March / April 2001

VECTOR

Pointing to Safer Aviation

Ice

Are Helmets a Good Investment?

Airmanship Standards

CO in the Cockpit

CAA
CIVIL AVIATION AUTHORITY OF NEW ZEALAND

VECTOR

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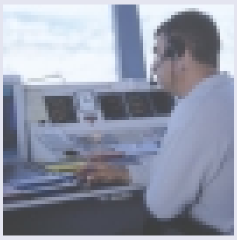
This is the first article in a series on airframe icing and its effects in the New Zealand environment. It compares the type and rate of icing occurrences with overseas experience, and introduces the effects and types of icing commonly experienced here.

Three cautionary tales from overseas that show helmets were the best investment the respective pilots ever made. Aircraft types involved include helicopter, vintage and a high performance sport aircraft.



There is increasing evidence that standards of airmanship are deteriorating in the GA community, particularly in RTF and controlled aerodrome procedures. What are the problems and how can we improve the situation?

Two recent New Zealand events highlight the dangers of carbon monoxide to the unwary pilot, and show that CO detectors do work and are worth installing and keeping up to date.

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Cover Photo:
An Air Nelson SAAB 340 shows off its lines against the backdrop of the outer Marlborough Sounds. Photograph courtesy of Air New Zealand.

Ice

This is the first in a series of articles on airframe icing and its effects. It is part of an on-going educational campaign by the CAA aimed at IFR pilots – particularly those who regularly fly at medium-level altitudes where airframe icing is most likely to occur.

Background

The icing education campaign arose out of recommendations made in the 1998 CAA Ministerial Inquiry following the Beech Baron accident in the Tararua Ranges. The Inquiry made a number of wide-ranging recommendations relating to aircraft icing certification standards, company operating procedures, and pilot training requirements. The Inquiry also recommended the implementation of an educational programme on icing. (We reported on this in the July/August, 2000 issue of *Vector.*)

This article touches briefly on aircraft icing certification levels, then examines the inherent icing hazards that exist in the New Zealand meteorological environment. Finally, we look at different types of airframe icing – where and how they occur and the effect they have on aircraft aerodynamics.

Aircraft Icing Certification Levels

Despite the US Federal Aviation Regulations (FARs) and the most current aircraft certification requirements, there is evidence that icing conditions and their effects on aircraft aerodynamics are not yet completely understood. Simply put, pilots must **not** be over reliant on de-icing and anti-icing equipment fitted aboard aircraft that have been certified for flight into icing conditions. Severe icing conditions can be outside the aircraft certification-icing envelope, and each pilot must be vigilant to avoid conditions beyond an aircraft's capabilities.

More specifically, CAA rule 91.421 *Operating in Icing Conditions* states that: "…a pilot-in-command operating an aircraft under IFR shall not fly an aircraft into known or forecast icing conditions unless the aircraft is certificated with ice protection equipment for flight in the type of known icing conditions".

It is vital that, as pilot in command, you know what level your aircraft is certificated to and that you abide by it – there is no room for complacency in this regard. There have been a number of reported instances in New Zealand of pilots commencing flights into known icing conditions that were more severe than the icing certification level of their aircraft.

Aircraft icing certification levels will be covered in more detail in a later article.

The New Zealand Icing Environment

In 1999 the CAA commissioned a study into New Zealand aircraft icing hazards. The resulting document (*The Aircraft Icing Handbook,* available on the CAA web site under **Safety Information – Publications – GAP booklets**) included a comparison with US icing accident rates. The New Zealand rate proved to be significantly lower. In fact, the New Zealand rate was so low that it was difficult to reconcile it with the opinion of local SAAB and ATR pilots that icing in

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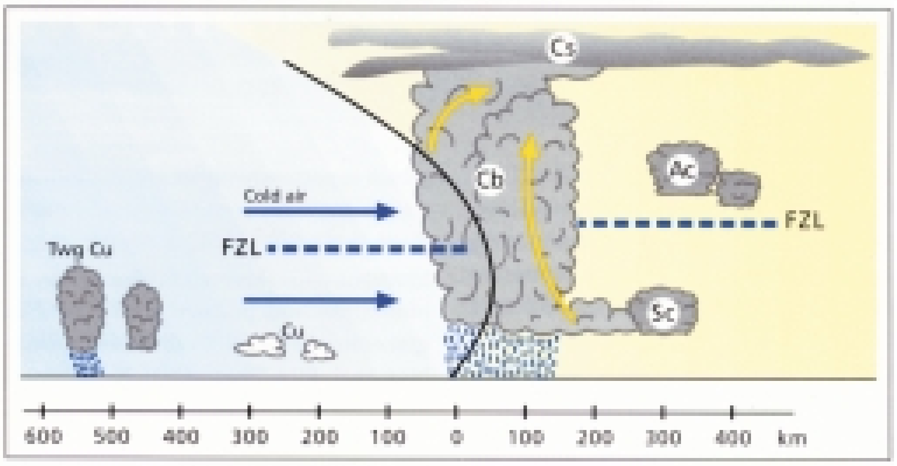
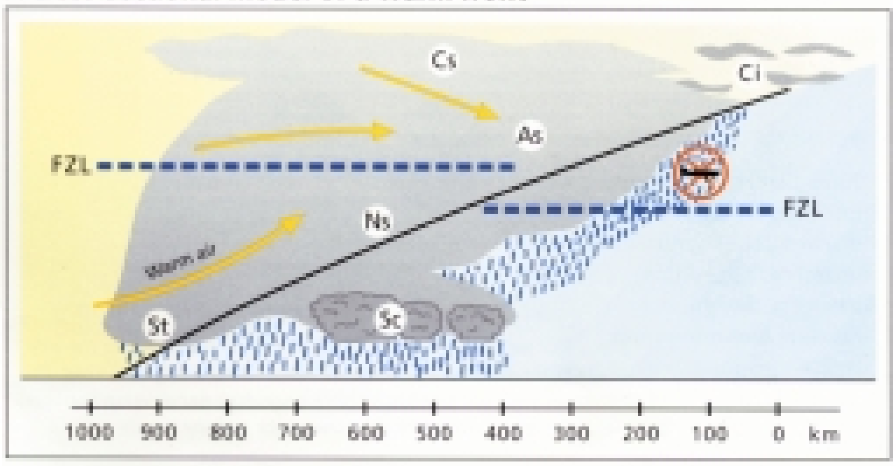
A cross-sectional model of a cold front



A cross-sectional model of a warm front



The above diagrams show the typical cloud types anf freezing levels associated with frontal activity. The FZL can vary considerably, depending on latitude, season and airmass characteristics. Note the area above the FZL ahead of the warm front where freezing rain is likely to occur.

Diagrams adaped from *Weather to Fly* by Walter Wagtendonk.

... continued from previous page

New Zealand was as severe, if not worse, than their counterparts experience in Europe and the US.

The New Zealand icing hazard often involves conveyor belt flows which, when subjected to suitable lifting and cooling, can pose a significant icing hazard. New Zealand's alpine chain is exposed to a relatively warm maritime airflow (conveyor belt) that is lifted and cooled (orographic lifting) by our mountainous interior. Sea surface temperatures are warmer, producing a higher moisture content in the maritime airflow than is experienced in higher-latitude countries such as North America and Northern Europe – thus the potential for icing at altitude (between 8000 and 20,000 feet) in New Zealand exists.

Weather patterns, specifically surface weather, are more extreme in Europe and North America – a simple product of colder latitude and continental modification. Without the benefit of research or a historical comparison, one can only speculate that New Zealand's surface weather is comparatively benign, yet the propensity for icing at altitude is equal to, if not greater than, that in colder continental environments. In this context, the FAA Flight Safety Research Section has recorded most US icing accidents during the approach and landing phase of flight. The tendency for higher-altitude icing in New Zealand could explain the statistical disparity between North America and New Zealand ice-related accidents.

While the incidence of low-altitude icing may be relatively small in New Zealand, the risk of severe icing at altitude exists – a risk as great, if not greater, than elsewhere in the world. Examples of New Zealand icing-related occurrences include:

- In 1987 a Cessna Caravan crashed off the coast of Kaikoura after descending out of control from 11,000 feet.
- In 1994 a SAAB 340 experienced loss of airspeed and a series of roll upsets at 11,000 feet while in the Tory holding pattern.
- In 1997 a Beech Baron climbed to 10,000 feet over the Tararua Ranges before the pilot lost control in forecast icing conditions.

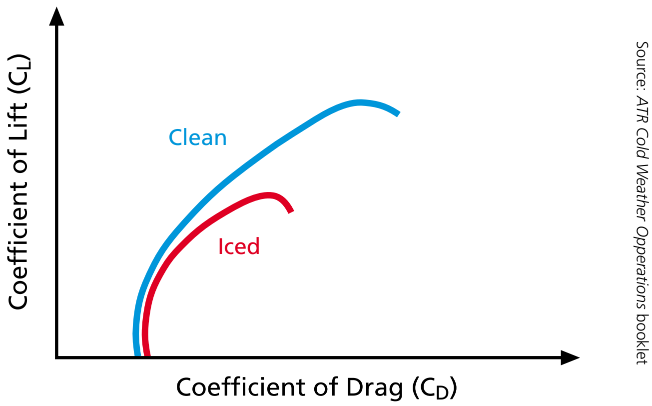
None of this means that we should discount the possibility of lower-level airframe icing in New Zealand. Severe icing can occur when **any** onshore conveyor is lifted and cooled, and it should be taken seriously by pilots. While it would be convenient to define specific locations and altitudes where this occurs, it is impractical to do so, as the variables defy simplification. Known ice areas and routes include the 'Otaki Iceberg;' Nelson-to-Christchurch, Timaru-to-Alexandra, and over the Southern Alps. Identification and advice on these hazardous areas are best left to individual operators and their pilot training programmes, rather than elaborating on them here.

Aerodynamic Considerations

Any in-flight icing can be a serious hazard to flight, particularly when operating over terrain that does not permit a descent into warmer conditions. The effects of ice on aircraft aerodynamics are many and varied.

Mainplane Icing

Although ice can accrete on many aeroplane surfaces, of most concern is mainplane aerofoil icing. Ice destroys the smooth flow of air over the wing, diminishing its ability to generate lift. Ice increases drag, increases the aircraft weight, and degrades the pilot's control authority. As power is added to compensate for the additional drag and the aircraft nose is lifted to maintain altitude (thus increasing the angle of attack), additional ice will begin to accumulate on the underside of the wings and fuselage. Testing has shown that ice accumulation (on the leading edges or upper wing surfaces) no thicker than a piece of coarse sandpaper can reduce lift by as much as 30 percent and increase drag by as much as 40 percent. Larger accretions can reduce lift even more and increase drag by more than 80 percent.



The effect of ice build-ups on C_L and C_D for a typical aerofoil.

> ***"It is vital that, as pilot in command, you know what level your aircraft is certificated to and that you abide by it…"***

Some aerofoil designs are less sensitive to contamination than others. An infinite variety of shapes, thickness and textures of ice can accrete at various locations on the aerofoil. Each ice shape essentially produces a new aerofoil with unique lift, drag, stall angle and pitching moment characteristics that are different from the wing's own aerofoil, and from other ice shapes. These shapes create a range of effects. Some effects are relatively benign. Others may alter the aerodynamic characteristics so drastically that all or part of the aerofoil stalls suddenly and without warning. Sometimes the difference in ice accretion between a benign shape and a more hazardous shape appears insignificant.

The effects of severe icing are often exclusively associated with ice thickness. On other occasions, a layer of ice having substantial chord-wise extent is more adverse than a seven-centimetre ice accretion having upper and lower horn-shaped ridges. Ice can contribute to partial or total wing stall followed by roll, aileron snatch or reduced aileron effectiveness.

Tailplane Icing

One hazard of severe structural icing is the tailplane or empennage stall. Sharp-edged surfaces are more susceptible to collecting ice than large blunt ones. For this reason, the tailplane may begin accumulating ice before the wings. The tailplane will also accumulate ice more quickly. Because pilots cannot readily see the tailplane, they may be unaware of the situation until a stall occurs when the critical angle of attack is exceeded (this may occur at a relatively high airspeed). Since the tailplane counters the natural nose-down tendency caused by the centre of lift of the main wing, the aeroplane will react by pitching nose down, sometimes uncontrollably. Application of flaps can initiate or aggravate this process. Caution should be used when applying flaps during an approach if there is the possibility of tailplane icing.

Roll Upsets

Roll upsets due to airframe icing are a serious control problem, which can be fatal. They occur for a number of reasons:

- Ice build-ups on the wing lower surface and fuselage eventually cause a conventional stall as the angle of attack is progressively increased, which is followed by a roll upset.
- Under certain conditions, ice can form in ridges just forward of the ailerons disturbing the airflow over them in such a way as to create an aerodynamic imbalance. Eventually the aileron will 'snatch' or deflect out of the neutral position of its own accord and cause the aircraft to roll. This can happen at angles of attack that may be considerably less than the stalling angle. On un-powered controls, it is felt as a change in control-column force. Instead of requiring a force to deflect the aileron, force is required to return the aileron to the neutral position. Aileron instability sensed as an oscillation, vibration or buffeting in the control column is another clue that the airflow over the ailerons is disturbed.
- Loss of roll effectiveness can result when ice forms ahead of the ailerons and disrupts the airflow over them in such a way that it reduces their effectiveness to the point where roll performance is less than desirable. This is different from the aileron 'snatching' scenario, where aerodynamic balance is disrupted but effectiveness is essentially maintained.
- A further condition that can contribute to roll-control problems is the accumulation of more ice at the wings tips than the roots. This occurs because the wings tips are thinner, may have a different camber and a shorter chord, and often have a degree of aerodynamic washout relative to their roots. For these reasons, the wing tips will tend to accumulate ice quicker, thicker and further aft than on a general-purpose aerofoil. Such ice build-ups cause separation of the airflow at the wing tips, which compromises aileron effectiveness.

Note: Because of the broad range of environmental conditions, limited availability of data, and various aircraft configurations, pilots must use the information detailed in the manufacturer's Flight Manual for specific guidance on how to deal with roll upsets in icing conditions in their aircraft type.

Loss of Thrust

Loss of thrust or lift due to ice build-ups on the propellers, rotor blades, or around engine intakes is also a serious consideration. Not only will ice accretion significantly reduce the amount of thrust or lift produced, but is also likely to cause the propeller or rotor to become unbalanced. Unbalancing can threaten the integrity of engine and gearbox mounts – the consequences of which could become terminal very quickly.

Normal residual ice on a SAAB 340 propeller during airborne icing certification trials.

Photograph courtesy of SAAB.

Instrument Errors

The blockage of pitot intakes and static vents by ice will produce pressure instrument errors – the last thing that you want in IMC while trying to cope with airframe icing. Airspeed indicator error is the most common occurrence, but other pressure instruments will give erroneous readings if their static source becomes blocked. Similar problems can occur with fuel vents, EPR sensors, flap mechanisms and undercarriage operation.

The best defence against pitot icing is to ensure that the heating elements are working during the pre-flight and are switched on well in advance of any anticipated icing conditions.

Appendages

Ice accumulates on every exposed frontal surface of the aircraft – not just its wings, tail, fuselage and propellers – but also on the windshield, antennas, intakes, vents, and cowlings. Most aircraft do not have anti-ice equipment that is effective in controlling ice accretion on these appendages. A severe icing problem can therefore develop very quickly. In moderate to severe icing conditions some aircraft (especially some light twins) can become so iced up that flight is impossible.

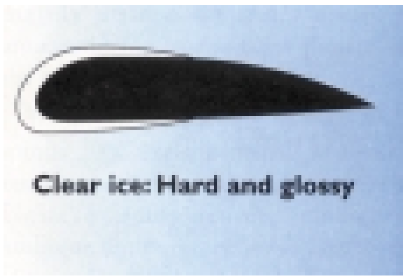
Photograph courtesy of ATR

Ice accumulation on the nose of an aircraft.

Types of Airframe Icing

Let's now look specifically at the different types of airframe icing, how and where they occur, and what effect they have on aircraft aerodynamics.

Clear Ice



Clear ice normally occurs when super-cooled water droplets freeze and then spread out on contact with a cold surface.

The most likely temperature range for clear ice is between approximately 0° and –15°C. Super-cooled droplets (rain droplets that exist in the atmosphere at temperatures well below the normal freezing point of water) are unstable and will freeze on contact with any surface below 0°C. As each droplet freezes, latent heat is released in the freezing process, allowing part of it to flow rearwards before it solidifies. The slower the freezing process, the greater the flow-back before it freezes. The result is a sheet of clear ice with very little trapped air. It has a high density and is correspondingly heavy and tenacious, characteristics that make it difficult to shed any significant accumulation.

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Clear ice is dangerous for many reasons. As mentioned, it can spread back over a large area to parts of the aircraft that do not have ice protection – this can cause a rapid increase in weight. It can be difficult to detect (particularly at night) because it is transparent and tends to follow the contours of the aircraft's surface. Initially, it may not adversely affect aerodynamic performance, and the accumulation may be undetected by the pilot. Clear ice is tenacious, and if allowed to flow back to the hinge line of a control surface, may render it unusable. It also tends to break off in large chunks when the aircraft encounters warmer air, possibly causing airframe damage.

Although not confined to cumulus developments, clear ice can be anticipated in cumulus cloud within the first 6000 to 8000 feet above the freezing level. This is largely due to convective movement producing high water content and consequent development of super-cooled droplets. Cumulus cloud formations (especially cumulonimbus) associated with frontal systems can be dangerous if the aircraft is flown along, or near to, the front line. Isolated clusters of cumulus cloud at this level, however, do not pose a serious icing threat, as the aircraft is only exposed to icing conditions for very short periods.

Super-cooled Large Water Droplets (SLDs) can, however, exist in stratiform clouds and, when this does occur, it often happens over a wide area. A number of aircraft have suffered upsets in these situations – usually while in a holding pattern in moderate to severe icing conditions arising from SLDs. In contrast to cumulus developments, icing layers in stratus formations are relatively shallow, and it is often possible to climb or descend out of the icing layer.

Rime Ice

Rime ice is rough and uneven in its appearance and fairly brittle in comparison to clear ice. This is due to rapid freezing that traps many pockets of air within its mass. Rime ice is usually the result of much smaller and colder (ie, below –15°C) super-cooled water droplets freezing almost instantaneously as they come into contact with the cold surface of the aircraft. The extent to which the droplets flow rearwards as latent heat is released is far more limited than it is with the larger super-cooled droplets that form clear ice. Thus the total surface area affected by ice is considerably reduced.

The large amount of air trapped within the ice gives it rough and crystalline characteristics. As it builds up on the leading edges of the wings and tail, it dramatically affects their aerodynamic qualities – accumulations around engine intakes can also have a detrimental effect on engine performance. The large increase in drag and loss of lift associated with rime ice build-up does not require elaboration, other than to stress the importance of clearing it quickly – there are numerous overseas examples of aircraft suffering tailplane stalling due to severe rime ice build-ups. Unlike clear ice, rime ice does not usually cause a significant increase in aircraft weight, and it can be readily cleared by the activation of de-ice equipment.

Rime ice is usually associated with stratiform cloud, where a lack of convective movement within the cloud means that large SLDs do not have time to form due to the reduced number of droplet collisions. The temperature range for the formation of rime ice is generally between 0° and –40°C, but is most commonly encountered within the range –10° to –20°C. If the flight takes place in temperatures colder than this, the ice particles may be so dry that they do not adhere to the aircraft skin. However, stratiform clouds associated with an active front,

Rime ice on the leading edge of an ATR wing. It is typically very brittle and frost-like in its appearance.

Photograph courtesy of ATR.

or with orographic lifting of a moist maritime airflow, increase the icing probability at lower-than-usual temperatures – continuous upward motion of air generally means a greater retention of moisture within the cloud.

Flight in stratiform cloud within the first 2000 to 3000 feet above the freezing level may produce SLD conditions conducive for moderate to severe clear ice formation. Stratiform cloud associated with a warm front often has embedded cumulus cloud. Care should be exercised in anticipating, and avoiding, the types of conditions that might be conducive to these icing combinations.

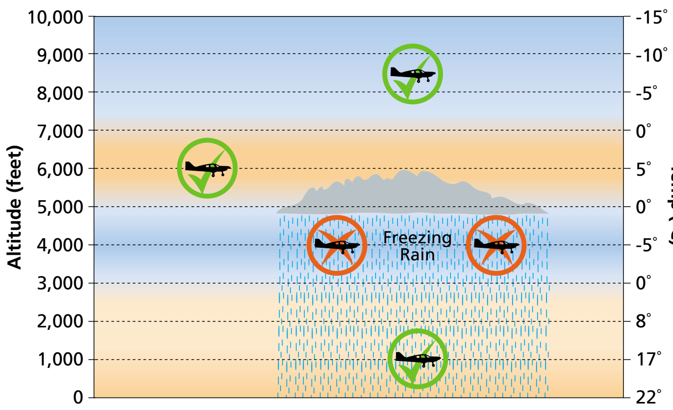
Freezing Rain

Freezing rain occurs when rain from a warm layer of cloud falls into an air mass that has a temperature below zero. If you happen to be flying through this area it is likely that your aircraft will be quickly enveloped in ice (usually clear ice) from the freezing rain.

Freezing rain is normally associated with the cold sector directly under the slope of a warm front, or in the cold sector just behind a cold front. Sometimes it can occur where there is a strong temperature inversion and rain falls from warmer air at altitude into cooler air just above the freezing level.

If flight is continued in the freezing rain environment, it is likely that anti-icing or de-icing systems will not be able to cope and aerodynamic performance will be quickly degraded. If these conditions are encountered, it is essential to vacate them as soon as possible.

Freezing rain associated with a frontal system inversion layer



This graph shows how a temperature inversion at altitude can produce conditions conducive to freezing rain.

Summary

- New Zealand's mid-latitude location, relatively warm oceans, and orographic lifting all combine to make a meteorological environment that is conducive to icing at altitude.
- Most of our light to medium weight IFR traffic cruises at medium-level altitudes (ie, generally between 8000 to 20,000 feet), which is where the main risk of airframe icing in New Zealand exists.
- Over reliance on de-icing and anti-icing equipment should be avoided.
- Ice destroys the smooth flow of air over the wing diminishing its ability to generate lift and dramatically increases drag and weight.
- Tail icing can lead to tailplane stalling and nose-down pitching particularly when landing flap is selected on final.
- Disruptions to the airflow around the ailerons and wingtips by ice can induce roll upsets.
- The effects of ice on aircraft pressure instruments are numerous and should never be underestimated.
- Clear ice normally occurs between 0° and –15°C. It can quickly build up undetected, dramatically increasing the aircraft weight and stall speed. Clear ice build-ups can freeze up control surfaces and is often difficult to get rid of. It is most commonly encountered in cumulus cloud within the first 6000 to 8000 feet above the freezing level.
- Rime ice can affect the aerodynamic qualities of the aircraft (because of its uneven crystalline nature) by degrading the laminar airflow over the wings and tailplane. Rime ice build-ups can cause unexpected stalling and degraded control effectiveness. Rime ice is most commonly encountered within the temperature range –10° to –20°C and is usually associated with stratiform cloud.
- Freezing rain occurs when rain from a warm layer of cloud falls into an air mass that has a temperature below zero. It can envelop the entire aircraft with clear ice in a matter of minutes to the point where de-icing equipment is unable to cope. Freezing rain is normally associated with the cold sector directly under the slope of a warm front, or in the cold sector just behind a cold front.

Watch out for the next article in this series where we will look at other types of airframe icing, identification and avoidance of icing conditions, aircraft icing certification levels, and company Standard Operating Procedures. ■

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Meteorology for Professional Pilots by Walter J. Wagtendonk

The Aircraft Icing Handbook published by the Civil Aviation Authority of New Zealand.

Are Helmets a Good Investment?

You Bet They Are!

From issue 2/2000 of Transport Canada's aviation safety magazine Vortex.

All hazards were identified in a thorough reconnaissance of the job site prior to landing, and the identified hazards were again reviewed on the ground before starting the work. The sky was clear, wind calm, temperature 12 degrees, and humidity 32 percent.

The spray job was in a rectangular 40-acre field with a power line on the west side running north and south and a row of mature trees on the north and south sides running east and west. A barbed wire fence surrounded the entire field.

The field was seeded to corn and the crop was about three inches high. The circumference of the field was bordered by a 30 to 40-foot strip of barley. The chemical used that day was WPA, and we were using an ultra-low-volume application. All equipment was tested before starting the work, and both the helicopter (a Robinson R22) and spray gear were operating as expected.

There is no doubt in my mind that my helmet saved me from serious injury and quite probably death.

I flew one orientation pass from south to north (the longest side of the rectangular field), noting the power line, which was about 50 feet away on my left. I turned right, away from the power line, and started to apply the product to the field. I had made three passes when I realised that I did not have enough product to do another full pass.

Because of the trees at either end of the field, I decided to spray a headland pass to give me more room to pull up at the treed end of the field. I figured I had enough product remaining to do one headland pass before heading back to refill.

I pulled up and flew out of the field to determine how best to approach the headland pass. Flying to the west would bring me too close to the power line at a high rate of speed, so I decided to fly away from the power line. I manoeuvred into position with the power line behind me. I had settled into what I thought was a stable hover but, as I moved slowly forward,

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I heard a loud bang and the helicopter started spinning violently. I closed the throttle and prepared for impact.

When all the parts stopped moving, I found myself partway outside the cockpit door opening (both doors had been removed), restrained by my seat belt. The top of the doorframe had landed on the temple area of the left side of my head with enough impact force to dent the top of the very rigid doorframe. I was firmly pinned under the machine between the doorframe and the ground. I undid the chinstrap and slid out of the helmet with little effort, as the helmet did not deform or compress enough to trap my head (see photograph on previous page). There was a large black impact mark on the helmet but no visible damage. There is no doubt in my mind that my helmet saved me from serious injury and quite probably death.

When I originally considered purchasing a helmet, I was somewhat deterred by the price. It didn't take me long to figure out that it was the prudent thing to do and now of course, I'm glad I made the choice – the right choice – to buy one.

We have a rigid policy in our company – no one will ride in or fly our helicopter without a helmet. We provide a generic style for our passengers to wear. We will not hire pilots unless they have and agree to wear proper head protection. I discussed this policy with another operator and he indicated that he felt he couldn't legally force his pilots to wear helmets – something to do with their freedom of choice. Be that as it may, **we** remain resolved in our decision that it is our freedom of choice that helmets are mandatory if aircrew want to work with us.

Helmets save lives. In this pilot's opinion, there is no acceptable substitute.

And from the British safety information publication GASIL, No 3 of 2000.

The photograph below shows the instrument panel after an aircraft with an open cockpit came to a sudden stop. The arrow points to the ignition key, which is, as you can see, rather bent.

The bending was caused by the head of the pilot as he hit the instrument panel. Since he was wearing lap and shoulder harness at the time, it makes one worry what the outcome would have been if he had not been. He was in fact wearing a helmet as we recommend in an open cockpit aircraft, and that was what hit the key, saving him from serious injury. Unfortunately, his passenger was not wearing a helmet, and suffered facial injuries in the front cockpit.

And finally, this example of the value of a helmet comes from closer to home, and features a New Zealand product.

I was the pilot of a Marchetti SF260 that suffered an engine failure after takeoff from Sydney's Bankstown Airport in September 2000. I was fortunate to be able to get the aircraft down 20 metres from the edge of the airfield, since beyond the airfield was 2 to 3 kilometres of housing before the next bit of open ground. The impact was a severe one, writing off the aircraft and breaking my spine in two places. I count myself very blessed to be able to walk again since, according to my doctors, I came within a hair's breadth of ending up in a wheelchair.

The other bit of good news is that I escaped from this accident with no head injuries whatsoever. This I attribute to one of my better recent investments – a Campbell Aero Classics, carbon fibre and kevlar Classic Leather helmet (pictured above), bought only a few months earlier, shortly after seeing them displayed at the Wanaka airshow.

I had, in the past, sometimes felt a little pretentious seated in the cockpit of a classic, though fairly modern aircraft wearing an old-style helmet, but on that day I was very glad of it and if I return to flying will undoubtedly continue to use it.

These helmets are not cheap, but whether you fly a Tiger Moth or a Pitts, a P-51 or a Piper, the money is unimportant if it's helping protect your most valuable asset! ■

TOURIST FLIGHT OPERATORS (NZ) SEMINAR

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or your local CAA Field Adviser.

Airmanship Standards

Chief Air Traffic Controllers around the country recently voiced their concerns over a decline in airmanship standards amongst general aviation pilots, particularly those relating to RTF usage. Controllers report that non-compliance with airspace and aerodrome procedures are on the rise, and this is increasing their workload. While these non-compliances are not always incidents in themselves, they can easily become so without corrective advice from the controller concerned. Areas identified by controllers as being problematic include:

- Failure to supply all the necessary details when requesting joining instructions prior to entering a control zone – especially when not on a flight plan. Requests for joining instructions should include aircraft registration, position and altitude, intentions, persons on board, QNH and acknowledgement of the ATIS.
- The inability to report at the designated visual reporting points as requested by ATC. This would seem to indicate poor pilot navigational or situational awareness skills and, in some cases, the lack of an up-to-date VTC.
- A lack of awareness as to ATC read-back requirements on clearances and instructions (refer to the Operations section of the AIP *Planning Manual* for details). Controllers are having to ask pilots to read back or clarify clearances more frequently, sometimes having to issue plain language clearances in their place.
- Taxiing, taking off, entering a control zone, or landing without obtaining an ATC clearance.
- Pilots not using standard RTF phraseology. Concise and unambiguous phraseology used at the correct time is vital to the safe and expeditious flow of air traffic – particularly in today's busy air traffic environment, where plain language communication is often not practical. Refer to the Operations section of the AIP *Planning Manual* for examples of correct RTF phraseology.
- Lack of understanding of the different airspace structures and requirements. This has included pilots flying through conditional airspace, such as Mandatory Broadcast Zones, without changing to the correct frequency or making the appropriate radio calls.
- A reluctance to carry up-to-date documentation and to spend time becoming familiar with specific airspace and aerodrome procedures before the flight. This is particularly apparent to controllers when, for example, pilots do not follow the standard arrival or departure procedures outlined in the VFG.
- Failure to obtain, and correctly interpret, all relevant NOTAM and *AIP Supplement* information associated with a particular flight. Airways New Zealand now has a dedicated flight planning information web site at **www.ifis.airways.co.nz** where Supplement and NOTAM information can be accessed free of charge for general aviation users.
- Two problem trends raised by FIOs are the use of abbreviated readbacks, eg, reading back the last two numbers of a QNH or only the last two letters of a callsign and secondly pilots launching into a position report without first establishing two-way communication.

On a more localised level, Hamilton and Rotorua controllers have noticed a distinct drop in GA pilots' procedural and RTF standards since the withdrawal of ATC from Ardmore aerodrome over two years ago. They believe that a lack of exposure to ATC procedures since its withdrawal is now manifesting itself among some flying instructors. The nett result is that their students are not gaining the benefits of this knowledge and experience. This appears to be translating into a reduction in airmanship standards among students, with the instances of airspace and aerodrome infringements (especially those associated with pilots' initial cross-country flights once they have gained their licence) steadily increasing. It is only a matter of time before there is a serious incident or accident because of this.

This points to the need for instructors to be especially diligent in their approach to tutoring students in areas such as RTF usage, airspace structure, carriage of appropriate documents, adequate pre-flight planning, etc. Thorough briefings, a reasonable level of exposure to controlled airspace, and close supervision of solo exercises into controlled airspace are a must and should be actively encouraged.

CAA Field Safety Advisers report that discourteous, inconsiderate, and unprofessional radio exchanges continue to be a problem among GA pilots. Holding a FRTO rating is a privilege, and it should go without saying that all radio transmissions should be carried out in a proper and professional manner, no matter what the circumstances. You can in fact be prosecuted by the Police under the *Summary Offences Act 1981* for using offensive language in a public place (transmitting obscenities over an aircraft radio constitutes offensive language in a public place). Also, angry words over the radio may exacerbate what might already be a stressful situation. Stressed pilots can be unsafe pilots.

If another pilot's actions cause you concern or annoyance while in the air, note their aircraft registration and wait until you are on the ground before discussing the problem with them. It is usually not too difficult to trace the pilot of an aircraft through its registration. ■

Classic Fighters Over Marlborough 2001

The Classic Fighters Over Marlborough 2001 airshow will take place at Omaka aerodrome over a three-day period beginning 13 April. It promises to be an exciting event with over 60 aircraft of a wide diversity taking part, including a number of types not seen before in New Zealand.

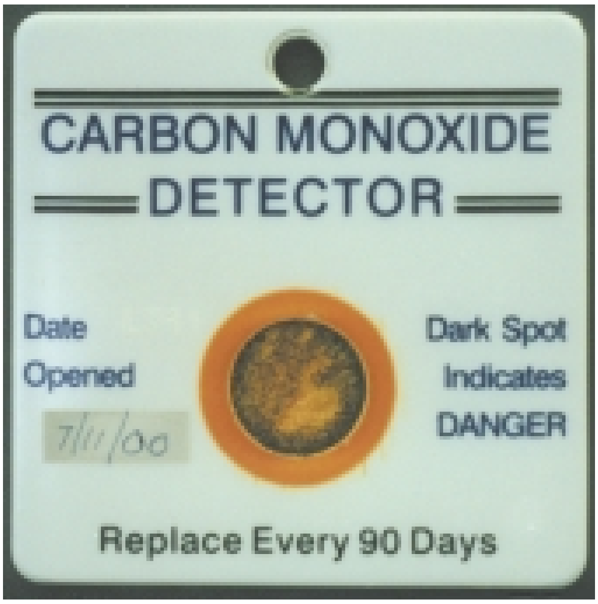
Organised and run by the New Zealand Aviation Museum Trust, Classic Fighters Over Omaka, which has been held biennially since Easter 1997, has grown from a relatively low-key 'fly-in' with around 30 display aircraft, to what should be a sizeable and high-profile airshow this year. Organisers are expecting in excess of 200 itinerant aircraft to fly in to Woodbourne aerodrome (Omaka aerodrome will be closed from Wednesday 11th to Monday 16th April) and between 30,000 and 50,000 people to attend over the two display days – an event that will be not too dissimilar in magnitude to Warbirds Over Wanaka if things go according to plan.

Because of the predicted scale and intensity of this event, pilots planning to fly to the show should consider a few basic points to help ensure that the event runs without incident.

- Carefully study the *AIP Supplement* relating to Classic Fighters Over Marlborough 2001 (AIRAC 01/3 effective 22 March 2001). Special attention should be given to becoming familiar with the two Restricted Areas (Woodbourne Control Zone and the practice area) and the arrival/departure procedures. The *Supplement* also contains detailed information on aircraft parking and refuelling options. The *Supplement* can be viewed free on the Airways New Zealand IFIS (Internet Flight Information Service) web site at **www.ifis.airways.co.nz** by looking under the **Publications** section and selecting **Documents Available Online.** (Note the Classic Fighters Internet site is also worth visiting at **www.classicfighters.voyager.org.nz** for additional flight planning details and general airshow information.)
- Obtain all the NOTAMs associated with NOTAM Area 6 before commencing your flight (a NOTAM reflecting the status of Omaka over the course of the event will be raised). These should be carried in the aircraft, along with a copy of the *Supplement,* for further reference when flying into and out of Woodbourne.
- Ensure that you have a full set of up-to-date charts (especially the Wellington VTC) and a current VFG (and any Change Notices) on board your aircraft. This is particularly important, as Woodbourne's airspace has recently changed (three new reporting points have been added, four CTR sectors re-named, and the attended/unattended frequency changed) and you can't afford to be in the wrong place at the wrong time in such high traffic densities.
- It is suggested that you file a full flight plan (now the same cost as a SARwatch) to avoid unnecessary delays at the Woodbourne CTR boundary – doing so also helps controllers to streamline the traffic flow by having accurate ETAs for each aircraft to work with. (Note that all NORDO aircraft participating in the airshow that plan to arrive after Wednesday 11 April will need to make arrangements to fly into the Woodbourne CTR accompanied by a radio-equipped aircraft.)
- Remember that it is easy to become spatially disorientated when flying into and out of Woodbourne because of the common mind-set that the two islands are aligned north to south. Pilots of aircraft joining Woodbourne from the North Island often believe that they are approaching the CTR from the north when in fact they are directly to the east. Similarly, pilots often believe that they are to the south of the CTR and make a joining call to that effect, when they are really to the west (eg, the Wairau Valley). An article titled "Woodbourne and You" in the January/February 2000 issue of *Vector* gives a good account of the specific problems associated with operating in and around the Woodbourne area and is worth re-reading.
- Ensure that you have arranged alternative transport to and from Omaka should the weather conditions en route be marginal on the day. **Do not** be tempted to push the limits to get to this event, whatever your experience level – there will always be other airshows you can fly to.

Adequate pre-flight preparation is essential for a safe and incident free flight to and from aviation events of this magnitude – observing the basic points outlined above is a vital part of this process. Please be thorough in your preparation and prudent with your in-flight decision-making at all times. ■

CO in the Cockpit



The expired CO detector.

Previous issues of *Vector* (see 1997 Issues 1, 2, 5 and 7) have suggested that aircraft owners and operators of piston-engine aircraft, and aircraft with heating systems that use fuel as a heat source, should consider fitting Carbon Monoxide (CO) detectors.

The value of a CO detector was recently demonstrated in an incident involving PA 31 Navajo, ZK-NPR. operated by Air Napier. In the course of a night-freight operation in November 2000 the pilot experienced some eye irritation. The pilot checked the CO detector located in the cockpit and noticed that it had blackened. The combustion heater was immediately switched off. The eye irritation reduced and the flight continued without further incident.

The company's maintenance organisation tested the heater for leaks and found the fuel nozzle sealing to be faulty. The heater had been tested recently during routine maintenance and was serviceable at that time.

Air Napier CEO, Gary Peacock, is in no doubt about the value of CO detectors and their regular replacement (the manufacturers suggest between 30 to 90 days). In Gary's view, the CO detector saved the pilot, the aircraft and quite possibly the company. The company has taken steps to ensure that current CO detectors are fitted in all their aircraft and that pilots fully report any events in which the detector responds to the presence of CO. In this way both the company and the maintenance engineers can work together to substantially reduce the likelihood of CO poisoning and its often-fatal consequences when flying.

Since the incident with ZK-NPR, Air Napier also detected an unacceptably high level of CO in its Cherokee Six. This appears to have been from a gas leak in the exhaust system and the gases penetrating into the cockpit through the many cable, control and wiring accesses in the firewall. The sealing on these apertures has been inspected and re-sealed. Again vigilance has paid off.

These incidents support the use of CO detectors. The risks of CO poisoning are real, and these inexpensive devices are widely available.

*The following carbon monoxide incidents were featured in the British safety publication **GASIL**, 2 of 2000.*

You've no doubt seen the little carbon monoxide (CO) indicators in some aircraft. In fact, we hope you see them every time you fly, because they are the only way you will have of knowing that dangerous fumes have entered your cockpit!

You may find yourself in the same situation as two pilots who were flying on a navigation exercise this winter, with of course the cabin heating selected. They were actually able to smell fumes, and at the same time the CO indicator started rapidly turning dark. They turned off the heating and opened the window side panels, and the smell quickly disappeared. They managed to convince themselves that the indicator was not becoming any blacker and flew on, checking each other regularly. Concern about the problem (and no doubt the cold!) persuaded them to cut the trip short.

On landing, a cracked weld was found in the exhaust system. After repair the problem did not recur, and the crew appeared to have suffered no lasting ill effects.

However, just as we were going to print, we received a report from a pilot who had a very narrow escape last year. He actually suffered all the symptoms of hypoxia, including the characteristic general feeling of well-being, while flying his light aircraft at quite a low altitude. He also noticed that his skin had developed the pink hue which is common in CO poisoning cases.

Unfortunately, although he could see that the CO detector in his aircraft had turned dark, he was affected so much that he did not treat his situation as the emergency it was. He was fortunate to make a safe if rather erratic approach and landing back at his base airfield, and subsequently suffered a severe headache.

Carbon monoxide has no smell itself, and by supplanting oxygen from the haemoglobin in the blood can rapidly cause all the symptoms of hypoxia. These vary from individual to individual, but can generally be regarded as similar to the symptoms of an excess of alcohol in the system, with its attendant euphoria, slurred speech, erratic behaviour and impaired decision making.

It is also difficult to flush CO out of the blood afterwards, so if you have been subjected to carbon monoxide poisoning, even without any obvious symptoms, you should seek medical assistance as soon as practicable. It is not a good idea to continue with the flight.

Please note, the indicators themselves have a limited life. Replace them at the recommended intervals, and at any time after the cockpit environment has been affected by chemicals. Carbon monoxide is a killer.

Thanks to Air Napier for sharing their CO incident with *Vector* readers. Sharing experiences enables others to learn from an incident and could perhaps save someone from disaster in a similar circumstance. ■

Letters to the Editor

Readers are invited to write to the Editor, commenting on articles appearing in Vector, recommending topics of interest for discussion, or drawing attention to any matters in general relating to air safety.

Vector Content and GPS

I refer to the letter from Ian Boag published in the January/February 2001 issue of *Vector*.

My views on the merits of *Vector* and the editorial policy differ to those of Ian Boag, and I find I also have some concerns regarding his lack of understanding of the need for basic navigation skills by VFR pilots.

Firstly, I congratulate all those involved with the production of this very fine magazine. I am never disappointed with the content (when I can wrestle it away from my student pilot son) and can always learn something new from the articles. Flying is my passion and I welcome any opportunity to be exposed to a part of aviation that may be new to me. Whatever the issue, the articles are designed to make us think about how we might react in given situations. They give us a perspective on things that we may never have had reason to consider. I can't believe that a pilot could not find at least some items of interest here.

It worries me when I hear VFR pilots chanting the merits of computer flight planning and GPS navigation without also acknowledging that there is still a very great need to have a sound understanding of map and pencil flight planning. When the GPS goes 'off line', a passenger vomits in the back and the base starts to lower with drizzle, I sure as hell would like my pilot in command to have a sound grasp of map reading and the ability to do some mental sums accurately and quickly. The electronic aids are great and I would not choose to fly without my GPS, but my map is always on my knee and my brain is tracking our progress across the page.

The "silly things I have done and survived" stories do make gripping reading, as Ian Boag suggests, but I can't help thinking that maybe the "silly things" would not have happened in the first place if pilots had thought about some of the issues before they found themselves in tight spots. This is why all the articles in *Vector* are so important.

Keep up the good work.

Grant Coldicott
Pleasant Point
January 2001

Vector Comment

Thank you for the compliments and we agree with the other points you make.

GPS

Reading your reply to Mr Boag indicated unawareness on your behalf of the capabilities of modern GPS.

You stated that GPS don't always work. The only time a GPS will not work on a flight-deck is if they are placed in a position where there is insufficient clear window for a view of satellites. Or if you forget to carry spare batteries.

You then stated that "it is an even bigger plus to know if you should be there".

My GPS cost $477, can be operated by one hand, is accurate to 5 metres on the horizontal plane, 15 metres on the vertical plane. It has capability of holding around 300 waypoints, sufficient to take most of the IFR intersections, VORs, NDBs and airports in New Zealand. These can be typed in manually or downloaded at a minimal cost. It can receive a route or work on a single waypoint.

From that information it will tell you bearing to waypoint, heading (both in text or pictorial), average speed, current groundspeed, ETA, distance, altitude (though only accurate to 90 feet). It will give you pictorial lines to allow you to follow your route if you so desire.

I agree wholeheartedly with you that as a newbie, I need to learn the basics of navigation and will pore over maps, but I for one will ensure that I always have my GPS with me as a back-up. I took my GPS up in a SAAB with its glass cockpit and was satisfied with the incredible accuracy compared to navigational aids on the plane, airspeed was accurate to only 1% – which is more accurate (aircraft or the GPS) is yet to be determined.

Dr Neville van Eerten BVSc
Christchurch.
January 2001

Vector Comment

You are quite correct – a GPS will not work if the aerial is shielded from the view of sufficient satellites or if the batteries run flat and you have no spares.

GPS Won't Work

Failure or non-availability of one or more GPS satellites.

Failure occurs for technical reasons related to the satellite. Ground-based repairs can only be effected in that part of the orbit visible to the controlling agency (in the case of GNSS, the US Department of Defense based in Colorado). Non-availability can occur when a satellite is not functioning for operational reasons. It may be 'off-line' for re-positioning. The effect can be that, from time to time, there are insufficient satellites available and 'in view' for the receiver unit to perform the navigation functions. These effects have been greater 'down-under' but are lessening with the particular orbits and the number of satellites available.

Sophisticated GPS units (those approved by aviation authorities through TSOs – Technical Standard Orders) for use as 'sole means' navigation tools in IFR flight are required to be able to detect and inform the pilot about the availability and operational status (accuracy) of the satellites in view. This function is called Remote Autonomous Integrity Monitoring – RAIM. At present GPS units in the price range cited are not TSO'd and do not have RAIM.

This can mean that a GPS unit may be working on faulty data or a reduced set of data. Typically a less expensive unit will indicate that it can achieve 3D navigation (but it cannot test the accuracy of particular satellite inputs). It probably will also indicate a step down to 2D navigation or to DR – dead reckoning. Each loss of information adds to error.

It could be argued that even under such circumstances the unit may be 'working', but the accuracy is degraded. If we are talking about 'sole reliance' use in the GA VFR environment, then there are risks in such errors. The risks can be managed

But there are other reasons why a GPS will not work, or will appear to work but deliver potentially unreliable information. See the accompanying list. These points do not detract from GPSs being really great 'navaids', but rather are cautionary hints.

Flight Planning Aids

It was with considerable interest I read the letter by Ian Boag concerning the use of electronic flight planning aids.

However, I disagree with his conclusions concerning the use of mechanical or alternative non-electronic aids, particularly by student pilots.

I agree that computer navigation aids are appropriate for pilots who have demonstrated and maintain suffcient competence using traditional methods of flight planning. To this end, I have written a website in which users may perform navigational and wind/temperature/pressure correction calculations. All New Zealand airports in the VFG are included in the database. (The website is at **www.saveguard.co.nz/flight**). Notams and current weather information are available from the Airways internet site, or via Datel.

Other pilots I know have created similar output from Excel spreadsheets in which they have programmed a lookup table of the New Zealand airports. Obviously, there is no reason to limit yourself to airports – any reference feature may be included in the database provided its latitude and longitude are determined with sufficient accuracy.

There is an obvious danger in such computer aids in that convenience may lead some pilots to become complacent. The atmosphere, in any computer aid, is modelled on the basis of the International Standard Atmosphere. Readings of upper level winds are estimates, the performance of any aircraft may vary from what is expected and variations in conditions may be encountered en route. There is no limit to how complex a navigational computer may be made. I offer my calculator as an aid to private GA pilots and hope that it is used in conjunction with, rather than as a replacement for, standard techniques.

If there is one issue I would raise it is the irritating tendency to use obsolete archaic units of measurement in aviation-related matters. For example, conducting weight and balance calculations using units of inches and pounds, rather than kilograms and metres, is confusing and unfortunate when every other sphere of activity is conducted in metric units.

Philip Ross
Lower Hutt
February 2001

Vector Comment

Modern technology can be a great boon for pilots and there are many ways, as you point out, that planning tasks can be made easier. One point to consider is that direct routes between aerodromes are not always the best option, and there is often a need to have intermediate turning points in order to fly the safest route.

The mix of units in aviation is definitely a potential area for mistakes, which could be life-threatening. While standardisation of units would be a significant and positive safety measure, it would be a mammoth task, requiring difficult international agreement.

For now, flight manual data is presented in the units used in the country of manufacture. This has been predominantly the United States – hence pounds, inches and US gallons are common. Our GAP booklet *Weight and Balance* offers some advice on dealing with various weight and balance units and includes a conversion diagram for weights (pounds or kilograms) and volumes (litres, US gallons and Imperial gallons).

Continued over ...

by an available standard navigation strategy.

Loss of signal can also occur in New Zealand by terrain shielding. This is more likely for low-level GA aircraft where one or more satellites are close to, or dipping over, the horizon.

A GPS unit won't work if it has an internal fault

These faults do happen. They are rare, but they are not unknown. Again the issue is 'sole reliance' and the associated risk if no other navigation strategy is available.

GPS power

For the portable units reliant on batteries, the condition of the back-up (spare) battery pack is important; a battery status indicator is a useful design feature. A weak battery back-up is no comfort. Finding that out in-flight can mean that the GPS won't work. Equally, it has been found that external power via a jack to the aircraft 'cigarette' power input can be a trap. There are cases where it was disabled but not placarded, so the GPS ran on battery until that died. After that it didn't work.

GPS Appears to Work

The following are common 'problems'.

User data entry errors

Data entry errors can occur where unit settings are not configured correctly or there is finger trouble (with lack of confirmation checks). Yes, pilots have headed off in the wrong direction following the CDI.

Out-of-date databases

Interestingly, being out of date is potentially more of a problem as entry-level units are becoming more sophisticated. Unless a database is current, then 'map' airspace information and frequency information is more likely to be out of date.

If not updated, a moving map display GPS with operational frequency information (that has almost become a pilot's substitute for VTCs, Topos and VFG) has the potential to become a dangerous piece of kit.

Cumulus granitis

Until terrain mapping gets incorporated, GPS units at the entry level will happily take you into the side of a hill or mountain, and in marginal VFR the risk is there. GPS nav is seductive – sadly these cases are accumulating in the GA VFR environment.

These last two points are relevant to our comment that "it is an even bigger plus to know if you should be there". Infringing airspace or impacting terrain is not impossible if one puts a blind trust in GPS.

Our comment may seem rather long but it is important that GPS users understand the limitations of their equipment.

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Human Errors in Maintenance

It was good to see the latest *Vector* feature an article on the subject of human errors in aircraft maintenance. It was a small article on a big subject, but the advice given was good.

I do however take issue with the writer's contention that complacency is not a major factor in maintenance errors. It has been my experience that errors usually occur through oversight, forgetfulness, thoughtlessness and poor working habits. Such attitudes only come about through a feeling of satisfaction and contentment, ie, complacency. On the other hand, an engineer who is alert, attentive, careful and thorough will rarely make an error. Why does this person exhibit these qualities – because he or she **knows the risks**.

The engineers least inclined to make an error are those who have seen the results of past errors, perhaps even their own, who understand that their work puts peoples lives at risk, and who read about and absorb the many examples of disasters that have resulted from maintenance error. The biggest enemy of engineers is a feeling that what they do is low risk. This is complacency, and is bound to result in error. Those most likely to fall into this category are those who are new to the industry, or who have been working in low risk areas. There is no better lesson for an engineer than to have been involved in an incident him or herself. We have to find a way of teaching all engineers the same lesson but by a less destructive method!

I have long advocated that human errors in maintenance will be minimised through having a strong safety culture in the workplace. Such a culture requires a four-pronged approach:

- Knowing the Risks
- Following Disciplines
- Good Work Habits
- Total Involvement

These can be achieved through education and commitment from managers and supervisors.

Complacency is our biggest enemy. Through education of the risks involved and the avoidance of these risks, complacency will be kept out of our industry.

Geoff Eban
Manager Technical, Air Nelson Ltd
February 2001

Vector Comment

Thank you for your thought-provoking letter.

Engineers play a vital role in aviation safety, and the complexities and human factor elements of their job do not always receive as much attention as that given to pilots. We hope to be more pro-active in this area in future. ■

Safety Videos

Here is a consolidated list of safety videos made available by CAA. Note the instructions on how to borrow or purchase (ie, don't ring the editors.)

Civil Aviation Authority of New Zealand

No	Title	Length	Year released
2	ELBA	15 min	1987
3	Wirestrike	15 min	1987
6	Single-pilot IFR	15 min	1989
7	Radar and the Pilot	20 min	1990
8	Fuel in Focus	35 min	1991
9	Fuel Management	35 min	1991
10	Passenger Briefing	20 min	1992
11	Apron Safety	15 min	1992
12	Airspace and the VFR Pilot	45 min	1992
13	Mark 1 Eyeball	24 min	1993
14	Collision Avoidance	21 min	1993
15	On the Ground	21 min	1994
16	Mind that Prop/Rotor!	11 min	1994
17	Fit to Fly?	23 min	1995
18	Drugs and Flying	14 min	1995
19	Fatal Impressions	5 min	1995
20	Decisions, Decisions	30 min	1996
21	To the Rescue	24 min	1996
22	It's Alright if You Know What You Are Doing – Mountain Flying	32 min	1997
23	Momentum and Drag	21 min	1998
24	The Final Filter	16 min	1998
25	We're Only Human	21 min	1998
26	You're On Your Own	15 min	1999
27	Rotary Tales	10 min	1999
28	Survival	19 min	2000
29	Weight and Balance – Getting it Right	28 min	2000
30	Mountain Survival	24 min	2000

Miscellaneous individual titles

Working With Helicopters	8 min	1996*

*re-release date

Civil Aviation Safety Authority, Australia

The Gentle Touch (Making a safe approach and landing)	27 min
Keep it Going (Airworthiness and maintenance)	24 min
Going Too Far (VFR weather decisions)	26 min
Going Ag – Grow (Agricultural operations)	19 min
Going Down (Handling emergencies)	30 min

Outside Productions

(may be borrowed, but not purchased, from CAA)

Mountain Flying (produced by High Country Productions, R D 2, Darfield)	66 min	2000

The CAANZ programmes have been produced over a period of years using three formats, Low-band, SVHS and Betacam. Programmes are being progressively replaced and it is the intention to eventually offer all programmes in Betacam. While the technical quality of some of the earlier videos may not be up to the standard of commercial programmes, the value lies in the safety messages.

To Borrow: The tapes may be borrowed, free of charge. Contact CAA Librarian by fax (0–4–569 2024), phone (0–4–560 9400) or letter (Civil Aviation Authority, PO Box 31–441, Lower Hutt, Attention Librarian). **There is a high demand for the videos, so please return a borrowed video no later than one week after receiving it.**

To Purchase (except Outside Productions): Obtain direct from Dove Video, PO Box 7413, Sydenham, Christchurch. Email **dovevideo@yahoo.com**. Enclose: **$10 for each title** ordered; plus **$10 for each tape** and box (maximum of 4 hours per tape); plus a **$5 handling fee** for each order. All prices include GST, packaging and domestic postage. Make cheques payable to "Dove Video".

How To – Fill the gap

The CAA publishes two series of information booklets.

The **How To** series aims to help interested people navigate their way through the aviation system to reach their goals. The following titles have been published so far:

Title	***Published***
How to be a Pilot	*1998*
How to Own an Aircraft	*1999*
How to Charter an Aircraft	*1999*
How to Navigate the CAA Web Site	*1999*
How to be an Aircraft Maintenance Engineer	*1999*
How to be a Good IA	*2000*
How to Navigate the Rules	*2000*
How to Get Your Licence Recognised in New Zealand (web site only)	*2000*
How to Report Your Accidents and Incidents	*2000*
How to Deal with an Aircraft Accident Scene	*2001*

The **GAP** (**G**ood **A**viation **P**ractice) series aim to provide the best safety advice possible to pilots. The following titles have been published so far:

Title	***Published***
Winter Operations	*1998*
Bird Hazards	*1998*
Wake Turbulence	*1998*
Weight and Balance	*1998*
Mountain Flying	*1999*
**Flight Instructor's Guide*	*1999*
Chief Pilot	*2000*
New Zealand Airspace	*2000*
Takeoff and Landing Performance	*2000*
**Aircraft Icing Handbook*	*2000*
In, Out and Around…Milford	*2001*

How To and **GAP** booklets (but not *Flight Instructor's Guide* or *Aircraft Icing Handbook*) are available free from most aero clubs, training schools or from Field Safety Advisers (FSA contact details are usually printed in each issue of *Vector*). Note that *How to be a Pilot* is also available from your local high school.

Bulk orders (but not *Flight Instructor's Guide* or *Aircraft Icing Handbook)* can be obtained from:

The Safety Education and Publishing Unit
Civil Aviation Authority
P O Box 31-441, Lower Hutt
Tel: 0–4–560 9400

*The *Flight Instructor's Guide* and *Aircraft Icing Handbook* can be purchased from either:

- **Expo Digital Document Centre**, P O Box 30–716, Lower Hutt. Tel: 0–4–569 7788, Fax: 0–4–569 2424, Email: expolhutt@expo.co.nz
- **The Colour Guy**, P O Box 30–464, Lower Hutt. Tel: 0800 438 785, Fax 0–4–570 1299, Email: orders@colourguy.co.nz

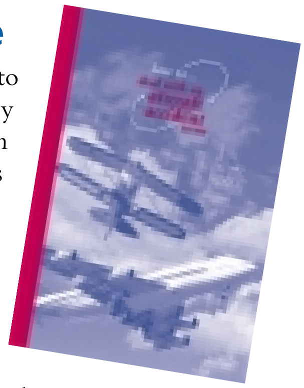
In, Out and Around … Milford

Milford Sound is world-famous for its scenery, and this is reflected in the numbers of tourists who visit each year by foot, by road or by air. The airfield and surrounding topography pose a special challenge for pilots.

A new GAP booklet, *In, Out and Around … Milford*, covers points a pilot should consider before planning a flight to Milford. These include pre-flight planning, weather considerations, aircraft performance, reporting points, communications, and the specific procedures at Milford in various wind conditions. Congestion and noise abatement aspects are also covered.

This is the first title of an *In, Out and Around…* airspace series. (These GAPs will update and replace the airspace articles that have appeared in the magazine in past years – those articles were very well received and we have had requests for revised versions.) The next *In, Out and Around…* GAP to be published will cover Queenstown airspace with other centres being reviewed in due course. These airspace GAPs are intended to be studied in conjunction with the applicable VTC.

How to Deal with an Aircraft Accident Scene



This new booklet has been written to provide guidance to Police, emergency services personnel and others in relation to aircraft accidents. It provides information on the actions to be taken in the event that they witness, or are required to attend, an aircraft accident. The booklet also includes advice on how to minimise any disturbance to the accident site so as to protect what might be vital accident investigation evidence.

Although primarily intended for the Police and emergency service organisations, other interested parties are welcome to obtain a copy of this booklet from the CAA or their local Field Safety Adviser. ■

AIP Supplement Cut-off Dates

Do you have a significant event or airshow coming up soon? If so, you should have the details published in an *AIP Supplement* – relying on a NOTAM is not as effective and the information may not reach all affected users. In order that such information can be promulgated in a timely manner, you need to submit it to the CAA with adequate notice (at least 90 days before the event). Please send the relevant details to the CAA (ATS Approvals Officer or AIS Coordinator) **at least** one week before the cut-off date(s) indicated below.

Supplement Cycle	*Supplement* Cut-off Date	*Supplement* Effective Date
01/6	19 April 01	14 June 01
01/7	17 May 01	12 July 01

OCCURRENCE BRIEFS

Lessons For Safer Aviation

The content of *Occurrence Briefs* comprises notified aircraft accidents, GA defect incidents (submitted by the aviation industry to the CAA), and selected foreign occurrences that we believe will most benefit engineers and operators. Statistical analyses of occurrences will normally be published in *CAA News*.

Individual Accident Reports (but not GA Defect Incidents) – as reported in *Occurrence Briefs* – are now accessible on the Internet at CAA's web site (http://www.caa.govt.nz/). These include all those that have been published in *Occurrence Briefs*, and some that have been released but not yet published. (Note that *Occurrence Briefs* and the web site are limited only to those accidents that have occurred since 1 January 1996.)

Accidents

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 CAA 005 to the CAA Safety Investigation Unit.

Some accidents are investigated by the Transport Accident Investigation Commission, and it is the CAA's responsibility to notify TAIC of all accidents. The reports which follow are the results of either CAA or TAIC investigations.

ZK-EPJ, Grumman American AA-5B, 1 Jan 97 at 1150, Pauanui. 4 POB, injuries 4 minor, damage unknown. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 46 yrs, flying hours unknown.

The aircraft suffered a total engine failure after taking off from Pauanui airport and was forced to ditch into a nearby river estuary. The aircraft operator said that the engine had stopped suddenly after spluttering briefly.

Further investigation revealed that there was fuel bacteria in the electric fuel pump filter fuel and water in the carburettor, although this could have been a result of submergence on ditching. The engine ran normally when tested.

Main sources of information: Accident details submitted by pilot plus further enquiries by CAA.

CAA Occurrence Ref 96/3421

ZK-CAD, Avid Mark IV Microlight, 19 Aug 97 at 1400, Taieri. 2 POB, injuries nil, damage minor. Nature of flight, training dual. Pilot CAA licence CPL (Aeroplane), age 53 yrs, flying hours 16740 total, 30 on type, 180 in last 90 days.

The microlight was just airborne off Runway 29 at Taieri when it experienced a complete engine failure at 300 feet necessitating a forced landing into a 90-metre field. The cause of the failure was thought to be due to the high nose attitude adopted on climb out, which caused fuel starvation due to problems with the fuel venting system. An additional fuel vent was added and the aircraft tested on the ground in the same high nose attitude. The engine ran satisfactorily during this test. A design fault is suspected.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 97/3819

ZK-CQB, Fletcher FU24-950M, 12 Dec 97 at 1600, Henley. 1 POB, injuries nil, damage minor. Nature of flight, agricultural. Pilot CAA licence CPL (Aeroplane), age 36 yrs, flying hours 12300 total, 1800 on type, 180 in last 90 days.

The wing dropped and contacted the ground while the aircraft was taking off in gusty conditions. As the aircraft was already airborne the pilot decided to continue the flight to Dunedin aerodrome, where an uneventful landing was made.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 97/3767

ZK-HQZ, Hughes 269C, 2 Nov 98 at 1145, Urewera National Park. 3 POB, injuries 1 fatal, damage destroyed. Nature of flight, private other. Pilot CAA licence CPL (Helicopter), age 46 yrs, flying hours 13091 total, 173 on type, 210 in last 90 days.

The pilot and two companions had been hunting in the Urewera National Park, using the helicopter for access to, and reconnaissance of, their hunting area. On completion of the expedition, the pilot's intention was to fly the helicopter with the two passengers and their gear to Opotiki, drop one passenger off and continue to Ardmore. Some of the equipment and a deer carcass were to be carried as a sling load. The helicopter was above its normal maximum all-up weight but within the weight limit permitted by the Flight Manual Supplement pertaining to cargo hook operations. The Supplement was, however, not included in the Flight Manual for HQZ. The pilot attempted to take off from an out-of-ground-effect hover, in which the engine power required was 25 inches manifold pressure. There was, however, little or no power margin available above this figure. In the early stages of the takeoff, the rotor rpm decayed, the helicopter turned to the right (it could not be established whether this was due to pilot input or as a result of the rpm loss) and struck trees in the adjacent stream bed. The pilot was probably killed by the impact with the trees, but the passengers survived this and the subsequent drop to the stream bed without serious injury. The ELT operated on impact, and was carried by one of the passengers to a more suitable location. The ELT signal was detected by satellite and resulted in a successful Search and Rescue operation.

Main sources of information: CAA field investigation.

CAA Occurrence Ref 98/2972

ZK-DUU, Piper PA-28-140, 21 Nov 99 at 1725, Waipara rv Mouth. 2 POB, injuries 2 fatal, damage substantial. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 26 yrs, flying hours 229 total, 164 on type, 80 in last 90 days.

The pilot reported an engine failure and advised that he was about to ditch. The aircraft was beyond gliding distance from land at the time. Search and Rescue efforts failed to locate the occupants, who were found to have drowned after safely vacating the aircraft into rough seas. It appears that the pilot neglected to recalculate his fuel reserves after a detour due to encountering significant weather on his planned return route. He did not refuel the aircraft at the various opportunities that arose en route. It was calculated that the aircraft's fuel supply would have been exhausted at a point consistent with the time taken to fly to the ditching site. A full accident report is available on the CAA web site.

Main sources of information: CAA field investigation.

CAA Occurrence Ref 99/3174

ZK-FGF, Cessna R172K, 25 Dec 99 at 0250, Te Wera. 2 POB, injuries 2 fatal, damage destroyed. Nature of flight, private other. Pilot CAA licence CPL (Aeroplane), age 21 yrs, flying hours 346 total, 85 on type, 26 in last 90 days.

On a night IFR cross-country flight, the pilot reported that he had a rough-running engine. He was on track between Maxwell and Ohura, and diverted towards New Plymouth. The engine failed and the aircraft faded from radar coverage at 4900 feet amsl. The engine failure was subsequently found to be due to a failed con rod. The burnt-out wreckage was found at Te Wera later in the morning, both occupants having been killed in the impact and subsequent fire. The ELT antenna cable was broken at the connector during the impact sequence, and also fire-damaged. No signal was emitted. The switch was in the ARMED position at impact. A full accident report is available on the CAA web site.

Main sources of information: CAA Field Investigation.

CAA Occurrence Ref 99/3689

ZK-ETP, Cessna T210N, 4 Jan 00 at 1100, Matauri Bay. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence CPL (Aeroplane), age 57 yrs, flying hours 4500 total, 2000 on type, 60 in last 90 days.

The aircraft was landing at a private airstrip at Matauri Bay near Kerikeri. During the landing roll the main landing gear partially retracted. This resulted in moderate damage to the tail and landing gear. The pilot believed that the gear was down and locked, which was confirmed by gear light indications.

Main sources of information: Accident details submitted by pilot plus further enquiries by CAA.

CAA Occurrence Ref 00/4

ZK-GLO, Schempp-Hirth Mini-Nimbus HS 7, 3 Feb 00 at 1200, Matamata. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence nil, flying hours 274 total, 103 on type, 41 in last 90 days.

An out-landing became necessary during the gliding competition. The only available area was rolling farmland with very few suitable paddocks. A short, newly mown hay paddock with a short flat area leading to a rolling upslope was chosen. The approach was slightly low and fast and the glider overshot the chosen touchdown point. In an effort to stop quickly the pilot forced the glider on to the field, which caused a bounce. The subsequent landing was very hard.

Main sources of information: Accident details submitted by pilot plus further enquiries by CAA.

CAA Occurrence Ref 00/265

ZK-HWK, Aerospatiale AS 350BA, 7 Mar 00 at 0930, Mt Karioi. 4 POB, injuries 4 fatal, damage destroyed. Nature of flight, transport passenger A to B. Pilot CAA licence CPL (Helicopter), age 39 yrs, flying hours 2816 total, 288 on type, 94 in last 90 days.

The helicopter was on a local charter flight from Raglan to Mount Karioi, carrying technicians to service telecommunications equipment located on the summit. It was being flown in conditions of reduced visibility resulting from local cloud when it collided with trees and the ground, killing all four occupants. The time of the accident and the detail of the flight path could not be conclusively established, but the pilot may have inadvertently lost visual reference with the surface in deteriorating visibility. A safety issue identified was the desirability of a less vulnerable ELT location in helicopters.

Main sources of information: Abstract from TAIC Accident Report 00-003.

CAA Occurrence Ref 00/597

ZK-CUH, Piper PA-28-140, 26 Mar 00 at 0830, Rangiora. 1 POB, injuries nil, damage substantial. Nature of flight, training solo. Pilot CAA licence nil, age 25 yrs, flying hours 20 total, 20 on type, 20 in last 90 days.

The student pilot was on his third hour of solo circuits and landed to the left of the grass vector. The nosewheel was also to the left of centre, which caused the aircraft to track left towards the runway edge markers (painted tyres). Overuse of the brakes caused the wheels to lock up and the aircraft to impact one of the tyres. The aircraft suffered propeller damage, a cracked crankshaft and damage to its nosewheel fairing.

Main sources of information: Accident details submitted by pilot plus further enquiries by CAA.

CAA Occurrence Ref 00/944

ZK-EGU, NZ Aerospace FU24-950, 27 Mar 00 at 0703, Stratford. 1 POB, injuries nil, damage minor. Nature of flight, agricultural. Pilot CAA licence CPL (Aeroplane), age 57 yrs, flying hours 14152 total, 9507 on type, 164 in last 90 days.

While taking off down the airstrip the pilot experienced sun strike. As a result, he temporarily lost sight of the airstrip and struck a fence strainer post just after the aircraft became airborne.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 00/945

GA Defect Incidents

The reports and recommendations which follow are based on details submitted mainly by Licensed Aircraft Maintenance Engineers on behalf of operators, in accordance with Civil Aviation Rule, Part 12 *Accidents, Incidents, and Statistics.* They relate only to aircraft of maximum certificated takeoff weight of 5700 kg or less. Details of defects should normally be submitted on Form CAA 005 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: **P/N** = part number
TIS = time in service
TSI = time since inspection
TSO = time since overhaul
TTIS = total time in service

Aerospatiale AS 350B – Fatigue failure of tail rotor gearbox

The pilot noticed an unusual noise from the tail of the aircraft.

On removal of the electrical chip plug from the tail rotor, oil ran out of the self-sealing plug. However, no metal was found on the chip plug. The helicopter was made unserviceable. A metallurgical report showed fatigue failure of teeth after high time usage with no abnormal indications prior to the failure. TSO 2409 hrs; TSI 77 hrs.

ATA 6400 CAA Occurrence Ref 99/1640

Bell 206B – Cabin roof structure cracks badly

The operator noticed that the aircraft was exhibiting some unusual vibration. The engineer inspected the aircraft and found that there were fatigue cracks in the cabin roof structure at the lefthand rear and righthand forward main rotor transmission mount points. The support assembly was cracked longitudinally and the lefthand rear mount foot had completely broken off.

The engineer who performed the 600-hour inspection just prior to the detection of the problem had not noticed the cracking. Further disassembly revealed the presence of an unapproved repair to the rear cabin bulkhead assembly frame underneath the rear lefthand transmission mount.

It could not be determined if this repair contributed to, or was related to, the fatigue cracking. All cracked and broken items were repaired and a transmission alignment check carried out.

ATA 5300 CAA Occurrence Ref 99/3042

Cessna 207 – Propeller blade ferrules found cracked, P/N C4451

The propeller hub and blades were received for scheduled overhaul. Two blade ferrules were found to be cracked at approximately 80 percent of their circumference. The propeller had a history of oil leaks between 1994 and 1995, but had no further leaks up to the present time. The aircraft was extremely close to losing a propeller blade. It was noted that the ferrules appear brittle, with pieces splintering out. TSO 1199 hrs.

ATA 6100 CAA Occurrence Ref 99/2336

Cessna 172P – Nose gear retaining collar breaks, P/N 0543018

The pilot reported that he felt a significant nosewheel shimmy at the end of the landing roll.

Further investigation revealed that the securing bolt (P/N AN5-10A) on the left side of the noseleg lower attachment fitting assembly had failed. One half of the assembly (P/N 0543018) had broken away and departed the aircraft. The nosewheel assembly was retained by the upper attachment fitting only.

ATA 3220 CAA Occurrence Ref 99/1768

Cessna 207 – Rear carry through spar severely corroded, P/N 1212866-4

During scheduled maintenance, a 12,000-hour inspection revealed that the rear carry-through spar was cracked on the starboard side. Considerable corrosion was found under the wing attachment fittings upon being removed. No corrosion protection was carried out at manufacture. TTIS 10618 hrs.

ATA 5700 CAA Occurrence Ref 99/1807

Hughes 369D – Manufacture of rotor blades defect, P/N 500 P2100-101

There have been two reports of defects found 'in service' with PMA main rotor blades manufactured overseas by Helicopter Technologies Co. The nature of the defects were de-bonding of the skin at the trailing edge and blade grip. The blades had 258 and 107 hours time-in-service respectively. The blades have been returned to the manufacturer and the FAA advised of the problem.

ATA 6210 CAA Occurrence Ref 99/2382

Micro Aviation Bantam B22S – Aileron cable breaks

During a pre-flight inspection, the starboard aileron was found jammed in the up position. It was determined that the aileron cable was broken. It is possible that the aileron cable may have been damaged by the pilot having put weight on it when getting in and out of the aircraft.

ATA 2710 CAA Occurrence Ref 99/197

Piper PA-28R-200 – Landing gear motor windings short

The aircraft undercarriage failed to extend normally.

Further investigation revealed that the landing gear motor had failed. This was caused by a direct short in the field windings to the motor attach screw. Insulation was fitted to the attach screw to prevent a reoccurrence.

ATA 3200 CAA Occurrence Ref 99/1506

Westland Scout AH/1 – Rotor blade crack detected, P/N H12-20-297

When carrying out an x-ray, the technician noticed a mark outside of the x-rayed area. An x-ray was taken of this new area, which showed up a positive crack. When the skin was pushed the crack opened up.

ATA 6300 CAA Occurrence Ref 99/2381

International Occurrences

Lessons from aviation experience cross international boundaries. In this section, we bring to your attention items from abroad which we believe could be relevant to New Zealand operations.

United States of America

Occurrences

The following occurrence comes from the NTSB's *Aviation Accident/Incident Database* contained on their web site.

Cessna 185 – Engine suffers catastrophic failure while IMC

On 3 January 2000, a Cessna A185F was substantially damaged during a forced landing following a loss of engine power after departing from Clover Field Airport. The commercial pilot, who was the owner of the aeroplane, and his three passengers were not injured.

The cross-country flight departed the Clover Field Airport at 1215 and was destined for the Gregg County Airport near Longview, Texas. The pilot stated that he departed to the north from Runway 32 and was climbing in instrument meteorological conditions through 3500 feet, when he heard a sequence of "loud bangs". The pilot stated that he looked at the digital engine monitor and noted that the cylinder head temperature for the No 3 cylinder was indicating an "excessively high temperature". The pilot also noted that the oil pressure and oil temperature gauges were indicating, "lower than normal". He added that the aeroplane was "vibrating violently" and therefore elected to pull the throttle to idle and initiate a descent.

The pilot declared an emergency to air traffic control (ATC) and they cleared him direct to the Clover Field Airport. The pilot stated that the aeroplane broke out of the clouds at 1500 feet, and he reported to ATC that he had the airport in sight. The pilot determined that he would not be able to fly the aeroplane to Runway 32 with the available power, and elected to land on Runway 22 (a 730-metre-long grass runway) instead.

On final approach, the pilot fully extended the flaps while maintaining a 90-knot glide speed. He added that the aeroplane landed halfway down the length of the runway at about 70 knots. The pilot applied heavy brake pressure in an attempt to stop the aeroplane before it contacted a ditch located at the end of the runway. When the aeroplane slowed to about 40 knots, it nosed over, coming to rest inverted.

Further investigation showed that the No 3 cylinder head had separated from the barrel.

NTSB Occurrence Ref FTW00LA058

United Kingdom

Occurrences

The following occurrences come from the Spring 2000 edition of *Flight Safety Bulletin*, which is published by the General Aviation Safety Council, United Kingdom.

Rans S6-116 – Soft surface causes nosegear to collapse

The pilot reported a normal approach and landing on the 350-metre grass strip, although the touchdown was slightly fast. During the landing roll the nosewheel collapsed and the aircraft inverted, causing substantial damage to the airframe and minor injury to the pilot and passenger. The pilot described the landing surface as soft. The recovery team described it as "like a bog".

PPL with 206 hrs total, 8 hrs on type, with 3 hrs in the last 90 days.

Cessna FRA150M – Pilot lands on nosegear

The pilot was doing a series of touch-and-go landings on the grass runway with a crosswind component of 5 to 8 knots. On the application of power after the third landing, the nosewheel struck the ground and collapsed, destroying the propeller and nose oleo, shock-loading the engine, and distorting the firewall. The pilot observed that he was not very familiar with the Cessna 150 flap operating system and may have applied power before retracting the flap. (All of the pilot's flying experience was on the Cessna 150.)

PPL with 109 hrs total, all on type, with 4 hrs in the last 90 days.

Piper PA-28-180 – Poor braking action results in over-run

The pilot was landing on an 800-metre grass strip in nil-wind conditions. He reported that braking on the lush grass was less than expected. The aircraft collided with a stout wire fence beyond the end of the strip, causing substantial damage to the propeller, nosegear, engine mounts, and exhaust. The pilot suggested that he should have used the short-field landing technique.

PPL with 463 hrs total, 278 on type, with 10 hrs in the last 90 days.

Auster D4-108 – Pilot loses control after abandoning takeoff

The pilot inspected the 820-metre grass strip before takeoff and found the final 230 metres covered in standing water. There were also some very wet patches to the south of the centreline at the strip midpoint. He assessed the ground north of the centreline to be firmer and that the first 455 metres was useable. He did not do a formal takeoff weight calculation, but estimated it to be 1622 lbs (278 lbs below MAW). He then calculated the takeoff distance required according to CAA Safety Sense Leaflet 7B (Aeroplane Performance) and this came out at 374 metres, including the 1.33 safety factor. The soft-field technique was used and the aircraft achieved 40 mph a short distance before reaching the windsock – about 270 metres from the start point. The pilot selected the takeoff attitude, the aircraft became airborne for about 20 metres and then settled back onto the ground. After another 10 metres it became airborne again for about 40 metres before settling again. The pilot decided to abandon the takeoff. He crossed the centreline onto softer ground where the nose pitched down and the propeller struck the ground before the aircraft settled back onto the tailwheel.

PPL with 426 hrs total, 124 hrs on type, with 4 hrs in the last 90 days.