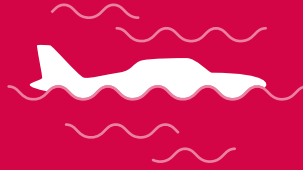


JULY 2022



# DITCHING

## LIGHT AIRCRAFT ON WATER



# YOUR SAFETY SENSE LEAFLET FOR: **DITCHING**

The purpose of this leaflet is to provide guidance to GA pilots regarding ditching light aircraft on water. It is primarily focused on the aeroplane pilot; although much will be applicable to helicopters. Ditching is a deliberate emergency landing on water, it is not an uncontrolled impact.

Ditching events beyond coastal waters are rare, but experience suggests that if the aircraft impacts the water under control, the chance of survival is high. There does not appear to be a statistical difference between high and low wing aeroplanes.

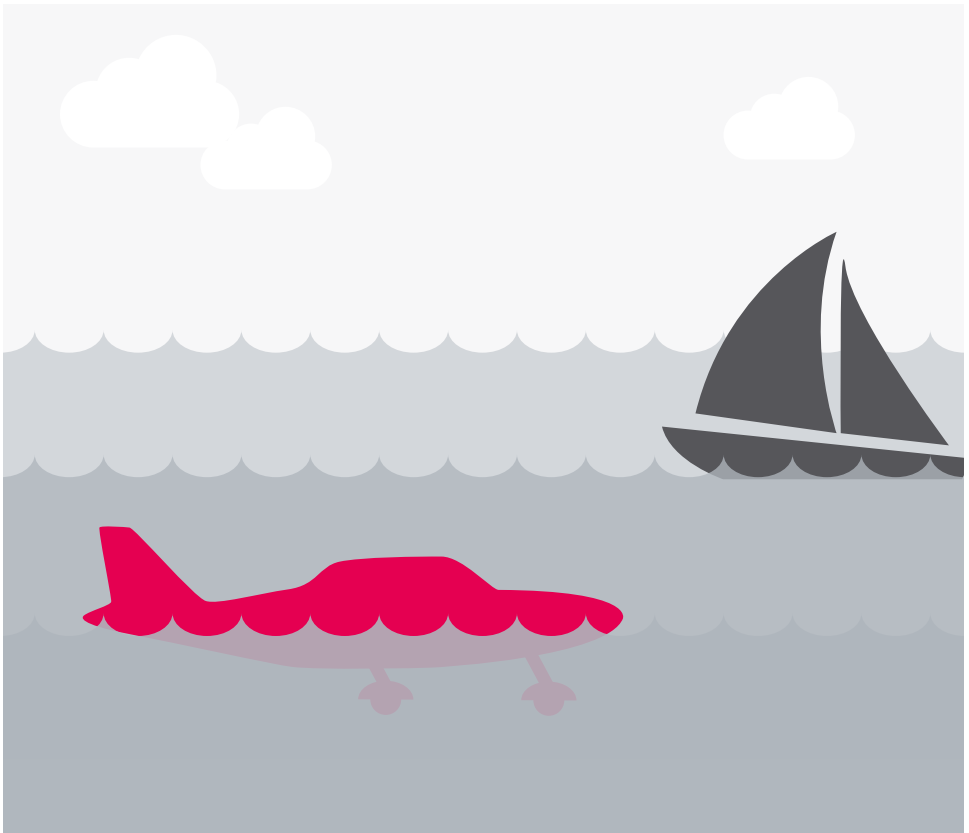
Despite most impacts being survivable, occupants sometimes drown after failing to vacate the aircraft or succumb to cold shock or hypothermia. It is therefore important to consider post impact escape and survival.

# DITCHING

## Sea conditions

Sea temperatures will have a significant impact on survival times. The temperature of the sea around the UK will lag seasonal changes in the outside air temperature, so is normally warmest in September. The sea is coldest towards the end of the winter in March. The sea temperature in the winter will be around 8°C or less and around 16°C by mid-summer. The North Sea and eastern regions of the Channel tend to be colder than areas to the southwest.

When planning to fly over a significant body of water, consider the likely sea conditions below. High winds, rain, poor visibility and heavy swell will reduce the chances of a successful ditching and rescue. The Met Office Shipping Forecast is a good indicator of sea state conditions. An explanation of the forecast and the 'Beaufort Scale' can be found on the [Met Office website](#).



## DITCHING

## Survival times

Even if you carry a life raft, consider the survival times associated with being in the water before rescue – in some ditchings, the raft is lost or difficult to enter due to heavy swell.

In low sea temperatures, cold shock can cause drowning and sometimes heart failure. This can happen in a matter of minutes. Cold shock may cause a gasp reflex, hyperventilation and an increase in blood pressure. These responses will likely diminish after several minutes if the head can be kept above water and breathing can be controlled.

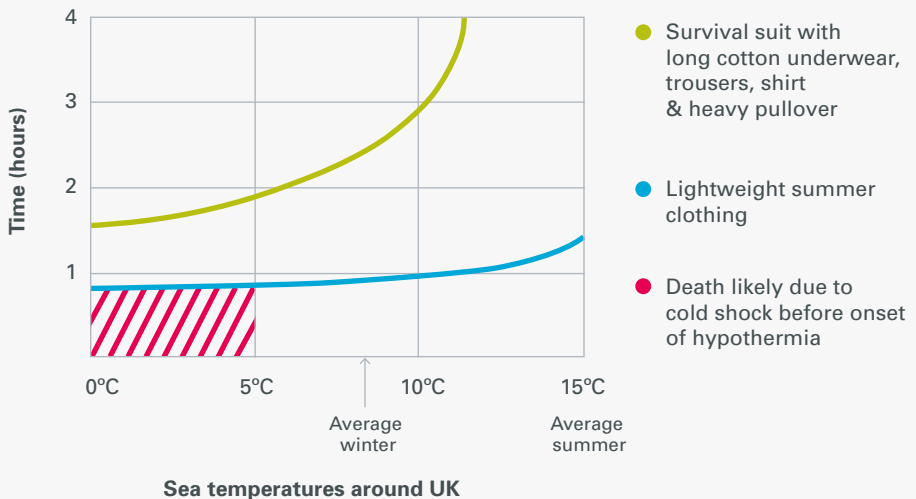
Drowning can also be caused by ‘swimming failure’, whereby the body’s reaction to the cold water is to restrict blood flow to the extremities. Even strong swimmers will lose the ability to

move their limbs effectively after a short period of time and the swimming action will become inefficient. This can result in the body adopting a more vertical position in the water, at which point the swimmer may panic and sink.

If in cold water for an extended period, the main threat is hypothermia caused by a decrease in body core temperature.

Contact with cold water is usually unavoidable in a ditching and the effect can be mitigated by wearing a survival suit. Removing yourself from the water and into a life raft will significantly extend the period before hypothermia sets in, but it may not be possible if the body has already succumbed to cold shock.

### Likely survival time - person of average body mass without liferaft



**INABILITY TO PERFORM TASKS WILL OCCUR LONG BEFORE DEATH**

## DITCHING


# Survival Equipment

## Regulations

Part-NCO (Part-21 aircraft) and the Air Navigation Order (non-Part-21 aircraft) contain equipment requirements for flight over water. Lifejackets for all onboard are required when in an aircraft beyond gliding range of land, or if in the opinion of the pilot in command, the planned flight path during takeoff or landing is near water, such that a ditching may occur in the event of an emergency. You should know your aircraft's gliding or autorotation range.

When flying more than **30 minutes or 50 NM from land** (whichever is less), the pilot in command is required to **assess the survival equipment** necessary to carrying on the flight.

Such an assessment should consider the sea state and temperature, weather conditions, distance from land and the availability of search and research services.



Equipment that may be deemed necessary could include distress signals, such as lights or flares, life rafts for all persons onboard and any life-saving equipment such as drinking water or first aid kits.

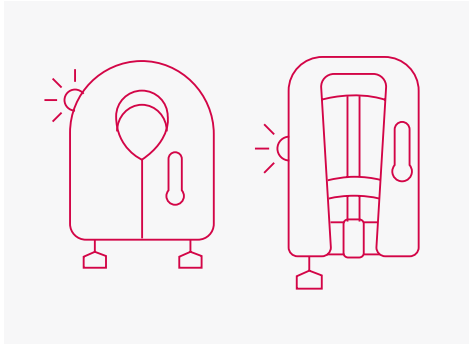


After reviewing this leaflet and assessing the flight, it is recommended to determine a list of items you feel are appropriate – the regulations do not specify all the detail, so a degree of personal judgement is required.

The [UK AIP](#) GEN 3.6 details Search and Rescue provision in the UK. GEN 3.6 is the normal ICAO assigned AIP section for Search and Rescue provision and will be detailed there by most states.

## DITCHING - SURVIVAL EQUIPMENT

### Life Jackets



It is recommended that lifejackets have the following features:

- > Light;
- > Whistle;
- > Crotch strap;
- > Spray hood; and
- > Reflective markings

Lifejackets should be serviced annually by a competent organisation – the original vendor of the jackets should be able to advise on this.

#### Life jacket selection

Only use lifejackets intended for use in light aircraft. Lifejackets should be designed for constant wear and have a protective covering over the uninflated buoyancy chambers. A suitable lifejacket provides around 150 newtons of buoyancy, which should be enough to keep an unconscious person afloat with the head above water. Check suitability for children or infants, you will likely need a lifejacket or floatation device designed for a smaller body size.

Airline style jackets are only suitable for occasional use – when worn uninflated they lack any protection from accidental tearing or other damage from constant wear. Lifejackets intended for marine use often inflate automatically on contact with water – this feature is unsuitable in an aviation environment since the jacket may inflate in the aircraft and make it impossible to escape.

Non-inflating ‘buoyancy aids’ used for leisure boating or similar are also unsuitable – the passive buoyancy will impede exit but will not usually be sufficient to keep an unconscious person floating with the head held above the water.

#### Wearing the life jacket

In a single engine piston aircraft, all occupants should wear their lifejackets in flight. The lifejacket should normally be donned prior to entry into the aircraft and seatbelts should be fastened over the jacket.

In the case of twin engine aircraft, carriage under the seats or other accessible location is acceptable but consider how practical it will be to don lifejackets in a timely fashion during an emergency. Passengers must be briefed on how to don lifejackets inside the aircraft and ensure they will not become entangled in the seatbelts.

Consider that some ditchings, including with multi-engine aircraft, have occurred due to fuel starvation, fire, control difficulties or factors aside from engine failure.

## DITCHING - SURVIVAL EQUIPMENT

### Life rafts

#### Life raft selection

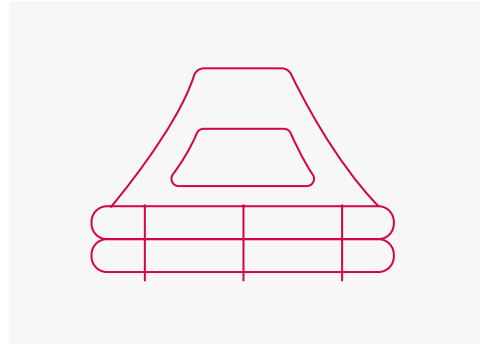
Life rafts should be designed for aviation use. The inflation cylinder for the raft should be designed to vent into the air (rather than inflate) in the event of a malfunction<sup>1</sup>. Inflation of the raft inside the cabin could be very dangerous.

It is recommended that the life raft has a canopy to reduce the effects of exposure. An integral canopy that erects itself on inflation is best and may make it easier to right the raft if it inflates upside down, since the canopy will prevent it from completely inverting in the water. Many life rafts also include some survival equipment inside, which is useful since it does not need to be carried separately – it should be listed in the documentation with the raft.

A boarding aid such as a rope ladder at the entrance will make it easier to climb in. Ensure the raft occupancy capacity is sufficient for the number of occupants on the aircraft.

As with lifejackets, rafts should be serviced annually, or as directed by the manufacture's recommendations.

A good quality raft is quite expensive, so some companies offer short or long-term hire, which may be more cost effective for the occasional user.



#### Carriage of the raft

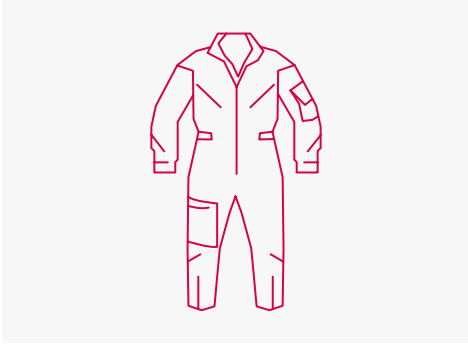
If crossing any significant body of water, it is strongly recommended to carry a life raft, in addition to wearing life jackets. A raft should allow the survivors of a ditching to remove themselves from the cold water, which could significantly improve the likelihood of survival.

When carrying the life raft in the aircraft, secure it (for example with a seatbelt) in an accessible location where it will not interfere with the controls. Include it in any weight and balance calculations – some rafts weigh more than 15 kgs.

<sup>1</sup> It is still wise to consider the event of an accidental inflation in the cabin, for example puncturing it with a knife or other sharp object may be necessary

## DITCHING - SURVIVAL EQUIPMENT

### Survival Suit



A survival or immersion suit designed for aviation use will significantly improve survival prospects in cold waters. Whilst some pilots may feel that this level of protection is 'over the top' for a cross-Channel flight, there have been cases where lives have been saved by the wearing of such clothing, particularly during periods of lower sea temperatures.

If the survival suit used is an uninsulated 'dry suit', it will keep the water out, but to be fully effective from the cold you will need to wear warm clothing underneath to create layers of air that trap your body heat.

Even if you carry a raft, it may be lost or damaged in the ditching. Experience has shown that it is often difficult to enter a raft during high winds and heavy swell. The raft may also be lost or damaged in the impact, so wearing a survival suit is still wise precaution.

### Clothing

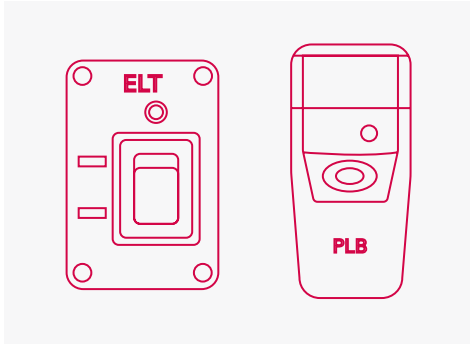


If a survival suit is not worn, high insulation clothing which traps air can still improve chances of survival in the water. Woollen clothing may be cumbersome when wet, but it retains around 50% of its insulating properties compared to wet cotton which is only 10% of its dry insulation. Warm headwear will prevent body heat escaping from your head.



## DITCHING - SURVIVAL EQUIPMENT

### ELT or PLB



It has been a requirement since 25th August 2016 for a Part-21 aircraft to have an emergency locator beacon (ELT) fitted. For aircraft fitted with up to six passenger seats, a portable locator beacon (PLB) may be carried instead, although for overwater flights it is recommended to have both devices.

The PLB should have a GNSS receiver and broadcast on both 406 MHz and 121.5 MHz. The PLB must be registered with the appropriate authority. Features such as buoyancy are also recommended.

Most fitted ELTs are activated on impact, although it may be possible to manually active prior to ditching. Some fixed ELTs will also activate on contact with water. You should check the specification fitted to your aircraft. For PLBs, be familiar with the operation of your device and keep it readily accessible during flight. Comply with any manufacturer instructions for testing and servicing.

### Survival accessories



There are no hard rules in terms of what should be carried, but items such as a portable VHF radio, flares, high power strobe, first aid kit, knife, signalling mirror, sea sickness tablets, water and small amounts of high energy food should be considered.

### Ditching bag



It is a good idea to carry a waterproof bag that contains items such as the PLB, your phone and the survival equipment. Brief passengers on its location and contents.

## DITCHING

# Preparation

You may have all the right equipment, but you need to know how to use it effectively and brief all occupants on what to do in the event of a ditching. The equipment also needs to be serviceable and accessible for use.



## Passenger Briefing

Part-NCO, and the Air Navigation Order for non-Part-21 aircraft, require that passengers are briefed on the safety and emergency procedures for the flight. Include all normal items such as operation of doors and seatbelts (see [SSL 02, Care of Passengers](#)).

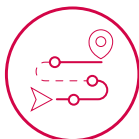
For flights over water also cover:

- > Use of lifejackets, including to only inflate once outside the aircraft;
- > Location and use of the life raft. Allocate someone to be responsible for taking the life raft from the aircraft in a ditching;
- > Use of the ELT/PLB;
- > Preparation for impact, such as brace position, tightening seatbelts, removing headsets and stowing eyeglasses;
- > The order in which people should evacuate the aircraft;
- > Reference points on the aircraft's structure to reach for when exiting the aircraft as well as any features which might impede exit;
- > The most effective way of opening doors if submerged; and
- > Actions when clear of the aircraft.



## Ditching courses

If you fly over water often, you should consider attending a ditching survival course. In a safe environment you will be taught the correct operation of lifejackets, methods of getting into life-rafts and the problems you might encounter after a ditching. Some specialist companies have light aircraft shaped 'dunkers' to practise underwater escapes. The cold and dark of a submerged aircraft is a very disorientating environment, so having had some practice, your chances of survival will be improved should the worst ever happen.



## Flight Planning

Fly as high as possible, this will give you more time in a ditching and may allow you to get closer to land. Radio reception will also be better. Consider taking a longer route to avoid exposure to a long water crossing. As you approach the sea, check the engine instruments to ensure everything is normal.

## DITCHING

# Surviving a Ditching

## Maintaining Control

Aircraft ditch for various reasons, it may be an engine failure, but there could be other factors such as fire.

Should the worst happen, remember to keep flying the aircraft. As per any emergency situation, **Aviate, Navigate and Communicate**, in that order.

Carry out any emergency procedures from the aircraft flight manual that may recover the situation, such as changing fuel tank or turning the fuel pump on. A common cause of ditching is fuel starvation, but often the fuel system was not correctly configured and there was still usable fuel onboard.

Once you have established you are in a ditching scenario, fly at best glide speed (if applicable) and turn towards the nearest coastline. If you are far from land, look for shipping. Small to medium sized vessels are preferable, large ships may not be able to stop in proximity to the ditching point and will be of limited assistance. If ditching near a ship, ahead but to the side of their path is best.

With the aircraft under control, transmit a Mayday call on the active frequency, or 121.5 MHz if you are not in contact with ATC. Set transponder code 7700. Give your situation, position and intentions.

## Landing technique

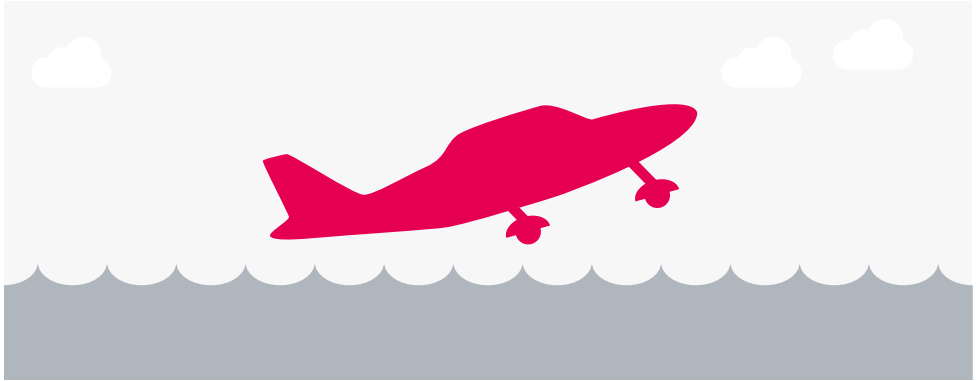
The swell direction is normally more important than wind direction when planning a ditching. Swell refers to the parallel lines of waves in the sea, which will typically be moving in the same direction. Below 2,000 ft, the swell direction should be apparent. Aim to touch down parallel to the line of the swell, attempting to land along the crest of the wave or slightly behind it.

The table below describes sea states and how to approach them:

Wind Speed	Appearance of Sea	Effect on Ditching
0-6 knots (Beaufort 0-2)	Glassy calm to small ripples.	Height very difficult to judge above surface. Ditch parallel to swell.
7-10 knots (Beaufort 3)	Small waves; few if any white caps.	Ditch parallel to swell.
11-21 knots (Beaufort 4-5)	Larger waves with many white caps.	Use headwind component, but still ditch along general line of swell.
22-33 knots (Beaufort 6-7)	Medium - large waves, some foam crests, numerous white caps.	Ditch into wind on crest or downslope of swell.
34 knots & above (Beaufort 8+)	Large waves, streaks of foam, waves crests forming spindrift.	Ditch into wind on crest or downslope of swell. Avoid at all costs ditching into the face of the rising swell.

## DITCHING - SURVIVING A DITCHING

### Landing technique (continued)



#### High Winds

If you can see spray and spume on the surface, then the surface wind is strong. In this case it is probably better to land into wind, rather than along the swell. Winds of 35 to 40 kt are generally associated with spray blowing like steam across waves and in these cases the waves could be 10 ft (3m) or more in height. Aim for the crest or failing that, into the downslope. You need to avoid being hit by a wave from above.

#### Preparing for impact

Review with your passengers the key points of the landing and egress. Ensure seat belts are tight. Headsets should be removed before touchdown. Passengers without an upper body restraint should adopt the brace position just prior to impact. Ensure all survival equipment is accessible. Consider unlatching a door to reduce the risk of it becoming jammed.

#### Landing Technique

The Aircraft Flight Manual/Pilot's Operating Handbook may provide suitable guidance, if the AFM conflicts with statements in this leaflet, follow the AFM.

The force of impact will be high so ditch as slowly as possible whilst maintaining control. Land tail down at the lowest possible forward speed, but do not stall into the water. It is important to keep the wings level, if a wing tip catches the water first the aircraft will likely spin or cartwheel. The use of flap is advisable to minimise the touchdown speed.

It may be difficult to judge your height above the water, for example if the sea is calm with a 'glassy' appearance or if visibility is poor. In this case, once at low level reduce speed below best glide but keep a margin above the stall – this will minimise the aircraft's sink rate while retaining control. Hold the descent attitude until impact. If some power is available from the engine, use it to reduce the descent rate. Some AFMs recommend always using a steady sink descent, rather than flaring, to avoid misjudging the height of the water.

There will likely be several 'skips' along the top of the water before the main impact. The deceleration will be very harsh and the nose will tip downwards. Water will rush over the nose and windscreen. It may smash the windscreen, letting water in rapidly and giving the impression of the aircraft sinking.

## DITCHING - SURVIVING A DITCHING

### Vacating the aircraft



With a high-wing aircraft, it may be necessary to wait until the cabin has filled with water before it is possible to open the doors – only wait for water to enter as a last resort though. If you cannot open the doors, open or kick out windows before you are underwater. Be aware of any panels designed to be pushed out in an emergency. Keeping your seatbelt fastened after the initial impact may allow you to apply more force to open the doors and windows.

The shock of cold water may adversely affect everyone's actions. Therefore, a pre-flight

passenger briefing which emphasises interior reference points and the agreed order in which to vacate the aircraft is vital. Do not inflate lifejackets inside the aircraft, inflate them as soon as you are outside.

Consider leaving the master switch and the anti-collision beacon or strobes on. If the aircraft floats for a while or sinks in shallow water, the lights may continue operating and provide some light and indication of your position. Exit the aircraft as swiftly as possible, remembering to take the raft and ditching bag if carried.

### Inflating the life raft

The natural buoyancy of the uninflated raft may make it hard to manoeuvre out of the aircraft. Keep hold of it by the cord, but do not inflate the raft immediately – doing so before being prepared will result in it blowing away.

Once inflated, currents and wind will immediately try to move the raft away from you and may invert it. If practical, the person with the raft should hold onto the aircraft when inflating it, so as not to be dragged away.

Check the manufacturer's recommendations for securing the raft while boarding – tying it to someone's belt or lifejacket harness is one option

but if the aircraft is still afloat, it may be more effective to initially tie it to a wing strut or exterior handle. Most rafts have a tear patch at the cord attachment point that should break off to prevent the sinking aircraft dragging it down.

If the sea state allows, getting into the raft by standing on the wing or other part of the aircraft will normally be easier than from the water. Position the raft near to the aircraft and take account of the wind direction – you do not want the raft blowing towards you or the aircraft structure (which may damage it), but if you position it downwind it may blow away and be harder to enter.

## DITCHING - INFLATING THE LIFE RAFT

### Dealing with a capsized raft



It is possible that the raft will inflate upside down or that the wind will blow it over. Should you need to turn it upright, position yourself downwind of the raft.

If it is floating partially on one side, position yourself by the underside that is resting in the water and move the raft so that the wind is blowing in the same direction as you want to tip it.

The inflation cylinder is normally attached on the bottom of the raft or to the side of the base.

Rotate the raft such that the cylinder is at the low point next to you. Push down at this point and grab any righting straps on the underside of the the raft.



Pull the high side down towards the water. The weight of the cylinder and the wind should help turn it over. As it falls towards you move out of the way and grab hold of the side to prevent it floating away.

Alternatively, standing on the aircraft may allow you to reach the high side of the inverted raft and pull it over.

## DITCHING - INFLATING THE LIFE RAFT

### Entering the raft



The raft should have a recommended entry point and sometimes a rope ladder to assist entry.

Remove any items such as high heeled shoes that may damage the raft. If you must enter the water before climbing into the raft, hold the bottom of your lifejacket with one hand and place the other hand over your mouth and nose to reduce the intake of cold water.

#### Assisting others

Some survivors may struggle to climb into the life raft from the water. The most physically able survivors may need to enter the raft first to assist others with entering.

If someone is struggling to climb in, position them with their back against the entrance point and then grip them under the armpits from behind (not by the arms) – this will be easier with two people in the raft to lift them. Anyone else in the raft should move to the opposite side to the entrance, to

provide balance. Initially the person in the water should be pushed down to create a resistance against the buoyancy of their inflated lifejacket. Then pull them sharply back up again – the buoyancy should give a spring effect to aid lifting them in.

As more people enter the raft, they should distribute themselves around the perimeter to stabilise it most effectively.

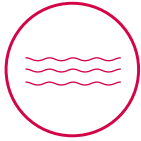
#### Securing the raft

Once everyone is aboard the life raft, there may be some additional actions to complete. You may need to separately inflate the floor, buoyancy chambers and trail the drogue or sea anchor. A sea anchor is designed to stop the raft drifting.

If not already in place from the inflation, erect the canopy to protect the occupants from the wind and spray.

## DITCHING

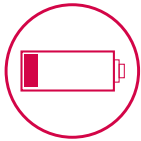
## Waiting for rescue



Remove as much water from the raft as possible. Try to remove water from clothes by wringing them out. If available, take sea sickness tablets immediately to reduce the risk of vomiting. The raft may have these in the survival equipment pouch. In the confines of the raft on a rough sea, survivors will likely feel nauseous and vomiting will cause the loss of vital fluids and energy. Due to the salt content, do not drink sea water, it will accelerate dehydration.



Deploy your PLB. Follow any instructions such as keeping the aerial vertical with a clear view of the sky - if necessary position the aerial through a gap in canopy. If your phone has survived the ditching and you are within network coverage, dial 999 (in the UK) and ask for the coastguard. With marginal signal, a text message to a friend or family member may also work.



Use any visual signalling equipment you have, but do not waste battery power or flares by setting them off when there is no one to observe them. However, if you have ditched in a busy area of the Channel for example, visual signals may be spotted quite soon. Flares should be held at arm's length, outside and pointing away from the life raft as they often leave hot deposits. If you have any gloves or other protection, use them to protect your hands.



Water dye that makes the raft's location more visible from the air may last around three hours, or less in rough seas, so do not deploy it immediately. If the sun is visible, a heliograph mirror can create a strong visual signal.



Assuming you were able to give an accurate location to ATC prior to ditching, search and rescue should be able to find you, but it could still take hours before you are lifted from the water. Some rafts will have a small aperture in the cover that can be opened to look out and show signals, so take it in turns to conduct a watch for rescuers.



**DITCHING**

## Without a raft

If you are without a raft or it is unusable for some reason, this decreases the chances of survival, but do not give up hope – the will to survive is the most powerful force to prolong life.

Tie important survival items such as the PLB to someone's life jacket. Try and keep the aerial of the PLB vertical. The cold will cause restriction of movement very quickly, so perform any manual tasks while you are still able.



### Conserving Heat

The most critical areas of the body for heat loss are the head, sides of the chest and the groin region. If the lifejacket has one, cover your head with the spray hood to reduce the risk of drowning.

Do not swim to keep warm. The increase in blood circulation in the arms, legs and skin will just transfer more heat to the cold water.

In a group of survivors, tie yourselves to each other and huddle with the sides of your chests and lower bodies pressed together. If there are children, sandwich them within the middle of the group for extra protection.

### Without a life jacket

If you end up in the water without a lifejacket, try to find some debris such as a seat cushion or luggage that will give buoyancy. Keeping afloat without anything to provide buoyancy will be exhausting. Even an inflated plastic bag may be better than nothing.

### Lone survivor

A lone survivor should adopt the 'HELP' position (Heat Escaping Lessening Posture). This position will increase your survival time. Hold the inner sides of your arms in contact with the side of the chest. Hold your thighs together and raise them slightly to protect the groin region.

### Attracting attention

Survivors in the water can be difficult to spot. When you see a search aircraft or nearby ship, signal with any devices you may have such as lights, flares or a heliograph mirror. Even splashing the water with your arms may attract attention as disturbed water may reflect off the beam of a search light. A whistle is more effective than shouting.

## DITCHING

## The rescue

When help arrives, stay where you are and follow any instructions from the rescuer. Do not try to do things on your own initiative.

If a helicopter is making the rescue, wait for instructions from the winchman. For example, do not reach out and touch the winch cable without being instructed to. The winchman will normally descend on the cable to supervise the winch. When being winched up, do not touch the cable or the helicopter, the crew will manoeuvre you up and inside as required.

If possible, deactivate your PLB once safely onboard the helicopter or rescue boat. The PLB signal on 121.5 MHz will often be heard by commercial aircraft monitoring the frequency, who may report it to ATC, so deactivating it may avoid any unnecessary confusion.

## SUMMARY



### Survival Equipment

- Always wear lifejackets over water
- Carry a Personal Locator Beacon (PLB)
- Consider equipment such as a life raft and survival suits



### Preparation

- Minimise the time over water
- Consider the weather and sea conditions
- Brief your passengers



### The Ditching

- Know your aircraft's technique
- Declare an emergency
- Have an escape plan



### Surviving at sea

- Know how to use your equipment
- Activate your PLB
- Consider cold water survival