ft.) to survey and confirm scoop 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, routes, helibases, and helispots.
- Commence operations as directed by the aerial supervisor or Incident Commander (IC) or at the discretion of the initial-attack-qualified PIC if first resource on scene.
- Advise non-standard patterns.
- Make blind calls (such as "Scooper 221 flight off the scoop" and "last scooper off the drop") to maximize situational awareness.
- Call for clearance or report at the checkpoint as directed.
- Incoming flight should attempt to join existing circuit, however, should not hesitate to suggest alternate scooping lanes, water sources, or circuits as conditions change.

Water Scooper Type Integration

On a short turn-around the multi engine and single engine scoopers operate at similar speeds, therefore spacing can generally be maintained between aircraft in the circuit. Coordination is necessary to ensure there are no conflicts during the scoop or drop and transitions to and from the target area.

On longer turnarounds multi engine scoopers will outpace single engine scoopers. Passing maneuvers must be coordinated and agreed upon on the radio, and the aerial supervisor should be advised. The aircraft/flight that is being overtaken has the right of way. The PIC (or flight lead) of the overtaking aircraft/flight should give way to other aircraft by altering the heading to the right or as coordinated. Passing should not occur in close proximity to the drop or the scoop. It may be prudent to pass after the scoop on the inbound/uphill leg as there is a greater speed differential between single and multiengine scoopers. The flight lead must consider the length of both flights and ensure minimal impact on the flight being overtaken.

Operational complexity, phase of flight, and assurance of appropriate spacing must be considered prior to a coordinated passing 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. See Parallel and Concentric circuit figures on page 5.

Operational Considerations

Constructive Airmanship

During each mission, aerial firefighters encounter different circumstances (peer skill level, comfort level, weather and water conditions, familiarity with other pilots/vendors, etc.). It is imperative for all pilots to work together to achieve a safe and effective mission while working toward common objectives.

Frequency / Radio Management

Water scoopers use 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 at all times.

Utilize a scooper frequency for circuit coordination, inter-flight communications, coordination with other flights, and to keep tactical frequencies less congested.

Hosting Unit

An agency aircraft manager will be assigned to the 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: Turbine scoopers require Jet A fuel. Fuel demand could be 750-2000 gallons a day depending on what type and how many aircraft are assigned. The multi engine scoopers (CL-215T/CL-415) will burn approximately 1,500 lbs. or 222 gallons per hour for ferry flights and 2000 lbs. or 296 gallons per hour during water dropping missions. A single engine scooper will hold 380 gallons of fuel and burns approximately 90 gallons or 608 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: two CL-215T/CL-415s (94' wingspan 68' long and 29.5' tall) and an ATGS platform require approximately a 400' by 400' ramp area. Vendors usually travel with one support truck and large trailer per aircraft.

The single engine scooper (amphibious AT-802F) 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).

A water spigot should be in close proximity to parking for wash down purposes for invasive species mitigation or in the case of having hauled retardant/foam/gel (single engine scooper).

Cooperator Canadian aircraft will travel with support equipment that will require a forklift or scissor lift for offload. Work with host unit and/or airport to identify needs and logistical support.

Hosting units should take into consideration notifications to water users especially during times of high use. Managers and Air Operations Branch Directors (AOBD) may utilize news and social media notifications, and visual aids posted at boat launches. Teams may consider public information officer and/or law enforcement engagement. Coordination with the assigned water scooper manager can assist with notifications as needed.

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

Previous editions: 2023, 2016, 2014.

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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