
Survival

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Our thanks to the industry specialists and rescue organisations that assisted us with updating *Survival*.

See the CAA website for civil aviation rules, advisory circulars, airworthiness directives, forms, and more safety publications. Visit aviation.govt.nz.

Every effort is made to ensure the information in this booklet is accurate and up-to-date at the time of publishing, but numerous changes can occur with time, especially in regard to airspace and legislation. Readers are reminded to obtain appropriate up-to-date information.

Introduction

If something goes wrong during a flight, and you need to make a forced landing in a remote location, it's vital to be well-prepared to survive until you're found.

There are some key considerations that will prepare you for the mental and physical challenges you'll encounter while you wait to be rescued.

This booklet gives you advice on survival priorities, tips for surviving in New Zealand's different environments, and suggestions for what you should pack in a survival kit.



Be prepared

Apart from survival gear and training, the factor that will help you the most in a survival situation is a positive mental attitude.

It's not just a case of sticking your chin out and saying, "We'll be fine, trust me". It's the result of having put in enough thought, training and preparation, so that when you're confronted with a survival situation, you have a good idea of how to handle it.

In the ideal survival scenario, everyone would have a positive mental attitude. No survival situation is ever ideal, and you may be the only positive one, but it will have a positive effect on any others with you as they see you handling the situation well.

As the pilot, you may have contributed to finding yourself in a survival situation. Don't dwell on the things you could have done better. It's more important to deal with the situation at hand. Concentrate on what needs to be done now to produce the best possible outcome.



Survival - immediate priorities

After a forced landing, your chances of survival are higher if you follow some well-established immediate priorities.

We explore these in more detail in the other sections of this booklet, but here's a quick summary.

Immediate safety checks

- Check for injuries to you and your passengers. Provide first aid if needed.
- Is the aircraft's emergency locator transmitter (ELT) or your personal locator beacon (PLB) switched on and working? Is the aerial intact and attached?
- Is the aircraft a safe place to be? If not, evacuate.
- Is the area around the aircraft safe? If not, move upwind.

Your next priority will be either shelter or signalling for help, depending on your situation.

Shelter

- If it's unsafe to stay in the aircraft, build a shelter using the materials available.

Signalling for help

- Use the aircraft's ELT if it's working, or a PLB, or your flight tracking system if you use one.

Preventing hypothermia

Don't let people get cold
Dry clothing
Shelter
Hot drinks and food
Exercise (produces four times the heat than when resting)

Treating hypothermia

Give warm drinks and energy food like chocolate, if they can be swallowed
Surround the person with other people to keep them warm

Remember

- Remain in charge.
- If you're using the aircraft for shelter, insulate it with seat cushions and survival blankets inside.
- Give people jobs to do that are useful and achievable.
- Cotton is only warm if it's dry.
- If you're leaving the aircraft to seek shelter, leave a note by the aircraft, saying where you intend to go. Then stick to that plan.
- Lots of warm drinks and high energy food are important if it's cold.
- Be ready to help searching aircraft find you with radio, smoke, mirrors, colour, and movement.

Survival training

You can develop a positive mental attitude by thinking about your actions in advance. Consider some training, talk through how to handle a range of situations with experienced people, and practise some of the skills that you'll expect to encounter in those situations.

Survival training prepares you for what happens after the aircraft comes to a stop.

Several organisations provide survival and first aid training courses. See the *Resources* section on **page 31**.

Decision making for survival

Use the **STAR** model to guide you.

Stop

Take a breath, sit down, and stay calm.

Think

Look around, listen, brainstorm ideas.

Assess

Evaluate the options and consequences.

Respond

Take the best alternative.

Survival kit contents

There are many variables to consider when preparing a survival kit.

The amount of equipment needs to be suitable for the maximum number of occupants of the aircraft, including infants.

The weight and physical size of the kit is important. If you'll keep your kit in the aircraft permanently, you'll need to include it in the aircraft weight and your centre of gravity calculations.

Make sure your survival kit is enough to sustain you for two or three nights. Balance what you might need in an emergency against what you can realistically fit in the survival kit, and your aircraft.

Your survival kit should cover your needs for most of the flying that you do. If you do something different, such as a long over-water flight, you will need to consider what additions you might need to make for that, such as a life raft.

Consider how you'll gain access to the kit after a forced landing.

You'll need to make some compromises, so it's best to figure out how much space and weight you have available before buying any equipment. Make up a list of what you think you should be carrying, then prioritise it in order of importance. Start from the top of the list and work down until your weight or space available is used up. See our list on **page 9**.

First aid

While most light aircraft are not required to carry a first aid kit, fire axe, or fire extinguisher, it's a good idea to carry these items.

Your first aid kit should be able to cover the number of potential occupants. Consider adding useful items to a standard kit, such as extra survival blankets.

Consider adding a first aid handbook to your survival kit if there isn't one in there already.

First aid training

Be prepared for when you find yourself alone or with a small group of people in a remote location. If you're the pilot-in-command, it's natural that others will look to you to provide help - so long as you're not badly injured yourself.

Keep up to date with a first aid qualification.

All first aid courses will cover the basic safety, airway, breathing, circulation, and major bleeding priorities. Make sure the course also includes dealing with fractures, lacerations, splints, and tourniquets. It would also be helpful to know how to improvise first aid items to supplement your first aid kit.

// Your first aid kit should be able to cover the number of potential occupants. Consider adding useful items to a standard kit, such as extra survival blankets. //

Personal survival items

Consider carrying a personal survival kit that you can store in a pocket at all times. It should contain items that will enhance your survivability, but that are small and light to carry. Ideally, the items will have more than one use. The container should be as big as your pocket allows. It should also have more than one use - for example, a metal can that can also be used for boiling water or to signal aircraft and rescuers.

Personal survival kit contents could include:



Aircraft survival kit checklist

Item	Lowlands	Bush	Alpine	Marine
Standard emergency equipment				
Axe	✓	✓	✓	✓
Fire extinguisher	✓	✓	✓	✓
First aid kit				
Aircraft first aid kit	✓	✓	✓	✓
Basic first aid instruction manual, preferably with an outdoors orientation	✓	✓	✓	✓
Signalling				
Mirror or signal mirror	✓	✓	✓	✓
Satellite phone/satellite tracking	✓	✓	✓	✓
ELT, EPIRB, or PLB	✓	✓	✓	✓
Torch	✓	✓	✓	✓
Cooking				
Billy (capacity one cup per person)	✓	✓	✓	
Cups	✓	✓	✓	
Spoon	✓	✓	✓	
Clothing and shelter				
Warm hats	✓	✓	✓	✓
Gloves	✓	✓	✓	
Warm socks	✓	✓	✓	
Wind/waterproof shell layer	✓	✓	✓	
Emergency shelter (bothy bag or similar)	✓	✓	✓	
Plastic bags (to put over gloves and socks)	✓	✓	✓	
Big plastic bags (to make rain ponchos)	✓	✓	✓	
Survival blankets (one per person, plus extras)	✓	✓	✓	✓
Duct tape	✓	✓	✓	
String/cord	✓	✓	✓	
Food and hydration				
Water container	✓	✓	✓	
Barley sugars	✓	✓	✓	✓
Nuts and raisins	✓	✓	✓	✓
Packet soups	✓	✓	✓	
Tea	✓	✓	✓	
Hot chocolate	✓	✓	✓	

Survival kits should be checked once a year, especially if they include batteries and food.

Survival priorities in detail

There are many environmental factors that influence a survival situation. It's not possible to be precise about survival times, but there are clear priorities you should prepare for. These are based on the 'rule of threes', which provides a general timeframe for survival.

The rule of threes

How long you can survive without:

Air



3 minutes

(drowning, carbon monoxide inhalation, or major trauma)

Clothing and shelter



3 hours

(in extreme cold, due to hypothermia)

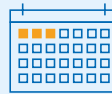
Rest



30 hours

(depending on levels of exertion)

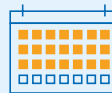
Water



3 days

(depending on temperature and activity level)

Food



3 weeks

(unless you're burning calories trying to keep warm)

Air

Use your first aid training to deal with someone's lack of air, or other injuries, before moving on to the other priorities.

Clothing

You need to consider clothing carefully. If you head off on your flight wearing the ideal set of clothing for a survival situation, you'll likely get hot, uncomfortable, and dehydrated.

However, you'll get very cold wearing cotton shorts and a t-shirt if you must spend a night outside. Ideally, you should dress comfortably for your planned flight with some additional clothing handy in case you need it.

Cotton

Cotton is a poor insulator when wet, but it will provide a minimal degree of protection against fire, because it doesn't melt and burn like synthetic fabric.

Down

Down is a great insulator and has poor flammability, but is often encased in a nylon shell, which will melt and burn when sufficiently heated.

Fireproof garments

Fireproof overalls and gloves are available, but they can be expensive.

Sensible layering of cotton and wool can provide some flame protection and can be practical flying apparel. Fleece or additional wool items can be set aside for additional warmth in emergency situations.

Fleece, fibre pile, polar fleece, and polypropylene

These are synthetic materials that will keep you warm, even when wet. However, they'll melt and burn when they're heated by fire. Clothing made from these materials is useful once you're away from the aircraft, but not ideal to wear while flying.

Wool

Wool will keep you warm when wet, and it doesn't burn when heated or in the presence of a flame.



Waterproof and windproof layers

Waterproof and windproof layers may be of limited use in and around an aircraft. However, if you find yourself out in the weather unexpectedly, they'll be invaluable. A windproof layer over warm layers will help trap your body heat, and stop the movement of air carrying the heat away from your body. Rain jackets/pants and survival blankets are the most practical and readily available options.

Some multi-person survival kits include one-piece coveralls, made from a paper-like nylon. These fit easily over existing clothing layers, and protect the wearer from the elements. They usually have a hood and elastic cuffs to reduce the loss of heat from around the body.

Their durability is limited, however, and after a day or so they become ineffective and will need to be replaced. They are a single-use item, which you should try out first.

Shelter

There are three options for shelter: the existing aircraft; an emergency shelter carried in the aircraft, such as a bothy bag (see **page 22**); or a shelter constructed from the natural materials around you, such as a bush shelter or a snow mound.

Think seriously about carrying a lightweight emergency shelter such as a bothy bag as part of your kit. It's easy to use and it works everywhere, except under water.

Hypothermia

Hypothermia is the real long-term enemy - the one that probably won't go away. Once you've dealt with all the other survival priorities, hypothermia will be the remaining challenge. It will remain the challenge

right up until help arrives and, in serious situations, well after you're found. You must be able to recognise hypothermia and know how to treat someone who is developing it.

Symptoms to watch out for

Hypothermia is the body's response to being cooled. Initially, the person will start shivering. This is the body's way of trying to generate warmth by muscle activity.

Make sure the person has dry clothes and shelter. Keep them covered (especially their head and neck), and insulate them from the ground. Give them warm drinks and high energy foods such as chocolate.

If you don't take these actions, the person will continue to cool, and their body reduces circulation to the extremities to prevent the core from cooling. Their hands and feet get cold because there's less warm blood flowing to them.

As they continue to cool, they lose their ability to think rationally; their coordination decreases; they stop shivering; and, vitally, their ability to hold down fluids is lost. This means it's no longer possible to warm them up by giving them a hot drink.

Actions to take if someone isn't improving

The best remaining option is to surround them closely with other warm people, especially around their core or chest area. If cooling continues unchecked, the person will lose consciousness and eventually die.

Don't rub the limbs of someone who is cold, because this will pump cold blood back into the cool core.

// Hypothermia is the real long-term enemy - the one that probably won't go away. //

Don't give up on someone who isn't responsive. If they're kept as warm as possible, and treated appropriately by a trained medic or doctor, they may make a full recovery.

So, the message is clear: don't let people get cold.

Get everyone into dry clothes quickly. Keep them dry and warm with extra clothing and shelter, especially as it gets dark.

To help stave off hypothermia, consider getting everyone to walk around the aircraft (if safe to do so) for 10 minutes every half hour to generate warmth.





Help rescuers to find you

If you've tackled the other survival priorities, think about helping rescuers find you.

Think about what might be happening on the 'outside' and respond accordingly. There's no point in lighting a signal fire in the middle of a remote valley if nobody knows you're overdue yet - but you can prepare to light a fire to keep warm, or cook food. This is a great way to make sure you use your resources (including your energy) to the best possible effect.

Rest, hydration, and food

The rule of threes gives different survival times if you're without rest, hydration, and food. However, bearing in mind New Zealand's climate, it's best to consider these factors together. Each has a marked impact on the other two.

Rest

Surviving is like trying to get the best economy out of your car. You're trying to make the energy you have stored in your body, plus the extra energy available to you from food, last as long as possible. Burning energy as economically as possible is the best way to survive. Rushing around doing things that don't need to be done will burn valuable energy.

Take stock of the situation, consider all the options, and decide on the best things to do.

Hydration

Unless it's a hot day, it's best to drink warm fluids. Cold water, such as from snow and glacier melt, can cause stomach cramps and vomiting if consumed to excess.

Boiling drinking water is a great way of keeping people busy. The fire or cooker will need to be kept going and will provide a focus for all involved, with the promise of a warm drink at the end of the chore.

Food

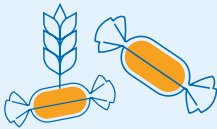
If it's cold and your shelter and clothing are deficient, you'll be burning energy trying to stay warm. Food is the best way to replace that energy.

Sugary food produces energy that's quickly burnt, creating an energy spike. That's great if you need a boost to get something done, but once you've burnt the energy, you'll feel worse than before.

It's recommended you carry the sorts of food that:

- will last a long time before it needs to be replaced
- can be eaten without any preparation
- can be mixed with hot water (for example, dried food)
- can provide a moderate rate of energy release.

Some food recommendations



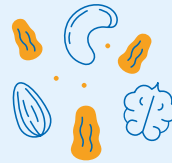
Barley sugars

Slow to medium energy release if sucked; faster if chewed.



Hot chocolate

Hot sugary energy, good for re-warming someone. It has a fast energy release, so needs to be followed with something with a more moderate energy release.



Nuts and raisins

Last moderately well. Medium energy release. Replace at least once every two years.



Packet soup

Lasts for years, warming if taken hot, and has a slower energy release.

Surviving in New Zealand's environments

This section covers priorities and considerations for surviving in the lowlands, the bush, alpine settings, and marine environments.

The lowlands

Most of our heavily populated areas are in the lowlands, and that's where a large percentage of general aviation flying is done. So, this is the terrain in which we should be most prepared to look after ourselves. It's also the easiest option to prepare for.

Emergency landings

Site selection is the first and most important issue when planning an emergency landing. Your range of options will be influenced by the availability of engine power and/or the presence of cloud.

You'll need to select a good landing site based on the information available to you at the time. During any flight, it's important to be aware of the best forced landing options, and what the influence of the wind is likely to be.

Priorities

Once you're on the ground and have come to a halt, remember you're still the pilot-in-command with responsibilities. Double-check the fuel and electrics are switched off. If it's not safe to stay in the aircraft, evacuate to a safe area. Head upwind if there's any damage to the aircraft and the possibility of leaking fuel or of fire.

Then tend to the survival priorities (see **page 5**).

Clothing

Clothing will become important as the temperature drops, so that jacket you threw in will be useful. Keeping everything dry is very important. Wet cotton loses warmth and, when exposed to the wind, quickly chills down your body. Once you're cold, it can be difficult to get warm again, so aim to keep everyone warm from the outset.

Shelter

Depending on the time of day and the reason for your unplanned landing, you may need to prepare for an overnight stay before it gets too late and starts cooling off.

The aircraft may be your best shelter option, if it's reasonably intact and sitting safely on the ground. If you can, remove the seats and put all the cushions on the floor to make the most of the space available. If the aircraft is too damaged to provide shelter, you'll need to find natural shelter or make a shelter from what you have available – bits of aircraft, an emergency shelter, or a shelter made from vegetation.

Signalling

This can be in the form of a torch, signal fire, signal mirror, silver survival blankets, or (after checking it's safe) turning the electrics back on and trying the radios. Airliners usually have a spare radio tuned to 121.50 MHz, so this is worth a try if you see any flying overhead. Using a cellphone light to signal is better than nothing.

Doing everything to minimise the search time should be your focus.

Once it starts to get dark, anti-collision lights can be a good way to attract attention, if they're still working and it's safe to use the electrics.

If it's safe, a fire is a wonderful thing. It provides warmth, a signal, a means of drying wet clothing, a focus for passengers, and something constructive for them to do.

Provided you have an active ELT, PLB, a satellite tracking system, or have made an acknowledged MAYDAY call, you could assume (given suitable weather and daylight) that help will be on its way within hours.

Leaving the aircraft

Usually, it's better to stay with the aircraft unless there's a risk of fire or explosion, or some other hazard makes it unsafe.

However, if there are signs of life nearby, you may decide to walk for help. Leave a note by the aircraft, saying where you intend to go. Then stick to that plan. As a rule of thumb, to judge travel time on foot, one minute's flying at 120 knots equates to roughly one hour of walking. So that farmhouse you flew over about 10 minutes ago, is too far away to consider walking to at 3pm.

Rest

At the very least, sit down long enough to take stock of your situation, decide what options are available to you, and what the best course of action is. Many people are not comfortable sitting still and confronting the reality but, if you can do it, a well-considered approach is better than wasting energy doing things that don't help your situation.

Unfortunately, sleep isn't recommended for anyone who has been knocked unconscious, so these people will need to be kept awake.

Liquids and food

Liquids and food help with warmth, energy levels and morale but, depending on what you have available, these may need to be rationed.

// If it's safe, a fire is a wonderful thing. It provides warmth, a signal, a means of drying wet clothing, a focus for passengers, and something constructive for them to do. //

The bush

If you must make a forced landing and the only option you have is covered in bush or trees then, all other things being equal, avoid the trees.

Trees, bush, and scrub all have distinct colours and shades of green. Next time you're flying over some bush, take note of what makes the lower height scrub distinctive from the trees. If you know what your preferred ground cover looks like from above, you'll be able to identify it earlier and make better site selections.

Both wind and slope need to be considered when deciding to land up or down-valley. If the valley climbs any more than gently, you should land uphill, even if you must accept some tailwind.

In the trees

If trees are your best or only option, then land on top of the canopy as if it's the ground.

If you end up hung up in the trees, you may want to climb down. This can be hazardous, so make sure you take everything you need with you.

Before you climb down, check the ELT is activated and its aerial is still intact. An active ELT signal can be heard easily on the aircraft's radio, mostly regardless of the frequency selected.

Shelter

There are some advantages to making a shelter in the trees or scrub. The vegetation will give you some natural shelter and help break the wind. Not being on snow is a huge warmth advantage, and there should be plenty of materials for a fire.

If the aircraft is reasonably intact and safely sitting on the ground, this will be your best shelter option, but it will probably need to be made safer and more habitable. Disconnect the battery or at least make sure the master is turned off. This should not affect your ELT because it has its own battery.

Inside the aircraft, reorganise the seating to provide an insulated area to sit or lie on. Patch up any holes in the fuselage with survival blankets and duct tape to keep the breeze and rain out. Don't cover the aircraft with scrub to make it warmer - you'll just make it harder to find.

If the aircraft is unsafe, you'll need to make an alternative shelter. There may be some natural shelter nearby you can use, like a rock overhang. However, if you need to move away from the aircraft to find shelter, make sure you leave clear evidence of which direction you went, and how far away you are. You've only done half the job if rescuers find the aircraft, but not you.

If you need to build shelter, pick a spot that offers as much natural shelter as possible. Cut, bend, and break whatever you can to make it as comfortable, dry, and sheltered as possible. This may or may not include bits of the aircraft. It's handy to have an axe. It helps you exit the aircraft after an accident, and it's useful for gathering firewood and building a shelter.

Another option for shelter, separate from the aircraft, is a bothy bag carried as part of your survival kit (see **page 22**). Alternatively, a lightweight tarpaulin, rainfly, or tent can be used.

Signalling

Make sure the ELT is activated, and the aerial is intact and attached. The less sky you can see, the less likely it is that a satellite is picking up the ELT signal. Trees don't help, so do your best to enhance the situation. If the signal is being received intermittently, it'll take longer to get an accurate set of coordinates for your location. In that situation, rescue may take longer and may not even be today, so start planning for an overnight stay.

Consider what you can do to make it easier for searchers to find you.

One of the better options is a smoky fire. Don't light it until you're sure someone will see it. Perhaps wait until you hear an aircraft in the area. However, start gathering up all the materials you can to make your signal fire - dry wood to get a fire started, and green vegetation to make smoke.

Keep a pile of materials in reserve, so if you need to make a bigger fire or make a second or third attempt, you're not searching for materials.

If there's plenty of firewood available and people to collect it, start a small fire to keep warm and to give the group a focus.

Fuel or oil from the aircraft can help start a fire and produce good puffs of smoke. However, if there's any spilt fuel or fumes present, don't light a signal fire too near, or downwind of, the aircraft.

// If you need to build shelter, pick a spot that offers as much natural shelter as possible. Cut, bend, and break whatever you can to make it as comfortable, dry, and sheltered as possible. //

Alpine

The only landing sites in high alpine environments are on snow or ice. There are lots of problems with making a forced landing in these situations, so it may be simpler to avoid flying over areas that offer no other forced landing options.

If it's your only option, here are some of the challenges you may need to address.

Lighting

Snow reflects light rather than absorbs it, so under a clear sky the snow surface will be reflecting a lot of light and is usually termed 'bright'. Under these conditions, it's nearly impossible to judge the distance above the surface without the aid of an object or mark on the surface to use as a reference. Without sunglasses, it's very difficult indeed.

You may be lucky and be able to pick out tracks left by skiers or climbers, but it's more likely you'll need to use a rock outcrop or an area of crevassing, to provide some reference. This is far from ideal because glaciers are uneven and steep as they flow around rocks. The landing area, when you finally see it, may be extremely poor.

You'll need to carry excess speed and make your approach towards a large and suitable area beyond the reference - preferably upslope. This might allow you to get close enough to the surface to be able to see it by using your reference feature, then flare along the surface, bleeding off speed until a suitable touchdown speed is reached, hopefully over the potentially suitable area.

Avoid landing among crevasses. These cracks in the ice can be over 100ft deep.

Flat light is common on snowy surfaces. This occurs under cloud cover or an overcast sky. In this situation, rather than having the full power of the sun reflected right at you (bright out), the cloud diffuses the sunlight, and the snow surface takes on the same grey hue as the cloud. Snow and cloud can become indistinguishable.

The best option for dealing with this lighting is the same as for bright out. Unfortunately, it may be even harder to see the snow surface and your chances of success will be poor. Ground reference features appear to hover in space, and it becomes challenging to accept what you see. It's possible, under extreme conditions, to be unable to see the surface as you walk on it.

Surface

Landing on snow presents a challenge, depending on how soft or firm it is.

Aircraft with a fixed undercarriage will have no problem stopping, provided the snow is soft, but the deceleration is likely to cause the aircraft to pitch nose over and come to rest lying on its back. Be prepared for this, and remember to brief your passengers before landing.

If a retractable undercarriage is fitted, you could consider landing wheels-up.

If the snow is soft and a helicopter is fitted with skids, the heels of the skids tend to sink in more than the toes, causing tail rotor strike. This is why some machines are fitted with snow shoes.

Firm or well-frozen snow surfaces can be as hard as polished concrete, so land up slope to have any chance of pulling up in a reasonable distance. If the slope is moderate and the surface firm, the aircraft may tend to slide off downhill as soon as it comes to rest.

After landing

The next step is to determine if you're now parked on a glacier or seasonal snow. Glaciers have crevasses; seasonal snow doesn't. If you're not sure if it's a glacier, getting out of the aircraft and walking around isn't recommended, because of the risk of stepping into snow-covered crevasses. However, that risk also needs to be weighed against any threat from the aircraft, such as fire or sliding off down the slope.

Limit how much you walk around in the snow and, when some footsteps in the snow are established, use those steps from then on, to lessen the risk of stepping down a crevasse.

The cold

You're now in snow, so if you're not already cold you soon will be. The reflected light of the sun radiates warmth during the day but, as soon as the sun disappears, you will become very cold.

Getting wet from the snow will spoil any insulation properties your clothing and footwear provide, so keeping dry is a high priority, especially if you're likely to spend the night outside.

Once you've dealt with any first aid priorities and checked your ELT is operating, the next task is to maximise your shelter and warmth options.

// You're now in snow, so if you're not already cold you soon will be. The reflected light of the sun radiates warmth during the day but, as soon as the sun disappears, you will become very cold. //

Shelter

There are three options. Choose the one that best fits your circumstances.

The aircraft

The first option is to use the aircraft and, provided it's basically intact and a safe place to be, that's your best bet. The downside is that metal, fabric, and composite are poor insulators, so the cold of the snow and the night air will be transmitted through the aircraft's skin to you.

At night, the air temperature can be considerably lower than the snow temperature, especially in winter, so one option is to pile up snow against the sides of the fuselage to improve the insulation. You don't want to make finding the aircraft harder, so don't bury it.

Inside, make sure everyone is fully clothed and insulated on seat cushions to keep them off cold outside surfaces. Huddling together helps prevent heat loss because the area of skin exposed to lower air temperatures is lessened.

It's a good idea to carry plenty of survival blankets because they're light and they have several uses. They can be used to wrap people in, and you can use them to double-glaze the aircraft windows by taping blankets to the aircraft lining.



Survival blankets.

You can also use survival blankets as reflectors to signal searching aircraft. Their multiple uses and light weight mean it's important to carry a good supply of them.



Bothy bags

The second option is a bothy bag. You'll need this if the aircraft is so damaged that it can't be used for shelter, or it's in a position that makes it dangerous to use. Alternatively, you can use a lightweight tarpaulin, rainfly, or tent as a temporary shelter.

A bothy bag is like a brightly coloured, round tent without poles or a door. You can throw it over a partly damaged aircraft for shelter or use it on its own. The people inside it keep the bothy bag structure upright.

The bothy bag's roof is a circle of lightweight nylon attached to a 1.5-metre-high strip of nylon, that acts as the wall. Passengers are grouped together facing inward in a tight circle. The bag gets thrown over their heads and everyone grabs the bottom of the nylon wall and sits down on it. With backs facing outward, they become the supporting wall, and the temperature inside soon rises a degree or two. People can be grouped around an injured person to shelter them.



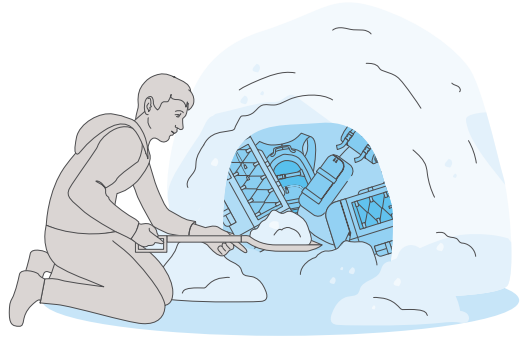
Digging a snow cave.

Snow mounds or caves

The third and least desirable option for shelter in the alpine environment is to build a snow mound or dig a snow cave. However, if you're wearing cotton, your clothing - and you - will soon become wet and cold.

If you don't have a snow shovel, or if the snow is well compacted and can't be dug easily, this option won't work for you.

It takes at least four hours of shovelling to make a shelter for four people. During that time, everyone gets cold. So, while a snow mound or snow cave can provide the warmest shelter, you'll burn a lot of energy digging and you risk getting hypothermia when you stop digging (especially if you're wearing wet cotton clothes). For these reasons, this option is the last resort, and only if you're prepared for it and the snow is favourable.



Making a snow mound.

Marine

The marine environment is one of the hardest to survive in. More than any other survival situation, it relies heavily on preflight preparation.

There are five main problems when it comes to surviving a ditching: successfully ditching the aircraft in the water, getting out of the aircraft with all the survival equipment you may need, staying afloat, staying alive, and getting rescued.

Your preparation needs to include a thorough passenger briefing, before you leave the ground, covering:

- where the exits are
- how to open them
- what order you want them to exit in
- where the survival gear and life raft are
- how to put on and operate the life jackets.

If you carry specialised marine survival equipment, such as a life raft, you must know how to find it and use it after the ditching, and how to get everybody in it. Practising in a swimming pool is invaluable because it's much harder than it looks.

Ditching

If the water is glassy calm, you'll have trouble seeing the surface and judging your height above it. You'll need to find a reference point to help you. A boat or even a bit of land would be ideal, but a slight ripple on the water or cloud shadow can also help.

If there are swells, you might want to land parallel to the biggest swells - just after the peak and as into wind as possible.

Try to reduce your speed as much as possible before touchdown, without stalling the aircraft onto the water.

Getting out of the aircraft

To get out of the aircraft successfully, it's important to adequately prepare yourself, the aircraft, and its contents. You need to have thought about it, and even rehearsed it as a dry run first.

Before touchdown, open or unlock doors and hatches, so they don't get jammed and impede your evacuation.

Wear appropriate clothing - not too bulky, and neutrally or slightly positively buoyant. If you're too buoyant, it might be difficult to get out of the aircraft, especially if it's upside down.

When water inevitably enters the cabin, loose articles float around and can be disorienting, hindering your exit. So, it's important to get rid of, or safely stow, as many loose articles as you can. Grab any emergency equipment that's within reach before you get out of the aircraft.

Don't remove your seat belt immediately. If you keep it on, you get less disorientated inside the cabin. When you have one hand firmly on a grab handle or something similar near the door, undo your seatbelt and pull yourself out of the door.

The chances of panic are high. Be prepared to help your passengers and to keep yourself calm.

Float first

If you can't swim well, your chances of survival without a life jacket are poor.

Put on your life jacket before you leave the ground. It'll be nearly impossible to put it on while strapped into the aircraft and trying to fly.

Do NOT inflate your life jacket until you're clear of the aircraft.

Beware of using other forms of buoyancy aids, such as wetsuits or drysuits. They may keep you afloat, and warmer than you would otherwise be, but you can't control the buoyancy. You don't want to be too buoyant until you're safely out of the aircraft.

A life raft is a lifesaver. It can help to keep you afloat, but more importantly it can keep you out of the water and reduce the effects of hypothermia.

If you don't have a life jacket or life raft, find anything that will help you to float. It buys you time to come up with a plan.

// To get out of the aircraft successfully, it's important to adequately prepare yourself, the aircraft, and its contents. You need to have thought about it, and even rehearsed it as a dry run first. //

Staying alive

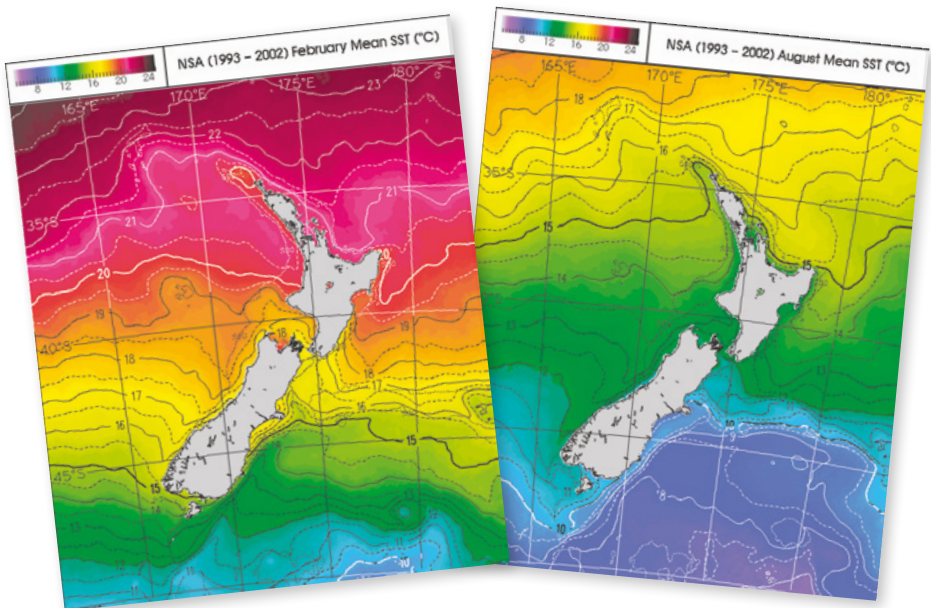
Hypothermia is by far the biggest killer in water survival situations.

The following table (contained in Advisory Circular AC121-7 & AC125-2 *Ditching - Techniques, Hazards, and Survival*) indicates approximate survival times for someone immersed in water without some form of protective clothing.

The maps below show the average sea surface temperature in New Zealand for summer and winter.

In summer, a person in the water in the North Island has a reasonable chance of surviving a few hours. Survival time progressively reduces as you move further south. In the lower South Island, your time of useful activity - the ability to do

Water temperature	Time to exhaustion or unconsciousness	Expected survival time
21-27°C	3-12 hours	3 hours-indefinitely
16-21°C	2-7 hours	2-40 hours
10-16°C	1-2 hours	1-6 hours
4-10°C	30-60 minutes	1-3 hours
0-4°C	15-30 minutes	30-90 minutes
<0°C	Under 15 minutes	Less than 45 minutes



The average sea surface temperatures in New Zealand for summer and winter.

things to save yourself - is likely to be less than two hours, and you will be dead in six hours.

In winter, the situation is much worse.

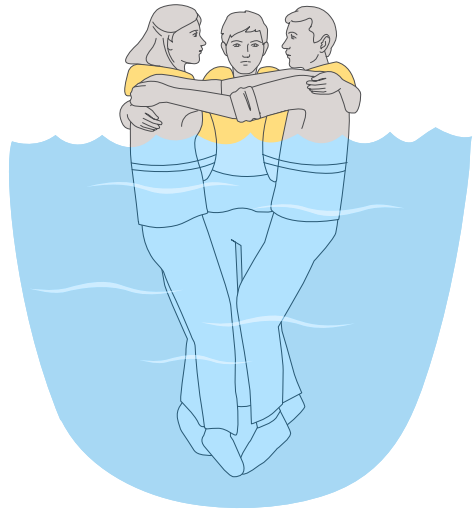
Survival time will be affected by factors such as your size and age, fitness level, clothing, how much you exert yourself to stay afloat, wind, and water conditions. Children are especially vulnerable.

If you have a life raft, and have managed to get into it, there are still challenges ahead. Wind chill, seasickness, hypothermia, dehydration, and sunburn are all common.

You may have been fortunate enough to ditch close to shore where you can get out of the water safely, without being injured by surf, rocks, and reefs. Another good option would be to ditch near any convenient boat. Most of the time, however, you'll be too far from shore to make it, either paddling a raft or swimming. Unless you're a fit and experienced ocean swimmer, swimming even a kilometre is likely too far, and will just exhaust you and reduce survival time. Stay with your raft and stay together.

If you don't have a raft, huddle closely together to preserve warmth, putting any children in the middle of the group. Minimise movement and activity. Moving might make you feel warmer, but it burns valuable energy that you'll need to stay alive until help arrives.

If you're alone, the technique is to huddle up with yourself, cross your legs, and pull your knees up towards your chest. Keep your arms against your sides and folded in front of you. The big heat loss areas are your head, armpits, and groin. So, keep your head out of the water, keep your arms by your sides, and keep your legs folded.



Huddle and hold.

Getting rescued

Your chances of surviving for long in New Zealand waters, especially without a life raft, are small. For most of the year, surviving overnight would be unlikely. That means you need to be rescued before dark. Flying over a large body of water without active flight following is asking for trouble. It may be a good idea to fly those routes only in the morning to make sure that if someone's looking for you, they can find you before darkness.

Assuming someone's looking for you, how will they find you? It helps if they know exactly where to look. There are four tools to help you here:

- accurate position reporting and distress call locations (a GPS position or radial and bearing will be much better than "mid Cook Strait")
- radar monitoring (don't forget to squawk 7700)
- flight tracking and/or flight following services
- a marine-capable ELT either in your life jacket or life raft.

An ELT will help a direction-finding equipped aircraft to find your exact location. The other methods will show roughly where you ditched, which will almost certainly not be where you are now. In strongly tidal areas, you may have drifted many miles by the time rescue vessels and aircraft get to your area.

Spotting floating survivors in the water is very difficult, particularly in anything other than a flat calm sea. A location aid such as smoke or flares, a mirror, radar reflector (for rafts), water dye, and brightly coloured clothing will all be helpful.

Remember also that ELTs don't work so well underwater. So, if you must ditch, and can manually activate the ELT in advance, then do so.

Ditching scenarios would seem the ideal situation for carrying a secondary portable ELT, marinised PLB, or Emergency Position-indicating Radio Beacon (EPIRB) which can be activated once safely clear of a submerging aircraft.

Keep it handy, in a watertight container. Attach a string to the box so once activated it can be tied to you, your raft, or your group of passengers, and it can bob around on the surface sending out its call for help.

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Cell net and satellite communication, and distress signalling devices

All satellite and cell net communication and emergency alerting devices rely on a communications network to transmit messages.

Most of us are aware of the limitations of cellphone network coverage, and that this is likely to be poor in the mountains, especially if you are in any valleys. However, some modern cellphones offer several emergency beacon and position features, if you're within network coverage at the time.

The limitations of satellite coverage may be less well understood. Satellite coverage for communications is provided by a small number of geostationary satellites positioned above the equator, and a few polar orbiting satellites which constantly circle the earth, passing close to both poles. If you're out on the ocean or on a mountaintop, with a good view of the whole sky, there's a strong chance there will be satellites in view all the time.

If, however, you're flying in a valley system surrounded by mountains, and the amount of sky you can see is greatly reduced, then it's possible no satellites will be in view. It'll be worse if there are trees. Because geostationary satellites are above the equator, the better your view to the north, the better your chances of seeing one. The orbiting satellites' coverage will come and go as they pass through the sky above you, so don't despair if no coverage is immediately available. You may need to wait for a while.

These comings and goings, and your ability to be in line of sight of a geostationary satellite, can affect such things as satellite phone coverage. Depending on your location, coverage may drop out as a satellite passes over the horizon. In the worst-case scenario, there may be no coverage at one point in time, but good coverage a few minutes later as a satellite crosses the visible sky. If this is the case, remember it will disappear just as quickly, so don't waste time.

This coverage issue can also affect satellite-tracking technology, which is relying on satellite coverage to transmit your position to a land station. Most units hold on to points that can't be successfully transmitted, and send them later when a satellite comes into view again. This fills in the missing points.

This works well. But if you have an accident while out of view of any satellites, then your last recorded position will be further away from where you really are.

This isn't a problem if searchers are aware of this when looking for an aircraft in terrain that may have precluded transmission of a point or series of points.

Locator devices

These devices have their limitations.

ELTs are fitted in aircraft and should activate automatically after an accident. Although they are constructed to withstand high G-loads and are usually fitted to areas of an aircraft less likely to be damaged, there's no guarantee they'll withstand a high energy impact. If the aerial cable is severed or if the aerial is damaged or in an unfavourable position, this may reduce or prevent a strong signal from transmitting. If triggered by G-force alone, ELTs may already be in a poor location for satellite coverage before they start transmitting.

While the 406 MHz beacons provide a more accurate position than the old 121.5 MHz system, and are individually encoded to aircraft, any search and rescue operation may still need to carry out a search pattern to finally pinpoint an accident site.

PLBs are portable and must be activated manually. While they are water-resistant, and some can float without needing to be in a float pouch, they may not transmit a signal if the unit (and its aerial) are fully submerged.

EPIRBs are mainly used in the marine industry and can float.

There are limitations to all the electronic communication and distress signalling devices available. This means it's wise not to rely on them entirely. But there is a huge advantage in carrying any of these devices if you need to be found.

Stay on the right side of the rules

Rule 91.529 *Aircraft emergency location system (AELS) and ELT* says that if you have a passenger, you must not fly an aircraft if the Rescue Coordination Centre (RCCNZ) doesn't have updated ELT information.

So do yourself a potentially lifesaving favour - and stay on the right side of the rules - by hiring or buying a beacon for your next flight. Then make sure it's registered to the aircraft operator to comply with regulations, and keep the information up to date (for example, distress contact). A registered PLB gives search and rescue authorities (SAR) quick access to your emergency contacts, enabling a quicker and more efficient response. It also helps SAR to quickly identify false alarms.

Check online for how to activate your PLB model, because these can vary. If you're familiar with how to activate it, that can make a big difference when you need to use it.

All the information on where to hire, buy, register, and update your beacon is at beacons.org.nz.

Resources

To find more information on topics described in this booklet, visit the online resources listed below.

CAA

To read Advisory Circular AC121-7 & AC125-2 *Ditching - Techniques, Hazards, and Survival*, go to aviation.govt.nz/rules or scan the QR code below.



First aid training

St John First Aid
stjohn.org.nz

New Zealand Red Cross
redcross.org.nz

Beacons, search and rescue, and mountain safety information

Beacons (Rescue Coordination Centre)
beacons.org.nz

Land Search and Rescue
landsar.org.nz

New Zealand Mountain Safety Council
mountainsafety.org.nz



Good Aviation Practice



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Email: info@caa.govt.nz

See the CAA website for civil aviation rules, advisory circulars, airworthiness directives, forms, and more safety publications.

To order publications such as GAPs and posters, go to aviation.govt.nz/education.



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