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Seaplane, Skiplane, and Float/Ski Equipped Helicopter Operations Handbook

SEAPLANE, SKIPLANE, and FLOAT/SKI EQUIPPED HELICOPTER OPERATIONS HANDBOOK

2004

**U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Flight Standards Service**

PREFACE

This operational handbook introduces the basic skills necessary for piloting seaplanes, skiplanes, and helicopters equipped with floats or skis. It is developed by the Flight Standards Service, Airman Testing Standards Branch, in cooperation with various aviation educators and industry.

This handbook is primarily intended to assist pilots who already hold private or commercial certificates and who are learning to fly seaplanes, skiplanes, or helicopters equipped for water or ski operations. It is also beneficial to rated seaplane pilots who wish to improve their proficiency, pilots preparing for flights using ski equipped aircraft, and flight instructors engaged in the instruction of both student and transitioning pilots. It introduces the future seaplane or skiplane pilot to the realm of water operations and cold weather operations, and provides information on the performance of procedures required for the addition of a sea class rating in airplanes. Information on general piloting skills, aeronautical knowledge, or flying techniques not directly related to water or cold weather operations are beyond the scope of this book, but are available in other Federal Aviation Administration (FAA) publications.

This handbook conforms to pilot training and certification concepts established by the FAA. There are different ways of teaching, as well as performing specific operating procedures, and many variations in the explanations of operating from water, snow, and ice. This handbook is not comprehensive, but provides a basic knowledge that can serve as a foundation on which to build further knowledge. The discussion and explanations reflect commonly used practices and principles. Occasionally the word “must” or similar language is used where the desired action is deemed critical. The use of such language is not intended to add to, interpret, or relieve a duty imposed by Title 14 of the Code of Federal Regulations (14 CFR).

It is essential for persons using this handbook to also become familiar with and apply the pertinent parts of 14 CFR and the *Aeronautical Information Manual (AIM)*. The AIM is available online at <http://www.faa.gov/atpubs>. Performance standards for demonstrating competence required for the seaplane rating are prescribed in the appropriate practical test standard.

The current Flight Standards Service airman training and testing material and subject matter knowledge codes for all airman certificates and ratings can be obtained from the Flight Standards Service web site at <http://av-info.faa.gov>.

The FAA greatly appreciates the valuable assistance provided by many individuals and organizations throughout the aviation community whose expertise contributed to the preparation of this handbook.

This handbook supercedes Chapters 16 and 17 of FAA-H-8083-3, *Airplane Flying Handbook*, dated 1999. This handbook is available for download from the Flight Standards Service Web site at <http://av-info.faa.gov>. This Web site also provides information about availability of printed copies.

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AC 00-2, *Advisory Circular Checklist*, transmits the current status of FAA advisory circulars and other flight information and publications. This checklist is available via the Internet at http://www.faa.gov/aba/html_policies/ac00_2.html.

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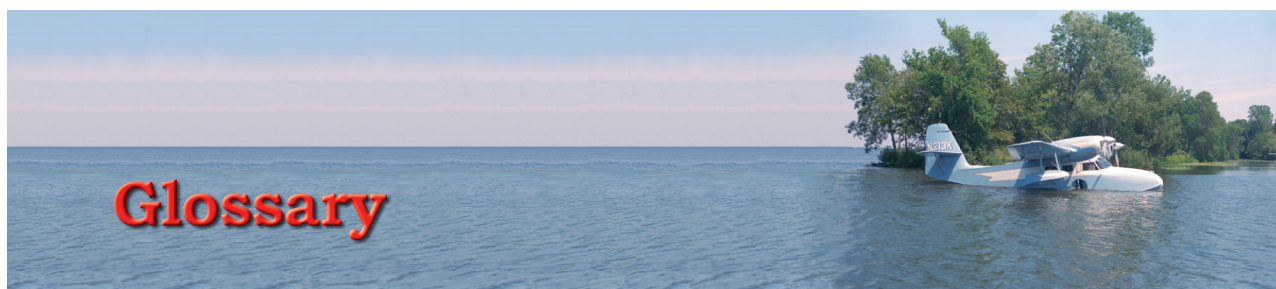
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AMPHIBIAN—A seaplane with retractable wheel-type landing gear that can be extended to allow landings to be made on land.

ANCHOR—A heavy hook connected to the seaplane by a line or cable, intended to dig into the bottom and keep the seaplane from drifting.

AUXILIARY FIN — An additional vertical stabilizer installed on some float planes to offset the increased surface area of the floats in front of the center of gravity.

BEACHING—Pulling a seaplane up onto a suitable shore so that its weight is supported by relatively dry ground rather than water.

BEAUFORT WIND SCALE—A standardized scale ranging from 0-12 correlating the velocity of the wind with predictable surface features of the water.

BILGE—The lowest point inside a float, hull, or watertight compartment.

BILGE PUMP—A pump used to extract water that has leaked into the bilge of a float or flying boat.

BULKHEAD—A structural partition that divides a float or a flying boat hull into separate compartments and provides additional strength.

BUOYANCY—The tendency of a body to float or to rise when submerged in a fluid.

BUOYS—Floating objects moored to the bottom to mark a channel, waterway, or obstruction.

CAN BUOYS—Cylindrical buoys marking the left side of a channel for an inbound vessel. They have odd numbers which increase from seaward.

CAPSIZE—To overturn.

CAST OFF—To release or untie a vessel from its mooring point.

CENTER OF BUOYANCY—The average point of buoyancy in floating objects. Weight added above this point will cause the floating object to sit deeper in the water in a level attitude.

CHINE—The longitudinal seam joining the sides to the bottom of the float. The chines serve a structural purpose, transmitting loads from the bottoms to the sides of the floats. They also serve a hydrodynamic purpose, guiding water away from the float, reducing spray, and contributing to hydrodynamic lift.

CHOP—A roughened condition of the sea surface caused by local winds. It is characterized by its irregularity, short distance between crests, and whitecaps.

COMBINATION SKI—A type of aircraft ski that can be used on snow or ice, but that also allows the use of the skiplane's wheels for landing on runways.

CREST—The top of a wave.

CURRENT — The horizontal movement of a body of water.

DAYBEACONS — Unlighted beacons.

DAYMARKS—Conspicuous markings or shapes that aid in making navigational aids readily visible and easy to identify against daylight viewing backgrounds.

DECK—The top of the float, which can serve as a step or walkway. Bilge pump openings, hand hole covers, and mooring cleats are typically located along the deck.

DISPLACEMENT

POSITION—The attitude of the seaplane when its entire weight is supported by the buoyancy of the floats, as it is when at rest or during a slow taxi. Also called the idling position.

DOCK—To secure a seaplane to a permanent structure fixed to the shore. As a noun, the platform or structure to which the seaplane is secured.

DOWNSWELL—Motion in the same direction the swell is moving.

FETCH—An area where wind is generating waves on the water surface. Also the distance the waves have been driven by the wind blowing in a constant direction without obstruction.

FLOATPLANE — A seaplane equipped with separate floats to support the fuselage well above the water surface.

FLOATS—The components of a floatplane's landing gear that provide the buoyancy to keep the airplane afloat.

FLOATS-ON-SKIDS—A type of helicopter float design where the floats sit on top of the fully functional skids. During water operations, the floats support the weight of the aircraft, and on hard surfaces the skids support the weight of the aircraft.

FLYING BOAT—A type of seaplane in which the crew, passengers, and cargo are carried inside a fuselage that is designed to support the seaplane on the water. Also called a hull seaplane.

GLASSY WATER—A calm water surface with no distinguishable surface features, with a glassy or mirror like appearance. Glassy water can deceive a pilot's depth perception.

HEIGHT-TO-LENGTH

RATIO—The ratio between the height of a swell to the length between two successive crests (swell length).

HYDRODYNAMIC FORCES

Forces relating to the motion of fluids and the effects of fluids acting on solid bodies in motion relative to them.

HYDRODYNAMIC LIFT—For seaplanes, the upward force generated by the motion of the hull or floats through the water. When the seaplane is at rest on the surface, there is no hydrodynamic lift, but as the seaplane moves faster, hydrodynamic lift begins to support more and more of the seaplane's weight.

IDLING POSITION—The attitude of the seaplane when its entire weight is supported by the buoyancy of the floats, as it is when at rest or during a slow taxi. Also called the displacement position.

KEEL—A strong longitudinal member at the bottom of a float or hull that helps guide the seaplane through the water, and, in the case of floats, supports the weight of the seaplane on land.

LEEWARD—Downwind, or the downwind side of an object.

MOOR—To secure or tie the seaplane to a dock, buoy, or other stationary object on the surface.

NUN BUOYS—Conical buoys marking the left side of a channel for an inbound vessel. They often have even numbers that increase as the vessel progresses from seaward.

PLAIN SKI—A type of aircraft ski that can only be used on snow or ice, as compared to combination skis, which also allow the use of the skiplane's wheels for landing on runways.

PLANING POSITION—The attitude of the seaplane when the entire weight of the aircraft is supported by hydrodynamic and aerodynamic lift, as it is during high-speed taxi or just prior to takeoff. This position produces the least amount of water drag. Also called the step position, or "on the step."

PLOWING POSITION—A nose high, powered taxi characterized by high water drag and an aftward shift of the center of buoyancy. The weight of the seaplane is supported primarily by buoyancy, and partially by hydrodynamic lift.

POP-OUT FLOATS—Helicopter floats that are stored deflated on the skids or in compartments along the lower portion of the helicopter, and deployed in the event of an emergency landing on water. Compressed nitrogen or helium inflates the floats very quickly.

PORPOISING—A rhythmic pitching motion caused by an incorrect planing attitude during takeoff.

PORT—The left side or the direction to the left of a vessel.

PRIMARY SWELL—The swell system having the greatest height from trough to crest.

RAMPING—Using a ramp that extends under the water surface as a means of getting the seaplane out of the water and onto the shore. The seaplane is typically driven under power onto the ramp, and slides partway up the ramp due to inertia and engine thrust.

SAILING—Using the wind as the main motive force while on the water.

SEA—Waves generated by the existing winds in the area. These wind waves are typically a chaotic mix of heights, periods, and wavelengths. Sometimes the term refers to the condition of the surface resulting from both wind waves and swells.

SEA STATE CONDITION

NUMBER—A standard scale ranging from 0-9 that indicates the height of waves.

SEAPLANE — An airplane designed to operate from water. Seaplanes are further divided into flying boats and floatplanes.

SEAPLANE LANDING

AREA—Any water area designated for the landing of seaplanes.

SEAWARD—The direction away from shore.

SECONDARY SWELLS—Those swell systems of less height than the primary swell.

SISTER KEELSONS—Structural members in the front portion of floats lying parallel to the keel and midway between the keel and chines, adding structural rigidity and adding to directional stability when on the water.

SKEG—A robust extension of the keel behind the step which helps prevent the seaplane from tipping back onto the rear portion of the float.

SKIDS-ON-FLOATS—A type of helicopter float design where the rigid portion of the landing gear rests on the floats. The floats support the whole weight of the helicopter in water or on hard surfaces.

SKIPPING — Successive sharp bounces along the water surface caused by excessive speed or an improper planing attitude when the seaplane is on the step.

SPONSONS—Short, winglike projections from the sides of the hull near the waterline of a flying boat. Their purpose is to stabilize the hull from rolling motion when the flying boat is on the water, and they may also provide some aerodynamic lift in flight. Tip floats also are sometimes known as sponsons.

SPRAY RAILS—Metal flanges attached to the inboard forward portions of the chines to reduce the amount of water spray thrown into the propeller.

STARBOARD—The right side or the direction to the right of a vessel.

STEP—An abrupt break in the longitudinal lines of the float or hull, which reduces water drag and allows the pilot to vary the pitch attitude when running along the water's surface.

STEP POSITION—The attitude of the seaplane when the entire weight of the aircraft is supported by hydrodynamic and aerodynamic lift, as it is during high-speed taxi or just prior to takeoff. This position produces the least amount of water drag. Also called the planing position.

SWELL—Waves that continue after the generating wind has ceased or changed direction. Swells also are generated by ships and boats in the form of wakes, and sometimes

by underwater disturbances such as volcanoes or earthquakes. The waves have a uniform and orderly appearance characterized by smooth, rounded, regularly spaced wave crests.

SWELL DIRECTION — The direction from which a swell is moving. Once set in motion, swells tend to maintain their original direction for as long as they continue in deep water, regardless of wind direction. Swells may be moving into or across the local wind.

SWELL FACE—The side of the swell toward the observer. The back is the side away from the observer. These terms apply regardless of the direction of swell movement.

SWELL LENGTH—The horizontal distance between successive crests.

SWELL PERIOD — The time interval between the passage of two successive crests at the same spot in the water, measured in seconds.

SWELL VELOCITY — The velocity with which the swell advances with relation to a fixed reference point, measured in knots. There is little movement of water in the horizontal direction. Each water particle transmits energy to its neighbor, resulting primarily in a vertical motion, similar to the motion observed when shaking out a carpet.

TIDES—The alternate rising and falling of the surface of the ocean and other bodies of water connected with the ocean. They are caused by the gravitational attraction of the sun and moon occurring unequally on different parts of the earth. Tides typically rise and fall twice a day.

TIP FLOATS—Small floats near the wingtips of flying boats or floatplanes with a single main float. The tip floats help stabilize the airplane on the water and prevent the wingtips from contacting the water.

TRANSOM—As it applies to seaplanes, the rear bulkhead of a float.

TROUGH—The low area between two wave crests.

UPSWELL—Motion opposite the direction the swell is moving. If the swell is moving from north to south, a seaplane going from south to north is moving upswell.

VESSEL—Anything capable of being used for transportation on water, including seaplanes.

WATER RUDDERS—Retractable control surfaces on the back of each float that can be extended downward into the water to provide more directional control when taxiing on the surface. They are attached by cables and springs to the air rudder and operated by the rudder pedals in the cockpit.

WEATHERVANING—The tendency of an aircraft to turn until it points into the wind.

WINDWARD—Upwind, or the upwind side of an object.

WING FLOATS—Stabilizer floats found near the wingtips of flying boats and single main float floatplanes to prevent the wingtips from contacting the water. Also called tip floats.

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