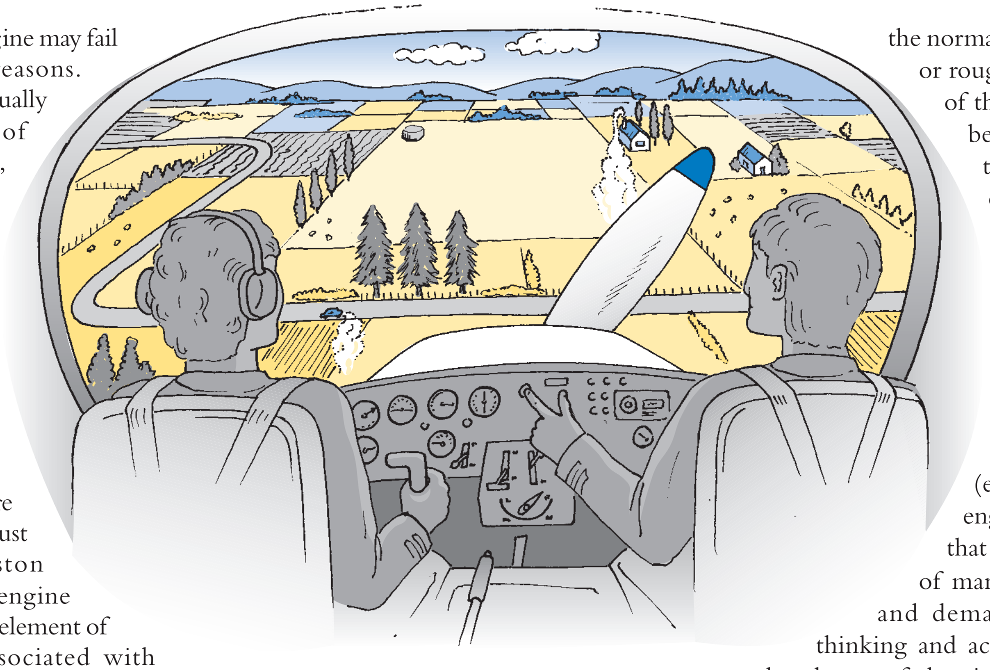
1998, Issue 3

VECTOR

Pointing to Safer Aviation

Engine Failure After Takeoff – *What If?*

An engine failure after takeoff (EFATO) is probably one of the most serious situations that the pilot of a light single-engine aircraft can face. Sudden silence from the engine department, after reaching only a few hundred feet, is never going to be a pleasant moment. It would probably leave you hoping that all your training, and those safety articles that you read, will start to kick in and allow you to take control of the situation. The following article discusses a variety of factors that should assist you with handling an engine failure after takeoff.



An aircraft engine may fail for many reasons. An engine will usually stop because of a fuel problem, foreign object ingestion, a restriction to the carburettor air intake, carburettor icing, electrical failure, loss of oil pressure, or a catastrophic mechanical failure – such as an exhaust valve or piston problem. Many engine stoppages have an element of human error associated with them. Such elements may include: poor maintenance, inadequate pre-flight checking, fuel starvation, fuel exhaustion, water in the fuel, carburettor icing, or bad engine handling skills.

Two of the major causes of engine failure after takeoff are fuel contamination and fuel starvation. The need to check fuel quantities, and quality, during the pre-flight inspection can not be emphasised enough. The risk of having an engine failure can certainly be reduced by paying careful attention to these factors.

The chances of having a catastrophic engine failure, due to a mechanical problem, have been shown to be higher during the takeoff phase – or whenever changes are made to engine power settings. Changes in power settings can subject an engine to rapid changes in temperature, which can cause metal stress failure. Inadvertent over-boosting of turbo or supercharged engines will cause excessive cylinder pressures that place the engine under considerable stress.

Be alert to the warning signs of an imminent engine failure. These might include changes in engine note, temperature and pressure readings outside the normal operating range, or rough running. Many of these problems can be detected during the engine run-up or during the takeoff roll.

Prioritising Your Actions

The failure of an engine (especially a piston engine) is something that lurks in the back of many a pilot's mind and demands very quick thinking and actions in order to take charge of the situation. Knowing the drills for engine failure after takeoff (EFATO), therefore, is extremely important in improving your chances of walking away from an engine failure after takeoff. EFATO drills should be learned so well that they become automatic and you are able to recognise and evaluate the situation

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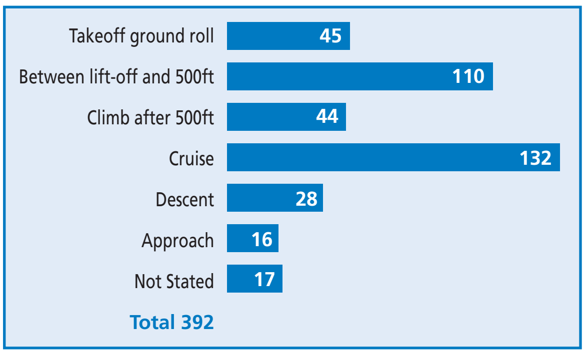
This chart shows the number of engine failures by phase of flight over a 10-year period from 1977 to 1986. Engine failures under 500 feet agl accounted for 40 percent of total failure. Note that these figures are not statistically weighted to allow for the number of hours flown within each flight-phase, ie, an engine in the cruise phase has less chance of failure per hour of operation than an engine in the takeoff phase does.



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extremely quickly. Being a pilot who is current with and can prioritise such drills may make all the difference.

If you experience an engine failure after takeoff, you may have very little time to carry out the appropriate engine failure drills. It is therefore critical that you do these drills in the correct order – depending on how much height you have up your sleeve. The first priority must always be to fly the aircraft, concentrating on guiding it down safely to a landing area. If time is short, then this process should take priority over becoming absorbed in cockpit drills and radio calls. The bulk of your pilot scan should be concentrated outside the cockpit so as to maintain good situational awareness relative to any possible forced-landing areas.

It is pertinent to have recited a pre-takeoff brief, as to what actions you will take if the engine fails after takeoff, **before** you line up on the runway. This is very similar to the pre-takeoff brief that the pilot of a multi-engine aircraft will give before departure. Such a brief might include something like, "If the engine fails before 300 feet agl, I will land straight ahead onto the runway; if it fails above 300 feet agl, I will turn 30 degrees to the left where I know there are several suitable paddocks to land in." Each brief will vary considerably from location to location and from pilot to pilot, but reciting it before takeoff will allow a decisive course of action with the minimum amount of delay.

The old saying of 'aviate, navigate and communicate' is certainly very relevant during an engine failure after takeoff. It is far better to make the best of a less-than-perfect situation, when you are desperate for height, than it is to concentrate on doing all the drills perfectly and ending up with a disastrous result.

Immediate Actions

Your first action, in the event of an engine failure, must always be to maintain control of the aircraft by lowering the nose and establishing the glide speed. While doing this, it is essential that carburettor heat or alternate air is applied, fuel tanks are changed (if applicable to aircraft type), the electric fuel pump is switched on (if fitted), and the throttle is closed. These are relatively simple tasks, which can be carried out without causing too much pilot distraction, but which are extremely important as the first part of the trouble-checking process.

By selecting the carburettor heat quickly it is possible to provide an alternative source of air to the carburettor if a blocked air filter has restricted the airflow, thereby restoring engine power again. Carburettor icing is not particularly common, but the application of carburettor heat would at least help to melt any ice which has accumulated and caused the engine to fail. Similarly, by switching fuel tanks and turning the electric fuel pump on, the chances of the engine bursting back into life after being starved for fuel are significantly improved. Why continue with a forced landing when you have a perfectly undamaged engine that will respond to a simple change of fuel tanks or application of carburettor heat?

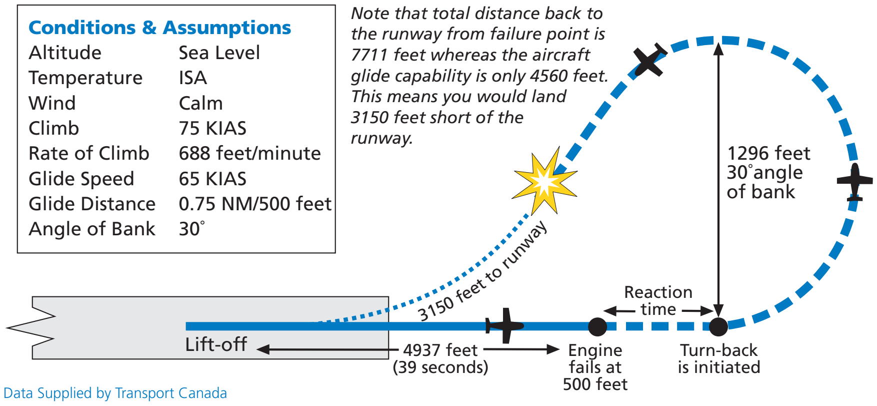
Note that if you are extremely close to the ground when the failure occurs, then there is little point worrying about fuel selection and carburettor heat application because the engine has less time to respond. It is far better to concentrate on guiding the aircraft to a suitable landing area. If the engine failure occurs during the takeoff roll, or just after you become airborne, then you will be committed landing straight ahead – hopefully back on to the runway. The throttle should be closed and firm braking action applied while maintaining directional control – this may include avoiding obstacles.

Data for a Cessna 172 turning back after an engine failure at 500 feet agl

Conditions & Assumptions

Altitude	Sea Level
Temperature	ISA
Wind	Calm
Climb	75 KIAS
Rate of Climb	688 feet/minute
Glide Speed	65 KIAS
Glide Distance	0.75 NM/500 feet
Angle of Bank	30˚

Note that total distance back to the runway from failure point is 7711 feet whereas the aircraft glide capability is only 4560 feet. This means you would land 3150 feet short of the runway.



Data Supplied by Transport Canada

Selecting a Landing Area

Selecting the best available landing area must be achieved as quickly as possible – while maintaining control of the aircraft. Average descent rates for a light single-engine aircraft, with the propeller windmilling, will be between 700 and 900 feet per minute, giving you approximately 35 to 40 seconds before you reach the ground from, say, 500 feet agl. There are a number of factors that require careful consideration when selecting a landing area. You can maximise your chances of a successful forced landing by adhering to the following guidelines:

- A landing area **must** be selected that is **within easy gliding distance** and is preferably contained within a 45 degree arc either side of the aircraft nose (up to 90 degrees if really necessary). This maximises your chances of landing as much into wind as possible (giving minimum groundspeed) and also reduces the need to make large heading changes while in close proximity to the ground.
- Assess the 90-degree (two 45s) arc immediately in front of the aircraft for landing spots that are of sufficient length, suitable surface, as into-wind as possible, and free of substantial obstacles. If no such area exists, then you must quickly choose an alternative area that is at least clear of buildings, power wires, trees, stock and has a reasonable surface. If you find yourself in such a desperate situation, then you can not afford to spend time debating the finer points of your landing area selection; you will need to make the best of the options that you have before you.
- You **must immediately** assess if you are high or low relative to your chosen landing area, and then manoeuvre the aircraft so as to achieve a glide profile that is going to make good the landing area. Note that if you are very high in relation to a perfect landing area that is in close proximity to you, and there are few other options, then it is wise to use flap (in conjunction with other manoeuvres) to increase your rate of descent. There is little point in flying straight past a perfect paddock because you hesitated to get your glide profile under control. This is, however, the only circumstance where flap should be deployed so early in the approach to a landing area – this is discussed later in the article.

Takeoff paths from some aerodromes may not provide many options for forced landings. With a few exceptions, there will seldom be an 'aerodrome style' paddock in front of you. It is far better to force land in a less-than-suitable area, knowing that you are going to cause some damage to your aircraft, than it is to keep searching for that paddock that doesn't exist and end up with absolutely nowhere to go. Sticking with a less-than-perfect landing area is the better option, even if it means going through the fence (at relatively low speed) at the end of your landing roll.

The Impossible Turn

You must not turn back towards the runway that you have just taken off from in an attempt to land – you will probably not make it. There are many reasons for this piece of advice. Turning back would commit you to landing downwind, which significantly increases your landing distance and gives a higher impact speed if you collide with anything. Consult your aircraft's performance charts to calculate the extra distances involved in landing downwind. Turning back also commits you to landing into the on-coming aerodrome traffic flow. But, most importantly, it will mean that you will probably lose a lot of height, and then run the risk of stalling the aircraft in the turn and possibly spinning into the ground. This is certainly a bleak option compared with landing ahead and colliding with something on the ground at a much lower speed.

This advice can be reinforced by way of an example. Typical figures for a light single-engine aircraft trying to turn back to an aerodrome after an engine failure prove that the odds are stacked against you. At a glide speed of 70 knots, with an angle of bank of 30 degrees, a turn through 180 degrees will scribe a radius of approximately 1480 feet away from the runway (depending on the wind). It will take 20 seconds to complete (assuming no wind), during which time you will lose around 320 feet. Most light aircraft will descend at around 900 to 1000 feet per minute when turning at an angle of bank of 30 degrees in the glide. If you add this 20 seconds to your reaction time of four seconds and then up to 10 seconds to regain the runway heading (as a result of executing the turn), you end up with a total of 34 seconds, which equates to 540 feet in height loss. If your engine failed at 500 feet agl then you would end up something like 40 feet bgl (below ground level.) Not a good situation to be in! Refer to *New Zealand Flight Safety* FSM-94-1, June 1994 for further information.

Many pilots who have elected to turn back after an engine failure have been faced with a situation where they have lost more height than they thought they were going to during the turn. They have then attempted to increase their rate of turn by increasing the angle of bank, stalled the aircraft, and have then spun earthward with insufficient height to recover. The fact that the stall speed goes up dramatically with increasing bank angle did not help their cause.

No doubt there will be a few situations, although very few, in which circumstances might dictate turning back – for instance a dense area of houses in front of your takeoff path, but this depends totally on height. Such a decision demands split-second action and expert skill which can be beyond the abilities of the average pilot – an out-of-balance steep turn at low altitude can spell disaster whatever the ground hazards are.

At some point above the terrain the engine failure after takeoff makes the transition into the more 'normal' forced landing without power (FLWOP), where other types of recovery action may be taken. It can become very difficult to determine this 'height of no return', as each situation will be different. It therefore follows that such 'rules of thumb' should err on the conservative side.

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We say that your 'rule of thumb' should be to always select a landing area ahead of you. The exception to this rule is that if you are above 800 to 1000 feet agl, with no other landing options in front of you, then turning beyond 90 degrees either side of the aircraft nose might be the best option.

Subsequent Actions

The following subsequent actions and checks should be carried out **after** you have selected your landing area – and if there is still sufficient time available to conduct them. They should never cause you to become distracted from the task of guiding the aircraft to the ground. Priority should be given to making an emergency radio call before completing the trouble checks – it is better to know that help is on its way rather than trying to revitalise your engine, perhaps to no avail. Prioritising your radio call will also mean that you might still have the height for your radio transmissions to be heard.

Emergency Radio Calls

It is important to let an Air Traffic Service (ATS) unit know of your predicament – if you have time. They can then activate the emergency services for you in the shortest possible time. When you are operating out of a controlled aerodrome, ATC may notice that you have had an engine failure, which takes some of the pressure off you to get that radio call out – but **don't** take this fact for granted.

Operating out of an unattended aerodrome is a different story – there may not be someone watching out for you. Even if you can only make an emergency call on the local unattended frequency, there is a chance that another pilot operating in the surrounding area, or someone listening to a base radio, will hear you and relay the information to the appropriate authorities. It is worth a try. The more remote the area you are in, the greater the need to get that emergency call out – if you have time.

If you are operating out of a remote airstrip where the radio coverage is unreliable, then an emergency call on the local flight information frequency (if you are already monitoring that frequency) may allow aircraft passing overhead to hear your transmission and take follow-up action. Generally, it is not wise to spend time changing radio frequencies when faced with an engine failure after takeoff, so this should be done **only when** you are confident that you have **sufficient time** to do so.

Most engine failure scenarios will warrant the use of a Mayday call, because they are an extremely urgent situation. For less urgent situations, such as a slight power loss or rough running, radio transmissions can be down-graded to a Pan call. If in any doubt as to the urgency of the situation, declare a full emergency using a Mayday call. In either case, your radio call should include the distress signal (Mayday or Pan) name of station addressed, your aircraft's callsign, nature of your problem, your intentions, present position and height. If insufficient time exists for you to make a complete distress call, then priority must be given to relaying your present position – this is better than no radio call at all.

Trouble Checks

Trouble checks are a set of drills that can help to identify the reason why an engine has lost power, thereby improving the chances of restoring it. Trouble checks must be attempted only if there is sufficient time left after the immediate actions have been completed. There is little point in trying to identify an engine problem and attempting an engine restart at the expense of becoming distracted from flying the aircraft. Trouble checks follow a priority sequence designed to find the most likely cause of a power loss and should be conducted in the order in which they are listed. The most commonly used trouble-check sequence is listed below:

Thoroughly inspecting the engine, and its fuel system, for tell-tale signs of problems could be a life saver.

F – Fuel. Confirm that the electric fuel pump was switched on and fuel tanks changed over during the immediate actions.

M – Mixture. A simple check of the mixture control, to make sure that it is full rich, will confirm that it has not inadvertently been moved to lean. Check also that the engine primer is locked in position (a primer that has become dislodged may cause an engine to run roughly). Check that the carburettor heat was selected to hot during the immediate actions.

I – Ignition. A quick check to confirm that the master switch is on and that the magnetos are selected to both will help identify whether or not you are experiencing electrical problems. By selecting one magneto at a time you can also determine if your power loss, or rough running, is caused by a malfunctioning magneto.

I – Instruments. A scan of the temperature and pressure gauges may help to identify any specific engine problems such as over-heating, loss of oil or fuel pressure, and lead you to appropriate corrective action.

P – Partial power check. It is worthwhile to try and ascertain how much power, if any, you have available. Partial power can be of use to help you to your landing area, though it should never be relied upon to return to the aerodrome. Once it has been established that there is absolutely no power available at all, then remember to close the throttle once again so as to prevent the engine unexpectedly bursting into life when you are trying to judge your final approach into a confined landing spot.

Final Actions

The final actions are to carry out the 'off checks' and to land the aircraft using techniques that are going to produce the best possible result.

Off Checks

To reduce the chances of a post-crash fire, 'off checks' **must** be completed before touching down. If your engine failure occurs when you have insufficient height to follow any of the actions and checks mentioned above, then you **must at least** complete the 'off checks'.

The 'off checks' can be carried out in a short space of time in an automatic fashion. They can be summarised as follows:

F – Fuel OFF. The fuel selector must be moved to the off position. This will stop the fuel flow at the engine firewall – this helps to prevent fuel coming into contact with the hot engine.

M – Mixture to IDLE CUT-OFF. The mixture must be fully lean to prevent further fuel vaporisation.

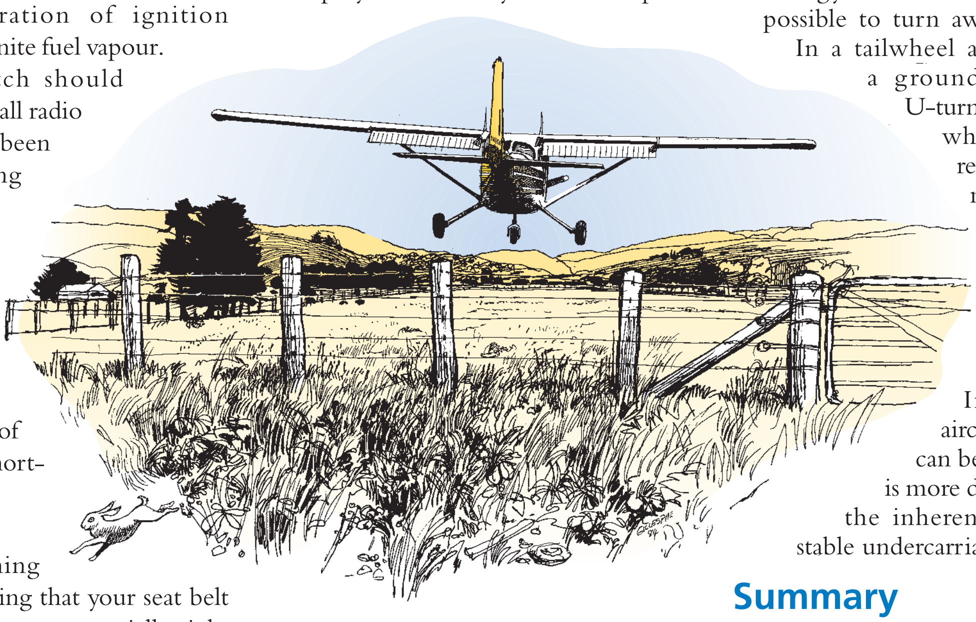
I – Ignition and master both OFF. The magnetos must be moved to the off position in order to prevent the continued generation of ignition sparks that could ignite fuel vapour. The master switch should be turned off once all radio transmissions have been completed, landing flap deployed, and the undercarriage has been selected. Deactivating the electrical system will significantly reduce the chances of a fire triggered by short-circuiting wires.

It is also worth considering reaching down and confirming that your seat belt and shoulder harness are especially tight (it may have worked loose since you last checked it) – you might need all the restraint you can get.

Landing the Aircraft

There are several recommended techniques that can maximise your chances of pulling off a successful forced landing. Assuming that you have chosen a reasonable landing area, there is no reason why you can't make a good job of it. The techniques are listed below and assume that you have located a modest paddock to attempt your forced landing into. (There will no doubt be plenty of variations to these techniques depending on the aircraft type and level of pilot experience involved):

- Pick an aiming point that is approximately 50 to 100 metres into the paddock – this helps to ensure that you achieve the desired landing area.
- Aim to approach at the normally accepted safe approach speed for your aircraft. Any slower than this and you run the risk of stalling, especially when the wind direction is uncertain to àùu. Once below 50 feet, airspeed may be reduced slightly to effect a shorter landing roll.
- Only when you are confident that you can achieve your aiming point, should flap be selected. Your aiming point should then become as close to the threshold boundary of the paddock as possible. (The glide approach profile will of course be steeper than for a powered approach.) Full flap should be utilised before touchdown to provide the greatest amount of aerodynamic drag possible and to achieve the lowest stall speed. Don't forget to turn the master switch off after you have deployed electrically activated flaps.



- If you find yourself too high after having selected flap, the best way to achieve your aiming point is to S-turn (medium turns that will increase the rate of descent) or sideslip (if such a manoeuvre is approved for your aircraft). S-turning, in conjunction with full flap selection, provides a very effective mechanism for losing height, but it will require careful control of bank angle, judicious use of rudder, and a good awareness of airspeed.
- The touchdown should be firm (no floating) with the wheel brakes being applied immediately and the elevator being held firmly back. Try to avoid skidding as it will result in loss of traction.

  Note that some pilots may employ flap retraction techniques to improve wheel-braking by reducing lift and transferring weight onto the undercarriage. Flap retraction is a trade off between loss of aerodynamic drag and improved braking action, so it may not necessarily reduce the landing roll. It should only be practiced if it is known to be effective for your type of aircraft and you are familiar with it. Flap retraction during the braking process can most easily be achieved in aircraft that have a manual flap lever; it should not be allowed to distract you from controlling the aircraft. Practical demonstrations of many aircraft types have shown that the shortest landing roll can be achieved by leaving the landing flaps deployed.
- If you start to run out of landing area, then you should try to preserve the fuselage at all costs, especially if you are going to collide with a substantial object. Preservation can be achieved by directing the fuselage between objects – tearing the wings off absorbs a large amount of hazardous kinetic energy. Alternatively, it may be possible to turn away from objects.

  In a tailwheel aircraft, initiating a ground-loop (a rapid U-turn, around one main wheel) will rapidly reduce your forward momentum. Tailwheel aircraft can easily do this (often unintentionally) by applying single-wheel braking. In a nosewheel aircraft turning away can be attempted, but it is more difficult because of the inherently directionally stable undercarriage.

Summary

There will always be a certain degree of good luck associated with completing a successful forced landing when an engine fails after takeoff – the remainder of this success will largely be determined by the use of sound EFATO techniques and piloting skills.

You can significantly reduce the risk of having an engine failure after takeoff by ensuring that you know the condition of your aircraft, do your pre-flight planning and engine run-up procedures correctly, and are able to recognise the symptoms of an imminent engine failure. If it does happen to you, then being current with the EFATO drills is worth its weight in gold.

Before your next flight, brief yourself on exactly **what you would do if your engine was to fail** after takeoff – make this question part of your pre-takeoff checks. Get to know the possible forced-landing areas adjacent to each runway at your local aerodrome. Make sure that you practice simulated EFATOs with an instructor on an annual basis – there is no substitute for regular practice.

If all else fails, (no pun intended) remember to at least stick to the basics that have been mentioned in this article – they might make all the difference between walking away from your aircraft and a disaster. When it comes to engine failures there is one thing for certain, and Murphy would have probably said it, "be prepared for it, because it might happen when you least expect it." ■

Cellphones and Refuelling

A query from a reader prompted us to do some research into the possible hazards of using a cellphone near refuelling operations.

Cellphones seem to have become an indispensable item of equipment these days – for business and pleasure – and many people wonder how they survived without them! Most pilots (and airline passengers) are probably familiar with the requirement contained in Civil Aviation rule 91.7, which prohibits the use of any portable electronic device on an aircraft operating IFR (except in cruise under certain conditions). This is because of the potential for interference with aircraft navigation systems. Cellphones, of course, fall into this category.

But what about the hazards when operating your cellphone on the ground, in close proximity to aircraft operations, particularly refuelling?

Using a cellphone anywhere on an aircraft apron can be hazardous because of the distraction it incurs for the user. It is a wise move for operators to discourage the use of cellphones by passengers when in the apron area. Passengers can be unpredictable at the best of times – a cellphone glued to the ear and the accompanying mind being miles away engrossed in the call could well be a recipe for disaster in an environment with moving propellers and rotors (and vehicles).

Pilots have also taken to this new technology – a cellphone can be a very useful piece of equipment at an airport to: ring for a taxi, or let the family know you arrived safely, or alter the business appointment, or make alternative arrangements in the event of weather delays. They can also play a part in radio failure situations in flight (or in the worst case scenario of search and rescue services being required).

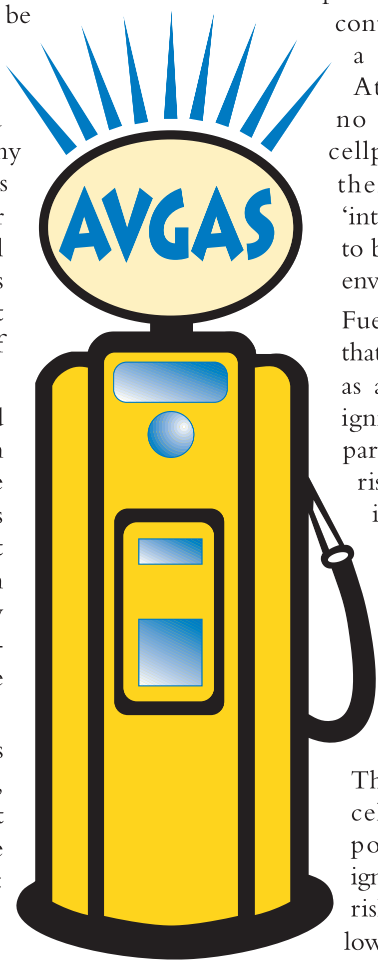
We might assume that pilots are aware of the potential dangers from aircraft movement in the apron area, but what about making that important phone call while refuelling the aircraft (or allowing your passengers to do so)? That may not be such a good idea.

The Dangerous Goods (Class 3 – Flammable Liquids) Regulations 1985 are applicable to Jet A-1 and Avgas. In order to eliminate the possibility of an ignition of dangerous goods, one very important feature of these regulations is to preclude any sources of ignition from within specified distances where dangerous goods or flammable vapours might be stored or used. It will depend on the class of dangerous goods present and the circumstances under which they are used.

A source of ignition is defined as any agency capable of igniting a flammable gas, vapour or other combustible substance. It includes a fire flame, a spark, or any electrical equipment of a type not approved for use in the particular location where flammable substances may be present.

In general, a source of ignition is not permitted within 15 metres of any place involving dangerous goods processing or handling. For electrical equipment, this distance is modified if the equipment is certified as flame-proof or 'intrinsically safe'.

A cellphone is considered as a source of ignition with respect to these regulations; it is classed as electrical equipment which has **not** been certified as 'intrinsically safe'. (Incidentally, a hand-held radio would come into the same category.)



The same situation applies when refuelling your car, and a recent pamphlet available at service stations recommends that cellphones or vehicle radio telephones not be used while on the service station forecourt.

We have heard reports of explosions at service stations overseas, reportedly involving cellphones. One newspaper report in December 1996 referred to an accident in Melbourne, where an Australian woman sustained serious burns after her stationary car exploded while she was using a cellphone. Fire investigators believed petrol leaking from the car ignited, and they were investigating whether the explosion was sparked by the cellphone or by other electrical equipment in the car.

A cellphone service provider contacted said that there was no record, to their knowledge, of any radio device igniting combustible materials. Explosions resulting from radio devices were mainly historical events when the equipment had high voltage. We have 3-volt technology nowadays (with nothing more than 7.2 volts in their products) and the potential for generating a spark is almost nil. It was conceded that if the battery contacts of a cellphone somehow came into contact with each other, a spark could occur. At present, however, no manufacturers of cellphones will warrant their phones to be 'intrinsically safe', ie, able to be used in combustible environments.

Fuel companies confirm that cellphones are classed as a potential source of ignition. The risk is not particularly high, but in risk management terms, it is a risk that can be readily controlled (indeed, eliminated).

We are all more conscious of hazard identification and risk management techniques these days. The simple answer is that cellphones could be a potential source of ignition, and although the risk is considered to be low – why take it? ■

Aircraft Battery Thermal Runaway

What is Thermal Runaway?

Battery thermal runaway occurs when the internal resistance of a cell (or cells) drops because of damage to cell plate separators. The voltage of the cell (or cells) also drops, causing the voltage regulator to increase the current from the generator. This increases the heat within the cell, causing further damage to the plate separator – and so on. This problem is prevalent in Nicad Batteries. However, under similar high-temperature/high-load conditions, lead acid batteries can also become prone to serious over-charging; this might result in explosion of the battery.

There have been a number of aircraft battery thermal runaways where high ambient temperatures of 35 to 40 degrees Celsius – and maybe defective voltage regulation – have possibly been the cause. In one case, neither of the battery over-temp warning lights illuminated (why not, has yet to be determined). The first indication of an thermal runaway was when steam was found coming from the breather vents.

Reducing The Risks of Thermal Runaway

There are some basic measures that can be incorporated into the maintenance programme to prevent battery thermal runaways:

- Check the voltage regulator output regularly under normal operating conditions. For a 24-volt system this should be around 28 volts, though it is recommended that in summer the charge voltage be set between 27 to 27.75 volts to allow for potentially higher ambient operating temperatures. Conversely, for winter set the voltage between 27.75 to 28.5 volts.
- Check the operation and integrity of the battery over-temp detection system on a regular basis. Generally, the sensor is incorporated into the battery itself and will be checked by the Battery Maintenance Facility during deep cycling. This normally requires raising the temperature of the sensor to a specific level and checking for sensor output/switching – this is best performed in a water or sand bath. It is not wise to apply heat from a heat gun, as it does not represent the normal temperature gradient felt by the sensor and could also damage the sensor.
- Properly scheduled battery maintenance should keep the internal condition of the battery at a peak and mean that it is less susceptible to problems.

Preventative Maintenance – Worth The Effort

An aircraft or helicopter battery is an item that may not be inspected on a daily basis (because it can be difficult to access) and can therefore go unnoticed for some time. It also happens to be one of the items which can deteriorate over time, and it does require maintenance. It is worth paying careful attention to the condition and maintenance of your battery to ensure that it remains as safe as possible thereby reducing the risk of fire or explosion.

Pilot Maintenance

So you want to roll your sleeves up and get grease and oil all over your hands by delving into the pits of your aeroplane to fix that little problem. Before you do, make sure that you are allowed to carry out that particular piece of maintenance, otherwise you may find yourself having to foot the engineer's bill to check on it anyway.

A recent amendment to Part 43 *General Maintenance*, now allows a Part 61 licence holder who has the appropriate aircraft type-rating and training, and the authorisation of the owner or operator, to do the following maintenance.

- Replacement of landing gear tyres or tail-skid shoes.
- Greasing and lubrication that does not require disassembly other than removal of access panels, fairings, or cowls.
- Simple or temporary fabric patch repairs where:
  - the repair is not applied to any flying control surface; and
  - the repair does not require the removal of any control surface or structural parts; and
  - the repair does not involve restringing or rib stitching
- Restoration of damaged or worn decorative coatings, and application of

preservative or protective material to components, provided the work does not involve:
  - removal or disassembly of any primary structure; or
  - disturbance of any operating system; or
  - control surface restoration, preservation, or protection.
- Simple or temporary repairs to fairings or non-structural cover plates.
- Replacing side windows, provided the work does not interfere with the structure or any operating system.
- Replacing the aircraft battery.
- Replacing fuses and lights.
- GPS equipment maintenance including:
  - the installation and removal of receivers, provided the equipment has quick-disconnect capabilities, provided any subsequent test requirements are built in to the equipment, and provided the applicable information for the installation and removal of the equipment is immediately available; and
  - the routine updating of database information.
- Replenishment of hydraulic fluid in hydraulic reservoirs.
- Compressor washing provided:
  - the installation of the wash equipment does not require the disassembly of any primary engine control system; and
  - the applicable information for the washing is immediately available and includes procedures for the installation and removal of any wash equipment and the safe operation of the engine during the wash runs and any necessary drying runs.
- Installation and removal of seats, doors, and role equipment provided:
  - the configuration of the aircraft with the particular equipment installed or removed has been approved; and
  - the aircraft Flight Manual incorporates the necessary information for the safe operation of the aircraft with the equipment

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installed or removed, including weight and balance data for each configuration; and
- the applicable information for the installation and removal of the equipment is immediately available; and
- no special tooling, special equipment, or subsequent inspection is required

• The completion of repetitive airworthiness directive inspections provided:
- each flight control system that is inspected is flight tested in accordance with Part 91, Subpart G and re-inspected before the aircraft is released to service; and
- no special tooling or special equipment is required.

A number of changes have been made in response to industry petitions to CAA. One of these changes is the ability to install and remove seats, doors and role equipment. Role equipment is equipment used for a specific role and would not normally be included as part of the aeroplane. Examples of role equipment are cargo nets, litters, external camera booms, spray gear and external fittings for carrying equipment under wings. Examples that are **not** role equipment are hoppers fitted to agricultural aeroplanes and winches on helicopters.

Also, pilots may now install and remove portable GPS equipment and may carry out compressor washes. A recent *Vector* article "Compressor Care" (1997, Issue 6, page 4) mentioned the fact that an engineer needed to complete the compressor wash; with the rule amendment this is now no longer a requirement.

You will notice that pilots are still not allowed to change, remove or clean spark plugs or change any other structural or engine componentry unless under the direct supervision of a licensed aircraft maintenance engineer. ■

Attention Chief Executives!

Aviation Safety Coordinator Courses

Dates have been set for Aviation Safety Coordinator training courses in June and July this year. The course runs for a day and a half. Courses will be held in Queenstown on 11–12 June, Auckland on 16–17 June, Rotorua on 18–19 June, and Nelson on 16–17 July.

An Aviation Safety Coordinator runs the safety programme in an organisation. Does your organisation have a properly administered and active safety programme?

This year the courses will be targeted primarily at commuter airlines, general aviation scenic operations, and flight training organisations. Sport aviation interests may be accommodated on some of the courses.

Some general information about an aviation safety programme was included in *Vector* 1998, Issue 1. Organisations will receive further information and enrolment forms by direct mail early in May.

Any queries should be addressed to: Pam Collings, Safety Education Adviser, Civil Aviation Authority, PO Box 31-441, Lower Hutt, e-mail collingsp@caa.govt.nz.

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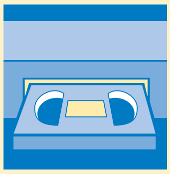

New Video

The latest in our series of safety videos has just been released. It is titled *Momentum and Drag* and looks at how these two important values differ in different classes of aircraft.

Understanding the differences is crucial when transitioning from one class of aircraft to another. The topic is relevant for all pilots, whether you fly a microlight or a wide-body jet. It is particularly important if you are planning to convert from one end of the scale to the other, but even moving from a Cherokee to a microlight can be hazardous, for example.

The video is 21 minutes long and can be borrowed from the CAA Library. A list of all videos available, and information on how to borrow or buy them, was included in the last issue.

Safety-conscious Instructors create Safety-conscious Students who become Safety-conscious Pilots.

Publications

0800 800 359 — Publishing Solutions, *for CA Rules and ACs, Part 39 Airworthiness Directives, CAA (saleable) Forms, and CAA Logbooks. Limited stocks of still-current AIC-AIRs, and AIC-GENs are also available. Also, paid subscriptions to Vector and Civil Aircraft Register.*
CAA Web Site, http://www.caa.govt.nz *for CA Rules, ACs and Airworthiness Directives.*
0800 500 045 — Aviation Publishing, *for AIP documents, including Planning Manual, IFG, VFG, SPFG, VTCs, and other maps and charts.*

Accident Notification

24-hour 7-day toll-free telephone

0800 656 454

CAA Act requires notification "as soon as practicable".