CHAPTER 7
DEALING WITH EMERGENCY SITUATIONS

When considering your responsibilities for the safe outcome of a flight (CASR 91.215), there should be no compromise when it comes to safety. If at any time, during your flight, you become aware of a situation that has occurred or is occurring that puts the aircraft and persons on board in danger or at risk you should take immediate action to avoid such danger or risk.

Planning

The Australian Maritime Safety Authority (AMSA) is responsible for aviation and maritime search and rescue (SAR) in Australia and, each year, hundreds of lives are saved by SAR efforts. Many pilots have discovered that the comforting phrase 'it can't happen to me' is far from correct. If you prepare adequately for all eventualities, you will improve your ability to deal with any emergency, therefore enabling AMSA to offer you better assistance.

To help you prepare, the following actions are recommended:

- Select the route which gives you short legs (for example, every 15–20 minutes) between the best visual fixes rather than featureless land areas and avoid extensive areas of inhospitable, rugged terrain. Make sure that your maps cover the entire route. Remember that external navigation aids, such as global positioning system (GPS), should be cross-checked using other navigational methods to ensure their accuracy.
- Always wear a watch.
- If your planned flight crosses high country or large water expanses, plan alternative routes that could be used in adverse weather. Remember the problems of rising ground in deteriorating meteorological conditions.
- When you get your weather forecast, take special note of, the freezing level, significant cloud cover and expected visibility, as well as fog, thunderstorm or turbulence predictions. Relate the forecast to your planned route and the nature of the terrain.
- Always tell someone what you are doing – either by lodging a flight plan or leaving a flight note. If the weather is not suitable, consider using an alternate route or postponing the flight. Discuss the situation with someone else with aviation experience.
- If you are making a day visual flight rules (VFR) flight, plan to arrive at least 10 minutes before the end of daylight, or earlier if your flight time is more than one hour, or if the terrain or the weather could reduce the light. If you are delayed, make sure that your departure is not too late to meet this requirement.

› Break your flight into route segments, measure distances carefully and use a computer to find time intervals. Do not guess or give just one time interval. Either lodge a flight plan or leave a flight note with a responsible person. Plan a realistic time that search action is required (SARTIME) and don't forget to amend it if you are delayed for any reason. Provide a destination telephone and or mobile number on your flight plan or flight note. Make sure you have sufficient fuel for the flight and unforeseen contingencies.

Helping search and rescue

Should you have to make a forced landing, many of the planning hints mentioned previously will help AMSA find you quickly. This is because SAR operations may involve the following:

› The search will be planned according to the forecast and actual weather conditions.

› The search will be based on the information you gave in your flight notification form or flight note, plus, (if necessary) the performance capabilities of your aircraft.

› The search pattern will be based on track-spacing, which is determined during SAR operation briefings or by the assessed visual range of the day (for example, a search pattern may start 10 NM either side of your planned route).

Other things which you can do to help yourself and AMSA in emergency situations are:

› If practicable, for drawing the attention of SAR personnel, remain near your aircraft after evacuating. Otherwise move to an area where SAR agencies will see your visual signals more easily (see also 'Hints for survival' in this Chapter).

› When moving, carry location aids for SAR, such as the following items (ERSA EMERG):

  » survival radios/beacons

  » heliograph or mirror to signal search aircraft by day (heliographs are available at most army disposal stores or camping stores)

  » day/night flares

  » rockets

  » strobes or electric torches for use at night

  » signal panels

  » sea dye markers.

- For making improvised aids, carry matches or a cigarette lighter, a pocket compass, knife and first aid kit, and wear warm clothing in winter (a space blanket is a cheap lightweight alternative to a blanket).
- Always carry water and take extra supplies if you are flying over hot arid areas.
- Carry a survival food kit of high calorie food items packed in a small waterproof container.

Survival kits may be purchased or homemade. Research the most appropriate contents for your survival kit for the flight you are planning.

A pilot who does not hold an instrument rating, or who is flying an aircraft not equipped for instrument flight, has no place in adverse weather. A well-prepared VFR pilot should never find themselves in adverse weather conditions if they have undertaken a careful study of the weather forecast.

Flight into marginal or non-visual meteorological conditions (VMC), generally is the result of poor planning or not deciding early enough to turn back or divert. Lack of preparedness and failure to make such decisions has all too frequently ended in tragedy.

Flying under the VFR or below the non-VMC criteria (CASR 91.280) is high risk and should not be undertaken or continued. History shows that flight in non-VMC has resulted in many non-survivable accidents. To avoid such conditions, you should decide to divert or turn back, and this decision must be made early.

VFR flight in weather which is below VMC is not permitted.

Make your decisions early

When you become aware that any element of the weather is about to fall below the VMC minima—do not hesitate, turn back immediately. Broadcast your intentions. Do not leave your decision until the weather has already fallen below VMC minima.

Plan your immediate flight path so that you can always remain in VMC. There have been many occasions when pilots have not intended to fly into cloud but, through inadequate planning or poor decision-making, their flight path has taken them into cloud.

Certified, uncertified aerodromes and some other suitable places available to take off or land are shown on world aeronautical charts (WACs), visual terminal charts (VTCs) and visual navigation charts (VNCs). Note which aerodromes lie close to your track and which might be suitable for a precautionary landing.

Where weather conditions deteriorate or become less than ideal, determine a critical point along your route where you will make a firm decision to continue, turn back, or divert to an alternate route or aerodrome. In the worst case, conduct a precautionary landing on a suitable nearby field if other options cannot be safely executed.

When weather begins to deteriorate, monitor the changes carefully. Weather conditions can deteriorate quickly. Make sure you have a clear discernible horizon between the cloud base and terrain. Thunderstorms can be unpredictable and generate heavy rain or hail and severe turbulence even in clear air miles from the cloud. Keep foremost in your mind your alternative actions, time limits and critical points for decision-making.

Know you own limits. Never succumb to 'I must get through or get home'. There is nothing that cannot be put off until tomorrow. Changes in conditions can happen quickly. Always have an out.

Distress beacons

A distress beacon is a small electronic device that, when activated in a life-threatening situation, assists rescue authorities in their search to locate those in distress. Distress beacons save lives and, moreover, carriage of distress beacons on certain aircraft and flights is required by law.

The following information will give you an understanding of how to use distress beacons and the different types available.

Carriage of emergency locator transmitters (ELTs)

(CASR 91 MOS 26.48 to 26.52)

As a minimum, all aircraft other than single-seat aircraft must be fitted with an automatic ELT or carry a survival ELT.

Exception: *This requirement does not apply if an aircraft is not flown more than 50 NM from its place of departure or is a flight for a purpose related to:*

- *the aircraft's manufacture*
- *the preparation or delivery of the aircraft following its purchase or transfer of operator*
- *the positioning of an Australian aircraft from a location outside Australia to the place at which any ELTs required to be fitted to the aircraft will be registered with AMSA.*

Single-engine aircraft over water

For a single-engine aircraft—including single-seat aircraft flown over water further than the distance from which, with the engine inoperative, the aircraft could reach an area of land that is suitable for a forced landing—the aircraft must carry a survival ELT.

Location of carriage

If the ELT carried is a survival ELT, then you must ensure that the ELT is carried in one of the following locations on the aircraft:

- on the person of a crew member, or
- in, or adjacent to, a life raft, or
- adjacent to an emergency exit used for evacuation of the aircraft in an emergency.

ELT – basic technical requirements

An ELT is a transmitter that must:

- when activated, transmit simultaneously on 121.5 MHz and 406 MHz
- when fitted to, or carried on, an Australian aircraft, be registered, solely, with AMSA
- when fitted to, or carried on, a foreign-registered aircraft, be registered with the authority of the aircraft's state of registry responsible for search and rescue services, and not with AMSA
- for identification purposes, be coded in accordance with the requirements for the transmitter in Appendix 1 to Chapter 5 of Part II, Voice Communications, in Volume III of the International Civil Aviation Organization (ICAO) Annex 10, Aeronautical Telecommunications
- where fitted with a lithium-sulphur dioxide battery, the battery must be authorised by the Federal Aviation Administration (FAA) or the European Aviation Safety Authority (EASA) in accordance with (E) technical standard order (TSO)-C142a.

Automatic ELT

An automatic ELT is one that meets the criteria of CASR 91 and MOS 26.49 above and must automatically activate on impact and be one of the following types:

- authorised by the FAA or EASA in accordance with (E)TSO-C126, or
- authorised by EASA in accordance with:
  - ETSO-2C91a for operation on 121.5 MHz
  - ETSO-2C126 for operation on 406 MHz, or
- approved under CASR Part 21 as having a level of performance equivalent to a type of transmitter mentioned above.

Survival ELT

A survival ELT is one that meets the criteria of CASR 91 and MOS 26.49 and can be removed from the aircraft, and is one of the following types:

- an emergency position-indicating radio beacon that meets the requirements of Australian New Zealand Standard (AS/NZS) 4280.1:2003, or
- a personal locator beacon that meets the requirements of AS/NZS 4280.2:2003, or
- authorised by the FAA or EASA in accordance with (E)TSO-C126, or
- authorised by EASA in accordance with:
  - ETSO-2C91a for operation on 121.5 MHz
  - ETSO-2C126 for operation on 406 MHz, or
- approved under CASR Part 21 as having a level of performance equivalent to a type mentioned above.

Aircraft flown with inoperative ELT

An aircraft required to carry either an automatic ELT, or a survival ELT but which is not required to carry a life raft, may begin a flight with either being inoperative if the purpose of the flight is to ferry the aircraft to have the ELT repaired or maintained.

An aircraft may be flown without an automatic or survival ELT if:

- the ELT has been temporarily removed for maintenance; and there is an entry in the aircraft's flight technical log, stating:
  - the ELT make, model and serial number
  - the date on which the ELT was removed from the aircraft
  - the reason for the removal of the ELT
- a placard stating 'Emergency locator transmitter not installed or carried' has been placed in the aircraft in a position where the pilot can see it
- no more than 90 days have passed since the ELT was temporarily removed for maintenance.

For a period not exceeding 90 days, an aircraft with an inoperative automatic ELT that has been removed is not required to carry a survival ELT. Conversely an aircraft with an inoperative survival ELT that has been removed, is not required to carry an automatic ELT.

ELT switches

If the ELT carried is an automatic ELT that has a switch marked (however described) as 'armed', then you must ensure that the switch is set to this position at the time the flight begins.

Types of beacons

Beacons of type 406 MHz are either GPS or non-GPS capable. GPS 406 MHz beacons provide an encoded GPS location that enables the COSPAS-SARSAT satellite-based system to calculate the beacon's location much faster than for that of a non-GPS 406 MHz beacon.

There are three types of distress beacons:

- emergency locator transmitter (ELT) – either automatic or survival (see above) for use in aircraft
- personal locator beacon (PLB) – used by bushwalkers, drivers of cross-country vehicles, and other adventurers on the ground, as well as employees working in remote areas and crew in watercraft and aircraft
- emergency position indicating radio beacons (EPIRB) – normally used in ships and boats but also used in life rafts.

ELTs must operate continuously for at least 24 hours once activated. ELTs are usually fixed in the aircraft and are designed to activate on impact. PLBs/survival ELTs or EPIRBs can be carried in an aircraft as an alternative to an automatic ELT that is fixed to the aircraft.

PLBs are designed for personal use in both land and marine environments. This type of beacon is becoming a multi-environment beacon. PLBs must also operate for a minimum of 24 hours once activated.

EPIRBs are designed to float in the water to optimise the signal to the satellite. An EPIRB must operate for a minimum of 48 hours continuously once activated. An EPIRB has a lanyard that is used to secure it to something that is not going to sink. There have been a number of incidents where vessels have sunk quickly, and crew have not been able to deploy an EPIRB. In such incidents, float-free EPIRBs could have reduced response times and saved lives. Float-free EPIRBs are held in a bracket and fitted with a water-activated hydrostatic release, deploying the beacon automatically if the vessel sinks. If the vessel continues to float the EPIRB can be manually deployed.

The COSPAS-SARSAT search and rescue satellite system

Operational use of the COSPAS-SARSAT system by SAR agencies started with the crash of a light aircraft in Canada on 10 September 1982, from which three people were rescued. Since then, the system has been instrumental in the rescue of over 35,000 people worldwide.

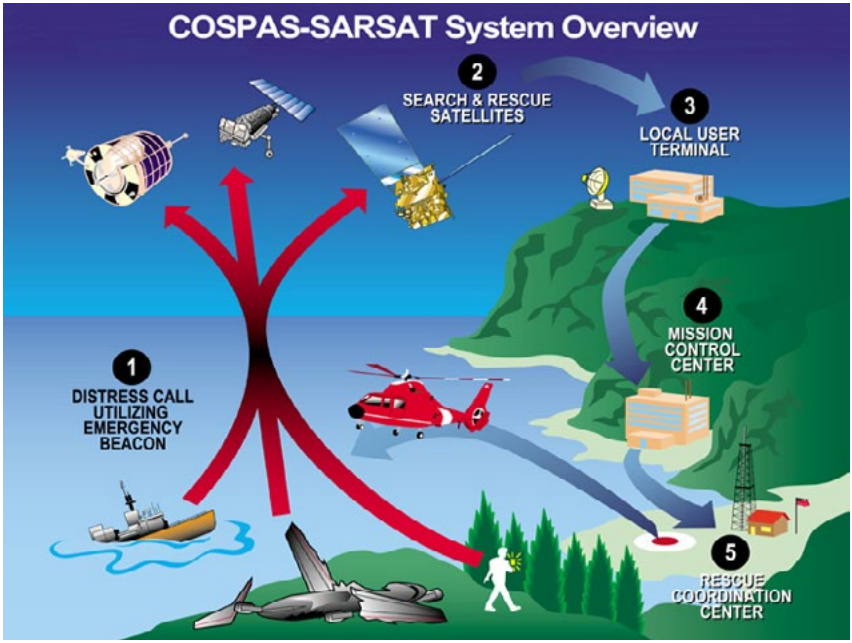
The COSPAS-SARSAT system is divided into space segments comprising distress beacon receivers on Polar-orbiting satellites and on satellites in geo-stationary orbit over the Equator. The ground segment is made up of a network of local user terminals (LUTs) that are the ground receiving stations for the satellite transmissions with mission control centres (MCCs) that analyse and pass the distress alerts to responsible rescue coordination centres (RCCs).

In the Australian search and rescue region there are three LUTs – located at Albany (WA), Bundaberg (QLD) and Wellington (NZ – that are controlled by the MCC located within the Australian Joint Rescue Coordination Centre (JRCC) in Canberra.

Alerts from 406 MHz distress beacons may be received and processed by geo-stationary satellites and passed to JRCC-Australia within minutes. If the beacon has GPS capability, then a very accurate position may be transmitted with the alert. Non-GPS beacons require detection by a Polar-orbiting satellite before a position can be obtained.

Note: Do not turn off your distress beacon until advised by rescue services.

Figure: COSPAS-SARSAT system



Source: www.cospas-sarsat.int

When should a distress beacon be used?

Distress beacons should only be used when there is a threat of grave and imminent danger. In the event of an emergency, communication should first be attempted with others close by using radios, phones and other signalling devices. Mobile phones can be used but should not be relied upon as they can be out of range or have low batteries or water damage.

If a person has made an aviation distress signal and the reason for making the signal no longer exists, they must as soon as the circumstances permit, cancel the signal, if the aircraft's location and state of the radio allow it to be cancelled (CASR 91.700).

A distress beacon with an encoded (GPS) location is usually detected by the RCC and located within minutes. Distress beacons without the capability to provide an encoded position also provide an initial alert to the RCC within minutes, but there will be no associated position. If emergency contacts are aware of trip details or trip details have been submitted online, search operations can begin sooner.

What happens after activation

› Distress beacon is activated.

When your life is in danger and you cannot contact emergency services by phone or radio, activate your distress beacon. Your beacon can be activated from anywhere on the Earth's surface, regardless of whether are were travelling by air, land or sea.

› Signal is received by satellite.

The international search and rescue satellite system, COSPAS-SARSAT, listens from space for distress signals. When it hears a signal, it notifies the nearest ground station.

Beacons transmit on 406 MHz which is detectable by satellite and 121.5MHz so emergency services can locate the beacon with special search and rescue equipment.

› Rescue coordination centre is notified.

Your distress call is escalated through a local user terminal, mission control centre and then the RCC responsible in that region for arranging search operations.

If your beacon is registered, the details are provided to the RCC in the country in which the beacon is both activated and registered.

› Search and rescue operations commence.

Search and rescue authorities commence search operations as soon as they can. If your beacon is registered, AMSA Search and Rescue will look up your account and ring your emergency contacts immediately. If emergency contacts are aware of trip details or trip details have been submitted online, search operations can be commenced much sooner. So, it is essential to keep your details up to date.

The time it takes for rescue will vary depending on the circumstances. Be prepared to survive. When you see or hear search personnel or aircraft in your area use flares, torches, or light a fire (if it is safe) to help them pinpoint your location.

How long does it take to be rescued?

The time it takes for search and rescue personnel to reach you depends on a number of factors, including the weather, terrain and accessibility of your location. The more remote the location of the distress incident, the longer the response time. In all instances, be prepared to survive.

Satellites cannot detect beacons through mountains, trees or buildings. If your beacon has not been deployed correctly with the aerial vertical in a clear open area or you are located in a valley, geostationary (GEO) satellites are unlikely to see you. In these cases, you must wait for polar-orbiting low earth orbit (LEO) satellites to pass overhead, which may take several hours.

Another important factor which determines how long your rescue takes is if you have a GPS beacon or a non-GPS beacon.

Source: **How distress beacons work – Beacons (amsa.gov.au)**

Accidental activation

If a beacon is inadvertently activated, the most important thing to do is to switch it off and contact JRCC as soon as possible to ensure a search and rescue operation is not commenced. There is no penalty for inadvertent activations.

JRCC Australia

t: 1800 815 257 or +61 2 6230 6899

Registration of beacons

A registered beacon allows AMSA Search and Rescue to phone your emergency contacts and look up important information to initiate a response as soon as possible. An unregistered beacon can cause a delay in the response.

Once an emergency position indicating radio beacon (EPIRB), personal locator beacon (PLB) or emergency locator transmitter (ELT) is registered a confirmation will be issued via SMS, email or letter so that you can prove registration when inspected by authorities. Beacon registration is valid for two years and must be renewed before its expiry date. Renewal can be done online on the beacon registration system or by contacting 1800 406 406.

Whenever your contact details or beacon details change, please update them online. Don't wait for your registration to expire before doing this because incorrect contact details can also delay the response.

The seller or purchaser of a second-hand beacon must contact AMSA to update their registration details.

Owners of a lost, stolen or disposed of beacon are asked to notify AMSA so that your beacon account details can be updated.

For comprehensive details on beacon registration check the AMSA website: **Beacons (amsa.gov.au)**

There is also a facility for owners to add their trip itineraries at the AMSA website, so when a beacon is activated the RCC will have access to your current movements and be better placed to organise the most suitable response.

This does not replace advising a responsible person of your trip details.

Testing

Self-test function

All COSPAS-SARSAT type approved 406 MHz beacons include a self-test mode.

All 406 MHz distress beacons can be tested at any time using the self-test functions without any notification to RCC Australia.

The self-test function performs an internal check and indicates that radio frequency power is being emitted at 406 MHz and at 121.5 MHz, as applicable. The beacon will provide an indication of the success or failure of a GNSS self-test.

The self-test mode signal is not processed by the satellite equipment.

To test your beacon using the self-test function, follow the instructions from your beacon manual or manufacturer.

Operational testing and remote cockpit activations

While a functional test of a beacon can be performed via the beacon's self-test capability the use of the remote aircraft cockpit activation switch results in operational activation of the ELT. Remote cockpit activations are performed on initial installation and during ongoing maintenance of the ELT.

In order to comply with ELT maintenance requirements, operational testing of a 406 MHz ELT from the cockpit of an aircraft may be undertaken by maintenance personnel, provided the test duration is no longer than five seconds and is undertaken within the first five minutes of the hour. You must advise that you are conducting an operational test and the location to the JRCC and the air traffic services (ATS).

The test duration must be restricted to five seconds so that there is no potential for an operationally coded 406 MHz digital burst transmitting and thus generating a false alert. The duration of the 121.5/243 MHz homing transmission, which will also be activated as part of this test, must also be restricted so as not to generate false alerts via ATS.

Emergency activation

Activation procedures (ERSA EMERG)

If you are forced down, activate the ELT immediately.

Where an ELT is permanently installed, and you are unable to confirm that it has activated automatically, activate the ELT manually, for example, by switching to the on or active position.

Where a portable distress beacon is being used, if possible, select an elevated site, clear of trees, boulders etc, and reasonably close to the aircraft.

Place the beacon on the ground on an earth mat. If an earth mat (see blow in Land activation section for how to make an earth mat) is not available, place the ELT on the wing of the aircraft or other reflective metal surface.

Secure the ELT with rocks, sticks, tape etc, so that the antenna remains vertical. Prevent anything touching the antenna as this will degrade ELT performance.

Do not switch off the beacon unless rescue is no longer required. A beacon which is damaged or under wreckage can still transmit some signal so always activate it.

To avoid confusing COSPAS-SARSAT and direction-finding equipment on search aircraft, avoid activating two or more beacons within one NM of each other. If two or more beacons are available, their use should be rationalised to extend the alerting period.

Water activation

If you are in the water and the beacon is water buoyant, it should be activated in the water and allowed to float to the end of the lanyard with the antenna vertical.

Do not hoist the ELT up a mast. The performance of an ELT can degrade if it is raised above the water surface.

Do not attach the lanyard to the aircraft, but rather attach it to a person or life raft. Keep the distress beacon vertical, with the antenna pointing skyward.

In situations where you are forced to use a distress beacon that is not certified for use in water, ensure that the beacon is kept dry. The beacon should operate successfully from inside a plastic bag.

Land activation

For operations over land, you will get the best performance from a distress beacon operating from its permanent installation in the aircraft or on the ground on an earth mat.

A simple inexpensive earth mat can be made by taping household aluminium foil into a 120 cm square. It is suggested that, if you carry a distress beacon you make a foil earth mat, fold it and tape it to your distress beacon. To use the earth mat, unfold it and place it flat on the ground, holding the edges down with rocks or earth. Switch on your distress beacon and place in the centre of the earth mat.

Alternatively, place the distress beacon on the wing of the aircraft.

In many cases, using an earth mat will increase the effective range of your portable ELT by 50%.

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Emergency signals

If practicable and you have a means of communicating with ATS, you must inform them of any threat to the safety of the aircraft or its occupants (an emergency). If dangerous goods are carried, you must also advise ATS of the nature and state of the goods (CASR 91.680).

You must report any contraventions to the regulation relating to an emergency (CASR 91.690).

If after making a distress signal the reason no longer exists, as soon as the circumstances permit and depending on the state of the aircraft and radio, you must cancel the signal (CASR 91.700).

Distress signal

The distress signal shall be transmitted only when the aircraft occupants are threatened with grave and immediate danger and require immediate assistance.

The distress signal shall be sent:

- **by radiotelephony:** the word '**Mayday**' repeated three times, followed by '**This is**', followed by the **callsign of the aircraft** repeated three times
  - squawk transponder code 7700
- **by radiotelegraphy**: the group SOS (dot,dot,dot,dash,dash,dash,dot,dot,dot) sent three times, followed by the group DE sent once, followed by the callsign of the aircraft sent three times. The signal specified above may be followed by the automatic alarm signal which consists of a series of 12 dashes sent in one minute, the duration of each dash being four seconds, and the duration of the interval between consecutive dashes being one second; or
- by one or more of the following means:
  - the Morse signal (dot,dot,dot,dash,dash,dash,dot,dot,dot) with visual apparatus or with sound apparatus
  - a succession of pyrotechnic lights, fired at short intervals, each showing a **single red light**
  - the two-flag signal corresponding to the letters **NC** of the International Code of Signals
  - the distant signal, consisting of a square flag having, either above or below it, a ball or anything resembling a ball
  - a parachute flare showing a red light and/or
  - a gun or other explosive signal fired at intervals of approximately one minute
  - squawk transponder code 7700.

Urgency signals

The following signals, either together or separately, shall be used by an aircraft for the purpose of giving notice of difficulties which compel it to land without requiring immediate assistance:

- the repeated switching on and off of the **landing lights**
- the repeated switching on and off of the **navigation lights**, in such a manner as to be distinctive from the flashing lights described below and/or
- a succession of **white** pyrotechnic lights.

The following signals, either together or separately shall be used by an aircraft for the purpose of giving notice that the aircraft has a very urgent message to transmit concerning the safety of a ship, aircraft or vehicle, or of some person on board or within sight:

- **by radiotelegraphy**: the group XXX (–··– –··– –··–) sent three times, with the letters of each group, and the successive groups, clearly separated from each other, and sent before the transmission of the message
- **by radiotelephony**: the words 'Pan-Pan' sent three times before the transmission of the message. It is also correct to use Pan-Pan if relaying a Mayday call from another aircraft or station that is out of range, or
- by one or more of the following means:
  - a succession of green pyrotechnic lights and/or
  - a succession of green flashes with a signal apparatus.

Forced landings

Initial action

1 Initial check

Altitude	Hold
Speed	Best glide speed
Mixture	Rich
Carb	Full hot
Fuel	On
	Pump on
	Change tanks
Trim	To best glide speed

2 Field selection

Wind	Determine direction
Surroundings	Power lines, trees
Size and shape	In relation to wind
Surface and slope	
Civilisation	Close proximity if possible

3 FMOST

Fuel	Check contents
	Pump on
	Primer locked
Mixture	Up and down range, leave rich
Oil	Temps green
	Pressures green
(mags) Switch	Left then right back to both
Throttle	Up and down range, then close

4 Mayday call and squawk 7700

Mayday Mayday Mayday

Melbourne Centre

This is ZTQ ZTQ ZTQ

Engine failure

3 NM west of Picton
4,500 ft

Landing in paddock

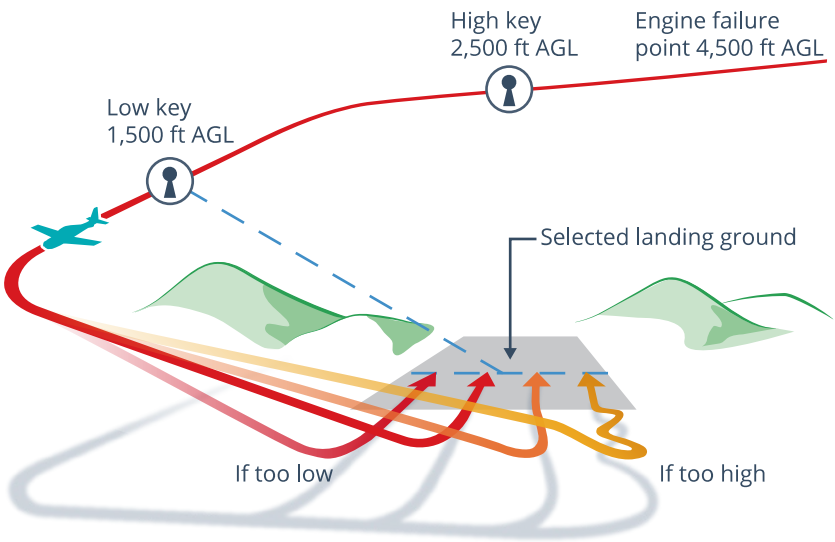
Plus any other useful information such as POB

5 Brief your passengers

6 Final actions

Fuel	Off
Mixture	Closed
Mags	Off
Harness	Tight
Door	As required
Master switch	Off **Caution if flaps are electrically operated**

Forced landing procedure



Emergency landing – multi-engine aircraft (CASR 91.685)

If you are flying a multi-engine aircraft and an emergency occurs that threatens the safety of the aircraft or persons onboard, you must land at the nearest suitable aerodrome.

The determination of the nearest suitable aerodrome might be based on—but not limited to—the following:

- nature of malfunction and possible mechanical difficulties that may be experienced
- nature and extent of any populous area over which the aircraft is likely to fly
- availability of thrust from a malfunctioning engine
- altitude, weight and usable fuel available
- characteristics of aerodromes available
- emergency services availability
- weather conditions en route and at possible landing places
- air traffic congestion
- type of terrain, including whether flight is likely to be over water
- familiarity with the aerodrome.

Sound decision-making using a formal process will allow you to achieve a safe flight outcome in the event of an emergency. A decision should never be made about commercial expedience; the safety of the flight must be your first and only priority.

Hints for survival

People have survived in almost impossible circumstances. The determination to beat the situation and the will to survive is the survivor's strongest weapon.

Being prepared when flying in remote areas by careful flight preparation, that includes carrying an ELT, a first aid kit, adequate clothing, additional water and rations is the best way to provide for a good outcome in the event of an emergency and forced landing.

Remote area survival

It is much easier for an aerial search to spot an aircraft than a walking survivor, and this applies whether your aircraft is still in one piece or not.

However, there are two exceptions to this rule:

- If your aircraft is completely hidden from sight by trees or undergrowth, try to find a clearing where you can set up signals for search aircraft.
- If you are absolutely certain that a town, settlement, road or homestead is within reasonable distance, you could walk out—but if you do, leave notes for a land search party telling them what you are doing and leave a trail which they can follow (see Signalling below).

Water

In a survival situation, salvage your water supply, conserve it as much as possible and augment it if you can, by rain, dew, river water or any other means. For example, dig down in the middle of the sandy bed of a watercourse to locate a soak, or distil salt water by holding a cloth in the steam of boiling water and wringing it into a container.

Some indicators for where ground water may be found include, terrain, birdlife, animal tracks and insects. Water may exist in pools in hills as well as underground in low lying creek areas.

Water is more important to survival than food – you can comfortably do without food for 48 hours or more, but lack of water causes dehydration, and you can lose no more than one-fifth of the body's fluids (about 11 litres) if you are to survive.

Under desert survival conditions, the preferred method after a forced landing is to wait until you are extremely thirsty before drinking at all, and then to drink at the rate at which sweating is taking place. This method ensures there is little impairment in efficiency and wastes no water. You can also save water by reducing sweating; for example, by keeping in the shade, not exposing the skin to sun or hot winds and resting during the day. If water supplies have to be restricted, do not take salt or eat salty foods.

Minimum water requirements				
Mean temperature*	35 °C	32 °C	30 °C	< 27 °C
Litres per 24 hours†	5	3.5	2.5	1

* Mean temperature is usually about 8 °C below daily maximum.
† Minimum water requirements per person to maintain the correct balance of body fluid, when resting in the shade

If you decide to walk out, you will double your body's need for water.

In desert or semi-desert areas, walk or exercise only at night or in the early morning.

For every 4.5 L of water carried, you should be able to walk 32 km at night in these types of terrain.

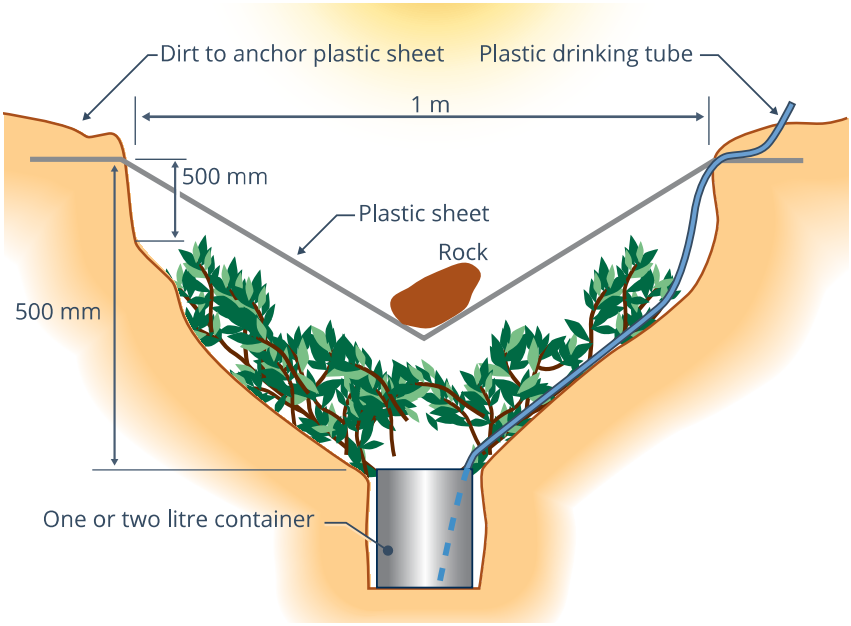
It is strongly recommended that you do not leave your aircraft or attempt to walk out unless you are certain there is help nearby. It is recommended that you stay with the aircraft until you are rescued. The discussion is about conserving water as it is the most critical substance for your survival. Any physical activity will increase your body's need for water The aircraft is much more easily seen that a person on their own. Do not drink urine or salt water.

Emergency water still

To supplement supplies, you can carry some basic equipment to setup an emergency water still, which can extract small amounts of water even from soil that looks quite dry.

Foliage (if available) should be placed as illustrated below around the container under the plastic sheet. Clear polythene, which 'wets' easily is best for the purpose but ordinary clear kitchen polythene sheet (or preferably the thicker 100 µm variety such as is laid down before concrete floors etc. are poured) is satisfactory, particularly if its surface is roughened so that the droplets of water will cling to it more easily and will not be wasted by dropping off before they run down to the point of the cone. It is wise to cut the sheets to size and roughen them with sandpaper before you store them in the aircraft, rather than waiting until you are stranded somewhere in the outback. If a 'nesting' set of containers is obtained and the sheets and tubing rolled inside them, a very compact bundle can be made. But see that it is very well wrapped—it may lie around in the luggage compartment for a long time before it is needed.

Figure: Emergency water still



Signalling

If you have a locator beacon, operate it as described in the COSPAS-SARSAT system section above.

Collect wood, grass, etc and build several signalling fires – preferably in the form of a triangle. Use oil from the engine and tyres to make black smoke. Unless there is ample firewood in the area, do not light fires until you hear or see search aircraft, or until desperate. Be careful to have a fire break between the fires and your aircraft. Try to have the fires downwind from the aircraft.

Conserve your batteries if the aircraft radio is undamaged. After one attempt to contact an airways operations unit, do not use your transmitter until you hear or see search aircraft. Maintain a listening watch, as search aircraft may broadcast information or instructions in the hope that you can receive. Make a note of (and call on) the overlying controlled airspace frequency. Watch for contrails.

Make signals on the ground using the SAR ground signals below and in ERSA-EMERG.

Aircraft may fly over your notified route on the first or second night. Light the fires as soon as you hear them and, if possible, keep them burning all night.

If you do not have a heliograph or a mirror, try to remove some bright metal fittings from your aircraft for signalling—any flash seen by searching aircraft will be investigated.

Ground–Air visual signal code

Message		Code signal
For use by survivors		
1	Require assistance	V
2	Require medical assistance	X
3	Proceeding in this direction	>
4	Yes or affirmative	Y
5	No or negative	N
If in doubt use international symbol		SOS
For use in civil emergencies		
1	Require fodder	FF
2	Require evacuation	III
3	Power failure	VI

Hygiene

To remain in reasonable condition, you should take as much care as possible to avoid accidents or illness. The following hints may help:

- Keep your body and clothes as clean as possible.
- Always wash your hands before eating.
- Properly dispose of body wastes, garbage, etc., in trenches.
- If possible, sterilise or boil water and cook food to avoid gastric troubles.
- Avoid activities which may lead to injury.
- Keep your clothing dry.
- Keep your head covered when in the sun.
- Do not sleep on the ground; make a raised bed with aircraft seats, wood, dry leaves etc.

Shelter

Some type of shelter is essential regardless of the type of terrain in which you find yourself.

If your aircraft is not badly damaged, it can be used as a shelter. Otherwise, you should use whatever is available from the aircraft or the environment. For example, use trees to rig up a temporary tent as protection against the weather.

Fires

You may find that a fire is essential for warmth, cooking, drying clothes, or for distilling or purifying water. If there is plenty of wood available, this should prove no problem. Otherwise, you may have to improvise a stove from a can or other container.

Snakebite

Snakebite is an unlikely event. In Australia there are both venomous and non-venomous snakes. Snakes are not naturally aggressive and will always prefer to retreat. They will only attack humans if they are hurt or provoked. Most snake bites occur when people try to kill or capture them. If you encounter a snake do not approach it; stay back and slowly retreat.

If a person is bitten always assume the snake is venomous. If you are able, seek help immediately.

The following immediate actions should be undertaken:

› The victim must remain calm – sit quietly this will reduce the speed that the venom will move around the body. It is a myth that snake venom gets straight into your blood stream after a bite. Instead, it moves through your lymphatic system. Lymph is a fluid in your body that contains white blood cells. Unlike blood, which is pumped around your body continuously, your lymph moves when you move your limbs. If you can stay still and calm, you can prevent the venom in your lymph traveling further into your body.

› Firmly bandage the whole limb. Start atop the bite site then bandage the limb upwards.

- Bandage firmly but not so tight as to cut off the circulation—if you don't have bandage any stretchy material will do (torn up T shirt, stockings or other fabric can be used as a bandage.
- Do not allow the victim to move; they must remain still.
- Splint the limb, immobilising as you would a fracture.
- Monitor the consciousness of the victim and circulation to the effected limb.

Don't wash, suck, cut or torniquet the bite. There are a lot of old methods of treating snake bites that are now known to cause more harm than good.

Washing the snake bite site can wash off venom that the hospital staff may be able to use to identify the type of snake that bit you. You should also keep clothing from around the bite site, because additional movement can cause venom to more readily move into the blood stream.

See also **Outback Survival: Snakes and Snakebites | Royal Flying Doctor Service** for more information.

Sea survival

Ditching into the sea is a rare event; however, in the unlikely event of this happening, you will normally have some time for preparation. Ensure seat belts are tightly fastened. Brief passengers to brace for impact. Try and ditch into the wind as much as possible and touch down along and on the crest of the swell. Avoid leaving your aircraft without your life jacket—only inflate your life jacket once you have left the aircraft.

Immediate actions

- Secure and deploy your life raft.
- Activate your ELT immediately.
- Gather useful equipment on and board raft (remain dry if possible).
- Roll call – locate missing passengers.
- Cut your raft adrift – if you have more than one raft tie rafts together on an 8 m line.
- Read the instructions contained in the raft.
- Check raft, adjust sea anchor length to half distance between waves, and in cold weather inflate floor and canopy.
- Retrieve and secure inventory equipment (to prevent loss if capsized).

A fully loaded life raft is cramped and uncomfortable

› If applicable rotate duties; duties should include look out with location aids, raft maintenance, maintaining water devices and procuring food.

› Exercise, keep occupied and work as a team and to avoid discomfort.

› Plan pyrotechnic operations to avoid damaging the raft or injury to persons.

Essential rules for sea survival – in short water

› Ration water and stay hydrated. Dehydration impairs general performance and does not decrease water consumption. Hold reliable water sources in reserve.

› In hot areas wear clothes dampened during the day and remain in the shade. This will halve water loss by minimising sweating. Protect eyes and skin against the sun. Do not exit the raft to swim.

› Fish should be eaten if short of water, sun dried until rain provides sufficient water. Fish that have an unusual shape or features of skin instead of scales should not be eaten.

› Avoid sea sickness. Use sea sickness tablets; seasickness will wear off.

› Do not drink sea water, urine, or blood from sea birds.

Keep raft dry

› Avoid immersion, foot and raft sores by regularly changing position.

Discourage predators

› Do not trail attractive items.

› Discard waste well away from the raft at night.

A small amount of control is possible by adjusting the raft for wind or currents. Deploy the sea anchor to travel with the current or retrieve it to travel with the wind.

Radio communication failure

Procedures

If VFR in G or E airspace (CASR 91 MOS 11.10)

If you are flying under the VFR in Class G or Class E airspace and your radio fails, you should:

› select code 7600 on the transponder (if fitted)

› remain outside controlled airspace

› assume the radio is broadcasting and broadcast position and intentions on the frequency appropriate to the area of operation

› as soon as practicable, descend below 5,000 ft to continue flight under the VFR.

You should not forget to report your arrival to ATS if on a SARTIME to **CENSAR 1800 814 931.**

If in controlled/restricted airspace (ERSA EMERG)

In the event of radio failure:

› maintain terrain clearance throughout all procedures, and

› squawk 7600 on your transponder

› transmit intentions and make normal position reports (assume transmitter is operating and prefix calls with 'Transmitting blind'), and then

› listen out on ATIS and/or voice modulated navigation aid (NAVAID)

› land at the most suitable aerodrome (note the special procedures if you are proceeding to a Class D aerodrome)

› report arrival to ATS.

Class D aerodrome – special procedures

› When flying into a class D aerodrome you should follow the procedures above. In addition, you should consult the ERSA – FAC for the procedures that apply at individual aerodromes. In all situation when landing, watch for standard light signals.

Indications by an aircraft (ERSA EMERG):

In flight:

› during the hours of daylight – by rocking the aircraft wings

Note: This signal should not be expected on the base and final legs of the approach.

› during the hours of darkness – by flashing the aircraft's landing lights on and off twice or, by switching its navigation lights on and off twice.

On the ground:

› during the hours of daylight – by moving the aircraft's ailerons or rudder

› during the hours of darkness – by flashing the aircraft's landing lights on and off twice or, by switching its navigation lights on and off twice.

If in VMC and certain of maintaining VMC:

› stay in VMC and land at the most suitable aerodrome (note special procedures if proceeding to a Class D aerodrome)

› report arrival to ATS.

Notes:

1. Initial and subsequent actions by the pilot at the time of loss of communications will depend largely on the pilot's knowledge of the destination aids, the air traffic/air space situation and meteorological conditions en route and at the destination. It is not possible to publish procedures that cover all radio failure circumstances. The following procedures ensure that air traffic services and other traffic should be aware of the pilot's most likely actions. Pilots should follow these procedures unless strong reasons dictate otherwise.
2. In determining the final level to which a pilot will climb after radio failure, air traffic control (ATC) will use the level provided on the flight notification, or the last level requested by the pilot and acknowledged by ATC.

Initial actions

If no clearance limit received and acknowledged:

› proceed in accordance with the latest ATC route clearance acknowledged and climb to planned level, or

If a clearance limit involving an altitude or route restriction has been received and acknowledged:

› maintain last assigned level (or minimum safe altitude if higher), for 3 minutes and/or

› hold at nominated location for three minutes, and then

  » proceed in accordance with the latest ATC route clearance acknowledged and climb to the planned level.

If being radar vectored:

› climb if necessary to minimum safe altitude, to maintain terrain clearance, and

› maintain the last assigned vector for 2 minutes, and then

  » proceed in accordance with the latest ATC route clearance acknowledged.

If holding:

› fly one more complete holding pattern, and then

  » proceed in accordance with the latest ATC clearance acknowledged.

Destination procedures

If no NAVAID:

› track to the destination in accordance with the flight plan (amended by the latest ATC clearance acknowledged, if applicable)

› commence descent in accordance with standard operating procedures or the flight plan

› proceed to overhead the aerodrome at that altitude

› ascertain the landing direction

› descend to join the desired circuit at circuit altitude via the downwind entry point (remain clear of other circuits)

› proceed with the normal circuit and land, maintaining separation from other aircraft

› watch the tower for light signals (below) (MOS 2.04).

If your aircraft is fitted with NAVAID:

› if possible, select the appropriate frequency and listen for instructions (this is one of the most effective ways of proceeding safely)

› when the control tower is active, follow normal procedure

› watch the tower for light signals (see below).

Light signals

Light signals

On ground	Light mode	In flight
Authorised to **take off** if pilot is satisfied that no collision risk exists	 Green	Authorised to **land** if pilot is satisfied that no collision risk exists
Authorised to **taxi** if pilot is satisfied that no collision risk exists	 Green flashing	**Return** for landing
Stop	 Red	**Give way** to other aircraft **and continue** circling
Taxi clear of landing area in use	 Red flashing	**Do not land** Aerodrome unsafe
Return to starting point on aerodrome	 White flashing	

Communication and NAVAID failure

In the event of complete failure of communications and navigation aids, maintain terrain clearance throughout all procedures and proceed as follows:

If VFR in G or E airspace (CASR 91 MOS 11.10):

If you are flying under the VFR in Class G or Class E airspace and your radio fails you should:

› select code 7600 on the transponder (if fitted)
› remain outside controlled airspace
› assume the radio is broadcasting and broadcast position and intentions on the frequency appropriate to the area of operation
› as soon as practicable, descend below 5,000 ft to continue flight under the VFR.

You should not forget to report your arrival to ATS if on a SARTIME.

If in controlled/restricted airspace or if IFR in any airspace:

› squawk 7600 if possible
› listen out on ATIS and/or voice-modulated NAVAIDS
› transmit intentions and normal position reports (assume transmitter is operating and prefix calls with 'Transmitting blind')
› if practicable leave/avoid controlled/restricted airspace and areas of dense traffic
› as soon as possible establish visual navigation
› land at the nearest suitable aerodrome
› report to ATS on arrival.

Emergency change of level in controlled airspace procedures

When it is necessary for an aircraft in controlled airspace to make a rapid change of flight level or altitude because of technical trouble, severe weather conditions, or other reasons, the change will be made as follows, using urgency message format, stating level changes involved and diversions, if applicable:

› squawk SSR code 7700

› transmit:
'Pan-Pan, Pan-Pan, Pan-Pan'
[agency being called]
[aircraft identification]
[nature of urgency problem]
[intention of person in command]
[present position flight level or altitude and heading]
[any other useful information]

Civil Aviation Safety Authority