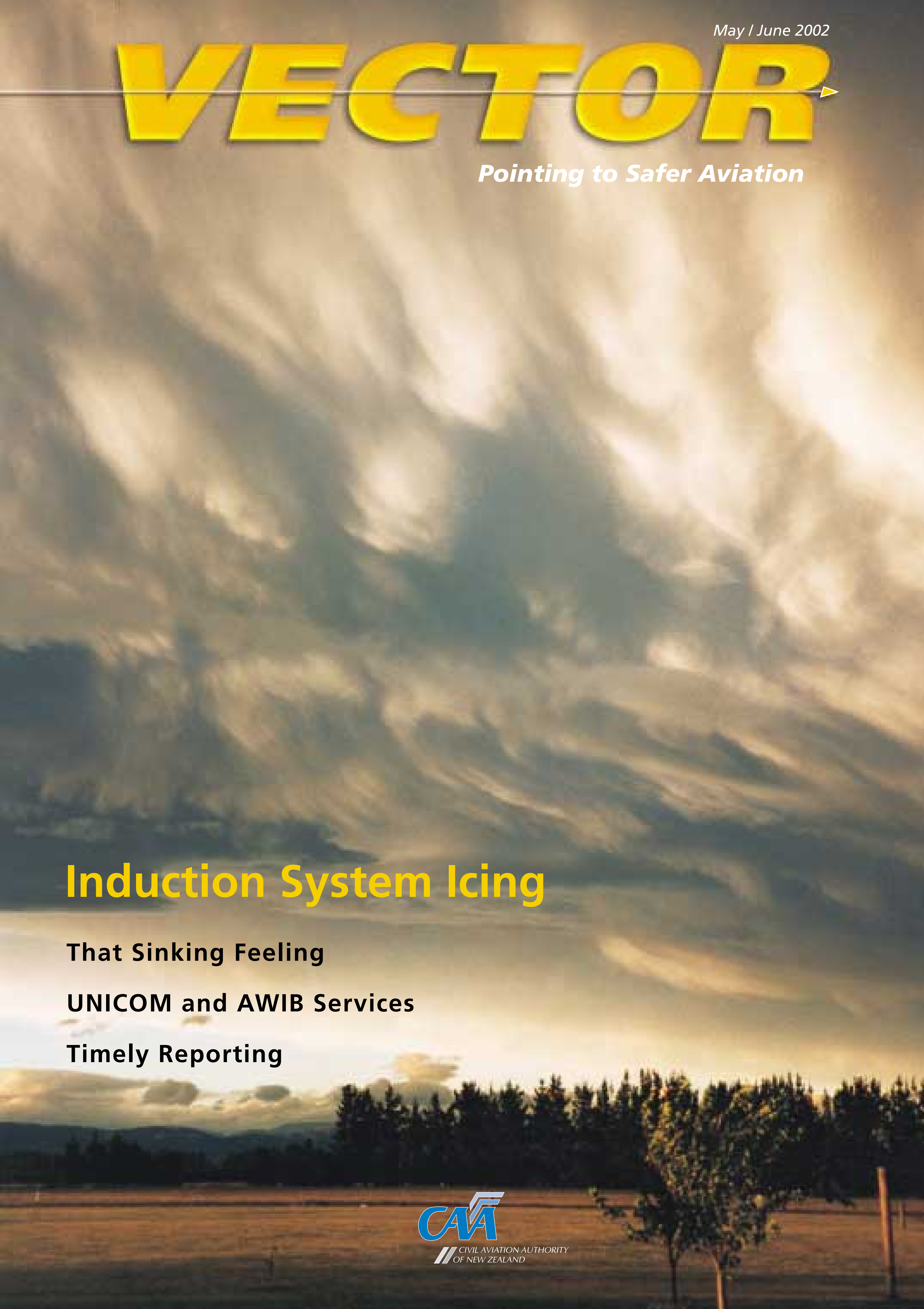
May / June 2002

VECTOR

Pointing to Safer Aviation



Induction System Icing

That Sinking Feeling

UNICOM and AWIB Services

Timely Reporting

CAA
CIVIL AVIATION AUTHORITY
OF NEW ZEALAND

VECTOR

Managing Editor, Cliff Jenks

Vector Editors, Pam Collings, Barnaby Hill, Jim Rankin.

CAA News Editors, Peter Singleton, Phillip Barclay.

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Induction system icing can occur at any time of year. Understanding what conditions cause induction icing, and knowing how to recognise and remedy it, could prevent an unwelcome engine failure.

A well organised tool-management system, meticulous workshop procedures and an up-to-date paperwork trail, all help to lessen the chance of Murphy striking in your maintenance organisation.

A recent aircraft accident due to a component failure highlighted why reporting of incidents, even minor ones, is so important within the aviation industry.

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Cover photo:
Sunset at Forest Field. Can you identify the cloud types?

Induction System Icing

This is a further article in the Vector series on icing. If it looks familiar, that is because the main text is a reprint of an article published in Issue 96-7 of *Vector*. The laws of physics and the design of induction systems have not changed much since then, so the article is just as relevant now as it was when first written.

Winter. Oh how we sometimes suffer through you, your brisk, chilly mornings, your cool afternoons and your howling southerlies with freezing cold rain and embedded CBs. We will not be sorry to see the back of you. We should, however, not be so hard on winter, as summer has its own traps for young players. One that does not immediately spring to everyone's mind is that of induction icing. Wait one chilly moment – we hear you ask, induction icing in summer? Absolutely, we reply, induction icing will occur at any time of year as long as the conditions are right.

What is Induction Icing?

Most pilots are familiar with the term 'carburettor icing' but induction icing is a more comprehensive term which includes all types of fuel metering (fuel injection as well as carburation), and all parts of the induction system where ice can accumulate such as the air filter, or bends in the system, as well as the critical areas of the fuel metering device like the throttle plate in the float-type carburettor.

There are two types of induction icing, *impact icing* and *refrigeration icing*.

Impact Icing

Impact icing occurs when supercooled water droplets impact on the forward-facing surfaces of an aircraft and immediately turn to ice. Impact ice may also occur when visible moisture contacts a supercooled surface (below 0°C) – for example, if an aircraft has been cruising above the freezing level and then descends into areas of visible moisture, such as cloud, rain or sleet.

This type of induction icing forms in the same way as airframe icing and is therefore only likely to occur in IFR flight conditions, but it is possible with all types of fuel metering systems. Induction ice forms on the surface of the air intakes, air filter and possibly in the bends in the system, creating disturbances in the airflow and gradually closing off the air intake. This can lead to a change in the fuel/air mixture, causing a loss of power.

Refrigeration Icing

Refrigeration icing forms in a **float-type carburettor** as a result of fuel vaporisation and low pressure. Under certain moist atmospheric conditions, when the relative humidity is more than 50%, with air temperatures anywhere up to 35°C, it is possible for such ice to form in the carburettor.

The rapid cooling in the carburettor is caused by two factors, the absorption of heat from the air during vaporisation of the fuel, and the high air velocity, which causes a low-pressure area – accompanied by a drop in temperature – through the venturi. If the air contains a large amount of moisture, the cooling process from these two factors can cause precipitation in the form of ice on the inlet manifold walls and the throttle 'butterfly'. This can seriously restrict the airflow and thus reduce the power output of the engine. If not corrected, ice accumulation may cause complete engine stoppage.

> ***"… even on a hot day, you could still have a temperature in the throttle butterfly area at or close to freezing."***

Figure 1 shows the change in air temperature through the venturi. Air temperature at entry is 15°C, but after passing through the venturi it falls to approximately 0°C – a net drop of 15°C.

Figure 2 shows a venturi and throttle valve as in *Figure 1*, except that a fuel discharge nozzle is present in the venturi bore. This is typical of float-type carburettor design. Location of the fuel discharge nozzle in the low-pressure area of the venturi causes fuel to flow from the float chamber to the discharge nozzle. The rate of flow varies according to the airflow through the venturi.

Fuel emerging from the nozzle is rapidly atomised by the high-speed airflow, and vaporisation occurs. This vaporisation process

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absorbs considerable heat from the surrounding area, with a consequent drop in temperature. At cruise and takeoff power, this refrigeration process can subtract as much as 20 to 25°C from surrounding temperatures.

Together, the venturi action and fuel vaporisation process can reduce the carburettor throat temperature by as much as 35°C, so that, even on a hot day, you could still have a temperature in the throttle butterfly area at or close to freezing.

Note in *Figure 2* how ice is forming on the throttle and throat below the venturi. If the situation were allowed to continue power loss must ultimately occur. Ice is not depicted on the discharge nozzle or the upper area of the venturi since it is intended to show only the effects of refrigeration icing from fuel vaporisation. However, it is possible to accumulate ice on the nozzle and upper venturi areas because they are also chilled by the venturi and vaporisation actions.

While you can expect throat temperatures of 35°C below ambient for *float-type carburettors*, the temperature drop for *pressure-injection carburettors* is only about half this amount. This is because of the location of the discharge nozzle. This more complex carburettor moves fuel to its nozzle under pressure from a fuel pump; consequently the nozzle may be located downstream from the venturi and throttle valve where it will not contribute to throttle or throat icing.

From what has been covered so far, it would appear that carburettor ice potential should decrease with lower power settings, since venturi effects and fuel flow decrease with throttle reduction. This would be true – except that reducing the throttle opening to the near closed position increases airflow velocity around the edges of the throttle butterfly plate. This, in turn, reduces its temperature (just as in the venturi process).

When sufficient moisture is present, ice will form on the cold throttle plate. This can be quite hazardous, as only a small amount of ice is required to quickly bridge the gap between the throttle and the throat wall (*Figure 3*). This condition can freeze the throttle valve to the walls of the carburettor throat, and when the unsuspecting pilot attempts to apply power she or he may find the throttle very difficult to move. Application of force is likely to result in breakage of the throttle linkage rather than breaking the weld-like grip of the ice. This type of icing can be prevented by use of carburettor heat and by gentle application of power every minute or so during prolonged, low-power descents.

Preventive measures

Fortunately, both impact and refrigeration icing can be dealt with before they reach extreme and dangerous proportions.

Impact Icing

Visible airframe ice should immediately trigger your mind to the danger of a similar buildup in the induction system. Indeed, this may be the only indication of induction system icing in aircraft that have fuel-injection systems.

Fuel-injected engines have an alternate air source somewhere downstream of the intake and filter. On some installations this alternate air source will operate automatically should the filter mass airflow diminish greatly.

If your aircraft has alternate air, as opposed to carburettor heat, an application of this will give an immediate result if the manifold pressure decay is due to impact icing. It does not warm the air at all as the air is taken from within the engine cowl, so it will not remove the ice buildup at the intake – but it will provide you with useable air for the engine.

The application of alternate air may produce effects similar to the application of carburettor heat, therefore the mixture may need to be leaned to restore smooth engine operation and to reduce power loss from an over-rich mixture.

With few exceptions, alternate air bypasses the air filter, so its use on the ground should be kept to a minimum.

Refrigeration Icing

The potential for refrigeration icing with carburettor-equipped aircraft occurs when ambient temperatures are between approximately plus 20°C and minus 10°C for pressure-injection

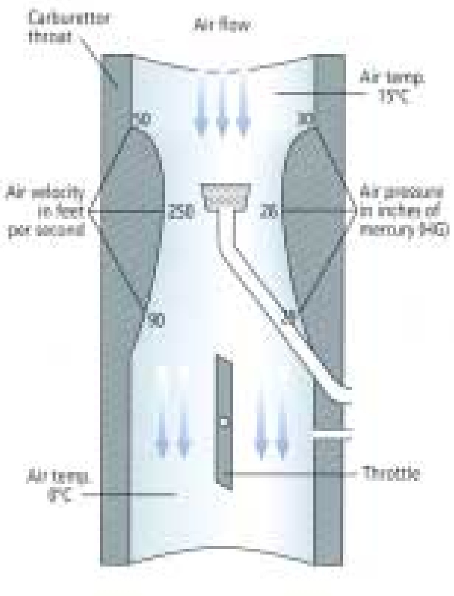

Figure 1. Simplified views of a venturi showing changes in air velocity and temperature. These vary in relation to changes in throttle opening and engine rpm.

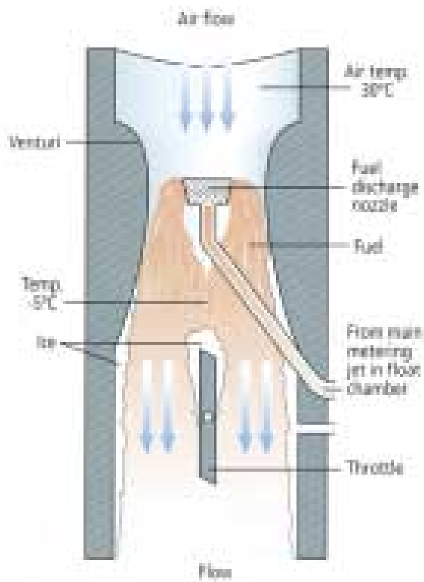

Figure 2. Float-type carburettors have a fuel discharge nozzle located in the venturi. Venturi action plus cooling effect of fuel vaporisation can reduce mixture temperatures markedly.

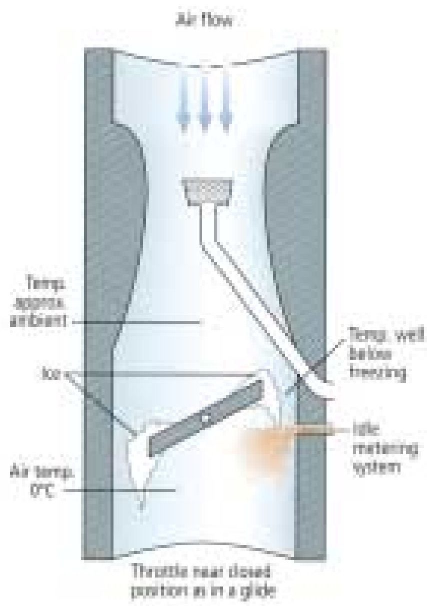

Figure 3. The risk of serious carburettor icing is greatest at low or idle power settings. When carrying out prolonged glides, the engine must be warmed regularly to provide sufficient exhaust heat to the hot-air heat exchanger.

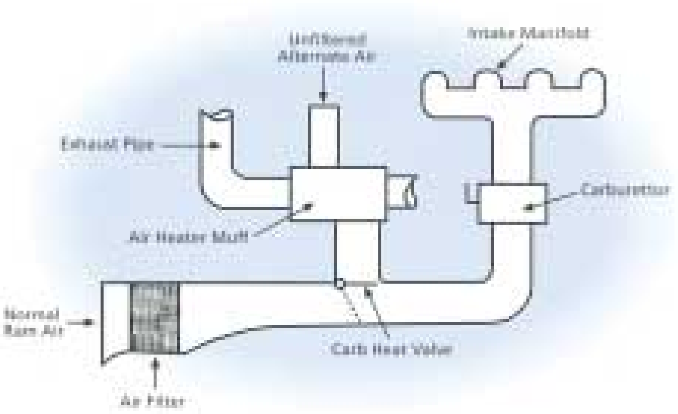

Figure 4. *Simplified induction system showing the carburettor hot-air heat exchanger and valve. For carburettor heat to be fully effective, exhaust system temperatures must be maintained at a reasonable level.*

carburettors, and plus 35°C and minus 10°C for float-type carburettors.

The best cure for carburettor icing is to prevent it. This requires a sound knowledge of the **symptoms**, as follows:

Fixed-pitch Propellers

For aircraft equipped with fixed-pitch propellers, a gradual loss of rpm and airspeed are early warning signs – exactly as if the throttle was being closed very slowly by the pilot. If left unheeded, the next warning will be a rough-running engine combined with severe power loss, and finally a complete power loss.

Constant-speed Propellers

The symptoms are somewhat different for aircraft fitted with constant-speed propellers. In the early stages, the propeller governor will maintain a constant engine rpm despite the loss of power. The first positive signs, therefore, will be decreasing airspeed coupled with falling manifold pressure. These symptoms come on very gradually and insidiously. They may well go unnoticed if the pilot is preoccupied with other matters. At a certain point other symptoms will be experienced, such as rough running and rpm loss, as for a fixed-pitch propeller aircraft.

Cures

The carburettor heat system heats induction air by passing it around the exhaust system of the engine before admitting it into the carburettor.

When the first warning manifests itself, **full** carburettor heat should be applied and the mixture leaned slightly to correct the over-rich situation that will result. A gradual return of airspeed (and engine rpm with fixed-pitch propellers) will indicate that ice had been present.

A period of at least 30 seconds, preferably longer, is necessary to ensure that the accumulation of ice has been cleared. In aircraft fitted with a constant-speed propeller, you can verify whether this has been accomplished by returning carburettor heat to full cold, re-enriching the mixture, and observing that the manifold pressure returns to normal.

Just observing manifold pressure while carburettor heat is on is not always an accurate way to discover ice. Different carburettor heat systems have varying effects on manifold pressure, depending on how much temperature rise and how much ram-air effect the alternate source negated.

Where considerable ice has accumulated, be prepared for some engine roughness immediately after application of heat. This is because of the extreme mixture changes caused by the heated air, and pieces of partly melted ice passing into the engine. If the use of carburettor heat is left until engine roughness has already occurred, the resultant rough running following application of heat can seem quite severe to an inexperienced pilot, but the temptation to select cold air again must be resisted. (It is important to realise that despite temporary roughness and associated moderate power loss, the pilot is not damaging the engine at a cruise power of 75% or less using any amount of heat.)

Once the ice has been cleared, pilots may be tempted to select a partial heat setting to prevent recurrence. This practice is **not** acceptable unless the aircraft is fitted with an accurate carburettor air temperature (CAT) gauge. If there is no gauge, the carburettor heat control should be set in either the full hot or full cold position. The reasoning behind this is that, if air temperatures in the carburettor are below the icing range, partial application of carburettor heat could bring the temperature up to the middle of the icing range, thus accentuating rather than overcoming the problem.

There are several types of CAT gauges, many of which feature range markings, or a 'desirable' indication. The desirable marking is safely above the icing range to prevent carburettor ice, but low enough to avoid much of the power loss associated with full heat. The pilot simply adjusts carburettor heat to maintain the gauge reading in the desirable range.

Helicopter Operations

Carburettor icing in rotary-wing aircraft can present added problems, and pilots operating these aircraft must be particularly alert to the dangers involved and methods of prevention. Unlike aeroplanes, which have a propeller to act as a 'flywheel' and keep the engine turning if it hesitates or backfires, helicopters have a freewheeling, or one-way drive. As a consequence, there is no inertia to keep the engine running. Extra caution must therefore be exercised by helicopter pilots to avoid the possibility of engine stoppage through carburettor icing.

Helicopter manufacturers advise operators not to use partial carburettor heat in the approach or during practice autorotation. Applying partial carburettor heat to prevent ice by keeping the CAT gauge out of the yellow is effective only during hover, climb and cruise, when the ice tends to form in the carburettor venturi or on the upstream side of the throttle butterfly, where

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It Does Happen!

The CAA incident database records only seven incidents of reported induction icing over the past five years to January 2002. Fortunately, none of these incidents led to an accident.

It appears likely that the number of reported induction-icing incidents is far lower than the number that actually occurs. Informal discussion with experienced GA operators shows that most can recount incidents of suspected or confirmed induction icing, which they were able to clear. The difference between an induction-icing incident and an induction-icing accident may sometimes be only a matter of minutes when flying in icing-conducive conditions.

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the temperature gauge is located. It is not effective when the throttle is closed, and a large temperature drop across the throttle butterfly causes ice to form on the downstream side of the butterfly. Ice can form at that point even though the CAT gauge is indicating a temperature well above the yellow arc.

For Robinson operators the advice is that, when conditions are conducive to carburettor icing, and manifold pressure is below 18 inches, ignore the CAT gauge and apply full carburettor heat.

System Checking

While application of carburettor heat is quite straightforward, its use requires a certain degree of knowledge. To begin with, the system should always be checked during each pre-takeoff engine run-up. A drop in rpm (both fixed-pitch and constant-speed propellers) when full heat is selected indicates that heated air is entering the induction system. If there is no loss of power, the carburettor heat system is unserviceable, and this means the aircraft is unserviceable. The problem must be rectified before the aircraft is flown.

While ground-checking, keep in mind that most carburettor heat systems bypass the induction air filter. Consequently, operation of the system in dusty, dirty areas will allow abrasive grit into the engine. A few minutes of this treatment can cause more wear than many hours of normal running.

Related Factors

When using heat, there are related factors or influences to remember.

The engine loses about 15 percent of its power when full heat is applied. When carburettor heat has to be applied for any length of time, such as during cruise, the mixture should be leaned enough to eliminate roughness from the over-rich mixture. (Leaning the mixture will also serve to increase the EGT, providing more heat.) This procedure will also restore much of the power loss caused by carburettor heat, and it will also minimise wastage of fuel. Hence, any application or removal of heat during cruise calls for an appropriate adjustment of the mixture.

At lower power settings, such as required in the circuit, it may be impractical to lean the mixture.

Some training exercises and all glide approaches require the use of carburettor heat. In such cases, heat should be applied before reducing power. If applied after power is reduced, it is a little like throwing a log in the wood-burner after the fire is out!

Heat should not be used for takeoff or climb, as it may bring on detonation and possible engine damage.

Be careful in a go-around situation. If the throttle is opened before the carburettor heat is turned off, it must be a smooth application. A straight-arm of the throttle generally results in the carburettor failing to respond – and no power.

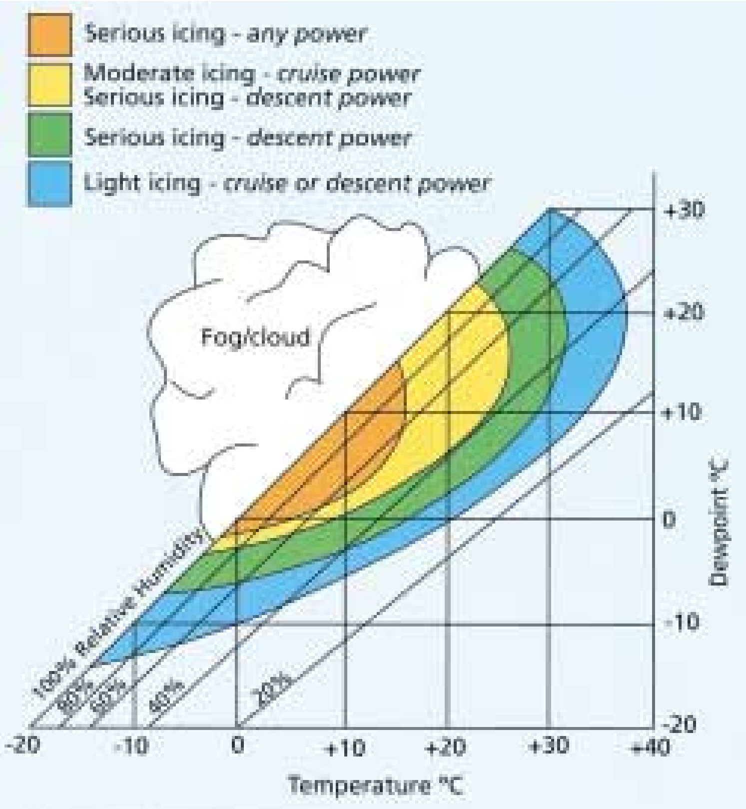
If the pilot forgets to remove carburettor heat on a go-around, loss of power may become critical at low altitude and low airspeed. In addition, on higher performance engines, there is the danger of detonation and engine damage using full heat and takeoff power.

Conclusion

The susceptibility to carburettor and induction ice varies greatly among the diverse range of aircraft types. The effects and recommendations described here, although of a general nature, are applicable to most modern light aircraft.

Specific, if somewhat abbreviated, information on the use of carburettor heat or alternate air will be found in the aircraft manufacturer's manual, along with detailed instructions relating to the particular aircraft type.

All pilots should become thoroughly familiar with the induction system for each type of aircraft they intend to fly. It's no good resolving to learn about it while contemplating the wreckage of your aircraft on some desolate beach or in the outback. ■



Stop Press!

The Transport Accident Investigation Commission (TAIC) has just released a report (01/007) into an accident at North Shore aerodrome involving a Partenavia. The aircraft lost power on both engines while en route from Auckland to Whangarei at 5000 feet in intermittent IMC conditions at night. The report attributes the engine failures to induction icing. The use of ALTERNATE AIR by the pilot may have prevented the accident. The full report can be found on the TAIC website at www.taic.org.nz. **It does happen**!

That Sinking Feeling

The Incident

The Cessna TU206A was taxiing clear of the grass vector when its lefthand main landing gear (MLG) leg fractured and separated from the fuselage. Fortunately the damage was limited, as the failure occurred at low speed. Investigation revealed the leg had suffered a fatigue failure resulting from a crack initiated by a very small corrosion pit (see accompanying photograph).

Previous Occurrences

New Zealand

Although there have been numerous Cessna 180 and 185 spring leg failures recorded in New Zealand, most have involved agricultural or ski-plane operations, and not regular A to B passenger type operations. While Airworthiness Directives DCA/CESS180/113A and DCA/CESS185/109A were intended to address this problem, the Cessna TU206A failure prompted recommendations to widen the AD to include all aircraft with spring steel legs, and to require their regular removal for NDT (non-destructive testing).

Overseas

There have also been many similar occurrences overseas. In September 1999, a Cessna 185F nosed over at the end of its landing roll in Alaska. As a result of this accident, the NTSB recommended that the FAA issue an AD for the regular removal and NDT of Cessna spring-leg equipped aircraft.

The FAA determined, however, that AD action was not appropriate in the USA, as their failures had been limited to aircraft operating environments that subjected their landing gear to high stresses (eg, ski or tundra-tyre equipped aircraft). As the proportion of aircraft so equipped in the USA was very small, the FAA determined an AD would impose an 'undue burden' on other Cessna operators. The New Zealand CAA could not immediately adopt this determination, as a much larger proportion of our aircraft operate in an environment of high landing-gear stress.

Crack Propagation

Causes

Cessna spring legs are made of a particularly hard steel, SAE 6150. The spring tempering process leaves the steel very sensitive to fatigue crack initiation. To overcome this 'notch sensitivity', the undersides of the legs (loaded in tension) are shot-peened at manufacture to produce a thin layer of steel in compression. The compressive stress in this surface layer increases fatigue resistance. In the case of the Cessna TU206A leg failure, the corrosion had in fact penetrated the shot-peened layer (0.006 inches or 0.15 mm). Without the benefit of the compressive stress, a crack soon initiated from the corrosion pit. The crack spread with each landing gear cycle until the remaining material failed. The small size of the fatigue crack relative to the failed leg cross-section showed that the Cessna spring legs are highly stressed, with very little damage tolerance.

The small size of the crack at the time of failure indicates:

- It would have been impossible to detect without removing the paint and carrying out an NDT inspection.

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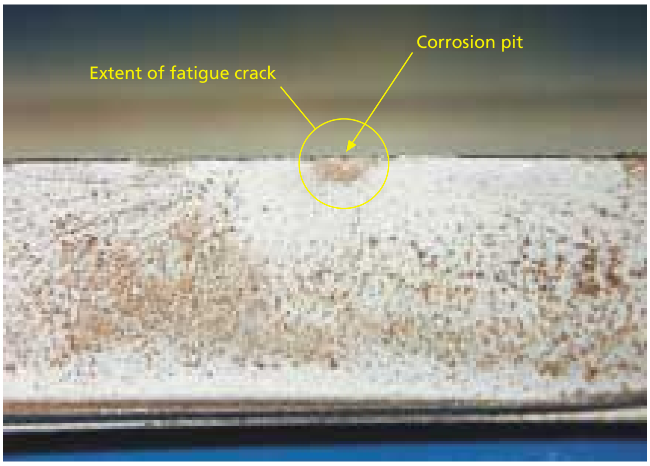

Photograph courtesy of Material Performance Technologies Ltd.

The small semicircular fatigue crack that led to the leg failure is highlighted above. The corrosion pit that initiated the crack is the barely-visible black dot indicated by the arrow.

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- Although the number of striations on the fatigue fracture could not be accurately determined, the small crack size implies a relatively short time from initiation to failure.

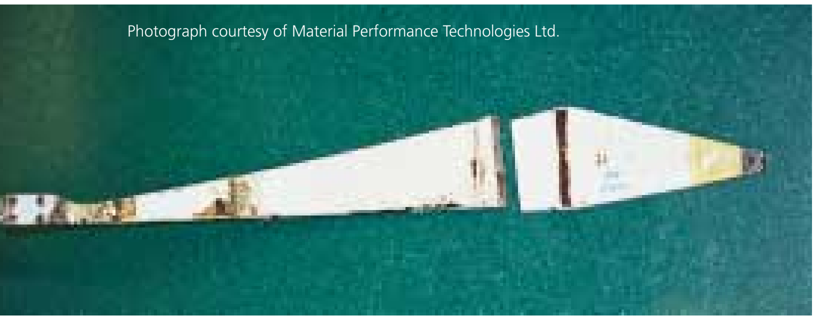
Prevention

In order to prevent another spring leg failure, an AD would have had to require the aircraft MLG legs to be removed, paint-stripped and NDT-inspected at intervals as short as 10 to 25 hours – doing so would clearly not be economically feasible. In addition, repeated paint removal by chemical or physical means could damage the shot-peened layer, which could require shot-peening after each strip. Although potentially life threatening, the failure of landing gear can only occur on the ground and must therefore be considered less hazardous than the failure of a wingspar, for example.

As the time from crack initiation to complete failure of MLG legs was unknown (but probably very short), an AD to detect cracking was clearly not practical. Cessna's engineers advised the CAA that the critical crack length is so short as to be almost undetectable. The only option remaining, therefore, is to prevent the initiation of cracks.

All of the failures to date have initiated from corrosion, which has resulted after a breakdown in the paint finish. To ensure the structural integrity of spring legs, it is clear that a high-quality paint finish must be maintained. The accompanying photograph of the TU206A accident leg shows that, in this particular case, it had suffered a moderate amount of wear and tear, but probably not enough to attract a LAME's attention.

Some operators have applied protective tape to leading edges of the legs to protect the paint from stone chips. Other operators, particularly those with aircraft on air transport operations in demanding environments, have introduced their own inspection requirements. One conscientious operator removes their MLG legs from service prior to them reaching 1000 hours in service. It should be remembered that CAA legal requirements are minimum standards only, and that if your operation is more demanding than average, or if you simply want to have a better-than-average safety record, you may need to adopt your own higher standards.



Photograph courtesy of Material Performance Technologies Ltd.

The failed TU206A undercarriage leg. Note the poor condition of the paint that allowed corrosion to develop.

Summary

Like propeller blades, undercarriage spring legs need to be protected from corrosion and foreign object damage. The best way to do this is to ensure that they are finished with a high-quality paint job. The emphasis **must** then be on protecting the paint, as once corrosion attacks the metal beneath, that sinking feeling could be only a few landings away. ■

In light of the investigation into the Cessna TU206A accident, the CAA is reviewing the effectiveness of Airworthiness Directives DCA/CESS180/113A and DCA/185/109A. Comments should be directed to Jack Stanton, Airworthiness Engineer, email: stantonj@caa.govt.nz.

UNICOM and AWIB Services

An Update

A new Subpart to Civil Aviation Rule, Part 139, which covers the provision of UNICOM and AWIB services at aerodromes, recently passed through the NPRM (notice of proposed rule making) public consultation phase, and a number of interested government agencies, as part of the rule-making process. It is anticipated that the new Subpart will come into force on 1 July 2002.

This article provides an update on what UNICOM and AWIB services may provide to aerodrome traffic under the new Subpart. Because this article is general in nature, specific details should be checked against the Subpart or applicable section of the AIP.

UNICOM Services

A UNICOM service is a ground-based radio service to aerodrome traffic that is designed to fill the gap between the provision of an aerodrome flight information service (AFIS) or aerodrome control service, and no service at all. The name UNICOM originates from the American term 'Universal Communications', and it has been adopted within the New Zealand aviation environment due to its common usage. In fact, UNICOM services have been provided at Mount Cook, Taupo, and Ardmore aerodromes for some years now.

It must be emphasised that a UNICOM service is **not** an air traffic service. This means that pilots are **fully** responsible for maintaining awareness as to the whereabouts of other traffic, and for ensuring adequate traffic separation when operating in the vicinity of the aerodrome.

Information on the types of services provided by a UNICOM can be found on the applicable aerodrome Operational Data page or in the COM Section (refer to the Radio Communication and Navigation Facilities table) of the VFG/IFG.

The following table compares the services provided to aerodrome traffic by UNICOM, AFIS, and ATC.

UNICOM Services (Uncertificated)	**AFIS** (Part 172 Certificated)	**ATC Services** (Part 172 Certificated)
Non-certificated but operates within the requirements of Part 139.	Certificated under Part 172 and uses certificated Part 171 communications equipment.	
Hours of service decided by operator and published accordingly.	Hours of service in accordance with certification and published accordingly.	
May advise the preferred runway in use.	Designates the preferred runway in use.	Designates the controlled runway.
May provide local basic weather reports (BWR). If Part 174 certificated, provides meteorological information in accordance with certification.	Provides meteorological information in accordance with Part 174 certification.	
Operator has staff training requirements under Part 139, but not certificated to Part 65 standards.	Operators certificated to Part 65.	
Communications equipment does not have to be Part 171 certificated.	Communications equipment Part 171 certificated.	
May relay whereabouts of known aircraft operating within the vicinity of the aerodrome.	Provides traffic information within the vicinity of the aerodrome.	Provides aerodrome control service, traffic information, and traffic avoidance advice.
May provide information relating to the physical characteristics of the aerodrome, and hazards to navigation in the vicinity of the aerodrome.	Provides information relating to the physical characteristics of the aerodrome, and hazards to navigation in the vicinity of the aerodrome.	
Does not action flight plan information.	May be contacted to close or amend flight plans.	
May provide a flight-following service in accordance with the requirements of Part 119. May provide a service to alert emergency services.	Provides an alerting service and may activate an aerodrome emergency service.	


Photograph courtesy of Taupo UNICOM Service.

AWIB Services

AWIB (Aerodrome Weather Information Broadcast) services are normally recording facilities that broadcast the actual local weather conditions and aerodrome information on a specified frequency (published in the VFG/IFG); they are peculiar to New Zealand. The information they provide is not intended to replace certificated meteorological information, and it must not be used for flight planning purposes. AWIB services are not part of an air traffic service and consequently do not have to be certificated under Part 171, 172 or 174.

The weather information provided by an AWIB must comply with the requirements of a BWR (Basic Weather Report) as prescribed by Part 174. It should be noted, however, that the QNH will **not** be provided unless the AWIB's service provider is certificated under Part 174. If uncertificated, the mean sea level air pressure provided by an AWIB service is not as reliable as QNH, and an allowance should be made for localised variations.

BWRs

BWRs are verbal reports that are made on the actual weather conditions in the vicinity of a particular aerodrome or place. The requirements for these reports, and the equipment used to gather the information, are prescribed in Part 174. Pilots should not accord BWRs the same level of confidence as meteorological information issued by a certificated service provider. ■

Civil Aviation Rule Parts

Part 65	Air Traffic Services Personnel Licences and Ratings
Part 119	Air Operator – Certification
Part 139	Aerodromes – Certification, Operation and Use
Part 171	Aeronautical Telecommunication Service Organisations – Certification
Part 172	Air Traffic Service Organisations – Certification
Part 174	Aviation Meteorological Service Organisations – Certification

Murphy's Aviation Division

Field Safety Adviser, Bob Jelley, has found that Murphy is alive and well in maintenance and flying organisations around the South Island. No doubt Murphy is active in the north as well!

Tool Control

Yes, we all know that Murphy is around, but why invite him to our facility or leave an opening for his mischief. When we leave an invitation by using the floor of a helicopter on rebuild as a tool bench, Murphy knows that a round socket easily rolls directly to the first lightening hole with his careful guidance. You guessed it – in it goes. He also knows that if we don't have tool control (a shadow tool box or tools confined to a tray) the socket's new home may not be discovered. Not the best situation.

The fact is that Murphy generally exploits openings we've left in our practices. A full hangar-controlled shadow tool board with tool tags would prevent an aircraft escaping with such FOD, but this may be impractical for a busy general aviation workshop, and not that well accepted due to our long culture of independence and a general pride in using one's own tools.

> *"Our Kiwi 'can do' job enthusiasm is admired by many, but a few of us are not keeping the paper trail up to speed as we do the tasks."*

There are, however, a number of other ways to lessen Murphy's opportunities. **Don't** use the aircraft as a tool box. Use a tool box appropriately shadowed to show up a missing tool or, at least, confine the tools to carry trays, or a smaller tool box. If on an urgent small job, take a tray and count the tools in and out of the aircraft, eg, six items in, six items out. These are some of the ways to reduce the risk of losing tools on the job.

Job Paperwork

It is important to use job paperwork from the outset of taking on a task. Enter the reason for the job and the individual tasks as they have been defected or as soon as discovered by inspection. This is then automatically a second check to our memories, which can often slip up, especially when distracted. Good paperwork records done during, not after, a work task can ensure that all tasks are billed to the client and, if all the job details are succinctly written, they can be entered straight in to the aircraft logs by a clerical person, then checked and certified by the LAME who undertook or certified the job. The above can save LAMEs some office time and give a better ratio of time on the job, plus streamline the required paperwork and the invoicing.

Whether your business is a one-man band or you have numerous employees, timely documentation can save the possibility of having to use one's memory doing the paperwork after a large job is completed. It is common for engineers to grab their tools and wade in to a job task, especially in a break-down situation, not armed with the required paperwork. It is very important, however, to write up the defect as described or discovered and, in some cases, even list your planned moves before the aircraft is on your doorstep. There is also nearly always a benefit in checking the aircraft maintenance manual for trouble-shooting and, in some cases, isolate the simple possibilities early. How many times have you been beaten by Murphy's curve ball against experience?

Keeping the paperwork side of things up to date, whether it be on a simple defect or a major repair, is not only vital but is also cost-beneficial to all of us. Our Kiwi 'can do' job enthusiasm is admired by many, but a few of us are not keeping the paper trail up to speed as we do the tasks.

Distraction

Murphy has been quick to pick up on the recent explosion of cellphone usage. A pilot doing a helicopter preflight is standing on the rear undercarriage leg step and has just unlocked the oil filler cap when a colleague walks toward the machine with an active cellphone call for the pilot. The pilot steps away from the helicopter to answer the call, leaving the filler cap unlocked. Just another one of Murphy's excellent opportunities.

Summary

Aviation is a great medium of transport but it can, and will, bite. We need to be professionally focused when going about the day-to-day tasks of maintenance and flying if we are going to 'up our game' in some areas. The examples described above are not plucked out of thin air – they are all occurrences witnessed by the writer recently.

Murphy can't operate if we deprive him of his opportunities. No names, no pack drill, but let's work on improvements if these possibilities linger around your organisation. ■

Fixed-Pitch Propellers

Does you aircraft engine have a fixed-pitch propeller fitted? If it does, this article should be of interest to you.

Aircraft fitted with a fixed-pitch propeller that was past its manufacturer's TBO, or whose total hours in service was unknown, were required to have the propeller overhauled by January 2000, under the requirements outlined in Advisory Circular 43-5A *Engine and propeller overhaul and testing*. Some aircraft owners suffered financially by having to overhaul or replace a propeller that may not have been out of hours at the time, but this could not be verified due to inadequate record-keeping of its history.

To avoid this happening to you in the future, ensure that your LAME enters and certifies the propeller installation in Section 3 of the *Aircraft Maintenance Logbook* (CAA 2101). The installation details should also be entered in Section 6 "Record of Lifed Components Installed" of the maintenance logbook, and Section 4 "Record of Engines/Propellers Installed" of the *Aircraft Airworthiness Directives, Aircraft Modifications, Engine and Propeller Installations* (CAA 1464).

It is recommended that aircraft owners installing new propellers start a separate *Propeller Logbook* (CAA 2110) or a *Component History Card* as an additional means of record-keeping. Both of these can be obtained from The Colour Guy by telephoning 0800 GET RULES (0800 438 785).

If the propeller is removed from the engine for some reason, its calendar time and total hours in service need to be transferred with the propeller on a CAA Form Two or Form One, along with the *Propeller Logbook* or *Component History Card*, if used. Also, details of any work carried out on the propeller (eg, Airworthiness Directives) should accompany these records.

As an aircraft owner, it is important for you to know what the status of your aircraft propeller is at any time throughout its life. Accurate record keeping is the best way of ensuring this. Failing to keep such records could mean that you are faced with the premature replacement of the propeller – at considerable expense. ■

Care to Join the *Vector* Team?

Are you interested in writing? Do you have substantial experience in aviation in New Zealand? We have a vacancy in the team that produces *Vector* (and other products), and we are looking to fill the vacancy some time after 1 July 2002.

Apart from your aviation knowledge, writing simple clear English is the main skill we would expect of you. If you were skilled also at presentation, there would be the opportunity to contribute to our safety seminars and courses.

While we will consider anyone with aviation experience, our ideal person would be a pilot with an instructor rating, and some solid aviation experience in that role.

For further details, keep an eye on the CAA web site www.caa.govt.nz "Vacancies" over the next month or so. ■

Timely Reporting

The following has been adapted from an article that appeared in a recent edition of the New Zealand Aerobatic Club's magazine. It illustrates why reporting incidents, even relatively minor ones, is so important to our industry.

We've flown Pitts Specials for years, and we've got to know their few foibles. The spectre of something totally off the radar suddenly happening doesn't really enter our thoughts. Nor do we sufficiently recognise in any of our flying that when something goes catastrophically wrong its origins may be something so miniscule as to have passed our attention, or, even worse, have been something completely avoidable.


A cross-section of the failed Pitts tailwheel fork.

Earlier this year, a Pitts S-1S made a normal approach and landing after an aerobatic sortie. Early in the landing roll there was a loud bang and a scraping sound. To the pilot it was pretty obvious that the tailwheel had departed. The real surprise came next – a sudden uncontrollable swing to the right of about 45 degrees. The left wingtip scraped the ground, and the aircraft went over its nose and on to its back. The pilot emerged from underneath unhurt. The tailwheel was recovered about 400 metres further on from where the aircraft had stopped inverted.

"It is often said that for every major accident there are ten major incidents and hundreds of minor but related events."

Inspection showed the tailwheel casting broke just above the tailwheel axle, then the left undercarriage leg had failed forward and outward, and in the subsequent flip the aircraft broke its top wing spar. The aircraft was written off by the insurers as repairable, but not for the insured cost.

So what preventive measures could have been in place to prevent this accident from occurring in the first place? Lets look back to some earlier incidents.

It transpires that this is not the first time a tailwheel has departed a Pitts in New Zealand. An S-2 had its tailwheel casting fail at a higher point, and the stunned pilot watched the entire ensemble zoom forward between his wings, just miss the propeller, and sail off down the grass strip. On that occasion, the aircraft stopped otherwise undamaged. Another S-1, with a different type of tailwheel, had its left undercarriage fail outwards and forwards, with the subsequent fracture of the left lower wing spar when its tailwheel departed while taxiing. An S-2, on its third landing after a complete refurbish, had the casting fail, and the aircraft went up on its nose before falling back on to its wheels. The difference between the S-2 meeting the same fate as the S-1S may only have been the fact that the pilot sits further behind the centre of gravity.

This time the incident became an accident and was reported to the Civil Aviation Authority. The tailwheel was subjected to detailed analysis by CAA investigators. The casting is a strange piece of metal – under the microscope it looks almost like hokey-pokey toffee with bubbles and vacuoles and comparatively large cavities (see the accompanying photograph). In short, it is not a piece of casting you'd expect to have take the repeated pounding of landing, or the centrifugal stresses associated with snap manoeuvres. A video of a Pitts landing showed the tailwheel oscillating very rapidly at the start of the landing roll. The analysis showed that cracking from multiple propagation sources had begun on the side closest to the wheel, which is the worst possible spot to inspect. The nature of the metal meant the cracks had little resistance to their propagation. When the cracking reached a large cavity at mid-point through the diameter of the casting, the rest of the metal failed in overload. Whoever flew this aircraft was in for a shock at some stage.

The CAA issued an Airworthiness Directive (DCA/Brakes/5 "Tailwheel Fork – Inspection", effective 28 February 2002), on this make of Maule tailwheel, requiring inspection of the casting by dye-penetrant within a month, with repeated inspections every 100 hours or annually. The intention is to prevent a recurrence. The AD can be viewed on the CAA web site by clicking on **Rules and More/Airworthiness Directives/Components/Brakes and Wheels**.

Which brings us back to what preventive measures could have been in place? It is obvious that the loss of the S-1S, and the near loss of two other Pitts, could have been avoided. There can be no criticism of engineers for not spotting the crack on the tailwheel casting amid so many other potential crack sources. Had an AD or Service Bulletin existed, it is almost certain that not one of these aircraft would have been threatened – the cracks would have been detected early and the part junked.

But there will be no ADs and no service bulletins if we don't report our incidents and defects. Filling in the CAA's "Form 5" takes less than five minutes. It is not onerous, but for most of us it is not an obvious thing to do. We do not have in general aviation a culture of reporting our failings – it just doesn't occur to us. We don't call the police when we bang into the driveway gatepost, so why file a form with the CAA? Yet somehow we expect the airlines and the air traffic control provider to do exactly that whenever **they** have a safety failure, however minor. And guess what? They do report! They know the inherent safety and cost penalty of not sharing safety information.

We do ourselves – and our colleagues in aviation – a huge disservice if we keep these things to ourselves, however inadvertently. It is often said that for every major accident there are ten major incidents and hundreds of minor but related events. It is better to learn from those minor incidents and to break the chain of events leading up to an accident, than to have the smoking hole. Recall "for the want of a nail a shoe was lost, for the want a shoe a horse was lost". We need to report when we lose a nail and not wait for the battle to be lost.

An open reporting culture is fundamental to any enterprise, whether it be a business or a safety system. We will have no improvements, and will continue to lose business or money or aircraft or colleagues, unless we report every 'whoops'. We will continue to see insurance premiums rise if we lose aircraft in accidents that may have been utterly avoidable if previous events that enjoyed a more benign outcome were reported. We just have to think about doing it and then act. ■

Going Far?...

The chances of being promptly rescued following an accident, and surviving to tell the tale, are significantly increased if a flight plan has been filed.

We recommend you file a flight plan before setting off on any cross-country flight, even if it is a relatively short one. This is especially important if the flight involves crossing rugged terrain or a significant amount of water. Be sure to utilise some kind of flight-following system for more localised flights – at least tell someone where you are going and what time you will be back.

It is now cheaper and easier than ever to file a full VFR flight plan; log in to Airways' Internet Flight Information Service (IFIS) web site at www.ifis.airways.co.nz, register as a user, and complete the VFR Flight Plan Activation screen. A flight plan can be filed in IFIS for as little as $3.60 if an electronic ticket is used. The plan can be amended at no additional charge. The nominated SARTIME can be amended as often as is necessary should the destination ETA change en route.

Alternatively, flight plans can be phoned, faxed or filed over the radio for around $6.50. See the January/February 2002 issue of *Vector* for further details.

...Then File a Flight Plan

2002 Safety Seminars

The theme for this year's CAA Av-Kiwi Safety Seminars will be weather. It affects everybody in aviation, and we all have our own ideas and experiences regarding it. None of us, however, can claim to know it all when it comes to understanding weather. This is your chance to learn a bit more about New Zealand meteorology.

Among the presenters will be one person who does know a bit more about the subject than the average pilot, Erick Brenstrum from New Zealand Met Service. He will be assisted by CAA Education Advisers as well as local experts from your area.

The seminar format will be half-day afternoon sessions over the weekend at six locations around the country. While exact location details and dates are still being finalised, the seminars are likely to be held from late July to October at Auckland, Taupo, Wellington, Nelson, Christchurch and Queenstown. The seminars will involve a mixture of practical work, presentations, and perhaps the opportunity to view a computer-based weather-training tool.

Look out for further information in the next issue of *Vector*, on the CAA website (www.caa.govt.nz), in other aviation publications, or on your local aero club notice board.

See you there!

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. The following titles are available (* Indicates available on CAA web site only):

Title	*Latest Version*
How to be a Pilot	2000
How to be an Aircraft Maintenance Engineer	2000
How to Charter an Aircraft	1999
How to Deal With an Aircraft Accident Scene	2001
How to Get Your Licence Recognised in New Zealand*	2000
How to Navigate the CAA Web site	2000
How to Report Your Accidents and Incidents	2000

The **GAP** (**G**ood **A**viation **P**ractice) series aim to provide the best safety advice for pilots. The following titles are available:

Title	*Latest Version*
Aircraft Icing Handbook	2000
Bird Hazards	1998
Chief Pilot	2000
Flight Instructor's Guide	1999
In, Out and Around Queenstown	2001
Mountain Flying	1999
Takeoff and Landing Performance	2000
Wake Turbulence	1998
Weight and Balance	1999
Winter Flying	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

Field Safety Advisers

John Fogden
(North Island, north of line, and including, New Plymouth-Taupo-East Cape)
Ph: 0–9–425 0077
Fax: 0–9–425 7945
Mobile: 025–852 096
fogdenj@caa.govt.nz

Owen Walker
(Maintenance, North Island)
Ph: 0–7–866 0236
Fax: 0–7–866 0235
Mobile: 025–244 1425
walkero@caa.govt.nz

Ross St George
(North Island, south of line, New Plymouth-Taupo-East Cape)
Ph: 0–6–353 7443
Fax: 0–6–353 3374
Mobile: 025–852 097
stgeorger@caa.govt.nz

Murray Fowler
(South Island)
Ph: 0–3–349 8687
Fax: 0–3–349 5851
Mobile: 025–852 098
fowlerm@caa.govt.nz

Bob Jelley
(Maintenance, South Island)
Ph: 0–3–322 6388
Fax: 0–3–322 6379
Mobile: 025–285 2022
jelleyb@caa.govt.nz

AIP Supplement Cut-off Dates

Do you have a significant event or airshow coming up soon? If so, you need to have the details published in an AIP *Supplement* instead of relying on a NOTAM. This information must be promulgated in a timely manner, and should be submitted to the CAA with adequate notice (within 90 days of 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. Note: If your AIP *Supplement* requires an illustrated graphic you need to add another 5 working days to this date.

Supplement Cycle	*Supplement* Cut-off Date (with graphic)	*Supplement* Cut-off Date (text only)	*Supplement* Effective Date
02/9	13 Jun 02	20 Jun 02	05 Sep 02
02/10	01 Aug 02	08 Aug 02	03 Oct 02
02/11	29 Aug 02	05 Sep 02	31 Oct 02

Accident Notification

24-hour 7-day toll-free telephone

0508 ACCIDENT
(0508 222 433)

CA Act requires notification "as soon as practicable".

Aviation Safety Concerns

A monitored toll-free telephone system during normal office hours. A voice mail message service outside office hours.

0508 4 SAFETY
(0508 472 338)

For all aviation-related safety concerns

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.)

This issue contains a number of accidents that have been withheld from publication until now due to insufficient information. Efforts have been made to source the missing information, but some data fields and synopses remain incomplete.

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-FTC, Quicksilver MXL II, 30 Oct 99 at 11:40, Matapihi. 1 POB, injuries nil, damage minor. Nature of flight, private other. Pilot CAA licence nil, age not known, flying hours 1000 total, 250 on type, 8 in last 90 days.

The propeller shaft broke in flight necessitating a forced landing. The aircraft suffered damage to its undercarriage.

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

CAA Occurrence Ref 99/3098

ZK-TAO, Neico Lancair 235, 8 Jan 00 at 12:00, Rotorua. 1 POB, injuries nil, damage minor. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 70 yrs, flying hours 14946 total, 0 on type, 6 in last 90 days.

The nosewheel collapsed on landing.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 00/8

ZK-JBJ, Cessna U206F, 24 Apr 00 at 11:50, Lindis Pass. 6 POB, injuries 6 fatal, aircraft destroyed. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 55 yrs, flying hours 333 total, 61 on type, 2 in last 90 days.

The aircraft was endeavouring to negotiate the Lindis Pass in marginal weather conditions by following State Highway 8 at low level. The pilot was observed to attempt a reversal turn near the summit of the Pass. During this manoeuvre, the angle of bank increased to the point where the aircraft began to lose height. The left wing subsequently struck the ground causing the aircraft to cartwheel on to its nose.

A full report is available on the CAA web site.

Main sources of information: CAA Field Investigation.

CAA Occurrence Ref 00/1160

ZK-PTO, Pitts S-2A, 15 Dec 00 at 14:40, Wanaka. 2 POB, injuries 2 fatal, aircraft destroyed. Nature of flight, transport passenger A to A. Pilot CAA licence ATPL (Aeroplane), age 54 yrs, flying hours 12346 total, 102 on type, 106 in last 90 days.

The aircraft crashed just south of the airfield while carrying out an aerobatic joyride flight. The aircraft was seen to do a stall turn that turned into a spin from which it did not recover. The pilot was a highly experienced aerobatic pilot. There was no evidence to indicate that there was any failure of the airframe or engine. It has not been possible, from the evidence presented, to determine a definite or likely cause for this accident. A full report is available on the CAA web site.

Main sources of information: CAA field investigation.

CAA Occurrence Ref 00/4114

ZK-SAC, Cessna R182, 18 Dec 00 at 11:45, Matapouri Bay. 3 POB, injuries 1 minor, damage substantial. Nature of flight, private other. Pilot CAA licence ATPL (Aeroplane), age 42 yrs, flying hours 10000 total, 600 on type, 161 in last 90 days.

The pilot was flying into a sloping topdressing strip for the first time; the strip had no windsocks. The aircraft encountered a severe downdraught (due to the gusty conditions) after a go-around was initiated. This caused the aircraft to descend after be coming airborne near the end of the airstrip. It continued to descend for approximately 800 metres, before a slight rate-of-climb could be achieved. There was, however, insufficient height to clear the next ridgeline, and the aircraft impacted with the terrain. The pilot stated that the cause of the accident was his lack of awareness of the gusty conditions and tailwind component present at the airstrip. He also stated he was unfamiliar with the surrounding terrain and the airstrip in tailwind conditions.

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

CAA Occurrence Ref 00/4116

Continued over ...

ZK-DQL, Lake LA-4-200, 7 Jan 01 at 13:35, Lake Wakatipu. 2 POB, injuries 2 serious, damage substantial. Nature of flight, private other. Pilot CAA licence CPL (Aeroplane), age 47 yrs, flying hours 8902 total, 150 on type, 164 in last 90 days.

The student pilot was undertaking an amphibian rating, of which he had completed six hours on type in the previous 60 days. He was nearing completion of the rating but had yet to experience porpoising, as water conditions had not provided the opportunity. (A go-around after no more than three bounces is standard procedure when porpoising is encountered.) The dissipating wake of the SS Earnslaw provided suitable conditions to complete this aspect of his training.

An approach was made, but the student pilot struggled with the ensuing bounces and instructor intervention was required. In hindsight, the student stated that he had found this approach disturbing and should have called for 'time out'.

After the go-around, a stable approach was established at about 150 feet above the water. As it was a 'glassy water' landing, the student was instructed to maintain 60 knots and a 100 ft/min descent rate until touchdown. However, the airspeed and rate of descent became too high – approximately 78 knots and 250 ft/min. The instructor warned the student to watch his airspeed and rate of descent, and the appropriate corrections were made. The approach then appeared to continue normally. Shortly thereafter, the instructor found himself ejected from the aircraft deep under water. He saw light above him and swam towards it. As he surfaced, he saw the floating wreck of the aircraft and swam towards it so as to hold on to a wing. The aircraft sank a short time later, and the instructor and student were picked up by nearby boats.

A possible explanation for the accident submitted by the instructor and the student, was that the student was shaken by the hard landing off the wake of the Earnslaw and should have had 'time out' at that point. Additionally, the instructor believed that the student may have "over-corrected" for indications provided by the Artificial Horizon (as opposed to scan emphasis being placed on the VSI and turn coordinator) just before touchdown, and briskly checked the control column forward. Witnesses on the lake observed the aircraft undercarriage to be in the retracted position, eliminating the possibility that it was inadvertently lowered and caused the aircraft to flip.

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

CAA Occurrence Ref 00/4196

ZK-HSI, Hughes 269B, 17 Jan 01 at 19:00, Eskdale. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence PPL (Helicopter), age 37 yrs, flying hours 90 total, 90 on type, 5 in last 90 days.

The helicopter was approaching the operator's home base, into a 5 to 10-knot westerly. The wind direction coincided with the strip direction, but on final the pilot saw the windsock indicate a marked change. He re-circuited to approach the strip from the north, but this manoeuvre placed him over power lines, trees and the adjacent highway. The helicopter came to a hover over the power lines, at which point rotor rpm decayed and the helicopter yawed to the right. It spun through 360 degrees three times, and, when the pilot lowered collective in an attempt to regain rpm, the helicopter descended and struck the ground heavily beside the road.

Main sources of information: Accident details submitted by operator.

CAA Occurrence Ref 01/132

ZK-HDN, Schweizer 269C, 26 Jan 01 at 16:30, S Auckland. 2 POB, injuries 2 serious, damage substantial. Nature of flight, private other. Pilot CAA licence PPL (Helicopter), age 25 yrs, flying hours 98 total, 20 on type, 6 in last 90 days.

The helicopter was on VFR cross-country from Ardmore to Matamata. The pilot had originally planned to fly direct to Matamata via the Hunua Valley, but on departure from Ardmore decided to fly a route that initially followed State Highway 1 (Southern Motorway). A Meteorological Service weather report confirmed that a cold front was in the vicinity of the proposed route at the time of the accident. Persistent rain was developing in the area, and the cloud base would have been between 600 and 800 feet amsl around the Bombay Hills, with visibility reducing to approximately 2000 metres. The average surface wind was reported to be a westerly of approximately 15 to 20 knots, possibly gusting to 35 knots.

The helicopter was observed by a number of witnesses who were driving on the Southern Motorway. One of them was an experienced helicopter pilot, who observed the helicopter intermittently entering cloud and reducing in altitude to approximately 100 feet above the motorway. He saw the helicopter enter cloud for the last time and, approximately eight to ten seconds later, heard the aerodynamic thumping of rotor blades; in his rear vision mirror he viewed the helicopter impact with the median barrier. The CAA undertook a complete inspection of the aircraft flying controls, structures and engine.

The engine was test-run and produced the required power once accident damaged components were replaced. No pre-accident abnormalities were found. The investigation concluded that the pilot inadvertently entered low cloud and, during a reversal turn, became spatially disorientated and lost control.

Main sources of information: CAA field investigation.

CAA Occurrence Ref 01/304

ZK-JDK, Micro Aviation B22 Bantam, 10 Mar 01 at 16:00, Howick. 2 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence nil, age 71 yrs, flying hours 271 total, 261 on type, 106 in last 90 days.

A formation of 13 microlights was returning from a fly-in at Kaipara Flats to their home base Te Kowhai when two of the aircraft (ZK-JDK and ZK-JEE) collided mid-air near Howick Beach. The propeller of ZK-JDK struck the underside of ZK-JEE, which caused injuries to the passenger of that aircraft. Both aircraft subsequently completed emergency landings safely.

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

CAA Occurrence Ref 01/1579

ZK-JEE, Micro Aviation B22 Bantam, 10 Mar 01 at 16:00, Howick. 2 POB, injuries 1 serious, damage substantial. Nature of flight, private other. Pilot CAA licence nil, age 41 yrs, flying hours 131 total, 131 on type, 23 in last 90 days.

A formation of 13 microlights was returning from a fly-in at Kaipara Flats to their home base Te Kowhai when two of the aircraft (ZK-JDK and ZK-JEE) collided mid-air near Howick Beach. The propeller of ZK-JDK struck the underside of ZK-JEE, which caused injuries to the passenger of that aircraft. Both aircraft subsequently completed emergency landings safely.

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

CAA Occurrence Ref 01/754

ZK-GSB, PZL-Swidnik PW-5 "Smyk", 18 Mar 01 at 16:00, Matamata Ad. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence nil, age 53 yrs, flying hours 2200 total, 515 on type, 10 in last 90 days.

The glider experienced heavy sink on 'short final' causing an undershoot situation. The pilot initiated a right turn to steer away from Highway 27 but encountered further turbulence. The right wing struck the ground causing the glider to swing around and impact in a fully nose-down attitude.

Main sources of information: Accident details submitted by pilot and operator.

CAA Occurrence Ref 01/842

ZK-FSF, Micro Aviation B22 Bantam, 1 Apr 01 at 17:00, Winton. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence nil, age not known, flying hours 27 total, 27 on type, 27 in last 90 days.

The microlight bounced on landing so the pilot made a go-around. Unfortunately, he encountered wind shear, which significantly degraded the climb performance. The aircraft undercarriage caught a power line, which rolled the aircraft over into the ground.

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

CAA Occurrence Ref 01/1051

ZK-JIL, Hawker Hunter FR 74S, 5 Apr 01 at 15:00, Ardmore. 1 POB, injuries nil, damage minor. Nature of flight, flight test. Pilot CAA licence SCPL (Aeroplane), age not known, flying hours 12000 total, 7 on type, 180 in last 90 days.

The pilot was engaged in an experimental test flight programme when he inadvertently landed the aircraft with its wheels up. The aircraft suffered minor belly damage. A small fire broke out that was able to be extinguished.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 01/1109

ZK-BJT, Cessna 170B, 22 Apr 01 at 14:15, NW Oxford. 2 POB, injuries 1 minor, damage substantial. Nature of flight, private other. Pilot CAA licence CPL (Aeroplane), age 50 yrs, flying hours 4958 total, 180 on type, 25 in last 90 days.

The aircraft was flying up a mountainous valley at 80 mph. The pilot lowered 20 degrees of flap, applied full power, and put the aircraft into a steep left turn to fly around the head of Salmon Creek. Half way through the turn, the aircraft suddenly rolled further to the left, dropped its nose, and entered a spin. Recovery action was initiated, but there was insufficient time to effect a recovery, and the aircraft crashed into the bush. It is likely that the aircraft stalled while in the steep left turn. Engineering investigation of the aircraft showed there to be no defects.

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

CAA Occurrence Ref 01/1433

ZK-HLB, Robinson R22 Beta, 26 Apr 01 at 16:30, Jacobs River. 2 POB, injuries nil, aircraft destroyed. Nature of flight, private other. Pilot CAA licence CPL (Helicopter), age 32 yrs, flying hours 1850 total, 1805 on type, 35 in last 90 days.

The helicopter was cruising slowly when the engine rpm reduced to an idle, forcing the pilot to carry out an autorotation. This resulted in a heavy landing, which significantly damaged the helicopter and briefly activated the ELT. Engineering investigation revealed a fuel blockage in the carburettor's idle and intermediate jets.

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

CAA Occurrence Ref 01/1483

ZK-HPQ, Robinson R22 Beta, 28 May 01 at 10:15, Waimauku Forest. 2 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence CPL (Helicopter), age 48 yrs, flying hours 797 total, 780 on type, 35 in last 90 days.

In the latter stages of a low-power approach, the pilot raised the collective to increase power prior to landing. There was insufficient response from the engine, and the helicopter landed short of the intended spot, in 15-foot manuka. No pre-accident defects were found with the helicopter. The pilot suspects that carburettor icing led to the loss of power.

Main sources of information: Accident details submitted by pilot

CAA Occurrence Ref 01/1864

ZK-HPC, Robinson R22 Beta, 3 Jun 01 at 14:40, North Shore. 2 POB, injuries nil, damage substantial. Nature of flight, training dual. Pilot CAA licence CPL (Helicopter), age 34 yrs, flying hours 760 total, 230 on type, 60 in last 90 days.

During a dual lesson, the student applied aft cyclic, significantly lowering the tail. Unfortunately, the tail rotor struck the ground before the instructor could correct the situation. As a consequence the helicopter rotated, contacted the ground and rolled over.

Main sources of information: Accident details submitted by pilot and operator.

CAA Occurrence Ref 01/1954

ZK-CIQ, Piper PA-25-235, 21 Jun 01 at 10:00, Ward. 1 POB, injuries 1 minor, damage substantial. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 52 yrs, flying hours 860 total, 91 on type, 12 in last 90 days.

The Piper Pawnee was landing on a farm strip when one of three sheep the pilot had already observed, ran into the path of the aircraft. The pilot, a vet, attributes this to the sheep hearing the sound of a motor and associating it with food (ie, a tractor), as they had been receiving grain for several months prior.

Main sources of information: Accident details submitted by pilot and operator.

CAA Occurrence Ref 01/2142

ZK-PWT, Pacific Aerospace Cresco 08-600, 26 Jun 01 at 12:08, Weber. 2 POB, injuries nil, damage substantial. Nature of flight, agricultural. Pilot CAA licence CPL (Aeroplane), age 29 yrs, flying hours 7165 total, 630 on type, 245 in last 90 days.

The aircraft was coming in to land at the Ora Station airstrip when it encountered a sudden downdraught just before touchdown, which resulted in a heavy landing.

Main sources of information: Accident details submitted by pilot and operator.

CAA Occurrence Ref 01/2182

Continued over ...

ZK-EMW, NZ Aerospace FU24-954, 27 Jun 01 at 11:00, Mangapai. 1 POB, injuries nil, damage substantial. Nature of flight, agricultural. Pilot CAA licence CPL (Aeroplane), age 55 yrs, flying hours 14274 total, 13726 on type, 212 in last 90 days.

The aircraft sank after becoming airborne from a sloping strip. A jettison was initiated, but the outer section of the left wing hit a fence, which damaged the aileron and flap, causing them to jam. The pilot managed to circuit the aircraft and land safely.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 01/2183

ZK-PMM, Cessna U206F, 8 Jul 01 at 11:59, D'Urville Is. 6 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence CPL (Aeroplane), age 49 yrs, flying hours 1282 total, 14 on type, 132 in last 90 days.

The aircraft was on short finals to the airstrip at Greville Harbour when excessive sink, possibly due to wind shear, was encountered. Full power was applied, but this did not arrest the sink rate, and a heavy landing ensued. Stress creases were evident at the rear end of the fuselage and the fairing below the rudder was cracked.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 01/2306

ZK-FMP, Cessna 172M, 9 Jul 01 at 16:45, Hokitika. 3 POB, injuries nil, damage minor. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 30 yrs, flying hours 199 total, 182 on type, 7 in last 90 days.

The aircraft wing strut hit a fence post to the side of the airstrip as it was lined up for takeoff. The takeoff was abandoned. Damage was limited to a dent and scrapes.

Main sources of information: Accident details submitted by operator.

CAA Occurrence Ref 01/2508

ZK-BOV, Piper PA-18A-150, 12 Aug 01 at 09:00, Arahura. 2 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 50 yrs, flying hours 1328 total, 199 on type, 13 in last 90 days.

A normal takeoff was conducted from the grass strip. On passing 50 feet, engine power suddenly reduced, requiring an immediate forced landing into a rough riverbed ahead. The aircraft remained fully controllable until touchdown. It was subsequently noted that the OAT was near zero and that there was some fog/cloud in the vicinity of the river. The engineer investigating the reason for the power loss was confident that it was due to carburettor icing.

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

CAA Occurrence Ref 01/2662

ZK-ISC, Robinson R22 Beta, 22 Aug 01 at 13:40, nr Owaka. 1 POB, injuries nil, damage substantial. Nature of flight, agricultural. Pilot CAA licence CPL (Helicopter), age 25 yrs, flying hours 358 total, 36 on type, 48 in last 90 days.

The pilot had just taken off from the loading site for his last spray run of the day, when he noticed that the wind had changed direction from straight ahead to the port beam. He continued down a creek to the area he had been spraying, and lined up on his first pass. The helicopter began shuddering, and despite the pilot's application of more power and dumping of the load, descended into the gully. With airspeed decreasing, the helicopter rotated to the right, and the tail section came into contact with the top two wires of a fence. Both tail rotor blades were severed by the wires, the tail boom immediately in front of the tail rotor gearbox was fractured, and a piece of one tail rotor blade struck one of the main rotor blades. Parts of the spray gear were damaged in the accident sequence. The helicopter came to rest upright.

The symptoms described by the pilot were consistent with inadequate airspeed, and the helicopter decelerating through translational lift, losing rotor rpm in the process.

Main sources of information: Accident details submitted by pilot and operator.

CAA Occurrence Ref 01/3220

ZK-SAJ, NZ Aerospace FU24-950M, 15 Sep 01 at 08:00, Mangatahi. 1 POB, injuries nil, damage substantial. Nature of flight, agricultural. Pilot CAA licence CPL (Aeroplane), age 59 yrs, flying hours 11176 total, 3500 on type, 43 in last 90 days.

The aircraft completed a normal takeoff from the topdressing airstrip but began to sink once airborne. The pilot jettisoned the load, but the aircraft clipped a fence at the end of the airstrip, necessitating an emergency landing in an adjacent paddock. The aircraft touched down heavily, which caused damage to the undercarriage and the fuselage.

Main sources of information: Accident details submitted by pilot and operator.

CAA Occurrence Ref 01/3127

ZK-RIR, Thruster Aircraft Thruster T500, 16 Sep 01 at 08:30, Rangiora. 2 POB, injuries nil, damage minor. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 30 yrs, flying hours 307 total, 24 on type, 14 in last 90 days.

The microlight suffered an engine failure just after takeoff, and landed heavily in a paddock just off the end of the airstrip.

Main sources of information: Accident details submitted by pilot and operator.

CAA Occurrence Ref 01/3148

ZK-HNC, Hughes 269C, 24 Sep 01 at 12:00, 15 NM SW Nelson. 1 POB, injuries nil, aircraft destroyed. Nature of flight, training solo. Pilot CAA licence PPL (Helicopter), age 20 yrs, flying hours 173 total, 1 on type, 91 in last 90 days.

The pilot was undertaking type rating training nearing the completion of his CPL(H). Because of traffic and mowing activity at Nelson Airport, the instructor elected to carry out the training at a forestry site that both he and the pilot had used extensively. After 1.1 hours of dual training, the instructor briefed the pilot to carry out one solo circuit before they returned to Nelson. As the pilot applied throttle to accelerate the main rotor, the helicopter entered ground resonance. The helicopter was destroyed. The rotor rpm had not reached the flight range, so the pilot was unable to lift off (the normal recovery action).

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

CAA Occurrence Ref 01/3261

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

Aircraft type not applicable – Continental conrod wears abnormally

During scheduled maintenance, the counterweight of a Continental TSIO-360 FB engine was found to have been striking the conrod at about 1¼ inches from the big-end bearing.

Further investigation revealed that one of the counterbalance weight bushings was cracked in two places and showing signs of significant wear. The cracks were running axially along the bush.

ATA 8520 CAA Occurrence Ref 01/4076

Cessna 172M – Magneto fails

The pilot reported a dead magneto during his post-start magneto check.

Further investigation revealed that the Slick model 4371 magneto had detached from its mounting and that the mounting flanges had broken. When the engineer removed and stripped the magneto, he discovered that one of the impulse coupling weights has seized on its pivot shaft, which had then fretted over time, causing the weight to become loose and contact the magneto housing. A significant amount of FOD was found to have been ingested into the engine accessory case as a result.

The fact that the drive gear meshing was disrupted and could have been badly damaged was a concern. This could have caused further damage to the drive train of the right magneto.

ATA 7400 CAA Occurrence Ref 01/4350

Cessna 207A – Wing spar found cracked

While undergoing maintenance, the lefthand rear wing spar was found to be cracked at the radius of the web above the attachment point. The crack appeared to be similar to that described in DCA/CESS185/110.

Upon further inspection, it appeared that this crack had propagated toward the nearest rivet hole from a small mark or nick in the radius. The wing spar required replacement.

ATA 5740 CAA Occurrence Ref 01/4027

Gulfstream American GA 7 – Propeller spinner attachment cracks

While airborne, the pilot noticed that the port spinner was rotating out of centre. On landing, the spinner was inspected and extensive cracking of the spinner back-plate found. A piece of steel floating freely behind the back-plate was also found, and the spinner dome had abnormal radial movement when deflected on the ground.

The spinner assembly was removed for closer inspection, whereupon the back-plate was found to be cracked at all four mount holes. The reinforcing plates were also cracked. The floating piece of steel was identified as part of one of the reinforcing plates. The radial cracking of the back-plate extended through to the outer ring of the spinner dome mount angle.

Over-torquing of the spinner back-plate mount bolts, inadequate centralisation of the propeller dome nut, and pushing and pulling on the spinner are possible causes of this damage.

ATA 6110 CAA Occurrence Ref 01/3796

Lycoming O-540 – Cylinder head cracks, P/N AEL 65102 NCN-10

The aircraft suffered an in-flight power loss resulting in a precautionary landing. This was one of three separate occurrences on the same aircraft due to cylinder cracking and loss of compression.

The aircraft's engineer reported that all of the defective PMA cylinders were manufactured by Engine Components Inc (EC). The latest cracking ran from one spark plug hole to the other, via the exhaust valve seat. This was similar to the other two cracked cylinders.

It is recommended that during routine engine inspections extra scrutiny should be given to EC cylinders to ensure that any cracking is detected early. The FAA have published a special airworthiness information bulletin No NE-01-32 on this subject, which can be viewed on their website http://av-info.faa.gov/.

Please report any instances of cracked EC cylinders to CAA.

ATA 8530 CAA Occurrence Ref 01/2975

Piper PA-23-250 – Hydraulic flap failure

On approach, after the gear was lowered, the aircraft flaps would not extend to the selected position. The flaps were recycled several times but would not move. The hand pump was then used to retract the flaps fully. The crew decided to divert to a suitable aerodrome, where a safe flapless landing was made.

Subsequent investigation and testing revealed no physical fault with the hydraulic system components. The ingress of air into the hydraulic system was suspected to have caused the incident. The aircraft's hydraulic filters had been replaced during maintenance the previous day, and it is suspected that the filter bowls were not half-filled with fresh fluid prior to installation. This recommended practice may have prevented air being introduced into the hydraulic system. The operators checksheet covering filter installation has since been amended.

ATA 2750 CAA Occurrence Ref 01/2800