Forced-Landing Practice

Have you ever noticed how paranoia can make aircraft engines seem to run rough while flying over water and make your fuel gauges read half empty when they are, in fact, half full?

In New Zealand around 50 engine failures occur each year (see "From the Accident Files" page 18). Statistically, the chances of an engine failure or partial failure happening are small, but if you are not prepared chances are that it will happen to you.

Keeping current with forced-landing techniques is an important way in which pilots can increase the safety of every flight they conduct. It helps by giving us and our passengers the best possible chance of walking away uninjured after an engine failure and subsequent forced landing. Successfully handling an engine failure, or partial power loss, requires decisive pilot action combined with well-rehearsed forced landing cockpit drills.

This article is a reminder of the basic techniques for conducting a forced landing without power (FLWOP) in a light single-engine aircraft. It assumes an engine failure from above 2500 feet over an area that offers reasonable forced landing possibilities.

Immediate Actions

Prioritising your time after an engine failure will help you to accomplish as many of the critical drills as possible. The 'immediate actions' are the first part of the FLWOP sequence. They help ensure that the aircraft is trimmed for its best glide speed and that the engine is given sufficient time to respond to carburettor (or induction system) ice and fuel starvation checks. Here are the immediate actions:

Convert Excess Speed to Height

At the first sign of engine trouble, any airspeed in excess of the best glide speed, should be converted to valuable height. In many light aircraft with modest cruise speeds this simply means preventing unnecessary loss of height by holding the nose up until the best glide speed is reached.

After trimming for the best glide speed, apply the appropriate amount of rudder to remain in balance. Although drag can be reduced by stopping the propeller, it is not a recommended practice, as it requires bringing the aircraft close to the stall. It is also doubtful whether the reduction in drag will compensate for the height lost in the subsequent recovery to the best glide speed.

If the aircraft is fitted with a constant-speed propeller, selection of coarse pitch will reduce drag and improve gliding performance.

Carburettor Ice and Fuel Checks

Carburettor heat or alternate air should be applied as soon as possible. In the case of a carburetted engine, this will allow the remaining heat from the engine to be utilised in melting carburettor ice that may have formed. The electric fuel pump should also be switched on, mixture 'full rich' should be applied, fuel tanks changed (if possible), and the throttle closed.

Confirming Wind Direction

Particular attention must be given to the direction of the wind when selecting a landing area, as a landing into wind ensures the lowest possible groundspeed at touchdown. Landing with a tailwind could be fatal – it not only reduces your chances of achieving your planned aim point, but could also cause a much higher impact speed in the case of an overrun. **It is a good habit to keep track of the wind direction at all times while flying.**

Wind direction and speed can be confirmed using any of the following indicators:

Smoke

If there is any smoke in the area, it will provide the best indication of the surface wind speed and direction.

Continued over...

... continued from previous page

Dust

Like smoke, dust provides a very good indication of the surface wind. Watch for vehicles moving along shingle roads, tractors working paddocks, fertiliser spreading, and even dust from river beds.

Tree or crop movement

The movement of large trees and wind ripples moving across the top of crops can give a good indication of the surface wind direction. Wind of 5 to 8 knots in willow and poplar trees turns the leaves upside down, exposing a silver side. The silver underside indicates the direction the wind is blowing from.

Wind lanes or wind shadow

In moderate to strong winds, water movement or waves can give an indication of surface wind direction, especially over large bodies of water. On the other hand, wind shadows are the result of water at the windward end of a body of water being protected by the shoreline, creating an area of calm. This effect is most noticeable in light to moderate wind conditions on small lakes or ponds.

Cloud shadow

The movement of cloud shadow over the ground indicates the direction of the wind at altitude, and is only an indicator of the 'general flow'. Care should be taken to ensure that there is not a marked difference between this indication and what is happening on the ground, especially in mountainous terrain.

Local knowledge

If you have local knowledge of the weather conditions in the area that you are operating in, then make full use of the information. The windsock indication and known takeoff direction at your aerodrome of departure (if nearby) may give an indication of wind direction.

Aircraft drift

By looking at any drift angle that you might be experiencing you can gain a limited indication of the wind direction at the aircraft's present altitude – but not at surface level.

Weather reports

If operating in close proximity to an aerodrome from which you have recently received weather information, such as an ATIS or METAR, then this could help to give you an approximate idea of the surface wind. This information should only be used to supplement that which you have gathered using the methods above.

Selecting a Landing Site

Selecting a suitable landing site in such a high stress situation can be difficult. In general, flights should always be conducted at an altitude that will allow sufficient glide time to plan and executed a forced landing.

The area of likely landing sites must be within easy gliding distance before any other selection criteria can be applied. The aircraft should be turned in the general direction of the area so as not to drift away and lose valuable height. Selecting a landing site can then be achieved by using a mnemonic such as 'the seven Ss', which stand for size, shape, slope, surface, surroundings, stock, and sun. They are listed in order of importance so as to help you narrow down the options.

Size

Look for the longest possible landing site that faces into wind. Your short-field-landing training will pay dividends here.

Shape

Don't limit your field selection to sites that resemble a rectangular runway. The perfect shape for a FLWOP is in fact a circle, as it allows approaches to be made from many different directions over obstacles and ensures a landing into wind. Landing diagonally across landing sites that are rectangular provides the longest possible landing distance.

Slope

An uphill slope for landing is preferred, as it will reduce the landing roll. A downhill slope should be avoided unless the wind strength negates the disadvantages of landing on a very gradual downhill slope. This should only be attempted when there is a strong headwind present and the gradient of the slope is known to be slight. It can be difficult to judge the gradient of a slope from altitude – rivers and creeks running downhill may give you some clues.

Surface

A dry, firm landing surface is preferred, in order to prevent the aircraft from digging in and then possibly nosing over. As with determining slope, assessing what kind of surface you are looking at has its problems. The colour and texture of the surface foliage can indicate how firm a potential landing site might be. The presence of surface water is always an indication that the site might be soft. A comparison of what each surface looks like in relation to a grass aerodrome runway can be useful.

Surroundings

Select a landing site that has a clear approach path. An approach should not be planned over tall trees, power lines and buildings that will prevent you from achieving an unimpeded profile. A clear approach path will also mean that undershooting your landing site is less likely to result in a collision with a solid obstacle. Some consideration should also be given to the possibility of an overrun. If an opportunity exists to land towards nearby buildings, which might have a telephone and people to assist you, then take it. If your forced landing does result in injuries, then you know that medical help will hopefully be only a phone call away.

Stock

Try to avoid landing sites where stock are present. If, however, they are concentrated at one end of the paddock and are not tending to move around too much, then consider using the site – if there are no other equally or more suitable alternatives.

Sun

Normally a problem only at sunrise and sunset. Under these conditions an approach in the direction of the sun may blind you on finals.

Planning Your Approach

Now that you have selected the most suitable into-wind landing site, you must plan your approach to it. This is one of the most important phases of the FLWOP process. A well planned approach profile will put you into a position from which you can turn onto a base leg at the correct height, and continue with a landing approach which is likely to have a successful outcome. The approach should be planned from the ground up. The following sequence is suggested for planning an approach to a landing site:

Aiming point

Selecting an aiming point that is approximately one third of the way into the landing site gives you a constant point to aim for, and it helps ensure that you do not undershoot the landing site (see diagram). Extending flap on short finals will move the touchdown point closer to the approach end of the field.

Circuit direction

A lefthand pattern is preferable, so that the pilot (sitting in the lefthand seat) has the best possible view of the landing site – unless there is a specific reason to fly a righthand pattern. (Righthand pattern FLWOP practice is important, however, because some landing sites may offer no alternative.) In the 'ideal' situation, try to maintain turns in a constant direction to improve an accurate judgement of drift, sink rate, and approach profile.

1000-foot AGL point

The 1000-foot point should be at 90 degrees to the landing site threshold and about three quarters of the normal circuit distance out. The same point as during glide approach training. **You must be at this point to achieve a successful landing.** Arriving at the 1000-foot point will allow you to position onto a base leg depending on the wind strength.

Continued over...

... continued from previous page

The stronger the wind the earlier you will need to turn on to a curved base leg (see diagram). Extending downwind in windy conditions would mean a very slow groundspeed on final approach, possibly causing an undershoot.

1500-foot AGL area

The 1500-foot area is situated at the upwind end of the landing site and helps you to position yourself correctly at the start of the downwind leg. The 1500-foot area works on the assumption that you will lose around 500 feet in the downwind leg (depending on aircraft type) meaning that you should arrive at the 1000-foot point at the correct height (see diagram).

Assessing Your Approach

Using your altimeter, work out how much height you have to glide to achieve the 1500-foot area. You can then make a decision, based on this information, whether to fly a direct line to the 1500-foot area, or purposely manoeuvre to lose height. Constantly assessing how your approach profile is going, is crucial. Estimate your height above ground level and the distance-to-run to achieve each reference point – and don't forget the effect wind will have on each segment of your approach pattern.

If you are too high relative to the 1500-foot area, commencing an orbit to lose height is the best course of action, but be careful not to lose sight of your landing site. When faced with turbulent and gusty conditions, it may be necessary to increase your airspeed a little above the aircraft's best glide speed to provide a greater margin above the stall. The same technique should also be applied when trying to make headway to a landing site into a strong headwind – it provides better forward penetration to the landing site relative to the amount of height lost.

Subsequent Actions

Once you have planned your approach to a landing site, and you feel that it is progressing well, the next priority is to carry out the subsequent actions. You can do this knowing that you have a definite plan to reach your landing site. It is very important to maintain good situational awareness while conducting any of the subsequent actions. You should fly the aircraft first and foremost, and then worry about completing the cockpit drills. Your pilot scan should be directed outside the aircraft cockpit on a regular basis so that small adjustments in heading can be made that ensure you are sticking to your planned approach.

Engine Trouble-Checking

Engine trouble-checking allows you the opportunity to assess what has caused your engine to lose power and to try and rectify the situation. There is little point in continuing with a forced landing if you are simply suffering from fuel starvation in one tank, when there is plenty in the other. If there is any doubt about whether your engine will continue to run, then you should stick with the forced-landing approach that you have planned. Trouble checks are based on the mnemonic FMITP (see Glossary) priority system and should be learned so that they are absolutely automatic. Check your progress to the landing site and make any necessary adjustments.

Emergency Radio Call

If you have a radio, it is important to transmit a MAYDAY call and also squawk 7700 on your transponder before you lose too much altitude, as this could reduce the range of your transmission. Details of the content of a distress call can be found in the 'pink' section of the *AIP New Zealand*. If time is limited, then at least transmit your present position and intentions to give authorities the best possible chance of finding you.

Check your progress to the landing site and make any necessary adjustments – by now you may be nearing the 1500-foot area.

Passenger Briefing

A passenger briefing is of great value to calm your passengers and to reassure them that you have the situation under control. It will not only remind them of what you told them during the preflight passenger briefing, but also enables you to stress that you need to concentrate on the rest of the forced-landing approach. For information on passenger briefing content, see the November/December 2006 issue of *Vector*. Check your progress to the landing site and make any appropriate adjustments.

Pre-Landing Checks

Pre-landing checks (BUMPFH – see Glossary) need to be completed before landing. Apart from being the normal pre-landing checks, they act as a reminder to check that everyone's harness is tight and to think about when hatches or doors should be unlocked. Pre-landing checks also provide a cue to consider when to put the undercarriage down. Leave the undercarriage up, however, until you are certain of reaching your landing site. By now you should be approaching the 1000-foot area that you selected. If you find that you are too high, then you will need to consider flying a wider base leg, and if too low, flying a closer base leg (see diagram).

Glossary

These checks are a general guide only. For comprehensive checklists refer to the aircraft's Flight Manual.

Trouble Checks

F Fuel pumps are on, change tanks, contents are sufficient
M Mixture full rich is applied
I Ignition is on both, check left mag, right mag
T Temperatures are in the green
P Pressures are in the green
Partial power check (advance throttle)

Pre-Landing Checks

B Park brake is off and there is pressure on the toe brakes
U Undercarriage is down and locked
M Mixture is full rich
P Propeller Pitch is set as required
F Fuel pumps are on
H Hatches and harness are secure

Shut Down Checks

F Fuel selector is off, pumps are off
M Mixture is full set to full lean
I Ignition is off

Final Actions

The final actions are to carry out the 'off checks' (FMI – see Glossary). It is extremely important that you arrive overhead the 1000-foot point as accurately as possible. as this will then set you up for a fairly normal type of glide approach.

Judging Your Final Approach

After you have completed the 'off checks', your focus must be drawn to judging the base leg and final approach to your aiming point. Do not extend downwind (especially in strong wind conditions) or you will run the risk of undershooting the landing site. It is better to fly a slightly wider base leg and use it to adjust your height as required. This can be achieved by turning slightly away from the landing site if too high, or turning towards the landing site if too low. This means that at no time are you committed to a final approach where there is insufficient space to control your height (see diagram). Final approaches directly into strong wind will mean low groundspeed and thus require greater judgement. In very strong headwind situations, it may be worth considering flying faster than the aircraft's best glide speed to avoid an undershoot. On the other hand, in light wind conditions you could end up high on final approach. The use of flap, side-slipping (if approved for your aircraft type), curved approach or S-turns are all effective ways of bleeding off extra height – but flap should not be selected too early. When you are absolutely certain that you can achieve your aiming point, then you can use flap to touch down earlier than your aiming point. If necessary, touchdown can now be attempted as close to the threshold as possible.

Landing the Aircraft

Touching down at the slowest speed possible will reduce your landing roll and reduce the amount of braking required to come to a complete stop. Previously unseen obstacles and ditches can be a problem on the rollout. If a collision is imminent then try at all costs to keep the cabin intact as this is your 'safety capsule'. Attempts to turn the aircraft should be used only as an absolute last resort, as an aircraft cockpit is designed for a forward impact, not a lateral impact. Once the aircraft has stopped, evacuate the aircraft and attend to your passengers. A call should be made to the emergency services and to the operator to inform them of the incident.

A forced landing is a situation that, if dealt with correctly, can have a positive outcome. If it is practised regularly with a disciplined approach, then you are giving yourself and your passengers the best possible chance. When was the last time you had a dual forced-landing training session? ■

Back to Basics ...

Technology Tips and Traps

Technology can be a wonderful tool. Innovations available to pilots today can provide large amounts of information, making flying more efficient and arguably safer. There are some pitfalls, however, if technology is not used appropriately, or if it fails, or distracts pilots from other basic tasks.

The theme of the CAA 2007 series of AvKiwi Safety Seminars is "Back to Basics", with an emphasis on the tips and traps in using new technology. Topics covered will include:

- Lookout
- Route planning
- Communications

The first in our series of seminars will be presented by Jim Rankin, RNZAF Instructor, at the Great Plains Fly-In:

Ashburton Aerodrome

Sunday 4 February at 9:30 am

The seminar will be held during Great Plains Fly-In 2007, in the Mid-Canterbury Aero Club on the airfield.

At 9:00 am, prior to the Av-Kiwi Seminar, Rex Kenny, CAA Manager Sport and Recreation, will be giving an update on sport aviation regulation, with time for questions and answers.

Check out the CAA web site, www.caa.govt.nz, for a list of further seminars in this series (dates yet to be scheduled), see "Safety information – Seminars".