July / August 2001

VECTOR

Pointing to Safer Aviation

Ways to Hurt Your Aircraft

Propeller Care

A Bolt is Lost and Found... Or is It?

Pilot's Logbook

CAA
CIVIL AVIATION AUTHORITY
OF NEW ZEALAND

VECTOR

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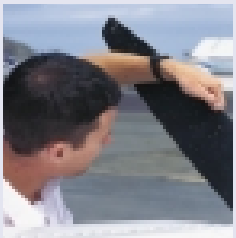
Overloading, excessive G-loading, excessive speed, flutter, exceeding gear or flap limiting speeds, flight in turbulence and fatigue damage can all damage your aircraft. While some are obvious, others are more subtle. Pilots may be inadvertently damaging their aircraft without being aware of it.

Sloppy workshop maintenance practices can result in parts being assembled in the wrong order, being left off, being lost, or even tools being mis-placed. *A Bolt is Lost or Found… Or Is It?* recounts how getting it wrong can be expensive and could result in an accident.

Are you sure you are filling in your logbook correctly? Most entries are straightforward, but sometimes sufficient detail is not included, and some types of flying experience seems to cause confusion as to what can be logged.



Many pilots find it hard to believe that a small cut, nick or corrosion pit in a sturdy metal propeller can lead to it breaking. They can and do result in failures. Find out why, and what you should be looking for during the pre-flight.

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

Ways to HURT Your Aircraft

Photograph of Rotor Cloud courtesy of Peter Knudsen

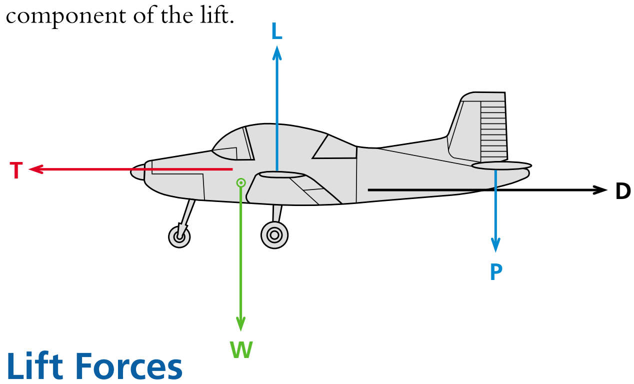
In the last 20 years there have been at least 35 aircraft structural failures in New Zealand. Most are the result of pilot-induced overstressing of the airframe, but the total number is not known as the damage is not always apparent. Maybe the aircraft you are flying right now falls into this category. *Vector* examines how you can hurt your aircraft's airframe, and how to avoid doing so.

Apart from obvious events, such as crashing into something in the air or on the ground, how many ways can you think of to cause damage to your aircraft structure? We are not talking about systems, which will be subject to a future article, but rather the airframe.

The team at *Vector* came up with a number of ways to damage the aircraft structure, most of which involve excessive aerodynamic loads on all or part of the airframe. They include overloading, excessive G-loading, rolling-G excursions, excessive speed, flutter, exceeding gear or flap limiting speeds, excessive G with flap deployed, flight in turbulence, incorrect loading leading to excessive wing bending moments, and finally fatigue damage. While some are fairly obvious, a number of them are more subtle. Pilots may inadvertently damage their aircraft without being aware of it.

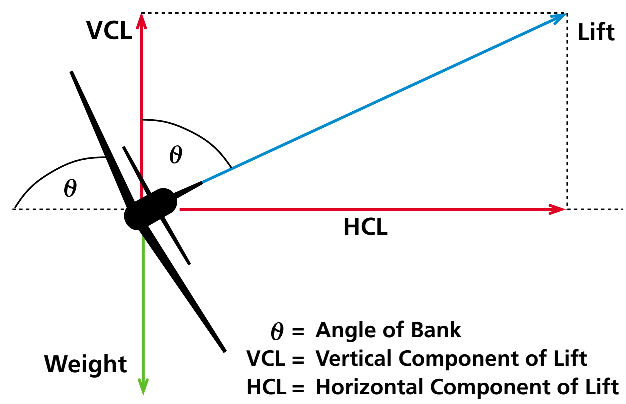
Principles of Flight

To understand the ways we can hurt our aircraft, a brief recap of some basic principles of flight is required. Any time our aircraft is airborne it is subject to at least three forces: lift, drag, and weight. An aircraft under power will also be subject to thrust. In stable level flight these will be in a 'balance of forces', which also includes any tailplane force required to balance pitching moments. Lift will be equal to the aircraft weight plus or minus (normally plus) the tailplane force. This tailplane force is normally much less than the lift force, so the lift and weight can be considered equal. The wings provide most of the lift force, although the fuselage may contribute some component of the lift.



Lift Forces

The higher the aircraft weight, the more lift required to maintain level flight. Any time the aircraft is manoeuvred, the lift required changes. For example, in a level turn at 60 degrees angle of bank, the lift required to maintain a level turn would be twice the aircraft weight – irrespective of that weight. If the aircraft weighs 1000 kg, the wings will be producing 2000 kg worth of force (kgf). Note that if the aircraft weight is increased to, say, 1500 kg and the same level turn flown, then the wings will have to produce 3000 kg of force, but the pilot will still only feel +2 G. The pilot may be quite unaware that a much greater load is being imposed on the airframe. The extra lift required at higher weights means that more drag will also be generated, so the aircraft will tend to slow down much faster the heavier it gets. This may be the only direct indication the pilot has of increased loading. A heavier aircraft flying in turbulence will also tend to ride better, since that aircraft will respond less to a given gust, again giving the impression of a smoother ride and less stress to the airframe. This is quite wrong. While the response to turbulence is reduced, the actual loads on the airframe will increase.



Load Factor and G Limits

The ratio of lift produced to aircraft weight is called the load factor. The pilot perceives this load factor as the G-force experienced. Three G means a load factor of three. Different categories of aircraft are designed to meet various load-factor requirements. These range from a positive load factor of +2.5 G for heavy air transport aircraft through to +6 G for aircraft in the aerobatic category. Negative G limits are generally around half the positive limits. These limits are found in the aircraft

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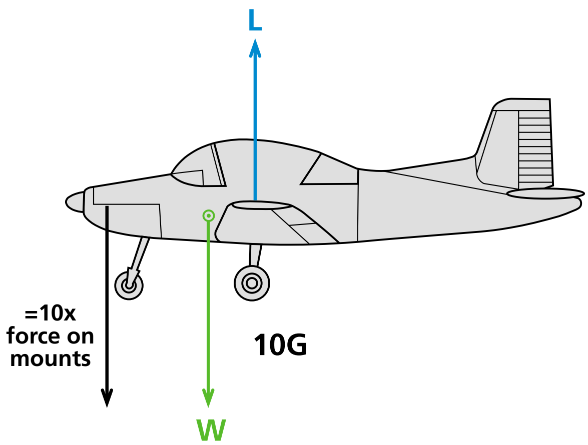
Flight Manual and relate to the aircraft at its maximum all up weight (MAUW). The 'limit load' should be attained without any resultant deformation of the aircraft. Beyond this – normally by another 50 percent – is the 'ultimate load', at which point the aircraft structure can be expected to fail. Between the limit load and ultimate load, some deformation or damage to the structure can be expected, so flight at this load is definitely not a good idea.

For an aerobatic aircraft with a MAUW of 1000 kg, the wings are designed to produce 6000 kgf without damage. The pilot might be forgiven for thinking that if he or she flies the aircraft at a lower weight, say 600 kg, then it would be OK to pull +10 G, since the wings would still only be producing 6000 kgf. That's fine for the wings, but unfortunately other structures come into the equation. For instance, the engine mounts would now be holding up an engine at +10 G rather than the designed +6 G, and may fail as a result. Aircraft G limits cannot be exceeded, even at reduced aircraft weights.



Manoeuvring Speed

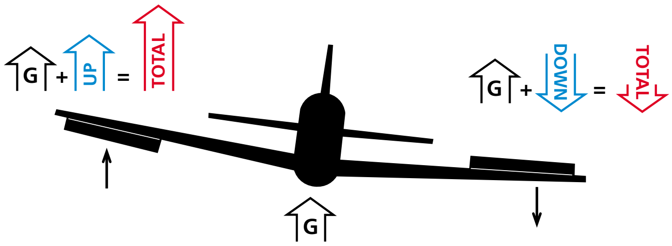
All pilots should be aware of the concept of manoeuvring speed; quite simply, it is that speed below which it is not possible to pull more than the aircraft G limit, because the wing will stall before the required lift can be generated. The placarded manoeuvre speed (or V_A) for any aircraft is for the MAUW.

For our hypothetical aircraft with a MAUW of 1000 kg, suppose the V_A is 150 knots. At this speed and weight, the aircraft will generate a +6 G load factor just before stalling. Any faster, and a pull to the stall buffet will mean an overstress. Also note that at weights below MAUW, a pull to the buffet at speeds below V_A might mean that more than +6 G is achieved. The lift produced will still be less than 6000 kgf, **but** this doesn't solve the problem mentioned above of stress to other parts of the airframe.

Tied in with manoeuvring speed is the concept of 'normal operating speed' (V_{NO}), a speed beyond which the aircraft should be flown only in smooth air. Beyond V_{NO}, loads imposed by turbulence may overstress the airframe.

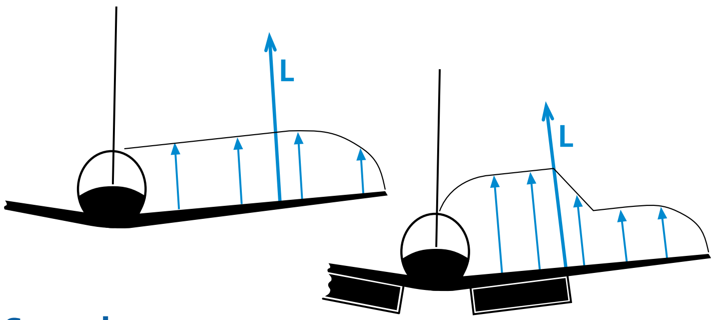
Rolling G

So far we have only discussed situations where the required lift is being produced equally by both wings. When aileron is applied to roll the aircraft, the up-going wing is producing more lift than the down-going wing. It is therefore possible to exceed the design strength of the up-going wing while still below the overall aircraft limits. This can be achieved by applying aileron when G is already applied – known as 'rolling G' – or in some cases simply by applying aileron at high speed.



Configuration

Another situation that creates changed lift distribution is when flaps are deployed. Flaps cause more lift to be generated on the inboard wing sections, and therefore change the wing-bending forces. Excessive lift generation or high speed can overload the flaps themselves, and their attachment points to the wings. Aircraft therefore have limits for both G and speed when flap is deployed.



Speed

As speed increases, drag, and hence the force on all parts of the aircraft exposed to the airflow, increases in a squared relationship – double the speed equals four times the drag and so four times the force. Go fast enough and these drag forces may be sufficient to damage the airframe. All aircraft have a 'never exceed speed' (V_{NE}) above which some damage can be expected. As well as flap mentioned above, retractable landing gear is often restricted by speed. Sometimes the limit is not the gear itself, but rather fairings or gear doors.

Changing speed also changes the lift distribution over the wings and tailplane. To produce the requisite lift at higher speeds requires less angle of attack, maybe only a few degrees. But most wings are designed with 'washout' or reduced incidence at the wingtips, to enhance stall characteristics. This can lead to the outer sections of the wing producing little or even negative lift. This changes the wing bending forces. The best illustration of this is a glider seen at high speed, where the outer wings often bend down due to negative lift. This washout dependent lift distribution also causes most negative G limits to actually reduce as speed increases. At high speed under negative G the lift is now being produced by the outer sections of the wing, and wing bending limits can be exceeded.

The remains of a L-13 Blanik glider wing after it suffered a complete in-flight break-up at 1000 feet. Over stressing prior to the event was thought to be a contributing factor.

Flutter

Flutter is the term given to a flexing or vibration of part of the airframe due to higher-than-normal speeds. Ailerons and outer wing sections are most susceptible, particularly on aircraft with high aspect ratio wings and reduced torsional stiffness, such as gliders and some homebuilt aircraft. Tail surfaces can also cause flutter. A full description of this phenomenon is outside the scope of this article, but it will be covered in a future *Vector*. Suffice to say that flutter relates to true airspeed (TAS) rather than equivalent airspeed (EAS), so aircraft that are operated at or beyond their V_{NE} at altitude – where TAS increases for a given EAS – are more susceptible to flutter.

Fatigue

Fatigue is cumulative damage to the aircraft structure caused by repetitive loads that, by themselves do not exceed limits, but over a period of time add up. Take a paperclip and bend it. One cycle of bending won't break it, but do it enough times and it will fail. The same happens to aircraft structures, particularly the wing. Fatigue is generated every time the wing is loaded – even a takeoff generates fatigue. Higher loads and a higher cycle rate hasten the process. Excessive repetitive G-loading, or flight in turbulence, all adds up. In turbulence higher speed exacerbates the problem, because it leads to higher loads, and in a given period of time it will generate more fatigue cycles.

The Manoeuvre Envelope (V_N diagram)

Most of the foregoing phenomena and limits are expressed graphically on the aircraft V_N diagram, sometimes called the manoeuvre envelope. This will be covered in a future *Vector* article.

Summary

We hope this article has shown you how easy it is to hurt your aircraft. To reduce the possibility of causing inadvertent damage, and to minimise the inevitable fatigue damage caused each time you fly, remember the following:

- Do not overload your aircraft
- Keep within G limits, irrespective of aircraft weight
- Be cautious about elevator inputs when operating beyond V_A
- Be cautious about application of aileron whenever under G or at high speeds
- Ensure you are below V_{NO} when turbulence is felt or suspected
- Ensure you are below limit speeds before extending flaps or landing gear
- Watch G-loading when flap is extended
- In aircraft susceptible to flutter, be cautious about speed and control inputs, particularly at high altitudes and in turbulence. ■

A Bolt is Lost, Then Found… Or Is It?

We know it's far easier to disassemble something than it is to put it back together again. Parts assembled in the wrong order, parts left over, parts lost and tools mis-placed are all problems that LAMEs contend with when re-assembling aircraft components – getting it wrong can be expensive or result in an accident. The following article recounts a series of mistakes that led to an expensive jet-engine failure and contains some good lessons on maintenance workshop practices.

If you work with any aircraft or any engine, you know about foreign object damage (FOD). But did you know that the incidents you will probably have to cope with more than FOD itself are the things that can cause FOD. These are called 'Potential Foreign Objects' or 'Potential FO'.

When maintenance personnel run into potential FO, they must make some really tough decisions. The safest position to take is to closely follow your procedures for investigating and reporting FO. The following is an example of just one of the challenges that can occur. While you are reading it, keep in mind it is based on an incident that really happened, and it resulted in a major jet engine failure on a test stand because the wrong decision was made.

Picture the scene in which mechanics are installing the final hardware on a jet engine that has just gone through a major rebuild. Personnel are working hard to meet their schedule, when one of the mechanics says something that brings everything to a halt. He exclaims, "I just dropped a bolt!"

Another mechanic asks, "Did it go into the engine?" The first mechanic responds, "I didn't see where it went. It could have."

Everyone knows exactly the impact of his statement and the seriousness of the situation. They also know that their procedures involving possible FOs require them to stop all work and search for the lost part.

The mechanic brings in his supervisor as required and explains what happened. He apologises for dropping the bolt, says he

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had oil on his hands and he was working with a rear flange bracket bolt. "I caught the nut, but the bolt bounced out of sight. The outer duct slides back, so the bolt could have gone in the engine."

Everybody wants to find the bolt right away. One mechanic gets a light; another finds an extension mirror and a borescope. Everybody starts looking around the area, including inside and outside of the engine. They know their procedures won't allow them to work on the engine until they find the bolt. They also know the engine is scheduled to go to test in the morning. Then it will be installed in an aircraft. But if the engine has to be torn down, it will delay the aircraft flight schedule, and that could affect the whole group's performance rating.

Everyone seems discouraged until a mechanic shouts, "Hey, I found a bolt!"

This provides some relief for the entire crew. They all move to where the mechanic saw the bolt. He is right. There is a bolt balanced on the narrow edge of a floor drain grating almost as if someone had just put it there. However, all mechanics know that parts that are dropped can end up in the strangest places and the weirdest positions.

"Multi-million dollar engines and people's lives depend on how well you can count. We all know that, but it still bears repeating."

They retrieve the bolt, and, because they are experienced maintenance personnel, they don't assume they have found the lost bolt. They immediately start going down their own checklists to be sure the bolt they have found is indeed the one that was missing. This is one of the most critical steps in potential FO investigations, because it is so easy to be fooled into believing the lost part has been found. But the question must still be asked: What if they continue building the engine, then send it to test, only to find out, with disastrous results, that the engine still contained the missing bolt?

To avoid this scenario, the mechanics check the tiny part number etched on the head of the bolt. It matches the number in the engine maintenance manuals for bolts on the rear flange bracket. The mechanics agree the bolt could have ended up where they found it, considering where it was dropped and how it could have bounced. They are also convinced that after they thoroughly inspected the engine internally with mirrors and a borescope, it looked clean.

Before they can get too confident, another mechanic climbs from under the engine and shouts, "Hey, I just found another bolt! It was on the floor near where we found the first one."

They stop to investigate this bolt, and it turns out to have the same part number as the other bolt. After checking the manual, they remember the part number of these bolts is common and could have come from many locations in this model engine.

"We dropped one bolt, and we found two," one mechanic says. "I'm twice as sure we found the lost bolt."

The supervisor is not convinced. "Wait a minute," he says. "If there were two bolts down there, it means we either dropped two bolts or we didn't follow our procedure to clean the stand of all loose parts before we started working on this engine."

Everybody immediately assures the supervisor that they did not drop any other parts. The supervisor, now visibly frustrated, tries to explain: "The only way we can be certain that the bolt we found was the one that was dropped is to be sure the floor was clean before we started. The fact that we found the second bolt makes this very doubtful. The bolt that was dropped may still be in the engine."

One mechanic spoke up. "We did a good borescope inspection, and the engine looked clean inside." The supervisor responded, "We can't rely 100 percent on the borescope. We've had problems with this model engine because it has some blind spots that we can't see with a borescope."

Having leftover parts from a previous build makes it painfully clear their "parts accountability" for this engine-build isn't very good. The risks of continuing with possible FO in the engine may be too high. Tearing it down will be costly, but nothing can compare to the cost if the engine is cranked up with a loose bolt inside. Everybody knows how much damage "one little bolt" can do to one big and very expensive jet engine.

There are many lessons to learn from this scenario. One of the most important is that when you work on an aircraft or an engine you must keep an accurate count of every part – even the smallest bolt – as well as every tool. To keep the count accurate, you must know what the count is before you start a new project. If you have loose parts under an engine and inside gratings before you begin, that can throw off your count in case something is dropped.

Multimillion dollar engines and people's lives depend on how well you can count. We all know that, but it still bears repeating.

Fortunately, to ensure wrong decisions are not made in cases of potential foreign objects like this, all effective FOD prevention programmes require a written report on such incidents. These reports must be approved by area managers before work on the engine can continue. This is the procedure, not because supervisors and managers make better decisions, but because they tend to get all the right people involved in the decisions before they are willing to give their approval.

Keeping in mind this scenario which, based on an incident that really happened, resulted in a major jet engine failure on a test stand because the wrong decision was made, what do you think the supervisor should have done?

What would you do? ■

Source: Article reproduced from the Summer 1998 edition of *Focus on Commercial Aviation Safety* (a UK Flight Safety Committee publication).

Human Factors Survey

Do you have an opinion on human factors? If so, we would like to hear it!

There is a general acceptance that human factors are important, and that aviation safety depends on their correct application. After all, around 70 to 80 percent of accidents involve some human factor element.

The current delivery and assessment system, however, may not be the most effective way of ensuring that all licence-holders have an adequate understanding of human factors. In fact, there is some debate, even amongst the experts, on exactly what constitutes human factors.

For those reasons CAA has begun an extensive project to completely review the Human Factors sections of flight crew and AME licenses. You will hear more about that project in the months ahead. The first part of the project is, however, a brief survey conducted by Aviation Services Limited. The whole point of the project is to benefit you, the 'end user', so your contribution at this early stage is invaluable.

The survey is available on-line, at www.aviation.co.nz/hfsurvey.asp. If you do not have access to the internet, or would prefer to use good old pen and paper, please fill out the questionnaire enclosed within this issue of *Vector*. When you have completed the questionnaire, simply fold it along the lines shown so that the freepost address is on the outside, hold it together with a small piece of sticky tape and drop it in the mail before 17 August. The results of the survey will be published in a future issue of *Vector*.

Measuring Up Seminars

The CAA is devoted to enhancing safety across all levels of aviation. It uses a number of mechanisms to do so, from audits to licensing to rules to Safety Advisers and education. At the end of the day though, the people who do most to control the level of safety in aviation are **you**, the people that work in aviation. How well are you doing?

This year, in place of the traditional Av-Kiwi seminar series, the CAA Safety Education team will be visiting various aviation gatherings to give you the opportunity to assess your own performance, using some interactive exercises. These seminars, entitled 'Measuring Up,' promise to be fun, with a bit of serious introspection as well. You won't be put on the spot or embarrassed in front of others, but you will get out of these seminars as much as you are prepared to put in. Initially, these seminars will be conducted through major training organisations and interest groups. Keep an eye on your notice boards and newsletters for details.

Instrument Failure Experiences

Photograph courtesy of *Australian Flying Magazine*

Reading John Laming's article about instrument failures "Surviving on Limited Panel", brought back a few memories of several unpleasant experiences.

My first instrument flying was in DC3s, but being in general aviation early in the 1960s I was flying I/F in single-engine Cessnas with only venturi-powered instruments and whistle-tuned radios, one ADF, and radio range. Icing, or even cloud at low temperatures, soon produced venturi icing, not good – anyway I digress.

In 1970 en route from Tauranga to Auckland at night on top of 8/8 cloud in a Cherokee 180, the vacuum pump failed. Left with only a primary panel, I elected to do a cloud break on a track Whitford–Whenuapai to avoid the problem of having to turn into Auckland International on a more southerly heading with only a standby magnetic compass. I survived.

Earlier, in 1966, again en route Tauranga to Auckland in lousy weather in a Cessna 402 (brand new) while in cloud, I experienced a complete electrical failure. This time the gyros continued to work, but with no radio or nav aids, the descent was interesting. I survived.

In the mid 1970s, when on approach to land at LAX USA in a DC10, we experienced a complete failure of the Captain's flight instruments (I was the co-pilot). I survived.

Around 1984 en route from Kerikeri to Auckland in a Piper Chieftain I experienced a vacuum pump failure. This shouldn't have been a problem, but all suction pressure was lost and the gyro instruments (except for the electric turn-and-slip indicator and the electric HSI) toppled. The weather at Kerikeri was poor and Auckland no better, with around a 400-foot cloud base and 3000 metres vis in heavy rain. An ILS on partial panel (well almost partial panel – the HSI was a great help) was made into Auckland. I survived.

I cannot count the number of vacuum pump failures I have experienced in light twins. On one flight, thankfully VFR, both failed.

In the 1980s while flying a Piper Chieftain between Auckland and Rotorua, I experienced a lightning strike. The result was no radios and nav aids, but the instruments were OK. Being in cloud within frontal conditions at the time made getting down interesting. I survived.

***Vector* Comment**

Such experiences highlight the fact that engine-driven suction pumps and electrical systems can and do fail more often than we think, sometimes while IMC when over high terrain.

This pilot's limited-panel instrument skills no doubt saved his and his passenger's lives on more than one occasion. The importance of keeping these skills current, particularly if you are an IFR pilot, cannot be stressed enough – something that is borne out by the above incidents. ■

Pilot's Logbook

A pilot's logbook is generally one of his or her most treasured possessions. As well as a record of flying experience, it serves as a diary, as a trigger to recall enjoyable trips, travelling companions, new experiences, new aircraft types – it stores a wealth of memories.

Although you may choose to record names of passengers and perhaps include photos of favourite aircraft, the prime purpose of the logbook is to maintain a record of flight time for the purpose of meeting the licence and rating requirements of Civil Aviation Rules, Part 61 *Pilot Licences and Ratings.*

Are you sure you are filling it in correctly? Most entries are straightforward, but sometimes sufficient detail is not included, and some types of flying experience seem to cause confusion as to what can be logged.

Applicable Rules

The applicable guidance is contained in rules 61.29 and 61.31, plus the relevant definitions in Part 1 *Definitions and Abbreviations*. The inside front cover of the logbook also contains notes for guidance.

Rule 61.29 *Pilot logbooks – general* specifies that entries shall be made in ink and outlines the time period within which entries should be made. For example, for domestic air operations, flight training, special operations, and operations not for hire or reward, the logbook entry should be made within seven days following the flight.

On each page the columns should be totalled and the total flight experience entered, and the pilot's signature should certify it as correct.

Flight Detail Columns

Date

Remember to fill in the year at the top of the page. Month and date are straightforward.

Aircraft Type and Registration

Enter the correct designation for aircraft model, eg, PA 28-140 (not Piper Cherokee). Checking the aircraft registration on the CAA web site will give you the correct model (as well as manufacturer, and sometimes the popular name).

For New Zealand aircraft, enter the three registration letters. If you fly overseas you will need to enter the full registration including the country prefix.

Pilot-in-Command

Enter the name of the pilot-in-command. If it is you, entering "Self" is sufficient (and saves time!).

Co-pilot or Student

When you begin flying, this is the column for you! If you are the student, again "Self" is sufficient. You will not have anybody else's name in this column of your logbook until you become an instructor or a captain of an aircraft requiring a co-pilot. (An exception may be when acting as a safety pilot, see below.)

Details of Flight

For **dual instruction**, the entry should include a brief record of the air exercises undertaken. It is not sufficient to just say "flight instruction" (likewise for the instructor's logbook). The first low flying lesson for instance should not be entered as just "Low Flying 1", but instead be summarised to reflect each different aspect of the lesson (eg, bad-weather configuration, general handling, reversal and constant radius turns).

For **cross-country flights**, the route details should be shown. For example, CH–Cheviot–KI. KI–OM. This entry indicates a landing at Kaikoura. Alternatively this could be indicated by –KI/–OM (the slash indicating a landing). There may be other methods used, such as the notation "TG" above the aerodrome designation to indicate a touch-and-go landing. The important thing is that the record indicates which are enroute points and when a landing has been made.

Instructors should ensure that they show students the correct method of recording their cross-country training flights to stand them in good stead for future flights. Just recording "Cross-country 1" or "Cross-country 2" is not acceptable.

NB. A cross-country flight is defined as a flight that ventures beyond 25 nautical miles in a straight-line distance from the aerodrome of departure.

Flight Time Columns

Flight time means the total time from the moment the aircraft or helicopter first moves under its own power for the purpose of taking off until the moment it comes to rest at the end of the flight. The phrase 'chock to chock' is sometimes used.

Flight time may be recorded in hours and decimals of hours, or hours and minutes.

Columns 1 to 12 represent your total flight experience.

Columns 13 to 15 are an additional subset to record instrument time, and Column 16 is available to record any other subsets that you wish.

Dual and Pilot-in-Command

Flight time should be recorded in the appropriate columns in the logbook. For single-engine aircraft, the choices are dual or pilot-in-command (day or night)

Dual flight time means flight time during which a person is receiving flight instruction from an appropriately licensed and rated pilot, on board an aircraft with dual controls.

Pilot-in-command, in relation to any aircraft, means the pilot responsible for the operation and safety of the aircraft.

Co-pilot and Command Practice

For multi-engine aircraft there are the additional options of Co-pilot or Command Practice.

Co-pilot means a licensed pilot, serving in any piloting capacity other than as pilot-in-command; it does not include a pilot receiving flight instruction from a pilot on board the aircraft.

Rule 61.31 outlines conditions associated with logging co-pilot time and how much can be credited towards experience for a licence requirement. (It depends on licence held, type of operation and other conditions.)

The aircraft type must be one that is required to be operated by two pilots. If pilots wish to record time acting as a co-pilot in an aircraft that is not required to be operated with a co-pilot, the time should be recorded in column 16 and cannot be credited toward a licence or rating (or included in the "total flight experience" required toward these). An example of column 16 recording would be when acting as 'co-pilot' of a light twin under IFR, for whatever reason.

Multi-engined Aircraft							
Day				Night			
Dual	P. in C.	Co-pilot	Comm'd Practice	Dual	P. in C.	Co-pilot	Comm'd Practice
(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

Command practice means the performance by a co-pilot of the duties and functions of a pilot-in-command during a flight, under the supervision of a pilot-in-command designated for the purpose by the operator.

Several conditions relating to the logging of command practice are described in rule 61.31(c).

Provided that these conditions are met, the holder of a CPL or ATPL who is acting as co-pilot on air operations, in aircraft required to be operated by two pilots, may be credited with the total flight time during which the pilot is performing the functions of a pilot-in-command. This time may be logged as command practice only when the co-pilot concerned is operating under the supervision of a pilot-in-command (Captain) who has been designated for the purpose by the operator.

Under these circumstances, the co-pilot is acting as pilot-in-command under supervision. However, this time is **not** logged as pilot-in-command, but is entered in column 8 or 12 as appropriate (command practice day or night). Each entry must be certified by the pilot-in-command designated by the operator to supervise the pilot concerned.

Pilots who have inadvertently logged co-pilot, command practice or safety pilot time incorrectly are advised to make a logbook entry to that effect and carry forward the corrected entries to the next logbook page.

Instrument Time

Instrument time includes instrument flight time and time during which a pilot is practising simulated instrument flight on an approved mechanical device.

	Instrument Time			
	Instrument Flight			
...m'd ...tice	Actual	Simu-lated	Ground	
...)	(13)	(14)	(15)	(16)

Instrument flight time means time during which an aircraft is piloted solely by reference to instruments and without external reference points. Instrument flight time gained by the handling pilot under actual or simulated instrument flight conditions (record the time in the appropriate column) may be credited towards the total instrument flight time required. Refer to rule 61.31(f) and (g) for what a supervising pilot or instructor may log.

Instrument ground time may be obtained under the supervision of an appropriately qualified instructor in an approved synthetic flight trainer. The instructor must certify the time in the pilot's logbook.

Note that, although a pilot operating an aircraft under simulated instrument conditions is required to have a safety pilot (and should record that pilot's name in their logbook), the safety pilot may not log the flight time (other than in column 16 if they wish). A safety pilot must be rated and current on the aircraft type; a current instrument rating must also be held if the training is to be conducted at night.

Column 16

The last column (16) can be used to record any significant experience you wish and enables you to keep track of time spent on aerobatics, formation flying, cross-country time, instructor time, glider time, etc.

Summary

Your logbook is your personal record of your flying experience, and you probably consider it a precious document. Take care of it, record your flights accurately and neatly – your degree of pride and professionalism will reflect in your logbook. Instructors, flight-testing officers and employers may well make a judgement about you and your flying from how it is presented in your logbook. ■

Propeller Care

The metal propeller appears to be one of the most durable parts of the modern light aircraft. But it has more pressure exerted against it than any other part of the aircraft. The blades are designed and constructed to withstand maximum power loading, but when the shape of the blade is marred or disturbed, its inherent strength can be reduced to a point where blade failure in flight is possible. Such failure can take place entirely without warning.

Many pilots find it hard to believe that a small cut, nick or corrosion pit in a sturdy metal propeller can lead to a broken prop – something that could very quickly wreck your day. To understand how this is possible, it helps to know something about the stresses and forces to which a propeller in action is subjected.

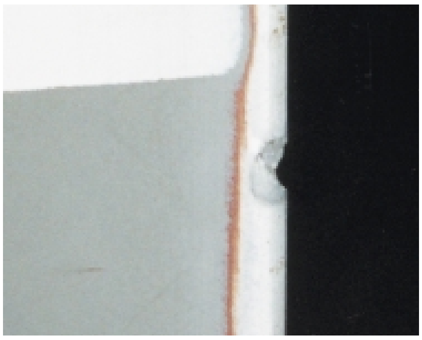
Forces

The most obvious force is centrifugal – the rotating action which exerts an outward pull on the blades. If you imagine the Incredible Hulk swinging you around by your arm trying to pull it out of its socket, exerting a force of 7500 times the weight of your arm, you can appreciate the strain on the blade.

The revolving blade is also subject to a centrifugal twisting force, which may be visualised as the effect of a gigantic hand attempting to flatten the blade, exerting a force as high as 20,000 pounds per square inch (1400 kg/sq cm). And then there's the thrust exerted by the propeller, which results in a forward pull of the blades. Straining the engine to pull the aircraft out of a mud hole can result in an out-of-track prop. These two kinds of stress produce lines of force running across the face of the blade.

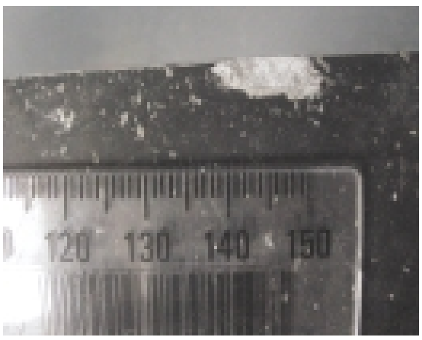
Stresses and Damage

But the kind of stress believed to be responsible for most blade failures in piston-engine aircraft, in conjunction with surface damage, is the vibratory stress set up by the engine forces and conveyed to the propeller by the crankshaft to which it is bolted. This produces oscillating forces within the blade, which change pattern as the engine rpm changes. The locations on the surface of the blade where maximum bending occurs are called nodes. At these locations the greatest amount of stress occurs. Even slight damage at these points can seriously weaken the propeller.



Stone-chip damage such as this should be referred to a LAME immediately.

Any mechanical damage to the prop creates an opportunity for blade failure. Nicks, cuts, or corrosion pits can set up stress points by interrupting lines of force. For this reason, aircraft engineers (LAMEs) are required to 'dress' or 'blend' any damage determined to be unacceptable, in accordance with strict criteria laid out in the propeller manufacturer's Maintenance Manual.



Watch for signs of corrosion, such as those pictured above, and seek the advice of a LAME if in any doubt.

Pre-flight Checks

With the consequences of an in-flight propeller failure in mind, on each pre-flight inspection the pilot should scrutinise and feel – with clean, dry hands – the **entire** surface of the blade. This means carefully running your hands along both the front and back surfaces of the blade as well as its leading edge. Nicks or cuts that escape the eye are often easily perceptible to the fingers. Inspection is easier and more accurate if the blade is kept clean. This can be aided by occasional waxing with a paste wax, which also helps prevent corrosion. Note that the removal of small nicks or defects is **not** maintenance that may be performed by the pilot or owner, but is work that requires the services of a LAME.

Corrosion can be identified by the presence of a fine grey powder and is usually accompanied by pitting of the blade surface. More severe corrosion cases can result in exfoliation of the blade's surface.

If you do find a noticeable nick, chip or corrosion pit on the propeller when you are doing a pre-flight, do not hesitate to bring it to the attention of the aircraft operator or owner. If there is some doubt whether the damage or corrosion is acceptable, it should be referred to a LAME for inspection **before** the aircraft is flown again – it's better to play safe than to risk losing your propeller mid-flight.

Attention should also be given during the pre-flight to the propeller hub on constant speed units as they can, and do, fail. Any signs of excessive oil or grease leakage should be checked by a LAME. Some variable pitch propeller hubs are filled with oil dyed red to make the detection of a leak easier – any signs of such a leakage should be referred to a LAME straight away.

It might be worthwhile taking the time to ask your local LAME to demonstrate the finer points of a propeller pre-flight inspection for your specific aircraft type – especially if you are an instructor who will be passing such information on to student pilots. ■

Cockpit Security

During the pre-start checks the crew of a Saab 340A unexpectedly found the battery/fuel temperature and prop sync switches to be in the OFF position. These switches were reset and the remaining checks completed normally. Once airborne, however, the crew noticed that the Flight Idle Stop knob (a latch that prevents the power levers from inadvertently being pulled into ground idle while in the air) had been pulled. The flight was continued uneventfully with this in mind.

It was suspected that an unknown person or persons had interfered with the aircraft while it was parked overnight. Although it could not be confirmed, it appeared cleaning staff might have been the cause of the problem. The switches were either bumped inadvertently while the cockpit was being cleaned, or had been fiddled with out of curiosity.

Whatever the case, such incidents highlight the importance of operators ensuring that all staff associated with providing ground services to aircraft are aware of the care that needs to be taken while working in the cockpit, and that intentionally fiddling with switches or controls is not a good idea. The dangers to flight safety of not observing these rules needs to be made very clear to all concerned. A secure overnight parking location is equally important – unauthorised entries into aircraft can and do occur.

By the same token, the chances of getting airborne with switches or controls in the incorrect position can be minimised by the flight crew meticulously adhering to the pre-flight/pre-start checklists. It should never be assumed that any item has been left in its correct position, because Murphy's Law is waiting to catch you out if you do. ■

Centre-seat Straps

Last July *Vector* ran an article on centre-seat shoulder harnesses. This related to the Schweizer 300 (formerly known as the Hughes 269 or Hughes 300) Flight Manual requirement for centre-seat passengers to wear a shoulder harness. It arose because some operators were not aware of this requirement and were allowing passengers to ride in the centre seat wearing only a lap strap – a fairly unsatisfactory situation in an accident.

Recently, CAA auditors have found Hughes 500C and D helicopters without the centre-seat shoulder harness fitted. The Flight Manual requirement for these aircraft is exactly the same as that for the Hughes 300.

In an email received by the CAA, McDonnell Douglas have reinforced that the Flight Manual statement is correct. They said, "By type design on the MD500 helicopter series, the middle front-seat passenger must wear a shoulder strap when operating in any category." In a further email, McDonnell Douglas stated that "By type design, shoulder harnesses must be installed in **all** positions when carrying passengers on 500-series helicopters; this is not optional from an FAA and a Manufacturer's point of view."

These kinds of discrepancies highlight the importance of owners and operators ensuring that they operate their aircraft in accordance with Flight Manual requirements – there are very good reasons why manufacturers place such restrictions or limitations upon their machines. Please make sure you are aware what Flight Manual limitations or requirements are placed on your aircraft – and that you are careful to observe them.

Pilot Prosecuted Over Shoulder Harness

Recently, the pilot of a Hughes 269C was prosecuted for carrying passengers in the centre seat of his helicopter, which did not have a shoulder harness fitted.

The pilot had been demonstrating low-level manoeuvres during a flight around his property when the helicopter struck the ground in a 45-degree bank with a moderate forward speed and rate of descent. It somersaulted and came to rest inverted. All three occupants were seriously injured.

The CAA charged the pilot under rule 91.109 *Aircraft flight manuals* with failing to comply with the centre-seat operating limitations specified in the helicopter's Flight Manual, namely by carrying a passenger in the centre seat without a shoulder harness being available for that seat.

The judge found the pilot guilty on two charges of breaching rule 91.109, which related to the accident flight and a previous flight. The pilot was also found guilty on two other charges associated with the flights – low flying and operating the helicopter in a manner that caused unnecessary danger to his passengers. In his summation, the judge stated: "It has been proved beyond reasonable doubt that the aircraft Flight Manual [Hughes 269C] provides a flight limitation that a shoulder harness and seatbelt is required for a centre-seat passenger. Whether the defendant was aware of that limitation is irrelevant. He has an obligation to make himself aware of the flight limitations in the Flight Manual."

See the "From the Enforcement Files" section in the *CAA News* for further details of this case. ■

SHARE YOUR EXPERIENCE

Dipstick Incident

I had the unfortunate experience of being the pilot-in-command of a Cherokee 6 (PA32-260) whose engine (a Lycoming O-540) consumed half its oil dipstick and spat the rest out onto the ground as it was being run up.

So why and how did this happen?

This particular engine has a push-in oil dipstick instead of the screw-in type. When replacing the dipstick, the pilot must ensure it is aligned with a small diameter hole in the top of the sump (there is no tube encasing the dipstick to guide it into the sump). Once the dipstick is aligned with the hole, all that is required is a gentle push to click it into place.

On the day of the incident, the oil was topped up, the dipstick replaced and locked in position. The first indication of anything being wrong was during the run-up, when the top half of the dipstick flew out from under the cowl. The subsequent bulk strip of the engine revealed the cause of the wayward dipstick.

The dipstick had been inadvertently inserted into the engine crankcase. You may ask how is it possible to put the dipstick into the crankcase without realising it?

When replacing the dipstick, instead of locating into the small hole in the top of the sump, it had gone down the side and into the crankcase. Once in there, every revolution of the crankshaft wore the dipstick away until it broke. Usually, if the dipstick is placed incorrectly, there is no way of being able to lock it as it protrudes out too far. For this incident to happen, the propeller has to be in a certain position (a 90-degree turn is all that is required) that enables the dipstick to be inserted and locked in position without the pilot knowing anything is wrong.

This appears to be a design fault with the engine. I was unaware that this could happen and have spoken to many other pilots who fly aircraft with the same engine type – they had also not heard of this anomaly.

Since this incident, the engine has been repaired and a modification made to avoid the same thing happening again.

I hope my experience will help inform other pilots of this potentially very damaging Lycoming O-540 engine trait. If you fly aircraft with this type of engine it might be in your best interests to find out if it has had a modification to prevent this from occurring, or at least be very careful when replacing the dipstick. ■

Safety Videos

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

Civil Aviation Authority of New Zealand

No	*Title*	*Length*	*Year released*
2	ELBA	15 min	1987
3	Wirestrike	15 min	1987
7	Radar and the Pilot	20 min	1990
8	Fuel in Focus	35 min	1991
9	Fuel Management	35 min	1991
10	Passenger Briefing	20 min	1992
11	Apron Safety	15 min	1992
12	Airspace and the VFR Pilot	45 min	1992
13	Mark 1 Eyeball	24 min	1993
14	Collision Avoidance	21 min	1993
15	On the Ground	21 min	1994
16	Mind that Prop/Rotor!	11 min	1994
17	Fit to Fly?	23 min	1995
18	Drugs and Flying	14 min	1995
19	Fatal Impressions	5 min	1995
20	Decisions, Decisions	30 min	1996
21	To the Rescue	24 min	1996
22	It's Alright if You Know What You Are Doing – Mountain Flying	32 min	1997
23	Momentum and Drag	21 min	1998
24	The Final Filter	16 min	1998
25	We're Only Human	21 min	1998
26	You're On Your Own	15 min	1999
27	Rotary Tales	10 min	1999
28	Survival	19 min	2000
29	Weight & Balance – Getting it Right	28 min	2000
30	Mountain Survival	24 min	2000
31	Survival – First Aid	26 min	2001
32	Light Twins	23 min	2001

Miscellaneous individual titles

Working With Helicopters	8 min	1996*

*re-release date

Outside Productions

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

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

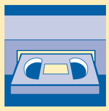
Civil Aviation Safety Authority, Australia

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

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

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

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



New Video – Light Twins

Flying a light twin-engine aircraft, particularly on a commercial operation, is very demanding of a pilot's skill and experience – the accident statistics confirm this.

In an effort to help reduce the accident rate, the CAA has just released a 23-minute safety video entitled *Light Twins.* Aimed at pilots who are about to complete a light-twin rating or those that are converting to a more sophisticated machine, the video covers basic twin-engine aerodynamic principles, engine failures, single-engine performance, weight and balance considerations, airframe icing, and organisational safety culture. It stresses the importance of receiving a thorough type rating and being totally familiar with your aircraft's systems, its performance limitations, and the engine failure drills. It should be emphasised, however, that the information presented in *Light Twins* is **not** in any way a substitute for a formalised aircraft type-rating course – rather, it highlights the need for such courses.

The information in this video can be supplemented by reading *Flying Light Twins Safely* (*Vector*, July/August 1999) and *Light-Commercial Ops* (*Vector*, 1998, Issue 5) and the recent series of *Vector* articles on airframe icing.

A Superior pilot is one who stays out of trouble by using Superior judgement to avoid situations, which might require the use of Superior skills

Letters to the Editor

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

Vector Content

In response to your article *Pilots Behaving Badly* and Ian Boag's letter, both in *Vector* January 2001.

I learned to fly in Tigers almost fifty years ago, and my flying is fairly typical of some aero club pilots. I own a homebuilt Jodel D-11.

My profession included accident investigation with the Labour Department, and handling explosive gas mixtures as an oxygen engineer. My friends think I have a bug about safety.

I keep many safety-related publications, but regrettably few *Vector* articles seem gripping enough to save. Ian's letter reflects in part my own unease with several *Vector* articles.

Perhaps in my writing, as in my flying, I was taught to standards that are no longer seen to be applicable. My tutor quoted "Discard the puffery, and reduce what is left by one third."

One aspect of rule-breaking seldom acknowledged, is the relationship between the rule-maker and the rule-breaker. Rules seen as illogical are only obeyed under coercion. Obedience depends upon the rule-maker's credibility, and a trusted leader will be followed without question.

At present CAA's standing is at an all-time low in many pilots' perceptions, and may sink even further, despite the sterling work done by some of the middle officers. This loss of moral authority and trust has many ramifications. A younger pilot absorbing discussions of the '1% rule' or the media scare campaign may easily decide CAA is totally out of touch with reality. Disregard of published safety rules is then only a matter of time.

Meanwhile, mature pilots are urging others to fly safely. I believe that once CAA regains the pilots' trust, infringements will decrease. Bullying and misinformation have no place in the air. Pilots do not see themselves as stupid, and are actually rather well informed. Well thought out limitations based on reality will be accepted.

On a different but allied subject. There are continuing rumours of personal intrusions into Kathleen Callaghan's private space. No matter how much her professional action may be questioned, her privacy should be considered absolutely inviolate. A quick note of apology in the cooler light of day would seem the decent approach.

Steve H.Rankin
Whangarei
March 2001

Vector Comment

The CAA and the Minister of Transport have disseminated much information in order to keep pilots well informed of developments surrounding medical certification. We trust that pilots will get their information from factual sources, rather than the rumour mill, which seems to have gone into overdrive on this particular issue. We look forward to vigorous informed debate taking place on all aspects of medical certification, which will be facilitated by the Ministerial Review of Medical Standards, and encourage anyone with concerns to participate in this process. You can do so by writing to: Part 67 Review Team, Ministry of Transport, P O Box 3175, Wellington.

AIP Supplement Cut-off Dates

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

Supplement Cycle	*Supplement* Cut-off Date	*Supplement* Effective Date
01/10	9 August 01	4 October 01
01/11	6 September 01	1 November 01

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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

OCCURRENCE BRIEFS

Lessons For Safer Aviation

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

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

Accidents

The pilot in command of an aircraft involved in an accident is required by the Civil Aviation Act to notify the Civil Aviation Authority "as soon as practicable", unless prevented by injury, in which case responsibility falls on the aircraft operator. The CAA has a dedicated telephone number 0508 ACCIDENT (0508 222 433) for this purpose. Follow-up details of accidents should normally be submitted on Form CAA 005 to the CAA Safety Investigation Unit.

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

ZK-SUN, Cessna TU206A, 18 Jun 00 at 0430, Tauranga. 6 POB, injuries nil, damage minor. Nature of flight, transport passenger A to B. Pilot CAA licence CPL (Aeroplane), age 29 yrs, flying hours 444 total, 230 on type, 89 in last 90 days.

The lefthand main undercarriage leg of the aircraft failed while taxiing just after landing. The failure was as a result of a fatigue crack that originated from a corrosion pit. The location of the corrosion pit was on the underside of the leg inboard of the fuselage skin and outboard of the main fuselage attachment. This corrosion pit, which appeared to have originated under the paint, may not have been found during routine inspections required by the aircraft Maintenance Manual or Rule Part 43 Appendix C.

Cessna have advised that the critical length of any fatigue crack that develops is so small as to be almost undetectable. An airworthiness directive (AD) has therefore been drafted for industry comment. The proposed AD would require an annual surface inspection of the legs for any signs of corrosion and refurbishment as necessary.

The intention of the AD is to prevent corrosion and thus the initiation of a fatigue crack.

Main sources of information: Accident details submitted by operator.

CAA Occurrence Ref 00/2046

ZK-BEW, De Havilland DH 82A Tiger Moth, 30 Jul 00 at 1500, Hastings. 2 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 46 yrs, flying hours 755 total, 330 on type, 5 in last 90 days.

The pilot had landed after a local flight and decided to complete some circuits. Power was applied for the takeoff, but the aircraft subsequently became uncontrollable. At approximately 30 feet the pilot found the control stick loose in her hands and immediately closed the throttle. The right wing tips struck the ground, slewing the aircraft around. It finally came to rest on its side.

Further investigation found that a duplicate inspection of the flight controls was completed in January of 2000 during the aircraft's rebuild. After the accident, an inspection of the fuselage did not reveal any control column attaching hardware. It can only be assumed that the attaching mechanism was removed by an unknown person(s) for unknown reasons.

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

CAA Occurrence Ref 00/2479

ZK-DRT, Cessna 172M, 10 Aug 00 at 1100, Raglan. 1 POB, injuries nil, damage substantial. Nature of flight, training solo. Pilot CAA licence PPL (Aeroplane), age 38 yrs, flying hours 297 total, 116 on type, 27 in last 90 days.

The private pilot decided to make a precautionary landing at Raglan due to deteriorating weather conditions en route from New Plymouth to Ardmore. During the landing roll, the pilot ran out of runway length due to poor braking action. Two hundred metres before the end of the runway full power was applied in an effort to become airborne and strike the fence with the aircraft wheels and not the propeller.

The wheels struck the upper strainer wires. The snapped wires struck the right tailplane while the top end of one fence post hit the left tailplane. The aircraft remained controllable so the pilot made the decision to continue to Ardmore.

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

CAA Occurrence Ref 00/2639

ZK-HSF, Bell (Garlick) UH-1B, 12 Aug 00 at 1400, Uruti. 1 POB, injuries nil, damage substantial. Nature of flight, agricultural. Pilot CAA licence CPL (Helicopter), age 31 yrs, flying hours 4213 total, 12 on type, 53 in last 90 days.

While the helicopter was being loaded for its next run, the wind changed direction. The change went undetected by the pilot, who performed the takeoff in the same direction as he had previously. The helicopter did not reach translational lift with the tailwind, so the pilot aborted the takeoff when he thought that he would not clear the fence ahead. The helicopter did not stop in time and collided with the fence, damaging the skid landing gear, the 'chin bubbles', and some of the ventral structure.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 00/2674

ZK-HRX, Schweizer 269C, 13 Aug 00 at 1400, nr Turangi. 2 POB, injuries nil, aircraft destroyed. Nature of flight, hunting. Pilot CAA licence CPL (Helicopter), age 38 yrs, flying hours 354 total, 354 on type, 106 in last 90 days.

Chasing two deer in a clearing, the pilot made a tight turn downwind, and the helicopter lost rotor rpm in the process. There was insufficient altitude to recover, and the helicopter sank into the trees beneath. The helicopter was still carrying a near-full fuel load, and the surface wind was stronger than the pilot had anticipated.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 00/2636

ZK-MGU, Cessna 182P, 17 Aug 00 at 1400, nr Turangi. 2 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 39 yrs, flying hours 335 total, 230 on type, 8 in last 90 days.

The pilot had made a normal approach into the private airstrip near Turangi. During landing he flared too high and bounced hard. This resulted in a sudden application of power as the pilot's hand was on the throttle at the time. The aircraft nosewheel subsequently impacted the ground causing it to detach, which resulted in damage to the propeller and left main landing gear.

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

CAA Occurrence Ref 00/2778

ZK-HKZ, Aerospatiale AS 350BA, 11 Sep 00 at 1015, nr Glade house. 2 POB, injuries nil, damage substantial. Nature of flight, transport passenger A to A. Pilot CAA licence CPL (Helicopter), age 51 yrs, flying hours 6933 total, 1000 on type, 60 in last 90 days.

The helicopter was on approach to a riverbank landing site when the passenger pointed out some ducks to the left. This momentarily distracted the pilot and the tail rotor struck a rock in the riverbed. Despite the destruction of the tail rotor blades and severe damage to the drive train and tail boom, the pilot was able to land safely.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 00/2913

ZK-TLC, Piper PA-34-200T, 29 Sep 00 at 1425, Gisborne. 1 POB, injuries nil, damage substantial. Nature of flight, ferry/positioning. Pilot CAA licence CPL (Aeroplane), age 44 yrs, flying hours 1380 total, 480 on type, 112 in last 90 days.

The aircraft was on a left base for Runway 32 at Gisborne, when the righthand engine surged and appeared to fail. The pilot applied full power on the left engine (to the extent that the over-boost light illuminated) and attempted to cross-feed the right engine from the left tank. Power was not restored to the right engine and the pilot believes that he reset the fuel selector back to the right tank and attempted to feather the right propeller. As the aeroplane was turning on to final approach, the aeroplane sank "alarmingly", probably because the power of the left engine was unable to overcome the drag of the windmilling right propeller, the extended undercarriage and the 10 degrees of flap set. Due to the decreasing airspeed and the increasing rate of descent, the pilot elected to ditch while he still had control, rather than risk stalling while trying to reach the runway. The surface wind was from 320 degrees magnetic at 35 knots gusting 40 knots, these conditions producing a marked wind gradient on final approach. It is likely that the wind gradient exacerbated the effects of the high-drag configuration of the aeroplane.

The aeroplane ditched in the sea several hundred metres off the beach, and remained on the surface long enough for the pilot to don a lifejacket and recover some other items from the cabin. The pilot was rescued by the Coastguard about 15 minutes after the aeroplane sank, by this time having swum part-way to the beach. He was suffering mild hypothermia and was taken to hospital for observation.

The pilot had flown the aircraft to Hastings for an engine change (the lefthand engine) on 26 September, landing one passenger at Napier en route. He had difficulty starting the left engine again at Napier, resulting in a 15-minute period of ground running on the right engine. The problem was diagnosed as a sticking magneto impulse coupling and was cleared with the assistance of a Napier-based pilot. The pilot remained in Hastings while the engine change was being carried out, and on 29 September performed a 38-minute test flight before returning to Gisborne.

He had calculated his fuel on departure from Gisborne as 530 pounds, and prior to departing Hastings he estimated that he still had sufficient on board to return to Gisborne under VFR, based on the amount of flying done so far. His figures indicated that he anticipated having 120 pounds on board on landing at Gisborne. Looking in the tanks at Hastings before the test flight, the pilot noted that the fuel level was not visible, but had expected that to be the case (a function of the wing dihedral and the location of the filler caps). He recalled that the right fuel gauge indicated about ¼ before the test flight. During the engine change, the engineers had used a small quantity of fuel (estimated as "about a litre") for clean-up purposes, and the aeroplane had not been left outside overnight.

Although the aeroplane was assessed as an insurance write-off, it was recovered from the sea by the owners and thoroughly washed in fresh water. Neither propeller had feathered. The engines were stripped and examined, but no mechanical defect was found.

It was not possible to state conclusively that the loss of power on the right engine was due to fuel starvation, but it is a possibility given the circumstances. An alternative is that the right tank outlet, with the low fuel level, unported momentarily in turbulence, allowing sufficient air to be inducted to cause the loss of power.

Main sources of information: CAA field investigation.

CAA Occurrence Ref 00/3191

GA Defect Incidents

The reports and recommendations which follow are based on details submitted mainly by Licensed Aircraft Maintenance Engineers on behalf of operators, in accordance with Civil Aviation Rule, Part 12 *Accidents, Incidents, and Statistics.* They relate only to aircraft of maximum certificated takeoff weight of 5700 kg or less. Details of defects should normally be submitted on Form CAA 005D to the CAA Safety Investigation Unit.

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

Key to abbreviations: **P/N** = part number
TIS = time in service
TSI = time since inspection
TSO = time since overhaul
TTIS = total time in service

Beech 76 – Throttle butterfly jams

The pilot reported that the starboard engine could not be throttled back below 2000 rpm in the descent. The aircraft landed safely.

Investigation revealed that a portion of scat hose wire reinforcement, which had been turned back into 'V' at the exhaust shroud end, had lodged in the carburettor. The scat wire had rusted until the 'V' portion had broken off and travelled to the carburettor, lodging around the throttle shaft, preventing the butterfly from closing.

ATA 7610 CAA Occurrence Ref 99/435

Bell 47G-4A – Lycoming VO-540 – Big-end bearings fail, P/N LW13212

A strip down of the number two, three, and four big-end bearings revealed that they had failed, distributing metal throughout the engine. All con rod bolts were still intact. There was no piston-pin plug wear, but the oil pump showed signs of damage due to metal having passed through it. The scavenge filter was found to be clogged with metal. A further problem was that the locking wires on the nuts securing the trans-adaptor plate to crankcase had been physically chopped off and were missing. It is very likely they went straight into the engine. TSO 1342 hrs; TSI 7 hrs.

ATA 8520 CAA Occurrence Ref 99/248

Cessna 152 – Faulty switch causes flap imbalance

The student pilot retracted the flaps while operating in the circuit, whereupon an asymmetric flap situation developed due to the port flap being fully extended and the starboard flap being fully retracted. This caused the aircraft to roll markedly to the right. The pilot attempted to re-cycle the flaps but to no effect. The aircraft was subsequently landed with assistance from an instructor flying in another aircraft close by.

Further engineering investigation found that the flap-up limit micro-switch had gone out of adjustment, which resulted in the flap motor continuing to drive after the flap had become fully retracted. The flap-actuating rod had failed prior to the motor circuit breaker tripping. The port flap had then jammed in the extended position.

The micro-switch installation was found to be secure when inspected by an engineer. This suggested that wear and tear over the years had caused it to go out of adjustment and not function correctly. This aircraft had a history of bending the flap actuator rods, which indicates that the switch may have been failing intermittently.

ATA 2750 CAA Occurrence Ref 00/3679

Cessna 180C – Tailwheel spring tube fails

The tail wheel assembly separated from the aircraft upon landing.

Investigation revealed that the tailwheel spring tube had been cracked at approximately 80 to 90 percent of its circumference for some time and had finally failed in overload on this particular landing.

ATA 3220 CAA Occurrence Ref 99/3095

Hughes 269C – Tail rotor pitch link cracks, P/N 269A6091-5

A crack was found in one of the tail rotor pitch links during maintenance. The submitter suggests that the crack was probably due to over-crimping of the bearing, resulting in swelling of the pitch link body and eventual failure. TTIS approx 400 hours.

ATA 6400 CAA Occurrence Ref 99/3526

NZ Aerospace FU24-950 – Con rod bearing breaks down, P/N 74309

During routine inspection, metal was found in both oil filters. The engine was initially monitored for five hours of operation and then for two additional 10-hour intervals without further contamination. Metal was again found in the filters following an inspection at a routine 50-hour check.

Investigation revealed that the No.5 con rod big-end bearing white metal was peeling and the steel backing of the bearing was cracking off. A piece of the No.5 gudgeon pin bush was also missing. TTIS 1100 hours; TSO 1100 hrs.

ATA 8500 CAA Occurrence Ref 99/3145

Piper PA-32-260 – Fuselage corrosion found

During routine inspection, light corrosion was found under the front spar attachment brackets on the inside of the fuselage. Corrosion was also found under the corner brackets on the rear corner of the front windscreen. TTIS 11000 hrs.

ATA 5340 CAA Occurrence Ref 99/3277

Piper PA-34-200T – Landing gear bolts incorrectly fitted

The pilot reported that the righthand main landing gear would not fully retract.

Investigation found that three of the righthand forward trunnion support securing bolts were completely missing and that one was loose. The wrong length bolts had been fitted, probably when the landing gear was last removed from the aircraft. The correct ones were refitted and the problem was corrected.

ATA 32 CAA Occurrence Ref 99/2509

International Occurrences

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

United States of America

Occurrences

The following are a selection of occurrences that come from the NTSB's *Aviation Accident/Incident Database* contained on their web site.

Robinson R-22 – Student fails to respond to instructor's control inputs

On 22 January 2000, a Robinson R-22B sustained substantial damage during an in-flight collision with terrain following a loss of control during takeoff. The CFI received minor injuries. The student was not injured.

According to the CFI's written statement, they were practising a running takeoff on Runway 18 and after traversing approximately 10 feet of the takeoff run the student applied right pedal input. The CFI stated that he tried to overcome the student's right pedal input by depressing the left pedal input and verbally commanding the student to do the same. The CFI reported that he was unable to counteract the student's control input and the aircraft yawed to the right. The helicopter's left skid impacted the terrain, the aircraft rolled onto its left side, and it slid for 15 feet before coming to rest.

NTSB Occurrence Ref CHI00LA060

Cessna 207 – Engine oil reduces pilot's visibility

On 4 July 2000 a Cessna 207A sustained minor damage during an emergency landing. The pilot was not injured.

The pilot reported that about 10 minutes after departure, while in the cruise, he noted a light sheen of oil forming on the windshield, and he elected to return to the airport. He said that by the time he was within two miles of the airport he was having difficulty seeing though the windshield due to a heavy accumulation of oil. The pilot reported that, while on approach to Runway 04, the propeller rpm increased for about 20 seconds, followed by the propeller detaching from the engine. He said that he was able to glide the aeroplane to the runway and land without further incident.

The propeller and engine crankshaft flange were located and sent to the NTSB metallurgical laboratory for examination. The aeroplane was equipped with a Teledyne Continental IO-520-F engine.

NTSB Occurrence Ref ANC00IA083

United Kingdom

Occurrences

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

Piper PA-34-200-2 – Heavy bounces cause gear to collapse

The pilot landed on Runway 21 with a reported wind of 220/15 knots and possible gusts. Touchdown was gentle and the aircraft bounced. The pilot increased back pressure on the control column and retarded the throttles. The aircraft bounced three or four more times with increasing severity until the nosegear collapsed. The pilot continued to apply increased back pressure on the controls. The aircraft was cleared onto the grass with engines shock-loaded, propeller tips bent, and the windscreen shattered.

PPL with 154 hrs total, 13 hrs on type, with 9 hrs in the last 90 days.

Piper PA-23-250 – Student and instructor land with gear up

The student was performing well below standard for visual circuits, and work on basic control was needed before he could achieve the correct visual approach path. The student forgot to lower the undercarriage and, distracted and fatigued, the instructor did not check. The aircraft landed wheels-up, causing substantial damage to the propellers and shock-loading the engines. The instructor stated that he had been on duty for 8 hours at the time of the incident and had had 14 hours available for rest prior to the commencement of duty.

ATPL, with 5400 hrs total, 450 hrs on type, with 120 hrs in the last 90 days.

Cessna 177B – Pilot mishandles aircraft during crosswind landing

The pilot was landing on a 520-metre grass strip, which had a 3-degree upslope. The runway was 20 metres wide and the surface wind was 120 degrees from the left at 8 knots. The pilot flew a normal 'crabbed' approach to the flare where he applied rudder to align the aircraft heading with the runway. The touchdown was close to the right edge of the runway, so the pilot applied left rudder, but the right main wheel ran into soft ground off the runway edge. The nosewheel struck a runway edge light, and the aircraft entered soft soil, decelerating rapidly. The propeller struck the ground before the aircraft stopped. The pilot attributed the accident to 'kicking off drift' too early and then drifting across the runway during the flare.

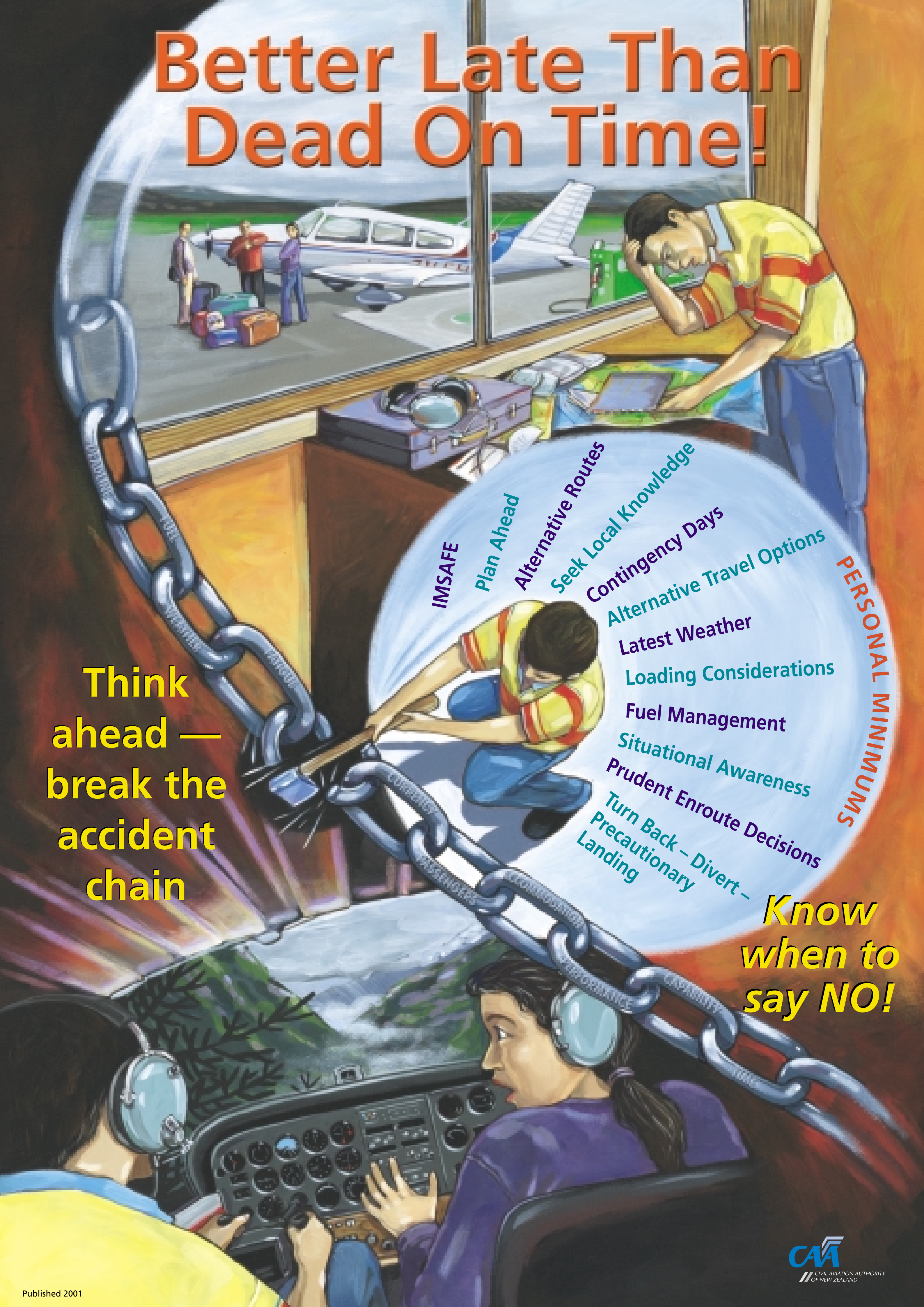
PPL with 218 hrs total, 141 hrs on type, with 24 hrs in the last 90 days.

Morane Saulnier MS.893A – Aircraft jumps chocks

The pilot was unable to start the engine because the battery was flat, so he decided to hand-swing the propeller. He checked the parking brake was fully applied and chocked the main wheels using old tyres. Nobody was available to assist. He set the throttle about one inch open and rechecked the parking brake and chocks before starting the engine.

The engine ran faster than expected and the pilot ran to the step to close the throttle. The aircraft moved forward and the pilot fell to the ground. The aircraft struck a fence, damaging the propeller and wing leading edges. The parking brake was still fully applied.

The pilot considered the cause of the accident was a defective parking brake and inappropriate chocking action.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