# A-312
Water Ditching & Survival
Student Guide

## Revision History

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<tr>
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Welcome and Introduction

Get to Know Your Classmates

Be prepared to share:

- Your name
- Your Bureau or employer
- Your position
- What are some of the ways your employer uses aviation resources to accomplish mission objectives
- Have you taken A-312 in the past, or had other underwater egress training?

Course Purpose

The purpose of this course is to provide classroom and hands-on training to better prepare students in the event they experience an aircraft water ditching.

Objectives

At the conclusion of this course, you should be able to:

❖ Identify the aviation life support (ALSE) and personal protective equipment (PPE) policy requirements of the student’s agency/bureau pertaining to overwater flights.
❖ Discuss the importance of the preflight briefing, ALSE and PPE related to overwater flights
❖ Discuss the purpose and order of the SIX STEP Egress Procedure
❖ Describe how a positive mental attitude and survival equipment can affect post-egress survival.
❖ Discuss and demonstrate the personal and group water survival techniques and equipment taught by the instructor(s)
❖ Perform a minimum of 3 procedurally correct egresses from a training device (SWET or dunker) using the SIX STEP Egress Procedure
“How am I doing?”

Take a few moments to consider how you currently feel when faced with the idea of having to survive an aircraft water ditching. Look at the graph below and make a mark, based on your current level of comfort with this idea, reflecting where you are.

Figure 1: Student’s Rating of Comfort Level Regarding a Water Ditching Situation

NOTES:_____________________________________________________________
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Unit 1: Policy

Objective
After completing this unit, participants should be able to:

❖ Identify the ALSE and PPE policy requirements of the student’s agency/bureau pertaining to overwater flights.

Definitions

Federal Aviation Administration (FAA)
Extended Overwater Operations:

- Airplanes: Operations overwater at a horizontal distance of more than 50 nautical miles from the nearest shoreline
- Helicopters: Operations overwater at a horizontal distance of more than 50 nautical miles from the nearest shoreline and more than 50 nautical miles from an offshore heliport structure

Departmental (DOI and USFS)
Operations Beyond Gliding Distance to Shore:

Overwater flights that occur beyond the point at which an aircraft that has lost all power can safely glide to shore

Dependent on a combination of factors, including:

- Altitude above the surface
- Airspeed
- Aircraft type (fixed- vs. rotor-wing)
- Aerodynamic capabilities of aircraft (glide ratio)
- Pilot’s reaction time to emergency

Glide ratio of an aircraft doesn’t change. Factors such as aircraft weight, adverse meteorological conditions and/or incorrect pilot inputs can affect glide ratio. Operating at higher altitudes and airspeeds simply increases both factors in the ratio, giving a pilot more time to determine a course of action.

If FAA rules mandate that a flight travel overwater as part of the take-off or landing sequence, the flight profile is not considered to be ‘beyond gliding distance to shore’ and DOI PPE requirements do not apply for that portion of the flight.
Personal Flotation Device (PFD) Policy

PFD’s Must:

- Be worn during all take-offs and landings to water
- When operating aircraft beyond gliding distance from shore:
  - be worn in a single-engine aircraft
  - be readily available in a multi-engine aircraft

NEVER inflate a PFD inside the aircraft. The difficulty of egress, and corresponding chance of becoming trapped, increases substantially.

Anti-Exposure Garment Policy

When conducting extended overwater flights AND where the temperature of the water is below 50°F, an anti-exposure garment must be:

- worn by occupants of a single-engine aircraft
- readily available to occupants of a multi-engine aircraft


Life Raft

- Life Rafts are required for extended overwater operations in accordance with 14 CFR 135.167.

Reference: ALSE Handbook/Guide, Chapter 4.6 (page 19)
Aircraft Floats

- Single-engine helicopters and single-engine airplanes operated beyond power-off gliding distance of shore shall be float-equipped, except where established traffic flow requires aircraft to operate beyond gliding distance to shore during take-offs and landings.

- Multi-engine aircraft operated at a weight that will allow it to climb, with the critical engine inoperative—at least 50 feet per minute, at an altitude of 1,000 feet above the surface—may be operated overwater without floats.

- DOI fleet land aircraft may be repositioned (ferried), with only flight crewmembers on board, without the required floats.

Reference: 351 DM 2.2.C: USFS–FSM 5713.4 Alaska Supplement

NOTES:_____________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
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⚠️ Take a few moments to answer the questions.
Be prepared to share your answers with your fellow students.

If known, explain your agency/bureau/home unit policy pertaining to ALSE, PPE and overwater flights.

NOTES:____________________________________________________________________
____________________________________________________________________
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Think of one or two realistic ways your home unit could increase safety by implementing a more restrictive PPE and/or ALSE policy.

NOTES:____________________________________________________________________
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Unit 2: Prior to your Flight

After completing this unit, participants should be able to:

❖ Discuss the importance of the preflight briefing, ALSE and PPE related to overwater flights.

Flight Helmets
The ALSE Handbook/Guide, Chapter 2.2 (pages 9–11), explains when flight helmets are required. Drowning victims frequently have received blows to the head that daze, or render them unconscious, thus preventing their escape. Wearing flight helmets, absorbs impact, and has prevented head injuries for many water ditching survivors.

Flight helmets also protect by:

• Offering shielding from the sun
• Retaining heat
• Providing flotation
• Providing eye protection

Make sure you know how to properly don and wear a flight helmet… It has saved lives!

Seat Belts

• Properly secured/tight
• Know how to latch and unlatch
• Ensure the buckle is positioned where you know to reach for and release it (belt low and tight on lap, with buckle centered under belly button, if possible)
• Do not remove until all violent motion has stopped and a reference point/grasp has been established
• Remove your seat belt with the opposite hand from the one holding your reference point
Cargo

- Weighed and manifested
- Stowed according to pilot direction (weight and balance)
- Pilots and passengers can be fatally injured by flying cargo and improperly stowed equipment. They can be hampered in their egress, or pinned inside the aircraft, by shifting cargo. It is essential that all toolboxes, cargo and equipment be secured before each flight.
- Only those items needed inside the aircraft should be placed in the passenger compartment. All other equipment should be secured in cargo compartments.

Ensure that life raft and survival kit are stowed in a location that allow for easy accessibility in an emergency.

Emergency Exits

- Know the location and operation of the Emergency Exits before take-off of the aircraft.
- Be aware of the exit that is closest to you, however, you should locate an alternate exit in case the closest exit becomes blocked.

Students should 'mock-up' (physically practice) the route to the primary, secondary, and any other alternate exits (if possible) during preflight.

Secondary Restraints:

In is critical for students to remember that, in a ditching scenario, they will be physically attached to the aircraft TWICE, so they will need to plan (preflight) how they will deal with the extra attachment.

DOI and Bureau policy requires that a knife is available to the user. Some programs require a specific type of knife and that it be worn and/or mounted in a specific location, on the user, or in the aircraft.

NOTES:______________________________________________________________________
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______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
Unit 3: Egress Procedures

After completing this unit, participants should be able to:

❖ Discuss the purpose and order of the SIX STEP Egress Procedure

Barriers to Egress

Hazards that can prevent egress:

- Inverted aircraft:
  - Might rollover and sink rapidly after impact
  - Might float upside down, with cabin submerged for a short period (due to buoyancy provided by internal fuel cells)
  - Underwater, inverted aircraft cabin makes escaping more difficult
- Onrushing water—for unbelted passengers—it can:
  - Be the greatest egress deterrent
  - Force them into the rear corners of the cabin
  - Affect their gravitational reference, disorienting them to the point that an exit cannot be located
- Entanglement Hazards:
  - Avionics cords
  - PFD
  - Entangled clothing
  - Seat belts
- Obstruction Hazards:
  - Other passengers (unconscious or incapacitated)
  - Other passenger or pilot actions (e.g. pilot sliding seat rearward in small fixed-wing aircraft, trapping a passenger’s feet under the seat)
  - Unsecured equipment, or secured equipment, that broke free upon impact
- Inability to see due to:
  - Darkness or murky water
  - Smoke or fire
  - Spilled fuel

Human factors that can prevent egress:

- Difficulty finding and/or releasing seatbelts
- Difficulty or inability opening doors or emergency exits
- Inability to hold breath long enough to egress aircraft and reach the surface
PANIC IS YOUR ENEMY!

_Fear and Panic must not be the driving force behind your actions._

Panic is the natural tendency in a sudden situation such as this. **You must make every effort to remain calm and think clearly.**

You must convince yourself that by using your knowledge, common sense, and a logical thought process you can survive the water ditching. Eliminate negative thoughts and images that may detract from your goal to survive.

Familiarity with the aircraft and a thorough understanding of emergency procedures are essential. You must have this knowledge to aid in your exit and survival of a water ditching aircraft.

In a water ditching situation, it is _critical_ that pilots and passengers must be:

- Protected physically, from impact forces **AND**
- They must be mentally prepared to cope with the events that rapidly occur

To be simultaneously shaken up, turned end-for-end, possibly rolled upside down, and submerged beneath cold, on-rushing water can be a great shock for even the most prepared person. The initial reactions of most water ditching survivors have been _disorientation, confusion and panic._

**Supplementary Emergency Air Systems**

General overview of the systems features and how they work:

- **Single-stage regulator**—bottle is pulled from mount and placed near face
- **Dual-stage regulator**—bottle stays mounted; hose is brought to face
- **Special vest** or **PFD** with location to mount
- **Compressed gas**—Hazardous materials restrictions for shipping or transport on aircraft
- **Bottle must be hydrostatically tested every 2 to 5 years**
  - **Training** is required for correct usage of the above listed items
THE SIX STEP CRASH EGRESS PROCEDURE:

1. “I’m a Survivor!”
   Set the stage for a positive attitude. You will survive.

2. Unplug flight helmet/headset mic jack from coil cord
   This action prevents getting "hung-up" when exiting the aircraft.

3. Prior to contact with the water, open aircraft door and lock open, then BRACE!
   External water pressure is reduced, making the door easier to open as the aircraft settles or submerges. Most doors are designed such that forward flight will not affect the door when opened. Keep in mind that the door may latch itself again upon impact. If this happens you may have to wait until the water pressure equalizes before being able to open it again.

4. WAIT 4—violent movement of the aircraft to come to a stop.
   This reduces the risk of you exiting into a potentially dangerous situation.

5. Locate and Clear Exit—Find your REFERENCE POINT.
   If you are seated by a door or an emergency exit, Locate and Open it. Your reference point would be either the door frame or the exit window. Once you have established your reference point/grasp, DO NOT REMOVE YOUR HAND until it is safe to leave the aircraft. Be aware that you may need to climb hand-over-hand from one seat to another to reach an exit. Never let go both hands at once.

6. Release your SEAT BELT and EXIT.
   Do not lose your grasp on your reference point! Exit the aircraft following your reference hand, by moving hand-over-hand. Do not climb over other occupants in the aircraft. Wait until they are out. This will lessen confusion and actually speed-up the process.

Take a moment to commit the SIX STEPS EGRESS PROCEDURE to memory.
You will be expected to have these steps memorized and be able to state them back, in order, to the instructors before the dunker exercise.

<table>
<thead>
<tr>
<th>SIX STEPS EGRESS PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. “I’m a Survivor!”</td>
</tr>
<tr>
<td>2. Unplug</td>
</tr>
<tr>
<td>3. Open Door → BRACE</td>
</tr>
<tr>
<td>4. Wait 4 → Sit Up</td>
</tr>
<tr>
<td>5. Locate and Clear Exit → grasp REFERENCE POINT</td>
</tr>
<tr>
<td>6. RELEASE Seat Belt and EXIT</td>
</tr>
</tbody>
</table>
List (in order) the SIX STEPS EGRESS PROCEDURE:

1. ____________________________________________

2. ____________________________________________

3. ____________________________________________

4. ____________________________________________

5. ____________________________________________

6. ____________________________________________
Unit 4: Post-Egress Survival

After completing this unit, participants should be able to:

❖ Describe how a positive mental attitude and survival equipment can affect post-egress survival.
❖ Discuss and demonstrate the personal and group water survival techniques and equipment taught by the instructor(s)

⚠ Interaction/Activity: Reaching the Surface

Take a moment to write down at least three methods you might use to determine the direction you must travel to reach the surface of the water.

NOTES:_____________________________________________________________  
__________________________________________________________________  
__________________________________________________________________  
__________________________________________________________________

⚠ Take a moment to write down at least two hazards you may encounter once reaching the surface.

NOTES:_____________________________________________________________  
__________________________________________________________________  
__________________________________________________________________  
__________________________________________________________________
Reaching the Surface

Disorientation during the rolling and sinking of the aircraft should be expected—plan for it. Be aware that many passengers have successfully egressed the aircraft only to swim down rather than up.

- Following air bubbles to the surface may help in maintaining surface orientation
- Flight helmet will float to the surface (due to its built-in buoyancy features)
- Inflate PFD as last resort (especially if injured)
  - Remember, however, that if hazardous conditions exist at the surface you will need to deflate your PFD to dive back under the water to move away from the danger.

Be aware of the potential for a water surface fire, due to a fuel spill. If you find yourself in this situation try to stay beneath the water surface and swim to a point beyond the fire. If you surface into fire, attempt to grasp a breath of air using your PFD as a shield, submerge yourself again and swim to a point of safety beyond the fuel spill/fire.

Students, while attempting to reach the surface of the water, should put their HAND UP, HEAD UP, INVESTIGATE, and then INFLATE their PFD.

- **HAND UP**—to feel whether the area is clear of debris and/or fire
- **HEAD UP**—to prevent spinal injuries
- **INVESTIGATE**—the area for danger and to take stock of the situation *BEFORE* inflating your PFD.
  - You might have to dive back under the water to move away from a dangerous situation!
  - Where are other survivors?
  - Where is the survival equipment?
- **INFLATE PFD**

**NOTES:**
____________________________________________________________________
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____________________________________________________________________
____________________________________________________________________
Hypothermia and Exposure

“Hypothermia is a potentially dangerous drop in body temperature, usually caused by prolonged exposure to cold temperatures. The risk of cold exposure...

Normal body temperature averages 98.6°F. With hypothermia, core temperature drops below 95°F. In severe hypothermia, core body temperature can drop to 82°F or lower.”

See: WebMD Hypothermia (Definitions) Article (https://www.webmd.com/a-to-z-guides/what-is-hypothermia#1)

If you are not able to get to a raft, the key to survival is to remain calm. From the standpoint of conserving body heat this is the best possible behavior. Struggling or swimming will cause maximum heat loss due to the flushing action of cold water against the body’s critical heat-loss areas. Also the expenditure of calories produced by strenuous exercise will lessen your endurance.

**Table 1: Survival Times in Cold Water Without Protective Clothing**

<table>
<thead>
<tr>
<th>Water Temperature</th>
<th>Loss of Dexterity</th>
<th>Exhaustion or Unconsciousness</th>
<th>Expected Time of Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrees C</td>
<td>Degrees F</td>
<td>with no protective clothing</td>
<td></td>
</tr>
<tr>
<td>0.3</td>
<td>32.5</td>
<td>Under 2 min.</td>
<td>Under 16 min.</td>
</tr>
<tr>
<td>0.3 to 4.5</td>
<td>32.5 - 40</td>
<td>Under 3 min.</td>
<td>15 to 30 min.</td>
</tr>
<tr>
<td>4.5 to 10</td>
<td>40 - 50</td>
<td>Under 5 min.</td>
<td>30 to 60 min.</td>
</tr>
<tr>
<td>10 to 15.5</td>
<td>50 - 60</td>
<td>10 to 15 min.</td>
<td>1 to 2 hrs.</td>
</tr>
<tr>
<td>15.5 to 21</td>
<td>60 - 70</td>
<td>30 to 40 min.</td>
<td>2 to 7 hrs.</td>
</tr>
<tr>
<td>21 to 26.5</td>
<td>70 - 80</td>
<td>1 to 2 hrs.</td>
<td>2 to 12 hrs.</td>
</tr>
<tr>
<td>Over 26.5</td>
<td>Over 80</td>
<td>2 to 12 hrs.</td>
<td>Indefinite</td>
</tr>
</tbody>
</table>

Table 2: Water Temperature—Survival Time (with & without protective survival devices)

<table>
<thead>
<tr>
<th>F. Water Temp.</th>
<th>No Protection</th>
<th>Exhaustion or Unconsciousness Occurs within</th>
<th>Expected Time of Survival with Fotation Device</th>
<th>Expected Time of Survival with Survival Suit</th>
</tr>
</thead>
<tbody>
<tr>
<td>32.5</td>
<td>under 15 min.</td>
<td>15 to 45 min.</td>
<td>18 hours +</td>
<td></td>
</tr>
<tr>
<td>32.5 - 40</td>
<td>15 to 30 min.</td>
<td>30 to 90 min.</td>
<td>22 hours +</td>
<td></td>
</tr>
<tr>
<td>40 - 50</td>
<td>30 to 60 min.</td>
<td>1 to 3 hours</td>
<td>Indefinite</td>
<td></td>
</tr>
<tr>
<td>50 - 60</td>
<td>1 to 2 hours</td>
<td>1 to 6 hours</td>
<td>Indefinite</td>
<td></td>
</tr>
<tr>
<td>60 - 70</td>
<td>2 to 7 hours</td>
<td>2 to 40 hours</td>
<td>Indefinite</td>
<td></td>
</tr>
</tbody>
</table>

The cold facts on time and temperature.
Figure 2: Survival Positions—Wearing Flotation Devices

If you are alone in the water assume the H.E.L.P. (Heat Escape Lessening Posture) position. Draw the knees to the chest, lock hands over knees. This position covers the most surface area of the body possible, and will help retain critical body heat for the areas of the body with very little insulation.

Survivors should huddle together while afloat in the water. This aids in preventing heat loss of the group as a whole, keeps the colder water outside the huddle, and presents a larger target for rescuers to locate. Morale is better as a group than being alone.

Survivors should make the Carpet Formation to create the largest visible target for rescue. This can help facilitate assistance of injured, incapacitated, or hypothermic personnel, as most of the survivor’s body is in the top 18 inches of water where temperatures are the warmest. The Carpet Position also provides the group with the ability to scan the entire horizon for rescue craft, and offers the best chance of remaining attached to each other in a heavy sea state.
Signaling for Rescue
There are many signaling devices to help survivors increase their chances of being rescued. Each type of signaling device has a specific design and purpose, as well as definite operating limitations. The wider range of devices you have, the greater your chance of rescue.

Being able to alert the rescue party of your situation or whereabouts is essential. The chance of being spotted accidentally does not generally occur. The negative effect of heavy swells on the visibility of any floating object in the ocean is well understood by sailors. The chance of an alerted ship or aircraft pinpointing and reaching the position of the raft is slim, unless the survivor can provide a constant signal.

REMEMBER: BIGGER, BRIGHTER, DIFFERENT

Signaling Devices

Hand-Held Rocket Flares: These are generally of two types—low altitude, with a short burn span and high altitude, with a long burn span.

Pen Gun Flares: A 45-caliber cartridge is screwed into the end of the pen gun and fired by a spring-loaded pin. The flare generates a candle power of 4,000 candelas, and attains altitudes of 450 to 500 feet, and has a burning time of between 5 and 10 seconds.

Pistol Launched Flares: These are generally available in 12 gauge, 25mm, and 37mm. They produce a candle power of 10,000 candelas and have a burning time of between 10–30 seconds. They are also referred to as meteor flares, are capable of alerting ships from as far away as 20 miles, and alerting aircraft at around 10 miles, depending on atmospheric conditions.

Aerial Flares: Very effective at night, or close range in daylight. These can be difficult to see against bright sunlight.

Rescue Lasers: Rescue lasers can be waterproof and have a long battery life. Used similarly to a signal mirror, rescue lasers can be seen up to 3 miles away during daylight and up to 20 miles away at night.
Signal Mirror: There must be a workable angle between the sun and your mirror, and the sun and the rescue craft. Mirrors have proven effective at 10 miles plus. (Limited to daytime and sunny skies.)

Figure 3: Correct Method for Utilizing a Signal Mirror, or Rescue Laser

1. Hold mirror by eye and reflect “fireball” from “mirror” onto “V” formed by fingers.
2. Move arm, align mirror so target is visible between “V”
3. Tilt mirror rapidly up and down to “flash” target.

Lights (strobe, flash): These are effective only at night and have a limited battery life; carry extra batteries.

Whistle or Horn: Your position relative to the wind direction and the rescue vessel will influence their effectiveness. The most obvious limitation of a whistle or horn is distance.

Dyes: Dyes are visible in the water at relatively close range only, one mile or less. Dye can best be seen by aircraft flying at higher altitudes, but have limited visibility at sea level from boats. Also, dyes will dissipate quickly in rough seas.
Search and Rescue Satellites: The latest in search and rescue technology is a satellite system called SARSAT (Search and Rescue Satellite). These satellites are equipped with special receivers that are tuned to standard international distress frequencies. Orbiting Earth, these satellites are capable of receiving and pinpointing transmissions almost anywhere on Earth.

**Figure 4: SARSAT (Search & Rescue Satellite) System Overview**

ELT (Emergency Locator Transmitter): an emergency transmitter that is carried aboard most general aviation aircraft in the U.S. In the event of an aircraft accident, these devices are (triggered by impact and) designed to transmit a distress signal on 121.5, 243.0 megahertz (MHz) frequencies—and for newer ELTs, on 406 MHz.

**Once Activated ELTs or EPIRBs Should Be Left On Continuously**

EPIRB (Emergency Position Indicating Radio Beacon): is a modified version of the aviation ELT (Emergency Locator Transmitter). It is usually equipped with both a manual and a salt water activation system. This self-contained, battery-operated unit transmits an inaudible, electric oscillating or "swept" tone. The beacon is capable of transmitting a continuous distress signal 24 hours a day for the life of the batteries. The important benefit of an EPIRB is that the survivor need not be awake or be able to see the rescue vessel in order to alert it.

PLB (Personal Locator Beacon): a particular type of EPIRB that is typically smaller, has a shorter battery life, and unlike a proper EPIRB, is registered to a person rather than a vessel.

Both ELTs and EPIRBs are capable of transmitting a continuous distress signal 24 hours a day for the life of the battery. One benefit of this is that the survivor need not be awake or be able to see the rescue vessel in order to alert it.
Personal Survival Kits

Students should carry a personal survival kit (that remains 'on your person' at all times) when traveling, regardless of the mode.

Suggested items:

- Signal mirror
- Brightly colored extra-large trash bag
  - Will make a good wetsuit
  - Could provide flotation
  - Weighs nothing/takes up little space
- Laser rescue light or strobe light
- Dye marker
- Knife or tool containing a knife blade
- Water purification tablets
- Personal Locator Beacon (PLB)
- Whistle
- Fire starter
- See/Rescue® Streamer
  - Lightweight (10 ounces)/deploys to 11 feet long
  - Retro-reflectors (search lights)/Chem-lights® (night vision goggles)
Raft Deployment and Use

1. Start exiting the aircraft as soon as the rotors or props have come to a full stop.

2. When deploying a life raft, maintain control of the lanyard—some rafts require attachment to the aircraft.

3. Deploy the raft into the wind. This will cause the raft to stay in proximity of the aircraft, making entry much easier.
   (Note: be very careful NOT to puncture raft on sharp edges of aircraft).

4. Your PFD should be inflated during the transition from the aircraft to the raft. Never inflate PFD inside the aircraft.

In calm seas entry into the raft can be done directly from the aircraft. In rougher seas this is more difficult to accomplish, and entry into the water first may be necessary. Enter the raft as quickly as possible in order to reduce the risk of hypothermia.

Make sure you are familiar with the raft onboard your aircraft.

Figure 5: How-to Board a Life Raft
Unit 5: Pool Exercises

Practical Exercises at Pool

After completing this unit, participants should be able to:

❖ Perform a minimum of 3 procedurally correct egresses from a training device (SWET or dunker) using the SIX STEP Egress Procedure

Pool logistical information:

- Address/map to pool location
- Instructor(s) Cell Phone numbers
- Class start time
- Pool attire:
  - Minimum swimsuit and T-shirt
  - Clean Field attire (Optional)
  - Pool shoes only (Optional)

Overview of how the pool exercise will proceed:

- Pool Safety Briefing
- Pool Exercises:
  - Breathing
  - Swimming
  - PFD Exercises
  - Raft Exercises (if included)
  - Visualization
- Dunker Exercise:
  - Safety Briefing
  - Dry runs
  - 3 successful egresses from dunker
- After Action Review (AAR)
Review Course Objectives

At the conclusion of this course, participants will:

❖ Identify the aviation life support (ALSE) and personal protective equipment (PPE) policy requirements, of the student’s agency/bureau, pertaining to overwater flights.

❖ Discuss the importance of the preflight briefing, ALSE and PPE, related to overwater flights.

❖ Discuss the purpose and order of the SIX STEP Egress Procedure.

❖ Describe how a positive mental attitude and survival equipment can affect post-egress survival.

❖ Discuss and demonstrate the personal and group water survival techniques and equipment taught by the instructor(s).

❖ Perform a minimum of 3 procedurally correct egresses from a training device (SWET or dunker) using the SIX STEP Egress Procedure.
Appendix A.1: Resources and References

Books/Articles

FAA "Extended Overwater" Definitions/Requirements
(http://fsims.faa.gov/wdocs/8900.1/v04%20ac%20equip%20&%20auth/chapter%2001/04_001_006.htm)


14 CFR135.167a—Emergency Equipment: Extended Overwater Operations
(http://rgl.faa.gov/regulatory_and_guidance_library/rgfar.nsf/daa4c54debeeb6dca86256f3400626ab0/67b9972e6143052d86256dfb0069d54flOpenDocument)

Interagency Aviation Life Support Equipment (ALSE) Handbook
(former ALSE Handbook)

Immersion/Survival Suit Definition
(https://www.wartsila.com/encyclopedia/term/immersion-suit-also-survival-suit)

Choices of Personal Flotation Devices (PFDs)—review by Rick Durden

Mayday! One Man's Story of Surviving a Plane Crash
(https://www.rd.com/true-stories/survival/mayday/)

WebMD Hypothermia (Definitions) Article
(https://www.webmd.com/a-to-z-guides/what-is-hypothermia#1)

NOAA Coastal Regions Water Temperatures Table
(https://www.nodc.noaa.gov/dsdt/cwtg/all_meanT.html)

1-10-1 rule
(http://www.coldwaterbootcamp.com/pages/1_10_60v2.html)

Brooks, Dr. C.J.  The Human Factors of Surviving a Helicopter Ditching. Survival Systems LTD.
(https://drive.google.com/file/d/10Bxbfn76VrddhmgsM9BqLWaY_I0kSFJR/view?usp=sharing)


(http://tsb.gc.ca/eng/rapparts-reports/aviation/etudes-studies/sa9401/sa9401.pdf)
NTSB Reports

Amphibious Aircraft—Anchorage, Alaska (Heather Wilson)

FWS (Top Cub) Accident—Anchorage, Alaska
Appendix B:  *Transport Canada* Article

**Underwater Egress—Revisited**

[Image of an airplane in the water]

The following accident represents a nightmare for all pilots (what accident doesn’t?), but particularly for seaplane pilots. It was the subject of “Learning from Others,” an excellent letter from a reader in Aviation Safety Letter 2/97, but the recent release of Transportation Safety Board (TSB) Final Report A96Q0114 gave us no alternative but to highlight this tragic accident before the summer of 1998 arrives. We will also address specific issues relating to the aft emergency exit on the Cessna 206 series floatplane and emergency egress from an inverted, water-filled aircraft. The following has been condensed from information contained in the TSB Final Report, which is available on the TSB’s Web site ([http://bst-tsb.gc.ca](http://bst-tsb.gc.ca)).

On July 20, 1996, the float-equipped Cessna U206F with six persons on board started its takeoff run on Rivière des Prairies, Quebec, on a water surface agitated by strong crosswinds from the right. The aircraft lifted out of the water at very low speed, travelled about 1000 ft. before taking off, and fell back on the water in a pronounced nose-up attitude. The pilot continued with the takeoff, and the aircraft lifted out of the water a second time. The left wing then struck the surface of the water, the left float dug into the water, and the aircraft capsized. The pilot told the passengers to unfasten their seatbelts as the aircraft rapidly filled with water. He then went toward the rear to try to open the two cargo doors to let the occupants out. A witness immediately proceeded to the site to assist the occupants. He opened the left front door, and the female passenger and her child evacuated the seaplane. As they had no life jackets, these two persons clung to the floats until the other rescuers arrived. The first firefighters and police officers arrived at the site about 15 min after the accident. The pilot and the other three passengers had drowned inside the aircraft.

The TSB determined that the pilot had been unable to maintain control of the aircraft, which was equipped with Robertson and Flint Aero kits, during a takeoff with 20° of flap in strong crosswind conditions. It also determined that the distribution of the passengers and the complexity of opening the leaves of the rear cargo door with the flaps extended to 20° contributed to the difficulty of the evacuation. There are several issues worth looking into here, but we will limit our discussion to two main areas: (1) the pilot’s decision-making process before and during the short flight, and (2) the aft emergency exit of the Cessna 206 and emergency egress from a water-filled, inverted aircraft.
The facts as provided in the TSB Report would lead many to question why this flight was attempted. Unfortunately, we will never know for sure what led the pilot to go ahead with it. Some would postpone a pleasure flight in a seaplane with three children on board when faced with strong crosswinds and agitated waves, but it often becomes a personal judgement call; it can be assumed that other experienced seaplane pilots might also have decided that the conditions at the time were acceptable. In any event, the pilot was obviously confident in his ability to handle the crosswind; perhaps the fact that the aircraft was equipped with a short takeoff and landing kit and auxiliary wing-tip tank kit, which increase lift and reduce the stall speed of the aircraft, reinforced his confidence.

The second question mark arises from the fact that, during the initial takeoff, the aircraft fell back on the water in a pronounced nose-up attitude, but the pilot decided to continue with the takeoff. The only answers to these questions reside in the complex world of human factors, as they apply to the pilot’s own motivations and self-imposed pressures to go ahead with the flight. As stated in the ASL 2/97 article, remember this particular occurrence the next time that you are faced with similar circumstances.

**Emergency Exit**

A second fatal accident in less than 12 months brought the issue of the Cessna 206 emergency exit to the forefront. On June 1, 1997, a U.S.-registered float-equipped Cessna 206 had a similar accident at Carroll Lake, Ontario, when the aircraft nosed over in the water, and two passengers were unable to evacuate the aircraft and drowned (TSB A97C0090). In this particular case, the pilot had left the wheels down when he touched down on the water.

The Cessna 206 is equipped with a double cargo door on the right rear side that doubles as an emergency exit. When the flaps are extended to 20°, the forward leaf of the cargo door can open only about 8 cm, and this makes it difficult to fully open the aft leaf of the cargo door. The emergency exit instructions found in the owner’s manual say that, if it is necessary to use the cargo doors as an emergency exit and the wing flaps are extended, the doors are to be opened in accordance with the instructions shown on the red placard mounted on the forward cargo door. According to the TSB Final Report, the instructions found on the placard of the accident aircraft were as follows:

**Emergency exit operation:**

1. Rotate forward cargo door handle full forward then full aft.
2. Open forward cargo door as far as possible.
3. Rotate red lever in rear cargo door forward.
4. Force rear cargo door full open.

**Cessna 206 Emergency Exit Operation Placard**
In ASL 7/90, as a result of a safety information letter from the Canadian Aviation Safety Board, we showed the correct procedure for opening the doors with the flaps down. The procedure is repeated below, along with aircraft photos, which clearly illustrates the difficulty:

1.) Unlatch and open the forward cargo door as much as possible, about 3 inches (see Figure 1).
2.) Unlatch the rear cargo door by pulling down on the red handle (see Figure 2).
3.) Partially open the rear door until the door latch at the base of the door is clear of the floor (see Figure 3).
4.) Close the rear cargo door latch by placing the red handle into the well in the door jamb (see Figure 4—the locking pins will now be extended, but clear of the fuselage).
5.) Push open the rear cargo door (see Figure 4).

**Cessna 206 Egress Procedure Through Cargo Doors**
3. Cessna 206 Egress Procedure Through Cargo Doors—continued

4. This sequence shows that the aircraft placard leaves out some of the above steps. Now this procedure is quite demanding for most people under normal circumstances. Picture the process in the dark, in an inverted airplane, in rushing water and with two or three distressed passengers trying to escape.
The Cessna 206 emergency exit issue has been addressed extensively in the past by, among others, the TSB in 1985 and 1989; the ASL 7/90 article referred to above; Cessna service bulletin (SB) SEB91-04, issued on March 22, 1991; and many letters exchanged among the industry, Transport Canada (TC), the TSB and the Federal Aviation Administration (FAA) since the last two fatal accidents. In addition, you — the owners, operators and associations — are well aware of the problem. Although the SB simplifies somewhat the steps required to open the double aft cargo door, the procedure does not eliminate the jamming of the forward cargo door against the flaps when they are lowered. TC clearly stated to the FAA its position that, even with the modification, when the flaps are down, the Cessna 206 emergency exit procedure remains a multistep procedure that can be difficult to execute under emergency conditions.

Following the Carroll Lake occurrence, TC reiterated its concerns to the FAA, and, in its November 1997 reply, the FAA said that new series 206H and T206H would incorporate the provisions of SEB91-04. The FAA also said that, if TC were to issue an airworthiness directive (AD) against 206 series airplanes, the FAA would examine it for possible similar action in the United States. However, owing to the proportionally wider use of floatplanes in Canada, than in the United States, the FAA could not say at that time whether an AD with the same intent would be supported by the evidence available from its U.S. databases.

Meanwhile, on November 16, 1997, TC issued Service Difficulty Alert AL-97-04, which strongly recommends that owners and operators of all Cessna 206, U206 and TU206 aircraft incorporate SB SEB91-04; instruct flight crews to brief passengers and demonstrate the steps necessary to open the exit when flaps are lowered; and ensure that flight crews periodically practice the procedure for opening the emergency exit from outside the aircraft when the flaps are down. It also recommends that there be a maximum of four occupants in the aircraft when waterborne operations are being conducted.

At this time, there is no modification available that completely resolves the emergency exit issue. Discussions are still ongoing among TC, the FAA and the industry about the possibility of AD action.

Underwater Egress

The TSB’s final report refers to a study relating to escape and survival from a ditched aircraft. It states that the rotation of the body underwater and loss of gravitational reference makes disorientation inevitable for survivors prior to their escape from an inverted aircraft. In addition, the darkness produced by water flooding into the aircraft aggravates the disorientation. Survivors who were questioned in this study reported having experienced confusion, panic and disorientation in the occurrences. The study concludes that only those who have experienced disorientation in an underwater trainer understand the problem and know how to deal with it to get out and survive.

Having personally experienced an underwater escape trainer twice, I can attest to the fact that the above statements reflect the reality of an underwater egress situation, except that, in the trainer, you expect the situation to arise (there is no surprise effect); you have a plan or escape route in your mind (or at least you think that you do...); and you are in a clean pool with safety scuba divers. Not so in the real world. Nevertheless, underwater egress training is invaluable for any pilot who flies regularly over water, regardless of the type of aircraft flown. As a matter of fact, passengers or non-pilot crews who also fly regularly over water should consider underwater escape training. Once you have had the training, you will also be in a better position to brief your passengers about what to expect...should the unexpected occur.