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VECTOR

POINTING TO SAFER AVIATION

CRM for the Single Pilot

Leaning

VFR Above Cloud

36,500-hour Pilot Attends AvKiwi Seminar

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36,500-hour Pilot Attends AvKiwi Seminar

Hallett Griffin has spent 36,500 hours flying agricultural aircraft, so you'd think there wouldn't be much he wouldn't know about fuel management. "No matter how experienced you are, you can always learn, and a good safety culture always needs refreshing."

In this issue...

Cover: *CRM has lessons all pilots can learn from. Photo by iStock.*

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New Zealand Government

CRM for the Single Pilot

At first glance crew resource management (CRM) for the single pilot might seem a paradox, just like 'fighting for peace' or 'a well-known secret agent' – but it is not.

While multi-pilot operations have traditionally been the focus of CRM training, many elements are applicable to the single pilot operation. In fact, many CRM practical skills are really just extensions of airmanship and human factors training.

Where Did CRM Come From?

CRM is now a key element in airline operations, but only 30 years ago it was a completely new concept.

In the 1970s, a number of airline hull losses in Europe and the United States led to the conception and introduction of CRM in airlines. NASA research showed human factors failures were involved in a large number of US jet transport accidents, particularly in the skill areas of:

- decision making,
- leadership,
- pilot judgement,
- communication, and
- crew coordination.

Lumping it all together as 'pilot error' was no longer acceptable.

What is CRM?

In a nutshell, CRM is the effective management of all resources available to the pilot to complete a safe and efficient flight. CRM has historically concentrated on management skills for pilots, and while it has focussed on a variety of skill sets through the years, the basic principles have remained the same.

Training courses typically include: communication and interpersonal skills, situation awareness, problem solving, decision making and judgement, leadership and 'followership', stress management, and critique. In recent years the introduction of threat and error management has been added to this list.

...CRM is the effective management of all resources available to the pilot to complete a safe and efficient flight

CRM for the Single Pilot

While some of the topics involved in a CRM course, such as leadership and followership, and inter-crew communication, are not relevant for the single pilot, other elements, such as threat and error management, decision making, and planning, take on additional importance when there is no other crew member to work with.

The most common factors in general aviation accidents and incidents are poor judgement and poor decision making. Adapting CRM for the single pilot can give pilots the tools they need to apply good judgement and improve their decision making skills, as it has done in the airline sector.

The critical lesson in CRM is to use all of the resources around you. Operating single pilot may make you feel on your own, but in fact there are plenty of resources at your disposal. The most obvious, and unfortunately most underused, is air traffic control. If you have a problem, let them know – they can't help if they don't know. And if they don't know, they may end up contributing to the problem.

You are never alone, even if it's just you in the aircraft. Use *all* available resources. Seek help from whoever you can contact: ATC, other aircraft, ground staff, passengers, company operations.

Practical Things You Can Do

Every day you fly, you can apply CRM practices – here are some things to get you started.

Communication

Keep people who need to know, in the loop. Updating your passengers or other non-flying crew members during normal and abnormal operations will lead to an improved information flow. You may need that critical piece of information they have.

When there is no second pilot to confirm the altitude restriction you copied, or the heading to turn onto, make sure you clarify whatever you need to with ATC.

Be alert to the fact that communication suffers when you are busy, tired,

Continued over...

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distracted, interrupted, and more importantly when the information you are receiving does not fit with your preconceived ideas.

Maintain Standards

Standard Operating Procedures (SOPs) are a critical part of any airline operation and an important tool for identifying and trapping errors. Every organisation will have SOPs in some form and it is your responsibility to be familiar with them and then comply with them. A lot of care, consideration and experience has gone into the development of SOPs, but they are not infallible, so if you do have an issue with any SOP, take it up with the organisation, don't just adapt it to suit yourself.

An important part of SOPs are checklists. As a single-pilot operation you are reliant on checklists to replace the 'challenge and response' element of a crew environment, so checklist discipline is critical. Just as important is the time at which you execute a particular checklist. Take some time to consider and develop some cues for when you would carry out particular checklists, and challenge yourself to use the checklist properly every time.

Maintaining and promoting a healthy safety culture within your organisation is everyone's responsibility.

Maintaining and promoting a healthy safety culture within your organisation is everyone's responsibility. Make a conscious effort to do this by setting a good example and freely sharing information.

Health

Incapacitation procedures are well practiced in the airlines, but single pilot, you have to be your own backup. Consequently, you must firstly take good care of yourself and secondly make sure you are fit to fly. Using the *"I'M SAFE"* checklist is a good idea.

While in flight, if you feel unwell, do not press on, get on the ground at the nearest suitable airfield and make use of all the available assistance. The single biggest cause of pilot incapacitation is gastroenteritis, and that can happen to anyone, at any time. SOP for pilot incapacitation in airlines is to declare an emergency. Engage the autopilot, if you have one, and declare an emergency.

Workload Management

This is the most important element of single-pilot CRM. You can only process a certain amount of information at one time, so being aware of your workload and preserving some mental capacity is important, but even more important is being well prepared.

Know your aircraft – what are the system failure indications, what are normal operating parameters, what are the emergency drills you must know off by heart? Spend time thinking about the 'what if' scenarios. Then, when 'what if' becomes 'right now' you have already considered what you will do.

Take the time to become familiar with every aspect of your operation. A thorough planning session and preflight briefing will go a long way towards eliminating any surprises. You should aim to have a good understanding of: the weather conditions en route, at destination and at the diversion airfield, ground and departure procedures, flight routing, aircraft serviceability, and arrival procedures.

Be completely familiar with how the autopilot and other automation devices (like the GPS) work. Practice getting to the information you need so that you are not distracted during critical phases of flight. Understand their limitations and then use them as much as practicable.

Situational Awareness

Just as important as workload management, is maintaining excellent situational awareness. You should be constantly updating your mental picture with all the new information you receive. Situational awareness is particularly important during the departure, approach, and landing phases. Controlled Flight Into Terrain (CFIT) accidents tend to occur because of a loss of situational awareness in these phases.

The critical lesson in CRM is to use all of the resources around you.

Threat and Error Management

This is a relatively new development in the CRM suite of skills, but is proving to work well operationally. Some research suggests that crews should expect at least one threat per flight. Aviation is an environment filled with threats.

Threat management aims to identify the potential threats to your operation, and to manage them so that they do not impact negatively on your flight. Some threats can be anticipated, others will happen without warning.

Take some time before the flight to consider the particular threats you may face on today's flight. The most common threats to the safe operation of a flight are:

- adverse weather,
- ATC,
- environmental operational pressures,
- aircraft malfunctions, and
- airline operational pressures.

Of these, the ATC threats are the ones most likely to be mismanaged.

For example, if you know that at a particular airport ATC could give you a late change to your departure, you should identify that as a threat. You can then choose to brief the alternative departure as well as the cleared one, so that you are prepared for the change if it comes.

Pilots make errors. We may never be able to eliminate errors completely from the aviation system – it is, after all, run by people, but we must be able to admit those errors, manage them, and above all learn from them.

Being completely familiar with your aircraft, and your operation, enables you to trap errors before they become significant.

One key strategy you might like to try is to identify times when errors are most likely to occur, such as during times of high workload. Isolate the type of errors you are likely to make and then develop and implement a safety procedure to increase your chances of either avoiding or catching those errors.

Decision Making

If an emergency or an abnormal situation does occur, be prepared for the 'startle reflex', and don't let it rush you into a decision. The startle reflex is a normal and instantaneous reaction as the brain absorbs information about an emotionally significant event, before we are aware of it ourselves. It often shows up as shock or disbelief.

There are only a few situations in which you have to act immediately, and your actions in those cases should be second nature, but in all cases *fly the aircraft*. Otherwise take time, *while making sure you fly the aircraft*, to make a proper diagnosis, take the appropriate actions, *while flying the aircraft*, and then at an appropriate time evaluate the information you received and the actions you took, to make sure your decisions were correct.

Here is one decision making model you might like to try:

D	Detect the fact that a change has occurred
E	Estimate the need to counter or react to the change
C	Choose a desirable outcome for the success of the flight
I	Identify actions which could successfully control the change
D	Do the necessary action to adapt to the change
E	Evaluate the effect of the action

CRM for the PPL

Just because you are a PPL does not exclude you from the responsibility of knowing about, and putting into practice, the principles of Crew Resource Management. In fact, the recently revised PPL and CPL human factors syllabuses include stress management, situational awareness, judgement and decision making, social psychology, flight deck management, threat and error management, culture, and documents and procedures, as separate topics.

Self Assessment

Operating as a single pilot means you do not have the benefit of feedback from another crew member – therefore, you need to learn from your own experiences. Having said that, there is no way you are going to make all the mistakes possible, so make sure you take every opportunity to learn from other people's mistakes.

An important element of the CRM programme is a reporting system – a way to learn from the experiences of others. Does your organisation have a reporting system or a feedback loop? ■

More Information

Aircraft Human Performance Limitations: notes on the human performance and limitations syllabuses for the private and commercial pilot licences. Wilson.

Air Pilot's Manual Series Volume 6 (Human Factors & Pilot Performance). Trevor Thom.

Human Factors for the Professional Pilot. Trevor Thom.

Human Factors for General Aviation. Trollip & Jensen.

Human Factors for Pilots. Green, Muir, James, Gradwell and Green.

UK CAP737 *Crew Resource Management (CRM) Training*. http://www.caa.co.uk/cap737

Advisory Circular 91-11 *Single Pilot IFR*. www.caa.govt.nz/rules/ACs.htm

VFR Above Cloud

If you encounter a lowering cloud base while on a cross country flight, it can be tempting to climb up through a hole and fly VFR above cloud or 'on top', particularly if the weather at your destination is clear. This is a risky decision, however, given the changeable nature of New Zealand's weather.

Not a Good Idea

Pilots create at least three major problems for themselves by flying VFR on top. First, you compromise your ability to navigate accurately. Second, you lose situational awareness of where terrain is below you, and third, if you have an engine failure, you will be forced to descend through the cloud layer – a terrifying situation to be in.

Given the changeable nature of New Zealand's weather, there is no guarantee that a hole will exist to enable you to get below a cloud layer again if you opt to go over the top. Even if you establish that a hole exists at your destination before deciding to fly on top, by the time you get there it could very easily have closed in.

"The best piece of advice is – don't do it. If you do, it could be the longest flight you can remember – if you live."

Descending through a cloud layer is not an option without appropriate equipment and a current instrument rating. This is incredibly dangerous due to the risk of spatial disorientation, and because you will have no way of maintaining terrain clearance. Not to mention that it is also against the rules.

Civil Aviation Rules set the minimum safety standard. Aircraft on air operations are not permitted to fly VFR on top. Rule 135.155(e) states that an air operation may not be performed under VFR above more than scattered cloud unless the aircraft is authorised and equipped for IFR flight, the pilot holds a current instrument rating, and sufficient fuel and fuel reserves are carried to proceed by IFR to an aerodrome where an instrument approach procedure can be carried out. Single engine aircraft are not permitted to fly VFR on top on an air operation under any circumstances (rule 135.155(f)).

The rules for private operations are less prescriptive. The VFR meteorological minima in Part 91 do not preclude private flights above cloud – however good airmanship does. If you get into a situation where you cannot find a hole or have an engine failure, and descend through cloud, then you will be breaking the rules.

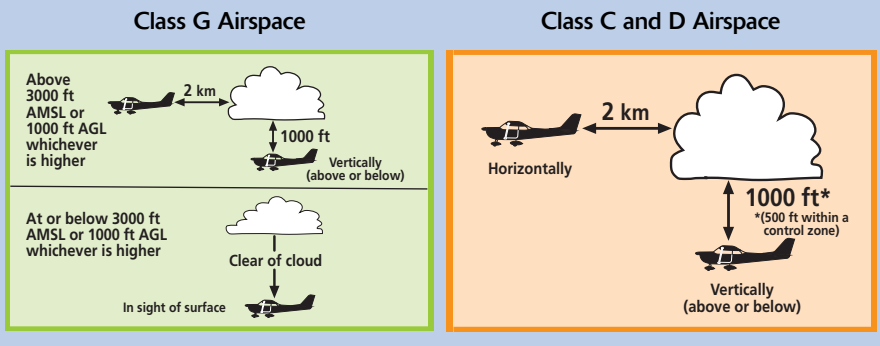
How to Avoid Getting Stuck on Top

Careful pre-flight planning is essential. Think about the weather and the suitability of your route given the conditions on the day. If you are unsure about whether you can make it through a mountain pass given the cloud base, pre-plan alternative routes before you depart. Changing to an alternative route is always preferable to climbing up through a hole and going over the top. Even if this means doubling back and taking the long way around. With this in mind, plan to have enough fuel on board to go the long way if necessary, without using your reserves.

Helicopter pilot Keith McKenzie is based in Taumarunui and has 36 years flying experience.

"The best piece of advice is – don't do it. If you do, it could be the longest flight you can remember – if you live. Holes seem to close extremely quickly

VFR Meteorological Minima (rule 91.301, Table 4).



and open very slowly. The weather can change so much, so quickly, that it can lead to an emergency situation almost instantly.

"The fastest way to lose weight is to fly VFR on top – you will be amazed how much you can sweat in a matter of minutes. Do not fly on top unless you have the knowledge and experience of a current instrument rating and an aircraft equipped with all the goodies.

"Always keep one eye in front for the next big hole and one eye behind on the last. If you lose sight of the hole behind without seeing another one in front – go back. It may take a while to go back to the last hole – but at least you know it exists, unlike continuing on, as there may not be another one," says Keith.

In order to make the best possible decisions en route, always obtain up to date weather information from an ATS unit and other aircraft.

What to Do if Stuck on Top

Most importantly, don't panic. Establish a plan for inadvertent VFR on top well before the situation arises. Fly the aircraft, and establish communications early with those who can help. Do some quick fuel and daylight calculations to establish how much time you have available to make a sound decision on how to proceed.

Seek help – make a mayday or pan call and squawk 7700. If you are inside radar coverage, ask your nearest ATS unit to confirm your position. Talk to other aircraft in the area, find out the position of those in VMC, or ask IFR aircraft higher than you if they can see areas of VMC. They may be able to direct you to a hole.

Use any and all navigation equipment at your disposal (if you know how). To help orient yourself, you could tune up an NDB station – the needle will point in the direction of the station, and if nearby aerodromes have DME you could use this to find out your distance from them. GPS can also help with navigation and possibly assist with terrain awareness if equipped with a moving map display.

Look at the Maximum Elevation Figures shown in each fifteen minute quadrangle on the Visual Navigation Charts. This gives (in feet above mean sea level) the highest known feature in each quadrangle, including terrain and obstructions. If you stay above this height, you will maintain terrain clearance.

When flying under low cloud towards rising terrain it can be tempting to climb through a hole. Don't do it – find an alternative route.

Fly higher – you will be able to see further, but remember there is a trade off between gaining height to see further, and requiring more power to maintain straight and level flight at higher altitudes.

If you climb above 10,000 feet be aware of how long you have spent up there as hypoxia will affect your decision making.

Adjust your power to fly at best range speed. You can find this setting in the flight manual. Don't go charging around at cruise power.

Subject to what you know about the weather behind you, in westerly conditions head east, the tail wind will help with range and the east coast will generally be clearer in westerly conditions, and vice versa in easterly conditions – head west.

Do not, under any circumstances, descend through cloud. The five hours of instrument time required for a fixed wing PPL (or 10 hours for a CPL) do not equip you with the skills to descend through a cloud layer, because of the dangers of spatial disorientation. You will also have no way of maintaining visual terrain clearance.

Fixed wing pilot Russell Baker has been flying for 40 years and clocked up 9500 hours. In Russell's experience, his students only lasted 90 seconds before suffering spatial disorientation in simulated IMC.

"If you inadvertently end up on top, have patience, because you have time to think about the situation and sort it out – if you end up in cloud you have no time at all – only a matter of seconds.

"VFR on top is a lonely experience. Anxiety builds, rational thinking becomes difficult, and every minute seems like an hour. Take note of your compass heading and make a gentle turn through 180 degrees. The return journey to clear skies seems to take an eternity. Once you can see the ground again your anxiety factor is still very high and good decision making can be some time away. It is essential that pilots take a good look at what has just happened and spend time reassessing the situation. Flying on top is throwing away your last trump card, and sometimes we all need a full pack of trumps," says Russell.

To get below a cloud layer again, find the biggest hole you can to minimise the angle of bank required to descend through it. Reduce your speed to minimise your turn radius, but caution is required due to a possible reduction in margin above the stall. The use of flap can assist in increasing your rate of descent but the increase in drag can make speed control more difficult – be careful not to exceed your flap speed.

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Make sure the aircraft is stable before you lose your visual horizon because at that point it gets harder to maintain attitude and air speed.

Position the aircraft at the edge of the hole and make a coordinated descent, anticipating the aircraft's position in advance. Be aware that the hole's position could shift and the dimensions may change. If in doubt, do not attempt to descend through it. Before starting a descent, anticipate the situation below it in terms of terrain, traffic, and the requirement for power to counteract a high descent rate.

Descending through a hole in a cloud layer is an emergency manoeuvre. In order to successfully complete this you must be competent in handling your aircraft. If you are not trained in, or competent in, carrying out a steep gliding turn, it is essential that you pick a hole big enough to make a straight descent through – with no angle of bank required.

Summary

Don't be tempted to go VFR on top. If you do, you compromise your ability to navigate accurately, your situational awareness of terrain below, and if you have an engine failure on top, you have no option but to go down blindly.

There is no guarantee that a hole will exist to enable you to get below a cloud layer again if you opt to go over the top, and descending through a cloud layer is not an option. This is incredibly dangerous due to the risk of spatial disorientation, and because you will have no way of maintaining terrain clearance. ■

SPATIAL DISORIENTATION

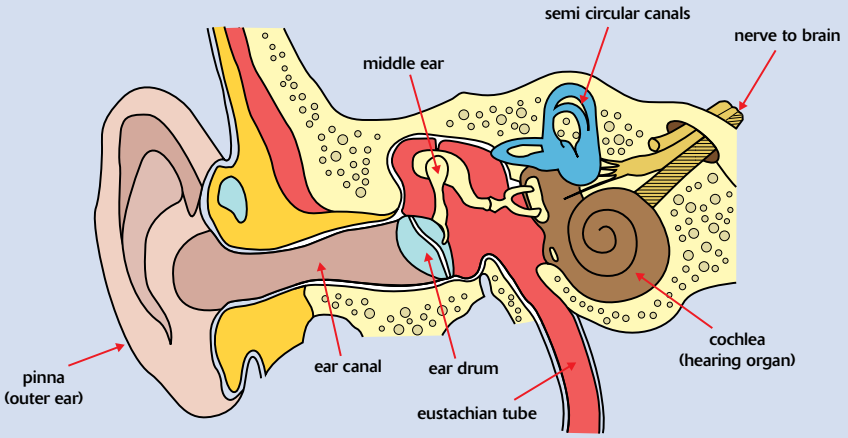
Our bodies orient themselves with reference to three things: visual cues, "seat of the pants" spatial cues, and the inner ear balance mechanism. If you completely lose visual reference, 80 percent of your orientation information has gone. The remaining two systems alone are not accurate.

The non-auditory portion of the inner ear contains three semicircular canals. Each canal is filled with fluid, and at one end of each canal are sensory hair cells or cilia. Rotation of the body moves the fluid in the canals, causing displacement of the cilia. This transmits messages to your brain telling it which way the cilia are displaced. The brain then figures out the direction of your rotation. Since the canals are located at approximately right angles to each other they can report on rotation in three dimensions, similar to a three axis gyro.

When outside visual input is obscured and the "seat of the pants" input is ambiguous, spatial disorientation can occur quickly because the fluid in the inner ear only reacts to rate of change, not a sustained change. For example, if a constant-rate turn continues for more than 15 seconds, it is impossible for the canals to detect that you are still in a turn, especially if it is gentle. If you are manoeuvring in IMC and believe what your body is telling you, instead of what your instruments are telling you, it can quickly lead to an unrecoverable situation.

For more information see the article "178 Seconds to Live", *Vector* January/February 2006.

The Inner Ear



Where is the terrain below?

Leaning

Less Air Requires Less Fuel

Air to Fuel Ratio

As an aircraft climbs from sea level, less air (oxygen) is available to burn a given quantity of fuel. The air to fuel ratio changes.

The air to fuel ratio is the ratio of the weight of the air to the weight of the fuel that enters the cylinders.

If you add more fuel to an engine, you are enriching the mixture. Conversely, if you are adding less fuel, you are leaning the mixture.

In a normally aspirated petrol engine, the workable limits of air to fuel ratio (mixture strength) are from 9:1 (rich) to 18:1 (lean).

If an engine is run too rich, spark plug fouling may occur. If an engine is run too lean, high temperatures, pre-ignition, and detonation may occur.

Why Lean?

Economy, range, engine longevity, and performance are only a few of the benefits gained from a correctly leaned piston engine aircraft.

Economy

A typical light training aircraft, properly leaned, can reduce fuel consumption by approximately 13 percent at normal cruise altitudes and power settings. In some situations, this could mean the difference between refuelling en route or not.

The most economical cruise occurs at a point where the lowest specific fuel consumption occurs (see graph). However, most engine manufacturers don't recommend operating on the lean side of the peak exhaust gas temperature (EGT). For the general aviation pilot, this means that the most economical cruise occurs at peak EGT.

Range and Performance

Cruise performance and range data contained in an aircraft flight manual is usually given for operation with the mixture correctly leaned. The difference in range between having the mixture rich and the mixture leaned can be significant – around 20 percent in some situations. Unless you correctly lean an aircraft engine you will not be able to achieve flight manual figures.

Engine Longevity

Operating with the mixture richer than necessary is not 'being kind' to the engine – in fact the opposite can be the case. Operating a normally aspirated engine at high altitude with an excessively rich mixture not only wastes fuel, but also produces less power. Surplus fuel is rarely required for combustion chamber cooling at high altitudes, and the use of mixtures that are too rich usually only introduces other problems such as spark plug fouling or increased cylinder wear.

Engine Trends vs. Fuel Flow

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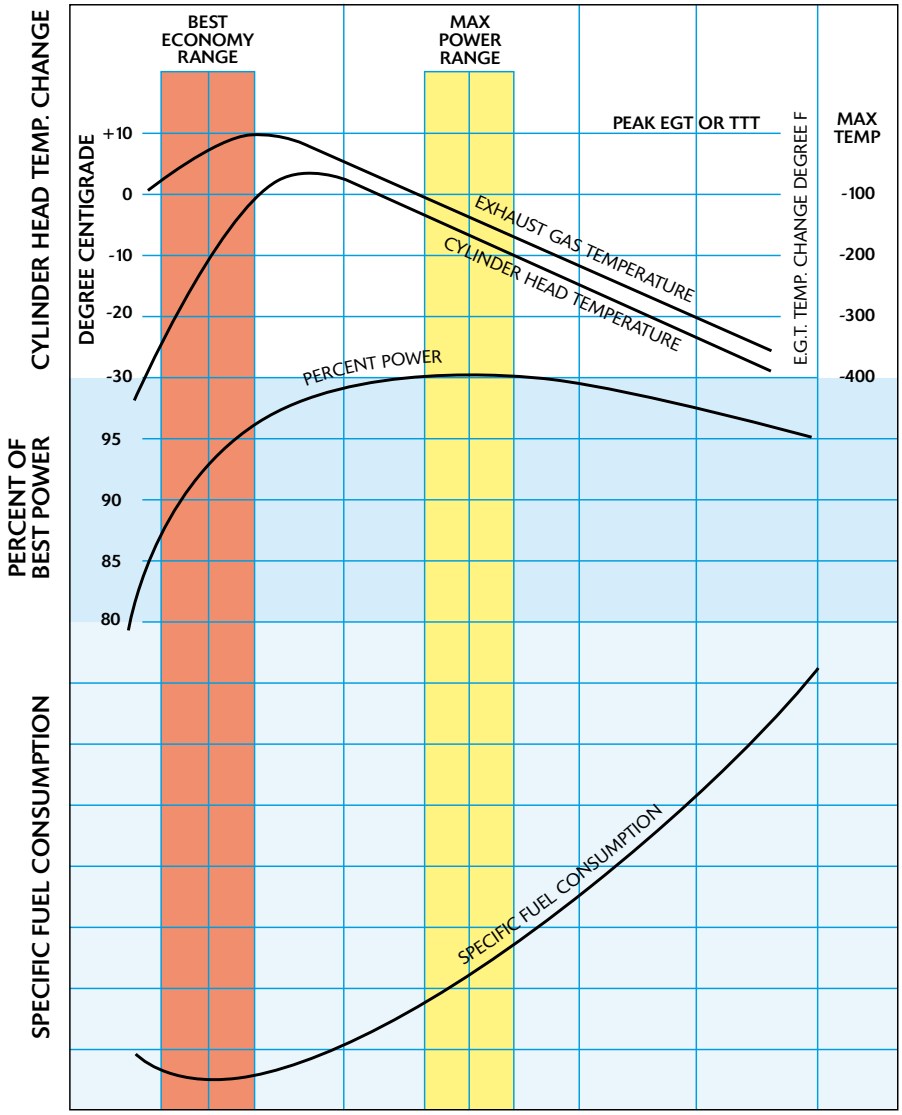

The orange and yellow areas in the graph indicate ranges of mixture strengths for both maximum power output and best economy.

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When to Lean

There are three occasions when an aircraft engine should be leaned:

- In the cruise at power settings below 75 percent
- When taking off from an aerodrome of high elevation or density altitude
- During an extended climb

Power Settings Below 75 Percent

Most aircraft should be leaned at any height providing the power setting is below 75 percent.

As many aircraft do not have a gauge that indicates power, pilots must use other gauges to judge power settings. Instruments such as manifold pressure or RPM gauges can indicate percentage power at a certain altitude. Performance data from an aircraft flight manual will indicate what manifold pressure, or RPM setting, should equate to a certain percentage of power.

High Elevation Aerodromes

In order to produce the maximum amount of power available during takeoff at aerodromes of high elevation or density altitude, normal aspirated engines should be leaned. At some high elevation aerodromes, when full throttle is applied, the engine might only be able to produce a percentage of the power available at sea level. In this situation, you should lean the aircraft engine to restore smooth engine operations. If you intend to land at the same aerodrome, take note of the mixture lever position, as it will need to be returned to this position during your approach to land. This will ensure that the maximum amount of power will be available if a go-around becomes necessary.

Extended Climb

A correctly leaned engine will produce more power in the climb. Engine leaning should only be carried out to restore smooth engine operations, as excess fuel is used for engine cooling.

When Not to Lean

There are two situations in which the mixture should be set in the full rich position during power settings below 75 percent:

- Prior to an increase or decrease in power or altitude
- On short final to land at aerodromes of low elevation

This exhaust valve has only been in service for 19 hours and shows severe damage caused by over leaning. Failure at the neck of the stem would eventually result. Picture courtesy of Lycoming A Textron Company.

Cessna 152 – Lead fouled spark plug.

The mixture must always be returned to the full rich position before increasing power, and then re-set. It should also be re-set for any change in altitude.

It is good practice to always select full rich mixture before joining the circuit for a landing at an aerodrome of low elevation. Other distractions near the ground can cause the mixture setting to be overlooked and in this situation a pilot could encounter serious difficulties with pre-ignition or overheating if a go-around became necessary.

How to Lean

There are three methods for manually leaning an aircraft engine:

- Revolutions Per Minute
- Fuel Flow or Pressure
- Exhaust Gas Temperature

Revolutions Per Minute Method

The revolutions per minute (RPM) gauge and, in favourable conditions, the airspeed indicator (ASI) are useful guides in establishing mixture settings.

Fixed Pitch Propellers

For aircraft with fixed pitch propellers, the throttle should be set for the desired cruise RPM as shown in the aircraft flight manual, and the mixture then gradually leaned from full rich until the RPM gauge gives a maximum reading. In smooth flight conditions, a gradual increase in airspeed will become evident. At peak RPM and IAS, the engine is operating in the maximum power range.

Constant Speed Propellers

In the case of constant speed propellers, the mixture should be leaned until the ASI reading reaches a peak, or there is a power loss, or evidence of rough running. The mixture should then be enriched until the engine runs smoothly, and power and airspeed are fully restored.

Where the use of cruise power at best economy settings are permitted in the aircraft flight

manual, the mixture is first leaned from full rich to maximum power. Then leaning is slowly continued until the engine begins to run roughly, or power and airspeed decrease rapidly. When either occurs, the mixture should be enriched sufficiently to obtain an evenly firing engine, or to regain most of the lost airspeed and engine RPM. Some engine power and airspeed must be sacrificed to achieve the most economical mixture setting.

Fuel Flow or Pressure Gauge Method

For aircraft with fuel-injected engines, the mixture can be leaned manually using the fuel flow or pressure gauge. Settings for a given cruise power and altitude are obtained from tables or other data provided by the aircraft manufacturer.

Exhaust Gas Temperature Method

One of the most accurate methods of establishing correct mixture strengths is to use an exhaust gas temperature (EGT) gauge.

To establish the maximum power setting by this means, lean the mixture to the point at which the temperature reading reaches maximum, and then enrich again to achieve a fixed temperature drop.

Whenever best economy operation is permitted by the aircraft flight manual or the engine operating manual, the mixture may be leaned to peak EGT. The fuel to air ratio graph shows that peak EGT occurs essentially at the rich edge of the best economy mixture range. It also shows that operation at peak EGT not only provides minimum specific fuel consumption, but also approximately 95 percent of the engine's maximum power capabilities for a given engine speed and manifold pressure. Specific fuel consumption is the best production of power for the amount of fuel used.

Aircraft with turbo-charged engines frequently have an exhaust gas temperature pick-up installed in the turbine inlet to measure turbine inlet (exhaust gas) temperature. The procedures for leaning these engines, using turbine inlet temperature, are slightly different, and the technique and reference temperatures published in the aircraft flight manual should be strictly observed.

Monitor Trends

Caution should be exercised if relying on one gauge when leaning. Unless the gauge remains accurate within close limits, the engine could be receiving a mixture that is either too rich or too lean. Although determining the correct strength by means of a fuel flow or exhaust gas temperature gauge is clearly preferable to setting it 'by ear', the accuracy of settings established by these methods still relies on the cockpit gauges and sensing units remaining close to correct calibration at all times.

As a final check, once the mixture has been set for cruise operation, the cylinder head temperature and oil temperature gauges should be constantly monitored. Although these two instruments have slow response times, the trend in their readings is a useful guide in maintaining the correct mixture strength.

When leaning, adjust the mixture lever slowly.

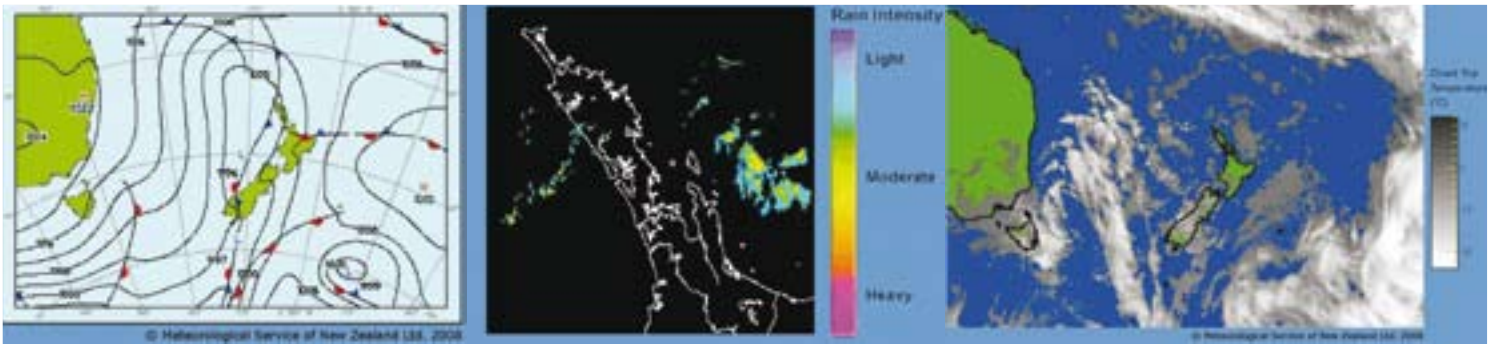
Points to Remember

- Sensible use of the mixture control at cruise power is, in practice, only correcting an over-rich situation.
- When fuel flow data from the aircraft flight manual is used for fuel planning, the mixture will need to be leaned in flight to at least best power setting to achieve the planned figures.
- At power settings above 75 percent, full rich mixture is required for cooling, but slight leaning may be used when climbing above 4000 to 5000 feet density altitude to smooth out engine operation.
- Always check that the optimum mixture setting is selected prior to all landings because you might need it for a go-around. This setting is full rich at aerodromes near sea level. ■

Case Study

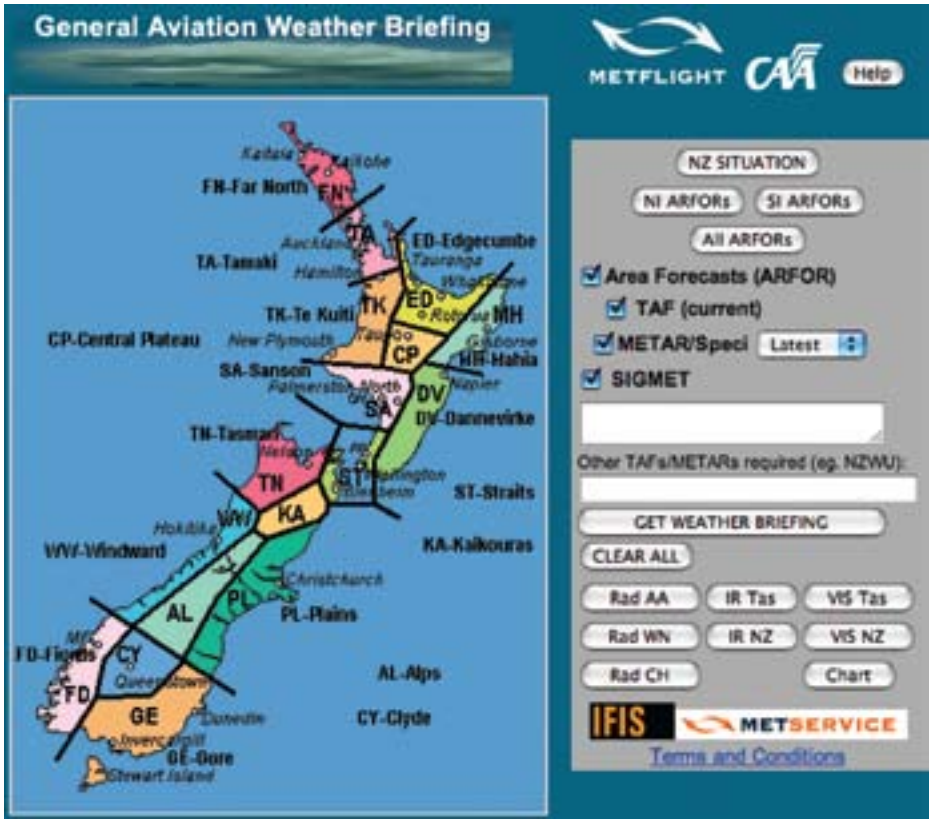
Captain Brian steps through the practical technique of leaning a Cessna 152.

- Captain Brian checks the weather for his cross country flight and decides he would like to cruise at 8500 feet.
- He then checks in the aircraft flight manual which RPM setting at 8500 feet equates to 75 percent or less power. He decides to use 2300 RPM.
- While climbing through 5000 feet, the engine starts running rough, so Captain Brian leans the mixture until the engine runs smoothly again.
- In the cruise, the throttle is set for 2300 RPM, and the mixture is leaned until the engine starts to run rough. The mixture is then enriched until the engine runs smoothly again.
- Captain Brian is reaching the top of descent. He starts to enrich the mixture and arrives in the circuit with full mixture selected.



MetFlight GA

http://metflight.metra.co.nz



MetFlight GA's meteorological information is available to all pilots, flying clubs and flight training organisations conducting VFR or IFR recreational or training flights, at or below 10,000 feet.

How to log on to MetFlight-GA

Username

Part 61 Pilots: pilot licence number.

Part 149 Pilots: membership or pilot certificate number, with the appropriate prefix in front. Prefixes: Gliding New Zealand – GNZ, NZHGPA – HP, RAANZ – R, SAC – S.

Password

Part 61 Pilots: initial issue date or your licence in the form d/mm/yyyy.

Part 149 Pilots: contact your Part 149 organisation, they will issue you with a password.

If you experience problems logging in contact Peter Lechner, Email: lechnerp@caa.govt.nz

36,500-hour Pilot Attends AvKiwi Seminar

Hallett Griffin has spent 36,500 hours flying agricultural aircraft. That's the equivalent of just over four years of continuous time. So you'd think there wouldn't be much he wouldn't know about fuel management.

"No matter how experienced you are, you can always learn, and a good safety culture always needs refreshing," Hallett says of his decision to attend this year's AvKiwi seminar on fuel management at Massey University, Palmerston North.

Hallett has been flying agricultural aircraft for 44 years. It caught his imagination as a young man on his parent's farm.

"I used to see the Ag aircraft on my father's property, and get the occasional ride in an Auster."

He took a job loader driving as soon as he could leave school, and says he loves agricultural flying because of its connection with farming.

"If I couldn't be a pilot, I'd want to be a farmer."

And the thrill.

"There's exhilaration in flying aircraft at low level."

In all his time flying, Hallett has only ever suffered one serious accident (wirestrike), and three other accidents.

About 15 years ago he ran out of fuel and had to carry out a forced landing.

"That was caused by me not having my mind on the job 100 percent, commercial pressures and rushing.

"Another pilot went on holiday at short notice, so I drove out to the area, rushing to beat the weather, hopped in the aircraft and forgot to check the fuel. It hadn't been refueled and I only had about two thirds of a tank.

"Rushing is often the cause of accidents such as running out of fuel. You've got to take the time out for sufficient planning. Stop thinking about the next job, sit down and do a calculation. Make sure you've got enough, and don't hesitate to put more than enough in the aeroplane," Hallett says.

"Encourage the ground crew, and everyone else involved with the aircraft to keep an eye on the fuel gauges and to pipe up if there's any doubt.

"I might be an experienced pilot, but even if the loader driver's only been working here for a year, he's still quite free to ask me if I've got the fuel right," Hallett says.

He made a determined effort to show up to this year's AvKiwi seminar.

"I'm rather embarrassed to admit that this is the first one I've been to. I've always thought I should, but then there's always been something else on.

"Having been, I would encourage everybody in aviation to go along. They are very well run. And they'll give you food for thought." Hallett says. ■

AV KIWI SAFETY SEMINARS

Fuel Management

Time in Your Tanks

- **one every two and a half days in the USA**
- **one every 10 days in Australia**
- **one every 52 days in New Zealand**

On average that's how often an accident is caused by fuel mismanagement. Feeling good about how New Zealand measures up? Well don't, because when you compare them to the hours flown in each country, they are practically the same.

Our presenters for this year's AvKiwi seminars had over 84 years of aviation experience between them. Some of our participants were also very experienced, but one in particular stood out, Hallett Griffin (see article on page 13), who has over 36,500 hours of agricultural flying, found the time out of his busy schedule to attend.

Carlton Campbell, CAA Training Standards Development Officer, Jim Rankin, RNZAF Instructor, and Andrew Warland-Browne, CASA Aviation Safety Adviser presented this year's seminars to almost a thousand participants, and were really pleased with the feedback and participation of the audiences.

Carlton was particularly pleased with the participation, "lots of people wanted to share their fuel mismanagement stories, and that is great, because that's how we all learn – by listening to others who have found themselves in a tricky situation and working out how we would avoid it."

There were a number of key themes and safety messages to emerge. The critical, and consequently the simplest, message was to *fly the aircraft*. Of the accidents that were highlighted, all of the fatalities, and many of the injuries, could have been avoided if the pilots spent less time trying to diagnose the problem and more time flying the aircraft.

Jim Rankin presents the AvKiwi seminar in Kerikeri.

Shaun Sutherland and Tim Spicer of the Northland Districts Aero Club use the dipstick readings to fill in the new Fuel Log.

Another important message was to take account of the impact a change in wind will have on your fuel planning. Try this question that Jim Rankin posed:

Q. If you plan a flight of 200 NM at a cruise speed of 90 kts, with a 10 kt tailwind and you carry fuel for 2.5 hours of flying, how much will the wind have to change in order for you to use up your entire reserve?

Answer at the end of this article.

Andrew Warland-Browne placed particular importance on always confirming how much fuel you have on board, "never waste an opportunity to check your fuel state. If you are on the ground, always dip your tanks." Then, when you know for a fact what you have, keep that knowledge updated so you always know how much fuel you have on board. Andrew also recommends, "when you next carry out a fuel drain remember to check for COWS – Colour, Odour, Water, and Sediment."

As part of this AvKiwi series, the CAA (in association with CASA) has produced a fuel management tool, a card that helps you to manage your fuel by working out how many minutes you have in your tanks before you depart, and then monitoring and updating the fuel on board throughout the flight. The card is hole-punched ready to fit into your *AIP Vol 4*, or on your clipboard, and is laminated so it can be written on with permanent marker, and then cleaned with some of that Avgas you just drained from the tanks! There are instructions below on using the fuel card enclosed in this issue of *Vector*.

To end with an aviation truism, the three most useless things in aviation are:

- Runway behind you,
- Sky above you, and
- Air in your fuel tanks.

Weather to Fly

Weather is the theme for next year's AvKiwi seminars. There are a lot of changes in the meteorological field and it's always good to keep up with the latest developments. Seminars will be held in selected regional centres next year so keep an eye on *Vector* and the CAA web site for the dates and venues.

Question answer: The wind will only have to change to a 10 kt headwind.■

Fuel Card Instructions

Let's work through an example:

1. Establish known fuel

Work out how many litres or gallons you have on board by dipping the tanks, visually checking, or by another trusted method. Write it in the boxes. For this example we have used 90 litres.

2. Determine cruise fuel flow from the Flight Manual

Fill in as many of the boxes as you can, or need to. You may want to fill in the taxi, climb and descent fuel flows, but we have just filled in the cruise (36) and a hold amount (24), because it's always useful to know this figure. Remember to make sure that you are dealing with the same units: litres and litres per hour, or gallons and gallons per hour.

3. Convert to fuel time

With our example of 36 litres per hour and 90 litres per side, the calculation is: 90 litres ÷ 36 litres per hour = 2.5 hours or 150 minutes, each side.

4. Turn over the card

In the *minutes each tank* column, find the minutes value for each tank and draw a line across the tank. In our example, the line is drawn at the 150 minute point. If your reserve is not the 45 minutes the card has allowed (22.5 minutes a side), draw a line at the bottom of the card to indicate what your reserve is and block it out.

This method also works if you have one tank or four.

5. Gauge column

Insert the readings from the fuel gauges next to the line.

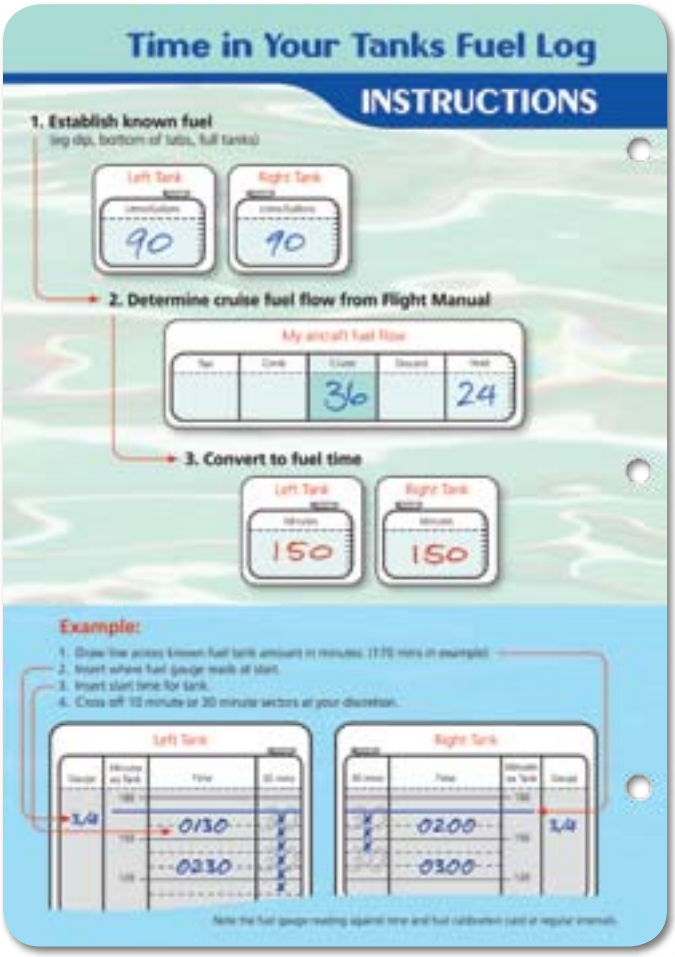
The planning stage is now over – from now on this card is used in flight.

6. Time

In the time column, below the line, write down the time you start using fuel from that tank. We will start on the left tank at 1230.

7. Progress

While you are flying, cross off every 10 minutes, or 30 minutes if you prefer, flown. Swap sides every time you change tanks and put the time you change tanks in the appropriate place – then you will know at a glance what fuel you have on board at any time.



Recreational Pilot Licence

The Recreational Pilot Licence (RPL) enables pilots who fail to meet the Class 2 medical certificate standards, or find the specialist reports too costly, to continue flying the aircraft they are familiar with, rather than convert to microlight aircraft that have a completely different set of performance characteristics.

As this is a new type of licence, pilots should familiarise themselves with the requirements in Part 61 *Pilot Licences and Ratings*. For additional information, see AC61–20 *Pilot Licences and Ratings – Recreational Pilot Licence*.

The Director has been able to issue RPLs since 8 May 2008.

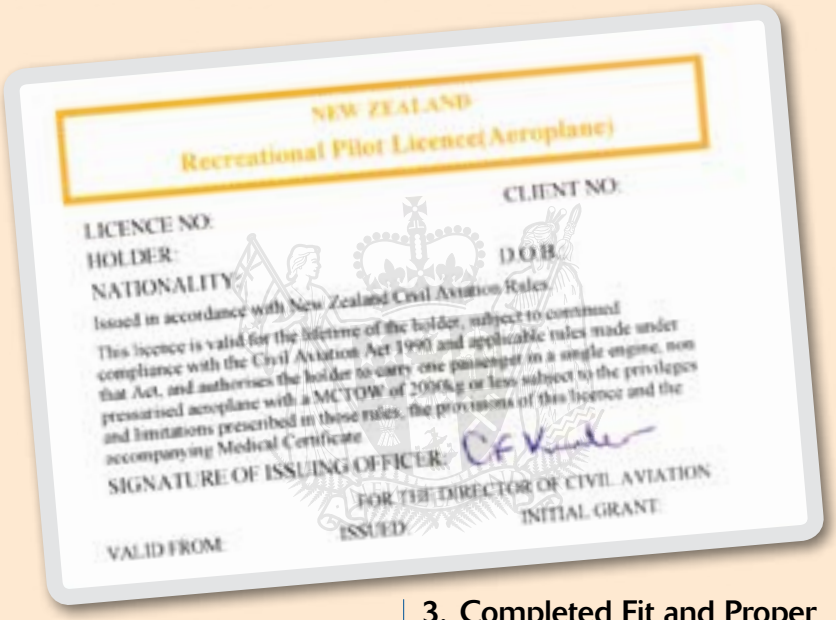
RPL Licence Privileges and Limitations

You may:

- act as pilot-in-command of a single engine non-pressurised aeroplane of 2000 kg or less for which you hold a type rating; and
- carry one passenger providing this person is informed that your medical was not issued under the Civil Aviation Act.

You may not:

- use an RPL to fly overseas;
- fly for remuneration;
- conduct an air operation;
- carry more than one passenger;
- fly at night;
- operate under IFR;
- fly over congested areas, except during takeoff and landing;
- tow gliders;
- perform aerobatic flight;
- conduct parachute drops;
- conduct agricultural operations;
- conduct banner or drogue tows;
- conduct flight instruction; and
- fly into or out of a controlled aerodrome unless evidence of a successful colour vision test is accepted by the Director (if you have held a Class 2 medical with no endorsements about colour vision, this will be acceptable).



Requirements for RPL Issue

1. Valid Part 61 Pilot Licence (Aeroplane) – PPL, CPL, SCPL, ATPL

Licensed pilots may apply for an RPL whether they have exercised the privileges of their licence recently or not.

Pilots who have not completed a biennial flight review (BFR), or competency demonstration, in the last five years, must resit the PPL Air Law examination before applying for an RPL. The valid examination credit must be supplied with the knowledge deficiency report (KDR) that has been certified by an A or B category flight instructor (aeroplane). A BFR will need to be completed before the licence can be used.

Pilots who have not completed a BFR within the last two years must do so before the RPL can be used.

2. Land Transport New Zealand Medical Certificate

Pilots wanting to apply for an RPL must hold a Land Transport New Zealand Medical Certificate that is valid for a Class 2, 3, 4, or 5 driver licence with passenger endorsement. A General Practitioner issues this medical certificate, which lasts five years for applicants under 40 years old or two years for applicants over 40.

3. Completed Fit and Proper Person Declaration or Questionnaire

Pilots who have successfully been through the fit and proper process since 1 February 2007, and whose declared information is unchanged, may fill out a Fit and Proper Person **Declaration** (CAA 24FPPDEC).

A Fit and Proper Person **Questionnaire** (CAA 24FPP) will need to be completed by applicants who have never completed the questionnaire, or have completed the questionnaire before 1 Feb 2007. Applicants that answer "No" to all of the questions in Section 7 of the CAA 24FPP form are not required to supply the Land Transport and Ministry of Justice reports. Those who have answered "Yes" to any of the questions in Section 7 must supply these reports.

These forms can be downloaded from the CAA web site, "Forms".

4. Application Form

The RPL application form (CAA 24061/01-RPL) can also be downloaded from the CAA web site. Once your application is completed, use the Applicant's Check List on the form to confirm that you have supplied everything required.

5. Licence Issue Fee

A licence issue fee of $55.00 will need to accompany your RPL application.

For further information, see the CAA web site, "Sport and Recreation". ■

Wake Vortex Reporting

The International Civil Aviation Organization (ICAO) is undertaking an overall review of wake turbulence provisions, including its current wake turbulence categorisation scheme. In order to provide a sound basis for any amendments, ICAO are collecting and analysing information on the wake vortex encounters of all aircraft types on a worldwide basis.

Pilots who experience wake vortex encounters, aircraft operators who are informed of encounters, and Airways New Zealand personnel are encouraged to report these occurrences to the CAA. The information will then be passed on to ICAO.

Two ICAO reporting forms can be found on the forms page on the CAA web site, one for pilots and one for air navigation service providers. Once completed, the forms can be emailed to ca005@caa.govt.nz, faxed to 0–4–560 9469, or posted to the Civil Aviation Authority, P O Box 31–441, Lower Hutt 5040. ■

▲ *Wake vortices generated behind a light agricultural aircraft (Thrush Commander) in a wake vortex study conducted by NASA. Photo courtesy of NASA Langley Research Center.*

◀ *This RNZAF airtrainer was caught in a wake vortex while landing at the Warbirds Over Wanaka Airshow in March 2008.*

Photo courtesy of Brian Greenwood.

In Among the Wires

International expert Bob Feerst is in New Zealand again presenting his *Flying in the Wire & Obstruction Environment* course at this year's AIA Conference in Tauranga.

Bob Feerst

This is a 'must do' course for everyone operating in the low-level environment, not just helicopters. The root cause of most wire strikes is usually the crew's lack of understanding of the specialised skills needed to operate an aircraft in the vicinity of wires.

Bob's acclaimed method for early detection of wires is taught worldwide to professional flight crews and fills a definite void in most low-level flight training programs.

There is plenty of evidence to show that operating low level near wires does not have to be a risky business. Joint efforts by the owners of obstructions – to mark some of the known hazards – and the aviation industry, to train crews to fly in the wire and obstruction environment, will save lives and improve safety.

The course is programmed to start Tuesday 22 July at 1330 and finish Wednesday at 1200. Come along to the course and get the understanding and specialised skills required to fly in among the wires.

Aircraft Lights

Navigation, strobe, landing, and other exterior aircraft lights used in the right combination, can inform other pilots of your position and intentions.

Standardising times that exterior lights are on, whether on the ground or in the air, can enhance safety and streamline flight operations.

Wellington Aero Club CFI, Dan Howe, says that you are more likely to see an aircraft's landing light than the aircraft itself.

"We train all of our pilots to make the aircraft as visible as possible when flying in the circuit or other high traffic areas, which means that the navigation and landing lights should be on.

"We have tried to standardise the times that our pilots use their lights by encouraging them to use a checklist which indicates the times that certain lights should be on," says Dan Howe.

Most aircraft operating in New Zealand have several exterior lights. Here are the appropriate times when the lights should be switched on:

Pre-Start

The beacon should be turned on before the engine is started and left on until after the engine is shut down at the end of the flight. It is used to warn aerodrome personnel of an imminent manoeuvre of the aircraft. When the light is on, the aircraft should be treated as 'live' and should not be approached.

Pre-Taxi

Before starting to taxi, turn the navigation lights on. The taxi light, if fitted, should be switched on if there is a need, such as to manoeuvre on an unlit apron at night. If the aircraft is not fitted with a taxi light, the landing light will need to be used.

Before Entering a Runway

The beacon, navigation, taxi, and strobe lights should all be switched on before entering a runway. This will help to make the aircraft as visible as possible for aircraft on final, or for air traffic control.

Takeoff

Turn on your landing light when you have received your takeoff clearance, or at unattended aerodromes, when you have made a departure call.

Circuit or Heavy Traffic Areas

In areas of high traffic density, all aircraft exterior lights should be on. The more conspicuous an aircraft is, the more likely it will be seen.

Approach and Landing

During approach and landing, all exterior lights should be on. Aircraft that have the taxi or landing light mounted on retractable nose gear will have to wait until the undercarriage is extended before the light is switched on.

Vacating the Runway

After vacating the runway, turn off strobe and landing lights. The taxi light should be left on, if there is an operational need, until the aircraft has been taxied to its parking position. The navigation lights should be switched off when the park brake is applied. The beacon should be switched off when the engine has been shut down.

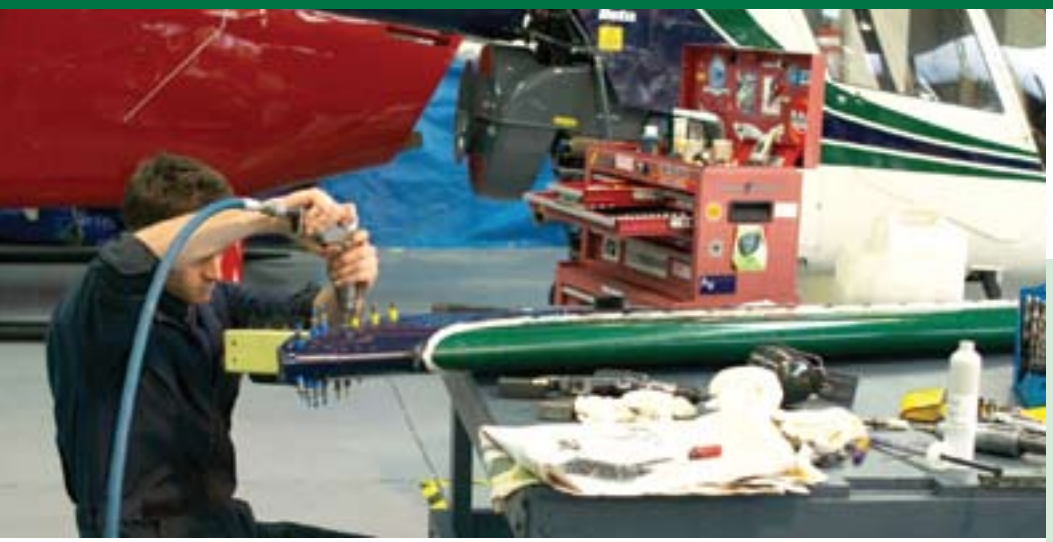
Considerations

- With New Zealand's range of aerodromes and farm strips, pilots need to exercise common sense in deciding the appropriateness of switching on certain lights. For example, excessive vibration on rough ground can break a hot landing light filament.
- Flashing beacons and strobe lights should be used with caution when flying through cloud, particularly at night, as the flashing light may reflect from water droplets which can produce vertigo or loss of orientation. (For more information on flicker vertigo, see the May/June 2007, issue of *Vector*.)
- Pilots need to consider what effect their lights will have on other aerodrome users. Will having your landing light on while you are holding at a hold point blind a pilot on short final? Will leaving your taxi light on when you are being marshalled to a stand, blind the marshaller? ■

Use of Exterior Aircraft Lights

	Beacon	Navigation Lights	Strobe Lights	Taxi Light	Landing Light
Pre–Start	✸				
Pre–Taxi	✸	✸		✸	
On the Runway	✸	✸	✸	✸	✸
Takeoff	✸	✸	✸	✸	✸
Circuit or Heavy Traffic Areas	✸	✸	✸		✸
Approach and Landing	✸	✸	✸	✸	✸
Vacating the Runway	✸	✸		✸	

✸ Shows situations that the lights should be switched on.



Aircraft Maintenance Engineer Examination Syllabuses

Draft Aircraft Maintenance Engineer (AME) basic licensing examination syllabuses have been developed and published for comment. These new syllabuses will come into effect on 1 December 2008.

In 2003, a Technical Study Group recommended significant changes to the syllabuses. Since then, the CAA has carried out extensive consultation and updated the syllabuses to reflect current technology and work practices. The new syllabuses clearly state the subject areas and depth of knowledge required, and use standard verbs to describe the type of performance or activity to be demonstrated.

Each syllabus is now contained in a stand-alone Advisory Circular (the AC66-2.x series). AC66-1 is also being revised to match these changes.

Summary of Major Changes

In the current syllabuses, Subject 1, *Aeronautical Science*, specifies the mathematics, physics and basic electricity requirements for the AMEL. This covers a broad area and candidates often struggle with the breadth of the subject. Subject 11, *Avionics 1*, is also a large syllabus covering both basic and applied electrical topics.

The new syllabuses combine the fundamental electrical topics from both Subject 1 and Subject 11 into one area. This has been done by splitting *Aeronautical Science* into two manageable subjects: Subject 1A, *Mathematics and Physics*, and Subject 1B, *Electrical Fundamentals*. 1B also contains new material on digital electronics. As a result Subject 11, *Avionics 1*, has been reduced to a more manageable size, and modern electronic and digital systems have been included.

Subject 12, *Avionics 2*, is a new subject introduced for avionics engineers who want to gain specific type ratings on aircraft above 5700 kg. It includes material that used to be part of Subjects 13, *Electrical Systems*, 14, *Instrument Systems*, and 15, *Radio Systems*, as well as digital techniques and computer/electronic devices for transport category aircraft, and aerodynamics for high speed flight. Subjects 13, 14, and 15 have all been reduced as a result, but they have had additional material on current technology, and material to meet ICAO requirements, added.

Subject 17, *Human Factors*, has been completely redeveloped, making it consistent with the ICAO and EASA Human Factor Syllabus and world best practice.

Transition

The draft Advisory Circulars can be found on the CAA web site. The new syllabuses

Continued over...

nmit
Nelson Marlborough Institute of Technology
Te Whare Wānanga o Te Tau Ihu o Te Waka a Maui

NMIT Online Training

The Nelson Marlborough Institute of Technology (NMIT) are about to launch a series of online training courses covering each of the AME licence examination syllabuses. Up until now most engineers have not had the option of formal training, instead they have independently studied for each exam by pouring over text books. NMIT have worked with the industry, CAA, and Aviation Services Limited, to develop online courses with features such as 3D animations to explain complex concepts. Students will also have the support of subject matter experts to help them in their learning and to monitor their progress. There will be weekly times when tutors are available online to answer questions, as well as being in contact with the students by email and phone. Opportunities will exist for students to join online forums with other AMEs from New Zealand and the Pacific.

The courses are suitable for all those working in the industry that have completed pre-employment training and are looking to become supervisors. Experienced engineers will not have to wade through information on areas that they already understand thoroughly. To avoid this, at the beginning of each course, students will work through a diagnostic test and real life scenarios which direct them to the sections of the syllabus they need to focus on.

The first course to be made available will be *Avionics 1* on 30 June 2008 (subject to TEC approval). Three others, *Aeronautical Science*, *Human Factors*, and *Air Law (Written)*, will become available around October. After 1 December 2008 the courses will be updated to meet the requirements of the new syllabuses. An *Air Law (Oral)* workshop course will also be introduced around September to help engineers gain confidence and prepare for the oral examination. Other subjects will be available early in 2009.

For more information on NMIT courses contact Kathy Taylor, Email: kathy.taylor@nmit.ac.nz, Tel: 0–3–572 9624 ext 511, or see the NMIT web site, www.nmit.ac.nz.

... continued from previous page

will replace the current syllabuses on 1 December 2008. Candidates will sit examinations set to the current syllabuses until 30 November 2008. From 1 December 2008, candidates will sit examinations set for the new syllabuses.

Applicants who have passed Subject 1, *Aeronautical Science*, prior to 1 December 2008 will be considered to have passed both Subject 1A and 1B. Applicants for an Electrical, Instrument, or Radio Rating who have passed Subjects 13, 14, or 15 prior to 1 December 2008 will be considered to have also passed Subject 12.

For further information see the CAA web site or contact Mark Price, Examiner AME, Tel: 0–4–560 9619, Email: pricem@caa.govt.nz. ■

Planning an Aviation Event?

If you are planning an event, large or small, such as an airshow, air race, rally, or major competition, the details should be published in an *AIP Supplement* to warn pilots of the activity.

The published cut-off dates for the AIP are listed below, but you must advise the CAA **at least one week** before those dates, to allow for inquiries and processing. Note that, even if you have applied to the CAA for an aviation event authorisation, this does not automatically generate an *AIP Supplement* or airspace request.

Email the CAA, aero@caa.govt.nz. Further information on aviation events is in AC91–1.

Effective Date	***Cut-off Date With Graphic***	***Cut-off Date Without Graphic***
31 Jul 08	22 May 08	29 May 08
28 Aug 08	19 Jun 08	26 Jun 08
25 Sep 08	17 Jul 08	24 Jul 08
23 Oct 08	14 Aug 08	21 Aug 08

Ohakea FISB – Back on the Air

The Ohakea Fight Information Service Broadcast (FISB) on 124.5 MHz gives the status of NZM306, the Raumai Military Operating Area (MOA). Initially established in 2007, a cut cable meant the Ohakea FISB has been out of action for a while, but it is now up and running again.

Aircraft tracking along the Manawatu coast between Wanganui and Foxton should listen to the Ohakea FISB southbound at the Whangaehu River Mouth, and northbound at the Manawatu River Mouth. NZM306 is active 24 hours a day, however the FISB advises pilots when they can enter the MOA, without contacting Ohakea Control.

If the FISB advises that pilots may enter NZM306 seaward of the coast, aircraft are only permitted to enter the portion of NZM306 that is over the sea. There is another MOA (NZM 310) east of the coast so pilots must be careful not to operate landward of the coastline. There is no need to contact Ohakea Control first. Pilots have 10 minutes from the time they hear on the FISB that they can enter, to transit NZM306 and vacate it. For this reason it is a good idea to check the FISB again just before entering the MOA.

If entry to NZM306 is not available, aircraft must fly out to sea and around the MOA, or an alternative route. Pilots can contact Ohakea Control on 125.1 MHz for assistance to remain clear of NZM306.

The airspace along the Manawatu Coast is within the Manawatu Common Frequency Zone (CFZ), 122.6 MHz. After listening to the Ohakea FISB, pilots should return to the Manawatu CFZ frequency to transmit their intentions and listen out for traffic, as a large number of aircraft use this coastal route. For collision avoidance, it is recommended

that northbound aircraft use 1,000 feet and southbound aircraft use 1,500 feet. Southbound aircraft should be further from the coast than the northbound aircraft when flying in accordance with the advisory tracks printed on the Visual Navigation Charts (VNCs).

If for any reason, the Ohakea FISB is not transmitting, this will be advised by NOTAM. In this instance the status of NZM306 can be obtained by contacting Ohakea Control on 125.1 MHz.

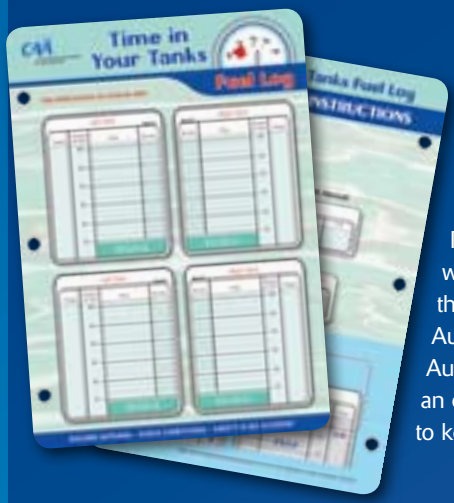
The Ohakea FISB frequency is not marked on the current VNCs – it will be added to the next chart series, effective 20 November 2008. ■

New Products

Fuel Management

This Good Aviation Practice (GAP) booklet was revised prior to the AvKiwi Seminars held earlier this year. There's updated information on static electricity, and reference to the *Time in Your Tanks Fuel Log*.

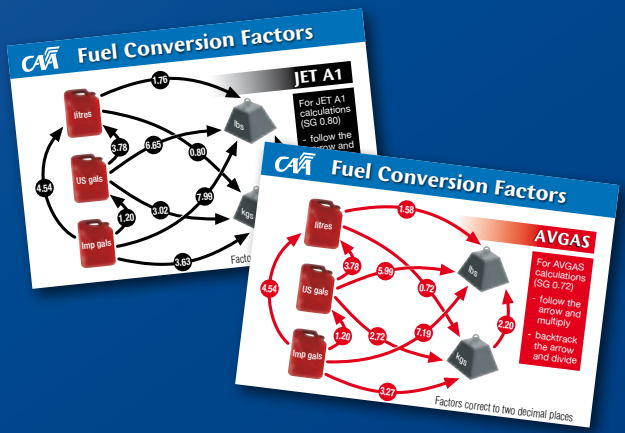
Time in Your Tanks Fuel Log



Produced in conjunction with our colleagues at the Civil Aviation Safety Authority (CASA) in Australia, the Fuel Log is an easy and excellent way to keep track of your fuel.

Fuel Conversion Factors Stickers

The Fuel Conversion Factors, for Avgas and Jet A-1, have been in the *Fuel Management* GAP booklet for some time, but we have now also produced them as stickers, as many of you said that would be a useful format for them.



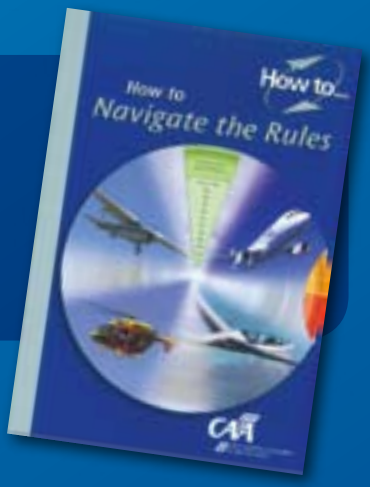
Technical Log

Formerly titled the "Aircraft Technical Log", this has been thoroughly revised to meet today's needs. But wait, there's more – now it's free!

The Standard Overhead Join Poster

One of our standard training aids, this poster has had a brush-up to refresh its appearance. All the essential information hasn't changed, of course, but the 'look' is cleaner and simpler.

The rules 'whizz wheel' booklet has had a minor revision.



See your local Field Safety Adviser (contact details on page 24), for these safety education products, or email: info@caa.govt.nz.

From left: Michael Tucker, Carlton Campbell, Cathy Penny, Mark Price, Christine Kirker, Suzanne Shirtliff, John Parker, and John McKinley.

Meet the CAA's Personnel Licensing Unit

Seventy percent of phone calls to the CAA go to the Personnel Licensing Unit. That's about 80 calls per day, and that's not counting the steady stream of email enquiries.

The team of eight is the first port of call for pilots, engineers, and air traffic controllers. They issue and amend licences, test air traffic services and flight examiners, audit flight training and examination organisations, carry out fit and proper person investigations, hold seminars, and develop, maintain and update the licensing syllabuses.

They also provide advice for rules and Advisory Circulars, check articles for *Vector* and other safety education material, develop and present the CAA's Inspection Authorisation seminars for maintenance engineers and are in constant liaison with key industry groups, such as the Aviation, Tourism & Travel Training Organisation, the Aviation Industry Association's flight training division, and the Royal New Zealand Aero Club's instructor council.

John McKinlay

Manager Personnel Licensing, John McKinlay, started out in the industry over 30 years ago as an Air Traffic Controller. He soon moved into the business side of the Airways Corporation, taking roles in quality management and auditing. He was the National Towers Quality Manager responsible for certification, training and standards, and also held a private pilot licence. John is a registered senior quality auditor, and joined the CAA in 1998, initially as an Air Traffic Services Examiner and auditor. He also conducted investigations and updated the Part 65 Air Traffic Control Advisory Circulars. He took up his current role managing the personnel licensing unit in 2001.

Michael Tucker

Principal Aviation Examiner, Michael (Mike) Tucker, first joined the Unit 18 years ago. An A-category flight instructor, Michael started flying at age 16, winning a scholarship to first solo from the Mid-Canterbury branch of the Canterbury Aero Club. He went on to become a top-dressing pilot, flying for several years, before leaving agricultural flying to become a flight instructor.

Michael gained his B-category instructor rating and was made Chief Flight Instructor at the South Canterbury Aero Club in Timaru, a position he held for nine years.

Michael joined the CAA's forerunner in 1982, flying its own aircraft and gaining his A-category instructor rating. Since 1990 he has worked for the Personnel Licensing Unit and since then has amassed the kind of detailed knowledge that would be impossible to replace. He is the CAA's first point of call for complex licensing issues.

Still an aircraft fanatic, Michael is also a keen aircraft modeler (both static and flying models).

Mark Price

Examiner AME Mark Price joined the Royal New Zealand Air Force at age 19 to take advantage of its maintenance training apprenticeship. He was car-mad through his teens, and had already completed the first year of his New Zealand Certificate in Engineering at Polytech. Mark spent seven years with the RNZAF, mostly working on the Iroquis. He left to travel and returned to a civil aviation role, working on agricultural aircraft in the Hawke's Bay. He spent twelve years in the sector, holding hangar foreman and chief engineer positions before joining the CAA in 1999.

A big part of Mark's day is spent fielding questions from engineers about licensing issues, but he also runs Inspection Authorisation courses and develops and maintains the maintenance engineer syllabus. December this year will see the first major change to the syllabus since its inception.

"Essentially, the syllabus for Aeronautical Science just got too big, and had to be split up," Mark says.

Mark likes fixing anything, including aircraft, but at heart he's still car-mad and is currently working on a 1969 Pontiac in his spare time.

Cathy Penney

Cathy Penney is a B-Category flight instructor, fixed wing, and an A-category instructor, helicopter. She has about 6000 hours total time including 4500 on helicopters. She has worked for the CAA for 13 years, initially as an auditor, and has been a member of the Personnel Licensing team for seven years. Cathy's focus is on audits and inspections of flight training organisations, testing flight examiners, and completing fit and proper person investigations.

Carlton Campbell

Training Standards Development Officer, Carlton Campbell, joined the unit in 2004. He is a mountain flying expert, with over 10,000 hours spent instructing and charter flying in the Queenstown and Southern Lakes areas. Carlton's main focus is managing the consultation and maintenance of the flight training syllabuses for pilots and air traffic controllers. He is also a regular contributor to *Vector* and the CAA's AvKiwi seminars.

John Parker

Flight Testing Officer John Parker is an A-category flight instructor, who has carried out CAA flight testing for the past 21 years. He developed the Flight Test Standard guides, and is a regular contributor to *Vector*.

Suzanne Shirtliff and Christine Kirker

There is a good chance that Licensing Advisers Suzanne Shirtliff and Christine Kirker have signed your flight crew licence. The pair run the Personnel Licensing unit, taking all incoming calls and answering all but the most complex queries. Christine says the vast majority of queries are about getting type ratings added to licences, fit and proper person tests, examination syllabuses, and enquiries from overseas pilots wanting to fly in New Zealand. ■

Workshop for Senior Persons, Air Operations

The CAA is holding a further training workshop for Senior Persons responsible for Air Operations in organisations with Part 119/135 certification. The workshop will also be of interest to Part 137 Chief Pilots, and Chief Flying Instructors in organisations that hold, or will hold, Part 141 Certificates.

The aim of the workshop is to equip Senior Persons, Chief Pilots, Flight Operations Managers, and Chief Flying Instructors, with an awareness of the responsibilities of their positions, and to cover the knowledge and tools needed.

The two-day course will cover the Civil Aviation Act, Civil Aviation Rules, and how operator expositions apply to the Senior Person/Chief Pilot role. Practical day-to-day aspects of the job will also be covered: Standard Operating Procedures, records and rosters, crew and staff management, training and checking responsibilities, safety culture, and professionalism in the aviation environment.

Senior Persons Workshop – Palmerston North

18 to 19 August 2008

Bentleys Motor Inn,
Cnr Linton and Chaytor Streets,
Palmerston North

Registrations close 1 August 2008

The places on this course are limited to 30, so be in quick. The registration form is on the CAA web site, see "Seminars and Courses".

A registration fee of $100 will be charged to help cover costs. Lunch and morning and afternoon teas will be provided on both days. Travel and accommodation is the responsibility of those attending.■

Field Safety Advisers

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Mobile: 027–285 2022
Email: jelleyb@caa.govt.nz

How to Get Aviation Publications

Rules, Advisory Circulars (ACs), Airworthiness Directives

All these are available for free from the CAA web site. Printed copies can be purchased from 0800 GET RULES (0800 438 785).

AIP New Zealand

AIP New Zealand Vols 1 to 4 are available free on the internet, www.aip.net.nz. Printed copies of Vols 1 to 4 and all **aeronautical charts** can be purchased from Aeronautical Information Management (a division of Airways New Zealand) on 0800 500 045, or their web site, www.aipshop.co.nz.

Pilot and Aircraft Logbooks

These can be obtained from your training organisation, or 0800 GET RULES (0800 438 785).

Available office hours (voicemail after hours).

0508 4 SAFETY
(0508 472 338)
info@caa.govt.nz
For all aviation-related safety and security concerns

Accident Notification
24-hour 7-day toll-free telephone
0508 ACCIDENT
(0508 222 433)
The Civil Aviation Act (1990) requires notification "as soon as practicable".

OCCURRENCE BRIEFS

LESSONS FOR SAFER AVIATION

The content of *Occurrence Briefs* comprises notified aircraft accidents, GA defect incidents, and sometimes selected foreign occurrences, which we believe will most benefit operators and engineers. Individual accident briefs, and GA defect incidents are available on CAA's web site. Accident briefs on the web comprise those for accidents that have been investigated since 1 January 1996 and have been published in *Occurrence Briefs*, plus any that have been recently released on the web but not yet published. Defects on the web comprise most of those that have been investigated since 1 January 2002, including all that have been published in *Occurrence Briefs*.

The pilot-in-command of an aircraft involved in an accident is required by the Civil Aviation Act to notify the Civil Aviation Authority "as soon as practicable", unless prevented by injury, in which case responsibility falls on the aircraft operator. The CAA has a dedicated telephone number 0508 ACCIDENT (0508 222 433) for this purpose. Follow-up details of accidents should normally be submitted on Form CA005 to the CAA Safety Investigation Unit.

Some accidents are investigated by the Transport Accident Investigation Commission (TAIC), and it is the CAA's responsibility to notify TAIC of all accidents. The reports that follow are the results of either CAA or TAIC investigations. Full TAIC accident reports are available on the TAIC web site, **www.taic.org.nz**.

ZK-WWI, Circa Reproductions Nieuport 11, 11 Feb 00 at 9:40, Napier Ad. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence nil, flying hours 206 total, 0 on type, 1 in last 90 days.

On its maiden flight, the aircraft groundlooped on landing and broke the undercarriage axle.

CAA Occurrence Ref 00/372

ZK-TAT, Cessna 172R, 30 May 07 at 15:30, Ardmore. 2 POB, injuries nil, damage substantial. Nature of flight, training dual. Pilot CAA licence CPL (Aeroplane), age 36 yrs, flying hours 745 total, 441 on type, 48 in last 90 days.

The student pilot returned to Ardmore in ZK-XAT (a Cessna 172) and joined the circuit for a touch-and-go on Runway 21 seal. The pilot then applied power for takeoff but lost directional control of the aircraft. The aircraft veered left off the runway and across the grass to the sealed taxiway which runs parallel to Runway 21.

Meanwhile, ZK-TAT (another Cessna 172) was undertaking a dual flight and was taxiing from the flying school to the Runway 21 holding point via the sealed taxiway. The instructor and student on board saw ZK-XAT leave the runway at an angle; the instructor took avoiding action by turning the aircraft to the right, but this was unsuccessful, and ZK-XAT's left wing struck the left wing of ZK-TAT.

CAA Occurrence Ref 07/1939

ZK-RZN, Zlin Z-137T, 3 Sep 07 at 10:00, Mangaweka. 1 POB, injuries nil, aircraft destroyed. Nature of flight, agricultural. Pilot CAA licence CPL (Aeroplane), age 54 yrs, flying hours 21433 total, 657 on type, 135 in last 90 days.

As the aircraft was taking off and passing over the brow in the airstrip, the pilot had to take avoiding action to miss a sheep. The aircraft skidded right and slid into an embankment. The pilot was not injured, but the aircraft was written off. The sheep had obviously been missed when the airstrip was initially cleared of stock, or it got back in afterwards.

CAA Occurrence Ref 07/3173

ZK-KAY, Pacific Aerospace 750XL, 17 Dec 07 at 0:45, Staffordshire, UK. 3 POB, injuries nil, damage substantial. Nature of flight, ferry/positioning (for engineering visit). Pilot CAA licence PPL (Aeroplane), age 39 yrs, flying hours 2035 total, 700 on type, 53 in last 90 days.

The pilot of ZK-KAY declared a Mayday and diverted to an airfield for an emergency landing due to an engine problem. After landing the pilot learned that his aircraft had actually had a midair collision with a Luscombe 8E Silvair. The wreckage of the other aircraft was located in farmland with two deceased occupants. The British AAIB is investigating this accident.

CAA Occurrence Ref 07/4482

ZK-FIL, Piper PA-31, 9 Feb 08 at 16:00, Hawera. 3 POB, injuries nil, damage substantial. Nature of flight, transport passengers A to B. Pilot CAA licence CPL (Aeroplane), age 52 yrs, flying hours 5500 total, 32 on type, 32 in last 90 days.

During a VFR flight, under a busy workload, the pilot confused the sounding of the landing gear warning horn with the stall warning horn. The aircraft was landed with the undercarriage in the UP position. No injuries were suffered, but the aircraft incurred substantial damage.

CAA Occurrence Ref 08/553

GA DEFECTS

The reports and recommendations that follow are based on details submitted mainly by Licensed Aircraft Maintenance Engineers on behalf of operators, in accordance with Civil Aviation Rules, Part 12 *Accidents, Incidents, and Statistics*. They relate only to aircraft of maximum certificated takeoff weight of 9000 lb (4082 kg) or less. These and more reports are available on the CAA web site. Details of defects should normally be submitted on Form CA005 or 005D to the CAA Safety Investigation Unit.

The CAA Occurrence Number at the end of each report should be quoted in any enquiries.

Key to abbreviations:

AD = Airworthiness Directive
NDT = non-destructive testing
P/N = part number
SB = Service Bulletin
TIS = time in service
TSI = time since installation
TSO = time since overhaul
TTIS = total time in service

Aerospatiale AS 350 B2
Ecureuil AS350 Vibration Leaf Spring

When opening the latches for the right forward belly panel, there was considerably more weight acting on the latches than normal. It was found that the right side vibration leaf spring attached to the lead weight of the cabin vibration damper had fractured, and the lead weight had come to rest on the inside of the belly panel. The leaf spring had failed about halfway between the lead weight and its mounting to the airframe. A review of the airworthiness directive involving the inspection and modification of the cabin vibration damper is being undertaken by the CAA. TSI 100 hours.

ATA 5300 CAA Occurrence Ref 07/157

Aerospatiale AS 355 F1
Aft Roller Support Shaft P/N 350A25-1275-20

When the aircraft landed to refill the monsoon bucket during a fire-fighting operation, the RH sliding door separated from its support shaft. The locking clip for the support shaft on the support bracket for the aft roller had dislodged, allowing the shaft to separate from the supporting bracket. An upgraded shaft and support bracket was installed on the operator's fleet.

ATA 5200 CAA Occurrence Ref 06/3424

AESL Airtourer 150
Lycoming O-320 Valve

While in the cruise, the engine began running rough, with a reduction of power down to 2000 rpm. The pilot was able to maintain height and divert to a safe landing. Investigation revealed that the engine problem was caused by a dropped exhaust valve head, causing damage to the cylinder. The cylinders had accumulated 1000 hrs since a top overhaul in June 1993. All cylinders were removed and replaced with new cylinder kits. TSO 1000 hours.

ATA 8530 CAA Occurrence Ref 08/776

Air Tractor AT-402B
Air Tractor AT 402B Tail Spring P/N 40060-1

The aircraft tail spring broke during the takeoff run. Investigation revealed the tail spring had fractured through the rear-most bolt hole. A new tail spring was fitted. The maintenance manual recommends replacement at about 1500 hours. The operator is now going to replace the tail spring at 1000 hours. TTIS 5320 hours.

ATA 3270 CAA Occurrence Ref 07/384

Alpi Aviation Pioneer 200
Fuel System

During a permit-to-fly inspection, half a teaspoon of a jelly-like substance was found in the fuel bowl strainer. The aircraft uses avgas from the Ashburton aerodrome. The fuel contamination did not affect the engine performance. TTIS 426 hours.

ATA 2810 CAA Occurrence Ref 06/4784

Bell 206B
Fuel Filter

During an annual fuel tank inspection, significant clear slimy contamination was discovered in the bottom of the fuel tank. The airframe and engine fuel filters were also contaminated with an unknown material. The fuel filters were sent for analysis where nothing unusual was discovered. The source of the fuel tank contamination was not able to be determined.

ATA 2820 CAA Occurrence Ref 06/2243

Britten-Norman BN2B-26
Camshaft

The operator reported that a ferrous metal was found in the oil filter. The engine was sent for a bulk strip, and the camshaft was found to be damaged.

ATA 7200 CAA Occurrence Ref 06/5024

Cessna 152
Cessna 152 LH Tailplane Outer Rib P/N 0432001-53

During a routine inspection, the lefthand tailplane outer rib was found to be cracked on both sides. The rib was removed and a replacement rib fitted. These cracks were detected only when the tailplane skins were lifted for other repairs. A thorough inspection is required in this area to detect any cracks. TTIS 6270 hours.

ATA 5510 CAA Occurrence Ref 07/383

Cessna 172M
Cessna 172M Aft Elevator Trim Cable P/N 0510105-45

The aft trim cable located in the tailplane was found corroded through, resulting in loss of trim control. Both aft trim cables and chain were replaced, and the elevator trim rigged IAW Cessna MM D972-3-13 para 9-14. Duplicate inspections carried out and aircraft released for operational check flight only. No abnormalities reported from the check flight.

ATA 2732 CAA Occurrence Ref 08/639

Cessna 172R
Cessna 172R Alternator

The aircraft was level at 2000 feet when the pilot noticed that all the avionics flickered and then went off. The control tower made contact with the pilot via a mobile phone. Investigation revealed that a terminal on the alternator had fractured and arced against the engine baffling, causing the terminal stud to burn off. The alternator had therefore stopped charging the aircraft battery, which eventually had gone flat. The engine had been recently installed, and the alternator lead appears to have been twisted during the installation, causing the terminal to fracture. TTIS 2.5 hours.

ATA 2430 CAA Occurrence Ref 06/3775

Cessna T182T
Lamar Alternator Control Unit P/N AC2101

The alternator CB popped during a VFR flight and several attempts to reset it were unsuccessful. Just prior to CB popping the voltage was observed to reach the overvoltage trip point. There had also been a long history of alternator CB popping during engine start on occasions. The alternator control unit (ACU) was suspected of an intermittent internal fault, which may have been heat related, but the unit is 'potted', so the failure mode could not be positively identified. The ACU was replaced, alternator and associated wiring inspected, engine ground run, and a VFR proving flight carried out. The fault could not be repeated. TSI 6.6 hours, TTIS 822.5 hours.

ATA 2420 CAA Occurrence Ref 06/2673

Diamond DA 42
Thielert Aircraft Engines TAE 125-01 Oil Pump

The lefthand engine suffered a power loss during an instrument approach. After landing it was noticed that oil was leaking from the engine cowling. The investigation revealed that the CSU pump outlet had cracked due to a lack of support for the hose and fittings. The hose had previously been changed from an aluminium pipe to a rubber hose in accordance with a service bulletin issued by Thielert Aircraft Engines (TAE 125-0015). The aircraft had flown only five hours since the installation of the service bulletin. The aircraft manufacturer subsequently issued a service bulletin (MSB42-24) shortly after this incident, requiring the installation of a support bracket to support all the hose fittings. TTIS 63.3 hours.

ATA 7140 CAA Occurrence Ref 06/2659

Diamond DA20-C1
Spark Plug

ATC advised that a training aircraft was experiencing engine problems and was returning to land. No emergency was declared and the aircraft landed safely. Investigation revealed number two cylinder bottom spark had fouled. New piston rings had recently been installed, and they had not yet bedded in, allowing oil past the rings, fouling the spark plug.

ATA 8500 CAA Occurrence Ref 06/1766

Diamond DA20-C1
Diamond DA20-C1 Fuel Pressure Gauge

During climb-out the pilot observed that the fuel pressure reading was within the red range. The aircraft returned to the airfield. The fuel pressure was tested and found to be within the manufacturer's limits. The high fuel pressure reading observed by the pilot was attributed to parallax error.

ATA 2800 CAA Occurrence Ref 07/1821

Diamond DA20-C1
Diamond D20 Canopy Support Spring P/N 20-5600-09-02

The pilot reported a loud bang from the rear of the cockpit. After landing it was ascertained that the noise had originated from a broken canopy spring. The broken spring did not affect the operation of the canopy. The spring was replaced. TTIS 3907.8 hours.

ATA 5320 CAA Occurrence Ref 06/2794

Grumman American AA-1C
Grumman American AA-1C Hydraulic Hose

During the pre-flight inspection, the pilot found hydraulic fluid leaking from the brake line to the left main wheel brake assembly. The rigid brake line had fractured, allowing hydraulic fluid to seep out. The hydraulic line was replaced.

ATA 3242 CAA Occurrence Ref 06/2507

Gulfstream American GA-7
Gulfstram American GA-7 Cylinder

On the downwind leg to a final approach, a noise was heard from the RH engine and it subsequently began to run roughly. Upon investigation, the number 2 lower spark plug was missing. The cylinder head thread was inspected, a new plug fitted and tightened as required. The remaining plugs were checked. TSI 2 hours, TTIS 7084 hours.

ATA 8530 CAA Occurrence Ref 07/2793

Hughes 369D
Fuel Tank Vent

The pilot made a precautionary landing when the helicopter suddenly experienced a high frequency vibration during flight. No information was supplied on the source of the vibration.

ATA 2810 CAA Occurrence Ref 06/4008

Hughes 369HS
ACK Technologies Inc E-01 G Switch

It was reported that the ELT was activated during spray runs. Pilot was aware of it only when an approaching AS350 with tracking antenna was sighted. This is a known problem with this ELT model when mounted on a 45-degree angle. There is too much pressure on 'G' switch, especially when getting older. Owner advised to upgrade to new 406 ELT. Batteries replaced and system tested IAW Pt 43 as activation time unknown.

ATA 2560 CAA Occurrence Ref 07/4119

Nanchang CJ-6
VHF Comms

The aircraft was observed squawking 7600. Attempts to contact the aircraft failed. The pilot contacted the tower on landing and reported the failure of the aircraft's communications equipment. The cause of the radio fault was not identified, but on a subsequent flight the radio failed again, and the fault was eventually traced to a connector on the aerial socket.

ATA 2300 CAA Occurrence Ref 07/196

From 1 July 2008, New Zealand aircraft without a 406 MHz ELT will be unable to fly legally. Refer to rule 91.529 for details.

SWITCH TO
406 DISTRESS BEACONS
www.beacons.org.nz

NZSAR
New Zealand POLICE
RESCUEcoordinationcentre MARITIME NEW ZEALAND
CAA CIVIL AVIATION AUTHORITY OF NEW ZEALAND
Ministry of Transport TE MANATŪ WAKA

BlackwoodGroup SAR00149A