

VECTOR

Pointing to Safer Aviation

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Static in the Operation

CAA Field Safety Adviser Owen Walker has contributed the following article. Owen is a qualified aircraft engineer and brings his knowledge, and over 30 years of practical experience, together in this article to explain how static electricity can affect us in everyday aircraft refuelling operations. He places particular emphasis on the formation of external static charges in flight and the use of equipment within the refuelling environment. This article complements "Static in the Fuel" in our previous issue.

External Static Charges

Static electricity is not generated by friction, but instead by the movement of a non-conducting material (such as dry air) across a surface, and in contact with a conducting material, thus creating a potential difference (PD). External static charge build-up occurs in an aircraft (and its fuel) as it moves through the air. The movement of an aircraft through the air can create a large PD relative to the earth, especially with the increasing use of composites in today's aircraft construction. The phenomenon called 'St Elmo's fire' is a marvellous example of large amounts of static build-up, and it can result in a powerful static discharge across the aircraft windscreen when in flight.

Separate aircraft components can create PDs in themselves, meaning that bonding wires have to be used throughout the aircraft to maintain the components at the same potential. Static generated by the aircraft is dissipated into the atmosphere through the fitting of static discharge lines, or simply from an extremity of the aircraft.

"It is therefore easy to become complacent about the need to static bond an aircraft."

In theory, there should be a zero PD between the aircraft and the ground upon landing. Trailing static wires, and tyres impregnated with conductive material, should dissipate any static charge, thus bringing the PD between the aircraft and earth back to zero. In practice, this is not necessarily the case.

Ground and atmospheric conditions affect



Static dischargers fitted to the trailing edge surfaces of some aircraft help to reduce static potential.



the rate of static dissipation – dry air will inhibit the process. Snow is also an insulator, as are wooden heli-pads, and the scrub on which helicopters sometimes land. Very dry concrete (sometimes poured with plastic under it) also provides insulation. Even on a dry windy day, with the aircraft stationary, a static charge may build if the aircraft is insulated from earth.

When it comes to fuelling, many factors can create a PD between an aircraft and the fuel being transferred to it. Aircraft electrical systems use the aircraft frame as part of the electrical circuit. This means that there is a potential for spark generation to occur during refuelling if

the aircraft electrical systems are left on. It is best to shut all electrical systems down before commencing refuelling operations. Note that ground-fuelling equipment may have a different polarity to the aircraft – especially if it is electrically operated.

Fuel and Air Mixtures

Commonly used terms when referring to fuels are flashpoint and volatility.

Flashpoint is a measure of the fuel temperature relative to the amount of vapour that needs to be given off to ignite it. This is not a precise measure, however, as there are too many variables. The temperature range at which fuel vapour concentrations can be explosive (at ground level in an equilibrium state) are approximately: Avgas –10 to –40 degrees Celsius; kerosenes (Avtur, Jet A-1) +38 to +80 degrees Celsius; and wide-cut fuels (JP-4) –20 to +10 degrees Celsius.

Volatility is a measure of a fuel's ability to evaporate under varying conditions of

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Next Issue

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temperature and pressure. Hydrocarbon fuels will not ignite as a liquid; rather, they must be in a vaporised form and combine with oxygen (present in the surrounding air) to create a flammable mixture.

There is a relationship between flashpoint and the volatility of aviation fuels. The temperature that gives about 10 percent distillation of a fuel is the point where just enough vapour is given off to create a flammable mixture.

"... often overlooked... fuel drums... insulated from the ground... sitting on the back of a truck, resting on scrub..."

Temperature is not the only method of creating fuel vapour. Mists or atomisation, generated by sloshing and forcing fuel through nozzles (at any temperature), are equally ignitable. This has proven to be the overriding factor when fuelling.

Fuel vapours, enclosed in a tank, will ignite with an air-to-fuel ratio of between 75:1 by volume at the lean limit and 13:1 at the rich limit. Beyond these limits the fuel vapours will not ignite. Note that the potentially most lethal air-to-fuel ratio occurs at approximately 34:1 by volume, because this is the ratio where the minimum amount of energy is required for ignition. Air-to-fuel ratios within these limits **can easily occur** through the misting or sloshing of fuel as it is forced through a nozzle into the tank. The **air-to-fuel ratio** is one of the most important variables in the prevention of refuelling fires or explosions.

Hot Refuelling

Hot refuelling is a term for a refuelling operation that takes place with the engine burning and the blades turning. This operation is mainly confined to helicopters, but it can also apply to some fixed-wing aircraft. In either case, the machine is made of conducting and non-conducting materials, and a static charge is building up while everything is rotating. This situation creates a very efficient self-generating 'charging machine' for want of a better term. The dissipation of the resulting charges that build up is to earth – if that is possible. If the aircraft is insulated



Fuel pump hose diameter, nozzle diameter, and fuel transfer speed, all affect the rate at which static is generated while refuelling.

from earth, or there is a resistance, the rate of dissipation through the atmosphere (or the earth) will be less than the rate at which the charge is building up. The static charge will then build up to such a level that it will overcome this resistance threshold and a discharge will occur – through the point of least resistance. If the easiest path is the hand-held fuel nozzle, then the static charge will take it.

Myths About Static Electricity

- Myth: Avtur (Jet A-1) and Avgas are safer than JP-4 (wide-cut fuels), therefore there is less of a fire risk through static discharge.

New Zealand does not use wide-cut fuels for general aviation. Avgas is generally more volatile at lower temperatures than both JP-4 and Jet A-1 in standard equilibrium conditions, and therefore may have vapour concentrations too high to actually explode. On the other hand, Jet A-1 is less volatile than Avgas, but it can generate an explosive mixture within the normal operating temperature range found at many aerodromes around the country. Jet A-1 can therefore be more dangerous in this respect than Avgas at normal environmental temperatures.

- Myth: New Zealand rarely gets hot enough to create an explosive fuel vapour mixture.

Research has shown that during refuelling operations, fuel vapours and/or mists are present at temperatures far below the standard equilibrium temperature required for vapour to be generated in hydrocarbon fuels. Flammable mixtures are present in all fuels within New Zealand's operating temperature range.

- Myth: Jet fuel is safe because it is not as volatile as Avgas or wide-cut fuels.

Fuel vapours and mists only need to have the correct air-to-fuel ratio to ignite. In practice this can be achieved at any operating temperature, making jet fuel (Jet A-1) just as dangerous.

Precautions

An area associated with 'in-the-field refuelling' that is often overlooked is the location of fuel drums. They can be insulated from the ground, and the aircraft, if they are sitting on the back of a truck, resting on scrub – or on any other insulating platform for that matter. Bonding the aircraft and the fuelling equipment **to ground is necessary** to ensure a conductive path is always available. This dissipates the static charge being continuously created and maintains the same PD between the aircraft, the fuelling equipment, and the earth.

Field operations often utilise portable pumping equipment. This equipment usually uses paper (WIX) filter elements,



Ensure that the static line clip makes metal-to-metal contact with the aircraft structure – this may require a slight scraping motion (on a non-painted surface such as an exhaust pipe or undercarriage strut) to confirm that a contact has been made. Note that many aircraft have grounding plug receptacles at or near the fuelling caps, and it is worth utilising these.

and sometimes Go-No-Go water separator filters, attached to a 12- or 24-volt pump with a short small-diameter hose, and nozzle. The rapid transfer of the fuel over these filters charges the fuel molecules. Small-diameter hoses create fast movement, and a misty mixture upon entering the fuel tank. Short hoses, and possibly the material that the hose is made of, do not allow time for the fuel to 'relax', and any internal static charge may dissipate by means of a spark inside the tank.

Bonding will not prevent this situation. To minimise the possibility of an internal static charge, the speed of the fuel transfer and the length and type of hose material **must be taken into account.**

External static charges are forever present, and their intensity at any given time cannot be measured or guessed. Preventing a static discharge at a crucial moment during refuelling is very important. Creating a closed circuit between the aircraft, fuelling equipment and the ground, through static-line bonding, is therefore **absolutely imperative.**

Human Factors

There can never be any 'positive reinforcement' that a static fuel fire has been prevented every time an aircraft has been bonded, especially as we probably have not experienced a fuel fire on the occasions where we have neglected to bond an aircraft. It is therefore **easy to become complacent** about the need to static bond an aircraft.

All the factors mentioned above must be present for a fire to start as a result of a static discharge. This makes it rather a rare event. Because of this, the awareness of the hazards involved has tended to diminish over time. Static electricity 'cause and effect' is not usually emphasised enough during pilot and ground handler training, and it may eventually be

completely lost as part of the formal training syllabus. Because we have 'got away with it' so often, some of us may have developed an attitude that we are impervious to the problem. Static by its very nature is **very unpredictable**, so it deserves to be treated with respect. The provision of proper training and operating procedures is very valuable in reducing the risks associated with refuelling.

Summary

Nothing is in equilibrium when refuelling an aircraft. The operation is dynamic by nature; fast fuelling speeds create sloshing and misting in fuel tanks. The faster the fuel transfer, the higher the risk of internal static discharge. The airspace, or ullage, in the fuel tank is rapidly changing at the rate the fuel is entering the tank. This constantly changes the air-to-fuel-vapour ratio as well as the temperatures and pressures within the fuel tank. Internal and external static discharge may therefore find the right combination for ignition at any time.

It is very important to remember that the pressures imposed by the modern refuelling environment can often bring the flashpoint of many aviation fuels way below that of the normal operating temperature range found at aerodromes around New Zealand. The risk of explosion is always present.

Aircraft materials and ground equipment are constantly being changed to meet changing operational roles. Some of these new operating procedures may introduce unknown hazards. Safe aircraft refuelling operations will always be more of a function of equipment design, proper handling techniques, and vigorous precautions, than the use of a particular type of fuel. The possibility of a fire or explosion created by static electricity is forever present – no matter how remote it may seem. ■

Pilot Rating Quiz

Question 1. What should I do if I have not flown a Piper Warrior (160 hp) for over six months and want to take a passenger for a scenic flight today?

I am a private pilot with around 100 hours total time, and I have flown four hours in the last three months on a Piper Archer (180 hp). My total time on both Piper aircraft is 20 hours. (I learnt to fly in Cessnas.)

Select the **most correct** option below that would allow me to take the passenger.

- A) Not worry about the three takeoffs and landings in 90 days rule, because I am current on the Archer, which covers me for the smaller aircraft.
- B) Do three takeoffs and landings with an instructor.
- C) Do three solo takeoffs and landings.
- D) Do a short dual check followed by three solo takeoffs and landings.
- E) Do a short 30-minute refresher flight with an instructor.

Question 2. I have just completed a type rating that took two hours of dual instruction, which included a MAUW check, the completion of an aircraft technical sheet, and which was signed off in my logbook. Can I now take a passenger for a flight? Yes or No?

The answers to both of these questions are on page 7 of this issue.

This year's series of safety seminars has started. The theme this year revolves around maintenance requirements and responsibilities and is applicable to general aviation pilots, operators, owners and engineers.

The focus is not upon the specifics of how to do particular maintenance but is upon the critical framework of rules, requirements and responsibilities that exist between pilots, aircraft operators, owners and engineers in order to achieve compliance and high safety standards.

Achieving a high standard of maintenance is a function of good plant, good planning and good decisions. The seminar looks at the ingredients to assist this and highlights the relationships that exist between engineer, owner, operator and pilot to achieve serviceability and safety. The roles and responsibilities of all the participants are explored.

If you fly, operate or own an aircraft, then this seminar is pertinent to you.

The seminars will be presented by Owen Walker, CAA Field Safety Adviser (Engineer), and he will be assisted by industry engineers.

While we will continue with the separate Heli-Kiwi and Aero-Kiwi titles, we emphasise again that you can attend either type of seminar – the topic is universal, and we will incorporate both helicopter and fixed-wing examples in each seminar.

The remaining Heli-Kiwi seminars and the first of the Aero-Kiwi seminars to be scheduled are listed below. Further Aero-Kiwi seminars are planned for **North Shore, Ardmore, Hamilton, Tauranga, New Plymouth, Nelson, Timaru and Greymouth.**

Safety Seminars

Tue, 4 Aug, 7.30 pm – 10.00 pm.

Heli-Kiwi Seminar. **Gisborne** Aerodrome, at Gisborne Pilots' Association.

Sun, 9 Aug, 2.00 pm – 4.30 pm.

Heli-Kiwi Seminar. **Kaikoura** Aerodrome, at Terminal Building.

Mon, 10 Aug, 7.30 pm – 10.00 pm

Heli-Kiwi Seminar. **Twizel**, at Mackenzie Country Inn.

Tue, 11 Aug, 7.30 pm – 10.00 pm

Heli-Kiwi Seminar. **Mandeville** Aerodrome, at Croydon Aircraft Company, Moth Restaurant.

Wed, 12 Aug, 7.30 pm – 10.00 pm

Heli-Kiwi Seminar. **Queenstown**, at Sherwood Manor Hotel.

Thu, 13 Aug, 7.30 pm – 10.00 pm

Heli-Kiwi Seminar. **Franz Josef**, at Franz Josef Glacier Hotel.

Sat, 5 Sep, 9.30 am – 12.30 pm

Aero-Kiwi Seminar. **Whitianga** Aerodrome at Mercury Bay Aero Club.

Sun, 13 Sep, 9.30 am – 12.30 pm

Aero-Kiwi Seminar. **Fielding** Aerodrome at Fielding Aviation Ltd.

Tue, 15 Sep, 7.00 pm – 10.00 pm

Aero-Kiwi Seminar. **Wanganui** Aerodrome at Wanganui Aero Club.

Tue, 29 Sep, 7.00 pm – 10.00 pm

Aero-Kiwi Seminar. **Christchurch** Airport at Canterbury Aero Club (west side of airport)

Sat, 10 Oct, 9.30 am – 12.00 pm

Aero-Kiwi Seminar. **Masterton** Masterton Aerodrome, Wairarapa Ruahine Aero Club.

Tue, 13 Oct, 7.00 pm – 10.00 pm

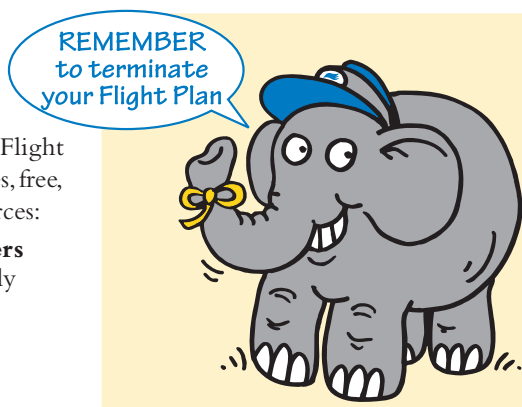
Aero-Kiwi Seminar. **Hastings** Aerodrome, Hawkes Bay and East Coast Aero Club.

Terminate Flight Plan Reminders

The Civil Aviation Authority and Airways Corporation have recently produced new brightly coloured stickers marked "Remember to terminate your Flight Plan". They are available in two sizes, free, on request from the following sources:

- **All CAA Field Safety Advisers** (FSA contact details are normally printed in each issue of *Vector*.)
- **The Safety Education and Publishing Unit**
Civil Aviation Authority
PO Box 31441, Lower Hutt
Phone 0-4-560 9400
- **National Flight Briefing Office**
PO Box 14131, Christchurch.
Phone 0-3-358 1500

We suggest that the large stickers could be placed on an appropriate wall in the ops area or hangar, or possibly on the toilet door – anywhere that it will be obvious to someone who has just returned from a cross-country flight. The front desk is usually the first stopping point for most



pilots after a flight. Another sticker placed on the staff side of the front counter will also help to remind those returning from a charter or instructional flight. The smaller stickers are ideal for placing on the front cover of your VFG, IFG, charts, pilot clipboard, flight satchel, or even the aircraft's instrument panel (provided that it does not obscure any instruments).

Another flight plan termination reminder is a keyring marked "Terminate Your Flight

Plan/Check Your ELT", produced by the CAA's National Rescue Coordination Centre. The aim is to have one of these in each aircraft.

These reminders are aimed at reducing unnecessary Search and Rescue (SAR) action, thereby reducing costs and keeping SAR free to deal fully with any aircraft that really does go missing.

So far the response from aircraft owners to the keyrings has been very positive, and the steady decline in the number of false Search and Rescue callouts may be an indication that "Terminate Your Flight Plan/Check Your ELT" keyrings are working. If your aircraft does not yet have one, they can be obtained from a CAA Field Safety Adviser or from the following address:

**National Rescue Coordination Centre
Civil Aviation Authority
PO Box 31441, Lower Hutt
Phone 0-4-560 9400**

Wellington Gulls



Bird strikes on aircraft are hazardous. At worst they can kill. Most often they can cost aircraft operators many thousands of dollars in repairs, delays, etc.

Most strikes occur near aerodromes.

Under current Civil Aviation Rules, operators of certificated aerodromes “shall, where any wildlife presents a hazard to aircraft operations at their aerodrome, in areas within their authority, establish an environmental management programme to minimise or eliminate any such wildlife hazard.” (rule 139.71)

Recently we were shown a report by Wellington International Airport Ltd (WIAL) on their strategy for managing the black-backed gull hazard around their aerodrome. We thought parts of the report could be made public to show the issues faced by an aerodrome trying to manage its wildlife. We are not singling out WIAL as necessarily being better than any other airports – but we are saying they do take their responsibility seriously. Operators of non-certificated aerodromes should not take comfort from the fact that rule 139.71 does not apply to them. Birds can’t read.

With the agreement of WIAL, here are excerpts and adaptations from their report:

The black-backed gull continues to cause a serious threat to the safe operation of aircraft at Wellington Airport. In the period 1 March 1997 to 28 February 1998, 58 percent of the bird hazard reports related to black-backed gulls.

On 1 October 1997 WIAL signed a sponsorship agreement with the Department of Conservation for revegetation and gull control on Matiu/Somes Island. This agreement is for a period of five years. It involves WIAL sponsoring the revegetation of Matiu/Somes Island, linked to an active programme to reduce the black-backed gull nests from the 1996 level of 1,000 down to 400 by 2004.

The revegetation programme involves the Department of Conservation planting at least 12,000 indigenous seedlings per year for the next five years. Over a period of time, it is hoped this revegetation will reduce the number of suitable nesting habitats for the black-backed gull. This will also aid in reaching, and maintaining, the target of only 400 nest sites.

The gull control strategy also involves an egg pricking, and, or, egg destruction programme on the three harbour islands of Matiu, Makaro and Mokopuna, targeting 80 percent of the active nests. Yearly surveys of the active nests will be carried out, and if these target levels are not being met by the above methods, then culling of some adult gull pairs will be initiated.

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Adult Southern black-backed gull

This three-year-old adult gull has a distinctive white body with black wings and a yellow beak. Adult gulls generally weigh around 1000 grams, making them quite a significant hazard to aircraft. They can live as long as 28 years.



Juvenile Southern black-backed gull

Juvenile gulls are a mottled brown colour, and they can weigh anything from 250 to 1000 grams.

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WIAL contracted Wildlife Management International Ltd (WMIL) to carry out black-backed gull control in various areas around the harbour. These were:

- Egg pricking at Tapu Te Ranga Island and Siren Rock.
- Gull culling at Pencarrow and Baring Head, following on from the 1996/97 summer programme.
- Gull culling at various sites around the Miramar Peninsular, including the Shelly Bay Wharves.

WMIL also carried out a gull-culling programme for the Hutt City Council at the Silverstream Landfill. This arose out of a requirement sought by WIAL during approval of a Resource Consent Application by the Hutt City Council. Unfortunately, the landfill-culling programme was cut short because the large numbers of dying gulls were causing concern to members of the public. WMIL are of the opinion that if a full poisoning programme can be completed at the landfill, it will have a significant impact on bird numbers at the tip face.

In October 1997, WIAL received a letter from Wellington City Council that contained gull-culling statistics for the northern and southern landfills. For the period July 1996 to August 1997 there were a total of 958 black-backed gulls culled at these landfills. WIAL acknowledges these endeavours and encourages

local authorities to use innovative solutions to further reduce the attractiveness of landfills to the black-backed gull.

In conclusion, some positive steps have been taken to reduce black-backed gull numbers, both at the nest sites and at the landfills over the last year. WIAL's sponsorship agreement with the Department of Conservation is obviously a longer-term strategy, which it is hoped will significantly reduce the number of black-backed gull occurrence reports at Wellington Airport.

The lessons from WIAL's report are that wildlife hazard control takes allocation of resources, which includes money; the payback comes from a safer aerodrome. The other major lesson is that some solutions are not easy to sell to the public. No one wants to see birds killed – but the alternative may be that people die as a result of birdstrike. ■



Murphy Strikes Again

The following is adapted from an article in a recent issue of Transport Canada's safety publication Vortex, and it contains lessons for both engineers and pilots. It highlights the desirability of pilot-engineer liaison, coupled with a thorough aircraft preflight after any kind of maintenance.

Our aircraft maintenance engineers (LAMEs) do a marvellous job of keeping us airborne. We trust these people with our lives, and we express our confidence in them and their work every time that we hit the starter button. However, Murphy is not a LAME, and he is lurking around every corner to ensure that what can go wrong will – as the incident described below illustrates.

The McDonnell Douglas model 369E helicopter was approximately two minutes into the flight when a loud bang occurred followed immediately by an engine failure. The autorotation performed by the pilot resulted in substantial damage to the helicopter when the main rotor severed the tail boom during the landing. The three passengers were uninjured.

The stage was set for this occurrence when the principal LAME performing a 300-hour inspection was called away and turned the job over to another LAME for completion. While completing the inspection, the replacement LAME noted some items that had not been signed off.



He completed these items, installed the engine-inlet bypass door, and signed off the applicable items. However, there was no procedure in place to account for all of the tools used during the inspection, and the LAME could not recall seeing a cardboard tube (a makeshift tool that had been used to hold the door open) in the engine-inlet bypass area. The unaccounted for cardboard tube blocked the engine inlet sufficiently to flameout the engine, causing the accident.

It is important that you pay careful attention to these cues if you are going to fly any aircraft that is just out of

maintenance. Things to watch out for include:

Shift Changes: Changes in or interruptions of LAMEs partway through a shift or job can lead to maintenance errors or omissions.

Communications: Be aware of all work that has been done, the reason why it has taken place, and any in-flight requirements, such as an engine power assurance check or a topping check. If you have not talked to your LAME, you are probably not ready for the flight.

Risk Management: Despite your best precautions, there is still some additional risk associated with the first flight after maintenance. Passengers should not be carried until the aircraft has been test flown and determined to be in an airworthy condition.

Pre-flight walk-around: A scrupulously thorough pre-flight walk-around is a must, paying particular attention to areas in which work has recently been done.

Where there has been any interruption, non-standard procedure carried out, or just a change to the maintenance schedule during maintenance, there is a good likelihood that error has crept in. An awareness by the pilot of the factors mentioned above will always go a long way to reducing the risk associated with initial flights after maintenance. ■

Lead-Acid Batteries – A Cautionary Tale

During a recent starting operation, the operator discovered that the aircraft battery was flat. The battery (Concorde RG390E) was wisely removed from the aircraft and sent to a technical specialist for a re-charge and test.

The battery open-circuit voltage was found to be at 11.9 volts. An attempt to charge the battery was made, but it got very warm very quickly. The charging process was then terminated and the battery rejected.

While battery manufacturers indicate that batteries that have been inadvertently discharged may be recharged in the aircraft at half the capacity charge rate, extreme caution should be exercised if such a procedure is undertaken. Rather, regulated external power should be used and closely monitored, ensuring that the stated charging schedule is used over a period of about three hours.

Maintenance specialists suggest that, unless this procedure is carried out in accordance with the stated steps, it is quite conceivable that a discharged aircraft battery that is being charged in situ may quickly overheat and melt – or even explode. Therefore, for practical and safety reasons (such as ramp commitments and distraction, etc), it is considered unwise to attempt to charge ‘dead’ batteries in situ using ground power.

There are also the operational constraints of an aircraft electrical

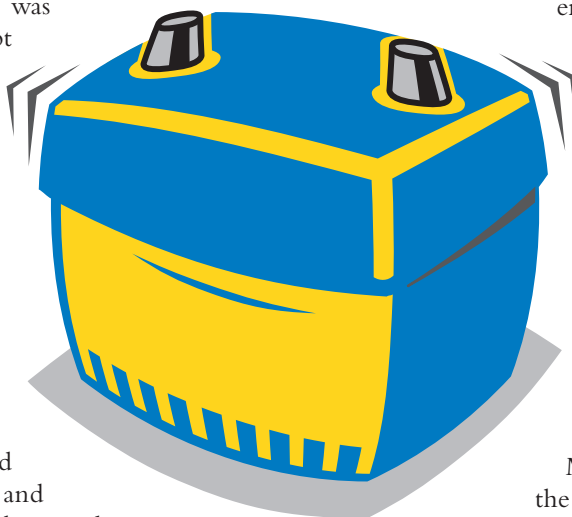
system to consider. Aircraft are certified with batteries that have reserve, or essential, capacity for emergency operation. Unless the battery has been recharged to its nominal capacity, it may not be able to perform to the specified

endurance time in the event of a primary electrical system fault. This could then cause the failure of the entire electrical system. Ideally, the battery should have its capacity checked at regular intervals that provide the operator with confidence that the battery is able to perform in an emergency as expected. If the battery fails to perform above its rated ampere-hour capacity, it is no longer considered airworthy and should be replaced.

Maintenance specialists indicate that of the 30 RG390E batteries submitted for testing, 13 were found to be unserviceable.

Most of these unserviceable batteries failed the capacity test – of which approximately 5 failed because they would not accept a charge.

While this is a cautionary tale about lead-acid sealed batteries, operators should also consider the dangers of jump-starting any battery. Light to medium aircraft alternators are quite capable of pumping out 50 to 100+ amps, more than enough to boil a battery – with the possibility of the accompanying caustic fumes, heat and, at worst, fire. ■



Pilot Rating Quiz Answers (from page 3)

Question 1. Options C and D are legally correct. Option D (a short dual check followed by three solo takeoffs and landings) is preferable because it has been some time since I have flown the Warrior. It would therefore be a good idea to ensure that I haven't forgotten anything, or developed any bad habits. This is totally over to the duty instructor's discretion, however, and depends on the conditions of the day. Note that aircraft owners who hire their aircraft out privately may consider insisting that any pilot who wishes to hire the aircraft, and who is not current, does a short dual check before completing their three solo takeoffs and landings. Option C (three solo takeoffs and landings) is fine provided that the duty instructor is happy with my ability and the prevailing conditions of the day.

Question 2. The short answer is **no**, I can not take any passengers until I have completed three solo (pilot in command) takeoffs and landings. Generally, instructors should not sign a new type rating off in a pilot's logbook until the pilot has completed three solo circuits (the instructor in the above example probably should not have signed off my logbook until I had done the three solo takeoffs and landings).

The important thing to remember, in both the instances given above, is that you must complete three solo takeoffs and landings to get a type rating, to keep your type rating current, or to get your type rating back.

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Note that Owen Walker now has a new phone/Fax number.



Letters to the Editor

Taildraggers

I am a B-category instructor and have a reasonable amount of experience flying off short airstrips in the Kaimanawa and Kaweka Ranges. I have operated Cessna 185, 206, 172 and Grumman AA5B aeroplanes off these strips.

We presently operate a Cessna 206 and a 180 hp Cessna 172. The Cessna 206 will lift the same load as a 300 hp Cessna 185 off the same airstrip – even though it is a heavier airframe.

When we operate the Cessna 185 we trim the aeroplane for takeoff load, allowing the tail to rise of its own accord – back-pressure is then applied to rotate the aeroplane off the ground. A download has therefore been applied to the tailplane as it would be for a ‘trike’.

For the forces to be acting as they are in Figure 1 of the article on taildraggers in the previous issue of *Vector*, the aircraft would have to be loaded with a severe rearward centre of gravity. This would make the aeroplane very unstable, and, unless it had computer controlled stabilisation augmentation, the following flight would be rather brief and exciting! During a properly flown takeoff, I believe, the tail of a taildragger is raised as a result of the centre of pressure (lift) being behind the main wheels. The wings are lifting the tail, and any stabilising down-force is provided by the tailplane and elevator. Both a taildragger and a ‘trike’ therefore have the same forces acting on their wings and tailplanes as they get airborne.

We had a competition at Taupo a few years ago between our C206, a C185 (260 hp) and a Wilga. Each aeroplane had the pilot and a minimum of two hours’ fuel. The requirements for the competition were minimum takeoff and landing distances. The C206 won the takeoff by a significant margin, with the C185 and Wilga being both very similar. The C206 lost the landing by a

significant margin – as a light dew on the grass meant both taildraggers had much more effective braking. The C185 and Wilga were very similar.

The nosewheel configuration enabled the C206 to be ‘positively rotated’ as soon as minimum flying speed was attained. Any attempt to use this technique with either taildragger resulted in the tailwheel contacting the ground firmly – thus causing the main wheels to contact again.

This clear takeoff advantage was maintained by the ‘trike’ throughout the weight range up to MAUW. Special care is needed, particularly at high AUW, to ensure that minimum flying speed is reached before rotating, otherwise excessive angles of attack at lower speed will cause high drag extending the takeoff roll.

This is the way I see it.

Keep up the good work. I find *Vector* is of great value. It is about the only aviation magazine I invariably read cover to cover.

Arthur Whitehead
Air Charter Taupo, June 1998

We thought that Arthur raised a very interesting point that warranted further discussion, so we contacted the author, Barry Schiff, who sent the following reply:

Taildragger’s Response

If you rotate a taildragger for takeoff, then you are correct regarding your criticism of the diagram that shows the tail developing positive lift. At such a time, there would be no difference between taking off in a taildragger or an equivalent aeroplane with tricycle gear.

Rotating a taildragger, however, does not enable a pilot to lift off in the minimum distance. During some rather extensive performance flight testing that I did in taildraggers, the minimum takeoff distance was found to result from allowing a taildragger to lift off in essentially its resting attitude. Takeoff roll is reduced simply by allowing the aeroplane to ‘levitate’ at minimum airspeed in a very tail-low attitude.

This minimum takeoff roll results for two reasons:

- If the taildragger is allowed to lift off by itself (tail-low), the tailplane (horizontal surfaces) will indeed develop lift in a positive direction (sans rotation), which reduces the load required to be produced by the wing, which in turn reduces stall speed, which in turn reduces the rolling distance.
- An aeroplane knows best when it is ready to fly (such as when it is poised for flight in a tail-low attitude) and will lift off sooner than when its pilot would otherwise rotate for takeoff. The difference of just a few knots in liftoff speed makes a significant difference in the takeoff rolling distance.

Barry Schiff
USA, July 1998

Taildraggers Too

Just a short note to say thanks for the article in the latest issue of *Vector* on taildraggers.

The flying school that I instruct for has just obtained a Piper Cub, and as I am the one with nearly 1000 hours tailwheel time, it was decided that I should be the person to instruct in it.

I obtained a Cub rating in 1973 when I was a teenager, and I was a part owner of a Cub for many years; I have also done 600 hours of Piper Pawnee glider towing.

But, when it came to writing a briefing for budding taildragger pilots, I found I was a little bit alone when it came to explaining the Principles of Flight.

This article was timely – it explains it exactly! There are not many tailwheel instructors around up here, that have had some experience, at least not any that I felt that I could talk to.

After 25 years of flying taildraggers as a private pilot, I now find it ironic that as a fairly new CPL C-category instructor I am instructing in the very aircraft that I did my tailwheel rating in!

Rob Utting
Auckland, June 1998

Thanks to all three correspondents, for sharing their thoughts.

“It won’t matter” eventually will.

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