September / October 2002

VECTOR

Pointing to Safer Aviation

Maintenance Mistakes and Systems Solutions

Trouble Checking

Transponder Basics

Erroneous ILS Indications

CAA
CIVIL AVIATION AUTHORITY
OF NEW ZEALAND

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Managing Editor, Cliff Jenks

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

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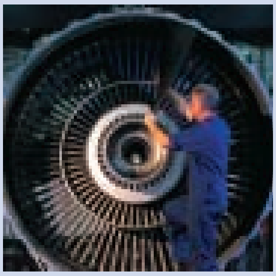

Human factors play a major part in accidents worldwide. In recent years there has been a significant effort to focus more on human factors in maintenance. This article deals with some of the issues involved, with lessons for both airline and general aviation organisations.

Being able to prioritise your actions in the event of an engine failure just after takeoff is an essential skill to have. This article looks at the role that engine trouble checks play when faced with such a situation.

In July 2000, an Air New Zealand Boeing 767 had to do a go-around after its autoflight system captured an erroneous glideslope signal that put it well below the minimum safe approach altitude. Air New Zealand and the CAA have just released a comprehensive report into the event, which is now available on the CAA web site.

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Maintenance Mistakes and Systems Solutions

This article by Alan Hobbs, a BASI human performance investigator, was published in Asia-Pacific Air Safety in March 1999.*

Human factors is not just about people: it is also about improving systems. While the focus of this article is on airline maintenance, there are also lessons for general aviation.

Ask someone about the threats to the airworthiness of an aircraft and they will probably mention metal fatigue, corrosion, excessive wear of components or other results of ageing and use.

Yet today, as aircraft become increasingly reliable, we have reached the point where the actions of the maintainers themselves lie at the heart of many airworthiness problems. According to Boeing, around 15% of major aircraft accidents involve maintenance error.

Human errors, and the frustration, sleepiness, misunderstandings and memory lapses which produce them, are powerful forces affecting the quality of maintenance and hence the airworthiness of aircraft.

There is now a worldwide effort to understand more about the human side of maintenance problems. This article deals with just a few of these issues.

Maintenance errors can have a significant impact not only on safety, but also on the financial performance of large and small operators alike. A single in-flight turn-back of a Boeing 747, with the need to accommodate passengers overnight, can easily wipe out $250,000 of profit. It has been estimated that in the USA, maintenance error could cost airlines one billion US dollars per year![1]

The term 'human error' is used throughout this article in recognition of the fact that most aviation accidents do involve human error at some point in the chain of events. However, we need to recognise that these errors (or unsafe acts) tend to be just one link in a chain of events. A useful framework to use when considering human factors issues is the Reason Model of accident causation illustrated.

*BASI (Bureau of Safety Investigation in Australia) no longer exists. Its role is now performed by ATSB (Australian Transport Safety Bureau).

Unsafe acts are not just problems in their own right, but can be seen as *symptoms* of wider problems. For example, in March 1994 the number one engine and pylon of a 747-200 rotated downward during the landing roll and contacted the runway. There were no injuries to passengers or crew. The aft fuse pin on the pylon diagonal brace had migrated from its fitting and was found loose in the pylon structure. The type of pin fitted to this aircraft was normally secured in place by two retaining devices, but on this occasion, neither of these retainers could be found.

Approximately 10 hours after the accident, the missing retainers were found in an unmarked cloth bag on a work stand near where the aircraft had recently undergone a C-check. The C-check had included an inspection of the diagonal brace fuse pin lugs on the two outboard engines.

It was never established who had made the errors that culminated in the accident; however, finding the people responsible may not have helped prevent future accidents. The most important lessons learnt from this accident were not about individuals, but about the way maintenance was organised and carried out.

The US National Transportation Safety Board (NTSB) identified a range of system problems including an error-producing work environment, potentially dangerous scaffolding, poor lighting, inappropriate storage of parts, a lack of training in company maintenance policies and inadequate oversight by the US Federal Aviation Administration (FAA). Addressing each of these upstream problems would not only reduce the chance of the same errors happening again, but should also help to prevent a host of other quality problems.[2]

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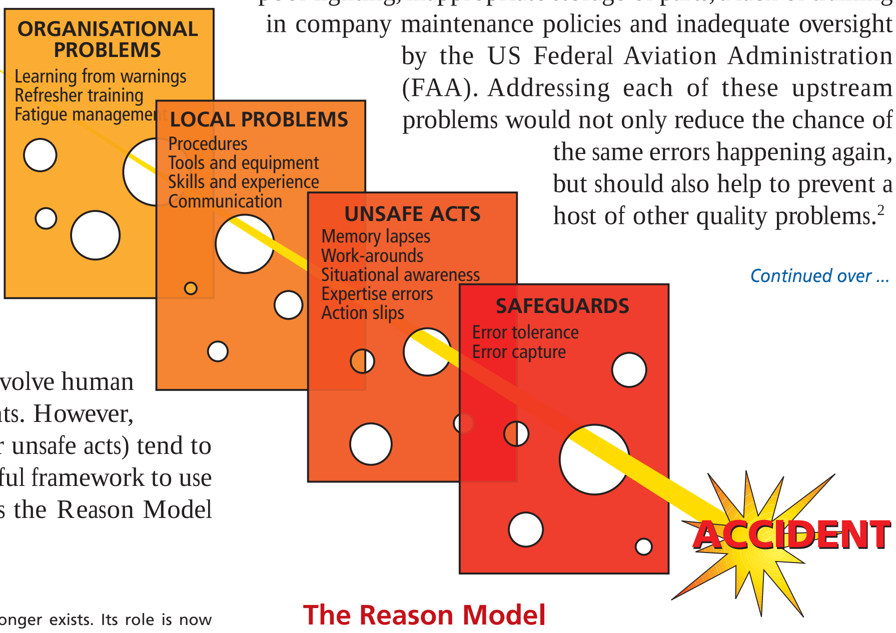

The Reason Model

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Unsafe Acts: What Goes Wrong?

In order to understand the types of errors made by maintenance engineers, the Bureau of Air Safety Investigation (BASI) has collected information on over 120 maintenance unsafe acts from interviews with airline engineering personnel and from incident reports received during a study of the regional airline industry. Most of the unsafe acts were corrected before the aircraft flew, or resulted in only minor consequences.

Over 80% of the unsafe acts of maintenance mechanics fell into one of five types:

Memory Lapse: 24%

Memory lapses do not generally happen randomly, but often occur when a person is interrupted to go and do something else. Juggling maintenance tasks on several aircraft is a common situation, which can lead to a memory lapse.

Being the only person on shift, I was responsible for both hangar and line maintenance. There was a fuel quantity problem on a [...]. I had to move fuel plumbing to gain access. I was distracted from my task by heavy commitments with line defects. I forgot to check the tightness of the B-nuts causing the aircraft to develop a potentially disastrous fuel leak.

– De-identified incident report.

Work-arounds: 23%

Typically, work-arounds involve performing a task without all the necessary equipment, or in a more convenient manner than in the approved procedures. However, some are more serious, as in the case of workers faced with time pressure who decide not to document their actions or decide not to perform all the required steps in a task. On their own, work-arounds may not necessarily result in an incident, but serious problems can result when other people are not aware that someone has taken a shortcut, or when a work-around is followed by an error.

It was a Friday afternoon and I was about to knock off for the weekend. I decided to do one last-minute job and tighten the nose-wheel steering cables on a twin-engine aircraft. Not having an appropriate flagged rig pin, I used a bolt through the aircraft floor to hold the rudder pedals in neutral. It got dark and everyone was anxious to go home, and I was holding them up. At the end of the job I signed off the Maintenance Release but forgot to remove the bolt. On the Monday I was asked if the aircraft was ready and I said 'yes'. The aircraft was flown for a whole day checking out a pilot, with landings every 20 minutes. If they had feathered an engine or there had been an engine failure they would have been in real trouble, as the limited rudder movement was from this bolt flexing in the floor structure.

– De-identified incident report.

Maintenance mechanics are often faced with the pressure of being informed by companies to follow the procedures, but at the same time are encouraged to get work done to deadlines. One mechanic summed it up this way: "Management tell us to follow the procedures to the letter, but then they tell us not to be obstructive and to use common sense." A recent European study found that a third of maintenance tasks involved a deviation from official task procedures.[3]

"Maintenance engineers are like torque wrenches: they need to be re-calibrated from time to time."

Situational Awareness: 18%

Situational awareness errors occur when the mechanic starts work without first gaining an accurate picture of the situation being dealt with. Often, they don't realise that the situation is different from normal, as when a mechanic activates hydraulics without noticing that cockpit controls have been moved while the hydraulics were off. In other cases, an engineer may not be aware of work being done by other workers on the same aircraft.

Expertise: 10%

Errors of expertise happen when someone doesn't have the knowledge, skills or experience to do all aspects of their job. As might be expected, errors of expertise tend to involve less experienced workers. The fact that 10% of errors are of this kind could indicate deficiencies in training.

Action Slips: 9%

Action slips occur when someone accidentally does something unintentionally. Slips tend to occur on routine, highly familiar tasks.

A mechanic accidentally put engine oil into the hydraulics system of an aircraft. Oil and hydraulic fluid were stored in nearly identical tins in a dark storeroom.

– De-identified incident report.

Local Problems: Why do Things go Wrong?

The BASI analysis of maintenance incident reports found that for incidents which had airworthiness implications, the most common factors in the work area at the time of the incident were:

Confusion, Misunderstandings, or Differences of Opinion About Procedures

It is not unusual to find that workers have a fairly limited understanding of a company's formal policies and procedures and instead follow informal practices developed on the job. Older, experienced workers will sometimes develop their own practices, which may be different from the approved procedures. Unworkable or inconvenient procedures prompt the sort of work-arounds described earlier.

Communication Breakdowns Between People

In a recent survey, senior US maintenance mechanics were asked to describe the most challenging part of their job.

Their most common answer was "human relations or dealing with people".[4] Performing in a team requires more than technical know-how, and we often overlook the need to develop these important communication and people skills.

Pressure or Haste

Since the early days of aviation maintenance, personnel have faced pressures to get aircraft back into service. However, as aircraft become more complex and operators strive to reduce the amount of time that aircraft spend in maintenance, pressure is a growing fact of life for maintenance engineers. A particular risk is that engineers faced with real or self-imposed time pressures will be tempted to take shortcuts to get an aircraft back into service more quickly.

Maintenance systems have built-in safeguards, such as independent inspections and functional tests designed to capture errors on critical tasks. By necessity, these error-capturing safeguards generally occur at the end of jobs, at exactly the time when pressures to get the aircraft back into service are likely to be greatest and the temptation to leave out or shorten a procedure is strongest.

In the recent BASI survey, 32% of mechanics reported that there had been an occasion when they had not done a required functional check because of a lack of time. At the time, such a decision may have seemed safe and reasonable; however, decisions made under pressure do not always stand the test of hindsight.

Inexperience

Younger personnel need to know about the traps lying in wait for them, yet too often they are allowed to discover these for themselves.

A Lack of Tools, Equipment, or Spares

Many work-arounds occur in response to lack of appropriate hardware or spares. It is understandable that airlines will try to reduce their stocks of expensive spares; however, in some cases relatively inexpensive spares such as O-rings are nil-stock items. Furthermore, a lack of major spares can lead to increased cannibalisation of parts from other aircraft, which in turn doubles the disturbance to systems and increases the potential for human error.

A common theme underlying these problems is that maintenance personnel may need training in human factors areas such as communication, supervision, and dealing with pressure and frustration.

The great benefit of human factors training is not only that people change, but that people can see the opportunities to change the systems in which they work. For this reason, managers, who have the most power to change things, should not be excluded from human factors training.

My company ran a human factors course for all mechanics in 1996. It was very informative and I learnt a lot of things I hadn't even thought about before. As a result, I have changed my attitudes and actions to increase my personal safety and awareness. This course should be given to all apprentices or new hires. It is invaluable.
– Survey comment.

Organisational Factors: What are the Weaknesses in the Overall System?

Maintenance incidents can reflect a range of organisational problems. Three of the most important of these are dealt with below.

Lack of Refresher Training

The regulations state that maintenance personnel must receive "proper and periodic instruction". However, in reality, few maintenance engineers receive refresher training once they have gained their licences. Without such training, non-standard work practices can develop or engineers can lose touch with changes in regulations or company procedures. One senior airline manager put it this way: "Maintenance engineers are like torque wrenches: they need to be re-calibrated from time to time".

Lack of Learning From Incidents

The conventional wisdom among safety experts is that for every accident there may be 30 or more previous minor incidents. When BASI interviewed maintenance engineers about incidents, it became apparent that before a serious quality lapse occurs, there are usually earlier incidents which could have acted as warnings of a problem.

Unfortunately we do not always learn the right lessons from these 'warning incidents', sometimes because they are never reported. It is never easy to admit a mistake; however, it is even harder when an organisation punishes people who make honest mistakes, perhaps by docking pay or placing notes on personnel files. A punitive culture within the company or the regulatory authority creates an atmosphere in which problems are quietly corrected and places barriers in the way of learning from our mistakes. In the recent BASI survey of maintenance personnel, 66% of respondents reported that they had corrected an error made by one of their colleagues without documenting it, in order to avoid getting them into trouble.

One action which managers can take to ensure that they hear about the 'warning incidents' is to have a clear 'responsibility policy', which outlines how the organisation will respond to maintenance incidents.

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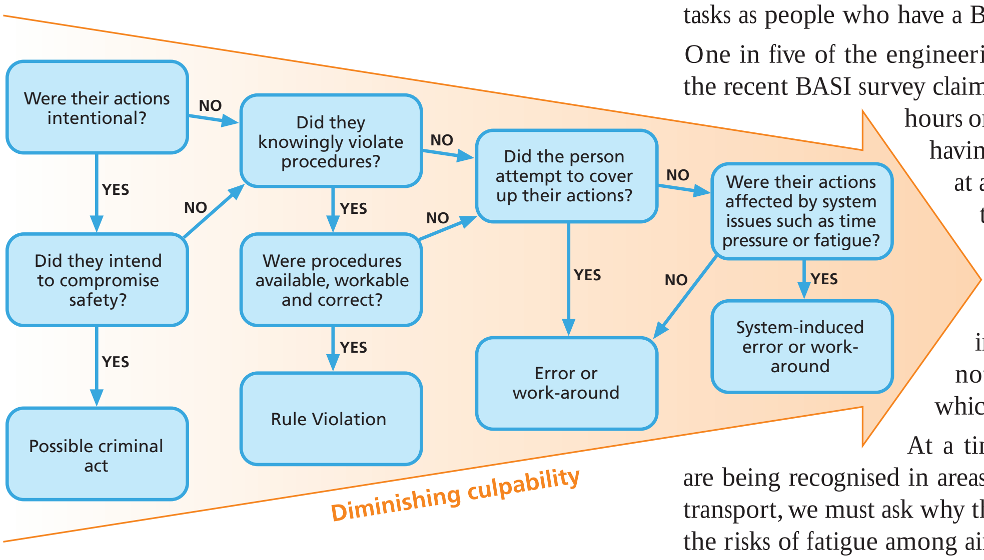
The following diagram illustrates how a responsibility policy might work, although every operation will need to tailor such a policy to its own requirements. Needless to say, no policy such as this can be expected to function if the regulatory authority penalises those who report their mistakes.



'Responsibility Policy' (adapted from James Reason[5])

Until the regulator's inspectors move away from the blame culture that is currently implemented, maintenance defects and incidents will always be covered up and hidden.
– Survey comment.

Once an incident has been reported, the focus of an internal investigation should normally be on identifying system problems, not on identifying personal deficiencies of individuals.

There **may** be rare times when incidents are related to intentional acts of malice, but the great majority of maintenance mechanics do their jobs with diligence and integrity and most incidents reflect system problems, which go beyond individual workers.

"After 23 hours of being continuously awake, people perform as badly on these tasks as people who have a blood alcohol concentration of 0.12%."

An internal investigation that only results in recommendations directed at the level of individuals, (such as reminders to engineers to 'be more careful' or to 'follow procedures more closely') are sure signs that the investigation did not identify the system failures which led to an occurrence. There are now structured methods to help managers identify system failings in maintenance, such as the Boeing maintenance error decision aid (MEDA) system[6].

Fatigue

There is probably no way to avoid the need for maintenance to be done at night; however, this does not mean that fatigue levels cannot be managed. Unfortunately, almost all night-shift workers suffer from a lack of quality sleep.

Recent Australian research has shown that moderate sleep deprivation of the kind experienced by shift workers can produce effects very similar to those produced by alcohol.[7] After 18 hours of being awake, mental and physical performance on many tasks is affected as though the person had a blood alcohol concentration (BAC) of 0.05%. Boring tasks, which require a person to detect a rare problem (like some inspection jobs), are most susceptible to fatigue effects. After 23 hours of being continuously awake, people perform as badly on these tasks as people who have a BAC of 0.12%.[8]

One in five of the engineering personnel who responded to the recent BASI survey claimed they had worked a shift of 18 hours or longer in the last year, with some having worked longer than 20 hours at a stretch. There is little doubt that these people's ability to do their job would have been degraded.

An important point to note is that like people who are intoxicated, fatigued individuals are not always aware of the extent to which their capabilities have degraded.

At a time when the dangers of fatigue are being recognised in areas as diverse as medicine and road transport, we must ask why there are no regulations to control the risks of fatigue among aircraft mechanics.

Safeguards: Reducing the Consequences of Maintenance Errors

Minimising Consequences of Errors vs 'Working Without Nets'

Functional checks and independent inspections are examples of safeguards designed to capture errors before they cause harm.

However, there is another approach to managing error which is sometimes overlooked. This is to acknowledge that errors will occur from time to time and that we need to design procedures and systems that can minimise the consequences of such errors. Special maintenance precautions applied to extended-range twin-engine operations (ETOPS) are an example of such an approach. When an aircraft is being maintained in accordance with ETOPS procedures, the performance of identical maintenance actions on multiple elements of critical systems is avoided wherever possible. Engines, fuel systems, fire-suppression systems and electrical power are examples of ETOPS critical systems on aircraft such as the B767 and B737.

However, these precautions are not generally applied to aircraft with more than two engines, or to twin-engine aircraft which are not being maintained in accordance with an ETOPS maintenance programme.

For example, in 1995, a European-operated Boeing 737-400 was forced to divert shortly after departure following a loss of oil quantity and pressure on both engines. Both of the aircraft's CFM-56 engines had been subject to boroscope inspections during the night prior to the incident flight. High-pressure rotor drive covers were not refitted on each engine and, as a result, nearly all the oil was lost from the engines during the brief flight[9].

Several months after this incident a similar overseas incident occurred on a Boeing 747-400. Shortly after departing on an over-water flight, the crew noticed reducing oil quantities on the number one and number two engines. The aircraft was turned back to its departure point, where it arrived safely without any need for the engines to be shut down in flight.

After landing, oil could be seen leaking from the engines.

Boroscope inspections had been carried out on all four of the GE CF6 engines. This inspection normally involves removing and then refitting the starter motor from each engine, and in fact the starter motors were removed from the number one and number two engines in preparation for the job. Because the tool to enable the engines to be turned by the starter drive could not be found, the starter motors for engines 3 and 4 were not removed and all engines were turned by an alternative method. A lack of spares had led to a practice of not replacing O-rings when refitting starter motors. However, on this occasion a mechanic **did** comply with documented procedures and removed the O-rings from the number one and two starters. The workers who refitted the starters apparently assumed that the situation was 'normal' and did not notice that the O-rings were missing – a 'situational awareness' error.

This incident had a variety of causal factors, such as informal procedures which had evolved to work around the frequent 'nil stock' state of spares, poor lighting and inadequate leak check inspections. However, an important point is that because the aircraft had four engines, it was not protected by ETOPS standards. In essence, the mechanics were 'working without nets'. Had the job proceeded as originally planned, the starter motors would have been removed from all four engines, with serious consequences.

The extension of some ETOPS precautions to non-ETOPS operations would help to contain such maintenance-induced problems.

Boeing has encouraged operators as a general practice "to institute a programme by which maintenance on similar or dual systems by the same personnel is avoided on a single maintenance visit".[10] BASI has also published the following suggested safety action: "Where possible, the simultaneous performance of the same maintenance tasks on similar redundant systems should be avoided, whether or not the aircraft is an ETOPS aircraft".[11]

Conclusions

Unfortunately, advances in aviation technology have not necessarily been matched by improvements in the way we organise the work of the people who maintain aircraft.

The remarkable aspect about maintenance incidents is that many of them share similar features. A relatively limited number of unsafe acts, such as work-arounds, memory lapses and situational awareness errors typically occur in the context of problems such as unclear or poor procedures, a lack of equipment or spares, communication breakdowns, time pressure and fatigue. Because unsafe acts are

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GA Maintenance Comment

As some smaller maintenance organisations often have additional human factors considerations that are specific to their operation, *Vector* sought comment from a New Zealand general aviation maintenance provider. They had this to say:

Engineers of smaller maintenance organisations are sometimes tasked with multiple roles. Sometimes, they not only have to carry out the day-to-day maintenance work on aircraft, but may also have to be either the CEO, Chief Engineer, Certifying Engineer or storeman at the same time. Changing between these roles can be stressful, and it increases the chances of introducing error.

An interruption, such as a business-related phone call to the CEO, while working on an aircraft could cause a memory lapse, the consequences of which need little elaboration. It is important that engineers in multiple roles are aware of such potential pitfalls and that they have strategies in place to minimise the risks.

Maintenance Controllers need to be mindful of the pressure they may be placing on their maintenance provider (especially a small business) when scheduling routine aircraft maintenance. An awareness of how much time is involved in each particular check, a good understanding of the scope of the work involved, and scheduling it well in advance within a realistic timeframe, does significantly reduce the amount of pressure on the maintenance provider.

The same is true when it comes to rectifying defects – Maintenance Controllers should be careful not to apply undue pressure to get the job done. Time pressure is an engineer's worst enemy.

A further problem that smaller maintenance organisations often face, unlike their larger counterparts, is carrying sufficient stocks of parts for the aircraft they maintain. Because of the diverse range of aircraft types that some smaller maintenance organisations can have on their books, it is often not financially economic to carry a full range of parts. This can mean an added time pressure when they have to be ordered in.

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generally symptoms of wider problems, human factors is not just about focusing on people but on the systems within which people work.

This article concludes with just five system-level improvements that may help to ensure safer maintenance:

- Introduce refresher training, particularly on company policies and procedures.
- Introduce a clear 'Responsibility Policy' to remove barriers that discourage people from reporting incidents.
- Introduce a fatigue management programme. This will almost certainly involve ensuring that workers get adequate sleep opportunities. If 12-hour shifts are being worked, a ban on extending shifts with overtime may be necessary.
- Introduce human factors training for management and workers.
- Minimise the simultaneous disturbance of multiple or parallel systems.

While striving for perfect performance by those maintaining aircraft, we should recognise that making mistakes is an unfortunate but unavoidable consequence of being human. ■

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Check Before Tightening

A recent fatal helicopter accident, in which the pilot experienced severe control difficulties following a loss of hydraulic systems pressure, was found to have been caused by a leaking hydraulic supply line. The leak was due to a fatigue crack, which had been propagating for some time. The crack was probably due to a combination of factors: reversed bending stresses (exacerbated by vibration) on the tube in the area of the fitting, previous wear and tear, and the fact that the MS flareless fitting securing the supply line had been repeatedly tightened in apparent attempts to stop a slow leak. When and by whom the attempted rectification was carried out could not be established.

It is reasonable to expect that a licensed aircraft maintenance engineer would be familiar with the characteristics and limitations of the MS flareless fittings and would not have attempted to over tighten the fitting to stem a leak. The over tightening is more likely to have been performed by somebody with mechanical skills, but with no training in aircraft maintenance. The simple remedy is to replace a leaking line; the components are readily available and are not expensive.

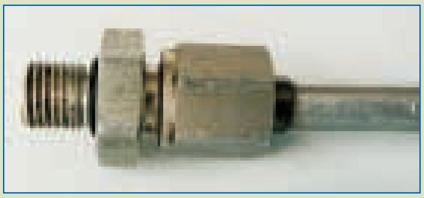
This accident highlights the susceptibility of MS flareless fittings to damage if over tightened. Ensuring that such fittings are tightened to the correct Maintenance Manual torque setting by an **appropriately qualified** aircraft engineer is vital. Suspect fittings or lines should always be replaced – doing so would have probably prevented this accident.

If you do discover a weeping flareless fitting on a hydraulic line and are unsure about the correct procedure to tighten it, then always refer to the aircraft Maintenance Manual **before** undertaking any work.

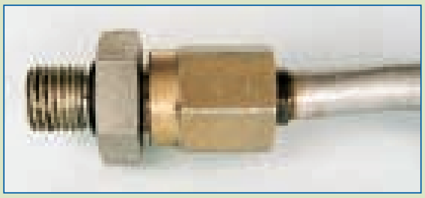
Further information on this topic can be found in the CAA Accident Report 01/44 on the CAA web site (**www.caa.govt.nz**) by clicking on **Accidents and Incidents/Fatal Accidents.** ■

Properly formed (new) tube end: The 'ridge' visible inside the tube end is normal.

MS flareless fitting components: (Tube, MS 21921 nut, MS 21922 sleeve and MS 21916D reducer)



The damaged MS fitting: The nut has been filed to obtain further travel after it has bottomed out on the reducer.



The nut at the opposite end of the same line, for comparison.

Trouble Checking

Photograph courtesy of TAIC

Fuel Starvation

The Cessna A185E Skywagon took off from Motueka Aerodrome on a local parachuting flight. Shortly after takeoff, at about 100 feet, a sudden and total power loss was experienced. Unable to re-establish power, the pilot guided the aircraft to a nearby kiwifruit orchard. The aircraft struck the ground heavily after clipping trees, resulting in the pilot and four parachutists receiving serious injuries. A fifth parachutist sustained minor injuries. The aircraft was substantially damaged.

The power loss was due to the pilot inadvertently selecting the fuel to OFF before the flight, because of his unfamiliarity with the aircraft's fuel selection system. Unfortunately, sufficient fuel remained in the accumulator tank (3.28 litres) to allow the aircraft to complete its pre-takeoff checks, taxi, takeoff and climb to approximately 100 feet before the engine was starved of fuel.

Findings and Recommendations

In its accident report, the Transport Accident Investigation Commission identified a number of reasons why the pilot inadvertently selected fuel OFF prior to takeoff. These included:

- the absence of labelling confirming the available fuel selection positions;
- the absence of a cover preventing the fuel from inadvertently being turned off (achieved by rotating the selector lever to the rearward position); and
- the assumption by the pilot that he could select BOTH by rotating the selector to the rearward position.

Note that this model of Cessna has LEFT, RIGHT and BOTH options only – it has no OFF position. Fuel cut-off is normally achieved by activating a separate fuel cut-off control lever. Rotating the fuel selector to the rearward position does, however, cause the fuel flow to stop.

The report went on to recommend that pilots be reminded of the importance, if time permits, of changing fuel tanks (if applicable to aircraft type) following an unexplained power loss shortly after takeoff.

Prioritising Your Actions

While changing the fuel tanks probably would not have restored the fuel flow in time to restart the engine on this particular occasion, and the pilot correctly concentrated his efforts on directing the aircraft to the most suitable forced landing area, it does remind us of the importance of carrying out the engine-trouble checks (FMIIP) **if time permits**.

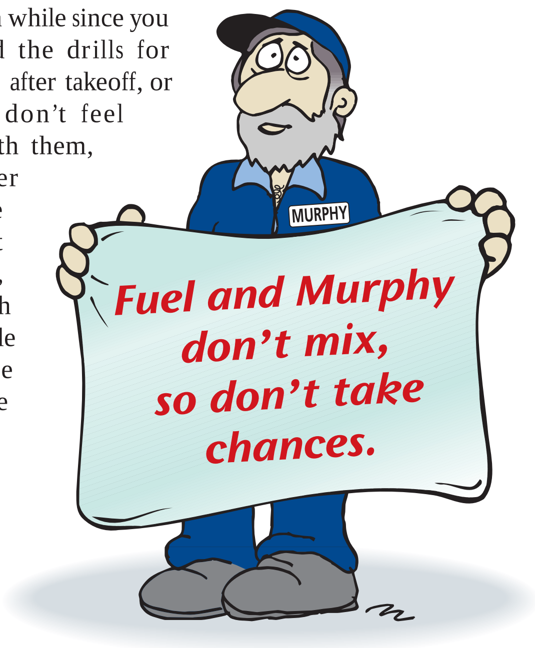
A large percentage of partial power losses or total engine failures (especially for normally aspirated engines) are caused by a fuel problem, induction icing, or an ignition system problem. Therefore it makes sense, if time permits, to start the engine-trouble checking process as soon as possible, to maximise the chances of restoring power before becoming committed to a forced landing. Fuel flow can take a considerable amount of time (up to 15 seconds) to be restored following fuel starvation, and the application of carburettor heat can take equally as long to clear any induction icing.

The height above the ground at which an engine failure occurs will dictate what actions can be taken, bearing in mind that the first priority always is to fly the aircraft. Practice, however, may mean that you are able to carry out the key checks of **fuel pump ON, change tanks**, **carburettor heat HOT** (or alternate air) for an engine failure relatively close to the ground. These actions might make all the difference between a successful engine restart and a disastrous forced landing.

In situations where more time is available, establish the aircraft in a trimmed glide **before** planning an approach to a suitable forced landing area, commencing the engine-trouble checks and transmitting a Mayday call. Always remember the old adage: 'Aviate, Navigate, Communicate'. A number of survivable forced landings in the past have ended badly because the pilot became distracted and forgot to fly the aircraft accurately all the way to the forced landing site.

To minimise the risks of a ground fire, the engine-shutdown checks (fuel OFF, mixture ICO, ignition OFF, electrics OFF) **must** be carried out should the trouble checks fail to restore engine power.

If it has been a while since you last practised the drills for engine failure after takeoff, or you simply don't feel confident with them, then consider taking some dual – or, at the very least, run through the drills while sitting in the cockpit on the ground. ■



TRANSPONDER BASICS

In the July/August 2002 issue we ran an article about leaving your transponder on, even where SSR radar coverage is limited. This gives a collision avoidance benefit whereby TCAS-equipped aircraft are alerted to other aircraft with an operating transponder. As a follow-on to that article, perhaps a reminder on transponder basics would be timely. We will cover them only briefly – for further information refer to the AIP Planning Manual, appropriate training texts, or your instructor.

A transponder unit enables secondary surveillance radar (SSR) to 'see' your aircraft. The SSR sends out a radar signal (interrogation) which triggers a response from the aircraft transponder. (The light on the transponder flashes as these interrogations occur.) Positive identification of aircraft on the radar screen enables controllers to determine quickly where potential conflicts could occur.

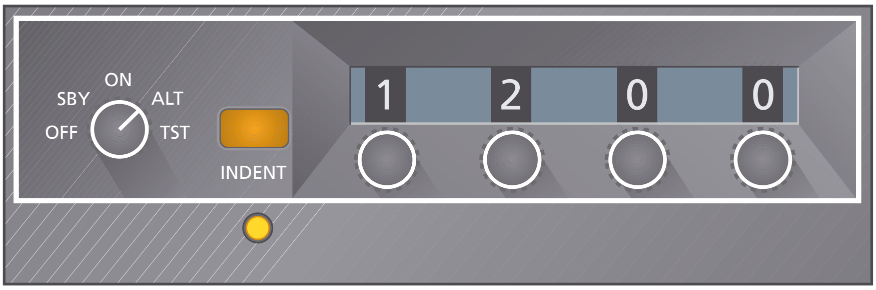
Adherence to transponder operating procedures provides both VFR and IFR aircraft with a higher degree of safety. Radio communications are reduced, and a more efficient service can be offered.

Some busy airspace areas are designated *transponder-mandatory*, and aircraft operating within them must have a fully functioning transponder. If your aircraft is fitted with a transponder, however, it is recommended that you always use it wherever you are, as it offers many safety benefits.

Basic Functions

A four-figure code is selected on the transponder. This may be a discrete code allocated to that aircraft[1] or a code appropriate to aircraft type and operating area. While you are in flight, a controller may request that you change to a specific code.

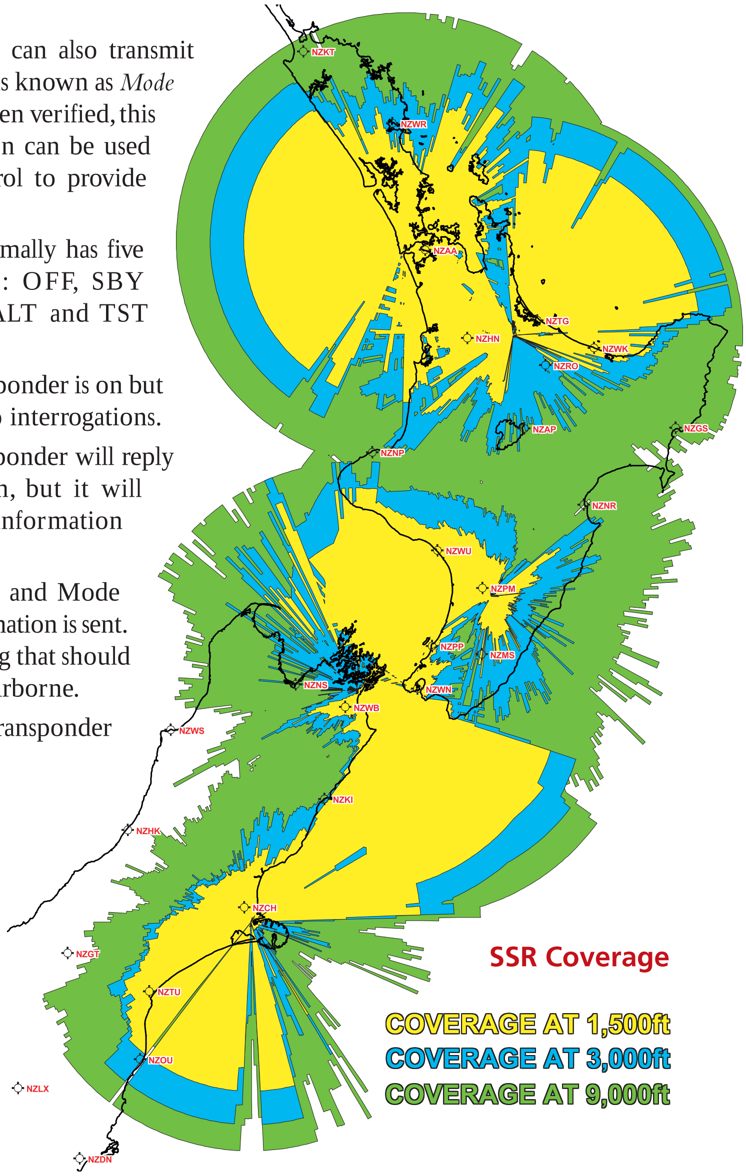
The information from the code is known as *Mode A* information, and it is transmitted back to the radar with each interrogation.



Most transponders can also transmit their altitude. This is known as *Mode C* information. When verified, this altitude information can be used by air traffic control to provide vertical separation.

A transponder normally has five switch positions: OFF, SBY (stand-by), ON, ALT and TST (test).

- SBY – the transponder is on but will not reply to interrogations.
- ON – the transponder will reply to interrogation, but it will send Mode A information only.
- ALT – Mode A and Mode C altitude information is sent. This is the setting that should be used when airborne.
- TST – this is a transponder test function.



The transponder is turned to the SBY position after engine start-up. Just prior to takeoff it is turned to ALT (except when operating in the circuit of a controlled aerodrome, when it should remain on SBY). After landing, the transponder is turned to SBY (or OFF), and prior to shutdown it is turned OFF. **See Erratum**

Occasionally a radar controller will instruct you to "squawk ident". This means you must press the IDENT button – just once. This causes your aircraft symbol on the radar screen to flash so that the controller can readily identify your aircraft. Do **not** operate the IDENT feature unless instructed by ATC.

Other phraseologies can follow the word squawk, eg, "squawk 3927", which means select the code 3927 on your transponder.

Note: When changing code numbers, it is important not to cycle through any of the emergency codes (7500, 7600 or 7700), as this would activate an alarm system in the radar unit. Change the numbers in a sequence that avoids that situation – or turn the transponder to SBY while changing.

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[1] If your aircraft does not have a discrete code, and you undertake significant VFR cross-country flying, you can apply for a code by contacting John McKenzie at Airways, on 0–3–358 1631 or john.mckenzie@airways.co.nz.

Advantages

Besides being a tool enabling safer air traffic management generally, your transponder is a very valuable piece of equipment for you in a variety of situations:

Radar Navigation Assistance

If you are in a position in uncontrolled airspace where navigation is difficult, such as crossing Cook Strait in weather conditions which do not provide the comfort of seeing the other side, don't hesitate to ask for radar navigational assistance. Your transponder signal will assist this process.

If you become uncertain of your position at any time, through a navigation error or becoming lost above cloud, for instance, ask for help. Where possible, you will be given radar assistance to a position where you can resume your own navigation. Your transponder signal will assist this process.

Emergencies

Selecting special codes for specific situations will activate an alert on the radar screen and enable controllers to focus any assistance required. In a distress or urgency situation, select 7700. For communications failure, select 7600. The code for unlawful interference (hijacking) is 7500.

Search and Rescue

In the event that your aircraft does suffer some misfortune, and Search and Rescue is activated, the information from a radar trace of your flight can provide specific location information and speed up any rescue effort, a time-saving which could well be crucial. (Remember that SAR action can happen only if you are known to be overdue – so always file a flight plan.)

Collision Avoidance

The collision avoidance benefit resulting from TCAS-equipped aircraft 'seeing' other aircraft with transponders operating on Mode C was covered in the previous article.

Summary

Except for collision avoidance, the benefits of having your transponder on depend on the aircraft being within SSR coverage. Collision avoidance is enhanced any time you're near a TCAS-equipped aircraft and have your Mode C switched on.

Understand how your transponder works, use it correctly, and use it at all times in flight. ■

America's Cup

Pilots operating in the Auckland region between 1 October 2002 and 6 March 2003 should brief themselves on the America's Cup procedures contained in AIP Supplement 94/02. If you do not have access to a paper copy, it can be viewed on the CAA website (**www.caa.govt.nz**) – select **Airspace/America's Cup/America's Cup Aviation Procedures**.

The Airways IFIS web site (**www.airways.ifis.co.nz**) also has a copy of Supplement 94/02 – select **Publications/Special Events.**

Also on the IFIS web site is another AIP Supplement, 95/02, which details America's Cup IFR procedures.

Pilots wishing to receive regular updated information on America's Cup airspace activation should subscribe to the notification service on the CAA website. Subscribe by clicking on **Airspace,** then select **Free notification service** (top of page in body text), scroll to the bottom of the notification page to the "Airspace Notifications" section, and choose **Yes** to **America's Cup** option. Complete your name and address details, and then click on the **Submit** button. You will be sent confirmation of your selection via email.

Overview – America's Cup 2002/2003 Airspace

AIP Supplement Cut-off Dates

Do you have a significant event or airshow coming up soon? If so, you need to have the details published in an AIP *Supplement* instead of relying on a NOTAM. This information must be promulgated in a timely manner, and should be submitted to the CAA with adequate notice (within 90 days of the event). Please send the relevant details to the CAA (ATS Approvals Officer or AIS Coordinator) at least one week before the cut-off date(s) indicated below. Note: If your AIP *Supplement* requires an illustrated graphic you need to add another 5 working days to this date.

Supplement Cycle	*Supplement* Cut-off Date (with graphic)	*Supplement* Cut-off Date (text only)	*Supplement* Effective Date
02/13	25 Oct 02	31 Oct 02	26 Dec 02
03/01	22 Nov 02	28 Nov 02	23 Jan 03
03/02	30 Dec 02	6 Jan 03	20 Feb 03

Erroneous ILS Indications

The Faleolo Incident

The crew of a late-evening Boeing 767 flight, NZ60, in to Faleolo International Airport, Apia, Samoa, reported that they had experienced a suspected *false glideslope* capture during the approach.

The approach for Runway 08 was planned to be an autocoupled ILS. The aircraft was established on the 15 NM arc as per the standard instrument arrival procedure.

The aircraft's autoflight system captured the inbound localiser course at 2800 feet amsl. During the turn on to the localiser, the aircraft was decelerated and configured to Flap 1. The autoflight system captured an *erroneous glideslope* shortly thereafter. The glideslope deviation indicators continued to display 'on glideslope' throughout the approach.

Shortly after making the landing flap selection, the Pilot Flying noted an anomaly in DME versus altitude. Around the same time the Pilot Not Flying, while trying to establish visual contact with the airfield and runway, became aware that visual cues did not correspond with what was expected, as did the Supplementary Pilot.

A go-around was initiated to join the VOR/DME arc for a second approach. This approach was flown with careful attention to distance and altitude using the published DME/altitude profile as per the approach plate. The glideslope deviation indicator still indicated 'on glideslope' throughout the second approach. These indications were ignored, however, and the approach continued to a successful landing.

Air Traffic Control at Faleolo was immediately notified of the problem, and a NOTAM was issued stating that the glideslope was unserviceable.

Analysis

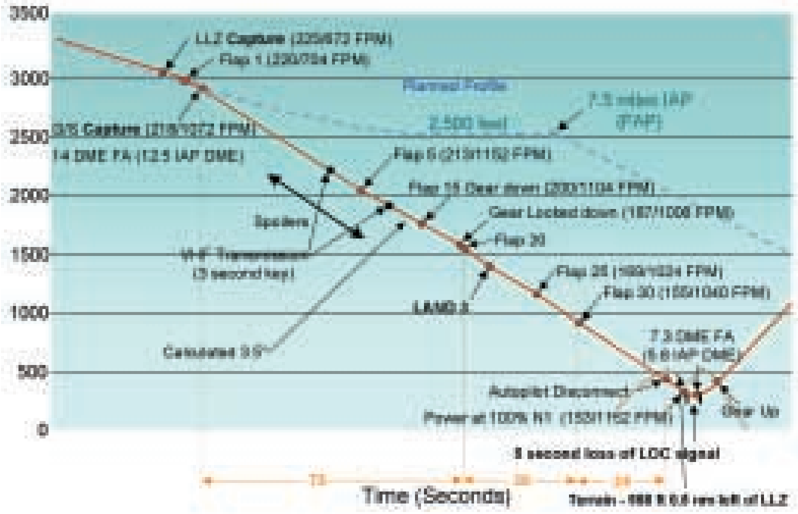
Subsequent analysis of the flight data recorder information established that the aircraft had descended on a glide path of approximately 3.5° to a point approximately 5 ½ miles short of the runway with 'normal' localiser and glideslope indications displayed on the flight instrumentation.

It was established that the ILS glide path transmitter had inadvertently been left in control (monitor) bypass mode, with the unserviceable transmitter selected. In the bypass mode, the glide path transmitter executive monitor was unable to shut down the faulty transmitter or to transfer to the serviceable transmitter. The result was the radiation of invalid glide path information.

A *false glideslope* is a normal byproduct of the glide path. If it is intercepted, and if it can be followed, it will guide the aircraft to the source of the glide path.

An *erroneous glideslope*, on the other hand, is not well known. It is the result of a faulty or partial signal being transmitted. It will indicate to the aircraft that it is 'on slope' irrespective of where the aircraft is in space, and it will not lead the aircraft to the source of the glide path. Erroneous glideslope signals are occasionally transmitted for maintenance purposes.

NZ60 Profile – First Approach Apia



Reports Available

There are many lessons that can be learnt from this very serious incident – a tragic accident was averted in this case only by the actions of an alert and quick-thinking crew.

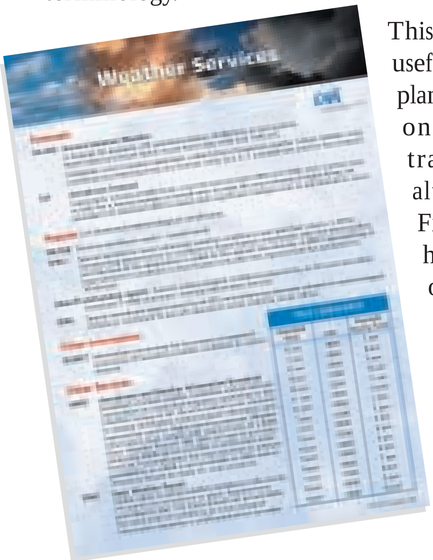
Because of the far-reaching implications of this incident to the aviation industry, the New Zealand CAA has released a comprehensive report into the event (available on the CAA web site by selecting **Accidents and Incidents/Occurrence Report – NZ60…**etc). The report's recommendations are currently under review by a number of aviation authorities and aircraft manufacturers world wide.

Extracts from the CAA report have been published, along with findings from other notable ILS-related accident investigation reports, in an article entitled "Erroneous ILS Indications Pose Risk of Controlled Flight into Terrain" in the July 2002 issue of *Flight Safety Digest*. The article can be viewed on the Flight Safety Foundation's web site at **www.flightsafety.org** by selecting **Publications/Flight Safety Digest**.

Air New Zealand has produced a 25-minute CRM training video on how to recognise and react to erroneous ILS indications. Entitled *NZ60, a Free Lesson*, it can be obtained from **Chris.Kriechbaum@airnz.co.nz**. The CAA holds a copy for loan from its Library. ■

Weather – Where From?

The Safety Education Unit launched a new product at the recent *Weather Wisdom* seminars. It is an A5 card outlining available weather services (forecasts, reports and other information and services) and interpretation of weather terminology.



This card should prove a very useful addition to your flight planning kit. You should find one at your local flight training organisation, alternatively your local Field Safety Adviser will have stocks or you can obtain them directly from the Safety Education and Publishing Unit.

This card will help you interpret the weather forecast but how do you obtain a forecast?

Aviation Forecasts

For non-commercial operators, pre-flight meteorological information is available free of charge from Airways New Zealand. Commercial operators must obtain the information from MetService.

The main methods of obtaining pre-flight information (weather and NOTAMs) from Airways are by:

- **Internet.** Access the IFIS (Internet Flight Information Service) web site, **www.ifis.airways.co.nz**. Click on the **Area Pre-Flight Briefing** option to obtain GAWX, TAFs, METARs, SIGMETS, etc. NOTAMs are also available. You can store regular requests as 'Favourites' to avoid having to select individually each time. This should be the primary site for your pre-flight planning weather information. Note that this site requires you to register as a user first.
- **Fax-On-Demand.** This service is a great tool. After dialling the 0800 number, follow the voice prompts and key in the codes for the required information. The information will be sent by fax either to your default number or to another number you select (eg, if you are away from home base). To obtain a Fax-On-Demand card, contact Michelle Frood, email: **michelle.frood@airways.co.nz** or Tel: 03–358–1564. (If you are already a Fax-On-Demand customer, an updated card is available on request.)
- **Fax.** If you do not have a Fax-On-Demand card, the weather can be faxed to you following a verbal request to the National Briefing Office, Tel: 0900 733 358 (or 0800 626 756 if you cannot access the 0900 service).
- **Phone.** Contact the National Briefing Office.
- **Personal visit.** Visit an Airways ATS unit.

Civil Aviation Rule Part 91 *General Operating and Flight Rules* requires a pilot to obtain meteorological information before a flight. The definition of meteorological information in Rule Part 1 *Definitions and Abbreviations* makes it clear that weather reports and forecasts must be "in support of aviation". Aviation forecasts through Airways, as above, or from MetService, are the only way to meet this requirement.

There are, however, other sources that are useful to **supplement** this information, particularly if you want to look a few days ahead.

Supplementary Weather Sources

Short and extended-range weather information is available on Teletext, the National Radio weather, commercial radio, television news and in the newspaper weather section.

Here are some useful web sites for obtaining weather information to supplement aviation forecasts. (Valid at time of writing.)

Specific Weather Sites

www.metservice.co.nz

The MetService (Meteorological Service of New Zealand) web site. Under **Forecasts** you will find Short forecasts (one day ahead) and Extended Forecasts (a four-day forecast). The Mountain Forecasts and Coastal Forecasts can also be useful. Other useful headings include: **Maps**, for analysis and prognosis charts; **Observations**, which contains radar and satellite imagery plus surface data and upper air data; and **Learning Centre**, lots of interesting and educational information. The **Business Services** heading can lead you to information about their aviation services (not a free service).

www.bom.gov.au/weather/national/charts/

The Bureau of Meteorology Australia web site. Analysis and forecast synoptic charts covering Australia, Tasman Sea and New Zealand. These are useful to gain an overview of long-range weather trends.

www.metvuw.com

Victoria University of Wellington, School of Earth Sciences, Weather and Climate Service web site. Choices are **Satellite Imagery**, **Weather Radar**, **Upper Air Data**, **Forecast Charts** (up to 72 hours ahead), **Current New Zealand Weather**

Continued over ...

... continued from previuos page

(up-to-date observations of temperature, pressure, wind and precipitation) and **Ocean Weather**.

Sites with Weather Sections

Many general and specialist (eg, glider pilots, boaties, skiers and farmers) sites can contain useful weather information, sometimes by links back to sites already mentioned.

home.nzcity.co.nz/weather

Pictorial and simple text information from Weather Workshop on New Zealand city and town weather. Current and next-day conditions are available. Click on the required city or town for the three-day-ahead forecast. The Ski Reports section links to:

www.snow.co.nz

Select **Snow Reports**. You can then select a National Short Report for all ski fields, individual ski fields or a National Weather selection, which has links to MetService and Bureau of Meteorology Australia. Some of the larger ski fields have up-to-date snow-cam pictures that give an indication of the current weather.

www.mtruapehu.com

This is a commercial site promoting central North Island ski fields. In the absence of much central North Island mountain weather, it can be a useful information source. Click on **Snow Report** for a report of current weather conditions. There are also one-hour web-cam images and a basic five-day mountain forecast (icons only) available.

www.nzski.com

This is a commercial site promoting South Island ski fields. Useful for supplementing weather information in the vicinity of Mt Hutt, Coronet Peak and The Remarkables. Select the ski field you are interested in for a report on snow and weather conditions and a web-cam picture.

www.wp1.co.nz

A marine website. After entering the site, click on **Weather and Tides** to access maritime coastal weather information via links to NZ Metservice.

www.gliding.co.nz

If you don't get too side-tracked by the other interesting information on this Gliding New Zealand site, under **Useful Stuff** click on **Meteorological Data for New Zealand**. This has links to other sites, some already mentioned above.

www.fencepost.com

This rural web site has a weather map and two-day regional forecasts. A 12-day regional forecast is available if you register on the site (no cost). This can be useful for forward planning.

Further Afield

If you are interested in other parts of the world, check out **www.intellicast.com** and **www.ghcc.msfc.nasa.gov/GOES/globalir.html**. ■

Field Safety Advisers

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

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

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

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

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

Care to Join the *Vector* Team?

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

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

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

For further details, see the CAA web site **www.caa.govt.nz** under **Vacancies**.

Accident Notification

24-hour 7-day toll-free telephone

0508 ACCIDENT

(0508 222 433)

CA Act requires notification "as soon as practicable".

Aviation Safety Concerns

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

0508 4 SAFETY

(0508 472 338)

For all aviation-related safety concerns

OCCURRENCE BRIEFS

Lessons For Safer Aviation

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

Individual Accident Reports (but not GA Defect Incidents) – as reported in *Occurrence Briefs* – are accessible on the Internet at CAA's web site **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-CGT, Denney Kitfox IV, 17 Aug 96 at 12:00, Napier. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 39 yrs, flying hours 900 total, 5 on type, 5 in last 90 days.

The aircraft suffered an engine failure shortly after takeoff. The pilot managed to accomplish a partially successful forced landing, collapsing one of the undercarriage legs in the process.

Fuel starvation, probably due to a combination of lean mixture and glass fibre residue in the fuel tank obstructing fuel jets, was the most likely cause of the engine failure.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 96/2179

ZK-DSQ, Piper PA-32-260, 1 Jul 00 at 15:00, Great Mercury Is. 5 POB, injuries nil, damage substantial. Nature of flight, transport passengers A to B. Pilot CAA licence CPL (Aeroplane), age 30 yrs, flying hours 940 total, 250 on type.

On Saturday 1 July 2000 at 1457, Great Barrier Airlines PA-32-260 aeroplane ZK-DSQ was on a charter flight to Great Mercury Island with 4 passengers when it overran the uphill grass runway on landing. No injury occurred, but the aircraft was substantially damaged.

The overrun resulted from excessive tailwind, and the pilot's decision to land was probably based on an incorrect assessment of the tailwind component on the runway. Safety issues identified include:

- The definition of the tailwind limitation in the airline's operations manual.
- The performance data in aircraft flight manuals.
- The calibration of the automatic weather station on Great Mercury Island.

Safety recommendations were made to address these issues.

Main sources of information: Abstract from TAIC Accident Report 00-007.

CAA Occurrence Ref 00/2186

ZK-TRS, Transavia PL-12/T-300A-1, 5 Aug 00 at 11:05, nr Masterton. 1 POB, injuries nil, aircraft destroyed. Nature of flight, agricultural. Pilot CAA licence CPL (Aeroplane), age 64 yrs, flying hours 11500 total, 350 on type, 86 in last 90 days.

The aircraft was applying slurry fertiliser on a property northeast of Masterton. The airstrip was wet and soft at the threshold end, so the pilot elected to carry light loads of around 400 kilograms. On the last flight, the aircraft took off into a 10 to 15 knot southwesterly wind. Just after lift-off, the aircraft sank back on to the strip about 30 metres from the end, and the soft ground prevented further acceleration. Beyond the end of the strip was a ravine, and the aircraft struck the far side about two metres below the lip. The pilot had started jettisoning the load as the aircraft sank back on to the ground, and the load was virtually gone by the time of final impact.

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

CAA Occurrence Ref 00/2616

ZK-ROY, Rans S-6ES Coyote II, 1 Sep 00 at 16:35, Nelson Ad. 2 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 58 yrs, flying hours 2870 total, 115 on type, 24 in last 90 days.

At about 50 feet after takeoff, a rough running engine necessitated a forced landing on the remaining grass runway. The landing was heavy and the aircraft nosed over, coming to rest on its propeller.

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

CAA Occurrence Ref 00/2868

ZK-VBC, Vans, RV 6A, 24 Nov 00 at 18:00, nr Crows Nest Queensland, Australia. 1 POB, injuries 1 fatal, aircraft destroyed. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 64 yrs, flying hours 1179 total, 380 on type, 31 in last 90 days.

The pilot of ZK-VBC was flying from Townsville to Toowoomba, when he reported that he had engine trouble and was making a forced landing.

The aircraft appears to have stalled on the approach to the selected field and impacted in a steep nose-down attitude .

The accident was investigated by ATSB (Australian Transport Safety Bureau), and a full report is available on their web site www.atsb.gov.au.

Main sources of information: From ATSB investigation.

CAA Occurrence Ref 00/3711

ZK-XIF, Micro Aviation B20 Bantam, 10 Dec 00 at 12:30, Feilding. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence nil, age not known, flying hours 145 total, 30 on type, 3 in last 90 days.

On returning to the aerodrome after a local flight, the engine misfired and stopped. During the attempted forced landing the microlight caught the top of a deer fence and tipped upside down.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 00/4417

ZK-EUC, NZ Aerospace FU24-954, 15 Jan 01 at 10:30, Patoka. 1 POB, injuries nil, damage minor. Nature of flight, agricultural. Pilot CAA licence CPL (Aeroplane), age 48 yrs, flying hours 3414 total, 3189 on type, 134 in last 90 days.

While starting the takeoff roll, the aircraft's righthand aileron contacted the ground. The takeoff was aborted.

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

CAA Occurrence Ref 01/2307

ZK-JAC, Piper PA-28-181, 8 Mar 01 at 10:30, Masterton. 2 POB, injuries nil, damage substantial. Nature of flight, private. Pilot CAA licence CPL (Aeroplane), age 34 yrs, flying hours 2070 total, 60 on type, 144 in last 90 days.

The aircraft landed on a farm airstrip and collided with a concealed irrigation pipe tie-down. The starboard wheel impacted the pipe, which was protruding approximately one foot above ground level, folding the wheel rearwards.

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

CAA Occurrence Ref 01/753

ZK-TAQ, Cessna 172R, 17 Mar 01 at 12:00, Kerikeri Ad. 3 POB, injuries nil, damage minor. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 33 yrs, flying hours 167 total, 35 on type, 5 in last 90 days.

The aircraft landed almost three-quarters of the way into the runway. The pilot realised that it was too late to go around and that the aircraft was going to hit the fence, so switched off the engine. The propeller struck the fence at low speed.

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

CAA Occurrence Ref 01/945

ZK-FRR, Cessna 152, 6 Apr 01 at 14:00, Wharepapa South. 1 POB, injuries nil, damage minor. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 21 yrs, flying hours 430 total, 33 on type, 38 in last 90 days.

The aircraft landed heavily after encountering windshear while on approach, collapsing its nose gear and skidding for 10 metres. The wind was reported as being a southwesterly at 25 knots at the time.

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

CAA Occurrence Ref 01/1287

ZK-CDN, Victa Airtourer 100, 3 May 01 at 12:30, Rangitata Island. 2 POB, injuries nil, damage minor. Nature of flight, private other. Pilot CAA licence CPL (Aeroplane), age 27 yrs, flying hours 1910 total, 55 on type, 79 in last 90 days.

The aircraft failed to accelerate through 40 knots during the takeoff roll. The pilot initially thought this was because of the long grass. He aborted the takeoff, but the aircraft continued on through a temporary fence, causing minor damage to the tailplane.

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

CAA Occurrence Ref 01/1897

ZK-EMN, NZ Aerospace FU24-954, 20 Aug 01 at 10:35, Dipton West. 1 POB, injuries nil, damage substantial. Nature of flight, agricultural. Pilot CAA licence CPL (Aeroplane), age 52 yrs, flying hours 12836 total, 12300 on type, 55 in last 90 days.

On the 17th flight from the strip, the right main undercarriage struck a clump of tussock or similar obstruction and became partially detached. The pilot also reported that a rectangular hole was torn in the top surface of the wing. He diverted to Gore (company base) where the trailing wheel caused further damage to the right flap on landing.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 01/2806

ZK-CMN, Fletcher FU24-950M, 8 Sep 01 at 07:10, Waiotira. 1 POB, injuries 1 serious, aircraft destroyed. Nature of flight, agricultural. Pilot CAA licence CPL (Aeroplane), age 48 yrs, flying hours 15131 total, 14935 on type, 115 in last 90 days.

The aircraft was flown to a farm airstrip then loaded with a small load of agricultural product. A combination of extremely soft airstrip conditions, a quartering tailwind, and under-slung spreader equipment, degraded performance to the extent that the aircraft was unable to become airborne within the available length of the strip. The load was jettisoned, but the aircraft struck a fence and scraped the ground with the left wing tip and aileron. The aircraft did become airborne, but was unable to be effectively controlled and subsequently struck the ground.

Main sources of information: CAA Field Investigation.

CAA Occurrence Ref 01/3065

ZK-FKE, Micro Aviation B10 Bantam, 20 Sep 01 at 18:00, Pataua. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence nil, age 62 yrs, flying hours 51 total, 30 on type, 1 in last 90 days.

The microlight was on approach to land at a small private airstrip when it struck some power lines. The aircraft recoiled backwards, hitting the ground tail first.

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

CAA Occurrence Ref 01/3219

ZK-LTC, Pacific Aerospace Cresco 08-600, 4 Oct 01 at 12:00, Hunterville. 2 POB, injuries nil, damage Minor. Nature of flight, ferry/positioning. Pilot CAA licence CPL (Aeroplane), age 39 yrs, flying hours 5850 total, 700 on type, 230 in last 90 days.

While landing on an airstrip the left main undercarriage leg broke off, causing the aircraft to slew left and stop short of departing the airstrip.

Engineers later jacked the aircraft up, replaced the leg and had it flown back to Wanganui. A new, modified, improved main undercarriage leg (PN 08-40085-1) is now available from the manufacturer. It has an increased wall thickness and better corrosion protection surface finish.

Main sources of information: Accident details submitted by pilot plus engineering investigation.

CAA Occurrence Ref 01/3432

ZK-BTI, Piper PA-18A-150, 29 Oct 01 at 11:00, Nelson Ad. 1 POB, injuries nil, damage substantial. Nature of flight, training solo. Pilot CAA licence PPL (Aeroplane), age 30 yrs, flying hours 198 total, 3 on type, 3 in last 90 days.

The pilot was on his first solo flight on type. On the sixth circuit, he landed too fast and too far down the runway. The aircraft ran off the end of the runway and groundlooped.

Main sources of information: Accident details submitted by operator.

CAA Occurrence Ref 01/3613

ZK-CTB, Cessna 150H, 25 Nov 01 at 11:40, Taumarunui. 1 POB, injuries nil, damage substantial. Nature of flight, training solo. Pilot CAA licence nil, age 35 yrs, flying hours 22 total, 22 on type, 7 in last 90 days.

The student pilot was on a local training flight, practising some ab-initio exercises. He was about to return to the aerodrome when the engine failed. He carried out a forced landing into a paddock approximately six miles to the south of the aerodrome, but the nosewheel folded rearwards on touchdown.

The pilot described the engine failure as abrupt, with no preceding roughness or other warning indications. No mechanical reason for the failure was found. Prior to commencing the flight,the pilot had visually ascertained that there was sufficient fuel on board for two hours endurance.

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

CAA Occurrence Ref 01/3913

ZK-MUZ, Cessna 180, 26 Nov 01 at 15:00, Hope R. 3 POB, injuries nil, damage minor. Nature of flight, private other. Pilot CAA licence ATPL (Aeroplane), age 56 yrs, flying hours 10000 total, 900 on type, 30 in last 90 days.

The extremely wet surface resulted in very poor braking action on landing at the private airstrip. The pilot initiated a ground-loop, but the aircraft slid into a depression, allowing the starboard wingtip and elevator to contact the ground.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 01/3936

ZK-SWK, Seawind 3000, 30 Nov 01 at 16:00, Tory Channel. 1 POB, injuries nil, damage minor. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 44 yrs, flying hours 167 total, 49 on type, 8 in last 90 days.

The pilot was carrying out a series of water landings and takeoffs, the last of which was adjacent to one of his vessels just to the south of the Tory Channel entrance. The aeroplane was 'planing' at about 35 knots on the takeoff run, when it was engulfed by a plume of water. The pilot closed the throttle as the aeroplane slewed to port, and as it came to rest, the pilot noticed that the engine had stopped.

It was found that the nose undercarriage doors had collapsed inwards, and the resulting inrush of water blew off the top hatch, breaking two propeller blades in the process. Although the aeroplane had porpoised slightly on takeoff, the pilot felt that this was insufficient to damage the gear doors. A strike mark was found adjacent to the doors, and there is a possibility that the aeroplane struck a piece of semi-submerged debris during the takeoff run.

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

CAA Occurrence Ref 01/3984

ZK-EGO, NZ Aerospace FU24-950, 13 Dec 01 at 07:50, Rangitumau. 2 POB, injuries nil, damage substantial. Nature of flight, agricultural. Pilot CAA licence ATPL (Aeroplane), age 37 yrs, flying hours 10070 total, 52 on type, 74 in last 90 days.

The pilot was positioning the aircraft for agricultural operations, and was making his first landing for the day on the strip. The one-way strip was relatively short, and the pilot anticipated poor braking action because of the long, dewy grass. On touch down, the left main undercarriage struck a sharp lip at the threshold of the strip; the lip was concealed by the long grass. The undercarriage leg separated from the aircraft, which slid to a halt on its left wing.

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

CAA Occurrence Ref 01/4100

ZK-GOL, Glasflugel Hornet, 22 Dec 01 at 15:15, Omarama. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence nil, age not known, flying hours 6200 total, 2 on type, 0 in last 90 days.

The pilot was flying locally when he experienced 'sink' near the top of a mountain. The pilot was unable to maintain terrain clearance and the glider struck a down-slope.

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

CAA Occurrence Ref 01/4335

ZK-DOY, Solar Wings Ltd Pegasus Quantum 15, 26 Dec 01 at 14:30, Pukekohe. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence nil, age not known, flying hours 52 total, 14 on type, 1 in last 90 days.

At about 40 feet after takeoff, the microlight encountered wind shear that caused the pilot to lose control and the right wing to clip a tree.

Main sources of information: Accident details submitted by pilot.

CAA Occurrence Ref 01/4204

ZK-HHM, Aerospatiale AS 350B, 1 Jan 02 at 11:00, Fox Glacier. 3 POB, injuries nil, damage minor. Nature of flight, transport passenger A to B. Pilot CAA licence CPL (Helicopter), age 33 yrs, flying hours 6600 total, 280 on type, 98 in last 90 days.

The pilot was tasked with picking up three passengers from Chancellor Hut and flying them down to Fox Glacier. Although there was heavy rain in the area, the pilot was able to reach the hut without difficulty, where he loaded the passengers and their equipment.

Just as the helicopter began forward flight, the hydraulic system failed, with none of the normal aural or visual warnings. The pilot was committed to the takeoff, and during the initial control difficulty that he experienced, the helicopter struck the ground heavily below the helipad. The forward section of the left skid was broken off in the impact, and some crush damage was inflicted on the belly of the helicopter. The extent of the damage was not known to the pilot at this stage of the flight.

The pilot continued down the glacier, not without some difficulty, and tried several times to restore hydraulic power by pressing the isolation switch on the collective. Approaching Fox Glacier township, he elected to make a run-on landing on the Fox airstrip. Once the skids had contacted the ground, the pilot noted a tendency for the helicopter to lurch forward and to the left. It was not until he disembarked that he saw the damage to the left skid.

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

CAA Occurrence Ref 02/9

ZK-PPS, Pitts S-1S, 7 Jan 02 at 13:55, Paraparaumu Ad. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 45 yrs, flying hours 1150 total, 450 on type, 3 in last 90 days.

The aeroplane made a normal approach and landing onto runway 16. Early in the landing roll, there was a loud bang from the rear. The aircraft yawed abruptly, the left main landing gear leg collapsed and the left wingtip struck the ground, causing the aircraft to tip onto its back. The tailwheel was found a few hundred metres past the point where the aircraft came to rest.

Preliminary examination found that the Maule SFS tailwheel fork had failed some 20 mm above the centreline of the tailwheel axle. The failure consisted of a fatigue crack through just under half of the cross section, with the remainder failing in overload. The fatigue crack showed multiple origins and had started on the tailwheel side of the casting. This would have been very difficult to see, even if it were being specifically looked for. A small amount of porosity was evident in the centre of the fracture, but this was discounted as being a contributing factor.

An Airworthiness Directive (DCA/Brake/5) was issued as a result of this investigation, requiring initial and periodic inspections of all Maule SFS fork assemblies.

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

CAA Occurrence Ref 01/4250

ZK-HIC, Schweizer 269C, 15 Mar 02 at 09:45, Karaka. 1 POB, injuries nil, aircraft destroyed. Nature of flight, agricultural. Pilot CAA licence CPL (Helicopter), age 29 yrs, flying hours 1707 total, 569 on type, 129 in last 90 days.

The helicopter was conducting agricultural spraying operations when, during a reversal turn, tailrotor control was lost. The helicopter hit the ground.

The helicopter had a previous maintenance history of a forward tailrotor driveshaft nut becoming loose. The cause of this was traced to incorrect assembly of the spline adapter, which is fitted to the input pinion of the tailrotor gearbox. This in turn caused damage to the driveshaft, allowing movement of the driveshaft and a loss of drive train continuity.

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

CAA Occurrence Ref 02/751

ZK-ENE, North American Harvard 3*, 26 Mar 02 at 12:30, Wanaka. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence nil, age 65 yrs, flying hours 4700 total, 2975 on type, 22 in last 90 days.

The overseas pilot was on a local photography flight in the Wanaka area. On completion, he made a normal, full-flap approach with the intention of making a three-point landing on runway 11.

The tailwheel touched the ground first, pitching the aircraft heavily onto the main wheels. A bounce ensued, and the pilot added power, holding the three-point attitude. On the second touchdown, the aeroplane started to groundloop to the right, breaking the left gear strut and sliding to a halt on its left wingtip.

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

CAA Occurrence Ref 02/872

ZK-LTV, Pacific Aerospace Cresco 08-600, 28 Mar 02 at 10:05, nr Taihape. 1 POB, injuries nil, aircraft destroyed. Nature of flight, agricultural. Pilot CAA licence CPL (Aeroplane), age 42 yrs, flying hours 7033 total, 327 on type, 107 in last 90 days.

The aircraft had been operating off the strip for about two and a half hours, and was on its fifth flight since refuelling. It became airborne at the same point as on previous takeoffs, but shortly after takeoff encountered 'sink'. The pilot was unable to prevent the aircraft colliding with the fence at the end of the strip and touching down in the next paddock. He applied reverse thrust, which reduced the effects of subsequent collisions with further fences and a set of cattle yards.

Conditions had been calm up to the time of the accident, and the pilot was certain that there was no power loss.

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

CAA Occurrence Ref 02/896

GA Defect Incidents

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

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

Key to abbreviations:

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

Cessna 177B – Poor engine cooling

Ten minutes after takeoff, the pilot noticed that the engine oil temperature had increased and that oil pressure was registering at the bottom of the green range. An immediate landing at a local airstrip was made without incident.

It was later found that too much oil had been added during maintenance and that this had caused inefficient oil cooling, which led to the high oil temperature and low pressure. Two litres of oil were drained from the engine. Operations have since been normal.

ATA N/A CAA Occurrence Ref 02/1083

Cessna A185F – Flap extension problem, P/N 0512128

During extension of the last notch of the flap while on approach to land, the pilot felt a twang through the flap handle. The flap setting was reduced and the landing successfully completed.

Inspection of the aircraft revealed that a pulley bracket (P/N 0512128) had failed on one side, allowing some free play in the system.

ATA 2750 CAA Occurrence Ref 00/1925

NZ Aerospace FU24-950 – Undercarriage lug bolts fail, P/N AN5-36A

After touchdown, the aircraft began to roll left followed by the right wing contacting the ground. The pilot was unable to raise the flaps in time and aircraft suffered minor damage to its flaps and a section of the outer wing. A visual check confirmed that the righthand undercarriage leg had detached.

There are three bolts that hold the lug to the flange on the lower undercarriage leg. These bolts had failed, causing the lug to separate, taking the lower leg with it. It is possible that one bolt failed, causing stress on the other two.

ATA 3200 CAA Occurrence Ref 00/2483

Piper PA-23-250 – Hartzell CSU spline worn, P/N F-6-5A

On climb-out, the pilot noticed a reduction in the lefthand engine rpm. The engine was shut down and an emergency declared. The flight continued without further incident.

Investigation revealed that the splines on the constant speed unit drive had worn away. The cause of the failure was not established. TSO 86 hours.

ATA 6120 CAA Occurrence Ref 00/1043

Piper PA-30 – Fuel selector assembly misaligned

The pilot reported that he had problems with an engine running roughly and that he had shut it down. Although the aircraft was not having any difficulties maintaining height, an emergency was declared. A safe landing was made.

During the pre-flight inspection, the pilot had noted that the fuel selector was stiff to operate. Post-flight inspection revealed that the fuel selector lever was indicating MAINS, but that this did not correspond to the fuel valve position within the selector assembly. This misalignment caused the fuel flow to be restricted, and over a certain manifold pressure, supply could not meet demand. The pilot was reluctant to change to cross-feed following the rough running due to the stiffness of the selector.

It appears that the link between the selector handle and the selector valve was bent, causing the selector to indicate its position incorrectly. The bending of the link could have been due the selector handle being forced against the stiffness in the valve assembly.

The selector mechanism was cleaned and adjusted to restore normal function. The engine was ground run and the aircraft satisfactorily test flown.

ATA 2800 CAA Occurrence Ref 00/3020

Piper PA-32-260 – Support ribs corroded, P/N 6559001

During a repair of the righthand flap, the leading-edge support ribs were found to have detached from the spar due to corrosion. TTIS 6698 hours.

ATA 2750 CAA Occurrence Ref 00/2545

Piper PA-32-300 – Starter motor remains engaged

Smoke was present in the cabin during takeoff. The takeoff was immediately aborted and the aircraft taxied clear of the active runway. The engine was shut down and the passengers evacuated.

The incorrect key, apparently almost identical to the correct one, had been used in the ignition switch, causing the switch tumblers to remain in the start position. The smoke and smell in the cockpit, was probably as a result of the starter motor being engaged for a prolonged period.

ATA 3900 CAA Occurrence Ref 00/2476

Piper PA-34-220T – Oil pressure relief valve jams, P/N 844678

The pilot noticed a lower-than-normal oil pressure while on approach to land.

Engineering investigation of the Continental engine found that a tension spring on the inlet valve guide seal was stuck under the oil pressure relief valve. All the remaining valve guide seals were found to be in poor condition and were replaced. TTIS 213 hours.

ATA 8550 CAA Occurrence Ref 00/286

CIVIL AVIATION AUTHORITY
OF NEW ZEALAND

Erratum

Page 10 of this magazine contains an error. Reference to changing to SBY mode while operating in the circuit of a controlled aerodrome is incorrect.

Within the circuit of a controlled aerodrome, pilots should set their transponder to a code of **2200** with the **ALT** mode selected, unless otherwise directed by ATC. There are two exceptions to this:

- When the aircraft has been assigned a permanent designated transponder code, in which case this code should be retained with the ALT mode selected.
- When operating within the 02/20 grass circuit at Christchurch, in which case 2200 should be set with the SBY mode selected.

For more detailed information refer to AIP Supplement 19/02 (effective 21 February 2002) **BACK**.