September / October 2000

VECTOR

Pointing to Safer Aviation

GLIDING IN NEW ZEALAND –
AN INSIGHT FOR POWER PILOTS

BELIEVE YOUR FUEL GAUGES

CONTROLLED AERODROME
OPERATIONS

CAA
CIVIL AVIATION AUTHORITY
OF NEW ZEALAND

VECTOR

Managing Editor, Cliff Jenks

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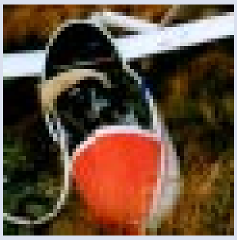

Gliders have the lowest injury rate compared to any other aircraft category. Why?

Poor fuel management is still causing more unnecessary accidents than it should in New Zealand. Are you as familiar with aircraft fuel systems as you should be?

Over the years a culture has developed in New Zealand of pilots dismissing fuel gauges as unreliable and therefore ignoring them. It is hoped that this is a trend that needs to be reversed.

Understanding how your aircraft fits into the dynamics of the traffic flow at a busy controlled aerodrome, and knowing what ATC clearances you are likely to receive helps improve aerodrome traffic flow efficiency and safety.

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Cover Photo:
An Omarama-based LS3 soars over wave-capped Mount Cook.

Photograph courtesy of Diederick Van Heinigen

Gliding in New Zealand

An Insight for Power Pilots

by Gavin Wills and Doug Hamilton

Introduction

Gliding has become a very popular pastime in New Zealand over the years. One in nine registered aircraft is a glider, and last year 934 glider pilots flew a total of approximately 17,700 hours and 610,300 km, which is the equivalent of 15 times around the equator.

Many world gliding records have been broken here, including the world's longest cross-country glider flight at 2,049 km. A new world gliding speed record was recently established from Omarama when a 500-km long course was flown at an average speed of 230 km/h. The New Zealand altitude record was set in the Wairarapa at 37,288 feet – an American U2 pilot later suggested that there was room for improvement when he reported lifting air at over 70,000 feet in the lee of the Southern Alps!

The international gliding community, which embraces about 123,000 pilots worldwide, recognises the South Island as having the world's best mountain and wave soaring conditions. As a result, increasing numbers of glider pilots are visiting New Zealand, in particular the Omarama area, to attempt records and to enjoy the area's phenomenal soaring.

But the North Island also has excellent gliding conditions and, as with population figures in general, the majority of glider pilots and their aircraft reside north of Cook Strait (see Figure 1). Last year a young Aucklander, John Coutts, stormed onto the world gliding stage by coming second in the World Championships in Germany, almost matching the 1995 performance by our own World Champion, Ray Lynskey.

Figure 1

The following notes are offered so power pilots may better understand where and how gliders soar, and to provide an insight into the glider pilot's world of invisible energy. It is hoped that this will promote greater understanding and help avoid close encounters of the unseen kind between gliders and powered aircraft.

Glider Pilots and their Aircraft

Just as in power flying, glider pilots come from all walks of life. Many of our most experienced pilots work in aviation as airline pilots, instructors, and engineers. Others, however – and you can tell from their radio chatter – are only fledglings, excited by their new experiences and their new wings.

Glider pilots are trained to similar standards to those of power pilots. The training of glider pilots, along with supervision of operations and engineering, is carried out by clubs and organisations affiliated to Gliding New Zealand. This body is approved by CAA to manage glider operations in this country.

"Glider pilots are trained to similar standards to those of power pilots."

The modern high-performance glider is a spectacular machine and is humankind's best attempt to imitate the soaring birds. It has a Vne of around 150 knots, cruises at 80 to 100 knots, stalls under 40 knots and has a glide angle approaching 1 in 60. (A Cherokee 140 is about 1 in 10 for comparison.)

The newest gliders are expensive and prized possessions. Constructed from hand-finished composite materials, they can cost upwards of $100,000, while older machines may cost only a few thousand dollars.

The modern glider is generally equipped with the best in miniaturised aeronautical instruments, multi-channel radio, GPS, transponder, emergency locator beacon and onboard flight computer. Many have sophisticated oxygen systems that can assist pilot breathing from 10,000 feet to almost the edge of space.

How and Where Gliders Soar

The sun and the rotation of the earth are the main forces that drive the volatile nature of our atmosphere. Working via the universal gas laws, these forces create all the ups and downs we encounter during almost every flight. These lumps and bumps are the many effects of wind, thermal updraughts, and atmospheric waves.

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Ridge Lift

When the wind blows it creates rising air by interaction, both with other air masses and, more importantly, with the terrain. Wind blowing over hills and mountains causes lift on the windward side and mostly sink and turbulence on the leeward side. Glider pilots exploit this 'ridge lift' to climb above the terrain crests and to follow the hills for as far as the ridgelines persist.

With pure ridge lift, the strongest updraughts are generally at the ridge crest but will persist above and in front of the ridge to about one third of it's total height. The canny glider pilot will be found climbing against the windward side of the hills or mountains and progressing across country along ridges at or above ridge height.

"…thermal updraughts can be powerful, with climb rates of 1000 feet per minute…"

Thermal Lift

When the sun heats the ground it warms the adjacent air. If that air is unstable and the atmosphere gets hot enough it will begin to boil and bubble like a saucepan of water. These bubbles of hot air are known to the glider pilot as thermals and rise in columns that are often, but not always, marked by tell-tale puffy cumulus clouds.

These thermal updraughts can be powerful, with climb rates of 1000 feet per minute often reported beneath the clouds. Although the thermals do continue upwards into the cloud, glider pilots find the most useful lift generally lies from a few hundred feet above ground level up to just beneath the cloud base.

Cumulus cloud bases in New Zealand are generally between 2,000 and 6,000 feet agl in the North Island, increasing to about 10,000 feet in the inland South Island. On active thermal days gliders may be found circling and climbing within this operating height band – from near the ground to near the cloud base. In these conditions, gliders progress across country by circling up to near the cloud base and then gliding on to the next cloud (see Figure 2).

Thermals and their clouds often form lines that follow linear terrain shapes, such as ridges or are blown by the wind into 'streets' of clouds. Pilots love these linear cloud features, because they offer a kind of aerial pathway where they can cruise at high speed near to the cloud base.

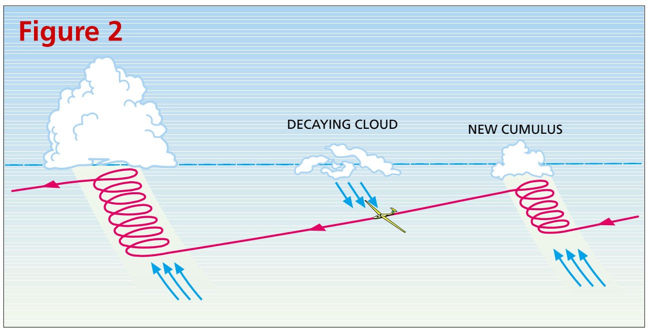


Figure 2

Wave Lift

The most powerful and dramatic form of lift available to the soaring pilot may be found downwind of mountain ranges. This is known to the enthusiast simply as 'wave' (see Figure 3). Climb rates of over 4,000 feet per minute have been recorded in New Zealand wave conditions.

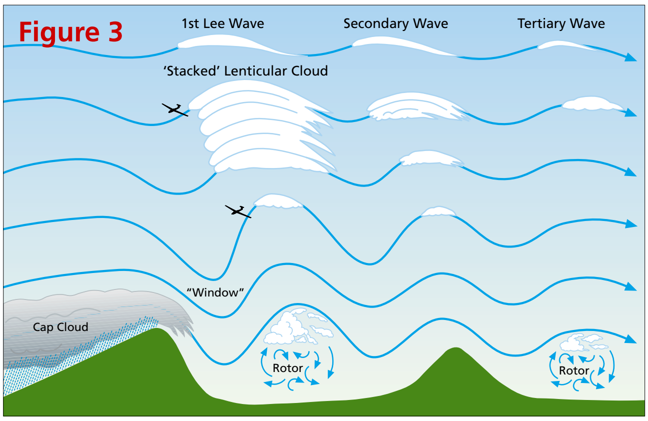


Figure 3

For good wave conditions to exist, wind velocities at ridge-top height must be between about 20 and 50 knots, usually with a westerly wind component and an atmospheric temperature profile that contains some special characteristics.

Like waves in a river downstream of an obstruction, standing atmospheric waves lie in long lines parallel to their mountain triggers. Often marked by lenticular clouds, the distances between these waves are commonly three to 30 km depending on the wind strength and the terrain shape.

During wave conditions glider pilots will often be found a few kilometres downwind of the mountains at about ridge-top height, searching for an aerial ladder to the wave above. Once found, and into the strong smooth wave lift, they climb close to the windward edge of the lenticular cloud and then cruise at high speed in the smooth air along its leading edge.

Powered pilots should note (particularly those who frequently fly controlled VFR or IFR) that gliders can often be found within controlled airspace at many levels (both the TMA and the UTA). They are equipped with an operating radio and transponder and will have received the appropriate clearance. They are subject to the controller's requests and must remain on the controller's radio frequency in the same way as powered aircraft do.

Spotting and Avoiding Gliders

How

Gliders by law have right of way over powered aircraft, but it is a bold glider pilot who would put that to test!

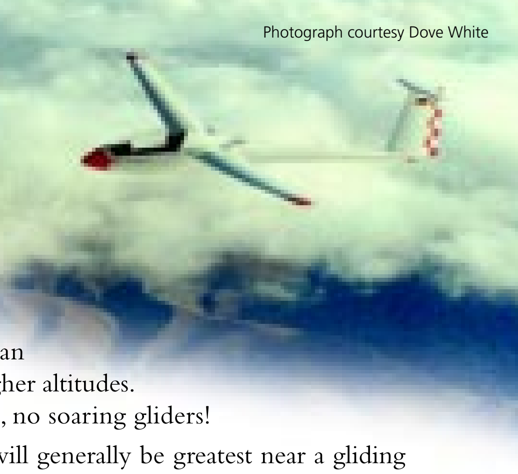
Most gliders are white and are relatively easy to see against the blue sky, dark clouds and most terrain. Their long polished wings will often glint in the sunlight as they turn. But against bright cloud or snowy mountains they can be very hard to spot. Glider design has one distinct disadvantage in this regard – to reduce drag it presents a low head-on profile, which makes a glider hard to see from in front.

Luckily glider pilots have excellent visibility from their cockpits and are trained to keep a good lookout. They often see (or even hear) powered aircraft before being seen themselves.

Where

On thermal days, marked by cumulus clouds, look for gliders below the cloud base either circling or following along lines of clouds. To minimise encounters with gliders, powered aircraft should track well clear of cloud where, of course, a much smoother ride can be expected.

Mountain ranges are favourite places for gliders, both on thermal days and on windy-ridge-running days. They can be



found close to the rocks, circling up out of narrow gullies and valleys, and cruising along the ridge crests that link the areas of thermic lift wafting up the sun-warmed mountain flanks. Gliders will generally fly straight across wide valleys to get to the friendly mountains on the other side, and they will rarely be found cruising up or down mid-valley. So when gliders are reported as operating in the mountains, try and track in the smoother valley air well clear of cloud and the mountainsides.

On windy wave days gliders will often be at altitudes of between 5,000 and 10,000 feet searching for a way up into the smooth lift above. They may appear erratic and dart about like nervous herrings, but generally they hunt beneath the leading edges of lenticular clouds or under the rolling cumulus clouds that mark the rotor below the wave (see Figure 3).

At higher altitudes, once established in wave, gliders follow bands of strong lift parallel to the mountain ranges. This lift is often marked by lenticular clouds, and gliders may be encountered here cruising at very high speeds. When gliders are known to be about, powered aircraft would be wise to remain well clear of the windward edge of these clouds and to track between the cloud lines. But be ready for bumps at about cloud base!

Don't hesitate to give reported glider traffic a call and get an updated position report. On cloudless bumpy days with light winds, smoother air can usually be found at higher altitudes. Remember no bumps, no soaring gliders!

Glider traffic density will generally be greatest near a gliding site (see Figure 1 and the table below), where power pilots should expect to encounter launches by aero-tow or winch, and traffic (both gliders and towplanes) rejoining the circuit. Winch launching could pose a special hazard to the unfamiliar power pilot, as the glider is hauled rapidly to about 2,000 feet within the runway length. Also, winch cables may be laid along the runway waiting for the next launch.

The accompanying table summarises the characteristics of a selection of busy gliding sites that are located near common VFR traffic routes. Gliders may of course be found many miles from these sites.

Examples of Gliding Bases located near common general aviation VFR routes

Location	Club(s)	Radio Freq (MHz)	Numbers of Gliders/Tugs	Frequency of Operations	General Comments
Drury (South Auckland)	Auckland Gliding Club	Aerodrome 134.45 MBZ 118.1 Chat 133.55 Occasionally AKL Control	28 Gliders 2 Tugs Winch up to 2000 ft	Wednesdays Weekends Public holidays (other days by arrangement Nov–Mar)	General conditions – to the south of Drury to upper limits of G275 and G276. Easterly – up to 5NM East of a line Karaka to Pukekohe to a maximum of 3500 ft amsl. Westerly – up to the Firth of Thames to a maximum of 3500 ft amsl
Centennial Park (Taupo)	Taupo Gliding Club	Taupo MBZ 118.4 Chat 133.55 AKL Control 119.5	6 Gliders 1 Tug	Wednesdays Weekends Public holidays	General conditions – in the vicinity of the Wairakei geothermal area up to 7000 ft amsl. Southwesterly – ridge soaring on the SW side of Mt Tauhara up to 5000 ft amsl. Easterly – ridge soaring on the eastern side of Mt Tauhara up to 4000 ft amsl.
Feilding	Wanganui Manawatu Gliding Club	Aerodrome 119.1 Chat 133.55	6 Gliders 1 Tug	Weekends Public Holidays	General conditions – within G371 and G372 to the north of Feilding up to 5500 ft amsl. Westerly – ridge soaring along the Ruahine Ranges north of Wharite Peak up to the TMA
Paraparaumu	Wellington Gliding Club	MBZ 118.3 Chat 133.55 Control 122.3	28 Gliders 2 Tugs	Wednesdays Weekends 7 days a week (Dec–Mar)	Expect gliders generally east of PP in thermal conditions. In westerly winds, gliders may operate along the ridges from Cape Terawhiti in the South to abeam Taihape in the North.
Omaka	Marlborough Gliding Club	Aerodrome 122.8 (WB Twr) Chat 133.55 Occasionally CH Control	5 Gliders 1 Tugs	Sundays Other days by arrangement	Northwesterly – south of a line Omaka to Domes in the vicinity of the Wither Hills up to 4500 ft amsl Southerly – around the hills to the North of the Wairau Plains in the vicinity of Rarangi up to 4500 ft amsl.
Omarama	GoGO Mountain & Wave Flying Alpine Soaring North Otago Gliding Club	Circuit 119.1 MBZ 118.6 Chat 133.55 Control 123.6	40 Gliders 3 Tugs Winch ops up to 2000 ft	7 days a week (mostly Oct–Apr) Intense activity on holidays and during competitions (mid Nov, and Jan)	Expect gliders around Mt Benmore, Mt St Cuthbert, Omarama Saddle and Lindis Pass. Also L Tekapo to Ben Ohau Range, Wanaka and Cromwell. Thermals, ridge and wave conditions.

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Gliders operate on the local frequency published for that airfield (often 119.1 MHz) while leaving or joining the circuit area. Once established clear of the airfield they may switch to the glider chat channel (133.55 MHz). To find out what glider traffic might be doing in your area, try calling on the chat channel first, and then closer to the field try the local unattended frequency. Glider pilots are only too happy to report their positions to their powered colleagues and pass on relevant information about other gliders in the area. Remember, however, that some gliders may be operating NORDO.

Gliding Competitions

Gliding competitions are a series of daily races held over a number of days. Up to 100 gliders may be racing (as in the 1995 World Championships at Omarama). Normally, however, most major New Zealand contests have between 30 and 50 gliders competing in several different classes. The races, which rarely start before midday, are flown around courses of between 200 and 600 km long and three to six hours in duration.

Major competitions are held every year at Matamata, in the Wairarapa, and at Omarama. They are always NOTAMed well in advance, and daily advice of the race course is faxed to Airways and any other affected commercial operators by about 10 am.

The racing gliders are generally easy to spot and avoid simply because there are many of them and they follow roughly the same track. If possible, it is wise to avoid the base airfield during the race launch, which takes about an hour. If you do need to land or take off, expect a lot of traffic and radio chatter, with up to six tow aircraft flying tight circuits, and gliders everywhere. You will win friends if you can expedite your circuit and vacate the runway as soon as practicable – of course without compromising your own safety!

At the end of a race, anticipate gliders returning low and fast to cross the finish line at 50 to 100 feet before pulling up to join for a 500-foot circuit.

Race Control on the local airfield frequency will have good information about the launch, race progress and the timing and direction of final glides to the finish line, as well as circuit traffic information. This frequency can get very busy, so it pays for power pilots to check in early and obtain a briefing on likely traffic movements.

Key Points

- Gliders are usually tuned to one of the following radio frequencies: local airfield frequency, air traffic control, or glider chat 133.55 MHz.
- Gliders are hard to see head on – look ahead for the flashing wings of circling gliders.
- Gliding traffic is greatest near their operating bases. Ask for glider traffic information on the unattended or chat frequencies.
- On puffy cumulus cloud days, stay in the blue between clouds and, if practicable (only if it is safe to do so), above the cloud base.
- In the mountains track in the blue well clear of the mountain ridges.
- On windy wave days, watch for gliders beneath, and in front of, the leading edges of lenticular clouds and roll clouds.

Summary

Glider pilots use a significant amount of New Zealand's airspace. They are all just as anxious as power pilots to fly safely and to avoid near misses, hence the reason for this article. Information on gliding operations in your local area can be obtained by ringing 0800 GLIDING, or better still by calling in to a nearby gliding airfield for a chat. ■

Gavin Wills is a PPL, Geologist, Mountain Guide and Film Producer who has been flying gliders for more than 30 years. He is also the Director of the goGO Mountain and Wave Soaring School based at Omarama.

Doug Hamilton is a CPL, the National Operations Officer for Gliding New Zealand and is the owner/manager of Alpine Soaring, Omarama.

Take Care of Your Passengers

It has been brought to our attention by Aviation Security staff and various airport managers around the country that there are occasionally problems with pilots letting their passengers wander around unsupervised on the tarmac, both at busy security-designated and at some non-security-designated aerodromes. (The Supplementary section on the aerodrome Operational Data page in the *VFG/IFG* shows whether the aerodrome is a designated security aerodrome.)

It is the pilot's responsibility to supervise their passengers at all times while on the apron of a security-designated aerodrome, or any aerodrome for that matter. This means physically escorting passengers to and from the aircraft in such a way that they are always at a safe distance from other aircraft and from ramp service vehicles that are manoeuvring on the apron. You should brief your passengers on basic ramp safety before venturing onto the apron, as once out there communication can be difficult over background engine noise.

You are required by CAA rule 19.357 *Airport identity cards*, for private operations, to carry a valid pilot licence with you at all times when on the tarmac at a security-designated aerodrome. This is in lieu of a CAA airport identity card, and it entitles you legitimately to escort your passengers to and from the aircraft. Ensuring your passengers' safety while on the aerodrome apron comes down to:

- adequately briefing them on basic ramp safety beforehand;
- supervising their movements once on the apron; and
- applying a common-sense approach to safety and security at all times. ■

Gliding Accidents and Injuries

This is the third article in a series of *Vector* articles, compiled by Dr David O'Hare of Otago University, which looks at the inherent risks and types of injuries associated with the operation of different aircraft types. In this article David looks at the reasons why glider pilots are less likely to be seriously injured in a crash than are their power-pilot counterparts.

Thinking about material for this third article prompted me to blow the dust off my own logbook and revisit some earlier experiences with gliders and sailplanes. During a fairly modest career, fifteen different types figured in these pages. These ranged from the wooden Slingsby T-49 (Capstan), which gave me my first solo, to the fibreglass Astir CS and the Grob-G109 motor glider. Other types included all-metal machines such as the Blanik, IS-28B2 and the Slingsby YS-53.

This diversity of construction materials was closely matched by the diversity of countries (the UK, Canada, Australia and New Zealand), launch methods (aero tow, winch and motor car-tow), and soaring conditions (ridge, thermal and wave) encountered. As well as recounting a bit of autobiography, this list serves to make the point that gliders are built using a vast number of different construction methods and operate in a wide variety of conditions.

The task of the researcher is to bring some order to diversity and to seek out common factors underlying a range of events. As part of the University of Otago study into aircraft crashes and associated injuries between 1988 and 1994, we looked at the fatal and non-fatal injury patterns associated with different categories of aircraft. The results from helicopter and fixed-wing crashes have been presented in previous *Vector* articles.

Accident Statistics

The focus of this article is on the nature of the injury risks associated with glider crashes. Gliders (including motor gliders) currently make up nearly 9.4 percent of the aircraft on the New Zealand aircraft register. Glider crashes made up 9.1 percent of the aircraft crashes recorded in the 1988 to 1994 period, so their crash involvement seems to be directly proportional to the number of gliders.

If we look at the outcomes of these crashes in terms of fatal and non-fatal injuries, gliders look markedly different to other aircraft types. Only two fatal injuries were sustained in glider crashes during the period of the investigation. This means that only 1.9 percent of fatalities in aviation were due to gliding accidents. This record is fairly good in terms of hospitalisable injuries, with only 6.1 percent of those recorded coming from gliding crashes.

Overall, while gliders have a crash involvement more or less in proportion to their numbers, they have an excellent record in terms of injury outcome. In fact, the fatal injury rate of 1.24 persons per 100,000 flying hours was lower than any other aircraft category. This excellent record highlights an important point. While there is a natural and under-standable tendency to focus on **accident** prevention and avoidance, it is of great importance to also focus on **injury** prevention and avoidance. In many sports (such as rugby for example) a focus on injury prevention has resulted in significant improvements to the safety of the participants.

Analysis

An analysis of injuries in gliding accidents is severely hampered by the very small numbers of fatal and hospitalisable injuries involved! Almost all the hospitalisable injuries involved fractures of either the neck/trunk or of the lower limbs. There were no traumatic chest/trunk injuries or head injuries at all. This pattern of injuries was quite similar to that found in homebuilt/experimental aircraft and quite different from the pattern associated with fixed-wing and rotary-wing aircraft.

The often-good safety outcomes of glider crashes might be due to a number of factors. The following list is suggestive. Readers may be able to generate additional factors. Many of these factors could be applied to other areas of aviation.

Absence of Fire

As noted in previous *Vector* articles, the occurrence of fire is the most significant factor in fatal and non-fatal injury in aircraft crashes. With the exception of a small number of motor gliders, gliders have (by definition) no engines, fuel tanks or ignition sources to generate a post-crash fire.

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Low Stall Speeds

Most gliders have stall speeds of around 33 to 39 knots. These relatively slow speeds mean that the distance required to decelerate is fairly short, so there is a much-reduced chance of high-speed impacts resulting in injury to the occupant(s).

Forced-landing Practice

Since all glider landings are by necessity 'forced landings', glider pilots may be more proficient at judging heights, speeds and approach profile on landing. Glider pilots are also more likely to have carried out a reasonable number of successful 'off-field' landings.

Cockpit Design

Instrument panels are generally smaller and lighter in gliders than those in most powered aircraft, representing less solid material to impact with the head and body in a crash. Glider pilots typically sit in a semi-reclining position, which helps to distribute the impact forces more evenly. Many pilots use impact absorbent cushioning, which results in significantly less spinal compression injury. Disappointingly, although there were few hospitalisable glider injuries in our study, one third of them were to the spine. Unfortunately, we don't have the data on whether these pilots were using impact absorbent cushioning or not. However, the British Gliding Association (BGA) has recently issued a warning on this subject (see side panel).

Harnesses

Glider pilots tend to wear full aerobatic type four-point harnesses. These provide superior restraint to lap-only or lap-and-diagonal systems. It is likely that pilots of homebuilt and experimental aircraft also wear better restraints, and they also benefit from lower rates of chest, trunk and head injuries. ■

Impact Absorbent Cushions

It has become apparent during a number of visits to clubs that many club fleet and private owner pilots do not fly seated on impact absorbing cushions, despite the advice given in the BGA Laws and Rules 'recommended practices'.

Some years ago it was proven that pilots who are involved in heavy landings or crashes seated on commercially available impact absorbent cushioning suffer significantly less spinal compression injury than if the cushioning was not there.

It is strongly recommended that clubs make impact absorbent cushions available for all club gliders and that private owners are encouraged to obtain their own.

Information Source: *BGA Laws and Rules* November 1999

Pilot Decision-Making Survey

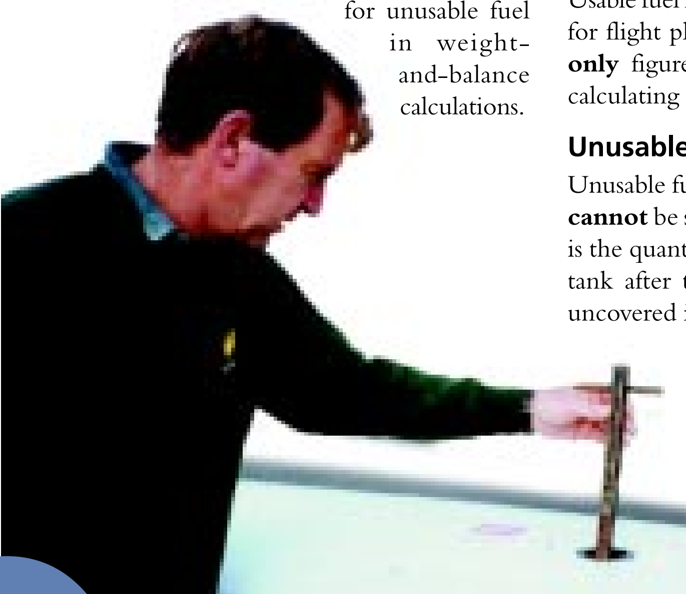
University study needs pilots for safety survey: Universities in the US, Australia and New Zealand are working together on a project looking at how previous experiences in pilot decision-making affects pilots' choices during critical flight situations. Aviators of all skill levels are being sought to take the NASA-funded on-line safety survey conducted by the University of Otago.

The study involves filling out a questionnaire that is available on-line at: **http://www.psy.otago.ac.nz/flightsafety/survey.html**

Copies of the questionnaire have also been sent to a random selection of aero clubs and flight training organisations around the country.

Dipstick?

Feedback from CAA field staff has indicated that some pilots are not as familiar as they should be with aircraft fuel systems and their associated terminology. This is of concern, as it has safety implications with regard to pilots correctly determining the usable fuel for flight, or making an allowance for unusable fuel in weight-and-balance calculations.



First, we look at aircraft fuel systems terminology, and then we offer some general advice that should help clarify any confusion.

Terminology

Usable Fuel

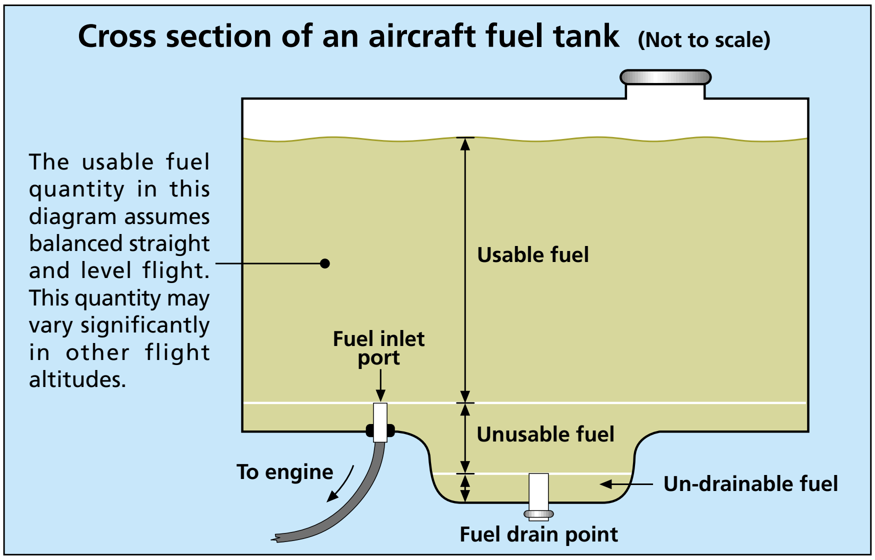
Usable fuel is the quantity of fuel available for flight planning purposes. This is the **only** figure that should be used when calculating fuel endurance.

Unusable Fuel

Unusable fuel is the quantity of fuel that **cannot** be safely used in level flight. This is the quantity of fuel remaining in each tank after the fuel inlet port becomes uncovered in level and balanced flight*. The amount of unusable fuel can vary considerably from aircraft type to aircraft type. Some light twin-engine aircraft, for example, can have a large amount of unusable fuel compared to many light single-engine aircraft, which often have only a few litres unusable in each tank. Note that most fuel dipsticks are calibrated to **include** the unusable fuel on board when the tank is dipped. Be careful to ascertain **which measure** the dipstick you are about to use has been calibrated for – ask the aircraft operator or maintenance provider if you are not sure. Using the incorrect figure for fuel endurance calculations could be fatal.

If you are an aircraft operator or owner, you might like to consider clearly marking the usable, unusable, and total fuel quantities by the filler cap on each wing if you have not already done so. This will lessen the chances of someone mistakenly using the total fuel quantity (including unusable) when calculating fuel endurance.

* *Any significant change in nose attitude or prolonged unbalanced flight may result in an interruption to the fuel flow from the selected tank and result in engine failure.*



Un-drainable Fuel

Un-drainable fuel is the quantity of fuel that remains in the aircraft fuel tanks and fuel lines after they have been drained for whatever purpose, for example, for an Empty Weight check or routine maintenance. The un-drainable fuel normally amounts to a small quantity only.

Aircraft Empty Weight

The aircraft Empty Weight includes unusable fuel, full operating fluids, and full engine oil as per the aircraft manufacturer's Flight Manual and CAA Advisory Circular 43-2 *Aircraft weight and balance control*. This value can be found on the MOT 2173 form or the Weight and Balance section of the aircraft Flight Manual, and it should be used for all weight-and-balance calculations.

Although the procedure differs from aircraft type to aircraft type, the Empty Weight is usually determined by placing the aircraft on an accurate set of scales in the straight-and-level flying attitude, draining its fuel tanks by disconnecting the engine fuel line at the fuel filter (this leaves unusable fuel only), topping up all fluid systems (including engine oil), moving the seats and emergency equipment to their specified positions, and then obtaining a reading off the scales.

Fuel Dipsticks

The fuel dipstick is often an under-rated and misused piece of aircraft on-board equipment. Dipsticks are more often than not scratched and chipped. Often their markings are faded (fuel graduation, units of quantity, and aircraft registration markings), making it more difficult to determine accurately what quantity of fuel is on board. If your aircraft's dipstick has been a little neglected over the years, consider a bit of general maintenance and having it clearly re-marked – ask your local LAME to do this next time your aircraft is in for a check.

"Over the years a culture has developed in New Zealand of pilots dismissing fuel gauges as unreliable and therefore ignoring them."

Each dipstick has been specifically calibrated to its aircraft's fuel tanks and is therefore not interchangeable with that from another aircraft, even of the same type, which is why it should be carefully marked with the aircraft's registration. Aircraft that are of the same type may have had fuel tank modifications carried out (eg, long-range tanks fitted) meaning that only a dipstick specifically calibrated to that aircraft can be used to determine fuel quantities.

Fuel dipsticks are calibrated by draining the aircraft fuel tank completely (usable and unusable fuel), adding a known quantity of fuel, and then marking the position on the dipstick with the corresponding value. Fuel is then added in known units of quantity, with each value being marked on the dipstick. Again, be certain as to whether the dipstick you are about to use is calibrated in total fuel quantity (usually the case) or usable fuel only.

Tank Dipping

Accurately determining what quantity of fuel you have on board is important for obvious reasons. There are several considerations that should be borne in mind when dipping a fuel tank.

- The aircraft should be parked on level ground – if this is not possible, dip each tank, turn the aircraft through 180 degrees, dip each again, and take the average of the two values. This may not be totally accurate, but it will be better than either of the two single readings.
- Ensure that the fuel system is not cross-feeding (slope and uneven fuel quantities in each tank can cause this on some types of aircraft) during dipping. The trap here is that, when you are refuelling the aircraft with the fuel selector set to BOTH, the tank that you are filling can be cross-feeding to the other tank. Although not large, this could result in a quantity of fuel less than was originally intended in the first tank by the time you have finishing filling the second tank – this could be a problem if the flight requires both tanks to be full. Note that cross-feeding during refuelling, or at any other time, can be prevented in most single-engine aircraft by selecting either the LEFT or RIGHT tank only.
- Fuel tanks should always be dipped after refuelling to establish the exact amount of fuel on board – even when adding a known quantity of fuel.
- The dipstick should be inserted in the filler neck perpendicular to the wing surface – unless there is another method specified in the Flight Manual (some aircraft fuel tanks must be dipped on an angle due to the main spar being directly below the filler neck).
- And, finally, always take a fuel sample from each drain point after re-fuelling, to check for correct fuel grade and any impurities.

Fuel Gauges

Over the years a culture has developed in New Zealand of pilots dismissing fuel gauges as unreliable and therefore ignoring them. This is most unfortunate, especially considering the number of fuel management related accidents we have had.

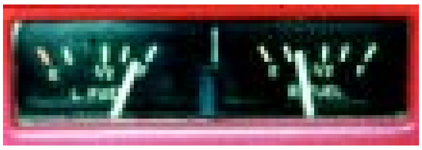
Most fuel gauges do read reasonably accurately, and if they don't they should be fixed. You can't get out and dip the tanks while in the air, so make sure you do understand your fuel gauges. After dipping the tanks, check the gauges and compare the readings – at least you will then **know** if the gauges are reading accurately, and if not, you can make allowances for any discrepancy.

Continued over...

... continued from previous page

Some aircraft have tank designs where you cannot obtain a dipstick reading at certain fuel levels, so the use and accuracy of the fuel gauges becomes even more important.

Unfortunately, it appears that many pilots do not look at the fuel gauges at all, thus removing one important thread from their safety net. Fuel loss in flight **can** happen – through fuel venting, for instance, or a leaking fuel drain. This may not be visible, especially in a low-wing aircraft, so the fuel gauges may be your only clue to what is happening.



Alternatively, your fuel calculations may be flawed, consumption may be higher than anticipated, or you may have made an arithmetical error – there are many possible pitfalls to relying solely on initial known quantities and estimated consumption. The fuel gauges should be an integral part of your fuel management strategy.

Instructors – please take note of these factors, and encourage your students to use all the fuel management resources available to them. ■

Aircraft Icing Handbook Available

The *Aircraft Icing Handbook* is now available in hardcopy from the CAA's publications distributor, by phoning 0800 GET RULES (0800 438 785). Alternatively, the Handbook is available free of charge on the CAA web site under **Publications – Good Aviation Practice.**

The CAA hopes that the *Aircraft Icing Handbook* will become a primary reference for pilots and be a catalyst in raising industry awareness of aircraft icing hazards. It will be particularly useful for IFR pilots and for those studying to sit their pilot licence theory exams.

What I Learnt From That

Recently, while returning home after a tiring trip away for work reasons, I was involved in a loss of separation with another aircraft upon joining a busy unattended aerodrome.

I had joined the downwind leg of the aerodrome circuit number three or four behind the aircraft in question (lets call it XYZ for convenience) making the standard radio calls as I did so. There was a faster retractable gear aircraft joining the circuit not far behind me. It soon became apparent that XYZ was flying more slowly than I was despite being the same type as my aircraft, so I throttled back, reducing my airspeed by around 20 knots. By the end of the downwind leg, however, I was getting close to XYZ and was rather hoping that they would turn onto a base leg. It wasn't until we were about three miles from the runway threshold that the pilot turned base – by this stage my level of frustration with the situation was building.

Not wanting to break up the circuit pattern, I lowered some flap, slowed up as much as I safely could, and started to gently S-turn to try to increase the distance between us. After a while it was starting to become obvious that this course of action was not having the desired effect. I widened my S-turns to reduce my forward speed even further (which, after a while, was effective in increasing the distance between us) and called XYZ telling them that I was close behind and could they please keep their speed up. They didn't reply, so I made a second radio call, this time asking them to please vacate the runway as quickly as possible after landing so that I could touch down behind. There was no response to my radio calls.

I was around 300 feet on my approach when XYZ touched down. I judged that there would be sufficient time for XYZ to clear the runway and for me to land behind. This did not happen, however, as they vacated the runway more slowly than I was expecting. Despite this, I chose to continue the approach, as I still considered that it was safe to do so. I touched down approximately 50 metres past the taxiway that XYZ was in the process of vacating (its tail was clear of the runway but not clear of the active portion of the taxiway).

So what did I learn from this incident? Well, a number of things:

- Be careful about anticipating another pilot's actions – they might be quite different to what you expect.
- Don't let frustration ("what is this guy doing" sort of thing) cloud your judgement.
- Be particularly careful in the approach and landing phases when returning home after a long flight – your concentration levels and decision-making abilities may not be quite as good as you image they are
- Always be prepared to overshoot if runway separations are beginning to be compromised (even if you feel the other guy is not quite doing things right).
- If you're an instructor, practice what you preach and lead by example.
- Always stick to your personal minima and maintain a professional approach as PIC in all situations.

In hindsight, my failure to recognise what should have been a go-around situation was poor. I let my frustrations, and to a certain extent a bit of complacency that the situation would work out OK, get in the way of my decision making – something that I will endeavour not do again. ■

Believe Your Fuel Gauges

AERO CLUB FLIGHT LOG Consumption rate 35 l/hr

	TIME	FUEL
Flight Time	2:30	87.5 l
Taxi	0:15	8.75 l
Reserve	0:45	26.25 l
Fuel Required	3:30	122.5 l
Usable Fuel Carried	4:00	140.0 l

Time	L	R	Total	Tank	Remarks
09:06	70	70	140	L	Startup
09:36	57.5	70	127.5	R	TOC
10:06	57.5	57.5	115	L	
10:56	28.5	57.5	86	R	Changed tanks 20 mins late

Recently the pilot of a light commercial twin-engine aircraft experienced a surging of the aircraft's righthand engine shortly after takeoff. The pilot changed fuel tanks as part of the engine trouble checks, but then decided to feather the engine to obtain maximum climb performance due to the nature of the terrain in the takeoff path. The engine was secured before it could be established that the surging was due to a fuel starvation problem. The aircraft was then re-circuited to land without further incident.

Subsequent investigation by the operator revealed that the aircraft had been incorrectly refuelled and that the righthand fuel tank selected at the time had been run dry.

The pilot had requested the company's fuel provider to supply a specified quantity of fuel to the aircraft outer tanks prior to its previous flight. The pilot observed the refueller fuelling the aircraft and later verified the quantity by checking the relevant fuel uplift documentation.

On this occasion the refueller did not refuel the outer tanks as requested, but instead placed the fuel in the inboard tanks. The refueller was new to the job and did not follow the appropriate refuelling procedures. Previously it had been operator company policy that, as long as the pilot observed the aircraft being refuelled and sighted the refuelling documentation to verify the quantity uplifted, fuel tank dipping was not required. The pilot did not dip the aircraft fuel tanks in this instance. (The company has since revised this policy so that pilots are now required to dip the tanks after refuelling to verify the fuel quantity on board.)

The operator's investigation suggests that pilot training up to the light commercial twin-engine level of the industry places little reliance on the aircraft fuel gauges. The reason for this may be that most gauges are not annotated in litres and that basic training from instructors focuses on fuel usage in terms of airborne time remaining, without reference to the fuel gauges.

Vector Comment

There are a number of lessons to be learned from what could have been a more serious incident or accident:

- Do not rely on someone else to correctly refuel your aircraft. Murphy's Law says that they will eventually get it wrong – as was the case in this incident.
- Always dip your aircraft fuel tanks (assuming that it is possible to do so) before every flight to verify that you have the fuel on board you think you have.
- Ensure that your fuel gauges are maintained in accordance with the aircraft maintenance program.
- Aircraft fuel gauges, when maintained correctly, do not usually lie. Although keeping a fuel log using the time-remaining method should always be the primary means of calculating fuel endurance, fuel gauges should **not** be ignored – especially when they are indicating a low fuel quantity. A fuel gauge reading that indicates less fuel on board than your fuel log shows may be a sign that an engine is burning more fuel than you think, or that the aircraft was under-fuelled in the first place. Where there is a noticeable discrepancy between the two, all available options should be reviewed and action taken that will allow positive verification of the fuel quantity remaining. Better to be a little late than not to arrive at all.

Fuel management is one aspect of aviation safety that you cannot afford to take short cuts with. Even if you are under time pressure to get airborne, it is still worth spending a few extra minutes dipping the tanks and verifying the amount of usable fuel on board. If the pressure is on to get to a destination, and you are unsure of the fuel remaining, then **land** (preferably at an enroute airfield) and positively verify the fuel tank contents. Good decisions and habits such as these save lives. ■

Controlled Aerodrome Operations

Understanding the operational dynamics of a busy controlled aerodrome is the key to maintaining an efficient and safe traffic flow. This means knowing what types of clearances and instructions to expect for a particular situation, being able to comply with them quickly, and always maintaining good situational awareness.

This article looks at the different types of separations that controllers can apply to your aircraft (both in the air and on the ground), gives examples of the clearances and instructions that controllers are likely to issue to achieve those separations, and discusses some pilot considerations that will help make flying in to and out of controlled aerodromes a little less stressful (and more safer) for all concerned.

Aerodrome Control

Air traffic control (ATC) is established at most busy aerodromes where medium or large passenger aircraft operate. Aerodrome control is provided from a control tower, which allows aerodrome controllers to have views of the aerodrome apron, taxiways, runways, and the aerodrome traffic circuit.

The purpose of an aerodrome control service is to provide ATC clearances, instructions, and information, for the purpose of preventing collisions between aircraft in the air and between aircraft and/or other entities on the ground. This does not mean, though, that ATC has all the responsibility in terms of preventing collisions. It is often shared between the pilot and ATC, depending on whether the flight is VFR or IFR, the type of airspace involved, and the meteorological conditions at the time.

There are at present 17 aerodromes around the country with control towers, although this number may change with the changing air traffic patterns in New Zealand. Milford Sound aerodrome is not controlled but has an aerodrome flight information service (AFIS) that provides flight information (traffic and weather information for example) and an alerting service.

"Pilots of VFR aircraft should be aware that by day they will be separated from IFR aircraft only when within class C airspace…"

Approach Control

Approach control is provided in order to separate and sequence arriving and departing IFR flights at aerodromes where traffic density dictates it is necessary. This may be done from the control tower concerned, or by radar controllers located at the Air Traffic Control Centre in Christchurch in cooperation with aerodrome controllers.

Control Zones

All controlled aerodromes have a control zone established around them to protect aerodrome traffic, unless an ATC service is not being provided at the time, in which case the control zone will revert to uncontrolled airspace.

Some control zones have VFR transit lanes that, as the name suggests, are designed for VFR aircraft to transit without having to call ATC and get an ATC clearance. These transit lanes are class G (uncontrolled airspace) **during daylight hours only**, and at night they revert back to controlled airspace. Many of these VFR transit lanes are located under the approach path for IFR aircraft, so it is always a good idea to ensure your transponder is switched on.

IFR aircraft are always separated from each other when within a control zone. VFR aircraft, on the other hand, are **not** separated from each other when within a control zone. Pilots of VFR aircraft should be aware that by day they will be separated from IFR aircraft **only** when within class C airspace (airspace established around major aerodromes) and not when within class D airspace. VFR pilots will, however, be provided with traffic information about other VFR or IFR aircraft when within class D airspace. This assists in the maintenance of orderly traffic flows and ensures safe separation standards. Refer to the "New Zealand Airspace Classifications" poster for further information.

Runway Separation Standards

At busy controlled aerodromes, runway occupancy is one of the main factors that affect aerodrome capacity. Air traffic controllers try to improve runway utilisation by issuing ATC clearances with efficiency in mind. For these to be effective, pilots need to have a basic understanding of the separation being applied and any restrictions imposed by ATC. Let's look briefly at examples of what types of separation might be applied by ATC at a controlled aerodrome.

- **Runway separation.** As a broad term, a standard runway separation requires that only one aircraft occupy the runway at a time. This means that the preceding aircraft must either have passed the runway end, have commenced a turn after takeoff, or have cleared off the active runway on the ground.
- **Reduced runway separation.** This applies in visual meteorological conditions (VMC) by day only, and it varies with aircraft size. As a general guide, 1,000 metres between aircraft

of 7,000 kg or less, and 600 metres between aircraft of 2,300 kg or less.

- **Parallel runway separation.** This is dependent on parallel runway spacing and the size of the aircraft using each runway. A good example of where parallel runway separations are often applied is to traffic in the western grass circuit at Christchurch.
- **Wake turbulence separation.** This is necessary, for safety reasons, to provide a specified time period (normally two or three minutes) between aircraft in different wake turbulence categories.
- **Crossing runway separation.** This requires an aircraft to either stop short, or pass clear, of a crossing runway about to be occupied by another aircraft.

These examples do not detail all the permutations, so familiarise yourself with the separation standards contained in the "Operations Section" of the NZAIP *Planning Manual*.

ATC Clearances and Instructions

ATC clearances, and ATC instructions (such as taxiing route or circuit joining requirements), may contain special requirements in order to help achieve the safe and orderly flow of aircraft. Pilots must ensure that they either comply with these requirements or advise ATC **immediately** if they cannot comply for a particular reason (remember that controllers may not be aware of your particular circumstances or experience level). An alternative clearance will usually then be issued.

Examples of conditions that are attached to a clearance or instruction are shown underlined in the following example transmissions:

"GIVE WAY TO THE ATR 72 ON YOUR RIGHT, TAXI TO THE HOLDING POINT RUNWAY 34"

"BEHIND THE TOMAHAWK ON FINAL, LINE UP BEHIND AND WAIT RUNWAY 34"

"JOIN DOWNWIND RIGHTHAND RUNWAY 34, NUMBER TWO TO THE METRO AT SOMES"

"MAINTAIN RUNWAY HEADING, CLEARED FOR TAKE OFF"

Aerodrome controllers may include information with a takeoff or landing clearance to advise a pilot that a preceding aircraft is not yet clear of the runway at that time. Anticipated takeoff or landing clearances, like reduced runway separations, are issued in VMC by **day only**. The controller, however, is still responsible for applying normal runway separations in these circumstances. Pilots should therefore note the information provided by the controller and carefully monitor the progress of the aircraft or vehicle ahead, just in case it does not clear the runway as expected.


Photograph courtesy of Airways Corporation of New Zealand

Examples of anticipated or 'qualified' ATC clearances are underlined in the following example transmissions:

"CHEROKEE VACATING RUNWAY LEFT, CLEARED TO LAND RUNWAY 02"

"CHEROKEE DEPARTING AND TURNING LEFT, CLEARED FOR TAKEOFF RUNWAY 02"

Pilot Considerations

Consider the following points in relation to operating at a controlled aerodrome.

- Familiarise yourself well beforehand with the control zone boundaries, the reporting points on the VTC, and the applicable aerodrome procedures in the VFG. Remember to ensure that you always carry up-to-date charts and VFG – Part 91 of the Civil Aviation Rules requires this.
- Always plan ahead, and listen to the ATIS for aerodrome information. Keep the controller informed of your preferences, and make any requests clear and concise.
- Listen carefully to the ATC clearances and instructions you are given. Write them down if necessary. If you are unable to comply with a clearance, tell the controller why and without delay.
- Read back all ATC clearances and instructions verbatim, and comply with the requirements as appropriate without delay (especially when cleared for an immediate takeoff). Do not read back a clearance that you do not fully understand – ask for further clarification.
- Listen to the radio dialogue between ATC and other aircraft in the vicinity of the aerodrome so as to form a mental picture of where you fit into the traffic flow, and what type of ATC clearance or instruction you are likely to be issued. Maintaining situational awareness is always the key.
- Finally, remember that as pilot in command it is your responsibility to go around off an approach or to abort a takeoff if you know that you will be unable to comply with the conditions associated with an ATC clearance.

Pilots who are unfamiliar with normal controlled aerodrome radio phraseologies should acquaint themselves with the RTF examples in the "Operations Section" of the NZAIP *Planning Manual*. It is critical that these standard phraseologies are understood and used whenever possible.

Summary

Understanding how your aircraft fits into the dynamics of the traffic flow at a busy controlled aerodrome, and knowing what ATC clearances and instructions you are likely to receive, all helps to maximise traffic flow efficiency and improve aerodrome safety. The information and considerations detailed in this article should help in this regard.

Even if you are an experienced pilot, consider visiting your local tower to gain a different perspective and meet the people behind the voices. Never stay silent if you need assistance – even if you are outside controlled airspace. Fortune tends to favour the brave who speak up! ■

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.

Emergency Gear Extension Procedures

On reading your article "Got a Hang-up?" in the July/August 2000 issue of *Vector,* I felt that the advice given may not have been the best.

The main problem with the article was the alternative advice given to that of inducing the aircraft into a stall in order to help extract hung-up landing gear. The problem with pulling the aircraft up into a steep climb at a relatively high airspeed to increase positive G-loading as suggested, is defining the amount of pull-up required.

Suggesting this course of action fails to define the amount (magnitude) of pull-up required, which in a pilot's enthusiasm to avoid a wheels-up landing, may end up overstressing the aircraft. This has already occurred in New Zealand.

I would suggest that a pilot complete the emergency gear extension procedures, and should these procedures fail to lock down the landing gear, that they may wish to apply a 'G-force' in the hope of extending the gear. The best way to accomplish this is to roll the aircraft into a turn, gradually increasing the angle of bank up to a maximum of 60 degrees.

A 60-degree angle of bank will subject the aircraft to exactly two G in a balanced turn. If doubling the extension forces on the landing gear fails to extend it, there is little point trying to apply a greater G-force, with the real risk of bending the aircraft. A 60-degree angle of bank and the desired two G allows a safety buffer if it is a while since you last practised a steep turn.

I hope this is advice that is never needed.

Brian J. Souter
Wellington, July 2000

Vector Comment

Thanks for that advice. It would be important that, in a similar way as you point out for the pull-up option, in the heat of the moment the pilot did not 'over-do' the steep turn and end up in a worse emergency situation. Sixty degrees is all that is required.

Hand-Swing Starting – Mags

Your publication deserves congratulations for its recent presentation of information about the hand-starting of aero engines (July/August 2000 issue). Perhaps you will allow me to add to your most informative article?

I suspect that there is widespread misunderstanding about the part played by magnetos fitted with an impulse device.

It is important to understand that an impulse magneto **not only** produces a 'fat' spark at low rpm during engine start, **but also it does so at a later (retarded) point** on the engine's compression stroke. This means that the chance of the engine 'kicking back' during starting is greatly reduced. (The magneto reverts to a more advanced firing position when the engine is running.)

However, if the other magneto is of the non-impulse type, and it also is turned on during starting, it will produce weak sparks at the normal advanced position, preceding the 'impulse' spark by something in the order of 20 degrees. It is quite likely that the engine will fire at this earlier point, thus greatly increasing the risk of the propeller 'kicking back'. **For this reason, only impulse magnetos should be turned on for starting**.

Where only one impulse magneto is fitted, and the aircraft has a key-operated starter, the non-impulse magneto is automatically turned off until the key is released when the engine starts.

It is useful to know when hand-starting whether one or both mags are the impulse type. This can generally be established by slowly turning the propeller and listening for a distinct click as the impulse is released. If two impulse mags are fitted, two clicks should occur at almost the same point. (Remember the Golden Rule – treat the prop as if it is 'alive' when doing this.)

If two impulse mags are fitted, both should be selected ON for easier hand-starting.

You correctly emphasise the importance of having a qualified person at the controls during hand-starting, but it should not be assumed that even a licensed pilot will not do something inappropriate during this seldom-taught and rarely-practised procedure.

To illustrate this point I will share this true experience with you.

Some years ago I went to the assistance of a pilot who was unable to start his aircraft. After briefing him, and assuring myself that the cockpit controls were correctly positioned, I prepared to swing the prop. **Just at that point he opened the window and asked when he should turn the key to START!**

After offering a short and frank expression of how I felt about his proposed assistance, I found myself having to convince him that the engine could be started without selecting the ignition key to that position!

I learned from this that one must not assume that the person at the controls, qualified or not, will not do something inappropriate at a critical time.

I believe that this whole area needs more attention during training.

Pat Scotter
Rangiora, August 2000

Vector Comment

Thanks for those additional points. Another way that pilots gained exposure to the correct handling of a propeller in the past was through the practice of pulling the prop through several times before starting. This originated with inverted cylinders but has advantages with modern engines as well – anyone care to comment on why it is no longer taught?

Hand-Swing Starting – Method

During a recent visit to CAA for a safety seminar, I was surprised to see, while scanning through the latest *Vector,* the photograph at the top right of page 6. In this picture an individual stands facing the propeller with both hands placed in position to carry out a hand-swing start.

While I commend the editors of *Vector* on both the intent and content of the "Hand-Swing Starting" article, I cannot, however, agree with the inclusion of this photo and its message on technique.

I am horrified at the number of pilots I observe in a face-to-the-propeller position, pulling the prop through using both hands as exhibited in the *Vector* photograph. My concern relates to the potential for horrendous injuries if an exponent of this technique loses balance and falls forward into the propeller arc as he or she applies the full swing necessary to overcome the engine compressions of a typical light aircraft.

I appreciate that the explanation requires a step backward as part of the technique, but I consider this a dangerous manoeuvre. Stepping back while taking the propeller down through a full compression is prone to taking the person into an off-balance position while leaning forward and down at the end of the swing.

I am an advocate of the propeller swinger standing side-on to the propeller, using one hand to pull it through from the top of its arc, bending the knees at the same time, so as to finish with the swinging hand in the small of their lower back (therefore ensuring that the swinging arm remains clear of the prop). In the event that the propeller swinger loses their balance or traction they would fall away from the propeller.

Alternatively, with aircraft like the C172 or Piper Cub, which have a suitable handhold to brace the non-swinging arm, standing behind the blade and swinging through the compression as one bends at the knees is also a considerably safer technique than that exhibited in the *Vector* photograph.

I otherwise applaud the inclusion of this article and am happy to demonstrate the merits of above techniques.

I must acknowledge techniques will require variations to the theme due to the many different aircraft types available.

Carlton Campbell
CFI Wakatipu Aero Club, July 2000

Vector Comment

Thanks for your comments. We have discovered this is a topic with a number of varying opinions and techniques.

Dealing with your last point first, the pros and cons of starting from behind were covered in the article, the main danger being the risk of being knocked forward by the wing towards the propeller should the aircraft move forward.

The photo in question showed the stance before starting the pull through – there is no pressure on the propeller until the weight of the body is going on to the back foot. The swing is accomplished by shifting the bodyweight rather than strength in the arms. Your concern about falling forward is unfounded if the correct technique is used. In the event of the person losing balance they will fall backwards away from the propeller and can roll well clear. (See sequence 1)

With the side-on stance described, the need to swing the hand behind the back suggests that the prop-swinger's body remains close to the prop at the point of start, but it is hard to fully reconstruct the actions from words alone. The following photos show a side-on stance being used on a Cessna 152 – with this aircraft the swinger is able to achieve the hand-start with one hand while at the same time moving away. (See sequence 2)

There will be variations to prop-swinging technique depending on the aircraft type (eg, height of prop, size of engine, strength of compression) and on the size and strength of the prop-swinger. These factors, plus the position of the prop at compression, have a bearing on whether it can be accomplished with one hand or two.

The two main criteria are:

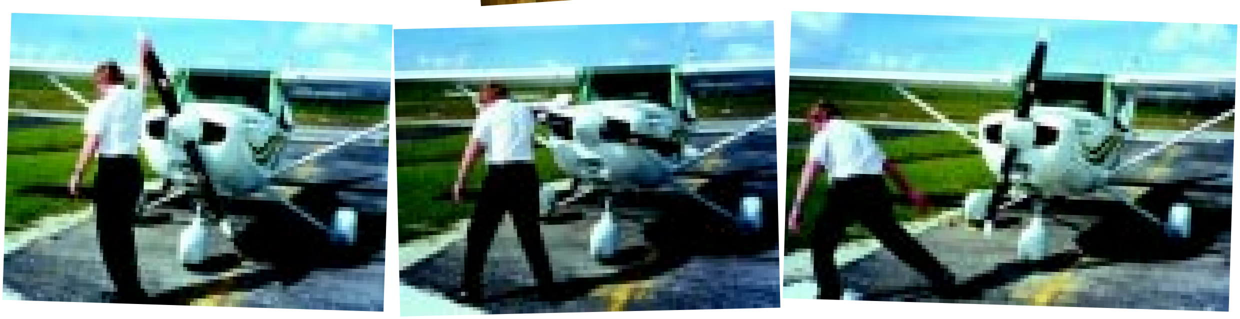
1. The body must be moving away from the propeller arc during the swing (this is particularly important with tailwheel aircraft, as the propeller tip is further forward and therefore closer to the prop-swinger's legs at the bottom of the arc).
2. When the engine fires, the prop-swinger should be moving away from the prop and be in a position to move rapidly clear should the aircraft move forward.

There is no **absolute** 'right' or 'wrong' way to hand-swing a propeller. The technique described in our article is the 'traditional' way, but there will be variations as we mention above.

The concerns expressed by Carlton emphasise our advice that, while words and photos can give guidance, safe prop-swinging requires training in person. ■

Sequence 1

Sequence 2



Safety Seminars

JUST PASSING THROUGH –
Airspace, Aerodrome, and Performance Considerations

This year's series of Av-Kiwi seminars is well under way, with around 10 having been completed so far. Seminars have been well received by pilots, with good numbers attending.

Last year's series focused on the planning and decision-making involved in making a VFR cross-country flight to the other island. *Going North* and *Going South* were very well attended, and it was good to see the wide range of experience levels of those participating. Attendees generally found the material covered to be interesting and useful, with the practical experience and advice shared by the industry presenters being particularly appreciated

This year's seminar topic, entitled *Just Passing Through,* expands on this cross-country theme and focuses on the pre-flight planning and in-flight considerations associated with arrival and departure from an aerodrome (either controlled or uncontrolled) – especially an unfamiliar one. Particular emphasis is placed on ensuring adequate pre-flight planning, understanding airspace, correct circuit joining procedures, ATC procedures, and determining takeoff and landing performance.

Experienced instructors will provide useful tips and advice about departing from and arriving at an unfamiliar aerodrome, and CAA staff will cover takeoff and landing performance considerations in general. A group exercise will focus on planning a flight to and from attended and unattended aerodromes.

Check the accompanying list for the date and place details of the remaining seminars, and watch out for advertising posters displayed at your local training organisation or aviation business.

These seminars are informative and popular – so we hope to see you and other pilots from your club or organisation at one soon. **See you there!**

Seminar Schedule

Wednesday 20 September, 7:00 pm – 10:00 pm.
Wellington Airport, at Wellington Aero Club.

Thursday 21 September, 7:00 pm – 10:00 pm.
Tauranga Aerodrome, at Tauranga Aero Club.

Saturday 23 September, 9:30 am – 12:30 pm.
Taupo Aerodrome, at Taupo Aero Club.

Tuesday 3 October, 7:00 pm – 10:00 pm.
Dunedin - Taieri Aerodrome, at Otago Aero Club.

Wednesday 4 October, 7:00 pm – 10:00 pm.
Invercargill Aerodrome, at Southland Aero Club.

Thursday 5 October, 7:00 pm – 10:00 pm.
Queenstown, at Sherwood Manor Hotel.

Wednesday 11 October, 7:00 pm – 10:00 pm.
Gisborne Aerodrome, at Air Gisborne Ltd.

Thursday 12 October, 7:00 pm – 10:00 pm.
Hastings Aerodrome, at Hawkes Bay & East Coast Aero Club.

Saturday 14 October, 9:30 am – 12:30 pm.
Masterton Aerodrome, at Heliflight Wairarapa Ltd.

Saturday 14 October, 9:30 am – 12:30 pm.
Matamata Aerodrome, at Matamata Soaring Club.

Wednesday 18 October, 7:00 pm – 10:00 pm.
Ardmore Aerodrome, at Auckland Aero Club.

Thursday 19 October, 7:00 pm – 10:00 pm.
Whitianga Aerodrome, at Mercury Bay Aero Club.

Tuesday 24 October, 7:00 pm – 10:00 pm.
Christchurch Airport, at Canterbury Aero Club.

Thursday 26 October, 7:00 pm – 10:00 pm.
Timaru Aerodrome, at South Canterbury Aero Club.

Saturday 28 October, 9:30 am – 12:30 pm.
Omarama Aerodrome, at The Country Time Resort.

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
email: fogdenj@caa.govt.nz

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

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

Owen Walker
(Maintenance, New Zealand-wide)
Ph: 0–7–866 0236 Fax: 0–7–866 0235
Mobile: 025–244 1425
email: walkero@caa.govt.nz

Accident Notification

24-hour 7-day toll-free telephone

0508 ACCIDENT
(0508 222 433)

CA Act requires notification "as soon as practicable".

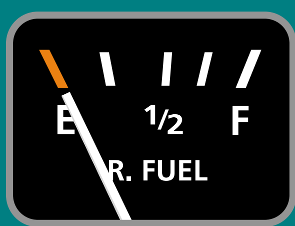
Aviation Safety Concerns

24-hour 7-day toll-free telephone

0508 4 SAFETY
(0508 472 338)

For all aviation-related safety concerns

What part of 'E' don't you understand?



OCCURRENCE BRIEFS

Lessons For Safer Aviation

The content of *Occurrence Briefs* comprises all 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, which 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-HVU, Robinson R22 Beta, 4 Nov 99 at 1000, Pyke Valley. 1 POB, injuries nil, damage substantial. Nature of flight, hunting. Pilot CAA licence CPL (Helicopter), age 41 yrs, flying hours 766 total, 220 on type, 104 in last 90 days.

The pilot reported that as he was approaching to pick up a deer, a severe gust of wind hit the helicopter from behind. The gust lifted the tail and caused the helicopter to spin approximately 270 degrees to the right. The pilot regained control and placed the machine on the ground momentarily, but a second gust from the opposite direction tipped the helicopter on to its side. The pilot estimated the strength of the gust to be over 40 knots.

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

CAA Occurrence Ref 99/3122

ZK-HNG, Hughes 269C, 11 Nov 99 at 1130, Matakana. 1 POB, injuries nil, aircraft destroyed. Nature of flight, ferry/positioning. Pilot CAA licence CPL (Helicopter), age 33 yrs, flying hours 11800 total, 3200 on type, 144 in last 90 days.

The pilot disengaged the clutch after landing, and during the run-down the helicopter encountered ground resonance. With the clutch not engaged, the pilot could not increase the rotor rpm or lift the machine off the ground. The main rotor blades struck and severed the tail boom, tore the rotor mast from the transmission, and destroyed the bubble. No mechanical cause for the ground resonance was established.

Main sources of information: Accident details submitted by operator.

CAA Occurrence Ref 99/3140

ZK-EJR, Cessna 172N, 13 Nov 99 at 0940, Kaipara Flats Ad. 1 POB, injuries nil, damage substantial. Nature of flight, ferry/positioining. Pilot CAA licence CPL (Aeroplane), age 22 yrs, flying hours 491 total, 106 on type, 99 in last 90 days.

The pilot decided to land downwind after a ferry flight. The pilot encountered a stronger tailwind than anticipated and touched down well into the grass runway. As a result of poor braking action caused by wet grass, a turn was initiated and the aircraft came to rest in a shallow ditch at the end of the airfield.

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

CAA Occurrence Ref 99/3149

ZK-HZV, Robinson R22 Beta, 14 Nov 99 at 1430, North Shore Ad. 1 POB, injuries nil, damage substantial. Nature of flight, training solo. Pilot CAA licence nil, age 32 yrs, flying hours 23 total, 23 on type, 23 in last 90 days.

The student pilot had made five normal circuits during a solo consolidation session. On his sixth approach, as he increased power to terminate in the hover, he perceived that his rate of descent had increased. He attempted to carry out a run-on landing, but struck the ground heavily just short of the intended landing point. The toes of the skids dug into the surface, causing the right front cross-tube to collapse. The helicopter then rolled on to its right side.

Main sources of information: Accident details submitted by operator.

CAA Occurrence Ref 99/3150

ZK-FFK, Cessna 120, 17 Nov 99 at 1649, Rotorua Ad. 1 POB, injuries nil, damage substantial. Nature

of flight, private other. Pilot CAA licence PPL (Aeroplane), age 67 yrs, flying hours 1243 total, 144 on type, 19 in last 90 days.

The high-wing tailwheel aircraft was making an approach in gusty conditions. During the roundout, with the aircraft in a three-point attitude, a wind gust caught and overturned it as the pilot closed the throttle.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 99/3160

ZK-PZO, PZL Warszawa-Okecie PZL-104 Wilga 35, 26 Nov 99 at 1900, Wanaka Ad. 1 POB, 1 serious, aircraft destroyed. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 54 yrs, flying hours 660 total, 320 on type, 20 in last 90 days.

The pilot was returning to Wanaka after having been out of the area for several hours. The wind had increased in both strength and gustiness in his absence.

The aeroplane was landing on the grass adjacent to runway 29 when a severe gust of wind lifted it sideways. It clipped the fence parallel to the runway, slewed through 90 degrees, struck the ground with its left wing tip, and cartwheeled on to its nose.

Main sources of information: CAA field investigation.

CAA Occurrence Ref 99/3353

ZK-JGJ, Cessna 310B, 27 Nov 99 at 1740, Omaka Ad. 3 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 62 yrs, flying hours 705 total, 75 on type, 12 in last 90 days.

Following a VFR flight from Ardmore, the pilot touched down approximately a quarter of the way into the grass vector. The pilot allowed the aircraft to roll, but then found braking to be ineffective because of the wet grass. The aircraft went through the fence at the far end of the vector, collapsing the nosewheel and damaging the propellers.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 99/3358

ZK-HEI, Hughes 269C, 28 Nov 99 at 2000, L Paringa. 2 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence CPL (Helicopter), age 22 yrs, flying hours 1800 total, 220 on type, 122 in last 90 days.

The helicopter was taking off with the pilot and shooter aboard, and a deer on the cargo sling. The pilot climbed vertically to about 100 feet and began transitioning forward. The takeoff location was in the lee of a ridge, and despite the application of full power and jettisoning the load, the pilot was unable to prevent the helicopter settling into the trees ahead.

No loss of rotor rpm had occurred before collision with the trees. Easterly wind conditions had prevailed in the area during the day but had increased in strength towards the evening. It appears that the helicopter was affected by a downdraft at a critical stage of flight, the magnitude of the downdraft exceeding the available climb performance of the helicopter.

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

CAA Occurrence Ref 99/3387

ZK-HCW, Robinson R22 Beta, 4 Dec 99 at 2040, 20 ESE Opotiki. 2 POB, injuries nil, aircraft destroyed. Nature of flight, hunting. Pilot CAA licence CPL (Helicopter), age 38 yrs, flying hours 845 total, 837 on type, 135 in last 90 days.

The pilot was positioning the helicopter to allow his shooter to disembark. The intended alighting point was the root end of a fallen tree. The left skid caught in a protruding root, and the helicopter rolled over.

Main sources of information: Accident details submitted by operator.

CAA Occurrence Ref 99/3456

ZK-BMD, Auster Mk 5D, 16 Jan 00 at 1830, Wanaka. 2 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 40 yrs, flying hours 404 total, 6 on type, 35 in last 90 days.

The aircraft was being operated off an airstrip but failed to reach flying speed. The pilot decided to abort the takeoff and initiate a groundloop, which subsequently caused damage to the wing and tailwheel.

The wind was calm before the takeoff attempt, but there was a significant tailwind present after the accident.

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

CAA Occurrence Ref 00/160

ZK-HCM, Robinson R22 Beta, 1 Jan 00 at 1530, Wanaka. 2 POB, injuries nil, aircraft destroyed. Nature of flight, training solo. Pilot CAA licence CPL (Helicopter), age 29 yrs, flying hours 346 total, 317 on type, 2 in last 90 days.

The pilot was on a mountain flying continuation sortie to the west of Wanaka. Climbing up a gully at low airspeed, he observed the rotor rpm decaying and initiated a turn to the right. There was insufficient height available in which to recover rotor rpm, and the helicopter sank and collided with the side of the gully.

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

CAA Occurrence Ref 00/1

ZK-HGH, Aerospatiale AS 350B, 12 Dec 99 at 1640, Greymouth. 2 POB, injuries 1 minor, damage substantial. Nature of flight, training solo. Pilot CAA licence CPL (Helicopter), age 35 yrs, flying hours 5065 total, 46 on type, 38 in last 90 days.

The helicopter was engaged in a winch-training exercise involving the picking up of a person from a small boat. About the time the helicopter was ready to make the lift, the boat rose on a swell, resulting in some slack forming in the winch cable. Part of the cable became caught on a fitting on the boat, and when the boat descended off the back of the swell, the cable snapped. The cable flicked back up through the main rotor, breaking the cable again. The winch operator suffered a gashed hand in the process.

One main rotor blade was damaged beyond repair and required replacement. The other two received superficial damage.

Main sources of information: Accident details submitted by operator.

CAA Occurrence Ref 99/3516

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.

Aerospatiale AS 350B – Fuel control unit fails

P/N 0164448560

The engine had been running at ground-idle for approximately one minute after start, when it shut itself down. The pilot attempted a restart but was unable to achieve one.

Further inspection revealed that the drive shaft in the fuel control unit had failed. The unit was returned to the manufacturer. TSO 20 hours; TSI 12.5 hrs.

ATA 7320 CAA Occurrence Ref 99/1285

Aerospatiale AS 355F1 – Lock plate breaks

During scheduled maintenance, evidence of contact between the main rotor mast and the inside of the swash plate was noticed.

Subsequent investigation revealed fretting of the bearing spacer and that the lower bearing lock plate was broken. This is a known problem. The manufacturer advises that care should be taken during reassembly of the mast.

ATA 6320 CAA Occurrence Ref 98/3458

Aerospatiale AS 355F1 – Throttle lever breaks

P/N 355A57-2155-23

The helicopter had just landed when the lefthand throttle lever broke off in the pilot's hand as it was being moved from the flight-idle to ground-idle position. Engineering assistance was required to complete the engine shutdown.

Further investigation revealed that the flexible coupling on the throttle lever had failed. The maintenance provider concerned now has a programme in place to replace all flex couplings.

ATA 7610 CAA Occurrence Ref 99/1340

Cessna A152 – Push rod breaks

P/N 73806-85

The engine had symptoms of slight rough running and was down on power.

The normal items, such as spark plugs, were checked but the symptoms remained. When the rocker covers were removed a pushrod was found to be broken at its end. TTIS 7137 hrs; TSO 2921 hrs; TSI 94 hrs.

ATA 8520 CAA Occurrence Ref 99/122

Hiller UH-12E – Input drive/freewheel clutch fails

P/N 23700-3

After landing the helicopter and during normal run down, the pilot heard the engine rpm decay slightly as though under load. After shutting down the engine, grinding noises were heard emanating from the main transmission.

The main rotors then decelerated and stopped very quickly.

A bulk strip indicated that the input drive duplex bearing had backed off and made contact with the end of the clutch sprag. The outer race and sun gear had then risen up and engaged the first stage planetary cage, resulting in considerable friction, heat, and metal transfer.

The cause for the loss of torque on the nut could not be determined. TSO 759 hrs.

ATA 6310 CAA Occurrence Ref 99/1055

Hughes 369HS – Tail rotor input bell-crank fails

P/N NAS 464-P5-25

The pilot realised, while in the cruise, that he had lost directional control of the tail rotor. He carried out a run-on landing.

Further investigation revealed that the tail rotor control input bell-crank pivot bolt had failed allowing the bell-crank to float freely. Microscopic examination of the bolt showed that there were small corrosion pits halfway along the length of the bolt and it was from one of these pits that a fatigue crack had initiated. The crack progressed until the bolt completely failed.

ATA 6720 CAA Occurrence Ref 99/1098

Jodel D.11 – Fuel pump diaphragm detaches

During a local flight in a recently purchased aircraft, fuel pressure was lost while the mechanical fuel pump was in use. The flight was completed using the electrical fuel pump.

The mechanical fuel pump was dismantled, revealing a failure of the yoke at the bottom of the diaphragm actuating pull-rod. The yoke was completely worn through. This disconnected the diaphragm from the pump-actuating lever, resulting in a loss of fuel pressure.

This is a timely reminder for operators to ensure that the fuel pump Airworthiness Directive inspection is carried out thoroughly every 12 months.

ATA 8500 CAA Occurrence Ref 99/1477

Piper PA-32R-300 – Gear-up pressure line ruptures

The gear retracted normally after takeoff, but the pilot noted that a low-voltage light had come on. After a short time the light went off, but the gear-unsafe light came on. Gear down was then selected with no effect. The emergency gear procedure worked satisfactorily, and the aircraft landed without incident. The pilot noted a hydraulic leak on the righthand side of the fuselage near the spar attachment.

An aluminium pressure gear-up line was found to have a hole worn in it where it passes through the fuselage spar box. There is a seal covering the access hole to the spar box, and corrosion had developed on the gear-up line where it touches the landing gear tube. The submitter indicated that the area is a difficult one to inspect, and that the pipes should be monitored closely.

ATA 3230 CAA Occurrence Ref 99/1468